MEMORANDUM

Ainley Graham & Associates Limited
139 Front Street Unit 100, Belleville, ON K8N 2Y6
Tel: (613) 966-4243 P Fax: (613) 966-1168

To: Lorelei Jones **Copy to:** File

From: Victoria Chapman

Date: November 1, 2021

Ref: Hanley Park Draft Plan Application – Flow Monitoring Review **File:** 18578-1

1.0 Background

Hanley Park Developments Inc. is proposing a Draft Plan of Subdivision to the east of Victoria Ave and Mercedes Drive in Belleville, Ontario, to be named Hanley Park North. The subject property is 35.2 hectares (ha) in size, of which 7.5 ha is developable. The current draft plan for the development has a total of 29 townhouse units and 74 single family units (**Figure 1**). The proposed development is separated into two development areas: an extension of Spruce Gardens and an extension of Tessa Boulevard, with the majority of the development extending from Tessa Boulevard.

The subject lands are not currently zoned for residential development. As such, they have not been incorporated into the City's master servicing plan for sanitary sewer allotment. The developers have therefore undertaken a flow monitoring program of the City's sanitary sewers downstream of the development, in order to determine actual flow usage and assess the available capacity for the proposed development. The purpose of this memo is to provide a review of the flow monitoring program results and the available capacity within the City's sanitary sewers downstream of the development site.

2.0 Existing Conditions

2.1 Mercedes Meadows Infrastructure

The development is proposed to connect to the eastern limits of Tessa Boulevard and Spruce Gardens within the recently constructed Mercedes Meadows subdivision (**Figure 1**). The sanitary sewers within the east end of Tessa Boulevard are 375mm diameter PVC. Immediately downstream of these sewers are 525mm diameter PVC sewers. The Tessa Boulevard sewers were sized to accommodate potential future development to the east of Mercedes Meadows. They are designed to accommodate 16.4 ha of development, assuming 50 people per hectare (i.e. population of 820 persons; **Appendix A**). The proposed Hanley Park North development east of Tessa Boulevard would have an estimated population of 277 people (2.5 people per townhouse unit, 3 people per single family unit). As such, the Tessa Boulevard sewers have sufficient capacity for Hanley Park North.

The Spruce Gardens sanitary sewers are 200mm diameter PVC. The sanitary sewer design incorporated lands to the east of Spruce Gardens, and allowed for a population of 160 persons (**Appendix A**). The proposed Hanley Park development shows only 6 single family units to the east of Spruce Gardens (i.e. 18 persons); the Spruce Gardens sewers therefore have sufficient capacity to support the proposed units.

2.2 City of Belleville Infrastructure

The Mercedes Meadows sanitary flows are conveyed to Haig Road sewers. The Haig Road flows are part of the Bayshore Trunk Sanitary Sewer catchment area (**Figure 2**). The sewers are 600mm diameter concrete and are designed for a peak flow of 178.04 L/s, as shown in the City's sanitary sewer design sheet (**Appendix A**). The sewers ultimately flow downstream to the Keegan Parkway sewers, which are 900mm diameter concrete and designed for a peak flow of 434.37 L/s.

2.3 Future Development within Catchment Area

The Bayshore Trunk Sanitary Sewer catchment area (**Figure 2**) shows areas that are not yet developed, but will be allowed to connect into the system as they have been allocated within the sewer system design. The build-out shown in **Figure 2** is from 2014 and is therefore partially dated. For example, the Mercedes Meadows subdivision is approximately 95% built-out as of the fall of 2019, and further development has proceeded in the Laird Drive area and Bell Creek residential subdivision.

The only major development that is allocated within the sewer system and not yet developed is the Hanley Park subdivision, which is draft approved for 280 units, and will connect to Bridge Street East and Victoria Ave. The subdivision will comprise approximately 33 hectares, with an estimated population of 840 persons. As such, the design flows anticipated from the draft approved Hanley Park subdivision are 22.3 L/s. Besides the Hanley Park development, the Bayshore Trunk Sewer catchment area appears to be 90% built out as of the fall of 2019.

3.0 Proposed Conditions

The Hanley Park North development plan proposes 6 new units (single family) to connect to the east end of Spruce Gardens, and 97 new units connect to the east end of Tessa Blvd (68 single family units and 29 townhouse units). The sanitary sewer flows that would be anticipated to be generated from this size of development is as follows:

1) 0.5 L/s peak flow to the east end of Spruce Gardens
2) 6.3 L/s peak flow to the east end of Tessa Boulevard.

Supporting calculations for the anticipated sanitary flows for Hanley Park North are included in **Appendix B**.

4.0 Monitoring Program

Flow monitoring was carried out by FlowMetrix Technical Services Inc. Monitors were installed on November 8, 2018 and removed January 16, 2019. The monitors were installed in two (2) sanitary manholes, at the following locations:

1) 665 Dundas Street East. This manhole is close to the Dundas Street East and Haig Road intersection. The sewer at this location is 600mm diameter concrete pipe.
2) Parking Lot at the end of Foster Ave, in south Foster Park. This manhole is within a pedestrian area. The sewer at this location is 900mm diameter concrete pipe.

The flow monitors collected data constantly for the nine weeks that they were installed. The data collected included flow (Q) in litres per section (l/s), depth (mm), and velocity (m/s). The full report prepared by FlowMetrix is provided in **Appendix C**. It describes the monitoring program and data collected in detail. **Tables 1** and **2** show the average flow, depth, and velocity collected during the monitoring period for each manhole.

Table 1: Dundas St E / Haig Road Manhole Data

Observed Flow Conditions			
	Depth (mm)	Velocity (m/s)	Flow (L/s)
Average	163	0.371	23.48
Minimum	129	0.241	11.34
Maximum	236	0.555	56.63

Table 2: Foster Park Manhole Data

Observed Flow Conditions			
	Depth (mm)	Velocity (m/s)	Flow (L/s)
Average	295	0.482	89.06
Minimum	190	0.168	27.62
Maximum	758	0.746	241.87

5.0 Results

As shown in **Tables 1** and **2**, the maximum flows observed throughout the monitoring period were 56.63 L/s for the Dundas St E / Haig manhole and 241.87 L/s for the Foster Park manhole. These values are significantly less than the peak flows that the sewers are designed for: 178.04 L/s and 434.37 L/s, respectively (**Appendix A**). Section 8.5.4 of the MOE Design Guidelines for Sewage Works (2008) states, “Wherever there are existing sewers and / or existing sewage treatment plants, the flow rates and sewage characteristics should be determined using real data”.

As outlined in Section 2.3 above, the entire catchment area for the Bayshore Trunk Sanitary Sewer has not yet been fully built-out. There are developments that will be allowed to connect to the sewers and these future flows need to be incorporated into this review. The largest area remaining to be built out is the future Hanley Park subdivision, with estimated flows of 22.3 L/s. To account for the remainder of other areas in the catchment to be built out, 10% of the peak design flow (i.e. 43.4 L/s) will be added to the review. Therefore, the flows anticipated from the remaining development to be built-out within the Bayshore Trunk catchment area are 65.7 L/s (i.e. 22.3 + 43.4 L/s).

