TOWN OF SIDNEY

SANITARY PUMP STATIONS
REPLACEMENT PUMP REVIEW

JUNE 18, 2024

SANITARY PUMP STATIONS

REPLACEMENT PUMP REVIEW

TOWN OF SIDNEY

DRAFT REPORT

PROJECT NO.: CA0010231.6061
DATE: JUNE 18, 2024

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June 18, 2024

TOWN OF SIDNEY
2440 Sidney Avenue
Sidney BC, V8L 1Y7

Attention: Ryan Campeau

Dear Sir:

Subject: Town of Sidney - Pump Station Review - Report #1

We are please to offer our review of replacement pumps for the Town of Sidney sanitary sewer pump stations.

Kind regards,

Bob Fulton, ROWP
Senior Technician

WSP ref.: CA0010231.6061

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REVISION HISTORY

FIRST ISSUE

2024-06-10	Draft Report			
Prepared by	Reviewed by			
Bob Fulton, ROWP	Eric Pettit, P.Eng.			
REVISION 1				
Prepared by	Reviewed by			

SIGNATURES

PREPARED BY

Bob Fulton
Senior Technician

2024-06-18

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Senior Project Engineer

2024-06-18

TABLE OF CONTENTS

1 BACKGROUND

The Town of Sidney (ToS) is looking to purchase replacement pumps for several of their sewage pump stations. Prior to ordering they would like to review the existing pumps to confirm capability of handling future flows and ensure the selected pumps are efficiently sized in regard to both flow and head. Figure 1 shows the overall sanitary sewer system and pump station locations.

WSP has been asked to review the existing pumps for the 10 pump stations reviewed as part of the previous Sidney Pump Station Assessment Project[1] and provide recommendations on whether replacement pumps should be "like for like" or differ from existing. Where possible, the Town would like to standardize their pump selection to streamline future maintenance, repairs, and replacements.

As part of the review the following Scope of Work was undertaken:

- Information on the existing pumps and force mains was obtained primarily from information provided as part of the Sidney Pump Station Assessment project (2020-2021). Information was reviewed for all 10 pump stations for any missing information.
- Pump performance curves for existing pumps were obtained from Flygt as required.
- System curves for each pump station were developed with existing pump curves plotted against to determine existing theoretical capacity. A comparison between the theoretical capacity and drawn down results from the 2016 KWL report[2] was completed to determine if there were any significant discrepancies that required additional investigation.
- Review of 2019 SCADA data to determine approximate pump cycle lengths and usage for general indication of existing capacity issues.
- Review existing capacities versus future (2035) peak design sewage flows from the information provided by ToS from the updated sewer model.
- Review suitability of existing pumps and provide recommendations for replacement pump sizing based on peak future design sewage flows. Initial pump selection was completed using Xylect pump selection program for Flygt pumps. Results were then reviewed and confirmed with supplier recommendations.

[1] WSP – "Town of Sidney, Sanitary Pump Station Condition Assessments, Revision 1, March 04, 2021"
[2] Kerr Wood Leidal - "Town of Sidney, Utility Study, Final Report – Revision 1, September 2016"

LEGEND:

- PUMP STATION
- MANHOLE / GRADE BREAK
- SANITARY GRAVITY MAIN
- SANITARY FORCE MAIN

SURFSIDE PS
ROTHESAY PS
SEAPORT PS
BEACON PS
(CRD) PS
ALLBAY PS
LATCH PS
AMELIA PS
ARDWELL PS
HARBOUR PS
PARKLAND PS
LOCHSIDE PS
SUMMERGATE PS
FROST PS

BEAUFORT RD
SURFSIDE PL
SUMMERSET PL
WILDFLOWER PL
ROTHESAY AVE
AVENUE
EASTVIEW DR
SEAPORT PL
FIRST ST
SECOND ST
THIRD ST
FOURTH ST
FIFTH ST
SIXTH ST
SEVENTH ST
EIGHTH
BEACON AVE
OCEAN AVE
OAKVILLE AVE
ORCHARD AVE
BEVAN AVE
SIDNEY AVE
MT. BAKER
AVE.
WHIDBY LN
LOVELL AVE
AMELIA AVE
AMHERST
MALAVIEW AVE
STREET
RESTHAVEN DR
BLVD.
BRETHOUR AVE
HENRY AVE
JAMES WHITE BLVD.
ALLBAY RD
JOCELYN PL
POWDER RD
HARBOUR RD
EARL ST
CRESCENT RD
CLEVELAND RD
GROVE CRES
MARKINCH PL
SMISTER PL
RATHDOWN PL
PLEASANT ST
ALMOND ST
BOOTH PL
MALAVIEW AVE
BROADMOOR AVE
COTONEASTER PL
CHICORY PL
JUDSON PL
SIMKIN PL
SIDDALL RD
SWIFTSURE PL
BRIDGEDGE PL
MELISSA ST
CALVIN AVE
MILLS RD
WIETERIA PL
BUDDLEIA PL
BOWERBANK RD
BOWERBANK
VALLIS PL
PERCY AVE
PERCY AVE
CYLINDRA
LINDA PL
ARDWELL AVE
CRESCENT PL
PATRICIA PL
MELVILLE DR
MALAVIEW AVE WEST
MILLS RD WEST
HENRY AVE WEST
PAT BAY HIGHWAY
ARBEDA PL
JAMES WHITE BLVD WEST
SKYLARK LN
PLACE
GALARAN RD
BEACON AVE WEST
McDONALD PARK RD
McDONALD PARK ROAD
BIRCH ROAD
WHITE
McDONALD
PARK ROAD
STIRLING WAY
BARNES PL
SHARPLES RD
PLACE
LAPWING
EDGEWATER WAY
EPCO
DRIVE
AVENUE
OCEAN
PLACE
CHRISTINE PL
HOURPARK
BRETHOUR AVE
RICHMOND WAY
WEST
WEILER AVE WEST
JANNON WAY
GREENGLADE RD
HIGHWAY
BAY
PAT
NORTHBROOK DRIVE
VILLAGE WAY
BROOKWOOD
PROSSER AVE WEST
MARYLAND DR.
MUIRFIELD PL
FROST AVE
CANAL PLACE
MURIEL PL
WEILER AVE
LOCHSIDE DR

Town of Sidney
Sanitary Pump Selection Review
Existing Sanitary Sewer Pump Stations
Figure 1

Based on the age of the existing systems it is expected that most pump stations would operate around the Hazen Williams friction coefficient of C=130. Some discrepancies are expected due to potential errors in draw down testing / calculations and the limited available as-built information used in developing the system curves.

The pump curves from the existing pumps were plotted on the system curves to review current operation and performance in relation to theoretical and identify any potential errors or issues in the existing system data.

A summary of the existing pumps based on available maintenance records is outlined in the table below:

Pump Station	Pump Model (Flygt)	Impeller Code	Voltage (V)	Phase	Horsepower	Discharge Size
Allbay	CP 3102 MT	434	230	3	5.0	100mm
Amelia	NP 3127.180 MT	438	208	3	10.0 / 9.4	100mm
Ardwell	NP 3102.180 MT	463	230	3	5.0	100mm
Frost	CP 3102.181 MT	433	230	3	5.0	100mm
Harbour	CP 3152.181-6143 MT	432	208	3	20.0	150mm
Latch	CP 3102.181 MT	433	230	1	3.9	100mm
Lochside	CP 3085.183 MT	436	230	1	2.4	75mm
Rothesay	CP 3127 MT	432	208	3	10.0	150mm
Seaport	NP 3085.182 MT	462	208	3	3.0	75mm
Surfside	NP 3085.183 MT	436	230	3	2.4	75mm

All existing sewage pumps are manufactured by Flygt and replacement pump selections are based on currently available Flygt pump models. Replacement pump sizing is based on a single pump capable of pumping the 2035 peak design sewage flow. For Amelia, which is a triplex pump station the selection is based on two pumps running.

The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the design flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used. In some stations pumping at the 2035 peak design sewage flow rate is lower that the pump rate required to produce the recommended scouring velocity within the forcemain. In these stations the pump rate used for selection was set at 8.0 L/s, the minimum rate to produce a velocity of 1.0m/s in a 100mm diameter forcemain.

Preliminary pump sizing was completed using the propriety Xylect pump selection program for Flygt pumps. Information was also provided to Xylem to review and select replacement pumps. Direction was to standardize pumps between the stations as much as reasonably possible. Based on the selection parameters provided to them, Xylem recommended the pumps for all stations.

Five (5) of the pump stations (Allbay, Frost, Latch, Seaport and Surfside) would work with the same pump model and size. Two (2) of the other pump stations (Ardwell and Rothesay) will also work with same pumps. The remaining three (3) pump stations (Amelia, Harbour and Lochside) would require unique pump models / sizes due to their flow and head requirements. In some cases, the proposed pumps have different discharge sizes and revisions to the station piping would be required to utilize the selected replacement pumps.

Two of the existing pump stations (Latch and Lochside) are single phase based. All replacement pumps were sized assuming three-phase. The three-phase option offers more pump options for selection, and they have a much higher unclogging capability. In order utilize three-phase pumps at the single phase stations the starters would need to be replaced with VFDs which can be used to convert the single phase to three phase.

The selected pump(s) for the Amelia station are significantly larger in horsepower than existing. This station is the only station that has an auxiliary generator and sizing should be reviewed to determine if the generator has capacity to run the selected pumps.

A summary of the proposed replacement pumps is outlined in the tables below:

Pump Station	2035 Inflow (L/s)	Minimum Pump Rate used for selection (L/s)	TDH @ design Pump Rate for pump selection (C=130)	Selected Flygt Replacement Pump Model	Horsepower	Discharge Size
Allbay	0.750	8.0	10.38m	NP 3069 SH 3~ Adaptive 275	2.7	75mm
Frost	3.06	8.0	7.1m	NP 3069 SH 3~ Adaptive 275	2.7	75mm
Latch	2.22	8.0	9.47m	NP 3069 SH 3~ Adaptive 275	2.7	75mm
Seaport	7.70	7.70	7.15m	NP 3069 SH 3~ Adaptive 275	2.7	75mm
Surfside	1.08	8.0	9.2m	NP 3069 SH 3~ Adaptive 275	2.7	75mm

Pump Station	2035 Inflow (L/s)	Minimum Pump Rate used for selection (L/s)	TDH @ design Pump Rate for pump selection (C=130)	Selected Flygt Replacement Pump Model	Horsepower	Discharge Size
Ardwell	24.15	24.15	8.56m	NP 3102 MT 3~ Adaptive 463	5	100mm
Rothesay	24.47	24.47	8.87m	NP 3102 MT 3~ Adaptive 463	5	100mm

Pump Station	2035 Inflow (L/s)	Minimum Pump Rate used for selection (L/s)	TDH @ design Pump Rate for pump selection (C=130)	Selected Flygt Replacement Pump Model	Horsepower	Discharge Size
Amelia	86.29	86.29	25.11m	NP 3171 MT 3~ 434 (two pumps)	34	150mm
Harbour	54.57	54.57	15.17m	NP 3153 MT 3~ 434	20	150mm
Lochside	4.25	8.0	3.44m	NP 3085 SH 3~ Adaptive 454	2.2	75mm

Additional information for each station is included in the relevant section.

2 ALLBAY PUMP STATION

2.1 BACKGROUND

The Allbay pump station is located at 10526 Allbay Road at the beach access at the end of road near foreshore. The station is a duplex submersible pump style station. Available records indicate it was originally constructed in 1974. The pump station serves approximately 19 properties. Flows from the station are pumped to the gravity main that flows to the Ardwell pump station, which in turn pumps to the Amelia pump station.

2.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak sewage flow of 0.74 L/s and a future peak sewage flow requirement of 0.75 L/s were provided. The existing calculated pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	10.4	9.2	10.3

Maintenance records indicate the existing pumps are Flygt CP 3102 MT – 434, 3-phase 230V, 5 hp. Pump specifications, including dimensions and pump curves were obtained from the manufacturer's website. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	*173.8m	108.0mm	C900 PVC
Pump Station - Interior piping 1	*20.9m	101.6mm	Steel
Geodetic Head	8.7m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate capacities and evaluate condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition

C=130 Fair Condition

C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve a single pump should have a maximum theoretical pump rate of approximately 10.8L/s (C=150) and two pumps a pump rate of approximately

13.4 L/s (C=150). The calculated pump rates would indicate that the system is operating between the C=110 and C=130 range while one pump is in operation. Under the two-pump scenario, the pump rates calculated by the KWL drawdown tests are lower than the single pump rate and would put the system operation below a C= 110. It would appear that there may be an error in the draw down calculations from the two-pump test as the single pump rate is operating in the expected range.

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Total daily pump run times are approximately 5.0 min dry season with total pump starts averaging 4 per day. During wet season pump runs increased to approximately 15 min with total starts averaging 5 per day. This would indicate that the system has some minor I&I.

The existing pumps are currently capable of pumping significantly higher flow than the 2035 peak flow of 0.75 L/s. The existing pumps are pumping between 12 to 14 times of the future flow rate. Based on this, the existing pumps are potentially oversized and replacement pumps could be smaller.

2.3 REPLACEMENT PUMP SELECTION

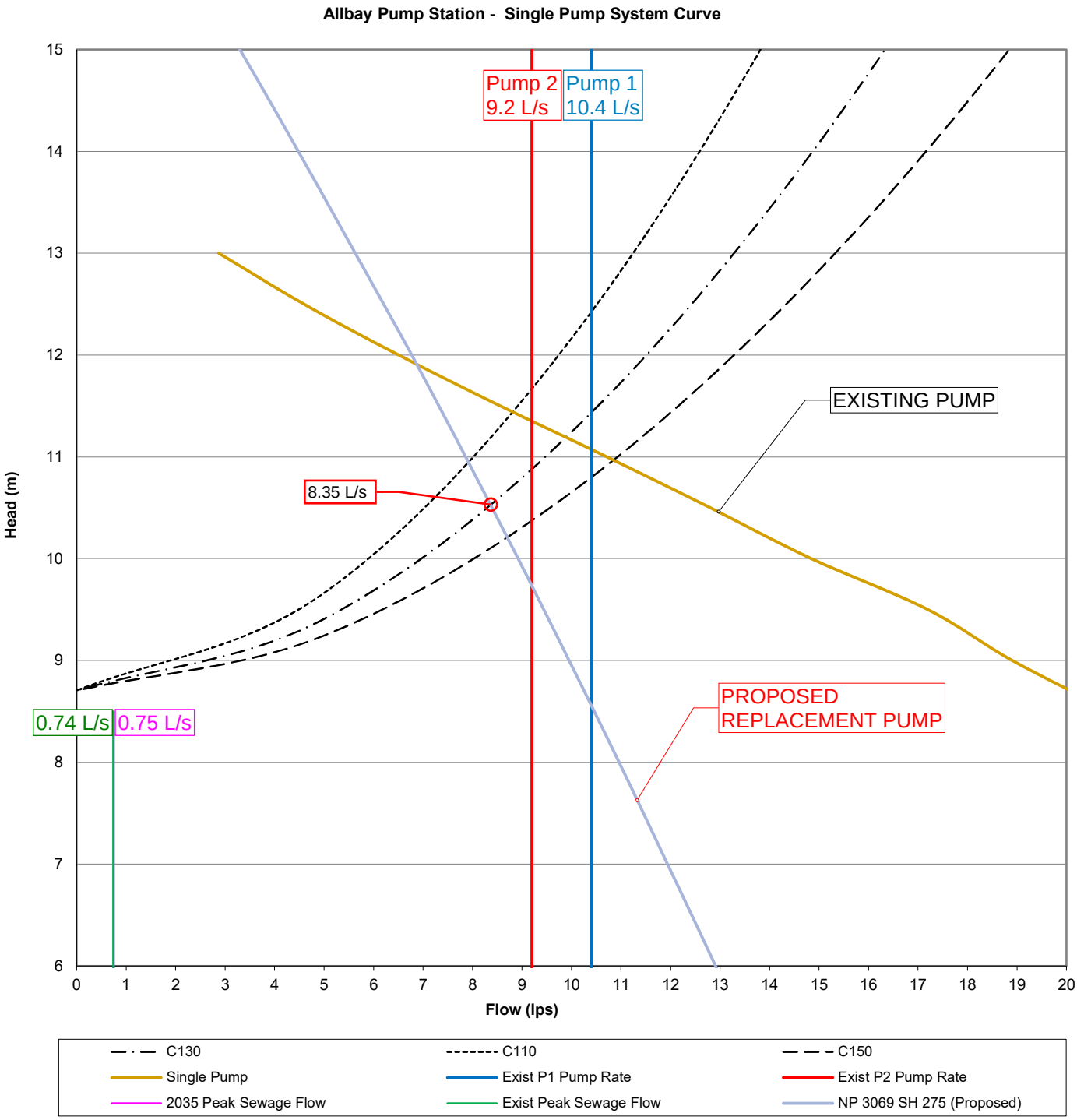
Replacement pump sizing is based on a single pump capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

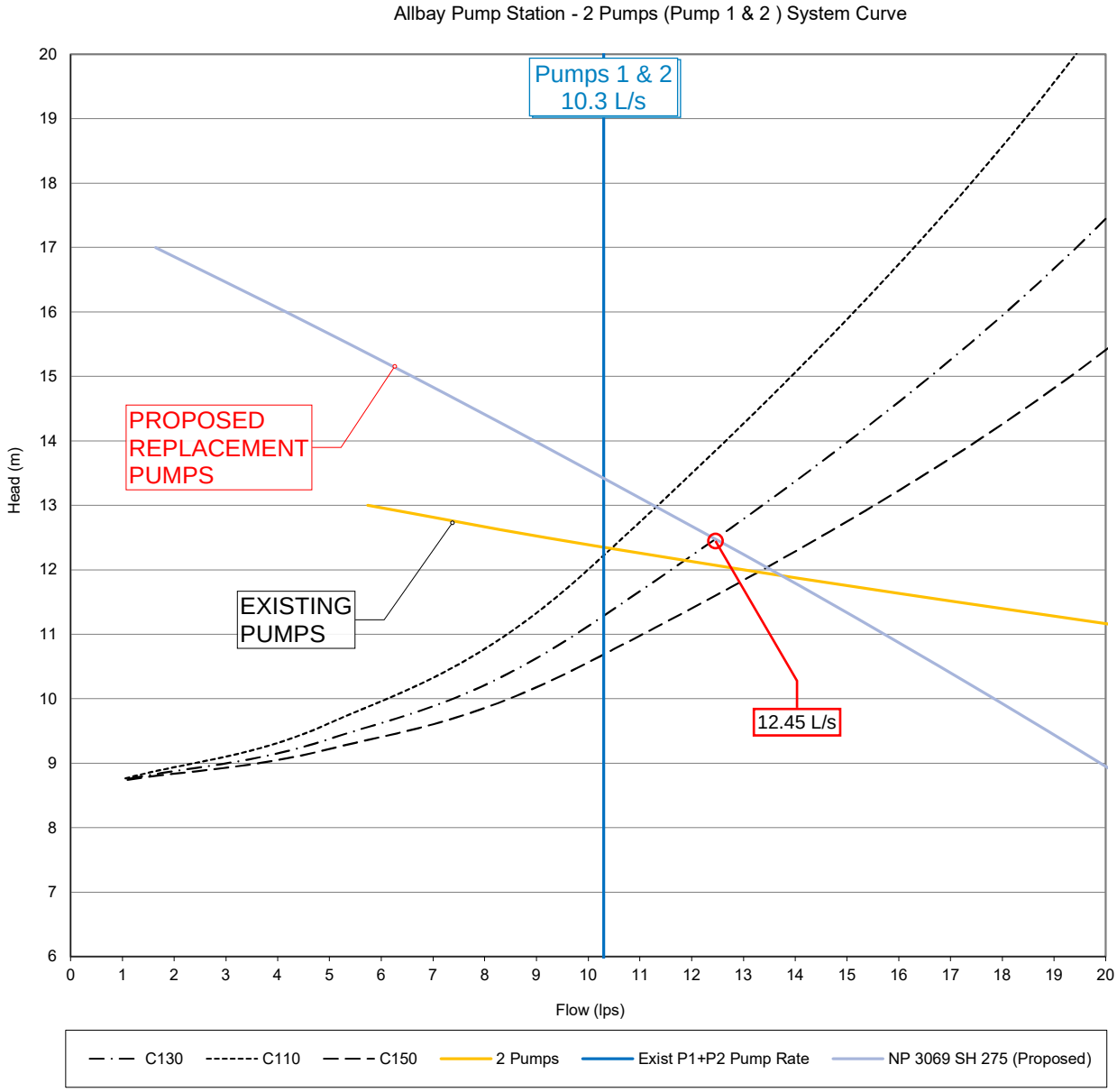
The required future peak flows for this station are lower than the pumping rate of any available pump selection. Lower pump rates result in low velocities in the force main and do not meet the recommended minimum scouring velocity of 1.0 m/s. In this station the pump rate used for selection was set at 8.0 L/s, the minimum rate to produce the scouring velocity in a 100mm diameter forcemain during single pump operation.

The replacement pump based on the selection parameters of 8.0 L/s @ 10.38m TDH (C=130) is the Flygt NP 3069 SH, 3-phase, adaptive 275, 2.7 hp. The discharge on this pump is 75mm diameter, so the existing 100mm piping would have to be modified to use this pump model. The selected pump is lower horsepower (2.7 vs 5.0) than the existing pump and the same pump model could potentially be used at four other pump stations.

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pump will have a theoretical capacity of 8.35 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (7 PAGES)


Allbay Pump Station - Single Pump System Curve
Pump 2
9.2 L/s
Pump 1
10.4 L/s
EXISTING PUMP
8.35 L/s
PROPOSED
REPLACEMENT PUMP
0.74 L/s
0.75 L/s
Head (m)
Flow (lps)
C130
C110
C150
Single Pump
Exist P1 Pump Rate
Exist P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3069 SH 275 (Proposed)


Allbay Pump Station - 2 Pumps (Pump 1 & 2) System Curve
Pumps 1 & 2
10.3 L/s
PROPOSED
REPLACEMENT
PUMPS
EXISTING
PUMPS
12.45 L/s
Head (m)
Flow (lps)
C130
C110
C150
2 Pumps
Exist P1+P2 Pump Rate
NP 3069 SH 275 (Proposed)

ALLBAY

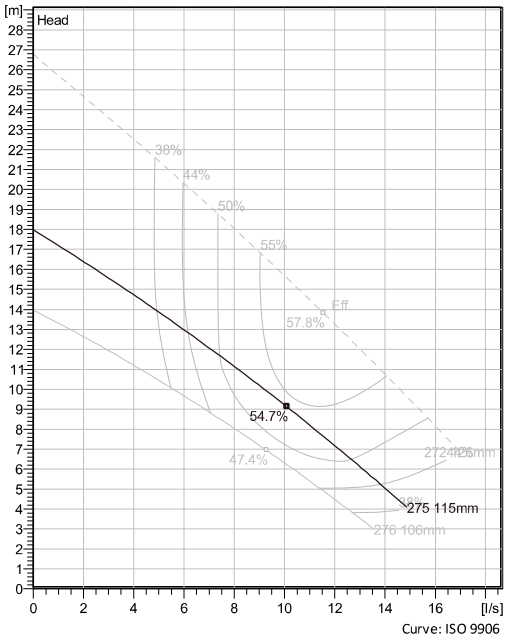
NP 3069 SH 3~ Adaptive 275

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3069.060 13-08-2BB-W 2.7hp

Installation type
P - Semi permanent, Wet

Impeller diameter
115 mm

Discharge diameter
65 mm

Pump information

Impeller diameter
115 mm

Discharge diameter
65 mm

Inlet diameter
100 mm

Maximum operating speed
3310 rpm

Number of blades
2

Max. fluid temperature
40 °C

Materials

Impeller
Hard-Iron ™

Stator housing material
Grey cast iron

Project	Xylect-21929325	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Technical specification

Motor - General

Motor number N3069.060 13-08-2BB-W 2.7hp	**Phases** 3~	**Rated speed** 3310 rpm	**Rated power** 2.7 hp
ATEX approved No	**Number of poles** 2	**Rated current** 7.5 A	**Stator variant** 6
Frequency 60 Hz	**Rated voltage** 230 V	**Insulation class** F	**Type of Duty** S1
Version code 060			

Motor - Technical

Power factor - 1/1 Load 0.87	**Motor efficiency - 1/1 Load** 77.8 %	**Total moment of inertia** 0.00313 kg m²	**Starts per hour max.** 15
Power factor - 3/4 Load 0.81	**Motor efficiency - 3/4 Load** 80.2 %	**Starting current, direct starting** 40 A	
Power factor - 1/2 Load 0.71	**Motor efficiency - 1/2 Load** 80.2 %	**Starting current, star-delta** 13.3 A	

Project	Xylect-21929325	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

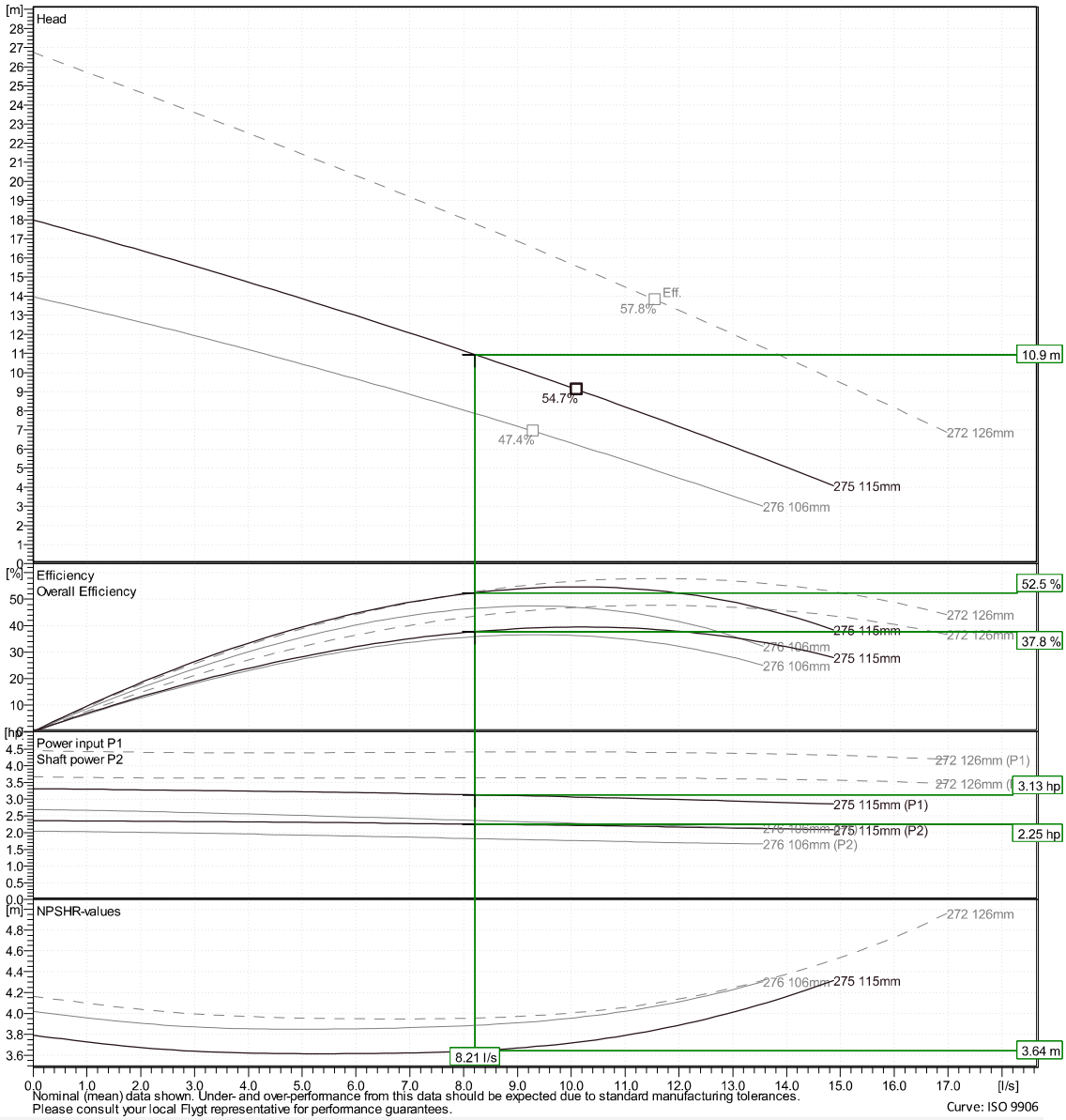
NP 3069 SH 3~ Adaptive 275

Performance curve

Duty point

Flow	Head
8.21 l/s	10.9 m

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

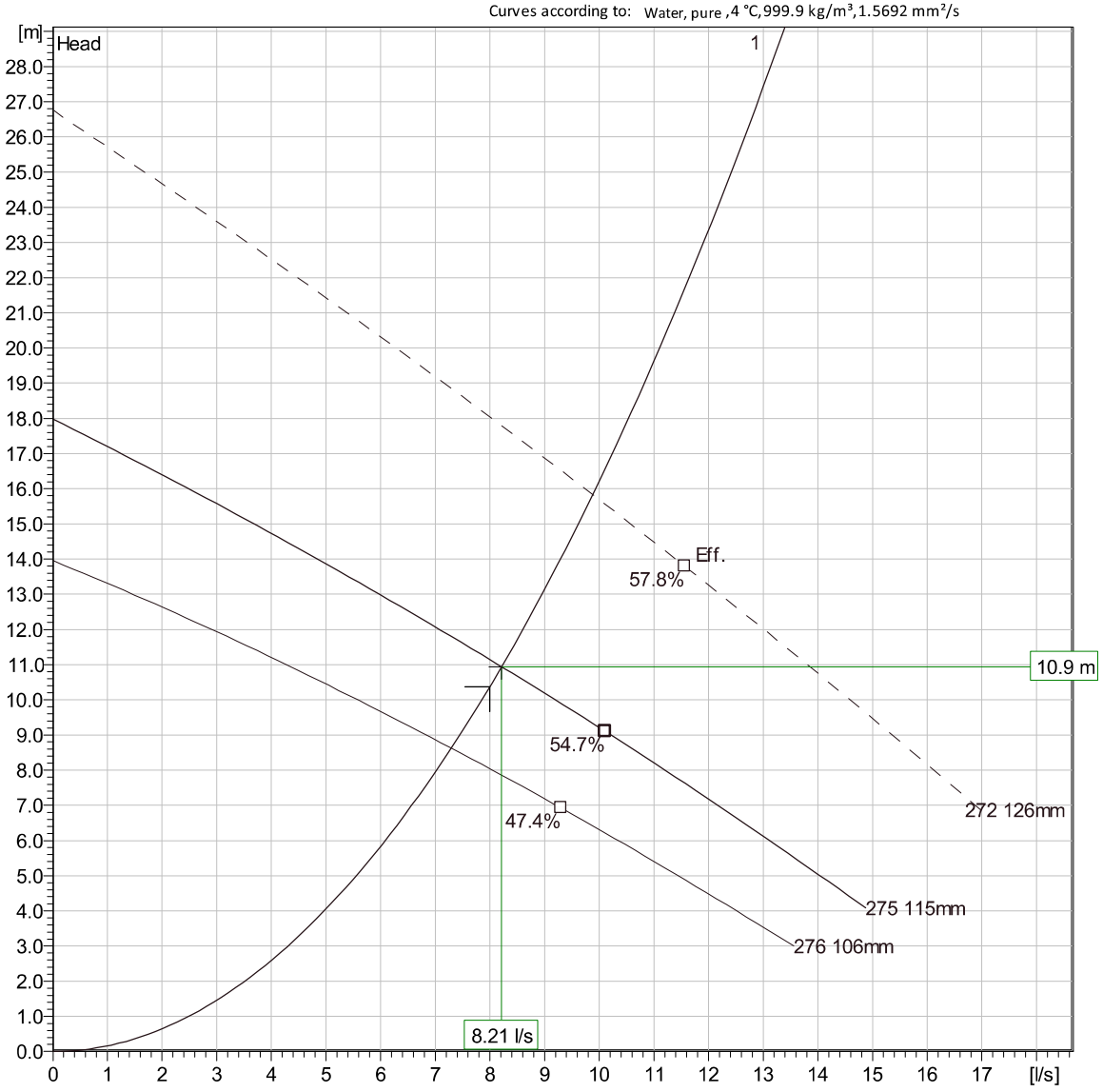
Curve: ISO 9906

Project	Xylect-21929325	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Duty Analysis

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



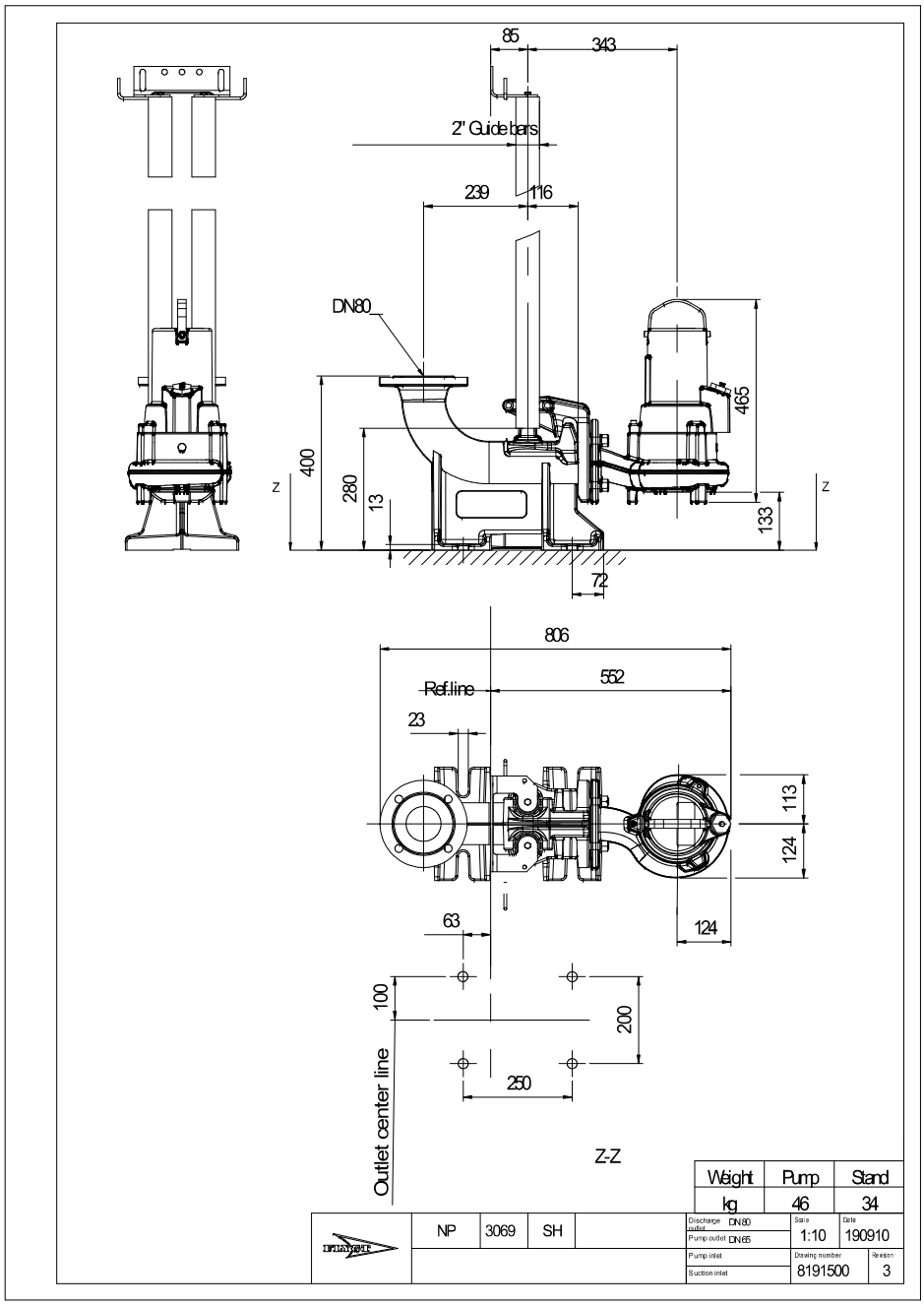
Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1	8.21 l/s	10.9 m	2.25 hp	8.21 l/s	10.9 m	2.25 hp	52.5 %	7.89E-5 kWh/l	3.64 m

Project	Xylect-21929325	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Dimensional drawing



Project	Xylect-21929325	**Created by**	xiaoyu Zhou
Block		**Created on**	2/29/2024 **Last update** 2/29/2024

3 AMELIA PUMP STATION

3.1 BACKGROUND

The Amelia pump station is located at 2351 Amelia Ave in Mermaid Park. The station is a triplex station with 3 submersible pumps, and the only station with auxiliary power. Available records indicate the station was originally constructed as a duplex drywell style station in 1954 and converted to a triplex wet well / submersible in 1972. An upgrade adding a control building with auxiliary power was completed in 2005. The pump station serves approximately 740 properties by gravity. Pumped sewage flows from the Allbay pump station via the Ardwell pump station also flow to the Amelia pump station.

3.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. Additional drawdown testing was completed after replacement of check valve in the station in 2020. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak flow of 76.3 L/s and a future peak flow requirement of 86.29 L/s were provided. The existing calculated pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMP 3	PUMPS 1 & 2	PUMPS 1+2+3
Pump Rate (L/s)	39.8	38.4	38.8	*62.1	64.0

Maintenance records indicate the existing pumps are Flygt NP 3127 MT – 438, 3-phase, 208V, 10 hp, Pump specifications, including dimension and pump curves were obtained from the manufacturer's website. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	451.5	203.2mm	CL100 Asbestos Concrete
Pump Station - Interior piping 1	*24.0m	154.0mm	C900 DR18 PVC
Pump Station - Interior piping 2	*5.3m	102.3mm	Cast Iron
Geodetic Head	8.1m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate capacities and evaluate the condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition

C=130 Fair Condition

C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve two pumps should have a maximum theoretical pump rate of approximately 58.8 L/s (C=150) and three pumps a pump rate of approximately 68.0 L/s (C=150). The calculated pump rates would indicate that the system is operating above the C=150 range

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Pump run times are generally around 2 hours per day / per pump.

Although the existing pumping capacity is lower than the current peak flows of 76.3 L/s, the station appears to be adequately handling the existing flows. The existing pumps do not have capacity to handle the anticipated 2035 design flows and will need to be upsized for the future flows.

