

**Pump Calculation**

**For**

**8456 SE 40<sup>TH</sup> ST**

**MERCER ISLAND WA 98040**



6/8/2024

25-year imperious area storm water runoff flow rate: 0.104 cfs

(please see the 25-year MGS Flood run off output)

$$1 \text{ cfs} = 448.8 \text{ gpm}$$

$$\text{Conver to gallon per minute} = 448.8 \times 0.104 = 46.6 \text{ gpm}$$

Require pump head: 8' per plan.

Calculate 10' > 8', 48 gmp. OK

### Size a Pump

CLIENT: ZHENG	COUNTY: King	DATE: 6/9/24
DSN BY: Steve Wu	CHK BY: Ly Cong	6/8/2024
COMMENTS:		

Elevation at Highest Point	328.0	ft
Elevation at Low Point	321.0	ft



#### DISCHARGE PIPE

Discharge Pipe Length	10.0	ft
Equivalent Length of Pipe Fittings	8.0	ft (see tables) =====>
Discharge Pipe Inside Diameter	2.00	in
Hazen-Williams Roughness, C	130	=====>

Other Losses	2.0	ft
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See first page calculation for Friction and Velocity head losses

Static Head	8.0	ft
Total Discharge Pipe Length	10.0	ft (includes equivalent length of fittings)

Hazen-Williams	
Material	C
Brass	130
Cast Iron	100
Concrete	100
Copper	130
Fiberglass	150
PE, no joints	150
PVC	130
Steel, Smooth	100
Steel, Spiral	90
Steel, CMP	60

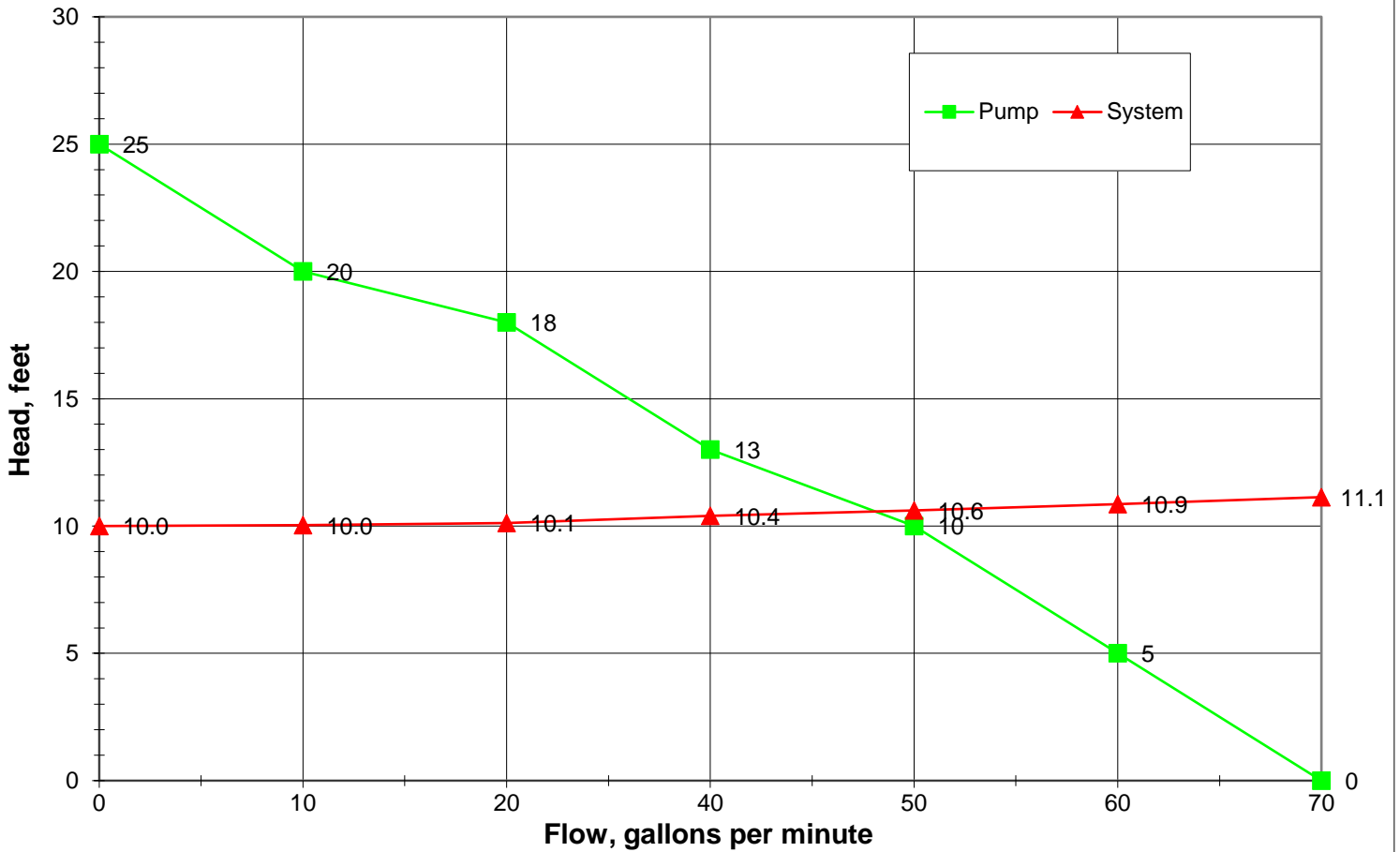
Pump Manufacturer	Liberty
Pump Model #	PC457 1/2 hp

