

May 8, 2026

Designing for Efficient Pump Station Operation

Pump Selection & Preferred Operating Range

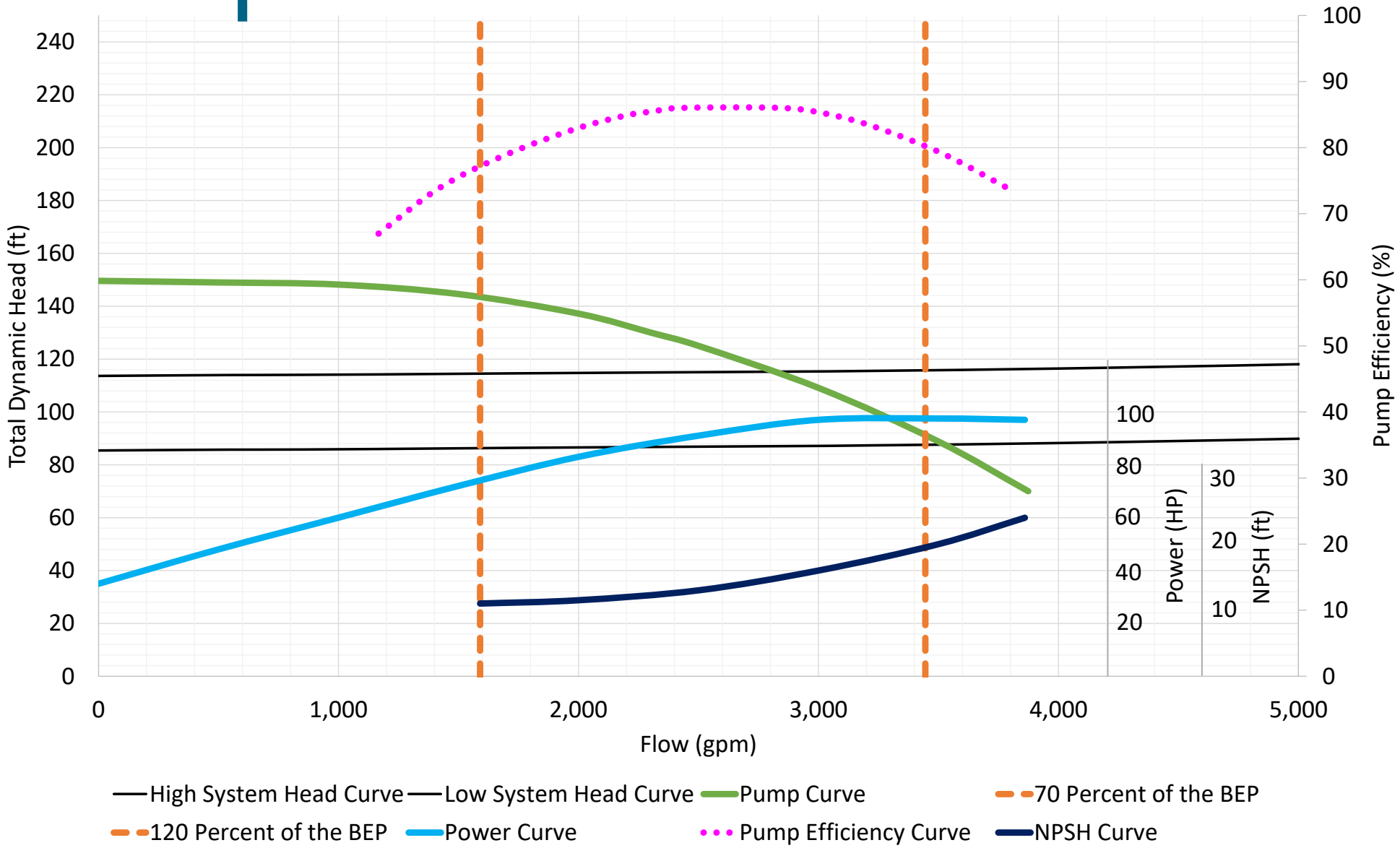
Presenters: Dylan Bright and Zach Schrempp, RH2 Engineering

Agenda

Pump station design basics

- Pump Curves Overview
- What is the Preferred Operating Range
- Pump Reliability Curve
- Pump Station Design Case Study
- Q&A

Pump Curves Overview



What is the Preferred Operating Range (POR)?

