

Terms of Reference (ToR)  
Preparation of the Design of  
Tulkarm Wastewater Treatment Plant (TWWTP),  
and North East Ramallah Wastewater Treatment Plant (NERWWTP)

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## List of Abbreviations

AHLC.....	Ad Hoc Liaison Committee
AOX .....	Adsorbable organic halides
AWP.....	Associated Works Program
BOD <sub>5</sub> .....	Biochemical Oxygen Demand within 5 days
CHP .....	Combined Heat and Power
COD .....	Chemical Oxygen Demand
DBO .....	Design Build Operate
DBOT .....	Design Build Operate Transfer
CHP .....	Combined Heat and Power Plant
COD .....	Chemical Oxygen Demand
DB .....	Distribution Board
DBOT .....	Design Build Operate Transfer
DS .....	Dry Solids
DNP .....	Defects Liability Period
EN .....	European Normes
EU .....	European Union
FIDIC.....	International Federation of Consulting Engineers
HDPE .....	High Density Poly-ethylene
ICA.....	Instrumentation, Control and Automation
IEC .....	International Electro technical Commission
IP .....	Ingress Protection
ISO .....	International Organization for Standardization
LV .....	Low Voltage
MCC .....	Motor Control Circuit
MDB .....	Main Distribution Board
MG .....	Million Gallons
MGD .....	Million Gallons per Day
MV .....	Medium Voltage
NEQS .....	National Environment Quality Standards
O&M .....	Operation and Maintenance
PE <sub>60</sub> .....	Population Equivalent based on a specific pollution load of 60 g <sub>BOD5</sub> /c.,d
PLC .....	Programmable Logic Controller
PSPS .....	Primary Sludge Pump Station
PWA.....	Palestinian Water Authority
RTU .....	Remote Terminal Unit
SCADA .....	Supervisory Control and Data Acquisition
SDG .....	Sustainable Development Goals
SS .....	Suspended Solids
SSPS .....	Secondary Sludge pumping station
NH <sub>4</sub> -N .....	Ammonium Nitrogen
NO <sub>3</sub> -N .....	Nitrate Nitrogen
N <sub>tot</sub> .....	Total Nitrogen
TKN.....	Kjeldahl Nitrogen
PO <sub>4</sub> -P .....	Phosphate Phosphorus
P <sub>tot</sub> .....	Total Phosphorus
TOR .....	Terms of Reference
TSS .....	Total Suspended Solids

UNDP.....	United Nations Development Programme
UPS .....	Uninterrupted Power Supply
USD .....	US Dollars
UV .....	Ultra-violet
VFD .....	Variable Frequency Drive
WTP .....	(Drinking) Water Treatment Plant
WW .....	Wastewater
WWTP .....	Wastewater Treatment Plant
WZJSC.....	Wadi Zeimar Joint Service Council

## 1 Background

The Palestinian Water Authority (PWA) presented plans for the development of the water and wastewater sector in the “National Water and Wastewater Strategy for Palestine toward Building State from Water Perspectives” endorsed in July 2013, and the “Water Sector Development Plan 2018-2023” and “PWA Executive Plan 2020-2022”. The improvement of the wastewater Sector in West Bank including the construction of the Wastewater Treatment Plan was considered one of the priorities. While, a number of Wastewater Treatment Plants (WWTPs) have already been put into operation, as presented in the table below, there is still other wastewater treatment plants that needs to be constructed urgently.

Table 1: Recently Constructed WWTPs in the West Bank

WWTP	Capacity Q	unit
Tubas	4,400	m <sup>3</sup> /d
Salfeet	2,400	m <sup>3</sup> /d
Anin	600	m <sup>3</sup> /d
Jericho Agro-Industrial	400	m <sup>3</sup> /d
Aroub (Sa’ir)	1,200	m <sup>3</sup> /d

There has been significant progress in the implementation of wastewater related projects at several governorates in the West Bank, in addition to other sewage collection systems implemented through Governmental local budget, as described in Table 2 below.

