
To: City of Stoughton
From: Greg Gunderson, P.E.
Subject: Matson Stoughton Development – Lift Station Capacity Evaluation
Date: August 7, 2023

This memo serves to evaluate the existing capacity of the City of Stoughton – Stonecrest Lift Station for future connections and sewer shed expansion. The Stonecrest Lift Station was constructed in 2003 and is located at the intersection north of Fall Haven Road and south of Autumn Crest Road.

Lift Station Service Area

The Stonecrest Lift Station serves 30 existing residential units. The estimated per capita sewage contribution during design was assumed to be 100 gallons per capita per day with a peaking factor of 4. The estimated ultimate average design flow for the lift station was estimated to be 0.013 cfs (5.7 gpm) with an ultimate peak flow of 0.051 cfs (22.9 gpm).

Current System Station Flow Estimation

The following flows were estimated using runtime data provided by the City of Stoughton:

Parameter	Units	Pump 1	Pump 2	TOTAL
Pumping Rate	gpm	200	200	200
Average Runtime (Hours/Day)	Hours/Day	0.2	0.2	0.4
Average Starts per Day	Starts/Day	5	5	10
Average Pumped Volume (gpd)	gpd	2400	2400	4800
Avg Influent Flow (gpm)	gpm	-	-	3.33
Estimated Per Capita Flow	gal/capita-day	-	-	57.8

The total flow for the existing service area is estimated at 3.33 gpm based on pump runtime data. The existing number of single family units was 28. The number of estimated people per single family unit was 2.8. The number of existing duplex units was 2 and the estimated number of people per duplex unit was 2.1. The entire existing population was estimated to be about 83. The estimated per capita daily flow for the existing lift station was estimated at 57.8 gallons per capita per day. The estimated flows based on pump runtime indicate the lift station is running below original design capacity. The conservative approach for this assessment will proceed with the original design flows based on 100 gallons per capita per day, the assumed existing service population of 83 people, and the pumping rate of 200 gpm.

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Summary of Existing Lift Station Design

Parameter	Units	Value
Pumping Rate	gpm	200
Single Family Residential Units	Units	28
People Per Single Family Unit	Capita per unit	2.8
Duplex Residential Units	Units	2
People Per Duplex Unit	Capita per Unit	2.1
Service Population	Capita	83
Design Flow Per Capita	gpcd	100
Avg Influent Flow (gpm)	gpm	5.7
Average Influent Flow	gpd	8,260

Future Design Area

The City of Stoughton is considering the addition of two new residential developments along Autumn Crest Road, Fall Haven, and along Stone Crest Road. The following two tables estimates the future flows expected from the developments South of Autumn Crest Road, Along Stone Crest Road, and Along Autumn Crest Road:

South of Autumn Crest Road Parameters		Value
Number of Single Family Units		33
Estimated People per Single Family Unit	x	2.8
Total Single-Family Population	=	92.4
Number of Duplex Units		12
Estimated People per Duplex Unit	x	2.1
Total Duplex Population	=	25.2
Number of Multi-Family Units		194
Estimated People per Multi-Family Unit	x	1.7
Total Multi-Family Population	=	328.8
Total Population Estimate (South of Autumn Crest Road)		447

Along Autumn Crest Road Parameters		Value
Number of Multifamily Units		57
Estimated People per Multifamily Unit	x	1.7
Total Multifamily Population	=	96.6
Total Population Estimate (Along Stone Crest Road)		97

Along Stone Crest Road Parameters		Value
Number of Single Family Units		49
Estimated People per Single Family Unit	x	2.8
Total Single-Family Population	=	137.2
Total Population Estimate (Along Stone Crest Road)		138

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Parameters		Value
Population Estimate (South of Autumn Crest Road)		447
Population Estimate (Along Stone Crest Road)	+	97
Population Estimate (Along Autumn Crest Road)		138
Total Additional Population	=	682
Per Capita Flow Rate (gal/capita-day)	x	100
Estimated Additional Flow (gpd)	=	68,200
Estimated Additional Flow Average Flow (gpm)	=	47.4

Ultimate Design Capacity

The existing lift station is served by two 7.5-hp pumps each rated at 200 gpm. Assuming the minimum pumping flow of 200 gpm and a typical peak hour peaking factor of 4, the lift station could serve a typical peak day collection flow of up to 50 gpm. Since the existing flow to the lift station from the 30 residential lots is approximately 5.7 gpm, there is approximately 44.3 gpm (50 gpm – 5.7 gpm) available for new development. At a peak hour peaking factor of 4, the total flow of the Stone Crest Lift Station after future development would be approximately 213 gpm.

