

Analysis and Design of a sewer network and storm water collection network for Deir Al Ghuson Village

Prepared by:
Fotoon Ghanem
Yasmeen Rawajbeh

Supervisor: Dr. Mohammad N. Al-Masri

OUTLINE:

- Introduction
- Objectives
- Study area
- Sewer system
- storm water collection network
- Conclusions and recommendations



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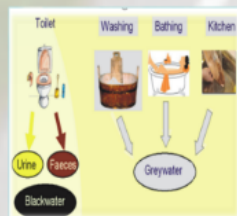
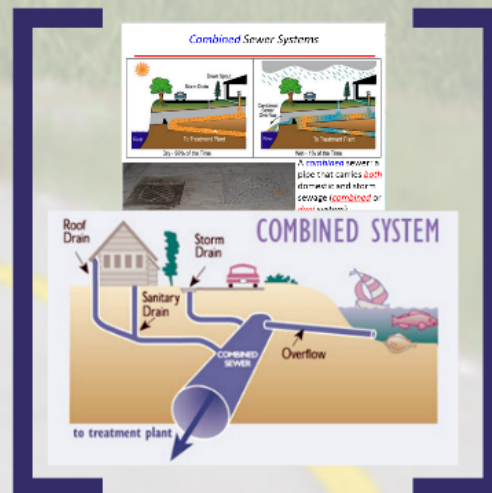
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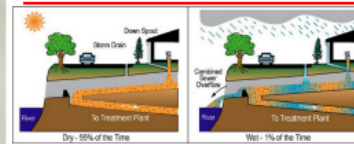
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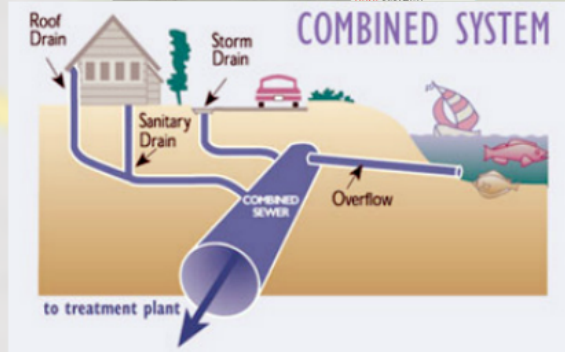
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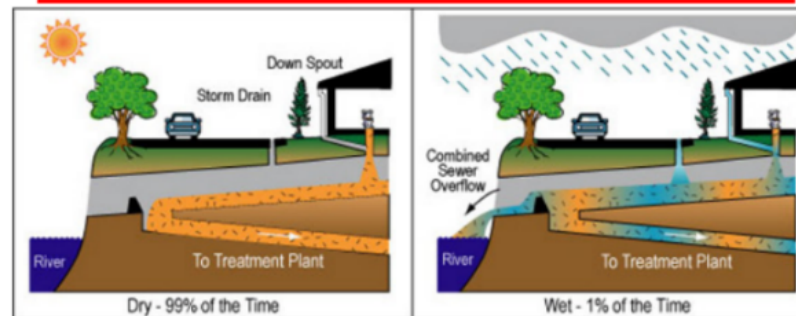
Combined Sewer Systems



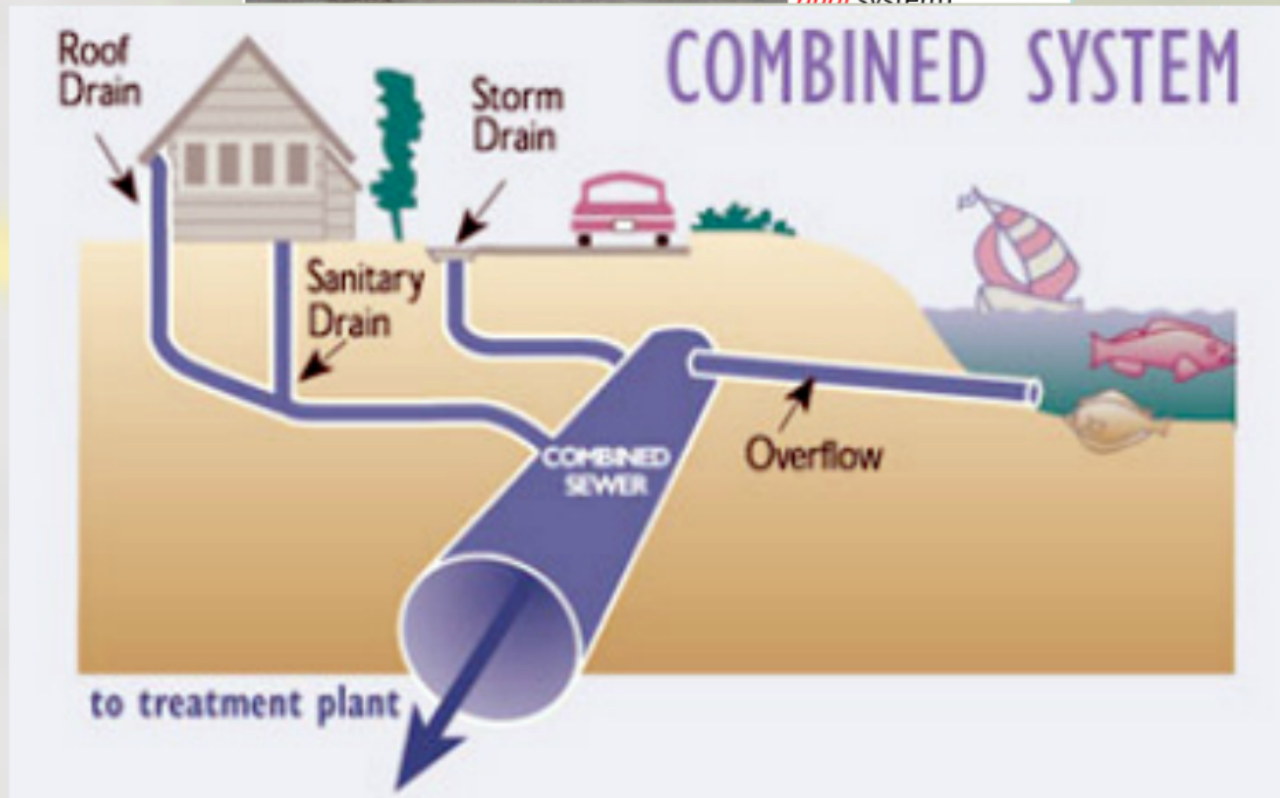
A **combined** sewer: a pipe that carries **both** domestic and storm sewage (**combined** or **dual** system).