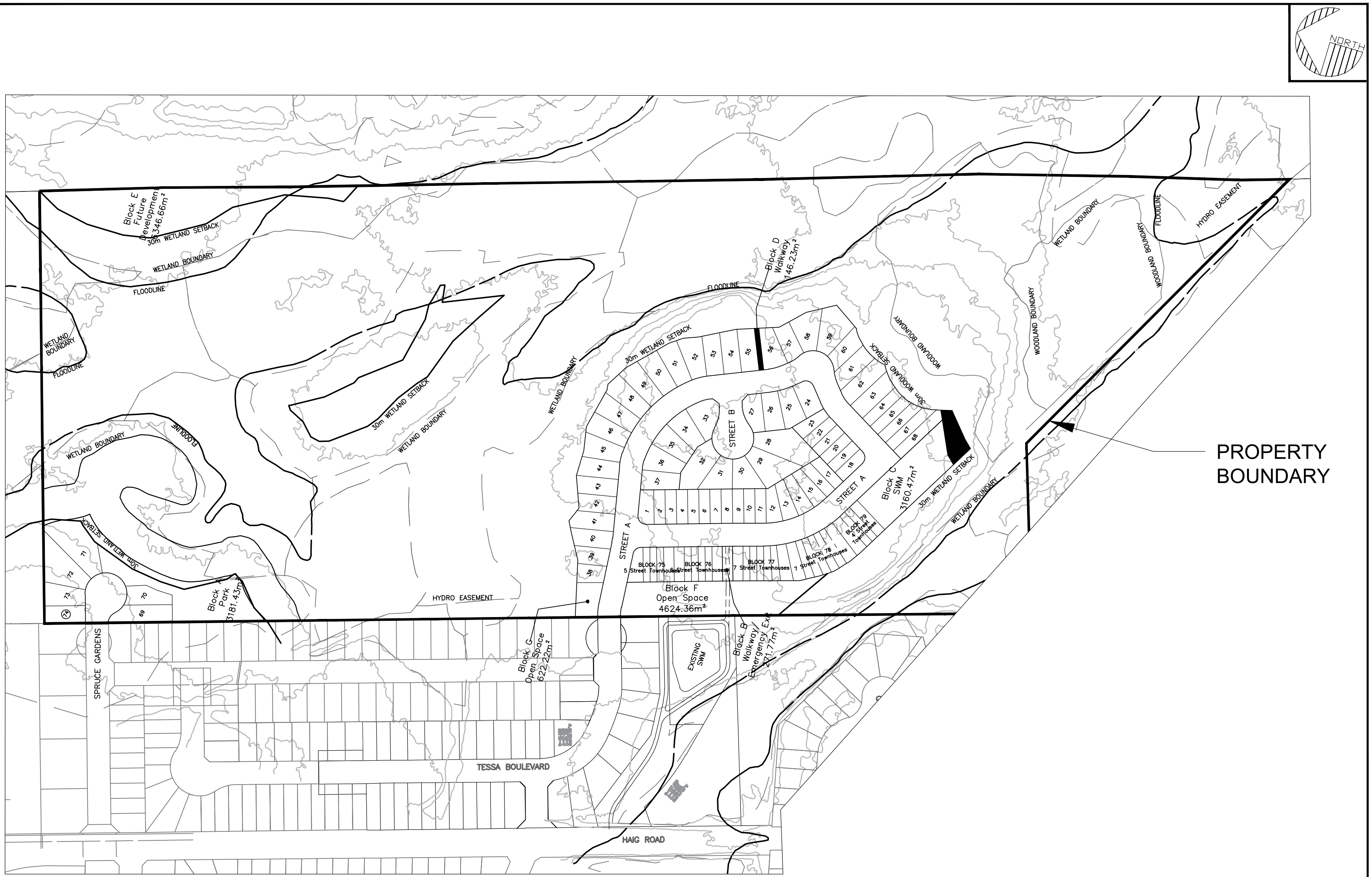
As outlined in Section 3.0 above, the sanitary sewer flows anticipated from the proposed Hanley Park North development are a total of 6.8 L/s. **Table 3** outlines the addition of flows anticipated from the remaining development to be constructed within the catchment area (65.7 L/s) and the anticipated peak flows from Hanley Park North to the maximum observed flows through the Dundas St E / Haig Road and Foster Park sewers.

Table 3: Comparison of Observed Flow to Design Flow

Manhole Monitoring Location	Flows Anticipated from Remaining Development within Bayshore Trunk Catchment (L/s)	Anticipated Hanley Park North Flow (L/s)	Maximum Observed Flows in Monitoring Program (L/s)	Total (L/s)	Original Sewer Design Flow (L/s)
Dundas St E / Haig Road	65.7	6.8	56.63	129.13	178.04
Foster Park	65.7	6.8	241.87	314.37	434.37

6.0 Conclusion

Table 3 shows that even with the addition of the anticipated flows from the Hanley Park North development, there should still be adequate capacity in the existing sewers, as the original design flows for the sewers far exceed the value of Observed Flows + Hanley Park Flows + Future Catchment Build Out Flows. Based on the above, the existing Mercedes Meadows, Haig Road, and Keegan Parkway infrastructure (Bayshore Trunk Sanitary Sewer Catchment Area) has capacity for the additional flows anticipated from the Hanley Park North development.



HANLEY PARK NORTH
CITY OF BELLEVILLE

FIGURE 1
DEVELOPMENT PLAN

Ainley GROUP
CONSULTING ENGINEERS PLANNERS

BAYSHORE TRUNK SANITARY SEWER

SEWER CATCHMENT AREA

CITY OF BELLEVILLE
ENGINEERING & DEVELOPMENT SERVICES DEPARTMENT
September, 2014

APPENDIX A

Existing Sanitary Design Information

LEGEND

- EXIST. PROPERTY LINE
- EXIST. ROAD SHOULDER
- EXISTING GRAVEL DRIVE
- EXISTING ASPHALT DRIVE
- EXISTING DITCH LINE
- PROPOSED LOT LINE
- PROPOSED TOWNHOUSE LOT LINE
- PROPOSED STOP SIGN & STREET NAME SIGNS
- PROPOSED LIGHT DUTY SILT FENCE
- PROPOSED CENTER LINE
- PROPOSED EDGE OF PAVEMENT
- PROPOSED EDGE CURB
- PROPOSED LIGHT STANDARD
- PROPOSED SIDEWALK
- FH PROPOSED FIRE HYDRANT
- 123.010 PROPOSED MIN. GROUND ELEV. AT YARD SETBACK
- CB1 PROPOSED CATCHBASIN
- SA#1 PROPOSED SAN. MAINTENANCE HOLE
- STM#1 PROPOSED STORM MAINTENANCE HOLE
- STM PROPOSED STORM SEWER
- SAN PROPOSED SANITARY SEWER
- WM PROPOSED WATERMAIN
- PROPOSED DRAINAGE ARROW
- SWALE (SEE DETAIL B OR C)
- PROPOSED CHAIN LINK FENCE
- PROPOSED ACOUSTIC FENCE

NO.	REVISIONS	DATE	INITIAL
5	REVISED PER CITY COMMENTS SEPT 19/2016	04/10/16	CRS
4	REVISED PER CITY COMMENTS AUG 5/2016 AND BELLEVILLE WATER COMMENTS AUG 26/16	15/09/16	CRS
3	REVISED PER CITY COMMENTS JULY 21/2016	02/08/16	CRS
2	REVISED PER CITY COMMENTS JULY 20/2016	20/07/16	CRS
1	PRELIMINARY DESIGN	12/07/16	CRS

Not Valid Unless Signed And Dated

SCALE: 1:1000
DESIGN: AW
DRAWN: CRS
CHECKED: AW
DATE: JULY 2016

MERCEDES MEADOWS HAIG ROAD SUBDIVISION
PHASE 3

SANITARY PLAN AND DRAINAGE AREAS

Ainley GROUP
CONSULTING ENGINEERS PLANNERS

CONTRACT No. 14526-2
DWG. 14526-SAN

Mercedes Meadows - Phases 3 and 4

Sanitary Design Sheet

Ainley Group — CONSULTING ENGINEERS PLANNERS

CITY OF BELLEVILLE

Project: **14526-2**

Revised: **July 13, 2016**

Prepared by: **CRS**

RATIONAL METHOD Qtotal = Qp + Qi

Where: Qp = peak population flow (L/s)
= PqM / 86.4 (L/s)
where M = Harmon's Peak Factor
Qi = peak extraneous flow (L/s)
= i * A (L/s)

HARMON FORMULA

$$M = 1 + \frac{14}{4 + \sqrt{P}}$$

where P population in 1000's

DESIGN ASSUMPTIONS

Design Flow Rates for area greater 50ha: 0.84 L/s/ha (incl. infiltration)
Residential Population : 3.00 Persons/unit (2.5 Persons/Unit - Townhouses)
Residential (q) : 350 Lpcd
Extraneous (i) : 0.28 L/s/ha
N-value = 0.013

