Faro Mine Complex Water Management Infrastructure Inventory

PREPARED FOR: Government of Yukon

PREPARED BY: CH2M HILL Canada Limited

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Purpose

The purpose of this memorandum is to present the Government of Yukon (YG) with a description and explanation of Table 1 (attached), which will be instrumental to the Water Management Infrastructure Inventory (WMII) at the Faro Mine Complex (FMC).

Background

While developing the GoldSim model for the FMC, it became clear to CH2M HILL Canada Limited (CH2M HILL) that a complete inventory of the site's pumping systems would be required to create an accurate hydraulic model. According to the Standing Offer Agreement and, more specifically, under Task Authorization (TA) 17, CH2M HILL was tasked with assembling this data and presenting it to YG. CH2M HILL will also use this data to complete risk assessments, plan future upgrade projects, and assist with critical spare parts identification.

Table Description and Explanation

Table 1 is first broken down by Area at the FMC, and then by type of water conveyance system. This table and the attached Piping and Instrumentation Diagrams (P&IDs) are living documents. CH2M HILL recommends they be updated as new information becomes available. CH2M HILL also recommends that more accurate and complete P&IDs be developed for each conveyance system onsite based on the limitations described below.

Limitations

The information in Table 1 and on the P&IDs has not been field verified and its accuracy has not been independently checked. The majority of this information has been gathered from personnel onsite, and not via direct engineering measurements. A large portion of this information was provided by the site Water Treatment Specialist, Dan Duivenvoorden, who has been working at the FMC for many years. CH2M HILL interviewed Dan to gather information that only he can provide, and compiled it in a document that YG, as well as the Design Team, can readily access.

Note: Table 1 is not complete. There is still a large amount of data to collect, which will not be available until summer 2014 when each conveyance system can be evaluated in detail and filed-verified. As mentioned, a list of critical spare parts must also be developed. Table 1 will be updated to include more photographs, specifications, and supporting documents as they become available.

