Hydraulic Flow Rates for Sump and Flow By Conditions for Edmonton and Northern Alberta Catch Basin Grates

Trojan Industries Inc.

January 2014

Comments January 2014

This is a first draft copy of theoretical hydraulic flow rates for Trojan's set of catch basin grates. These values have not been verified. Please let us know if there are any apparent errors or omissions. These values are theoretical values that have been calculated using the methods from HEC 22. Where possible, these values have been compared with those derived by others. Please note that the values referenced to Calgary Stantec (1996) were taken from the City of Calgary Design Standards as posted on the City of Calgary website in 2013. Values attributed to Wilson (1983) are from his thesis, "Capacities of Catch Basin Inlets Based on Use in Alberta". Values attributed to Townsend and Moss (1980) were measured from a model study.

These values are given with and without a safety factor (SF) so that the design engineer can choose when and how to include this and/or any other safety factor. The safety factor used herein is 0.5 * the intercepted flow rate. The safety factor is intended to allow for some trash clogging but does not preclude the need for catch basin maintenance. It should be emphasized that when flat grates (without side inlets) such as the K-3 or TF-51 (without side inlet) are prone to clogging and should not be used in sump locations without an additional safety factor.

These values are provided for the purpose of assisting in the selection of an appropriate style and number of grates. Each municipality has their own preferred styles of grates. Some grates have fallen out of favour such as the TF-33, the TF-35 and the K-2. Many of the grates have additional options such as two piece side inlets or locking grates. Some municipalities require "logo" frame and grates which carry the name of the municipality. It is essential to check the design standards for the municipality for which the design is being done to ensure the correct styles and options are chosen.

The selection of the concrete slab used on the top of the concrete catch basin depends on which frame and grate is selected. The TF-51 (with side inlet) goes on a sloped slab whereas the TF-51 without side inlet goes on a flat slab (K-3). Furthermore, northern and southern Alberta use different concrete slabs so it is important to select a frame and grate that is appropriate to the region of interest.

Finally, there are various naming systems used across the province. Some names are ambiguous such as the TF-51 which can be the name of the frame and grate with or without the side inlet. Some frame and grates such as the K-7 come in either a single or, more commonly, a double which should be clarified in the design. A double consists of a double frame with two grates that goes on one concrete catch basin.

When in doubt, give us a call! Take the time to do it right and avoid a Change Order later!

Trojan Edmonton 780 474 1478

Trojan Calgary 403 269 6525

www.trojanindustries.com

An Engineer's Guide to Specifiying Manhole Covers, Grates and Frames for Northern Alberta

(including the greater Edmonton area and north but not including the City of Edmonton) *October 2013*

Manhole Covers (& Frames)			
TF-39 cover diam 565mm	standard	can get locking with cam lock	fits on slab top
	standard	can get locking with bar lock	
	standard	can get low profile frame	
	standard	can get 1 or 4 vent holes	
	standard	can get labeled sewer, water, storm, sanitary	
	standard	can get logo for larger communities	
TF-80 diam 643mm	floating cover (& frame)	can get logo for larger communities	fits on slab top
TF-90 diam 658mm	floating cover (& frame)	sealed to prevent infiltration (gasket)	fits on slab top
TF-41 diam 918mm	large cover	can get labeled water	fits on 1200mm slab top w 900mm opening

Curb and Gutter Grates (& Frames)			
TF-51A (T-K1A)*	two piece side inlet to facilitate side grate replacement		slots are diagonal
	grate is flat & rectangular	fits on tee top on min 900mm barrel	
TF-51 (TK-1)*	one piece side inlet	fits on tee top on min 900mm barrel	slots are diagonal
	grate is flat & rectangular	can get low profile frame	
TF-33	rolled faced curb	fits on slab top	frame diam 736mm
TF-35	round faced curb	fits on slab top	frame diam 736mm
TF-36	small & straight curb	fits on slab top	frame diam 736mm
	one or two piece grate option		
TF-36A	large and straight curb	fits on slab top	frame diam 842mm
	two piece grate		

* specify 'with curb inlet' to ensure inclusion of curb inlet

Just Gutter Grates (& Frames)			
TF-51 (T-K1)**	flat	can get locking	fits on K-3 top min 900mm barrel
T-K7 or SK7	rolled faced		fits on K-7 top on min 600mm barrel
DK7	double frame with 2 grates of SK7		fits on DK-7 top on min 900mm barrel

** specify 'without curb inlet' to avoid getting curb inlet

Circular Grates (& Frames)

TF-39	standard circular grate (domed)	slab top	
	cover diam 565mm		
TF-38	lane paving (V-top)	slab top	
TF-80 (Leduc)	floating cover (& frame)	cover diam 643mm	fits on 900mm slab tops

Specialty Grates

TF-39 standard trashguard
TF-39 short trashguard

Ductile iron is used for thinner or larger parts and parts at risk of damage by snowplows (side inlets) The following items are made with ductile iron: TF-36 & 36A top grate insert, TF-80 & 90 cover & grate, TK-7 grate, & TF-51 inlet & road grate			
standards of cast iron	good	better	best (AASHTO M-306)
gray iron is ASTM A48	CL20B	CL25B or 30B	CL35B
ductile iron is ASTM A536	GR 60-40-18	GR 65-45-12	GR 80-55-06
For example, most northern Alberta communities specify ASTM A48 CL20B for gray iron and ASTM A536 CL 60-40-18 for ductile.			

Always check the specifications for the municipality for which the drainage is being designed.
Drawings for these and other municipal castings are available on our website: www.trojanindustries.com
Save time and money by calling TROJAN Edmonton (1 800 272 5662 or 780 474 1478) if municipal specs differ from this chart.

TROJAN INDUSTRIES

An Engineer's Guide to Specifiying Manhole Covers, Grates and Frames for City of Edmonton

The City of Edmonton is using the AASHTO M-306 specifications and all frames, covers, and grates are undipped. *October 2013*

Manhole Covers (& Frames)			
TF-39	No. 6	just frame	can get low profile frame
	No. 6A	just cover	can get locking with bar lock
	cover diam 565mm	fits on 900mm slab tops	can get labeled water
TF-80	TYPE 80	floating frame (DI) and cover (DI)	
	cover diam 643mm	fits on 900mm slab tops	can get labeled epcor water
TF-90	TYPE 90	floating frame (DI) and cover (DI)	
	cover diam 658mm	fits on 900mm slab tops	sealed to prevent infiltration (gasket)
TF-41	TYPE 41	frame and grate	can get labeled water
	cover diam 918mm	fits on 1200mm slab tops w 910mm opening	
PM-A	cover diam 805mm	epcor power and water covers	

For access MH deeper than 40 feet or sewers 1200mm diam, must use slab top with 900mm opening with frames and covers min diameter 900mm *i.e.* TF-41.

Curb and Gutter Grates (& Frames)			
TF-51	F-51 (rect & flat)	frame, grate, side inlet and side inlet grate	fits on Tee Top
	No. 17	TF-51 just frame	for capacities greater than that of TF-51 without curb inlet
	No. 18	TF-51 just grate (DI)	grate is flat & rectangular
	No. 19	TF-51 just side inlet back	fits on 900mm tee top
	No. 20	TF-51 just side inlet insert (DI)	
	N.B. specify 'with curb inlet' to ensure inclusion of curb inlet		
TF-36	No. 2A	frame	fits on 600, 750 or 900mm slab top CB only
	frame diam 736mm	grate and side inlet (DI)	
TF-36A	No. 4A	frame and grate	fits on 1200mm slab top (635 opening) CBMH only
	frame diam 842mm	grate and side inlet (DI)	conical tops w 635mm opening preferred
Just Gutter Grates (& Frames)			
TF-51/ TK-1	No. 17	TF-51 just frame	fits on K-3 top | grate is flat & rectangular
	No. 18	TF-51 just grate (DI)	for capacities greater than that of TF-36/2A or no curb
	N.B. specify 'without curb inlet' to avoid getting curb inlet		fits on 900mm tee top
TK-7/ SK-7	K-7 (rect & sloped)	frame and grate (DI)	current preferred inlet for residential areas
	K-7	single frame and grate (DI)	fits on K-7 top on min 600 barrel
DK-7	K-7	double frame and grate (DI)	fits on DK-7 top on min 900 barrel

Circular Grates (& Frames)			
TF-39	No. 6	just frame	for off roadway locations or temporary inlets
	No. 6B	just grate domed	fits on slab tops min 600 barrel
	No. 6C	just grate flat	fits on slab tops min 600 barrel
TF-38	No. 8	frame and grate (V-top)	fits on slab tops min 600 barrel

Specialty Grates
TF-39 standard trashguard
TF-39 short trashguard

Ductile iron is used for thinner or larger parts and parts at risk of damage by snowplows (side inlets).
The following items are made with ductile iron:
TF-36 top grate insert, TF-36A top grate insert, TF-80 & TF-90 frame & cover, TK-7 grate, and TF-51 inlet & road grate
The AASHTO M-306 standard for ductile iron is ASTM A536 GR 80-55-06.
The AASHTO M-306 standard for grey iron is ASTM A48 CL 35B.

Save time and money by calling TROJAN Edmonton with questions about these and other products or visit our website at www.trojanindustries.com

January 2014

AASHTO M 306 Standard Specification for Drainage, Sewer, Utility, and Related Castings

What is AASHTO M-306 Standard Specification for Drainage, Sewer, Utility, and Related Castings? How is this different from H-20 and HS-20?

H 20 and HS20 are AASHTO standards from 1944 which were originally intended for bridge and road loading. They detail a representative truck having axles of a particular axle load and location that would represent most of the trucks that the road or bridge would be subjected to. The H 20 truck is represented as having a front axle of 8000 lbs (35.6 kN) while the rear axle is 32,000 lbs (142.3 kN). The HS20 allows for an additional rear axle of 32,000 lbs (142.3 kN). While this standard does not address municipal castings *per se*, the general application of this standard to castings has been that if the casting can bear the 16,000 lbs (71.2 kN) which is the equivalent of one wheel load (one half of the axle) of a 32,000 lb axle, the casting is considered to meet the equivalent of the H 20 or HS20 standard.

Using this type of standard for municipal castings has many issues including:

What is an appropriate area over which to apply the load? For how long? How should the per axle load be divided? Does a 'wheel' include both of the dual wheels? What about super singles? Is a safety factor included or should one be added? What about materials standards? Manufacturing quality? Inspection and certification?

In Canada, a similar problem has developed with engineers trying to use a bridge/road standard (CL-W) to specify municipal castings. The CL-W standard does not specifically address municipal castings. Again, it does not answer the above questions.

The AASHTO system has since introduced the M-306 standard to address these issues.

Issues addressed in the M-306 standard that are not addressed in either the H 20/HS20 system or the CL-W system:

- Loading details are specified: A 178 kN load is applied to an area 229 mm by 229 mm at a constant rate between 45 kg/sec and 454 kg/sec. The load is held for 1 minute. The testing machine must be NIST compliant. To pass this test, there can be no cracks and any deformation must be less than 3.2mm.
- The material is specified: ASTM A 48 Class 35B for gray cast iron and ASTM A 536 Grade 80-55-06.
- Quality of manufacture is specified.
- Inspection and Certification is required.
- A safety factor of 2.5 times is used.

Why isn't ASTM A48 or ASTM A536 designation enough without M 306?

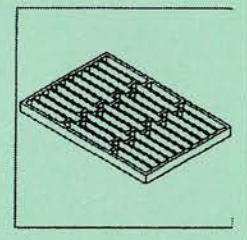
The traditional load tests done on test rods for the cast iron and ductile iron in ASTM A48 and A536 only measure the strength of the iron without considering the shape of the final casting. It is possible for a casting to fail the proof load test (due to poor design in shape) while passing the strength requirements for the material itself.

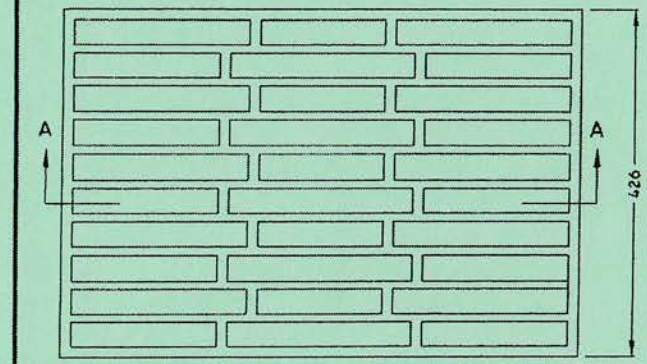
N.B. In 2012, the City of Edmonton switched to a modified form of the M-306 standard.

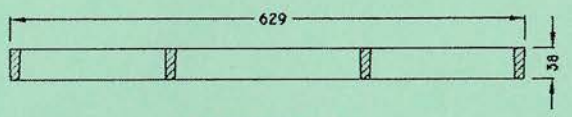
STANDARD GRATE

T-KI

PLAN







SECTION A-A

CITY OF EDMONTON

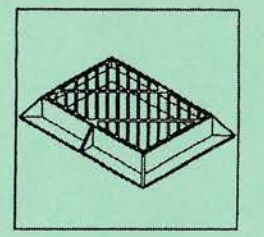
ISO 9001-2000 CERTIFIED | RATED FOR HS-20 LIVE LOAD | MEASUREMENTS IN MILLIMETERS

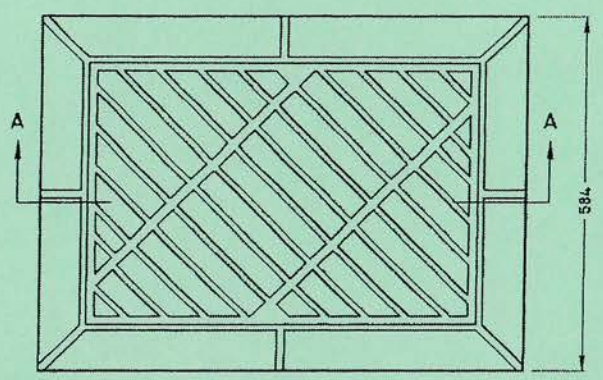
TROJAN INDUSTRIES INC.
CALGARY • EDMONTON, ALBERTA

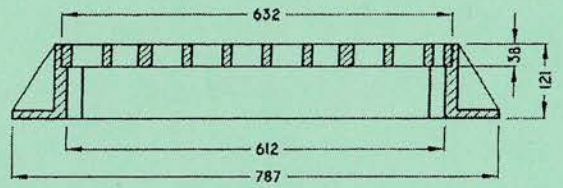
FRAME AND GRATE

K-I/TF-5I

PLAN







SECTION A-A

ALL MUNICIPALITIES EXCEPT FOR THE CITY OF EDMONTON

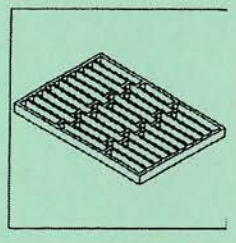
ISO 9001-2000 CERTIFIED | RATED FOR HS-20 LIVE LOAD | MEASUREMENTS IN MILLIMETERS

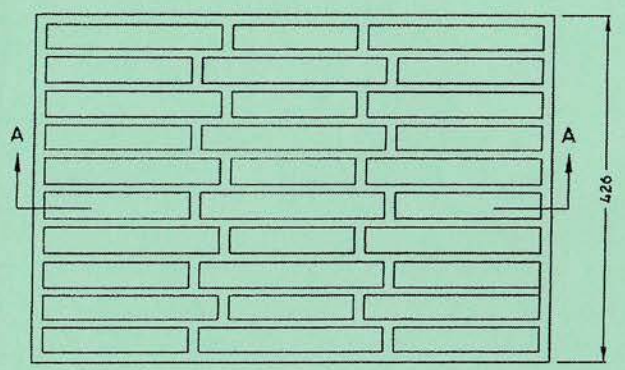
TROJAN INDUSTRIES INC.
CALGARY • EDMONTON, ALBERTA

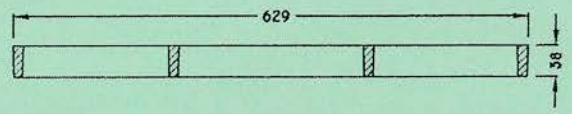
STANDARD GRATE

T-K1

PLAN







SECTION A-A

CITY OF EDMONTON

ISO 9001-2000 CERTIFIED | RATED FOR HS-20 LIVE LOAD | MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.
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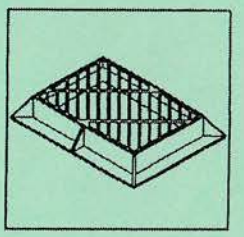
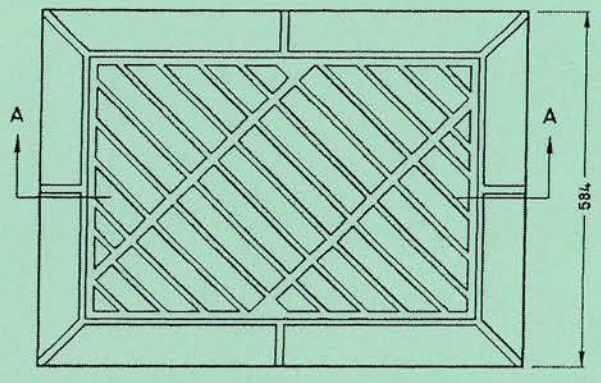
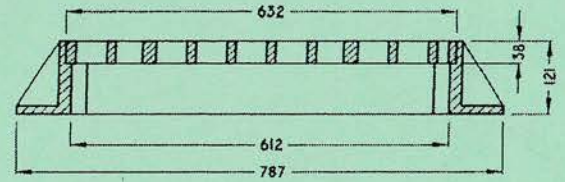
FRAME AND GRATE

K-1/TF-51

PLAN







SECTION A-A

ALL MUNICIPALITIES EXCEPT FOR THE CITY OF EDMONTON

ISO 9001-2000 CERTIFIED | RATED FOR HS-20 LIVE LOAD | MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.
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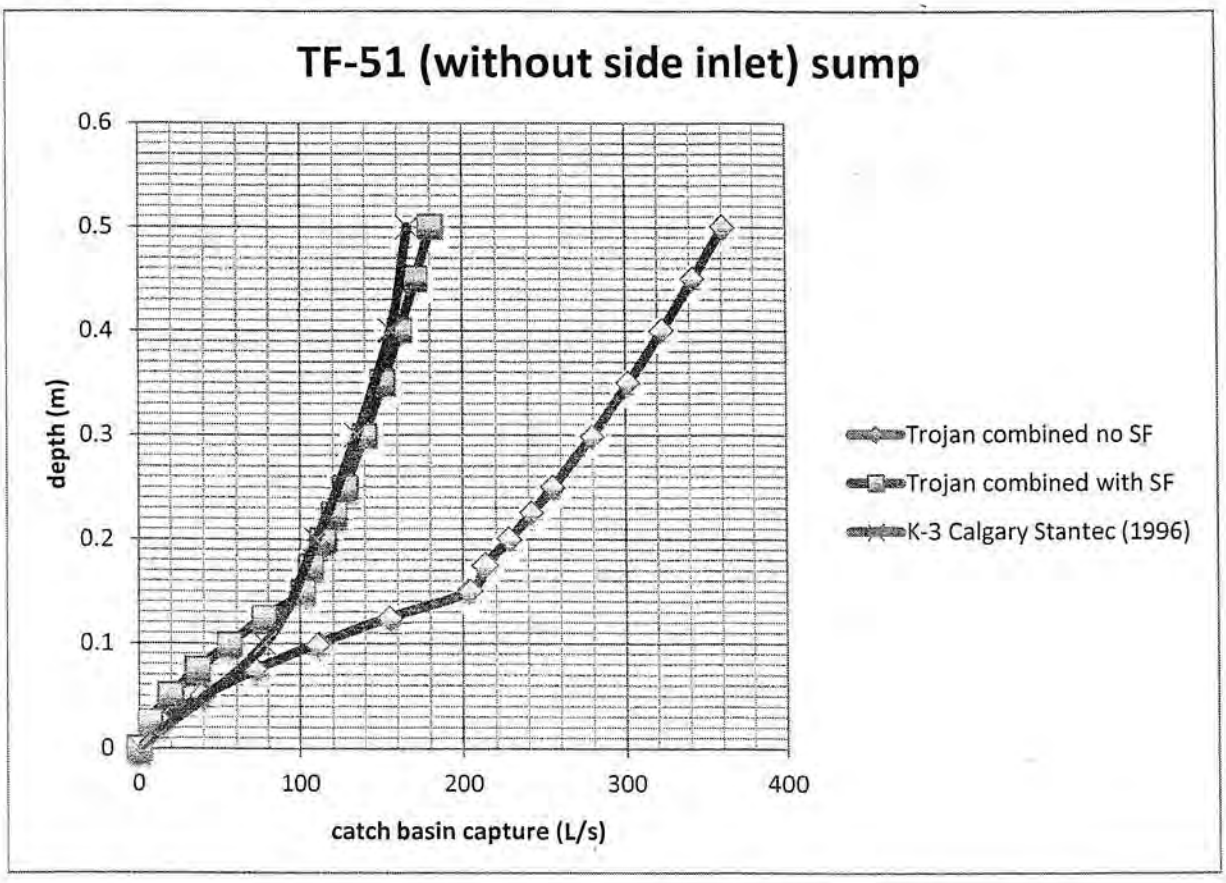
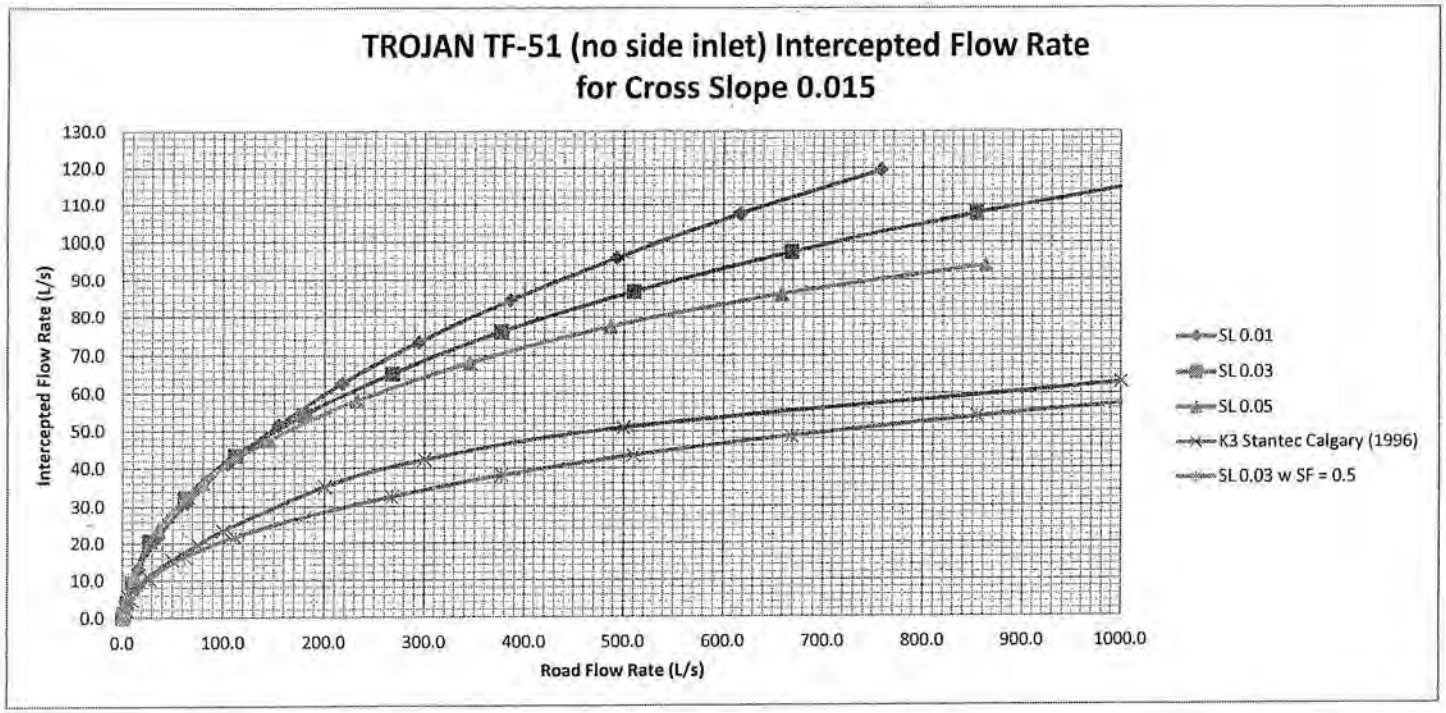
TF-51 (without side inlet) sump condition

Trojan (2014) without safety factor		Trojan with SF	K-3 Calgary Stantec (1996)	
depth	Q combined	Q combined	depth	Q
(m)	(L/s)	(L/s)	(m)	(L/s)
0	0	0	0.000	0
0.025	14	7	0.100	78
0.050	39	20	0.200	110
0.075	72	36	0.300	135
0.100	111	56	0.400	156
0.125	155	78	0.500	166
0.150	204	102		
0.175	213	107		
0.200	228	114		
0.225	242	121		
0.250	255	128		
0.300	279	140		
0.350	302	151		
0.400	323	161		
0.450	342	171		
0.500	361	180		

N.B. grate is not sloped when installed without side inlet



TROJAN TF-51 (no side inlet) Cross Slope 0.015



K3 Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
6	6.0
10	7.6
25	10.8
50	15.5
75	19.6
100	23.5
200	35.2
300	42.2
500	51.0
1000	63.0

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.1	0.1	0.21
0.020	0.9	0.8	0.34
0.030	2.6	2.5	0.45
0.040	5.5	5.4	0.54
0.050	15.8	12.9	0.63
0.060	35.6	21.9	0.71
0.070	64.6	31.2	0.79
0.080	103.8	41.1	0.87
0.090	154.4	51.6	0.94
0.100	217.6	62.8	1.00
0.110	294.4	73.5	1.07
0.120	385.9	84.6	1.14
0.130	493.0	95.9	1.20
0.140	616.7	107.6	1.26
0.150	757.9	119.5	1.32

SL 0.03

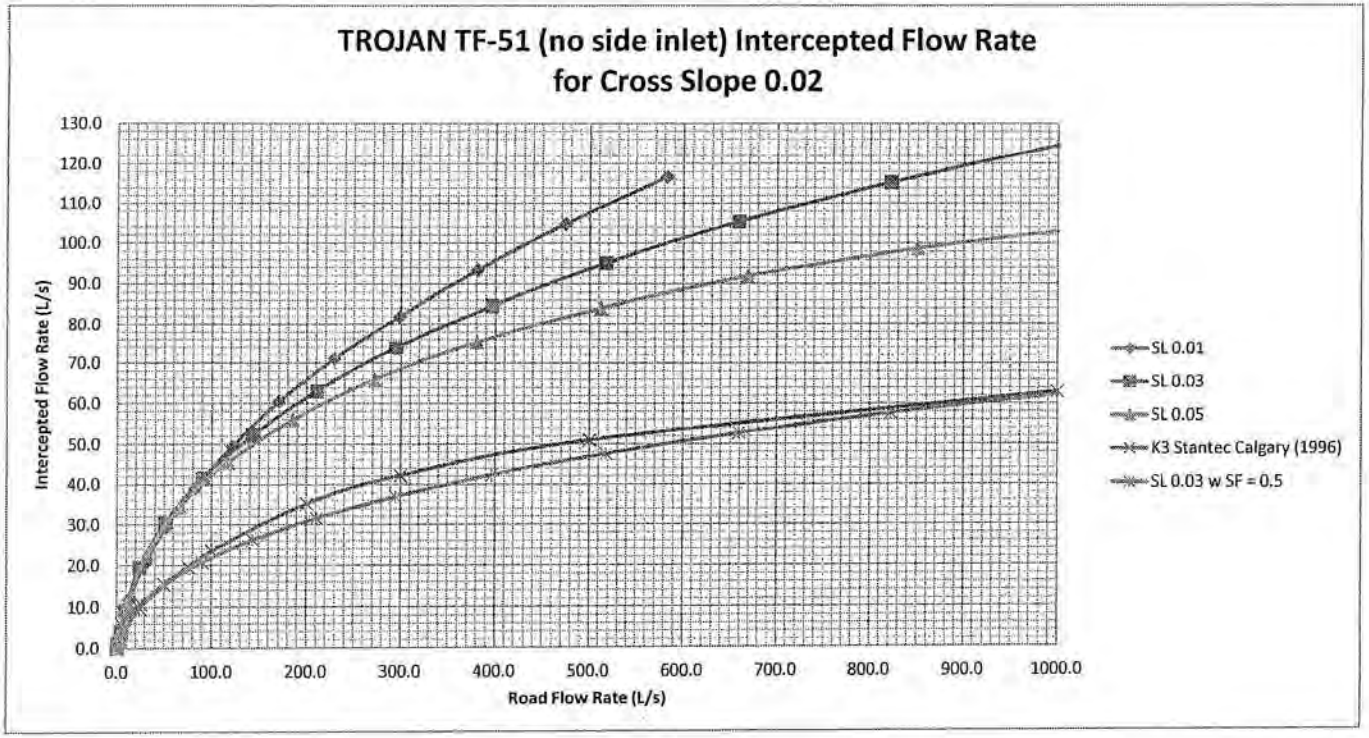
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF = 0.5 (L/s)
0.010	0.2	0.1	0.37	0.1
0.020	1.5	1.3	0.59	0.6
0.030	4.4	4.2	0.78	2.1
0.040	9.6	9.3	0.94	4.6
0.050	27.3	20.7	1.09	10.4
0.060	61.7	32.3	1.24	16.2
0.070	111.8	43.4	1.37	21.7
0.080	179.7	54.3	1.50	27.2
0.090	267.4	65.2	1.62	32.6
0.100	376.9	76.1	1.74	38.1
0.110	509.9	86.9	1.86	43.4
0.120	668.4	97.4	1.97	48.7
0.130	853.9	107.7	2.07	53.9
0.140	1068.1	117.7	2.18	58.8

SL 0.05

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.3	0.1	0.37
0.020	1.9	1.6	0.59
0.030	5.7	5.4	0.78
0.040	12.4	11.2	0.94
0.050	35.2	23.9	1.09
0.060	79.7	36.2	1.24
0.070	144.3	47.5	1.37
0.080	232.0	58.1	1.50
0.090	345.2	68.1	1.62
0.100	486.6	77.5	1.74
0.110	658.3	86.2	1.86
0.120	862.8	94.0	1.97

TROJAN TF-51 (no side inlet)

Cross Slope 0.02



K3 Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
6	6.0
10	7.6
25	10.8
50	15.5
75	19.6
100	23.5
200	35.2
300	42.2
500	51.0
1000	63.0

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.1	0.1	0.21
0.020	0.9	0.8	0.34
0.030	2.6	2.5	0.45
0.040	5.5	5.4	0.54
0.050	14.0	12.1	0.63
0.060	29.7	20.4	0.71
0.070	52.2	29.4	0.79
0.080	82.6	39.1	0.87
0.090	121.6	49.4	0.94
0.100	170.1	60.4	1.00
0.110	228.9	71.0	1.07
0.120	298.8	82.0	1.14
0.130	380.4	93.3	1.20
0.140	474.6	104.9	1.26
0.150	582.0	116.7	1.32

