Active Chemical Treatment System Environmental Management Plan Review Application

Under Section 1.2.9 of the 1200-CA NPDES Construction Stormwater General Discharge Permit, if "treatment chemicals" are to be added to stormwater and/or authorized non-stormwater prior to discharge, a local permit application may not be submitted without the following EMP application. Submit this form to describe the proposed use of treatment chemicals.

I. Permit Registrant Information

Permit Registrant Name: Robert L Fraley			
Mailing Address: 1120 SW 5th Avenue			
City: Portland	State: OR	Zip: 97204	County: Multnomah
Phone: 503-319-9207	Email:	robert.fraley@portlandoregon.gov	

II. Project/Site Information

Project/Site Name: Bull Run Filtration Facility			
Project/Site Address: Adjacent 35319 SE Carpenter Ln			
City:	State:	Zip:	County:
Gresham	OR	97080	Multnomah/Clackamas

Site contact name (if different from permit registrant):

Name: Michael Zenthoefer	Phone: 541-207-8441	Email: mikez@pointenv.com
Name:	Phone:	Email:

Names of receiving waterbodies:

Johnson Creek		

III. Map

Attach a map that illustrates the entire site including all of the below items. Include this map in your Erosion and Sediment Control Plan (ESCP):

- DEQ Environmental Cleanup Site Information (ECSI) site number (if applicable) NA
- A list or table of all known contaminants with lab tests results showing concentration and depth NA
- A list of all disposal locations Onsite stockpile 00-C-30, DEQ approved offsite disposal TBD.
- Notice of approval from local jurisdiction if discharge is to public storm system NA
- A map with sample locations Included on system schematic and ESCP sheet 00-C-30 .
- Temporary Erosion and Sediment Control Plans specific to contaminated soils; NA
- Plans for offsite disposal of contaminated soils; NA
- Any relevant (related) portions of ESCP that address the management of contaminated and potentially contaminated construction stormwater and dewatering program (if applicable); and, NA
- The dewatering plan (if applicable) Active treatment system O&M + 00-C-30 .
- All proposed point(s) of discharge to receiving waterbodies Included on ESCP sheet 00-C-30
- All soil types within areas to be disturbed Included on ESCP sheet 00-C-302
- All area of earth disturbance Included on ESCP Sheet 00-C-302
- Sufficient indication of topography to indicate where stormwater flows Included on ESCP

Attach a schematic drawing of the proposed treatment system(s). Include all components of the treatment train, sample points, and pipe configurations. In addition to sufficient holding capacity upstream of treatment, the system must have the capacity to hold water for testing and to re-treat water that does not meet water quality standards.

IV. Responsible Personnel

Treatment System Operator	Subcontractor (if applicable)
MWH-Kiewit, a Joint Venture	

Street/Location:	City:	State	Zip	County
9900 SW Greenburg Rd Suite 295	Portland	OR	97223	Multnomah

Responsible personnel. List personnel who will be responsible for operating the chemical treatment systems and application of the chemicals. Cite the training that the personnel have received in operation and maintenance of the treatment system(s) and use of the specific chemical(s) proposed.

Michael Zenthoefer, mikez@pointenv.com, 541-207-8441

More operators to be added during system setup.

V. Proposed Treatment

- Check proposed treatment system.
- Chitosan enhanced sand filtration with discharge to infiltration (ground water)
- Chitosan enhanced sand filtration with discharge to temporary holding ponds (batch).
- Chitosan enhanced sand filtration with discharge to surface waters (flow-through).
- Other (describe below and submit documentation that the proposed system and chemical(s) demonstrate the ability to remove turbidity and produce non-toxic effluent/ discharge)

Check proposed cationic chemical(s) to be used:			
FlocClear™ (2% chitosan acetate solution)		LiquiFloc™ (1% chitosan acetate solution).	
ChitoVan™ (1% chitosan acetate solution)		StormKlear™	
LiquiFloc™ (3% Chitosan acetate solution)		StormKlearTM LiquiFlocTM (1% chitosan acetate solution)	
Other" Tidal Clear 1% - Chitosan (CAS 9012-76-4), organic acid (CAS 64-19-7, 77-92-9, 79-33-4, and/or 6915-15-7), water (CAS 7732-18-5)			
Estimated Treatment Period Start Date:		Estimated Treatment Period End Date:	
November 2023		March 2028	

Describe sampling and recordkeeping schedule. Attach additional sheets as needed:

See Attached Operation and Maintenance Plan for Active Treatment System

VI. Certification Information

I have documented and hereby certify that the following information is correct and has been documented in the ESCP for this project:

- The ESCP includes a complete site-specific description of the chemical treatment system herein proposed for use, including specifications, design, and Material Safety Data Sheets for all chemicals to be used.
- The controls to be used on the site are compatible with the safe and effective use of cationic chemical treatment.
- I verified through jar tests that the site soil is conducive to chemical treatment.
- I verified that the chemical treatment system operators for this project received training.
- I read, understand, and will follow all conditions and design criteria in the applicable use designation(s).
- If the discharge is to tribal waters, I notified the appropriate tribal government of the intent to use chemical treatment on a site located within that jurisdiction.
- I will keep the use level designation, operation and maintenance manual, and training certificate on site prior to and during use of chemical treatment.
- A licensed engineer designed the system for this project including system sizing, pond sizing, and flow requirements.
- I verify that the discharge will not adversely affect downstream conveyance systems or stream channels (e.g. cause erosion).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Authorized Official First Name, Middle Initial, Last Name:

Title: Principal Program Analyst

Signature: *Robert L Fraley* Date: 10/27/2023

Email: robert.fraley@portlandoregon.gov

Bull Run Filtration Facility
Permit/PLC #: TBD
Project Location: Adjacent 35319 SE Carpenter Ln, Multnomah County, Oregon 97080
Operation and Maintenance Plan for Active Treatment System 10/26/23

Description

The following narrative describes the proposed systems for storage, treatment, filtration, and discharge of stormwater runoff and clean groundwater accumulation during construction of the Bull Run Filtration Facility in Gresham, Oregon. This proposed plan will be included as part of the overall ESCP submitted with application for coverage under the 1200-CA permit and is not intended to negate or replace the ESCP BMP's which will be shown separately and implemented onsite.

The Bull Run Filtration Facility (BRFF) is a 95-acre site that slopes generally west and southwest. Approximately 83 acres of the site will be disturbed by construction activities. Excavation will be deep, extending approximately 35-feet, into the saprolite layer, which generates large volumes of groundwater. The site consists mainly of Cazadero Silt Clay Loam soils on 0-15% slopes. Current site conditions consist of fallow nursery stock fields. The site is proposed to be the location of a drinking water treatment facility for the City of Portland's Bull Run water supply. Site perimeters will be protected during construction by controls including sediment fences, compost socks, check dams, and straw mulching. At current grade, the site drains west and southwest towards the headwaters of Johnson Creek. During grading, mass excavation, and utilities, stormwater surface flows, and construction discharge water will be controlled by a temporary stormwater management system. The system will consist of ponds, piping, and diversion ditches supplemented by pumps. Water collected and stored by the temporary stormwater management system will be analyzed, treated, and discharged through an Enhanced Sand Filtration Active Treatment System (ATS) to a flow spreader at an upland location. The site will discharge to a vegetated upland location outside of the receiving water's buffer and will not discharge directly to Johnson Creek. Johnson Creek is located on an adjacent parcel to which this project does not currently have access. The following section describes the plan for operation and maintenance of the ATS. A separate Temporary Stormwater Management Plan drawing and dewatering plan memo have been included by reference herein.

Referenced Documents

- Filtration Facility Construction Stormwater Tech Memo

Operation

System Schematic

The site will include six (6) stormwater holding ponds, ponds A-F, linked together via pumps and gravity flow HDPE piping (See Figure #1, Temporary Stormwater Management Plan (TSMP) and Figure #2, Pond Section Details). Pond E will be the collection point for water pumped from the SE corner of the site (Partners Site). Though hydrologically separated from the other ponds by a central topographical ridge, the design storm from the SE corner has been included in the overall storm volume for which this plan was designed (See Filtration Facility Construction Stormwater Tech Memo). Pond F (also known as the overflow basin), consisting of two individual basins, will have a capacity of 36 acre-feet and will be the final storage point for water prior to entering the ATS. Water will be pumped from pond F through a flow meter, sampling port, and optional flocculent injection port before entering 14 individual 18k gallon open top weir tanks plumbed in parallel for initial settling. Six (6) 30-HP electric pumps will force water from the tanks through six (6) flocculant injection ports and into six (6) individual, four (4) pod sand filter racks. Water leaving the sand filters will pass into six (6) sediment filter bag pods and out through a sampling port and effluent flow meter to an engineered flow spreader. If water exceeds effluent limits, discharges to the flow spreader will be ceased and the system will be automatically set to shift discharge to the recirculation circuit until water clarity can be corrected. Sand filter pods will be set up to backflush (recirculate) into the weir tanks or to pond F.

The system will be powered by two (2) 150 kVA generators, one primary and one backup. Discharges will be controlled by a self-contained trailer mounted unit known as the control unit. Sensors monitoring flow rates, turbidity, and pH will be placed throughout the system and will relay data back to the control unit. Based on the data, the control unit will dispense flocculant and automatically control the direction of the discharge, whether it be to the flow spreader or back into pond F via the recirculation circuit (if effluent limitations are not being met).

The site will also have the capability to manually bypass clean/clear water from any given point directly to the discharge location, this might come from groundwater de-watering un-affected by surface operations. CO2 sparging equipment can be quickly and easily added to the beginning of the system should pH become affected by any engineered soils placement. The temporary stormwater management plan and ATS schematic drawings have been attached to the plan for more detail.

Location of System

The system will be initially located on the east side (uphill) of pond F. See figure #1, TSMP for more detail.

Location of Inlet

The inlet or influent suction pipe will be located on the surface of pond F and will be suspended from a float to ensure water is being pumped from the upper and cleanest layer. See Figure #1, TSMP (EC-9.0) for more detail.

Location of Discharge/Dispersion

The system will discharge to an engineered flow spreader installed below Pond F in the SW corner of the project area. This is an upland location, 50-feet above the Johnson Creek SEC-WR Buffer. From the flow spreader, water will be discharged overland through densely vegetated uplands to the northern edge of SEC-WR buffer zone and will either 1) infiltrate into the soil or 2) flow off the project property. The SEC-WR zone will be a densely vegetated buffer extending 200 feet from Johnson Creek (see Figure #1). Water that flows off the site will enter Johnson Creek which flows through a parcel adjacent to the project property. See Figure #1, TSMP, for details.

Construction and post-construction drainage will mimic predevelopment drainage patterns, generally flowing towards the southwest corner of the site and Johnson Creek. Activities are significantly limited at the Southwest corner of the site due to a Multnomah County SEC-water resource overlay that surrounds Johnson Creek and acts as an environmental buffer. This regulation includes limitations on temporary and permanent activities that may be employed to manage stormwater runoff. Thus, the project will rely heavily on the planting of native vegetation to increase the stability of this environmental area, which is allowed. The selection of species, the overall landscaping approach, and the actual habitat restoration represents a significant effort supported by landscape architects, habitat restoration experts, engineers, and other PWB staff.

Plantings will be generally consistent with regional native species plant lists with a goal of maximizing planting density for the southwest corner in the SEC-water resource area. It will be seeded with a grassland mix with small bareroot plantings being installed throughout. Most of the recommend plant varieties are needled evergreen trees and a planting of native shrubs to help develop an understory and hold the soil as larger trees get established. Planting density will be high, with approximately 170 trees/acre, 1,740 shrubs/acre, and full cover grassland seeding.

The effectiveness of the plantings for erosion and sediment control will increase as the plantings establish and grow. To accelerate planting establishment over 900 native plants were

planted in spring 2023 and watered periodically over the summer. The Water Bureau is coordinating with Water Bureau Resource Protection staff who are familiar with habitat restoration goals for the area to perform this work. Staff will work with regional nursery stock availability and resume planting this fall and again in early 2024. Resource Protection staff will monitor plantings and maintain the area as it establishes. The enhancement of this riparian area will provide improved long-term erosion and sediment control post-construction.

Sampling Plan and Frequency

Sample Points

Effluent water quality parameters will be sampled to ensure compliance with the following water quality standards prior to discharging from the ATS to the flow spreader. Turbidity in NTU (nephelometric turbidity units) will be sampled at the flow spreader after the ATS at a representative sampling point (Sample Point (SP) #1, See TSMP) using a portable turbidity meter. Turbidity will also be sampled at the effluent sample port near the end of the ATS treatment train, (SP #2) using the built-in system turbidity meter (See Figure #3, schematic layout). The integrated system turbidity monitoring equipment will be checked using a portable turbidity meter once per day during periods of operation.

Johnson Creek is located on an adjacent parcel, and does not pass through the filtration facility property, or land owned by the Water Bureau. Thus, the project does not have access to Johnson Creek and cannot perform in-water sampling of the creek near the southwest corner of the site. Downstream monitoring where the creek crosses public ROW was also considered, but this section of creek is affected by a variety of other factors including settling ponds, existing discharges, and other water quality impacts thereby preventing the project from being able to assess and determine potential water quality impacts associated with the project's construction.

Effluent Limitations

The system will not directly discharge to Johnson Creek, it will discharge to an upland location and flow diffusely overland approximately 270 feet through heavily vegetated land both within and upslope of the SEC-WR buffer zone before reaching the creek. However, the off-site creek will be visually monitored from the property line to ensure overland flows do not cause or contribute to an exceedance of the applicable water quality standards as established in OAR 340-041; specifically OAR 340-041-0036: Turbidity (Nephelometric Turbidity Units, NTU); No more than a 10% (ten percent) cumulative increase in natural stream turbidities may be allowed, as measured relative to the control point immediately upstream of the discharge point. Access directly to the creek's edge in the vicinity of the flow spreader is not possible (off site), therefore, per PWB direction, monitoring will be performed via visual observation (in

addition to the multiple sampling points identified above) . The effluent limitation achievable through visual observation is “visibly clear.” The construction manager general contractor (CMGC) will provide clear water discharged from the flow spreader to the Northern edge of SEC-WR Boundary buffer zone. If a difference in the downstream creek clarity can be observed from the site boundary, this will be assumed to be a cumulative increase of more than 10% in the natural stream background.

The pH of the effluent will be monitored within the control unit. The acceptable range for pH of the effluent is between 6.5 to 8.5. If pH of the discharge should exceed this limit the system will be set to automatically shift discharge to the recirculation circuit. Should the use of engineered soil be employed on the site CO2 sparging equipment will be integrated into the ATS. pH of the effluent will be checked daily with a portable meter to ensure the systems integrated pH meter is functioning properly. pH meters will be calibrated daily, and the calibration logs kept in the erosion and sediment control log.

Monitoring Frequency

The ATS will be monitored at least 3x daily (start of shift, mid-day, and end of shift) by trained CMGC staff, when in operation. More or continuous monitoring may be required during periods of heavy rain or sensitive operations. If the placement of engineered soils is in progress the ATS must be operational with CO2 sparge capabilities. All stormwater discharge from areas affected by engineered soils must be directed to the ATS. The ATS shall not be run overnight without a successful daytime run of at least 6 hours with turbidity measuring under 25 NTU during all checks. All water quality test results and ATS monitoring logs will be recorded and kept on site in the erosion and sediment control log.

Trained ATS Operators

The ATS provider (WSA) will provide substantial training for all the project staff on the operation and maintenance of the system. The training must include sufficient information for trained operators to feel confident:

- Starting and stopping the system
- Performing routine daily maintenance and systems checks
- Adjusting the level of flocculant injection
- Trouble shooting basic system errors including failure to achieve sufficient water clarity.
- Identifying when the system needs servicing by WSA technicians.

The training must be outlined in a printable format and kept onsite within the control unit during operation. A log of trained operators must be kept onsite as well. One trained operator must be onsite during the work shift while the system is in active operation.

Trained Staff

Michael Zenthoefer (Point Env.) – mikez@pointenv.com
More staff to be added during system setup.

Maintenance

Trained operators will perform maintenance on the ATS on a regular basis or when turbidity/pH measurements at the discharge point are in exceedance of 25 NTU/6.5-8.5, respectively. The filter media will be cleaned or replaced when the pressure differential equals or exceeds the manufacturer's specifications. Used filter media (sediment laden sand) will be mixed with other onsite stockpiled soils for re-use or removal. The generators and systems will be serviced or checked at least every 250 hours of run time.

Trained operators will be monitoring the following during troubleshooting of the ATS:

- Increased turbidity in discharge
- Equipment malfunction
- Increase in incoming flow rates.
- Decrease in outgoing flow rates.
- Increase in outgoing turbidity.
- Increase in outgoing pH.
- Pressure differential equaling or exceeding the manufacturer's specifications.

Emergency Action Plan

If an unforeseeable failure including equipment breakdown, pump failure, power loss, etc. occurs and discharge above the allowable limits are encountered, the onsite trained operators will close the discharge valve and put the system into a recirculation mode until WSA can be consulted for immediate corrective action.

Flocculent

The ATS will utilize Tidal Clear 0.5-1.0% chitosan, or other approved flocculent to increase settlement and enhance the abilities of the sand filter pods. The flocculant level will be adjusted to use the least amount possible while still bringing turbidity to an acceptable discharge range.

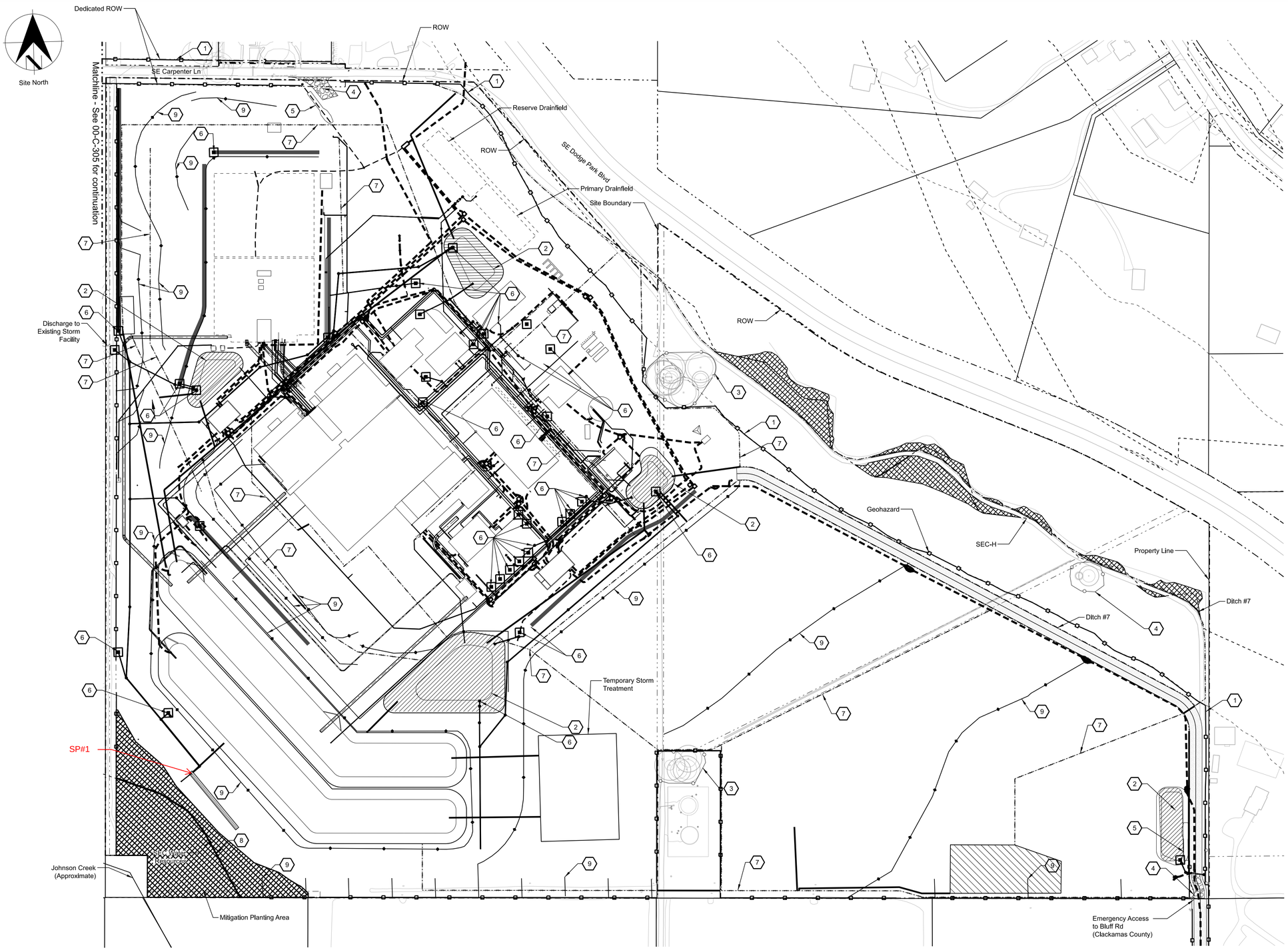
PH Treatment

The ATS will utilize C02 sparging to neutralize water, if necessary, prior to discharge.

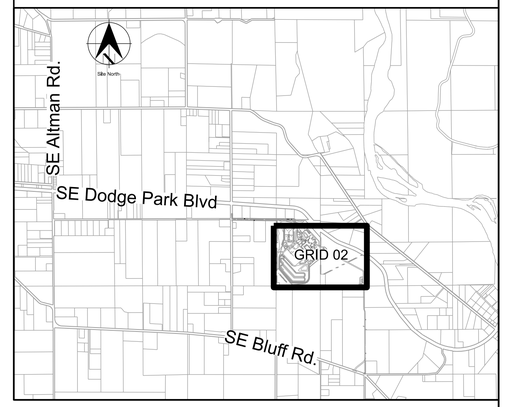
Sediment Removal

Sediment depths will be monitored within the tanks on a weekly basis. If sediment volumes within the tanks begin to hinder treatment and clarification of stormwater, the tanks can be individually shut down, drained, and sediment removed via vacuum truck.

Figure #1. Temporary Stormwater Management Plan (00-C-308)



KEY PLAN



General Sheet Notes

1. Refer to Filtration Facility Stormwater Report attached to EMP for stormwater calculations and sizing.
2. See 00-LU-506 (Grading Plan) for ground disturbance limits.
3. See 00-LU-508 (Landscape Plan) for proposed vegetation.
4. All storm pipe outfalls will include scour protection. See Detail 3 on Sheet 00-C-903.

Sheet Keynotes

1. Install Silt Fence, See Detail 2 on Sheet 00-C-901.
2. Construct Detention Pond.
3. Install Tree Protection Fence, See Detail 1 on Sheet 00-C-902.
4. Install Stabilized Construction Entrance, See Detail 1 on Sheet 00-C-901.
5. Install Wheel wash, See Detail 3 on sheet 00-C-901.
6. Install Inlet Protection. See Detail 2 on Sheet 00-C-902.
7. Install Temp storm ditches with check dams, See Detail 6 on sheet 00-C-901.
8. Install Compost Filter Sock, See Detail 2 on Sheet 00-C-903.
9. Install Straw Wattle, See Detail 2 on Sheet 00-C-903.

Legend

- Detention Pond
- Site Boundary
- Tree Removal
- Silt Fence
- Tree Protection Fence
- Electrical Duct Bank
- Piping
- Temporary Storm Ditches with check dams
- Vegetated Buffer
- Stabilized Construction Entrance
- Wheel Wash
- Straw Wattle
- Compost Filter Sock
- Inlet Protection

0 120 240
SCALE IN FEET

REGISTERED PROFESSIONAL ENGINEER 84283
OREGON JULY 13, 2010 ROY W. HAWKINS
EXPIRES 6-30-25

No	Date	Description	Appd
		Revision	
Survey			

10/24/2023

User: stanpw11ics03$ 00-C-308.dgn

Stantec
EMERIO ENGINEERING • SURVEYING • DESIGN

Designed By	JSL	Design Mgr	LSH
Drawn By	BYS	Const Mgr	TG
Checked By	RG	Const Supvr	RM
Project Mgr	MRG	Date	

Warning
0 ½ 1
If this bar does not measure 1" then the drawing is not to scale

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

David W. Peters, Engineering Manager, PE No 16683

Date

CITY OF PORTLAND, OREGON 1851

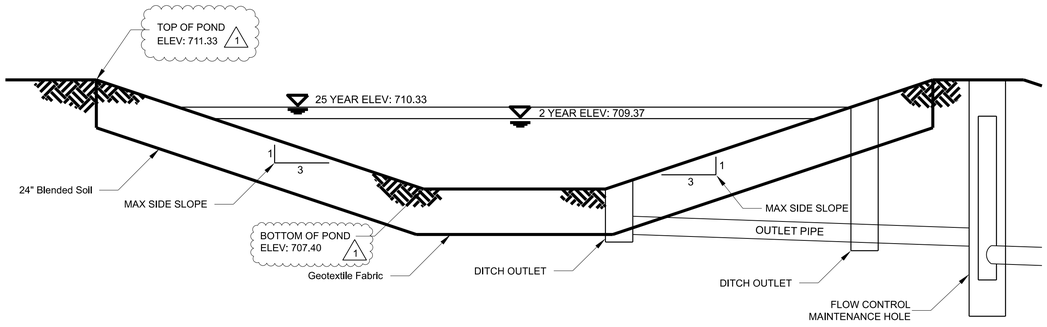
Bull Run Filtration Facility

Erosion and Sediment Control

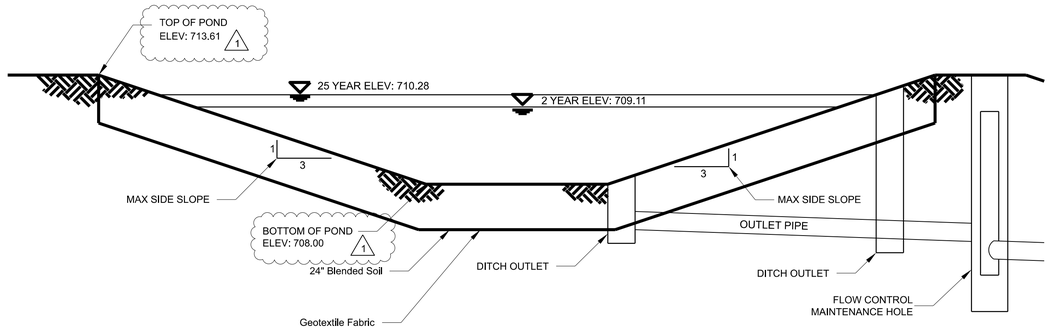
Utility Permanent Storm & Temp. Storm Management
Filtration Facility
Across from 35319 SE Carpenter Lane

SAP Project No
W02229
1/4 Section
3765 / 3766
Sheet No
00-C-308
9 of 19

Figure #2. Pond Section Details
(02-C-903)



A 02-C-903 Pond A N.T.S.



