THE SOCIALIST REPUBLIC OF VIETNAM
MINISTRY OF CONSTRUCTION

SMALL-SCALE SEWERAGE SYSTEM MASTER PLAN FOR CUWC

DRAWINGS

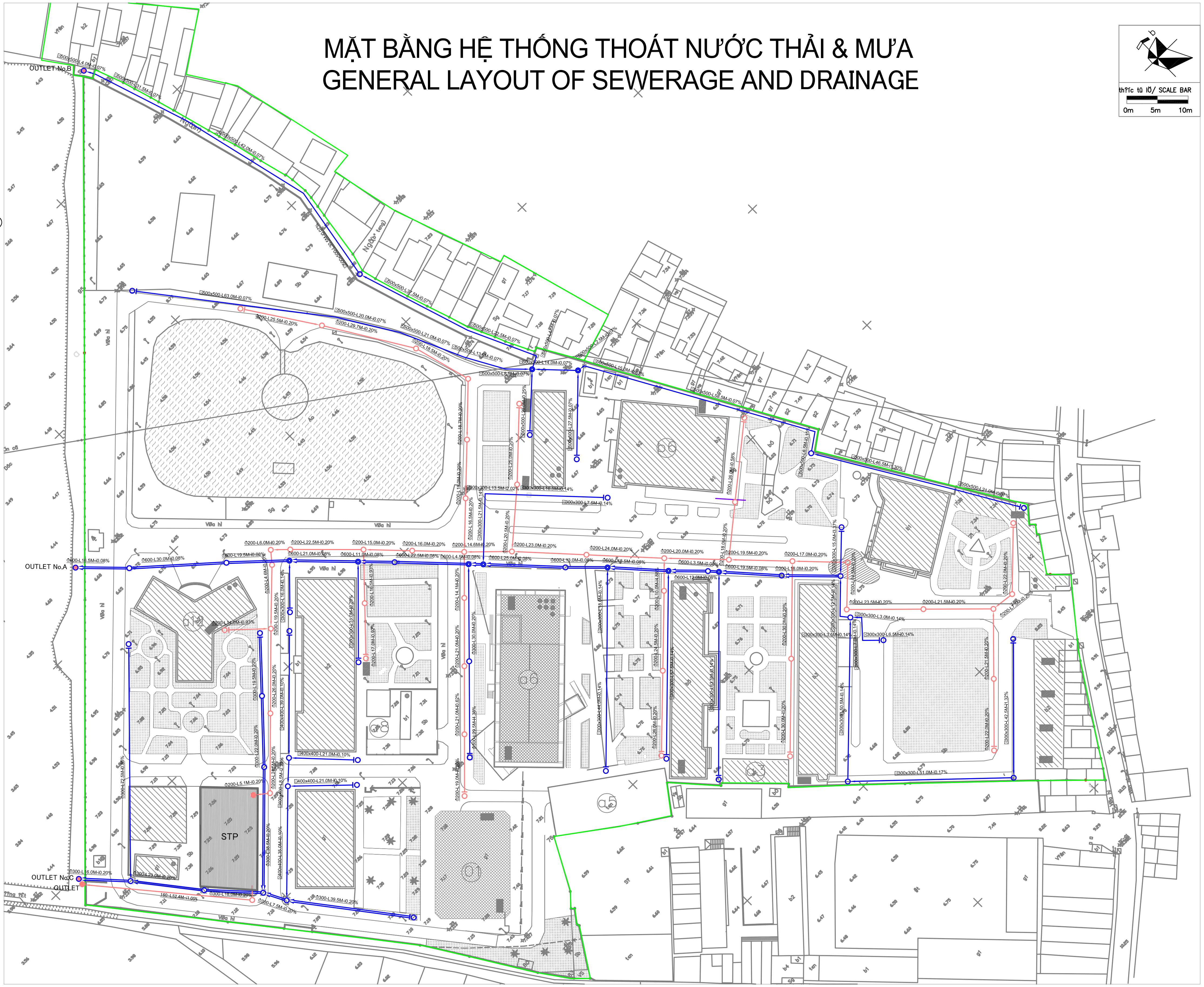
November 2019

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIPPON KOEI CO., LTD
SEWERAGE BUSINESS MANAGEMENT CENTRE

MẶT BẰNG HỆ THỐNG THOÁT NƯỚC THẢI & MƯA
GENERAL LAYOUT OF SEWERAGE AND DRAINAGE

KÝ HIỆU / SYMBOL

- DRAINAGE PIPELINE
- SEWERAGE PIPELINE
- MANHOLE
- ⊙200 - L25.5M - i0.20% DIAMETER – LENGTH(m) – SLOPE(%)
- STP — SEWERAGE TREATMENT PLANT
- OUTLET



				College of Urban Works Construction (CUWC)	Check	Name	Signature		Check	Name	Signature	
					Designed				Drawing			
					Drawn				Design			
					Checked				Check			
					Approved				Team Leader			

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC					
MẶT BẰNG HỆ THỐNG THOÁT NƯỚC THẢI & MƯA GENERAL LAYOUT OF SEWERAGE AND DRAINAGE SYSTEM					Package Items
Scale.	DWG Number: CUWC - GENERAL - LAYOUT - 1	Sheet 1 / 1	Rev A	Date Nov. 2019	

MẶT BẰNG HỆ THỐNG THOÁT NƯỚC THẢI
GENERAL LAYOUT OF SEWERAGE SYSTEM

KÝ HIỆU/ SYMBOL

- ĐƯỜNG ỐNG THOÁT NƯỚC XÂY MỚI
  NEW SANITARY PIPELINE
- HỐ GA XÂY MỚI
  NEW MANHOLES
- HỐ GA TẠI TRẠM XỬ LÝ – ĐIỂM XẢ
  MANHOLE AT STP OR OUTPUT
- ⊙200-L14.1M ĐƯỜNG KÍNH–CHIỀU DÀI (M)
  DIAMETER–LENGTH (M)
- STP-1 TRẠM XỬ LÝ NƯỚC THẢI
  SEWERAGE TREATMENT PLANT
- S9-2 TÊN CỌC / HỐ GA
  NAME OF MAIN MANHOLE

NOTE: THE STP DISCHARGES GRAVITY TO EXISTING CHANNEL THROUGH DISCHARGING POINT 3 WHEN THE WATER LEVEL IN XUAN DUC LAKE IS LOW. ELSE, IT WILL PUMP TO THE LAKE

TRẠM XỬ LÝ SẼ TỰ CHẢY RA HỆ THỐNG THOÁT NƯỚC THÔNG QUA ĐIỂM XẢ SỐ 1 KHI MỰC NƯỚC HỒ XUÂN DỤC THẤP, VÀ SẼ THOÁT BẰNG BƠM QUA KHI MỰC NƯỚC HỒ CAO

THƯỚC TỶ LỆ/ SCALE BAR
0M 5M 10M

KHU ĐẤT QUY HOẠCH NHÀ GIÁO DỤC THỂ CHẤT
PLANNED AREA FOR GYMNASIUM

SÂN BÊ TÔNG
CONCRETE YARD

TRẠM XỬ LÝ
STP

CỔNG VÀO
ENTRANCE

RANH GIỚI HÀNH LANG DỰ KIẾN
RED LINE UNDER PLANNING

ĐI UBND XÃ YÊN THƯỜNG

Đ.YÊN THƯỜNG
ROAD YEN THUONG

				College of Urban Works Construction (CUWC)	Check	Name	Signature		Check	Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

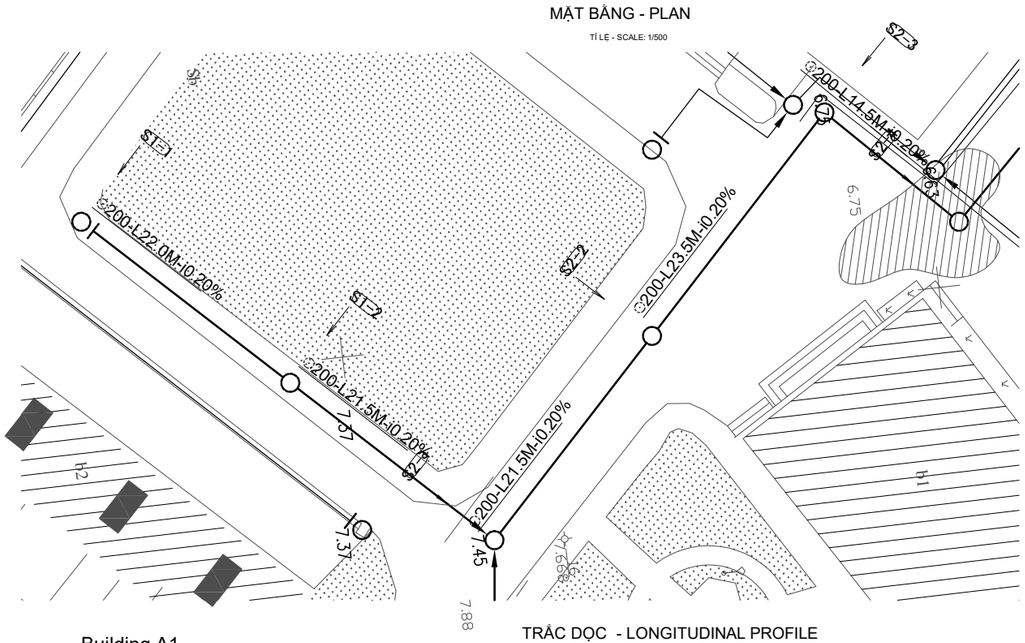
MẶT BẰNG HỆ THỐNG THOÁT NƯỚC THẢI
GENERAL LAYOUT OF SEWERAGE SYSTEM

Package:
Items:

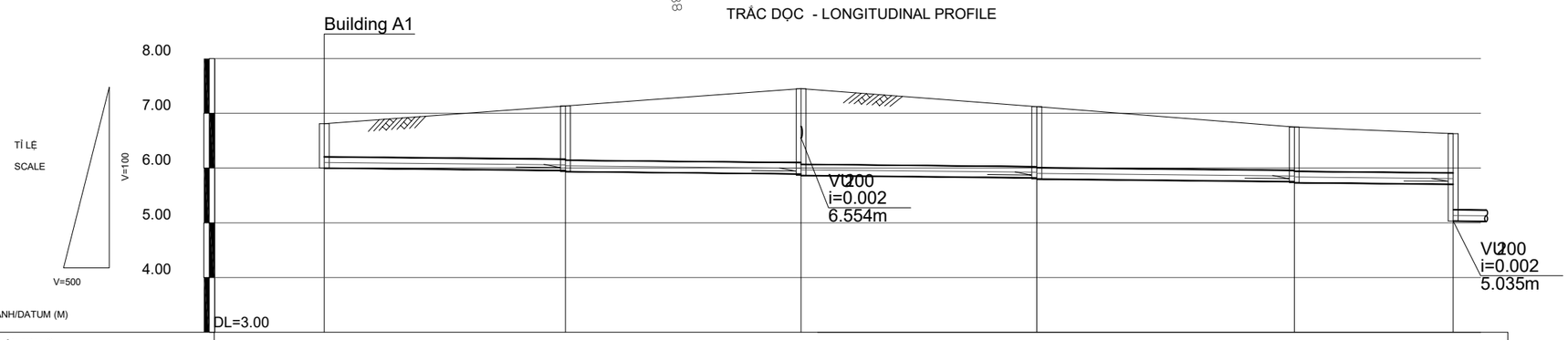
Scale.	DWG Number:	Sheet	Rev	Date
	CUWC–SEWERAGE–LAYOUT–01	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER											
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.81		+7.13		+7.45		+7.12		+6.75		+6.63
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.003		+5.959 +5.939		+5.896 +5.866		+5.823 +5.803		+5.756 +5.736		+5.707
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.60		0.97 0.99		1.35 1.38		1.09 1.11		0.79 0.81		0.72
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.002				0.002					
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	VU200 - Polyvinyl chloride pipe VU										
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	22.00	22.00	21.50	43.50	21.50	65.00	23.50	88.50	14.50	103.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	S1-1		S1-2		S2-1		S2-2		S2-3		S2-4
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)			180		90		180		271		90

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE FROM S1-1 TO S2-4

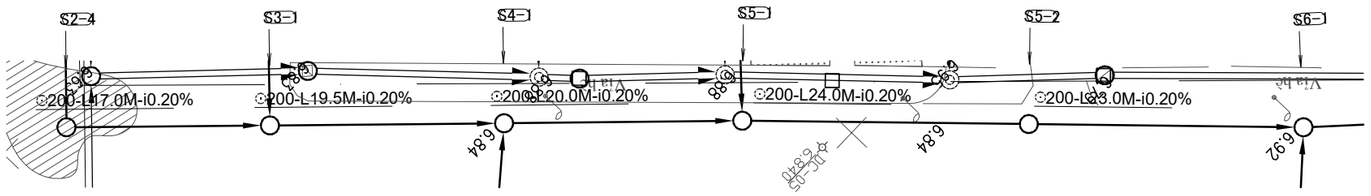
Package

Items

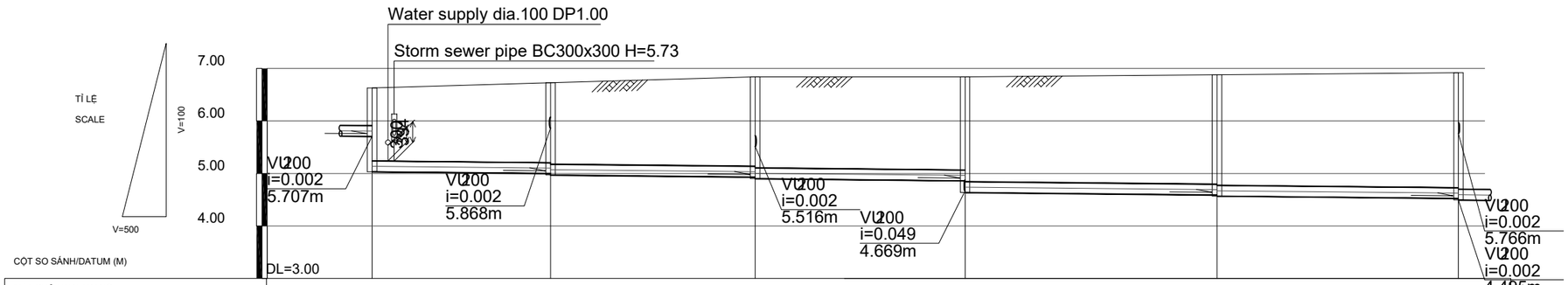
Scale.	CUWC-SEWERAGE-LT-01	Sheet 1/1	Rev A	Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE

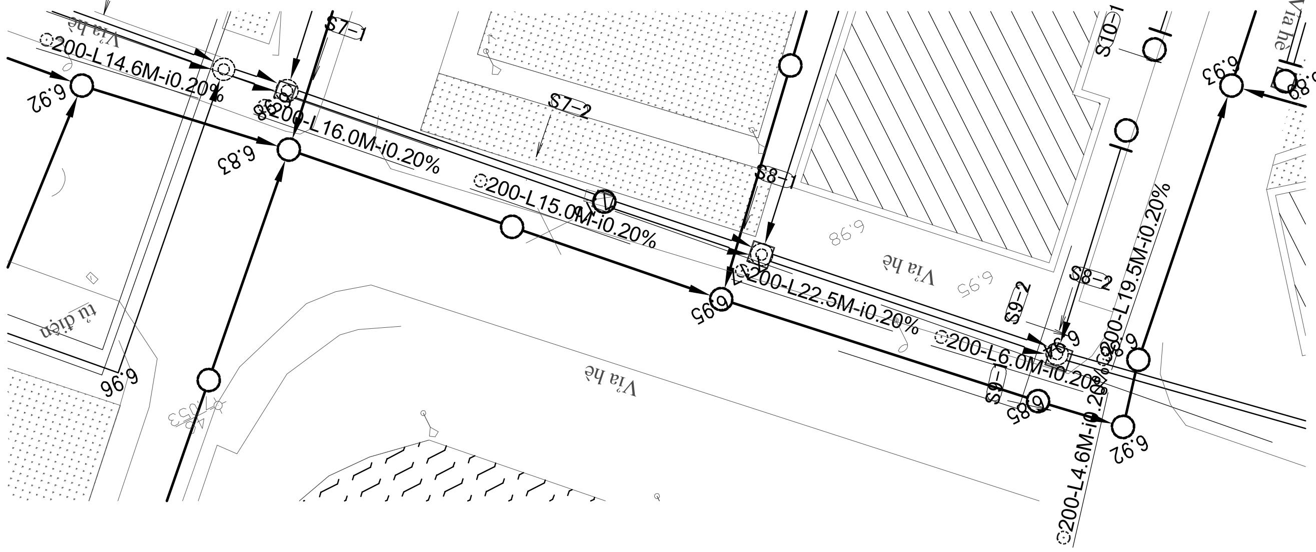


MẶT PHỦ HIỆN TRẠNG EXISTING COVER											
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.63		+6.73		+6.84		+6.84		+6.88		+6.92
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+5.035		+5.001 +4.971		+4.932 +4.902		+4.862 +4.639		+4.591 +4.571		+4.525
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	1.39		1.52 1.55		1.70 1.73		1.77 1.99		2.08 2.10		2.19
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.002		0.002		0.002		0.002			
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	VU200 - Polyvinyl chloride pipe VU										
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	17.00	17.00	19.50	36.50	20.00	56.50	24.00	80.50	23.00	103.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	S2-4		S3-1		S4-1		S5-1		S5-2		S6-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	90		180		180		181		180		177

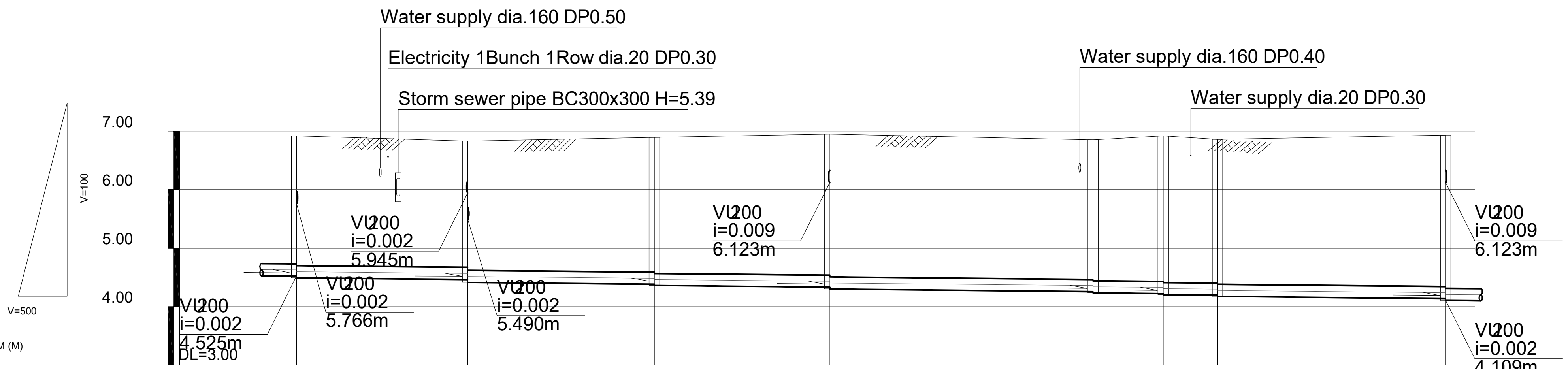
				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature	Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC
					Designed				Drawing			MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE FROM S2-4 TO S6-1
					Drawn				Design			Package / Items
					Checked				Check			
					Approved				Team Leader			Scale. / CUWC-SEWERAGE-LT-02 / Sheet 1/1 / Rev A / Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



	S6-1		S7-1		S7-2		S8-1		S8-2		S9-1		S9-2		S10-1
CỘT SO SÁNH/DATUM (M)															
MẶT PHỦ HIỆN TRẠNG / EXISTING COVER															
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) / EXISTING COVER ELEVATION (M)	+6.92		+6.83		+6.89		+6.95		+6.85		+6.92		+6.86		+6.93
CAO ĐỘ ĐÁY CỐNG (M) / INVERT ELEVATION (M)	+4.495		+4.466 +4.416		+4.384 +4.364		+4.334 +4.304		+4.259 +4.239		+4.227 +4.207		+4.198 +4.178		+4.139
CHIỀU DÀY MẶT PHỤ (M) / DEPTH OF COVER (M)	2.22		2.16 2.21		2.30 2.32		2.41 2.44		2.38 2.40		2.49 2.51		2.46 2.48		2.58
ĐỘ DỐC ĐẶT CỐNG / CULVERT GRADIENT		0.002		0.002				0.002				0.002			
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU / SIZE AND MATERIAL	VU200 - Polyvinyl chloride pipe VU														
KHOẢNG CÁCH VÀ CỘNG DỒN (M) / PARTIAL & ACUMULATIVE DISTANCE (M)	0.00	14.63	14.63	15.95	30.58	15.00	45.58	22.50	68.08	6.00	74.08	4.65	78.73	19.50	98.23
TÊN CỌC/ HỐ GA / STATION/MANHOLE	S6-1		S7-1		S7-2		S8-1		S8-2		S9-1		S9-2		S10-1
GÓC QUAY TRÊN MẶT BẰNG / HORIZONTAL ANGLE (degree)	265		182		180		179		179		86		186		179

College of Urban Works Construction (CUWC)	Check	Name	Signature
	Designed		
	Drawn		
	Checked		
	Approved		

	Name	Signature
Drawing		
Design		
Check		
Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

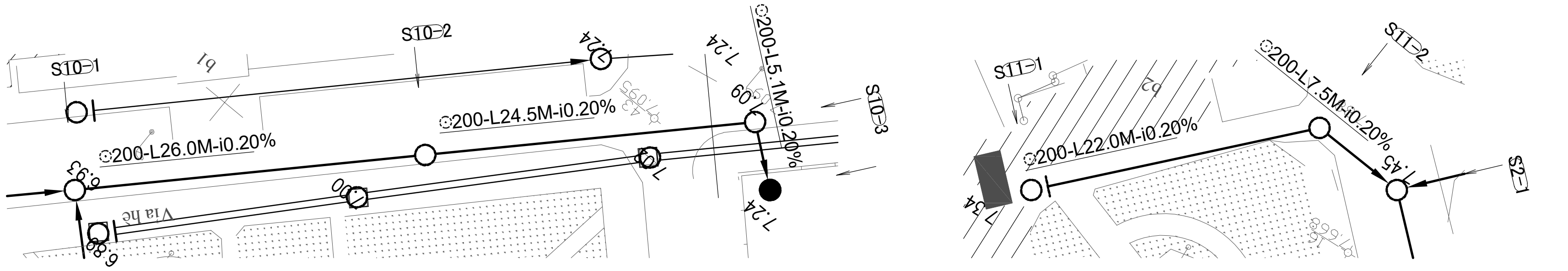
MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM S6-1 TO S10-1

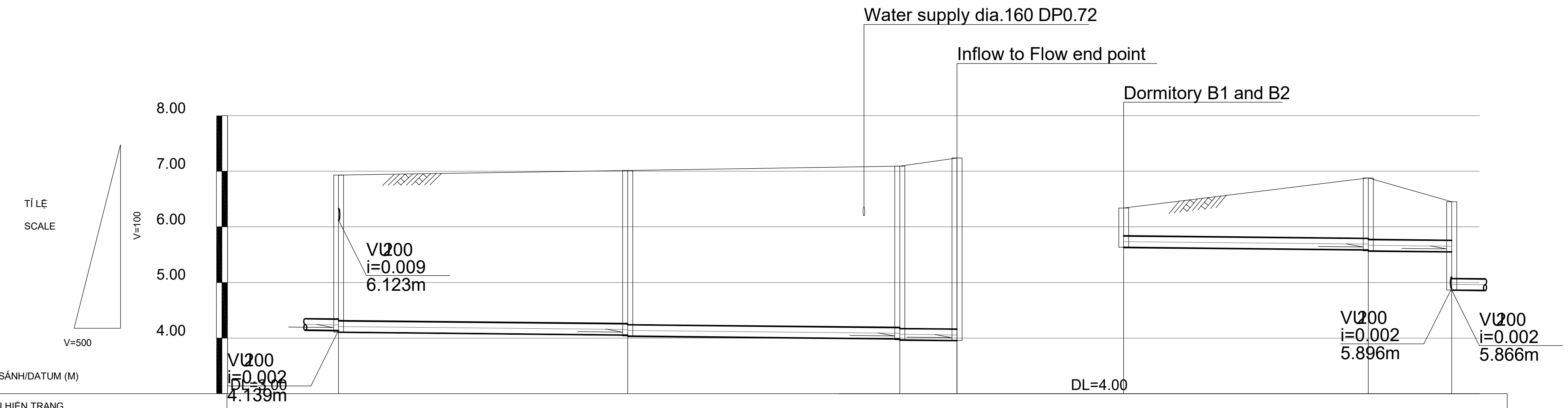
Package	Items	Scale.		Sheet	Rev	Date
			CUWC-SEWERAGE-LT-03	1//1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



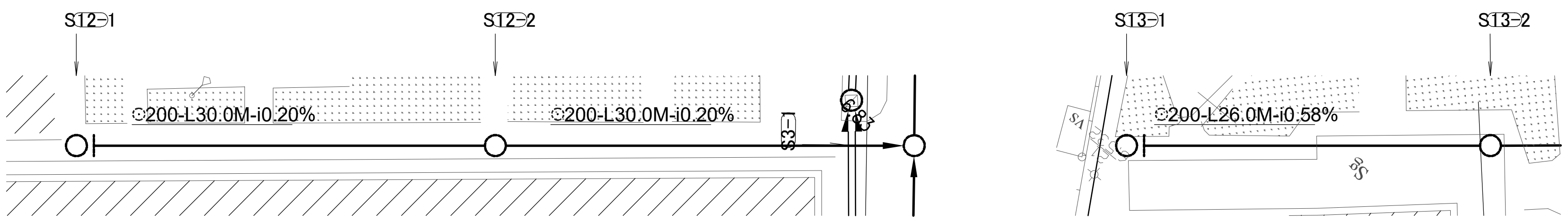
CỘT SO SÁNH/DATUM (M)

MẶT PHỦ HIỆN TRẠNG EXISTING COVER												
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.93		+7.01		+7.09		+7.24	+7.34		+7.88		+7.45
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+4.109		+4.057 +4.037		+3.988 +3.968		+3.958	+6.633		+6.589 +6.569		+6.554
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	2.61		2.75 2.77		2.90 2.92		3.08	0.50		1.08 1.10		0.69
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT			0.002							0.002		
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL			VU200 - Polyvinyl chloride pipe VU							VU200 - Polyvinyl chloride pipe VU		
KHOẢNG CÁCH VÀ CỘNG DỒN (M) PARTIAL & ACUMULATIVE DISTANCE (M)	0.00	26.00	26.00	24.48	50.48	5.14	55.62	0.00	22.00	22.00	7.50	29.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	S10-1		S10-2		S10-3			S11-1		S11-2		S2-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	179		180		263					231		218

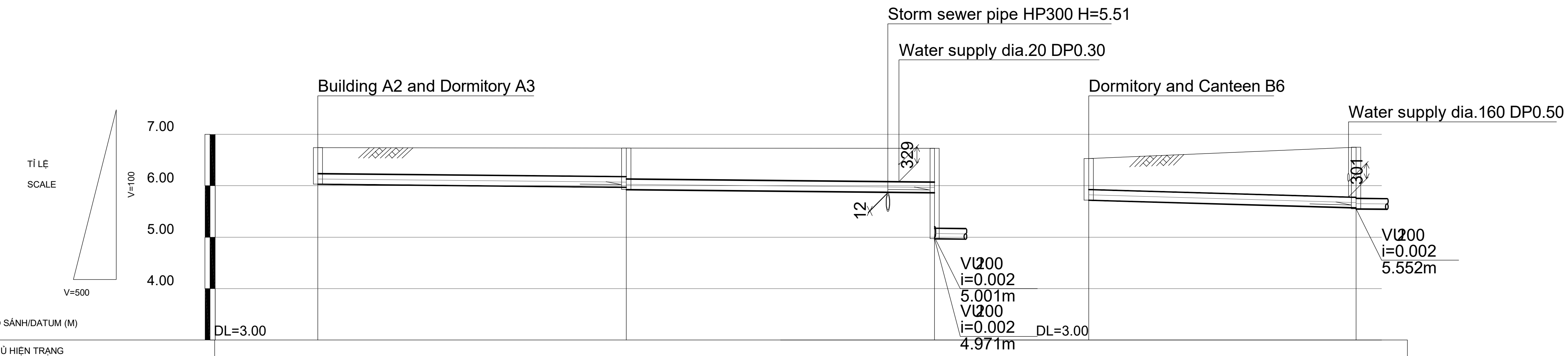
College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature	Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC
	Designed			Drawing			MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE FROM S10-1 TO S10-3, FROM S11-1 TO S2-1
	Drawn			Design			Package
	Checked			Check			Items
	Approved			Team Leader			Scale. CUWC-SEWERAGE-LT-04 · Sheet 1/1 · Rev A · Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỌT SO SÁNH/DATUM (M)								
MẶT PHỦ HIỆN TRẠNG / EXISTING COVER								
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) / EXISTING COVER ELEVATION (M)	+6.74		+6.74		+6.73	+6.53		+6.75
CAO ĐỘ ĐÁY CỐNG (M) / INVERT ELEVATION (M)	+6.033		+5.973 +5.928		+5.868	+5.723		+5.572
CHIỀU DÀY MẶT PHỦ (M) / DEPTH OF COVER (M)	0.50		0.56 0.60		0.66	0.60		0.97
ĐỘ DỐC ĐẶT CỐNG / CULVERT GRADIENT			0.002				0.006	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU / SIZE AND MATERIAL			VU200 - Polyvinyl chloride pipe VU				VU200 - Polyvinyl chloride pipe VU	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) / PARTIAL & ACUMULATIVE DISTANCE (M)	0.00	30.00	30.00	30.00	60.00	0.00	26.00	26.00
TÊN CỌC/ HỐ GA / STATION/MANHOLE	S12-1		S12-2		S3-1	S13-1		S13-2
GÓC QUAY TRÊN MẶT BẰNG / HORIZONTAL ANGLE (degree)			180		91			180

