ODTÜ KIBRIS'LA BİLİM EĞLENCELİDİR.

Three Ponds of Dikmen: Is It Possible to avoid flooding of Dikmen Village ?

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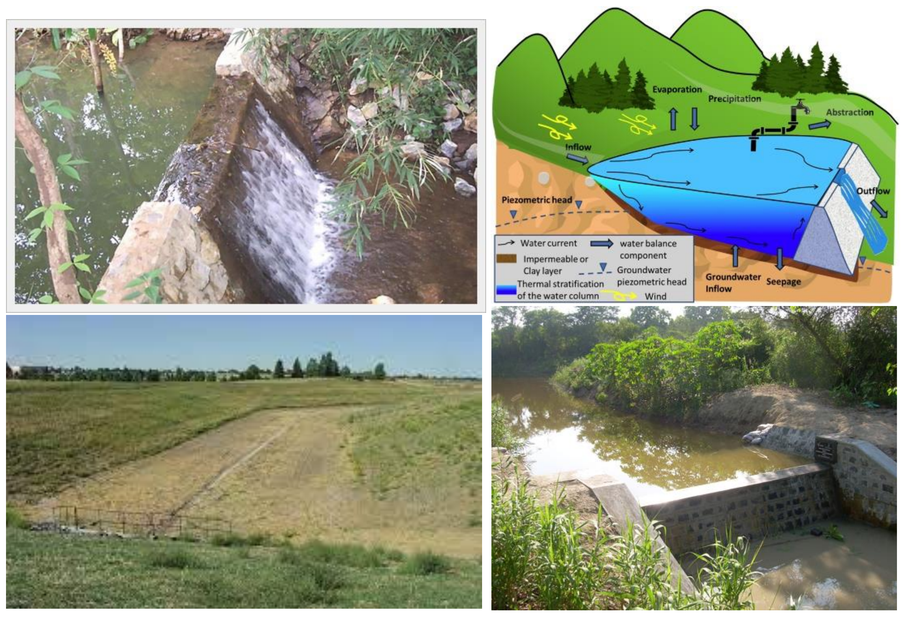
Introduction and Statement of the Problem

Dikmen Town in Lefkoşa is exposed to flood events frequently caused by heavy rainfall and topographic structure of its location. Town of Dikmen is built on streams that water flows down from the mountain that most of rainfall accumulate in residential area of the Town. In order to prevent that, we are given a Project to design Detention Ponds in the area to reduce the rainfall run-off discharge in Dikmen streams. We are given a task to use various software programs to design detention ponds to prevent flooding of the area.



Demonstrative Detention Ponds

Problems to consider initially are

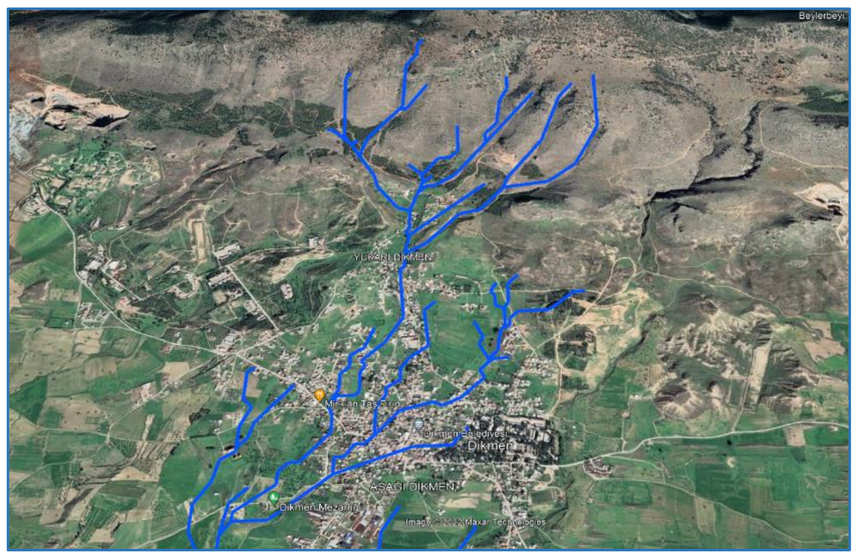
- Residential area boundaries
- Steepness/Flatness of the terrain
- Location of the Pond and its potential of storing water
- Economical approach for the design

What is a Detention Pond ?

A detention pond is an artificial pond designed to store excess amount of water that is caused by rainfall or snow melting etc. Detention ponds can have various features according to the problem that it is facing such as spillway, bottom outlet (orifice) or not feature at all.

What can we do to prevent flooding ?

