

Figure 9.6 Manmade Fill Type-S3

The DDC will consist of high energy compaction by dropping octagonal heavy tampers (see below Figure 9.7), low energy compaction (called ironing phase) by dropping square light tampers (see below Figure 9.8), impact rolling by using impact roller with 3-sided non-circular steel drum (see below Figure 9.9), final leveling and smooth rolling.



Figure 9.7 Octagonal heavy tamper



Figure 9.8 Square light tamper



Figure 9.9 3-Sided impact roller

The tampers (up to 32 tons) will be raised (up to 33.5m) and dropped on a repeated basis without a significant amount of down time by using a crawler crane >=150 tons with cable size of >=38mm (see below Figure 9.10).

After each drop, craters created by the tampers will be backfilled and graded with quarry runs Engineering Fill - 0/304.8mm (A-1-a with fines up to 15%) before the next drop is applied (see below Figure 9.11).

A seismograph will be used to measure the magnitude of ground vibrations being transmitted off-site. The Particle Velocity (at frequency of 6 to 10 hertz) will be limited to 19mm/sec during the DDC, accordingly; the overall DDC area (Areas Phase 1, Phase 2a and Phase 2b) will be surrounded by a 3m deep and 0.6m wide trench as a ground-vibration barrier within a setback of 6m, to minimize the effect of ground-vibration and lateral soil-mass displacement on neighboring structures (such as the side-slopes of landfill cells and airport's runway).

An open trench is the most effective in reducing vibrations, however; open trench is a concern for side-slope stability of landfill cells and airport's runway. Accordingly, the open trench will be backfilled with loosely placed (dumped) compressible material resulted from excavation of the trench.



Figure 9.10 Crawler Crane



Figure 9.11 Backfilling the craters created by the tampers

A detailed safety program to provide protection for job site personnel / off-site personnel and adjacent properties, will be submitted prior to commencement of the DDC operations.

The safety program will include required setback distances from the point of impact / from the weight for personnel so that they are not within range of flying particles that may occur from impact of the weight into the ground. It will also include the manner in which the cable is attached to the tamper and the frequency of safety checks on the cable and associated equipment to prevent failure during DDC operations.

Photographs will also be made of nearby structures / adjacent properties that might be affected by the DDC operations and included with the safety plan submittal.

Based on previous experience Lukas (FHWA-SA-95-037, 1995) recommends a maximum depth of improvement (d max) that can be achieved, given by:

d max = n (WH)^0.5

Where W is the tamper weight in tones, and H is the height of drop in m. The value of n depends on soil type, and decreases with an increase in degree of saturation.

Area Phase 1 (20,396m^2)

<u>High Energy Compaction with 3 nos. of passes on a grid pattern of 6m by 6m (see below Figures 9.12 and 13):</u>

- 1st Pass (8 nos. of drops at each grid-point location), for W=25ton and H=25m;

  Energy per drop=25ton*9.807*25m=6.1MJ, and

  d max=0.4(25*25)^0.5=10m > 9.5m,

- 2nd Pass (8 nos. of drops at each grid-point location), for W=25ton and H=25m;

  Energy per drop=25ton*9.807*25m=6.1MJ, and

  d max=0.4(25*25)^0.5=10m > 9.5m,

- 3rd Pass (5 nos. of drops at each grid-point location), for W=25ton and H=25m;

  Energy per drop=25ton*9.807*25m=6.1MJ, and

  d max=0.4(25*25)^0.5=10m > 9.5m,

  Unit Applied Energy (kJ/m^3)=(N*W*H*P)/Grid Spacing^2, where N: Average Number of drop and P: Number of Passes,

  Unit Applied Energy=(7*25ton*25m*3)/6^2=365kJ/m^3*0.8 (80% efficiency)=292kJ/m^3,

  250kJ/m^3<292kJ/m^3<350kJ/m^3 for semipervious fully saturated / submerged very Silty fine SAND (Zone 2), CONFIRMED with a Total Applied Energy of 2,774kJ/m^2 (292kJ/m3*9.5m)

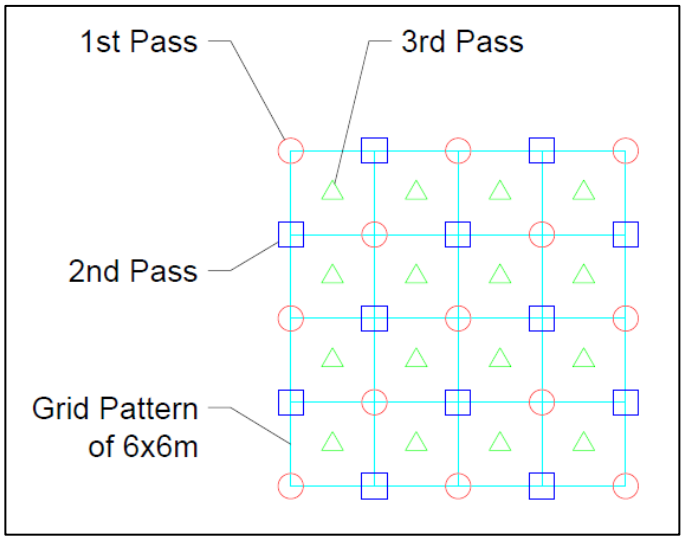


Figure 9.12 Grid Pattern



Figure 9.13 Heavy Energy Compaction

Low Energy Compaction (Ironing phase) with 2 nos. of passes (see below Figure 9.14):

- 1st ironing pass with continuous overlapping (5 nos. of drops), for W=10tons and H=3m;

  Energy per drop=10ton*9.807*3m=0.3MJ, and

  d max=0.5(10*3)^0.5=2.7m > 2.25,

- 2nd ironing pass with continuous overlapping (4 nos. of drops), for W=10tons and H=3m;

  Energy per drop=10ton*9.807*3m=0.3MJ, and

  d max=0.5(10*3)^0.5=2.7m > 2.25,

  Unit Applied Energy (kJ/m^3)=(N*W*H*P)/Grid Spacing^2, where N: Average Number of drop and P: Number of Passes,

  Unit Applied Energy=(4.5*10ton*3m*2)/1^2=270kJ/m3*0.8 (80% efficiency)=216kJ/m^3,

  200kJ/m^3<216kJ/m^3<250kJ/m^3 for Pervious partially saturated / submerged Manmade Fill (Zone 1), CONFIRMED with a Total Applied Energy of 486kJ/m^2 (216kJ/m^3*2.25m)



Figure 9.14 Low Energy Compaction

Impact Rolling (see below Figure 9.15):

- The impact rolling (at least 8 nos. of passes) will be done by using impact rollers (12-ton class and 25 Kilojoules of potential energy, each) with 3-sided non-circular steel drum running at a speed of 9kph.



Figure 9.15 Impact Rolling

Final Leveling and Smooth Rolling (see Figure 9.16):

- The smooth rolling (at least 6 nos. of passes and/or until reaching >=96% of proctor density) will be done by using 15-ton class single-drum vibratory smooth rollers.15-ton class single-drum vibratory smooth-roller, at least 6 nos. of passes (>=98% of Proctor Density).



Figure 9.16 Final Leveling and Smooth Rolling

Areas Phase 2a (39,462m^2) and Phase 2b (47,988m^2)

<u>High Energy Compaction with 3 nos. of passes on a grid pattern of 6m by 6m (see above Figures 9.12 and 9.13):</u>

- 1st Pass (5 nos. of drops at each grid-point location), for W=32ton and H=33.5m;

  Energy per drop=32ton*9.807*33.5m=10.5MJ, and

  d max=0.4(32*33.5)^0.5=13m ~ 14.75m,

- 2nd Pass (5 nos. of drops at each grid-point location), for W=32ton and H=33.5m;

  Energy per drop=32ton*9.807*33.5m=10.5MJ, and

  d max=0.4(32*33.5)^0.5=13m ~ 14.75m,

- 3rd Pass (4 nos. of drops at each grid-point location), for W=32ton and H=33.5m;

  Energy per drop=32ton*9.807*33.5m=10.5MJ, and

  d max=0.4(32*33.5)^0.5=13m ~ 14.75m,

  Unit Applied Energy (kJ/m3)=(N*W*H*P)/Grid Spacing^2, where N: Average Number of drop and P: Number of Passes,

  Unit Applied Energy=(4.7*32ton*33.5m*3)/6^2=420kJ/m3*0.8 (80% efficiency)=336kJ/m^3,

  250kJ/m^3<336kJ/m^3<350kJ/m^3 for semipervious fully saturated / submerged very Silty fine SAND (Zone 2), CONFIRMED with a Total Applied Energy of 4,368kJ/m^2 (336kJ/m^3*13m).