College of Urban Works Construction (CUWC)

Check	Name	Signature
Designed		
Drawn		
Checked		
Approved		

	Name	Signature
Drawing		
Design		
Check		
Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM S12-1 TO S3-1, FROM S13-1 TO S13-2

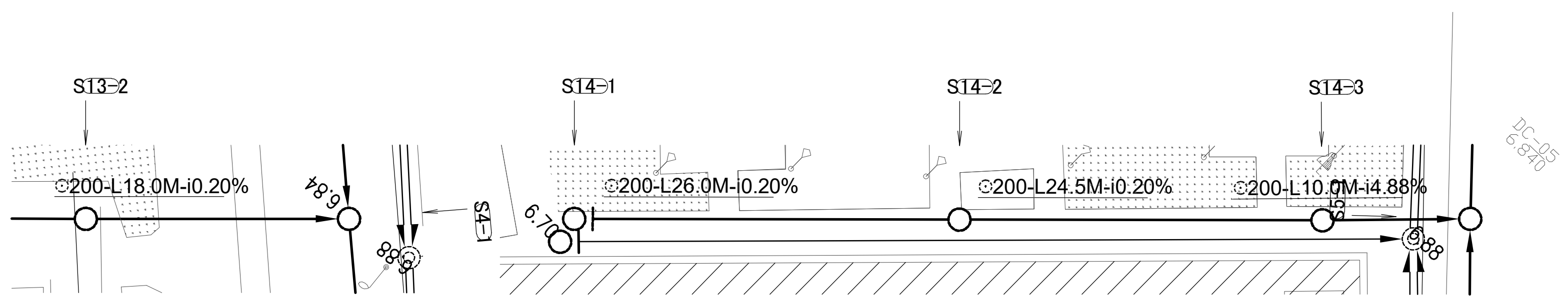
Package

Items

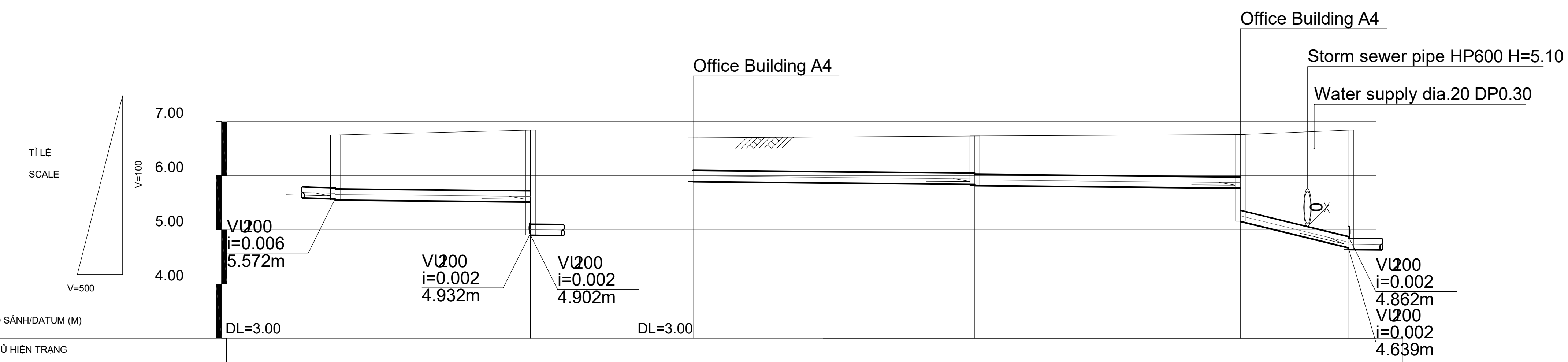
Scale.		Sheet	Rev	Date
	CUWC-SEWERAGE-LT-05	1//1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỌT SO SÁNH/DATUM (M)

	S13-2		S4-1	S14-1		S14-2		S14-3		S5-1
MẶT PHỦ HIỆN TRẠNG / EXISTING COVER										
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) / EXISTING COVER ELEVATION (M)	+6.75		+6.84	+6.70		+6.73		+6.76		+6.84
CAO ĐỘ ĐÁY CÔNG (M) / INVERT ELEVATION (M)	+5.552		+5.516	+5.893		+5.841 +5.821		+5.772 +5.157		+4.669
CHIỀU DÀY MẶT PHỤ (M) / DEPTH OF COVER (M)	0.99		1.12	0.60		0.68 0.70		0.78 1.40		1.96
ĐỘ DỐC ĐẶT CÔNG / CULVERT GRADIENT		0.002			0.002				0.049	
KÍCH THƯỚC CÔNG VÀ VẬT LIỆU / SIZE AND MATERIAL		VU200 - Polyvinyl chloride pipe VU				VU200 - Polyvinyl chloride pipe VU				
KHOẢNG CÁCH VÀ CỌNG DỒN (M) / PARTIAL & ACUMULATIVE DISTANCE (M)	0.00	18.00	18.00	0.00	26.00	26.00	24.50	50.50	10.00	60.50
TÊN CỌC/ HỐ GA / STATION/MANHOLE	S13-2		S4-1	S14-1		S14-2		S14-3		S5-1
GÓC QUAY TRÊN MẶT BẰNG / HORIZONTAL ANGLE (degree)	180		265			180		179		92

College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
	Designed			Drawing		
	Drawn			Design		
	Checked			Check		
	Approved			Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

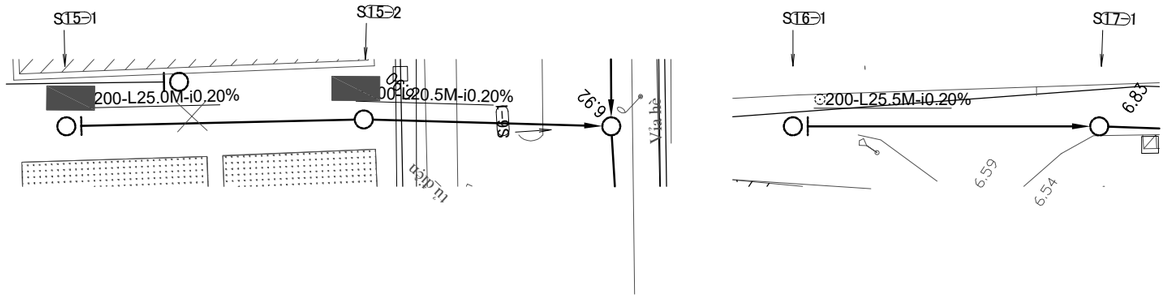
MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM S13-2 TO S4-1, FROM S14-1 TO S5-1

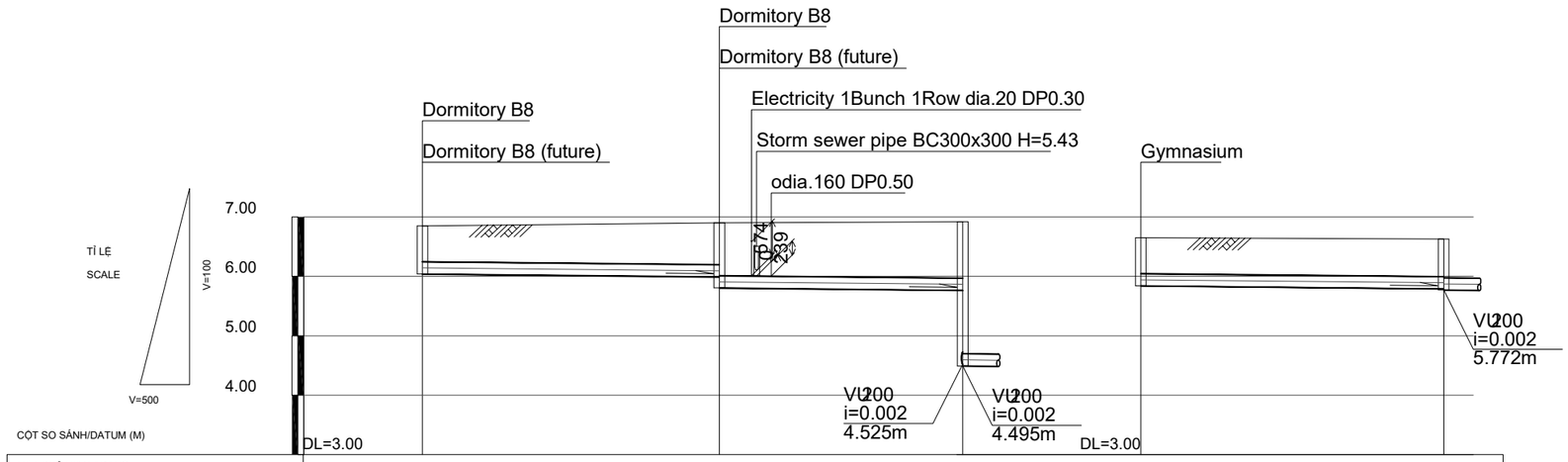
Package	Items	Scale.		Sheet	Rev	Date
			CUWC-SEWERAGE-LT-06	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER					
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.85	+6.90	+6.92	+6.65	+6.63
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.043	+5.993 +5.807	+5.766	+5.843	+5.792
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.60	0.70 0.89	0.95	0.60	0.63
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.002			0.002
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		VU200 - Polyvinyl chloride pipe VU			VU200 - Polyvinyl chloride pipe VU
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	25.00 25.00	20.50 45.50	0.00	25.51 25.51
TÊN CỌC/ HỐ GA STATION/MANHOLE	S15-1	S15-2	S6-1	S16-1	S17-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)		183	265		182

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM S15-1 TO S6-1, FROM S16-1 TO S17-1

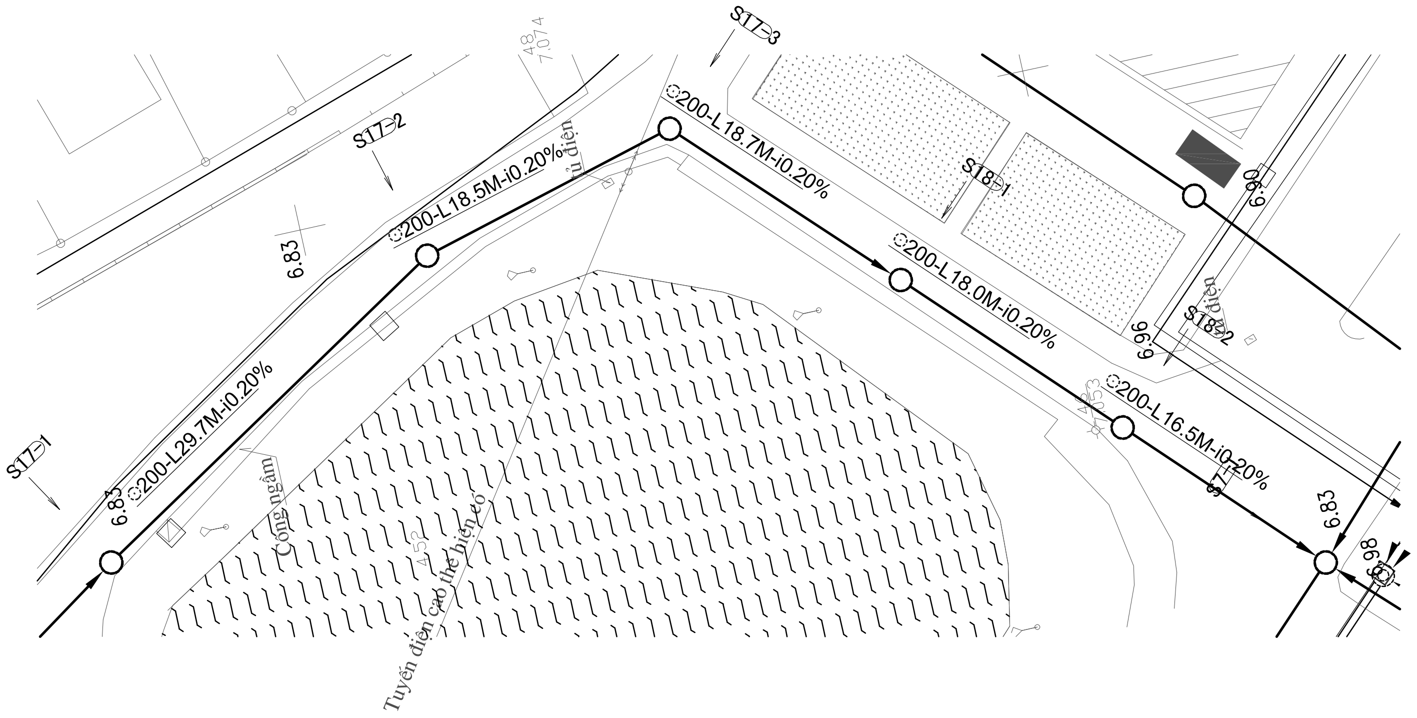
Package

Items

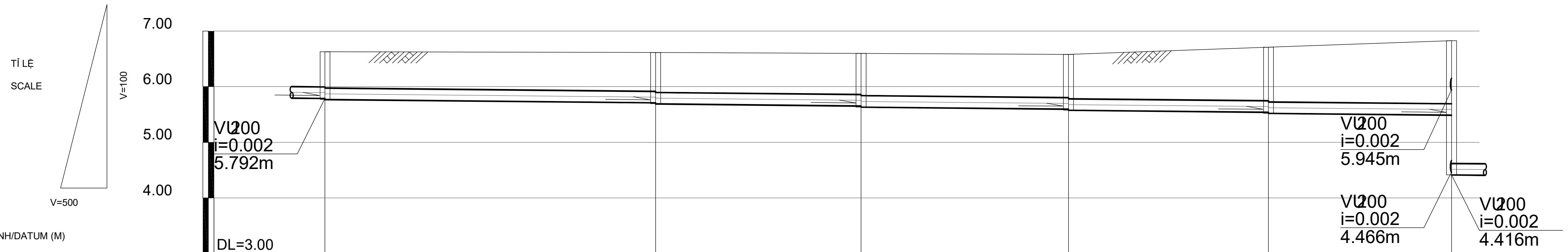
Scale.	CUWC-SEWERAGE-LT-07	Sheet 1/1	Rev A	Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỘT SO SÁNH/DATUM (M)

	S17-1		S17-2		S17-3		S18-1		S18-2		S7-1
MẶT PHỦ HIỆN TRẠNG EXISTING COVER											
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.63		+6.61		+6.60		+6.58		+6.71		+6.83
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+5.772		+5.713 +5.693		+5.656 +5.636		+5.599 +5.579		+5.543 +5.523		+5.490
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.65		0.69 0.71		0.73 0.75		0.77 0.79		0.96 0.98		1.13
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT				0.002				0.002			
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL					VU200 - Polyvinyl chloride pipe VU						
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	29.74	29.74	18.48	48.22	18.66	66.88	18.00	84.88	16.48	101.36
TÊN CỌC/ HỐ GA STATION/MANHOLE	S17-1		S17-2		S17-3		S18-1		S18-2		S7-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	182		196		241		180		180		270

College of Urban Works Construction (CUWC)

Check	Name	Signature
Designed		
Drawn		
Checked		
Approved		

	Name	Signature
Drawing		
Design		
Check		
Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM S17-1 TO S7-1

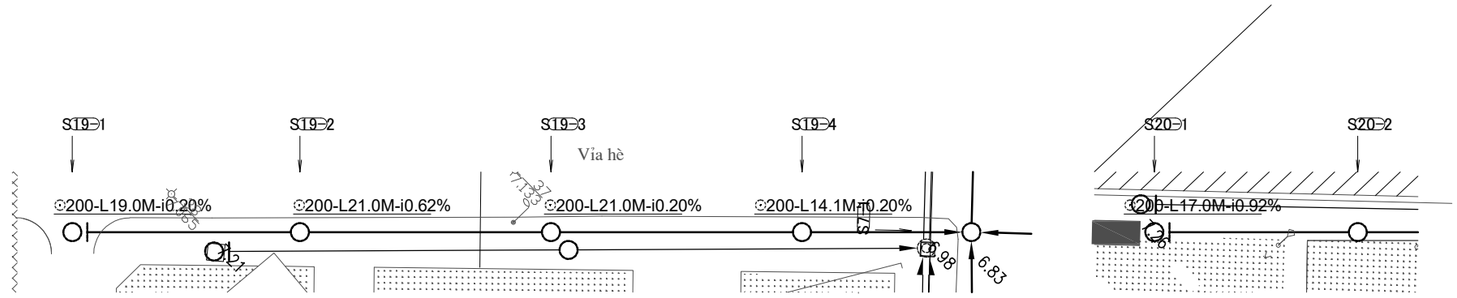
Package

Items

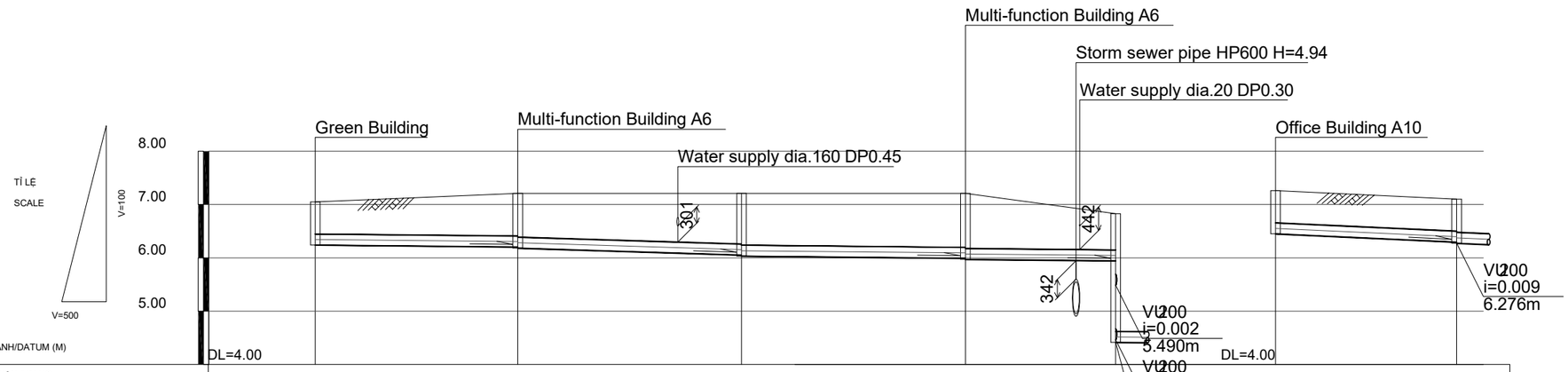
Scale.		Sheet	Rev	Date
	CUWC-SEWERAGE-LT-08	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE

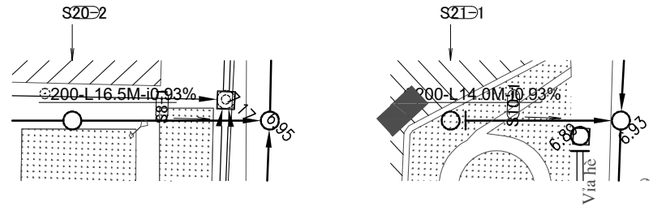


CỌT SO SÁNH/DATUM (M)													
MẶT PHỦ HIỆN TRẠNG EXISTING COVER													
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.05		+7.21		+7.21		+7.21		+6.83		+7.26		+7.10
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.243		+6.205 +6.185		+6.055 +6.035		+5.993 +5.973		+5.945		+6.452		+6.296
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.60		0.80 0.82		0.95 0.97		1.01 1.03		0.68		0.60		0.60
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.002		0.006		0.002						0.009	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		VU200 - Polyvinyl chloride pipe VU									VU200 - Polyvinyl chloride pipe VU		
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	19.00	19.00	21.00	40.00	21.00	61.00	14.10	75.10		0.00	17.00	17.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	S19-1		S19-2		S19-3		S19-4		S7-1		S20-1		S20-2
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)			180		180		180		91				180

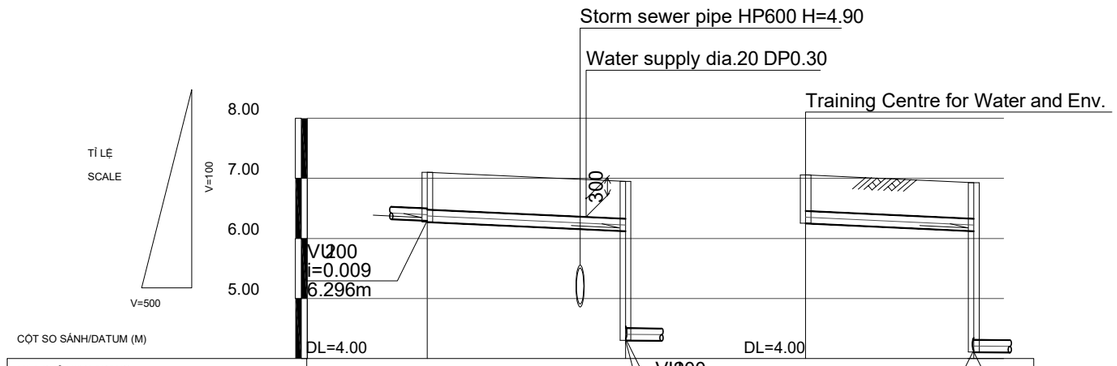
				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature	Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC	
					Designed				Drawing			MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE FROM S19-1 TO S7-1, FROM S20-1 TO S20-2	Package
					Drawn				Design				Items
					Checked				Check				
					Approved				Team Leader			Scale. CUWC-SEWERAGE-LT-09 / Sheet 1/1 / Rev A / Date Nov. 2019	

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER			
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.10	+6.95	+7.06	+6.93
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.276	+6.123	+6.253	+6.123
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.62	0.62	0.60	0.60
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.009		0.009	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	VU200 - Polyvinyl chloride pipe VU		VU200 - Polyvinyl chloride pipe VU	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	16.50	16.50	0.00	14.00	14.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	S20-2	S8-1	S21-1	S10-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	180	91		272

College of Urban Works Construction (CUWC)			
Check	Name	Signature	
Designed			
Drawn			
Checked			
Approved			

	Name	Signature
Drawing		
Design		
Check		
Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM S20-2 TO S8-1, FROM S21-1 TO S10-1

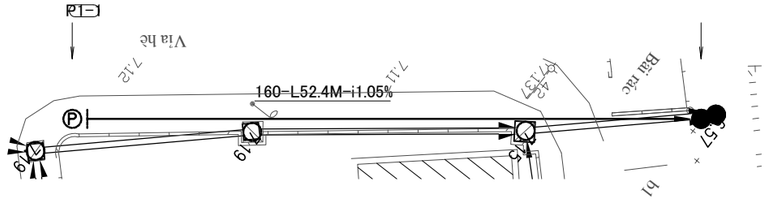
Package

Items

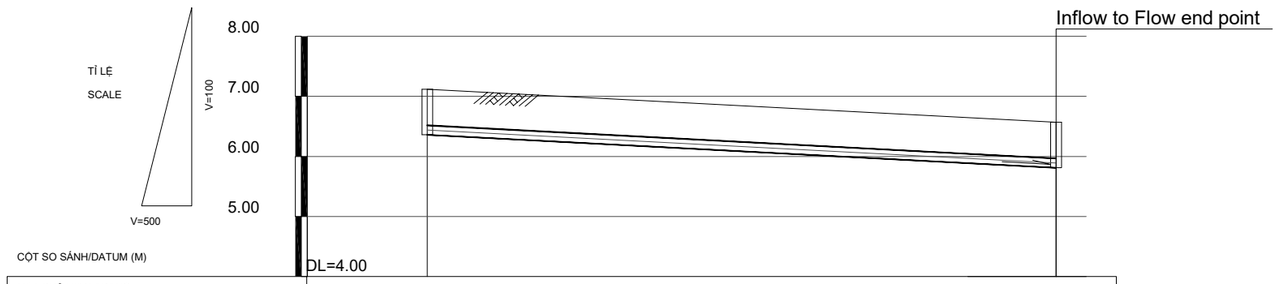
Scale.		Sheet	Rev	Date
	CUWC-SEWERAGE-LT-10	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER	
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.12 ; +6.57
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.364 ; +5.814
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.60 ; 0.60
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.011
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	HDPE160 - Pressure pipe
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00 ; 52.36
TÊN CỌC/ HỐ GA STATION/MANHOLE	P1-1 ; EP2
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	

				College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
					Designed			Drawing		
					Drawn			Design		
					Checked			Check		
					Approved			Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM P1-1 TO END POINT 2

Package

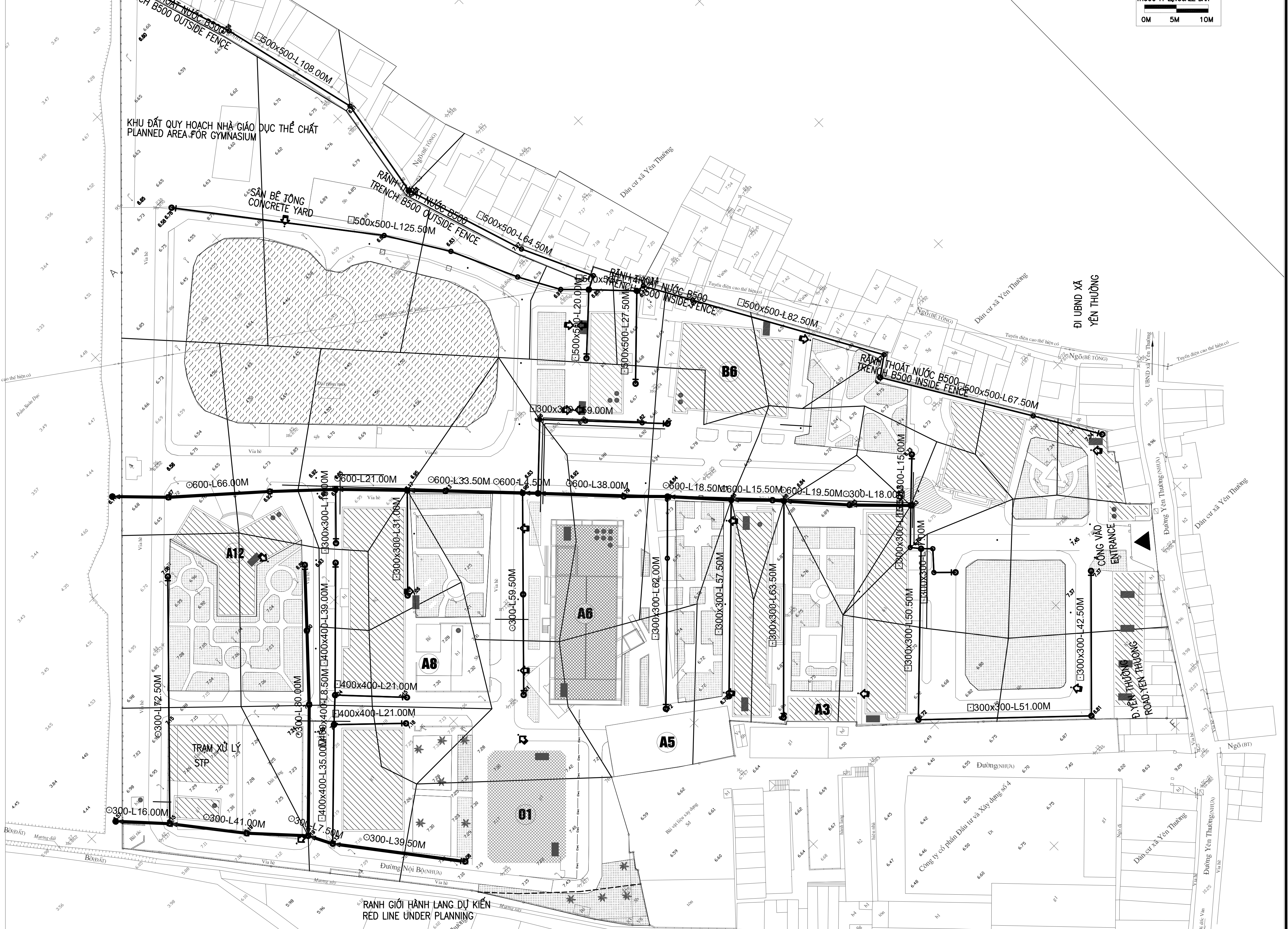
Items

Scale.	CUWC-SEWERAGE-LT-11	Sheet 1/1	Rev A	Date Nov. 2019

MẶT BẰNG HỆ THỐNG THOÁT NƯỚC MƯA
GENERAL LAYOUT OF DRAINAGE SYSTEM

KÝ HIỆU/ SYMBOL

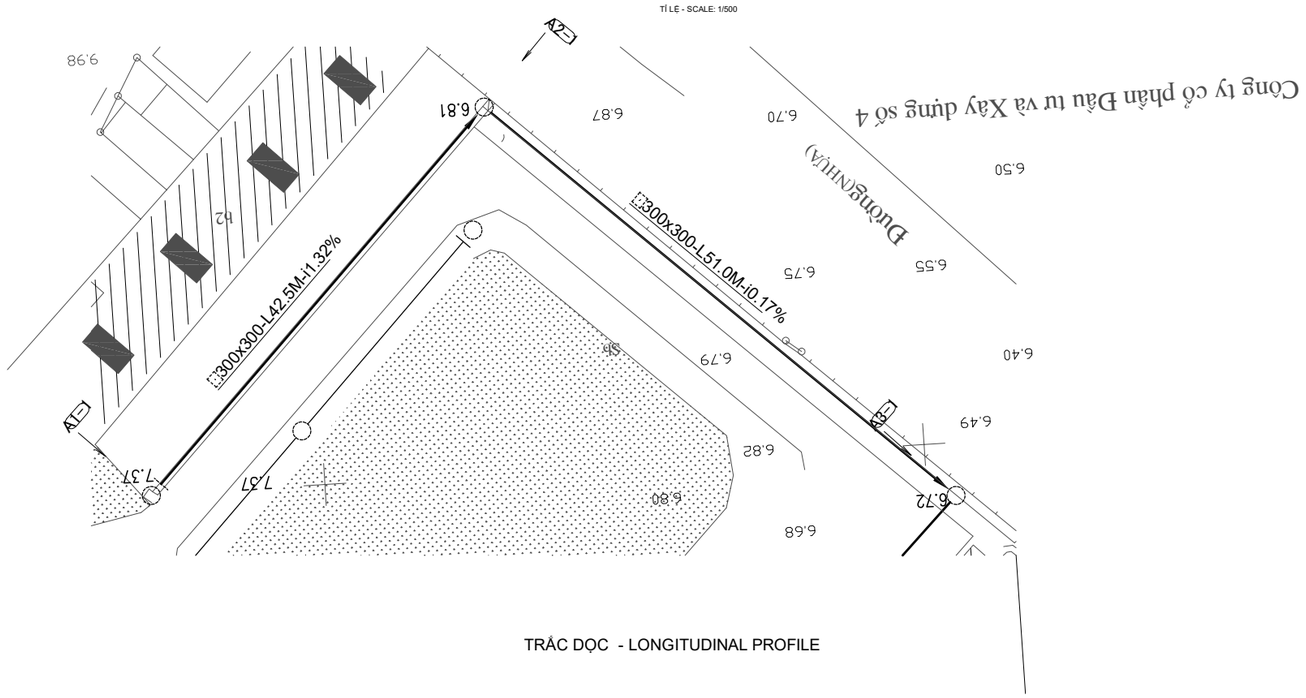
Symbol	Description
(double line)	CỐNG TRÒN STORM PIPE
(single line)	RÃNH THOÁT NƯỚC XÂY GẠCH BRICK TRENCHES
(circle)	HỐ GA XÂY MỚI NEW MANHOLES
(crossed circle)	CỬA XẢ OUTLET
⊙200-L14.1M	ĐƯỜNG KÍNH-CHIỀU DÀI (M) DIAMETER-LENGTH (M)
⊡300X300-L14.1M	RỘNG X SÂU-CHIỀU DÀI (M) WIDTH X HEIGTH-LENGTH (M)