SL 0.03

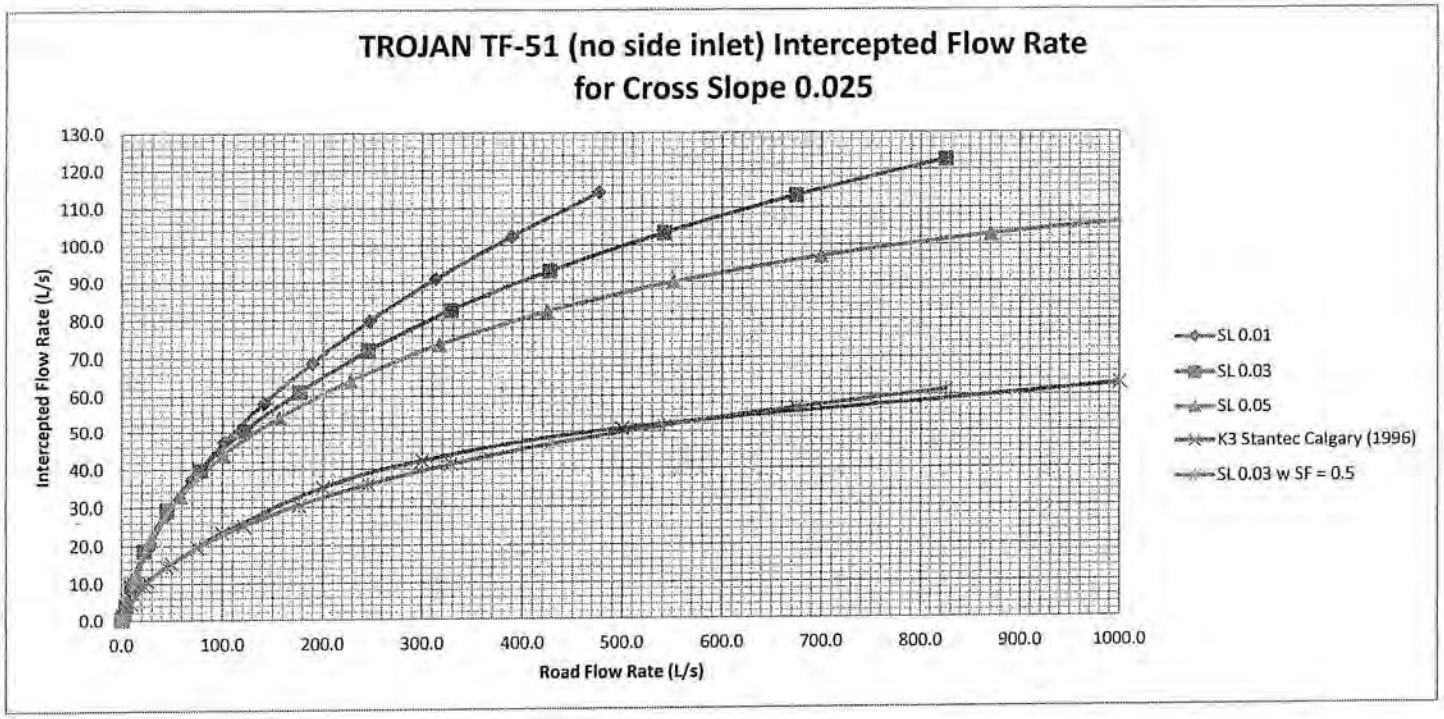
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF = 0.5 (L/s)
0.010	0.2	0.1	0.37	0.1
0.020	1.5	1.3	0.59	0.6
0.030	4.4	4.2	0.78	2.1
0.040	9.6	9.3	0.94	4.6
0.050	24.2	19.6	1.09	9.8
0.060	51.4	30.6	1.24	15.3
0.070	90.5	41.4	1.37	20.7
0.080	143.0	52.2	1.50	26.1
0.090	210.6	63.1	1.62	31.5
0.100	294.6	73.9	1.74	36.9
0.110	396.5	84.6	1.86	42.3
0.120	517.5	95.1	1.97	47.6
0.130	658.9	105.4	2.07	52.7
0.140	822.1	115.3	2.18	57.7
0.150	1008.1	124.9	2.28	62.4

SL 0.05

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.3	0.1	0.48
0.020	1.9	1.6	0.76
0.030	5.7	5.4	1.00
0.040	12.4	11.2	1.22
0.050	31.3	22.6	1.41
0.060	66.3	34.4	1.60
0.070	116.8	45.4	1.77
0.080	184.6	56.0	1.93
0.090	271.9	66.0	2.09
0.100	380.4	75.4	2.25
0.110	511.9	84.1	2.40
0.120	668.1	91.9	2.54
0.130	850.7	98.8	2.68
0.140	1061.3	104.6	2.82

TROJAN TF-51 (no side inlet)

Cross Slope 0.025



K3 Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
6	6.0
10	7.6
25	10.8
50	15.5
75	19.6
100	23.5
200	35.2
300	42.2
500	51.0
1000	63.0

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.1	0.1	0.21
0.020	0.9	0.8	0.34
0.030	2.6	2.5	0.45
0.040	5.5	5.4	0.54
0.050	12.9	11.5	0.63
0.060	26.1	19.3	0.71
0.070	44.8	28.0	0.79
0.080	69.9	37.4	0.87
0.090	101.9	47.5	0.94
0.100	141.6	58.4	1.00
0.110	189.6	68.9	1.07
0.120	246.5	79.7	1.14
0.130	312.9	90.9	1.20
0.140	389.4	102.4	1.26
0.150	476.5	114.1	1.32

SL 0.03

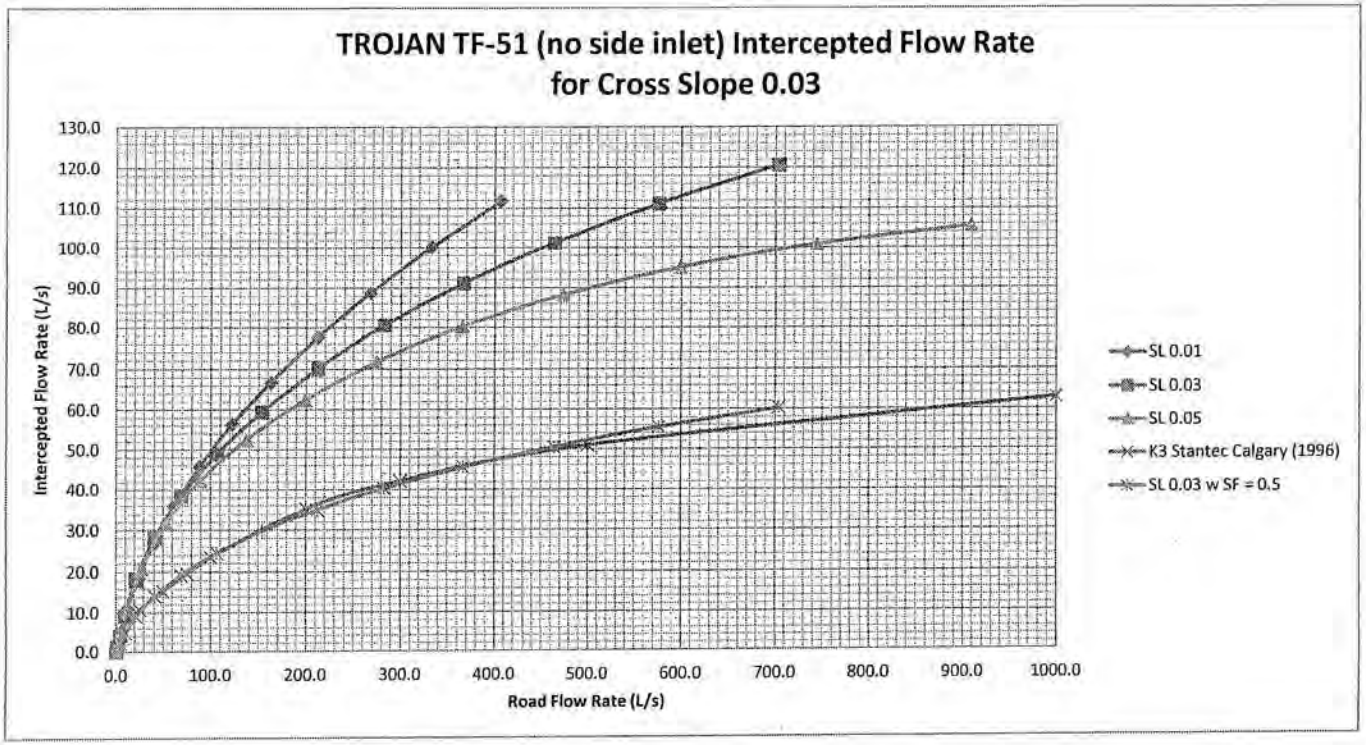
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF = 0.5 (L/s)
0.010	0.2	0.1	0.37	0.1
0.020	1.5	1.3	0.59	0.6
0.030	4.4	4.2	0.78	2.1
0.040	9.6	9.3	0.94	4.6
0.050	22.4	18.7	1.09	9.4
0.060	45.2	29.2	1.24	14.6
0.070	77.6	39.8	1.37	19.9
0.080	121.0	50.4	1.50	25.2
0.090	176.5	61.2	1.62	30.6
0.100	245.3	71.9	1.74	35.9
0.110	328.4	82.5	1.86	41.3
0.120	427.0	93.0	1.97	46.5
0.130	542.0	103.2	2.07	51.6
0.140	674.4	113.2	2.18	56.6
0.150	825.3	122.7	2.28	61.3

SL 0.05

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.3	0.1	0.48
0.020	1.9	1.6	0.76
0.030	5.7	5.4	1.00
0.040	12.4	11.2	1.22
0.050	28.9	21.7	1.41
0.060	58.3	32.9	1.60
0.070	100.2	43.7	1.77
0.080	156.2	54.1	1.93
0.090	227.9	64.1	2.09
0.100	316.7	73.4	2.25
0.110	424.0	82.1	2.40
0.120	551.2	90.0	2.54
0.130	699.7	96.9	2.68
0.140	870.7	102.7	2.82
0.150	1065.5	107.4	2.95

TROJAN TF-51 (no side inlet)

Cross Slope 0.03



K3 Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
6	6.0
10	7.6
25	10.8
50	15.5
75	19.6
100	23.5
200	35.2
300	42.2
500	51.0
1000	63.0

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.1	0.1	0.21
0.020	0.9	0.8	0.34
0.030	2.6	2.5	0.45
0.040	5.5	5.4	0.54
0.050	12.2	11.1	0.63
0.060	23.7	18.5	0.71
0.070	39.9	26.8	0.79
0.080	61.4	35.9	0.87
0.090	88.8	45.9	0.94
0.100	122.6	56.5	1.00
0.110	163.4	66.9	1.07
0.120	211.7	77.6	1.14
0.130	267.9	88.7	1.20
0.140	332.6	100.1	1.26
0.150	406.1	111.7	1.32

SL 0.03

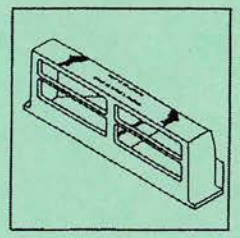
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF = 0.5 (L/s)
0.010	0.2	0.1	0.37	0.1
0.020	1.5	1.3	0.59	0.6
0.030	4.4	4.2	0.78	2.1
0.040	9.6	9.3	0.94	4.6
0.050	21.2	18.1	1.09	9.1
0.060	41.1	28.2	1.24	14.1
0.070	69.1	38.4	1.37	19.2
0.080	106.3	48.9	1.50	24.4
0.090	153.8	59.5	1.62	29.7
0.100	212.4	70.1	1.74	35.0
0.110	283.0	80.7	1.86	40.3
0.120	366.6	91.1	1.97	45.5
0.130	464.0	101.2	2.07	50.6
0.140	576.0	111.1	2.18	55.6
0.150	703.5	120.6	2.28	60.3

SL 0.05

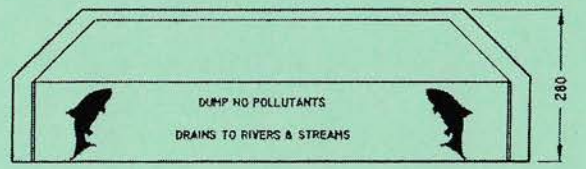
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.3	0.1	0.48
0.020	1.9	1.6	0.76
0.030	5.7	5.4	1.00
0.040	12.4	11.2	1.22
0.050	27.3	21.0	1.41
0.060	53.0	31.8	1.60
0.070	89.2	42.3	1.77
0.080	137.3	52.6	1.93
0.090	198.5	62.4	2.09
0.100	274.2	71.7	2.25
0.110	365.4	80.3	2.40
0.120	473.3	88.2	2.54
0.130	599.0	95.1	2.68
0.140	743.7	100.9	2.82
0.150	908.2	105.6	2.95

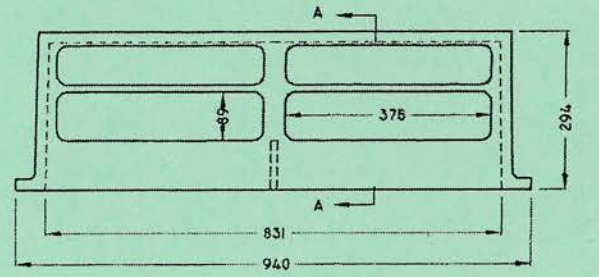
1 PIECE SIDE INLET

K-1/TF-51

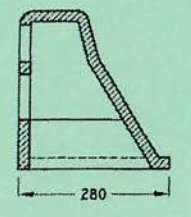


PLAN





FRONT VIEW



SECTION A-A

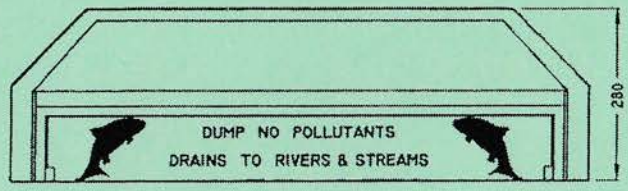
ISO 9001-2000 CERTIFIED | RATED FOR HS-20 LIVE LOAD | MEASUREMENTS IN MILLIMETERS

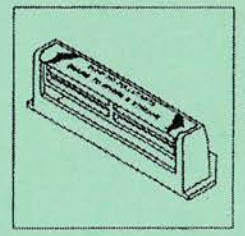
TROJAN INDUSTRIES INC.
CALGARY • EDMONTON, ALBERTA

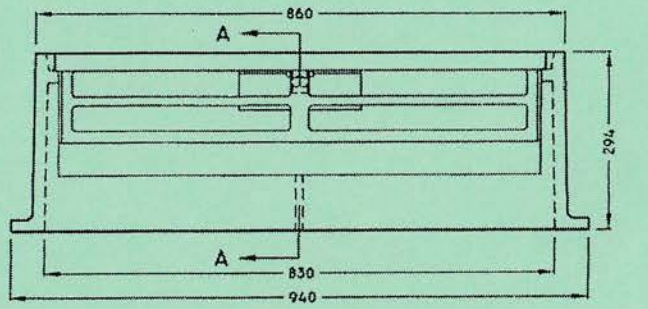
2 PIECE SIDE INLET WITH LOCK

K-1A/51A

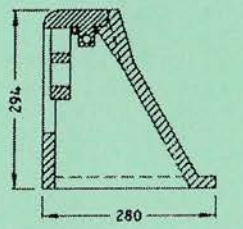
PLAN







FRONT VIEW



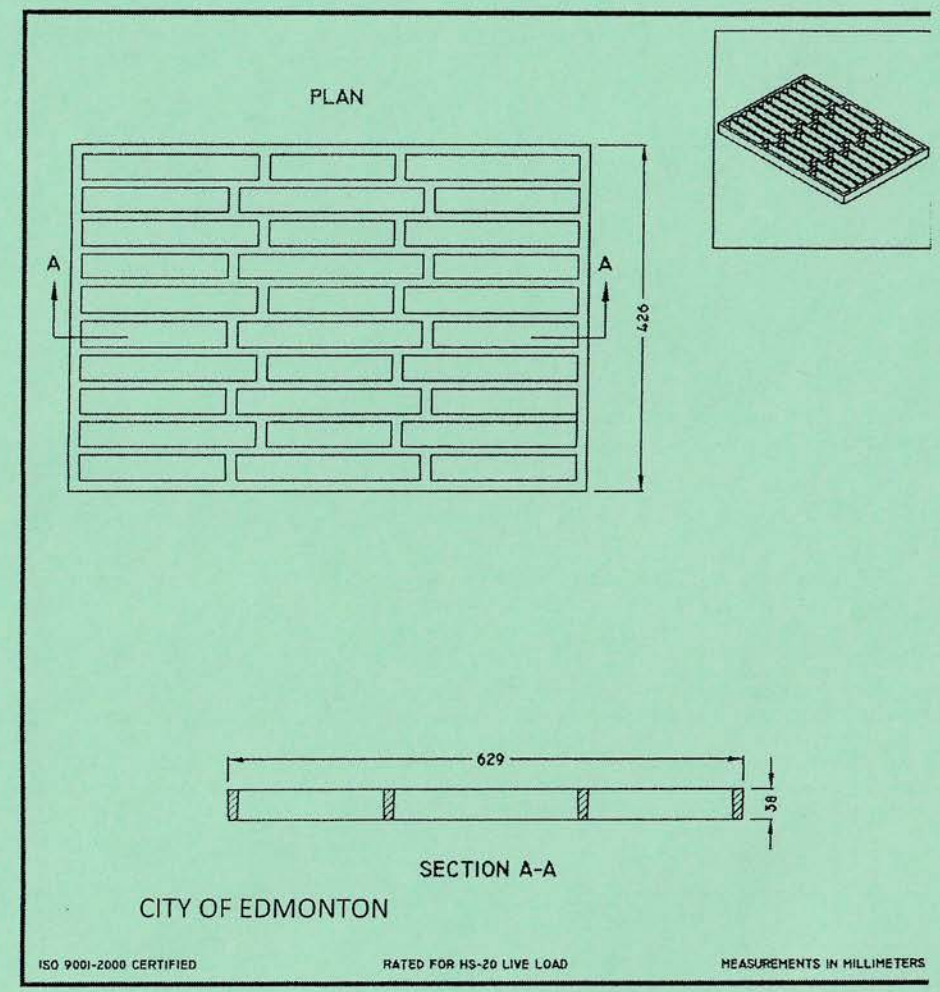
SECTION A-A

ISO 9001-2000 CERTIFIED | RATED FOR HS-20 LIVE LOAD | MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.
CALGARY • EDMONTON, ALBERTA

STANDARD GRATE

T-K1



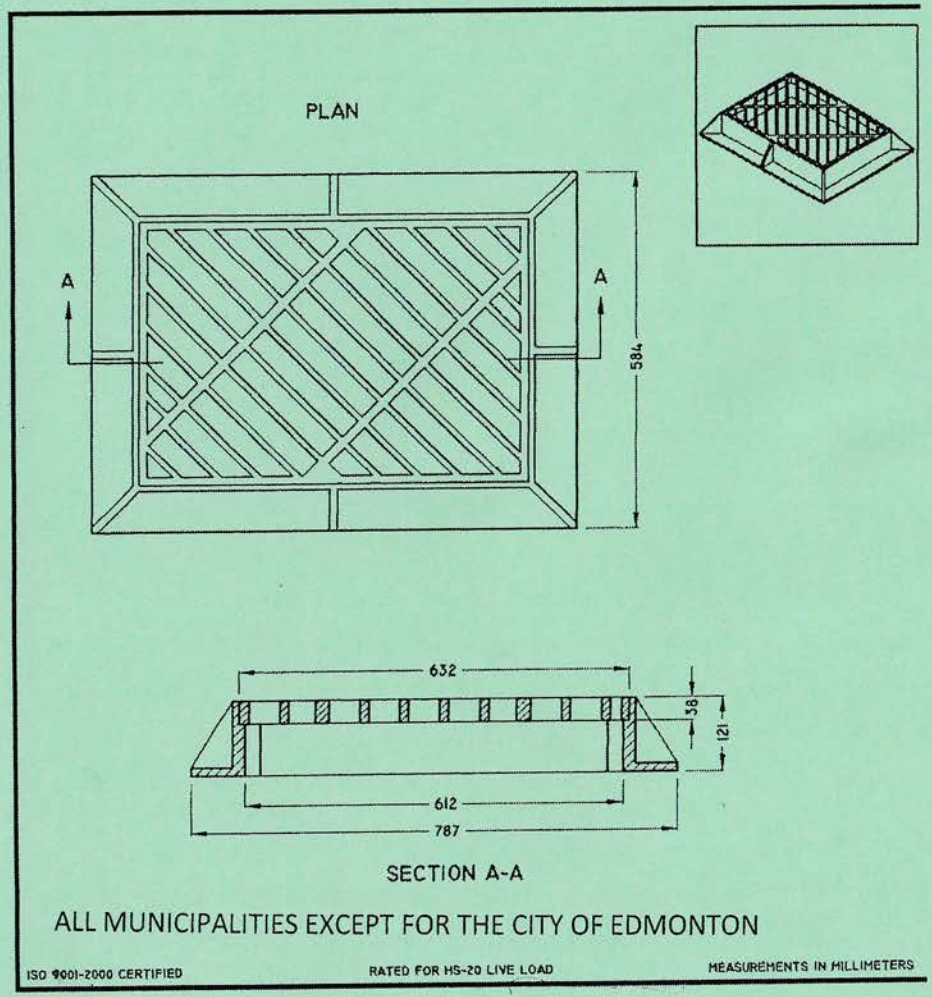
CITY OF EDMONTON

ISO 9001-2000 CERTIFIED | RATED FOR HS-20 LIVE LOAD | MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.
CALGARY • EDMONTON, ALBERTA

FRAME AND GRATE

K-1/TF-51



ALL MUNICIPALITIES EXCEPT FOR THE CITY OF EDMONTON

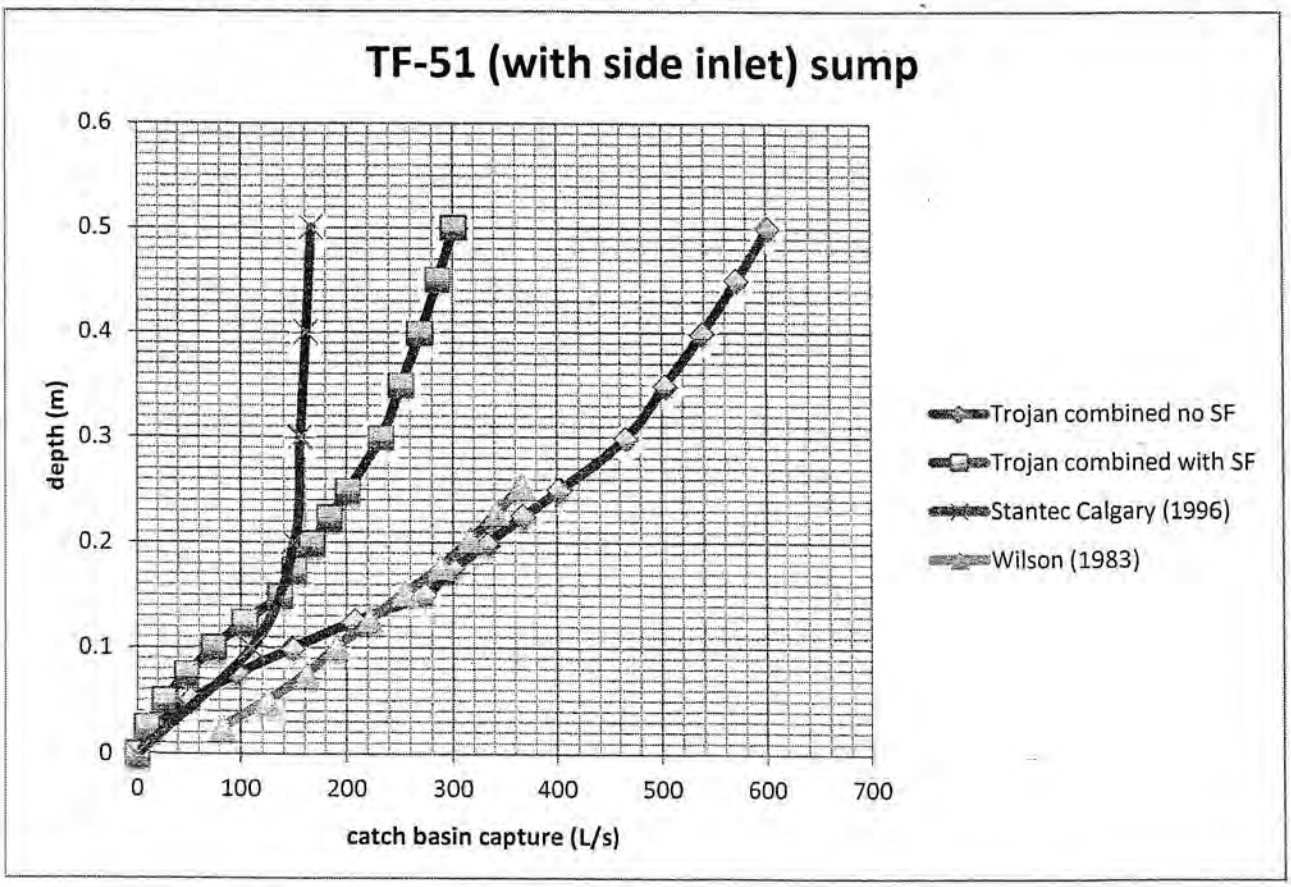
ISO 9001-2000 CERTIFIED | RATED FOR HS-20 LIVE LOAD | MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.
CALGARY • EDMONTON, ALBERTA

TF-51 (with side inlet) sump condition

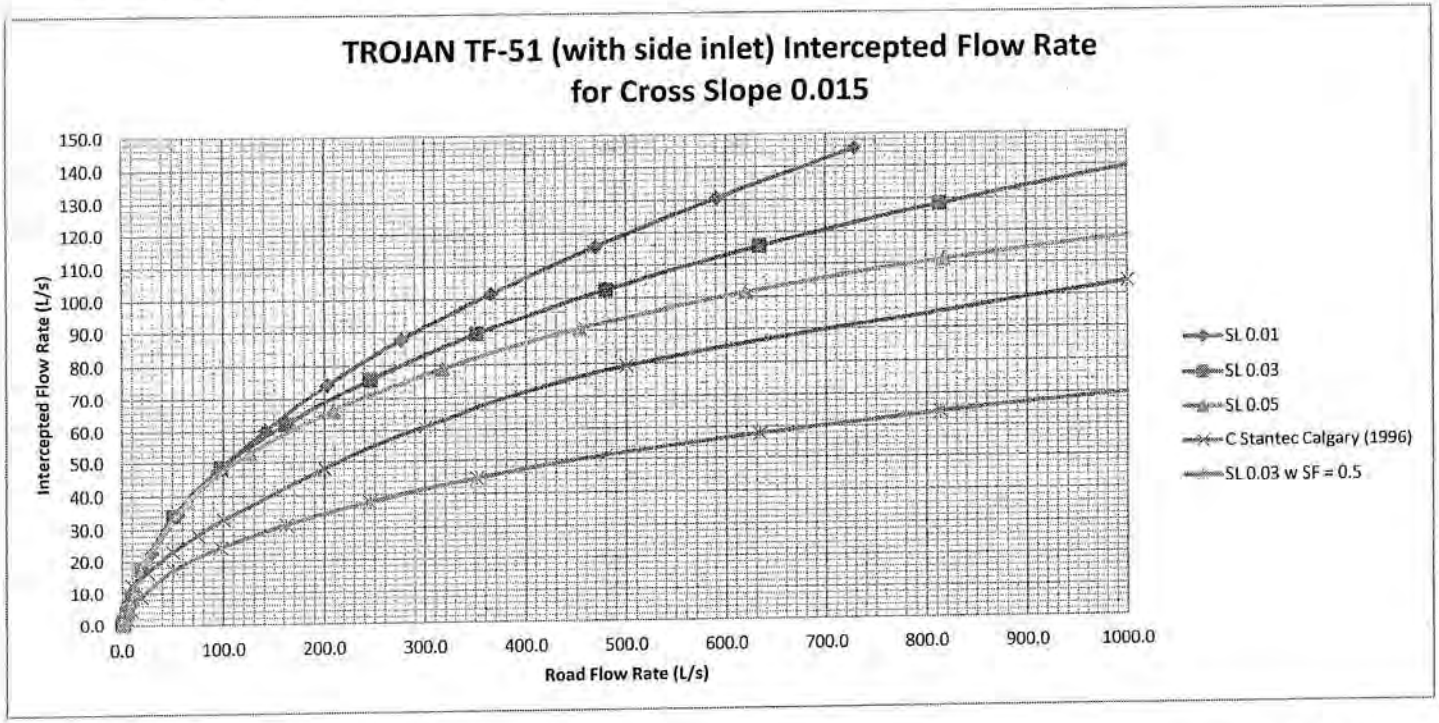
Trojan (2014) without safety factor		Trojan with SF	Wilson (1983)		Stantec Calgary (1996)	
depth	Q combined	Q combined	depth	Q	depth	Q
(m)	(L/s)	(L/s)	(m)	(L/s)	(m)	(L/s)
0	0	0	0.025	83	0.000	0
0.025	19	9	0.051	125	0.100	110
0.050	52	26	0.076	162	0.200	150
0.075	96	48	0.102	191	0.300	156
0.100	148	74	0.127	223	0.400	161
0.125	207	104	0.152	255	0.500	166
0.150	273	136	0.178	288		
0.175	300	150	0.203	316		
0.200	334	167	0.229	342		
0.225	368	184	0.254	366		
0.250	402	201				
0.300	466	233				
0.350	503	252				
0.400	538	269				
0.450	571	286				
0.500	602	301				

N.B. grate is not sloped when installed without side inlet



TROJAN TF-51 (with side inlet)

Cross Slope 0.015



C Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
6	9.0
10	12.7
25	16.5
50	23.0
75	28.2
100	32.8
200	48.0
300	61.1
500	79.3
1000	104.0

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.1	0.1	0.21
0.020	0.9	0.8	0.34
0.030	2.6	2.5	0.45
0.040	5.5	5.4	0.54
0.050	11.1	10.8	0.63
0.060	29.3	22.7	0.71
0.070	56.3	34.6	0.79
0.080	93.5	47.2	0.87
0.090	141.9	60.4	0.94
0.100	202.7	74.3	1.00
0.110	276.9	87.8	1.07
0.120	365.6	101.7	1.14
0.130	469.8	115.9	1.20
0.140	590.5	130.5	1.26
0.150	728.5	145.4	1.32

SL 0.03

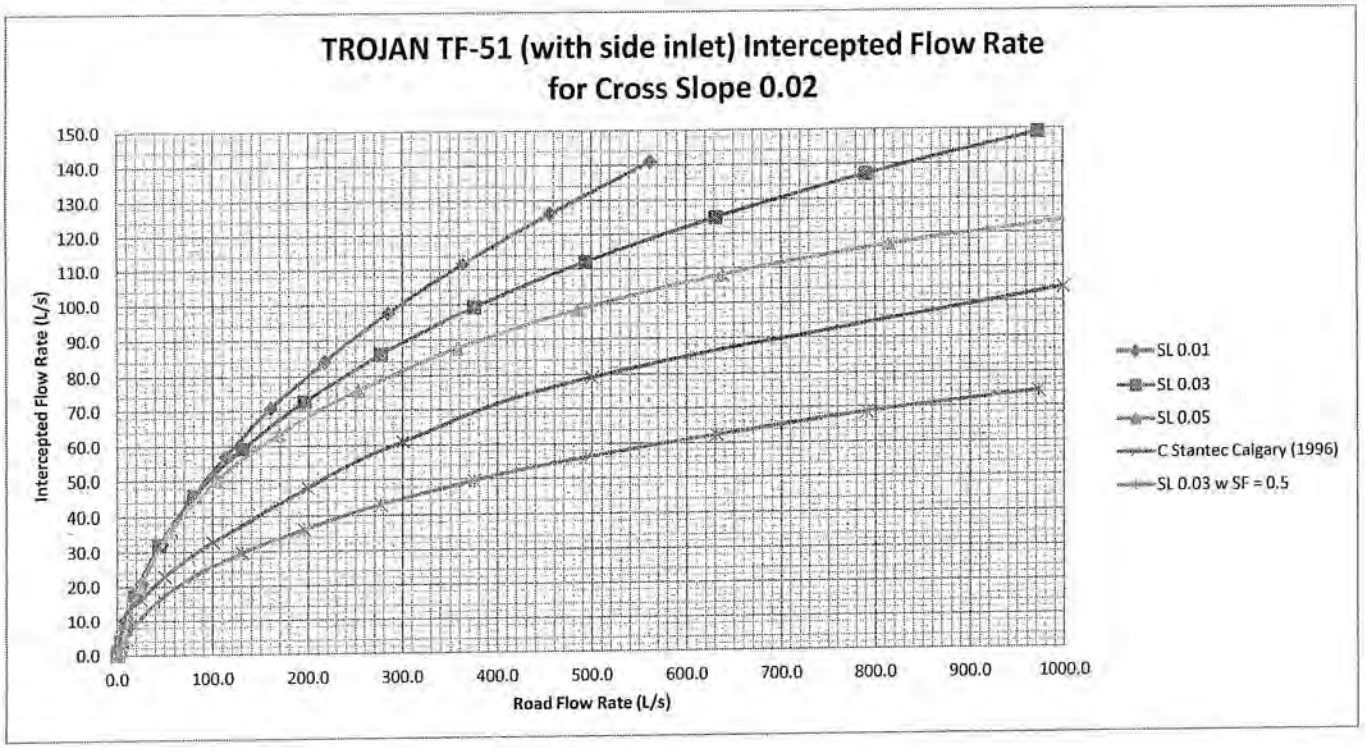
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF = 0.5 (L/s)
0.010	0.2	0.1	0.37	0.1
0.020	1.5	1.3	0.59	0.7
0.030	4.4	4.2	0.78	2.1
0.040	9.6	9.3	0.94	4.7
0.050	19.2	17.9	1.09	9.0
0.060	50.7	34.2	1.24	17.1
0.070	97.6	48.5	1.37	24.2
0.080	161.9	62.3	1.50	31.1
0.090	245.7	75.9	1.62	37.9
0.100	351.0	89.3	1.74	44.7
0.110	479.6	102.6	1.86	51.3
0.120	633.3	115.7	1.97	57.8
0.130	813.8	128.4	2.07	64.2
0.140	1022.7	140.8	2.18	70.4