<u>Low Energy Compaction (Ironing phase) with 2 nos. of passes (see above Figure 9.14):</u>

- 1st ironing pass with continuous overlapping (2 nos. of drops), for W=15tons and H=5m;

  Energy per drop=15ton*9.807*5m=0.7MJ, and

  d max=0.5(15*5)^0.5=4.3m > 4.25,

- 2nd ironing pass with continuous overlapping (2 nos. of drops), for W=15tons and H=5m;

  Energy per drop=15ton*9.807*5m=0.7MJ, and

  d max=0.5(15*5)^0.5=4.3m > 4.25,

  Unit Applied Energy (kJ/m^3)=(N*W*H*P)/Grid Spacing^2, where N: Average Number of drop and P: Number of Passes,

  Unit Applied Energy=(2*15ton*5m*2)/1^2=300kJ/m^3*0.8 (80% efficiency)=240kJ/m^3,

  200kJ/m^3<240kJ/m^3<250kJ/m^3 for Pervious partially saturated / submerged Manmade Fill (Zone 1), CONFIRMED with a Total Applied Energy of 1020kJ/m^2 (240kJ/m^3*4.25m)

<u>Impact Rolling (see above Figure 9.15):</u>

- The impact rolling (at least 12 nos. of passes) shall be done by using impact rollers (12-ton class and 25 Kilojoules of potential energy, each) with 3-sided non-circular steel drum running at a speed of 9kph.

<u>Final Leveling and Smooth Rolling (see above Figure 9.16):</u>

- The smooth rolling (at least 6 nos. of passes and/or until reaching >=96% of proctor density) shall be done by using 15-ton class single-drum vibratory smooth rollers.15-ton class single-drum vibratory smooth-roller, at least 6 nos. of passes (>=98% of Proctor Density).

  If the desired improvement (having dense to very dense Manmade Fill and underlying gravely very silty fine SAND that is called multi-layered foundation soil) has not been achieved upon completion of Deep Dynamic Compaction; additional energy will be applied, to result in greater ground improvement.

The DDC operations will be monitored. The monitoring will include, but not be limited to counting the number of drops, observations of crater depths, monitoring ground-vibrations by using seismograph, determining the heave adjacent to craters that is a sign of excess porewater pressure and measuring the surface settlement on grid basis before and after DDC.

Accurate records of the DDC operations will be kept, and this information will be submitted to the Client on weekly basis.

9.2 Verification Tests

The verification tests (Pressiometer and Static Cone Penetration) will be executed before and 30 days after the Deep Dynamic Compaction (including final leveling and smooth rolling), taking the multi-layered foundation soil improvement with additional time (due to dissipation of the excess porewater pressure) into consideration, to determine the depth and degree of improvement.

9.2.1 Pressiometer Test (PMT) in Manmade Fill

The precored (T2 76) Pressiometer test in Manmade Fill will be performed (according to ASTM D4719) at 2m intervals by using Menard type volume displacement tricell probe 74mm in outside diameter with maximum working pressure of 10Mpa.

The Pressiometer test will be performed, to obtain Menard Limit Pressure and Pressiometer Modulus. To obtain viable test results; disturbance to the borehole-wall will be minimized, and in case of having difficulties to form a satisfactory pocket, the probe will be driven into the precored hole with thin wall slotted steel casing.

One (1) borehole for every 7,000m^2 will be cored (in Manmade Fill, and according to ASTM D6640) to a depth of 4m / to a depth of reaching the Gravely very Silty fine SAND (seabed sediments) before and 30 days after the Deep Dynamic Compaction (including final leveling and smooth rolling). The core descriptions will be according to BS 5930 - Section 8.

Perforated (one third of the standpipe) uPVC pressure pipes (according to ASTM D1785), 73mm in OD and 5.2mm thick, wrapped with geotextile (PP, 150 gr/m^2) will be installed into the boreholes as open standpipe-piezometer (and a casing for the Static Cone Penetration Test that will be executed in the same location) with concrete heading (the number of the borehole, its depth and elevation will permanently be written on concrete head) and steel pipe protection, to measure the depth and fluctuations of the groundwater table after air lifting.

9.2.2 Static Cone Penetration Test with Pore Pressure Measurement (CPTu / Piezocone Sounding) in Seabed Sediments

A cone with electrical sensors will be driven into Gravely very Silty fine SAND (seabed sediments) at a standard rate of penetration 2cm per second.

One (1) CPTu sounding for every 7,000m^2 will be performed (according to ASTM D5778) to a depth of 15.5m (14m + 1.5m) / to a depth of cone refusal (50MPa) / to a depth of reaching the bedrock (Calcareous SANDSTONE / very Sandy LIMESTONE) from the seabed-level, before and 30 days after the Deep Dynamic Compaction (including final leveling and smooth rolling). The cone will be equipped with friction reducer (if needed / where needed), to improve the depth of penetration.

A truck (reaction frame of 25 tons) mounted trust mechanism of GEOMIL (or equivalent having pushing and pulling forces of >= 200kN and >=150kN, respectively) with cone data acquisition system will be used in CPTu.

The truck mounted trust mechanism will be setup by using hydraulic pistons, to obtain a trust direction as near as possible to the vertical. The non-verticality of the sounding will continuously be measured with slope sensors, to avoid breaking the push rods.

The continuously measured analogue data (cone resistance, sleeve friction, friction ratio and dynamic pore pressure) will be converted to the digital form at 25mm intervals. Zero load readings of all sensors (reference measurements) will be recorded at the start and end of each CPTu sounding.

Calibrations will be carried out at regular intervals based on the stability of the zero load readings with functional checks during the work.

Semi-empirical correlations will be used to estimate the following geo-mechanical parameters (CPTu interpretations).

- Soil profile (normalized/non-normalized soil behavior type),
- Equivalent SPT N60 profile,
- Soil unit weight,
- Undrained shear strength,
- Soil sensitivity,
- Undrained shear strength ratio,
- Over consolidation ratio,
- In-situ stress ratio,
- Friction angle,
- Relative density,
- Stiffness and modulus,
- Hydraulic conductivity,
- Consolidation characteristics (coefficient of consolidation), and
- Constrained modulus (estimating the consolidation settlement).

And the Client will be provided with verification test reports.

9.3 Final Report

A final report giving full description of site, site preparation, DDC equipment, DDC works (including monitoring), additional works (if any) and results of verification tests (including depth and degree of improvement) will be prepared and submitted to the Client as One (1) soft and Two (2) hard copies.

The report shall include (but not limited to):

- Current topography,
- As-built drawings (Plans and Sections),
- Weekly records,
- Site photos,
- Engineering analysis as requested by the Engineer (the depth and degree of improvement shall be taken into consideration in analysis), and
- Conclusions / recommendations.

CHAPTER 10 REHABILITATION OF THE EXISTING WWTP (CIVIL WORKS)

Chapter 10 - Rehabilitation of the Existing WWTP (Civil Works)

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Appendix 10.1 General Layout Drawing of the Existing Ghadir WWTP

Chapter 10 Rehabilitation of the Existing WWTP (Civil Works)

10.1 Introduction

The proposed rehabilitation works, described in this chapter, aim to restore and improve the existing building structures and finishes including, electrical and mechanical interventions strictly related to the building functionality. This excludes the works related to the treatment scheme and process.

However, the rehabilitation works include also replacement, extension and/or demolition of specific structures, including related finishes, accessories, etc … where needed, as well as improvements of the existing plant landscaping.

Since some rehabilitation works are being implemented separately by Unicef under a different ongoing project, therefore these related civil works will be excluded from the civil works rehabilitation discussed in this chapter.

10.2 WWTP Layout

Figure 10.1 provides an overview layout of the existing Ghadir WWTP site, showing the following:

- The construction under rehabilitation by others (UNICEF)
- The constructions to be rehabilitated/extended/demolished through the current project.
- The new constructions proposed in this Project.

The main structures covered by the rehabilitation and expansion works in this plant, are identified in the mentioned above layout, and include:

1. Screw pumps lifting station: New inlet and overflow structure, new flow measurement structure/s, refurbishment and expansion of channels and screw pumps area, in addition to covering the lifting station structures for odor control, where appropriate.
2. Screw pumps motors and MCC building refurbishment and expansion
3. Bar screens channels refurbishment and adjustment including covering for odor control
4. Grit Classifiers (2 Units) pit adjustment (Mechanical parts will be replaced by new ones)
5. Aerated degritting tanks refurbishment and expansion including covering for odor control
6. Blower room demolishing and relocation
7. Main pumping station building refurbishment
8. Transformer and generators building refurbishment
9. Old consultant building demolishing
10. Parking structure refurbishment and expansion
11. Guard house refurbishment
12. Laboratory (Within pumping station building)
13. Boundary wall and access gate
14. Remaining outdoor area refurbishment.

Figure 10.1 shows also, in the existing WWTP site, the new structures which are not tackled in this chapter but, they are required to be constructed in the current project – phase 1. They consist, but are not limited to: Primary sedimentation tanks, interim pumping station, flowmeter/valve chambers, new administration building, odor control unit, new workshop and storage building, power supply building, new access road and bridge connecting the existing WWTP site to the new WWTP site .