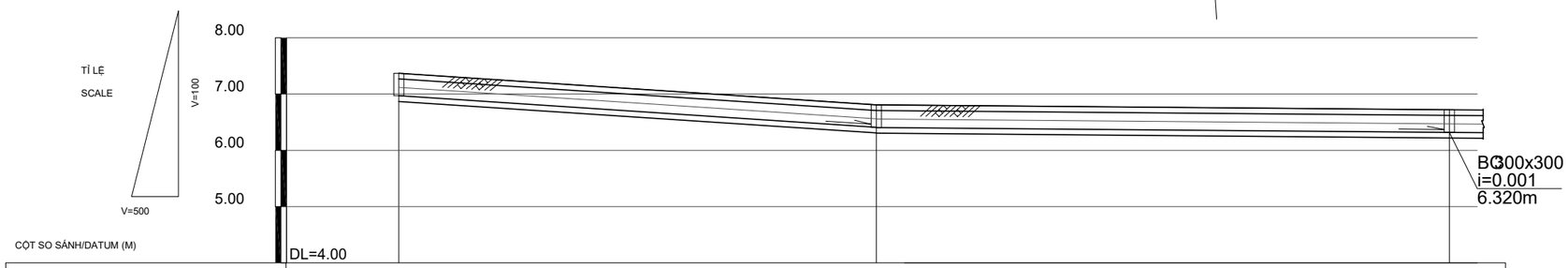
				College of Urban Works Construction (CUWC)	Check	Name	Signature	Check	Name	Signature	Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC
					Designed			Drawing			MẶT BẰNG HỆ THỐNG THOÁT NƯỚC MƯA GENERAL LAYOUT OF DRAINAGE SYSTEM
					Drawn			Design			Package
					Checked			Check			Items
					Approved			Team Leader			Scale. / DWG Number: CUWC-DRAINAGE-LAYOUT-01 / Sheet 1/1 / Rev A / Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỘT SO SÁNH/DATUM (M)			
MẶT PHỦ HIỆN TRẠNG EXISTING COVER			
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.37	+6.81	+6.72
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.970	+6.409 +6.407	+6.320
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.00	0.00	0.00
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.013		0.002
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	BC300x300 - Box culvert		
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	42.50 42.50	51.00 93.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	A1-1	A2-1	A3-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)		269	272

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM A1-1 TO A3-1

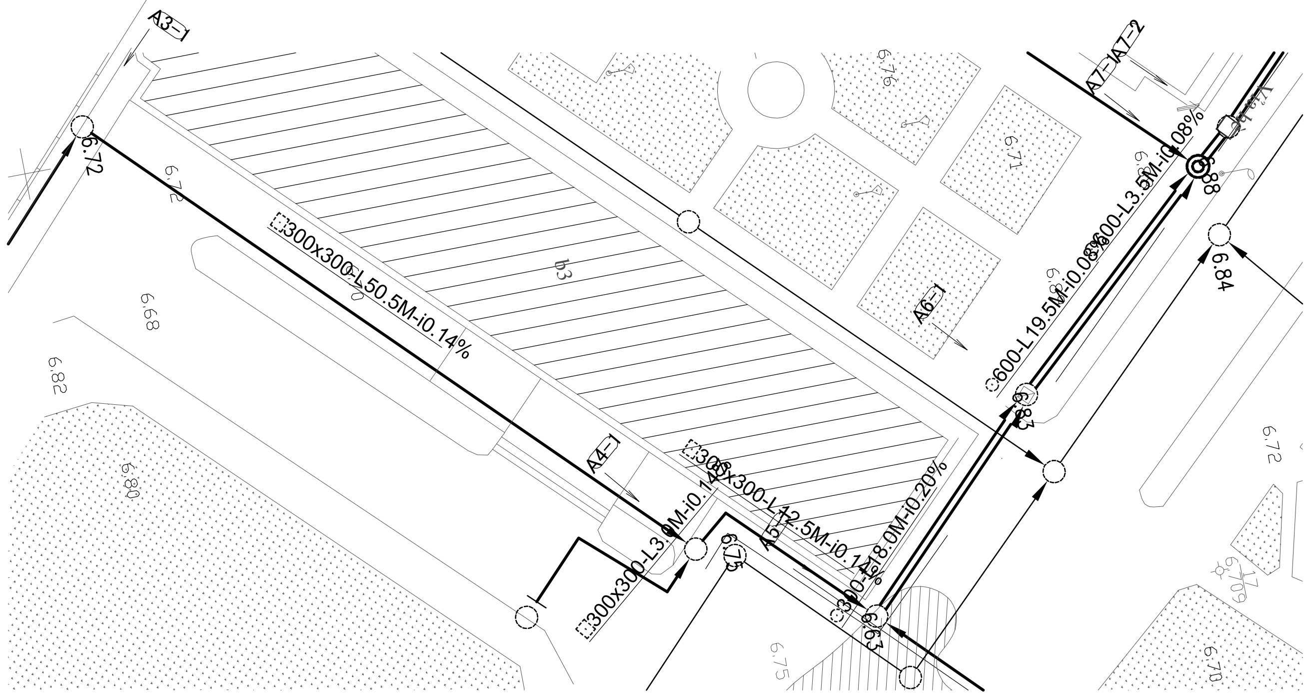
Package

Items

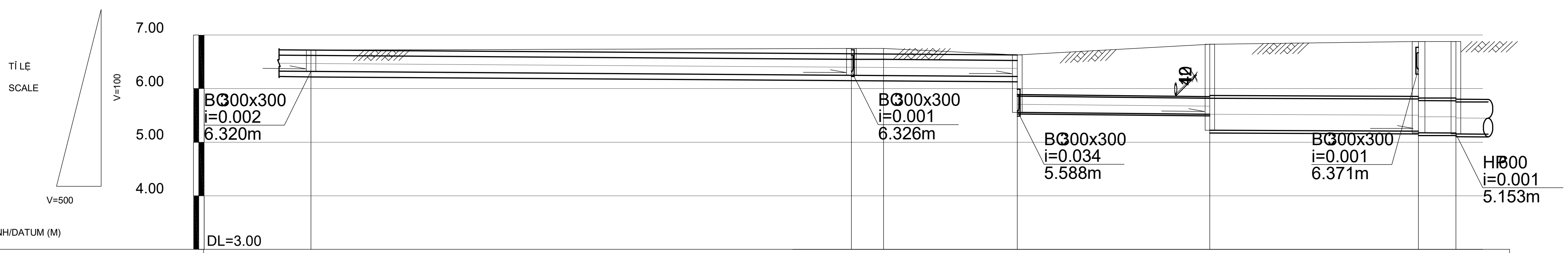
Scale.	CUWC-DRAINAGE-LT-01	Sheet 1/1	Rev A	Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỘT SO SÁNH/DATUM (M)

	A3-1		A4-1		A4-2		A5-1		A6-1		A7-1		A7-2
MẶT PHỦ HIỆN TRẠNG EXISTING COVER													
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.72		+6.75		+6.75		+6.63		+6.83		+6.88		+6.88
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.320		+6.249		+6.245		+6.227 +5.558		+5.522 +5.222		+5.206 +5.176		+5.173
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.00		0.10		0.11		0.00 0.74		0.98 0.96		1.02 1.05		1.06
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.001				0.001		0.002		0.001		0.001	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		BC300x300 - Box culvert						HP300 - Hume pipe		HP600 - Hume pipe			
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	50.50	50.50	3.00	53.50	12.50	66.00	18.00	84.00	19.50	103.50	3.50	107.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	A3-1		A4-1		A4-2		A5-1		A6-1		A7-1		A7-2
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	272		95		264		90		183		181		176

College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
	Designed			Drawing		
	Drawn			Design		
	Checked			Check		
	Approved			Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

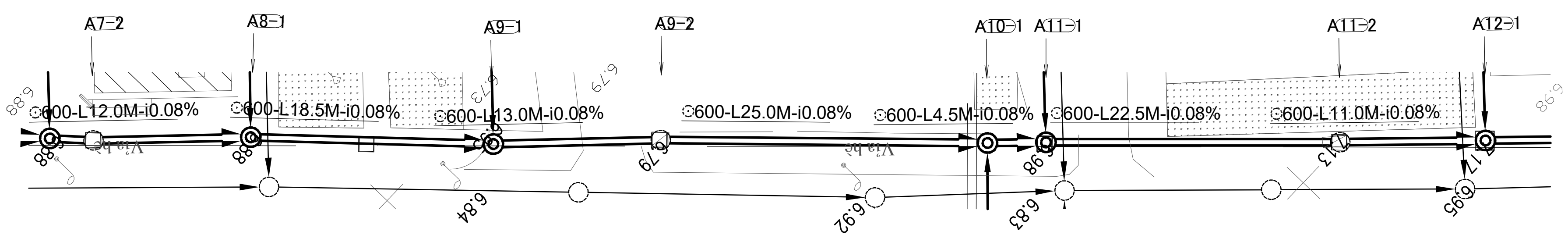
MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM A3-1 TO A7-2

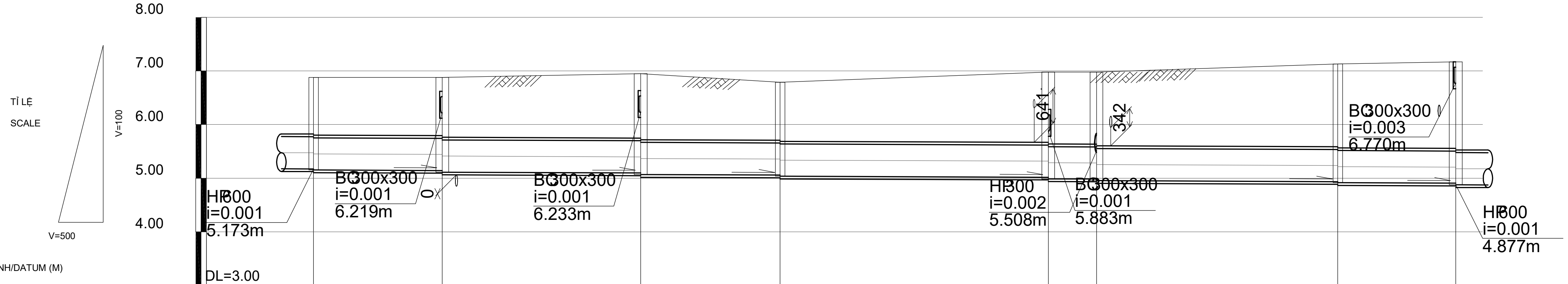
Scale.		Sheet	Rev	Date	Package	Items
	CUWC-DRAINAGE-LT-02	1/1	A	Nov. 2019		

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỌT SO SÁNH/DATUM (M) DL=3.00

	A7-2		A8-1		A9-1		A9-2		A10-1		A11-1		A11-2		A12-1
MẶT PHỦ HIỆN TRẠNG EXISTING COVER															
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.88		+6.88		+6.95		+6.79		+6.98		+6.98		+7.13		+7.17
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+5.153		+5.143 +5.113		+5.098 +5.068		+5.058 +5.038		+5.018 +4.988		+4.984 +4.954		+4.936 +4.916		+4.907
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	1.08		1.09 1.12		1.20 1.23		1.08 1.10		1.31 1.34		1.35 1.38		1.54 1.56		1.61
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.001		0.001		0.001				0.001		0.001			
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	HP600 - Hume pipe														
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	12.00	12.00	18.50	30.50	13.00	43.50	25.00	68.50	4.50	73.00	22.50	95.50	11.00	106.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	A7-2		A8-1		A9-1		A9-2		A10-1		A11-1		A11-2		A12-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	176		183		177		182		179		181		179		180

College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
	Designed			Drawing		
	Drawn			Design		
	Checked			Check		
	Approved			Team Leader		

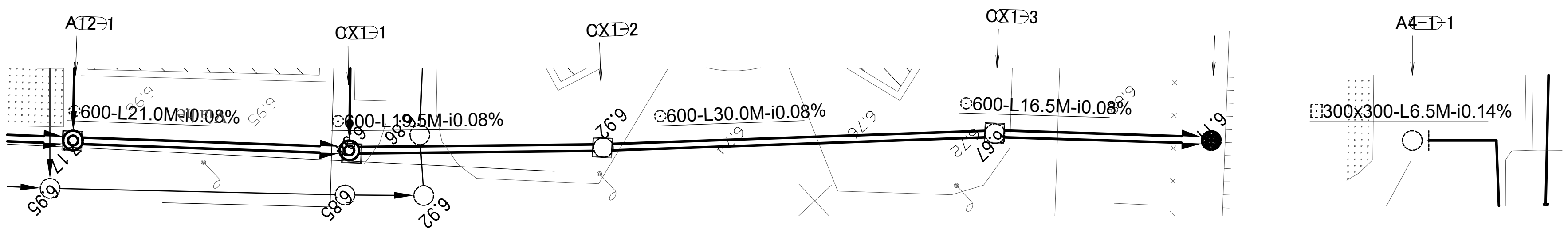
Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM A7-2 TO A12-1

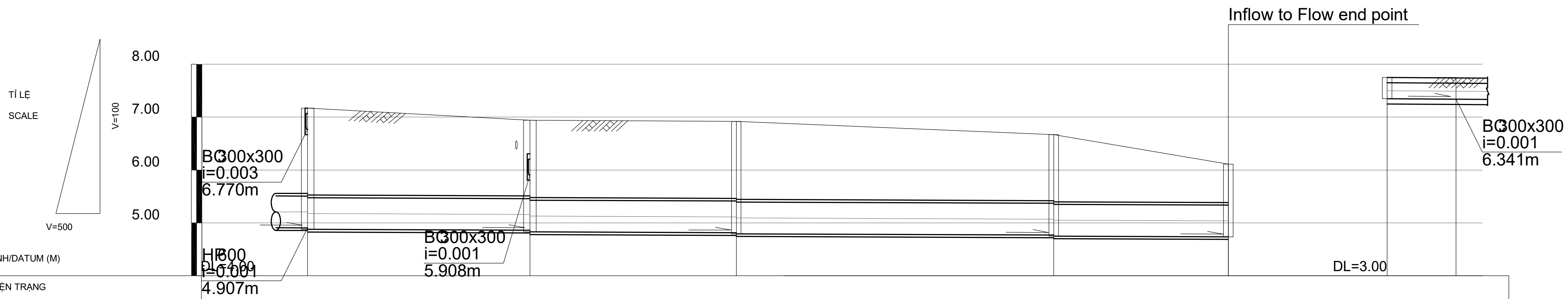
Scale.		Sheet	Rev	Date	Package	Items
	CUWC-DRAINAGE-LT-03	1/1	A	Nov. 2019		

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER												
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.17		+6.94		+6.92		+6.67		+6.11	+6.75		+6.75
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+4.877		+4.860 +4.830		+4.814 +4.794		+4.770 +4.750		+4.737	+6.350		+6.341
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	1.64		1.43 1.46		1.46 1.48		1.25 1.27		0.72	0.00		0.01
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.001		0.001							0.001	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL					HP600 - Hume pipe						BC300x300 - Box culvert	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	21.00	21.00	19.50	40.50	30.00	70.50	16.50	87.00	0.00	6.50	6.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	A12-1		CX1-1		CX1-2		CX1-3			A4-1-1		A4-1-2
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	91		177		179		184					268

College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
	Designed			Drawing		
	Drawn			Design		
	Checked			Check		
	Approved			Team Leader		

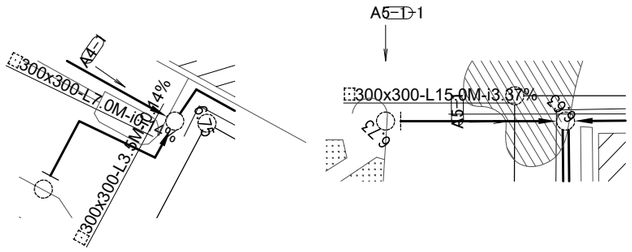
Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM A12-1 TO CX1, FROM A4-1-1 TP A4-1-2

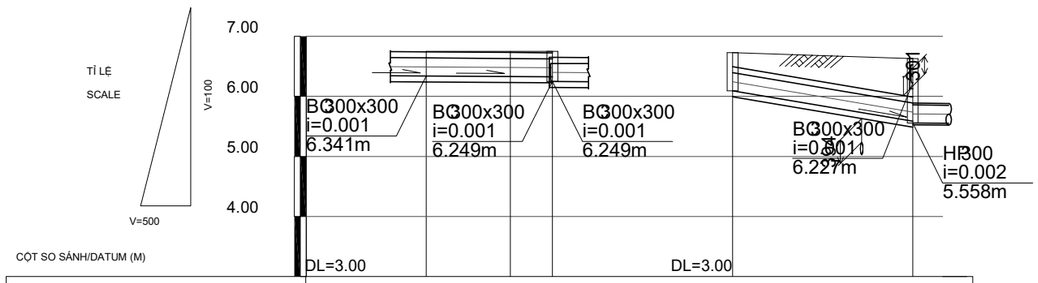
Package	Items	Scale.		Sheet	Rev	Date
			CUWC-DRAINAGE-LT-04	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER							
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.75	+6.75	+6.75		+6.73		+6.63
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.341	+6.331	+6.326		+6.094		+5.588
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.01	0.02	0.02		0.24		0.64
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.001				0.034	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		BC300x300 - Box culvert				BC300x300 - Box culvert	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	7.00	7.00	3.50 10.50	0.00	15.00	15.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	A4-1-2		A4-1-3	A4-1	A5-1-1		A5-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	268		93	186			269

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM A4-1-2 TO A5-1

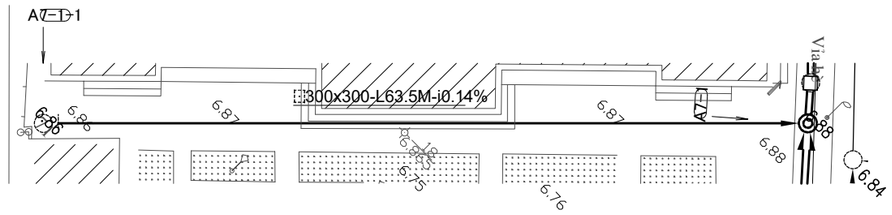
Package

Items

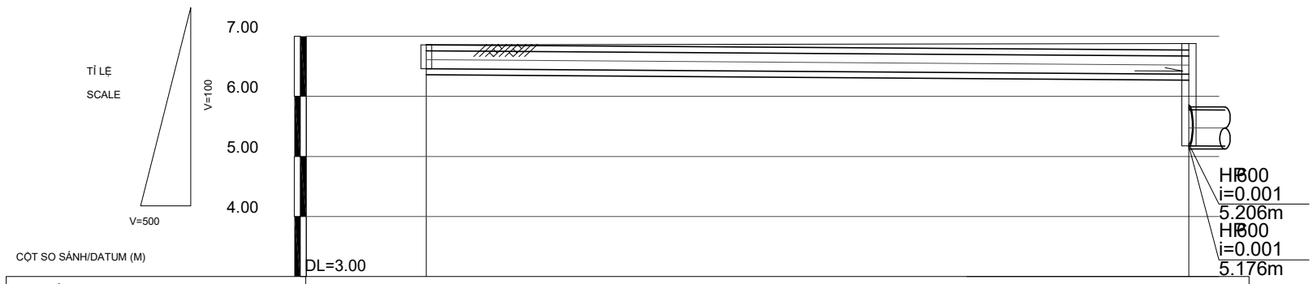
Scale.		Sheet	Rev	Date
	CUWC-DRAINAGE-LT-05	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER		
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.86	+6.88
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.460	+6.371
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.00	0.11
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.001	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	BC300x300 - Box culvert	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00 / 63.50	63.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	A7-1-1	A7-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)		94

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM A7-1-1 TO A7-1

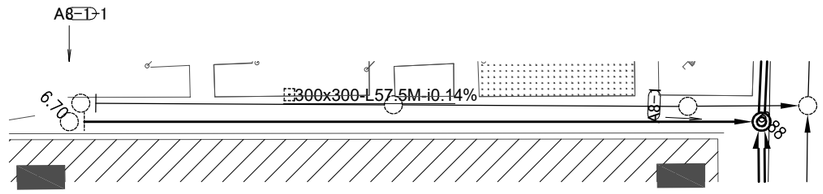
Package

Items

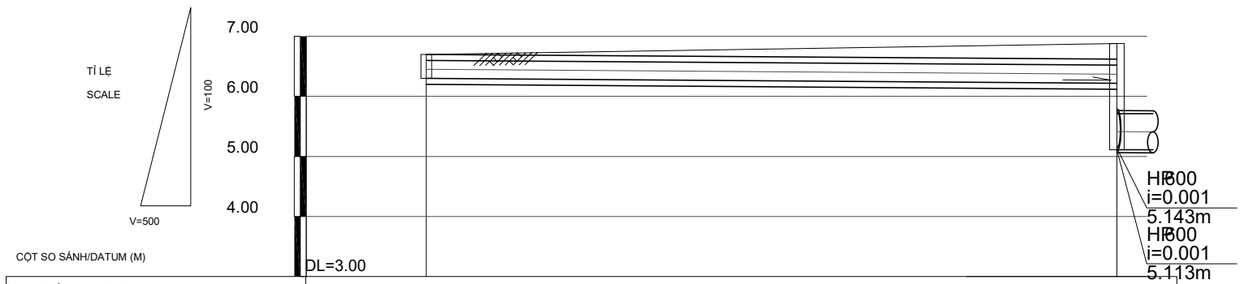
Scale.	CUWC-DRAINAGE-LT-06	Sheet 1/1	Rev A	Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER		
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.70	+6.88
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.300	+6.219
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.00	0.26
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.001	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	BC300x300 - Box culvert	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00 / 57.50	57.50 / 57.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	A8-1-1	A8-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)		93

				College of Urban Works Construction (CUWC)	Check	Name	Signature		
					Designed				
					Drawn				
					Checked				
					Approved				

	Name	Signature
Drawing		
Design		
Check		
Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM A8-1-1 TO A8-1

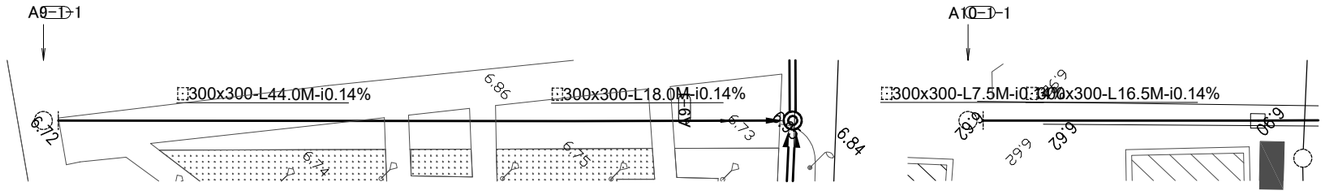
Package

Items

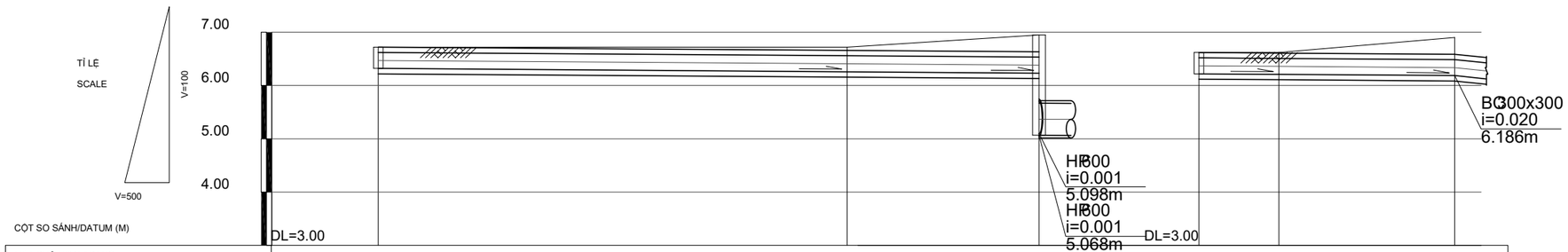
Scale.		Sheet	Rev	Date
	CUWC-DRAINAGE-LT-07	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER						
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.72	+6.72	+6.95	+6.62	+6.62	+6.90
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.320	+6.258	+6.233	+6.220	+6.209	+6.186
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.00	0.06	0.32	0.00	0.01	0.31
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.001			0.001		
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	BC300x300 - Box culvert			BC300x300 - Box culvert		
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	44.00	44.00 / 18.00 / 62.00	0.00	7.50 / 7.50	16.50 / 24.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	A9-1-1	A9-1-2	A9-1	A10-1-1	A10-1-2	A10-1-3
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)		180	90		180	180

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM A9-1-1 TO A9-1, FROM A10-1-1 TO A10-1-3

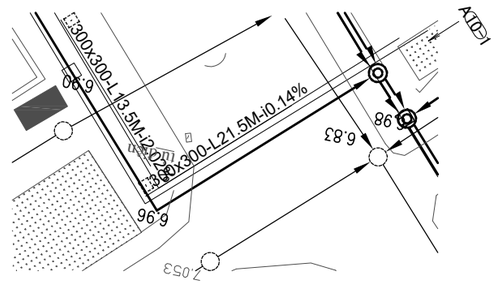
Package

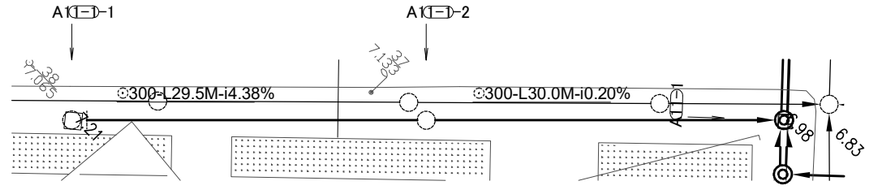
Items

Scale.	CUWC-DRAINAGE-LT-08	Sheet	Rev	Date
		1/1	A	Nov. 2019

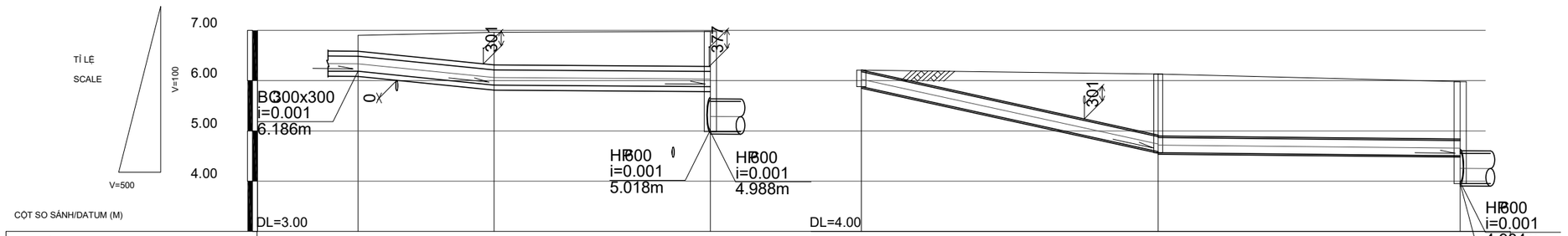
MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500





TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER											
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.90	+6.96	+6.98	+7.21	+7.13	+6.98					
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.186	+5.913	+5.883	+6.880	+5.588 +5.568	+5.508					
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.31	0.65	0.70	0.00	1.21 1.23	1.14					
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.020		0.001		0.044		0.002			
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		BC300x300 - Box culvert				HP300 - Hume pipe					
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	13.50	13.50	21.50	35.00	0.00	29.50	29.50	30.00	59.50	
TÊN CỌC/ HỐ GA STATION/MANHOLE	A10-1-3		A10-1-4		A10-1	A11-1-1		A11-1-2		A11-1	
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	180		90		269			180		92	

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM A10-1-3 TO A10-1, FROM A11-1-1 TO A11-1

