WHALE TAIL NORTH BASIN DEWATERING

Construction Summary Report

Submitted by:
Agnico Eagle Mines Limited
Meadowbank Division
P.O. Box 540
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X0C 0A0

September 11, 2020

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited ("AEM") has prepared this as-built report (construction summary) for the dewatering of Whale Tail North. The objective of this system was to dewater Whale Tail North to free up the footprint required for the mining of the Whale Tail Pit and to establish the Whale Tail Attenuation Pond.

The overall schedule for the dewatering of Whale Tail North was the following:

- Installation and commissioning: from December 24, 2018 to September 23, 2019
- Operation of system: from March 6, 2019, to May 20, 2020
- Decommissioning of system: May 20, 2020

The system was constructed and operated by AEM. The controls applied during the construction were used to confirm that construction was completed in compliance with the design intent of the construction document. Quality control during construction activity comprised of visual observation and surveying.

During the construction, two design changes and two field adjustments were applied to take into account the site conditions, optimize the construction activities, and to facilitate the operation of the system.

The system was decommissioned when dewatering of Whale Tail North was completed and the Whale Tail Attenuation Pond was commissioned.

DOCUMENT CONTROL

Document Version	Date	Revised Section	Revision
Final	09/11/2020	-	-

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TABLES

APPENDIX

SECTION 1.0 – INTRODUCTION

The objective of the Whale Tail North dewatering system was to dewater Whale Tail North (WTN) to free up the footprint required for the mining of the Whale Tail Pit and to establish the Whale Tail Attenuation Pond.

This document presents the construction summary report of the Whale Tail North Dewatering required by the Water License 2AM-WTP1830 Part D Item 16. This report presents a summary of the construction activities, the QA/QC activities, as well as the overall information used to produce the as-built drawings.

1.1 Roles and Responsibilities

The engineering design of the dewatering system for Whale Tail North was developed by Agnico Eagle Mines Limited ("AEM"). AEM was responsible for the construction of the system and the QA/QC program.

Table 1 presents a summary of the roles and responsibilities of the parties involved during the dewatering.

Table 1: Roles, Responsibilities and Key Personnel

Company	Role	Responsibility	Key Personnel	Position
Agnico Eagle Mines Limited (AEM)	Owner	Engineering of the system Carry out construction activity Supervise work Provide survey Produce as-built drawings Operation of system	Yan Côté	Engineering Superintendant
			Guillaume Gemme	E&I Superintendant
			Shawn Valiquette / Gaetan Martel	Construction Supervisor
			Pascal Poirier	Water & Tailing Engineer

1.2 Overall Project Schedule

The overall schedule for Whale Tail North Dewatering was the following:

- Installation and commissioning:
    - The 60 days' notice approval was received on December 20, 2018
    - The system from Whale Tail North (WTN) to Whale Tail South (WTS) comprising of a pump, intake, discharge line and diffuser was installed from December 24, 2018 to March 5, 2019
    - The system from WTN to Mammoth Lake comprising of a pump, intake, discharge line and diffuser was installed from April 23, 2019 to May 25, 2019
    - The system from Whale Tail Dike (WTD) seepage to WTS comprising of a pump, intake and discharge line was installed from September 18, 2019 to September 23, 2019

- Operation of the system:
    - The system from WTN to WTS was operated from March 5 2019 to May 20, 2020. The system was used without water treatment prior to July 2019. The water was sent through the water treatment plant when required after July 2019.
    - The system from WTN to Mammoth Lake was operated from June 17, 2019 to October 26, 2019. The water was sent through the water treatment plant when required.
    - The system from WTD Seepage to WTS was in use from October 4, 2019 to November 16, 2020. The system was used without water treatment.

- Decommissioning of the system:
    - On May 20, 2020 the dewatering was completed, and Whale Tail North became the Whale Tail Attenuation pond ending the use of the dewatering system.

1.3 Construction Documents

The Design Report and Construction Drawings of the dewatering system was completed by AEM. Table 2 presents the available construction documents. The Construction drawings are presented in Appendix A1.

Table 2: List of Construction Documents

Drawing Title	Date	Rev
Design Report - Whale Tail Lake North Basin Dewatering	2018/11/23	1
Drawing 0 – Drawing Index	2019/01/30	1
Drawing 1 – General Site Map	2018/11/18	2
Drawing 2 – Whale Tail North Basin Dewatering – North Basin to South Basin	2018/11/22	3
Drawing 3 – Whale Tail North Basin Dewatering – North Basin to Mammoth Lake	2018/11/22	3
Drawing 4 – Intake Cross-Section	2018/11/22	2
Drawing 5 – Diffuser Cross-Section	2018/11/22	3

1.4 As-Built Drawings

Table 3 presents the as-built drawings list for the Whale Tail North dewatering system. The survey and as-built drawings were made by AEM. The as-built drawings are included in Appendix A2.

Table 3: List of As-Built Drawings

Drawing #	Drawing Title	Date	Rev
0	Drawing Index	31/07/2020	1
1	Whale Tail North Basin Dewatering – WTN to WTS – March 2019 to June 2019	31/07/2020	1
2	Whale Tail North Basin Dewatering – WTN to WTS – June 2019 to May 2020	31/07/2020	1
3	Whale Tail North Basin Dewatering – WTN to Mammoth Lake – June 2019 to May 2020	31/07/2020	1
4	Intake Cross-Section	31/07/2020	1
5	Discharge Cross-Section	31/07/2020	1

SECTION 2.0 – INSTALLATION AND COMMISSIONING

The pumping system installation for the Whale Tail North Basin dewatering consisted of the following components:

- Pump installation
- Installation of intake
- Installation of header and sampling port
- Installation of discharge line and diffuser

Selected photographs of the work progress taken throughout the construction are shown in Appendix B.

From March 2019 to June 2019, three (3) HL 250 pumps were installed on the Phase 1 of the dewatering ramps. The suction cage was 60 m from each pump in Whale Tail North. The pumps had their own fuel tank and were connected to a header system which allowed performing a partial stop of the system without running the risk of freezing pipes. There were three discharge pipes made of 14'' HDPE (DR17) (each was 700 m long). The pipe connected to a 3:1 connector before entering Whale Tail South through a single diffuser 90 m away from the shore. The diffuser was a floating pipe with a 90-degree elbow extending in the water. A sampling port was installed near the Whale Tail South shore.

From June 2019 to May 2020, two (2)2 HL 250 pumps having their own fuel tanks were installed on the Phase 2 extension of the dewatering ramp which allowed to decrease the water level further. The suction cage was 60 m from each pump in Whale Tail North. There were two (2) discharge pipes made of 14'' HDPE (DR17). These pipes were connected to the WTP header system. From the WTP, the WTP pump and discharge line could either send the water to the WTS diffuser or to the dewatering diffuser in Mammoth Lake by flanging and unflanging the pipe. Each line from WTN to Mammoth Lake was 3800 m long. The pipe connected to a 2:1 connector before entering Mammoth Lake through a single diffuser located 110 m from the shore. The diffuser was a floating pipe with a 90-degree elbow extending in the water. A sampling port was installed near the Mammoth Lake shore.

The seepage line from WTD to WTS consisted of a submersible pump and a 240 m long 14'' HDPE pipe (DR 17) that connected to the WTS diffuser.

The pump datasheet is presented in Appendix C. and the Technical specification of the HDPE pipe can be found in Appendix D. Appendix E presents the specifications of the flowmeters installed.

SECTION 3.0 – QA/QC PROGRAM

After the installation of each component, a quality control check was performed to confirm the system integrity. A visual inspection was done to confirm no equipment was missing or improperly installed. The location of the intake, pump and discharge were also surveyed to ensure conformance with the design.

A hydrostatic test was completed during commissioning to ensure there was no leak in the system.

No deficiencies were found during construction and commissioning.

SECTION 4.0 – DESIGN CHANGES AND FIELD ADJUSTMENTS

Design changes and field adjustments were implemented during the construction to adapt the design to the encountered field conditions. These changes were implemented by AEM and are documented in this section.

Design Change – Addition of a Seepage Line to WTS

The higher than anticipated seepage rate from Whale Tail Dike had an impact on the dewatering as unexpected water was reporting to Whale Tail North. To reduce pressure on the pumping system and the WTP, a line from the downstream toe of WTD going directly to the Whale Tail South diffuser was installed. Authorization was obtained prior to adding this component to the dewatering system.

Design Change – Change in Dewatering Ramp Configuration

The Dewatering Ramp configuration had to be modified during the dewatering. Details of the ramp configuration and reason for the changes are documented in the as-built report of the Attenuation Pond ramp.

Field Adjustment – Change in the Pump Location, Intake and Header Location

Due to the change in the dewatering ramp configuration (refer to attenuation pond as-built report) the location of the pump, intake and header were adjusted accordingly.

Field Adjustment– Change in the Pipe Routing

Modification to the originally proposed pipe routing was done to reduce the amount of piping required. The original routing was following site roads. During construction some of the piping was installed in the tundra along a more direct route. This construction was done in the winter to ensure no damage to the natural ground. As the construction was done in winter, no pipe crossing was installed in the tundra.

SECTION 5.0 – OPERATION AND DECOMMISSIONING

The dewatering pumping system was operated from March 5th 2019 until May 20th 2020.

The dewatering period was longer than anticipated due to these factors:

- The initial volume submitted for dewatering did not include any inflow or runoff to the basin during the dewatering period.
    - There was significant inflow to the North Basin during Freshet. Freshet 2019 was characterized by very high precipitation which created high runoff in Whale Tail North.
    - The seepage at Whale Tail Dike from WTS to WTN occurred at a rate much higher than anticipated.
- Dewatering was slowed down in winter of 2020 as the Mammoth Lake outlet was frozen and the capacity of Mammoth Lake to receive water was limited without impacting the Mammoth Dike structure.

The dewatering system was decommissioned on May 20, 2020 when the Attenuation Pond was commissioned.

SECTION 6.0 – WATER QUALITY MONITORING

Routine monitoring of water quality monitoring was performed as per the Type A Water Licence Part D Item 8, the Water Quality Monitoring and Management Plan For Dike Construction and Dewatering (Version 1, Jan 2017), and the Metal and Diamond Mining Effluent Regulation (MDMER). As per the Water Quality Monitoring and Management Plan For Dike Construction and Dewatering, TSS/turbidity were also measured in the receiving environment (Whale Tail South Basin and/or Mammoth Lake) on a weekly basis; monitoring took place, when safely possible, approximately 30 - 100 meters from end-of pipe, dependent on stable ice conditions during ice-up. This monitoring allowed Agnico Eagle to follow the receiving environment water quality and detect any problem associated with the dewatering. In addition to the monitoring and management of suspended sediments, a hydraulic monitoring plan was conducted to monitor the following components:

- Water levels in Mammoth Lake and the South Basin were monitored on a regular basis while dewatering activities were occurring; and
- Outlet erosion inspections to monitor outlet stability, including potential erosion and/or ice damming within the outlets.

A complete discussion and analyses of the results can be found in Appendix 19 – Whale Tail 2019 Water Quality Monitoring for Dike Construction and Dewatering Report of the Agnico Eagle 2019 Annual Report.

SIGNATURE

Mark Morin, Engineering General Supervisor
NAPEG # L4003
Agnico Eagle Mines Limited
Meadowbank, Nunavut Division

APPENDIX A1- CONSTRUCTION DRAWINGS

DRAWING NO.

FORMAT ARCHD–PORTRAIT

Notes:

1- The water crossing will not interfere the natural water course It will be temporary, built and dismantled in freezing conditions. A type-bridge crossing will be installed and no culvert will be installed.

2- The temporary dewatering ramp will be built in phases as the water level goes down.

WTP

Temporary dewatering ramp
(See note 2)

Intake
(See Fig. 4)

Pumps
HL250

Flowmeter
Seacan
Installation

Pumps
HL250

Water Course
Crossing (see note 1)

HDPE ø14"
DR17 min.

WHALE TAIL NORTH BASIN

Road Crossing

"Y" Connector

WHALE TAIL DIKE

Sampling Port

Discharge Diffuser
(See Fig. 5)

WHALE TAIL SOUTH BASIN

		3	Issued for Construction	22/11/2018	PP
Diffuser Cross–Section	5	2	Issued for Internal Revision	18/11/2018	EH
Intake Cross–Section	4	1	Issued for Internal Revision	11/05/18	P.P.
TITLE	# DWG	REV	DESCRIPTION	DATE	BY
REFERENCE DRAWINGS		REVISIONS			

REGISTERED PROFESSIONAL ENGINEER
P. POIRIER
LICENSEE
NUNAVUT

AGNICO EAGLE
MEADOWBANK

DRAWN BY	Eric Haley	18/11/2018
CHECKED BY	Pascal Poirier, P.Eng.	22/11/2018
APPROVED BY	Pascal Poirier, P.Eng.	22/11/2018
PROJECT NO.		
DATE	22/11/2018	

TITLE
AGNICO–EAGLE – MEADOWBANK DIVISION
WHALE TAIL NORTH BASIN DEWATERING
NORTH BASIN TO SOUTH BASIN
SYSTEM LAYOUT

SCALE N.T.S. | FILE

DRAWING NO. 2 | REVISION 3 | SHEET 3 / 6

P:\Engineering\05–Geotechnic\14– Amaruq\04– Water Management\4– Water Management Infrastucture\2– 2019\1 – Planning\9– 60 days notice\Drawings\DWG–latest\WhaleTail North Basin Dewatering Layout_V3.dwg, 27 Nov 2018

DRAWING NO.

