SIZING GUIDELINES

For New or Replacement Sewage Pumps

Sump and Sewage Pump Manufacturers Association

Deron Oberkorn
derono@Zoeller.com

SSPMA

Sump and Sewage Pump Manufacturers Association

Since 1956, we are a North American trade organization of sump, effluent, and sewage pump manufacturers and their suppliers.

Working together to:

- train wastewater and plumbing professionals, and
- create product performance and safety standards.

SSPMA members collaborate with each other and government regulators to educate consumers and professionals on the latest products, their application, proper sizing techniques, safe installation and use, and good maintenance practices.

SSPMA MEMBERS

Barnes Pumps / Crane Pumps & Systems

Champion Pump Company, Inc.

Eco-Flo Products Inc. / Ashland Pump Company

Franklin Electric / Little Giant

Goulds Water Technology, a xylem brand

GP Enterprises Co., Ltd.

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John Crane, Inc.

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See Water, Inc.

SJE-Rhombus

Topp Industries, Inc.

Pumps bearing the "SSPMA-Certified" seal have been tested by the member manufacturer in accordance with SSPMA Industry Standards.

The Standards are designed to provide accurate performance data for sump, effluent and sewage pumping equipment, to assist in their proper application and selection.

CONTENTS

- **Pump Capacity** How much flow do you need?
- **Total Dynamic Head (TDH)** of the installation
- **Solids-Handling** Requirements
- **Basin** Selecting the right size
- **Simplex or Duplex** System?
- **Sizing Example**

PUMP CAPACITY

- Refers to the rate of flow in **gallons per minute (GPM)** which is necessary to efficiently maintain the system.

- Most practical approach to determine this figure is the **Fixture Unit method**. This method assigns a relative value to each fixture, or group of fixtures that flow into the pump system.

Pump Capacity

To determine the required
PUMP CAPACITY,
follow these 2 steps:

Step 1: Determine Total Fixture Units

Step 2: Find resulting Pump Capacity

Step 1

List all fixtures involved in the installation and, using Figure A, assign a Fixture Unit value to each. Determine the **Total Fixture Units**.

Fixture Description	Fixture Unit Value	Fixture Description	Fixture Unit Value
Bathtub, 1 1/2" trap	2	Sink, service type	3
Bathtub, 2" trap	3	Sink, scullery	4
Bidet, 1 1/2" trap	3	Sink, surgeons	3
Dental unit or cuspidor	1	Swimming pool (per 1000 gal)	1
Drinking fountain	1	Urinal	4**
Dishwasher, domestic	2	Washing machine	2
Kitchen sink	2	Water closet	3**
Kitchen sink with disposal	3	Water softener	4
Lavatory, 1 1/2" trap	1	Unlisted fixture, 1 1/4" trap	2
Lavatory, barber/beautician	2	Unlisted fixture, 1 1/2" trap	3
Laundry tray	2	Unlisted fixture, 2" trap	4
Shower	2	Unlisted fixture, 2 1/2" trap	5
Shower, group (per head)	3	Unlisted fixture, 3" trap	6
Bathroom group consisting of lavatory, bathtub or shower, and water closet			6**

*Graph data taken from ASPE Handbook, Uniform Plumbing Code, Cameron Hydraulic Data and Plastic Pipe Institute.

** Add 4 fixture units for each flush valve fixture

PUMP CAPACITY

FIGURE A

Step 2

- Refer to Figure B, locate the total Fixture Unit amount along the horizontal axis of the graph. Follow vertically along until the intersecting plotted line. Follow this intersection point horizontally and read the PUMP CAPACITY in GPM on the vertical axis.

