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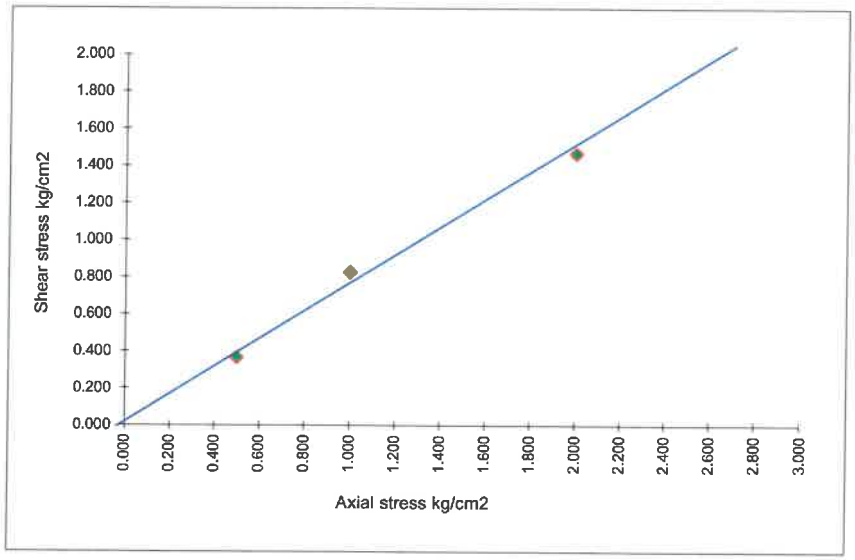
Client : M/S CDR
Project : Expansion & Upgrade of Al-Ghadir Wastewater Treatment Plar
Location : Aley Caza - Mount Lebanon
Date : 23/11/24

SHEAR BOX TEST

ASTM Designation - D3080
AASHTO T - 236

Sample No : BH1
Depth : 4.00 m
Gearing Rate : 0.2 mm/min²

Shear stress kg/cm²	Axial stress kg/cm²
0.369	0.500
0.831	1.000
1.471	2.000



Results : Cohesion **C = 0.06 kg/cm²**
Angle of friction **Φ= 32 °**

Head of laboratory section

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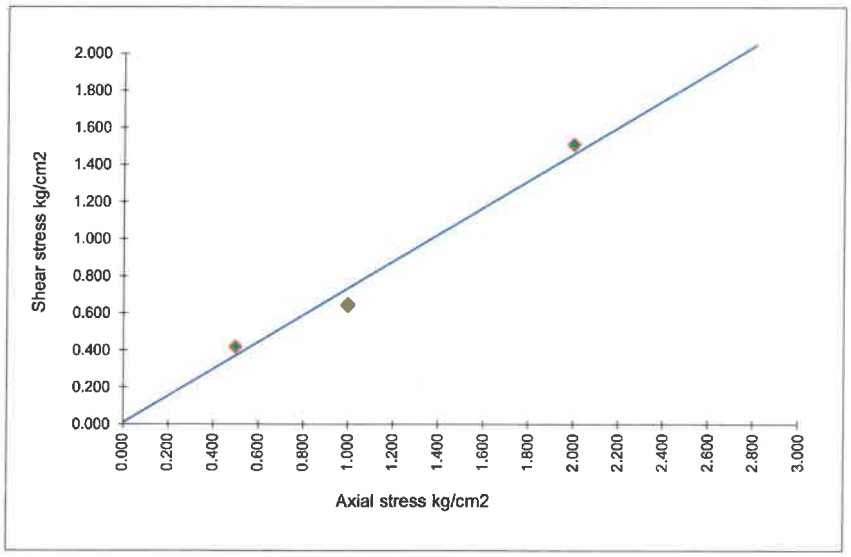
Client : M/S CDR
Project : Expansion & Upgrade of Al-Ghadir Wastewater Treatment Plai
Location : Aley Caza - Mount Lebanon
Date : 23/11/24

SHEAR BOX TEST

ASTM Designation - D3080
AASHTO T - 236

Sample No : BH3
Depth : 11.00 m
Gearing Rate : 0.2 mm/min²

Shear stress kg/cm²	Axial stress kg/cm²
0.421	0.500
0.647	1.000
1.512	2.000



Results : Cohesion **C = 0.00 kg/cm²**
Angle of friction **Φ= 33 °**

Head of laboratory section

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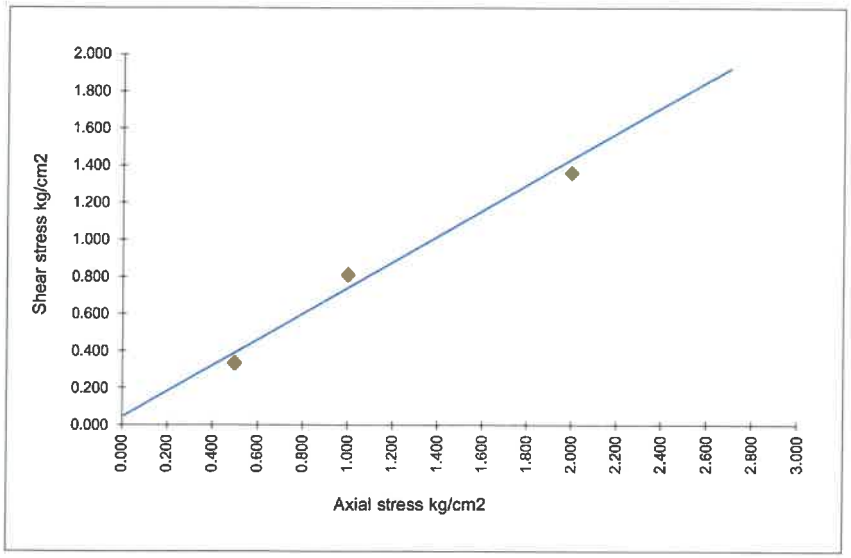
Client : M/S CDR
Project : Expansion & Upgrade of Al-Ghadir Wastewater Treatment Plar
Location : Aley Caza - Mount Lebanon
Date : 23/11/24

SHEAR BOX TEST

ASTM Designation - D3080
AASHTO T - 236

Sample No : BH4
Depth : 7.00 m
Gearing Rate : 0.2 mm/min²

Shear stress kg/cm²	Axial stress kg/cm²
0.337	0.500
0.812	1.000
1.364	2.000



Results : Cohesion **C = 0.00 kg/cm²**
Angle of friction **Φ= 34 °**

Head of laboratory section

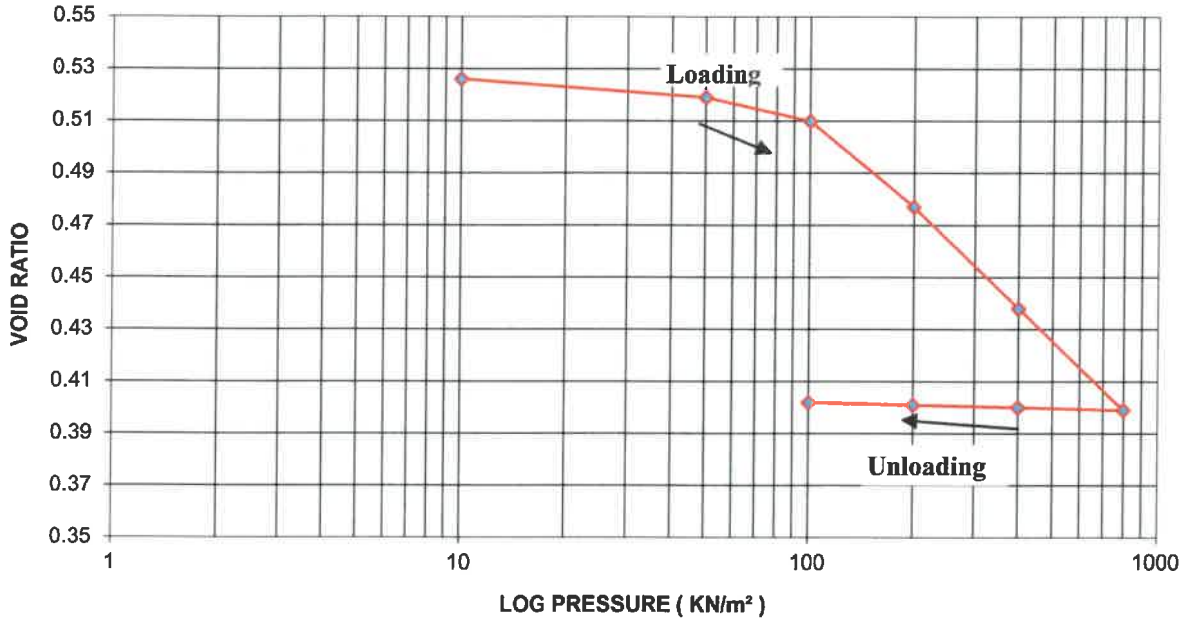
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Client : M/S CDR
Project : Expansion & Upgrade of Al-Ghadir Wastewater Treatment Plant
Location : Aley Caza - Mount Lebanon
Date : 23/11/24

CONSOLIDATION TEST
ASTM - D2435



Borehole : BH-4			Depth : 7.00 m	Pressure KN / m²	Coefficient of compressibility - m_v m²/MN
Bulk density	g/cm³	:	1.79	10	0.065
Initial void ratio		:	0.694	50	0.115
Specific gravity		:	2.598	100	0.118
Natural M.C.	%	:	16.7	200	0.219
Dry density	g/cm³	:	1.53	400	0.132
Degree of saturation	%	:	62.5	800	0.068
Atterberg limits	%	:	LL = 30 : PL = 22	400	0.002
Compression index		:	Cc = 0.110	200	0.004
				100	0.007

Head of laboratory section

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Client: M/S CDR
Project: Expansion & Upgrade of Al-Ghadir Wastewater Treatment
Location: Aley Caza - Mount Lebanon
Date: 23/11/24

Determination of Organic Content in Soils by Loss On Ignition

AASHTO DESIGNATION T 267-86 (1993)

Sample No.	Sample Depth (m)	A	B	C	Percent Organic Matter, %
BH2	1.00	79.05	78.54	35.62	1.17
BH4	2.00	93.12	91.97	33.24	1.92

A = Weight of crucible or evaporating dish and oven dried soil, before ignition, in g.
B = Weight of crucible or evaporating dish and oven dried soil, after ignition, in g.
C = Weight of crucible or evaporating dish,to the nearest 0.01 g.
Percent Organic Matter = (A-B)/(A-C)*100

