City of Shoreline
Stormwater Pump Station and SCADA Improvements
Preliminary Design Report

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ACKNOWLEDGEMENTS

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ABBREVIATIONS AND ACRONYMS LIST

ac-ft	Acre-Foot
BMP	Best Management Practice
CB	Catch Basin
CIP	Capital Improvements Plan
City	City of Shoreline
CMP	Corrugated Metal Pipe
gpm	Gallons per Minute
hrs	Hours
LS	Lift Station
MGS Flood	Hydrologic Modeling Software by MGS Software
NFPA	National Fire Protection Association
OPPC	Opinion of Probable Project Costs
PPE	Personal Protective Equipment
PS	Pump Station
PVC	Polyvinyl Chloride
SBUH	Santa Barbara Urban Hydrograph
SCADA	Supervisory Control and Data Acquisition
SCL	Seattle City Light
TDH	Total Dynamic Head

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1. Introduction & Objectives

The City of Shoreline (City) owns and operates eight stormwater pump stations (PS). In 2016, the City evaluated the condition, capacity, and overall functionality of these pump stations. The evaluation recommended replacement of two pump stations and miscellaneous improvements to the other six stations. The City has also identified the need for off-site monitoring and control of these facilities using a utility-wide supervisory control and data acquisition (SCADA) system. This work has been grouped into several projects within the City's Capital Improvements Plan (CIP). BHC has been tasked with evaluating these pump stations, reviewing the prior recommendations, providing updated recommendations, and developing a preliminary design and project implementation strategy for the recommended improvements.

This preliminary design report summarizes existing conditions, alternatives, recommended facility improvements, and a recommended project implementation strategy.

2. Existing Conditions

The existing conditions at each of the eight pump stations were reviewed during a site visit in August 2019 and general recommendations from that site visit and associated discussions were documented in the Existing Conditions Review Memorandum (Appendix A). The existing configuration of the individual pump stations and generalized improvement needs are summarized as follows:

- Linden & Palatine Pump Stations: These stations are catch basins which have been retrofitted with individual submersible pumps. Palatine requires limited improvements to enhance reliability and access, and Linden requires a full replacement.
- Ronald Bog Pump Station: This station utilizes a diesel-driven portable pump which requires only limited improvements to enhance reliability and access. While outside the scope of this study, this pump station should eventually be replaced with either a permanent electric pump station or a gravity pipe.
- Pan Terra, Serpentine, and PS-25 Pump Stations: These stations are all duplex submersible pump stations which require some improvements to enhance reliability, safety, and access.
- PS-26 and PS-30 Pump Stations: These are the two oldest stations in the system. The pump equipment and structures at both locations are at the end of their service life and are due for replacement.
- SCADA: None of the existing pump stations currently have an active remote monitoring system although both Pan Terra and PS-25 include an automated alarm call out system (auto dialer). The City has identified the need to provide a SCADA system for all the stormwater pump stations.

3. Improvement Alternatives Evaluation

The need for improvements of the existing stormwater pump stations was previously addressed in the 2016 condition assessment and in the initial phases of this project through an initial workshop, document review, and site visits with City staff. From those documents and activities, the recommended improvements for six of the eight stations (all except PS-26 and PS-30) were readily defined in the Existing Conditions Review Memorandum (Appendix A), without the need for detailed review or evaluation. Similarly, the determination for a SCADA system was reviewed and documented in the SCADA Evaluation Memorandum (Appendix B). As such, no additional alternatives evaluation is required for these facilities and systems.

Both PS-26 and PS-30 require full replacement of the pump stations due to the age and condition of the equipment and structures, and the City has expressed interest in determining if either of these facilities can or should be eliminated by providing gravity conveyance from these locations and/or from locations within the drainage basin. This section describes the alternatives that were identified and evaluated using available drainage system information and hydrologic modeling to develop recommendations for the improvements at each of these two sites.

3.1 Alternatives

3.1.1 PS-26

Two generalized alternatives were considered for PS-26. The first was a gravity conveyance option which would eliminate the need for the pump station, and the second was a range of options to replace the existing pond and pump station system at this site. The gravity conveyance option would rely heavily on new regional bioretention facilities. Bioretention facilities were found to provide benefits to each alternative, but not resolve the issues completely. Therefore, alternatives were compared with and without regional bioretention.

Gravity Option with Bioretention

In April 2017, the City investigated gravity conveyance options which would eliminate the need for PS-26. This evaluation is documented in a draft memorandum prepared by the City. The investigation included installation of approximately 2,000 linear feet of new gravity main with perceived construction and operational challenges including flat slope, utility conflicts, and deep pipe segments. This investigation also relied extensively on new bioretention facilities within the existing Seattle City Light (SCL) transmission corridor and on the Rotary Park parcel; these facilities could reduce a considerable volume of runoff through infiltration and provide water quality treatment.

As part of this study, the basin drainage areas were evaluated and modeled using MGS Flood. Appendix C includes basin mapping and model output. An important focus of the modeling for the gravity option was to determine if flows could be reduced significantly through bioretention. Reduced flows would require less storage volume in the PS-26 pond and may be more easily conveyed within the existing system without substantial improvements. Based on the evaluation prepared for this study, it appears that the PS-26 basin would benefit from bioretention but would still need to rely on the pump station during significant storm events. Without bioretention, additional evaluation would be recommended identify potentially deficiencies in the downstream system and develop a plan for improvements. Also, the soils and ground characteristics within the areas available for bioretention may not provide as much infiltration potential as initially assumed

based on City-wide mapping. In addition, the existing pond at the pump station location provides some attenuation of high storm flows within the system. If the pond and pump station were by-passed, the downstream system would receive higher peak flows. At this time, it is uncertain whether the downstream system can accommodate higher flows.

In discussions with the City, it was agreed that the gravity conveyance alternative should be considered infeasible due to the uncertainty of the downstream conveyance system capacity, cost of installing a new gravity main, and limitations related to infiltration capacity. The benefits provided by a combined pump station and pond facility, including stormwater flow attenuation and water quality treatment, were also a deciding factor in abandoning the gravity only conveyance option.

Pump Station Replacement Options

Three new alternatives were developed for the replacement of PS-26. Each alternative includes a storage system, which provides some attenuation of stormwater flows. The existing pond and pump station are partially located within an easement. The three new alternatives are configured to provide storage and the pump station entirely within City property at the PS-26 site, where there is an approximately 90-foot wide by 120-foot long space available. This footprint is based on 5-foot setbacks from surrounding property lines. A facility depth of 8-feet was selected for this preliminary analysis. In addition to the improvements at the site, the potential future implementation of upstream bioretention facilities was considered, including a 0.25-acre facility on the SCL property and a 0.10-acre facility at the Rotary Park Property. The areas for each facility were identified using aerial photography and GIS information. Actual space available within existing easements will need to be better defined during design. See Section 3.2.1 for modeling assumptions.

The three alternatives are summarized below, and each alternative was analyzed with and without the potential future upstream bioretention facilities.

- Alternative 1 – Pond with Vertical Walls (86,400 ft^3 detention volume)
  - Replaces the existing pond with a new, vertical-walled infiltration pond, maximizing the available footprint.
  - Eliminates the existing park space.
  - Includes a new pump station and force main.
- Alternative 2 – Underground Bottomless Vault (86,400 ft^3 detention volume)
  - Replaces the existing pond with a new infiltration vault, maximizing the available footprint.
  - Expands the existing park space.
  - Includes a new pump station and force main.
- Alternative 3 – Underground Infiltration Gallery (66,350 ft^3 detention volume)
  - Replaces the existing pond with a new infiltration gallery using corrugated metal pipes (CMPs) or similar, maximizing the available footprint.
  - Expands the existing park space.
  - Includes a new pump station and force main.

These alternatives will incorporate subgrade improvements to maximize stormwater infiltration at the site. These improvements may include replacing the top few feet of soils with more permeable material that has not been impacted by sedimentation. Currently, there is limited infiltration occurring through the existing pond; this could be the result of poor underlying soils or silt buildup. The alternatives will include a pre-treatment system upstream of the storage and infiltration system, to reduce sedimentation in the downstream systems. Infiltration capacity of the site is addressed in Section 3.2.

3.1.2 PS-30

Two alternatives were considered for replacement of PS-30, as follows:

- Alternative 1 – Partial Gravity Conversion
  - Re-routes the majority of the PS-30 drainage basin stormwater flows south along 15th Avenue NE, and then east along NE 169th Street, where the proposed gravity conveyance line will tie into the existing gravity system, bypassing the existing pond and pump station.
  - Provides a new smaller pump station to support drainage from the depression area just north of PS-30 and uses the existing force main.
  - A gravity conversion alternative was dismissed due to unknown downstream capacity and the ability to handle increased flows that would not be attenuated through the pond.
- Alternative 2 – Existing Pond with Limited Improvements
  - Maintains basin drainage to the site.
  - Reconfigures the pond to provide a single cell optimized for infiltration and storage and installs a new pre-treatment system.
  - Provides a new pump station and force main routed along NE 170th Street and 12th Place NE.

3.2 Hydrologic and Hydraulic Modeling

Hydrologic and hydraulic modeling was conducted for each of the alternatives to identify peak flow rates and storm volumes to evaluate the capacity and flooding potential of the existing and proposed storage and pump systems under future development conditions.

3.2.1 Methods and Assumptions

The methods and assumptions used for modeling of the alternatives are summarized as follows:

- Methodology:
  - Identify design storms:
    - For preliminary design, evaluate existing and proposed conditions using the following 10- and 25-year return periods:
      - November 23, 1990 storm, approximately a 25-year flow frequency based on continuous simulation (MGS Flood) model results – select as the candidate design storm.
      - Santa Barbra Urban Hydrograph (SBUH) Type 1A 24-hour duration, 10- and 25-year return period – evaluate for comparative purposes.

        - For the final design, facilities will be sized based on the 25-year storm and will include an evaluation of the 100-year storm to check for concerns related to excessive flooding and erosion.
    - Generate design flow event hydrograph and size bioretention facilities using MGS Flood for existing and full build-out conditions.
    - Generate 10- and 25-year event hydrographs using the SBUH method for existing and full build-out conditions.
    - Use MS Excel for storm flow routing to evaluate pumps and pond configurations.
        - Set pumping rate to 1,800 and 450 gpm for PS-26 and PS-30, respectively. Pumping rates were selected based on existing facilities (approximate pump and force main capacity).
        - Set pump-on height to 4 feet for PS-26, and 2-feet for PS-30. These heights were determined based on a preliminary analysis which evaluated multiple pump-on heights and their effect on flooding time and volume.
    - Calculate the approximate geometry of existing ponds:
        - PS-26: From satellite photo information (32,950 ft^3 detention volume).
        - PS-30: From record drawings (68,200 ft^3 detention volume).
    - Determine maximum detention and infiltration facility size based on aerial imagery and City required setbacks. Develop stage-storage curves based on an assumed 8-foot facility depth.
    - Evaluate alternatives for the November 23, 1990, and 10- and 25-year SBUH events.
- Assumptions:
    - Evaluate full build-out percent impervious areas based on future comprehensive plan land use included in 2012 City of Shoreline Comprehensive Plan as amended by the 185th Station Subarea Plan.
        - Peak flows estimated using the full build-out land use condition are typically conservative, as developers are required to implement on-site stormwater management and flow control (detention) Best Management Practices (BMPs).
    - Evaluate existing conditions percent impervious areas based on aerial imagery (this will be used to generate existing conditions storm modeling for comparison with the significantly more conservative full buildout conditions evaluated with the PS-26 alternatives).
    - Delineate drainage areas based on GIS contours, existing stormwater infrastructure, existing roads, and other mapped features.
    - Assign Hydrologic Soil Group A for pervious land use conditions within both PS-26 and PS-30 drainage basins based on the City's 2018 Surface Water Master Plan. This was selected because the Table 3-1 of the Plan stated that soils were generally "till" or Esperance Sand and Appendix E-1, Figure 6 shows significant portions of PS-26 and PS-30 drainage areas located in areas of "non-till" soils. Site specific information will be used during the design phase.

- Apply an infiltration rate of 5.5 inches per hour (in/hr) to modeled bioretention areas and proposed pond/facility bottom improvements intended to promote infiltration. This is based on Hydrologic Soil Group A soils, described above. This infiltration rate may be optimistically high and will be further evaluated during the design phase. Additional data may be available based on nearby projects. Ultimately, for final design, site specific data and Pilot Infiltration Testing will be needed.
- PS-26 upstream bioretention modeling:
  - The MGS Flood modeling completed for proposed bioretention facilities demonstrates that nearly all of the stormwater runoff contributing to those facilities is infiltrated with no flow continuing to the downstream system. To account for this in the SBUH calculations for preliminary design of pump station facilities, omit the surface area of the sub-basins where the bioretention facilities are located. Final design will include revised bioretention design based on site soil and groundwater conditions, space available with respect to nearby development, and storm flow routing through the proposed bioretention facility.
  - SCL property bioretention facility geometry:
    - 460-foot length by 25-foot top width, 16-foot bottom width;
    - 1-foot ponding depth, 6-inch freeboard depth; and
    - 3:1 side slopes.
  - Rotary Park property bioretention facility geometry:
    - 200-foot length by 20-foot top width, 11-foot bottom width;
    - 1-foot ponding depth, 6-inch freeboard depth; and
    - 3:1 side slopes.

3.2.2 PS-26 Results

Model results for the existing pond and Alternatives 1, 2, and 3 with and without bioretention are presented in Table 3-1 and Table 3-2. Alternatives 1 and 2 are presented together because the pond and vault have the same detention volume. All alternatives result in significantly less flooding compared to the existing pond. With the upstream bioretention systems included in the modeling the storm volumes are reduced significantly and they eliminate flooding during 10-year flow events for each alternative. Without bioretention, only the 10-year event under existing development conditions can be managed by Alternatives 1 and 2 without flooding.

In general, the peak of the SBUH event hydrograph rises and falls over a longer period than the November 23, 1990 event. In relation to flooding, the SBUH events typically overtop the pond for longer periods but have lower flooding volumes compared to the November 23, 1990 event, as the pumps are better able to keep pace with the longer, drawn out character of the SBUH hydrograph, whereas the November 23, 1990 event experienced such high flows that the storage volume was quickly filled and the pumps were overwhelmed. The addition of upstream bioretention only results in a small reduction in time overtopped for the November 23, 1990 event because, while the storm volume is reduced, the hydrograph retains the same shape and the peak flow overwhelms the infiltration rates in the bioretention swales, resulting in significantly less storm volume reduction than the SBUH based events. The November 1990

storm is a notable event in the Puget Sound and is known to have caused considerable flood damage in the region. Reported model results provide useful information for potential flood-related impacts during significant storm events.

3.2.3 PS-30 Results

Alternative 1 would require installing a new 24-inch diameter gravity pipeline at approximately 0.5% slope to convey the 25-year flow event and tie in with the existing gravity stormwater system downstream of PS-30. This alternative would allow approximately 75% of the drainage basin to bypass the pond and pump station and flow by gravity into the downstream system. However, the condition and capacity of the downstream system are not known, so routing the full hydrograph through this system could result in downstream flooding. Also, a portion of the PS-30 basin directly north of the pump station is located within an isolated depression and gravity flow from this area does not appear feasible. Thus, the pump station, in some form, would still be needed. Given the uncertainties, flooding risks, significant costs, and limited benefit, this alternative was discontinued and was not evaluated further.

Table 3-1
Pump Station 26: Existing Pond, Alternatives 1, 2, and 3 Modeled without Regional Bioretention

Storm Event	Land Cover Condition	Cumulative Storm Volume ft^3	Time Pond Overtopped (hrs)			Volume Flooding (ac-ft)		
			Exist. Pond (storage vol: 32,950 ft^3)	Alt. 1 & 2 (storage vol: 86,400 ft^3)	Alt. 3 (storage vol: 66,350 ft^3)	Exist. Pond (storage vol: 32,950 ft^3)	Alt. 1 & 2 (storage vol: 86,400 ft^3)	Alt. 3 (storage vol: 66,350 ft^3)
Nov 23, 1990	Full Build-Out	750,351	9.8	8.0	8.3	8.0	6.3	6.5
SBUH 10-year	Existing	414,390	5.2	0.0	2.3	0.9	0.0	0.2
SBUH 25-year	Existing	714,523	13.7	9.3	9.5	5.3	3.9	4.1
SBUH 10-year	Full Build-Out	472,072	6.5	3.7	4.2	1.7	0.5	0.8
SBUH 25-year	Full Build-Out	781,166	16.8	9.8	10.0	6.3	4.8	5.0

Table 3-2
Pump Station 26: Existing Pond, Alternatives 1, 2, and 3 Modeled with Regional Bioretention

Storm Event	Land Cover Condition	Cumulative Storm Volume ft^3	Time Pond Overtopped (hrs)			Volume Flooding (ac-ft)		
			Exist. Pond (storage vol: 32,950 ft^3)	Alt. 1 & 2 (storage vol: 86,400 ft^3)	Alt. 3 (storage vol: 66,350 ft^3)	Exist. Pond (storage vol: 32,950 ft^3)	Alt. 1 & 2 (storage vol: 86,400 ft^3)	Alt. 3 (storage vol: 66,350 ft^3)
Nov 23, 1990	Full Build-Out	605,185	9.5	8.0	8.5	6.6	5.0	5.3
SBUH 10-year	Existing	205,125	0.0	0.0	0.0	0.0	0.0	0.0
SBUH 25-year	Existing	352,713	1.8	0.0	0.7	0.6	0.0	0.1
SBUH 10-year	Full Build-Out	236,557	0.0	0.0	0.0	0.0	0.0	0.0
SBUH 25-year	Full Build-Out	388,857	2.8	0.8	1.2	0.9	0.2	0.4

PS-30 Alternative 2 model results are included in Table 3-3. Flooding occurs during all storm events, with a maximum flooded volume of 5.30 ac-ft for the November 23, 1990 event. The SBUH 10-year storm event has a lower cumulative storm volume and less flooding volume compared to the November 23, 1990 storm event, yet it is overtopped longer. These differences are due to the shape of the hydrographs: the peak of the SBUH event hydrograph rises and falls over a longer period than the November 23, 1990 event. Because the SBUH hydrograph is spread out over a longer period, the pumps are better able to control the flows and reduce the flooding volume.

Table 3-3
Pump Station 30 Results: Alternative 2

Storm Event	Land Cover Condition	Cumulative Storm Volume (ft^3)	Time Pond Overtopped (hrs)	Volume Flooding (ac-ft)
Nov 23, 1990	Full Build-Out	381,738	10.5	5.3
SBUH 10-year	Full Build-Out	272,444	13.8	1.1
SBUH 25-year	Full Build-Out	456,045	15.8	4.1

3.3 Alternatives Evaluation and Recommendations

3.3.1 PS-26

Without bioretention, the alternatives reduce the volume of flooding by over one acre-foot during the November 23, 1990 design event. Alternatives 1 and 2 reduce flooding volumes by an additional 0.2 acre-feet compared to Alternative 3. Flooding durations are reduced by over an hour for all alternatives. In general, all three alternatives result in a large decrease in flooding compared to the existing pond geometry. The difference in flooding between the alternatives is comparatively minor, as shown in Tables 3-1 and 3-2. A planning level OPPC was developed for the three alternatives. The OPPC for Alternative 1 is $2,950,000, Alternative 2 is $3,250,000, and Alternative 3 is $2,700,000. Due to relative similarities in performance between Alternatives, Alternative 3 is recommended because it is less expensive than Alternatives 1 and 2, and it will allow the City to preserve and enhance the park area at this site.

Bioretention would be beneficial to any of the alternatives, as it results in reduced storm volumes and less potential for flooding at the pump station regardless of the alternative selected and will also provide an additional water quality benefit for the drainage basin.

3.3.2 PS-30

Alternative 1 was eliminated based on uncertainties, cost, and limited benefits.

Alternative 2 optimizes the existing pond for infiltration and could potentially increase storage capacity. This would increase flow attenuation, reduce flooding, provide water quality benefits, and not require utility work within the 15th Avenue NE roadway. Furthermore, rerouting the force main along NE 170th Street and tying into the existing gravity conveyance system in 12th Place NE eliminates the need for the existing force main which is routed through backyard easements and improves reliability and access for operations and maintenance. For these reasons, Alternative 2 is recommended for PS-30.

4. Recommended Improvements

This section presents the recommended improvements for each of the eight stormwater pump stations. These improvements are based on the preliminary recommendations presented in the Existing Conditions Review Memorandum and the SCADA Evaluation Memorandum, and the updated recommendations developed through the alternative evaluations for PS-26 and PS-30 in this report and workshops with District staff. The recommended improvements for each pump station are presented in this section together with figures to illustrate the improvements, and the opinion of probable project costs (OPPC) for those improvements. The OPPC values include costs for construction, planning, design, and construction administration with contingencies. The detailed OPPCs are included in Appendix C.

4.1 Common Improvements

Several improvements are common to all pump stations and are included here to avoid duplication with the discussion of each facility. These common improvements are as follows:

- Installing information and no parking signs:
  - Information signs will include the City logo, pump station name, and emergency contact phone number.
  - The "no parking" signs will be placed in strategic locations for best visibility.
  - Depending on the pump station layout and location, the information and parking signs may be placed on the same support pole. The sign locations and configuration will be determined during the design phase.
- Providing safety and emergency response improvements:
  - Safety grates will be added over wetwells and valve vaults where they do not currently exist, and where the pumps are not located in a catch basin.
  - Post mounts will be provided to accommodate davit cranes (Miller Durahoist) for equipment removal and emergency extraction at wetwells where the pumps are not located in a catch basin.
  - Pump station forcemains will be configured to provide a connection with an isolation valve downstream of the installed pumps to allow for connection of a portable pump.
  - Generator receptacles and transfer switches will be provided at stations which do not have generators (excluding Linden and Palatine). Two different generator receptacle types will be required to accommodate pump stations with single-phase utility power (120/240V) and three-phase utility power (480V).
- Installing shelters for electrical and control cabinets:
  - A prefabricated metal shelter will be installed to cover the electrical and control panels. The shelters may be a two- or four-post system. In locations where the electrical and control panels are separated, one large or two small shelters will be installed.
  - The shelter posts will be secured with concrete footings. A concrete pad will be provided at the electrical and control panels under the shelter where there is not an existing pad of paved area.

- Providing SCADA:
  - Mission Communications MyDro 150 terminal units will be added to the pump stations to provide remote monitoring and alarm annunciation. The installation at each station will be configured as presented SCADA Evaluation Memorandum (Appendix B) to optimize monitoring and protection of the pump station equipment. Equipment installation configuration will focus on protection of the MyDro hardware and antennas from vandalism.
  - Existing local beacons and remote alarm notification systems will be disabled and removed, where they are currently in use.
  - Intrusion detection switches will be added at all control panels and vault hatches.
- Preparing arc-flash evaluation and code classification document for each facility:
  - Arc flash energy and available fault currents will be calculated for equipment labelling and identification of suitable personal protective equipment (PPE) for individuals working on that equipment. Electrical arc flash incident energies will be calculated during design and updated upon completion of work in accordance with procedures described in the occupational safety rules.
  - For the code classification document, Washington State Rules require a licensed engineer and authority having jurisdiction, generally the Fire Marshal, to evaluate and designate areas with a risk from explosive atmospheres. Stormwater collection systems require such an evaluation. Standards from the National Fire Protection Association (NFPA) will be used to perform the analysis during design to ensure equipment is suitably rated.

4.2 Linden

The improvements to the Linden pump station were identified based on the on-site review of the station and discussion with City staff in conjunction with the recommendations of the 2016 condition assessment. The primary differences from the recommendations of the 2016 condition assessment are the replacement of the infiltration system at this site, improvements intended to limit floating debris entering the pump station and the infiltration system, and replacement of the existing pump. The facility specific improvements are as follows:

- Replace the existing catch basin (CB) with a new CB (roadside) and install second new CB with a new pump (retain the existing pump as a spare kept in storage) and high-level float for alarming. A 12-inch pipe will connect the two CBs. The pipe end in the roadside CB will be fitted with a down-turned 90-degree bend to reduce floating debris from entering the pump station CB.
- Install a high-level float in the pump station CB to provide an alarm to the SCADA system.
- Connect the new pump discharge to the existing force main.
- Relocate the electrical panel together with the new SCADA cabinet under the new shelter.
- Excavate and replace the existing infiltration pipe and trench system. The trench is approximately 75 feet in length. The new perforated infiltration pipe will be fitted with a down-turned 90-degree bend in each of the CBs to reduce floating debris from entering the infiltration pipe. The exact configuration of the infiltration system will be determined during detailed design. Mesh screens will be considered for installation on the inlets to the infiltration pipe during detailed design.

The recommended improvements are shown in Figure 4-1 and Figure 4-2, and the OPPC for these improvements is $90,000.

4.3 Palatine

Improvements at the Palatine pump station are generally consistent with the recommendations from the 2016 condition assessment. The facility specific improvements (not including the common items) are as follows:

- Add a high-level float in the pump station CB to provide an alarm to the SCADA system.
- Install a new pump and retain the existing pump as a spare.
- Relocate the electrical panel together with the new SCADA cabinet under the new shelter and reconfigure the electrical pathway to remove the existing conduits from the catch basin adjacent to the pump.

The recommended improvements are shown in Figure 4-3, Figure 4-4, and Figure 4-5, and the OPPC for these improvements is $51,000.

4.4 Ronald Bog

The Ronald Bog pump station was initially implemented as a temporary measure and is infrequently utilized, but some improvements are still required in the short term until a more permanent solution is designed and funded. The short-term improvements expand on the recommendations from the 2016 condition assessment, with the recommendation of providing utility power for the control system. The short-term facility specific improvements (not including the common items) are as follows:

- Install a high-level float in the pump station catch basin and provide an alarm.
- Provide a single phase (120V) electrical utility service to the site to increase reliability over the existing solar system, support the SCADA system and allow for use of the block heater for the diesel engine.

The recommended short-term improvements are shown in Figure 4-6, Figure 4-7, Figure 4-8, Figure 4-9, and Figure 4-10, and the OPPC for these improvements is $72,000. Beyond these short-term improvements, the current portable pump arrangement is recommended to be replaced with a permanent submersible pump station similar to the recommended PS-30 station or a gravity alternative. The order of magnitude OPPC for that work would be approximately $1.3-1.8M, depending upon the size of wetwell or storage required. Additional analysis would be required to determine the feasibility and OPPC for a gravity alternative.

4.5 Pan Terra

The Pan Terra pump station is one of the newer stations and it requires only limited improvements, which are consistent with the recommendations from the 2016 condition assessment. The facility specific improvements (not including the common items) are as follows:

- Installation of intrusion switches to provide an alarm to the SCADA system at the following locations:
  - Generator access door;

  - Pump station vault hatch; and
  - Valve vault hatch.
- Add rock to the existing access road.
- Install portable concrete barriers to protect the generator and electrical equipment from potential vehicle impacts.
- Add davit bases and portable pump connection to the forcemain.
- Add lift cylinders on the pump station vault and valve vault hatch doors to assist with opening and closing the heavy doors.
- Repair the concrete cable trough where it is cracked and separated.
- Install pressure gauges the discharge header in the valve vault.

The recommended improvements are shown in Figure 4-11, Figure 4-12, Figure 4-13, Figure 4-14, and Figure 4-15, and the OPPC for these improvements is $88,000.

4.6 Serpentine

The Serpentine pump station is located in the shoulder of the road. The future zoning for this area includes a roadway expansion for this road, which may require a full replacement of the pump station to move it outside of the roadway. A gravity diversion or alternative pumping alternatives may be feasible and would likely be evaluated as part of the future road expansion project.

Some of the primary concerns at this station relate to surface water and debris flow around the pump station structures. The recommendations for this station are consistent with the recommendations from the 2016 condition assessment. The facility specific improvements (not including the common items) are as follows:

- Install a low-level curb around the wetwell and vault to divert shoulder runoff around the hatches.
- Replace and protect the wire splices located in the handhole between the wetwell and the control panel.
- Provide safety and emergency response improvements including davit bases, portable pump connection, and replacement of the generator receptacle.
- Provide safety grating over pump station and the valve vault openings for personnel safety when the hatches are open. The safety grating system would be similar to that used at the Pan Terra pump station.

The recommended improvements are shown in Figure 4-16, Figure 4-17, Figure 4-18, and Figure 4-19, and the OPPC for these improvements is $64,000.

4.7 PS-25

PS-25 is another newer pump station, and it requires limited improvements, which are consistent with the recommendations from the 2016 condition assessment, but it also requires some additional review and maintenance. The control system programming needs to be reviewed to resolve some pump starter issues, and both pumps are currently scheduled for inspection and rebuild based on seal failure alarms and operational issued identified in February 2020. The facility specific improvements (not including the common items or the pump rebuilds) are as follows:

- Install metal railing behind pump station at the top of the detention pond's slope for safety purposes.
- Provide erosion control on detention pond's steep slopes.
- Provide safety grating over pump station wetwell opening for personnel safety when the hatches are open. The safety grating system would be similar that used at the Pan Terra pump station.
- Provide safety and emergency response improvements including davit bases, portable pump connection, and replacement of the generator receptacle.
- Locate buried isolation valves and test for operation and seating performance.

The recommended improvements are shown in Figure 4-20, Figure 4-21, Figure 4-22, Figure 4-23, and Figure 4-24, and the OPPC for these improvements is $84,000.

4.8 PS-26

The PS-26 mechanical and electrical equipment has reached or exceeded the end of its useful life and requires a full replacement. Additionally, property research has identified that the existing pump station and a portion of the existing pond are located in an easement on the adjacent property, and the City has determined that improvements to this system shall include removing City facilities from the easement with the exception of the pump station forcemain, which is also routed through this property. Alternatives for the replacement system configuration were developed and evaluated in Section 3, and the recommendations from that evaluation are incorporated into the following facility specific improvements:

- New pump station facilities will be located near the north east corner of the property to facilitate access and maintenance from 10th Avenue NE.
- New 12-foot precast wet well, with two new submersible solids handling pumps on variable frequency drives, in a lead-standby configuration, with a duty point of approximately 1,800 gpm and 24 feet total dynamic head (TDH). Wetwell and pump sizing will be verified during final design.
- New electrical, instrumentation, and controls equipment, including variable frequency drives and transfer switch and interconnection with the existing LS-15 generator.
- New piping from the pond/infiltration gallery to the wet well.
- New 12-inch force main connecting to the existing force main at the location of the existing pump station. Pump discharge pipes will connect to the new forcemain through check valves and isolation valves located in a below-grade valve vault. The forcemain will also be configured to accommodate connection to a future force main located in 10th Avenue NE. The new force main is expected to be constructed in conjunction with future wastewater LS-15 improvements at the same site.

- New storage/infiltration gallery using large diameter perforated pipes, maximizing the available footprint and including subgrade improvements to promote infiltration.
- New pre-treatment system consisting of a vortex solids separator at the storage/infiltration gallery inlet to reduce quantity of solids entering infiltration system in order to prolong operational life and reduce maintenance requirements.
- Remove pump station facilities except the forcemain within the easement on the adjacent parcel to the north (Parcel 6163900111) and backfill the existing pond where it extended onto this property.
- Provide open park space (lawn) over the infiltration gallery and frontage improvements along 10th Avenue NE which may include but not be limited to landscaping, sidewalk, gutter, and driveway for pump station and pre-treatment system access.

The recommended improvements are shown in Figure 4-25 and Figure 4-26, and the OPPC for these improvements is $2.7M.

4.9 PS-30

The PS-30 mechanical equipment has reached or exceeded the end of its useful life and requires a full replacement. Alternatives for the replacement system configuration were evaluated in Section 3, and the recommendations from that evaluation are incorporated into the following facility specific improvements:

- New pump station facilities will be located near the northwest corner of the property to facilitate access and maintenance from NE 170th Street.
- New 8-foot precast wet well, with two new submersible solids handling pumps on variable frequency drives, in a lead-standby configuration, with a duty point of approximately 450 gpm and 15 feet TDH. Wetwell and pump sizing will be verified during final design.
- New electrical, instrumentation, and controls equipment, including variable frequency drives and transfer switch and generator receptacle.
- New pre-treatment system consisting of a vortex solids separator at the storage/infiltration pond inlet to reduce quantity of solids entering infiltration system in order to prolong operational life and reduce maintenance requirements.
- New 8-inch force main to be located within the right-of-way (shoulder) of NE 170th Street and 12th Place NE and discharging into the existing gravity storm sewer at the northeast corner of NE 169th Street and 12th Place NE.
- Regrade the area of the existing access ramp to provide a terrace where the new pump station wetwell and valve vault will be located.
- New pond inlet and outlet piping to prevent short circuiting.
- Rehabilitate the existing pond by removing accumulated solids, removing the baffle wall, preparing the subgrade and providing soil improvements as needed to promote infiltration and enhance water quality treatment.
- Provide frontage improvements along NE 170th Street, which may include but not be limited to landscaping, sidewalk, gutter, and driveway for pump station and pre-treatment system access.

The recommended improvements are shown in Figure 4-26 and Figure 4-27, and the OPPC for these improvements is $1.8M.

5. Project Implementation

The implementation of the individual pump station improvement projects must be coordinated with the urgency of the identified improvements, the available funding, and the size and type of work. The following options for implementation were identified for consideration:

- Single Project – Implement improvements for all facilities as a single project.
- Two Projects (Alternative A):
  - Combine smaller pump station improvements including SCADA (all stations except PS-26 and PS-30).
  - Combine PS-26 and PS-30 as a single project.
- Two Projects (Alternative B):
  - PS-26 as a stand-alone project.
  - Combine PS-30 and smaller pump station improvements including SCADA (all stations except PS-26)
- Three Projects:
  - Combine smaller pump station improvements including SCADA at (all stations excluding PS-26 and PS-30).
  - PS-26 as stand-alone project.
  - PS-30 as a stand-alone project.

5.1 Limitations and Drivers

The known limitations and drivers for these projects are as follows:

- Budget limitations:
  - $1M is currently budgeted for 2020 for design and construction work related to the stormwater pump station improvements.
  - The overall budget has not been fully determined as the estimates included in this document are needed to help define that amount. The current estimated costs are significantly greater than what was identified in the 2016 condition assessment.
- Schedule limitations and drivers:
  - Work at PS-26, PS-30, and Linden pump station should be completed outside of the wet season.
  - PS-26 has had some mechanical issues during the fall of 2019, which has prioritized this pump station for replacement.
  - The design and permitting efforts for PS-26 and PS-30 are much larger than for all of the other smaller pump stations combined, and the earliest these projects could be constructed in the dry season is 2021.

5.2 Implementation Recommendations

The various implementation alternatives have been reviewed in conjunction with the budget and schedule limitations. In order to prioritize the PS-26 replacement, the following implementation approach is recommended:

- 2020:
  - Engineering: Complete studies, design, and permitting for PS-26 improvements.
  - Approximate budget for Engineering: $400,000.
- 2021:
  - Engineering: Design smaller pump station improvements including SCADA.
  - Construct PS-26 improvements.
  - Approximate budget for Engineering: $66,000.
  - Approximate budget for Capital and CM: $2.30M.
- 2022:
  - Engineering: Complete studies, design, and permitting for PS-30 improvements.
  - Capital and CM: Construct smaller pump station improvements including SCADA as a single project.
  - Approximate budget for Engineering: $267,000.
  - Approximate budget for Capital and CM: $383,000.
- 2023:
  - Capital and CM: Construct PS-30 improvements.
  - Approximate budget for Capital and CM: $1.53M.

Figure 5-1 provides a Gantt-type preliminary implementation schedule, showing the major activities and estimated time.

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FIGURES

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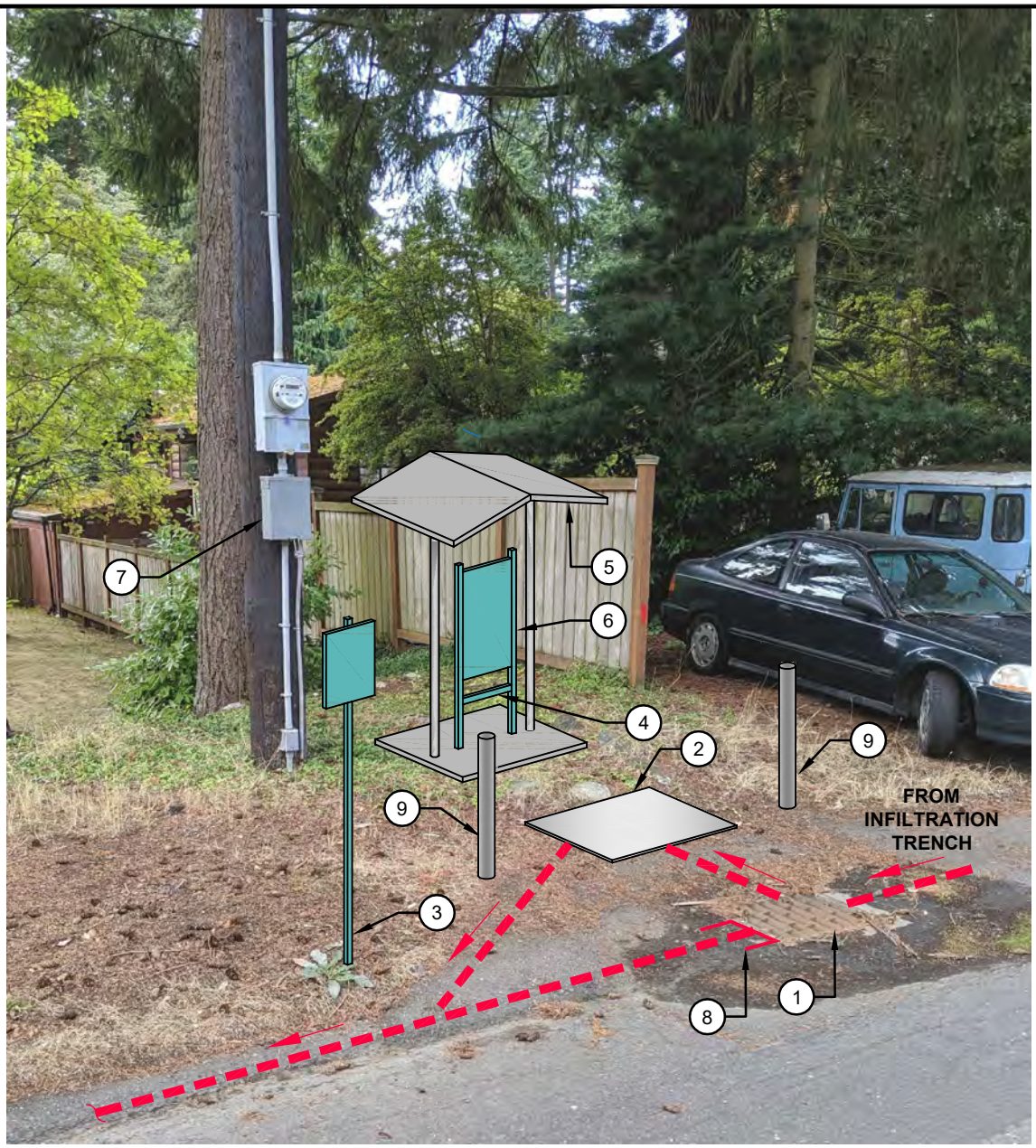

CONSTRUCTION NOTES

1. REPLACE CB AND MOVE PS
2. INSTALL NEW CB / MH PS
3. INSTALL INFO AND NO PARKING SIGNS
4. CONSTRUCT STRUT SUPPORT FRAME
5. CONSTRUCT SHELTER
6. NEW SCADA W/ CABINET
7. MOVE CIRCUIT BREAKER TO STRUT FRAME
8. DISCONNECT EFFLUENT PIPE AND PLUG
9. INSTALL BOLLARDS

DRAFT
05-2020

BHC CONSULTANTS

CITY OF SHORELINE

Linden PS
Improvement Recommendations
SW Pump Stations & SCADA
May 2020

Figure
4-1

CONSTRUCTION NOTES

1. MODIFY CB OUTLET TO REDUCE AND / OR COLLECT DEBRIS
2. REHAB INFILTRATION TRENCH

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03-2020

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CITY OF SHORELINE

Linden PS
Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-2

CONSTRUCTION NOTES

1. ADD HIGH LEVEL FLOAT IN PS
2. INSTALL NEW PUMP

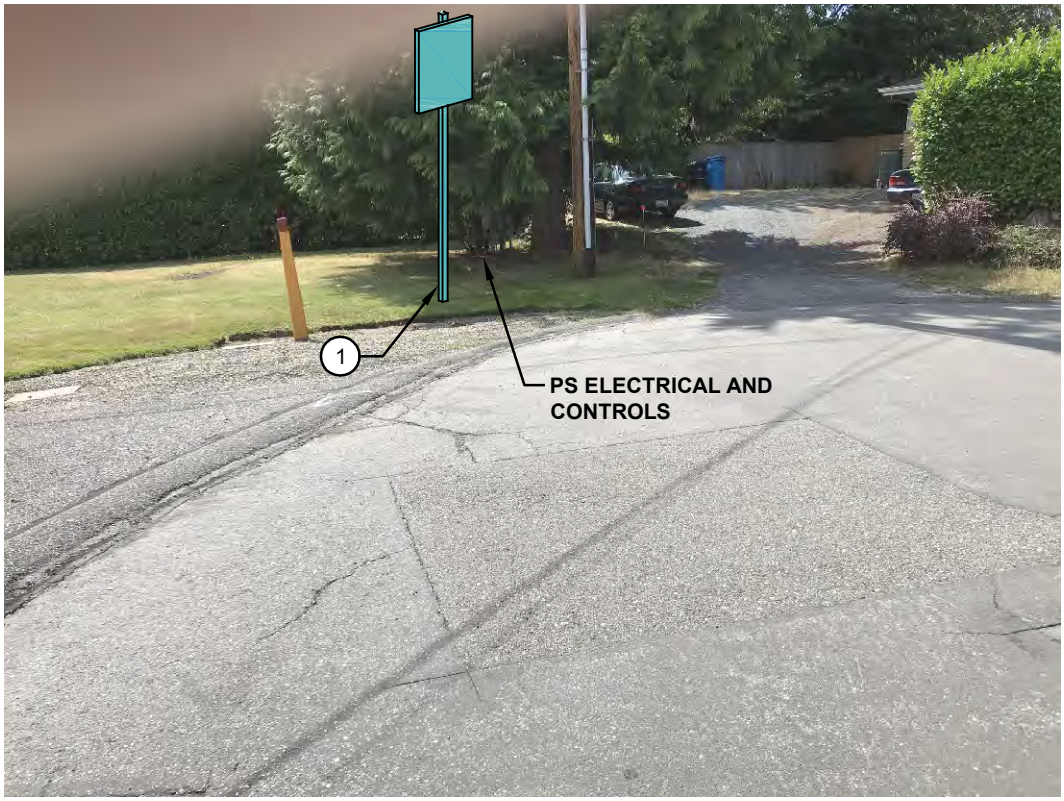
DRAFT
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Palatine PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-3



CONSTRUCTION NOTES

(1) INSTALL INFO AND NO PARKING SIGNS

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CITY OF SHORELINE

Palatine PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-4

CONSTRUCTION NOTES

1. INSTALL SCADA W / CABINET
2. CONSTRUCT SHELETER

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03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Palatine PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-5

CONSTRUCTION NOTES

1 INSTALL INFO AND NO PARKING SIGN

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03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Ronald Bog PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-6

CONSTRUCTION NOTES

(1) INSTALL SCADA IN GENERATOR / CONTROL CABINET

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CITY OF SHORELINE

Ronald Bog PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-7

CONSTRUCTION NOTES

(1) PROVIDE HIGH LEVEL FLOAT IN CB PS

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03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Ronald Bog PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-8

CONSTRUCTION NOTES

(1) INSTALL INFO SIGN

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BHC CONSULTANTS

CITY OF SHORELINE

Ronald Bog PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-9

CONSTRUCTION NOTES

(1) ELECTRICAL UTILITY SERVICE.

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05-2020

BHC CONSULTANTS

CITY OF SHORELINE

Ronald Bog PS Improvement Recommendations
SW Pump Stations & SCADA
May 2020

Figure
4-10

CONSTRUCTION NOTES

(1) INSTALL INFO AND PARKING SIGN

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03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Pan Terra PS
Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-11

CONSTRUCTION NOTES

1. INSTALL SHELTERS AT ELECTRICAL AND CONTROL PANELS
2. ADD INTRUSION SWITCH TO GENERATOR DOOR
3. INSTALL CONCRETE BARRIERS ON THE OUTSIDE OF THE FENCE.

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05-2020

BHC CONSULTANTS

CITY OF SHORELINE

Pan Terra PS Improvement Recommendations
SW Pump Stations & SCADA
May 2020

Figure
4-12

CONSTRUCTION NOTES

(1) INSTALL SCADA

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BHC CONSULTANTS

CITY OF SHORELINE

Pan Terra PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-13

CONSTRUCTION NOTES

(1) INSTALL HATCH LIFT CYLINDERS ON PUMP AND VALVE VAULT DOORS

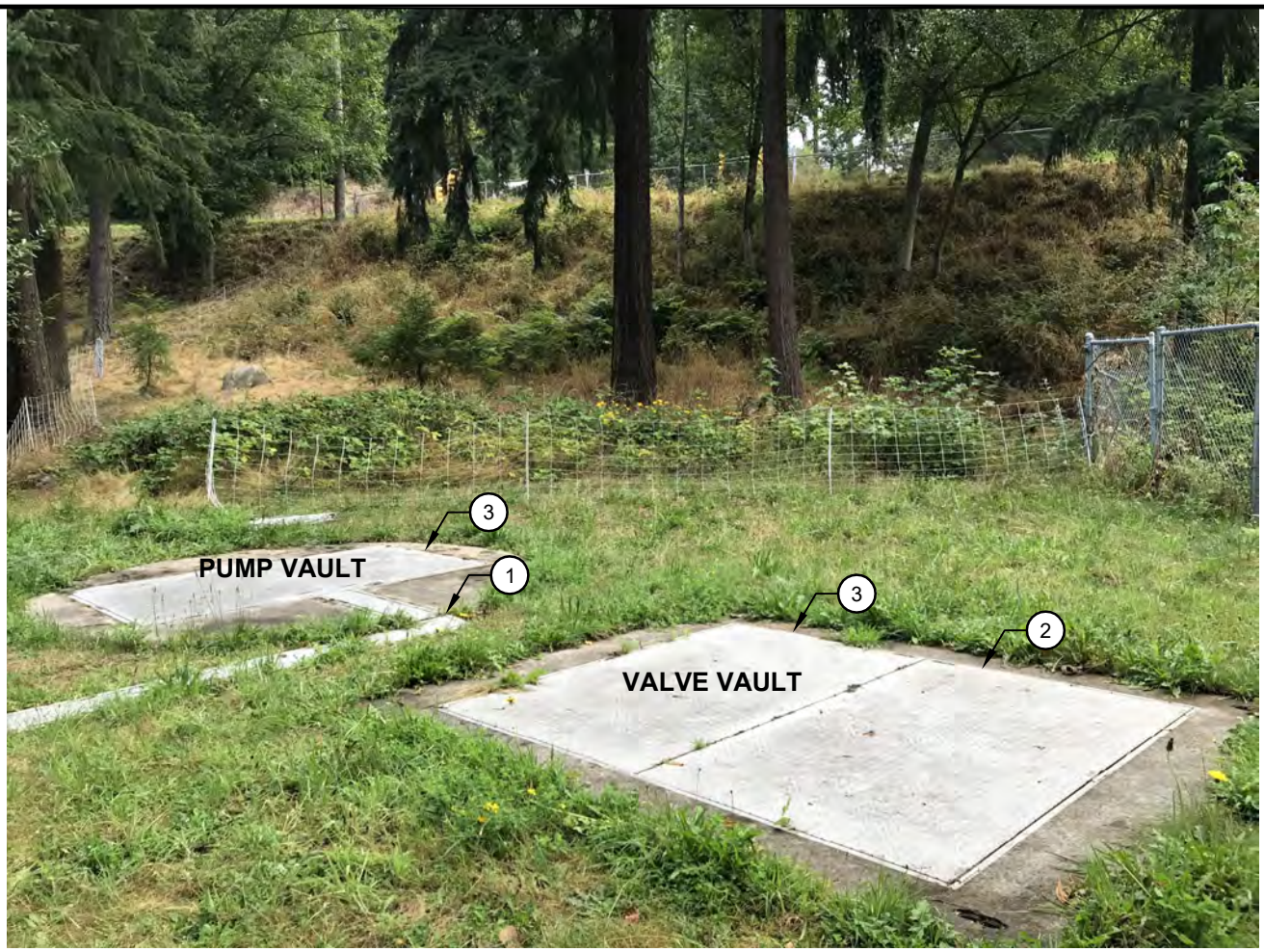
DRAFT
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Pan Terra PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-14



CONSTRUCTION NOTES

1. REPAIR CABLE TROUGH
2. ADD PRESSURE GAUGES ON PIPING IN VALVE VAULT
3. ADD INTRUSION SWITCHES

DRAFT
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Pan Terra PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-15

CONSTRUCTION NOTES

(1) CONSTRUCT LOW-RISE WATER DIVERSION CURB AROUND VAULTS

DRAFT
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Serpentine PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-16

CONSTRUCTION NOTES

(1) INSTALL SAFETY GRATING AT WET WELL

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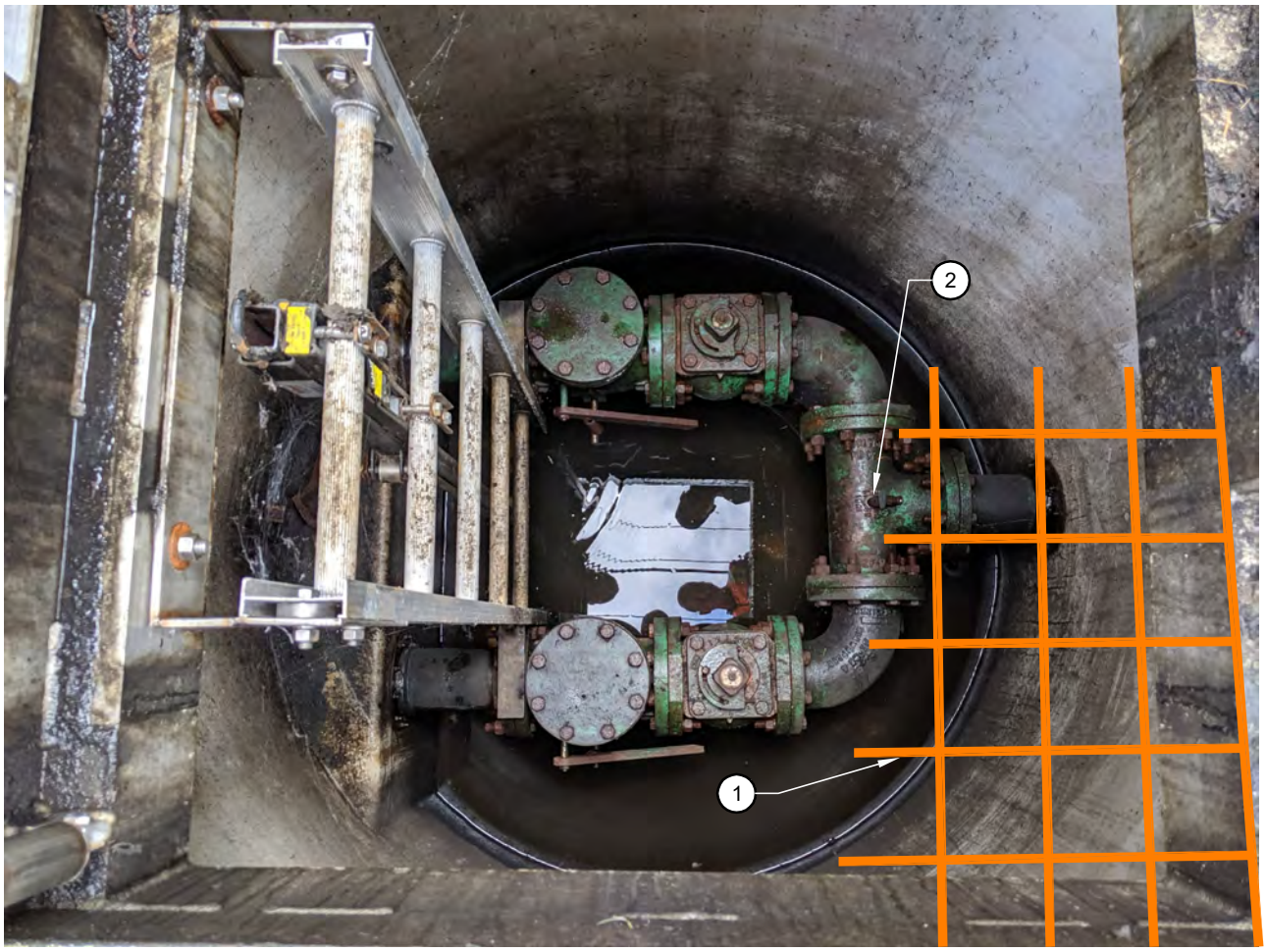
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Serpentine PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-17



CONSTRUCTION NOTES

1. INSTALL SAFETY GRATING AT VALVE VAULT
2. INSTALL PRESSURE GAUGE

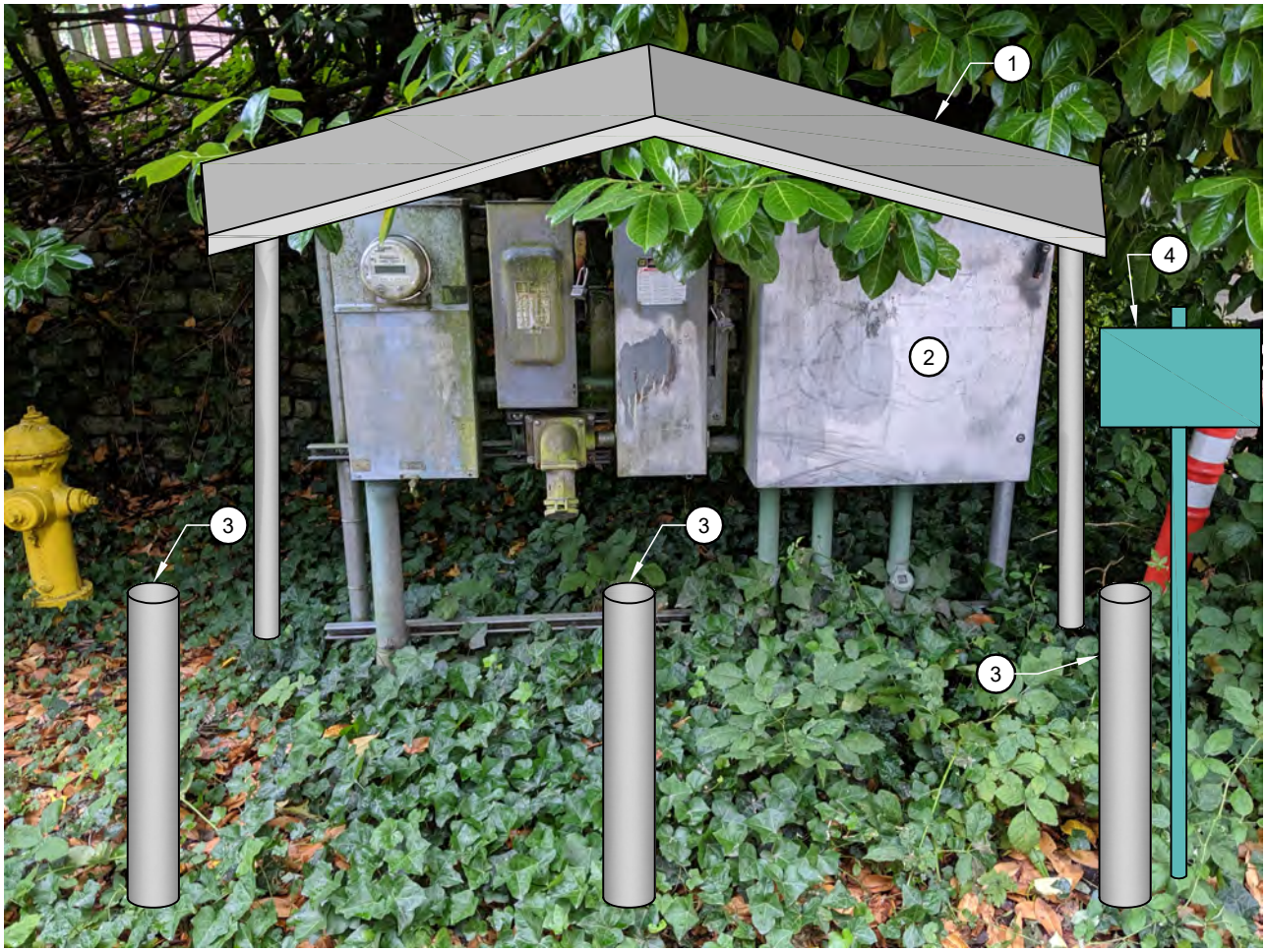
DRAFT
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Serpentine PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-18



CONSTRUCTION NOTES

1. INSTALL SHELTER
2. ADD SCADA
3. INSTALL BOLLRDS
4. INSTALL INFORMATION AND PARKING SIGNS

DRAFT
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

Serpentine PS Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-19

CONSTRUCTION NOTES

1. INSTALL INFO AND NO PARKING SIGNS
2. LOCATE BURIED ISOLATION VALVES

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03-2020

BHC CONSULTANTS

CITY OF SHORELINE

PS 25
Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-20

CONSTRUCTION NOTES

1 CONSTRUCT SHELTER

DRAFT
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

PS 25
Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-21

CONSTRUCTION NOTES

1. INSTALL SCADA
2. TROUBLESHOOT CONTROL PANEL

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03-2020

BHC CONSULTANTS

CITY OF SHORELINE

PS 25
Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-22

CONSTRUCTION NOTES

1 INSTALL SAFETY GRATING AT WET WELL

DRAFT
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

PS 25
Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-23

CONSTRUCTION NOTES

1. INSTALL SAFETY RAILING
2. PROVIDE EROSION CONTROL ON DETENTION POND'S ON STEEP SLOPES

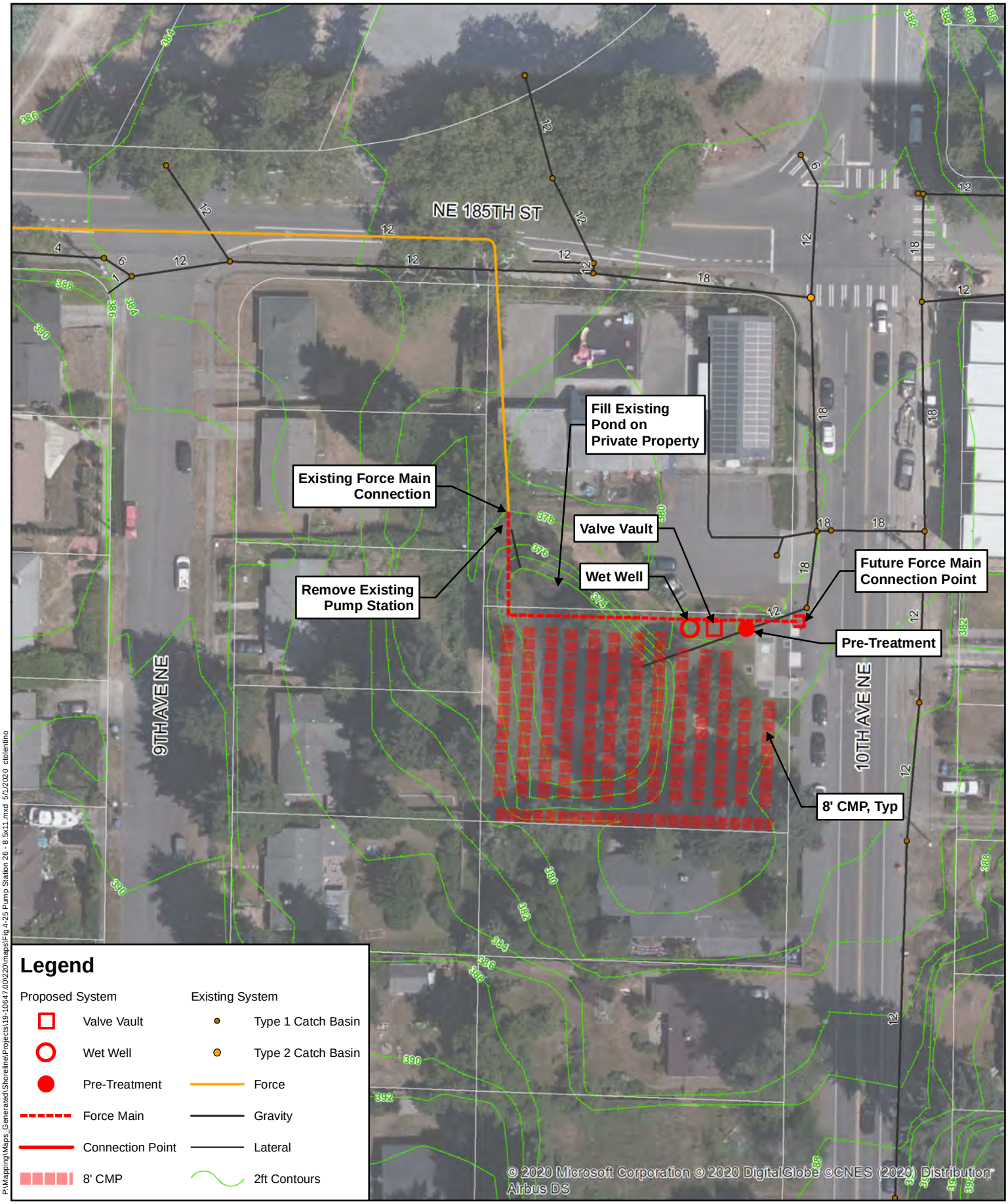
DRAFT
03-2020

BHC CONSULTANTS

CITY OF SHORELINE

PS 25
Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-24



Legend

Proposed System	Existing System
Valve Vault	Type 1 Catch Basin
Wet Well	Type 2 Catch Basin
Pre-Treatment	Force
Force Main	Gravity
Connection Point	Lateral
8' CMP	2ft Contours

P:\Mapping\Maps_Generated\Shoreline\Projects\19-10647.00\220\maps\Fig 4-25 Pump Station 26 - 8.5x11.mxd 5/1/2020 ctolentino

This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

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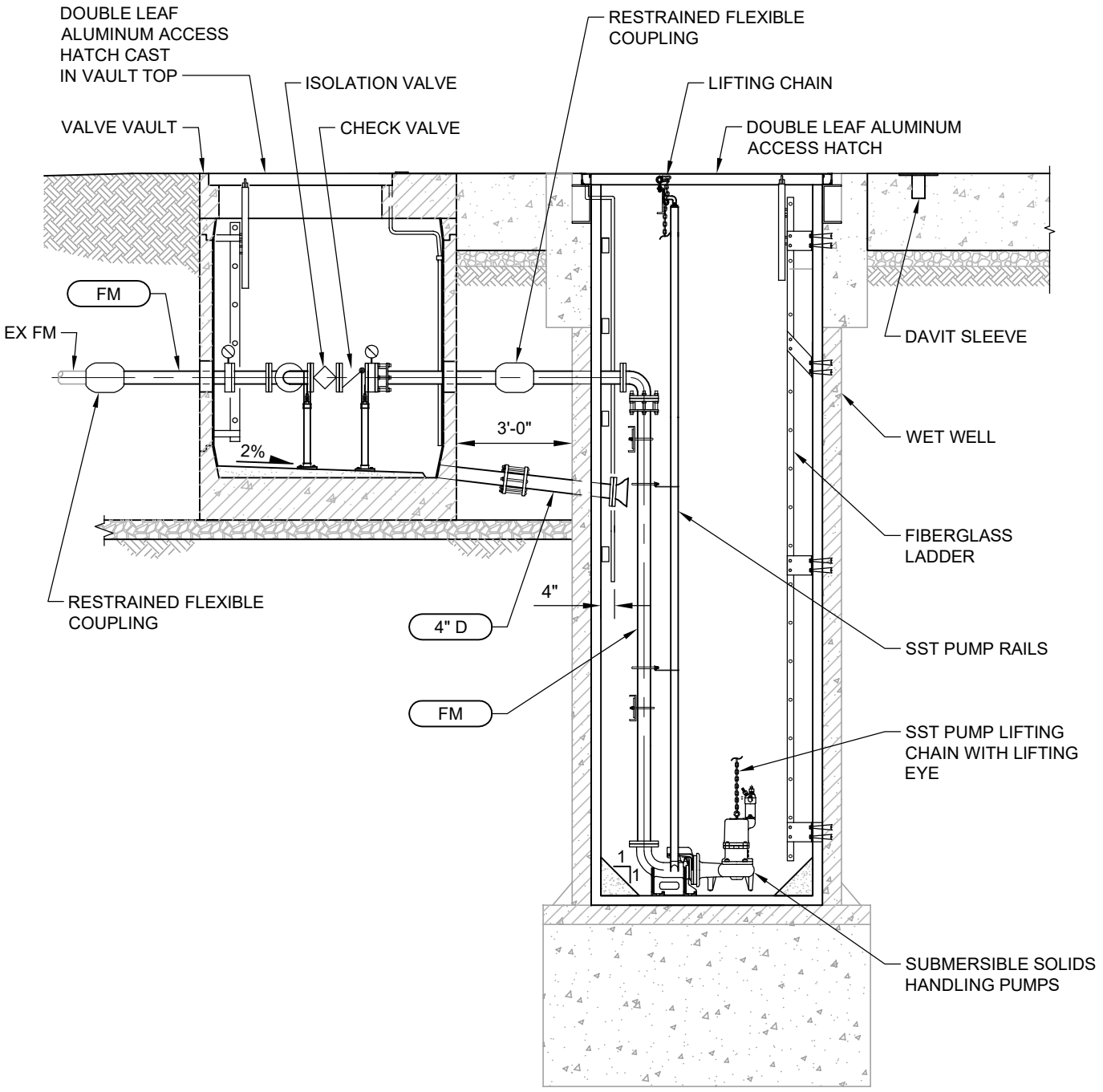
0 30 60 Feet

N

CITY OF SHORELINE

Pump Station 26
Improvement Recommendations
City of Shoreline, Washington
May 2020

Figure 4-25



SECTION

SCALE: 1/4" - 1'-0"

DRAFT

03-2020

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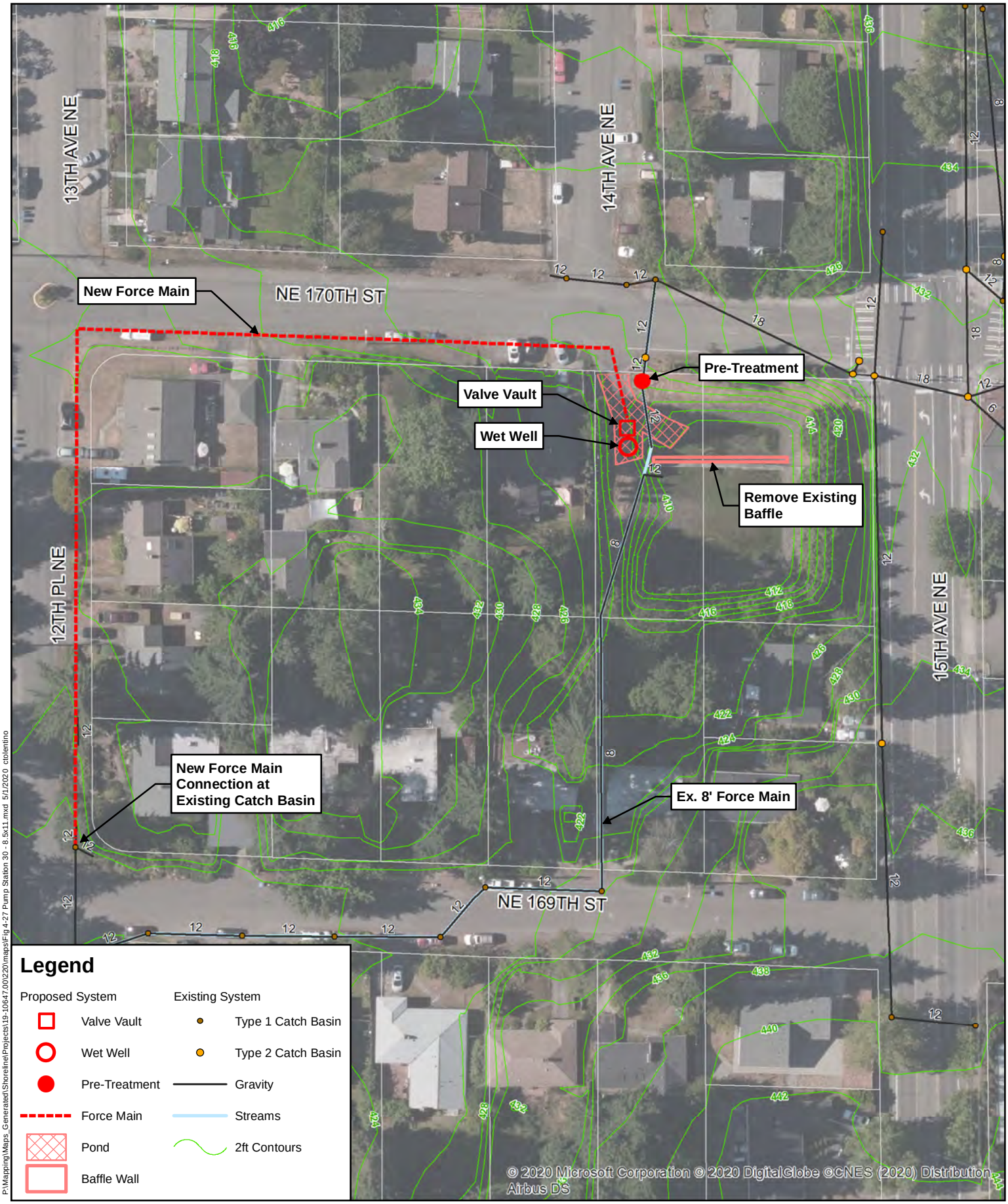
CITY OF SHORELINE

PS-26 AND PS-30
Improvement Recommendations
SW Pump Stations & SCADA
March 2020

Figure
4-26



Legend

Proposed System	Existing System
Valve Vault	Type 1 Catch Basin
Wet Well	Type 2 Catch Basin
Pre-Treatment	Gravity
Force Main	Streams
Pond	2ft Contours
Baffle Wall	

P:\Mapping\Maps_Generated\Shoreline\Projects\19-10647.00\220\maps\Fig 4-27 Pump Station 30 - 8.5x11.mxd 5/1/2020 ctolentino

This map is a geographic representation based on information available. No warranty is made concerning the accuracy, currency, or completeness of data depicted on this map.

BHC CONSULTANTS

0 35 70 Feet

N

CITY OF SHORELINE

Pump Station 30

Improvement Recommendations
City of Shoreline, Washington
May 2020

Figure 4-27

Preliminary Implemenation Schedule

ID	Task Name	Duration
1	**Phase 1 (PS-26)**	**400 days**
2	**Phase 1 Design**	**165 days**
3	Ph1-Des, Scoping	30 days
4	Ph1-Des, NTP	0 days
5	Ph1-Des, 60% CDs	60 days
6	Ph1-Des, 60% Review	10 days
7	Ph1-Des, 90% CDs	40 days
8	Ph1-Des, 90% Review	10 days
9	Ph1-Des, IFB CDs	15 days
10	**Phase 1 Construction**	**235 days**
11	Ph1-Con, Bidding	60 days
12	Ph1-Con, NTP	0 days
13	Ph1-Con, Procurement	80 days
14	Ph1-Con, PS-26 Excavation	15 days
15	Ph1-Con, PS-26 Pipe, Structures & Backfill	20 days
16	Ph1-Con, PS-26 Mechanical	10 days
17	Ph1-Con, PS-26 EI&C	15 days
18	Ph1-Con, PS-26 Startup and Testing	5 days
19	Ph1-Con, PS-26 LS & Frontage	15 days
20	Ph1-Con, Punchlist and Closeout	20 days
21	**Phase 2 (Small Projects)**	**335 days**
22	**Phase 2 Design**	**120 days**
23	Ph2-Des, Scoping	15 days
24	Ph2-Des, NTP	0 days
25	Ph2-Des, 60% CDs	40 days
26	Ph2-Des, 60% Review	10 days
27	Ph2-Des, 90% CDs	30 days
28	Ph2-Des, 90% Review	10 days
29	Ph2-Des, IFB CDs	15 days
30	**Phase 2 Construction**	**160 days**
31	Ph2-Con, Bidding	40 days
32	Ph2-Con, NTP	0 days
33	Ph2-Con, Procurement	60 days
34	Ph2-Con, Linden	10 days
35	Ph2-Con, Serpentine	10 days
36	Ph2-Con, Pan Terra	5 days
37	Ph2-Con, PS-25	10 days
38	Ph2-Con, Palatine	5 days
39	Ph2-Con, Ronald Bog	5 days
40	Ph2-Con, Punchlist and Closeout	15 days
41	**Phase 3 (PS-30)**	**490 days**
42	**Phase 3 Design**	**165 days**
43	Ph3-Des, Scoping	30 days
44	Ph3-Des, NTP	0 days
45	Ph3-Des, 60% CDs	60 days
46	Ph3-Des, 60% Review	10 days
47	Ph3-Des, 90% CDs	40 days
48	Ph3-Des, 90% Review	10 days
49	Ph3-Des, IFB CDs	15 days
50	**Phase 3 Construction**	**230 days**
51	Ph3-Con, Bidding	60 days
52	Ph3-Con, NTP	0 days
53	Ph3-Con, Procurement	80 days
54	Ph3-Con, PS-30 Grading	15 days
55	Ph3-Con, PS-30 Pipe and Structures	15 days
56	Ph3-Con, PS-30 Forcemain	10 days
57	Ph3-Con, PS-30 Mechanical	10 days
58	Ph3-Con, PS-30 EI&C	15 days
59	Ph3-Con, PS-30 Startup and Testing	5 days
60	Ph3-Con, PS-30 LS & Frontage	15 days
61	Ph3-Con, Punchlist and Closeout	20 days

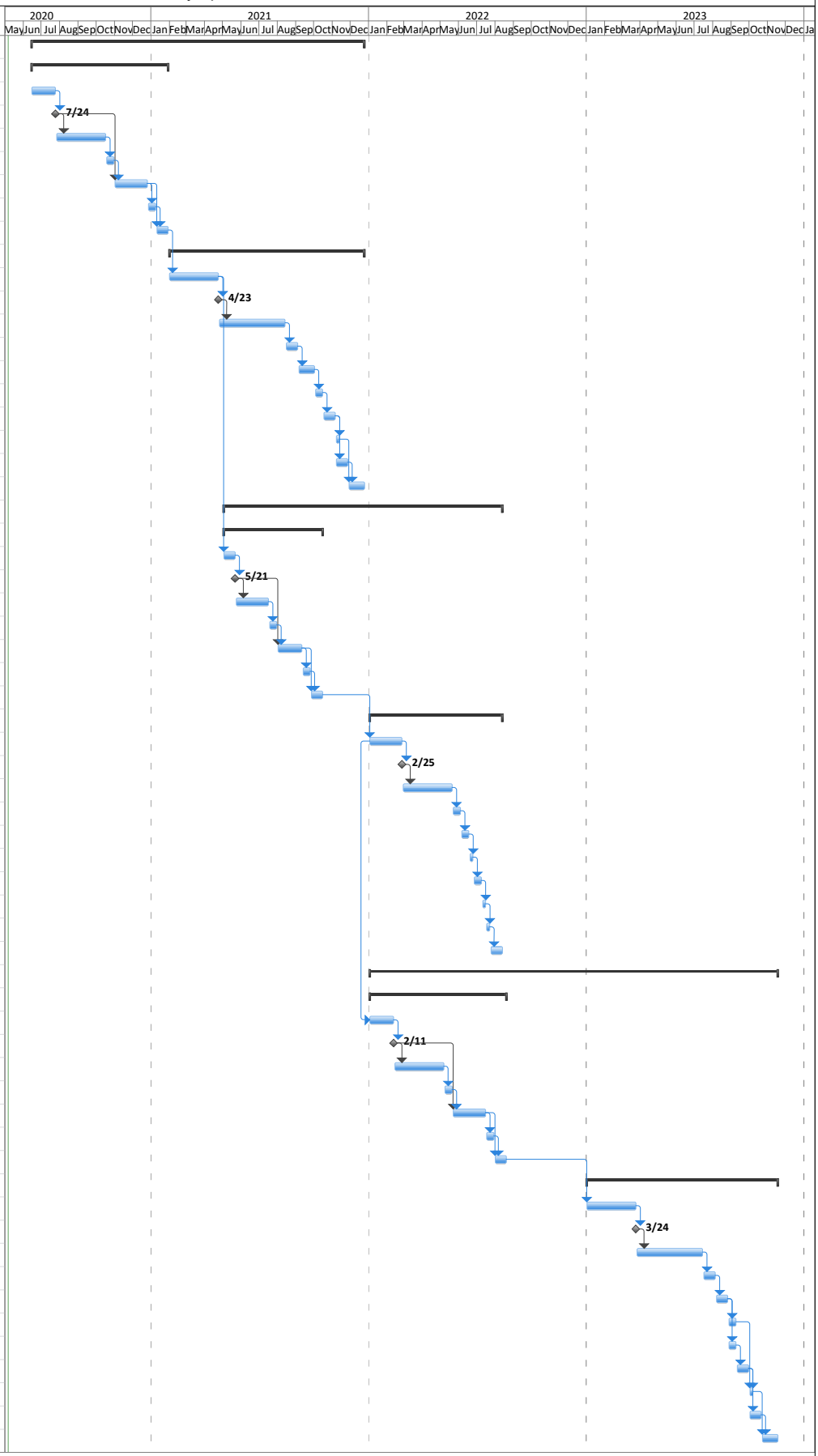


Figure 5-1
City of Shoreline
Stormwater Pump Station and SCADA Improvements

APPENDIX A

SHORELINE STORMWATER PUMP STATIONS
EXISTING CONDITIONS REVIEW MEMORANDUM

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MEMORANDUM

Date: October 23, 2019

To: Zach Evans, PE; John Featherstone, PE

From: Cameron Ochiltree, PE; John Gillespie, PE; Carla Talich, PE; and Peter Cunningham, PE

Subject: Existing Conditions Review

BHC Consultants (BHC) has completed an existing conditions review of the eight (8) City of Shoreline (City) owned and operated storm water pump stations. The pump station (PS) names and locations are listed below and presented on Figure 1.

- Linden Avenue (749 N 148th Street)
- Palatine (15532 Palatine Ave N)
- Pan Terra (18500 Dayton Ave N)
- Pump Station 25 (17548 2nd Place NE)
- Pump Station 26 (18331 10th Ave NE)
- Pump Station 30 (NE 170th Street and 15th Ave NE)
- Ronald Bog (NE 178th Street and Corliss Ave N)
- Serpentine (NE 178th Street and 5th Ave NE)

BHC has reviewed available information on the 8 pump stations including the following:

- Information provided by the City, such as inspection check lists, drawings, maps, equipment manuals, etc.
- Stormwater Pump Station Condition and Capacity Assessment dated June 24, 2016 by DCG (2016 Report).
- Site visits conducted on August 22, 2019 with City staff.

Based on the data reviews and input from City staff, a preliminary list of potential improvements for each pump station has been identified in Table 1. The potential improvements will be carried

forward to the Pump Stations Project Definition, SCADA System Definition, and Project Implementation Plan Tasks.

Table 1
Preliminary List of Potential Improvements

Pump Station	**Potential Improvements** ➢ (added by BHC Consultants) • (from 2016 Report)
Linden Avenue	➢ Replace infiltration trench and catch basins and outlets to collect floating debris and solids ➢ Replace catch basin and separate pump station from catch basin ➢ Install control and electrical panel shelter • Add Information sign with pump station name and City phone number, and a No Parking sign by catch basin and electrical connection • Provide SCADA with high level float and alarm • Upgrade pump discharge piping • Calculate arc flash energy and available fault currents to determine if applicable NFPA, NEC, and OSHA requirements are met • Generate code classification document in accordance with NFPA 820 to determine if any violations are present
Palatine	➢ Install control and electrical panel shelter • Add Information sign with pump station name and City phone number, and a No Parking sign by catch basin and electrical connection • Provide SCADA with high level float and alarm • Calculate arc flash energy and available fault currents to determine if applicable NFPA, NEC, and OSHA requirements are met • Generate code classification document in accordance with NFPA 820 to determine if any violations are present
Pan Terra	➢ Repair section of cable trough to cable termination box ➢ Install control and electrical panel shelter • Add pressure gauge(s) • Provide SCADA • Add hatch lift cylinders • Add Information sign with pump station name and City phone number, and a No Parking sign by gates • Add intrusion switches in both vaults and at generator • Calculate arc flash energy and available fault currents to determine if applicable NFPA, NEC, and OSHA requirements are met • Generate code classification document in accordance with NFPA 820 to determine if any violations are present

Table 1 Preliminary List of Potential Improvements	
Pump Station	**Potential Improvements** ➢ (added by BHC Consultants) • (from 2016 Report)
PS-25	➢ Troubleshoot control panel ➢ Locate buried isolation valves ➢ Install control and electrical panel shelter ➢ Provide erosion control on steep slopes • Install safety grating or netting at wet well • Provide SCADA • Add Information sign with pump station name and City phone number, and a No Parking sign by driveway • Install railing or fence at top of steep slope behind wet well • Calculate arc flash energy and available fault currents to determine if applicable NFPA, NEC, and OSHA requirements are met • Generate code classification document in accordance with NFPA 820 to determine if any violations are present
PS-26 (Figure 2)	➢ Investigate possibility of using gravity system in lieu of pump station ➢ Investigate use of temporary portable pump(s) if one or both of the existing pumps fail ➢ Investigate possible reconfiguration of pond ➢ Check capacity of existing wastewater generator for co-use with new pump station ➢ CATV forcemain and check size for future conditions • Replace existing pump station with new station • Provide SCADA
PS-30 (Figure 3)	➢ Investigate possibility of using gravity system in lieu of pump station ➢ Provide new power service ➢ Investigate possible reconfiguration of the pond (both sides) • Provide SCADA • Replace existing pump station with new station • Provide adequate access around wet well • Calculate arc flash energy and available fault currents to determine if applicable NFPA, NEC, and OSHA requirements are met • Generate code classification document in accordance with NFPA 820 to determine if any violations are present

Table 1 Preliminary List of Potential Improvements	
Pump Station	**Potential Improvements** ➢ (added by BHC Consultants) • (from 2016 Report)
Ronald Bog	➢ Provide electrical utility power supply to replace solar panels • Provide SCADA • Provide high level float and alarm • Add information and parking signs • If electrical service is brought to the site, applicable NFPA, NEC, and OSHA requirements will need to be met
Serpentine	➢ Revise drainage pattern along shoulder and around wet well to direct runoff away from wet well, valve box, and electrical pull box ➢ Install control and electrical panel shelter • Provide SCADA • Add information and parking signs • Install safety grating or net at wet well • Install pressure gauge • Add bollards in front of control and electrical panels • Calculate arc flash energy and available fault currents to determine if applicable NFPA, NEC, and OSHA requirements are met • Generate code classification document in accordance with NFPA 820 to determine if any violations are present

During the development of this memorandum, several data gaps have been identified and are described below.

- Property ownership and easement documentation for each pump station and force main.
- Operating records for pumps stations including any reports of failures or resident complaints related to issues with the stations.
- Catch Basin Rim and Measure-down Information (described in the following section).

Catch Basin Rim and Measure-down Data Needs

Figures 2 and 3 have been developed for Pump Stations 26 and 30 to begin investigating the possibility of a gravity system in lieu of pumping. Figures 2 and 3 were developed using the City's GIS data. Pipe inverts and catch basin rim elevation data are not available.

Figure 2 shows the drainage basin for Pump Station 26. The drainage area delineated by the City as part of the gravity system alternatives analysis was reviewed and confirmed. The drainage area is approximately 70 acres. The City's evaluation will be further reviewed during the next phase of work to determine what portions of the drainage basin might be converted to infiltration via green stormwater infrastructure. Some amount of pumping at Pump Station 26 is anticipated to be necessary, so additional ground surface and pipe invert elevation data are needed to evaluate the pumping needs.

Figure 3 shows the drainage basin for Pump Station 30. The drainage area is approximately 44-acres. A good portion of the drainage basin appears to be feasible to convert to gravity flow. There is a closed depression north of Pump Station 30, across 170th Street, which will likely require pumping. An option for gravity flow would include installing a new storm pipe from the intersection of NE 170th Street and 15th Ave NE to the south along 15th Ave NE towards NE 169th Street then turn to the west and run along NE 169th Street to the connection point with the force main outfall. This new gravity flow pipe would be approximately 460 feet long with a longitudinal slope of 0.5%. This slope is based on an average ground surface elevation. Additional rim and pipe invert elevational data are needed to further evaluate this concept.

Figures 2 and 3 include an inset for each pump station with catch basin (CB) numbers. For the CB numbers highlighted in yellow, rim elevations and measure-downs to pipe inverts are requested from the City. These are included in Table 2.