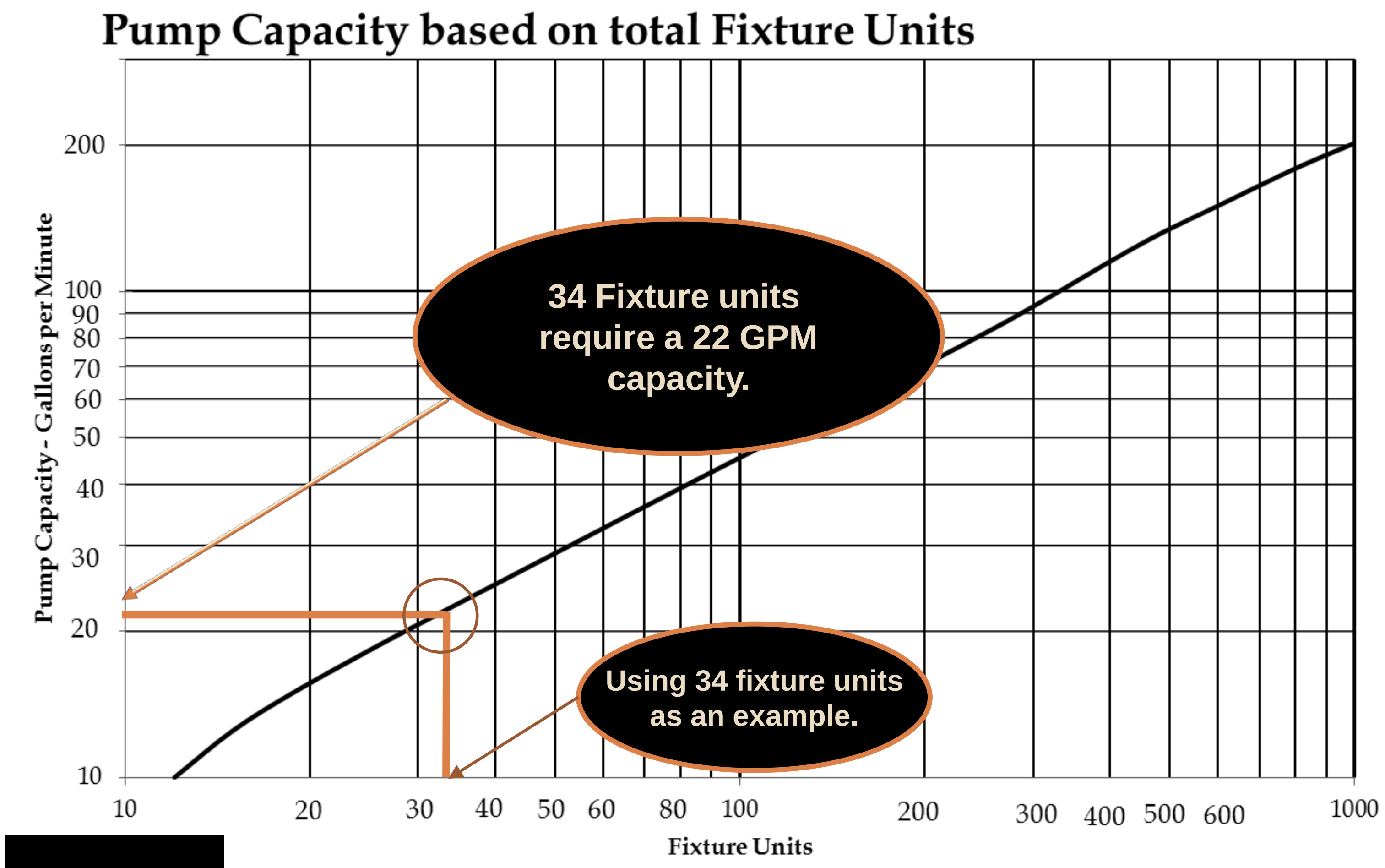


FIGURE B

TOTAL DYNAMIC HEAD (TDH)

TDH is a combination of **Static Head** and **Friction Head** and is expressed in feet.

TDH = Static Head + Friction Head

- **Static Head** is the actual vertical distance measured from the minimum water level in the BASIN to the point of discharge.
  Refer to Figure C.

Static Head

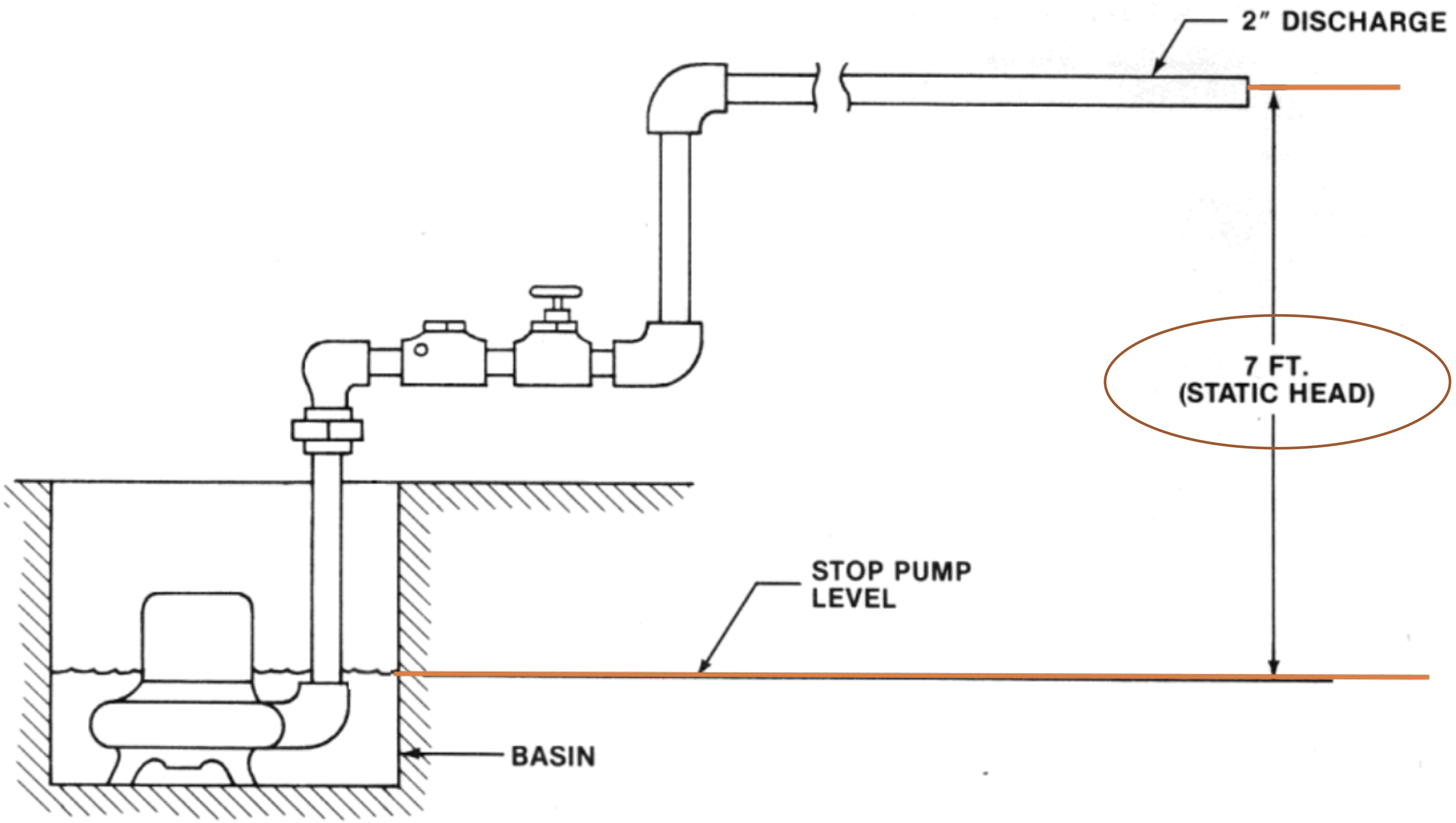


FIGURE C

CAUTION!