LOCATION				DESIGN FLOWS									SEWER DATA						
				INDIVIDUAL			CUMULATIVE		PEAKING	FLOWS									
AREA #	STREET	FROM MH	TO MH	# of UNITS	POP (persons)	AREA (ha)	POP persons	AREA (ha)	FACTOR (M)	RES Qp (L/s)	EXTRAN Qi (L/s)	TOTAL Qt (L/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (L/s)	VELOCITY (m/s)	Q/Qcap %	Comments
203	North of Spruce Gardens		9			19.86		19.86		Assuming 1.05 L/s/ha		20.9	250	0.30	1.0	32.57	0.66	0.64	
103	Spruce Gardens	9	8	13	35	0.66	35	0.66	4.34	0.62	0.18	21.65	250	0.30	75.0	32.57	0.66	0.66	
102	Spruce Gardens	8	7	12	32	0.62	67	1.28	4.29	1.16	0.36	22.38	250	0.30	75.0	32.57	0.66	0.69	
202	East of Spruce Gardens/Cul De Sac		10	Assuming 50 p/ha		3.20	160	3.20	4.18	2.71	0.90	3.6	200	0.40	7.7	20.74	0.66	0.17	
101	Spruce Gardens	10	7	4	10	0.23	170	3.43	4.17	2.87	0.96	3.83	200	0.40	37.4	20.74	0.66	0.18	
104	Mercedes Drive	7	6	6	18	0.48	255	5.19	4.11	4.24	1.45	26.55	375	0.15	82.0	67.91	0.61	0.39	
105	Mercedes Drive	6	18	13	39	0.97	294	6.16	4.08	4.86	1.72	27.44	375	0.15	111.5	67.91	0.61	0.40	
106	Mercedes Drive	18	17	13	39	0.81	333	6.97	4.06	5.48	1.95	28.28	375	0.15	90.0	67.91	0.61	0.42	
107	Mercedes Drive	17	16	11	33	0.77	366	7.74	4.04	5.99	2.17	29.01	375	0.15	90.0	67.91	0.61	0.43	
108	Mercedes Drive	16	14	6	18	0.44	384	8.18	4.03	6.27	2.29	29.41	375	0.15	72.4	67.91	0.61	0.43	
201	East of Tessa Boulevard/Cul de Sac		15	Assuming 50 p/ha		16.40	820	16.40	3.85	12.80	4.59	17.4	375	0.15	5.5	67.91	0.61	0.26	
109	*Tessa Boulevard*	*15*	*14*	*3*	*9*	*0.23*	*829*	*16.63*	*3.85*	*12.93*	*4.66*	*17.59*	*375*	*0.15*	*37.0*	*67.91*	*0.61*	*0.26*	
110	*Tessa Boulevard*	*14*	*13*	*3*	*9*	*0.21*	*1222*	*25.02*	*3.74*	*18.52*	*7.01*	*46.38*	*525*	*0.10*	*30.0*	*136.00*	*0.63*	*0.34*	
111	*Tessa Boulevard*	*13*	*12*	*5*	*15*	*0.33*	*1237*	*25.35*	*3.74*	*18.73*	*7.10*	*46.68*	*525*	*0.10*	*40.0*	*136.00*	*0.63*	*0.34*	
112	*Tessa Boulevard*	*12*	*11*	*3*	*9*	*0.27*	*1246*	*25.62*	*3.74*	*18.86*	*7.17*	*46.89*	*525*	*0.10*	*28.0*	*136.00*	*0.63*	*0.34*	
113	*Tessa Boulevard*	*11*	*1*	*2*	*6*	*0.21*	*1252*	*25.83*	*3.73*	*18.94*	*7.23*	*47.03*	*525*	*0.10*	*24.6*	*136.00*	*0.63*	*0.35*	
117	Tessa Boulevard	5	4	9	27	0.54	27	0.54	4.36	0.48	0.15	0.63	200	0.70	52.3	27.44	0.87	0.02	Phase 2
116	Tessa Boulevard	4	3	17	51	1.12	78	1.66	4.27	1.35	0.46	1.81	200	0.40	118.4	20.74	0.66	0.09	Phase 2
115	*Tessa Boulevard*	*3*	*2*	*18*	*54*	*1.11*	*132*	*2.77*	*4.21*	*2.25*	*0.78*	*3.03*	*200*	*0.40*	*120.0*	*20.74*	*0.66*	*0.15*	
114	*Tessa Boulevard*	*2*	*1*	*8*	*24*	*0.57*	*156*	*3.34*	*4.19*	*2.64*	*0.94*	*3.58*	*200*	*0.40*	*60.3*	*20.74*	*0.66*	*0.17*	
All	Oak Ridge Boulevard	1	Ex				1408	29.17	3.70	21.10	8.17	50.12	525	0.10	65.3	136.00	0.63	0.37	

Sanitary Sewer Design Sheet

Project:

q = average daily per capita flow = 350L/cap/d
I = unit of peak extraneous flow = 0.28L/ha/s
M = peaking factor
Q(p) peak population flow (L/s)
Q(I) peak extraneous flow (L/s)
Q(d) peak design flow (L/s)
Use 2.5 people/Townhouse Unit or 3.0 people/Lot

Design By:
Checked By:
Date:
Sheet:

Industrial/Commercial Flow (ICF) = 1.05 L/ha/s including extraneous flow

M = 1+14/(4+P^1\2) where P= population in 1000s
Q(p) = P*q*M/86.4 (L/s)
Q(i/c) = IF*A (L/s) where A= Cumulative Industrial/Commercial area in hectares
Q(i) = I*A (L/s) where A= Cumulative Residential area in hectares
Q(d) = Q(p) + Q(i) + Q(i/c) (L/s)
Q_{Full} =Capacity = (1\n)*A*$R^{2/3}$*$S^{1\2}$
V_{Full} = Full Flow Velocity = (Q_{Full}/1000)/πr^2

Location (Street)	Area Labels	From MH	To MH	Residential Individual Pop	Residential Individual Area (ha)	Residential Cumulative Pop	Residential Cumulative Area (ha)	Peaking Factor (M)	Residential Population Flow Q(p) (L/s)	Residential Extraneous Flow Q(i)	Industrial Commercial Area (ha)	Cumulative Ind./Comm. Area (ha)	Industrial Commercial Flow Q(i/c) (L/s)	Peak Design Flow Q(d) (L/s)	SANITARY SEWER DATA: Pipe Diameter (mm)	Type of Pipe	Pipe Slope (%)	Pipe Length (m)	Capacity n= 0.013 (L/s)	Full Flow Velocity Vf (m/s)	Qa/Qf	Vp/Vf	Actual Velocity Vp (m/s)
From Haig/Dundas		31	30	5095	159.4	###	159.37	3.24	66.81	44.62	63.43	63.43	66.60	178.04	600		0.052	16	139.928	0.49	1.27	1.14	0.56
		30	29			###	159.37	3.24	66.81	44.62		63.43	66.60	178.04	600		0.34	74	357.801	1.27	0.50	0.995	1.26
		29	28			###	159.37	3.24	66.81	44.62		63.43	66.60	178.04	600		0.488	77	428.659	1.52	0.42	0.955	1.45
		28	27			###	159.37	3.24	66.81	44.62		63.43	66.60	178.04	600		1.128	93	651.713	2.30	0.27	0.86	1.98
		27	26			###	159.37	3.24	66.81	44.62		63.43	66.60	178.04	600		1.083	100	638.581	2.26	0.28	0.86	1.94
		26	25			###	159.37	3.24	66.81	44.62		63.43	66.60	178.04	600		1.155	94	659.467	2.33	0.27	0.86	2.01
		25	C			###	159.37	3.24	66.81	44.62		63.43	66.60	178.04	600		1.069	75	634.440	2.24	0.28	0.87	1.95
From Bradgate		C	24	1134	35.98	###	195.35	3.16	79.61	54.70	4.47	67.90	71.30	205.60	600		1.069	32	634.440	2.24	0.32	0.89	2.00
		24	23			###	195.35	3.16	79.61	54.70		67.90	71.30	205.60	600		1.266	122	690.429	2.44	0.30	0.875	2.14
From Bakelite (Osprey Sho		23	22			###	195.35	3.16	79.61	54.70	24.28	92.18	96.79	231.10	600		0.212	133	282.533	1.00	0.82	1.115	1.11
		22	21			###	195.35	3.16	79.61	54.70		92.18	96.79	231.10	600		0.144	57	232.854	0.82	0.99	1.14	0.94
From Farley		21	20	1808	46.61	###	241.96	3.05	99.24	67.75	16.82	109.00	114.45	281.44	900		0.053	103	416.558	0.65	0.68	1.07	0.70
		20	19			###	241.96	3.05	99.24	67.75		109.00	114.45	281.44	900		0.136	103	667.278	1.05	0.42	0.96	1.01
		19	18			###	241.96	3.05	99.24	67.75		109.00	114.45	281.44	900		0.095	109	557.698	0.88	0.50	1	0.88
		18	17			###	241.96	3.05	99.24	67.75		109.00	114.45	281.44	900		0.142	79	681.838	1.07	0.41	0.955	1.02
From Kennametal		17	16			###	241.96	3.05	99.24	67.75	7.83	116.83	122.67	289.66	900		0.145	86	689.003	1.08	0.42	0.96	1.04
		16	15			###	241.96	3.05	99.24	67.75		116.83	122.67	289.66	900		0.058	92	435.764	0.68	0.66	1.06	0.73
From Herchimer		15	14	927	35.46	###	277.42	3.00	108.99	77.68	10.30	127.13	133.49	320.15	900		0.046	97	388.075	0.61	0.82	1.115	0.68
		14	13			###	277.42	3.00	108.99	77.68		127.13	133.49	320.15	900		0.133	92	659.877	1.04	0.49	0.99	1.03
		13	12			###	277.42	3.00	108.99	77.68		127.13	133.49	320.15	900		0.119	114	624.181	0.98	0.51	1	0.98
From Pier 31		12	11	108	5.72	###	283.14	3.00	110.11	79.28	0.81	127.94	134.34	323.73	900		0.086	116	530.624	0.83	0.61	1.04	0.87
		11	10			###	283.14	3.00	110.11	79.28		127.94	134.34	323.73	900		0.092	99	548.822	0.86	0.59	1.03	0.89
		10	9			###	283.14	3.00	110.11	79.28		127.94	134.34	323.73	900		0.06	99	443.213	0.70	0.73	1.09	0.76
		9	8			###	283.14	3.00	110.11	79.28		127.94	134.34	323.73	900		0.1	99	572.186	0.90	0.57	1.02	0.92
		8	7			###	283.14	3.00	110.11	79.28		127.94	134.34	323.73	900		0.1	67	572.186	0.90	0.57	1.02	0.92
From MacDonald		7	6	4102	138.6	###	421.73	2.84	151.28	118.08	15.85	143.79	150.98	423.39	900		0.18	85	767.668	1.21	0.55	1.02	1.23
		6	5			###	421.73	2.84	151.28	118.08		143.79	150.98	420.34	900		0.1	39	572.186	0.90	0.73	1.09	0.98
		5	4			###	421.73	2.84	151.28	118.08		143.79	150.98	420.34	900		0.15	115	700.782	1.10	0.60	1.03	1.13
		4	3			###	421.73	2.84	151.28	118.08		143.79	150.98	420.34	900		0.15	124	700.782	1.10	0.60	1.03	1.13
rom Bioniche & S/A		3	2 (a)			###	421.73	2.84	151.28	118.08	12.71	156.50	164.33	433.69	900		0.19	78	788.704	1.24	0.55	1.01	1.25
		2 (a)	2			###	421.73	2.84	151.28	118.08		156.50	164.33	433.69	900		0.06	134	443.213	0.70	0.98	1.14	0.79
From Foster		2	1	36	1.19	###	422.92	2.83	151.63	118.42		156.50	164.33	434.37	900		0.14	42	677.020	1.06	0.64	1.05	1.12
		1	WWTP			###	422.92	2.83	151.63	118.42		156.50	164.33	434.37	900		0.14	133	677.020	1.06	0.64	1.05	1.12