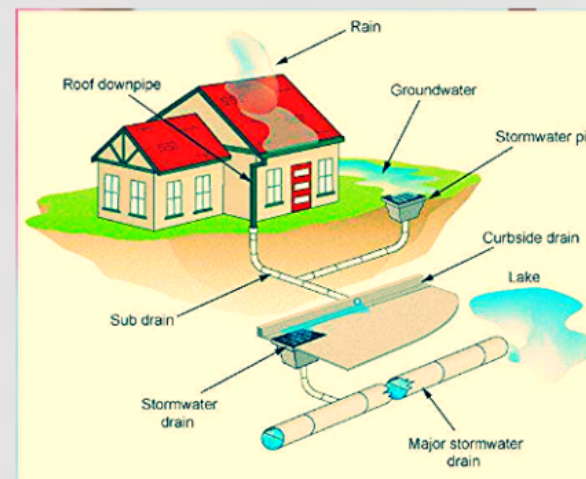
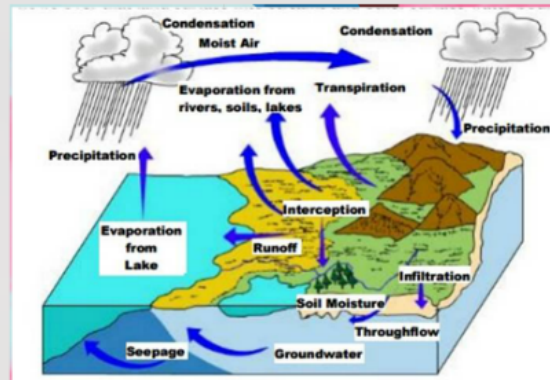
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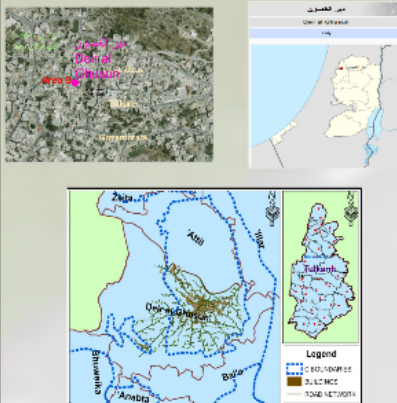
OBJECTIVES:

- To design a waste water collection network
- To design a storm water collection network

THE STUDY AREA



Location of Deir Al Ghuson



Population

Year	Population
1997	5020
2007	8168
2009	11000
2017	12500

Climate

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Avg. temp. (°C)	16	17	20	23	27	30	33	32	29	26	22	20
Avg. rainfall (mm)	48.6	21.8	27.6	7.9	2.8	0	0	0	10.5	36.9	40.1	
Avg. Humidity (%)	61	57	67	63	61	68	67	66	65	56	57	50

Water resources

Springs "wells"	% of supply
Municipality well	80%
Dair-Bala'a well	10%
Farm land well	10%