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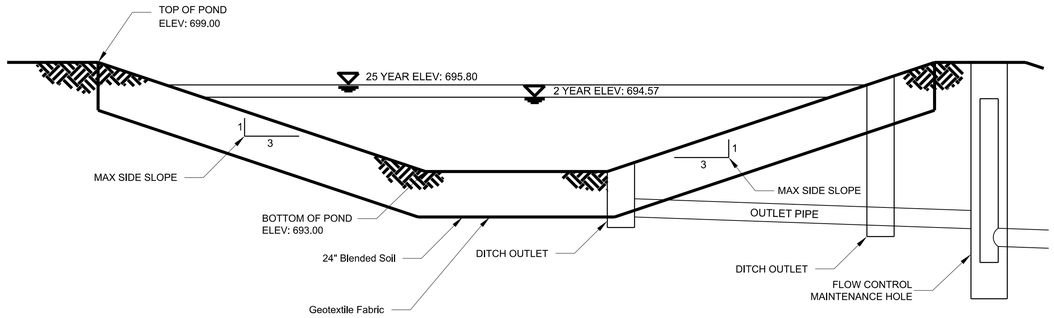

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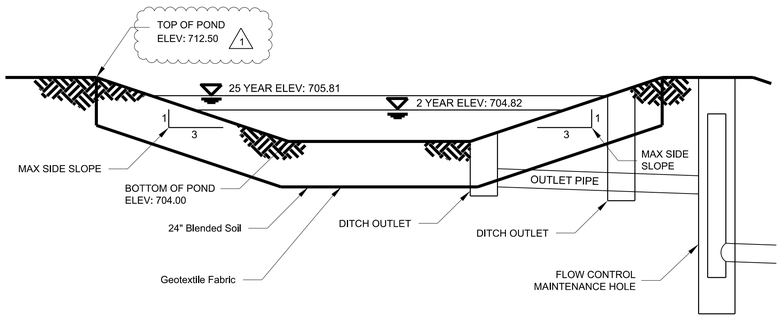
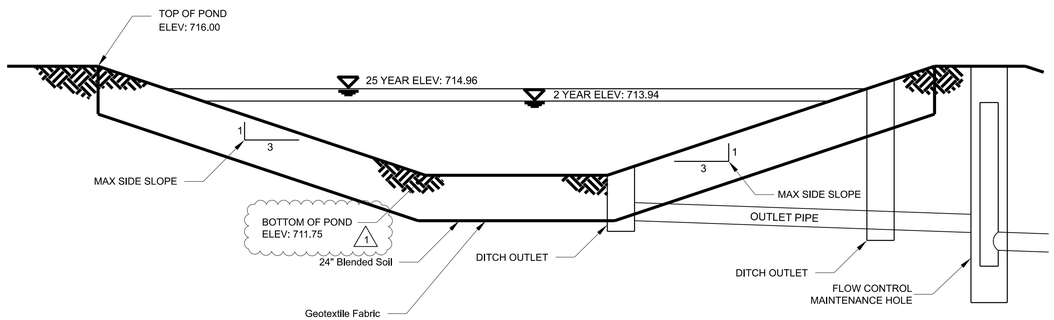


C 02-C-903 Pond C N.T.S.



E 02-C-903 Pond E N.T.S.

REGISTERED PROFESSIONAL ENGINEER 55529PE OREGON JULY 15, 2003 RAFAEL GAETA EXPIRES: 6-30-25

$$$$FILENAME$$$$
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$$$$DATE$$$$

No	Date	Description	Appd
1	06/30/23	Addendum 5	MRG

Revision

Survey

Stantec

EMERIO ENGINEERING • SURVEYING • DESIGN

Designed By	JSL	Design Mgr	LSH
Drawn By	KRF	Const Mgr	TG
Checked By	LCS	Const Supvr	RM
Project Mgr	MRG	Date	06/30/23

Warning

0 ½ 1

If this bar does not measure 1" then the drawing is not to scale

PORTLAND WATER BUREAU

FROM FOREST TO FAUCET

David W. Peters, Engineering Manager, PE No 16683

Date

CITY OF PORTLAND OREGON 1851

Bull Run Filtration Facility

Civil

Pond Section Details

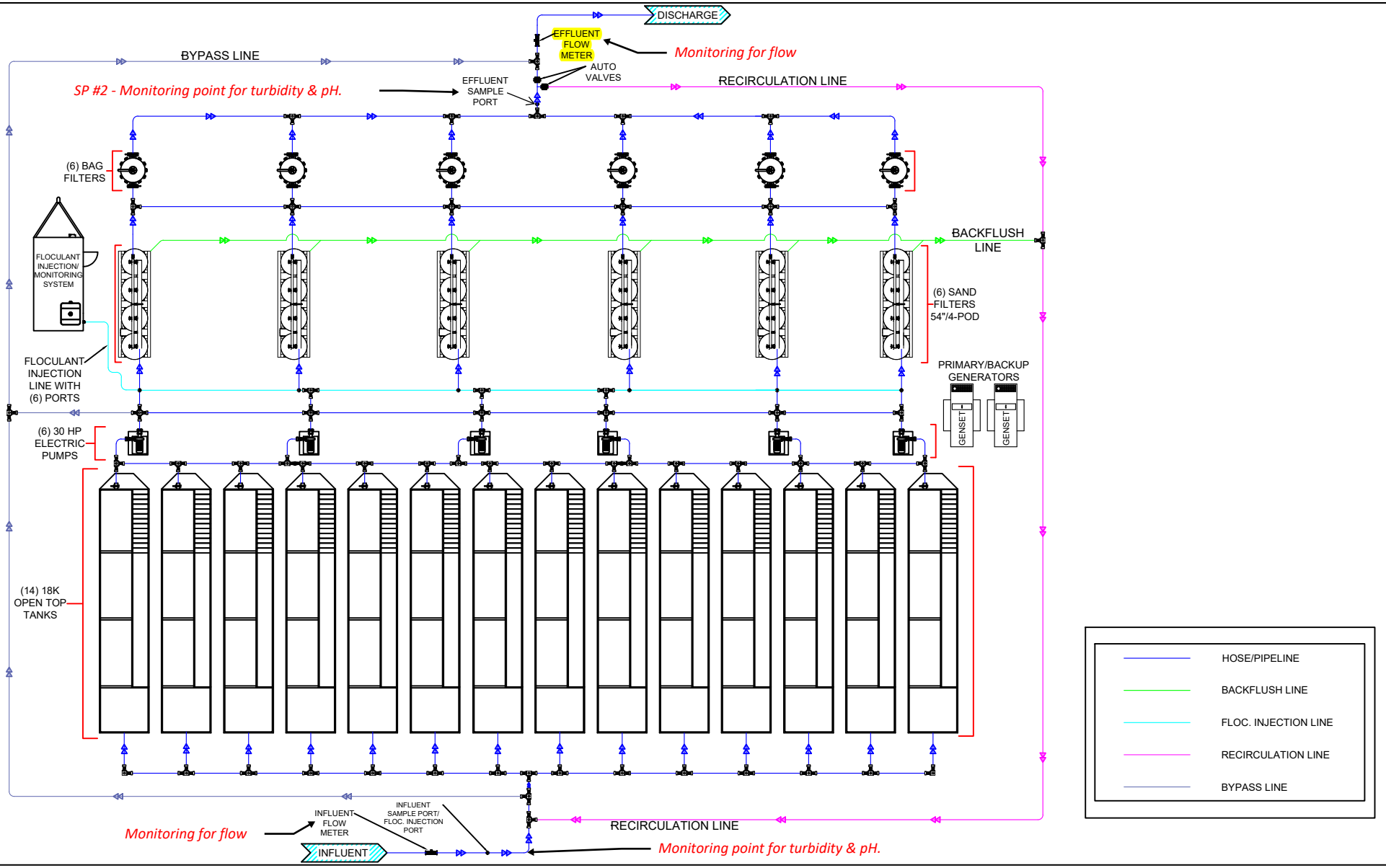
SAP Project No W02229

1/4 Section 3765 / 3766

Sheet No 02-C-903

168 of 2410

Figure #3. Active Treatment System Schematic Layout



WSA
WATER SOIL AIR
WSA Compliance, LLC

TITLE: Bull Run Water Treatment Plant

ADDRESS: Carpenter Lane, Gresham, OR

CUSTOMER: MWH–Kiewit JV

DESCRIPTION: 2,500 GPM Water Treatment System

SCALE: NOT TO SCALE

DRWN. BY: D.King

CHKD. BY: S.K.

DATE: 3.17.2023

REVISION: 0.1

Easy-to-clean, smooth-wall interior

18,000 Gallon
Open-Top Weir Tank

Capacity: 18,060 gal (430 bbl)
Height: 13'
Width: 8'
Length: 43' 6"
Tare Weight: 30,000 lbs

All sizes are approximate

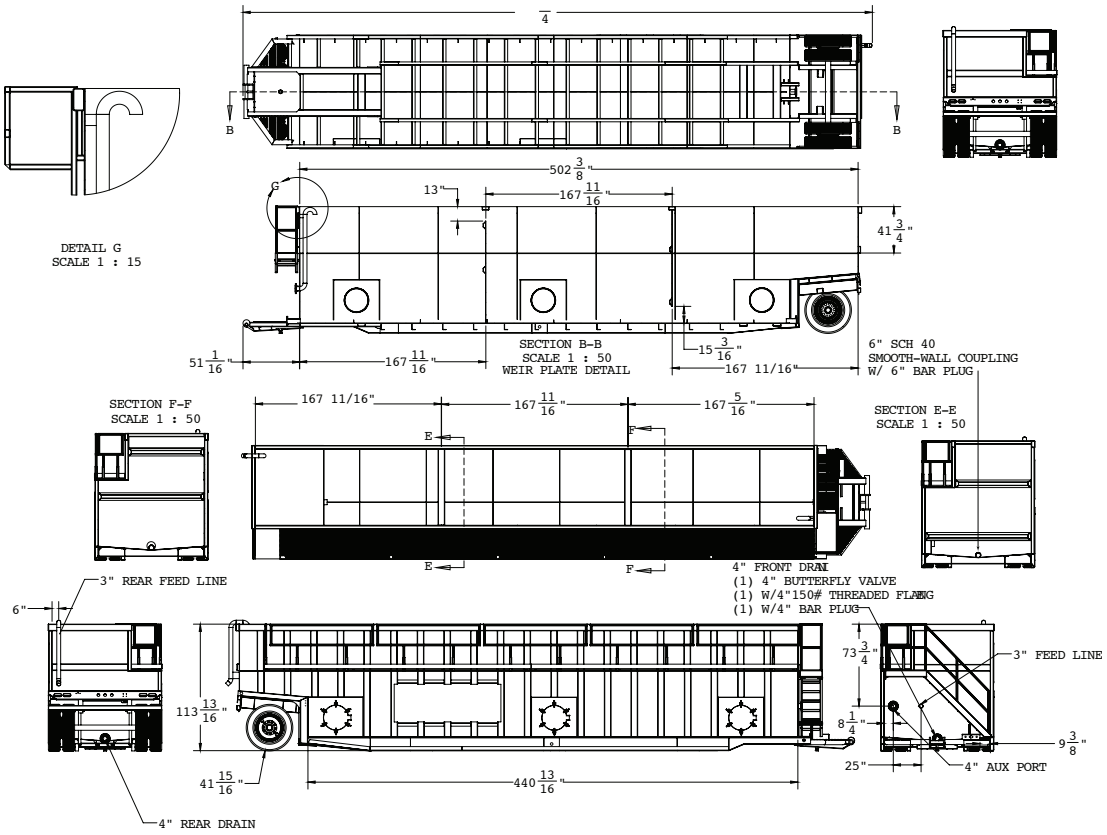
At Adler Tank Rentals, we are committed to providing safe and reliable containment solutions for all types of applications where performance matters.

Designed with internal weirs to promote faster separation of oils and particulate contaminants from stored groundwater, the 18,000 Gallon Open-Top Weir Tank can efficiently accommodate flows of up to 100 GPM or more in either pump-through or batch-treatment capacities.

Mechanical Features

- 3" fill line
- Three (3) standard 22" side-hinged manways
- Multiple 4" valved fill/drain ports, including floor-level valves for low point drain out
- Sloped and V bottom for quicker drain out and easier cleaning
- Easy-to-clean design with smooth-wall interior, no corrugations and no internal rods
- Front-mounted ladderwell for top access
- Fixed rear axle for increased maneuverability
- Nose rail cut-out for easy access when installing hose and fittings on the front/bottom of tank
- Internal baffles, or weirs (over and under), to accelerate settling of unwanted solids and fine sediments; may also be used in the separation of unwanted floating materials
- Can be used in a pump-through or batch-treatment capacity
- Flows of up to 100 GPM achievable depending on circumstances; may also be modified to achieve higher flows while maintaining efficiency
- One (1) front and one (1) rear 4" valved fill/drain port

18,000 Gallon Open-Top Weir Tank



Safety Features

- Non-slip step materials on ladderwells and catwalks
- "Safety yellow" rails and catwalks for high visibility
- Safe operation reminder decals
- Built-in stair and walkway

Options

- Weirs
- Audible alarms, strobes and level gauges (digital and mechanical)
- Interior-bare steel or lined

Comprehensive Service

Adler Tank Rentals provides containment solutions for hazardous and non-hazardous liquids and solids. We offer 24-hour emergency service, expert planning assistance, transportation, repair and cleaning services. All of our rental equipment is serviced by experienced Adler technicians and tested to exceed even the most stringent industry standards.

ADLER TANK RENTALS

800-421-7471 www.adlertankrentals.com

End Suction Split Coupled Pump

PACO LCS

The LCS single stage, end suction, split coupled pump serves as the industry standard in performance, quality, and durability. The LCS provides hydraulic performance equal to that of a frame mounted, long coupled model, but in a compact design. Advanced features and benefits incorporated as standard, as well as optional features that meet specialized needs, set these high-efficiency, end suction pumps apart as the broadest line offered to the marketplace.

Key Features and Benefits

- No baseplate grouting required
- Axially split, rigid coupling enhances ease of service with reduced maintenance costs
- No alignment required between the pump and motor eliminates laser alignment costs and reduces installation time
- Optimized, space-saving design has 35% smaller footprint than frame mount design
- Spacer coupling allows rapid mechanical seal access without motor removal for service friendly design
- Vesconite case wear rings extend pump life and increase efficiency
- Double volute design increases efficiency, lowers life cycle costs and prolongs seal and bearing life
- Francis Vane impeller design increases efficiency and reduces NPSH required
- Reduced installation and wiring cost
- Integrally cast diffuser vane reduces turbulence and need for suction guides
- Trimmed and balanced impellers allow customization, reduce noise and vibration for quiet operation and prolong seal and bearing life
- Large seal chamber allows various seal configurations and customization

APPLICATIONS

- Chilled water
- Condensed water
- Hot water
- District heating/cooling
- HVAC
- Process water
- Light industrial
- Water utility

Pump Performance Datasheet

Customer	:	Quote number	:
Customer reference	:	Size	: 4 x 5 x 12 BH (B4GPBH)
Item number	: Default	Stages	: 1
Service	:	Based on curve number	: 1234
Quantity	: 1	Date last saved	: 15 Nov 2018 6:27 PM

Operating Conditions

Flow, rated	: 904.1 USgpm
Differential head / pressure, rated (requested)	: 100.0 ft
Differential head / pressure, rated (actual)	: 98.91 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available, rated	: Ample
Frequency	: 60 Hz

Performance

Speed, rated	: 1770 rpm
Impeller diameter, rated	: 11.13 in
Impeller diameter, maximum	: 12.75 in
Impeller diameter, minimum	: 9.50 in
Efficiency	: 81.16 %
NPSH required / margin required	: 12.33 / 0.00 ft
Ns (imp. eye flow) / Nss (imp. eye flow)	: 1,485 / 8,628 US Units
MCSF	: 337.1 USgpm
Head, maximum, rated diameter	: 122.9 ft
Head rise to shutoff	: 19.16 %
Flow, best eff. point	: 874.8 USgpm
Flow ratio, rated / BEP	: 103.35 %
Diameter ratio (rated / max)	: 87.25 %
Head ratio (rated dia / max dia)	: 66.31 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: --Water
Additional liquid description	:
Solids diameter, max	: 0.00 in
Solids concentration, by volume	: 0.00 %
Temperature, max	: 68.00 deg F
Fluid density, rated / max	: 1.000 / 1.000 SG
Viscosity, rated	: 1.00 cP
Vapor pressure, rated	: 0.00 psi.a

Material

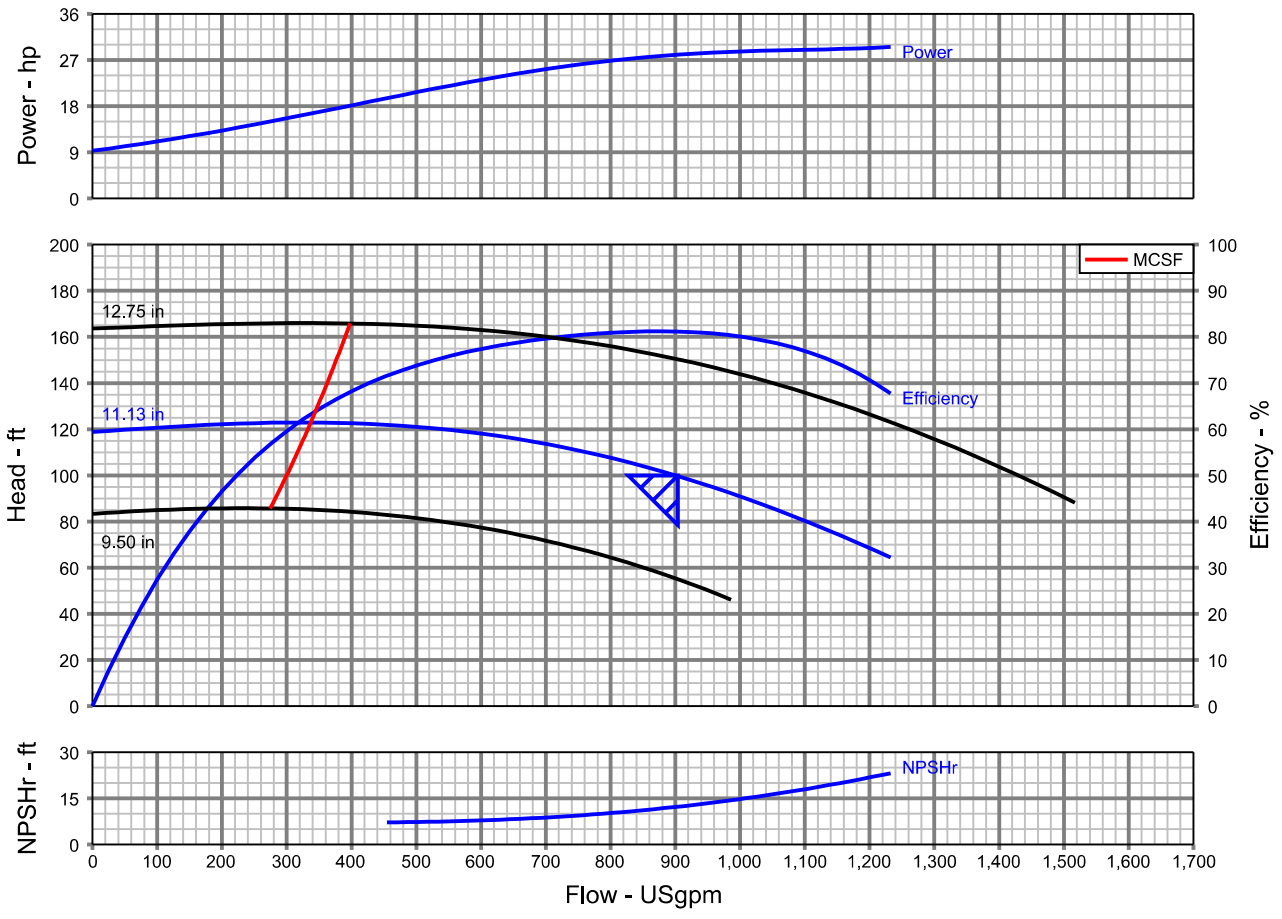
Material selected	: Not specified

Pressure Data

Maximum working pressure	: 53.21 psi.g
Maximum allowable working pressure	: 165.0 psi.g
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: N/A

Driver & Power Data (@Max density)

Driver sizing specification	: Rated power
Margin over specification	: 0.00 %
Service factor	: 1.25
Power, hydraulic	: 22.76 hp
Power, rated	: 28.04 hp
Power, maximum, rated diameter	: 29.57 hp
Minimum recommended motor rating	: 30.00 hp / 22.37 kW



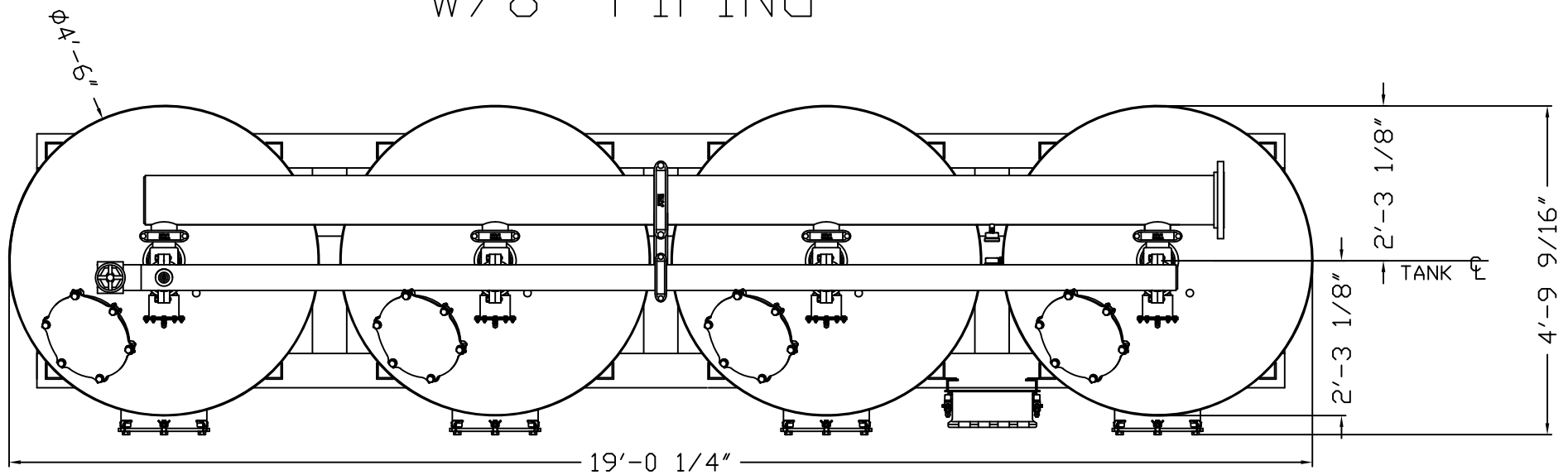
NOTES:

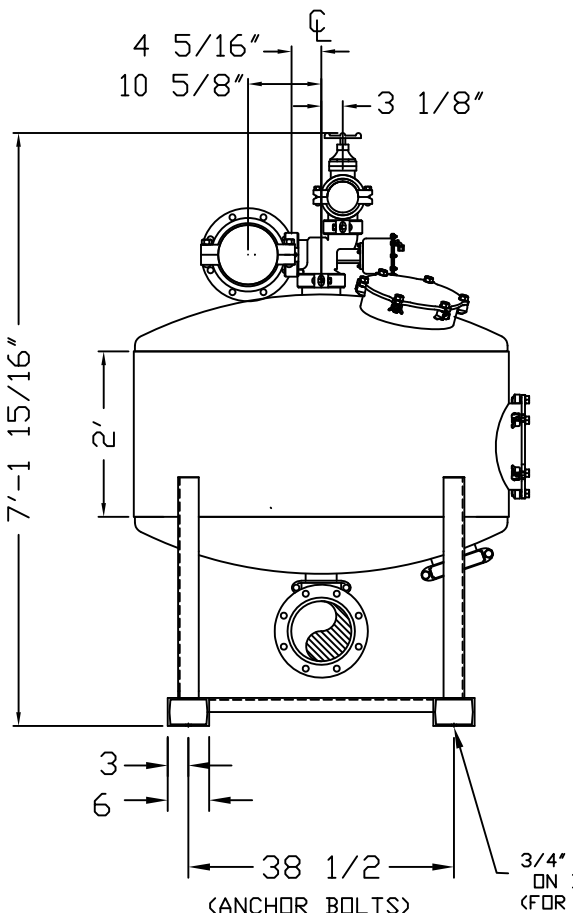
1. FLOW RATE DESIGN: 636-952 GPM.
   BACKWASH RATE: 15 GPM/FT^2.
2. MAXIMUM WORKING PRESSURE: 80 PSI.
3. ELECTRICAL REQUIREMENTS:
   CONTROLLER 120V;
   SOLENOIDS 24VAC; FACTORY WIRED
4. AIR SUPPLY REQUIRED: 2 CFM @ 70 PSIG (MIN.).
5. MEDIA REQUIREMENT PER TANK:
   A. 1/2"x3/4" CRUSHED ROCK: 9.5 CU. FT. .
   B. 0.47mm CRUSHED SILICA SAND: 23.0 CU. FT. .
6. WEIGHTS: (APPROX.)

