Multiline
Hydraulic Design and Dimensioning

The future of drainage

First Edition:
June 2016

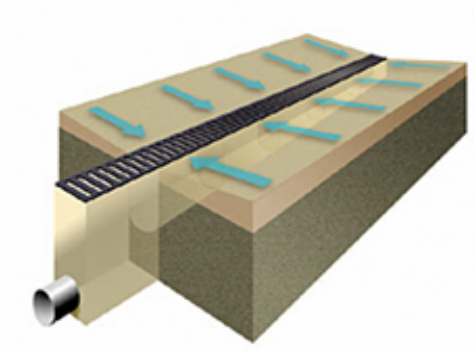
CONTENTS

Benefits of Line Drainage

Surface drainage is important. Whether frequent light rainfall or occasional heavy downpours, surface drainage is necessary. To prevent damage to pavement or property, and reduces safety hazards caused by ponding. Surface drainage systems aim to control surface rainfall run-off by slowing its drainage rate, relieving pressure on sewerage systems and mimicking natural drainage as closely as possible.

Surface drainage is designed to:

- Reduce standing water
- Reduce slip hazards and subsequent injury
- Protect and extend life of pavements and roadways
- Protect property from flood damage
- Reduce inconvenience to public users
- Reduce hydroplaning on roads

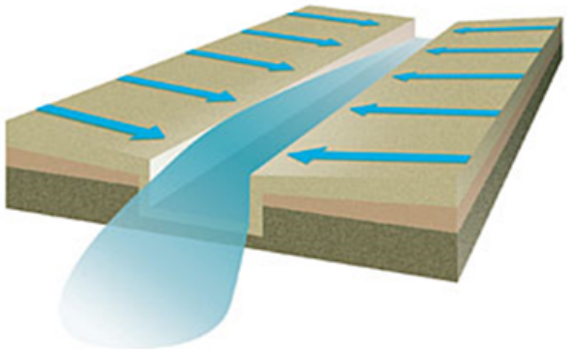


Line drainage offers many advantages compared to point drain solutions due to the high drainage capacity and easy installation and maintenance. Some further advantages are:

- Neat linear appearance
- Simple grades to design and construct
- Easy to install - shallower excavation and easy grading of pavement
- Continuously intercepts water along its length and provides superior drainage
- Minimal need for underground pipes
- Maintenance is quick and easy as trench is at the surface and easier to access

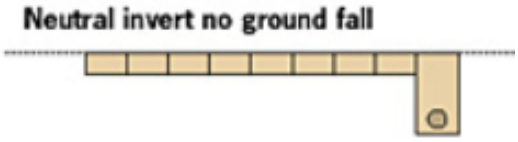
Surface Water Drainage Flow

The continuous interception of water along the drainage length results in a non-uniform flow in the drain channels. This means that the liquid velocity and -height change along the drain section.



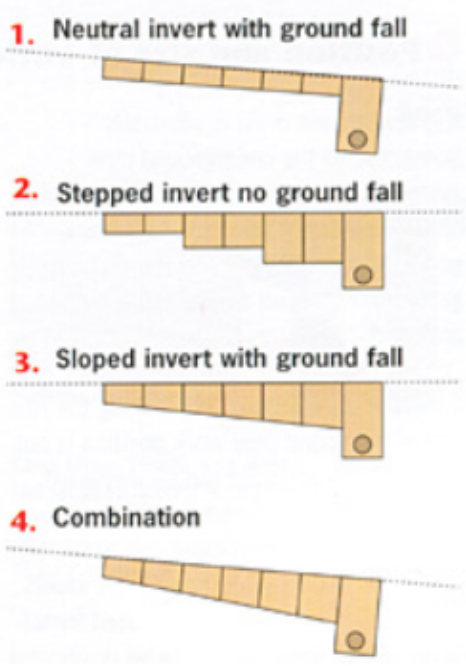
Other factors affecting hydraulic capacity are the actual conditions of the site and the possible slope of the channels.

Ground fall or slope



Slope increases the velocity of liquid within the trench drain and therefore improves hydraulic efficiency. Slope can be introduced by:

1. Existing pavement with natural fall.
2. Introduce a stepped configuration.
3. Introduce slope along the base of the trench run.
4. Combination.



Hydraulic Design

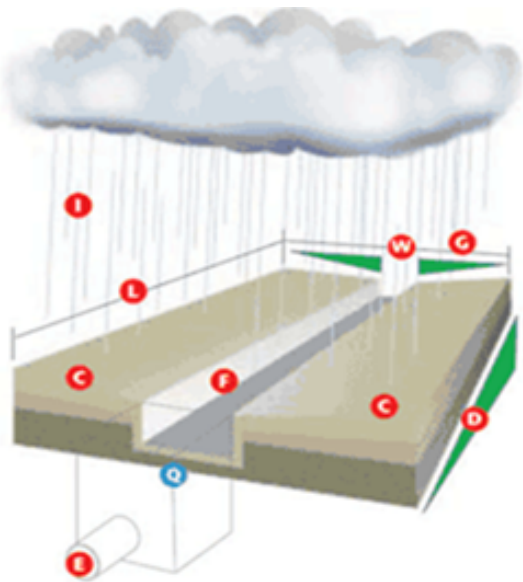
The ACO online hydraulic design software has been developed to enable the users to design and select the most appropriate channel drainage system. Using differential equations for spatially varied flow, the online tool calculates the hydraulic capacity of channels accepting flow along their entire length. The software accurately analyses flow in the selected channel to check it has sufficient capacity. Furthermore it can optimise the selection and potentially downsize all or part of a channel run if it is oversized.

To calculate the correct size of channel the following variables have to be defined:

- Catchment area - length x width of pavement — L x W
- Rainfall intensity in mm per hour — I
- Run-off coefficient - ie. pavement material, some surfaces absorb liquids e.g. block pavers — C

Other factors that affect the transfer of liquids include:

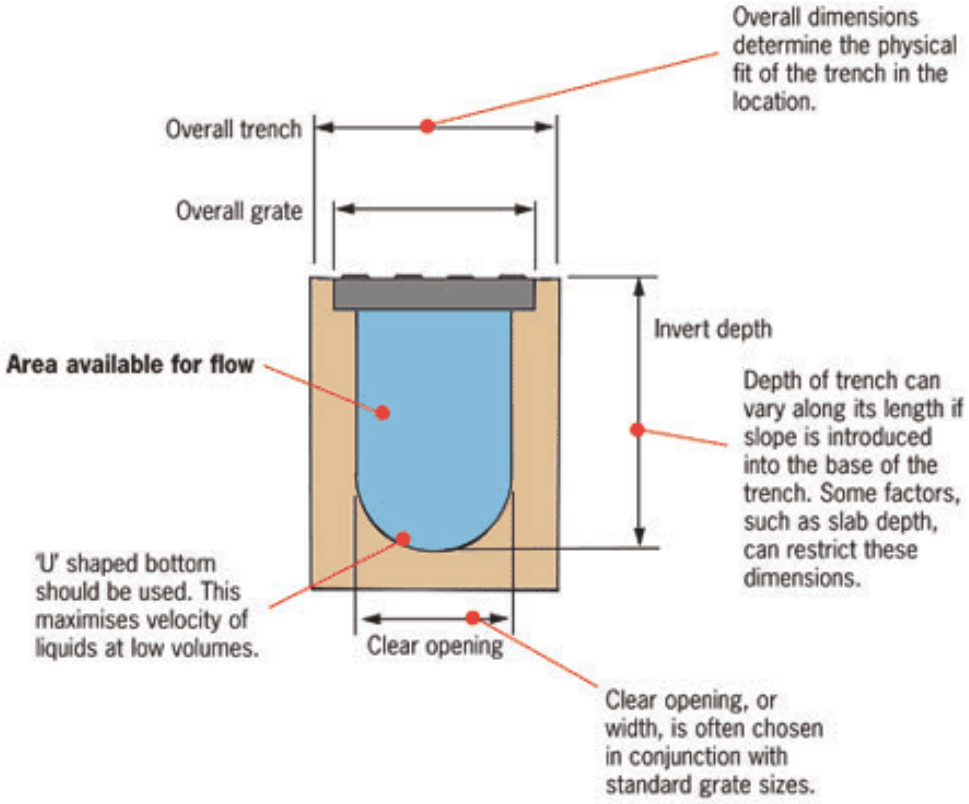
- Ground fall along trench % — D
- Position and size of outlet pipe — E
- Surface roughness of trench material. Manning's coefficient of roughness — F
- Pavement angle of approach to trench - this can affect grate hydraulics (steep slopes may cause bypass) — G



Determining trench size

The calculated run-off Q, is combined with the other factors above to determine the correct size of trench. The trench size is specified by the clear opening and invert depth - changing either or both of these will create a smaller or larger 'flow area'.

- Clear opening of trench is the normal specified dimension, e.g., 100mm, 200mm, etc.
- Overall grate and outside trench dimensions are misleading.



The ACO online hydraulic design software was further refined with empirical data, following a series of experiments modelling lateral intake into trenches. Analysis of the effect of slope, run length, and trench cross sectional profiles were incorporated into the program. Complex scenarios such as the effects of water inflow from downpipes or inlets along the length of the trench can also be modelled by the software. Furthermore, the software can be used to recommend optimum outlet positions along trench runs. Results are provided either electronically (PDF) and/or in printout format.

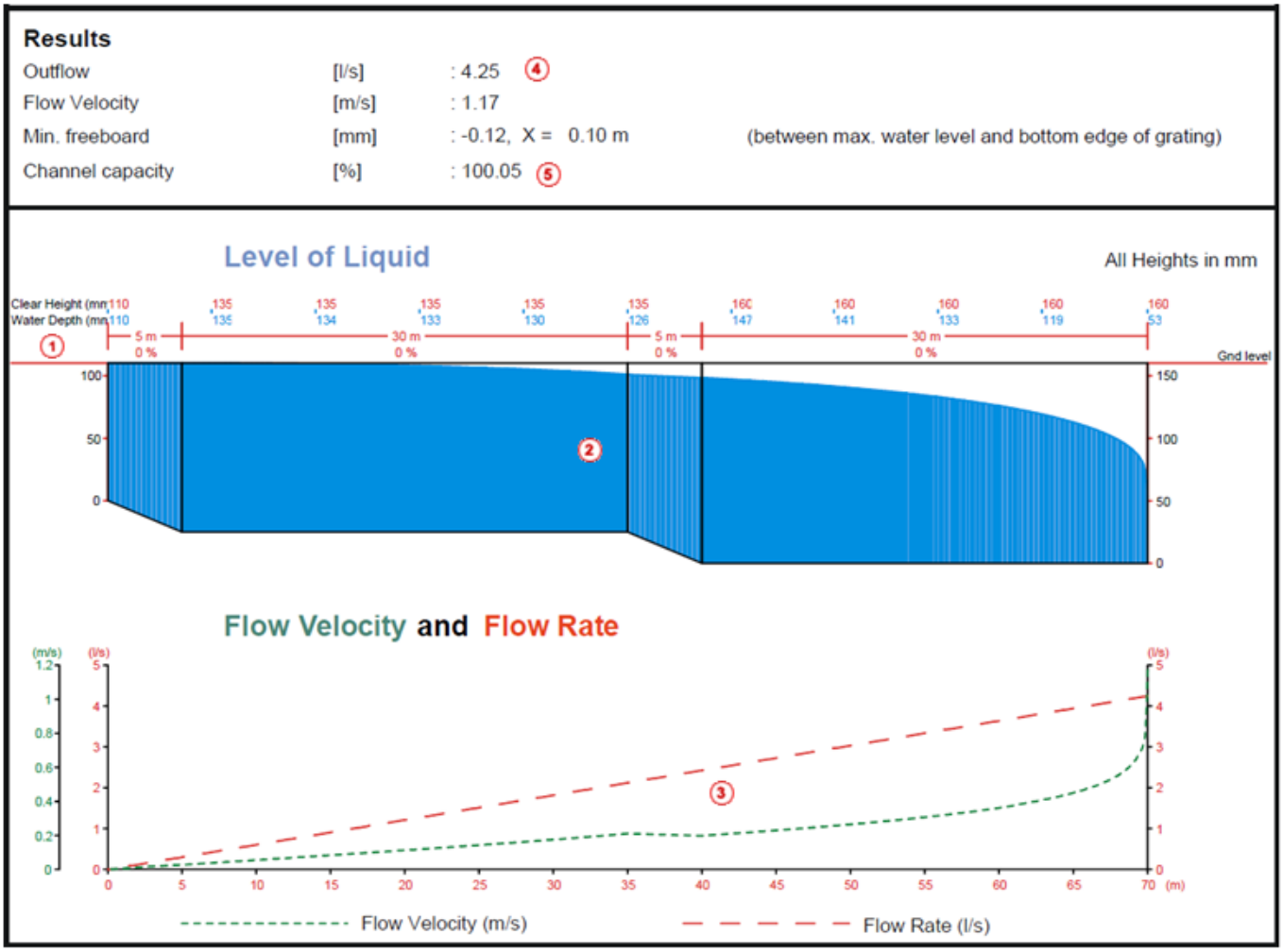
① Position and size of minimum 'freeboard' (gap between the underside of grate and the top of liquid in trench).

② The hydraulic profile of the liquid

③ Flow velocity and flow rate at all points along the trench

④ Discharge flowrate capacity of the channel run. (14.75 l/s from example below)

⑤ Hydraulic utilisation of trench (%) is given. If over 100% flooding occurs. (71.35% from example below)



Hydraulic Calculation Examples:

In the following you will find calculation examples for three different scenarios; drive ways, podiums and basements. The three scenarios are divided into three chapters including calculations of both neutral and sloped channels and the calculation sheet from the ACO design software is attached for reference.

From the tables you can extract the hydraulic capacity of a specific drain solution. This means that you can define the maximum area to be drained (m2) and the discharge (l/s) of a specific solution. Please note that some calculations are marked yellow and red. This is to indicate that some area calculations are not realistic due to a very large area to be drained by a relatively short channel. Calculations marked yellow might work depending of the geometry of the area. Calculations marked red, seem unrealistic.

DRIVE WAYS

MULTILINE V100 NEUTRAL CHANNELS (WITHOUT SLOPE):					
Channel type	0.0	5.0	10.0	15.0	20.0
Height (mm)	150	175	200	225	250
Length (m)	16	21	26	32	38
Area (m^2)	128	168	208	256	304
Discharge (l/s)	3.3	4.43	5.49	6.76	8.02

MULTILINE SLOPED CHANNELS (WITH SLOPE):				
Drain type	V100	V150	V200	V300
Channel type	(1-10)-10.0	(1-5)-5.0-(6-10)-10.0	(1-5)-5.0-(6-10)-10.0	(1-5)-5.0-(6-10)-10.0
Height (mm)	(150-200)-200	(210-235)-235-(235-260)-260	(265-290)-290-(290-315)-315	(385-410)-410-(410-435)-435
Length (m)	26	57	70 (64%)	-
Area (m^2)	208	456	560	-
Discharge (l/s)	5.49	12.03	14.78	-

Note:

1. Considered 5 different types of depths (Channel types) for V100 drain channel - Constant depth
2. Considered 100mm/hour intensity of rainfall
3. Considered 0.95 impermiability factor
4. Considered 100% maximum channel capacity
5. Considered 8m drive way which is constant for all the drive way channels
6. Considered maximum of 30m constant depth channels length
7. Considered maximum of 70m sloped depth channels length

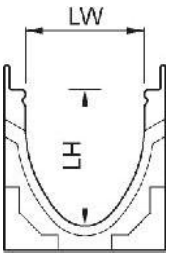
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V100@16m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V100 @125 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 16.00
Catchment area	[m²]	: 125
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 16.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	110									
Inner height end	[mm]	110									
Length	[m]	16.00									
Type of slope	[%]	0.000									

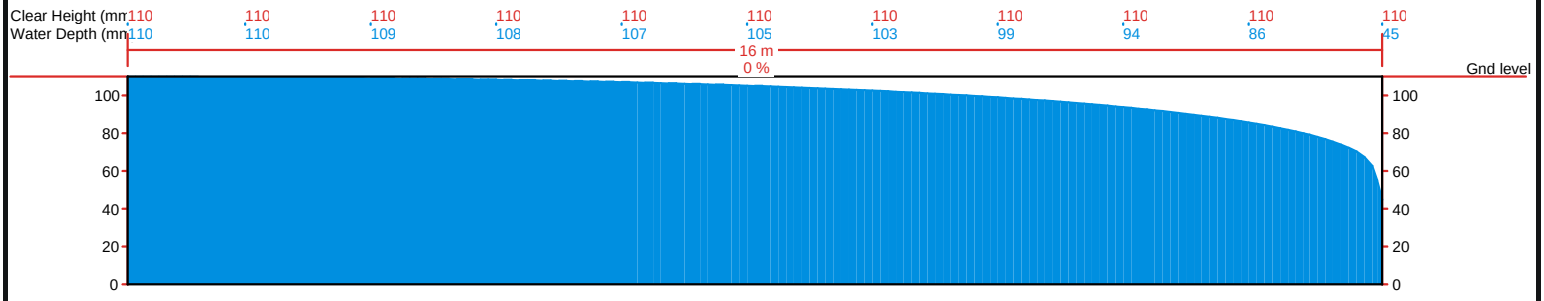
Results

Outflow	[l/s]	: 3.30
Flow Velocity	[m/s]	: 1.07
Min. freeboard	[mm]	: 0.29, X = 0.00 m
Channel capacity	[%]	: 99.87

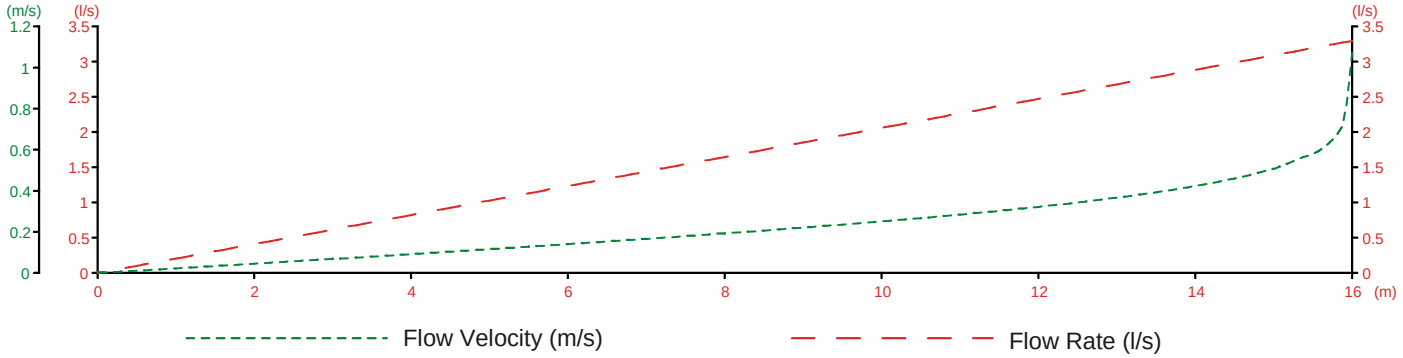
(between max. water level and bottom edge of grating)

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

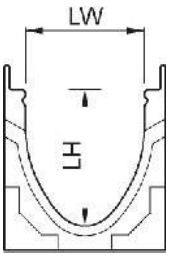
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project		: V100@21m Length
ACO Project.-No.		:
Address		:
Postal code / city		: India

Input data



Naming of channel		: V100 @168 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 5.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 21.00
Catchment area	[m²]	: 168
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 21.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	135									
Inner height end	[mm]	135									
Length	[m]	21.00									
Type of slope	[%]	0.000									