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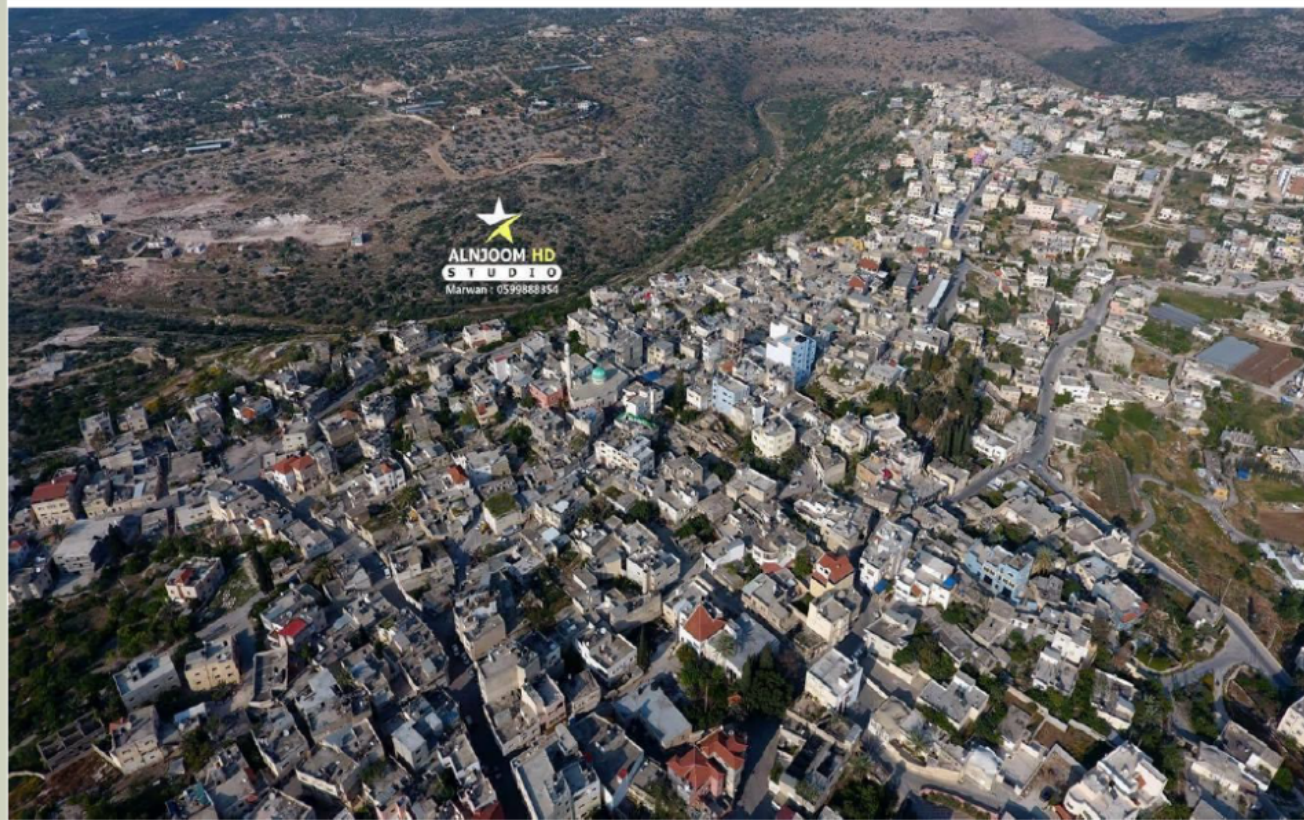
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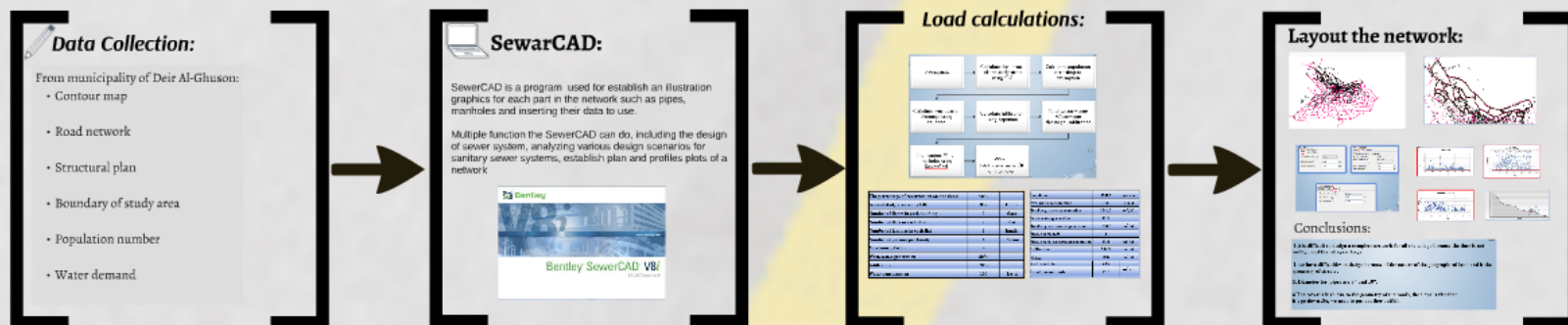
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Design of sewer network



Design of sewer network

Data Collection:

From municipality of Deir Al-Ghuson:

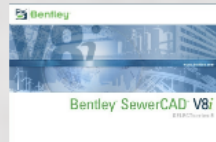
- Contour map
- Road network
- Structural plan
- Boundary of study area
- Population number
- Water demand



SewarCAD:

SewerCAD is a program used for establish an illustration graphics for each part in the network such as pipes, manholes and inserting their data to use.