Head of laboratory section

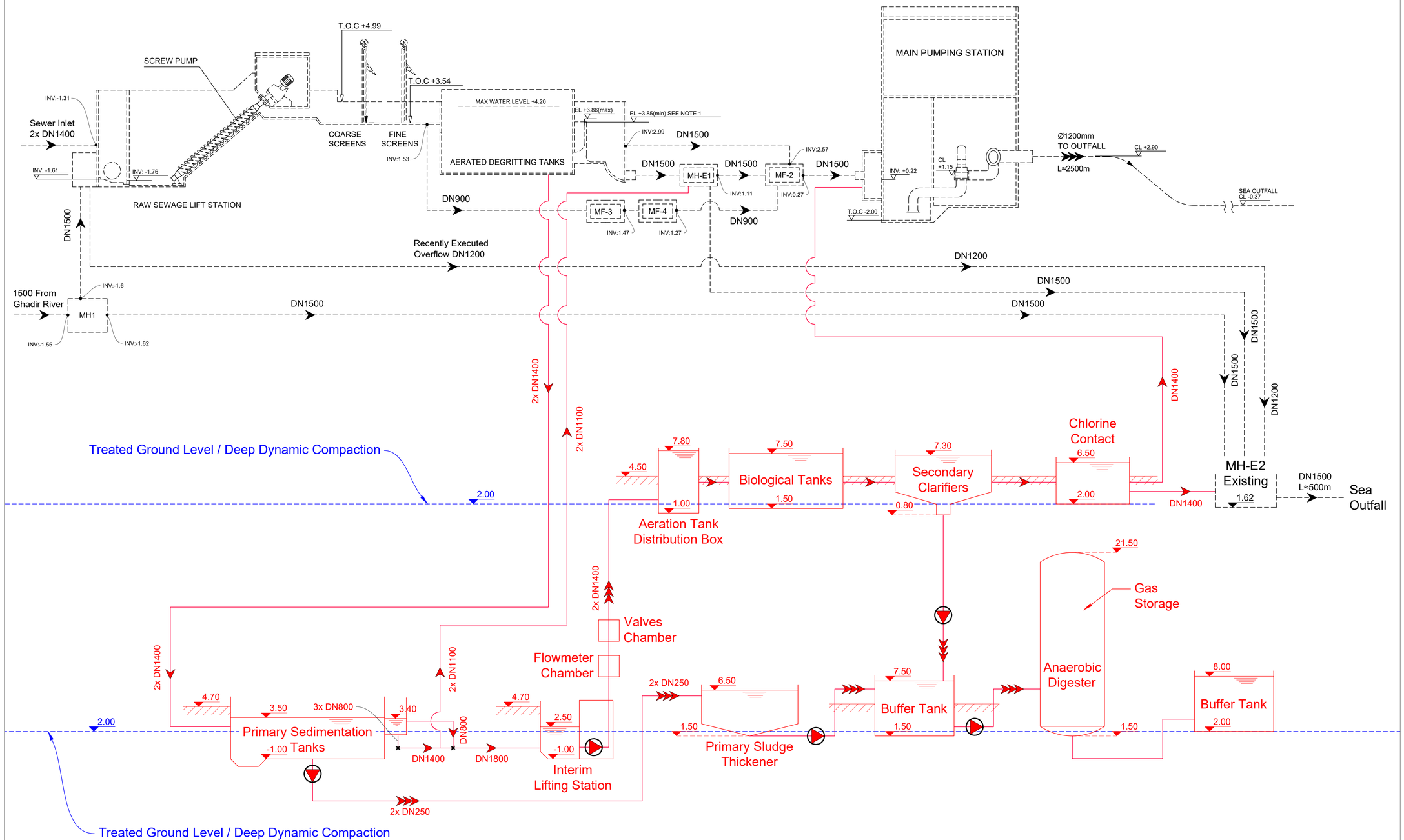
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CHAPTER 4 GEOTECHNICAL INVESTIGATION

Appendix 4.5 Overall Hydraulic Profile



LEGEND:

Dashed Black : Existing

Red : Proposed

INV : Pipe Invert Level

CHAPTER 8 PROCESS CALCULATION

Appendix 8.1 Ghadir WWTP–Load Schedule & Estimated Consumption

Ghadir Wastewater Treatment Plant

Load Schedule & Estimated Consumption

SN	Desccription	Power Each	Existing						Current Extension of Existing WWTP (Phase I)						New Current Expansion Site (Phase I)						New - Future (Phase II)					
		Kw	# Duty	# Standby	Running hr each per day	TTL Duty Power, kW	TTL connected Power, Kw	TTL consumption kWh/day	# Duty	# Standby	Running hr each per day	TTL Duty Power, kW	TTL connected Power, Kw	TTL consumption kWh/day	# Duty	# Standby	Running hr each per day	TTL Duty Power, kW	TTL connected Power, Kw	TTL consumption kWh/day	# Duty	# Standby	Running hr each per day	TTL Duty Power, kW	TTL connected Power, Kw	TTL consumption kWh/day
A	**Lifting Station**																									
A.1	Lifting Screw Pumps. 1584 m^3/hr, 5.3 m head	37	6	1	14	222	259	3,108	6	1	14	222	259	3,108												
A.2	Grease Pump 10.4 m^3/hr	0.18	6	1	0.5	1.08	1.26	0.54	6	1	0.5	1.08	1.26	0.54												
B	**Preliminary Treatment**																									
B.1	**Screening**																									
B.1.1	Coarse Screens, 40 mm clear opening	1.1	5	0	3	5.5	5.5	16.5																		
B.1.2	Coarse Screenings Belt Conveyor	3	1	0	3.5	3	3	10.5																		
B.1.3	Screenings Compactor	4	1	0	2	4	4	8																		
B.1.4	Fine Screens	2							5	5	3	10	20	30												
B.1.5	Screenings Conveyor	3							1	0	3.5	3	3	10.5												
B.2	**Grit Removal**																									
B.2.1	Grit Classifer	1.5	2	0	3	3	3	9	1	0	3	1.5	1.5	4.5												
B.2.2	Screw Conveyor	5.5	2	0	3	11	11	33	1	0	3	5.5	5.5	16.5												
B.2.3	Degritting Bridge	0.55	2	0	24	1.1	1.1	26.4	1	0	24	0.55	0.55	13.2												
B.2.4	Grit pump 2m3/h, 6 m	1.5	4	0	2	6	6	12	2	0	2	3	3	6												
B.2.5	Air Blowers 960 m3/hr, 400 mbar	15	2	1	24	30	45	720																		
B.3	**Main Pumping Station**																									
B.3.1	Motorized Gate Valve DN1100 (Pumps Suction)	2.2	3	0	0.5	6.6	6.6	3.3	1	0	0.5	2.2	2.2	1.1												
B.3.2	Motorized Gate Valve DN800 (Pump Discharge)	1.1	3	0	0.5	3.3	3.3	1.65	1	0	0.5	1.1	1.1	0.55												
B.3.3	Motorized Gate Valve DN600 (Purge Pipe)	2.2	1	0	0.5	2.2	2.2	1.1																		
B.3.4	Motorized Butterfly Valve DN1200 (Discharge Header)	2.2	1	0	0.5	2.2	2.2	1.1																		
B.3.5	Sump Pump	3	1	0	0.5	3	3	1.5																		
B.3.6	Ventilator Fan	2.2	2	0	18	4.4	4.4	79.2																		
B.3.7	Ventilator Fan	3.7	1	0	18	3.7	3.7	66.6																		
B.3.8	Crane	3	1	0	1	3	3	3																		
B.3.9	Flowmeter																									
B.3.10	Main Outfall Pump	250	2	1	12	500	750	6,000	1	0	12	250	250	3,000												
B.3.11	Grease Pump	0.37	2	1	0.5	0.74	1.11	0.37	1	0	0.5	0.37	0.37	0.185												
B.4	**Generator**																									
B.4.1	Fuel Pump	0.56	2	1	1	1.12	1.68	1.12	2	1	1	1.12	1.68	1.12							4	1	1	2.24	2.8	2.24
C	**Primary Treatment**																									
C.1	PST Scraper	0.5							12	0	24	6	6	144												
C.2	Primary Sludge Pumps, 30 m^3/h, 6 m hd	1.1							12	4	2	13.2	17.6	26.4												
C.3	PST Effluent Pumps 1,590 m^3/h, 10 m	60							12	6		720	1,080	0							12	6	12			8640
D	**Secondary Treatment**																									
D.1	Anoxic Tanks Mixers	18.5																			24	0	24	444	444	10656
D.2	Air Blowers 14,732 m^3/h, 7 m	330																			12	6	24	3960	5940	95040
D.3	IR Pumps 910 m^3/h, 0.8 m	10																			24	12	24	240	360	5760
D.4	FST Scraper, Diameter 40 m	0.75																			12	0	24	9	9	216
D.5	RAS Pumps 610 m^3/h, 6 m	15																			12	6	24	180	270	4320
D.6	SAS Pumps 90 m^3/h, 10 m	5.5																			6	6	3	33	66	99
E	**Disinfection & Dechlorination**																									
E.1	NaOCl Dosing Pumps 150 L/h	10																			3	3	24	30	60	720
E.2	$NaHSO_3$ Dosing Pumps 90 L/h	7.5																			3	3	24	22.5	45	540
F	**Sludge Treatment**																									
F.1	**Gravity Thickener PS, dia 18 m**																									
F.1.1	Sludge Scraper	0.18													3	0	24	0.54	0.54	12.96						
F.1.2	Thickened Sludge Pumps 30 m^3/h, 6 m	15													3	3	8	45	90	360						
F.1.3	Supernatant Pumps 30 m^3/h, 5 m	1.3													3	3	2	3.9	7.8	7.8						
F.1.4	Sludge screen 3 mm	0.25													3	0	8	0.75	0.75	6						