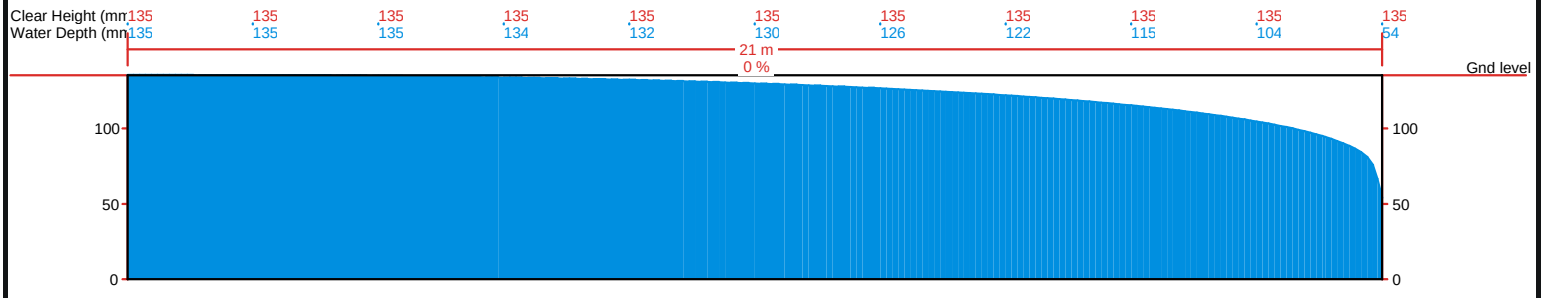
Max. possible hydraulic length 20.98 m

Results

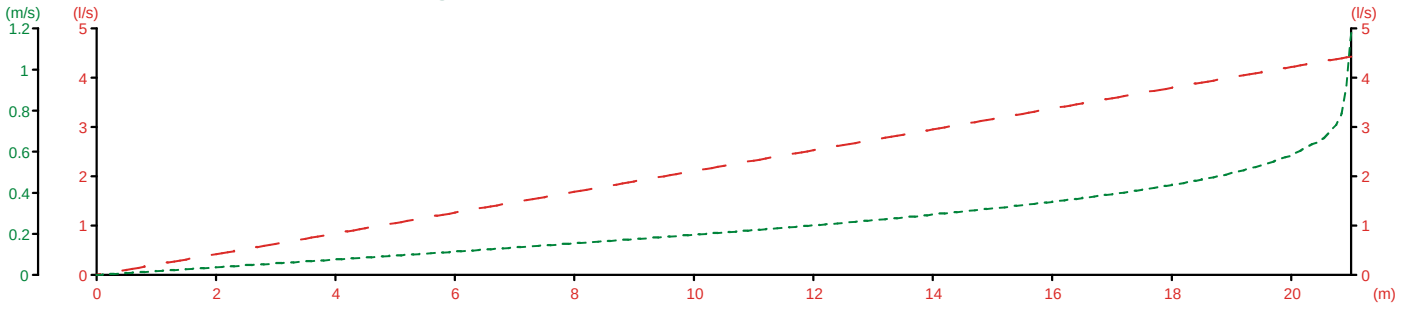
Outflow	[l/s]	: 4.43	
Flow Velocity	[m/s]	: 1.18	
Min. freeboard	[mm]	: -0.26, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.09	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

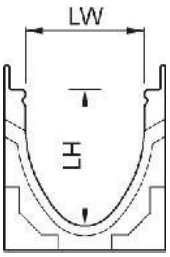
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V100@26m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @208 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 10.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 26.00
Catchment area	[m²]	: 208
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 26.00

The summation of all (sectional) lengths results in the hydraulic length.

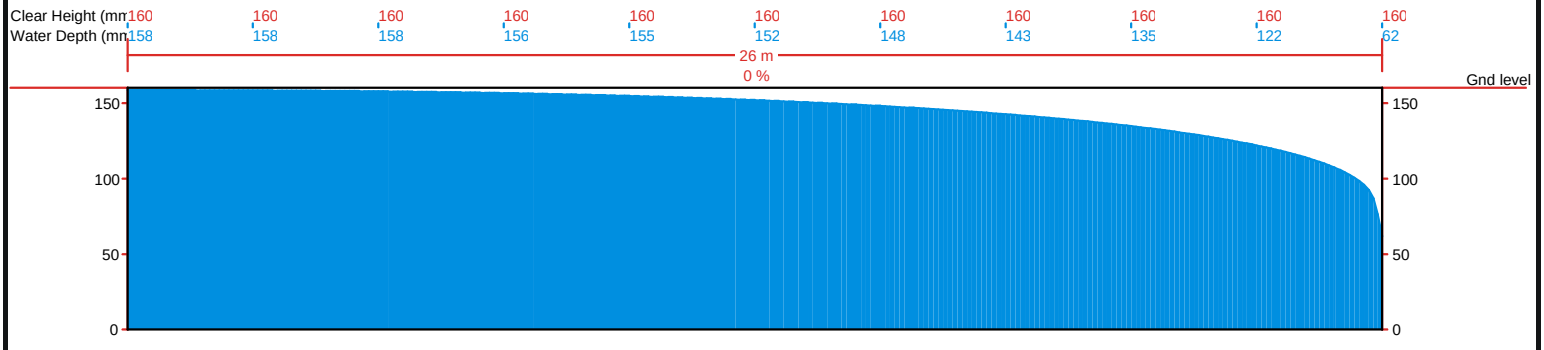
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	160									
Inner height end	[mm]	160									
Length	[m]	26.00									
Type of slope	[%]	0.000									

Results

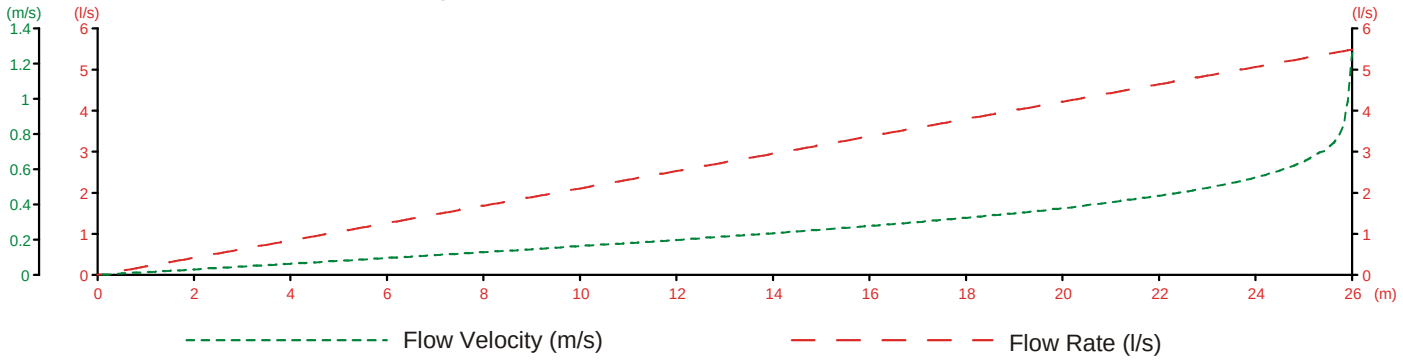
Outflow	[l/s]	: 5.49	
Flow Velocity	[m/s]	: 1.26	
Min. freeboard	[mm]	: 1.63, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.49	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



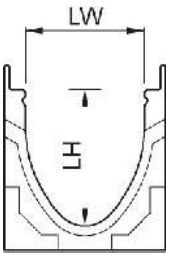
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V100@32m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V100 @256 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 15.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 32.00
Catchment area	[m²]	: 256
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 32.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	185									
Inner height end	[mm]	185									
Length	[m]	32.00									
Type of slope	[%]	0.000									

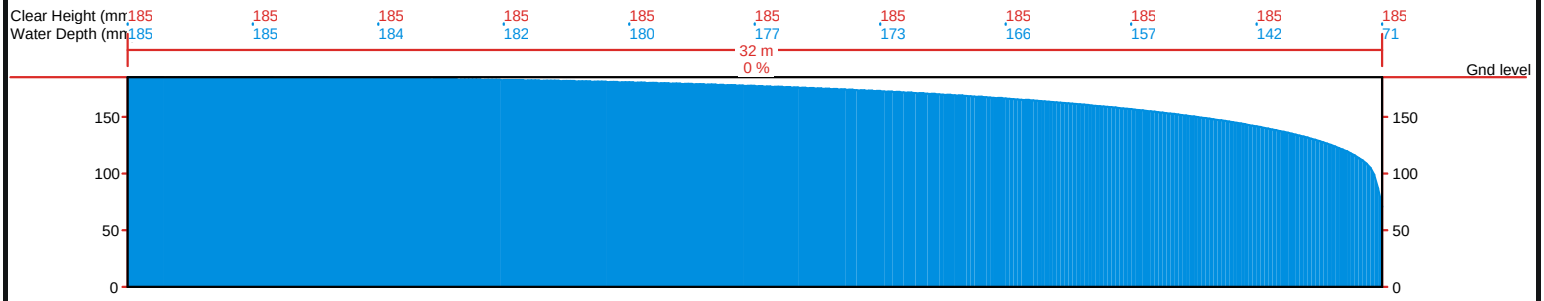
Results

Outflow	[l/s]	: 6.76
Flow Velocity	[m/s]	: 1.35
Min. freeboard	[mm]	: 0.27, X = 0.00 m
Channel capacity	[%]	: 99.93

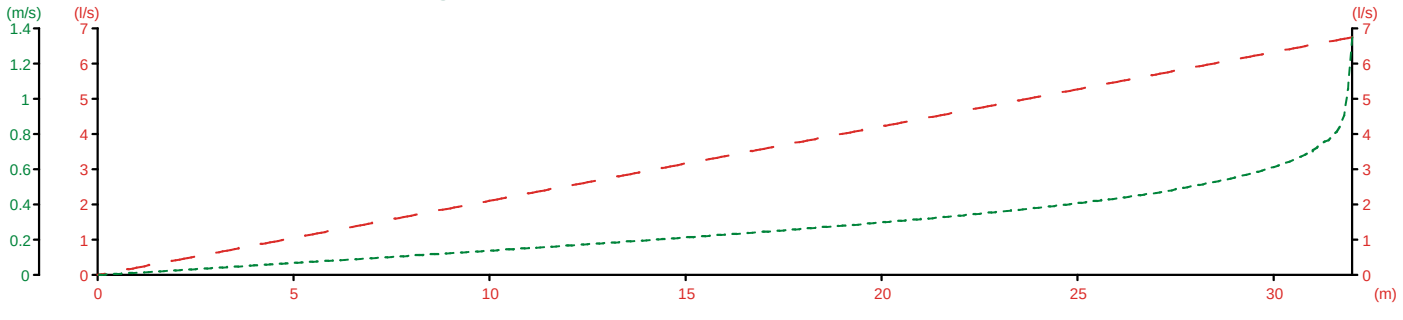
(between max. water level and bottom edge of grating)

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

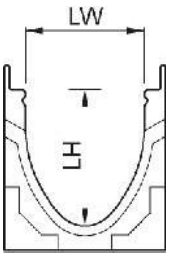
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V100@38m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @304 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 20.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 38.00
Catchment area	[m²]	: 304
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 38.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	210									
Inner height end	[mm]	210									
Length	[m]	38.00									
Type of slope	[%]	0.000									

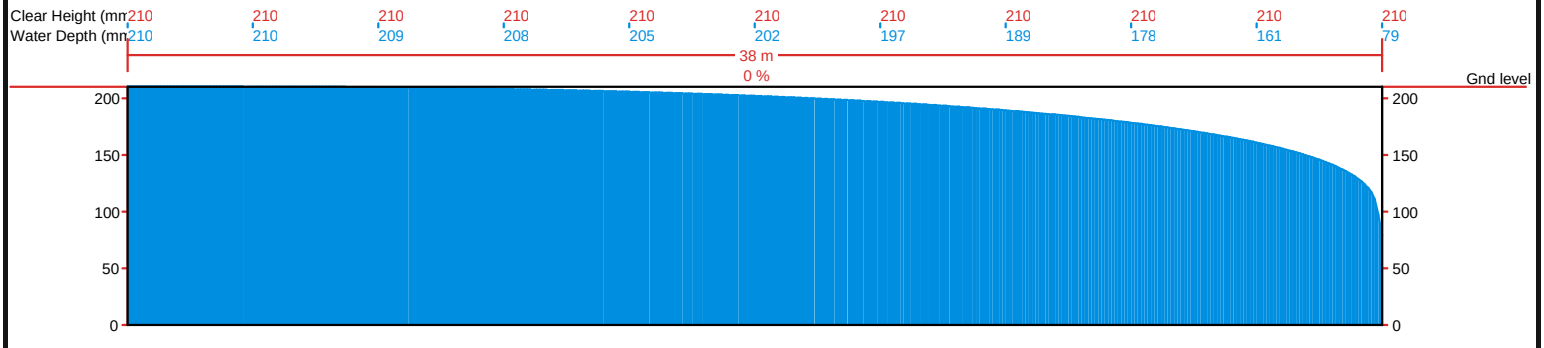
Max. possible hydraulic length 37.96 m

Results

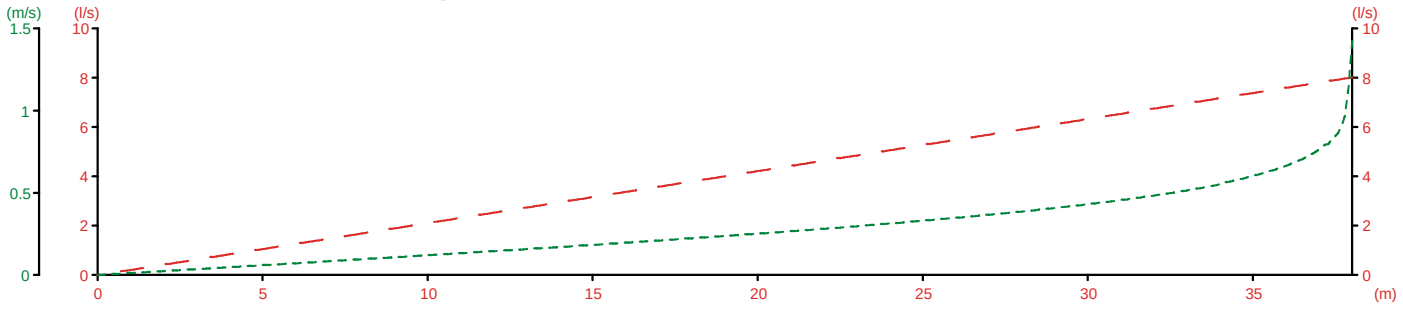
Outflow	[l/s]	: 8.02	
Flow Velocity	[m/s]	: 1.43	
Min. freeboard	[mm]	: -0.49, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.12	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

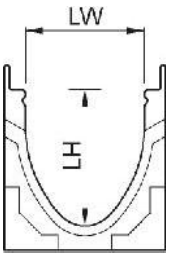
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V100@26m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @208 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 26.00
Catchment area	[m²]	: 208
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 26.00

The summation of all (sectional) lengths results in the hydraulic length.

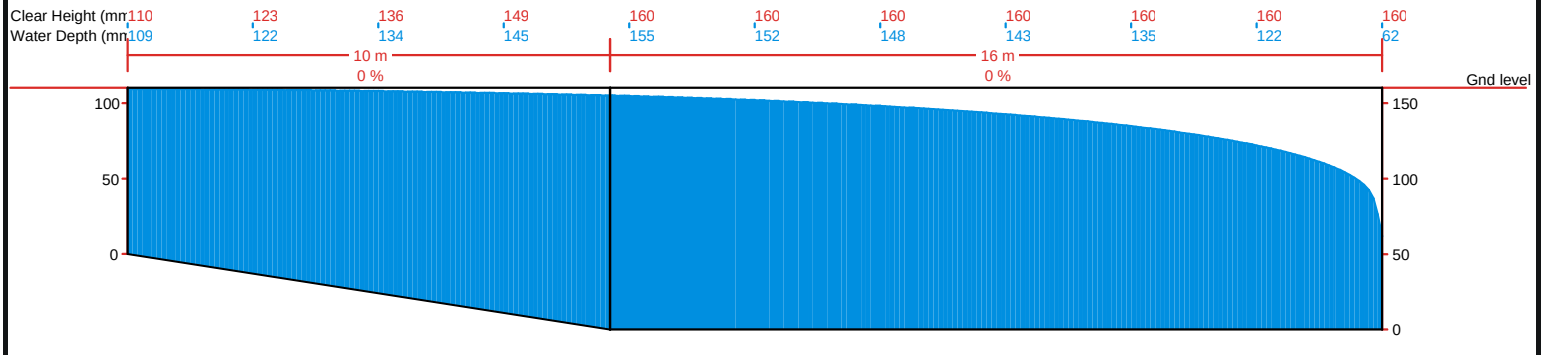
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100	100								
Inner height beg.	[mm]	110	160								
Inner height end	[mm]	160	160								
Length	[m]	10.00	16.00								
Type of slope	[%]	0.000	0.000								

Results

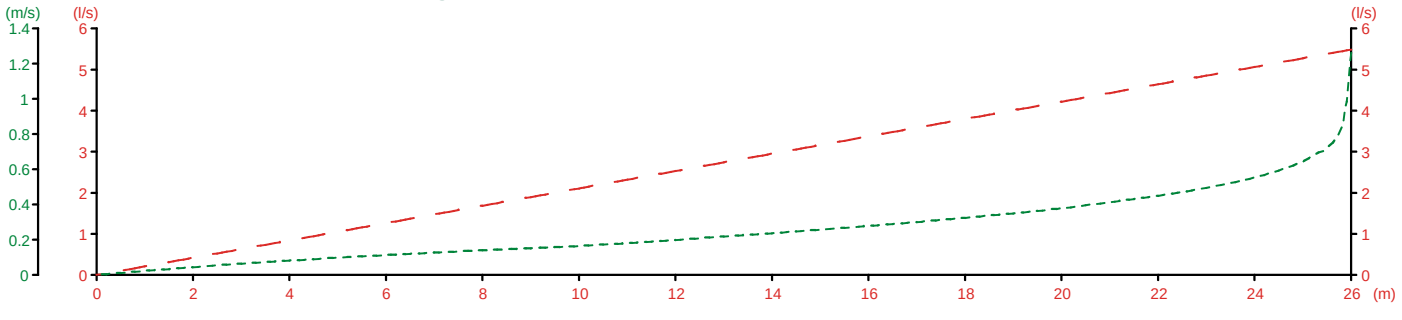
Outflow	[l/s]	: 5.49	
Flow Velocity	[m/s]	: 1.26	
Min. freeboard	[mm]	: 0.91, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.59	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

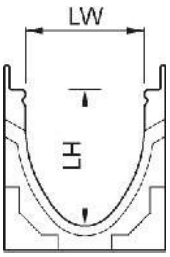
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V150@57m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V150 @456 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 57.00
Catchment area	[m²]	: 456
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 57.00

The summation of all (sectional) lengths results in the hydraulic length.