Table 2: List of wastewater on-going projects:

WWTP		Capacity (Q)	Unit	Degree of progress
	Hebron	26,000	m <sup>3</sup> /d	80 %
	Jenin Industrial Zone	2,000	m <sup>3</sup> /d	90 %
Collection Systems				
	Attil and Deir Al Ghusoun sewage	27	km	65 %
	Nablus East Azmout, Salem, Deir IHatab, Beit Furik	100	km	30 %

### 1.1 Tulkarm Wastewater Treatment Plant (TWWTP):

A Feasibility Report titled “Treated Wastewater Reuse Strategy for the West Bank” has been prepared in June and July 2022. The Project Components that have been developed in the Feasibility Report for the reuse of the treated wastewater from Tulkarm and Nablus West include:

1. **Water Conveyance System:** this is the system comprising (i) the main pumps required to convey water uphill from the WWTP to the (ii) elevated storage / buffer tanks via (iii) the main large-diameters pipelines
2. **The Reservoir(s) System:** depending on the alternative option, one or two reservoirs might be built to store water during the months when irrigation is not required.

3. **The Irrigation Project(s) System:** depending on alternative option, one or two drip irrigation projects are proposed to reuse the largest amount (potential) of treated wastewater.
4. **The Renewable Energy System:** for all alternatives there is an opportunity to add a photovoltaic (PV) and / or a small hydropower system that can help lower the cost of electricity and the dependency on the national power grid.

In the AHLC meeting held in Brussels, in May 2022, and in the water sector group meeting held on June 28<sup>th</sup> 2022, “Tulkarm WWTP and Reuse Scheme” has been identified as a high priority project. It is in line with the strategic objectives of the water sector plan to improve the wastewater services and to expand the services across the country to serve more people, addressing public health issues, protecting the environment and groundwater resources, minimizing the transboundary flow of wastewater across the Green Line, and making treated wastewater available for use in agriculture and other purposes.

**Tulkarm WWTP and Reuse Scheme consists of 6 components:**

- Tulkarm Wastewater Treatment Plant (TWWTP)
- Treated Wastewater Conveyance System to the Jordan Valley
- Collection system for five villages South of Tulkarm
- Environmental and Social Impact Assessment Study (ESIA)
- Capacity Building of Wadi Zeimar Joint Service Council
- Reuse Scheme at the Jordan Valley.

The specification of the design requirements of Tulkarem WWTP is subject of this terms of reference (TOR). The implementation of the other listed components will be subject of other tenders.

The first component comprises several sub-tasks, including:

The Conceptual design for:

- Collection tank and pumping station at the site of the lagoons,
- WWTP for the pollution load of the first design horizon including a concept for the upgrading of the capacity to the ultimate pollution load including full scheme design of solar panels, and
- Effluent pipe from the new WWTP to the dedicated location of the effluent pump station at the site of the currently operating WWTP with lagoons.

## **1.2 North East Ramallah Wastewater Treatment Plant (NERWWTP):**

The Feasibility study of “North East Ramallah Villages Wastewater Treatment and Collection system” conducted by the EIB, recommended building a regional WWTP for the treatment of the wastewater generated in the 14 localities / villages affected by the project, wastewater collection systems fully or partially in these villages and trunk lines to convey the collected sewage from the villages to the regional WWTP. The most appropriate location for the construction of the regional WWTP is Wadi Al Balat.

This sewerage project was identified in the AHLC meeting held in Brussels in May 2020 as one with a high priority. It is in line with the strategic objectives of the water sector plan to improve the wastewater services and to expand the services across the country to serve more people, addressing public health issues, protecting the environment and groundwater resources, minimizing the transboundary flow of wastewater across the Green Line, and making treated wastewater available for use in agriculture and other purposes.

The specification of the design requirements of North East Ramallah WWTP is subject of this terms of reference (TOR).

### 1.3 Beneficiary / Authority

Under the AWP project, the Palestinian Water Authority has requested the World Bank to prepare the engineering design for Water Supply and the Sanitation infrastructure priority projects to be ready for investments once available.

Among those projects the Tulkarm and North East Ramallah WWTPs have been identified as of high priority. PWA has received a grant from the World Bank for the preparation of the design of TWWTTP and NERWWTP projects.

Beneficiary country: Palestine, West Bank

Contracting Authority: Palestinian Water Authority

## 2 Project Description

### 2.1 Activity 1: Tulkarm WWTP

The **existing WWTP in Tulkarm** comprises of mechanical and biological treatment with screening and two anaerobic lagoons. Due to the configuration of the WWTP the purification focuses on the removal of coarse matters, suspended solids and carbonaceous compounds but includes neither nutrient removal (nitrogen, phosphorus) nor disinfection. The effluent passes through an open channel measurement device and flows across the green line to Israeli.