Figure 10.1 General Layout Drawing of the Existing Ghadir WWTP

10.3 Rehabilitation works undertaken by Unicef

Table 10.1 presents a detailed Bill of Quantities (BoQ), as received from BMLWE, specifying the civil works to be implemented by Unicef, and therefore they are excluded from the current project scope.

These works can be summarized as following:

1. Rehabilitation of all metallic outdoor, steel cabinets for electrical control panels, doors, windows and louvers of the pretreatment facility, pumping station, electrical room, generator room, and main entrance gate.
2. Replacement of all damaged/rusted outdoor steel cabinets for electrical control panels, doors, windows and louvers of the pretreatment facility, pumping station, electrical room and generator room.
3. Installation of a new electrical motor for the main entrance gate, steel rails and guiding wheels.
4. Concrete repairs for damaged part of the concrete fence.
5. Installation of new aluminum handrails for basins, with a minimum height 105 cm, matching existing railings.
6. Installation of new Double Glazed Doors: 2 units, 2.2mx1.6m each
7. Complete rehabilitation for the guard house including all type of civil, painting, mechanical and electrical works
8. Complete rehabilitation for the Laboratory including all type of civil, painting, mechanical and electrical works.

9. Sanitary works for the guard house and the laboratory (Laboratory, Kitchen and 4 WCs), including tiling, full installation of cold and hot water systems, drainage, accessories, water tanks, …
10. Civil repairs (Concrete and plaster) and painting inside the Main Pumping station.
11. Painting inside the generator room.

Table 10.1 Bill of Quantities - Critical Rehabilitation of El Ghadir Pre-treatment WWTP (Civil Works)

ITEM Nb	DESCRIPTION	Unit	Qty	Unit Price ($)	Total Price ($)
	The contractor is responsible for the replacement/rehabilitation of all components as listed below. It is the contractor's responsibility to ensure the proper functioning of the entire system. The prices provided should include all necessary conduits, electrical and hydraulic accessories, trays, fittings, and any other required items to the satisfaction of the Supervisor Engineer.				
A	**General Works**				
A.9.1	Rehabilitate of all metallic outdoor, steel cabinets for electrical control panels, doors and window and louvers of the pretreatment facility, pumping station, electrical room and generator room, and main entrance gate. The price includes the cost of rust removal, wire brush, application of epoxy primer coat and epoxy final coats with colors similar to the existing. All works are subject to the approval and satisfactory of the engineer	LS			
A.9.2	Replacement of all damaged/rusted metallic outdoor steel cabinets for electrical control panels, doors and window and louvers of the pretreatment facility, pumping station, electrical room and generator room. The price includes the cost of steel, wire brush, application of epoxy primer coat and epoxy final coats with colors similar to the existing. All works are subject to the approval and satisfactory of the engineer	kg			
A.10	Supply, transport and install new electrical motor for the main entrance gate and steel rails and guiding wheels. Work to include any civil, electrical and mechanical work to complete the installation and testing of the main entrance gate.	LS			
A.12	Concrete repair for damaged part of the concrete fence. Works includes but not limited to Wire brush to remove all loose rust on steel bars, apply three coats paint primer or sealant to prevent future oxidation and corrosion, reinforcing damaged concrete columns', beams and walls or any other works necessary for the proper rehabilitation of the fence work to including plastering of repaired sections. All works are subject to the Engineer approval and satisfaction.	LS			
A.14	Supply, transport and installation of Aluminum handrails for basins minimum height 105 cm, similar to the existing, work to include removal of damaged handrails, civil works for fixation of new handrail.	LM			
A.15	**Double Glazed Doors & Windows:** Supply and install powder coated aluminum doors & windows include frames, angles, channels, cover joints, mullions, mastic pointing, sealants, 6mm thick annealed clear glass+12mm air space+6mm annealed clear glass, hardware, and all necessary material and accessories.				

ITEM Nb	DESCRIPTION	Unit	Qty	Unit Price ($)	Total Price ($)
A.15.1	Door with new frame (2.2 m x 1.6 m)	m^2			
A.16	**Guardian House**				
A.16.1	Perform complete rehabilitation for the guardian house including all type civil, painting mechanical and electrical works. All works are subject to the approval and satisfaction of the Engineer.	LS			
A.17	**Laboratory**				
A.17.2	Perform complete rehabilitation for the Laboratory including all type civil, painting, mechanical and electrical works. All works are subject to the approval and satisfaction of the Engineer.	LS			
A.18	**Sanitary Works**				
A.18.1	Rehabilitate/replacement the existing Hot & Cold water system included but not limited to the Laboratory, the WCs x 4 & the kitchen. The works include, supply and apply of all needed PPR pipes (with insulation where exposed to sun) with necessary valves, fittings and accessories and all equipment necessary for the proper functioning of the system. Works are subject to the engineer approval and satisfactory.	LS			
A.18.2	Rehabilitate/replacement works for sanitary including uPVC pipes for drainage pipes for kitchen and WCs to reach main sewer collectors at ground floor level.	LS			
A.18.3	Rehabilitate/replacement works for external rain water drainage pipes including uPVC DN 100 pipes for drainage reach storm water channel.	LS			
A.18.4	Supply, transport and installation of stainless-steel kitchen sink along with connection to domestic water supply network. Complete including all civil and mechanical works and accessories (i.e tap (mixer), gaskets, flexible pipes fixation, etc.).	set			
A.18.5	Supply, transport and installation of porcelain laboratory sink along with connection to domestic water supply network. Complete including all civil and mechanical works and accessories (i.e tap (mixer), gaskets, flexible pipes fixation, etc.).	set			
A.18.6	Supply, transport and installation of Kitchen & laboratory Floor drain along with connection to existing domestic grey water network.	set			
A.18.7	Supply, transport and installation of WC closet along with connection to domestic water supply network. Complete including all civil and mechanical works and accessories (i.e tap, gaskets, flexible pipes fixation, etc.).	set			
A.18.8	Supply, transport and installation of Toilet Sink along with connection to domestic water supply network. Complete including all civil and mechanical works and accessories (i.e tap, gaskets, flexible pipes fixation, etc.).	set			
A.18.9	Supply, transport and installation of Electric Heater water heater 80 liters capacity including connection to existing domestic electrical network	set			

ITEM Nb	DESCRIPTION	Unit	Qty	Unit Price ($)	Total Price ($)
A.18.10	Supply, transport and installation of Toilet floor drain with connection to existing domestic grey water network.	set			
A.18.11	Supply, transport and installation of water mixer tab	ea.			
A.18.12	Shower tray 80 x 80 cm with shower mixer and shower handle complete with installation.	set			
A.18.13	Supply and installation of PE reservoir 3 layers capacity 2000 L including all necessary works to complete connections towards station & guardian room	ea.			
A.18.14	Ceramic enameled tiles (minimum 30x30) for the floor of WCs including labor, sand, cement mortar, polished ceramic tiles and all necessary materials where needed and directed by the Engineer.	m^2			
A.18.15	Skirting for the ceramic tiles, including labor, cement mortar polishing, tools, accessories and all necessary materials where needed and as directed by the Engineer.	LM			
A.19	**Pumping facility Civil Rehabilitation**				
A.19.1	Interior painting finish including preparation of surfaces, rubbing with sealer, sanding, cleaning, application of thin putty filler where required, under coat application and two final enamel painting coats.	LS			
A.19.2	Perform civil reparation for any damaged concrete or plaster inside the pumping facility	LS			
A.20	**Generator Room**				
A.20.1	Prepare surface, supply and apply undercoat paint and the needed coats of putty and paint to walls and roof with colors similar to the existing. All woks are subject to the Engineer approval and satisfaction	LS			
	Total Civil Works				

10.4 Site Inspection

Site visits were conducted at the Ghadir WWTP with plant operator assistance to inspect the current condition of structures and buildings, with the latest visit occurring on October 18, 2024.

Photos of the site, showcasing the existing conditions and the areas needing remediation, are presented below, organized according to the primary plant structures listed in Section 10.2, following the wastewater flow direction, starting from the the screw pumps lifting station till the main pumping station and the other ancillary structures.

1- Screw Pumps Lifting Station:



Concrete repair and painting and install new aluminum cover



Concrete repair



Concrete repair and painting



Concrete repair and painting and new Aluminum hand rails painting and install new aluminum cover



Concrete repair and painting and hand rails repair painting and install new aluminum cover.