We can build 3 detention Ponds at the skirts of the mountain which is out of the residential area of Dikmen. Our main objective is to reduce the discharge of main Dikmen stream from 26 cms (cubic-meter/seconds) to safer levels to prevent flooding of the Town. Therefore, we have decided to build 3 different ponds located in 3 different main streams of Dikmen sub-basins. Determined location of ponds is empty lands with vegetations and forests which will slow down the accumulation of water stored in ponds.



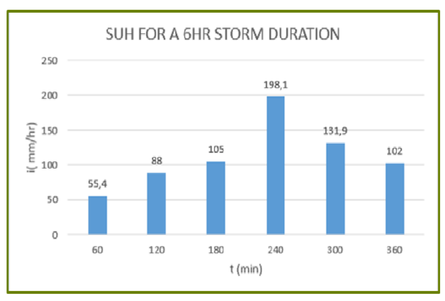
Streamlines flowing through Dikmen

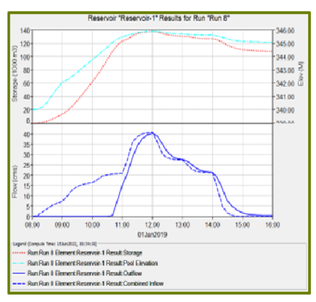
Design of Pond and its Features

Ponds in this projects only have spillway as feature. So that ponds can discharge the excess water just before the flooding the capacity. Spillways of ponds in this project are designed to have 1m head for pond 1 and pond 2, 0.5m for pond 3. Then necessary storage vs outflow calculations are made, then we have transferred found calculations to HEC-HMS to for reservoir routing.

Pond 1	Co = 2,18	22m
Elevation (m)	Storage (10^3 m3)	Outflow Discharge (m3/s)
340	0	0.00
341	4.95	0.00
342	11.61	0.00
343	38.6	0.00
344	68.57	0.00
345	105.8	0.00
345.1	109.34	1.52
345.2	112.88	4.29
345.3	116.42	7.88
345.4	119.96	12.13
345.5	123.5	16.96
345.6	127.04	22.29
345.7	130.58	28.09
345.8	134.12	34.32
345.9	137.66	40.95
346	141.2	47.96

From Unit Hydrograph to Reservoir Routing



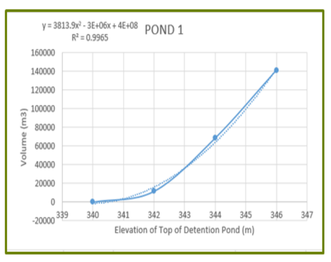


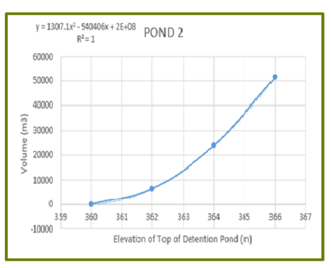
We have combined our Unit hydrograph and calculated pond storage vs outflow data at HEC-HMS. Then we have processed reservoir routing on each pond to analyse stored water. As conclusion, we have obtained better results than we have expected. Designed ponds are found to be successfully effective for storing rainfall water during the most extreme storm event.

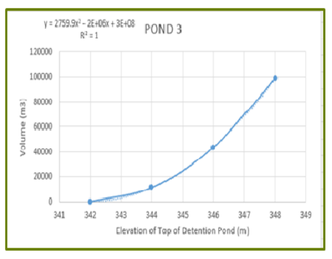
Storing the Water in Ponds

Area and Volume of storage catchment of each Pond is found and calculated using Arc-GIS software. A graph of Volume (m3) vs Elevation (m) is extracted using MS Excel with obtained data for each Pond. Then equations of those graph curves are used for Storage vs Discharge calculations.

	Elevation of top of Pond (m)	Area Sq*km	Height of Pond	Volume (m^3)
POND 1	340	0	0	0
	342	0.005805	2	11610
	344	0.017143	4	68572
	346	0.023534	6	141204
POND 2	360	0	0	0
	362	0.00327	2	6540
	364	0.005969	4	23876
	366	0.008555	6	51330
POND 3	342	0	0	0
	344	0.005568	2	11136
	346	0.010877	4	43508
	348	0.016467	6	98802







The reason that elevation difference between each step is the 2m contour line difference in Arc-GIS. And the reason of the max elevation of detention ponds is that a detention pond should not be higher than 6 meters, otherwise it will be classified as a "dam".

For more detailed information about Detention Ponds, check https://www.youtube.com/watch?v=oXSCde0RJN4&ab_channel=IsaacWait