Responding to the goals of the “National Water and Wastewater Strategy for Palestine” and taking into account the value of treated wastewater as a scarce resource, the existing WWTP shall be upgraded in terms of capacity (wastewater volume) and purification requirement. The effluent shall be made usable for agriculture. This goal requires the upgrading of the existing WWTP to match the requirements.

The site of the new WWTP is located north of the existing plant. The site of the ponds shall be integrated into the set-up of the new WWTP, maybe for sludge drying beds, sludge storage, effluent storage, effluent pumping station or else. The ponds will stay in operation during the construction of the new WWTP, but will have to be evacuated after the start of the new WWTP. The old site will have to be redeveloped and harnessed for the new purpose.

The effluent treated wastewater shall be used for irrigation in agriculture in the Jordan valley (Future conveyance and reuse scheme) will be designed under another project.

#### 2.1.1 Design Parameters

In the first phase the wastewater treatment plant shall be designed to accept and treat the forecasted flows and loads up to the year 2035. The plant shall receive domestic wastewater from

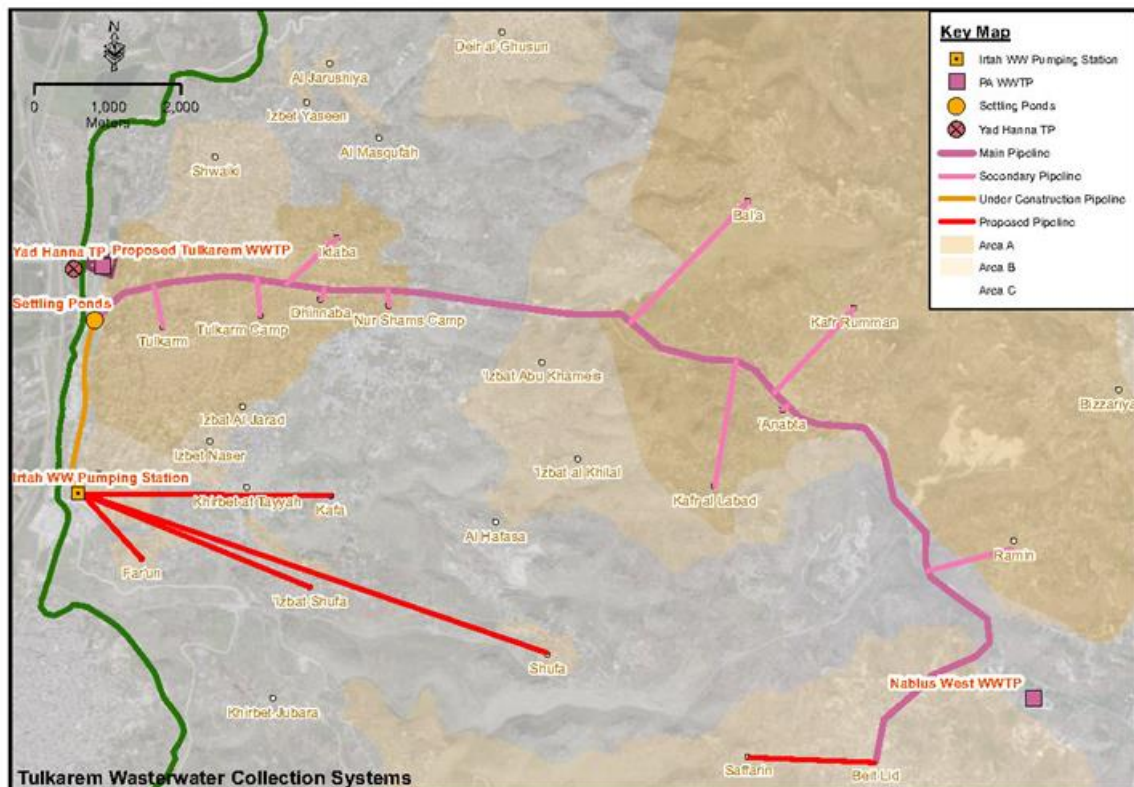
- Tulkarm ,Wadi Zeimar,
- Villages located in Wadi At-teen
- Sewage recovered from cesspits and septic tanks.