FORMAT ARCHD-LANDSCAPE

Whale Tail Pit

Whale Tail Pit
Ring Road

POND AP-5

PAD D

QUARRY 1

PAD H

WTP Flowmeter

WRSF DIKE

HDPE ø14" DR17 min.
WTP to Mammoth Lake

See Note 1

Starter Pit

WTP

Intake
(See Fig. 4)

Temporary dewatering ramp
(See note 3)

Pumps
HL250

MAMMOTH DIKE

MAMMOTH LAKE

Discharge Diffuser
(See Fig. 5)

"Y" Connector

Sampling Port

Alternative Piping
Routing (See Note 2)

WHALE TAIL NORTH BASIN

WHALE TAIL DIKE

WHALE TAIL SOUTH BASIN

KEY PLAN

GENERAL NOTES

Notes:

1- The piping crossing the Whale Tail North Basin will be installed on Whale Tail Pit ring road depending on the water level during dewatering.

2- Piping might be routed on Whale Tail Dike based on site condition.

3- The temporary dewatering ramp will be built in phases as the water level goes down.

REGISTERED PROFESSIONAL ENGINEER
P. POIRIER
LICENSEE
NT/NU

TITLE	# DWG
Intake Cross-Section	4
Diffuser Cross-Section	5

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT
3	22/11/2018	Issued for Construction	EH	P.P.	–
2	18/11/2018	Issued for Internal Revision	EH	–	–
1	11/05/18	Issued for Internal Revision	CG	P.P	–

REVISIONS

AGNICO EAGLE
MEADOWBANK

TITLE
AGNICO-EAGLE – MEADOWBANK DIVISION
WHALE TAIL NORTH BASIN DEWATERING
NORTH BASIN TO MAMMOTH LAKE
SYSTEM LAYOUT

DRAWN BY	Eric Haley	DATE 18/11/2018
CHECKED BY	Pascal Poirier, P. Eng.	22/11/2018
APPROVED BY	Pascal Poirier, P. Eng.	22/11/2018
SCALE	N.T.S.	DATE 22/11/2018
DRAWING NO.	3	
PROJECT NO.	REVISION 3	SHEET 4 / 6

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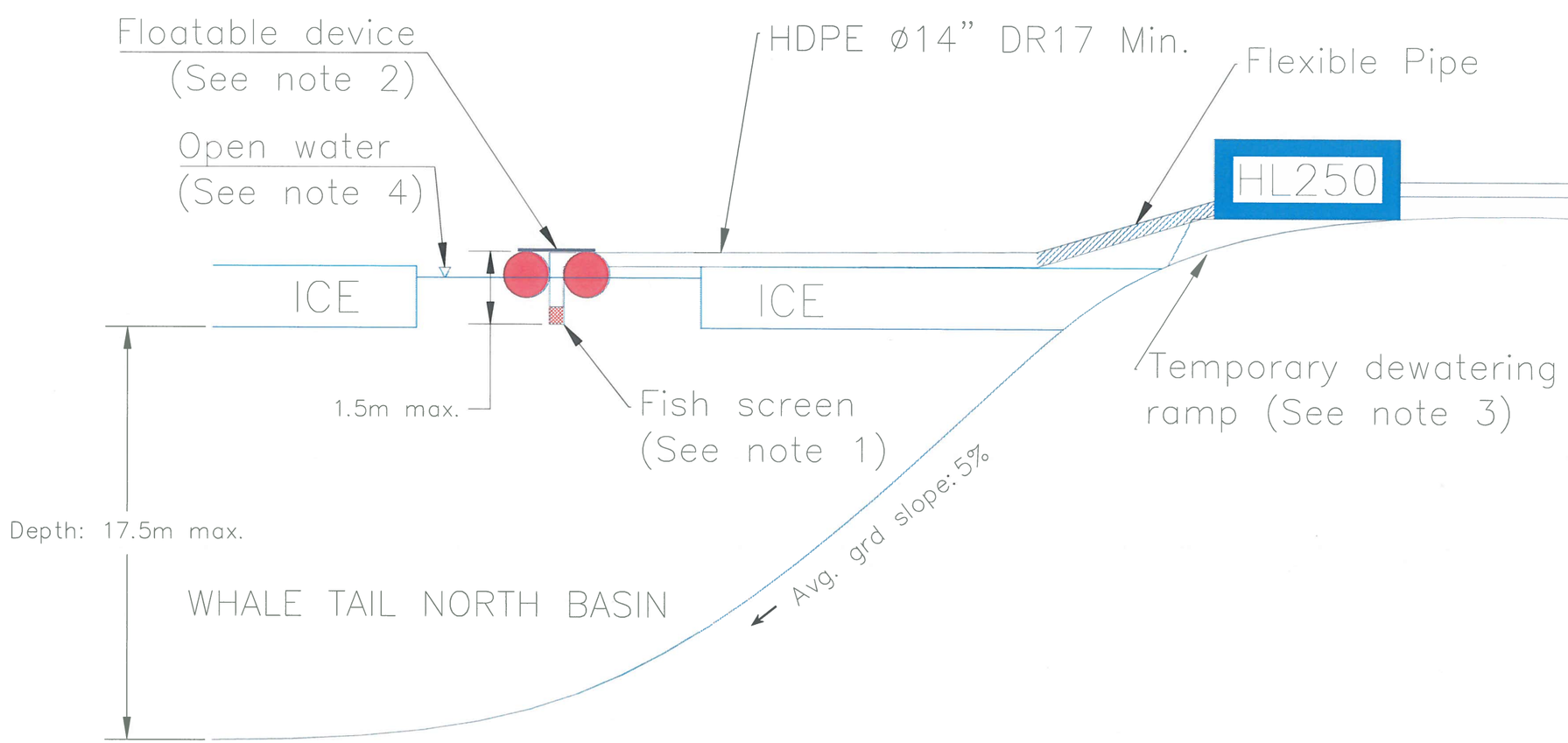
FILE NO. .DWG

DRAWING NO.

FORMAT ARCH-D-LANDSCAPE

WHALE TAIL NORTH BASIN DEWATERING

INTAKE CROSS-SECTION



KEY PLAN

GENERAL NOTES

Notes:

1-A fish screen in compliance with DFO criteria shall be installed.

2-A floatable device with a buoyant force of 7300N shall be installed.

3-The temporary dewatering ramp will be built in phases as the water level goes down.

4- Ice cover shall be removed prior intake installation. Water flow will prevent the intake from freezing.

REGISTERED PROFESSIONAL ENGINEER
P. POIRIER
LICENSEE
NT/NU

TITLE	# DWG

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT
2	22/11/2018	Issued for Construction	C.G.	P.P.	-
1	06/11/2018	Issued for Internal Revision	C.G.	P.P	-

REVISIONS

AGNICO EAGLE
MEADOWBANK

TITLE
AGNICO-EAGLE - MEADOWBANK DIVISION
WHALE TAIL NORTH BASIN DEWATERING
INTAKE CROSS-SECTION

DRAWN BY	Claude Gagné	DATE 06/11/18
CHECKED BY	Pascal Poirier, P. Eng.	22/11/18
APPROVED BY	Pascal Poirier, P. Eng.	22/11/18
SCALE	N.T.S.	DATE 22/11/18
DRAWING NO.	4	
PROJECT NO.	REVISION 2	SHEET 5 / 6

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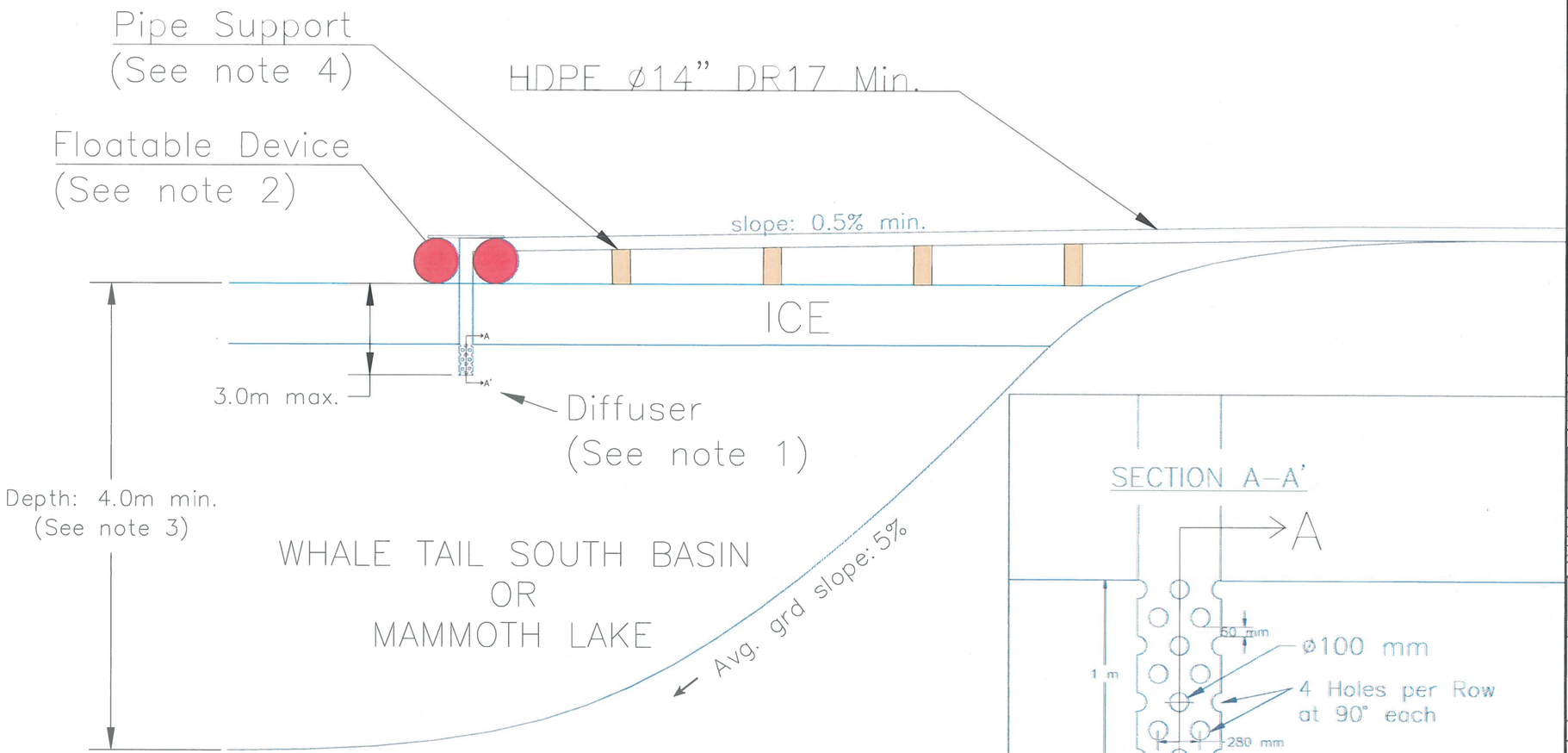
FILE NO. Intake and Diffuser.DWG

DRAWING NO.

FORMAT ARCH-D-LANDSCAPE

WHALE TAIL NORTH BASIN DEWATERING

DIFFUSER CROSS-SECTION



KEY PLAN

GENERAL NOTES

Notes:

1-The diffuser is designed for 3000 m3/h and shall be installed as per drawing to prevent potential erosion and sediment suspension.

2-A floatable device with a buoyant force of 7300N shall be installed. The floatable device can be installed on ice as per drawing.

3-A minimum of 4m depth is required (corresponding to 1m depth below the diffuser) to prevent potential erosion and sediment suspension.

4- Quantity and spacing of the pipe support shall allow a minimum slope of 0.5%.

REGISTERED PROFESSIONAL ENGINEER
P. POIRIER
LICENSEE
NT/NU

TITLE	# DWG

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT
3	22/11/2018	Issued for Construction	E.H.	P.P.	–
2	16/11/2018	Issued for Internal Revision	EH	–	–
1	11/08/18	Issued for Internal Revision	C.G	P.P	–

REVISIONS

AGNICO EAGLE
MEADOWBANK

TITLE
AGNICO-EAGLE – MEADOWBANK DIVISION
WHALE TAIL NORTH BASIN DEWATERING
DIFFUSER CROSS-SECTION

DRAWN BY	Eric Haley	DATE 16/11/2018
CHECKED BY	Pascal Poirier, P. Eng.	22/11/2018
APPROVED BY	Pascal Poirier, P. Eng.	22/11/2018
SCALE	N.T.S.	DATE 22/11/2018
DRAWING NO.	5	
PROJECT NO.	REVISION 3	SHEET 6 / 6

P:\Engineering\05-Geotechnic\14- Amaruq\04- Water Management\4- Water Management Infrastructure\2- 2018\1 - Planning\8- 60 days notice\Drawings\DWG-latest\intake and diffuser V4.dwg, 27 Nov 2018

FILE NO. Intake and Diffuser.DWG

APPENDIX A2 - AS-BUILT DRAWINGS

DRAWING NO.