SL 0.05

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.3	0.1	0.48
0.020	1.9	1.7	0.76
0.030	5.7	5.4	1.00
0.040	12.4	11.2	1.22
0.050	24.7	20.8	1.41
0.060	65.4	38.4	1.60
0.070	125.9	53.1	1.77
0.080	209.0	66.4	1.93
0.090	317.2	79.0	2.09
0.100	453.2	90.7	2.25
0.110	619.2	101.5	2.40
0.120	817.6	111.3	2.54
0.130	1050.6	119.9	2.68

TROJAN TF-51 (with side inlet)

Cross Slope 0.02



C Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
6	9.0
10	12.7
25	16.5
50	23.0
75	28.2
100	32.8
200	48.0
300	61.1
500	79.3
1000	104.0

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.1	0.1	0.21
0.020	0.9	0.8	0.34
0.030	2.6	2.5	0.45
0.040	5.5	5.4	0.54
0.050	10.7	10.5	0.63
0.060	25.3	21.0	0.71
0.070	46.5	32.2	0.79
0.080	75.5	44.2	0.87
0.090	112.9	57.0	0.94
0.100	159.8	70.7	1.00
0.110	216.8	84.0	1.07
0.120	284.8	97.7	1.14
0.130	364.4	111.7	1.20
0.140	456.5	126.2	1.26
0.150	561.7	141.0	1.32

SL 0.03

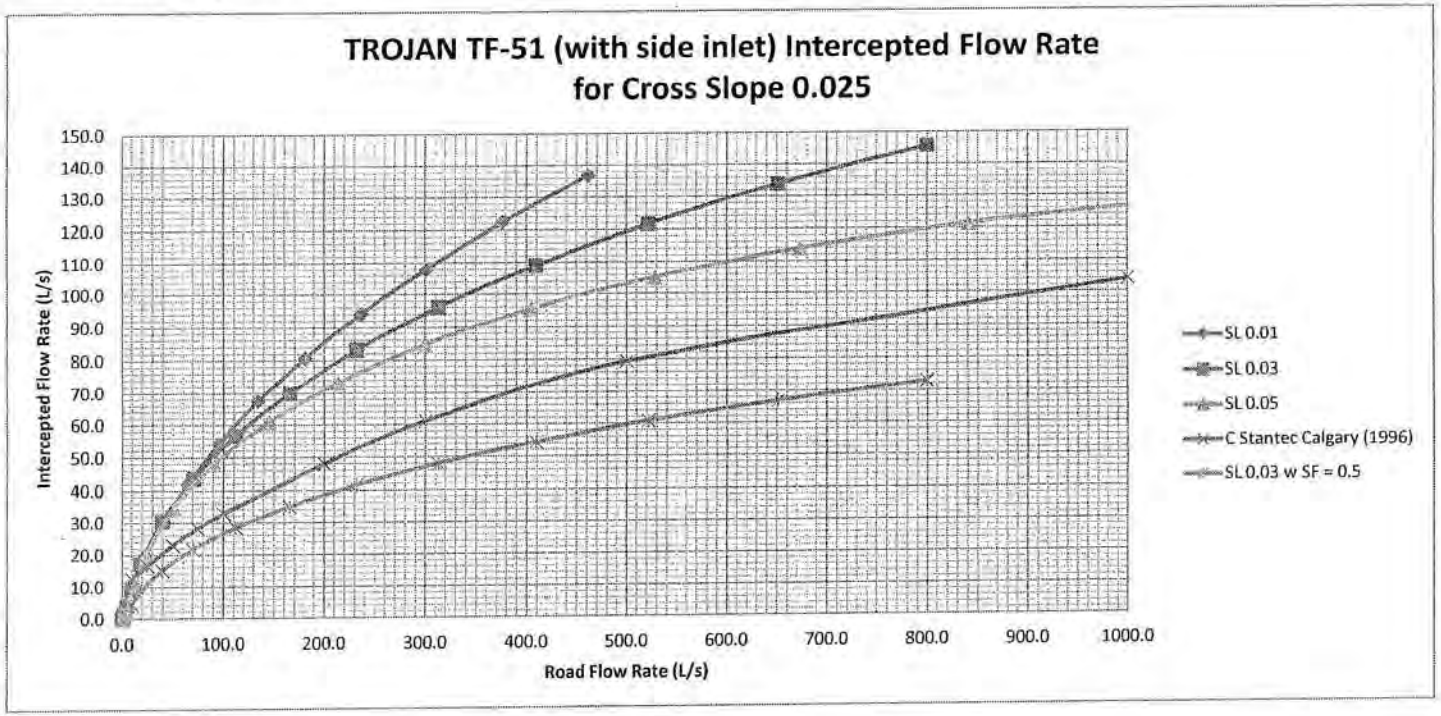
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF = 0.5 (L/s)
0.010	0.2	0.1	0.37	0.1
0.020	1.5	1.3	0.59	0.7
0.030	4.4	4.2	0.78	2.1
0.040	9.6	9.3	0.94	4.7
0.050	18.6	17.5	1.09	8.8
0.060	43.8	32.0	1.24	16.0
0.070	80.6	45.8	1.37	22.9
0.080	130.7	59.2	1.50	29.6
0.090	195.6	72.7	1.62	36.3
0.100	276.8	86.0	1.74	43.0
0.110	375.5	99.2	1.86	49.6
0.120	493.3	112.2	1.97	56.1
0.130	631.2	124.9	2.07	62.4
0.140	790.7	137.2	2.18	68.6
0.150	972.9	149.0	2.28	74.5

SL 0.05

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.3	0.1	0.48
0.020	1.9	1.7	0.76
0.030	5.7	5.4	1.00
0.040	12.4	11.2	1.22
0.050	24.0	20.4	1.41
0.060	56.5	36.1	1.60
0.070	104.1	50.2	1.77
0.080	168.7	63.4	1.93
0.090	252.5	75.8	2.09
0.100	357.3	87.5	2.25
0.110	484.8	98.3	2.40
0.120	636.8	108.1	2.54
0.130	814.9	116.8	2.68
0.140	1020.8	124.2	2.82

TROJAN TF-51 (with side inlet)

Cross Slope 0.025



C Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
6	9.0
10	12.7
25	16.5
50	23.0
75	28.2
100	32.8
200	48.0
300	61.1
500	79.3
1000	104.0

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.1	0.1	0.00
0.020	0.9	0.8	0.21
0.030	2.6	2.5	0.45
0.040	5.5	5.4	0.54
0.050	10.6	10.3	0.63
0.060	22.9	19.8	0.71
0.070	40.7	30.3	0.79
0.080	64.7	41.8	0.87
0.090	95.6	54.3	0.94
0.100	134.1	67.6	1.00
0.110	180.8	80.6	1.07
0.120	236.3	94.1	1.14
0.130	301.2	108.0	1.20
0.140	376.1	122.3	1.26
0.150	461.6	136.9	1.32

SL 0.03

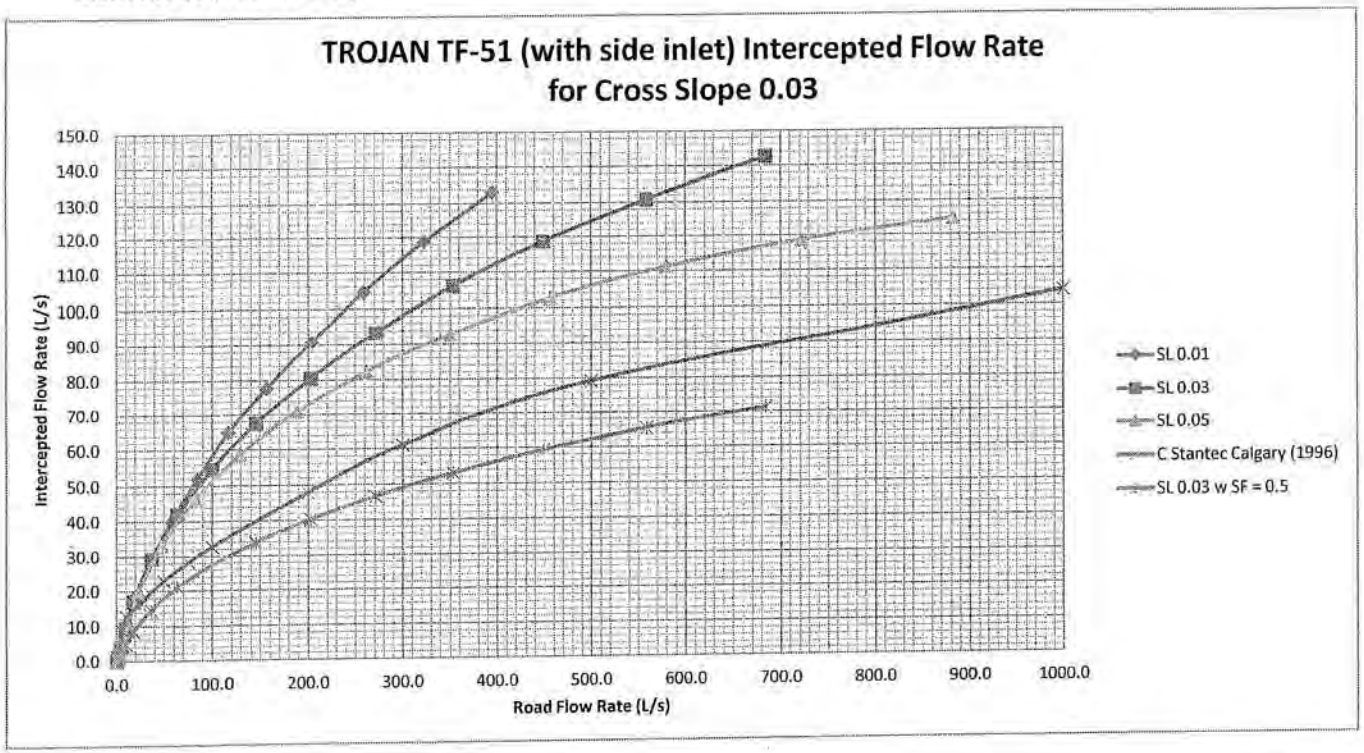
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF = 0.5 (L/s)
0.010	0.2	0.1	0.37	0.1
0.020	1.5	1.3	0.59	0.7
0.030	4.4	4.2	0.78	2.1
0.040	9.6	9.3	0.94	4.7
0.050	18.3	17.3	1.09	8.6
0.060	39.6	30.5	1.24	15.2
0.070	70.4	43.6	1.37	21.8
0.080	112.0	56.7	1.50	28.4
0.090	165.5	69.9	1.62	35.0
0.100	232.2	83.1	1.74	41.5
0.110	313.1	96.1	1.86	48.1
0.120	409.2	109.0	1.97	54.5
0.130	521.7	121.6	2.07	60.8
0.140	651.5	133.9	2.18	66.9
0.150	799.6	145.7	2.28	72.8

SL 0.05

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.3	0.1	0.48
0.020	1.9	1.7	0.76
0.030	5.7	5.4	1.00
0.040	12.4	11.2	1.22
0.050	23.6	20.1	1.41
0.060	51.1	34.5	1.60
0.070	90.9	48.0	1.77
0.080	144.6	60.9	1.93
0.090	213.7	73.1	2.09
0.100	299.8	84.7	2.25
0.110	404.2	95.4	2.40
0.120	528.3	105.2	2.54
0.130	673.5	113.9	2.68
0.140	841.1	121.3	2.82
0.150	1032.2	127.4	2.95

TROJAN TF-51 (with side inlet)

Cross Slope 0.03



C Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
6	9.0
10	12.7
25	16.5
50	23.0
75	28.2
100	32.8
200	48.0
300	61.1
500	79.3
1000	104.0

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.1	0.1	0.21
0.020	0.9	0.8	0.34
0.030	2.6	2.5	0.45
0.040	5.5	5.4	0.54
0.050	10.4	10.2	0.63
0.060	21.3	18.9	0.71
0.070	36.7	28.8	0.79
0.080	57.5	39.9	0.87
0.090	84.0	52.0	0.94
0.100	116.9	65.0	1.00
0.110	156.7	77.7	1.07
0.120	203.9	91.0	1.14
0.130	259.1	104.7	1.20
0.140	322.6	118.8	1.26
0.150	394.9	133.2	1.32

SL 0.03

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF = 0.5 (L/s)
0.010	0.2	0.1	0.37	0.1
0.020	1.5	1.3	0.59	0.7
0.030	4.4	4.2	0.78	2.1
0.040	9.6	9.3	0.94	4.7
0.050	18.1	17.1	1.09	8.5
0.060	36.8	29.3	1.24	14.7
0.070	63.6	41.8	1.37	20.9
0.080	99.5	54.6	1.50	27.3
0.090	145.5	67.5	1.62	33.8
0.100	202.5	80.5	1.74	40.2
0.110	271.4	93.4	1.86	46.7
0.120	353.2	106.2	1.97	53.1
0.130	448.7	118.7	2.07	59.3
0.140	558.7	130.9	2.18	65.4
0.150	684.0	142.6	2.28	71.3

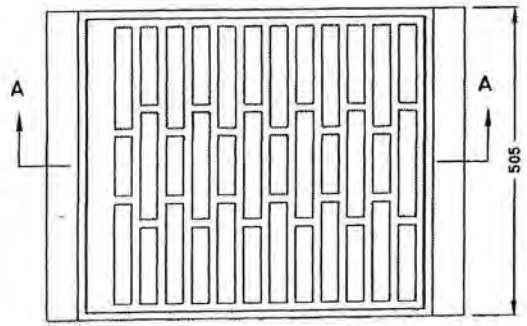
SL 0.05

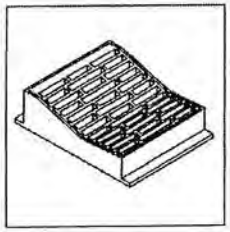
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.3	0.1	0.48
0.020	1.9	1.7	0.76
0.030	5.7	5.4	1.00
0.040	12.4	11.2	1.22
0.050	23.3	19.9	1.41
0.060	47.6	33.2	1.60
0.070	82.2	46.2	1.77
0.080	128.5	58.7	1.93
0.090	187.8	70.8	2.09
0.100	261.4	82.2	2.25
0.110	350.4	92.9	2.40
0.120	456.0	102.6	2.54
0.130	579.3	111.3	2.68
0.140	721.3	118.7	2.82
0.150	883.0	124.8	2.95

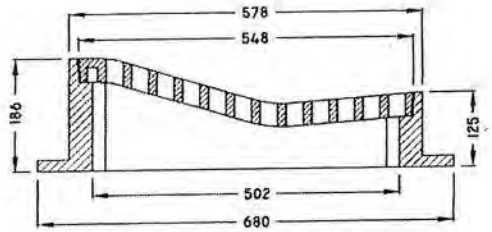
SINGLE FRAME AND GRATE

T-K7

PLAN







SECTION A-A

ISO 9001-2000 CERTIFIED

RATED FOR HS-20 LIVE LOAD

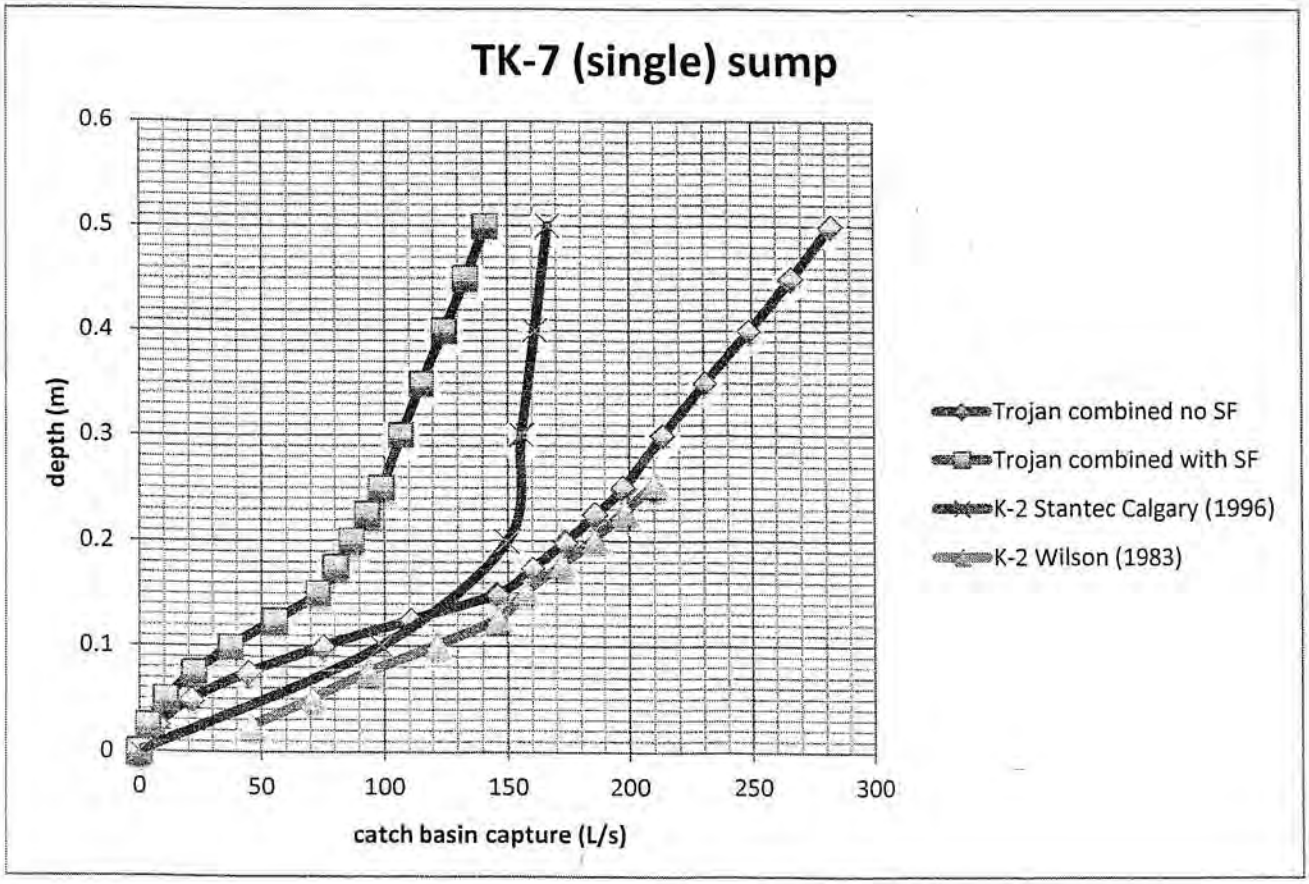
MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.

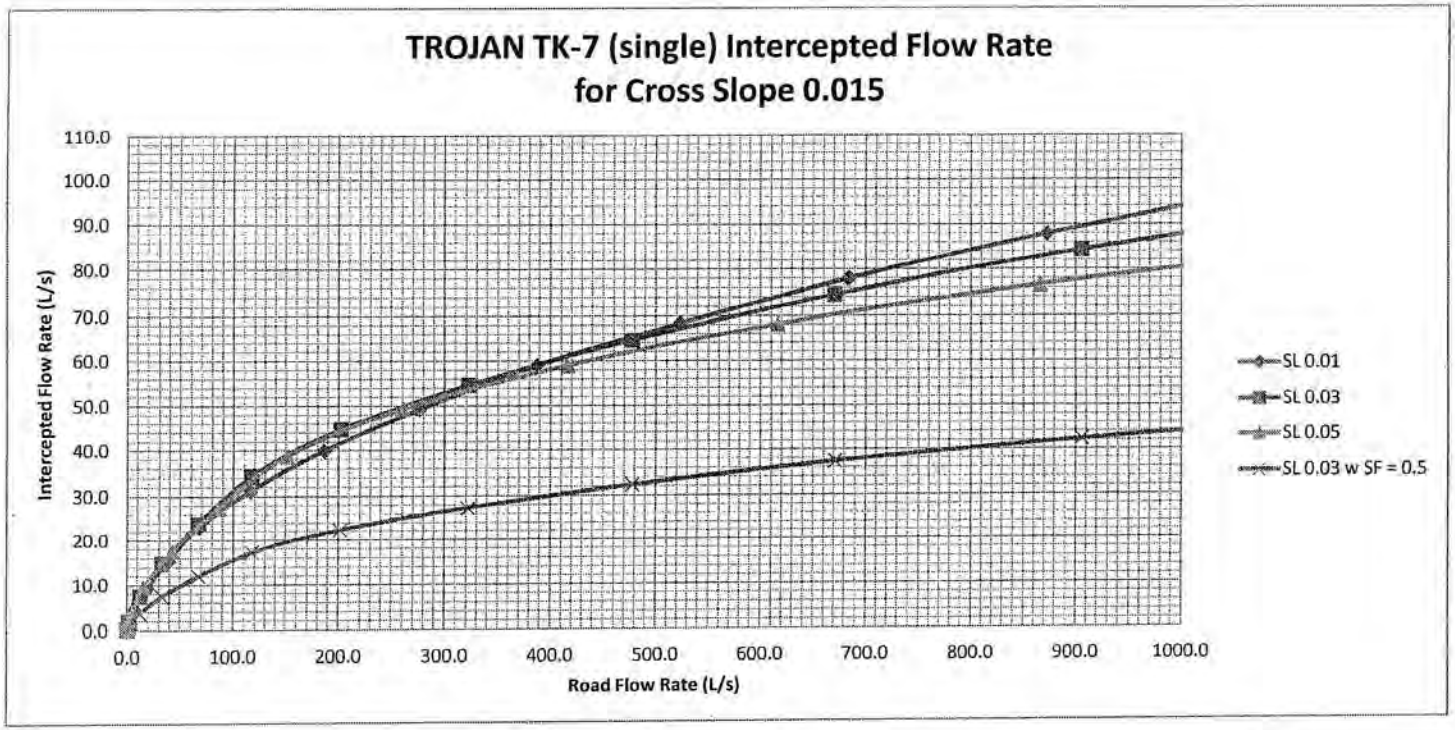
CALGARY • EDMONTON, ALBERTA

TK-7 (single) sump condition

Trojan (2014) without safety factor		Trojan with SF	K-2 Wilson (1983)		K-2 Stantec Calgary (1996)	
depth	Q combined	Q combined	depth	Q	depth	Q
(m)	(L/s)	(L/s)	(m)	(L/s)	(m)	(L/s)
0	0	0	0.025	46	0.000	0
0.025	7	4	0.051	71	0.100	98
0.050	22	11	0.076	94	0.200	150
0.075	45	22	0.102	122	0.300	156
0.100	75	38	0.127	146	0.400	161
0.125	111	55	0.152	157	0.500	166
0.150	146	73	0.178	172		
0.175	160	80	0.203	186		
0.200	174	87	0.229	198		
0.225	186	93	0.254	210		
0.250	197	99				
0.300	213	107				
0.350	231	115				
0.400	249	124				
0.450	266	133				
0.500	282	141				



TROJAN TK-7 (single) Cross Slope 0.015



SL 0.01

depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.2	0.2	0.21
0.020	1.1	1.1	0.34
0.030	7.0	4.7	0.45
0.040	19.0	9.3	0.54
0.050	38.7	15.4	0.63
0.060	67.6	23.0	0.71
0.070	116.5	31.2	0.79
0.080	186.0	39.9	0.87
0.090	275.6	49.1	0.94
0.100	387.3	59.0	1.00
0.110	522.8	68.4	1.07
0.120	684.1	78.0	1.14
0.130	872.8	87.9	1.20
0.140	1090.6	98.1	1.26

SL 0.03

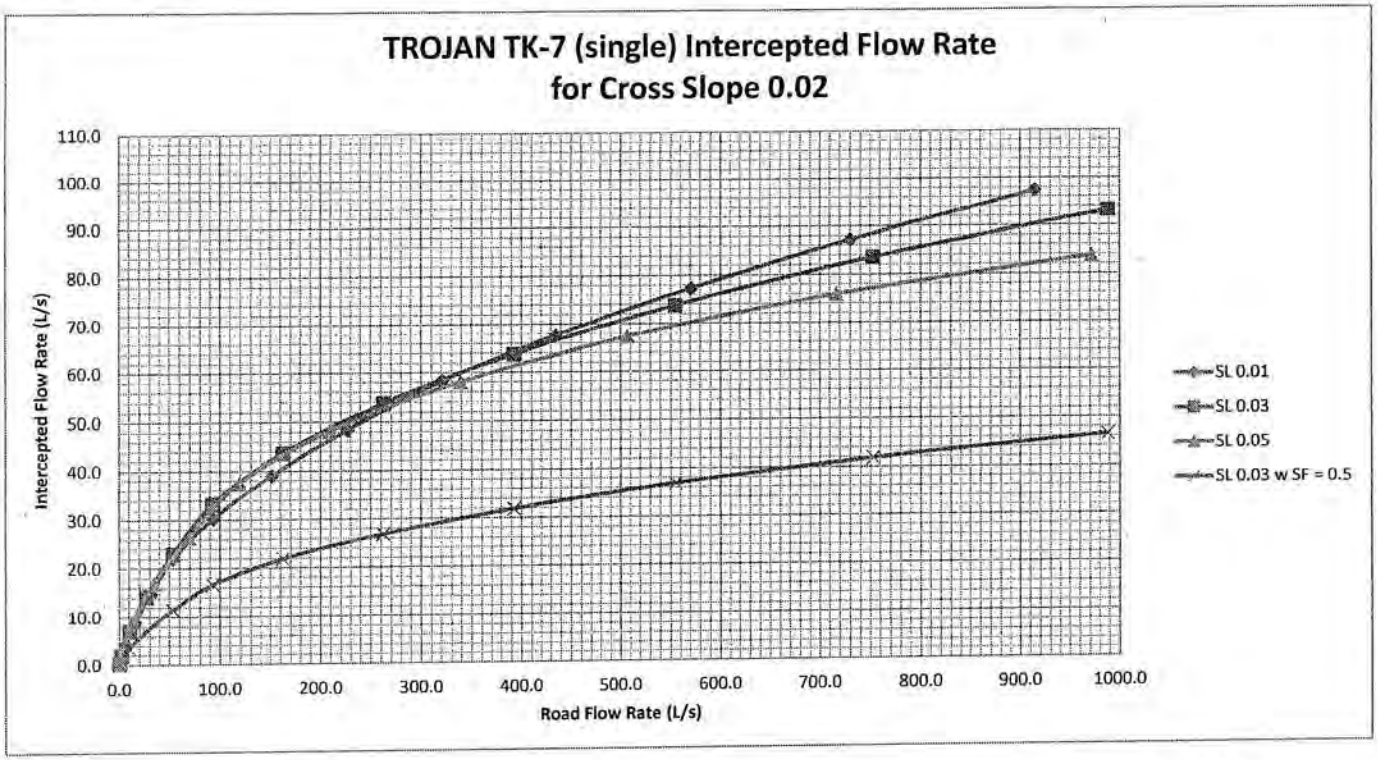
depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF = 0.5 (L/s)
0.010	0.3	0.3	0.37	0.2
0.020	2.0	1.9	0.59	1.0
0.030	12.1	7.5	0.78	3.8
0.040	32.8	14.9	0.94	7.4
0.050	67.0	23.9	1.09	11.9
0.060	117.0	34.4	1.24	17.2
0.070	201.9	44.7	1.37	22.4
0.080	322.2	54.7	1.50	27.3
0.090	477.4	64.6	1.62	32.3
0.100	670.8	74.6	1.74	37.3
0.110	905.6	84.4	1.86	42.2
0.120	1184.9	93.9	1.97	47.0

SL 0.05

depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.4	0.4	0.48
0.020	2.5	2.5	0.76
0.030	15.6	9.5	1.00
0.040	42.4	17.6	1.22
0.050	86.5	27.4	1.41
0.060	151.1	38.7	1.60
0.070	260.6	49.3	1.77
0.080	416.0	59.0	1.93
0.090	616.3	68.2	2.09
0.100	866.0	76.7	2.25
0.110	1169.1	84.5	2.40

TROJAN TK-7 (single)

Cross Slope 0.02



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.2	0.2	0.21
0.020	1.1	1.1	0.34
0.030	5.9	4.3	0.45
0.040	15.3	8.8	0.54
0.050	30.8	14.7	0.63
0.060	53.3	22.1	0.71
0.070	93.5	30.4	0.79
0.080	151.4	39.1	0.87
0.090	226.5	48.4	0.94
0.100	320.3	58.3	1.00
0.110	434.5	67.6	1.07
0.120	570.5	77.3	1.14
0.130	730.0	87.2	1.20
0.140	914.3	97.4	1.26

SL 0.03

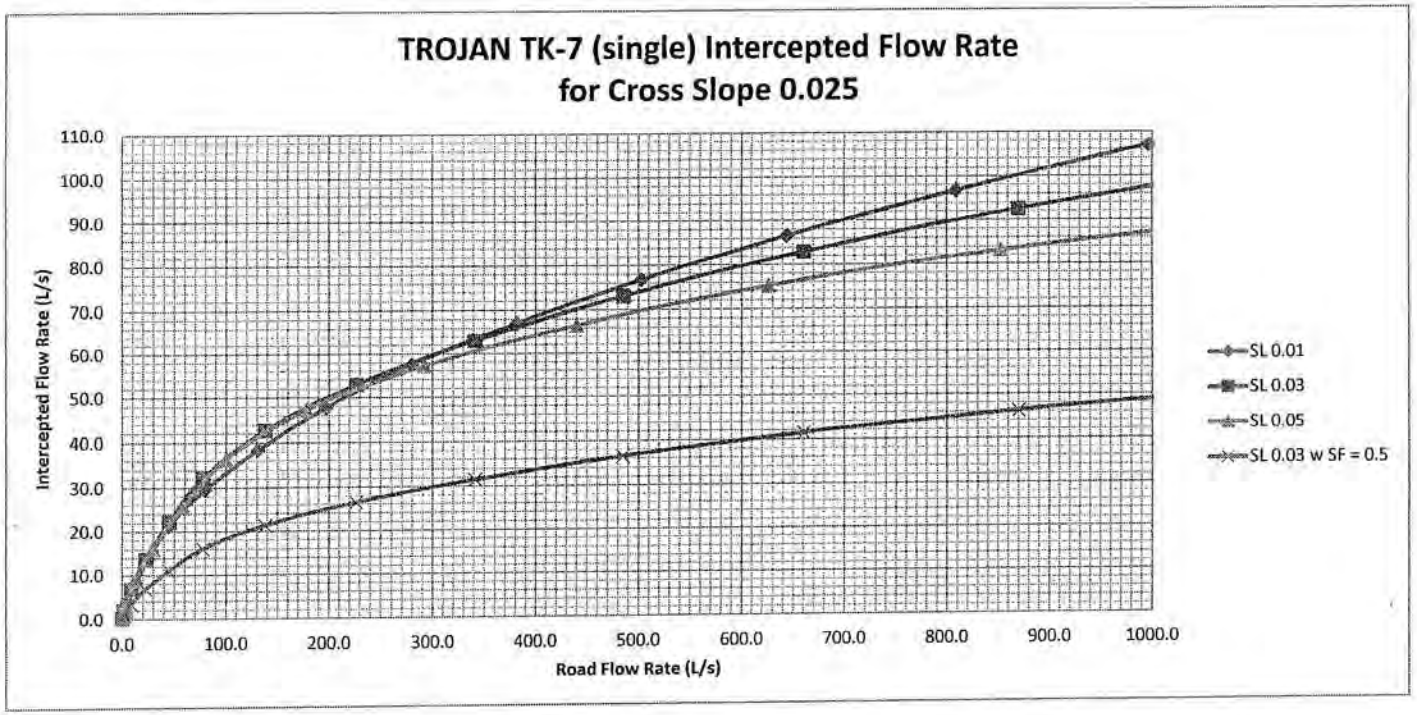
depth	Road Flow	Intercepted	Velocity	SL 0.03 w SF = 0.5
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.3	0.3	0.37	0.2
0.020	2.0	1.9	0.59	1.0
0.030	10.1	7.1	0.78	3.5
0.040	26.6	14.2	0.94	7.1
0.050	53.3	23.0	1.09	11.5
0.060	92.3	33.2	1.24	16.6
0.070	161.9	43.7	1.37	21.8
0.080	262.3	53.7	1.50	26.9
0.090	392.3	63.8	1.62	31.9
0.100	554.8	73.8	1.74	36.9
0.110	752.5	83.6	1.86	41.8
0.120	988.2	93.2	1.97	46.6

