SEWERAGE BOARD LIMASSOL-AMATHUS

SUSTAINABLE URBAN DRAINAGE SYSTEMS – SuDS

Michalis Vrionides Civil Engineer
SBLA

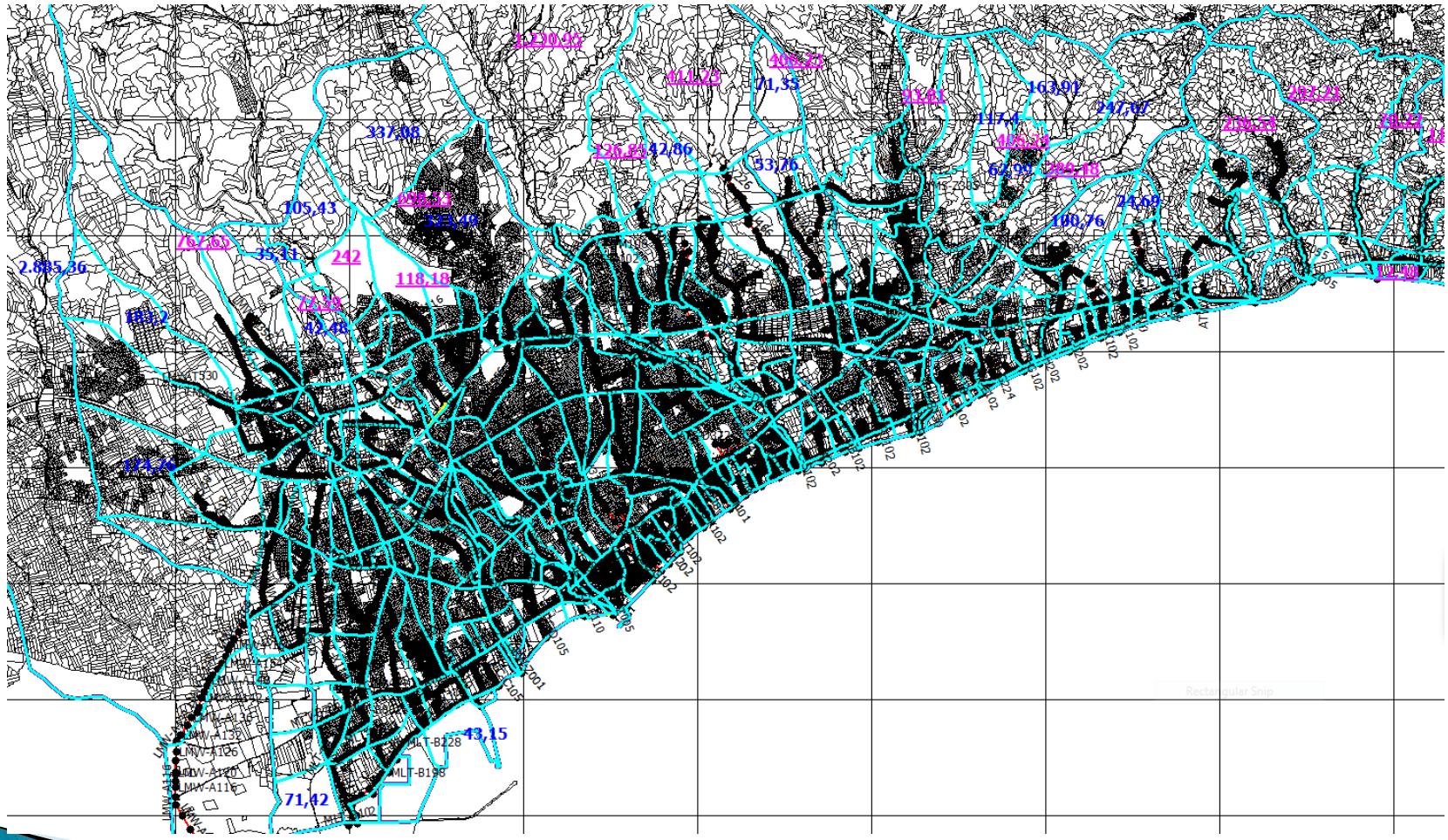
- Section 1 : Slides 3-12 What has been done on drainage
- Section 2 : Slides 13-29 SuDS details
- Section 3 : Slides 30-33 Training on SuDS
- Section 4 : Slides 34-39 Conclusions