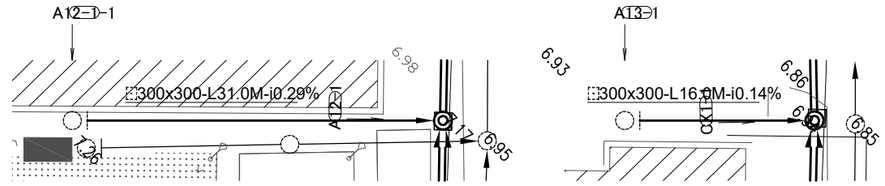
Package

Items

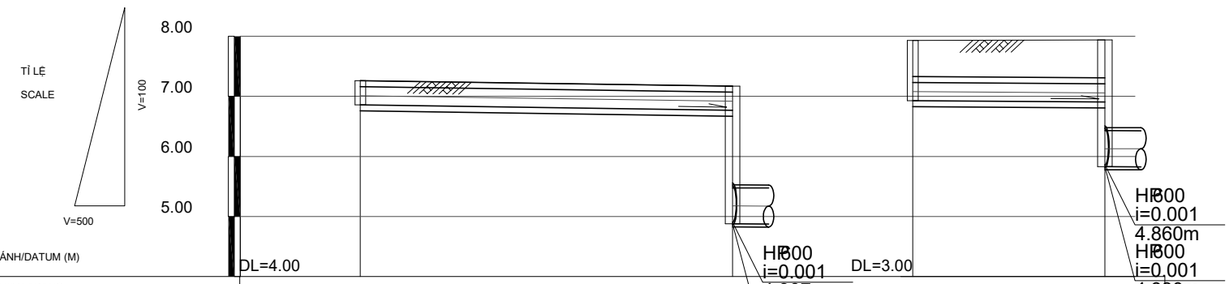
Scale.	CUWC-DRAINAGE-LT-09	Sheet 1/1	Rev A	Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER				
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.26	+7.17	+6.93	+6.94
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.860	+6.770	+5.930	+5.908
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.00	0.00	0.60	0.63
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.003		0.001	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	BC300x300 - Box culvert		BC300x300 - Box culvert	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	31.00 / 31.00	0.00	16.00 / 16.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	A12-1-1	A12-1	A13-1	CX1-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)		91		89

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM A12-1-1 TO A12-1, FROM A13-1 TO CX1-1

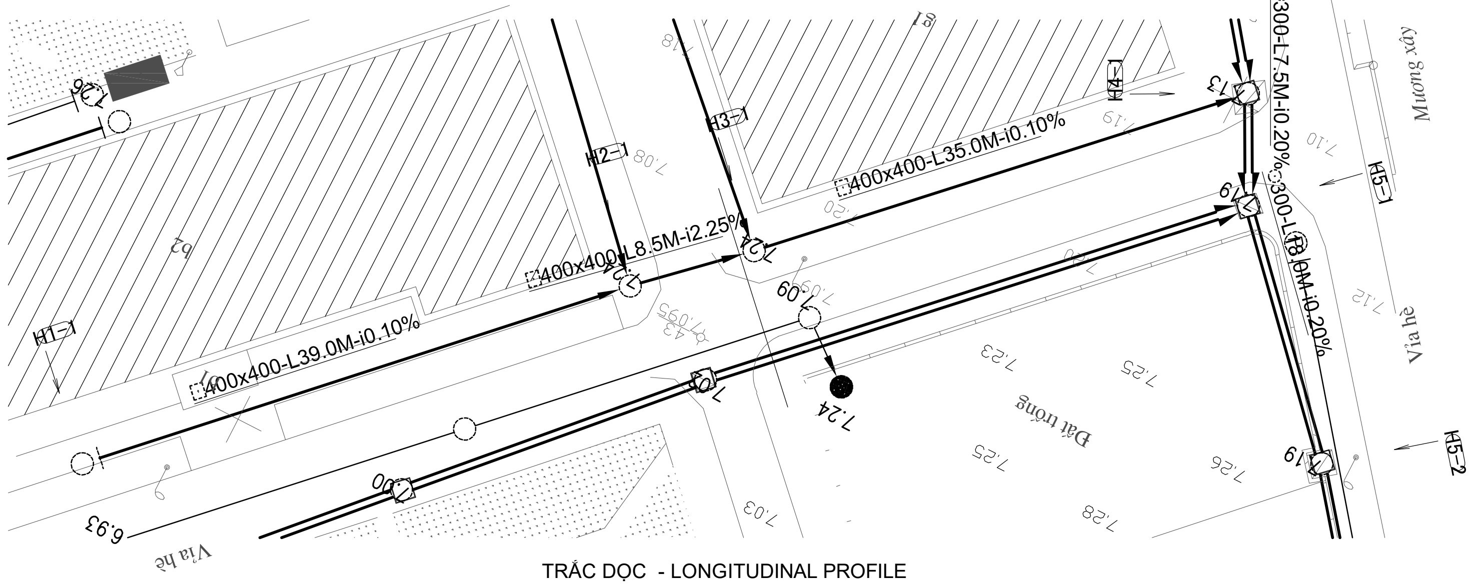
Package

Items

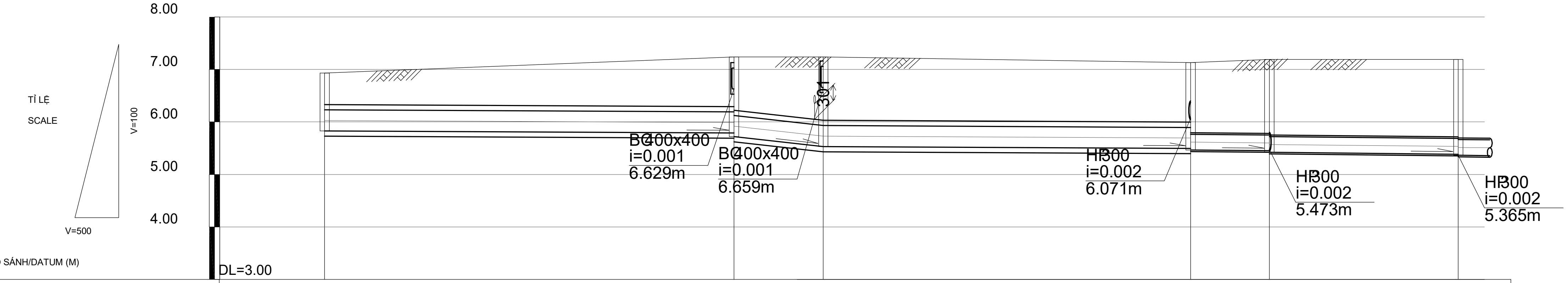
Scale.	CUWC-DRAINAGE-LT-10	Sheet 1/1	Rev A	Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỘT SO SÁNH/DATUM (M)

MẶT PHỦ HIỆN TRẠNG EXISTING COVER											
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.93		+7.24		+7.24		+7.13		+7.19		+7.19
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+5.830		+5.791 +5.722		+5.531		+5.496 +5.466		+5.451 +5.421		+5.385
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.60		0.95 1.02		1.21		1.13 1.33		1.41 1.44		1.48
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.001		0.023		0.001		0.002		0.002	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		BC400x400 - Box culvert						HP300 - Hume pipe			
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	39.00	39.00	8.50	47.50	35.00	82.50	7.50	90.00	18.00	108.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	H1-1		H2-1		H3-1		H4-1		H5-1		H5-2
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)			182		178		288		164		185

College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
	Designed			Drawing		
	Drawn			Design		
	Checked			Check		
	Approved			Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

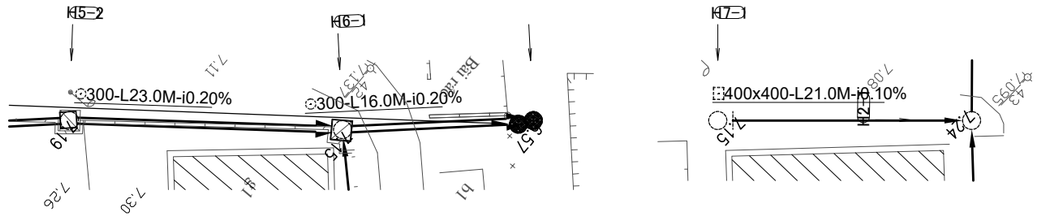
MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM H1-1 TO H5-2

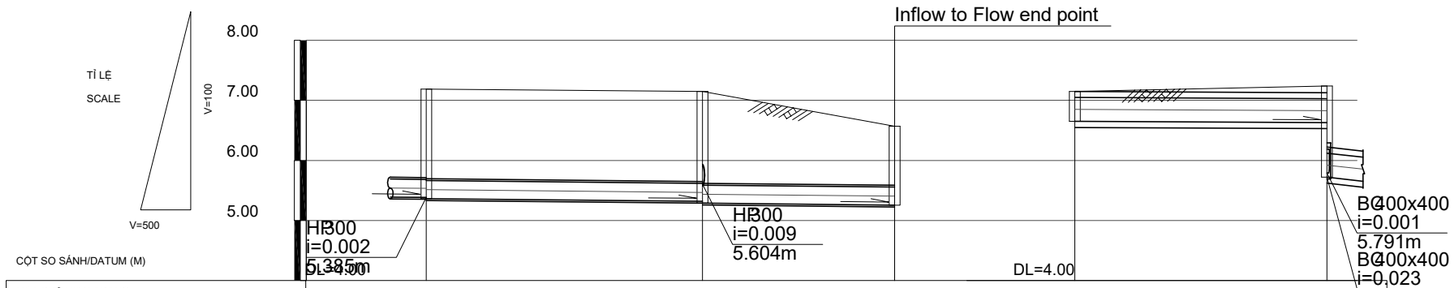
Scale.		Sheet	Rev	Date	Package	Items
	CUWC-DRAINAGE-LT-11	1/1	A	Nov. 2019		

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER					
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.19	+7.15	+6.57	+7.15	+7.24
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+5.365	+5.319 +5.289	+5.257	+6.650	+6.629
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	1.50	1.50 1.53	0.98	0.00	0.11
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.002	0.002		0.001
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		HP300 - Hume pipe		BC400x400 - Box culvert	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	23.00 23.00	16.00 39.00	0.00	21.00 21.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	H5-2	H6-1		H7-1	H2-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	185	175			90

College of Urban Works Construction (CUWC)			
Check	Name	Signature	
Designed			
Drawn			
Checked			
Approved			

	Name	Signature
Drawing		
Design		
Check		
Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM H5-2 TO H2-1

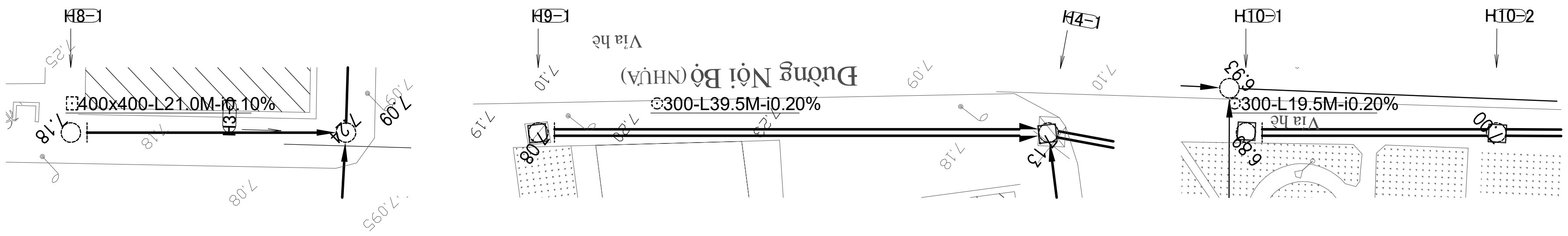
Package

Items

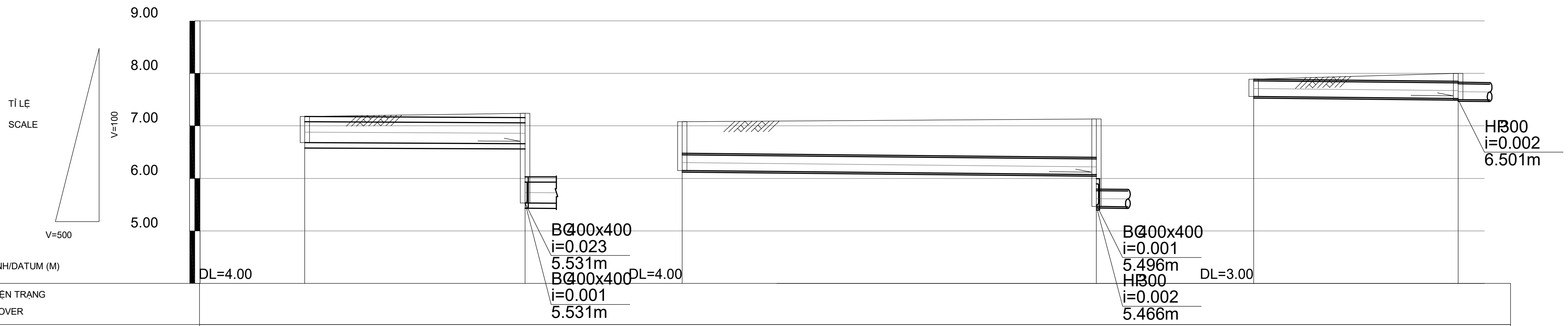
Scale.		Sheet	Rev	Date
	CUWC-DRAINAGE-LT-12	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỌT SO SÁNH/DATUM (M)	DL=4.00		DL=4.00		DL=3.00	
MẶT PHỦ HIỆN TRẠNG EXISTING COVER						
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.18	+7.24	+7.08	+7.13	+6.89	+7.00
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.680	+6.659	+6.150	+6.071	+6.560	+6.521
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.00	0.08	0.60	0.73	0.00	0.15
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.001		0.002		0.002	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	BC400x400 - Box culvert		HP300 - Hume pipe		HP300 - Hume pipe	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) PARTIAL & ACUMULATIVE DISTANCE (M)	0.00 / 21.00	21.00	0.00 / 39.50	39.50	0.00 / 19.50	19.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	H8-1	H3-1	H9-1	H4-1	H10-1	H10-2
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)		92		190		180

College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
	Designed			Drawing		
	Drawn			Design		
	Checked			Check		
	Approved			Team Leader		

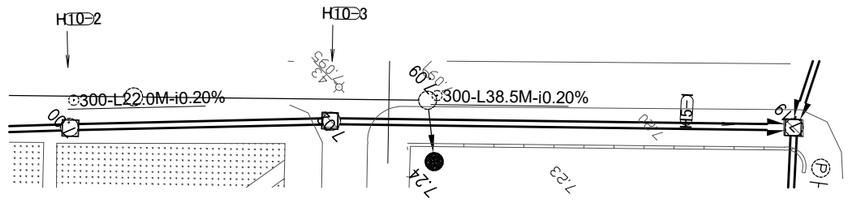
Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM H8-1 TO H3-1, FROM H9-1 TO H4-1, FROM H10-1 TO H10-2

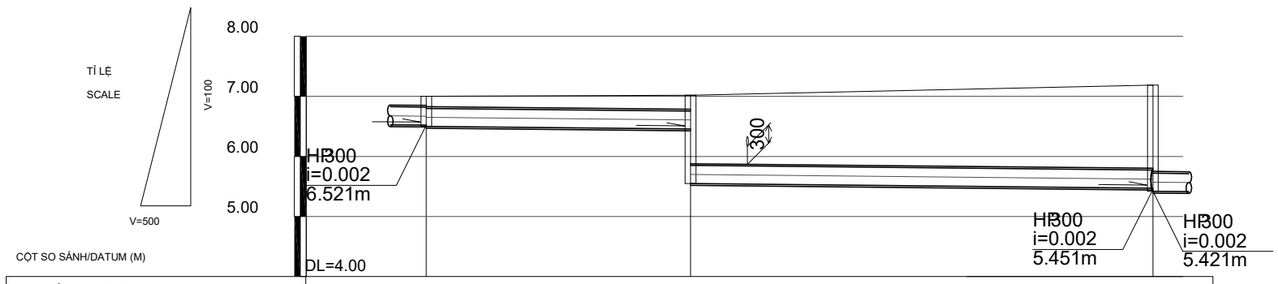
Package	Items	Scale.		Sheet	Rev	Date
			CUWC-DRAINAGE-LT-13	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER			
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.00	+7.02	+7.19
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.501	+6.457 +5.550	+5.473
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.17	0.23 1.14	1.39
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.002		
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	HP300 - Hume pipe		
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	22.00 22.00	38.50 60.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	H10-2	H10-3	H5-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	180	182	272

				College of Urban Works Construction (CUWC)	Check	Name	Signature		
					Designed				
					Drawn				
					Checked				
					Approved				

	Name	Signature
Drawing		
Design		
Check		
Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM H10-2 TO H5-1

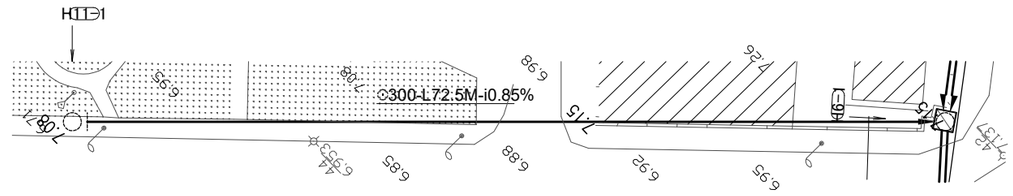
Package

Items

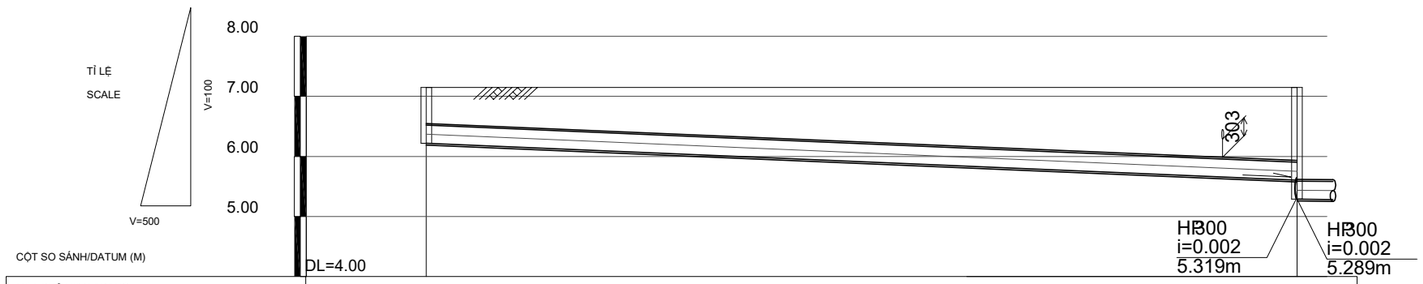
Scale.		Sheet	Rev	Date
	CUWC-DRAINAGE-LT-14	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER		
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.15	+7.15
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.220	+5.604
CHIỀU DÀY MẶT PHỤ (M) DEPTH OF COVER (M)	0.60	1.22
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.009	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	HP300 - Hume pipe	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00 / 72.50	72.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	H11-1	H6-1
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)		273

				College of Urban Works Construction (CUWC)	Check	Name	Signature		
					Designed				
					Drawn				
					Checked				
					Approved				

	Name	Signature
Drawing		
Design		
Check		
Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE
FROM H11-1 TO H6-1

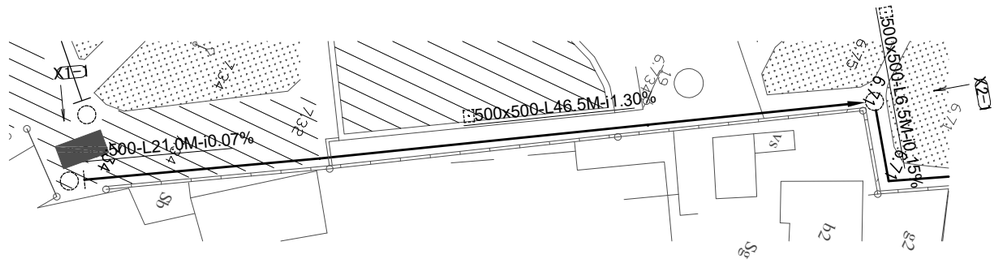
Package

Items

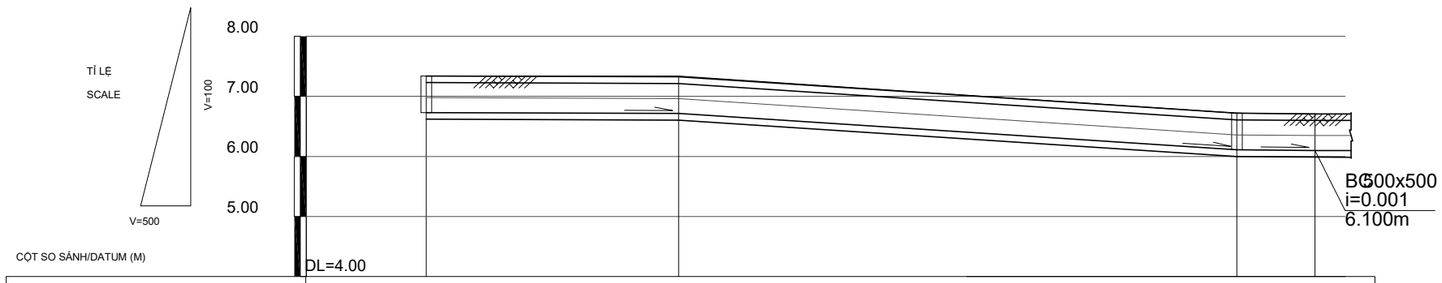
Scale.		Sheet	Rev	Date
	CUWC-DRAINAGE-LT-15	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



COT SO SÁNH/DATUM (M)

MẶT PHỦ HIỆN TRẠNG EXISTING COVER						
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+7.34	+7.34			+6.72	+6.71
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.730	+6.715			+6.110	+6.100
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.00	0.02			0.00	0.00
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.001		0.013		0.002
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		BC500x500 - Box culvert				
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	21.00	21.00	46.50	67.50	6.50 74.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	X1-1		X1-2		X2-1	X2-2
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)			179		266	96

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM X1-1 TO X2-2

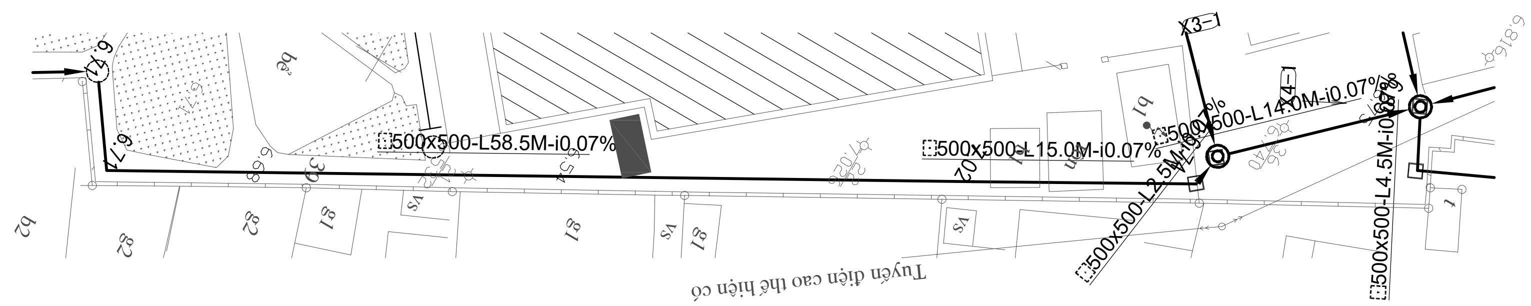
Package

Items

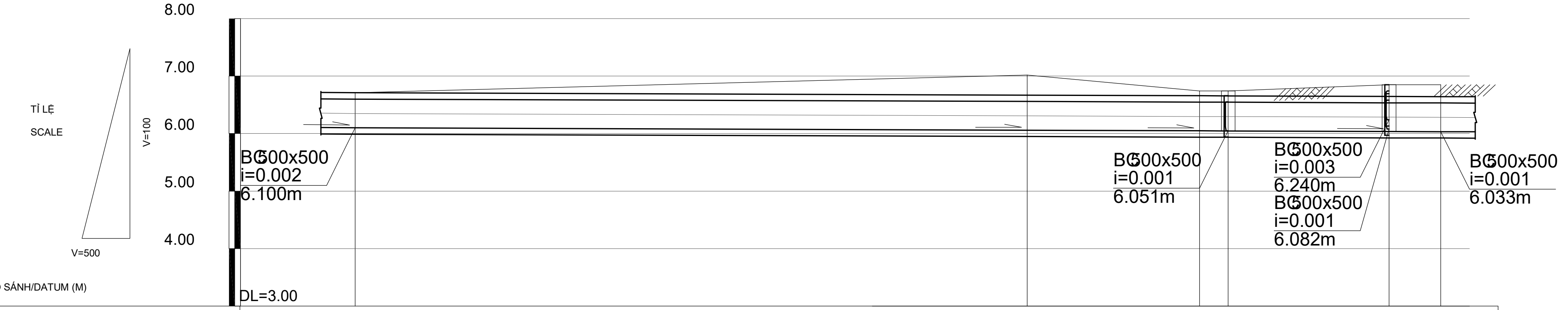
Scale.	CUWC-DRAINAGE-LT-16	Sheet 1/1	Rev A	Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỌT SO SÁNH/DATUM (M) DL=3.00

MẶT PHỦ HIỆN TRẠNG EXISTING COVER						
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.71	+7.02	+6.74	+6.74	+6.85	+6.85
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.100	+6.059	+6.048	+6.046	+6.036	+6.033
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.00	0.35	0.08	0.08	0.20	0.21
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.001			0.001	0.001	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	BC500x500 - Box culvert					
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00 / 58.50	58.50 / 15.00	73.50 / 2.50	76.00 / 14.00	90.00 / 4.50	94.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	X2-2	X2-3	X2-4	X3-1	X4-1	X4-2
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	96	180	127	218	286	92

College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
	Designed			Drawing		
	Drawn			Design		
	Checked			Check		
	Approved			Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM X2-2 TO X4-2

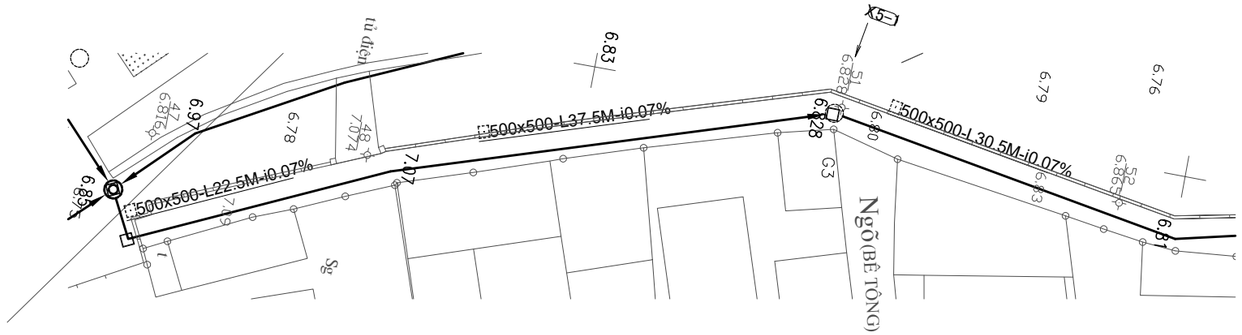
Package

Items

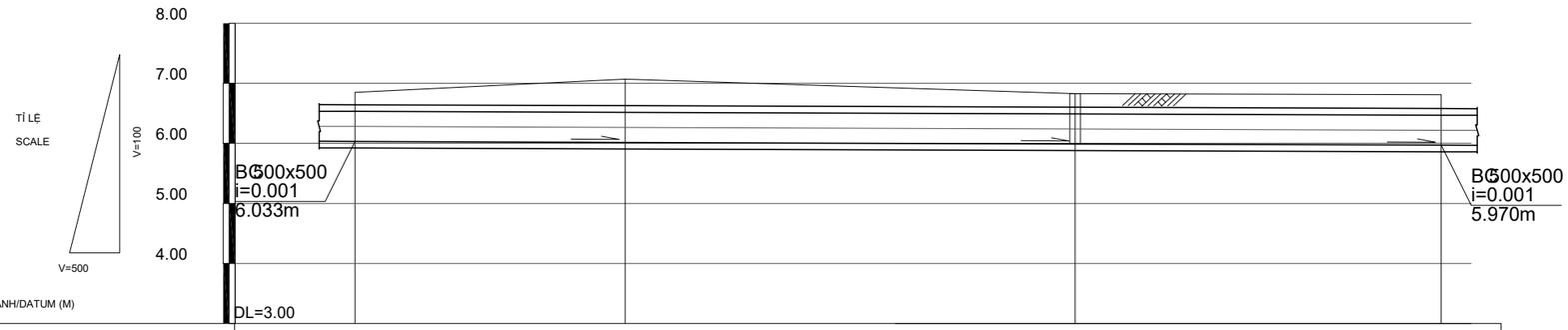
Scale.		Sheet	Rev	Date
	CUWC-DRAINAGE-LT-17	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



COT SO SÁNH/DATUM (M)

MẶT PHỦ HIỆN TRẠNG EXISTING COVER								
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.85		+7.07		+6.83		+6.81	
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.033		+6.017		+5.991		+5.970	
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.21		0.44		0.23		0.23	
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.001				0.001		
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		BC500x500 - Box culvert						
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	22.50	22.50	37.50	60.00	30.50	90.50	
TÊN CỌC/ HỐ GA STATION/MANHOLE	X4-2		X4-3		X5-1		X5-2	
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	92		187		208		157	

				College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
					Designed			Drawing		
					Drawn			Design		
					Checked			Check		
					Approved			Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM X4-2 TO X5-2