Pump Curve		System Curve	
Flow GPM	Pump Head, ft	Flow GPM	System Head, ft
0	25	0	10.0
10	20	10	10.0
20	18	20	10.1
40	13	40	10.4
50	10	50	10.6
60	5	60	10.9
70	0	70	11.1

Head at Operating Point	10.5	ft (Intersection of curves from graph below)
Flow at Operating Point	48	gpm (Intersection of curves from graph below)
	0.107	cfs
Operating Velocity	4.9	feet/sec
Operating Pressure	4.6	psi

Note: Velocity will increase as static head pressure (acting against the pump) decreases

### Pump & System Curves



#### POWER REQUIREMENTS

Hydraulic Power

0.1	WHP
0.1	WkW

(net energy transferred to the fluid)  
(net energy transferred to the fluid)

Installed Pump Efficiency  
Brake Power

70.0	%
0.2	bHP
0.1	bkW

(see manufacturer's efficiency curves)  
(power delivered by the motor to the pump)  
(power delivered by the motor to the pump)

Motor Efficiency  
Motor Input Power

70.0	%
0.3	HP
0.2	kW

#### COST OF ELECTRICITY

Cost per kW-hr  
Hours used  
Total Cost

\$0.200	Dollars
1.0	Hours
\$0.04	Dollars

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# MGS FLOOD PROJECT REPORT

**Program Version: MGSFlood 4.52**  
**Program License Number: 456210003**  
**Project Simulation Performed on: 06/09/2024 8:15 PM**  
**Report Generation Date: 06/09/2024 8:15 PM**

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Input File Name: Detention Flow.fld  
Project Name: Mercer Island 8456  
Analysis Title: Detention Flow Rates  
Comments:

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## PRECIPITATION INPUT

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Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected  
Climatic Region Number: 32

Full Period of Record Available used for Routing  
Precipitation Station : 99003805 Seattle 38 in\_5min 10/01/1939-10/01/2097  
Evaporation Station : 991038 Seattle 38 in MAP  
Evaporation Scale Factor : 0.750

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

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

## \*\*\*\*\* WATERSHED DEFINITION \*\*\*\*\*

### Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	0.269	0.269
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	0.269	0.269

## -----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

----- Subbasin : Subbasin 1 -----  
-----Area (Acres) -----  
Till Grass 0.231  
Impervious 0.038  
-----  
Subbasin Total 0.269

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

----- Subbasin : Subbasin 1 -----	
	-----Area (Acres) -----
Till Grass	0.181
Impervious	0.088
-----	
Subbasin Total	0.269

\*\*\*\*\* LINK DATA \*\*\*\*\*

-----SCENARIO: PREDEVELOPED

Number of Links: 0

\*\*\*\*\* LINK DATA \*\*\*\*\*

-----SCENARIO: POSTDEVELOPED

Number of Links: 1

-----  
**Link Name: New Infiltr Trench Lnk1**

Link Type: Infiltration Trench

Downstream Link: None

Trench Type : Trench on Embankment Sideslope  
Trench Length (ft) : 300.00  
Trench Width (ft) : 0.09  
Trench Depth (ft) : 4.00  
Trench Bottom Elev (ft) : 100.00  
Trench Rockfill Porosity (%) : 30.00