The point of discharge *may not* be the highest point in the piping system. A pump must be selected that has a shut-off head greater than the highest point in the pipe system.

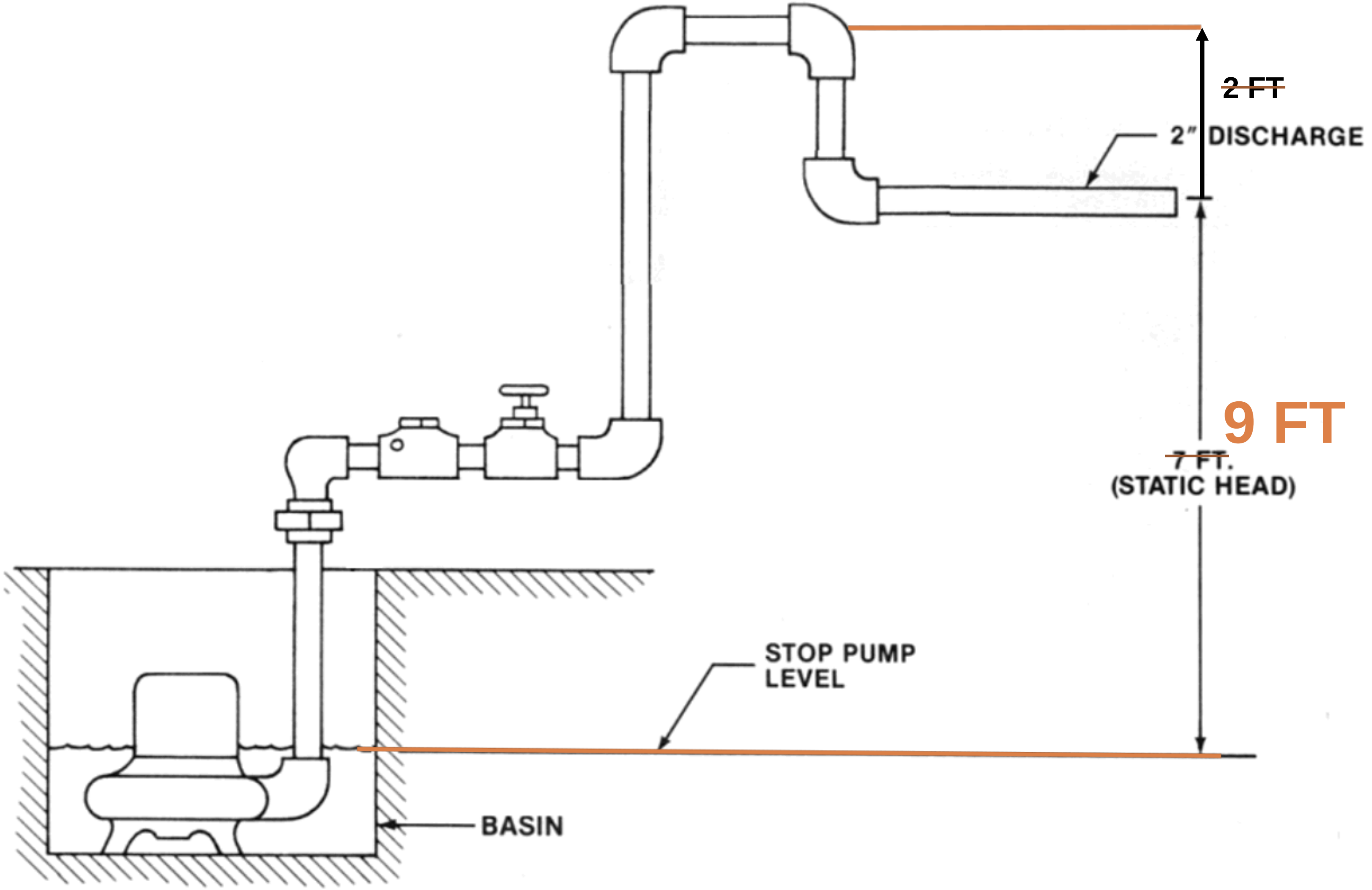


FIGURE C

Friction Head

- Friction Head is the additional head created in the discharge system due to resistance to flow within its components. All straight pipe, fittings, valves, etc. have a friction factor which must be considered.

- These friction factors are converted, and expressed as equivalent feet of straight pipe, which can be totaled and translated into feet of head.

Step 1 in calculating Friction Head

- First determine the discharge pipe size.
- 2” or 3” diameter is common on solids-handling sewage applications in residential / light commercial
- In order to ensure sufficient fluid velocity to carry solids (which is generally accepted to be 2 feet per second), the following are *minimum* required flows - even if the GPM required for the fixture units is less.