Concrete repair and new steel opening gratings

2- Screw Pumps Motors and MCC Building:



Demolish and extend building including new access (Defected tiles)



Demolish and extend building including new access (Defected concrete)



Major concrete repair Beam and Crane supports



Major concrete repair Beam (Outside)



Major concrete repair and exterior painting and Projector replacement



Interior paint



Lamps replacement and interior paint



Exterior paint and check existing cameras and replace earthing cables

3- Bar Screens:



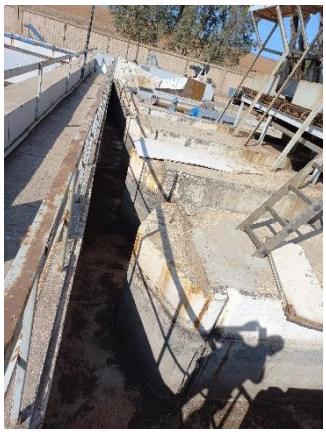
Defected concrete passage to be replaced and install new aluminum covers



Repair concrete and plaster and paint



Replace concrete cover slab



Install aluminum covers (Triangular shape) and repair concrete and paint



Install aluminum covers (Triangular shape)



Concrete and plaster repair

4- Grit Classifier:



Grit collection pit to be adjusted (Or replaced) as per the selection of the new grit classifiers



Grit collection pit to be adjusted (Or replaced) as per the selection of the new grit classifiers



Grit collection pit to be adjusted (Or replaced) as per the selection of the new grit classifiers



Grit collection pit to be adjusted (Or replaced) as per the selection of the new grit classifiers



Repair concrete in parapet



Raise opening cover with concrete frame and install new steel cover



Repair Concrete



Repair concrete

5- Aerated Degritting Tanks:



Replace reinforced concrete mobile bridge stoppers



Replace reinforced concrete movable bridge stoppers



Repair Concrete and paint walls and Install new aluminum cover



Paint walls upper part and paint steel gratings and install missing and repair concrete at fixation of steel rails and Install new aluminum cover



Paint steel rails and Install new aluminum cover



Repair Concrete and Paint Walls and Install new aluminum cover

6- Blower Room To be Demolished and Relocated:



Equipment to be Dismantled and Relocated



Louvers, Windows, Doors shall be Dismantled and Relocated



Existing Roof Waterproofing



General View



Louvers, Windows, Doors shall be Dismantled and Relocated



Access Step

7- Main Pumping Station Building:



General View



General View



Damaged parapet



Damaged parapet



Repair concrete



Replace ventilation ducting system



Replace Lamps and fixtures



General View



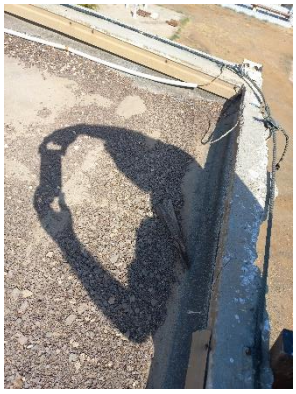
Replace ventilators and ducting system



Replace ACs



Replace fire extinguishers



Repair replace parapet and extend waterproofing



Repair roof drainage

8- Transformers and Generators Building:



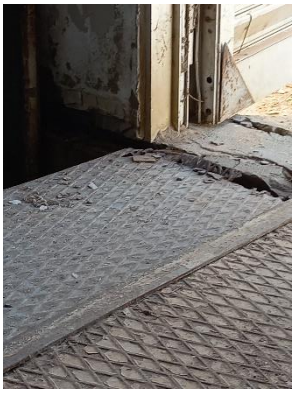
Gen 300KVA in service (Outdoor) and Trans-Elec Building



General View



Replace and add channels steel covers (2)



Replace and add channels steel covers



Generators room-Repair concrete and paint walls and ceiling and repair waterproofing



Replace lamps and fixtures and fire extinguishers



Transformers room- Paint and remove not in use materials

9- Old Consultant building- To be dismantled:



General View



General View



Damaged Concrete Canopy



Damaged Ceiling



Damaged False Ceiling



Roof Slab Not Spported on Interior Walls

10- Existing Parking Area:



General View



Damaged Concrete Beams

11- Guard House (Under Rehabilitation by Others:



12- Outside Area:



General View at Entrance



Current unpaved area and not in use stored equipment



The Concrete Boundary Wall



Old WC room outside fenced area to be demolished



Current unpaved area and not in use stored equipment



Some manholes steel covers need replacement



The Access Gate

10.5 Proposed Rehabilitation Works

Based on the site assessments and taking into consideration of the existing structures upgrades/extension/replacements proposed in the current study, specific rehabilitation works are suggested for each of the plant structures as detailed below.

To clarify at the beginning that, for some of the mentioned below works types, the works shall include, but not restricted to, the following:

- Earth Works: Clearing and grubbing, grading, excavation in all types of soil and rocks, backfilling (Any fill material, excavated or imported), all related needed materials (Geotextile, geomembrane, …), ...
- Concrete Works: Providing and installing any type of concrete, steel reinforcement, Prestressed/post tensioned steel if any, hollow concrete blocks, waterproofing, damp proofing, sealant, all related needed materials…
- Finishing Works: All needed metallic and miscellaneous civil works: Plastering, painting, tiling, stone cladding, doors, windows, louvers, gratings, hand rails, access covers, rails, false ceiling if any, structural steel, red clay tiles, ….
- MEP Works: Providing and installing all needed mechanical, electrical, plumbing works related to the structure functionality, excluding the works related to the waste water process (Accounted in other appropriate chapters)
- Covers for odor control purposes.

10.5.1 Screw Pumps Lifting Station

The screw pumps area covers the screw pumps basin, penstocks, inlet chambers, overflow chamber, …

As proposed in the current study, the screw pumps area shall be extended at both sides allowing the installation of 7 additional screw pumps alongside the existing seven, 3 at western side and 4 at eastern side.

The needed civil works can be summarized as follows:

- Demolish and cart away the overflow and inlet manholes located at the western side of the screw pumps basin
- Construct new inlet and overflow structure, and install all the needed pipelines connections and accessories, permitting the following:
  - Reconnect the existing stormwater pipeline (DN1500mm) to the inlet culvert, upstream the screw pumps lifting station structure.
  - Discharge the sewage overflow to the nearest existing overflow pipeline manhole.
- Construct new flow measurement structure/s upstream the screw pumps lifting station structure enabling to define the total influent flow. This construction shall be equipped with all the needed mechanical and electrical equipment.
- Construct a reinforced concrete structure, similar to the existing screw pumps basin, at both sides of the basin permitting the installation of 7 screw pumps (3 from one side and 4 from another side) and permitting the installation of the related penstocks and access covers.

  This additional structure shall include the needed concrete access stairs.
- Install Aluminium handrails where needed for the extended parts.
- Repair concrete where needed in: Stairs, walls, roof slab beside penstocks ...

  The major noted defects: Cracks, concrete cover pulled out, exposed and rusted steel reinforcement...
- Repaint concrete faces with appropriate epoxy coating protecting from site environment effects.at the following locations:
  - Inclined walls/stairs faces (L=9.5, h=1.4m)
  - Exterior walls faces (Interior: hmax=4.8m, Exterior: h=1.1m)
- Provide 14 steel gratings/openings covers beside the penstocks (7 units for existing structure and 7 for the extension parts): 12 units 50x125cm, 2 units 75x145cm
- Supply and install aluminum covers for the lifting station area for odor control purposes

Note: *The rehabilitation of the existing hand rails is not included in the proposed works since they are involved in the project under implementation by Unicef.*

10.5.2 Screw Pumps Motors and MCC Building

This building is composed of one room and comprises the electro-mechanical equipment which enable operating the existing 7 screw pumps.

Consequent to the extension of the screw pumps structure permitting the installation of 7 new screw pumps, the lifting station shall also be extended at both sides allowing the operation of the 7 additional screw pumps, 3 at western side and 4 at eastern side.

The required civil works can be summarized as follows:

- Demolish and cart away part of or all the existing structures located in the extension area (Access stairs, access slope, …)

- Construct a reinforced concrete structure, as an extension to the existing lifting station building, at both sides of the basin permitting the operation of the new 7 screw pumps, including all needed earthworks, concrete works, finishing works and MEP works.

  This additional structure shall include new access stairs and access slope.

- Repair concrete where needed in: Access Stairs, columns, beams, travelling crane supports.

  The major noted defects: Noticeable pulled out concrete cover, exposed and rusted steel reinforcement, cracks, ...

- Repaint exterior concrete faces with epoxy coating.
- Repaint interior concrete faces, including removal of the existing paint.
- Install new tiles for the access stairs, including removal of existing tiles.
- Replace all earthing and lightning system
- Install new lamps and fixtures (14)
- Install new fire extinguishers: One powder type (50kg) and 3 Co2 type (6kg).

Note: *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.*

10.5.3 Bar Screens

This area includes concrete channels, steel screens, concrete crossover/pedestrian bridge, permitting to drive the wastewater to the aerated degritting tanks.

This structure does not need to be extended, despite the mentioned above extension of the screw pumps structures. However, it may need to be adjusted to be able to install new fine screens in addition to the existing coarse screen

The required civil works can be summarized as follows:

- Replace pedestrian concrete bridge (Major cracks and apparent steel reinforcement).
- Replace damaged concrete cover slab part above ventilation grill, including removal and reinstallation of the grill, with new anti-mosquito net concrete bridge.
- Repair concrete/plaster where needed in pulled out/cracked on concrete faces and apply needed adjustments to match with the screens replacement.
- Treat/repair and paint rusted steel cover gratings.
- Supply and install aluminum covers for odor control purposes

Note: *The rehabilitation of the hand rails is not included in the proposed works since they are involved in the project under implementation by Unicef.*

10.5.4 Grit Classifiers

Two grit classifiers are installed in two concrete channels upstream the degritting tanks (One at each side) with electric panelboards.