Parameters		Value
Existing Service Area Average Day Design Flow (gpm)		5.7
Future Service Area Additional Average Day Flow (gpm)	+	47.4
Estimated Total Average Day Flow (gpm)	=	53.1
Assumed Peak Hour Peaking Factor (NR 110)	x	4
Estimated Peak Hour Flow (gpm)	=	213

With the estimated flow from the two new developments being approximately 47.4 gpm, there does not appear to be sufficient capacity available for this connection to the Stonecrest Lift Station. It should be noted that this analysis is conservative in estimating the typical per capita flow for an apartment complex. The value from Metcalf & Eddy Wastewater Engineering for an apartment complex (45 gpcd) is much lower than the per capita flow used in this analysis (assumed typical residential housing).

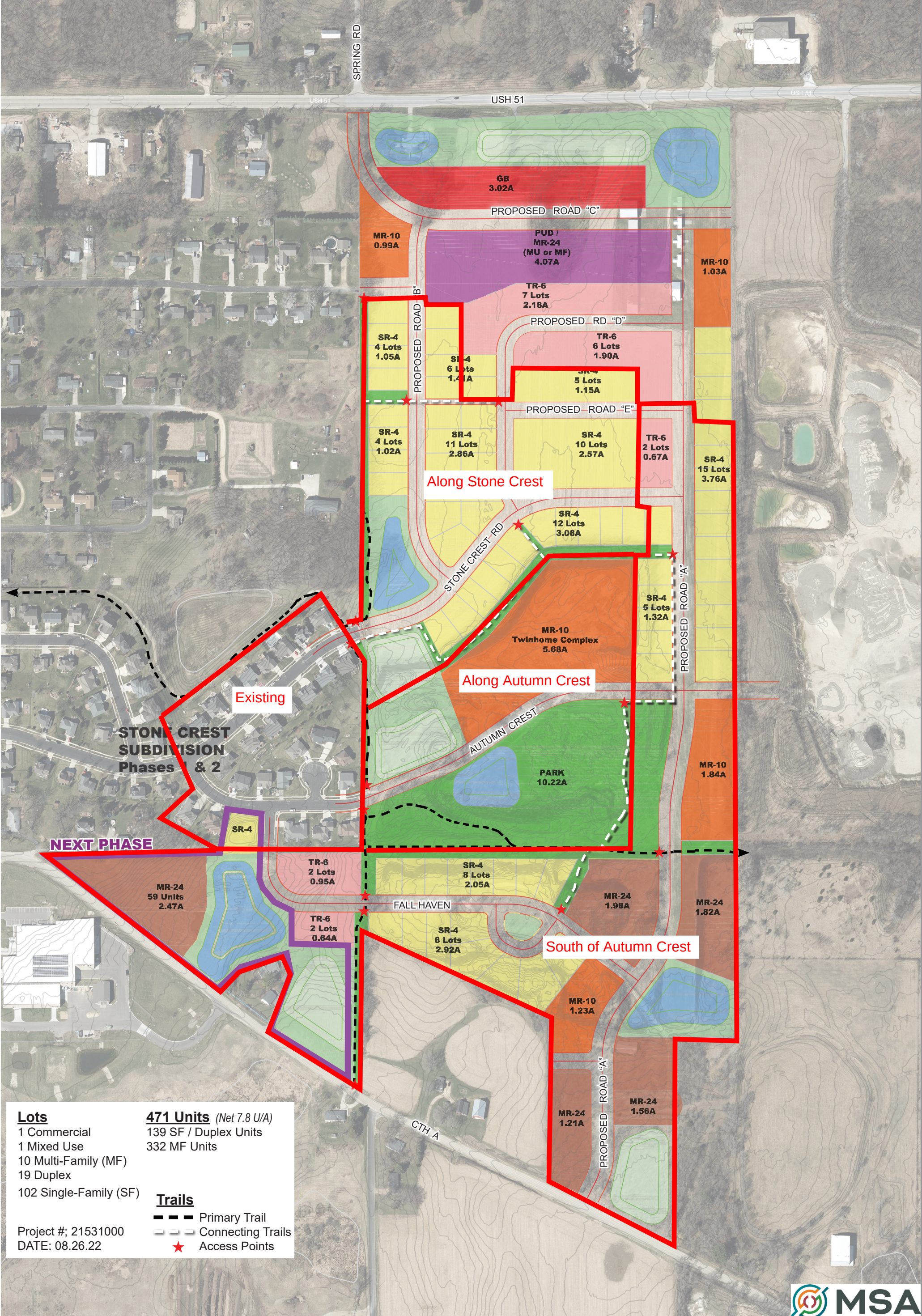
An evaluation into increasing the pump motor/impellers or a replacing the pumps should be completed to increase the capacity of the existing lift station. A drawdown test is also recommended to verify the existing capacity.