Hydraulic Conductivity (in/hr) : 6.00  
Massmann Regression Used to Estimate Hydralic Gradient  
Depth to Water Table (ft) : 100.00  
Bio-Fouling Potential : Low  
Maintenance : Average or Better

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

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

Number of Links: 1

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

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

Total Predeveloped Recharge During Simulation	
Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	21.049
<b>Total:</b>	<b>21.049</b>

Total Post Developed Recharge During Simulation	
Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	16.739
Link: New Infiltration Trench Ln	80.074
<b>Total:</b>	<b>96.814</b>

**Total Predevelopment Recharge is Less than Post Developed Average Recharge Per Year, (Number of Years= 158)**  
**Predeveloped: 0.133 ac-ft/year, Post Developed: 0.613 ac-ft/year**

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

-----**SCENARIO: PREDEVELOPED**

Number of Links: 0

-----**SCENARIO: POSTDEVELOPED**

Number of Links: 1

\*\*\*\*\* Link: New Infiltration Trench Lnk1 \*\*\*\*\*

Infiltration/Filtration Statistics-----  
 Inflow Volume (ac-ft): 80.07  
 Inflow Volume Including PPT-Evap (ac-ft): 80.07  
 Total Runoff Infiltrated (ac-ft): 80.07, 100.00%  
 Total Runoff Filtered (ac-ft): 0.00, 0.00%  
 Primary Outflow To Downstream System (ac-ft): 0.00  
 Secondary Outflow To Downstream System (ac-ft): 0.00  
 Percent Treated (Infiltrated+Filtered)/Total Volume: 100.00%

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

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Link: New Infiltration Trench Lnk1

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

Recurrence Interval Computed Using Gringorten Plotting Position

Development Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	4.319E-02	2-Year	0.000
5-Year	6.474E-02	5-Year	0.000
10-Year	8.505E-02	10-Year	0.000
25-Year	0.104	25-Year	0.000
50-Year	0.116	50-Year	0.000
100-Year	0.134	100-Year	0.000
200-Year	0.144	200-Year	0.000
500-Year	0.158	500-Year	0.000

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

\*\*\*\* **Flow Duration Performance** \*\*\*\*

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	0.0%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	0.0%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	0.0%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

-----  
 MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS  
 -----

\*\*\*\* **LID Duration Performance** \*\*\*\*

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	0.0%	PASS
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	0.0%	PASS

-----  
 MEETS ALL LID DURATION DESIGN CRITERIA: PASS  
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# PC 441-10A-Series

Sump Pump Combo Series

# Liberty Pumps®

A Family and Employee Owned Company

Pre-assembled primary pump and battery back-up system

Compact design

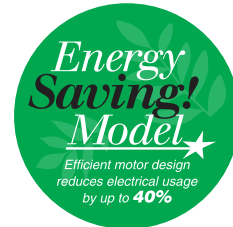
Drop-in-the-pit ready

## Features

- Provides uninterrupted pumping in the event of power outage or main pump failure
- Fully assembled
- Primary pumps available in 1/3 or 1/2 hp
- Ready to connect to 1-1/2" discharge
- 12-Volt battery operated
- Compact profile will fit minimum 15" diameter and 18" deep sump pits
- System includes separate check valves for both primary and back-up pumps
- Model 441-10A back-up system includes:
  - 10A Battery charger and maintainer, with integrated back-up pump controls
  - Meets US DOE and California CEC energy efficiency standards
  - Self-resetting 24 hour silence
  - Audible and visual alarm warns of back-up pump operation
  - Battery voltage display on charger

## Models

PC237-441-10A	1/3 hp (Model 237 and 441-10A)
PC257-441-10A	1/3 hp (Model 257 and 441-10A)
PC457-441-10A	1/2 hp (Model 457 and 441-10A)
PCS37-441-10A	1/3 hp (Model S37 and 441-10A)
PCS37-P-441-10A	1/3 hp (Model S37-P and 441-10A)



Battery not included



innovate. evolve.