Based on the process assessment (Referring to Chapter 7 (7.6.3), the exiting grit classifiers shall be replaced with 2 new stainless steel grit classifiers that will be installed at the same locations.

The required civil works can be summarized as follows:

- Demolish and cart away the existing two concrete grit collection pits and provide civil works, as needed, for the installation of the new grit classifier.

- Or adjust and refurbish the existing two concrete grit collection pits through the needed concrete repair, painting and other needed finishing works.

10.5.5 Aerated Degritting Tanks

This structure is composed of four uncovered aerated degritting tanks, connected at the upstream side to the bar screens and the grit classifiers. They are constructed with inclined reinforced walls ending at the bottom with concrete channels. A concrete channel is built above the wall separating two basins, from each side, covered with steel gratings. Two steel mobile bridges are supported on the central wall and on the external walls, at both tanks edges (Eastern and western sides). Three reinforced concrete pedestals are fixed on the northern wall serving as stopper for the mobile bridge.

As proposed in the current study, the aerated degritting tanks shall be extended by constructing one additional aerated degritting tank, at the eastern side which necessitate to relocate the blower room. Consequently, the blower room shall be demolished and a new building will be constructed at another location.

The required civil works can be summarized as follows:

- Demolish the existing blower room building including:
  - Transport to approved dumping site all the broken/damaged/not useful material or equipment…
  - Any useful material or equipment shall be defined by BMLWE representatives and shall be appropriately stored in the plant, or delivered to them, at other approved stores locations.

  Note: Special attention shall be taken in order not to damage the existing equipment/material (Used for Wastewater process or building functionality) that are in good condition and shall be used/installed in the new blower building construction.
- Construct an additional reinforced concrete aerated degritting tank, as an extension to the existing tanks structure, at the eastern side including all needed earthworks, concrete works, finishing works and MEP works.
- Treat and paint rusted steel:
  - Gratings covers for channels
  - Steel rails for mobile bridge, above the concerned walls and at wall side faces and steel fixations.
- Repair concrete at rails fixations (For mobile bridge)
- Replace concrete columns/Pedestals for mobile bridge braking system) (3 units: 50x40x105 cm each)
- Paint internal and external concrete faces
- Install new steel gratings where missing: 20 Units in the existing tanks channels (50x107 cm each)
- Supply and install aluminum covers for odor control purposes

Note: *The rehabilitation of the existing hand rails is not included in the proposed works since they are involved in the project under implementation by Unicef.*

10.5.6 Blower Room Building

This building is composed of one room, housing three blowers, including all the related electro-mechanical equipment.

As explained in above section, the existing blower room shall be demolished and relocated due to the extension of the aerated degritting tanks. Therefore, a new building, with similar dimensions, shall be constructed in other location, including all needed earth works, finishing works, MEP works, ….

To be highlighted that some of the existing equipment is in good condition; therefore, they shall be adequately dismantled before demolishing, stored and reinstalled in the new location.

10.5.7 Main Pumping Station Building

The main pumping station building is the biggest of the existing buildings in the plant, from both area and height features. It encloses, in addition to the electro-mechanical pumping system, a laboratory and an operator office room.

Knowing that the rehabilitation works **INSIDE** this building related to the concrete repair and painting and the full rehabilitation of the laboratory are involved in the project under implementation by Unicef, therefore the proposed civil works rehabilitation will cover mainly the **EXTERIOR** elements of the building, in addition to some equipment for inside the building.

Noting especially that the reinforced concrete roof parapet is in bad condition as can be clearly noticed.

The required civil works can be summarized as follows:

- Repair concrete where needed in the exterior aspects: Columns, walls.

  The major noted defects: Noticeable pulled out concrete cover, exposed and rusted steel reinforcement, cracks, ...

- Demolish and reconstruct the concrete roof parapet. In fact, the parapet is too much damaged. Significant pulled out concrete cover exposing rusted steel reinforcement in large areas. So, it is proposed to demolish all the parapet and reconstruct new parapet, starting from the roof ceiling level, excluding the current downward parapet extension.
- Repaint exterior concrete faces with epoxy coating.
- Repair/extend concrete roof drainage (Broken) beyond the parapet faces.
- Extend roof waterproofing to above parapets including repair, where needed if any , ensuring appropriated waterproof connection with existing membrane.
- Replace lamps and fixtures (15 units)
- Replace all earthing and lightning system
- Replace defected AC: 4 units: 24000 btu, 1 unit: 9000 btu
- Replace all ventilation and ducting system in Pumps building including the related roof equipment (Defected ventilators and rusted ducts).
- Dismantle old/rusted fire extinguishers and install new fire extinguishers: One powder type (50kg) and 9 Co2 type (6kg).

Note: *The rehabilitation works inside this building related to the concrete repair and painting and the full rehabilitation of the laboratory, in addition to the rehabilitation of 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.*

10.5.8 Transformers and Generators Building

This building is composed of two separated rooms. One room at the northern side comprises two transformers and another bigger room at the southern side contains three generators, small fuel tanks and several electrical panel boards. The building is generally in good structural condition.

An additional fuel stockage has been ensured through three fuel tanks, located outside the building, having a capacity of $15m^3$ each. However, these tanks are out of service and they shall be replaced with new fuel tanks with same capacities, and relocated at different location (Refer to 10.5.12 – Exterior works)

To be noted that the transformers room includes also various materials and equipment not related to the transformers usage. They all shall be removed to an approved storage area or installed and put in service where needed. This room shall be strictly used for electrical operation and maintenance related to the transformers and firmly shall not be used as storage room.

The required civil works can be summarized as follows:

- Minor concrete repair works where needed, …
- Repaint exterior concrete faces with epoxy coating
- Repaint interior concrete faces, including removal of the existing paint.
- Treat and paint rusted steel fuel tanks, …
- Replace all earthing and lightning system
- Replace lamps and fixtures (25 units)
- Replace solid steel channels covers: 10 units (110x96 cm each).
- Treat and paint rusted steel channels covers.
- Install new fire extinguishers: One powder type (50kg) and 6 Co2 type (6kg).

Note: *The rehabilitation of 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.*

10.5.9 Old Consultant Building

The old consultant building was erected outside the plant fence during the plant construction as "Consultant Office". This building is the property of BMLWE but is not in use since the plant construction.

This building is not safe for access inside. It is always closed and the plant operator does not allow anyone for the access inside.

Based on site inspection, from outside the building and through the opened widows, the following is noted:

- The roof slab is totally damaged. Major deflections inside and significant pulled out concrete cover showing important areas of rusted steel reinforcement layers. The roof slab is supported on the external hollow blocks walls but not supported on the internal walls partitions.
- The false ceiling is defected because of ceiling damages.
- The internal finishing needs almost total refurbishment for any rehabilitation purpose.

Therefore, it is proposed to totally dismantle this building, excluding any construction at the same location, since it is located outside the plant fenced area.

However, an uncovered parking area is proposed to be implemented at the demolished construction place.

Consequently, the required works are:

- Demolish the existing construction and transport to approved dumping site all the broken/damaged/not useful material or equipment …
- Any useful material or equipment shall be defined by BMLWE representatives and shall be appropriately stored in the plant, or delivered to them, at other approved stores locations.
- Because of the current danger structural condition, special safety measures shall be provided, while removing any equipment/material and while demolishing.
- Achieve the needed road construction and finishing works for an uncovered parking area.

10.5.10 Parking Structure

The parking structure, located beside the guard house, covers an area of about 50 m^2 (10mx5m) and is composed of 6 circular concrete columns (Diameter=25cm, h= 220cm) supporting transversal and

longitudinal grid of concrete beams (Cross Section: h=50cm, b=25cm). The concrete beams are specifically in bad condition, having many defects in the concrete and reinforcement, and they are not covered by any shading material. (Currently cut palm branches are temporarily installed).

This parking area is sufficient for the cars of the management and operation teams (Better to be covered). However, additional space is needed for the visitors and maintenance vehicles.

The required civil works can be summarized as follows:

- Demolish all reinforced concrete beams: Pulled out concrete cover, cracks, apparent rusted steel reinforcement in many locations.
- Repair concrete in the columns in some locations: Pulled out concrete cover, cracks, apparent rusted steel reinforcement.
- Construct new reinforced concrete beams, supported by the columns.
- Construct a new steel structure with shading material supported by the concrete beams.

10.5.11 Guard House

The guard house rehabilitation is a part of the rehabilitation works undertaken by Unicef, who will perform complete rehabilitation for the guardian house building including all type: Civil, painting mechanical and electrical works.