Table 2
Catch Basin Rim and Measure-down Information Data Needs

Pump Station 26	Pump Station 30
CB-48	CB-3536
CB-49	CB-4109
CB-4030	CB-4138
CB-4037	CB-6404
CB-6338	CB-6481
CB-7289	CB-6506
CB-9223	CB-7190
CB-10276	CB-9632
CB-10291	CB-12644

Pan Terra PS
Pump Station 26
Serpentine PS
PS 25
Ronald Bog PS
Pump Station 30
Palantine PS
Linden PS

Legend

- Pump Station
- Type 1 Catch Basin
- Type 2 Catch Basin
- Area Drain
- Downspout Drain
- Yard Drain
- Storm Culverts
- Channel
- Force
- Gravity
- Lateral
- Detention Tank
- Infiltration
- Vent
- Streams

P:\Mapping\Maps_Generated\Shoreline\Projects\2018 SW Pump Stations & SCADA - Aug 2019\Task\maps\Fig 1 Stormwater Pump Stations - 11x17.mxd 8/8/2019 dolentino

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GIS Base data: City of Shoreline.
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CITY OF SHORELINE

Pump Stations

Pump Station Condition & Capacity Assessment
City of Shoreline, Washington
August 2019

Figure 1

Inset Map

Legend

- Drainage Area (73.3 ac)
- Pump Station
- Type 1 Catch Basin
- Type 2 Catch Basin
- Area Drain
- Downspout Drain
- Yard Drain
- Storm Culverts
- Channel
- Force
- Gravity
- Lateral
- Detention Tank
- Infiltration
- Vent
- Ditch
- Streams
- 2ft Contours

P:\Mapping\Maps_Generated\Shoreline\Projects\19-10647.00\210\maps\Fig 2 Pump Station 26 Basin - 11x17.mxd 10/16/2019 pwurden

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Pump Station 26 - Drainage Basin

Pump Station Condition & Capacity Assessment
City of Shoreline, Washington
August 2019

Figure 2

Inset Map

Existing Force Main, L= ~250 ft

Ground Surface El. ~430 ft. Potentially route to the south via gravity

Potential New Gravity Pipe, L = ~460' s=0.5% (based on average ground slope)

Ground Surface El. ~428 ft

Pump Station 30

15TH

170TH

169TH

CB-6507 CB-4352 CB-6470 CB-4138 CB-8527 CB-10565 CB-4132 CB-6478 CB-4109 CB-6481 CB-12644 CB-3536 CB-11050 CB-3541 CB-6506 CB-6496 CB-11727 CB-6404 CB-4092 CB-7190 CB-9632 CB-6484 CB-4113 CB-10431 CB-11248 CB-6483 CB-4142 CB-4141 CB-9213 CB-4136

Legend

- Drainage Basin Boundary (43.7 ac)
- Pump Station
- Type 1 Catch Basin
- Type 2 Catch Basin
- Area Drain
- Downspout Drain
- Yard Drain
- Storm Culverts
- Channel
- Force
- Gravity
- Lateral
- Detention Tank
- Infiltration
- Vent
- Ditch
- Streams
- 2ft Contours

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0 250 500 Feet

CITY OF SHORELINE

Pump Station 30 - Drainage Basin

Pump Station Condition & Capacity Assessment
City of Shoreline, Washington
August 2019

Figure 3

APPENDIX B

SHORELINE STORMWATER PUMP STATIONS
SCADA SYSTEM EVALUATION MEMORANDUM

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MEMORANDUM

Date: **February 11, 2020**

To: **Zach Evans, PE and John Featherstone, PE, City of Shoreline**

From: **Cameron Ochiltree, PE and Nate Palmatier, PE, BHC Consultants, LLC**

Subject: **Stormwater Pump Station SCADA Evaluation**

The City of Shoreline (City) operates a system of eight (8) stormwater pump stations ranging in size from a single 1 horsepower pump station to a duplex 60 horsepower pump station. The City would like to implement a consistent remote monitoring program across all eight pump stations to enhance the monitoring and reporting capabilities of the system. The City has experience with Mission Communications managed supervisory control and data acquisition (SCADA) service and remote terminal units with their wastewater facilities. This memorandum evaluates options for monitoring approaches and presents recommendations for implementation.

1. Survey of Alarming Techniques

A wide range of different alarming systems and strategies can be utilized for pump station facilities. These can range from a full custom network SCADA implementation to local systems (e.g., red light and a horn) with alarm dialers and packaged and managed SCADA applications (e.g., Mission Communications) falling somewhere in between. Many systems are a hybrid of these approaches to address preferences for redundancy, on-line continuous monitoring, control functions, and various forms of notifications (e.g., emails, text messages, automated voice phone calls, etc.).

Custom built communications networks are reliable and may be marginally less costly to maintain because the Owner purchases all equipment. However, these networks require significant upfront capital costs for the design, installation, configuration, programming, commissioning, and testing. This type of network can be customized to accommodate any specific features that may be desirable to the users or specific Owner policy requirements. Compared to local or limited remote alarming functions, with the associated cost of staff trips to the site, a customized network can represent a long-term savings.

Local alarms are common with private district or individual house pump stations. They can be as simple as a red light attached to the control panel. When the station is in alarm, a curious or concerned neighbor will contact the response team, or staff can have a regular monitoring route to check facilities and watch for alarm conditions. This alarming configuration is typical of many of the City's stormwater pump station facilities. This is a low-cost approach, but it requires more staff time to support monitoring.

An intermediate option such as an automatic alarm dialer or a packaged and managed SCADA application provides a middle ground between the two extremes. These systems provide remote notification of staff, and they can provide limited operating data for remote monitoring in the case of a managed SCADA package. Alarm dialers using public telephone network services connections at individual sites to notify an on-call staff member have been a traditional approach to provide remote monitoring of facilities including an implementation at PS-25. The phone service charges and functional limitations (e.g., no level or power trend data) of these systems are dissuading many Owners from selecting this as a primary approach for new installations. A managed SCADA application, utilizing a cellular network connection, provides all the features of an alarm dialer, but it also provides basic operational monitoring data for the complete system of facilities to the users through an internet-based interface. For less complex facilities where the facility Owner does not already have a custom SCADA network in place already, a managed SCADA application can provide useful functionality with modest capital and operating costs.

The capital and annual operating costs of the alarm systems vary widely. In general, the level of customization increases with the higher cost. A relative comparison of these options is presented in Table 1.

Table 1
Comparison of

	Capital Cost	**Annual Cost**	**Response Time**
Local-only alarms	$	--	□□□□
Managed SCADA	$$	$	□
Custom SCADA	$$$$	$$	□

The City's familiarity with the Mission Communications system for the wastewater collection facilities makes this system a great choice for the stormwater pump stations. The cost to implement a custom SCADA network or change to a different managed solution would not yield commensurate benefits to the City. Mission Communications offers two levels of service, and the cost breakdown for those options is presented in Table 2.

Table 2
Mission Communications MyDro

	MyDro 150	MyDro 850
Unit Cost	$1,500	$2,250
Service Cost (3 years)	$900	$1,500
Analog Reporting Resolution	15-minute	2-minute

The Mission Communications hardware is the same for both levels of service. The higher level of service is an over-the-air upgrade that can be purchased by contacting Mission Communications. The upgrade can be implemented immediately and for limited durations if needed. Both levels of service offer immediate response (and user notification) to alarms, such as power failure, high level, motor overload, fire/flood/intrusion, etc. The MyDro 150 15-minute reporting resolution is sufficient for most stormwater pump station monitoring and analysis including hydrological modelling calibration and assessment. This MyDro 150 is also the level of service being utilized for all but one of the City's wastewater pump stations[1]. The MyDro 850 offers some advanced capacities, but it does not appear to provide sufficient added value for the stormwater pump stations as the standard monitoring provisions capture all key station monitoring parameters.

2. Controls

The pump stations operations are controlled using local controls, such as float switches, a level transmitter, or a combination of these. These controls are independent of the pump station monitoring system. SCADA packages can include provisions to remotely start pumps or allow for programing on the local unit to respond to a process conditions, like high level. The hardware equipment associated with the SCADA package system, such as a remote terminal unit, could serve as a backup or redundant controller to the main pump control system, if desired.

[1] Although outside the scope of this document, it may be worth the City's consideration if the MyDro 150 would be acceptable for all sanitary pump stations.

It is recommended that the pump controls be kept separate from the monitoring system, but the monitoring system can be configured to provide a backup mode of operation for the pumps. This arrangement can be beneficial because an independent monitoring system is unlikely to fail at the same time as the local control system.

The default configuration of the MyDro systems includes monitoring pump running feedback (for motor run time and start count metrics) as well as motor overload or fault conditions. There are also provisions to monitor analog level and high-level float switches. The sensing inputs into the MyDro system are pre-configured to include default sensors but are easily changed to allow for alternative sensor assignments. It is possible to monitor additional status and measurements through expansion modules to the base MyDro unit, but these are unlikely to be necessary for the stormwater pump stations. The standard monitoring inputs are shown in Table 3.

Table 3
Mission Communications MyDro Standard Monitoring Provisions

Address	Description	Description
DI 1	Pump 1 Running	Closed when running
DI 2	Pump 2 Running	Closed when running
DI 3	Simultaneous Pump Running	Closed when two pumps are running
DI 4	High Level Float	Closed when high level is detected
DI 5	Pump 1 Alarm	Closed when motor overload is in fault
DI 6	Pump 2 Alarm	Closed when motor overload is in fault
DI 7	Phase Fail	Closed on power failure
DI 8		[Not Available on MyDro 150]
AI 0	Wet Well Level	Signal is proportional to level (where equipped)
AI 1	Pump Station Amperage	Signal is proportional to the amperage draw at the station
DI – Discrete Input, AI – Analog Input		

The majority of these monitoring provisions can be utilized for Pump Stations (PS) 25, 26, 30, Pan Terra, and Serpentine, while the Ronald Bog diesel pump and the simpler Linden and Palatine pump stations would require some additional features to allow for monitoring of those stations. Table 4 summarizes the suggested monitoring configuration for each pump station.

Table 4
Proposed Monitoring Configuration

Input	Label	PS-26	PS-30	Linden	Palatine	Pan Terra	PS-25	Ronald Bog	Serpentine
		CP	**CP**	**CB**	**CB**	**CP**	**CP**	**Diesel**	**CP**
DI 1	Pump 1 Running	CS	CS	CS	CS	CS	CS	CP Aux	CS
DI 2	Pump 2 Running	CS	CS	N/A	N/A	CS	CS	N/A	CS
DI 3	Spare	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DI 4	High Level Float	New	New	New	New	Existing	Existing	New	New
DI 5	Pump 1 Alarm	OL	OL	N/A	N/A	CP[2]	OL	Engine Alarm	OL
DI 6	Pump 2 Alarm	OL	OL	N/A	N/A	CP[2]	OL	N/A	OL
DI 7	Intrusion[4]	IS	IS	IS	IS	IS	IS	IS	IS
AI 0	Wet Well Level	New	New	N/A	N/A	Existing	Existing	Fuel Level	N/A
AI 1	Pump Station Amperage	CT	CT	CT	CT	CT	CT	N/A	CT

DI – Discrete Input, AI – Analog Input, CP – Control Panel (existing), CB – Catch Basin (existing),
CS – Current Switch, CT – Current Transmitter, IS – Intrusion Switch, N/A – Not Applicable

Notes:

1) Pump Station 30 replacement will have 2 pumps; it will have redundant pumps.
2) The pumps are monitored by the pump manufacturer's monitor relay.
3) DI 8 is physically present, but it is not available/assigned to a channel on the MyDro 150 unit.
4) Fire and flood alarming could be added using DI 3 and DI-8, but given the pump station configurations, this is probably not necessary.

3. Conclusions

For SCADA monitoring, we recommend the Mission Communications MyDro 150 series of controllers. The existing control systems (or new systems where required with planned station replacements) will be used for primary control pump start/stop controls using the pump station water levels. The MyDro units will be used to monitor the stations, record the historical measurements through online storage systems, and initiate alarm callouts. This arrangement also allows for upgrading to including additional discrete and analog inputs if desired for an incremental per module increase in capital cost ($300) and annual fee ($60). Existing monitoring and alarming systems will be disabled or removed from the pump stations and services canceled to avoid confusion and duplication.

The installation configuration is anticipated to use a “slim” panel controller into the interior, swing-door panel of existing and new PS-26 and PS-30 control panels. Installation within the control panels is desirable to reduce the aesthetic changes and provide a similar level of protection. New outdoor rated NEMA 4X enclosures will be used for stations where a new separate enclosure is required (e.g., PS-25, Linden, and Palatine) because little or no space would be available in the existing panels. The stormwater pump station sites have adequate cell phone coverage, so the included standard antenna arrangement is expected to be sufficient. The detailed design will consider options for antenna arrangements to minimize the potential for vandalism.

APPENDIX C

STORMWATER MODELING

1. Figures
2. Pump Modeling and Basin Flood Analyses
3. MGS Flood Model Output
4. SBUH Model Output

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Inset Map

Legend

Type

- Drainage Basin (73.3 ac)
- Subbasin
- Pump Station
- Type 1 Catch Basin
- Type 2 Catch Basin
- Area Drain
- Downspout Drain
- Yard Drain
- Storm Culverts
- Channel
- Force
- Gravity
- Lateral
- Detention Tank
- Infiltration
- Vent
- Ditch
- Streams
- 2ft Contours

P:\Mapping\Maps_Generated\Shoreline\Projects\19-10647.00\210\maps\Fig 2 Pump Station 26 Basin - 11x17.mxd 10/18/2019 pwurden

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0 250 500 Feet

Pump Station 26 - Drainage Basin

Pump Station Condition & Capacity Assessment
City of Shoreline, Washington
August 2019

Figure 2

Inset Map

Existing Force Main, L= ~250 ft

Ground Surface El. ~430 ft. Potentially route to the south via gravity

Potential New Gravity Pipe, L = ~460' s=0.5% (based on average ground slope)

Ground Surface El. ~428 ft

Pump Station 30

15TH

170TH

169TH

CB-6507 CB-4352 CB-6470 CB-4138 CB-8527 CB-10565 CB-4132 CB-6478 CB-4109 CB-6481 CB-12644 CB-3536 CB-11050 CB-3541 CB-6506 CB-6496 CB-11727 CB-6404 CB-4092 CB-7190 CB-9632 CB-6484 CB-4113 CB-10431 CB-11248 CB-6483 CB-4142 CB-4141 CB-9213 CB-4136

Legend

- Drainage Basin Boundary (43.7 ac)
- Pump Station
- Type 1 Catch Basin
- Type 2 Catch Basin
- Area Drain
- Downspout Drain
- Yard Drain
- Storm Culverts
- Channel
- Force
- Gravity
- Lateral
- Detention Tank
- Infiltration
- Vent
- Ditch
- Streams
- 2ft Contours

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CITY OF SHORELINE

Pump Station 30 - Drainage Basin

Pump Station Condition & Capacity Assessment
City of Shoreline, Washington
August 2019

Figure 3

King County iMap

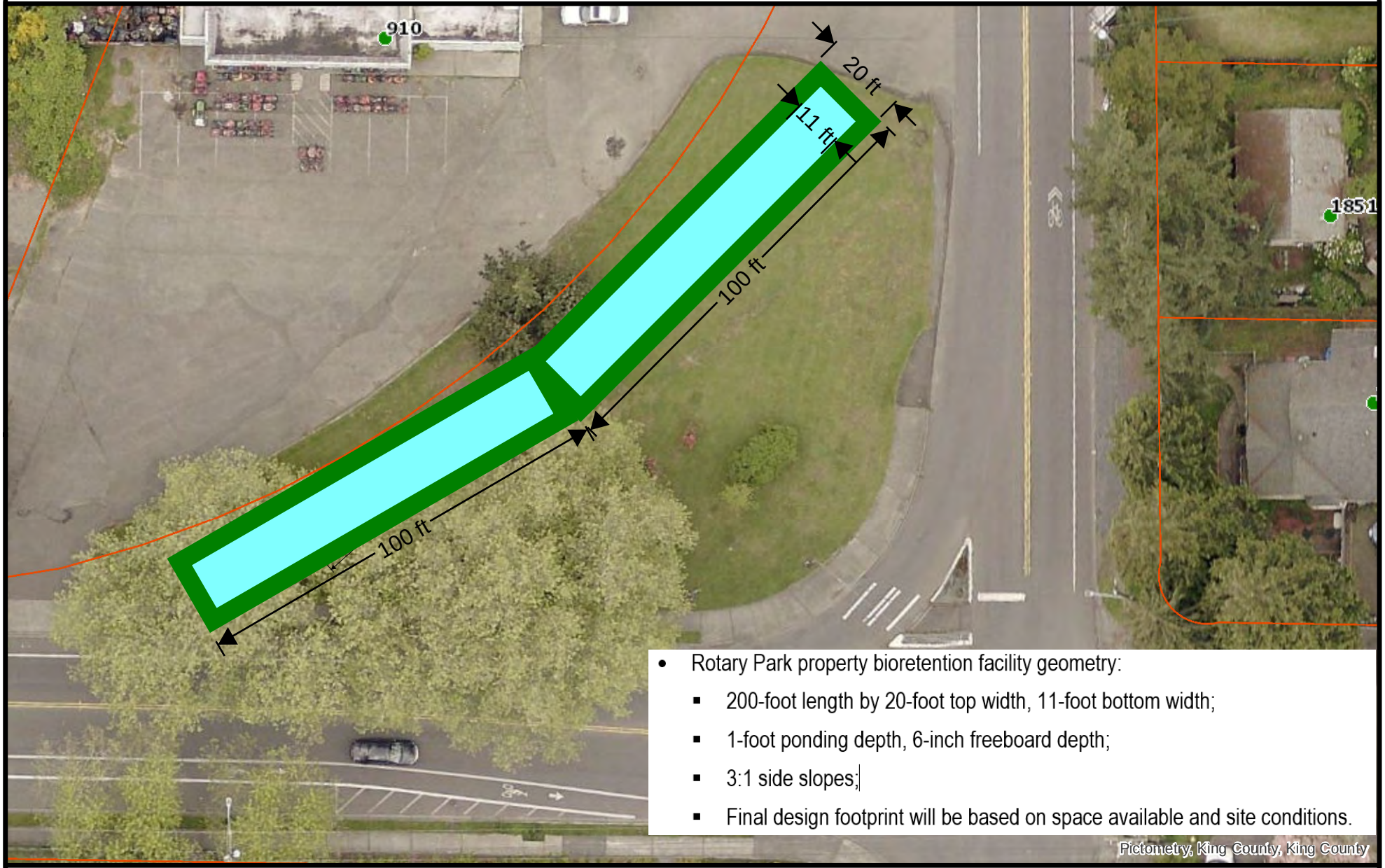
- SCL property bioretention facility geometry:
  - 460-foot length by 25-foot top width, 16-foot bottom width;
  - 1-foot ponding depth, 6-inch freeboard depth; and
  - 3:1 side slopes.

Date: 4/30/2020 Notes:

N

King County

King County iMap



- Rotary Park property bioretention facility geometry:
  - 200-foot length by 20-foot top width, 11-foot bottom width;
  - 1-foot ponding depth, 6-inch freeboard depth;
  - 3:1 side slopes;
  - Final design footprint will be based on space available and site conditions.

Pictometry, King County, King County

Date: 12/11/2019 Notes:

N

King County

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Existing Pond

Bioretention	10-Year SBUH Hydrology	Existing Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	80.21	cf

Pond Information		
Pond Overtop Elevation	10	ft
Pond Overtop Volume	32,940	cf
Time Pond Overtopped	0.00	hr
Volume Flooding	0.00	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(80)	0	0.00	0.00	0	0
20	0.00	0	0	0	(80)	0	0.00	0.00	0	0
30	0.00	0	0	0	(80)	0	0.00	0.00	0	0
40	0.00	0	0	0	(80)	0	0.00	0.00	0	0
50	0.00	1	1	0	(80)	0	0.00	0.00	0	0
60	0.02	10	11	0	(80)	0	0.00	0.00	0	0
70	0.05	30	41	0	(80)	0	0.00	0.00	0	0
80	0.09	57	98	0	(80)	0	0.00	0.00	0	0
90	0.14	86	184	0	(80)	6	0.00	0.00	0	0
100	0.19	116	300	0	(80)	42	0.02	0.00	0	0
110	0.26	155	455	0	(80)	116	0.06	0.00	0	0
120	0.33	201	656	0	(80)	237	0.13	0.00	0	0
130	0.40	241	897	0	(80)	398	0.21	0.00	0	0
140	0.46	277	1,174	0	(80)	595	0.31	0.00	0	0
150	0.52	311	1,485	0	(80)	825	0.43	0.00	0	0
160	0.57	339	1,824	0	(80)	1,084	0.57	0.00	0	0
170	0.63	380	2,204	0	(80)	1,384	0.72	0.00	0	0
180	0.72	431	2,635	0	(80)	1,735	0.90	0.00	0	0
190	0.78	470	3,105	0	(80)	2,125	1.10	0.00	0	0
200	0.84	501	3,607	0	(80)	2,546	1.31	0.00	0	0
210	0.88	529	4,135	0	(80)	2,994	1.53	0.00	0	0
220	0.92	555	4,690	0	(80)	3,469	1.76	0.00	0	0
230	1.01	605	5,295	0	(80)	3,994	2.01	0.00	0	0
240	1.12	673	5,968	0	(80)	4,587	2.29	0.00	0	0
250	1.22	731	6,700	0	(80)	5,238	2.59	0.00	0	0
260	1.30	782	7,482	0	(80)	5,940	2.91	0.00	0	0
270	1.38	828	8,310	0	(80)	6,688	3.24	0.00	0	0
280	1.45	870	9,179	0	(80)	7,477	3.58	0.00	0	0
290	1.57	940	10,120	0	(80)	8,337	3.95	0.00	0	0
300	1.72	1,032	11,152	0	(80)	9,289	4.34	0.00	0	0
310	1.84	1,104	12,256	(3,609)	(80)	6,703	3.25	0.00	3,609	0
320	1.94	1,163	13,418	0	(80)	7,786	3.71	0.00	3,609	0
330	2.02	1,212	14,631	0	(80)	8,918	4.19	0.00	3,609	0
340	2.09	1,255	15,886	(3,609)	(80)	6,483	3.15	0.00	7,219	0
350	2.23	1,336	17,222	0	(80)	7,739	3.69	0.00	7,219	0
360	2.40	1,441	18,663	0	(80)	9,100	4.26	0.00	7,219	0
370	2.53	1,520	20,183	(3,609)	(80)	6,931	3.35	0.00	10,828	0
380	2.64	1,583	21,766	0	(80)	8,433	3.99	0.00	10,828	0
390	2.72	1,633	23,399	0	(80)	9,986	4.61	0.00	10,828	0
400	2.80	1,678	25,077	(3,609)	(80)	7,975	3.79	0.00	14,438	0
410	3.10	1,859	26,936	0	(80)	9,753	4.52	0.00	14,438	0
420	3.55	2,129	29,065	(3,609)	(80)	8,193	3.89	0.00	18,047	0
430	3.86	2,317	31,382	0	(80)	10,430	4.79	0.00	18,047	0
440	4.38	2,628	34,011	(3,609)	(80)	9,368	4.37	0.00	21,656	0
450	5.04	3,022	37,033	(3,609)	(80)	8,701	4.10	0.00	25,266	0
460	6.57	3,944	40,977	(3,609)	(80)	8,956	4.20	0.00	28,875	0
470	10.12	6,069	47,046	(3,609)	(80)	11,336	5.13	0.00	32,484	0
480	11.96	7,177	54,223	(3,609)	(80)	14,823	6.36	0.00	36,094	0
490	10.64	6,384	60,607	(3,609)	(80)	17,517	7.20	0.00	39,703	0
500	8.87	5,322	65,929	(3,609)	(80)	19,150	7.66	0.00	43,313	0
510	7.46	4,476	70,405	(3,609)	(80)	19,936	7.86	0.00	46,922	0
520	6.60	3,960	74,365	(3,609)	(80)	20,206	7.93	0.00	50,531	0
530	5.73	3,440	77,804	(3,609)	(80)	19,956	7.87	0.00	54,141	0
540	4.86	2,916	80,721	(3,609)	(80)	19,183	7.66	0.00	57,750	0
550	4.33	2,597	83,318	(3,609)	(80)	18,090	7.36	0.00	61,360	0
560	4.00	2,402	85,720	(3,609)	(80)	16,802	6.99	0.00	64,969	0
570	3.81	2,285	88,005	(3,609)	(80)	15,398	6.55	0.00	68,578	0
580	3.69	2,217	90,222	(3,609)	(80)	13,925	6.06	0.00	72,188	0
590	3.63	2,176	92,398	(3,609)	(80)	12,412	5.53	0.00	75,797	0
600	3.59	2,153	94,551	(3,609)	(80)	10,875	4.96	0.00	79,407	0
610	3.57	2,141	96,692	(3,609)	(80)	9,327	4.35	0.00	83,016	0
620	3.56	2,137	98,829	(3,609)	(80)	7,774	3.71	0.00	86,625	0
630	3.56	2,137	100,966	0	(80)	9,831	4.55	0.00	86,625	0
640	3.57	2,140	103,107	(3,609)	(80)	8,282	3.92	0.00	90,235	0

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	3.45	2,068	105,175	0	(80)	10,270	4.73	0.00	90,235	0
660	3.25	1,952	107,128	(3,609)	(80)	8,533	4.03	0.00	93,844	0
670	3.14	1,882	109,010	(3,609)	(80)	6,726	3.26	0.00	97,453	0
680	3.06	1,839	110,848	0	(80)	8,484	4.01	0.00	97,453	0
690	3.02	1,814	112,662	(3,609)	(80)	6,609	3.21	0.00	101,063	0
700	3.00	1,800	114,463	0	(80)	8,329	3.94	0.00	101,063	0
710	2.99	1,793	116,256	0	(80)	10,042	4.64	0.00	101,063	0
720	2.98	1,790	118,046	(3,609)	(80)	8,142	3.86	0.00	104,672	0
730	2.98	1,789	119,835	0	(80)	9,851	4.56	0.00	104,672	0
740	2.98	1,790	121,625	(3,609)	(80)	7,951	3.78	0.00	108,282	0
750	2.99	1,792	123,416	0	(80)	9,662	4.49	0.00	108,282	0
760	2.99	1,795	125,211	(3,609)	(80)	7,768	3.71	0.00	111,891	0
770	2.88	1,726	126,937	0	(80)	9,413	4.39	0.00	111,891	0
780	2.68	1,610	128,547	(3,609)	(80)	7,334	3.52	0.00	115,500	0
790	2.57	1,540	130,086	0	(80)	8,793	4.13	0.00	115,500	0
800	2.50	1,498	131,584	(3,609)	(80)	6,601	3.20	0.00	119,110	0
810	2.45	1,472	133,056	0	(80)	7,992	3.80	0.00	119,110	0
820	2.43	1,457	134,512	0	(80)	9,369	4.37	0.00	119,110	0
830	2.41	1,449	135,961	(3,609)	(80)	7,128	3.43	0.00	122,719	0
840	2.40	1,443	137,404	0	(80)	8,491	4.01	0.00	122,719	0
850	2.40	1,440	138,844	(3,609)	(80)	6,241	3.04	0.00	126,329	0
860	2.40	1,441	140,285	0	(80)	7,602	3.64	0.00	126,329	0
870	2.40	1,442	141,727	0	(80)	8,963	4.20	0.00	126,329	0
880	2.40	1,442	143,169	(3,609)	(80)	6,716	3.25	0.00	129,938	0
890	2.35	1,410	144,579	0	(80)	8,046	3.82	0.00	129,938	0
900	2.27	1,359	145,938	0	(80)	9,324	4.35	0.00	129,938	0
910	2.21	1,328	147,265	(3,609)	(80)	6,963	3.36	0.00	133,547	0
920	2.18	1,308	148,574	0	(80)	8,191	3.88	0.00	133,547	0
930	2.16	1,298	149,872	0	(80)	9,408	4.38	0.00	133,547	0
940	2.15	1,291	151,163	(3,609)	(80)	7,010	3.38	0.00	137,157	0
950	2.15	1,287	152,450	0	(80)	8,217	3.90	0.00	137,157	0
960	2.14	1,286	153,735	0	(80)	9,422	4.39	0.00	137,157	0
970	2.14	1,286	155,022	(3,609)	(80)	7,019	3.38	0.00	140,766	0
980	2.14	1,286	156,308	0	(80)	8,225	3.90	0.00	140,766	0
990	2.14	1,285	157,593	0	(80)	9,430	4.39	0.00	140,766	0
1000	2.14	1,286	158,879	(3,609)	(80)	7,026	3.39	0.00	144,375	0
1010	2.06	1,237	160,117	0	(80)	8,184	3.88	0.00	144,375	0
1020	1.93	1,157	161,274	0	(80)	9,261	4.32	0.00	144,375	0
1030	1.85	1,109	162,383	(3,609)	(80)	6,680	3.24	0.00	147,985	0
1040	1.80	1,079	163,462	0	(80)	7,679	3.67	0.00	147,985	0
1050	1.77	1,059	164,521	0	(80)	8,658	4.08	0.00	147,985	0
1060	1.75	1,047	165,568	(3,609)	(80)	6,015	2.94	0.00	151,594	0
1070	1.74	1,041	166,609	0	(80)	6,976	3.37	0.00	151,594	0
1080	1.73	1,037	167,647	0	(80)	7,933	3.78	0.00	151,594	0
1090	1.72	1,035	168,681	0	(80)	8,888	4.17	0.00	151,594	0
1100	1.72	1,035	169,716	(3,609)	(80)	6,233	3.04	0.00	155,204	0
1110	1.72	1,034	170,750	0	(80)	7,187	3.46	0.00	155,204	0
1120	1.72	1,034	171,785	0	(80)	8,141	3.86	0.00	155,204	0
1130	1.72	1,034	172,819	0	(80)	9,095	4.26	0.00	155,204	0
1140	1.72	1,033	173,852	(3,609)	(80)	6,439	3.13	0.00	158,813	0
1150	1.72	1,033	174,885	0	(80)	7,392	3.55	0.00	158,813	0
1160	1.73	1,036	175,922	0	(80)	8,348	3.95	0.00	158,813	0
1170	1.73	1,037	176,958	0	(80)	9,304	4.34	0.00	158,813	0
1180	1.73	1,036	177,994	(3,609)	(80)	6,650	3.22	0.00	162,422	0
1190	1.73	1,036	179,030	0	(80)	7,606	3.64	0.00	162,422	0
1200	1.73	1,037	180,067	0	(80)	8,563	4.04	0.00	162,422	0
1210	1.73	1,038	181,105	(3,609)	(80)	5,912	2.90	0.00	166,032	0
1220	1.73	1,039	182,144	0	(80)	6,871	3.32	0.00	166,032	0
1230	1.73	1,038	183,183	0	(80)	7,829	3.73	0.00	166,032	0
1240	1.73	1,039	184,222	0	(80)	8,788	4.13	0.00	166,032	0
1250	1.74	1,041	185,263	(3,609)	(80)	6,139	3.00	0.00	169,641	0
1260	1.73	1,041	186,304	0	(80)	7,100	3.42	0.00	169,641	0
1270	1.73	1,041	187,345	0	(80)	8,061	3.83	0.00	169,641	0
1280	1.74	1,042	188,387	0	(80)	9,022	4.23	0.00	169,641	0
1290	1.74	1,043	189,430	(3,609)	(80)	6,376	3.10	0.00	173,251	0
1300	1.74	1,043	190,473	0	(80)	7,338	3.52	0.00	173,251	0
1310	1.74	1,043	191,516	0	(80)	8,302	3.93	0.00	173,251	0
1320	1.74	1,045	192,561	0	(80)	9,266	4.33	0.00	173,251	0
1330	1.74	1,046	193,607	(3,609)	(80)	6,622	3.21	0.00	176,860	0
1340	1.74	1,045	194,652	0	(80)	7,587	3.63	0.00	176,860	0
1350	1.74	1,045	195,696	0	(80)	8,552	4.04	0.00	176,860	0
1360	1.74	1,046	196,742	(3,609)	(80)	5,908	2.89	0.00	180,469	0
1370	1.74	1,046	197,788	0	(80)	6,873	3.32	0.00	180,469	0
1380	1.74	1,045	198,833	0	(80)	7,839	3.74	0.00	180,469	0
1390	1.75	1,047	199,880	0	(80)	8,806	4.14	0.00	180,469	0
1400	1.75	1,048	200,929	(3,609)	(80)	6,164	3.01	0.00	184,079	0
1410	1.75	1,048	201,977	0	(80)	7,132	3.43	0.00	184,079	0
1420	1.75	1,049	203,026	0	(80)	8,101	3.85	0.00	184,079	0
1430	1.75	1,049	204,075	0	(80)	9,070	4.25	0.00	184,079	0
1440	1.75	1,050	205,125	(3,609)	(80)	6,430	3.13	0.00	187,688	0

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Existing Pond

Bioretention	25-Year SBUH Hydrology	Existing Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	80.21	cf

Pond Information		
Pond Overtop Elevation	10	ft
Pond Overtop Volume	32,940	cf
Time Pond Overtopped	1.83	hr
Volume Flooding	0.60	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(80)	0	0.00	0.00	0	0
20	0.00	0	0	0	(80)	0	0.00	0.00	0	0
30	0.00	0	0	0	(80)	0	0.00	0.00	0	0
40	0.02	13	13	0	(80)	0	0.00	0.00	0	0
50	0.08	50	63	0	(80)	0	0.00	0.00	0	0
60	0.17	105	168	0	(80)	25	0.01	0.00	0	0
70	0.28	166	334	0	(80)	111	0.06	0.00	0	0
80	0.38	228	563	0	(80)	259	0.14	0.00	0	0
90	0.48	286	849	0	(80)	465	0.24	0.00	0	0
100	0.56	338	1,187	0	(80)	723	0.38	0.00	0	0
110	0.68	408	1,595	0	(80)	1,051	0.55	0.00	0	0
120	0.82	492	2,087	0	(80)	1,463	0.76	0.00	0	0
130	0.93	561	2,648	0	(80)	1,943	1.00	0.00	0	0
140	1.03	617	3,266	0	(80)	2,480	1.27	0.00	0	0
150	1.11	664	3,929	0	(80)	3,064	1.56	0.00	0	0
160	1.18	709	4,638	0	(80)	3,693	1.86	0.00	0	0
170	1.32	792	5,430	0	(80)	4,404	2.20	0.00	0	0
180	1.50	902	6,333	0	(80)	5,227	2.58	0.00	0	0
190	1.66	997	7,330	0	(80)	6,144	3.00	0.00	0	0
200	1.80	1,081	8,411	0	(80)	7,144	3.44	0.00	0	0
210	1.93	1,156	9,567	0	(80)	8,220	3.90	0.00	0	0
220	2.04	1,224	10,791	0	(80)	9,364	4.37	0.00	0	0
230	2.22	1,331	12,122	(3,609)	(80)	7,005	3.38	0.00	3,609	0
240	2.44	1,464	13,586	0	(80)	8,389	3.97	0.00	3,609	0
250	2.62	1,570	15,156	0	(80)	9,879	4.57	0.00	3,609	0
260	2.76	1,657	16,812	(3,609)	(80)	7,846	3.74	0.00	7,219	0
270	2.88	1,729	18,542	0	(80)	9,495	4.42	0.00	7,219	0
280	2.99	1,794	20,336	(3,609)	(80)	7,600	3.64	0.00	10,828	0
290	3.20	1,917	22,253	0	(80)	9,437	4.40	0.00	10,828	0
300	3.46	2,078	24,330	(3,609)	(80)	7,825	3.73	0.00	14,438	0
310	3.66	2,198	26,528	0	(80)	9,942	4.60	0.00	14,438	0
320	3.82	2,290	28,818	(3,609)	(80)	8,542	4.03	0.00	18,047	0
330	3.94	2,366	31,184	(3,609)	(80)	7,218	3.47	0.00	21,656	0
340	4.05	2,429	33,613	0	(80)	9,567	4.45	0.00	21,656	0
350	4.27	2,564	36,177	(3,609)	(80)	8,442	3.99	0.00	25,266	0
360	4.58	2,745	38,922	0	(80)	11,107	5.05	0.00	25,266	0
370	4.79	2,877	41,798	(3,609)	(80)	10,293	4.74	0.00	28,875	0
380	4.96	2,975	44,773	(3,609)	(80)	9,579	4.45	0.00	32,484	0
390	5.08	3,051	47,824	(3,609)	(80)	8,940	4.19	0.00	36,094	0
400	5.19	3,113	50,937	(3,609)	(80)	8,363	3.96	0.00	39,703	0
410	5.71	3,424	54,361	0	(80)	11,708	5.27	0.00	39,703	0
420	6.49	3,893	58,255	(3,609)	(80)	11,911	5.35	0.00	43,313	0
430	7.01	4,207	62,462	(3,609)	(80)	12,429	5.54	0.00	46,922	0
440	7.90	4,741	67,203	(3,609)	(80)	13,481	5.91	0.00	50,531	0
450	9.03	5,417	72,621	(3,609)	(80)	15,208	6.49	0.00	54,141	0
460	11.68	7,007	79,628	(3,609)	(80)	18,526	7.48	0.00	57,750	0
470	17.76	10,657	90,285	(3,609)	(80)	25,494	9.09	0.00	61,360	0
480	20.83	12,501	102,786	(3,609)	(80)	32,940	10.08	0.17	64,969	1,365
490	18.43	11,060	113,846	(3,609)	(80)	32,940	10.08	0.33	68,578	8,735
500	15.30	9,177	123,023	(3,609)	(80)	32,940	10.08	0.50	72,188	14,222
510	12.81	7,683	130,706	(3,609)	(80)	32,940	10.08	0.67	75,797	18,216
520	11.28	6,768	137,473	(3,609)	(80)	32,940	10.08	0.83	79,407	21,294
530	9.77	5,861	143,335	(3,609)	(80)	32,940	10.08	1.00	83,016	23,466
540	8.26	4,959	148,293	(3,609)	(80)	32,940	10.08	1.17	86,625	24,735
550	7.34	4,403	152,696	(3,609)	(80)	32,940	10.08	1.33	90,235	25,448
560	6.77	4,062	156,758	(3,609)	(80)	32,940	10.08	1.50	93,844	25,820
570	6.42	3,855	160,612	(3,609)	(80)	32,940	10.08	1.67	97,453	25,985
580	6.22	3,729	164,342	(3,609)	(80)	32,940	10.08	1.83	101,063	26,025
590	6.09	3,654	167,996	(3,609)	(80)	32,905	10.08	1.83	104,672	26,025
600	6.02	3,612	171,608	(3,609)	(80)	32,827	10.07	1.83	108,282	26,025
610	5.98	3,589	175,197	(3,609)	(80)	32,727	10.06	1.83	111,891	26,025
620	5.96	3,577	178,774	(3,609)	(80)	32,614	10.05	1.83	115,500	26,025
630	5.95	3,571	182,345	(3,609)	(80)	32,496	10.04	1.83	119,110	26,025
640	5.95	3,570	185,916	(3,609)	(80)	32,376	10.03	1.83	122,719	26,025

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	5.74	3,447	189,363	(3,609)	(80)	32,134	10.01	1.83	126,329	26,025
660	5.42	3,250	192,612	(3,609)	(80)	31,694	9.97	1.83	129,938	26,025
670	5.22	3,129	195,742	(3,609)	(80)	31,134	9.91	1.83	133,547	26,025
680	5.09	3,055	198,797	(3,609)	(80)	30,499	9.84	1.83	137,157	26,025
690	5.02	3,011	201,808	(3,609)	(80)	29,820	9.76	1.83	140,766	26,025
700	4.97	2,984	204,792	(3,609)	(80)	29,115	9.67	1.83	144,375	26,025
710	4.95	2,969	207,761	(3,609)	(80)	28,395	9.57	1.83	147,985	26,025
720	4.94	2,962	210,723	(3,609)	(80)	27,667	9.46	1.83	151,594	26,025
730	4.93	2,959	213,683	(3,609)	(80)	26,937	9.34	1.83	155,204	26,025
740	4.93	2,958	216,640	(3,609)	(80)	26,205	9.22	1.83	158,813	26,025
750	4.93	2,959	219,599	(3,609)	(80)	25,474	9.09	1.83	162,422	26,025
760	4.93	2,961	222,560	(3,609)	(80)	24,746	8.95	1.83	166,032	26,025
770	4.74	2,846	225,406	(3,609)	(80)	23,902	8.78	1.83	169,641	26,025
780	4.43	2,659	228,066	(3,609)	(80)	22,872	8.56	1.83	173,251	26,025
790	4.24	2,544	230,610	(3,609)	(80)	21,727	8.31	1.83	176,860	26,025
800	4.12	2,474	233,084	(3,609)	(80)	20,511	8.01	1.83	180,469	26,025
810	4.05	2,431	235,515	(3,609)	(80)	19,252	7.68	1.83	184,079	26,025
820	4.01	2,404	237,919	(3,609)	(80)	17,967	7.33	1.83	187,688	26,025
830	3.98	2,389	240,308	(3,609)	(80)	16,666	6.94	1.83	191,298	26,025
840	3.97	2,380	242,687	(3,609)	(80)	15,356	6.54	1.83	194,907	26,025
850	3.96	2,375	245,062	(3,609)	(80)	14,042	6.10	1.83	198,516	26,025
860	3.96	2,373	247,436	(3,609)	(80)	12,725	5.64	1.83	202,126	26,025
870	3.95	2,372	249,808	(3,609)	(80)	11,408	5.16	1.83	205,735	26,025
880	3.95	2,373	252,181	(3,609)	(80)	10,091	4.66	1.83	209,344	26,025
890	3.86	2,317	254,498	(3,609)	(80)	8,719	4.10	1.83	212,954	26,025
900	3.71	2,225	256,723	(3,609)	(80)	7,255	3.49	1.83	216,563	26,025
910	3.62	2,170	258,893	0	(80)	9,344	4.36	1.83	216,563	26,025
920	3.56	2,136	261,029	(3,609)	(80)	7,790	3.72	1.83	220,173	26,025
930	3.52	2,114	263,143	0	(80)	9,824	4.55	1.83	220,173	26,025
940	3.51	2,104	265,247	(3,609)	(80)	8,238	3.90	1.83	223,782	26,025
950	3.50	2,097	267,344	0	(80)	10,255	4.72	1.83	223,782	26,025
960	3.49	2,092	269,436	(3,609)	(80)	8,658	4.08	1.83	227,391	26,025
970	3.48	2,089	271,524	(3,609)	(80)	7,057	3.40	1.83	231,001	26,025
980	3.48	2,088	273,612	0	(80)	9,064	4.25	1.83	231,001	26,025
990	3.48	2,087	275,700	(3,609)	(80)	7,462	3.58	1.83	234,610	26,025
1000	3.48	2,088	277,788	0	(80)	9,470	4.41	1.83	234,610	26,025
1010	3.35	2,010	279,798	(3,609)	(80)	7,790	3.72	1.83	238,220	26,025
1020	3.13	1,880	281,678	0	(80)	9,590	4.46	1.83	238,220	26,025
1030	3.00	1,801	283,479	(3,609)	(80)	7,702	3.68	1.83	241,829	26,025
1040	2.92	1,752	285,232	0	(80)	9,374	4.37	1.83	241,829	26,025
1050	2.87	1,724	286,955	(3,609)	(80)	7,408	3.55	1.83	245,438	26,025
1060	2.84	1,706	288,661	0	(80)	9,034	4.23	1.83	245,438	26,025
1070	2.82	1,692	290,354	(3,609)	(80)	7,037	3.39	1.83	249,048	26,025
1080	2.81	1,686	292,040	0	(80)	8,643	4.07	1.83	249,048	26,025
1090	2.80	1,683	293,723	(3,609)	(80)	6,636	3.22	1.83	252,657	26,025
1100	2.80	1,681	295,404	0	(80)	8,237	3.90	1.83	252,657	26,025
1110	2.80	1,680	297,084	0	(80)	9,837	4.56	1.83	252,657	26,025
1120	2.80	1,680	298,764	(3,609)	(80)	7,828	3.73	1.83	256,266	26,025
1130	2.80	1,680	300,445	0	(80)	9,428	4.39	1.83	256,266	26,025
1140	2.80	1,679	302,124	(3,609)	(80)	7,418	3.56	1.83	259,876	26,025
1150	2.80	1,680	303,803	0	(80)	9,017	4.23	1.83	259,876	26,025
1160	2.80	1,680	305,483	(3,609)	(80)	7,007	3.38	1.83	263,485	26,025
1170	2.80	1,680	307,163	0	(80)	8,607	4.06	1.83	263,485	26,025
1180	2.80	1,680	308,843	(3,609)	(80)	6,597	3.20	1.83	267,095	26,025
1190	2.80	1,681	310,525	0	(80)	8,199	3.89	1.83	267,095	26,025
1200	2.80	1,682	312,207	0	(80)	9,801	4.54	1.83	267,095	26,025
1210	2.80	1,683	313,890	(3,609)	(80)	7,794	3.72	1.83	270,704	26,025
1220	2.80	1,683	315,573	0	(80)	9,396	4.38	1.83	270,704	26,025
1230	2.81	1,683	317,256	(3,609)	(80)	7,390	3.55	1.83	274,313	26,025
1240	2.81	1,685	318,940	0	(80)	8,994	4.22	1.83	274,313	26,025
1250	2.81	1,684	320,624	(3,609)	(80)	6,989	3.37	1.83	277,923	26,025
1260	2.81	1,684	322,308	0	(80)	8,593	4.05	1.83	277,923	26,025
1270	2.81	1,685	323,993	(3,609)	(80)	6,588	3.20	1.83	281,532	26,025
1280	2.81	1,686	325,679	0	(80)	8,193	3.89	1.83	281,532	26,025
1290	2.81	1,686	327,365	0	(80)	9,799	4.54	1.83	281,532	26,025
1300	2.81	1,686	329,051	(3,609)	(80)	7,796	3.72	1.83	285,142	26,025
1310	2.81	1,688	330,739	0	(80)	9,404	4.38	1.83	285,142	26,025
1320	2.81	1,689	332,428	(3,609)	(80)	7,403	3.55	1.83	288,751	26,025
1330	2.81	1,688	334,116	0	(80)	9,010	4.22	1.83	288,751	26,025
1340	2.81	1,689	335,804	(3,609)	(80)	7,009	3.38	1.83	292,360	26,025
1350	2.82	1,689	337,494	0	(80)	8,618	4.06	1.83	292,360	26,025
1360	2.82	1,690	339,183	(3,609)	(80)	6,618	3.21	1.83	295,970	26,025
1370	2.82	1,690	340,873	0	(80)	8,228	3.90	1.83	295,970	26,025
1380	2.82	1,690	342,563	0	(80)	9,837	4.56	1.83	295,970	26,025
1390	2.82	1,691	344,254	(3,609)	(80)	7,839	3.74	1.83	299,579	26,025
1400	2.82	1,691	345,944	0	(80)	9,449	4.40	1.83	299,579	26,025
1410	2.82	1,690	347,635	(3,609)	(80)	7,450	3.57	1.83	303,189	26,025
1420	2.82	1,693	349,327	0	(80)	9,063	4.24	1.83	303,189	26,025
1430	2.82	1,693	351,020	(3,609)	(80)	7,066	3.41	1.83	306,798	26,025
1440	2.82	1,693	352,713	0	(80)	8,679	4.09	1.83	306,798	26,025

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Existing Pond

Bioretention	10-Year SBUH Hydrology	Future Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	80.21	cf

Pond Information		
Pond Overtop Elevation	10	ft
Pond Overtop Volume	32,940	cf
Time Pond Overtopped	0.00	hr
Volume Flooding	0.00	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(80)	0	0.00	0.00	0	0
20	0.00	0	0	0	(80)	0	0.00	0.00	0	0
30	0.00	0	0	0	(80)	0	0.00	0.00	0	0
40	0.00	0	0	0	(80)	0	0.00	0.00	0	0
50	0.00	2	2	0	(80)	0	0.00	0.00	0	0
60	0.03	17	19	0	(80)	0	0.00	0.00	0	0
70	0.09	53	72	0	(80)	0	0.00	0.00	0	0
80	0.16	98	170	0	(80)	18	0.01	0.00	0	0
90	0.25	149	319	0	(80)	87	0.05	0.00	0	0
100	0.34	202	521	0	(80)	208	0.11	0.00	0	0
110	0.45	269	789	0	(80)	397	0.21	0.00	0	0
120	0.58	348	1,137	0	(80)	664	0.35	0.00	0	0
130	0.70	419	1,556	0	(80)	1,003	0.52	0.00	0	0
140	0.80	480	2,036	0	(80)	1,403	0.73	0.00	0	0
150	0.90	539	2,575	0	(80)	1,861	0.96	0.00	0	0
160	0.98	588	3,163	0	(80)	2,370	1.22	0.00	0	0
170	1.10	659	3,823	0	(80)	2,949	1.50	0.00	0	0
180	1.24	747	4,570	0	(80)	3,615	1.83	0.00	0	0
190	1.36	815	5,385	0	(80)	4,350	2.18	0.00	0	0
200	1.45	869	6,254	0	(80)	5,139	2.54	0.00	0	0
210	1.53	917	7,171	0	(80)	5,976	2.92	0.00	0	0
220	1.60	959	8,129	0	(80)	6,854	3.31	0.00	0	0
230	1.72	1,031	9,161	0	(80)	7,805	3.72	0.00	0	0
240	1.87	1,124	10,284	0	(80)	8,849	4.16	0.00	0	0
250	1.99	1,196	11,481	(3,609)	(80)	6,356	3.09	0.00	3,609	0
260	2.09	1,254	12,734	0	(80)	7,529	3.60	0.00	3,609	0
270	2.17	1,300	14,034	0	(80)	8,749	4.12	0.00	3,609	0
280	2.23	1,340	15,374	(3,609)	(80)	6,399	3.11	0.00	7,219	0
290	2.37	1,421	16,795	0	(80)	7,740	3.69	0.00	7,219	0
300	2.55	1,531	18,326	0	(80)	9,191	4.30	0.00	7,219	0
310	2.68	1,610	19,936	(3,609)	(80)	7,111	3.42	0.00	10,828	0
320	2.78	1,670	21,605	0	(80)	8,700	4.10	0.00	10,828	0
330	2.86	1,716	23,321	(3,609)	(80)	6,726	3.26	0.00	14,438	0
340	2.92	1,751	25,072	0	(80)	8,397	3.97	0.00	14,438	0
350	3.06	1,838	26,910	0	(80)	10,155	4.68	0.00	14,438	0
360	3.26	1,957	28,867	(3,609)	(80)	8,422	3.98	0.00	18,047	0
370	3.40	2,039	30,906	0	(80)	10,381	4.77	0.00	18,047	0
380	3.50	2,099	33,005	(3,609)	(80)	8,791	4.13	0.00	21,656	0
390	3.57	2,144	35,149	(3,609)	(80)	7,245	3.48	0.00	25,266	0
400	3.63	2,179	37,328	0	(80)	9,344	4.36	0.00	25,266	0
410	3.97	2,385	39,713	(3,609)	(80)	8,039	3.82	0.00	28,875	0
420	4.50	2,701	42,414	0	(80)	10,659	4.88	0.00	28,875	0
430	4.85	2,910	45,323	(3,609)	(80)	9,879	4.57	0.00	32,484	0
440	5.44	3,262	48,585	(3,609)	(80)	9,452	4.40	0.00	36,094	0
450	6.18	3,709	52,295	(3,609)	(80)	9,472	4.41	0.00	39,703	0
460	7.95	4,770	57,064	(3,609)	(80)	10,552	4.84	0.00	43,313	0
470	12.00	7,202	64,266	(3,609)	(80)	14,064	6.11	0.00	46,922	0
480	14.01	8,408	72,674	(3,609)	(80)	18,783	7.56	0.00	50,531	0
490	12.36	7,416	80,091	(3,609)	(80)	22,509	8.48	0.00	54,141	0
500	10.24	6,141	86,232	(3,609)	(80)	24,961	8.99	0.00	57,750	0
510	8.55	5,132	91,364	(3,609)	(80)	26,403	9.25	0.00	61,360	0
520	7.52	4,510	95,874	(3,609)	(80)	27,224	9.39	0.00	64,969	0
530	6.50	3,897	99,772	(3,609)	(80)	27,432	9.42	0.00	68,578	0
540	5.48	3,290	103,061	(3,609)	(80)	27,032	9.36	0.00	72,188	0
550	4.86	2,917	105,978	(3,609)	(80)	26,259	9.23	0.00	75,797	0
560	4.48	2,688	108,666	(3,609)	(80)	25,257	9.05	0.00	79,407	0
570	4.25	2,547	111,213	(3,609)	(80)	24,115	8.83	0.00	83,016	0
580	4.11	2,463	113,676	(3,609)	(80)	22,888	8.57	0.00	86,625	0
590	4.02	2,412	116,088	(3,609)	(80)	21,611	8.28	0.00	90,235	0
600	3.97	2,381	118,469	(3,609)	(80)	20,302	7.96	0.00	93,844	0
610	3.94	2,362	120,831	(3,609)	(80)	18,975	7.61	0.00	97,453	0
620	3.92	2,352	123,183	(3,609)	(80)	17,637	7.23	0.00	101,063	0
630	3.91	2,348	125,532	(3,609)	(80)	16,296	6.83	0.00	104,672	0
640	3.91	2,347	127,878	(3,609)	(80)	14,953	6.40	0.00	108,282	0

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	3.77	2,264	130,142	(3,609)	(80)	13,527	5.93	0.00	111,891	0
660	3.56	2,134	132,276	(3,609)	(80)	11,971	5.37	0.00	115,500	0
670	3.42	2,054	134,330	(3,609)	(80)	10,336	4.75	0.00	119,110	0
680	3.34	2,003	136,333	(3,609)	(80)	8,649	4.08	0.00	122,719	0
690	3.29	1,974	138,307	(3,609)	(80)	6,934	3.35	0.00	126,329	0
700	3.26	1,957	140,264	0	(80)	8,811	4.14	0.00	126,329	0
710	3.24	1,946	142,211	(3,609)	(80)	7,068	3.41	0.00	129,938	0
720	3.23	1,940	144,151	0	(80)	8,928	4.19	0.00	129,938	0
730	3.23	1,937	146,088	(3,609)	(80)	7,175	3.45	0.00	133,547	0
740	3.23	1,935	148,023	0	(80)	9,030	4.23	0.00	133,547	0
750	3.22	1,935	149,958	(3,609)	(80)	7,275	3.50	0.00	137,157	0
760	3.23	1,937	151,895	0	(80)	9,132	4.27	0.00	137,157	0
770	3.10	1,860	153,755	(3,609)	(80)	7,302	3.51	0.00	140,766	0
780	2.89	1,733	155,488	0	(80)	8,955	4.20	0.00	140,766	0
790	2.76	1,657	157,145	(3,609)	(80)	6,923	3.34	0.00	144,375	0
800	2.68	1,611	158,756	0	(80)	8,454	3.99	0.00	144,375	0
810	2.63	1,581	160,337	0	(80)	9,954	4.60	0.00	144,375	0
820	2.61	1,564	161,900	(3,609)	(80)	7,828	3.73	0.00	147,985	0
830	2.59	1,554	163,454	0	(80)	9,302	4.34	0.00	147,985	0
840	2.58	1,546	165,000	(3,609)	(80)	7,158	3.45	0.00	151,594	0
850	2.57	1,543	166,543	0	(80)	8,620	4.06	0.00	151,594	0
860	2.57	1,542	168,084	(3,609)	(80)	6,472	3.15	0.00	155,204	0
870	2.57	1,541	169,625	0	(80)	7,933	3.78	0.00	155,204	0
880	2.57	1,541	171,166	0	(80)	9,393	4.38	0.00	155,204	0
890	2.51	1,505	172,671	(3,609)	(80)	7,209	3.47	0.00	158,813	0
900	2.42	1,451	174,122	0	(80)	8,580	4.05	0.00	158,813	0
910	2.36	1,416	175,538	(3,609)	(80)	6,306	3.07	0.00	162,422	0
920	2.32	1,394	176,932	0	(80)	7,620	3.64	0.00	162,422	0
930	2.30	1,383	178,315	0	(80)	8,923	4.19	0.00	162,422	0
940	2.29	1,374	179,689	(3,609)	(80)	6,607	3.21	0.00	166,032	0
950	2.28	1,369	181,058	0	(80)	7,896	3.76	0.00	166,032	0
960	2.28	1,367	182,426	0	(80)	9,183	4.29	0.00	166,032	0
970	2.28	1,367	183,793	(3,609)	(80)	6,861	3.32	0.00	169,641	0
980	2.28	1,367	185,159	0	(80)	8,147	3.87	0.00	169,641	0
990	2.27	1,365	186,524	0	(80)	9,432	4.39	0.00	169,641	0
1000	2.27	1,364	187,888	(3,609)	(80)	7,106	3.42	0.00	173,251	0
1010	2.19	1,312	189,199	0	(80)	8,337	3.95	0.00	173,251	0
1020	2.04	1,226	190,425	0	(80)	9,483	4.41	0.00	173,251	0
1030	1.96	1,175	191,600	(3,609)	(80)	6,969	3.36	0.00	176,860	0
1040	1.91	1,144	192,744	0	(80)	8,032	3.82	0.00	176,860	0
1050	1.87	1,122	193,866	0	(80)	9,074	4.25	0.00	176,860	0
1060	1.85	1,109	194,975	(3,609)	(80)	6,493	3.15	0.00	180,469	0
1070	1.84	1,101	196,076	0	(80)	7,514	3.60	0.00	180,469	0
1080	1.83	1,096	197,172	0	(80)	8,530	4.03	0.00	180,469	0
1090	1.82	1,093	198,265	(3,609)	(80)	5,934	2.91	0.00	184,079	0
1100	1.82	1,093	199,359	0	(80)	6,947	3.35	0.00	184,079	0
1110	1.82	1,094	200,453	0	(80)	7,960	3.79	0.00	184,079	0
1120	1.82	1,092	201,545	0	(80)	8,972	4.21	0.00	184,079	0
1130	1.82	1,091	202,636	(3,609)	(80)	6,374	3.10	0.00	187,688	0
1140	1.82	1,090	203,726	0	(80)	7,384	3.54	0.00	187,688	0
1150	1.82	1,090	204,816	0	(80)	8,393	3.97	0.00	187,688	0
1160	1.82	1,092	205,908	0	(80)	9,405	4.38	0.00	187,688	0
1170	1.82	1,093	207,001	(3,609)	(80)	6,809	3.29	0.00	191,298	0
1180	1.82	1,092	208,093	0	(80)	7,820	3.73	0.00	191,298	0
1190	1.82	1,091	209,184	0	(80)	8,831	4.15	0.00	191,298	0
1200	1.82	1,091	210,275	(3,609)	(80)	6,233	3.04	0.00	194,907	0
1210	1.82	1,093	211,368	0	(80)	7,246	3.48	0.00	194,907	0
1220	1.82	1,094	212,462	0	(80)	8,259	3.91	0.00	194,907	0
1230	1.82	1,093	213,555	0	(80)	9,272	4.33	0.00	194,907	0
1240	1.82	1,092	214,647	(3,609)	(80)	6,675	3.23	0.00	198,516	0
1250	1.82	1,094	215,741	0	(80)	7,688	3.67	0.00	198,516	0
1260	1.82	1,095	216,836	0	(80)	8,703	4.10	0.00	198,516	0
1270	1.82	1,094	217,929	(3,609)	(80)	6,107	2.98	0.00	202,126	0
1280	1.82	1,093	219,023	0	(80)	7,120	3.43	0.00	202,126	0
1290	1.82	1,095	220,117	0	(80)	8,134	3.86	0.00	202,126	0
1300	1.83	1,095	221,213	0	(80)	9,150	4.28	0.00	202,126	0
1310	1.82	1,094	222,307	(3,609)	(80)	6,554	3.18	0.00	205,735	0
1320	1.83	1,096	223,403	0	(80)	7,570	3.62	0.00	205,735	0
1330	1.83	1,097	224,499	0	(80)	8,586	4.05	0.00	205,735	0
1340	1.83	1,095	225,595	(3,609)	(80)	5,992	2.93	0.00	209,344	0
1350	1.82	1,094	226,689	0	(80)	7,006	3.38	0.00	209,344	0
1360	1.83	1,096	227,784	0	(80)	8,021	3.81	0.00	209,344	0
1370	1.83	1,096	228,881	0	(80)	9,037	4.23	0.00	209,344	0
1380	1.83	1,095	229,976	(3,609)	(80)	6,443	3.13	0.00	212,954	0
1390	1.83	1,097	231,072	0	(80)	7,459	3.57	0.00	212,954	0
1400	1.83	1,097	232,170	0	(80)	8,476	4.00	0.00	212,954	0
1410	1.83	1,096	233,266	(3,609)	(80)	5,883	2.88	0.00	216,563	0
1420	1.83	1,097	234,363	0	(80)	6,900	3.33	0.00	216,563	0
1430	1.83	1,098	235,461	0	(80)	7,917	3.77	0.00	216,563	0
1440	1.83	1,097	236,557	0	(80)	8,934	4.19	0.00	216,563	0

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Existing Pond

Bioretention	25-Year SBUH Hydrology	Future Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	80.21	cf

Pond Information		
Pond Overtop Elevation	10	ft
Pond Overtop Volume	32,940	cf
Time Pond Overtopped	2.83	hr
Volume Flooding	0.87	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(80)	0	0.00	0.00	0	0
20	0.00	0	0	0	(80)	0	0.00	0.00	0	0
30	0.00	0	0	0	(80)	0	0.00	0.00	0	0
40	0.04	22	22	0	(80)	0	0.00	0.00	0	0
50	0.15	88	110	0	(80)	7	0.00	0.00	0	0
60	0.30	182	292	0	(80)	109	0.06	0.00	0	0
70	0.48	288	580	0	(80)	317	0.17	0.00	0	0
80	0.66	396	976	0	(80)	633	0.33	0.00	0	0
90	0.83	496	1,472	0	(80)	1,049	0.55	0.00	0	0
100	0.98	586	2,058	0	(80)	1,555	0.81	0.00	0	0
110	1.18	708	2,766	0	(80)	2,183	1.12	0.00	0	0
120	1.42	853	3,619	0	(80)	2,956	1.51	0.00	0	0
130	1.62	973	4,592	0	(80)	3,848	1.94	0.00	0	0
140	1.78	1,070	5,662	0	(80)	4,838	2.41	0.00	0	0
150	1.92	1,151	6,813	0	(80)	5,909	2.89	0.00	0	0
160	2.03	1,220	8,034	0	(80)	7,049	3.40	0.00	0	0
170	2.23	1,338	9,372	0	(80)	8,307	3.93	0.00	0	0
180	2.48	1,488	10,860	0	(80)	9,715	4.51	0.00	0	0
190	2.67	1,604	12,465	(3,609)	(80)	7,630	3.65	0.00	3,609	0
200	2.83	1,696	14,160	0	(80)	9,245	4.32	0.00	3,609	0
210	2.95	1,769	15,929	(3,609)	(80)	7,325	3.52	0.00	7,219	0
220	3.05	1,833	17,762	0	(80)	9,077	4.25	0.00	7,219	0
230	3.25	1,950	19,712	(3,609)	(80)	7,338	3.52	0.00	10,828	0
240	3.50	2,101	21,813	0	(80)	9,358	4.36	0.00	10,828	0
250	3.69	2,211	24,024	(3,609)	(80)	7,880	3.75	0.00	14,438	0
260	3.82	2,295	26,319	0	(80)	10,094	4.66	0.00	14,438	0
270	3.93	2,359	28,677	(3,609)	(80)	8,764	4.12	0.00	18,047	0
280	4.02	2,409	31,087	(3,609)	(80)	7,483	3.59	0.00	21,656	0
290	4.23	2,537	33,624	0	(80)	9,941	4.60	0.00	21,656	0
300	4.52	2,712	36,336	(3,609)	(80)	8,963	4.20	0.00	25,266	0
310	4.72	2,831	39,167	(3,609)	(80)	8,105	3.85	0.00	28,875	0
320	4.86	2,916	42,083	0	(80)	10,940	4.98	0.00	28,875	0
330	4.96	2,979	45,062	(3,609)	(80)	10,230	4.71	0.00	32,484	0
340	5.05	3,028	48,090	(3,609)	(80)	9,568	4.45	0.00	36,094	0
350	5.27	3,164	51,254	(3,609)	(80)	9,042	4.24	0.00	39,703	0
360	5.59	3,354	54,608	(3,609)	(80)	8,707	4.10	0.00	43,313	0
370	5.80	3,481	58,089	(3,609)	(80)	8,499	4.01	0.00	46,922	0
380	5.95	3,568	61,658	(3,609)	(80)	8,377	3.96	0.00	50,531	0
390	6.05	3,630	65,288	0	(80)	11,927	5.35	0.00	50,531	0
400	6.13	3,677	68,965	(3,609)	(80)	11,915	5.35	0.00	54,141	0
410	6.69	4,011	72,976	(3,609)	(80)	12,236	5.47	0.00	57,750	0
420	7.54	4,523	77,499	(3,609)	(80)	13,069	5.77	0.00	61,360	0
430	8.08	4,850	82,349	(3,609)	(80)	14,230	6.16	0.00	64,969	0
440	9.03	5,420	87,769	(3,609)	(80)	15,960	6.73	0.00	68,578	0
450	10.24	6,144	93,913	(3,609)	(80)	18,415	7.45	0.00	72,188	0
460	13.11	7,864	101,776	(3,609)	(80)	22,589	8.50	0.00	75,797	0
470	19.67	11,804	113,580	(3,609)	(80)	30,703	9.86	0.00	79,407	0
480	22.88	13,728	127,308	(3,609)	(80)	32,940	10.08	0.17	83,016	7,801
490	20.13	12,076	139,384	(3,609)	(80)	32,940	10.08	0.33	86,625	16,187
500	16.63	9,976	149,360	(3,609)	(80)	32,940	10.08	0.50	90,235	22,474
510	13.86	8,317	157,677	(3,609)	(80)	32,940	10.08	0.67	93,844	27,101
520	12.16	7,295	164,971	(3,609)	(80)	32,940	10.08	0.83	97,453	30,706
530	10.49	6,295	171,266	(3,609)	(80)	32,940	10.08	1.00	101,063	33,311
540	8.85	5,310	176,576	(3,609)	(80)	32,940	10.08	1.17	104,672	34,932
550	7.83	4,701	181,277	(3,609)	(80)	32,940	10.08	1.33	108,282	35,943
560	7.21	4,325	185,603	(3,609)	(80)	32,940	10.08	1.50	111,891	36,579
570	6.83	4,096	189,699	(3,609)	(80)	32,940	10.08	1.67	115,500	36,986
580	6.59	3,956	193,655	(3,609)	(80)	32,940	10.08	1.83	119,110	37,252
590	6.45	3,870	197,524	(3,609)	(80)	32,940	10.08	2.00	122,719	37,432
600	6.37	3,819	201,343	(3,609)	(80)	32,940	10.08	2.17	126,329	37,561
610	6.32	3,789	205,133	(3,609)	(80)	32,940	10.08	2.33	129,938	37,661
620	6.28	3,770	208,902	(3,609)	(80)	32,940	10.08	2.50	133,547	37,741
630	6.27	3,760	212,662	(3,609)	(80)	32,940	10.08	2.67	137,157	37,811
640	6.26	3,755	216,416	(3,609)	(80)	32,940	10.08	2.83	140,766	37,876

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	6.03	3,621	220,037	(3,609)	(80)	32,871	10.07	2.83	144,375	37,876
660	5.69	3,411	223,448	(3,609)	(80)	32,593	10.05	2.83	147,985	37,876
670	5.47	3,282	226,731	(3,609)	(80)	32,186	10.01	2.83	151,594	37,876
680	5.34	3,201	229,932	(3,609)	(80)	31,697	9.97	2.83	155,204	37,876
690	5.25	3,152	233,084	(3,609)	(80)	31,159	9.91	2.83	158,813	37,876
700	5.20	3,121	236,205	(3,609)	(80)	30,591	9.85	2.83	162,422	37,876
710	5.17	3,103	239,308	(3,609)	(80)	30,004	9.78	2.83	166,032	37,876
720	5.16	3,094	242,402	(3,609)	(80)	29,409	9.71	2.83	169,641	37,876
730	5.15	3,089	245,491	(3,609)	(80)	28,808	9.62	2.83	173,251	37,876
740	5.14	3,084	248,575	(3,609)	(80)	28,202	9.54	2.83	176,860	37,876
750	5.14	3,084	251,658	(3,609)	(80)	27,596	9.45	2.83	180,469	37,876
760	5.14	3,084	254,742	(3,609)	(80)	26,990	9.35	2.83	184,079	37,876
770	4.94	2,962	257,704	(3,609)	(80)	26,263	9.23	2.83	187,688	37,876
780	4.61	2,766	260,470	(3,609)	(80)	25,339	9.06	2.83	191,298	37,876
790	4.41	2,646	263,116	(3,609)	(80)	24,295	8.86	2.83	194,907	37,876
800	4.29	2,571	265,687	(3,609)	(80)	23,177	8.63	2.83	198,516	37,876
810	4.21	2,524	268,211	(3,609)	(80)	22,012	8.37	2.83	202,126	37,876
820	4.16	2,495	270,706	(3,609)	(80)	20,817	8.09	2.83	205,735	37,876
830	4.13	2,479	273,185	(3,609)	(80)	19,606	7.78	2.83	209,344	37,876
840	4.11	2,469	275,654	(3,609)	(80)	18,385	7.45	2.83	212,954	37,876
850	4.11	2,463	278,117	(3,609)	(80)	17,159	7.09	2.83	216,563	37,876
860	4.10	2,460	280,577	(3,609)	(80)	15,929	6.72	2.83	220,173	37,876
870	4.10	2,458	283,035	(3,609)	(80)	14,697	6.32	2.83	223,782	37,876
880	4.10	2,457	285,492	(3,609)	(80)	13,465	5.90	2.83	227,391	37,876
890	4.00	2,398	287,890	(3,609)	(80)	12,173	5.44	2.83	231,001	37,876
900	3.84	2,302	290,192	(3,609)	(80)	10,786	4.93	2.83	234,610	37,876
910	3.74	2,244	292,435	(3,609)	(80)	9,340	4.36	2.83	238,220	37,876
920	3.68	2,207	294,643	(3,609)	(80)	7,858	3.74	2.83	241,829	37,876
930	3.64	2,185	296,828	0	(80)	9,962	4.61	2.83	241,829	37,876
940	3.62	2,173	299,001	(3,609)	(80)	8,446	3.99	2.83	245,438	37,876
950	3.61	2,166	301,168	0	(80)	10,532	4.83	2.83	245,438	37,876
960	3.60	2,160	303,328	(3,609)	(80)	9,003	4.22	2.83	249,048	37,876
970	3.59	2,156	305,484	(3,609)	(80)	7,469	3.58	2.83	252,657	37,876
980	3.59	2,154	307,638	0	(80)	9,543	4.44	2.83	252,657	37,876
990	3.59	2,153	309,791	(3,609)	(80)	8,007	3.81	2.83	256,266	37,876
1000	3.59	2,154	311,945	0	(80)	10,080	4.65	2.83	256,266	37,876
1010	3.45	2,073	314,017	(3,609)	(80)	8,463	4.00	2.83	259,876	37,876
1020	3.23	1,938	315,955	0	(80)	10,321	4.75	2.83	259,876	37,876
1030	3.09	1,856	317,811	(3,609)	(80)	8,487	4.01	2.83	263,485	37,876
1040	3.01	1,806	319,617	(3,609)	(80)	6,603	3.20	2.83	267,095	37,876
1050	2.96	1,775	321,392	0	(80)	8,298	3.93	2.83	267,095	37,876
1060	2.93	1,756	323,148	0	(80)	9,974	4.61	2.83	267,095	37,876
1070	2.90	1,742	324,890	(3,609)	(80)	8,027	3.82	2.83	270,704	37,876
1080	2.89	1,736	326,626	0	(80)	9,683	4.49	2.83	270,704	37,876
1090	2.89	1,732	328,358	(3,609)	(80)	7,725	3.69	2.83	274,313	37,876
1100	2.88	1,730	330,088	0	(80)	9,374	4.37	2.83	274,313	37,876
1110	2.88	1,728	331,816	(3,609)	(80)	7,413	3.56	2.83	277,923	37,876
1120	2.88	1,728	333,544	0	(80)	9,061	4.24	2.83	277,923	37,876
1130	2.88	1,727	335,271	(3,609)	(80)	7,099	3.42	2.83	281,532	37,876
1140	2.88	1,725	336,996	0	(80)	8,744	4.11	2.83	281,532	37,876
1150	2.88	1,726	338,722	(3,609)	(80)	6,780	3.28	2.83	285,142	37,876
1160	2.88	1,726	340,448	0	(80)	8,426	3.98	2.83	285,142	37,876
1170	2.88	1,726	342,175	0	(80)	10,072	4.65	2.83	285,142	37,876
1180	2.88	1,726	343,901	(3,609)	(80)	8,109	3.85	2.83	288,751	37,876
1190	2.88	1,727	345,628	0	(80)	9,755	4.52	2.83	288,751	37,876
1200	2.88	1,727	347,355	(3,609)	(80)	7,793	3.72	2.83	292,360	37,876
1210	2.88	1,727	349,083	0	(80)	9,440	4.40	2.83	292,360	37,876
1220	2.88	1,728	350,810	(3,609)	(80)	7,478	3.58	2.83	295,970	37,876
1230	2.88	1,728	352,538	0	(80)	9,126	4.27	2.83	295,970	37,876
1240	2.88	1,728	354,266	(3,609)	(80)	7,164	3.45	2.83	299,579	37,876
1250	2.88	1,728	355,994	0	(80)	8,812	4.14	2.83	299,579	37,876
1260	2.88	1,728	357,722	(3,609)	(80)	6,850	3.31	2.83	303,189	37,876
1270	2.88	1,728	359,450	0	(80)	8,498	4.01	2.83	303,189	37,876
1280	2.88	1,728	361,179	(3,609)	(80)	6,537	3.17	2.83	306,798	37,876
1290	2.88	1,729	362,907	0	(80)	8,185	3.88	2.83	306,798	37,876
1300	2.88	1,729	364,636	0	(80)	9,834	4.55	2.83	306,798	37,876
1310	2.88	1,729	366,365	(3,609)	(80)	7,873	3.75	2.83	310,407	37,876
1320	2.88	1,729	368,094	0	(80)	9,522	4.43	2.83	310,407	37,876
1330	2.88	1,729	369,823	(3,609)	(80)	7,562	3.62	2.83	314,017	37,876
1340	2.88	1,729	371,553	0	(80)	9,211	4.31	2.83	314,017	37,876
1350	2.88	1,730	373,282	(3,609)	(80)	7,251	3.49	2.83	317,626	37,876
1360	2.88	1,730	375,012	0	(80)	8,901	4.18	2.83	317,626	37,876
1370	2.88	1,730	376,742	(3,609)	(80)	6,941	3.35	2.83	321,235	37,876
1380	2.88	1,730	378,472	0	(80)	8,590	4.05	2.83	321,235	37,876
1390	2.88	1,730	380,202	(3,609)	(80)	6,631	3.22	2.83	324,845	37,876
1400	2.88	1,730	381,932	0	(80)	8,281	3.92	2.83	324,845	37,876
1410	2.88	1,730	383,662	0	(80)	9,931	4.59	2.83	324,845	37,876
1420	2.89	1,732	385,394	(3,609)	(80)	7,973	3.79	2.83	328,454	37,876
1430	2.89	1,732	387,126	0	(80)	9,625	4.47	2.83	328,454	37,876
1440	2.89	1,731	388,857	(3,609)	(80)	7,667	3.66	2.83	332,064	37,876

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Existing Pond

No Bioretention | **10-Year SBUH Hydrology** | **Existing Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	10	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	80.21	cf	Pond Overtop Volume	32,940	cf
	3,609	cf				Time Pond Overtopped	5.17	hr
Pump on height[1]	4	ft				Volume Flooding	0.91	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(80)	0	0.00	0.00	0	0
20	0.00	0	0	0	(80)	0	0.00	0.00	0	0
30	0.00	0	0	0	(80)	0	0.00	0.00	0	0
40	0.00	0	0	0	(80)	0	0.00	0.00	0	0
50	0.00	1	1	0	(80)	0	0.00	0.00	0	0
60	0.01	5	5	0	(80)	0	0.00	0.00	0	0
70	0.03	16	21	0	(80)	0	0.00	0.00	0	0
80	0.05	32	53	0	(80)	0	0.00	0.00	0	0
90	0.09	53	105	0	(80)	0	0.00	0.00	0	0
100	0.13	78	183	0	(80)	0	0.00	0.00	0	0
110	0.18	109	292	0	(80)	29	0.02	0.00	0	0
120	0.25	149	441	0	(80)	98	0.05	0.00	0	0
130	0.32	191	632	0	(80)	208	0.11	0.00	0	0
140	0.39	234	866	0	(80)	362	0.19	0.00	0	0
150	0.47	279	1,145	0	(80)	561	0.30	0.00	0	0
160	0.54	324	1,469	0	(80)	805	0.42	0.00	0	0
170	0.63	376	1,845	0	(80)	1,101	0.58	0.00	0	0
180	0.73	435	2,280	0	(80)	1,456	0.76	0.00	0	0
190	0.82	493	2,774	0	(80)	1,869	0.97	0.00	0	0
200	0.92	550	3,324	0	(80)	2,339	1.20	0.00	0	0
210	1.01	606	3,929	0	(80)	2,864	1.46	0.00	0	0
220	1.10	661	4,590	0	(80)	3,445	1.75	0.00	0	0
230	1.21	727	5,317	0	(80)	4,092	2.05	0.00	0	0
240	1.34	805	6,122	0	(80)	4,817	2.40	0.00	0	0
250	1.47	884	7,006	0	(80)	5,620	2.76	0.00	0	0
260	1.61	963	7,969	0	(80)	6,503	3.16	0.00	0	0
270	1.74	1,042	9,012	0	(80)	7,465	3.58	0.00	0	0
280	1.87	1,121	10,133	0	(80)	8,506	4.02	0.00	0	0
290	2.02	1,214	11,347	(3,609)	(80)	6,031	2.95	0.00	3,609	0
300	2.20	1,322	12,669	0	(80)	7,273	3.49	0.00	3,609	0
310	2.38	1,427	14,096	0	(80)	8,620	4.06	0.00	3,609	0
320	2.55	1,531	15,627	(3,609)	(80)	6,461	3.14	0.00	7,219	0
330	2.72	1,631	17,258	0	(80)	8,012	3.81	0.00	7,219	0
340	2.88	1,730	18,988	0	(80)	9,661	4.49	0.00	7,219	0
350	3.07	1,845	20,833	(3,609)	(80)	7,817	3.73	0.00	10,828	0
360	3.29	1,976	22,808	0	(80)	9,712	4.51	0.00	10,828	0
370	3.50	2,102	24,911	(3,609)	(80)	8,125	3.86	0.00	14,438	0
380	3.71	2,225	27,135	0	(80)	10,269	4.73	0.00	14,438	0
390	3.90	2,342	29,478	(3,609)	(80)	8,922	4.19	0.00	18,047	0
400	4.09	2,457	31,934	(3,609)	(80)	7,689	3.67	0.00	21,656	0
410	4.39	2,632	34,566	0	(80)	10,240	4.71	0.00	21,656	0
420	4.78	2,866	37,432	(3,609)	(80)	9,416	4.39	0.00	25,266	0
430	5.15	3,090	40,521	(3,609)	(80)	8,816	4.14	0.00	28,875	0
440	5.64	3,385	43,906	(3,609)	(80)	8,512	4.02	0.00	32,484	0
450	6.25	3,749	47,655	(3,609)	(80)	8,571	4.04	0.00	36,094	0
460	7.32	4,395	52,049	(3,609)	(80)	9,276	4.33	0.00	39,703	0
470	9.51	5,704	57,753	(3,609)	(80)	11,290	5.12	0.00	43,313	0
480	11.35	6,809	64,563	(3,609)	(80)	14,410	6.23	0.00	46,922	0
490	11.91	7,143	71,706	(3,609)	(80)	17,864	7.30	0.00	50,531	0
500	11.98	7,186	78,892	(3,609)	(80)	21,360	8.22	0.00	54,141	0
510	11.90	7,137	86,030	(3,609)	(80)	24,808	8.96	0.00	57,750	0
520	11.83	7,096	93,125	(3,609)	(80)	28,214	9.54	0.00	61,360	0
530	11.61	6,965	100,090	(3,609)	(80)	31,490	9.95	0.00	64,969	0
540	11.25	6,752	106,842	(3,609)	(80)	32,940	10.08	0.17	68,578	1,612
550	10.93	6,558	113,401	(3,609)	(80)	32,940	10.08	0.33	72,188	4,481
560	10.64	6,382	119,783	(3,609)	(80)	32,940	10.08	0.50	75,797	7,173
570	10.37	6,222	126,004	(3,609)	(80)	32,940	10.08	0.67	79,407	9,705
580	10.13	6,076	132,081	(3,609)	(80)	32,940	10.08	0.83	83,016	12,092
590	9.91	5,944	138,025	(3,609)	(80)	32,940	10.08	1.00	86,625	14,346
600	9.71	5,823	143,848	(3,609)	(80)	32,940	10.08	1.17	90,235	16,480
610	9.52	5,714	149,562	(3,609)	(80)	32,940	10.08	1.33	93,844	18,505
620	9.36	5,615	155,177	(3,609)	(80)	32,940	10.08	1.50	97,453	20,430
630	9.21	5,526	160,703	(3,609)	(80)	32,940	10.08	1.67	101,063	22,267
640	9.08	5,445	166,148	(3,609)	(80)	32,940	10.08	1.83	104,672	24,022

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	8.90	5,337	171,486	(3,609)	(80)	32,940	10.08	2.00	108,282	25,670
660	8.68	5,205	176,691	(3,609)	(80)	32,940	10.08	2.17	111,891	27,186
670	8.47	5,085	181,776	(3,609)	(80)	32,940	10.08	2.33	115,500	28,581
680	8.29	4,974	186,750	(3,609)	(80)	32,940	10.08	2.50	119,110	29,866
690	8.12	4,874	191,624	(3,609)	(80)	32,940	10.08	2.67	122,719	31,050
700	7.97	4,783	196,407	(3,609)	(80)	32,940	10.08	2.83	126,329	32,144
710	7.83	4,700	201,107	(3,609)	(80)	32,940	10.08	3.00	129,938	33,154
720	7.71	4,624	205,732	(3,609)	(80)	32,940	10.08	3.17	133,547	34,089
730	7.59	4,555	210,287	(3,609)	(80)	32,940	10.08	3.33	137,157	34,954
740	7.49	4,493	214,780	(3,609)	(80)	32,940	10.08	3.50	140,766	35,758
750	7.39	4,436	219,216	(3,609)	(80)	32,940	10.08	3.67	144,375	36,504
760	7.31	4,385	223,601	(3,609)	(80)	32,940	10.08	3.83	147,985	37,200
770	7.18	4,305	227,906	(3,609)	(80)	32,940	10.08	4.00	151,594	37,815
780	7.00	4,199	232,105	(3,609)	(80)	32,940	10.08	4.17	155,204	38,325
790	6.84	4,102	236,207	(3,609)	(80)	32,940	10.08	4.33	158,813	38,737
800	6.69	4,013	240,220	(3,609)	(80)	32,940	10.08	4.50	162,422	39,060
810	6.55	3,932	244,152	(3,609)	(80)	32,940	10.08	4.67	166,032	39,302
820	6.43	3,858	248,010	(3,609)	(80)	32,940	10.08	4.83	169,641	39,471
830	6.32	3,791	251,800	(3,609)	(80)	32,940	10.08	5.00	173,251	39,572
840	6.21	3,729	255,529	(3,609)	(80)	32,940	10.08	5.17	176,860	39,611
850	6.12	3,672	259,201	(3,609)	(80)	32,923	10.08	5.17	180,469	39,611
860	6.04	3,621	262,823	(3,609)	(80)	32,854	10.07	5.17	184,079	39,611
870	5.96	3,575	266,398	(3,609)	(80)	32,740	10.06	5.17	187,688	39,611
880	5.89	3,532	269,930	(3,609)	(80)	32,583	10.05	5.17	191,298	39,611
890	5.80	3,478	273,408	(3,609)	(80)	32,371	10.03	5.17	194,907	39,611
900	5.69	3,415	276,823	(3,609)	(80)	32,097	10.01	5.17	198,516	39,611
910	5.59	3,356	280,180	(3,609)	(80)	31,763	9.97	5.17	202,126	39,611
920	5.50	3,303	283,482	(3,609)	(80)	31,377	9.94	5.17	205,735	39,611
930	5.42	3,254	286,737	(3,609)	(80)	30,941	9.89	5.17	209,344	39,611
940	5.35	3,210	289,946	(3,609)	(80)	30,461	9.83	5.17	212,954	39,611
950	5.28	3,169	293,115	(3,609)	(80)	29,941	9.77	5.17	216,563	39,611
960	5.22	3,132	296,247	(3,609)	(80)	29,383	9.70	5.17	220,173	39,611
970	5.16	3,099	299,346	(3,609)	(80)	28,792	9.62	5.17	223,782	39,611
980	5.11	3,068	302,414	(3,609)	(80)	28,171	9.53	5.17	227,391	39,611
990	5.07	3,040	305,454	(3,609)	(80)	27,521	9.44	5.17	231,001	39,611
1000	5.02	3,014	308,468	(3,609)	(80)	26,845	9.33	5.17	234,610	39,611
1010	4.95	2,968	311,436	(3,609)	(80)	26,124	9.20	5.17	238,220	39,611
1020	4.84	2,903	314,338	(3,609)	(80)	25,337	9.06	5.17	241,829	39,611
1030	4.74	2,843	317,182	(3,609)	(80)	24,491	8.90	5.17	245,438	39,611
1040	4.65	2,789	319,971	(3,609)	(80)	23,590	8.72	5.17	249,048	39,611
1050	4.56	2,739	322,710	(3,609)	(80)	22,639	8.51	5.17	252,657	39,611
1060	4.49	2,692	325,402	(3,609)	(80)	21,642	8.29	5.17	256,266	39,611
1070	4.42	2,651	328,052	(3,609)	(80)	20,603	8.03	5.17	259,876	39,611
1080	4.35	2,612	330,665	(3,609)	(80)	19,525	7.76	5.17	263,485	39,611
1090	4.29	2,577	333,242	(3,609)	(80)	18,413	7.45	5.17	267,095	39,611
1100	4.24	2,545	335,787	(3,609)	(80)	17,268	7.12	5.17	270,704	39,611
1110	4.19	2,516	338,303	(3,609)	(80)	16,095	6.77	5.17	274,313	39,611
1120	4.15	2,489	340,792	(3,609)	(80)	14,895	6.39	5.17	277,923	39,611
1130	4.11	2,465	343,257	(3,609)	(80)	13,670	5.97	5.17	281,532	39,611
1140	4.07	2,442	345,699	(3,609)	(80)	12,423	5.53	5.17	285,142	39,611
1150	4.04	2,422	348,121	(3,609)	(80)	11,154	5.07	5.17	288,751	39,611
1160	4.01	2,404	350,525	(3,609)	(80)	9,869	4.57	5.17	292,360	39,611
1170	3.98	2,387	352,912	(3,609)	(80)	8,566	4.04	5.17	295,970	39,611
1180	3.95	2,371	355,283	(3,609)	(80)	7,248	3.48	5.17	299,579	39,611
1190	3.93	2,357	357,640	0	(80)	9,524	4.43	5.17	299,579	39,611
1200	3.91	2,344	359,984	(3,609)	(80)	8,179	3.88	5.17	303,189	39,611
1210	3.89	2,333	362,317	0	(80)	10,432	4.79	5.17	303,189	39,611
1220	3.87	2,323	364,640	(3,609)	(80)	9,065	4.25	5.17	306,798	39,611
1230	3.85	2,312	366,952	(3,609)	(80)	7,687	3.67	5.17	310,407	39,611
1240	3.84	2,304	369,256	0	(80)	9,911	4.58	5.17	310,407	39,611
1250	3.83	2,296	371,552	(3,609)	(80)	8,518	4.02	5.17	314,017	39,611
1260	3.82	2,289	373,842	(3,609)	(80)	7,118	3.43	5.17	317,626	39,611
1270	3.80	2,282	376,124	0	(80)	9,320	4.35	5.17	317,626	39,611
1280	3.79	2,277	378,401	(3,609)	(80)	7,907	3.77	5.17	321,235	39,611
1290	3.79	2,272	380,673	0	(80)	10,099	4.66	5.17	321,235	39,611
1300	3.78	2,267	382,940	(3,609)	(80)	8,676	4.09	5.17	324,845	39,611
1310	3.77	2,263	385,203	(3,609)	(80)	7,249	3.48	5.17	328,454	39,611
1320	3.77	2,259	387,462	0	(80)	9,429	4.39	5.17	328,454	39,611
1330	3.76	2,256	389,718	(3,609)	(80)	7,995	3.80	5.17	332,064	39,611
1340	3.75	2,253	391,971	0	(80)	10,168	4.69	5.17	332,064	39,611
1350	3.75	2,250	394,221	(3,609)	(80)	8,728	4.11	5.17	335,673	39,611
1360	3.75	2,247	396,468	(3,609)	(80)	7,286	3.50	5.17	339,282	39,611
1370	3.74	2,245	398,714	0	(80)	9,451	4.40	5.17	339,282	39,611
1380	3.74	2,243	400,957	(3,609)	(80)	8,004	3.81	5.17	342,892	39,611
1390	3.74	2,242	403,198	0	(80)	10,166	4.69	5.17	342,892	39,611
1400	3.73	2,241	405,439	(3,609)	(80)	8,717	4.10	5.17	346,501	39,611
1410	3.73	2,239	407,678	(3,609)	(80)	7,266	3.49	5.17	350,111	39,611
1420	3.73	2,238	409,916	0	(80)	9,424	4.39	5.17	350,111	39,611
1430	3.73	2,237	412,154	(3,609)	(80)	7,972	3.79	5.17	353,720	39,611
1440	3.73	2,237	414,390	0	(80)	10,129	4.67	5.17	353,720	39,611