APPENDIX B

Sanitary Design Flows – Hanley Park North

Hanley Park North

Sanitary Design Sheet

CITY OF BELLEVILLE

Project: 18578-1

Revised: November 2, 2021

Prepared by: VBC

RATIONAL METHOD Qtotal = Qp + Qi

Where: Qp = peak population flow (L/s)
= PqM / 86.4 (L/s)
where M = Harmon's Peak Factor
Qi = peak extraneous flow (L/s)
= i * A (L/s)

HARMON FORMULA

$$M = 1 + \frac{14}{4 + \sqrt{P}}$$

where P population in 1000's

DESIGN ASSUMPTIONS

Design Flow Rates for area greater 50ha: 0.84 L/s/ha (incl. infiltration)
Residential Population : 3.00 Persons/unit (2.5 Persons/Unit - Townhouses)
Residential (q) : 350 Lpcd
Extraneous (i) : 0.28 L/s/ha
N-value = 0.013

LOCATION				DESIGN FLOWS									SEWER DATA						
				INDIVIDUAL			CUMULATIVE		PEAKING	FLOWS									
AREA #	STREET	FROM MH	TO MH	# of UNITS	POP (persons)	AREA (ha)	POP persons	AREA (ha)	FACTOR (M)	RES Qp (L/s)	EXTRAN Qi (L/s)	TOTAL Qt (L/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (L/s)	VELOCITY (m/s)	Q/Qcap %	Comments
202	East of Spruce Gardens/Cul De Sac		10	6	18	0.63	18	0.63	4.39	0.32	0.18	0.5							
201	East of Tessa Boulevard/Cul de Sac		15	97	277	6.06	277	6.06	4.09	4.59	1.70	6.3							

APPENDIX C

FlowMetrix Monitoring Report

FLOWMETRIX
TECHNICAL SERVICES INC.

MERCEDES DR
SEWER FLOW MONITORING
FINAL REPORT

PREPARED FOR:

AINLEY GROUP

JANUARY 2019

LONDON | TORONTO | TRENTON

Ainley Group – Flow Monitoring Final Report
January 2019

Prepared by:

Flowmetrix Technical Services Inc.
15 Connie Crescent, Unit 5
Concord ON, L4K 1L3

www.flowmetrix.ca

Lawton McCracken, EIT
Project Manager

Jay Gong
Data Analyst

Jordan Minos, C.E.T.
Jr. Project Manager

Reviewed by:

Curtis King
Vice-President

15 Connie Cres Unit 5
Concord, ON L4K 1L3
www.flowmetrix.ca

January 24, 2019

Caitlin Sheahan, M.Sc., P.Eng.
Project Engineer
Ainley Group
45 South Front Street
Belleville, ON
K8N 2Y5

Dear Ms. Sheahan,

Flowmetrix is pleased to present the following data report for the Mercedes Dr flow monitoring project, which consisted of two (2) flow meters for a period of 2 months.

All data results are outlined in the report. If after review of the report there are any questions or concerns regarding the content, please let me know at your earliest convenience.

We thank you for the opportunity to provide our services.

Sincerely,

Lawton McCracken, EIT
Project Manager
lawton@flowmetrix.com

Contents

15 Connie Cres Unit 5
Concord, ON L4K 1L3
www.flowmetrix.ca

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Concord, ON L4K 1L3
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1. Introduction

Ainley Group (Ainley) retained Flowmetrix Technical Services Inc. (Flowmetrix) in October of 2018 to provide Real-Time Sewer Flow Monitoring services in two sanitary sewer maintenance holes. All data obtained from the monitors was available in near real-time on the FlowWorks remote Data Acquisition (RDA) platform.

The main objective of the flow monitoring program was the assessment, installation, maintenance and data acquisition of 2 flow monitoring locations for a duration of 2 months.

All data corrections were completed in-house by Flowmetrix staff. The correcting process involved weekly QA/QC, monthly correcting and any additional final correcting, if necessary. The built-in data correcting features in the RDA software gave analysts a variety of tools to correct raw data, so that the most accurate data is delivered.

2. Flow Monitoring

2.1 Site Location

The target manholes were located at the southern section of Haig Road and the western section of Keegan Parkway in Belleville, Ontario. The monitoring locations were 600mm and 900mm concrete sanitary inlet pipes.

2.2 Site Assessment

Ainley provided 2 site locations for assessment by Flowmetrix prior to the installation of the flow monitoring equipment. The sites were assessed based on hydraulic suitability and the condition of the infrastructure. Both locations were deemed suitable for flow monitoring.

2.3 Site Installation

The installations were completed on November 8, 2018 in the target location. Refer to Appendix A for Installation Reports.

3. Data Collection

3.1 Equipment Specifications

The ADS Triton+ monitor was selected for this project. This flow monitor is an area-velocity flow monitor that uses the Continuity equation to measure flow. The ADS Triton monitors consist of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor readings.

Figure 1 – ADS Triton Meter with Peak Combo Meter (shown below meter)

The Triton+ was paired with a Peak Combo Sensor, mounted at the invert of the pipe. The sensor includes three types of data acquisition technologies, as described below:

1. The up looking ultrasonic depth uses sound waves from two independent transceivers to measure the distance from the sensor upward toward the flow surface; applying the speed of sound in the water and the temperature measured by sensor to calculate depth.

2. The pressure depth is calculated by using a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube.

3. To obtain peak velocity, the sensor sends an ultrasonic signal at an angle upward through the widest cross-section of the oncoming flow. The signal is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity.

The flow meters were synchronized to ***Eastern Standard Time*** and programmed to collect depth and velocity data at five (5) minute intervals and transmit the data via cellular telemetry at 12 hour intervals to the Remote Data Acquisition (RDA) application currently implemented using FlowWorks web-hosting site (www.flowworks.com).

3.2 Field-Level Data QA/QC

Data collections were done remotely via telemetry, if available, otherwise manually collected data was transferred to the Data Analysis Team. During the monitoring period, field crews performed routine maintenance verifying proper monitor operation and documenting field conditions. Refer to Appendix B for the Confirmation Report.

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The following quality assurance steps are taken to assure the integrity of the collected data:

- Clock synchronization: Field crews synchronized monitor clocks to master clocks. **Please note all flow monitoring data is in Eastern Standard Time (EST).**

- Confirm depth and velocity readings: Field crews descended into meter manholes to manually measure depths and velocities and compare them to meter readings. If silt was present in the pipe invert, silt levels were measured.

- Confirm average velocities through cross-sectional velocity profiles: Since ADS velocity sensors measures peak velocity, field crews collected cross-sectional velocity profiles in order to develop a relationship between peak and average velocity to ensure that the hydraulic criteria were met.

- Upload and Review Data: Data collected from the monitor was uploaded and reviewed by a Data Analyst for completeness, outliers and deviations in the flow pattern, which indicate system anomalies or equipment failure.