MINIMUM FLOW REQUIREMENTS

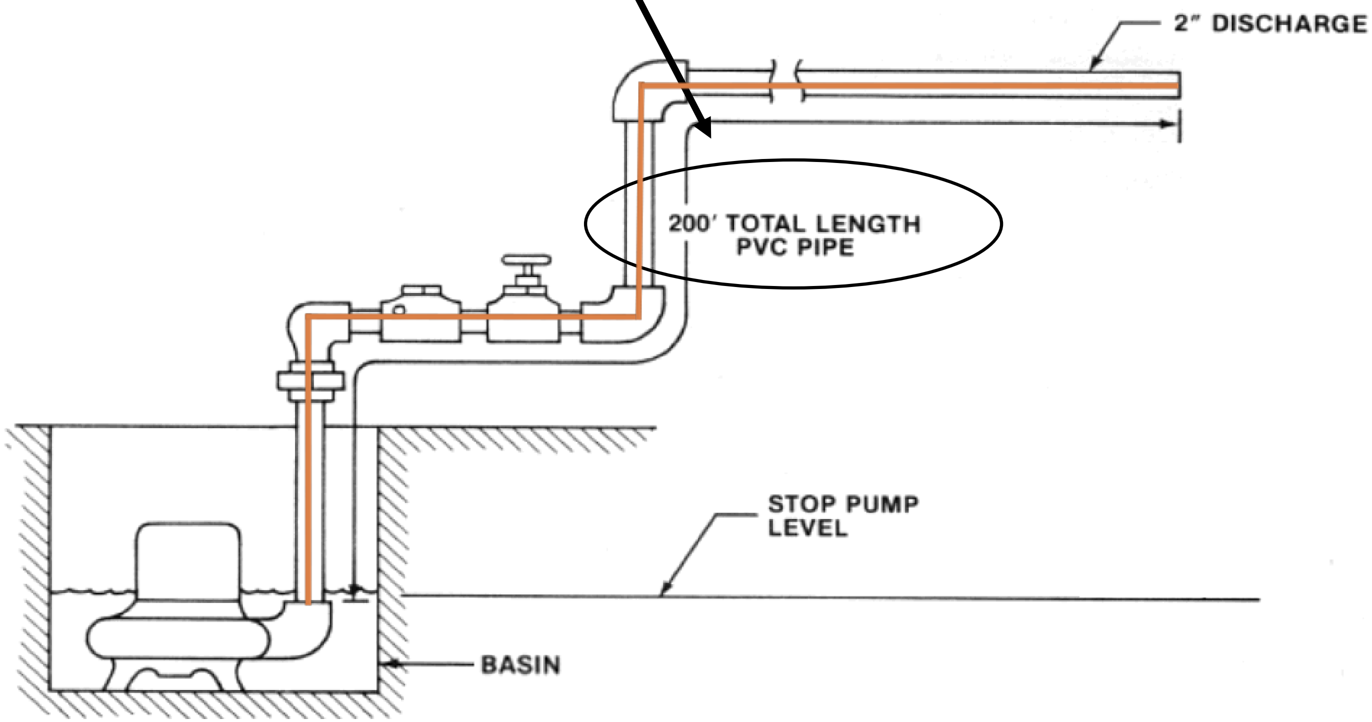
2 feet per second =

- 21 GPM through 2” pipe
- 46 GPM through 3” pipe
- 78 GPM through 4” pipe

If you don’t have these minimums – you won’t move the solids!

Step 2 in calculating friction head

- The length of the discharge piping is measured from the discharge opening of the pump to the point of final discharge, following all contours and bends.



Step 3

FIGURE D

Friction factors for pipe fittings in terms of equivalent feet of straight pipe						
Nominal Pipe Size	90 Elbow	45 Elbow	Tee (Thru-flow)	Tee (Branch flow)	Swing Check Valve	Gate Valve
2"	5.2	2.8	3.5	10.3	17.2	1.4
2 1/2"	6.2	3.3	4.1	12.3	20.0	1.7
3"	7.7	4.1	5.1	15.3	25.5	2.0

Consider all fittings - elbows, gate valves, check valves used in the installation…

(2) …..2" 90 degree elbows = 5.2 x 2 elbows in our example = 10.4 feet of pipe
(1) …..2" check valve = 17.2 feet of pipe
Added all up……. **27.6 feet (or 28 feet)**

Now add this 28' (equivalent feet) to the existing 200' length of discharge piping for a total of 228'.

Step 4

Refer to Figure E. Using the required PUMP CAPCITY (GPM) in the left column, follow across to the number below the pipe size being used. This number represents the Friction Head per 100 feet of pipe. Multiply this number by the number of 100ft increments to determine Friction Head.

Nominal Pipe Size						
	2"		2 1/2"		3"	
GPM	Plastic	Steel	Plastic	Steel	Plastic	Steel
20	0.9	0.9				
25	1.3	1.3				
30	1.8	1.8	0.6	0.8	[illegible]	[illegible]
35	2.4	2.4	0.8	[illegible]	[illegible]	[illegible]
40	3.1	3.1	1.0	[illegible]	[illegible]	[illegible]
45	3.8	3.8	1.3	[illegible]	[illegible]	[illegible]
50	4.7	4.7	[illegible]	[illegible]	[illegible]	[illegible]
60	6.5	6.6	[illegible]	[illegible]	[illegible]	[illegible]
70	8.6	8.8	[illegible]	[illegible]	[illegible]	[illegible]
80	11.1	11.4	3.7	[illegible]	[illegible]	[illegible]
90	13.8	14.3	4.6	[illegible]	[illegible]	[illegible]
100	16.8	17.5	5.6	[illegible]	[illegible]	[illegible]
125			8.3	[illegible]	[illegible]	[illegible]
120			12.0	15.5	4.9	5.1
175			16.4	20.9	6.4	6.9
200					8.4	8.9

Our Example required 22 GPM

FRICTION

Using a 2" line with flow of 25 GPM, we have 1.3 feet of head for every 100 feet of pipe. For our example with 228' of equivalent length of pipe…
2.28 x 1.3 = 2.96 feet of head.
(round up to 3' of Friction Head)

FIGURE E

TOTAL DYNAMIC HEAD (TDH) IS?