USAID has recently (in July 2022) prepared the tender documents for the construction of the Pumping station at Irtah and the force main line from the before named pumping station to the sedimentation lagoons in West Tulkarm. Irtah pumping station is located in the Southern part of Tulkarm Municipality and will serve Wadi At-Teen communities in the future. Its implementation is directly linked to the implementation of Tulkarm WWTP as it will convey sewage to the new WWTP. Construction of the pumping station and the force main has started in October 2022, and expected to be completed in



July 2024. The expected pollution volumes and loads from that inflow of the pumping station are included in the figures presented in Table 3 and Table 4

The following tables show the estimated design flows and loads for the TWWTP.



**Fig. 1: Irtah Pumping Station and Collection System**

Table 3: Hydraulic design loads of TWWTP

Parameter	Unit	Design flows
Average dry weather daily flow	m <sup>3</sup> /d	<b>22,300</b>
Average wet weather daily flow	m <sup>3</sup> /d	<b>29,000</b>
Average wet weather peak flow	m <sup>3</sup> /h	<b>1,200</b>
Peak wet weather peak flow	m <sup>3</sup> /h	<b>1,800</b>

Table 4: Assessed pollution design loads of the WWTP (design horizon 1, 2035)

Parameter	Specific load	Unit	Design loads	unit
BOD <sub>5</sub>	60	g/c, d	<b>12,200</b>	kg/d
COD	110	g/c, d	<b>22,350</b>	kg/d
TSS	70	g/c, d	<b>14,220</b>	kg/d
TN	7.5	g/c, d	<b>1,520</b>	kg/d
TP	1.5	g/c, d	<b>300</b>	kg/d

Reference: Roadmap Study March 2022

As the connection ratio will reach 100% in 2040 and afterwards, the calculated influent characteristics will become constant starting 2040, as shown in Table 5 below.

Table 5: Inflow raw wastewater concentration (2040)

Parameter	Specific load	Unit
BOD <sub>5</sub>	500	mg/l
COD	917	mg/l
TSS	584	mg/l
TN	62.5	mg/l
TP	12.5	mg/l

The ultimate design horizon is the year 2050. The BOD pollution load is expected to increase to BOD = 17,652 kg/d until 2050. The treatment requirements are the same for both design horizons

Table 6: Design discharge levels for the WWTP

Parameters	Effluent Limits 2035 and 2050	Units
BOD <sub>5</sub>	< 10	mg/l
TSS	< 10	mg/l
TN	< 15	mg/l
Coliforms	< 200	CFU/1000 ml

Table 7: Excess Sludge Quality

Parameter		Units
DS	> 25	%
DS capture rate	≥ 95	%
VSS / MSS	≤ 60	%

- 
- According to the standards, phosphorus removal is not required. However, taking into consideration that the conveyance system shall include two reservoirs (Rameen, Yassed) and the installation of hydroelectric power plants, the Consultant needs to assess the risk of eutrophication and mass production of algae in the reservoirs. The formation of algae in the reuse water shall also be avoided in view of the irrigation technology that is used in the reuse area, namely drip irrigation. Algae could clog the orifices of the irrigation pipes. The results and Conclusions shall be discussed with the employer in an early stage of the project as the modification of the purification requirements has an impact on the design of the WWTP.

The treatment process shall include (but is not limited to):

- Stone trap
- Inflow lifting station (if needed)
- Equalization tank (if needed)
- Coarse and fine screening
- Grit and grease removal
- Cesspit and septic tank effluent reception and treatment
- Flow control and bypass to buffer tank in wet weather conditions
- Continuous flow activated sludge treatment process (for removal of carbonaceous compounds, nitrogen through nitrification-de-nitrification, TSS reduction)
- Degassing
- Secondary clarifiers
- UV disinfection (provision for sand filtration)
- Biological treatment of grease
- Primary (if applicable) and secondary sludge gravity thickening

- Excess sludge digestion
- CHP using biogas for energy and heat production
- Mechanical dewatering of stabilised sludge
- Sludge Drying Beds
- Polluted air treatment
- Outdoor control treatment

In addition to the treatment process, the consultant shall consider the following:

- Administration building with operation and administration office, laboratory, workshop; rest rooms, store, kitchen
- Boundary fence or protection wall
- Solar panels
- Reservoir for pumping of treated effluent
- Adapting the site of the existing lagoons (15 donums) for future use after abandonment of the lagoons (e.g. for effluent storage and pumping station, stabilised excess sludge storage, reed beds for excess sludge storage and transformation, etc.)