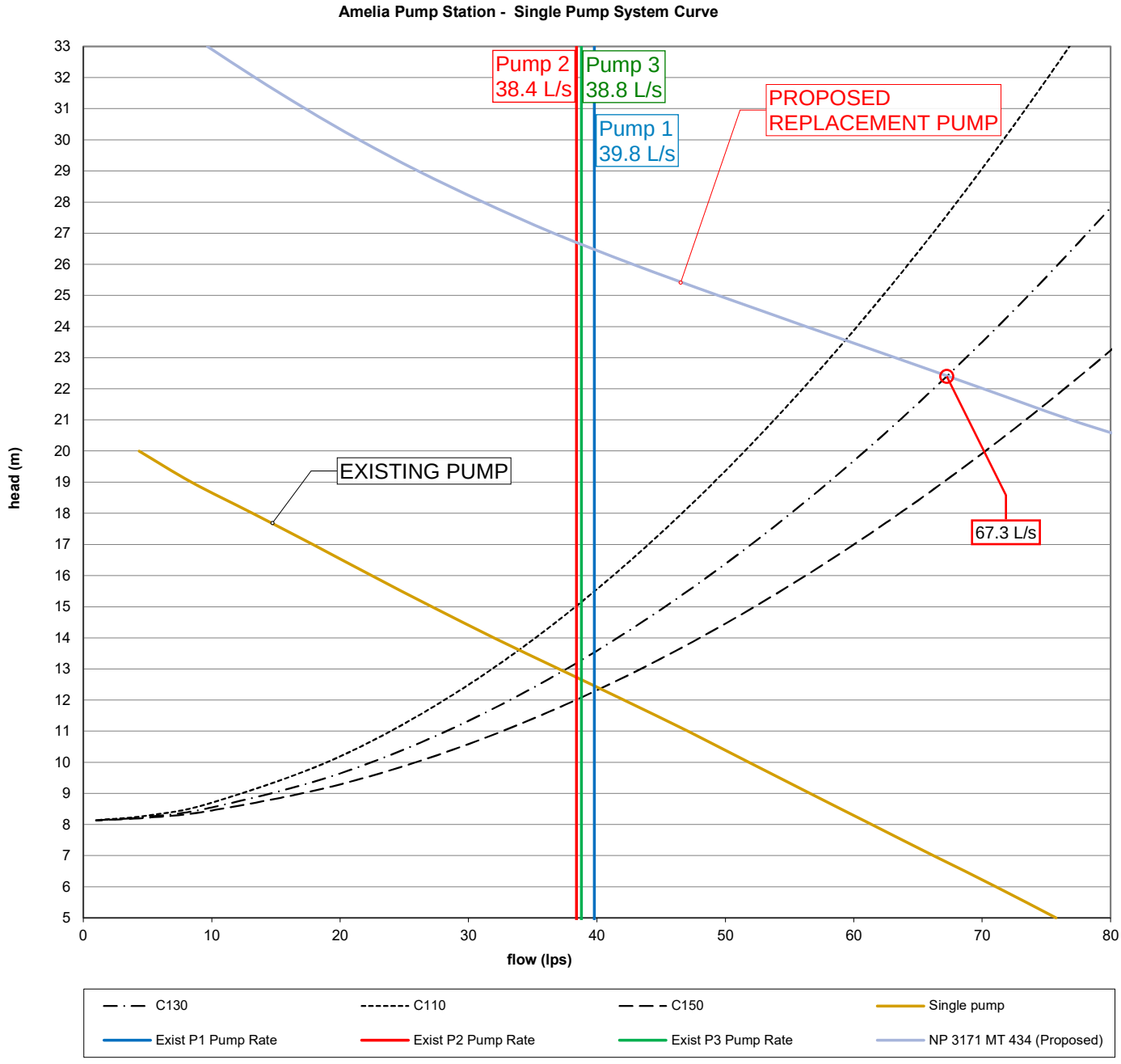
3.3 REPLACEMENT PUMP STATION

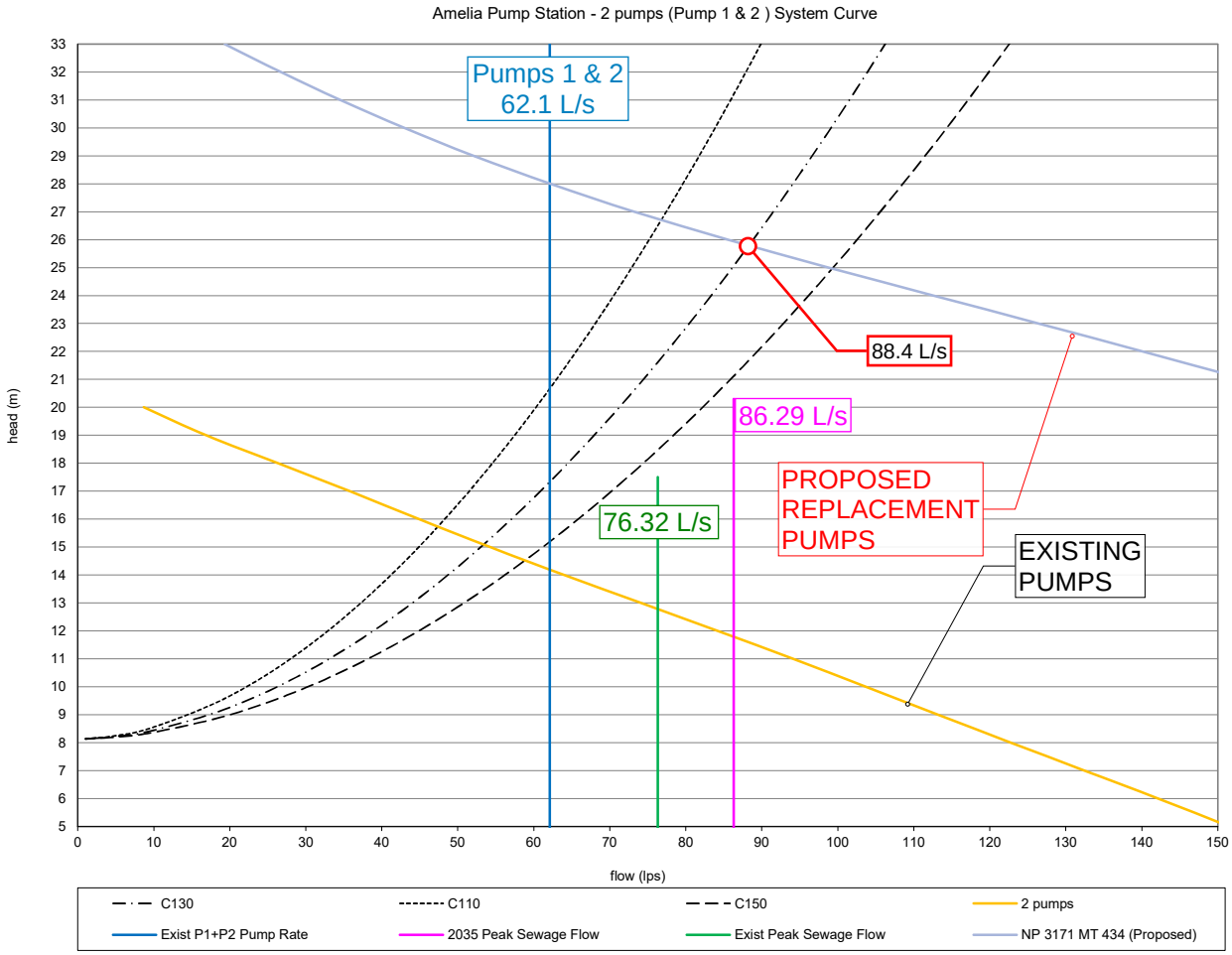
Amelia is a triplex station and replacement pump sizing is based on two pump operation capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

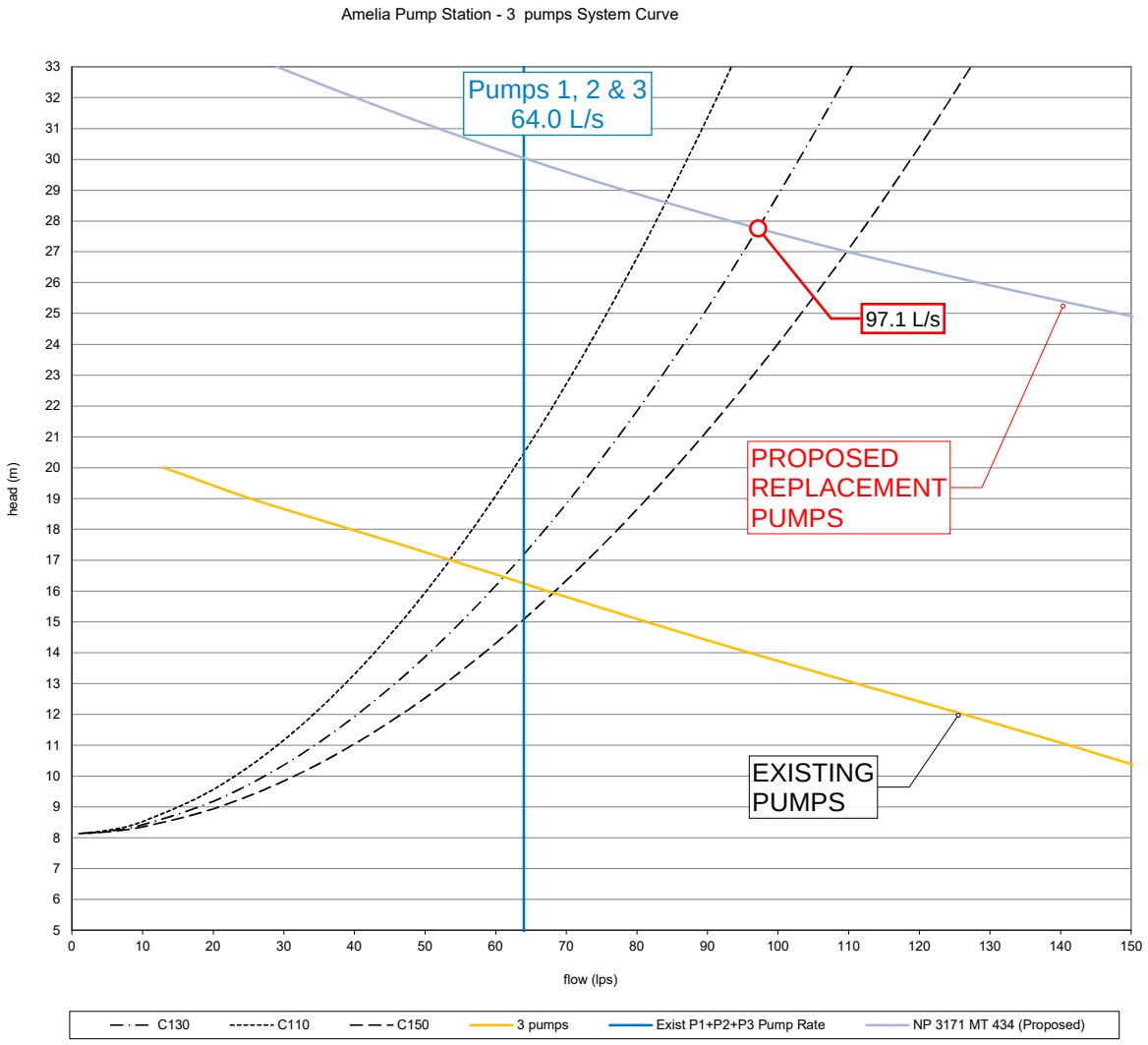
Replacement pumps were selected based on the selection parameters of 86.3 L/s @ 25.11m TDH (C=130). The proposed replacement pumps are Flygt NP 3171 MT 3~ Adaptive 463, 34 hp. The discharge on this pump model is 150mm diameter so the existing 100mm piping would have to be upgraded to use this pump model. The selected pumps are significantly larger than the existing pumps (34 hp vs 10 hp) and available power at the station including auxiliary generator capacity should be reviewed prior to any installation.

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pumps (2 pump operation) will have a theoretical capacity of 88.4 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (12 PAGES)


Amelia Pump Station - Single Pump System Curve
head (m)
flow (lps)
Pump 2
38.4 L/s
Pump 3
38.8 L/s
Pump 1
39.8 L/s
PROPOSED
REPLACEMENT PUMP
EXISTING PUMP
67.3 L/s
C130
C110
C150
Single pump
Exist P1 Pump Rate
Exist P2 Pump Rate
Exist P3 Pump Rate
NP 3171 MT 434 (Proposed)


Amelia Pump Station - 2 pumps (Pump 1 & 2) System Curve
head (m)
flow (lps)
Pumps 1 & 2
62.1 L/s
88.4 L/s
86.29 L/s
76.32 L/s
PROPOSED
REPLACEMENT
PUMPS
EXISTING
PUMPS
C130
C110
C150
2 pumps
Exist P1+P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3171 MT 434 (Proposed)


Amelia Pump Station - 3 pumps System Curve
Pumps 1, 2 & 3
64.0 L/s
97.1 L/s
PROPOSED
REPLACEMENT
PUMPS
EXISTING
PUMPS
head (m)
flow (lps)
C130
C110
C150
3 pumps
Exist P1+P2+P3 Pump Rate
NP 3171 MT 434 (Proposed)

AMELIA

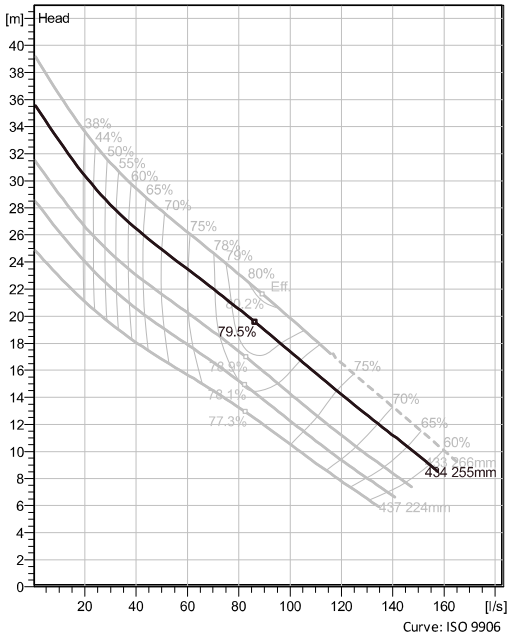
NP 3171 MT 3~ 434

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3171.185 25-19-4AA-W 34hp

Installation type
P - Semi permanent, Wet

Impeller diameter
255 mm

Discharge diameter
150 mm

Pump information

Impeller diameter
255 mm

Discharge diameter
150 mm

Inlet diameter
200 mm

Maximum operating speed
1760 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Project	Xylect-21929367	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3171 MT 3~ 434

Technical specification

Motor - General

Motor number N3171.185 25-19-4AA-W 34hp	**Phases** 3~	**Rated speed** 1760 rpm	**Rated power** 34 hp
ATEX approved No	**Number of poles** 4	**Rated current** 81 A	**Stator variant** 7
Frequency 60 Hz	**Rated voltage** 230 V	**Insulation class** H	**Type of Duty** S1
Version code 185			

Motor - Technical

Power factor - 1/1 Load 0.87	**Motor efficiency - 1/1 Load** 90.0 %	**Total moment of inertia** 0.176 kg m²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.83	**Motor efficiency - 3/4 Load** 91.0 %	**Starting current, direct starting** 560 A	
Power factor - 1/2 Load 0.74	**Motor efficiency - 1/2 Load** 91.0 %	**Starting current, star-delta** 187 A	

Project	Xylect-21929367	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

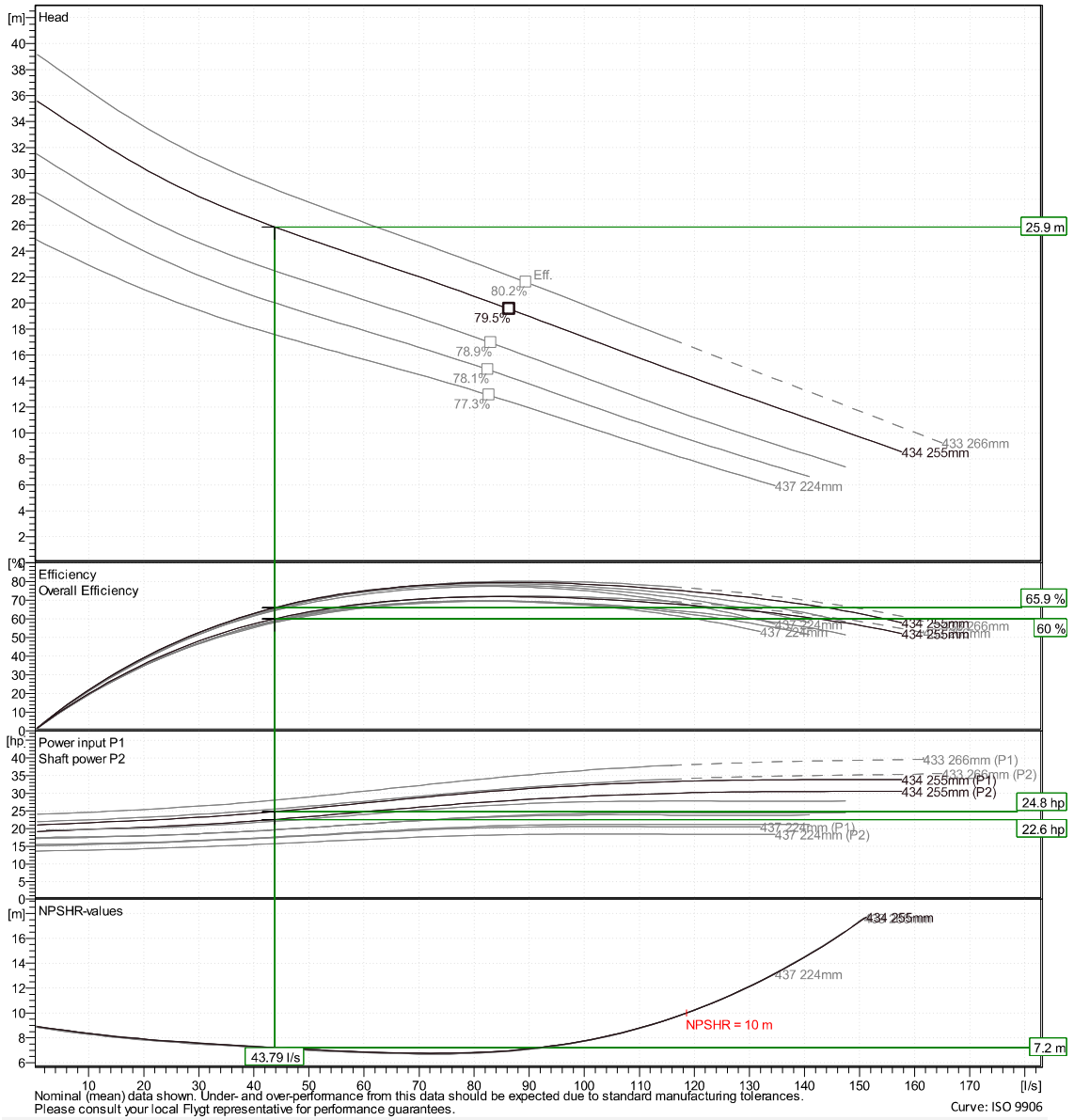
NP 3171 MT 3~ 434

Performance curve

Duty point

Flow	Head
43.8 l/s	25.9 m

Curves according to: Water, pure Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

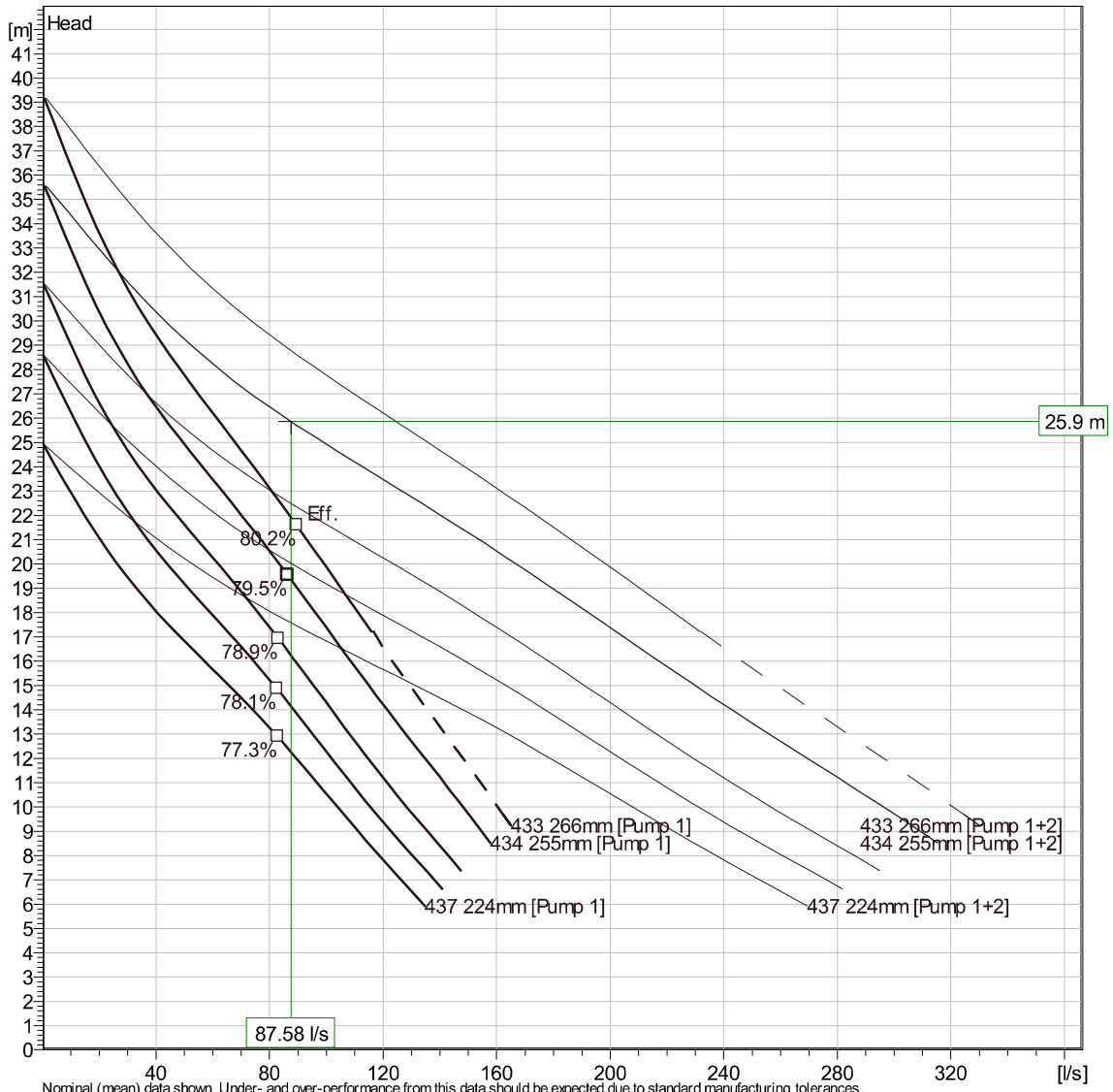
Xylect-21929367		xiaoyu Zhou	
	Created on	2/29/2024	**Last update** 2/29/2024

NP 3171 MT 3~ 434

Duty Analysis

FLYGT a xylem brand

Curves according to: Water, pure [100%] ; 4°C; 999.9kg/m³; 1.5692mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	l/s	m	hp	l/s	m	hp		kWh/l	m
2 / 1	43.8	25.9	22.6	87.6	25.9	45.2	65.9 %	0.000117	7.2
1 / 1	78.5	20.8	27.1	78.5	20.8	27.1	79.1 %	7.9E-5	6.78

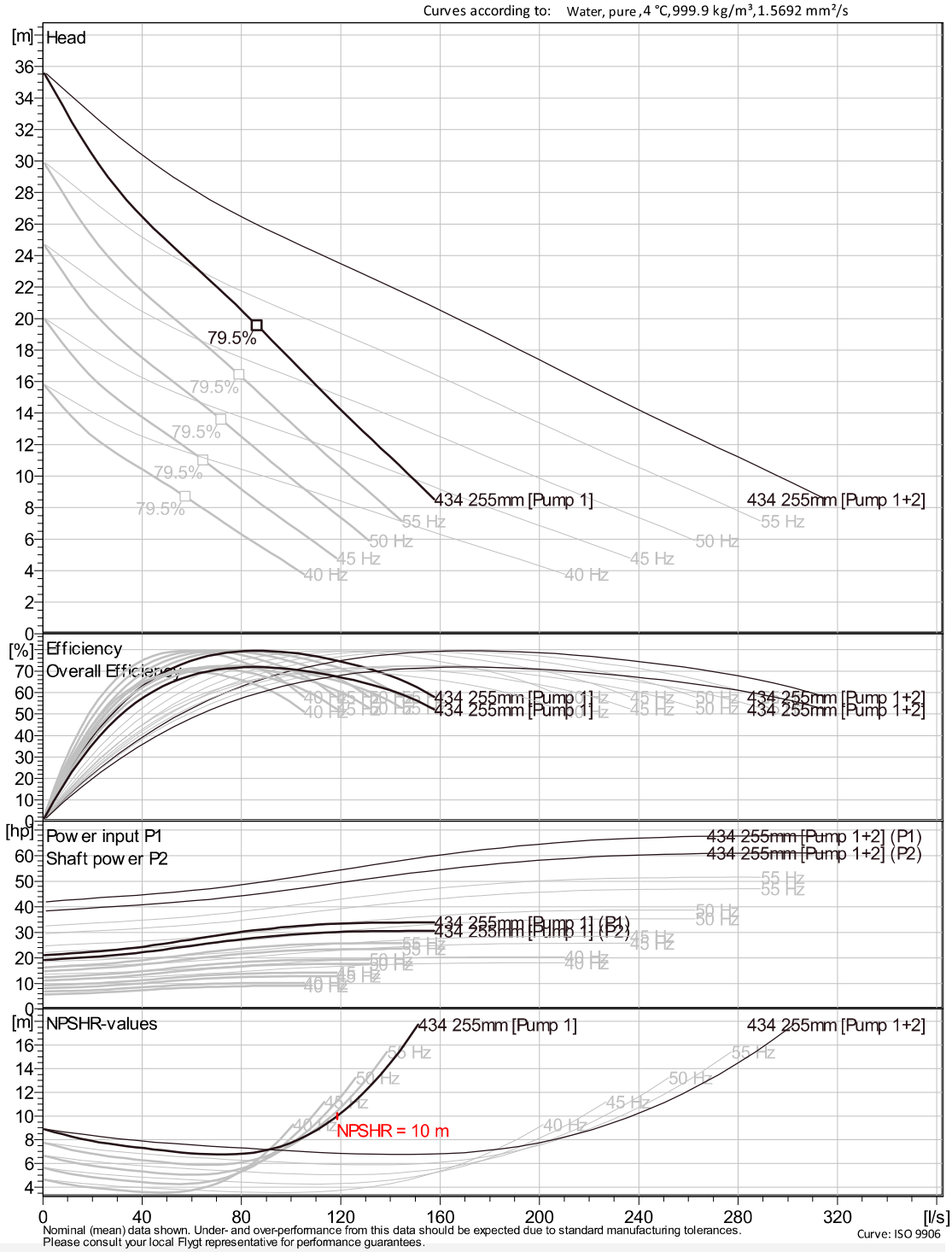
Project		**Created by**	xiaoyu Zhou		
Block	Xylect-21929367	**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3171 MT 3~ 434

VFD Curve

FLYGT
a xylem brand

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

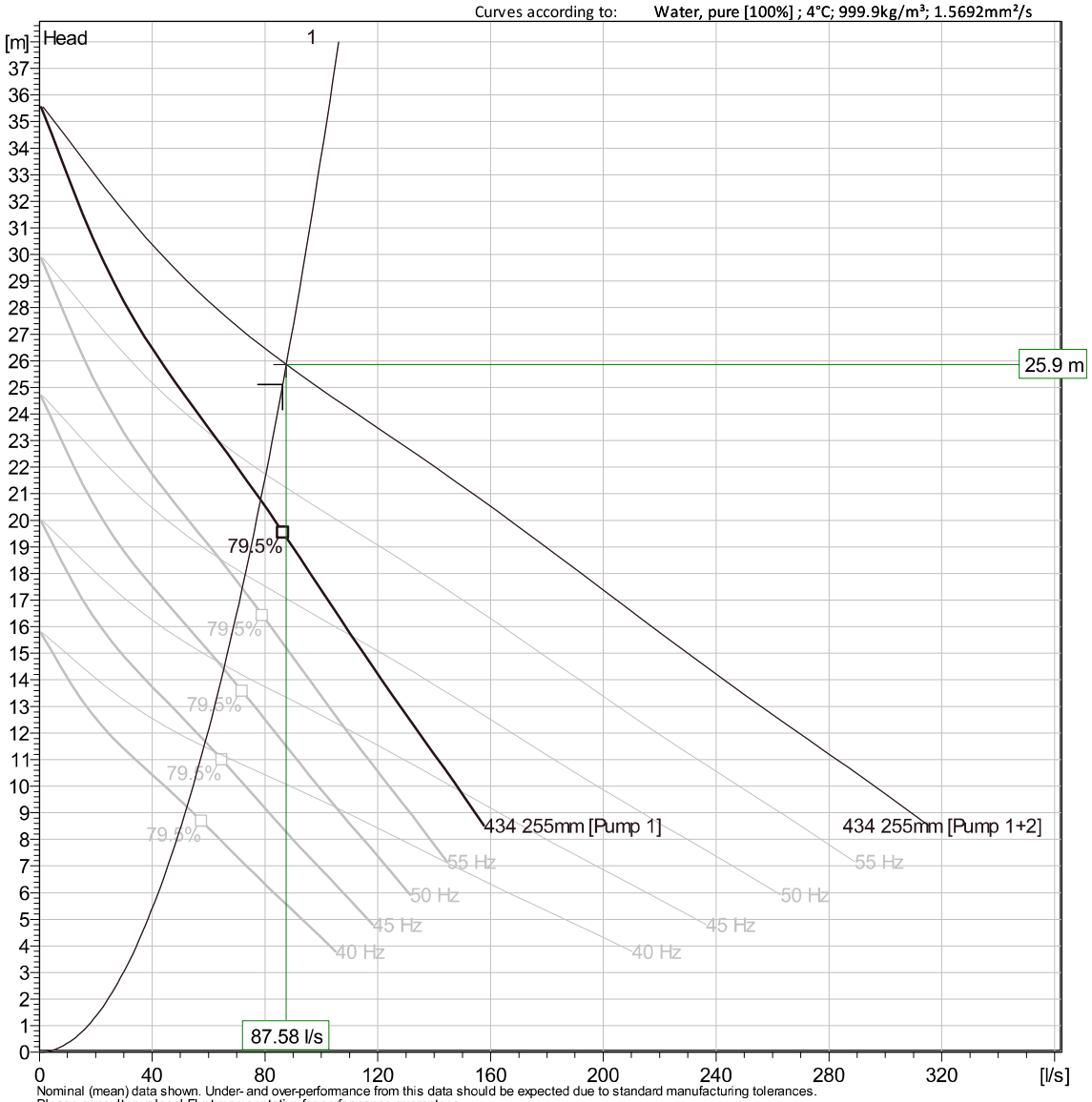
Curve: ISO 9906

Project	Xylect-21929367	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3171 MT 3~ 434

VFD Analysis

Curves according to: Water, pure [100%] ; 4°C; 999.9kg/m³; 1.5692mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating Characteristics

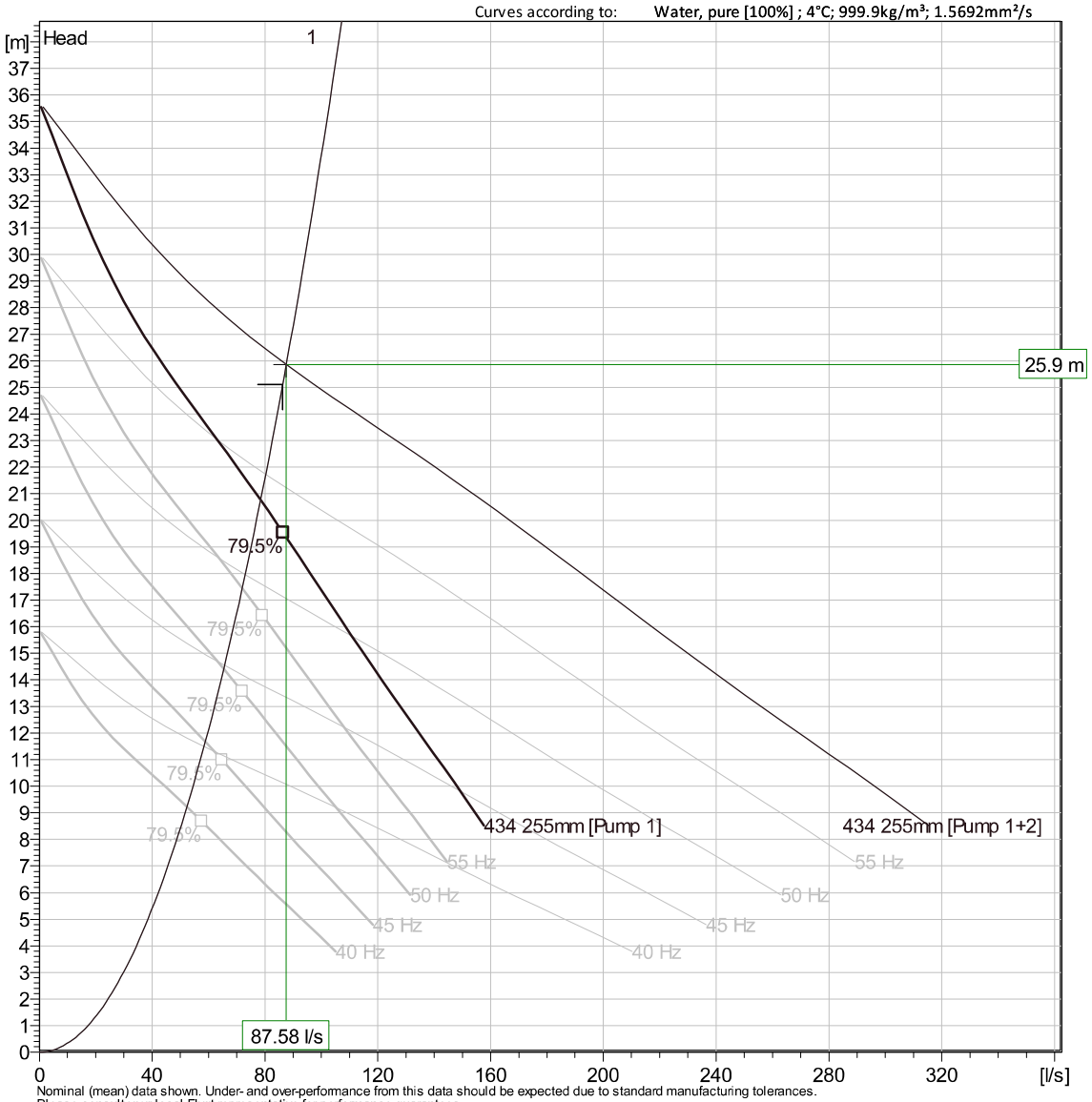
Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
2 / 1	60 Hz	43.8	25.9	22.6	87.6	25.9	45.2	65.9 %	0.000117	7.2
2 / 1	55 Hz	40.1	21.7	17.4	80.3	21.7	34.8	65.9 %	9.85E-5	6.27
2 / 1	50 Hz	36.5	18	13.1	73	18	26.1	65.9 %	8.2E-5	5.38
2 / 1	45 Hz	32.8	14.5	9.53	65.7	14.5	19.1	65.9 %	6.77E-5	4.54

Project	Xylect-21929367	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3171 MT 3~ 434

VFD Analysis

Curves according to: Water, pure [100%] ; 4°C; 999.9kg/m³; 1.5692mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

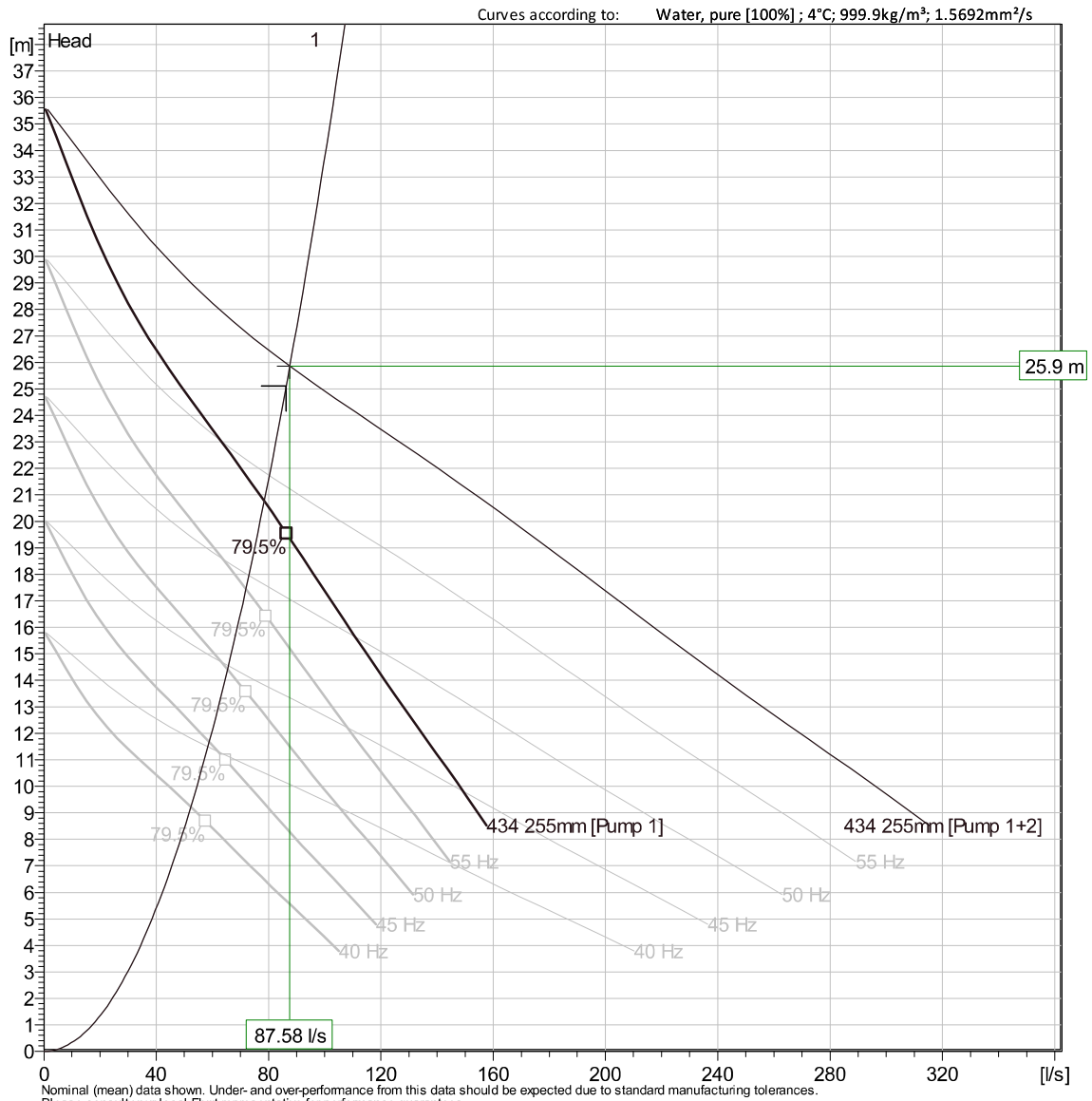
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
2 / 1	40 Hz	29.2	11.5	6.69	58.4	11.5	13.4	65.9 %	5.55E-5	3.76
1 / 1	60 Hz	78.5	20.8	27.1	78.5	20.8	27.1	79.1 %	7.9E-5	6.78
1 / 1	55 Hz	71.9	17.4	20.9	71.9	17.4	20.9	79.1 %	6.58E-5	5.9
1 / 1	50 Hz	65.4	14.4	15.7	65.4	14.4	15.7	79.1 %	5.46E-5	5.06

Project	Xylect-21929367	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3171 MT 3~ 434

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

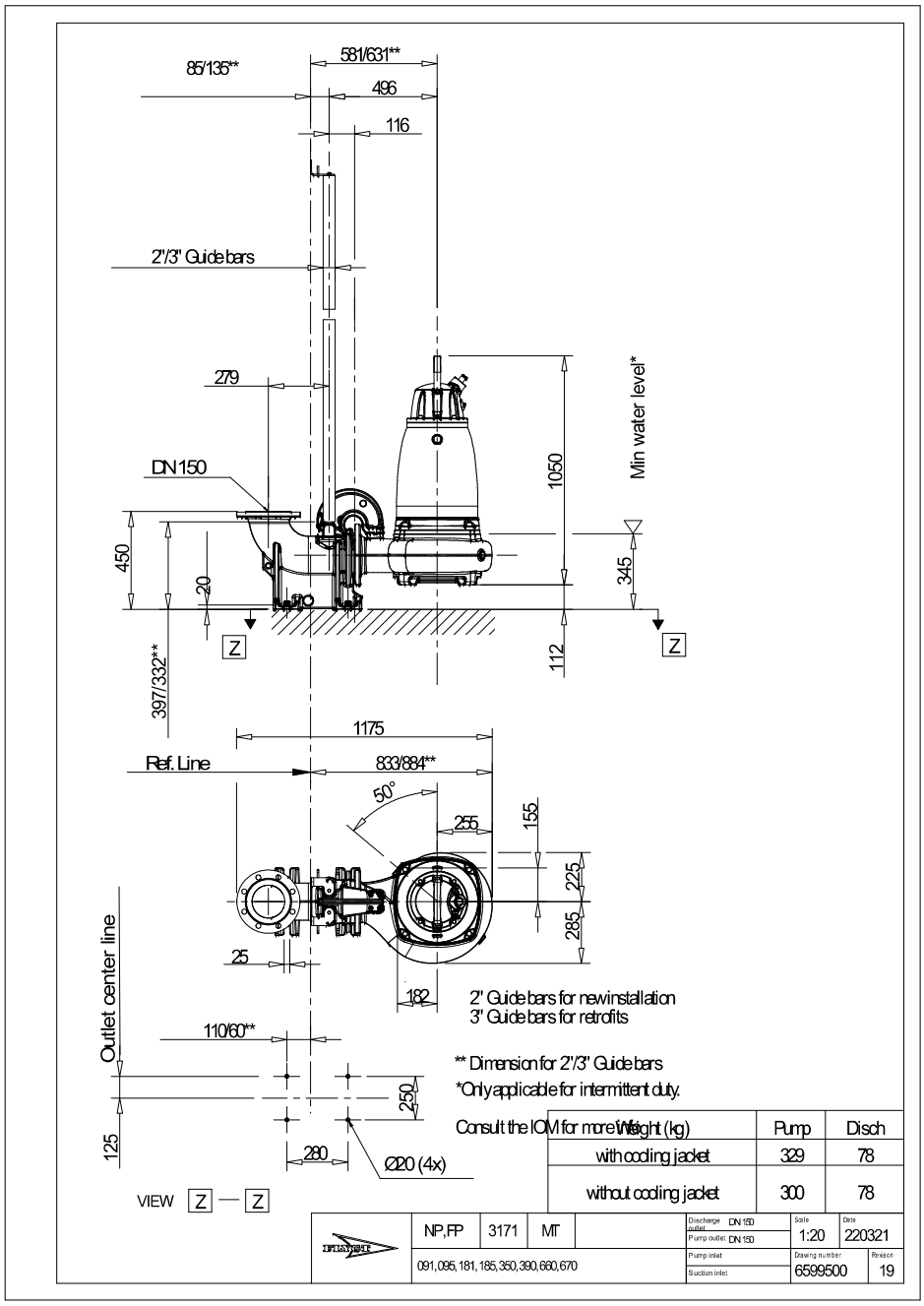
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
1 / 1	45 Hz	58.9	11.7	11.4	58.9	11.7	11.4	79.1 %	4.48E-5	4.28
1 / 1	40 Hz	52.3	9.23	8.03	52.3	9.23	8.03	79.1 %	3.64E-5	3.54

Project	Xylect-21929367	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3171 MT 3~ 434

Dimensional drawing



Project	Xylect-21929367	**Created by**	xiaoyu Zhou
Block		**Created on**	2/29/2024 **Last update** 2/29/2024

4 ARDWELL PUMP STATION

4.1 BACKGROUND

The Ardwell pump station is located at the SE corner of Resthaven Drive and Ardwell Avenue. The station is a duplex station with submersible pumps. The station serves approximately 238 properties by gravity and receives pumped flows from the Allbay pump station. Flows are pumped to the gravity sewer system that flows to the Amelia pump station.

4.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak flow of 20.36 L/s and a future peak flow requirement of 24.15 L/s were provided. The existing calculated pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	12.1[1]	21.6	22.2

[1] pump equipped with flush valve.