FORMAT ARCHD–LANDSCAPE

AGNICO EAGLE - MEADOWBANK COMPLEX

AMARUQ PROJECT

DRAWING No.	TITLE	REVISION	DATE
0	DRAWING INDEX	1	31/07/2020
1	WHALE TAIL NORTH BASIN DEWATERING – WTN TO WTS – MARCH 2019 TO JUNE 2019	1	31/07/2020
2	WHALE TAIL NORTH BASIN DEWATERING – WTN TO WTS – JUNE 2019 TO MAY 2020	1	31/07/2020
3	WHALE TAIL NORTH BASIN DEWATERING – WTN TO MAMMOTH LAKE – JUNE 2019 TO MAY 2020	1	31/07/2020
4	INTAKE CROSS–SECTION	1	31/07/2020
5	DISCHARGE CROSS–SECTION	1	31/07/2020

KEY PLAN

GENERAL NOTES

TITLE	# DWG

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT
1	31/07/2020	As Built Drawings	TD	FLB	

REVISIONS

AGNICO EAGLE
MEADOWBANK

TITLE
AGNICO–EAGLE – MEADOWBANK DIVISION
WHALE TAIL NORTH BASIN DEWATERING
DRAWING INDEX

DRAWN BY	Thomas Dahm	DATE 31/07/2020
CHECKED BY	FLB, P. Eng.	31/07/2020
APPROVED BY	FLB, P. Eng.	31/07/2020
SCALE –	DATE 22/11/2018	
DRAWING NO. 0		
PROJECT NO.	REVISION 1	SHEET 1 / 6

\\Gamba01\groups\Engineering\05–Geotechnic\14– Amaruq\04– Water Management\2– Construction\1– Dewatering PH1\4– Deliverable\1– As–Built Report\As–built Drawings\WhaleTail North Basin Dewatering Layout_V4.dwg, 02 Aug 2020

FILE NO. .DWG

DRAWING NO.

FORMAT ARCHD–PORTRAIT

Dewatering Ramp
Phase 1

Intake
(Refer to
Drawing #4)

Pumps
HL250

Header Container

WTP

HDPE ø14"
DR17 (3)

Attenuation
Pond

WHALE TAIL NORTH BASIN

WHALE TAIL DIKE

Road Crossing

Sampling Port

Discharge Diffuser
(Refer to Detail A)
Drawing #5

WHALE TAIL SOUTH BASIN

Discharge Cross Section	5				
Intake Cross Section	4	1	As Built Drawings	31/07/2020	TD
TITLE	# DWG	REV	DESCRIPTION	DATE	BY

REFERENCE DRAWINGS

REVISIONS

AGNICO EAGLE
MEADOWBANK

DRAWN BY	Thomas Dahm	DATE 30/07/2020
CHECKED BY	FLB, P.Eng.	30/07/2020
APPROVED BY	FLB, P.Eng.	30/07/2020
PROJECT NO.		
DATE	30/07/2020	

TITLE
AGNICO–EAGLE – MEADOWBANK COMPLEX
WHALE TAIL NORTH BASIN DEWATERING
WTN TO WTS PLAN VIEW
MARCH 2019 TO JUNE 2019
AS BUILT DRAWINGS

SCALE	FILE		
N.T.S.			
DRAWING NO.		REVISION	SHEET
1		1	1 / 5

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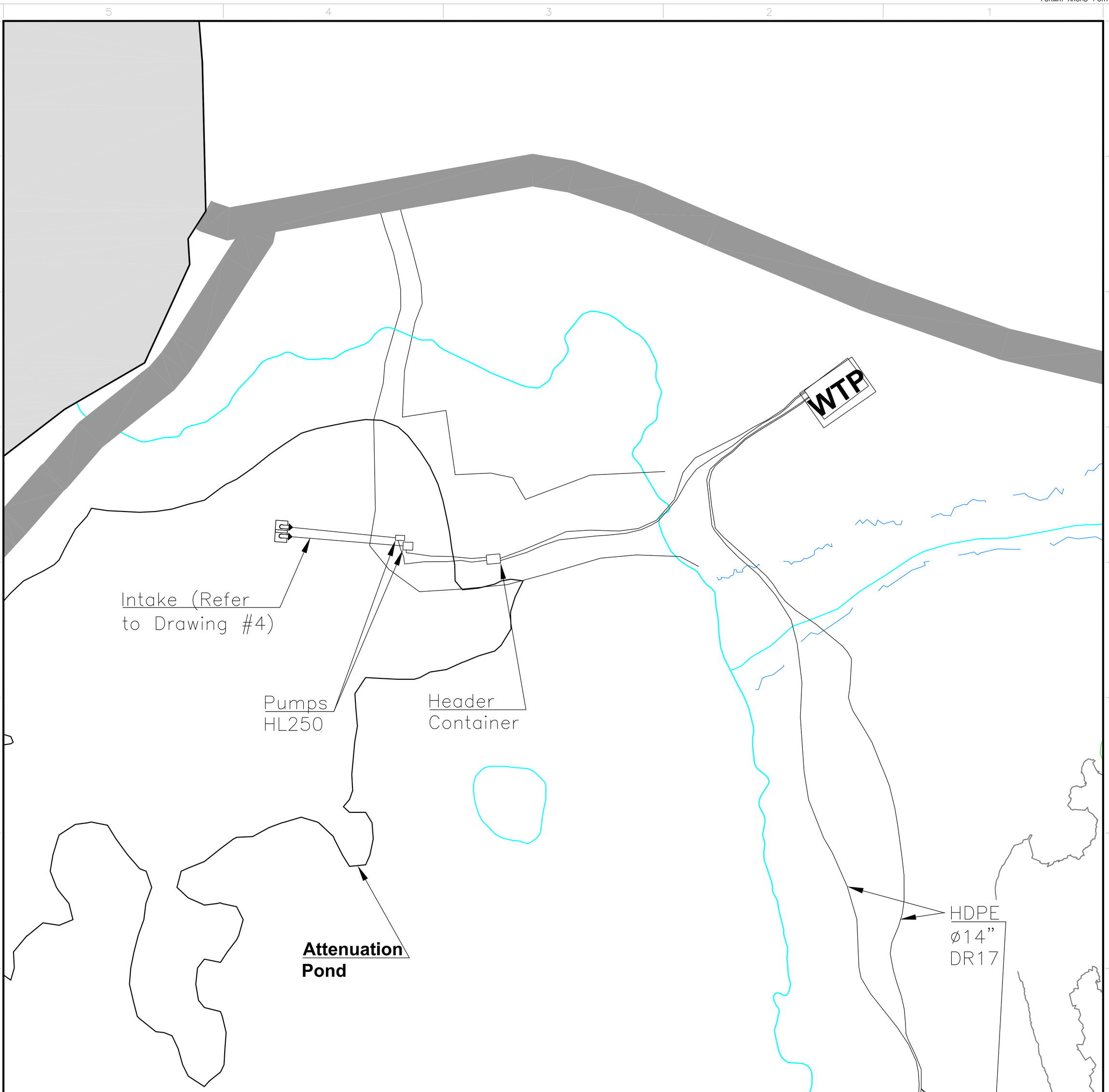
DRAWING NO.

FORMAT ARCHD–PORTRAIT



Discharge Cross Section	5				
Intake Cross–Section	4	1	As Built Drawings	31/07/2020	TD
TITLE	# DWG	REV	DESCRIPTION	DATE	BY
REFERENCE DRAWINGS		REVISIONS			

AGNICO EAGLE MEADOWBANK

DRAWN BY	Thomas Dahm	DATE 30/07/2020
CHECKED BY	FLB, P.Eng.	30/07/2020
APPROVED BY	FLB, P.Eng.	30/07/2020
PROJECT NO.		
DATE	31/07/2020	

TITLE
AGNICO–EAGLE – MEADOWBANK COMPLEX
WHALE TAIL NORTH BASIN DEWATERING
WTN TO WTS PLAN VIEW
JUNE 2019 TO MAY 2020
AS BUILT DRAWINGS

SCALE	FILE		
N.T.S.			
DRAWING NO.		REVISION	SHEET
2		1	2 / 5

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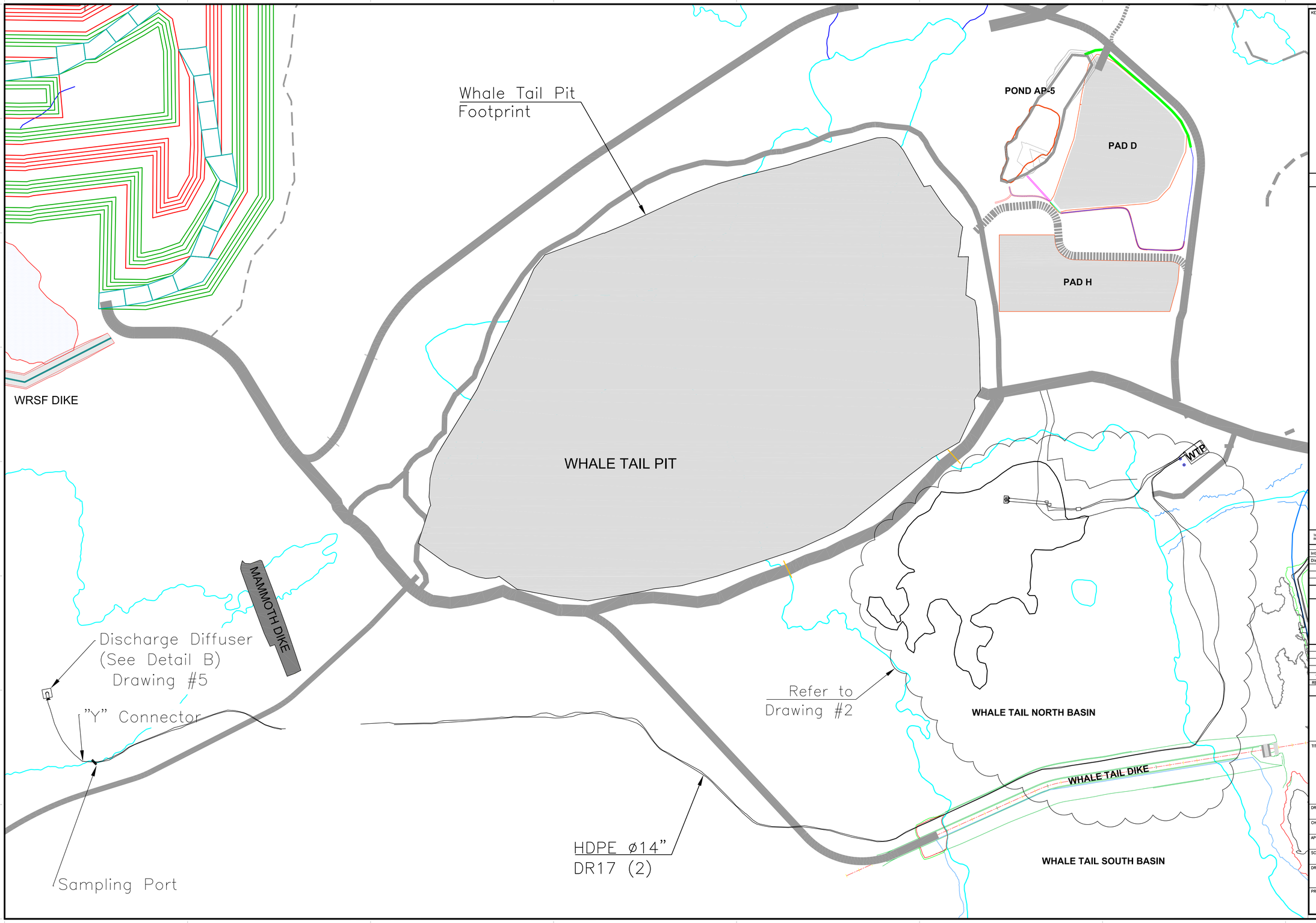
DRAWING NO.