Defined by ANSI HI 9.6.3 (70- to 120-percent of BEP)

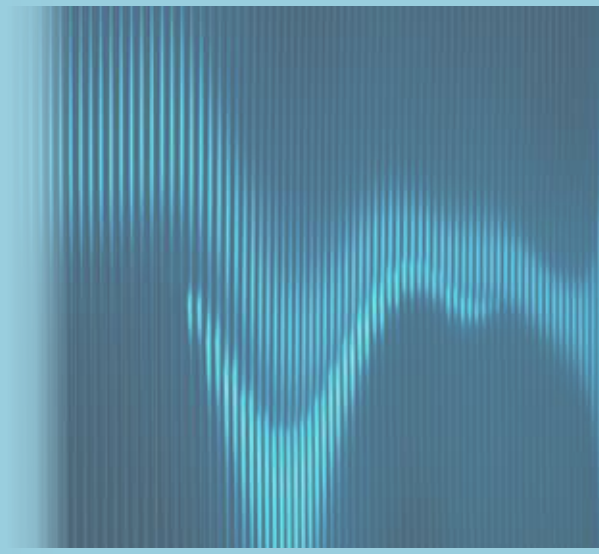




Sources: ANSI/HI 9.6.3

POR (continued)

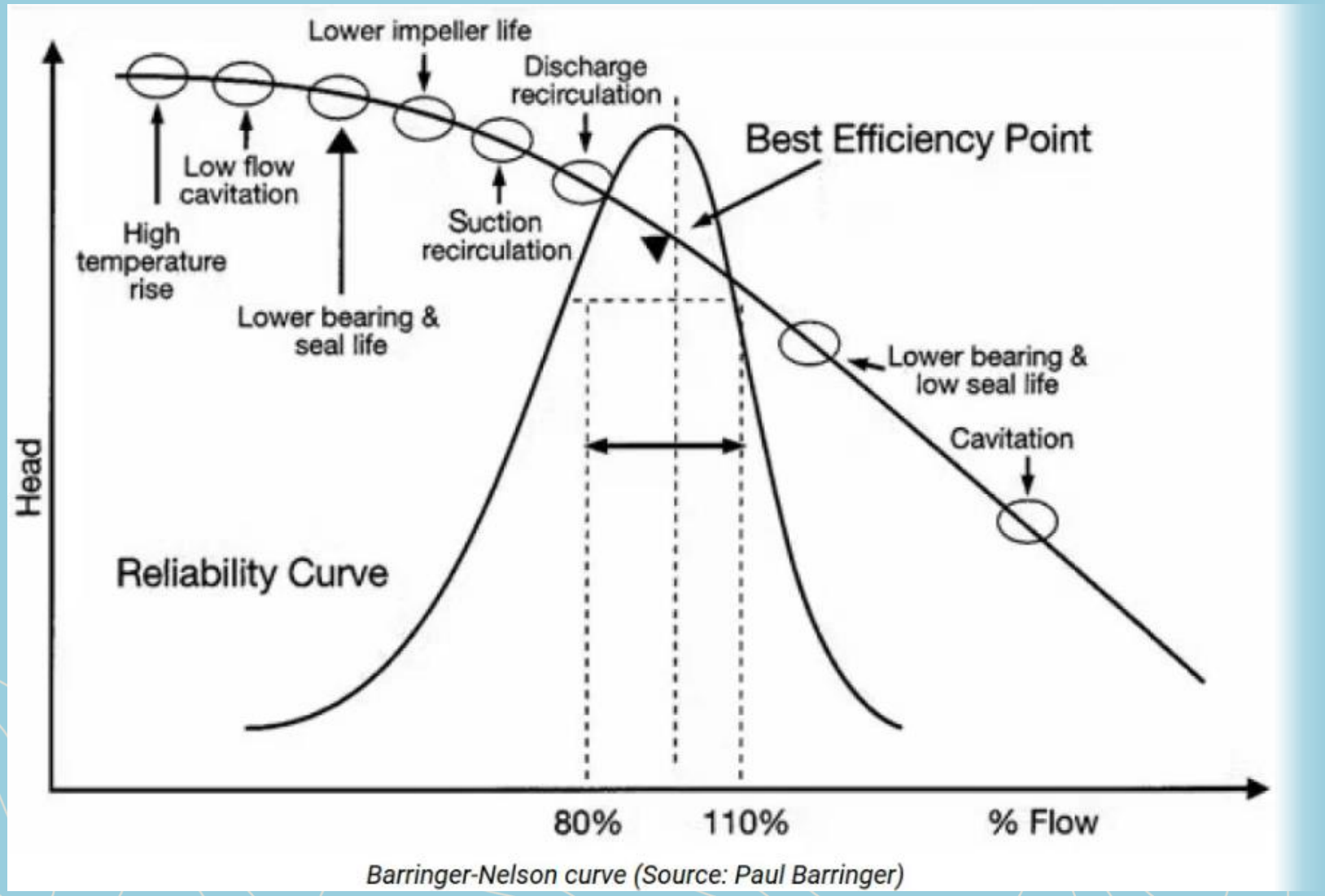
- High-energy pumps may have **narrower** POR (80 to 115-percent of BEP)
- Operating outside POR increases **vibration, recirculation, cavitation**
- HI notes POR ensures **minimal degradation** in efficiency/reliability