Maintenance records indicate the existing pumps are Flygt NP 3102 MT – 463, 3-phase, 230V, 5 hp. Pump specifications, including dimension and pump curves were obtained from the manufacturer's website. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	*124.4m	152.4mm	CL100 Asbestos Concrete
Pump Station - Interior piping 1	*22.9m	101.6mm	Steel
Geodetic Head	4.93m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate capacities and evaluate condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition

C=130 Fair Condition

C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve a single pump should have a maximum theoretical pump rate of approximately 28.0 L/s (C=150) and two pumps a pump rate of approximately

39.8 L/s (C=150). The calculated pump rates would indicate that the system is operating below C=110. This may indicate that the drawdown calculations are incorrect, or that there may be an issue with the forcemain.

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Total pump run times are fairly consist between 5-7 hours per day. Pump hours in January 2019 were significantly unbalanced with Pump 1 run times approximately four (4) times that of Pump 2

The existing pumps are currently pumping at approximately 89% of the 2035 peak flow. The theoretical pump rate at C=130 for the existing pumps is 25.8 L/s. This would indicate that the existing pumps should be capable of handling the future flows, but the drawdown results indicate otherwise. This would indicate that the system curve may be incorrect or that the pumps are not performing to full capacity.

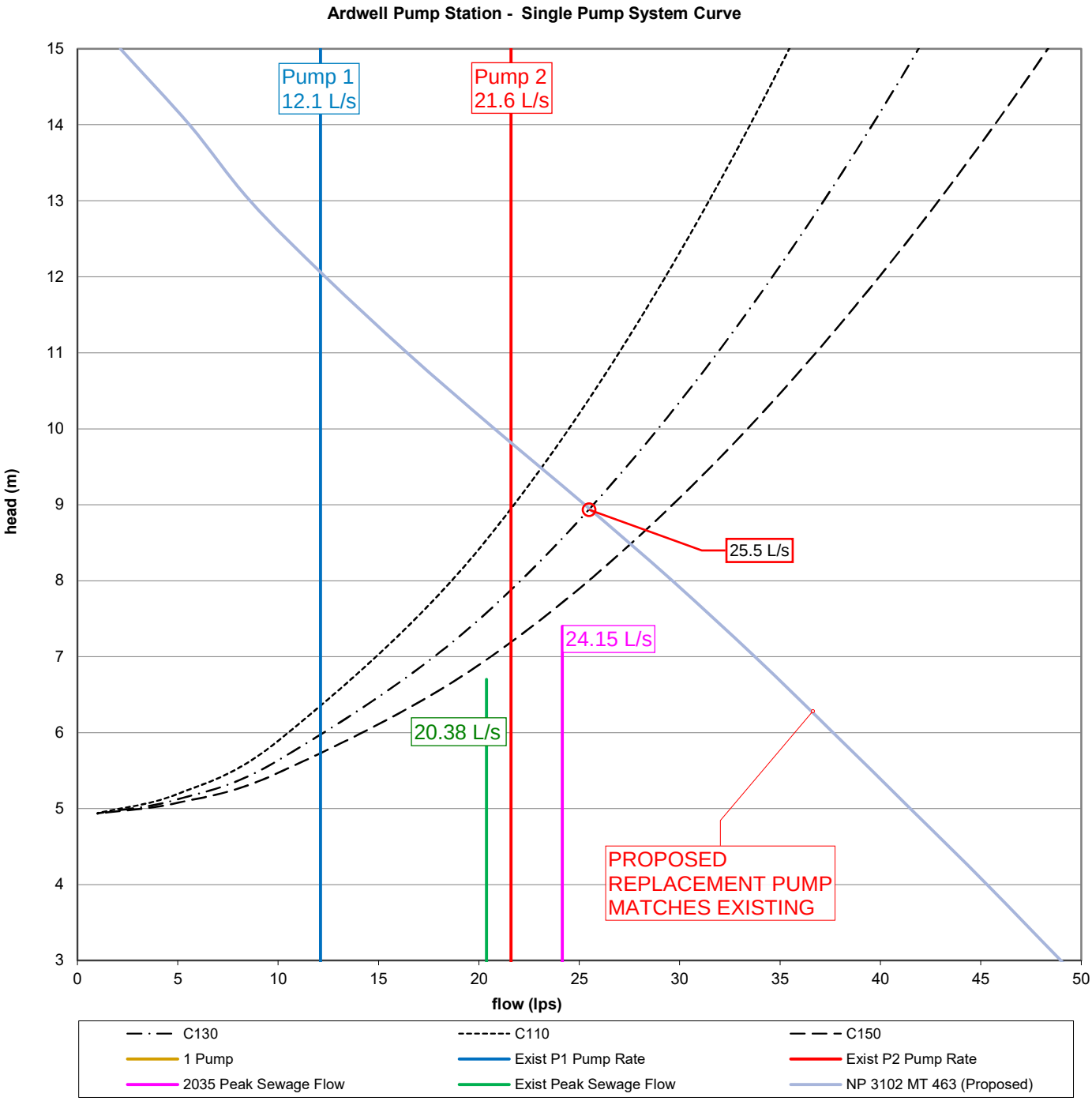
4.3 REPLACEMENT PUMP SELECTION

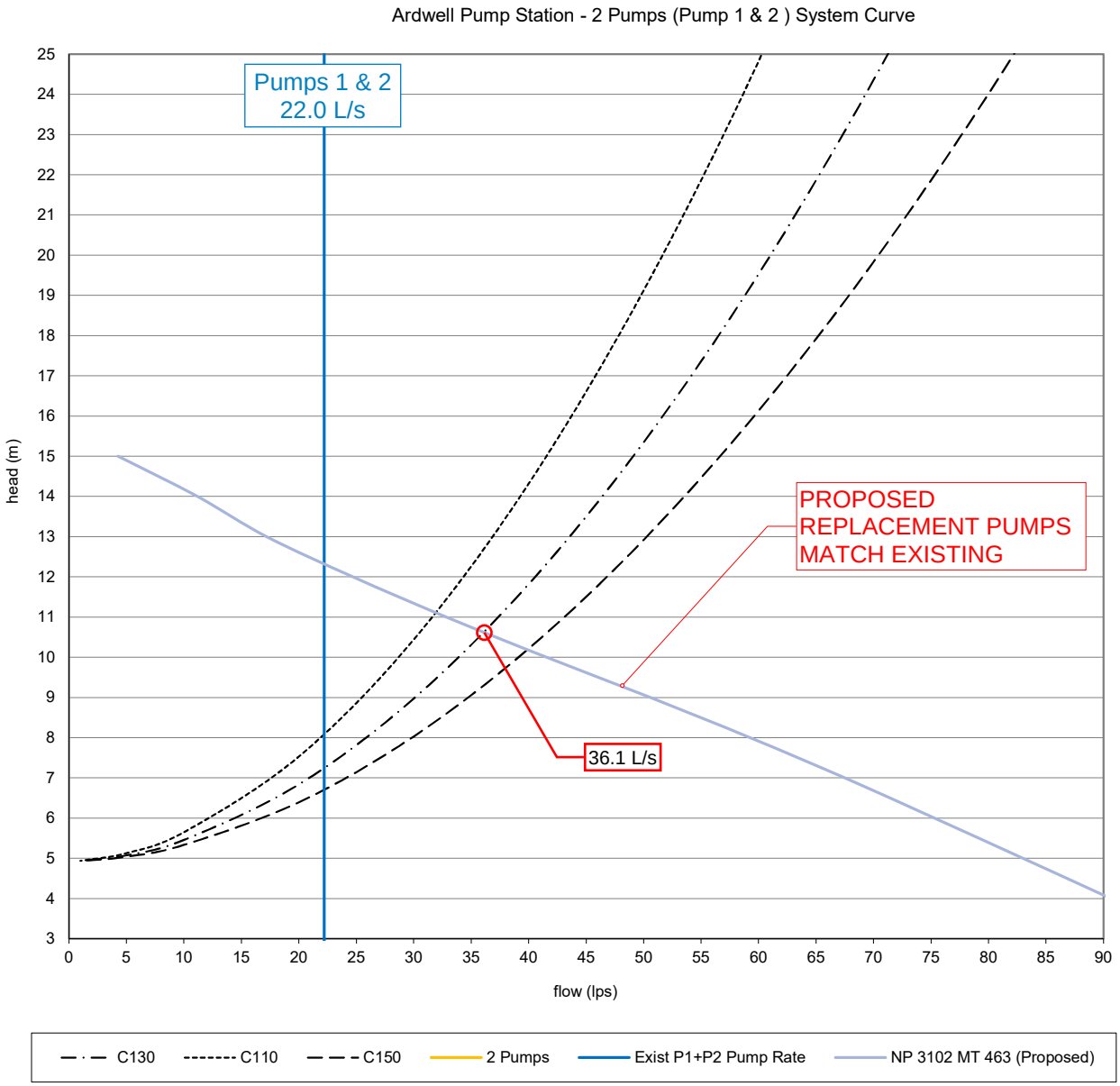
Replacement pump sizing is based on a single pump capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

The replacement pump based on the selection parameters of 24.15 L/s @ 8.56m TDH (C=130) derived from the system curve resulted in the recommended replacement pump being the same as the existing; Flygt NP 3102 MT ~3 Adaptive 463, 5.0 hp. As the existing pumps are operating below expected capacity, the draw down tests should be re-done to confirm flow rates and determine if the underperformance is due to age / condition of the pumps or errors in the system information. If the pump selection remains the same, the selected pump model could be used at one other station (Rothesay).

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pump will have a theoretical capacity of 25.2 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (10 PAGES)


Ardwell Pump Station - Single Pump System Curve
head (m)
flow (lps)
Pump 1
12.1 L/s
Pump 2
21.6 L/s
25.5 L/s
24.15 L/s
20.38 L/s
PROPOSED
REPLACEMENT PUMP
MATCHES EXISTING
C130
C110
C150
1 Pump
Exist P1 Pump Rate
Exist P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3102 MT 463 (Proposed)


Ardwell Pump Station - 2 Pumps (Pump 1 & 2) System Curve
Pumps 1 & 2
22.0 L/s
PROPOSED
REPLACEMENT PUMPS
MATCH EXISTING
36.1 L/s
head (m)
flow (lps)
C130
C110
C150
2 Pumps
Exist P1+P2 Pump Rate
NP 3102 MT 463 (Proposed)

ARDWELL

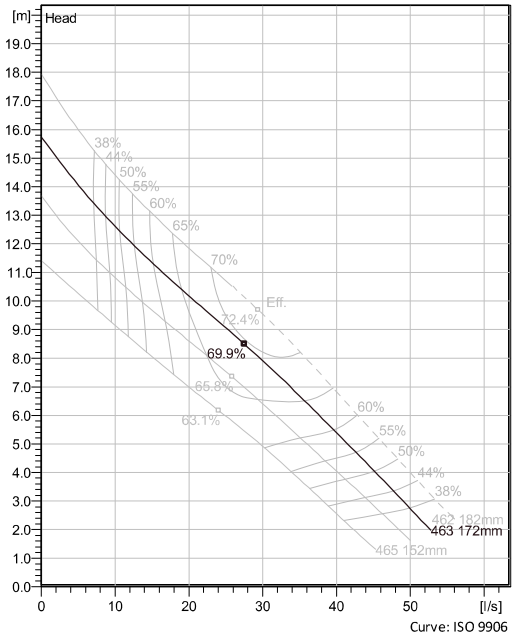
NP 3102 MT 3~ Adaptive 463

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3102.060 18-11-4AL-W 5hp

Installation type
P - Semi permanent, Wet

Impeller diameter
172 mm

Discharge diameter
100 mm

Pump information

Impeller diameter
172 mm

Discharge diameter
100 mm

Inlet diameter
100 mm

Maximum operating speed
1735 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Stator housing material
Grey cast iron

Project	Xylect-21929384	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

Technical specification

Motor - General

Motor number N3102.060 18-11-4AL-W 5hp	**Phases** 3~	**Rated speed** 1735 rpm	**Rated power** 5 hp
ATEX approved No	**Number of poles** 4	**Rated current** 13 A	**Stator variant** 68
Frequency 60 Hz	**Rated voltage** 230 V	**Insulation class** H	**Type of Duty** S1
Version code 060			

Motor - Technical

Power factor - 1/1 Load 0.86	**Motor efficiency - 1/1 Load** 84.7 %	**Total moment of inertia** 0.0258 kg m²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.83	**Motor efficiency - 3/4 Load** 85.9 %	**Starting current, direct starting** 69 A	
Power factor - 1/2 Load 0.74	**Motor efficiency - 1/2 Load** 85.4 %	**Starting current, star-delta** 23 A	

Project	Xylect-21929384	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

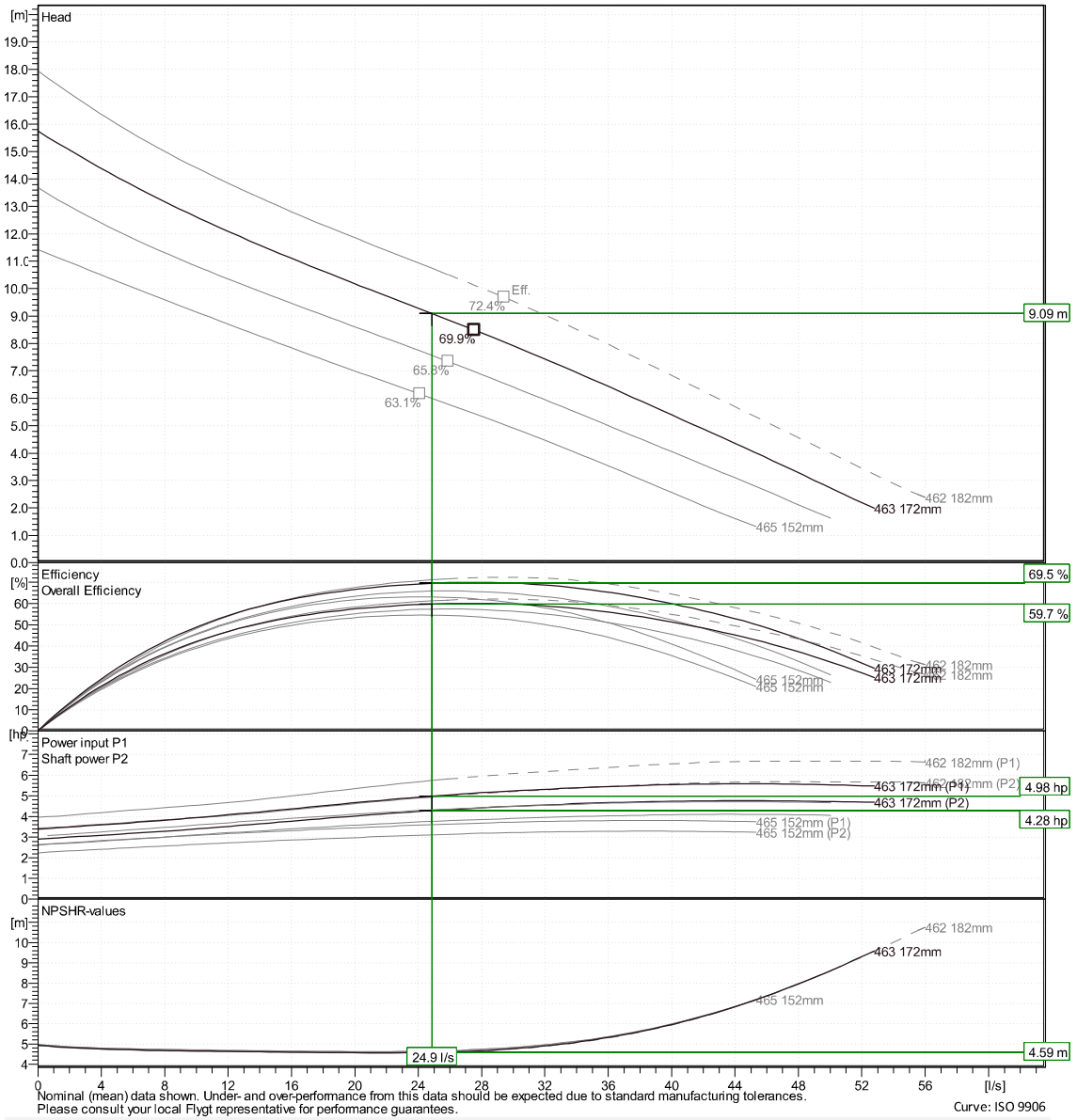
NP 3102 MT 3~ Adaptive 463

Performance curve

Duty point

Flow	Head
24.9 l/s	9.09 m

Curves according to: Water, pure Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

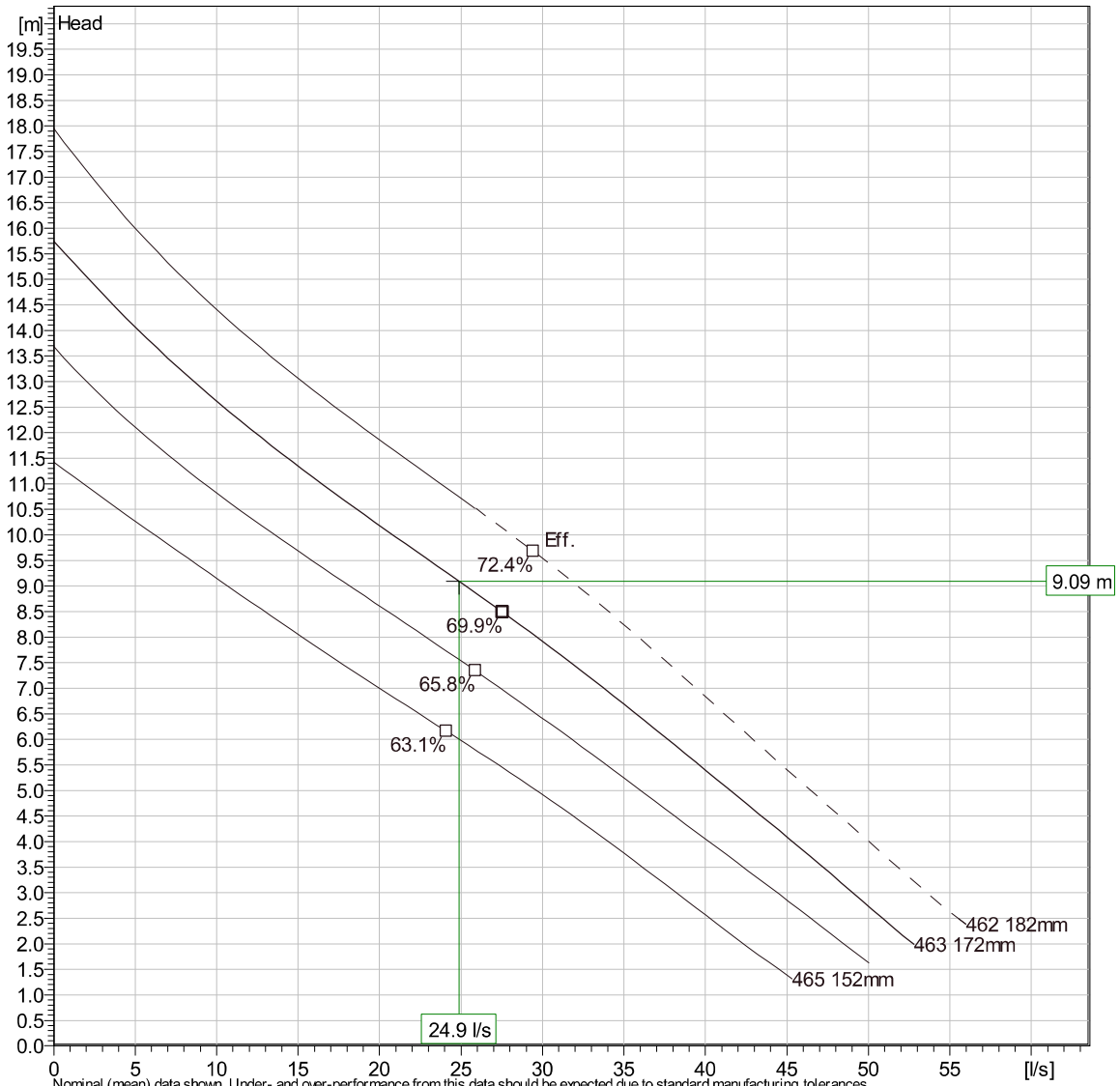
Curve: ISO 9906

Xylect-21929384		xiaoyu Zhou	
	Created on	2/29/2024	**Last update** 2/29/2024

NP 3102 MT 3~ Adaptive 463

Duty Analysis

Curves according to: Water, pure [100%] ; 4°C; 999.9kg/m³; 1.5692mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	l/s	m	hp	l/s	m	hp		kWh/l	m
1	24.9	9.09	4.28	24.9	9.09	4.28	69.5 %	4.15E-5	4.59

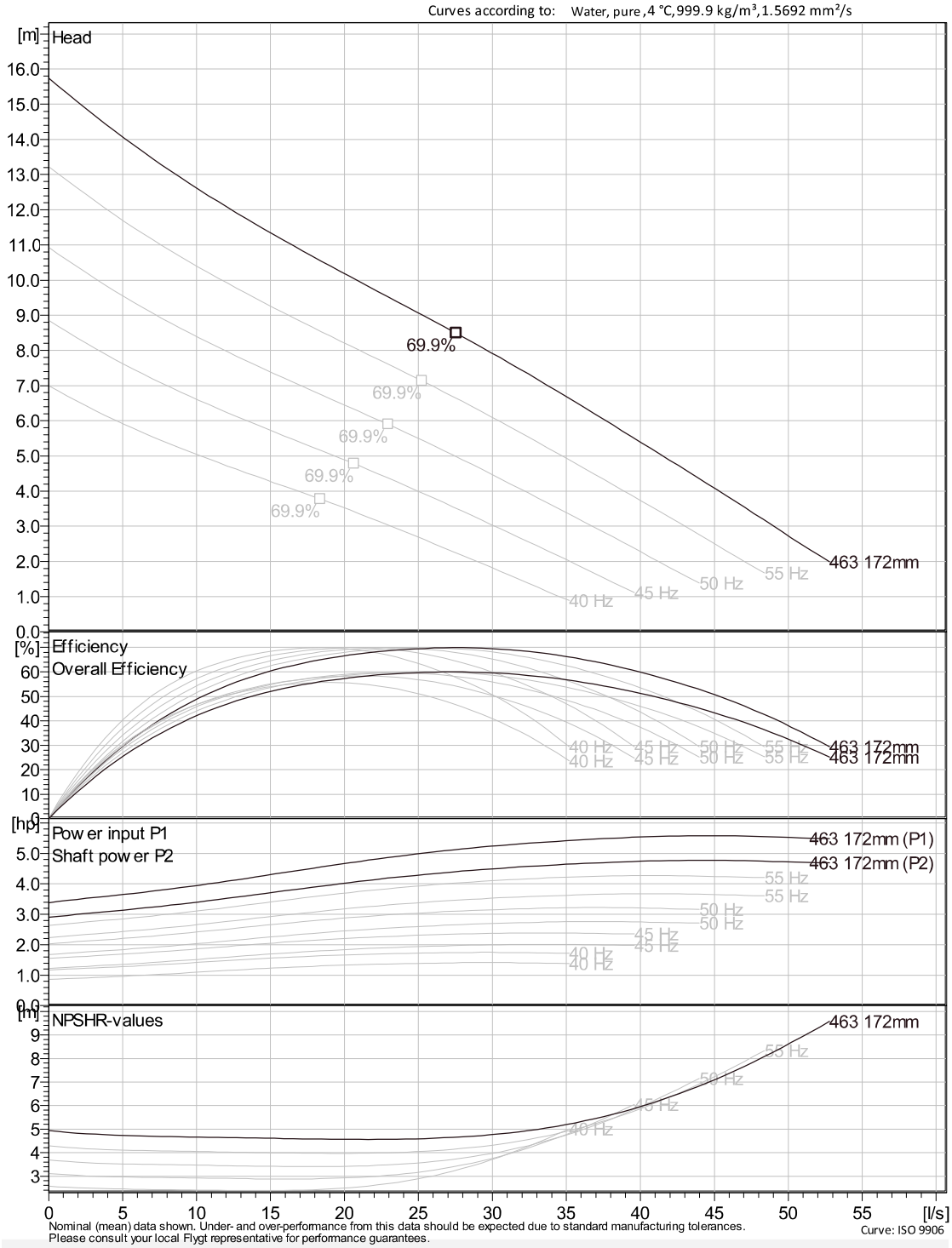
Project		**Created by**	xiaoyu Zhou		
Block	Xylect-21929384	**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

VFD Curve

FLYGT
a xylem brand

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



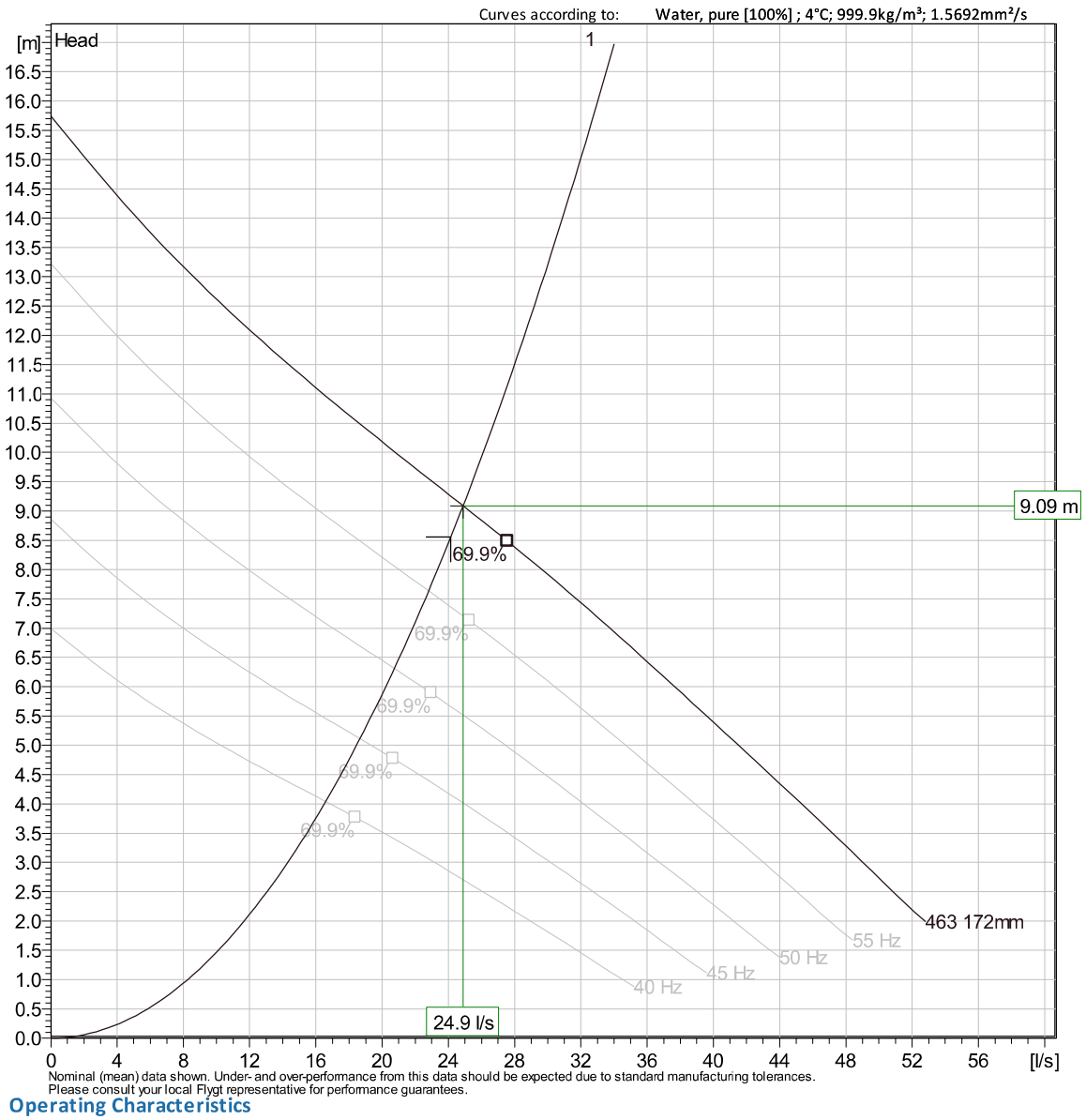
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

Project	Xylect-21929384	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

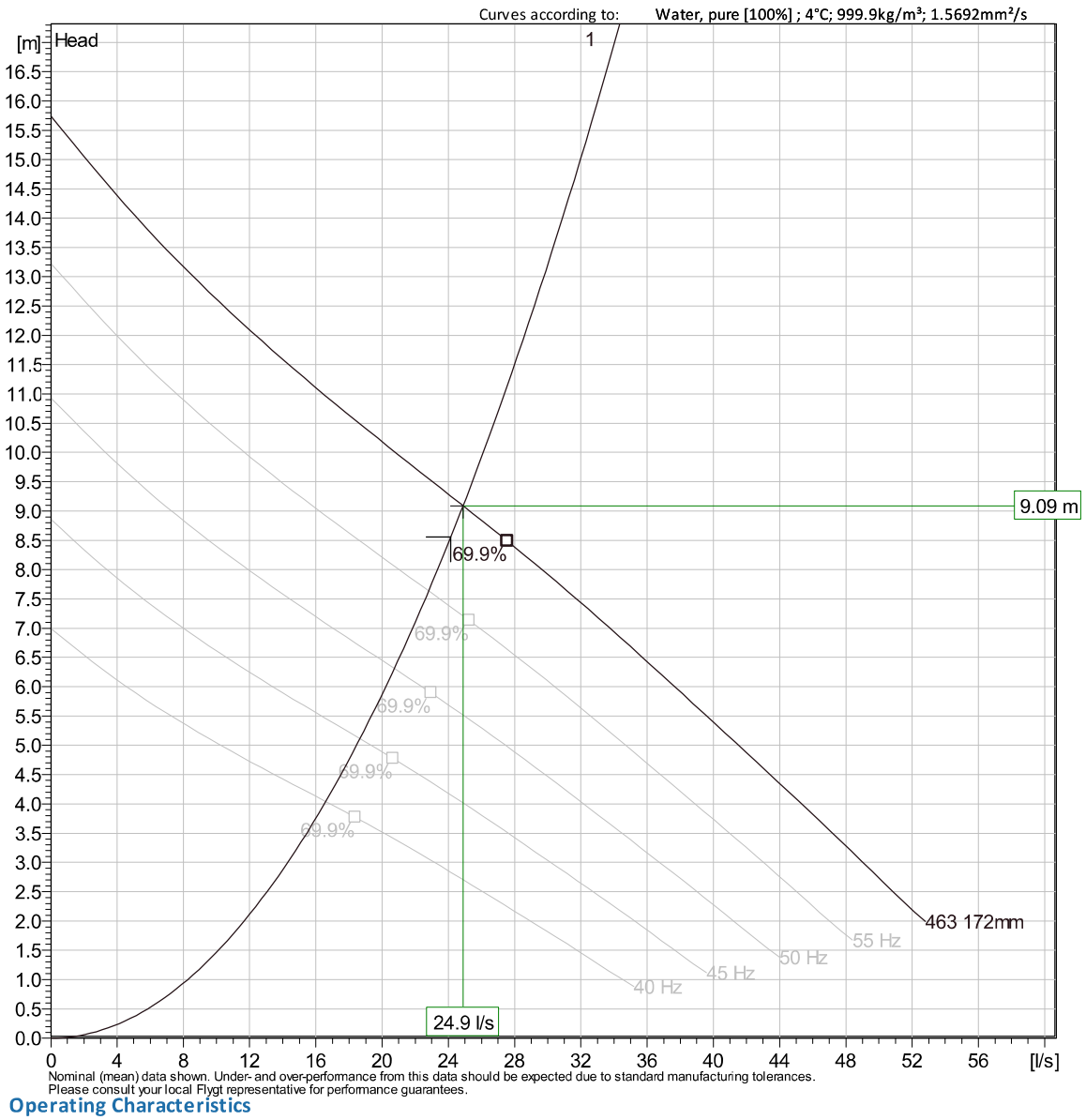
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
1	60 Hz	24.9	9.09	4.28	24.9	9.09	4.28	69.5 %	4.15E-5	4.59
1	55 Hz	22.8	7.64	3.3	22.8	7.64	3.3	69.5 %	3.48E-5	3.99
1	50 Hz	20.7	6.31	2.48	20.7	6.31	2.48	69.5 %	2.9E-5	3.43
1	45 Hz	18.7	5.11	1.81	18.7	5.11	1.81	69.5 %	2.41E-5	2.89

Project	Xylect-21929384	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

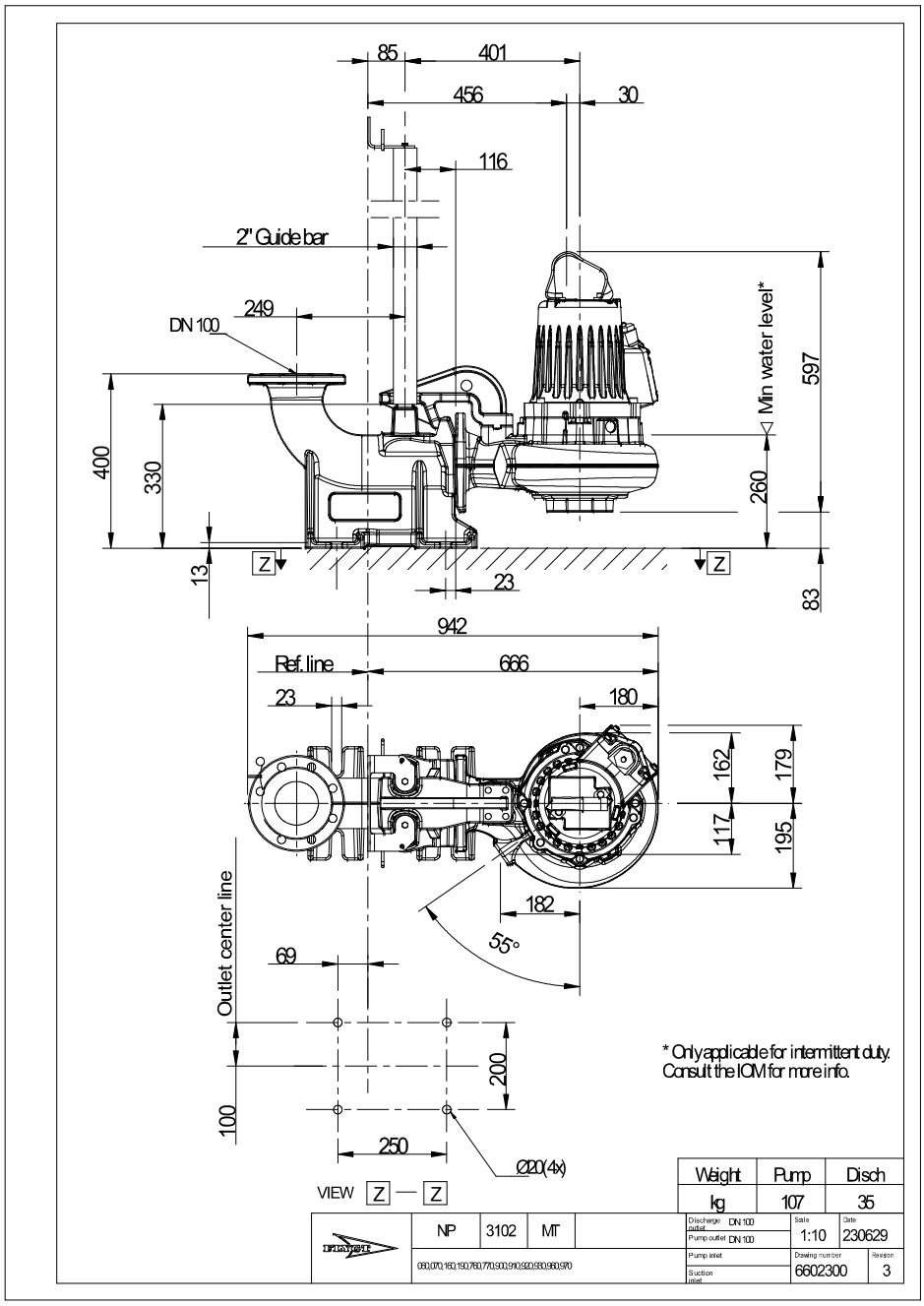
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
1	40 Hz	16.6	4.04	1.27	16.6	4.04	1.27	69.5 %	2E-5	2.4

Project	Xylect-21929384	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

Dimensional drawing



Project	Xylect-21929384	**Created by**	xiaoyu Zhou
Block		**Created on**	2/29/2024 **Last update** 2/29/2024

5 FROST PUMP STATION

5.1 BACKGROUND

The Frost pump station is located at 2020 Frost Ave West in Reay Creek Park. The station is accessible by a gated gravel access at the end of Frost Ave West. The station is a duplex submersible style pump station. Approximately 32 properties are served by the station.

5.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak flow of 2.62 L/s and a future peak flow requirement of 3.06 L/s were provided. The existing calculated pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	16.0	15.9	19.5

Maintenance records indicate the existing pumps are Flygt CP 3102 MT – 433, 3-phase, 230V, 5 hp. Pump specifications, including dimension and pump curves were obtained from the manufacturer's website. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	*100.0m	108mm	C900 DR18 PVC
Pump Station - Interior piping 1	*26.5m	101.6mm	Steel
Geodetic Head	5.99m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate capacities and evaluate the condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition
C=130 Fair Condition
C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve a single pump should have a maximum theoretical pump rate of approximately 13.7 L/s (C=150) and two pumps a pump rate of approximately 18.0 L/s (C=150). The calculated pump rates would indicate that the system is operating above C=150. This could be due to incorrect data used in the draw-down calculations or inconsistencies in the system data used to develop the system curve.

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Total pump run times range from approximately 20 minutes dry season to approximately 1 hour during wet season. An average of 8 pump starts per day.

The existing pumps are currently capable of pumping significantly higher flow than the 2035 peak flow of 3.06 L/s. The existing pumps are pumping approximately five (5) times of the future flow rate. Based on this, the existing pumps are potentially oversized and replacement pumps could be smaller.

5.3 REPLACEMENT PUMP SELECTION

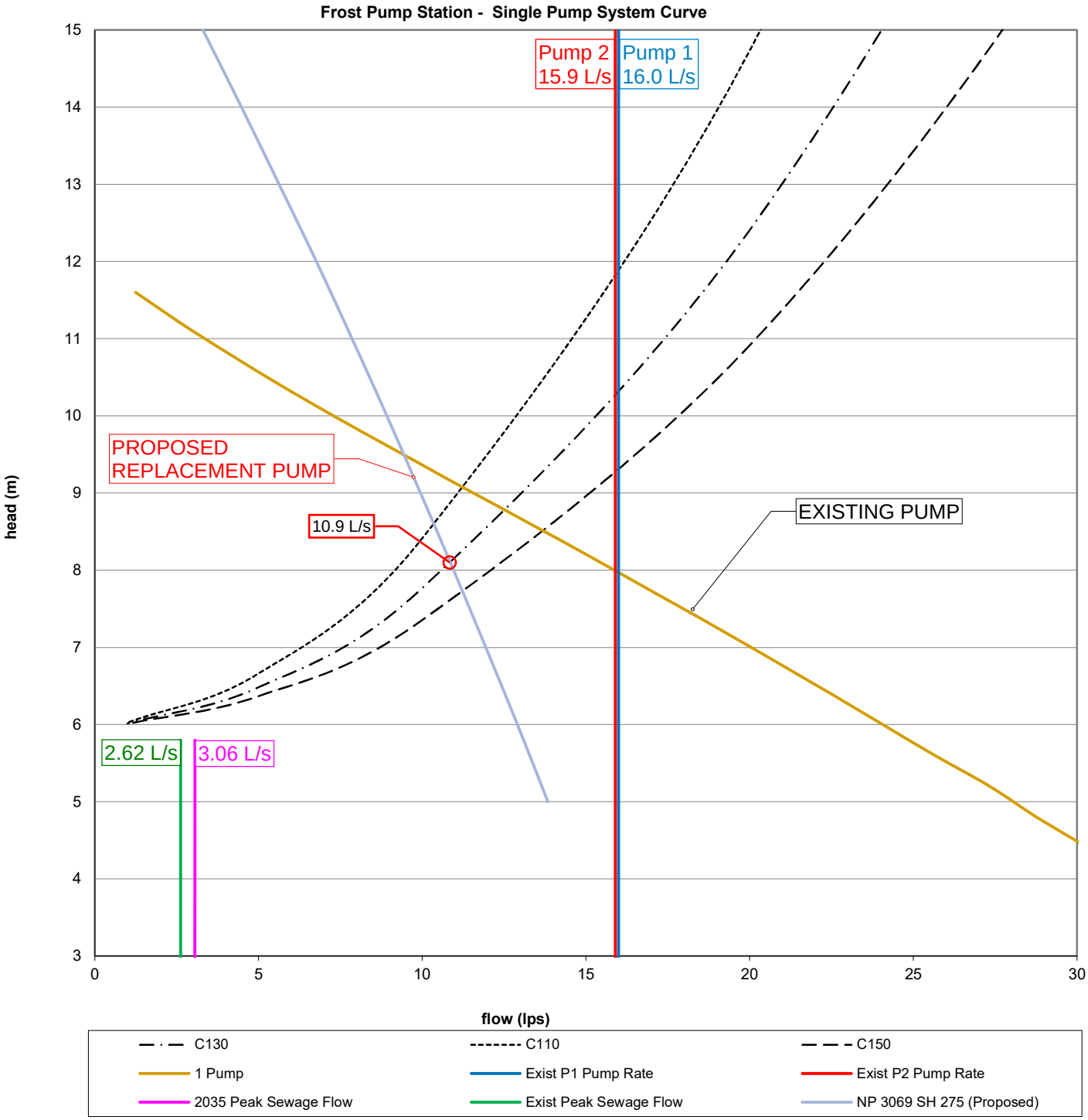
Replacement pump sizing is based on a single pump capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

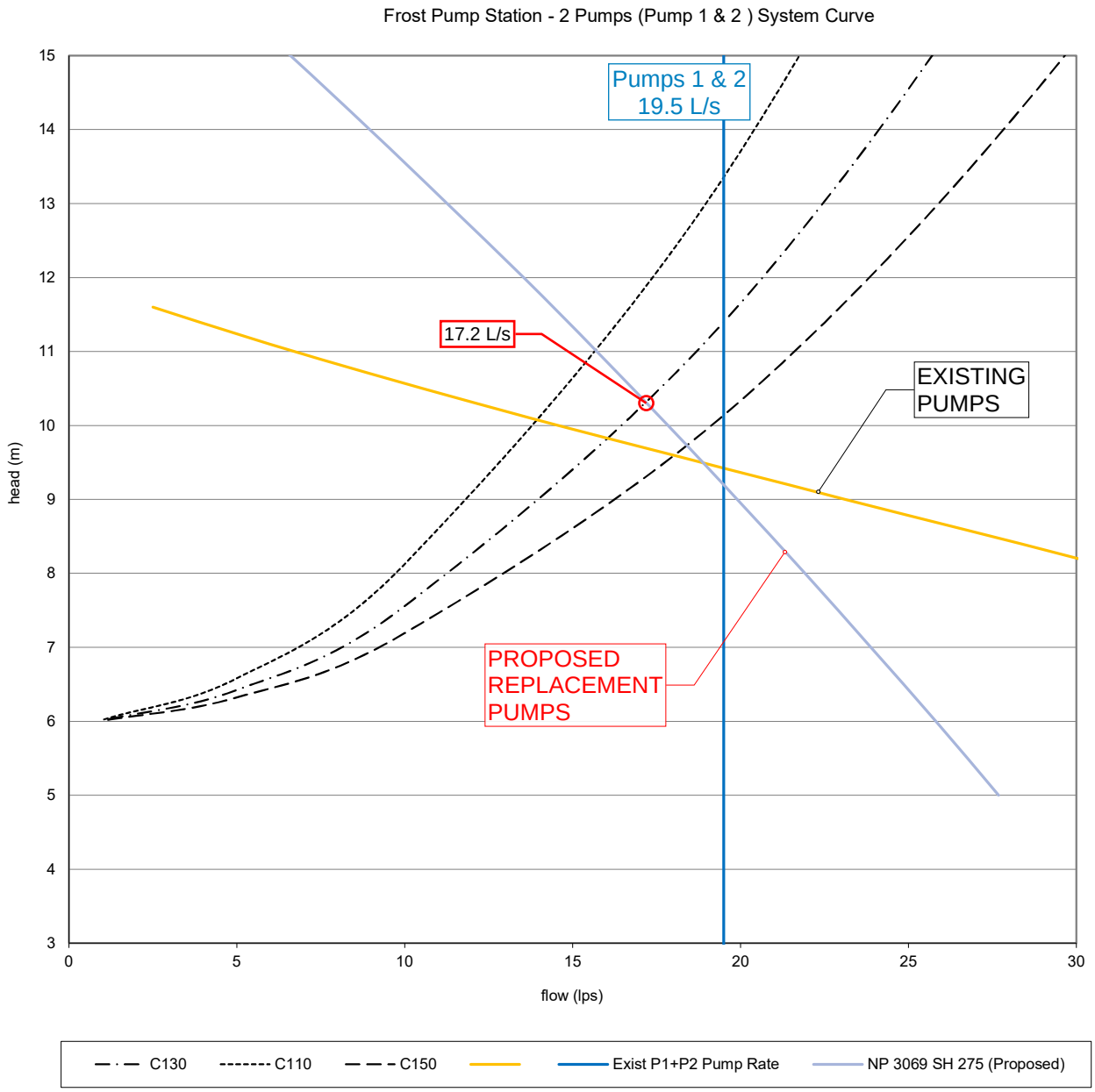
The required future peak flows for this station are lower than the pumping rate of any available pump selection. Lower pump rates result in low velocities in the force main and do not meet the recommended minimum scouring velocity of 1.0 m/s. In this station the pump rate used for selection was set at 8.0 L/s, the minimum rate to produce the scouring velocity in a 100mm diameter forcemain during single pump operation.