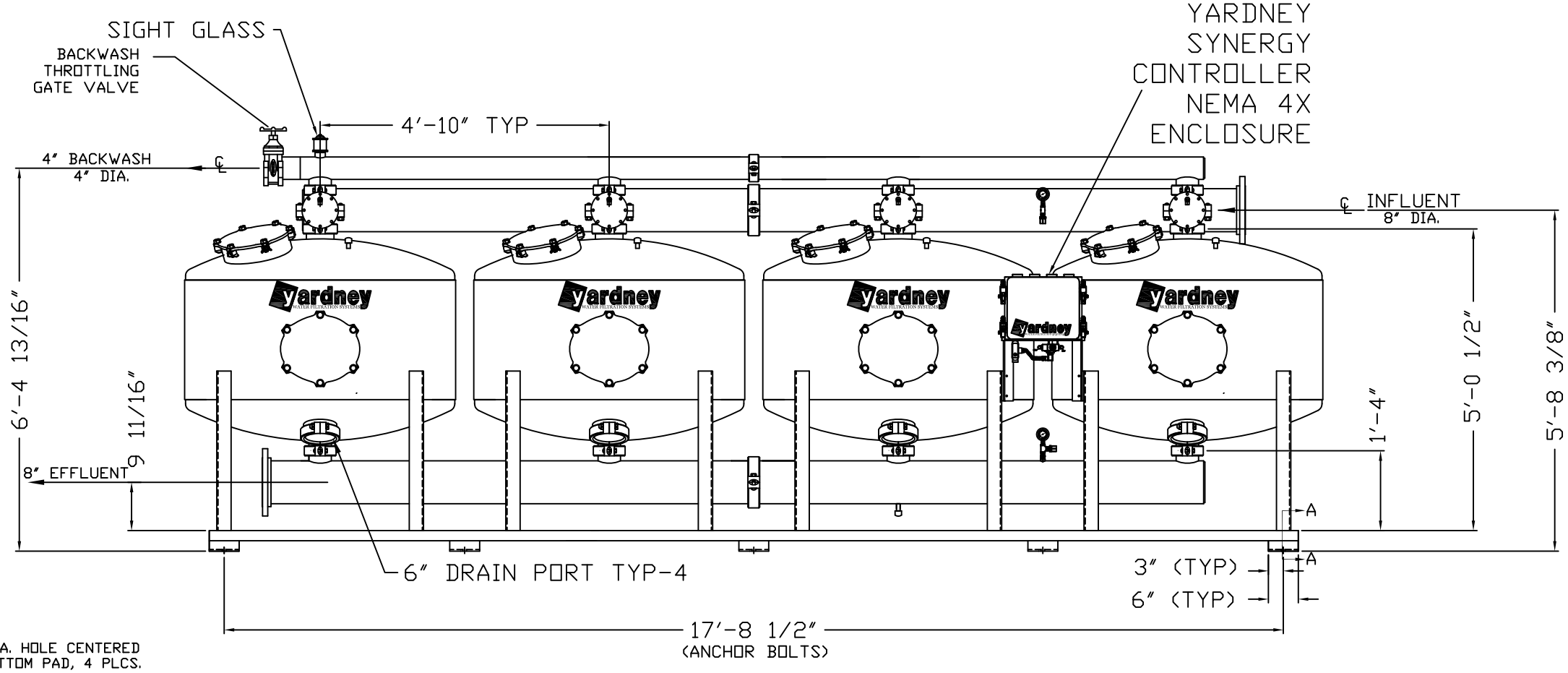
EQUIPMENT:	4,800 LBS (LESS MEDIA)
MEDIA:	14,400 LBS
OPERATION:	25,800 LBS

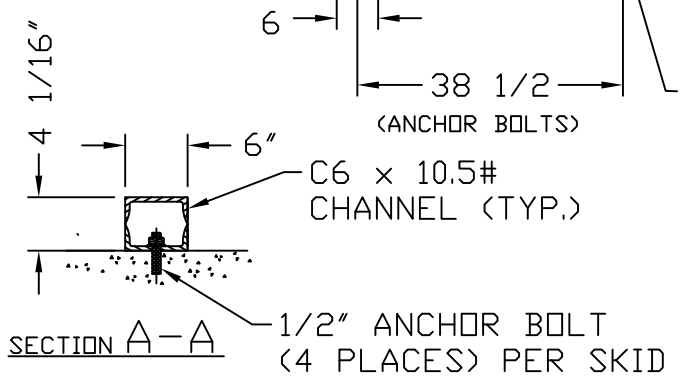
7. EXTERIOR PAINT COLOR: STANDARD BLUE, RAL 5010.

IL 5424-4A
W/8" PIPING









SYM	REVISIONS	BY	DATE	APP
E	4" DRAIN PORT CHANGED TO 6"	DTD	5-15	APP
D	UPDATED YARDNEY LOGO	DTD	1-13	APP
C	WELD TABS ON MANWAY RINGS	DTD	11-12	APP
B	ADDED 4" DRAIN PORT	DTD	11-09	APP
A	DESIGNED WITH NEMA 4 ENCLOSURE	DTC	9-06	APP

APPROVALS | DATE
DRAWN BY: DTC 1/22/06
CHECKED BY:
APPROVED BY:
ARCHITECTURAL SCALE:
USED ON:

yardney WATER FILTRATION SYSTEMS RIVERSIDE, CALIFORNIA

IL 5424-4A
FILTER SYSTEM

SIZE: D | DRAWING NO: 9500542400 | REV: E
SCALE: | ACAD #: SYSTEMS\IL | SHEET 1 OF 1

yardney
WATER FILTRATION SYSTEMS

Sand Media Filters

Removal of Solids Down to 20 Microns

Yardney Sand Media filters are designed for the most challenging dirty water conditions with a high performance solution for water filtration down to 20 microns. These durable carbon steel filters utilize a 24" vertical side shell depth for removal of organic and inorganic suspended solids for filtering large volumes of water with very little pressure drop and a long-term value. All Yardney industrial media filters utilize our simple backwash system for ease of operation and consistent water quality. The Yardney automatically controlled filter systems operate for extended periods of time prior to a short backwash cycle.

Applications

- Removal of organic and/or inorganic suspended solids down to 20 microns
- Storm water runoff, industrial process water, incoming plant water, waste water clean-up, industrial water for plant reuse
- Pre-filtration in applications such as granular activated carbon, reverse osmosis, cartridge or bag filtration and deionized water
- 80 psi standard operating pressure (high pressure systems available)
- Flow ranges from 10 gpm

Advantages

- State of the art fabrication provides added strength under pressure and long system life
- ASME code shaped head construction for durability and safety
- Stainless steel wedgewire underdrain
  - ➤ Ensures structural integrity in the harshest conditions
  - ➤ Hydraulically balanced to increase effectiveness of backwash while reducing flush frequency and waste of water
  - ➤ High strength stainless steel wedgewire will withstand a collapse pressure in excess of 600 psi
- Standard carbon steel products, 3/16" thick material
- Backwash automatically initiated by elapsed time or pressure differential
- Yardney easy-entry lid closure with weld tabs for operator safety
- Available in welded carbon steel
- 3M Scotchkote® 134 fusion bonded epoxy coating on interior surfaces
- Made in USA

Sand Media Filters

Specifications

SPECIFICATIONS | INDUSTRIAL | SAND MEDIA FILTERS													
Model	Number of Tanks in System	Standard Flow Range				Filtration Surface Area (total sq ft)	Backwash Flow Rate (per tank)		Media Requirements (cubic feet)		Maximum Pressure	Inlet/ Outlet Pipe Size	Backwash Line Pipe Size
		Minimum		Maximum									
		gpm	m^3/hr	gpm	m^3/hr		gpm	m^3/hr	Gravel 1/2" - 3/4"	Media			
IL-1824-1A	1	18	4	26	6	1.75	26	6	1	3	100 psi	2"	2"
IL-2424-1A	1	32	7	47	11	3.15	47	11	2	5	100 psi	2"	2"
IL-1824-2A	2	35	8	53	12	3.50	26	6	2	5	100 psi	3"	2"
IL-3024-1A	1	49	11	74	17	4.91	74	17	3	7	100 psi	3"	3"
IL-1824-3A	3	53	12	79	18	5.25	26	6	3	8	100 psi	3"	2"
IL-2424-2A	2	63	14	95	22	6.30	47	11	3	9	100 psi	3"	2"
IL-3624-1A	1	71	16	107	24	7.10	107	24	4	10	100 psi	3"	3"
IL-2424-3A	3	95	22	142	32	9.45	47	11	5	14	100 psi	3"	2"
IL-3024-2A	2	98	22	147	33	9.82	74	17	5	14	100 psi	4"	2"
IL-4824-1A	1	126	29	189	43	12.60	189	43	7	21	80 psi	4"	4"
IL-3624-2A	2	142	32	213	48	14.20	107	24	8	20	100 psi	4"	4"
IL-3024-3A	3	147	33	221	50	14.73	74	17	8	21	100 psi	4"	2"
IL-5424-1A	1	159	36	238	54	15.90	239	54	10	23	80 psi	4"	4"
IL-3624-3A	3	213	48	320	73	21.30	107	24	12	30	100 psi	4"	4"
IL-4824-2A	2	252	57	378	86	25.20	189	43	14	42	80 psi	6"	4"
IL-5424-2A	2	318	72	476	108	31.80	239	54	19	46	80 psi	6"	4"
IL-4824-3A	3	378	86	567	129	37.80	189	43	21	63	80 psi	6"	4"
IL-5424-3A	3	477	108	714	162	47.70	239	54	29	69	80 psi	6"	4"
IL-4824-4A	4	504	115	756	172	50.40	189	43	28	84	80 psi	8"	4"
IL-4824-5A	5	630	143	945	215	63.00	189	43	35	105	80 psi	10"	4"
IL-4824-6A	6	756	172	1134	258	75.60	189	43	42	126	80 psi	10"	4"
IL-5424-4A	4	636	145	952	216	63.60	239	54	38	92	80 psi	8"	4"
IL-5424-5A	5	795	181	1190	270	79.50	239	54	48	115	80 psi	10"	4"
IL-5424-6A	6	954	217	1428	325	95.40	239	54	57	138	80 psi	10"	4"

Standard product includes:

- Completely assembled for easy installation
- Skid mounted tanks
- Yardney easy-entry lid closure with side manway
- Valves
- Inlet/outlet and backwash manifolds
- Controller, solenoids, electrical wire, tubing
- Removable underdrain
- 3M Scotchkote® 134 fusion bonded epoxy coating on interior surfaces

Available options:

- ASME code
- High pressure
- Solar package
- PLC controller
- Custom filter station layout piping
- Air scour

Made in USA

Phone: 951.656.6716
Toll-Free: 800.854.4788
Fax: 951.656.3867
info@yardneyfilters.com

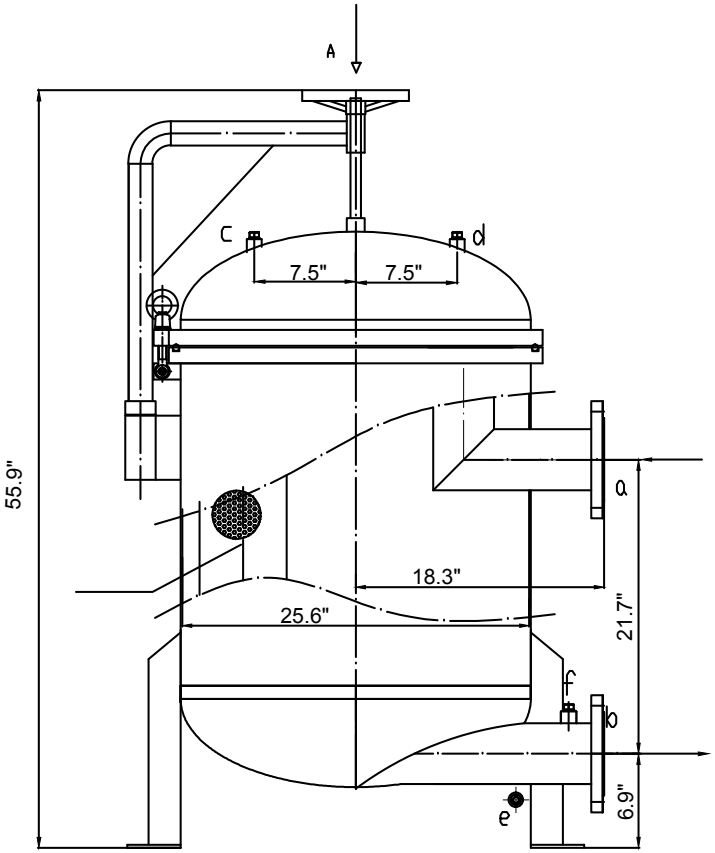
yardney WATER FILTRATION SYSTEMS

www.yardneyfilters.com

STAINLESS STEEL BAG HOUSING

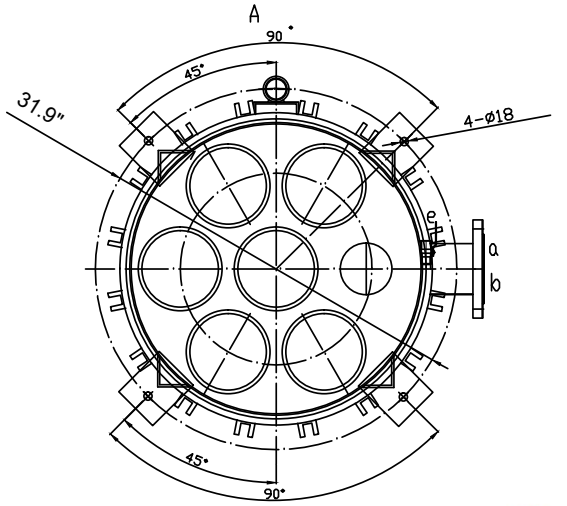
FS-SST-6

1,200 GPM



CONNECTION SIZE TABLE

Item	Normal Size	Connection Dimension standard	Connection Type	Function Or Name
a	4"150#	ANSI	RF(A)	Inlet
b	4"150#	ANSI	RF(A)	Outlet
c	1/2" NPT		Female Thread	Pressure gauge connection
d	1/2" NPT		Female Thread	Exhaust Outlet
e	1/2" NPT		Female Thread	Drain
f	1/2" NPT		Female Thread	Pressure gauge connection



327 LEY ROAD, FORT WAYNE, IN 46825 ▪ PHONE: 844.789.1996 ▪ FAX: 260.486.6232

100% Polyester (Self-Supported) Liquid Filtration Media			
Nominal Micron	**CFM (1/2"W.C.)**	**Weight Oz./Sq. Yard**	**Thickness (Inches)**
1	10-20	16/18	.066-.075
5	50-90	11/12	.055-.075
10	80-140	10/11	.060-.080
25	170-270	11/12	.065-.085
50	200-300	11/12	.065-.085
75	240-340	12/13	.065-.095
100	270-470	14/16	.075-.095
200	350-650	14/16	.120-.150

AIRMAN
MOBILE GENERATORS

ANA

SDG150

150 kVA PRIME POWER

Shown equipped with optional
SMARTLOAD™
LOAD BANK SYSTEM

PERFORMANCE //
1 - DSE® Digital Control Panel
2 - Curbside Electrical Panel
3 - Large Electrical Lugs
4 - Emergency Shut-off Button
5 - Delta Demand Excitation™
6 - QuieTech™ Sound Attenuation
7 - Lockable Voltage Selector

MAINTENANCE //
8 - Lift-off Door Hinges
9 - 110% Fluid Containment
10 - Ext. Fuel Tank Connections
11 - Built-in Service Ladder
12 - Service Extensions
13 - Front DEF Access Door

CONSTRUCTION //
14 - Powder-coated Steel Enclosure
15 - Stainless Steel Hardware
16 - Lockable Access Doors
17 - Automotive Door Seals
18 - 204 Gallon Fuel Tank
19 - Heavy-Duty Steel Trailer

AIRMAN® GENERATORS 4 TIER4F TIER 4 FINAL

John Deere® 6068
Tier 4 / CARB
Diesel Engine

1 | DSEGenset® Digital Control Panel
Model 7310 MKII

2 | Single-Phase Receptacles
120V - 20A x 2 | 240V - 50A x 3
Optional Dual Row Cam-Loks™ Shown

7 | Lockable Voltage Selector Switch
3Φ 277/480V & 139/240V-120/208V
1Φ 120/240V

10 | External Fuel Tank Connections
with 3-Way Selection Valve

BEST-IN-CLASS dBA RATING // 24-HOUR RUNTIME // WIDEST VOLTAGE RANGE
THE INDUSTRY'S HIGHEST-QUALITY MOBILE GENERATORS

GENERATOR MODEL
SDG150S-8E1

RUN WITH AIRMAN

GENERATOR SPECIFICATIONS	SDG150S-8E1
ALTERNATOR TYPE	TAIYO WYE Winding
STANDBY OUTPUT	
THREE-PHASE AT 240V 3CD-4 WIRE	165 kVA / 132 kW
SINGLE-PHASE AT 240V 1CD-3 WIRE	95.7 kVA / 95.7 kW
PRIME OUTPUT	
THREE-PHASE AT 240V 3CD-4 WIRE	150 kVA / 120 kW
SINGLE-PHASE AT 240V 1CD-3 WIRE	87 kVA / 87 kW
FREQUENCY	60 Hz
VOLTAGE (THREE-PHASE), SWITCHABLE	208/220/240/416/440/480
VOLTAGE (SINGLE-PHASE), SWITCHABLE	120/127/139/240/254/277
ARMATURE CONNECTION	Star with Neutral / Zig Zag
EXCITATION	Brushless with AVR
NUMBER OF POLES	4
POWER FACTOR (THREE-PHASE)	0.8
POWER FACTOR (SINGLE-PHASE)	1.0
INSULATION	Class F
VOLTAGE REGULATION	±0.5%
FREQUENCY REGULATION, STEADY STATE	±0.25% of Overall Mean Value
AMPERAGE	
SINGLE-PHASE (120V) - ZIG ZAG	363A x 2
SINGLE-PHASE (240V) - ZIG ZAG	363A
THREE-PHASE (208V)	394A
THREE-PHASE (240V)	361A
THREE-PHASE (480V)	180A
ENGINE MAKE & MODEL	**JOHN DEERE® 6068**
ENGINE CONTROL PANEL	DSE® 7310 MKII
EPA TIER 4 / CARB EMISSION CERTIFIED 2021	CARB Exec. Order U-R-004-0604 EPA Cert. No. MJDXL06.8312-014
TYPE OF AFTERTREATMENT	DEF, DOC, SCR, ASC
ENGINE TYPE	Electronic Direct Injection 4-Cycle Liquid Cooled Diesel
ASPIRATION	Turbocharged + Turbo After Cooler

ENGINE MAKE & MODEL (Continued)	JOHN DEERE® 6068
SAE GROSS HP / BHP@1800 RPM	257 BHP / 192 kW
HORSEPOWER RATING (@1800 RPM)	235 HP / 175 kW
NUMBER OF CYLINDERS	6
DISPLACEMENT	415 cu in
ENGINE SPEED	1800 RPM
GOVERNOR TYPE	Electronic
FUEL TYPE	Ultra-low sulfer diesel
DEF CAPACITY	11.7 gal
DEF CONSUMPTION (MAXIMUM)	4.1 gal Per Tank of Diesel
DEF RUNTIME @ FULL LOAD	67 hrs
FUEL TANK CAPACITY	204 gal
FUEL CONSUMPTION	
FULL LOAD	8.5 gal/hr
75% LOAD	6.9 gal/hr
50% LOAD	5.1 gal/hr
RUNTIME @ FULL LOAD	24 hrs
FUEL PUMP (w/SERVICEABLE STRAINER)	Self-priming Electric Fuel Pump
FUEL FILTER TYPE / QUANTITY	Pre-filter/Sedimenter x 1 Fuel Filter x 1
LUBRICATING OIL CAPACITY	8.7 gal
BATTERY	
SYSTEM VOLTAGE	12V
BATTERY CHARGER ALTERNATOR	90 A
QUANTITY	1
COLD CRANKING AMPS	925 CCA
AMP HOURS	150 Ah
COOLING SYSTEM	
COOLING SYSTEM TYPE	Liquid/Air Fin and Tube Radiator 50/50 Mix
COOLANT CAPACITY	7.1 gal
WATER PUMP TYPE	Impeller
FAN TYPE	Blower Fan, Viscous Clutch
NOISE LEVEL @ 23 FEET (NO/FULL LOAD)	61 dBA / 66 dBA

ENCLOSURE	
PAINT TYPE	Positively Charged Ion (E-coat) Electrodeposition Coating, Baking Finish Coating for Weatherproof, and Anti-corrosion and Salt Pollution
ENCLOSURE METAL / CONSTRUCTION	Steel
GAUGE STEEL	16 Gauge
DOOR HINGES	Stainless Steel
SERVICE ACCESS POINTS HARDWARE	Stainless Steel
SPILL CONTAINMENT	110%
WEIGHTS & DIMENSIONS	
LENGTH x WIDTH x HEIGHT	113.4" x 51.2" x 72.8"
DRY WEIGHT	6,878 lbs
OPERATING WEIGHT	8,488 lbs
TRAILER WEIGHT	1,350 lbs
OPERATING WEIGHT w/ TRAILER (GVWR)	9,838 lbs
TRAILER WEIGHTS & DIMENSIONS	
LENGTH	196"
WIDTH	79"
HEIGHT W/GENERATOR INSTALLED	85"
WEIGHT	1,350 lbs
WHEEL SIZE-TIRE RATING	ST225/75R15 Load Limit E, 3520 lbs @ 80 psi
NUMBER OF AXLES / RATING	2 Axles / 6,000 lbs each
BRAKING TYPE	Surge or Electric
LIGHTING TYPE	LED
CERTIFICATIONS USA/DOT COMPLIANT	FMVSS
ADJUSTABLE HITCH HEIGHT	Yes
COMPLIANCE & CERTIFICATIONS	
FLUID CONTAINMENT	110%
USA DOT COMPLIANT	Yes
CSA LISTED	Yes
TRANSPORT CANADA COMPLIANT	Yes
DIESEL ENGINE EPA TIER LEVEL	Tier 4 Final

All specifications are subject to change without prior notice. Visit **anacorp.com** for the most current information.

SMARTLOAD™
LOAD BANK SYSTEM
– U.S. PATENT PENDING –

SmartLoad™ System


Parallelling Control Panel

OPTIONAL ACCESSORIES
- SmartLoad™ System
- Paralleling Feature
- Dual Row Cam-Loks™ (See Front)
- 4-Position Selector Switch
- Lockable Battery Disconnect
- Fuel Filter Heater
- Engine Coolant Heater
- Engine Block Heater
- Battery Charger
- Battery Blanket

BUMPER TO BUMPER 1 YEAR 1500 HOUR WARRANTY

ALTERNATOR 2 YEAR 2000 HOUR WARRANTY

FULL ENGINE 2 YEAR 2000 HOUR WARRANTY

SOLD AND SERVICED BY

ANA N. California
1315 Vinci Avenue
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1335 Hayne Street
Spartanburg, SC 29301

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Alliance North America, Inc.
Corporate Headquarters
11100 Hope Street, Cypress, CA 90630

ANACORP.COM
(562) 450-3570 // sales@anacorp.com

ANA
We make your world easier.

Dunlop Type 388V
- High Pressure Suction and Discharge Hose

Generally complying with BS EN 1765: 2004 - Type S15

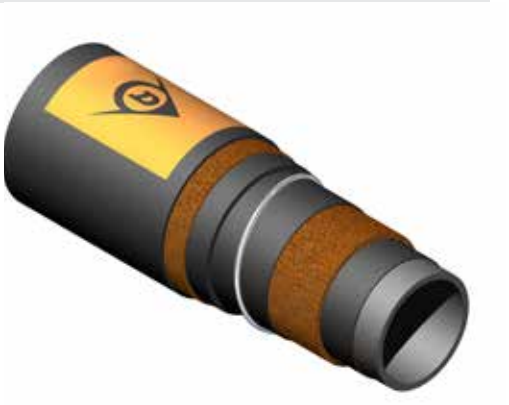
Application

Generally used for medium to heavy duty service on docks, jetties and tankers where the working conditions call for strength and robustness combined with flexibility. The Viton rubber compound offers resistance to 100% aromatics and many industrial chemicals. Generally used on hose handling rigs, rather than being manually handled.

*Hose equivalent also available with butyl lining - Type 388B.