3.3 Data Analyst-level Data QA/QC

Flowmetrix data analysts reviewed the data daily and the site was flagged for observations such as:

- No Telemetry Communication (i.e. no new data)
- Low Battery Voltage
- Depth Sensor Comparison
- Velocity Sensor Functionality
- Change in Typical Trend
- Response to Rain Events

Data analysts were responsible for issuing work orders if the site required service, or a regular maintenance call was required.

4. Data Analysis

Whether uploaded via telemetry, or manually, collected data was uploaded to the online RDA software. Data analysts had the ability to view the raw data collected by the meter and examine its integrity. Flowmetrix analysts were required to review both site verification records and comments provided during each visit. This technique would allow the analyst to identify any inconsistencies in the data collected by the monitor, and flag it for further investigation.

4.1 Data Quality

AA-Haig had good data quality for the duration of the monitoring period. The site experienced typical free-flow conditions.

AA-Keeg had good data quality for the majority of the monitoring period. There were minor periods of noise, likely caused by silt or pump action. The site experienced typical free-flow conditions with occasional periods of pump action.

4.2 Data Corrections

All data analysis and corrections were made in-house by Flowmetrix analysts. Both field confirmations and site comments were used when making corrections to the data.

4.2.1 Flow Quantification

The flow quantification method used strictly for this monitoring project was the Continuity Equation. There are two main equations used to calculate open channel flow, the Continuity Equation and Manning's Equation.

4.2.2.1 Continuity Equation

The Continuity Equation, which is considered most accurate, can be used if both depth of flow and velocity are available.

$$Q = A \times V$$

Where,

$Q =$ Flow (m^3/s)
$A =$ Cross-sectional Flow Area (m^2)
$V =$ Average Velocity (m/s)

4.3 Data Results

Data results are displayed with the exclusion of all zero (0) values. Zero (0) values in the data are a result of sensor ragging and equipment malfunctions. Average flow depth, velocity, and quantity data observed during the monitoring period of November 8, 2018 to January 16, 2018, are provided in the following table.

Table 1: AA-Haig Flow Data Results

Observed Flow Conditions			
Item	Depth (mm)	Velocity (m/s)	Quantity (l/s)
Average	163	0.371	23.48
Minimum	129	0.241	11.34
Maximum	236	0.555	56.63

Table 2: AA-Keeg Flow Data Results

Observed Flow Conditions			
Item	Depth (mm)	Velocity (m/s)	Quantity (l/s)
Average	295	0.482	89.06
Minimum	190	0.168	27.62
Maximum	758	0.746	241.87

5. Graphical Analysis

The following plots have been provided:

1. Monthly Hydrograph
    a. Flow
    b. Level
    c. Velocity

2. Scatter Graph (entire monitoring period)
    a. Level
    b. Velocity

The hydrographs and scatter graphs for all monitoring locations are available in Appendix C.

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Concord, ON L4K 1L3
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APPENDIX A

INSTALLATION REPORTS

FLOWMETRIX
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SITE INSTALLATION FORM

General Information

Project	Ainley-Mercedes Dr
Site Name	AA-Haig
Weather	Cloudy
Date / Time	2018-11-08 11:30
Crew	Jordan/Scott
Work Type	Installation
Task Status	Completed

Site Details

Address	665 Dundas St E
Closest Intersection	Dundas St E and Haig Rd.
Access Detail	Right shoulder beside hydrant on Dundas St
Traffic Control	Pedestrian Control Only
Atmospheric Hazard	none
MH Chamber Conditions	Good
Rim to Invert	2866

Pipe Details

Details	Outlet	Inlet 1	Inlet 2	Inlet 3 / Overflow
Flow Condition	Laminar	Laminar		
Pipe Height	600	600		
Pipe Width	600	600		
Pipe Shape	Circular	Circular		
Pipe Material	Concrete	Concrete		
Flow Depth		150		
Velocity		0.36		
Silt Depth	50	40		
Suitable	yes	yes		
Status	no	installed		

Velocity Verification

Time	Type	Manual	Peak	Surface
12:24:00 PM	Peak	0.35	0.38	
12:24:00 PM	Peak	0.33	0.38	
12:24:00 PM	Peak	0.36	0.38	

Velocity Profile

Time	Spot	Manual	Peak	Surface
12:22:00 PM	LC	0.33	0.39	
12:22:00 PM	RC	0.27	0.43	
12:22:00 PM	0.8	0.3	0.39	
	0.6			
12:22:00 PM	0.2	0.1	0.38	

Equipment Details

Meter Type / S/N	Triton+	40814
Sensor Type / S/N	Peak	29687
Physical Offset	70	
SIM #	*07375	
Firmware	6.15	

Depth Verification

Time	Manual	UpDepth	Pdepth	Sdepth
12:20:00 PM	151	155	154	
12:20:00 PM	152	155	154	
12:20:00 PM	154	155	154	

NOTES

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SITE INSTALLATION FORM

Site Vicinity	Chamber
	
Inlet	Outlet
	
Install	Meter
	
Extra A	Extra B

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SITE INSTALLATION FORM

General Information

Project	Ainley-Mercedes Dr. (Belleville)
Site Name	AA-Keeg
Weather	Cloudy
Date / Time	2018-11-08 9:34
Crew	Jordan/Scott
Work Type	Installation
Task Status	Completed

Site Details

Address	South Foster Park
Closest Intersection	Foster Ave. and Wills St.
Access Detail	In parking lot at end of Foster Ave.
Traffic Control	Pedestrian Control Only
Atmospheric Hazard	None
MH Chamber Conditions	Good
Rim to Invert	3839

Pipe Details

Details	Outlet	Inlet 1	Inlet 2	Inlet 3 / Overflow
Flow Condition	Laminar	Laminar		
Pipe Height	900	900		
Pipe Width	900	900		
Pipe Shape	Circular	Circular		
Pipe Material	Concrete	Concrete		
Flow Depth		250		
Velocity		0.56		
Silt Depth	0	0		
Suitable	Yes	Yes		
Status	No	Installed		

Velocity Verification

Time	Type	Manual	Peak	Surface
10:46:00 AM	Peak	0.55	0.56	
10:46:00 AM	Peak	0.58	0.56	
10:46:00 AM	Peak	0.56	0.56	

Velocity Profile

Time	Spot	Manual	Peak	Surface
10:45:00 AM	LC	0.4	0.55	
10:45:00 AM	RC	0.44	0.56	
10:45:00 AM	0.8	0.58	0.56	
10:45:00 AM	0.6	0.44	0.56	
10:45:00 AM	0.2	0.35	0.57	

Equipment Details

Meter Type / S/N	Triton+	40927
Sensor Type / S/N	Peak	11222
Physical Offset	0	
SIM #	*14699	
Firmware	6.15	

Depth Verification

Time	Manual	Updepth	Pdepth	Sdepth
10:44:00 AM	250	249	251	
10:44:00 AM	252	249	251	
10:44:00 AM	250	249	251	

NOTES

Battery 10.8V

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SITE INSTALLATION FORM

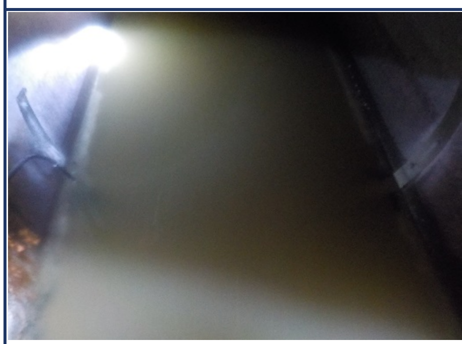
Site Vicinity

Chamber

Inlet

Outlet

Install



Meter

Extra A

Extra B

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APPENDIX B

CONFIRMATION REPORTS

FLOWMETRIX
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CONFIRMATION REPORTS

Site ID	Work Type	Date	Status	Time	Level Verifications		Velocity Verifications		Comments
					Manual	Depth	Manual	Peak	
AA-Haig	Installation	2018-11-08	Completed	12:20	152	155	0.35	0.38	
	Maintenance	2018-11-27	Completed	10:37	248	234	0.5	0.58	
	Maintenance	2018-12-11	Completed	10:23	163	168	0.34	0.39	
	Maintenance	2018-12-20	Completed	10:22	150	154	0.32	0.41	
	Removal	2019-01-17	Completed	12:25	141	147	0.33	0.39	

Site ID	Work Type	Date	Status	Time	Level Verifications		Velocity Verifications		Comments
					Manual	Depth	Manual	Peak	
AA-Keeg	Installation	2018-11-08	Completed	10:44	250	249	0.56	0.56	
	Maintenance	2018-11-27	Completed	10:15	479	480	0.68	0.64	
	Maintenance	2018-12-11	Completed	9:59	286	285	0.53	0.49	
	Maintenance	2018-12-20	Completed	10:01	281	273	0.46	0.45	
	Removal	2019-01-17	Completed	11:28	286	290	0.44	0.42	