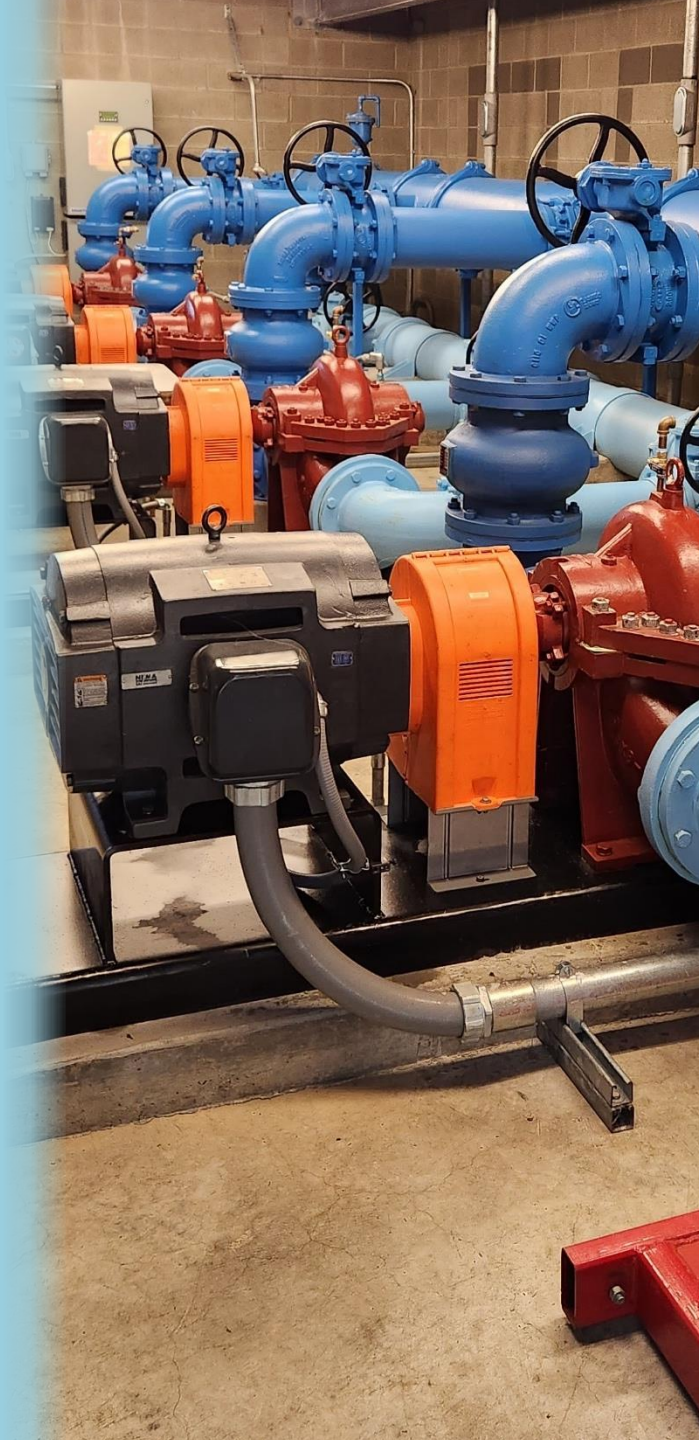


Sources: ANSI/HI 9.6.3, API 610

Pump Reliability Curve

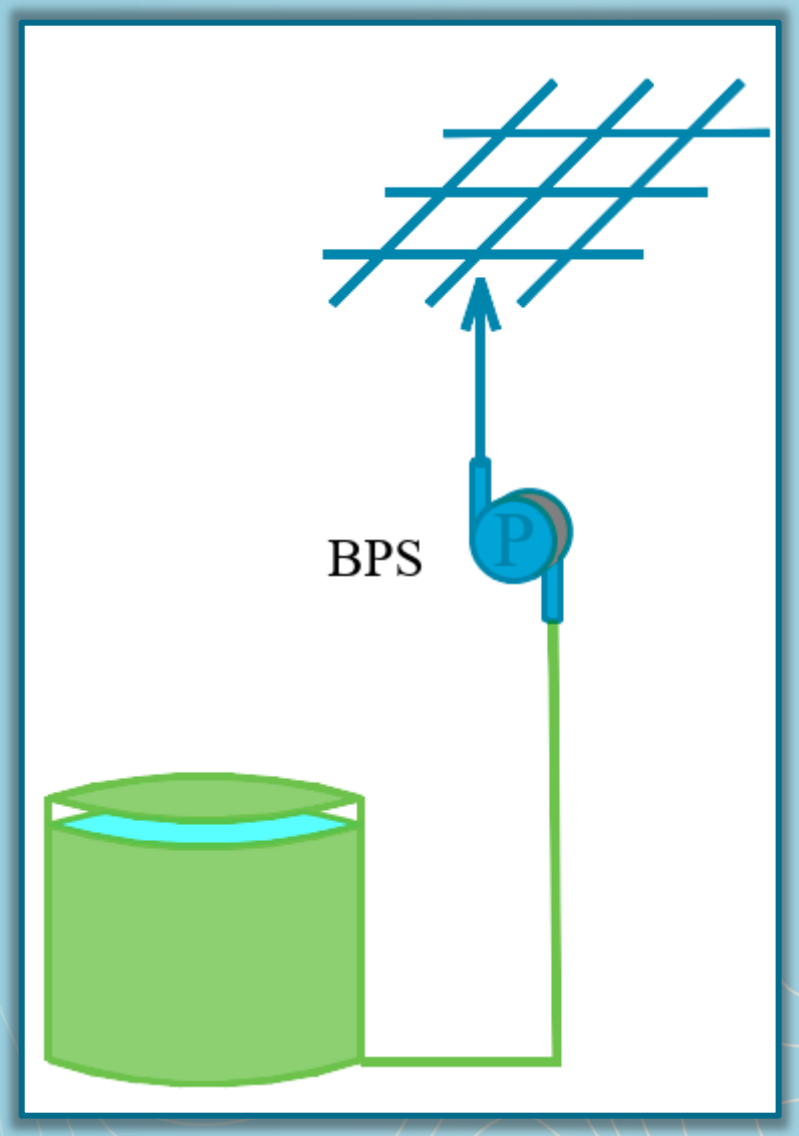


Barringer-Nelson curve (Source: Paul Barringer)

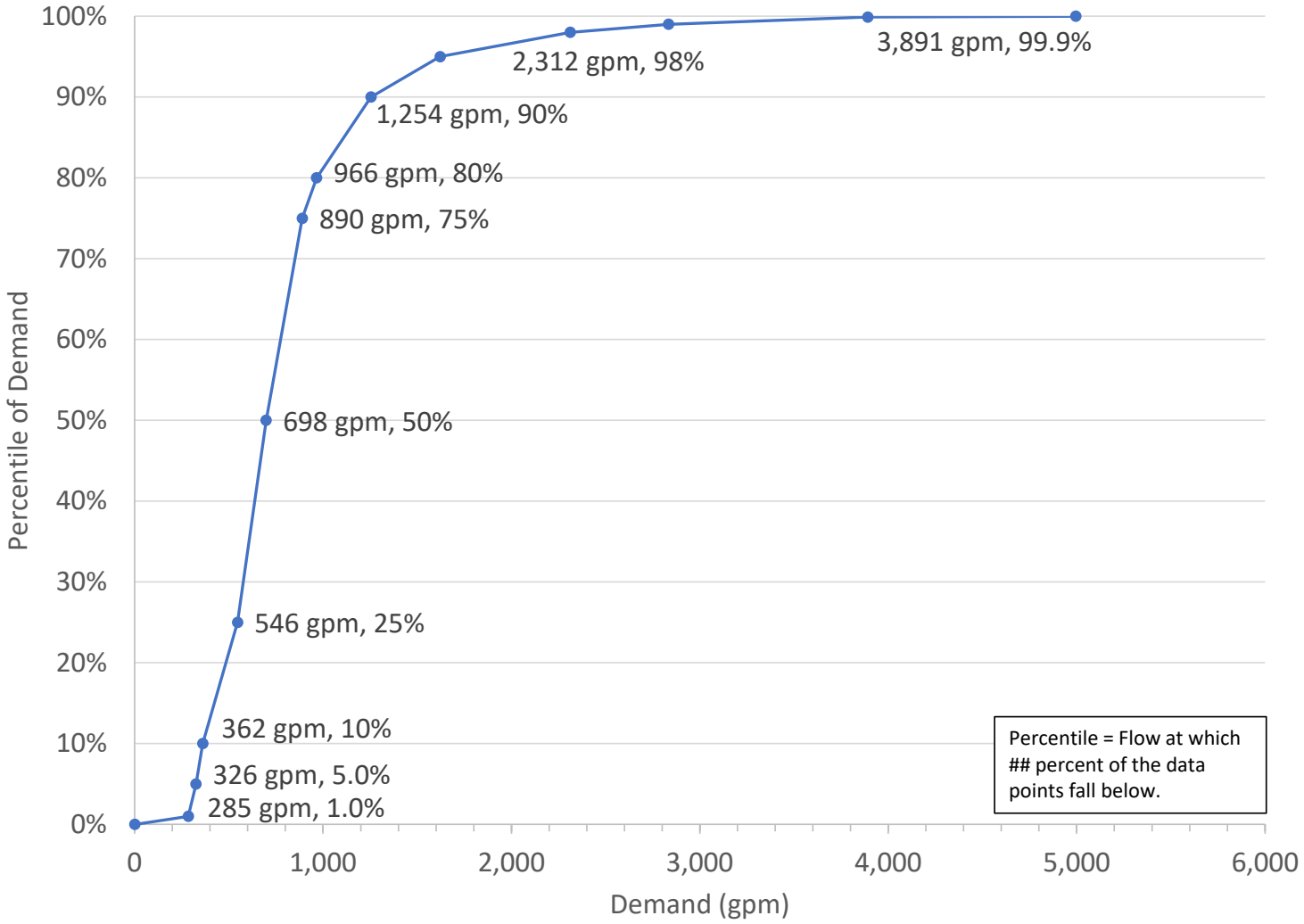


Pump Station Design Case Study

- Closed Zone Pump Station
  - Discharge Setpoint = 483 ft (53 psi)
  - Reservoir High Operating Level = 398 ft
  - Reservoir Low Operating Level = 370 ft
- Demand Considerations
  - Existing and Future Domestic Demands
  - Existing and Future Fire Flow Demands