FORMAT ARCHD – LANDSCAPE



KEY PLAN

GENERAL NOTES

TITLE	# DWG
Intake Cross Section	4
Discharge Cross Section	5

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT
				–	–
1	31/07/2020	As Built Drawings	TD	FLB	–

REVISIONS

AGNICO EAGLE
MEADOWBANK

TITLE
AGNICO–EAGLE – MEADOWBANK DIVISION
WHALE TAIL NORTH BASIN DEWATERING
WTN TO MAMMOTH PLAN VIEW
JUNE 2019 TO MAY 2020

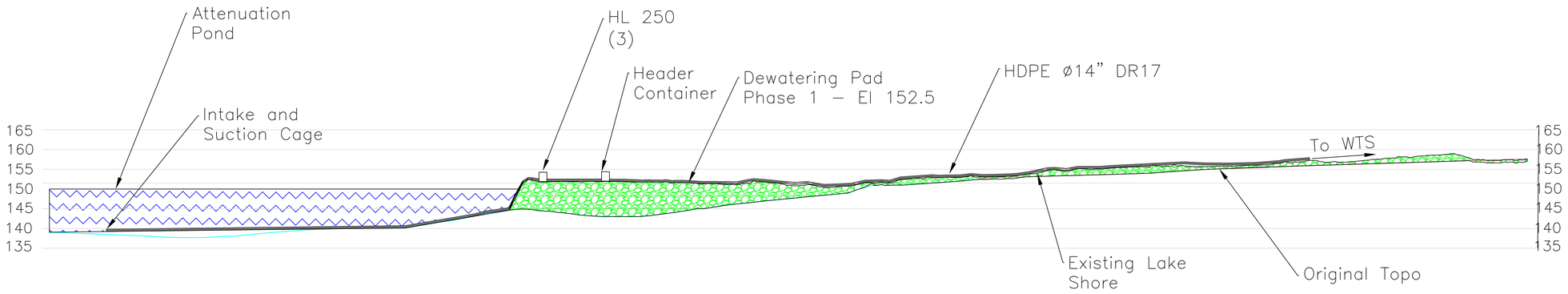
DRAWN BY	Thomas Dahm	DATE 31/07/2020
CHECKED BY	FLB, P. Eng.	31/07/2020
APPROVED BY	FLB, P. Eng.	31/07/2020
SCALE N.T.S.	DATE 31/07/2020	
DRAWING NO.	3	
PROJECT NO.	REVISION 1	SHEET 3 / 5

\\Gamfs01\groups\Engineering\05-Geotechnic\14- Amaruq\04- Water Management\2- Construction\1- Dewatering PH1\4- Deliverable\1- As-Built Report\As-built Drawings\WhaleTail North Basin Dewatering Layout_V4.dwg, 03 Aug 2020

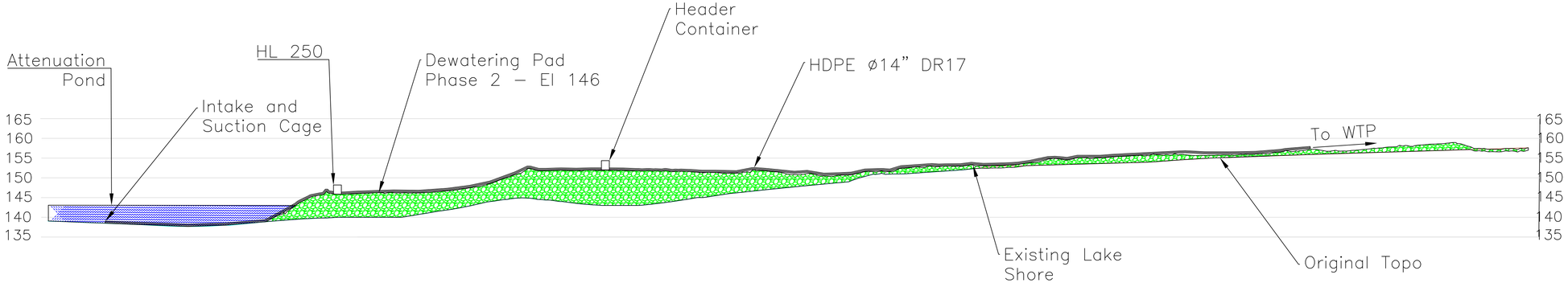
FILE NO. .DWG

DRAWING NO.

FORMAT ARCHD–LANDSCAPE



Phase 1 Dewatering Ramp Cross Section



Phase 2 Dewatering Ramp Cross Section

KEY PLAN

GENERAL NOTES

TITLE	# DWG
Diffuser Cross–Section	5

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT
				–	–
1	31/07/2020	As Built Drawings	TD	FLB	–

REVISIONS

AGNICO EAGLE
MEADOWBANK

TITLE
AGNICO–EAGLE – MEADOWBANK DIVISION
WHALE TAIL NORTH BASIN DEWATERING
WTN TO MAMMOTH PLAN VIEW
INTAKE DETAILS

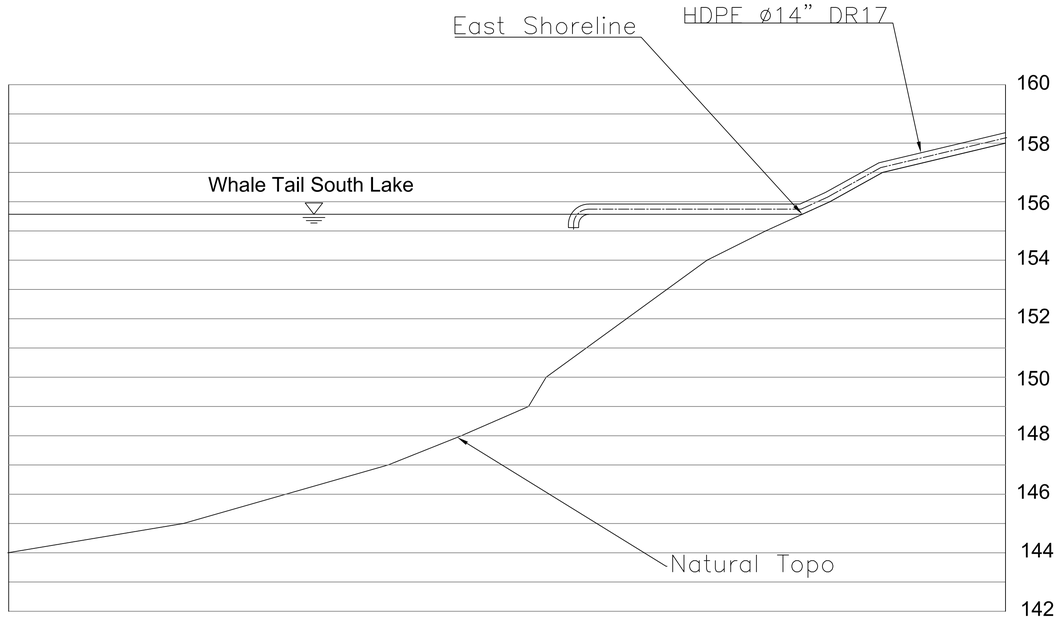
DRAWN BY	Thomas Dahm	DATE 31/07/2020
CHECKED BY	FLB, P. Eng.	31/07/2020
APPROVED BY	FLB, P. Eng.	31/07/2020
SCALE	N.T.S.	DATE 31/07/2020
DRAWING NO.	1	
PROJECT NO.	REVISION 1	SHEET 4 / 5

\\Cambfs01\groups\Engineering\05–Geotechnic\14– Amaruq\04– Water Management\2– Construction\1– Dewatering PH1\4– Deliverable\1– As–Built Report\As–built Drawings\WhaleTail North Basin Dewatering Layout_V4.dwg, 03 Aug 2020

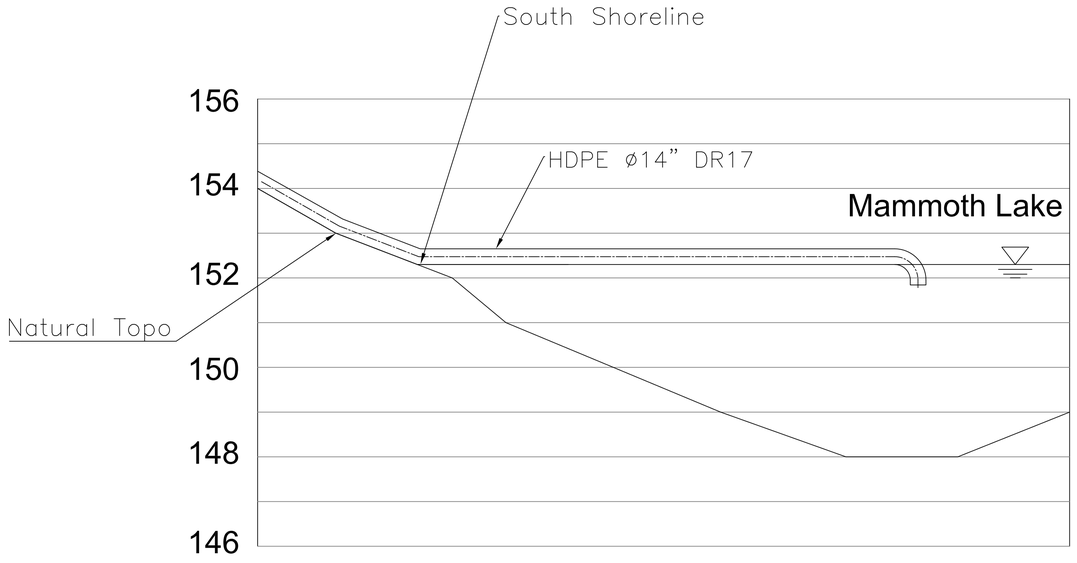
FILE NO. .DWG

DRAWING NO.

FORMAT ARCHD–LANDSCAPE



Detail 'A' -Discharge Section Whale Tail South



Detail 'B' -Discharge Section Mammoth Lake

KEY PLAN

GENERAL NOTES

TITLE	# DWG
Intake Cross Section	4

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT
				–	–
1	31/07/2020	As Built Drawings	TD	FLB	–

REVISIONS

AGNICO EAGLE
MEADOWBANK

TITLE
AGNICO–EAGLE – MEADOWBANK DIVISION
WHALE TAIL NORTH BASIN DEWATERING
WTN TO MAMMOTH PLAN VIEW
DISCHARGE DETAILS

DRAWN BY	Thomas Dahm	DATE 31/07/2020
CHECKED BY	FLB, P. Eng.	31/07/2020
APPROVED BY	FLB, P. Eng.	31/07/2020
SCALE	N.T.S.	DATE 31/07/2020

DRAWING NO.
5

PROJECT NO.	REVISION	SHEET
	1	5 / 5

\\Cambfs01\groups\Engineering\05–Geotechnic\14– Amaruq\04– Water Management\2– Construction\1– Dewatering PH1\4– Deliverable\1– As–Built Report\As–built Drawings\WhaleTail North Basin Dewatering Layout_V4.dwg, 03 Aug 2020

FILE NO. .DWG

APPENDIX B - CONSTRUCTION PHOTOGRAPHS

Photo 1. View of Whale Tail Lake prior to infrastructure construction (June 2017)

Photo 2. View of Whale Tail Lake prior to infrastructure construction (September 2017)

Photo 2. View of the header seacan, 3 HL 250 on the Phase 1 Dewatering ramp and the discharge pipe to WTS (March, 2019)

Photo 2. View of the header seacan, 3 HL 250 on the Phase 1 Dewatering ramp and the discharge pipe to WTS (March, 2019)

Photo 3. View of the HL250 pump and fuel tank install on Phase 1 of Dewatering Ramp (March, 2019)

Photo 4. Outside view of the header seacan (March, 2019)

Photo 5. View inside the header seacan (March, 2019)

Photo 6. View of intake line into Whale Tail North (March, 2019)

Photo 7. View of discharge line from WTN toward WTS (March, 2019)

Photo 8. View of discharge line into Whale Tail South (March, 2019)

Photo 10. Interior view of the 3:1 reducer and sampling port (March, 2019)

Photo 11. View of the **2** HL 250 on the Phase 2 Dewatering ramp (May, 2019)

Photo 12. Piping from Dewatering ramp to WTP (May, 2019)

Photo 13. Piping from Dewatering ramp to WTP and then to WTS or Mammoth (May, 2019)

Photo 14. Aerial view of WTD downstream area. View of the dewatering line going toward Mammoth Lake while the seepage discharge line is being installed (September, 2019)

Photo 15 : View of dewatering line toward Mammoth on the downstream area of WTD (September 2019)

Photo 16 : Dewatering line going toward Mammoth Lake dewatering diffuser (September 2019)

Photo 17 : View of the Mammoth Lake dewatering diffuser (September 2019)

Photo 18 : View of Whale Tail North Basin after commissioning of the Whale Tail Attenuation Pond. Picture taken from the dewatering ramp (June 2020)

Photo 19 : View of Whale Tail North Basin after commissioning of the Whale Tail Attenuation Pond. Picture taken from Whale Tail Dike looking toward the Whale Tail Attenuation Pond (June 2020)

APPENDIX C - HL 250 PUMP DATA SHEET

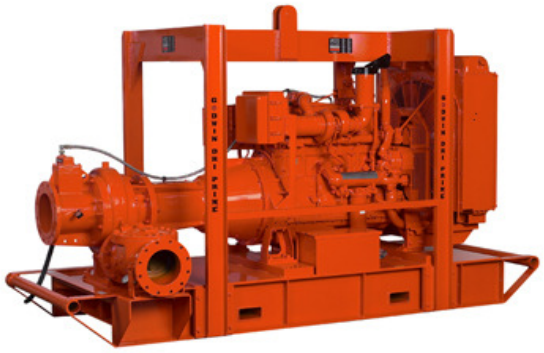
HL250M Dri-Prime Pump

HL250M

The Godwin Dri-Prime HL250M pump offers flow rates to 5,389 USGPM and discharge heads to 389' (119 m). Also it has the capability of handling solids up to 3" (65mm) in diameter.