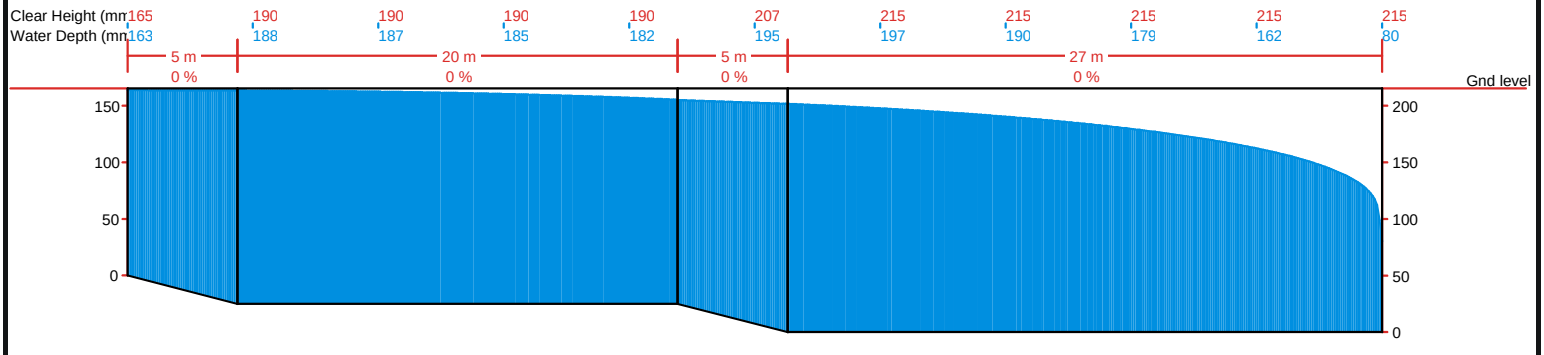
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150	150	150	150						
Inner height beg.	[mm]	165	190	190	215						
Inner height end	[mm]	190	190	215	215						
Length	[m]	5.00	20.00	5.00	27.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

Results

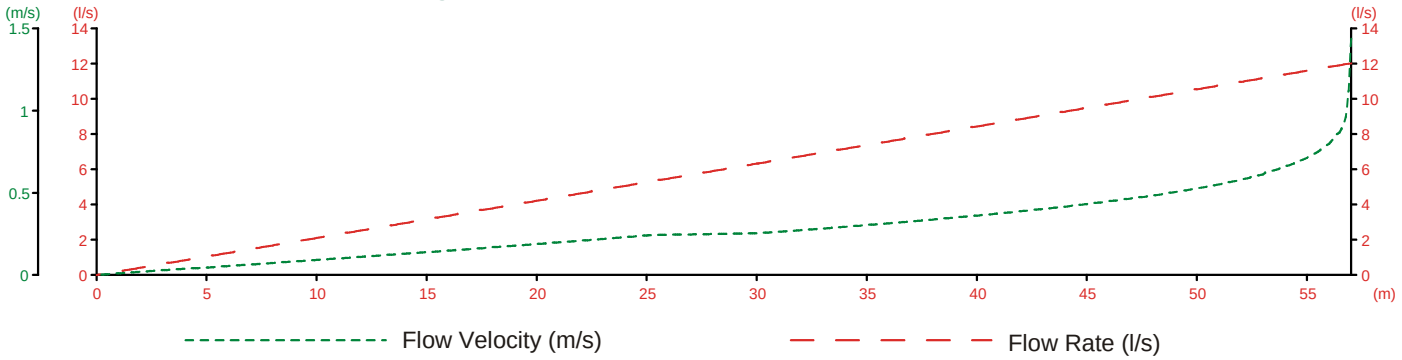
Outflow	[l/s]	: 12.03	
Flow Velocity	[m/s]	: 1.44	
Min. freeboard	[mm]	: 1.68, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.51	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

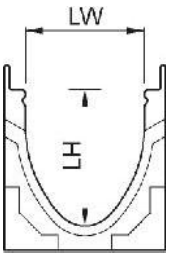
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project		: V200@70m Length
ACO Project.-No.		:
Address		:
Postal code / city		: India

Input data



Naming of channel		: V200 @560 Sq.m
Channel system		: ACO DRAIN Multiline V 200
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD200
Total length of channel	[m]	: 70.00
Catchment area	[m²]	: 560
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 70.00

The summation of all (sectional) lengths results in the hydraulic length.

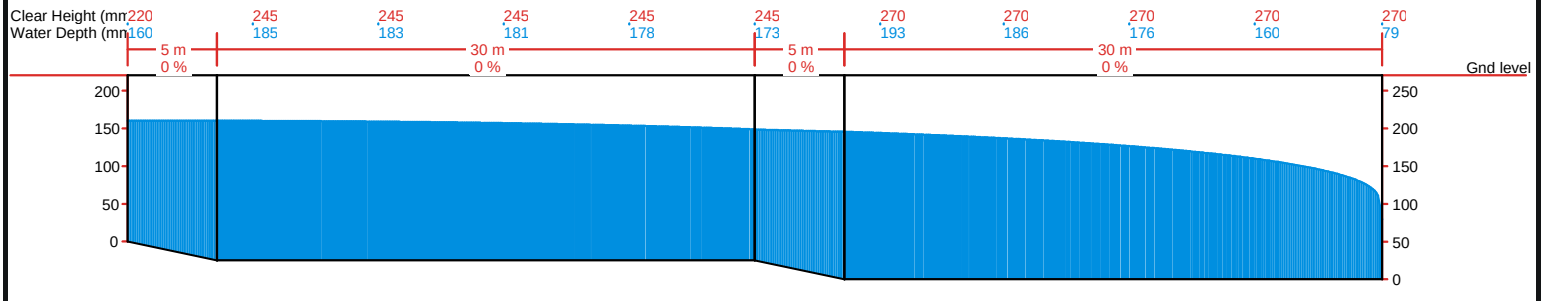
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	200	200	200	200						
Inner height beg.	[mm]	220	245	245	270						
Inner height end	[mm]	245	245	270	270						
Length	[m]	5.00	30.00	5.00	30.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

Results

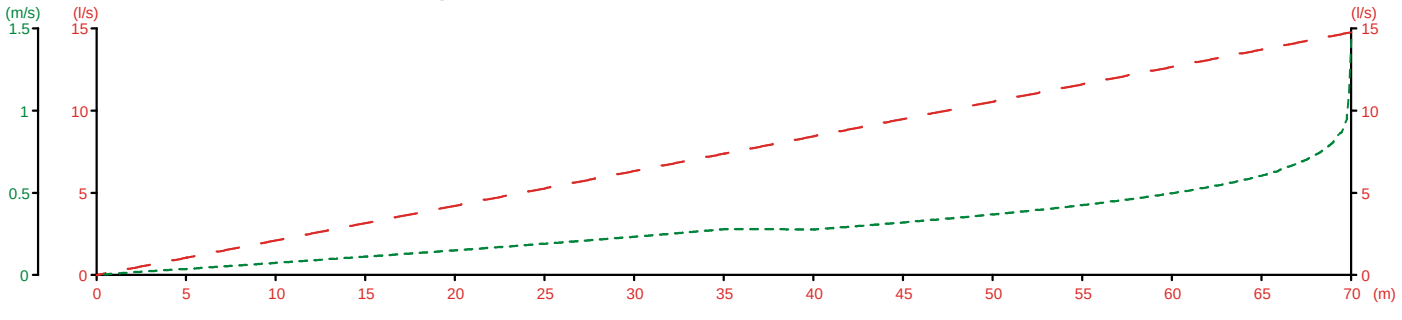
Outflow	[l/s]	: 14.78	
Flow Velocity	[m/s]	: 1.43	
Min. freeboard	[mm]	: 60.18, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 64.19	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



PODIUMS

MULTILINE V100 NEUTRAL CHANNELS (WITHOUT SLOPE):					
Channel type	0.0	5.0	10.0	15.0	20.0
Height (mm)	150	175	200	225	250
Length (m)	12	15	20	25	29
Area (m^2)	132	180	220	275	320
Discharge (l/s)	3.48	4.75	5.81	7.26	8.44

MULTILINE V150 NEUTRAL CHANNELS (WITHOUT SLOPE):					
Channel type	0.0	5.0	10.0	15.0	20.0
Height (mm)	210	235	260	285	310
Length (m)	20	30	30	30	30
Area (m^2)	360	420	540	600	720
Discharge (l/s)	9.5	11.08	14.25	15.83	19

MULTILINE SLOPED CHANNELS (WITH SLOPE):				
Drain type	V100	V150	V200	V300
Channel type	(1-5)-5.0-(6-10)-10.0	(1-5)-5.0-(6-10)-10.0	(1-5)-5.0-(6-10)-10.0	(1-5)-5.0-(6-10)-10.0
Height (mm)	(150-175)-175-(175-200)-200	(210-235)-235-(235-260)-260	(265-290)-290-(290-315)-315	(385-410)-410-(410-435)-435
Length (m)	70	70	70	70 (87%)
Area (m^2)	161	420	910	2100
Discharge (l/s)	4.25	11.08	24.01	55.42

Note:

1. Considered 5 different types of depths (Channel types) for V100 & V150 drain channel - Constant depth
2. Considered 100mm/hour intensity of rainfall
3. Considered 0.95 impermiability factor
4. Considered 100% maximum channel capacity
5. Considered maximum of 30m constant depth channels length
6. Considered maximum of 70m sloped depth channels length

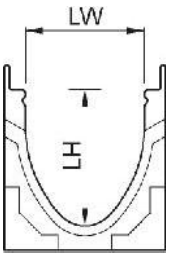
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V100@12m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V100 @132 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 12.00
Catchment area	[m²]	: 132
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 12.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	110									
Inner height end	[mm]	110									
Length	[m]	12.00									
Type of slope	[%]	0.000									

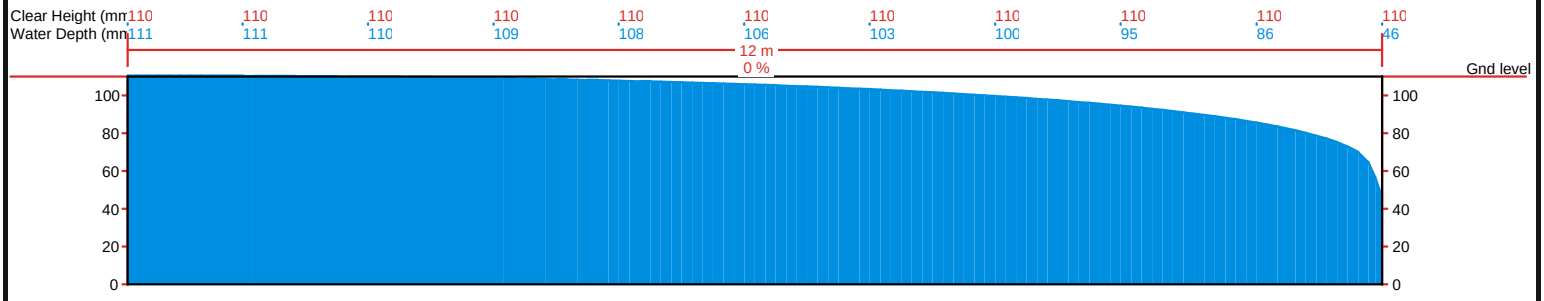
Max. possible hydraulic length 11.97 m

Results

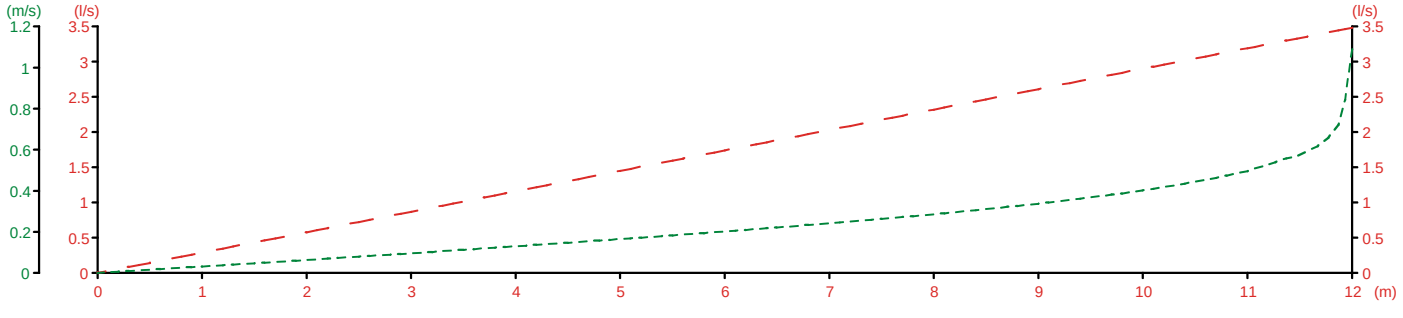
Outflow	[l/s]	: 3.48	
Flow Velocity	[m/s]	: 1.09	
Min. freeboard	[mm]	: -0.64, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.29	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



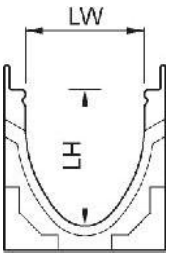
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project	: V100@15m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @180 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 5.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 15.00
Catchment area	[m²]	: 180
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 15.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	135									
Inner height end	[mm]	135									
Length	[m]	15.00									
Type of slope	[%]	0.000									

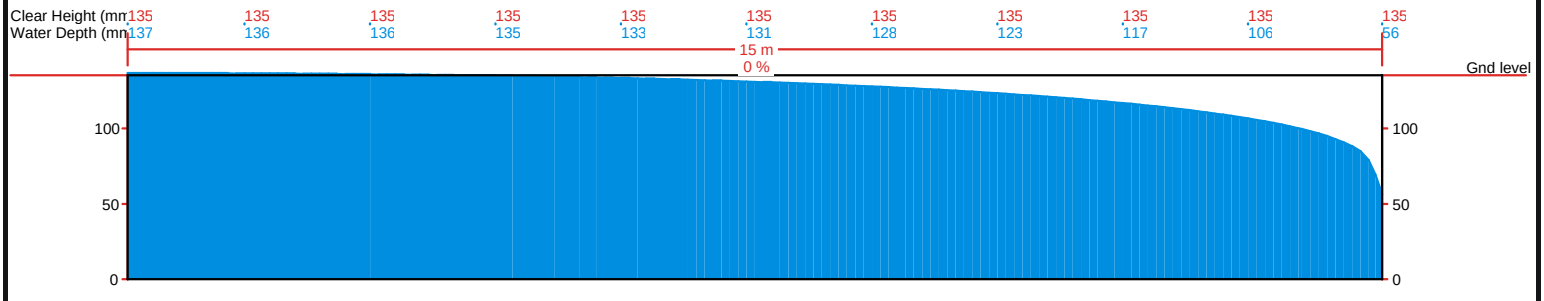
Max. possible hydraulic length 14.91 m

Results

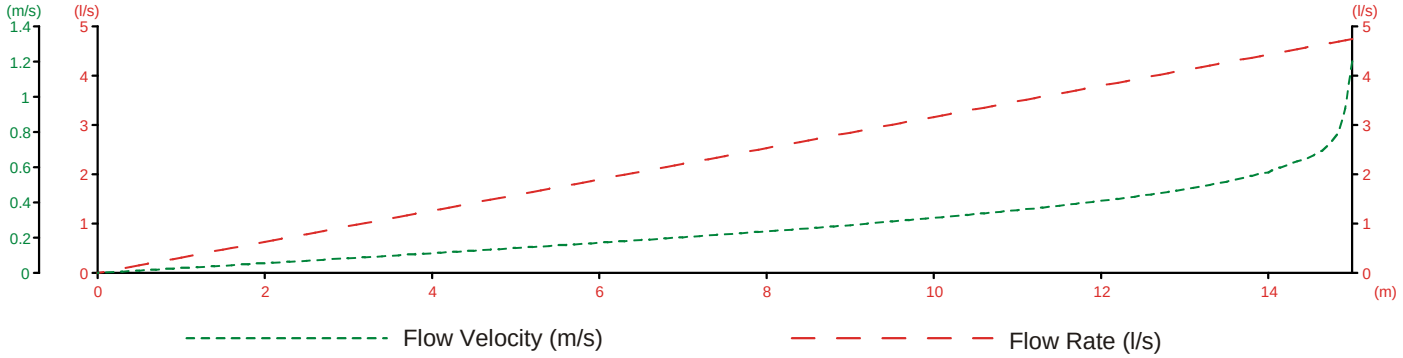
Outflow	[l/s]	: 4.75	
Flow Velocity	[m/s]	: 1.20	
Min. freeboard	[mm]	: -1.62, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.60	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



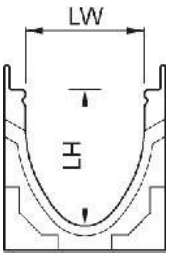
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V100@20m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V100 @220 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 10.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 20.00
Catchment area	[m²]	: 220
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 20.00

The summation of all (sectional) lengths results in the hydraulic length.

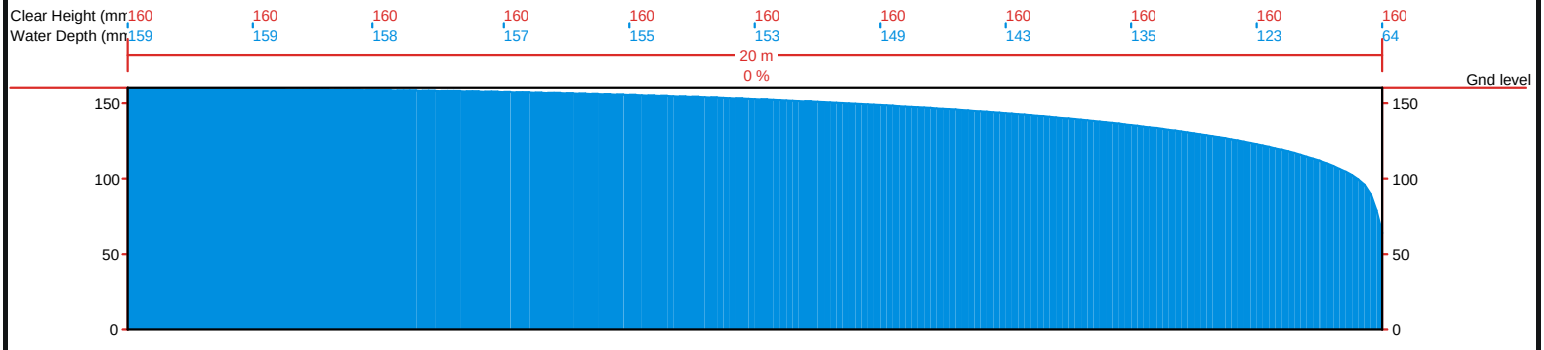
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	160									
Inner height end	[mm]	160									
Length	[m]	20.00									
Type of slope	[%]	0.000									

Results

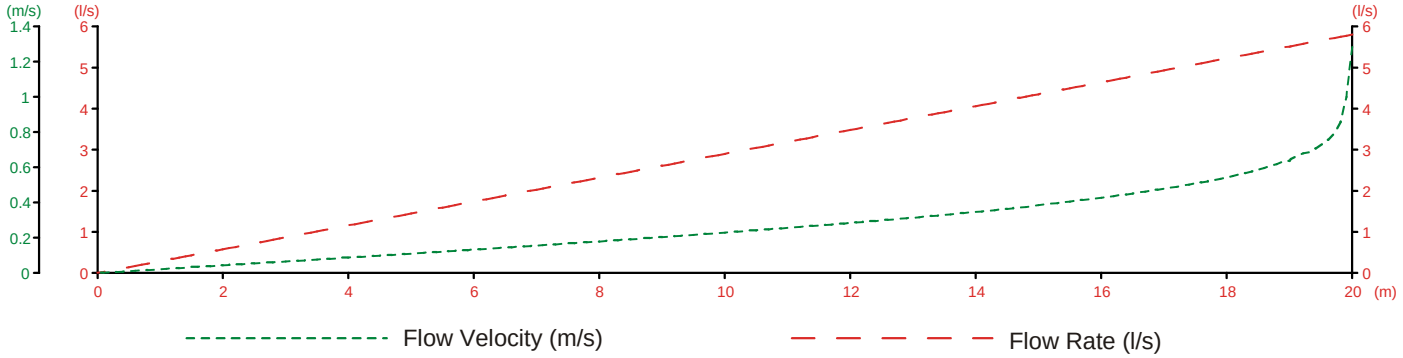
Outflow	[l/s]	: 5.81	
Flow Velocity	[m/s]	: 1.28	
Min. freeboard	[mm]	: 0.71, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.78	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