Working/Burst Pressure	**15/60 bar (Dunlop Type 388V)**
Operating Temperature	* -20°C to +150°C
Electrical Continuity	Electrically continuous or discontinuous as required
Maximum lengths	12m

* High temperature limit for non-continuous service only



Construction

Lining	Synthetic Viton rubber compound for petroleum products with an aromatic content up to 100%
Main reinforcement	Multiple plies of high tenacity rayon cord designed for a combination of high strength and resistance to fatigue. Each layer is fully encapsulated in rubber to prevent abrasion with adjacent layers
Embed wire	Helical steel wires to resist collapse and crush loads
Holding ply	Textile reinforcement to increase adhesion between hose body and cover
Cover	Weathering and abrasion resistant rubber compound
Fittings	Built-in steel nipples with flanges or couplings to suit customer requirements

Technical Design Data

ID		OD	Body Weight	End Weight	MBR	Maximum Working Tensile Load
inch	mm	mm	kg/m	kg/hose	m	Tonnes
2	51	93	7.0	11	0.30	1.6
2.5	64	106	8.3	14	0.38	1.5
3	76	119	9.8	18	0.46	1.7
4	102	144	12.9	29	0.60	1.9
5	127	172	16.5	38	0.76	3.0
6	152	206	24.7	46	0.90	4.9
8	203	260	32.1	67	1.20	5.8
10	254	312	44.0	96	1.50	7.9
12	304	371	59.3	122	1.80	7.7

Hoses manufactured in the United Kingdom
CE branded hoses showing full compliance with European Pressure Equipment Directive PED 97/23/EC

Turbine Flow Meters
Stainless Steel Flange Mount

FTB700-S Series

- **High-Accuracy Machined Turbine Internals Removable with Meter in Line**
- **Standard Meter Bodies are Flanged**

FTB730-S, shown with DPF143P and DPF140-W2M sold separately, smaller than actual size.

OMEGA® FTB700-S Series turbine meters have a unique system of precisely-machined helical rotors and high-quality jewel bearings. The rotor is the only moving part. Small magnets on the rotor hub are electronically detected by a solid state Hall-effect sensor outside the wetted area. The turbine rotor uses journal-type sapphire and ruby bearings for minimum friction and maximum life. These bearings are ideal for long life in water and water-based fluids, and they have exceptional low-flow characteristics. The entire rotor assembly (rotor, hubs, bearings, rotor strut) can be removed from the meter as a single unit without removing the meter from the pipe.

Specifications

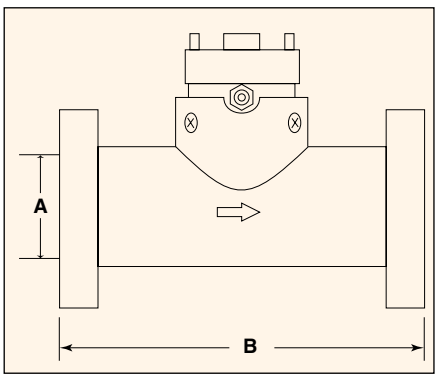
Maximum Working Pressure: 200 psi stainless steel
Maximum Temperature:
Stainless Steel: 93°C (200°F)
Accuracy: ±1% FS
Signal: Squarewave pulse
Power: 6 to 24 Vdc

Materials

Meter Body: Stainless steel
Flanges: 150# ANSI
Turbine Rotor: PVDF
Rotor Shafts: Zirconia ceramic
Bearings: Sapphire journal, ruby ball

FTB700-T (Optional Blind Transmitter)

Output: 4 to 20 mA
Loop Power: 12 to 26 Vdc (isolated)
Accuracy: ±1%
Response Time: 3 sec, 95% FS



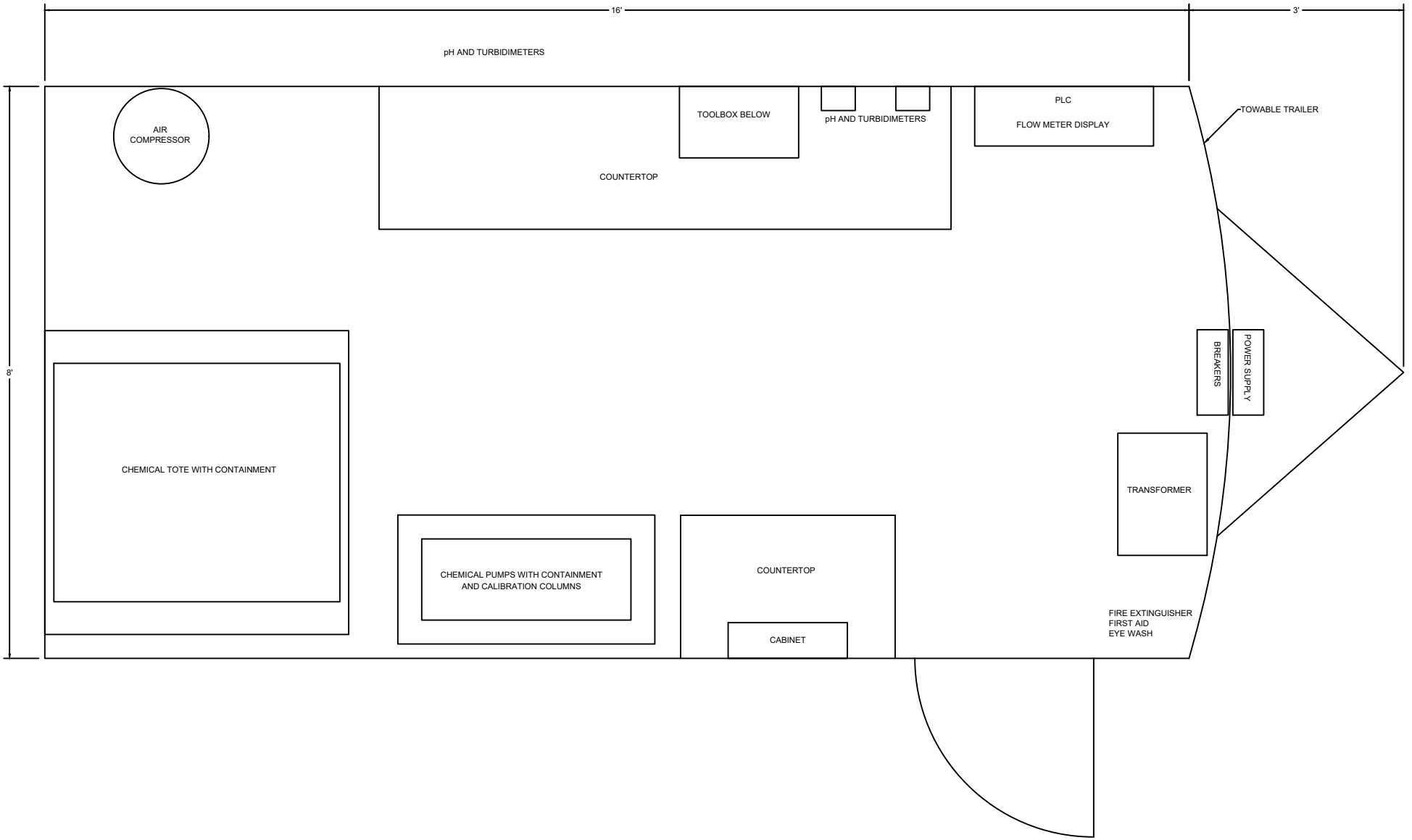
To Order

Model No. Stainless Steel	Flow GPM	Pulses/Gal	Pipe Size "A" mm (inch)	Length "B" mm (inch)
FTB720-S	2 to 150	60	51 (2)	254 (10)
FTB730-S	3 to 400	10	76 (3)	305 (12)
FTB740-S	6 to 600	5	102 (4)	356 (14)
FTB760-S	12 to 1200	2	152 (6)	457 (18)
FTB780-S	30 to 3000	2	204 (8)	508 (20)

Accessories

Model No.	Description
FTB700-T	Blind 4 to 20 mA transmitter
PSU-93	24 Vdc power supply

Comes complete with 5.5 m (18') cable and operator's manual.



DRAWN BY:	APPROVED BY:	SCALE:	DATE:
BK	SK	NTS	2/16/18

DRAWING TITLE:
INTERNAL LAYOUT

PROJECT:
WATER TREATMENT SYSTEM
CONTROL UNIT

11300 SANDERS DR., UNIT 24
RANCHO CORDOVA, CA 95742

WSA
WATER SOIL AIR
WSA Compliance, LLC

SAFETY DATA SHEET

Tidal Clear™

Issuing Date 15-Apr-2021 **Revision Date** 21-Jul-2021

1. IDENTIFICATION	
Product identifier	
Product name	Tidal Clear™ High molecular weight (HMW) or low molecular weight (LMW) 0.5–6% concentration
Other means of identification	
CAS #	Not available
Recommended use of the chemical and restrictions on use	
Recommended use	Water treatment
Restrictions on use	Not applicable
Details of the supplier of the safety data sheet	
Supplier identification	Tidal Vision Products, Inc.
Address	3710 Iron Gate Rd Bellingham, WA 98226 USA
Telephone	1-360-603-7676
Emergency telephone number	1-800-222-1222 (Poison Control)
2. HAZARDS IDENTIFICATION	
Classification	Not classified. The product contains no substances which at their given concentration are considered to be hazardous to the health.
Appearance	Clear/amber liquid
Physical state	Liquid
Odor	Slightly vinegar-like
GHS label elements, including precautionary statements	
Hazard statements	Not classified.

Other information	
Unknown acute toxicity	0% of the mixture consists of ingredient(s) of unknown toxicity 0% of the mixture consists of ingredient(s) of unknown acute oral toxicity 0% of the mixture consists of ingredient(s) of unknown acute dermal toxicity 0% of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (gas) 0% of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (vapor) 0% of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (dust/mist)
3. COMPOSITION/INFORMATION ON INGREDIENTS	
Substances	Chitosan (CAS 9012-76-4), organic acid (CAS 64-19-7, 77-92-9, 79-33-4, and/or 6915-15-7), water (CAS 7732-18-5)
Mixtures	Not applicable
4. FIRST AID MEASURES	
First aid measures	
Inhalation	Remove to fresh air.
Eye contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
Skin contact	Wash skin with soap and water.
Ingestion	Clean mouth with water and afterward drink plenty of water.
Most important symptoms and effects, both acute and delayed	
Symptoms	No information available.
Indication of any immediate medical attention and special treatment needed	
Note to physicians	Treat symptomatically.
5. FIRE-FIGHTING MEASURES	
Suitable extinguishing media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	CAUTION: Use of water spray when fighting fire may be inefficient.
Specific hazards arising from the chemical	No information available.
Hazardous combustion products	Carbon oxides.
Explosion Data	
Sensitivity to Mechanical Impact	None.
Sensitivity to Static Discharge	None.
Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES	
Personal precautions, protective equipment and emergency procedures	
Personal precautions	Avoid contact with eyes.
Methods and material for containment and cleaning up	
Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Dam up. Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.
7. HANDLING AND STORAGE	
Precautions for safe handling	
Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice.
Conditions for safe storage, including any incompatibilities	
Storage conditions	Keep containers tightly closed in a dry, cool and well-ventilated place.
8. EXPOSURE CONTROLS/PERSONAL PROTECTION	
Control parameters	
Exposure Limits	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Appropriate engineering controls	
Engineering controls	Showers, eyewash stations, ventilation systems
Individual protection measures, such as personal protective equipment	
Eye/face protection	No special protective equipment required.
Skin and body protection	No special protective equipment required.
Respiratory protection	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.
General hygiene considerations	Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES	
Physical and Chemical Properties	
Appearance	Clear/amber liquid
Odor	Vinegar-like
Odor Threshold	No data available
pH	No data available
Melting/freezing point	No data available
Boiling point/boiling range	No data available
Flash point	No data available
Evaporation rate	No data available
Flammability (solid, gas)	No data available
Upper/lower flammability or explosive limits	No data available
Vapor pressure	No data available
Vapor density	No data available
Relative density	No data available
Solubility(ies)	No data available
Partition coefficient: n-octanol/water	No data available
Auto-ignition temperature	No data available
Decomposition temperature	No data available
Viscosity	No data available
10. STABILITY AND REACTIVITY	
Reactivity	No information available.
Chemical stability	Stable under normal conditions.
Possibility of hazardous reactions	None under normal processing.
Hazardous polymerization	Hazardous polymerization does not occur.
Conditions to avoid	None known based on information supplied.
Incompatible materials	None known based on information supplied.
Hazardous decomposition products	Carbon oxides.

11. TOXICOLOGICAL INFORMATION	
Information on likely routes of exposure	
Product Information	
Inhalation	Specific test data for the substance or mixture is not available.
Eye contact	Specific test data for the substance or mixture is not available.
Skin contact	Specific test data for the substance or mixture is not available.
Ingestion	Specific test data for the substance or mixture is not available.
Information on toxicological effects	
Symptoms	No information available.
Numerical measures of toxicity	
Acute Toxicity	
Unknown acute toxicity	0% of the mixture consists of ingredient(s) of unknown toxicity 0% of the mixture consists of ingredient(s) of unknown acute oral toxicity 0% of the mixture consists of ingredient(s) of unknown acute dermal toxicity 0% of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (gas) 0% of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (vapor) 0% of the mixture consists of ingredient(s) of unknown acute inhalation toxicity (dust/mist)
Delayed and immediate effects as well as chronic effects from short and long-term exposure	
Skin corrosion/irritation	No information available.
Serious eye damage/eye irritation	No information available.
Respiratory or skin sensitization	No information available.
Germ cell mutagenicity	No information available.
Carcinogenicity	No information available.
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

12. ECOLOGICAL INFORMATION	
Ecotoxicity	The environmental impact of this product has not been fully investigated.
Persistence and degradability	No information available.
Bioaccumulation	There is no data for this product.
Mobility	No information available.
Other adverse effects	No information available.
13. DISPOSAL CONSIDERATIONS	
Waste treatment methods	
Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.
14. TRANSPORT INFORMATION	
DOT	Not regulated
Proper shipping name	Not regulated
Hazard class	Not applicable
TDG	Not regulated
MEX	Not regulated
ICAO	Not regulated
IATA	Not regulated
Proper shipping name	Not regulated
Hazard class	Not applicable
IMDG/IMO	Not regulated
Hazard class	Not applicable
RID	Not regulated
ADR	Not regulated
ADN	Not regulated

15. REGULATORY INFORMATION	
Safety, health and environmental regulations/legislation specific for the substance or mixture	
International Regulations	
Ozone-depleting substances (ODS)	Not applicable
Persistent organic pollutants	Not applicable
Export notification requirements	Not applicable
International Inventories	
TSCA	Contact supplier for inventory compliance status.
DSL/NDSL	Contact supplier for inventory compliance status.
EINECS/ELINCS	Contact supplier for inventory compliance status.
ENCS	Contact supplier for inventory compliance status.
KECL	Contact supplier for inventory compliance status.
PICCS	Contact supplier for inventory compliance status.
AICS	Contact supplier for inventory compliance status.
Legend	
TSCA	United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL	Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS	European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS	Japan Existing and New Chemical Substances
KECL	Korean Existing and Evaluated Chemical Substances
PICCS	Philippines Inventory of Chemicals and Chemical Substances
AICS	Australian Inventory of Chemical Substances
US federal regulations	
SARA 313	Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372
Acute health hazard	No
Chronic health hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive hazard	No

CWA (Clean Water Act)	This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)
CERCLA	This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material
US state regulations	
California Proposition 65	This product does not contain any Proposition 65 chemicals.
U.S. state right-to-know regulations	This product does not contain any substances above threshold limits that are regulated by state right-to-know.

16. OTHER INFORMATION

NFPA	**Health hazards** 1	**Flammability** 0	**Instability** 0	**Physical and chemical properties** -
HMIS	**Health hazards** 1	**Flammability** 0	**Physical hazards** 0	**Personal protection** X

Prepared by	Tidal Vision Products, Inc. 3710 Iron Gate Rd Bellingham, WA 98226 USA 1-360-603-7676
Issuing date	15-Apr-2021
Revision date	21-Jul-2021
Revision note	Revised section 9 (Physical and Chemical Properties)
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

END OF SAFETY DATA SHEET

Portland Water Bureau — From Forest to Faucet

Bull Run Treatment Projects | Filtration

Technical Memorandum

Subject:	Filtration Facility Construction Stormwater Runoff Rate and Volume
PWB Project #s:	W02229
Date:	April 20, 2023
To:	David Peters, Program Director Portland Water Bureau
From:	Rafael Gaeta, PE Principal Engineer Emerio Design
Prepared by:	Roy Hankins, PE, Project Engineer Emerio Design
Reviewed by:	Angela Wieland, PE Brown and Caldwell
	Mark Graham, PE Stantec

EMERIO

Stantec

Contents

List of Tables

List of Attachments

1.0 Purpose of this Report

The purpose of this technical memorandum is to provide PWB's filtration facility contractor with estimated discharge rates and volumes applicable during construction activities. These estimated discharge rates and volumes are intended to support the contractor's sizing of detention basins so that discharge rates to Johnson Creek can be limited as part of an overall approach to meeting Oregon Department of Environmental Quality 1200-C permit guidance. The calculated discharge rates and volumes reflect stormwater runoff as well as estimated flows from the dewatering of groundwater seepage into excavations during construction.

2.0 Rainfall Data

The 24-hour rainfall depths used in the hydrographs to determine the peak stormwater runoff rates for this analysis were obtained from NOAA ATLAS 2, Volume X, Isopluvial Maps Figures 25 to 30 summarized in Table 1.

These rainfall depths are based on the physical location of the project. As such, they are higher than the City of Portland rainfall depths listed in the 2020 Portland Stormwater Management Manual (SWMM), Table A-9.

Table 1. 24 hour Rainfall Depths

Design Storm Event	Rainfall (inches)
2 Year	2.8
5 Year	3.4
10 Year	3.8
25 Year	4.5
50 Year	5.0
100 Year	5.5

3.0 Pre-Developed Runoff Rates

The pre-developed stormwater runoff rates are based on existing subbasins that drain to Johnson Creek. The contributing area is approximately 69 acres. This area excludes existing subbasin 5, which discharges to the Sandy River. See Attachment A, Figure 1 for a map of the existing drainage basins.

Pre-developed Curve Numbers

The existing site primarily consists of a hydrologic soil group (HSG) of C.

Using the TR-55 Urban Hydrology for Small Watersheds, Table 2-2b. Runoff Curve Numbers for Cultivated Agricultural Lands and a land cover type of Row Crops in good condition, a curve number of 82 has been selected to represent existing development conditions. This land coverage and associated curve number is consistent across the entire site. This curve number is being used in the hydrologic flow calculations to determine the existing stormwater runoff rates that occur from the site.

4.0 Construction Runoff Rates

The construction stormwater runoff rates are based on the entire project area (including existing subbasin 5), approximately 83 acres. Stormwater runoff from existing subbasin 5 will be routed to the southwest corner of the site and added to the Johnson Creek discharge during construction. See Attachment A, Figure 2 for a map of the construction area basin routing.

A Preliminary Groundwater Seepage Quantity Estimate that was written on May 10, 2022 (see Attachment C) determined that the three primary onsite excavation locations (the Finished Water Clearwell, Treatment Process Complex, and Overflow Basins) will each have a steady-state groundwater seepage discharge rate of 300 gpm during the wet season. A steady-state groundwater seepage rate at the Pipeline Shaft excavation location was determined by Delve Underground be 250 gpm during the wet season, and was provided in an email shown in Attachment C. The total groundwater seepage discharge of 1,150 gpm (2.6 cfs) will be routed to the Overflow Basins for detention as outlined in Section 5.0 of this memo.

Developed Curve Numbers

During construction, the site will experience significant disturbance, causing the existing soil profile to be altered and consolidated. Construction activities including mass grading and soil compaction, utility installation, building construction, and roadway construction will alter the soil profile. For purposes of construction-related stormwater runoff calculations, the area within the project limits is considered impervious surface and a curve number of 98 is applied as a conservative assumption.

5.0 Targeted and Actual Release Flows

During construction, the target release rates from the project area to Johnson Creek are limited to 50 percent of the 2-year pre-developed flow rate, 100 percent of the 5-year pre-developed flow rate, and 100 percent of the 10-year pre-developed flow rate. As specific detention standards are not listed in the 1200-C NPDES permit, this project proposes to adhere to the target release rates, which also pertain to permanent post-construction stormwater flow control requirements.

The proposed onsite overflow basins can provide detention during the construction period. The location of the overflow basins can be seen in Attachment A, Figure 2. The basins were analyzed for their combined capacity to detain stormwater flow from the entire project area and groundwater seepage flows as discussed in Section 4.0. Both basins have a bottom elevation of 684.00’ and a top elevation of 693.00’ per the proposed grading for post-construction site conditions. The total storage volume of the combined system is approximately 1,568,000 CF. HydroCAD was used to analyze existing stormwater runoff conditions, construction-related stormwater and groundwater flow conditions, and detained flows using the same modeling methodology outlined in Section 1.6.4 of the *Filtration Site Stormwater Report.* The modeling of the combined basin system determined that a single 9.0” orifice with an invert elevation of 684.00’ is required to meet the design criteria. The results of the flow analysis are shown in Attachment B and summarized in Table 2 below.

Table 2. Construction Runoff Rates and Volume Summary			
Design Storm Event	2 Year	5 Year	10 Year
Pre-Developed Runoff Rate (cfs)	11.8	17.7	21.9
Target Release Rate (cfs)	5.9	17.7	21.9
Undetained Construction Runoff Rate (cfs)	49.0	60.0	67.3
Construction Dewatering Rate (cfs)	2.6	2.6	2.6
Detained Release Rate (cfs)	4.6	5.0	5.3
Active Basin Volume (cf)	709,000	863,000	967,000

The results above show that the combined overflow basins are capable of providing adequate detention for all stormwater and groundwater flow up to the 10-year design event. The maximum water surface elevation in the basin system during the 10-year event is 690.10', and the top of basin elevation is at 693.00'.

Again, the contractor may use the proposed overflow basins for detention of stormwater and groundwater during the construction period. The 2.9 ft of freeboard within the system measured from the maximum 10-year water surface elevation shows that the overflow basins have additional storage capacity to use in the event of a larger (>10-year) storm event or a temporary failure in the construction drainage system.