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Existing Pond

No Bioretention | **25-Year SBUH Hydrology** | **Existing Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	10	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	80.21	cf	Pond Overtop Volume	32,940	cf
	3,609	cf				Time Pond Overtopped	13.67	hr
Pump on height[1]	4	ft				Volume Flooding	5.29	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(80)	0	0.00	0.00	0	0
20	0.00	0	0	0	(80)	0	0.00	0.00	0	0
30	0.00	0	0	0	(80)	0	0.00	0.00	0	0
40	0.01	6	6	0	(80)	0	0.00	0.00	0	0
50	0.04	25	31	0	(80)	0	0.00	0.00	0	0
60	0.10	57	88	0	(80)	0	0.00	0.00	0	0
70	0.17	99	187	0	(80)	19	0.01	0.00	0	0
80	0.25	149	336	0	(80)	88	0.05	0.00	0	0
90	0.34	204	540	0	(80)	211	0.11	0.00	0	0
100	0.44	261	801	0	(80)	392	0.21	0.00	0	0
110	0.55	332	1,133	0	(80)	644	0.34	0.00	0	0
120	0.69	415	1,548	0	(80)	979	0.51	0.00	0	0
130	0.83	499	2,048	0	(80)	1,398	0.73	0.00	0	0
140	0.97	583	2,631	0	(80)	1,901	0.98	0.00	0	0
150	1.11	665	3,296	0	(80)	2,486	1.28	0.00	0	0
160	1.25	748	4,044	0	(80)	3,154	1.60	0.00	0	0
170	1.42	850	4,893	0	(80)	3,923	1.97	0.00	0	0
180	1.62	970	5,863	0	(80)	4,813	2.39	0.00	0	0
190	1.82	1,092	6,956	0	(80)	5,825	2.86	0.00	0	0
200	2.03	1,216	8,172	0	(80)	6,961	3.36	0.00	0	0
210	2.23	1,341	9,513	0	(80)	8,222	3.90	0.00	0	0
220	2.44	1,465	10,978	0	(80)	9,606	4.46	0.00	0	0
230	2.68	1,609	12,586	(3,609)	(80)	7,525	3.60	0.00	3,609	0
240	2.95	1,771	14,357	0	(80)	9,216	4.31	0.00	3,609	0
250	3.22	1,931	16,289	(3,609)	(80)	7,458	3.57	0.00	7,219	0
260	3.48	2,088	18,376	0	(80)	9,465	4.41	0.00	7,219	0
270	3.73	2,240	20,617	(3,609)	(80)	8,016	3.81	0.00	10,828	0
280	3.98	2,389	23,005	0	(80)	10,325	4.75	0.00	10,828	0
290	4.27	2,564	25,569	(3,609)	(80)	9,199	4.30	0.00	14,438	0
300	4.60	2,763	28,332	(3,609)	(80)	8,272	3.92	0.00	18,047	0
310	4.93	2,955	31,287	0	(80)	11,147	5.06	0.00	18,047	0
320	5.23	3,140	34,427	(3,609)	(80)	10,597	4.85	0.00	21,656	0
330	5.53	3,318	37,744	(3,609)	(80)	10,225	4.71	0.00	25,266	0
340	5.81	3,489	41,233	(3,609)	(80)	10,024	4.63	0.00	28,875	0
350	6.15	3,689	44,922	(3,609)	(80)	10,023	4.63	0.00	32,484	0
360	6.53	3,918	48,840	(3,609)	(80)	10,252	4.72	0.00	36,094	0
370	6.90	4,137	52,978	(3,609)	(80)	10,700	4.89	0.00	39,703	0
380	7.24	4,346	57,324	(3,609)	(80)	11,356	5.14	0.00	43,313	0
390	7.57	4,544	61,868	(3,609)	(80)	12,211	5.46	0.00	46,922	0
400	7.89	4,734	66,602	(3,609)	(80)	13,255	5.83	0.00	50,531	0
410	8.39	5,033	71,634	(3,609)	(80)	14,598	6.29	0.00	54,141	0
420	9.06	5,434	77,069	(3,609)	(80)	16,343	6.85	0.00	57,750	0
430	9.69	5,814	82,882	(3,609)	(80)	18,467	7.47	0.00	61,360	0
440	10.53	6,318	89,201	(3,609)	(80)	21,096	8.15	0.00	64,969	0
450	11.57	6,940	96,141	(3,609)	(80)	24,346	8.87	0.00	68,578	0
460	13.42	8,051	104,191	(3,609)	(80)	28,707	9.61	0.00	72,188	0
470	17.16	10,297	114,488	(3,609)	(80)	32,940	10.08	0.17	75,797	2,375
480	20.28	12,168	126,656	(3,609)	(80)	32,940	10.08	0.33	79,407	10,853
490	21.16	12,696	139,352	(3,609)	(80)	32,940	10.08	0.50	83,016	19,859
500	21.20	12,723	152,075	(3,609)	(80)	32,940	10.08	0.67	86,625	28,893
510	20.99	12,595	164,671	(3,609)	(80)	32,940	10.08	0.83	90,235	37,798
520	20.80	12,482	177,152	(3,609)	(80)	32,940	10.08	1.00	93,844	46,591
530	20.37	12,220	189,373	(3,609)	(80)	32,940	10.08	1.17	97,453	55,121
540	19.71	11,823	201,196	(3,609)	(80)	32,940	10.08	1.33	101,063	63,255
550	19.10	11,459	212,655	(3,609)	(80)	32,940	10.08	1.50	104,672	71,025
560	18.54	11,127	223,782	(3,609)	(80)	32,940	10.08	1.67	108,282	78,462
570	18.04	10,824	234,605	(3,609)	(80)	32,940	10.08	1.83	111,891	85,596
580	17.58	10,547	245,152	(3,609)	(80)	32,940	10.08	2.00	115,500	92,453
590	17.16	10,294	255,446	(3,609)	(80)	32,940	10.08	2.17	119,110	99,057
600	16.77	10,064	265,510	(3,609)	(80)	32,940	10.08	2.33	122,719	105,431
610	16.42	9,854	275,364	(3,609)	(80)	32,940	10.08	2.50	126,329	111,596
620	16.10	9,663	285,027	(3,609)	(80)	32,940	10.08	2.67	129,938	117,569
630	15.81	9,488	294,515	(3,609)	(80)	32,940	10.08	2.83	133,547	123,368
640	15.55	9,330	303,845	(3,609)	(80)	32,940	10.08	3.00	137,157	129,008

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	15.21	9,127	312,972	(3,609)	(80)	32,940	10.08	3.17	140,766	134,446
660	14.81	8,886	321,859	(3,609)	(80)	32,940	10.08	3.33	144,375	139,643
670	14.44	8,666	330,525	(3,609)	(80)	32,940	10.08	3.50	147,985	144,619
680	14.11	8,464	338,988	(3,609)	(80)	32,940	10.08	3.67	151,594	149,393
690	13.80	8,279	347,267	(3,609)	(80)	32,940	10.08	3.83	155,204	153,983
700	13.52	8,110	355,377	(3,609)	(80)	32,940	10.08	4.00	158,813	158,403
710	13.26	7,956	363,333	(3,609)	(80)	32,940	10.08	4.17	162,422	162,669
720	13.03	7,815	371,148	(3,609)	(80)	32,940	10.08	4.33	166,032	166,795
730	12.81	7,687	378,835	(3,609)	(80)	32,940	10.08	4.50	169,641	170,792
740	12.62	7,569	386,405	(3,609)	(80)	32,940	10.08	4.67	173,251	174,672
750	12.44	7,463	393,867	(3,609)	(80)	32,940	10.08	4.83	176,860	178,445
760	12.28	7,365	401,233	(3,609)	(80)	32,940	10.08	5.00	180,469	182,121
770	12.04	7,223	408,456	(3,609)	(80)	32,940	10.08	5.17	184,079	185,654
780	11.73	7,039	415,495	(3,609)	(80)	32,940	10.08	5.33	187,688	189,003
790	11.45	6,870	422,365	(3,609)	(80)	32,940	10.08	5.50	191,298	192,184
800	11.19	6,716	429,080	(3,609)	(80)	32,940	10.08	5.67	194,907	195,210
810	10.96	6,574	435,654	(3,609)	(80)	32,940	10.08	5.83	198,516	198,095
820	10.74	6,445	442,099	(3,609)	(80)	32,940	10.08	6.00	202,126	200,850
830	10.54	6,326	448,425	(3,609)	(80)	32,940	10.08	6.17	205,735	203,486
840	10.36	6,218	454,643	(3,609)	(80)	32,940	10.08	6.33	209,344	206,014
850	10.20	6,118	460,761	(3,609)	(80)	32,940	10.08	6.50	212,954	208,443
860	10.05	6,028	466,789	(3,609)	(80)	32,940	10.08	6.67	216,563	210,781
870	9.91	5,945	472,735	(3,609)	(80)	32,940	10.08	6.83	220,173	213,037
880	9.78	5,870	478,605	(3,609)	(80)	32,940	10.08	7.00	223,782	215,218
890	9.63	5,775	484,380	(3,609)	(80)	32,940	10.08	7.17	227,391	217,304
900	9.44	5,662	490,042	(3,609)	(80)	32,940	10.08	7.33	231,001	219,276
910	9.26	5,558	495,600	(3,609)	(80)	32,940	10.08	7.50	234,610	221,144
920	9.11	5,463	501,064	(3,609)	(80)	32,940	10.08	7.67	238,220	222,918
930	8.96	5,376	506,440	(3,609)	(80)	32,940	10.08	7.83	241,829	224,605
940	8.83	5,298	511,738	(3,609)	(80)	32,940	10.08	8.00	245,438	226,213
950	8.71	5,225	516,963	(3,609)	(80)	32,940	10.08	8.17	249,048	227,749
960	8.60	5,159	522,122	(3,609)	(80)	32,940	10.08	8.33	252,657	229,218
970	8.50	5,097	527,219	(3,609)	(80)	32,940	10.08	8.50	256,266	230,626
980	8.40	5,042	532,261	(3,609)	(80)	32,940	10.08	8.67	259,876	231,978
990	8.32	4,991	537,252	(3,609)	(80)	32,940	10.08	8.83	263,485	233,279
1000	8.24	4,945	542,197	(3,609)	(80)	32,940	10.08	9.00	267,095	234,534
1010	8.11	4,866	547,063	(3,609)	(80)	32,940	10.08	9.17	270,704	235,711
1020	7.93	4,756	551,819	(3,609)	(80)	32,940	10.08	9.33	274,313	236,778
1030	7.76	4,657	556,476	(3,609)	(80)	32,940	10.08	9.50	277,923	237,745
1040	7.61	4,565	561,041	(3,609)	(80)	32,940	10.08	9.67	281,532	238,620
1050	7.47	4,481	565,522	(3,609)	(80)	32,940	10.08	9.83	285,142	239,412
1060	7.34	4,405	569,927	(3,609)	(80)	32,940	10.08	10.00	288,751	240,127
1070	7.22	4,334	574,260	(3,609)	(80)	32,940	10.08	10.17	292,360	240,771
1080	7.12	4,269	578,530	(3,609)	(80)	32,940	10.08	10.33	295,970	241,351
1090	7.02	4,210	582,740	(3,609)	(80)	32,940	10.08	10.50	299,579	241,871
1100	6.93	4,156	586,896	(3,609)	(80)	32,940	10.08	10.67	303,189	242,338
1110	6.85	4,107	591,003	(3,609)	(80)	32,940	10.08	10.83	306,798	242,755
1120	6.77	4,062	595,065	(3,609)	(80)	32,940	10.08	11.00	310,407	243,128
1130	6.70	4,021	599,086	(3,609)	(80)	32,940	10.08	11.17	314,017	243,459
1140	6.64	3,983	603,069	(3,609)	(80)	32,940	10.08	11.33	317,626	243,752
1150	6.58	3,948	607,017	(3,609)	(80)	32,940	10.08	11.50	321,235	244,011
1160	6.53	3,916	610,933	(3,609)	(80)	32,940	10.08	11.67	324,845	244,238
1170	6.48	3,887	614,820	(3,609)	(80)	32,940	10.08	11.83	328,454	244,435
1180	6.43	3,860	618,681	(3,609)	(80)	32,940	10.08	12.00	332,064	244,606
1190	6.39	3,837	622,517	(3,609)	(80)	32,940	10.08	12.17	335,673	244,753
1200	6.36	3,815	626,332	(3,609)	(80)	32,940	10.08	12.33	339,282	244,878
1210	6.32	3,794	630,127	(3,609)	(80)	32,940	10.08	12.50	342,892	244,983
1220	6.29	3,776	633,903	(3,609)	(80)	32,940	10.08	12.67	346,501	245,069
1230	6.27	3,759	637,662	(3,609)	(80)	32,940	10.08	12.83	350,111	245,139
1240	6.24	3,744	641,406	(3,609)	(80)	32,940	10.08	13.00	353,720	245,193
1250	6.22	3,730	645,136	(3,609)	(80)	32,940	10.08	13.17	357,329	245,234
1260	6.19	3,717	648,853	(3,609)	(80)	32,940	10.08	13.33	360,939	245,261
1270	6.18	3,705	652,558	(3,609)	(80)	32,940	10.08	13.50	364,548	245,277
1280	6.16	3,695	656,253	(3,609)	(80)	32,940	10.08	13.67	368,157	245,282
1290	6.14	3,685	659,938	(3,609)	(80)	32,936	10.08	13.67	371,767	245,282
1300	6.13	3,676	663,615	(3,609)	(80)	32,923	10.08	13.67	375,376	245,282
1310	6.11	3,669	667,284	(3,609)	(80)	32,902	10.08	13.67	378,986	245,282
1320	6.10	3,662	670,946	(3,609)	(80)	32,874	10.07	13.67	382,595	245,282
1330	6.09	3,655	674,601	(3,609)	(80)	32,840	10.07	13.67	386,204	245,282
1340	6.08	3,649	678,250	(3,609)	(80)	32,800	10.07	13.67	389,814	245,282
1350	6.07	3,644	681,894	(3,609)	(80)	32,754	10.06	13.67	393,423	245,282
1360	6.07	3,639	685,534	(3,609)	(80)	32,704	10.06	13.67	397,033	245,282
1370	6.06	3,635	689,169	(3,609)	(80)	32,649	10.06	13.67	400,642	245,282
1380	6.05	3,631	692,799	(3,609)	(80)	32,591	10.05	13.67	404,251	245,282
1390	6.05	3,628	696,427	(3,609)	(80)	32,529	10.05	13.67	407,861	245,282
1400	6.04	3,624	700,051	(3,609)	(80)	32,463	10.04	13.67	411,470	245,282
1410	6.04	3,621	703,672	(3,609)	(80)	32,395	10.03	13.67	415,080	245,282
1420	6.03	3,619	707,291	(3,609)	(80)	32,324	10.03	13.67	418,689	245,282
1430	6.03	3,617	710,908	(3,609)	(80)	32,252	10.02	13.67	422,298	245,282
1440	6.02	3,615	714,523	(3,609)	(80)	32,177	10.01	13.67	425,908	245,282

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Existing Pond

No Bioretention | **10-Year SBUH Hydrology** | **Future Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	10	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	80.21	cf	Pond Overtop Volume	32,940	cf
	3,609	cf				Time Pond Overtopped	6.50	hr
Pump on height[1]	4	ft				Volume Flooding	1.68	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(80)	0	0.00	0.00	0	0
20	0.00	0	0	0	(80)	0	0.00	0.00	0	0
30	0.00	0	0	0	(80)	0	0.00	0.00	0	0
40	0.00	0	0	0	(80)	0	0.00	0.00	0	0
50	0.00	1	1	0	(80)	0	0.00	0.00	0	0
60	0.01	8	9	0	(80)	0	0.00	0.00	0	0
70	0.04	25	34	0	(80)	0	0.00	0.00	0	0
80	0.09	52	86	0	(80)	0	0.00	0.00	0	0
90	0.14	86	171	0	(80)	5	0.00	0.00	0	0
100	0.21	126	297	0	(80)	51	0.03	0.00	0	0
110	0.30	178	475	0	(80)	149	0.08	0.00	0	0
120	0.40	242	717	0	(80)	311	0.16	0.00	0	0
130	0.52	310	1,028	0	(80)	541	0.28	0.00	0	0
140	0.63	381	1,408	0	(80)	842	0.44	0.00	0	0
150	0.76	454	1,862	0	(80)	1,215	0.63	0.00	0	0
160	0.88	527	2,389	0	(80)	1,662	0.86	0.00	0	0
170	1.02	612	3,001	0	(80)	2,194	1.13	0.00	0	0
180	1.18	708	3,709	0	(80)	2,821	1.44	0.00	0	0
190	1.34	803	4,512	0	(80)	3,544	1.79	0.00	0	0
200	1.49	895	5,406	0	(80)	4,358	2.18	0.00	0	0
210	1.64	985	6,391	0	(80)	5,263	2.60	0.00	0	0
220	1.79	1,073	7,465	0	(80)	6,256	3.05	0.00	0	0
230	1.96	1,175	8,640	0	(80)	7,351	3.53	0.00	0	0
240	2.15	1,290	9,930	0	(80)	8,561	4.04	0.00	0	0
250	2.34	1,402	11,332	(3,609)	(80)	6,274	3.06	0.00	3,609	0
260	2.52	1,511	12,843	0	(80)	7,705	3.68	0.00	3,609	0
270	2.69	1,616	14,460	0	(80)	9,241	4.32	0.00	3,609	0
280	2.86	1,718	16,178	(3,609)	(80)	7,269	3.49	0.00	7,219	0
290	3.06	1,836	18,014	0	(80)	9,025	4.23	0.00	7,219	0
300	3.29	1,972	19,986	(3,609)	(80)	7,308	3.51	0.00	10,828	0
310	3.50	2,101	22,087	0	(80)	9,329	4.35	0.00	10,828	0
320	3.71	2,226	24,313	(3,609)	(80)	7,865	3.75	0.00	14,438	0
330	3.91	2,344	26,657	0	(80)	10,129	4.67	0.00	14,438	0
340	4.09	2,456	29,113	(3,609)	(80)	8,895	4.18	0.00	18,047	0
350	4.31	2,588	31,701	(3,609)	(80)	7,794	3.72	0.00	21,656	0
360	4.56	2,738	34,439	0	(80)	10,452	4.80	0.00	21,656	0
370	4.80	2,881	37,320	(3,609)	(80)	9,643	4.48	0.00	25,266	0
380	5.03	3,016	40,336	(3,609)	(80)	8,969	4.21	0.00	28,875	0
390	5.24	3,143	43,480	(3,609)	(80)	8,423	3.98	0.00	32,484	0
400	5.44	3,264	46,744	0	(80)	11,607	5.24	0.00	32,484	0
410	5.76	3,458	50,202	(3,609)	(80)	11,375	5.15	0.00	36,094	0
420	6.20	3,721	53,922	(3,609)	(80)	11,406	5.16	0.00	39,703	0
430	6.61	3,968	57,891	(3,609)	(80)	11,685	5.26	0.00	43,313	0
440	7.16	4,296	62,187	(3,609)	(80)	12,292	5.49	0.00	46,922	0
450	7.83	4,701	66,888	(3,609)	(80)	13,303	5.85	0.00	50,531	0
460	9.04	5,426	72,314	(3,609)	(80)	15,040	6.43	0.00	54,141	0
470	11.49	6,895	79,209	(3,609)	(80)	18,245	7.41	0.00	57,750	0
480	13.52	8,112	87,321	(3,609)	(80)	22,668	8.52	0.00	61,360	0
490	14.08	8,445	95,766	(3,609)	(80)	27,423	9.42	0.00	64,969	0
500	14.09	8,451	104,218	(3,609)	(80)	32,185	10.01	0.00	68,578	0
510	13.93	8,357	112,575	(3,609)	(80)	32,940	10.08	0.17	72,188	3,913
520	13.79	8,272	120,847	(3,609)	(80)	32,940	10.08	0.33	75,797	8,495
530	13.48	8,090	128,936	(3,609)	(80)	32,940	10.08	0.50	79,407	12,895
540	13.03	7,819	136,755	(3,609)	(80)	32,940	10.08	0.67	83,016	17,024
550	12.62	7,572	144,328	(3,609)	(80)	32,940	10.08	0.83	86,625	20,907
560	12.24	7,346	151,674	(3,609)	(80)	32,940	10.08	1.00	90,235	24,564
570	11.90	7,140	158,814	(3,609)	(80)	32,940	10.08	1.17	93,844	28,014
580	11.59	6,952	165,766	(3,609)	(80)	32,940	10.08	1.33	97,453	31,276
590	11.30	6,780	172,546	(3,609)	(80)	32,940	10.08	1.50	101,063	34,367
600	11.04	6,622	179,168	(3,609)	(80)	32,940	10.08	1.67	104,672	37,300
610	10.80	6,479	185,647	(3,609)	(80)	32,940	10.08	1.83	108,282	40,089
620	10.58	6,347	191,994	(3,609)	(80)	32,940	10.08	2.00	111,891	42,746
630	10.38	6,228	198,222	(3,609)	(80)	32,940	10.08	2.17	115,500	45,284
640	10.20	6,119	204,341	(3,609)	(80)	32,940	10.08	2.33	119,110	47,714

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	9.97	5,982	210,323	(3,609)	(80)	32,940	10.08	2.50	122,719	50,006
660	9.70	5,820	216,143	(3,609)	(80)	32,940	10.08	2.67	126,329	52,137
670	9.45	5,673	221,816	(3,609)	(80)	32,940	10.08	2.83	129,938	54,120
680	9.23	5,537	227,352	(3,609)	(80)	32,940	10.08	3.00	133,547	55,967
690	9.02	5,413	232,765	(3,609)	(80)	32,940	10.08	3.17	137,157	57,690
700	8.83	5,300	238,065	(3,609)	(80)	32,940	10.08	3.33	140,766	59,300
710	8.66	5,196	243,261	(3,609)	(80)	32,940	10.08	3.50	144,375	60,806
720	8.50	5,101	248,362	(3,609)	(80)	32,940	10.08	3.67	147,985	62,218
730	8.36	5,014	253,376	(3,609)	(80)	32,940	10.08	3.83	151,594	63,543
740	8.23	4,935	258,312	(3,609)	(80)	32,940	10.08	4.00	155,204	64,789
750	8.10	4,863	263,174	(3,609)	(80)	32,940	10.08	4.17	158,813	65,962
760	8.00	4,797	267,972	(3,609)	(80)	32,940	10.08	4.33	162,422	67,070
770	7.84	4,702	272,674	(3,609)	(80)	32,940	10.08	4.50	166,032	68,082
780	7.63	4,578	277,252	(3,609)	(80)	32,940	10.08	4.67	169,641	68,971
790	7.44	4,466	281,718	(3,609)	(80)	32,940	10.08	4.83	173,251	69,747
800	7.27	4,363	286,082	(3,609)	(80)	32,940	10.08	5.00	176,860	70,421
810	7.11	4,268	290,350	(3,609)	(80)	32,940	10.08	5.17	180,469	71,000
820	6.97	4,182	294,533	(3,609)	(80)	32,940	10.08	5.33	184,079	71,493
830	6.84	4,104	298,636	(3,609)	(80)	32,940	10.08	5.50	187,688	71,907
840	6.72	4,030	302,667	(3,609)	(80)	32,940	10.08	5.67	191,298	72,248
850	6.61	3,964	306,631	(3,609)	(80)	32,940	10.08	5.83	194,907	72,523
860	6.51	3,904	310,535	(3,609)	(80)	32,940	10.08	6.00	198,516	72,737
870	6.41	3,849	314,384	(3,609)	(80)	32,940	10.08	6.17	202,126	72,896
880	6.33	3,798	318,182	(3,609)	(80)	32,940	10.08	6.33	205,735	73,005
890	6.23	3,736	321,918	(3,609)	(80)	32,940	10.08	6.50	209,344	73,051
900	6.11	3,664	325,582	(3,609)	(80)	32,914	10.08	6.50	212,954	73,051
910	6.00	3,597	329,180	(3,609)	(80)	32,822	10.07	6.50	216,563	73,051
920	5.89	3,536	332,716	(3,609)	(80)	32,668	10.06	6.50	220,173	73,051
930	5.80	3,481	336,196	(3,609)	(80)	32,460	10.04	6.50	223,782	73,051
940	5.72	3,429	339,626	(3,609)	(80)	32,199	10.02	6.50	227,391	73,051
950	5.64	3,382	343,008	(3,609)	(80)	31,892	9.99	6.50	231,001	73,051
960	5.57	3,340	346,348	(3,609)	(80)	31,543	9.95	6.50	234,610	73,051
970	5.50	3,302	349,650	(3,609)	(80)	31,155	9.91	6.50	238,220	73,051
980	5.44	3,266	352,916	(3,609)	(80)	30,732	9.87	6.50	241,829	73,051
990	5.39	3,233	356,149	(3,609)	(80)	30,275	9.81	6.50	245,438	73,051
1000	5.34	3,203	359,352	(3,609)	(80)	29,788	9.75	6.50	249,048	73,051
1010	5.25	3,151	362,504	(3,609)	(80)	29,250	9.68	6.50	252,657	73,051
1020	5.13	3,080	365,584	(3,609)	(80)	28,641	9.60	6.50	256,266	73,051
1030	5.03	3,015	368,599	(3,609)	(80)	27,966	9.50	6.50	259,876	73,051
1040	4.93	2,956	371,555	(3,609)	(80)	27,233	9.39	6.50	263,485	73,051
1050	4.83	2,901	374,456	(3,609)	(80)	26,444	9.26	6.50	267,095	73,051
1060	4.75	2,850	377,306	(3,609)	(80)	25,604	9.11	6.50	270,704	73,051
1070	4.67	2,804	380,110	(3,609)	(80)	24,719	8.95	6.50	274,313	73,051
1080	4.60	2,761	382,871	(3,609)	(80)	23,790	8.76	6.50	277,923	73,051
1090	4.54	2,723	385,594	(3,609)	(80)	22,823	8.55	6.50	281,532	73,051
1100	4.48	2,688	388,281	(3,609)	(80)	21,821	8.33	6.50	285,142	73,051
1110	4.43	2,656	390,937	(3,609)	(80)	20,788	8.08	6.50	288,751	73,051
1120	4.38	2,626	393,563	(3,609)	(80)	19,724	7.81	6.50	292,360	73,051
1130	4.33	2,599	396,162	(3,609)	(80)	18,633	7.51	6.50	295,970	73,051
1140	4.29	2,573	398,735	(3,609)	(80)	17,516	7.20	6.50	299,579	73,051
1150	4.25	2,550	401,285	(3,609)	(80)	16,377	6.86	6.50	303,189	73,051
1160	4.22	2,530	403,815	(3,609)	(80)	15,217	6.49	6.50	306,798	73,051
1170	4.19	2,511	406,326	(3,609)	(80)	14,039	6.10	6.50	310,407	73,051
1180	4.16	2,494	408,820	(3,609)	(80)	12,843	5.69	6.50	314,017	73,051
1190	4.13	2,477	411,297	(3,609)	(80)	11,631	5.24	6.50	317,626	73,051
1200	4.10	2,463	413,760	(3,609)	(80)	10,404	4.78	6.50	321,235	73,051
1210	4.08	2,450	416,210	(3,609)	(80)	9,164	4.29	6.50	324,845	73,051
1220	4.06	2,438	418,648	(3,609)	(80)	7,913	3.77	6.50	328,454	73,051
1230	4.04	2,426	421,074	0	(80)	10,259	4.72	6.50	328,454	73,051
1240	4.03	2,416	423,490	(3,609)	(80)	8,985	4.21	6.50	332,064	73,051
1250	4.01	2,407	425,898	(3,609)	(80)	7,703	3.68	6.50	335,673	73,051
1260	4.00	2,399	428,297	0	(80)	10,022	4.63	6.50	335,673	73,051
1270	3.99	2,391	430,688	(3,609)	(80)	8,724	4.11	6.50	339,282	73,051
1280	3.97	2,384	433,072	(3,609)	(80)	7,418	3.56	6.50	342,892	73,051
1290	3.96	2,378	435,450	0	(80)	9,716	4.51	6.50	342,892	73,051
1300	3.95	2,372	437,822	(3,609)	(80)	8,398	3.97	6.50	346,501	73,051
1310	3.94	2,367	440,189	0	(80)	10,685	4.89	6.50	346,501	73,051
1320	3.94	2,362	442,551	(3,609)	(80)	9,358	4.36	6.50	350,111	73,051
1330	3.93	2,358	444,910	(3,609)	(80)	8,027	3.82	6.50	353,720	73,051
1340	3.92	2,354	447,263	0	(80)	10,300	4.74	6.50	353,720	73,051
1350	3.92	2,350	449,613	(3,609)	(80)	8,960	4.20	6.50	357,329	73,051
1360	3.91	2,347	451,960	(3,609)	(80)	7,618	3.64	6.50	360,939	73,051
1370	3.91	2,344	454,304	0	(80)	9,881	4.57	6.50	360,939	73,051
1380	3.90	2,341	456,645	(3,609)	(80)	8,533	4.03	6.50	364,548	73,051
1390	3.90	2,339	458,984	(3,609)	(80)	7,182	3.46	6.50	368,157	73,051
1400	3.90	2,337	461,321	0	(80)	9,439	4.40	6.50	368,157	73,051
1410	3.89	2,335	463,655	(3,609)	(80)	8,084	3.84	6.50	371,767	73,051
1420	3.89	2,333	465,988	0	(80)	10,337	4.75	6.50	371,767	73,051
1430	3.89	2,332	468,320	(3,609)	(80)	8,979	4.21	6.50	375,376	73,051
1440	3.88	2,330	470,650	(3,609)	(80)	7,619	3.64	6.50	378,986	73,051

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Existing Pond

No Bioretention | **25-Year SBUH Hydrology** | **Future Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	10	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	80.21	cf	Pond Overtop Volume	32,940	cf
	3,609	cf				Time Pond Overtopped	16.83	hr
Pump on height[1]	4	ft				Volume Flooding	6.34	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(80)	0	0.00	0.00	0	0
20	0.00	0	0	0	(80)	0	0.00	0.00	0	0
30	0.00	0	0	0	(80)	0	0.00	0.00	0	0
40	0.02	10	10	0	(80)	0	0.00	0.00	0	0
50	0.07	41	50	0	(80)	0	0.00	0.00	0	0
60	0.15	93	143	0	(80)	13	0.01	0.00	0	0
70	0.27	161	304	0	(80)	94	0.05	0.00	0	0
80	0.40	242	547	0	(80)	256	0.14	0.00	0	0
90	0.55	331	878	0	(80)	507	0.27	0.00	0	0
100	0.71	425	1,303	0	(80)	852	0.45	0.00	0	0
110	0.90	540	1,843	0	(80)	1,312	0.68	0.00	0	0
120	1.13	675	2,518	0	(80)	1,906	0.99	0.00	0	0
130	1.35	812	3,330	0	(80)	2,638	1.35	0.00	0	0
140	1.58	948	4,279	0	(80)	3,507	1.77	0.00	0	0
150	1.80	1,082	5,361	0	(80)	4,508	2.25	0.00	0	0
160	2.02	1,213	6,574	0	(80)	5,641	2.77	0.00	0	0
170	2.28	1,367	7,941	0	(80)	6,928	3.35	0.00	0	0
180	2.57	1,542	9,484	0	(80)	8,391	3.97	0.00	0	0
190	2.86	1,714	11,198	0	(80)	10,025	4.63	0.00	0	0
200	3.14	1,881	13,079	(3,609)	(80)	8,216	3.90	0.00	3,609	0
210	3.40	2,042	15,121	0	(80)	10,178	4.69	0.00	3,609	0
220	3.67	2,199	17,320	(3,609)	(80)	8,688	4.09	0.00	7,219	0
230	3.96	2,378	19,698	(3,609)	(80)	7,376	3.54	0.00	10,828	0
240	4.29	2,577	22,275	0	(80)	9,872	4.57	0.00	10,828	0
250	4.61	2,768	25,043	(3,609)	(80)	8,951	4.20	0.00	14,438	0
260	4.92	2,950	27,993	(3,609)	(80)	8,211	3.89	0.00	18,047	0
270	5.21	3,124	31,117	0	(80)	11,255	5.10	0.00	18,047	0
280	5.48	3,289	34,406	(3,609)	(80)	10,854	4.95	0.00	21,656	0
290	5.81	3,484	37,890	(3,609)	(80)	10,649	4.87	0.00	25,266	0
300	6.18	3,706	41,595	(3,609)	(80)	10,665	4.88	0.00	28,875	0
310	6.53	3,915	45,510	(3,609)	(80)	10,890	4.97	0.00	32,484	0
320	6.85	4,113	49,623	(3,609)	(80)	11,313	5.13	0.00	36,094	0
330	7.17	4,299	53,922	(3,609)	(80)	11,923	5.35	0.00	39,703	0
340	7.46	4,475	58,398	(3,609)	(80)	12,709	5.64	0.00	43,313	0
350	7.81	4,685	63,083	(3,609)	(80)	13,704	5.99	0.00	46,922	0
360	8.21	4,926	68,008	(3,609)	(80)	14,940	6.40	0.00	50,531	0
370	8.59	5,151	73,159	(3,609)	(80)	16,402	6.86	0.00	54,141	0
380	8.94	5,363	78,522	(3,609)	(80)	18,075	7.36	0.00	57,750	0
390	9.27	5,561	84,083	(3,609)	(80)	19,946	7.87	0.00	61,360	0
400	9.58	5,747	89,829	(3,609)	(80)	22,003	8.37	0.00	64,969	0
410	10.09	6,056	95,885	(3,609)	(80)	24,369	8.88	0.00	68,578	0
420	10.80	6,478	102,363	(3,609)	(80)	27,157	9.38	0.00	72,188	0
430	11.45	6,871	109,234	(3,609)	(80)	30,339	9.82	0.00	75,797	0
440	12.33	7,399	116,633	(3,609)	(80)	32,940	10.08	0.17	79,407	1,108
450	13.42	8,053	124,686	(3,609)	(80)	32,940	10.08	0.33	83,016	5,471
460	15.39	9,231	133,917	(3,609)	(80)	32,940	10.08	0.50	86,625	11,013
470	19.37	11,624	145,541	(3,609)	(80)	32,940	10.08	0.67	90,235	18,947
480	22.65	13,589	159,130	(3,609)	(80)	32,940	10.08	0.83	93,844	28,846
490	23.50	14,101	173,231	(3,609)	(80)	32,940	10.08	1.00	97,453	39,258
500	23.47	14,079	187,310	(3,609)	(80)	32,940	10.08	1.17	101,063	49,648
510	23.16	13,895	201,205	(3,609)	(80)	32,940	10.08	1.33	104,672	59,853
520	22.88	13,727	214,931	(3,609)	(80)	32,940	10.08	1.50	108,282	69,889
530	22.34	13,405	228,336	(3,609)	(80)	32,940	10.08	1.67	111,891	79,605
540	21.57	12,942	241,278	(3,609)	(80)	32,940	10.08	1.83	115,500	88,857
550	20.86	12,518	253,796	(3,609)	(80)	32,940	10.08	2.00	119,110	97,685
560	20.21	12,129	265,924	(3,609)	(80)	32,940	10.08	2.17	122,719	106,124
570	19.62	11,773	277,698	(3,609)	(80)	32,940	10.08	2.33	126,329	114,208
580	19.08	11,448	289,146	(3,609)	(80)	32,940	10.08	2.50	129,938	121,967
590	18.58	11,150	300,296	(3,609)	(80)	32,940	10.08	2.67	133,547	129,428
600	18.13	10,878	311,175	(3,609)	(80)	32,940	10.08	2.83	137,157	136,616
610	17.72	10,630	321,805	(3,609)	(80)	32,940	10.08	3.00	140,766	143,557
620	17.34	10,402	332,206	(3,609)	(80)	32,940	10.08	3.17	144,375	150,269
630	16.99	10,193	342,400	(3,609)	(80)	32,940	10.08	3.33	147,985	156,772
640	16.67	10,003	352,402	(3,609)	(80)	32,940	10.08	3.50	151,594	163,085

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	16.28	9,768	362,171	(3,609)	(80)	32,940	10.08	3.67	155,204	169,164
660	15.83	9,495	371,666	(3,609)	(80)	32,940	10.08	3.83	158,813	174,970
670	15.41	9,246	380,912	(3,609)	(80)	32,940	10.08	4.00	162,422	180,526
680	15.03	9,016	389,927	(3,609)	(80)	32,940	10.08	4.17	166,032	185,852
690	14.68	8,805	398,732	(3,609)	(80)	32,940	10.08	4.33	169,641	190,967
700	14.35	8,612	407,344	(3,609)	(80)	32,940	10.08	4.50	173,251	195,890
710	14.06	8,436	415,780	(3,609)	(80)	32,940	10.08	4.67	176,860	200,636
720	13.79	8,275	424,055	(3,609)	(80)	32,940	10.08	4.83	180,469	205,221
730	13.55	8,127	432,182	(3,609)	(80)	32,940	10.08	5.00	184,079	209,659
740	13.32	7,992	440,174	(3,609)	(80)	32,940	10.08	5.17	187,688	213,961
750	13.11	7,868	448,042	(3,609)	(80)	32,940	10.08	5.33	191,298	218,140
760	12.93	7,756	455,798	(3,609)	(80)	32,940	10.08	5.50	194,907	222,206
770	12.66	7,596	463,394	(3,609)	(80)	32,940	10.08	5.67	198,516	226,113
780	12.33	7,395	470,789	(3,609)	(80)	32,940	10.08	5.83	202,126	229,818
790	12.02	7,211	478,000	(3,609)	(80)	32,940	10.08	6.00	205,735	233,339
800	11.74	7,042	485,042	(3,609)	(80)	32,940	10.08	6.17	209,344	236,692
810	11.48	6,887	491,929	(3,609)	(80)	32,940	10.08	6.33	212,954	239,889
820	11.24	6,744	498,673	(3,609)	(80)	32,940	10.08	6.50	216,563	242,943
830	11.02	6,614	505,287	(3,609)	(80)	32,940	10.08	6.67	220,173	245,868
840	10.82	6,495	511,782	(3,609)	(80)	32,940	10.08	6.83	223,782	248,673
850	10.64	6,386	518,168	(3,609)	(80)	32,940	10.08	7.00	227,391	251,369
860	10.48	6,286	524,454	(3,609)	(80)	32,940	10.08	7.17	231,001	253,966
870	10.32	6,195	530,648	(3,609)	(80)	32,940	10.08	7.33	234,610	256,471
880	10.19	6,111	536,760	(3,609)	(80)	32,940	10.08	7.50	238,220	258,892
890	10.01	6,008	542,767	(3,609)	(80)	32,940	10.08	7.67	241,829	261,210
900	9.81	5,885	548,653	(3,609)	(80)	32,940	10.08	7.83	245,438	263,406
910	9.62	5,774	554,426	(3,609)	(80)	32,940	10.08	8.00	249,048	265,490
920	9.45	5,671	560,098	(3,609)	(80)	32,940	10.08	8.17	252,657	267,472
930	9.30	5,577	565,675	(3,609)	(80)	32,940	10.08	8.33	256,266	269,360
940	9.15	5,492	571,167	(3,609)	(80)	32,940	10.08	8.50	259,876	271,163
950	9.02	5,414	576,582	(3,609)	(80)	32,940	10.08	8.67	263,485	272,887
960	8.90	5,342	581,924	(3,609)	(80)	32,940	10.08	8.83	267,095	274,540
970	8.79	5,276	587,199	(3,609)	(80)	32,940	10.08	9.00	270,704	276,126
980	8.69	5,215	592,414	(3,609)	(80)	32,940	10.08	9.17	274,313	277,651
990	8.60	5,159	597,574	(3,609)	(80)	32,940	10.08	9.33	277,923	279,121
1000	8.52	5,109	602,683	(3,609)	(80)	32,940	10.08	9.50	281,532	280,540
1010	8.38	5,026	607,708	(3,609)	(80)	32,940	10.08	9.67	285,142	281,876
1020	8.18	4,910	612,618	(3,609)	(80)	32,940	10.08	9.83	288,751	283,097
1030	8.01	4,805	617,424	(3,609)	(80)	32,940	10.08	10.00	292,360	284,212
1040	7.85	4,709	622,132	(3,609)	(80)	32,940	10.08	10.17	295,970	285,232
1050	7.70	4,621	626,753	(3,609)	(80)	32,940	10.08	10.33	299,579	286,163
1060	7.57	4,540	631,293	(3,609)	(80)	32,940	10.08	10.50	303,189	287,013
1070	7.44	4,465	635,758	(3,609)	(80)	32,940	10.08	10.67	306,798	287,788
1080	7.33	4,397	640,155	(3,609)	(80)	32,940	10.08	10.83	310,407	288,496
1090	7.22	4,335	644,490	(3,609)	(80)	32,940	10.08	11.00	314,017	289,141
1100	7.13	4,278	648,767	(3,609)	(80)	32,940	10.08	11.17	317,626	289,729
1110	7.04	4,226	652,993	(3,609)	(80)	32,940	10.08	11.33	321,235	290,265
1120	6.96	4,178	657,171	(3,609)	(80)	32,940	10.08	11.50	324,845	290,753
1130	6.89	4,134	661,305	(3,609)	(80)	32,940	10.08	11.67	328,454	291,198
1140	6.82	4,093	665,398	(3,609)	(80)	32,940	10.08	11.83	332,064	291,601
1150	6.76	4,056	669,454	(3,609)	(80)	32,940	10.08	12.00	335,673	291,968
1160	6.70	4,023	673,477	(3,609)	(80)	32,940	10.08	12.17	339,282	292,301
1170	6.65	3,992	677,468	(3,609)	(80)	32,940	10.08	12.33	342,892	292,603
1180	6.61	3,963	681,432	(3,609)	(80)	32,940	10.08	12.50	346,501	292,877
1190	6.56	3,938	685,369	(3,609)	(80)	32,940	10.08	12.67	350,111	293,125
1200	6.52	3,914	689,283	(3,609)	(80)	32,940	10.08	12.83	353,720	293,349
1210	6.49	3,892	693,175	(3,609)	(80)	32,940	10.08	13.00	357,329	293,552
1220	6.45	3,872	697,048	(3,609)	(80)	32,940	10.08	13.17	360,939	293,734
1230	6.42	3,854	700,902	(3,609)	(80)	32,940	10.08	13.33	364,548	293,899
1240	6.40	3,838	704,740	(3,609)	(80)	32,940	10.08	13.50	368,157	294,047
1250	6.37	3,822	708,562	(3,609)	(80)	32,940	10.08	13.67	371,767	294,180
1260	6.35	3,808	712,370	(3,609)	(80)	32,940	10.08	13.83	375,376	294,298
1270	6.33	3,796	716,166	(3,609)	(80)	32,940	10.08	14.00	378,986	294,404
1280	6.31	3,784	719,950	(3,609)	(80)	32,940	10.08	14.17	382,595	294,499
1290	6.29	3,773	723,723	(3,609)	(80)	32,940	10.08	14.33	386,204	294,582
1300	6.27	3,764	727,487	(3,609)	(80)	32,940	10.08	14.50	389,814	294,656
1310	6.26	3,755	731,241	(3,609)	(80)	32,940	10.08	14.67	393,423	294,722
1320	6.24	3,747	734,988	(3,609)	(80)	32,940	10.08	14.83	397,033	294,779
1330	6.23	3,739	738,727	(3,609)	(80)	32,940	10.08	15.00	400,642	294,829
1340	6.22	3,733	742,460	(3,609)	(80)	32,940	10.08	15.17	404,251	294,872
1350	6.21	3,726	746,186	(3,609)	(80)	32,940	10.08	15.33	407,861	294,908
1360	6.20	3,721	749,907	(3,609)	(80)	32,940	10.08	15.50	411,470	294,939
1370	6.19	3,716	753,623	(3,609)	(80)	32,940	10.08	15.67	415,080	294,965
1380	6.18	3,711	757,334	(3,609)	(80)	32,940	10.08	15.83	418,689	294,987
1390	6.18	3,707	761,040	(3,609)	(80)	32,940	10.08	16.00	422,298	295,004
1400	6.17	3,703	764,743	(3,609)	(80)	32,940	10.08	16.17	425,908	295,017
1410	6.17	3,699	768,442	(3,609)	(80)	32,940	10.08	16.33	429,517	295,026
1420	6.16	3,697	772,139	(3,609)	(80)	32,940	10.08	16.50	433,126	295,034
1430	6.16	3,694	775,833	(3,609)	(80)	32,940	10.08	16.67	436,736	295,038
1440	6.15	3,691	779,524	(3,609)	(80)	32,940	10.08	16.83	440,345	295,039

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alt 1 and 2

Bioretention	10-Year SBUH Hydrology	Existing Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	825.00	cf

Pond Information		
Pond Overtop Elevation	8	ft
Pond Overtop Volume	86,400	cf
Time Pond Overtopped	0.00	hr
Volume Flooding	0.00	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.00	0.00	0	0
20	0.00	0	0	0	(825)	0	0.00	0.00	0	0
30	0.00	0	0	0	(825)	0	0.00	0.00	0	0
40	0.00	0	0	0	(825)	0	0.00	0.00	0	0
50	0.00	1	1	0	(825)	0	0.00	0.00	0	0
60	0.02	10	11	0	(825)	0	0.00	0.00	0	0
70	0.05	30	41	0	(825)	0	0.00	0.00	0	0
80	0.09	57	98	0	(825)	0	0.00	0.00	0	0
90	0.14	86	184	0	(825)	0	0.00	0.00	0	0
100	0.19	116	300	0	(825)	0	0.00	0.00	0	0
110	0.26	155	455	0	(825)	0	0.00	0.00	0	0
120	0.33	201	656	0	(825)	0	0.00	0.00	0	0
130	0.40	241	897	0	(825)	0	0.00	0.00	0	0
140	0.46	277	1,174	0	(825)	0	0.00	0.00	0	0
150	0.52	311	1,485	0	(825)	0	0.00	0.00	0	0
160	0.57	339	1,824	0	(825)	0	0.00	0.00	0	0
170	0.63	380	2,204	0	(825)	0	0.00	0.00	0	0
180	0.72	431	2,635	0	(825)	0	0.00	0.00	0	0
190	0.78	470	3,105	0	(825)	0	0.00	0.00	0	0
200	0.84	501	3,607	0	(825)	0	0.00	0.00	0	0
210	0.88	529	4,135	0	(825)	0	0.00	0.00	0	0
220	0.92	555	4,690	0	(825)	0	0.00	0.00	0	0
230	1.01	605	5,295	0	(825)	0	0.00	0.00	0	0
240	1.12	673	5,968	0	(825)	0	0.00	0.00	0	0
250	1.22	731	6,700	0	(825)	0	0.00	0.00	0	0
260	1.30	782	7,482	0	(825)	0	0.00	0.00	0	0
270	1.38	828	8,310	0	(825)	3	0.00	0.00	0	0
280	1.45	870	9,179	0	(825)	48	0.00	0.00	0	0
290	1.57	940	10,120	0	(825)	163	0.02	0.00	0	0
300	1.72	1,032	11,152	0	(825)	370	0.03	0.00	0	0
310	1.84	1,104	12,256	0	(825)	649	0.06	0.00	0	0
320	1.94	1,163	13,418	0	(825)	987	0.09	0.00	0	0
330	2.02	1,212	14,631	0	(825)	1,374	0.13	0.00	0	0
340	2.09	1,255	15,886	0	(825)	1,804	0.17	0.00	0	0
350	2.23	1,336	17,222	0	(825)	2,315	0.21	0.00	0	0
360	2.40	1,441	18,663	0	(825)	2,931	0.27	0.00	0	0
370	2.53	1,520	20,183	0	(825)	3,626	0.34	0.00	0	0
380	2.64	1,583	21,766	0	(825)	4,384	0.41	0.00	0	0
390	2.72	1,633	23,399	0	(825)	5,192	0.48	0.00	0	0
400	2.80	1,678	25,077	0	(825)	6,046	0.56	0.00	0	0
410	3.10	1,859	26,936	0	(825)	7,079	0.66	0.00	0	0
420	3.55	2,129	29,065	0	(825)	8,384	0.78	0.00	0	0
430	3.86	2,317	31,382	0	(825)	9,876	0.91	0.00	0	0
440	4.38	2,628	34,011	0	(825)	11,679	1.08	0.00	0	0
450	5.04	3,022	37,033	0	(825)	13,876	1.28	0.00	0	0
460	6.57	3,944	40,977	0	(825)	16,996	1.57	0.00	0	0
470	10.12	6,069	47,046	0	(825)	22,240	2.06	0.00	0	0
480	11.96	7,177	54,223	0	(825)	28,591	2.65	0.00	0	0
490	10.64	6,384	60,607	0	(825)	34,151	3.16	0.00	0	0
500	8.87	5,322	65,929	0	(825)	38,647	3.58	0.00	0	0
510	7.46	4,476	70,405	0	(825)	42,298	3.92	0.00	0	0
520	6.60	3,960	74,365	0	(825)	45,433	4.21	0.00	0	0
530	5.73	3,440	77,804	(3,609)	(825)	44,438	4.11	0.00	3,609	0
540	4.86	2,916	80,721	(3,609)	(825)	42,920	3.97	0.00	7,219	0
550	4.33	2,597	83,318	0	(825)	44,692	4.14	0.00	7,219	0
560	4.00	2,402	85,720	(3,609)	(825)	42,660	3.95	0.00	10,828	0
570	3.81	2,285	88,005	0	(825)	44,120	4.09	0.00	10,828	0
580	3.69	2,217	90,222	(3,609)	(825)	41,902	3.88	0.00	14,438	0
590	3.63	2,176	92,398	0	(825)	43,253	4.00	0.00	14,438	0
600	3.59	2,153	94,551	(3,609)	(825)	40,972	3.79	0.00	18,047	0
610	3.57	2,141	96,692	0	(825)	42,288	3.92	0.00	18,047	0
620	3.56	2,137	98,829	0	(825)	43,600	4.04	0.00	18,047	0
630	3.56	2,137	100,966	(3,609)	(825)	41,303	3.82	0.00	21,656	0
640	3.57	2,140	103,107	0	(825)	42,619	3.95	0.00	21,656	0

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	3.45	2,068	105,175	0	(825)	43,862	4.06	0.00	21,656	0
660	3.25	1,952	107,128	(3,609)	(825)	41,380	3.83	0.00	25,266	0
670	3.14	1,882	109,010	0	(825)	42,437	3.93	0.00	25,266	0
680	3.06	1,839	110,848	0	(825)	43,451	4.02	0.00	25,266	0
690	3.02	1,814	112,662	(3,609)	(825)	40,831	3.78	0.00	28,875	0
700	3.00	1,800	114,463	0	(825)	41,806	3.87	0.00	28,875	0
710	2.99	1,793	116,256	0	(825)	42,774	3.96	0.00	28,875	0
720	2.98	1,790	118,046	0	(825)	43,739	4.05	0.00	28,875	0
730	2.98	1,789	119,835	(3,609)	(825)	41,094	3.80	0.00	32,484	0
740	2.98	1,790	121,625	0	(825)	42,058	3.89	0.00	32,484	0
750	2.99	1,792	123,416	0	(825)	43,025	3.98	0.00	32,484	0
760	2.99	1,795	125,211	0	(825)	43,995	4.07	0.00	32,484	0
770	2.88	1,726	126,937	(3,609)	(825)	41,286	3.82	0.00	36,094	0
780	2.68	1,610	128,547	0	(825)	42,071	3.90	0.00	36,094	0
790	2.57	1,540	130,086	0	(825)	42,786	3.96	0.00	36,094	0
800	2.50	1,498	131,584	0	(825)	43,458	4.02	0.00	36,094	0
810	2.45	1,472	133,056	(3,609)	(825)	40,496	3.75	0.00	39,703	0
820	2.43	1,457	134,512	0	(825)	41,127	3.81	0.00	39,703	0
830	2.41	1,449	135,961	0	(825)	41,751	3.87	0.00	39,703	0
840	2.40	1,443	137,404	0	(825)	42,369	3.92	0.00	39,703	0
850	2.40	1,440	138,844	0	(825)	42,984	3.98	0.00	39,703	0
860	2.40	1,441	140,285	0	(825)	43,600	4.04	0.00	39,703	0
870	2.40	1,442	141,727	(3,609)	(825)	40,607	3.76	0.00	43,313	0
880	2.40	1,442	143,169	0	(825)	41,224	3.82	0.00	43,313	0
890	2.35	1,410	144,579	0	(825)	41,809	3.87	0.00	43,313	0
900	2.27	1,359	145,938	0	(825)	42,343	3.92	0.00	43,313	0
910	2.21	1,328	147,265	0	(825)	42,846	3.97	0.00	43,313	0
920	2.18	1,308	148,574	0	(825)	43,330	4.01	0.00	43,313	0
930	2.16	1,298	149,872	(3,609)	(825)	40,193	3.72	0.00	46,922	0
940	2.15	1,291	151,163	0	(825)	40,659	3.76	0.00	46,922	0
950	2.15	1,287	152,450	0	(825)	41,121	3.81	0.00	46,922	0
960	2.14	1,286	153,735	0	(825)	41,582	3.85	0.00	46,922	0
970	2.14	1,286	155,022	0	(825)	42,043	3.89	0.00	46,922	0
980	2.14	1,286	156,308	0	(825)	42,504	3.94	0.00	46,922	0
990	2.14	1,285	157,593	0	(825)	42,964	3.98	0.00	46,922	0
1000	2.14	1,286	158,879	0	(825)	43,425	4.02	0.00	46,922	0
1010	2.06	1,237	160,117	(3,609)	(825)	40,228	3.72	0.00	50,531	0
1020	1.93	1,157	161,274	0	(825)	40,561	3.76	0.00	50,531	0
1030	1.85	1,109	162,383	0	(825)	40,845	3.78	0.00	50,531	0
1040	1.80	1,079	163,462	0	(825)	41,099	3.81	0.00	50,531	0
1050	1.77	1,059	164,521	0	(825)	41,333	3.83	0.00	50,531	0
1060	1.75	1,047	165,568	0	(825)	41,555	3.85	0.00	50,531	0
1070	1.74	1,041	166,609	0	(825)	41,771	3.87	0.00	50,531	0
1080	1.73	1,037	167,647	0	(825)	41,983	3.89	0.00	50,531	0
1090	1.72	1,035	168,681	0	(825)	42,193	3.91	0.00	50,531	0
1100	1.72	1,035	169,716	0	(825)	42,403	3.93	0.00	50,531	0
1110	1.72	1,034	170,750	0	(825)	42,612	3.95	0.00	50,531	0
1120	1.72	1,034	171,785	0	(825)	42,821	3.96	0.00	50,531	0
1130	1.72	1,034	172,819	0	(825)	43,031	3.98	0.00	50,531	0
1140	1.72	1,033	173,852	0	(825)	43,239	4.00	0.00	50,531	0
1150	1.72	1,033	174,885	(3,609)	(825)	39,838	3.69	0.00	54,141	0
1160	1.73	1,036	175,922	0	(825)	40,049	3.71	0.00	54,141	0
1170	1.73	1,037	176,958	0	(825)	40,261	3.73	0.00	54,141	0
1180	1.73	1,036	177,994	0	(825)	40,471	3.75	0.00	54,141	0
1190	1.73	1,036	179,030	0	(825)	40,683	3.77	0.00	54,141	0
1200	1.73	1,037	180,067	0	(825)	40,894	3.79	0.00	54,141	0
1210	1.73	1,038	181,105	0	(825)	41,108	3.81	0.00	54,141	0
1220	1.73	1,039	182,144	0	(825)	41,322	3.83	0.00	54,141	0
1230	1.73	1,038	183,183	0	(825)	41,535	3.85	0.00	54,141	0
1240	1.73	1,039	184,222	0	(825)	41,750	3.87	0.00	54,141	0
1250	1.74	1,041	185,263	0	(825)	41,966	3.89	0.00	54,141	0
1260	1.73	1,041	186,304	0	(825)	42,181	3.91	0.00	54,141	0
1270	1.73	1,041	187,345	0	(825)	42,397	3.93	0.00	54,141	0
1280	1.74	1,042	188,387	0	(825)	42,614	3.95	0.00	54,141	0
1290	1.74	1,043	189,430	0	(825)	42,832	3.97	0.00	54,141	0
1300	1.74	1,043	190,473	0	(825)	43,050	3.99	0.00	54,141	0
1310	1.74	1,043	191,516	0	(825)	43,269	4.01	0.00	54,141	0
1320	1.74	1,045	192,561	(3,609)	(825)	39,879	3.69	0.00	57,750	0
1330	1.74	1,046	193,607	0	(825)	40,100	3.71	0.00	57,750	0
1340	1.74	1,045	194,652	0	(825)	40,320	3.73	0.00	57,750	0
1350	1.74	1,045	195,696	0	(825)	40,539	3.75	0.00	57,750	0
1360	1.74	1,046	196,742	0	(825)	40,760	3.77	0.00	57,750	0
1370	1.74	1,046	197,788	0	(825)	40,981	3.79	0.00	57,750	0
1380	1.74	1,045	198,833	0	(825)	41,201	3.81	0.00	57,750	0
1390	1.75	1,047	199,880	0	(825)	41,423	3.84	0.00	57,750	0
1400	1.75	1,048	200,929	0	(825)	41,647	3.86	0.00	57,750	0
1410	1.75	1,048	201,977	0	(825)	41,870	3.88	0.00	57,750	0
1420	1.75	1,049	203,026	0	(825)	42,094	3.90	0.00	57,750	0
1430	1.75	1,049	204,075	0	(825)	42,318	3.92	0.00	57,750	0
1440	1.75	1,050	205,125	0	(825)	42,543	3.94	0.00	57,750	0

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alt 1 and 2

Bioretention	25-Year SBUH Hydrology	Existing Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	825.00	cf

Pond Information		
Pond Overtop Elevation	8	ft
Pond Overtop Volume	86,400	cf
Time Pond Overtopped	0.00	hr
Volume Flooding	0.00	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.00	0.00	0	0
20	0.00	0	0	0	(825)	0	0.00	0.00	0	0
30	0.00	0	0	0	(825)	0	0.00	0.00	0	0
40	0.02	13	13	0	(825)	0	0.00	0.00	0	0
50	0.08	50	63	0	(825)	0	0.00	0.00	0	0
60	0.17	105	168	0	(825)	0	0.00	0.00	0	0
70	0.28	166	334	0	(825)	0	0.00	0.00	0	0
80	0.38	228	563	0	(825)	0	0.00	0.00	0	0
90	0.48	286	849	0	(825)	0	0.00	0.00	0	0
100	0.56	338	1,187	0	(825)	0	0.00	0.00	0	0
110	0.68	408	1,595	0	(825)	0	0.00	0.00	0	0
120	0.82	492	2,087	0	(825)	0	0.00	0.00	0	0
130	0.93	561	2,648	0	(825)	0	0.00	0.00	0	0
140	1.03	617	3,266	0	(825)	0	0.00	0.00	0	0
150	1.11	664	3,929	0	(825)	0	0.00	0.00	0	0
160	1.18	709	4,638	0	(825)	0	0.00	0.00	0	0
170	1.32	792	5,430	0	(825)	0	0.00	0.00	0	0
180	1.50	902	6,333	0	(825)	77	0.01	0.00	0	0
190	1.66	997	7,330	0	(825)	249	0.02	0.00	0	0
200	1.80	1,081	8,411	0	(825)	505	0.05	0.00	0	0
210	1.93	1,156	9,567	0	(825)	836	0.08	0.00	0	0
220	2.04	1,224	10,791	0	(825)	1,235	0.11	0.00	0	0
230	2.22	1,331	12,122	0	(825)	1,742	0.16	0.00	0	0
240	2.44	1,464	13,586	0	(825)	2,381	0.22	0.00	0	0
250	2.62	1,570	15,156	0	(825)	3,126	0.29	0.00	0	0
260	2.76	1,657	16,812	0	(825)	3,957	0.37	0.00	0	0
270	2.88	1,729	18,542	0	(825)	4,862	0.45	0.00	0	0
280	2.99	1,794	20,336	0	(825)	5,831	0.54	0.00	0	0
290	3.20	1,917	22,253	0	(825)	6,923	0.64	0.00	0	0
300	3.46	2,078	24,330	0	(825)	8,175	0.76	0.00	0	0
310	3.66	2,198	26,528	0	(825)	9,548	0.88	0.00	0	0
320	3.82	2,290	28,818	0	(825)	11,013	1.02	0.00	0	0
330	3.94	2,366	31,184	0	(825)	12,553	1.16	0.00	0	0
340	4.05	2,429	33,613	0	(825)	14,158	1.31	0.00	0	0
350	4.27	2,564	36,177	0	(825)	15,897	1.47	0.00	0	0
360	4.58	2,745	38,922	0	(825)	17,817	1.65	0.00	0	0
370	4.79	2,877	41,798	0	(825)	19,868	1.84	0.00	0	0
380	4.96	2,975	44,773	0	(825)	22,018	2.04	0.00	0	0
390	5.08	3,051	47,824	0	(825)	24,244	2.24	0.00	0	0
400	5.19	3,113	50,937	0	(825)	26,532	2.46	0.00	0	0
410	5.71	3,424	54,361	0	(825)	29,131	2.70	0.00	0	0
420	6.49	3,893	58,255	0	(825)	32,200	2.98	0.00	0	0
430	7.01	4,207	62,462	0	(825)	35,582	3.29	0.00	0	0
440	7.90	4,741	67,203	0	(825)	39,498	3.66	0.00	0	0
450	9.03	5,417	72,621	0	(825)	44,091	4.08	0.00	0	0
460	11.68	7,007	79,628	(3,609)	(825)	46,663	4.32	0.00	3,609	0
470	17.76	10,657	90,285	(3,609)	(825)	52,886	4.90	0.00	7,219	0
480	20.83	12,501	102,786	(3,609)	(825)	60,953	5.64	0.00	10,828	0
490	18.43	11,060	113,846	(3,609)	(825)	67,578	6.26	0.00	14,438	0
500	15.30	9,177	123,023	(3,609)	(825)	72,321	6.70	0.00	18,047	0
510	12.81	7,683	130,706	(3,609)	(825)	75,569	7.00	0.00	21,656	0
520	11.28	6,768	137,473	(3,609)	(825)	77,903	7.21	0.00	25,266	0
530	9.77	5,861	143,335	(3,609)	(825)	79,329	7.35	0.00	28,875	0
540	8.26	4,959	148,293	(3,609)	(825)	79,854	7.39	0.00	32,484	0
550	7.34	4,403	152,696	(3,609)	(825)	79,822	7.39	0.00	36,094	0
560	6.77	4,062	156,758	(3,609)	(825)	79,449	7.36	0.00	39,703	0
570	6.42	3,855	160,612	(3,609)	(825)	78,869	7.30	0.00	43,313	0
580	6.22	3,729	164,342	(3,609)	(825)	78,164	7.24	0.00	46,922	0
590	6.09	3,654	167,996	(3,609)	(825)	77,385	7.17	0.00	50,531	0
600	6.02	3,612	171,608	(3,609)	(825)	76,562	7.09	0.00	54,141	0
610	5.98	3,589	175,197	(3,609)	(825)	75,717	7.01	0.00	57,750	0
620	5.96	3,577	178,774	(3,609)	(825)	74,859	6.93	0.00	61,360	0
630	5.95	3,571	182,345	(3,609)	(825)	73,996	6.85	0.00	64,969	0
640	5.95	3,570	185,916	(3,609)	(825)	73,132	6.77	0.00	68,578	0

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	5.74	3,447	189,363	(3,609)	(825)	72,145	6.68	0.00	72,188	0
660	5.42	3,250	192,612	(3,609)	(825)	70,960	6.57	0.00	75,797	0
670	5.22	3,129	195,742	(3,609)	(825)	69,655	6.45	0.00	79,407	0
680	5.09	3,055	198,797	(3,609)	(825)	68,276	6.32	0.00	83,016	0
690	5.02	3,011	201,808	(3,609)	(825)	66,852	6.19	0.00	86,625	0
700	4.97	2,984	204,792	(3,609)	(825)	65,402	6.06	0.00	90,235	0
710	4.95	2,969	207,761	(3,609)	(825)	63,937	5.92	0.00	93,844	0
720	4.94	2,962	210,723	(3,609)	(825)	62,465	5.78	0.00	97,453	0
730	4.93	2,959	213,683	(3,609)	(825)	60,990	5.65	0.00	101,063	0
740	4.93	2,958	216,640	(3,609)	(825)	59,513	5.51	0.00	104,672	0
750	4.93	2,959	219,599	(3,609)	(825)	58,037	5.37	0.00	108,282	0
760	4.93	2,961	222,560	(3,609)	(825)	56,564	5.24	0.00	111,891	0
770	4.74	2,846	225,406	(3,609)	(825)	54,976	5.09	0.00	115,500	0
780	4.43	2,659	228,066	(3,609)	(825)	53,201	4.93	0.00	119,110	0
790	4.24	2,544	230,610	(3,609)	(825)	51,310	4.75	0.00	122,719	0
800	4.12	2,474	233,084	(3,609)	(825)	49,350	4.57	0.00	126,329	0
810	4.05	2,431	235,515	(3,609)	(825)	47,347	4.38	0.00	129,938	0
820	4.01	2,404	237,919	(3,609)	(825)	45,317	4.20	0.00	133,547	0
830	3.98	2,389	240,308	(3,609)	(825)	43,271	4.01	0.00	137,157	0
840	3.97	2,380	242,687	(3,609)	(825)	41,216	3.82	0.00	140,766	0
850	3.96	2,375	245,062	0	(825)	42,766	3.96	0.00	140,766	0
860	3.96	2,373	247,436	0	(825)	44,314	4.10	0.00	140,766	0
870	3.95	2,372	249,808	(3,609)	(825)	42,252	3.91	0.00	144,375	0
880	3.95	2,373	252,181	0	(825)	43,800	4.06	0.00	144,375	0
890	3.86	2,317	254,498	(3,609)	(825)	41,683	3.86	0.00	147,985	0
900	3.71	2,225	256,723	0	(825)	43,083	3.99	0.00	147,985	0
910	3.62	2,170	258,893	0	(825)	44,428	4.11	0.00	147,985	0
920	3.56	2,136	261,029	(3,609)	(825)	42,129	3.90	0.00	151,594	0
930	3.52	2,114	263,143	0	(825)	43,419	4.02	0.00	151,594	0
940	3.51	2,104	265,247	(3,609)	(825)	41,088	3.80	0.00	155,204	0
950	3.50	2,097	267,344	0	(825)	42,360	3.92	0.00	155,204	0
960	3.49	2,092	269,436	0	(825)	43,627	4.04	0.00	155,204	0
970	3.48	2,089	271,524	(3,609)	(825)	41,281	3.82	0.00	158,813	0
980	3.48	2,088	273,612	0	(825)	42,544	3.94	0.00	158,813	0
990	3.48	2,087	275,700	0	(825)	43,806	4.06	0.00	158,813	0
1000	3.48	2,088	277,788	(3,609)	(825)	41,460	3.84	0.00	162,422	0
1010	3.35	2,010	279,798	0	(825)	42,645	3.95	0.00	162,422	0
1020	3.13	1,880	281,678	0	(825)	43,700	4.05	0.00	162,422	0
1030	3.00	1,801	283,479	(3,609)	(825)	41,067	3.80	0.00	166,032	0
1040	2.92	1,752	285,232	0	(825)	41,995	3.89	0.00	166,032	0
1050	2.87	1,724	286,955	0	(825)	42,893	3.97	0.00	166,032	0
1060	2.84	1,706	288,661	0	(825)	43,774	4.05	0.00	166,032	0
1070	2.82	1,692	290,354	(3,609)	(825)	41,032	3.80	0.00	169,641	0
1080	2.81	1,686	292,040	0	(825)	41,894	3.88	0.00	169,641	0
1090	2.80	1,683	293,723	0	(825)	42,752	3.96	0.00	169,641	0
1100	2.80	1,681	295,404	0	(825)	43,607	4.04	0.00	169,641	0
1110	2.80	1,680	297,084	(3,609)	(825)	40,853	3.78	0.00	173,251	0
1120	2.80	1,680	298,764	0	(825)	41,709	3.86	0.00	173,251	0
1130	2.80	1,680	300,445	0	(825)	42,564	3.94	0.00	173,251	0
1140	2.80	1,679	302,124	0	(825)	43,418	4.02	0.00	173,251	0
1150	2.80	1,680	303,803	(3,609)	(825)	40,663	3.77	0.00	176,860	0
1160	2.80	1,680	305,483	0	(825)	41,518	3.84	0.00	176,860	0
1170	2.80	1,680	307,163	0	(825)	42,373	3.92	0.00	176,860	0
1180	2.80	1,680	308,843	0	(825)	43,228	4.00	0.00	176,860	0
1190	2.80	1,681	310,525	(3,609)	(825)	40,475	3.75	0.00	180,469	0
1200	2.80	1,682	312,207	0	(825)	41,332	3.83	0.00	180,469	0
1210	2.80	1,683	313,890	0	(825)	42,190	3.91	0.00	180,469	0
1220	2.80	1,683	315,573	0	(825)	43,048	3.99	0.00	180,469	0
1230	2.81	1,683	317,256	0	(825)	43,906	4.07	0.00	180,469	0
1240	2.81	1,685	318,940	(3,609)	(825)	41,156	3.81	0.00	184,079	0
1250	2.81	1,684	320,624	0	(825)	42,016	3.89	0.00	184,079	0
1260	2.81	1,684	322,308	0	(825)	42,874	3.97	0.00	184,079	0
1270	2.81	1,685	323,993	0	(825)	43,734	4.05	0.00	184,079	0
1280	2.81	1,686	325,679	(3,609)	(825)	40,986	3.79	0.00	187,688	0
1290	2.81	1,686	327,365	0	(825)	41,847	3.87	0.00	187,688	0
1300	2.81	1,686	329,051	0	(825)	42,708	3.95	0.00	187,688	0
1310	2.81	1,688	330,739	0	(825)	43,571	4.03	0.00	187,688	0
1320	2.81	1,689	332,428	(3,609)	(825)	40,825	3.78	0.00	191,298	0
1330	2.81	1,688	334,116	0	(825)	41,688	3.86	0.00	191,298	0
1340	2.81	1,689	335,804	0	(825)	42,552	3.94	0.00	191,298	0
1350	2.82	1,689	337,494	0	(825)	43,416	4.02	0.00	191,298	0
1360	2.82	1,690	339,183	(3,609)	(825)	40,671	3.77	0.00	194,907	0
1370	2.82	1,690	340,873	0	(825)	41,536	3.85	0.00	194,907	0
1380	2.82	1,690	342,563	0	(825)	42,400	3.93	0.00	194,907	0
1390	2.82	1,691	344,254	0	(825)	43,267	4.01	0.00	194,907	0
1400	2.82	1,691	345,944	(3,609)	(825)	40,523	3.75	0.00	198,516	0
1410	2.82	1,690	347,635	0	(825)	41,388	3.83	0.00	198,516	0
1420	2.82	1,693	349,327	0	(825)	42,256	3.91	0.00	198,516	0
1430	2.82	1,693	351,020	0	(825)	43,124	3.99	0.00	198,516	0
1440	2.82	1,693	352,713	0	(825)	43,992	4.07	0.00	198,516	0

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alt 1 and 2

Bioretention | **10-Year SBUH Hydrology** | **Future Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	8	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	825.00	cf	Pond Overtop Volume	86,400	cf
	3,609	cf				Time Pond Overtopped	0.00	hr
Pump on height[1]	4	ft				Volume Flooding	0.00	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.00	0.00	0	0
20	0.00	0	0	0	(825)	0	0.00	0.00	0	0
30	0.00	0	0	0	(825)	0	0.00	0.00	0	0
40	0.00	0	0	0	(825)	0	0.00	0.00	0	0
50	0.00	2	2	0	(825)	0	0.00	0.00	0	0
60	0.03	18	20	0	(825)	0	0.00	0.00	0	0
70	0.09	54	73	0	(825)	0	0.00	0.00	0	0
80	0.17	100	174	0	(825)	0	0.00	0.00	0	0
90	0.25	152	325	0	(825)	0	0.00	0.00	0	0
100	0.34	206	531	0	(825)	0	0.00	0.00	0	0
110	0.46	274	805	0	(825)	0	0.00	0.00	0	0
120	0.59	355	1,159	0	(825)	0	0.00	0.00	0	0
130	0.71	427	1,586	0	(825)	0	0.00	0.00	0	0
140	0.82	490	2,076	0	(825)	0	0.00	0.00	0	0
150	0.92	549	2,625	0	(825)	0	0.00	0.00	0	0
160	1.00	600	3,225	0	(825)	0	0.00	0.00	0	0
170	1.12	672	3,897	0	(825)	0	0.00	0.00	0	0
180	1.27	761	4,658	0	(825)	0	0.00	0.00	0	0
190	1.38	831	5,489	0	(825)	6	0.00	0.00	0	0
200	1.48	886	6,375	0	(825)	67	0.01	0.00	0	0
210	1.56	934	7,310	0	(825)	177	0.02	0.00	0	0
220	1.63	977	8,287	0	(825)	329	0.03	0.00	0	0
230	1.75	1,051	9,338	0	(825)	555	0.05	0.00	0	0
240	1.91	1,145	10,483	0	(825)	874	0.08	0.00	0	0
250	2.03	1,218	11,700	0	(825)	1,267	0.12	0.00	0	0
260	2.13	1,275	12,976	0	(825)	1,717	0.16	0.00	0	0
270	2.20	1,322	14,297	0	(825)	2,214	0.21	0.00	0	0
280	2.27	1,361	15,659	0	(825)	2,750	0.25	0.00	0	0
290	2.41	1,443	17,102	0	(825)	3,369	0.31	0.00	0	0
300	2.59	1,554	18,656	0	(825)	4,097	0.38	0.00	0	0
310	2.72	1,633	20,288	0	(825)	4,905	0.45	0.00	0	0
320	2.82	1,693	21,981	0	(825)	5,773	0.53	0.00	0	0
330	2.90	1,739	23,720	0	(825)	6,687	0.62	0.00	0	0
340	2.96	1,774	25,494	0	(825)	7,636	0.71	0.00	0	0
350	3.10	1,861	27,355	0	(825)	8,672	0.80	0.00	0	0
360	3.30	1,980	29,336	0	(825)	9,827	0.91	0.00	0	0
370	3.44	2,063	31,399	0	(825)	11,065	1.02	0.00	0	0
380	3.54	2,123	33,522	0	(825)	12,363	1.14	0.00	0	0
390	3.61	2,167	35,689	0	(825)	13,706	1.27	0.00	0	0
400	3.67	2,202	37,891	0	(825)	15,082	1.40	0.00	0	0
410	4.01	2,409	40,299	0	(825)	16,666	1.54	0.00	0	0
420	4.55	2,727	43,027	0	(825)	18,568	1.72	0.00	0	0
430	4.89	2,937	45,964	0	(825)	20,680	1.91	0.00	0	0
440	5.49	3,291	49,255	0	(825)	23,147	2.14	0.00	0	0
450	6.23	3,741	52,996	0	(825)	26,062	2.41	0.00	0	0
460	8.01	4,808	57,803	0	(825)	30,045	2.78	0.00	0	0
470	12.09	7,254	65,057	0	(825)	36,474	3.38	0.00	0	0
480	14.11	8,465	73,522	0	(825)	44,114	4.08	0.00	0	0
490	12.44	7,464	80,986	(3,609)	(825)	47,143	4.37	0.00	3,609	0
500	10.30	6,179	87,165	(3,609)	(825)	48,888	4.53	0.00	7,219	0
510	8.60	5,162	92,327	(3,609)	(825)	49,615	4.59	0.00	10,828	0
520	7.56	4,535	96,862	(3,609)	(825)	49,716	4.60	0.00	14,438	0
530	6.53	3,918	100,781	(3,609)	(825)	49,200	4.56	0.00	18,047	0
540	5.51	3,307	104,087	(3,609)	(825)	48,073	4.45	0.00	21,656	0
550	4.89	2,932	107,019	(3,609)	(825)	46,570	4.31	0.00	25,266	0
560	4.50	2,701	109,720	(3,609)	(825)	44,836	4.15	0.00	28,875	0
570	4.27	2,559	112,279	(3,609)	(825)	42,961	3.98	0.00	32,484	0
580	4.12	2,475	114,754	0	(825)	44,611	4.13	0.00	32,484	0
590	4.04	2,423	117,176	(3,609)	(825)	42,599	3.94	0.00	36,094	0
600	3.99	2,391	119,568	0	(825)	44,165	4.09	0.00	36,094	0
610	3.95	2,373	121,940	(3,609)	(825)	42,104	3.90	0.00	39,703	0
620	3.94	2,362	124,302	0	(825)	43,640	4.04	0.00	39,703	0
630	3.93	2,358	126,660	(3,609)	(825)	41,564	3.85	0.00	43,313	0
640	3.93	2,356	129,016	0	(825)	43,095	3.99	0.00	43,313	0

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	3.79	2,272	131,289	0	(825)	44,543	4.12	0.00	43,313	0
660	3.57	2,142	133,431	(3,609)	(825)	42,251	3.91	0.00	46,922	0
670	3.44	2,062	135,493	0	(825)	43,488	4.03	0.00	46,922	0
680	3.35	2,011	137,504	(3,609)	(825)	41,064	3.80	0.00	50,531	0
690	3.30	1,982	139,486	0	(825)	42,221	3.91	0.00	50,531	0
700	3.27	1,964	141,449	0	(825)	43,360	4.01	0.00	50,531	0
710	3.26	1,953	143,403	(3,609)	(825)	40,879	3.79	0.00	54,141	0
720	3.25	1,947	145,350	0	(825)	42,001	3.89	0.00	54,141	0
730	3.24	1,944	147,294	0	(825)	43,120	3.99	0.00	54,141	0
740	3.24	1,942	149,236	0	(825)	44,237	4.10	0.00	54,141	0
750	3.24	1,941	151,177	(3,609)	(825)	41,744	3.87	0.00	57,750	0
760	3.24	1,943	153,121	0	(825)	42,862	3.97	0.00	57,750	0
770	3.11	1,866	154,986	0	(825)	43,903	4.07	0.00	57,750	0
780	2.90	1,739	156,725	(3,609)	(825)	41,208	3.82	0.00	61,360	0
790	2.77	1,663	158,388	0	(825)	42,045	3.89	0.00	61,360	0
800	2.69	1,616	160,004	0	(825)	42,836	3.97	0.00	61,360	0
810	2.64	1,586	161,590	0	(825)	43,597	4.04	0.00	61,360	0
820	2.61	1,569	163,159	(3,609)	(825)	40,731	3.77	0.00	64,969	0
830	2.60	1,559	164,717	0	(825)	41,465	3.84	0.00	64,969	0
840	2.58	1,550	166,268	0	(825)	42,190	3.91	0.00	64,969	0
850	2.58	1,547	167,815	0	(825)	42,913	3.97	0.00	64,969	0
860	2.58	1,546	169,361	0	(825)	43,634	4.04	0.00	64,969	0
870	2.58	1,545	170,907	(3,609)	(825)	40,745	3.77	0.00	68,578	0
880	2.58	1,545	172,452	0	(825)	41,465	3.84	0.00	68,578	0
890	2.52	1,510	173,962	0	(825)	42,150	3.90	0.00	68,578	0
900	2.43	1,455	175,417	0	(825)	42,780	3.96	0.00	68,578	0
910	2.37	1,420	176,837	0	(825)	43,375	4.02	0.00	68,578	0
920	2.33	1,398	178,235	(3,609)	(825)	40,339	3.74	0.00	72,188	0
930	2.31	1,387	179,622	0	(825)	40,901	3.79	0.00	72,188	0
940	2.30	1,378	181,000	0	(825)	41,454	3.84	0.00	72,188	0
950	2.29	1,373	182,372	0	(825)	42,001	3.89	0.00	72,188	0
960	2.29	1,371	183,743	0	(825)	42,547	3.94	0.00	72,188	0
970	2.28	1,371	185,114	0	(825)	43,093	3.99	0.00	72,188	0
980	2.28	1,371	186,485	0	(825)	43,639	4.04	0.00	72,188	0
990	2.28	1,368	187,853	(3,609)	(825)	40,572	3.76	0.00	75,797	0
1000	2.28	1,367	189,220	0	(825)	41,115	3.81	0.00	75,797	0
1010	2.19	1,315	190,535	0	(825)	41,605	3.85	0.00	75,797	0
1020	2.05	1,229	191,764	0	(825)	42,009	3.89	0.00	75,797	0
1030	1.96	1,178	192,942	0	(825)	42,362	3.92	0.00	75,797	0
1040	1.91	1,146	194,089	0	(825)	42,683	3.95	0.00	75,797	0
1050	1.87	1,125	195,214	0	(825)	42,983	3.98	0.00	75,797	0
1060	1.85	1,112	196,326	0	(825)	43,270	4.01	0.00	75,797	0
1070	1.84	1,104	197,429	(3,609)	(825)	39,940	3.70	0.00	79,407	0
1080	1.83	1,099	198,528	0	(825)	40,214	3.72	0.00	79,407	0
1090	1.83	1,096	199,624	0	(825)	40,485	3.75	0.00	79,407	0
1100	1.83	1,096	200,721	0	(825)	40,756	3.77	0.00	79,407	0
1110	1.83	1,096	201,817	0	(825)	41,027	3.80	0.00	79,407	0
1120	1.82	1,095	202,912	0	(825)	41,297	3.82	0.00	79,407	0
1130	1.82	1,094	204,005	0	(825)	41,565	3.85	0.00	79,407	0
1140	1.82	1,093	205,098	0	(825)	41,833	3.87	0.00	79,407	0
1150	1.82	1,092	206,191	0	(825)	42,101	3.90	0.00	79,407	0
1160	1.82	1,095	207,285	0	(825)	42,370	3.92	0.00	79,407	0
1170	1.83	1,096	208,381	0	(825)	42,641	3.95	0.00	79,407	0
1180	1.82	1,094	209,475	0	(825)	42,911	3.97	0.00	79,407	0
1190	1.82	1,094	210,569	0	(825)	43,179	4.00	0.00	79,407	0
1200	1.82	1,094	211,663	0	(825)	43,448	4.02	0.00	79,407	0
1210	1.83	1,095	212,758	(3,609)	(825)	40,109	3.71	0.00	83,016	0
1220	1.83	1,097	213,855	0	(825)	40,380	3.74	0.00	83,016	0
1230	1.83	1,095	214,950	0	(825)	40,651	3.76	0.00	83,016	0
1240	1.82	1,095	216,045	0	(825)	40,920	3.79	0.00	83,016	0
1250	1.83	1,096	217,141	0	(825)	41,192	3.81	0.00	83,016	0
1260	1.83	1,097	218,238	0	(825)	41,464	3.84	0.00	83,016	0
1270	1.83	1,096	219,334	0	(825)	41,735	3.86	0.00	83,016	0
1280	1.83	1,096	220,430	0	(825)	42,006	3.89	0.00	83,016	0
1290	1.83	1,097	221,527	0	(825)	42,278	3.91	0.00	83,016	0
1300	1.83	1,098	222,625	0	(825)	42,550	3.94	0.00	83,016	0
1310	1.83	1,097	223,722	0	(825)	42,822	3.97	0.00	83,016	0
1320	1.83	1,098	224,820	0	(825)	43,095	3.99	0.00	83,016	0
1330	1.83	1,099	225,919	0	(825)	43,369	4.02	0.00	83,016	0
1340	1.83	1,097	227,016	(3,609)	(825)	40,032	3.71	0.00	86,625	0
1350	1.83	1,096	228,112	0	(825)	40,304	3.73	0.00	86,625	0
1360	1.83	1,098	229,210	0	(825)	40,577	3.76	0.00	86,625	0
1370	1.83	1,099	230,309	0	(825)	40,850	3.78	0.00	86,625	0
1380	1.83	1,097	231,406	0	(825)	41,123	3.81	0.00	86,625	0
1390	1.83	1,099	232,505	0	(825)	41,396	3.83	0.00	86,625	0
1400	1.83	1,100	233,605	0	(825)	41,671	3.86	0.00	86,625	0
1410	1.83	1,098	234,703	0	(825)	41,944	3.88	0.00	86,625	0
1420	1.83	1,099	235,802	0	(825)	42,219	3.91	0.00	86,625	0
1430	1.83	1,100	236,902	0	(825)	42,494	3.93	0.00	86,625	0
1440	1.83	1,099	238,001	0	(825)	42,768	3.96	0.00	86,625	0

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alt 1 and 2

Bioretention	25-Year SBUH Hydrology	Future Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	825.00	cf