SL 0.05

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.4	0.4	0.48
0.020	2.5	2.5	0.76
0.030	13.1	9.0	1.00
0.040	34.3	16.9	1.22
0.050	68.8	26.4	1.41
0.060	119.2	37.5	1.60
0.070	209.0	48.2	1.77
0.080	338.6	58.0	1.93
0.090	506.4	67.3	2.09
0.100	716.2	75.9	2.25
0.110	971.5	83.8	2.40

TROJAN TK-7 (single)

Cross Slope 0.025



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.2	0.2	0.21
0.020	1.1	1.1	0.34
0.030	5.2	4.1	0.45
0.040	13.2	8.4	0.54
0.050	26.1	14.1	0.63
0.060	44.7	21.3	0.71
0.070	79.6	29.6	0.79
0.080	130.7	38.4	0.87
0.090	197.0	47.8	0.94
0.100	280.1	57.7	1.00
0.110	381.4	67.1	1.07
0.120	502.4	76.7	1.14
0.130	644.3	86.7	1.20
0.140	808.6	96.8	1.26
0.150	996.3	107.1	1.32

SL 0.03

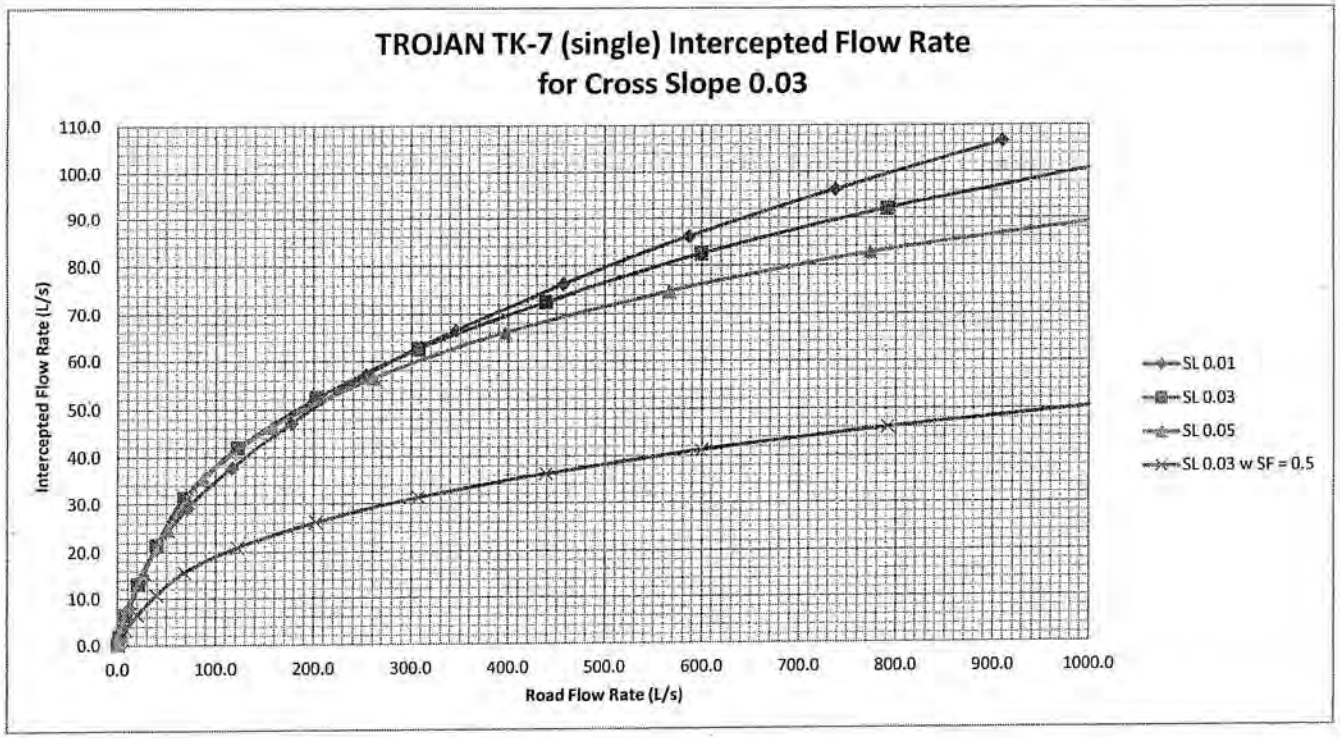
depth	Road Flow	Intercepted	Velocity	SL 0.03 w SF = 0.5
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.3	0.3	0.37	0.2
0.020	2.0	1.9	0.59	1.0
0.030	9.0	6.8	0.78	3.4
0.040	22.8	13.6	0.94	6.8
0.050	45.1	22.2	1.09	11.1
0.060	77.5	32.2	1.24	16.1
0.070	137.9	42.8	1.37	21.4
0.080	226.3	53.0	1.50	26.5
0.090	341.2	63.1	1.62	31.5
0.100	485.1	73.1	1.74	36.6
0.110	660.7	83.0	1.86	41.5
0.120	870.2	92.6	1.97	46.3
0.130	1116.0	101.9	2.07	51.0

SL 0.05

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.4	0.4	0.48
0.020	2.5	2.5	0.76
0.030	11.6	8.6	1.00
0.040	29.4	16.2	1.22
0.050	58.3	25.5	1.41
0.060	100.0	36.4	1.60
0.070	178.0	47.2	1.77
0.080	292.2	57.2	1.93
0.090	440.5	66.6	2.09
0.100	626.3	75.3	2.25
0.110	852.9	83.2	2.40
0.120	1123.4	90.2	2.54

TROJAN TK-7 (single)

Cross Slope 0.03



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.2	0.2	0.21
0.020	1.1	1.1	0.34
0.030	4.7	3.9	0.45
0.040	11.7	8.0	0.54
0.050	22.9	13.6	0.63
0.060	39.0	20.6	0.71
0.070	70.4	29.0	0.79
0.080	116.8	37.8	0.87
0.090	177.3	47.2	0.94
0.100	253.3	57.1	1.00
0.110	346.1	66.6	1.07
0.120	457.0	76.3	1.14
0.130	587.2	86.2	1.20
0.140	738.1	96.3	1.26
0.150	910.6	106.6	1.32

SL 0.03

depth	Road Flow	Intercepted	Velocity	SL 0.03 w SF = 0.5
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.3	0.3	0.37	0.2
0.020	2.0	1.9	0.59	1.0
0.030	8.2	6.5	0.78	3.2
0.040	20.3	13.1	0.94	6.6
0.050	39.7	21.5	1.09	10.8
0.060	67.6	31.3	1.24	15.7
0.070	121.9	42.0	1.37	21.0
0.080	202.3	52.3	1.50	26.2
0.090	307.1	62.5	1.62	31.2
0.100	438.7	72.6	1.74	36.3
0.110	599.5	82.4	1.86	41.2
0.120	791.5	92.1	1.97	46.0
0.130	1017.1	101.4	2.07	50.7

SL 0.05

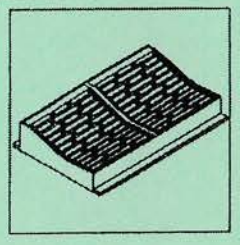
depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.4	0.4	0.48
0.020	2.5	2.5	0.76
0.030	10.6	8.3	1.00
0.040	26.2	15.7	1.22
0.050	51.2	24.8	1.41
0.060	87.3	35.4	1.60
0.070	157.4	46.4	1.77
0.080	261.2	56.5	1.93
0.090	396.5	66.0	2.09
0.100	566.4	74.7	2.25
0.110	773.9	82.7	2.40
0.120	1021.9	89.7	2.54

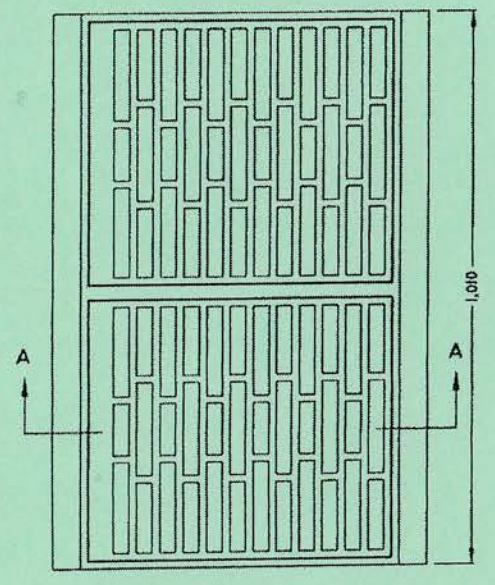
Trojan

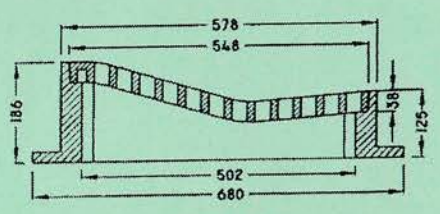
DOUBLE FRAME AND GRATE

T-K7

PLAN







SECTION A-A

ISO 9001-2000 CERTIFIED

RATED FOR HS-20 LIVE LOAD

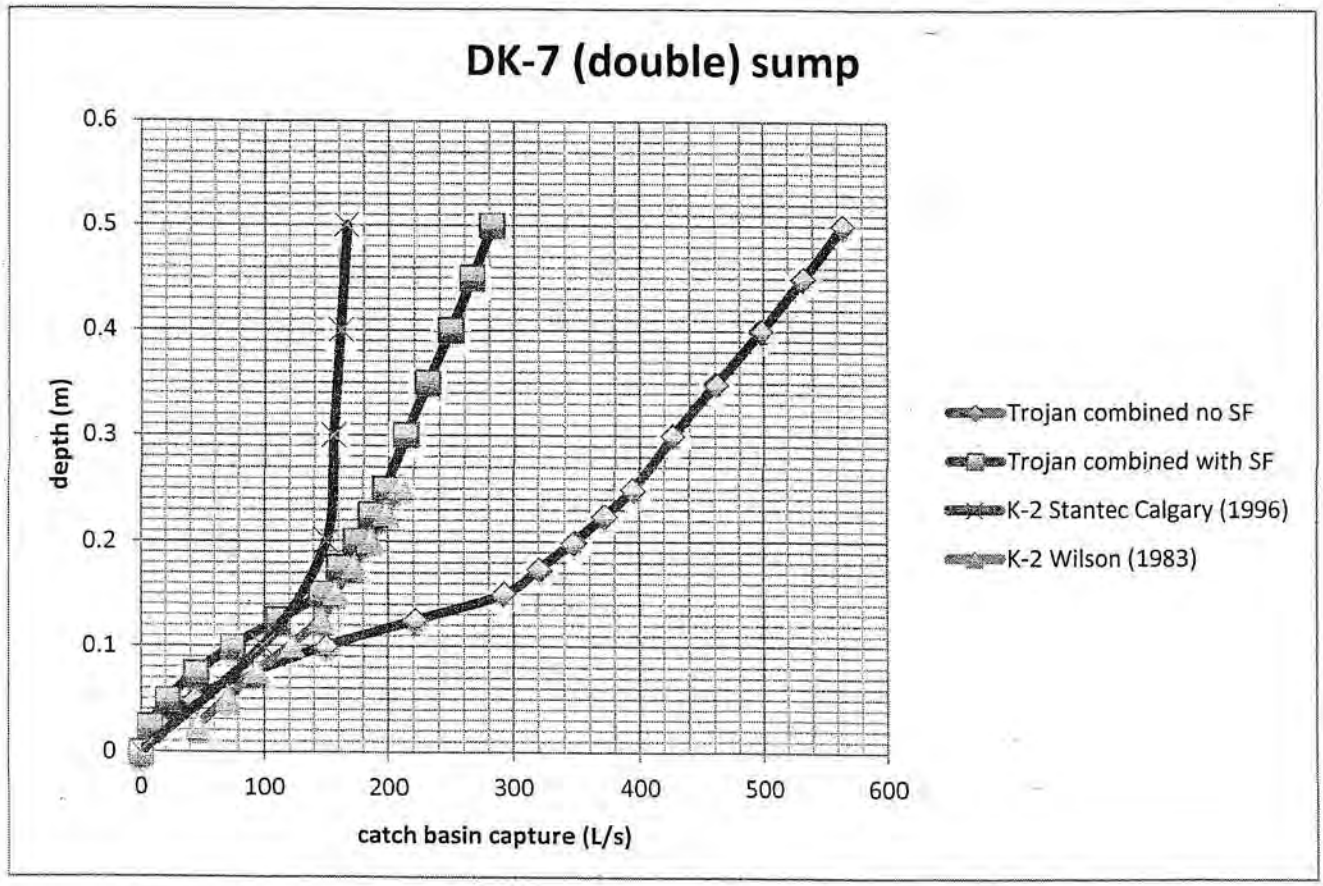
MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.

CALGARY • EDMONTON, ALBERTA

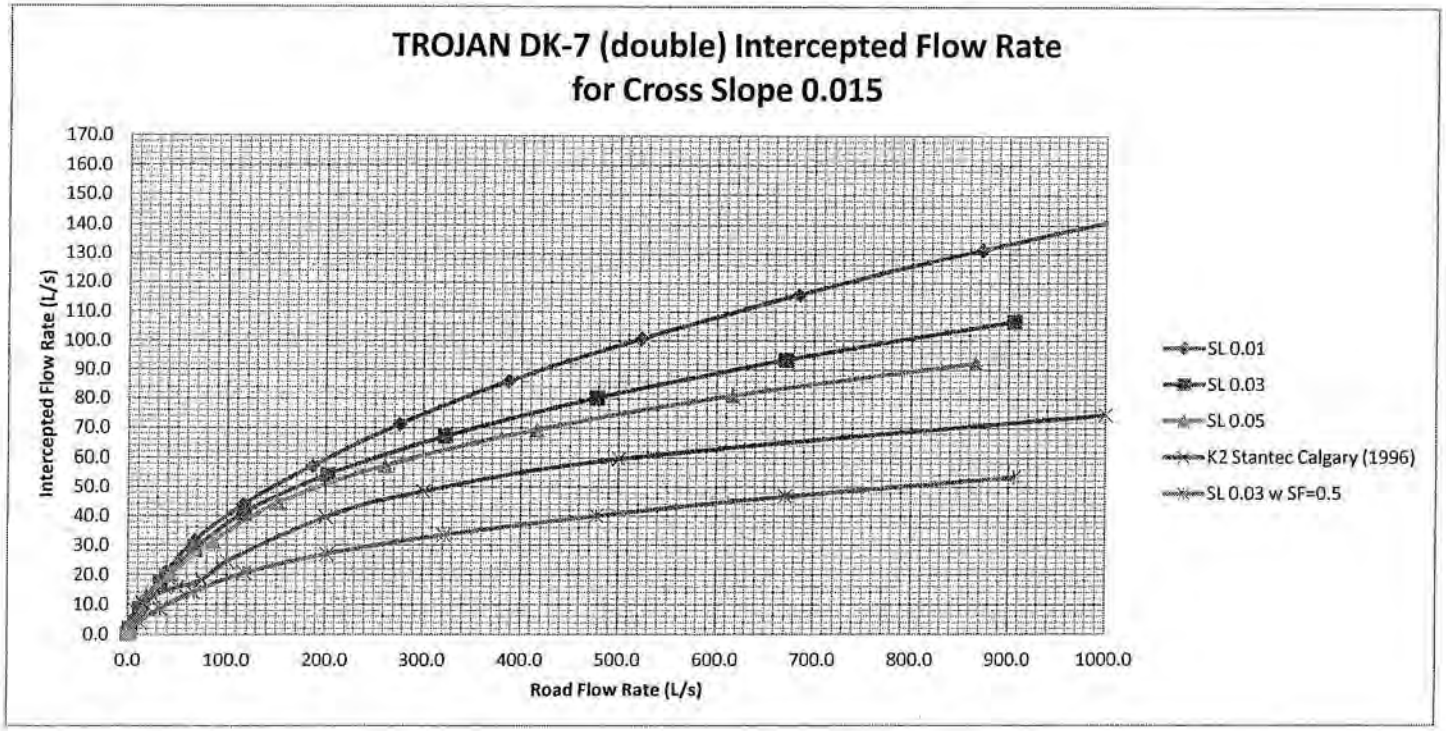
DK-7 (single) sump condition

Trojan (2014) without safety factor		Trojan with SF	K-2 Wilson (1983)		K-2 Stantec Calgary (1996)	
depth	Q combined	Q combined	depth	Q	depth	Q
(m)	(L/s)	(L/s)	(m)	(L/s)	(m)	(L/s)
0	0	0	0.025	46	0.000	0
0.025	15	7	0.051	71	0.100	98
0.050	43	22	0.076	94	0.200	150
0.075	90	45	0.102	122	0.300	156
0.100	150	75	0.127	146	0.400	161
0.125	221	111	0.152	157	0.500	166
0.150	292	146	0.178	172		
0.175	321	160	0.203	186		
0.200	347	174	0.229	198		
0.225	372	186	0.254	210		
0.250	395	197				
0.300	427	213				
0.350	461	231				
0.400	498	249				
0.450	532	266				
0.500	564	282				



TROJAN DK-7 (double)

Cross Slope 0.015



K2 Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
8	8.0
15	10.6
25	12.8
50	15.7
75	18.2
100	24.4
200	39.6
300	48.4
500	59.6
1000	74.7

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.2	0.2	0.21
0.020	1.1	1.1	0.34
0.030	7.0	5.6	0.45
0.040	19.0	12.2	0.54
0.050	38.7	20.9	0.63
0.060	67.6	31.5	0.71
0.070	116.5	43.9	0.79
0.080	186.0	57.1	0.87
0.090	275.6	71.2	0.94
0.100	387.3	86.1	1.00
0.110	522.8	100.8	1.07
0.120	684.1	115.9	1.14
0.130	872.8	131.5	1.20
0.140	1090.6	147.6	1.26

SL 0.03

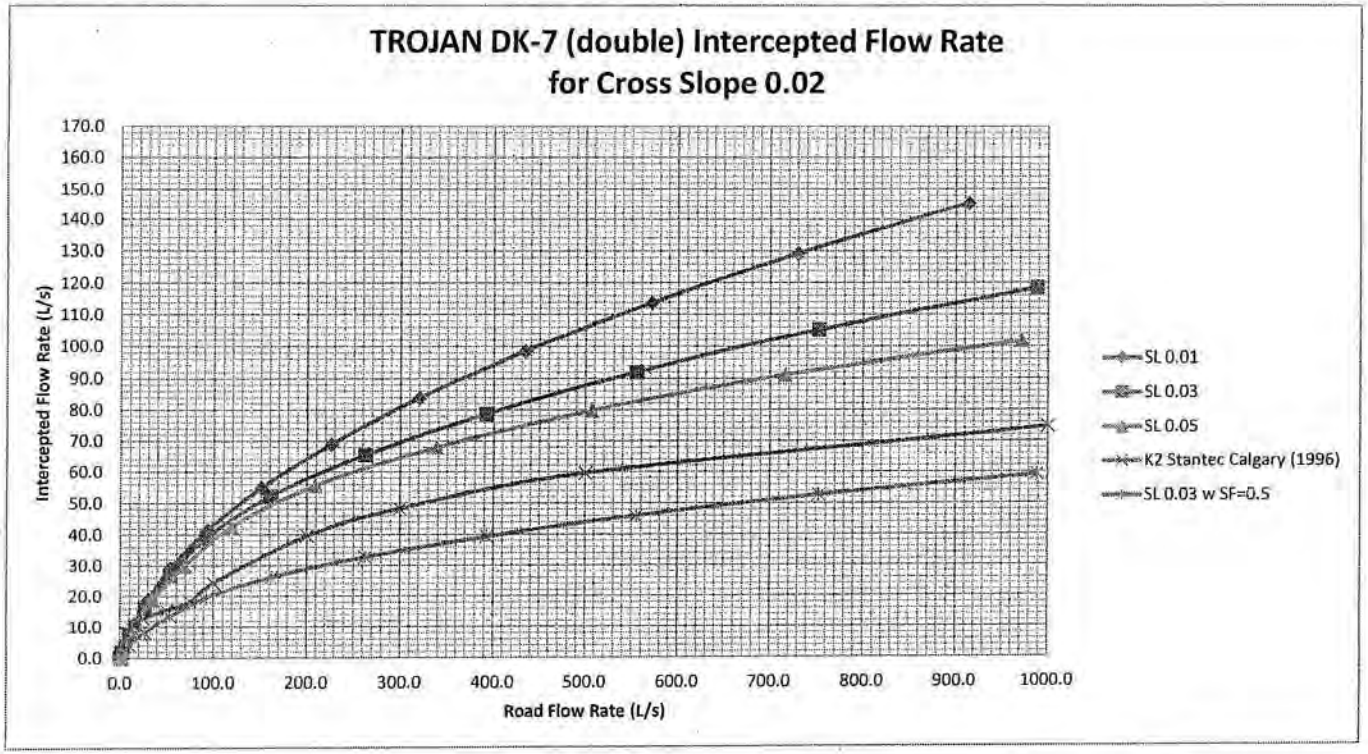
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF=0.5 (L/s)
0.010	0.3	0.3	0.37	0.2
0.020	2.0	1.9	0.59	1.0
0.030	12.1	8.6	0.78	4.3
0.040	32.8	17.5	0.94	8.8
0.050	67.0	28.5	1.09	14.2
0.060	117.0	41.1	1.24	20.5
0.070	201.9	54.2	1.37	27.1
0.080	322.2	67.2	1.50	33.6
0.090	477.4	80.3	1.62	40.2
0.100	670.8	93.6	1.74	46.8
0.110	905.6	106.8	1.86	53.4

SL 0.05

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.4	0.4	0.48
0.020	2.5	2.5	0.76
0.030	15.6	10.5	1.00
0.040	42.4	20.0	1.22
0.050	86.5	31.4	1.41
0.060	151.1	44.4	1.60
0.070	260.6	57.3	1.77
0.080	416.0	69.5	1.93
0.090	616.3	81.2	2.09
0.100	866.0	92.5	2.25

TROJAN DK-7 (double)

Cross Slope 0.02



K2 Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
8	8.0
15	10.6
25	12.8
50	15.7
75	18.2
100	24.4
200	39.6
300	48.4
500	59.6
1000	74.7

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.2	0.2	0.21
0.020	1.1	1.1	0.34
0.030	5.9	5.0	0.45
0.040	15.3	11.0	0.54
0.050	30.8	19.1	0.63
0.060	53.3	29.2	0.71
0.070	93.5	41.5	0.79
0.080	151.4	54.8	0.87
0.090	226.5	69.0	0.94
0.100	320.3	83.9	1.00
0.110	434.5	98.5	1.07
0.120	570.5	113.7	1.14
0.130	730.0	129.3	1.20
0.140	914.3	145.3	1.26

SL 0.03

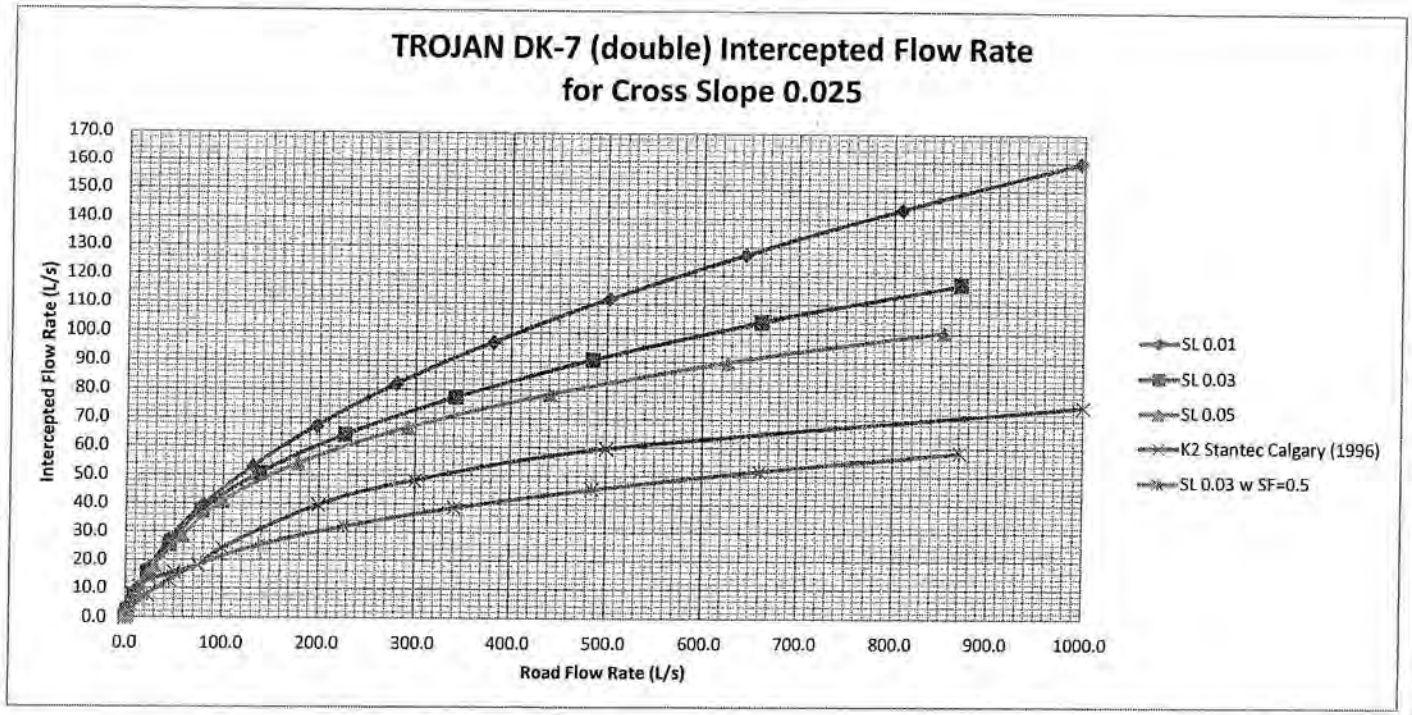
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF=0.5 (L/s)
0.010	0.3	0.3	0.37	0.2
0.020	2.0	1.9	0.59	1.0
0.030	10.1	7.9	0.78	3.9
0.040	26.6	16.4	0.94	8.2
0.050	53.3	26.9	1.09	13.4
0.060	92.3	39.1	1.24	19.5
0.070	161.9	52.3	1.37	26.2
0.080	262.3	65.5	1.50	32.7
0.090	392.3	78.7	1.62	39.4
0.100	554.8	92.0	1.74	46.0
0.110	752.5	105.2	1.86	52.6
0.120	988.2	118.4	1.97	59.2

SL 0.05

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.4	0.4	0.48
0.020	2.5	2.5	0.76
0.030	13.1	9.8	1.00
0.040	34.3	18.8	1.22
0.050	68.8	29.8	1.41
0.060	119.2	42.5	1.60
0.070	209.0	55.6	1.77
0.080	338.6	67.9	1.93
0.090	506.4	79.8	2.09
0.100	716.2	91.1	2.25
0.110	971.5	101.8	2.40

TROJAN DK-7 (double)

Cross Slope 0.025



K2 Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
8	8.0
15	10.6
25	12.8
50	15.7
75	18.2
100	24.4
200	39.6
300	48.4
500	59.6
1000	74.7

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.2	0.2	0.21
0.020	1.1	1.1	0.34
0.030	5.2	4.6	0.45
0.040	13.2	10.2	0.54
0.050	26.1	17.7	0.63
0.060	44.7	27.3	0.71
0.070	79.6	39.6	0.79
0.080	130.7	53.0	0.87
0.090	197.0	67.2	0.94
0.100	280.1	82.1	1.00
0.110	381.4	96.8	1.07
0.120	502.4	111.9	1.14
0.130	644.3	127.5	1.20
0.140	808.6	143.5	1.26
0.150	996.3	159.9	1.32

SL 0.03

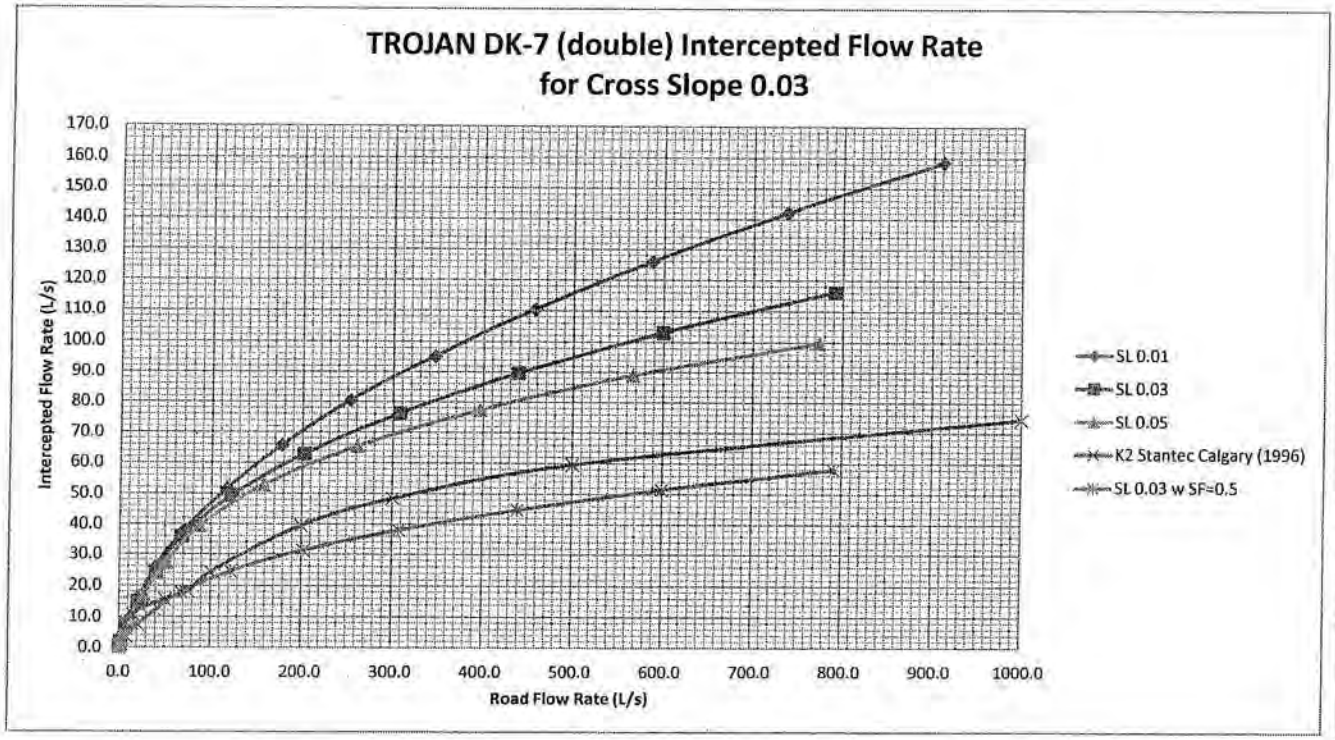
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF=0.5 (L/s)
0.010	0.3	0.3	0.37	0.2
0.020	2.0	1.9	0.59	1.0
0.030	9.0	7.4	0.78	3.7
0.040	22.8	15.4	0.94	7.7
0.050	45.1	25.5	1.09	12.8
0.060	77.5	37.4	1.24	18.7
0.070	137.9	50.7	1.37	25.4
0.080	226.3	64.0	1.50	32.0
0.090	341.2	77.4	1.62	38.7
0.100	485.1	90.7	1.74	45.4
0.110	660.7	104.0	1.86	52.0
0.120	870.2	117.2	1.97	58.6