Section 1

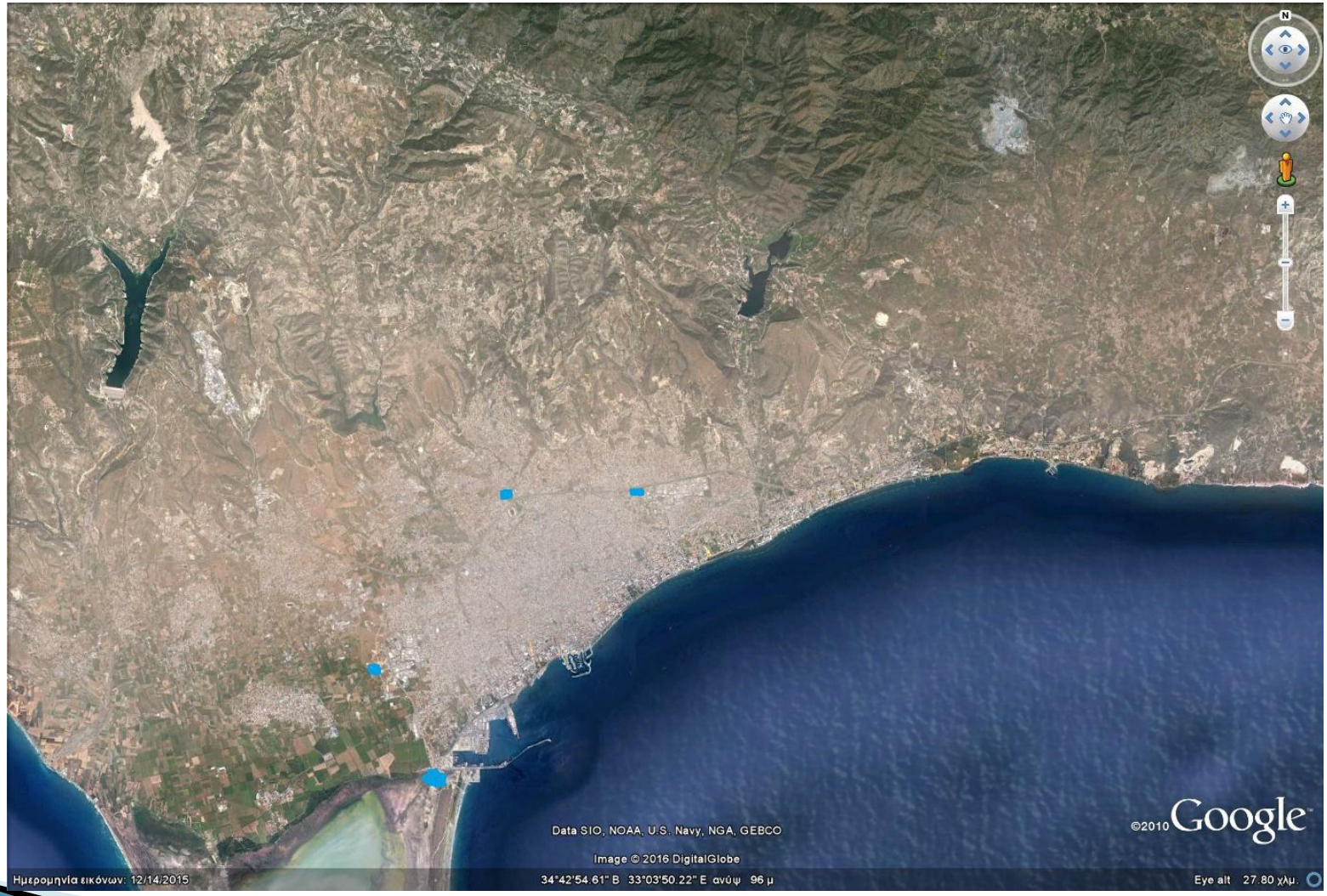
- **<u>WHAT HAS BEEN DONE SO FAR ON DRAINAGE</u>**
- VARIOUS STUDIES (Master Plan, Ayia Phyla River, Vathias river in Ayios Athanasios)
- CONSTRUCTION OF DRAINAGE WORKS (SBLA, PWD and MUNICIPALITIES)

- **<u>PENDING</u>**
- MAJOR DRAINAGE WORKS TO SOLVE LOCAL PROBLEMS IN VARIOUS AREAS

STORM WATER DRAINAGE MASTER PLAN



LIMASSOL CITY EXPANSION



West Limassol Flood Control Project – Retention pond in progress

New Plant in Implementation: K. Polemidia

Tendering Stage: 2013-2014

Construction Start up: 2014

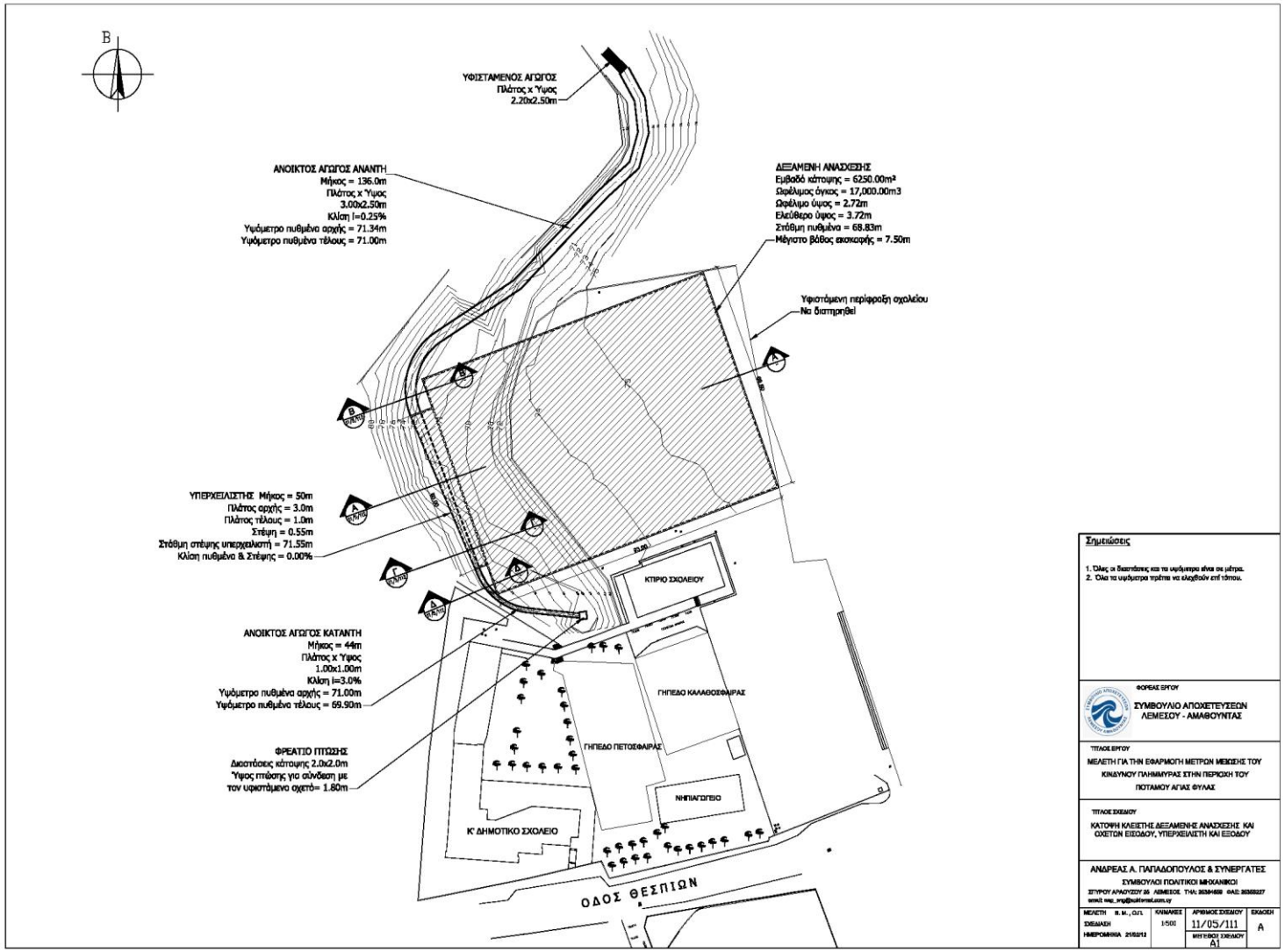
Contract Completion and Commissioning: 2017