In the territory of the Jordan valley, an area of A= 250 donums has been designated to be used for the deposit of the stabilised and dewatered sludge. It is intended that it will be deposited there in layers to cover the top soil layer with high salt concentration and bad quality. The sludge will be biologically converted into natural soil after a couple years of storage (appr. 10 years).



**Fig. 2:** Proposed Site of Tulkarm WWTP

### **Additional Designs**

In addition to the Components that have been described above under the (WWTP), a wastewater collection tank and pumping station have to be designed at the site of the existing WWTP with lagoons. The tank shall collect the existing wastewater by gravity stream from the town, the sewage stream that is currently by-passes the WWTP and the projected new pressure pipeline from Irtah pumping station. The accepted total wastewater flow shall be diverted to the site of the new WWTP. The length

of the pressure pipe is about  $L = 653$  m and the geodetic height difference  $dH = 10$  m. The tank volume, lifting capacity and operation have to match the configuration and design of the new WWTP.

Keeping in mind that the site of the existing lagoons shall remain part of the wastewater treatment system, and shall provide a buffer tank for the effluent and the pumping station feeding the conveyance system of the treated wastewater transmission pipeline from the final treatment stage at the new WWTP to the location of the future effluent lifting station.

The Feasibility Report titled “Treated Wastewater Reuse Strategy for the West Bank” has elaborated also on the reservoir system, the irrigation system and renewable energy system that have to be developed with this project.

### 2.1.2 Renewable Energy System

As already indicated a photovoltaic (PV) power plant shall be built to supply and cover the energy demand of TWWTP. The Consultant has to investigate for the available location and most possible generation of electricity. Surplus energy shall be supplied to the public grid. The PV modules shall be made up of many individual, interconnected photovoltaic cells each assumed to be able to produce more than of 300W .

To ensure that the modules are tilted correctly and facing the sun, they shall be placed on support structures that are flexible and can be adjusted to the position of the sun. Every module shall have two output terminals that collect the generated current and transfer it to the management systems at the solar power station. The inverter shall transform the continuous current produced by the solar panels into an alternating current so that it can be converted by a transformer into a medium voltage current. A control system shall monitor the power station’s operations and connect it to the electric grid to make the resulting green energy available to others if the production exceeds the demand.

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### 2.1.3 Project Area - Existing Conditions