The replacement pump is based on the selection parameters of 8.0 L/s @ 7.1m TDH (C=130) is the Flygt NP 3069 SH, 3-phase, adaptive 275, 2.7 hp. The discharge on this pump is 75mm diameter, so the existing 100mm piping would have to be modified to use this pump model. The selected pump is lower horsepower (2.7 hp vs 5.0 hp) than the existing pump and the same pump model could potentially be used at four other pump stations.

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pump will have a theoretical capacity of 10.9 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (7 PAGES)


Frost Pump Station - Single Pump System Curve
head (m)
flow (lps)
Pump 2
15.9 L/s
Pump 1
16.0 L/s
PROPOSED
REPLACEMENT PUMP
10.9 L/s
EXISTING PUMP
2.62 L/s
3.06 L/s
C130
C110
C150
1 Pump
Exist P1 Pump Rate
Exist P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3069 SH 275 (Proposed)


Frost Pump Station - 2 Pumps (Pump 1 & 2) System Curve
Pumps 1 & 2
19.5 L/s
17.2 L/s
EXISTING
PUMPS
PROPOSED
REPLACEMENT
PUMPS
head (m)
flow (lps)
15
14
13
12
11
10
9
8
7
6
5
4
3
0
5
10
15
20
25
30
C130
C110
C150
Exist P1+P2 Pump Rate
NP 3069 SH 275 (Proposed)

FROST

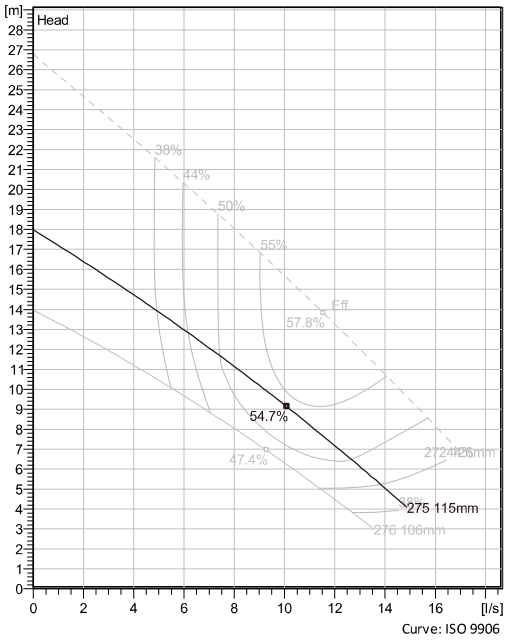
NP 3069 SH 3~ Adaptive 275

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3069.060 13-08-2BB-W 2.7hp

Installation type
P - Semi permanent, Wet

Impeller diameter
115 mm

Discharge diameter
65 mm

Pump information

Impeller diameter
115 mm

Discharge diameter
65 mm

Inlet diameter
100 mm

Maximum operating speed
3310 rpm

Number of blades
2

Max. fluid temperature
40 °C

Materials

Impeller
Hard-Iron ™

Stator housing material
Grey cast iron

Project	Xylect-21929407	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Technical specification

Motor - General

Motor number N3069.060 13-08-2BB-W 2.7hp	**Phases** 3~	**Rated speed** 3310 rpm	**Rated power** 2.7 hp
ATEX approved No	**Number of poles** 2	**Rated current** 7.5 A	**Stator variant** 6
Frequency 60 Hz	**Rated voltage** 230 V	**Insulation class** F	**Type of Duty** S1
Version code 060			

Motor - Technical

Power factor - 1/1 Load 0.87	**Motor efficiency - 1/1 Load** 77.8 %	**Total moment of inertia** 0.00313 kg m²	**Starts per hour max.** 15
Power factor - 3/4 Load 0.81	**Motor efficiency - 3/4 Load** 80.2 %	**Starting current, direct starting** 40 A	
Power factor - 1/2 Load 0.71	**Motor efficiency - 1/2 Load** 80.2 %	**Starting current, star-delta** 13.3 A	

Project	Xylect-21929407	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

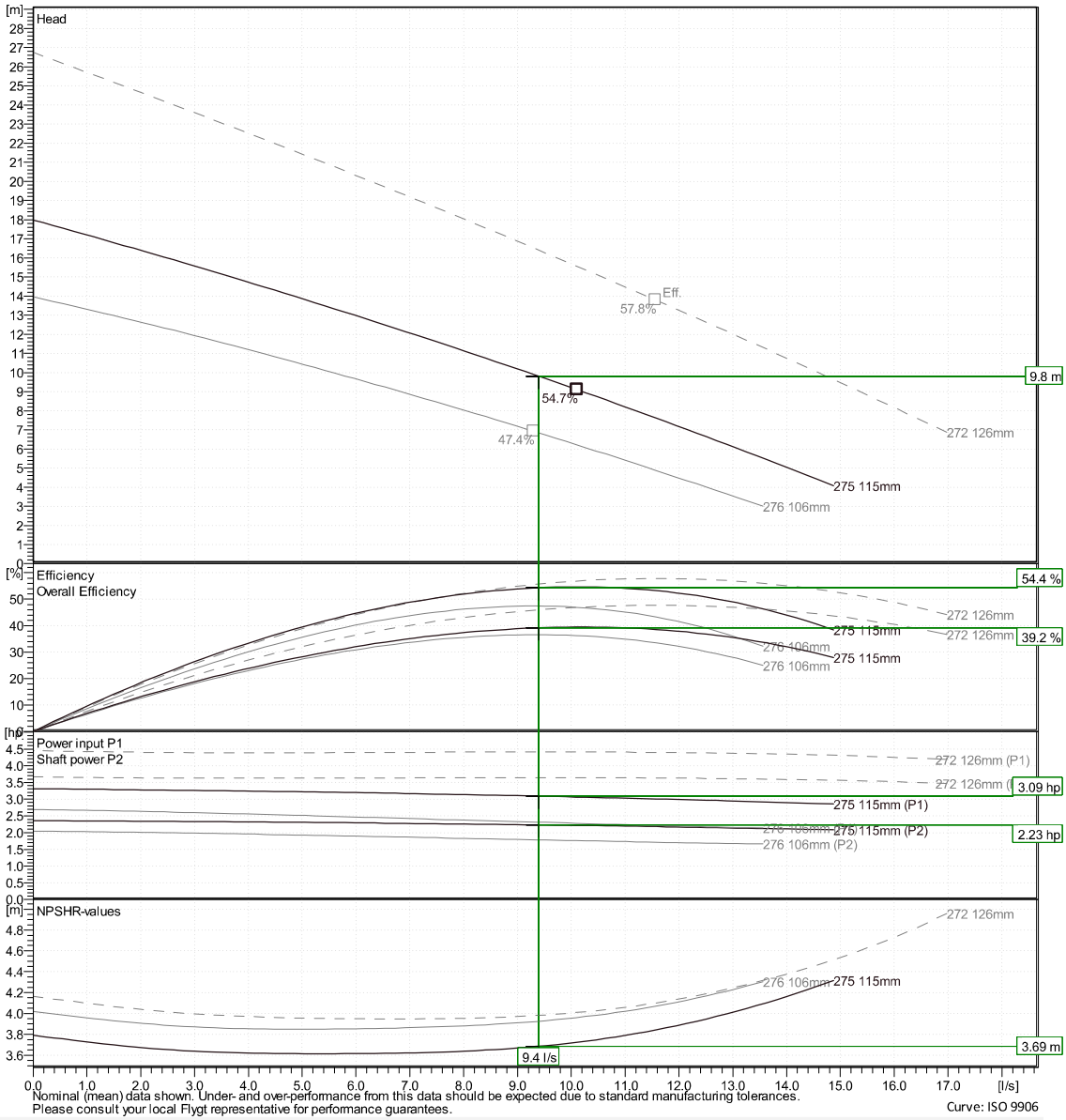
NP 3069 SH 3~ Adaptive 275

Performance curve

Duty point

Flow	Head
9.4 l/s	9.8 m

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

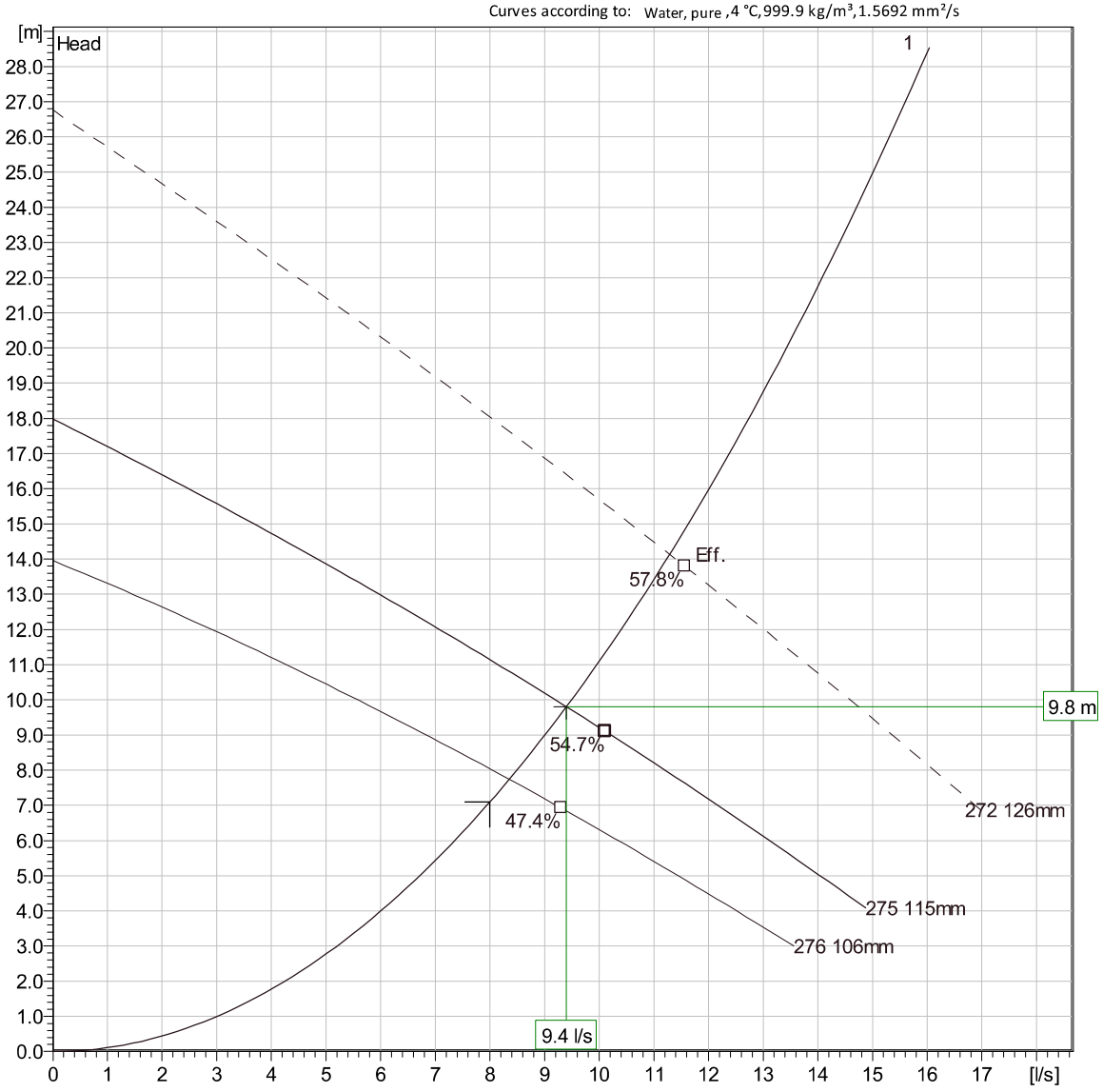
Curve: ISO 9906

Project	Xylect-21929407	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Duty Analysis

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



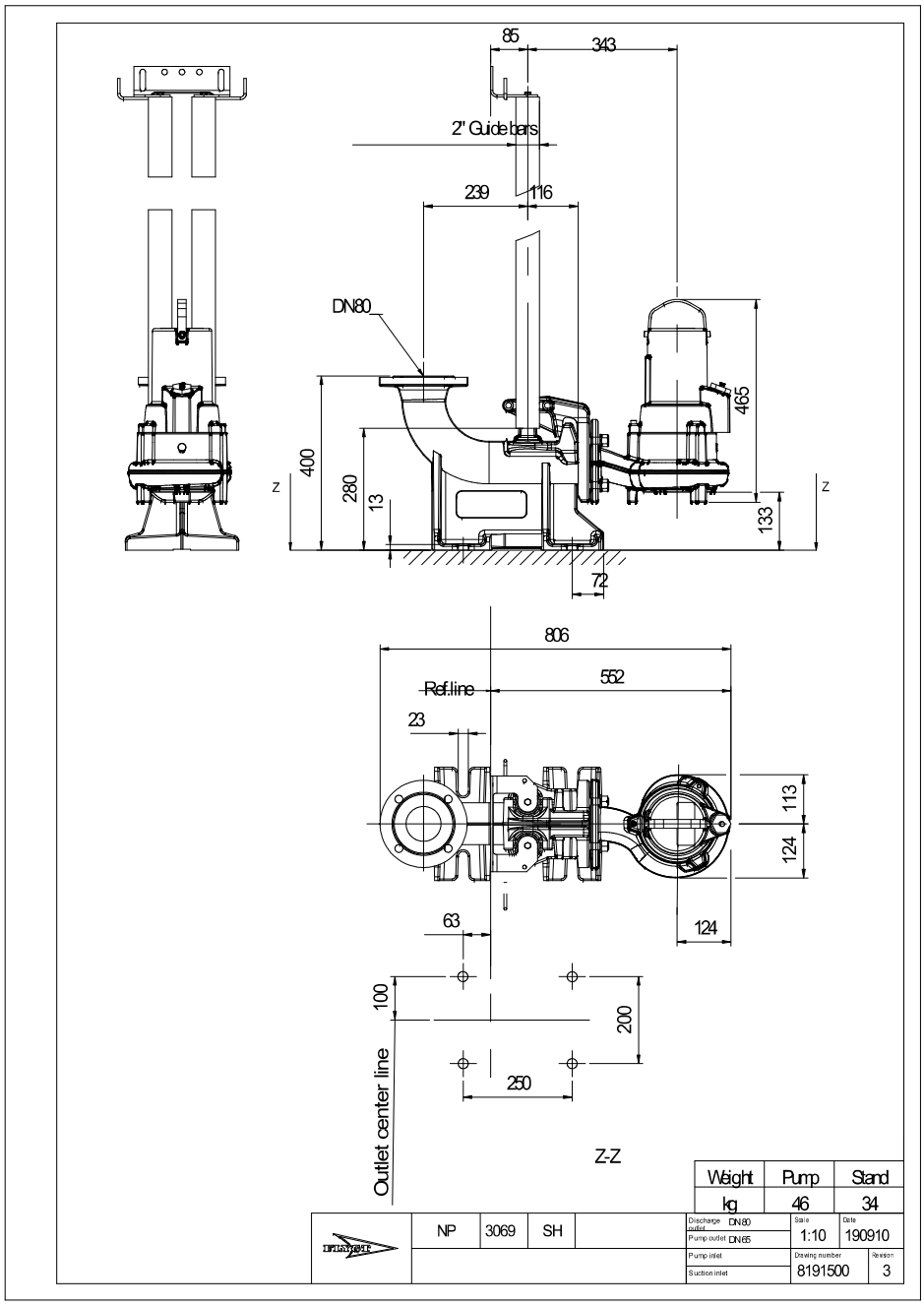
Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1	9.4 l/s	9.8 m	2.23 hp	9.4 l/s	9.8 m	2.23 hp	54.4 %	6.81E-5 kWh/l	3.69 m

Project	Xylect-21929407	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Dimensional drawing



Project	Xylect-21929407	**Created by**	xiaoyu Zhou
Block		**Created on**	2/29/2024 **Last update** 2/29/2024

6 HARBOUR RD PUMP STATION

6.1 BACKGROUND

The Harbour Road pump station is located at 2202 Harbour Road (SE corner of Resthaven Drive & Harbour Road). The station is a duplex submersible pump station with piping for future third pump. Available records indicate that the station was originally constructed in 1972. Approximately 415 properties are connected by gravity to the station. Pumped flows from the Latch pump station are also received by the station. The Harbour Road. pump station has been identified for replacement or relocation.

6.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak flow of 43.75 L/s and a future peak flow requirement of 54.57L/s were provided. The existing calculated pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	57.9	56.7	69.0

Maintenance records indicate the existing pumps are Flygt CP 3152 MT – 432, 3-phase, 208V, 20 hp Pump specifications, including dimension and pump curves were obtained from the manufacturer's website. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	*972.2m	254.0mm	CL100 Asbestos Concrete
Pump Station - Interior piping 1	*28.1m	153.2mm	Steel
Geodetic Head	9.02m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate capacities and evaluate condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition

C=130 Fair Condition

C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve a single pump should have a maximum theoretical pump rate of approximately 62.5 L/s (C=150) and two pumps a pump rate of approximately 88.1 L/s (C=150). The calculated pump rates would indicate that the system is operating between around the C=130 range with a single pump and just below C=110 with two pumps. This may be explained by incorrect data for the forcemain or an error in the draw down calculations or data from the two-pump test.

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Total pump run time range from 1h 45 min dry season to approximately 3 hours during wet season. This would indicate that the system likely has some I&I.

The existing pumps are currently capable of pumping approximately 105% of the expected future flow. Based on this, replacement pumps should be the same or of similar size. The existing station is piped to accept a third pump, and the system was reviewed to determine potential pump rates. Addition of a third pump would increase the pump rate to approximately 99 L/s (C=150). This theoretical pump rate may not be achievable based on the results of the 2-pump flow rate. As the station is already capable of pumping the future flows this is not expected to be an issue. The station is also identified for replacement or relocation, and pump sizing should be re-assessed at that time to account for changes that could affect the required head.

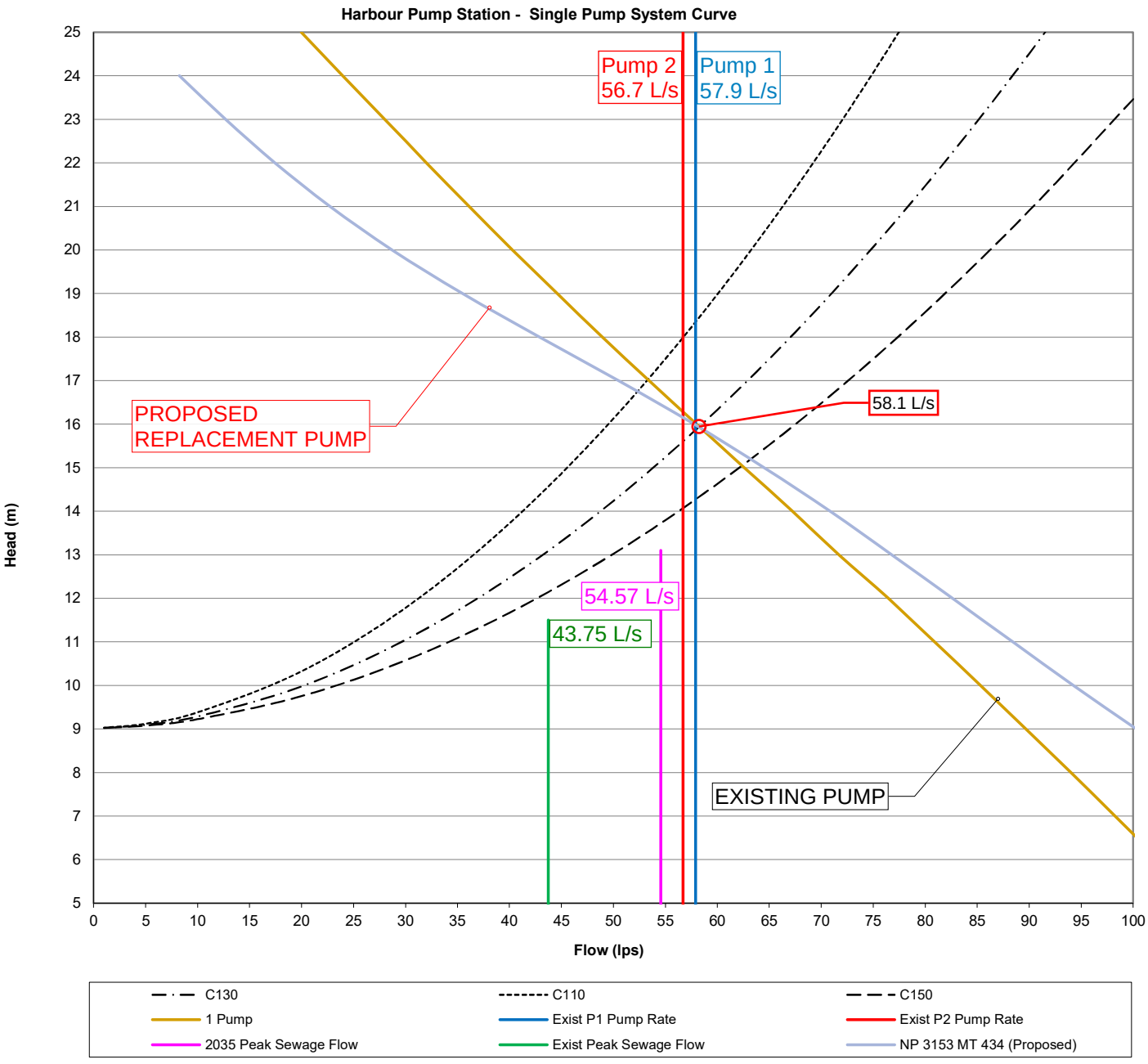
6.3 REPLACEMENT PUMP SELECTION

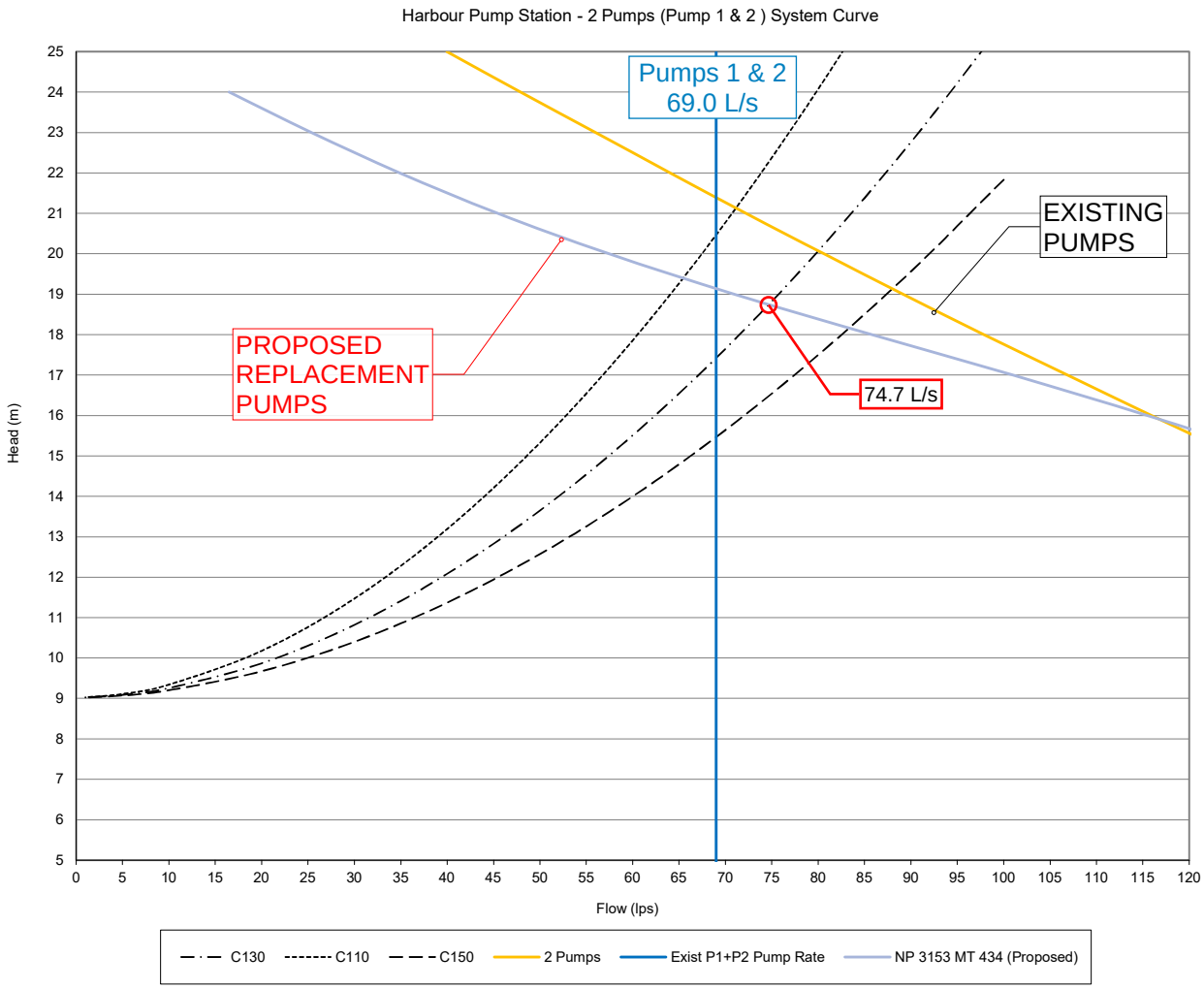
Replacement pump sizing is based on a single pump capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

The replacement pump is based on the selection parameters of 54.57 L/s @ 15.2m TDH (C=130) is the Flygt NP 3153 MT, 3-phase, adaptive 435, 20 hp. The discharge on this pump is 150mm diameter which matches the existing piping. The selected pump is the same horsepower as the existing pump. The selected pump would be unique to the Harbour pump station.

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pump will have a theoretical capacity of 58.1 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (10 PAGES)


Harbour Pump Station - Single Pump System Curve
Pump 2
56.7 L/s
Pump 1
57.9 L/s
PROPOSED
REPLACEMENT PUMP
58.1 L/s
54.57 L/s
43.75 L/s
EXISTING PUMP
Head (m)
Flow (lps)
C130
C110
C150
1 Pump
Exist P1 Pump Rate
Exist P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3153 MT 434 (Proposed)


Harbour Pump Station - 2 Pumps (Pump 1 & 2) System Curve
Pumps 1 & 2
69.0 L/s
EXISTING
PUMPS
PROPOSED
REPLACEMENT
PUMPS
74.7 L/s
Head (m)
Flow (lps)
C130
C110
C150
2 Pumps
Exist P1+P2 Pump Rate
NP 3153 MT 434 (Proposed)

HARBOUR

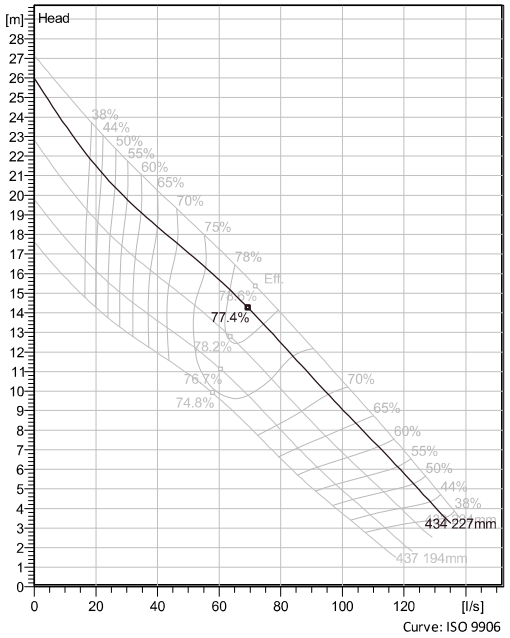
NP 3153 MT 3~ 434

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3153.185 21-18-4AA-W 20hp

Installation type
P - Semi permanent, Wet

Impeller diameter
227 mm

Discharge diameter
150 mm

Pump information

Impeller diameter
227 mm

Discharge diameter
150 mm

Inlet diameter
150 mm

Maximum operating speed
1755 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Project	Xylect-21929422	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3153 MT 3~ 434

Technical specification

Motor - General

Motor number N3153.185 21-18-4AA-W 20hp	**Phases** 3~	**Rated speed** 1755 rpm	**Rated power** 20 hp
ATEX approved No	**Number of poles** 4	**Rated current** 52 A	**Stator variant** 5
Frequency 60 Hz	**Rated voltage** 230 V	**Insulation class** H	**Type of Duty** S1
Version code 185			

Motor - Technical

Power factor - 1/1 Load 0.83	**Motor efficiency - 1/1 Load** 87.5 %	**Total moment of inertia** 0.0873 kg m²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.77	**Motor efficiency - 3/4 Load** 89.0 %	**Starting current, direct starting** 296 A	
Power factor - 1/2 Load 0.66	**Motor efficiency - 1/2 Load** 89.0 %	**Starting current, star-delta** 98.6 A	

Project	Xylect-21929422	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

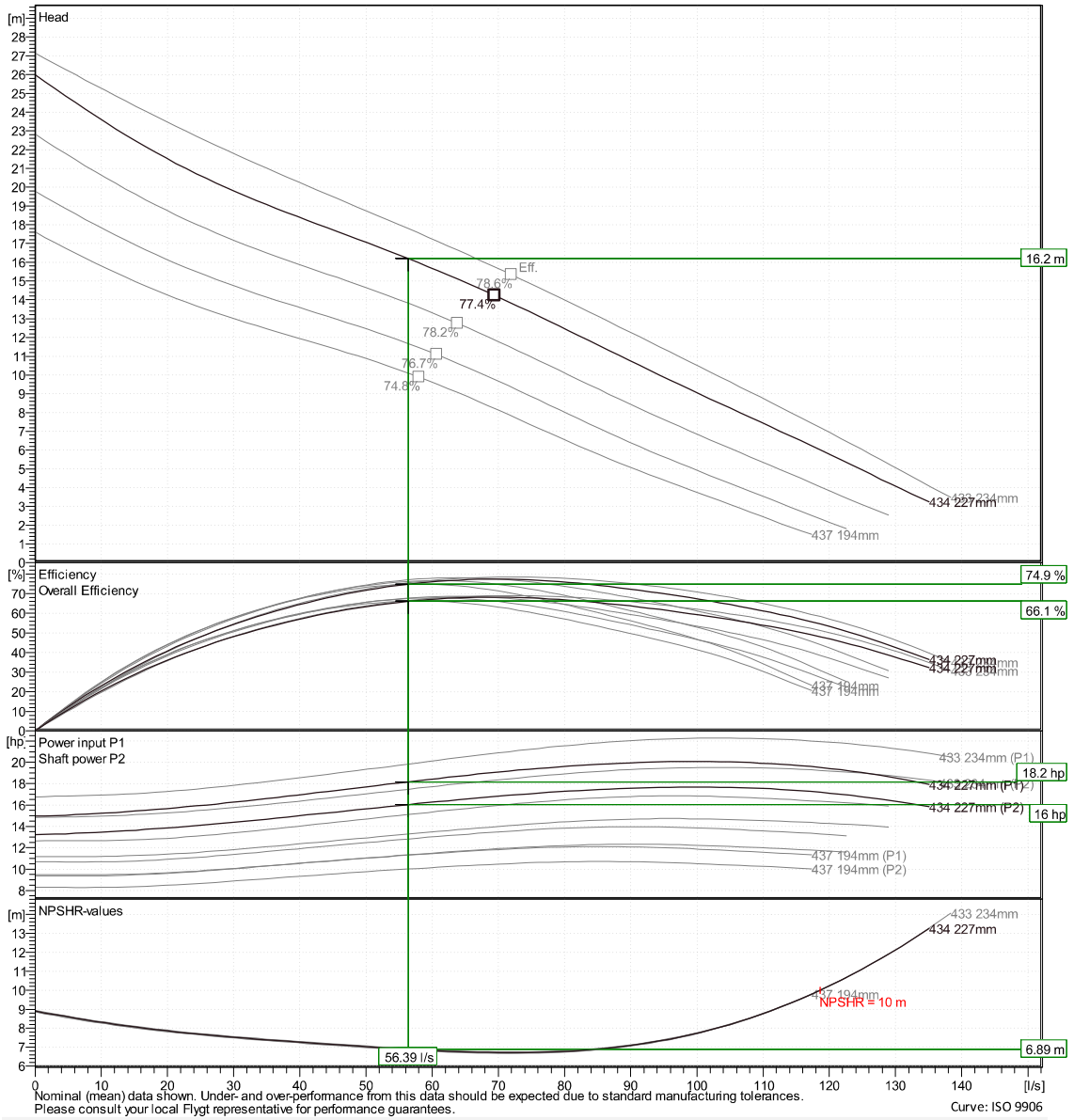
NP 3153 MT 3~ 434

Performance curve

Duty point

Flow	Head
56.4 l/s	16.2 m

Curves according to: Water, pure Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

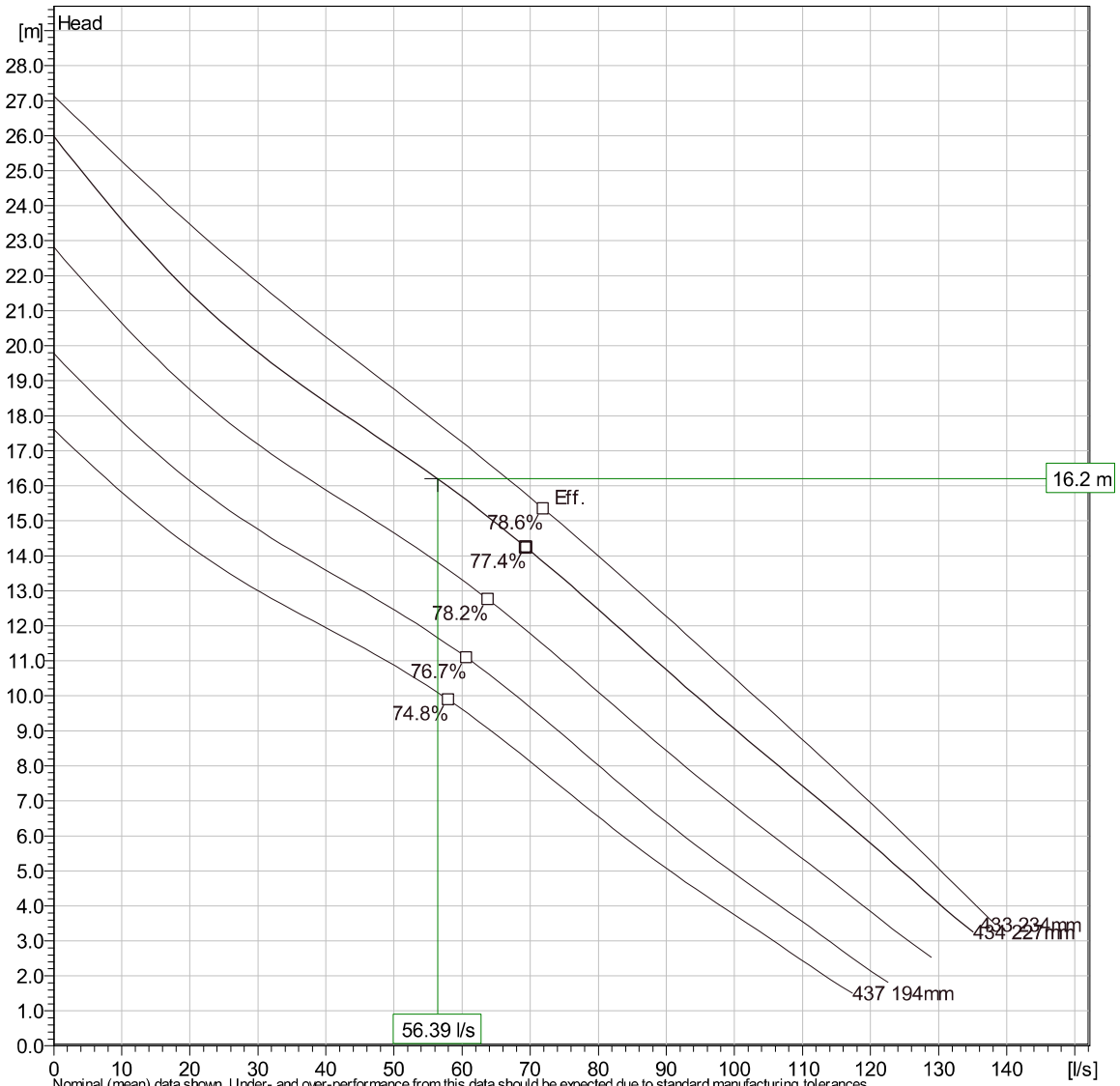
Curve: ISO 9906

Xylect-21929422		xiaoyu Zhou	
	Created on	2/29/2024	**Last update** 2/29/2024

NP 3153 MT 3~ 434

Duty Analysis

Curves according to: Water, pure [100%] ; 4°C; 999.9kg/m³; 1.5692mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	l/s	m	hp	l/s	m	hp		kWh/l	m
1	56.4	16.2	16	56.4	16.2	16	74.9 %	6.67E-5	6.89