Table

TABLE 1

Faro Mine Complex Water Management Infrastructure Inventory

Faro Mine Remediation Project

Area	System		Frequency and Period of use	Typical Range of Fluid Characteristics (PH, Temp, TSS)	Pump Housing or Supporting Structure	Intake Location & Elevation (masl)	Discharge Location & Elevation	Pumps (& elevation)	Serial / Model #'s	Motor (VFD or constant) HP, Manufacturer, Model #	Flange Size		Piping *				System Flow Capacity **	Reducers, elbows, headers and other fittings	Instruments (pressure gauges, flow meters)	Valves (serial #'s)	Critical Spares List	Relevant Pictures, Figures and Diagrams
											Inlet	Discharge	ID	OD	SDR	Length						
Down Valley	**X5 Siphon**		Used when needed. Maximum draw down of 10cm.	PH: 7.11 - 8.20 Temperature: Avg = 8.33 C Total Suspended Solids: Avg=2 mg/L	Intake floats	Min: 1026.307 Max: 1020.329 Avg: 1028.384	-	-	-	-	-	-	- 13.812	10" 16"	Variable 15.5	1000' 1000'	7,000 L/min 20,000 L/min					
Faro	**IP to Faro**	**IP to Tailing Pump House**	Typically April to October	PH: 3.06 - 7.56 Temperature: Avg= 5.17 C Total Suspended Solids: Avg=10 mg/L	A barge supports the pumps and a seaman houses the MCC, instrument and surge protection.	Min: 1042.959 Max: 1047.575 Avg: 1045.993	Pumps are on water surface and assumed to be discharging at same height	Two vertical turbine electric Robco pumps	9TLE 2100 16/17	Electric, variable frequency drive	-	10"	8.219" 10.701" 11.301" 12.882"	10" 14" 14" 14"	9 9 11.5 15.5	100' 300m 900m 1500m	8,200 L/min					
		ETA to Tailings Pump House	Typically April to October	PH: 3.26 - 5.80 Temperature: Avg = 5.06 C Total Suspended Solids: Avg=213 mg/L	Large vertical concrete culvert. Pump suspends from a come-along into the culvert.	Information forthcoming		Submersible electric Flygt pump		Electric, continuous drive. 30HP, 575V	-	4"	-	8"	Variable	1,500'	1,000 L/min					
		Tailings Pump House to Faro Pit	Typically April to October	Not available	125m3 sump tank inside the tailings pump house. New Miller Skid Pump comes with its own tank	Information forthcoming		Miller Skid Pump	SC86C17-HO, CD4MCV	Electric, variable frequency drive. 200HP, 575V	8"	6"	18.346" 12.086"	24" 14"	9 15.5	4,200' 100'	3,000 USG/min					
	S- Wells		Continuous	PH: 6.34 - 7.30 Temperature: Avg = 5.09 C Total Suspended Solids: Avg=23 mg/L	Seacan is sitting over a collection sump. Heat trace is now installed	Min: Max: Avg:		Submersible electric Grundfos pump		Electric, variable frequency drive. 15HP	-	3"		2" 4"		5,000'	2.9 L/sec 7 L/sec (combined)					
	Zone 2		Continuous	PH: 6.59 - 7.08 Temperature: Avg = 5.66 C Total Suspended Solids: Avg=15 mg/L	Seacan is above the well and houses the instrumentation	Min: 1097.924 Max: 1113.301 Avg: 1106.048		Submersible electric Grundfos pump		15HP	-	3"		3"		1,500'	5 L/sec					
Vangorda & Grum	**Grum Pit to Vangorda Pit**		Typically April to October	PH: 7.75 - 8.38 Temperature: Avg=5.07 C Total Suspended Solids: Avg= 6 mg/L	A small barge will support the pump.	Min: 1203.198 Max: 1186.658 Avg: 1216.816	Pumps are on water surface and assumed to be discharging at same height	Submersible electric Sulzer pump		Electric, soft start, fixed speed. 140HP 575V	-	6"	10.453 11.441 11.919	16" 16" 12"	6.3 7.3 32.5	500m 320m 2,200m	50 L/sec					
	Vangorda Pit to WTP	**Pit to Booster**	Typically June to September	PH: 3.07 - 7.43 Temperature: Avg = 6.14 C Total Suspended Solids: Avg=12 mg/L	A barge supports the pump. A walkway runs from the barge to a float, and another walkway runs from the float to the shore	Min: 1074.584 Max: 1094.085 Avg: 1085.167	Pumps are on water surface and assumed to be discharging at same height	Vertical turbine electric Robco pump	14 JHE	Electric, soft start, fixed speed. 350HP 4160V	-	10" (150 Psi 30' Flex hose)	11.353	16"	7.3	1100m	8,500 L/min					
		Booster to Water Treatment Plant	Typically June to September	PH: 3.07 - 7.43 Temperature: Avg = 6.14 C Total Suspended Solids: Avg=12 mg/L	A small hut with a roof and two walls is built over the pump. A large "sump can" is used to gather the water from the first pump, and boost it to the plant		Same as the intake elevation.	Vertical turbine electric Robco pump	14 JHE	Electric, soft start, fixed speed. 350HP 4160V	-	10" (300Psi)	10.615" 12.231" 12.915" 12.086"	16" 16" 16" 14"	6.3 9 11 15.5	1,100m 150m 270m 1,240m	8,500 L/min					
	GSC Lined Pond		Typically April to October	Not available	Suction hose	Min: 1081.416 Max: 1189.659 Avg: 1182.985		Diesel Godwin pump	HL6M	Constant drive, Cat N7 motor	8"	6" (High pressure LayFlat)		8"	17	1,200'	4,000 L/min					
	GSC Un-Lined Pond		April to July	PH: 7.31 - 8.30 Temperature: Avg = 8.33 C Total Suspended Solids: Avg=2 mg/L	Suction hose	Min: 1165.361 Max: 1189.086 Avg: 1167.367		Rental pump required						10"	32.5	1,000'						
	V-15		Excessive flows are pumped from April to June	PH: 7.31 - 8.30 Temperature: Avg = 3.75 C Total Suspended Solids: Avg=3 mg/L	Seacan is above a 22' gravity fed culvert for collection and pumping			Vertical turbine electric Grundfos pump		Electric, variable frequency drive. Uncommissioned. 15HP 575V	-	3"		3"		3,000'	9 L/sec					
	Little Creek Dam		Typically April to October	PH: 2.82 - 6.90 Temperature: Avg = 10.79 C Total Suspended Solids: Avg=19 mg/L	Small float	Min: 1106.484 Max: 1111696 Avg: 1108.864	Pumps are on water surface and assumed to be discharging at same height	Submersible electric Flygt pump		Electric, constant drive. 30HP 575V	-	4"		6"	Variable	2,000'						
	Swimming Hole		Typically April to October	Not available	A frame support system for the pump			Submersible electric Flygt pump		Electric, constant drive. 15HP 575V	-	4"		6"	Variable	300'	Unknown					
	Groucho Pond		June to September	Not available	Vertical culvert in the pond			Gallagher sump pump		Electric, constant drive. 20HP 575V	-	4"		3"	Variable	700'	Unknown					
	Dredging Line * **		Depends on discharge requirements	Not available	A frame support on a donut shaped float. Winches also used to raise and lower the pump			Submersible electric Toyo pump		Electric, constant drive. 75HP 575V	-	6"		8"	17	120'	5,000 L/min					