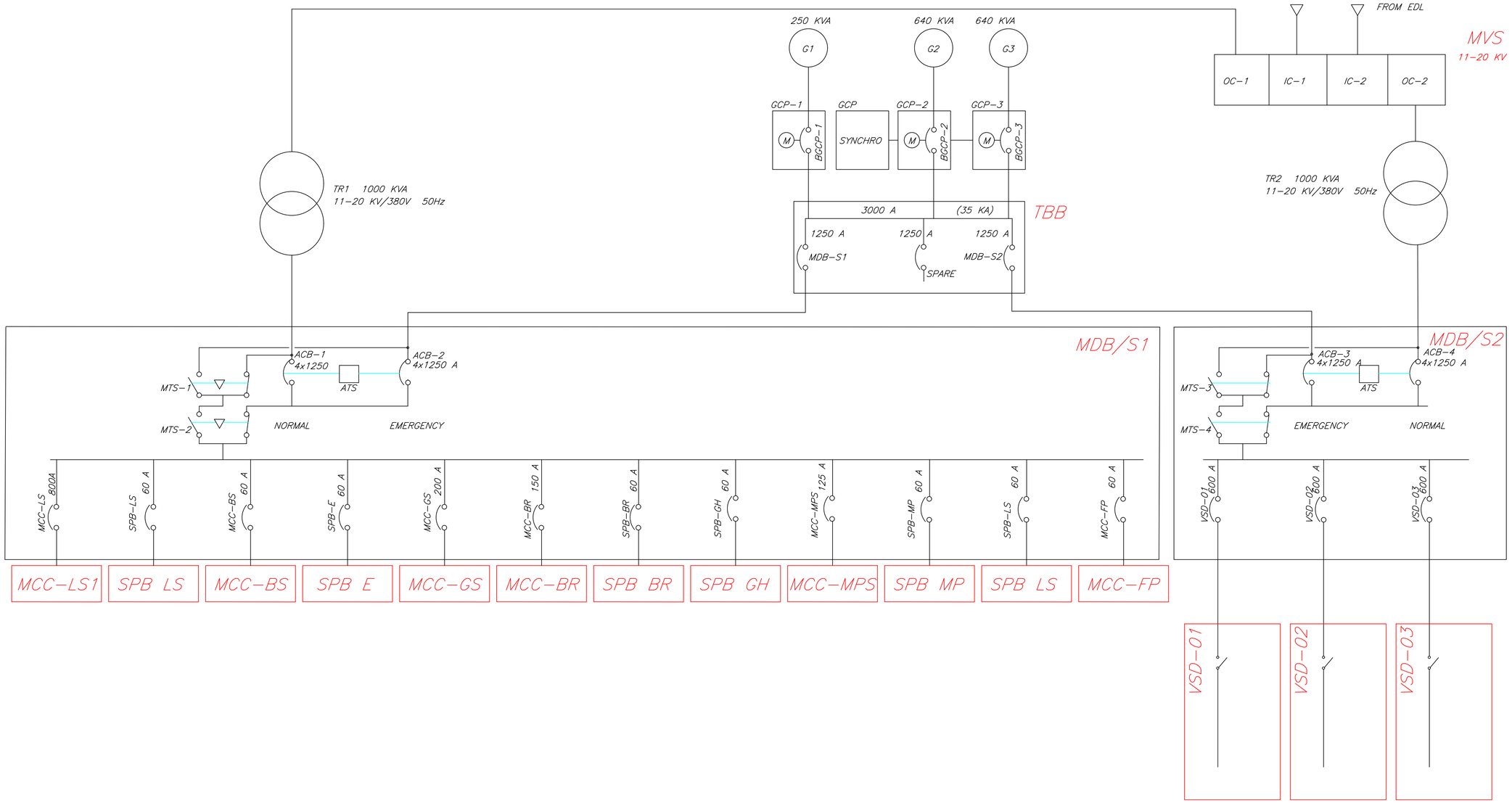
Ghadir Wastewater Treatment Plant

Load Schedule & Estimated Consumption

SN	Desccription	Power Each	Existing						Current Extension of Existing WWTP (Phase I)						New Current Expansion Site (Phase I)						New - Future (Phase II)					
		Kw	# Duty	# Standby	Running hr each per day	TTL Duty Power, kW	TTL connected Power, Kw	TTL consumption kWh/day	# Duty	# Standby	Running hr each per day	TTL Duty Power, kW	TTL connected Power, Kw	TTL consumption kWh/day	# Duty	# Standby	Running hr each per day	TTL Duty Power, kW	TTL connected Power, Kw	TTL consumption kWh/day	# Duty	# Standby	Running hr each per day	TTL Duty Power, kW	TTL connected Power, Kw	TTL consumption kWh/day
F.2	**Mechanical Thickening of Secondary sludge (Closed drum type) 90 m^3/h each**																									
F.2.1	Feed pump 86 m^3/h, 5 m	2.2																			6	0	8	13.2	13.2	105.6
F.2.2	Polyelectrolyte Dosing Pump, 10 L/hr, 5 m	10																			6	0	8	60	60	480
F.2.3	Thickened Sludge Pumps 12 m^3/h, 30 m	10																								
F.2.4	Supernatant return pump 149 m^3/h, 5 m	22																			2	1	4	44	66	176
F.2.5	Polyelectrolyte preparation system Mixer	7.5																			1	0	8	7.5	7.5	60
F.3	**Anaerobic Digestion**																									
F.3.1	Feeding Pump 24 m^3/hr, 22 m	15													2	2	10	30	60	300	2	2	10	30	60	300
F.3.2	Mixing System	30													2	0	24	60	60	1440	2	0	24	60	60	1440
F.3.3	Recirculation Pump 48 m^3/h, 20 m	11													2	2	24	22	44	528	2	2	24	22	44	528
F.3.4	Biogas Blowers 250 m^3/h, 5 m	7.5													4	2	18	30	45	540	2	1	18	15	22.5	270
F.4	**Digester Sludge Buffer Tank Prior to Dewatering**																									
F.4.1	Aeration Blowers 5,368 m^3/h, 6 m	250													4	2	24	1000	1500	24000						
F.5	**Sludge Dewatering**																									
F.5.1	Centrifuge 60 m^3/h	132													3	1	8	396	528	3168	2	0	8	264	264	2112
F.5.2	Feed pump 50 m^3/h, 5 m	30													3	1	8	90	120	720	2	0	8	60	60	480
F.5.3	Polyelectrolyte Dosing (Pump, 20 L/hr, 5 m)	10													3	1	8	30	40	240	2	0	8	20	20	160
F.5.4	Dewatering Sludge Pumps 8 m^3/h, 12 m	7.5													3	1	8	22.5	30	180	2	0	8	15	15	120
F.5.5	Supernatant Liquor Pumps 57 m^3/h, 6 m	2.2													2	2	2	4.4	8.8	8.8	2	0	2	4.4	4.4	8.8
F.5.6	Crane 12 TONS	11													1	0	1	11	11	11						
G	**Odor Control Unit**																									
G.1		30							1	1	24	30	60	720	1	1	24	30	60	720						
H	**Washwater Booster Set**																									
		22							1	1	3	22	44	66	1	1	3	22	44	66						
I	**New Buildings**																									
I.1	Lifting station control building (Extension)	10							1		4	10	10	40												
I.2	Blower Room	10							1		4	10	10	40												
I.3	Administration Building	30							1		8	30	30	240	1		8	30	30	240						
I.4	Workshop and Storage Building	30							1		8	30	30	240	1		8	30	30	240						
I.5	Transformer Building	10							1		4	10	10	40	1		4	10	10	40	1		4	10	10	40
I.6	Interim Lifting Station	5							1		4	5	5	20												
I.7	Sludge Dewatering Building	10													1		4	10	10	40						
I.8	Anaerobic Digester Equipment Building	10													1		4	10	10	40						
I.9	Secondary Sludge Thickening Building	10																			1		4	10	10	40
I.10	CHP Building	20													1		4	20	20	80						
I.11	Accomodation Building	10													1		4	10	10	40						
I.12	Chemical Storage	10																			1		4	10	10	40
I.13	Blower Building	10																			1		4	10	10	40
I.14	RAS / SAS Pumping Station	10																			1		4	10	10	40
I.15	Outdoor Lighting	10																			1		12	10	10	120
	Duty Power / Installed Power (kW)					817	1,120					1,388	1,852					2,563	3,496	33,029				4,949	7,224	
	Duty Power / Installed Power (kVA)					**1,021**	1,400					**1,735**	2,315					**3,204**	4,371	41,286				**6,186**	9,030	
	Proposed Transformer Sizing (kVA)		2			1,000	Existing		1	1		2,500	New		2	1		2,000	New		2 x 2	2 x 1		2,500	New	
	Proposed Diesel Generator Sizing (kVA)		1			250	Existing		2			1,000	New		2			1,250	New		2 x 2			2,000	New	
			2			640	Existing																			
	Proposed Gaz Generator Sizing (kVA)														2		Phase I	1,110	New							
															1		Phase II	1,110	New							
	Estimated Consumption (kWh/day)							**8,587**						**6,603**						**28,074**						**112,671**
	Note: Equipment in column V (Phase II) highlighted in green are been taken in the load schedule for Phase I.																									

CHAPTER 8 PROCESS CALCULATION

Appendix 8.2 Single Line Diagram for Ghadir Existing WWTP



LEGEND:

G1	–GENERATOR #1.
GCP–1	–GENERATOR CONTROL PANEL #1.
BGCP	–BREAKER IN GENERATOR CONTROL PANEL #1.
OC–01	–OUTPUT CELL.
IC–01	–INCOMING CELL.
MVS	–MEDIUM VOLTAGE SWITCH.
MDB–S2	–MAIN DISTRIBUTION BOARD FOR 3 MAIN PUMPS.
SPB–BR	–SUB –PANEL BOARD FOR BLOWER ROOM.
SPB–GH	–SUB–PANEL BOARD FOR GUARD HOUSE.
SPB–MPS	–SUB–PANEL BOARD FOR PUMPING STATION.
SPB–LS	SUB–PANEL BOARD FOR LIFT STATION.
MCC–BR	–MOTOR CONTROL CENTER FOR BLOWER ROOM.
MCC–MPS	–MOTOR CONTROL CENTER FOR PUMPING STATION.
MCC–FP	–MOTOR CONTROL CENTER FOR FUEL PUMP.
VSD–01	–VARIABLE SPEED DRIVE #1.
MCC–LS1	–MOTOR CONTROL CENTER FOR LIFT STATION .
MDB–S1	–MAIN DISTRIBUTION BOARD .
TFX	–TRANSFORMER.
SPB–LS	–SUB–PANEL BOARD FOR LIFT STATION.
SPB–E	–SUB–PANEL BOARD.
MCC–BS	–MOTOR CONTROL CENTER FOR BAR SCREENS.
MCC–GS	–MOTOR CONTROL CENTER FOR DEGRITTING AREA.
CPBS–01	–CONTROL PANEL FOR TWO BAR SCREENS.
CPDB–01	–CONTROL PANEL FOR DEGRITTING BRIDGE #1.
ACB–01	–AIR CIRCUIT BREAKER #1
MTS–1	–MAIN TRANSFORMER SWITCH #1.