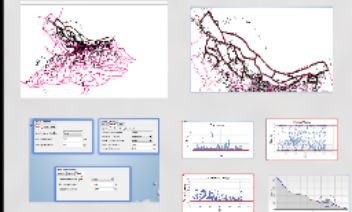
Multiple function the SewerCAD can do, including the design of sewer system, analyzing various design scenarios for sanitary sewer systems, establish plan and profiles plots of a network



Load calculations:

[illegible]

Layout the network:



Conclusions:

[illegible]



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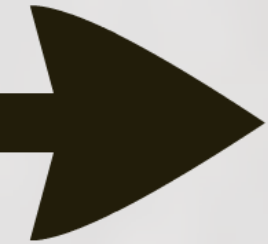
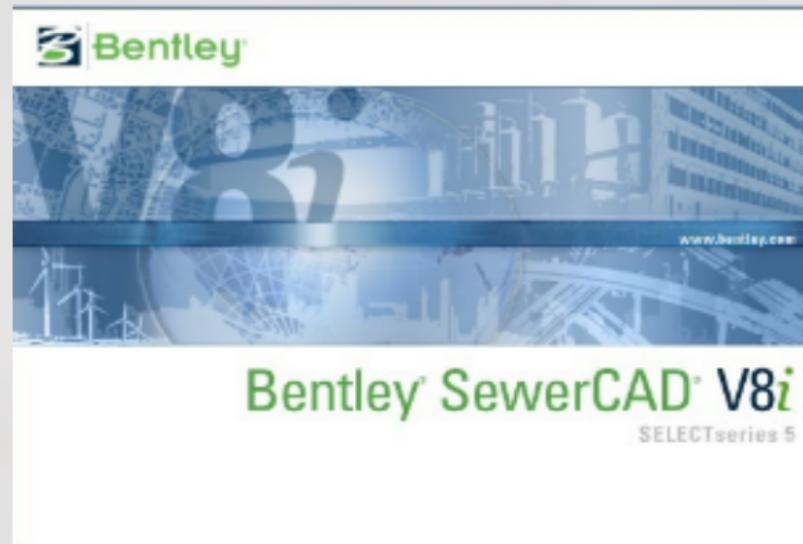




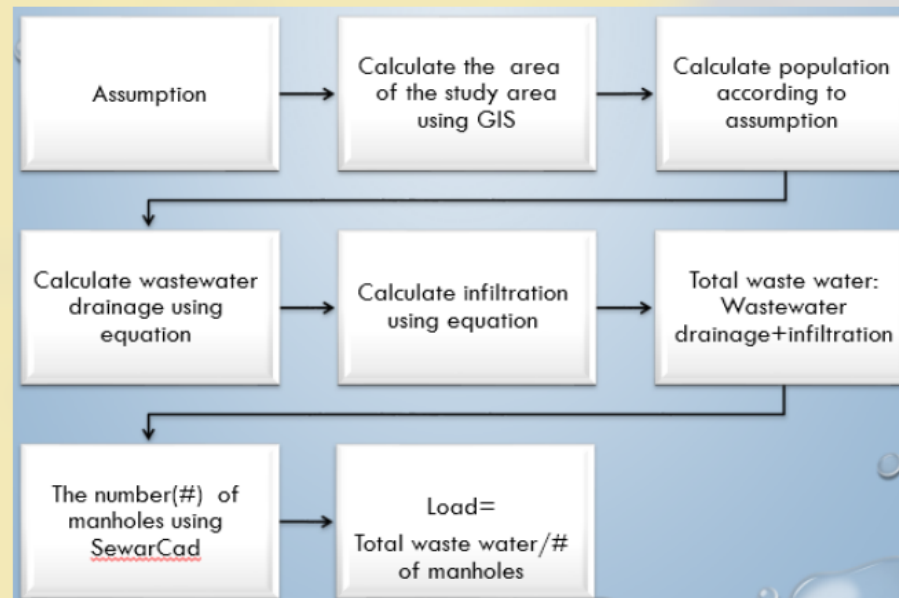
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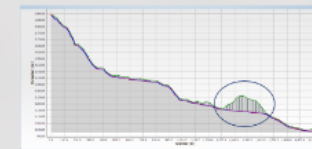
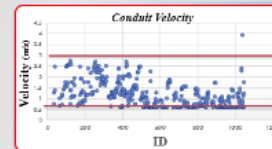
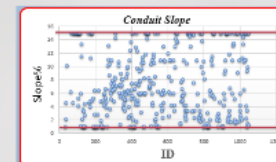
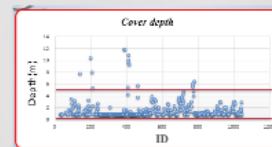
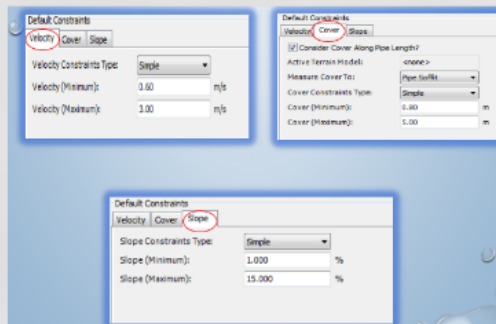
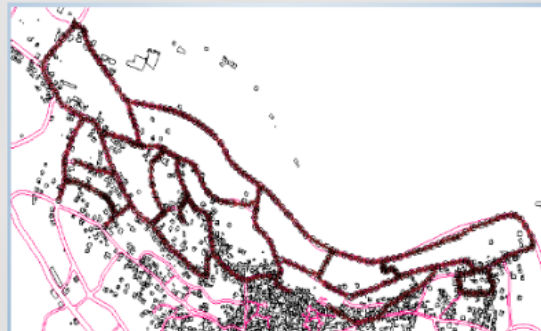
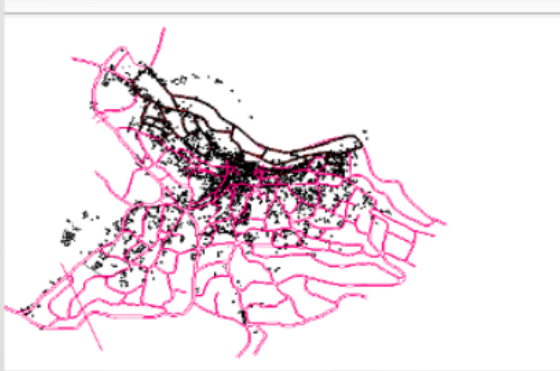
Load calculations:



The percentage of construction on one dunm	50%	
Area of study area using GIS	857	Dunm
Number of floors in each building	3	floor
Number of flats in each floor	2	flat
Number of families in each flat	1	family
Number of persons per family	6	Person
Max hourly factor	4	
Wastewater generation	80%	
Infiltration	20%	
Water consumption	100	L/c-d

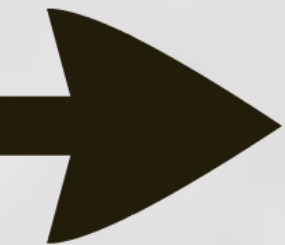
Population	15462	person
Avg. water consumption	100	L/c-d
Total avg. water consumption	1546.2	m ³ /d
Wastewater generation	80%	
Total avg. wastewater generation	1234.5	m ³ /d
Max. hourly rate	4	
Max. hourly wastewater generation	4938	m ³ /d
Infiltration	246.9	m ³ /d
<i>Q_{desin}</i>	5184	m ³ /d
# of manhole	415	
Load per manhole	12.5	m ³ /d

Layout the network:



Conclusions:

1. It is difficult to design a complete network for all the village because the time is not enough and the village is large.
2. we have difficulties in design because of the nature of the geographical land and its geometry of streets.
3. Diameter for pipes are 8" and 10".
4. The cover is high due to the geometry of the roads, the slope is rise then it's go down. So, we need to put another outfall.

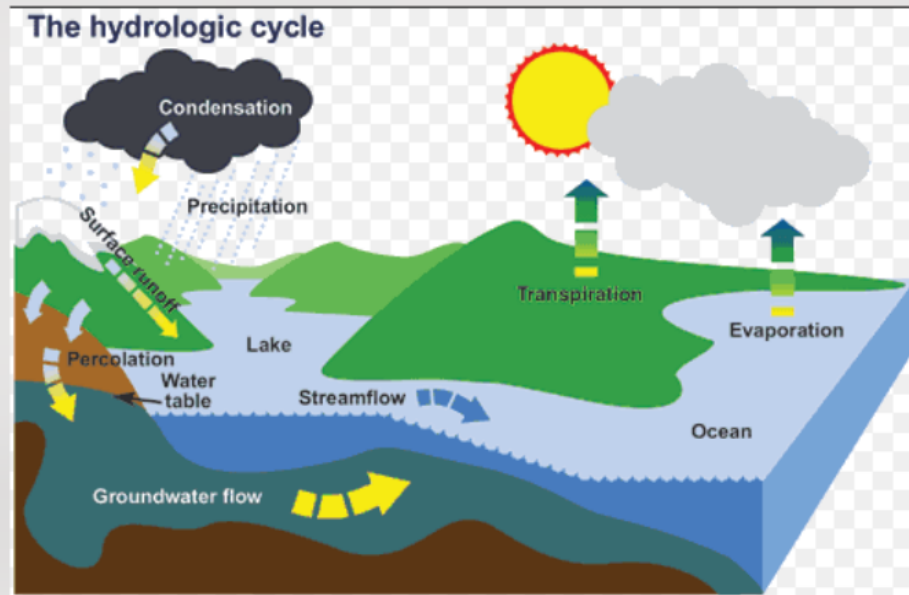


Design of storm water collection network

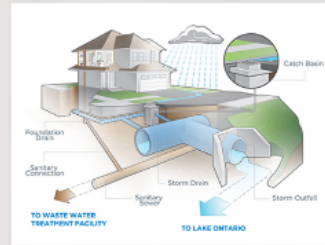


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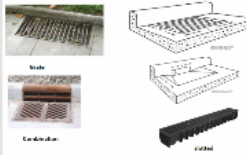
Component of storm water network:



Catch basin(Inlet)

- Inlets are structures that convey storm water from the surface into a drainage system.

Inlet type



Catchment

- Associated with each catch basin there is catchment over which rainfall becomes storm water.



- The principle that used in calculation is Rational method which depends on :
Area, runoff, time of concentration

$$Q = CIA$$



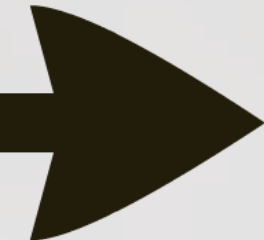
Conduits

- Diameter
- Length
- Slope
- Shape
- Material
- Number of pipes

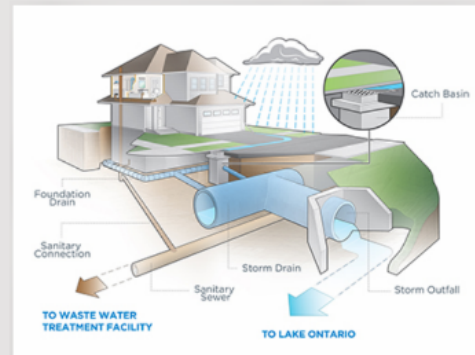


Outfalls

- Outfalls are locations where the storm water exists the collection network



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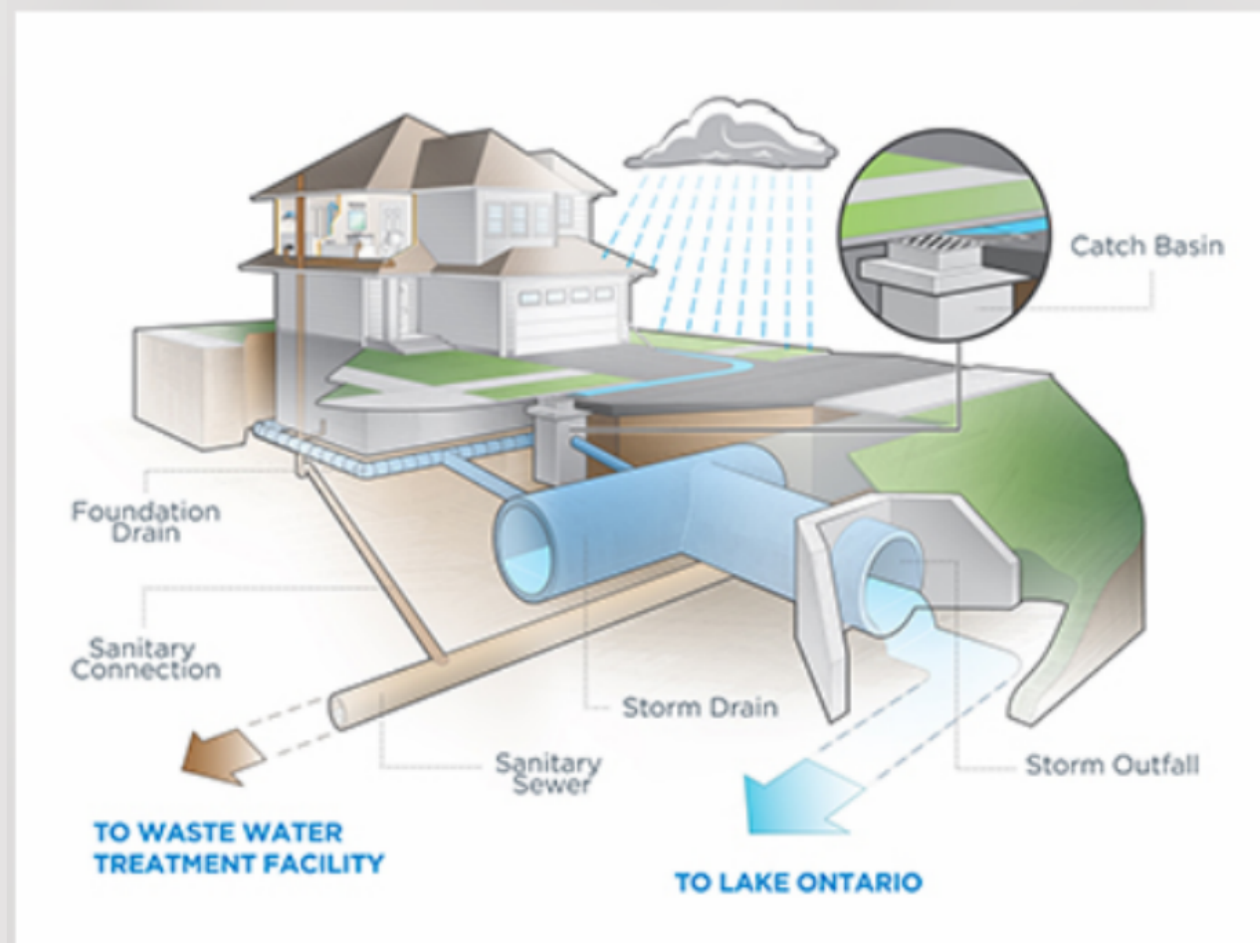