POLEMIDIA POND

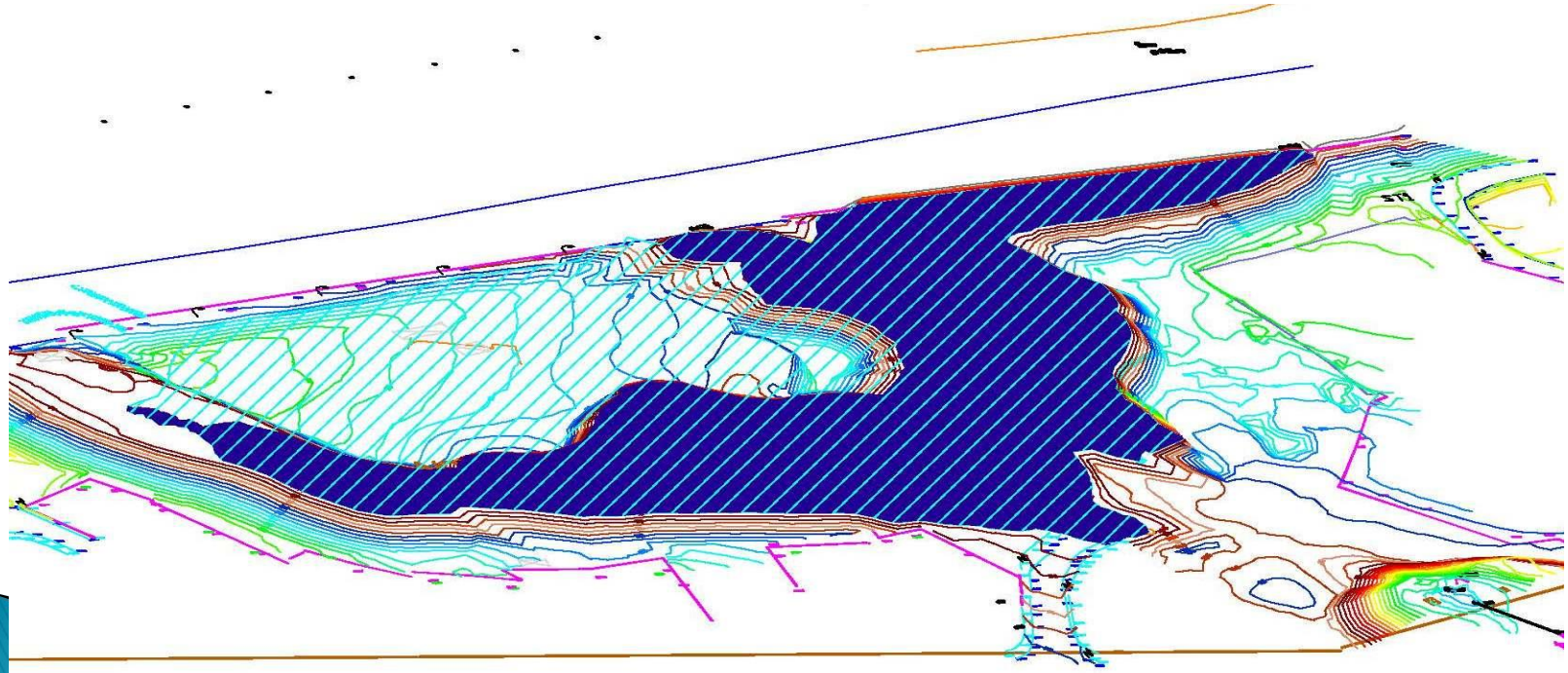
Inlet facility of MAKRIA

Attenuation lagoon –MAKRIA

AYIA PHYLA Retention Reservoir



Ayios Athanasios lagoon



West Limassol Flood Control Project

Section 2
CLIMATE CHANGE

- SHORT PERIODS OF RAINFALL
- INCREASED INTENSITY
- REPEATED RAINSTORMS

THE PROBLEM

Pollution – Quality

Flooding – Quantity

THE INCREASING NEED OF SuDS

1. MAJOR FLOODING EVENTS IN RECENT YEARS HAVE DEMONSTRATED THE LIMITATIONS OF TRADITIONAL DRAINAGE SYSTEMS

2. REDUCED NATURAL DRAINAGE DUE TO DEVELOPMENT AND A HIGHER DENSITY OF HARD PAVING, COMBINED WITH CLIMATE CHANGE HAVE INCREASED FLOOD RISK IN POPULATED AREAS.

Volume of runoff water in cubic meters

- Q = C x I x A where

- C = runoff coefficient depending on the surface (0.2- 1.0)
- I = Rainfall Intensity
- A = Area of the catchment

WHAT IS THE PRINCIPLE?

- The runoff water from a development/piece of land, has to be the same as it was before the development.

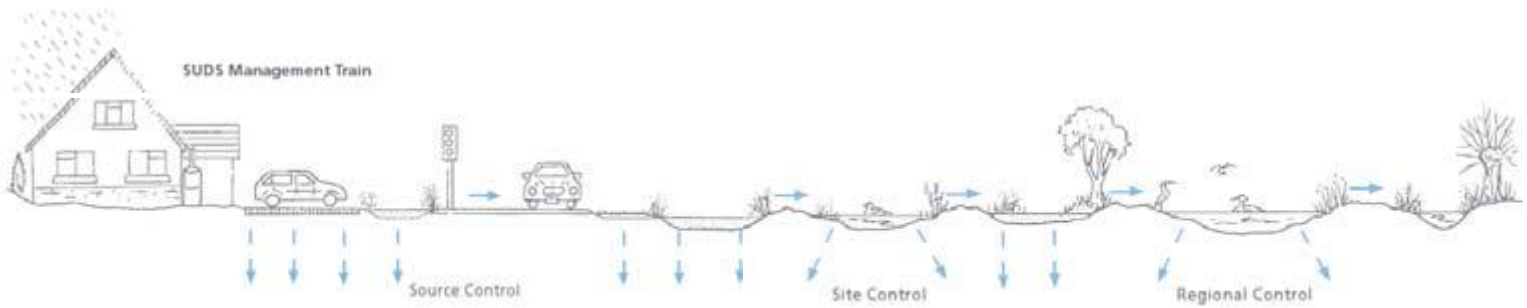
The SuDS philosophy

- • Reduce runoff rates
- • Reduce additional runoff volumes and frequencies
- • Encourage natural groundwater recharge
- • Reduce pollution and protect quality of receiving waters