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COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Expansion And Upgrade of Al-Ghadir Wastewater Treatment Plant Project

DAR AL HANDASAH
NAZIH TALEB & PARTNERS
Founded 1956

ARTELIA

Technical Drawings & Schematics

Existing WWTP Single Line Diagram

DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 December 2024
SCALE :	–
FILE NAME	Sc–ES–04

PROJECT	DIVISION	SUB–DIVISION	SHEET	REVISION
L2401DS	Sc	ES	04	1

CHAPTER 8 PROCESS CALCULATION

Appendix 8.3 Single Line Diagram for Ghadir Existing WWTP Extension – (Phase 1)

EXISTING POWER SUBSTATION

FROM EDL

OC-4 | OC-3 | OC-2 | OC-1 | IC-2 | IC-1

MVS
11-20 KV

MDB/S1 | MDB/S2

NEW POWER SUBSTATION

1000 KVA G5 | 1000 KVA G4

TR2 2500 KVA
20 KV/380V 50Hz

TR1 2500 KVA
20 KV/380V 50Hz

GCP SYNCHRO | GCP-5 (M) BCP-5 | GCP-4 (M) BCP-4

4000 A

MDB/S3

ACB-6 4x4000A | ACB-5 4x4000A | ATS

MTS-5 | MTS-6

NORMAL | NORMAL

ACB-6 4x4000A | ACB-7 4x4000A | ATS

MTS-7 | MTS-8

EMERGENCY | NORMAL

MCC-LS2	MCC-BS2	MCC-GS	MCC-MPS2	MCC-BR	MCC-PT1	MCC-PT2	MCC-OW	MCC-FP2	SPB-LS	SPB-BR	SPB-AB	SPB-WB	SPB-PS2	SPB-ILS
800A	60 A	200 A	600 A	150 A	1000 A	1000 A	80 A	60 A	80 A	60 A	80 A	60 A	60 A	60 A
MCC-LS2	MCC-BS2	MCC-GS	MCC-MPS2	MCC-BR	MCC-PT1	MCC-PT2	MCC-OW	MCC-FP2	SPB LS	SPB BR	SPB AB	SPB WB	SPB PS2	SPB ILS

VSD-04

LEGEND:

G1	-GENERATOR #1.
GCP-1	-GENERATOR CONTROL PANEL #1.
BGCP	-BREAKER IN GENERATOR CONTROL PANEL #1.
OC-01	-OUTPUT CELL.
IC-01	-INCOMING CELL.
MVS	-MEDIUM VOLTAGE SWITCH.
TFX	-TRANSFORMER.
MDB-S3	-MAIN DISTRIBUTION BOARD EXTENSION.
MCC-LS2	-MOTOR CONTROL CENTER LIFT STATION .
MCC-BS2	-MOTOR CONTROL CENTER BAR SCREENS.
MCC-GS	-MOTOR CONTROL CENTER DEGRITTING AREA.
MCC-MPS2	-MOTOR CONTROL CENTER PUMPING STATION.
MCC-BR	-MOTOR CONTROL CENTER BLOWER ROOM.
MCC-PT1	-MOTOR CONTROL CENTER PRIMARY TREATMENT.
MCC-OW	-MOTOR CONTROL CENTER ODOR CONTROL. & WASHWATER BOOSTER SET
MCC-FP2	-MOTOR CONTROL CENTER FUEL PUMP.
VSD-04	-VARIABLE SPEED DRIVE #4.
SPB-LS	-SUB-PANEL BOARD LIFT STATION.
SPB-BR	-SUB-PANEL BOARD BLOWER ROOM.
SPB-AB	-SUB-PANEL BOARD ADMINISTRATION BUILDING.
SPB-WB	-SUB-PANEL BOARD WORKSHOP BUILDING.
SPB-PS2	-SUB-PANEL BOARD NEW POWER SUBSTATION.
SPB-ILS	-SUB-PANEL BOARD INTERIM LIFTING STATION.
ACB-1	-AIR CIRCUIT BREAKER #1
MTS-1	-AIR CIRCUIT BREAKER #1
ATS-1	-AUTOMATIC TRANSFER SWITCH #1.

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Expansion And Upgrade of Al-Ghadir Wastewater Treatment Plant Project

DAR AL HANDASAH NAZIH TALEB & PARTNERS Founded 1956 | ARTELIA

Technical Drawings & Schematics

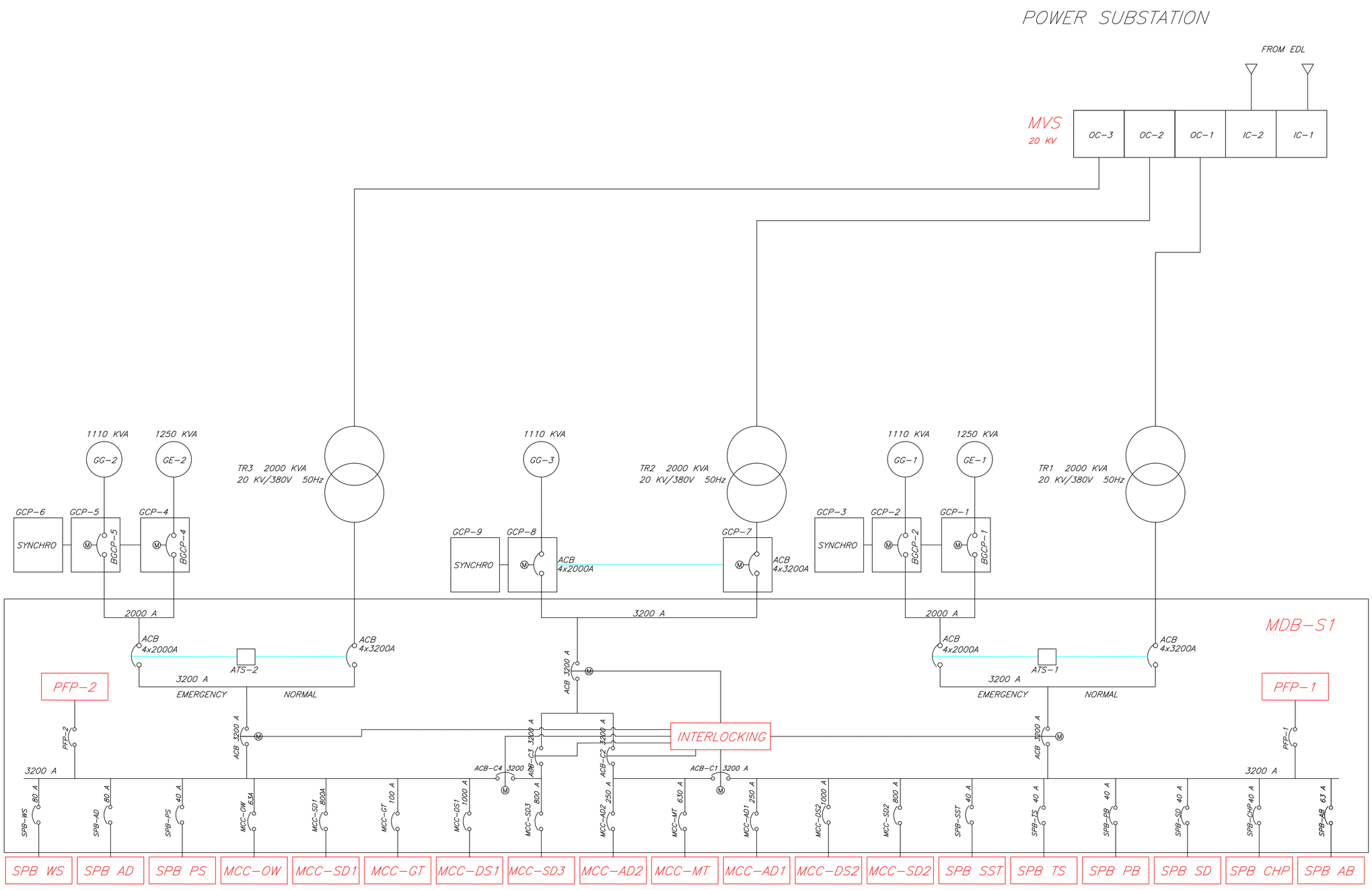
Existing WWTP Extension - Phase 1 - Single Line Diagram

DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 December 2024
SCALE :	-
FILE NAME	Sc-ES1-05

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Sc	ES1	05	1

CHAPTER 8 PROCESS CALCULATION

Appendix 8.4 Single Line Diagram for Ghadir New WWTP Expansion Site – (Phase 1)



LEGEND:

GE-1	-DIESEL GENERATOR #1.
GG-1	-GAS GENERATOR #1.
GCP-1	-GENERATOR CONTROL PANEL #1.
BGCP	-BREAKER IN GENERATOR CONTROL PANEL #1.
OC-01	-OUTPUT CELL.
IC-01	-INCOMING CELL.
MVS	-MEDIUM VOLTAGE SWITCH.
TR-1	-TRANSFORMER #1.
MDB-S1	-MAIN DISTRIBUTION BOARD.
MCC	-MOTOR CONTROL CENTER.
MCC-SDx	-MCC FOR SLUDGE DEWATERING.
MCC-GT	-MCC FOR GRAVITY THICKENER PS.
MCC-MT	-MCC FOR MECHANICAL THICKENING SECONDARY.
MCC-ADx	-MCC FOR ANAEROBIC DIGESTION.
MCC-DSx	-MCC FOR DIGESTER SLUDGE BUFFER TANK.
MCC-OW	-MOTOR CONTROL CENTER ODOR CONTROL, & WASHWATER BOOSTER SET & FUEL PUMP
SPB-AB	-SUB-PANEL BOARD ACCOMODATION BUILDING.
SPB-CHP	-SUB-PANEL BOARD CHP BUILDING.
SPB-SD	-SUB-PANEL BOARD SLUDGE DEWATERING BLG.
SPB-PB	-SUB-PANEL BOARD PUMP BLOWERS.
SPB-TS	-SUB-PANEL BOARD THICKENED PUMPS BLG.
SPB-SST	-SUB-PANEL BOARD SECONDARY SLUDGE BLG.
SPB-PS	-SUB-PANEL BOARD POWER STATION.
SPB-AD	-SUB-PANEL BOARD ADMINISTRATIVE BUILDING.
SPB-WS	-SUB-PANEL BOARD WORKSHOP.
ACB-1	-AIR CIRCUIT BREAKER #1
ATS-1	-AUTOMATIC TRANSFER SWITCH #1.
PFP-1	-POWER FACTOR PANEL (CAPACITOR BANK) #1.