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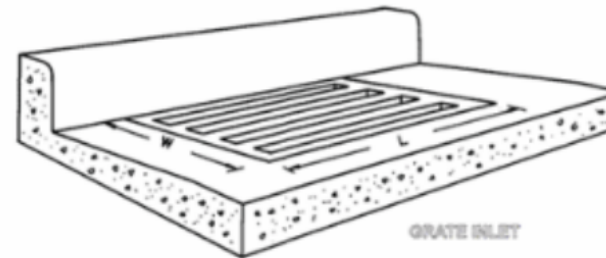
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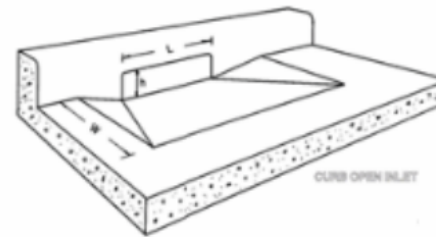
Grate



Combination



GRATE INLET



CURB OPEN INLET

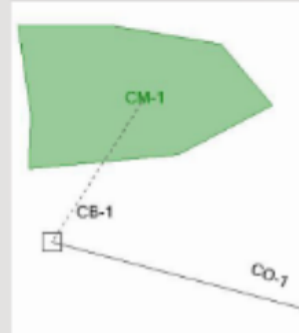


slotted

- Associated catchment water.

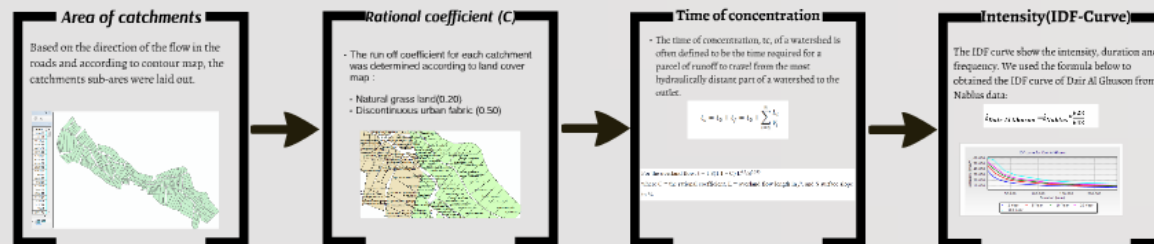
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Area of catchments

Based on the direction of the flow in the roads and according to contour map, the catchments sub-ares were laid out.



Rational coefficient (C)

- The run off coefficient for each catchment was determined according to land cover map :
- Natural grass land(0.20)
- Discontinuous urban fabric (0.50)



Time of concentration

- The time of concentration, t_c , of a watershed is often defined to be the time required for a parcel of runoff to travel from the most hydraulically distant part of a watershed to the outlet.

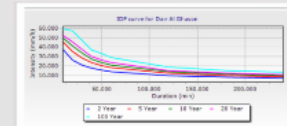
$$t_c = t_0 + t_f = t_0 + \sum_{i=1}^n \frac{L_i}{V_i}$$

For the overland flow: $t = 1.8(1.1 - C) L^{0.5} S^{-0.333}$
where C = the rational coefficient, L = overland flow length in ft, and S surface slope in %

Intensity(IDF-Curve)