Therefore, no woks will be proposed for the Guard House.

10.5.12 Exterior Works

The plant area limited by the constructed fence contains a vast non constructed surfaces which is composed of roads and non-planted soil, separated by concrete curbstones.

The non-planted area is currently used as storage for materials and equipment: (Pipes, generators, fuel tanks, containers, …)

Referring to the current upgrading design, the non-planted area will be exploited by constructing additional buildings fulfilling the required project needs.

The rehabilitation of the current concrete fence and the main steel gate are involved in the rehabilitation works undertaken by Unicef project.

Therefore, the exterior works can be proposed as follows:

- General cleaning and rearrangement inside all the plant area. The non useful materials or equipment shall be removed and transported to approved dumping site, while the useful material or equipment shall be defined formally by BMLWE representatives and shall be either gathered in a specific storage area inside the plant or formally delivered to them, at outside approved stores locations.
- Demolish and cart away the exiting 3 fuel tanks having a capacity of 15 m^3 each
- Install new 3 fuel tanks, replacing the existing tanks, with same capacities, including:
  - Reinforced concrete pad
  - Fuel containment
  - Steel structure with shading cover.
- Install new curbstones, where needed: New, or replacing defected parts or replacing that will be damaged during construction.
- Install new tiles where needed: New, or replacing defected parts or replacing that will be damaged during construction.
- Repair concrete where needed, in open area, excluding fence and above constructions: curbstones, ground slabs, manholes cover slab, parapets, …

- Repaint exterior concrete faces with epoxy coating where needed, in open area, excluding fence and above constructions.
- Treat, repair if any, and paint rusted steel gills and opening covers.
- Maintenance of Security/Control cameras, including needed partial replacement
- Replace exterior lighting projectors with new waterproof projectors, solar powered (20) and Led Projectors (10)
- Plantation of grass inside areas limited by the curbstones: beside fence and around constructions.
- Plantation of trees: around 50 units (Palm, pin, cypress, juniper, …)
- Asphalt reinstatement for the all the internal access roads.

10.6 General Evaluation

Based on the site assessment and the detailed needed civil rehabilitation works, as detailed in the above sections, the proposed rehabilitation works shall in summary cover the following:

- Extend some structures: Screw pumps lifting station, Screw pumps motors and MCC building, Aerated degritting tanks.
- Demolish existing constructions and construct new other structures at different locations: Blower room Inlet and overflow manholes and fuel tanks and add flow measuring structure;
- Demolish or adjust the existing concrete grit collection pits and replace the steel grit classifiers.
- Demolish damaged and not needed constructions: Old Consultant building and old WC rooms, located outside the fence.
- Rehabilitate the existing structures
- Revise the landscape finishing aspects.

Noting that some facilities will be under rehabilitation by Unicef, namely: Access gate, fence, Guard house, laboratory, concrete repair and painting inside main pumping station building

In addition, the rehabilitation works, under execution by Unicef, cover the metallic doors, windows, panel boards for all the buildings (Main pumping stations, Transformers and generators building, screw lifting station, and the blower room)

The proposed civil works included in the planned rehabilitation of the existing Ghadir Wastewater treatment plant can be summarized as follows:

- Demolish existing structures, general cleaning and grabbing, transport defected materials to approved dumping areas, deliver materials to BMLWE Stores,
- Construct new building including all earth works, concrete works, finishing works and MEP works including:
  - Excavation, backfilling, …
  - Concrete works: Reinforced concrete structures and all type of concrete for basins and buildings: Foundation, columns, walls, ground slabs, roof slabs, stairs, parapets, channels.… including hollow blocks, waterproofing, damp proofing, sealing and related needed materials.
  - Finishing works: Plaster, painting, tiling, doors, windows, glazing, steel/metallic works: Hand rails, gratings, rails, opening covers, …
  - Electrical installation for buildings: Fixtures, cables, lamps, earthing and lightning, electric panel board.
  - Mechanical installation for buildings where appropriate: Ventilation, ducting, fire extinguisher, travelling crane, …

- Plumbing where needed: Drainage, …
- Flow measurement equipment

- Rehabilitate existing structures:
  - Repair/replace the defected/damaged reinforced concrete structures parts, where needed.
  - Paint, in general, all interior and exterior faces. The exterior paint shall be epoxy coating that can withstand especially the sea side climatic conditions and the sewage environment including related chemicals.
  - Repair/replace steel/metallic works, including appropriate painting materials withstanding the plant environment: Gratings, handrails, rails, access opening covers, ladders, …
  - Replace existing lamps and fixtures
  - Replace existing earthing and lightning system
  - Replace/add fire extinguishers.
  - Replace ACs
- Enhance the exterior landscaping area:
  - General cleaning and organize outside material/equipment.
  - Revise the landscape materials/plantations by installing grass and trees where there is soil.
  - Provide additional parking area.
  - Tiling and asphalt reinstatement, especially following the possible defects due to the construction works.

CHAPTER 11 ACCESS AND CONNECTION OF THE TWO SITES OF THE WASTEWATER TREATMENT PLANT

Chapter 11 – Access and Connection of the Two Sites of the Wastewater Treatment Plant

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Figure 11.2 Single flat-wide-trench 3

Chapter 11 Access and Connection of the Two Sites of the Wastewater Treatment Plant

11.1 Introduction

This chapter outlines the connection for establishing direct access from the existing wastewater treatment plant site to the new site for operation and maintenance activities. It also considers the necessary piping system trench to connect the two sites.

11.2 General Description of the Access and the connection of the Two Sites of the WWTP

The connection between the two sites includes an access / service road with a bridge spanning over the highway and wing-wall abutments (U-Shaped RWs) as shown in Figure 11.1 (Refer to Vol 3/Drawing Con-BCD-05-Rev 0). The piping system includes a single flat-wide-trench (cut-and-cover method) as shown in Figure11.2 (Refer to Vol 3/Drawing Con-PTS-12-Rev 0).