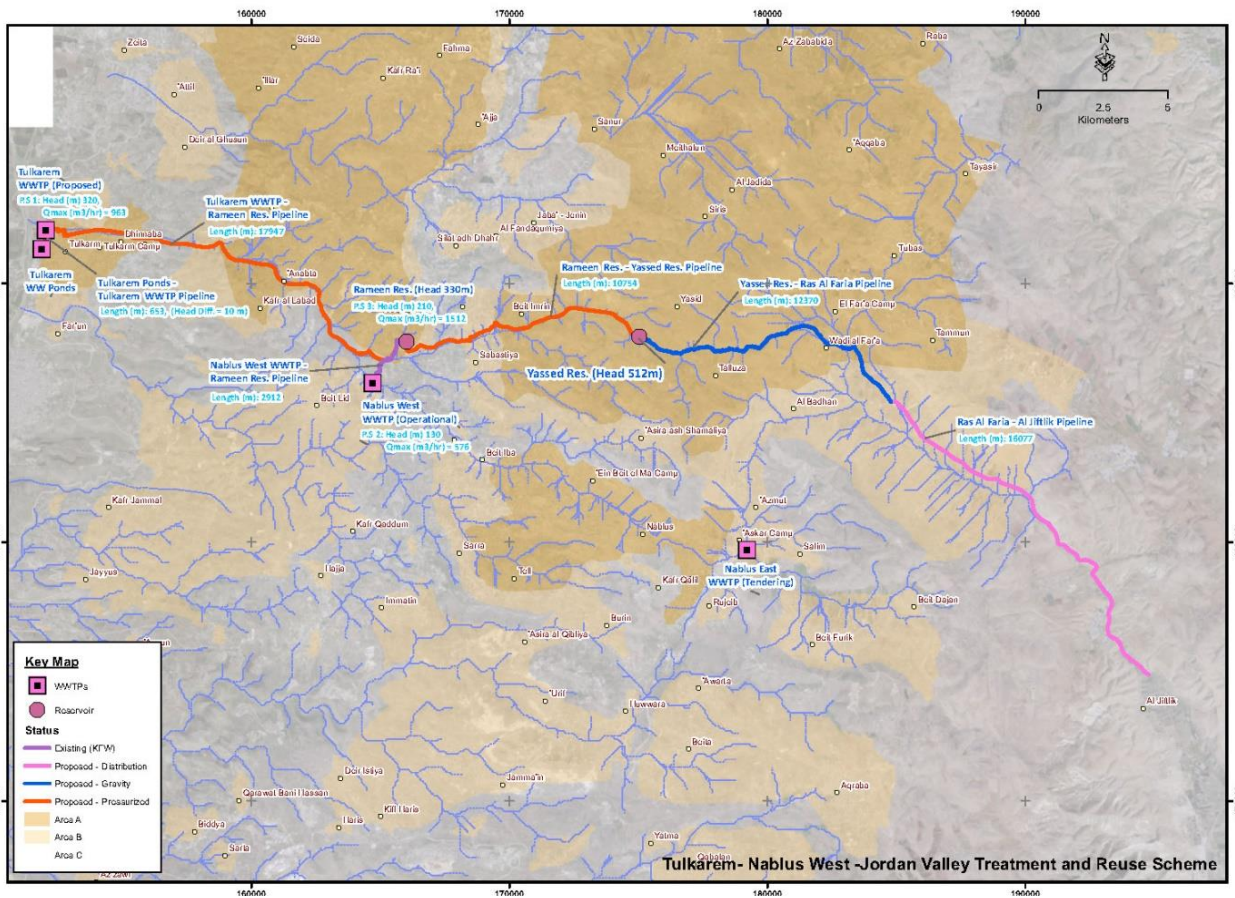
The Wastewater Treatment Plant is located west of Tulkarm. Fig. illustrates the location of the WWTP.

The Conveyance system with all associated structures extends from the proposed TWWTP, passing by the existing and operating West Nablus WWTP, to Al Malaki Bridge and finally reaching the targeted irrigation areas in the Jordan River Basin. Fig. illustrates the general alignment of the conveyance system based on the feasibility study. The conveyance component will be covered under separate assignment but should be considered during design preparation.



**Fig. 3: Tulkarm WWTP site Location**





**Fig. 4: Conveyance System of the effluent to the Reuse area**

### 2.1.4 Geographical area to be covered

The study shall cover municipalities, villages, camps and localities distributed among the two catchment areas as follows:

- “Wadi Zeimar” catchment area which includes:
- Anabta, Rameen, Ba’la, Beit Leed, Iktaba, Irtah, Kafr El Labad, Kafr Rumman (part of Anabta), Nur Shams Camp, Shuweika, Thinnabeh, Tulkarm City, Tulkarm Camp, and Saffareen

## 2.2 Activity 2: North East Ramallah Wastewater Treatment Plant (NERWWTP)

The Feasibility study “North East Ramallah Villages Wastewater Treatment and Collection system” conducted by the EIB, recommended building a regional WWTP for the treatment of the wastewater generated in the 14 localities / villages affected by the project, wastewater collection systems fully or partially in these villages and trunk lines to convey the collected sewage from the villages to the regional WWTP. The most appropriate location for the construction of the regional WWTP is Wadi Al Balat.

### 2.2.1 Design Parameters

The following tables (Table and Table ) show the estimated design flows and loads of the raw sewage) that shall be treated at the regional WWTP for the two design horizons.