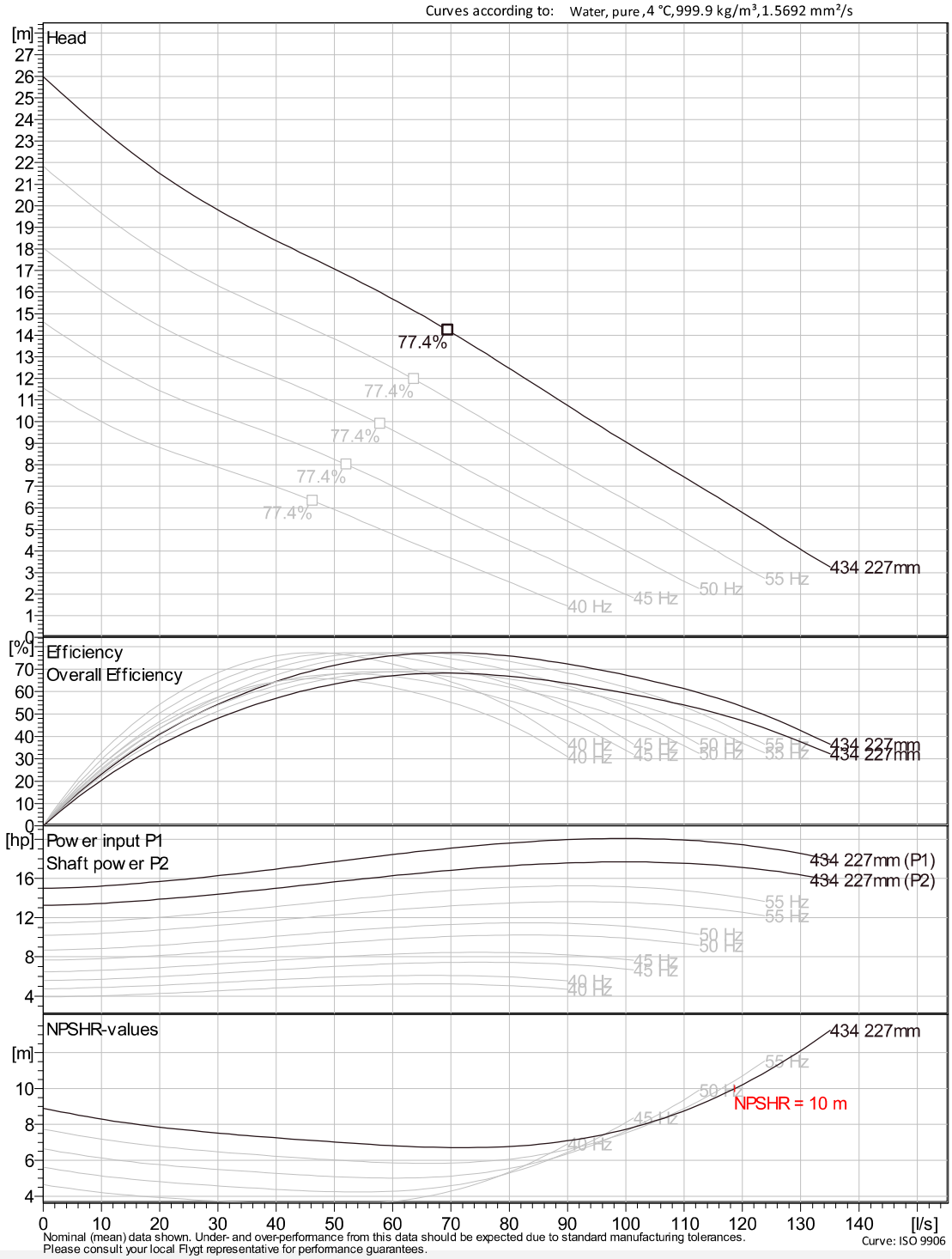
Project		**Created by**	xiaoyu Zhou		
Block	Xylect-21929422	**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3153 MT 3~ 434

VFD Curve

FLYGT
a xylem brand

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



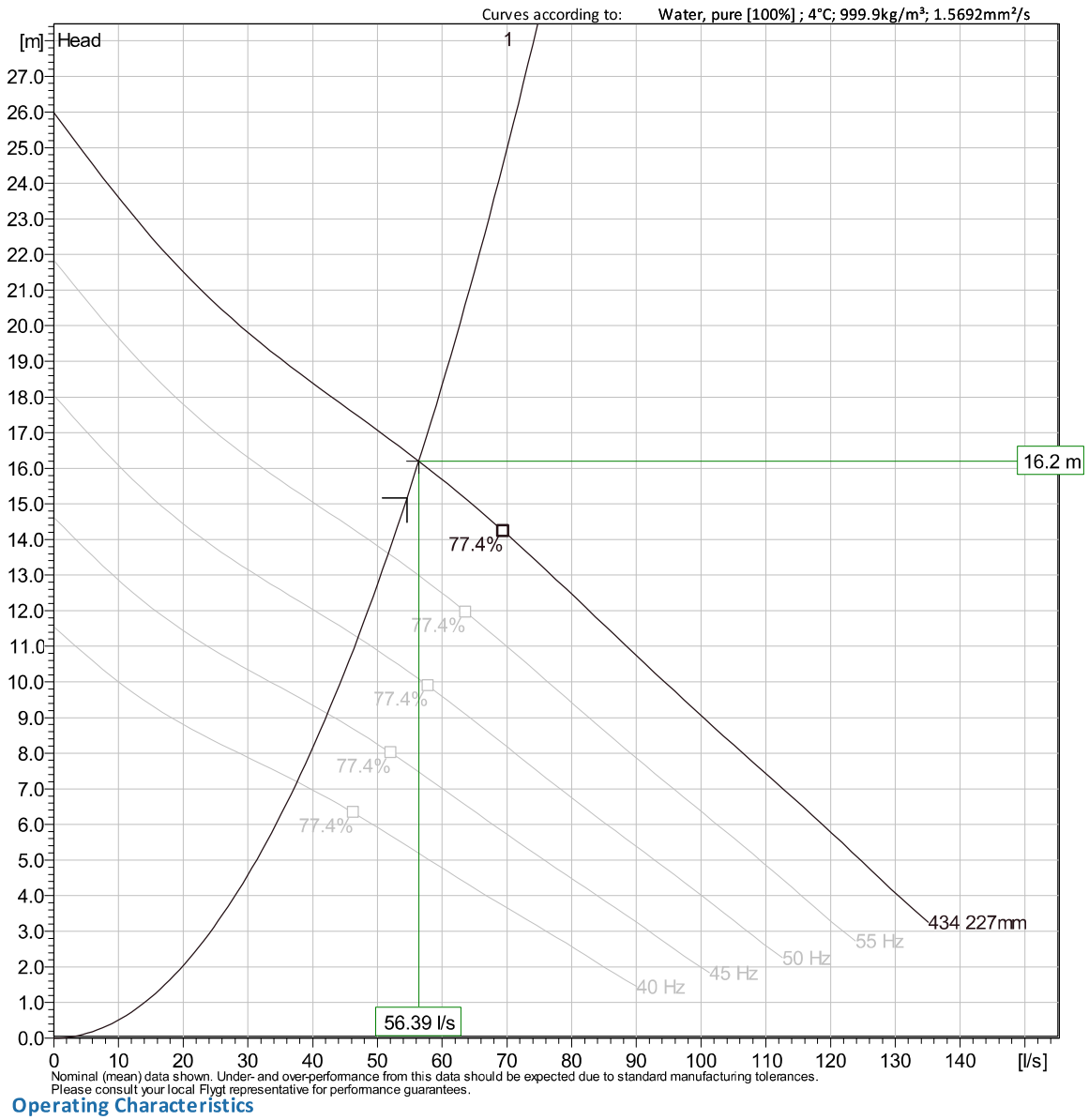
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

Project	Xylect-21929422	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3153 MT 3~ 434

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

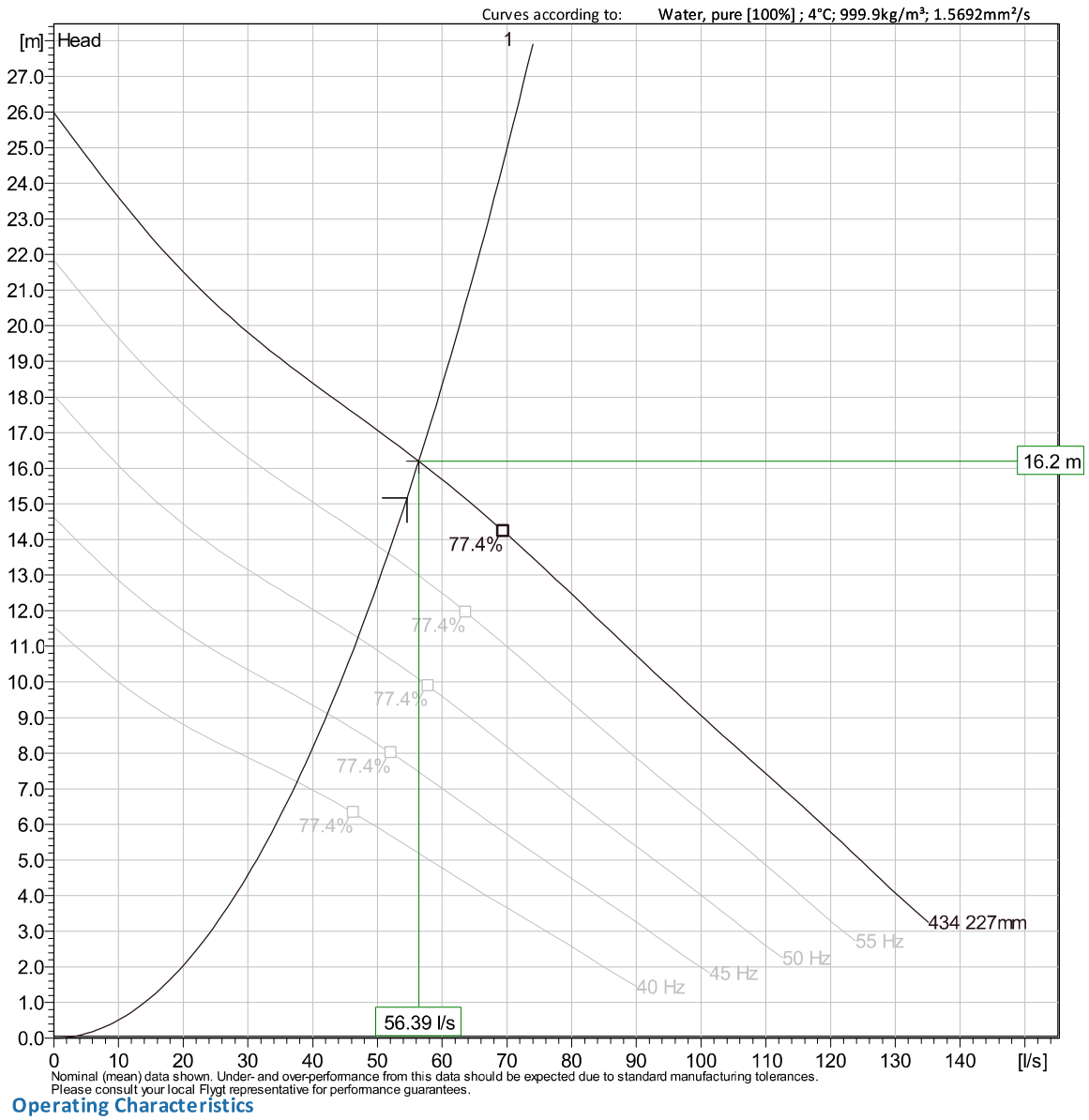
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
1	60 Hz	56.4	16.2	16	56.4	16.2	16	74.9 %	6.67E-5	6.89
1	55 Hz	51.7	13.6	12.4	51.7	13.6	12.4	74.9 %	5.54E-5	5.99
1	50 Hz	47	11.2	9.28	47	11.2	9.28	74.9 %	4.6E-5	5.14
1	45 Hz	42.3	9.11	6.77	42.3	9.11	6.77	74.9 %	3.79E-5	4.35

Project	Xylect-21929422	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3153 MT 3~ 434

VFD Analysis



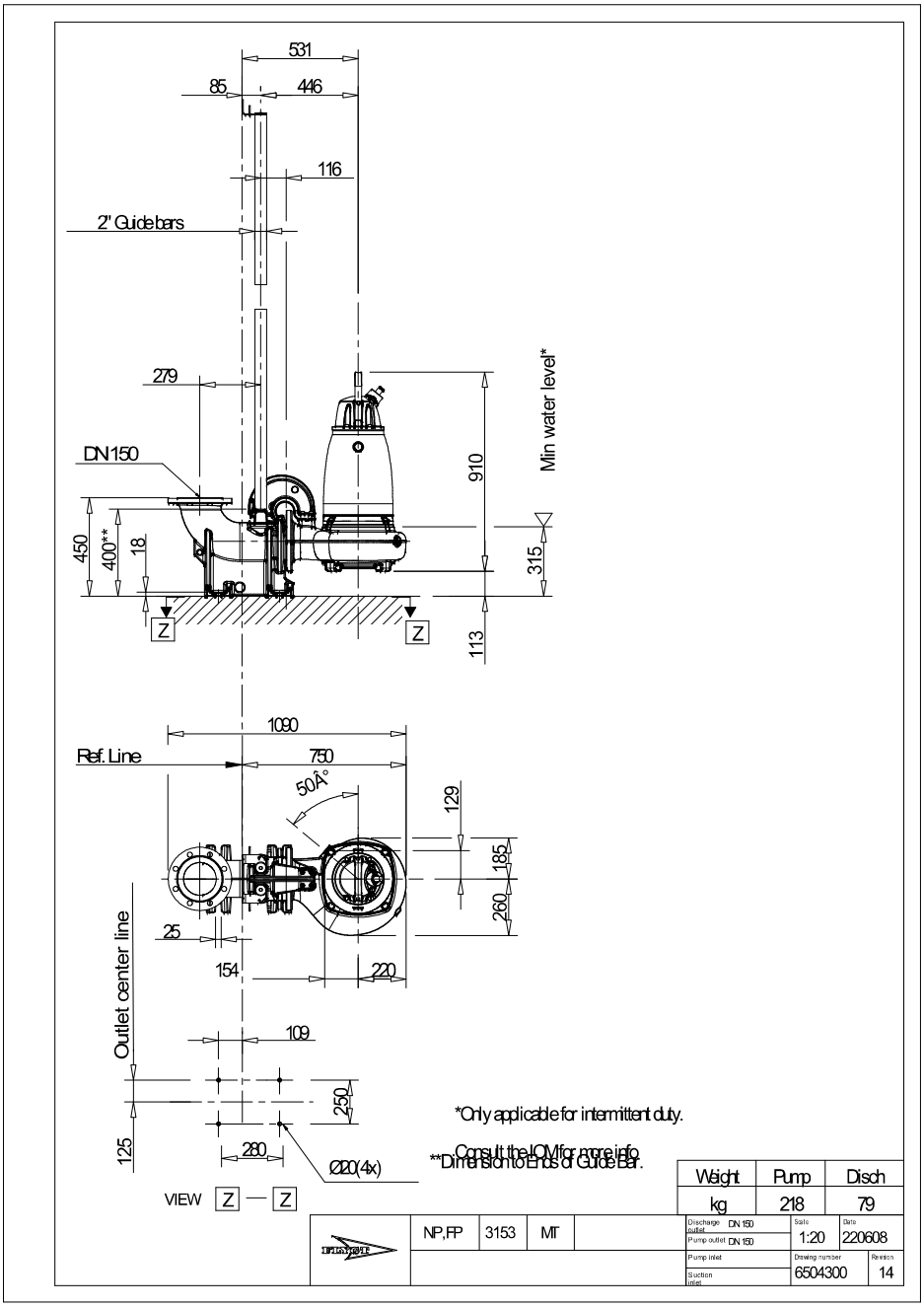
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
1	40 Hz	37.6	7.2	4.75	37.6	7.2	4.75	74.9 %	3.09E-5	3.6

Project	Xylect-21929422	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3153 MT 3~ 434

Dimensional drawing



Project	Xylect-21929422	**Created by**	xiaoyu Zhou
Block		**Created on**	2/29/2024 **Last update** 2/29/2024

7 LATCH PUMP STATION

7.1 BACKGROUND

The Latch pump station is located at 2328 Harbour Road in the center island of the cul de sac. The station is a duplex submersible pump style station. Approximately 4 properties are connected to the station. Connected properties include a restaurant and multi-family sites. Flows are pumped to the gravity system that flows to the Harbour Road pump station.

7.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak flow of 1.92 L/s and a future peak flow requirement of 2.22 L/s were provided.

The existing calculated pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	11.7	12.1	15.0

Maintenance records indicate the existing pumps are Flygt CP 3102 MT – 433, single phase, 230V, 3.9 hp. Pump specifications, including dimension and pump curves were obtained from the manufacturer's website. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	*65.9m	101.6mm	CL100 Asbestos Concrete
Pump Station - Interior piping 1	*25.5m	101.6mm	Steel
Geodetic Head	8.41m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate capacities and evaluate condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition

C=130 Fair Condition

C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve a single pump should have a maximum theoretical pump rate of approximately 11.0 L/s (C=150) and two pumps a flow rate of approximately 15.1 L/s (C=150). The calculated pump rates would indicate that the system is operating at or above the C=150 range.

The existing pumps are currently capable of pumping significantly higher flow than the 2035 peak flow of 2.22 L/s. The existing pumps are pumping approximately five (5) times of the future flow rate. Based on this, the existing pumps are potentially oversized and replacement pumps could be smaller.

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Pump run times range from 14-20 minutes throughout the year. This would indicate that the system likely has little I&I.

7.3 REPLACEMENT PUMP SELECTION

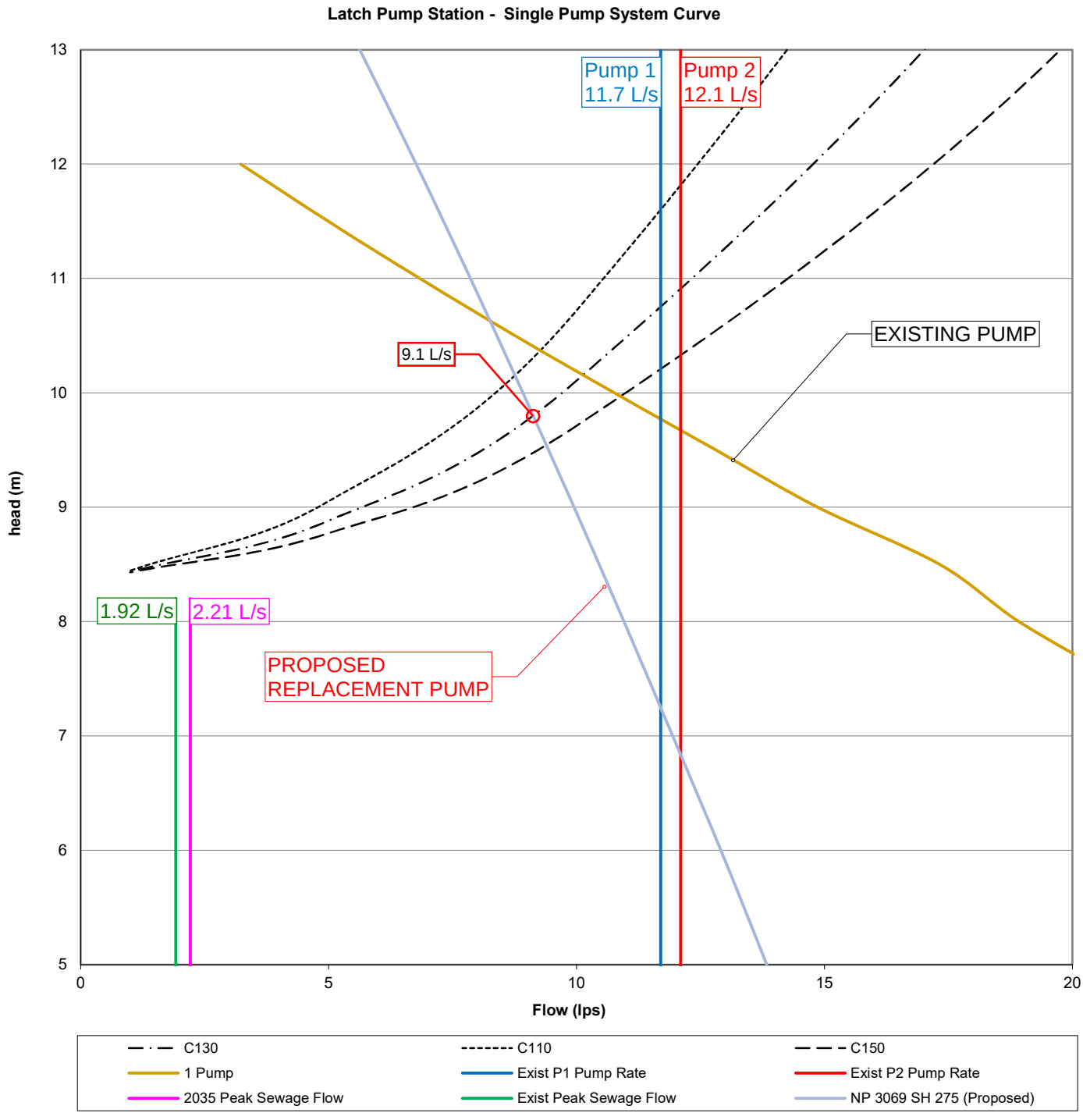
Replacement pump sizing is based on a single pump capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

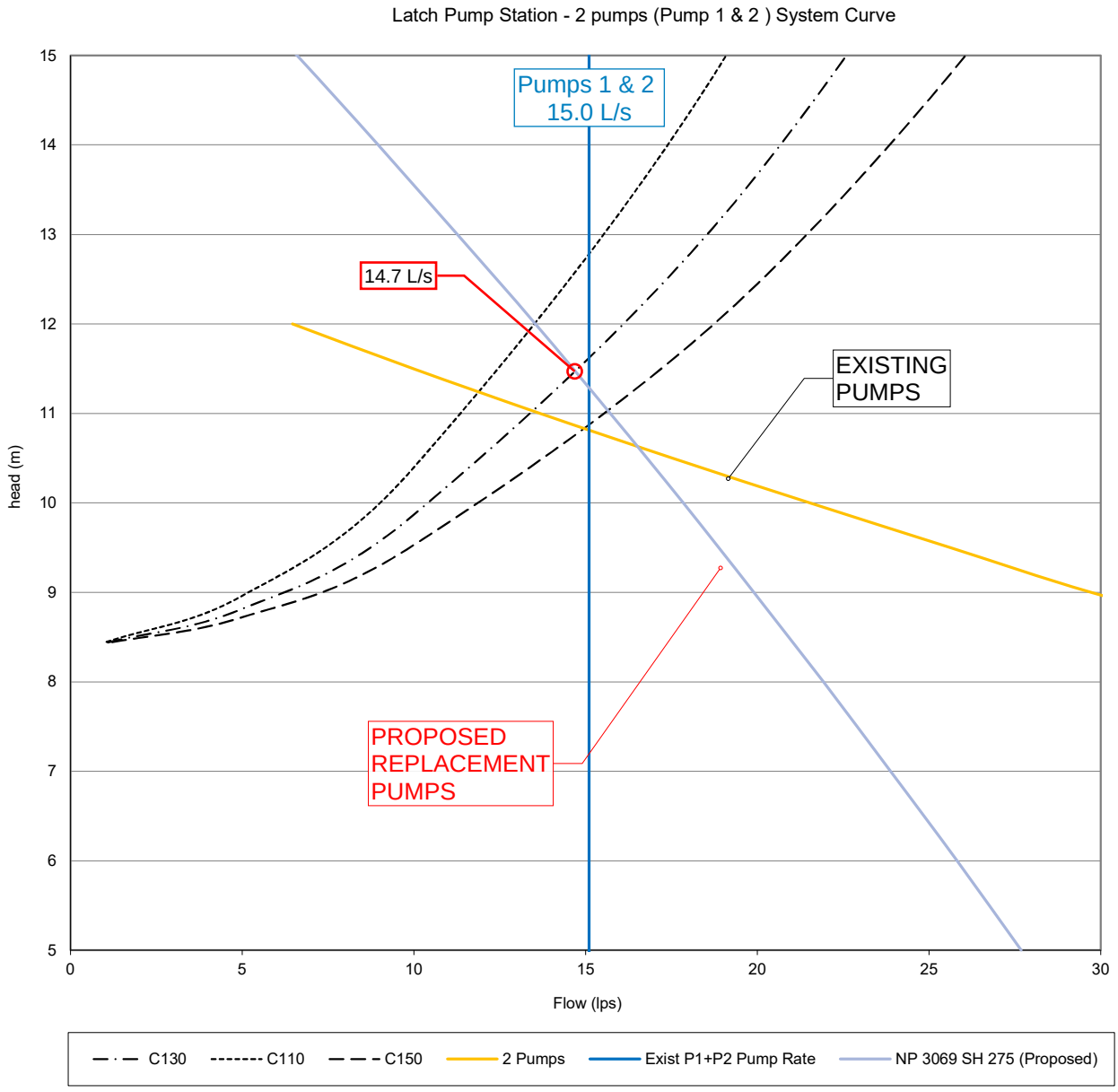
The required future peak flows for this station are lower than the pumping rate of any available pump selection. Lower pump rates result in low velocities in the force main and do not meet the recommended minimum scouring velocity of 1.0 m/s. In this station the pump rate used for selection was set at 8.0 L/s, the minimum rate to produce the scouring velocity in a 100mm diameter forcemain during single pump operation.

The replacement pump is based on the selection parameters of 8.0 L/s @ 9.47m TDH (c=130) is the Flygt NP 3069 SH, 3-phase, adaptive 275, 2.7 hp. The discharge on this pump is 75mm diameter, so the existing 100mm piping would have to be modified to use this pump model. The existing electrical service to the pumpstation is single phase, and the replacement has been sized as 3-phase. The service would need to be upgraded to 3-phase or a VFD could be installed and used as a phase converter. The selected pump is lower horsepower (2.7 hp vs 3.9 hp) than the existing pump and the same pump model could potentially be used at four other pump stations.

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pump will have a theoretical capacity of 9.1 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (7 PAGES)


Latch Pump Station - Single Pump System Curve
head (m)
Flow (lps)
13
12
11
10
9
8
7
6
5
0
5
10
15
20
Pump 1
11.7 L/s
Pump 2
12.1 L/s
EXISTING PUMP
9.1 L/s
1.92 L/s
2.21 L/s
PROPOSED
REPLACEMENT PUMP
C130
C110
C150
1 Pump
Exist P1 Pump Rate
Exist P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3069 SH 275 (Proposed)


Latch Pump Station - 2 pumps (Pump 1 & 2) System Curve
Pumps 1 & 2
15.0 L/s
14.7 L/s
EXISTING
PUMPS
PROPOSED
REPLACEMENT
PUMPS
head (m)
Flow (lps)
15
14
13
12
11
10
9
8
7
6
5
0
5
10
15
20
25
30
C130
C110
C150
2 Pumps
Exist P1+P2 Pump Rate
NP 3069 SH 275 (Proposed)

LATCH

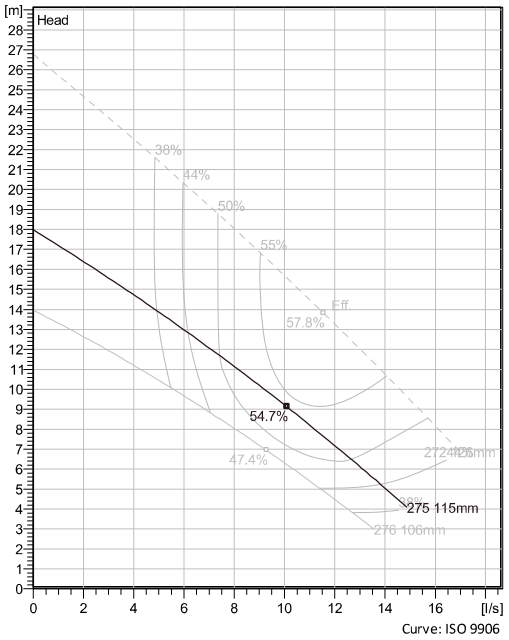
NP 3069 SH 3~ Adaptive 275

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3069.060 13-08-2BB-W 2.7hp

Installation type
P - Semi permanent, Wet

Impeller diameter
115 mm

Discharge diameter
65 mm

Pump information

Impeller diameter
115 mm

Discharge diameter
65 mm

Inlet diameter
100 mm

Maximum operating speed
3310 rpm

Number of blades
2

Max. fluid temperature
40 °C

Materials

Impeller
Hard-Iron ™

Stator housing material
Grey cast iron

Project	Xylect-21929434	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Technical specification

Motor - General

Motor number N3069.060 13-08-2BB-W 2.7hp	**Phases** 3~	**Rated speed** 3310 rpm	**Rated power** 2.7 hp
ATEX approved No	**Number of poles** 2	**Rated current** 7.5 A	**Stator variant** 6
Frequency 60 Hz	**Rated voltage** 230 V	**Insulation class** F	**Type of Duty** S1
Version code 060			

Motor - Technical

Power factor - 1/1 Load 0.87	**Motor efficiency - 1/1 Load** 77.8 %	**Total moment of inertia** 0.00313 kg m²	**Starts per hour max.** 15
Power factor - 3/4 Load 0.81	**Motor efficiency - 3/4 Load** 80.2 %	**Starting current, direct starting** 40 A	
Power factor - 1/2 Load 0.71	**Motor efficiency - 1/2 Load** 80.2 %	**Starting current, star-delta** 13.3 A	

Project	Xylect-21929434	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

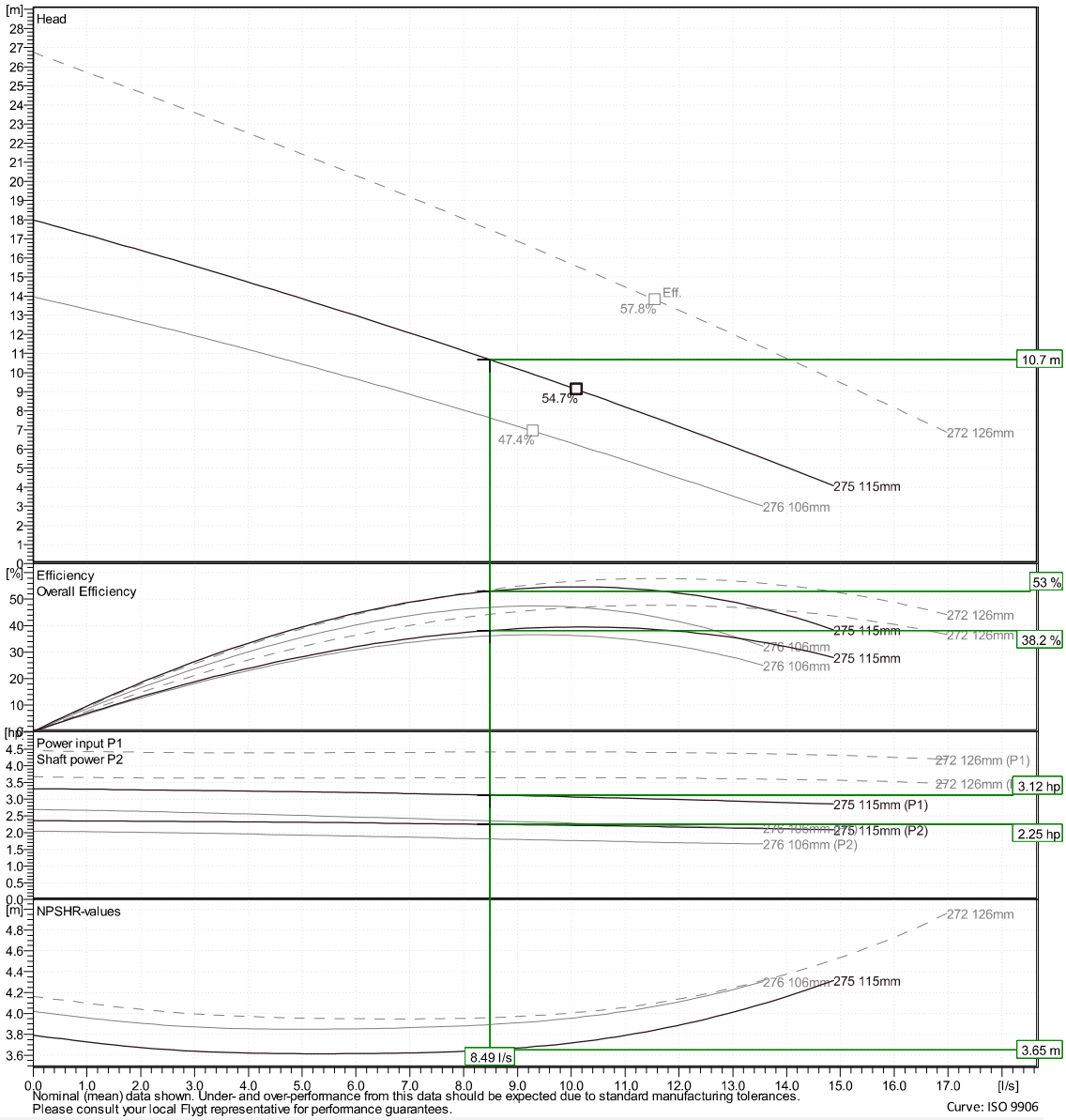
NP 3069 SH 3~ Adaptive 275

Performance curve

Duty point

Flow	Head
8.49 l/s	10.7 m

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

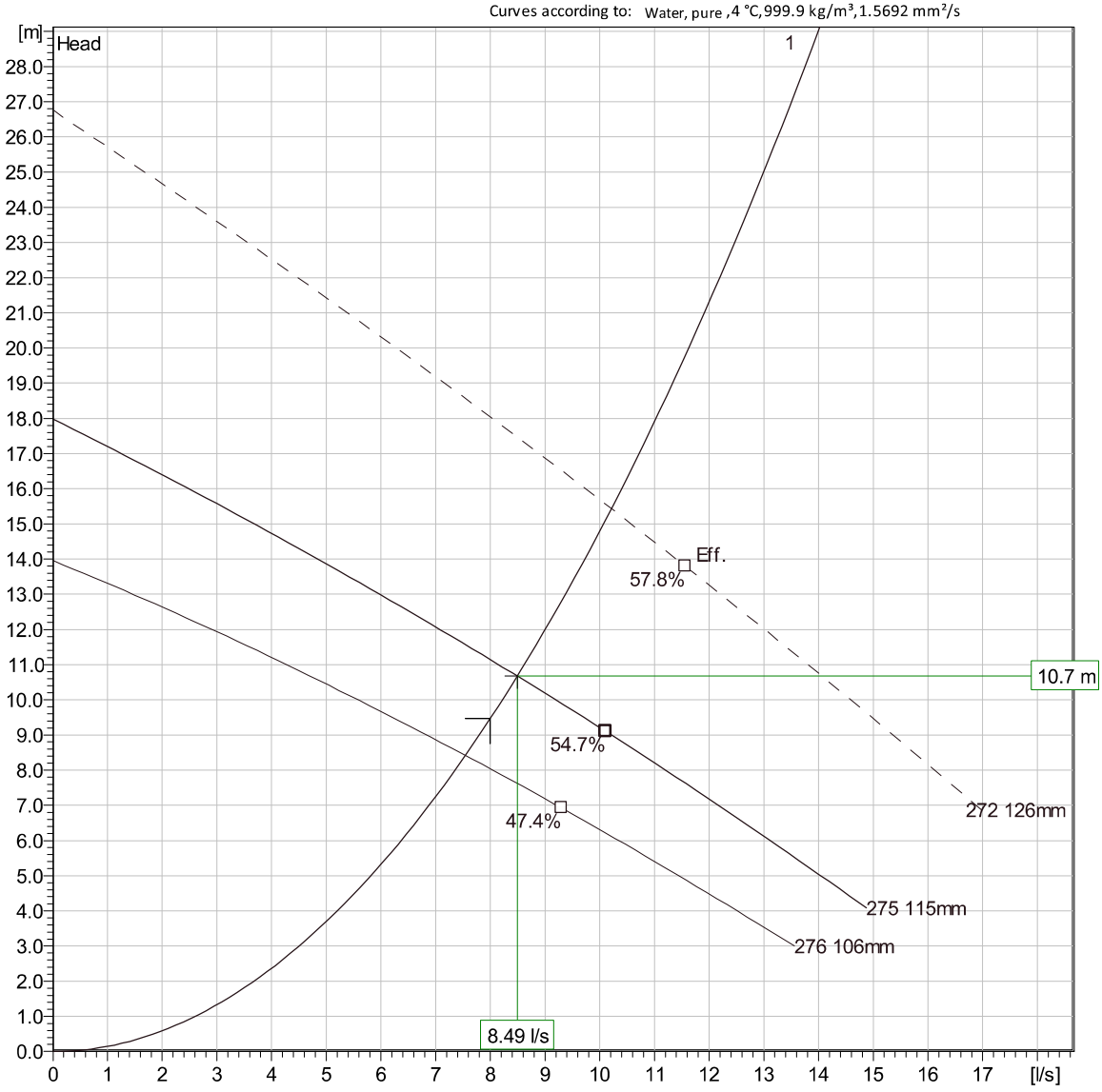
Curve: ISO 9906

Project	Xylect-21929434	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Duty Analysis

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



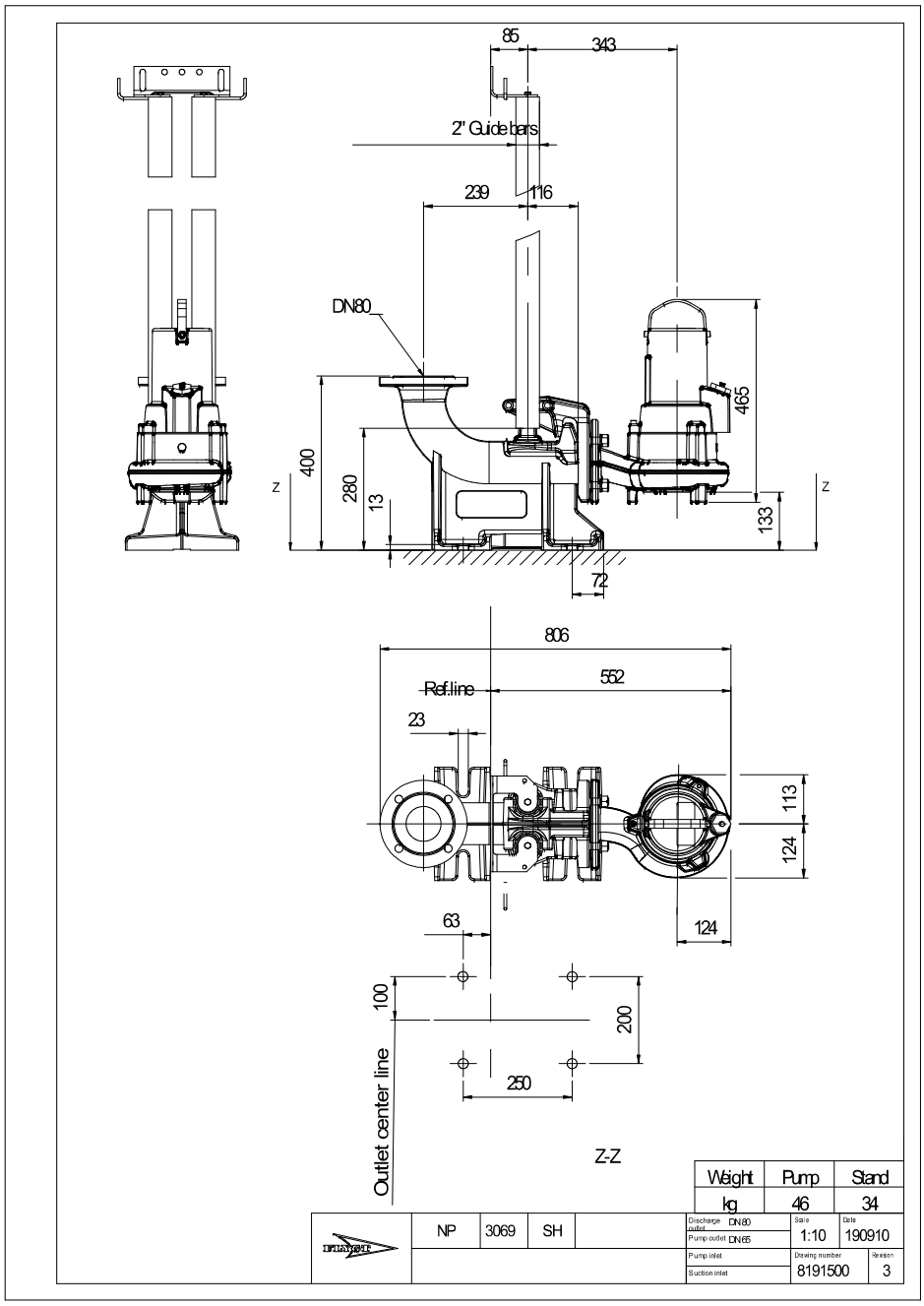
Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1	8.49 l/s	10.7 m	2.25 hp	8.49 l/s	10.7 m	2.25 hp	53 %	7.61E-5 kWh/l	3.65 m

Project	Xylect-21929434	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Dimensional drawing



Project	Xylect-21929434	**Created by**	xiaoyu Zhou
Block		**Created on**	2/29/2024 **Last update** 2/29/2024

8 LOCHSIDE PUMP STATION

8.1 BACKGROUND

The Lochside pump station is located at 9344 Lochside Drive on west side of the roadway. The station is a duplex submersible style. Approximately 39 properties are connected the station. Flows are pumped to gravity manhole adjacent to station.

8.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak flow of 3.64 L/s and a future peak flow requirement of 4.25 L/s were provided. The existing calculated pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	23.2	26.2	38.5

The pump rates provided were well outside the capability of the installed pumps. A review of the drawdown calculations was completed, and it was determined that an incorrect wetwell size was used. The corrected pump rates were:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	10.0	11.6	16.6

Maintenance records indicate the existing pumps are Flygt CP 3085 MT – 440, single phase, 230V, 2.4 hp. The pumps are single phase. The pump curve was obtained through the manufacturer. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	*3.6m	101.6mm	CL100 Asbestos Concrete
Pump Station - Interior piping 1	*23.5m	77.3mm	Steel
Geodetic Head	2.41m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate capacities and evaluate condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition

C=130 Fair Condition

C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve a single pump should have a maximum theoretical pump rate of approximately 8.6 L/s (C=150) and two pumps a pump rate of approximately 13.6 L/s (C=150). The calculated pump rates would indicate that the system is operating outside the pump curve, indicating an error in the system data.

The existing pumps are currently capable of pumping at approximately 2.5 times the expected future flow. Based on this, it is not expected that upsizing of the pumps will be required in the future.