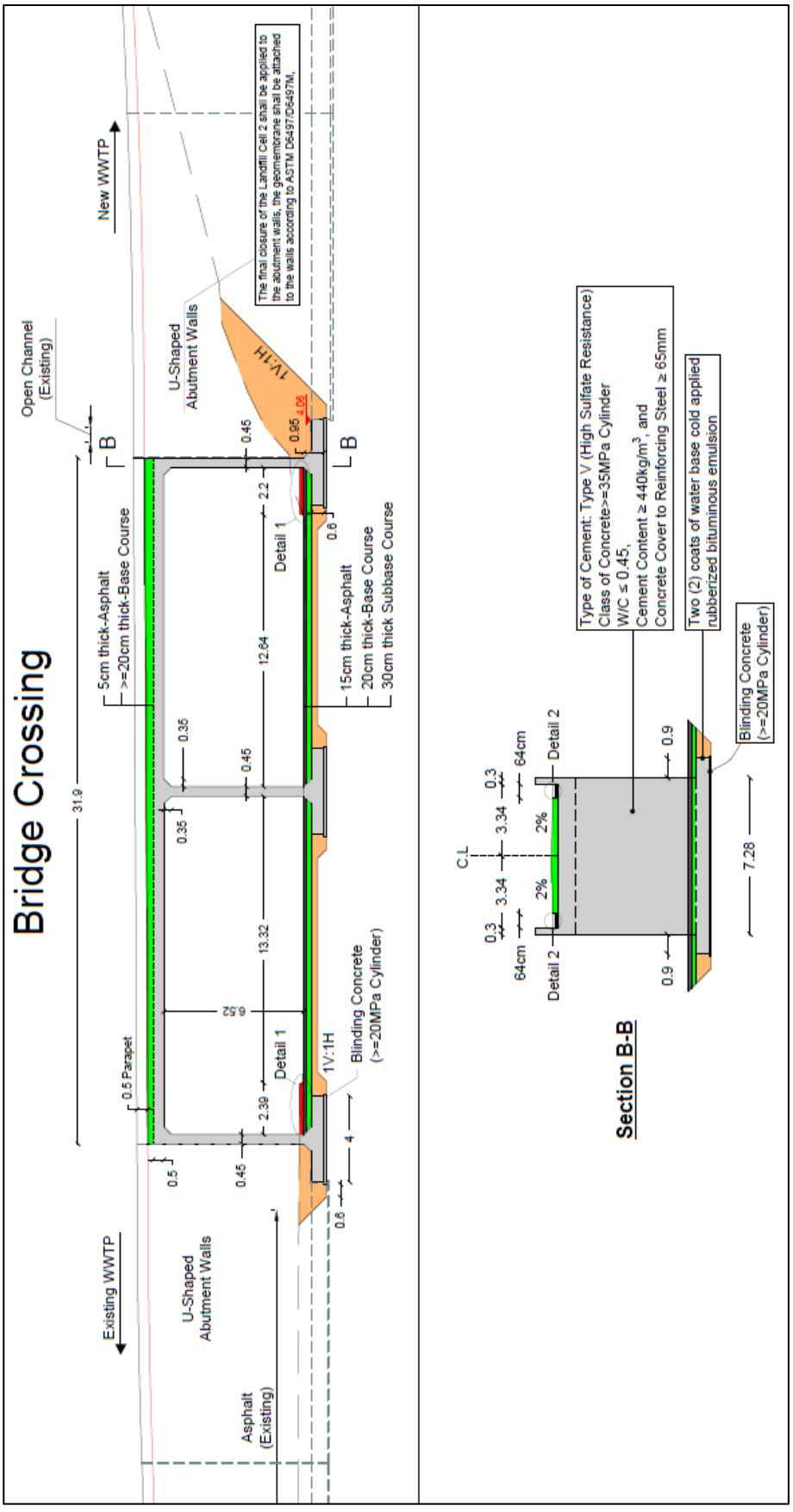


Figure 11.1 Access / Service Road Bridge

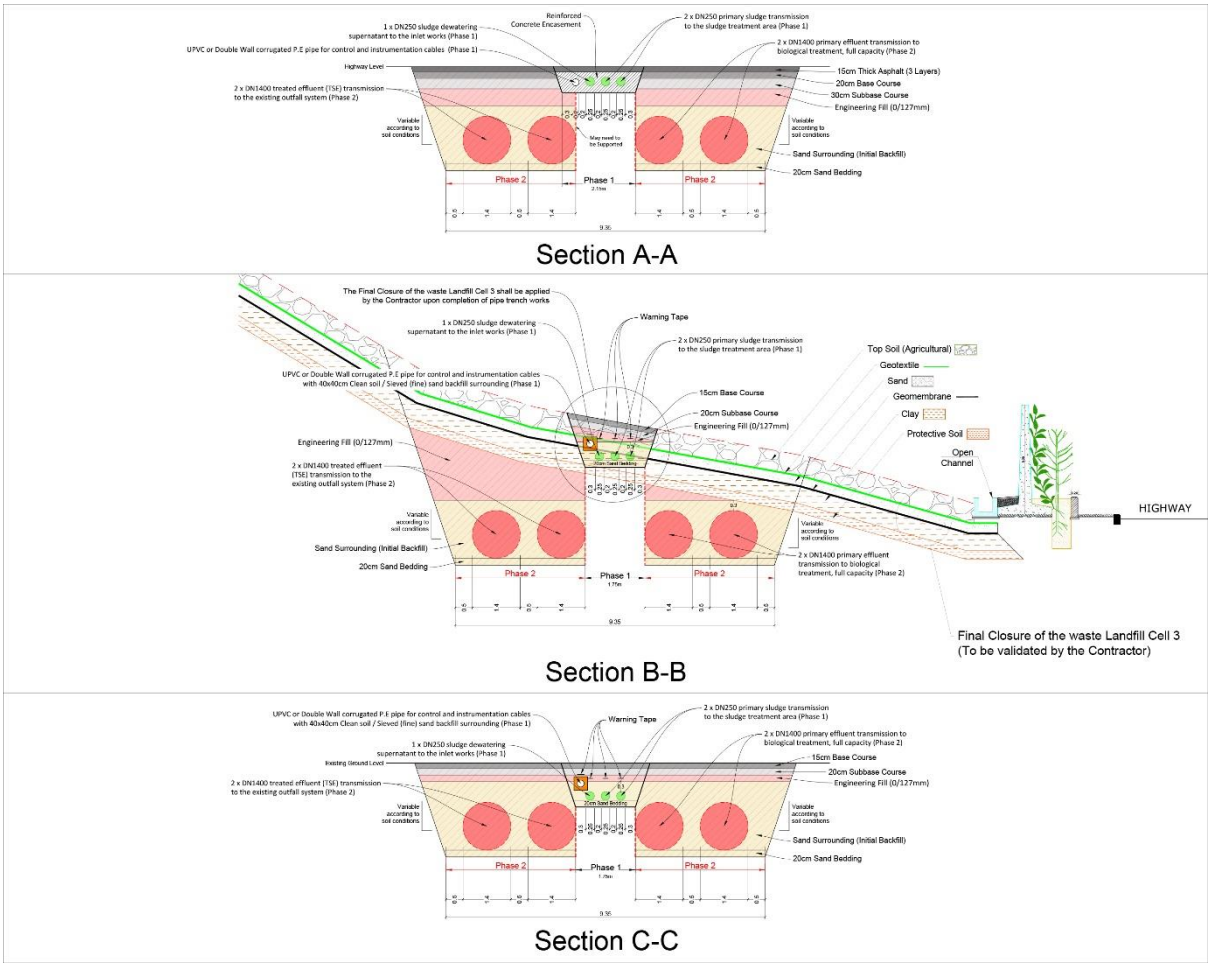


Figure 11.2 Single flat-wide-trench

The main advantages of this connection are:

- Elevated Structure: Minimizes ground disturbance, reducing risks associated with the underground water table.
- Minimal Impact on the Highway: Since the bridge spans over the road, disruption to the existing traffic flow would be minimal.

11.2.1 Service Road and Bridge

The paved access / service road (two-lane with two-way operation) connecting the two sites will start with an enlarged-horizontal curve (up to 2m high ramp-embankment with side-slopes), and will continue with U-Shaped RWs 3m to 8m high. It will then cross the highway via a bridge (31.9m long with 2 nos. of spans, 6.52m high and 7.28m wide) with wing wall abutments (U-Shaped RWs 8.5m to 9.5m high), before reaching the existing access dirt road at the sanitary landfill (Cell 2) in front of the existing wastewater treatment plant (WWTP). This dirt road will geometrically be upgraded (horizontal and vertical profiles), paved and widened (to a traveled-way width of 5.4m to 5.7m) according to AASHTO Level of Service: D, ultimately leading to the reclaimed land. It is important to note that the access / service road is paved and includes a surface-runoff-water drainage system (Refer to Vol 3 / Drawings Con-ARPV-01-Rev 0, Con-ARPr-02-Rev 0, Con-ARS1-03-Rev 0 and Con-ARS2-04-Rev 0).

11.2.2 Pipes Trench

The trench will have a width of around 1.75m to 2.15 (for Phase 1) and 9.35m (for Phase 2), as per the AWWA standards outlined in the Flowlite Installation Guide for Buried Pipes (Revision V5 2016-12, Section 7.0), and will contain the Following pipes:

- 2 pumping DN 1400mm of primary effluent to secondary treatment (Phase 2),
- 2 transmission pipes DN 1400 of TSE from storage tank to outfall discharge structure (Phase 2).
- 2 pipe DN 250 of primary sludge to sludge treatment (Phase 1).
- 1 pipe DN 250 of sludge dewatering supernatant to the inlet works (Phase 1).
- Control and Instrumentation pipe and cables (Phase 1)

Based on the as-built drawings for Ouzaii-Khaldeh highway infrastructures received from Chair through CDR, our above proposed pipes will cross at the highway with the following existing pipes:

- 2 Inlet sewer pipes DN 1400,
- 4 PW pipes (2 old pipes 2*DN700 and 2 newer ones DN 900 and DN 1000 from Naameh Source to Tallet El Khayat Reservoir)
- Some drainage pipes/manholes
- Various phone ducts and electrical layout.

A profile for the proposed sludge pipes (Phase 1) is provided in Volume 3-Tender Drawings, avoiding as much as possible the relocation of the existing pipelines.

CHAPTER 12 POW OF THE EXECUTION OF THE FIRST PHASE (INCLUDING O & M)