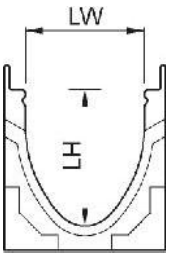
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V100@25m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V100 @275 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 15.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 25.00
Catchment area	[m²]	: 275
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 25.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	185									
Inner height end	[mm]	185									
Length	[m]	25.00									
Type of slope	[%]	0.000									

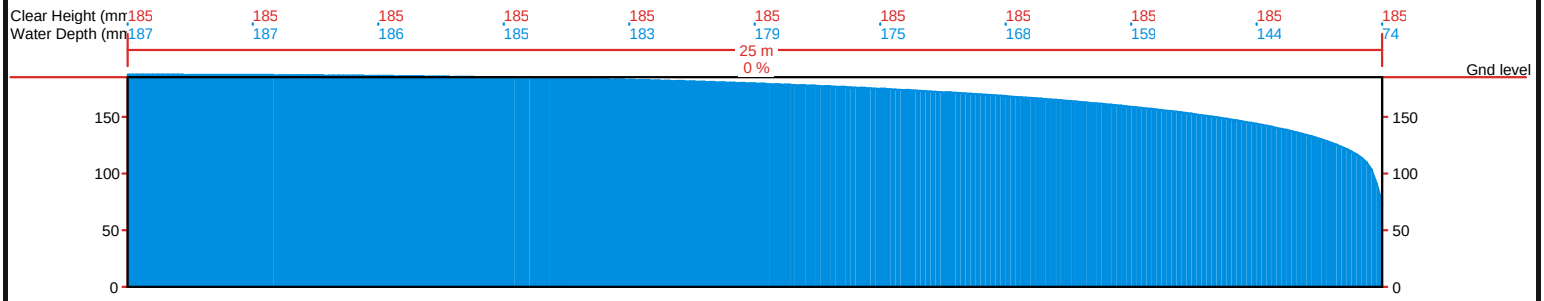
Max. possible hydraulic length 24.85 m

Results

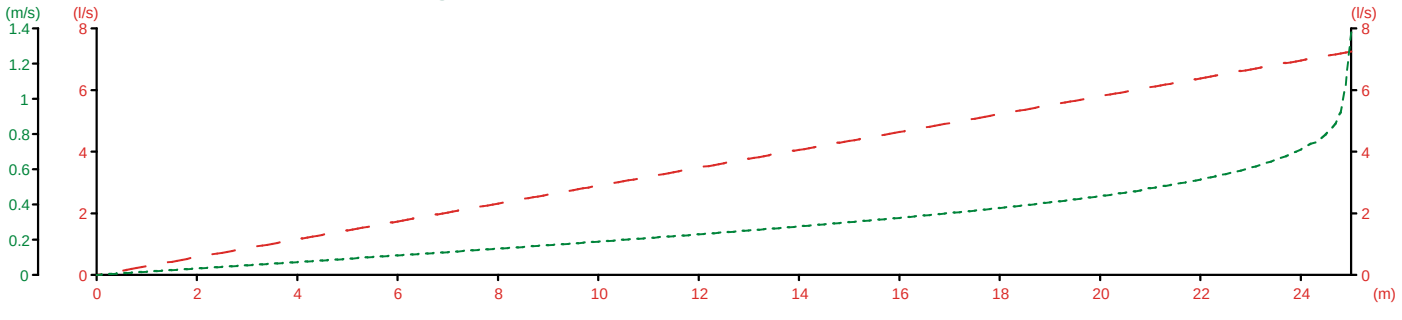
Outflow	[l/s]	: 7.26	
Flow Velocity	[m/s]	: 1.38	
Min. freeboard	[mm]	: -2.31, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.62	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



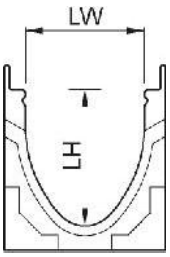
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project	: V100@29m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @320 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 20.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 29.00
Catchment area	[m²]	: 320
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 29.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	210									
Inner height end	[mm]	210									
Length	[m]	29.00									
Type of slope	[%]	0.000									

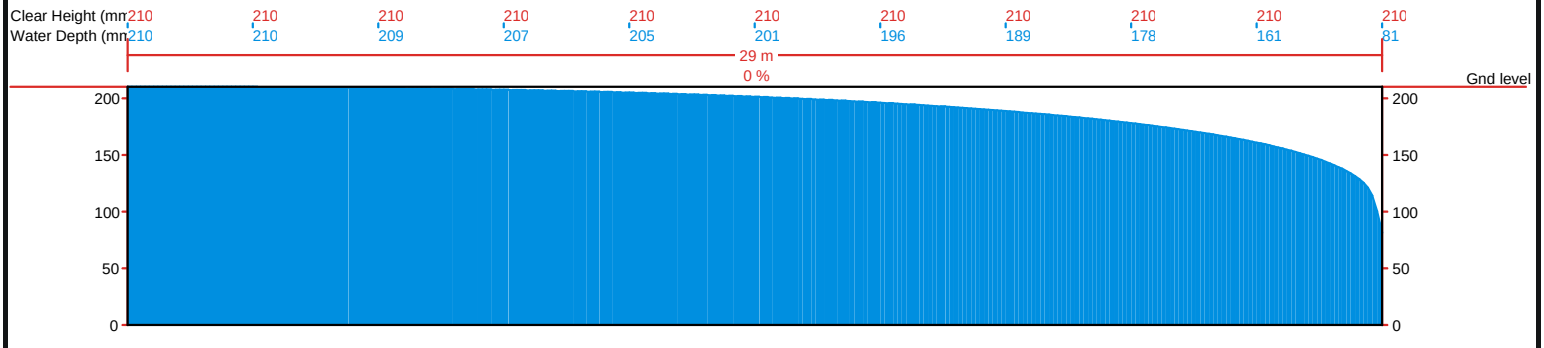
Results

Outflow	[l/s]	: 8.44
Flow Velocity	[m/s]	: 1.45
Min. freeboard	[mm]	: 0.01, X = 0.00 m
Channel capacity	[%]	: 100.00

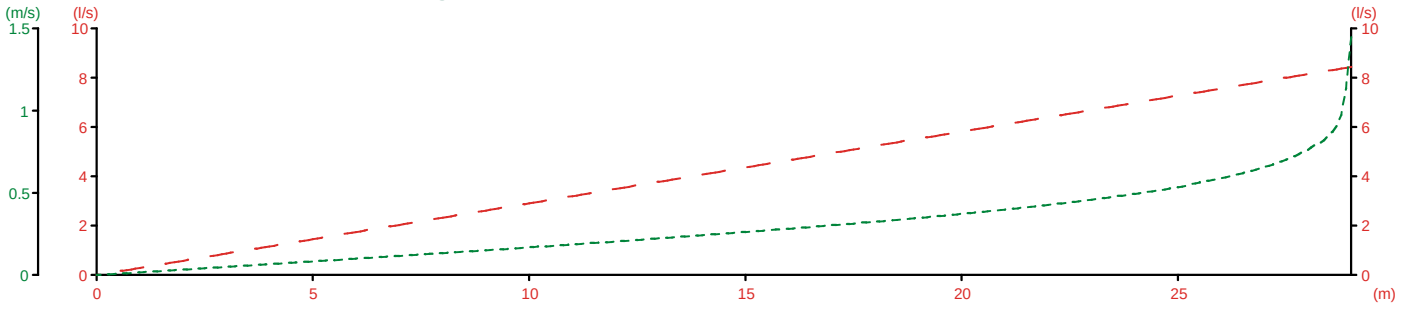
(between max. water level and bottom edge of grating)

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



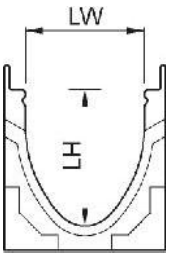
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V150@20m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V150 @360 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 20.00
Catchment area	[m²]	: 360
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 20.00

The summation of all (sectional) lengths results in the hydraulic length.

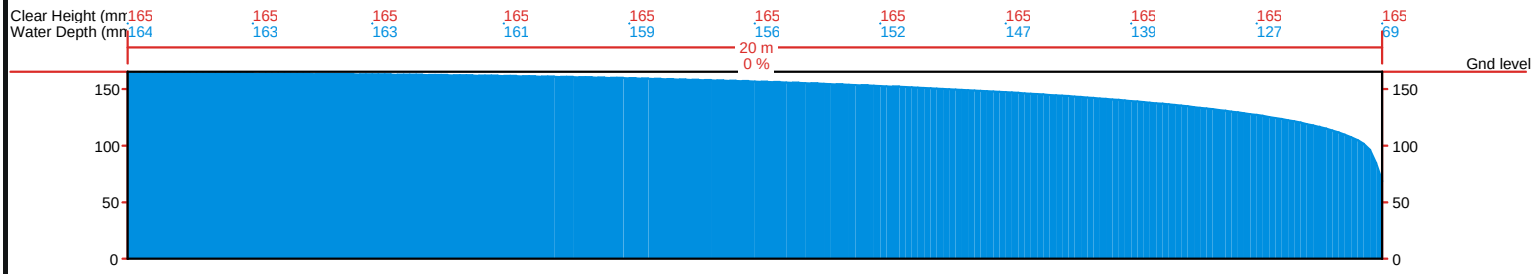
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	165									
Inner height end	[mm]	165									
Length	[m]	20.00									
Type of slope	[%]	0.000									

Results

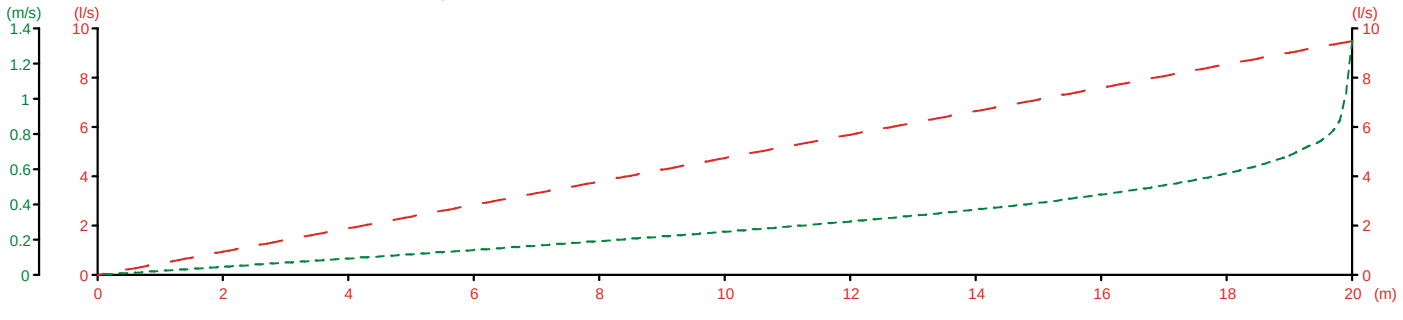
Outflow	[l/s]	: 9.50
Flow Velocity	[m/s]	: 1.33
Min. freeboard	[mm]	: 1.46, X = 0.00 m (between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.56

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

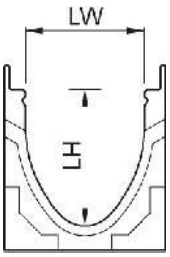
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V150@30m Length	
ACO Project.-No.	:	
Address	:	
Postal code / city	: India	

Input data



Naming of channel		: V150 @420 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 5.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 420
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

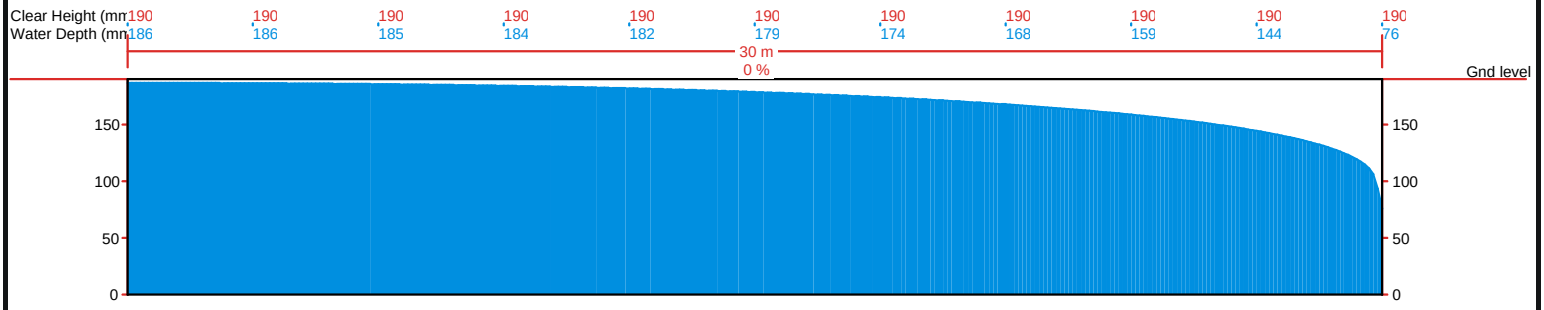
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	190									
Inner height end	[mm]	190									
Length	[m]	30.00									
Type of slope	[%]	0.000									

Results

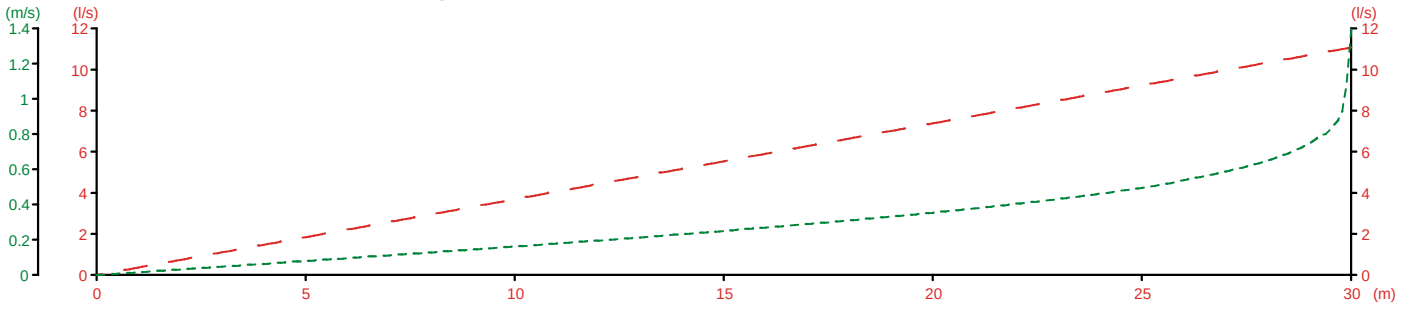
Outflow	[l/s]	: 11.08	
Flow Velocity	[m/s]	: 1.40	
Min. freeboard	[mm]	: 3.54, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.06	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

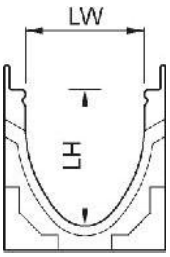
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V150@30m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V150 @540 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 10.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 540
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	215									
Inner height end	[mm]	215									
Length	[m]	30.00									
Type of slope	[%]	0.000									

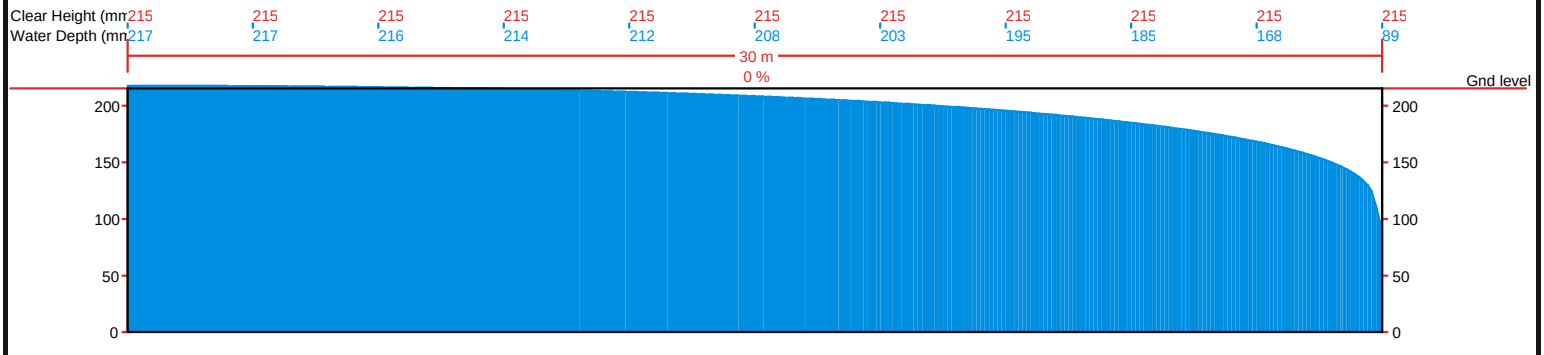
Max. possible hydraulic length 29.83 m

Results

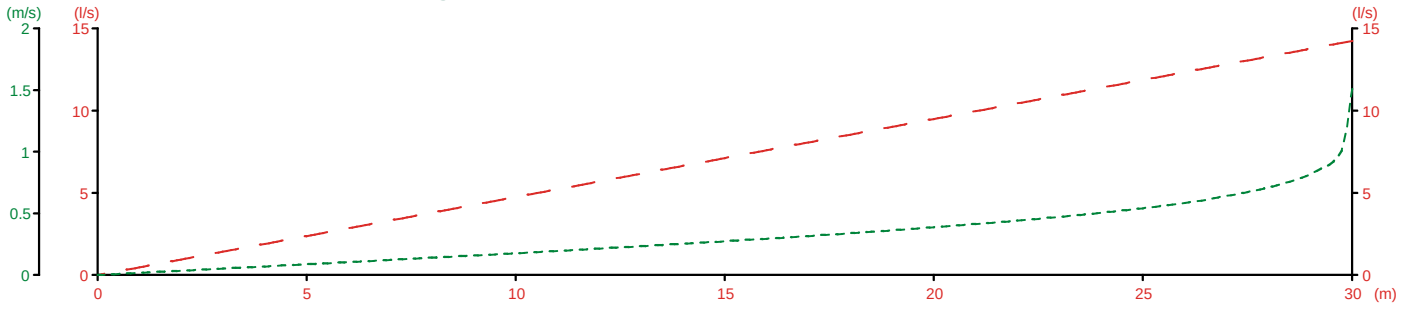
Outflow	[l/s]	: 14.25	
Flow Velocity	[m/s]	: 1.51	
Min. freeboard	[mm]	: -2.45, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.57	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

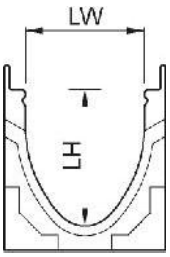
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V150@30m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V150 @600 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 15.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 600
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

