ODTÜ KIBRIS'LA BİLİM EĞLENCELİDİR.

Stormwater Detention for Urban Water Management

Selin Altunbasak, Serhat Oguz Dongel, Abdulaziz El Yaman
Amin Ibrahim Hassan, Mohammed Mhanna

Supervisor: Asst. Prof. Dr. Hasan Zaifoglu

Introduction and Statement of the Problem

Sustainable water management in the urban centers is crucial in collecting the excess water and using it for other purposes. Surface runoff causes water erosion, pollution and urban flooding which can cause property damage . In order to prevent this a stormwater drainage network which discharges water in a detention basin can be constructed having in mind the economic cost and sustainability of the process.

Examples of urban runoff ,stormwater detention basin and the drainage network

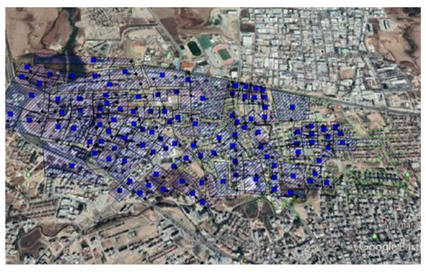
Stormwater Detention Basin

Drainage Network

Urban Runoff causing flooding

Processes involved in design

SWMM software and Google Earth pro were the main softwares used in the design process. Properties of the study area include conduits, subcatchments and junctions.



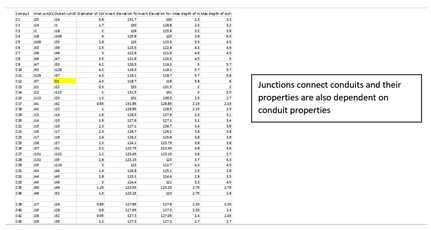
115 sub catchments in total drawn using SWMM software and Google Earth. Each sub catchment has an outlet which is a junction

Figure XX: SWMM model sub-catchments

Property	Value
Name	37
X-Coordinate	-2898.964
Y-Coordinate	5655.440
Description	
Tag	
Rain Gage	R1
Outlet	J39
Area	2.66
Width	115.32
% Slope	1.71
% Imperv	90
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.1
Dstore-Perv	0.2
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration Data	CURVE_NUMBER

Sub catchment properties in SWMM model

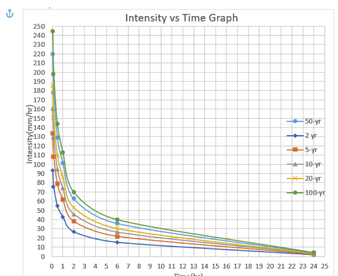
Subcatchments	Area (m^2)	Area (ha)	Width (m)	Slope (%)	Impervious %	Impervious area(ha)	Pervious area(ha)	Curve Numbe
S30	2000	0,2	39,21	3,11	80	0,16	0,04	94,4
S31	2400	0,24	68,25	1,53	80	0,192	0,048	94,4
S32	16200	1,62	74,27	1,73	80	1,296	0,324	94,4
S33	10100	1,01	47,72	0,89	80	0,808	0,202	94,4
S34	13400	1,34	51,79	0,57	85	1,139	0,201	95,3
S35	11900	1,19	56,27	0,89	85	1,0115	0,1785	95,3
S36	50800	5,08	119,42	1,03	85	4,318	0,762	95,3
S37	26600	2,66	115,32	1,71	90	2,394	0,266	96,2
S38	31500	3,15	107,05	0,76	90	2,835	0,315	96,2
S39	13800	1,38	59,17	1,06	85	1,173	0,207	95,3
S40	13700	1,37	59,73	1,06	85	1,1645	0,2055	95,3
S41	22300	2,23	60,52	2,21	90	2,007	0,223	96,2
S42	13900	1,39	83,44	1,1	90	1,251	0,139	96,2
S44	29300	2,93	106,24	1,81	90	2,637	0,293	96,2
S45	8700	0,87	44,48	1,37	90	0,783	0,087	96,2
S46	12900	1,29	30,43	0,54	90	1,161	0,129	96,2
S47	6300	0,63	57,63	1,39	90	0,567	0,063	96,2
S48	3000	0,3	25,36	1,42	90	0,27	0,03	96,2
S49	11000	1,1	64,01	1,01	90	0,99	0,11	96,2
S50	10200	1,02	56,36	1,02	90	0,918	0,102	96,2
S51	6100	0,61	58,92	1,62	90	0,549	0,061	96,2
S52	5500	0,55	34,3	1,68	90	0,495	0,055	96,2
S53	7100	0,71	48,03	2,46	90	0,639	0,071	96,2
S54	13300	1,33	73,02	1,14	90	1,197	0,133	96,2
S55	8600	0,86	51,19	1,54	90	0,774	0,086	96,2
S57	13500	1,35	64,71	1,36	90	1,215	0,135	96,2
S58	14500	1,45	60,23	0,84	90	1,305	0,145	96,2
S59	32100	3,21	98,79	1,51	90	2,889	0,321	96,2
S60	19800	1,98	76,24	1,57	90	1,782	0,198	96,2
S61	12500	1,25	42,9	1,01	90	1,125	0,125	96,2
S62	6900	0,69	36,4	1,04	90	0,621	0,069	96,2
S63	10300	1,03	58,3	1,5	85	0,8755	0,1545	95,3
S64	8700	0,87	57,83	1,63	90	0,783	0,087	96,2
S65	10400	1,04	44,62	1,65	85	0,884	0,156	95,3
S66	10000	1	54,23	1,56	85	0,85	0,15	95,3
S67	10900	1,09	60,3	1,48	90	0,981	0,109	96,2
S68	7600	0,76	39,62	2,02	90	0,684	0,076	96,2
S69	3900	0,39	27,8	0,1	90	0,351	0,039	96,2
S70	5600	0,56	31,77	1,9	90	0,504	0,056	96,2