The HL250M is able to prime to 28' (8.5 m) of suction lift from dry.

Indefinite dry-running is no problem due to the unique Godwin oil bath mechanical seal design. Solids handling, dry-running and portability make the HL250M the perfect choice for dewatering and bypass applications. The standard model is mounted on a skid, with a highway trailer option.



Features

- Simple maintenance normally limited to checking fluid levels.
- Close coupled centfrigual pump with vacuum priming compressor mounted to a diesel engine. Also available in electric drive or as a bare shaft pumpend.
- Extensive application flexibility. It will handle sewage, slurries and liquids with solids up to 3" in diameter.
- Continuously operated Godwin venturi air ejector priming device requiring no form of periodic adjustment or control.
- Dry-running heavy duty mechanical seal with abrasion resistant interfaces.
- Also availabe as a Critically Silenced unit which drastically reduces noise levels of the pump.
- Standard engine Caterpillar C15. .
- The volute & suction cover are made from cast iron bs1452:1990 grade 220 and the impeller is made from cast steel bs3100 a5 hardness to 200 hb brinell.

Specifications

Suction connection	12" 125# ANSI B16.1
Delivery connection	10" 125# ANSI B16.1
Max capacity	5389 USGPM
Max head	389' (119 m)
Max solids handling	3" (65mm)
Max Impeller diameter	17" (440mm)
Max operating temp	176°F (80°C)
Max working pressure	188.5 psi (13.0 bar)
Max suction pressure	87.0 psi (6.0 bar)
Max casing pressure	282.8 psi (19.5 bar)
Max operating speed	2000 rpm

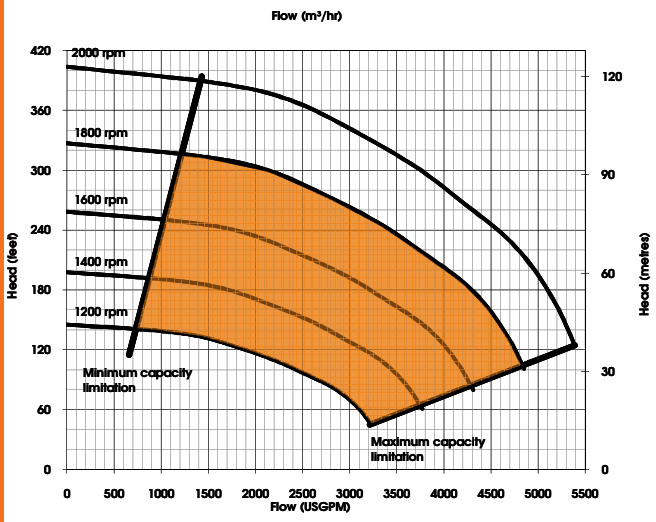
godwin
a xylem brand

Reference number : 95-1114-3000
Date of issue : Auaust 25. 2011
Issue : 1

Please contact Godwin for further details.
A typical picture of the pump is shown.
All information is approximate and for general guidance only.

HL250M

Performance Curve



Materials

Pump casing & suction cover	Cast iron BS1452:1990 Grade 220
Wearplates	Cast Iron - Chrome 1.0/1.5% Nickle 2%
Pump Shaft	Nickel Chrome Steel to BS970-1:1991 Grade 817M40T EN24T
Impeller	Cast Steel BS3100 A5 Hardness to 200 HB Brinell
Non-return valve body	Cast Iron
Mechanical seal faces	Silicon carbide vs silicon carbide

Engine option 1

Caterpillar, C15, 474.4 HP @ 1800 rpm

Impeller diameter 17" (440mm)

Suction Lift Table

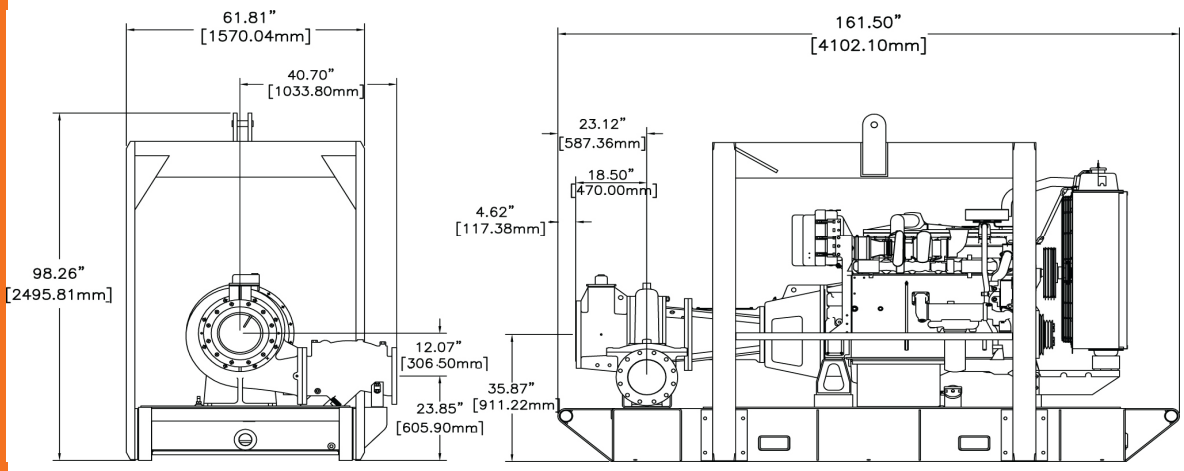
Total Suction Head (')	Total Delivery Head (')				
	93	133	194	247	295
	Output (USGPM)				
8.0	4815	4557	3864	3012	1783
12.2	4755	4526	3764	2972	1486
16.2	4359	4161	3772	2853	1308
20.2	3467	3368	3170	2708	-

Fuel capacity (Full) 215 US Gal, (Usable) 215 US Gal

Fuel consumption @ 1800 rpm BEP 17 US Gal/hr

Weight: (Dry) 11,464 lbs, (Wet) 13,250 lbs

Dimensions: (L) 161" x (W) 61" x (H) 100"



Performance data provided in tables is based on water tests at sea level and 68°F ambient.

All information is approximate and for general guidance only.

Please contact Godwin Pumps for further details.

Reference number : 95-1114-3000
Date of issue : August 25, 2011
Issue : 1

godwin a xylem brand

84 Floodgate Road | Bridgeport, NJ 08014
P:(856) 467-3636 | F:(856) 467-4841
sales@godwinpumps.com | godwinpumps.com

APPENDIX D – HDPE PIPE SPECIFICATION

SANDALE
UTILITY PRODUCTS
a division of EMCO CORPORATION

www.sandale.ca
Phone 604-882-2080

MUNICIPAL & INDUSTRIAL SERIES/IPS PIPE DATA

Pipe weights are calculated in accordance with PPI TR-7. Average inside diameter calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimensions and tolerances in applicable pipe specifications.

Pressure Ratings are for water at 73.4deg F. For other fluid and service temperature, ratings may differ. Refer to Engineering Manual for Chemical and Environmental Considerations.

PRESSURE RATING 3408		DR17 100 PSI			DR21 80 PSI			DR26 65 PSI			DR32.5 50 PSI			
PRESSURE RATING 4710		DR17 125 PSI			DR 21 100 PSI			DR26 80 PSI			DR 32.5 63 PSI			
IPS Pipe Size	Nominal OD (in)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	IPS Pipe Size
3/4"	1.050													3/4"
1"	1.315													1"
1 1/4"	1.660													1 1/4"
1 1/2"	1.900													1 1/2"
2"	2.375	0.140	2.078	0.43										2"
3"	3.500	0.206	3.063	0.93										3"
4"	4.500	0.265	3.938	1.54	0.214	4.046	1.26							4"
5 3/8"	5.375	0.316	4.705	2.20	0.256	4.832	1.80	0.207	4.936	1.47				5 3/8"
5"	5.563	0.327	4.870	2.35	0.265	5.001	1.93	0.214	5.109	1.57				5"
6"	6.625	0.390	5.798	3.34	0.315	5.957	2.73	0.255	6.084	2.23	0.204	6.193	1.80	6"
7 1/8"	7.125	0.419	6.237	3.86	0.339	6.406	3.16	0.274	6.544	2.58	0.219	6.661	2.08	7 1/8"
8"	8.625	0.507	7.550	5.65	0.411	7.754	4.64	0.332	7.921	3.79	0.265	8.063	3.05	8"
10"	10.750	0.632	9.410	8.78	0.512	9.665	7.21	0.413	9.874	5.87	0.331	10.048	4.75	10"
12"	12.750	0.750	11.160	12.36	0.607	11.463	10.13	0.490	11.711	8.26	0.392	11.919	6.67	12"
13 3/8"	13.375	0.787	11.707	13.61	0.637	12.025	11.15	0.514	12.285	9.09	0.412	12.502	7.35	13 3/8"
14"	14.000	0.824	12.253	14.91	0.667	12.586	12.22	0.538	12.859	9.96	0.431	13.086	8.05	14"
16"	16.000	0.941	14.005	19.46	0.762	14.385	15.96	0.615	14.696	13.01	0.492	14.957	10.50	16"
18"	18.000	1.059	15.755	24.64	0.857	16.183	20.19	0.692	16.533	16.47	0.554	16.826	13.30	18"
20"	20.000	1.176	17.507	30.41	0.952	17.982	24.93	0.769	18.370	20.34	0.615	18.696	16.41	20"
22"	22.000	1.294	19.257	36.80	1.048	19.778	30.18	0.846	20.206	24.61	0.677	20.565	19.86	22"
24"	24.000	1.412	21.007	43.81	1.143	21.577	35.91	0.923	22.043	29.30	0.738	22.435	23.62	24"
26"	26.000	1.529	22.759	51.39	1.238	23.375	42.14	1.000	23.880	34.39	0.800	24.304	27.74	26"
28"	28.000	1.647	24.508	59.62	1.333	25.174	48.86	1.077	25.717	39.88	0.862	26.173	32.19	28"
30"	30.000	1.765	26.258	68.45	1.429	26.971	56.12	1.154	27.554	45.78	0.923	28.043	36.93	30"
32"	32.000	1.882	28.010	77.86	1.524	28.769	63.84	1.231	29.390	52.10	0.985	29.912	42.04	32"
34"	34.000	2.000	29.760	87.91	1.619	30.568	72.06	1.308	31.227	58.81	1.046	31.782	47.43	34"
36"	36.000	2.118	31.510	98.57	1.714	32.366	80.78	1.385	33.064	65.94	1.108	33.651	53.20	36"
42"	42.000	2.471	36.761	134.16	2.000	37.760	109.97	1.615	38.576	89.710	1.292	39.261	72.37	42"
48"	48.000	2.824	42.013	175.23	2.286	43.154	143.65	1.846	44.086	117.180	1.477	44.869	94.56	48"
54"	54.000				2.571	48.549	181.75	2.077	49.597	148.330	1.662	50.477	119.70	54"
63"	63.000				3.000	56.640	247.42	2.423	57.863	201.880	1.938	58.891	162.84	63"
65"	65.000				3.095	58.810	263.38	2.500	60.000	214.910	2.000	61.000	173.39	65"

Sandale Utility Products can supply to specialized pipe dimensions. Check with you Sandale Utility Products contact for availability of dimensions not listed.

H.D.P.E. Piping Solutions

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Phone 604-882-2080

MUNICIPAL & INDUSTRIAL SERIES/IPS PIPE DATA

Pipe weights are calculated in accordance with PPI TR-7. Average inside diameter calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimensions and tolerances in applicable pipe specifications.

Pressure Ratings are for water at 73.4deg F. For other fluid and service temperature, ratings may differ. Refer to Engineering Manual for Chemical and Environmental Considerations.