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APPENDIX C

HYDROGRAPHS & SCATTER GRAPHS

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AA-HAIG

HYDROGRAPHS & SCATTER GRAPH

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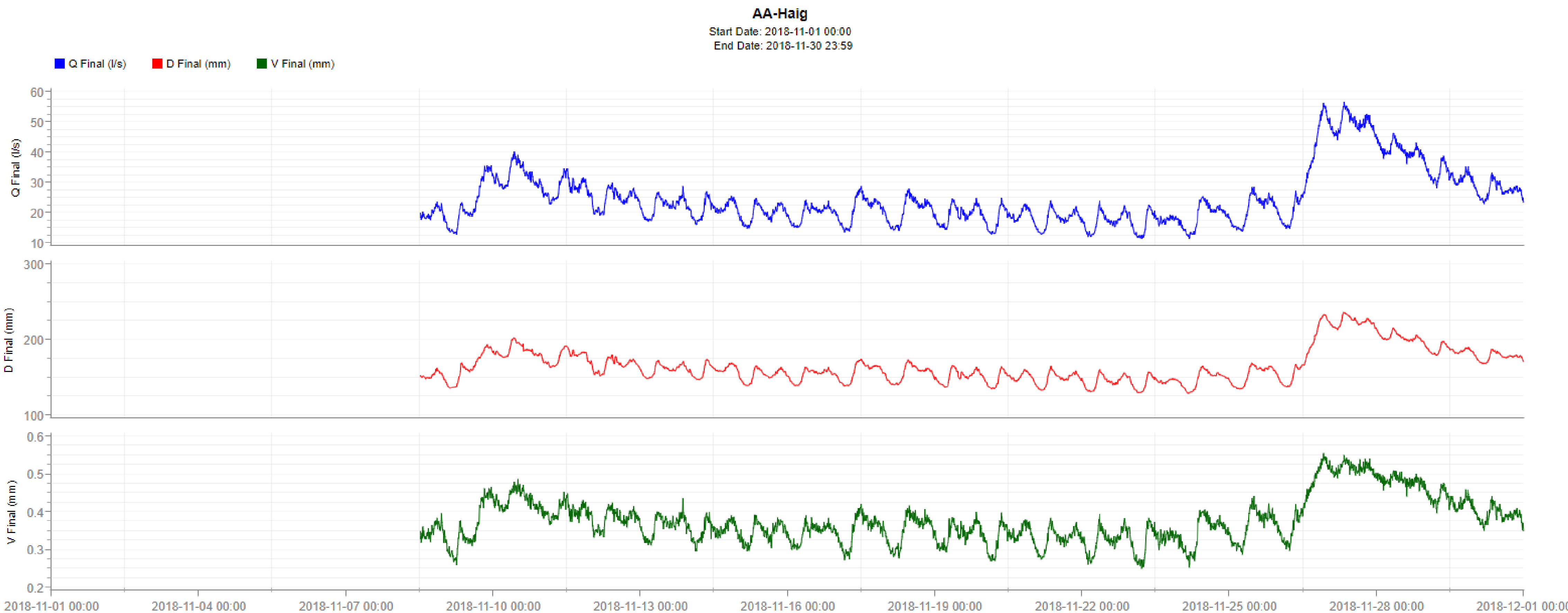

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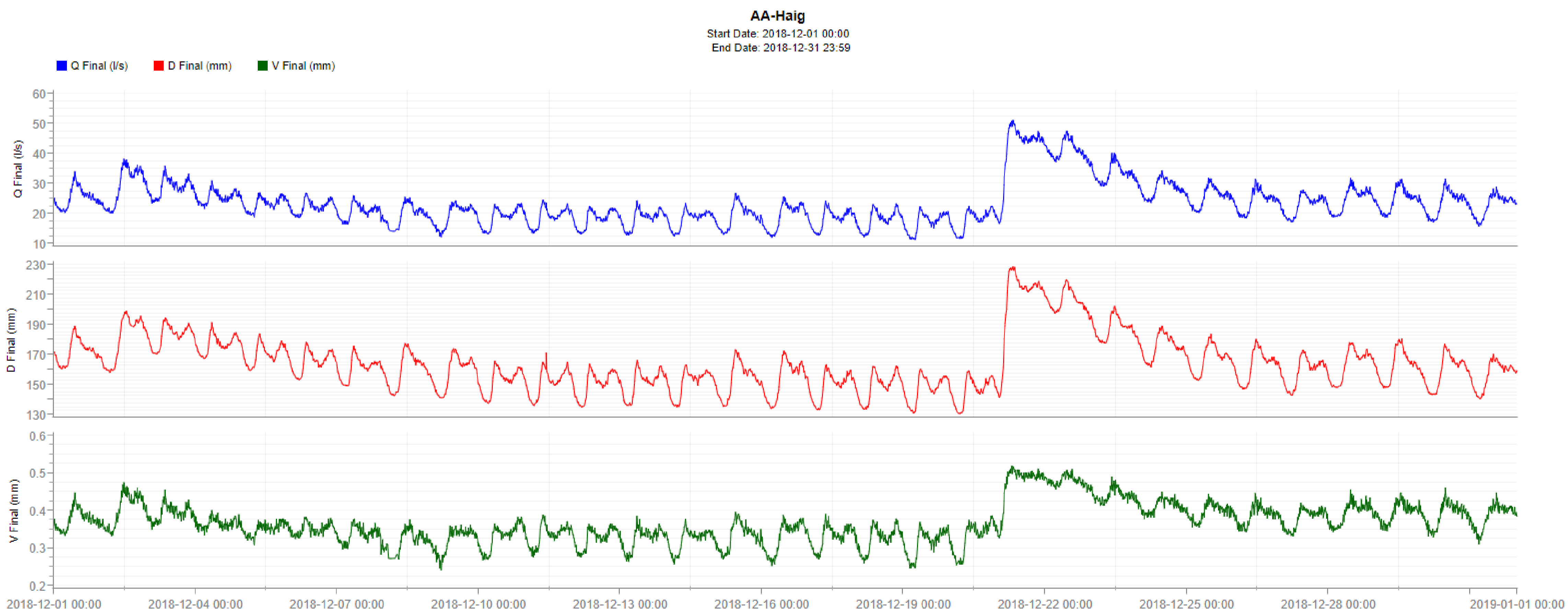

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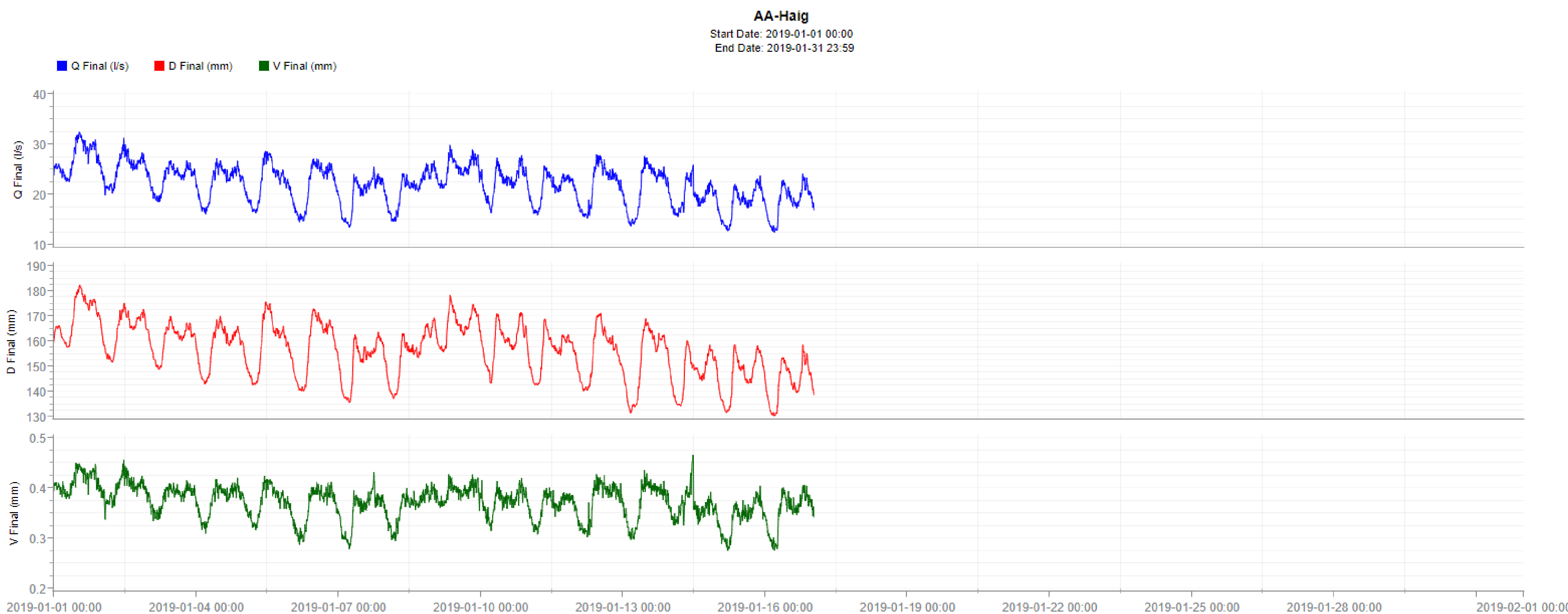