Enclosures:

Lift Station Service Area
Stone Crest Pumps Specifications

STONE CREST SUBDIVISION

Phase 3 (And Future Phases)



4" NON-CLOG EXPLOSION PROOF SUBMERSIBLE SEWAGE PUMPS

1.01 GENERAL

- A. Contractor shall furnish all labor, materials, equipment and incidentals required to provide 2 non-clog submersible centrifugal sewage pump(s) as specified herein.
- B. (OPTIONAL) Pump shall be equipped with stainless steel nameplate, stating the unit is accepted for use in NEC class 1, division 1, group C, D hazardous locations with third party, Factory Mutual, approval.

2.01 OPERATING CONDITIONS

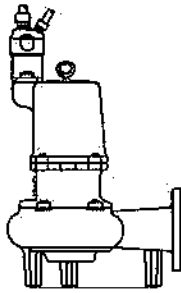
- A. Each pump shall be rated 7.5 H.P., 208 volts 3 phase, 60 hertz, 1750 R.P.M. The unit shall produce 200 U.S. GPM at 40 feet TDH, with a minimum pump efficiency of _____ % and maximum input KW of _____ KW. The pump shall be capable of handling a 3" spherical solid. The pump shall be non-overloading throughout the entire range of operation without employing service factor. The pump shall reserve a minimum service factor of 1.20. The performance curve submitted for approval shall state in addition to head and capacity performance, the pump efficiency, solid handling capacity, and reflect motor service factor.

3.01 CONSTRUCTION

- A. The pump shall be a centrifugal, non-clog, solids handling, submersible, wastewater type, model S4NX as manufactured by Hydromatic Pumps. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. The pump discharge shall be fitted with a 4" standard ASA 125 lb. flange, faced and drilled. All external mating parts shall be machined and Buna N Rubber O-ring sealed on a beveled edge. All mating surfaces shall be flame proof joints with special labyrinth joint to prevent a flame or spark to travel to the media being pumped. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel.