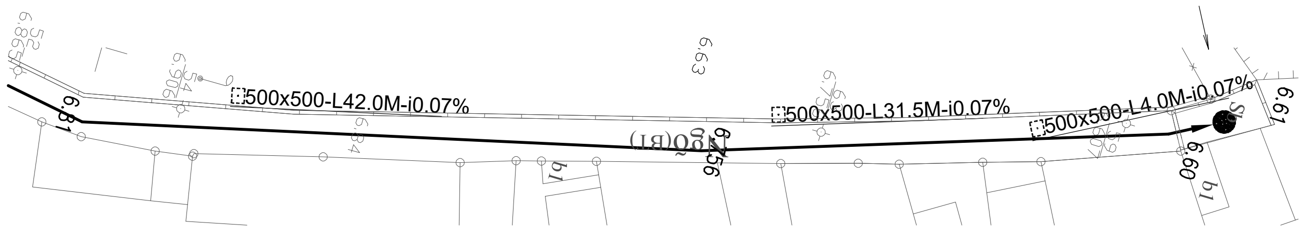
Package

Items

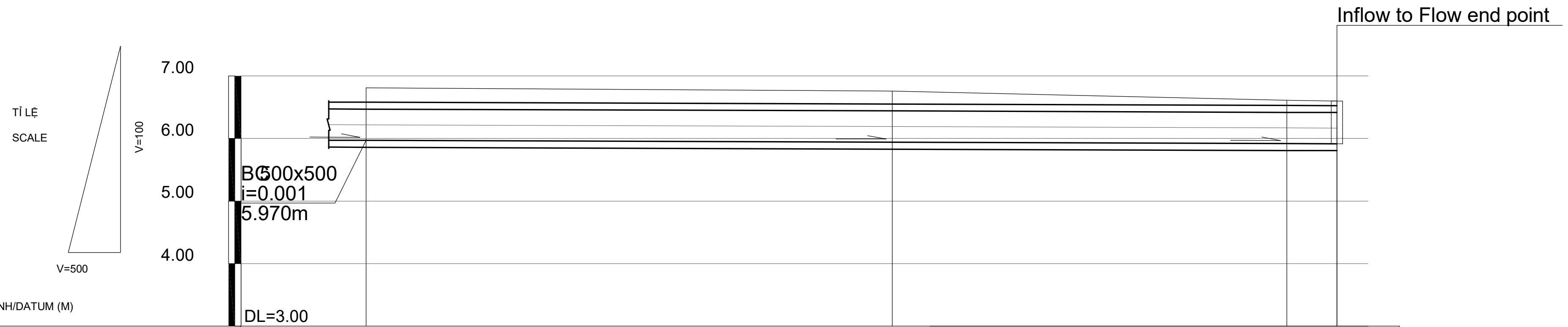
Scale.	CUWC-DRAINAGE-LT-18	Sheet 1/1	Rev A	Date Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



CỘT SO SÁNH/DATUM (M)					
MẶT PHỦ HIỆN TRẠNG EXISTING COVER					
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.81	+6.76	+6.61	+6.60	
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+5.970	+5.941	+5.919	+5.916	
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.23	0.21	0.08	0.07	
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.001				
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	BC500x500 - Box culvert				
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	42.00	42.00	31.50	73.50 / 4.00 / 77.50
TÊN CỌC/ HỐ GA STATION/MANHOLE	X5-2	X5-3	X5-4		
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	157	175	170		

College of Urban Works Construction (CUWC)	Check	Name	Signature		Name	Signature
	Designed			Drawing		
	Drawn			Design		
	Checked			Check		
	Approved			Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

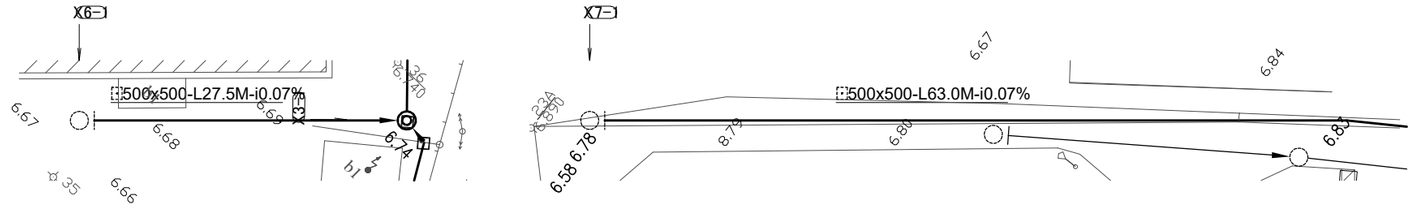
MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE

FROM X5-2 TO X5-4

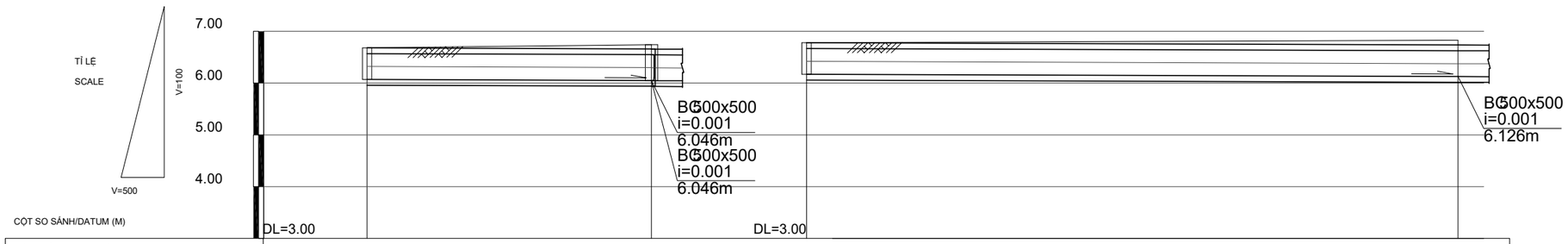
Scale.		Sheet	Rev	Date	Package	Items
	CUWC-DRAINAGE-LT-19	1/1	A	Nov. 2019		

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



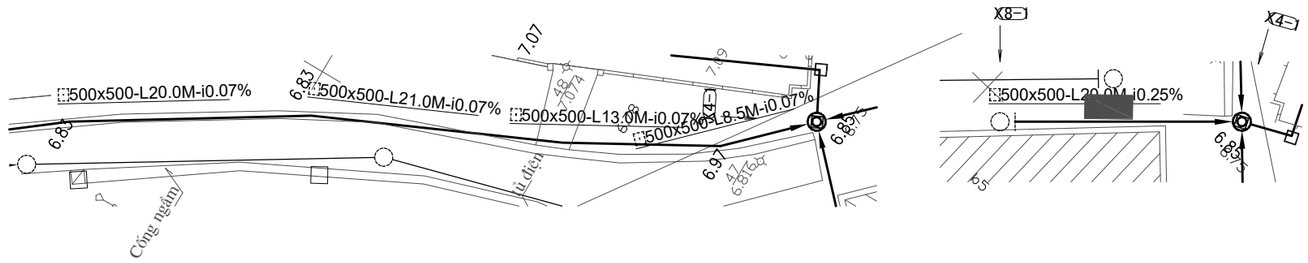
MẶT PHỦ HIỆN TRẠNG EXISTING COVER				
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.68	+6.74	+6.78	+6.83
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.070	+6.051	+6.170	+6.126
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.00	0.08	0.00	0.09
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT	0.001		0.001	
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL	BC500x500 - Box culvert		BC500x500 - Box culvert	
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	27.50	0.00	63.00
	27.50	27.50	63.00	63.00
TÊN CỌC/ HỐ GA STATION/MANHOLE	X6-1	X3-1	X7-1	X7-2
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)		91		186

				College of Urban Works Construction (CUWC)	Check	Name	Signature			Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC
					Designed					MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE FROM X6-1 TO X7-2
					Drawn					
					Checked					
					Approved					
					Drawing					
					Design					
					Check					
					Team Leader					

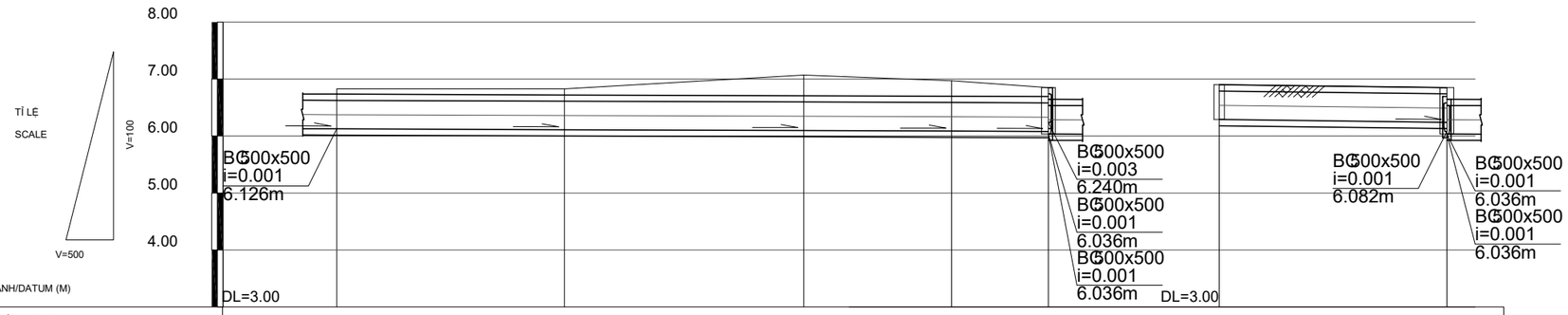
Package	Items	Scale.		Sheet	Rev	Date
			CUWC-DRAINAGE-LT-20	1/1	A	Nov. 2019

MẶT BẰNG - PLAN

TỈ LỆ - SCALE: 1/500



TRẮC DỌC - LONGITUDINAL PROFILE



MẶT PHỦ HIỆN TRẠNG EXISTING COVER													
CAO ĐỘ MẶT PHỦ HIỆN TRẠNG (M) EXISTING COVER ELEVATION (M)	+6.83		+6.83		+7.07		+6.97	+6.85	+6.90		+6.85		
CAO ĐỘ ĐÁY CỐNG (M) INVERT ELEVATION (M)	+6.126		+6.112		+6.097		+6.088	+6.082	+6.290		+6.240		
CHIỀU DÀY MẶT PHỦ (M) DEPTH OF COVER (M)	0.09		0.11		0.36		0.27	0.16	0.00		0.00		
ĐỘ DỐC ĐẶT CỐNG CULVERT GRADIENT		0.001								0.003			
KÍCH THƯỚC CỐNG VÀ VẬT LIỆU SIZE AND MATERIAL		BC500x500 - Box culvert								BC500x500 - Box culvert			
KHOẢNG CÁCH VÀ CỘNG DỒN (M) **PARTIAL & ACUMULATIVE DISTANCE (M)**	0.00	20.00	20.00	21.00	41.00	13.00	54.00	8.50	62.50	0.00	20.00	20.00	
TÊN CỌC/ HỐ GA STATION/MANHOLE	X7-2		X7-3		X7-4		X7-5	X4-1	X8-1		X4-1		
GÓC QUAY TRÊN MẶT BẰNG HORIZONTAL ANGLE (degree)	186		188		175		185	107			196		

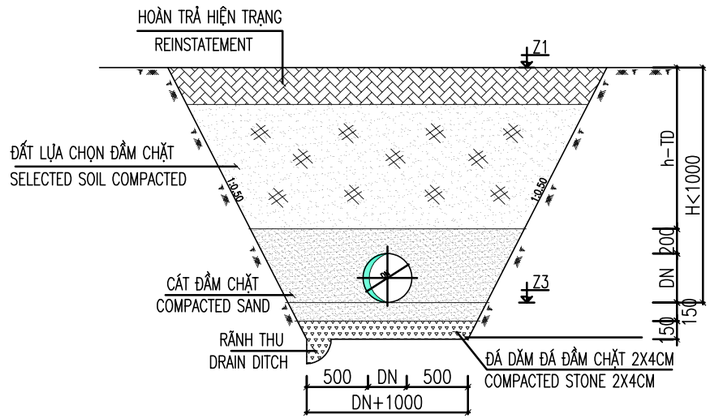
				College of Urban Works Construction (CUWC)	Check	Name	Signature			Name	Signature	Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC	
					Designed				Drawing			MẶT BẰNG VÀ TRẮC DỌC / PLAN AND LONGITUDINAL PROFILE FROM X7-2 TO X4-1	Package
					Drawn				Design				Items
					Checked				Check				
					Approved				Team Leader			Scale. / CUWC-DRAINAGE-LT-21 / Sheet 1/1 / Rev A / Date Nov. 2019	

MƯƠNG ĐẶT ỐNG CẤP NƯỚC
TYPICAL TRENCH FOR SEWERAGE PIPE

MƯƠNG ĐẶT ỐNG LOẠI 1
TYPICAL SECTION OPTION 1

TRƯỜNG HỢP MẶT BẰNG RỘNG RÃI–WIDE AREA

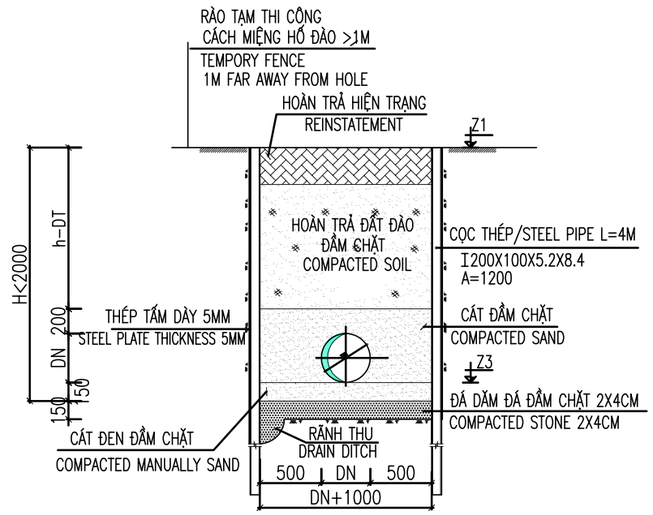
TỈ LỆ–SCALE: 1/50



MƯƠNG ĐẶT ỐNG LOẠI 2
TYPICAL SECTION OPTION 2

ÁP DỤNG CHO CÁC TRƯỜNG HỢP SÁT NHÀ, CỐNG HIỆN TRẠNG VÀ ĐƯỜNG BÊ TÔNG/ NHỰA
LOCATED NEAR HOUSES, EXISTING PIPES AND IN ASPHAL OR CONCRETE ROADS

TỈ LỆ–SCALE: 1/50



				College of Urban Works Construction (CUWC)	Check	Name	Signature		Check	Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

MƯƠNG ĐẶT ỐNG ĐIỂN HÌNH
TYPICAL TRENCH FOR SEWERAGE PIPES

Package

Items

Scale.	DWG Number:	Sheet	Rev	Date
	CUWC–SEW.–11	1/1	A	March 2019

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TL: 1/50

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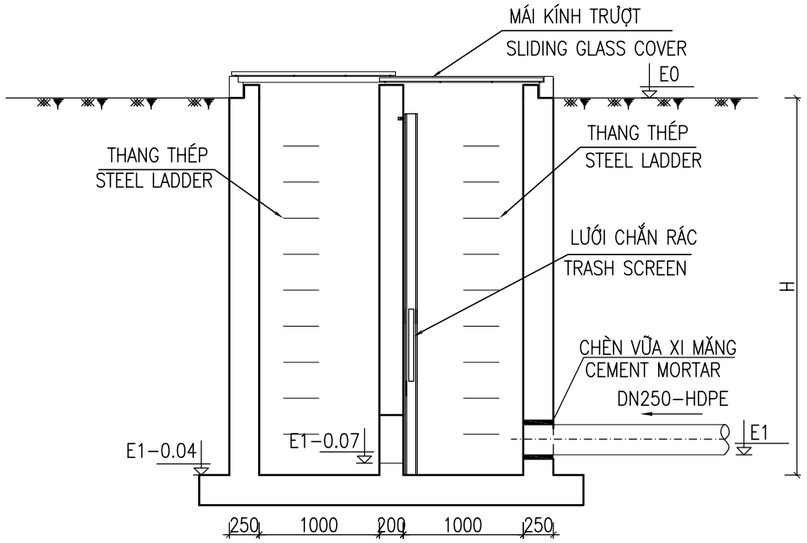

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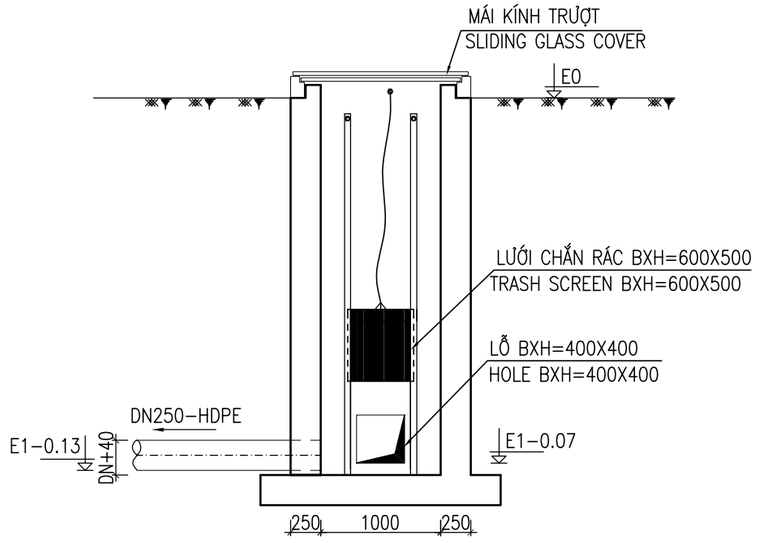

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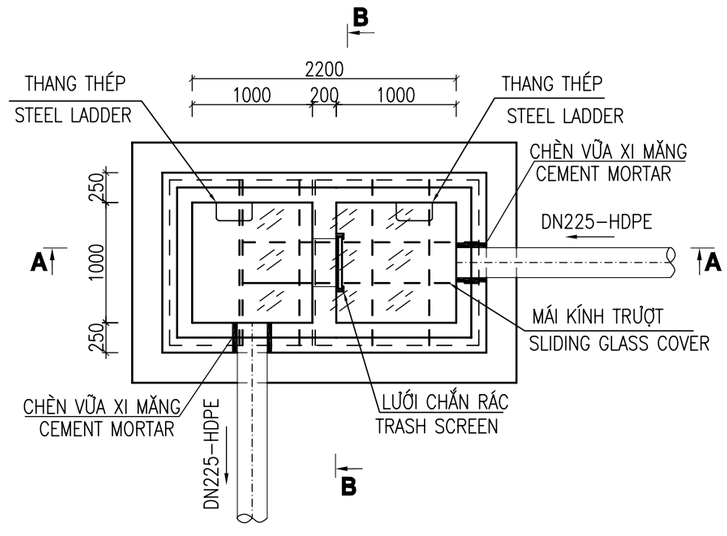

GHI CHÚ/ LEGEND:

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DN1–HDPE	ĐƯỜNG KÍNH(MM)–VẬT LIỆU DIAMETER(MM)–MATERIAL	HDPE	NHỰA HDPE/HDPE PLASTIC

* HỐ GA NƯỚC THẢI LOẠI 3 DÙNG CHO HỐ GA TRƯỚC TRẠM XỬ LÝ
MANHOLE TYPE 3 USING FOR MANHOLE NEAR SEWERAGE TREATMENT PLANT

				College of Urban Works Construction (CUWC)	Check	Name	Signature		Check	Name	Signature
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					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

HỐ GA THĂM NƯỚC THẢI LOẠI 3
WASTEWATER MANHOLE TYPE 3

Package

Items

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	CUWC–SEW.–12	1/1	A	March 2019

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TL: 1/25

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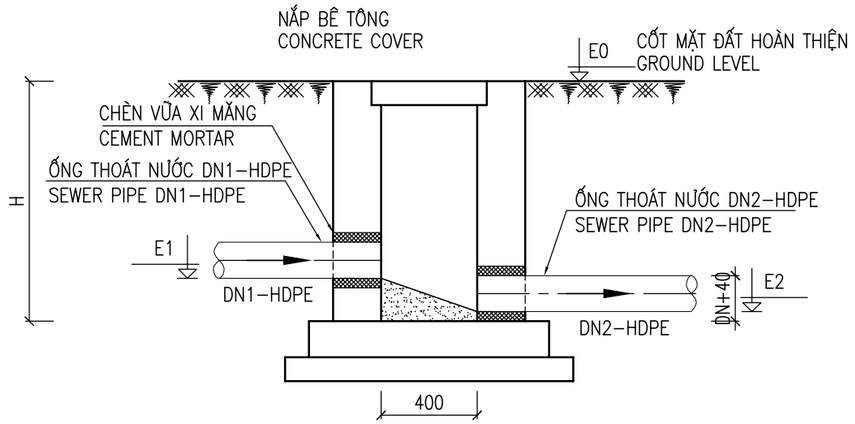

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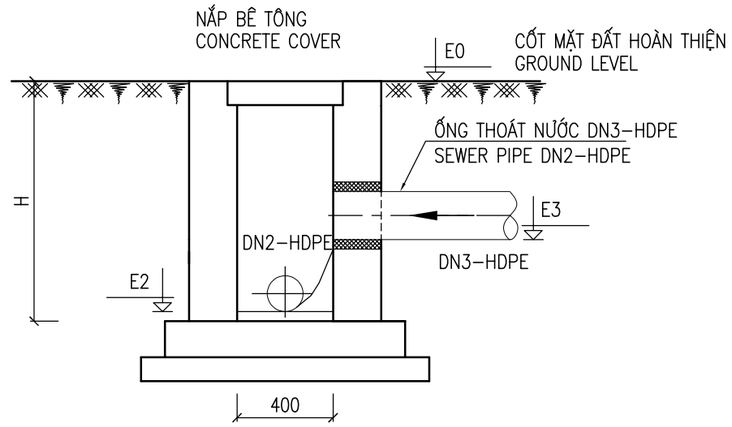

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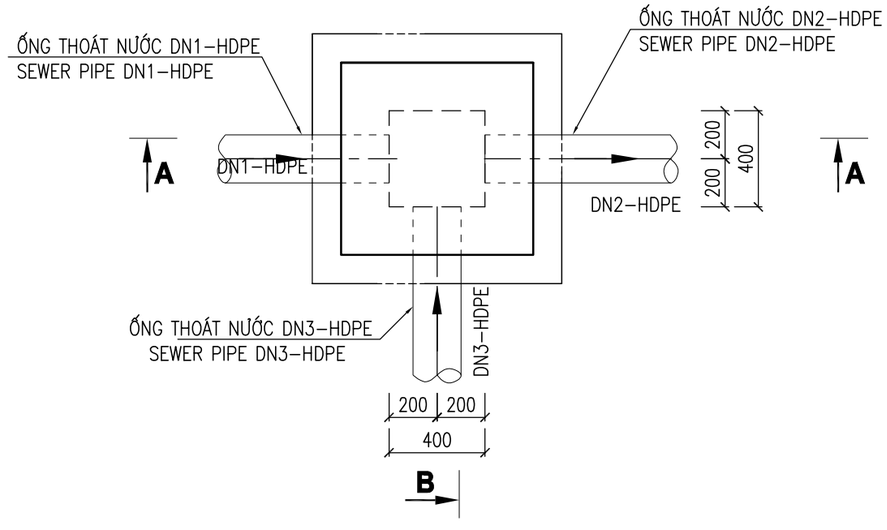

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DN1–HDPE	ĐƯỜNG KÍNH(MM)–VẬT LIỆU DIAMETER(MM)–MATERIAL	HDPE	NHỰA HDPE/HDPE PLASTIC

* HỐ GA LOẠI 2 DÙNG CHO GA ĐẤU NỐI TÒA NHÀ, GA THĂM TRÊN TUYẾN ỐNG NỐI D<200

MANHOLE TYPE 2 USING FOR CONNECTION POINT FROM HOUSEHOLD, INSPECTION MANHOLE FOR PIPE WITH D<200

College of Urban Works Construction (CUWC)	Check	Name	Signature
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Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

HỐ GA THĂM NƯỚC THẢI LOẠI 1
WASTEWATER MANHOLE TYPE 1

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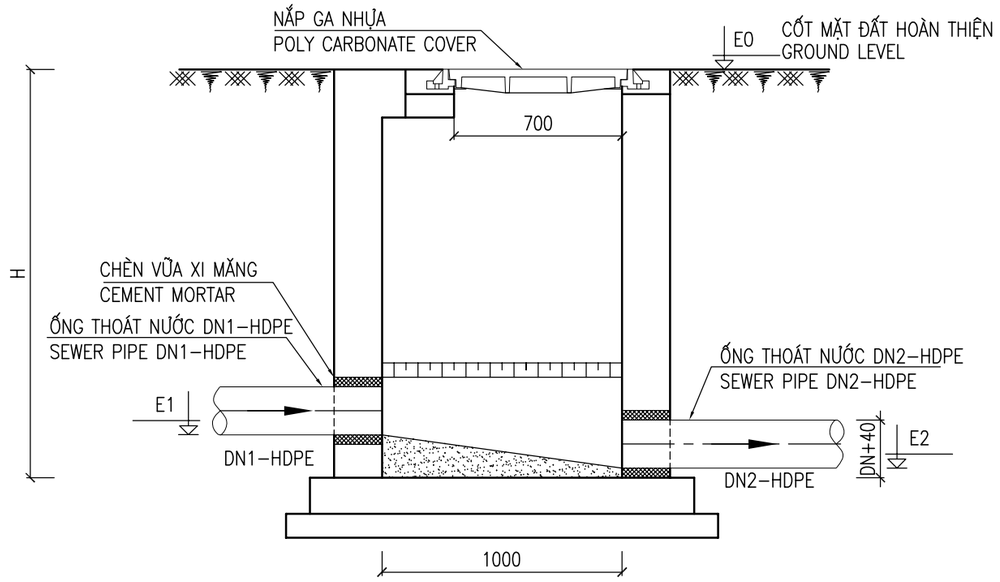
HỐ GA NƯỚC THẢI LOẠI 1/ WASTEWATER MANHOLE TYPE 1

MẶT CẮT A/ SECTION A

TL: 1/25



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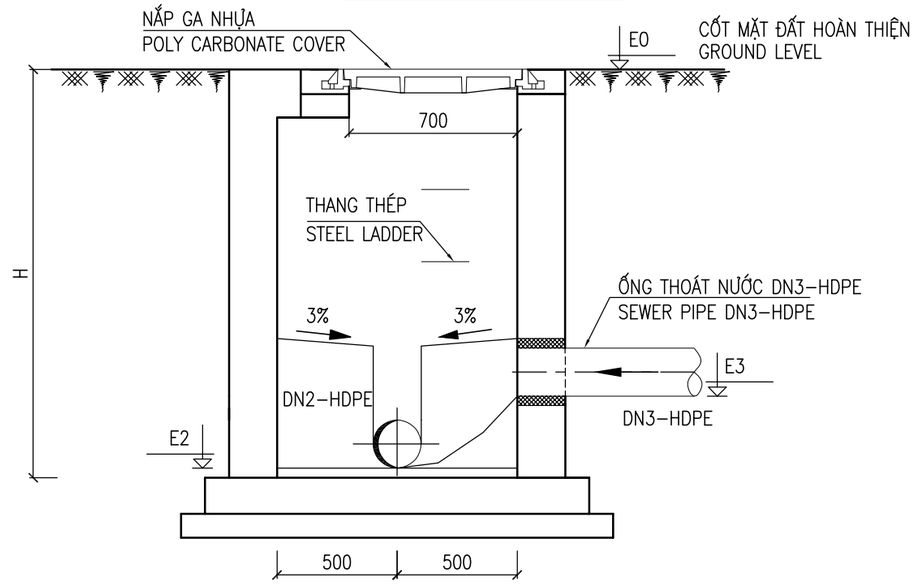

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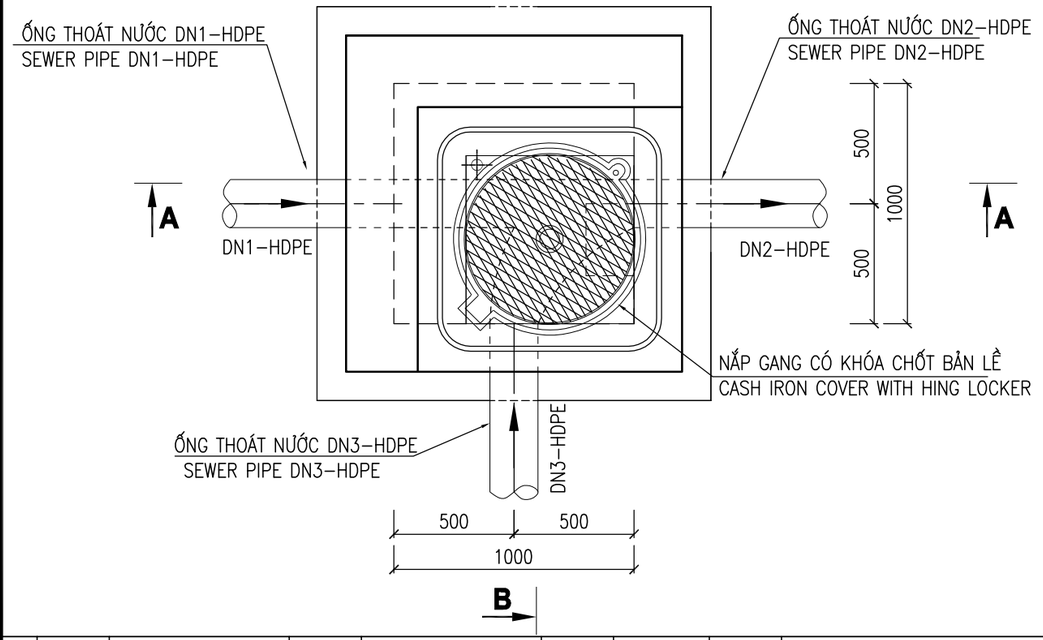

GHI CHÚ/ LEGEND:

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DN1–HDPE	ĐƯỜNG KÍNH(MM)–VẬT LIỆU DIAMETER(MM)–MATERIAL	HDPE	NHỰA HDPE/HDPE PLASTIC

* HỐ GA NƯỚC THẢI LOẠI 1 DÙNG CHO HẦU HẾT CÁC HỐ GA TRÊN TUYẾN CÓ ĐƯỜNG KÍNH D200, D225
MANHOLE TYPE 1 USING FOR ALMOST MANHOLES OF PIPES D200, D225

				College of Urban Works Construction (CUWC)	Check	Name	Signature		Check	Name	Signature
					Designed				Drawing		
					Drawn				Design		
					Checked				Check		
					Approved				Team Leader		

Study on the Planning of Experience-Based Training Facility (Small Scale Sewerage Facilities) in CUWC

HỐ GA THĂM NƯỚC THẢI LOẠI 1
WASTEWATER MANHOLE TYPE 1

Package

Items

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添付資料 J

ナムディン市セクターマスタープラン概要版

SOCIALIST REPUBLIC OF VIETNAM

PEOPLE'S COMMITTEE OF NAM DINH CITY

SEWERAGE AND DRAINAGE MASTER PLAN FOR NAM DINH CITY UP TO 2030, ORIENTATION TO 2050

APRIL 2019

PREFACE

Sewerage and Draiange Master Plan for Nam Dinh City has been formulated as the pilot project of Project Implementation Support, PIS, function under JICA Study. JICA Study team subcontracts with Vietnam Investment Consulting and Construction Designing JSC – CDC in September, 2017, then CDC has implemented the master plan study to follow master plan study procedures in Vietnam and guidelines regulated by Ministry of Construction of Vietnam.