Table 8: Wastewater Flows and Specific Loads

Parameter	Unit	2035	2050
<b>POPULATION SERVED - WATER DEMANDS</b>			
Population served by sewerage	inhabitants	59,907	78,394
Population served by cesspits and vacuum trucks	inhabitants	3,857	5,097
<b>WASTEWATER FLOWS</b>			
Residential wastewater production	m <sup>3</sup> /d	5,287	7,496
Commercial wastewater ratio	%	7%	7%
Commercial wastewater flow	m <sup>3</sup> /d	370	525
Industrial wastewater ratio	%	3%	2%
Industrial wastewater flow	m <sup>3</sup> /d	151	151
Total average dry weather flow	m <sup>3</sup> /d	5,807.8	8,171.3
	m <sup>3</sup> /h	242	340
	l/s	67.2	94.6
Wet weather infiltration (30%)	m <sup>3</sup> /d	1,586	2,249
Dry weather flow	m <sup>3</sup> /d	<b>5,808</b>	<b>8,171</b>
	m <sup>3</sup> /h	242	340
	l/s	67.2	94.6
Wet weather flow	m <sup>3</sup> /d	<b>7,394</b>	<b>10,420</b>
	m <sup>3</sup> /h	308	434
	l/s	85.6	120.6
Peak factor	-	2.53	2.42
Peak flow	m <sup>3</sup> /h	678	917
	l/s	188	255
Septic sewage transferred by vacuum trucks	m <sup>3</sup> /d	10.53	13.91
Total design dry weather flow	m <sup>3</sup> /d	5,818	8,185

Ref: NE Ramallah Feasibility Study

Table shows the assessed increase of the specific pollution load from phase 1 to phase 2.

Table 9: Domestic and Industrial Wastewater Specific Loads [g/c, d]

Parameter	Unit	2035	2050
<b>Domestic wastewater specific loads</b>			
Specific COD load	g/c, d	110	120
Specific BOD load	g/c, d	55	60
Specific SS load-	g/c, d	65	70
Specific TN load	g/c, d	10.0	11.0
Specific TP load	g/c, d	2.0	2.5
<b>Faecal sludge/septage specific loads</b>			
Specific COD load	g/c, d	25.0	25.0
Specific BOD load	g/c, d	10.6	10.6
Specific SS load-	g/c, d	12.0	12.0
Specific TN load	g/c, d	1.0	1.0
Specific TP load	g/c, d	0.2	0.2
<b>Industrial wastewater quality</b>			
COD concentration	mg/l	1,000.0	1,000.0
BOD concentration	mg/l	500.0	500.0
TSS concentration	mg/l	500.0	500.0
TN concentration	mg/l	150.0	150.0
TP concentration	mg/l	30.0	30.0

Table 10: Design discharge limits for the WWTP

Parameter	Unit	Limit value
Biological Oxygen demand BOD	mg/l	20.0
Total Suspended Solids, TSS	mg/l	30.0
Ammonium nitrogen N-NH <sub>4</sub>	mg/l	2.0
Nitrate and Nitrite Nitrogen N-NO <sub>x</sub>	mg/l	21.0
Organic nitrogen N <sub>org</sub>	mg/l	2.0
Total Nitrogen, TN	mg/l	25.0
Total coliforms	MPN/100ml	100

According to the standards phosphorus removal is not required.

Table 11: Excess Sludge Quality

Parameter		Units
DS	≥ 25	%
DS capture rate	≥ 95	%
VSS / MSS	≤ 60	%

Ref: NE Ramallah Feasibility Study

The treatment process shall include but is not limited to:

- Stone trap
- Inflow lifting station (if needed)
- Equalization tank (if needed)
- Coarse and fine screening
- Grit and grease removal
- Cesspit and septic tank acceptance and storage facility
- Flow control and bypass to buffer tank
- Continuous flow activated sludge treatment process (for removal of carbonaceous compounds, nitrogen through nitrification-de-nitrification, TSS reduction)
- Secondary clarifiers
- UV disinfection
- Primary (if applicable) and secondary sludge gravity thickening

### **Additional Designs**

In addition to the treatment process, the consultant shall consider the following:

- Administration building with operation and administration office, laboratory, workshop; rest rooms, store, kitchen
- Boundary fence or protection wall
- The treated water will flow to the Wadi.