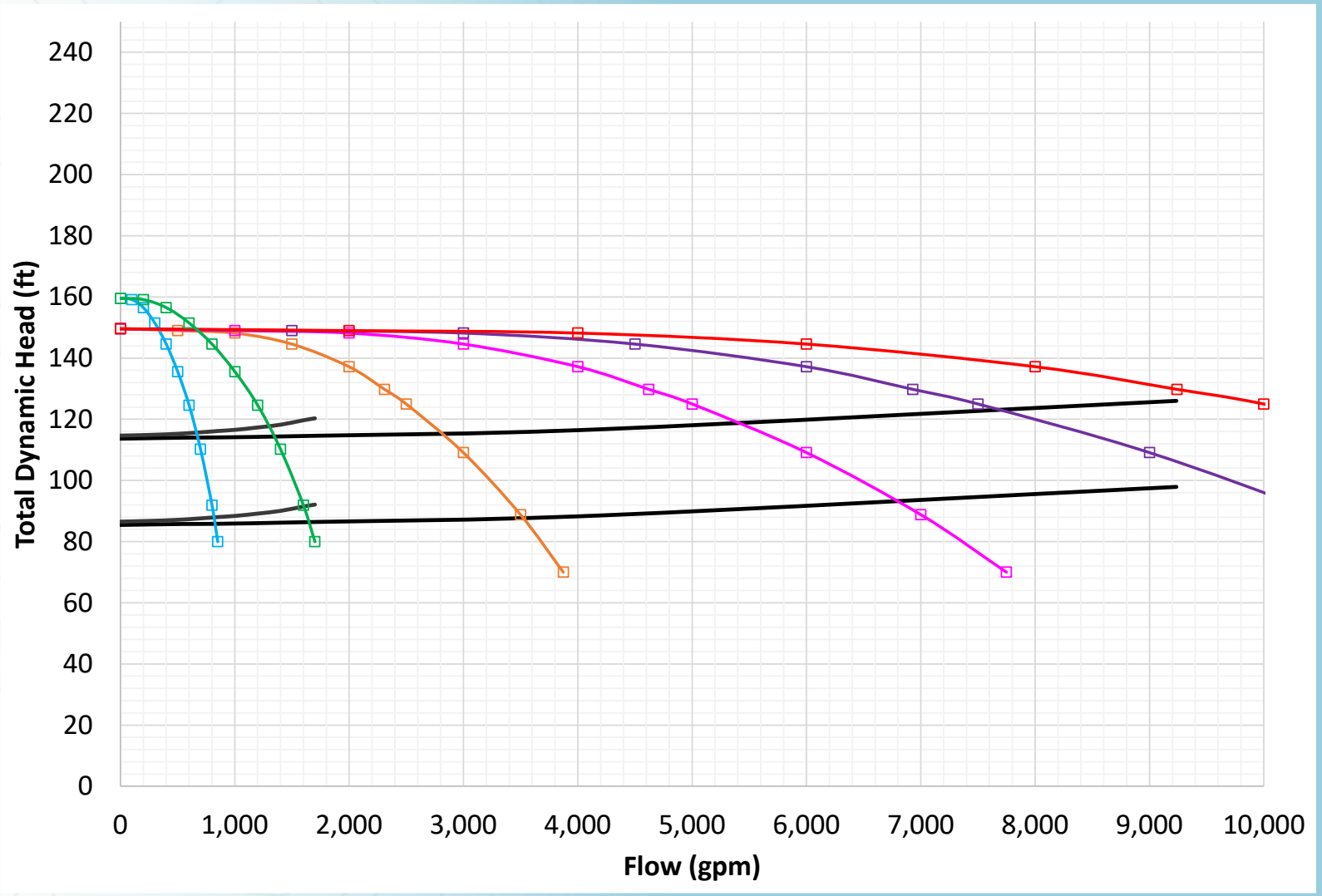


System Demands



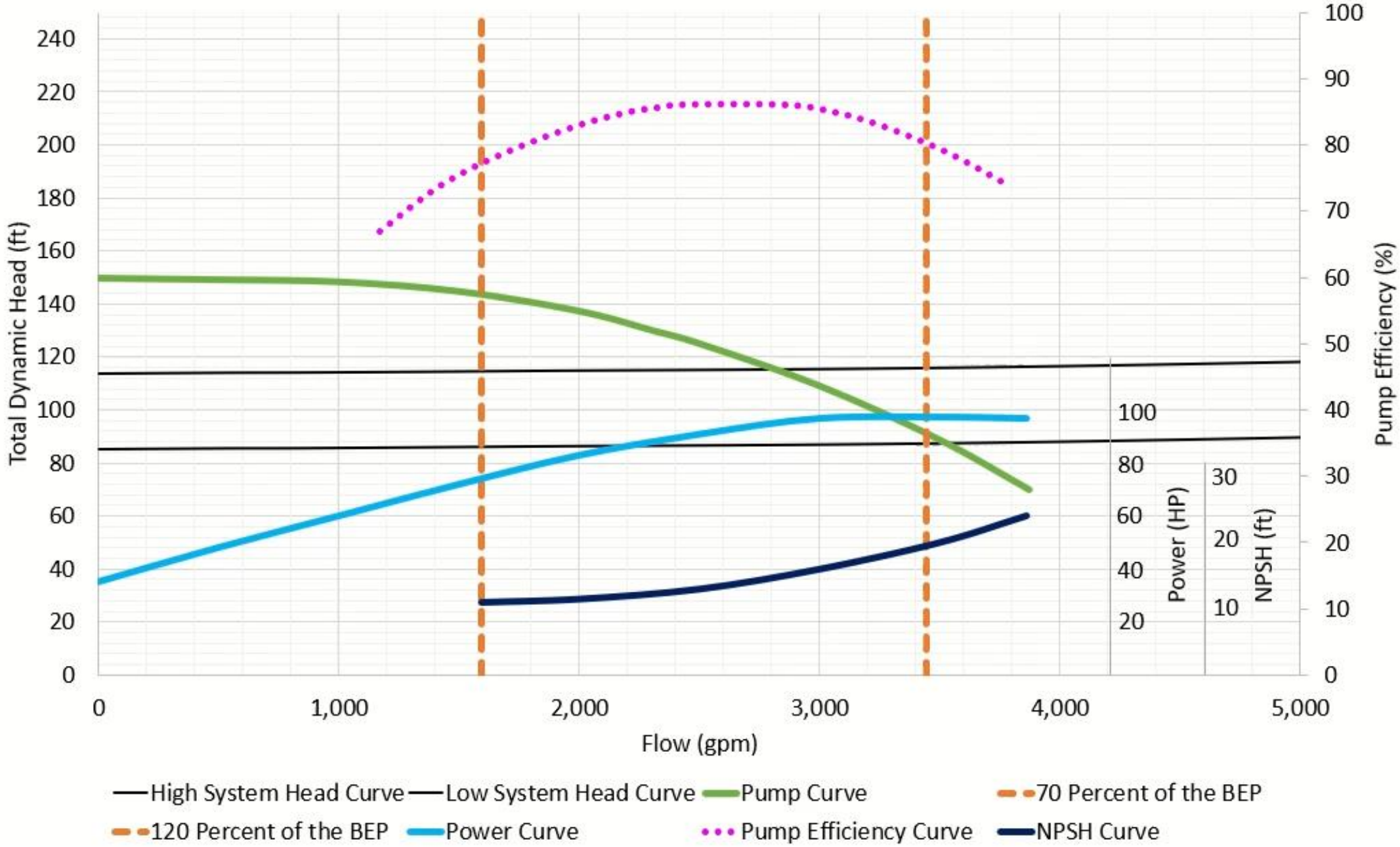
- WADD = 535 gpm
- ADD = 836 gpm
- MDD = 1,711 gpm
- PHD = 4,172 gpm
- FF = 5,000 gpm