* All lengths are approximate

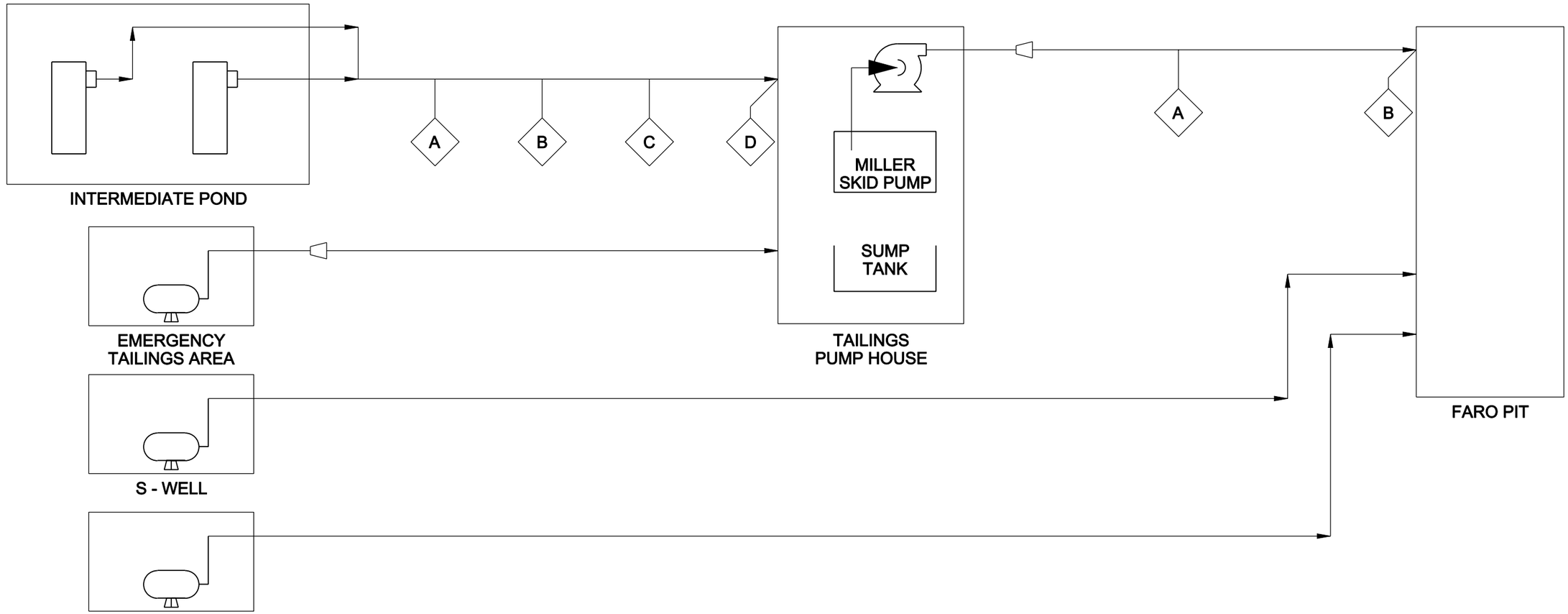
** All flows are approximate and will require verification.

*** The dredging line uses the same infrastructure as the "Booster to Water Treatment Plant" system, in reverse. It then pours into the Vangorda Pit

**** Hidden cells reserved for new piping system to deliver water to and from the Interim Water Treatment Plant

All information in this table is preliminary, and will need to be field verified.