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Total pump run times range from approximately 30 min to over 4 hours in some instances. The high pump run time instances are likely due to pump or mechanical issues within the station.

8.3 REPLACEMENT PUMP SELECTION

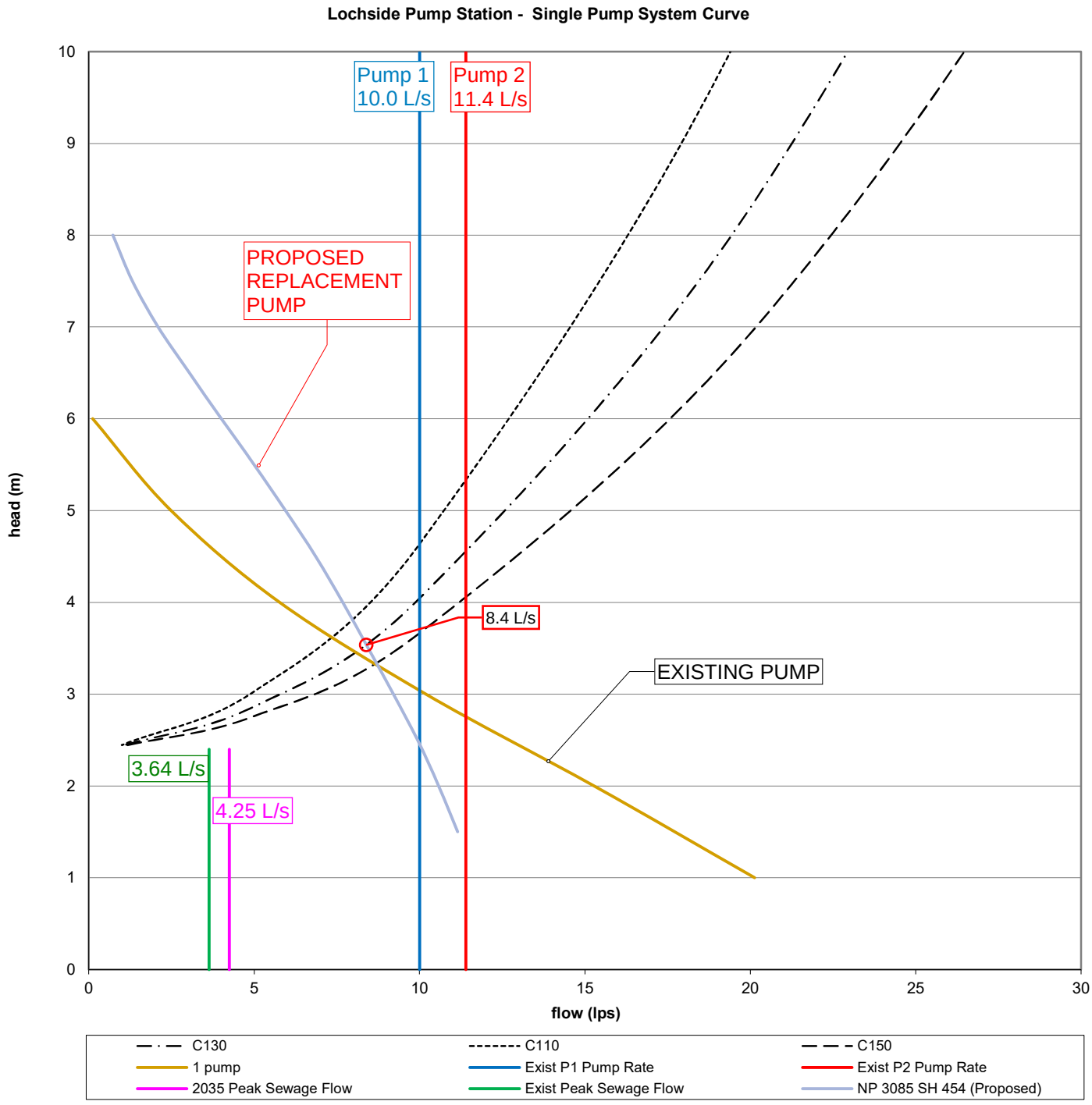
Replacement pump sizing is based on a single pump capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

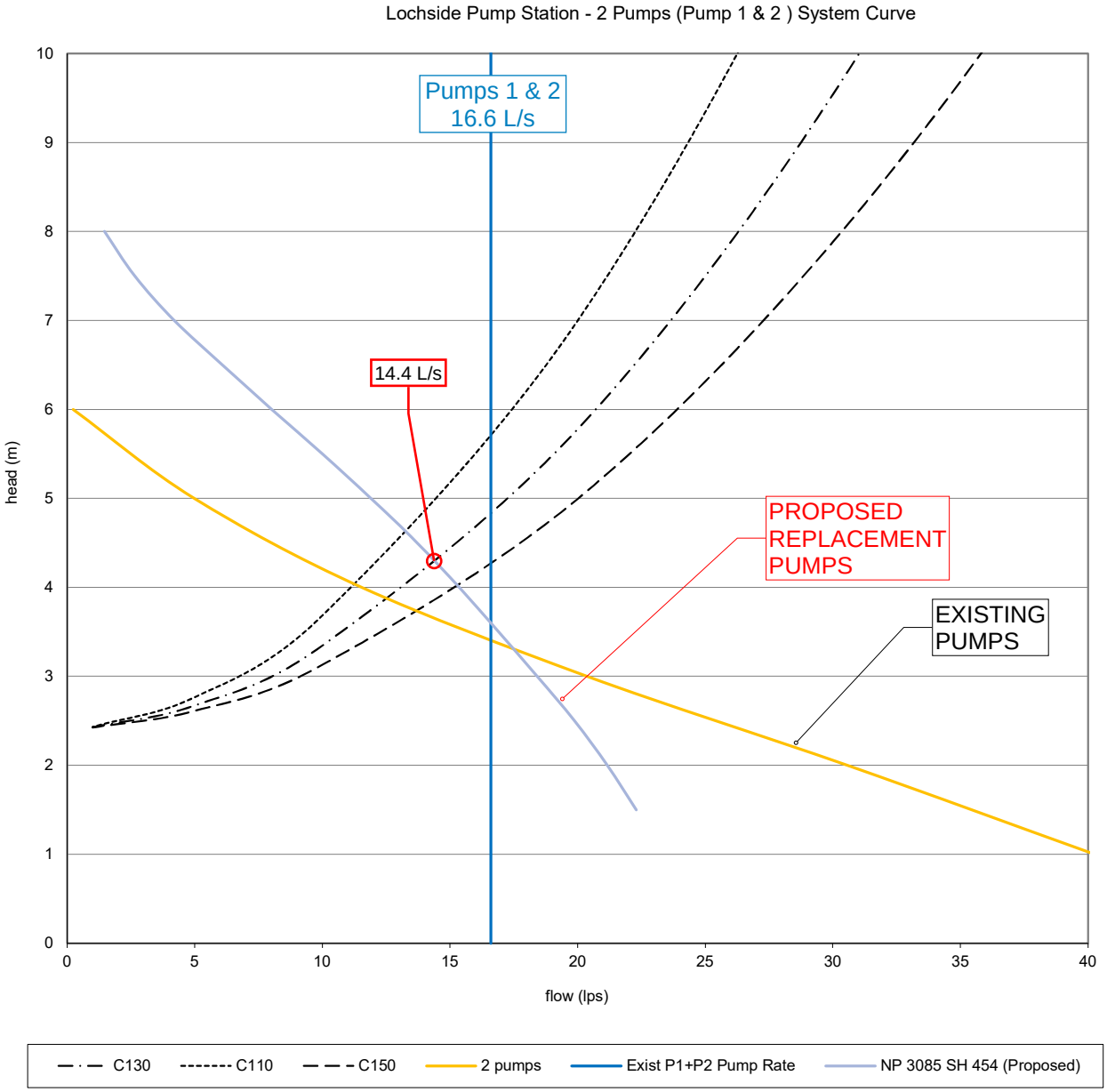
The required future peak flows for this station are lower than the pumping rate of any available pump selection. Lower pump rates result in low velocities in the force main and do not meet the recommended minimum scouring velocity of 1.0 m/s. In this station the pump rate used for selection was set at 8.0 L/s, the minimum rate to produce the scouring velocity in a 100mm diameter forcemain during single pump operation.

The replacement pump is based on the selection parameters of 8.0 L/s @ 3.44m TDH (C=130) is the Flygt NP 3069 SH, 3-phase, adaptive 275, 2.7 hp. The discharge on this pump is 75mm diameter which matches the existing piping. The existing electrical service to the pumpstation is single phase, and the replacement has been sized as 3-phase. The service would need to be upgraded to 3-phase or a VFD could be installed and used as a phase converter. The selected pump is slightly larger in horsepower (2.7 hp vs 2.4 hp) than the existing pump and the same pump model could potentially be used at four other pump stations.

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pump will have a theoretical capacity of 8.4 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (10 PAGES)


Lochside Pump Station - Single Pump System Curve
head (m)
flow (lps)
Pump 1
10.0 L/s
Pump 2
11.4 L/s
PROPOSED
REPLACEMENT
PUMP
8.4 L/s
EXISTING PUMP
3.64 L/s
4.25 L/s
C130
C110
C150
1 pump
Exist P1 Pump Rate
Exist P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3085 SH 454 (Proposed)


Lochside Pump Station - 2 Pumps (Pump 1 & 2) System Curve
Pumps 1 & 2
16.6 L/s
14.4 L/s
PROPOSED
REPLACEMENT
PUMPS
EXISTING
PUMPS
head (m)
flow (lps)
0
1
2
3
4
5
6
7
8
9
10
0
5
10
15
20
25
30
35
40
C130
C110
C150
2 pumps
Exist P1+P2 Pump Rate
NP 3085 SH 454 (Proposed)

LOCHSIDE

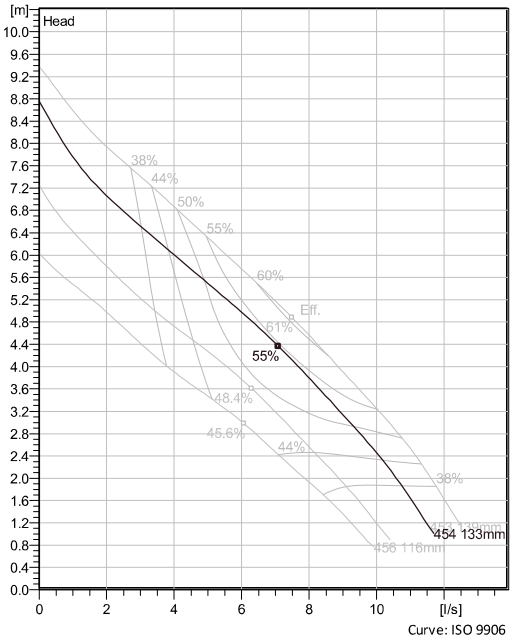
NP 3085 SH 3~ Adaptive 454

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3085.060 15-07-4AL-W 2.2hp

Installation type
P - Semi permanent, Wet

Impeller diameter
133 mm

Discharge diameter
80 mm

Pump information

Impeller diameter
133 mm

Discharge diameter
80 mm

Inlet diameter
80 mm

Maximum operating speed
1670 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Stator housing material
Grey cast iron

Project	Xylect-21929451	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3085 SH 3~ Adaptive 454

Technical specification

Motor - General

Motor number N3085.060 15-07-4AL-W 2.2hp	**Phases** 3~	**Rated speed** 1670 rpm	**Rated power** 2.2 hp
ATEX approved No	**Number of poles** 4	**Rated current** 6.6 A	**Stator variant** 12
Frequency 60 Hz	**Rated voltage** 230 V	**Insulation class** H	**Type of Duty** S1
Version code 060			

Motor - Technical

Power factor - 1/1 Load 0.87	**Motor efficiency - 1/1 Load** 71.6 %	**Total moment of inertia** 0.0079 kg m²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.83	**Motor efficiency - 3/4 Load** 74.2 %	**Starting current, direct starting** 29 A	
Power factor - 1/2 Load 0.75	**Motor efficiency - 1/2 Load** 73.4 %	**Starting current, star-delta** 9.66 A	

Project	Xylect-21929451	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

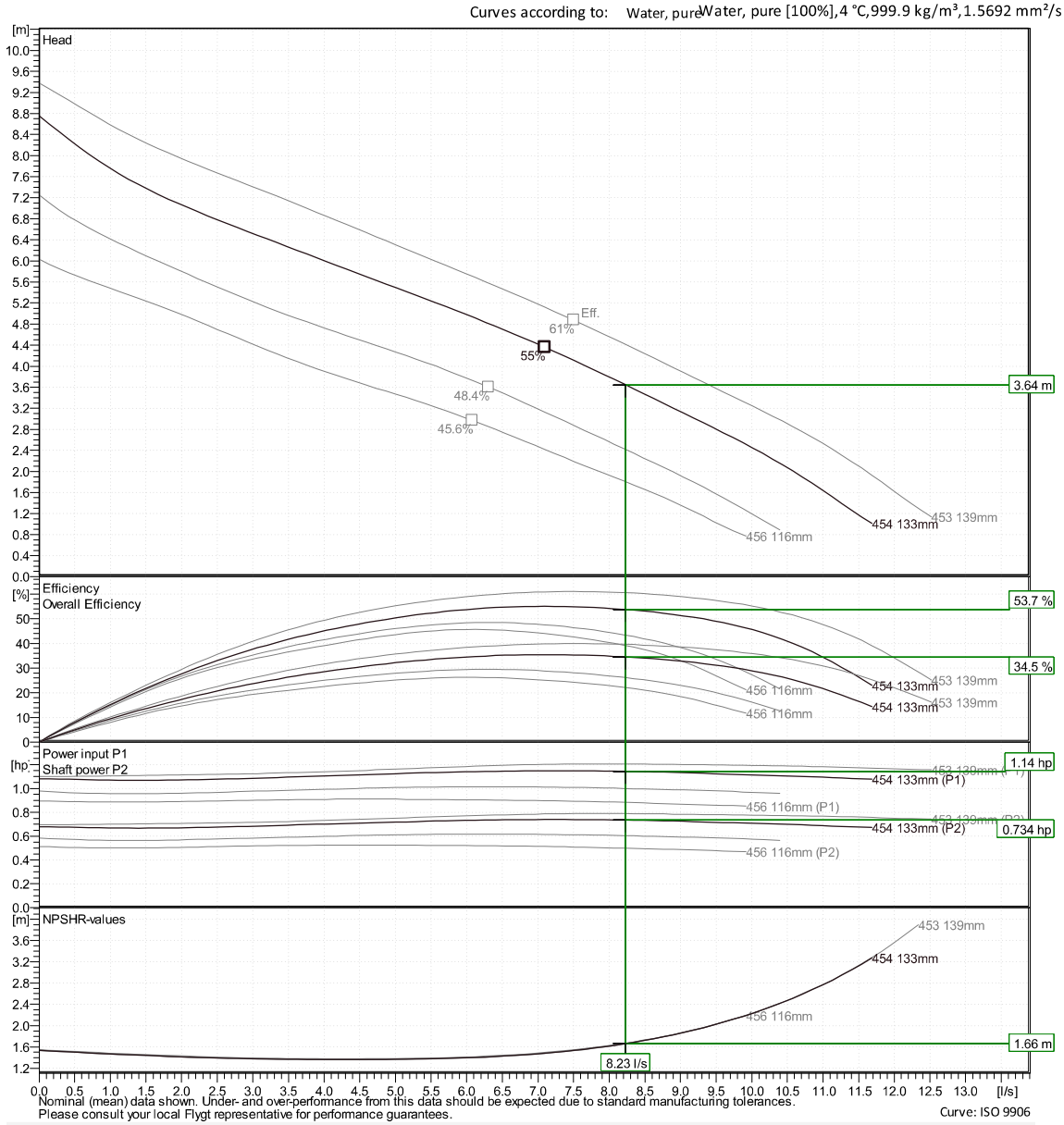
NP 3085 SH 3~ Adaptive 454

Performance curve

Duty point

Flow	Head
8.23 l/s	3.64 m

Curves according to: Water, pure Water, pure [100%], 4 °C, 999.9 kg/m³, 1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

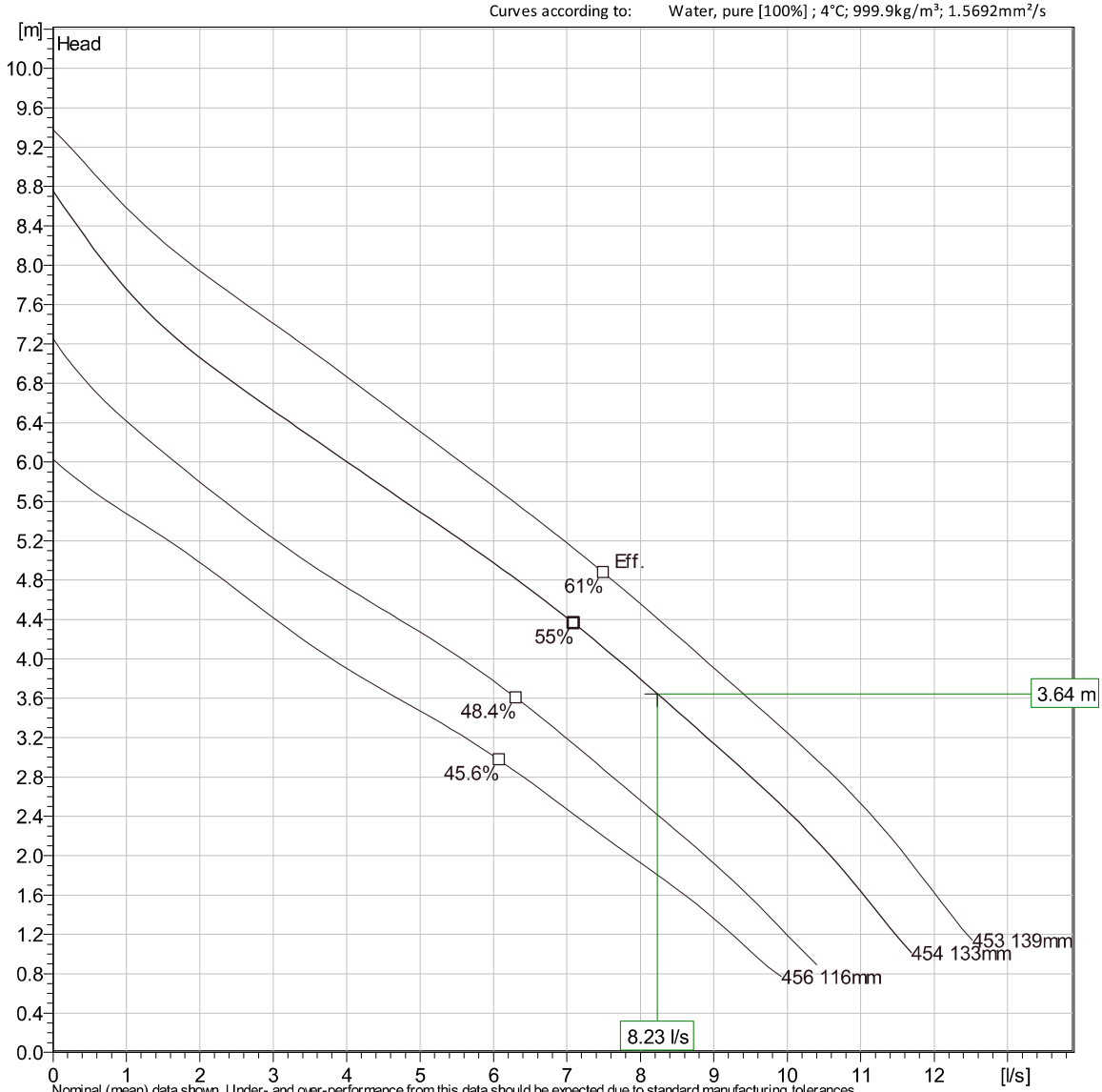
Curve: ISO 9906

Xylect-21929451		xiaoyu Zhou	
Created on	2/29/2024	**Last update**	2/29/2024

NP 3085 SH 3~ Adaptive 454

Duty Analysis

Curves according to: Water, pure [100%] ; 4°C; 999.9kg/m³; 1.5692mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

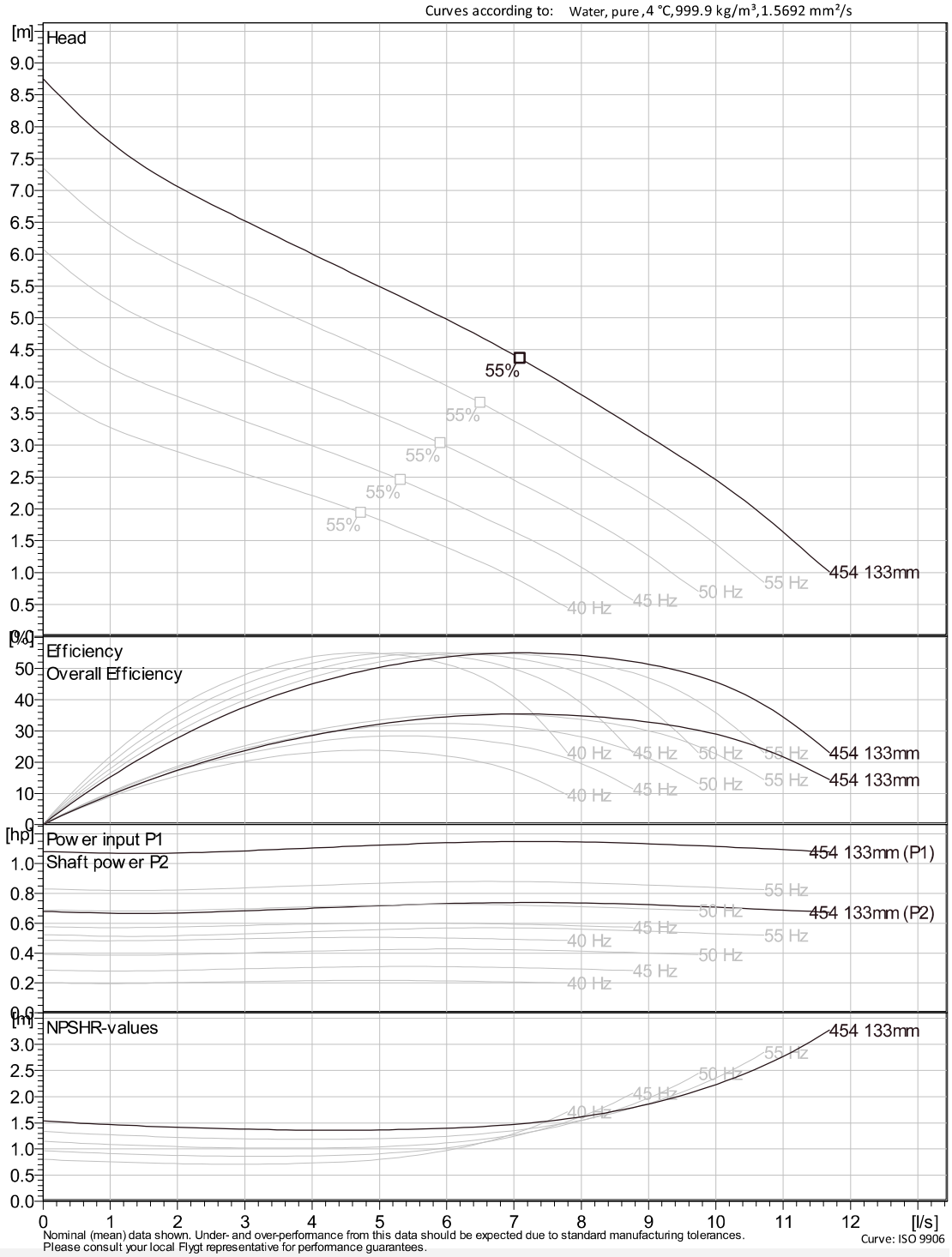
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	l/s	m	hp	l/s	m	hp		kWh/l	m
1	8.23	3.64	0.734	8.23	3.64	0.734	53.7 %	2.88E-5	1.66

Project		**Created by**	xiaoyu Zhou		
Block	Xylect-21929451	**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3085 SH 3~ Adaptive 454

VFD Curve

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

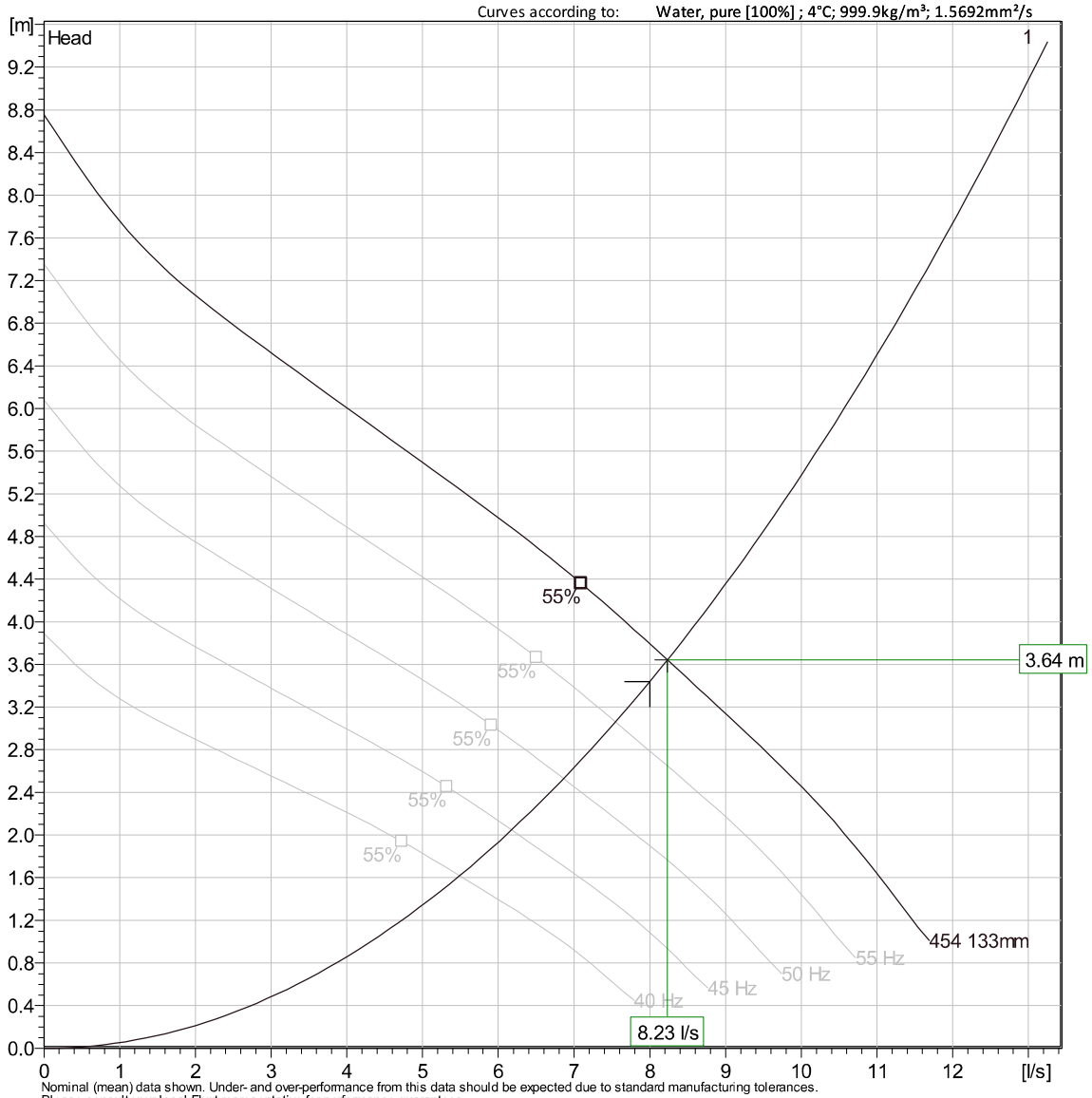
Curve: ISO 9906

Project	Xylect-21929451	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3085 SH 3~ Adaptive 454

VFD Analysis

Curves according to: Water, pure [100%] ; 4°C; 999.9kg/m³; 1.5692mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

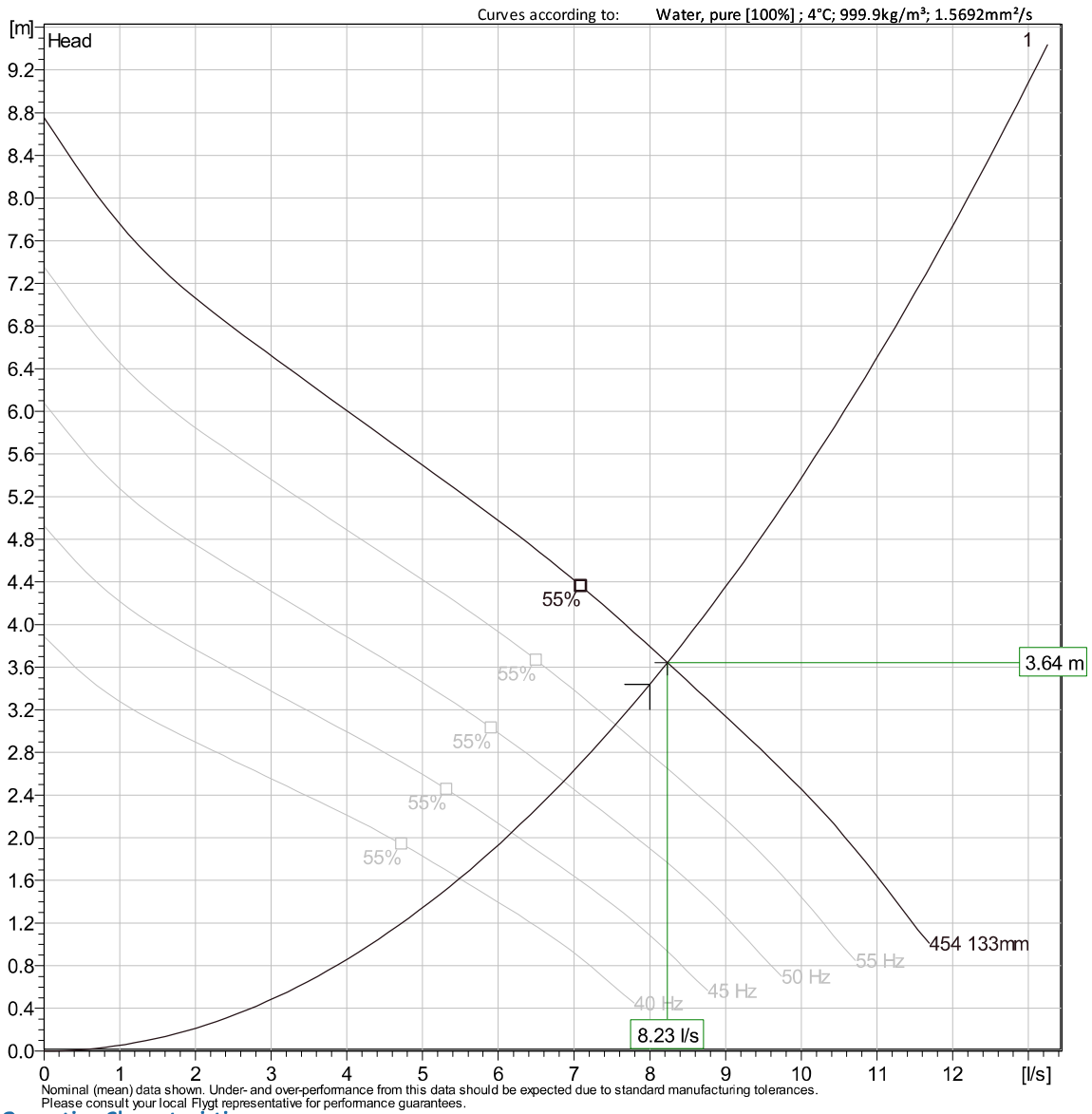
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
1	60 Hz	8.23	3.64	0.734	8.23	3.64	0.734	53.7 %	2.88E-5	1.66
1	55 Hz	7.55	3.06	0.566	7.55	3.06	0.566	53.7 %	2.41E-5	1.45
1	50 Hz	6.86	2.53	0.425	6.86	2.53	0.425	53.7 %	2.18E-5	1.24
1	45 Hz	6.17	2.05	0.31	6.17	2.05	0.31	53.7 %	2.02E-5	1.05

Project	Xylect-21929451	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3085 SH 3~ Adaptive 454

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

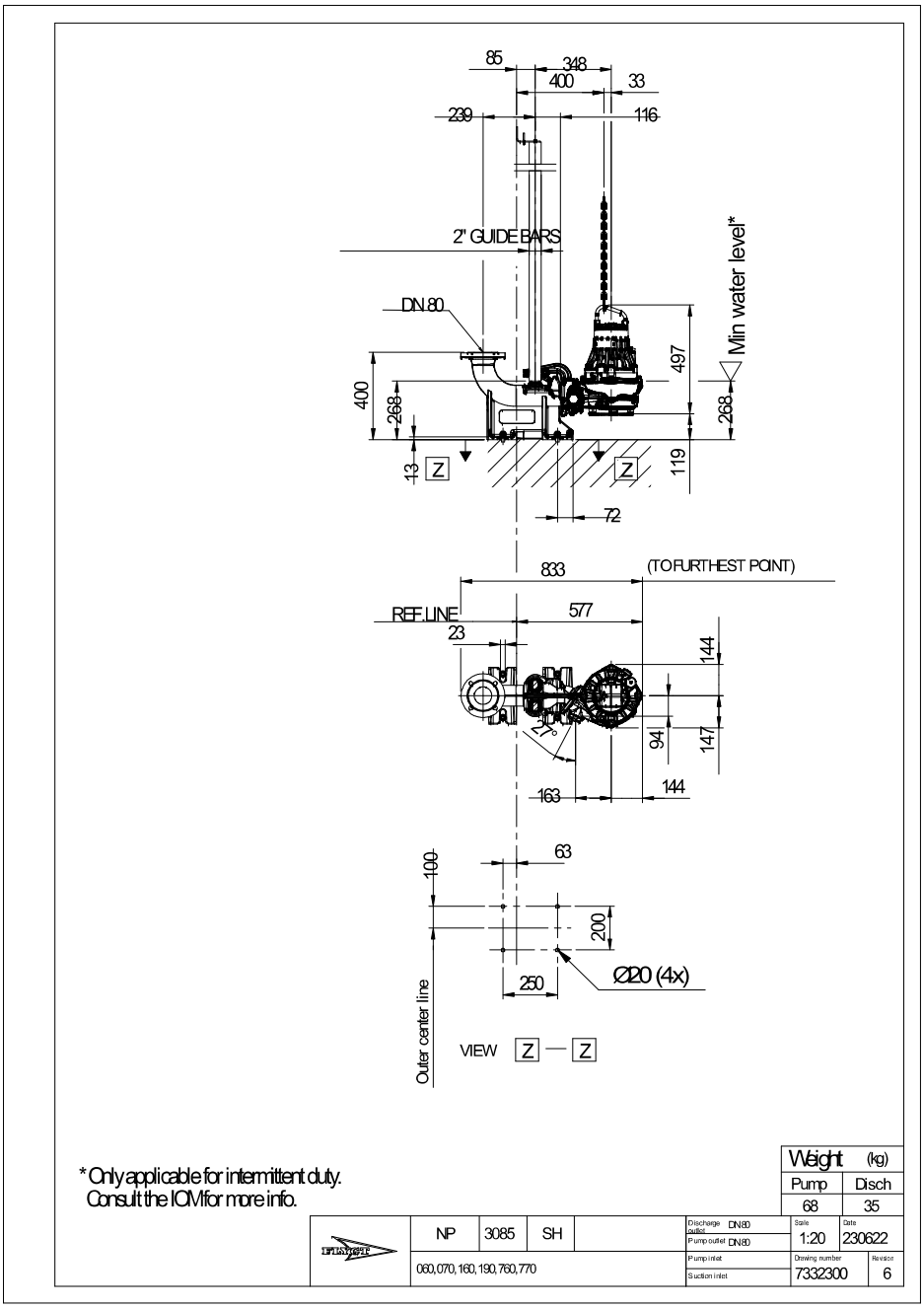
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
1	40 Hz	5.49	1.62	0.218	5.49	1.62	0.218	53.7 %	1.9E-5	0.869

Project	Xylect-21929451	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3085 SH 3~ Adaptive 454

Dimensional drawing



Project	Xylect-21929451	**Created by**	xiaoyu Zhou
Block		**Created on**	2/29/2024 **Last update** 2/29/2024

9 ROTHESAY PUMP STATION

9.1 BACKGROUND

The Rothesay pump station is located at 2525 Rothesay Ave near the foreshore. The station is accessible by a paved access driveway off the end of the road. The station is a duplex submersible pump station with piping for future third pump. Available records indicate the station was originally constructed in 1972. Gravity flows from approximately 156 properties, which includes a number of apartment building complexes and condominiums, are received by the station. Flows from the Surfside pump station are also pumped to a gravity main that flows to the Rothesay pump station.

9.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak flow of 20.84 L/s and a future peak flow requirement of 24.47 L/s were provided. The existing calculated pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	33.7	32.5	39.6

Maintenance records indicate the existing pumps are Flygt CP 3127 MT – 432, 3-phase, 208V, 10 hp. Pump specifications, including dimension and pump curves were obtained from the manufacturer's website. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	*511.9m	203.2mm	CL100 Asbestos Concrete
Forcemain 2	*173.5m	204.0mm	C900 DR18 PVC
Pump Station - Interior piping 1	*28.9m	154.0mm	Steel
Geodetic Head	6.30m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate capacities and evaluate condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition

C=130 Fair Condition

C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve a single pump should have a maximum theoretical pump rate of approximately 38.6 L/s (C=150) and two pumps a pump rate of approximately 52.7 L/s (C=150). The calculated pump would indicate that the system is operating between the C=110 and C=130 range which would be considered typical for the age of the system.

The existing pumps are currently capable of pumping at over 150% of the expected future flow. Based on this the pumps are potentially oversized. The existing station is piped to accept a third pump, and the system was reviewed to determine potential pump rates. Addition of a third pump would only increase the pump rate to 55.8 L/s (C=150) indicating that the existing forcemain size is the limiting factor.

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Total pump run times range from 35 min dry season to between 1-2 hours during wet season. This would indicate that the system likely has some significant I&I. It was noted during the station assessment that inlet flows were steady and clear similar to adjacent stormwater outfalls at the time.