3.02 ELECTRICAL POWER CORD

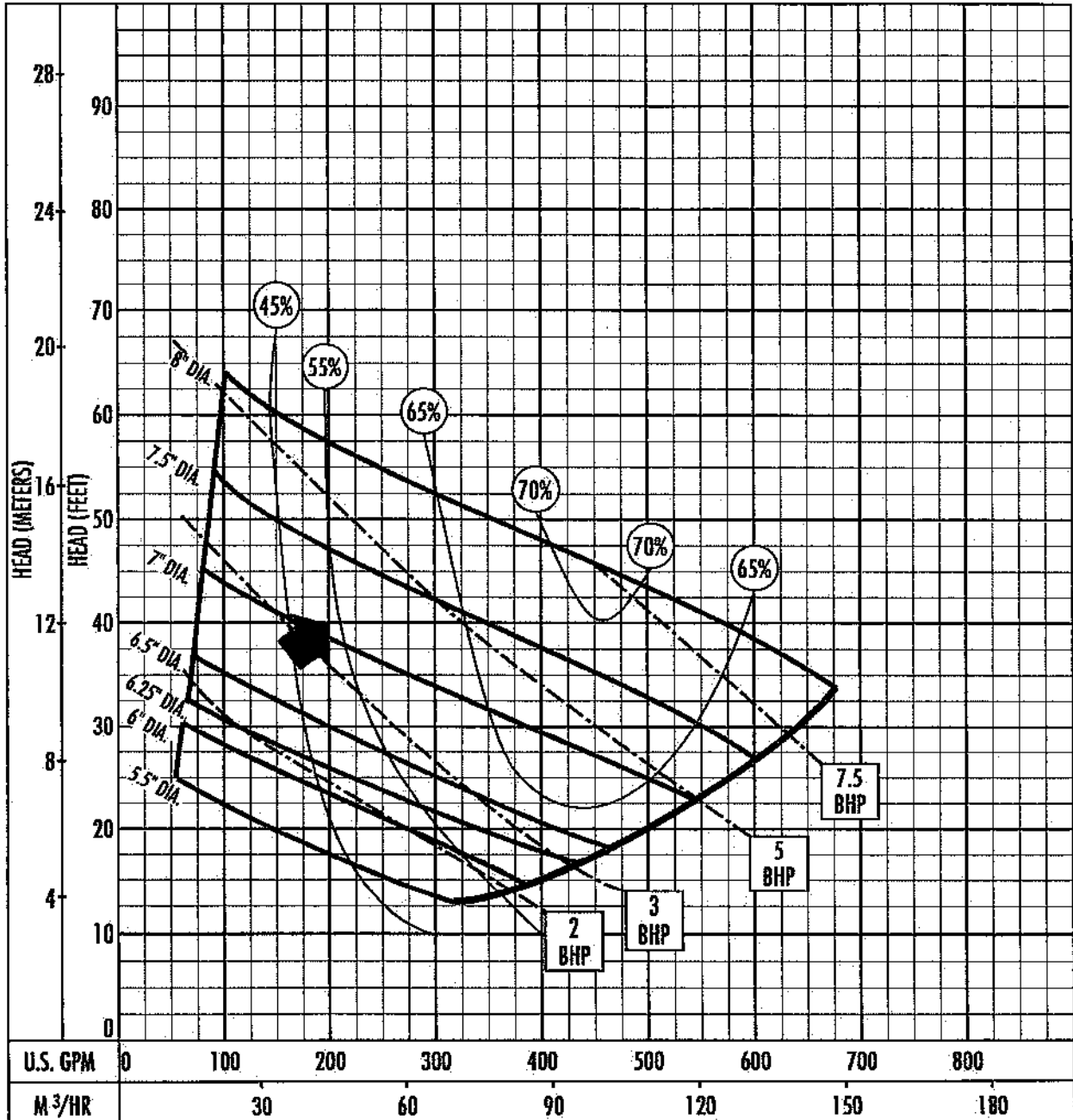
- A. Electrical power cord shall be STW-A, water resistant 600V, 60°C., UL and CSA approved and applied dependent on amp draw for size.
- B. The pump shall be triple protected with a compression fitting and two epoxy potted areas at the power cord entry to the pump. A separation between the junction box area of the pump and the motor by a stator lead sealing gland or terminal board shall not be acceptable.
- C. The power cable entry into the cord cap assembly shall first be made with a compression fitting. Each individual lead shall be stripped down to bare wire at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary attraction.
- D. The power cord leads shall then be connected to the motor leads with extra heavy connectors having brass inserts with a screwed wire to wire connection, rather than a terminal board that allows for possible leaks.
- E. The connection box wiring shall be separated from the motor housing wiring by stripping each lead down to bare wire, at staggered intervals, and separating each strand. This area shall be filled with an epoxy compound potting. Fiberglass terminal boards which are subject to heat fatigue and cracking, and which may lead to possible leaks shall not be acceptable.
- F. The cord cap assembly where bolted to the connection box assembly and the connection box assembly where bolted to the motor housing shall each be sealed with a Buna N Rubber O-ring on a beveled edge to assure proper sealing.