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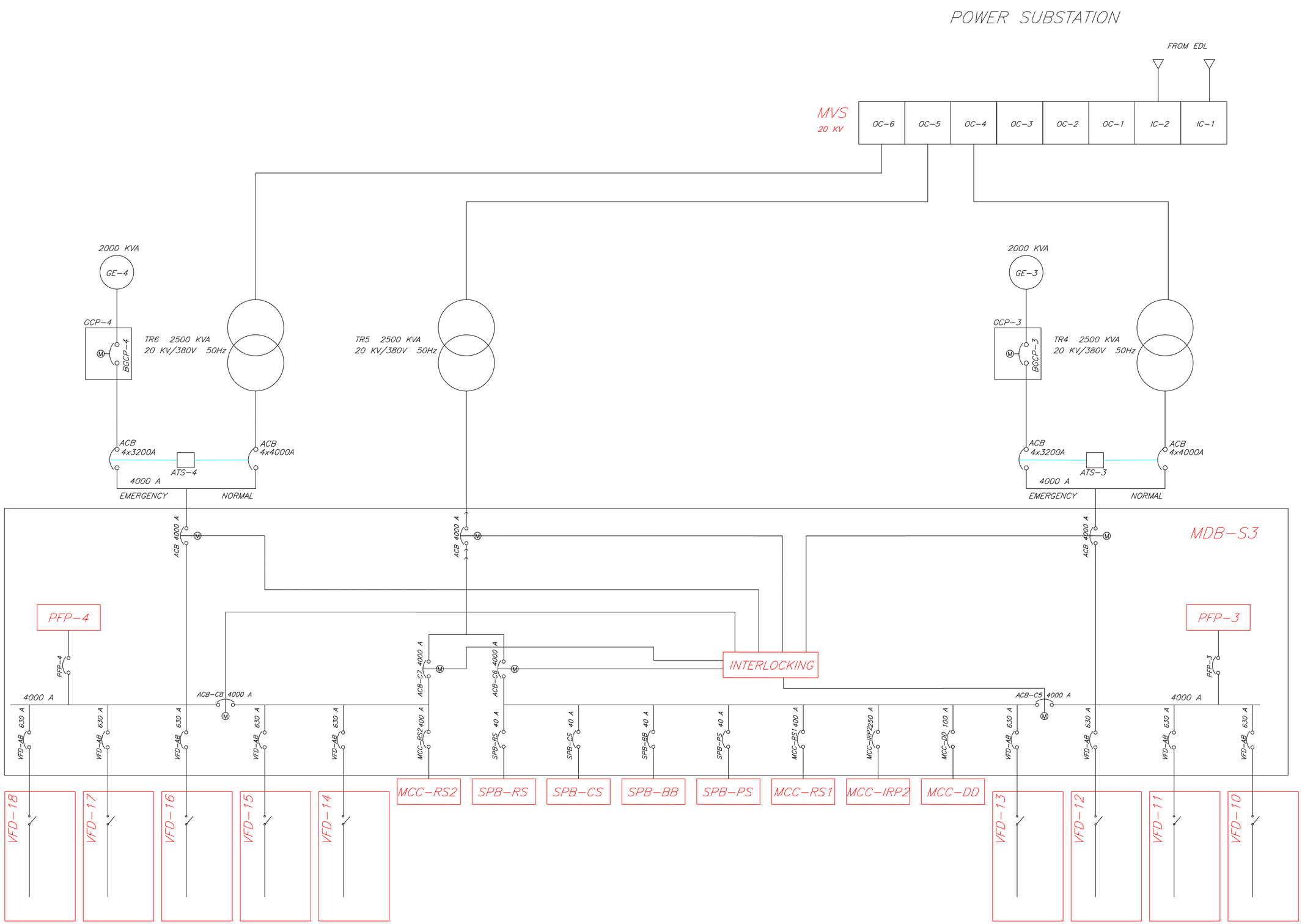
New WWTP Expansion Site - Phase 1 - Single Line Diagram

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APPROVED :	F.L
DATE :	05 December 2024
SCALE :	-
FILE NAME	Sc-NS1-06

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Sc	NS1	06	1

CHAPTER 8 PROCESS CALCULATION

Appendix 8.5 Single Line Diagram for Ghadir New WWTP Expansion Site – (Phase 2a)



LEGEND:

GE-1	-DIESEL GENERATOR #1.
GCP-1	-GENERATOR CONTROL PANEL #1.
BGCP	-BREAKER IN GENERATOR CONTROL PANEL #1.
OC-01	-OUTPUT CELL.
IC-01	-INCOMING CELL.
MVS	-MEDIUM VOLTAGE SWITCH.
TR-1	-TRANSFORMER #1.
MDB-S1	-MAIN DISTRIBUTION BOARD.
MCC	-MOTOR CONTROL CENTER.
MCC-ATM	-MCC FOR ANOXIC TANKS MIXERS.
MCC-IRPx	-MCC FOR IR PUMPS.
MCC-DD	-MCC FOR DISINFECTION & DECHLORINATION.
MCC-RSx	-MCC FOR RAS/SAS PUMPS.
VFD-x	-VFD FOR AIR BLOWERS.
SPB-PS	-SUB-PANEL BOARD POWER STATION PHASE II.
SPB-BB	-SUB-PANEL BOARD BLOWERS BUILDING.
SPB-CS	-SUB-PANEL BOARD CHEMICAL STORAGE.
SPB-RS	-SUB-PANEL BOARD RAS/SAS PUMPING STATION.
ACB-1	-AIR CIRCUIT BREAKER #1
ATS-1	-AUTOMATIC TRANSFER SWITCH #1.
PFP-1	-POWER FACTOR PANEL (CAPACITOR BANK) #1.

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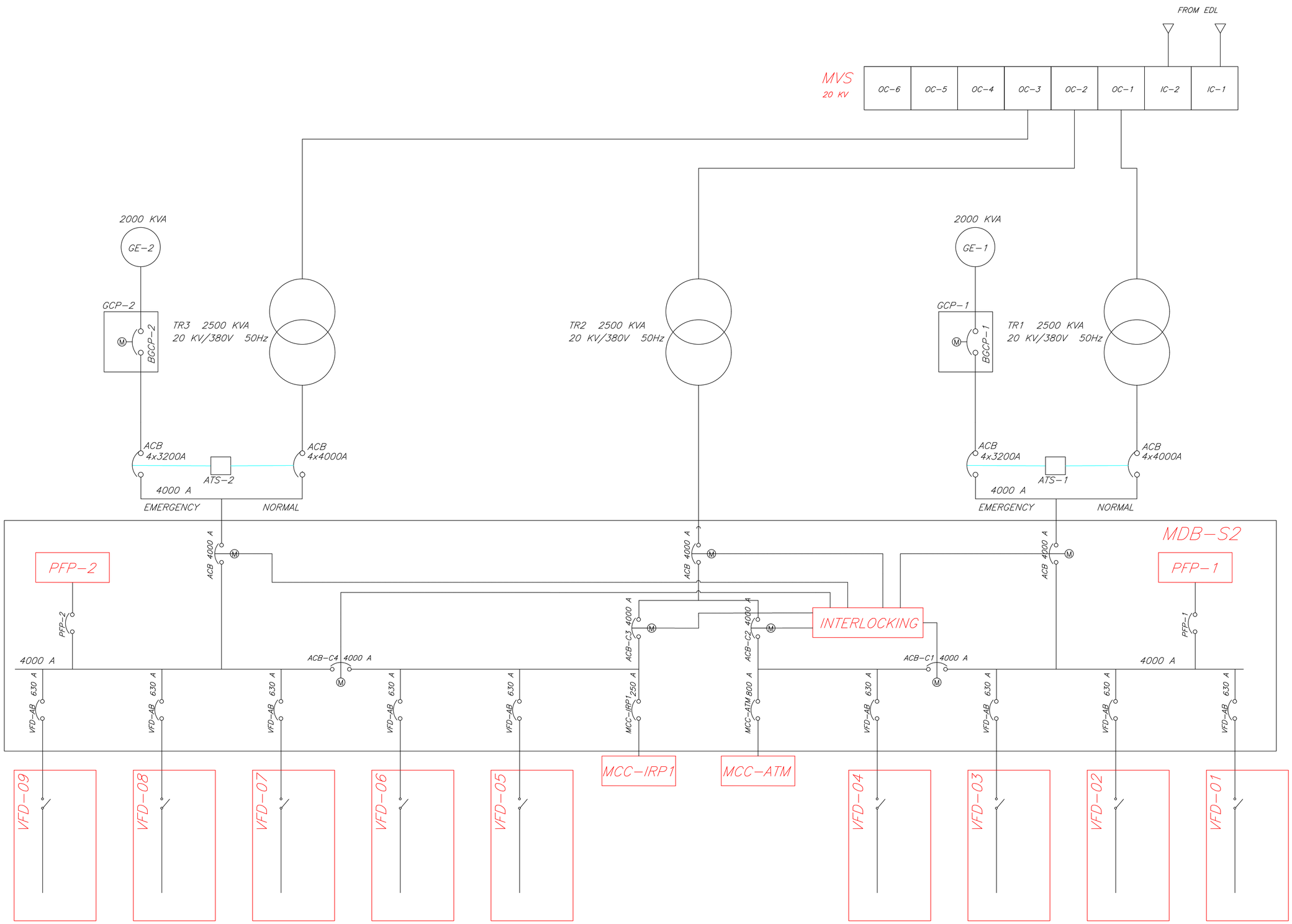
New WWTP Expansion Site - Phase 2 - Single Line Diagram (1 / 2)

DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 December 2024
SCALE :	-
FILE NAME	Sc-NS2a-07

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Sc	NS2a	07	1

CHAPTER 8 PROCESS CALCULATION

Appendix 8.6 Single Line Diagram for Ghadir New WWTP Expansion Site – (Phase 2b)



LEGEND:

GE-1	-DIESEL GENERATOR #1.
GCP-1	-GENERATOR CONTROL PANEL #1.
BGCP	-BREAKER IN GENERATOR CONTROL PANEL #1.
OC-01	-OUTPUT CELL.
IC-01	-INCOMING CELL.
MVS	-MEDIUM VOLTAGE SWITCH.
TR-1	-TRANSFORMER #1.
MDB-S1	-MAIN DISTRIBUTION BOARD.
MCC	-MOTOR CONTROL CENTER.
MCC-ATM	-MCC FOR ANOXIC TANKS MIXERS.
MCC-IRPx	-MCC FOR IR PUMPS.
MCC-DD	-MCC FOR DISINFECTION & DECHLORINATION.
MCC-RSx	-MCC FOR RAS/SAS PUMPS.
VFD-x	-VFD FOR AIR BLOWERS.
SPB-PS	-SUB-PANEL BOARD POWER STATION PHASE II.
SPB-BB	-SUB-PANEL BOARD BLOWERS BUILDING.
SPB-CS	-SUB-PANEL BOARD CHEMICAL STORAGE.
SPB-RS	-SUB-PANEL BOARD RAS/SAS PUMPING STATION.
ACB-1	-AIR CIRCUIT BREAKER #1.
ATS-1	-AUTOMATIC TRANSFER SWITCH #1.
PFP-1	-POWER FACTOR PANEL (CAPACITOR BANK) #1.