PRESSURE RATING 3408		DR7.3 255 PSI			DR9 200 PSI			DR11 160 PSI			DR13.5 128 PSI			
PRESSURE RATING 4710		DR7.3 320 PSI			DR9 252 PSI			DR11 202 PSI			DR 13.5 160 PSI			
IPS Pipe Size	Nominal OD (in)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	IPS Pipe Size
3/4"	1.050	0.150	0.732	0.18	0.117	0.802	0.15	0.095	0.849	0.12	0.078	0.885	0.10	3/4"
1"	1.315	0.188	0.916	0.29	0.146	1.005	0.23	0.120	1.061	0.20	0.097	1.109	0.16	1"
1 1/4"	1.660	0.227	1.179	0.44	0.184	1.270	0.37	0.151	1.340	0.31	0.123	1.399	0.26	1 1/4"
1 1/2"	1.900	0.260	1.349	0.58	0.211	1.453	0.49	0.173	1.533	0.41	0.141	1.601	0.34	1 1/2"
2"	2.375	0.325	1.686	0.91	0.264	1.815	0.76	0.216	1.917	0.64	0.176	2.002	0.53	2"
3"	3.500	0.479	2.485	1.98	0.389	2.675	1.66	0.318	2.826	1.39	0.259	2.951	1.15	3"
4"	4.500	0.616	3.194	3.27	0.500	3.440	2.74	0.409	3.633	2.29	0.333	3.794	1.90	4"
5 3/8"	5.375	0.736	3.815	4.66	0.597	4.109	3.90	0.489	4.338	3.27	0.398	4.531	2.72	5 3/8"
5"	5.563	0.762	3.948	5.00	0.618	4.253	4.18	0.506	4.490	3.51	0.412	4.690	2.91	5"
6"	6.625	0.908	4.700	7.09	0.736	5.065	5.93	0.602	5.349	4.97	0.491	5.584	4.13	6"
7 1/8"	7.125	0.976	5.056	8.20	0.792	5.446	6.86	0.648	5.751	5.75	0.528	6.006	4.78	7 1/8"
8"	8.625	1.182	6.119	12.01	0.958	6.594	10.05	0.784	6.963	8.42	0.639	7.270	7.00	8"
10"	10.750	1.473	7.627	18.66	1.194	8.219	15.61	0.977	8.679	13.09	0.796	9.062	10.87	10"
12"	12.750	1.747	9.046	26.25	1.417	9.746	21.97	1.159	10.293	18.41	0.944	10.749	15.29	12"
13 3/8"	13.375	1.832	9.491	28.88	1.486	10.225	24.18	1.216	10.797	20.26	0.991	11.274	16.84	13 3/8"
14"	14.000	1.918	9.934	31.64	1.556	10.701	26.50	1.273	11.301	22.20	1.037	11.802	18.44	14"
16"	16.000	2.192	11.353	41.33	1.778	12.231	34.60	1.455	12.915	29.00	1.185	13.488	24.09	16"
18"	18.000	2.466	12.772	52.31	2.000	13.760	43.79	1.636	14.532	36.69	1.333	15.174	30.48	18"
20"	20.000	2.740	14.191	64.58	2.222	15.829	54.05	1.818	16.146	45.30	1.481	16.860	37.63	20"
22"	22.000	3.014	15.610	78.14	2.444	16.819	65.40	2.000	17.760	54.82	1.630	18.544	45.56	22"
24"	24.000	3.288	17.029	93.00	2.667	18.346	77.85	2.182	19.374	65.24	1.778	20.231	54.21	24"
26"	26.000				2.889	19.875	91.36	2.364	20.988	76.57	1.926	21.917	63.62	26"
28"	28.000				3.111	21.405	105.95	2.545	22.605	88.78	2.074	23.603	73.78	28"
30"	30.000				3.333	22.934	121.62	2.727	24.219	101.92	2.222	25.289	84.69	30"
32"	32.000							2.909	25.833	115.97	2.370	26.976	96.35	32"
34"	34.000							3.091	27.447	130.93	2.519	28.660	108.81	34"
36"	36.000							3.273	29.061	146.80	2.667	30.346	121.98	36"
42"	42.000										3.111	35.405	166.00	42"
48"	48.000													48"
54"	54.000													54"
63"	63.000													63"
65"	65.000													65"

Sandale Utility Products can supply to specialized pipe dimensions. Check with you Sandale Utility Products contact for availability of dimensions not listed.

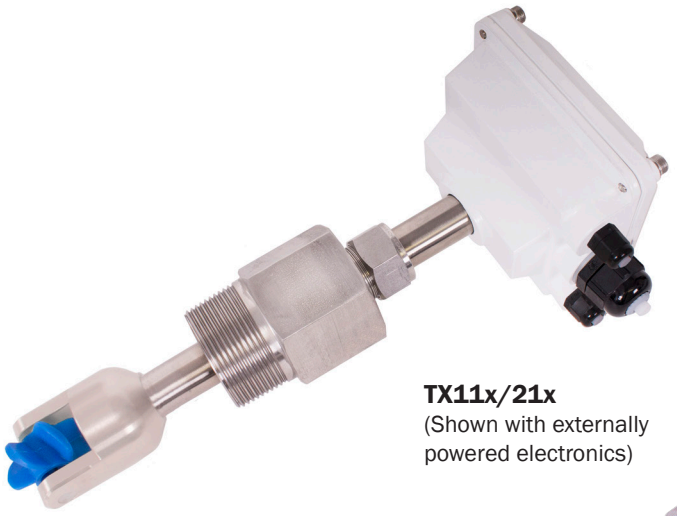
H.D.P.E. Piping Solutions

APPENDIX E – FLOWMETER SPECIFICATION

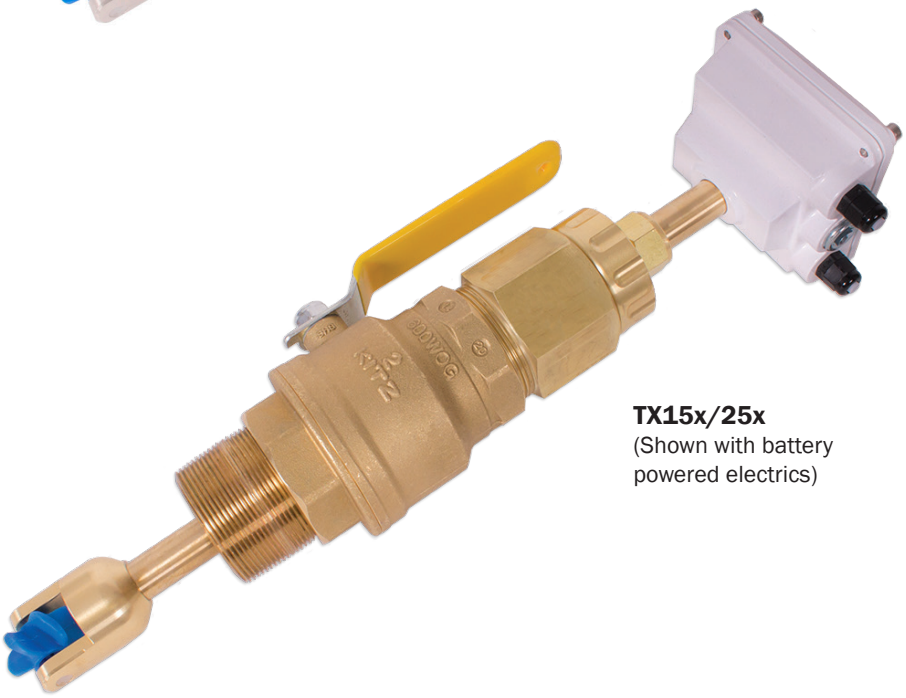
TX100/200-SERIES

Seametrics

INSERTION TURBINE INSTRUCTIONS



TX11x/21x
(Shown with externally powered electronics)



TX15x/25x
(Shown with battery powered electrics)

ISO 9001:2008 CERTIFIED COMPANY

TABLES AND DIAGRAMS

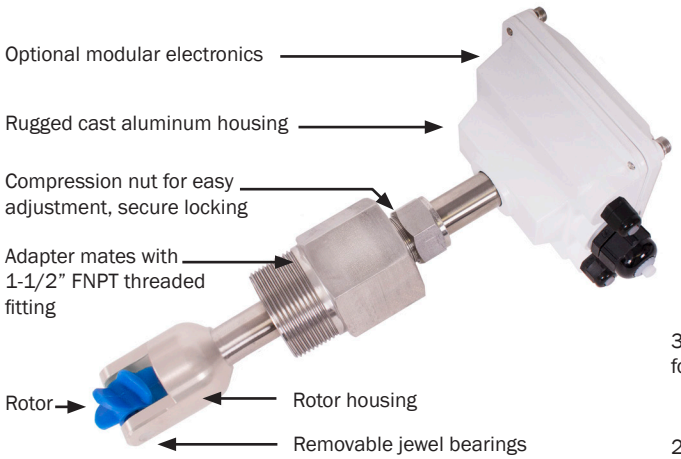
The **TX100/200-Series** are adjustable depth insertion turbines that come in brass or 316 stainless models to fit 3" to 40" pipe. Adapters mate with standard 1-1/2" (11x/21x) or 2" (15x/25x) FNPT threaded fittings such as saddles and weldolets which may be purchased either locally or from Seametrics.

Ruby bearings and a non-drag pickoff give these adjustable insertion turbine flow sensors a wide flow range and long life. A sensor detects the passage of miniature magnets in the rotor blades. The resulting square-wave signal can be sent for hundreds of feet without a transmitter, over unshielded cable. This signal can be connected directly to many PLC's and other controls without any additional electronics.

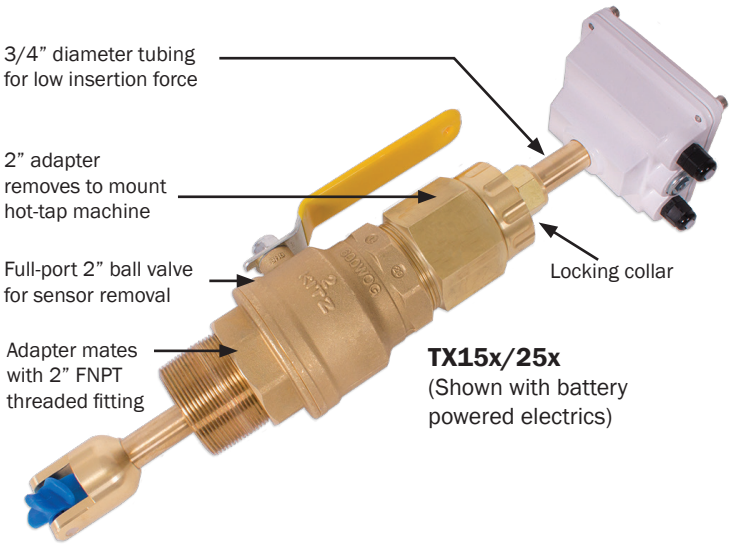
A modular system of electronics can be installed directly on the flow sensor or mounted remotely. The FT430 (externally powered with pulse), FT440 (loop powered), and FT450 (battery powered) all provide digital rate and total displays, as well as a programmable pulse; the FT440 also provides a 4-20 mA analog output. The A055 is a blind analog (4-20 mA) transmitter. Programmable pulse for pump pacing is available with the PD10.

The "hot-tap" models (TX15x/25x) can be installed or serviced without shutting down the line by means of a 2" full-port isolation valve that comes with a nipple for installation on the pipe fitting. In most circumstances, no special tool is required.

FEATURES



TX11x/21x
(Shown with externally powered electronics)



TX15x/25x
(Shown with battery powered electrics)

SPECIFICATIONS*

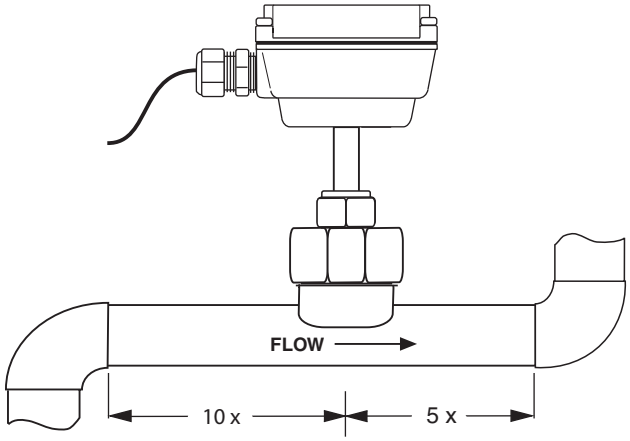
Power Source		**Low Power**	**Micropowered (-04 Option)**
	Supply Voltage/Current	6-40 Vdc/< 2 mA	3.1-16 Vdc/60 µA @ 3.6 Vdc
Sensor	**Type**	Digital Magnetoresistive	Giant Manetoresistance (GMR)
	Output	Current Sinking Pulse	Voltage Output
	Sinking Current	150 mA max	2 mA max
Pipe Size		**TX11x/15x**	**TX21x/25x**
		3" 12" (75 - 300mm)	12" - 40" (300 - 1000mm)
Materials	**Housing**	Cast aluminum	
	Sensor Body	Brass or 316 SS	
	Rotor	PVDF (Kynar®)	
	Shaft/Bearings	Nickel-bound tungsten carbide/Ruby	
	Isolation Valve	**TX11x/21x (Brass/SS)**	**TX15x/25x (Brass/SS)**
		None	Bronze (316SS optional)
Fitting Size Required		1-1/2" FNPT	2" FNPT
Flow Range		0.5 - 30 feet/sec (0.15 - 9.14 meter/sec)	
Accuracy		+/- 1.5% of full scale	
Maximum Temperature		200˚ F (93˚ C)	
Maximum Pressure		200 psi (14 bar)	
Insertion Force		0.44 x pressure in pipe	
Cable		#22 AWG 3-con, 18' (6m); 2,000' (610m) maximum cable run	
Regulatory		CE	

**Specifications subject to change. Please consult our website for the most current data (www.seametrics.com).*

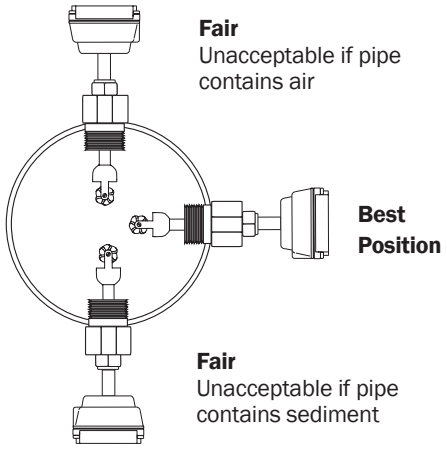
Positioning the Meter

An insertion flow sensor measures the velocity of flow at one point in the pipe; flow rate and total can be inferred from this one point. Accuracy is decreased by any factor which makes the flow at the measured point unrepresentative of the entire flow stream. This includes distorted flow patterns caused by upstream fittings too close to the sensor. The worst offenders are fittings that increase the flow on one side of the pipe, such as partially-opened gate or butterfly valves. Fluid moving in a pipe does not flow at the same velocity. Toward the center of the pipe, fluid moves faster than at the wall, and the relationship between the two changes as overall flow rate increases. This change in the "velocity profile" can result in non-linearity, which means that the K-factor (see page 7) that is correct for one flow rate may be incorrect for another. Recommended depth settings (see page 7) have been carefully chosen to minimize this source of error, and should be followed carefully, especially in the smaller pipe sizes.