- • Prevent direct discharge of spillage
- • Reduce volume of surface waste runoff to sewers
- • Contribute amenity and aesthetic value to development
- • Provide habitat for wildlife and biodiversity

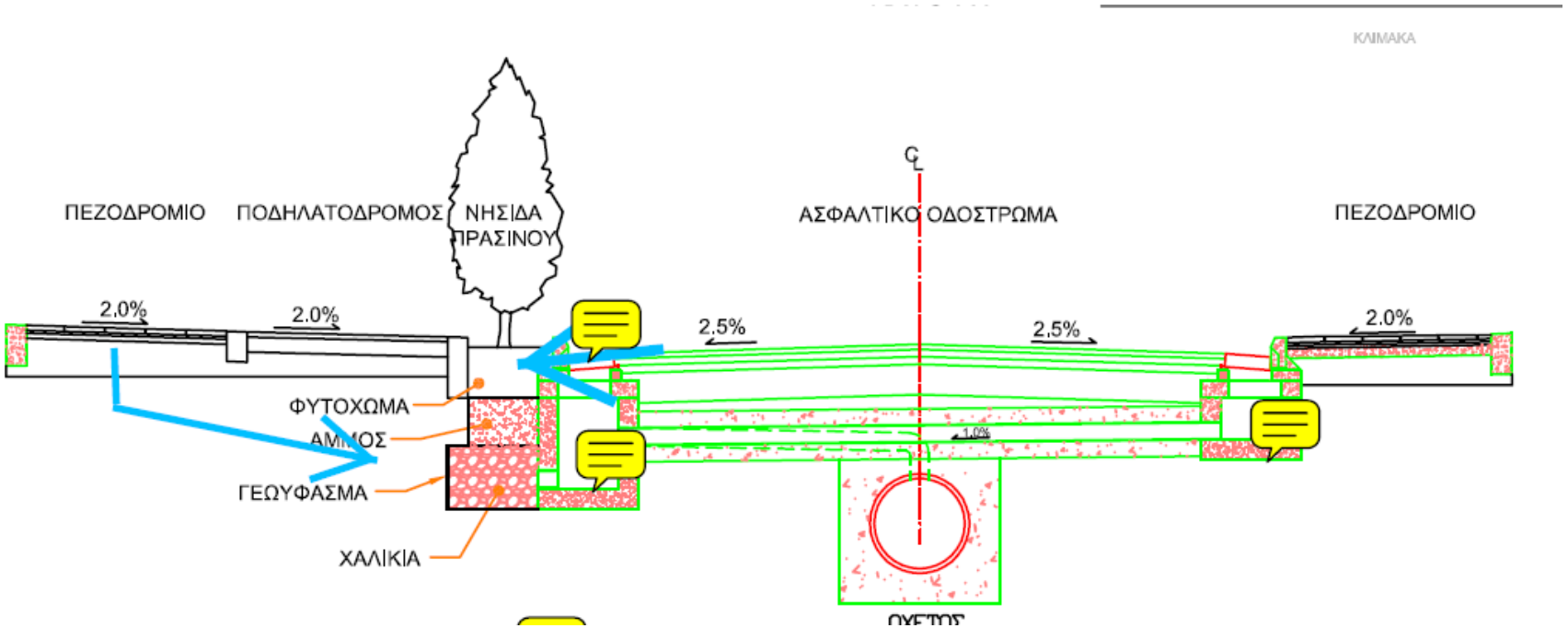
- PREVENTION – good housekeeping measures within development