Pond Information		
Pond Overtop Elevation	8	ft
Pond Overtop Volume	86,400	cf
Time Pond Overtopped	0.83	hr
Volume Flooding	0.15	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.00	0.00	0	0
20	0.00	0	0	0	(825)	0	0.00	0.00	0	0
30	0.00	0	0	0	(825)	0	0.00	0.00	0	0
40	0.04	22	22	0	(825)	0	0.00	0.00	0	0
50	0.15	89	112	0	(825)	0	0.00	0.00	0	0
60	0.31	186	297	0	(825)	0	0.00	0.00	0	0
70	0.49	294	591	0	(825)	0	0.00	0.00	0	0
80	0.67	404	995	0	(825)	0	0.00	0.00	0	0
90	0.84	506	1,501	0	(825)	0	0.00	0.00	0	0
100	1.00	598	2,099	0	(825)	0	0.00	0.00	0	0
110	1.20	722	2,820	0	(825)	0	0.00	0.00	0	0
120	1.45	870	3,690	0	(825)	45	0.00	0.00	0	0
130	1.65	991	4,681	0	(825)	211	0.02	0.00	0	0
140	1.82	1,091	5,772	0	(825)	477	0.04	0.00	0	0
150	1.96	1,173	6,946	0	(825)	825	0.08	0.00	0	0
160	2.07	1,244	8,190	0	(825)	1,244	0.12	0.00	0	0
170	2.27	1,363	9,553	0	(825)	1,783	0.17	0.00	0	0
180	2.53	1,515	11,068	0	(825)	2,473	0.23	0.00	0	0
190	2.72	1,632	12,700	0	(825)	3,280	0.30	0.00	0	0
200	2.87	1,724	14,424	0	(825)	4,179	0.39	0.00	0	0
210	3.00	1,797	16,221	0	(825)	5,151	0.48	0.00	0	0
220	3.10	1,861	18,082	0	(825)	6,187	0.57	0.00	0	0
230	3.30	1,978	20,061	0	(825)	7,340	0.68	0.00	0	0
240	3.55	2,130	22,191	0	(825)	8,645	0.80	0.00	0	0
250	3.73	2,241	24,431	0	(825)	10,061	0.93	0.00	0	0
260	3.87	2,324	26,755	0	(825)	11,560	1.07	0.00	0	0
270	3.98	2,388	29,143	0	(825)	13,123	1.22	0.00	0	0
280	4.06	2,438	31,580	0	(825)	14,735	1.36	0.00	0	0
290	4.28	2,566	34,146	0	(825)	16,476	1.53	0.00	0	0
300	4.57	2,741	36,888	0	(825)	18,392	1.70	0.00	0	0
310	4.77	2,860	39,748	0	(825)	20,428	1.89	0.00	0	0
320	4.91	2,945	42,693	0	(825)	22,547	2.09	0.00	0	0
330	5.01	3,007	45,700	0	(825)	24,729	2.29	0.00	0	0
340	5.09	3,056	48,755	0	(825)	26,960	2.50	0.00	0	0
350	5.32	3,192	51,947	0	(825)	29,326	2.72	0.00	0	0
360	5.64	3,382	55,329	0	(825)	31,884	2.95	0.00	0	0
370	5.85	3,509	58,838	0	(825)	34,568	3.20	0.00	0	0
380	5.99	3,596	62,433	0	(825)	37,338	3.46	0.00	0	0
390	6.09	3,657	66,090	0	(825)	40,170	3.72	0.00	0	0
400	6.17	3,703	69,793	0	(825)	43,048	3.99	0.00	0	0
410	6.73	4,038	73,831	0	(825)	46,261	4.28	0.00	0	0
420	7.59	4,552	78,383	(3,609)	(825)	46,378	4.29	0.00	3,609	0
430	8.13	4,880	83,263	(3,609)	(825)	46,824	4.34	0.00	7,219	0
440	9.09	5,451	88,714	(3,609)	(825)	47,840	4.43	0.00	10,828	0
450	10.30	6,177	94,891	(3,609)	(825)	49,583	4.59	0.00	14,438	0
460	13.17	7,903	102,794	(3,609)	(825)	53,052	4.91	0.00	18,047	0
470	19.76	11,856	114,650	(3,609)	(825)	60,474	5.60	0.00	21,656	0
480	22.97	13,784	128,434	(3,609)	(825)	69,823	6.47	0.00	25,266	0
490	20.20	12,123	140,557	(3,609)	(825)	77,512	7.18	0.00	28,875	0
500	16.69	10,013	150,570	(3,609)	(825)	83,090	7.69	0.00	32,484	0
510	13.91	8,346	158,916	(3,609)	(825)	86,400	8.00	0.17	36,094	602
520	12.20	7,319	166,234	(3,609)	(825)	86,400	8.00	0.33	39,703	3,486
530	10.52	6,315	172,549	(3,609)	(825)	86,400	8.00	0.50	43,313	5,366
540	8.88	5,326	177,875	(3,609)	(825)	86,400	8.00	0.67	46,922	6,258
550	7.86	4,715	182,590	(3,609)	(825)	86,400	8.00	0.83	50,531	6,539
560	7.23	4,338	186,928	(3,609)	(825)	86,303	7.99	0.83	54,141	6,539
570	6.85	4,107	191,035	(3,609)	(825)	85,976	7.96	0.83	57,750	6,539
580	6.61	3,966	195,001	(3,609)	(825)	85,508	7.92	0.83	61,360	6,539
590	6.47	3,879	198,881	(3,609)	(825)	84,953	7.87	0.83	64,969	6,539
600	6.38	3,829	202,709	(3,609)	(825)	84,347	7.81	0.83	68,578	6,539
610	6.33	3,798	206,508	(3,609)	(825)	83,711	7.75	0.83	72,188	6,539
620	6.30	3,778	210,286	(3,609)	(825)	83,055	7.69	0.83	75,797	6,539
630	6.28	3,768	214,054	(3,609)	(825)	82,389	7.63	0.83	79,407	6,539
640	6.27	3,763	217,817	(3,609)	(825)	81,718	7.57	0.83	83,016	6,539

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	6.05	3,629	221,446	(3,609)	(825)	80,912	7.49	0.83	86,625	6,539
660	5.70	3,419	224,865	(3,609)	(825)	79,896	7.40	0.83	90,235	6,539
670	5.48	3,290	228,154	(3,609)	(825)	78,752	7.29	0.83	93,844	6,539
680	5.35	3,208	231,362	(3,609)	(825)	77,525	7.18	0.83	97,453	6,539
690	5.26	3,158	234,520	(3,609)	(825)	76,249	7.06	0.83	101,063	6,539
700	5.21	3,128	237,648	(3,609)	(825)	74,942	6.94	0.83	104,672	6,539
710	5.18	3,109	240,757	(3,609)	(825)	73,617	6.82	0.83	108,282	6,539
720	5.17	3,100	243,857	(3,609)	(825)	72,282	6.69	0.83	111,891	6,539
730	5.16	3,095	246,952	(3,609)	(825)	70,943	6.57	0.83	115,500	6,539
740	5.15	3,090	250,042	(3,609)	(825)	69,598	6.44	0.83	119,110	6,539
750	5.15	3,089	253,131	(3,609)	(825)	68,253	6.32	0.83	122,719	6,539
760	5.15	3,089	256,220	(3,609)	(825)	66,908	6.20	0.83	126,329	6,539
770	4.95	2,967	259,187	(3,609)	(825)	65,441	6.06	0.83	129,938	6,539
780	4.62	2,771	261,959	(3,609)	(825)	63,778	5.91	0.83	133,547	6,539
790	4.42	2,650	264,609	(3,609)	(825)	61,993	5.74	0.83	137,157	6,539
800	4.29	2,576	267,185	(3,609)	(825)	60,135	5.57	0.83	140,766	6,539
810	4.21	2,528	269,713	(3,609)	(825)	58,229	5.39	0.83	144,375	6,539
820	4.16	2,499	272,212	(3,609)	(825)	56,294	5.21	0.83	147,985	6,539
830	4.14	2,483	274,695	(3,609)	(825)	54,342	5.03	0.83	151,594	6,539
840	4.12	2,473	277,168	(3,609)	(825)	52,381	4.85	0.83	155,204	6,539
850	4.11	2,467	279,635	(3,609)	(825)	50,413	4.67	0.83	158,813	6,539
860	4.11	2,464	282,099	(3,609)	(825)	48,443	4.49	0.83	162,422	6,539
870	4.10	2,462	284,561	(3,609)	(825)	46,470	4.30	0.83	166,032	6,539
880	4.10	2,461	287,022	(3,609)	(825)	44,497	4.12	0.83	169,641	6,539
890	4.00	2,402	289,423	(3,609)	(825)	42,464	3.93	0.83	173,251	6,539
900	3.84	2,306	291,729	0	(825)	43,945	4.07	0.83	173,251	6,539
910	3.74	2,247	293,976	(3,609)	(825)	41,757	3.87	0.83	176,860	6,539
920	3.68	2,211	296,187	0	(825)	43,143	3.99	0.83	176,860	6,539
930	3.65	2,188	298,375	0	(825)	44,506	4.12	0.83	176,860	6,539
940	3.63	2,177	300,552	(3,609)	(825)	42,249	3.91	0.83	180,469	6,539
950	3.62	2,170	302,721	0	(825)	43,593	4.04	0.83	180,469	6,539
960	3.61	2,163	304,884	(3,609)	(825)	41,322	3.83	0.83	184,079	6,539
970	3.60	2,159	307,044	0	(825)	42,656	3.95	0.83	184,079	6,539
980	3.60	2,157	309,201	0	(825)	43,988	4.07	0.83	184,079	6,539
990	3.59	2,156	311,357	(3,609)	(825)	41,710	3.86	0.83	187,688	6,539
1000	3.60	2,157	313,514	0	(825)	43,042	3.99	0.83	187,688	6,539
1010	3.46	2,075	315,589	0	(825)	44,292	4.10	0.83	187,688	6,539
1020	3.23	1,940	317,529	(3,609)	(825)	41,798	3.87	0.83	191,298	6,539
1030	3.10	1,859	319,388	0	(825)	42,832	3.97	0.83	191,298	6,539
1040	3.01	1,808	321,196	0	(825)	43,815	4.06	0.83	191,298	6,539
1050	2.96	1,778	322,974	(3,609)	(825)	41,158	3.81	0.83	194,907	6,539
1060	2.93	1,759	324,732	0	(825)	42,092	3.90	0.83	194,907	6,539
1070	2.91	1,744	326,477	0	(825)	43,011	3.98	0.83	194,907	6,539
1080	2.90	1,738	328,215	0	(825)	43,924	4.07	0.83	194,907	6,539
1090	2.89	1,734	329,949	(3,609)	(825)	41,224	3.82	0.83	198,516	6,539
1100	2.89	1,732	331,681	0	(825)	42,131	3.90	0.83	198,516	6,539
1110	2.88	1,731	333,412	0	(825)	43,037	3.98	0.83	198,516	6,539
1120	2.88	1,730	335,142	0	(825)	43,942	4.07	0.83	198,516	6,539
1130	2.88	1,730	336,871	(3,609)	(825)	41,237	3.82	0.83	202,126	6,539
1140	2.88	1,727	338,598	0	(825)	42,139	3.90	0.83	202,126	6,539
1150	2.88	1,728	340,326	0	(825)	43,042	3.99	0.83	202,126	6,539
1160	2.88	1,728	342,054	0	(825)	43,945	4.07	0.83	202,126	6,539
1170	2.88	1,728	343,783	(3,609)	(825)	41,239	3.82	0.83	205,735	6,539
1180	2.88	1,729	345,511	0	(825)	42,143	3.90	0.83	205,735	6,539
1190	2.88	1,729	347,241	0	(825)	43,047	3.99	0.83	205,735	6,539
1200	2.88	1,729	348,970	0	(825)	43,951	4.07	0.83	205,735	6,539
1210	2.88	1,730	350,699	(3,609)	(825)	41,246	3.82	0.83	209,344	6,539
1220	2.88	1,730	352,429	0	(825)	42,151	3.90	0.83	209,344	6,539
1230	2.88	1,730	354,159	0	(825)	43,055	3.99	0.83	209,344	6,539
1240	2.88	1,730	355,889	0	(825)	43,961	4.07	0.83	209,344	6,539
1250	2.88	1,730	357,619	(3,609)	(825)	41,256	3.82	0.83	212,954	6,539
1260	2.88	1,730	359,349	0	(825)	42,161	3.90	0.83	212,954	6,539
1270	2.88	1,730	361,079	0	(825)	43,066	3.99	0.83	212,954	6,539
1280	2.88	1,730	362,809	0	(825)	43,972	4.07	0.83	212,954	6,539
1290	2.88	1,731	364,540	(3,609)	(825)	41,268	3.82	0.83	216,563	6,539
1300	2.88	1,731	366,270	0	(825)	42,173	3.90	0.83	216,563	6,539
1310	2.89	1,731	368,001	0	(825)	43,079	3.99	0.83	216,563	6,539
1320	2.89	1,731	369,733	0	(825)	43,986	4.07	0.83	216,563	6,539
1330	2.89	1,731	371,464	(3,609)	(825)	41,282	3.82	0.83	220,173	6,539
1340	2.89	1,731	373,195	0	(825)	42,189	3.91	0.83	220,173	6,539
1350	2.89	1,731	374,926	0	(825)	43,095	3.99	0.83	220,173	6,539
1360	2.89	1,732	376,658	0	(825)	44,001	4.07	0.83	220,173	6,539
1370	2.89	1,732	378,389	(3,609)	(825)	41,299	3.82	0.83	223,782	6,539
1380	2.89	1,732	380,121	0	(825)	42,205	3.91	0.83	223,782	6,539
1390	2.89	1,732	381,853	0	(825)	43,112	3.99	0.83	223,782	6,539
1400	2.89	1,732	383,585	0	(825)	44,019	4.08	0.83	223,782	6,539
1410	2.89	1,732	385,317	(3,609)	(825)	41,316	3.83	0.83	227,391	6,539
1420	2.89	1,734	387,051	0	(825)	42,226	3.91	0.83	227,391	6,539
1430	2.89	1,734	388,784	0	(825)	43,134	3.99	0.83	227,391	6,539
1440	2.89	1,733	390,518	0	(825)	44,042	4.08	0.83	227,391	6,539

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alt 1 and 2

No Bioretention	10-Year SBUH Hydrology	Existing Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	825.00	cf

Pond Information		
Pond Overtop Elevation	8	ft
Pond Overtop Volume	86,400	cf
Time Pond Overtopped	0.00	hr
Volume Flooding	0.00	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.00	0.00	0	0
20	0.00	0	0	0	(825)	0	0.00	0.00	0	0
30	0.00	0	0	0	(825)	0	0.00	0.00	0	0
40	0.00	0	0	0	(825)	0	0.00	0.00	0	0
50	0.00	1	1	0	(825)	0	0.00	0.00	0	0
60	0.01	5	5	0	(825)	0	0.00	0.00	0	0
70	0.03	16	21	0	(825)	0	0.00	0.00	0	0
80	0.05	32	53	0	(825)	0	0.00	0.00	0	0
90	0.09	53	105	0	(825)	0	0.00	0.00	0	0
100	0.13	78	183	0	(825)	0	0.00	0.00	0	0
110	0.18	109	292	0	(825)	0	0.00	0.00	0	0
120	0.25	149	441	0	(825)	0	0.00	0.00	0	0
130	0.32	191	632	0	(825)	0	0.00	0.00	0	0
140	0.39	234	866	0	(825)	0	0.00	0.00	0	0
150	0.47	279	1,145	0	(825)	0	0.00	0.00	0	0
160	0.54	324	1,469	0	(825)	0	0.00	0.00	0	0
170	0.63	376	1,845	0	(825)	0	0.00	0.00	0	0
180	0.73	435	2,280	0	(825)	0	0.00	0.00	0	0
190	0.82	493	2,774	0	(825)	0	0.00	0.00	0	0
200	0.92	550	3,324	0	(825)	0	0.00	0.00	0	0
210	1.01	606	3,929	0	(825)	0	0.00	0.00	0	0
220	1.10	661	4,590	0	(825)	0	0.00	0.00	0	0
230	1.21	727	5,317	0	(825)	0	0.00	0.00	0	0
240	1.34	805	6,122	0	(825)	0	0.00	0.00	0	0
250	1.47	884	7,006	0	(825)	59	0.01	0.00	0	0
260	1.61	963	7,969	0	(825)	197	0.02	0.00	0	0
270	1.74	1,042	9,012	0	(825)	415	0.04	0.00	0	0
280	1.87	1,121	10,133	0	(825)	711	0.07	0.00	0	0
290	2.02	1,214	11,347	0	(825)	1,100	0.10	0.00	0	0
300	2.20	1,322	12,669	0	(825)	1,597	0.15	0.00	0	0
310	2.38	1,427	14,096	0	(825)	2,199	0.20	0.00	0	0
320	2.55	1,531	15,627	0	(825)	2,905	0.27	0.00	0	0
330	2.72	1,631	17,258	0	(825)	3,711	0.34	0.00	0	0
340	2.88	1,730	18,988	0	(825)	4,616	0.43	0.00	0	0
350	3.07	1,845	20,833	0	(825)	5,636	0.52	0.00	0	0
360	3.29	1,976	22,808	0	(825)	6,786	0.63	0.00	0	0
370	3.50	2,102	24,911	0	(825)	8,063	0.75	0.00	0	0
380	3.71	2,225	27,135	0	(825)	9,463	0.88	0.00	0	0
390	3.90	2,342	29,478	0	(825)	10,980	1.02	0.00	0	0
400	4.09	2,457	31,934	0	(825)	12,612	1.17	0.00	0	0
410	4.39	2,632	34,566	0	(825)	14,419	1.34	0.00	0	0
420	4.78	2,866	37,432	0	(825)	16,459	1.52	0.00	0	0
430	5.15	3,090	40,521	0	(825)	18,724	1.73	0.00	0	0
440	5.64	3,385	43,906	0	(825)	21,284	1.97	0.00	0	0
450	6.25	3,749	47,655	0	(825)	24,207	2.24	0.00	0	0
460	7.32	4,395	52,049	0	(825)	27,777	2.57	0.00	0	0
470	9.51	5,704	57,753	0	(825)	32,656	3.02	0.00	0	0
480	11.35	6,809	64,563	0	(825)	38,640	3.58	0.00	0	0
490	11.91	7,143	71,706	0	(825)	44,959	4.16	0.00	0	0
500	11.98	7,186	78,892	(3,609)	(825)	47,710	4.42	0.00	3,609	0
510	11.90	7,137	86,030	(3,609)	(825)	50,414	4.67	0.00	7,219	0
520	11.83	7,096	93,125	(3,609)	(825)	53,075	4.91	0.00	10,828	0
530	11.61	6,965	100,090	(3,609)	(825)	55,606	5.15	0.00	14,438	0
540	11.25	6,752	106,842	(3,609)	(825)	57,923	5.36	0.00	18,047	0
550	10.93	6,558	113,401	(3,609)	(825)	60,047	5.56	0.00	21,656	0
560	10.64	6,382	119,783	(3,609)	(825)	61,995	5.74	0.00	25,266	0
570	10.37	6,222	126,004	(3,609)	(825)	63,782	5.91	0.00	28,875	0
580	10.13	6,076	132,081	(3,609)	(825)	65,424	6.06	0.00	32,484	0
590	9.91	5,944	138,025	(3,609)	(825)	66,934	6.20	0.00	36,094	0
600	9.71	5,823	143,848	(3,609)	(825)	68,323	6.33	0.00	39,703	0
610	9.52	5,714	149,562	(3,609)	(825)	69,602	6.44	0.00	43,313	0
620	9.36	5,615	155,177	(3,609)	(825)	70,783	6.55	0.00	46,922	0
630	9.21	5,526	160,703	(3,609)	(825)	71,875	6.66	0.00	50,531	0
640	9.08	5,445	166,148	(3,609)	(825)	72,885	6.75	0.00	54,141	0

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	8.90	5,337	171,486	(3,609)	(825)	73,788	6.83	0.00	57,750	0
660	8.68	5,205	176,691	(3,609)	(825)	74,559	6.90	0.00	61,360	0
670	8.47	5,085	181,776	(3,609)	(825)	75,210	6.96	0.00	64,969	0
680	8.29	4,974	186,750	(3,609)	(825)	75,750	7.01	0.00	68,578	0
690	8.12	4,874	191,624	(3,609)	(825)	76,189	7.05	0.00	72,188	0
700	7.97	4,783	196,407	(3,609)	(825)	76,538	7.09	0.00	75,797	0
710	7.83	4,700	201,107	(3,609)	(825)	76,804	7.11	0.00	79,407	0
720	7.71	4,624	205,732	(3,609)	(825)	76,993	7.13	0.00	83,016	0
730	7.59	4,555	210,287	(3,609)	(825)	77,114	7.14	0.00	86,625	0
740	7.49	4,493	214,780	(3,609)	(825)	77,173	7.15	0.00	90,235	0
750	7.39	4,436	219,216	(3,609)	(825)	77,174	7.15	0.00	93,844	0
760	7.31	4,385	223,601	(3,609)	(825)	77,125	7.14	0.00	97,453	0
770	7.18	4,305	227,906	(3,609)	(825)	76,996	7.13	0.00	101,063	0
780	7.00	4,199	232,105	(3,609)	(825)	76,761	7.11	0.00	104,672	0
790	6.84	4,102	236,207	(3,609)	(825)	76,428	7.08	0.00	108,282	0
800	6.69	4,013	240,220	(3,609)	(825)	76,007	7.04	0.00	111,891	0
810	6.55	3,932	244,152	(3,609)	(825)	75,504	6.99	0.00	115,500	0
820	6.43	3,858	248,010	(3,609)	(825)	74,928	6.94	0.00	119,110	0
830	6.32	3,791	251,800	(3,609)	(825)	74,284	6.88	0.00	122,719	0
840	6.21	3,729	255,529	(3,609)	(825)	73,578	6.81	0.00	126,329	0
850	6.12	3,672	259,201	(3,609)	(825)	72,816	6.74	0.00	129,938	0
860	6.04	3,621	262,823	(3,609)	(825)	72,003	6.67	0.00	133,547	0
870	5.96	3,575	266,398	(3,609)	(825)	71,144	6.59	0.00	137,157	0
880	5.89	3,532	269,930	(3,609)	(825)	70,242	6.50	0.00	140,766	0
890	5.80	3,478	273,408	(3,609)	(825)	69,286	6.42	0.00	144,375	0
900	5.69	3,415	276,823	(3,609)	(825)	68,266	6.32	0.00	147,985	0
910	5.59	3,356	280,180	(3,609)	(825)	67,188	6.22	0.00	151,594	0
920	5.50	3,303	283,482	(3,609)	(825)	66,056	6.12	0.00	155,204	0
930	5.42	3,254	286,737	(3,609)	(825)	64,876	6.01	0.00	158,813	0
940	5.35	3,210	289,946	(3,609)	(825)	63,652	5.89	0.00	162,422	0
950	5.28	3,169	293,115	(3,609)	(825)	62,386	5.78	0.00	166,032	0
960	5.22	3,132	296,247	(3,609)	(825)	61,084	5.66	0.00	169,641	0
970	5.16	3,099	299,346	(3,609)	(825)	59,748	5.53	0.00	173,251	0
980	5.11	3,068	302,414	(3,609)	(825)	58,382	5.41	0.00	176,860	0
990	5.07	3,040	305,454	(3,609)	(825)	56,987	5.28	0.00	180,469	0
1000	5.02	3,014	308,468	(3,609)	(825)	55,567	5.15	0.00	184,079	0
1010	4.95	2,968	311,436	(3,609)	(825)	54,100	5.01	0.00	187,688	0
1020	4.84	2,903	314,338	(3,609)	(825)	52,569	4.87	0.00	191,298	0
1030	4.74	2,843	317,182	(3,609)	(825)	50,978	4.72	0.00	194,907	0
1040	4.65	2,789	319,971	(3,609)	(825)	49,332	4.57	0.00	198,516	0
1050	4.56	2,739	322,710	(3,609)	(825)	47,637	4.41	0.00	202,126	0
1060	4.49	2,692	325,402	(3,609)	(825)	45,895	4.25	0.00	205,735	0
1070	4.42	2,651	328,052	(3,609)	(825)	44,111	4.08	0.00	209,344	0
1080	4.35	2,612	330,665	(3,609)	(825)	42,289	3.92	0.00	212,954	0
1090	4.29	2,577	333,242	0	(825)	44,040	4.08	0.00	212,954	0
1100	4.24	2,545	335,787	(3,609)	(825)	42,151	3.90	0.00	216,563	0
1110	4.19	2,516	338,303	0	(825)	43,842	4.06	0.00	216,563	0
1120	4.15	2,489	340,792	(3,609)	(825)	41,898	3.88	0.00	220,173	0
1130	4.11	2,465	343,257	0	(825)	43,538	4.03	0.00	220,173	0
1140	4.07	2,442	345,699	(3,609)	(825)	41,545	3.85	0.00	223,782	0
1150	4.04	2,422	348,121	0	(825)	43,142	3.99	0.00	223,782	0
1160	4.01	2,404	350,525	0	(825)	44,721	4.14	0.00	223,782	0
1170	3.98	2,387	352,912	(3,609)	(825)	42,673	3.95	0.00	227,391	0
1180	3.95	2,371	355,283	0	(825)	44,219	4.09	0.00	227,391	0
1190	3.93	2,357	357,640	(3,609)	(825)	42,142	3.90	0.00	231,001	0
1200	3.91	2,344	359,984	0	(825)	43,661	4.04	0.00	231,001	0
1210	3.89	2,333	362,317	(3,609)	(825)	41,560	3.85	0.00	234,610	0
1220	3.87	2,323	364,640	0	(825)	43,057	3.99	0.00	234,610	0
1230	3.85	2,312	366,952	0	(825)	44,545	4.12	0.00	234,610	0
1240	3.84	2,304	369,256	(3,609)	(825)	42,414	3.93	0.00	238,220	0
1250	3.83	2,296	371,552	0	(825)	43,886	4.06	0.00	238,220	0
1260	3.82	2,289	373,842	(3,609)	(825)	41,740	3.86	0.00	241,829	0
1270	3.80	2,282	376,124	0	(825)	43,198	4.00	0.00	241,829	0
1280	3.79	2,277	378,401	0	(825)	44,650	4.13	0.00	241,829	0
1290	3.79	2,272	380,673	(3,609)	(825)	42,487	3.93	0.00	245,438	0
1300	3.78	2,267	382,940	0	(825)	43,929	4.07	0.00	245,438	0
1310	3.77	2,263	385,203	(3,609)	(825)	41,758	3.87	0.00	249,048	0
1320	3.77	2,259	387,462	0	(825)	43,192	4.00	0.00	249,048	0
1330	3.76	2,256	389,718	0	(825)	44,623	4.13	0.00	249,048	0
1340	3.75	2,253	391,971	(3,609)	(825)	42,442	3.93	0.00	252,657	0
1350	3.75	2,250	394,221	0	(825)	43,867	4.06	0.00	252,657	0
1360	3.75	2,247	396,468	(3,609)	(825)	41,680	3.86	0.00	256,266	0
1370	3.74	2,245	398,714	0	(825)	43,100	3.99	0.00	256,266	0
1380	3.74	2,243	400,957	0	(825)	44,518	4.12	0.00	256,266	0
1390	3.74	2,242	403,198	(3,609)	(825)	42,325	3.92	0.00	259,876	0
1400	3.73	2,241	405,439	0	(825)	43,741	4.05	0.00	259,876	0
1410	3.73	2,239	407,678	(3,609)	(825)	41,545	3.85	0.00	263,485	0
1420	3.73	2,238	409,916	0	(825)	42,959	3.98	0.00	263,485	0
1430	3.73	2,237	412,154	0	(825)	44,371	4.11	0.00	263,485	0
1440	3.73	2,237	414,390	(3,609)	(825)	42,173	3.90	0.00	267,095	0

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alt 1 and 2

No Bioretention | **25-Year SBUH Hydrology** | **Existing Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	8	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	825.00	cf	Pond Overtop Volume	86,400	cf
	3,609	cf				Time Pond Overtopped	9.33	hr
Pump on height[1]	4	ft				Volume Flooding	3.85	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.00	0.00	0	0
20	0.00	0	0	0	(825)	0	0.00	0.00	0	0
30	0.00	0	0	0	(825)	0	0.00	0.00	0	0
40	0.01	6	6	0	(825)	0	0.00	0.00	0	0
50	0.04	25	31	0	(825)	0	0.00	0.00	0	0
60	0.10	57	88	0	(825)	0	0.00	0.00	0	0
70	0.17	99	187	0	(825)	0	0.00	0.00	0	0
80	0.25	149	336	0	(825)	0	0.00	0.00	0	0
90	0.34	204	540	0	(825)	0	0.00	0.00	0	0
100	0.44	261	801	0	(825)	0	0.00	0.00	0	0
110	0.55	332	1,133	0	(825)	0	0.00	0.00	0	0
120	0.69	415	1,548	0	(825)	0	0.00	0.00	0	0
130	0.83	499	2,048	0	(825)	0	0.00	0.00	0	0
140	0.97	583	2,631	0	(825)	0	0.00	0.00	0	0
150	1.11	665	3,296	0	(825)	0	0.00	0.00	0	0
160	1.25	748	4,044	0	(825)	0	0.00	0.00	0	0
170	1.42	850	4,893	0	(825)	25	0.00	0.00	0	0
180	1.62	970	5,863	0	(825)	169	0.02	0.00	0	0
190	1.82	1,092	6,956	0	(825)	437	0.04	0.00	0	0
200	2.03	1,216	8,172	0	(825)	828	0.08	0.00	0	0
210	2.23	1,341	9,513	0	(825)	1,344	0.12	0.00	0	0
220	2.44	1,465	10,978	0	(825)	1,984	0.18	0.00	0	0
230	2.68	1,609	12,586	0	(825)	2,767	0.26	0.00	0	0
240	2.95	1,771	14,357	0	(825)	3,714	0.34	0.00	0	0
250	3.22	1,931	16,289	0	(825)	4,820	0.45	0.00	0	0
260	3.48	2,088	18,376	0	(825)	6,083	0.56	0.00	0	0
270	3.73	2,240	20,617	0	(825)	7,498	0.69	0.00	0	0
280	3.98	2,389	23,005	0	(825)	9,062	0.84	0.00	0	0
290	4.27	2,564	25,569	0	(825)	10,800	1.00	0.00	0	0
300	4.60	2,763	28,332	0	(825)	12,738	1.18	0.00	0	0
310	4.93	2,955	31,287	0	(825)	14,868	1.38	0.00	0	0
320	5.23	3,140	34,427	0	(825)	17,183	1.59	0.00	0	0
330	5.53	3,318	37,744	0	(825)	19,675	1.82	0.00	0	0
340	5.81	3,489	41,233	0	(825)	22,339	2.07	0.00	0	0
350	6.15	3,689	44,922	0	(825)	25,203	2.33	0.00	0	0
360	6.53	3,918	48,840	0	(825)	28,296	2.62	0.00	0	0
370	6.90	4,137	52,978	0	(825)	31,609	2.93	0.00	0	0
380	7.24	4,346	57,324	0	(825)	35,130	3.25	0.00	0	0
390	7.57	4,544	61,868	0	(825)	38,849	3.60	0.00	0	0
400	7.89	4,734	66,602	0	(825)	42,758	3.96	0.00	0	0
410	8.39	5,033	71,634	0	(825)	46,966	4.35	0.00	0	0
420	9.06	5,434	77,069	(3,609)	(825)	47,965	4.44	0.00	3,609	0
430	9.69	5,814	82,882	(3,609)	(825)	49,345	4.57	0.00	7,219	0
440	10.53	6,318	89,201	(3,609)	(825)	51,229	4.74	0.00	10,828	0
450	11.57	6,940	96,141	(3,609)	(825)	53,734	4.98	0.00	14,438	0
460	13.42	8,051	104,191	(3,609)	(825)	57,351	5.31	0.00	18,047	0
470	17.16	10,297	114,488	(3,609)	(825)	63,213	5.85	0.00	21,656	0
480	20.28	12,168	126,656	(3,609)	(825)	70,947	6.57	0.00	25,266	0
490	21.16	12,696	139,352	(3,609)	(825)	79,208	7.33	0.00	28,875	0
500	21.20	12,723	152,075	(3,609)	(825)	86,400	8.00	0.17	32,484	1,097
510	20.99	12,595	164,671	(3,609)	(825)	86,400	8.00	0.33	36,094	9,258
520	20.80	12,482	177,152	(3,609)	(825)	86,400	8.00	0.50	39,703	17,305
530	20.37	12,220	189,373	(3,609)	(825)	86,400	8.00	0.67	43,313	25,091
540	19.71	11,823	201,196	(3,609)	(825)	86,400	8.00	0.83	46,922	32,480
550	19.10	11,459	212,655	(3,609)	(825)	86,400	8.00	1.00	50,531	39,505
560	18.54	11,127	223,782	(3,609)	(825)	86,400	8.00	1.17	54,141	46,197
570	18.04	10,824	234,605	(3,609)	(825)	86,400	8.00	1.33	57,750	52,586
580	17.58	10,547	245,152	(3,609)	(825)	86,400	8.00	1.50	61,360	58,699
590	17.16	10,294	255,446	(3,609)	(825)	86,400	8.00	1.67	64,969	64,558
600	16.77	10,064	265,510	(3,609)	(825)	86,400	8.00	1.83	68,578	70,187
610	16.42	9,854	275,364	(3,609)	(825)	86,400	8.00	2.00	72,188	75,607
620	16.10	9,663	285,027	(3,609)	(825)	86,400	8.00	2.17	75,797	80,836
630	15.81	9,488	294,515	(3,609)	(825)	86,400	8.00	2.33	79,407	85,890
640	15.55	9,330	303,845	(3,609)	(825)	86,400	8.00	2.50	83,016	90,785

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	15.21	9,127	312,972	(3,609)	(825)	86,400	8.00	2.67	86,625	95,478
660	14.81	8,886	321,859	(3,609)	(825)	86,400	8.00	2.83	90,235	99,930
670	14.44	8,666	330,525	(3,609)	(825)	86,400	8.00	3.00	93,844	104,162
680	14.11	8,464	338,988	(3,609)	(825)	86,400	8.00	3.17	97,453	108,191
690	13.80	8,279	347,267	(3,609)	(825)	86,400	8.00	3.33	101,063	112,036
700	13.52	8,110	355,377	(3,609)	(825)	86,400	8.00	3.50	104,672	115,711
710	13.26	7,956	363,333	(3,609)	(825)	86,400	8.00	3.67	108,282	119,233
720	13.03	7,815	371,148	(3,609)	(825)	86,400	8.00	3.83	111,891	122,613
730	12.81	7,687	378,835	(3,609)	(825)	86,400	8.00	4.00	115,500	125,866
740	12.62	7,569	386,405	(3,609)	(825)	86,400	8.00	4.17	119,110	129,001
750	12.44	7,463	393,867	(3,609)	(825)	86,400	8.00	4.33	122,719	132,029
760	12.28	7,365	401,233	(3,609)	(825)	86,400	8.00	4.50	126,329	134,961
770	12.04	7,223	408,456	(3,609)	(825)	86,400	8.00	4.67	129,938	137,749
780	11.73	7,039	415,495	(3,609)	(825)	86,400	8.00	4.83	133,547	140,353
790	11.45	6,870	422,365	(3,609)	(825)	86,400	8.00	5.00	137,157	142,789
800	11.19	6,716	429,080	(3,609)	(825)	86,400	8.00	5.17	140,766	145,070
810	10.96	6,574	435,654	(3,609)	(825)	86,400	8.00	5.33	144,375	147,210
820	10.74	6,445	442,099	(3,609)	(825)	86,400	8.00	5.50	147,985	149,220
830	10.54	6,326	448,425	(3,609)	(825)	86,400	8.00	5.67	151,594	151,112
840	10.36	6,218	454,643	(3,609)	(825)	86,400	8.00	5.83	155,204	152,895
850	10.20	6,118	460,761	(3,609)	(825)	86,400	8.00	6.00	158,813	154,579
860	10.05	6,028	466,789	(3,609)	(825)	86,400	8.00	6.17	162,422	156,173
870	9.91	5,945	472,735	(3,609)	(825)	86,400	8.00	6.33	166,032	157,684
880	9.78	5,870	478,605	(3,609)	(825)	86,400	8.00	6.50	169,641	159,120
890	9.63	5,775	484,380	(3,609)	(825)	86,400	8.00	6.67	173,251	160,461
900	9.44	5,662	490,042	(3,609)	(825)	86,400	8.00	6.83	176,860	161,688
910	9.26	5,558	495,600	(3,609)	(825)	86,400	8.00	7.00	180,469	162,812
920	9.11	5,463	501,064	(3,609)	(825)	86,400	8.00	7.17	184,079	163,841
930	8.96	5,376	506,440	(3,609)	(825)	86,400	8.00	7.33	187,688	164,783
940	8.83	5,298	511,738	(3,609)	(825)	86,400	8.00	7.50	191,298	165,646
950	8.71	5,225	516,963	(3,609)	(825)	86,400	8.00	7.67	194,907	166,437
960	8.60	5,159	522,122	(3,609)	(825)	86,400	8.00	7.83	198,516	167,161
970	8.50	5,097	527,219	(3,609)	(825)	86,400	8.00	8.00	202,126	167,824
980	8.40	5,042	532,261	(3,609)	(825)	86,400	8.00	8.17	205,735	168,432
990	8.32	4,991	537,252	(3,609)	(825)	86,400	8.00	8.33	209,344	168,989
1000	8.24	4,945	542,197	(3,609)	(825)	86,400	8.00	8.50	212,954	169,499
1010	8.11	4,866	547,063	(3,609)	(825)	86,400	8.00	8.67	216,563	169,931
1020	7.93	4,756	551,819	(3,609)	(825)	86,400	8.00	8.83	220,173	170,253
1030	7.76	4,657	556,476	(3,609)	(825)	86,400	8.00	9.00	223,782	170,475
1040	7.61	4,565	561,041	(3,609)	(825)	86,400	8.00	9.17	227,391	170,605
1050	7.47	4,481	565,522	(3,609)	(825)	86,400	8.00	9.33	231,001	170,652
1060	7.34	4,405	569,927	(3,609)	(825)	86,370	8.00	9.33	234,610	170,652
1070	7.22	4,334	574,260	(3,609)	(825)	86,270	7.99	9.33	238,220	170,652
1080	7.12	4,269	578,530	(3,609)	(825)	86,104	7.97	9.33	241,829	170,652
1090	7.02	4,210	582,740	(3,609)	(825)	85,880	7.95	9.33	245,438	170,652
1100	6.93	4,156	586,896	(3,609)	(825)	85,602	7.93	9.33	249,048	170,652
1110	6.85	4,107	591,003	(3,609)	(825)	85,275	7.90	9.33	252,657	170,652
1120	6.77	4,062	595,065	(3,609)	(825)	84,903	7.86	9.33	256,266	170,652
1130	6.70	4,021	599,086	(3,609)	(825)	84,489	7.82	9.33	259,876	170,652
1140	6.64	3,983	603,069	(3,609)	(825)	84,038	7.78	9.33	263,485	170,652
1150	6.58	3,948	607,017	(3,609)	(825)	83,551	7.74	9.33	267,095	170,652
1160	6.53	3,916	610,933	(3,609)	(825)	83,033	7.69	9.33	270,704	170,652
1170	6.48	3,887	614,820	(3,609)	(825)	82,486	7.64	9.33	274,313	170,652
1180	6.43	3,860	618,681	(3,609)	(825)	81,912	7.58	9.33	277,923	170,652
1190	6.39	3,837	622,517	(3,609)	(825)	81,314	7.53	9.33	281,532	170,652
1200	6.36	3,815	626,332	(3,609)	(825)	80,694	7.47	9.33	285,142	170,652
1210	6.32	3,794	630,127	(3,609)	(825)	80,054	7.41	9.33	288,751	170,652
1220	6.29	3,776	633,903	(3,609)	(825)	79,396	7.35	9.33	292,360	170,652
1230	6.27	3,759	637,662	(3,609)	(825)	78,721	7.29	9.33	295,970	170,652
1240	6.24	3,744	641,406	(3,609)	(825)	78,031	7.23	9.33	299,579	170,652
1250	6.22	3,730	645,136	(3,609)	(825)	77,326	7.16	9.33	303,189	170,652
1260	6.19	3,717	648,853	(3,609)	(825)	76,609	7.09	9.33	306,798	170,652
1270	6.18	3,705	652,558	(3,609)	(825)	75,880	7.03	9.33	310,407	170,652
1280	6.16	3,695	656,253	(3,609)	(825)	75,140	6.96	9.33	314,017	170,652
1290	6.14	3,685	659,938	(3,609)	(825)	74,391	6.89	9.33	317,626	170,652
1300	6.13	3,676	663,615	(3,609)	(825)	73,633	6.82	9.33	321,235	170,652
1310	6.11	3,669	667,284	(3,609)	(825)	72,868	6.75	9.33	324,845	170,652
1320	6.10	3,662	670,946	(3,609)	(825)	72,095	6.68	9.33	328,454	170,652
1330	6.09	3,655	674,601	(3,609)	(825)	71,316	6.60	9.33	332,064	170,652
1340	6.08	3,649	678,250	(3,609)	(825)	70,531	6.53	9.33	335,673	170,652
1350	6.07	3,644	681,894	(3,609)	(825)	69,741	6.46	9.33	339,282	170,652
1360	6.07	3,639	685,534	(3,609)	(825)	68,946	6.38	9.33	342,892	170,652
1370	6.06	3,635	689,169	(3,609)	(825)	68,146	6.31	9.33	346,501	170,652
1380	6.05	3,631	692,799	(3,609)	(825)	67,343	6.24	9.33	350,111	170,652
1390	6.05	3,628	696,427	(3,609)	(825)	66,536	6.16	9.33	353,720	170,652
1400	6.04	3,624	700,051	(3,609)	(825)	65,726	6.09	9.33	357,329	170,652
1410	6.04	3,621	703,672	(3,609)	(825)	64,912	6.01	9.33	360,939	170,652
1420	6.03	3,619	707,291	(3,609)	(825)	64,097	5.93	9.33	364,548	170,652
1430	6.03	3,617	710,908	(3,609)	(825)	63,280	5.86	9.33	368,157	170,652
1440	6.02	3,615	714,523	(3,609)	(825)	62,460	5.78	9.33	371,767	170,652

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alt 1 and 2

No Bioretention | **10-Year SBUH Hydrology** | **Future Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	8	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	825.00	cf	Pond Overtop Volume	86,400	cf
	3,609	cf				Time Pond Overtopped	3.67	hr
Pump on height[1]	4	ft				Volume Flooding	0.53	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.00	0.00	0	0
20	0.00	0	0	0	(825)	0	0.00	0.00	0	0
30	0.00	0	0	0	(825)	0	0.00	0.00	0	0
40	0.00	0	0	0	(825)	0	0.00	0.00	0	0
50	0.00	1	1	0	(825)	0	0.00	0.00	0	0
60	0.01	8	9	0	(825)	0	0.00	0.00	0	0
70	0.04	26	34	0	(825)	0	0.00	0.00	0	0
80	0.09	52	86	0	(825)	0	0.00	0.00	0	0
90	0.14	86	173	0	(825)	0	0.00	0.00	0	0
100	0.21	127	300	0	(825)	0	0.00	0.00	0	0
110	0.30	180	480	0	(825)	0	0.00	0.00	0	0
120	0.41	244	724	0	(825)	0	0.00	0.00	0	0
130	0.52	313	1,038	0	(825)	0	0.00	0.00	0	0
140	0.64	384	1,422	0	(825)	0	0.00	0.00	0	0
150	0.76	458	1,880	0	(825)	0	0.00	0.00	0	0
160	0.89	532	2,413	0	(825)	0	0.00	0.00	0	0
170	1.03	618	3,030	0	(825)	0	0.00	0.00	0	0
180	1.19	715	3,745	0	(825)	0	0.00	0.00	0	0
190	1.35	810	4,556	0	(825)	0	0.00	0.00	0	0
200	1.51	903	5,459	0	(825)	78	0.01	0.00	0	0
210	1.66	995	6,453	0	(825)	248	0.02	0.00	0	0
220	1.81	1,084	7,537	0	(825)	507	0.05	0.00	0	0
230	1.98	1,187	8,724	0	(825)	868	0.08	0.00	0	0
240	2.17	1,302	10,026	0	(825)	1,346	0.12	0.00	0	0
250	2.36	1,415	11,442	0	(825)	1,936	0.18	0.00	0	0
260	2.54	1,525	12,967	0	(825)	2,636	0.24	0.00	0	0
270	2.72	1,631	14,597	0	(825)	3,442	0.32	0.00	0	0
280	2.89	1,733	16,330	0	(825)	4,350	0.40	0.00	0	0
290	3.09	1,852	18,183	0	(825)	5,377	0.50	0.00	0	0
300	3.31	1,988	20,171	0	(825)	6,540	0.61	0.00	0	0
310	3.53	2,118	22,289	0	(825)	7,834	0.73	0.00	0	0
320	3.74	2,243	24,533	0	(825)	9,252	0.86	0.00	0	0
330	3.94	2,362	26,894	0	(825)	10,789	1.00	0.00	0	0
340	4.12	2,474	29,369	0	(825)	12,438	1.15	0.00	0	0
350	4.34	2,607	31,976	0	(825)	14,220	1.32	0.00	0	0
360	4.60	2,758	34,733	0	(825)	16,153	1.50	0.00	0	0
370	4.83	2,900	37,634	0	(825)	18,228	1.69	0.00	0	0
380	5.06	3,036	40,670	0	(825)	20,439	1.89	0.00	0	0
390	5.27	3,164	43,833	0	(825)	22,778	2.11	0.00	0	0
400	5.47	3,285	47,118	0	(825)	25,237	2.34	0.00	0	0
410	5.80	3,479	50,597	0	(825)	27,891	2.58	0.00	0	0
420	6.24	3,742	54,339	0	(825)	30,808	2.85	0.00	0	0
430	6.65	3,990	58,329	0	(825)	33,974	3.15	0.00	0	0
440	7.20	4,319	62,649	0	(825)	37,468	3.47	0.00	0	0
450	7.88	4,725	67,374	0	(825)	41,368	3.83	0.00	0	0
460	9.09	5,452	72,826	0	(825)	45,995	4.26	0.00	0	0
470	11.54	6,925	79,751	(3,609)	(825)	48,486	4.49	0.00	3,609	0
480	13.57	8,145	87,896	(3,609)	(825)	52,197	4.83	0.00	7,219	0
490	14.13	8,478	96,374	(3,609)	(825)	56,241	5.21	0.00	10,828	0
500	14.14	8,483	104,858	(3,609)	(825)	60,290	5.58	0.00	14,438	0
510	13.98	8,388	113,246	(3,609)	(825)	64,243	5.95	0.00	18,047	0
520	13.84	8,301	121,547	(3,609)	(825)	68,110	6.31	0.00	21,656	0
530	13.53	8,118	129,665	(3,609)	(825)	71,794	6.65	0.00	25,266	0
540	13.08	7,846	137,511	(3,609)	(825)	75,205	6.96	0.00	28,875	0
550	12.66	7,598	145,109	(3,609)	(825)	78,369	7.26	0.00	32,484	0
560	12.28	7,371	152,480	(3,609)	(825)	81,305	7.53	0.00	36,094	0
570	11.94	7,163	159,643	(3,609)	(825)	84,034	7.78	0.00	39,703	0
580	11.62	6,974	166,617	(3,609)	(825)	86,400	8.00	0.17	43,313	174
590	11.33	6,801	173,418	(3,609)	(825)	86,400	8.00	0.33	46,922	2,540
600	11.07	6,643	180,061	(3,609)	(825)	86,400	8.00	0.50	50,531	4,749
610	10.83	6,498	186,559	(3,609)	(825)	86,400	8.00	0.67	54,141	6,812
620	10.61	6,366	192,924	(3,609)	(825)	86,400	8.00	0.83	57,750	8,743
630	10.41	6,246	199,170	(3,609)	(825)	86,400	8.00	1.00	61,360	10,554
640	10.23	6,136	205,306	(3,609)	(825)	86,400	8.00	1.17	64,969	12,256

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	10.00	5,998	211,304	(3,609)	(825)	86,400	8.00	1.33	68,578	13,820
660	9.73	5,836	217,140	(3,609)	(825)	86,400	8.00	1.50	72,188	15,222
670	9.48	5,688	222,827	(3,609)	(825)	86,400	8.00	1.67	75,797	16,475
680	9.25	5,551	228,378	(3,609)	(825)	86,400	8.00	1.83	79,407	17,591
690	9.04	5,426	233,805	(3,609)	(825)	86,400	8.00	2.00	83,016	18,583
700	8.85	5,313	239,117	(3,609)	(825)	86,400	8.00	2.17	86,625	19,461
710	8.68	5,208	244,326	(3,609)	(825)	86,400	8.00	2.33	90,235	20,235
720	8.52	5,113	249,439	(3,609)	(825)	86,400	8.00	2.50	93,844	20,914
730	8.38	5,026	254,465	(3,609)	(825)	86,400	8.00	2.67	97,453	21,506
740	8.24	4,946	259,411	(3,609)	(825)	86,400	8.00	2.83	101,063	22,018
750	8.12	4,874	264,285	(3,609)	(825)	86,400	8.00	3.00	104,672	22,457
760	8.01	4,808	269,093	(3,609)	(825)	86,400	8.00	3.17	108,282	22,831
770	7.85	4,712	273,805	(3,609)	(825)	86,400	8.00	3.33	111,891	23,108
780	7.65	4,588	278,393	(3,609)	(825)	86,400	8.00	3.50	115,500	23,262
790	7.46	4,475	282,868	(3,609)	(825)	86,400	8.00	3.67	119,110	23,303
800	7.29	4,372	287,241	(3,609)	(825)	86,338	7.99	3.67	122,719	23,303
810	7.13	4,277	291,518	(3,609)	(825)	86,180	7.98	3.67	126,329	23,303
820	6.98	4,191	295,708	(3,609)	(825)	85,937	7.96	3.67	129,938	23,303
830	6.85	4,111	299,820	(3,609)	(825)	85,614	7.93	3.67	133,547	23,303
840	6.73	4,038	303,858	(3,609)	(825)	85,217	7.89	3.67	137,157	23,303
850	6.62	3,972	307,829	(3,609)	(825)	84,755	7.85	3.67	140,766	23,303
860	6.52	3,911	311,741	(3,609)	(825)	84,232	7.80	3.67	144,375	23,303
870	6.43	3,856	315,596	(3,609)	(825)	83,653	7.75	3.67	147,985	23,303
880	6.34	3,805	319,401	(3,609)	(825)	83,024	7.69	3.67	151,594	23,303
890	6.24	3,743	323,144	(3,609)	(825)	82,332	7.62	3.67	155,204	23,303
900	6.12	3,670	326,814	(3,609)	(825)	81,568	7.55	3.67	158,813	23,303
910	6.01	3,603	330,418	(3,609)	(825)	80,737	7.48	3.67	162,422	23,303
920	5.90	3,542	333,959	(3,609)	(825)	79,844	7.39	3.67	166,032	23,303
930	5.81	3,487	337,446	(3,609)	(825)	78,896	7.31	3.67	169,641	23,303
940	5.73	3,435	340,881	(3,609)	(825)	77,897	7.21	3.67	173,251	23,303
950	5.65	3,388	344,269	(3,609)	(825)	76,850	7.12	3.67	176,860	23,303
960	5.58	3,345	347,614	(3,609)	(825)	75,761	7.01	3.67	180,469	23,303
970	5.51	3,307	350,921	(3,609)	(825)	74,634	6.91	3.67	184,079	23,303
980	5.45	3,271	354,192	(3,609)	(825)	73,471	6.80	3.67	187,688	23,303
990	5.40	3,238	357,430	(3,609)	(825)	72,274	6.69	3.67	191,298	23,303
1000	5.35	3,208	360,638	(3,609)	(825)	71,047	6.58	3.67	194,907	23,303
1010	5.26	3,156	363,794	(3,609)	(825)	69,769	6.46	3.67	198,516	23,303
1020	5.14	3,084	366,878	(3,609)	(825)	68,419	6.34	3.67	202,126	23,303
1030	5.03	3,020	369,898	(3,609)	(825)	67,004	6.20	3.67	205,735	23,303
1040	4.93	2,960	372,858	(3,609)	(825)	65,530	6.07	3.67	209,344	23,303
1050	4.84	2,905	375,763	(3,609)	(825)	64,001	5.93	3.67	212,954	23,303
1060	4.76	2,854	378,617	(3,609)	(825)	62,420	5.78	3.67	216,563	23,303
1070	4.68	2,808	381,425	(3,609)	(825)	60,794	5.63	3.67	220,173	23,303
1080	4.61	2,765	384,190	(3,609)	(825)	59,124	5.47	3.67	223,782	23,303
1090	4.54	2,726	386,916	(3,609)	(825)	57,416	5.32	3.67	227,391	23,303
1100	4.49	2,691	389,608	(3,609)	(825)	55,673	5.15	3.67	231,001	23,303
1110	4.43	2,659	392,267	(3,609)	(825)	53,898	4.99	3.67	234,610	23,303
1120	4.38	2,629	394,896	(3,609)	(825)	52,093	4.82	3.67	238,220	23,303
1130	4.34	2,602	397,498	(3,609)	(825)	50,261	4.65	3.67	241,829	23,303
1140	4.29	2,576	400,075	(3,609)	(825)	48,403	4.48	3.67	245,438	23,303
1150	4.26	2,553	402,628	(3,609)	(825)	46,522	4.31	3.67	249,048	23,303
1160	4.22	2,533	405,161	(3,609)	(825)	44,621	4.13	3.67	252,657	23,303
1170	4.19	2,515	407,676	(3,609)	(825)	42,701	3.95	3.67	256,266	23,303
1180	4.16	2,497	410,173	0	(825)	44,372	4.11	3.67	256,266	23,303
1190	4.13	2,480	412,653	(3,609)	(825)	42,419	3.93	3.67	259,876	23,303
1200	4.11	2,466	415,118	0	(825)	44,059	4.08	3.67	259,876	23,303
1210	4.09	2,453	417,571	(3,609)	(825)	42,077	3.90	3.67	263,485	23,303
1220	4.07	2,441	420,012	0	(825)	43,693	4.05	3.67	263,485	23,303
1230	4.05	2,429	422,441	(3,609)	(825)	41,688	3.86	3.67	267,095	23,303
1240	4.03	2,419	424,860	0	(825)	43,282	4.01	3.67	267,095	23,303
1250	4.02	2,410	427,271	(3,609)	(825)	41,258	3.82	3.67	270,704	23,303
1260	4.00	2,402	429,673	0	(825)	42,835	3.97	3.67	270,704	23,303
1270	3.99	2,394	432,066	0	(825)	44,404	4.11	3.67	270,704	23,303
1280	3.98	2,387	434,453	(3,609)	(825)	42,356	3.92	3.67	274,313	23,303
1290	3.97	2,381	436,834	0	(825)	43,912	4.07	3.67	274,313	23,303
1300	3.96	2,375	439,209	(3,609)	(825)	41,852	3.88	3.67	277,923	23,303
1310	3.95	2,369	441,578	0	(825)	43,397	4.02	3.67	277,923	23,303
1320	3.94	2,365	443,943	(3,609)	(825)	41,327	3.83	3.67	281,532	23,303
1330	3.93	2,361	446,304	0	(825)	42,863	3.97	3.67	281,532	23,303
1340	3.93	2,356	448,660	0	(825)	44,395	4.11	3.67	281,532	23,303
1350	3.92	2,352	451,013	(3,609)	(825)	42,312	3.92	3.67	285,142	23,303
1360	3.92	2,349	453,362	0	(825)	43,837	4.06	3.67	285,142	23,303
1370	3.91	2,347	455,709	(3,609)	(825)	41,749	3.87	3.67	288,751	23,303
1380	3.91	2,343	458,052	0	(825)	43,267	4.01	3.67	288,751	23,303
1390	3.90	2,341	460,393	(3,609)	(825)	41,174	3.81	3.67	292,360	23,303
1400	3.90	2,340	462,733	0	(825)	42,689	3.95	3.67	292,360	23,303
1410	3.89	2,337	465,070	0	(825)	44,201	4.09	3.67	292,360	23,303
1420	3.89	2,336	467,405	(3,609)	(825)	42,102	3.90	3.67	295,970	23,303
1430	3.89	2,334	469,739	0	(825)	43,611	4.04	3.67	295,970	23,303
1440	3.89	2,332	472,072	(3,609)	(825)	41,509	3.84	3.67	299,579	23,303

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alt 1 and 2

No Bioretention	25-Year SBUH Hydrology	Future Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	825.00	cf

Pond Information		
Pond Overtop Elevation	8	ft
Pond Overtop Volume	86,400	cf
Time Pond Overtopped	9.83	hr
Volume Flooding	4.81	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.00	0.00	0	0
20	0.00	0	0	0	(825)	0	0.00	0.00	0	0
30	0.00	0	0	0	(825)	0	0.00	0.00	0	0
40	0.02	10	10	0	(825)	0	0.00	0.00	0	0
50	0.07	41	51	0	(825)	0	0.00	0.00	0	0
60	0.16	94	145	0	(825)	0	0.00	0.00	0	0
70	0.27	163	307	0	(825)	0	0.00	0.00	0	0
80	0.41	245	552	0	(825)	0	0.00	0.00	0	0
90	0.56	335	887	0	(825)	0	0.00	0.00	0	0
100	0.72	429	1,316	0	(825)	0	0.00	0.00	0	0
110	0.91	545	1,861	0	(825)	0	0.00	0.00	0	0
120	1.14	682	2,543	0	(825)	0	0.00	0.00	0	0
130	1.37	820	3,363	0	(825)	0	0.00	0.00	0	0
140	1.60	958	4,320	0	(825)	133	0.01	0.00	0	0
150	1.82	1,092	5,413	0	(825)	400	0.04	0.00	0	0
160	2.04	1,225	6,638	0	(825)	800	0.07	0.00	0	0
170	2.30	1,380	8,018	0	(825)	1,355	0.13	0.00	0	0
180	2.59	1,557	9,575	0	(825)	2,087	0.19	0.00	0	0
190	2.88	1,730	11,305	0	(825)	2,992	0.28	0.00	0	0
200	3.16	1,898	13,203	0	(825)	4,065	0.38	0.00	0	0
210	3.43	2,060	15,263	0	(825)	5,300	0.49	0.00	0	0
220	3.70	2,218	17,480	0	(825)	6,693	0.62	0.00	0	0
230	4.00	2,397	19,878	0	(825)	8,265	0.77	0.00	0	0
240	4.33	2,597	22,475	0	(825)	10,037	0.93	0.00	0	0
250	4.65	2,789	25,264	0	(825)	12,001	1.11	0.00	0	0
260	4.95	2,972	28,236	0	(825)	14,148	1.31	0.00	0	0
270	5.24	3,146	31,382	0	(825)	16,469	1.52	0.00	0	0
280	5.52	3,312	34,694	0	(825)	18,956	1.76	0.00	0	0
290	5.84	3,507	38,201	0	(825)	21,638	2.00	0.00	0	0
300	6.22	3,729	41,930	0	(825)	24,543	2.27	0.00	0	0
310	6.57	3,939	45,870	0	(825)	27,657	2.56	0.00	0	0
320	6.90	4,137	50,007	0	(825)	30,969	2.87	0.00	0	0
330	7.21	4,324	54,331	0	(825)	34,468	3.19	0.00	0	0
340	7.50	4,500	58,831	0	(825)	38,143	3.53	0.00	0	0
350	7.85	4,710	63,541	0	(825)	42,029	3.89	0.00	0	0
360	8.25	4,951	68,492	0	(825)	46,155	4.27	0.00	0	0
370	8.63	5,177	73,669	(3,609)	(825)	46,897	4.34	0.00	3,609	0
380	8.98	5,388	79,058	(3,609)	(825)	47,851	4.43	0.00	7,219	0
390	9.31	5,586	84,644	(3,609)	(825)	49,003	4.54	0.00	10,828	0
400	9.62	5,772	90,416	(3,609)	(825)	50,341	4.66	0.00	14,438	0
410	10.14	6,082	96,498	(3,609)	(825)	51,988	4.81	0.00	18,047	0
420	10.84	6,504	103,002	(3,609)	(825)	54,058	5.01	0.00	21,656	0
430	11.50	6,898	109,900	(3,609)	(825)	56,521	5.23	0.00	25,266	0
440	12.38	7,426	117,326	(3,609)	(825)	59,513	5.51	0.00	28,875	0
450	13.47	8,081	125,407	(3,609)	(825)	63,160	5.85	0.00	32,484	0
460	15.44	9,261	134,668	(3,609)	(825)	67,986	6.30	0.00	36,094	0
470	19.43	11,657	146,325	(3,609)	(825)	75,209	6.96	0.00	39,703	0
480	22.71	13,625	159,950	(3,609)	(825)	84,400	7.81	0.00	43,313	0
490	23.56	14,137	174,087	(3,609)	(825)	86,400	8.00	0.17	46,922	7,702
500	23.52	14,114	188,200	(3,609)	(825)	86,400	8.00	0.33	50,531	17,381
510	23.21	13,927	202,128	(3,609)	(825)	86,400	8.00	0.50	54,141	26,874
520	22.93	13,758	215,886	(3,609)	(825)	86,400	8.00	0.67	57,750	36,198
530	22.39	13,435	229,320	(3,609)	(825)	86,400	8.00	0.83	61,360	45,198
540	21.62	12,970	242,291	(3,609)	(825)	86,400	8.00	1.00	64,969	53,734
550	20.91	12,544	254,835	(3,609)	(825)	86,400	8.00	1.17	68,578	61,844
560	20.26	12,154	266,989	(3,609)	(825)	86,400	8.00	1.33	72,188	69,564
570	19.66	11,797	278,787	(3,609)	(825)	86,400	8.00	1.50	75,797	76,927
580	19.12	11,471	290,258	(3,609)	(825)	86,400	8.00	1.67	79,407	83,963
590	18.62	11,172	301,430	(3,609)	(825)	86,400	8.00	1.83	83,016	90,701
600	18.17	10,899	312,329	(3,609)	(825)	86,400	8.00	2.00	86,625	97,165
610	17.75	10,649	322,978	(3,609)	(825)	86,400	8.00	2.17	90,235	103,381
620	17.37	10,420	333,398	(3,609)	(825)	86,400	8.00	2.33	93,844	109,366
630	17.02	10,211	343,609	(3,609)	(825)	86,400	8.00	2.50	97,453	115,143
640	16.70	10,020	353,629	(3,609)	(825)	86,400	8.00	2.67	101,063	120,728

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	16.31	9,785	363,414	(3,609)	(825)	86,400	8.00	2.83	104,672	126,078
660	15.85	9,511	372,924	(3,609)	(825)	86,400	8.00	3.00	108,282	131,155
670	15.43	9,260	382,185	(3,609)	(825)	86,400	8.00	3.17	111,891	135,981
680	15.05	9,030	391,214	(3,609)	(825)	86,400	8.00	3.33	115,500	140,576
690	14.70	8,818	400,032	(3,609)	(825)	86,400	8.00	3.50	119,110	144,960
700	14.37	8,625	408,657	(3,609)	(825)	86,400	8.00	3.67	122,719	149,150
710	14.08	8,448	417,105	(3,609)	(825)	86,400	8.00	3.83	126,329	153,164
720	13.81	8,286	425,391	(3,609)	(825)	86,400	8.00	4.00	129,938	157,016
730	13.56	8,139	433,530	(3,609)	(825)	86,400	8.00	4.17	133,547	160,720
740	13.34	8,002	441,532	(3,609)	(825)	86,400	8.00	4.33	137,157	164,288
750	13.13	7,879	449,411	(3,609)	(825)	86,400	8.00	4.50	140,766	167,732
760	12.94	7,765	457,176	(3,609)	(825)	86,400	8.00	4.67	144,375	171,063
770	12.68	7,606	464,782	(3,609)	(825)	86,400	8.00	4.83	147,985	174,234
780	12.34	7,404	472,186	(3,609)	(825)	86,400	8.00	5.00	151,594	177,204
790	12.03	7,219	479,406	(3,609)	(825)	86,400	8.00	5.17	155,204	179,989
800	11.75	7,050	486,456	(3,609)	(825)	86,400	8.00	5.33	158,813	182,605
810	11.49	6,894	493,350	(3,609)	(825)	86,400	8.00	5.50	162,422	185,065
820	11.25	6,751	500,102	(3,609)	(825)	86,400	8.00	5.67	166,032	187,382
830	11.04	6,621	506,723	(3,609)	(825)	86,400	8.00	5.83	169,641	189,569
840	10.84	6,502	513,225	(3,609)	(825)	86,400	8.00	6.00	173,251	191,637
850	10.65	6,393	519,618	(3,609)	(825)	86,400	8.00	6.17	176,860	193,595
860	10.49	6,293	525,910	(3,609)	(825)	86,400	8.00	6.33	180,469	195,453
870	10.34	6,201	532,111	(3,609)	(825)	86,400	8.00	6.50	184,079	197,220
880	10.20	6,117	538,229	(3,609)	(825)	86,400	8.00	6.67	187,688	198,903
890	10.02	6,013	544,242	(3,609)	(825)	86,400	8.00	6.83	191,298	200,482
900	9.82	5,891	550,133	(3,609)	(825)	86,400	8.00	7.00	194,907	201,938
910	9.63	5,779	555,912	(3,609)	(825)	86,400	8.00	7.17	198,516	203,283
920	9.46	5,677	561,589	(3,609)	(825)	86,400	8.00	7.33	202,126	204,526
930	9.30	5,582	567,171	(3,609)	(825)	86,400	8.00	7.50	205,735	205,674
940	9.16	5,497	572,669	(3,609)	(825)	86,400	8.00	7.67	209,344	206,736
950	9.03	5,419	578,088	(3,609)	(825)	86,400	8.00	7.83	212,954	207,721
960	8.91	5,347	583,434	(3,609)	(825)	86,400	8.00	8.00	216,563	208,633
970	8.80	5,280	588,715	(3,609)	(825)	86,400	8.00	8.17	220,173	209,479
980	8.70	5,219	593,934	(3,609)	(825)	86,400	8.00	8.33	223,782	210,264
990	8.61	5,164	599,097	(3,609)	(825)	86,400	8.00	8.50	227,391	210,993
1000	8.52	5,113	604,211	(3,609)	(825)	86,400	8.00	8.67	231,001	211,672
1010	8.38	5,030	609,240	(3,609)	(825)	86,400	8.00	8.83	234,610	212,267
1020	8.19	4,914	614,154	(3,609)	(825)	86,400	8.00	9.00	238,220	212,747
1030	8.01	4,809	618,963	(3,609)	(825)	86,400	8.00	9.17	241,829	213,121
1040	7.85	4,712	623,676	(3,609)	(825)	86,400	8.00	9.33	245,438	213,400
1050	7.71	4,624	628,300	(3,609)	(825)	86,400	8.00	9.50	249,048	213,589
1060	7.57	4,543	632,843	(3,609)	(825)	86,400	8.00	9.67	252,657	213,698
1070	7.45	4,468	637,311	(3,609)	(825)	86,400	8.00	9.83	256,266	213,732
1080	7.33	4,400	641,712	(3,609)	(825)	86,366	8.00	9.83	259,876	213,732
1090	7.23	4,338	646,049	(3,609)	(825)	86,269	7.99	9.83	263,485	213,732
1100	7.13	4,281	650,330	(3,609)	(825)	86,116	7.97	9.83	267,095	213,732
1110	7.05	4,229	654,559	(3,609)	(825)	85,910	7.95	9.83	270,704	213,732
1120	6.97	4,181	658,740	(3,609)	(825)	85,656	7.93	9.83	274,313	213,732
1130	6.89	4,137	662,877	(3,609)	(825)	85,359	7.90	9.83	277,923	213,732
1140	6.83	4,096	666,972	(3,609)	(825)	85,020	7.87	9.83	281,532	213,732
1150	6.77	4,059	671,031	(3,609)	(825)	84,645	7.84	9.83	285,142	213,732
1160	6.71	4,025	675,057	(3,609)	(825)	84,236	7.80	9.83	288,751	213,732
1170	6.66	3,994	679,051	(3,609)	(825)	83,796	7.76	9.83	292,360	213,732
1180	6.61	3,966	683,017	(3,609)	(825)	83,327	7.72	9.83	295,970	213,732
1190	6.57	3,940	686,957	(3,609)	(825)	82,833	7.67	9.83	299,579	213,732
1200	6.53	3,916	690,873	(3,609)	(825)	82,315	7.62	9.83	303,189	213,732
1210	6.49	3,895	694,768	(3,609)	(825)	81,775	7.57	9.83	306,798	213,732
1220	6.46	3,875	698,643	(3,609)	(825)	81,216	7.52	9.83	310,407	213,732
1230	6.43	3,857	702,499	(3,609)	(825)	80,638	7.47	9.83	314,017	213,732
1240	6.40	3,840	706,339	(3,609)	(825)	80,043	7.41	9.83	317,626	213,732
1250	6.37	3,825	710,164	(3,609)	(825)	79,434	7.36	9.83	321,235	213,732
1260	6.35	3,811	713,975	(3,609)	(825)	78,810	7.30	9.83	324,845	213,732
1270	6.33	3,798	717,773	(3,609)	(825)	78,173	7.24	9.83	328,454	213,732
1280	6.31	3,786	721,559	(3,609)	(825)	77,525	7.18	9.83	332,064	213,732
1290	6.29	3,776	725,334	(3,609)	(825)	76,866	7.12	9.83	335,673	213,732
1300	6.28	3,766	729,100	(3,609)	(825)	76,198	7.06	9.83	339,282	213,732
1310	6.26	3,757	732,857	(3,609)	(825)	75,520	6.99	9.83	342,892	213,732
1320	6.25	3,749	736,606	(3,609)	(825)	74,835	6.93	9.83	346,501	213,732
1330	6.24	3,741	740,347	(3,609)	(825)	74,142	6.87	9.83	350,111	213,732
1340	6.22	3,735	744,082	(3,609)	(825)	73,442	6.80	9.83	353,720	213,732
1350	6.21	3,728	747,810	(3,609)	(825)	72,736	6.73	9.83	357,329	213,732
1360	6.20	3,723	751,533	(3,609)	(825)	72,025	6.67	9.83	360,939	213,732
1370	6.20	3,718	755,251	(3,609)	(825)	71,308	6.60	9.83	364,548	213,732
1380	6.19	3,713	758,964	(3,609)	(825)	70,586	6.54	9.83	368,157	213,732
1390	6.18	3,709	762,672	(3,609)	(825)	69,861	6.47	9.83	371,767	213,732
1400	6.17	3,705	766,377	(3,609)	(825)	69,131	6.40	9.83	375,376	213,732
1410	6.17	3,701	770,078	(3,609)	(825)	68,398	6.33	9.83	378,986	213,732
1420	6.16	3,699	773,777	(3,609)	(825)	67,662	6.27	9.83	382,595	213,732
1430	6.16	3,696	777,473	(3,609)	(825)	66,923	6.20	9.83	386,204	213,732
1440	6.16	3,693	781,166	(3,609)	(825)	66,182	6.13	9.83	389,814	213,732

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alternative 3

Bioretention	10-Year SBUH Hydrology	Existing Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	825.00	cf

Pond Information		
Pond Overtop Elevation	8	ft
Pond Overtop Volume	66,350	cf
Time Pond Overtopped	0.00	hr
Volume Flooding	0.00	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.06	0.00	0	0
20	0.00	0	0	0	(825)	0	0.06	0.00	0	0
30	0.00	0	0	0	(825)	0	0.06	0.00	0	0
40	0.00	0	0	0	(825)	0	0.06	0.00	0	0
50	0.00	1	1	0	(825)	0	0.06	0.00	0	0
60	0.02	10	11	0	(825)	0	0.06	0.00	0	0
70	0.05	30	41	0	(825)	0	0.06	0.00	0	0
80	0.09	57	98	0	(825)	0	0.06	0.00	0	0
90	0.14	86	184	0	(825)	0	0.06	0.00	0	0
100	0.19	116	300	0	(825)	0	0.06	0.00	0	0
110	0.26	155	455	0	(825)	0	0.06	0.00	0	0
120	0.33	201	656	0	(825)	0	0.06	0.00	0	0
130	0.40	241	897	0	(825)	0	0.06	0.00	0	0
140	0.46	277	1,174	0	(825)	0	0.06	0.00	0	0
150	0.52	311	1,485	0	(825)	0	0.06	0.00	0	0
160	0.57	339	1,824	0	(825)	0	0.06	0.00	0	0
170	0.63	380	2,204	0	(825)	0	0.06	0.00	0	0
180	0.72	431	2,635	0	(825)	0	0.06	0.00	0	0
190	0.78	470	3,105	0	(825)	0	0.06	0.00	0	0
200	0.84	501	3,607	0	(825)	0	0.06	0.00	0	0
210	0.88	529	4,135	0	(825)	0	0.06	0.00	0	0
220	0.92	555	4,690	0	(825)	0	0.06	0.00	0	0
230	1.01	605	5,295	0	(825)	0	0.06	0.00	0	0
240	1.12	673	5,968	0	(825)	0	0.06	0.00	0	0
250	1.22	731	6,700	0	(825)	0	0.06	0.00	0	0
260	1.30	782	7,482	0	(825)	0	0.06	0.00	0	0
270	1.38	828	8,310	0	(825)	3	0.07	0.00	0	0
280	1.45	870	9,179	0	(825)	48	0.07	0.00	0	0
290	1.57	940	10,120	0	(825)	163	0.09	0.00	0	0
300	1.72	1,032	11,152	0	(825)	370	0.13	0.00	0	0
310	1.84	1,104	12,256	0	(825)	649	0.18	0.00	0	0
320	1.94	1,163	13,418	0	(825)	987	0.24	0.00	0	0
330	2.02	1,212	14,631	0	(825)	1,374	0.31	0.00	0	0
340	2.09	1,255	15,886	0	(825)	1,804	0.39	0.00	0	0
350	2.23	1,336	17,222	0	(825)	2,315	0.47	0.00	0	0
360	2.40	1,441	18,663	0	(825)	2,931	0.58	0.00	0	0
370	2.53	1,520	20,183	0	(825)	3,626	0.69	0.00	0	0
380	2.64	1,583	21,766	0	(825)	4,384	0.82	0.00	0	0
390	2.72	1,633	23,399	0	(825)	5,192	0.94	0.00	0	0
400	2.80	1,678	25,077	0	(825)	6,046	1.07	0.00	0	0
410	3.10	1,859	26,936	0	(825)	7,079	1.23	0.00	0	0
420	3.55	2,129	29,065	0	(825)	8,384	1.42	0.00	0	0
430	3.86	2,317	31,382	0	(825)	9,876	1.62	0.00	0	0
440	4.38	2,628	34,011	0	(825)	11,679	1.86	0.00	0	0
450	5.04	3,022	37,033	0	(825)	13,876	2.13	0.00	0	0
460	6.57	3,944	40,977	0	(825)	16,996	2.49	0.00	0	0
470	10.12	6,069	47,046	0	(825)	22,240	3.03	0.00	0	0
480	11.96	7,177	54,223	0	(825)	28,591	3.61	0.00	0	0
490	10.64	6,384	60,607	0	(825)	34,151	4.09	0.00	0	0
500	8.87	5,322	65,929	(3,609)	(825)	35,038	4.17	0.00	3,609	0
510	7.46	4,476	70,405	(3,609)	(825)	35,080	4.17	0.00	7,219	0
520	6.60	3,960	74,365	(3,609)	(825)	34,605	4.13	0.00	10,828	0
530	5.73	3,440	77,804	(3,609)	(825)	33,610	4.05	0.00	14,438	0
540	4.86	2,916	80,721	(3,609)	(825)	32,092	3.92	0.00	18,047	0
550	4.33	2,597	83,318	0	(825)	33,864	4.07	0.00	18,047	0
560	4.00	2,402	85,720	(3,609)	(825)	31,831	3.89	0.00	21,656	0
570	3.81	2,285	88,005	0	(825)	33,292	4.02	0.00	21,656	0
580	3.69	2,217	90,222	(3,609)	(825)	31,074	3.83	0.00	25,266	0
590	3.63	2,176	92,398	0	(825)	32,425	3.94	0.00	25,266	0
600	3.59	2,153	94,551	0	(825)	33,753	4.06	0.00	25,266	0
610	3.57	2,141	96,692	(3,609)	(825)	31,460	3.86	0.00	28,875	0
620	3.56	2,137	98,829	0	(825)	32,772	3.97	0.00	28,875	0
630	3.56	2,137	100,966	0	(825)	34,084	4.09	0.00	28,875	0
640	3.57	2,140	103,107	(3,609)	(825)	31,790	3.89	0.00	32,484	0

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	3.45	2,068	105,175	0	(825)	33,034	4.00	0.00	32,484	0
660	3.25	1,952	107,128	0	(825)	34,161	4.09	0.00	32,484	0
670	3.14	1,882	109,010	(3,609)	(825)	31,609	3.87	0.00	36,094	0
680	3.06	1,839	110,848	0	(825)	32,623	3.96	0.00	36,094	0
690	3.02	1,814	112,662	0	(825)	33,612	4.05	0.00	36,094	0
700	3.00	1,800	114,463	(3,609)	(825)	30,978	3.82	0.00	39,703	0
710	2.99	1,793	116,256	0	(825)	31,946	3.90	0.00	39,703	0
720	2.98	1,790	118,046	0	(825)	32,911	3.99	0.00	39,703	0
730	2.98	1,789	119,835	0	(825)	33,875	4.07	0.00	39,703	0
740	2.98	1,790	121,625	(3,609)	(825)	31,230	3.84	0.00	43,313	0
750	2.99	1,792	123,416	0	(825)	32,197	3.92	0.00	43,313	0
760	2.99	1,795	125,211	0	(825)	33,167	4.01	0.00	43,313	0
770	2.88	1,726	126,937	(3,609)	(825)	30,458	3.77	0.00	46,922	0
780	2.68	1,610	128,547	0	(825)	31,243	3.84	0.00	46,922	0
790	2.57	1,540	130,086	0	(825)	31,958	3.90	0.00	46,922	0
800	2.50	1,498	131,584	0	(825)	32,630	3.96	0.00	46,922	0
810	2.45	1,472	133,056	0	(825)	33,277	4.02	0.00	46,922	0
820	2.43	1,457	134,512	(3,609)	(825)	30,299	3.76	0.00	50,531	0
830	2.41	1,449	135,961	0	(825)	30,923	3.81	0.00	50,531	0
840	2.40	1,443	137,404	0	(825)	31,541	3.87	0.00	50,531	0
850	2.40	1,440	138,844	0	(825)	32,156	3.92	0.00	50,531	0
860	2.40	1,441	140,285	0	(825)	32,772	3.97	0.00	50,531	0
870	2.40	1,442	141,727	0	(825)	33,389	4.03	0.00	50,531	0
880	2.40	1,442	143,169	(3,609)	(825)	30,396	3.77	0.00	54,141	0
890	2.35	1,410	144,579	0	(825)	30,981	3.82	0.00	54,141	0
900	2.27	1,359	145,938	0	(825)	31,515	3.87	0.00	54,141	0
910	2.21	1,328	147,265	0	(825)	32,018	3.91	0.00	54,141	0
920	2.18	1,308	148,574	0	(825)	32,501	3.95	0.00	54,141	0
930	2.16	1,298	149,872	0	(825)	32,974	3.99	0.00	54,141	0
940	2.15	1,291	151,163	0	(825)	33,440	4.03	0.00	54,141	0
950	2.15	1,287	152,450	(3,609)	(825)	30,293	3.76	0.00	57,750	0
960	2.14	1,286	153,735	0	(825)	30,754	3.80	0.00	57,750	0
970	2.14	1,286	155,022	0	(825)	31,215	3.84	0.00	57,750	0
980	2.14	1,286	156,308	0	(825)	31,676	3.88	0.00	57,750	0
990	2.14	1,285	157,593	0	(825)	32,136	3.92	0.00	57,750	0
1000	2.14	1,286	158,879	0	(825)	32,597	3.96	0.00	57,750	0
1010	2.06	1,237	160,117	0	(825)	33,010	3.99	0.00	57,750	0
1020	1.93	1,157	161,274	0	(825)	33,342	4.02	0.00	57,750	0
1030	1.85	1,109	162,383	(3,609)	(825)	30,016	3.74	0.00	61,360	0
1040	1.80	1,079	163,462	0	(825)	30,270	3.76	0.00	61,360	0
1050	1.77	1,059	164,521	0	(825)	30,505	3.78	0.00	61,360	0
1060	1.75	1,047	165,568	0	(825)	30,727	3.80	0.00	61,360	0
1070	1.74	1,041	166,609	0	(825)	30,943	3.82	0.00	61,360	0
1080	1.73	1,037	167,647	0	(825)	31,155	3.83	0.00	61,360	0
1090	1.72	1,035	168,681	0	(825)	31,365	3.85	0.00	61,360	0
1100	1.72	1,035	169,716	0	(825)	31,575	3.87	0.00	61,360	0
1110	1.72	1,034	170,750	0	(825)	31,784	3.89	0.00	61,360	0
1120	1.72	1,034	171,785	0	(825)	31,993	3.91	0.00	61,360	0
1130	1.72	1,034	172,819	0	(825)	32,203	3.93	0.00	61,360	0
1140	1.72	1,033	173,852	0	(825)	32,411	3.94	0.00	61,360	0
1150	1.72	1,033	174,885	0	(825)	32,619	3.96	0.00	61,360	0
1160	1.73	1,036	175,922	0	(825)	32,830	3.98	0.00	61,360	0
1170	1.73	1,037	176,958	0	(825)	33,042	4.00	0.00	61,360	0
1180	1.73	1,036	177,994	0	(825)	33,252	4.02	0.00	61,360	0
1190	1.73	1,036	179,030	(3,609)	(825)	29,854	3.72	0.00	64,969	0
1200	1.73	1,037	180,067	0	(825)	30,066	3.74	0.00	64,969	0
1210	1.73	1,038	181,105	0	(825)	30,280	3.76	0.00	64,969	0
1220	1.73	1,039	182,144	0	(825)	30,494	3.78	0.00	64,969	0
1230	1.73	1,038	183,183	0	(825)	30,707	3.80	0.00	64,969	0
1240	1.73	1,039	184,222	0	(825)	30,921	3.81	0.00	64,969	0
1250	1.74	1,041	185,263	0	(825)	31,137	3.83	0.00	64,969	0
1260	1.73	1,041	186,304	0	(825)	31,353	3.85	0.00	64,969	0
1270	1.73	1,041	187,345	0	(825)	31,569	3.87	0.00	64,969	0
1280	1.74	1,042	188,387	0	(825)	31,786	3.89	0.00	64,969	0
1290	1.74	1,043	189,430	0	(825)	32,004	3.91	0.00	64,969	0
1300	1.74	1,043	190,473	0	(825)	32,222	3.93	0.00	64,969	0
1310	1.74	1,043	191,516	0	(825)	32,440	3.95	0.00	64,969	0
1320	1.74	1,045	192,561	0	(825)	32,660	3.96	0.00	64,969	0
1330	1.74	1,046	193,607	0	(825)	32,881	3.98	0.00	64,969	0
1340	1.74	1,045	194,652	0	(825)	33,101	4.00	0.00	64,969	0
1350	1.74	1,045	195,696	(3,609)	(825)	29,711	3.71	0.00	68,578	0
1360	1.74	1,046	196,742	0	(825)	29,932	3.73	0.00	68,578	0
1370	1.74	1,046	197,788	0	(825)	30,153	3.75	0.00	68,578	0
1380	1.74	1,045	198,833	0	(825)	30,373	3.77	0.00	68,578	0
1390	1.75	1,047	199,880	0	(825)	30,595	3.79	0.00	68,578	0
1400	1.75	1,048	200,929	0	(825)	30,819	3.81	0.00	68,578	0
1410	1.75	1,048	201,977	0	(825)	31,042	3.82	0.00	68,578	0
1420	1.75	1,049	203,026	0	(825)	31,265	3.84	0.00	68,578	0
1430	1.75	1,049	204,075	0	(825)	31,490	3.86	0.00	68,578	0
1440	1.75	1,050	205,125	0	(825)	31,715	3.88	0.00	68,578	0

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alternative 3

Bioretention	25-Year SBUH Hydrology	Existing Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	825.00	cf

Pond Information		
Pond Overtop Elevation	8	ft
Pond Overtop Volume	66,350	cf
Time Pond Overtopped	0.67	hr
Volume Flooding	0.14	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.06	0.00	0	0
20	0.00	0	0	0	(825)	0	0.06	0.00	0	0
30	0.00	0	0	0	(825)	0	0.06	0.00	0	0
40	0.02	13	13	0	(825)	0	0.06	0.00	0	0
50	0.08	50	63	0	(825)	0	0.06	0.00	0	0
60	0.17	105	168	0	(825)	0	0.06	0.00	0	0
70	0.28	166	334	0	(825)	0	0.06	0.00	0	0
80	0.38	228	563	0	(825)	0	0.06	0.00	0	0
90	0.48	286	849	0	(825)	0	0.06	0.00	0	0
100	0.56	338	1,187	0	(825)	0	0.06	0.00	0	0
110	0.68	408	1,595	0	(825)	0	0.06	0.00	0	0
120	0.82	492	2,087	0	(825)	0	0.06	0.00	0	0
130	0.93	561	2,648	0	(825)	0	0.06	0.00	0	0
140	1.03	617	3,266	0	(825)	0	0.06	0.00	0	0
150	1.11	664	3,929	0	(825)	0	0.06	0.00	0	0
160	1.18	709	4,638	0	(825)	0	0.06	0.00	0	0
170	1.32	792	5,430	0	(825)	0	0.06	0.00	0	0
180	1.50	902	6,333	0	(825)	77	0.08	0.00	0	0
190	1.66	997	7,330	0	(825)	249	0.11	0.00	0	0
200	1.80	1,081	8,411	0	(825)	505	0.16	0.00	0	0
210	1.93	1,156	9,567	0	(825)	836	0.22	0.00	0	0
220	2.04	1,224	10,791	0	(825)	1,235	0.29	0.00	0	0
230	2.22	1,331	12,122	0	(825)	1,742	0.38	0.00	0	0
240	2.44	1,464	13,586	0	(825)	2,381	0.49	0.00	0	0
250	2.62	1,570	15,156	0	(825)	3,126	0.61	0.00	0	0
260	2.76	1,657	16,812	0	(825)	3,957	0.75	0.00	0	0
270	2.88	1,729	18,542	0	(825)	4,862	0.89	0.00	0	0
280	2.99	1,794	20,336	0	(825)	5,831	1.04	0.00	0	0
290	3.20	1,917	22,253	0	(825)	6,923	1.21	0.00	0	0
300	3.46	2,078	24,330	0	(825)	8,175	1.39	0.00	0	0
310	3.66	2,198	26,528	0	(825)	9,548	1.58	0.00	0	0
320	3.82	2,290	28,818	0	(825)	11,013	1.77	0.00	0	0
330	3.94	2,366	31,184	0	(825)	12,553	1.97	0.00	0	0
340	4.05	2,429	33,613	0	(825)	14,158	2.16	0.00	0	0
350	4.27	2,564	36,177	0	(825)	15,897	2.36	0.00	0	0
360	4.58	2,745	38,922	0	(825)	17,817	2.57	0.00	0	0
370	4.79	2,877	41,798	0	(825)	19,868	2.79	0.00	0	0
380	4.96	2,975	44,773	0	(825)	22,018	3.00	0.00	0	0
390	5.08	3,051	47,824	0	(825)	24,244	3.22	0.00	0	0
400	5.19	3,113	50,937	0	(825)	26,532	3.43	0.00	0	0
410	5.71	3,424	54,361	0	(825)	29,131	3.66	0.00	0	0
420	6.49	3,893	58,255	0	(825)	32,200	3.92	0.00	0	0
430	7.01	4,207	62,462	0	(825)	35,582	4.22	0.00	0	0
440	7.90	4,741	67,203	(3,609)	(825)	35,889	4.24	0.00	3,609	0
450	9.03	5,417	72,621	(3,609)	(825)	36,872	4.33	0.00	7,219	0
460	11.68	7,007	79,628	(3,609)	(825)	39,445	4.56	0.00	10,828	0
470	17.76	10,657	90,285	(3,609)	(825)	45,667	5.14	0.00	14,438	0
480	20.83	12,501	102,786	(3,609)	(825)	53,734	6.03	0.00	18,047	0
490	18.43	11,060	113,846	(3,609)	(825)	60,359	6.93	0.00	21,656	0
500	15.30	9,177	123,023	(3,609)	(825)	65,102	7.70	0.00	25,266	0
510	12.81	7,683	130,706	(3,609)	(825)	66,350	7.92	0.17	28,875	2,000
520	11.28	6,768	137,473	(3,609)	(825)	66,350	7.92	0.33	32,484	4,333
530	9.77	5,861	143,335	(3,609)	(825)	66,350	7.92	0.50	36,094	5,760
540	8.26	4,959	148,293	(3,609)	(825)	66,350	7.92	0.67	39,703	6,284
550	7.34	4,403	152,696	(3,609)	(825)	66,319	7.91	0.67	43,313	6,284
560	6.77	4,062	156,758	(3,609)	(825)	65,946	7.85	0.67	46,922	6,284
570	6.42	3,855	160,612	(3,609)	(825)	65,366	7.74	0.67	50,531	6,284
580	6.22	3,729	164,342	(3,609)	(825)	64,661	7.62	0.67	54,141	6,284
590	6.09	3,654	167,996	(3,609)	(825)	63,881	7.49	0.67	57,750	6,284
600	6.02	3,612	171,608	(3,609)	(825)	63,059	7.35	0.67	61,360	6,284
610	5.98	3,589	175,197	(3,609)	(825)	62,214	7.22	0.67	64,969	6,284
620	5.96	3,577	178,774	(3,609)	(825)	61,356	7.08	0.67	68,578	6,284
630	5.95	3,571	182,345	(3,609)	(825)	60,493	6.95	0.67	72,188	6,284
640	5.95	3,570	185,916	(3,609)	(825)	59,629	6.82	0.67	75,797	6,284