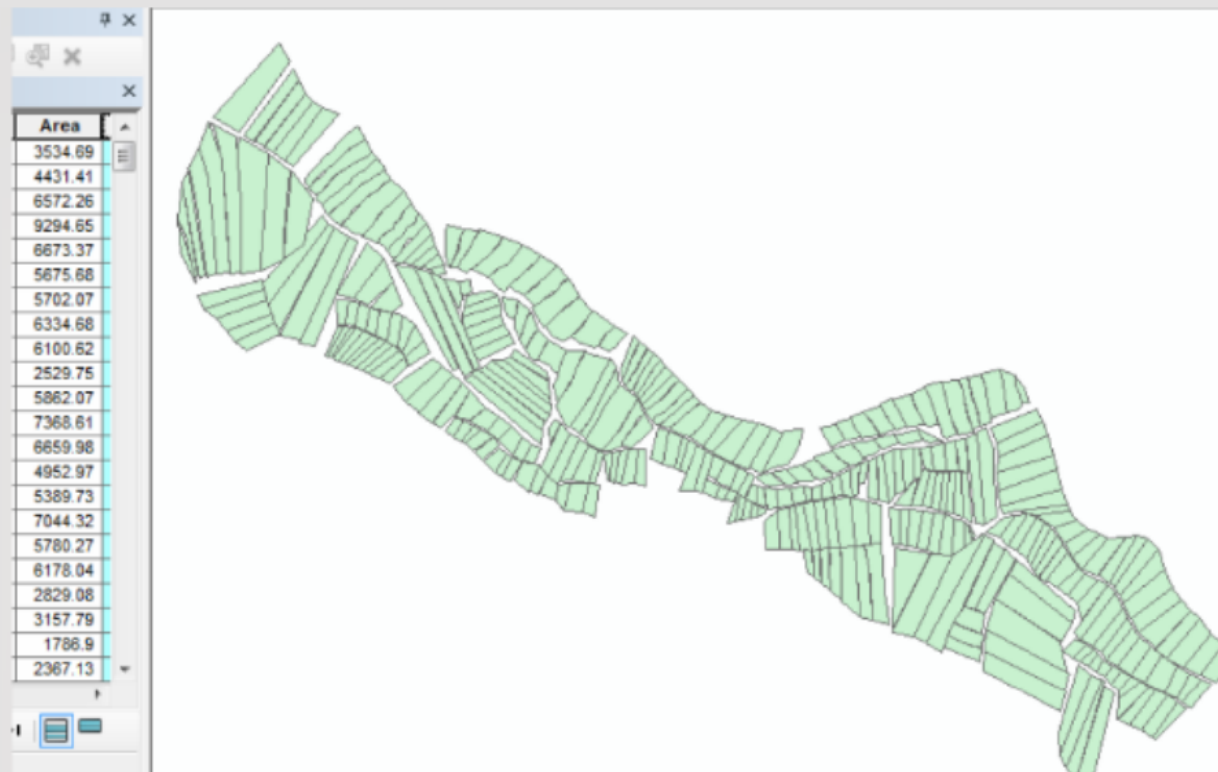
The IDF curve show the intensity, duration and frequency. We used the formula below to obtained the IDF curve of Dair Al Ghuson from Nablus data:

$$I_{Dair\ Al\ Ghuson} = I_{Nablus} \cdot \frac{623}{643}$$



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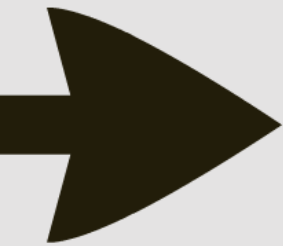
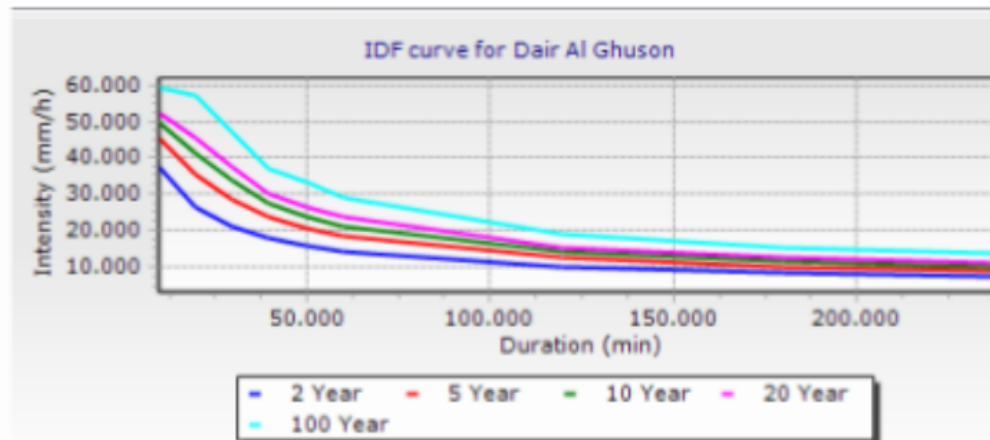
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Conduits

- Diameter
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- Slope
- Shape
- Material
- Number of pipes



Outfalls

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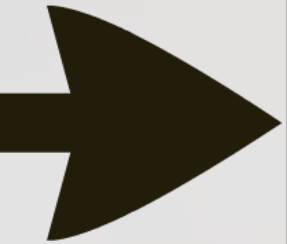


By using "model builder" tool, the catchments with its properties were brought to StormCAD program. Then the proposed pipes and catchments were located beside the road.



Conclusions and recommendations:

- The design of network is not completed, it is difficult and requires a great field effort Which includes visit to the village in order to do the design since the maps we used are not sufficient.
- The design requires more time since the topography of study area is difficult.
- We can work with the municipality in order to complete the design with less cost and good efficiency.







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