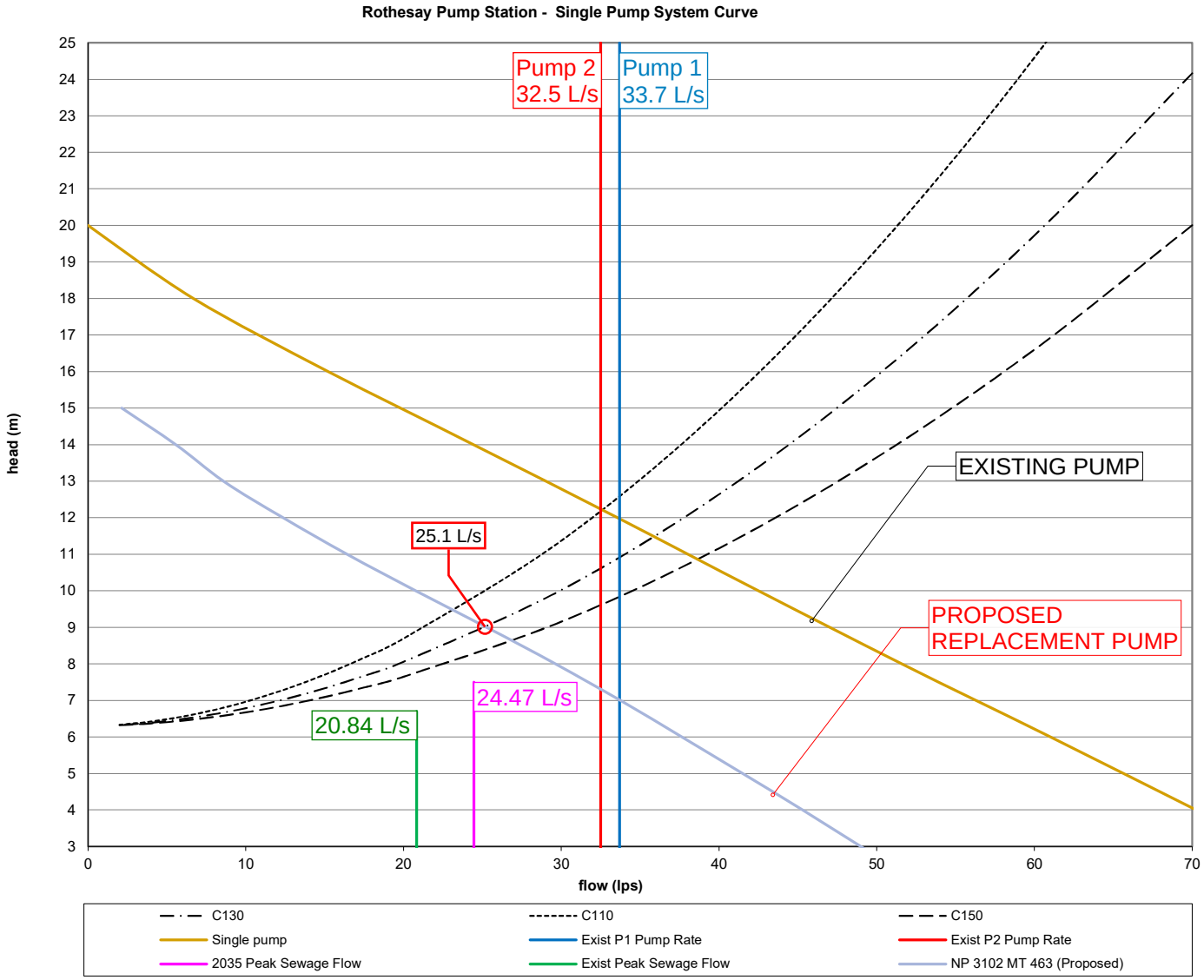
9.3 REPLACEMENT PUMP SELECTION

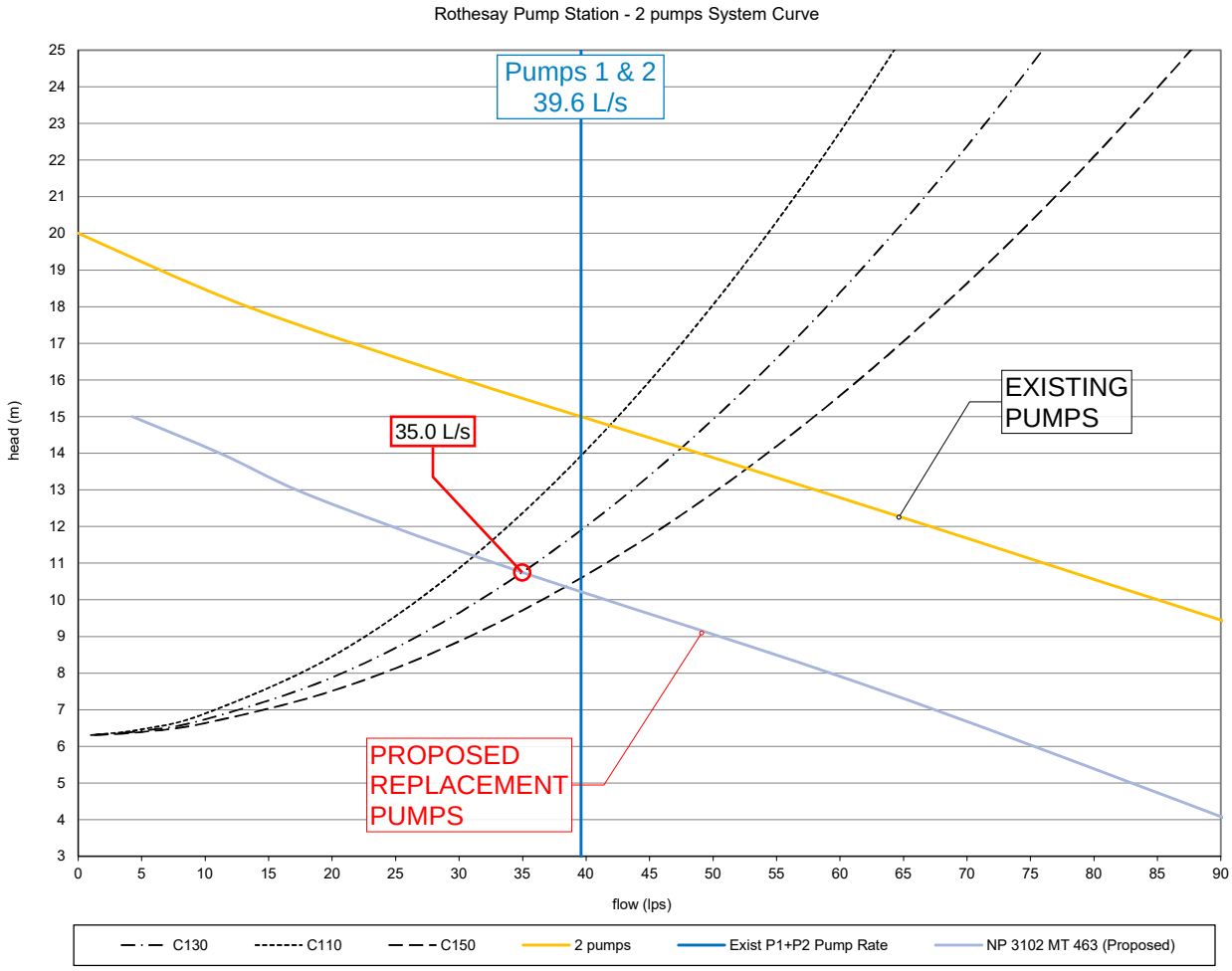
Replacement pump sizing is based on a single pump capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

The replacement pump is based on the selection parameters of 24.47 L/s @ 8.87m TDH (C=130) derived from the system curve is the Flygt NP 3102 MT ~3 Adaptive 463, 5.0 hp. The discharge on this pump is 100mm diameter, so the existing 150mm piping would have to be modified to use this pump model. The selected pump is lower horsepower (5.0 hp vs 10.0 hp) than the existing pump and the same pump model could potentially be used at one other pump station. (Ardwell).

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pump will have a theoretical capacity of 25.1 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (10 PAGES)


Rothesay Pump Station - Single Pump System Curve
Pump 2
32.5 L/s
Pump 1
33.7 L/s
EXISTING PUMP
PROPOSED
REPLACEMENT PUMP
25.1 L/s
24.47 L/s
20.84 L/s
head (m)
flow (lps)
C130
C110
C150
Single pump
Exist P1 Pump Rate
Exist P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3102 MT 463 (Proposed)


Rothesay Pump Station - 2 pumps System Curve
Pumps 1 & 2
39.6 L/s
35.0 L/s
EXISTING
PUMPS
PROPOSED
REPLACEMENT
PUMPS
head (m)
flow (lps)
C130
C110
C150
2 pumps
Exist P1+P2 Pump Rate
NP 3102 MT 463 (Proposed)

ROTHESAY

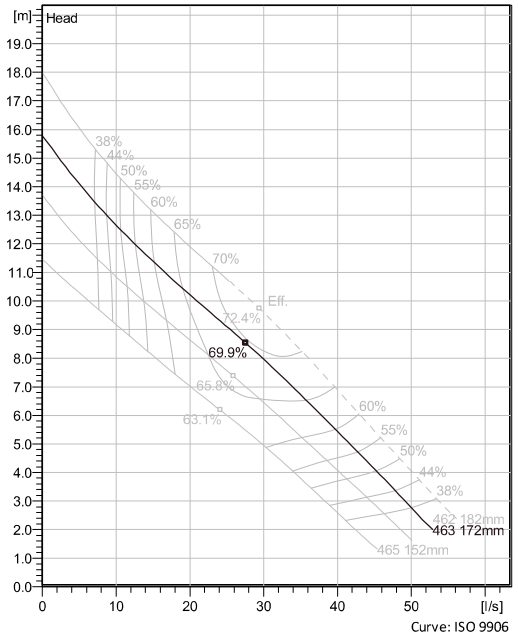
NP 3102 MT 3~ Adaptive 463

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

FLYGT a xylem brand

Technical specification

Curves according to: Water, pure Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3102.060 18-11-4AL-W 5hp

Installation type
P - Semi permanent, Wet

Impeller diameter
172 mm

Discharge diameter
100 mm

Pump information

Impeller diameter
172 mm

Discharge diameter
100 mm

Inlet diameter
100 mm

Maximum operating speed
1740 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Stator housing material
Grey cast iron

Project	Xylect-21929483	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

Technical specification

Motor - General

Motor number N3102.060 18-11-4AL-W 5hp	**Phases** 3~	**Rated speed** 1740 rpm	**Rated power** 5 hp
ATEX approved No	**Number of poles** 4	**Rated current** 14 A	**Stator variant** 66
Frequency 60 Hz	**Rated voltage** 208 V	**Insulation class** H	**Type of Duty** S1
Version code 060			

Motor - Technical

Power factor - 1/1 Load 0.88	**Motor efficiency - 1/1 Load** 84.3 %	**Total moment of inertia** 0.0258 kg m²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.85	**Motor efficiency - 3/4 Load** 85.5 %	**Starting current, direct starting** 71 A	
Power factor - 1/2 Load 0.78	**Motor efficiency - 1/2 Load** 84.8 %	**Starting current, star-delta** 23.7 A	

Project	Xylect-21929483	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

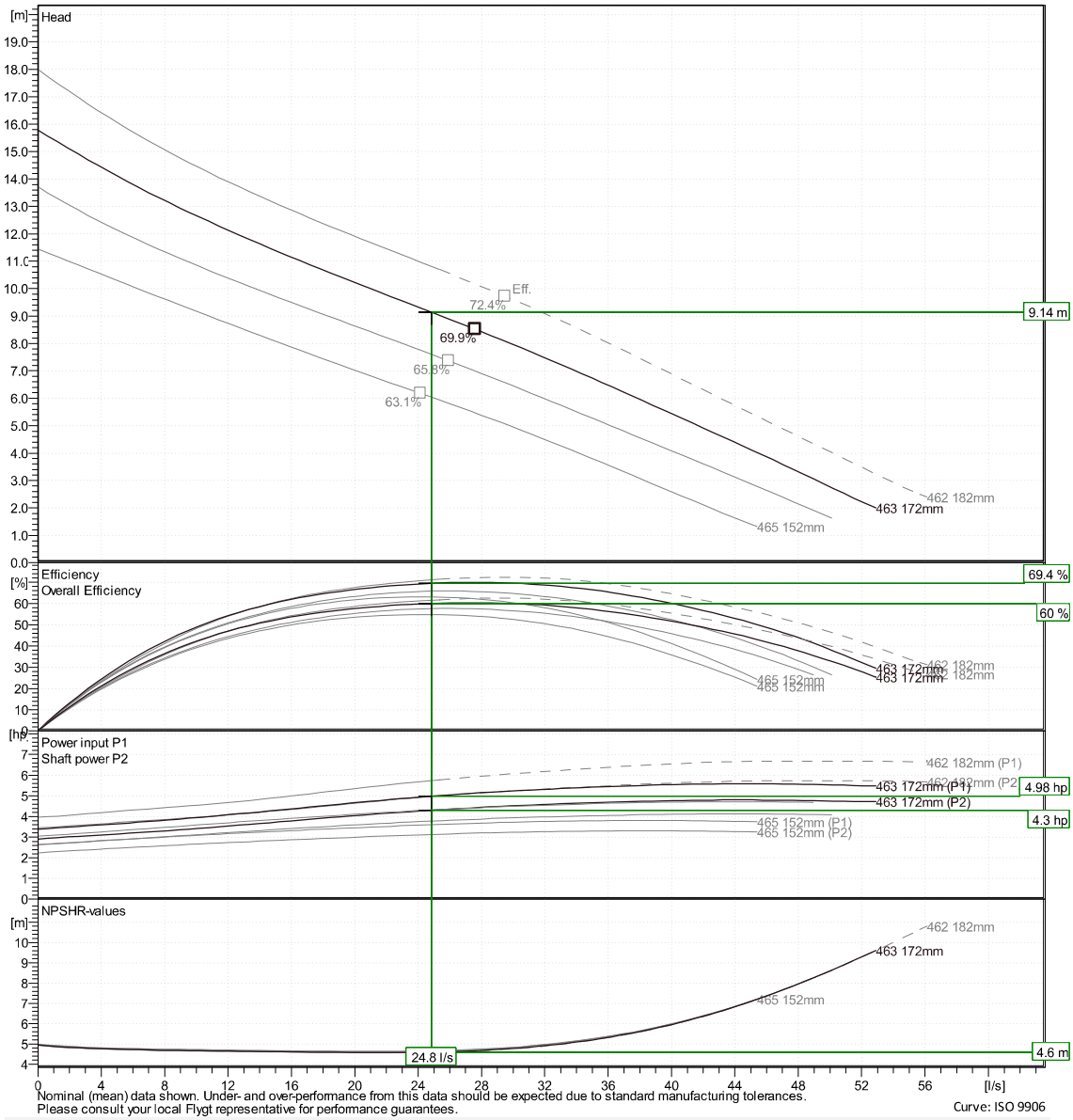
NP 3102 MT 3~ Adaptive 463

Performance curve

Duty point

Flow	Head
24.8 l/s	9.14 m

Curves according to: Water, pure Water, pure [100%], 4 °C, 999.9 kg/m³, 1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

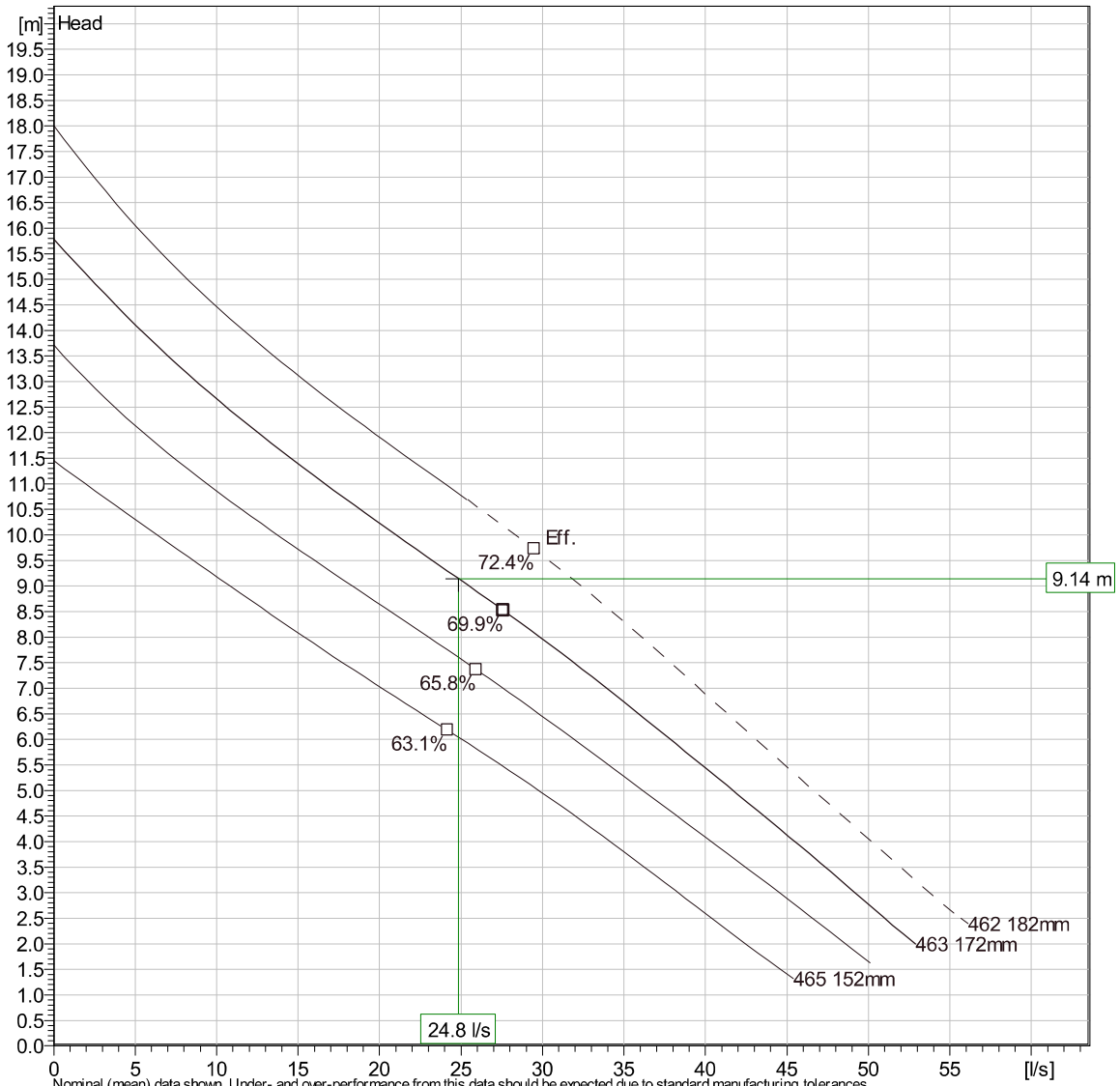
Curve: ISO 9906

Xylect-21929483		xiaoyu Zhou	
	Created on	2/29/2024	**Last update** 2/29/2024

NP 3102 MT 3~ Adaptive 463

Duty Analysis

Curves according to: Water, pure [100%] ; 4°C; 999.9kg/m³; 1.5692mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	l/s	m	hp	l/s	m	hp		kWh/l	m
1	24.8	9.14	4.3	24.8	9.14	4.3	69.4 %	4.15E-5	4.6

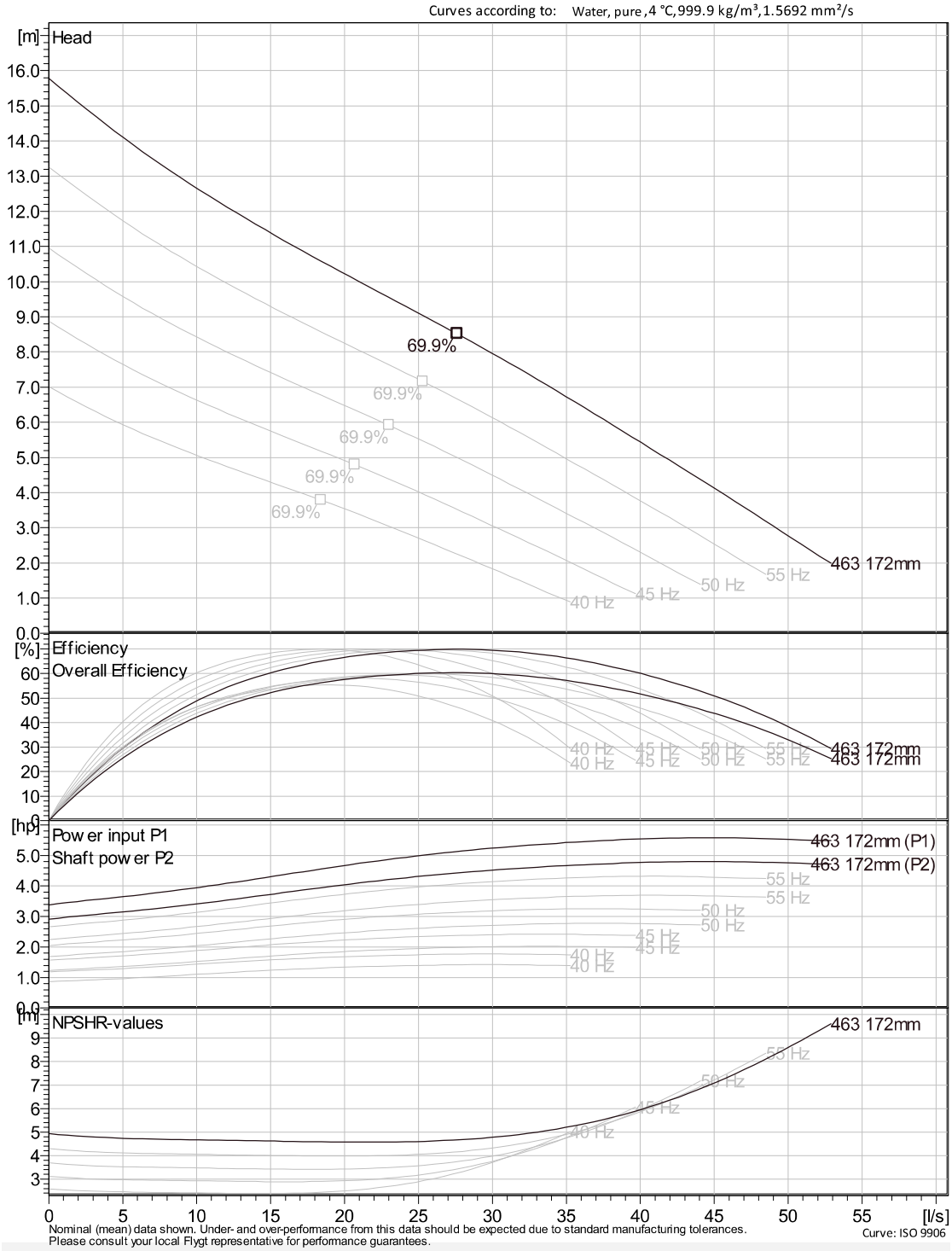
Project		**Created by**	xiaoyu Zhou		
Block	Xylect-21929483	**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

VFD Curve

FLYGT
a xylem brand

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



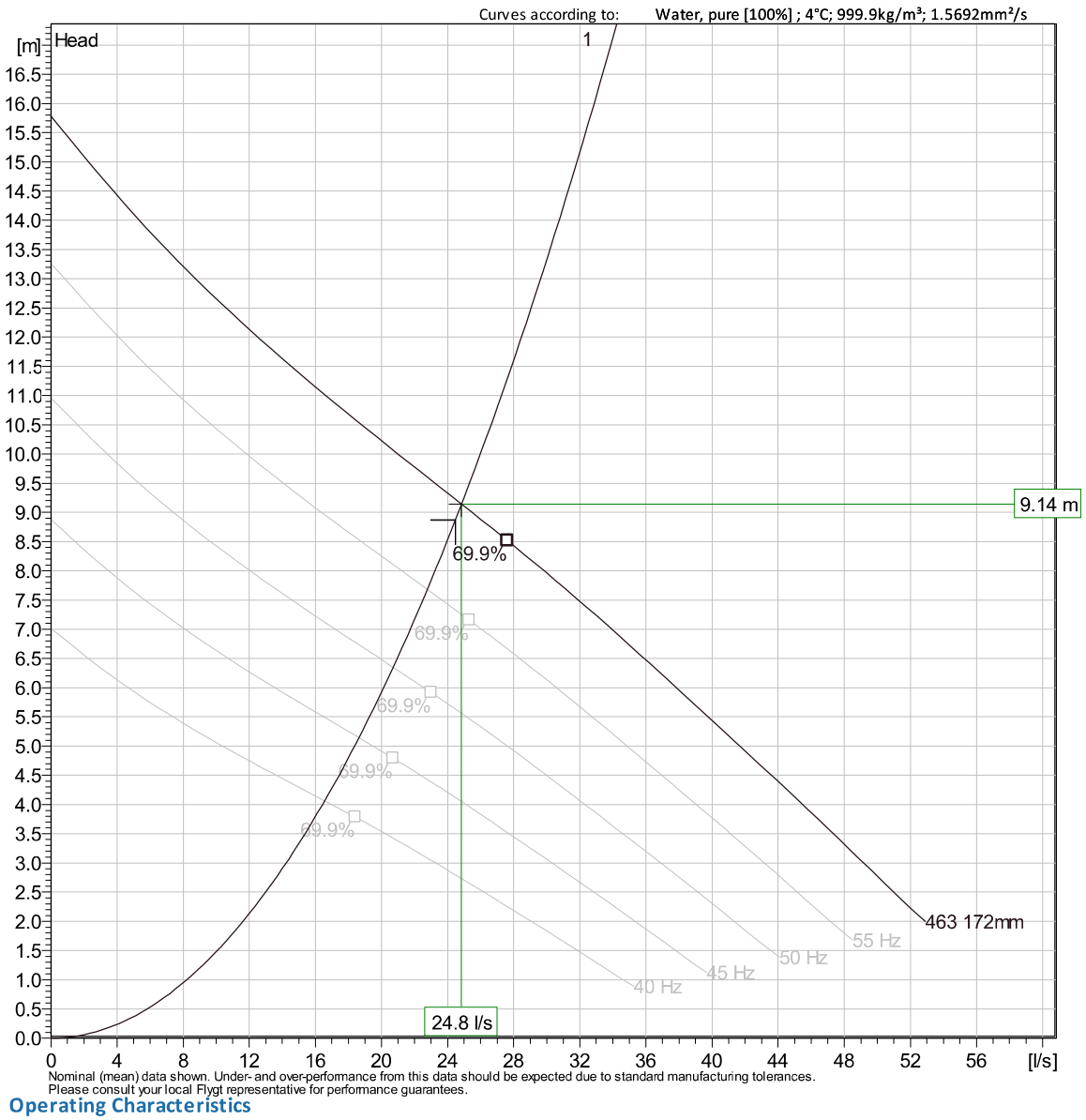
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

Project	Xylect-21929483	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

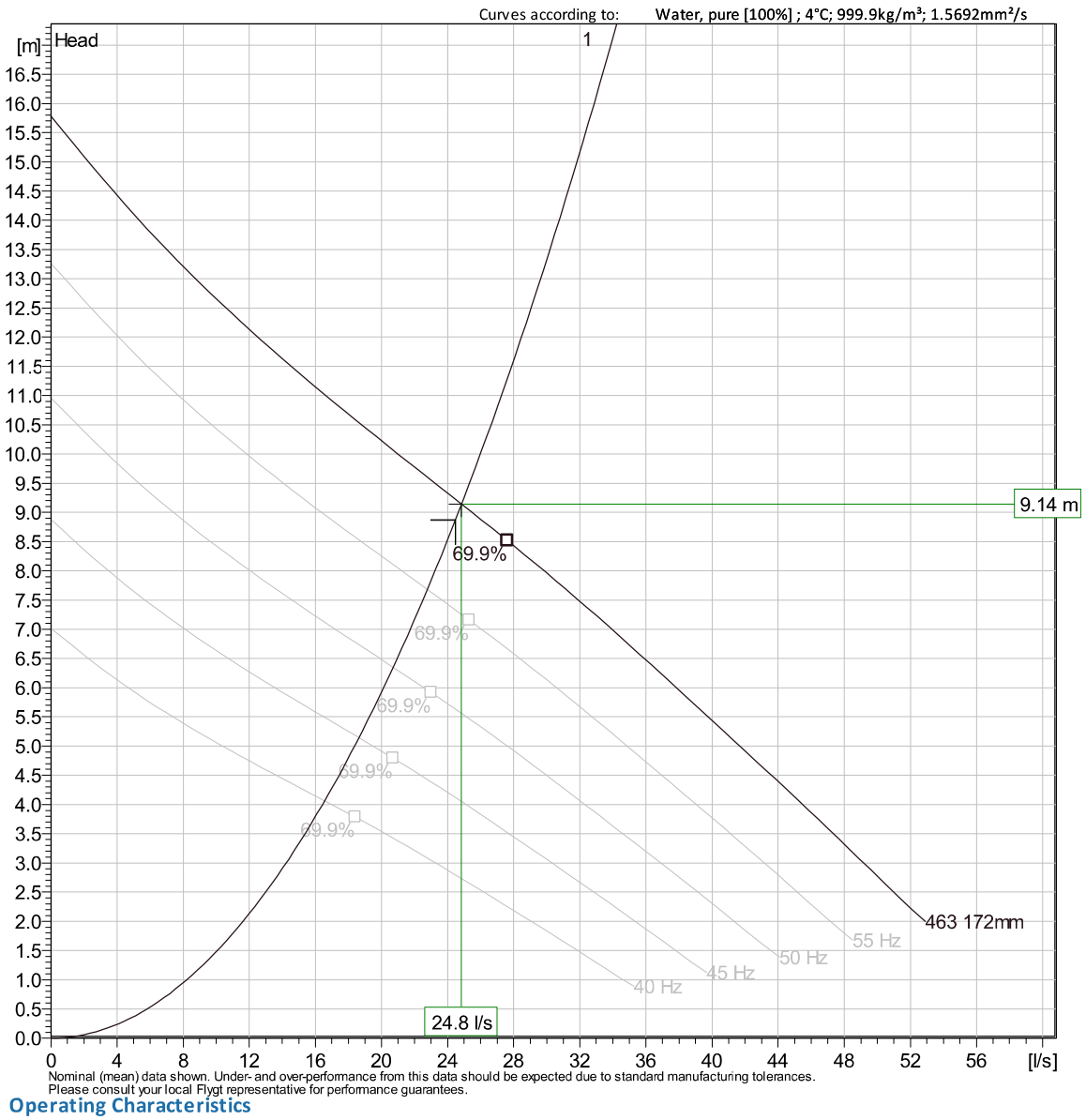
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
1	60 Hz	24.8	9.14	4.3	24.8	9.14	4.3	69.4 %	4.15E-5	4.6
1	55 Hz	22.8	7.68	3.32	22.8	7.68	3.32	69.4 %	3.52E-5	4
1	50 Hz	20.7	6.35	2.49	20.7	6.35	2.49	69.4 %	2.94E-5	3.43
1	45 Hz	18.6	5.14	1.82	18.6	5.14	1.82	69.4 %	2.44E-5	2.9

Project	Xylect-21929483	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

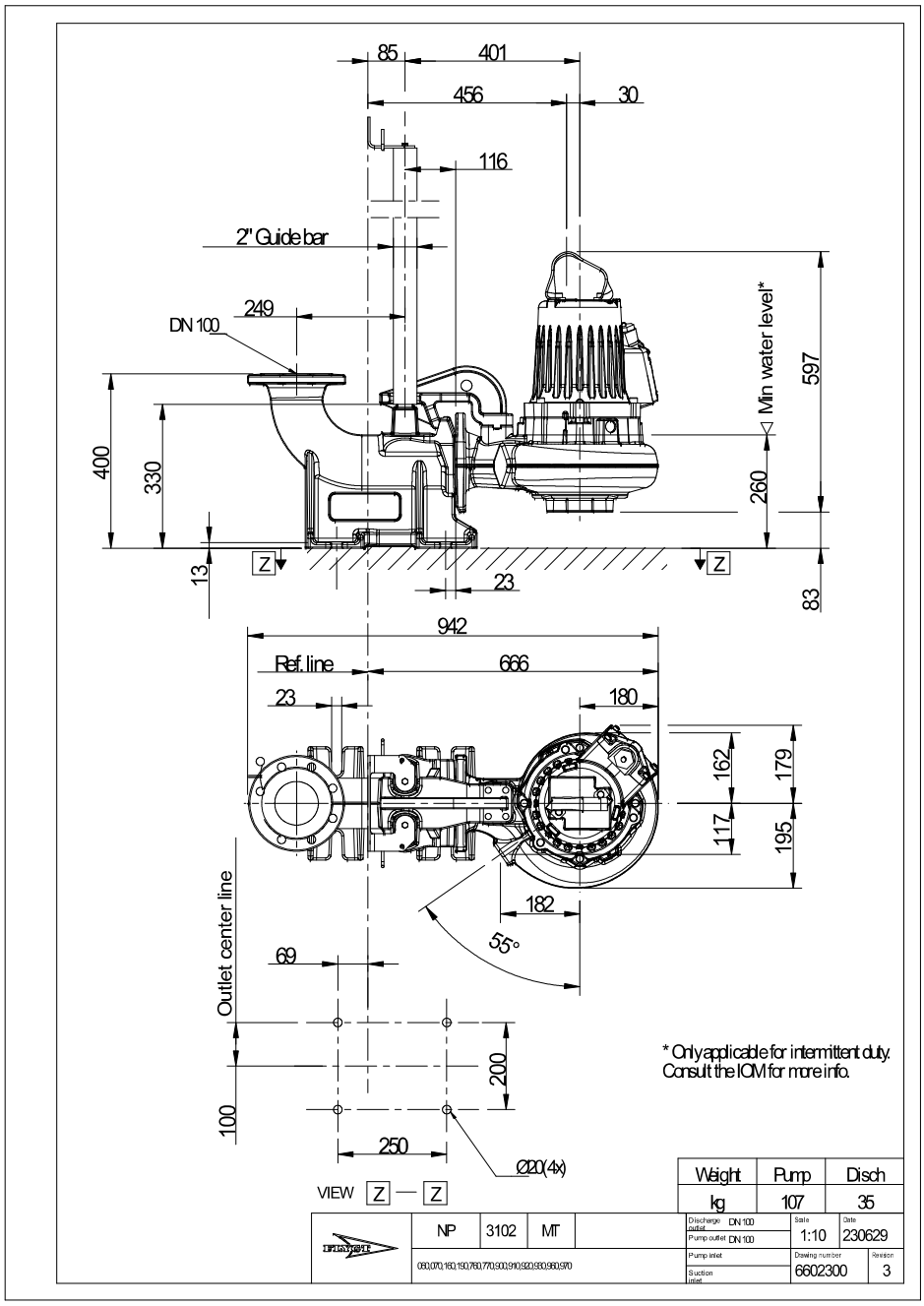
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		l/s	m	hp	l/s	m	hp		kWh/l	m
1	40 Hz	16.6	4.06	1.28	16.6	4.06	1.28	69.4 %	2.02E-5	2.4

Project	Xylect-21929483	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3102 MT 3~ Adaptive 463

Dimensional drawing



Project	Xylect-21929483	**Created by**	xiaoyu Zhou
Block		**Created on**	2/29/2024 **Last update** 2/29/2024

10 SEAPORT PUMP STATION

10.1 BACKGROUND

The Seaport pump station is located at 9881 Seaport Place behind the sidewalk at the edge of a parking lot. The station is a duplex submersible pump type. Available records indicate the station was originally constructed around 1990. The station was rebuilt / upgraded in 2004, including pump and mechanical replacement. Sewage from approximately 3 commercial properties and a pumped service from the nearby marine float flow to the station.

10.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak flow of 7.7 L/s and a future peak flow requirement of 7.7 L/s were provided.

The existing calculated pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	5.1[1]	7.7	8.5

[1] pump equipped with flush valve.

Maintenance records indicate the existing pumps are Flygt NP 3085 MT – 462, 3-phase, 208V, 3 hp. Pump specifications, including dimension and pump curves were obtained from the manufacturer's website. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	*227.1m	101.mm	SCH 40 PVC
Pump Station - Interior piping 1	*18.76m	77.3mm	Steel
Geodetic Head	5.27m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate capacities and evaluate condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition

C=130 Fair Condition

C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve a single pump should have a maximum theoretical pump rate of approximately 10.4 L/s (C=150) and two pumps a pump rate of approximately 13.2 L/s (C=150). The calculated pump rate would indicate that the system is operating below the C=110. This may be due to incorrect system information or errors in the draw-down calculations.

The existing pumps are currently capable of pumping the anticipated future flow. However, the current pumps should be capable of pumping roughly 130% of the future design flow. The existing pumps seem to be appropriately sized for the anticipated flows.

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Pump run times range from approximately 30 minutes to over 2 hours in the summer months. The peak in the summer months is likely attributed to increased usage at the marina and restaurants during that time.

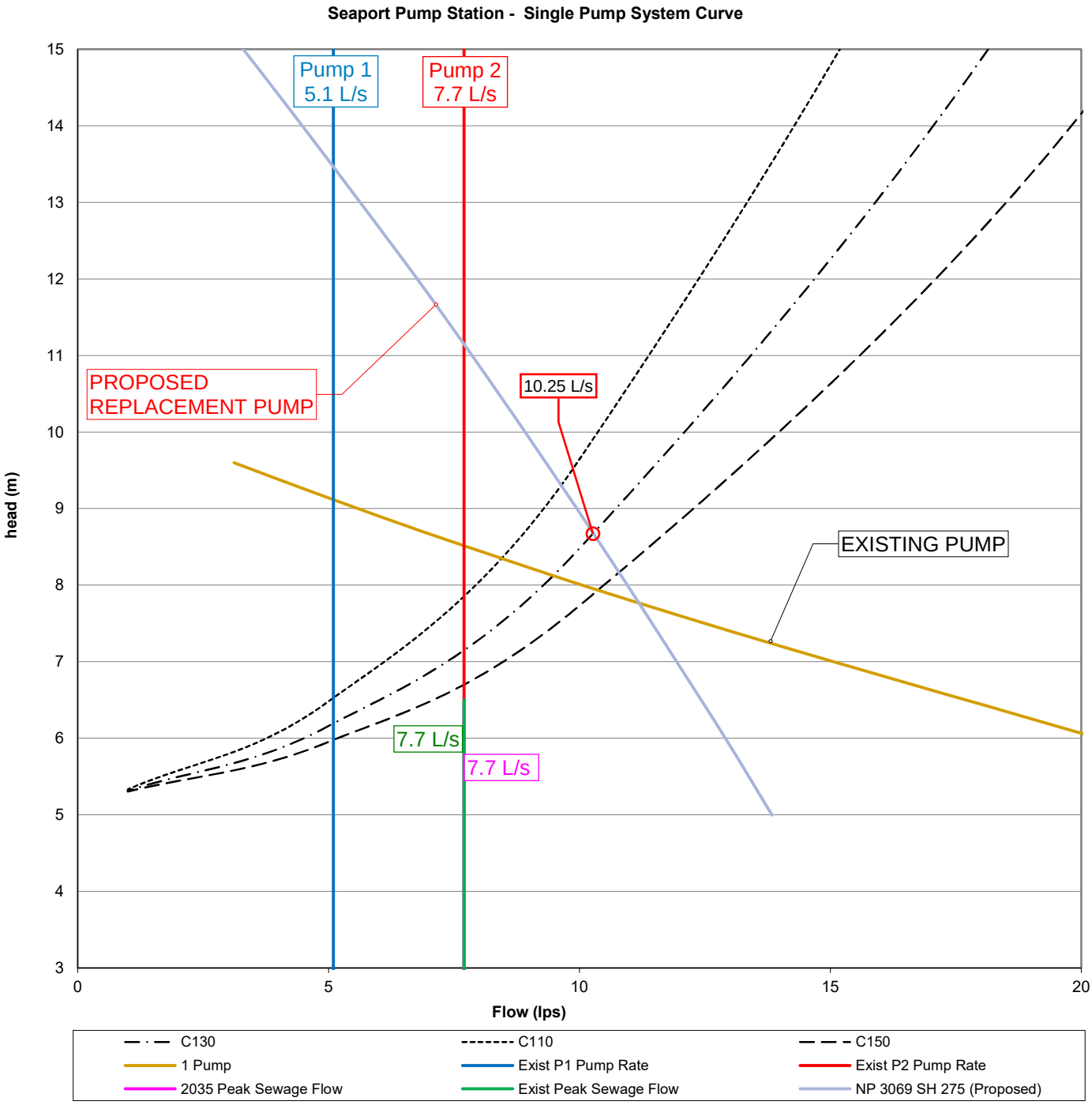
10.3 REPLACEMENT PUMP SELECTION

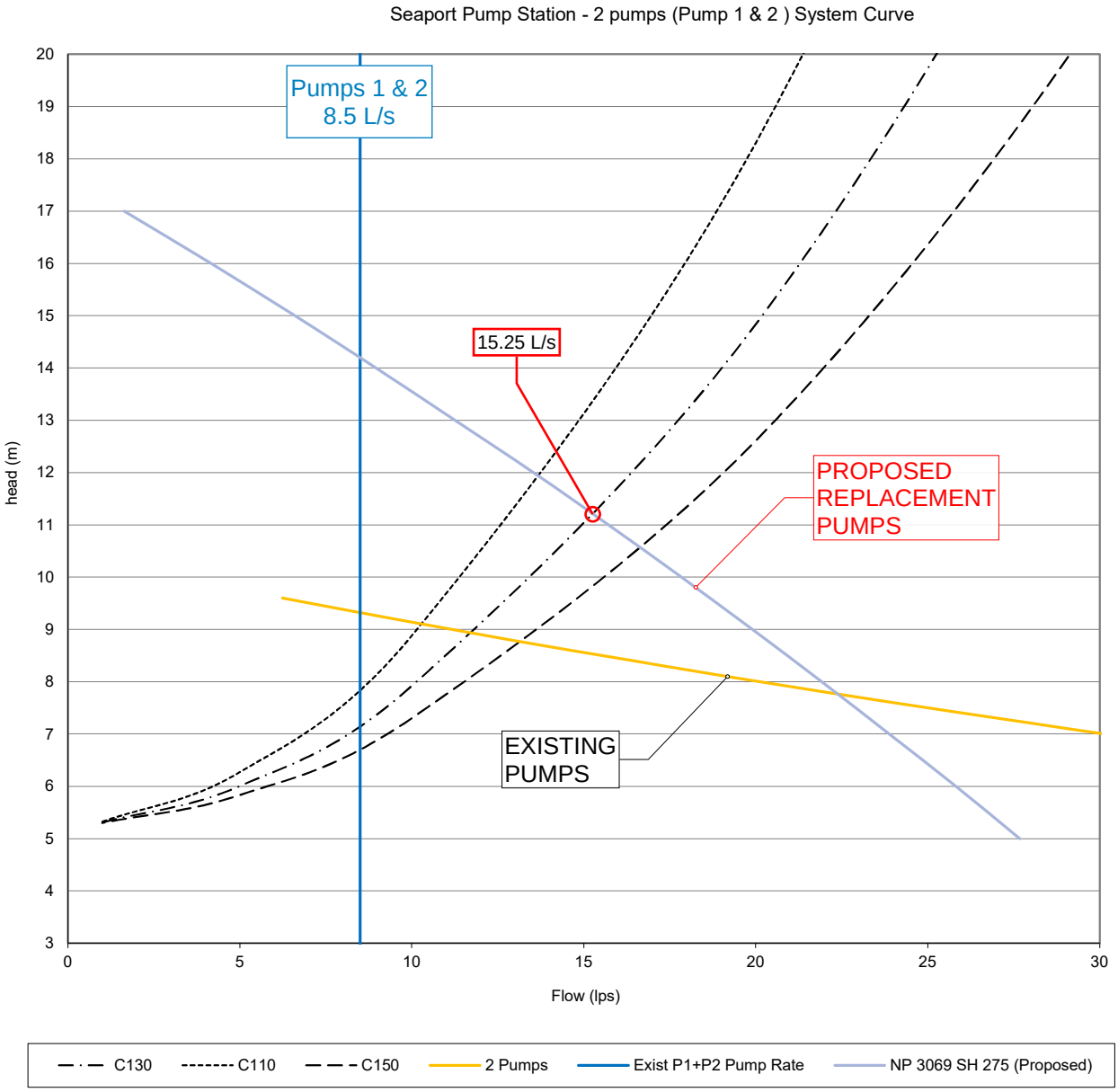
Replacement pump sizing is based on a single pump capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

The replacement pump is based on the selection parameters of 7.7 L/s @ 7.15m TDH (C=130) is the Flygt NP 3069 SH, 3-phase, adaptive 275, 2.7 hp. The discharge on this pump is 75mm diameter, which matches the existing piping. The selected pump is slightly lower horsepower (2.7 hp vs 3.0 hp) than the existing pump and the same pump model could potentially be used at four other pump stations.