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	5.74	3,447	189,363	(3,609)	(825)	58,641	6.68	0.67	79,407	6,284
660	5.42	3,250	192,612	(3,609)	(825)	57,457	6.51	0.67	83,016	6,284
670	5.22	3,129	195,742	(3,609)	(825)	56,152	6.34	0.67	86,625	6,284
680	5.09	3,055	198,797	(3,609)	(825)	54,773	6.16	0.67	90,235	6,284
690	5.02	3,011	201,808	(3,609)	(825)	53,349	5.98	0.67	93,844	6,284
700	4.97	2,984	204,792	(3,609)	(825)	51,899	5.81	0.67	97,453	6,284
710	4.95	2,969	207,761	(3,609)	(825)	50,434	5.64	0.67	101,063	6,284
720	4.94	2,962	210,723	(3,609)	(825)	48,962	5.48	0.67	104,672	6,284
730	4.93	2,959	213,683	(3,609)	(825)	47,486	5.33	0.67	108,282	6,284
740	4.93	2,958	216,640	(3,609)	(825)	46,010	5.18	0.67	111,891	6,284
750	4.93	2,959	219,599	(3,609)	(825)	44,534	5.03	0.67	115,500	6,284
760	4.93	2,961	222,560	(3,609)	(825)	43,061	4.89	0.67	119,110	6,284
770	4.74	2,846	225,406	(3,609)	(825)	41,472	4.74	0.67	122,719	6,284
780	4.43	2,659	228,066	(3,609)	(825)	39,698	4.58	0.67	126,329	6,284
790	4.24	2,544	230,610	(3,609)	(825)	37,807	4.41	0.67	129,938	6,284
800	4.12	2,474	233,084	(3,609)	(825)	35,847	4.24	0.67	133,547	6,284
810	4.05	2,431	235,515	(3,609)	(825)	33,843	4.07	0.67	137,157	6,284
820	4.01	2,404	237,919	(3,609)	(825)	31,813	3.89	0.67	140,766	6,284
830	3.98	2,389	240,308	0	(825)	33,377	4.03	0.67	140,766	6,284
840	3.97	2,380	242,687	(3,609)	(825)	31,322	3.85	0.67	144,375	6,284
850	3.96	2,375	245,062	0	(825)	32,872	3.98	0.67	144,375	6,284
860	3.96	2,373	247,436	0	(825)	34,421	4.12	0.67	144,375	6,284
870	3.95	2,372	249,808	(3,609)	(825)	32,359	3.94	0.67	147,985	6,284
880	3.95	2,373	252,181	0	(825)	33,907	4.07	0.67	147,985	6,284
890	3.86	2,317	254,498	(3,609)	(825)	31,789	3.89	0.67	151,594	6,284
900	3.71	2,225	256,723	0	(825)	33,190	4.01	0.67	151,594	6,284
910	3.62	2,170	258,893	(3,609)	(825)	30,925	3.81	0.67	155,204	6,284
920	3.56	2,136	261,029	0	(825)	32,236	3.93	0.67	155,204	6,284
930	3.52	2,114	263,143	0	(825)	33,525	4.04	0.67	155,204	6,284
940	3.51	2,104	265,247	(3,609)	(825)	31,194	3.84	0.67	158,813	6,284
950	3.50	2,097	267,344	0	(825)	32,466	3.95	0.67	158,813	6,284
960	3.49	2,092	269,436	0	(825)	33,733	4.06	0.67	158,813	6,284
970	3.48	2,089	271,524	(3,609)	(825)	31,387	3.85	0.67	162,422	6,284
980	3.48	2,088	273,612	0	(825)	32,650	3.96	0.67	162,422	6,284
990	3.48	2,087	275,700	0	(825)	33,913	4.07	0.67	162,422	6,284
1000	3.48	2,088	277,788	(3,609)	(825)	31,567	3.87	0.67	166,032	6,284
1010	3.35	2,010	279,798	0	(825)	32,751	3.97	0.67	166,032	6,284
1020	3.13	1,880	281,678	0	(825)	33,807	4.06	0.67	166,032	6,284
1030	3.00	1,801	283,479	(3,609)	(825)	31,174	3.84	0.67	169,641	6,284
1040	2.92	1,752	285,232	0	(825)	32,101	3.92	0.67	169,641	6,284
1050	2.87	1,724	286,955	0	(825)	33,000	3.99	0.67	169,641	6,284
1060	2.84	1,706	288,661	0	(825)	33,880	4.07	0.67	169,641	6,284
1070	2.82	1,692	290,354	(3,609)	(825)	31,138	3.83	0.67	173,251	6,284
1080	2.81	1,686	292,040	0	(825)	32,000	3.91	0.67	173,251	6,284
1090	2.80	1,683	293,723	0	(825)	32,858	3.98	0.67	173,251	6,284
1100	2.80	1,681	295,404	0	(825)	33,713	4.06	0.67	173,251	6,284
1110	2.80	1,680	297,084	(3,609)	(825)	30,959	3.82	0.67	176,860	6,284
1120	2.80	1,680	298,764	0	(825)	31,815	3.89	0.67	176,860	6,284
1130	2.80	1,680	300,445	0	(825)	32,670	3.97	0.67	176,860	6,284
1140	2.80	1,679	302,124	0	(825)	33,524	4.04	0.67	176,860	6,284
1150	2.80	1,680	303,803	(3,609)	(825)	30,770	3.80	0.67	180,469	6,284
1160	2.80	1,680	305,483	0	(825)	31,624	3.88	0.67	180,469	6,284
1170	2.80	1,680	307,163	0	(825)	32,479	3.95	0.67	180,469	6,284
1180	2.80	1,680	308,843	0	(825)	33,334	4.02	0.67	180,469	6,284
1190	2.80	1,681	310,525	(3,609)	(825)	30,581	3.78	0.67	184,079	6,284
1200	2.80	1,682	312,207	0	(825)	31,439	3.86	0.67	184,079	6,284
1210	2.80	1,683	313,890	0	(825)	32,296	3.93	0.67	184,079	6,284
1220	2.80	1,683	315,573	0	(825)	33,154	4.01	0.67	184,079	6,284
1230	2.81	1,683	317,256	(3,609)	(825)	30,403	3.77	0.67	187,688	6,284
1240	2.81	1,685	318,940	0	(825)	31,263	3.84	0.67	187,688	6,284
1250	2.81	1,684	320,624	0	(825)	32,122	3.92	0.67	187,688	6,284
1260	2.81	1,684	322,308	0	(825)	32,981	3.99	0.67	187,688	6,284
1270	2.81	1,685	323,993	0	(825)	33,841	4.07	0.67	187,688	6,284
1280	2.81	1,686	325,679	(3,609)	(825)	31,092	3.83	0.67	191,298	6,284
1290	2.81	1,686	327,365	0	(825)	31,953	3.90	0.67	191,298	6,284
1300	2.81	1,686	329,051	0	(825)	32,814	3.98	0.67	191,298	6,284
1310	2.81	1,688	330,739	0	(825)	33,677	4.05	0.67	191,298	6,284
1320	2.81	1,689	332,428	(3,609)	(825)	30,931	3.82	0.67	194,907	6,284
1330	2.81	1,688	334,116	0	(825)	31,794	3.89	0.67	194,907	6,284
1340	2.81	1,689	335,804	0	(825)	32,658	3.96	0.67	194,907	6,284
1350	2.82	1,689	337,494	0	(825)	33,522	4.04	0.67	194,907	6,284
1360	2.82	1,690	339,183	(3,609)	(825)	30,777	3.80	0.67	198,516	6,284
1370	2.82	1,690	340,873	0	(825)	31,642	3.88	0.67	198,516	6,284
1380	2.82	1,690	342,563	0	(825)	32,507	3.95	0.67	198,516	6,284
1390	2.82	1,691	344,254	0	(825)	33,373	4.03	0.67	198,516	6,284
1400	2.82	1,691	345,944	(3,609)	(825)	30,629	3.79	0.67	202,126	6,284
1410	2.82	1,690	347,635	0	(825)	31,495	3.86	0.67	202,126	6,284
1420	2.82	1,693	349,327	0	(825)	32,362	3.94	0.67	202,126	6,284
1430	2.82	1,693	351,020	0	(825)	33,230	4.01	0.67	202,126	6,284
1440	2.82	1,693	352,713	(3,609)	(825)	30,489	3.78	0.67	205,735	6,284

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alternative 3

Bioretention	10-Year SBUH Hydrology	Future Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	825.00	cf

Pond Information		
Pond Overtop Elevation	8	ft
Pond Overtop Volume	66,350	cf
Time Pond Overtopped	0.00	hr
Volume Flooding	0.00	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.06	0.00	0	0
20	0.00	0	0	0	(825)	0	0.06	0.00	0	0
30	0.00	0	0	0	(825)	0	0.06	0.00	0	0
40	0.00	0	0	0	(825)	0	0.06	0.00	0	0
50	0.00	2	2	0	(825)	0	0.06	0.00	0	0
60	0.03	18	20	0	(825)	0	0.06	0.00	0	0
70	0.09	54	73	0	(825)	0	0.06	0.00	0	0
80	0.17	100	174	0	(825)	0	0.06	0.00	0	0
90	0.25	152	325	0	(825)	0	0.06	0.00	0	0
100	0.34	206	531	0	(825)	0	0.06	0.00	0	0
110	0.46	274	805	0	(825)	0	0.06	0.00	0	0
120	0.59	355	1,159	0	(825)	0	0.06	0.00	0	0
130	0.71	427	1,586	0	(825)	0	0.06	0.00	0	0
140	0.82	490	2,076	0	(825)	0	0.06	0.00	0	0
150	0.92	549	2,625	0	(825)	0	0.06	0.00	0	0
160	1.00	600	3,225	0	(825)	0	0.06	0.00	0	0
170	1.12	672	3,897	0	(825)	0	0.06	0.00	0	0
180	1.27	761	4,658	0	(825)	0	0.06	0.00	0	0
190	1.38	831	5,489	0	(825)	6	0.07	0.00	0	0
200	1.48	886	6,375	0	(825)	67	0.08	0.00	0	0
210	1.56	934	7,310	0	(825)	177	0.10	0.00	0	0
220	1.63	977	8,287	0	(825)	329	0.12	0.00	0	0
230	1.75	1,051	9,338	0	(825)	555	0.17	0.00	0	0
240	1.91	1,145	10,483	0	(825)	874	0.22	0.00	0	0
250	2.03	1,218	11,700	0	(825)	1,267	0.29	0.00	0	0
260	2.13	1,275	12,976	0	(825)	1,717	0.37	0.00	0	0
270	2.20	1,322	14,297	0	(825)	2,214	0.46	0.00	0	0
280	2.27	1,361	15,659	0	(825)	2,750	0.55	0.00	0	0
290	2.41	1,443	17,102	0	(825)	3,369	0.65	0.00	0	0
300	2.59	1,554	18,656	0	(825)	4,097	0.77	0.00	0	0
310	2.72	1,633	20,288	0	(825)	4,905	0.90	0.00	0	0
320	2.82	1,693	21,981	0	(825)	5,773	1.03	0.00	0	0
330	2.90	1,739	23,720	0	(825)	6,687	1.17	0.00	0	0
340	2.96	1,774	25,494	0	(825)	7,636	1.31	0.00	0	0
350	3.10	1,861	27,355	0	(825)	8,672	1.46	0.00	0	0
360	3.30	1,980	29,336	0	(825)	9,827	1.61	0.00	0	0
370	3.44	2,063	31,399	0	(825)	11,065	1.78	0.00	0	0
380	3.54	2,123	33,522	0	(825)	12,363	1.94	0.00	0	0
390	3.61	2,167	35,689	0	(825)	13,706	2.11	0.00	0	0
400	3.67	2,202	37,891	0	(825)	15,082	2.27	0.00	0	0
410	4.01	2,409	40,299	0	(825)	16,666	2.45	0.00	0	0
420	4.55	2,727	43,027	0	(825)	18,568	2.65	0.00	0	0
430	4.89	2,937	45,964	0	(825)	20,680	2.87	0.00	0	0
440	5.49	3,291	49,255	0	(825)	23,147	3.11	0.00	0	0
450	6.23	3,741	52,996	0	(825)	26,062	3.38	0.00	0	0
460	8.01	4,808	57,803	0	(825)	30,045	3.74	0.00	0	0
470	12.09	7,254	65,057	0	(825)	36,474	4.29	0.00	0	0
480	14.11	8,465	73,522	(3,609)	(825)	40,504	4.65	0.00	3,609	0
490	12.44	7,464	80,986	(3,609)	(825)	43,534	4.93	0.00	7,219	0
500	10.30	6,179	87,165	(3,609)	(825)	45,278	5.10	0.00	10,828	0
510	8.60	5,162	92,327	(3,609)	(825)	46,006	5.18	0.00	14,438	0
520	7.56	4,535	96,862	(3,609)	(825)	46,107	5.19	0.00	18,047	0
530	6.53	3,918	100,781	(3,609)	(825)	45,591	5.13	0.00	21,656	0
540	5.51	3,307	104,087	(3,609)	(825)	44,463	5.02	0.00	25,266	0
550	4.89	2,932	107,019	(3,609)	(825)	42,961	4.88	0.00	28,875	0
560	4.50	2,701	109,720	(3,609)	(825)	41,227	4.72	0.00	32,484	0
570	4.27	2,559	112,279	(3,609)	(825)	39,352	4.55	0.00	36,094	0
580	4.12	2,475	114,754	(3,609)	(825)	37,392	4.38	0.00	39,703	0
590	4.04	2,423	117,176	(3,609)	(825)	35,380	4.20	0.00	43,313	0
600	3.99	2,391	119,568	(3,609)	(825)	33,337	4.02	0.00	46,922	0
610	3.95	2,373	121,940	(3,609)	(825)	31,275	3.84	0.00	50,531	0
620	3.94	2,362	124,302	0	(825)	32,812	3.98	0.00	50,531	0
630	3.93	2,358	126,660	0	(825)	34,345	4.11	0.00	50,531	0
640	3.93	2,356	129,016	(3,609)	(825)	32,267	3.93	0.00	54,141	0

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	3.79	2,272	131,289	0	(825)	33,715	4.06	0.00	54,141	0
660	3.57	2,142	133,431	(3,609)	(825)	31,422	3.86	0.00	57,750	0
670	3.44	2,062	135,493	0	(825)	32,659	3.96	0.00	57,750	0
680	3.35	2,011	137,504	0	(825)	33,845	4.07	0.00	57,750	0
690	3.30	1,982	139,486	(3,609)	(825)	31,393	3.86	0.00	61,360	0
700	3.27	1,964	141,449	0	(825)	32,532	3.95	0.00	61,360	0
710	3.26	1,953	143,403	0	(825)	33,660	4.05	0.00	61,360	0
720	3.25	1,947	145,350	(3,609)	(825)	31,173	3.84	0.00	64,969	0
730	3.24	1,944	147,294	0	(825)	32,292	3.93	0.00	64,969	0
740	3.24	1,942	149,236	0	(825)	33,409	4.03	0.00	64,969	0
750	3.24	1,941	151,177	(3,609)	(825)	30,916	3.81	0.00	68,578	0
760	3.24	1,943	153,121	0	(825)	32,034	3.91	0.00	68,578	0
770	3.11	1,866	154,986	0	(825)	33,075	4.00	0.00	68,578	0
780	2.90	1,739	156,725	(3,609)	(825)	30,379	3.77	0.00	72,188	0
790	2.77	1,663	158,388	0	(825)	31,217	3.84	0.00	72,188	0
800	2.69	1,616	160,004	0	(825)	32,008	3.91	0.00	72,188	0
810	2.64	1,586	161,590	0	(825)	32,769	3.97	0.00	72,188	0
820	2.61	1,569	163,159	0	(825)	33,512	4.04	0.00	72,188	0
830	2.60	1,559	164,717	(3,609)	(825)	30,637	3.79	0.00	75,797	0
840	2.58	1,550	166,268	0	(825)	31,362	3.85	0.00	75,797	0
850	2.58	1,547	167,815	0	(825)	32,084	3.91	0.00	75,797	0
860	2.58	1,546	169,361	0	(825)	32,806	3.98	0.00	75,797	0
870	2.58	1,545	170,907	0	(825)	33,526	4.04	0.00	75,797	0
880	2.58	1,545	172,452	(3,609)	(825)	30,637	3.79	0.00	79,407	0
890	2.52	1,510	173,962	0	(825)	31,322	3.85	0.00	79,407	0
900	2.43	1,455	175,417	0	(825)	31,952	3.90	0.00	79,407	0
910	2.37	1,420	176,837	0	(825)	32,547	3.95	0.00	79,407	0
920	2.33	1,398	178,235	0	(825)	33,120	4.00	0.00	79,407	0
930	2.31	1,387	179,622	(3,609)	(825)	30,072	3.74	0.00	83,016	0
940	2.30	1,378	181,000	0	(825)	30,625	3.79	0.00	83,016	0
950	2.29	1,373	182,372	0	(825)	31,173	3.84	0.00	83,016	0
960	2.29	1,371	183,743	0	(825)	31,719	3.88	0.00	83,016	0
970	2.28	1,371	185,114	0	(825)	32,265	3.93	0.00	83,016	0
980	2.28	1,371	186,485	0	(825)	32,810	3.98	0.00	83,016	0
990	2.28	1,368	187,853	0	(825)	33,354	4.02	0.00	83,016	0
1000	2.28	1,367	189,220	(3,609)	(825)	30,287	3.76	0.00	86,625	0
1010	2.19	1,315	190,535	0	(825)	30,777	3.80	0.00	86,625	0
1020	2.05	1,229	191,764	0	(825)	31,181	3.84	0.00	86,625	0
1030	1.96	1,178	192,942	0	(825)	31,534	3.87	0.00	86,625	0
1040	1.91	1,146	194,089	0	(825)	31,855	3.90	0.00	86,625	0
1050	1.87	1,125	195,214	0	(825)	32,155	3.92	0.00	86,625	0
1060	1.85	1,112	196,326	0	(825)	32,442	3.95	0.00	86,625	0
1070	1.84	1,104	197,429	0	(825)	32,721	3.97	0.00	86,625	0
1080	1.83	1,099	198,528	0	(825)	32,995	3.99	0.00	86,625	0
1090	1.83	1,096	199,624	0	(825)	33,266	4.02	0.00	86,625	0
1100	1.83	1,096	200,721	(3,609)	(825)	29,928	3.73	0.00	90,235	0
1110	1.83	1,096	201,817	0	(825)	30,199	3.75	0.00	90,235	0
1120	1.82	1,095	202,912	0	(825)	30,469	3.77	0.00	90,235	0
1130	1.82	1,094	204,005	0	(825)	30,737	3.80	0.00	90,235	0
1140	1.82	1,093	205,098	0	(825)	31,005	3.82	0.00	90,235	0
1150	1.82	1,092	206,191	0	(825)	31,272	3.84	0.00	90,235	0
1160	1.82	1,095	207,285	0	(825)	31,542	3.87	0.00	90,235	0
1170	1.83	1,096	208,381	0	(825)	31,813	3.89	0.00	90,235	0
1180	1.82	1,094	209,475	0	(825)	32,082	3.91	0.00	90,235	0
1190	1.82	1,094	210,569	0	(825)	32,351	3.94	0.00	90,235	0
1200	1.82	1,094	211,663	0	(825)	32,620	3.96	0.00	90,235	0
1210	1.83	1,095	212,758	0	(825)	32,890	3.98	0.00	90,235	0
1220	1.83	1,097	213,855	0	(825)	33,162	4.01	0.00	90,235	0
1230	1.83	1,095	214,950	(3,609)	(825)	29,822	3.72	0.00	93,844	0
1240	1.82	1,095	216,045	0	(825)	30,092	3.74	0.00	93,844	0
1250	1.83	1,096	217,141	0	(825)	30,364	3.77	0.00	93,844	0
1260	1.83	1,097	218,238	0	(825)	30,636	3.79	0.00	93,844	0
1270	1.83	1,096	219,334	0	(825)	30,907	3.81	0.00	93,844	0
1280	1.83	1,096	220,430	0	(825)	31,177	3.84	0.00	93,844	0
1290	1.83	1,097	221,527	0	(825)	31,449	3.86	0.00	93,844	0
1300	1.83	1,098	222,625	0	(825)	31,722	3.88	0.00	93,844	0
1310	1.83	1,097	223,722	0	(825)	31,994	3.91	0.00	93,844	0
1320	1.83	1,098	224,820	0	(825)	32,267	3.93	0.00	93,844	0
1330	1.83	1,099	225,919	0	(825)	32,541	3.95	0.00	93,844	0
1340	1.83	1,097	227,016	0	(825)	32,813	3.98	0.00	93,844	0
1350	1.83	1,096	228,112	0	(825)	33,085	4.00	0.00	93,844	0
1360	1.83	1,098	229,210	(3,609)	(825)	29,748	3.71	0.00	97,453	0
1370	1.83	1,099	230,309	0	(825)	30,022	3.74	0.00	97,453	0
1380	1.83	1,097	231,406	0	(825)	30,294	3.76	0.00	97,453	0
1390	1.83	1,099	232,505	0	(825)	30,568	3.78	0.00	97,453	0
1400	1.83	1,100	233,605	0	(825)	30,843	3.81	0.00	97,453	0
1410	1.83	1,098	234,703	0	(825)	31,116	3.83	0.00	97,453	0
1420	1.83	1,099	235,802	0	(825)	31,391	3.85	0.00	97,453	0
1430	1.83	1,100	236,902	0	(825)	31,666	3.88	0.00	97,453	0
1440	1.83	1,099	238,001	0	(825)	31,939	3.90	0.00	97,453	0

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alternative 3

Bioretention	25-Year SBUH Hydrology	Future Land Use

Pump Information		
Pump Rate	1,800	gpm
Pumped vol. / 15 min.	27,000	gal
	3,609	cf
Pump on height[1]	4	ft

Infiltration Information		
Infiltration Rate[2]	5.5	in/hr
Infiltration vol. / 10 min.	825.00	cf

Pond Information		
Pond Overtop Elevation	8	ft
Pond Overtop Volume	66,350	cf
Time Pond Overtopped	1.17	hr
Volume Flooding	0.36	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.06	0.00	0	0
20	0.00	0	0	0	(825)	0	0.06	0.00	0	0
30	0.00	0	0	0	(825)	0	0.06	0.00	0	0
40	0.04	22	22	0	(825)	0	0.06	0.00	0	0
50	0.15	89	112	0	(825)	0	0.06	0.00	0	0
60	0.31	186	297	0	(825)	0	0.06	0.00	0	0
70	0.49	294	591	0	(825)	0	0.06	0.00	0	0
80	0.67	404	995	0	(825)	0	0.06	0.00	0	0
90	0.84	506	1,501	0	(825)	0	0.06	0.00	0	0
100	1.00	598	2,099	0	(825)	0	0.06	0.00	0	0
110	1.20	722	2,820	0	(825)	0	0.06	0.00	0	0
120	1.45	870	3,690	0	(825)	45	0.07	0.00	0	0
130	1.65	991	4,681	0	(825)	211	0.10	0.00	0	0
140	1.82	1,091	5,772	0	(825)	477	0.15	0.00	0	0
150	1.96	1,173	6,946	0	(825)	825	0.21	0.00	0	0
160	2.07	1,244	8,190	0	(825)	1,244	0.29	0.00	0	0
170	2.27	1,363	9,553	0	(825)	1,783	0.38	0.00	0	0
180	2.53	1,515	11,068	0	(825)	2,473	0.50	0.00	0	0
190	2.72	1,632	12,700	0	(825)	3,280	0.64	0.00	0	0
200	2.87	1,724	14,424	0	(825)	4,179	0.78	0.00	0	0
210	3.00	1,797	16,221	0	(825)	5,151	0.94	0.00	0	0
220	3.10	1,861	18,082	0	(825)	6,187	1.10	0.00	0	0
230	3.30	1,978	20,061	0	(825)	7,340	1.27	0.00	0	0
240	3.55	2,130	22,191	0	(825)	8,645	1.45	0.00	0	0
250	3.73	2,241	24,431	0	(825)	10,061	1.65	0.00	0	0
260	3.87	2,324	26,755	0	(825)	11,560	1.84	0.00	0	0
270	3.98	2,388	29,143	0	(825)	13,123	2.04	0.00	0	0
280	4.06	2,438	31,580	0	(825)	14,735	2.23	0.00	0	0
290	4.28	2,566	34,146	0	(825)	16,476	2.43	0.00	0	0
300	4.57	2,741	36,888	0	(825)	18,392	2.64	0.00	0	0
310	4.77	2,860	39,748	0	(825)	20,428	2.85	0.00	0	0
320	4.91	2,945	42,693	0	(825)	22,547	3.06	0.00	0	0
330	5.01	3,007	45,700	0	(825)	24,729	3.26	0.00	0	0
340	5.09	3,056	48,755	0	(825)	26,960	3.47	0.00	0	0
350	5.32	3,192	51,947	0	(825)	29,326	3.68	0.00	0	0
360	5.64	3,382	55,329	0	(825)	31,884	3.90	0.00	0	0
370	5.85	3,509	58,838	0	(825)	34,568	4.13	0.00	0	0
380	5.99	3,596	62,433	(3,609)	(825)	33,729	4.06	0.00	3,609	0
390	6.09	3,657	66,090	(3,609)	(825)	32,951	3.99	0.00	7,219	0
400	6.17	3,703	69,793	0	(825)	35,829	4.24	0.00	7,219	0
410	6.73	4,038	73,831	(3,609)	(825)	35,433	4.20	0.00	10,828	0
420	7.59	4,552	78,383	(3,609)	(825)	35,550	4.21	0.00	14,438	0
430	8.13	4,880	83,263	(3,609)	(825)	35,995	4.25	0.00	18,047	0
440	9.09	5,451	88,714	(3,609)	(825)	37,012	4.34	0.00	21,656	0
450	10.30	6,177	94,891	(3,609)	(825)	38,755	4.50	0.00	25,266	0
460	13.17	7,903	102,794	(3,609)	(825)	42,224	4.81	0.00	28,875	0
470	19.76	11,856	114,650	(3,609)	(825)	49,646	5.56	0.00	32,484	0
480	22.97	13,784	128,434	(3,609)	(825)	58,995	6.73	0.00	36,094	0
490	20.20	12,123	140,557	(3,609)	(825)	66,350	7.92	0.17	39,703	333
500	16.69	10,013	150,570	(3,609)	(825)	66,350	7.92	0.33	43,313	5,911
510	13.91	8,346	158,916	(3,609)	(825)	66,350	7.92	0.50	46,922	9,823
520	12.20	7,319	166,234	(3,609)	(825)	66,350	7.92	0.67	50,531	12,707
530	10.52	6,315	172,549	(3,609)	(825)	66,350	7.92	0.83	54,141	14,588
540	8.88	5,326	177,875	(3,609)	(825)	66,350	7.92	1.00	57,750	15,480
550	7.86	4,715	182,590	(3,609)	(825)	66,350	7.92	1.17	61,360	15,760
560	7.23	4,338	186,928	(3,609)	(825)	66,254	7.90	1.17	64,969	15,760
570	6.85	4,107	191,035	(3,609)	(825)	65,927	7.84	1.17	68,578	15,760
580	6.61	3,966	195,001	(3,609)	(825)	65,458	7.76	1.17	72,188	15,760
590	6.47	3,879	198,881	(3,609)	(825)	64,903	7.66	1.17	75,797	15,760
600	6.38	3,829	202,709	(3,609)	(825)	64,298	7.56	1.17	79,407	15,760
610	6.33	3,798	206,508	(3,609)	(825)	63,662	7.45	1.17	83,016	15,760
620	6.30	3,778	210,286	(3,609)	(825)	63,006	7.34	1.17	86,625	15,760
630	6.28	3,768	214,054	(3,609)	(825)	62,340	7.24	1.17	90,235	15,760
640	6.27	3,763	217,817	(3,609)	(825)	61,668	7.13	1.17	93,844	15,760

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	6.05	3,629	221,446	(3,609)	(825)	60,862	7.01	1.17	97,453	15,760
660	5.70	3,419	224,865	(3,609)	(825)	59,847	6.85	1.17	101,063	15,760
670	5.48	3,290	228,154	(3,609)	(825)	58,702	6.69	1.17	104,672	15,760
680	5.35	3,208	231,362	(3,609)	(825)	57,476	6.52	1.17	108,282	15,760
690	5.26	3,158	234,520	(3,609)	(825)	56,199	6.34	1.17	111,891	15,760
700	5.21	3,128	237,648	(3,609)	(825)	54,892	6.17	1.17	115,500	15,760
710	5.18	3,109	240,757	(3,609)	(825)	53,567	6.01	1.17	119,110	15,760
720	5.17	3,100	243,857	(3,609)	(825)	52,233	5.85	1.17	122,719	15,760
730	5.16	3,095	246,952	(3,609)	(825)	50,893	5.70	1.17	126,329	15,760
740	5.15	3,090	250,042	(3,609)	(825)	49,549	5.55	1.17	129,938	15,760
750	5.15	3,089	253,131	(3,609)	(825)	48,203	5.40	1.17	133,547	15,760
760	5.15	3,089	256,220	(3,609)	(825)	46,858	5.26	1.17	137,157	15,760
770	4.95	2,967	259,187	(3,609)	(825)	45,391	5.11	1.17	140,766	15,760
780	4.62	2,771	261,959	(3,609)	(825)	43,728	4.95	1.17	144,375	15,760
790	4.42	2,650	264,609	(3,609)	(825)	41,944	4.78	1.17	147,985	15,760
800	4.29	2,576	267,185	(3,609)	(825)	40,085	4.61	1.17	151,594	15,760
810	4.21	2,528	269,713	(3,609)	(825)	38,179	4.44	1.17	155,204	15,760
820	4.16	2,499	272,212	(3,609)	(825)	36,244	4.27	1.17	158,813	15,760
830	4.14	2,483	274,695	(3,609)	(825)	34,292	4.11	1.17	162,422	15,760
840	4.12	2,473	277,168	(3,609)	(825)	32,331	3.94	1.17	166,032	15,760
850	4.11	2,467	279,635	0	(825)	33,973	4.08	1.17	166,032	15,760
860	4.11	2,464	282,099	(3,609)	(825)	32,003	3.91	1.17	169,641	15,760
870	4.10	2,462	284,561	0	(825)	33,639	4.05	1.17	169,641	15,760
880	4.10	2,461	287,022	(3,609)	(825)	31,666	3.88	1.17	173,251	15,760
890	4.00	2,402	289,423	0	(825)	33,243	4.02	1.17	173,251	15,760
900	3.84	2,306	291,729	(3,609)	(825)	31,114	3.83	1.17	176,860	15,760
910	3.74	2,247	293,976	0	(825)	32,536	3.95	1.17	176,860	15,760
920	3.68	2,211	296,187	0	(825)	33,922	4.07	1.17	176,860	15,760
930	3.65	2,188	298,375	(3,609)	(825)	31,675	3.88	1.17	180,469	15,760
940	3.63	2,177	300,552	0	(825)	33,027	4.00	1.17	180,469	15,760
950	3.62	2,170	302,721	0	(825)	34,372	4.11	1.17	180,469	15,760
960	3.61	2,163	304,884	(3,609)	(825)	32,101	3.92	1.17	184,079	15,760
970	3.60	2,159	307,044	0	(825)	33,435	4.03	1.17	184,079	15,760
980	3.60	2,157	309,201	(3,609)	(825)	31,158	3.83	1.17	187,688	15,760
990	3.59	2,156	311,357	0	(825)	32,488	3.95	1.17	187,688	15,760
1000	3.60	2,157	313,514	0	(825)	33,820	4.06	1.17	187,688	15,760
1010	3.46	2,075	315,589	(3,609)	(825)	31,462	3.86	1.17	191,298	15,760
1020	3.23	1,940	317,529	0	(825)	32,577	3.96	1.17	191,298	15,760
1030	3.10	1,859	319,388	0	(825)	33,610	4.05	1.17	191,298	15,760
1040	3.01	1,808	321,196	(3,609)	(825)	30,984	3.82	1.17	194,907	15,760
1050	2.96	1,778	322,974	0	(825)	31,937	3.90	1.17	194,907	15,760
1060	2.93	1,759	324,732	0	(825)	32,870	3.98	1.17	194,907	15,760
1070	2.91	1,744	326,477	0	(825)	33,790	4.06	1.17	194,907	15,760
1080	2.90	1,738	328,215	(3,609)	(825)	31,093	3.83	1.17	198,516	15,760
1090	2.89	1,734	329,949	0	(825)	32,003	3.91	1.17	198,516	15,760
1100	2.89	1,732	331,681	0	(825)	32,909	3.99	1.17	198,516	15,760
1110	2.88	1,731	333,412	0	(825)	33,815	4.06	1.17	198,516	15,760
1120	2.88	1,730	335,142	(3,609)	(825)	31,111	3.83	1.17	202,126	15,760
1130	2.88	1,730	336,871	0	(825)	32,015	3.91	1.17	202,126	15,760
1140	2.88	1,727	338,598	0	(825)	32,917	3.99	1.17	202,126	15,760
1150	2.88	1,728	340,326	0	(825)	33,820	4.06	1.17	202,126	15,760
1160	2.88	1,728	342,054	(3,609)	(825)	31,114	3.83	1.17	205,735	15,760
1170	2.88	1,728	343,783	0	(825)	32,018	3.91	1.17	205,735	15,760
1180	2.88	1,729	345,511	0	(825)	32,921	3.99	1.17	205,735	15,760
1190	2.88	1,729	347,241	0	(825)	33,825	4.07	1.17	205,735	15,760
1200	2.88	1,729	348,970	(3,609)	(825)	31,120	3.83	1.17	209,344	15,760
1210	2.88	1,730	350,699	0	(825)	32,025	3.91	1.17	209,344	15,760
1220	2.88	1,730	352,429	0	(825)	32,929	3.99	1.17	209,344	15,760
1230	2.88	1,730	354,159	0	(825)	33,834	4.07	1.17	209,344	15,760
1240	2.88	1,730	355,889	(3,609)	(825)	31,130	3.83	1.17	212,954	15,760
1250	2.88	1,730	357,619	0	(825)	32,035	3.91	1.17	212,954	15,760
1260	2.88	1,730	359,349	0	(825)	32,940	3.99	1.17	212,954	15,760
1270	2.88	1,730	361,079	0	(825)	33,845	4.07	1.17	212,954	15,760
1280	2.88	1,730	362,809	(3,609)	(825)	31,141	3.83	1.17	216,563	15,760
1290	2.88	1,731	364,540	0	(825)	32,046	3.91	1.17	216,563	15,760
1300	2.88	1,731	366,270	0	(825)	32,952	3.99	1.17	216,563	15,760
1310	2.89	1,731	368,001	0	(825)	33,858	4.07	1.17	216,563	15,760
1320	2.89	1,731	369,733	(3,609)	(825)	31,155	3.83	1.17	220,173	15,760
1330	2.89	1,731	371,464	0	(825)	32,061	3.91	1.17	220,173	15,760
1340	2.89	1,731	373,195	0	(825)	32,967	3.99	1.17	220,173	15,760
1350	2.89	1,731	374,926	0	(825)	33,874	4.07	1.17	220,173	15,760
1360	2.89	1,732	376,658	(3,609)	(825)	31,171	3.84	1.17	223,782	15,760
1370	2.89	1,732	378,389	0	(825)	32,077	3.91	1.17	223,782	15,760
1380	2.89	1,732	380,121	0	(825)	32,984	3.99	1.17	223,782	15,760
1390	2.89	1,732	381,853	0	(825)	33,891	4.07	1.17	223,782	15,760
1400	2.89	1,732	383,585	(3,609)	(825)	31,188	3.84	1.17	227,391	15,760
1410	2.89	1,732	385,317	0	(825)	32,095	3.92	1.17	227,391	15,760
1420	2.89	1,734	387,051	0	(825)	33,004	3.99	1.17	227,391	15,760
1430	2.89	1,734	388,784	0	(825)	33,913	4.07	1.17	227,391	15,760
1440	2.89	1,733	390,518	(3,609)	(825)	31,212	3.84	1.17	231,001	15,760

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alternative 3

No Bioretention | **10-Year SBUH Hydrology** | **Existing Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	8	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	825.00	cf	Pond Overtop Volume	66,350	cf
	3,609	cf				Time Pond Overtopped	2.33	hr
Pump on height[1]	4	ft				Volume Flooding	0.17	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.06	0.00	0	0
20	0.00	0	0	0	(825)	0	0.06	0.00	0	0
30	0.00	0	0	0	(825)	0	0.06	0.00	0	0
40	0.00	0	0	0	(825)	0	0.06	0.00	0	0
50	0.00	1	1	0	(825)	0	0.06	0.00	0	0
60	0.01	5	5	0	(825)	0	0.06	0.00	0	0
70	0.03	16	21	0	(825)	0	0.06	0.00	0	0
80	0.05	32	53	0	(825)	0	0.06	0.00	0	0
90	0.09	53	105	0	(825)	0	0.06	0.00	0	0
100	0.13	78	183	0	(825)	0	0.06	0.00	0	0
110	0.18	109	292	0	(825)	0	0.06	0.00	0	0
120	0.25	149	441	0	(825)	0	0.06	0.00	0	0
130	0.32	191	632	0	(825)	0	0.06	0.00	0	0
140	0.39	234	866	0	(825)	0	0.06	0.00	0	0
150	0.47	279	1,145	0	(825)	0	0.06	0.00	0	0
160	0.54	324	1,469	0	(825)	0	0.06	0.00	0	0
170	0.63	376	1,845	0	(825)	0	0.06	0.00	0	0
180	0.73	435	2,280	0	(825)	0	0.06	0.00	0	0
190	0.82	493	2,774	0	(825)	0	0.06	0.00	0	0
200	0.92	550	3,324	0	(825)	0	0.06	0.00	0	0
210	1.01	606	3,929	0	(825)	0	0.06	0.00	0	0
220	1.10	661	4,590	0	(825)	0	0.06	0.00	0	0
230	1.21	727	5,317	0	(825)	0	0.06	0.00	0	0
240	1.34	805	6,122	0	(825)	0	0.06	0.00	0	0
250	1.47	884	7,006	0	(825)	59	0.08	0.00	0	0
260	1.61	963	7,969	0	(825)	197	0.10	0.00	0	0
270	1.74	1,042	9,012	0	(825)	415	0.14	0.00	0	0
280	1.87	1,121	10,133	0	(825)	711	0.19	0.00	0	0
290	2.02	1,214	11,347	0	(825)	1,100	0.26	0.00	0	0
300	2.20	1,322	12,669	0	(825)	1,597	0.35	0.00	0	0
310	2.38	1,427	14,096	0	(825)	2,199	0.45	0.00	0	0
320	2.55	1,531	15,627	0	(825)	2,905	0.57	0.00	0	0
330	2.72	1,631	17,258	0	(825)	3,711	0.71	0.00	0	0
340	2.88	1,730	18,988	0	(825)	4,616	0.85	0.00	0	0
350	3.07	1,845	20,833	0	(825)	5,636	1.01	0.00	0	0
360	3.29	1,976	22,808	0	(825)	6,786	1.19	0.00	0	0
370	3.50	2,102	24,911	0	(825)	8,063	1.37	0.00	0	0
380	3.71	2,225	27,135	0	(825)	9,463	1.57	0.00	0	0
390	3.90	2,342	29,478	0	(825)	10,980	1.77	0.00	0	0
400	4.09	2,457	31,934	0	(825)	12,612	1.97	0.00	0	0
410	4.39	2,632	34,566	0	(825)	14,419	2.19	0.00	0	0
420	4.78	2,866	37,432	0	(825)	16,459	2.43	0.00	0	0
430	5.15	3,090	40,521	0	(825)	18,724	2.67	0.00	0	0
440	5.64	3,385	43,906	0	(825)	21,284	2.93	0.00	0	0
450	6.25	3,749	47,655	0	(825)	24,207	3.21	0.00	0	0
460	7.32	4,395	52,049	0	(825)	27,777	3.54	0.00	0	0
470	9.51	5,704	57,753	0	(825)	32,656	3.96	0.00	0	0
480	11.35	6,809	64,563	0	(825)	38,640	4.49	0.00	0	0
490	11.91	7,143	71,706	(3,609)	(825)	41,350	4.73	0.00	3,609	0
500	11.98	7,186	78,892	(3,609)	(825)	44,101	4.99	0.00	7,219	0
510	11.90	7,137	86,030	(3,609)	(825)	46,804	5.26	0.00	10,828	0
520	11.83	7,096	93,125	(3,609)	(825)	49,466	5.54	0.00	14,438	0
530	11.61	6,965	100,090	(3,609)	(825)	51,996	5.82	0.00	18,047	0
540	11.25	6,752	106,842	(3,609)	(825)	54,314	6.10	0.00	21,656	0
550	10.93	6,558	113,401	(3,609)	(825)	56,438	6.38	0.00	25,266	0
560	10.64	6,382	119,783	(3,609)	(825)	58,385	6.64	0.00	28,875	0
570	10.37	6,222	126,004	(3,609)	(825)	60,173	6.90	0.00	32,484	0
580	10.13	6,076	132,081	(3,609)	(825)	61,815	7.15	0.00	36,094	0
590	9.91	5,944	138,025	(3,609)	(825)	63,324	7.40	0.00	39,703	0
600	9.71	5,823	143,848	(3,609)	(825)	64,713	7.63	0.00	43,313	0
610	9.52	5,714	149,562	(3,609)	(825)	65,993	7.85	0.00	46,922	0
620	9.36	5,615	155,177	(3,609)	(825)	66,350	7.92	0.17	50,531	823
630	9.21	5,526	160,703	(3,609)	(825)	66,350	7.92	0.33	54,141	1,915
640	9.08	5,445	166,148	(3,609)	(825)	66,350	7.92	0.50	57,750	2,926

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	8.90	5,337	171,486	(3,609)	(825)	66,350	7.92	0.67	61,360	3,828
660	8.68	5,205	176,691	(3,609)	(825)	66,350	7.92	0.83	64,969	4,599
670	8.47	5,085	181,776	(3,609)	(825)	66,350	7.92	1.00	68,578	5,250
680	8.29	4,974	186,750	(3,609)	(825)	66,350	7.92	1.17	72,188	5,790
690	8.12	4,874	191,624	(3,609)	(825)	66,350	7.92	1.33	75,797	6,230
700	7.97	4,783	196,407	(3,609)	(825)	66,350	7.92	1.50	79,407	6,578
710	7.83	4,700	201,107	(3,609)	(825)	66,350	7.92	1.67	83,016	6,844
720	7.71	4,624	205,732	(3,609)	(825)	66,350	7.92	1.83	86,625	7,034
730	7.59	4,555	210,287	(3,609)	(825)	66,350	7.92	2.00	90,235	7,155
740	7.49	4,493	214,780	(3,609)	(825)	66,350	7.92	2.17	93,844	7,213
750	7.39	4,436	219,216	(3,609)	(825)	66,350	7.92	2.33	97,453	7,215
760	7.31	4,385	223,601	(3,609)	(825)	66,301	7.91	2.33	101,063	7,215
770	7.18	4,305	227,906	(3,609)	(825)	66,172	7.89	2.33	104,672	7,215
780	7.00	4,199	232,105	(3,609)	(825)	65,937	7.84	2.33	108,282	7,215
790	6.84	4,102	236,207	(3,609)	(825)	65,604	7.79	2.33	111,891	7,215
800	6.69	4,013	240,220	(3,609)	(825)	65,183	7.71	2.33	115,500	7,215
810	6.55	3,932	244,152	(3,609)	(825)	64,680	7.62	2.33	119,110	7,215
820	6.43	3,858	248,010	(3,609)	(825)	64,104	7.53	2.33	122,719	7,215
830	6.32	3,791	251,800	(3,609)	(825)	63,460	7.42	2.33	126,329	7,215
840	6.21	3,729	255,529	(3,609)	(825)	62,754	7.30	2.33	129,938	7,215
850	6.12	3,672	259,201	(3,609)	(825)	61,992	7.18	2.33	133,547	7,215
860	6.04	3,621	262,823	(3,609)	(825)	61,179	7.05	2.33	137,157	7,215
870	5.96	3,575	266,398	(3,609)	(825)	60,320	6.92	2.33	140,766	7,215
880	5.89	3,532	269,930	(3,609)	(825)	59,418	6.79	2.33	144,375	7,215
890	5.80	3,478	273,408	(3,609)	(825)	58,462	6.65	2.33	147,985	7,215
900	5.69	3,415	276,823	(3,609)	(825)	57,442	6.51	2.33	151,594	7,215
910	5.59	3,356	280,180	(3,609)	(825)	56,364	6.37	2.33	155,204	7,215
920	5.50	3,303	283,482	(3,609)	(825)	55,232	6.22	2.33	158,813	7,215
930	5.42	3,254	286,737	(3,609)	(825)	54,052	6.07	2.33	162,422	7,215
940	5.35	3,210	289,946	(3,609)	(825)	52,828	5.92	2.33	166,032	7,215
950	5.28	3,169	293,115	(3,609)	(825)	51,562	5.77	2.33	169,641	7,215
960	5.22	3,132	296,247	(3,609)	(825)	50,260	5.62	2.33	173,251	7,215
970	5.16	3,099	299,346	(3,609)	(825)	48,924	5.48	2.33	176,860	7,215
980	5.11	3,068	302,414	(3,609)	(825)	47,558	5.33	2.33	180,469	7,215
990	5.07	3,040	305,454	(3,609)	(825)	46,163	5.19	2.33	184,079	7,215
1000	5.02	3,014	308,468	(3,609)	(825)	44,743	5.05	2.33	187,688	7,215
1010	4.95	2,968	311,436	(3,609)	(825)	43,276	4.91	2.33	191,298	7,215
1020	4.84	2,903	314,338	(3,609)	(825)	41,745	4.77	2.33	194,907	7,215
1030	4.74	2,843	317,182	(3,609)	(825)	40,154	4.62	2.33	198,516	7,215
1040	4.65	2,789	319,971	(3,609)	(825)	38,508	4.47	2.33	202,126	7,215
1050	4.56	2,739	322,710	(3,609)	(825)	36,813	4.32	2.33	205,735	7,215
1060	4.49	2,692	325,402	(3,609)	(825)	35,071	4.17	2.33	209,344	7,215
1070	4.42	2,651	328,052	(3,609)	(825)	33,287	4.02	2.33	212,954	7,215
1080	4.35	2,612	330,665	(3,609)	(825)	31,464	3.86	2.33	216,563	7,215
1090	4.29	2,577	333,242	0	(825)	33,216	4.01	2.33	216,563	7,215
1100	4.24	2,545	335,787	(3,609)	(825)	31,327	3.85	2.33	220,173	7,215
1110	4.19	2,516	338,303	0	(825)	33,018	4.00	2.33	220,173	7,215
1120	4.15	2,489	340,792	0	(825)	34,683	4.14	2.33	220,173	7,215
1130	4.11	2,465	343,257	(3,609)	(825)	32,714	3.97	2.33	223,782	7,215
1140	4.07	2,442	345,699	0	(825)	34,331	4.11	2.33	223,782	7,215
1150	4.04	2,422	348,121	(3,609)	(825)	32,318	3.94	2.33	227,391	7,215
1160	4.01	2,404	350,525	0	(825)	33,897	4.07	2.33	227,391	7,215
1170	3.98	2,387	352,912	(3,609)	(825)	31,849	3.89	2.33	231,001	7,215
1180	3.95	2,371	355,283	0	(825)	33,395	4.03	2.33	231,001	7,215
1190	3.93	2,357	357,640	(3,609)	(825)	31,318	3.85	2.33	234,610	7,215
1200	3.91	2,344	359,984	0	(825)	32,837	3.98	2.33	234,610	7,215
1210	3.89	2,333	362,317	0	(825)	34,345	4.11	2.33	234,610	7,215
1220	3.87	2,323	364,640	(3,609)	(825)	32,233	3.93	2.33	238,220	7,215
1230	3.85	2,312	366,952	0	(825)	33,721	4.06	2.33	238,220	7,215
1240	3.84	2,304	369,256	(3,609)	(825)	31,590	3.87	2.33	241,829	7,215
1250	3.83	2,296	371,552	0	(825)	33,062	4.00	2.33	241,829	7,215
1260	3.82	2,289	373,842	0	(825)	34,526	4.13	2.33	241,829	7,215
1270	3.80	2,282	376,124	(3,609)	(825)	32,374	3.94	2.33	245,438	7,215
1280	3.79	2,277	378,401	0	(825)	33,826	4.07	2.33	245,438	7,215
1290	3.79	2,272	380,673	(3,609)	(825)	31,663	3.88	2.33	249,048	7,215
1300	3.78	2,267	382,940	0	(825)	33,105	4.00	2.33	249,048	7,215
1310	3.77	2,263	385,203	(3,609)	(825)	30,934	3.82	2.33	252,657	7,215
1320	3.77	2,259	387,462	0	(825)	32,368	3.94	2.33	252,657	7,215
1330	3.76	2,256	389,718	0	(825)	33,799	4.06	2.33	252,657	7,215
1340	3.75	2,253	391,971	(3,609)	(825)	31,618	3.87	2.33	256,266	7,215
1350	3.75	2,250	394,221	0	(825)	33,042	4.00	2.33	256,266	7,215
1360	3.75	2,247	396,468	0	(825)	34,465	4.12	2.33	256,266	7,215
1370	3.74	2,245	398,714	(3,609)	(825)	32,276	3.93	2.33	259,876	7,215
1380	3.74	2,243	400,957	0	(825)	33,694	4.05	2.33	259,876	7,215
1390	3.74	2,242	403,198	(3,609)	(825)	31,501	3.86	2.33	263,485	7,215
1400	3.73	2,241	405,439	0	(825)	32,917	3.99	2.33	263,485	7,215
1410	3.73	2,239	407,678	0	(825)	34,331	4.11	2.33	263,485	7,215
1420	3.73	2,238	409,916	(3,609)	(825)	32,135	3.92	2.33	267,095	7,215
1430	3.73	2,237	412,154	0	(825)	33,547	4.04	2.33	267,095	7,215
1440	3.73	2,237	414,390	(3,609)	(825)	31,349	3.85	2.33	270,704	7,215

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alternative 3

No Bioretention | **25-Year SBUH Hydrology** | **Existing Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	8	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	825.00	cf	Pond Overtop Volume	66,350	cf
	3,609	cf				Time Pond Overtopped	9.50	hr
Pump on height[1]	4	ft				Volume Flooding	4.06	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.06	0.00	0	0
20	0.00	0	0	0	(825)	0	0.06	0.00	0	0
30	0.00	0	0	0	(825)	0	0.06	0.00	0	0
40	0.01	6	6	0	(825)	0	0.06	0.00	0	0
50	0.04	25	31	0	(825)	0	0.06	0.00	0	0
60	0.10	57	88	0	(825)	0	0.06	0.00	0	0
70	0.17	99	187	0	(825)	0	0.06	0.00	0	0
80	0.25	149	336	0	(825)	0	0.06	0.00	0	0
90	0.34	204	540	0	(825)	0	0.06	0.00	0	0
100	0.44	261	801	0	(825)	0	0.06	0.00	0	0
110	0.55	332	1,133	0	(825)	0	0.06	0.00	0	0
120	0.69	415	1,548	0	(825)	0	0.06	0.00	0	0
130	0.83	499	2,048	0	(825)	0	0.06	0.00	0	0
140	0.97	583	2,631	0	(825)	0	0.06	0.00	0	0
150	1.11	665	3,296	0	(825)	0	0.06	0.00	0	0
160	1.25	748	4,044	0	(825)	0	0.06	0.00	0	0
170	1.42	850	4,893	0	(825)	25	0.07	0.00	0	0
180	1.62	970	5,863	0	(825)	169	0.10	0.00	0	0
190	1.82	1,092	6,956	0	(825)	437	0.14	0.00	0	0
200	2.03	1,216	8,172	0	(825)	828	0.21	0.00	0	0
210	2.23	1,341	9,513	0	(825)	1,344	0.31	0.00	0	0
220	2.44	1,465	10,978	0	(825)	1,984	0.42	0.00	0	0
230	2.68	1,609	12,586	0	(825)	2,767	0.55	0.00	0	0
240	2.95	1,771	14,357	0	(825)	3,714	0.71	0.00	0	0
250	3.22	1,931	16,289	0	(825)	4,820	0.89	0.00	0	0
260	3.48	2,088	18,376	0	(825)	6,083	1.08	0.00	0	0
270	3.73	2,240	20,617	0	(825)	7,498	1.29	0.00	0	0
280	3.98	2,389	23,005	0	(825)	9,062	1.51	0.00	0	0
290	4.27	2,564	25,569	0	(825)	10,800	1.74	0.00	0	0
300	4.60	2,763	28,332	0	(825)	12,738	1.99	0.00	0	0
310	4.93	2,955	31,287	0	(825)	14,868	2.24	0.00	0	0
320	5.23	3,140	34,427	0	(825)	17,183	2.51	0.00	0	0
330	5.53	3,318	37,744	0	(825)	19,675	2.77	0.00	0	0
340	5.81	3,489	41,233	0	(825)	22,339	3.03	0.00	0	0
350	6.15	3,689	44,922	0	(825)	25,203	3.31	0.00	0	0
360	6.53	3,918	48,840	0	(825)	28,296	3.58	0.00	0	0
370	6.90	4,137	52,978	0	(825)	31,609	3.87	0.00	0	0
380	7.24	4,346	57,324	0	(825)	35,130	4.18	0.00	0	0
390	7.57	4,544	61,868	(3,609)	(825)	35,240	4.19	0.00	3,609	0
400	7.89	4,734	66,602	(3,609)	(825)	35,539	4.21	0.00	7,219	0
410	8.39	5,033	71,634	(3,609)	(825)	36,137	4.27	0.00	10,828	0
420	9.06	5,434	77,069	(3,609)	(825)	37,137	4.35	0.00	14,438	0
430	9.69	5,814	82,882	(3,609)	(825)	38,517	4.47	0.00	18,047	0
440	10.53	6,318	89,201	(3,609)	(825)	40,400	4.64	0.00	21,656	0
450	11.57	6,940	96,141	(3,609)	(825)	42,906	4.87	0.00	25,266	0
460	13.42	8,051	104,191	(3,609)	(825)	46,523	5.23	0.00	28,875	0
470	17.16	10,297	114,488	(3,609)	(825)	52,385	5.87	0.00	32,484	0
480	20.28	12,168	126,656	(3,609)	(825)	60,119	6.89	0.00	36,094	0
490	21.16	12,696	139,352	(3,609)	(825)	66,350	7.92	0.17	39,703	2,030
500	21.20	12,723	152,075	(3,609)	(825)	66,350	7.92	0.33	43,313	10,318
510	20.99	12,595	164,671	(3,609)	(825)	66,350	7.92	0.50	46,922	18,479
520	20.80	12,482	177,152	(3,609)	(825)	66,350	7.92	0.67	50,531	26,527
530	20.37	12,220	189,373	(3,609)	(825)	66,350	7.92	0.83	54,141	34,313
540	19.71	11,823	201,196	(3,609)	(825)	66,350	7.92	1.00	57,750	41,701
550	19.10	11,459	212,655	(3,609)	(825)	66,350	7.92	1.17	61,360	48,726
560	18.54	11,127	223,782	(3,609)	(825)	66,350	7.92	1.33	64,969	55,419
570	18.04	10,824	234,605	(3,609)	(825)	66,350	7.92	1.50	68,578	61,808
580	17.58	10,547	245,152	(3,609)	(825)	66,350	7.92	1.67	72,188	67,920
590	17.16	10,294	255,446	(3,609)	(825)	66,350	7.92	1.83	75,797	73,780
600	16.77	10,064	265,510	(3,609)	(825)	66,350	7.92	2.00	79,407	79,409
610	16.42	9,854	275,364	(3,609)	(825)	66,350	7.92	2.17	83,016	84,829
620	16.10	9,663	285,027	(3,609)	(825)	66,350	7.92	2.33	86,625	90,057
630	15.81	9,488	294,515	(3,609)	(825)	66,350	7.92	2.50	90,235	95,111
640	15.55	9,330	303,845	(3,609)	(825)	66,350	7.92	2.67	93,844	100,007

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	15.21	9,127	312,972	(3,609)	(825)	66,350	7.92	2.83	97,453	104,700
660	14.81	8,886	321,859	(3,609)	(825)	66,350	7.92	3.00	101,063	109,152
670	14.44	8,666	330,525	(3,609)	(825)	66,350	7.92	3.17	104,672	113,383
680	14.11	8,464	338,988	(3,609)	(825)	66,350	7.92	3.33	108,282	117,413
690	13.80	8,279	347,267	(3,609)	(825)	66,350	7.92	3.50	111,891	121,257
700	13.52	8,110	355,377	(3,609)	(825)	66,350	7.92	3.67	115,500	124,933
710	13.26	7,956	363,333	(3,609)	(825)	66,350	7.92	3.83	119,110	128,454
720	13.03	7,815	371,148	(3,609)	(825)	66,350	7.92	4.00	122,719	131,835
730	12.81	7,687	378,835	(3,609)	(825)	66,350	7.92	4.17	126,329	135,087
740	12.62	7,569	386,405	(3,609)	(825)	66,350	7.92	4.33	129,938	138,222
750	12.44	7,463	393,867	(3,609)	(825)	66,350	7.92	4.50	133,547	141,251
760	12.28	7,365	401,233	(3,609)	(825)	66,350	7.92	4.67	137,157	144,182
770	12.04	7,223	408,456	(3,609)	(825)	66,350	7.92	4.83	140,766	146,970
780	11.73	7,039	415,495	(3,609)	(825)	66,350	7.92	5.00	144,375	149,575
790	11.45	6,870	422,365	(3,609)	(825)	66,350	7.92	5.17	147,985	152,010
800	11.19	6,716	429,080	(3,609)	(825)	66,350	7.92	5.33	151,594	154,292
810	10.96	6,574	435,654	(3,609)	(825)	66,350	7.92	5.50	155,204	156,432
820	10.74	6,445	442,099	(3,609)	(825)	66,350	7.92	5.67	158,813	158,442
830	10.54	6,326	448,425	(3,609)	(825)	66,350	7.92	5.83	162,422	160,333
840	10.36	6,218	454,643	(3,609)	(825)	66,350	7.92	6.00	166,032	162,117
850	10.20	6,118	460,761	(3,609)	(825)	66,350	7.92	6.17	169,641	163,801
860	10.05	6,028	466,789	(3,609)	(825)	66,350	7.92	6.33	173,251	165,395
870	9.91	5,945	472,735	(3,609)	(825)	66,350	7.92	6.50	176,860	166,906
880	9.78	5,870	478,605	(3,609)	(825)	66,350	7.92	6.67	180,469	168,341
890	9.63	5,775	484,380	(3,609)	(825)	66,350	7.92	6.83	184,079	169,682
900	9.44	5,662	490,042	(3,609)	(825)	66,350	7.92	7.00	187,688	170,910
910	9.26	5,558	495,600	(3,609)	(825)	66,350	7.92	7.17	191,298	172,034
920	9.11	5,463	501,064	(3,609)	(825)	66,350	7.92	7.33	194,907	173,063
930	8.96	5,376	506,440	(3,609)	(825)	66,350	7.92	7.50	198,516	174,004
940	8.83	5,298	511,738	(3,609)	(825)	66,350	7.92	7.67	202,126	174,868
950	8.71	5,225	516,963	(3,609)	(825)	66,350	7.92	7.83	205,735	175,659
960	8.60	5,159	522,122	(3,609)	(825)	66,350	7.92	8.00	209,344	176,383
970	8.50	5,097	527,219	(3,609)	(825)	66,350	7.92	8.17	212,954	177,046
980	8.40	5,042	532,261	(3,609)	(825)	66,350	7.92	8.33	216,563	177,653
990	8.32	4,991	537,252	(3,609)	(825)	66,350	7.92	8.50	220,173	178,210
1000	8.24	4,945	542,197	(3,609)	(825)	66,350	7.92	8.67	223,782	178,720
1010	8.11	4,866	547,063	(3,609)	(825)	66,350	7.92	8.83	227,391	179,152
1020	7.93	4,756	551,819	(3,609)	(825)	66,350	7.92	9.00	231,001	179,474
1030	7.76	4,657	556,476	(3,609)	(825)	66,350	7.92	9.17	234,610	179,696
1040	7.61	4,565	561,041	(3,609)	(825)	66,350	7.92	9.33	238,220	179,827
1050	7.47	4,481	565,522	(3,609)	(825)	66,350	7.92	9.50	241,829	179,874
1060	7.34	4,405	569,927	(3,609)	(825)	66,321	7.91	9.50	245,438	179,874
1070	7.22	4,334	574,260	(3,609)	(825)	66,220	7.90	9.50	249,048	179,874
1080	7.12	4,269	578,530	(3,609)	(825)	66,055	7.87	9.50	252,657	179,874
1090	7.02	4,210	582,740	(3,609)	(825)	65,831	7.83	9.50	256,266	179,874
1100	6.93	4,156	586,896	(3,609)	(825)	65,553	7.78	9.50	259,876	179,874
1110	6.85	4,107	591,003	(3,609)	(825)	65,225	7.72	9.50	263,485	179,874
1120	6.77	4,062	595,065	(3,609)	(825)	64,853	7.65	9.50	267,095	179,874
1130	6.70	4,021	599,086	(3,609)	(825)	64,440	7.58	9.50	270,704	179,874
1140	6.64	3,983	603,069	(3,609)	(825)	63,988	7.51	9.50	274,313	179,874
1150	6.58	3,948	607,017	(3,609)	(825)	63,502	7.43	9.50	277,923	179,874
1160	6.53	3,916	610,933	(3,609)	(825)	62,984	7.34	9.50	281,532	179,874
1170	6.48	3,887	614,820	(3,609)	(825)	62,436	7.25	9.50	285,142	179,874
1180	6.43	3,860	618,681	(3,609)	(825)	61,862	7.16	9.50	288,751	179,874
1190	6.39	3,837	622,517	(3,609)	(825)	61,265	7.07	9.50	292,360	179,874
1200	6.36	3,815	626,332	(3,609)	(825)	60,645	6.97	9.50	295,970	179,874
1210	6.32	3,794	630,127	(3,609)	(825)	60,005	6.88	9.50	299,579	179,874
1220	6.29	3,776	633,903	(3,609)	(825)	59,347	6.78	9.50	303,189	179,874
1230	6.27	3,759	637,662	(3,609)	(825)	58,671	6.68	9.50	306,798	179,874
1240	6.24	3,744	641,406	(3,609)	(825)	57,981	6.59	9.50	310,407	179,874
1250	6.22	3,730	645,136	(3,609)	(825)	57,277	6.49	9.50	314,017	179,874
1260	6.19	3,717	648,853	(3,609)	(825)	56,559	6.39	9.50	317,626	179,874
1270	6.18	3,705	652,558	(3,609)	(825)	55,830	6.30	9.50	321,235	179,874
1280	6.16	3,695	656,253	(3,609)	(825)	55,091	6.20	9.50	324,845	179,874
1290	6.14	3,685	659,938	(3,609)	(825)	54,342	6.11	9.50	328,454	179,874
1300	6.13	3,676	663,615	(3,609)	(825)	53,584	6.01	9.50	332,064	179,874
1310	6.11	3,669	667,284	(3,609)	(825)	52,818	5.92	9.50	335,673	179,874
1320	6.10	3,662	670,946	(3,609)	(825)	52,046	5.83	9.50	339,282	179,874
1330	6.09	3,655	674,601	(3,609)	(825)	51,267	5.74	9.50	342,892	179,874
1340	6.08	3,649	678,250	(3,609)	(825)	50,482	5.65	9.50	346,501	179,874
1350	6.07	3,644	681,894	(3,609)	(825)	49,691	5.56	9.50	350,111	179,874
1360	6.07	3,639	685,534	(3,609)	(825)	48,896	5.48	9.50	353,720	179,874
1370	6.06	3,635	689,169	(3,609)	(825)	48,097	5.39	9.50	357,329	179,874
1380	6.05	3,631	692,799	(3,609)	(825)	47,293	5.31	9.50	360,939	179,874
1390	6.05	3,628	696,427	(3,609)	(825)	46,486	5.22	9.50	364,548	179,874
1400	6.04	3,624	700,051	(3,609)	(825)	45,676	5.14	9.50	368,157	179,874
1410	6.04	3,621	703,672	(3,609)	(825)	44,863	5.06	9.50	371,767	179,874
1420	6.03	3,619	707,291	(3,609)	(825)	44,048	4.98	9.50	375,376	179,874
1430	6.03	3,617	710,908	(3,609)	(825)	43,230	4.91	9.50	378,986	179,874
1440	6.02	3,615	714,523	(3,609)	(825)	42,411	4.83	9.50	382,595	179,874

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alternative 3

No Bioretention | **10-Year SBUH Hydrology** | **Future Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	8	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	825.00	cf	Pond Overtop Volume	66,350	cf
	3,609	cf				Time Pond Overtopped	4.17	hr
Pump on height[1]	4	ft				Volume Flooding	0.75	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.06	0.00	0	0
20	0.00	0	0	0	(825)	0	0.06	0.00	0	0
30	0.00	0	0	0	(825)	0	0.06	0.00	0	0
40	0.00	0	0	0	(825)	0	0.06	0.00	0	0
50	0.00	1	1	0	(825)	0	0.06	0.00	0	0
60	0.01	8	9	0	(825)	0	0.06	0.00	0	0
70	0.04	26	34	0	(825)	0	0.06	0.00	0	0
80	0.09	52	86	0	(825)	0	0.06	0.00	0	0
90	0.14	86	173	0	(825)	0	0.06	0.00	0	0
100	0.21	127	300	0	(825)	0	0.06	0.00	0	0
110	0.30	180	480	0	(825)	0	0.06	0.00	0	0
120	0.41	244	724	0	(825)	0	0.06	0.00	0	0
130	0.52	313	1,038	0	(825)	0	0.06	0.00	0	0
140	0.64	384	1,422	0	(825)	0	0.06	0.00	0	0
150	0.76	458	1,880	0	(825)	0	0.06	0.00	0	0
160	0.89	532	2,413	0	(825)	0	0.06	0.00	0	0
170	1.03	618	3,030	0	(825)	0	0.06	0.00	0	0
180	1.19	715	3,745	0	(825)	0	0.06	0.00	0	0
190	1.35	810	4,556	0	(825)	0	0.06	0.00	0	0
200	1.51	903	5,459	0	(825)	78	0.08	0.00	0	0
210	1.66	995	6,453	0	(825)	248	0.11	0.00	0	0
220	1.81	1,084	7,537	0	(825)	507	0.16	0.00	0	0
230	1.98	1,187	8,724	0	(825)	868	0.22	0.00	0	0
240	2.17	1,302	10,026	0	(825)	1,346	0.31	0.00	0	0
250	2.36	1,415	11,442	0	(825)	1,936	0.41	0.00	0	0
260	2.54	1,525	12,967	0	(825)	2,636	0.53	0.00	0	0
270	2.72	1,631	14,597	0	(825)	3,442	0.66	0.00	0	0
280	2.89	1,733	16,330	0	(825)	4,350	0.81	0.00	0	0
290	3.09	1,852	18,183	0	(825)	5,377	0.97	0.00	0	0
300	3.31	1,988	20,171	0	(825)	6,540	1.15	0.00	0	0
310	3.53	2,118	22,289	0	(825)	7,834	1.34	0.00	0	0
320	3.74	2,243	24,533	0	(825)	9,252	1.54	0.00	0	0
330	3.94	2,362	26,894	0	(825)	10,789	1.74	0.00	0	0
340	4.12	2,474	29,369	0	(825)	12,438	1.95	0.00	0	0
350	4.34	2,607	31,976	0	(825)	14,220	2.17	0.00	0	0
360	4.60	2,758	34,733	0	(825)	16,153	2.39	0.00	0	0
370	4.83	2,900	37,634	0	(825)	18,228	2.62	0.00	0	0
380	5.06	3,036	40,670	0	(825)	20,439	2.85	0.00	0	0
390	5.27	3,164	43,833	0	(825)	22,778	3.08	0.00	0	0
400	5.47	3,285	47,118	0	(825)	25,237	3.31	0.00	0	0
410	5.80	3,479	50,597	0	(825)	27,891	3.55	0.00	0	0
420	6.24	3,742	54,339	0	(825)	30,808	3.80	0.00	0	0
430	6.65	3,990	58,329	0	(825)	33,974	4.08	0.00	0	0
440	7.20	4,319	62,649	(3,609)	(825)	33,859	4.07	0.00	3,609	0
450	7.88	4,725	67,374	(3,609)	(825)	34,149	4.09	0.00	7,219	0
460	9.09	5,452	72,826	(3,609)	(825)	35,167	4.18	0.00	10,828	0
470	11.54	6,925	79,751	(3,609)	(825)	37,658	4.40	0.00	14,438	0
480	13.57	8,145	87,896	(3,609)	(825)	41,369	4.73	0.00	18,047	0
490	14.13	8,478	96,374	(3,609)	(825)	45,412	5.12	0.00	21,656	0
500	14.14	8,483	104,858	(3,609)	(825)	49,461	5.54	0.00	25,266	0
510	13.98	8,388	113,246	(3,609)	(825)	53,415	5.99	0.00	28,875	0
520	13.84	8,301	121,547	(3,609)	(825)	57,282	6.49	0.00	32,484	0
530	13.53	8,118	129,665	(3,609)	(825)	60,966	7.02	0.00	36,094	0
540	13.08	7,846	137,511	(3,609)	(825)	64,377	7.57	0.00	39,703	0
550	12.66	7,598	145,109	(3,609)	(825)	66,350	7.92	0.17	43,313	1,190
560	12.28	7,371	152,480	(3,609)	(825)	66,350	7.92	0.33	46,922	4,127
570	11.94	7,163	159,643	(3,609)	(825)	66,350	7.92	0.50	50,531	6,855
580	11.62	6,974	166,617	(3,609)	(825)	66,350	7.92	0.67	54,141	9,395
590	11.33	6,801	173,418	(3,609)	(825)	66,350	7.92	0.83	57,750	11,762
600	11.07	6,643	180,061	(3,609)	(825)	66,350	7.92	1.00	61,360	13,970
610	10.83	6,498	186,559	(3,609)	(825)	66,350	7.92	1.17	64,969	16,033
620	10.61	6,366	192,924	(3,609)	(825)	66,350	7.92	1.33	68,578	17,965
630	10.41	6,246	199,170	(3,609)	(825)	66,350	7.92	1.50	72,188	19,776
640	10.23	6,136	205,306	(3,609)	(825)	66,350	7.92	1.67	75,797	21,478

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	10.00	5,998	211,304	(3,609)	(825)	66,350	7.92	1.83	79,407	23,041
660	9.73	5,836	217,140	(3,609)	(825)	66,350	7.92	2.00	83,016	24,443
670	9.48	5,688	222,827	(3,609)	(825)	66,350	7.92	2.17	86,625	25,696
680	9.25	5,551	228,378	(3,609)	(825)	66,350	7.92	2.33	90,235	26,812
690	9.04	5,426	233,805	(3,609)	(825)	66,350	7.92	2.50	93,844	27,804
700	8.85	5,313	239,117	(3,609)	(825)	66,350	7.92	2.67	97,453	28,683
710	8.68	5,208	244,326	(3,609)	(825)	66,350	7.92	2.83	101,063	29,457
720	8.52	5,113	249,439	(3,609)	(825)	66,350	7.92	3.00	104,672	30,136
730	8.38	5,026	254,465	(3,609)	(825)	66,350	7.92	3.17	108,282	30,727
740	8.24	4,946	259,411	(3,609)	(825)	66,350	7.92	3.33	111,891	31,239
750	8.12	4,874	264,285	(3,609)	(825)	66,350	7.92	3.50	115,500	31,679
760	8.01	4,808	269,093	(3,609)	(825)	66,350	7.92	3.67	119,110	32,052
770	7.85	4,712	273,805	(3,609)	(825)	66,350	7.92	3.83	122,719	32,330
780	7.65	4,588	278,393	(3,609)	(825)	66,350	7.92	4.00	126,329	32,483
790	7.46	4,475	282,868	(3,609)	(825)	66,350	7.92	4.17	129,938	32,524
800	7.29	4,372	287,241	(3,609)	(825)	66,288	7.91	4.17	133,547	32,524
810	7.13	4,277	291,518	(3,609)	(825)	66,131	7.88	4.17	137,157	32,524
820	6.98	4,191	295,708	(3,609)	(825)	65,887	7.84	4.17	140,766	32,524
830	6.85	4,111	299,820	(3,609)	(825)	65,564	7.78	4.17	144,375	32,524
840	6.73	4,038	303,858	(3,609)	(825)	65,168	7.71	4.17	147,985	32,524
850	6.62	3,972	307,829	(3,609)	(825)	64,705	7.63	4.17	151,594	32,524
860	6.52	3,911	311,741	(3,609)	(825)	64,182	7.54	4.17	155,204	32,524
870	6.43	3,856	315,596	(3,609)	(825)	63,604	7.44	4.17	158,813	32,524
880	6.34	3,805	319,401	(3,609)	(825)	62,974	7.34	4.17	162,422	32,524
890	6.24	3,743	323,144	(3,609)	(825)	62,282	7.23	4.17	166,032	32,524
900	6.12	3,670	326,814	(3,609)	(825)	61,518	7.11	4.17	169,641	32,524
910	6.01	3,603	330,418	(3,609)	(825)	60,687	6.98	4.17	173,251	32,524
920	5.90	3,542	333,959	(3,609)	(825)	59,794	6.85	4.17	176,860	32,524
930	5.81	3,487	337,446	(3,609)	(825)	58,847	6.71	4.17	180,469	32,524
940	5.73	3,435	340,881	(3,609)	(825)	57,847	6.57	4.17	184,079	32,524
950	5.65	3,388	344,269	(3,609)	(825)	56,801	6.42	4.17	187,688	32,524
960	5.58	3,345	347,614	(3,609)	(825)	55,712	6.28	4.17	191,298	32,524
970	5.51	3,307	350,921	(3,609)	(825)	54,584	6.14	4.17	194,907	32,524
980	5.45	3,271	354,192	(3,609)	(825)	53,421	5.99	4.17	198,516	32,524
990	5.40	3,238	357,430	(3,609)	(825)	52,225	5.85	4.17	202,126	32,524
1000	5.35	3,208	360,638	(3,609)	(825)	50,998	5.71	4.17	205,735	32,524
1010	5.26	3,156	363,794	(3,609)	(825)	49,720	5.57	4.17	209,344	32,524
1020	5.14	3,084	366,878	(3,609)	(825)	48,370	5.42	4.17	212,954	32,524
1030	5.03	3,020	369,898	(3,609)	(825)	46,955	5.27	4.17	216,563	32,524
1040	4.93	2,960	372,858	(3,609)	(825)	45,481	5.12	4.17	220,173	32,524
1050	4.84	2,905	375,763	(3,609)	(825)	43,951	4.97	4.17	223,782	32,524
1060	4.76	2,854	378,617	(3,609)	(825)	42,371	4.82	4.17	227,391	32,524
1070	4.68	2,808	381,425	(3,609)	(825)	40,744	4.67	4.17	231,001	32,524
1080	4.61	2,765	384,190	(3,609)	(825)	39,075	4.52	4.17	234,610	32,524
1090	4.54	2,726	386,916	(3,609)	(825)	37,367	4.37	4.17	238,220	32,524
1100	4.49	2,691	389,608	(3,609)	(825)	35,624	4.22	4.17	241,829	32,524
1110	4.43	2,659	392,267	(3,609)	(825)	33,849	4.07	4.17	245,438	32,524
1120	4.38	2,629	394,896	(3,609)	(825)	32,044	3.91	4.17	249,048	32,524
1130	4.34	2,602	397,498	0	(825)	33,820	4.06	4.17	249,048	32,524
1140	4.29	2,576	400,075	(3,609)	(825)	31,963	3.90	4.17	252,657	32,524
1150	4.26	2,553	402,628	0	(825)	33,691	4.05	4.17	252,657	32,524
1160	4.22	2,533	405,161	(3,609)	(825)	31,790	3.89	4.17	256,266	32,524
1170	4.19	2,515	407,676	0	(825)	33,479	4.04	4.17	256,266	32,524
1180	4.16	2,497	410,173	(3,609)	(825)	31,542	3.87	4.17	259,876	32,524
1190	4.13	2,480	412,653	0	(825)	33,197	4.01	4.17	259,876	32,524
1200	4.11	2,466	415,118	(3,609)	(825)	31,228	3.84	4.17	263,485	32,524
1210	4.09	2,453	417,571	0	(825)	32,856	3.98	4.17	263,485	32,524
1220	4.07	2,441	420,012	0	(825)	34,472	4.12	4.17	263,485	32,524
1230	4.05	2,429	422,441	(3,609)	(825)	32,467	3.95	4.17	267,095	32,524
1240	4.03	2,419	424,860	0	(825)	34,061	4.09	4.17	267,095	32,524
1250	4.02	2,410	427,271	(3,609)	(825)	32,037	3.91	4.17	270,704	32,524
1260	4.00	2,402	429,673	0	(825)	33,614	4.05	4.17	270,704	32,524
1270	3.99	2,394	432,066	(3,609)	(825)	31,573	3.87	4.17	274,313	32,524
1280	3.98	2,387	434,453	0	(825)	33,135	4.01	4.17	274,313	32,524
1290	3.97	2,381	436,834	(3,609)	(825)	31,081	3.83	4.17	277,923	32,524
1300	3.96	2,375	439,209	0	(825)	32,631	3.96	4.17	277,923	32,524
1310	3.95	2,369	441,578	0	(825)	34,175	4.10	4.17	277,923	32,524
1320	3.94	2,365	443,943	(3,609)	(825)	32,106	3.92	4.17	281,532	32,524
1330	3.93	2,361	446,304	0	(825)	33,642	4.05	4.17	281,532	32,524
1340	3.93	2,356	448,660	(3,609)	(825)	31,564	3.87	4.17	285,142	32,524
1350	3.92	2,352	451,013	0	(825)	33,091	4.00	4.17	285,142	32,524
1360	3.92	2,349	453,362	(3,609)	(825)	31,006	3.82	4.17	288,751	32,524
1370	3.91	2,347	455,709	0	(825)	32,528	3.95	4.17	288,751	32,524
1380	3.91	2,343	458,052	0	(825)	34,046	4.08	4.17	288,751	32,524
1390	3.90	2,341	460,393	(3,609)	(825)	31,953	3.90	4.17	292,360	32,524
1400	3.90	2,340	462,733	0	(825)	33,467	4.03	4.17	292,360	32,524
1410	3.89	2,337	465,070	(3,609)	(825)	31,370	3.85	4.17	295,970	32,524
1420	3.89	2,336	467,405	0	(825)	32,880	3.98	4.17	295,970	32,524
1430	3.89	2,334	469,739	0	(825)	34,390	4.11	4.17	295,970	32,524
1440	3.89	2,332	472,072	(3,609)	(825)	32,288	3.93	4.17	299,579	32,524

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 26 - Alternative 3

No Bioretention | **25-Year SBUH Hydrology** | **Future Land Use**

Pump Information			Infiltration Information			Pond Information		
Pump Rate	1,800	gpm	Infiltration Rate[2]	5.5	in/hr	Pond Overtop Elevation	8	ft
Pumped vol. / 15 min.	27,000	gal	Infiltration vol. / 10 min.	825.00	cf	Pond Overtop Volume	66,350	cf
	3,609	cf				Time Pond Overtopped	10.00	hr
Pump on height[1]	4	ft				Volume Flooding	5.02	ac-ft

1 - Height measured from bottom of pond

2 - Infiltration rate assumed based on Hydrologic Soil Group A

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0.00	0	0	0	(825)	0	0.06	0.00	0	0
20	0.00	0	0	0	(825)	0	0.06	0.00	0	0
30	0.00	0	0	0	(825)	0	0.06	0.00	0	0
40	0.02	10	10	0	(825)	0	0.06	0.00	0	0
50	0.07	41	51	0	(825)	0	0.06	0.00	0	0
60	0.16	94	145	0	(825)	0	0.06	0.00	0	0
70	0.27	163	307	0	(825)	0	0.06	0.00	0	0
80	0.41	245	552	0	(825)	0	0.06	0.00	0	0
90	0.56	335	887	0	(825)	0	0.06	0.00	0	0
100	0.72	429	1,316	0	(825)	0	0.06	0.00	0	0
110	0.91	545	1,861	0	(825)	0	0.06	0.00	0	0
120	1.14	682	2,543	0	(825)	0	0.06	0.00	0	0
130	1.37	820	3,363	0	(825)	0	0.06	0.00	0	0
140	1.60	958	4,320	0	(825)	133	0.09	0.00	0	0
150	1.82	1,092	5,413	0	(825)	400	0.14	0.00	0	0
160	2.04	1,225	6,638	0	(825)	800	0.21	0.00	0	0
170	2.30	1,380	8,018	0	(825)	1,355	0.31	0.00	0	0
180	2.59	1,557	9,575	0	(825)	2,087	0.44	0.00	0	0
190	2.88	1,730	11,305	0	(825)	2,992	0.59	0.00	0	0
200	3.16	1,898	13,203	0	(825)	4,065	0.76	0.00	0	0
210	3.43	2,060	15,263	0	(825)	5,300	0.96	0.00	0	0
220	3.70	2,218	17,480	0	(825)	6,693	1.17	0.00	0	0
230	4.00	2,397	19,878	0	(825)	8,265	1.40	0.00	0	0
240	4.33	2,597	22,475	0	(825)	10,037	1.64	0.00	0	0
250	4.65	2,789	25,264	0	(825)	12,001	1.90	0.00	0	0
260	4.95	2,972	28,236	0	(825)	14,148	2.16	0.00	0	0
270	5.24	3,146	31,382	0	(825)	16,469	2.43	0.00	0	0
280	5.52	3,312	34,694	0	(825)	18,956	2.69	0.00	0	0
290	5.84	3,507	38,201	0	(825)	21,638	2.97	0.00	0	0
300	6.22	3,729	41,930	0	(825)	24,543	3.24	0.00	0	0
310	6.57	3,939	45,870	0	(825)	27,657	3.53	0.00	0	0
320	6.90	4,137	50,007	0	(825)	30,969	3.82	0.00	0	0
330	7.21	4,324	54,331	0	(825)	34,468	4.12	0.00	0	0
340	7.50	4,500	58,831	(3,609)	(825)	34,534	4.13	0.00	3,609	0
350	7.85	4,710	63,541	(3,609)	(825)	34,810	4.15	0.00	7,219	0
360	8.25	4,951	68,492	(3,609)	(825)	35,326	4.20	0.00	10,828	0
370	8.63	5,177	73,669	(3,609)	(825)	36,069	4.26	0.00	14,438	0
380	8.98	5,388	79,058	(3,609)	(825)	37,023	4.34	0.00	18,047	0
390	9.31	5,586	84,644	(3,609)	(825)	38,175	4.44	0.00	21,656	0
400	9.62	5,772	90,416	(3,609)	(825)	39,513	4.56	0.00	25,266	0
410	10.14	6,082	96,498	(3,609)	(825)	41,160	4.71	0.00	28,875	0
420	10.84	6,504	103,002	(3,609)	(825)	43,230	4.91	0.00	32,484	0
430	11.50	6,898	109,900	(3,609)	(825)	45,693	5.14	0.00	36,094	0
440	12.38	7,426	117,326	(3,609)	(825)	48,685	5.45	0.00	39,703	0
450	13.47	8,081	125,407	(3,609)	(825)	52,331	5.86	0.00	43,313	0
460	15.44	9,261	134,668	(3,609)	(825)	57,158	6.47	0.00	46,922	0
470	19.43	11,657	146,325	(3,609)	(825)	64,381	7.57	0.00	50,531	0
480	22.71	13,625	159,950	(3,609)	(825)	66,350	7.92	0.17	54,141	7,221
490	23.56	14,137	174,087	(3,609)	(825)	66,350	7.92	0.33	57,750	16,923
500	23.52	14,114	188,200	(3,609)	(825)	66,350	7.92	0.50	61,360	26,603
510	23.21	13,927	202,128	(3,609)	(825)	66,350	7.92	0.67	64,969	36,095
520	22.93	13,758	215,886	(3,609)	(825)	66,350	7.92	0.83	68,578	45,419
530	22.39	13,435	229,320	(3,609)	(825)	66,350	7.92	1.00	72,188	54,419
540	21.62	12,970	242,291	(3,609)	(825)	66,350	7.92	1.17	75,797	62,955
550	20.91	12,544	254,835	(3,609)	(825)	66,350	7.92	1.33	79,407	71,065
560	20.26	12,154	266,989	(3,609)	(825)	66,350	7.92	1.50	83,016	78,785
570	19.66	11,797	278,787	(3,609)	(825)	66,350	7.92	1.67	86,625	86,148
580	19.12	11,471	290,258	(3,609)	(825)	66,350	7.92	1.83	90,235	93,185
590	18.62	11,172	301,430	(3,609)	(825)	66,350	7.92	2.00	93,844	99,922
600	18.17	10,899	312,329	(3,609)	(825)	66,350	7.92	2.17	97,453	106,387
610	17.75	10,649	322,978	(3,609)	(825)	66,350	7.92	2.33	101,063	112,602
620	17.37	10,420	333,398	(3,609)	(825)	66,350	7.92	2.50	104,672	118,588
630	17.02	10,211	343,609	(3,609)	(825)	66,350	7.92	2.67	108,282	124,364
640	16.70	10,020	353,629	(3,609)	(825)	66,350	7.92	2.83	111,891	129,950