SL 0.05

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.4	0.4	0.48
0.020	2.5	2.5	0.76
0.030	11.6	9.2	1.00
0.040	29.4	17.9	1.22
0.050	58.3	28.5	1.41
0.060	100.0	40.9	1.60
0.070	178.0	54.1	1.77
0.080	292.2	66.6	1.93
0.090	440.5	78.6	2.09
0.100	626.3	90.0	2.25
0.110	852.9	100.7	2.40

TROJAN DK-7 (double)

Cross Slope 0.03



K2 Stantec Calgary (1996)

Road Flow (L/s)	Intercepted (L/s)
0	0.0
8	8.0
15	10.6
25	12.8
50	15.7
75	18.2
100	24.4
200	39.6
300	48.4
500	59.6
1000	74.7

SL 0.01

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.2	0.2	0.21
0.020	1.1	1.1	0.34
0.030	4.7	4.3	0.45
0.040	11.7	9.5	0.54
0.050	22.9	16.6	0.63
0.060	39.0	25.8	0.71
0.070	70.4	38.0	0.79
0.080	116.8	51.5	0.87
0.090	177.3	65.7	0.94
0.100	253.3	80.6	1.00
0.110	346.1	95.3	1.07
0.120	457.0	110.5	1.14
0.130	587.2	126.1	1.20
0.140	738.1	142.1	1.26
0.150	910.6	158.4	1.32

SL 0.03

Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	SL 0.03 w SF=0.5 (L/s)
0.010	0.3	0.3	0.37	0.2
0.020	2.0	1.9	0.59	1.0
0.030	8.2	7.0	0.78	3.5
0.040	20.3	14.7	0.94	7.3
0.050	39.7	24.4	1.09	12.2
0.060	67.6	35.9	1.24	18.0
0.070	121.9	49.4	1.37	24.7
0.080	202.3	62.8	1.50	31.4
0.090	307.1	76.3	1.62	38.1
0.100	438.7	89.6	1.74	44.8
0.110	599.5	103.0	1.86	51.5
0.120	791.5	116.2	1.97	58.1

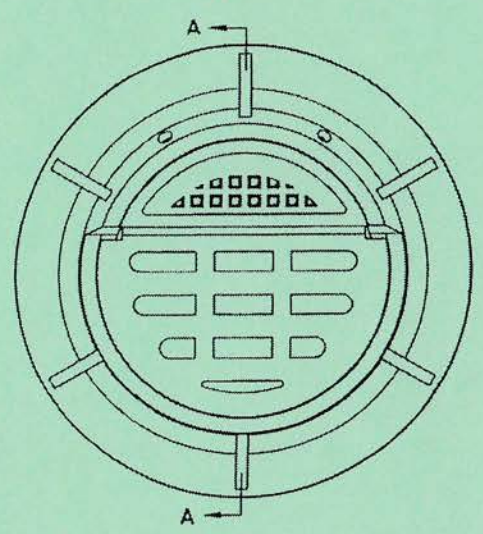
SL 0.05

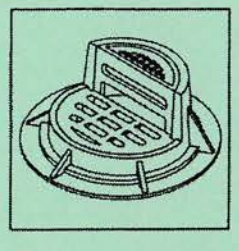
Depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.4	0.4	0.48
0.020	2.5	2.5	0.76
0.030	10.6	8.8	1.00
0.040	26.2	17.1	1.22
0.050	51.2	27.4	1.41
0.060	87.3	39.4	1.60
0.070	157.4	52.8	1.77
0.080	261.2	65.5	1.93
0.090	396.5	77.6	2.09
0.100	566.4	89.0	2.25
0.110	773.9	99.8	2.40

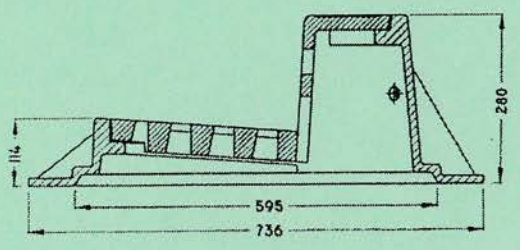
FRAME AND 1 PIECE BIKE PROOF GRATE

TF-36 BP

PLAN







SECTION A-A

ISO 9001-2000 CERTIFIED

RATED FOR HS-20 LIVE LOAD

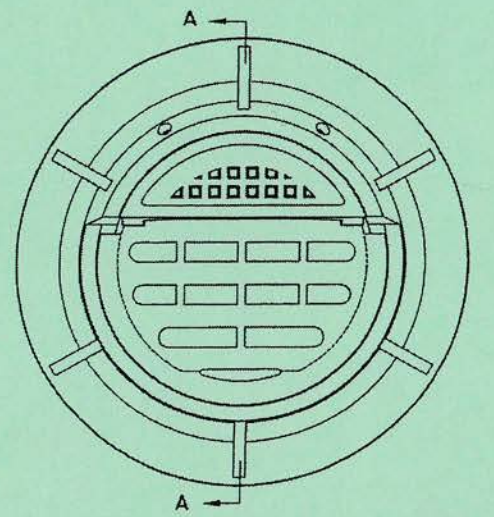
MEASUREMENTS IN MILLIMETERS

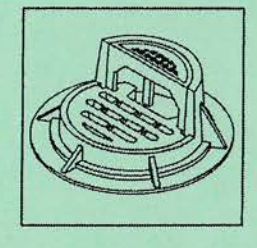
TROJAN INDUSTRIES INC.
CALGARY • EDMONTON, ALBERTA

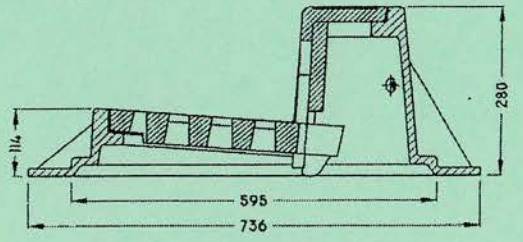
FRAME AND 2 PIECE BIKE PROOF GRATE

TF-36 BP

PLAN







SECTION A-A

ISO 9001-2000 CERTIFIED

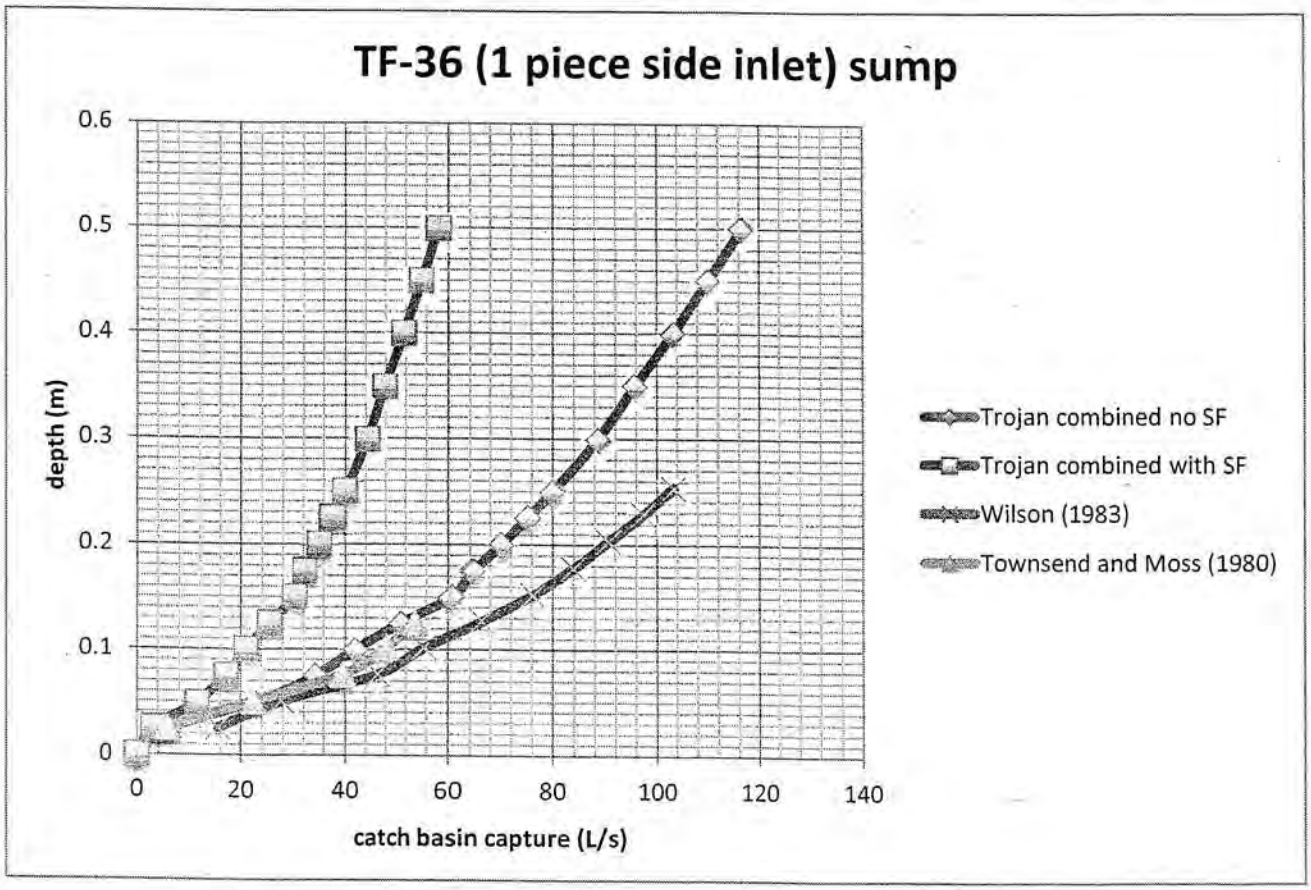
RATED FOR HS-20 LIVE LOAD

MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.
CALGARY • EDMONTON, ALBERTA

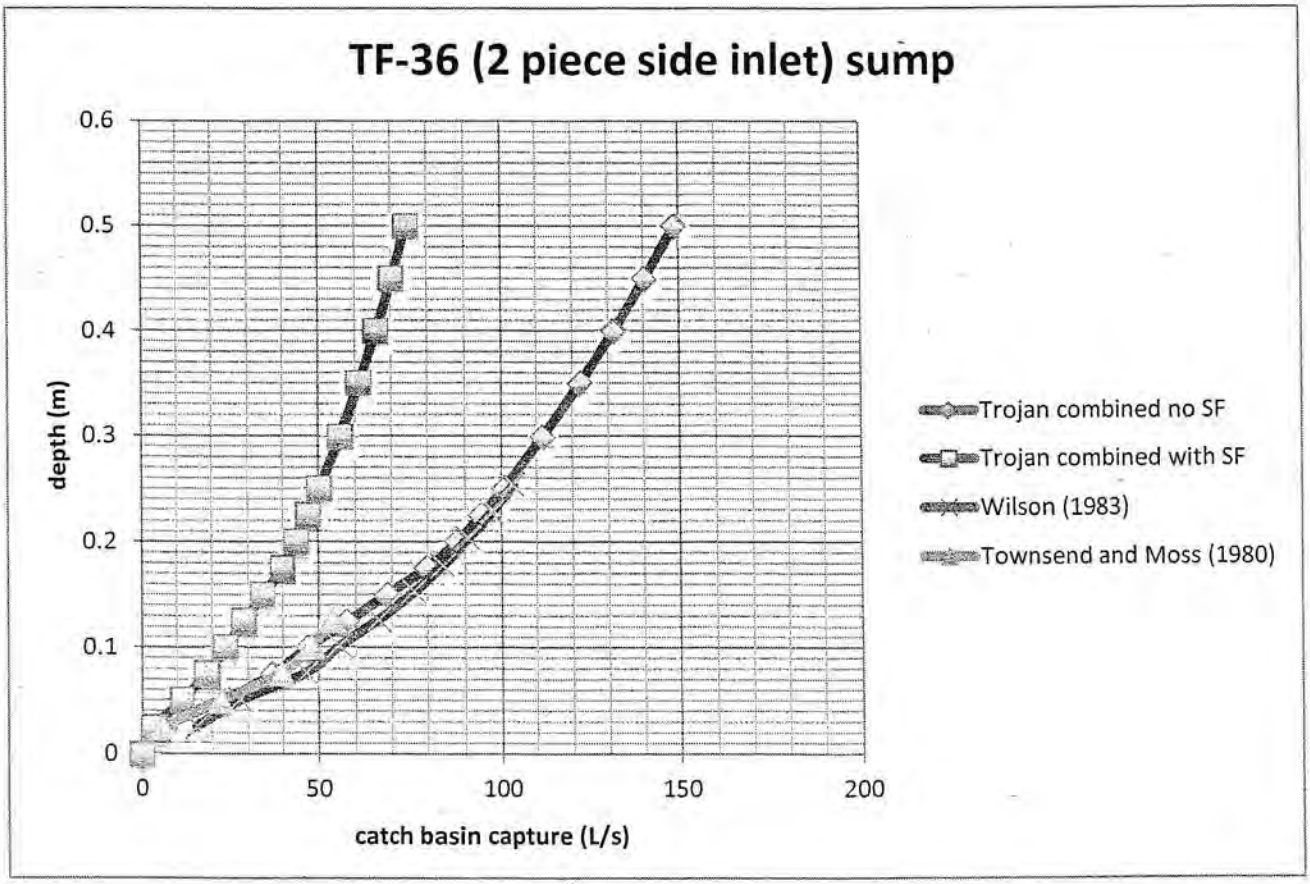
TF-36 (1piece side inlet) sump condition

Trojan (2014) without safety factor		Trojan with SF	Wilson (1983)		Townsend and Moss (1980)	
depth	Q combined	Q combined	depth	Q	depth	Q
(m)	(L/s)	(L/s)	(m)	(L/s)	(m)	(L/s)
0	0	0	0.025	16	0.025	6
0.025	6	3	0.051	28	0.051	22
0.050	23	11	0.076	46	0.076	40
0.075	34	17	0.102	56	0.102	48
0.100	42	21	0.127	66	0.127	54
0.125	51	25	0.152	76		
0.150	61	30	0.178	84		
0.175	65	32	0.203	91		
0.200	70	35	0.229	97		
0.225	75	38	0.254	103		
0.250	80	40				
0.300	89	44				
0.350	96	48				
0.400	103	52				
0.450	110	55				
0.500	116	58				

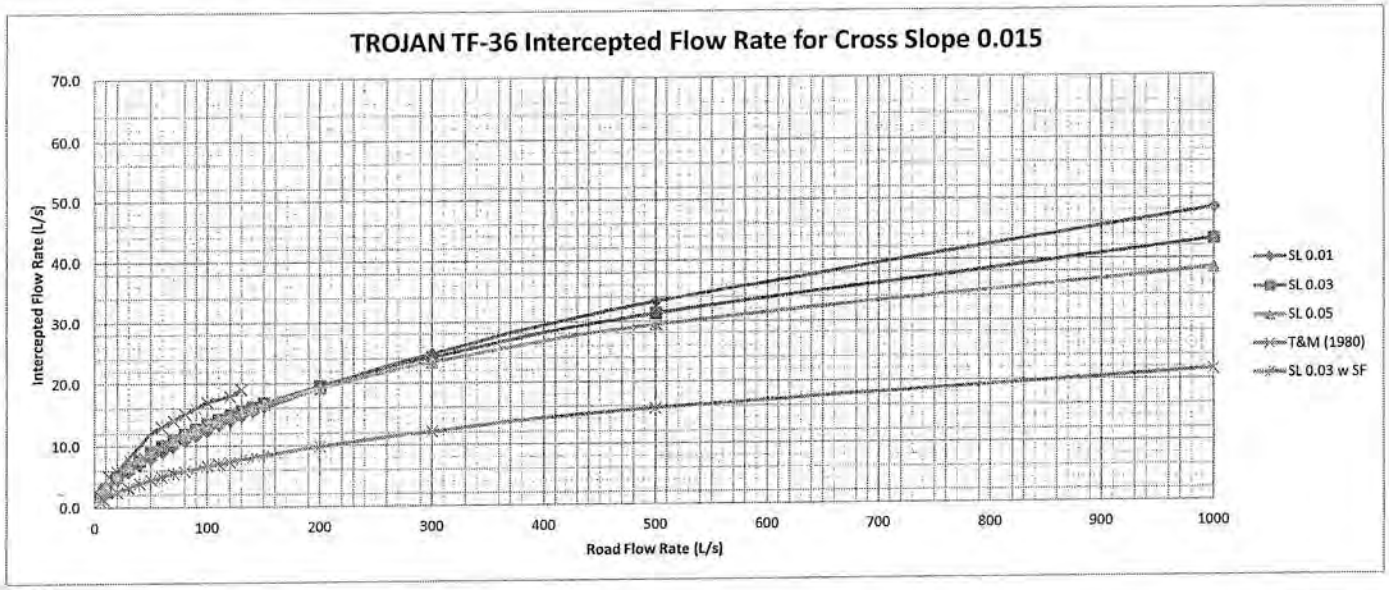


TF-36 (2 piece side inlet) sump condition

Trojan (2014) without safety factor		Trojan with SF	Wilson (1983)		Townsend and Moss (1980)	
depth	Q combined	Q combined	depth	Q	depth	Q
(m)	(L/s)	(L/s)	(m)	(L/s)	(m)	(L/s)
0	0	0	0.025	16	0.025	6
0.025	6	3	0.051	28	0.051	22
0.050	23	11	0.076	46	0.076	40
0.075	37	18	0.102	56	0.102	48
0.100	47	24	0.127	66	0.127	54
0.125	58	29	0.152	76		
0.150	69	34	0.178	84		
0.175	80	40	0.203	91		
0.200	88	44	0.229	97		
0.225	94	47	0.254	103		
0.250	101	50				
0.300	112	56				
0.350	122	61				
0.400	132	66				
0.450	140	70				
0.500	149	74				



TROJAN TF-36 Cross Slope 0.015



Intercepted Flow Rates

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05	SL 0.03 w SF
	(L/s)	(L/s)	(L/s)	(L/s)
5	1.8	1.9	2.1	1.0
8	2.4	2.7	2.8	1.3
10	2.8	3.1	3.3	1.5
20	4.4	4.9	5.2	2.5
30	5.8	6.4	6.8	3.2
40	6.9	7.7	8.1	3.8
50	8.0	8.9	9.2	4.4
60	9.0	10.0	10.1	5.0
70	9.9	11.0	11.1	5.5
80	10.8	11.9	11.9	5.9
90	11.6	12.7	12.7	6.3
100	12.4	13.4	13.4	6.7
110	13.2	14.2	14.1	7.1
120	14.0	14.9	14.8	7.4
130	14.7	15.5	15.4	7.8
140	15.4	16.2	16.0	8.1
150	16.1	16.8	16.6	8.4
200	19.3	19.6	19.2	9.8
300	24.8	24.3	23.4	12.1
500	33.3	31.3	29.4	15.7
1000	48.4	43.2	38.5	21.6

Depth

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m)	(m)	(m)
5	0.021	0.017	0.015
8	0.024	0.020	0.018
10	0.027	0.022	0.020
20	0.035	0.028	0.026
30	0.040	0.033	0.030
40	0.045	0.036	0.033
50	0.049	0.040	0.036
60	0.052	0.042	0.039
70	0.055	0.045	0.041
80	0.058	0.047	0.043
90	0.061	0.049	0.045
100	0.063	0.051	0.047
110	0.065	0.053	0.048
120	0.068	0.055	0.050
130	0.070	0.057	0.052
140	0.072	0.058	0.053
150	0.073	0.060	0.054
200	0.082	0.067	0.061
300	0.095	0.078	0.070
500	0.115	0.094	0.085
1000	0.150	0.122	0.111

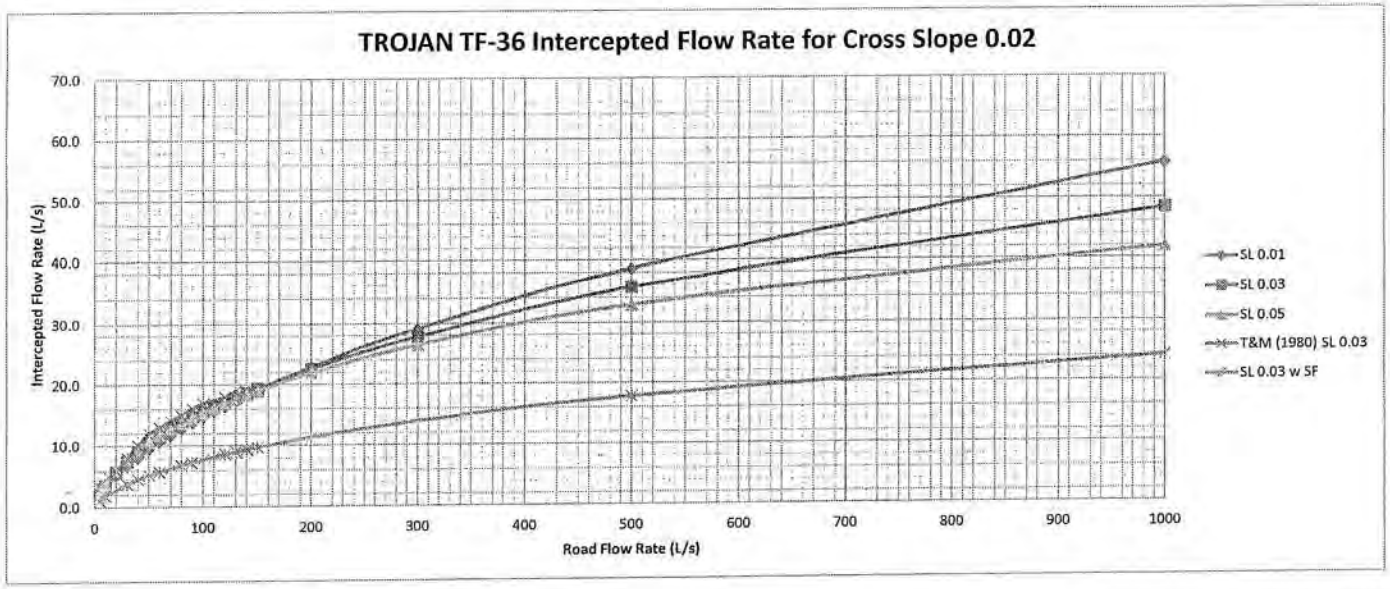
Velocity

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m/s)	(m/s)	(m/s)
5	0.35	0.52	0.64
8	0.39	0.59	0.71
10	0.41	0.62	0.76
20	0.49	0.74	0.90
30	0.55	0.82	1.00
40	0.59	0.88	1.07
50	0.62	0.94	1.13
60	0.65	0.98	1.19
70	0.67	1.02	1.23
80	0.70	1.05	1.28
90	0.72	1.08	1.31
100	0.74	1.11	1.35
110	0.76	1.14	1.38
120	0.77	1.17	1.41
130	0.79	1.19	1.44
140	0.80	1.21	1.47
150	0.82	1.23	1.49
200	0.88	1.33	1.61
300	0.97	1.47	1.78
500	1.11	1.67	2.02
1000	1.32	1.99	2.41

Townsend and Moss (1980)

Road Flow Rate	SL 0.03
(L/s)	(m/s)
13	5
20	6
30	8
40	10
50	12
60	13
70	14
80	15
90	16
100	17
120	18
130	19

TROJAN TF-36 Cross Slope 0.02



Intercepted Flow Rates

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05	SL 0.03 w SF
	(L/s)	(L/s)	(L/s)	(L/s)
5	2.1	2.3	2.4	1.1
8	2.8	3.1	3.3	1.6
10	3.3	3.6	3.8	1.8
20	5.2	5.8	6.1	2.9
30	6.8	7.5	7.9	3.8
40	8.2	9.1	9.3	4.5
50	9.4	10.5	10.5	5.2
60	10.6	11.6	11.7	5.8
70	11.7	12.7	12.7	6.4
80	12.8	13.7	13.6	6.9
90	13.7	14.6	14.5	7.3
100	14.7	15.5	15.4	7.8
110	15.6	16.4	16.2	8.2
120	16.5	17.2	16.9	8.6
130	17.4	17.9	17.6	9.0
140	18.2	18.7	18.3	9.3
150	19.0	19.4	18.9	9.7
200	22.8	22.6	21.8	11.3
300	29.1	27.8	26.4	13.9
500	38.6	35.7	32.9	17.8
1000	55.9	48.4	41.9	24.2

Depth

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m)	(m)	(m)
5	0.023	0.019	0.017
8	0.027	0.022	0.020
10	0.030	0.024	0.022
20	0.038	0.031	0.028
30	0.045	0.036	0.033
40	0.050	0.041	0.037
50	0.054	0.044	0.040
60	0.058	0.047	0.043
70	0.062	0.050	0.045
80	0.065	0.053	0.048
90	0.068	0.055	0.050
100	0.070	0.057	0.052
110	0.073	0.059	0.054
120	0.075	0.061	0.056
130	0.078	0.063	0.057
140	0.080	0.065	0.059
150	0.082	0.067	0.061
200	0.091	0.074	0.067
300	0.106	0.086	0.079
500	0.129	0.105	0.095
1000	0.167	0.136	0.123

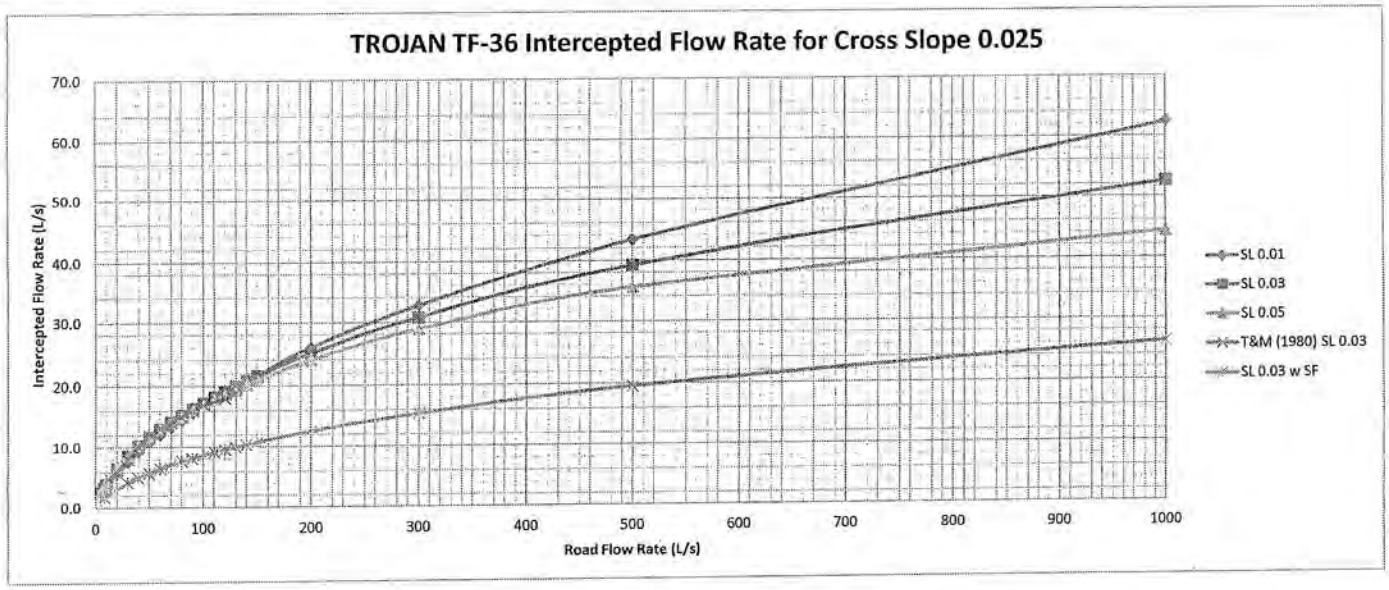
Velocity

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m/s)	(m/s)	(m/s)
5	0.37	0.56	0.68
8	0.42	0.63	0.77
10	0.44	0.67	0.81
20	0.53	0.80	0.97
30	0.59	0.88	1.07
40	0.63	0.95	1.15
50	0.67	1.01	1.22
60	0.70	1.05	1.28
70	0.73	1.09	1.33
80	0.75	1.13	1.37
90	0.77	1.17	1.41
100	0.79	1.20	1.45
110	0.81	1.23	1.48
120	0.83	1.25	1.52
130	0.85	1.28	1.55
140	0.86	1.30	1.58
150	0.88	1.33	1.61
200	0.94	1.43	1.73
300	1.05	1.58	1.91
500	1.19	1.79	2.17
1000	1.42	2.14	2.59

Townsend and Moss (1980)

Road Flow Rate	SL 0.03
(L/s)	(m/s)
13	5
20	6
30	8
40	10
50	12
60	13
70	14
80	15
90	16
100	17
120	18
130	19

TROJAN TF-36 Cross Slope 0.025



Intercepted Flow Rates

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05	SL 0.03 w SF
	(L/s)	(L/s)	(L/s)	(L/s)
5	2.3	2.5	2.7	1.3
8	3.2	3.5	3.7	1.7
10	3.7	4.1	4.3	2.0
20	5.9	6.5	6.9	3.2
30	7.7	8.5	8.7	4.3
40	9.3	10.3	10.3	5.1
50	10.7	11.7	11.7	5.8
60	12.0	13.0	12.9	6.5
70	13.3	14.2	14.1	7.1
80	14.5	15.3	15.1	7.6
90	15.6	16.3	16.1	8.2
100	16.7	17.3	17.0	8.7
110	17.8	18.2	17.9	9.1
120	18.8	19.1	18.7	9.6
130	19.8	20.0	19.5	10.0
140	20.7	20.8	20.2	10.4
150	21.7	21.6	20.9	10.8
200	26.0	25.1	24.0	12.5
300	32.7	30.8	28.9	15.4
500	43.3	39.2	35.5	19.6
1000	62.4	52.6	44.2	26.3

Depth

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m)	(m)	(m)
5	0.025	0.020	0.018
8	0.030	0.024	0.022
10	0.032	0.026	0.024
20	0.042	0.034	0.031
30	0.049	0.040	0.036
40	0.054	0.044	0.040
50	0.059	0.048	0.044
60	0.063	0.051	0.047
70	0.067	0.054	0.049
80	0.070	0.057	0.052
90	0.073	0.060	0.054
100	0.076	0.062	0.057
110	0.079	0.064	0.059
120	0.082	0.067	0.061
130	0.084	0.069	0.062
140	0.087	0.071	0.064
150	0.089	0.072	0.066
200	0.099	0.081	0.073
300	0.115	0.094	0.085
500	0.140	0.114	0.103
1000	0.181	0.148	0.134

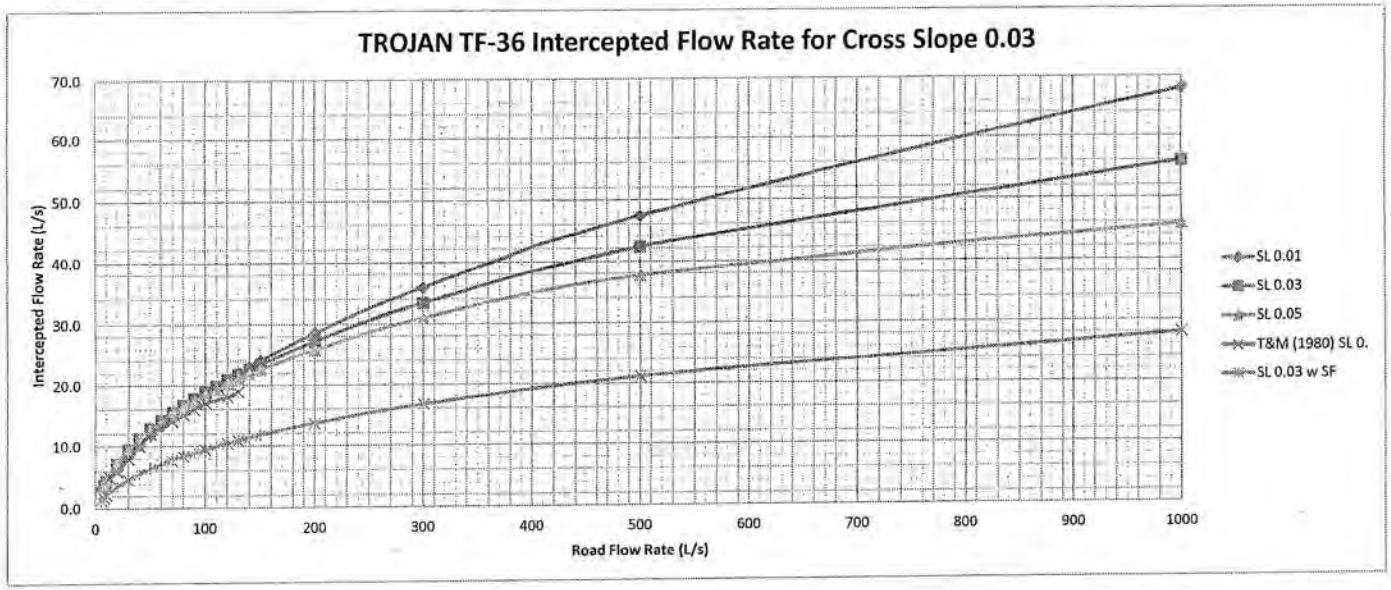
Velocity

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m/s)	(m/s)	(m/s)
5	0.40	0.60	0.72
8	0.44	0.67	0.81
10	0.47	0.71	0.86
20	0.56	0.85	1.02
30	0.62	0.94	1.13
40	0.67	1.01	1.22
50	0.71	1.06	1.29
60	0.74	1.11	1.35
70	0.77	1.16	1.40
80	0.79	1.20	1.45
90	0.82	1.23	1.49
100	0.84	1.27	1.53
110	0.86	1.30	1.57
120	0.88	1.33	1.61
130	0.90	1.35	1.64
140	0.91	1.38	1.67
150	0.93	1.40	1.70
200	1.00	1.51	1.82
300	1.11	1.67	2.02
500	1.26	1.90	2.30
1000	1.50	2.26	2.73