Performance Curve

S4NX

RPM: **1750** Discharge: **4"** Solids: **3"**



The curves reflect maximum performance characteristics without exceeding full load (Nameplate) horsepower. All pumps have a service factor of 1.2. Operation is recommended in the bounded area with operational point within the curve limit. Performance curves are based on actual tests with clear water at 70° F. and 1280 feet site elevation.

Conditions of Service:

GPM: 200 TDH: 40'

HYDROMATIC®

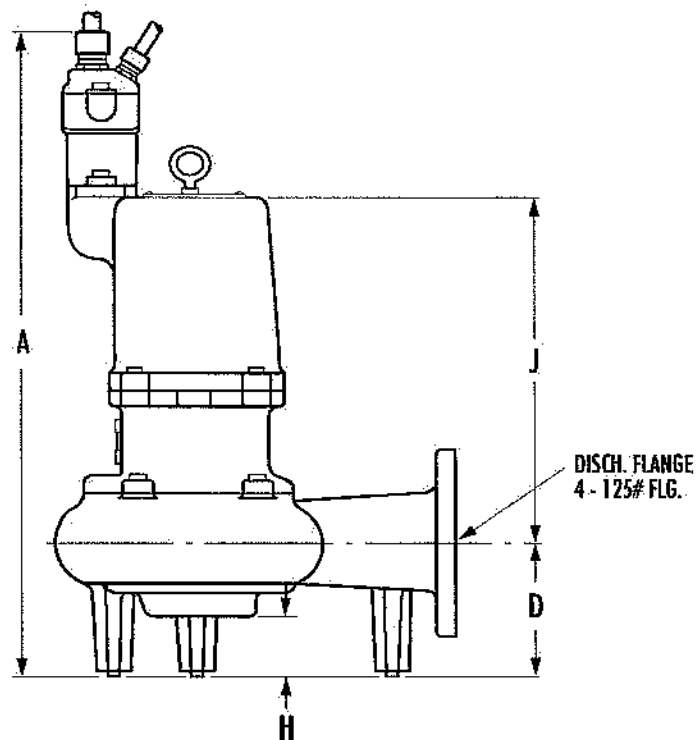
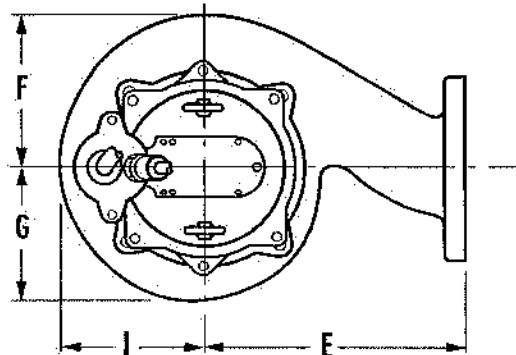
Dimensional Data

S4NX

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Dated **FEBRUARY 1995**

Supersedes **SEPTEMBER 1993**



S4NX illustrated above

	A	D	E	F	G	H	I	J
~~S4N~~	~~28-9/16~~	~~6-1/2~~	~~12-1/2~~	~~7-9/16~~	~~6-8/8~~	~~3-1/8~~	~~6-15/16~~	~~15-7/16~~
S4NX	31-1/2	6-1/2	12-1/2	7-9/16	6-3/8	3-1/8	6-15/16	16-3/4

ALL DIMENSIONS IN INCHES

NOTE: CASTING DIMENSIONS MAY VARY $\pm 1/8"$

MODEL: S4N & S4NX—Non-Clog Sewage Pump

R.P.M.	1750			
MOTOR TYPE	ENCLOSED, OIL COOLED INDUCTION, VFD SUITABLE			
MOTOR DESIGN NEMA TYPE	B (3Ø) L (1Ø)			
GENERAL INSULATION CLASS	F			
STATOR WINDING CLASS	F			
MAXIMUM STATOR TEMPERATURE	311°F			
MOTOR PROTECTION	BI-METALLIC, TEMPERATURE SENSITIVE DISC, SIZED TO OPEN AT 120°C AND AUTOMATICALLY RESET @ 30–35°C DIFFERENTIAL, ONE IN SINGLE PHASE, TWO IN THREE PHASE			
ELECTRICAL RATINGS	HEAT SENSOR	24VDC 5AMPS	115VAC 5AMPS	230VAC 5AMPS
VOLTAGE TOLERANCE	SEAL FAIL	300VAC 5mA		
	±10%			