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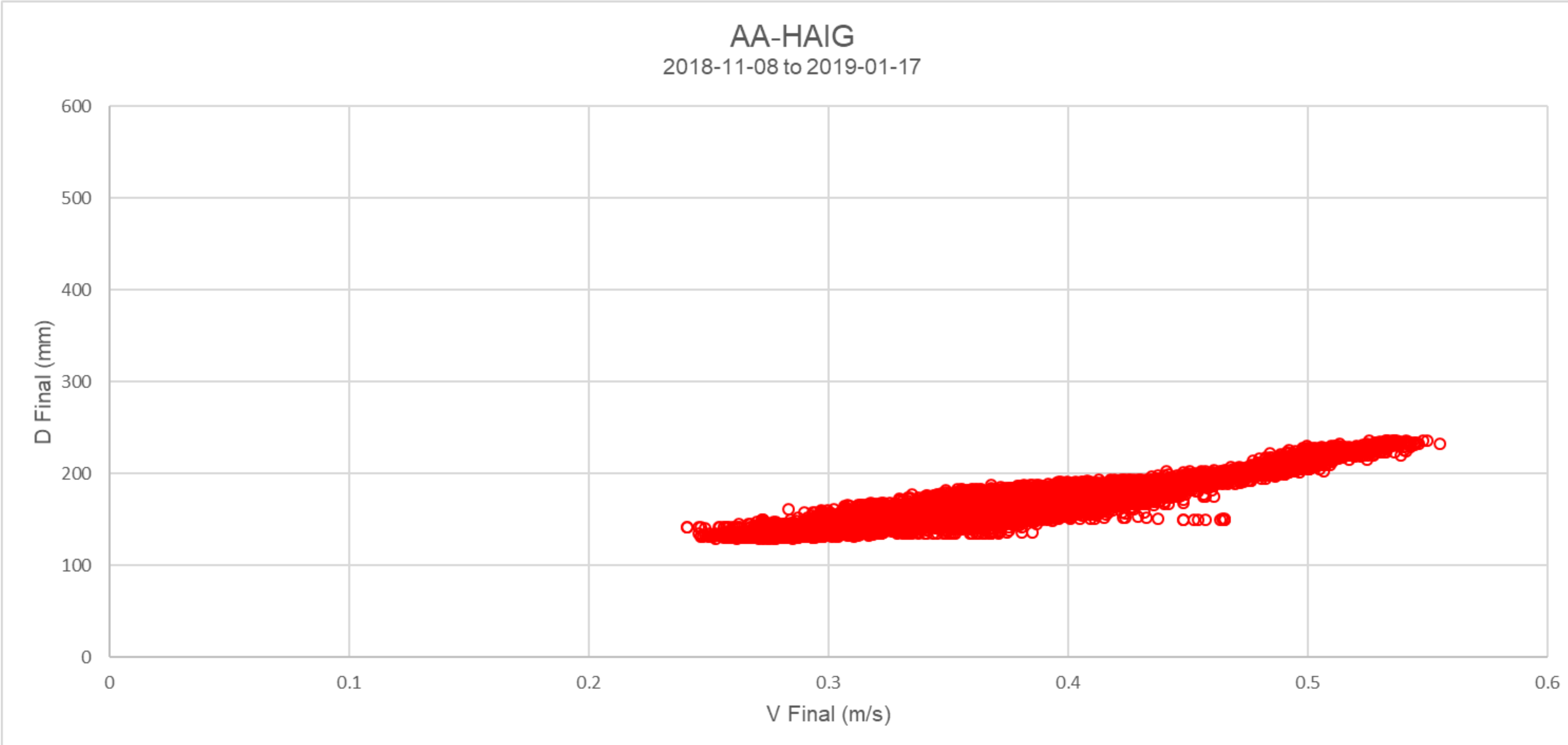

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AA-KEEG

HYDROGRAPHS & SCATTER GRAPH

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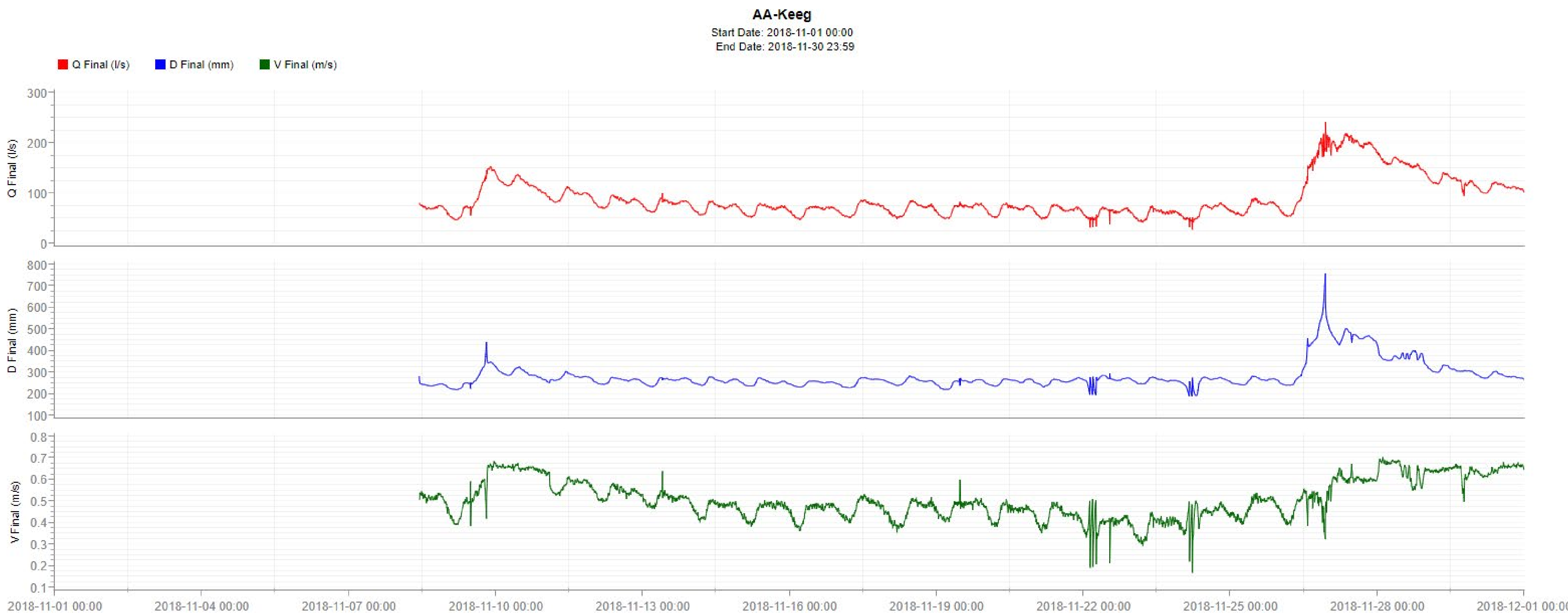