Townsend and Moss (1980)

Road Flow Rate	SL 0.03
(L/s)	(m/s)
13	5
20	6
30	8
40	10
50	12
60	13
70	14
80	15
90	16
100	17
120	18
130	19

TROJAN TF-36 Cross Slope 0.03



Intercepted Flow Rates

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05	SL 0.03 w SF
	(L/s)	(L/s)	(L/s)	(L/s)
5	2.5	2.7	2.9	1.4
8	3.5	3.8	4.1	1.9
10	4.0	4.5	4.7	2.2
20	6.5	7.2	7.5	3.6
30	8.5	9.4	9.5	4.7
40	10.2	11.2	11.2	5.6
50	11.8	12.8	12.7	6.4
60	13.3	14.2	14.1	7.1
70	14.7	15.5	15.3	7.7
80	16.1	16.7	16.4	8.3
90	17.3	17.8	17.4	8.9
100	18.6	18.9	18.4	9.4
110	19.7	19.9	19.3	9.9
120	20.9	20.8	20.2	10.4
130	22.0	21.8	21.0	10.9
140	23.0	22.6	21.8	11.3
150	24.1	23.5	22.6	11.7
200	28.6	27.2	25.9	13.6
300	35.9	33.3	30.9	16.7
500	47.4	42.3	37.7	21.1
1000	68.1	55.9	45.7	28.0

Depth

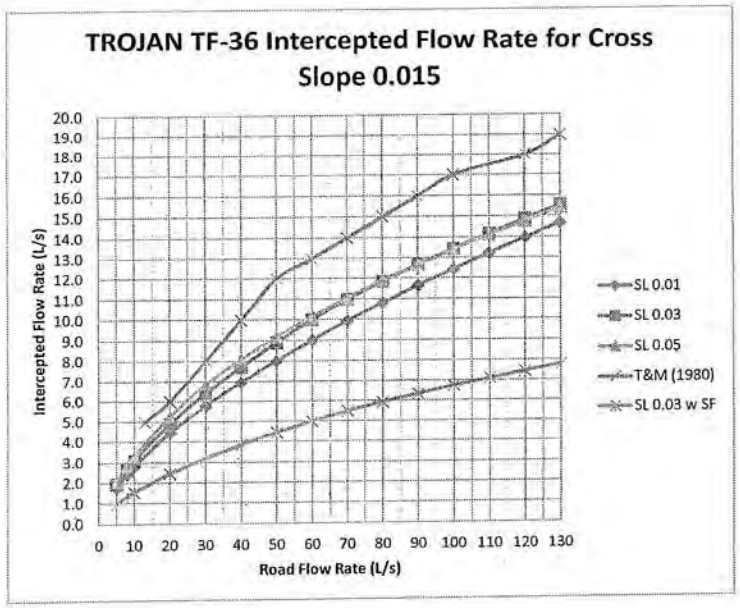
Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m)	(m)	(m)
5	0.027	0.022	0.020
8	0.032	0.026	0.023
10	0.035	0.028	0.026
20	0.045	0.036	0.033
30	0.052	0.042	0.039
40	0.058	0.047	0.043
50	0.063	0.051	0.047
60	0.068	0.055	0.050
70	0.072	0.058	0.053
80	0.075	0.061	0.056
90	0.079	0.064	0.058
100	0.082	0.067	0.061
110	0.085	0.069	0.063
120	0.088	0.071	0.065
130	0.090	0.074	0.067
140	0.093	0.076	0.069
150	0.095	0.078	0.070
200	0.106	0.086	0.079
300	0.124	0.101	0.091
500	0.150	0.122	0.111
1000	0.194	0.158	0.144

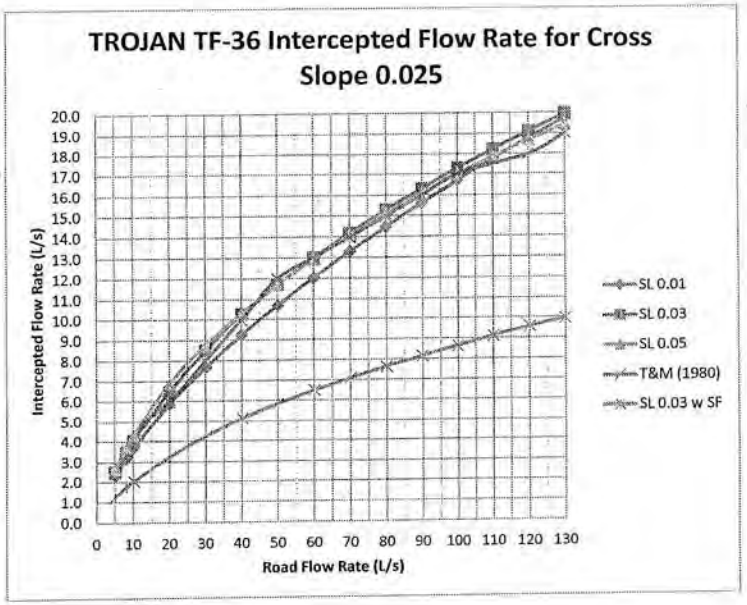
Velocity

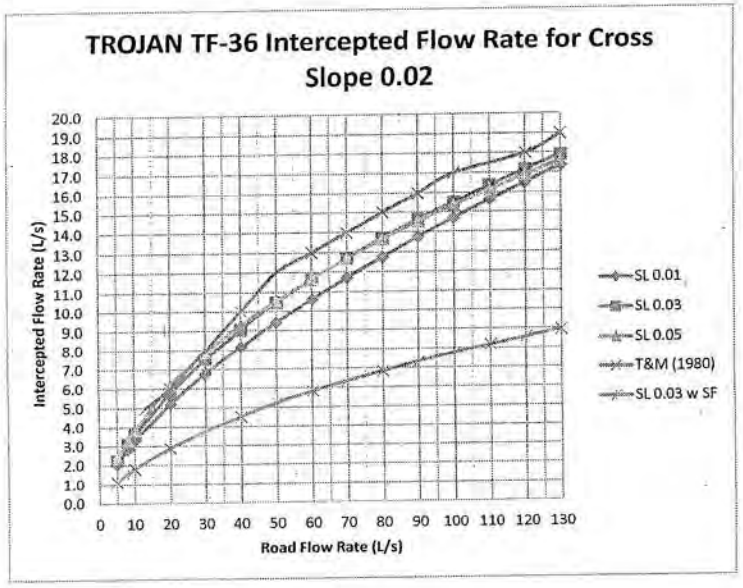
Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m/s)	(m/s)	(m/s)
5	0.41	0.62	0.76
8	0.47	0.70	0.85
10	0.49	0.74	0.90
20	0.59	0.88	1.07
30	0.65	0.98	1.19
40	0.70	1.05	1.28
50	0.74	1.11	1.35
60	0.77	1.17	1.41
70	0.80	1.21	1.47
80	0.83	1.25	1.52
90	0.86	1.29	1.56
100	0.88	1.33	1.61
110	0.90	1.36	1.64
120	0.92	1.39	1.68
130	0.94	1.42	1.71
140	0.96	1.44	1.75
150	0.97	1.47	1.78
200	1.05	1.58	1.91
300	1.16	1.75	2.12
500	1.32	1.99	2.41
1000	1.57	2.36	2.86

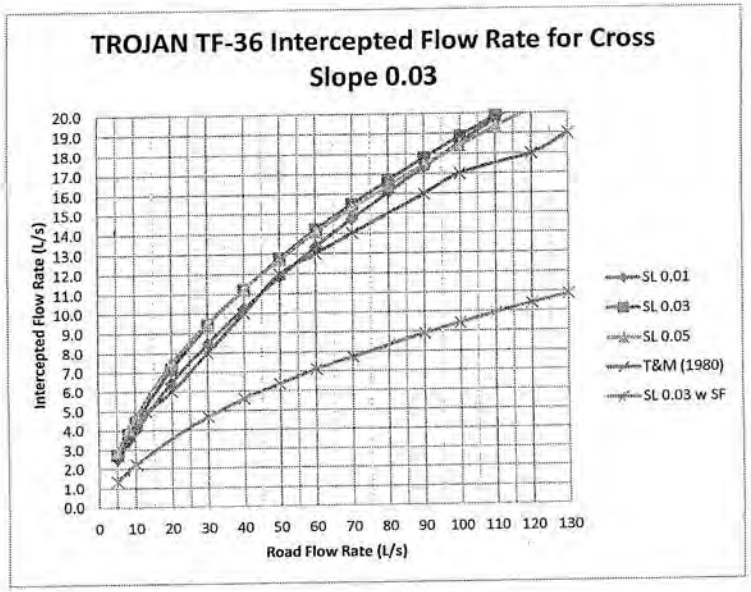
Townsend and Moss (1980)

Road Flow Rate	SL 0.03
(L/s)	(m/s)
13	5
20	6
30	8
40	10
50	12
60	13
70	14
80	15
90	16
100	17
120	18
130	19


TROJAN TF-36 Intercepted Flow Rate for Cross Slope 0.015
Intercepted Flow Rate (L/s)
Road Flow Rate (L/s)
SL 0.01
SL 0.03
SL 0.05
T&M (1980)
SL 0.03 w SF

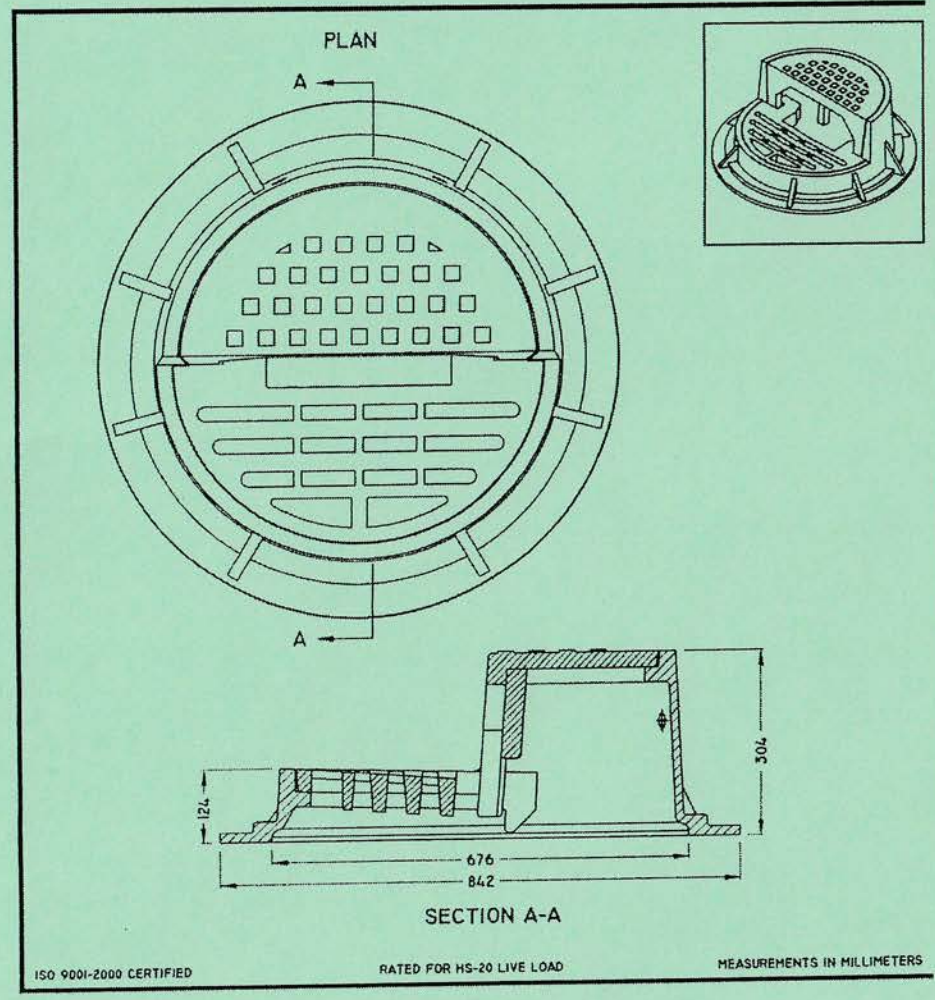

TROJAN TF-36 Intercepted Flow Rate for Cross Slope 0.025
Intercepted Flow Rate (L/s)
Road Flow Rate (L/s)
SL 0.01
SL 0.03
SL 0.05
T&M (1980)
SL 0.03 w SF


TROJAN TF-36 Intercepted Flow Rate for Cross Slope 0.02
Intercepted Flow Rate (L/s)
Road Flow Rate (L/s)
SL 0.01
SL 0.03
SL 0.05
T&M (1980)
SL 0.03 w SF


TROJAN TF-36 Intercepted Flow Rate for Cross Slope 0.03
Intercepted Flow Rate (L/s)
Road Flow Rate (L/s)
SL 0.01
SL 0.03
SL 0.05
T&M (1980)
SL 0.03 w SF

FRAME AND 2 PIECE BIKE PROOF GRATE

TF-36A-BP



ISO 9001-2000 CERTIFIED

RATED FOR HS-20 LIVE LOAD

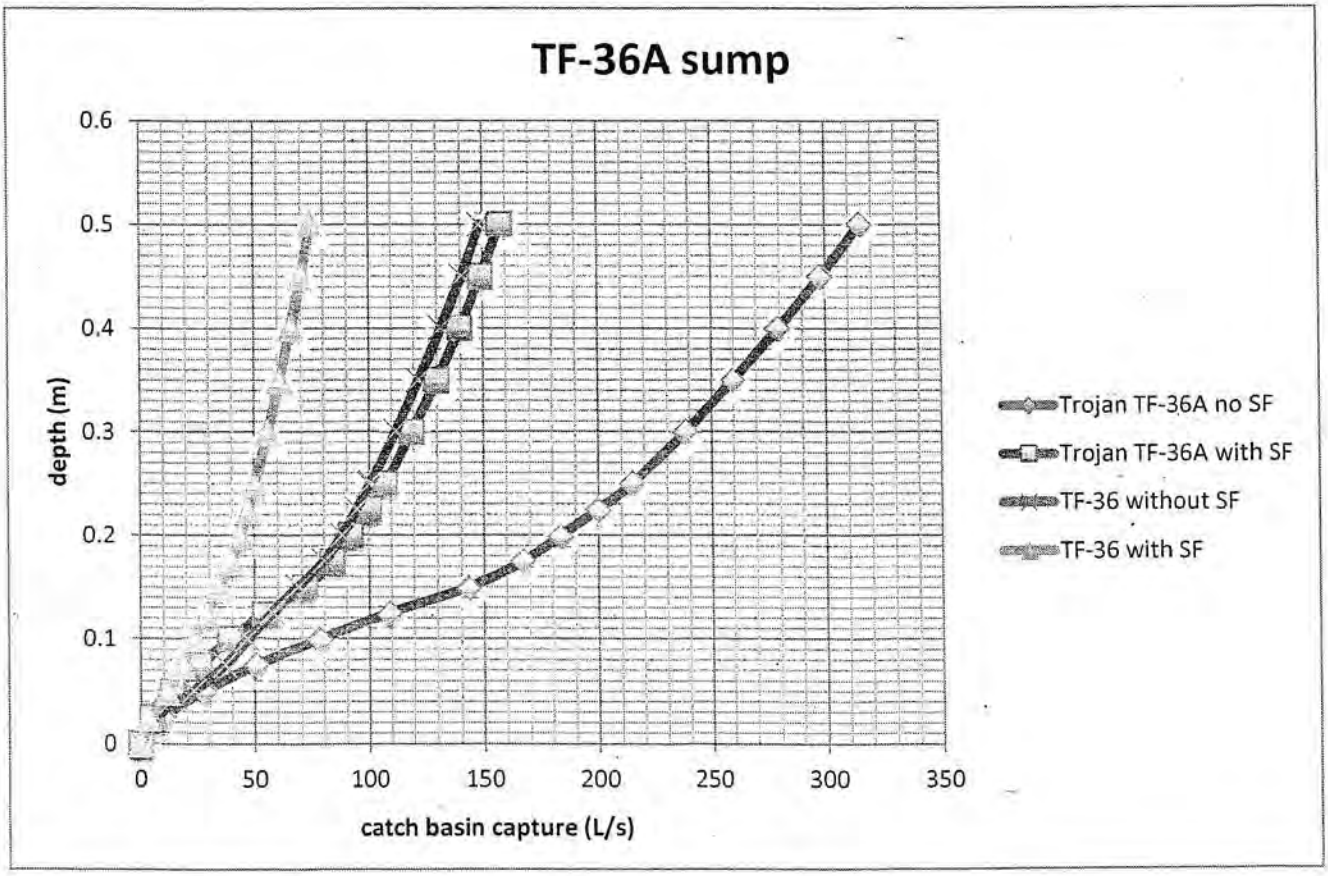
MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.

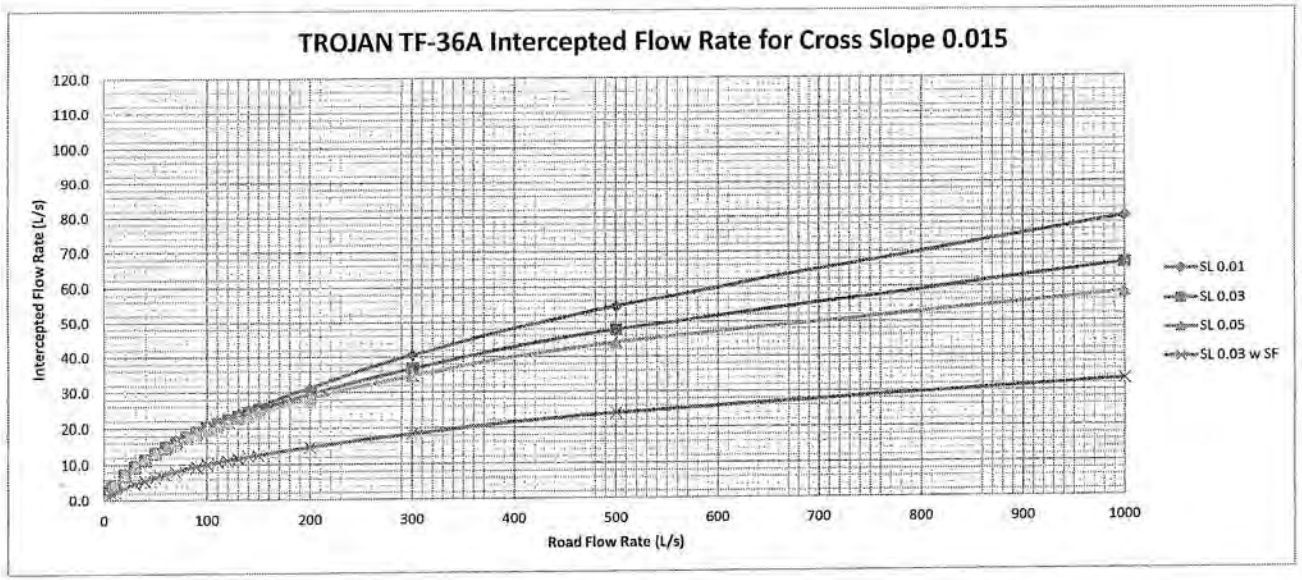
CALGARY • EDMONTON, ALBERTA

TF-36A sump condition

Trojan (2014) without safety factor		Trojan with SF	TF-36 without SF	TF-36 with SF
depth	Q combined	Q combined	Q	Q
(m)	(L/s)	(L/s)	(L/s)	(L/s)
0	0	0	0	0
0.025	10	5	6	3
0.050	28	14	23	11
0.075	51	25	37	18
0.100	78	39	47	24
0.125	109	55	58	29
0.150	143	72	69	34
0.175	167	84	80	40
0.200	184	92	88	44
0.225	200	100	94	47
0.250	215	107	101	50
0.300	238	119	112	56
0.350	260	130	122	61
0.400	279	140	132	66
0.450	298	149	140	70
0.500	315	158	149	74



TROJAN TF-36A Cross Slope 0.015



Intercepted Flow Rates

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05	SL 0.03 w SF
	(L/s)	(L/s)	(L/s)	(L/s)
5	2.7	2.7	2.8	1.4
8	3.7	3.8	4.0	1.9
10	4.4	4.5	4.6	2.2
20	7.0	7.2	7.5	3.6
30	9.2	9.4	9.8	4.7
40	11.1	11.4	11.7	5.7
50	12.9	13.2	13.3	6.6
60	14.5	14.9	14.8	7.4
70	16.0	16.4	16.1	8.2
80	17.5	17.7	17.4	8.8
90	18.8	18.9	18.5	9.5
100	20.2	20.1	19.7	10.1
110	21.4	21.2	20.7	10.6
120	22.7	22.3	21.7	11.2
130	23.8	23.3	22.7	11.7
140	25.0	24.3	23.6	12.2
150	26.1	25.3	24.5	12.6
200	31.4	29.6	28.4	14.8
300	40.5	36.8	34.8	18.4
500	54.5	47.8	44.1	23.9
1000	79.9	66.5	58.3	33.3

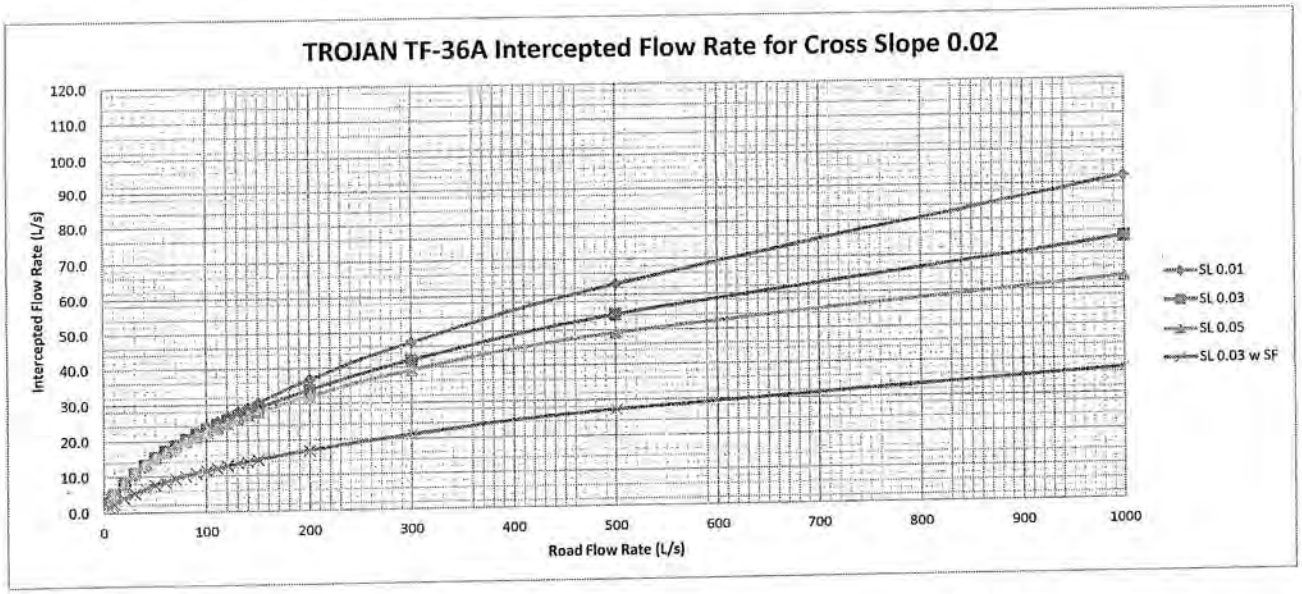
Depth

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m)	(m)	(m)
5	0.021	0.017	0.015
8	0.024	0.020	0.018
10	0.027	0.022	0.020
20	0.035	0.028	0.026
30	0.040	0.033	0.030
40	0.045	0.036	0.033
50	0.049	0.040	0.036
60	0.052	0.042	0.039
70	0.055	0.045	0.041
80	0.058	0.047	0.043
90	0.061	0.049	0.045
100	0.063	0.051	0.047
110	0.065	0.053	0.048
120	0.068	0.055	0.050
130	0.070	0.057	0.052
140	0.072	0.058	0.053
150	0.073	0.060	0.054
200	0.082	0.067	0.061
300	0.095	0.078	0.070
500	0.115	0.094	0.085
1000	0.150	0.122	0.111

Velocity

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m/s)	(m/s)	(m/s)
5	0.35	0.52	0.64
8	0.39	0.59	0.71
10	0.41	0.62	0.76
20	0.49	0.74	0.90
30	0.55	0.82	1.00
40	0.59	0.88	1.07
50	0.62	0.94	1.13
60	0.65	0.98	1.19
70	0.67	1.02	1.23
80	0.70	1.05	1.28
90	0.72	1.08	1.31
100	0.74	1.11	1.35
110	0.76	1.14	1.38
120	0.77	1.17	1.41
130	0.79	1.19	1.44
140	0.80	1.21	1.47
150	0.82	1.23	1.49
200	0.88	1.33	1.61
300	0.97	1.47	1.78
500	1.11	1.67	2.02
1000	1.32	1.99	2.41

TROJAN TF-36A Cross Slope 0.02



Intercepted Flow Rates

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05	SL 0.03 w SF
	(L/s)	(L/s)	(L/s)	(L/s)
5	3.0	3.1	3.2	1.5
8	4.2	4.4	4.5	2.2
10	5.0	5.1	5.3	2.6
20	8.1	8.3	8.7	4.1
30	10.6	10.9	11.2	5.5
40	12.9	13.3	13.3	6.6
50	14.9	15.4	15.2	7.7
60	16.9	17.2	16.8	8.6
70	18.7	18.8	18.4	9.4
80	20.4	20.3	19.8	10.2
90	22.0	21.7	21.1	10.9
100	23.6	23.1	22.4	11.5
110	25.1	24.4	23.6	12.2
120	26.5	25.6	24.7	12.8
130	27.9	26.8	25.8	13.4
140	29.3	27.9	26.8	14.0
150	30.6	29.0	27.8	14.5
200	36.8	33.9	32.2	17.0
300	47.2	42.0	39.1	21.0
500	63.0	54.3	49.1	27.2
1000	92.1	74.6	63.6	37.3

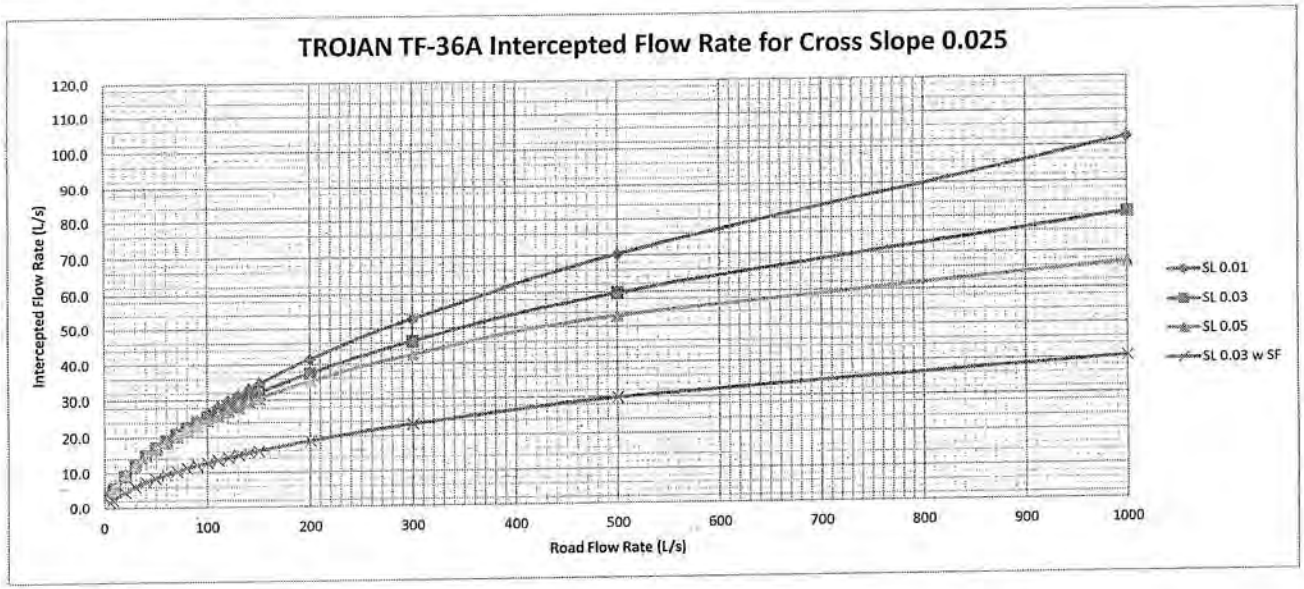
Depth

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m)	(m)	(m)
5	0.023	0.019	0.017
8	0.027	0.022	0.020
10	0.030	0.024	0.022
20	0.038	0.031	0.028
30	0.045	0.036	0.033
40	0.050	0.041	0.037
50	0.054	0.044	0.040
60	0.058	0.047	0.043
70	0.062	0.050	0.045
80	0.065	0.053	0.048
90	0.068	0.055	0.050
100	0.070	0.057	0.052
110	0.073	0.059	0.054
120	0.075	0.061	0.056
130	0.078	0.063	0.057
140	0.080	0.065	0.059
150	0.082	0.067	0.061
200	0.091	0.074	0.067
300	0.106	0.086	0.079
500	0.129	0.105	0.095
1000	0.167	0.136	0.123

Velocity

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m/s)	(m/s)	(m/s)
5	0.37	0.56	0.68
8	0.42	0.63	0.77
10	0.44	0.67	0.81
20	0.53	0.80	0.97
30	0.59	0.88	1.07
40	0.63	0.95	1.15
50	0.67	1.01	1.22
60	0.70	1.05	1.28
70	0.73	1.09	1.33
80	0.75	1.13	1.37
90	0.77	1.17	1.41
100	0.79	1.20	1.45
110	0.81	1.23	1.48
120	0.83	1.25	1.52
130	0.85	1.28	1.55
140	0.86	1.30	1.58
150	0.88	1.33	1.61
200	0.94	1.43	1.73
300	1.05	1.58	1.91
500	1.19	1.79	2.17
1000	1.42	2.14	2.59

TROJAN TF-36A Cross Slope 0.025



Intercepted Flow Rates

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05	SL 0.03 w SF
	(L/s)	(L/s)	(L/s)	(L/s)
5	3.3	3.4	3.5	1.7
8	4.6	4.8	5.0	2.4
10	5.5	5.7	5.9	2.8
20	8.9	9.3	9.6	4.6
30	11.8	12.3	12.3	6.1
40	14.4	14.9	14.7	7.4
50	16.8	17.1	16.7	8.5
60	18.9	19.0	18.6	9.5
70	21.0	20.8	20.3	10.4
80	22.9	22.5	21.8	11.3
90	24.8	24.1	23.3	12.0
100	26.5	25.6	24.7	12.8
110	28.2	27.0	25.9	13.5
120	29.9	28.4	27.2	14.2
130	31.5	29.7	28.3	14.8
140	33.1	30.9	29.5	15.5
150	34.6	32.1	30.5	16.1
200	41.6	37.5	35.2	18.8
300	52.7	46.4	42.7	23.2
500	70.4	59.6	53.1	29.8
1000	102.5	81.1	67.2	40.5