Time	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	16.31	9,785	363,414	(3,609)	(825)	66,350	7.92	3.00	115,500	135,300
660	15.85	9,511	372,924	(3,609)	(825)	66,350	7.92	3.17	119,110	140,376
670	15.43	9,260	382,185	(3,609)	(825)	66,350	7.92	3.33	122,719	145,202
680	15.05	9,030	391,214	(3,609)	(825)	66,350	7.92	3.50	126,329	149,797
690	14.70	8,818	400,032	(3,609)	(825)	66,350	7.92	3.67	129,938	154,181
700	14.37	8,625	408,657	(3,609)	(825)	66,350	7.92	3.83	133,547	158,372
710	14.08	8,448	417,105	(3,609)	(825)	66,350	7.92	4.00	137,157	162,385
720	13.81	8,286	425,391	(3,609)	(825)	66,350	7.92	4.17	140,766	166,237
730	13.56	8,139	433,530	(3,609)	(825)	66,350	7.92	4.33	144,375	169,941
740	13.34	8,002	441,532	(3,609)	(825)	66,350	7.92	4.50	147,985	173,509
750	13.13	7,879	449,411	(3,609)	(825)	66,350	7.92	4.67	151,594	176,954
760	12.94	7,765	457,176	(3,609)	(825)	66,350	7.92	4.83	155,204	180,284
770	12.68	7,606	464,782	(3,609)	(825)	66,350	7.92	5.00	158,813	183,456
780	12.34	7,404	472,186	(3,609)	(825)	66,350	7.92	5.17	162,422	186,426
790	12.03	7,219	479,406	(3,609)	(825)	66,350	7.92	5.33	166,032	189,211
800	11.75	7,050	486,456	(3,609)	(825)	66,350	7.92	5.50	169,641	191,827
810	11.49	6,894	493,350	(3,609)	(825)	66,350	7.92	5.67	173,251	194,287
820	11.25	6,751	500,102	(3,609)	(825)	66,350	7.92	5.83	176,860	196,604
830	11.04	6,621	506,723	(3,609)	(825)	66,350	7.92	6.00	180,469	198,791
840	10.84	6,502	513,225	(3,609)	(825)	66,350	7.92	6.17	184,079	200,858
850	10.65	6,393	519,618	(3,609)	(825)	66,350	7.92	6.33	187,688	202,816
860	10.49	6,293	525,910	(3,609)	(825)	66,350	7.92	6.50	191,298	204,675
870	10.34	6,201	532,111	(3,609)	(825)	66,350	7.92	6.67	194,907	206,441
880	10.20	6,117	538,229	(3,609)	(825)	66,350	7.92	6.83	198,516	208,124
890	10.02	6,013	544,242	(3,609)	(825)	66,350	7.92	7.00	202,126	209,703
900	9.82	5,891	550,133	(3,609)	(825)	66,350	7.92	7.17	205,735	211,160
910	9.63	5,779	555,912	(3,609)	(825)	66,350	7.92	7.33	209,344	212,505
920	9.46	5,677	561,589	(3,609)	(825)	66,350	7.92	7.50	212,954	213,747
930	9.30	5,582	567,171	(3,609)	(825)	66,350	7.92	7.67	216,563	214,895
940	9.16	5,497	572,669	(3,609)	(825)	66,350	7.92	7.83	220,173	215,958
950	9.03	5,419	578,088	(3,609)	(825)	66,350	7.92	8.00	223,782	216,943
960	8.91	5,347	583,434	(3,609)	(825)	66,350	7.92	8.17	227,391	217,855
970	8.80	5,280	588,715	(3,609)	(825)	66,350	7.92	8.33	231,001	218,701
980	8.70	5,219	593,934	(3,609)	(825)	66,350	7.92	8.50	234,610	219,485
990	8.61	5,164	599,097	(3,609)	(825)	66,350	7.92	8.67	238,220	220,215
1000	8.52	5,113	604,211	(3,609)	(825)	66,350	7.92	8.83	241,829	220,894
1010	8.38	5,030	609,240	(3,609)	(825)	66,350	7.92	9.00	245,438	221,489
1020	8.19	4,914	614,154	(3,609)	(825)	66,350	7.92	9.17	249,048	221,968
1030	8.01	4,809	618,963	(3,609)	(825)	66,350	7.92	9.33	252,657	222,343
1040	7.85	4,712	623,676	(3,609)	(825)	66,350	7.92	9.50	256,266	222,621
1050	7.71	4,624	628,300	(3,609)	(825)	66,350	7.92	9.67	259,876	222,811
1060	7.57	4,543	632,843	(3,609)	(825)	66,350	7.92	9.83	263,485	222,920
1070	7.45	4,468	637,311	(3,609)	(825)	66,350	7.92	10.00	267,095	222,954
1080	7.33	4,400	641,712	(3,609)	(825)	66,316	7.91	10.00	270,704	222,954
1090	7.23	4,338	646,049	(3,609)	(825)	66,220	7.90	10.00	274,313	222,954
1100	7.13	4,281	650,330	(3,609)	(825)	66,066	7.87	10.00	277,923	222,954
1110	7.05	4,229	654,559	(3,609)	(825)	65,860	7.83	10.00	281,532	222,954
1120	6.97	4,181	658,740	(3,609)	(825)	65,607	7.79	10.00	285,142	222,954
1130	6.89	4,137	662,877	(3,609)	(825)	65,309	7.73	10.00	288,751	222,954
1140	6.83	4,096	666,972	(3,609)	(825)	64,971	7.67	10.00	292,360	222,954
1150	6.77	4,059	671,031	(3,609)	(825)	64,595	7.61	10.00	295,970	222,954
1160	6.71	4,025	675,057	(3,609)	(825)	64,186	7.54	10.00	299,579	222,954
1170	6.66	3,994	679,051	(3,609)	(825)	63,746	7.47	10.00	303,189	222,954
1180	6.61	3,966	683,017	(3,609)	(825)	63,278	7.39	10.00	306,798	222,954
1190	6.57	3,940	686,957	(3,609)	(825)	62,783	7.31	10.00	310,407	222,954
1200	6.53	3,916	690,873	(3,609)	(825)	62,265	7.22	10.00	314,017	222,954
1210	6.49	3,895	694,768	(3,609)	(825)	61,726	7.14	10.00	317,626	222,954
1220	6.46	3,875	698,643	(3,609)	(825)	61,166	7.05	10.00	321,235	222,954
1230	6.43	3,857	702,499	(3,609)	(825)	60,588	6.96	10.00	324,845	222,954
1240	6.40	3,840	706,339	(3,609)	(825)	59,994	6.87	10.00	328,454	222,954
1250	6.37	3,825	710,164	(3,609)	(825)	59,384	6.79	10.00	332,064	222,954
1260	6.35	3,811	713,975	(3,609)	(825)	58,760	6.70	10.00	335,673	222,954
1270	6.33	3,798	717,773	(3,609)	(825)	58,124	6.61	10.00	339,282	222,954
1280	6.31	3,786	721,559	(3,609)	(825)	57,476	6.52	10.00	342,892	222,954
1290	6.29	3,776	725,334	(3,609)	(825)	56,817	6.43	10.00	346,501	222,954
1300	6.28	3,766	729,100	(3,609)	(825)	56,148	6.34	10.00	350,111	222,954
1310	6.26	3,757	732,857	(3,609)	(825)	55,471	6.25	10.00	353,720	222,954
1320	6.25	3,749	736,606	(3,609)	(825)	54,785	6.16	10.00	357,329	222,954
1330	6.24	3,741	740,347	(3,609)	(825)	54,092	6.07	10.00	360,939	222,954
1340	6.22	3,735	744,082	(3,609)	(825)	53,393	5.99	10.00	364,548	222,954
1350	6.21	3,728	747,810	(3,609)	(825)	52,687	5.90	10.00	368,157	222,954
1360	6.20	3,723	751,533	(3,609)	(825)	51,975	5.82	10.00	371,767	222,954
1370	6.20	3,718	755,251	(3,609)	(825)	51,258	5.74	10.00	375,376	222,954
1380	6.19	3,713	758,964	(3,609)	(825)	50,537	5.66	10.00	378,986	222,954
1390	6.18	3,709	762,672	(3,609)	(825)	49,811	5.58	10.00	382,595	222,954
1400	6.17	3,705	766,377	(3,609)	(825)	49,081	5.50	10.00	386,204	222,954
1410	6.17	3,701	770,078	(3,609)	(825)	48,348	5.42	10.00	389,814	222,954
1420	6.16	3,699	773,777	(3,609)	(825)	47,612	5.34	10.00	393,423	222,954
1430	6.16	3,696	777,473	(3,609)	(825)	46,874	5.26	10.00	397,033	222,954
1440	6.16	3,693	781,166	(3,609)	(825)	46,132	5.19	10.00	400,642	222,954

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 30

10-Year SBUH Hydrology | **Future Land Use**

Pump Information		
Pump Rate	450	gpm
Pumped vol. / 15 min.	6,750	gal
	902	cf
Pump on elevation	405	ft

Infiltration Information		
Infiltration Rate[1]	5.5	in/hr
Infiltration vol. / 10 min.	364.45	cf

Pond Information		
Pond Overtop Elevation	412	ft
Pond Overtop Volume	68,174	cf
Time Pond Overtopped	13.83	hr
Volume Flooding	1.10	ac-ft

1 - Infiltration rate assumed based on Hydrologic Soil Group A

Date	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0	0	0	0	(364)	0	403.00	0.00	0	0
20	0	0	0	0	(364)	0	403.00	0.00	0	0
30	0	0	0	0	(364)	0	403.00	0.00	0	0
40	0	0	0	0	(364)	0	403.00	0.00	0	0
50	0.000836378	1	1	0	(364)	0	403.00	0.00	0	0
60	0.007451505	4	5	0	(364)	0	403.00	0.00	0	0
70	0.024339276	15	20	0	(364)	0	403.00	0.00	0	0
80	0.049731163	30	49	0	(364)	0	403.00	0.00	0	0
90	0.082019112	49	99	0	(364)	0	403.00	0.00	0	0
100	0.120577368	72	171	0	(364)	0	403.00	0.00	0	0
110	0.169855221	102	273	0	(364)	0	403.00	0.00	0	0
120	0.230552717	138	411	0	(364)	0	403.00	0.00	0	0
130	0.294942602	177	588	0	(364)	0	403.00	0.00	0	0
140	0.36101707	217	805	0	(364)	0	403.00	0.00	0	0
150	0.429459636	258	1,062	0	(364)	0	403.00	0.00	0	0
160	0.497546285	299	1,361	0	(364)	0	403.00	0.00	0	0
170	0.576182221	346	1,707	0	(364)	0	403.00	0.00	0	0
180	0.666082945	400	2,106	0	(364)	35	403.01	0.00	0	0
190	0.753680612	452	2,559	0	(364)	123	403.02	0.00	0	0
200	0.838347826	503	3,062	0	(364)	262	403.05	0.00	0	0
210	0.921186878	553	3,614	0	(364)	450	403.09	0.00	0	0
220	1.002253586	601	4,216	0	(364)	687	403.14	0.00	0	0
230	1.096906582	658	4,874	0	(364)	980	403.20	0.00	0	0
240	1.204639337	723	5,597	0	(364)	1,339	403.27	0.00	0	0
250	1.310519782	786	6,383	0	(364)	1,761	403.35	0.00	0	0
260	1.413516467	848	7,231	0	(364)	2,244	403.44	0.00	0	0
270	1.513417844	908	8,139	0	(364)	2,788	403.55	0.00	0	0
280	1.610141631	966	9,105	0	(364)	3,389	403.67	0.00	0	0
290	1.724192241	1,035	10,140	0	(364)	4,060	403.80	0.00	0	0
300	1.8555601	1,113	11,253	0	(364)	4,808	403.94	0.00	0	0
310	1.981258216	1,189	12,442	0	(364)	5,633	404.09	0.00	0	0
320	2.101801068	1,261	13,703	0	(364)	6,529	404.26	0.00	0	0
330	2.216820073	1,330	15,033	0	(364)	7,495	404.44	0.00	0	0
340	2.325980095	1,396	16,428	0	(364)	8,526	404.63	0.00	0	0
350	2.455663359	1,473	17,902	0	(364)	9,635	404.83	0.00	0	0
360	2.604007561	1,562	19,464	0	(364)	10,833	405.05	0.00	0	0
370	2.744668341	1,647	21,111	(902)	(364)	11,213	405.12	0.00	902	0
380	2.87797975	1,727	22,838	(902)	(364)	11,673	405.20	0.00	1,805	0
390	3.0037723	1,802	24,640	(902)	(364)	12,208	405.29	0.00	2,707	0
400	3.123091415	1,874	26,514	(902)	(364)	12,816	405.40	0.00	3,609	0
410	3.317707757	1,991	28,505	(902)	(364)	13,539	405.52	0.00	4,512	0
420	3.583550977	2,150	30,655	(902)	(364)	14,423	405.68	0.00	5,414	0
430	3.833337764	2,300	32,955	(902)	(364)	15,456	405.85	0.00	6,316	0
440	4.166864933	2,500	35,455	(902)	(364)	16,689	406.06	0.00	7,219	0
450	4.57965915	2,748	38,203	(902)	(364)	18,170	406.30	0.00	8,121	0
460	5.327038484	3,196	41,399	(902)	(364)	20,100	406.62	0.00	9,023	0
470	6.853085239	4,112	45,511	(902)	(364)	22,945	407.06	0.00	9,926	0
480	8.11038021	4,866	50,377	(902)	(364)	26,544	407.60	0.00	10,828	0
490	8.434602005	5,061	55,438	(902)	(364)	30,338	408.15	0.00	11,731	0
500	8.415235709	5,049	60,487	(902)	(364)	34,120	408.66	0.00	12,633	0
510	8.292673007	4,976	65,462	(902)	(364)	37,829	409.13	0.00	13,535	0
520	8.18304756	4,910	70,372	(902)	(364)	41,472	409.57	0.00	14,438	0
530	7.974201104	4,785	75,157	(902)	(364)	44,990	409.97	0.00	15,340	0
540	7.674773922	4,605	79,762	(902)	(364)	48,328	410.33	0.00	16,242	0
550	7.40407981	4,442	84,204	(902)	(364)	51,504	410.65	0.00	17,145	0
560	7.158675115	4,295	88,499	(902)	(364)	54,532	410.93	0.00	18,047	0
570	6.936628199	4,162	92,661	(902)	(364)	57,427	411.19	0.00	18,949	0
580	6.736292774	4,042	96,703	(902)	(364)	60,202	411.42	0.00	19,852	0
590	6.55449918	3,933	100,636	(902)	(364)	62,868	411.62	0.00	20,754	0
600	6.389928064	3,834	104,470	(902)	(364)	65,435	411.81	0.00	21,656	0
610	6.241016637	3,745	108,214	(902)	(364)	67,913	411.97	0.00	22,559	0
620	6.10634392	3,664	111,878	(902)	(364)	68,174	411.99	0.17	23,461	2,136
630	5.985454251	3,591	115,469	(902)	(364)	68,174	411.99	0.33	24,363	4,461
640	5.876260565	3,526	118,995	(902)	(364)	68,174	411.99	0.50	25,266	6,720

Date	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	5.737423669	3,442	122,438	(902)	(364)	68,174	411.99	0.67	26,168	8,895
660	5.573306181	3,344	125,782	(902)	(364)	68,174	411.99	0.83	27,070	10,972
670	5.424444065	3,255	129,036	(902)	(364)	68,174	411.99	1.00	27,973	12,960
680	5.288616654	3,173	132,209	(902)	(364)	68,174	411.99	1.17	28,875	14,867
690	5.166313918	3,100	135,309	(902)	(364)	68,174	411.99	1.33	29,777	16,700
700	5.055472233	3,033	138,343	(902)	(364)	68,174	411.99	1.50	30,680	18,466
710	4.95505161	2,973	141,316	(902)	(364)	68,174	411.99	1.67	31,582	20,172
720	4.864106429	2,918	144,234	(902)	(364)	68,174	411.99	1.83	32,484	21,824
730	4.781776877	2,869	147,103	(902)	(364)	68,174	411.99	2.00	33,387	23,426
740	4.707281162	2,824	149,927	(902)	(364)	68,174	411.99	2.17	34,289	24,984
750	4.639908431	2,784	152,711	(902)	(364)	68,174	411.99	2.33	35,192	26,501
760	4.579848715	2,748	155,459	(902)	(364)	68,174	411.99	2.50	36,094	27,982
770	4.487360068	2,692	158,152	(902)	(364)	68,174	411.99	2.67	36,996	29,408
780	4.36502198	2,619	160,771	(902)	(364)	68,174	411.99	2.83	37,899	30,760
790	4.254621376	2,553	163,324	(902)	(364)	68,174	411.99	3.00	38,801	32,046
800	4.154601809	2,493	165,816	(902)	(364)	68,174	411.99	3.17	39,703	33,272
810	4.063184915	2,438	168,254	(902)	(364)	68,174	411.99	3.33	40,606	34,443
820	3.980899678	2,389	170,643	(902)	(364)	68,174	411.99	3.50	41,508	35,565
830	3.906444256	2,344	172,987	(902)	(364)	68,174	411.99	3.67	42,410	36,642
840	3.837908632	2,303	175,289	(902)	(364)	68,174	411.99	3.83	43,313	37,678
850	3.776428391	2,266	177,555	(902)	(364)	68,174	411.99	4.00	44,215	38,677
860	3.721253248	2,233	179,788	(902)	(364)	68,174	411.99	4.17	45,117	39,643
870	3.671084764	2,203	181,991	(902)	(364)	68,174	411.99	4.33	46,020	40,579
880	3.625468629	2,175	184,166	(902)	(364)	68,174	411.99	4.50	46,922	41,487
890	3.567088256	2,140	186,306	(902)	(364)	68,174	411.99	4.67	47,824	42,361
900	3.497938264	2,099	188,405	(902)	(364)	68,174	411.99	4.83	48,727	43,193
910	3.434589801	2,061	190,466	(902)	(364)	68,174	411.99	5.00	49,629	43,986
920	3.376989655	2,026	192,492	(902)	(364)	68,174	411.99	5.17	50,531	44,746
930	3.325452594	1,995	194,487	(902)	(364)	68,174	411.99	5.33	51,434	45,474
940	3.278118843	1,967	196,454	(902)	(364)	68,174	411.99	5.50	52,336	46,174
950	3.235080214	1,941	198,395	(902)	(364)	68,174	411.99	5.67	53,238	46,849
960	3.196783341	1,918	200,313	(902)	(364)	68,174	411.99	5.83	54,141	47,500
970	3.162324725	1,897	202,211	(902)	(364)	68,174	411.99	6.00	55,043	48,131
980	3.130992925	1,879	204,089	(902)	(364)	68,174	411.99	6.17	55,945	48,742
990	3.101667834	1,861	205,950	(902)	(364)	68,174	411.99	6.33	56,848	49,337
1000	3.07536689	1,845	207,795	(902)	(364)	68,174	411.99	6.50	57,750	49,915
1010	3.026152308	1,816	209,611	(902)	(364)	68,174	411.99	6.67	58,653	50,464
1020	2.955266922	1,773	211,384	(902)	(364)	68,174	411.99	6.83	59,555	50,970
1030	2.891650139	1,735	213,119	(902)	(364)	68,174	411.99	7.00	60,457	51,438
1040	2.83380602	1,700	214,819	(902)	(364)	68,174	411.99	7.17	61,360	51,872
1050	2.780374369	1,668	216,488	(902)	(364)	68,174	411.99	7.33	62,262	52,273
1060	2.731791171	1,639	218,127	(902)	(364)	68,174	411.99	7.50	63,164	52,646
1070	2.687979624	1,613	219,740	(902)	(364)	68,174	411.99	7.67	64,067	52,992
1080	2.64814359	1,589	221,328	(902)	(364)	68,174	411.99	7.83	64,969	53,314
1090	2.611922327	1,567	222,896	(902)	(364)	68,174	411.99	8.00	65,871	53,614
1100	2.579824202	1,548	224,443	(902)	(364)	68,174	411.99	8.17	66,774	53,895
1110	2.550638699	1,530	225,974	(902)	(364)	68,174	411.99	8.33	67,676	54,159
1120	2.523628301	1,514	227,488	(902)	(364)	68,174	411.99	8.50	68,578	54,406
1130	2.499068858	1,499	228,987	(902)	(364)	68,174	411.99	8.67	69,481	54,639
1140	2.476374816	1,486	230,473	(902)	(364)	68,174	411.99	8.83	70,383	54,858
1150	2.456103212	1,474	231,947	(902)	(364)	68,174	411.99	9.00	71,285	55,065
1160	2.438870609	1,463	233,410	(902)	(364)	68,174	411.99	9.17	72,188	55,261
1170	2.422838559	1,454	234,864	(902)	(364)	68,174	411.99	9.33	73,090	55,448
1180	2.4074249	1,444	236,308	(902)	(364)	68,174	411.99	9.50	73,992	55,626
1190	2.393773048	1,436	237,745	(902)	(364)	68,174	411.99	9.67	74,895	55,795
1200	2.381359982	1,429	239,174	(902)	(364)	68,174	411.99	9.83	75,797	55,957
1210	2.37090967	1,423	240,596	(902)	(364)	68,174	411.99	10.00	76,699	56,113
1220	2.361407632	1,417	242,013	(902)	(364)	68,174	411.99	10.17	77,602	56,263
1230	2.351931442	1,411	243,424	(902)	(364)	68,174	411.99	10.33	78,504	56,407
1240	2.343678287	1,406	244,830	(902)	(364)	68,174	411.99	10.50	79,407	56,547
1250	2.337010411	1,402	246,232	(902)	(364)	68,174	411.99	10.67	80,309	56,682
1260	2.330584432	1,398	247,631	(902)	(364)	68,174	411.99	10.83	81,211	56,814
1270	2.324268331	1,395	249,025	(902)	(364)	68,174	411.99	11.00	82,114	56,941
1280	2.318888513	1,391	250,417	(902)	(364)	68,174	411.99	11.17	83,016	57,066
1290	2.314470091	1,389	251,805	(902)	(364)	68,174	411.99	11.33	83,918	57,188
1300	2.310452602	1,386	253,192	(902)	(364)	68,174	411.99	11.50	84,821	57,307
1310	2.30632644	1,384	254,575	(902)	(364)	68,174	411.99	11.67	85,723	57,424
1320	2.303411068	1,382	255,958	(902)	(364)	68,174	411.99	11.83	86,625	57,540
1330	2.300760241	1,380	257,338	(902)	(364)	68,174	411.99	12.00	87,528	57,653
1340	2.297513576	1,379	258,716	(902)	(364)	68,174	411.99	12.17	88,430	57,765
1350	2.294561517	1,377	260,093	(902)	(364)	68,174	411.99	12.33	89,332	57,875
1360	2.292713709	1,376	261,469	(902)	(364)	68,174	411.99	12.50	90,235	57,984
1370	2.291033574	1,375	262,843	(902)	(364)	68,174	411.99	12.67	91,137	58,092
1380	2.288669518	1,373	264,217	(902)	(364)	68,174	411.99	12.83	92,039	58,198
1390	2.28771951	1,373	265,589	(902)	(364)	68,174	411.99	13.00	92,942	58,304
1400	2.286855707	1,372	266,961	(902)	(364)	68,174	411.99	13.17	93,844	58,409
1410	2.285233909	1,371	268,333	(902)	(364)	68,174	411.99	13.33	94,746	58,513
1420	2.284595653	1,371	269,703	(902)	(364)	68,174	411.99	13.50	95,649	58,617
1430	2.284015313	1,370	271,074	(902)	(364)	68,174	411.99	13.67	96,551	58,721
1440	2.283014409	1,370	272,444	(902)	(364)	68,174	411.99	13.83	97,453	58,824

Data extracted from MGS Flood

Spreadsheet Inputs

Output

Pump Station 30

25-Year SBUH Hydrology | Future Land Use

Pump Information			Infiltration Information			Pond Information		
Pump Rate	450	gpm	Infiltration Rate[1]	5.5	in/hr	Pond Overtop Elevation	412	ft
Pumped vol. / 15 min.	6,750	gal	Infiltration vol. / 10 min.	364.45	cf	Pond Overtop Volume	68,174	cf
	902	cf				Time Pond Overtopped	15.83	hr
Pump on elevation	405	ft				Volume Flooding	4.13	ac-ft

1 - Infiltration rate assumed based on Hydrologic Soil Group A

Date	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
10	0	0	0	0	(364)	0	403.00	0.00	0	0
20	0	0	0	0	(364)	0	403.00	0.00	0	0
30	0	0	0	0	(364)	0	403.00	0.00	0	0
40	0.009200154	6	6	0	(364)	0	403.00	0.00	0	0
50	0.039311293	24	29	0	(364)	0	403.00	0.00	0	0
60	0.089272307	54	83	0	(364)	0	403.00	0.00	0	0
70	0.154772861	93	176	0	(364)	0	403.00	0.00	0	0
80	0.231893746	139	315	0	(364)	0	403.00	0.00	0	0
90	0.316235007	190	504	0	(364)	0	403.00	0.00	0	0
100	0.404632328	243	747	0	(364)	0	403.00	0.00	0	0
110	0.51260883	308	1,055	0	(364)	0	403.00	0.00	0	0
120	0.64006063	384	1,439	0	(364)	20	403.00	0.00	0	0
130	0.768492964	461	1,900	0	(364)	116	403.02	0.00	0	0
140	0.895307724	537	2,437	0	(364)	289	403.06	0.00	0	0
150	1.018978935	611	3,048	0	(364)	536	403.11	0.00	0	0
160	1.140771235	684	3,733	0	(364)	856	403.17	0.00	0	0
170	1.285143009	771	4,504	0	(364)	1,263	403.25	0.00	0	0
180	1.451608052	871	5,375	0	(364)	1,769	403.35	0.00	0	0
190	1.615216244	969	6,344	0	(364)	2,374	403.47	0.00	0	0
200	1.774917218	1,065	7,409	0	(364)	3,074	403.61	0.00	0	0
210	1.929865989	1,158	8,567	0	(364)	3,868	403.76	0.00	0	0
220	2.080603848	1,248	9,815	0	(364)	4,752	403.93	0.00	0	0
230	2.254199851	1,353	11,168	0	(364)	5,740	404.11	0.00	0	0
240	2.448942975	1,469	12,637	0	(364)	6,845	404.32	0.00	0	0
250	2.636117282	1,582	14,219	0	(364)	8,062	404.55	0.00	0	0
260	2.814846891	1,689	15,908	0	(364)	9,386	404.79	0.00	0	0
270	2.985061707	1,791	17,699	0	(364)	10,813	405.05	0.00	0	0
280	3.147061148	1,888	19,587	(902)	(364)	11,434	405.16	0.00	902	0
290	3.340129936	2,004	21,591	(902)	(364)	12,172	405.29	0.00	1,805	0
300	3.561338729	2,137	23,728	(902)	(364)	13,042	405.44	0.00	2,707	0
310	3.770068046	2,262	25,990	(902)	(364)	14,037	405.61	0.00	3,609	0
320	3.966723981	2,380	28,370	(902)	(364)	15,150	405.80	0.00	4,512	0
330	4.15240209	2,491	30,861	(902)	(364)	16,375	406.01	0.00	5,414	0
340	4.327735359	2,597	33,458	(902)	(364)	17,705	406.23	0.00	6,316	0
350	4.537979252	2,723	36,181	(902)	(364)	19,161	406.46	0.00	7,219	0
360	4.780692244	2,868	39,049	(902)	(364)	20,762	406.72	0.00	8,121	0
370	5.008138064	3,005	42,054	(902)	(364)	22,500	406.99	0.00	9,023	0
380	5.220975767	3,133	45,187	(902)	(364)	24,366	407.28	0.00	9,926	0
390	5.419804606	3,252	48,439	(902)	(364)	26,351	407.58	0.00	10,828	0
400	5.606258914	3,364	51,802	(902)	(364)	28,448	407.88	0.00	11,731	0
410	5.922368283	3,553	55,356	(902)	(364)	30,735	408.20	0.00	12,633	0
420	6.35698389	3,814	59,170	(902)	(364)	33,282	408.55	0.00	13,535	0
430	6.760371462	4,056	63,226	(902)	(364)	36,072	408.91	0.00	14,438	0
440	7.305896494	4,384	67,610	(902)	(364)	39,188	409.30	0.00	15,340	0
450	7.982950253	4,790	72,400	(902)	(364)	42,711	409.72	0.00	16,242	0
460	9.21629356	5,530	77,929	(902)	(364)	46,974	410.19	0.00	17,145	0
470	11.73747703	7,042	84,972	(902)	(364)	52,750	410.77	0.00	18,047	0
480	13.79408304	8,276	93,248	(902)	(364)	59,760	411.38	0.00	18,949	0
490	14.29293812	8,576	101,824	(902)	(364)	67,069	411.92	0.00	19,852	0
500	14.22291401	8,534	110,358	(902)	(364)	68,174	411.99	0.17	20,754	6,161
510	13.98399115	8,390	118,748	(902)	(364)	68,174	411.99	0.33	21,656	13,285
520	13.76892737	8,261	127,010	(902)	(364)	68,174	411.99	0.50	22,559	20,280
530	13.39427424	8,037	135,046	(902)	(364)	68,174	411.99	0.67	23,461	27,049
540	12.87462317	7,725	142,771	(902)	(364)	68,174	411.99	0.83	24,363	33,507
550	12.40201579	7,441	150,212	(902)	(364)	68,174	411.99	1.00	25,266	39,682
560	11.97301969	7,184	157,396	(902)	(364)	68,174	411.99	1.17	26,168	45,599
570	11.5845139	6,951	164,347	(902)	(364)	68,174	411.99	1.33	27,070	51,283
580	11.2319879	6,739	171,086	(902)	(364)	68,174	411.99	1.50	27,973	56,755
590	10.91217685	6,547	177,633	(902)	(364)	68,174	411.99	1.67	28,875	62,036
600	10.62294852	6,374	184,007	(902)	(364)	68,174	411.99	1.83	29,777	67,143
610	10.36105458	6,217	190,224	(902)	(364)	68,174	411.99	2.00	30,680	72,092
620	10.12281514	6,074	196,297	(902)	(364)	68,174	411.99	2.17	31,582	76,899
630	9.907393365	5,944	202,242	(902)	(364)	68,174	411.99	2.33	32,484	81,577
640	9.712245531	5,827	208,069	(902)	(364)	68,174	411.99	2.50	33,387	86,137

Date	Flow	Storm		Volume Out		Pond			Cumulative Pumped Volume	Cumulative Volume Flooded
		Incremental Volume	Cumulative Volume	Pumping	Infiltration	Volume	Elevation	Cumulative Time Flood		
	(cfs)	(cf)	(cf)	(cf)	(cf)	(cf)	(ft)	(hr)	(cf)	(cf)
650	9.470900304	5,683	213,752	(902)	(364)	68,174	411.99	2.67	34,289	90,553
660	9.189222446	5,514	219,265	(902)	(364)	68,174	411.99	2.83	35,192	94,800
670	8.933467531	5,360	224,625	(902)	(364)	68,174	411.99	3.00	36,094	98,893
680	8.700446902	5,220	229,845	(902)	(364)	68,174	411.99	3.17	36,996	102,847
690	8.488934001	5,093	234,939	(902)	(364)	68,174	411.99	3.33	37,899	106,673
700	8.29697719	4,978	239,917	(902)	(364)	68,174	411.99	3.50	38,801	110,385
710	8.122801926	4,874	244,791	(902)	(364)	68,174	411.99	3.67	39,703	113,992
720	7.965631067	4,779	249,570	(902)	(364)	68,174	411.99	3.83	40,606	117,504
730	7.823085235	4,694	254,264	(902)	(364)	68,174	411.99	4.00	41,508	120,931
740	7.69300096	4,616	258,880	(902)	(364)	68,174	411.99	4.17	42,410	124,280
750	7.575920221	4,546	263,425	(902)	(364)	68,174	411.99	4.33	43,313	127,559
760	7.469826683	4,482	267,907	(902)	(364)	68,174	411.99	4.50	44,215	130,774
770	7.313526674	4,388	272,295	(902)	(364)	68,174	411.99	4.67	45,117	133,895
780	7.112049213	4,267	276,562	(902)	(364)	68,174	411.99	4.83	46,020	136,896
790	6.928854062	4,157	280,720	(902)	(364)	68,174	411.99	5.00	46,922	139,786
800	6.762645413	4,058	284,777	(902)	(364)	68,174	411.99	5.17	47,824	142,577
810	6.611045515	3,967	288,744	(902)	(364)	68,174	411.99	5.33	48,727	145,277
820	6.473201975	3,884	292,628	(902)	(364)	68,174	411.99	5.50	49,629	147,894
830	6.348702902	3,809	296,437	(902)	(364)	68,174	411.99	5.67	50,531	150,436
840	6.235501026	3,741	300,178	(902)	(364)	68,174	411.99	5.83	51,434	152,911
850	6.132934378	3,680	303,858	(902)	(364)	68,174	411.99	6.00	52,336	155,324
860	6.040037906	3,624	307,482	(902)	(364)	68,174	411.99	6.17	53,238	157,681
870	5.955570972	3,573	311,056	(902)	(364)	68,174	411.99	6.33	54,141	159,988
880	5.879131823	3,527	314,583	(902)	(364)	68,174	411.99	6.50	55,043	162,248
890	5.780730046	3,468	318,051	(902)	(364)	68,174	411.99	6.67	55,945	164,450
900	5.661995402	3,397	321,449	(902)	(364)	68,174	411.99	6.83	56,848	166,580
910	5.554398037	3,333	324,781	(902)	(364)	68,174	411.99	7.00	57,750	168,646
920	5.456564187	3,274	328,055	(902)	(364)	68,174	411.99	7.17	58,653	170,653
930	5.367607899	3,221	331,276	(902)	(364)	68,174	411.99	7.33	59,555	172,607
940	5.287923143	3,173	334,449	(902)	(364)	68,174	411.99	7.50	60,457	174,513
950	5.215469079	3,129	337,578	(902)	(364)	68,174	411.99	7.67	61,360	176,376
960	5.148753206	3,089	340,667	(902)	(364)	68,174	411.99	7.83	62,262	178,198
970	5.088091213	3,053	343,720	(902)	(364)	68,174	411.99	8.00	63,164	179,984
980	5.033296915	3,020	346,740	(902)	(364)	68,174	411.99	8.17	64,067	181,737
990	4.983474719	2,990	349,730	(902)	(364)	68,174	411.99	8.33	64,969	183,461
1000	4.939009827	2,963	352,693	(902)	(364)	68,174	411.99	8.50	65,871	185,157
1010	4.858048768	2,915	355,608	(902)	(364)	68,174	411.99	8.67	66,774	186,805
1020	4.742703719	2,846	358,454	(902)	(364)	68,174	411.99	8.83	67,676	188,384
1030	4.638661598	2,783	361,237	(902)	(364)	68,174	411.99	9.00	68,578	189,900
1040	4.54406038	2,726	363,964	(902)	(364)	68,174	411.99	9.17	69,481	191,360
1050	4.458406553	2,675	366,639	(902)	(364)	68,174	411.99	9.33	70,383	192,768
1060	4.380525054	2,628	369,267	(902)	(364)	68,174	411.99	9.50	71,285	194,130
1070	4.308511085	2,585	371,852	(902)	(364)	68,174	411.99	9.67	72,188	195,448
1080	4.244231283	2,547	374,399	(902)	(364)	68,174	411.99	9.83	73,090	196,728
1090	4.185784307	2,511	376,910	(902)	(364)	68,174	411.99	10.00	73,992	197,973
1100	4.132640881	2,480	379,390	(902)	(364)	68,174	411.99	10.17	74,895	199,185
1110	4.084682907	2,451	381,840	(902)	(364)	68,174	411.99	10.33	75,797	200,369
1120	4.041076697	2,425	384,265	(902)	(364)	68,174	411.99	10.50	76,699	201,527
1130	4.001427368	2,401	386,666	(902)	(364)	68,174	411.99	10.67	77,602	202,661
1140	3.96453949	2,379	389,045	(902)	(364)	68,174	411.99	10.83	78,504	203,773
1150	3.931835239	2,359	391,404	(902)	(364)	68,174	411.99	11.00	79,407	204,865
1160	3.902098613	2,341	393,745	(902)	(364)	68,174	411.99	11.17	80,309	205,940
1170	3.875060323	2,325	396,070	(902)	(364)	68,174	411.99	11.33	81,211	206,998
1180	3.850475521	2,310	398,380	(902)	(364)	68,174	411.99	11.50	82,114	208,042
1190	3.828484727	2,297	400,677	(902)	(364)	68,174	411.99	11.67	83,016	209,072
1200	3.808489404	2,285	402,962	(902)	(364)	68,174	411.99	11.83	83,918	210,090
1210	3.790308481	2,274	405,237	(902)	(364)	68,174	411.99	12.00	84,821	211,098
1220	3.773777316	2,264	407,501	(902)	(364)	68,174	411.99	12.17	85,723	212,095
1230	3.75874621	2,255	409,756	(902)	(364)	68,174	411.99	12.33	86,625	213,084
1240	3.745442198	2,247	412,003	(902)	(364)	68,174	411.99	12.50	87,528	214,064
1250	3.732982255	2,240	414,243	(902)	(364)	68,174	411.99	12.67	88,430	215,037
1260	3.721652942	2,233	416,476	(902)	(364)	68,174	411.99	12.83	89,332	216,003
1270	3.711714817	2,227	418,703	(902)	(364)	68,174	411.99	13.00	90,235	216,963
1280	3.702678491	2,222	420,925	(902)	(364)	68,174	411.99	13.17	91,137	217,918
1290	3.694462131	2,217	423,142	(902)	(364)	68,174	411.99	13.33	92,039	218,868
1300	3.686991334	2,212	425,354	(902)	(364)	68,174	411.99	13.50	92,942	219,814
1310	3.680561599	2,208	427,562	(902)	(364)	68,174	411.99	13.67	93,844	220,755
1320	3.674715306	2,205	429,767	(902)	(364)	68,174	411.99	13.83	94,746	221,693
1330	3.66903636	2,201	431,968	(902)	(364)	68,174	411.99	14.00	95,649	222,628
1340	3.664235881	2,199	434,167	(902)	(364)	68,174	411.99	14.17	96,551	223,559
1350	3.659871004	2,196	436,363	(902)	(364)	68,174	411.99	14.33	97,453	224,489
1360	3.655902201	2,194	438,556	(902)	(364)	68,174	411.99	14.50	98,356	225,415
1370	3.652293532	2,191	440,748	(902)	(364)	68,174	411.99	14.67	99,258	226,340
1380	3.649012317	2,189	442,937	(902)	(364)	68,174	411.99	14.83	100,160	227,263
1390	3.646391998	2,188	445,125	(902)	(364)	68,174	411.99	15.00	101,063	228,184
1400	3.643646296	2,186	447,311	(902)	(364)	68,174	411.99	15.17	101,965	229,103
1410	3.641149742	2,185	449,496	(902)	(364)	68,174	411.99	15.33	102,868	230,021
1420	3.64007926	2,184	451,680	(902)	(364)	68,174	411.99	15.50	103,770	230,938
1430	3.638269537	2,183	453,863	(902)	(364)	68,174	411.99	15.67	104,672	231,854
1440	3.63662403	2,182	456,045	(902)	(364)	68,174	411.99	15.83	105,575	232,769

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.50
Program License Number: 201910002
Project Simulation Performed on: 04/27/2020 11:18 AM
Report Generation Date: 04/27/2020 11:22 AM

Input File Name: Existing Condition.fld
Project Name: Shoreline PS 26 Analysis
Analysis Title:
Comments: 40% Porosity in BSM from 2012 LID Manual, Section 7.1.3. 12 in/hr BSM infiltration rate from SWMMWW Vol 5 pg. 7-15

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** WATERSHED DEFINITION **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	73.259	73.040
Area of Links that Include Precip/Evap (acres)	0.000	0.219
Total (acres)	73.259	73.259

----------SCENARIO: PS 26
Number of Subbasins: 11

---------- Subbasin : 6 ----------

	-------Area (Acres) --------
Outwash Grass	10.557
Impervious	9.986
Subbasin Total	20.543

---------- Subbasin : 3A ----------

	-------Area (Acres) --------
Outwash Grass	3.946
Impervious	3.625
Subbasin Total	7.571

---------- Subbasin : 2A ----------

	-------Area (Acres) --------
Outwash Grass	2.620
Impervious	2.518
Subbasin Total	5.138

---------- Subbasin : 1C ----------

	-------Area (Acres) --------
Outwash Grass	6.797
Impervious	6.417
Subbasin Total	13.214

---------- Subbasin : 1A ----------

	-------Area (Acres) --------
Outwash Grass	1.817
Impervious	1.674
Subbasin Total	3.491

---------- Subbasin : 1B ----------

	-------Area (Acres) --------
Outwash Grass	2.977
Impervious	2.030
Subbasin Total	5.007

---------- Subbasin : 2B ----------

	-------Area (Acres) --------
Outwash Grass	1.824
Impervious	1.593
Subbasin Total	3.417

---------- Subbasin : 3B ----------

	-------Area (Acres) --------
Outwash Grass	0.920
Impervious	0.701
Subbasin Total	1.621

---------- Subbasin : 4 ----------

	-------Area (Acres) --------
Outwash Grass	4.545
Impervious	4.448
Subbasin Total	8.993

---------- Subbasin : 5 ----------

	-------Area (Acres) --------
Outwash Grass	1.836
Impervious	1.973
Subbasin Total	3.809

---------- Subbasin : 8C ----------

	-------Area (Acres) --------
Outwash Grass	0.051
Impervious	0.404
Subbasin Total	0.455

----------SCENARIO: PS 26 WITH BIORETENTION

Number of Subbasins: 11

---------- Subbasin : 3B ----------

	-------Area (Acres) --------
Outwash Grass	0.870
Impervious	0.701
Subbasin Total	1.571

---------- Subbasin : 4 ----------

	-------Area (Acres) --------
Outwash Grass	4.545
Impervious	4.448
Subbasin Total	8.993

---------- Subbasin : 1A ----------

	-------Area (Acres) --------
Outwash Grass	1.817
Impervious	1.674
Subbasin Total	3.491

---------- Subbasin : 1B ----------

	-------Area (Acres) --------
Outwash Grass	2.977
Impervious	2.030

Subbasin Total	5.007

---------- Subbasin : 1C ----------

	-------Area (Acres) --------
Outwash Grass	6.797
Impervious	6.417
Subbasin Total	13.214

---------- Subbasin : 2A ----------

	-------Area (Acres) --------
Outwash Grass	2.620
Impervious	2.518
Subbasin Total	5.138

---------- Subbasin : 2B ----------

	-------Area (Acres) --------
Outwash Grass	1.824
Impervious	1.593
Subbasin Total	3.417

---------- Subbasin : 3A ----------

	-------Area (Acres) --------
Outwash Grass	3.777
Impervious	3.625
Subbasin Total	7.402

---------- Subbasin : 5 ----------

	-------Area (Acres) --------
Outwash Grass	1.836
Impervious	1.973
Subbasin Total	3.809

---------- Subbasin : 6 ----------

	-------Area (Acres) --------
Outwash Grass	10.557
Impervious	9.986
Subbasin Total	20.543

---------- Subbasin : 8C ----------

	-------Area (Acres) --------
Outwash Grass	0.051
Impervious	0.404

Subbasin Total 0.455

********** **LINK DATA** **********

----------SCENARIO: PS 26
Number of Links: 1

Link Name: New Copy Lnk1
Link Type: Copy
Downstream Link: None

********** **LINK DATA** **********

----------SCENARIO: PS 26 WITH BIORETENTION
Number of Links: 3

Link Name: Rotary Park
Link Type: Bioretention Facility
Downstream Link Name: New Copy Lnk2

Base Elevation (ft) : 100.00
Riser Crest Elevation (ft) : 101.00
Storage Depth (ft) : 1.00
Bottom Length (ft) : 200.0
Bottom Width (ft) : 11.0
Side Slopes (ft/ft) : L1= 3.00 L2= 3.00 W1= 3.00 W2= 3.00
Bottom Area (sq-ft) : 2200.
Area at Riser Crest El (sq-ft) : 3,502.
(acres) : 0.080
Volume at Riser Crest (cu-ft) : 4,165.
(ac-ft) : 0.096

Infiltration on Bottom only Selected

Soil Properties
Biosoil Thickness (ft) : 1.50
Biosoil Saturated Hydraulic Conductivity (in/hr) : 12.00
Biosoil Porosity (Percent) : 40.00
Maximum Elevation of Bioretention Soil : 101.50
Native Soil Hydraulic Conductivity (in/hr) : 5.50

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 12.00
Common Length (ft) : 0.000
Riser Crest Elevation : 101.00 ft

Hydraulic Structure Geometry

Number of Devices: 0

Link Name: New Copy Lnk2
Link Type: Copy
Downstream Link: None

Link Name: SCL Property
Link Type: Bioretention Facility
Downstream Link Name: New Copy Lnk2

Base Elevation (ft) : 100.00
Riser Crest Elevation (ft) : 101.00
Storage Depth (ft) : 1.00
Bottom Length (ft) : 460.0
Bottom Width (ft) : 16.0
Side Slopes (ft/ft) : L1= 3.00 L2= 3.00 W1= 3.00 W2= 3.00
Bottom Area (sq-ft) : 7360.
Area at Riser Crest El (sq-ft) : 10,252.
(acres) : 0.235
Volume at Riser Crest (cu-ft) : 13,216.
(ac-ft) : 0.303

Infiltration on Bottom only Selected

Soil Properties
Biosoil Thickness (ft) : 1.50
Biosoil Saturated Hydraulic Conductivity (in/hr) : 12.00
Biosoil Porosity (Percent) : 40.00
Maximum Elevation of Bioretention Soil : 101.50
Native Soil Hydraulic Conductivity (in/hr) : 5.50

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 12.00
Common Length (ft) : 0.000
Riser Crest Elevation : 101.00 ft

Hydraulic Structure Geometry

Number of Devices: 0

**************************FLOOD FREQUENCY AND DURATION STATISTICS*********************

----------SCENARIO: PS 26
Number of Subbasins: 11
Number of Links: 1

----------SCENARIO: PS 26 WITH BIORETENTION

Number of Subbasins: 11
Number of Links: 3

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: 6	3504.393
Subbasin: 3A	1309.874
Subbasin: 2A	869.708
Subbasin: 1C	2256.262
Subbasin: 1A	603.153
Subbasin: 1B	988.214
Subbasin: 2B	605.476
Subbasin: 3B	305.394
Subbasin: 4	1508.711
Subbasin: 5	609.460
Subbasin: 8C	16.929
Link: New Copy Lnk1	0.000
Total:	12577.570

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: 3B	288.630
Subbasin: 4	1508.711
Subbasin: 1A	603.153
Subbasin: 1B	988.214
Subbasin: 1C	2256.262
Subbasin: 2A	869.708
Subbasin: 2B	605.476
Subbasin: 3A	1253.774
Subbasin: 5	609.460
Subbasin: 6	3504.393
Subbasin: 8C	16.929
Link: Rotary Park	2248.045
Link: New Copy Lnk2	0.000
Link: SCL Property	6069.404
Total:	20822.160

Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 79.605 ac-ft/year, Post Developed: 131.786 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PS 26

Number of Links: 1

********** Link: New Copy Lnk1 **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 15886.39
Inflow Volume Including PPT-Evap (ac-ft): 15886.39
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 15886.39
Secondary Outflow To Downstream System (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered)/Total Volume: 0.00%

----------SCENARIO: PS 26 WITH BIORETENTION

Number of Links: 3

********** Link: Rotary Park **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 2312.66
Inflow Volume Including PPT-Evap (ac-ft): 2335.05
Total Runoff Infiltrated (ac-ft): 2248.05, 96.27%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 94.47
Secondary Outflow To Downstream System (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered)/Total Volume: 96.27%

********** Link: New Copy Lnk2 **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 7688.85
Inflow Volume Including PPT-Evap (ac-ft): 7688.85
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 7688.85
Secondary Outflow To Downstream System (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered)/Total Volume: 0.00%

********** Link: SCL Property **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 6113.35
Inflow Volume Including PPT-Evap (ac-ft): 6186.37
Total Runoff Infiltrated (ac-ft): 6069.40, 98.11%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 134.16
Secondary Outflow To Downstream System (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered)/Total Volume: 98.11%

**********Compliance Point Results **********

Scenario PS 26 Compliance Link: New Copy Lnk1
Scenario PS 26 with Bioretention Compliance Link: New Copy Lnk2

*** Point of Compliance Flow Frequency Data ***

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	13.377	2-Year	7.333
5-Year	17.182	5-Year	10.447
10-Year	20.223	10-Year	11.577
25-Year	25.555	25-Year	14.732
50-Year	32.350	50-Year	17.669
100-Year	35.725	100-Year	20.638
200-Year	37.058	200-Year	21.689
500-Year	38.819	500-Year	23.037

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.50
Program License Number: 201910002
Project Simulation Performed on: 04/27/2020 11:11 AM
Report Generation Date: 04/27/2020 11:11 AM

Input File Name: Full Build Out.fld
Project Name: Shoreline PS 26 Analysis
Analysis Title: Sub-basin 6 Modeling
Comments: 40% Porosity in BSM from 2012 LID Manual, Section 7.1.3. 12 in/hr BSM infiltration rate from SWMMWW Vol 5 pg. 7-15

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** WATERSHED DEFINITION **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	73.260	73.041
Area of Links that Include Precip/Evap (acres)	0.000	0.219
Total (acres)	73.260	73.260

----------SCENARIO: PS 26
Number of Subbasins: 11

---------- Subbasin : 6 ----------

	-------Area (Acres) --------
Outwash Grass	5.380
Impervious	15.160
Subbasin Total	20.540

---------- Subbasin : 3A ----------

	-------Area (Acres) --------
Outwash Grass	0.810
Impervious	6.760
Subbasin Total	7.570

---------- Subbasin : 2A ----------

	-------Area (Acres) --------
Outwash Grass	0.400
Impervious	4.740
Subbasin Total	5.140

---------- Subbasin : 1C ----------

	-------Area (Acres) --------
Outwash Grass	2.340
Impervious	10.870
Subbasin Total	13.210

---------- Subbasin : 1A ----------

	-------Area (Acres) --------
Outwash Grass	0.370
Impervious	3.120
Subbasin Total	3.490

---------- Subbasin : 1B ----------

	-------Area (Acres) --------
Outwash Grass	0.470
Impervious	4.540
Subbasin Total	5.010

---------- Subbasin : 2B ----------

	-------Area (Acres) --------
Outwash Grass	0.280
Impervious	3.140
Subbasin Total	3.420

---------- Subbasin : 3B ----------

	-------Area (Acres) --------
Outwash Grass	0.460
Impervious	1.160
Subbasin Total	1.620

---------- Subbasin : 4 ----------

	-------Area (Acres) --------
Outwash Grass	3.340
Impervious	5.660
Subbasin Total	9.000

---------- Subbasin : 5 ----------

	-------Area (Acres) --------
Outwash Grass	1.310
Impervious	2.500
Subbasin Total	3.810

---------- Subbasin : 8C ----------

	-------Area (Acres) --------
Impervious	0.450
Subbasin Total	0.450

----------SCENARIO: PS 26 WITH BIORETENTION

Number of Subbasins: 11

---------- Subbasin : 3B ----------

	-------Area (Acres) --------
Outwash Grass	0.410
Impervious	1.160
Subbasin Total	1.570

---------- Subbasin : 4 ----------

	-------Area (Acres) --------
Outwash Grass	3.340
Impervious	5.660
Subbasin Total	9.000

---------- Subbasin : 1A ----------

	-------Area (Acres) --------
Outwash Grass	0.370
Impervious	3.120
Subbasin Total	3.490

---------- Subbasin : 1B ----------

	-------Area (Acres) --------
Outwash Grass	0.470
Impervious	4.540
Subbasin Total	5.010

---------- Subbasin : 1C ----------

	-------Area (Acres) --------
Outwash Grass	2.340
Impervious	10.870
Subbasin Total	13.210

---------- Subbasin : 2A ----------

	-------Area (Acres) --------
Outwash Grass	0.400
Impervious	4.740
Subbasin Total	5.140

---------- Subbasin : 2B ----------

	-------Area (Acres) --------
Outwash Grass	0.280
Impervious	3.140
Subbasin Total	3.420

---------- Subbasin : 3A ----------

	-------Area (Acres) --------
Outwash Grass	0.641
Impervious	6.760
Subbasin Total	7.401

---------- Subbasin : 5 ----------

	-------Area (Acres) --------
Outwash Grass	1.310
Impervious	2.500
Subbasin Total	3.810

---------- Subbasin : 6 ----------

	-------Area (Acres) --------
Outwash Grass	5.380
Impervious	15.160
Subbasin Total	20.540

---------- Subbasin : 8C ----------

	-------Area (Acres) --------
Impervious	0.450
Subbasin Total	0.450

********** **LINK DATA** **********

----------SCENARIO: PS 26
Number of Links: 1

Link Name: New Copy Lnk1
Link Type: Copy
Downstream Link: None

********** **LINK DATA** **********

----------SCENARIO: PS 26 WITH BIORETENTION
Number of Links: 3

Link Name: Rotary Park
Link Type: Bioretention Facility
Downstream Link Name: New Copy Lnk2

Base Elevation (ft) : 100.00
Riser Crest Elevation (ft) : 101.00
Storage Depth (ft) : 1.00
Bottom Length (ft) : 200.0
Bottom Width (ft) : 11.0
Side Slopes (ft/ft) : L1= 3.00 L2= 3.00 W1= 3.00 W2= 3.00
Bottom Area (sq-ft) : 2200.
Area at Riser Crest El (sq-ft) : 3,502.
(acres) : 0.080
Volume at Riser Crest (cu-ft) : 4,165.
(ac-ft) : 0.096

Infiltration on Bottom only Selected

Soil Properties
Biosoil Thickness (ft) : 1.50
Biosoil Saturated Hydraulic Conductivity (in/hr) : 12.00
Biosoil Porosity (Percent) : 40.00
Maximum Elevation of Bioretention Soil : 101.50
Native Soil Hydraulic Conductivity (in/hr) : 5.50

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 12.00
Common Length (ft) : 0.000
Riser Crest Elevation : 101.00 ft

Hydraulic Structure Geometry

Number of Devices: 0

Link Name: New Copy Lnk2
Link Type: Copy
Downstream Link: None

Link Name: SCL Property
Link Type: Bioretention Facility
Downstream Link Name: New Copy Lnk2

Base Elevation (ft) : 100.00
Riser Crest Elevation (ft) : 101.00
Storage Depth (ft) : 1.00
Bottom Length (ft) : 460.0
Bottom Width (ft) : 16.0
Side Slopes (ft/ft) : L1= 3.00 L2= 3.00 W1= 3.00 W2= 3.00
Bottom Area (sq-ft) : 7360.
Area at Riser Crest El (sq-ft) : 10,252.
(acres) : 0.235
Volume at Riser Crest (cu-ft) : 13,216.
(ac-ft) : 0.303

Infiltration on Bottom only Selected

Soil Properties
Biosoil Thickness (ft) : 1.50
Biosoil Saturated Hydraulic Conductivity (in/hr) : 12.00
Biosoil Porosity (Percent) : 40.00
Maximum Elevation of Bioretention Soil : 101.50
Native Soil Hydraulic Conductivity (in/hr) : 5.50

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 12.00
Common Length (ft) : 0.000
Riser Crest Elevation : 101.00 ft

Hydraulic Structure Geometry

Number of Devices: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PS 26
Number of Subbasins: 11
Number of Links: 1

----------SCENARIO: PS 26 WITH BIORETENTION
Number of Subbasins: 11
Number of Links: 3

*************Groundwater Recharge Summary ***************

Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: 6	1785.889
Subbasin: 3A	268.879
Subbasin: 2A	132.780
Subbasin: 1C	776.762
Subbasin: 1A	122.821
Subbasin: 1B	156.016
Subbasin: 2B	92.946
Subbasin: 3B	152.697
Subbasin: 4	1108.712
Subbasin: 5	434.854
Subbasin: 8C	0.000
Link: New Copy Lnk1	0.000
Total:	5032.357

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: 3B	135.933
Subbasin: 4	1108.712
Subbasin: 1A	122.821
Subbasin: 1B	156.016
Subbasin: 1C	776.762
Subbasin: 2A	132.780
Subbasin: 2B	92.946
Subbasin: 3A	212.780
Subbasin: 5	434.854
Subbasin: 6	1785.889
Subbasin: 8C	0.000
Link: Rotary Park	2824.936
Link: New Copy Lnk2	0.000
Link: SCL Property	9066.695
Total:	16851.130

Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 31.850 ac-ft/year, Post Developed: 106.653 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PS 26

Number of Links: 1

********** Link: New Copy Lnk1 **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 26060.55
Inflow Volume Including PPT-Evap (ac-ft): 26060.55
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 26060.55
Secondary Outflow To Downstream System (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered)/Total Volume: 0.00%

----------SCENARIO: PS 26 WITH BIORETENTION

Number of Links: 3

********** Link: Rotary Park **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 3060.58
Inflow Volume Including PPT-Evap (ac-ft): 3083.78
Total Runoff Infiltrated (ac-ft): 2824.94, 91.61%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 269.21
Secondary Outflow To Downstream System (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered)/Total Volume: 91.61%

********** Link: New Copy Lnk2 **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 14305.85
Inflow Volume Including PPT-Evap (ac-ft): 14305.85
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 14305.85
Secondary Outflow To Downstream System (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered)/Total Volume: 0.00%

********** Link: SCL Property **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 9832.37
Inflow Volume Including PPT-Evap (ac-ft): 9908.25
Total Runoff Infiltrated (ac-ft): 9066.70, 91.51%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 869.20
Secondary Outflow To Downstream System (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered)/Total Volume: 91.51%

*************Compliance Point Results ***************

Scenario PS 26 Compliance Link: New Copy Lnk1
Scenario PS 26 with Bioretention Compliance Link: New Copy Lnk2

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	21.721	2-Year	14.073
5-Year	28.124	5-Year	18.259
10-Year	31.642	10-Year	20.701
25-Year	40.162	25-Year	23.177
50-Year	50.701	50-Year	29.781
100-Year	58.630	100-Year	33.703
200-Year	60.783	200-Year	36.113
500-Year	63.627	500-Year	39.251

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 10-yr, 24hr

Subbasin ID: PS 26 10-Year Bioretention Existing Land Use

	Value	Units	Notes
Area =	34.53	*ac*	
P_t =	2.25	*in*	(10 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	21.15	*min*	
w =	0.1912	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	16.61	17.92	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**21.15**	min
T_{Peak} =	**8.00**	hr
Q_{Peak} =	**11.96**	ft^3/s
$V_{Total\ Runoff}$ =	**205125**	ft^3

Time of Concentration **21.15**

Sheet Flow

$T_t = (0.42(n_sL)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 4.57 min

ns 0.011

L 300 ft

P_2 1.75 in

S 0.013333333 ft/ft

Shallow Flow$_1$

Tt = L/V = 16.58 min

L 922

Velocity (V) = kS0.5 = 0.93 ft/s

k 47.47058824

S 0.04 ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.009	0.0090	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.009	0.0180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.009	0.0270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.009	0.0360	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
5	50	0.4	0.009	0.0450	0.0001	0.0001	0.0000	0.0000	0.0000	0.0	0.00
6	60	0.4	0.009	0.0540	0.0008	0.0007	0.0000	0.0000	0.0003	0.1	0.02
7	70	0.4	0.009	0.0630	0.0022	0.0014	0.0000	0.0000	0.0007	0.1	0.05
8	80	0.4	0.009	0.0720	0.0041	0.0019	0.0000	0.0000	0.0009	0.2	0.09
9	90	0.4	0.009	0.0810	0.0066	0.0025	0.0000	0.0000	0.0012	0.3	0.14
10	100	0.4	0.009	0.0900	0.0096	0.0030	0.0000	0.0000	0.0014	0.3	0.19
11	110	0.5	0.0113	0.1013	0.0138	0.0042	0.0000	0.0000	0.0020	0.4	0.26
12	120	0.5	0.0113	0.1126	0.0187	0.0049	0.0000	0.0000	0.0024	0.5	0.33
13	130	0.5	0.0113	0.1239	0.0240	0.0053	0.0000	0.0000	0.0025	0.5	0.40
14	140	0.5	0.0113	0.1352	0.0298	0.0058	0.0000	0.0000	0.0028	0.6	0.46
15	150	0.5	0.0113	0.1465	0.0361	0.0063	0.0000	0.0000	0.0030	0.6	0.52
16	160	0.5	0.0113	0.1578	0.0426	0.0065	0.0000	0.0000	0.0031	0.7	0.57
17	170	0.6	0.0135	0.1713	0.0509	0.0083	0.0000	0.0000	0.0040	0.8	0.63
18	180	0.6	0.0135	0.1848	0.0596	0.0087	0.0000	0.0000	0.0042	0.9	0.72
19	190	0.6	0.0135	0.1983	0.0686	0.0090	0.0000	0.0000	0.0043	0.9	0.78
20	200	0.6	0.0135	0.2118	0.0779	0.0093	0.0000	0.0000	0.0045	0.9	0.84
21	210	0.6	0.0135	0.2253	0.0876	0.0097	0.0000	0.0000	0.0047	1.0	0.88
22	220	0.6	0.0135	0.2388	0.0975	0.0099	0.0002	0.0002	0.0049	1.0	0.92
23	230	0.7	0.0158	0.2546	0.1094	0.0119	0.0009	0.0007	0.0061	1.3	1.01
24	240	0.7	0.0158	0.2704	0.1215	0.0121	0.0020	0.0011	0.0064	1.3	1.12
25	250	0.7	0.0158	0.2862	0.1340	0.0125	0.0035	0.0015	0.0068	1.4	1.22
26	260	0.7	0.0158	0.3020	0.1466	0.0126	0.0053	0.0018	0.0070	1.5	1.30
27	270	0.7	0.0158	0.3178	0.1595	0.0129	0.0076	0.0023	0.0074	1.5	1.38
28	280	0.7	0.0158	0.3336	0.1725	0.0130	0.0101	0.0025	0.0076	1.6	1.45
29	290	0.82	0.0185	0.3521	0.1880	0.0155	0.0136	0.0035	0.0093	1.9	1.57
30	300	0.82	0.0185	0.3706	0.2037	0.0157	0.0175	0.0039	0.0096	2.0	1.72
31	310	0.82	0.0185	0.3891	0.2196	0.0159	0.0218	0.0043	0.0099	2.1	1.84
32	320	0.82	0.0185	0.4076	0.2357	0.0161	0.0265	0.0047	0.0102	2.1	1.94
33	330	0.82	0.0185	0.4261	0.2519	0.0162	0.0316	0.0051	0.0104	2.2	2.02
34	340	0.82	0.0185	0.4446	0.2682	0.0163	0.0371	0.0055	0.0107	2.2	2.09
35	350	0.95	0.0214	0.4660	0.2873	0.0191	0.0439	0.0068	0.0127	2.7	2.23
36	360	0.95	0.0214	0.4874	0.3065	0.0192	0.0511	0.0072	0.0130	2.7	2.40
37	370	0.95	0.0214	0.5088	0.3259	0.0194	0.0588	0.0077	0.0133	2.8	2.53
38	380	0.95	0.0214	0.5302	0.3454	0.0195	0.0668	0.0080	0.0135	2.8	2.64
39	390	0.95	0.0214	0.5516	0.3650	0.0196	0.0753	0.0085	0.0138	2.9	2.72
40	400	0.95	0.0214	0.5730	0.3847	0.0197	0.0842	0.0089	0.0141	2.9	2.80
41	410	1.34	0.0302	0.6032	0.4126	0.0279	0.0973	0.0131	0.0202	4.2	3.10
42	420	1.34	0.0302	0.6334	0.4408	0.0282	0.1111	0.0138	0.0207	4.3	3.55
43	430	1.34	0.0302	0.6636	0.4691	0.0283	0.1255	0.0144	0.0211	4.4	3.86
44	440	1.8	0.0405	0.7041	0.5072	0.0381	0.1458	0.0203	0.0289	6.0	4.38
45	450	1.8	0.0405	0.7446	0.5456	0.0384	0.1671	0.0213	0.0295	6.2	5.04
46	460	3.4	0.0765	0.8211	0.6185	0.0729	0.2097	0.0426	0.0572	11.9	6.57
47	470	5.4	0.1215	0.9426	0.7354	0.1169	0.2833	0.0736	0.0944	19.7	10.12
48	480	2.7	0.0608	1.0034	0.7942	0.0588	0.3225	0.0392	0.0486	10.2	11.96
49	490	1.8	0.0405	1.0439	0.8335	0.0393	0.3493	0.0268	0.0328	6.9	10.64
50	500	1.34	0.0302	1.0741	0.8629	0.0294	0.3697	0.0204	0.0247	5.2	8.87
51	510	1.34	0.0302	1.1043	0.8923	0.0294	0.3904	0.0207	0.0249	5.2	7.46
52	520	1.34	0.0302	1.1345	0.9217	0.0294	0.4113	0.0209	0.0250	5.2	6.60
53	530	0.88	0.0198	1.1543	0.9410	0.0193	0.4252	0.0139	0.0165	3.4	5.73
54	540	0.88	0.0198	1.1741	0.9603	0.0193	0.4392	0.0140	0.0165	3.5	4.86
55	550	0.88	0.0198	1.1939	0.9797	0.0194	0.4533	0.0141	0.0166	3.5	4.33
56	560	0.88	0.0198	1.2137	0.9990	0.0193	0.4675	0.0142	0.0167	3.5	4.00
57	570	0.88	0.0198	1.2335	1.0184	0.0194	0.4819	0.0144	0.0168	3.5	3.81
58	580	0.88	0.0198	1.2533	1.0378	0.0194	0.4963	0.0144	0.0168	3.5	3.69
59	590	0.88	0.0198	1.2731	1.0572	0.0194	0.5108	0.0145	0.0169	3.5	3.63
60	600	0.88	0.0198	1.2929	1.0766	0.0194	0.5254	0.0146	0.0169	3.5	3.59
61	610	0.88	0.0198	1.3127	1.0960	0.0194	0.5401	0.0147	0.0170	3.5	3.57
62	620	0.88	0.0198	1.3325	1.1154	0.0194	0.5549	0.0148	0.0170	3.6	3.56
63	630	0.88	0.0198	1.3523	1.1349	0.0195	0.5698	0.0149	0.0171	3.6	3.56
64	640	0.88	0.0198	1.3721	1.1543	0.0194	0.5848	0.0150	0.0171	3.6	3.57
65	650	0.72	0.0162	1.3883	1.1702	0.0159	0.5971	0.0123	0.0140	2.9	3.45
66	660	0.72	0.0162	1.4045	1.1862	0.0160	0.6095	0.0124	0.0141	3.0	3.25
67	670	0.72	0.0162	1.4207	1.2021	0.0159	0.6219	0.0124	0.0141	2.9	3.14
68	680	0.72	0.0162	1.4369	1.2180	0.0159	0.6344	0.0125	0.0141	3.0	3.06
69	690	0.72	0.0162	1.4531	1.2340	0.0160	0.6469	0.0125	0.0142	3.0	3.02
70	700	0.72	0.0162	1.4693	1.2499	0.0159	0.6595	0.0126	0.0142	3.0	3.00
71	710	0.72	0.0162	1.4855	1.2659	0.0160	0.6721	0.0126	0.0142	3.0	2.99
72	720	0.72	0.0162	1.5017	1.2818	0.0159	0.6848	0.0127	0.0142	3.0	2.98
73	730	0.72	0.0162	1.5179	1.2978	0.0160	0.6975	0.0127	0.0143	3.0	2.98
74	740	0.72	0.0162	1.5341	1.3137	0.0159	0.7103	0.0128	0.0143	3.0	2.98
75	750	0.72	0.0162	1.5503	1.3297	0.0160	0.7231	0.0128	0.0143	3.0	2.99
76	760	0.72	0.0162	1.5665	1.3457	0.0160	0.7360	0.0129	0.0144	3.0	2.99
77	770	0.57	0.0128	1.5793	1.3583	0.0126	0.7462	0.0102	0.0114	2.4	2.88

					Pervious Area			Impervious Area				
Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Accumulated Rainfall (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
78	780	0.57	0.0128	1.5921	1.3709	0.0126	0.7564	0.0102	0.0114	2.4	2.68
79	790	0.57	0.0128	1.6049	1.3836	0.0127	0.7666	0.0102	0.0114	2.4	2.57
80	800	0.57	0.0128	1.6177	1.3962	0.0126	0.7769	0.0103	0.0114	2.4	2.50
81	810	0.57	0.0128	1.6305	1.4088	0.0126	0.7872	0.0103	0.0114	2.4	2.45
82	820	0.57	0.0128	1.6433	1.4215	0.0127	0.7975	0.0103	0.0115	2.4	2.43
83	830	0.57	0.0128	1.6561	1.4341	0.0126	0.8079	0.0104	0.0115	2.4	2.41
84	840	0.57	0.0128	1.6689	1.4467	0.0126	0.8182	0.0103	0.0114	2.4	2.40
85	850	0.57	0.0128	1.6817	1.4594	0.0127	0.8286	0.0104	0.0115	2.4	2.40
86	860	0.57	0.0128	1.6945	1.4720	0.0126	0.8391	0.0105	0.0115	2.4	2.40
87	870	0.57	0.0128	1.7073	1.4847	0.0127	0.8495	0.0104	0.0115	2.4	2.40
88	880	0.57	0.0128	1.7201	1.4973	0.0126	0.8600	0.0105	0.0115	2.4	2.40
89	890	0.5	0.0113	1.7314	1.5085	0.0112	0.8692	0.0092	0.0102	2.1	2.35
90	900	0.5	0.0113	1.7427	1.5197	0.0112	0.8785	0.0093	0.0102	2.1	2.27
91	910	0.5	0.0113	1.7540	1.5308	0.0111	0.8878	0.0093	0.0102	2.1	2.21
92	920	0.5	0.0113	1.7653	1.5420	0.0112	0.8971	0.0093	0.0102	2.1	2.18
93	930	0.5	0.0113	1.7766	1.5532	0.0112	0.9064	0.0093	0.0102	2.1	2.16
94	940	0.5	0.0113	1.7879	1.5643	0.0111	0.9158	0.0094	0.0102	2.1	2.15
95	950	0.5	0.0113	1.7992	1.5755	0.0112	0.9251	0.0093	0.0102	2.1	2.15
96	960	0.5	0.0113	1.8105	1.5867	0.0112	0.9345	0.0094	0.0103	2.1	2.14
97	970	0.5	0.0113	1.8218	1.5979	0.0112	0.9439	0.0094	0.0103	2.1	2.14
98	980	0.5	0.0113	1.8331	1.6091	0.0112	0.9533	0.0094	0.0103	2.1	2.14
99	990	0.5	0.0113	1.8444	1.6202	0.0111	0.9627	0.0094	0.0102	2.1	2.14
100	1000	0.5	0.0113	1.8557	1.6314	0.0112	0.9722	0.0095	0.0103	2.2	2.14
101	1010	0.4	0.009	1.8647	1.6403	0.0089	0.9797	0.0075	0.0082	1.7	2.06
102	1020	0.4	0.009	1.8737	1.6492	0.0089	0.9873	0.0076	0.0082	1.7	1.93
103	1030	0.4	0.009	1.8827	1.6582	0.0090	0.9948	0.0075	0.0082	1.7	1.85
104	1040	0.4	0.009	1.8917	1.6671	0.0089	1.0024	0.0076	0.0082	1.7	1.80
105	1050	0.4	0.009	1.9007	1.6760	0.0089	1.0099	0.0075	0.0082	1.7	1.77
106	1060	0.4	0.009	1.9097	1.6849	0.0089	1.0175	0.0076	0.0082	1.7	1.75
107	1070	0.4	0.009	1.9187	1.6938	0.0089	1.0251	0.0076	0.0082	1.7	1.74
108	1080	0.4	0.009	1.9277	1.7027	0.0089	1.0327	0.0076	0.0082	1.7	1.73
109	1090	0.4	0.009	1.9367	1.7116	0.0089	1.0403	0.0076	0.0082	1.7	1.72
110	1100	0.4	0.009	1.9457	1.7206	0.0090	1.0479	0.0076	0.0083	1.7	1.72
111	1110	0.4	0.009	1.9547	1.7295	0.0089	1.0555	0.0076	0.0082	1.7	1.72
112	1120	0.4	0.009	1.9637	1.7384	0.0089	1.0632	0.0077	0.0083	1.7	1.72
113	1130	0.4	0.009	1.9727	1.7473	0.0089	1.0708	0.0076	0.0082	1.7	1.72
114	1140	0.4	0.009	1.9817	1.7562	0.0089	1.0784	0.0076	0.0082	1.7	1.72
115	1150	0.4	0.009	1.9907	1.7651	0.0089	1.0861	0.0077	0.0083	1.7	1.72
116	1160	0.4	0.009	1.9997	1.7741	0.0090	1.0938	0.0077	0.0083	1.7	1.73
117	1170	0.4	0.009	2.0087	1.7830	0.0089	1.1014	0.0076	0.0082	1.7	1.73
118	1180	0.4	0.009	2.0177	1.7919	0.0089	1.1091	0.0077	0.0083	1.7	1.73
119	1190	0.4	0.009	2.0267	1.8008	0.0089	1.1168	0.0077	0.0083	1.7	1.73
120	1200	0.4	0.009	2.0357	1.8097	0.0089	1.1245	0.0077	0.0083	1.7	1.73
121	1210	0.4	0.009	2.0447	1.8187	0.0090	1.1322	0.0077	0.0083	1.7	1.73
122	1220	0.4	0.009	2.0537	1.8276	0.0089	1.1399	0.0077	0.0083	1.7	1.73
123	1230	0.4	0.009	2.0627	1.8365	0.0089	1.1476	0.0077	0.0083	1.7	1.73
124	1240	0.4	0.009	2.0717	1.8454	0.0089	1.1554	0.0078	0.0083	1.7	1.73
125	1250	0.4	0.009	2.0807	1.8544	0.0090	1.1631	0.0077	0.0083	1.7	1.74
126	1260	0.4	0.009	2.0897	1.8633	0.0089	1.1708	0.0077	0.0083	1.7	1.73
127	1270	0.4	0.009	2.0987	1.8722	0.0089	1.1786	0.0078	0.0083	1.7	1.73
128	1280	0.4	0.009	2.1077	1.8811	0.0089	1.1864	0.0078	0.0083	1.7	1.74
129	1290	0.4	0.009	2.1167	1.8901	0.0090	1.1941	0.0077	0.0083	1.7	1.74
130	1300	0.4	0.009	2.1257	1.8990	0.0089	1.2019	0.0078	0.0083	1.7	1.74
131	1310	0.4	0.009	2.1347	1.9079	0.0089	1.2097	0.0078	0.0083	1.7	1.74
132	1320	0.4	0.009	2.1437	1.9169	0.0090	1.2175	0.0078	0.0084	1.8	1.74
133	1330	0.4	0.009	2.1527	1.9258	0.0089	1.2253	0.0078	0.0083	1.7	1.74
134	1340	0.4	0.009	2.1617	1.9347	0.0089	1.2331	0.0078	0.0083	1.7	1.74
135	1350	0.4	0.009	2.1707	1.9436	0.0089	1.2409	0.0078	0.0083	1.7	1.74
136	1360	0.4	0.009	2.1797	1.9526	0.0090	1.2487	0.0078	0.0084	1.8	1.74
137	1370	0.4	0.009	2.1887	1.9615	0.0089	1.2565	0.0078	0.0083	1.7	1.74
138	1380	0.4	0.009	2.1977	1.9704	0.0089	1.2643	0.0078	0.0083	1.7	1.74
139	1390	0.4	0.009	2.2067	1.9794	0.0090	1.2722	0.0079	0.0084	1.8	1.75
140	1400	0.4	0.009	2.2157	1.9883	0.0089	1.2800	0.0078	0.0083	1.7	1.75
141	1410	0.4	0.009	2.2247	1.9972	0.0089	1.2879	0.0079	0.0084	1.8	1.75
142	1420	0.4	0.009	2.2337	2.0062	0.0090	1.2957	0.0078	0.0084	1.8	1.75
143	1430	0.4	0.009	2.2427	2.0151	0.0089	1.3036	0.0079	0.0084	1.8	1.75
144	1440	0.4	0.009	2.2517	2.0240	0.0089	1.3115	0.0079	0.0084	1.8	1.75

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 25-yr, 24hr

Subbasin ID: PS 26 25-Year Bioretention Existing Land Use

	Value	Units	Notes
Area =	34.53	*ac*	
P_t =	3.5	*in*	(25 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	21.15	*min*	
w =	0.1912	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	16.61	17.92	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**21.15**	min
T_{Peak} =	**8.00**	hr
Q_{Peak} =	**20.83**	ft^3/s
$V_{Total\ Runoff}$ =	**352713**	ft^3

Time of Concentration **21.15**

Sheet Flow

$T_t = (0.42(n_s L)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 4.57 min

ns	0.011
L	300 ft
P_2	1.75 in
S	0.013333333 ft/ft

Shallow Flow$_1$

Tt = L/V =	16.58 min
L	922
Velocity (V) = kS0.5 =	0.93 ft/s
k	47.47058824
S	0.04 ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.014	0.0140	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.014	0.0280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.014	0.0420	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.014	0.0560	0.0011	0.0011	0.0000	0.0000	0.0005	0.1	0.02
5	50	0.4	0.014	0.0700	0.0037	0.0026	0.0000	0.0000	0.0013	0.3	0.08
6	60	0.4	0.014	0.0840	0.0075	0.0038	0.0000	0.0000	0.0018	0.4	0.17
7	70	0.4	0.014	0.0980	0.0125	0.0050	0.0000	0.0000	0.0024	0.5	0.28
8	80	0.4	0.014	0.1120	0.0184	0.0059	0.0000	0.0000	0.0028	0.6	0.38
9	90	0.4	0.014	0.1260	0.0251	0.0067	0.0000	0.0000	0.0032	0.7	0.48
10	100	0.4	0.014	0.1400	0.0324	0.0073	0.0000	0.0000	0.0035	0.7	0.56
11	110	0.5	0.0175	0.1575	0.0424	0.0100	0.0000	0.0000	0.0048	1.0	0.68
12	120	0.5	0.0175	0.1750	0.0532	0.0108	0.0000	0.0000	0.0052	1.1	0.82
13	130	0.5	0.0175	0.1925	0.0647	0.0115	0.0000	0.0000	0.0055	1.2	0.93
14	140	0.5	0.0175	0.2100	0.0767	0.0120	0.0000	0.0000	0.0058	1.2	1.03
15	150	0.5	0.0175	0.2275	0.0892	0.0125	0.0000	0.0000	0.0060	1.3	1.11
16	160	0.5	0.0175	0.2450	0.1021	0.0129	0.0005	0.0005	0.0065	1.4	1.18
17	170	0.6	0.021	0.2660	0.1181	0.0160	0.0017	0.0012	0.0083	1.7	1.32
18	180	0.6	0.021	0.2870	0.1346	0.0165	0.0036	0.0019	0.0089	1.9	1.50
19	190	0.6	0.021	0.3080	0.1515	0.0169	0.0061	0.0025	0.0094	2.0	1.66
20	200	0.6	0.021	0.3290	0.1687	0.0172	0.0094	0.0033	0.0100	2.1	1.80
21	210	0.6	0.021	0.3500	0.1862	0.0175	0.0132	0.0038	0.0104	2.2	1.93
22	220	0.6	0.021	0.3710	0.2041	0.0179	0.0176	0.0044	0.0109	2.3	2.04
23	230	0.7	0.0245	0.3955	0.2251	0.0210	0.0234	0.0058	0.0131	2.7	2.22
24	240	0.7	0.0245	0.4200	0.2465	0.0214	0.0299	0.0065	0.0137	2.9	2.44
25	250	0.7	0.0245	0.4445	0.2681	0.0216	0.0371	0.0072	0.0141	3.0	2.62
26	260	0.7	0.0245	0.4690	0.2900	0.0219	0.0448	0.0077	0.0145	3.0	2.76
27	270	0.7	0.0245	0.4935	0.3120	0.0220	0.0532	0.0084	0.0149	3.1	2.88
28	280	0.7	0.0245	0.5180	0.3342	0.0222	0.0622	0.0090	0.0153	3.2	2.99
29	290	0.82	0.0287	0.5467	0.3605	0.0263	0.0733	0.0111	0.0184	3.8	3.20
30	300	0.82	0.0287	0.5754	0.3869	0.0264	0.0852	0.0119	0.0189	3.9	3.46
31	310	0.82	0.0287	0.6041	0.4135	0.0266	0.0977	0.0125	0.0193	4.0	3.66
32	320	0.82	0.0287	0.6328	0.4402	0.0267	0.1108	0.0131	0.0196	4.1	3.82
33	330	0.82	0.0287	0.6615	0.4671	0.0269	0.1245	0.0137	0.0200	4.2	3.94
34	340	0.82	0.0287	0.6902	0.4941	0.0270	0.1387	0.0142	0.0204	4.3	4.05
35	350	0.95	0.0333	0.7235	0.5256	0.0315	0.1558	0.0171	0.0240	5.0	4.27
36	360	0.95	0.0333	0.7568	0.5572	0.0316	0.1736	0.0178	0.0244	5.1	4.58
37	370	0.95	0.0333	0.7901	0.5889	0.0317	0.1921	0.0185	0.0248	5.2	4.79
38	380	0.95	0.0333	0.8234	0.6207	0.0318	0.2111	0.0190	0.0252	5.3	4.96
39	390	0.95	0.0333	0.8567	0.6526	0.0319	0.2306	0.0195	0.0255	5.3	5.08
40	400	0.95	0.0333	0.8900	0.6846	0.0320	0.2507	0.0201	0.0258	5.4	5.19
41	410	1.34	0.0469	0.9369	0.7299	0.0453	0.2797	0.0290	0.0368	7.7	5.71
42	420	1.34	0.0469	0.9838	0.7752	0.0453	0.3097	0.0300	0.0374	7.8	6.49
43	430	1.34	0.0469	1.0307	0.8207	0.0455	0.3405	0.0308	0.0379	7.9	7.01
44	440	1.8	0.063	1.0937	0.8819	0.0612	0.3831	0.0426	0.0515	10.8	7.90
45	450	1.8	0.063	1.1567	0.9434	0.0615	0.4269	0.0438	0.0523	10.9	9.03
46	460	3.4	0.119	1.2757	1.0597	0.1163	0.5127	0.0858	0.1005	21.0	11.68
47	470	5.4	0.189	1.4647	1.2454	0.1857	0.6559	0.1432	0.1636	34.2	17.76
48	480	2.7	0.0945	1.5592	1.3385	0.0931	0.7302	0.0743	0.0833	17.4	20.83
49	490	1.8	0.063	1.6222	1.4006	0.0621	0.7805	0.0503	0.0560	11.7	18.43
50	500	1.34	0.0469	1.6691	1.4469	0.0463	0.8184	0.0379	0.0419	8.8	15.30
51	510	1.34	0.0469	1.7160	1.4933	0.0464	0.8566	0.0382	0.0421	8.8	12.81
52	520	1.34	0.0469	1.7629	1.5396	0.0463	0.8951	0.0385	0.0423	8.8	11.28
53	530	0.88	0.0308	1.7937	1.5701	0.0305	0.9206	0.0255	0.0279	5.8	9.77
54	540	0.88	0.0308	1.8245	1.6006	0.0305	0.9462	0.0256	0.0280	5.8	8.26
55	550	0.88	0.0308	1.8553	1.6310	0.0304	0.9719	0.0257	0.0280	5.8	7.34
56	560	0.88	0.0308	1.8861	1.6615	0.0305	0.9977	0.0258	0.0281	5.9	6.77
57	570	0.88	0.0308	1.9169	1.6920	0.0305	1.0236	0.0259	0.0281	5.9	6.42
58	580	0.88	0.0308	1.9477	1.7225	0.0305	1.0496	0.0260	0.0282	5.9	6.22
59	590	0.88	0.0308	1.9785	1.7530	0.0305	1.0757	0.0261	0.0282	5.9	6.09
60	600	0.88	0.0308	2.0093	1.7836	0.0306	1.1019	0.0262	0.0283	5.9	6.02
61	610	0.88	0.0308	2.0401	1.8141	0.0305	1.1283	0.0264	0.0284	5.9	5.98
62	620	0.88	0.0308	2.0709	1.8446	0.0305	1.1547	0.0264	0.0284	5.9	5.96
63	630	0.88	0.0308	2.1017	1.8752	0.0306	1.1812	0.0265	0.0285	5.9	5.95
64	640	0.88	0.0308	2.1325	1.9057	0.0305	1.2078	0.0266	0.0285	5.9	5.95
65	650	0.72	0.0252	2.1577	1.9307	0.0250	1.2296	0.0218	0.0233	4.9	5.74
66	660	0.72	0.0252	2.1829	1.9558	0.0251	1.2515	0.0219	0.0234	4.9	5.42
67	670	0.72	0.0252	2.2081	1.9808	0.0250	1.2734	0.0219	0.0234	4.9	5.22
68	680	0.72	0.0252	2.2333	2.0058	0.0250	1.2954	0.0220	0.0234	4.9	5.09
69	690	0.72	0.0252	2.2585	2.0308	0.0250	1.3174	0.0220	0.0234	4.9	5.02
70	700	0.72	0.0252	2.2837	2.0558	0.0250	1.3395	0.0221	0.0235	4.9	4.97
71	710	0.72	0.0252	2.3089	2.0808	0.0250	1.3616	0.0221	0.0235	4.9	4.95
72	720	0.72	0.0252	2.3341	2.1059	0.0251	1.3838	0.0222	0.0236	4.9	4.94
73	730	0.72	0.0252	2.3593	2.1309	0.0250	1.4060	0.0222	0.0235	4.9	4.93
74	740	0.72	0.0252	2.3845	2.1559	0.0250	1.4283	0.0223	0.0236	4.9	4.93
75	750	0.72	0.0252	2.4097	2.1810	0.0251	1.4506	0.0223	0.0236	4.9	4.93
76	760	0.72	0.0252	2.4349	2.2060	0.0250	1.4730	0.0224	0.0237	4.9	4.93
77	770	0.57	0.02	2.4549	2.2259	0.0199	1.4908	0.0178	0.0188	3.9	4.74