HP	VOLTAGE	PHASE	NEC CODE	SF	FULL LOAD AMPS	SF AMPS	LOAD RTR. AMPS	RUN KW	START KVA	RUN KVA	MTR. EFF. @ SF	MTR. EFF. 100% FL	MTR. EFF. 75% FL	MTR. EFF. 50% FL	PWR. FACT. @ SF	PWR. FACT. 100% FL	PWR. FACT. 75% FL	PWR. FACT. 50% FL
2	200	1	J	1.2	14.7	17.0	71.5	2.4	14.3	2.9	.63	.63	.60	.54	.84	.81	.75	.66
	230				12.8	14.8	62											
2	200	3	J	1.2	7.8	8.8	46	2.1	15.9	2.7	.74	.73	.70	.63	.79	.76	.70	.59
	230				6.8	7.7	40											
	460				3.4	3.8	20											
3	200	1	G	1.2	19.6	22.9	91.0	3.3	18.2	3.9	.67	.67	.65	.57	.88	.85	.80	.71
	230				17.1	20	79											
	460				10.9	12.8	64.5											
3	200	3	J	1.2	9.5	11.1	56	3.1	22.3	3.8	.73	.72	.70	.64	.83	.82	.80	.72
	230				4.8	5.6	28											
	460				3.8	4.5	22.5											
5	200	1	G	1.2	33.9	39.3	144	5.7	28.8	6.8	.66	.66	.65	.60	.87	.84	.77	.64
	230				29.5	34.2	125											
	460				17.6	20.6	108											
5	200	3	J	1.2	15.3	17.9	94	4.8	37.4	6.1	.79	.79	.77	.72	.80	.76	.73	.62
	230				7.6	8.9	47											
	460				6.1	7.2	37.6											
7½	200	3	K	1.2	29	32.9	194	7.2	67	10.1	.78	.78	.76	.71	.76	.72	.66	.56
	230				25.2	28.6	160											
	460				12.6	14.3	84											
	575				10.1	11.4	67.2											

MODEL: S4NX — Explosion Proof Non-Clog Sewage Pumps**Physical Data:**

DISCHARGE SIZE	4"
SOLIDS SIZE	3"
IMPELLER TYPE	BALANCED, ENCLOSED, 2 VANE
CABLE LENGTH	50'
PAINT	PAINTED AFTER ASSEMBLY. DARK GREEN, WATER REDUCIBLE ENAMEL, ONE COAT, AIR DRIED.

Temperature:

MAXIMUM LIQUID	104°F LABELED/140°F UNLABELED
MAXIMUM STATOR	311°F
OIL FLASH POINT	390°F
HEAT SENSOR	Open: 257°F MAX./239°F MIN. Closed: 194°F MAX./119°F MIN.

Technical Data:

POWER CORD TYPE		STW-A WATER RESISTANT 600V, 60°C			
SENSOR CORD TYPE		18-5 STW-A WATER RESISTANT 600V, 60°C, 5.5 AMPS			
MATERIALS OF CONSTRUCTION	MOTOR HOUSING	CAST IRON	ASTM	A-48	CLASS 30
	CASING	CAST IRON	ASTM	A-48	CLASS 30
	IMPELLER	DUCTILE IRON	ASTM	A-536	
	CASING WEAR RING	BRONZE	ASTM	B-584-932	ALLOY 315
	MOTOR SHAFT	416 STAINLESS STEEL			
	HARDWARE	300 SERIES STAINLESS STEEL			
	"O" RINGS	BUNA N			
MECHANICAL SEALS		LOWER TUNGSTEN CARBIDE/TUNGSTEN CARBIDE, TYPE 21, BD1D1			
UPPER BEARING		(RADIAL) SINGLE ROW — BALL			
LOWER BEARING		(THRUST) SINGLE ROW — BALL			