JICA Study team has prepared “Outline of sewage works and structure of Sewerage and Drainage Master Plan” as the manual text to be used for workshop training course under training function of JICA Study. This manual is prepared based on Sewerage Works Planning Guidelines in Japan.

The manual fully covers sewerage and drainage master plan study contents. Sewerage and Drainage Master Plan for Nam Dinh City can be used as a sample master plan material for training, therefore, master plan composition follows the manual contents in principle.

Relationship of contents among Guideline in Japan, the training manual, and Nam Dinh master plan study are shown in the following page table.

There are one item that Sewerage and Drainage Master Plan for Nam Dinh City does not describe in the report. It is “Study on Sludge Treatment and Disposal Method”. In Vietnam, sludge brings to disposal site by vacuum truck or dump truck, then it dumps at there. There is no other methods for sludge treatment at this moment unless particular environmental issue may arise. Therefore, this chapter is omitted in the master plan report.

Several sections rearrange from the original manual contents. One reason is that additional explanation shall be necessary such as cost estimate and phasing plan. It shall be better that collection system describes in the sewerage facility plan so that it shifts from fundamental elements to sewerage facility plan in the manual content.

Introduction is added in Chapter1 to describe general matter. As the result, the content of surveys starts from Chapter2.

Composition among Japanese Guideline, Training Manual, and Master Plan Report

No.	Items described in planning guideline in Japan
1	**Basic Concept**
1.1	Target year
1.2	Target area
1.3	Collection system (Combined/Separated)
1.4	Outfall location
1.5	High water level at outfall
2	**Surveys**
2.1	Natural conditions
2.2	Related plans
2.3	Load volume and outfall situation
2.4	Existing facilities
2.5	Recycling and multifunction of resources
3	**Sewage Treatment Plan**
3.1	Population projection
3.2	Sewage volume
3.3	Sewage load volume inflow water quality
3.4	Outflow water quality
4	**Sewerage Facility Plan**
4.1	Sewer
4.2	Pumping station
4.3	Wastewater treatment plant
5	**Sludge Treatment Plan**
5.1	Sludge volume
5.2	Centered sludge collection
5.3	Transportation method
6	**Stormwater Management Plan**
6.1	Necessary survey
6.2	Rainfall volume
6.3	High water level calculation
6.4	Sewer plan
6.5	Pumping station
6.6	Stormwater storage
6.7	Stepwised development
6.8	Software countermeasures

No.	Items prepared by VSC Team	Text
1	**Surveys**	Chap2
1.1	Basic investigation (Natural conditions)	2.1
1.2	Social condition	2.2
1.3	Land use	2.3
1.4	Population and industrial trend	2.4
1.5	Legal system including environment law	2.5
1.6	Current water supply, sewerage, and drainage system	2.6
1.7	Public health situation	2.7
1.8	Budget condition	2.8
2	**Basic Concept**	Chap3
2.1	Target year	3.1
2.2	Target area	3.2
2.3	Collection system (Combined/Separated)	5.1
3	**Design Parameters**	Chap4
3.1	Design population	4.1
3.2	Per capita sewage flow	4.2
3.3	Daily sewage flow	4.3
3.4	Stormwater volume	4.4
4	**Sewerage Facility Plan**	Chap5
4.1	Catchment area	5.1
4.2	Wastewater treatment plant	5.2
4.3	Wastewater pumping station	5.3
5	**Drainage Facility Plan**	Chap6
5.1	Rainwater effluent outfall	6.1
5.2	Drainage pipes and rainwater pumping station	6.2
6	**Wastewater Treatment Method**	Chap7
6.1	Effluent standard	7.1
6.2	Treatment method	7.2
6.3	Phasing development plan	9.2
7	**Study on Sludge Treatment and Disposal Method**	Not applied
8	**Cost Estimate**	Chap8
8.1	Construction cost	8.3
8.2	O&M cost	8.4
9	**Phasing Improvement Plan**	Chap9
9.1	Sewage collecting method	9.2
9.2	Wastewater treatment system	9.3
9.3	Phasing improvement plan	9.4
9.4	Implementing organization	9.5
9.5	Economc evaluation	9.6
9.6	Financial sources	9.7
9.7	EIA	9.8

SEWERAGE AND DRAINAGE MASTER PLAN

FOR

NAM DINH CITY UP TO 2030,

ORIENTATION TO 2050

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CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Currently, Nam Dinh City is a city grade I located in the center of the Northern Delta. The revised general master plan for Nam Dinh City was formulated in 2011 and infrastructures had been developed to follow the master plan. Wastewater treatment plan was the first priority in the plan, however, there was no concrete implementation plan and donors support for sewerage and drainage section. Though the drainage network had been already invested for some wards and districts, local flooding situation had not yet been solved in the city area. JICA VSC Consultant implemented the needs survey in May 2016 and Nam Dinh City strongly requested to conduct the Sewerage and Drainage Master Plan Study. Nam Dinh City was under a process of completing its infrastructure system to meet the requirements of expanding administrative criteria. Sewerage and Drainage Master Plan Study for Nam Dinh City was accepted taking into consideration of strong request by the local authorities and current infrastructure situation.

1.2 OBJECTIVES

The main objective of the Study is to formulate the Sewerage and Drainage Master Plan for Nam Dinh City.

CHAPTER 2 SURVEYS

2.1 NATURAL CONDITIONS

2.1.1 Terrain Features

Nam Dinh is located in the confluence of the Red River and Day River. In the city, the two large rivers flowing through are the Red River and Dao River. Nam Dinh city has natural terrain which is relatively flat, tilted and lowered from northwest to southeast, altitude from 0.3 to 5.7 m above the sea level. Many ponds, lakes and canals with the Dao River flow through the city in the north-southwest direction.

2.1.2 Climate

Nam Dinh city is characterized by tropical monsoon climate, with typical features of hot, humid, heavy rain and four distinct seasons:

2.1.3 Temperature:

High temperature, average temperature of 27-28°C, number of months having temerature higher than 28°C is 7-8 months; the hottest months are July and August. In winter, temperatures average is 18.9°C, the coldest months are January and February.

2.1.4 Rainfall

The rainfall is quite large, the annual average is from 1,700 to 1,800 mm. Rainfall distribution is relatively even in the city area but unevenly distributed in the year. The rainy season is from May to October, accounting for nearly 80% of the whole year rainfall, the time having most rainfall is from July to September. Dry season is from November to April.

2.1.5 Wind

The prevailing winds of the year change with the seasons. Winter wind is prevailing in the North with the frequency of 70-80%, the average wind speed of 2.4-2.6 m/s. In the last months of the winter, the winds gradually shifted eastwards. In summer, the wind blow in the south-east direction, with the frequency of 50-70%, the wind speed of 1.9 - 2.2 m/s.

2.1.6 Hydrographical Characteristics

Nam Dinh city has the meteorological station at Dao River. Hydrological data are tabulated in below. Dao River bed gradient is 0.0012% and river bed levels range from -0.6m to -0.8m.

Table 2.1 Hydrological Information at Nam Dinh Meteological Station

No.	Item	Water level:	Flow rate
		m	m^3/s
1	Averate	1.52	896
2	Highest	5.77	6,650
3	Lowest	-0.40	0

Alarming water levels at Dao River and Red River in Nam Dinh city are as follows.

Table 2.2 Alarming River Water Levels at Nam Dinh City

No.	Item	Dao River	Red River
		m	m
1	Level I	+3.20	+4,50
2	Level II	+3.80	+5.00
3	Level III	+4.30	+5.50

2.2 SOCIAL CONDITIONS

Total investment capital for social development in 2016 was VND 8,037.61 billion, VND 7,006.9 billion in 2015 and VND 8,568.98 billion in 2013. The state budget has been invested in building socio-economic infrastructure, creating conditions to attract resources in the people to invest in production and business.

Non-state investment capital in Nam Dinh city has seen a strong development trend, showing that the attractiveness of the city and the economic potentials are abundant among the people. In 2014, the non-state capital reached VND 2,379.24 billion, VND 3,282.2 billion in 2015, and VND 3,784.94 billion in 2016.

2.3 LAND USE

Land use from 2013 to 2016 is summarized in table below. Unused land is mainly water surface land and cultivated land after being recovered for infrastructure and industrial zones and is able to be exploited and developed for aquaculture. In 2016, the unused land area of the city is 7.65 ha, equaling 0.17% of the total land area and decreasing 9.23 ha from 2013.

Table 2.3 Land Use Status of Nam Dinh City in 2013 and 2016

Targets	2013		2016	
	Area (ha)	(%)	Area (ha)	(%)
I. Agricultural land	1,517.65	32.68	1,567.58	33.93
1. Agricultural production	1,284.53	27.66	1,309.71	28.35
2. Forestry land	0.00	0.00	0.00	0.00
3. Aquaculture land	233.12	5.02	257.87	5.58
II. Non-agricultural land	3,109.28	66.96	3,044.19	65.90
1. Household land	1,037.33	22.34	929.00	20.11
2. Specialized land	1,774.12	38.20	1,824.60	39.50
3. Land of religion	28.20	0.61	28.24	0.61
4. Cemetery land, grave	50.23	1.08	55.70	1.21
5. Rivers and water surfaces	219.34	4.72	206.65	4.47
III. Unused land	16.88	0.36	7.65	0.17
Total	4,643.81	100.00	4,619.42	100.00

2.4 POPULATION AND INDUSTRIAL TREND

Population distribution of Nam Dinh city is quite high in the central ward. Apart from the concentrated distribution area, the population in the neighboring communes in the northern and southern regions has average population density within the research boundary. Nam Dinh city center experienced sudden population change from 2010 to 2013. Afterward there is no noticeable change until 2016.

Employment proportion in Nam Dinh city in 2016 is agriculture sector, 4.2%, industry and construction sector, 43.8%. services sector, 52.0%. Labor force shifts from industrial sector to service economy gradually. Service-oriented economies will lead to the growth of the urban economy, promote other material industries, and create jobs and ability to exploit natural and economic resources for economic development.

2.5 APPLIED LAWS AND REGULATIONS

Sewerage and Drainage Master Plan for Nam Dinh City is formulated to follow the relevant laws, design standard and criteria regulated in TCVN and QCVN as follows.

- QCVN 07-2:2016/BXD National Technical Regulation on technical infrastructure work – sewerage.
- QCVN 01:2008/BXD National Technical Regulation on construction planning.
- QCVN 14:2008/BTNMT National Technical Regulation on domestic wastewater.
- QCVN 08-MT:2015/BTNMT National Technical Regulation on surface water quality.
- QCVN 40:2011/BTNMT National Technical Regulation on industrial wastewater - Discharge standards.
- TCVN 7957:2008 National Technical Regulation on Drainage and sewerage - external networks and facilities - design standard.

2.6 EXISTING PLANS AND ON-GOING PROJECTS

2.6.1 Existing Plans

(1) Revised General Master Plan for Nam Dinh City up to 2025

It mentions as the sewerage plan. The sewerage plan formulates stepwise wastewater collection rate. It targets 85% wastewater collection rate by 2015 and increases up to 95% by 2025.

The sewerage plan applies to combined sewer system for the old inner city area. It applies to separate sewer system for new development area in the North Dao River basin and whole area in South Dao River basin.

(2) Plan on sewerage and wastewater treatment system for residential area and industrial zones in basin of Nhue – Day River up to 2030

The plan formulates two wastewater treatment plant in Nam Dinh City.

1) Wastewater treatment plant No.1

It is planned at 29,000m^3/day up to 2015 for Phase1 and increases to 50,000m^3/day up to 2030 for Phase2.

It is located in the field of My Tan commune (near Quan Chuot pumping station). Estimated plant area is 5ha.

2) Wastewater treatment plant No.2

It is planned at 14,500m^3/day up to 2015 for Phase1 and increases to 26,000m^3/day up to 2030 for Phase2.

It is located in the field of Luong Xa village. Estimated plant area is 3ha

2.6.2 On-going Projects

T3-11 canal and Quan Chuot pumping station were constructed by the World Bank funded project. It was completed in 2015. Afterward, there is no on-going sewerage and drainage project by foreign fund in Nam Dinh City. Hungary mission team visited to Nam Dinh City to find a new project in Nam Dinh City, however, it is not concrete program as of April 2018.

2.6.3 Existing Sewerage and Drainage Status

(1) Nam Dinh central city

The existing sewerage and drainage system is divided into three basins, Northeast, Northwest and Southwest (Figure2.1). It is formulated by Revised General Master Plan. Area boundary is drawn based on topographic condition.

1) Northeast basin

Sewerage and drainage flow into the existing sewers and ditches. It partially pours into the existing reservoirs such as Vi Xuyen lake, Le Hong Phong lake, and Vi Hoang lake. It flows into T3-11 canal and finally reaches to Quan Chuot pump station, which has the capacity of 57,000m^3/h. Then it pumps up into the Dao river.

2) Northwest basin

Sewerage and drainage flow into the existing sewers and ditches. Some pours into An Trach and Gia Bao lakes, then flows out to An Trach canal. Remaining sewerage and drainage flow into the lakes of Truyen Thong, Loc Vuong, and it partly flows into Thuong River. The entire system is connected to each other. It finally flows into T3-11 canal and reaches to Quan Chuot pump station.

3) Southwest basin

Sewerage and drainage flows through the existing sewers and ditches and reaches to Kenh Gia pumping station. It is pumped into Dao River. Kenh Gia pumping station has capacity of 43,000 m^3/h.

(2) Suburban residential area

It is divided by irrigation canal and drainage network (Figire2.1). Because irrigation drainage is also used to drain domestic water.

1) North side of Dao River

Drainage basin of north side of Dao River is divided by Vinh Giang River flow. The drainage system to the northwest Dao River drains through Coc Thanh pumping station.

The northeast of Dao River drain water flows to the Red River through Huu Bi pumping station.

2) South side of Dao River

The drainage of southeast basin is discharged to the Red River through the drainage canal system.

The one of southwest basin is discharged to An La pumping station. This is the pumping station for irrigation and drainage purpose in the basin.

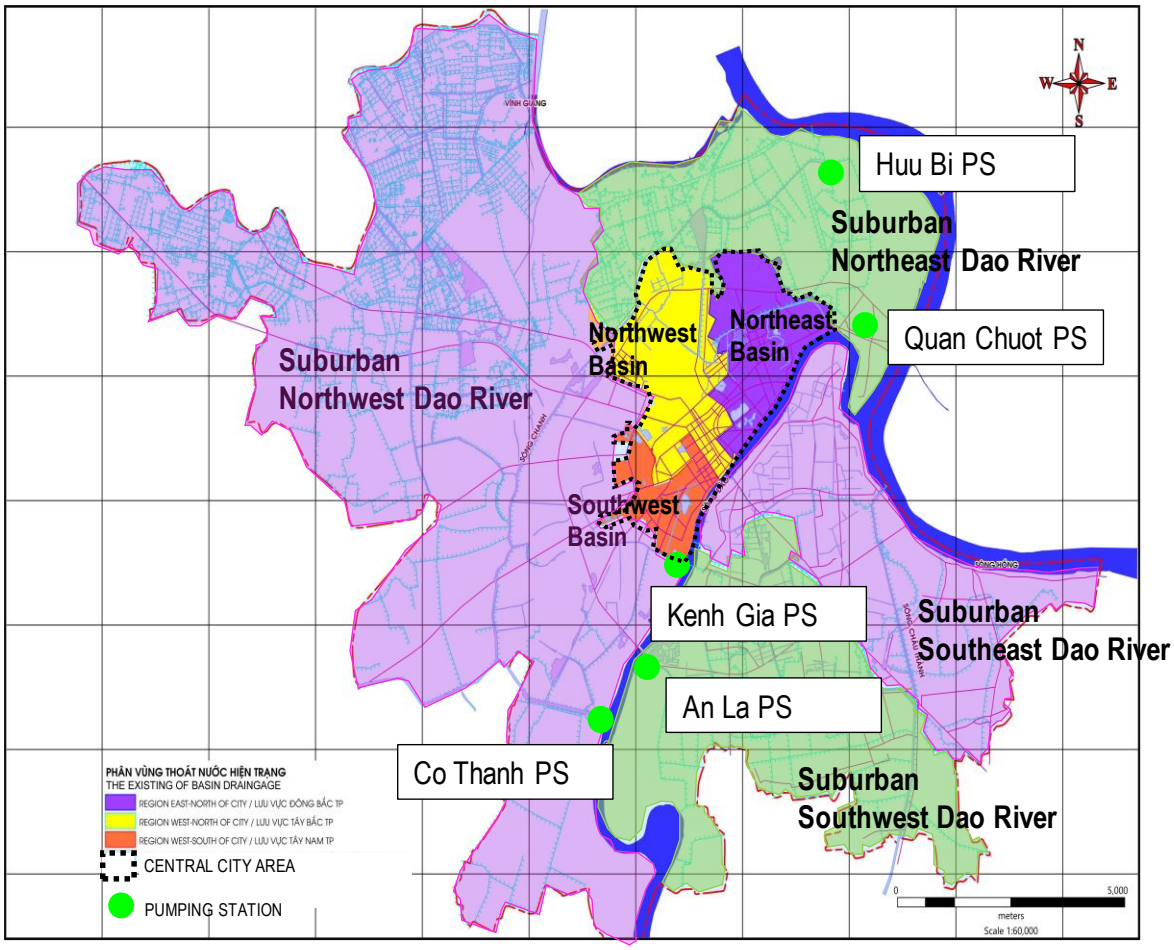


Figure 2.1 Current Status of Sewerage and Drainage Basin

2.6.4 Summary of Existing Sewerage and Drainage Facilities

(1) Central city

1) On-site system

Currently, houses, offices, and public buildings have septic tank with two compartments or three compartments for preliminary sanitary sewerage treatment. Sanitary water passes through septic tank and connects to combined sewer pipe in the basin. Septic tank serviced area is 100%.

2) Sewerage

Combined sewers are widely installed.

Concrete pipe : 48.5km with dimensions from 300 ~ 2000mm

Open ditch and canal : 22.0km

3) Regulating reservoir

Lakes : 60.0ha consisting of 10 lakes

4) Pumping station

Kenh Gia pumping station : 43,000 m^3/h

Quan Chuột pump station : 57,000m^3/h

(2) Suburban residential area

1) On-site system

It mostly installs the septic tank with two compartments or three compartments for houses, offices, and public buildings. Sanitary water through septic tank is discharged to open ditch and canal in the basin.

2) Sewerage

Open ditches and canals are used for sewerage purpose.

North side of Dao River : Irrigation canals network

South side of Dao River : Irrigation canals network with some box conduit such as Van Diep 2000x6000, Ngo Xa 1000x7000.

3) Pumping station

North side of Dao River : Coc Thanh pumping station 7sets x 32,000m^3/h.

Ditto : Huu Bi pumping station 59,44m^3/h

South side of Dao River : An La 1 pumping station(5 sets x 4,000m^3/h), An La 2 pumping station(7 sets x 4,000m^3/h).

2.6.5 Current Issues on Existing Sewerage and Drainage Structures

(1) Sewerage facilities

Wastewater water treatment plant is selected as the first priority issue by the Revised General Master Plan. However, there is no concrete development plan of wastewater treatment plant such as treatment volume and treatment method. Therefore, sewerage plan is expected to be formulated.

The existing water supply intake facility is located at several kilometers upstream from Kenh Gia pumping station. Raw sewage is discharged from Kenh Gia pumping station to Dao River. Though raw sewage is diluted by river water and water intake is located at the upstream area, river flows toward the water intake in dry season and it may affect to water quality in future accompanying with sewage volume increment. Improvement of effluent water quality is highly required by the development plan of wastewater treatment plant.

(2) Drainage facilities

Some main sewers in Southwest area do not have enough drainage dimensions. For example, the sewers at Hang Thao anh May To are 300x250mm, and the one of Tran Hung Dao sewer pipe is D400mm. Heavy rainwater cannot flow in those sections, accordingly, local flooding occurs frequently in rainy season even though concrete flooding record is not available in the authority. Recently, flooding has occurred 8 times in 2015 and rain in Oct. 2017, flooding has occurred total 18 times/places (flood time: 20-25hrs, flood depth 30-100cm). Drainage improvement for those sections are the first priority to mitigate the flood damage in rainy season. Drainage plan is formulated to consider this situation.

Kenh Gia pumping station has large enough pumping capacity as the drainage pumping station. However, there is no regulating lake in front of Kenh Gia pumping station and it cannot function effectively because peak drainage volume is larger than pump capacity. In order to use the Ken Gia pumping station sufficiently, regulating lake is expected to be involved in the drainage plan.

2.7 PUBLIC HEALTH

Provincial hospitals exist in Nam Dinh city. It shall be updgraded to meet the medical service requirement formulated in the urban master plan. New medical center, which has 700 beds, is planned to be the regional medical center. It plans to be built at My Trung new urban area.

2.8 BUDGET CONDITION

2.8.1 Revenue

Total revenue of the State budget in Nam Dinh city in 2013 is 1,764 billion VND, and it reaches 2,475 billion VND in 2016, which is in140% increase. Proportion of revenue from the economy in the area is highest for four years raining from 80% to 90%

Table 2.4 Breakdown of Revenues in Nam Dinh City

Unit: Million VND

Item	2013	2014	2015	2016
1. Economic collection in the area	1,427,514	1,614,217	1,911,726	2,237,826
2. Collection from upper level state budget	304,526	312,951	242,798	186,085
3. Other collection	31,982	37,313	32,052	51,434
Total	1,764,022	1,964,481	2,186,576	2,475,345

2.8.2 Expenditure

The total state budget expenditure in 2013 is 766,019 billion VND and the one in 2016 is 969,812 billion VND; it increases 127% for four years. However, in 2013, development

investment expenditures are VND 87,337 billion, accounting for 11.4% and in 2016 it is 97,085 billion, equivalent to 10.0%, Expenditures have promptly responded to socio-economic and security-defense activities. Nam Dinh city has paid attention to allocate budget for infrastructure investment to cope with fast growth.

Table2.5 Breakdown of Expenditures in Nam Dinh City

Unit: Million VND

Item	2013	2014	2015	2016
1. Investment and development	87,337	121,627	23,430	97,085
2. Regular expenditure	485,499	540,333	576,267	665,431
3. Other expenditure	193,183	184,974	217,400	207,296
Total	766,019	846,934	817,097	969,812

CHAPTER 3 BASIC CONCEPT

3.1 TARGET YEAR

The target year of the master plan contents is set to 2030. In addition, the target year of the planning strategy is set to 2050 to follow vision 2050.

3.2 STUDY AREA

3.2.1 Whole Study Area

The study area consists of direct study area and indirect study area (Figure 3.1).

Direct study area is mainly current geological boundary of Nam Dinh City, which is 4,089ha. Indirect study area is the surrounding district and communes consisting of the geological boundary of My Loc district, communes of Nam Truc district and, communes of Vu Ban district, which is 14,732ha.

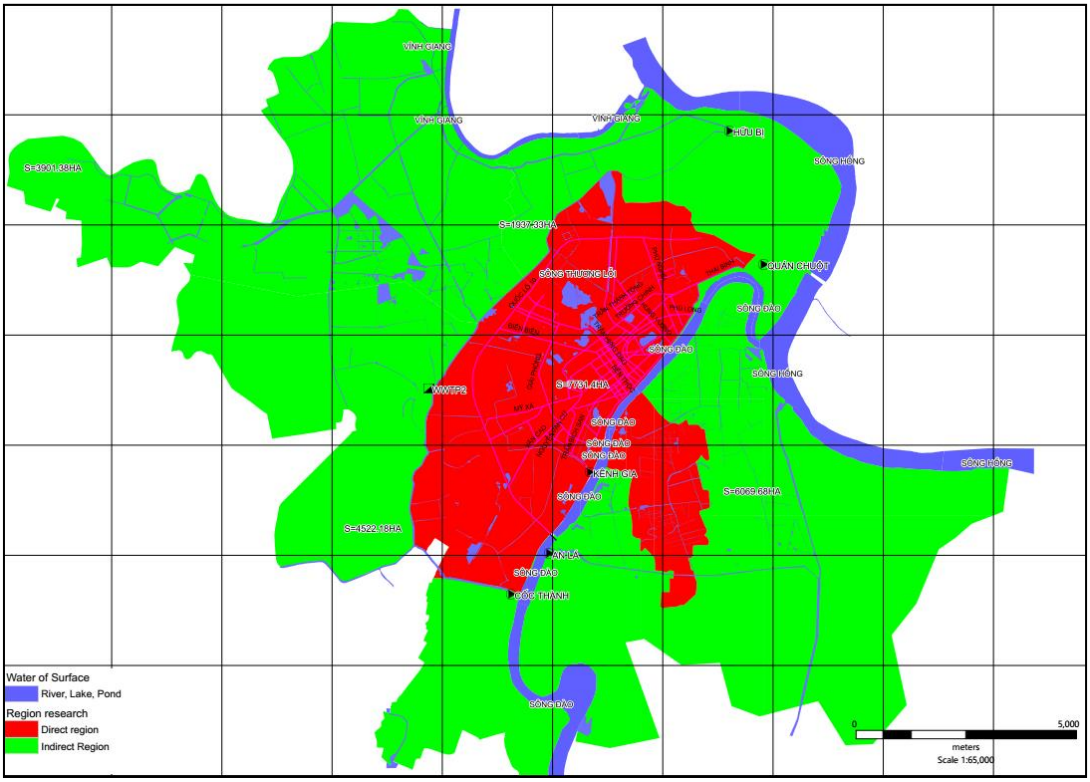


Figure 3.1 Study Area

3.2.2 Design Area Boundary

(1) Sewerage basin

It follows the Revised General Master Plan of Nam Dinh City up to 2025. Sewerage basin is largely divided by direct area and indirect area. Though a part of South Dao River basin includes in direct area, it excludes from sewerage basin of direct area. It is limited in North Dao River basin. Direct area consists of two sewerage basins

considering the existing treatment areas. One is discharged to Quan Chuot pumping station and the other one is discharged to Dai An pumping station (Figure3.2).

(2) Drainage plan basin

Six drainage basins are designed taking into consideration of topographic conditions, and the existing drainage conditions.

Two drainage basins in the central area are as same as the sewerage basins. Suburban area consists of four drainage basins shown in the map below (Figure3.2).

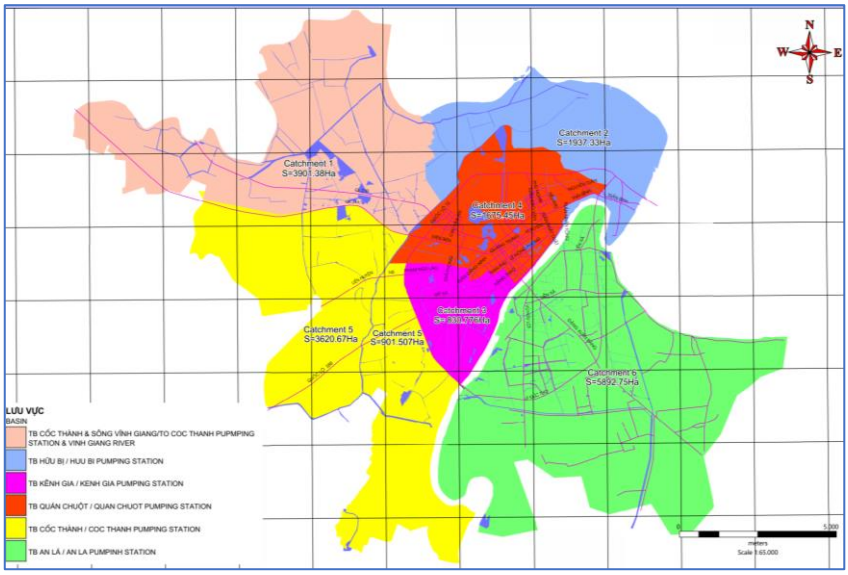


Figure 3.2 Sewerage and Drainage Basin Boundary Map

CHAPTER 4 DESIGN PARAMETERS

4.1 POPULATION FORECAST

Population data using for population forecast is taken from the Revised General Master Plan of Nam Dinh City up to 2025.

Population growth rate is adopted to 2.0% for 2030 and 2050 respectively.

4.2 PER CAPITA SEWAGE FLOW

(1) Unit water supply volume

It is estimated in Plan on water supply for Nam Dinh city in the period 2015-2020, orientation to 2025 as follows. Unit water supply volume is designed up to 2025, the same quantities are applied to 2030 and 2050.

Table 4.1 Unit Water Supply Volume for Design Calculation

l/person-day

No.	Target Year	Urban water supply	Suburban water supply	Concentrated industry	Craft and handicraft
1	2020	150	90	40	5-7% Q_{sh}
2	2025	160	100	40	5-7% Q_{sh}
3	2030	160	100	40	5-7% Q_{sh}
4	2050	160	100	40	5-7% Q_{sh}

Note: Q_{sh} means domestic water supply volume.

(2) Wastewater collection rate

It is designed by domestic and industrial wastewater use.