- SOURCE CONTROL – managing runoff at or near its source where it falls as rain

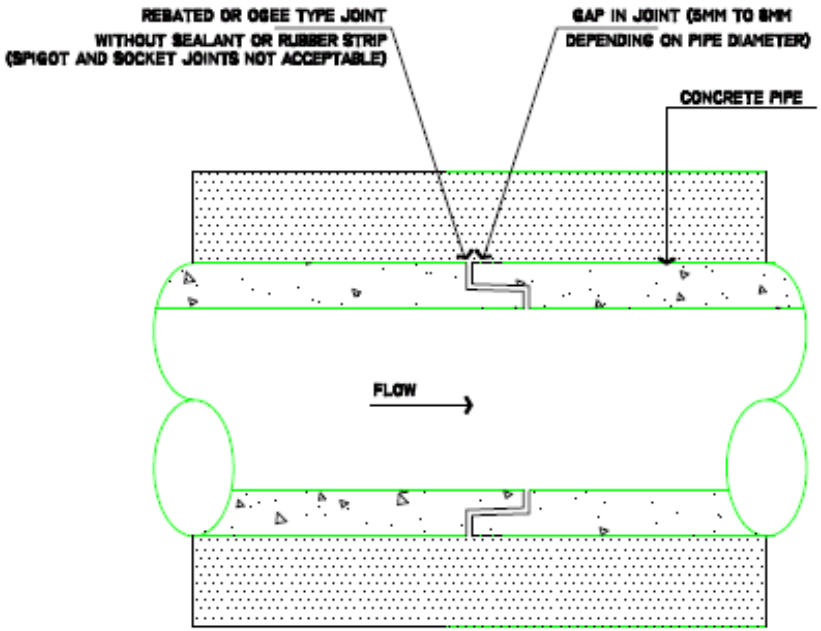


Use of permeable surfaces and voided stone for treatment and storage

SuDS on streets



Drainpipe joint without gasket allowing water to escape in gravel surround



DETAIL AT JOINTS OF CONCRETE PIPES

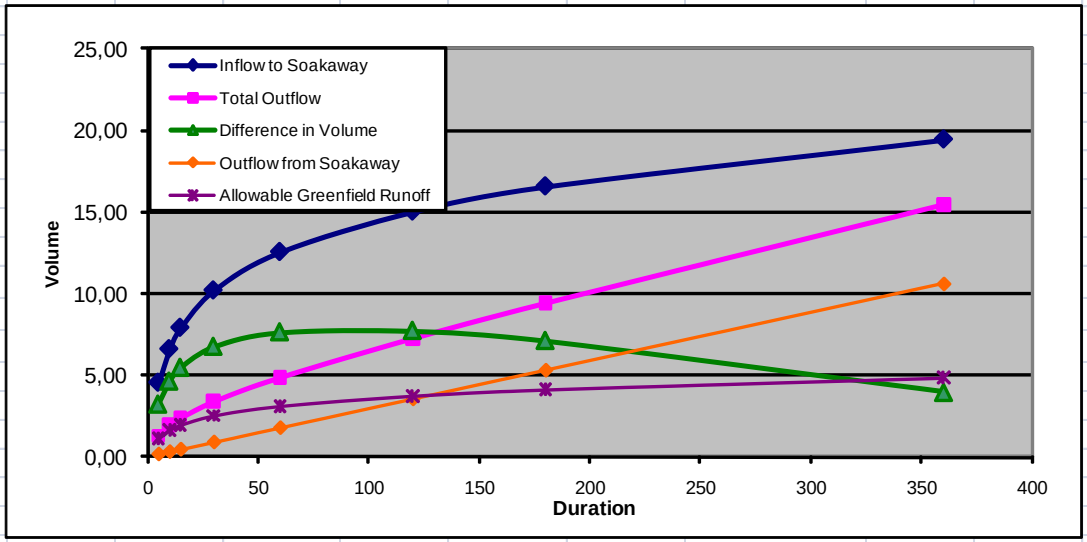
(SUDS DETAIL)

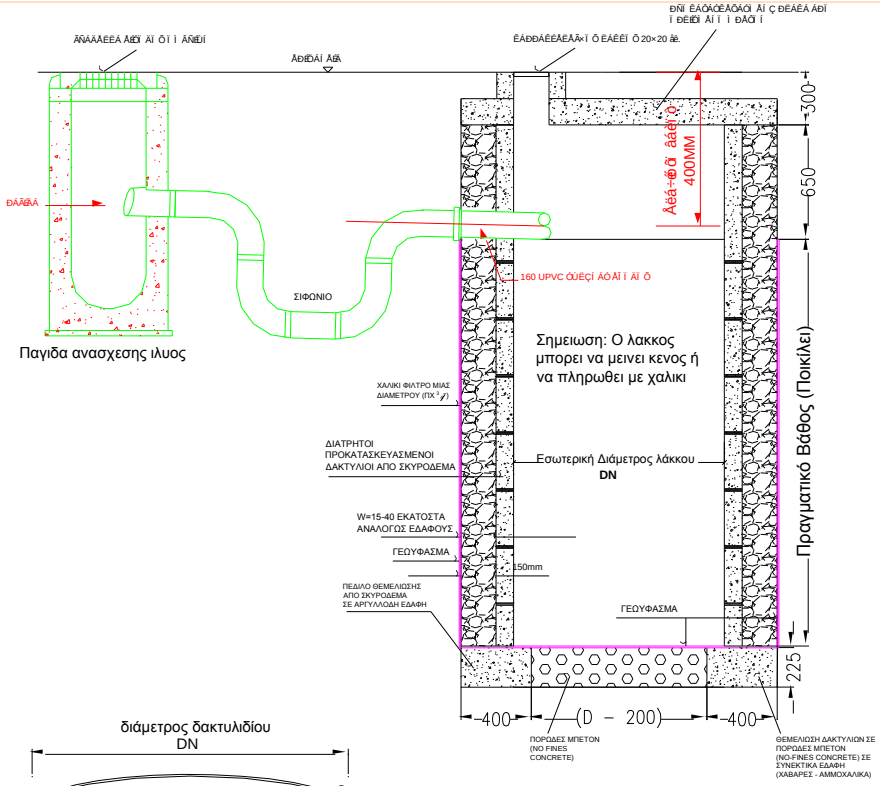
DESIGN TOOLS
for
IMPLEMENTATION

Soakway design – BRE 365

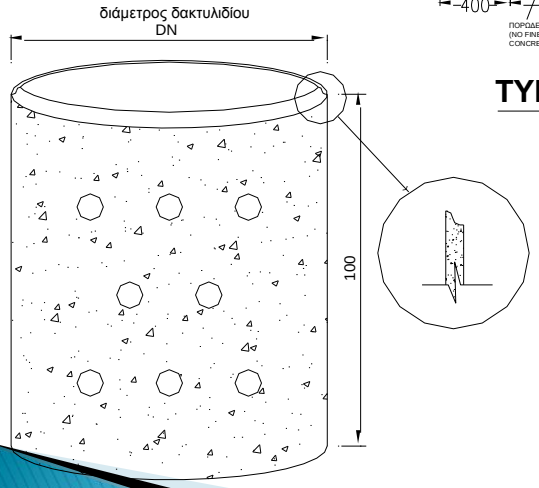
Plot/Development Details		
Total Plot Area	500	m^2
Allowable Runoff (existing)	20	%
Built/Paved Area	400	m^2
Roads	0	m^2
Total	400	m^2
Circular Soakaway Dimensions		
number of circular soakaways	1	m
diameter	1,2	m
effective depth	7	m
f	0,0000186	m/s
void ratio	1	
Results		
Max Storage	7,74	m^3
Available Storage	7,91	m^3
Remaining Storage	**-0,18**	m^3
SUDS OK?	**YES**	
Time to Half Empty	2,24	hours
Time to Half Empty OK?	**YES**	

Duration	Rainfall M10-D	Inflow to Soakaway		Outflow from Soakaway	Allowable outflow (1)	Total Outflow	Difference
minutes	**(mm)**	**I (m^3)**	**As50**	**Os (m^3)**	**Og (m^3)**	**O=Os+Og (m^3)**	**I-O (m^3)**
5	11,40	4,56	26,376	0,15	1,14	1,29	3,27
10	16,53	6,61	26,376	0,29	1,65	1,95	4,67
15	19,80	7,92	26,376	0,44	1,98	2,42	5,50
30	25,52	10,21	26,376	0,88	2,55	3,43	6,77
60	31,38	12,55	26,376	1,77	3,14	4,90	7,65
120	37,56	15,02	26,376	3,53	3,76	7,29	7,74
180	41,41	16,57	26,376	5,30	4,14	9,44	7,13
360	48,58	19,43	26,376	10,60	4,86	15,46	3,98