TDH = Static Head + Friction Head

Static Head…………….	7 Feet
+ Friction Head…………..	3 Feet
Total Dynamic Head……	**10 Feet**

Now look at pump curves in Figure F…..
At 10 feet of head, we need a pump that can give us a minimum of 22 GPM.

Pump Selection

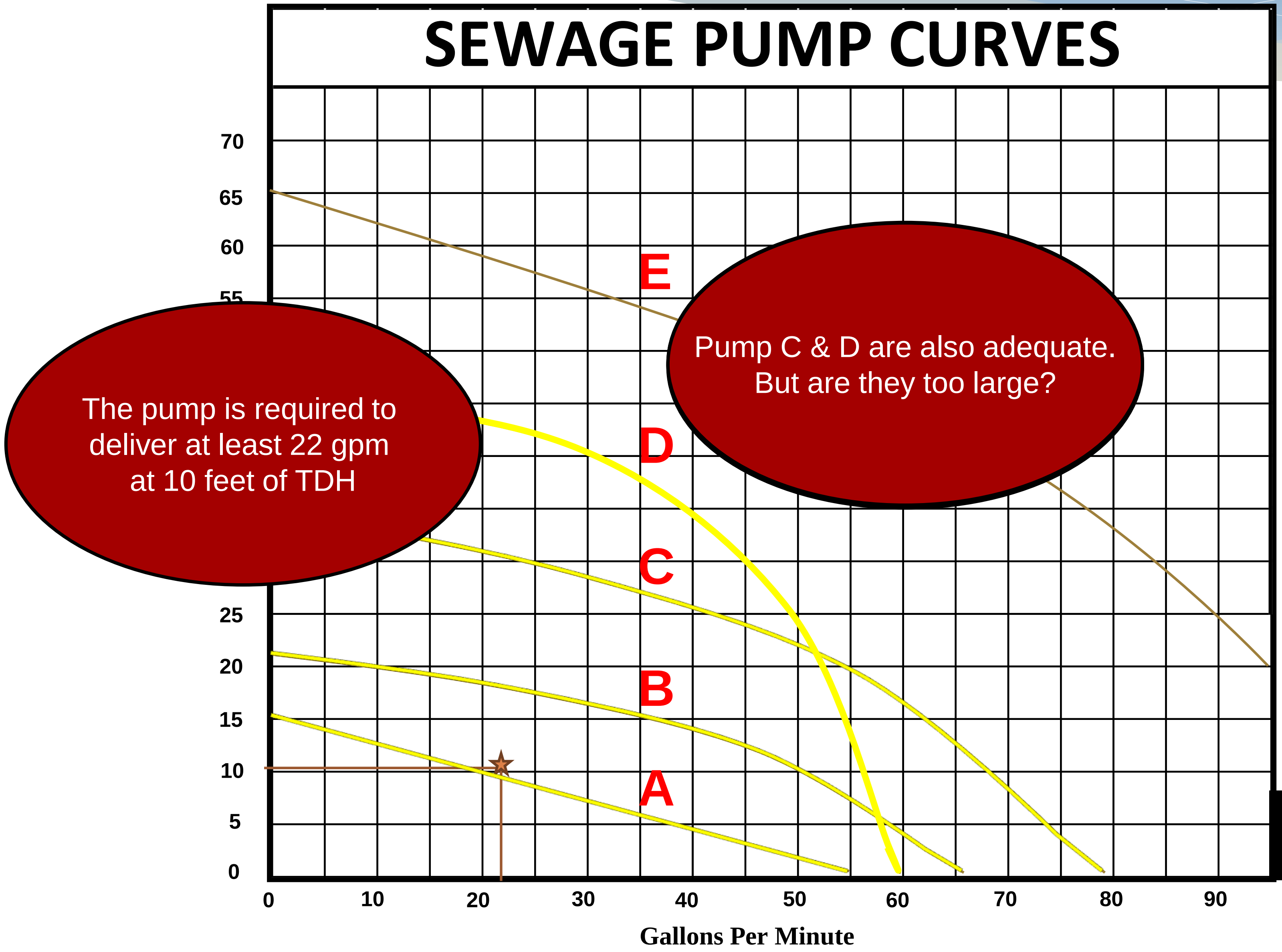


FIGURE F

Oversizing the Pump?

- The most efficient part of the curve is usually in the middle of the curve, away from maximum head or flow
- More horsepower or flow is not always better – especially in smaller basins.
- Short cycling may reduce the life of the pump. A longer pumping cycle will be better for pump longevity.

SOLIDS HANDLING

- Solids-Handling requirements may be determined by local codes and/or by the type of application and types of solids.