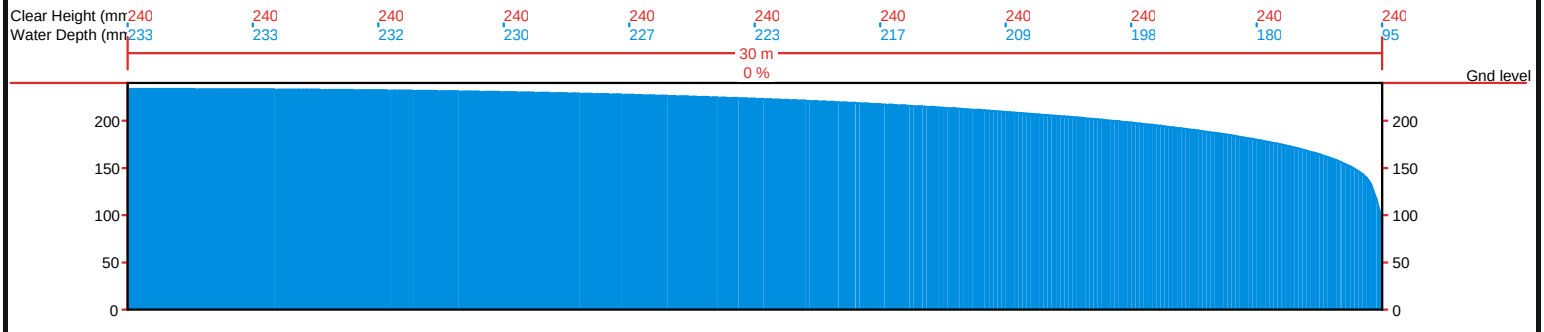
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	240									
Inner height end	[mm]	240									
Length	[m]	30.00									
Type of slope	[%]	0.000									

Results

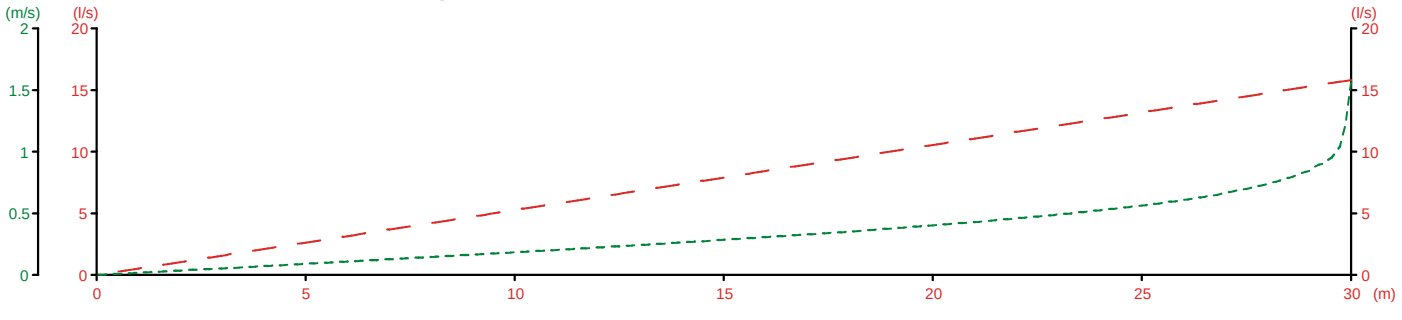
Outflow	[l/s]	: 15.83	
Flow Velocity	[m/s]	: 1.56	
Min. freeboard	[mm]	: 6.68, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 96.90	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

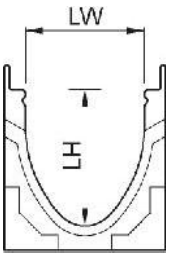
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V150@30m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V150 @720 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 20.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 720
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

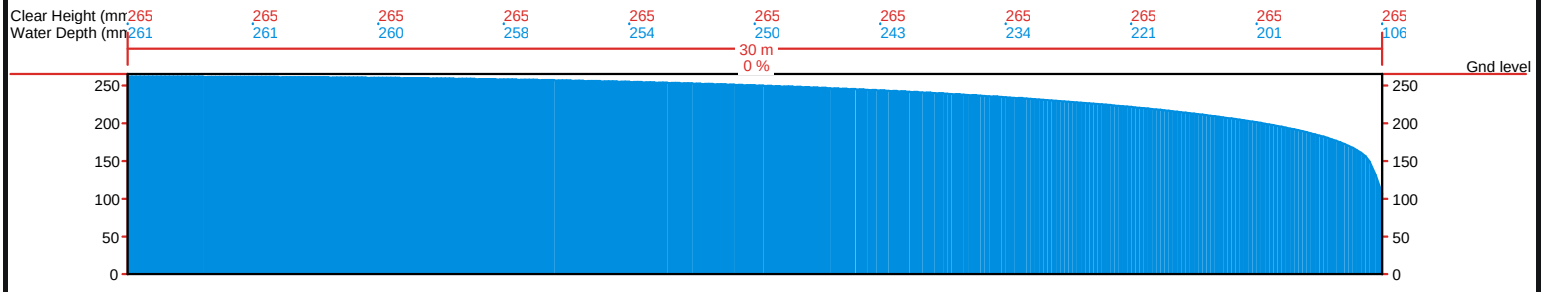
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	265									
Inner height end	[mm]	265									
Length	[m]	30.00									
Type of slope	[%]	0.000									

Results

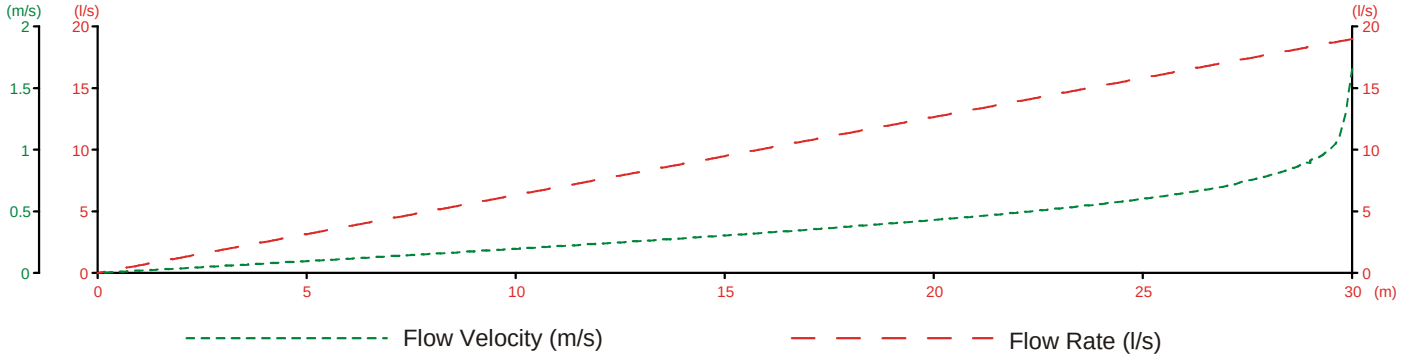
Outflow	[l/s]	: 19.00	
Flow Velocity	[m/s]	: 1.66	
Min. freeboard	[mm]	: 3.68, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.30	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

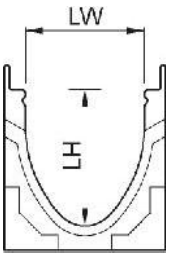
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V100@70m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @161 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 70.00
Catchment area	[m²]	: 161
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 70.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100	100	100	100						
Inner height beg.	[mm]	110	135	135	160						
Inner height end	[mm]	135	135	160	160						
Length	[m]	5.00	30.00	5.00	30.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

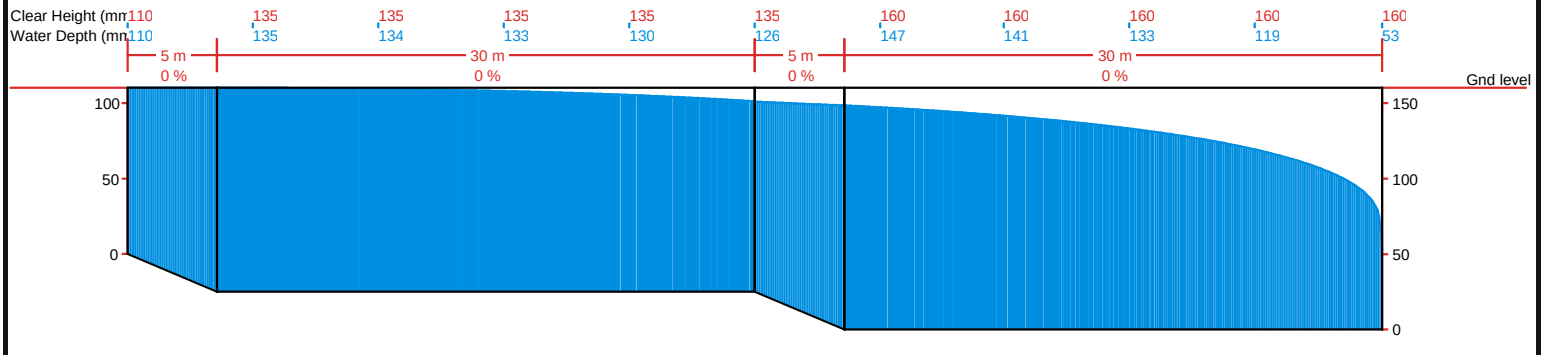
Max. possible hydraulic length 69.96 m

Results

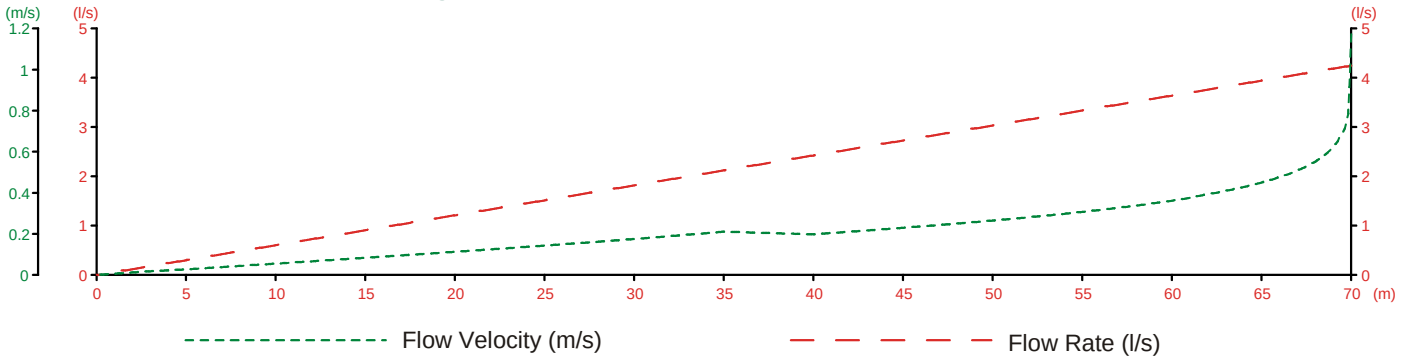
Outflow	[l/s]	: 4.25	
Flow Velocity	[m/s]	: 1.17	
Min. freeboard	[mm]	: -0.12, X = 0.10 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.05	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

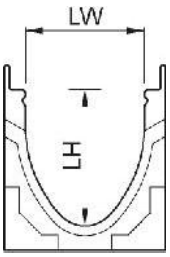
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V150@70m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V150 @420 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 70.00
Catchment area	[m²]	: 420
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 70.00

The summation of all (sectional) lengths results in the hydraulic length.

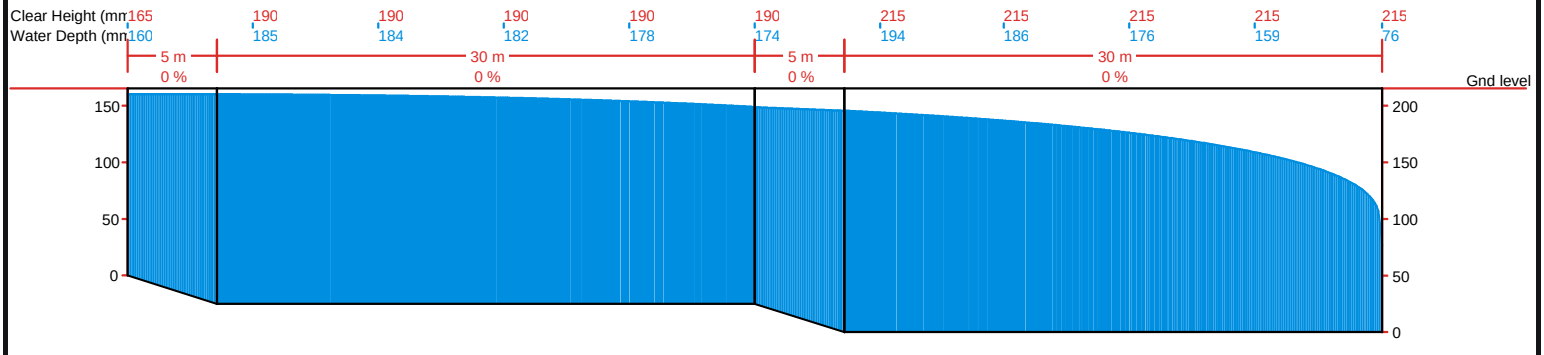
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150	150	150	150						
Inner height beg.	[mm]	165	190	190	215						
Inner height end	[mm]	190	190	215	215						
Length	[m]	5.00	30.00	5.00	30.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

Results

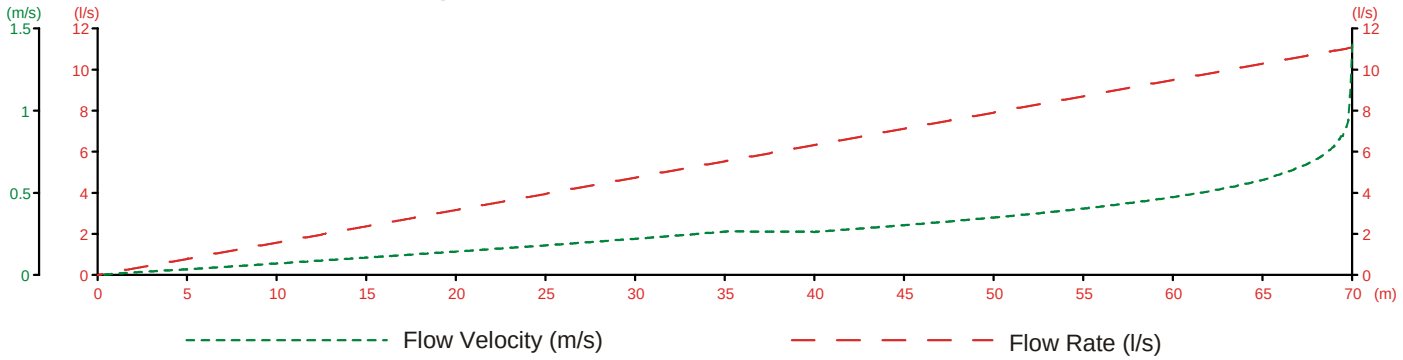
Outflow	[l/s]	: 11.08	
Flow Velocity	[m/s]	: 1.40	
Min. freeboard	[mm]	: 5.13, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 97.65	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

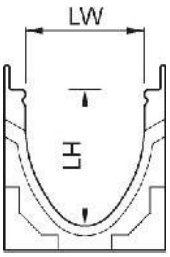
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V200@70m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V200 @910 Sq.m
Channel system		: ACO DRAIN Multiline V 200
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD200
Total length of channel	[m]	: 70.00
Catchment area	[m²]	: 910
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 70.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	200	200	200	200						
Inner height beg.	[mm]	220	245	245	270						
Inner height end	[mm]	245	245	270	270						
Length	[m]	5.00	30.00	5.00	30.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

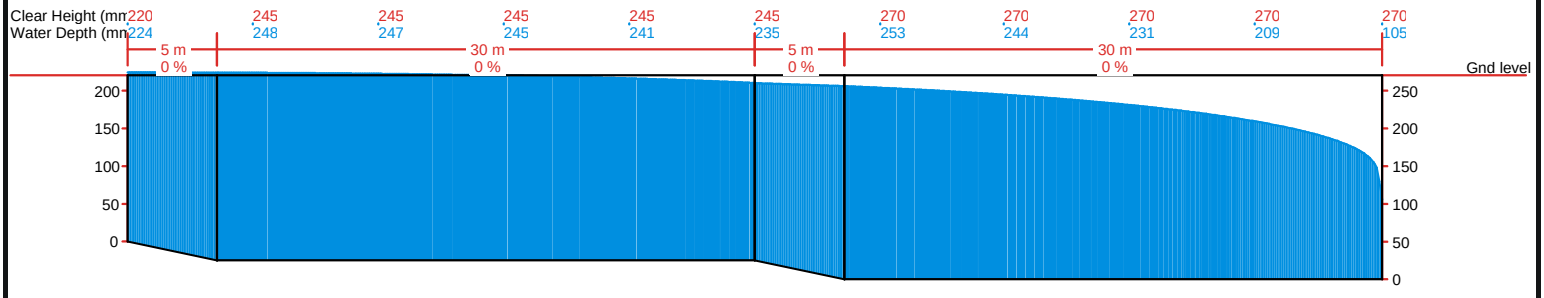
Max. possible hydraulic length 69.39 m

Results

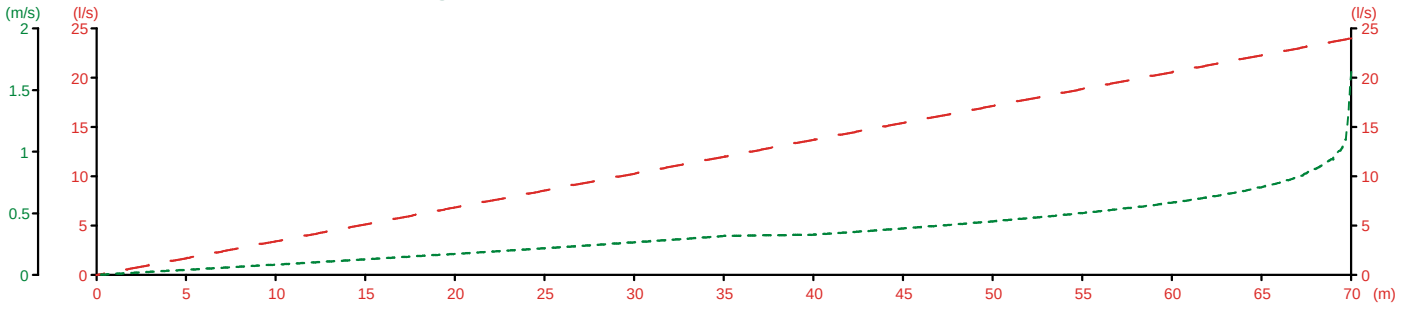
Outflow	[l/s]	: 24.01	
Flow Velocity	[m/s]	: 1.65	
Min. freeboard	[mm]	: -3.89, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.88	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

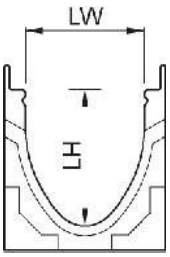
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V300@70m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V300 @2100 Sq.m
Channel system		: ACO DRAIN Multiline V 300
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD200
Total length of channel	[m]	: 70.00
Catchment area	[m²]	: 2100
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 70.00

The summation of all (sectional) lengths results in the hydraulic length.