Multiple Pump Curves



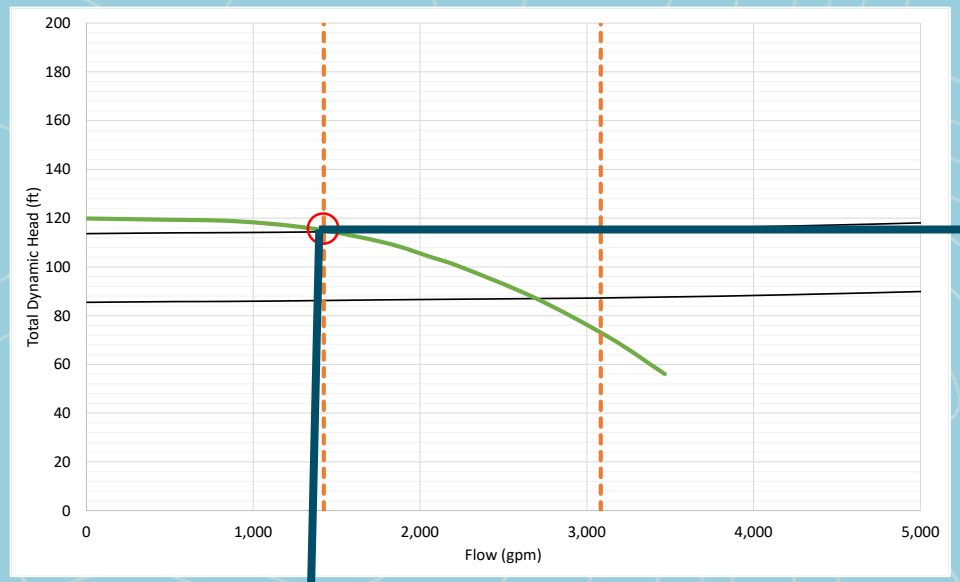


Pump VFD Operation

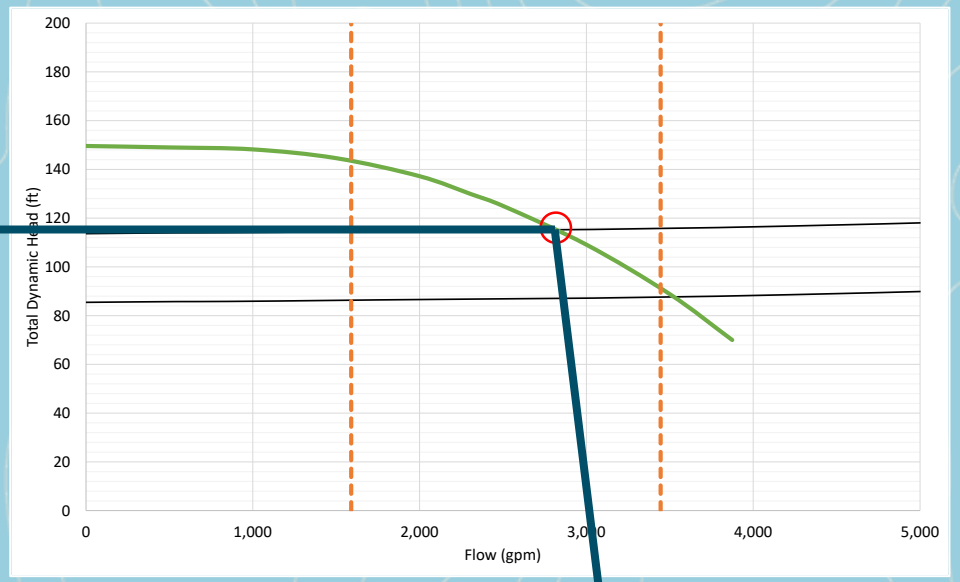

Total Dynamic Head (ft)
240
220
200
180
160
140
120
100
80
60
40
20
0
0
1,000
2,000
3,000
4,000
5,000
Flow (gpm)
100
80
60
40
20
Power (HP)
30
20
10
NPSH (ft)
100
90
80
70
60
50
40
30
20
10
0
Pump Efficiency (%)
High System Head Curve
Low System Head Curve
Pump Curve
70 Percent of the BEP
120 Percent of the BEP
Power Curve
Pump Efficiency Curve
NPSH Curve