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New WWTP Expansion Site - Phase 2 - Single Line Diagram (2 / 2)

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APPROVED :	F.L
DATE :	05 December 2024
SCALE :	-
FILE NAME	Sc-NS2b-08

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	Sc	NS2b	08	1

CHAPTER 8 PROCESS CALCULATION

Appendix 8.7 Ghadir WWTP – Electrical Panel Sizing (Estimation)

Ghadir Wastewater Treatment Plant

ELECTRICAL PANEL SIZING (Estimation)

		Height	Depth	Width
A	**New Current Existing WWTP (Phase I)**	(mm)	(mm)	(mm)
A.1	Main Distribution Board - MDB/S3	2,000	1,000	4,600
A.2	Motor Control Center - Lift Station (MCC-LS2)	2,000	1,000	1,750
A.3	Motor Control Center - Bar Screens (MCC-BS2)	2,000	1,000	1,100
A.4	Motor Control Center - Degritting Area (MCC-GS)	2,000	1,000	1,100
A.5	Motor Control Center - Main Pumping Station (MCC-MPS2)	2,000	1,000	1,750
A.6	Motor Control Center - Blower Room (MCC-BR)	2,000	1,000	1,100
A.7	Motor Control Center - Primary Treatment (MCC-PT1)	2,000	1,000	2,850
A.8	Motor Control Center - Primary Treatment (MCC-PT2)	2,000	1,000	2,850
A.9	Motor Control Center - Odor Control (MCC-OW)	2,000	1,000	650
A.10	Motor Control Center - Fuel Pump (MCC-FP2)	2,000	1,000	650
B	**New Current Expansion Site (Phase I)**			
B.1	Main Distribution Board - MDB/S1	2,000	1,000	8,300
B.2	Motor Control Center - Sludge Dewatering (MCC-SD1)	2,000	1,000	1,750
B.3	Motor Control Center - Sludge Dewatering (MCC-SD2)	2,000	1,000	1,750
B.4	Motor Control Center - Sludge Dewatering (MCC-SD3)	2,000	1,000	1,750
B.5	Motor Control Center - Gravity Thickener PS (MCC-GT)	2,000	1,000	1,750
B.6	Motor Control Center - Mechanical Thickening Secondary (MCC-MT)	2,000	1,000	1,750
B.7	Motor Control Center - Anaerobic Digestion (MCC-AD1)	2,000	1,000	1,750
B.8	Motor Control Center - Anaerobic Digestion (MCC-AD2)	2,000	1,000	1,750
B.9	Motor Control Center - Digester Sludge Buffer Tank (MCC-DS1)	2,000	1,000	1,750
B.10	Motor Control Center - Digester Sludge Buffer Tank (MCC-DS2)	2,000	1,000	1,750
B.11	Motor Control Center - Odor Control (MCC-OW)	2,000	1,000	650
C	**New - Future (Phase II)**			
C.1	Main Distribution Board - MDB/S2	2,000	1,000	7,200
C.2	Main Distribution Board - MDB/S3	2,000	1,000	8,300
C.3	Motor Control Center - Anoxic Tank Mixers (MCC-ATM)	2,000	1,000	2,400
C.4	Motor Control Center - IR Pumps (MCC-IRP1)	2,000	1,000	3,050
C.5	Motor Control Center - IR Pumps (MCC-IRP2)	2,000	1,000	3,050
C.6	Motor Control Center - Disinfection & Dechlorination (MCC-DD)	2,000	1,000	1,750
C.7	Motor Control Center - RAS / SAS Pumps (MCC-RS1)	2,000	1,000	2,400
C.8	Motor Control Center - RAS / SAS Pumps (MCC-RS2)	2,000	1,000	2,400

CHAPTER 8 PROCESS CALCULATION

Appendix 8.8 Ghadir WWTP – Fuel Consumption (Estimation)

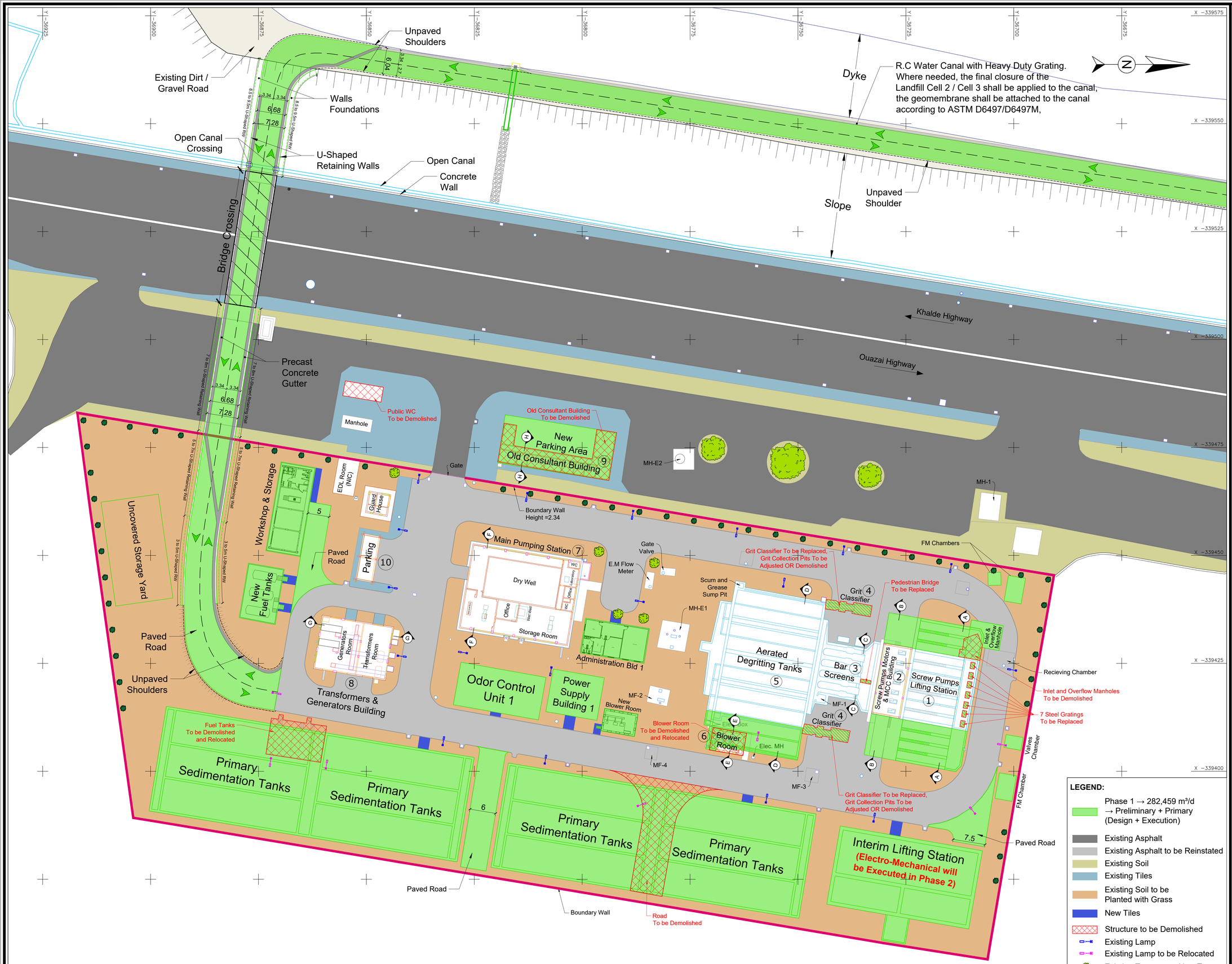
Ghadir Wastewater Treatment Plant

Fuel Consumption (Estimation)

		Power (kVA)	Fuel Consumption Liters/h	Dailly Running Time (h/d)	Daily Fuel Consumption (l/d)
A	**Existing Plant**				
A.1	Generator G1	250	45	4	180
A.2	Generator G2	640	105	4	420
A.3	Generator G3	640	105	4	420
	Consumption for 4 hours of running by day (liters)				1,020
B	**New Current Existing WWTP (Phase I)**				
B.1	Generator G4	1,000	170	4	680
B.2	Generator G5	1,000	170	4	680
	Consumption for 4 hours of running by day (liters)				1,360
C	**New Current Expansion Site (Phase I)**				
C.1	Generator G1	1,250	215	4	860
C.2	Generator G2	1,250	215	4	860
	Consumption for 4 hours of running by day (liters)				1,720
D	**New - Future (Phase II)**				
D.1	Generator G1	2,000	325	4	1,300
D.2	Generator G2	2,000	325	4	1,300
D.3	Generator G3	2,000	325	4	1,300
D.4	Generator G4	2,000	325	4	1,300
	Consumption for 4 hours of running by day (liters)				5,200
E	**Total consumption for Phase I with 4 hours of running by day (liters)**				**4,100**
F	**Total consumption for Phase II with 4 hours of running by day (liters)**				**5,200**

CHAPTER 10 REHABILITATION OF THE EXISTING WWTP (CIVIL WORKS)

Appendix 10.1 General Layout Drawing of the Existing Ghadir WWTP and Sections



PROPOSED REHABILITATION WORKS:

- For structures Nb. (1) to Nb. (9), refer to Sections (1 of 3), (2 of 3) and (3 of 3).

- Guard House: No rehabilitation works are proposed, since it is fully under rehabilitation by others (Unicef).

For Exterior works:

- **Parking (10):**
  - Demolish existing reinforced concrete beams.
  - Repair reinforced concrete columns.
  - construct new reinforced concrete beams.
  - Construct a steel canopy.
  - Implement a new uncovered parking area at the location of the old consultant building.
- General cleaning and rearrangement for all the existing plant area in coordination with BMLWE, including: Transport not useful materials to approved damping site, rearrange needed useful materials in one location in the WWTP yard, deliver useful materials to other BMLWE stores.
- Demolish and transport to approved damping sites the old public W.C structure.
- Demolish and transport to approved damping site the existing 3 fuel tanks having a capacity of 15m³ each, including concrete ground slab.
- Provide and install 3 new fuel tanks (15m³ each) including reinforced concrete pad, fuel containment and steel canopy.
- Repair and repaint concrete where needed in the exterior open area, excluding the fence (Curbstones, ground slabs, manholes cover slabs, parapets, ...).
- Treat and repaint rusted steel where needed in the exterior open area (Grills, access covers, ...).
- Install new curbstones where needed or replacing damaged parts.
- Install new tiles where needed or replacing damaged parts.
- Provide an asphalt reinstatement layer for all the existing internal roads.
- Provide and install grass inside the plant area, outside roads, tiles areas and constructions.
- Provide and plant a mix of about 50 trees (Palm, pin, cyprus, juniper, ...).
- Replace exterior lighting projectors with new waterproof projectors (LED projectors (10) and solar powered projectors (20)) including repair, where needed the existing pylones and fixation.
- Achieve a full maintenance of the existing security / control systems, and replacement where needed, including cameras, cables, software...

NOTES:

- The presented dimensions and the above mentioned proposed rehabilitation works shall be confirmed by the bidder during the bid phase through site visit for a better evaluation of the existing status, consequently enabling more accurate estimation of the quantities and costs.