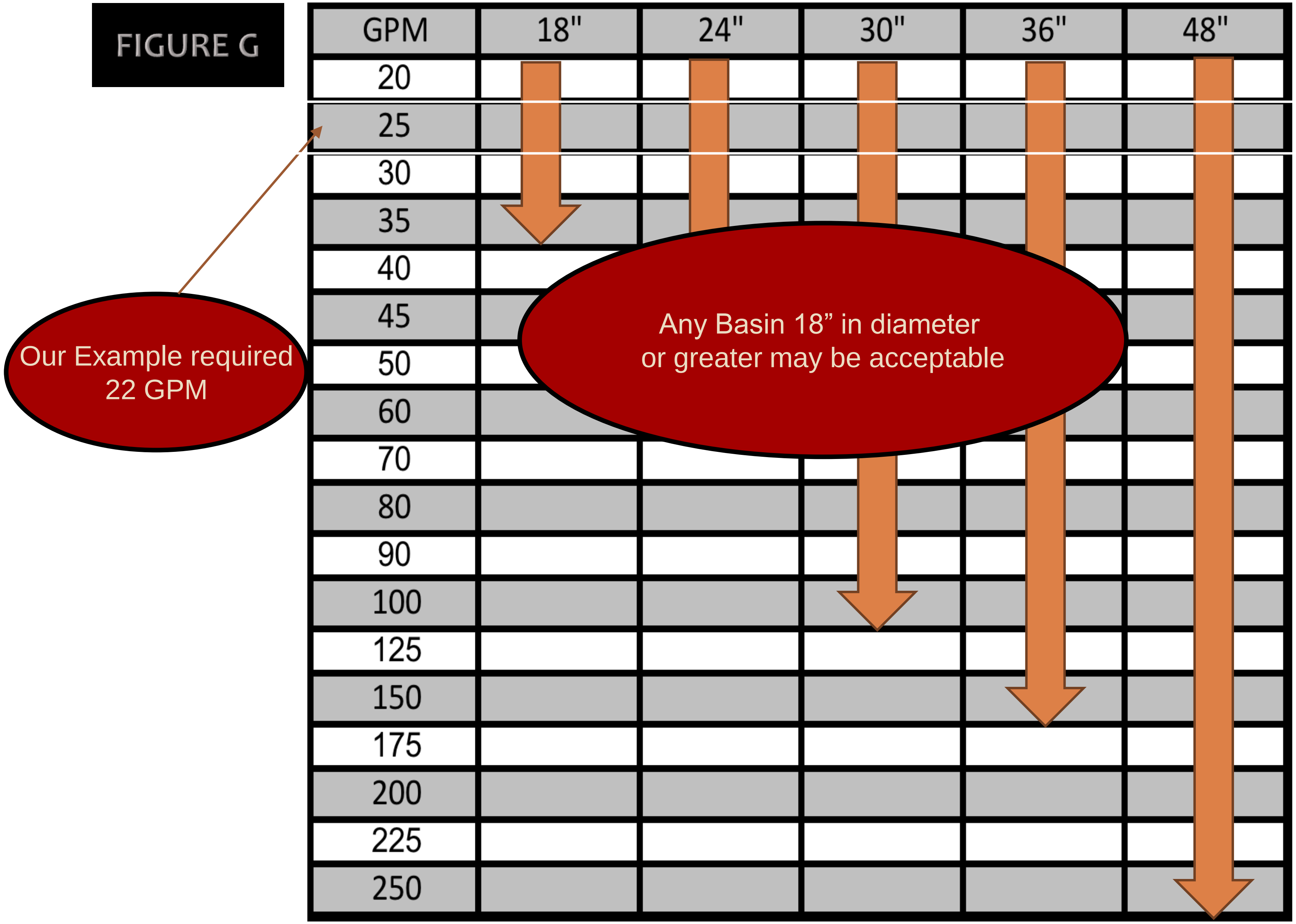
- Unless otherwise specifically stated, **SSPMA** recommends that a sewage pump should have the capacity of handling spherical solids of at least 2” diameter.

BASIN SELECTION

- Selection of the basin is best accomplished by relating to the required Pump Capacity as determined by the Fixture Unit method.
- Figure G shows the recommended Basin Diameters assuming a pump differential of 8” (Distance between pump turn-on and turn-off).
- Other factors such as pump size, controls, and accessories may impact the required basin size.
- Basin depth should normally be at least 24” for most pumps, and deeper where greater pumping differentials are anticipated.

Recommended BASIN Diameters

FIGURE G



SIMPLEX OR DUPLEX

The question of whether to use a Simplex (one pump) or Duplex (two pump) System depends on the type of installation and/or local codes requirements.

- Domestic/Residential Use:
  Simplex System is adequate in most instances; however if entire residence is on the system, duplex may be required.

- Public/Commercial Use:
  Duplex System is essential.

Simplex or Duplex System?

Duplex systems make use of special controls in order to alternate the usage of two pumps. Duplex systems provide several advantages over Simplex systems:

- The pumps alternate and therefore share the load.
- The lag pump is activated in the event of failure or lockage of the lead pump.
- The second pump is activated along with the lead pump in instances of unusually high inflow.

SIZING EXAMPLE

Using the pump curves from Figure F, fill out the Sewage Pump Sizing Worksheet and find a suitable pump to serve a 4 bathroom home, including a dishwasher, kitchen sink with disposal, washing machine, laundry tray, and a water softener.

- The Static Head is 15 feet
- The discharge pipe is 2” diameter
- The discharge piping is 500 feet long
- The discharge piping will include (1) check valve, (3) 90 degree elbows, (2) 45 degree elbows, and (1) gate valve.