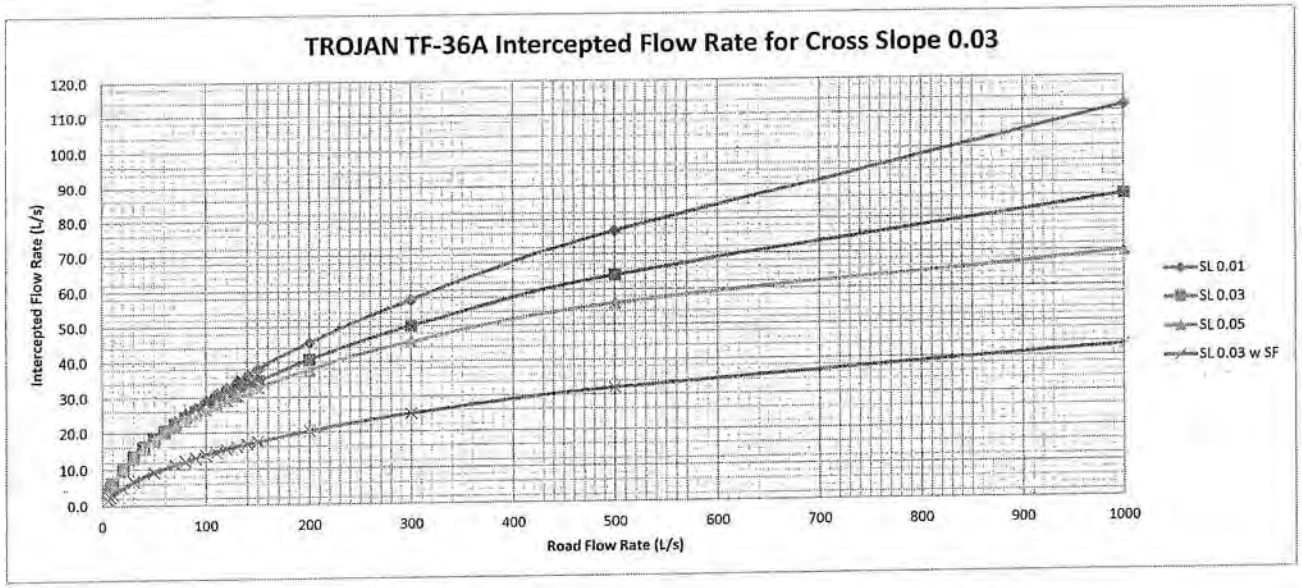
Depth

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m)	(m)	(m)
5	0.025	0.020	0.018
8	0.030	0.024	0.022
10	0.032	0.026	0.024
20	0.042	0.034	0.031
30	0.049	0.040	0.036
40	0.054	0.044	0.040
50	0.059	0.048	0.044
60	0.063	0.051	0.047
70	0.067	0.054	0.049
80	0.070	0.057	0.052
90	0.073	0.060	0.054
100	0.076	0.062	0.057
110	0.079	0.064	0.059
120	0.082	0.067	0.061
130	0.084	0.069	0.062
140	0.087	0.071	0.064
150	0.089	0.072	0.066
200	0.099	0.081	0.073
300	0.115	0.094	0.085
500	0.140	0.114	0.103
1000	0.181	0.148	0.134

Velocity

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m/s)	(m/s)	(m/s)
5	0.40	0.60	0.72
8	0.44	0.67	0.81
10	0.47	0.71	0.86
20	0.56	0.85	1.02
30	0.62	0.94	1.13
40	0.67	1.01	1.22
50	0.71	1.06	1.29
60	0.74	1.11	1.35
70	0.77	1.16	1.40
80	0.79	1.20	1.45
90	0.82	1.23	1.49
100	0.84	1.27	1.53
110	0.86	1.30	1.57
120	0.88	1.33	1.61
130	0.90	1.35	1.64
140	0.91	1.38	1.67
150	0.93	1.40	1.70
200	1.00	1.51	1.82
300	1.11	1.67	2.02
500	1.26	1.90	2.30
1000	1.50	2.26	2.73

TROJAN TF-36A Cross Slope 0.03



Intercepted Flow Rates

Road Flow Rate	SL 0.01	SL 0.03	SL 0.05	SL 0.03 w SF
	(L/s)	(L/s)	(L/s)	(L/s)
5	3.5	3.6	3.8	1.8
8	5.0	5.2	5.4	2.6
10	5.9	6.1	6.4	3.1
20	9.7	10.1	10.3	5.0
30	12.9	13.4	13.3	6.7
40	15.8	16.1	15.8	8.1
50	18.4	18.5	18.0	9.2
60	20.8	20.6	20.0	10.3
70	23.0	22.6	21.9	11.3
80	25.2	24.4	23.5	12.2
90	27.2	26.1	25.1	13.1
100	29.2	27.8	26.6	13.9
110	31.1	29.3	28.0	14.7
120	32.9	30.8	29.3	15.4
130	34.7	32.2	30.5	16.1
140	36.4	33.5	31.7	16.8
150	38.1	34.8	32.8	17.4
200	45.5	40.6	37.8	20.3
300	57.6	50.1	45.6	25.1
500	76.8	64.2	56.2	32.1
1000	111.7	86.3	69.6	43.1

Depth

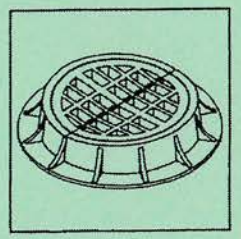
Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m)	(m)	(m)
5	0.027	0.022	0.020
8	0.032	0.026	0.023
10	0.035	0.028	0.026
20	0.045	0.036	0.033
30	0.052	0.042	0.039
40	0.058	0.047	0.043
50	0.063	0.051	0.047
60	0.068	0.055	0.050
70	0.072	0.058	0.053
80	0.075	0.061	0.056
90	0.079	0.064	0.058
100	0.082	0.067	0.061
110	0.085	0.069	0.063
120	0.088	0.071	0.065
130	0.090	0.074	0.067
140	0.093	0.076	0.069
150	0.095	0.078	0.070
200	0.106	0.086	0.079
300	0.124	0.101	0.091
500	0.150	0.122	0.111
1000	0.194	0.158	0.144

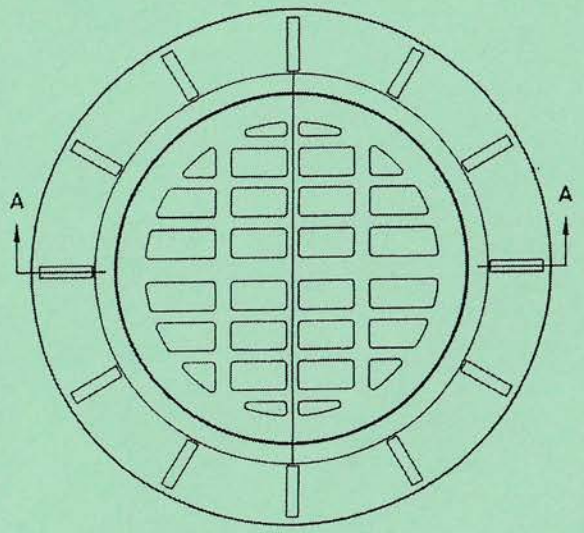
Velocity

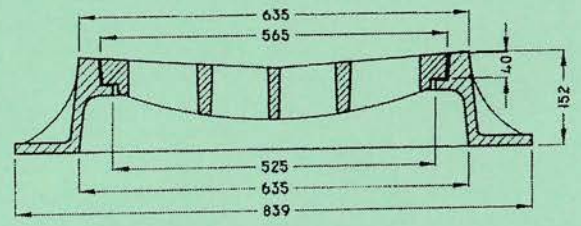
Road Flow Rate	SL 0.01	SL 0.03	SL 0.05
(L/s)	(m/s)	(m/s)	(m/s)
5	0.41	0.62	0.76
8	0.47	0.70	0.85
10	0.49	0.74	0.90
20	0.59	0.88	1.07
30	0.65	0.98	1.19
40	0.70	1.05	1.28
50	0.74	1.11	1.35
60	0.77	1.17	1.41
70	0.80	1.21	1.47
80	0.83	1.25	1.52
90	0.86	1.29	1.56
100	0.88	1.33	1.61
110	0.90	1.36	1.64
120	0.92	1.39	1.68
130	0.94	1.42	1.71
140	0.96	1.44	1.75
150	0.97	1.47	1.78
200	1.05	1.58	1.91
300	1.16	1.75	2.12
500	1.32	1.99	2.41
1000	1.57	2.36	2.86

LANE PAVING FRAME AND GRATE TF-38

PLAN







SECTION A-A

ISO 9001-2000 CERTIFIED

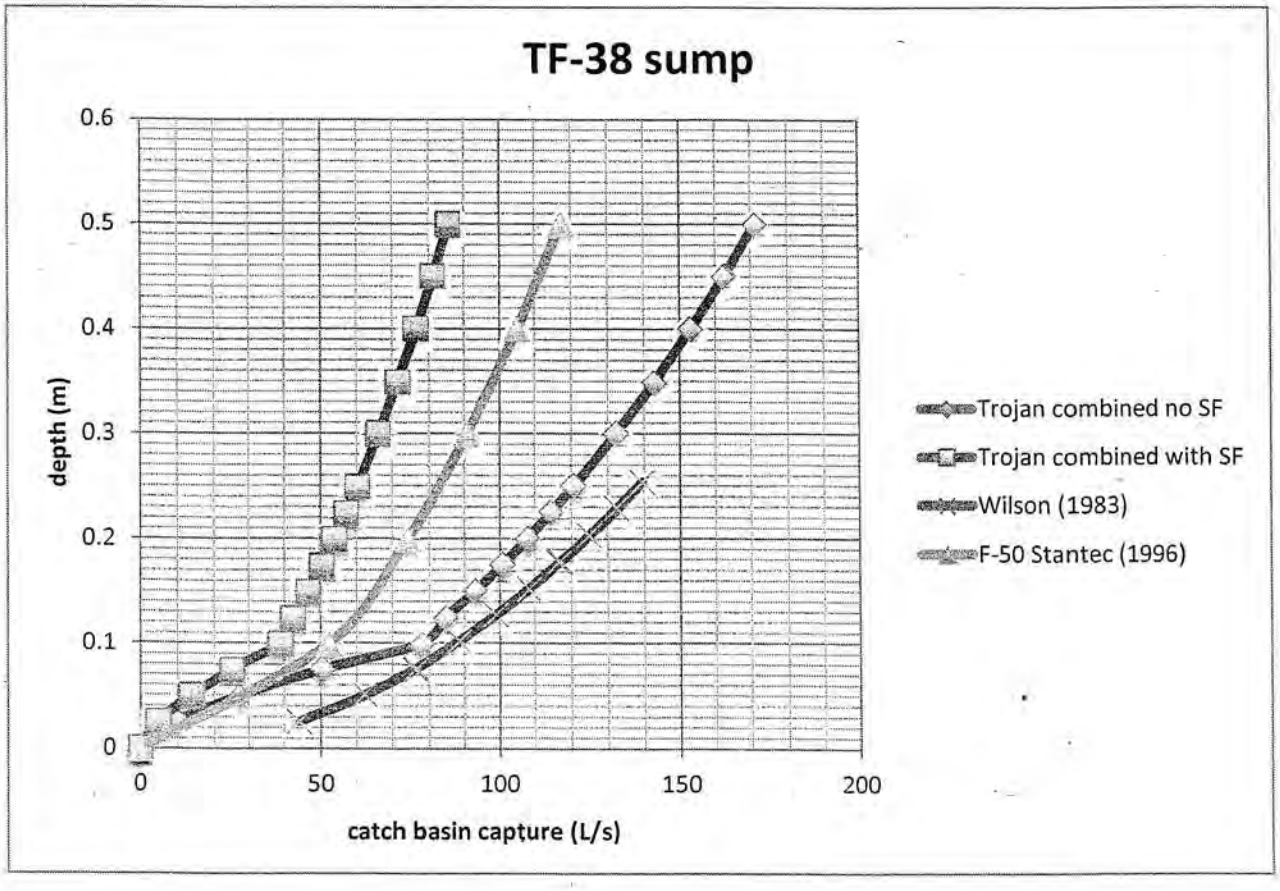
RATED FOR HS-20 LIVE LOAD

MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.
CALGARY • EDMONTON, ALBERTA

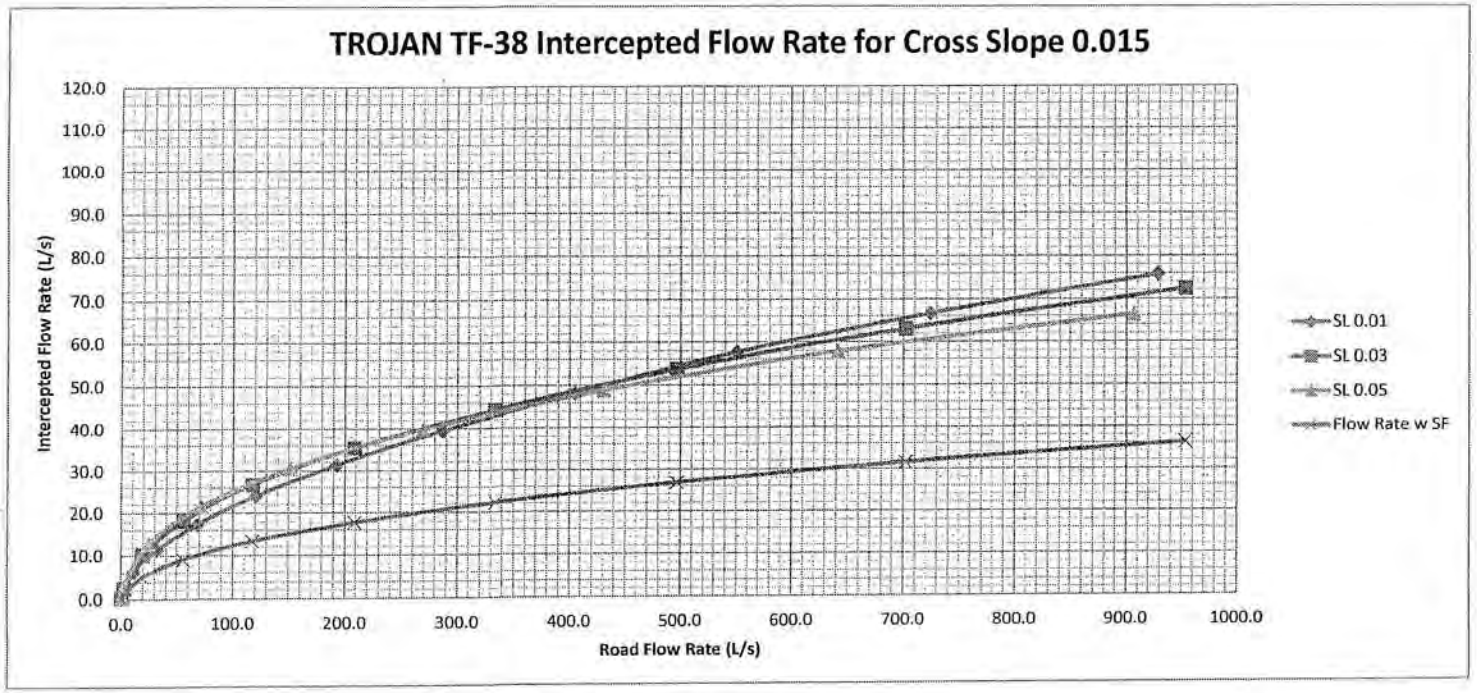
TF-38 sump condition

Trojan (2014) without safety factor		Trojan with SF	Wilson (1983)		F-50 Stantec (1996)	
depth	Q combined	Q combined	depth	Q	depth	Q
(m)	(L/s)	(L/s)	(m)	(L/s)	(m)	(L/s)
0	0	0	0.025	44	0.000	0
0.025	10	5	0.051	63	0.100	52
0.050	28	14	0.076	77	0.200	74
0.075	51	25	0.102	88	0.300	91
0.100	78	39	0.127	99	0.400	105
0.125	85	42	0.152	108	0.500	117
0.150	93	47	0.178	117		
0.175	101	50	0.203	125		
0.200	108	54	0.229	133		
0.225	114	57	0.254	140		
0.250	121	60				
0.300	132	66				
0.350	143	72				
0.400	153	76				
0.450	162	81				
0.500	171	86				



TROJAN TF-38

Cross Slope 0.015



SL 0.01

depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.2	0.2	0.21
0.020	1.5	1.5	0.34
0.030	10.9	6.2	0.45
0.040	32.1	11.4	0.54
0.050	67.7	17.3	0.63
0.060	120.3	24.0	0.71
0.070	192.6	31.4	0.79
0.080	286.8	39.5	0.87
0.090	405.3	48.3	0.94
0.100	550.3	57.7	1.00
0.110	723.8	66.6	1.07
0.120	927.8	75.8	1.14

SL 0.03

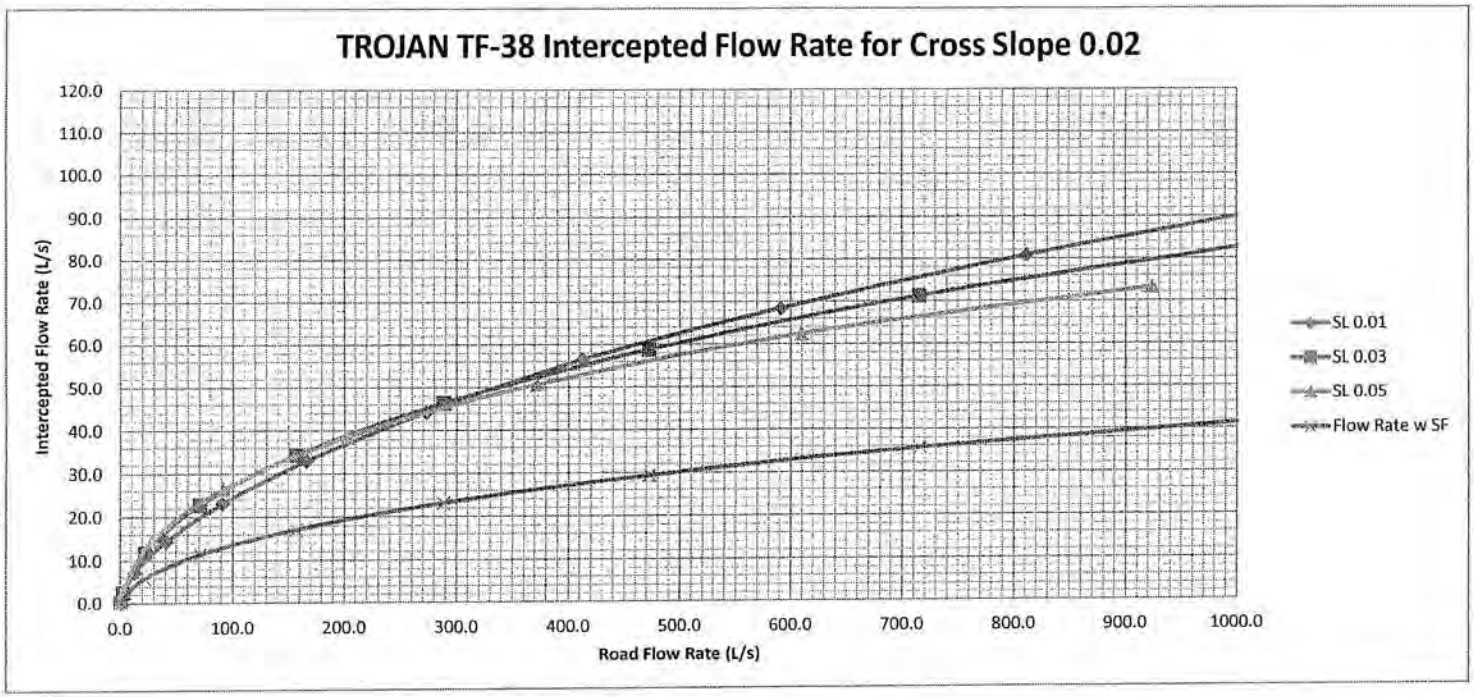
depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	Flow Rate w SF (L/s)
0.010	0.4	0.4	0.37	0.2
0.020	2.6	2.6	0.59	1.3
0.030	18.9	10.1	0.78	5.1
0.040	55.6	18.2	0.94	9.1
0.050	117.2	26.7	1.09	13.3
0.060	208.4	35.4	1.24	17.7
0.070	333.5	44.4	1.37	22.2
0.080	496.8	53.7	1.50	26.9
0.090	702.1	63.1	1.62	31.5
0.100	953.2	72.5	1.74	36.2

SL 0.05

depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.5	0.5	0.48
0.020	3.4	3.4	0.76
0.030	24.4	12.8	1.00
0.040	71.8	21.6	1.22
0.050	151.3	30.6	1.41
0.060	269.0	39.7	1.60
0.070	430.6	48.9	1.77
0.080	641.3	57.9	1.93
0.090	906.4	66.4	2.09

TROJAN TF-38

Cross Slope 0.02



SL 0.01

depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.2	0.2	0.21
0.020	1.5	1.5	0.34
0.030	12.7	7.2	0.48
0.040	40.9	14.5	0.60
0.050	90.6	23.1	0.71
0.060	166.4	33.0	0.81
0.070	272.6	44.2	0.91
0.080	413.1	56.5	1.00
0.090	591.5	68.5	1.09
0.100	811.6	80.9	1.17
0.110	1076.7	93.7	1.26

SL 0.03

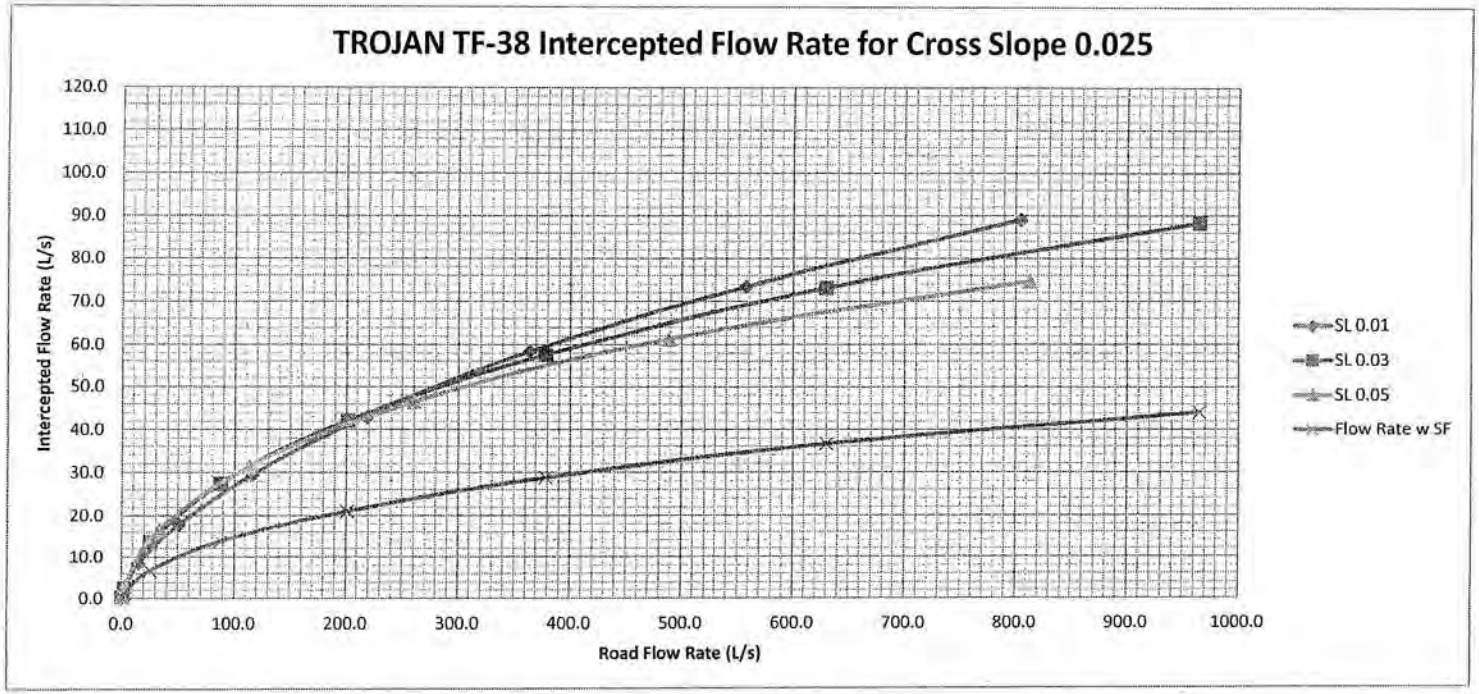
depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	Flow Rate w SF (L/s)
0.010	0.4	0.4	0.37	0.2
0.020	2.6	2.6	0.59	1.3
0.030	22.0	11.8	0.83	5.9
0.040	70.8	22.8	1.04	11.4
0.050	156.9	34.3	1.23	17.1
0.060	288.2	46.3	1.41	23.2
0.070	472.1	58.7	1.58	29.4
0.080	715.4	71.2	1.73	35.6
0.090	1024.6	83.6	1.89	41.8

SL 0.05

depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.5	0.5	0.48
0.020	3.4	3.4	0.76
0.030	28.4	14.7	1.07
0.040	91.4	26.4	1.34
0.050	202.5	38.6	1.59
0.060	372.1	50.7	1.82
0.070	609.5	62.4	2.03
0.080	923.6	73.3	2.24

TROJAN TF-38

Cross Slope 0.025



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.2	0.2	0.21
0.020	1.5	1.5	0.34
0.030	14.6	8.3	0.50
0.040	50.4	17.8	0.65
0.050	116.0	29.5	0.78
0.060	218.3	43.1	0.91
0.070	363.4	58.3	1.02
0.080	557.1	73.4	1.13
0.090	804.9	89.2	1.23
0.100	1112.1	105.5	1.33

SL 0.03

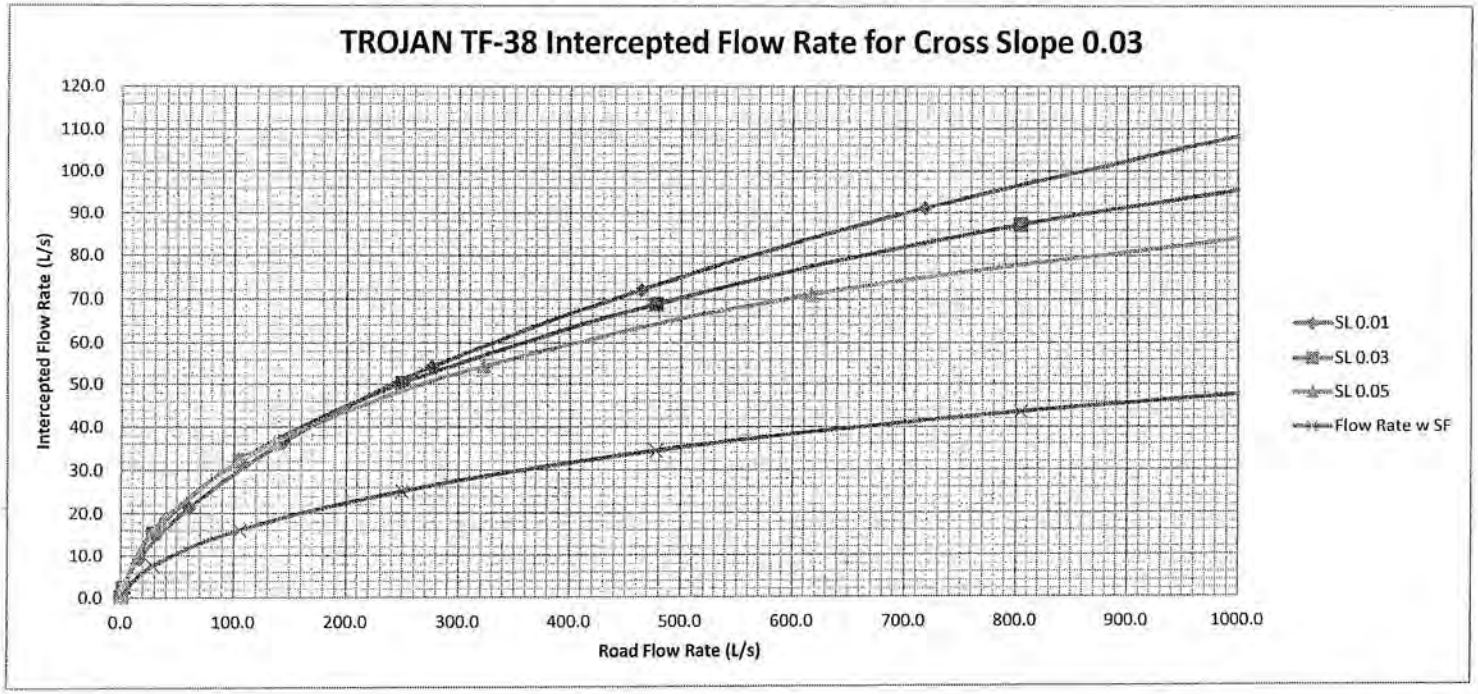
depth	Road Flow	Intercepted	Velocity	Flow Rate w SF
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.4	0.4	0.37	0.2
0.020	2.6	2.6	0.59	1.3
0.030	25.3	13.5	0.87	6.8
0.040	87.3	27.4	1.13	13.7
0.050	201.0	42.2	1.36	21.1
0.060	378.1	57.6	1.57	28.8
0.070	629.4	73.1	1.77	36.6
0.080	964.9	88.4	1.96	44.2

SL 0.05

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.5	0.5	0.48
0.020	3.4	3.4	0.76
0.030	32.6	16.5	1.13
0.040	112.7	31.3	1.46
0.050	259.5	46.5	1.75
0.060	488.1	61.3	2.03
0.070	812.6	74.8	2.28

TROJAN TF-38

Cross Slope 0.03



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.2	0.2	0.21
0.020	1.5	1.5	0.34
0.030	16.6	9.4	0.53
0.040	60.7	21.4	0.70
0.050	144.0	36.4	0.85
0.060	275.7	54.3	1.00
0.070	464.4	72.2	1.13
0.080	717.9	91.2	1.25
0.090	1043.9	110.9	1.37