LEGEND:

- Phase 1 → 282,459 m³/d → Preliminary + Primary (Design + Execution)
- Existing Asphalt
- Existing Asphalt to be Reinstated
- Existing Soil
- Existing Tiles
- Existing Soil to be Planted with Grass
- New Tiles
- Structure to be Demolished
- Existing Lamp
- Existing Lamp to be Relocated
- Existing Tree
- New Tree

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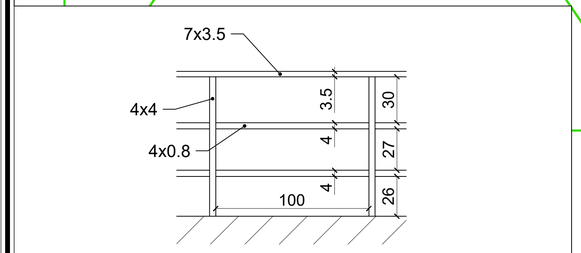
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Existing WWTP Site

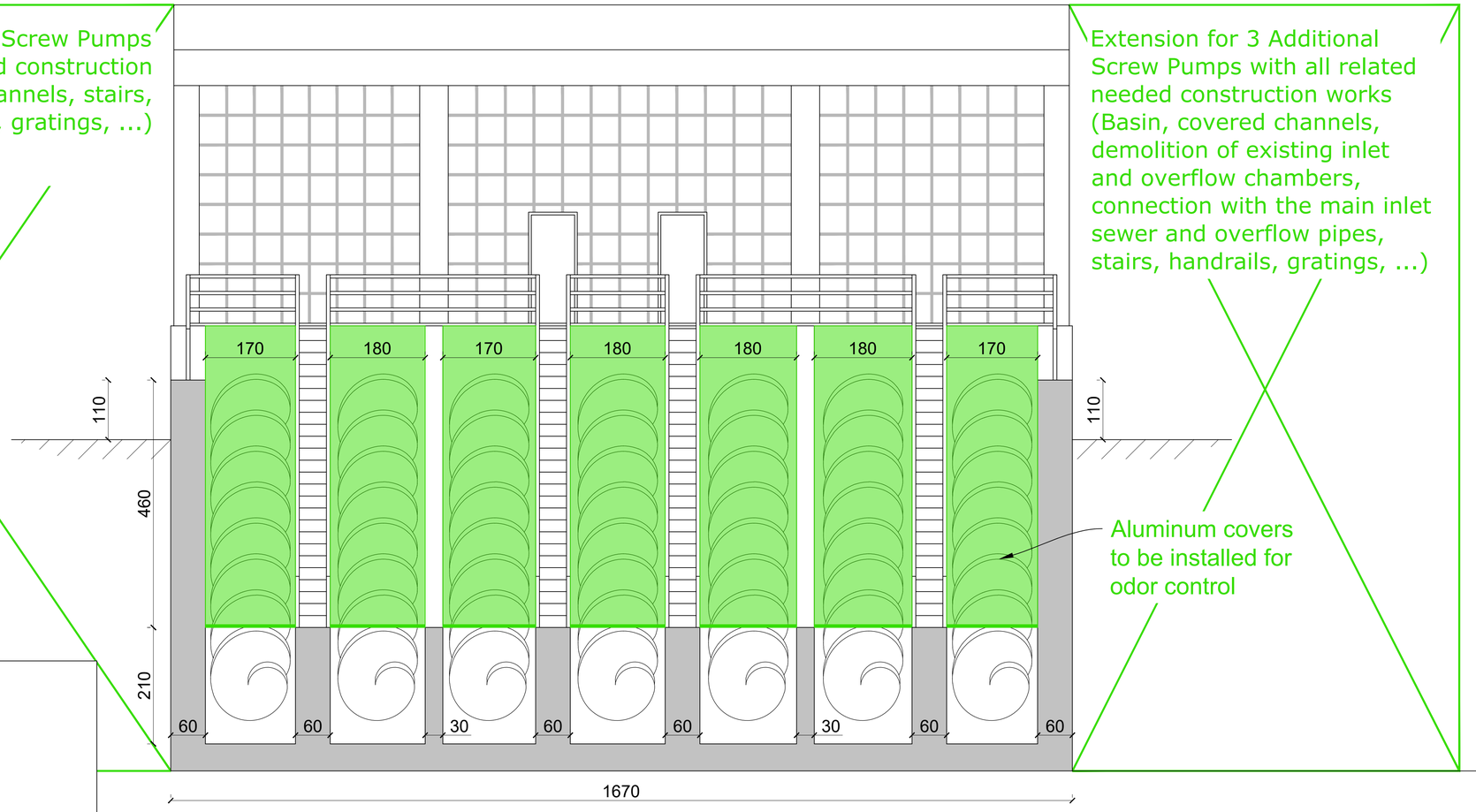
Rehabilitation Plan

DRAWN :	H.J
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2020
SCALE :	1:400
FILE NAME	ETP-RP-02

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	ETP	RP	02	1

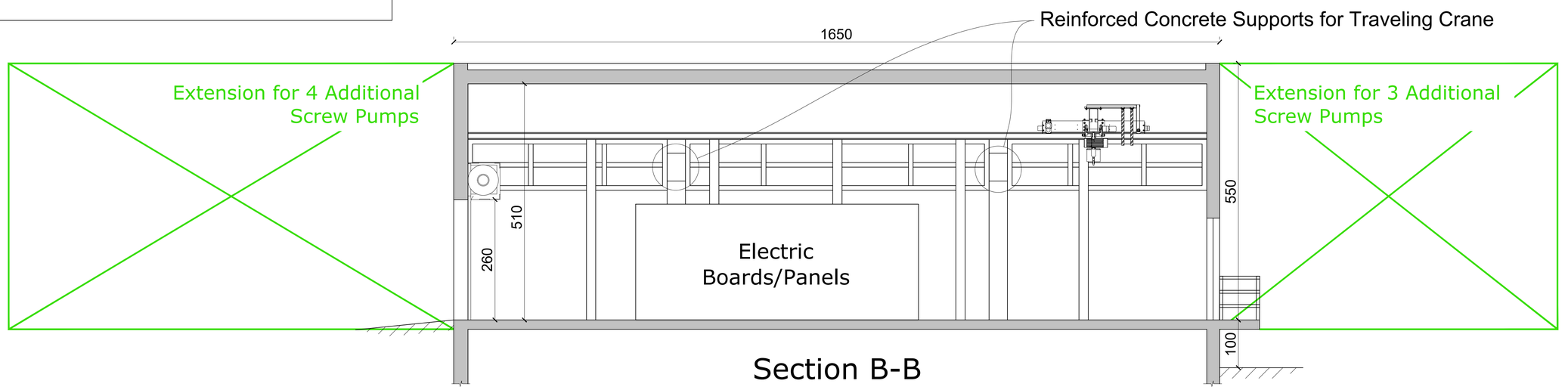


Typical Existing Handrail Detail



Section A-A

(1) Screw Pumps Lifting Station (To be Rehabilitated & Extended)



Section B-B

(2) Screw Pumps Motors & MCC Building (To be Rehabilitated & Extended)

PROPOSED REHABILITATION WORKS:

1. Screw Pumps Lifting Station:
   - Concrete repairs (Stairs, walls, roof slab beside penstocks).
   - Repaint concrete faces (Down to 4.8m depth).
   - Replace steel gratings (7).
   - Aluminum covers to be installed for odor control.
   - Extension for 7 new screw pumps (including all needed earthworks, concrete works, finishing works, and MEP works).

2. Screw Pumps Motors & MCC Building:
   - Concrete repairs (Columns, beams, traveling crane supports, ...)
   - Repaint interior and exterior faces.
   - Replace earthing and lightning system.
   - Replace lamps and fixtures.
   - Install new fire extinguishers.
   - Extension for 7 new screw pumps (including all needed earthworks, concrete works, finishing works, and MEP works).

NOTES:

- The rehabilitation of the hand rails and all metallic outdoor, steel cabinets for electrical control panels, doors and windows and louvers are not included in the proposed works since they are involved in the project under implementation by Unicef.
- The presented dimensions and the above mentioned proposed rehabilitation works shall be confirmed by the bidder during the bid phase through site visit for a better evaluation of the existing status, consequently enabling more accurate estimation of the quantities and costs.
- All Dimensions are in centimeters.

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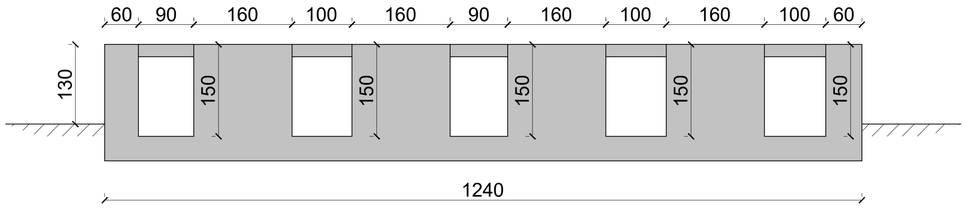
Design, Construction & Operation of The Expansion & Upgrade of Al-Ghadir Wastewater Treatment Plant Project - Phase 1 -

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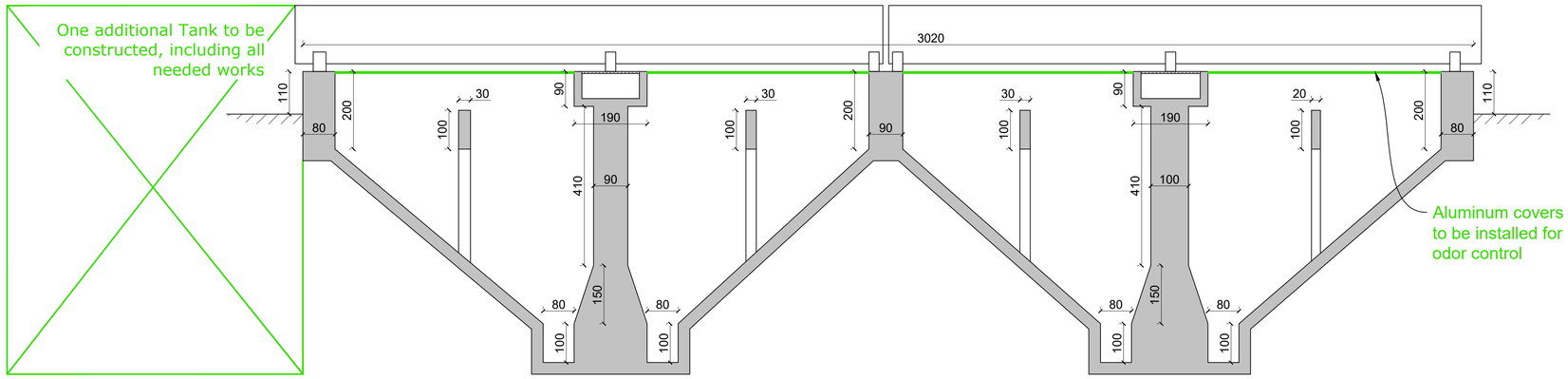
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	CHECKED : S.H
	APPROVED : F.L
	DATE : 05 March 2025
	SCALE : 1:50; 1:20
Sections (1 of 3)	FILE NAME ETP-S1-03

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	ETP	S1	03	1



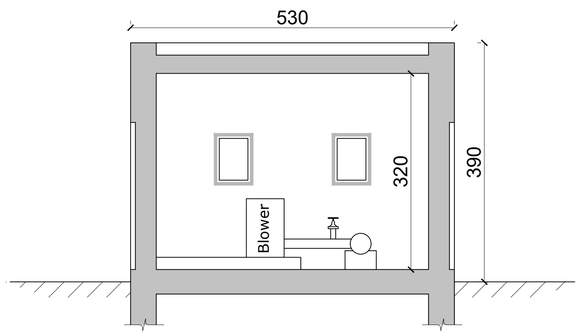
Section C-C
(3) Bar Screens (To be Rehabilitated)

Scale : 1:50



Section D-D
(5) Aerated Degritting Tanks (To be Rehabilitated & Extended)

Scale : 1:75



Section E-E
(6) Blower Room
(To be Demolished /Relocated)

Scale : 1:50

PROPOSED REHABILITATION WORKS:

3. Bar Screens:
   - Replace pedestrian concrete bridge.
   - Replace concrete cover slab part above ventilation grill.
   - Repair concrete and plaster.
   - Install missing gratings.
   - Treat / repair and repaint rusted gratings.
   - Aluminum covers to be installed for odor control.