Example: Pump Capacity

Step 1: Determine Total Fixture Units

(Reference Figure A)

▪ (4) Bathroom Groups	6 Fixture Units each	X4	= 24 Fixture Units
▪ (1) Dishwasher			= 2 Fixture Units
▪ (1) Kitchen sink w/ disposal			= 3 Fixture Units
▪ (1) Washing Machine			= 2 Fixture Units
▪ (1) Laundry Tray			= 2 Fixture Units
▪ (1) Water Softener			= 4 Fixture Units
Total			= **37 Fixture Units**

Step 2

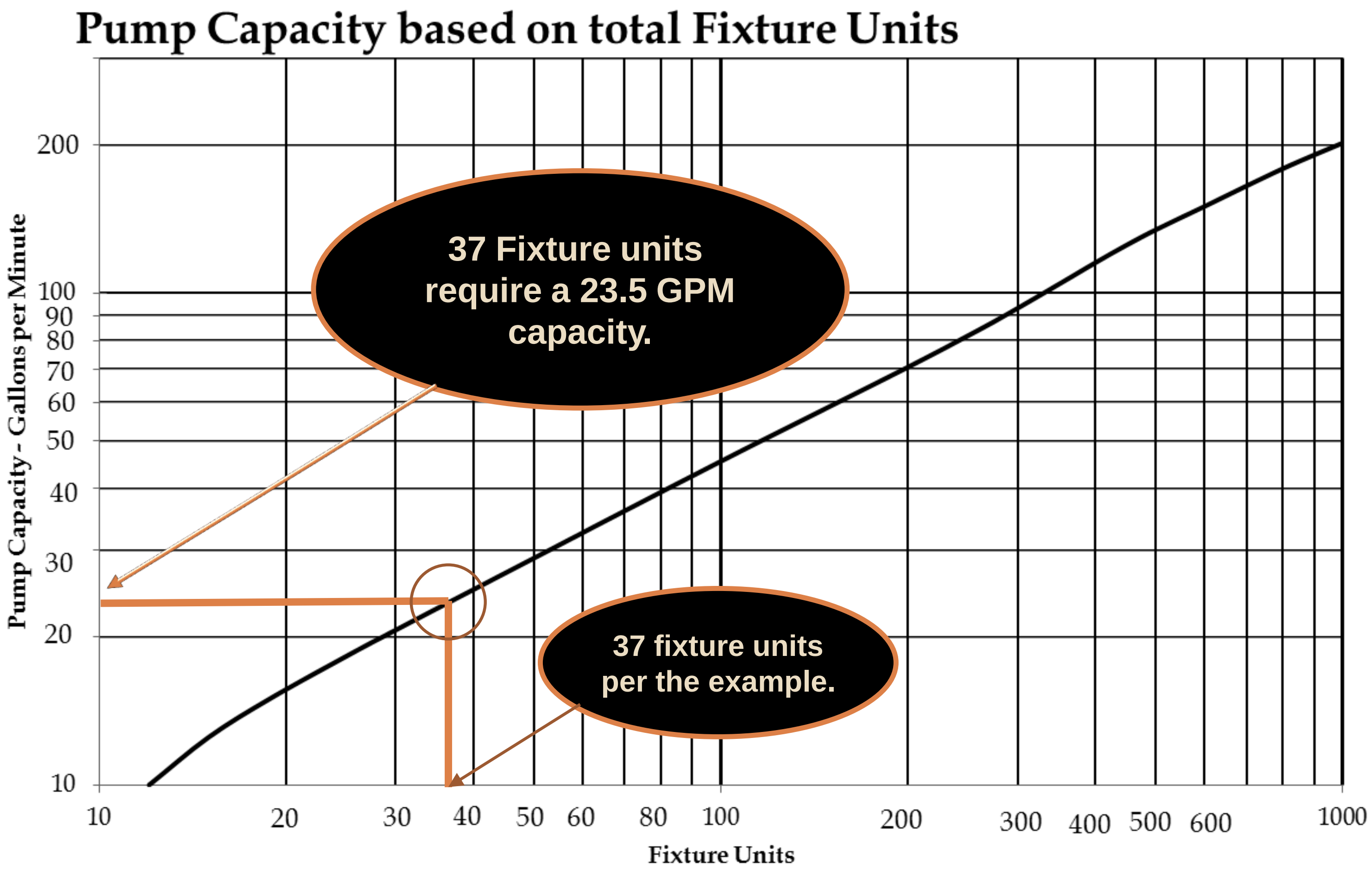


FIGURE B

Step 2: Find resulting Pump Capacity

(Reference Figure B)