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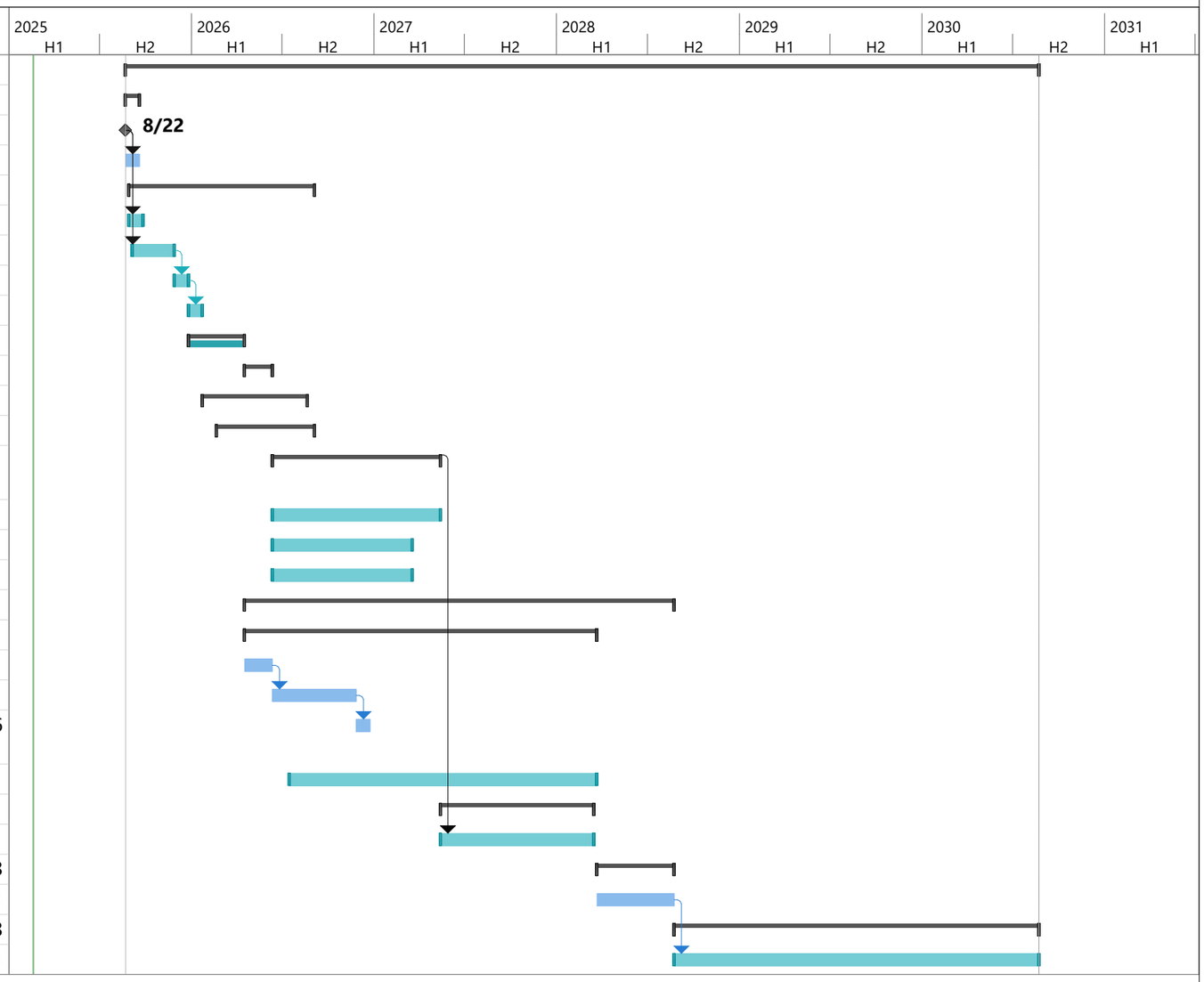
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دار الهندسة نزيه طالب وشركاه

Founded 1956

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

COUNCIL FOR DEVELOPMENT & RECONSTRUCTION

ID	Task Mode	Task Name	Duration	Duration/Month	Start
1		**GWWTP Project Duration**	**1305 days**	**60**	**Fri 8/22/25**
2		**Ghadir WWTP General**	**20 days**	**1**	**Fri 8/22/25**
3		Award of Contract	0 days	0	Fri 8/22/25
4		Mobilisation	0.95 mons	1	Fri 8/22/25
5		**Design Phase**	**265 days**	**12**	**Fri 8/29/25**
6		Site Assessment	0.95 mons	1	Fri 8/29/25
7		Detailed Design	2.86 mons	3	Fri 9/5/25
8		Design Review and Approval	0.95 mons	1	Fri 11/28/25
9		Soil Investigation	0.95 mons	1	Fri 12/26/25
10		**Material Submittals**	**80 days**	**4**	**Fri 12/26/25**
15		**Material Approval**	**40 days**	**2**	**Fri 4/17/26**
20		**Method Statements Submittal**	**150 days**	**7**	**Fri 1/23/26**
28		**Method Statements Approval**	**140 days**	**6**	**Fri 2/20/26**
36		**Procurement and Material Delivery**	**240 days**	**11**	**Fri 6/12/26**
37		Mechanical Equipment	11.43 mons	11	Fri 6/12/26
38		Electrical Equipment	9.52 mons	9	Fri 6/12/26
39		Instruments	9.52 mons	9	Fri 6/12/26
40		**Construction**	**613 days**	**28**	**Fri 4/17/26**
41		**CIvil Works**	**503 days**	**23**	**Fri 4/17/26**
42		Deep Dynamic Compaction	1.86 mons	2	Fri 4/17/26
43		Highway Crossing Bridge	5.71 mons	6	Thu 6/11/26
44		Highway Crossing Trench (Pipes Only)	0.95 mons	1	Thu 11/26/26
45		Construction Works	20.9 mons	20	Thu 7/16/26
46		**Electromechanical Works**	**219 days**	**10**	**Fri 5/14/27**
47		Installation Works	10.43 mons	10	Fri 5/14/27
48		**Testing and Commissioning**	**110 days**	**5**	**Wed 3/22/28**
49		Testing and Commissioning	5.24 mons	5	Wed 3/22/28
50		**Operation and Maintenance**	**522 days**	**24**	**Wed 8/23/28**
51		Operation and Maintenance	24.86 mons	24	Wed 8/23/28



Project: Project Sch Ghadir WW
Date: Wed 2/19/25

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

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Appendix 4.3 Photos of Core Boxes

Appendix 4.4 Laboratory Test Results

Appendix 4.5 Overall Hydraulic Profile

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Appendix 8.2 Single Line Diagram for Ghadir Existing WWTP

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

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

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

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

Appendix 8.7 Ghadir WWTP – Electrical Panel Sizing (Estimation)

Appendix 8.8 Ghadir WWTP – Fuel Consumption (Estimation)

CHAPTER 10 REHABILITATION OF THE EXISTING WWTP (CIVIL WORKS)

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

CHAPTER 3 TOPOGRAPHIC SURVEY

Appendix 3.1 Existing WWTP Survey

Existing Dirt / Gravel Road

Dyke

Open Canal

Concrete Wall

Slope

Khalde Highway

Ouazai Highway

Public W.C

Manhole

Old Consultant Building

Gate

EDL Room (NIC)

Gland House

Parking

Boundary Wall Height =2.34

Main Pumping Station

Dry Well

Office

Storage Room

WC

Electrical

WC

Office

E.M Flow Meter

Gate Valve

Generators Room

Transformers Room

Transformers & Generators Building

Wall Height =1.1

Fuel Tanks

Scum and Grease Sump Pit

MH-E1

Grit Classifier

Aerated Degritting Tanks

Bar Screens

Screw Pumps Motors & MCC Building

Screw Pumps Lifting Station

Overflow Manhole

Inlet Manhole

Recieving Chamber

MF-1

MF-2

MF-3

MF-4

MH-E2

MH-1

Elec. Box

Blower Room

Elec. MH

Ramp

Boundary Wall

X -339550

X -339525

X -339500

X -339475

X -339450

X -339425

X -339400

X -339375

X -339350

Y -36925

Y -36900

Y -36875

Y -36850

Y -36825

Y -36800

Y -36775

Y -36750

Y -36725

Y -36700

Y -36675

N

LEGEND:

- Elev Survey Point
- Tree
- Lamp
- Concrete
- Column
- Diesel Tank
- Door
- Electrical Box
- Gate
- Fuel Tank
- Manhole Storm
- Road
- Sewer Manhole
- Side Walk
- Stairs / Ladder
- Steel Cover
- Transformer
- Water Machine
- Watertank
- Windows
- Building
- Concrete
- Container
- Garbage
- Generator
- Gully
- Manhole
- Pipe
- Scrap
- Wall
- Boundary Wall

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

Topographic Survey

Existing WWTP Site

DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2025
SCALE :	1:400
FILE NAME	TS-ETP-01

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	TS	ETP	01	1

CHAPTER 3 TOPOGRAPHIC SURVEY

Appendix 3.2 Reclaimed Land Survey

Landfill Cell 2

Access Road

Dyke

Landfill Cell 3

Slope

Open Channel

Upstand Wall 25*60 cm

Old Concrete Beam

STORM BOX CULVERT 2 CELLS (3.75x2.25m)

T-wall

Ancient Wall

Existing Ghadir WWTP

STORWATER CULVERT

Landfill Cell 2B

Landfill Cell 2A

N

LEGEND:

- Elev — Survey Point
- Contour Every 1m
- Reclaimed Expansion & Upgrade WWTP Area - Phase 1: 18,226m²
- Reclaimed Expansion & Upgrade WWTP Area - Phase 2: 101,093m²
- WWTP Area Within Setback of 150m From Runway Centerline: 14,870m²
- Ancient Wall Area: 4,726m²

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NAZIH TALEB & PARTNERS
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Topographic Survey

New WWTP Site & Connection With Existing WWTP Site

DRAWN :	H.I
CHECKED :	S.H
APPROVED :	F.L
DATE :	05 March 2025
SCALE :	1:1,000
FILE NAME	TS-NTP-02

PROJECT	DIVISION	SUB-DIVISION	SHEET	REVISION
L2401DS	TS	NTP	02	1

CHAPTER 4 GEOTECHNICAL INVESTIGATION

Appendix 4.1 Borehole Locations