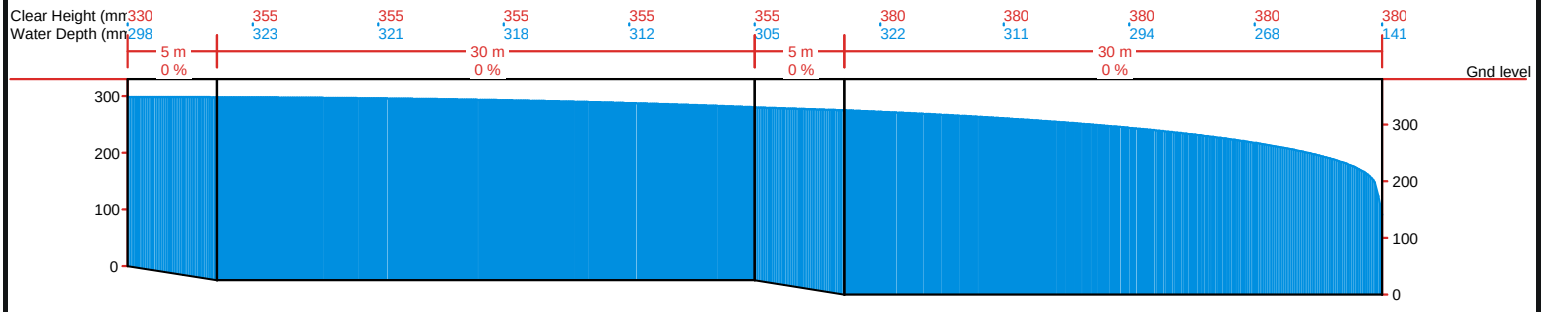
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	300	300	300	300						
Inner height beg.	[mm]	330	355	355	380						
Inner height end	[mm]	355	355	380	380						
Length	[m]	5.00	30.00	5.00	30.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

Results

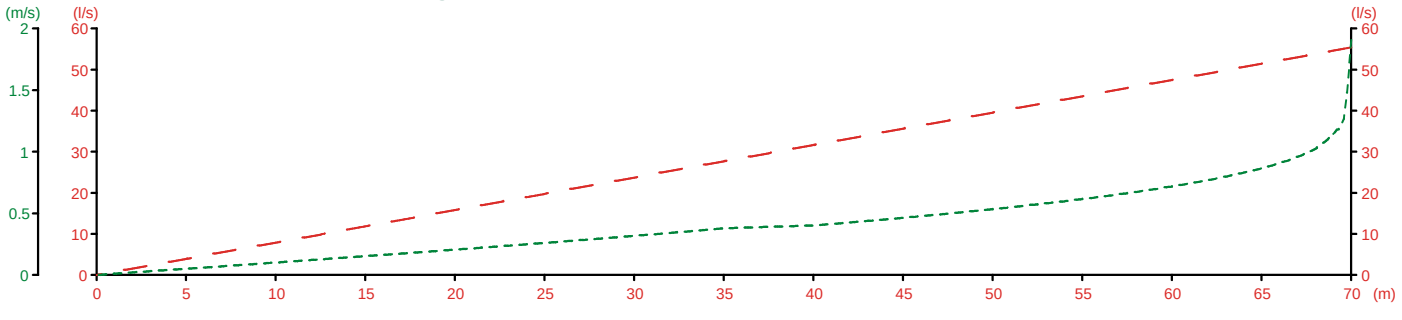
Outflow	[l/s]	: 55.42	
Flow Velocity	[m/s]	: 1.91	
Min. freeboard	[mm]	: 31.93, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 86.98	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



BASEMENT

MULTILINE V100 NEUTRAL CHANNELS (WITHOUT SLOPE):					
Channel type	0.0	5.0	10.0	15.0	20.0
Height (mm)	150	175	200	225	250
Length (m)	30	30	30	30	30
Area (m^2)	360	510	690	870	1050
Discharge (l/s)	2.85	4.04	5.46	6.89	8.31

MULTILINE V150 NEUTRAL CHANNELS (WITHOUT SLOPE):					
Channel type	0.0	5.0	10.0	15.0	20.0
Height (mm)	210	235	260	285	310
Length (m)	30	30	30	30	30
Area (m^2)	1140	1410	1800	2100	2460
Discharge (l/s)	9.02	11.16	14.25	16.63	19.48

MULTILINE SLOPED CHANNELS (WITH SLOPE):				
Drain type	V100	V150	V200	V300
Channel type	(1-5)-5.0-(6-10)-10.0	(1-5)-5.0-(6-10)-10.0	(1-5)-5.0-(6-10)-10.0	(1-5)-5.0-(6-10)-10.0
Height (mm)	(150-175)-175-(175-200)-200	(210-235)-235-(235-260)-260	(265-290)-290-(290-315)-315	(385-410)-410-(410-435)-435
Length (m)	70	70	70	70
Area (m^2)	525	1435	2870	8050
Discharge (l/s)	4.16	11.36	22.72	63.73

Note:

1. Considered 5 different types of depths (Channel types) for V100 & V150 drain channel - Constant depth
2. Considered 30mm/hour intensity of rainfall
3. Considered 0.95 impermiability factor
4. Considered 100% maximum channel capacity
5. Considered maximum of 30m constant depth channels length
6. Considered maximum of 70m sloped depth channels length

Hydraulic calculation for ACO DRAIN® channel systems

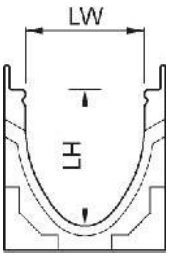
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V100@30m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @360 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 360
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

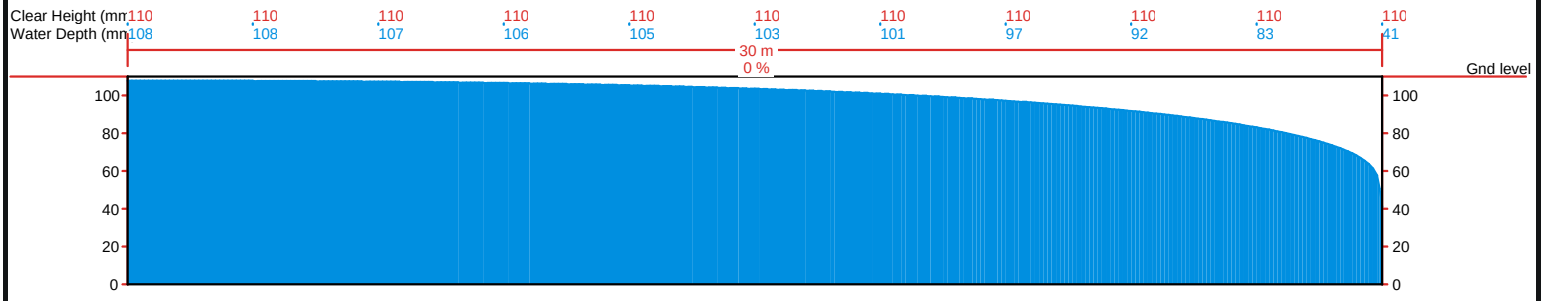
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	110									
Inner height end	[mm]	110									
Length	[m]	30.00									
Type of slope	[%]	0.000									

Results

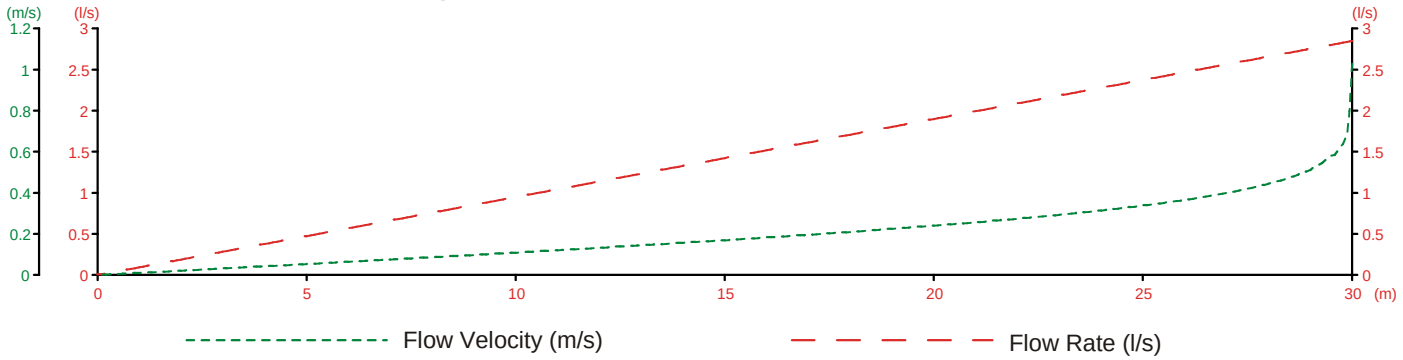
Outflow	[l/s]	: 2.85
Flow Velocity	[m/s]	: 1.03
Min. freeboard	[mm]	: 2.25, X = 0.10 m (between max. water level and bottom edge of grating)
Channel capacity	[%]	: 98.23

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



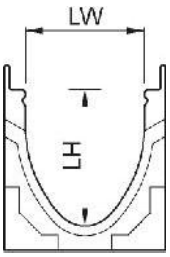
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V100@30m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V100 @510 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 5.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 510
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	135									
Inner height end	[mm]	135									
Length	[m]	30.00									
Type of slope	[%]	0.000									

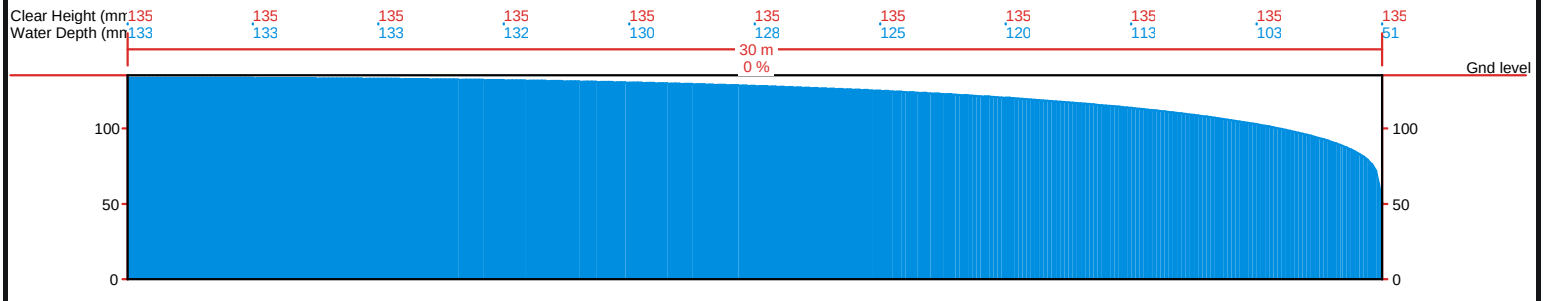
Results

Outflow	[l/s]	: 4.04
Flow Velocity	[m/s]	: 1.15
Min. freeboard	[mm]	: 1.76, X = 0.00 m
Channel capacity	[%]	: 99.35

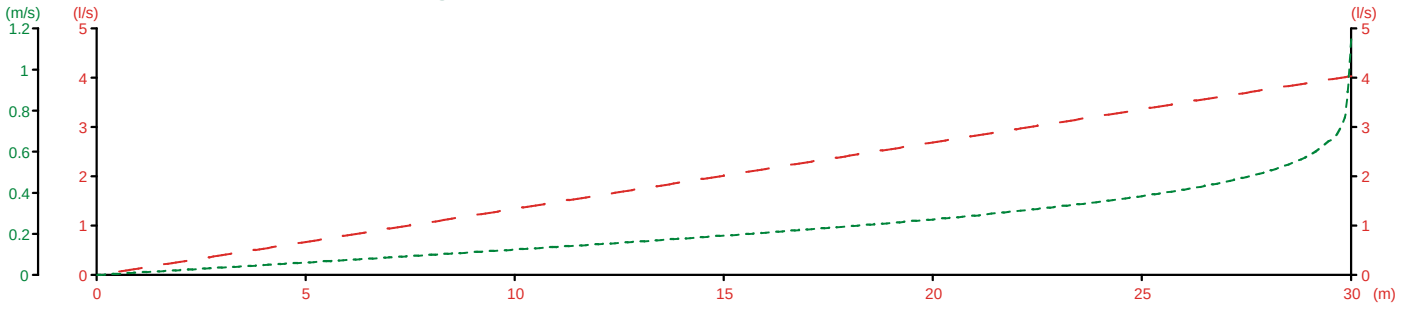
(between max. water level and bottom edge of grating)

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

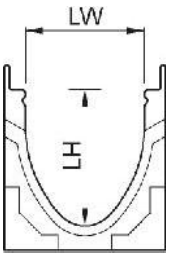
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V100@30m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @690 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 10.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 690
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	160									
Inner height end	[mm]	160									
Length	[m]	30.00									
Type of slope	[%]	0.000									

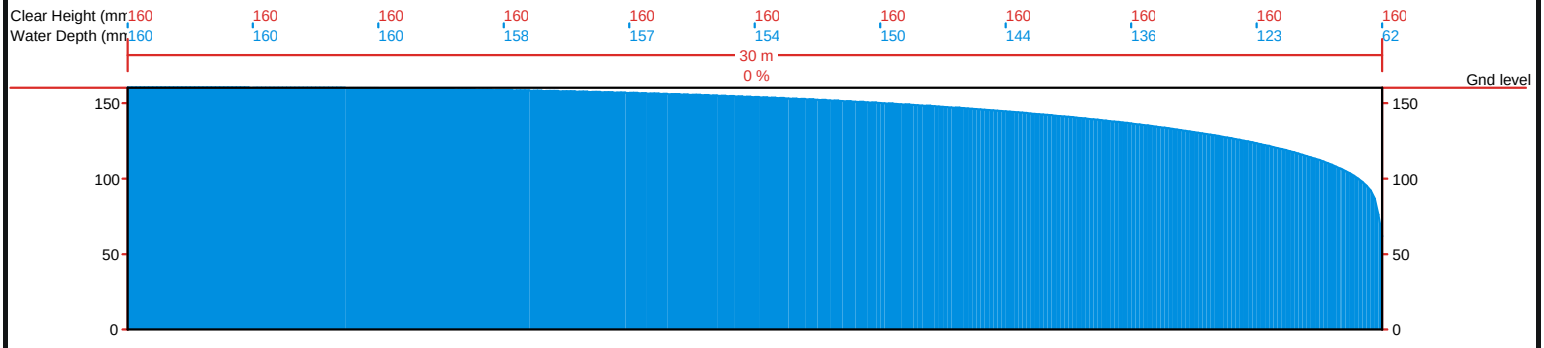
Max. possible hydraulic length 29.96 m

Results

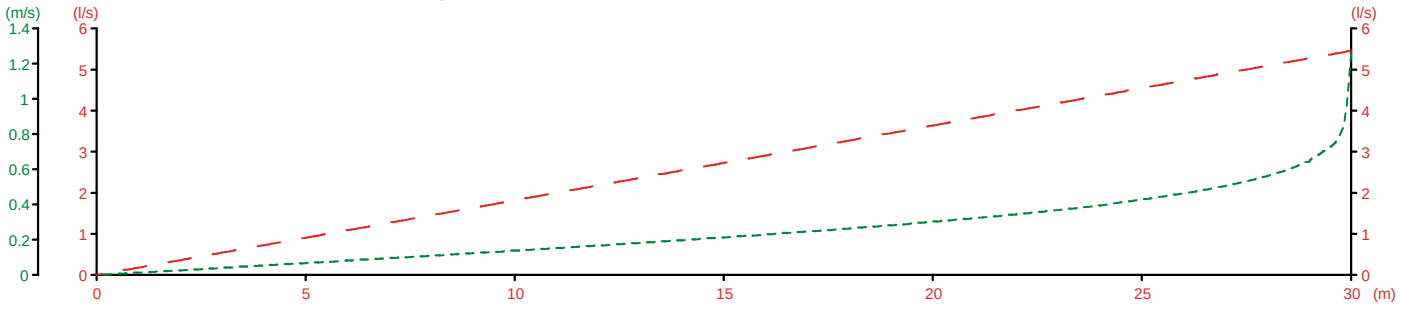
Outflow	[l/s]	: 5.46	
Flow Velocity	[m/s]	: 1.26	
Min. freeboard	[mm]	: -0.39, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.12	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



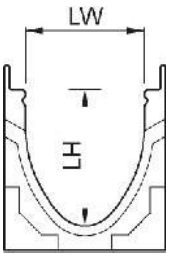
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V100@30m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V100 @870 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 15.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 870
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	185									
Inner height end	[mm]	185									
Length	[m]	30.00									
Type of slope	[%]	0.000									

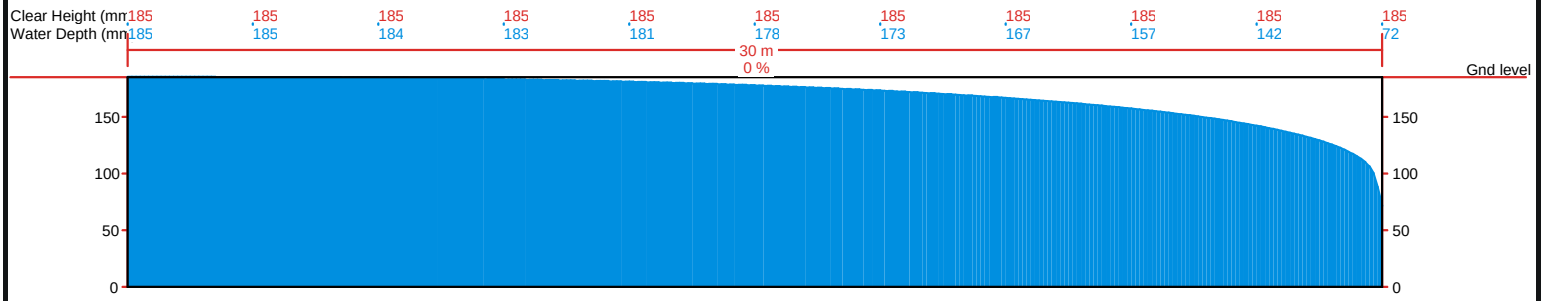
Max. possible hydraulic length 29.97 m

Results

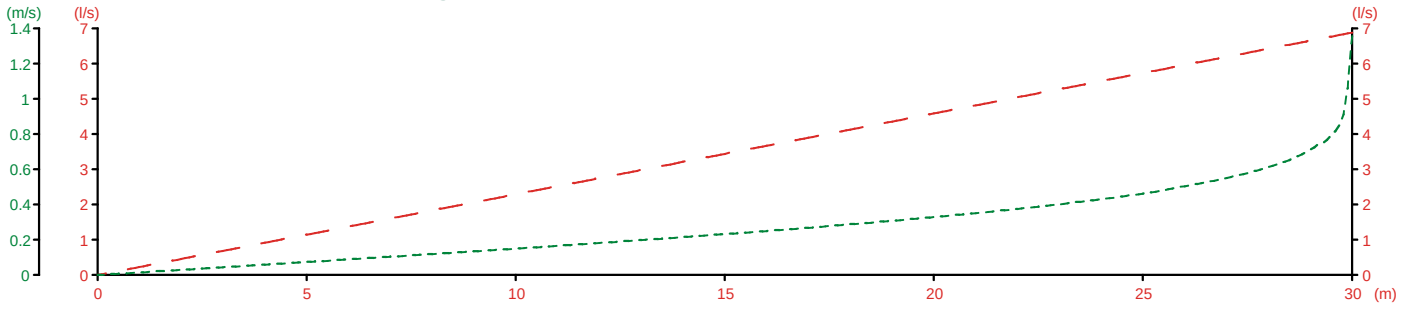
Outflow	[l/s]	: 6.89	
Flow Velocity	[m/s]	: 1.36	
Min. freeboard	[mm]	: -0.39, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.11	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

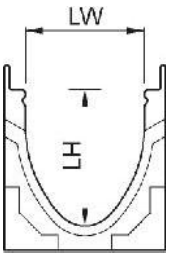
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V100@30m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @1050 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 20.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 1050
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