Piping and Instrument Diagrams (P&IDs)



NOTE: PRELIMINARY INFORMATION IN THE TABLE TO BE FIELD VERIFIED

Area	System		System Data: Pumps	System Data: Serial / Model #'s	System Data: Typical Operating Flow (L/min)	System Data: Discharge (inches)	Piping Data: Span	Piping Data: Pipe dia (inches)	Piping Data: MOC	Piping Data: SDR	Piping Data: Length (meters)	Typical Fluid Data (pH, Temp, TSS)
Faro	**IP to Faro**	**IP to Tailing Pump House**	Two vertical turbine electric Robco pumps	9TLE 2100 16/17	8200 L/min	10"	UPTO 'A' UPTO 'B' UPTO 'C' UPTO 'D'	10 14 14 14	HDPE	9 9 11.5 15.5	30.5 300 900 1500	PH: 3.06 - 7.56 Temperature: Avg= 5.17 C Total Suspended Solids: Avg=10 mg/L
		ETA to Tailings Pump House	Submersible electric Flygt pump		1000 L/min	4"		8	HDPE	Variable	457	PH: 3.26 - 5.80 Temperature: Avg = 5.06 C Total Suspended Solids: Avg=213 mg/L
		Tailings Pump House to Faro Pit	Miller Skid Pump	SC86C17-HO, CD4MCV	11356 L/min	6"	UPTO 'A' UPTO 'B'	24 14	HDPE	9 15.5	1280 30.5	Not available
	S- Wells		Submersible electric Grundfos pump		174 L/min 420 L/min (combined)	3"		2 4	HDPE		1524	PH: 6.34 - 7.30 Temperature: Avg = 5.09 C Total Suspended Solids: Avg=23 mg/L
	Zone 2		Submersible electric Grundfos pump		300 L/min	3"		3	HDPE		457	PH: 6.59 - 7.08 Temperature: Avg = 5.66 C Total Suspended Solids: Avg=15 mg/L

NOTES:

1. PRELIMINARY DRAWING, INFORMATION TO BE FIELD VERIFIED.

FARO PUMPING SYSTEMS

472645-PS-001

CH2MHILL

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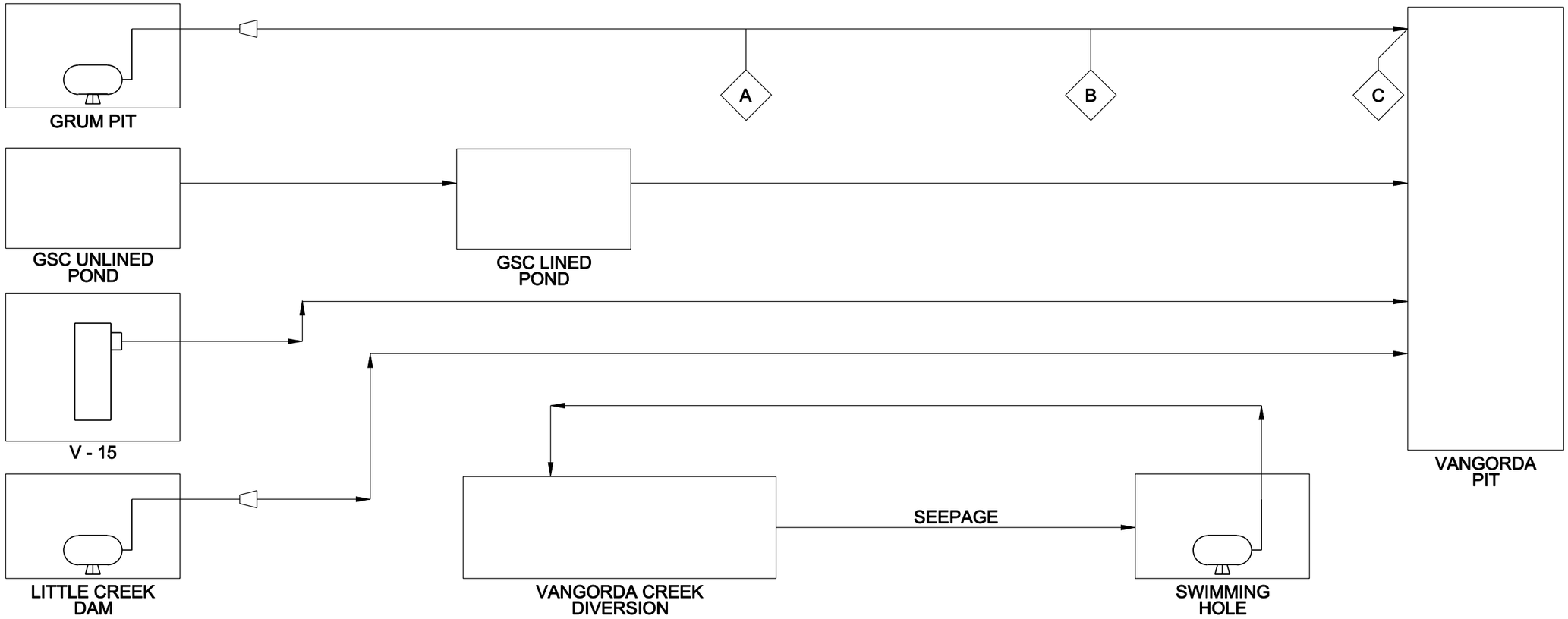