4. Grit Classifiers:
   - Demolish existing two grit classifiers structures.
   - Provide minor civil works as needed for the installation of new metallic grit classifiers.

5. Aerated Degritting Tanks:
   - Demolish existing blower room located beside the aerated degritting tanks.
   - Construct an additional aerated degritting tank, at the eastern side, as extension to the existing 4 tanks structure (including all needed earthworks, concrete works, finishing works, and MEP works).
   - Repair concrete (at rails fixations for movable bridge, ...)
   - Replace concrete pedestals (3 units) for movable bridge braking system.
   - Paint internal and external concrete faces.
   - Install new steel gratings where missing in the existing structure.
   - Treat and paint rusted steel (channels gratings covers, rails and fixations, ...).
   - Aluminum covers to be installed for odor control.

6. Blower Room:
   - Demolish existing blower room building including:
     - Transport to approved damp site all not useful material.
     - Store in the plant or deliver to other BMLWE stores needed material.
   - Construct a new blower room, with same dimensions, at new location as shown on the plan view drawing (including all needed earthworks, concrete works, finishing works, and MEP works).

NOTES:

- The rehabilitation of the hand rails and all metallic outdoor, steel cabinets for electrical control panels, doors and windows and louvers are not included in the proposed works since they are involved in the project under implementation by Unicef.
- The presented dimensions and the above mentioned proposed rehabilitation works shall be confirmed by the bidder during the bid phase through site visit for a better evaluation of the existing status, consequently enabling more accurate estimation of the quantities and costs.
- All Dimensions are in centimeters.

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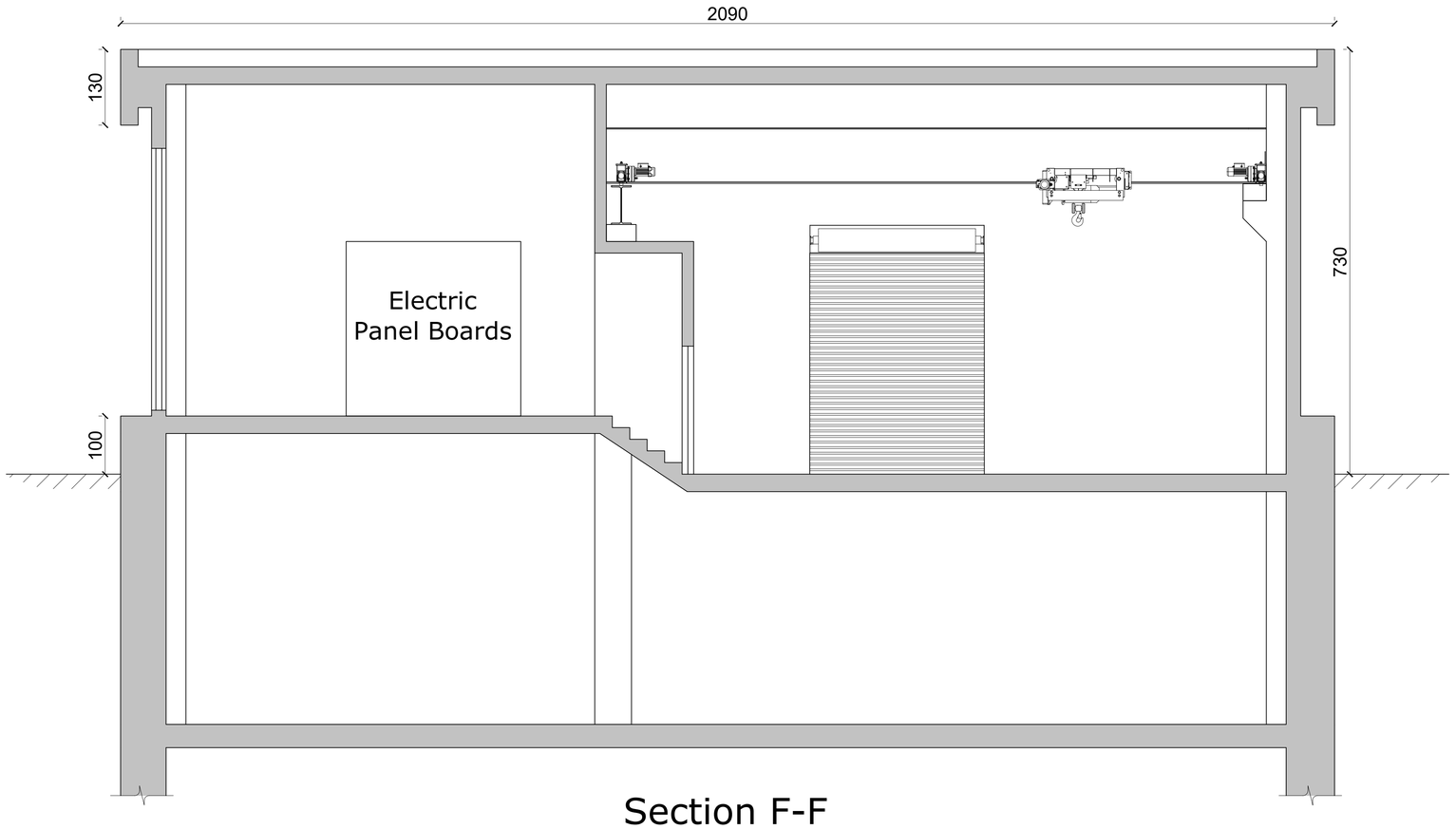
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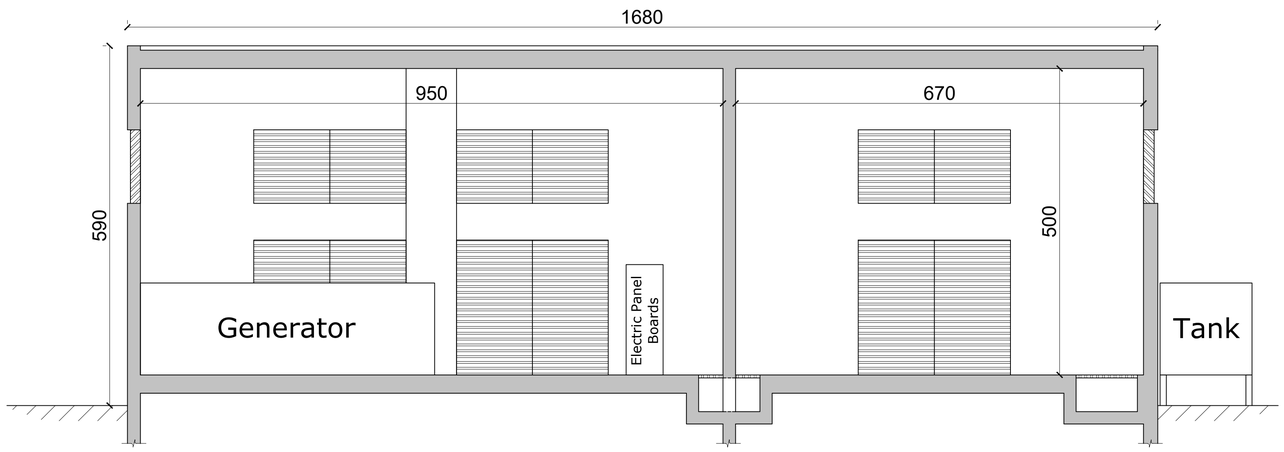
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Existing WWTP Site	DRAWN : H.I CHECKED : S.H APPROVED : F.L DATE : 05 March 2025 SCALE : 1:50; 1:75; 1:50
Sections (2 of 3)	FILE NAME ETP-S2-04

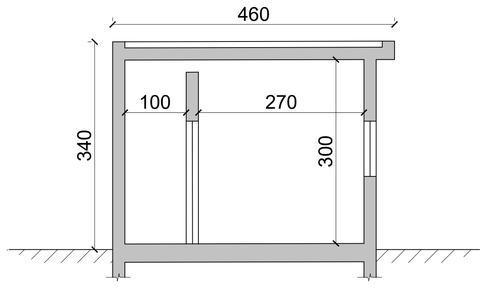
PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	ETP	S2	04	1



Section F-F
(7) Main Pumping Station (To be Rehabilitated)



Section G-G
(8) Power Supply Building 1
(To be Rehabilitated)



Section H-H
(9) Old Consultant Building
(To be Demolished)

PROPOSED REHABILITATION WORKS:

7. Main Pumping Station:
   - Repair concrete in the exterior aspects (Columns, walls, roof drainage elements, ...)
   - Demolish the damaged roof parapet and reconstruct a roof parapet starting from the roof ceiling level, excluding the current downward parapet extension.
   - Repaint exterior concrete faces
   - Repair and extend roof waterproofing to the upper parapet faces.
   - Replace lamps and fixtures.
   - Replace all earthing and lightning system.
   - Replace rusted fire extinguisher units (10 new units).
   - Replace defective ACs (4 new units).

8. Power Supply Building 1:
   - Minor concrete repair where needed.
   - Repaint interior and exterior concrete and plaster faces.
   - Replace solid steel channels covers (10).
   - Treat and paint existing solid steel channels covers.
   - Treat and paint rusted steel fuel tanks.
   - Replace all earthing and lightning system.
   - Replace lamps and fixtures.
   - Install new fire extinguishers.

9. Old Consultant Building:
   - Demolish the old consultant building and transport to approved damping sites all not useful / damaged material or equipment.
   - Store in the plant or deliver to other BMLWE stores any useful material or equipment.
   - Because of the danger structural condition, special safety measures shall be provided during all above works.

NOTES:

- The rehabilitation of the hand rails and all metallic outdoor, steel cabinets for electrical control panels, doors and windows and louvers are not included in the proposed works since they are involved in the project under implementation by Unicef.
- The presented dimensions and the above mentioned proposed rehabilitation works shall be confirmed by the bidder during the bid phase through site visit for a better evaluation of the existing status, consequently enabling more accurate estimation of the quantities and costs.
- All Dimensions are in centimeters.

LEBANESE REPUBLIC
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

Design, Construction & Operation of The Expansion & Upgrade of Al-Ghadir Wastewater Treatment Plant Project - Phase 1 -

DAR AL HANDASAH NAZIH TALEB & PARTNERS Founded 1956

ARTELIA

Existing WWTP Site	DRAWN : H.J
	CHECKED : S.H
	APPROVED : F.L
	DATE : 05 March 2025
Sections (3 of 3)	SCALE : 1:50
	FILE NAME ETP-S3-05

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	ETP	S3	05	1