Junctions connect conduits and their properties are also dependent on conduit properties

Conduits	Length
C1	82.2
C2	65.4
C3	79.4
C4	111.4
C5	97.1
C6	66.9
C7	67.9
C8	146.2
C9	137.0
C10	100.6
C11	81.7
C12	100.3
C13	141.6
C14	132.3
C15	205.8
C17	128.6
C18	216.2
C19	76.0
C20	189.2
C21	122.8
C22	125.0
C23	212.0

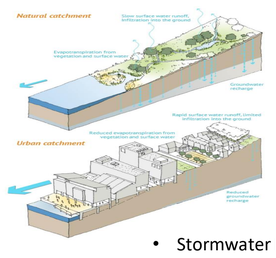
Conduits are pipes that connect junctions. It has an inlet and outlet. The pipes should not have a full flow and its max and min velocity should be according to the limitation



Intensity time graph is used to calculate the hyetograph for the rain gauge of the sub catchment according to the return period of 20 yrs

Sustainability and cost

Sustainable urban drainage system is used to deal with surface runoff locally through collection , storage and cleaning. Green roof , water harvesting systems and infiltration basins are among uses of urban drainage systems. Cost estimation determines project risk and to determine whether the benefits balance the expected cost.



Per Unit	Cost (TL /Day)	No. of Unit/day	Total Cost (TL)
Labor	150	50	150000
Excavator	500	2	20000
Crane	250	3	15000
Truck	1000	3	60000

Cost of Pipe (Per 1 m Length) (in Turkish Lira)		
For 1.2m Diameter	=	366.6
For 1 m Diameter	=	116,34
For 0.8 m Diameter	=	65
For 0.6m Diameter	=	50

BETON SINIFI	MİKSERLİ BETON DÖKÜMÜ
C 16	194,00 + KDV =228,92 TL
C 20	197,00 + KDV =232,46 TL
C 25	207,00 + KDV =244,26TL
C 30	217,00 + KDV =256,06 TL
C 35	226,00 + KDV =266,68 TL
C 40	237,00 + KDV =279,66 TL
C 45	249,00 + KDV =293,82 TL
C 50	260,00 + KDV =306,80 TL

Application in real life

- Stormwater Detention Basin: https://www.youtube.com/watch?v=wdcXmerZWDc&ab_channel=PracticalEngineering
- Sustainable Urban Drainage System: https://www.youtube.com/watch?v=SZ5qVD7brPE&ab_channel=Marshalls

ODTÜ Kuzey Kıbrıs Kampusu