- Domestic wastewater : 90% of water supply volume
- Industrial wastewater : 100% of water supply volume

(3) Unit wastewater volume forecast

Following unit wastewater volumes are estimated for design calculation.

Table 4.2 Unit Wastewater Volume for Design Calculation

No.	Category	Unit	Year 2020	Year 2030	Year 2050
1	Center area	l/person - day	135	144	144
2	New township	l/ person - day	135	144	144
3	Towns	l/ person - day	81	90	90
4	Public, visitors, service	% domestic	10 – 8	10 - 8	10 - 8
5	Concentrated industry	m^3/day-ha	40	40	40
6	Craft and handcraft	% Q_{sh}	5 – 7	5 - 7	5 - 7

(4) Peak coefficient

Water supply volume fluctuates in a day. It is the largest in morning time and facilities have to be designed to apply to the largest water volume. Peak coefficient 1.3 for direct area and 1.4 for indirect area are applied to the target area based on TCVN7957-2008.

- Direct area : K_{max} = 1.3
- Indirect area : K_{max} = 1.4

(5) Dilution factor on combined sewer

Combined sewer flows stormwater so that wastewater volume is calculated on the basis of preliminary dilution factor equivalent to 2.3 times of wastewater flow in dry season. It is regulated in item 3.28 National standard TCXDVN51:2008 Drainage and sewerage – External Network and Facilities Design Standard. The dilution factor is applied to combined sewer areas.

4.3 POPULATION AND WASTEWATER VOLUME ESTIMATE IN 2030 AND 2050

It is calculated to apply to the above figures. Estimated figures are tabulated in below.

Table 4.3 Population and Wastewater Demand Forecast in 2030 and 2050

Year	Population	Wastewater Generation
2016	396,474	52,120m3/day
2030	579,992	175,586m3/day
2050	742,628	238,885m3/day

Summary of area, population and wastewater volume for sewerage facility plan is described as Table 4.4 and calculation result of wastewater volume is attached in the Appendix of main report.

Table 4.4 Breakdown of Area, Population and Wastewater Demand in 2030 and 2050

Year	Item	Basin 1 (Quan Chuot)	Basin 2 (Dai An)	Other Area	Total
2016	Population	135,681	83,400	177,393	396,474
	Wastewater (m^3/day)	N/A	N/A	N/A	52,120
2030	Area(ha)	1,594	1,848	15,379	18,821
	Population	145,967	114,405	319,620	579,992
	Wastewater (m^3/day)	89,000	68,000	18,586	175,586
2050	Area(ha)	1,594	1,848	15,379	18,821
	Population	190,595	211,998	340,035	742,628
	Wastewater (m^3/day)	117,000	95,000	26,885	238,885

4.4 STORMWATER VOLUME

4.4.1 Rainfall Volume

216.3mm/day rainfall occurs on September 9th, 2003 and it is close to occurrence once in a ten years. Based on this rainfall volume, design rainfall is calculated at 227.4mm/day

Design rainfall volume calculation follows TCVN7957:2008 Drainage and Sewerage-External Networks and Facilities Design Standard. According to TCVN7957:2008,

design rainfall is designed by city scale. Nam Dinh City is grade I and it applies to 10 years probability. Design rainfall and other information are described as below.

- Frequency of rainfall : P = 10% (Rainfall volume once in a 10 years)
- Rainfall duration : 24 hours; daily maximum rainfall record per annum
- Observation period : Rainfall record is taken from 1985 to 2005
- Design rainfall : 227.4 mm/day

In the middle of the 21st century, annual rainfall is likely to increase up to 5~10% in comparison with the baseline rainfall volume because of the impact on climate change. By the end of the 21st century, the annual rainfall is likely to increase up to 10-15% to compare with the baseline rainfall volume. Therefore, the study considers the climate change factor, Representative Concentration Pathway, RCP 4.5 and 8.5 are applied to the design rainfall volume from 2016 to 2099. RCP 4.5 is the scenario that greenhouse gas emission is medium stable level. RCP 8.5 is the scenario that greenhouse gas emission is equivalent to the maximum level.

Table 4.5 Design Rainfall Volume up to 2050

No	Period	Planning target year	Design rainfall volume (mm/day)
1	Scenario RCP4.5		
	Period 2016 – 2035	2030	273.97
	Period 2046 – 2065	2050	275.32
2	Scenario RCP8.5		
	Period 2016 – 2035	2030	268.78
	Period 2046 – 2065	2050	299.15

4.4.2 Drainage Model Set Up

- Data source : Drainage Management Unit of Nam Dinh City
- Input data : Sewer pipe and canal dimensions,
  Regulating lake high and low water levels,
  Pumping stations capacities, and high and low water levels
- Software : MIKE-URBAN

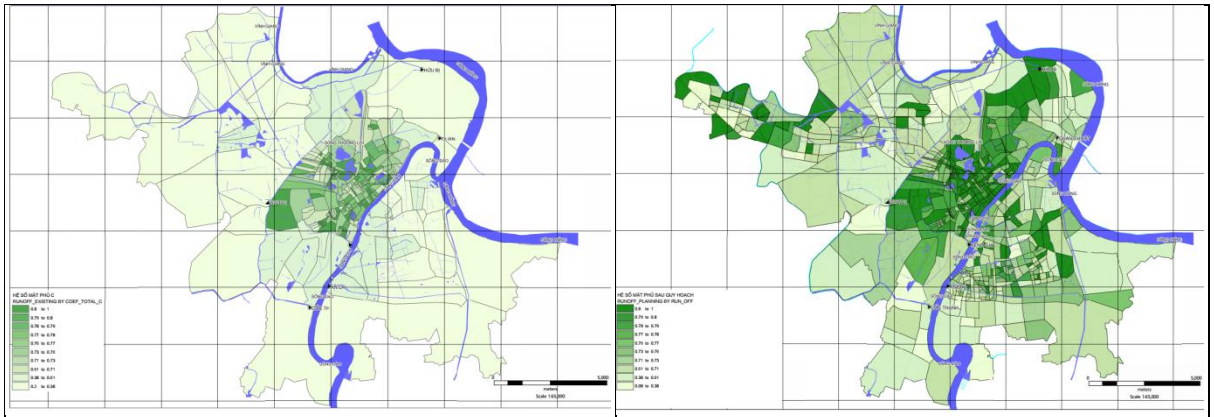
4.4.3 Flooding Analysis

(1) Calculation of run-off coefficient

Run-off coefficient of each land plot is designed. The study prepares two run-off coefficient map for the existing land use and land use plan, which is formulated in the Revised General Master Plan of Nam Dinh City up to 2025.

Run-off coefficient is low in case of grass field and agricultural areas. When a land use is urbanized, it is larger than before. The maps below is the comparison between the

existing land use and future land use formulated in the Revised General Master Plan (Figure4.1). It is evident that run-off coefficient map of land use plan is green colored rather than the existing land use map. It shows that run-off coefficient is larger in case that urban development will progress in future. Particularly, the land use along Dao River and the road QL21A and QL21B show dark green color. It means that they will be urbanized remarkably.



Run-off coefficient map of existing land use | Run-off coefficient map of land use plan

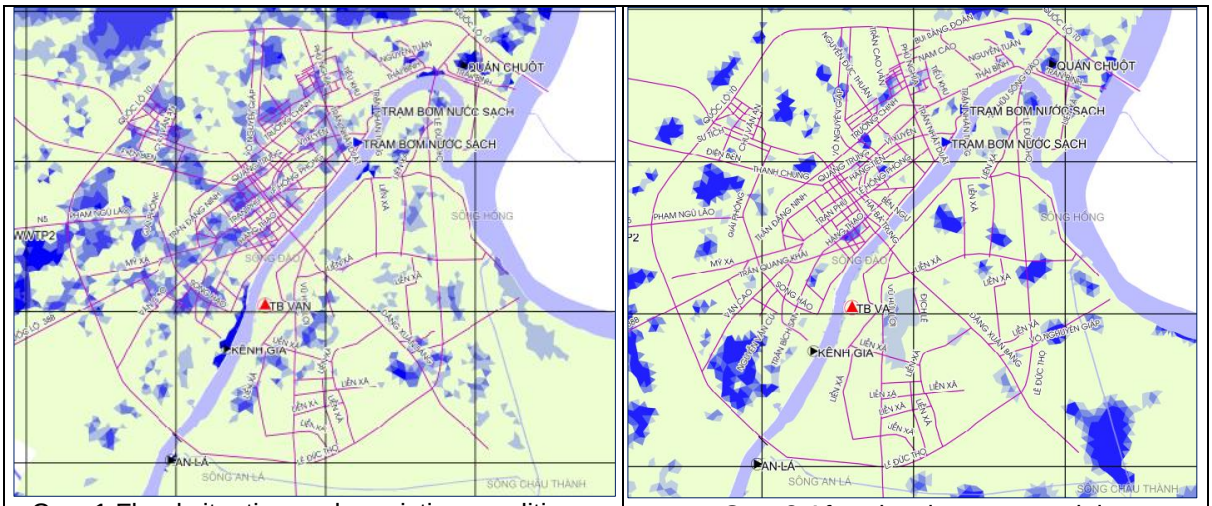
Figure 4.1 Comparison of Run-off Coefficient between Existing and Planning Land Use

(2) Flood analysis

Flood analysis is conducted to study two flood model cases. One is the existing condition and the other one is after the development model. The development model case shall be applied after 2020 so that rainfall intensity adds climate change scenarios, RCP 4.5 and 8.5.

- Case1 : Current land use and drainage facilities with P=10% rainfall 227.4mm/d
- Case2 : After drainage facilities development with rainfall RCP 4.5/8.5 scenario

Analysis results are shown in the maps below (Figure4.2). Case1 is left side. It can see large area of flooding in the map. Particularly the north side of Dao River is flooded entirely under the current situation. As for Case2, flood situation in direct area is mostly dissolved. It still remain at surroundings of the center city where elevation is relatively lower area.



Case1 Flood situation under existing conditions

Case2 After development model (RCP4.5 by 2050)

Figure 4.2 Flood Analysis Results before and after Development

Table below shows the calculation results of flooding time and flood depth for the existing case and the future climate change scenarios.

According to the calculation, the current flooding time continues 15 hours with depth 0.3 ~ 0.9m. Flooding time reduces around 3 hours and flood depth is less than 0.1m after the drainage improvement works. The flood analysis results clearly indicate the drainage project effect in view of flooding time and flood depth.

Table4.6 Summary of Results of the Scenarios

No.	Scenario	Flooding Time (hr.)	Flood Depth (m)
1	Current situation	15.0	0.30 - 0.90
2	RCP 4.5 2016 – 2035	3.0	0.05 – 0.10
3	RCP 4.5 2046 – 2065	3.5	0.05 – 0.10
4	RCP 8.5 2016 – 2035	2.9	0.05 – 0.10
5	RCP 8.5 2046 – 2065	3.6	0.05 – 0.10

CHAPTER 5 SEWERAGE FACILITY PLAN

5.1 CATCHMENT AREA

(1) Direct area

Treatment area in direct area is divided by sewerage basin01 and 02 to follow the existing treatment area. And combined sewerage system is selected for the direct area because both sewage treatment and countermeasure against frequent inundation are the most prioritized tasks, which is based on the revised general master plan.

Combined sewer shall be separated into wastewater and stormwater at diversion chamber before pouring into lake and open canal. Wastewater is collected through interceptor sewer and flows into the wastewater treatment plant.

There are major 4 combined sewer routes for the both basins.

Wastewater in the basin01 is transferred to WWTP1 close to Quan Chuot pumping station next to Dao River right side dyke (Figure5.1).

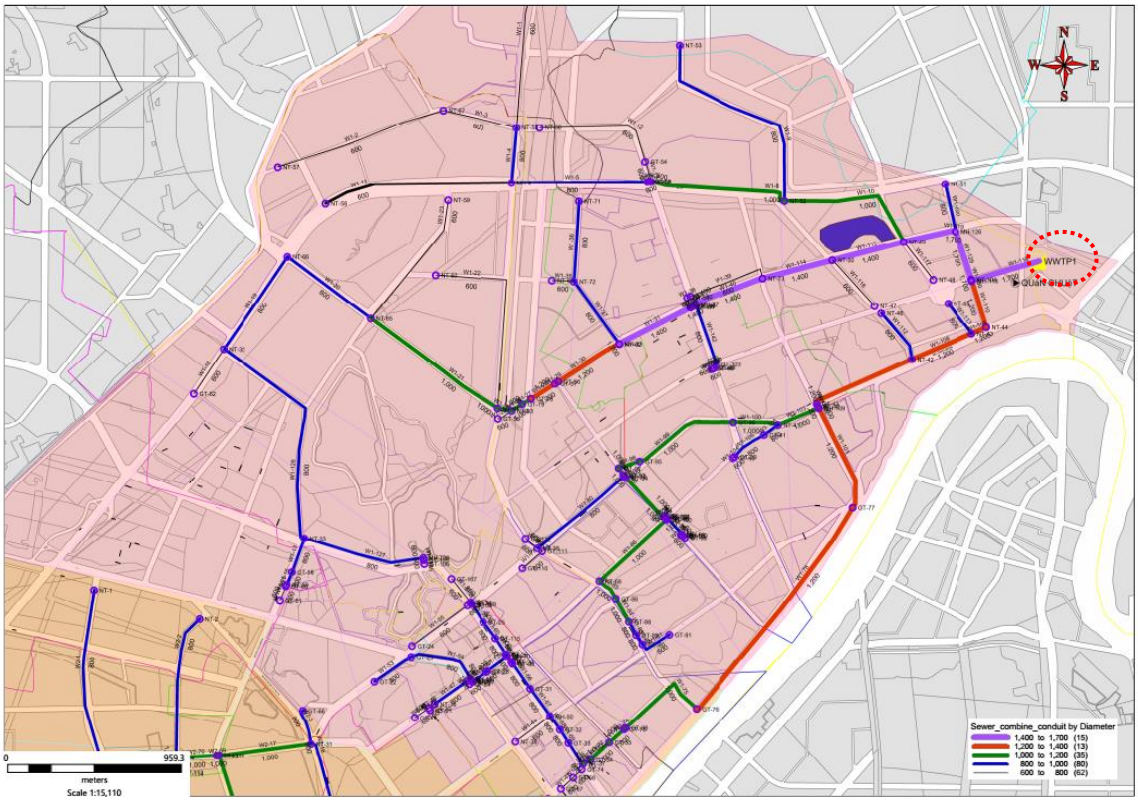


Figure 5.1 Major Interceptor Sewer Routes in Basin1

As for the basin02, wastewater is transferred to WWTP2 next to pumping station close to the road No. N5A near Chanh River (Figure5.2).

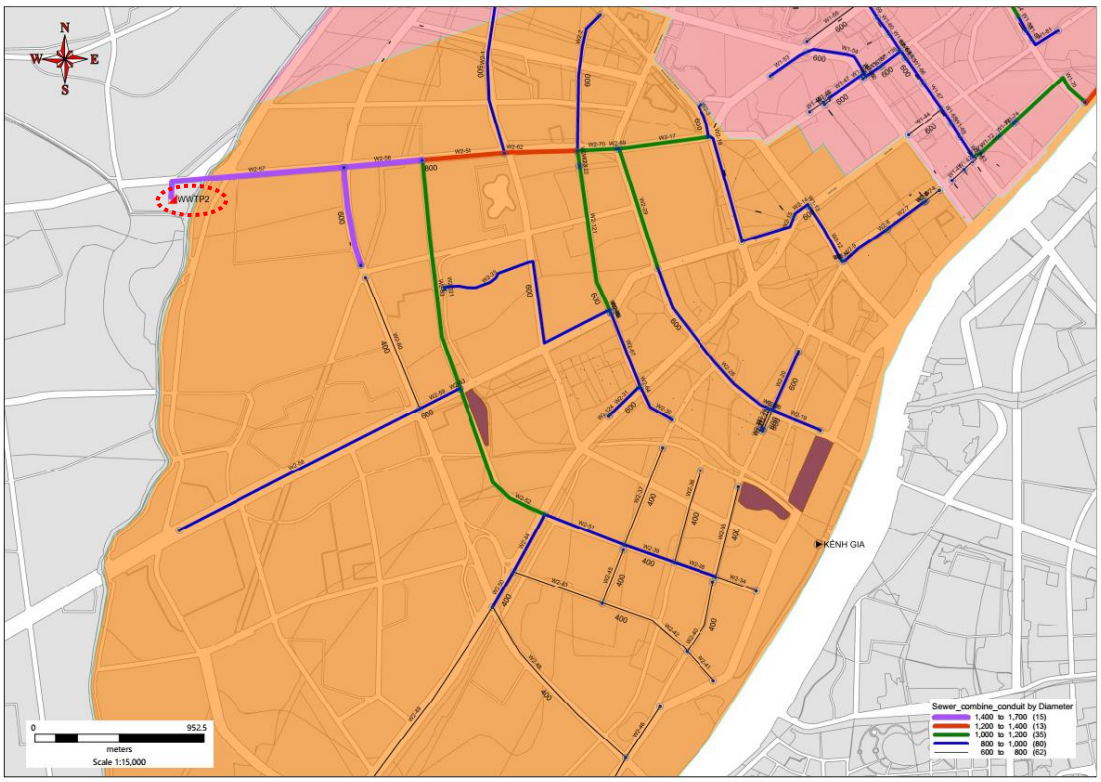


Figure 5.2 Major Interceptor Sewer Routes in Basin2

(2) Indirect area

Treatment area in indirect area is composed of commune level taking into consideration of residential area density and commune locations.

Sewer line is planned individually and only wastewater flows into the sewer. Sewer network collects to each small scaled wastewater treatment plant, which is planned in the form of dispersion.

5.2 FEATURES OF WASTEWATER TREATMENT PLANT

Locations of two wastewater treatment plants are indicated in the Revised General Master Plan for Nam Dinh City up to 2025. It has been already approved by the Prime Minister and the proposed locations follow it. Particularly, land acquisition around Kenh Gia pumping station area is rather than difficult. In order to avoid land acquisition time consuming process, Dai An WWTP is located at upstream of Kenh Gia pumping station.

Features of each wastewater treatment plant are tabulated in below.

Table 5.1 Wastewater Treatment Plant Features

No	Name	Location	Area	2030	2050
1	Quan Chuot WWTP	My Tan commune, opposite to Quan Chuot PS crossing the national road No.10	8ha	89,000m^3/d	117,000m^3/d
2	Dai An WWTP	Dai An commune	6ha	68,000m^3/d	95,000m^3/d

Development of wastewater treatment plants for indirect area are summarized in table below and each location is shown in the following map (Figure5.3).

The treatment plants in the period 2021 – 2030 shall be transformed into place for collecting and pumping out to collective wastewater treatment plant. The number of wastewater treatment plant shall be reduced to 42 plants. Some inactive wastewater treatment plant in the period 2021 – 2030 will be transformed into transitional pumping station to deliver wastewater to collective stations.

Table 5.2 Indirect Area Wastewater Treatment Plants

No.	Description	North Dao River Basin	South Dao River Basin
1	2021-2025		
1.1	Number of WWT Station	49place	33places
1.2	Treated volume range	33~827m^3/day	52~1,177m^3/day
1.3	Total volume	9,477m^3/day	9,900m^3/day
2	2026-2030		
2.1	Number of WWT Station	27place	13places
2.2	Treated volume range	72~1,464m^3/day	149~3,780m^3/day
2.3	Total volume	9,188m^3/day	11,232m^3/day
3	2031-2050		
3.1	Number of WWT Station	27places	13places
3.2	Treated volume range	81~1,464m^3/day	189~7,200m^3/day
3.3	Total volume	10,076m^3/day	17,250m^3/day

Note: Numbers of WWTP from 2031 are extension of WWTP construction by 2030.

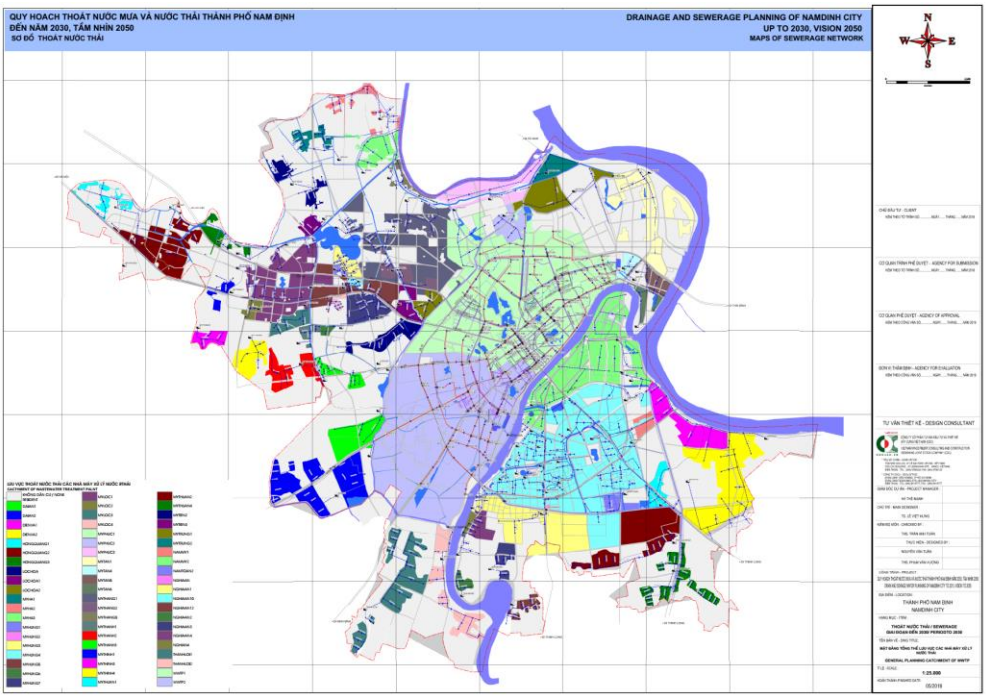


Figure 5.3 Location of Wastewater Treatment Plant in the Indirect Area

5.3 FEATURES OF WASTEWATER PUMPING STATION

(1) Direct area

Three booster pumping stations are planned in the direct area. Sewage cannot flow to the wastewater treatment plant by gravity, therefore, they are designed before the wastewater treatment plant.

Table 5.3 Wastewater Pumping Station Capacity in the Direct Area

No.	Name	Capacity
A	Basin01	
1	Booster PS at Highway No.10	3,500 m^3/hr
2	Booster PS before Quan Chuot WWTP	17,000 m^3/hr
B	Basin02	
3	Booster PS at Road No.N5A	5,000 m^3/hr

(2) Indirect area

10 wastewater treatment plants in the indirect area shall be replaced to pumping stations with total capacity of 1,030m^3/day. They shall work as primary treatment plant so that treated water shall need to be treated at a higher level at the centralized wastewater treatment plant. As the result, 10 pumping statins are planned.

Besides, 3 new pumping stations will be planned with total capacity of 1,490m^3/day.

Table 5.4 Wastewater Pumping Station Capacity in the Indirect Area

No.	Name	Capacity	Quantity
A	North Dao River Basin		
1	Replacement to pumping station	100~110 m^3/day	9 places
2	New pumping station	110~1,270 m^3/day	3 places
B	South Dao River Basin		
3	Replacement to pumping station	100 m^3/day	1 place

CHAPTER 6 DRAINAGE FACILITY PLAN

6.1 STORMWATER EFFLUENT OUTFALL

There are six outfall facilities in the draiange plan. Five facilities have already been operated and can function satifsactory under the current condtion. No.5 Van Diep pummping station will be planned to improve indirect area flood situation after 2030.

Table 6.1 Features of Outfall Facility

Basin No.	Drainage area	Pumping station	Capacity (m^3/s)	Discharge
1	North Dao River	Cốc Thành	56.00	Red River
2	North Dao River	Hữu Bị	32.00	Red River
3	North Dao River	Kênh Gia	11.94	Dao River
4	North Dao River	Quán Chuột	15.83	Red River
5	North Dao River	Van Diep	22.00	Dao River
6	South Dao River	An Lá	4.45	Dao River

6.2 DRAINAGE FACILITY PLAN

(1) Drainage canal

It is designed to follow the dimensions and route shown in the Revised General Master Plan of Nam Dinh City. Basic strategy of drainage canal is;

- To ensure enough drainage capacity for target year
- To follow the current inland canal alignment
- To expand necessary canal to increase discharge volume for flood area

(2) Regulating lake

It is designed to regulate the drainage inflow in front of Quan Chuot and Kenh Gia pumping station (Figure6.1).

Regulating lake provides dyke and peripheral road. Dyke protects from stormwater overflow. Peripheral road is used for maintenance purpose firstly. Further, it contributes to improve urban water environment and be attractive for residents of Nam Dinh City.

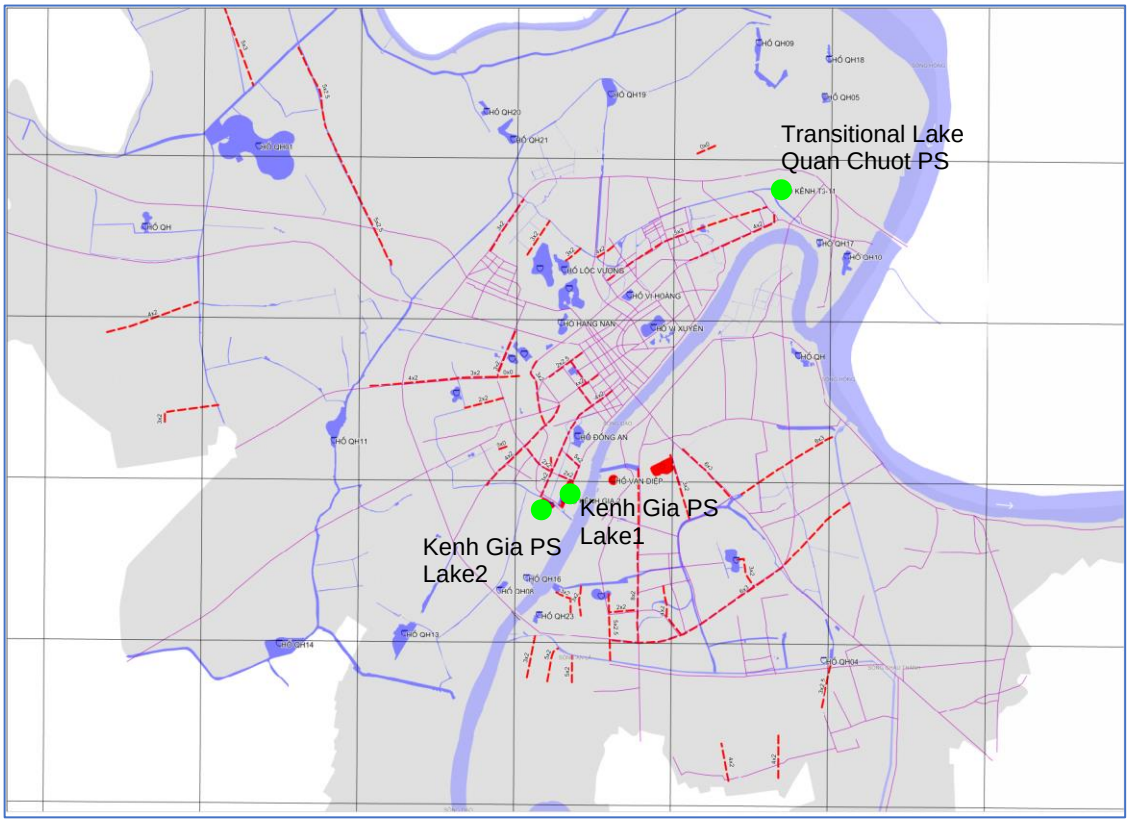


Figure 6.1 Major Drainage Canals and Regulating Lakes Plan

CHAPTER 7 WASTEWATER TREATMENT METHOD

7.1 WASTEWATER INFLUENT QUALITY AND EFFLUENT QUALITY

Influent water quality is designed based on the water quality test results conducted in Sep. 2017. Effluent water qualities follow the relevant national standard of Vietnam QCVN14: 2008/BTNMT, National Technical Regulation on Domestic Water. It is because treated water is discharged into Dao River and it is used for domestic water resource for Nam Dinh City. Effluent is diluted to Dao River water and it should satisfy to influent water quality of surface water quality.

Table 7.1 Wastewater Inflow Water Quality and Effluent Water Quality

No.	Item	Sample information/ Applied regulations	Permissible level			
			pH	BOD_5	Ammonium (as N)	Nitrate (as N03-)
				mg/l	mg/l	mg/l
1	Water quality test results	Kenh Gia PS1 Sep/2017	7.1	164	16.3	44
		Kenh Gia PS1 Sep/2017	7.2	88	13.8	34
2	Upper limit value of wastewater inflow	Designed from No.1 water quality test results	7.1	130-200	30-40	60-90
3	Effluent water quality	QCVN14: 2008/BTNMT National Technical Regulation on Domestic Water	5~9	30	5	30
4	Influent water quality	QCVN 08-MT:2015/BTNMT National technical regulation on surface water quality	6~8.5	4	0.3	2

7.2 TREATMENT METHOD

(1) Direct area

Conventional Activated Sludge, CAS, method is applied to the wastewater treatment plant. Though CAS method can remove nitrogen and phosphorus with limited volume, it is standardized method and widely applied in Vietnam at present. Therefore, CAS method (Figure6) is selected for Nam Dinh City wastewater treatment plant at this moment and treatment method should be finalized by further study taking into consideration of life-cycle cost, expected influent/effluent water quality, necessary land area, required skill for O&M and so on. Advantages and disadvantages of CAS method are summarized in Table7.2.