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pump will have a theoretical capacity of 10.25 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (7 PAGES)


Seaport Pump Station - Single Pump System Curve
Pump 1
5.1 L/s
Pump 2
7.7 L/s
PROPOSED
REPLACEMENT PUMP
10.25 L/s
EXISTING PUMP
7.7 L/s
7.7 L/s
head (m)
Flow (lps)
C130
C110
C150
1 Pump
Exist P1 Pump Rate
Exist P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3069 SH 275 (Proposed)


Seaport Pump Station - 2 pumps (Pump 1 & 2) System Curve
Pumps 1 & 2
8.5 L/s
15.25 L/s
PROPOSED
REPLACEMENT
PUMPS
EXISTING
PUMPS
head (m)
Flow (lps)
C130
C110
C150
2 Pumps
Exist P1+P2 Pump Rate
NP 3069 SH 275 (Proposed)

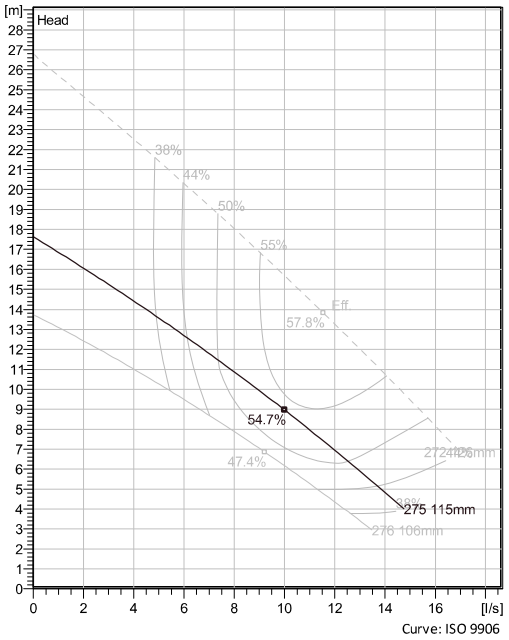
SEAPORT

NP 3069 SH 3~ Adaptive 275

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3069.060 13-08-2BB-W 2.7hp

Installation type
P - Semi permanent, Wet

Impeller diameter
115 mm

Discharge diameter
65 mm

Pump information

Impeller diameter
115 mm

Discharge diameter
65 mm

Inlet diameter
100 mm

Maximum operating speed
3255 rpm

Number of blades
2

Max. fluid temperature
40 °C

Materials

Impeller
Hard-Iron ™

Stator housing material
Grey cast iron

Project	Xylect-21929499	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Technical specification

Motor - General

Motor number N3069.060 13-08-2BB-W 2.7hp	**Phases** 3~	**Rated speed** 3255 rpm	**Rated power** 2.7 hp
ATEX approved No	**Number of poles** 2	**Rated current** 8.1 A	**Stator variant** 7
Frequency 60 Hz	**Rated voltage** 208 V	**Insulation class** F	**Type of Duty** S1
Version code 060			

Motor - Technical

Power factor - 1/1 Load 0.91	**Motor efficiency - 1/1 Load** 75.9 %	**Total moment of inertia** 0.00313 kg m²	**Starts per hour max.** 15
Power factor - 3/4 Load 0.87	**Motor efficiency - 3/4 Load** 79.7 %	**Starting current, direct starting** 38 A	
Power factor - 1/2 Load 0.80	**Motor efficiency - 1/2 Load** 81.1 %	**Starting current, star-delta** 12.7 A	

Project	Xylect-21929499	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

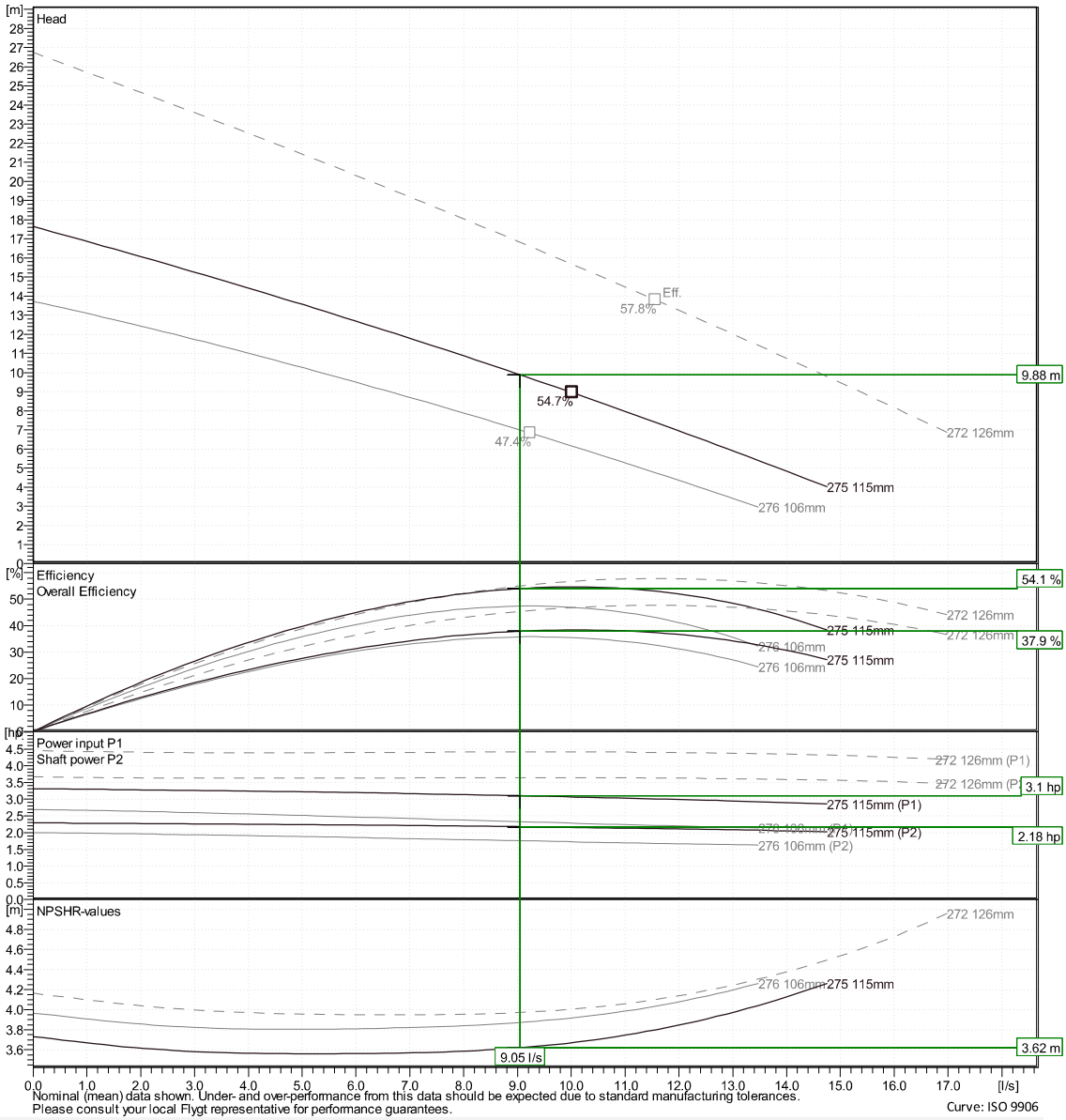
NP 3069 SH 3~ Adaptive 275

Performance curve

Duty point

Flow	Head
9.05 l/s	9.88 m

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

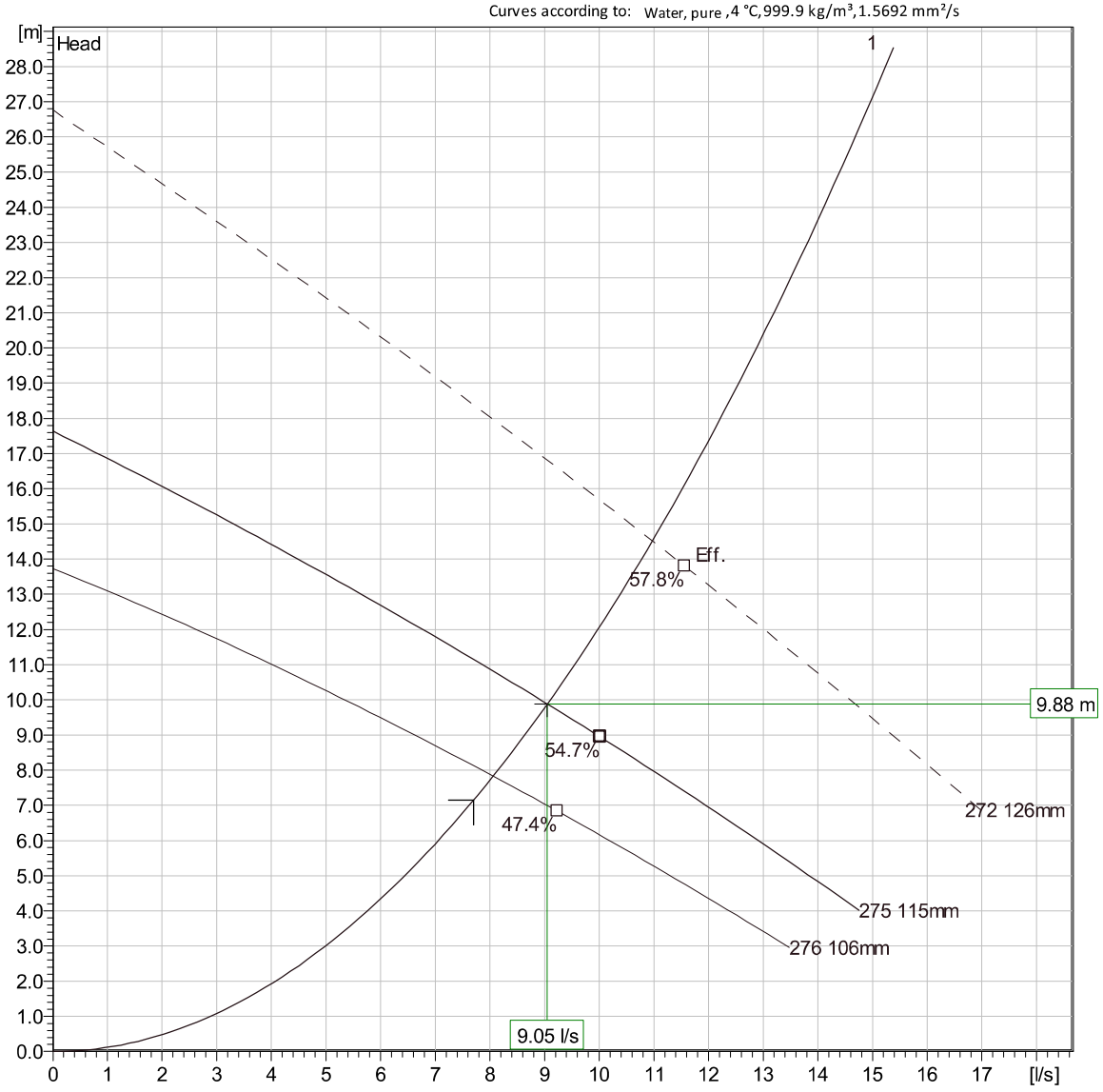
Curve: ISO 9906

Project	Xylect-21929499	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Duty Analysis

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



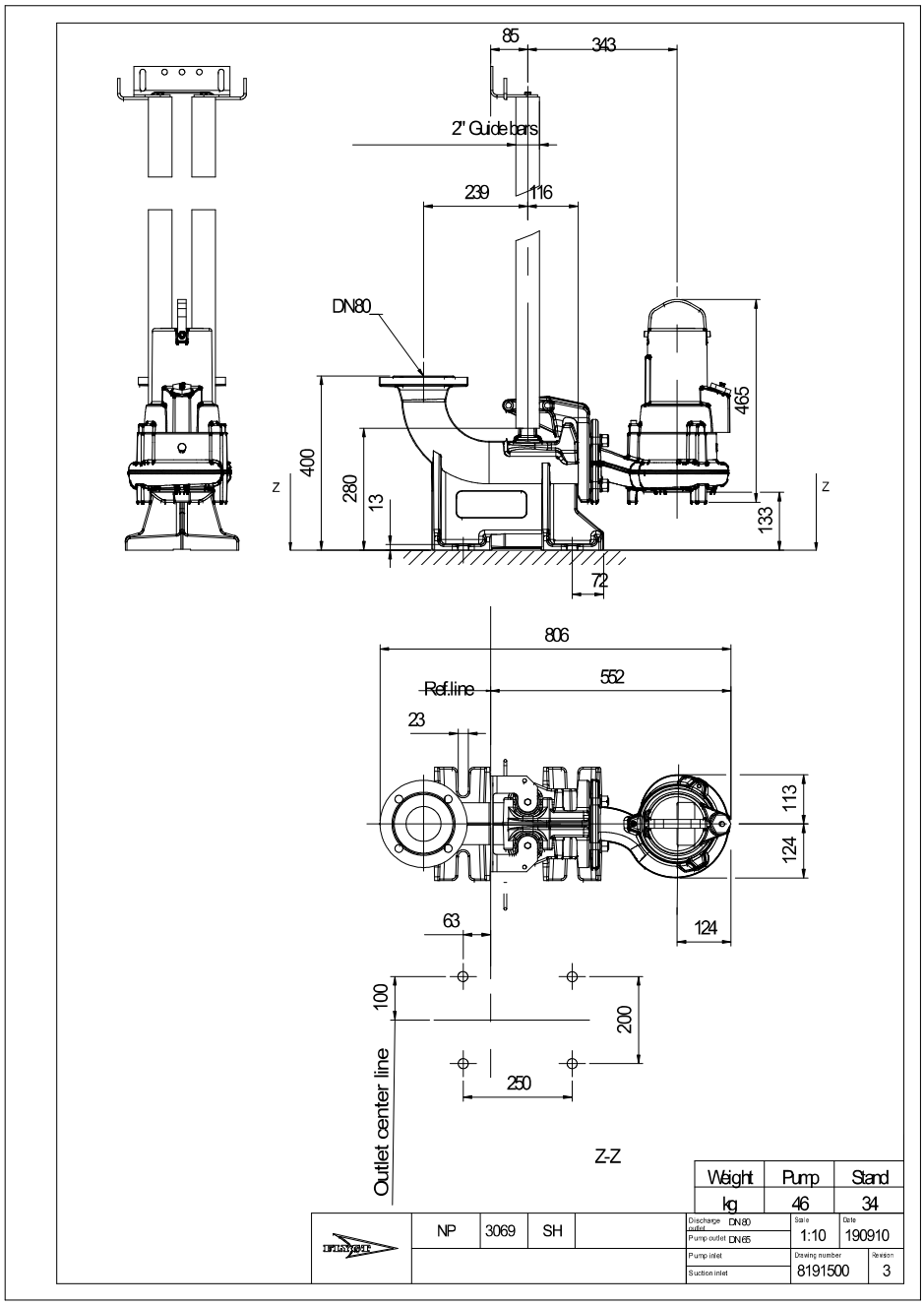
Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1	9.05 l/s	9.88 m	2.18 hp	9.05 l/s	9.88 m	2.18 hp	54.1 %	7.1E-5 kWh/l	3.62 m

Project	Xylect-21929499	**Created by**	xiaoyu Zhou		
Block		**Created on**	2/29/2024	**Last update**	2/29/2024

NP 3069 SH 3~ Adaptive 275

Dimensional drawing



Project	Xylect-21929499	**Created by**	xiaoyu Zhou
Block		**Created on**	2/29/2024 **Last update** 2/29/2024

11 SURFSIDE PUMP STATION

11.1 BACKGROUND

The Surfside pump station is located at 10215 Surfside Place adjacent to the foreshore seawall. Access to the station is by the pedestrian beach access off the end of the road. The station is a duplex submersible type. Available records indicate the station was originally constructed in 1972. Approximately 10 properties are serviced by the station. Flows are pumped to the gravity main that flows to the Rothesay pump station.

11.2 EXISTING PUMPS AND SYSTEM

Information was previously provided by ToS as part of the pump station assessment project and was reviewed as part of this study. Additional information provided by ToS included pump rates for the existing pumps calculated from draw down testing for the 2016 KWL Utility Study. An update to the ToS sewer model was completed in 2020 and future peak flows were revised. An existing peak flow of 0.92 L/s and a future peak flow requirement of 1.1 L/s were provided. The existing pump rates provided were as follows:

	PUMP 1	PUMP 2	PUMPS 1 & 2
Pump Rate (L/s)	4.2	4.5	5.0

Maintenance records indicate the existing pumps are Flygt CP 3085 MT – 436, 3-phase, 230V, 2.4 hp. Pump specifications, including dimension and pump curves were obtained from the manufacturer's website. A system curve was developed based on the available as-constructed information for the pump station and associated sewer forcemain.

A summary of the information used to develop the system curve is shown in the table below:

	LENGTH	SIZE (ID)	MATERIAL
Forcemain 1	*227.07m	101.6mm	CL100 Asbestos Concrete
Pump Station - Interior piping 1	*15.70m	72.7mm	Sch80 PVC
Geodetic Head	5.72m		

**Length includes equivalent length for fittings*

The system curve was plotted at three different Hazen Williams friction coefficients to calculate theoretical capacities and evaluate condition of the forcemain. The system curve was plotted using the following coefficients:

C=150 New/ Clean Condition

C=130 Fair Condition

C=110 Poor Condition

The manufacturer pump curves were plotted against the system curves to determine the theoretical condition of the forcemain based on friction.

Based on the published performance data for the existing pumps and the system curve a single pump should have a maximum theoretical pump rate of approximately 5.4 L/s (C=150) and two pumps a pump rate of approximately 7.0 L/s (C=150). The calculated pump rates would indicate that the system is operating around the C=110 range.

The existing pumps are currently capable of pumping approximately 4 times the anticipated future peak flow. Based on this, it is not expected that upsizing of the pumps will be required in the future.

The station has been identified for relocation and pump sizing should be re-assessed at that time to account for changes that could affect the required head.

2019 SCADA data provided as part of the pumpstation assessment project was reviewed. Total pump run times range from approximately 15 min to 1 hour throughout the year. There are some days with significantly longer run times (up to 4 hrs) that may be attributed to inflow from waves overtopping the station.

11.3 REPLACEMENT PUMP SELECTION

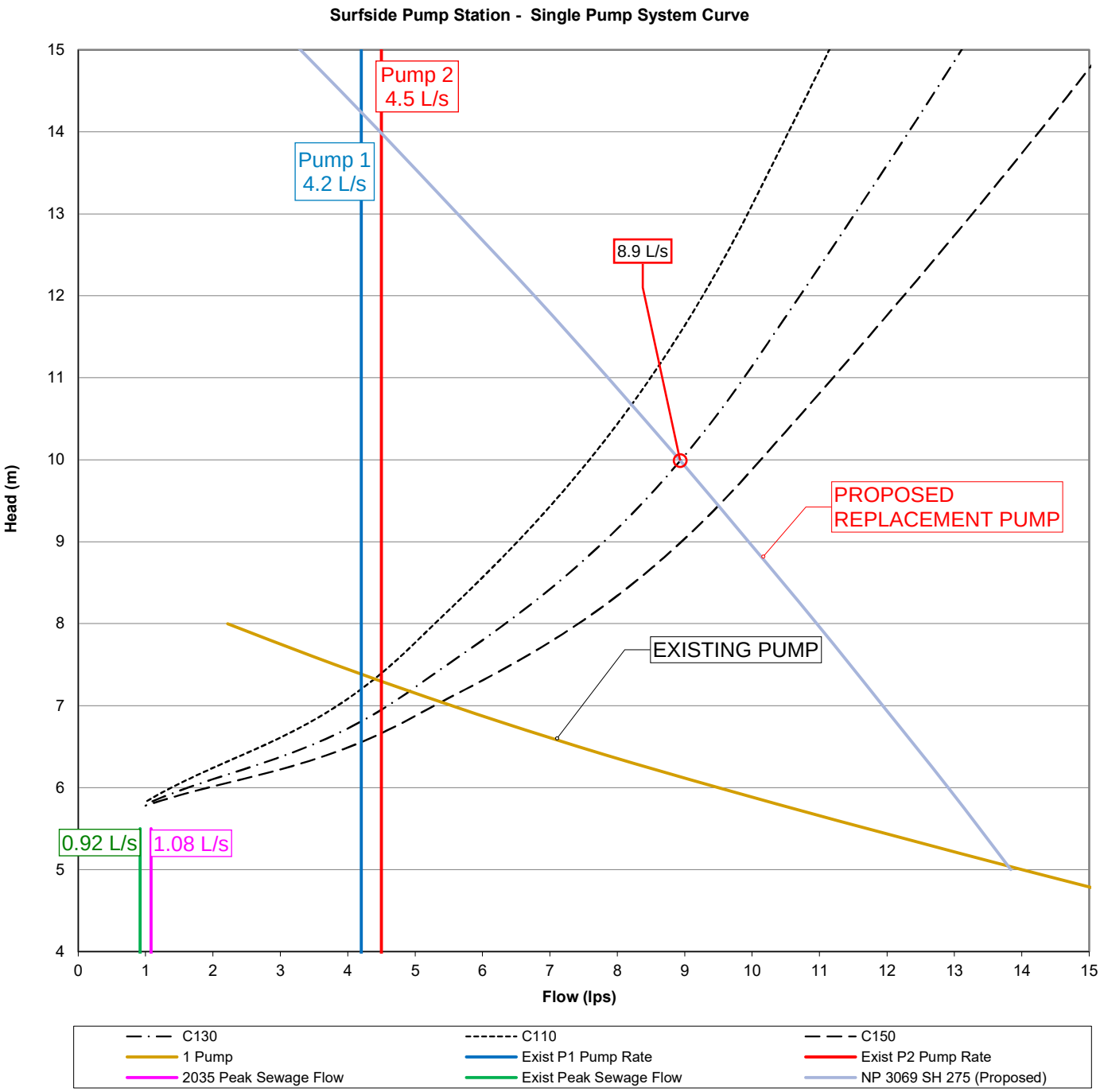
Replacement pump sizing is based on a single pump capable of pumping the minimum peak design sewage flow. The provided 2035 peak design sewage flows were plotted on the system curves that were developed to determine the required Total Dynamic Head (TDH) at the future peak flow for each station. For pump selection, a conservative friction coefficient of C=130 at the 2035 design inflow was used.

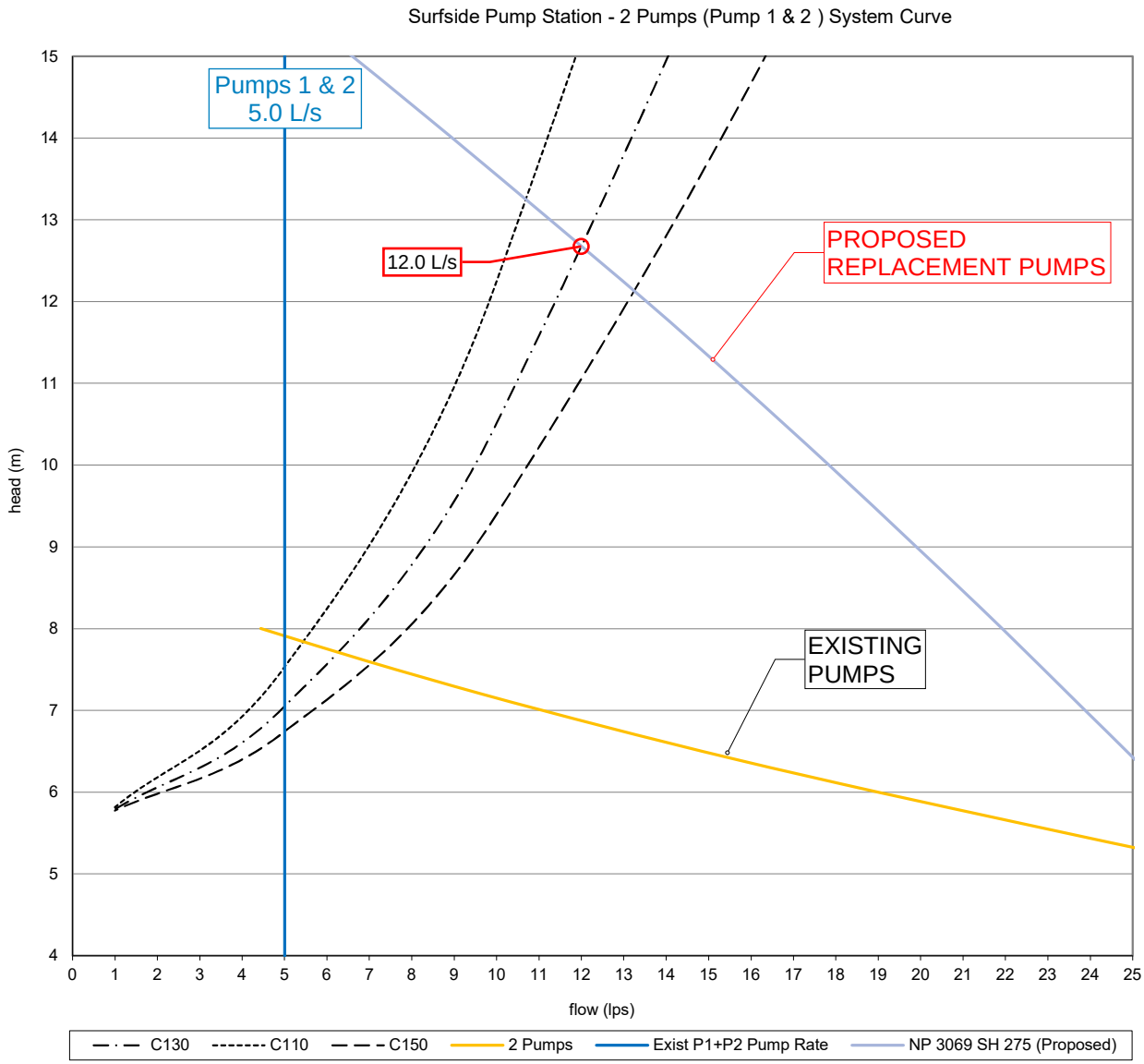
The required future peak flows for this station are lower than the pumping rate of any available pump selection. Lower pump rates result in low velocities in the force main and do not meet the recommended minimum scouring velocity of 1.0 m/s. In this station the pump rate used for selection was set at 8.0 L/s, the minimum rate to produce the scouring velocity in a 100mm diameter forcemain during single pump operation.

The replacement pump is based on the selection parameters of 8.0 L/s @ 9.2m TDH (C=130) is the Flygt NP 3069 SH, 3-phase, adaptive 275, 2.7 hp. The discharge on this pump is 75mm diameter, which matches the existing piping. The selected pump is slightly higher horsepower (2.7 hp vs 2.4 hp) than the existing pump and the same pump model could potentially be used at four other pump stations.

Copies of the system curve developed from the available information with the existing and proposed design flows and pump curves plotted are attached. Based on the graphing the proposed selected pump will have a theoretical capacity of 8.9 L/s at C=130. Also attached is the selected replacement pump model information.

SYSTEM CURVES AND PUMP INFORMATION (7 PAGES)


Surfside Pump Station - Single Pump System Curve
Head (m)
Flow (lps)
Pump 2
4.5 L/s
Pump 1
4.2 L/s
8.9 L/s
PROPOSED
REPLACEMENT PUMP
EXISTING PUMP
0.92 L/s
1.08 L/s
C130
C110
C150
1 Pump
Exist P1 Pump Rate
Exist P2 Pump Rate
2035 Peak Sewage Flow
Exist Peak Sewage Flow
NP 3069 SH 275 (Proposed)


Surfside Pump Station - 2 Pumps (Pump 1 & 2) System Curve
Pumps 1 & 2
5.0 L/s
12.0 L/s
PROPOSED
REPLACEMENT PUMPS
EXISTING
PUMPS
head (m)
flow (lps)
C130
C110
C150
2 Pumps
Exist P1+P2 Pump Rate
NP 3069 SH 275 (Proposed)

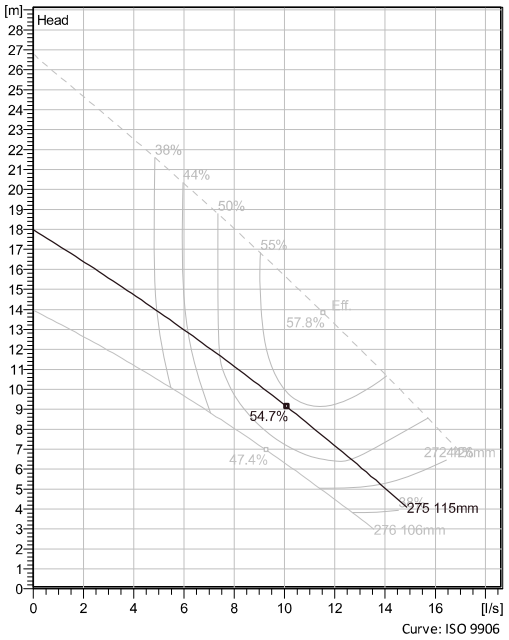
SURFSIDE

NP 3069 SH 3~ Adaptive 275

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3069.060 13-08-2BB-W 2.7hp

Installation type
P - Semi permanent, Wet

Impeller diameter
115 mm

Discharge diameter
65 mm

Pump information

Impeller diameter
115 mm

Discharge diameter
65 mm

Inlet diameter
100 mm

Maximum operating speed
3310 rpm

Number of blades
2

Max. fluid temperature
40 °C

Materials

Impeller
Hard-Iron ™

Stator housing material
Grey cast iron

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NP 3069 SH 3~ Adaptive 275

Technical specification

Motor - General

Motor number N3069.060 13-08-2BB-W 2.7hp	**Phases** 3~	**Rated speed** 3310 rpm	**Rated power** 2.7 hp
ATEX approved No	**Number of poles** 2	**Rated current** 7.5 A	**Stator variant** 6
Frequency 60 Hz	**Rated voltage** 230 V	**Insulation class** F	**Type of Duty** S1
Version code 060			

Motor - Technical

Power factor - 1/1 Load 0.87	**Motor efficiency - 1/1 Load** 77.8 %	**Total moment of inertia** 0.00313 kg m²	**Starts per hour max.** 15
Power factor - 3/4 Load 0.81	**Motor efficiency - 3/4 Load** 80.2 %	**Starting current, direct starting** 40 A	
Power factor - 1/2 Load 0.71	**Motor efficiency - 1/2 Load** 80.2 %	**Starting current, star-delta** 13.3 A	

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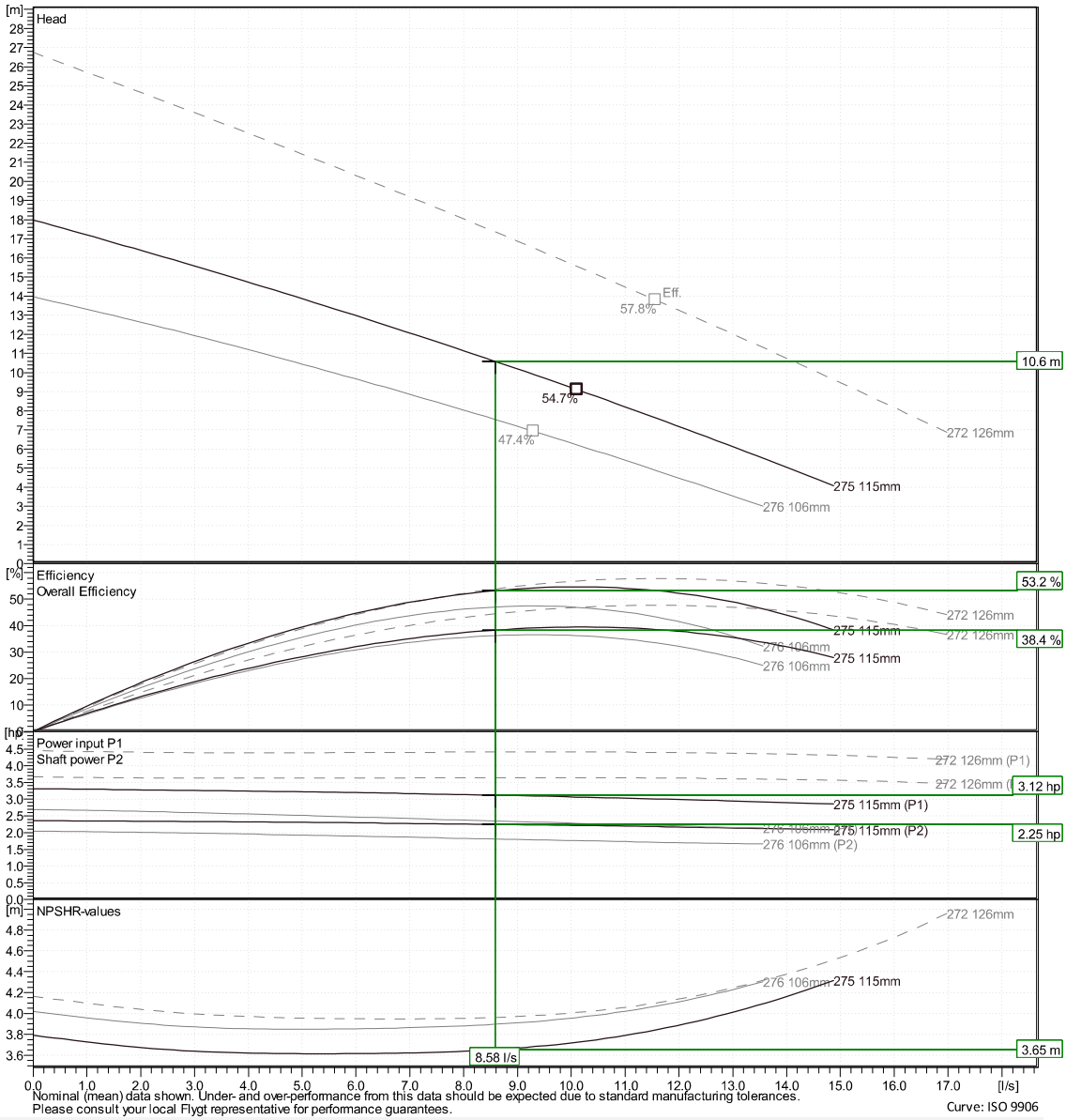
NP 3069 SH 3~ Adaptive 275

Performance curve

Duty point

Flow	Head
8.58 l/s	10.6 m

Curves according to: Water, pure [100%],4 °C,999.9 kg/m³,1.5692 mm²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

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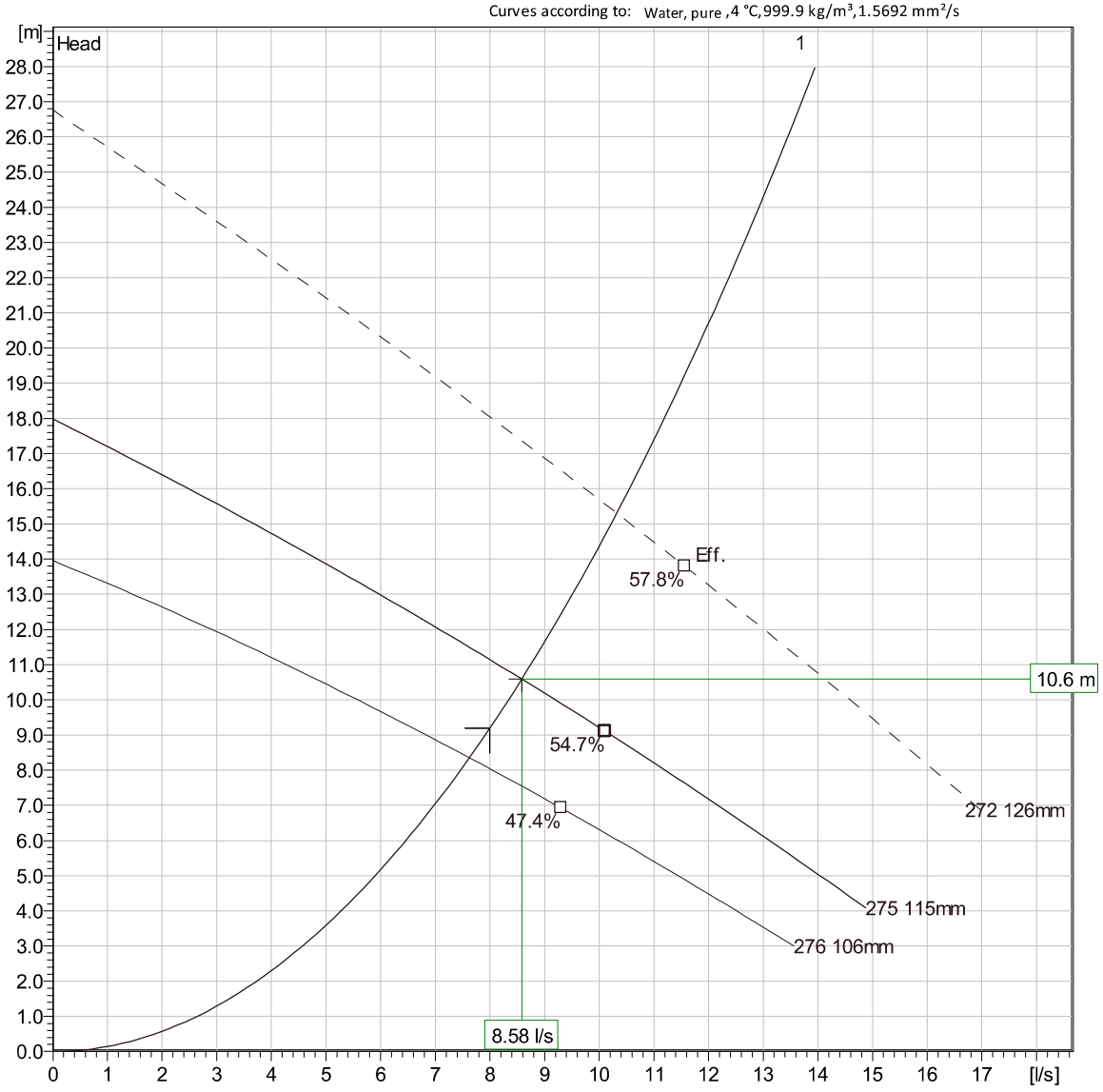
NP 3069 SH 3~ Adaptive 275

Duty Analysis

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1	8.58 l/s	10.6 m	2.25 hp	8.58 l/s	10.6 m	2.25 hp	53.2 %	7.52E-5 kWh/l	3.65 m

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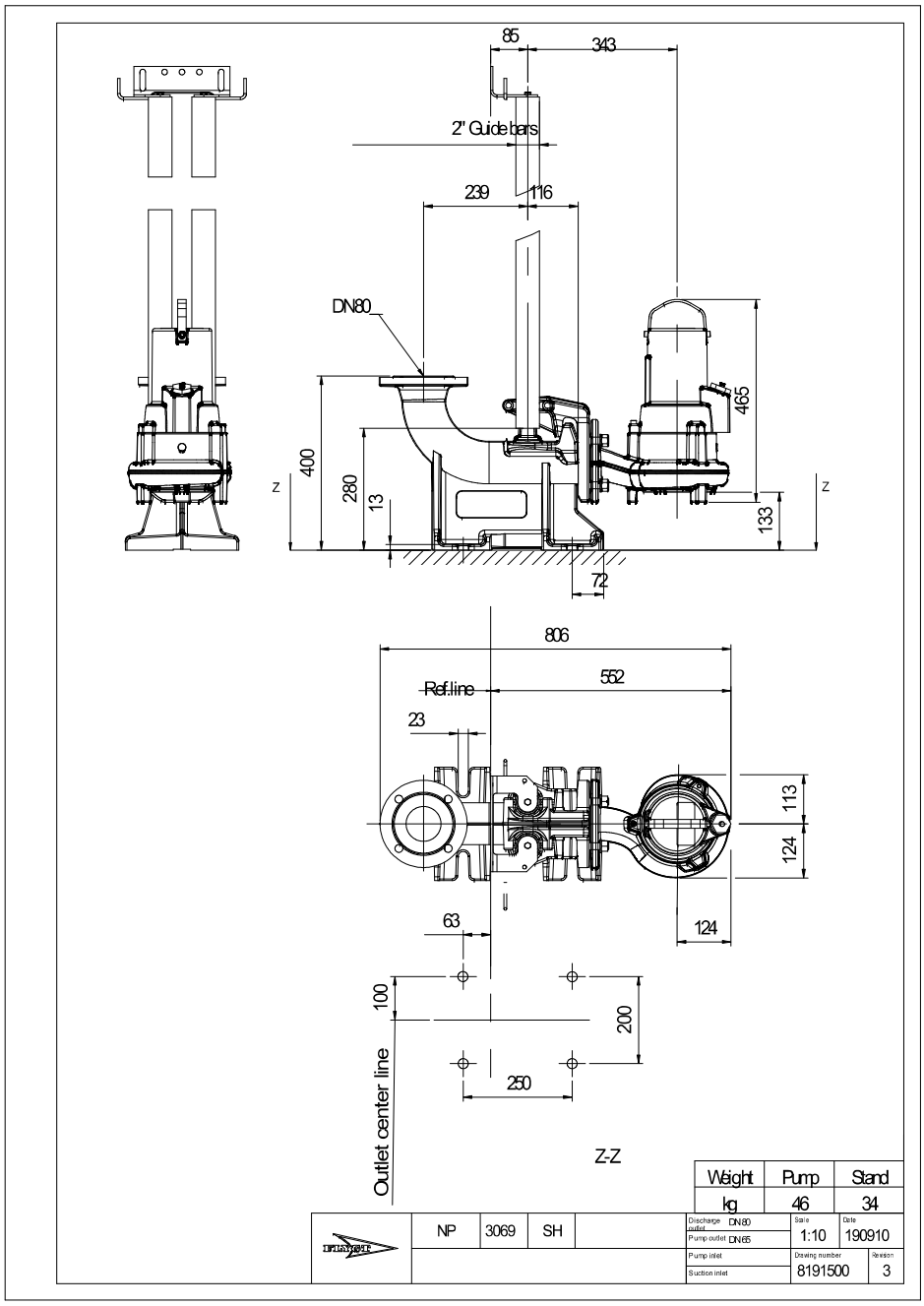
NP 3069 SH 3~ Adaptive 275

Dimensional drawing



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Block		**Created on**	2/29/2024 **Last update** 2/29/2024