Attachment A: Figures

Figure 1 – Existing Stormwater Drainage Basin Map (extracted from the *Filtration Site Stormwater Report* dated February 2, 2023)

Figure 2 – Construction Stormwater Basin Map

DODGE PARK BLVD

CARPENTER LANE

EXISTING PRIVATE GRAVEL ACCESS ROAD

EXISTING DRAINAGE PATH

UNNAMED TRIBUTARY JOHNSON CREEK

EXISTING POINT OF DISCHARGE #1

EXISTING DRAINAGE PATH

JOHNSON CREEK

JOHNSON CREEK HEADWATERS

EXISTING POINT OF DISCHARGE #2

EX SUBBASIN 1
237,766 SF

EXISTING FARM DIRT ACCESS ROAD

EX SUBBASIN 2
1,817,364 SF

EXISTING FARM DIRT ACCESS ROAD

HIGH POINT (RIDGE LINE)

EX SUBBASIN 3
304,813 SF

EX SUBBASIN 4
652,076 SF

EXISTING FARM DIRT ACCESS ROAD

EXISTING FARM GRAVEL ACCESS ROAD

HIGH POINT (RIDGE LINE)

EX SUBBASIN 5
600,190 SF

PLEASANT HOME WATER DISTRICT WATER TANKS

EXISTING FARM DIRT ACCESS ROAD

EXISTING FARM GRAVEL ACCESS ROAD

EXISTING RESIDENCE

EXISTING POINT OF DISCHARGE #3

EXISTING BARN

JOHNSON CREEK HEADWATERS

LEGEND

- EXISTING STORMWATER BASIN
- XXX EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- PROPERTY LINE
- DIRECTION OF SURFACE WATER FLOW

N

200' 0 100' 200' 400'

SCALE: 1" = 200'

BULL RUN FILTRATION FACILITY

MULTNOMAH COUNTY, OREGON

EXISTING STORMWATER DRAINAGE BASIN MAP

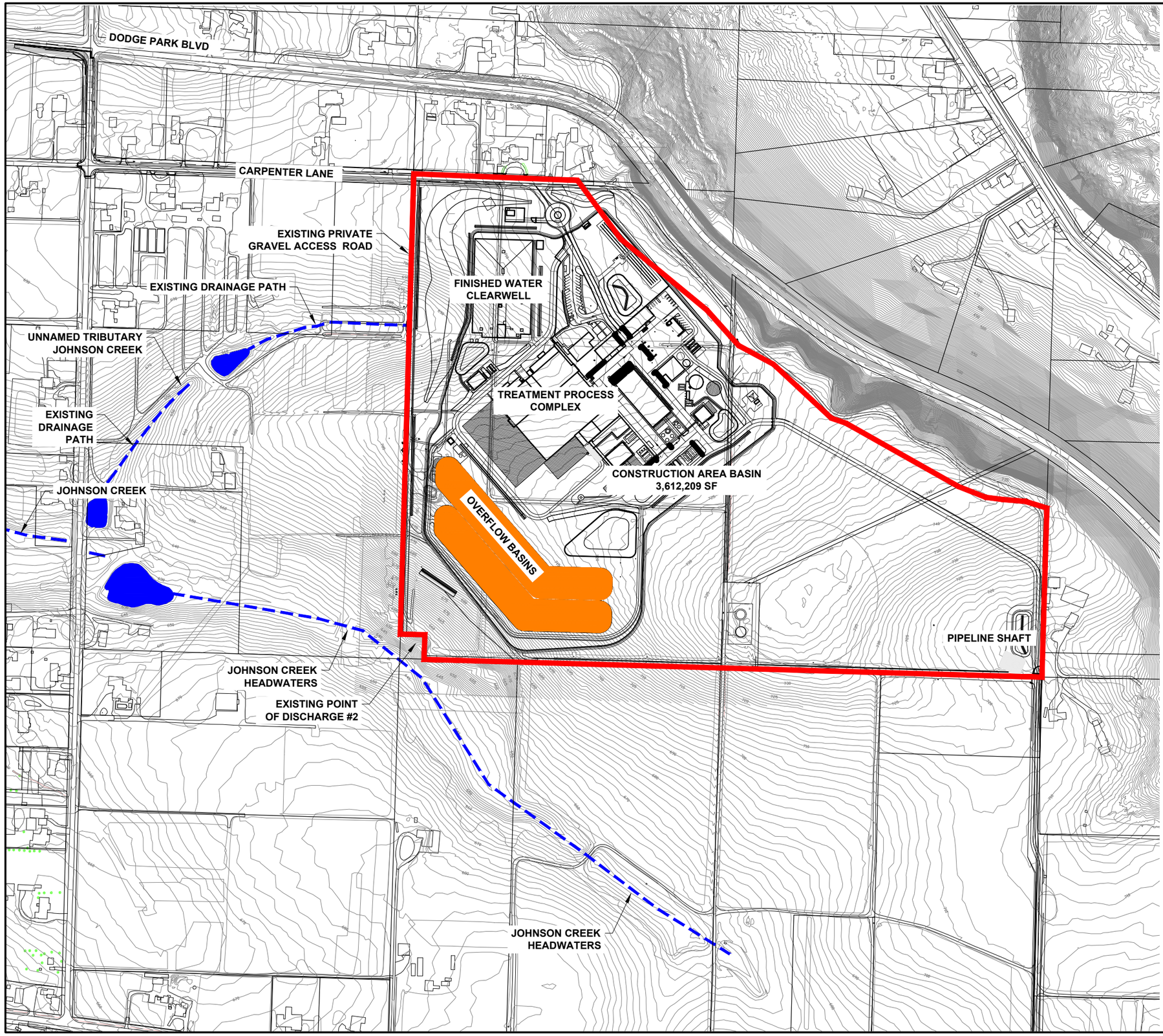
REVISIONS

NO.	DATE	DESCRIPTION

EMERIO
ENGINEERING • SURVEYING • DESIGN
6445 SW FALLBROOK PLACE, SUITE 100
BEAVERTON, OREGON 97008
TEL: (503) 746-8812
FAX: (503) 639-9592
www.emeriodesign.com

SHEET 01 OF 02

FILE:P:\0596-003 Bull Run WTP Filtration Facility\docs\civil\Stormwater\Construction Tech Memo\0596-003 Figure 1 Existing Storm Runoff Basin Map, Layout: Figure 1, Plot Date: 2/10/2023 2:53 PM, by: Josh Meyer



LEGEND

- CONSTRUCTION STORMWATER BASIN
- XXX EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- PROPERTY LINE
- OVERFLOW BASINS

N

200' 0 100' 200' 400'

SCALE: 1" = 200'

BULL RUN FILTRATION FACILITY

MULTNOMAH COUNTY, OREGON

CONSTRUCTION STORMWATER BASIN MAP

REVISIONS

NO.	DATE	DESCRIPTION

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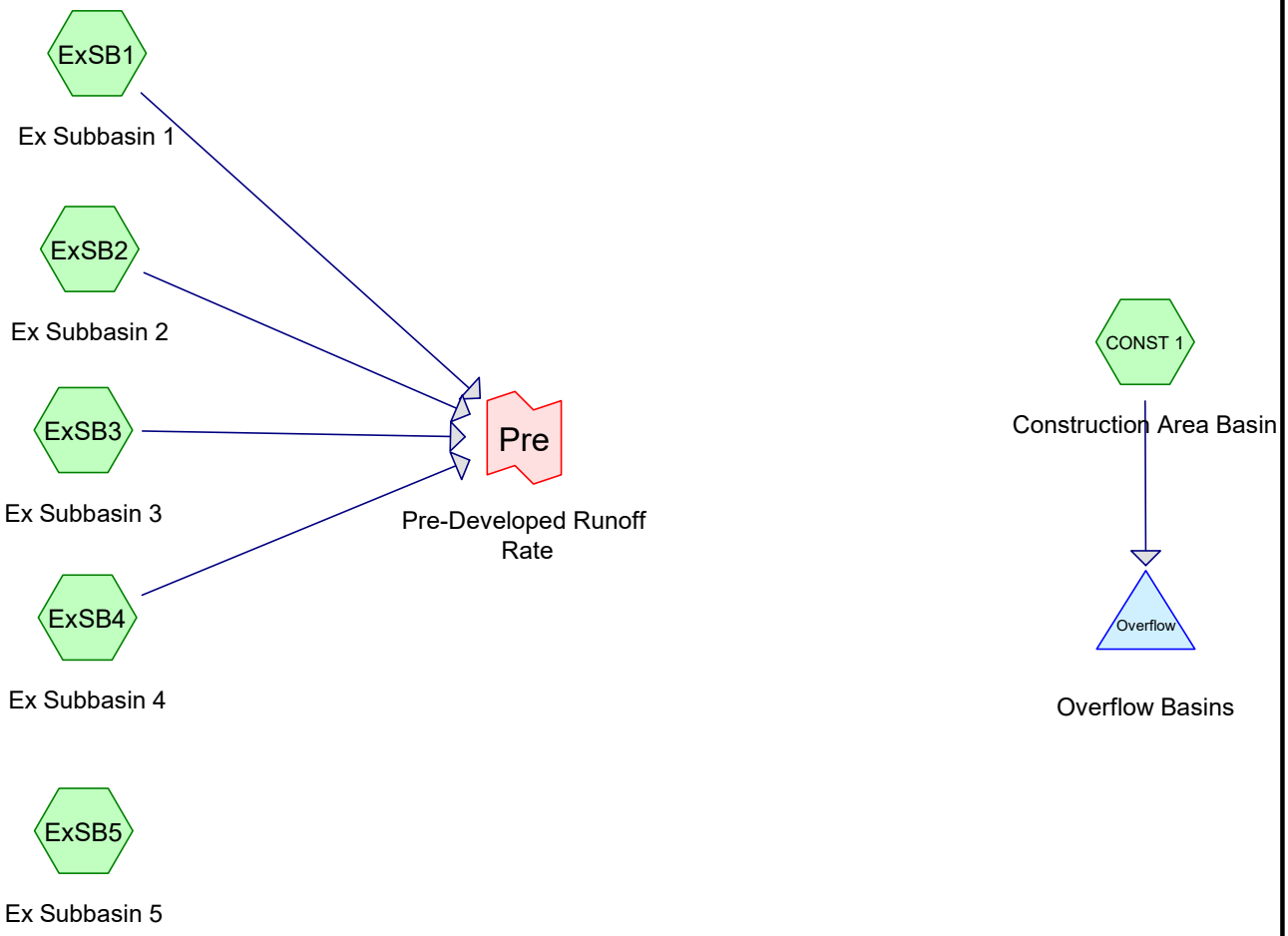
SHEET 02 OF 02

FILE P: \0596-003 Bull Run WTP Filtration Facility\docs\civil\Stormwater\Construction Tech Memo\0596-003 Figure 2 Construction Basin Map, Layout: Figure 1, Plot Date: 3/22/2023 2:44 PM, by: Josh Meyer

Attachment B: Hydrologic Analysis of Pre-Construction and Construction Flows



Subcat Reach Pond Link

Routing Diagram for Bull Run Filt Proj - Construction Flows

Prepared by {enter your company name here}, Printed 3/22/2023

Summary for Subcatchment CONST 1: Construction Area Basin

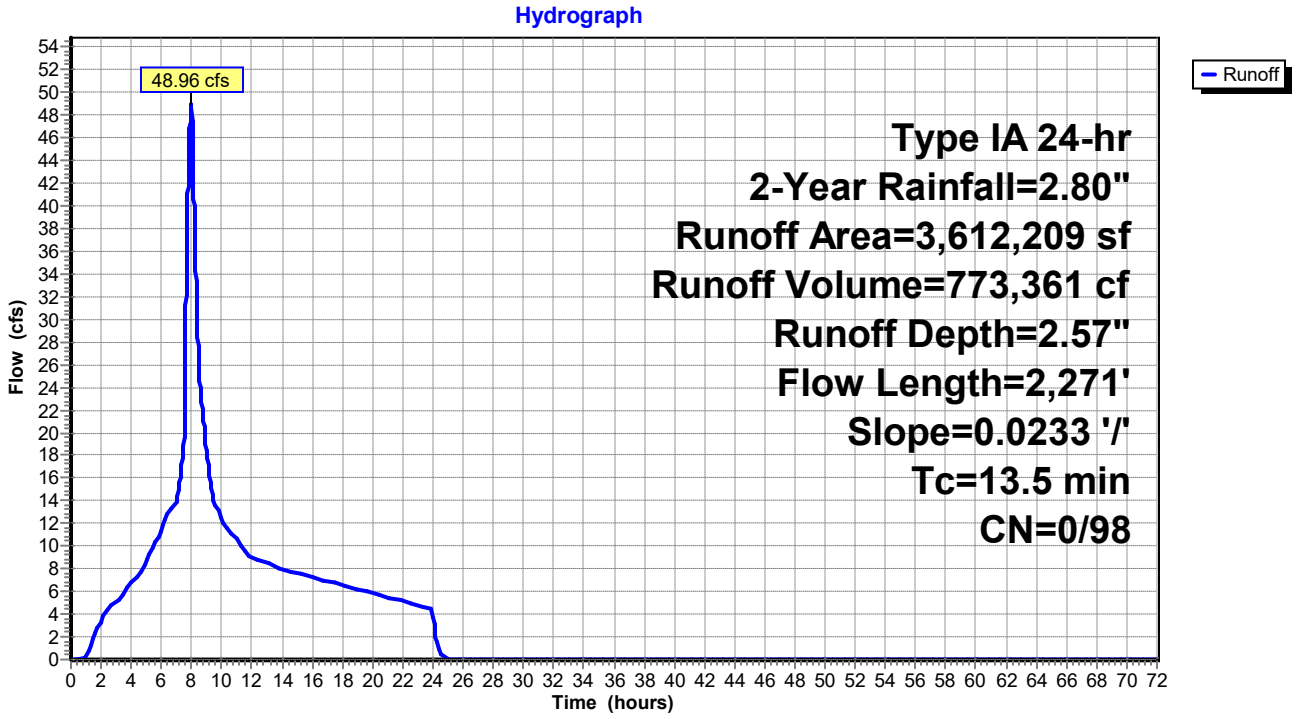
Runoff = 48.96 cfs @ 8.00 hrs, Volume= 773,361 cf, Depth= 2.57"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Rainfall=2.80"

	Area (sf)	CN	Description
*	3,612,209	98	Impervious
	3,612,209	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	300	0.0233	1.70		**Sheet Flow, Sheetflow** Smooth surfaces n= 0.011 P2= 2.80"
10.6	1,971	0.0233	3.10		**Shallow Concentrated Flow, Shallow Flow** Paved Kv= 20.3 fps
13.5	2,271	Total			

Subcatchment CONST 1: Construction Area Basin



Summary for Subcatchment ExSB1: Ex Subbasin 1

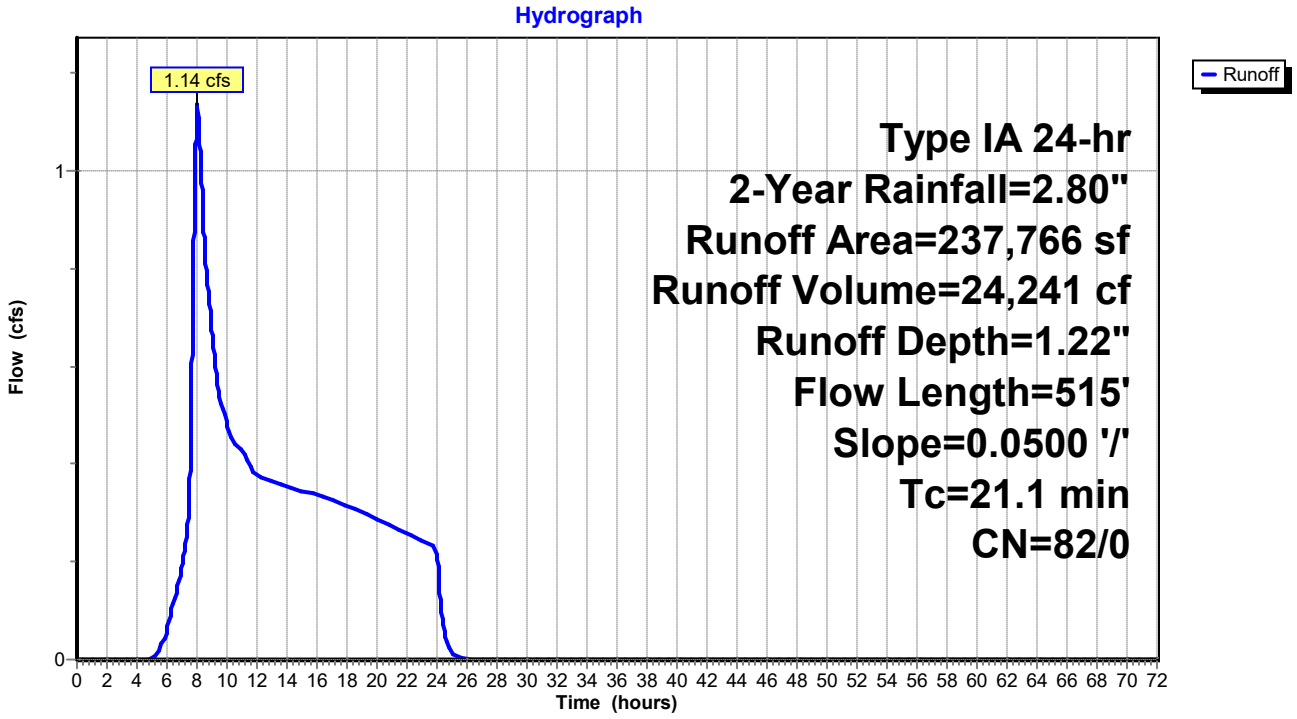
Runoff = 1.14 cfs @ 8.01 hrs, Volume= 24,241 cf, Depth= 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
237,766	82	Row crops, SR + CR, Good, HSG C
237,766	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	300	0.0500	0.26		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
1.8	215	0.0500	2.01		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
21.1	515	Total			

Subcatchment ExSB1: Ex Subbasin 1



Summary for Subcatchment ExSB2: Ex Subbasin 2

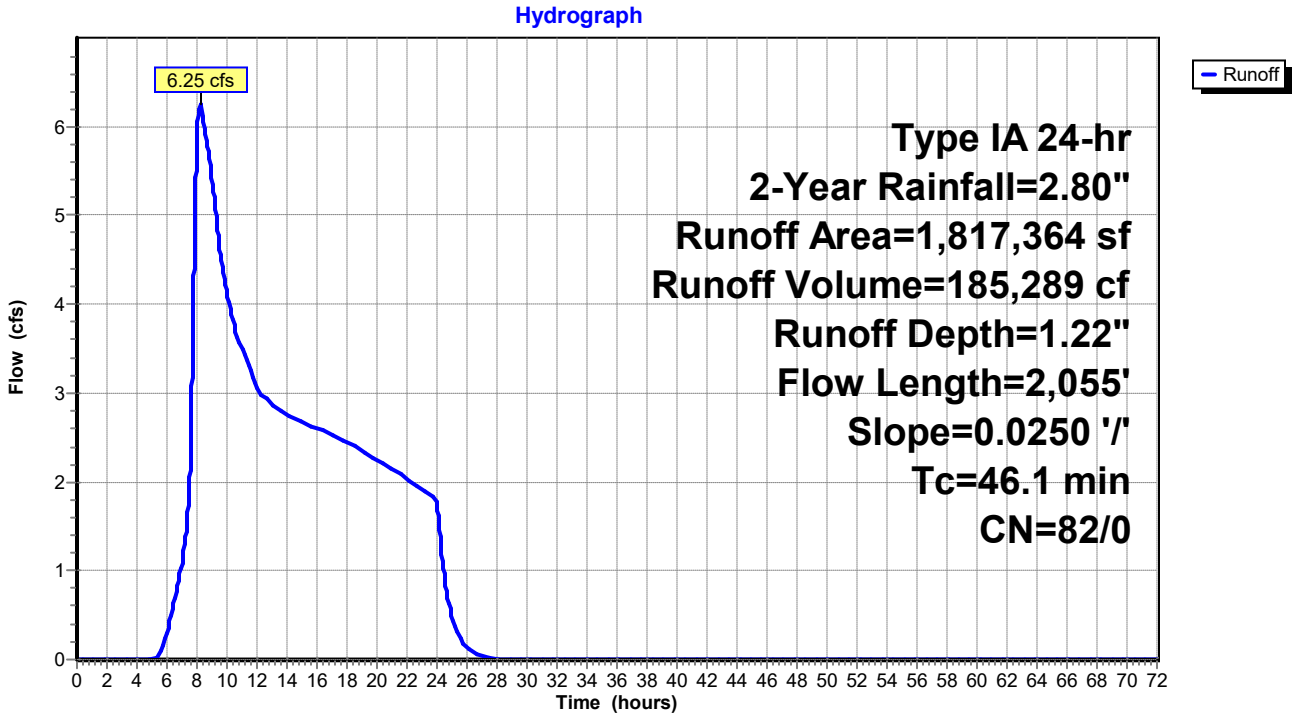
Runoff = 6.25 cfs @ 8.22 hrs, Volume= 185,289 cf, Depth= 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
1,817,364	82	Row crops, SR + CR, Good, HSG C
1,817,364	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	300	0.0250	0.20		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
20.6	1,755	0.0250	1.42		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
46.1	2,055	Total			

Subcatchment ExSB2: Ex Subbasin 2



Summary for Subcatchment ExSB3: Ex Subbasin 3

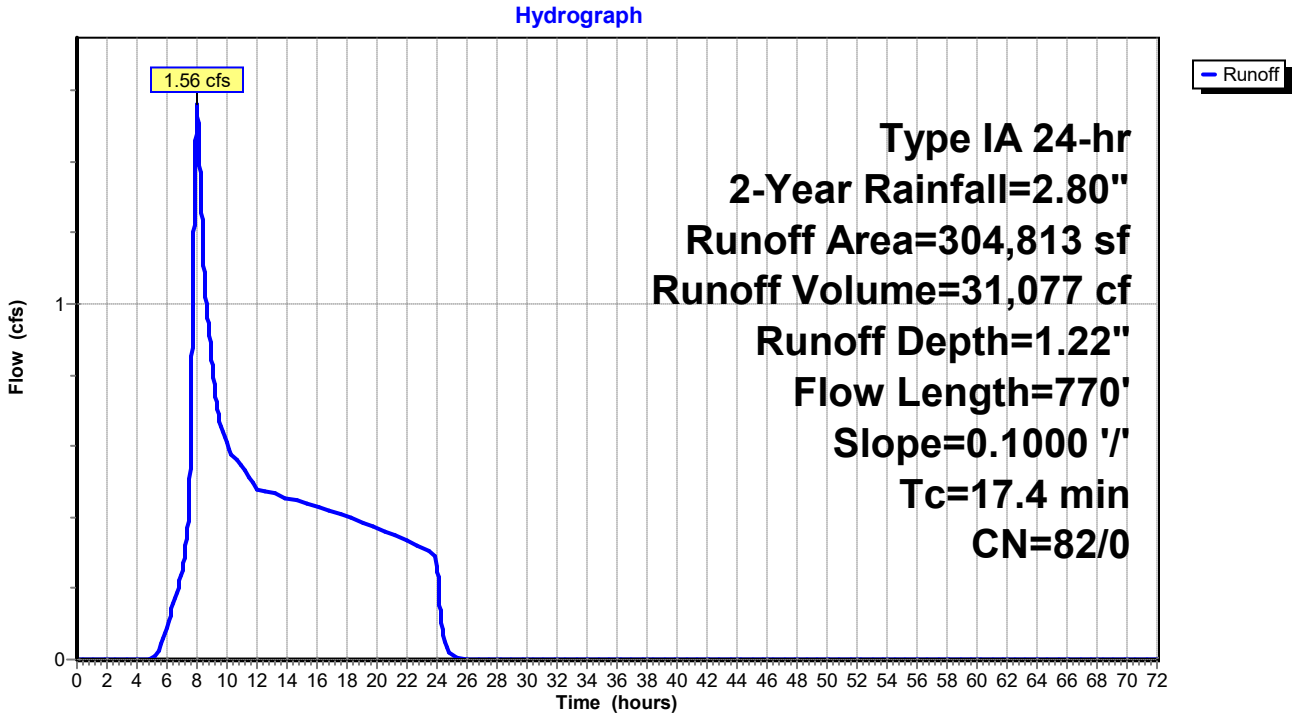
Runoff = 1.56 cfs @ 8.01 hrs, Volume= 31,077 cf, Depth= 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
304,813	82	Row crops, SR + CR, Good, HSG C
304,813	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	300	0.1000	0.34		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
2.8	470	0.1000	2.85		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
17.4	770	Total			

Subcatchment ExSB3: Ex Subbasin 3



Summary for Subcatchment ExSB4: Ex Subbasin 4

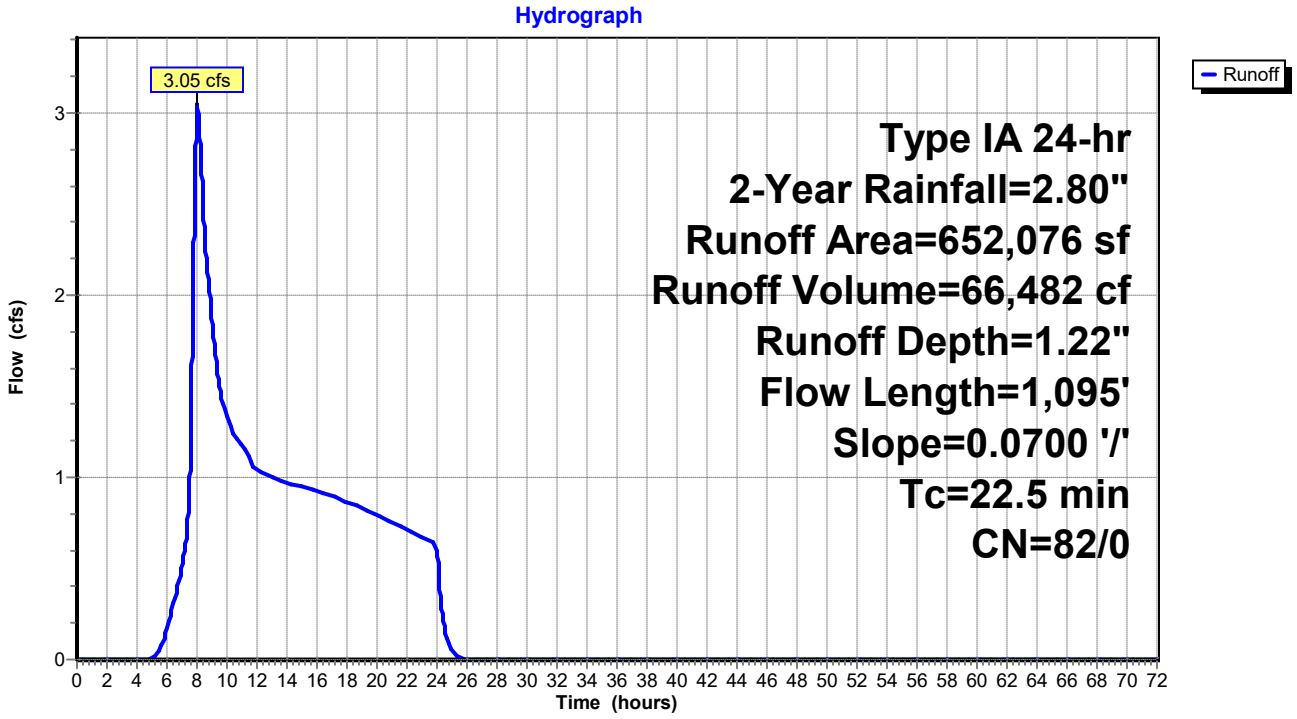
Runoff = 3.05 cfs @ 8.01 hrs, Volume= 66,482 cf, Depth= 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
652,076	82	Row crops, SR + CR, Good, HSG C
652,076	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	300	0.0700	0.30		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
5.6	795	0.0700	2.38		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
22.5	1,095	Total			