37 Fixture Units = 23.5 Gallons per Minute

Minimum flow for 2” diameter pipe = 21 Gallons per Minute

Minimum GPM for this example = 23.5 Gallons per Minute

Round up to 24 Gallons per Minute

TDH = Static Head + Friction Head = 22 feet

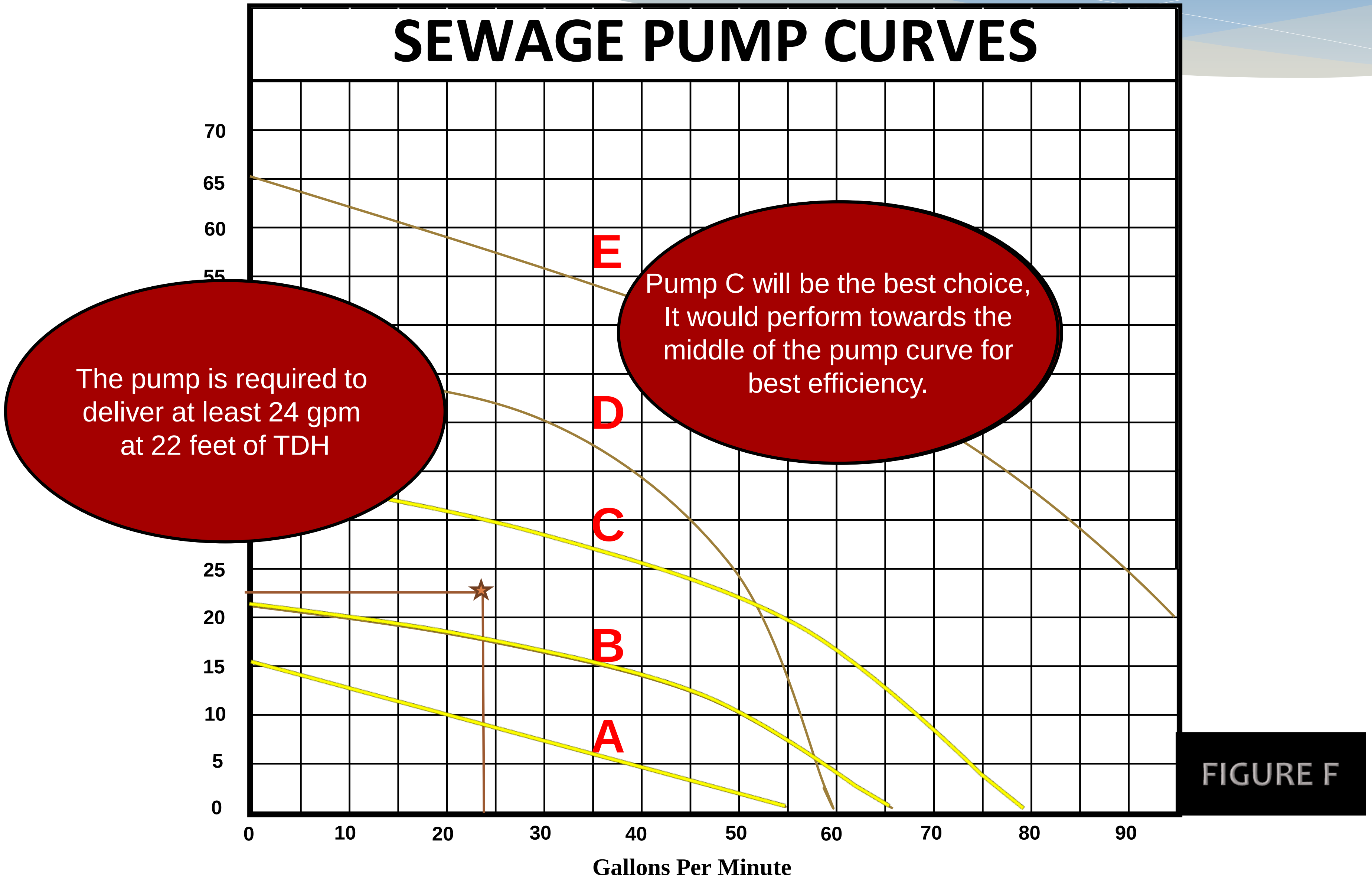
Static Head = 15 feet

Friction Head = 7 feet

Friction Factors	Equivalent feet (Reference Figure D)
(3) 90 degree 2" elbows = 5.2 X 3	15.6
(2) 45 degree 2" elbows = 2.8 X 2	5.6
(1) 2" Gate valve = 1.4 X 1	1.4
(1) 2" Swing Check valve = 17.2 X 1	17.2
	39.8 equivalent ft
+ 500' straight pipe =	539.8 equivalent ft

539.8 ft X 1.3/per 100 ft = **7.02 ft. of friction head**

Example: Pump Selection



Questions?

Thank You

Septic System Issues

Field experiences and common fixes

Onsite Common Problems

Septic Systems
- Pumps
- Controls
- Junction Boxes
- Effluent / Debris

Onsite Common Problems

Pumps:

- Never use an automatic pump with an integral switch
- Always use a non-automatic pump with a piggyback switch
- Switch can be / recommended to be hardwired
- Pump last less than 18 months, floats not set right
- Never use a grinder pump before a septic system
- Pumps should set on a block in the tank

I found the problem, it's the pump!

Onsite Common Problems

Controls:

- Number 1 failure mode is electrical issues
- Inadequate power supply
- Lack of dedicated alarm circuit
- Improper neutral
- Float levels critical
- When should 230v 1ph be used?
- Distributor doesn’t stock 230v piggyback switches
- If there is an electrical failure, who do they call?
- Understand, inspect, sign off, or you will be back.

Onsite Common Problems

Junction Boxes:

- Number 2 failure mode is improper sealing / splicing
- All splices in tank must be gas tight
- If they are gas tight they will be water tight
- Improper neutral
- Float levels critical

Onsite Common Problems

Onsite Common Problems

Onsite Common Problems

Onsite Common Problems

Onsite Common Problems

Effluent / Debris

- Grease biggest problem when a pump is present
- Wipes are pump killers
- Wipes are float killers
- Filters aren't popular, pumps and leach fields love them
- Garbage disposal present, great! Service contract
- Use powdered detergent, great! Service contract

Onsite Common Problems

Onsite Common Problems

Sump and Sewage Pump Manufacturers Association

This concludes the education portion of this session

Thank you for attending enjoy the show