Understanding POR

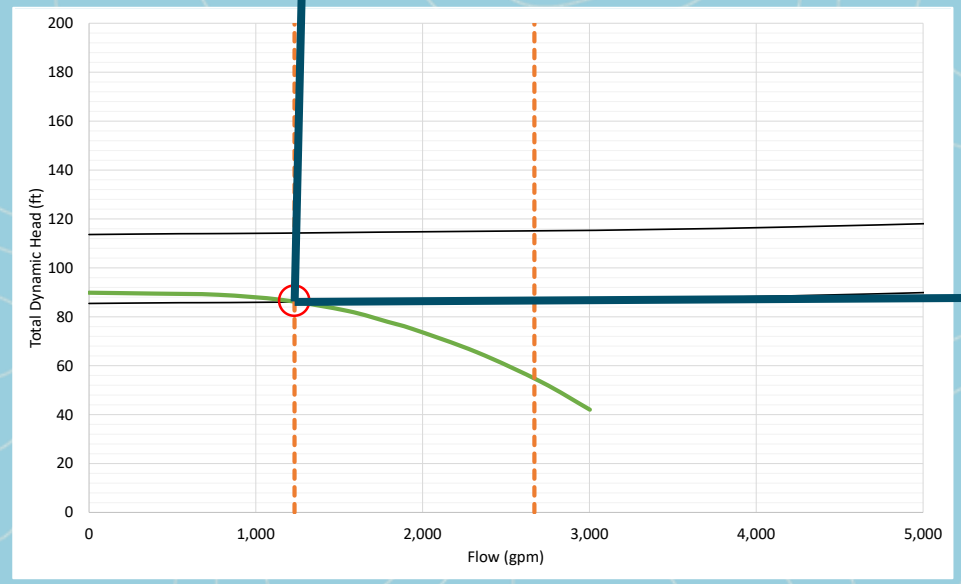
89 Percent Pump Speed



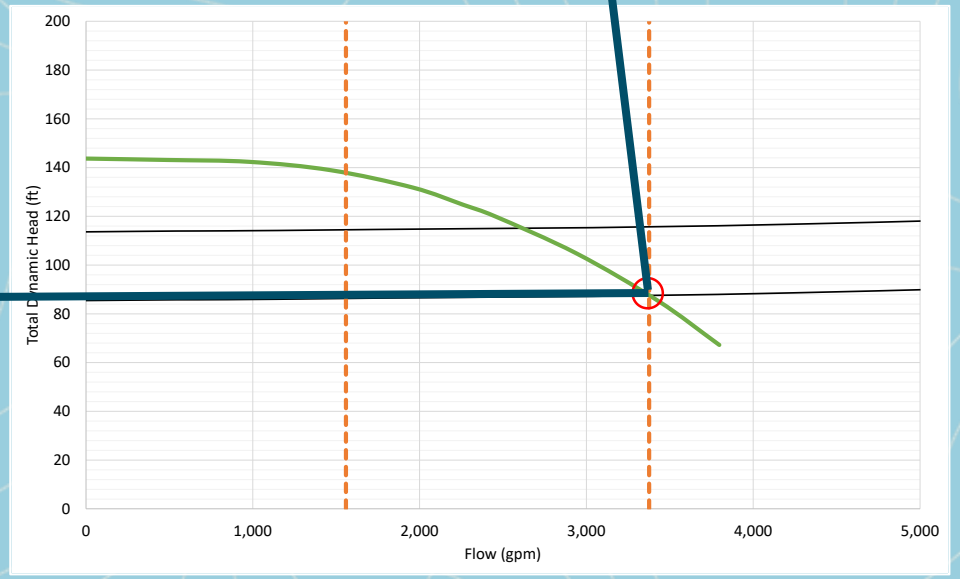
100 Percent Pump Speed



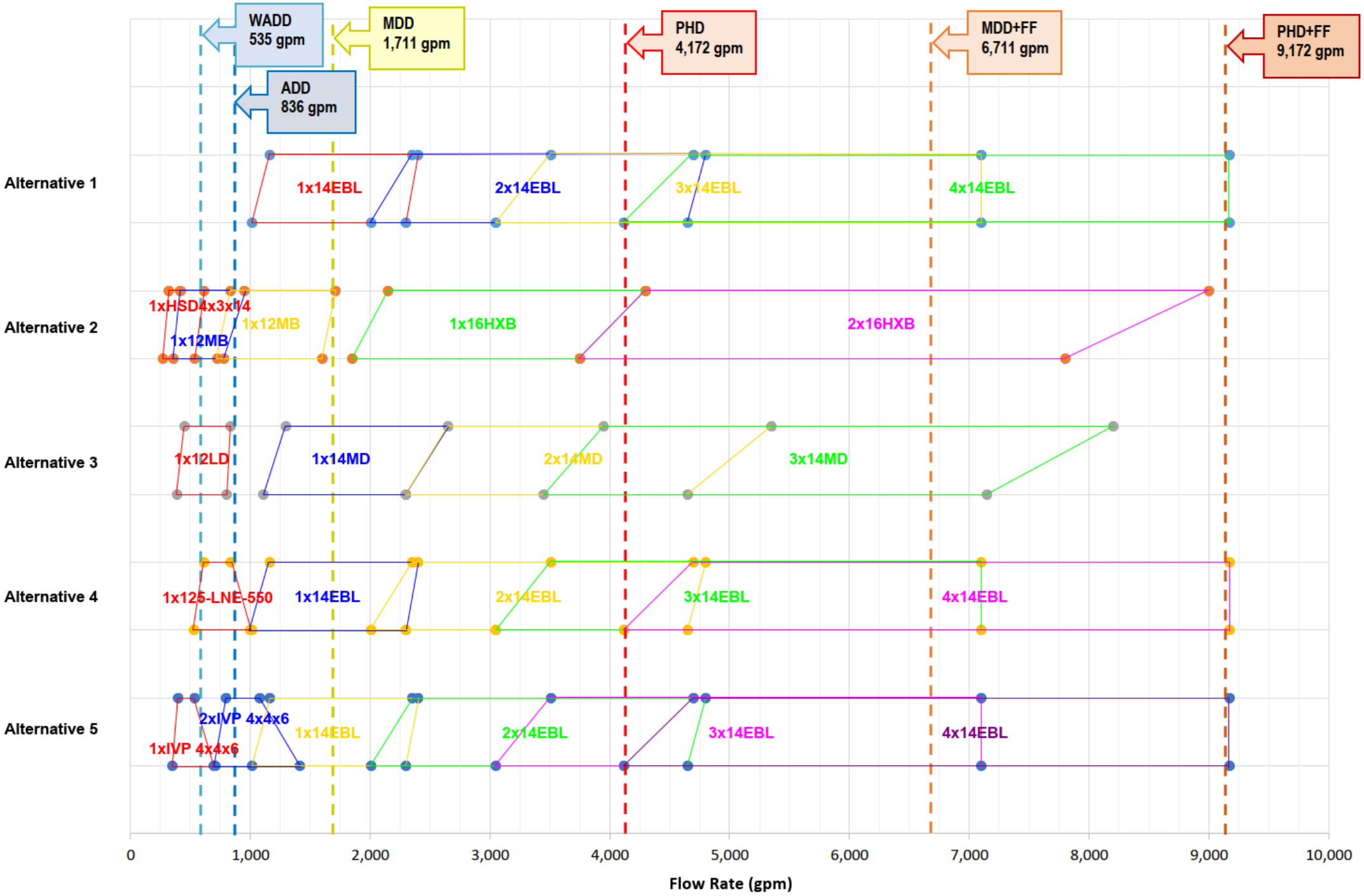
78 Percent Pump Speed



98 Percent Pump Speed



Evaluating Alternatives





Takeaways

Takeaways

- Identify critical flow and TDH requirements
- Understand flow ranges and the optimal pump selection to maintain operation in the POR
- Preferred Operating Range
  - Operate within 70- to 120-percent of BEP (Lowest vibration, recirculation, cavitation)



Questions?

Thank You!

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