ΤΥΠΙΚΗ ΤΟΜΗ



Τυπικος δακτυλιος με [illegible]ες Φ50 ή 75mm

ΠΙΝΑΚΑΣ Α

Διάμετρος δακτυλιδίου (λάκκου)	Τυποποιημένος αριθμός οπών διαμέτρου 75mm	
DN	0.6m βαθος	0.9m βαθος
900	5	9
1050	8	12
1200	8	12
1350	8	12
1500	10	15
1800	12	18
2100	12	18
2400	14	21
2700	16	24
3000	18	27

Πραγματικό "Βάθος" Λάκκου Απορρόφησης σε μέτρα (για Λάκκο χωρίς χαλίκι)					
"Αδιαπέρατη" Επιφάνεια Κάλυψης της Ανάπτυξης	Εσωτερική Διάμετρος Λάκκου Απορρόφησης Ομβρίων DN				
	1.00m	1.25m	1.50m	1.75m	2.00m
100 m^2	2.60	1.80	1.30	1.00	0.80
200 m^2	5.20	3.60	2.60	2.00	1.60
300 m^2		5.40	3.90	3.00	2.40
400 m^2		7.20	5.20	4.00	3.20
500 m^2			6.50	5.00	4.00
600 m^2				6.00	4.80
700 m^2				7.00	5.60
800 m^2					6.40

ΠΙΝΑΚΑΣ Β

Πραγματικό "Βάθος" Λάκκου Απορρόφησης σε μέτρα (για Λάκκο με χαλίκι)					
"Αδιαπέρατη" Επιφάνεια Κάλυψης της Ανάπτυξης	Εσωτερική Διάμετρος Λάκκου Απορρόφησης Ομβρίων DN				
	1.00m	1.25m	1.50m	1.75m	2.00m
100 m^2	6.00	4.10	3.00	2.40	1.90
200 m^2			6.00	4.80	3.80
300 m^2					5.70

ΟΟΙ ΑΙ ΟΕΕΕ ΑΕΙ ×ΑΟΑΟΟΑΙΙ ΕΑΙ ΑΟΙ ΟΑΙ ΑΕΙ ΟΙ ΟΑΟ

ΣΗΜΕΙΩΣΕΙΣ:

SUDS:
Sustainable Urban Drainage Systems ή Αειφόρα Συστήματα Αποχετευσης Ομβρίων. (ΑΣΑΟ)

Σκοπός:
Η διοχέτευση στο έδαφος των ομβρίων νερών όσο πιο κοντά στον αρχικό χώρο της βροχής.