					Pervious Area			Impervious Area				
Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Accumulated Rainfall (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
78	780	0.57	0.02	2.4749	2.2458	0.0199	1.5086	0.0178	0.0188	3.9	4.43
79	790	0.57	0.02	2.4949	2.2657	0.0199	1.5264	0.0178	0.0188	3.9	4.24
80	800	0.57	0.02	2.5149	2.2856	0.0199	1.5443	0.0179	0.0189	3.9	4.12
81	810	0.57	0.02	2.5349	2.3054	0.0198	1.5622	0.0179	0.0188	3.9	4.05
82	820	0.57	0.02	2.5549	2.3253	0.0199	1.5801	0.0179	0.0189	3.9	4.01
83	830	0.57	0.02	2.5749	2.3452	0.0199	1.5980	0.0179	0.0189	3.9	3.98
84	840	0.57	0.02	2.5949	2.3651	0.0199	1.6159	0.0179	0.0189	3.9	3.97
85	850	0.57	0.02	2.6149	2.3850	0.0199	1.6339	0.0180	0.0189	4.0	3.96
86	860	0.57	0.02	2.6349	2.4049	0.0199	1.6519	0.0180	0.0189	4.0	3.96
87	870	0.57	0.02	2.6549	2.4248	0.0199	1.6699	0.0180	0.0189	4.0	3.95
88	880	0.57	0.02	2.6749	2.4447	0.0199	1.6880	0.0181	0.0190	4.0	3.95
89	890	0.5	0.0175	2.6924	2.4621	0.0174	1.7038	0.0158	0.0166	3.5	3.86
90	900	0.5	0.0175	2.7099	2.4795	0.0174	1.7196	0.0158	0.0166	3.5	3.71
91	910	0.5	0.0175	2.7274	2.4969	0.0174	1.7355	0.0159	0.0166	3.5	3.62
92	920	0.5	0.0175	2.7449	2.5143	0.0174	1.7513	0.0158	0.0166	3.5	3.56
93	930	0.5	0.0175	2.7624	2.5317	0.0174	1.7672	0.0159	0.0166	3.5	3.52
94	940	0.5	0.0175	2.7799	2.5492	0.0175	1.7831	0.0159	0.0167	3.5	3.51
95	950	0.5	0.0175	2.7974	2.5666	0.0174	1.7990	0.0159	0.0166	3.5	3.50
96	960	0.5	0.0175	2.8149	2.5840	0.0174	1.8149	0.0159	0.0166	3.5	3.49
97	970	0.5	0.0175	2.8324	2.6014	0.0174	1.8308	0.0159	0.0166	3.5	3.48
98	980	0.5	0.0175	2.8499	2.6188	0.0174	1.8468	0.0160	0.0167	3.5	3.48
99	990	0.5	0.0175	2.8674	2.6362	0.0174	1.8627	0.0159	0.0166	3.5	3.48
100	1000	0.5	0.0175	2.8849	2.6537	0.0175	1.8787	0.0160	0.0167	3.5	3.48
101	1010	0.4	0.014	2.8989	2.6676	0.0139	1.8915	0.0128	0.0133	2.8	3.35
102	1020	0.4	0.014	2.9129	2.6815	0.0139	1.9043	0.0128	0.0133	2.8	3.13
103	1030	0.4	0.014	2.9269	2.6955	0.0140	1.9171	0.0128	0.0134	2.8	3.00
104	1040	0.4	0.014	2.9409	2.7094	0.0139	1.9299	0.0128	0.0133	2.8	2.92
105	1050	0.4	0.014	2.9549	2.7234	0.0140	1.9428	0.0129	0.0134	2.8	2.87
106	1060	0.4	0.014	2.9689	2.7373	0.0139	1.9556	0.0128	0.0133	2.8	2.84
107	1070	0.4	0.014	2.9829	2.7512	0.0139	1.9684	0.0128	0.0133	2.8	2.82
108	1080	0.4	0.014	2.9969	2.7652	0.0140	1.9813	0.0129	0.0134	2.8	2.81
109	1090	0.4	0.014	3.0109	2.7791	0.0139	1.9941	0.0128	0.0133	2.8	2.80
110	1100	0.4	0.014	3.0249	2.7931	0.0140	2.0070	0.0129	0.0134	2.8	2.80
111	1110	0.4	0.014	3.0389	2.8070	0.0139	2.0199	0.0129	0.0134	2.8	2.80
112	1120	0.4	0.014	3.0529	2.8210	0.0140	2.0328	0.0129	0.0134	2.8	2.80
113	1130	0.4	0.014	3.0669	2.8349	0.0139	2.0457	0.0129	0.0134	2.8	2.80
114	1140	0.4	0.014	3.0809	2.8488	0.0139	2.0586	0.0129	0.0134	2.8	2.80
115	1150	0.4	0.014	3.0949	2.8628	0.0140	2.0715	0.0129	0.0134	2.8	2.80
116	1160	0.4	0.014	3.1089	2.8767	0.0139	2.0844	0.0129	0.0134	2.8	2.80
117	1170	0.4	0.014	3.1229	2.8907	0.0140	2.0973	0.0129	0.0134	2.8	2.80
118	1180	0.4	0.014	3.1369	2.9046	0.0139	2.1102	0.0129	0.0134	2.8	2.80
119	1190	0.4	0.014	3.1509	2.9186	0.0140	2.1232	0.0130	0.0135	2.8	2.80
120	1200	0.4	0.014	3.1649	2.9325	0.0139	2.1361	0.0129	0.0134	2.8	2.80
121	1210	0.4	0.014	3.1789	2.9465	0.0140	2.1491	0.0130	0.0135	2.8	2.80
122	1220	0.4	0.014	3.1929	2.9604	0.0139	2.1620	0.0129	0.0134	2.8	2.80
123	1230	0.4	0.014	3.2069	2.9744	0.0140	2.1750	0.0130	0.0135	2.8	2.81
124	1240	0.4	0.014	3.2209	2.9883	0.0139	2.1880	0.0130	0.0134	2.8	2.81
125	1250	0.4	0.014	3.2349	3.0023	0.0140	2.2009	0.0129	0.0134	2.8	2.81
126	1260	0.4	0.014	3.2489	3.0162	0.0139	2.2139	0.0130	0.0134	2.8	2.81
127	1270	0.4	0.014	3.2629	3.0302	0.0140	2.2269	0.0130	0.0135	2.8	2.81
128	1280	0.4	0.014	3.2769	3.0441	0.0139	2.2399	0.0130	0.0134	2.8	2.81
129	1290	0.4	0.014	3.2909	3.0581	0.0140	2.2529	0.0130	0.0135	2.8	2.81
130	1300	0.4	0.014	3.3049	3.0720	0.0139	2.2659	0.0130	0.0134	2.8	2.81
131	1310	0.4	0.014	3.3189	3.0860	0.0140	2.2790	0.0131	0.0135	2.8	2.81
132	1320	0.4	0.014	3.3329	3.0999	0.0139	2.2920	0.0130	0.0134	2.8	2.81
133	1330	0.4	0.014	3.3469	3.1139	0.0140	2.3050	0.0130	0.0135	2.8	2.81
134	1340	0.4	0.014	3.3609	3.1278	0.0139	2.3181	0.0131	0.0135	2.8	2.81
135	1350	0.4	0.014	3.3749	3.1418	0.0140	2.3311	0.0130	0.0135	2.8	2.82
136	1360	0.4	0.014	3.3889	3.1557	0.0139	2.3442	0.0131	0.0135	2.8	2.82
137	1370	0.4	0.014	3.4029	3.1697	0.0140	2.3572	0.0130	0.0135	2.8	2.82
138	1380	0.4	0.014	3.4169	3.1836	0.0139	2.3703	0.0131	0.0135	2.8	2.82
139	1390	0.4	0.014	3.4309	3.1976	0.0140	2.3834	0.0131	0.0135	2.8	2.82
140	1400	0.4	0.014	3.4449	3.2115	0.0139	2.3964	0.0130	0.0134	2.8	2.82
141	1410	0.4	0.014	3.4589	3.2255	0.0140	2.4095	0.0131	0.0135	2.8	2.82
142	1420	0.4	0.014	3.4729	3.2395	0.0140	2.4226	0.0131	0.0135	2.8	2.82
143	1430	0.4	0.014	3.4869	3.2534	0.0139	2.4357	0.0131	0.0135	2.8	2.82
144	1440	0.4	0.014	3.5009	3.2674	0.0140	2.4488	0.0131	0.0135	2.8	2.82

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 10-yr, 24hr

Subbasin ID: PS 26 10-Year Bioretention Future Land Use

	Value	Units	Notes
Area =	34.53	*ac*	
P_t =	2.25	*in*	(10 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	21.15	*min*	
w =	0.1912	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	29.36	5.17	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**21.15**	min
T_{Peak} =	**8.00**	hr
Q_{Peak} =	**14.11**	ft^3/s
$V_{Total\ Runoff}$ =	**238001**	ft^3

Time of Concentration **21.15**

Sheet Flow

$T_t = (0.42(n_s L)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 4.57 min

ns	0.011
L	300 ft
P_2	1.75 in
S	0.013333333 ft/ft

Shallow Flow$_1$

Tt = L/V =	16.58 min
L	922
Velocity (V) = kS0.5 =	0.93 ft/s
k	47.47058824
S	0.04 ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.009	0.0090	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.009	0.0180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.009	0.0270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.009	0.0360	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
5	50	0.4	0.009	0.0450	0.0001	0.0001	0.0000	0.0000	0.0001	0.0	0.00
6	60	0.4	0.009	0.0540	0.0008	0.0007	0.0000	0.0000	0.0006	0.1	0.03
7	70	0.4	0.009	0.0630	0.0022	0.0014	0.0000	0.0000	0.0012	0.2	0.09
8	80	0.4	0.009	0.0720	0.0041	0.0019	0.0000	0.0000	0.0016	0.3	0.17
9	90	0.4	0.009	0.0810	0.0066	0.0025	0.0000	0.0000	0.0021	0.4	0.25
10	100	0.4	0.009	0.0900	0.0096	0.0030	0.0000	0.0000	0.0026	0.5	0.34
11	110	0.5	0.0113	0.1013	0.0138	0.0042	0.0000	0.0000	0.0036	0.7	0.46
12	120	0.5	0.0113	0.1126	0.0187	0.0049	0.0000	0.0000	0.0042	0.9	0.59
13	130	0.5	0.0113	0.1239	0.0240	0.0053	0.0000	0.0000	0.0045	0.9	0.71
14	140	0.5	0.0113	0.1352	0.0298	0.0058	0.0000	0.0000	0.0049	1.0	0.82
15	150	0.5	0.0113	0.1465	0.0361	0.0063	0.0000	0.0000	0.0054	1.1	0.92
16	160	0.5	0.0113	0.1578	0.0426	0.0065	0.0000	0.0000	0.0055	1.2	1.00
17	170	0.6	0.0135	0.1713	0.0509	0.0083	0.0000	0.0000	0.0071	1.5	1.12
18	180	0.6	0.0135	0.1848	0.0596	0.0087	0.0000	0.0000	0.0074	1.5	1.27
19	190	0.6	0.0135	0.1983	0.0686	0.0090	0.0000	0.0000	0.0077	1.6	1.38
20	200	0.6	0.0135	0.2118	0.0779	0.0093	0.0000	0.0000	0.0079	1.7	1.48
21	210	0.6	0.0135	0.2253	0.0876	0.0097	0.0000	0.0000	0.0082	1.7	1.56
22	220	0.6	0.0135	0.2388	0.0975	0.0099	0.0002	0.0002	0.0084	1.8	1.63
23	230	0.7	0.0158	0.2546	0.1094	0.0119	0.0009	0.0007	0.0102	2.1	1.75
24	240	0.7	0.0158	0.2704	0.1215	0.0121	0.0020	0.0011	0.0105	2.2	1.91
25	250	0.7	0.0158	0.2862	0.1340	0.0125	0.0035	0.0015	0.0109	2.3	2.03
26	260	0.7	0.0158	0.3020	0.1466	0.0126	0.0053	0.0018	0.0110	2.3	2.13
27	270	0.7	0.0158	0.3178	0.1595	0.0129	0.0076	0.0023	0.0113	2.4	2.20
28	280	0.7	0.0158	0.3336	0.1725	0.0130	0.0101	0.0025	0.0114	2.4	2.27
29	290	0.82	0.0185	0.3521	0.1880	0.0155	0.0136	0.0035	0.0137	2.9	2.41
30	300	0.82	0.0185	0.3706	0.2037	0.0157	0.0175	0.0039	0.0139	2.9	2.59
31	310	0.82	0.0185	0.3891	0.2196	0.0159	0.0218	0.0043	0.0142	3.0	2.72
32	320	0.82	0.0185	0.4076	0.2357	0.0161	0.0265	0.0047	0.0144	3.0	2.82
33	330	0.82	0.0185	0.4261	0.2519	0.0162	0.0316	0.0051	0.0145	3.0	2.90
34	340	0.82	0.0185	0.4446	0.2682	0.0163	0.0371	0.0055	0.0147	3.1	2.96
35	350	0.95	0.0214	0.4660	0.2873	0.0191	0.0439	0.0068	0.0173	3.6	3.10
36	360	0.95	0.0214	0.4874	0.3065	0.0192	0.0511	0.0072	0.0174	3.6	3.30
37	370	0.95	0.0214	0.5088	0.3259	0.0194	0.0588	0.0077	0.0176	3.7	3.44
38	380	0.95	0.0214	0.5302	0.3454	0.0195	0.0668	0.0080	0.0178	3.7	3.54
39	390	0.95	0.0214	0.5516	0.3650	0.0196	0.0753	0.0085	0.0179	3.7	3.61
40	400	0.95	0.0214	0.5730	0.3847	0.0197	0.0842	0.0089	0.0181	3.8	3.67
41	410	1.34	0.0302	0.6032	0.4126	0.0279	0.0973	0.0131	0.0257	5.4	4.01
42	420	1.34	0.0302	0.6334	0.4408	0.0282	0.1111	0.0138	0.0260	5.4	4.55
43	430	1.34	0.0302	0.6636	0.4691	0.0283	0.1255	0.0144	0.0262	5.5	4.89
44	440	1.8	0.0405	0.7041	0.5072	0.0381	0.1458	0.0203	0.0354	7.4	5.49
45	450	1.8	0.0405	0.7446	0.5456	0.0384	0.1671	0.0213	0.0358	7.5	6.23
46	460	3.4	0.0765	0.8211	0.6185	0.0729	0.2097	0.0426	0.0684	14.3	8.01
47	470	5.4	0.1215	0.9426	0.7354	0.1169	0.2833	0.0736	0.1104	23.1	12.09
48	480	2.7	0.0608	1.0034	0.7942	0.0588	0.3225	0.0392	0.0559	11.7	14.11
49	490	1.8	0.0405	1.0439	0.8335	0.0393	0.3493	0.0268	0.0374	7.8	12.44
50	500	1.34	0.0302	1.0741	0.8629	0.0294	0.3697	0.0204	0.0281	5.9	10.30
51	510	1.34	0.0302	1.1043	0.8923	0.0294	0.3904	0.0207	0.0281	5.9	8.60
52	520	1.34	0.0302	1.1345	0.9217	0.0294	0.4113	0.0209	0.0281	5.9	7.56
53	530	0.88	0.0198	1.1543	0.9410	0.0193	0.4252	0.0139	0.0185	3.9	6.53
54	540	0.88	0.0198	1.1741	0.9603	0.0193	0.4392	0.0140	0.0185	3.9	5.51
55	550	0.88	0.0198	1.1939	0.9797	0.0194	0.4533	0.0141	0.0186	3.9	4.89
56	560	0.88	0.0198	1.2137	0.9990	0.0193	0.4675	0.0142	0.0185	3.9	4.50
57	570	0.88	0.0198	1.2335	1.0184	0.0194	0.4819	0.0144	0.0187	3.9	4.27
58	580	0.88	0.0198	1.2533	1.0378	0.0194	0.4963	0.0144	0.0187	3.9	4.12
59	590	0.88	0.0198	1.2731	1.0572	0.0194	0.5108	0.0145	0.0187	3.9	4.04
60	600	0.88	0.0198	1.2929	1.0766	0.0194	0.5254	0.0146	0.0187	3.9	3.99
61	610	0.88	0.0198	1.3127	1.0960	0.0194	0.5401	0.0147	0.0187	3.9	3.95
62	620	0.88	0.0198	1.3325	1.1154	0.0194	0.5549	0.0148	0.0187	3.9	3.94
63	630	0.88	0.0198	1.3523	1.1349	0.0195	0.5698	0.0149	0.0188	3.9	3.93
64	640	0.88	0.0198	1.3721	1.1543	0.0194	0.5848	0.0150	0.0187	3.9	3.93
65	650	0.72	0.0162	1.3883	1.1702	0.0159	0.5971	0.0123	0.0154	3.2	3.79
66	660	0.72	0.0162	1.4045	1.1862	0.0160	0.6095	0.0124	0.0155	3.2	3.57
67	670	0.72	0.0162	1.4207	1.2021	0.0159	0.6219	0.0124	0.0154	3.2	3.44
68	680	0.72	0.0162	1.4369	1.2180	0.0159	0.6344	0.0125	0.0154	3.2	3.35
69	690	0.72	0.0162	1.4531	1.2340	0.0160	0.6469	0.0125	0.0155	3.2	3.30
70	700	0.72	0.0162	1.4693	1.2499	0.0159	0.6595	0.0126	0.0154	3.2	3.27
71	710	0.72	0.0162	1.4855	1.2659	0.0160	0.6721	0.0126	0.0155	3.2	3.26
72	720	0.72	0.0162	1.5017	1.2818	0.0159	0.6848	0.0127	0.0154	3.2	3.25
73	730	0.72	0.0162	1.5179	1.2978	0.0160	0.6975	0.0127	0.0155	3.2	3.24
74	740	0.72	0.0162	1.5341	1.3137	0.0159	0.7103	0.0128	0.0154	3.2	3.24
75	750	0.72	0.0162	1.5503	1.3297	0.0160	0.7231	0.0128	0.0155	3.2	3.24
76	760	0.72	0.0162	1.5665	1.3457	0.0160	0.7360	0.0129	0.0155	3.2	3.24
77	770	0.57	0.0128	1.5793	1.3583	0.0126	0.7462	0.0102	0.0122	2.6	3.11

					Pervious Area			Impervious Area				
Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Accumulated Rainfall (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
78	780	0.57	0.0128	1.5921	1.3709	0.0126	0.7564	0.0102	0.0122	2.6	2.90
79	790	0.57	0.0128	1.6049	1.3836	0.0127	0.7666	0.0102	0.0123	2.6	2.77
80	800	0.57	0.0128	1.6177	1.3962	0.0126	0.7769	0.0103	0.0123	2.6	2.69
81	810	0.57	0.0128	1.6305	1.4088	0.0126	0.7872	0.0103	0.0123	2.6	2.64
82	820	0.57	0.0128	1.6433	1.4215	0.0127	0.7975	0.0103	0.0123	2.6	2.61
83	830	0.57	0.0128	1.6561	1.4341	0.0126	0.8079	0.0104	0.0123	2.6	2.60
84	840	0.57	0.0128	1.6689	1.4467	0.0126	0.8182	0.0103	0.0123	2.6	2.58
85	850	0.57	0.0128	1.6817	1.4594	0.0127	0.8286	0.0104	0.0124	2.6	2.58
86	860	0.57	0.0128	1.6945	1.4720	0.0126	0.8391	0.0105	0.0123	2.6	2.58
87	870	0.57	0.0128	1.7073	1.4847	0.0127	0.8495	0.0104	0.0124	2.6	2.58
88	880	0.57	0.0128	1.7201	1.4973	0.0126	0.8600	0.0105	0.0123	2.6	2.58
89	890	0.5	0.0113	1.7314	1.5085	0.0112	0.8692	0.0092	0.0109	2.3	2.52
90	900	0.5	0.0113	1.7427	1.5197	0.0112	0.8785	0.0093	0.0109	2.3	2.43
91	910	0.5	0.0113	1.7540	1.5308	0.0111	0.8878	0.0093	0.0108	2.3	2.37
92	920	0.5	0.0113	1.7653	1.5420	0.0112	0.8971	0.0093	0.0109	2.3	2.33
93	930	0.5	0.0113	1.7766	1.5532	0.0112	0.9064	0.0093	0.0109	2.3	2.31
94	940	0.5	0.0113	1.7879	1.5643	0.0111	0.9158	0.0094	0.0108	2.3	2.30
95	950	0.5	0.0113	1.7992	1.5755	0.0112	0.9251	0.0093	0.0109	2.3	2.29
96	960	0.5	0.0113	1.8105	1.5867	0.0112	0.9345	0.0094	0.0109	2.3	2.29
97	970	0.5	0.0113	1.8218	1.5979	0.0112	0.9439	0.0094	0.0109	2.3	2.28
98	980	0.5	0.0113	1.8331	1.6091	0.0112	0.9533	0.0094	0.0109	2.3	2.28
99	990	0.5	0.0113	1.8444	1.6202	0.0111	0.9627	0.0094	0.0108	2.3	2.28
100	1000	0.5	0.0113	1.8557	1.6314	0.0112	0.9722	0.0095	0.0109	2.3	2.28
101	1010	0.4	0.009	1.8647	1.6403	0.0089	0.9797	0.0075	0.0087	1.8	2.19
102	1020	0.4	0.009	1.8737	1.6492	0.0089	0.9873	0.0076	0.0087	1.8	2.05
103	1030	0.4	0.009	1.8827	1.6582	0.0090	0.9948	0.0075	0.0088	1.8	1.96
104	1040	0.4	0.009	1.8917	1.6671	0.0089	1.0024	0.0076	0.0087	1.8	1.91
105	1050	0.4	0.009	1.9007	1.6760	0.0089	1.0099	0.0075	0.0087	1.8	1.87
106	1060	0.4	0.009	1.9097	1.6849	0.0089	1.0175	0.0076	0.0087	1.8	1.85
107	1070	0.4	0.009	1.9187	1.6938	0.0089	1.0251	0.0076	0.0087	1.8	1.84
108	1080	0.4	0.009	1.9277	1.7027	0.0089	1.0327	0.0076	0.0087	1.8	1.83
109	1090	0.4	0.009	1.9367	1.7116	0.0089	1.0403	0.0076	0.0087	1.8	1.83
110	1100	0.4	0.009	1.9457	1.7206	0.0090	1.0479	0.0076	0.0088	1.8	1.83
111	1110	0.4	0.009	1.9547	1.7295	0.0089	1.0555	0.0076	0.0087	1.8	1.83
112	1120	0.4	0.009	1.9637	1.7384	0.0089	1.0632	0.0077	0.0087	1.8	1.82
113	1130	0.4	0.009	1.9727	1.7473	0.0089	1.0708	0.0076	0.0087	1.8	1.82
114	1140	0.4	0.009	1.9817	1.7562	0.0089	1.0784	0.0076	0.0087	1.8	1.82
115	1150	0.4	0.009	1.9907	1.7651	0.0089	1.0861	0.0077	0.0087	1.8	1.82
116	1160	0.4	0.009	1.9997	1.7741	0.0090	1.0938	0.0077	0.0088	1.8	1.82
117	1170	0.4	0.009	2.0087	1.7830	0.0089	1.1014	0.0076	0.0087	1.8	1.83
118	1180	0.4	0.009	2.0177	1.7919	0.0089	1.1091	0.0077	0.0087	1.8	1.82
119	1190	0.4	0.009	2.0267	1.8008	0.0089	1.1168	0.0077	0.0087	1.8	1.82
120	1200	0.4	0.009	2.0357	1.8097	0.0089	1.1245	0.0077	0.0087	1.8	1.82
121	1210	0.4	0.009	2.0447	1.8187	0.0090	1.1322	0.0077	0.0088	1.8	1.83
122	1220	0.4	0.009	2.0537	1.8276	0.0089	1.1399	0.0077	0.0087	1.8	1.83
123	1230	0.4	0.009	2.0627	1.8365	0.0089	1.1476	0.0077	0.0087	1.8	1.83
124	1240	0.4	0.009	2.0717	1.8454	0.0089	1.1554	0.0078	0.0087	1.8	1.82
125	1250	0.4	0.009	2.0807	1.8544	0.0090	1.1631	0.0077	0.0088	1.8	1.83
126	1260	0.4	0.009	2.0897	1.8633	0.0089	1.1708	0.0077	0.0087	1.8	1.83
127	1270	0.4	0.009	2.0987	1.8722	0.0089	1.1786	0.0078	0.0087	1.8	1.83
128	1280	0.4	0.009	2.1077	1.8811	0.0089	1.1864	0.0078	0.0087	1.8	1.83
129	1290	0.4	0.009	2.1167	1.8901	0.0090	1.1941	0.0077	0.0088	1.8	1.83
130	1300	0.4	0.009	2.1257	1.8990	0.0089	1.2019	0.0078	0.0087	1.8	1.83
131	1310	0.4	0.009	2.1347	1.9079	0.0089	1.2097	0.0078	0.0087	1.8	1.83
132	1320	0.4	0.009	2.1437	1.9169	0.0090	1.2175	0.0078	0.0088	1.8	1.83
133	1330	0.4	0.009	2.1527	1.9258	0.0089	1.2253	0.0078	0.0087	1.8	1.83
134	1340	0.4	0.009	2.1617	1.9347	0.0089	1.2331	0.0078	0.0087	1.8	1.83
135	1350	0.4	0.009	2.1707	1.9436	0.0089	1.2409	0.0078	0.0087	1.8	1.83
136	1360	0.4	0.009	2.1797	1.9526	0.0090	1.2487	0.0078	0.0088	1.8	1.83
137	1370	0.4	0.009	2.1887	1.9615	0.0089	1.2565	0.0078	0.0087	1.8	1.83
138	1380	0.4	0.009	2.1977	1.9704	0.0089	1.2643	0.0078	0.0087	1.8	1.83
139	1390	0.4	0.009	2.2067	1.9794	0.0090	1.2722	0.0079	0.0088	1.8	1.83
140	1400	0.4	0.009	2.2157	1.9883	0.0089	1.2800	0.0078	0.0087	1.8	1.83
141	1410	0.4	0.009	2.2247	1.9972	0.0089	1.2879	0.0079	0.0088	1.8	1.83
142	1420	0.4	0.009	2.2337	2.0062	0.0090	1.2957	0.0078	0.0088	1.8	1.83
143	1430	0.4	0.009	2.2427	2.0151	0.0089	1.3036	0.0079	0.0088	1.8	1.83
144	1440	0.4	0.009	2.2517	2.0240	0.0089	1.3115	0.0079	0.0088	1.8	1.83

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 25-yr, 24hr

Subbasin ID: PS 26 25-Year Bioretention Future Land Use

	Value	Units	Notes
Area =	34.53	*ac*	
P_t =	3.5	*in*	(25 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	21.15	*min*	
w =	0.1912	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	29.36	5.17	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**21.15**	min
T_{Peak} =	**8.00**	hr
Q_{Peak} =	**22.97**	ft^3/s
$V_{Total\ Runoff}$ =	**390518**	ft^3

Time of Concentration **21.15**

Sheet Flow

$T_t = (0.42(n_sL)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 4.57 min

ns 0.011
L 300 ft
P_2 1.75 in
S 0.013333333 ft/ft

$Shallow\ Flow_1$

Tt = L/V = 16.58 min
L 922
Velocity (V) = kS0.5 = 0.93 ft/s
k 47.47058824
S 0.04 ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.014	0.0140	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.014	0.0280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.014	0.0420	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.014	0.0560	0.0011	0.0011	0.0000	0.0000	0.0009	0.2	0.04
5	50	0.4	0.014	0.0700	0.0037	0.0026	0.0000	0.0000	0.0022	0.5	0.15
6	60	0.4	0.014	0.0840	0.0075	0.0038	0.0000	0.0000	0.0032	0.7	0.31
7	70	0.4	0.014	0.0980	0.0125	0.0050	0.0000	0.0000	0.0043	0.9	0.49
8	80	0.4	0.014	0.1120	0.0184	0.0059	0.0000	0.0000	0.0050	1.0	0.67
9	90	0.4	0.014	0.1260	0.0251	0.0067	0.0000	0.0000	0.0057	1.2	0.84
10	100	0.4	0.014	0.1400	0.0324	0.0073	0.0000	0.0000	0.0062	1.3	1.00
11	110	0.5	0.0175	0.1575	0.0424	0.0100	0.0000	0.0000	0.0085	1.8	1.20
12	120	0.5	0.0175	0.1750	0.0532	0.0108	0.0000	0.0000	0.0092	1.9	1.45
13	130	0.5	0.0175	0.1925	0.0647	0.0115	0.0000	0.0000	0.0098	2.0	1.65
14	140	0.5	0.0175	0.2100	0.0767	0.0120	0.0000	0.0000	0.0102	2.1	1.82
15	150	0.5	0.0175	0.2275	0.0892	0.0125	0.0000	0.0000	0.0106	2.2	1.96
16	160	0.5	0.0175	0.2450	0.1021	0.0129	0.0005	0.0005	0.0110	2.3	2.07
17	170	0.6	0.021	0.2660	0.1181	0.0160	0.0017	0.0012	0.0138	2.9	2.27
18	180	0.6	0.021	0.2870	0.1346	0.0165	0.0036	0.0019	0.0143	3.0	2.53
19	190	0.6	0.021	0.3080	0.1515	0.0169	0.0061	0.0025	0.0147	3.1	2.72
20	200	0.6	0.021	0.3290	0.1687	0.0172	0.0094	0.0033	0.0151	3.2	2.87
21	210	0.6	0.021	0.3500	0.1862	0.0175	0.0132	0.0038	0.0154	3.2	3.00
22	220	0.6	0.021	0.3710	0.2041	0.0179	0.0176	0.0044	0.0159	3.3	3.10
23	230	0.7	0.0245	0.3955	0.2251	0.0210	0.0234	0.0058	0.0187	3.9	3.30
24	240	0.7	0.0245	0.4200	0.2465	0.0214	0.0299	0.0065	0.0192	4.0	3.55
25	250	0.7	0.0245	0.4445	0.2681	0.0216	0.0371	0.0072	0.0194	4.1	3.73
26	260	0.7	0.0245	0.4690	0.2900	0.0219	0.0448	0.0077	0.0198	4.1	3.87
27	270	0.7	0.0245	0.4935	0.3120	0.0220	0.0532	0.0084	0.0200	4.2	3.98
28	280	0.7	0.0245	0.5180	0.3342	0.0222	0.0622	0.0090	0.0202	4.2	4.06
29	290	0.82	0.0287	0.5467	0.3605	0.0263	0.0733	0.0111	0.0240	5.0	4.28
30	300	0.82	0.0287	0.5754	0.3869	0.0264	0.0852	0.0119	0.0242	5.1	4.57
31	310	0.82	0.0287	0.6041	0.4135	0.0266	0.0977	0.0125	0.0245	5.1	4.77
32	320	0.82	0.0287	0.6328	0.4402	0.0267	0.1108	0.0131	0.0247	5.2	4.91
33	330	0.82	0.0287	0.6615	0.4671	0.0269	0.1245	0.0137	0.0249	5.2	5.01
34	340	0.82	0.0287	0.6902	0.4941	0.0270	0.1387	0.0142	0.0251	5.2	5.09
35	350	0.95	0.0333	0.7235	0.5256	0.0315	0.1558	0.0171	0.0293	6.1	5.32
36	360	0.95	0.0333	0.7568	0.5572	0.0316	0.1736	0.0178	0.0295	6.2	5.64
37	370	0.95	0.0333	0.7901	0.5889	0.0317	0.1921	0.0185	0.0297	6.2	5.85
38	380	0.95	0.0333	0.8234	0.6207	0.0318	0.2111	0.0190	0.0299	6.2	5.99
39	390	0.95	0.0333	0.8567	0.6526	0.0319	0.2306	0.0195	0.0300	6.3	6.09
40	400	0.95	0.0333	0.8900	0.6846	0.0320	0.2507	0.0201	0.0302	6.3	6.17
41	410	1.34	0.0469	0.9369	0.7299	0.0453	0.2797	0.0290	0.0429	9.0	6.73
42	420	1.34	0.0469	0.9838	0.7752	0.0453	0.3097	0.0300	0.0430	9.0	7.59
43	430	1.34	0.0469	1.0307	0.8207	0.0455	0.3405	0.0308	0.0433	9.0	8.13
44	440	1.8	0.063	1.0937	0.8819	0.0612	0.3831	0.0426	0.0584	12.2	9.09
45	450	1.8	0.063	1.1567	0.9434	0.0615	0.4269	0.0438	0.0588	12.3	10.30
46	460	3.4	0.119	1.2757	1.0597	0.1163	0.5127	0.0858	0.1117	23.3	13.17
47	470	5.4	0.189	1.4647	1.2454	0.1857	0.6559	0.1432	0.1793	37.5	19.76
48	480	2.7	0.0945	1.5592	1.3385	0.0931	0.7302	0.0743	0.0903	18.9	22.97
49	490	1.8	0.063	1.6222	1.4006	0.0621	0.7805	0.0503	0.0603	12.6	20.20
50	500	1.34	0.0469	1.6691	1.4469	0.0463	0.8184	0.0379	0.0450	9.4	16.69
51	510	1.34	0.0469	1.7160	1.4933	0.0464	0.8566	0.0382	0.0452	9.4	13.91
52	520	1.34	0.0469	1.7629	1.5396	0.0463	0.8951	0.0385	0.0451	9.4	12.20
53	530	0.88	0.0308	1.7937	1.5701	0.0305	0.9206	0.0255	0.0298	6.2	10.52
54	540	0.88	0.0308	1.8245	1.6006	0.0305	0.9462	0.0256	0.0298	6.2	8.88
55	550	0.88	0.0308	1.8553	1.6310	0.0304	0.9719	0.0257	0.0297	6.2	7.86
56	560	0.88	0.0308	1.8861	1.6615	0.0305	0.9977	0.0258	0.0298	6.2	7.23
57	570	0.88	0.0308	1.9169	1.6920	0.0305	1.0236	0.0259	0.0298	6.2	6.85
58	580	0.88	0.0308	1.9477	1.7225	0.0305	1.0496	0.0260	0.0298	6.2	6.61
59	590	0.88	0.0308	1.9785	1.7530	0.0305	1.0757	0.0261	0.0298	6.2	6.47
60	600	0.88	0.0308	2.0093	1.7836	0.0306	1.1019	0.0262	0.0299	6.3	6.38
61	610	0.88	0.0308	2.0401	1.8141	0.0305	1.1283	0.0264	0.0299	6.2	6.33
62	620	0.88	0.0308	2.0709	1.8446	0.0305	1.1547	0.0264	0.0299	6.2	6.30
63	630	0.88	0.0308	2.1017	1.8752	0.0306	1.1812	0.0265	0.0300	6.3	6.28
64	640	0.88	0.0308	2.1325	1.9057	0.0305	1.2078	0.0266	0.0299	6.2	6.27
65	650	0.72	0.0252	2.1577	1.9307	0.0250	1.2296	0.0218	0.0245	5.1	6.05
66	660	0.72	0.0252	2.1829	1.9558	0.0251	1.2515	0.0219	0.0246	5.1	5.70
67	670	0.72	0.0252	2.2081	1.9808	0.0250	1.2734	0.0219	0.0245	5.1	5.48
68	680	0.72	0.0252	2.2333	2.0058	0.0250	1.2954	0.0220	0.0246	5.1	5.35
69	690	0.72	0.0252	2.2585	2.0308	0.0250	1.3174	0.0220	0.0246	5.1	5.26
70	700	0.72	0.0252	2.2837	2.0558	0.0250	1.3395	0.0221	0.0246	5.1	5.21
71	710	0.72	0.0252	2.3089	2.0808	0.0250	1.3616	0.0221	0.0246	5.1	5.18
72	720	0.72	0.0252	2.3341	2.1059	0.0251	1.3838	0.0222	0.0247	5.2	5.17
73	730	0.72	0.0252	2.3593	2.1309	0.0250	1.4060	0.0222	0.0246	5.1	5.16
74	740	0.72	0.0252	2.3845	2.1559	0.0250	1.4283	0.0223	0.0246	5.1	5.15
75	750	0.72	0.0252	2.4097	2.1810	0.0251	1.4506	0.0223	0.0247	5.2	5.15
76	760	0.72	0.0252	2.4349	2.2060	0.0250	1.4730	0.0224	0.0246	5.1	5.15
77	770	0.57	0.02	2.4549	2.2259	0.0199	1.4908	0.0178	0.0196	4.1	4.95

					Pervious Area		Impervious Area				
Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Accumulated Rainfall (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
78	780	0.57	0.02	2.4749	2.2458	0.0199	1.5086	0.0178	0.0196	4.1	4.62
79	790	0.57	0.02	2.4949	2.2657	0.0199	1.5264	0.0178	0.0196	4.1	4.42
80	800	0.57	0.02	2.5149	2.2856	0.0199	1.5443	0.0179	0.0196	4.1	4.29
81	810	0.57	0.02	2.5349	2.3054	0.0198	1.5622	0.0179	0.0195	4.1	4.21
82	820	0.57	0.02	2.5549	2.3253	0.0199	1.5801	0.0179	0.0196	4.1	4.16
83	830	0.57	0.02	2.5749	2.3452	0.0199	1.5980	0.0179	0.0196	4.1	4.14
84	840	0.57	0.02	2.5949	2.3651	0.0199	1.6159	0.0179	0.0196	4.1	4.12
85	850	0.57	0.02	2.6149	2.3850	0.0199	1.6339	0.0180	0.0196	4.1	4.11
86	860	0.57	0.02	2.6349	2.4049	0.0199	1.6519	0.0180	0.0196	4.1	4.11
87	870	0.57	0.02	2.6549	2.4248	0.0199	1.6699	0.0180	0.0196	4.1	4.10
88	880	0.57	0.02	2.6749	2.4447	0.0199	1.6880	0.0181	0.0196	4.1	4.10
89	890	0.5	0.0175	2.6924	2.4621	0.0174	1.7038	0.0158	0.0172	3.6	4.00
90	900	0.5	0.0175	2.7099	2.4795	0.0174	1.7196	0.0158	0.0172	3.6	3.84
91	910	0.5	0.0175	2.7274	2.4969	0.0174	1.7355	0.0159	0.0172	3.6	3.74
92	920	0.5	0.0175	2.7449	2.5143	0.0174	1.7513	0.0158	0.0172	3.6	3.68
93	930	0.5	0.0175	2.7624	2.5317	0.0174	1.7672	0.0159	0.0172	3.6	3.65
94	940	0.5	0.0175	2.7799	2.5492	0.0175	1.7831	0.0159	0.0173	3.6	3.63
95	950	0.5	0.0175	2.7974	2.5666	0.0174	1.7990	0.0159	0.0172	3.6	3.62
96	960	0.5	0.0175	2.8149	2.5840	0.0174	1.8149	0.0159	0.0172	3.6	3.61
97	970	0.5	0.0175	2.8324	2.6014	0.0174	1.8308	0.0159	0.0172	3.6	3.60
98	980	0.5	0.0175	2.8499	2.6188	0.0174	1.8468	0.0160	0.0172	3.6	3.60
99	990	0.5	0.0175	2.8674	2.6362	0.0174	1.8627	0.0159	0.0172	3.6	3.59
100	1000	0.5	0.0175	2.8849	2.6537	0.0175	1.8787	0.0160	0.0173	3.6	3.60
101	1010	0.4	0.014	2.8989	2.6676	0.0139	1.8915	0.0128	0.0137	2.9	3.46
102	1020	0.4	0.014	2.9129	2.6815	0.0139	1.9043	0.0128	0.0137	2.9	3.23
103	1030	0.4	0.014	2.9269	2.6955	0.0140	1.9171	0.0128	0.0138	2.9	3.10
104	1040	0.4	0.014	2.9409	2.7094	0.0139	1.9299	0.0128	0.0137	2.9	3.01
105	1050	0.4	0.014	2.9549	2.7234	0.0140	1.9428	0.0129	0.0138	2.9	2.96
106	1060	0.4	0.014	2.9689	2.7373	0.0139	1.9556	0.0128	0.0137	2.9	2.93
107	1070	0.4	0.014	2.9829	2.7512	0.0139	1.9684	0.0128	0.0137	2.9	2.91
108	1080	0.4	0.014	2.9969	2.7652	0.0140	1.9813	0.0129	0.0138	2.9	2.90
109	1090	0.4	0.014	3.0109	2.7791	0.0139	1.9941	0.0128	0.0137	2.9	2.89
110	1100	0.4	0.014	3.0249	2.7931	0.0140	2.0070	0.0129	0.0138	2.9	2.89
111	1110	0.4	0.014	3.0389	2.8070	0.0139	2.0199	0.0129	0.0138	2.9	2.88
112	1120	0.4	0.014	3.0529	2.8210	0.0140	2.0328	0.0129	0.0138	2.9	2.88
113	1130	0.4	0.014	3.0669	2.8349	0.0139	2.0457	0.0129	0.0138	2.9	2.88
114	1140	0.4	0.014	3.0809	2.8488	0.0139	2.0586	0.0129	0.0138	2.9	2.88
115	1150	0.4	0.014	3.0949	2.8628	0.0140	2.0715	0.0129	0.0138	2.9	2.88
116	1160	0.4	0.014	3.1089	2.8767	0.0139	2.0844	0.0129	0.0138	2.9	2.88
117	1170	0.4	0.014	3.1229	2.8907	0.0140	2.0973	0.0129	0.0138	2.9	2.88
118	1180	0.4	0.014	3.1369	2.9046	0.0139	2.1102	0.0129	0.0138	2.9	2.88
119	1190	0.4	0.014	3.1509	2.9186	0.0140	2.1232	0.0130	0.0139	2.9	2.88
120	1200	0.4	0.014	3.1649	2.9325	0.0139	2.1361	0.0129	0.0138	2.9	2.88
121	1210	0.4	0.014	3.1789	2.9465	0.0140	2.1491	0.0130	0.0139	2.9	2.88
122	1220	0.4	0.014	3.1929	2.9604	0.0139	2.1620	0.0129	0.0138	2.9	2.88
123	1230	0.4	0.014	3.2069	2.9744	0.0140	2.1750	0.0130	0.0139	2.9	2.88
124	1240	0.4	0.014	3.2209	2.9883	0.0139	2.1880	0.0130	0.0138	2.9	2.88
125	1250	0.4	0.014	3.2349	3.0023	0.0140	2.2009	0.0129	0.0138	2.9	2.88
126	1260	0.4	0.014	3.2489	3.0162	0.0139	2.2139	0.0130	0.0138	2.9	2.88
127	1270	0.4	0.014	3.2629	3.0302	0.0140	2.2269	0.0130	0.0139	2.9	2.88
128	1280	0.4	0.014	3.2769	3.0441	0.0139	2.2399	0.0130	0.0138	2.9	2.88
129	1290	0.4	0.014	3.2909	3.0581	0.0140	2.2529	0.0130	0.0139	2.9	2.88
130	1300	0.4	0.014	3.3049	3.0720	0.0139	2.2659	0.0130	0.0138	2.9	2.88
131	1310	0.4	0.014	3.3189	3.0860	0.0140	2.2790	0.0131	0.0139	2.9	2.89
132	1320	0.4	0.014	3.3329	3.0999	0.0139	2.2920	0.0130	0.0138	2.9	2.89
133	1330	0.4	0.014	3.3469	3.1139	0.0140	2.3050	0.0130	0.0139	2.9	2.89
134	1340	0.4	0.014	3.3609	3.1278	0.0139	2.3181	0.0131	0.0138	2.9	2.89
135	1350	0.4	0.014	3.3749	3.1418	0.0140	2.3311	0.0130	0.0139	2.9	2.89
136	1360	0.4	0.014	3.3889	3.1557	0.0139	2.3442	0.0131	0.0138	2.9	2.89
137	1370	0.4	0.014	3.4029	3.1697	0.0140	2.3572	0.0130	0.0139	2.9	2.89
138	1380	0.4	0.014	3.4169	3.1836	0.0139	2.3703	0.0131	0.0138	2.9	2.89
139	1390	0.4	0.014	3.4309	3.1976	0.0140	2.3834	0.0131	0.0139	2.9	2.89
140	1400	0.4	0.014	3.4449	3.2115	0.0139	2.3964	0.0130	0.0138	2.9	2.89
141	1410	0.4	0.014	3.4589	3.2255	0.0140	2.4095	0.0131	0.0139	2.9	2.89
142	1420	0.4	0.014	3.4729	3.2395	0.0140	2.4226	0.0131	0.0139	2.9	2.89
143	1430	0.4	0.014	3.4869	3.2534	0.0139	2.4357	0.0131	0.0138	2.9	2.89
144	1440	0.4	0.014	3.5009	3.2674	0.0140	2.4488	0.0131	0.0139	2.9	2.89

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 10-yr, 24hr

Subbasin ID: PS 26 10-Year No Bioretention Existing Land Use

	Value	Units	Notes
Area =	73.26	*ac*	
P_t =	2.25	*in*	(10 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	115.56	*min*	
w =	0.0415	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	35.37	37.89	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**115.56**	min
T_{Peak} =	**8.33**	hr
Q_{Peak} =	**11.98**	ft^3/s
$V_{Total\ Runoff}$ =	**414390**	ft^3

Time of Concentration **115.56**

Sheet Flow

$T_t = (0.42(n_sL)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 4.57 min

ns 0.011
L 300 ft
P_2 1.75 in
S 0.013333333 ft/ft

Shallow $Flow_1$

Tt = L/V = 94.52 min
L 1065
Velocity (V) = kS0.5 = 0.19 ft/s
k 20
S 0.02 ft/ft

Shallow $Flow_2$

Tt = L/V = 16.47 min
L 685
city (V) = kS0.5 = 0.69 ft/s
k 47.470588
S 0.03 ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.009	0.0090	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.009	0.0180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.009	0.0270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.009	0.0360	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
5	50	0.4	0.009	0.0450	0.0001	0.0001	0.0000	0.0000	0.0000	0.0	0.00
6	60	0.4	0.009	0.0540	0.0008	0.0007	0.0000	0.0000	0.0003	0.1	0.01
7	70	0.4	0.009	0.0630	0.0022	0.0014	0.0000	0.0000	0.0007	0.3	0.03
8	80	0.4	0.009	0.0720	0.0041	0.0019	0.0000	0.0000	0.0009	0.4	0.05
9	90	0.4	0.009	0.0810	0.0066	0.0025	0.0000	0.0000	0.0012	0.5	0.09
10	100	0.4	0.009	0.0900	0.0096	0.0030	0.0000	0.0000	0.0014	0.6	0.13
11	110	0.5	0.0113	0.1013	0.0138	0.0042	0.0000	0.0000	0.0020	0.9	0.18
12	120	0.5	0.0113	0.1126	0.0187	0.0049	0.0000	0.0000	0.0024	1.0	0.25
13	130	0.5	0.0113	0.1239	0.0240	0.0053	0.0000	0.0000	0.0026	1.1	0.32
14	140	0.5	0.0113	0.1352	0.0298	0.0058	0.0000	0.0000	0.0028	1.2	0.39
15	150	0.5	0.0113	0.1465	0.0361	0.0063	0.0000	0.0000	0.0030	1.3	0.47
16	160	0.5	0.0113	0.1578	0.0426	0.0065	0.0000	0.0000	0.0031	1.4	0.54
17	170	0.6	0.0135	0.1713	0.0509	0.0083	0.0000	0.0000	0.0040	1.8	0.63
18	180	0.6	0.0135	0.1848	0.0596	0.0087	0.0000	0.0000	0.0042	1.9	0.73
19	190	0.6	0.0135	0.1983	0.0686	0.0090	0.0000	0.0000	0.0043	1.9	0.82
20	200	0.6	0.0135	0.2118	0.0779	0.0093	0.0000	0.0000	0.0045	2.0	0.92
21	210	0.6	0.0135	0.2253	0.0876	0.0097	0.0000	0.0000	0.0047	2.1	1.01
22	220	0.6	0.0135	0.2388	0.0975	0.0099	0.0002	0.0002	0.0049	2.2	1.10
23	230	0.7	0.0158	0.2546	0.1094	0.0119	0.0009	0.0007	0.0061	2.7	1.21
24	240	0.7	0.0158	0.2704	0.1215	0.0121	0.0020	0.0011	0.0064	2.8	1.34
25	250	0.7	0.0158	0.2862	0.1340	0.0125	0.0035	0.0015	0.0068	3.0	1.47
26	260	0.7	0.0158	0.3020	0.1466	0.0126	0.0053	0.0018	0.0070	3.1	1.61
27	270	0.7	0.0158	0.3178	0.1595	0.0129	0.0076	0.0023	0.0074	3.3	1.74
28	280	0.7	0.0158	0.3336	0.1725	0.0130	0.0101	0.0025	0.0076	3.4	1.87
29	290	0.82	0.0185	0.3521	0.1880	0.0155	0.0136	0.0035	0.0093	4.1	2.02
30	300	0.82	0.0185	0.3706	0.2037	0.0157	0.0175	0.0039	0.0096	4.3	2.20
31	310	0.82	0.0185	0.3891	0.2196	0.0159	0.0218	0.0043	0.0099	4.4	2.38
32	320	0.82	0.0185	0.4076	0.2357	0.0161	0.0265	0.0047	0.0102	4.5	2.55
33	330	0.82	0.0185	0.4261	0.2519	0.0162	0.0316	0.0051	0.0105	4.6	2.72
34	340	0.82	0.0185	0.4446	0.2682	0.0163	0.0371	0.0055	0.0107	4.7	2.88
35	350	0.95	0.0214	0.4660	0.2873	0.0191	0.0439	0.0068	0.0127	5.6	3.07
36	360	0.95	0.0214	0.4874	0.3065	0.0192	0.0511	0.0072	0.0130	5.8	3.29
37	370	0.95	0.0214	0.5088	0.3259	0.0194	0.0588	0.0077	0.0133	5.9	3.50
38	380	0.95	0.0214	0.5302	0.3454	0.0195	0.0668	0.0080	0.0136	6.0	3.71
39	390	0.95	0.0214	0.5516	0.3650	0.0196	0.0753	0.0085	0.0139	6.1	3.90
40	400	0.95	0.0214	0.5730	0.3847	0.0197	0.0842	0.0089	0.0141	6.3	4.09
41	410	1.34	0.0302	0.6032	0.4126	0.0279	0.0973	0.0131	0.0202	9.0	4.39
42	420	1.34	0.0302	0.6334	0.4408	0.0282	0.1111	0.0138	0.0208	9.2	4.78
43	430	1.34	0.0302	0.6636	0.4691	0.0283	0.1255	0.0144	0.0211	9.4	5.15
44	440	1.8	0.0405	0.7041	0.5072	0.0381	0.1458	0.0203	0.0289	12.8	5.64
45	450	1.8	0.0405	0.7446	0.5456	0.0384	0.1671	0.0213	0.0296	13.1	6.25
46	460	3.4	0.0765	0.8211	0.6185	0.0729	0.2097	0.0426	0.0572	25.4	7.32
47	470	5.4	0.1215	0.9426	0.7354	0.1169	0.2833	0.0736	0.0945	41.9	9.51
48	480	2.7	0.0608	1.0034	0.7942	0.0588	0.3225	0.0392	0.0487	21.6	11.35
49	490	1.8	0.0405	1.0439	0.8335	0.0393	0.3493	0.0268	0.0328	14.6	11.91
50	500	1.34	0.0302	1.0741	0.8629	0.0294	0.3697	0.0204	0.0247	11.0	11.98
51	510	1.34	0.0302	1.1043	0.8923	0.0294	0.3904	0.0207	0.0249	11.0	11.90
52	520	1.34	0.0302	1.1345	0.9217	0.0294	0.4113	0.0209	0.0250	11.1	11.83
53	530	0.88	0.0198	1.1543	0.9410	0.0193	0.4252	0.0139	0.0165	7.3	11.61
54	540	0.88	0.0198	1.1741	0.9603	0.0193	0.4392	0.0140	0.0166	7.3	11.25
55	550	0.88	0.0198	1.1939	0.9797	0.0194	0.4533	0.0141	0.0167	7.4	10.93
56	560	0.88	0.0198	1.2137	0.9990	0.0193	0.4675	0.0142	0.0167	7.4	10.64
57	570	0.88	0.0198	1.2335	1.0184	0.0194	0.4819	0.0144	0.0168	7.5	10.37
58	580	0.88	0.0198	1.2533	1.0378	0.0194	0.4963	0.0144	0.0168	7.5	10.13
59	590	0.88	0.0198	1.2731	1.0572	0.0194	0.5108	0.0145	0.0169	7.5	9.91
60	600	0.88	0.0198	1.2929	1.0766	0.0194	0.5254	0.0146	0.0169	7.5	9.71
61	610	0.88	0.0198	1.3127	1.0960	0.0194	0.5401	0.0147	0.0170	7.5	9.52
62	620	0.88	0.0198	1.3325	1.1154	0.0194	0.5549	0.0148	0.0170	7.5	9.36
63	630	0.88	0.0198	1.3523	1.1349	0.0195	0.5698	0.0149	0.0171	7.6	9.21
64	640	0.88	0.0198	1.3721	1.1543	0.0194	0.5848	0.0150	0.0171	7.6	9.08
65	650	0.72	0.0162	1.3883	1.1702	0.0159	0.5971	0.0123	0.0140	6.2	8.90
66	660	0.72	0.0162	1.4045	1.1862	0.0160	0.6095	0.0124	0.0141	6.3	8.68
67	670	0.72	0.0162	1.4207	1.2021	0.0159	0.6219	0.0124	0.0141	6.2	8.47
68	680	0.72	0.0162	1.4369	1.2180	0.0159	0.6344	0.0125	0.0141	6.3	8.29
69	690	0.72	0.0162	1.4531	1.2340	0.0160	0.6469	0.0125	0.0142	6.3	8.12
70	700	0.72	0.0162	1.4693	1.2499	0.0159	0.6595	0.0126	0.0142	6.3	7.97
71	710	0.72	0.0162	1.4855	1.2659	0.0160	0.6721	0.0126	0.0142	6.3	7.83
72	720	0.72	0.0162	1.5017	1.2818	0.0159	0.6848	0.0127	0.0142	6.3	7.71
73	730	0.72	0.0162	1.5179	1.2978	0.0160	0.6975	0.0127	0.0143	6.3	7.59
74	740	0.72	0.0162	1.5341	1.3137	0.0159	0.7103	0.0128	0.0143	6.3	7.49
75	750	0.72	0.0162	1.5503	1.3297	0.0160	0.7231	0.0128	0.0143	6.4	7.39
76	760	0.72	0.0162	1.5665	1.3457	0.0160	0.7360	0.0129	0.0144	6.4	7.31
77	770	0.57	0.0128	1.5793	1.3583	0.0126	0.7462	0.0102	0.0114	5.0	7.18

					Pervious Area		Impervious Area				
Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Accumulated Rainfall (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
78	780	0.57	0.0128	1.5921	1.3709	0.0126	0.7564	0.0102	0.0114	5.0	7.00
79	790	0.57	0.0128	1.6049	1.3836	0.0127	0.7666	0.0102	0.0114	5.1	6.84
80	800	0.57	0.0128	1.6177	1.3962	0.0126	0.7769	0.0103	0.0114	5.1	6.69
81	810	0.57	0.0128	1.6305	1.4088	0.0126	0.7872	0.0103	0.0114	5.1	6.55
82	820	0.57	0.0128	1.6433	1.4215	0.0127	0.7975	0.0103	0.0115	5.1	6.43
83	830	0.57	0.0128	1.6561	1.4341	0.0126	0.8079	0.0104	0.0115	5.1	6.32
84	840	0.57	0.0128	1.6689	1.4467	0.0126	0.8182	0.0103	0.0114	5.1	6.21
85	850	0.57	0.0128	1.6817	1.4594	0.0127	0.8286	0.0104	0.0115	5.1	6.12
86	860	0.57	0.0128	1.6945	1.4720	0.0126	0.8391	0.0105	0.0115	5.1	6.04
87	870	0.57	0.0128	1.7073	1.4847	0.0127	0.8495	0.0104	0.0115	5.1	5.96
88	880	0.57	0.0128	1.7201	1.4973	0.0126	0.8600	0.0105	0.0115	5.1	5.89
89	890	0.5	0.0113	1.7314	1.5085	0.0112	0.8692	0.0092	0.0102	4.5	5.80
90	900	0.5	0.0113	1.7427	1.5197	0.0112	0.8785	0.0093	0.0102	4.5	5.69
91	910	0.5	0.0113	1.7540	1.5308	0.0111	0.8878	0.0093	0.0102	4.5	5.59
92	920	0.5	0.0113	1.7653	1.5420	0.0112	0.8971	0.0093	0.0102	4.5	5.50
93	930	0.5	0.0113	1.7766	1.5532	0.0112	0.9064	0.0093	0.0102	4.5	5.42
94	940	0.5	0.0113	1.7879	1.5643	0.0111	0.9158	0.0094	0.0102	4.5	5.35
95	950	0.5	0.0113	1.7992	1.5755	0.0112	0.9251	0.0093	0.0102	4.5	5.28
96	960	0.5	0.0113	1.8105	1.5867	0.0112	0.9345	0.0094	0.0103	4.6	5.22
97	970	0.5	0.0113	1.8218	1.5979	0.0112	0.9439	0.0094	0.0103	4.6	5.16
98	980	0.5	0.0113	1.8331	1.6091	0.0112	0.9533	0.0094	0.0103	4.6	5.11
99	990	0.5	0.0113	1.8444	1.6202	0.0111	0.9627	0.0094	0.0102	4.5	5.07
100	1000	0.5	0.0113	1.8557	1.6314	0.0112	0.9722	0.0095	0.0103	4.6	5.02
101	1010	0.4	0.009	1.8647	1.6403	0.0089	0.9797	0.0075	0.0082	3.6	4.95
102	1020	0.4	0.009	1.8737	1.6492	0.0089	0.9873	0.0076	0.0082	3.6	4.84
103	1030	0.4	0.009	1.8827	1.6582	0.0090	0.9948	0.0075	0.0082	3.6	4.74
104	1040	0.4	0.009	1.8917	1.6671	0.0089	1.0024	0.0076	0.0082	3.6	4.65
105	1050	0.4	0.009	1.9007	1.6760	0.0089	1.0099	0.0075	0.0082	3.6	4.56
106	1060	0.4	0.009	1.9097	1.6849	0.0089	1.0175	0.0076	0.0082	3.6	4.49
107	1070	0.4	0.009	1.9187	1.6938	0.0089	1.0251	0.0076	0.0082	3.6	4.42
108	1080	0.4	0.009	1.9277	1.7027	0.0089	1.0327	0.0076	0.0082	3.6	4.35
109	1090	0.4	0.009	1.9367	1.7116	0.0089	1.0403	0.0076	0.0082	3.6	4.29
110	1100	0.4	0.009	1.9457	1.7206	0.0090	1.0479	0.0076	0.0083	3.7	4.24
111	1110	0.4	0.009	1.9547	1.7295	0.0089	1.0555	0.0076	0.0082	3.6	4.19
112	1120	0.4	0.009	1.9637	1.7384	0.0089	1.0632	0.0077	0.0083	3.7	4.15
113	1130	0.4	0.009	1.9727	1.7473	0.0089	1.0708	0.0076	0.0082	3.6	4.11
114	1140	0.4	0.009	1.9817	1.7562	0.0089	1.0784	0.0076	0.0082	3.6	4.07
115	1150	0.4	0.009	1.9907	1.7651	0.0089	1.0861	0.0077	0.0083	3.7	4.04
116	1160	0.4	0.009	1.9997	1.7741	0.0090	1.0938	0.0077	0.0083	3.7	4.01
117	1170	0.4	0.009	2.0087	1.7830	0.0089	1.1014	0.0076	0.0082	3.6	3.98
118	1180	0.4	0.009	2.0177	1.7919	0.0089	1.1091	0.0077	0.0083	3.7	3.95
119	1190	0.4	0.009	2.0267	1.8008	0.0089	1.1168	0.0077	0.0083	3.7	3.93
120	1200	0.4	0.009	2.0357	1.8097	0.0089	1.1245	0.0077	0.0083	3.7	3.91
121	1210	0.4	0.009	2.0447	1.8187	0.0090	1.1322	0.0077	0.0083	3.7	3.89
122	1220	0.4	0.009	2.0537	1.8276	0.0089	1.1399	0.0077	0.0083	3.7	3.87
123	1230	0.4	0.009	2.0627	1.8365	0.0089	1.1476	0.0077	0.0083	3.7	3.85
124	1240	0.4	0.009	2.0717	1.8454	0.0089	1.1554	0.0078	0.0083	3.7	3.84
125	1250	0.4	0.009	2.0807	1.8544	0.0090	1.1631	0.0077	0.0083	3.7	3.83
126	1260	0.4	0.009	2.0897	1.8633	0.0089	1.1708	0.0077	0.0083	3.7	3.82
127	1270	0.4	0.009	2.0987	1.8722	0.0089	1.1786	0.0078	0.0083	3.7	3.80
128	1280	0.4	0.009	2.1077	1.8811	0.0089	1.1864	0.0078	0.0083	3.7	3.79
129	1290	0.4	0.009	2.1167	1.8901	0.0090	1.1941	0.0077	0.0083	3.7	3.79
130	1300	0.4	0.009	2.1257	1.8990	0.0089	1.2019	0.0078	0.0083	3.7	3.78
131	1310	0.4	0.009	2.1347	1.9079	0.0089	1.2097	0.0078	0.0083	3.7	3.77
132	1320	0.4	0.009	2.1437	1.9169	0.0090	1.2175	0.0078	0.0084	3.7	3.77
133	1330	0.4	0.009	2.1527	1.9258	0.0089	1.2253	0.0078	0.0083	3.7	3.76
134	1340	0.4	0.009	2.1617	1.9347	0.0089	1.2331	0.0078	0.0083	3.7	3.75
135	1350	0.4	0.009	2.1707	1.9436	0.0089	1.2409	0.0078	0.0083	3.7	3.75
136	1360	0.4	0.009	2.1797	1.9526	0.0090	1.2487	0.0078	0.0084	3.7	3.75
137	1370	0.4	0.009	2.1887	1.9615	0.0089	1.2565	0.0078	0.0083	3.7	3.74
138	1380	0.4	0.009	2.1977	1.9704	0.0089	1.2643	0.0078	0.0083	3.7	3.74
139	1390	0.4	0.009	2.2067	1.9794	0.0090	1.2722	0.0079	0.0084	3.7	3.74
140	1400	0.4	0.009	2.2157	1.9883	0.0089	1.2800	0.0078	0.0083	3.7	3.73
141	1410	0.4	0.009	2.2247	1.9972	0.0089	1.2879	0.0079	0.0084	3.7	3.73
142	1420	0.4	0.009	2.2337	2.0062	0.0090	1.2957	0.0078	0.0084	3.7	3.73
143	1430	0.4	0.009	2.2427	2.0151	0.0089	1.3036	0.0079	0.0084	3.7	3.73
144	1440	0.4	0.009	2.2517	2.0240	0.0089	1.3115	0.0079	0.0084	3.7	3.73

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 25-yr, 24hr

Subbasin ID: PS 26 25-Year No Bioretention Existing Land Use

	Value	Units	Notes
Area =	73.26	*ac*	
P_t =	3.5	*in*	(25 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	115.56	*min*	
w =	0.0415	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	35.37	37.89	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**115.56**	min
T_{Peak} =	**8.33**	hr
Q_{Peak} =	**21.20**	ft^3/s
$V_{Total\ Runoff}$ =	**714523**	ft^3

Time of Concentration **115.56**

Sheet Flow

$T_t = (0.42(n_sL)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 4.57 min

ns 0.011

L 300 ft

P_2 1.75 in

S 0.013333333 ft/ft

Shallow $Flow_1$

Tt = L/V = 94.52 min

L 1065

Velocity (V) = kS0.5 = 0.19 ft/s

k 20

S 0.02 ft/ft

Shallow $Flow_2$

Tt = L/V = 16.47 min

L 685

city (V) = kS0.5 = 0.69 ft/s

k 47.470588

S 0.03 ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.014	0.0140	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.014	0.0280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.014	0.0420	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.014	0.0560	0.0011	0.0011	0.0000	0.0000	0.0005	0.2	0.01
5	50	0.4	0.014	0.0700	0.0037	0.0026	0.0000	0.0000	0.0013	0.6	0.04
6	60	0.4	0.014	0.0840	0.0075	0.0038	0.0000	0.0000	0.0018	0.8	0.10
7	70	0.4	0.014	0.0980	0.0125	0.0050	0.0000	0.0000	0.0024	1.1	0.17
8	80	0.4	0.014	0.1120	0.0184	0.0059	0.0000	0.0000	0.0028	1.3	0.25
9	90	0.4	0.014	0.1260	0.0251	0.0067	0.0000	0.0000	0.0032	1.4	0.34
10	100	0.4	0.014	0.1400	0.0324	0.0073	0.0000	0.0000	0.0035	1.6	0.44
11	110	0.5	0.0175	0.1575	0.0424	0.0100	0.0000	0.0000	0.0048	2.1	0.55
12	120	0.5	0.0175	0.1750	0.0532	0.0108	0.0000	0.0000	0.0052	2.3	0.69
13	130	0.5	0.0175	0.1925	0.0647	0.0115	0.0000	0.0000	0.0056	2.5	0.83
14	140	0.5	0.0175	0.2100	0.0767	0.0120	0.0000	0.0000	0.0058	2.6	0.97
15	150	0.5	0.0175	0.2275	0.0892	0.0125	0.0000	0.0000	0.0060	2.7	1.11
16	160	0.5	0.0175	0.2450	0.1021	0.0129	0.0005	0.0005	0.0065	2.9	1.25
17	170	0.6	0.021	0.2660	0.1181	0.0160	0.0017	0.0012	0.0083	3.7	1.42
18	180	0.6	0.021	0.2870	0.1346	0.0165	0.0036	0.0019	0.0089	4.0	1.62
19	190	0.6	0.021	0.3080	0.1515	0.0169	0.0061	0.0025	0.0095	4.2	1.82
20	200	0.6	0.021	0.3290	0.1687	0.0172	0.0094	0.0033	0.0100	4.4	2.03
21	210	0.6	0.021	0.3500	0.1862	0.0175	0.0132	0.0038	0.0104	4.6	2.23
22	220	0.6	0.021	0.3710	0.2041	0.0179	0.0176	0.0044	0.0109	4.8	2.44
23	230	0.7	0.0245	0.3955	0.2251	0.0210	0.0234	0.0058	0.0131	5.8	2.68
24	240	0.7	0.0245	0.4200	0.2465	0.0214	0.0299	0.0065	0.0137	6.1	2.95
25	250	0.7	0.0245	0.4445	0.2681	0.0216	0.0371	0.0072	0.0142	6.3	3.22
26	260	0.7	0.0245	0.4690	0.2900	0.0219	0.0448	0.0077	0.0146	6.5	3.48
27	270	0.7	0.0245	0.4935	0.3120	0.0220	0.0532	0.0084	0.0150	6.6	3.73
28	280	0.7	0.0245	0.5180	0.3342	0.0222	0.0622	0.0090	0.0154	6.8	3.98
29	290	0.82	0.0287	0.5467	0.3605	0.0263	0.0733	0.0111	0.0184	8.2	4.27
30	300	0.82	0.0287	0.5754	0.3869	0.0264	0.0852	0.0119	0.0189	8.4	4.60
31	310	0.82	0.0287	0.6041	0.4135	0.0266	0.0977	0.0125	0.0193	8.6	4.93
32	320	0.82	0.0287	0.6328	0.4402	0.0267	0.1108	0.0131	0.0197	8.7	5.23
33	330	0.82	0.0287	0.6615	0.4671	0.0269	0.1245	0.0137	0.0201	8.9	5.53
34	340	0.82	0.0287	0.6902	0.4941	0.0270	0.1387	0.0142	0.0204	9.0	5.81
35	350	0.95	0.0333	0.7235	0.5256	0.0315	0.1558	0.0171	0.0241	10.7	6.15
36	360	0.95	0.0333	0.7568	0.5572	0.0316	0.1736	0.0178	0.0245	10.8	6.53
37	370	0.95	0.0333	0.7901	0.5889	0.0317	0.1921	0.0185	0.0249	11.0	6.90
38	380	0.95	0.0333	0.8234	0.6207	0.0318	0.2111	0.0190	0.0252	11.2	7.24
39	390	0.95	0.0333	0.8567	0.6526	0.0319	0.2306	0.0195	0.0255	11.3	7.57
40	400	0.95	0.0333	0.8900	0.6846	0.0320	0.2507	0.0201	0.0258	11.5	7.89
41	410	1.34	0.0469	0.9369	0.7299	0.0453	0.2797	0.0290	0.0369	16.3	8.39
42	420	1.34	0.0469	0.9838	0.7752	0.0453	0.3097	0.0300	0.0374	16.6	9.06
43	430	1.34	0.0469	1.0307	0.8207	0.0455	0.3405	0.0308	0.0379	16.8	9.69
44	440	1.8	0.063	1.0937	0.8819	0.0612	0.3831	0.0426	0.0516	22.9	10.53
45	450	1.8	0.063	1.1567	0.9434	0.0615	0.4269	0.0438	0.0523	23.2	11.57
46	460	3.4	0.119	1.2757	1.0597	0.1163	0.5127	0.0858	0.1005	44.6	13.42
47	470	5.4	0.189	1.4647	1.2454	0.1857	0.6559	0.1432	0.1637	72.6	17.16
48	480	2.7	0.0945	1.5592	1.3385	0.0931	0.7302	0.0743	0.0834	37.0	20.28
49	490	1.8	0.063	1.6222	1.4006	0.0621	0.7805	0.0503	0.0560	24.8	21.16
50	500	1.34	0.0469	1.6691	1.4469	0.0463	0.8184	0.0379	0.0420	18.6	21.20
51	510	1.34	0.0469	1.7160	1.4933	0.0464	0.8566	0.0382	0.0422	18.7	20.99
52	520	1.34	0.0469	1.7629	1.5396	0.0463	0.8951	0.0385	0.0423	18.7	20.80
53	530	0.88	0.0308	1.7937	1.5701	0.0305	0.9206	0.0255	0.0279	12.4	20.37
54	540	0.88	0.0308	1.8245	1.6006	0.0305	0.9462	0.0256	0.0280	12.4	19.71
55	550	0.88	0.0308	1.8553	1.6310	0.0304	0.9719	0.0257	0.0280	12.4	19.10
56	560	0.88	0.0308	1.8861	1.6615	0.0305	0.9977	0.0258	0.0281	12.4	18.54
57	570	0.88	0.0308	1.9169	1.6920	0.0305	1.0236	0.0259	0.0281	12.5	18.04
58	580	0.88	0.0308	1.9477	1.7225	0.0305	1.0496	0.0260	0.0282	12.5	17.58
59	590	0.88	0.0308	1.9785	1.7530	0.0305	1.0757	0.0261	0.0282	12.5	17.16
60	600	0.88	0.0308	2.0093	1.7836	0.0306	1.1019	0.0262	0.0283	12.6	16.77
61	610	0.88	0.0308	2.0401	1.8141	0.0305	1.1283	0.0264	0.0284	12.6	16.42
62	620	0.88	0.0308	2.0709	1.8446	0.0305	1.1547	0.0264	0.0284	12.6	16.10
63	630	0.88	0.0308	2.1017	1.8752	0.0306	1.1812	0.0265	0.0285	12.6	15.81
64	640	0.88	0.0308	2.1325	1.9057	0.0305	1.2078	0.0266	0.0285	12.6	15.55
65	650	0.72	0.0252	2.1577	1.9307	0.0250	1.2296	0.0218	0.0233	10.3	15.21
66	660	0.72	0.0252	2.1829	1.9558	0.0251	1.2515	0.0219	0.0234	10.4	14.81
67	670	0.72	0.0252	2.2081	1.9808	0.0250	1.2734	0.0219	0.0234	10.4	14.44
68	680	0.72	0.0252	2.2333	2.0058	0.0250	1.2954	0.0220	0.0234	10.4	14.11
69	690	0.72	0.0252	2.2585	2.0308	0.0250	1.3174	0.0220	0.0234	10.4	13.80
70	700	0.72	0.0252	2.2837	2.0558	0.0250	1.3395	0.0221	0.0235	10.4	13.52
71	710	0.72	0.0252	2.3089	2.0808	0.0250	1.3616	0.0221	0.0235	10.4	13.26
72	720	0.72	0.0252	2.3341	2.1059	0.0251	1.3838	0.0222	0.0236	10.5	13.03
73	730	0.72	0.0252	2.3593	2.1309	0.0250	1.4060	0.0222	0.0236	10.4	12.81
74	740	0.72	0.0252	2.3845	2.1559	0.0250	1.4283	0.0223	0.0236	10.5	12.62
75	750	0.72	0.0252	2.4097	2.1810	0.0251	1.4506	0.0223	0.0237	10.5	12.44
76	760	0.72	0.0252	2.4349	2.2060	0.0250	1.4730	0.0224	0.0237	10.5	12.28
77	770	0.57	0.02	2.4549	2.2259	0.0199	1.4908	0.0178	0.0188	8.3	12.04

Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Accumulated Rainfall (in)	Pervious Area Accumulated Runoff (in)	Pervious Area Incremental Runoff (in)	Impervious Area Accumulated Runoff (in)	Impervious Area Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
78	780	0.57	0.02	2.4749	2.2458	0.0199	1.5086	0.0178	0.0188	8.3	11.73
79	790	0.57	0.02	2.4949	2.2657	0.0199	1.5264	0.0178	0.0188	8.3	11.45
80	800	0.57	0.02	2.5149	2.2856	0.0199	1.5443	0.0179	0.0189	8.4	11.19
81	810	0.57	0.02	2.5349	2.3054	0.0198	1.5622	0.0179	0.0188	8.3	10.96
82	820	0.57	0.02	2.5549	2.3253	0.0199	1.5801	0.0179	0.0189	8.4	10.74
83	830	0.57	0.02	2.5749	2.3452	0.0199	1.5980	0.0179	0.0189	8.4	10.54
84	840	0.57	0.02	2.5949	2.3651	0.0199	1.6159	0.0179	0.0189	8.4	10.36
85	850	0.57	0.02	2.6149	2.3850	0.0199	1.6339	0.0180	0.0189	8.4	10.20
86	860	0.57	0.02	2.6349	2.4049	0.0199	1.6519	0.0180	0.0189	8.4	10.05
87	870	0.57	0.02	2.6549	2.4248	0.0199	1.6699	0.0180	0.0189	8.4	9.91
88	880	0.57	0.02	2.6749	2.4447	0.0199	1.6880	0.0181	0.0190	8.4	9.78
89	890	0.5	0.0175	2.6924	2.4621	0.0174	1.7038	0.0158	0.0166	7.3	9.63
90	900	0.5	0.0175	2.7099	2.4795	0.0174	1.7196	0.0158	0.0166	7.3	9.44
91	910	0.5	0.0175	2.7274	2.4969	0.0174	1.7355	0.0159	0.0166	7.4	9.26
92	920	0.5	0.0175	2.7449	2.5143	0.0174	1.7513	0.0158	0.0166	7.3	9.11
93	930	0.5	0.0175	2.7624	2.5317	0.0174	1.7672	0.0159	0.0166	7.4	8.96
94	940	0.5	0.0175	2.7799	2.5492	0.0175	1.7831	0.0159	0.0167	7.4	8.83
95	950	0.5	0.0175	2.7974	2.5666	0.0174	1.7990	0.0159	0.0166	7.4	8.71
96	960	0.5	0.0175	2.8149	2.5840	0.0174	1.8149	0.0159	0.0166	7.4	8.60
97	970	0.5	0.0175	2.8324	2.6014	0.0174	1.8308	0.0159	0.0166	7.4	8.50
98	980	0.5	0.0175	2.8499	2.6188	0.0174	1.8468	0.0160	0.0167	7.4	8.40
99	990	0.5	0.0175	2.8674	2.6362	0.0174	1.8627	0.0159	0.0166	7.4	8.32
100	1000	0.5	0.0175	2.8849	2.6537	0.0175	1.8787	0.0160	0.0167	7.4	8.24
101	1010	0.4	0.014	2.8989	2.6676	0.0139	1.8915	0.0128	0.0133	5.9	8.11
102	1020	0.4	0.014	2.9129	2.6815	0.0139	1.9043	0.0128	0.0133	5.9	7.93
103	1030	0.4	0.014	2.9269	2.6955	0.0140	1.9171	0.0128	0.0134	5.9	7.76
104	1040	0.4	0.014	2.9409	2.7094	0.0139	1.9299	0.0128	0.0133	5.9	7.61
105	1050	0.4	0.014	2.9549	2.7234	0.0140	1.9428	0.0129	0.0134	6.0	7.47
106	1060	0.4	0.014	2.9689	2.7373	0.0139	1.9556	0.0128	0.0133	5.9	7.34
107	1070	0.4	0.014	2.9829	2.7512	0.0139	1.9684	0.0128	0.0133	5.9	7.22
108	1080	0.4	0.014	2.9969	2.7652	0.0140	1.9813	0.0129	0.0134	6.0	7.12
109	1090	0.4	0.014	3.0109	2.7791	0.0139	1.9941	0.0128	0.0133	5.9	7.02
110	1100	0.4	0.014	3.0249	2.7931	0.0140	2.0070	0.0129	0.0134	6.0	6.93
111	1110	0.4	0.014	3.0389	2.8070	0.0139	2.0199	0.0129	0.0134	5.9	6.85
112	1120	0.4	0.014	3.0529	2.8210	0.0140	2.0328	0.0129	0.0134	6.0	6.77
113	1130	0.4	0.014	3.0669	2.8349	0.0139	2.0457	0.0129	0.0134	5.9	6.70
114	1140	0.4	0.014	3.0809	2.8488	0.0139	2.0586	0.0129	0.0134	5.9	6.64
115	1150	0.4	0.014	3.0949	2.8628	0.0140	2.0715	0.0129	0.0134	6.0	6.58
116	1160	0.4	0.014	3.1089	2.8767	0.0139	2.0844	0.0129	0.0134	5.9	6.53
117	1170	0.4	0.014	3.1229	2.8907	0.0140	2.0973	0.0129	0.0134	6.0	6.48
118	1180	0.4	0.014	3.1369	2.9046	0.0139	2.1102	0.0129	0.0134	5.9	6.43
119	1190	0.4	0.014	3.1509	2.9186	0.0140	2.1232	0.0130	0.0135	6.0	6.39
120	1200	0.4	0.014	3.1649	2.9325	0.0139	2.1361	0.0129	0.0134	5.9	6.36
121	1210	0.4	0.014	3.1789	2.9465	0.0140	2.1491	0.0130	0.0135	6.0	6.32
122	1220	0.4	0.014	3.1929	2.9604	0.0139	2.1620	0.0129	0.0134	5.9	6.29
123	1230	0.4	0.014	3.2069	2.9744	0.0140	2.1750	0.0130	0.0135	6.0	6.27
124	1240	0.4	0.014	3.2209	2.9883	0.0139	2.1880	0.0130	0.0134	6.0	6.24
125	1250	0.4	0.014	3.2349	3.0023	0.0140	2.2009	0.0129	0.0134	6.0	6.22
126	1260	0.4	0.014	3.2489	3.0162	0.0139	2.2139	0.0130	0.0134	6.0	6.19
127	1270	0.4	0.014	3.2629	3.0302	0.0140	2.2269	0.0130	0.0135	6.0	6.18
128	1280	0.4	0.014	3.2769	3.0441	0.0139	2.2399	0.0130	0.0134	6.0	6.16
129	1290	0.4	0.014	3.2909	3.0581	0.0140	2.2529	0.0130	0.0135	6.0	6.14
130	1300	0.4	0.014	3.3049	3.0720	0.0139	2.2659	0.0130	0.0134	6.0	6.13
131	1310	0.4	0.014	3.3189	3.0860	0.0140	2.2790	0.0131	0.0135	6.0	6.11
132	1320	0.4	0.014	3.3329	3.0999	0.0139	2.2920	0.0130	0.0134	6.0	6.10
133	1330	0.4	0.014	3.3469	3.1139	0.0140	2.3050	0.0130	0.0135	6.0	6.09
134	1340	0.4	0.014	3.3609	3.1278	0.0139	2.3181	0.0131	0.0135	6.0	6.08
135	1350	0.4	0.014	3.3749	3.1418	0.0140	2.3311	0.0130	0.0135	6.0	6.07
136	1360	0.4	0.014	3.3889	3.1557	0.0139	2.3442	0.0131	0.0135	6.0	6.07
137	1370	0.4	0.014	3.4029	3.1697	0.0140	2.3572	0.0130	0.0135	6.0	6.06
138	1380	0.4	0.014	3.4169	3.1836	0.0139	2.3703	0.0131	0.0135	6.0	6.05
139	1390	0.4	0.014	3.4309	3.1976	0.0140	2.3834	0.0131	0.0135	6.0	6.05
140	1400	0.4	0.014	3.4449	3.2115	0.0139	2.3964	0.0130	0.0134	6.0	6.04
141	1410	0.4	0.014	3.4589	3.2255	0.0140	2.4095	0.0131	0.0135	6.0	6.04
142	1420	0.4	0.014	3.4729	3.2395	0.0140	2.4226	0.0131	0.0135	6.0	6.03
143	1430	0.4	0.014	3.4869	3.2534	0.0139	2.4357	0.0131	0.0135	6.0	6.03
144	1440	0.4	0.014	3.5009	3.2674	0.0140	2.4488	0.0131	0.0135	6.0	6.02

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 10-yr, 24hr

Subbasin ID: PS 26 10-Year No Bioretention Future Land Use

	Value	Units	Notes
Area =	73.26	*ac*	
P_t =	2.25	*in*	(10 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	115.56	*min*	
w =	0.0415	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	58.09	15.17	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**115.56**	min
T_{Peak} =	**8.33**	hr
Q_{Peak} =	**14.14**	ft^3/s
$V_{Total\ Runoff}$ =	**472072**	ft^3

Time of Concentration **115.56**

Sheet Flow

$T_t = (0.42(n_sL)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 4.57 min

ns 0.011

L 300 ft

P_2 1.75 in

S 0.013333333 ft/ft

Shallow $Flow_1$

Tt = L/V = 94.52 min

L 1065

Velocity (V) = kS0.5 = 0.19 ft/s

k 20

S 0.02 ft/ft

Shallow $Flow_2$

Tt = L/V = 16.47 min

L 685

city (V) = kS0.5 = 0.69 ft/s

k 47.470588

S 0.03 ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.009	0.0090	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.009	0.0180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.009	0.0270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.009	0.0360	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
5	50	0.4	0.009	0.0450	0.0001	0.0001	0.0000	0.0000	0.0001	0.0	0.00
6	60	0.4	0.009	0.0540	0.0008	0.0007	0.0000	0.0000	0.0006	0.2	0.01
7	70	0.4	0.009	0.0630	0.0022	0.0014	0.0000	0.0000	0.0011	0.5	0.04
8	80	0.4	0.009	0.0720	0.0041	0.0019	0.0000	0.0000	0.0015	0.7	0.09
9	90	0.4	0.009	0.0810	0.0066	0.0025	0.0000	0.0000	0.0020	0.9	0.14
10	100	0.4	0.009	0.0900	0.0096	0.0030	0.0000	0.0000	0.0024	1.1	0.21
11	110	0.5	0.0113	0.1013	0.0138	0.0042	0.0000	0.0000	0.0033	1.5	0.30
12	120	0.5	0.0113	0.1126	0.0187	0.0049	0.0000	0.0000	0.0039	1.7	0.41
13	130	0.5	0.0113	0.1239	0.0240	0.0053	0.0000	0.0000	0.0042	1.9	0.52
14	140	0.5	0.0113	0.1352	0.0298	0.0058	0.0000	0.0000	0.0046	2.0	0.64
15	150	0.5	0.0113	0.1465	0.0361	0.0063	0.0000	0.0000	0.0050	2.2	0.76
16	160	0.5	0.0113	0.1578	0.0426	0.0065	0.0000	0.0000	0.0052	2.3	0.89
17	170	0.6	0.0135	0.1713	0.0509	0.0083	0.0000	0.0000	0.0066	2.9	1.03
18	180	0.6	0.0135	0.1848	0.0596	0.0087	0.0000	0.0000	0.0069	3.1	1.19
19	190	0.6	0.0135	0.1983	0.0686	0.0090	0.0000	0.0000	0.0071	3.2	1.35
20	200	0.6	0.0135	0.2118	0.0779	0.0093	0.0000	0.0000	0.0074	3.3	1.51
21	210	0.6	0.0135	0.2253	0.0876	0.0097	0.0000	0.0000	0.0077	3.4	1.66
22	220	0.6	0.0135	0.2388	0.0975	0.0099	0.0002	0.0002	0.0079	3.5	1.81
23	230	0.7	0.0158	0.2546	0.1094	0.0119	0.0009	0.0007	0.0096	4.2	1.98
24	240	0.7	0.0158	0.2704	0.1215	0.0121	0.0020	0.0011	0.0098	4.4	2.17
25	250	0.7	0.0158	0.2862	0.1340	0.0125	0.0035	0.0015	0.0102	4.5	2.36
26	260	0.7	0.0158	0.3020	0.1466	0.0126	0.0053	0.0018	0.0104	4.6	2.54
27	270	0.7	0.0158	0.3178	0.1595	0.0129	0.0076	0.0023	0.0107	4.7	2.72
28	280	0.7	0.0158	0.3336	0.1725	0.0130	0.0101	0.0025	0.0108	4.8	2.89
29	290	0.82	0.0185	0.3521	0.1880	0.0155	0.0136	0.0035	0.0130	5.8	3.09
30	300	0.82	0.0185	0.3706	0.2037	0.0157	0.0175	0.0039	0.0133	5.9	3.31
31	310	0.82	0.0185	0.3891	0.2196	0.0159	0.0218	0.0043	0.0135	6.0	3.53
32	320	0.82	0.0185	0.4076	0.2357	0.0161	0.0265	0.0047	0.0137	6.1	3.74
33	330	0.82	0.0185	0.4261	0.2519	0.0162	0.0316	0.0051	0.0139	6.2	3.94
34	340	0.82	0.0185	0.4446	0.2682	0.0163	0.0371	0.0055	0.0141	6.2	4.12
35	350	0.95	0.0214	0.4660	0.2873	0.0191	0.0439	0.0068	0.0166	7.3	4.34
36	360	0.95	0.0214	0.4874	0.3065	0.0192	0.0511	0.0072	0.0167	7.4	4.60
37	370	0.95	0.0214	0.5088	0.3259	0.0194	0.0588	0.0077	0.0170	7.5	4.83
38	380	0.95	0.0214	0.5302	0.3454	0.0195	0.0668	0.0080	0.0171	7.6	5.06
39	390	0.95	0.0214	0.5516	0.3650	0.0196	0.0753	0.0085	0.0173	7.7	5.27
40	400	0.95	0.0214	0.5730	0.3847	0.0197	0.0842	0.0089	0.0175	7.7	5.47
41	410	1.34	0.0302	0.6032	0.4126	0.0279	0.0973	0.0131	0.0248	11.0	5.80
42	420	1.34	0.0302	0.6334	0.4408	0.0282	0.1111	0.0138	0.0252	11.2	6.24
43	430	1.34	0.0302	0.6636	0.4691	0.0283	0.1255	0.0144	0.0254	11.3	6.65
44	440	1.8	0.0405	0.7041	0.5072	0.0381	0.1458	0.0203	0.0344	15.3	7.20
45	450	1.8	0.0405	0.7446	0.5456	0.0384	0.1671	0.0213	0.0349	15.5	7.88
46	460	3.4	0.0765	0.8211	0.6185	0.0729	0.2097	0.0426	0.0666	29.5	9.09
47	470	5.4	0.1215	0.9426	0.7354	0.1169	0.2833	0.0736	0.1079	47.8	11.54
48	480	2.7	0.0608	1.0034	0.7942	0.0588	0.3225	0.0392	0.0547	24.3	13.57
49	490	1.8	0.0405	1.0439	0.8335	0.0393	0.3493	0.0268	0.0367	16.3	14.13
50	500	1.34	0.0302	1.0741	0.8629	0.0294	0.3697	0.0204	0.0275	12.2	14.14
51	510	1.34	0.0302	1.1043	0.8923	0.0294	0.3904	0.0207	0.0276	12.2	13.98
52	520	1.34	0.0302	1.1345	0.9217	0.0294	0.4113	0.0209	0.0276	12.3	13.84
53	530	0.88	0.0198	1.1543	0.9410	0.0193	0.4252	0.0139	0.0182	8.1	13.53
54	540	0.88	0.0198	1.1741	0.9603	0.0193	0.4392	0.0140	0.0182	8.1	13.08
55	550	0.88	0.0198	1.1939	0.9797	0.0194	0.4533	0.0141	0.0183	8.1	12.66
56	560	0.88	0.0198	1.2137	0.9990	0.0193	0.4675	0.0142	0.0182	8.1	12.28
57	570	0.88	0.0198	1.2335	1.0184	0.0194	0.4819	0.0144	0.0184	8.1	11.94
58	580	0.88	0.0198	1.2533	1.0378	0.0194	0.4963	0.0144	0.0184	8.1	11.62
59	590	0.88	0.0198	1.2731	1.0572	0.0194	0.5108	0.0145	0.0184	8.1	11.33
60	600	0.88	0.0198	1.2929	1.0766	0.0194	0.5254	0.0146	0.0184	8.2	11.07
61	610	0.88	0.0198	1.3127	1.0960	0.0194	0.5401	0.0147	0.0184	8.2	10.83
62	620	0.88	0.0198	1.3325	1.1154	0.0194	0.5549	0.0148	0.0184	8.2	10.61
63	630	0.88	0.0198	1.3523	1.1349	0.0195	0.5698	0.0149	0.0185	8.2	10.41
64	640	0.88	0.0198	1.3721	1.1543	0.0194	0.5848	0.0150	0.0185	8.2	10.23
65	650	0.72	0.0162	1.3883	1.1702	0.0159	0.5971	0.0123	0.0152	6.7	10.00
66	660	0.72	0.0162	1.4045	1.1862	0.0160	0.6095	0.0124	0.0153	6.8	9.73
67	670	0.72	0.0162	1.4207	1.2021	0.0159	0.6219	0.0124	0.0152	6.7	9.48
68	680	0.72	0.0162	1.4369	1.2180	0.0159	0.6344	0.0125	0.0152	6.7	9.25
69	690	0.72	0.0162	1.4531	1.2340	0.0160	0.6469	0.0125	0.0153	6.8	9.04
70	700	0.72	0.0162	1.4693	1.2499	0.0159	0.6595	0.0126	0.0152	6.7	8.85
71	710	0.72	0.0162	1.4855	1.2659	0.0160	0.6721	0.0126	0.0153	6.8	8.68
72	720	0.72	0.0162	1.5017	1.2818	0.0159	0.6848	0.0127	0.0152	6.8	8.52
73	730	0.72	0.0162	1.5179	1.2978	0.0160	0.6975	0.0127	0.0153	6.8	8.38
74	740	0.72	0.0162	1.5341	1.3137	0.0159	0.7103	0.0128	0.0153	6.8	8.24
75	750	0.72	0.0162	1.5503	1.3297	0.0160	0.7231	0.0128	0.0153	6.8	8.12
76	760	0.72	0.0162	1.5665	1.3457	0.0160	0.7360	0.0129	0.0154	6.8	8.01
77	770	0.57	0.0128	1.5793	1.3583	0.0126	0.7462	0.0102	0.0121	5.4	7.85