Subcatchment ExSB4: Ex Subbasin 4



Summary for Subcatchment ExSB5: Ex Subbasin 5

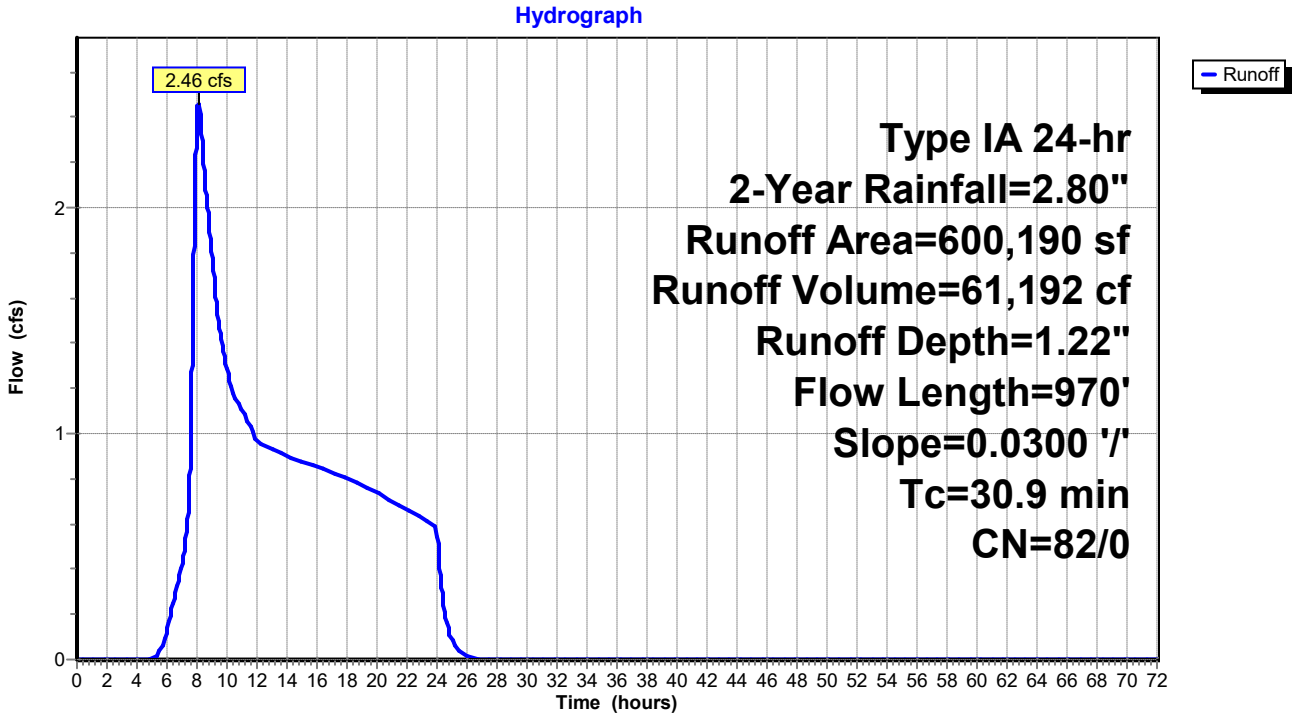
Runoff = 2.46 cfs @ 8.08 hrs, Volume= 61,192 cf, Depth= 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-Year Rainfall=2.80"

Area (sf)	CN	Description
600,190	82	Row crops, SR + CR, Good, HSG C
600,190	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.7	300	0.0300	0.21		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
7.2	670	0.0300	1.56		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
30.9	970	Total			

Subcatchment ExSB5: Ex Subbasin 5



Summary for Pond Overflow: Overflow Basins

Inflow Area = 3,612,209 sf,100.00% Impervious, Inflow Depth > 4.81" for 2-Year event
Inflow = 51.56 cfs @ 8.00 hrs, Volume= 1,447,375 cf, Incl. 2.60 cfs Base Flow
Outflow = 4.61 cfs @ 24.18 hrs, Volume= 1,006,757 cf, Atten= 91%, Lag= 971.3 min
Primary = 4.61 cfs @ 24.18 hrs, Volume= 1,006,757 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 688.70' @ 24.18 hrs Surf.Area= 177,788 sf Storage= 709,121 cf

Plug-Flow detention time= 1,582.1 min calculated for 1,006,710 cf (70% of inflow)
Center-of-Mass det. time= 907.9 min (2,275.8 - 1,367.9)

Volume	Invert	Avail.Storage	Storage Description
#1	684.00'	760,666 cf	**South Basin (Prismatic)** Listed below (Recalc)
#2	684.00'	806,919 cf	**North Basin (Prismatic)** Listed below (Recalc)
		1,567,585 cf	Total Available Storage

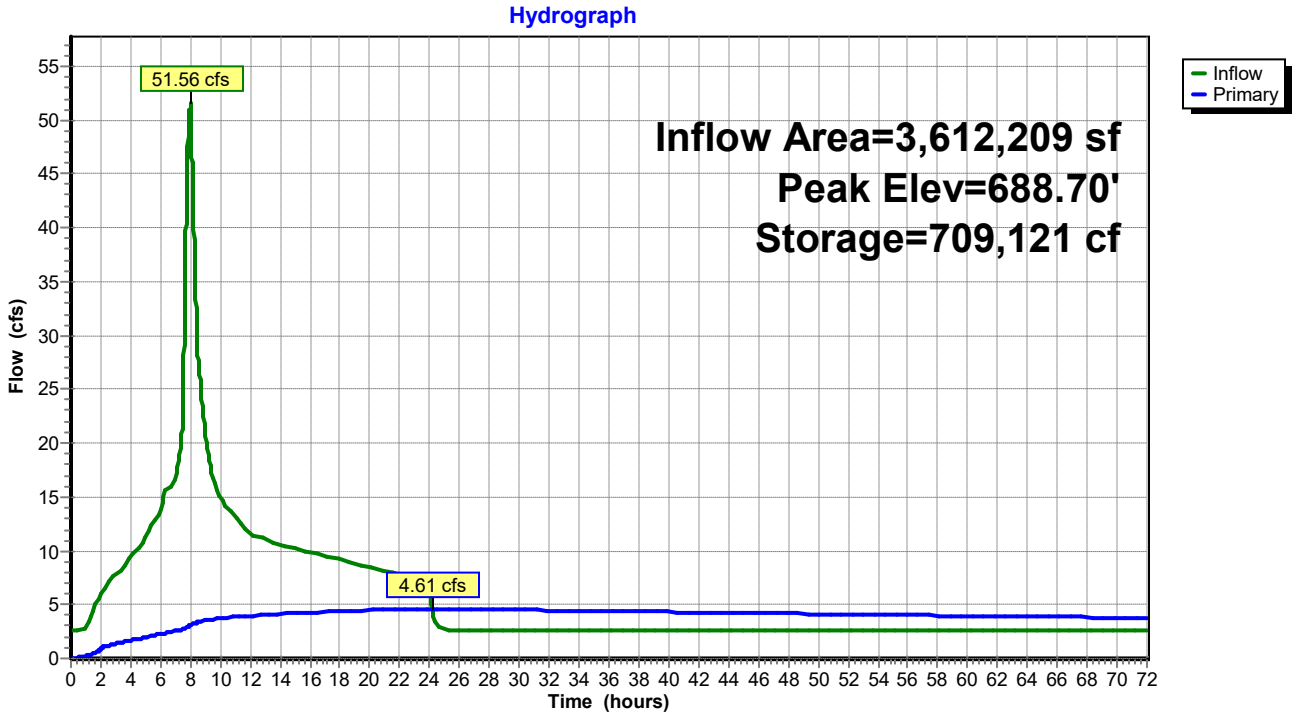
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
684.00	29,903	0	0
685.00	69,069	49,486	49,486
686.00	73,956	71,513	120,999
687.00	78,710	76,333	197,332
688.00	83,799	81,255	278,586
689.00	88,812	86,306	364,892
690.00	93,849	91,331	456,222
691.00	99,018	96,434	552,656
692.00	104,068	101,543	654,199
693.00	108,867	106,468	760,666

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
684.00	66,768	0	0
685.00	72,428	69,598	69,598
686.00	77,062	74,745	144,343
687.00	81,957	79,510	223,853
688.00	86,936	84,447	308,299
689.00	91,978	89,457	397,756
690.00	97,111	94,545	492,301
691.00	102,276	99,694	591,994
692.00	107,483	104,880	696,874
693.00	112,607	110,045	806,919

Device	Routing	Invert	Outlet Devices
#1	Primary	684.00'	**9.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.61 cfs @ 24.18 hrs HW=688.70' (Free Discharge)
1=Orifice/Grate (Orifice Controls 4.61 cfs @ 10.44 fps)

Pond Overflow: Overflow Basins

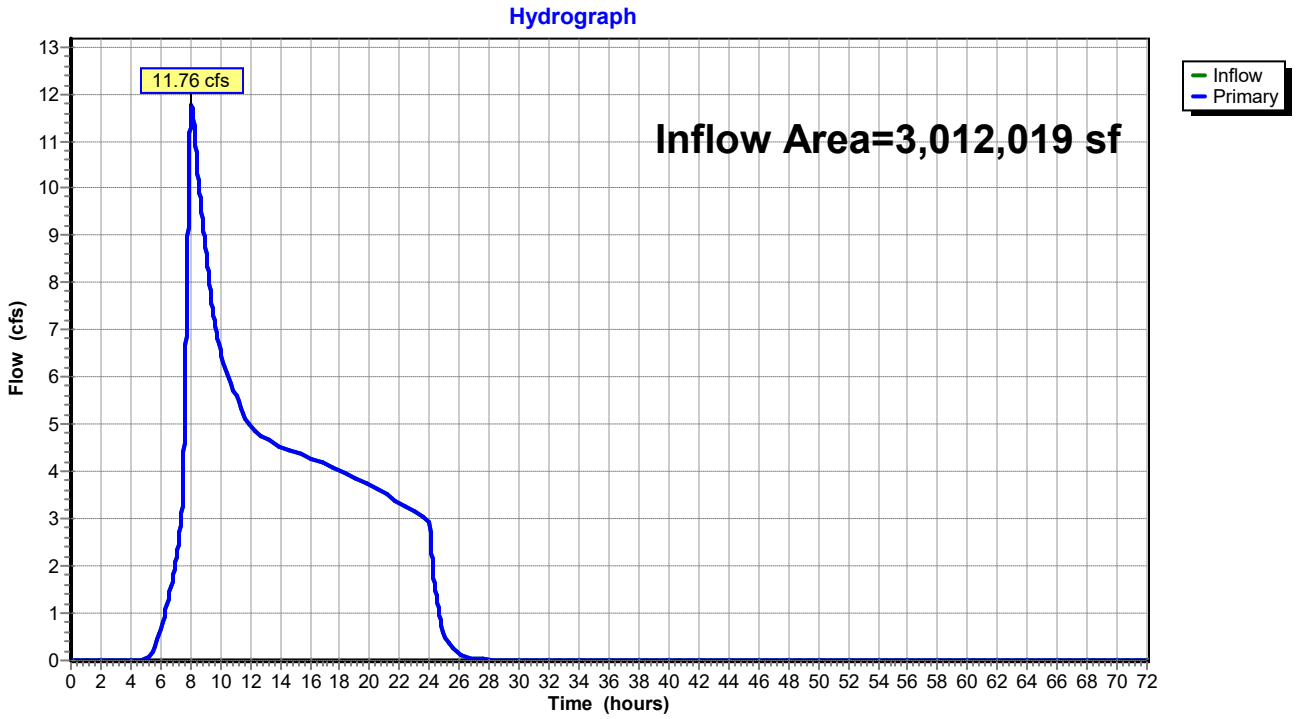


Summary for Link Pre: Pre-Developed Runoff Rate

Inflow Area = 3,012,019 sf, 0.00% Impervious, Inflow Depth = 1.22" for 2-Year event
Inflow = 11.76 cfs @ 8.06 hrs, Volume= 307,091 cf
Primary = 11.76 cfs @ 8.06 hrs, Volume= 307,091 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link Pre: Pre-Developed Runoff Rate



Summary for Subcatchment CONST 1: Construction Area Basin

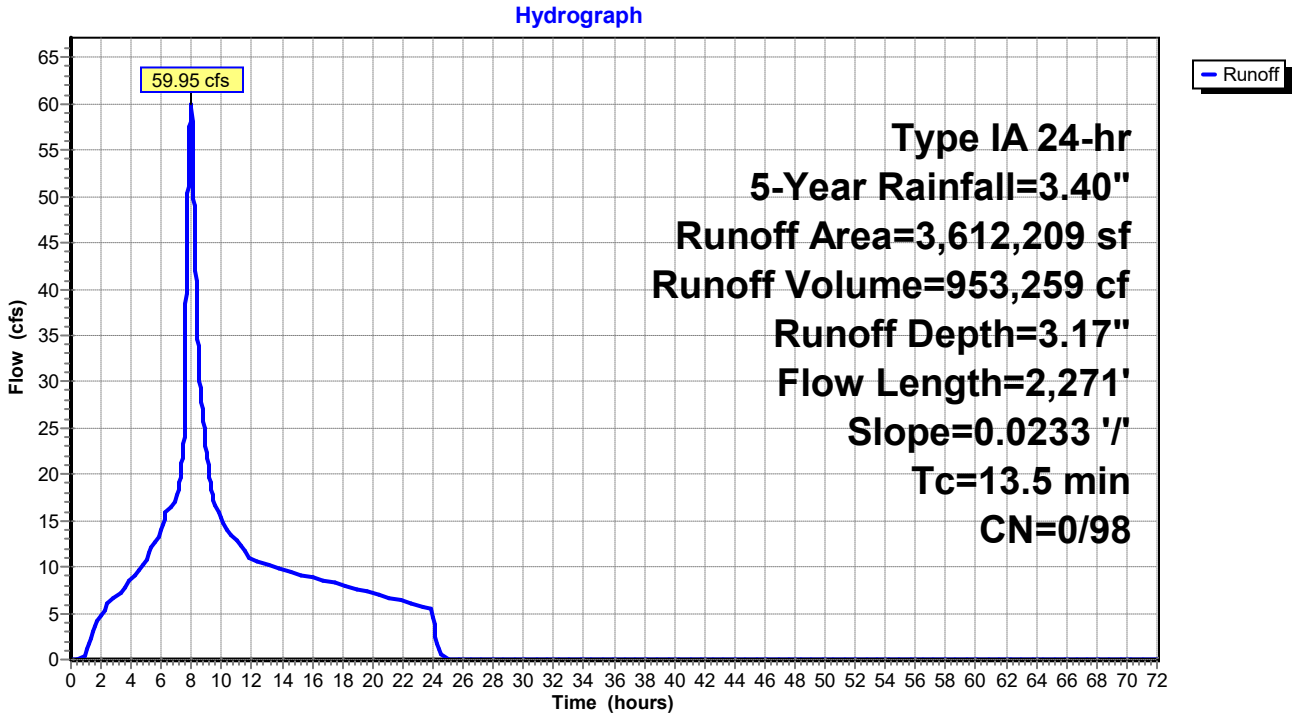
Runoff = 59.95 cfs @ 8.00 hrs, Volume= 953,259 cf, Depth= 3.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Rainfall=3.40"

	Area (sf)	CN	Description
*	3,612,209	98	Impervious
	3,612,209	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	300	0.0233	1.70		**Sheet Flow, Sheetflow** Smooth surfaces n= 0.011 P2= 2.80"
10.6	1,971	0.0233	3.10		**Shallow Concentrated Flow, Shallow Flow** Paved Kv= 20.3 fps
13.5	2,271	Total			

Subcatchment CONST 1: Construction Area Basin



Summary for Subcatchment ExSB1: Ex Subbasin 1

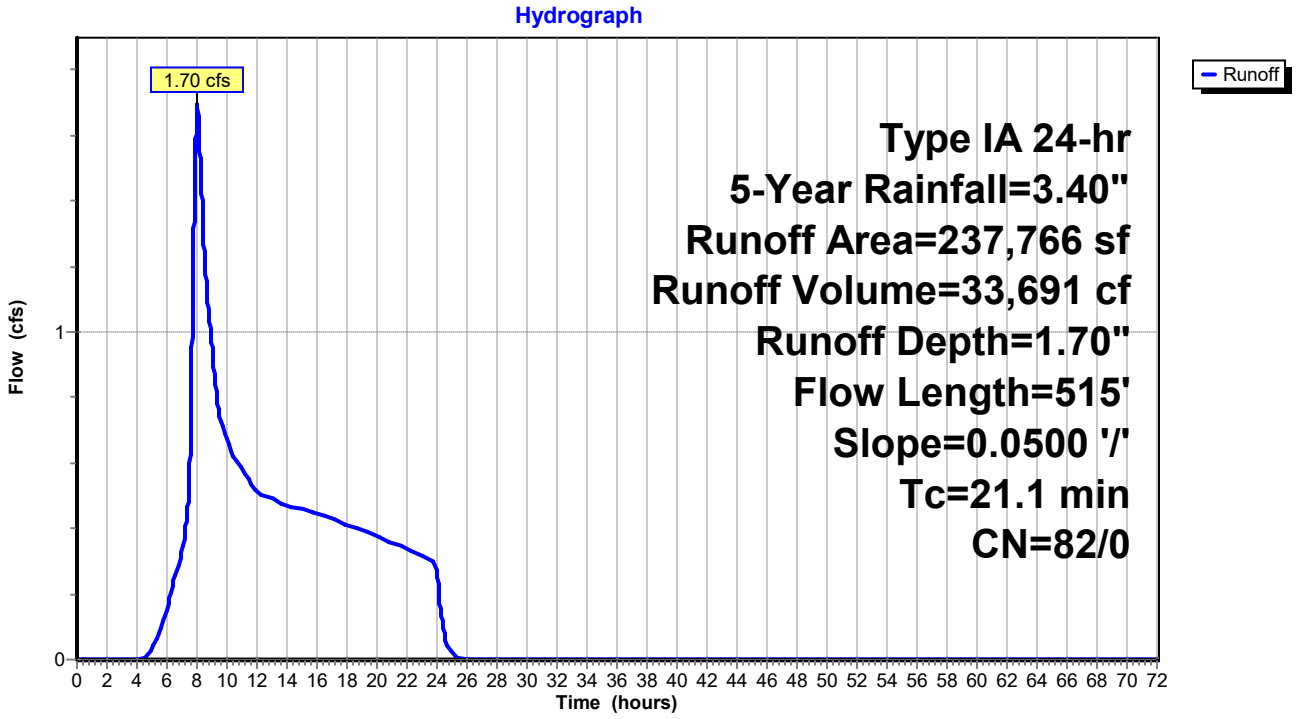
Runoff = 1.70 cfs @ 8.01 hrs, Volume= 33,691 cf, Depth= 1.70"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Rainfall=3.40"

Area (sf)	CN	Description
237,766	82	Row crops, SR + CR, Good, HSG C
237,766	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	300	0.0500	0.26		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
1.8	215	0.0500	2.01		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
21.1	515	Total			

Subcatchment ExSB1: Ex Subbasin 1



Summary for Subcatchment ExSB2: Ex Subbasin 2

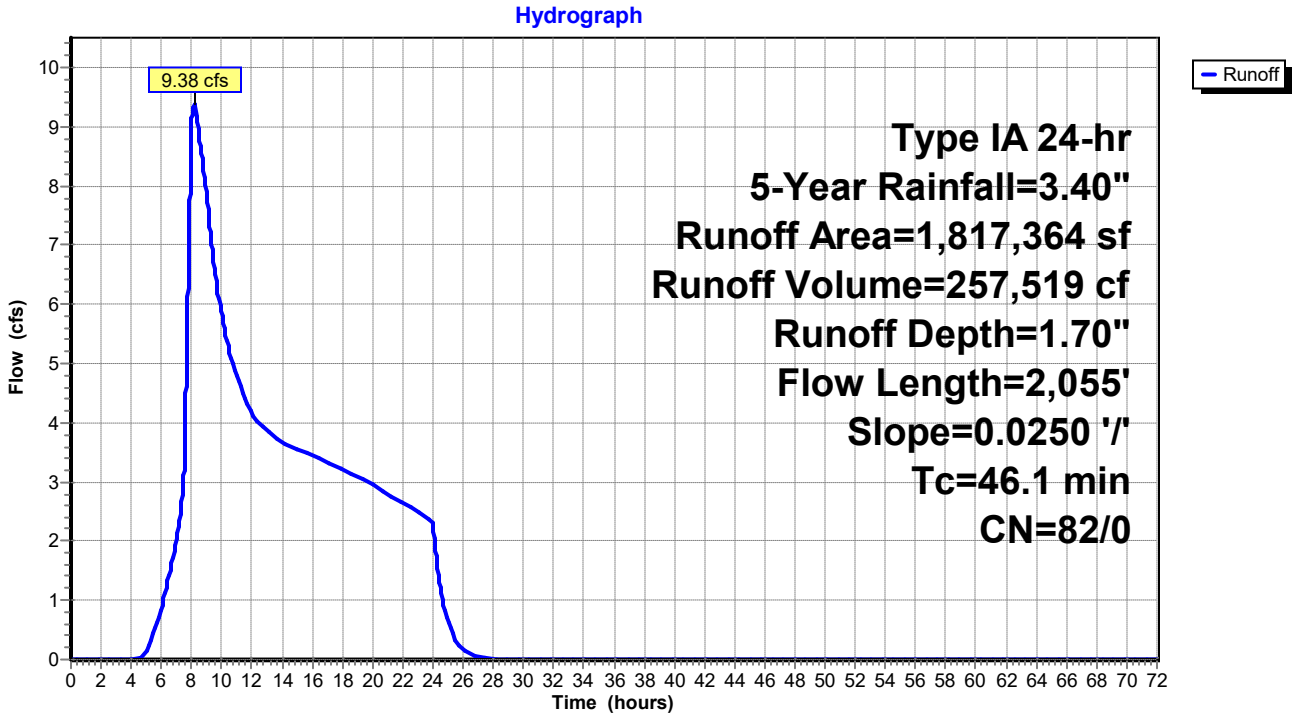
Runoff = 9.38 cfs @ 8.18 hrs, Volume= 257,519 cf, Depth= 1.70"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Rainfall=3.40"

Area (sf)	CN	Description
1,817,364	82	Row crops, SR + CR, Good, HSG C
1,817,364	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	300	0.0250	0.20		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
20.6	1,755	0.0250	1.42		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
46.1	2,055	Total			

Subcatchment ExSB2: Ex Subbasin 2



Summary for Subcatchment ExSB3: Ex Subbasin 3

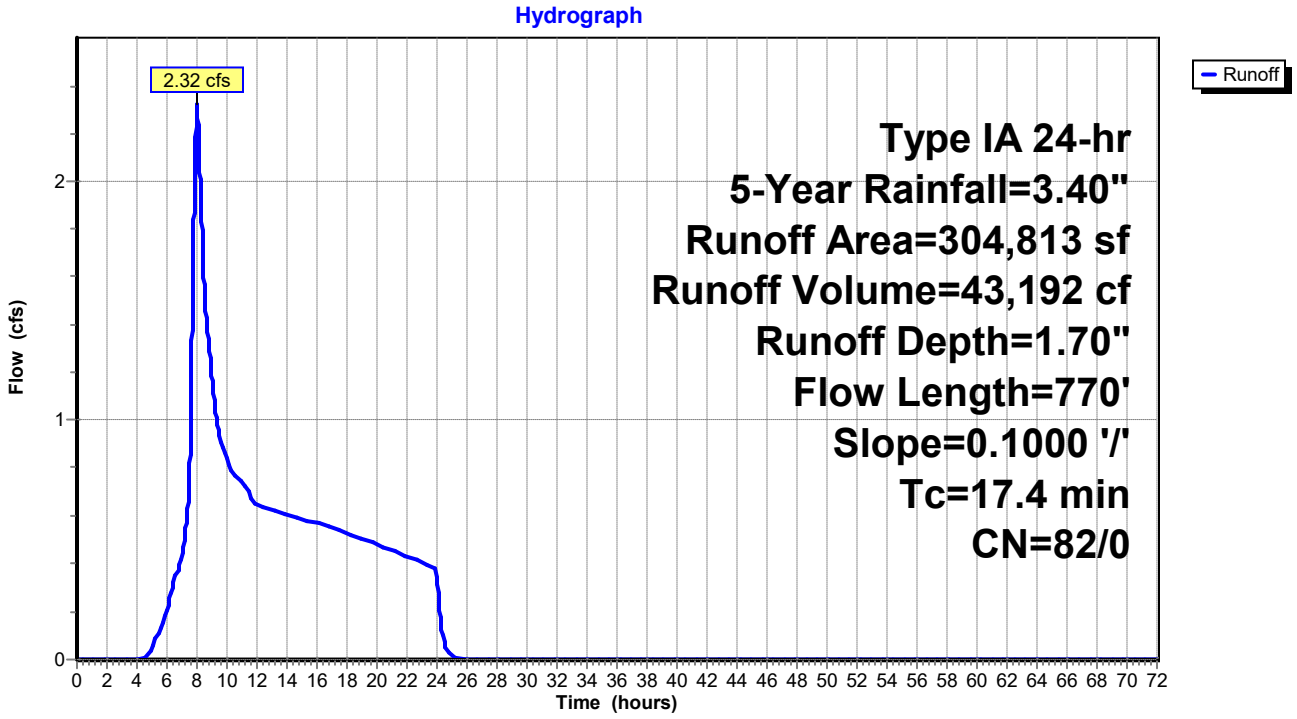
Runoff = 2.32 cfs @ 8.01 hrs, Volume= 43,192 cf, Depth= 1.70"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Rainfall=3.40"

Area (sf)	CN	Description
304,813	82	Row crops, SR + CR, Good, HSG C
304,813	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	300	0.1000	0.34		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
2.8	470	0.1000	2.85		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
17.4	770	Total			