rev	Date	DESCRIPTION

ΣΑΛΑ

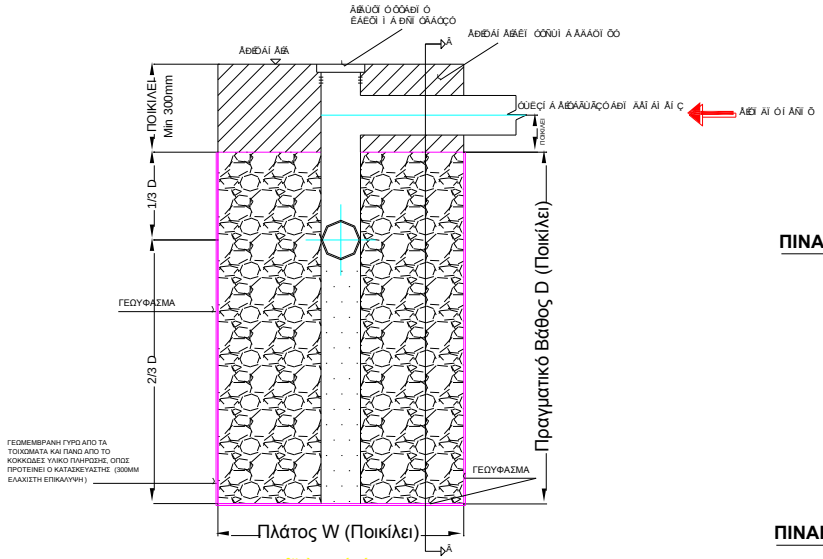
ΟΟΟΟΟΓΙ ΑΟΑ ΑΑΕΙΟΙ ΝΙ Ο ΑΕΑ×ΑΕΙΙΓΟΟΟΙ Ι ΑΝΕΙΙ

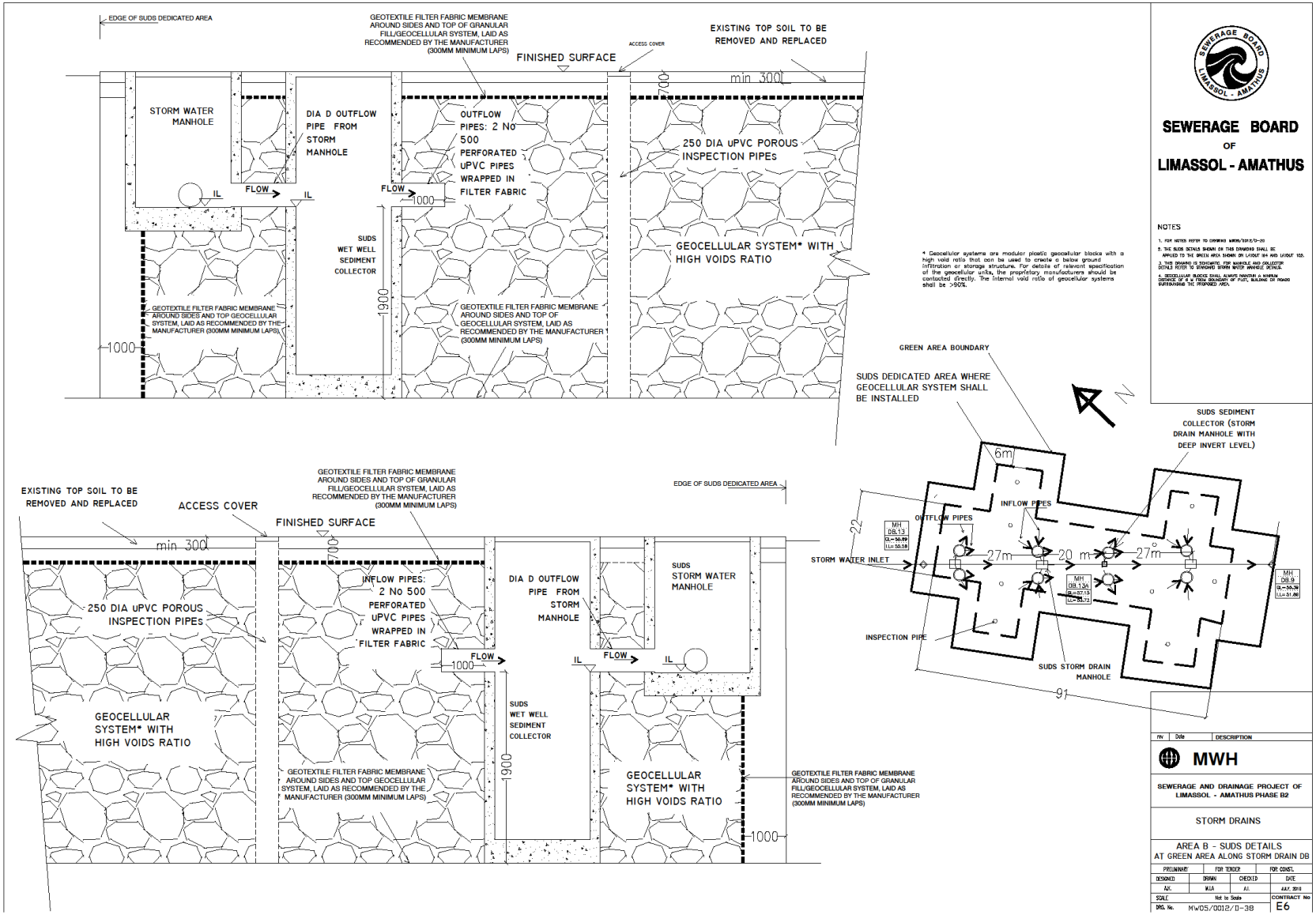
ΟΟΟΙΕΕΑΟ ΕΑΕΙΟΙ Ι ΑΝΑΕΕΑΟ

ΕΑΕΕΙ ΕΑΕΙ ΝΝΙ ΟΓΟΟΟΙ Ι ΑΝΕΙΙ

Ο×ΑΑΕ 1

			FOR CONST.
DESIGNED	DRAWN	CHECKED	DATE
SCALE	NTS		
DRG. No.	01/2010/S1		S1


ΑΠΟΥΟΙ Ο ΟΟΑΠΙ Ο
ΕΛΕΟΙ Ι Α ΒΝΙ ΟΑΑΟΟ
ΑΠΙΠΑΙ ΑΠΑΕΙ ΟΟΝΙΙ Α ΑΑΑΟΙ ΟΟ
ΑΠΙΠΑΙ ΑΠΑ
ΟΙΕΟΙ ΑΙ ΟΙ ΑΝΙ Ο


EDGE OF SUDS DEDICATED AREA
GEOTEXTILE FILTER FABRIC MEMBRANE AROUND SIDES AND TOP OF GRANULAR FILL/GEOCELLULAR SYSTEM, LAID AS RECOMMENDED BY THE MANUFACTURER (300MM MINIMUM LAPS)
ACCESS COVER
FINISHED SURFACE
EXISTING TOP SOIL TO BE REMOVED AND REPLACED
min 300
700
STORM WATER MANHOLE
DIA D OUTFLOW PIPE FROM STORM MANHOLE
OUTFLOW PIPES: 2 No 500 PERFORATED uPVC PIPES WRAPPED IN FILTER FABRIC
250 DIA uPVC POROUS INSPECTION PIPES
FLOW
IL
1000
SUDS WET WELL SEDIMENT COLLECTOR
1900
GEOCELLULAR SYSTEM* WITH HIGH VOIDS RATIO
GEOTEXTILE FILTER FABRIC MEMBRANE AROUND SIDES AND TOP OF GEOCELLULAR SYSTEM, LAID AS RECOMMENDED BY THE MANUFACTURER (300MM MINIMUM LAPS)
* Geocellular systems are modular plastic geocellular blocks with a high void ratio that can be used to create a below ground infiltration or storage structure. For details of relevant specification of the geocellular units, the proprietary manufacturers should be contacted directly. The internal void ratio of geocellular systems shall be >90%.
GREEN AREA BOUNDARY
SUDS DEDICATED AREA WHERE GEOCELLULAR SYSTEM SHALL BE INSTALLED
N
SUDS SEDIMENT COLLECTOR (STORM DRAIN MANHOLE WITH DEEP INVERT LEVEL)
6m
22
INFLOW PIPES
OUTFLOW PIPES
MH DB.13 CL=56.89 LL=55.58
STORM WATER INLET
27m
20 m
27m
MH DB.1A CL=57.15 LL=55.72
MH DB.9 CL=56.36 LL=51.86
INSPECTION PIPE
SUDS STORM DRAIN MANHOLE
91
SUDS STORM WATER MANHOLE
SEWERAGE BOARD OF LIMASSOL - AMATHUS
NOTES
1. FOR NOTES REFER TO DRAWING MWO5/2012/0-20
2. THE SUDS DETAILS SHOWN ON THIS DRAWING SHALL BE APPLIED TO THE GREEN AREA SHOWN ON LAYOUT 84 AND LAYOUT 103.
3. THIS DRAWING IS SCHEMATIC. FOR MANHOLE AND COLLECTOR DETAILS REFER TO DRAWING STORM WATER MANHOLE DETAILS.
4. GEOCELLULAR BLOCKS SHALL ALWAYS MAINTAIN A MINIMUM DISTANCE OF 6 m FROM BOUNDARY OF PLOT, BUILDING OR ROADS SURROUNDING THE PROPOSED AREA.
rev | Date | DESCRIPTION
MWH
SEWERAGE AND DRAINAGE PROJECT OF LIMASSOL - AMATHUS PHASE B2
STORM DRAINS
AREA B - SUDS DETAILS AT GREEN AREA ALONG STORM DRAIN DB
PRELIMINARY | FOR TENDER | FOR CONST.
DESIGNED | DRAWN | CHECKED | DATE
A.K. | M.K.A | A.I. | JULY, 2016
SCALE: Not to Scale
CONTRACT No
DRG. No. MW05/0012/0-38
E6