					Pervious Area			Impervious Area				
Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Accumulated Rainfall (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
78	780	0.57	0.0128	1.5921	1.3709	0.0126	0.7564	0.0102	0.0121	5.4	7.65
79	790	0.57	0.0128	1.6049	1.3836	0.0127	0.7666	0.0102	0.0122	5.4	7.46
80	800	0.57	0.0128	1.6177	1.3962	0.0126	0.7769	0.0103	0.0121	5.4	7.29
81	810	0.57	0.0128	1.6305	1.4088	0.0126	0.7872	0.0103	0.0121	5.4	7.13
82	820	0.57	0.0128	1.6433	1.4215	0.0127	0.7975	0.0103	0.0122	5.4	6.98
83	830	0.57	0.0128	1.6561	1.4341	0.0126	0.8079	0.0104	0.0121	5.4	6.85
84	840	0.57	0.0128	1.6689	1.4467	0.0126	0.8182	0.0103	0.0121	5.4	6.73
85	850	0.57	0.0128	1.6817	1.4594	0.0127	0.8286	0.0104	0.0122	5.4	6.62
86	860	0.57	0.0128	1.6945	1.4720	0.0126	0.8391	0.0105	0.0122	5.4	6.52
87	870	0.57	0.0128	1.7073	1.4847	0.0127	0.8495	0.0104	0.0122	5.4	6.43
88	880	0.57	0.0128	1.7201	1.4973	0.0126	0.8600	0.0105	0.0122	5.4	6.34
89	890	0.5	0.0113	1.7314	1.5085	0.0112	0.8692	0.0092	0.0108	4.8	6.24
90	900	0.5	0.0113	1.7427	1.5197	0.0112	0.8785	0.0093	0.0108	4.8	6.12
91	910	0.5	0.0113	1.7540	1.5308	0.0111	0.8878	0.0093	0.0107	4.8	6.01
92	920	0.5	0.0113	1.7653	1.5420	0.0112	0.8971	0.0093	0.0108	4.8	5.90
93	930	0.5	0.0113	1.7766	1.5532	0.0112	0.9064	0.0093	0.0108	4.8	5.81
94	940	0.5	0.0113	1.7879	1.5643	0.0111	0.9158	0.0094	0.0107	4.8	5.73
95	950	0.5	0.0113	1.7992	1.5755	0.0112	0.9251	0.0093	0.0108	4.8	5.65
96	960	0.5	0.0113	1.8105	1.5867	0.0112	0.9345	0.0094	0.0108	4.8	5.58
97	970	0.5	0.0113	1.8218	1.5979	0.0112	0.9439	0.0094	0.0108	4.8	5.51
98	980	0.5	0.0113	1.8331	1.6091	0.0112	0.9533	0.0094	0.0108	4.8	5.45
99	990	0.5	0.0113	1.8444	1.6202	0.0111	0.9627	0.0094	0.0107	4.8	5.40
100	1000	0.5	0.0113	1.8557	1.6314	0.0112	0.9722	0.0095	0.0108	4.8	5.35
101	1010	0.4	0.009	1.8647	1.6403	0.0089	0.9797	0.0075	0.0086	3.8	5.26
102	1020	0.4	0.009	1.8737	1.6492	0.0089	0.9873	0.0076	0.0086	3.8	5.14
103	1030	0.4	0.009	1.8827	1.6582	0.0090	0.9948	0.0075	0.0087	3.9	5.03
104	1040	0.4	0.009	1.8917	1.6671	0.0089	1.0024	0.0076	0.0086	3.8	4.93
105	1050	0.4	0.009	1.9007	1.6760	0.0089	1.0099	0.0075	0.0086	3.8	4.84
106	1060	0.4	0.009	1.9097	1.6849	0.0089	1.0175	0.0076	0.0086	3.8	4.76
107	1070	0.4	0.009	1.9187	1.6938	0.0089	1.0251	0.0076	0.0086	3.8	4.68
108	1080	0.4	0.009	1.9277	1.7027	0.0089	1.0327	0.0076	0.0086	3.8	4.61
109	1090	0.4	0.009	1.9367	1.7116	0.0089	1.0403	0.0076	0.0086	3.8	4.54
110	1100	0.4	0.009	1.9457	1.7206	0.0090	1.0479	0.0076	0.0087	3.9	4.49
111	1110	0.4	0.009	1.9547	1.7295	0.0089	1.0555	0.0076	0.0086	3.8	4.43
112	1120	0.4	0.009	1.9637	1.7384	0.0089	1.0632	0.0077	0.0087	3.8	4.38
113	1130	0.4	0.009	1.9727	1.7473	0.0089	1.0708	0.0076	0.0086	3.8	4.34
114	1140	0.4	0.009	1.9817	1.7562	0.0089	1.0784	0.0076	0.0086	3.8	4.29
115	1150	0.4	0.009	1.9907	1.7651	0.0089	1.0861	0.0077	0.0087	3.8	4.26
116	1160	0.4	0.009	1.9997	1.7741	0.0090	1.0938	0.0077	0.0087	3.9	4.22
117	1170	0.4	0.009	2.0087	1.7830	0.0089	1.1014	0.0076	0.0086	3.8	4.19
118	1180	0.4	0.009	2.0177	1.7919	0.0089	1.1091	0.0077	0.0087	3.8	4.16
119	1190	0.4	0.009	2.0267	1.8008	0.0089	1.1168	0.0077	0.0087	3.8	4.13
120	1200	0.4	0.009	2.0357	1.8097	0.0089	1.1245	0.0077	0.0087	3.8	4.11
121	1210	0.4	0.009	2.0447	1.8187	0.0090	1.1322	0.0077	0.0087	3.9	4.09
122	1220	0.4	0.009	2.0537	1.8276	0.0089	1.1399	0.0077	0.0087	3.8	4.07
123	1230	0.4	0.009	2.0627	1.8365	0.0089	1.1476	0.0077	0.0087	3.8	4.05
124	1240	0.4	0.009	2.0717	1.8454	0.0089	1.1554	0.0078	0.0087	3.8	4.03
125	1250	0.4	0.009	2.0807	1.8544	0.0090	1.1631	0.0077	0.0087	3.9	4.02
126	1260	0.4	0.009	2.0897	1.8633	0.0089	1.1708	0.0077	0.0087	3.8	4.00
127	1270	0.4	0.009	2.0987	1.8722	0.0089	1.1786	0.0078	0.0087	3.8	3.99
128	1280	0.4	0.009	2.1077	1.8811	0.0089	1.1864	0.0078	0.0087	3.8	3.98
129	1290	0.4	0.009	2.1167	1.8901	0.0090	1.1941	0.0077	0.0087	3.9	3.97
130	1300	0.4	0.009	2.1257	1.8990	0.0089	1.2019	0.0078	0.0087	3.8	3.96
131	1310	0.4	0.009	2.1347	1.9079	0.0089	1.2097	0.0078	0.0087	3.8	3.95
132	1320	0.4	0.009	2.1437	1.9169	0.0090	1.2175	0.0078	0.0088	3.9	3.94
133	1330	0.4	0.009	2.1527	1.9258	0.0089	1.2253	0.0078	0.0087	3.8	3.93
134	1340	0.4	0.009	2.1617	1.9347	0.0089	1.2331	0.0078	0.0087	3.8	3.93
135	1350	0.4	0.009	2.1707	1.9436	0.0089	1.2409	0.0078	0.0087	3.8	3.92
136	1360	0.4	0.009	2.1797	1.9526	0.0090	1.2487	0.0078	0.0088	3.9	3.92
137	1370	0.4	0.009	2.1887	1.9615	0.0089	1.2565	0.0078	0.0087	3.8	3.91
138	1380	0.4	0.009	2.1977	1.9704	0.0089	1.2643	0.0078	0.0087	3.8	3.91
139	1390	0.4	0.009	2.2067	1.9794	0.0090	1.2722	0.0079	0.0088	3.9	3.90
140	1400	0.4	0.009	2.2157	1.9883	0.0089	1.2800	0.0078	0.0087	3.8	3.90
141	1410	0.4	0.009	2.2247	1.9972	0.0089	1.2879	0.0079	0.0087	3.9	3.89
142	1420	0.4	0.009	2.2337	2.0062	0.0090	1.2957	0.0078	0.0088	3.9	3.89
143	1430	0.4	0.009	2.2427	2.0151	0.0089	1.3036	0.0079	0.0087	3.9	3.89
144	1440	0.4	0.009	2.2517	2.0240	0.0089	1.3115	0.0079	0.0087	3.9	3.89

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 25-yr, 24hr

Subbasin ID: PS 26 25-Year No Bioretention Future Land Use

	Value	Units	Notes
Area =	73.26	*ac*	
P_t =	3.5	*in*	(25 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	115.56	*min*	
w =	0.0415	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	58.09	15.17	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**115.56**	min
T_{Peak} =	**8.17**	hr
Q_{Peak} =	**23.56**	ft^3/s
$V_{Total\ Runoff}$ =	**781166**	ft^3

Time of Concentration **115.56**

Sheet Flow

$T_t = (0.42(n_s L)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 4.57 min

ns 0.011

L 300 ft

P_2 1.75 in

S 0.013333333 ft/ft

$Shallow\ Flow_1$

Tt = L/V = 94.52 min

L 1065

Velocity (V) = kS0.5 = 0.19 ft/s

k 20

S 0.02 ft/ft

$Shallow\ Flow_2$

Tt = L/V = 16.47 min

L 685

Velocity (V) = kS0.5 = 0.69 ft/s

k 47.470588

S 0.03 ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.014	0.0140	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.014	0.0280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.014	0.0420	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.014	0.0560	0.0011	0.0011	0.0000	0.0000	0.0009	0.4	0.02
5	50	0.4	0.014	0.0700	0.0037	0.0026	0.0000	0.0000	0.0021	0.9	0.07
6	60	0.4	0.014	0.0840	0.0075	0.0038	0.0000	0.0000	0.0030	1.3	0.16
7	70	0.4	0.014	0.0980	0.0125	0.0050	0.0000	0.0000	0.0040	1.8	0.27
8	80	0.4	0.014	0.1120	0.0184	0.0059	0.0000	0.0000	0.0047	2.1	0.41
9	90	0.4	0.014	0.1260	0.0251	0.0067	0.0000	0.0000	0.0053	2.4	0.56
10	100	0.4	0.014	0.1400	0.0324	0.0073	0.0000	0.0000	0.0058	2.6	0.72
11	110	0.5	0.0175	0.1575	0.0424	0.0100	0.0000	0.0000	0.0079	3.5	0.91
12	120	0.5	0.0175	0.1750	0.0532	0.0108	0.0000	0.0000	0.0086	3.8	1.14
13	130	0.5	0.0175	0.1925	0.0647	0.0115	0.0000	0.0000	0.0091	4.0	1.37
14	140	0.5	0.0175	0.2100	0.0767	0.0120	0.0000	0.0000	0.0095	4.2	1.60
15	150	0.5	0.0175	0.2275	0.0892	0.0125	0.0000	0.0000	0.0099	4.4	1.82
16	160	0.5	0.0175	0.2450	0.1021	0.0129	0.0005	0.0005	0.0103	4.6	2.04
17	170	0.6	0.021	0.2660	0.1181	0.0160	0.0017	0.0012	0.0129	5.7	2.30
18	180	0.6	0.021	0.2870	0.1346	0.0165	0.0036	0.0019	0.0135	6.0	2.59
19	190	0.6	0.021	0.3080	0.1515	0.0169	0.0061	0.0025	0.0139	6.2	2.88
20	200	0.6	0.021	0.3290	0.1687	0.0172	0.0094	0.0033	0.0143	6.3	3.16
21	210	0.6	0.021	0.3500	0.1862	0.0175	0.0132	0.0038	0.0147	6.5	3.43
22	220	0.6	0.021	0.3710	0.2041	0.0179	0.0176	0.0044	0.0151	6.7	3.70
23	230	0.7	0.0245	0.3955	0.2251	0.0210	0.0234	0.0058	0.0179	7.9	4.00
24	240	0.7	0.0245	0.4200	0.2465	0.0214	0.0299	0.0065	0.0183	8.1	4.33
25	250	0.7	0.0245	0.4445	0.2681	0.0216	0.0371	0.0072	0.0186	8.3	4.65
26	260	0.7	0.0245	0.4690	0.2900	0.0219	0.0448	0.0077	0.0190	8.4	4.95
27	270	0.7	0.0245	0.4935	0.3120	0.0220	0.0532	0.0084	0.0192	8.5	5.24
28	280	0.7	0.0245	0.5180	0.3342	0.0222	0.0622	0.0090	0.0195	8.6	5.52
29	290	0.82	0.0287	0.5467	0.3605	0.0263	0.0733	0.0111	0.0232	10.3	5.84
30	300	0.82	0.0287	0.5754	0.3869	0.0264	0.0852	0.0119	0.0234	10.4	6.22
31	310	0.82	0.0287	0.6041	0.4135	0.0266	0.0977	0.0125	0.0237	10.5	6.57
32	320	0.82	0.0287	0.6328	0.4402	0.0267	0.1108	0.0131	0.0239	10.6	6.90
33	330	0.82	0.0287	0.6615	0.4671	0.0269	0.1245	0.0137	0.0242	10.7	7.21
34	340	0.82	0.0287	0.6902	0.4941	0.0270	0.1387	0.0142	0.0243	10.8	7.50
35	350	0.95	0.0333	0.7235	0.5256	0.0315	0.1558	0.0171	0.0285	12.6	7.85
36	360	0.95	0.0333	0.7568	0.5572	0.0316	0.1736	0.0178	0.0287	12.7	8.25
37	370	0.95	0.0333	0.7901	0.5889	0.0317	0.1921	0.0185	0.0290	12.8	8.63
38	380	0.95	0.0333	0.8234	0.6207	0.0318	0.2111	0.0190	0.0291	12.9	8.98
39	390	0.95	0.0333	0.8567	0.6526	0.0319	0.2306	0.0195	0.0293	13.0	9.31
40	400	0.95	0.0333	0.8900	0.6846	0.0320	0.2507	0.0201	0.0295	13.1	9.62
41	410	1.34	0.0469	0.9369	0.7299	0.0453	0.2797	0.0290	0.0419	18.6	10.14
42	420	1.34	0.0469	0.9838	0.7752	0.0453	0.3097	0.0300	0.0421	18.7	10.84
43	430	1.34	0.0469	1.0307	0.8207	0.0455	0.3405	0.0308	0.0425	18.8	11.50
44	440	1.8	0.063	1.0937	0.8819	0.0612	0.3831	0.0426	0.0573	25.4	12.38
45	450	1.8	0.063	1.1567	0.9434	0.0615	0.4269	0.0438	0.0578	25.6	13.47
46	460	3.4	0.119	1.2757	1.0597	0.1163	0.5127	0.0858	0.1100	48.7	15.44
47	470	5.4	0.189	1.4647	1.2454	0.1857	0.6559	0.1432	0.1769	78.4	19.43
48	480	2.7	0.0945	1.5592	1.3385	0.0931	0.7302	0.0743	0.0892	39.5	22.71
49	490	1.8	0.063	1.6222	1.4006	0.0621	0.7805	0.0503	0.0597	26.4	23.56
50	500	1.34	0.0469	1.6691	1.4469	0.0463	0.8184	0.0379	0.0446	19.8	23.52
51	510	1.34	0.0469	1.7160	1.4933	0.0464	0.8566	0.0382	0.0447	19.8	23.21
52	520	1.34	0.0469	1.7629	1.5396	0.0463	0.8951	0.0385	0.0447	19.8	22.93
53	530	0.88	0.0308	1.7937	1.5701	0.0305	0.9206	0.0255	0.0295	13.1	22.39
54	540	0.88	0.0308	1.8245	1.6006	0.0305	0.9462	0.0256	0.0295	13.1	21.62
55	550	0.88	0.0308	1.8553	1.6310	0.0304	0.9719	0.0257	0.0294	13.0	20.91
56	560	0.88	0.0308	1.8861	1.6615	0.0305	0.9977	0.0258	0.0295	13.1	20.26

Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Accumulated Rainfall (in)	Pervious Area Accumulated Runoff (in)	Pervious Area Incremental Runoff (in)	Impervious Area Accumulated Runoff (in)	Impervious Area Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
57	570	0.88	0.0308	1.9169	1.6920	0.0305	1.0236	0.0259	0.0295	13.1	19.66
58	580	0.88	0.0308	1.9477	1.7225	0.0305	1.0496	0.0260	0.0296	13.1	19.12
59	590	0.88	0.0308	1.9785	1.7530	0.0305	1.0757	0.0261	0.0296	13.1	18.62
60	600	0.88	0.0308	2.0093	1.7836	0.0306	1.1019	0.0262	0.0297	13.2	18.17
61	610	0.88	0.0308	2.0401	1.8141	0.0305	1.1283	0.0264	0.0297	13.1	17.75
62	620	0.88	0.0308	2.0709	1.8446	0.0305	1.1547	0.0264	0.0297	13.1	17.37
63	630	0.88	0.0308	2.1017	1.8752	0.0306	1.1812	0.0265	0.0298	13.2	17.02
64	640	0.88	0.0308	2.1325	1.9057	0.0305	1.2078	0.0266	0.0297	13.2	16.70
65	650	0.72	0.0252	2.1577	1.9307	0.0250	1.2296	0.0218	0.0243	10.8	16.31
66	660	0.72	0.0252	2.1829	1.9558	0.0251	1.2515	0.0219	0.0244	10.8	15.85
67	670	0.72	0.0252	2.2081	1.9808	0.0250	1.2734	0.0219	0.0244	10.8	15.43
68	680	0.72	0.0252	2.2333	2.0058	0.0250	1.2954	0.0220	0.0244	10.8	15.05
69	690	0.72	0.0252	2.2585	2.0308	0.0250	1.3174	0.0220	0.0244	10.8	14.70
70	700	0.72	0.0252	2.2837	2.0558	0.0250	1.3395	0.0221	0.0244	10.8	14.37
71	710	0.72	0.0252	2.3089	2.0808	0.0250	1.3616	0.0221	0.0244	10.8	14.08
72	720	0.72	0.0252	2.3341	2.1059	0.0251	1.3838	0.0222	0.0245	10.9	13.81
73	730	0.72	0.0252	2.3593	2.1309	0.0250	1.4060	0.0222	0.0244	10.8	13.56
74	740	0.72	0.0252	2.3845	2.1559	0.0250	1.4283	0.0223	0.0244	10.8	13.34
75	750	0.72	0.0252	2.4097	2.1810	0.0251	1.4506	0.0223	0.0245	10.9	13.13
76	760	0.72	0.0252	2.4349	2.2060	0.0250	1.4730	0.0224	0.0245	10.8	12.94
77	770	0.57	0.02	2.4549	2.2259	0.0199	1.4908	0.0178	0.0195	8.6	12.68
78	780	0.57	0.02	2.4749	2.2458	0.0199	1.5086	0.0178	0.0195	8.6	12.34
79	790	0.57	0.02	2.4949	2.2657	0.0199	1.5264	0.0178	0.0195	8.6	12.03
80	800	0.57	0.02	2.5149	2.2856	0.0199	1.5443	0.0179	0.0195	8.6	11.75
81	810	0.57	0.02	2.5349	2.3054	0.0198	1.5622	0.0179	0.0194	8.6	11.49
82	820	0.57	0.02	2.5549	2.3253	0.0199	1.5801	0.0179	0.0195	8.6	11.25
83	830	0.57	0.02	2.5749	2.3452	0.0199	1.5980	0.0179	0.0195	8.6	11.04
84	840	0.57	0.02	2.5949	2.3651	0.0199	1.6159	0.0179	0.0195	8.6	10.84
85	850	0.57	0.02	2.6149	2.3850	0.0199	1.6339	0.0180	0.0195	8.6	10.65
86	860	0.57	0.02	2.6349	2.4049	0.0199	1.6519	0.0180	0.0195	8.6	10.49
87	870	0.57	0.02	2.6549	2.4248	0.0199	1.6699	0.0180	0.0195	8.6	10.34
88	880	0.57	0.02	2.6749	2.4447	0.0199	1.6880	0.0181	0.0195	8.7	10.20
89	890	0.5	0.0175	2.6924	2.4621	0.0174	1.7038	0.0158	0.0171	7.6	10.02
90	900	0.5	0.0175	2.7099	2.4795	0.0174	1.7196	0.0158	0.0171	7.6	9.82
91	910	0.5	0.0175	2.7274	2.4969	0.0174	1.7355	0.0159	0.0171	7.6	9.63
92	920	0.5	0.0175	2.7449	2.5143	0.0174	1.7513	0.0158	0.0171	7.6	9.46
93	930	0.5	0.0175	2.7624	2.5317	0.0174	1.7672	0.0159	0.0171	7.6	9.30
94	940	0.5	0.0175	2.7799	2.5492	0.0175	1.7831	0.0159	0.0172	7.6	9.16
95	950	0.5	0.0175	2.7974	2.5666	0.0174	1.7990	0.0159	0.0171	7.6	9.03
96	960	0.5	0.0175	2.8149	2.5840	0.0174	1.8149	0.0159	0.0171	7.6	8.91
97	970	0.5	0.0175	2.8324	2.6014	0.0174	1.8308	0.0159	0.0171	7.6	8.80
98	980	0.5	0.0175	2.8499	2.6188	0.0174	1.8468	0.0160	0.0171	7.6	8.70
99	990	0.5	0.0175	2.8674	2.6362	0.0174	1.8627	0.0159	0.0171	7.6	8.61
100	1000	0.5	0.0175	2.8849	2.6537	0.0175	1.8787	0.0160	0.0172	7.6	8.52
101	1010	0.4	0.014	2.8989	2.6676	0.0139	1.8915	0.0128	0.0137	6.1	8.38
102	1020	0.4	0.014	2.9129	2.6815	0.0139	1.9043	0.0128	0.0137	6.1	8.19
103	1030	0.4	0.014	2.9269	2.6955	0.0140	1.9171	0.0128	0.0138	6.1	8.01
104	1040	0.4	0.014	2.9409	2.7094	0.0139	1.9299	0.0128	0.0137	6.1	7.85
105	1050	0.4	0.014	2.9549	2.7234	0.0140	1.9428	0.0129	0.0138	6.1	7.71
106	1060	0.4	0.014	2.9689	2.7373	0.0139	1.9556	0.0128	0.0137	6.1	7.57
107	1070	0.4	0.014	2.9829	2.7512	0.0139	1.9684	0.0128	0.0137	6.1	7.45
108	1080	0.4	0.014	2.9969	2.7652	0.0140	1.9813	0.0129	0.0138	6.1	7.33
109	1090	0.4	0.014	3.0109	2.7791	0.0139	1.9941	0.0128	0.0137	6.1	7.23
110	1100	0.4	0.014	3.0249	2.7931	0.0140	2.0070	0.0129	0.0138	6.1	7.13
111	1110	0.4	0.014	3.0389	2.8070	0.0139	2.0199	0.0129	0.0137	6.1	7.05
112	1120	0.4	0.014	3.0529	2.8210	0.0140	2.0328	0.0129	0.0138	6.1	6.97
113	1130	0.4	0.014	3.0669	2.8349	0.0139	2.0457	0.0129	0.0137	6.1	6.89
114	1140	0.4	0.014	3.0809	2.8488	0.0139	2.0586	0.0129	0.0137	6.1	6.83
115	1150	0.4	0.014	3.0949	2.8628	0.0140	2.0715	0.0129	0.0138	6.1	6.77
116	1160	0.4	0.014	3.1089	2.8767	0.0139	2.0844	0.0129	0.0137	6.1	6.71
117	1170	0.4	0.014	3.1229	2.8907	0.0140	2.0973	0.0129	0.0138	6.1	6.66
118	1180	0.4	0.014	3.1369	2.9046	0.0139	2.1102	0.0129	0.0137	6.1	6.61
119	1190	0.4	0.014	3.1509	2.9186	0.0140	2.1232	0.0130	0.0138	6.1	6.57
120	1200	0.4	0.014	3.1649	2.9325	0.0139	2.1361	0.0129	0.0137	6.1	6.53
121	1210	0.4	0.014	3.1789	2.9465	0.0140	2.1491	0.0130	0.0138	6.1	6.49
122	1220	0.4	0.014	3.1929	2.9604	0.0139	2.1620	0.0129	0.0137	6.1	6.46
123	1230	0.4	0.014	3.2069	2.9744	0.0140	2.1750	0.0130	0.0138	6.1	6.43
124	1240	0.4	0.014	3.2209	2.9883	0.0139	2.1880	0.0130	0.0137	6.1	6.40
125	1250	0.4	0.014	3.2349	3.0023	0.0140	2.2009	0.0129	0.0138	6.1	6.37
126	1260	0.4	0.014	3.2489	3.0162	0.0139	2.2139	0.0130	0.0137	6.1	6.35
127	1270	0.4	0.014	3.2629	3.0302	0.0140	2.2269	0.0130	0.0138	6.1	6.33
128	1280	0.4	0.014	3.2769	3.0441	0.0139	2.2399	0.0130	0.0137	6.1	6.31
129	1290	0.4	0.014	3.2909	3.0581	0.0140	2.2529	0.0130	0.0138	6.1	6.29
130	1300	0.4	0.014	3.3049	3.0720	0.0139	2.2659	0.0130	0.0137	6.1	6.28
131	1310	0.4	0.014	3.3189	3.0860	0.0140	2.2790	0.0131	0.0138	6.1	6.26
132	1320	0.4	0.014	3.3329	3.0999	0.0139	2.2920	0.0130	0.0137	6.1	6.25
133	1330	0.4	0.014	3.3469	3.1139	0.0140	2.3050	0.0130	0.0138	6.1	6.24
134	1340	0.4	0.014	3.3609	3.1278	0.0139	2.3181	0.0131	0.0137	6.1	6.22
135	1350	0.4	0.014	3.3749	3.1418	0.0140	2.3311	0.0130	0.0138	6.1	6.21
136	1360	0.4	0.014	3.3889	3.1557	0.0139	2.3442	0.0131	0.0137	6.1	6.20
137	1370	0.4	0.014	3.4029	3.1697	0.0140	2.3572	0.0130	0.0138	6.1	6.20
138	1380	0.4	0.014	3.4169	3.1836	0.0139	2.3703	0.0131	0.0137	6.1	6.19
139	1390	0.4	0.014	3.4309	3.1976	0.0140	2.3834	0.0131	0.0138	6.1	6.18
140	1400	0.4	0.014	3.4449	3.2115	0.0139	2.3964	0.0130	0.0137	6.1	6.17
141	1410	0.4	0.014	3.4589	3.2255	0.0140	2.4095	0.0131	0.0138	6.1	6.17
142	1420	0.4	0.014	3.4729	3.2395	0.0140	2.4226	0.0131	0.0138	6.1	6.16
143	1430	0.4	0.014	3.4869	3.2534	0.0139	2.4357	0.0131	0.0137	6.1	6.16
144	1440	0.4	0.014	3.5009	3.2674	0.0140	2.4488	0.0131	0.0138	6.1	6.16

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 10-yr, 24hr

Subbasin ID: PS 30 10-Year Future Land Use

	Value	Units	Notes
Area =	43.70	*ac*	
P_t =	2.25	*in*	(10 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	105.20	*min*	
w =	0.0454	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	30.47	13.23	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**105.20**	min
T_{Peak} =	**8.17**	hr
Q_{Peak} =	**8.43**	ft^3/s
$V_{Total\ Runoff}$ =	**272444**	ft^3

Time of Concentration **105.20**

Sheet Flow

$T_t = (0.42(n_s L)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 38.92 min

ns	0.24	
L	300	ft
P_2	1.75	in
S	0.03	ft/ft

$Shallow\ Flow_1$

Tt = L/V =	33.55	min
L	349	
Velocity (V) = kS0.5 =	0.17	ft/s
k	11	
S	0.03	ft/ft

$Shallow\ Flow_2$

Tt = L/V =	32.73	min
L	1631	
locity (V) = kS0.5 =	0.83	ft/s
k	42.333333	
S	0.04	ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.009	0.0090	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.009	0.0180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.009	0.0270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.009	0.0360	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
5	50	0.4	0.009	0.0450	0.0001	0.0001	0.0000	0.0000	0.0001	0.0	0.00
6	60	0.4	0.009	0.0540	0.0008	0.0007	0.0000	0.0000	0.0005	0.1	0.01
7	70	0.4	0.009	0.0630	0.0022	0.0014	0.0000	0.0000	0.0010	0.3	0.02
8	80	0.4	0.009	0.0720	0.0041	0.0019	0.0000	0.0000	0.0013	0.4	0.05
9	90	0.4	0.009	0.0810	0.0066	0.0025	0.0000	0.0000	0.0017	0.5	0.08
10	100	0.4	0.009	0.0900	0.0096	0.0030	0.0000	0.0000	0.0021	0.6	0.12
11	110	0.5	0.0113	0.1013	0.0138	0.0042	0.0000	0.0000	0.0029	0.8	0.17
12	120	0.5	0.0113	0.1126	0.0187	0.0049	0.0000	0.0000	0.0034	0.9	0.23
13	130	0.5	0.0113	0.1239	0.0240	0.0053	0.0000	0.0000	0.0037	1.0	0.29
14	140	0.5	0.0113	0.1352	0.0298	0.0058	0.0000	0.0000	0.0040	1.1	0.36
15	150	0.5	0.0113	0.1465	0.0361	0.0063	0.0000	0.0000	0.0044	1.2	0.43
16	160	0.5	0.0113	0.1578	0.0426	0.0065	0.0000	0.0000	0.0045	1.2	0.50
17	170	0.6	0.0135	0.1713	0.0509	0.0083	0.0000	0.0000	0.0058	1.5	0.58
18	180	0.6	0.0135	0.1848	0.0596	0.0087	0.0000	0.0000	0.0061	1.6	0.67
19	190	0.6	0.0135	0.1983	0.0686	0.0090	0.0000	0.0000	0.0063	1.7	0.75
20	200	0.6	0.0135	0.2118	0.0779	0.0093	0.0000	0.0000	0.0065	1.7	0.84
21	210	0.6	0.0135	0.2253	0.0876	0.0097	0.0000	0.0000	0.0068	1.8	0.92
22	220	0.6	0.0135	0.2388	0.0975	0.0099	0.0002	0.0002	0.0070	1.8	1.00
23	230	0.7	0.0158	0.2546	0.1094	0.0119	0.0009	0.0007	0.0085	2.2	1.10
24	240	0.7	0.0158	0.2704	0.1215	0.0121	0.0020	0.0011	0.0088	2.3	1.20
25	250	0.7	0.0158	0.2862	0.1340	0.0125	0.0035	0.0015	0.0092	2.4	1.31
26	260	0.7	0.0158	0.3020	0.1466	0.0126	0.0053	0.0018	0.0093	2.5	1.41
27	270	0.7	0.0158	0.3178	0.1595	0.0129	0.0076	0.0023	0.0097	2.6	1.51
28	280	0.7	0.0158	0.3336	0.1725	0.0130	0.0101	0.0025	0.0098	2.6	1.61
29	290	0.82	0.0185	0.3521	0.1880	0.0155	0.0136	0.0035	0.0119	3.1	1.72
30	300	0.82	0.0185	0.3706	0.2037	0.0157	0.0175	0.0039	0.0121	3.2	1.86
31	310	0.82	0.0185	0.3891	0.2196	0.0159	0.0218	0.0043	0.0124	3.3	1.98
32	320	0.82	0.0185	0.4076	0.2357	0.0161	0.0265	0.0047	0.0126	3.3	2.10
33	330	0.82	0.0185	0.4261	0.2519	0.0162	0.0316	0.0051	0.0128	3.4	2.22
34	340	0.82	0.0185	0.4446	0.2682	0.0163	0.0371	0.0055	0.0130	3.4	2.33
35	350	0.95	0.0214	0.4660	0.2873	0.0191	0.0439	0.0068	0.0154	4.1	2.46
36	360	0.95	0.0214	0.4874	0.3065	0.0192	0.0511	0.0072	0.0156	4.1	2.60
37	370	0.95	0.0214	0.5088	0.3259	0.0194	0.0588	0.0077	0.0159	4.2	2.74
38	380	0.95	0.0214	0.5302	0.3454	0.0195	0.0668	0.0080	0.0160	4.2	2.88
39	390	0.95	0.0214	0.5516	0.3650	0.0196	0.0753	0.0085	0.0162	4.3	3.00
40	400	0.95	0.0214	0.5730	0.3847	0.0197	0.0842	0.0089	0.0164	4.3	3.12
41	410	1.34	0.0302	0.6032	0.4126	0.0279	0.0973	0.0131	0.0234	6.2	3.32
42	420	1.34	0.0302	0.6334	0.4408	0.0282	0.1111	0.0138	0.0238	6.3	3.58
43	430	1.34	0.0302	0.6636	0.4691	0.0283	0.1255	0.0144	0.0241	6.4	3.83
44	440	1.8	0.0405	0.7041	0.5072	0.0381	0.1458	0.0203	0.0327	8.6	4.17
45	450	1.8	0.0405	0.7446	0.5456	0.0384	0.1671	0.0213	0.0332	8.8	4.58
46	460	3.4	0.0765	0.8211	0.6185	0.0729	0.2097	0.0426	0.0637	16.8	5.33
47	470	5.4	0.1215	0.9426	0.7354	0.1169	0.2833	0.0736	0.1038	27.4	6.85
48	480	2.7	0.0608	1.0034	0.7942	0.0588	0.3225	0.0392	0.0529	14.0	8.11
49	490	1.8	0.0405	1.0439	0.8335	0.0393	0.3493	0.0268	0.0355	9.4	8.43
50	500	1.34	0.0302	1.0741	0.8629	0.0294	0.3697	0.0204	0.0267	7.1	8.42
51	510	1.34	0.0302	1.1043	0.8923	0.0294	0.3904	0.0207	0.0268	7.1	8.29
52	520	1.34	0.0302	1.1345	0.9217	0.0294	0.4113	0.0209	0.0268	7.1	8.18
53	530	0.88	0.0198	1.1543	0.9410	0.0193	0.4252	0.0139	0.0177	4.7	7.97
54	540	0.88	0.0198	1.1741	0.9603	0.0193	0.4392	0.0140	0.0177	4.7	7.67
55	550	0.88	0.0198	1.1939	0.9797	0.0194	0.4533	0.0141	0.0178	4.7	7.40
56	560	0.88	0.0198	1.2137	0.9990	0.0193	0.4675	0.0142	0.0178	4.7	7.16

					Pervious Area		Impervious Area				
Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Accumulated Rainfall (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Accumulated Runoff (in)	Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
57	570	0.88	0.0198	1.2335	1.0184	0.0194	0.4819	0.0144	0.0179	4.7	6.94
58	580	0.88	0.0198	1.2533	1.0378	0.0194	0.4963	0.0144	0.0179	4.7	6.74
59	590	0.88	0.0198	1.2731	1.0572	0.0194	0.5108	0.0145	0.0179	4.7	6.55
60	600	0.88	0.0198	1.2929	1.0766	0.0194	0.5254	0.0146	0.0179	4.7	6.39
61	610	0.88	0.0198	1.3127	1.0960	0.0194	0.5401	0.0147	0.0180	4.8	6.24
62	620	0.88	0.0198	1.3325	1.1154	0.0194	0.5549	0.0148	0.0180	4.8	6.11
63	630	0.88	0.0198	1.3523	1.1349	0.0195	0.5698	0.0149	0.0181	4.8	5.99
64	640	0.88	0.0198	1.3721	1.1543	0.0194	0.5848	0.0150	0.0181	4.8	5.88
65	650	0.72	0.0162	1.3883	1.1702	0.0159	0.5971	0.0123	0.0148	3.9	5.74
66	660	0.72	0.0162	1.4045	1.1862	0.0160	0.6095	0.0124	0.0149	3.9	5.57
67	670	0.72	0.0162	1.4207	1.2021	0.0159	0.6219	0.0124	0.0148	3.9	5.42
68	680	0.72	0.0162	1.4369	1.2180	0.0159	0.6344	0.0125	0.0149	3.9	5.29
69	690	0.72	0.0162	1.4531	1.2340	0.0160	0.6469	0.0125	0.0149	4.0	5.17
70	700	0.72	0.0162	1.4693	1.2499	0.0159	0.6595	0.0126	0.0149	3.9	5.06
71	710	0.72	0.0162	1.4855	1.2659	0.0160	0.6721	0.0126	0.0150	4.0	4.96
72	720	0.72	0.0162	1.5017	1.2818	0.0159	0.6848	0.0127	0.0149	3.9	4.86
73	730	0.72	0.0162	1.5179	1.2978	0.0160	0.6975	0.0127	0.0150	4.0	4.78
74	740	0.72	0.0162	1.5341	1.3137	0.0159	0.7103	0.0128	0.0150	4.0	4.71
75	750	0.72	0.0162	1.5503	1.3297	0.0160	0.7231	0.0128	0.0150	4.0	4.64
76	760	0.72	0.0162	1.5665	1.3457	0.0160	0.7360	0.0129	0.0151	4.0	4.58
77	770	0.57	0.0128	1.5793	1.3583	0.0126	0.7462	0.0102	0.0119	3.1	4.49
78	780	0.57	0.0128	1.5921	1.3709	0.0126	0.7564	0.0102	0.0119	3.1	4.37
79	790	0.57	0.0128	1.6049	1.3836	0.0127	0.7666	0.0102	0.0119	3.2	4.25
80	800	0.57	0.0128	1.6177	1.3962	0.0126	0.7769	0.0103	0.0119	3.1	4.15
81	810	0.57	0.0128	1.6305	1.4088	0.0126	0.7872	0.0103	0.0119	3.1	4.06
82	820	0.57	0.0128	1.6433	1.4215	0.0127	0.7975	0.0103	0.0120	3.2	3.98
83	830	0.57	0.0128	1.6561	1.4341	0.0126	0.8079	0.0104	0.0119	3.2	3.91
84	840	0.57	0.0128	1.6689	1.4467	0.0126	0.8182	0.0103	0.0119	3.1	3.84
85	850	0.57	0.0128	1.6817	1.4594	0.0127	0.8286	0.0104	0.0120	3.2	3.78
86	860	0.57	0.0128	1.6945	1.4720	0.0126	0.8391	0.0105	0.0120	3.2	3.72
87	870	0.57	0.0128	1.7073	1.4847	0.0127	0.8495	0.0104	0.0120	3.2	3.67
88	880	0.57	0.0128	1.7201	1.4973	0.0126	0.8600	0.0105	0.0120	3.2	3.63
89	890	0.5	0.0113	1.7314	1.5085	0.0112	0.8692	0.0092	0.0106	2.8	3.57
90	900	0.5	0.0113	1.7427	1.5197	0.0112	0.8785	0.0093	0.0106	2.8	3.50
91	910	0.5	0.0113	1.7540	1.5308	0.0111	0.8878	0.0093	0.0106	2.8	3.43
92	920	0.5	0.0113	1.7653	1.5420	0.0112	0.8971	0.0093	0.0106	2.8	3.38
93	930	0.5	0.0113	1.7766	1.5532	0.0112	0.9064	0.0093	0.0106	2.8	3.33
94	940	0.5	0.0113	1.7879	1.5643	0.0111	0.9158	0.0094	0.0106	2.8	3.28
95	950	0.5	0.0113	1.7992	1.5755	0.0112	0.9251	0.0093	0.0106	2.8	3.24
96	960	0.5	0.0113	1.8105	1.5867	0.0112	0.9345	0.0094	0.0107	2.8	3.20
97	970	0.5	0.0113	1.8218	1.5979	0.0112	0.9439	0.0094	0.0107	2.8	3.16
98	980	0.5	0.0113	1.8331	1.6091	0.0112	0.9533	0.0094	0.0107	2.8	3.13
99	990	0.5	0.0113	1.8444	1.6202	0.0111	0.9627	0.0094	0.0106	2.8	3.10
100	1000	0.5	0.0113	1.8557	1.6314	0.0112	0.9722	0.0095	0.0107	2.8	3.08
101	1010	0.4	0.009	1.8647	1.6403	0.0089	0.9797	0.0075	0.0085	2.2	3.03
102	1020	0.4	0.009	1.8737	1.6492	0.0089	0.9873	0.0076	0.0085	2.2	2.96
103	1030	0.4	0.009	1.8827	1.6582	0.0090	0.9948	0.0075	0.0085	2.3	2.89
104	1040	0.4	0.009	1.8917	1.6671	0.0089	1.0024	0.0076	0.0085	2.2	2.83
105	1050	0.4	0.009	1.9007	1.6760	0.0089	1.0099	0.0075	0.0085	2.2	2.78
106	1060	0.4	0.009	1.9097	1.6849	0.0089	1.0175	0.0076	0.0085	2.2	2.73
107	1070	0.4	0.009	1.9187	1.6938	0.0089	1.0251	0.0076	0.0085	2.2	2.69
108	1080	0.4	0.009	1.9277	1.7027	0.0089	1.0327	0.0076	0.0085	2.2	2.65
109	1090	0.4	0.009	1.9367	1.7116	0.0089	1.0403	0.0076	0.0085	2.2	2.61
110	1100	0.4	0.009	1.9457	1.7206	0.0090	1.0479	0.0076	0.0086	2.3	2.58
111	1110	0.4	0.009	1.9547	1.7295	0.0089	1.0555	0.0076	0.0085	2.2	2.55
112	1120	0.4	0.009	1.9637	1.7384	0.0089	1.0632	0.0077	0.0085	2.3	2.52
113	1130	0.4	0.009	1.9727	1.7473	0.0089	1.0708	0.0076	0.0085	2.2	2.50
114	1140	0.4	0.009	1.9817	1.7562	0.0089	1.0784	0.0076	0.0085	2.2	2.48
115	1150	0.4	0.009	1.9907	1.7651	0.0089	1.0861	0.0077	0.0085	2.3	2.46
116	1160	0.4	0.009	1.9997	1.7741	0.0090	1.0938	0.0077	0.0086	2.3	2.44
117	1170	0.4	0.009	2.0087	1.7830	0.0089	1.1014	0.0076	0.0085	2.2	2.42
118	1180	0.4	0.009	2.0177	1.7919	0.0089	1.1091	0.0077	0.0085	2.3	2.41
119	1190	0.4	0.009	2.0267	1.8008	0.0089	1.1168	0.0077	0.0085	2.3	2.39
120	1200	0.4	0.009	2.0357	1.8097	0.0089	1.1245	0.0077	0.0085	2.3	2.38
121	1210	0.4	0.009	2.0447	1.8187	0.0090	1.1322	0.0077	0.0086	2.3	2.37
122	1220	0.4	0.009	2.0537	1.8276	0.0089	1.1399	0.0077	0.0085	2.3	2.36
123	1230	0.4	0.009	2.0627	1.8365	0.0089	1.1476	0.0077	0.0085	2.3	2.35
124	1240	0.4	0.009	2.0717	1.8454	0.0089	1.1554	0.0078	0.0086	2.3	2.34
125	1250	0.4	0.009	2.0807	1.8544	0.0090	1.1631	0.0077	0.0086	2.3	2.34
126	1260	0.4	0.009	2.0897	1.8633	0.0089	1.1708	0.0077	0.0085	2.3	2.33
127	1270	0.4	0.009	2.0987	1.8722	0.0089	1.1786	0.0078	0.0086	2.3	2.32
128	1280	0.4	0.009	2.1077	1.8811	0.0089	1.1864	0.0078	0.0086	2.3	2.32
129	1290	0.4	0.009	2.1167	1.8901	0.0090	1.1941	0.0077	0.0086	2.3	2.31
130	1300	0.4	0.009	2.1257	1.8990	0.0089	1.2019	0.0078	0.0086	2.3	2.31
131	1310	0.4	0.009	2.1347	1.9079	0.0089	1.2097	0.0078	0.0086	2.3	2.31
132	1320	0.4	0.009	2.1437	1.9169	0.0090	1.2175	0.0078	0.0086	2.3	2.30
133	1330	0.4	0.009	2.1527	1.9258	0.0089	1.2253	0.0078	0.0086	2.3	2.30
134	1340	0.4	0.009	2.1617	1.9347	0.0089	1.2331	0.0078	0.0086	2.3	2.30
135	1350	0.4	0.009	2.1707	1.9436	0.0089	1.2409	0.0078	0.0086	2.3	2.29
136	1360	0.4	0.009	2.1797	1.9526	0.0090	1.2487	0.0078	0.0086	2.3	2.29
137	1370	0.4	0.009	2.1887	1.9615	0.0089	1.2565	0.0078	0.0086	2.3	2.29
138	1380	0.4	0.009	2.1977	1.9704	0.0089	1.2643	0.0078	0.0086	2.3	2.29
139	1390	0.4	0.009	2.2067	1.9794	0.0090	1.2722	0.0079	0.0087	2.3	2.29
140	1400	0.4	0.009	2.2157	1.9883	0.0089	1.2800	0.0078	0.0086	2.3	2.29
141	1410	0.4	0.009	2.2247	1.9972	0.0089	1.2879	0.0079	0.0086	2.3	2.29
142	1420	0.4	0.009	2.2337	2.0062	0.0090	1.2957	0.0078	0.0086	2.3	2.28
143	1430	0.4	0.009	2.2427	2.0151	0.0089	1.3036	0.0079	0.0086	2.3	2.28
144	1440	0.4	0.009	2.2517	2.0240	0.0089	1.3115	0.0079	0.0086	2.3	2.28

Project: Shoreline Stormwater Pump Station Evaluation
Design Storm Event: 25-yr, 24hr

Subbasin ID: PS 30 25-Year Future Land Use

	Value	Units	Notes
Area =	43.70	*ac*	
P_t =	3.5	*in*	(25 year 24 hour storm event)
d_t =	10	*min*	(Time step for hydrograph construction)
T_c =	105.20	*min*	
w =	0.0454	--	(Routing Constant = dt/ (2Tc + dt))

	Impervious	Pervious	Units
Area =	30.47	13.23	*ac*
CN =	98	90	--
S =	0.20	1.11	--
0.2S =	0.04	0.22	--

Summary:

T_c =	**105.20**	min
T_{Peak} =	**8.17**	hr
Q_{Peak} =	**14.29**	ft^3/s
$V_{Total\ Runoff}$ =	**456045**	ft^3

Time of Concentration **105.20**

Sheet Flow

$T_t = (0.42(n_sL)^{0.8})/(P_2)^{0.527}(S)^{0.4})$ 38.92 min
ns 0.24
L 300 ft
P_2 1.75 in
S 0.03 ft/ft

Shallow $Flow_1$
Tt = L/V = 33.55 min
L 349
Velocity (V) = kS0.5 = 0.17 ft/s
k 11
S 0.03 ft/ft

Shallow $Flow_2$
Tt = L/V = 32.73 min
L 1631
city (V) = kS0.5 = 0.83 ft/s
k 42.333333
S 0.04 ft/ft

Runoff Hydrograph Calculation

Column C = SCS Type IA Rainfall Distribution
Column D = Column C x Pt
Column E = Cumulated sum of Column D
Column F = 0 if Pt < 0.2 Pervious S; = (Column E - 0.2 Pervious S)^2 /(Column E + 0.8 x Pervious S)
Column G = Column F of present time step - Column F of previous time step
Column H = 0 if Pt < 0.2 impervious S; = (Column E - 0.2 impervious S)^2 /(Column E + 0.8 x impervious S)
Column I = Column H of present time step - Column F of previous time step
Column J = ((Pervious Area/Total Area) x Column G + (Impervious Area/Total Area) x Column I)
Column K = 60.5 x Column J x Total Area / dt
Column L = Column L of Previous Time Step + w x (Column K of the Previous Time Step + Column K of the Present Time Step - 2 x Column L of Previous Time Step)

					Pervious Area		Impervious Area				
Time Increment	**Time (min)**	**Rainfall Distribution (% of Pt)**	**Incremental Rainfall (in)**	**Accumulated Rainfall (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Accumulated Runoff (in)**	**Incremental Runoff (in)**	**Total Runoff R (In)**	**Instant Hydrograph I (cfs)**	**Design Hydrograph Q (cfs)**
1	10	0.4	0.014	0.0140	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
2	20	0.4	0.014	0.0280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
3	30	0.4	0.014	0.0420	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.00
4	40	0.4	0.014	0.0560	0.0011	0.0011	0.0000	0.0000	0.0008	0.2	0.01
5	50	0.4	0.014	0.0700	0.0037	0.0026	0.0000	0.0000	0.0018	0.5	0.04
6	60	0.4	0.014	0.0840	0.0075	0.0038	0.0000	0.0000	0.0026	0.7	0.09
7	70	0.4	0.014	0.0980	0.0125	0.0050	0.0000	0.0000	0.0035	0.9	0.15
8	80	0.4	0.014	0.1120	0.0184	0.0059	0.0000	0.0000	0.0041	1.1	0.23
9	90	0.4	0.014	0.1260	0.0251	0.0067	0.0000	0.0000	0.0047	1.2	0.32
10	100	0.4	0.014	0.1400	0.0324	0.0073	0.0000	0.0000	0.0051	1.3	0.40
11	110	0.5	0.0175	0.1575	0.0424	0.0100	0.0000	0.0000	0.0070	1.8	0.51
12	120	0.5	0.0175	0.1750	0.0532	0.0108	0.0000	0.0000	0.0075	2.0	0.64
13	130	0.5	0.0175	0.1925	0.0647	0.0115	0.0000	0.0000	0.0080	2.1	0.77
14	140	0.5	0.0175	0.2100	0.0767	0.0120	0.0000	0.0000	0.0084	2.2	0.90
15	150	0.5	0.0175	0.2275	0.0892	0.0125	0.0000	0.0000	0.0087	2.3	1.02
16	160	0.5	0.0175	0.2450	0.1021	0.0129	0.0005	0.0005	0.0091	2.4	1.14
17	170	0.6	0.021	0.2660	0.1181	0.0160	0.0017	0.0012	0.0115	3.0	1.29
18	180	0.6	0.021	0.2870	0.1346	0.0165	0.0036	0.0019	0.0121	3.2	1.45
19	190	0.6	0.021	0.3080	0.1515	0.0169	0.0061	0.0025	0.0125	3.3	1.62
20	200	0.6	0.021	0.3290	0.1687	0.0172	0.0094	0.0033	0.0130	3.4	1.77
21	210	0.6	0.021	0.3500	0.1862	0.0175	0.0132	0.0038	0.0134	3.5	1.93
22	220	0.6	0.021	0.3710	0.2041	0.0179	0.0176	0.0044	0.0138	3.7	2.08
23	230	0.7	0.0245	0.3955	0.2251	0.0210	0.0234	0.0058	0.0164	4.3	2.25
24	240	0.7	0.0245	0.4200	0.2465	0.0214	0.0299	0.0065	0.0169	4.5	2.45
25	250	0.7	0.0245	0.4445	0.2681	0.0216	0.0371	0.0072	0.0172	4.6	2.64
26	260	0.7	0.0245	0.4690	0.2900	0.0219	0.0448	0.0077	0.0176	4.7	2.81
27	270	0.7	0.0245	0.4935	0.3120	0.0220	0.0532	0.0084	0.0179	4.7	2.99
28	280	0.7	0.0245	0.5180	0.3342	0.0222	0.0622	0.0090	0.0182	4.8	3.15
29	290	0.82	0.0287	0.5467	0.3605	0.0263	0.0733	0.0111	0.0217	5.7	3.34
30	300	0.82	0.0287	0.5754	0.3869	0.0264	0.0852	0.0119	0.0220	5.8	3.56
31	310	0.82	0.0287	0.6041	0.4135	0.0266	0.0977	0.0125	0.0223	5.9	3.77
32	320	0.82	0.0287	0.6328	0.4402	0.0267	0.1108	0.0131	0.0226	6.0	3.97
33	330	0.82	0.0287	0.6615	0.4671	0.0269	0.1245	0.0137	0.0229	6.1	4.15
34	340	0.82	0.0287	0.6902	0.4941	0.0270	0.1387	0.0142	0.0231	6.1	4.33
35	350	0.95	0.0333	0.7235	0.5256	0.0315	0.1558	0.0171	0.0271	7.2	4.54
36	360	0.95	0.0333	0.7568	0.5572	0.0316	0.1736	0.0178	0.0274	7.2	4.78
37	370	0.95	0.0333	0.7901	0.5889	0.0317	0.1921	0.0185	0.0277	7.3	5.01
38	380	0.95	0.0333	0.8234	0.6207	0.0318	0.2111	0.0190	0.0279	7.4	5.22
39	390	0.95	0.0333	0.8567	0.6526	0.0319	0.2306	0.0195	0.0281	7.4	5.42
40	400	0.95	0.0333	0.8900	0.6846	0.0320	0.2507	0.0201	0.0284	7.5	5.61
41	410	1.34	0.0469	0.9369	0.7299	0.0453	0.2797	0.0290	0.0404	10.7	5.92
42	420	1.34	0.0469	0.9838	0.7752	0.0453	0.3097	0.0300	0.0407	10.8	6.36
43	430	1.34	0.0469	1.0307	0.8207	0.0455	0.3405	0.0308	0.0410	10.9	6.76
44	440	1.8	0.063	1.0937	0.8819	0.0612	0.3831	0.0426	0.0556	14.7	7.31
45	450	1.8	0.063	1.1567	0.9434	0.0615	0.4269	0.0438	0.0561	14.8	7.98
46	460	3.4	0.119	1.2757	1.0597	0.1163	0.5127	0.0858	0.1071	28.3	9.22
47	470	5.4	0.189	1.4647	1.2454	0.1857	0.6559	0.1432	0.1728	45.7	11.74
48	480	2.7	0.0945	1.5592	1.3385	0.0931	0.7302	0.0743	0.0874	23.1	13.79
49	490	1.8	0.063	1.6222	1.4006	0.0621	0.7805	0.0503	0.0585	15.5	14.29
50	500	1.34	0.0469	1.6691	1.4469	0.0463	0.8184	0.0379	0.0438	11.6	14.22
51	510	1.34	0.0469	1.7160	1.4933	0.0464	0.8566	0.0382	0.0439	11.6	13.98
52	520	1.34	0.0469	1.7629	1.5396	0.0463	0.8951	0.0385	0.0439	11.6	13.77
53	530	0.88	0.0308	1.7937	1.5701	0.0305	0.9206	0.0255	0.0290	7.7	13.39
54	540	0.88	0.0308	1.8245	1.6006	0.0305	0.9462	0.0256	0.0290	7.7	12.87
55	550	0.88	0.0308	1.8553	1.6310	0.0304	0.9719	0.0257	0.0290	7.7	12.40
56	560	0.88	0.0308	1.8861	1.6615	0.0305	0.9977	0.0258	0.0291	7.7	11.97
57	570	0.88	0.0308	1.9169	1.6920	0.0305	1.0236	0.0259	0.0291	7.7	11.58
58	580	0.88	0.0308	1.9477	1.7225	0.0305	1.0496	0.0260	0.0291	7.7	11.23
59	590	0.88	0.0308	1.9785	1.7530	0.0305	1.0757	0.0261	0.0292	7.7	10.91
60	600	0.88	0.0308	2.0093	1.7836	0.0306	1.1019	0.0262	0.0293	7.7	10.62
61	610	0.88	0.0308	2.0401	1.8141	0.0305	1.1283	0.0264	0.0293	7.7	10.36
62	620	0.88	0.0308	2.0709	1.8446	0.0305	1.1547	0.0264	0.0293	7.7	10.12
63	630	0.88	0.0308	2.1017	1.8752	0.0306	1.1812	0.0265	0.0294	7.8	9.91
64	640	0.88	0.0308	2.1325	1.9057	0.0305	1.2078	0.0266	0.0293	7.8	9.71
65	650	0.72	0.0252	2.1577	1.9307	0.0250	1.2296	0.0218	0.0240	6.4	9.47
66	660	0.72	0.0252	2.1829	1.9558	0.0251	1.2515	0.0219	0.0241	6.4	9.19
67	670	0.72	0.0252	2.2081	1.9808	0.0250	1.2734	0.0219	0.0241	6.4	8.93
68	680	0.72	0.0252	2.2333	2.0058	0.0250	1.2954	0.0220	0.0241	6.4	8.70
69	690	0.72	0.0252	2.2585	2.0308	0.0250	1.3174	0.0220	0.0241	6.4	8.49
70	700	0.72	0.0252	2.2837	2.0558	0.0250	1.3395	0.0221	0.0241	6.4	8.30
71	710	0.72	0.0252	2.3089	2.0808	0.0250	1.3616	0.0221	0.0241	6.4	8.12
72	720	0.72	0.0252	2.3341	2.1059	0.0251	1.3838	0.0222	0.0242	6.4	7.97
73	730	0.72	0.0252	2.3593	2.1309	0.0250	1.4060	0.0222	0.0242	6.4	7.82
74	740	0.72	0.0252	2.3845	2.1559	0.0250	1.4283	0.0223	0.0242	6.4	7.69
75	750	0.72	0.0252	2.4097	2.1810	0.0251	1.4506	0.0223	0.0243	6.4	7.58
76	760	0.72	0.0252	2.4349	2.2060	0.0250	1.4730	0.0224	0.0242	6.4	7.47
77	770	0.57	0.02	2.4549	2.2259	0.0199	1.4908	0.0178	0.0193	5.1	7.31

Time Increment	Time (min)	Rainfall Distribution (% of Pt)	Incremental Rainfall (in)	Pervious Area Accumulated Rainfall (in)	Pervious Area Accumulated Runoff (in)	Pervious Area Incremental Runoff (in)	Impervious Area Accumulated Runoff (in)	Impervious Area Incremental Runoff (in)	Total Runoff R (In)	Instant Hydrograph I (cfs)	Design Hydrograph Q (cfs)
78	780	0.57	0.02	2.4749	2.2458	0.0199	1.5086	0.0178	0.0193	5.1	7.11
79	790	0.57	0.02	2.4949	2.2657	0.0199	1.5264	0.0178	0.0193	5.1	6.93
80	800	0.57	0.02	2.5149	2.2856	0.0199	1.5443	0.0179	0.0193	5.1	6.76
81	810	0.57	0.02	2.5349	2.3054	0.0198	1.5622	0.0179	0.0192	5.1	6.61
82	820	0.57	0.02	2.5549	2.3253	0.0199	1.5801	0.0179	0.0193	5.1	6.47
83	830	0.57	0.02	2.5749	2.3452	0.0199	1.5980	0.0179	0.0193	5.1	6.35
84	840	0.57	0.02	2.5949	2.3651	0.0199	1.6159	0.0179	0.0193	5.1	6.24
85	850	0.57	0.02	2.6149	2.3850	0.0199	1.6339	0.0180	0.0193	5.1	6.13
86	860	0.57	0.02	2.6349	2.4049	0.0199	1.6519	0.0180	0.0193	5.1	6.04
87	870	0.57	0.02	2.6549	2.4248	0.0199	1.6699	0.0180	0.0193	5.1	5.96
88	880	0.57	0.02	2.6749	2.4447	0.0199	1.6880	0.0181	0.0194	5.1	5.88
89	890	0.5	0.0175	2.6924	2.4621	0.0174	1.7038	0.0158	0.0169	4.5	5.78
90	900	0.5	0.0175	2.7099	2.4795	0.0174	1.7196	0.0158	0.0169	4.5	5.66
91	910	0.5	0.0175	2.7274	2.4969	0.0174	1.7355	0.0159	0.0169	4.5	5.55
92	920	0.5	0.0175	2.7449	2.5143	0.0174	1.7513	0.0158	0.0169	4.5	5.46
93	930	0.5	0.0175	2.7624	2.5317	0.0174	1.7672	0.0159	0.0169	4.5	5.37
94	940	0.5	0.0175	2.7799	2.5492	0.0175	1.7831	0.0159	0.0170	4.5	5.29
95	950	0.5	0.0175	2.7974	2.5666	0.0174	1.7990	0.0159	0.0169	4.5	5.22
96	960	0.5	0.0175	2.8149	2.5840	0.0174	1.8149	0.0159	0.0169	4.5	5.15
97	970	0.5	0.0175	2.8324	2.6014	0.0174	1.8308	0.0159	0.0169	4.5	5.09
98	980	0.5	0.0175	2.8499	2.6188	0.0174	1.8468	0.0160	0.0170	4.5	5.03
99	990	0.5	0.0175	2.8674	2.6362	0.0174	1.8627	0.0159	0.0169	4.5	4.98
100	1000	0.5	0.0175	2.8849	2.6537	0.0175	1.8787	0.0160	0.0170	4.5	4.94
101	1010	0.4	0.014	2.8989	2.6676	0.0139	1.8915	0.0128	0.0136	3.6	4.86
102	1020	0.4	0.014	2.9129	2.6815	0.0139	1.9043	0.0128	0.0136	3.6	4.74
103	1030	0.4	0.014	2.9269	2.6955	0.0140	1.9171	0.0128	0.0136	3.6	4.64
104	1040	0.4	0.014	2.9409	2.7094	0.0139	1.9299	0.0128	0.0136	3.6	4.54
105	1050	0.4	0.014	2.9549	2.7234	0.0140	1.9428	0.0129	0.0137	3.6	4.46
106	1060	0.4	0.014	2.9689	2.7373	0.0139	1.9556	0.0128	0.0136	3.6	4.38
107	1070	0.4	0.014	2.9829	2.7512	0.0139	1.9684	0.0128	0.0136	3.6	4.31
108	1080	0.4	0.014	2.9969	2.7652	0.0140	1.9813	0.0129	0.0137	3.6	4.24
109	1090	0.4	0.014	3.0109	2.7791	0.0139	1.9941	0.0128	0.0136	3.6	4.19
110	1100	0.4	0.014	3.0249	2.7931	0.0140	2.0070	0.0129	0.0137	3.6	4.13
111	1110	0.4	0.014	3.0389	2.8070	0.0139	2.0199	0.0129	0.0136	3.6	4.08
112	1120	0.4	0.014	3.0529	2.8210	0.0140	2.0328	0.0129	0.0137	3.6	4.04
113	1130	0.4	0.014	3.0669	2.8349	0.0139	2.0457	0.0129	0.0136	3.6	4.00
114	1140	0.4	0.014	3.0809	2.8488	0.0139	2.0586	0.0129	0.0136	3.6	3.96
115	1150	0.4	0.014	3.0949	2.8628	0.0140	2.0715	0.0129	0.0137	3.6	3.93
116	1160	0.4	0.014	3.1089	2.8767	0.0139	2.0844	0.0129	0.0136	3.6	3.90
117	1170	0.4	0.014	3.1229	2.8907	0.0140	2.0973	0.0129	0.0137	3.6	3.88
118	1180	0.4	0.014	3.1369	2.9046	0.0139	2.1102	0.0129	0.0136	3.6	3.85
119	1190	0.4	0.014	3.1509	2.9186	0.0140	2.1232	0.0130	0.0137	3.6	3.83
120	1200	0.4	0.014	3.1649	2.9325	0.0139	2.1361	0.0129	0.0136	3.6	3.81
121	1210	0.4	0.014	3.1789	2.9465	0.0140	2.1491	0.0130	0.0137	3.6	3.79
122	1220	0.4	0.014	3.1929	2.9604	0.0139	2.1620	0.0129	0.0136	3.6	3.77
123	1230	0.4	0.014	3.2069	2.9744	0.0140	2.1750	0.0130	0.0137	3.6	3.76
124	1240	0.4	0.014	3.2209	2.9883	0.0139	2.1880	0.0130	0.0136	3.6	3.75
125	1250	0.4	0.014	3.2349	3.0023	0.0140	2.2009	0.0129	0.0137	3.6	3.73
126	1260	0.4	0.014	3.2489	3.0162	0.0139	2.2139	0.0130	0.0136	3.6	3.72
127	1270	0.4	0.014	3.2629	3.0302	0.0140	2.2269	0.0130	0.0137	3.6	3.71
128	1280	0.4	0.014	3.2769	3.0441	0.0139	2.2399	0.0130	0.0136	3.6	3.70
129	1290	0.4	0.014	3.2909	3.0581	0.0140	2.2529	0.0130	0.0137	3.6	3.69
130	1300	0.4	0.014	3.3049	3.0720	0.0139	2.2659	0.0130	0.0136	3.6	3.69
131	1310	0.4	0.014	3.3189	3.0860	0.0140	2.2790	0.0131	0.0137	3.6	3.68
132	1320	0.4	0.014	3.3329	3.0999	0.0139	2.2920	0.0130	0.0136	3.6	3.67
133	1330	0.4	0.014	3.3469	3.1139	0.0140	2.3050	0.0130	0.0137	3.6	3.67
134	1340	0.4	0.014	3.3609	3.1278	0.0139	2.3181	0.0131	0.0137	3.6	3.66
135	1350	0.4	0.014	3.3749	3.1418	0.0140	2.3311	0.0130	0.0137	3.6	3.66
136	1360	0.4	0.014	3.3889	3.1557	0.0139	2.3442	0.0131	0.0137	3.6	3.66
137	1370	0.4	0.014	3.4029	3.1697	0.0140	2.3572	0.0130	0.0137	3.6	3.65
138	1380	0.4	0.014	3.4169	3.1836	0.0139	2.3703	0.0131	0.0137	3.6	3.65
139	1390	0.4	0.014	3.4309	3.1976	0.0140	2.3834	0.0131	0.0137	3.6	3.65
140	1400	0.4	0.014	3.4449	3.2115	0.0139	2.3964	0.0130	0.0136	3.6	3.64
141	1410	0.4	0.014	3.4589	3.2255	0.0140	2.4095	0.0131	0.0137	3.6	3.64
142	1420	0.4	0.014	3.4729	3.2395	0.0140	2.4226	0.0131	0.0137	3.6	3.64
143	1430	0.4	0.014	3.4869	3.2534	0.0139	2.4357	0.0131	0.0137	3.6	3.64
144	1440	0.4	0.014	3.5009	3.2674	0.0140	2.4488	0.0131	0.0137	3.6	3.64

APPENDIX D

OPINION OF PROBABLE PROJECT COSTS (OPPC)

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City of Shoreline
Stormwater Pump Station and SCADA Improvements
Planning Level Opinion of Probable Project Costs
Summary
Prepared by: P. Cunningham
Reviewed by: C. Ochiltree
November 2019

Pump Station	Opinion of Probable Construction Cost (plus SDC)	Opinion of Probable Allied Cost (less SDC)	Opinion of Probable Project Cost (Total)	2020	2021
Linden	$77,000	$13,000	$90,000	$90,000	$0
Palatine	$43,000	$8,000	$51,000	$51,000	$0
Ronald Bog	$61,000	$11,000	$72,000	$72,000	$0
Pan Terra	$75,000	$13,000	$88,000	$88,000	$0
Serpentine	$55,000	$9,000	$64,000	$64,000	$0
Pump Station 25	$72,000	$12,000	$84,000	$84,000	$0
Pump Station 26	$2,301,000	$400,000	$2,700,000	$400,000	$2,301,000
Pump Station 30	$1,533,000	$267,000	$1,800,000	$267,000	$1,533,000
Total OPPC	**$4,217,000**	**$733,000**	**$4,949,000**	**$1,116,000**	**$3,834,000**

The opinion of probable cost herein is based on our perception of current conditions at the project location. This opinion reflects our professional opinion of construction costs at this time and is subject to change as the project design matures. BHC Consultants has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. BHC Consultants cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown. Actual costs can and will differ from the opinions of probable costs. Volatility in the bidding climate, the number of contractors bidding on a project, and their approach to bidding and completing the work will all impact actual project costs.

City of Shoreline
Stormwater Pump Station and SCADA Improvements
Planning Level Opinion of Probable Project Costs
Linden PS
Prepared by: P. Cunningham
Reviewed by: C. Ochiltree
November 2019

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Mobilization / Demobilization	$3,500	1	LS	$3,500
2	Temporary Erosion & Sediment Control	$700	1	LS	$700
3	Traffic Control	$700	1	LS	$700
4	General Restoration	$700	1	LS	$700
5	Information and No Parking Signs	$1,000	1	LS	$1,000
6	Electrical and Control Shelter	$5,000	1	LS	$5,000
7	Relocate Electrical Panel	$3,000	1	LS	$3,000
8	SCADA	$3,000	1	LS	$3,000
9	High Level Float	$500	1	LS	$500
10	Replace Type 1 Catch Basin	$2,500	2	EA	$5,000
11	New Pump	$2,500	1	EA	$2,500
12	Infiltration Trench	$150	75	LF	$11,250
13	Misc. Piping Improvements	$2,500	1	LS	$2,500
14	CSBC	$44	10	TN	$452
15	HMA Trench Patch	$204	17	TN	$3,485
	Subtotal				$44,000
	Sales Tax	10.2%			$5,000
	OPINION OF PROBABLE CONSTRUCTION COST				$49,000
	Construction Contingency	35%			$17,150
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST				$67,000

Planning	5%	$3,000
Design and Permitting	15%	$10,000
Services During Construction	15%	$10,000
TOTAL OPINION OF PROBABLE ALLIED COST		$23,000
TOTAL OPINION OF PROBABLE PROJECT COST		$90,000

Notes
1. Gen. Rest., Dewatering, Traffic Control, Erosion Control at 2% Construction Costs
2. Mobilization is assumed to be 10% of Construction
3. Pipe costs includes all fittings, pipe, bedding, excavation, haul, and pavement restoration
4. Costs are in 2019 dollars

City of Shoreline
Stormwater Pump Station and SCADA Improvements
Planning Level Opinion of Probable Project Costs
Palatine PS
Prepared by: P. Cunningham
Reviewed by: C. Ochiltree
November 2019

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Mobilization / Demobilization	$2,000	1	LS	$2,000
2	Temporary Erosion & Sediment Control	$400	1	LS	$400
3	Traffic Control	$400	1	LS	$400
4	General Restoration	$400	1	LS	$400
5	Information and No Parking Signs	$1,000	1	LS	$1,000
6	Electrical and Control Shelter	$5,000	1	LS	$5,000
7	Relocate Electrical Panel and reroute conduit at CB	$5,000	1	LS	$5,000
8	SCADA	$3,000	1	LS	$3,000
9	High Level Float	$2,000	1	LS	$2,000
10	New Pump and Pipe Modiications	$4,000	1	LS	$4,000
	Subtotal				$24,000
	Sales Tax	10.2%			$3,000
	OPINION OF PROBABLE CONSTRUCTION COST				$27,000
	Construction Contingency	35%			$9,450
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST				$37,000

Planning	5%	$2,000
Design and Permitting	15%	$6,000
Services During Construction	15%	$6,000
TOTAL OPINION OF PROBABLE ALLIED COST		$14,000
TOTAL OPINION OF PROBABLE PROJECT COST		$51,000

Notes
1. Gen. Rest., Dewatering, Traffic Control, Erosion Control at 2% Construction Costs
2. Mobilization is assumed to be 10% of Construction
3. Costs are in 2019 dollars

The opinion of probable cost herein is based on our perception of current conditions at the project location. This opinion reflects our professional opinion of costs at this time and is subject to change as the project design progresses. BHC Consultants has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. BHC Consultants cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

City of Shoreline
Stormwater Pump Station and SCADA Improvements
Planning Level Opinion of Probable Project Costs
Ronald Bog PS
Prepared by: P. Cunningham
Reviewed by: C. Ochiltree
November 2019

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Mobilization / Demobilization	$3,000	1	LS	$3,000
2	Temporary Erosion & Sediment Control	$600	1	LS	$600
3	Traffic Control	$600	1	LS	$600
4	General Restoration	$600	1	LS	$600
5	Information and No Parking Signs	$1,000	1	LS	$1,000
6	Electrical Utility Service	$25,000	1	LS	$25,000
7	SCADA	$3,000	1	LS	$3,000
8	High Level Float and Alarm	$500	1	LS	$500
	Subtotal				$35,000
	Sales Tax	10.2%			$4,000
	OPINION OF PROBABLE CONSTRUCTION COST				$39,000
	Construction Contingency	35%			$13,650
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST				$53,000

Planning	5%	$3,000
Design and Permitting	15%	$8,000
Services During Construction	15%	$8,000
TOTAL OPINION OF PROBABLE ALLIED COST		$19,000
TOTAL OPINION OF PROBABLE PROJECT COST		$72,000

Notes
1. Gen. Rest., Dewatering, Traffic Control, Erosion Control at 2% Construction Costs
2. Mobilization is assumed to be 10% of Construction
3. Costs are in 2019 dollars

The opinion of probable cost herein is based on our perception of current conditions at the project location. This opinion reflects our professional opinion of costs at this time and is subject to change as the project design progresses. BHC Consultants has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. BHC Consultants cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

City of Shoreline
Stormwater Pump Station and SCADA Improvements
Planning Level Opinion of Probable Project Costs
Pan Terra PS
Prepared by: P. Cunningham
Reviewed by: C. Ochiltree
November 2019

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Mobilization / Demobilization	$3,700	1	LS	$3,700
2	Temporary Erosion & Sediment Control	$700	1	LS	$700
3	Traffic Control	$700	1	LS	$700
4	General Restoration	$700	1	LS	$700
5	Information and No Parking Signs	$1,000	1	LS	$1,000
6	Access Road Improvements	$2,500	1	LS	$2,500
7	Equipment Protection - Portable Concrete Blocks	$4,000	1	LS	$4,000
8	Davit Bases	$2,000	1	LS	$2,000
9	Portable Pump Connection	$3,000	1	LS	$3,000
10	Electrical and Control Shelter	$10,000	1	LS	$10,000
11	SCADA	$3,000	1	LS	$3,000
12	Intrusion Switch on Generator Door and Alarm	$500	1	LS	$500
13	Intrusion Switches on Wet Well and Valve Vault	$1,500	1	LS	$1,500
14	Hatch Lift Cylinders on Wet Well and Vault	$5,000	1	EA	$5,000
15	Repair Concrete Cable Trough	$2,000	1	LS	$2,000
16	Install Pressure Gauges	$2,500	1	LS	$2,500
	Subtotal				$43,000
	Sales Tax	10.2%			$5,000
	OPINION OF PROBABLE CONSTRUCTION COST				$48,000
	Construction Contingency	35%			$16,800
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST				$65,000

Planning	5%	$3,000
Design and Permitting	15%	$10,000
Services During Construction	15%	$10,000
TOTAL OPINION OF PROBABLE ALLIED COST		$23,000
TOTAL OPINION OF PROBABLE PROJECT COST		$88,000

Notes
1. Gen. Rest., Dewatering, Traffic Control, Erosion Control at 2% Construction Costs
2. Mobilization is assumed to be 10% of Construction
3. Costs are in 2019 dollars

City of Shoreline
Stormwater Pump Station and SCADA Improvements
Planning Level Opinion of Probable Project Costs
Serpentine PS
Prepared by: P. Cunningham
Reviewed by: C. Ochiltree
November 2019

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Mobilization / Demobilization	$2,600	1	LS	$2,600
2	Temporary Erosion & Sediment Control	$500	1	LS	$500
3	Traffic Control	$500	1	LS	$500
4	General Restoration	$500	1	LS	$500
5	Information and No Parking Signs	$1,000	1	LS	$1,000
6	Electrical and Control Shelter	$5,000	1	LS	$5,000
7	SCADA	$3,000	1	LS	$3,000
8	Replace and protect wire splices in handhole	$1,000	1	LS	$1,000
9	Runoff Diversion Curb	$100	10	LF	$1,000
10	Retrofit Safety Grating (Wetwell and Vault Hatches)	$8,000	1	LS	$8,000
11	Davit Bases	$2,500	1	LS	$2,500
12	Portable Pump Connection	$3,000	1	LS	$3,000
11	Install Bollards	$600	3	EA	$1,800
	Subtotal				$31,000
	Sales Tax	10.2%			$4,000
	OPINION OF PROBABLE CONSTRUCTION COST				$35,000
	Construction Contingency	35%			$12,250
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST				$48,000

Planning	5%	$2,000
Design and Permitting	15%	$7,000
Services During Construction	15%	$7,000
TOTAL OPINION OF PROBABLE ALLIED COST		$16,000
TOTAL OPINION OF PROBABLE PROJECT COST		$64,000

Notes
1. Gen. Rest., Dewatering, Traffic Control, Erosion Control at 2% Construction Costs
2. Mobilization is assumed to be 10% of Construction
3. Costs are in 2019 dollars

City of Shoreline
Stormwater Pump Station and SCADA Improvements
Planning Level Opinion of Probable Project Costs
Pump Station 25
Prepared by: P. Cunningham
Reviewed by: C. Ochiltree
November 2019

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Mobilization / Demobilization	$3,500	1	LS	$3,500
2	Temporary Erosion & Sediment Control	$700	1	LS	$700
3	Traffic Control	$700	1	LS	$700
4	General Restoration	$700	1	LS	$700
5	Information and No Parking Signs	$1,000	1	LS	$1,000
6	Electrical and Control Shelter	$5,000	1	LS	$5,000
7	SCADA	$3,000	1	LS	$3,000
8	Install Metal Railing	$150	20	LF	$3,000
9	Erosion Control on Steep Slopes	$5,000	1	LS	$5,000
10	Retrofit Safety Grating (Wetwell Hatch)	$5,000	1	LS	$5,000
11	Davit Base	$2,500	1	LS	$2,500
12	Portable Pump Connection downstream of isolation valves	$5,000	1	LS	$5,000
13	Locate and Test Buried Valves	$1,500	1	LS	$1,500
14	Troubleshoot Controls and Control Panel	$4,000	1	LS	$4,000
	Subtotal				$41,000
	Sales Tax	10.2%			$5,000
	OPINION OF PROBABLE CONSTRUCTION COST				$46,000
	Construction Contingency	35%			$16,100
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST				$63,000

Planning	5%	$3,000
Design and Permitting	15%	$9,000
Services During Construction	15%	$9,000
TOTAL OPINION OF PROBABLE ALLIED COST		$21,000
TOTAL OPINION OF PROBABLE PROJECT COST		$84,000

Notes
1. Gen. Rest., Dewatering, Traffic Control, Erosion Control at 2% Construction Costs
2. Mobilization is assumed to be 10% of Construction
3. Costs are in 2019 dollars

The opinion of probable cost herein is based on our perception of current conditions at the project location. This opinion reflects our professional opinion of costs at this time and is subject to change as the project design progresses. BHC Consultants has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. BHC Consultants cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.

City of Shoreline
Stormwater Pump Station and SCADA Improvements
Planning Level Opinion of Probable Project Costs
Pump Station 26
Prepared by: P. Cunningham
Reviewed by: C. Ochiltree
November 2019

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Mobilization	$115,900	1	LS	$115,900
2	Temporary Erosion & Sediment Control	$23,200	1	LS	$23,200
3	Traffic Control	$23,200	1	LS	$23,200
4	General Restoration	$23,200	1	LS	$23,200
5	Dewatering	$25,000	1	LS	$25,000
6	Wet Well (12 ft ID precast MH)	$120,000	1	LS	$120,000
7	Discharge Piping in Wet Well	$5,000	1	LS	$5,000
8	Duplex Submersible Pumps	$68,000	1	LS	$68,000
9	Valve Vault Excav & Backfill	$70,000	1	LS	$70,000
10	18" Piping (inlet to pre-treatment)	$172	60	LF	$10,317
11	18" Inlet Piping from Pond to Wet Well	$172	20	LF	$3,440
12	12" PVC C900	$159	160	LF	$25,440
13	Electrical Equipment Foundation	$2,000	1	LS	$2,000
14	Structural Aluminum Equipment Canopy/Shelter	$10,000	1	LS	$10,000
15	Electrical, Instrumentation, and Controls Equipment	$200,000	1	LS	$200,000
16	Electrical Utility Service	$40,000	1	LS	$40,000
17	SCADA	$3,000	1	LS	$3,000
18	Yard Piping (vault drains, site SD, etc.)	$10,000	1	LS	$10,000
19	Pre-Treatment	$86,000	1	LS	$86,000
20	Storage and Infiltration System Installation & Backfill	$400,000	1	LS	$400,000
21	Frontage and Landscaping	$80,000	1	LS	$80,000
	Subtotal				$1,344,000
	Sales Tax	10.2%			$138,000
	OPINION OF PROBABLE CONSTRUCTION COST				$1,482,000
	Construction Contingency	35%			$518,700
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST				$2,001,000

Planning	5%	$100,000
Design and Permitting	15%	$300,000
Services During Construction	15%	$300,000
TOTAL OPINION OF PROBABLE ALLIED COST		$700,000
TOTAL OPINION OF PROBABLE PROJECT COST		$2,700,000

Notes
1. Import backfill assumed to be 50%
2. Foundation Gravel assumed to be 10%
3. Gen. Rest., Dewatering, Traffic Control, Erosion Control at 2% Construction Costs
4. Mobilization is assumed to be 10% of Construction
5. Pipe costs includes all fittings, pipe, bedding, excavation, haul, and pavement restoration
6. Costs are in 2019 dollars

City of Shoreline
Stormwater Pump Station and SCADA Improvements
Planning Level Opinion of Probable Project Costs
Pump Station 30
Prepared by: P. Cunningham
Reviewed by: C. Ochiltree
November 2019

Bid Item No.	Bid Item Description	Unit Bid Price	Quantity	Unit	Total
1	Mobilization	$75,900	1	LS	$75,900
2	Temporary Erosion & Sediment Control	$15,200	1	LS	$15,200
3	Traffic Control	$15,200	1	LS	$15,200
4	General Restoration	$30,400	1	LS	$30,400
5	Dewatering	$25,000	1	LS	$25,000
6	Wet Well (8 ft ID precast MH)	$60,000	1	LS	$60,000
7	Discharge Piping in Wet Well	$5,000	1	LS	$5,000
8	Duplex Submersible Pumps	$50,000	1	LS	$50,000
9	Valve Vault Excav & Backfill	$36,000	1	LS	$36,000
10	12" Inlet and Outlet Piping	$124	150	LF	$18,600
11	8" PVC C900	$135	650	LF	$87,750
12	Electrical Equipment Foundation	$1,800	1	LS	$1,800
13	Structural Aluminum Equipment Canopy/Shelter	$10,000	1	LS	$10,000
14	Electrical, Instrumentation, and Controls Equipment	$200,000	1	LS	$200,000
15	Electrical Utility Service	$40,000	1	LS	$40,000
16	SCADA	$3,000	1	LS	$3,000
17	Yard Piping (vault drains, site SD, etc.)	$10,000	1	LS	$10,000
18	Pre-Treatment	$56,000	1	LS	$56,000
19	Grading and Pond Improvements	$80,000	1	LS	$80,000
20	Frontage and Shoulder Restoration	$75,000	1	LS	$75,000
	Subtotal				$895,000
	Sales Tax	10.2%			$92,000
	OPINION OF PROBABLE CONSTRUCTION COST				$987,000
	Construction Contingency	35%			$345,450
	TOTAL OPINION OF PROBABLE CONSTRUCTION COST				$1,333,000

Planning	5%	$67,000
Design and Permitting	15%	$200,000
Services During Construction	15%	$200,000
TOTAL OPINION OF PROBABLE ALLIED COST		$467,000
TOTAL OPINION OF PROBABLE PROJECT COST		$1,800,000

1. Import backfill assumed to be 50%
2. Foundation Gravel assumed to be 10%
3. Gen. Rest., Dewatering, Traffic Control, Erosion Control at 2% Construction Costs
4. Mobilization is assumed to be 10% of Construction
5. Pipe costs includes all fittings, pipe, bedding, excavation, haul, and pavement restoration
6. Costs are in 2019 dollars