For best results, the TX sensor should be installed with at least ten diameters of straight pipe upstream and five downstream. Certain extreme situations such as partially-opened valves are particularly difficult and may require more straight diameters upstream. See Straight Pipe and Full Pipe recommendations on following pages.



Horizontal (3 o'clock or 9 o'clock position) is the preferred installation orientation, since it improves low-flow performance and avoids problems with trapped air and sediment. (See Orienting the Meter diagram below.) Bottom (6 o'clock), top (12 o'clock), and vertical pipe installations are all acceptable if required by the piping layout.



Orienting the Meter

Immersion

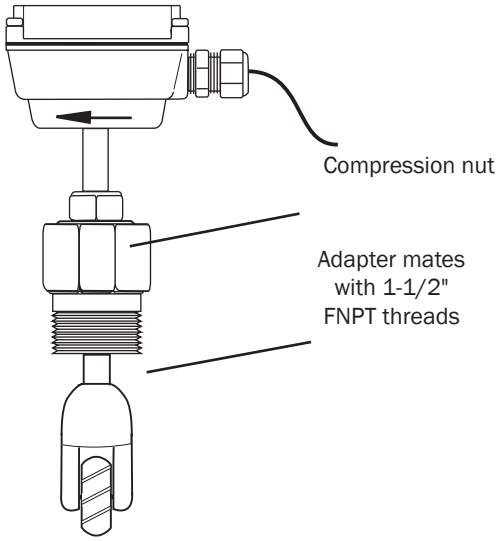
The TX100/200-Series standard sensors are not designed for continuous underwater operation. If your meter may experience occasional temporary immersion, as in a flooded vault, a unit modified for immersion should be specified (Option -40).

Caution: These water meters are not recommended for installation downstream of the boiler feedwater pump where installation fault may expose the meter to boiler pressure and temperature. Maximum recommended temperature is 200ºF.

TX11x/21x INSTALLATION

Fitting Installation. TX11x/21x adapters mate with a 1-1/2" female NPT pipe thread adapter fitting. Any fitting that provides the matching NPT female thread may be used. Installation procedure compensates for fitting height differences. Cut a minimum 1-3/4" hole in the pipe. If possible, measure the wall thickness and write it down for use in depth setting. Then install the threaded fitting (saddle, weldolet, etc.) on the pipe.

Meter Installation. Loosen the compression nut so that the adapter slides freely. Pull the meter fully upward and finger-tighten the compression nut. Using a thread sealant, install the adapter in the pipe fitting. Do not overtighten. Now loosen the compression nut, lower the meter to the appropriate depth setting (see diagram and instructions that follow). Caution: Do not allow the meter to fall into the pipe uncontrolled, as this may damage the meter. Be sure flow is in the direction of the arrow on the housing. Tighten compression nut fully.



TX15x/25x INSTALLATION

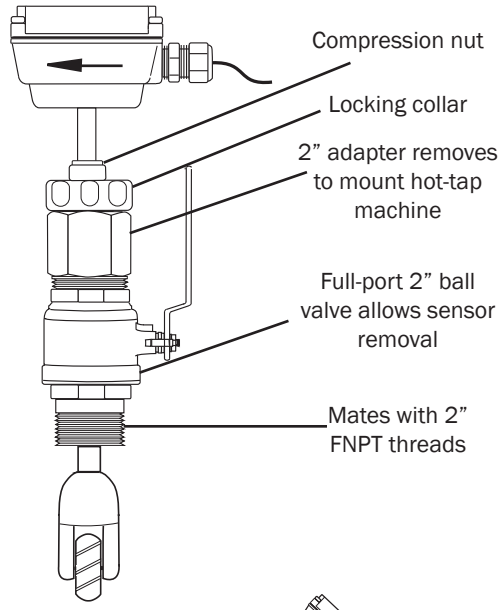
Hot tap' TX meters are designed to be installed and serviced without depressurizing the pipe.

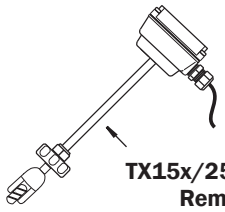
Fitting Installation. The TX15x/25x adapters mate with a 2" FNPT threaded fitting for compatibility with the 2" isolation valve. Any fitting that provides matching NPT female thread may be used. The installation procedure compensates for differences in fitting height.

If initial installation is performed on an unpressurized pipe, cut a minimum 1-3/4" hole in the pipe. If possible, measure the wall thickness and write it down for use in depth setting. Then install the threaded fitting (saddle, weldolet, etc.) on the pipe.

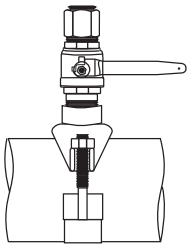
If it is necessary to do the initial installation under pressure, any standard hot tap drilling machine with 2" NPT adapter, such as a Transmate or a Mueller, can be used. Ordinarily, it is not necessary to use an installation tool, since the small-diameter tube can be controlled by hand at all but the highest pressures.

Meter Installation. Remove the sensor unit from the valve assembly. Using a thread sealant, install the valve assembly on the pipe fitting. If the initial installation is a pressure ("hot") tap, remove the 1-1/2" x 2" adapter bushing at the back of the valve. Thread the tapping machine on, open the valve, and tap using a minimum of 1-3/4" or maximum 1-7/8" cutter. After retracting the machine and closing the valve, reinstall the flow sensor. When the sensor is secure, open the valve and adjust depth setting (see diagram and instructions that follow). Be sure flow is in the direction of the arrow on the housing. Tighten locking collar and compression nut fully.





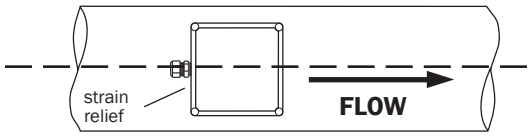
TX15x/25x Sensor Removal



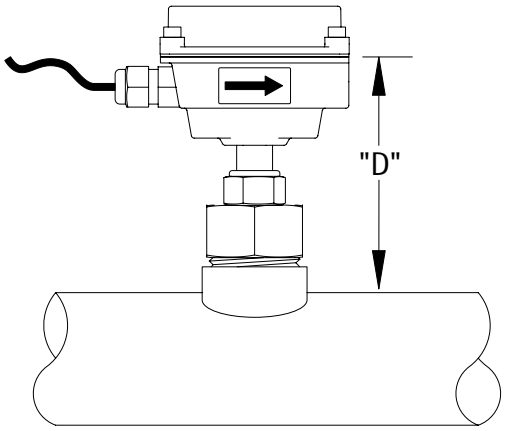
Depth Setting

It is important for accuracy that the sensor be inserted to the correct depth into the pipe.

1. Go to **www.seametrics.com** and select the **K-factor Calculator** located at the bottom of the home page to find dimension D (insertion depth setting)*.
2. Measuring from the outside of the pipe to the joint in the housing, as shown in the diagram, adjust the sensor to Dimension D and hand-tighten compression nut.
3. Align the conduit housing with the centerline of the pipe, as shown. Be sure the arrow on the housing points in the direction of flow.



4. Check Dimension D one more time.
5. Fully tighten the compression nut.



Proper Depth Setting

Record your settings. Once you have the meter set up and operational, it is important to record you meter settings and save them future reference.

K-Factor _____

Insertion Depth (Dim. D) _____

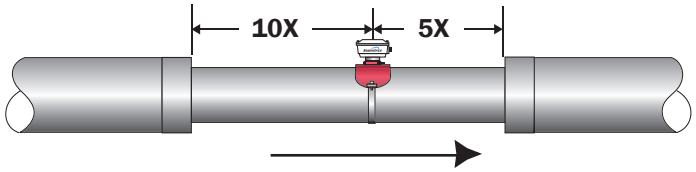
** For pipe sizes larger than 50", please consult factory.*

Table 1: Pipe Wall Thickness

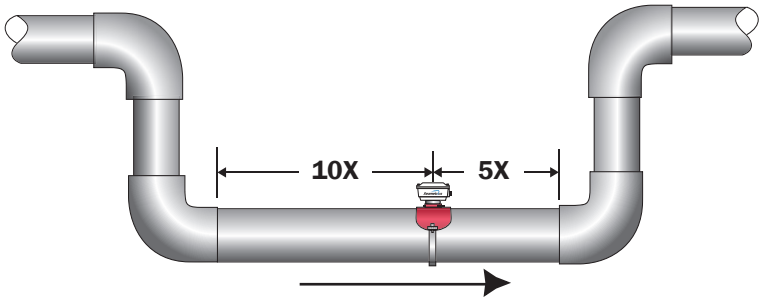
	NOMINAL PIPE SIZE												
	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"
PVC/Steel Sch. 40	0.216	0.237	0.280	0.322	0.365	0.406	0.438	0.500	0.562	0.593	0.687		
PVC/Steel Sch. 80	0.300	0.337	0.432	0.500	0.593	0.687	0.750	0.843	0.937	1.031	1.218		
Stainless Steel (10S)	0.120	0.120	0.134	0.148	0.165	0.180	0.188	0.188	0.188	0.218	0.250	0.312	0.312
Stainless Steel (40S)	0.216	0.237	0.280	0.322	0.365	0.375	0.375	0.375	0.375	0.375	0.375	0.375	0.375
Copper Tubing (Type L)	0.090	0.110	0.140	0.200	0.250	0.280							
Copper Tubing (Type K)	0.109	0.134	0.192	0.271	0.338	0.405							
Brass Pipe	0.219	0.250	0.250	0.312	0.365	0.375							
Duct. Iron (Class 52)	0.280	0.290	0.310	0.330	0.350	0.370	0.390	0.400	0.410	0.420	0.440	0.470	0.530

Straight Pipe Recommendations (X = diameter)