LARGE DEVELOPMENTS THAT CONRIBUTE TO INCREASE IN RUNOFF AND NEED TO TAKE MEASURES

PRIVATE SECTOR

- SHOPPING CENTRES
- SCHOOLS
- HOSPITALS
- PETROL STATIONS
- OFFICE BLOCKS

PUBLIC BUILDINGS

- ARMY CAMPS
- SCHOOLS
- OFFICE BUILDINGS
- STADIUMS
- CHURCHES

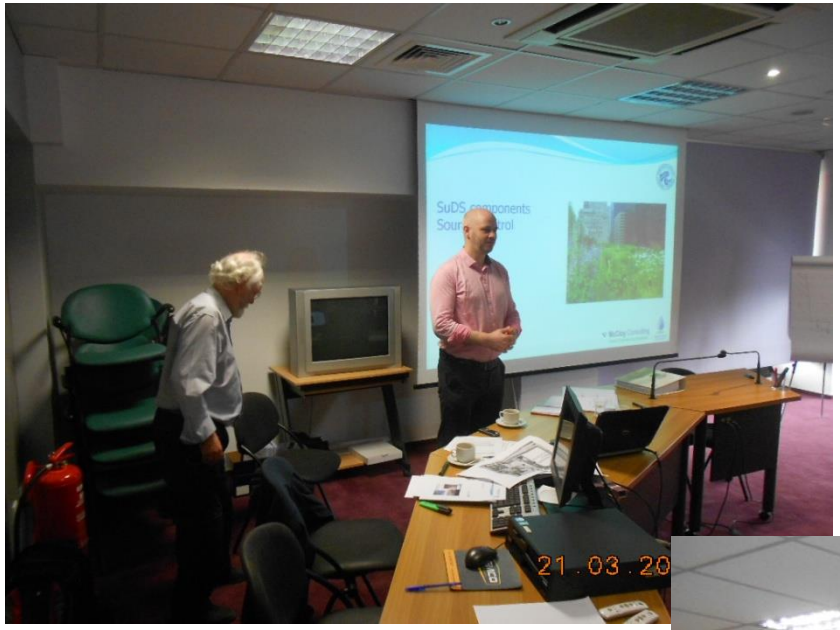
Section 3
TRAINING ON SUDS

- CIRIA in UK (2 day workshop) in 2011
- CIRIA Manual

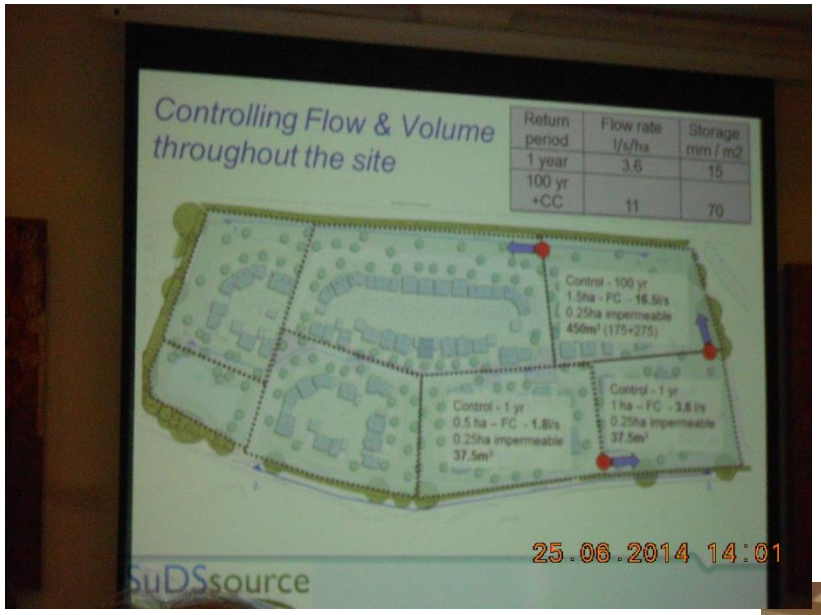
- BRE UK (Building Research Establishment) Digest 365

- NORTHAMPTON NATIONAL CONFERENCE IN 2014

SuDS –A two- day Seminar
at SBLA offices March 2013



Northampton National Conference 2014



Northampton National Conference 2014

DSCN2291.AVI

Section 4
DIFFICULTIES IN IMPLEMENTING SUDS

1.VARIOUS DEPARTMENTS RESPONSIBLE FOR DRAINAGE SUCH AS

- GOVERNMENT: WATER DEVELOPMENT DEPT FOR RIVERS AND RESERVOIRS AND
- PUBLIC WORKS DEPARTMENT ON MAIN ROADS UNDER THEIR JURISTICTION.
- DISTRICT OFFICE FOR COMUNITIES
- LOCAL MUNICIPALITIES
- LOCAL SEWERAGE AND DRAINAGE BOARDS

2. NO COMMON LEGISLATION

WATER DEVELOPMENT DEPARTMENT
EUROPEAN FLOOD DIRECTIVE 2007/60/EC

FLOOD RISK MANAGEMENT PLAN

- IDENTIFIED THE AREAS IN DANGER AND PREPAIRED MAPS
- IT WILL SUGGEST MEASURES
- ONE OF THEM WILL BE SUDS

ΑΓΙΟΣ ΑΘΑΝΑΣΙΟΣ
ΜΕΣΑ ΓΕΙΤΟΝΙΑ
ΓΕΡΜΑΣΟΓΕΙΑ
ΛΕΜΕΣΟΣ
Λεωφόρος Μακάριου
Ανατ. Ο.Σ.Ο. Θ.Λάρνακας
Κεντρικός Δρόμος Μελέτης
Αναβαθμός Ποταμού Βαθιάς
Γέφυρα Ο.Σ.Ο. Θ.Λάρνακας
Γέφυρα Λεωφόρου Μακάριου
Γέφυρα Κεντρικού Δρόμου Μελέτης

MEDITERRANEAN BASIN

Summary

- Various locations across the world have introduced new ways of managing water
- Most are still in early stages of strategy development
- Methods are transferable – details can be localized

- THANK YOU FOR YOUR ATTENTION