SL 0.03

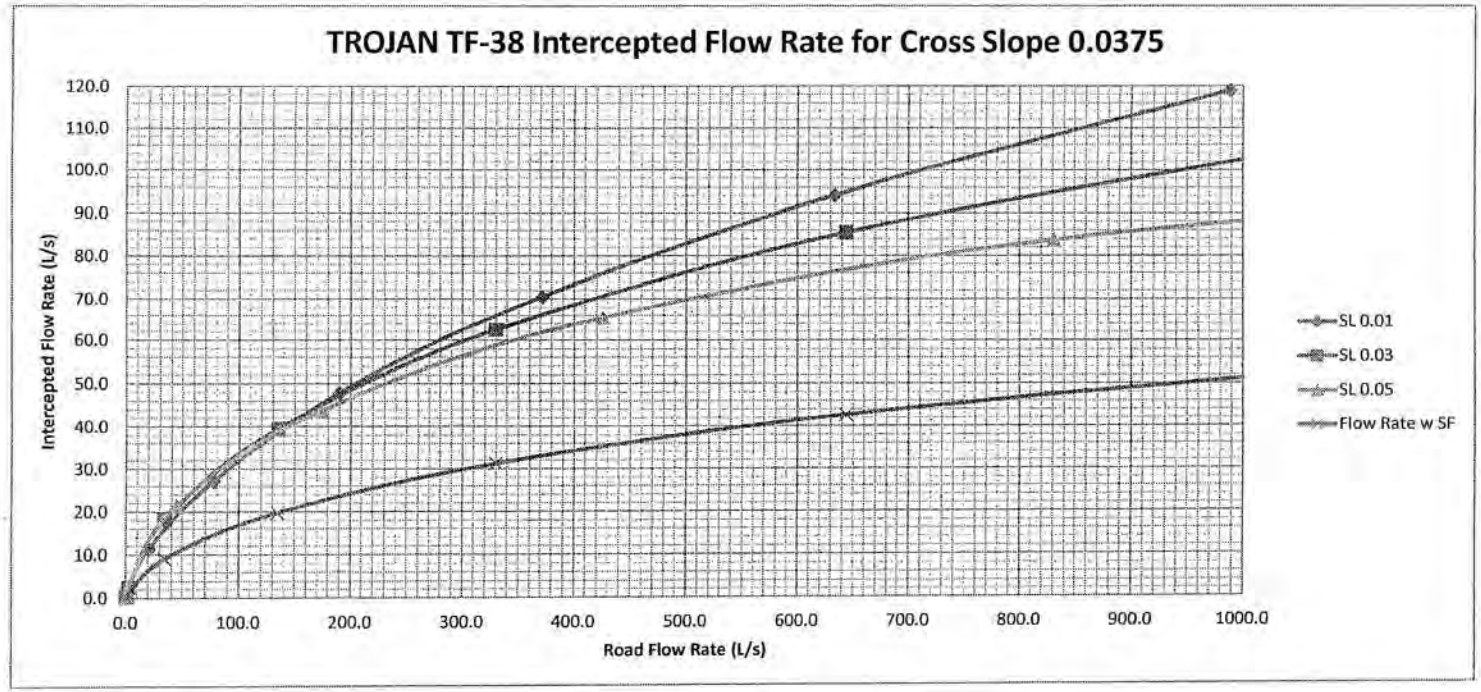
depth	Road Flow	Intercepted	Velocity	Flow Rate w SF
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.4	0.4	0.37	0.2
0.020	2.6	2.6	0.59	1.3
0.030	28.7	15.4	0.92	7.7
0.040	105.2	32.2	1.22	16.1
0.050	249.4	50.2	1.48	25.1
0.060	477.5	68.9	1.72	34.4
0.070	804.3	87.2	1.95	43.6
0.080	1243.5	104.6	2.17	52.3

SL 0.05

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.5	0.5	0.48
0.020	3.4	3.4	0.76
0.030	37.1	18.5	1.19
0.040	135.8	36.3	1.57
0.050	322.0	54.4	1.91
0.060	616.5	71.1	2.23
0.070	1038.4	85.3	2.52

TROJAN TF-38

Cross Slope 0.0375



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.2	0.2	0.21
0.020	1.5	1.5	0.34
0.030	19.8	11.2	0.57
0.040	77.7	27.3	0.78
0.050	190.3	48.0	0.96
0.060	371.6	70.5	1.12
0.070	633.9	94.2	1.28
0.080	988.9	119.0	1.42

SL 0.03

depth	Road Flow	Intercepted	Velocity	Flow Rate w SF
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.4	0.4	0.37	0.2
0.020	2.6	2.6	0.59	1.3
0.030	34.3	18.3	0.99	9.2
0.040	134.5	39.5	1.34	19.8
0.050	329.7	62.5	1.66	31.3
0.060	643.6	85.5	1.94	42.7
0.070	1097.9	107.0	2.21	53.5

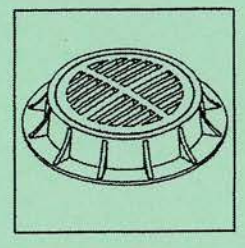
SL 0.05

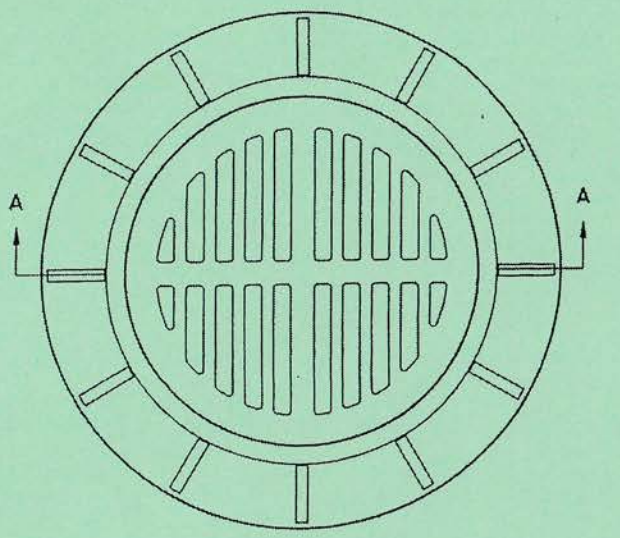
depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.5	0.5	0.48
0.020	3.4	3.4	0.76
0.030	44.2	21.4	1.27
0.040	173.7	43.8	1.73
0.050	425.6	65.5	2.14
0.060	830.9	83.8	2.51
0.070	1417.4	96.6	2.85

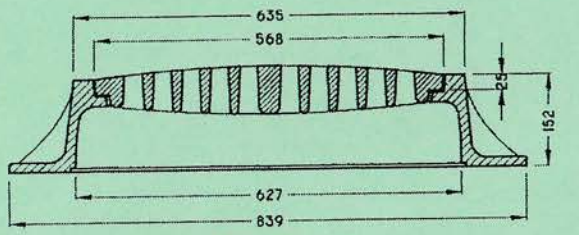
FRAME AND GRATE

TF-39

PLAN







SECTION A-A

ISO 9001-2000 CERTIFIED

RATED FOR HS-20 LIVE LOAD

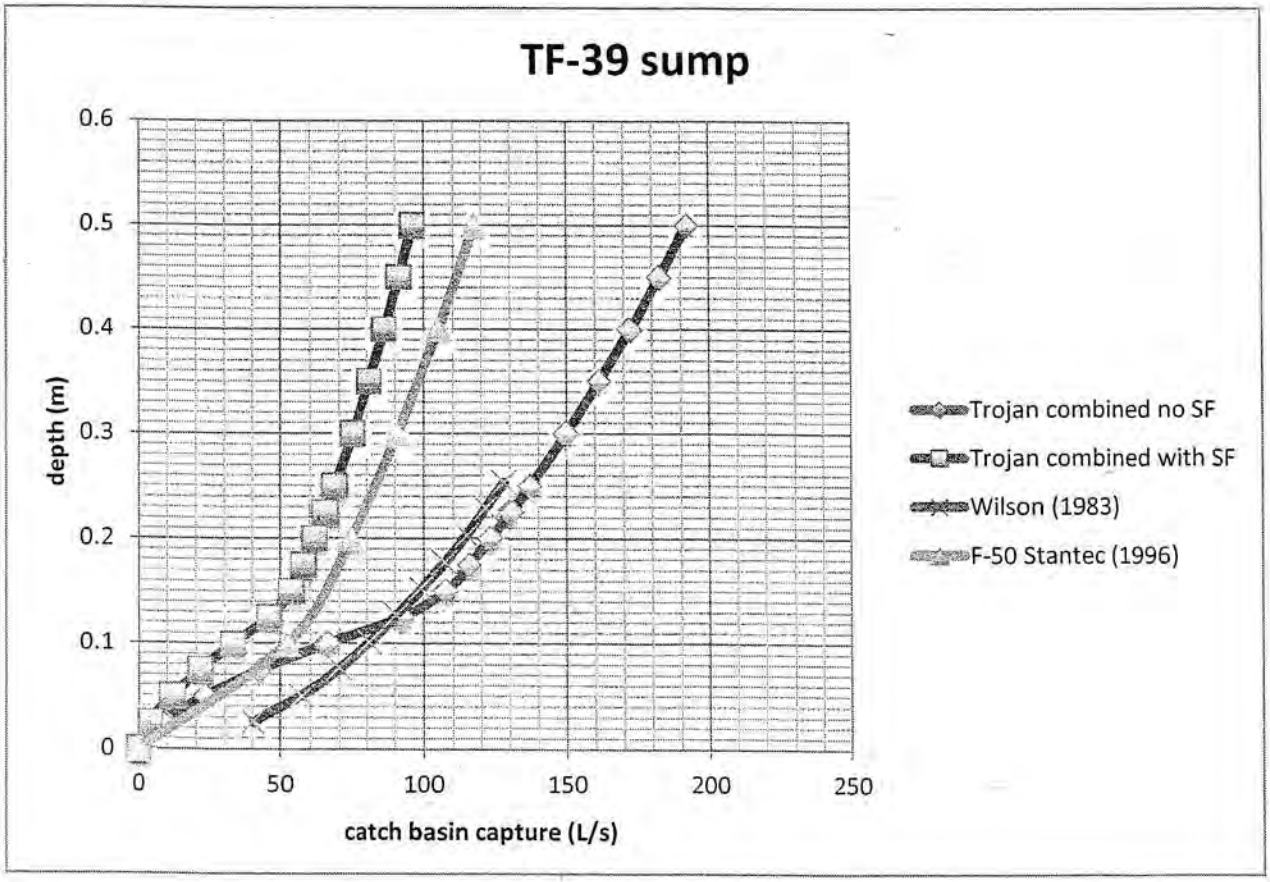
MEASUREMENTS IN MILLIMETERS

TROJAN INDUSTRIES INC.

CALGARY • EDMONTON, ALBERTA

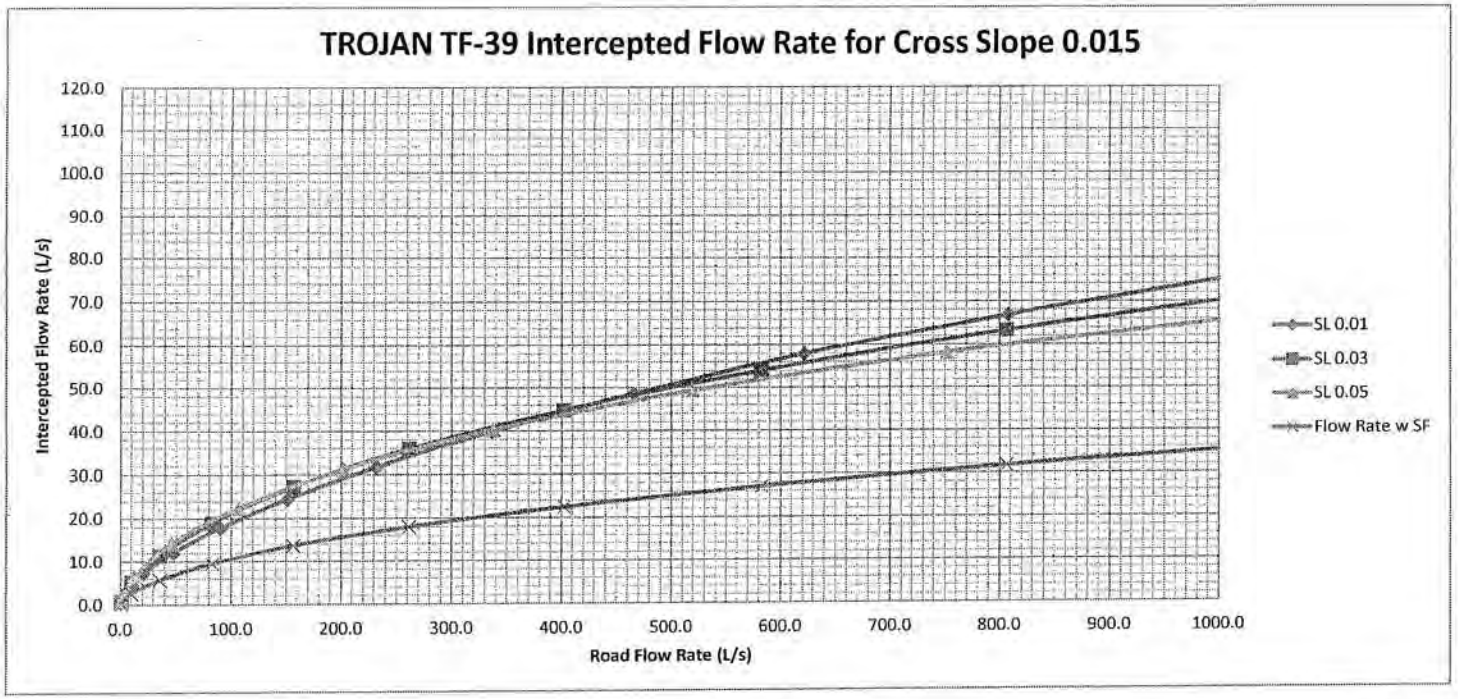
TF-39 sump condition

Trojan (2014) without safety factor		Trojan with SF	Wilson (1983)		F-50 Stantec (1996)	
depth	Q combined	Q combined	depth	Q	depth	Q
(m)	(L/s)	(L/s)	(m)	(L/s)	(m)	(L/s)
0	0	0	0.025	40	0.000	0
0.025	8	4	0.051	57	0.100	52
0.050	23	12	0.076	70	0.200	74
0.075	43	21	0.102	81	0.300	91
0.100	66	33	0.127	90	0.400	105
0.125	92	46	0.152	99	0.500	117
0.150	107	54	0.178	107		
0.175	116	58	0.203	114		
0.200	123	62	0.229	121		
0.225	130	65	0.254	128		
0.250	137	69				
0.300	150	75				
0.350	161	81				
0.400	172	86				
0.450	182	91				
0.500	192	96				



TROJAN TF-39

Cross Slope 0.015



SL 0.01

depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	0.5	0.5	0.21
0.020	5.9	3.2	0.34
0.030	20.5	7.2	0.45
0.040	47.7	12.1	0.54
0.050	90.2	17.8	0.63
0.060	150.9	24.4	0.71
0.070	232.1	31.8	0.79
0.080	336.2	39.8	0.87
0.090	465.5	48.6	0.94
0.100	622.1	58.0	1.00
0.110	807.9	66.9	1.07
0.120	1025.1	76.1	1.14

SL 0.03

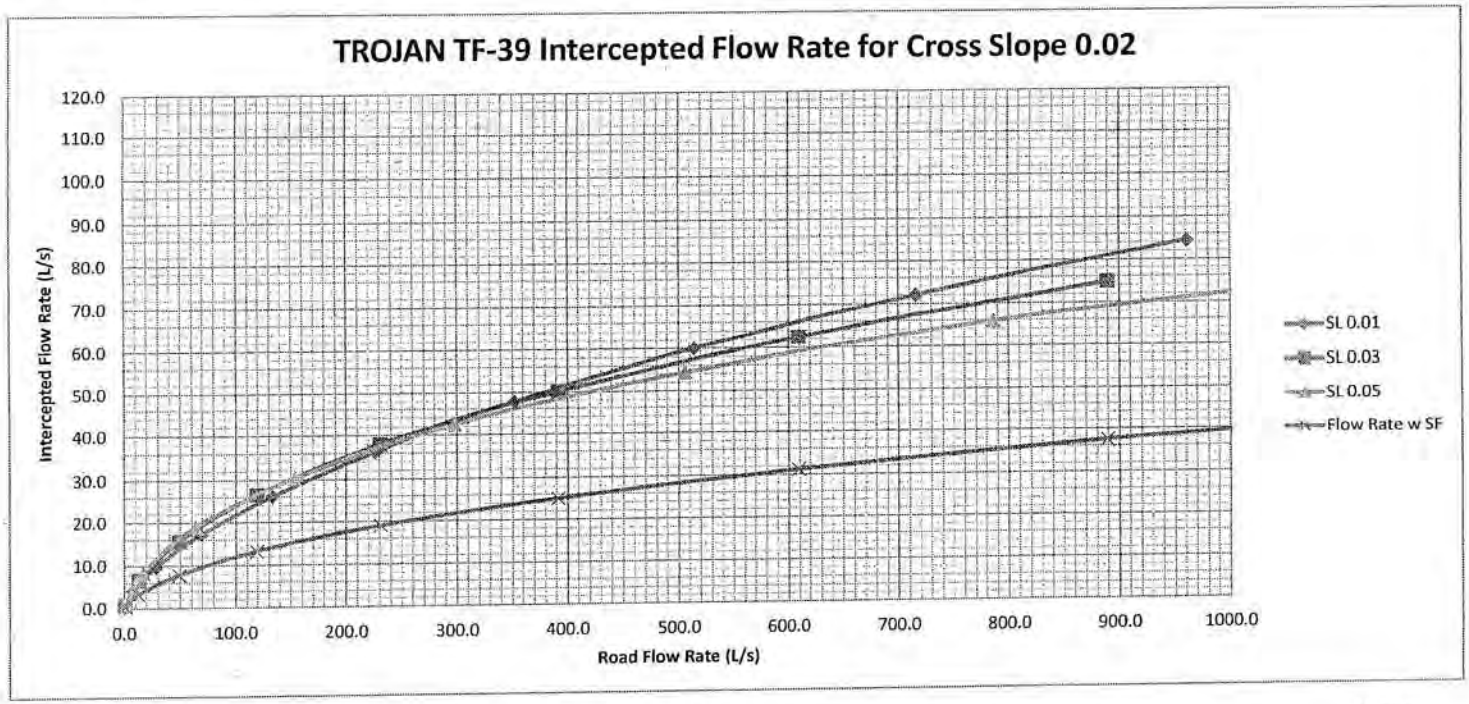
depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)	Flow Rate w SF (L/s)
0.010	0.8	0.8	0.37	0.4
0.020	10.2	5.2	0.59	2.6
0.030	35.5	11.3	0.78	5.7
0.040	82.5	19.0	0.94	9.5
0.050	156.3	27.3	1.09	13.6
0.060	261.3	35.9	1.24	17.9
0.070	402.0	44.9	1.37	22.4
0.080	582.4	54.1	1.50	27.0
0.090	806.3	63.4	1.62	31.7
0.100	1077.4	72.8	1.74	36.4
0.110	1399.4	82.0	1.86	41.0

SL 0.05

depth (m)	Road Flow (L/s)	Intercepted (L/s)	Velocity (m/s)
0.010	1.1	1.1	0.48
0.020	13.1	6.6	0.76
0.030	45.9	14.3	1.00
0.040	106.6	22.5	1.22
0.050	201.8	31.2	1.41
0.060	337.4	40.3	1.60
0.070	519.0	49.3	1.77
0.080	751.9	58.2	1.93
0.090	1040.9	66.8	2.09

TROJAN TF-39

Cross Slope 0.02



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.5	0.5	0.21
0.020	7.5	4.1	0.38
0.030	28.4	9.9	0.51
0.040	68.6	17.2	0.63
0.050	133.1	26.1	0.74
0.060	226.0	36.3	0.84
0.070	351.6	47.8	0.93
0.080	513.6	60.0	1.03
0.090	715.6	72.0	1.11
0.100	961.2	84.6	1.20
0.110	1253.6	97.5	1.28

SL 0.03

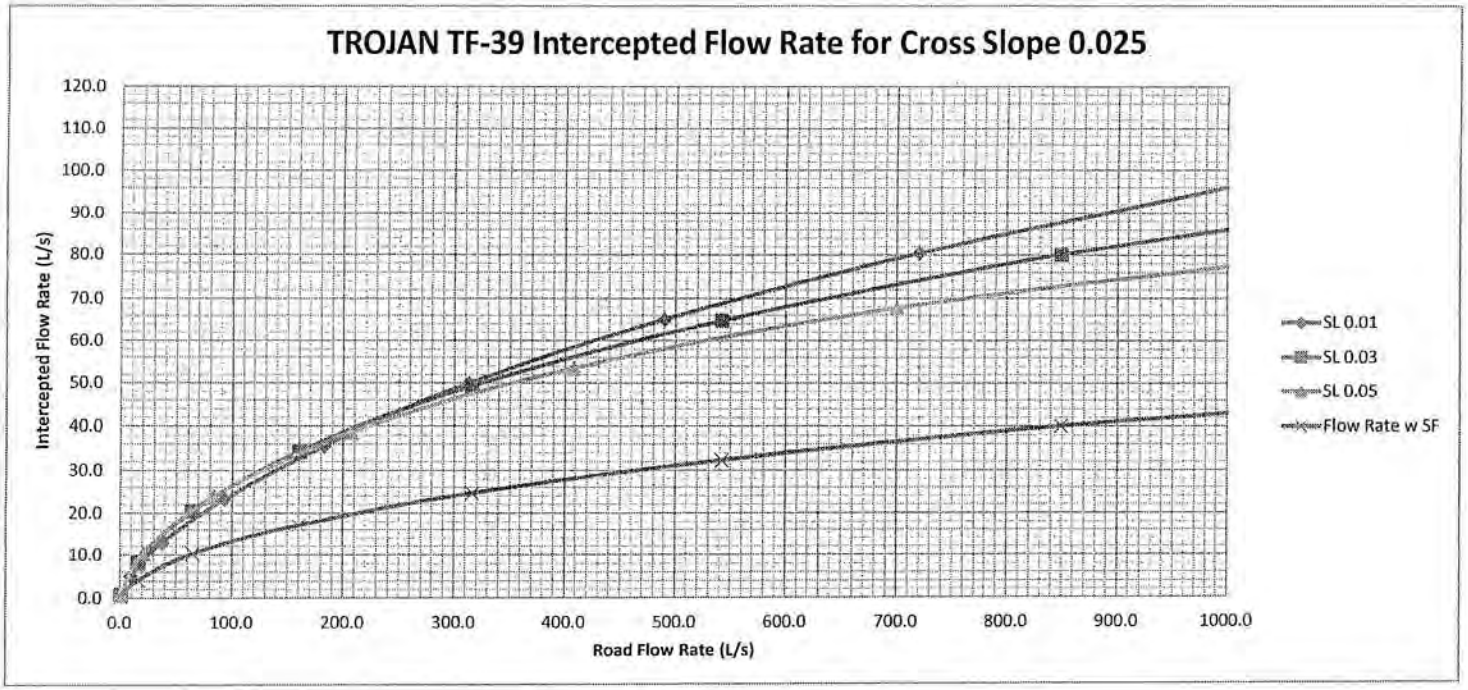
depth	Road Flow	Intercepted	Velocity	Flow Rate w SF
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.8	0.8	0.37	0.4
0.020	12.9	6.6	0.65	3.3
0.030	49.1	15.6	0.88	7.8
0.040	118.9	26.6	1.09	13.3
0.050	230.5	38.0	1.28	19.0
0.060	391.5	50.1	1.45	25.1
0.070	609.0	62.5	1.62	31.3
0.080	889.6	74.9	1.78	37.5
0.090	1239.5	87.1	1.93	43.6

SL 0.05

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	1.1	1.1	0.48
0.020	16.7	8.4	0.84
0.030	63.4	19.0	1.14
0.040	153.5	30.4	1.41
0.050	297.5	42.4	1.65
0.060	505.4	54.4	1.88
0.070	786.2	65.9	2.09
0.080	1148.4	76.4	2.29

TROJAN TF-39

Cross Slope 0.025



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.5	0.5	0.21
0.020	9.2	5.1	0.41
0.030	37.2	12.9	0.57
0.040	92.6	23.1	0.71
0.050	182.3	35.6	0.84
0.060	312.9	50.0	0.96
0.070	490.2	65.1	1.07
0.080	719.8	80.4	1.17
0.090	1007.1	96.5	1.28
0.100	1357.0	113.0	1.37

SL 0.03

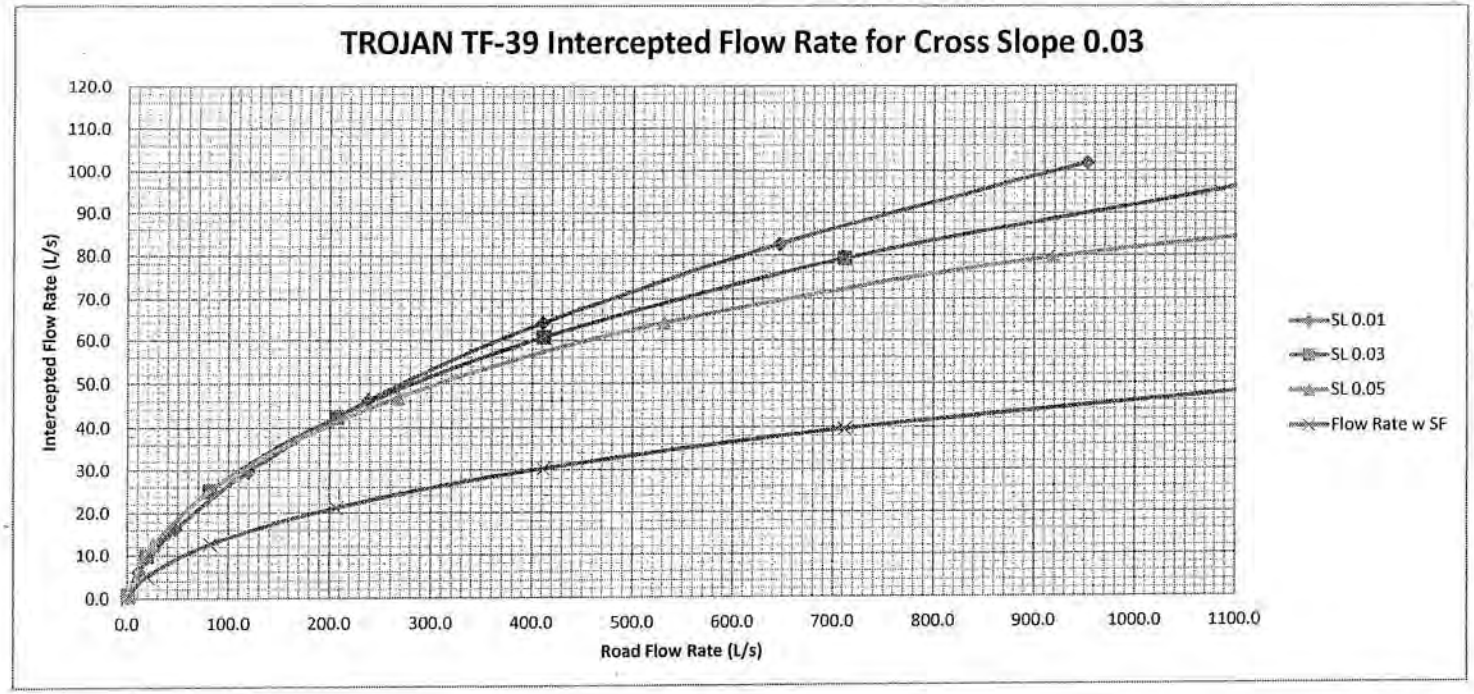
depth	Road Flow	Intercepted	Velocity	Flow Rate w SF
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.8	0.8	0.37	0.4
0.020	15.9	8.2	0.71	4.1
0.030	64.4	20.5	0.99	10.2
0.040	160.3	34.3	1.23	17.2
0.050	315.8	49.3	1.45	24.6
0.060	542.0	64.7	1.66	32.4
0.070	849.1	80.2	1.85	40.1
0.080	1246.8	95.1	2.03	47.6

SL 0.05

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	1.1	1.1	0.48
0.020	20.6	10.4	0.92
0.030	83.2	23.9	1.27
0.040	207.0	38.6	1.59
0.050	407.7	53.6	1.87
0.060	699.7	67.7	2.14
0.070	1096.1	80.4	2.39

TROJAN TF-39

Cross Slope 0.03



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.5	0.5	0.21
0.020	11.1	6.1	0.44
0.030	47.0	16.2	0.63
0.040	119.3	29.7	0.79
0.050	237.6	46.2	0.93
0.060	410.7	64.2	1.07
0.070	646.7	82.7	1.19
0.080	953.1	102.0	1.31
0.090	1337.1	122.0	1.43

SL 0.03

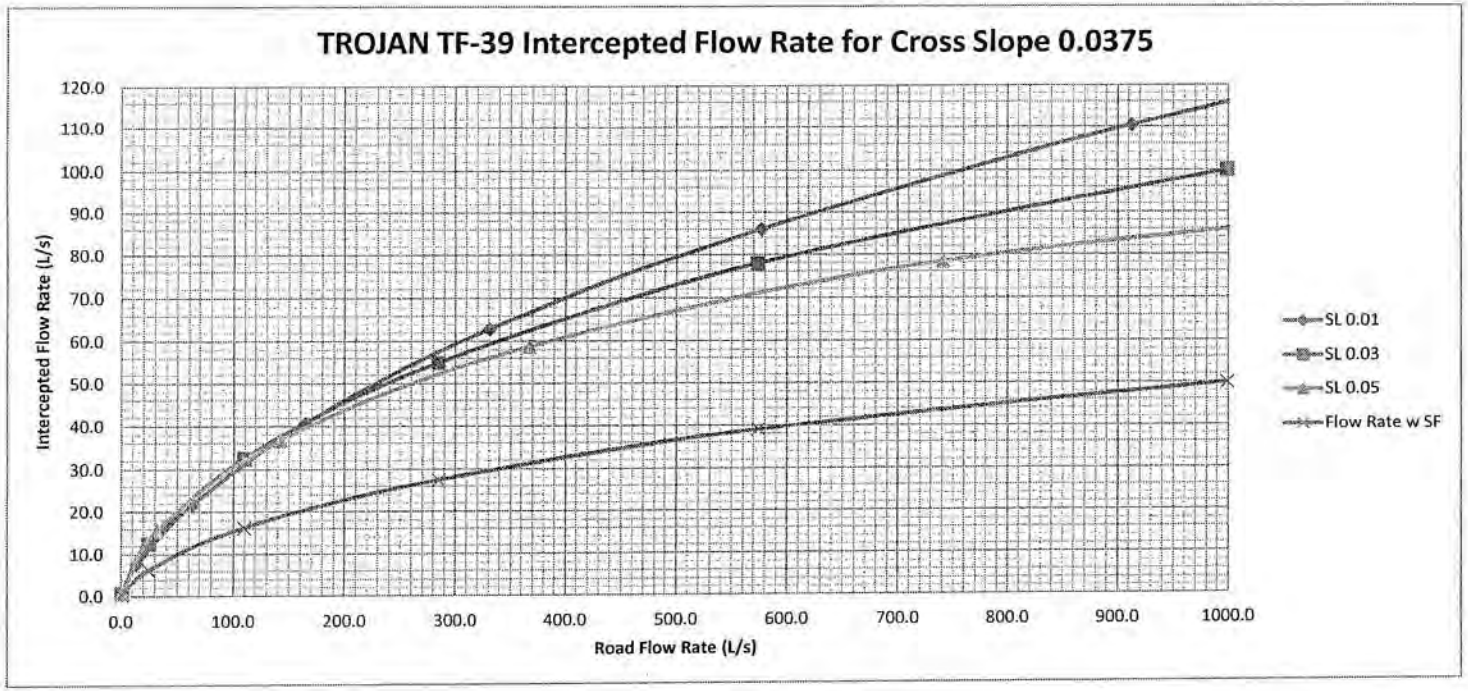
depth	Road Flow	Intercepted	Velocity	Flow Rate w SF
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.8	0.8	0.37	0.4
0.020	19.2	9.9	0.76	4.9
0.030	81.4	25.2	1.08	12.6
0.040	206.6	42.4	1.36	21.2
0.050	411.6	60.8	1.61	30.4
0.060	711.4	79.3	1.85	39.6
0.070	1120.1	97.1	2.07	48.5

SL 0.05

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	1.1	1.1	0.48
0.020	24.8	12.5	0.99
0.030	105.1	29.0	1.40
0.040	266.7	46.8	1.76
0.050	531.4	64.2	2.08
0.060	918.4	79.5	2.38
0.070	1446.0	91.8	2.67

TROJAN TF-39

Cross Slope 0.0375



SL 0.01

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	0.5	0.5	0.21
0.020	14.2	7.8	0.49
0.030	63.3	21.7	0.71
0.040	164.3	40.7	0.89
0.050	331.2	63.0	1.06
0.060	576.8	86.0	1.22
0.070	912.9	110.5	1.37
0.080	1350.5	135.8	1.51

SL 0.03

depth	Road Flow	Intercepted	Velocity	Flow Rate w SF
(m)	(L/s)	(L/s)	(m/s)	(L/s)
0.010	0.8	0.8	0.37	0.4
0.020	24.5	12.6	0.84	6.3
0.030	109.7	32.6	1.22	16.3
0.040	284.6	54.9	1.55	27.5
0.050	573.7	77.9	1.84	39.0
0.060	999.1	100.0	2.12	50.0

SL 0.05

depth	Road Flow	Intercepted	Velocity
(m)	(L/s)	(L/s)	(m/s)
0.010	1.1	1.1	0.48
0.020	31.7	15.6	1.09
0.030	141.6	36.7	1.58
0.040	367.4	58.7	2.00
0.050	740.7	78.3	2.38
0.060	1289.8	93.2	2.73