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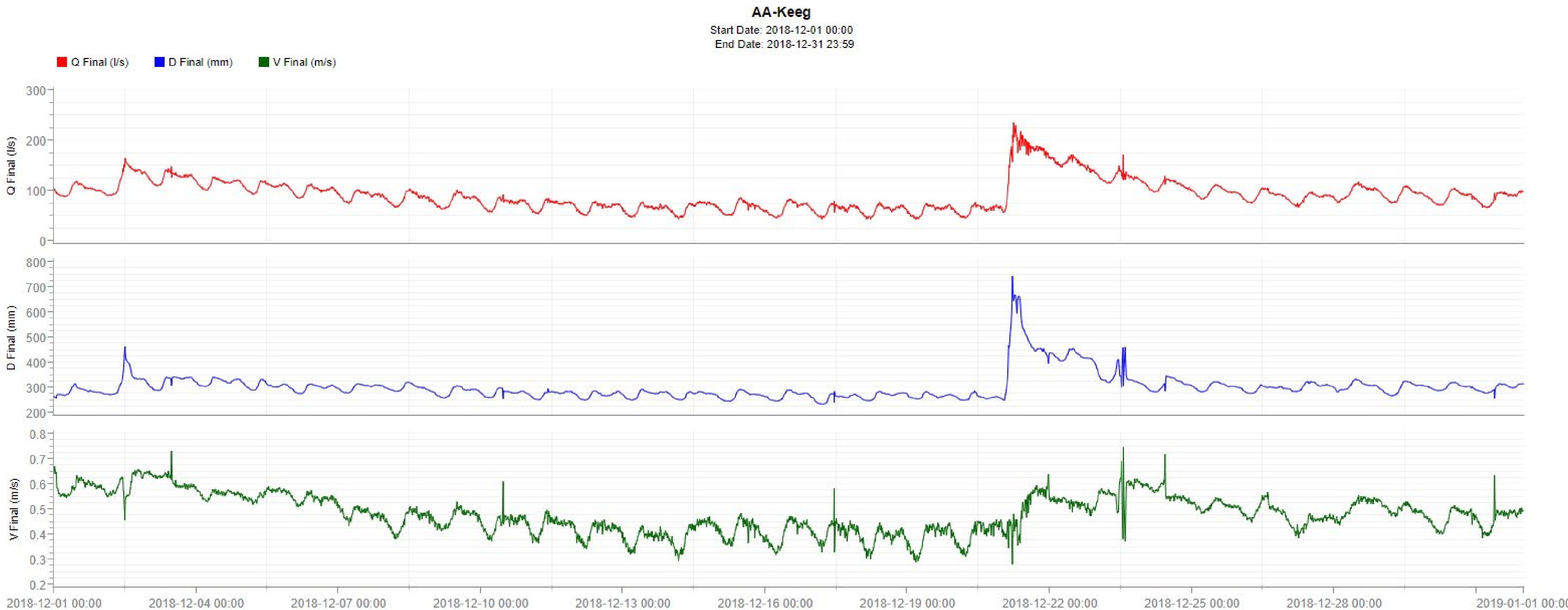

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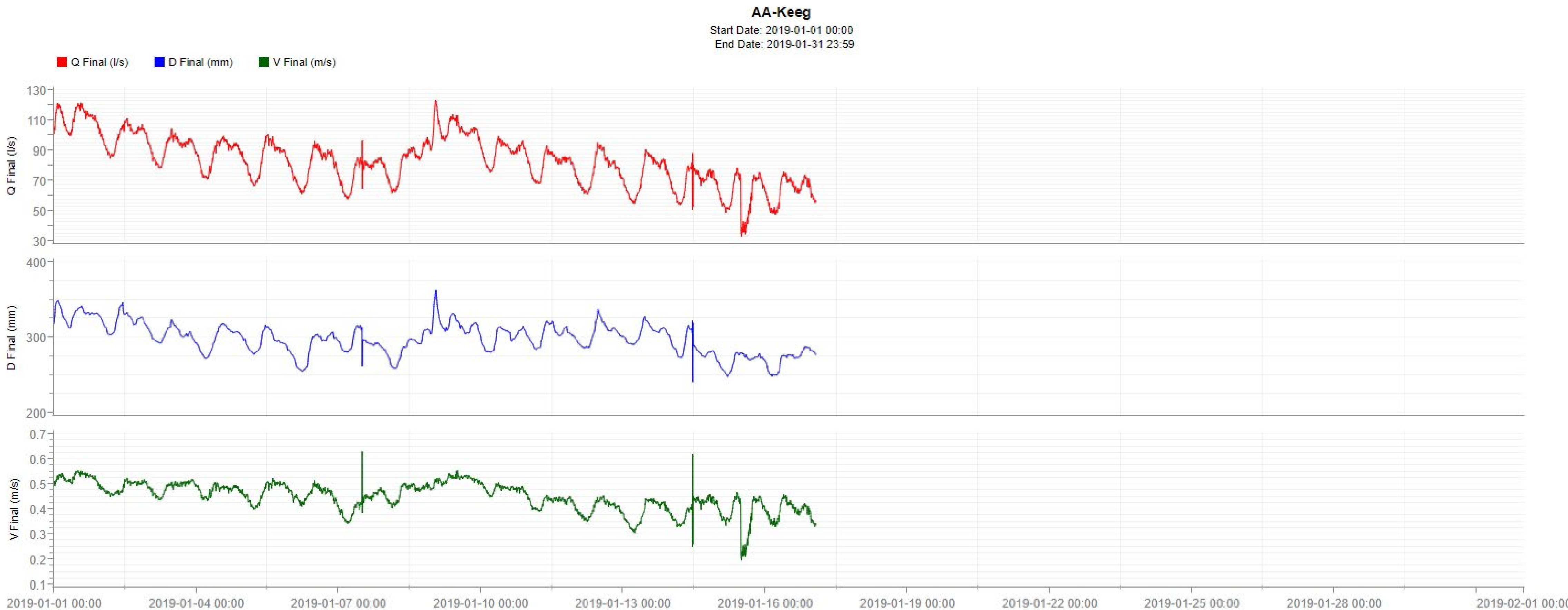

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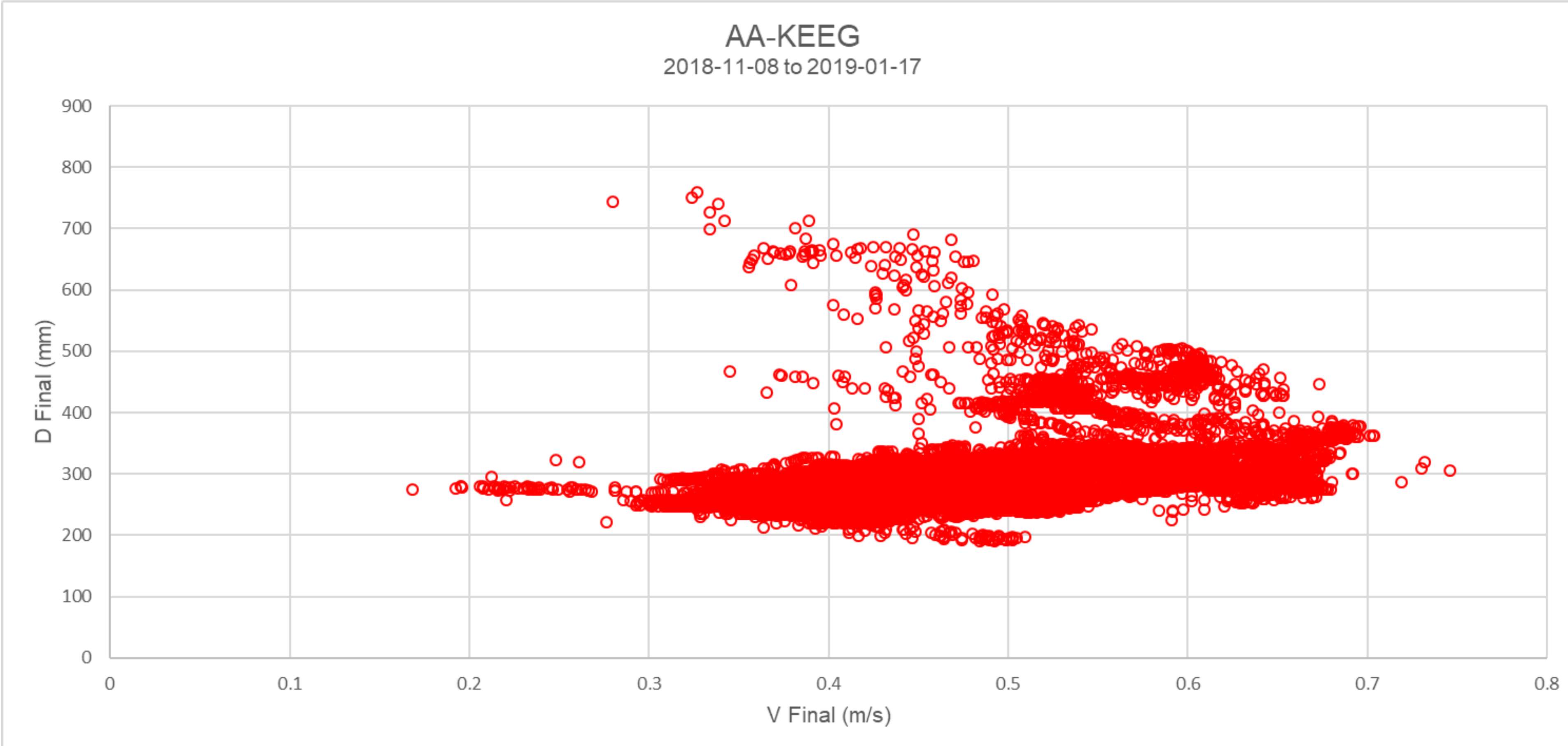

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15 Connie Cres, Unit 5
Concord, ON, L4K 1L3