Subcatchment ExSB3: Ex Subbasin 3



Summary for Subcatchment ExSB4: Ex Subbasin 4

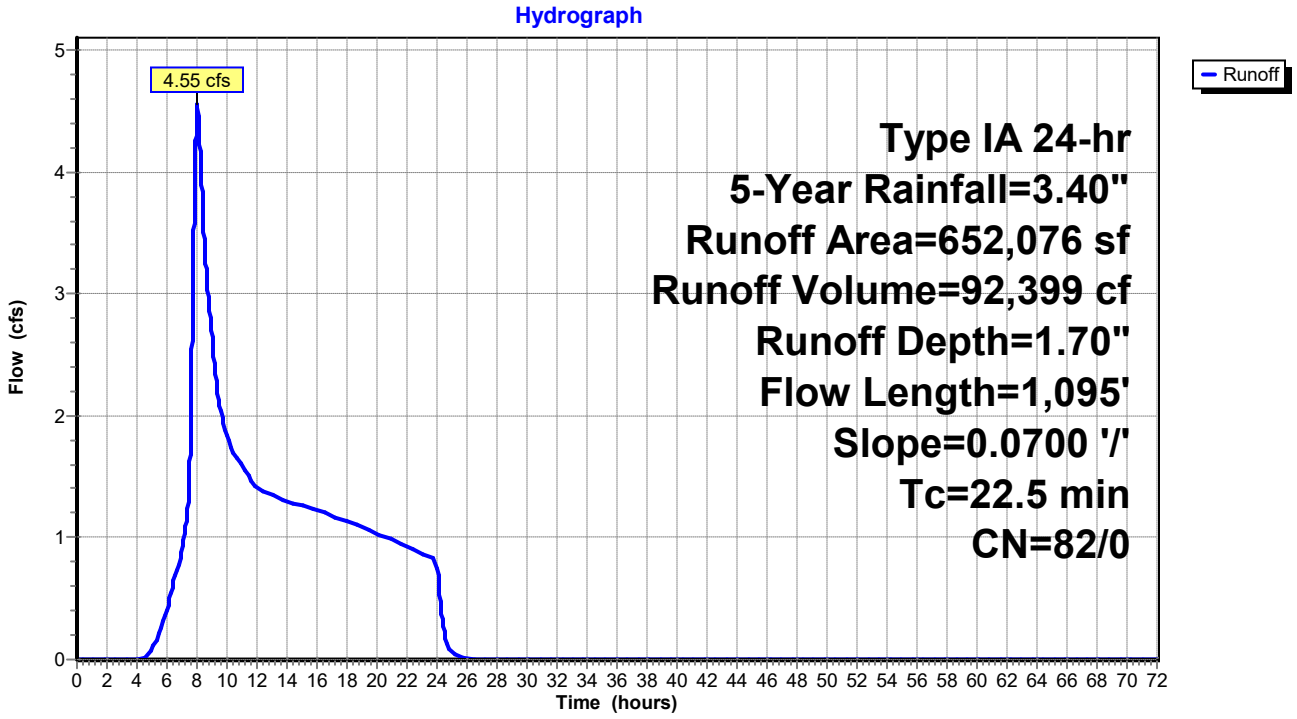
Runoff = 4.55 cfs @ 8.01 hrs, Volume= 92,399 cf, Depth= 1.70"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Rainfall=3.40"

Area (sf)	CN	Description
652,076	82	Row crops, SR + CR, Good, HSG C
652,076	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	300	0.0700	0.30		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
5.6	795	0.0700	2.38		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
22.5	1,095	Total			

Subcatchment ExSB4: Ex Subbasin 4



Summary for Subcatchment ExSB5: Ex Subbasin 5

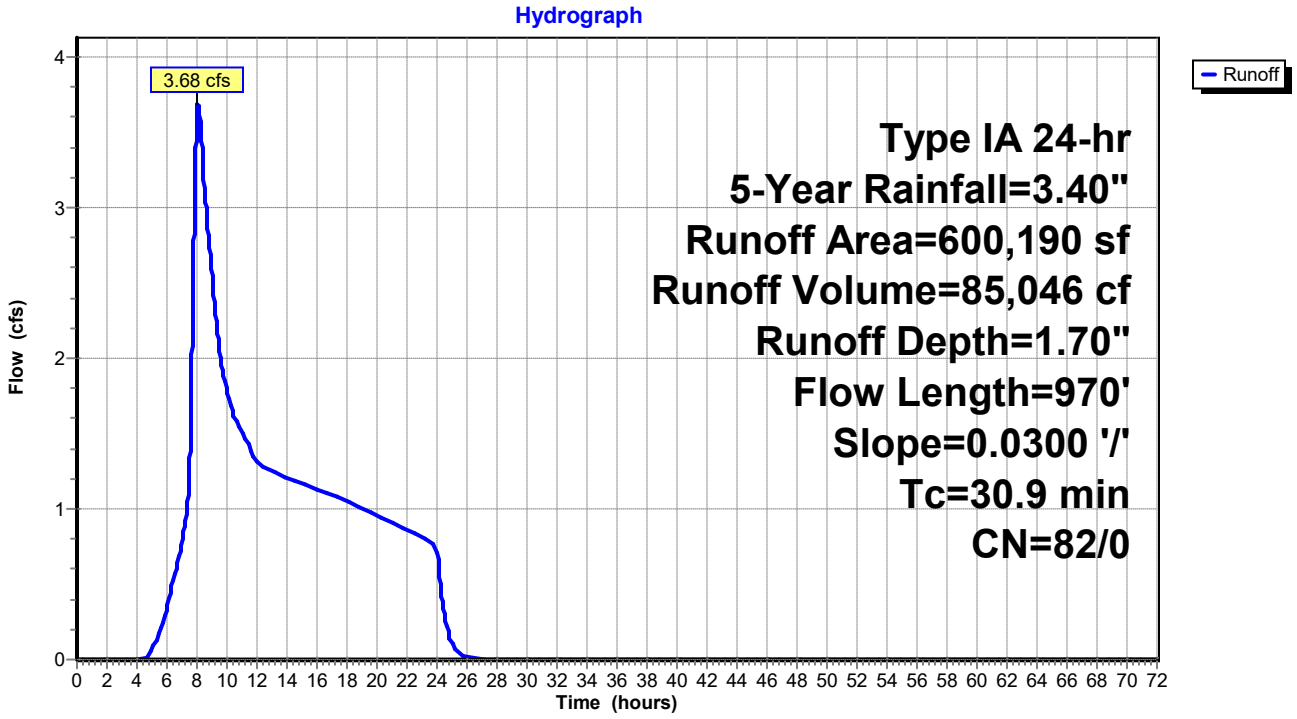
Runoff = 3.68 cfs @ 8.05 hrs, Volume= 85,046 cf, Depth= 1.70"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Rainfall=3.40"

Area (sf)	CN	Description
600,190	82	Row crops, SR + CR, Good, HSG C
600,190	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.7	300	0.0300	0.21		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
7.2	670	0.0300	1.56		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
30.9	970	Total			

Subcatchment ExSB5: Ex Subbasin 5



Summary for Pond Overflow: Overflow Basins

Inflow Area = 3,612,209 sf,100.00% Impervious, Inflow Depth > 5.41" for 5-Year event
Inflow = 62.55 cfs @ 8.00 hrs, Volume= 1,627,273 cf, Incl. 2.60 cfs Base Flow
Outflow = 5.01 cfs @ 24.19 hrs, Volume= 1,094,991 cf, Atten= 92%, Lag= 971.5 min
Primary = 5.01 cfs @ 24.19 hrs, Volume= 1,094,991 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 689.55' @ 24.19 hrs Surf.Area= 186,357 sf Storage= 863,131 cf

Plug-Flow detention time= 1,645.8 min calculated for 1,094,792 cf (67% of inflow)
Center-of-Mass det. time= 986.8 min (2,275.1 - 1,288.4)

Volume	Invert	Avail.Storage	Storage Description
#1	684.00'	760,666 cf	**South Basin (Prismatic)** Listed below (Recalc)
#2	684.00'	806,919 cf	**North Basin (Prismatic)** Listed below (Recalc)
		1,567,585 cf	Total Available Storage

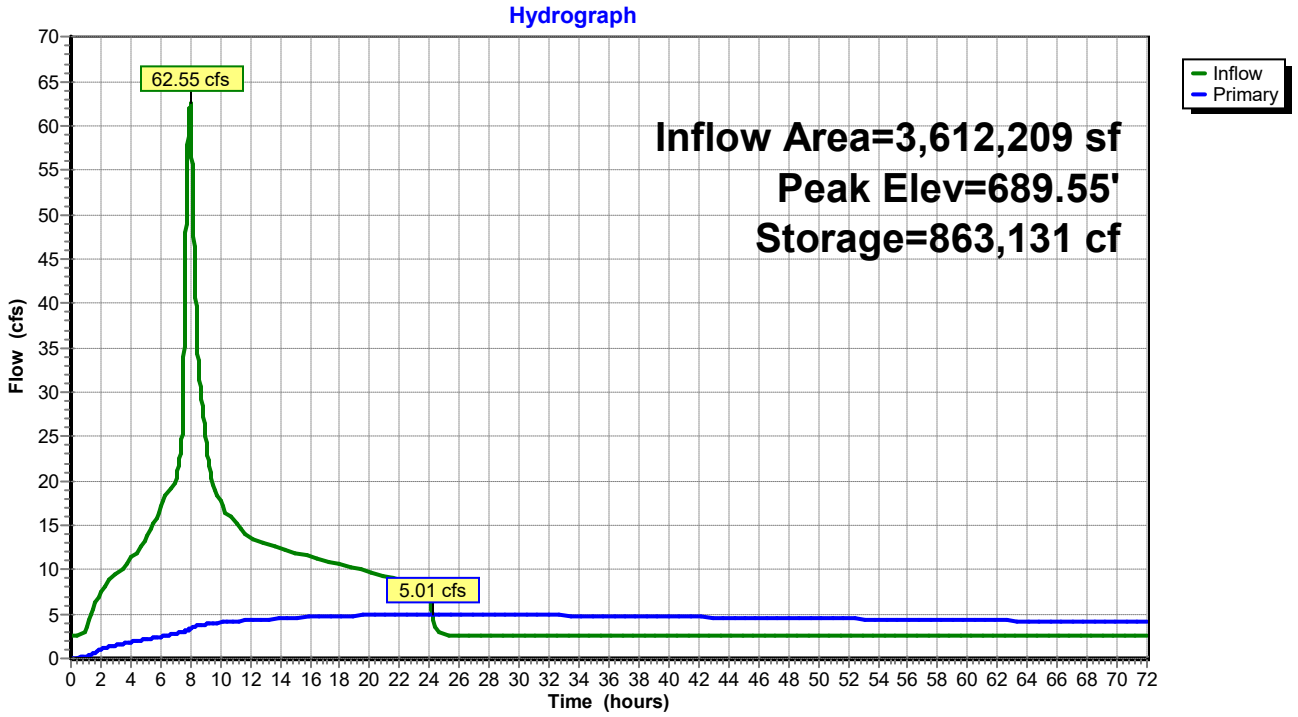
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
684.00	29,903	0	0
685.00	69,069	49,486	49,486
686.00	73,956	71,513	120,999
687.00	78,710	76,333	197,332
688.00	83,799	81,255	278,586
689.00	88,812	86,306	364,892
690.00	93,849	91,331	456,222
691.00	99,018	96,434	552,656
692.00	104,068	101,543	654,199
693.00	108,867	106,468	760,666

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
684.00	66,768	0	0
685.00	72,428	69,598	69,598
686.00	77,062	74,745	144,343
687.00	81,957	79,510	223,853
688.00	86,936	84,447	308,299
689.00	91,978	89,457	397,756
690.00	97,111	94,545	492,301
691.00	102,276	99,694	591,994
692.00	107,483	104,880	696,874
693.00	112,607	110,045	806,919

Device	Routing	Invert	Outlet Devices
#1	Primary	684.00'	**9.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.01 cfs @ 24.19 hrs HW=689.55' (Free Discharge)
1=Orifice/Grate (Orifice Controls 5.01 cfs @ 11.34 fps)

Pond Overflow: Overflow Basins

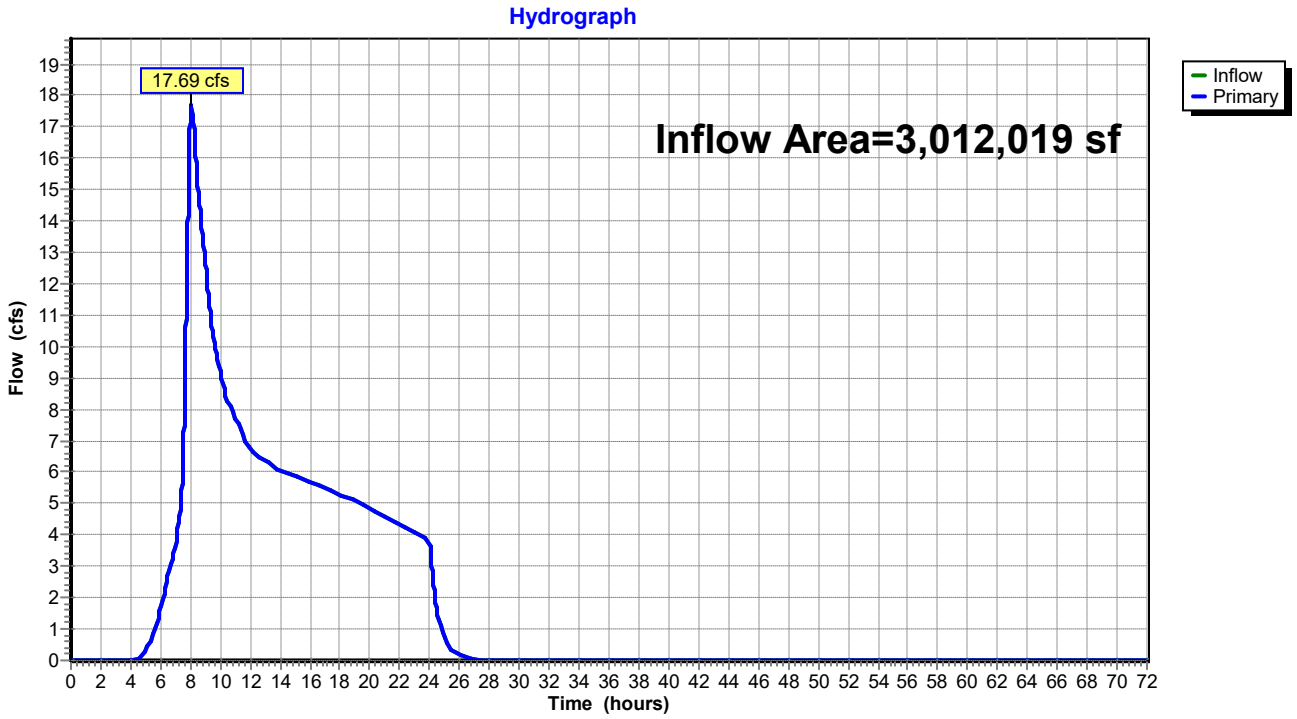


Summary for Link Pre: Pre-Developed Runoff Rate

Inflow Area = 3,012,019 sf, 0.00% Impervious, Inflow Depth = 1.70" for 5-Year event
Inflow = 17.69 cfs @ 8.02 hrs, Volume= 426,801 cf
Primary = 17.69 cfs @ 8.02 hrs, Volume= 426,801 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link Pre: Pre-Developed Runoff Rate



Summary for Subcatchment CONST 1: Construction Area Basin

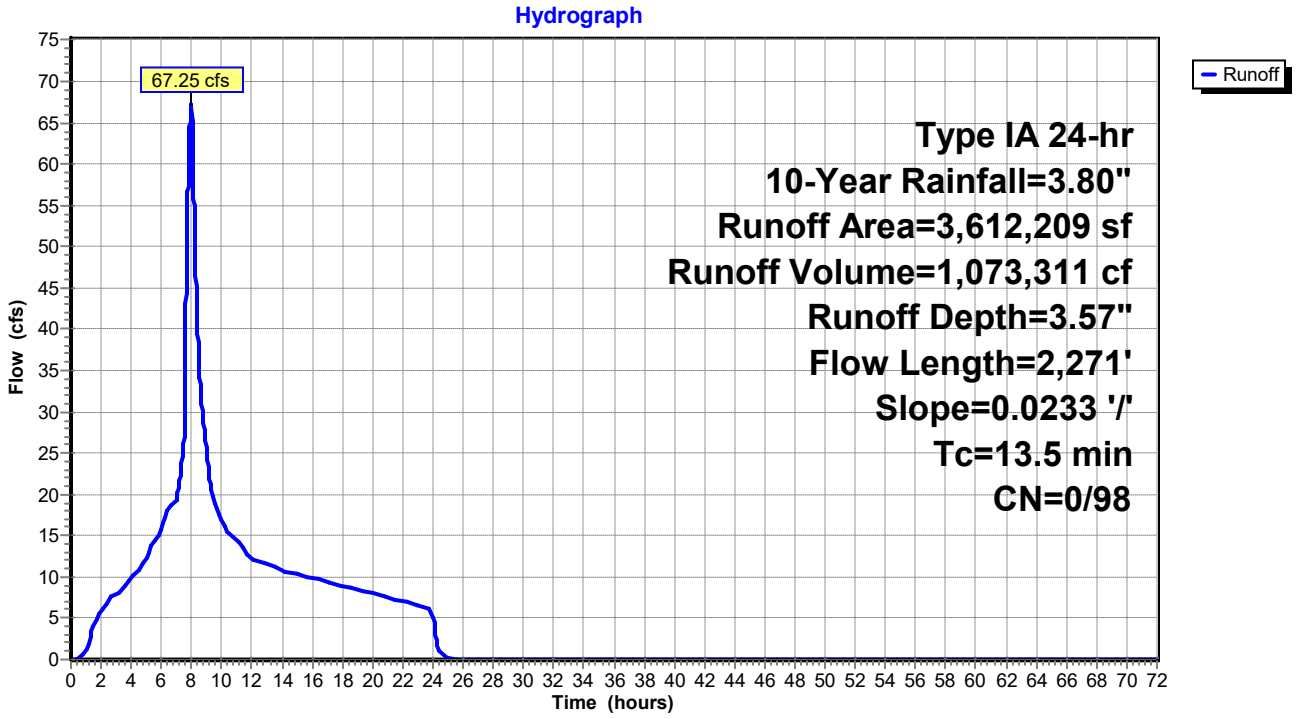
Runoff = 67.25 cfs @ 8.00 hrs, Volume= 1,073,311 cf, Depth= 3.57"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Rainfall=3.80"

	Area (sf)	CN	Description
*	3,612,209	98	Impervious
	3,612,209	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	300	0.0233	1.70		**Sheet Flow, Sheetflow** Smooth surfaces n= 0.011 P2= 2.80"
10.6	1,971	0.0233	3.10		**Shallow Concentrated Flow, Shallow Flow** Paved Kv= 20.3 fps
13.5	2,271	Total			

Subcatchment CONST 1: Construction Area Basin



Summary for Subcatchment ExSB1: Ex Subbasin 1

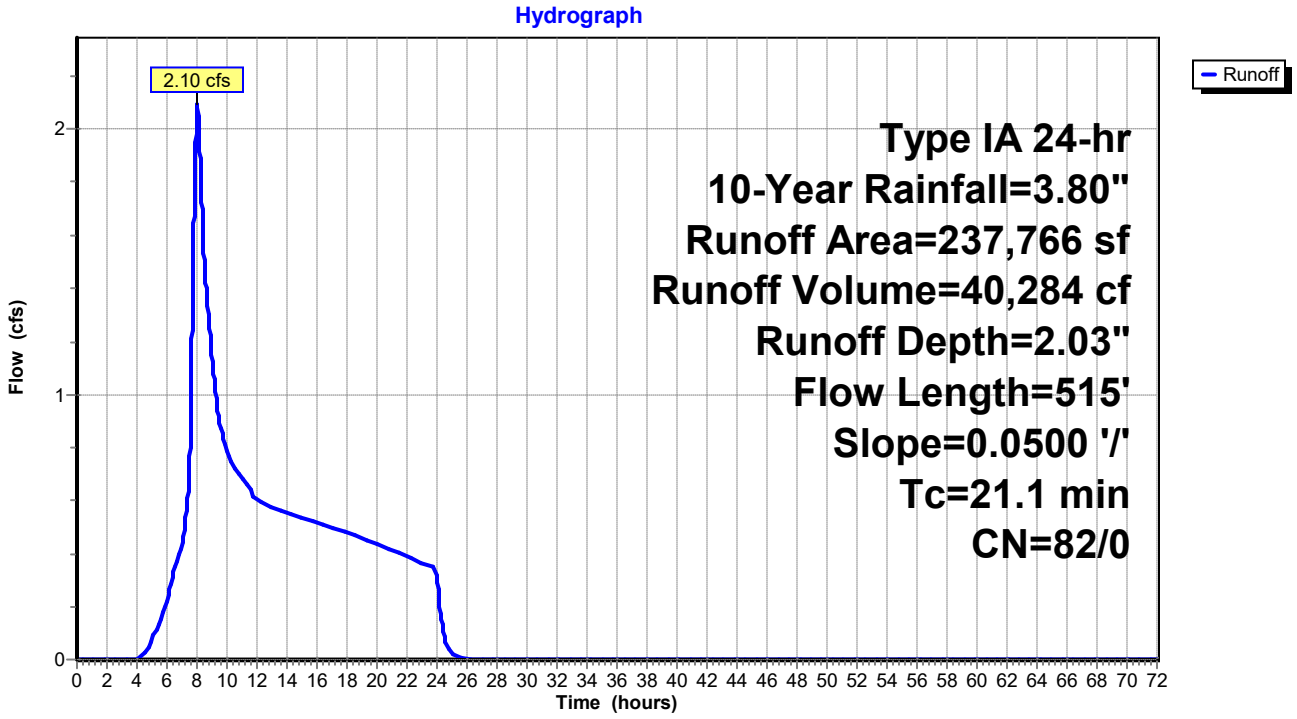
Runoff = 2.10 cfs @ 8.01 hrs, Volume= 40,284 cf, Depth= 2.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Rainfall=3.80"

Area (sf)	CN	Description
237,766	82	Row crops, SR + CR, Good, HSG C
237,766	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	300	0.0500	0.26		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
1.8	215	0.0500	2.01		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
21.1	515	Total			

Subcatchment ExSB1: Ex Subbasin 1



Summary for Subcatchment ExSB2: Ex Subbasin 2

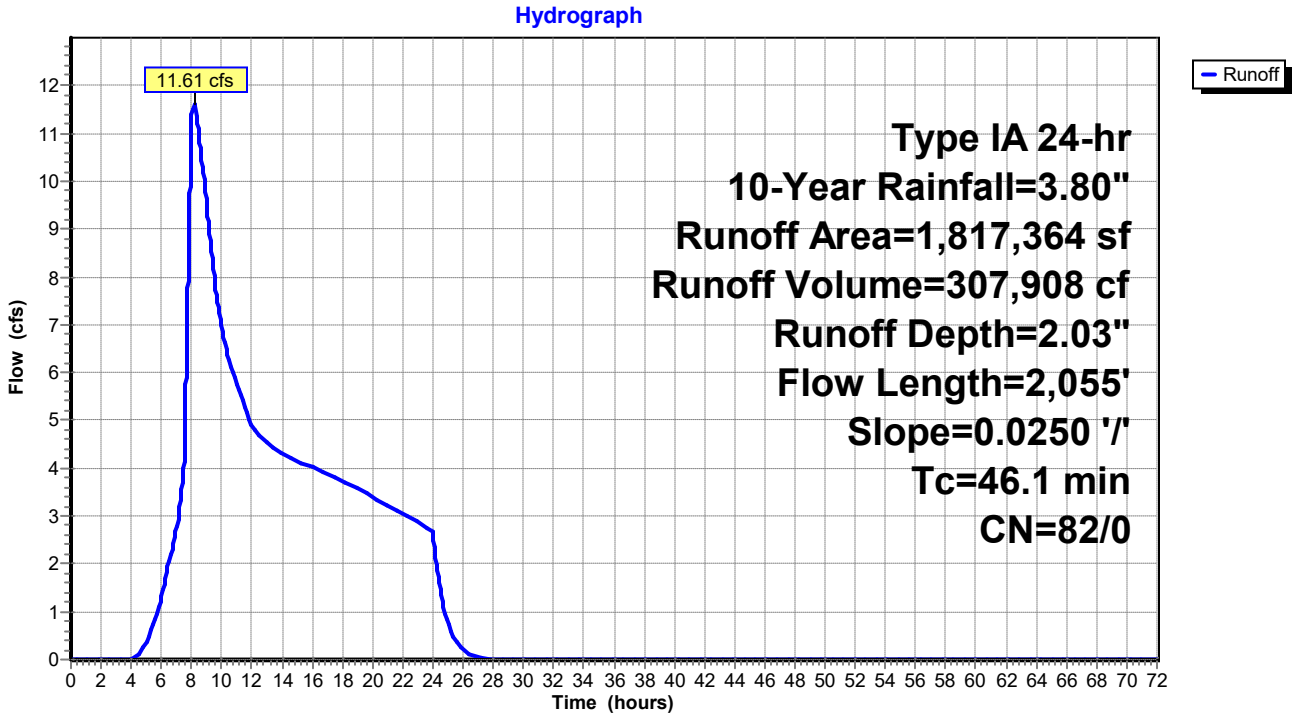
Runoff = 11.61 cfs @ 8.16 hrs, Volume= 307,908 cf, Depth= 2.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Rainfall=3.80"

Area (sf)	CN	Description
1,817,364	82	Row crops, SR + CR, Good, HSG C
1,817,364	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.5	300	0.0250	0.20		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
20.6	1,755	0.0250	1.42		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
46.1	2,055	Total			