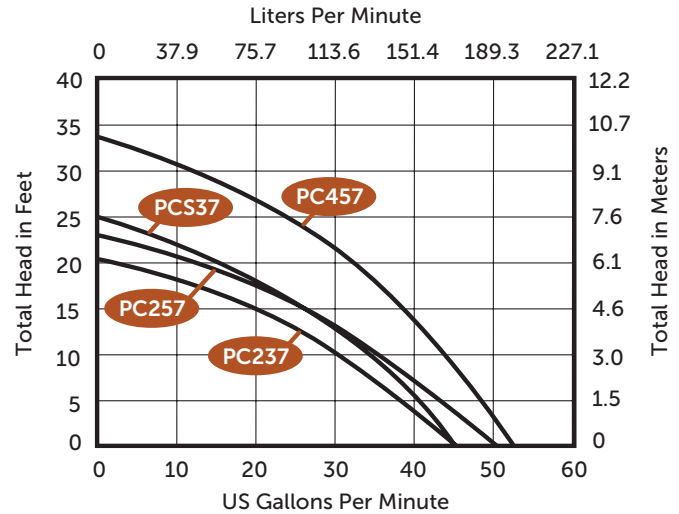
# PC441-10A-Series

## Included in Complete System

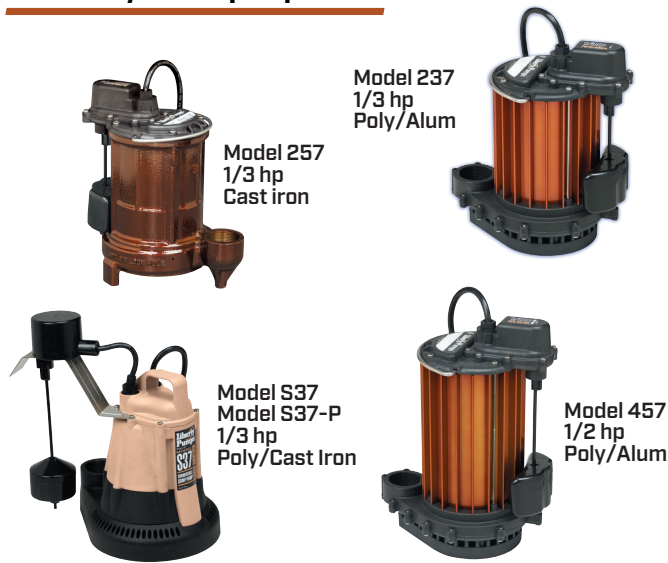
- Primary Pump, 115V
- 441-10A Back-up pump, 12 VDC
- 1-1/2" PVC piping with rubber coupler between primary pump and back-up pump (rubber coupler provides easy removal and serviceability of back-up pump)
- Check valve included on primary pump and back-up pump
- Completely assembled
- Maximum fluid temperature 140°F
- Battery not included. 12-Volt marine-type deep cycle battery recommended. (Charger compatible with Group 27 or 31, AGM, Gel, and Wet cell batteries)

For optimum performance, Liberty Pumps StormCell® batteries recommended

## Primary Pump Performance Curve

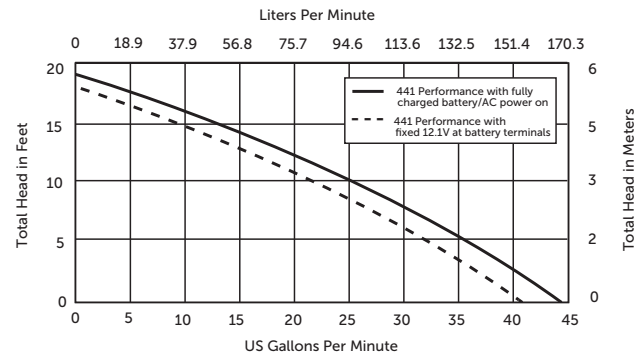


## Primary Pump Options



## Back-Up Pump Performance Curve

Model 441-10A



## Models and Specifications

MODELS	DESCRIPTION	PRIMARY PUMP	BACK-UP PUMP	BATTERY CHARGER	WEIGHT IN LBS
PC237-441-10A	1/3 hp (Model 237 and 441-10A)	115V, 5.2A	12 VDC	10A	27
PC257-441-10A	1/3 hp (Model 257 and 441-10A)	115V, 5.2A	12 VDC	10A	39
PC457-441-10A	1/2 hp (Model 457 and 441-10A)	115V, 7.3A	12 VDC	10A	32
PCS37-441-10A	1/3 hp (Model S37 and 441-10A)	115V, 6.2A	12 VDC	10A	30
PCS37-P-441-10A	1/3 hp (Model S37-P and 441-10A)	115V, 6.2A	12 VDC	10A	30

8' Cord length. Minimum pit size for all above systems 15" diameter x 18" depth

For complete primary pump specifications see appropriate 230-Series, 250-Series, 450-Series or S30-Series literature.

For complete back-up pump specifications see Model 441 literature.