Table 7.2 Advantage and Disadvantage of CAS Method

Advantage	Disadvantage
1. Average investment cost 2. Use of standardized equipment 3. Average operation cost 4. Stable and easy operation	1. Large facility area 2. Difficulty for facility expansion

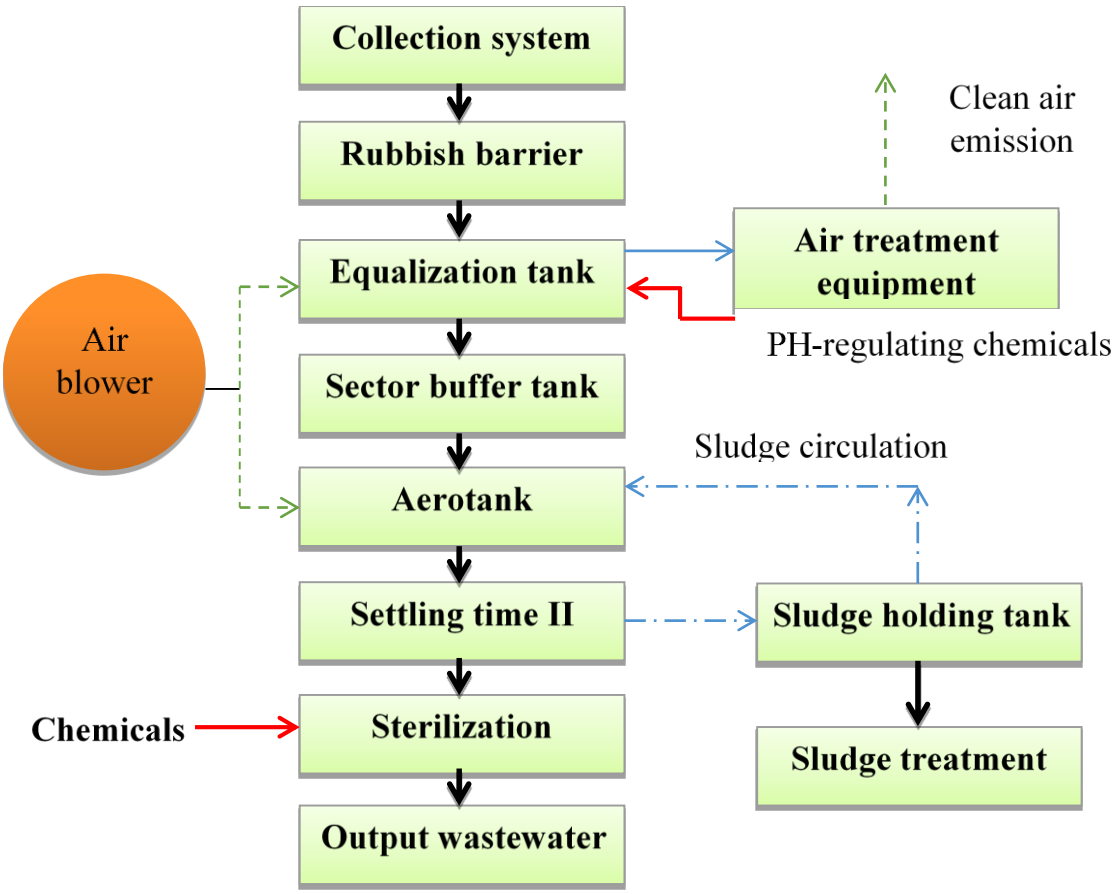


Figure 7.1 Wastewater Treatment Flow by CAS Method

(2) Indirect area

Buffered Septic Tank with Anaerobic Filter, BASTAF, and wetland method is applied to the wastewater treatment method for indirect area.

CHAPTER 8 COST ESTIMATE

8.1 PROPOSED WORKS FOR NAM DINH CITY

Construction work items for Sewerage and Drainage Master Plan for Nam Dinh City are listed in below. It is all the work items, which will be necessary to solve issues up to 2050.

(1) Sewerage works

Table8.1 Sewerage Construction Works Summary

No	Item	Unit	Quantity
1	**Direct Area**		
A	**Sewerage Basin 01**		
1.1	Sewer network		
1.1.1	Sewer line works DN 600 ~ 1700	m	32,940
1.1.2	Diversion chamber	nos.	134
1.1.3	Booster pumping station1	m^3/hr.	3,500
1.1.4	Booster pumping station2	m^3/hr.	17,000
1.2	Quan Chuot Wastewater Treatment Plant	m^3/day	117,000
B	**Sewerage Basin 02**		
1.1	Sewer network		
1.1.1	Sewer line works DN 600 ~ 1700	m	27,524
1.1.2	Diversion chamber	nos.	71
1.1.3	Booster pumping station1	m^3/hr.	5,000
1.2.	Dai An Wastewater Treatment Plant	m^3/day	95,000
2	**Indirect Area**		
C	**Northern Basin of Dao River**		
1.1	Sewer network		
1.1.1	DN150 ~ 300	m	157,273
1.1.2	Diversion chamber	nos.	408
1.2	46/27 wastewater treatment stations	m^3/day	9,710
1.3	12 wastewater pumping stations	m^3/day	2,410
D	**Southern Basin of Dao River**		
1.1	Sewer network		
1.1.1	DN150 ~ 300	m	120,904
1.1.2	Diversion chamber	nos.	335
1.2	33/13 wastewater treatment stations	m^3/day	17,174
1.3	1 wastewater pumping station	m^3/day	110

(2) Drainage works

Table 8.2 Drainage Construction Works Summary

No	Item	Unit	Quantity
A	**Direct Area**		
1	Rainwater drainage		
1.1	Drainage sewer grade I	m	52,421
1.2	Drainage sewer grade II	m	86,581
2	Regulating lake improvement		
2.1	Lake1 of Kenh Gia PS	ha	3.32
2.2	Lake2 of Kenh Gia PS	ha	4.28
2.3	Transitional lake of Quan Chuot PS	ha	3.14
B	**Indirect Area**		
1	Rainwater drainage		
1.1	Drainage sewer grade I	m	98,571
1.2	Drainage sewer grade II	m	115,156
2	Regulating lake improvement	ha	183.00
3	Drainage pump station	m^3/hr.	79,200

8.2 PRECONDITIONS

Following preconditions are applied to the construction cost estimate.

- Construction rate and unit cost of Nam Dinh city are applied to pipeline cost estimate having diameter ≤ DN800.
- Unit cost of sewer pipe installation refers to the existing regulation by Nam Dinh PPC.
- Unit cost of pipe jacking method refers to the project of Duong water supply river in Hanoi.
- Unit cost of wastewater treatment plant by CAS method refers to the existing project cost estimate in Vietnam.
- Exchange rate is JPY 1.0 = VND 0.00478 as of April 2018.

8.3 CONSTRUCTION COST

Total construction cost is VND 15,467,158,875,577 equivalent to JPY 73,934,793,860 as of April 2018 price level.

It is total construction costs up to 2050, phasing of project and implementation program up to 2025 by the priority projects will be studied in the succeeding section.

Table 8.3 Construction Cost Estimate for Entire Project Components by 2050

No	Items	VND	JPY
1	**Sewerage Works**		
1.1	Direct area Basin 01	3,938,940,004,630	18,828,585,108
1.2	Direct area Basin 02	2,718,881,733,375	12,996,566,603
1.3	Northern Basin of Dao River	418,736,940,000	2,001,610,612
1.4	Southern Basin of Dao River	395,684,200,000	1,891,415,870
	Total of Sewerage Works	7,472,242,878,005	35,718,178,193
2	**Drainage Works**		
2.1	Direct area	2,209,125,997,850	10,559,875,707
2.2	Indirect area	5,785,789,999,721	27,656,739,960
	Total of Drainage Works	7,994,915,997,572	38,216,615,667
	Total Construction Works	**15,467,158,875,577**	**73,934,793,860**

8.4 OPERATION AND MAINTENANCE COST

(1) Base operation and maintenance cost

Firstly, Nam Dinh Urban Construction Management Joint Company, UCMC prepares the annual Operation and Maintenance budget application to Nam Dinh CPC. Nam Dinh CPC reviews UCMC budget proposal and provides the annual budget. It is around VND 7,000 million in each year. As for the electricity cost in item 1.2, which is VND 1,100 Million, it is provided by Nam Dinh PPC. Total annual O&M budbget is VND 8,300 Million. Annual budget is almost same in every year. When UCMC needs heavy pump repair or replacement, they request to CPC as the additional budget.

Table 8.4 Annual O&M Budget for Sewerage and Drainage Facilities

No.	Item	Amount (VND Million)
1	Pumping station	
1.1	Staff salary, maintenance consumables, minor repair	2,700
1.2	Electricity	1,100
2	Sewer	
2.1	Staffs salary, vehicle fuel, materials for repair cost	4,300
3	Lake	
3.1	Staffs salary, etc.	200
	Total	8,300

(2) Additional operation and maintenance cost for new facilities

Additional operation and maintenancee costs shall be required for newly constructed WWTP, pumping stations, and 3 lakes as below. Operation and maintenance costs of sewers and drainage canals extension shall be covered by the existing staffs' work.

Table 8.5 Additional Annual O&M Budget

Unit: VND Million

No.	Item	Quantity	Unit price	Annual amount
1	Wastewater treatment plant			
1.1	Quan Chuot WWTP	117,000m^3/d	800VND/m^3	34,164
1.2	Dai An WWTP	95,000m^3/d	800VND/m^3	27,740
2	Pumping stations			
2.1	Booster pumping stations	8hrs/d	1,400,00VND/hr	2,016
2.2	Indirect area	8hrs/d	150,000VND/hr	216
3	Lakes	3nos	100 Mil/nos	300
	Total			64,436

(3) Total operation and maintenance cost

Based on the assumption in above, annual operation and maintenance cost is estimated to VND 72,736 Million = 8,300Million + 64,436Million. It is mainly electricity fee and other physical costs. Work load on each staff also increase accompanying with infrastrucure development, UCMC may consider to increase staffs in charge of maintenance works. Labor cost will increase and total operation and maintenance cost will also increase in such case.

CHAPTER 9 PHASING IMPROVEMENT PLAN

9.1 SELECTION OF PRIORITY PROJECTS

The development goals are set at 2030 and 2050 respectively. The proposed sewerage and drainage project components shall be selected to attain the project objectives by 2030 and 2050. Then, the priority projects are studied in this section.

It is set that Phase1 project implementation period is up to 2030. In general, project approval procedures for implementation takes long period in Vietnam. It assumes that this process takes about 2 years until 2020. Then, the project implementation stage will be proceeded from 2021. Ten years implementation period is relatively longer than standard project implementation case. Thus, Phase1 is also divided by 2stages. Stage1 is from 2021 to 2025 and stage2 from 2026 to 2030. As for Phase2, it will commence from 2031. The concrete project implementation program will be realized during Phase1 implementation. It is early to divide Phase2 by stages at this moment, therefore, it keeps one stage.

- Phase1 : Stage1 2021 ~ 2025
- Phase1 : Stage2 2026 ~ 2030
- Phase2 2031 ~ 2050

(1) Priority conditions for Phase1 sewerage project component

- Concentrated residential area
- Urbanization progressed area
- District administrative center
- Resort area
- Area of serious environmental pollution caused by wastewater

Sewerage Basin01 in direct area is selected as priority project area to be implemented by 2025.

(2) Priority conditions for Phase1 drainage project component

It considers that following conditions.

- Population density
- Frequency of flood by heavy rain
- Economic activities area

Economic activity is aggressive in urban developed area. Such area also has many construction works as urban development. Also, population density is higher than indirect area. As the result, the direct area is selected as the drainage priority project area.

9.2 SEWAGE AND DRAINAGE COLLECTING METHOD

(1) Sewage collection

Most sanitary sewer lines in sewerage basin01 are implemented under Stage1 component. Sanitary sewer lines, which do not match with the priority conditions, will be implemented after 2031.

Sanitary sewer line in Sewerage Basin02, North and South of Dao River Basin, are not the priority project area. Thus, it will be implemented under Stage2.

(2) Drainage sewer

In order to solve the flood issue entirely, it is important to construct trunk drainages. It can show the project effect maximum. Then, branch drainages will be improved as next step. Drainage sewer grade I and II construction work are 52km and 86km respectively in total. Major trunk drainage sewer construction with grade I is implemented after 2026. Grade II will be implemented from Phase2.

(3) Regulating lake improvement

Lake improvement is closely related to the drainage construction because it functions to regulate the flood water before flowing into drainage canal. Regulating lake improvement work stores floodwater largely and contributes to reduce flood damage from heavy rain. The proposed regulating lake improvement is 3 lakes and construction area is 10.7ha. All lake improvement is implemented after 2026.

9.3 WASTEWATER TREATMENT PLANT

Two wastewater treatment plants are one of the highest priority project. As mentioned above, Sewerage basin01 has higher priority than basin02, therefore, Quan Chuot WWTP construction with treatment volume 32,000m^3/day will be conducted under Stage1. Stage2 is the implementation, which will attain the design wastewater treatment by 2030. Therefore, extension of Quan Chuot WWTP is 57,000m^3/day and Dai An WWTP is 68,000m^3/day.

9.4 PHASING IMPROVEMENT PLAN

9.4.1 Each Phase Component

Project development frame up to 2050 is formulated to be divided by Phase1 consisting of Stage1 and 2, and Phase2.

Sewerage works are prioritized, and projects components are formulated in Phase1. Drainage projects are mainly implemented in Phase2. Each project component is summarized in below.

Table 9.1 Sewerage and Drainage Project Development by 2050

No.	Description	Phase1 Stage1	Phase1 Stage2	Phase2
	Period	2021-2025	2026-2030	2031-2050
1	Sewerage works			
1.1	Direct area Basin01	- Major sewer L=10.9km - WWTP 32,000m3/d	- Major sewer L=12.6km - WWTP 57,000m3/d	- Remaining sewer L=9.4km - WWTP 28,000m3/d
1.2	Direct area Basin02		- Major sewer L=17.7km - WWTP 68,000m3/d	- Remaining sewer L=9.8km - WWTP 27,000m3/d
1.3	Indirect area North Dao River Basin		- Major sewer L=147.1km - WWTP 49places	- Remaining sewer L=10.2km - WWTP 27places - Pump sta. 12places
1.4	Indirect area South Dao River Basin		- Major sewer L=72.3km - WWTP 33places	- Remaining sewer L=48.6km - WWTP 13places - Pump Sta. 1place
2	Drainage works			
2.1	Direct area		- Drainage sewer grade I L=27.9km - Lake improvement A= 10.7ha	- Drainage sewer grade I L=24.5km - Drainage sewer grade II L=86.6km - Lake improvement ancillary works
2.2	Indirect area			- Drainage sewer grade I L=98.6km - Drainage sewer grade II L=115.2km - Lake improvement A=183ha - Pump sta. Q=79,200m3/d

9.4.2 Project Implementation Schedule for Phase1

It is prepared to follow the above project development frame. Priority projects are conducted by 2025 and the remaining construction works are done by 2030 in Stage2 (Figure9.1). Stage1 project component is listed below.

- Sewer network in sewerage basin01 : L=10.9km
- Quan Chuot WWTP with capacity : Q=32,000m^3/day

No	Item	Quantity	Unit	Stage 1					Stage 2				
	Sewerage Plan			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	**Direct Area Sewerage Basin01**												
1.1	Sanitary Sewerage collection system in Basin01-1	10900	m										
1.2	Sanitary Sewerage collection system in Basin01-2	12591	m										
1.3	Quan Chuot WWTP in Basin01	32000	m^3/day										
1.4	Quan Chuot WWTP Extension in Basin01	57000	m^3/day										
2	**Direct Area Sewerage Basin02**												
2.1	Sanitary Sewerage collection system in Basin02	17687	m										
2.2	Dai An WWTP in Basin02	68000	m^3/day										
3	**Indirect Area Dao River North Basin**												
3.1	Sewer Construction gravity flow	147100	m										
3.2	Wastewater Treatment Plant	49	nos										
4	**Indirect Area Dao River South Basin**												
4.1	Sewer Construction gravity flow - Priority Area	72300	m										
4.2	Wastewater Treatment Plant & Pump Station	33	nos										
B	**Drainage Plan**												
1	**Direct area Drainage System**												
1.1	Drainage sewer grade I	12703	m										
1.2	Drainage sewer grade II	15211	m										
2	**Direct Area Rergulating Lake Improvement**												
2.1	Kenh Gia PS1	3.28	ha										
2.2	Kenh Gia PS1	4.28	ha										
2.3	Transitional lake of Quan Chuot PS	3.14	ha										

Figure 9.1 Project Implementation Schedule for Phase1

9.4.3 Phase1 Stage1 Construction Cost Estimate

Total construction amount of Stage1 is VND 953,968,823,753. It is JPY 4,559,970,978 as of April 2018.

Applied exchange rate is JPY 1.0 = VND 0.00478

Table 9.2 Construction Cost Estimate for Stage1

Unit : VND

No	Item	Unit	Quantity	Unit price	Total
A	**Sewerage works**				
1	Basin01 Sewer newtwork				
1.1	DN 600 sewer pipe	m	5,609	4,000,025	22,435,342,368
1.2	DN 800 sewer pipe	m	3,371	9,998,662	33,705,488,700
1.3	DN 1000 sewer pipe	m	585	114,954,420	67,248,335,985
1.4	DN 1200 sewer pipe	m	389	119,837,463	46,616,773,200
1.5	DN 1400 sewer pipe	m	499	139,858,287	69,789,285,300
1.6	DN 1700 sewer pipe	m	385	199,970,014	76,988,455,200
1.7	Main catch pit and CSO	nos	134	62,149,254	8,328,000,000
1.8	Booster pumping station1 Q=3,500m3/h	nos	1	14,000,000,000	14,000,000,000
1.9	Booster pumping station2 Q=17,000m3/h	nos	1	38,857,143,000	38,857,143,000
	Sub-total1			53,507,911,125	377,968,823,753
2	Quan Chuot Wstewater Treatment Plant				
2.1	Upto 2025	m3/day	32,000	18,000,000	576,000,000,000
	Total of sewerage works				**953,968,823,753**
	Total				**953,968,823,753**

9.4.4 Project Cost for Stage1

Estimated construction cost is huge to implement by Vietnam government budget. Therefore, project shall be required to apply to ODA loan fund and the project cost estimate for ODA fund case is conducted. It consists of the following cost items and estimated amounts are tabulated in below.

Table 9.3 Project Cost Assuming as ODA Loan Project

No.	Portion	Cost item	Amount (VND billion)	Amount (JPY Million)
1	Eligible portion	1 Construction cost	954	4,560
		2 Engineering service cost	48	228
		3 Contingency	143	684
2	Non-eligible portion	1 Land acquisition cost	95	45
		2 Project management cost	9	41
		3 VAT, import tax, and so on	172	821
3	Interest and so on		17	82
	Grand total		1,438	6,872

9.5 IMPLEMENTING ORGANIZATION

9.5.1 Present O&M Organization

Nam Dinh Urban Construction Management Joint Company, UCMC, is responsible for the operation and maintenance works for the sewerage and drainage facilities in Nam Dinh City. They are responsible for not only sewerage and drainage facilities but also parks, housing, cemetery, and lighting system. Total number of staffs are 220 persons. The organization chart is shown in below (Figure9.2).

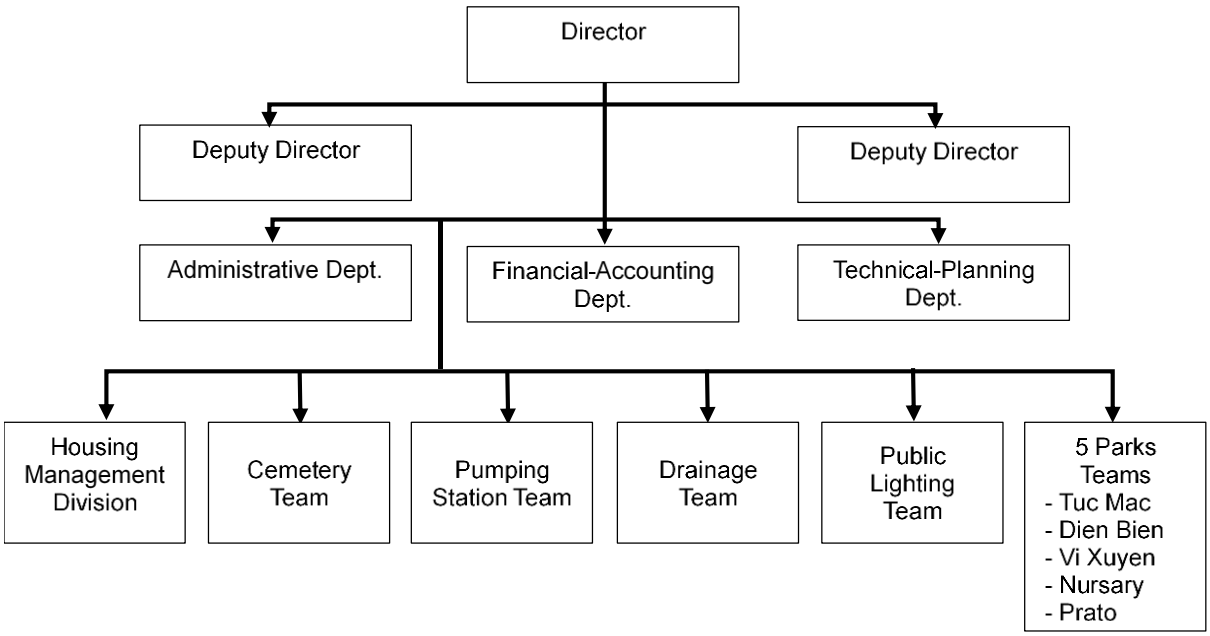


Figure 9.2 Nam Dinh UCMC Organization Chart

9.5.2 O&M Works on Each Sewerage and Drainage Facility

(1) Pumping station

1) Number of staffs

11 pernament staffs work at Quan Chuot and Kenh Gia pumping station respectively. Total staffs are 22 persons. UCMC hires temporary staffs in rainy season for removing obstables.

2) Work contents

Nam Dinh UCMC maintains Quan Chuot and Kenh Gia pumping stations. Though Nam Dinh City has other three pumping stations, they are used as the irrigation purpose mainly, they are managed by irrigation management company. Followings are major work items.

- Managing and operating Kenh Gia and Quan Chuot pumping stations
- Removing grass and obstacles on the inlet canals of pumping stations
- Removing the obstacles in suction tank, discharge tank, and drainage pump
- Removing grass and obstacles on the outlet canals to Red River and Dao River.
- Maintaining pumps and checking machinery regularly

(2) Sewer and drainage canals

1) Number of staffs

30 pernament staffs work for sewer cleaning for total length 100km sewer.

2) Work contents

Their main work is to remove sludge and obstacles and make sewer flow smoothly. As for drainage canal dredging, Nam Dinh CPC contracts with contractor, which owns construction heavy equipment such as excavator and dump truck. UCMC does not have such construction heavy equipment.

- Dredging sludge in manhole, box culvert, and outlet by manual
- Dredging sludge in sewer by machinery
- Solving stuck or local flood by sludge in sewer
- Removing the obstacles in catch pit
- Solving sewer pipe settlement

(3) Lake

1) Number of staffs

2 staffs are assigned for maintenance work of lakes.

2) Work contents

Though Nam Dinh City has many lakes, UCMC manages only two lakes, Vi Xuyen and Thong Nhat lakes. Major works are as follows:

- Checking the water level of lakes by observation
- Checking the situation to avoid encroachment by residents
- Removing the grass and obstacles in lakes

9.5.3 O&M Plan for Proposed Sewerage and Drainage Facilities

Followings can be pointed out as O&M plan strategy after the stage1 project implementation.

- UCMC will be in charge of O&M works including Quan Chuot WWTP.
- CPC and PPC shall allocate to the additional O&M budget for Quan Chuot WWTP (VND 17,500 million = 800VND/m^3 x 60,000m^3/day x 365 days) and 3 lakes (VND 300 million) about VND 17,800 million according to the previous JICA Study result.
- Staff training must be necessary for the operation and maintenance of Quan Chuot WWTP.
- Close communication will be sought with experienced WWTP operational organization such as Hanoi Sewerage and Drainage Company to get knowledge.

9.6 ECONOMIC EVALUATION

Any type of master plan in Vietnam is to set objectives and draw grand design at the target year incorporating into all necessary projects from concerned organizations. When master plan is approved by Provincial People's Committee, each listed project shall be indispensable and project contents cannot alter. Current master plan formulation method in Vietnam does not match with ecoconic evaluation. Thus, no master plan studies economic evalution in case of under domestic procedures. Nam Dinh Sewerage and Drainage Master Plan also has been implemented to follow the Vietnam procedures, therefore, no economic evaluation is studied.

9.7 FINANCIAL SOURCES

Financial sources for sewerage and drainage facility plan is considered the followings:

- State budget
- Private capital by enterprises and investors
- Sponsorship from organization by Official Development Assistant, ODA, fund
- Other legal capital sources

It is too huge amount to implement by state budget. Drainage project does not bear any income source so that it is not interested for private sectors to be sponsor for entire

project. ODA fund is the only proper financial source to implement sewerage and drainage master plan.

Once financial source is decided, investment fund shall comply with Law on Public Investment of Vietnam

9.8 STRATEGIC ENVIRONMENTAL ASSESSMENT

(1) Applied laws

- Law on water resources no. 17/2012/QH13 dated 21/6/2012
- Law on construction no. 50/2014/QH13 dated 18/6/2014
- Law on environmental protection no. 55/2014/QH13 dated 23/6/2014

Further, relevant decrees, decisions, circulars, and regulations are applied to the strategic environmental assessment.

(2) Current environmental status

Current environment status affected by the project is tabulated in below.

Table 9.4 Current Environment Status Related to the Project Implementation

No.	Category	Current status
1	Water environment	
1.1	Surface water	Red River water quality is affected by Qua Chuot outflow. COD, BOD5, Animal fat and vegetable grease, and phenol are higher than other river. Dao River water quality is affected by Kenh Gia outflow. There are local pollution by COD, BOD_5, oil, and phenol.
1.2	Lake and pond	Lake and pond water is polluted by organic matters. It is about 1.5 to 3.5 times higher than National Technical Regulation No.QCVN08:2008.
2	Air	The main causes are construction, transportation, and industrial activities. Suspended Solid exceeds 1.0~1.5 times more than allowable standard. It is affected by emissions of SO_2, CO_2, CO, and NOx.
3	Land	Land is affected by illegal waste discharge. Soil is degraded and is affected to agricultural product quantity and quality.
4	Ecosystem	
4.1	Lake ecosystem	It is severely affected by the urbanization. Lake area has been reduced alarmingly and biodiversity declines steadily.
4.2	River ecosystem	Wetland of rivers is encroached and levelled as land and turn into waste dumping site.

(3) Environmental impact during project implementation

1) Construction stage

Table 9.5 Environment Impact during Construction Stage

No.	Items	Environmental impact during construction stage
1	Water resource	Red River and Dao River are affected impact from industrial waste, and domestic wastewater.
2	Air	Vehicle and heavy equipment generate dust and smoke.
3	Noise and vibration	Construction noise and vibration generates at local area.
4	Solid waste	Sedimentation generates by dredging works. Extra soil may generate by excavation.
5	Land	Land is used as construction site for temporary purpose Resettlement of residents or compensation for relocation may generate.
6	Ecosystem	Ecological impacts are mainly on livestock and crops. There is no rare and endangered species, therefore, it has few impact on natural ecological system.
7	Transportation	It may generate traffic jam or increase traffic volume during temporary barred due to pipeline construction.
8	Socio-economic	It mostly affects to great positive impact on economic and social development. It may need social security due to many labor workers.
9	Historical heritages	It may have possibility of relocation of tombs and affect to environmental pollution for temples and pagodas.
10	Human health	It may pay attention to possibility of labor worker's accident.

2) Operation stage

Table 9.6 Environment Impact during Operation Stage

No.	Items	Environmental impact during operation stage
1	Water resource	Treated water quality effluent will improve Red River and Dao River water quality as the water resource.
2	Air	It may affect to air when dissolved gas occurs from diesel generator when it uses as backup electrical source.
3	Noise and vibration	It generates from the pumping station during pump operation.
4	Solid waste	It shall pay attention to the residue generated through sedimentation and drying at the mud drying yard.
5	Land	No impact on operation stage
6	Ecosystem	No impact on operation stage
7	Transportation	Chemical vehicles and mud damp trucks may increase the transportation amount caused by WWTP operation.
8	Socio-economic	No impact on operation stage
9	Historical heritages	No impact on operation sage
10	Human health	It pays attention to accident for exposed electricity and toxic chemicals.

(4) Environmental mitigation method

There are minor negative impacts generated by sewerage and drainage project. Those can be mitigated or eliminated by appropriate solutions.

Table 9.7 Environment Mitigation Measures

No.	Items	Construction stage	Operation stage
1	Water resource	Surface water collects to rubber tube and flows to ditch	Request upstream provinces not to discharge toxic substances to keep Red River clean
2	Air	Area having dust and smoke shall be fenced and be sprayed water.	Protection of gas and other harmful materials from generator.
3	Noise and vibration	Arrange of proper construction road	Fence and green planting is provided for protection.
4	Solid waste	Provision of dumping site for sedimentation and extra soil	Use of damp truck not to leak the residue. Dumping site used in the construction stage will be used continuously.
5	Land	Formulation of resettlement or compensation plan	Not necessary
6	Ecosystem	Proper construction method and use of proper equipment	Not necessary
7	Transportation	Provision of guard for local transportation	Transport plan will be studied to monitor the traffic situation.
8	Socio-economic	Establishment of liaison committee consisting of neighbors around the site to secure area safety.	Not necessary
9	Historical heritages	Further analysis will be studied.	Not necessary
10	Human health	Formulation of labor safety plan	It shall provide training course for operators' safety education

(5) Conclusion

The construction and operation of sewerage and drainage system do not create critical negative impacts on environments. Though minor environmental impacts will occur, it can be solved to apply to above mitigation methods.

Sewerage and drainage project will be implemented under sustainable development policy. It enhances to save water resource and protect water environment. Urban water environment will improve by the project.

9.9 RECOMMENDATION FOR AUTHENTIC SEWERAGE SYSTEM

In the direct area, interceptor pipes will be constructed as a first step of the development of sewerage system in Nam Dinh City. However, the following action and project should be implemented in the future.

1) Separate sewerage system will be developed as authentic sewerage system.

2) Connection between household and sewer will be implemented in whole target area.

3) Actual condition survey on house connection and existing sewer will be implemented in whole target area.