Subcatchment ExSB2: Ex Subbasin 2



Summary for Subcatchment ExSB3: Ex Subbasin 3

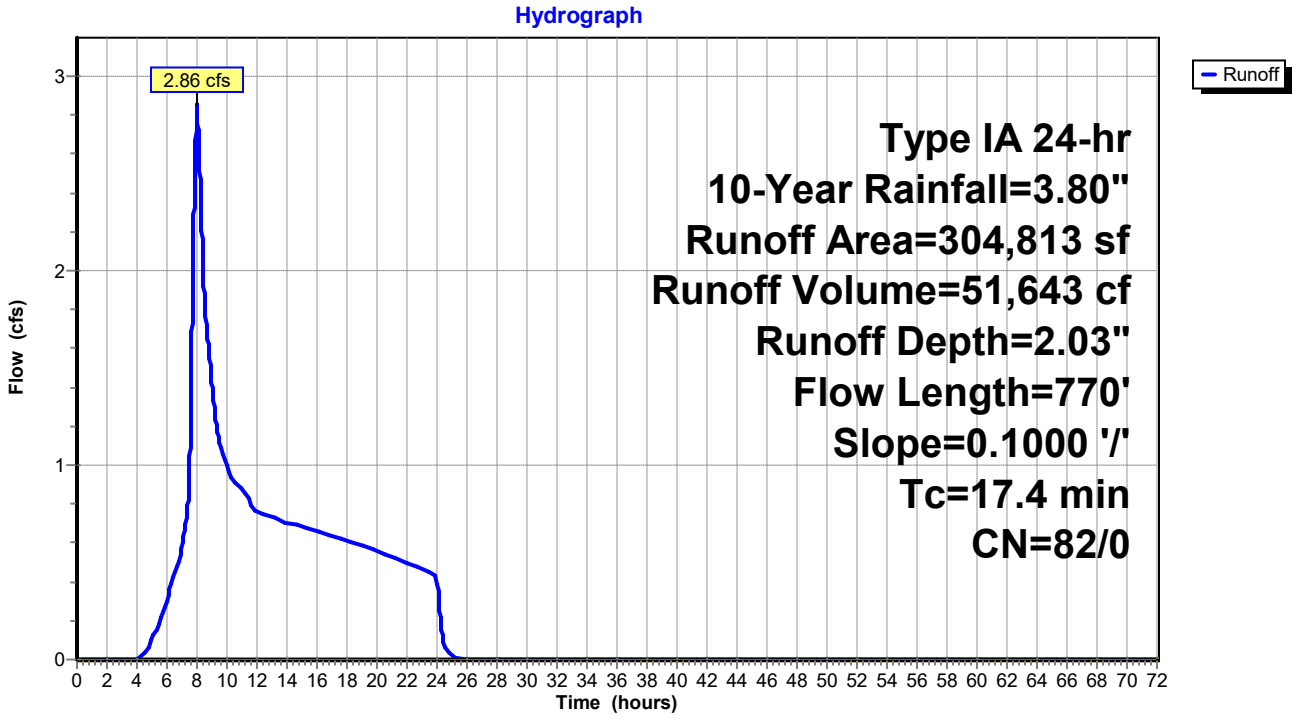
Runoff = 2.86 cfs @ 8.00 hrs, Volume= 51,643 cf, Depth= 2.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Rainfall=3.80"

Area (sf)	CN	Description
304,813	82	Row crops, SR + CR, Good, HSG C
304,813	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	300	0.1000	0.34		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
2.8	470	0.1000	2.85		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
17.4	770	Total			

Subcatchment ExSB3: Ex Subbasin 3



Summary for Subcatchment ExSB4: Ex Subbasin 4

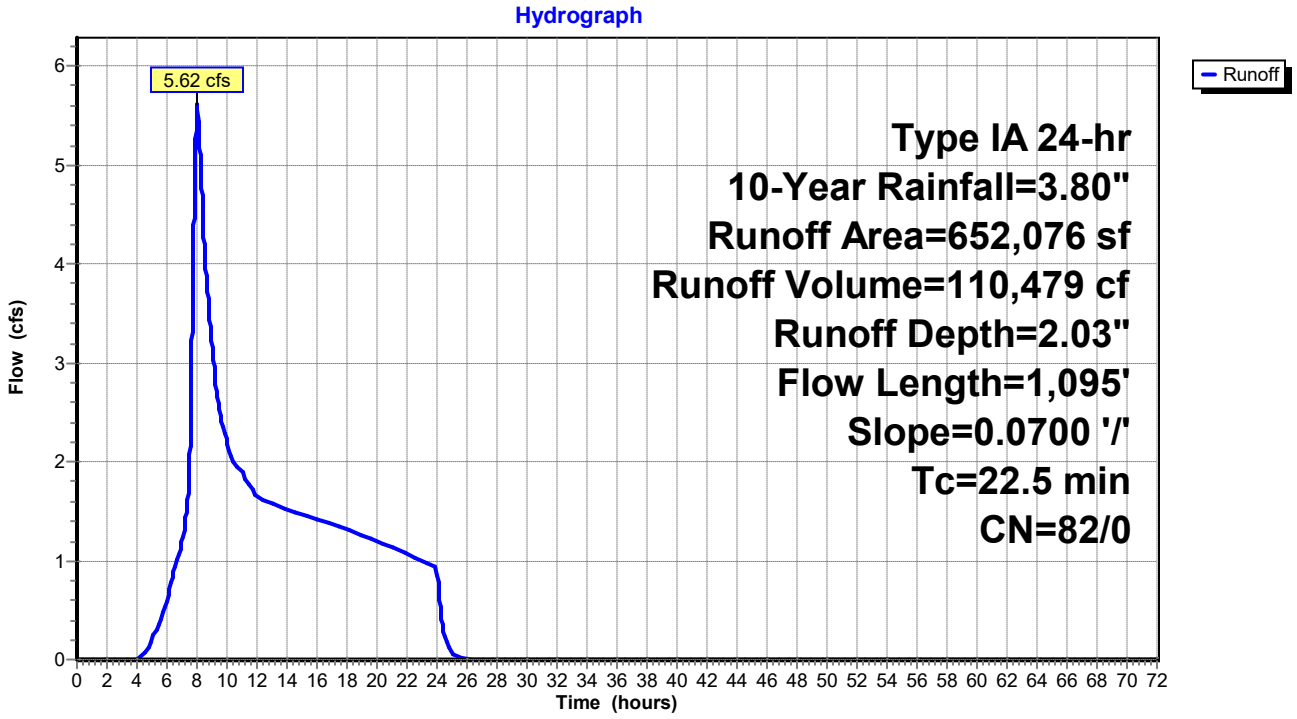
Runoff = 5.62 cfs @ 8.01 hrs, Volume= 110,479 cf, Depth= 2.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Rainfall=3.80"

Area (sf)	CN	Description
652,076	82	Row crops, SR + CR, Good, HSG C
652,076	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	300	0.0700	0.30		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
5.6	795	0.0700	2.38		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
22.5	1,095	Total			

Subcatchment ExSB4: Ex Subbasin 4



Summary for Subcatchment ExSB5: Ex Subbasin 5

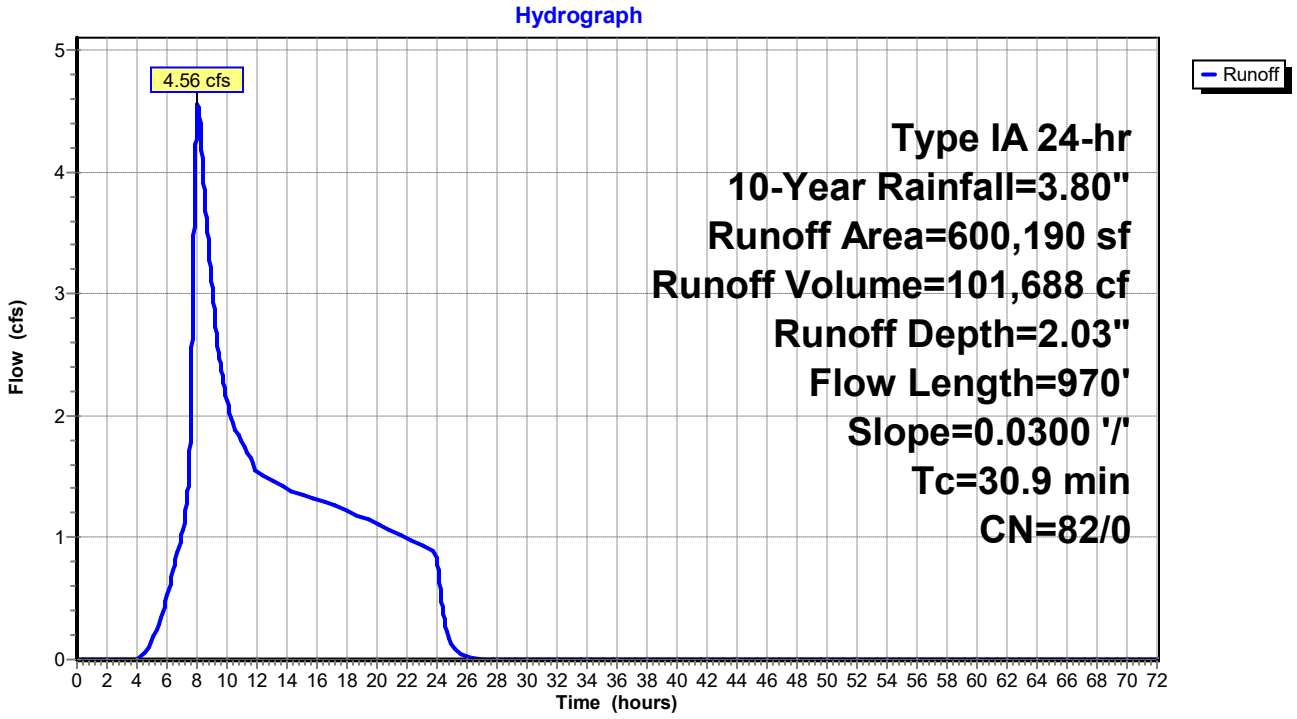
Runoff = 4.56 cfs @ 8.03 hrs, Volume= 101,688 cf, Depth= 2.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Rainfall=3.80"

Area (sf)	CN	Description
600,190	82	Row crops, SR + CR, Good, HSG C
600,190	82	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.7	300	0.0300	0.21		**Sheet Flow, Sheetflow** Cultivated: Residue>20% n= 0.170 P2= 2.80"
7.2	670	0.0300	1.56		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps
30.9	970	Total			

Subcatchment ExSB5: Ex Subbasin 5



Summary for Pond Overflow: Overflow Basins

Inflow Area = 3,612,209 sf,100.00% Impervious, Inflow Depth > 5.80" for 10-Year event
Inflow = 69.85 cfs @ 8.00 hrs, Volume= 1,747,325 cf, Incl. 2.60 cfs Base Flow
Outflow = 5.25 cfs @ 24.19 hrs, Volume= 1,149,930 cf, Atten= 92%, Lag= 971.7 min
Primary = 5.25 cfs @ 24.19 hrs, Volume= 1,149,930 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 690.10' @ 24.19 hrs Surf.Area= 191,973 sf Storage= 967,283 cf

Plug-Flow detention time= 1,679.8 min calculated for 1,149,724 cf (66% of inflow)
Center-of-Mass det. time= 1,031.3 min (2,275.6 - 1,244.3)

Volume	Invert	Avail.Storage	Storage Description
#1	684.00'	760,666 cf	**South Basin (Prismatic)** Listed below (Recalc)
#2	684.00'	806,919 cf	**North Basin (Prismatic)** Listed below (Recalc)
		1,567,585 cf	Total Available Storage

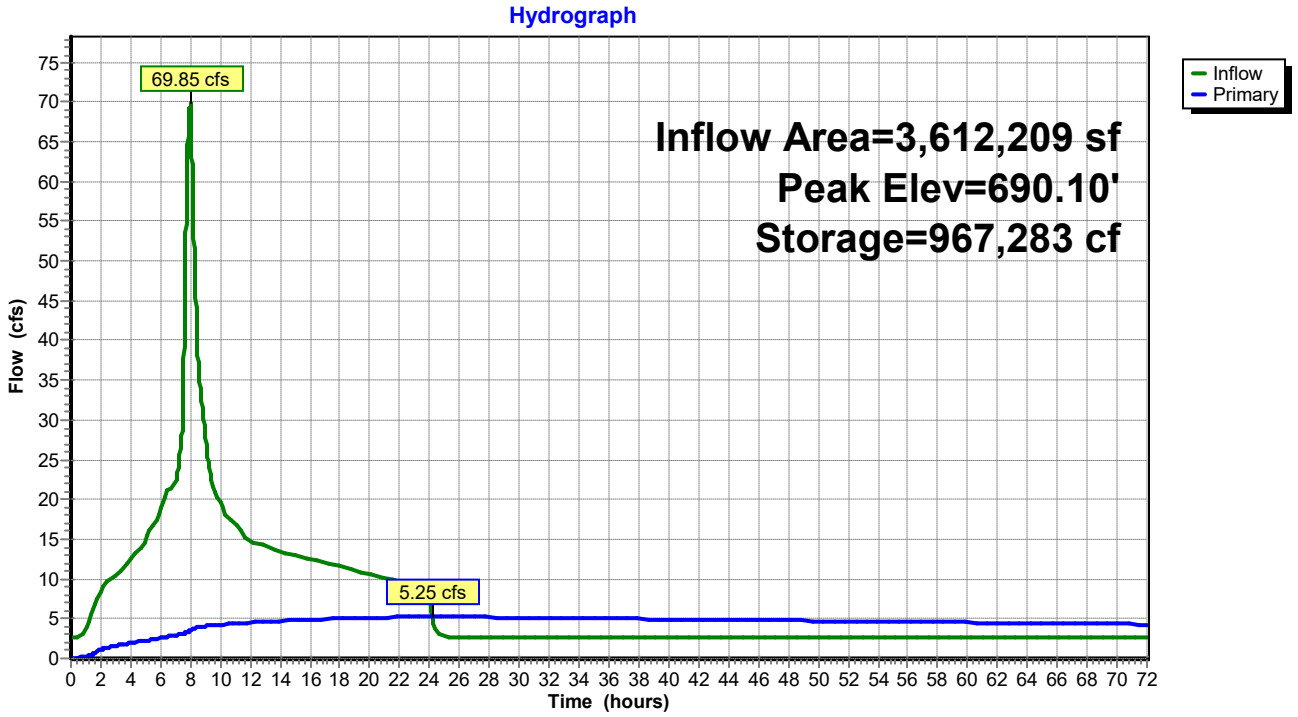
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
684.00	29,903	0	0
685.00	69,069	49,486	49,486
686.00	73,956	71,513	120,999
687.00	78,710	76,333	197,332
688.00	83,799	81,255	278,586
689.00	88,812	86,306	364,892
690.00	93,849	91,331	456,222
691.00	99,018	96,434	552,656
692.00	104,068	101,543	654,199
693.00	108,867	106,468	760,666

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
684.00	66,768	0	0
685.00	72,428	69,598	69,598
686.00	77,062	74,745	144,343
687.00	81,957	79,510	223,853
688.00	86,936	84,447	308,299
689.00	91,978	89,457	397,756
690.00	97,111	94,545	492,301
691.00	102,276	99,694	591,994
692.00	107,483	104,880	696,874
693.00	112,607	110,045	806,919

Device	Routing	Invert	Outlet Devices
#1	Primary	684.00'	**9.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.25 cfs @ 24.19 hrs HW=690.10' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 5.25 cfs @ 11.89 fps)

Pond Overflow: Overflow Basins

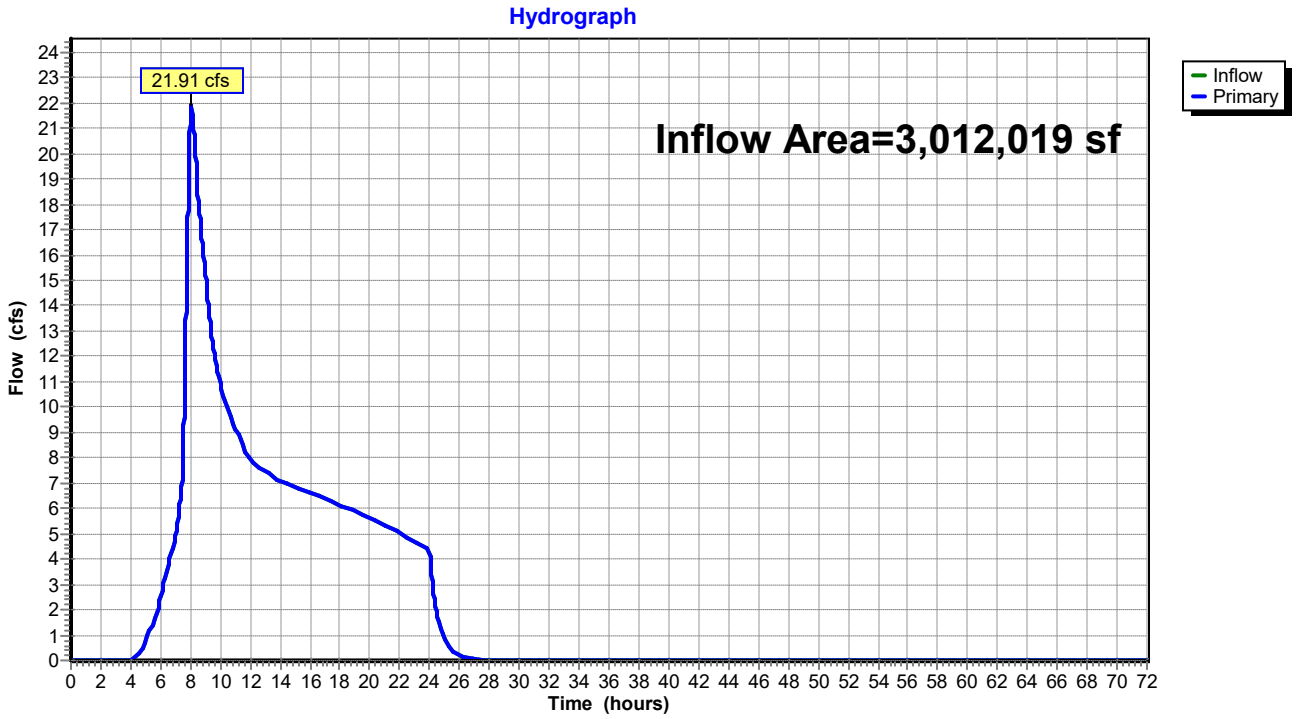


Summary for Link Pre: Pre-Developed Runoff Rate

Inflow Area = 3,012,019 sf, 0.00% Impervious, Inflow Depth = 2.03" for 10-Year event
Inflow = 21.91 cfs @ 8.01 hrs, Volume= 510,314 cf
Primary = 21.91 cfs @ 8.01 hrs, Volume= 510,314 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link Pre: Pre-Developed Runoff Rate



Attachment C: Groundwater Seepage Estimates

Preliminary Groundwater Seepage Quantity Estimates (May 10, 2022)

Delve Underground Email (March 2, 2023)

Technical Memorandum

To:	Mark Graham, P.E., Stantec	Project:	Bull Run Filtration Facility
From:	Yuxin (Wolfe) Lang, P.E. G.E.	cc:	Jonathan Holland (Brown and Caldwell)
Prepared by:	Todd LaVielle P.E.	Job No.:	6084 Task 3.3.7
Date:	May 10, 2022		
Subject:	Preliminary Groundwater Seepage Quantity Estimates		

This Technical Memorandum (TM) presents the preliminary groundwater seepage estimates for excavation dewatering. This TM was prepared by McMillen Jacobs Associates (McMillen Jacobs) for the Bull Run Filtration Facility project. The findings from the Geotechnical Test Excavation (test pit excavation) revealed that the groundwater seepage rates during excavations on site will be highly influenced by the erratic distribution of the underground fissures/cracks and recharge from the precipitations. These baseline dewatering estimates were developed at the request of the design team.

A technical memorandum was prepared providing observations of Test Excavation performed in early December 2021. The TM is included as Attachment H to the Geotechnical Engineering Report (GER) (McMillen Jacobs, 2021). The GER provided geotechnical recommendations and further discussion of the groundwater conditions (McMillen Jacobs, 2022). The Geotechnical Data Report (GDR) was prepared summarizing the geotechnical surface investigations performed for the project. Note that the GDR was released prior to the completion of Geotechnical Test Excavation and does not include the findings made from the excavation.

The construction of the facility will include three primary excavations: the Finished Water Clearwell, the Treatment Process Complex and the Overflow Basin. Due to the similarity in the sizes of excavation and the roughness of the preliminary estimates, the seepage rate for each excavation is anticipated to be roughly on the same order of magnitude. The seepage rate estimates presented here assume that the excavations will be constructed with open cut method and excavation dewatering will be performed by continuous sump pumping within the footprint of the excavation. The preliminary seepage rate estimates considered three dewatering scenarios:

1. Dry season steady-state groundwater seepage rate: 100 gpm/excavation

2. Wet season steady-state groundwater seepage rate: 300 gpm/excavation

3. Wet season groundwater seepage rate if no prior dewatering is performed: 1000 to 2000 gpm/excavation during the first 2 weeks then diminishing to 300 gpm/excavation.

The dry season steady-state seepage rate was established using a simplified 2D numerical groundwater model. Soil unit thicknesses and groundwater level were estimated based on available subsurface information. Hydraulic conductivity was estimated based on slug-testing in a standpipe install at boring FF-B-203 (McMillen Jacobs 2021). For this scenario, we assume that the excavation will be conducted in the mid-summer and early fall (July to early October) where the groundwater level is lowest. Under this scenario, groundwater seepage will mainly be the steady-state flow from the water bearing Sensitive Saprolite layer, and the concentrated flows from the ground fissures/cracks will be minimum and dissipate quickly. The peak flow from this scenario may be on the order of a few hundred gallons per minutes, but will diminished quickly (within a couple of days or less) to the steady-state seepage rate.

The second scenario assumes the excavation was conducted during the dry season and the dewatering measures have been installed and operational for a several weeks (and reached steady state flow in the first scenario) to control the groundwater seepage. The wet season steady-state seepage rate is estimated based on the same 2D numerical model; however, the groundwater level is increased to represent the groundwater conditions during the wet season.

For the third scenario, groundwater stored in the erratic fissures/cracks in the wet season will increase the initial groundwater seepage rate (peak flow) drastically as the excavation proceeds down to the Sensitive Saprolite layer. The wet season groundwater seepage rate was estimated by scaling up the groundwater seepage rate observed during the Geotechnical Test Excavation. Because the groundwater flow direction in the ground fissures/cracks is expected to be primarily horizontal, the seepage rate was scaled based on the perimeter of the excavation. The Test Excavation dimension at the contact between Residual soil and Sensitive Saprolite (Sensitive Saprolite is considered the water bearing unit and the ground fissures/cracks and heavy groundwater flows were observed here) was approximately 23 feet by 23 feet. The groundwater flow rate (peak flow condition) during Test Excavation was roughly measured as 120 gpm. The Clearwell excavation is approximately 270 feet wide by 420 feet long at the contact between Residual soil and Sensitive Saprolite, or 15 time larger. Based on this approximation the initial groundwater seepage rate (peak flow rate) for the Clearwell is estimated as 1,700 gpm. Some dewatering of the Sensitive Saprolite will occur as the excavation progresses. Therefore, the estimated seepage rate will be on the order of 1000 to 2000 gpm.

For the steady-state seepage rate of the third scenario, because the site is located at the highest point in the area and not adjacent any major bodies of water recharge to the Sensitive Saprolite aquitard is expected to be from rainfall. Recharge, and therefore dewatering, is limited to the volume of water falling as precipitation. This reasoning can be used to calculate a theoretical maximum daily dewatering volume. The following calculation is made assuming 50% of rainfall infiltrates to the Sensitive Saprolite aquitard. The daily precipitation data from a NOAA rainfall gauge located in Boring indicated that 12-inches of precipitation fell during the wettest 30-day-period in the last 5 years. If the 6-inchs of infiltrated rainfall over the 84 acre site, about 13.7 million gallons, is dewatered over 30 days the required flowrate is 317gpm.

The preliminary groundwater seepage assessments above present our approach and logic, and are approximate in nature. They are based on the current geotechnical exploration and Test Excavation programs. We understand that the CMGC Contractor has proposed drilling some large diameter exploratory holes with dewatering wells and pump tests. In our opinion, the proposed tests will help to

refine and update the groundwater seepage rates and will help to narrow down the dewatering construction estimates, as well as the contingencies.

References

McMillen Jacobs Associates (McMillen Jacobs). 2021. *Geotechnical Data Report, Bull Run Treatment Projects, Filtration Facility, Portland*, Oregon, October 21, 2021.

McMillen Jacobs Associates (McMillen Jacobs). 2022. *Geotechnical Engineering Report, Bull Run Treatment Projects, Filtration Facility, Portland*, Oregon, March 11, 2022.

From: Miles, Laura <miles@delveunderground.com>
Sent: Thursday, March 2, 2023 10:40 AM
To: Phelps, Brad <Brad.Phelps@jacobs.com>; Jon Holland <JRHolland@BrwnCald.com>
Cc: Havekost, Mark D. <Havekost@mcmjac.com>; Hakes, Lyda <Lyda.Hakes@portlandoregon.gov>; Hogan, Dan (Dan.Hogan@portlandoregon.gov) <dan.hogan@portlandoregon.gov>; Bowker, Christopher (Christopher.Bowker@portlandoregon.gov) <christopher.bowker@portlandoregon.gov>
Subject: RE: Groundwater / Dewatering

For the permit, assuming we do not have a water tight shaft and are planning on a dewatering system only
We estimate 250 gpm wet season (Nov-Apr) and
75 gpm dry season (May-Oct) at the shaft location.

Respectfully,

Laura Miles PE*, DBIA
Principal Engineer

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