NOTE: PRELIMINARY INFORMATION IN THE TABLE TO BE FIELD VERIFIED

Area	System	System Data				Piping Data					Typical Fluid Data (pH, Temp, TSS)
		Pumps	Serial / Model #'s	Typical Operating Flow (L/min)	Discharge (inches)	Span	Pipe dia (inches)	MOC	SDR	Length (meters)	
Vangorda & Grum	**Grum Pit to Vangorda Pit**	Submersible electric Sulzer pump		3000 L/min	6"	UPTO 'A' UPTO 'B' UPTO 'C'	16 16 12	HDPE	6.3 7.3 32.5	500 320 2200	PH: 7.75 - 8.38 Temperature: Avg=5.07 C Total Suspended Solids: Avg= 6 mg/L
	GSC Lined Pond	Diesel Godwin pump	HL6M	4000 L/min	6" (High pressure LayFlat)		8	HDPE	17	365	Not available
	GSC Un-Lined Pond	Rental pump required					10	HDPE	32.5	305	PH: 7.31 - 8.30 Temperature: Avg = 8.33 C Total Suspended Solids: Avg=2 mg/L
	V-15	Vertical turbine electric Grundfos pump		540 L/min	3"		3	HDPE		915	PH: 7.31 - 8.30 Temperature: Avg = 3.75 C Total Suspended Solids: Avg=3 mg/L
	Little Creek Dam	Submersible electric Flygt pump			4"		6	HDPE	Variable	610	PH: 2.82 - 6.90 Temperature: Avg = 10.79 C Total Suspended Solids: Avg=19 mg/L
	Swimming Hole	Submersible electric Flygt pump		Unknown	4"		6	HDPE	Variable	91	Not available

NOTES:

1. PRELIMINARY DRAWING, INFORMATION TO BE FIELD VERIFIED.

VANGORDA & GRUM PUMPING SYSTEMS - 1

472645-PS-002

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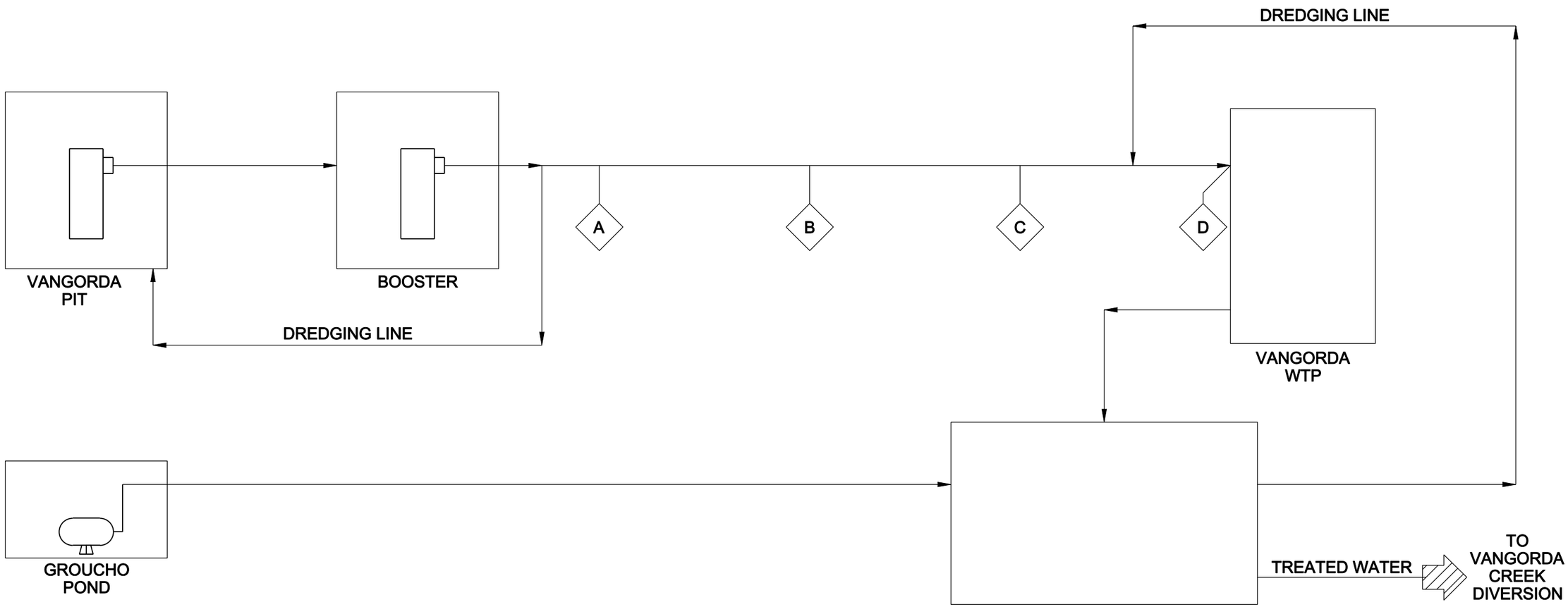