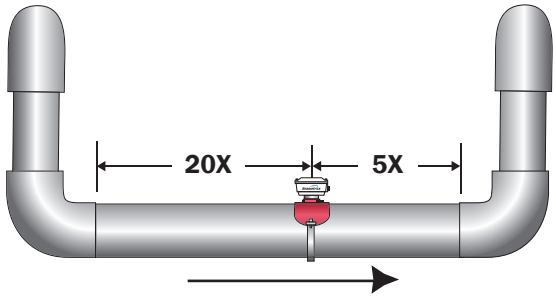
Reduced Pipe



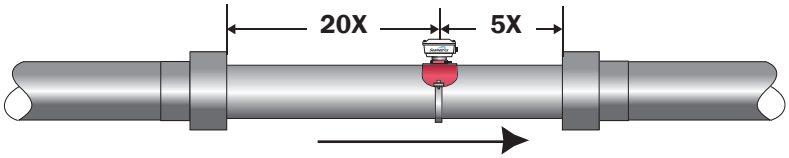
Two Elbows In Plane



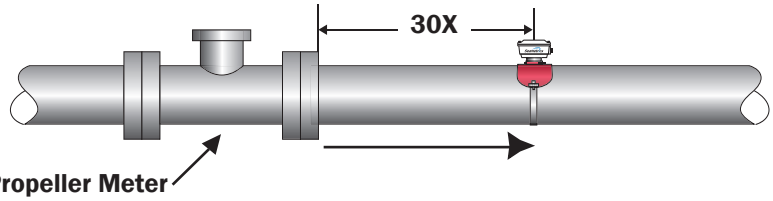
Two Elbows, Out Of Plane



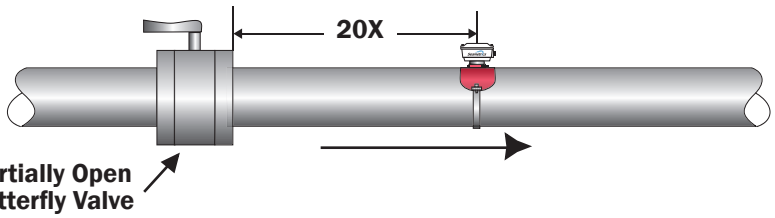
Expanded Pipe



Spiral Flow

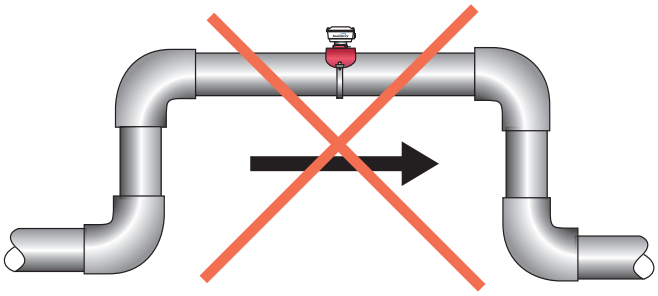


Swirling Flow



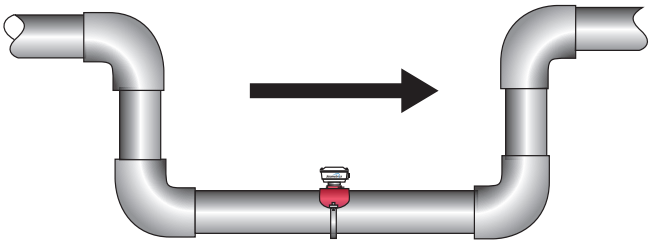
Full Pipe Recommendations

Possible Problem



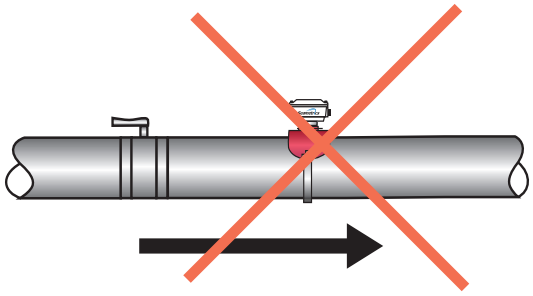
Allows air pockets to form at sensor

Better Installation



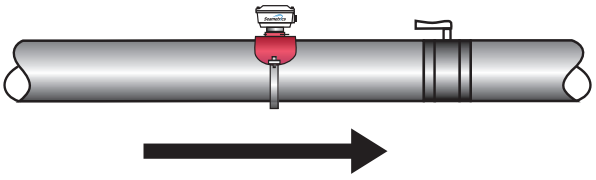
Ensures full pipe

Possible Problem



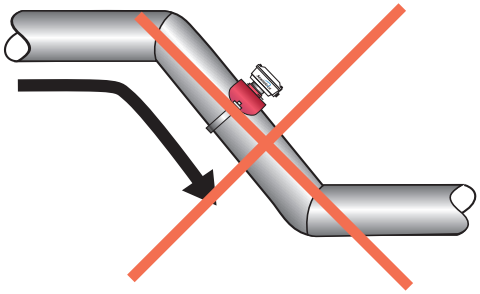
Post-valve cavitation can create air pocket

Better Installation



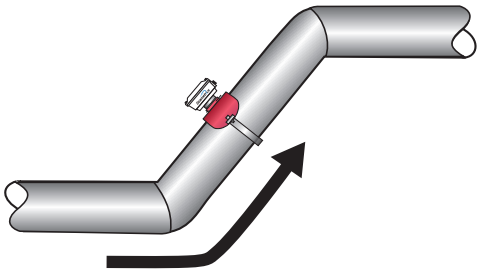
Keeps pipe full at sensor

Possible Problem



Air can be trapped

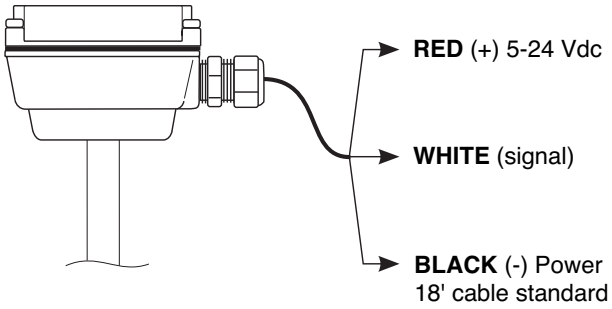
Better Installation



Allows air to bleed off

Connection

Sensors are supplied with 18 ft. (6 m) of cable. For sensors with no additional electronics, see diagram for color coding. For sensors with on-board electronics, see the manual accompanying the electronics module.



Calibration ("K-Factor")

In order to properly process pulses from the flow sensor, a number must be entered into the control to which the sensor is connected. This number, called the K-factor, is the number of pulses the sensor puts out per unit of fluid passing through the pipe. It is normally provided for Seametrics sensors in pulses per gallon, and can be ascertained by using the "K-Factor Calculator" on the Seametrics website. These numbers are based on extensive testing, which has shown close agreement between different TX sensors in the same installation. Most K-factor error can be attributed to installation variables, such as depth setting and fitting configuration.

It is possible to field calibrate a sensor by catching the fluid in a measured container and comparing with the number of pulses recorded. (To record individual pulses, set the K-factor on the control to 1.00.) This is especially desirable if the installation has less than the recommended length of straight pipe upstream of the sensor. For detailed intructions on field calibration, please refer to the technical bulletin "Field Calibration of Seametrics Meters" on the Downloads page on our website (www.seametrics.com).

Flow Rate

These sensors are designed to operate at flow velocities of 0.5 to 30 feet per second (see Table 2, below). If erratic readings are encountered at low flows, check the chart to see if flow is below minimum for the pipe size. The standard shaft and bearings should have a long life at continuous high flow.

TABLE 2: Flow Rates converted from Feet/Sec to Gallons/Minute at various velocities: Schedule 40 pipe

Feet / Sec	Nominal pipe size											
	3"	4"	5"	6"	8"	10"	12"	16"	24"	36"	38"	40"
(0.5)	11.5	19.8	31.2	45	78	123	176	313	704	1585	1770	1960
(1.0)	23	39.7	62.4	90	156	246	349	551	1250	2910	3530	3915
(2.0)	46.1	79.4	125	180	312	492	698	1100	2510	5830	7070	7825
(5.0)	115	198	312	450	780	1230	1740	2750	6270	14570	17670	19560
(10.0)	230	397	624	900	1560	2460	3490	5510	12530	29140	35350	39120
(20.0)	461	794	1250	1800	3120	4920	6980	11020	25060	58270	70700	78240
(30.0)	691	1190	1870	2700	4680	7370	10470	16520	37600	87410	106050	117500

Troubleshooting

The flow sensor has only one moving part, the rotor. If this is turning properly and there is no signal, the Hall-effect sensor is not operating properly. To check the signal, apply 12 Vdc regulated* power to the red (+) and black (-) leads. Set a multimeter to voltage reading. Put the positive multimeter lead on the red wire and the negative lead on the white wire. Slowly turn the rotor. Voltage reading should swing between +12 Volts and 0 Volts as the rotor turns. If it does not, the Hall effect sensor is not working properly. Checking for continuity is not a useful test of these sensors.

***NOTE:** An unregulated power supply can exceed max voltage of micro powered sensor (gray cable) and damage sensor.

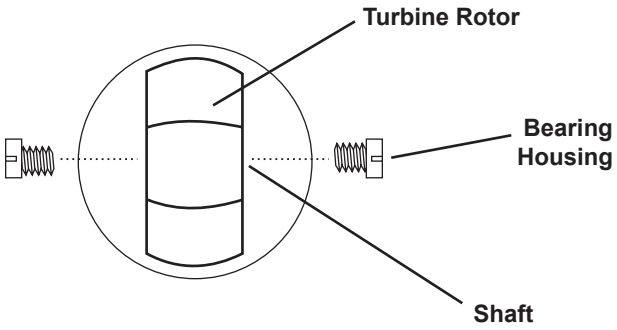
Caution: Never attempt to remove a flow sensor when there is pressure in the pipe. Loosen the compression nut slowly to release any trapped pressure. If fluid sprays out when removing the sensor, stop turning and depressurize the pipe. Failure to do so could result in the sensor being thrown from the pipe, resulting in damage or serious injury.

Repair

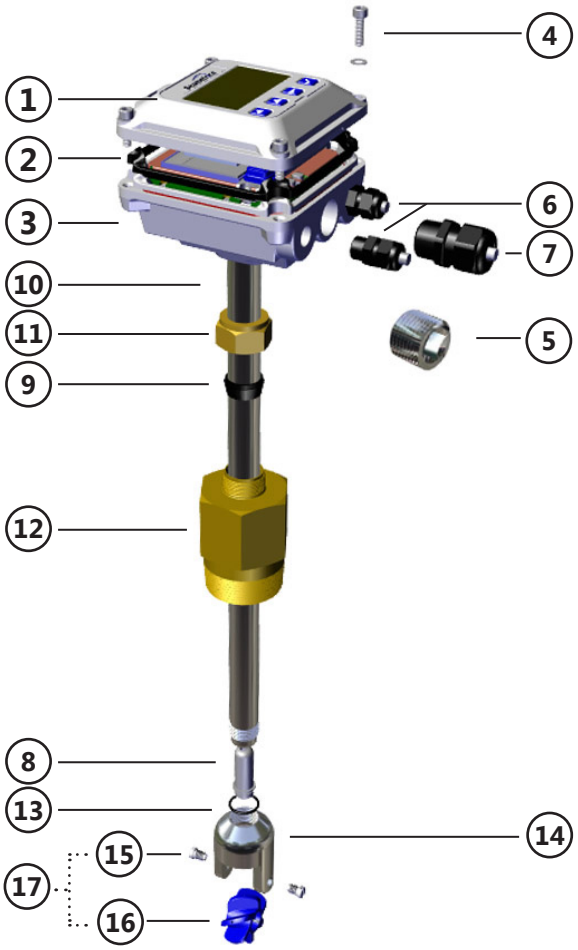
All Seametrics flow sensors are repairable, and can be returned to the factory or distributor for repair.
Please first obtain a Return Material Authorization (RMA) number.

Rotor Replacement. Rotors are easily field-replaced. Shaft and rotor are a single unit, and are not replaced separately. If replacement is due only to normal shaft wear, bearing replacement is probably not necessary. If the rotor has been damaged by impact, the bearings should also be replaced. Rotor and bearings can be ordered as a kit (see parts listing). Follow these steps:

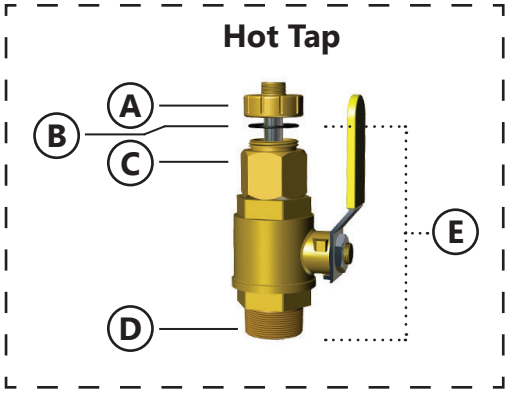
1. Unscrew the threaded bearing housings to expose the shaft ends. If bearings are being replaced, back them completely out.
2. Remove the rotor. Put the new rotor in its place.
3. Thread in one bearing housing part way, then the other. Take care to start the end of the shaft into the bearing hole before tightening further.
4. Screw in bearing housings until they bottom.
   Note: Do not use excessive force.
5. Check for free spin. Blowing lightly on the rotor should result in it spinning rapidly and coasting to a smooth stop.



TX100/200 Series Parts List



TX 11x/21x Parts		
1	Upper housing assembly	100662
2	Housing Gasket	100411
3	Lower housing	Not field replaceable
4	Housing screw/washer kit (4 each)	103702
5	Plug, steel (battery units)	100360
6	Strain relief kit, small (includes 2)	100364
7	Strain relief kit, large (includes 1) (externally powered units)	103700
8	Sensor pickup	100508 (Micropower, green cable, FT450) 100419 (Standard, blue cable, FT430/440)
9	Tube	Not field replaceable
10	Compression nut	100064 (brass) 100084 (ss)
11	Compression ferrule	100358
12	Adapter	100845 (brass) 100846 (ss)
13	Rotor housing o-ring	100218 (EPDM)
14	Rotor housing	101868 (brass) 101869 (ss)
15	Bearings (includes 2)	100315
16	Rotor assembly	101862 (Kynar®/tungsten carbide)
17	Rotor repair kit (#15 & #16 above)	101912 (Kynar®/tungsten carbide)



TX 15x/25x Parts (Hot Tap) All parts are the same except those below, which replace #12		
A	Locking collar	100061 (brass) 100116 (ss)
B	Adapter fitting o-ring	100345 (EPDM)
C	Adapter, hot tap	100384 (brass) 100385 (ss)
D	Nipple, 2 inch	100066 (brass) 100103 (ss)
E	Valve assembly (includes valve plus B, C, & D above)	100069 (brass) 100119 (ss)