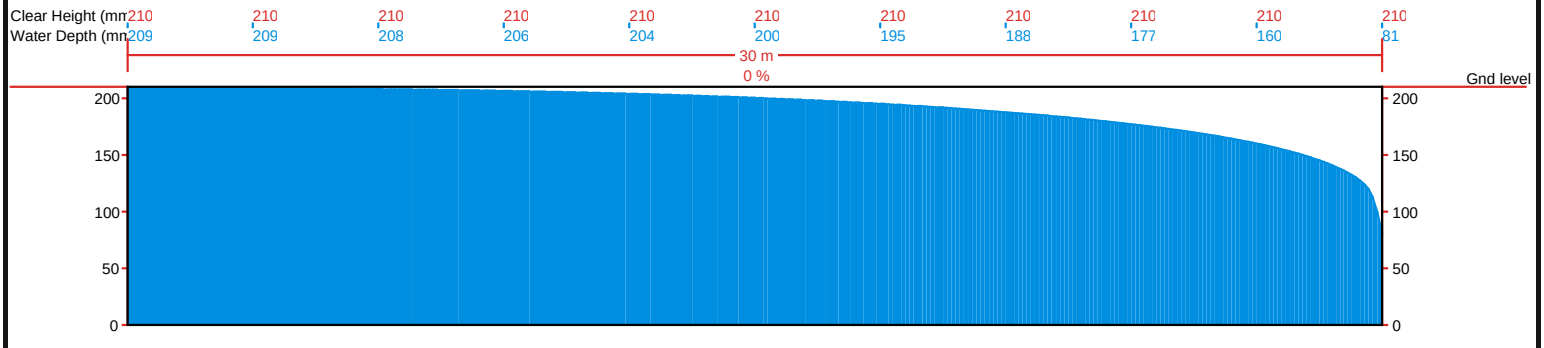
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100									
Inner height beg.	[mm]	210									
Inner height end	[mm]	210									
Length	[m]	30.00									
Type of slope	[%]	0.000									

Results

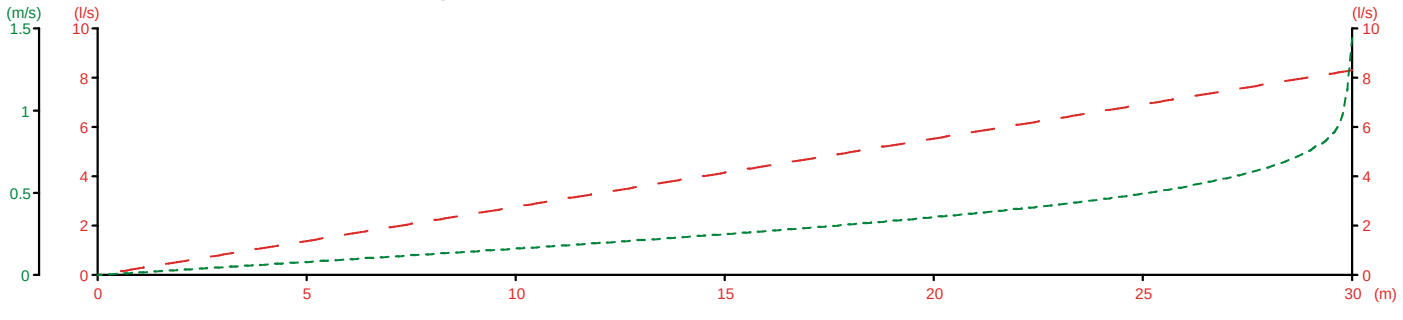
Outflow	[l/s]	: 8.31	
Flow Velocity	[m/s]	: 1.44	
Min. freeboard	[mm]	: 1.10, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.74	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

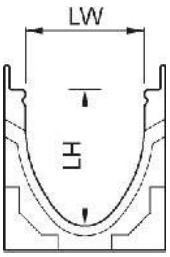
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project		: V150@30m Length
ACO Project.-No.		:
Address		:
Postal code / city		: India

Input data



Naming of channel		: V150 @1140 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 1140
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

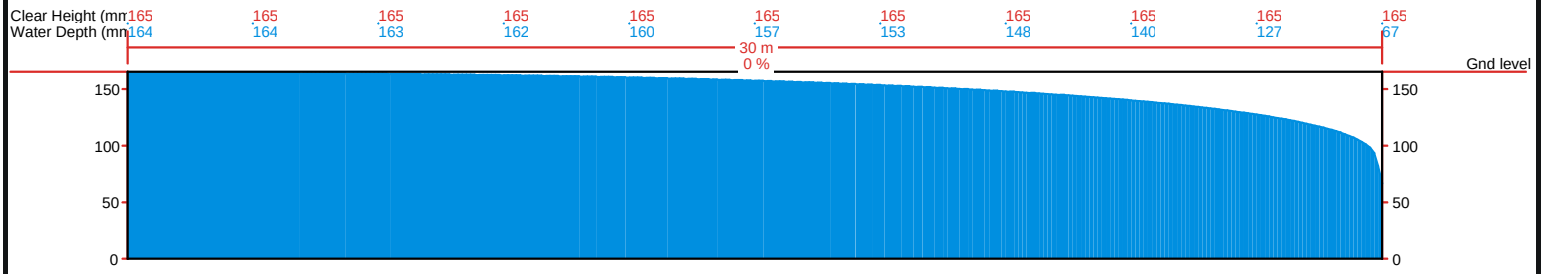
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	165									
Inner height end	[mm]	165									
Length	[m]	30.00									
Type of slope	[%]	0.000									

Results

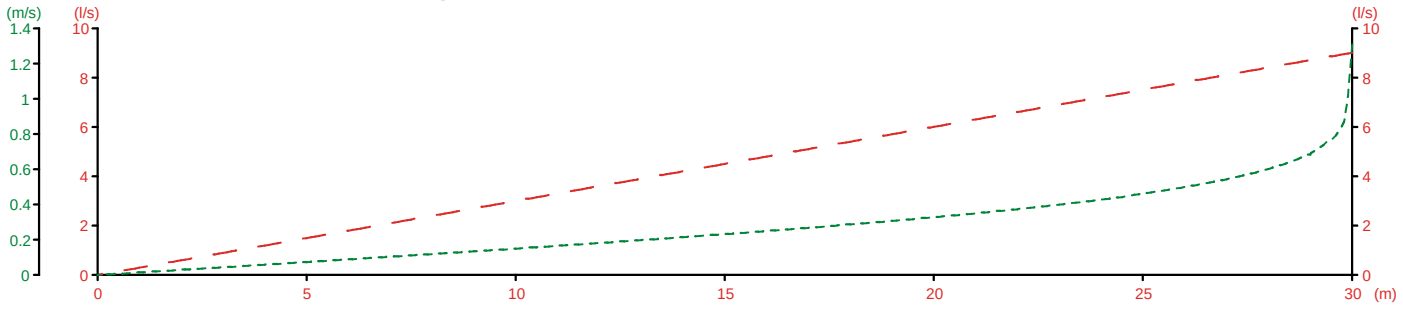
Outflow	[l/s]	: 9.02	
Flow Velocity	[m/s]	: 1.31	
Min. freeboard	[mm]	: 1.01, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.69	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

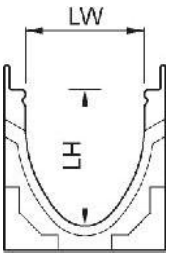
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V150@30m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V150 @1410 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 5.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 1410
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	190									
Inner height end	[mm]	190									
Length	[m]	30.00									
Type of slope	[%]	0.000									

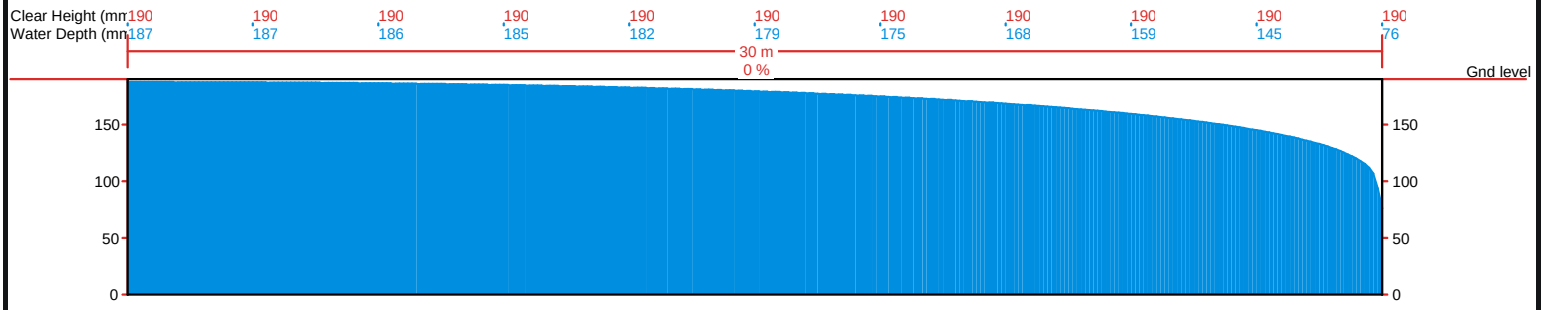
Results

Outflow	[l/s]	: 11.16
Flow Velocity	[m/s]	: 1.40
Min. freeboard	[mm]	: 2.79, X = 0.00 m
Channel capacity	[%]	: 99.26

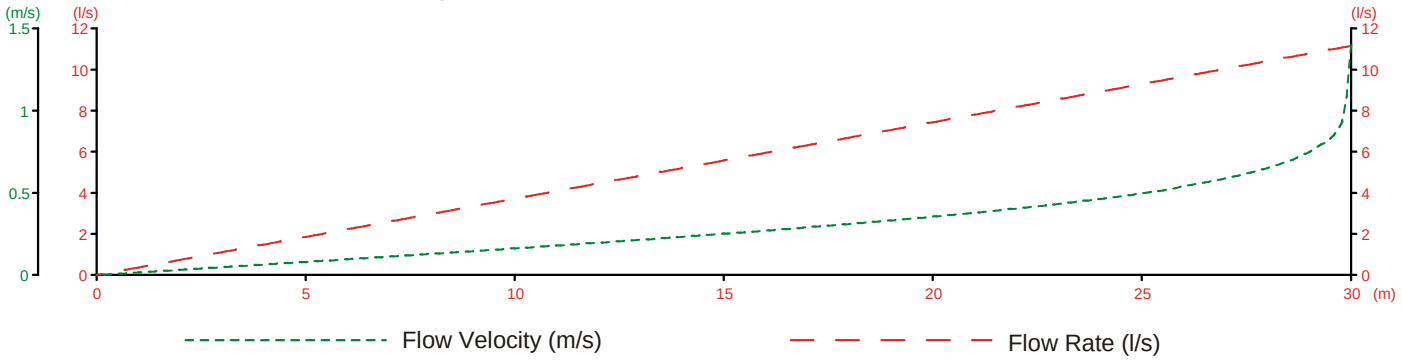
(between max. water level and bottom edge of grating)

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

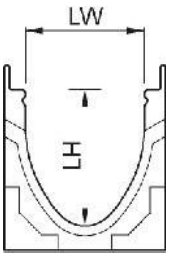
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V150@30m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V150 @1800 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 10.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 1800
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	215									
Inner height end	[mm]	215									
Length	[m]	30.00									
Type of slope	[%]	0.000									

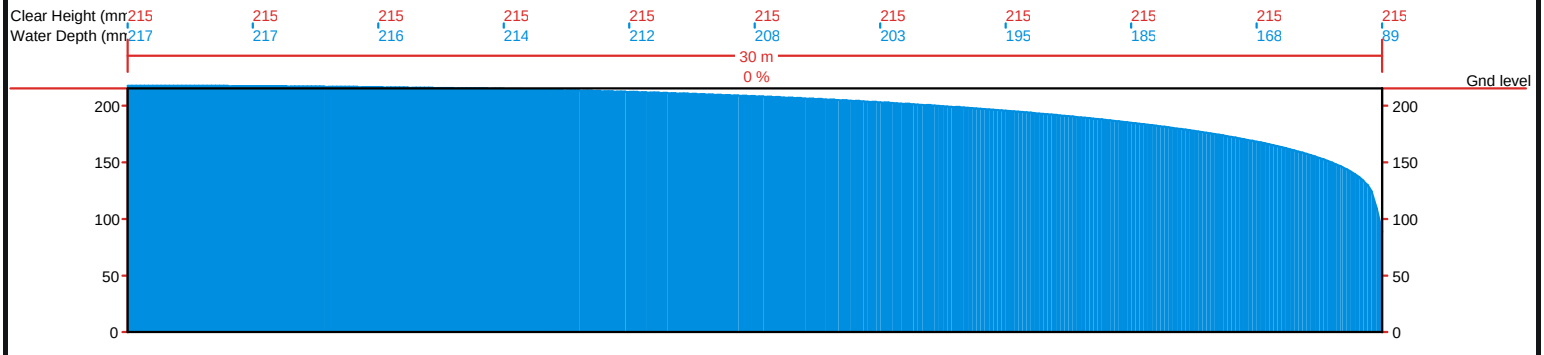
Max. possible hydraulic length 29.83 m

Results

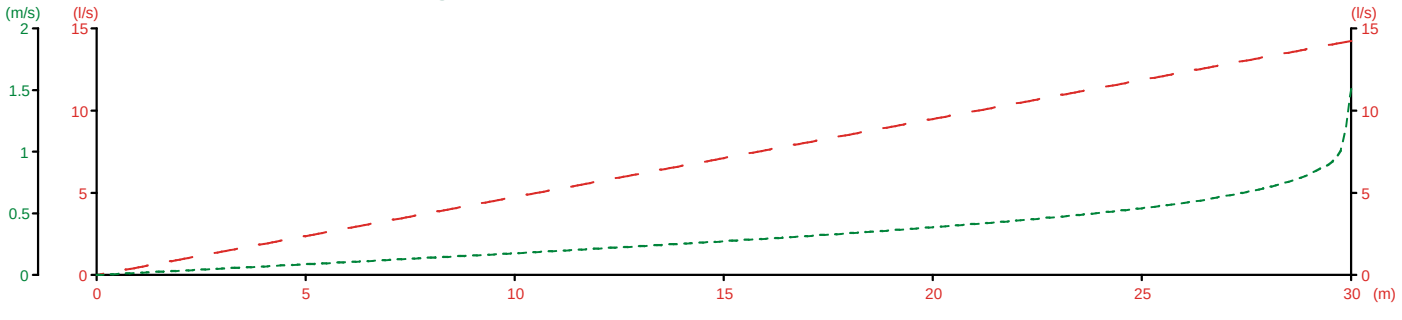
Outflow	[l/s]	: 14.25	
Flow Velocity	[m/s]	: 1.51	
Min. freeboard	[mm]	: -2.45, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.57	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



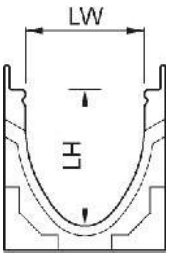
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V150@30m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V150 @2100 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 15.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 2100
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

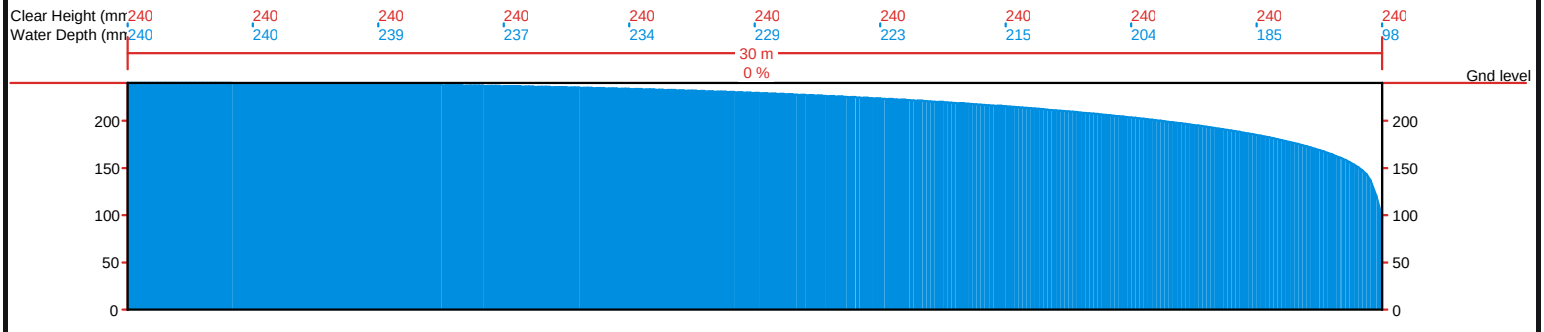
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	240									
Inner height end	[mm]	240									
Length	[m]	30.00									
Type of slope	[%]	0.000									

Results

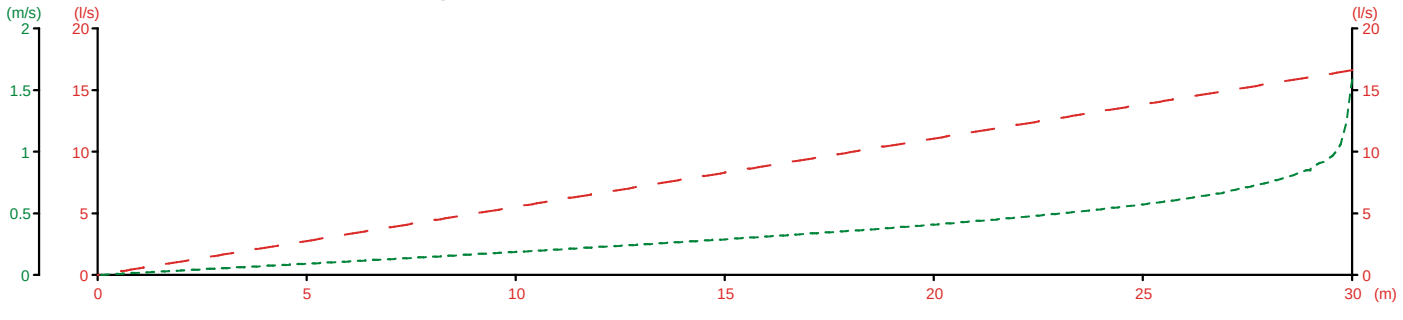
Outflow	[l/s]	: 16.63	
Flow Velocity	[m/s]	: 1.59	
Min. freeboard	[mm]	: 0.10, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.98	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



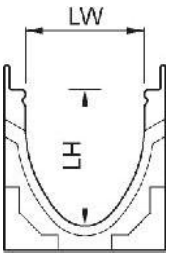
Hydraulic calculation for ACO DRAIN® channel systems

ACO DRAIN Design Services Department

Project data

Project : V150@30m Length
ACO Project.-No. :
Address :
Postal code / city : India

Input data



Naming of channel		: V150 @2460 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 20.0
Coefficient of roughness		: 95
Type of slope		: Constant depth
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 30.00
Catchment area	[m²]	: 2460
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 30.00

The summation of all (sectional) lengths results in the hydraulic length.

Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150									
Inner height beg.	[mm]	265									
Inner height end	[mm]	265									
Length	[m]	30.00									
Type of slope	[%]	0.000									

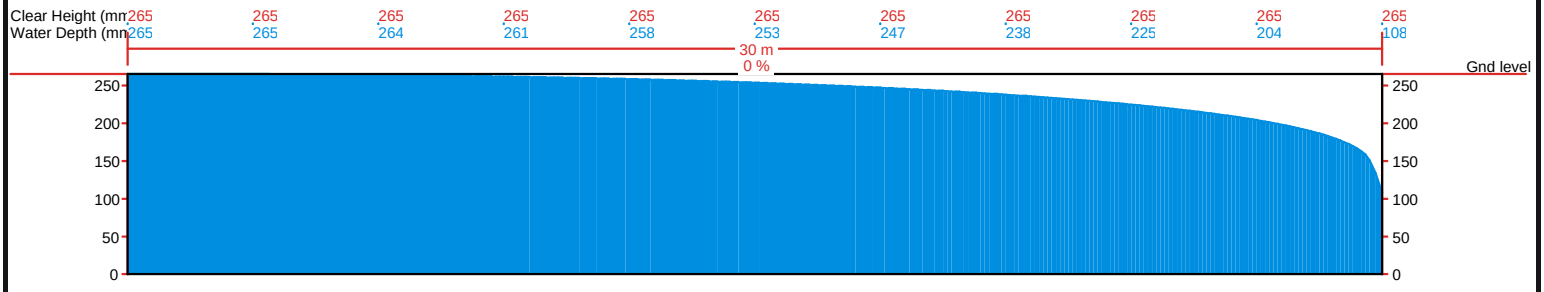
Max. possible hydraulic length 30.00 m

Results

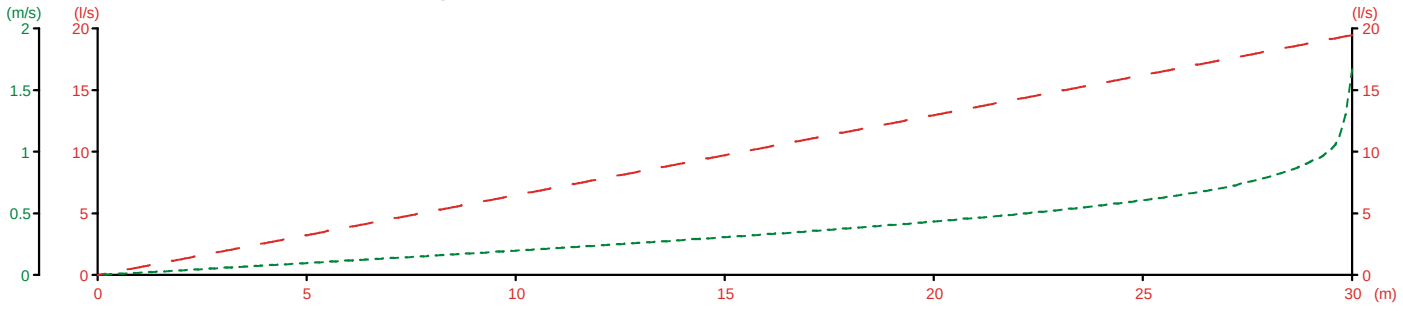
Outflow	[l/s]	: 19.48	
Flow Velocity	[m/s]	: 1.67	
Min. freeboard	[mm]	: -0.07, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 100.01	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

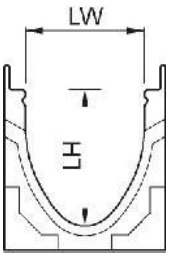
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V100@70m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V100 @525 Sq.m
Channel system		: ACO DRAIN Multiline V 100
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD110
Total length of channel	[m]	: 70.00
Catchment area	[m²]	: 525
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 70.00

The summation of all (sectional) lengths results in the hydraulic length.

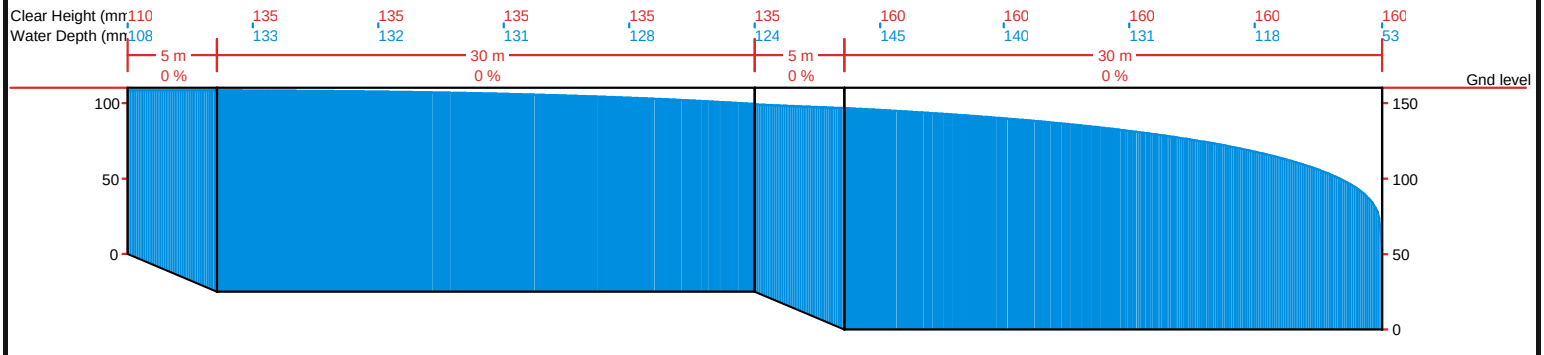
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	100	100	100	100						
Inner height beg.	[mm]	110	135	135	160						
Inner height end	[mm]	135	135	160	160						
Length	[m]	5.00	30.00	5.00	30.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

Results

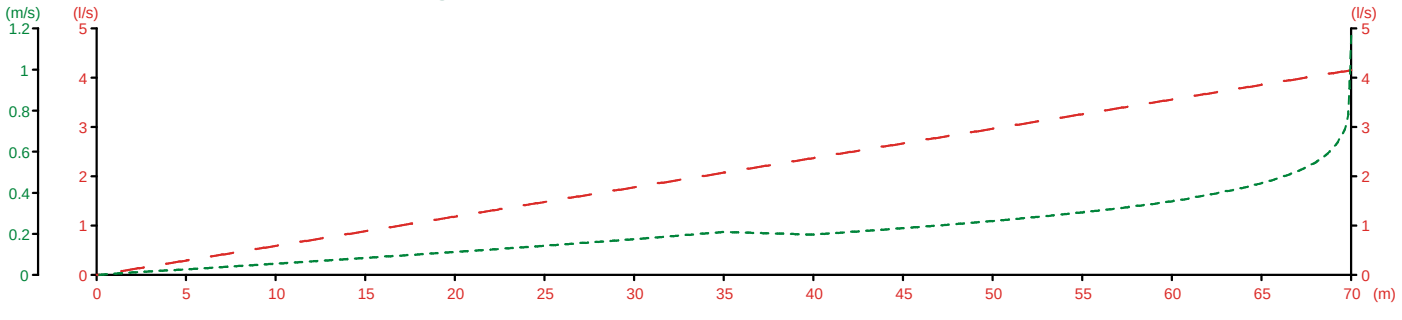
Outflow	[l/s]	: 4.16	
Flow Velocity	[m/s]	: 1.16	
Min. freeboard	[mm]	: 1.74, X = 0.10 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.32	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

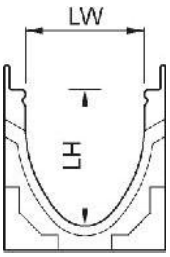
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V150@70m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V150 @1435 Sq.m
Channel system		: ACO DRAIN Multiline V 150
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD160
Total length of channel	[m]	: 70.00
Catchment area	[m²]	: 1435
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 70.00

The summation of all (sectional) lengths results in the hydraulic length.

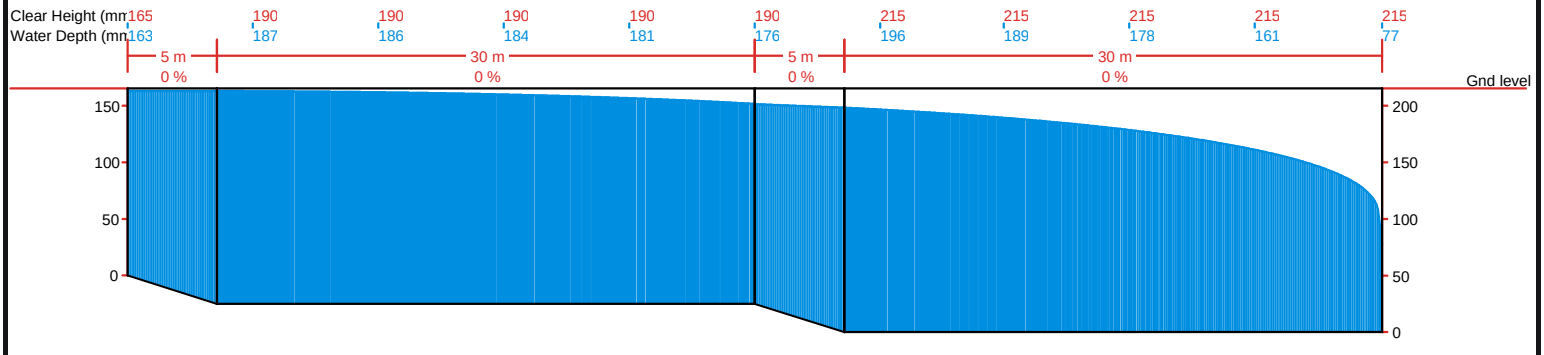
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	150	150	150	150						
Inner height beg.	[mm]	165	190	190	215						
Inner height end	[mm]	190	190	215	215						
Length	[m]	5.00	30.00	5.00	30.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

Results

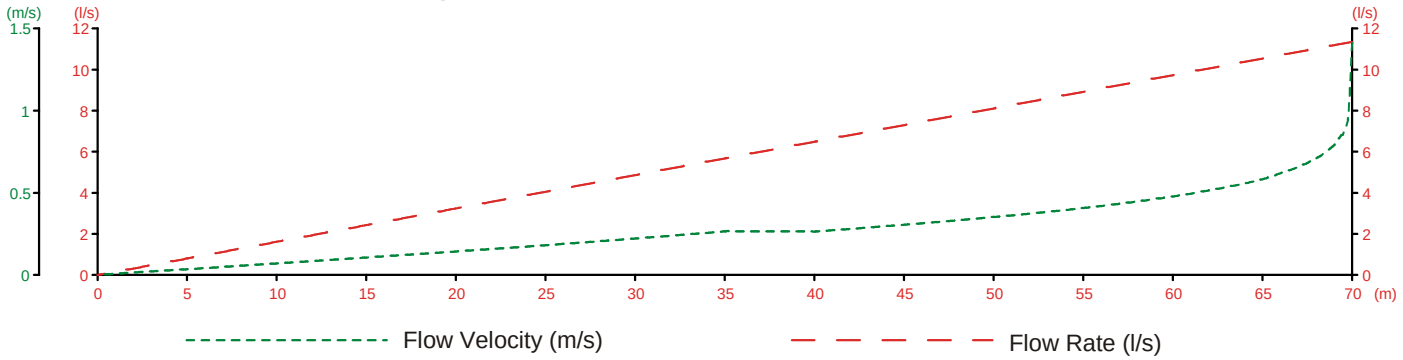
Outflow	[l/s]	: 11.36	
Flow Velocity	[m/s]	: 1.41	
Min. freeboard	[mm]	: 2.29, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.36	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

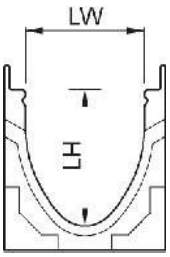
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V200@70m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V200 @2870 Sq.m
Channel system		: ACO DRAIN Multiline V 200
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD200
Total length of channel	[m]	: 70.00
Catchment area	[m²]	: 2870
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 70.00

The summation of all (sectional) lengths results in the hydraulic length.

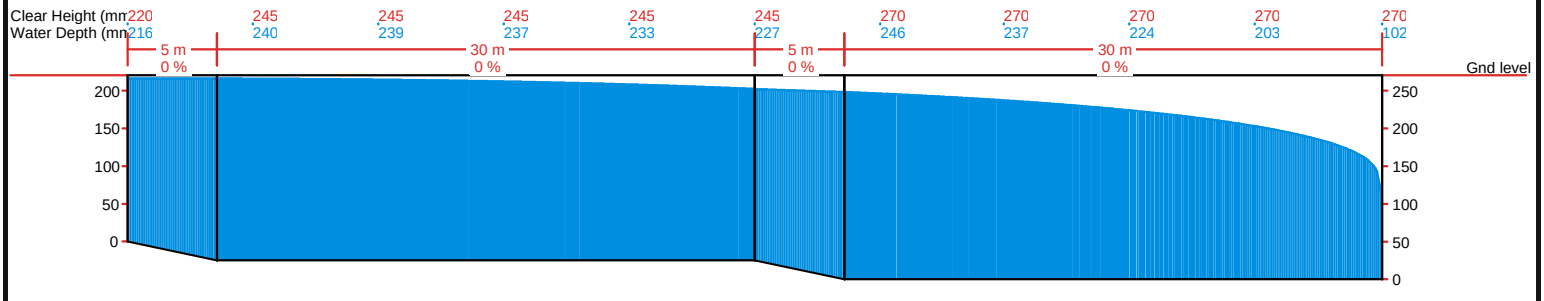
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	200	200	200	200						
Inner height beg.	[mm]	220	245	245	270						
Inner height end	[mm]	245	245	270	270						
Length	[m]	5.00	30.00	5.00	30.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

Results

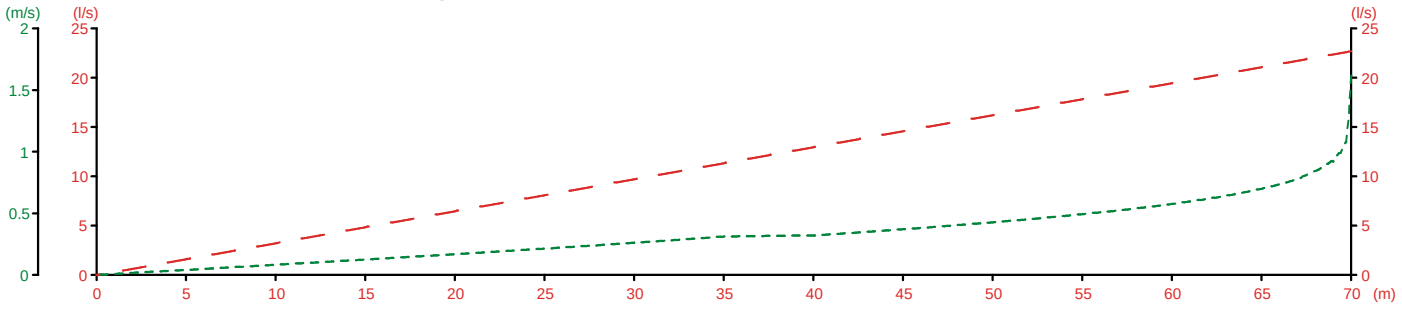
Outflow	[l/s]	: 22.72	
Flow Velocity	[m/s]	: 1.62	
Min. freeboard	[mm]	: 4.33, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.07	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



Hydraulic calculation for ACO DRAIN® channel systems

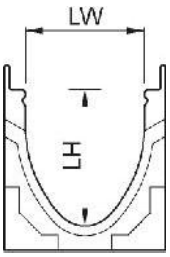
ACO DRAIN Design Services Department

Project data

Date: 29-04-2016

Project	: V300@70m Length
ACO Project.-No.	:
Address	:
Postal code / city	: India

Input data



Naming of channel		: V300 @8050 Sq.m
Channel system		: ACO DRAIN Multiline V 300
Type of channel		: 0.0
Coefficient of roughness		: 95
Type of slope		: Sloping
Type of outlet		: vertical DN/OD200
Total length of channel	[m]	: 70.00
Catchment area	[m²]	: 8050
Impermeability factor	[C_m]	: 0.95

Hydraulic length [m] : 70.00

The summation of all (sectional) lengths results in the hydraulic length.

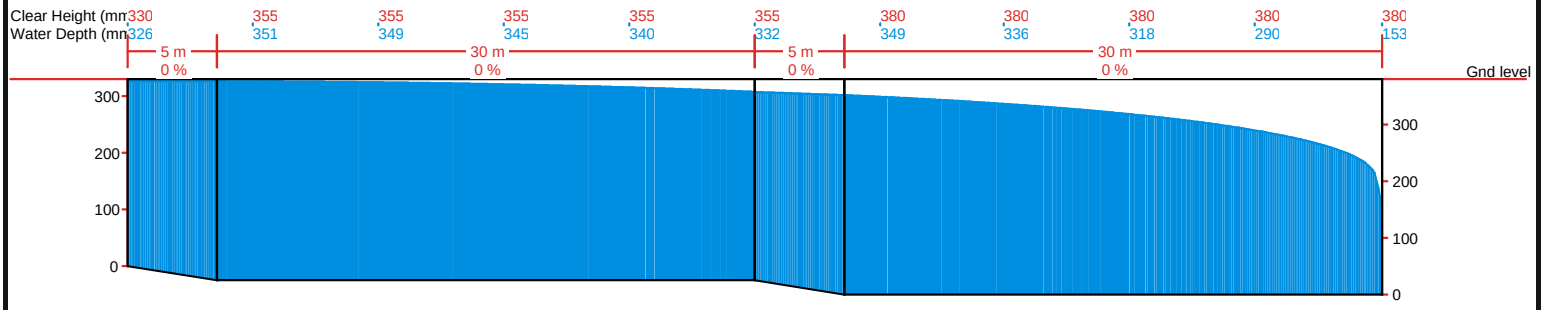
Part		1	2	3	4	5	6	7	8	9	10
Bore width	[mm]	300	300	300	300						
Inner height beg.	[mm]	330	355	355	380						
Inner height end	[mm]	355	355	380	380						
Length	[m]	5.00	30.00	5.00	30.00						
Type of slope	[%]	0.000	0.000	0.000	0.000						

Results

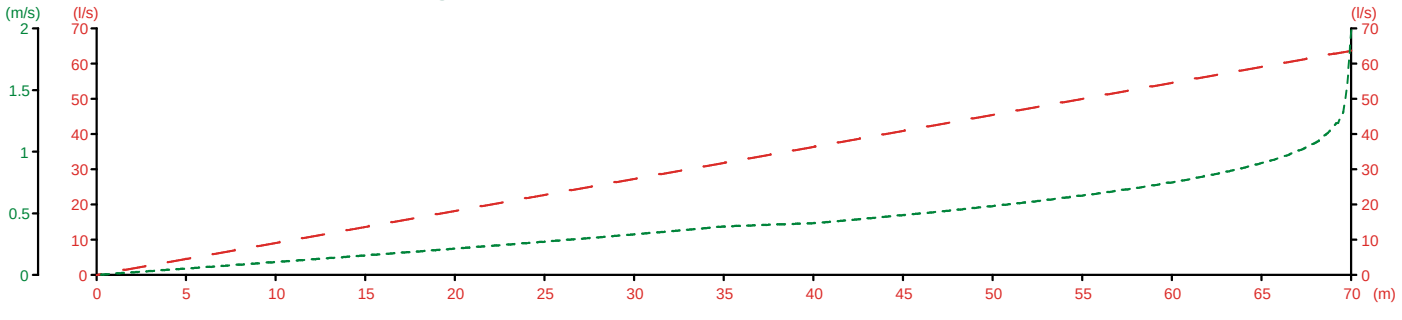
Outflow	[l/s]	: 63.73	
Flow Velocity	[m/s]	: 1.99	
Min. freeboard	[mm]	: 3.58, X = 0.00 m	(between max. water level and bottom edge of grating)
Channel capacity	[%]	: 99.46	

Level of Liquid

All Heights in mm



Flow Velocity and Flow Rate



INPUT DETAILS TO FIND THE HYDRAULIC DESIGN FOR DRAIN CHANNELS

The important details which should get it from the client/consultant to make the design of drain channels are as follows,

- Length
- Width
- Available Depth For Drain
- Type Of Surface
- Intensity Of Rain Fall
- Load Class
- Type Of Outlet
- Outlet Locations

OUTPUT FACTORS FROM THE HYDRAULIC DESIGN FOR DRAIN CHANNELS:

The output details of the hydraulic design for the drain channels which can be shared to the client/consultant is as follows,

- Discharge
- Velocity
- Channel Capacity
- Freeboard