NOTE: PRELIMINARY INFORMATION IN THE TABLE TO BE FIELD VERIFIED

Area	System		System Data: Pumps	System Data: Serial / Model #'s	System Data: Typical Operating Flow (L/min)	System Data: Discharge (inches)	Piping Data: Span	Piping Data: Pipe dia (inches)	Piping Data: MOC	Piping Data: SDR	Piping Data: Length (meters)	Typical Fluid Data (pH, Temp, TSS)
Vangorda & Grum	Vangorda Pit to WTP	Pit to Booster	Vertical turbine electric Robco pump	14 JHE	8500 L/min	10" (150 Psi 30' Flex hose)		16	HDPE	7.3	1100	PH: 3.07 - 7.43 Temperature: Avg = 6.14 C Total Suspended Solids: Avg=12 mg/L
		Booster to Water Treatment Plant	Vertical turbine electric Robco pump	14 JHE	8500 L/min	10" (300Psi)	UPTO 'A' UPTO 'B' UPTO 'C' UPTO 'D	16 16 16 14	HDPE	6.3 9 11 15.5	1100 150 270 1240	PH: 3.07 - 7.43 Temperature: Avg = 6.14 C Total Suspended Solids: Avg=12 mg/L
	Groucho Pond		Gallagher sump pump		Unknown	4"		3	HDPE	Variable	213	Not available
	Dredging Line		Submersible electric Toyo pump		5000 L/min	6"		8	HDPE	17	37	Not available

NOTES:

1. PRELIMINARY DRAWING, INFORMATION TO BE FIELD VERIFIED.

VANGORDA & GRUM PUMPING SYSTEMS - 2

472645-PS-003

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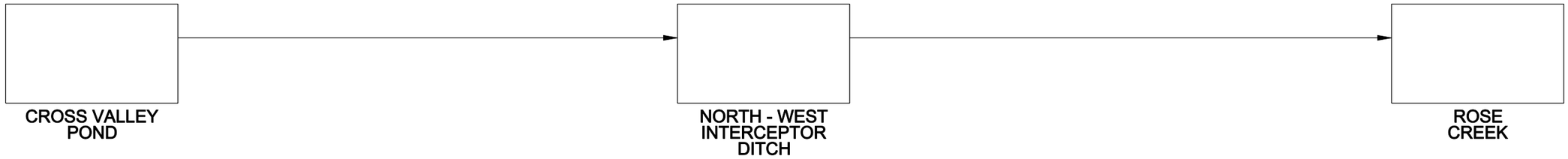

NOTE: PRELIMINARY INFORMATION IN THE TABLE TO BE FIELD VERIFIED

Area	System	System Data				Piping Data					Typical Fluid Data (pH, Temp, TSS)
		Pumps	Serial / Model #'s	Typical Operating Flow (L/min)	Discharge (inches)	Span	Pipe dia (inches)	MOC	SDR	Length (meters)	
Down Valley	X5 Siphon	-	-	7000 L/min 20000 L/min	-		10 16	HDPE	Variable 15.5	305 305	PH: 7.11 - 8.20 Temperature: Avg = 8.33 C Total Suspended Solids: Avg=2 mg/L

NOTES:

1. PRELIMINARY DRAWING, INFORMATION TO BE FIELD VERIFIED.

DOWN VALLEY-X5 SIPHON SYSTEM

472645-PS-004

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