### **2.2.2 Renewable Energy System**

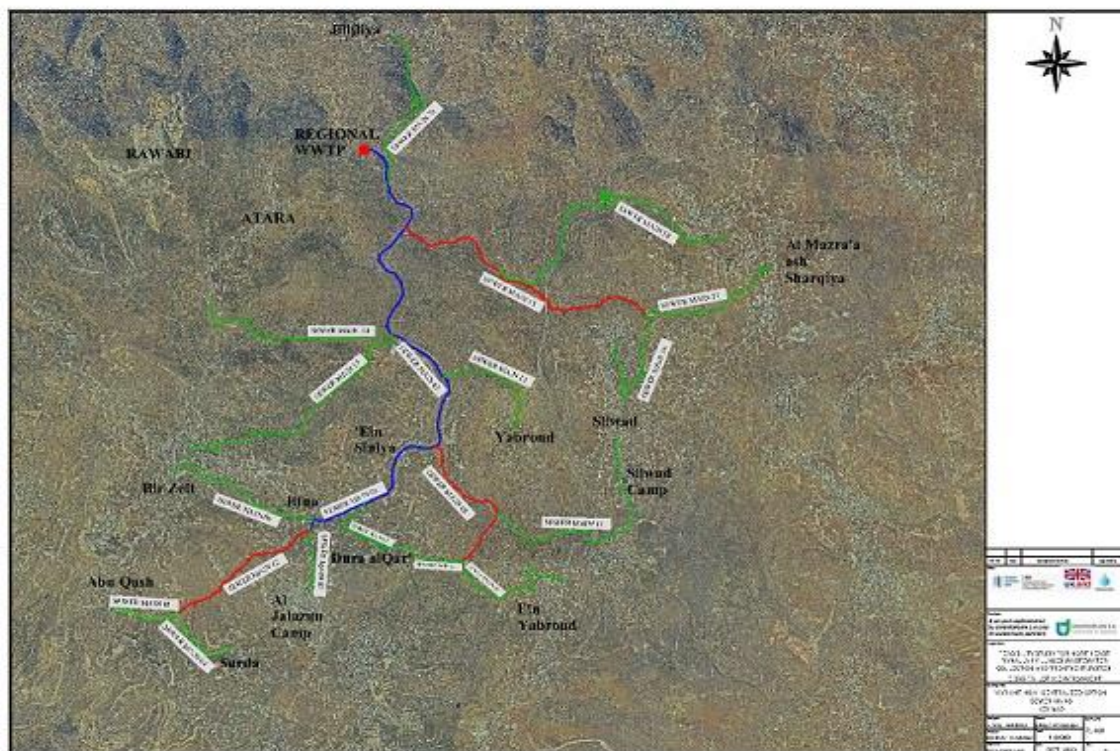
As already indicated a photovoltaic (PV) power plant shall be built to supply and cover the energy demand of the WWTP. The Consultant has to investigate for the available location and most possible generation of electricity. Surplus energy shall be supplied to the public grid. The PV modules shall be made up of many individual, interconnected photovoltaic cells each assumed to be able to produce more than of 300W .



To ensure that the modules are tilted correctly and facing the sun, they shall be placed on support structures that are flexible and can be adjusted to the position of the sun. Every module shall have two output terminals that collect the generated current and transfer it to the management systems at the solar power station. The inverter shall transform the continuous current produced by the solar panels into an alternating current so that it can be converted by a transformer into a medium voltage current. A control system shall monitor the power station's operations and connect it to the electric grid to make the resulting green energy available to others if the production exceeds the demand.

### 2.2.3 Project Area

The WWTP will be located in the North Eastern Part of Ramallah Governorate in Wadi Al Balat just north of Atara. Fig. illustrates the location of the WWTP and associated trunk lines.



**Fig. 5: NERWWTP Project Area**

The project area is located in the North East of Ramallah. It comprises part of the North Ramallah catchment area. It is part of the service area of Jerusalem Water Undertaking. The whole area suffers from a bad sanitation system. Only about 18.2 % of the total population of the project area (inhabitants of Al Jalazun Refugee camp and about 20 % of the inhabitants of Jifna and Ein Siniya) is already connected to a sewage collection system. Although the sewage of those settlements is collected, no treatment is applied and the wastewater flows untreated to the Wadi at Ein Siniya. Because of this discharge and the dumping of faeces from other villages to the Wadi, the area suffers from odorous nuisance.

The sewage collection network of Al Jalazun Refugee Camp has been established by the UN organisation UNRWA and is under its management. Although the wastewater is collected in the camp it is conveyed without any treatment to a trunk line outside the camp discharging to an open channel. In the channel , water partially infiltrates into the soil and partially flows as an open stream.



Some areas of the villages that are located close to the above mentioned trunk line (Dura al Qari, Jifna, Ein Siniya) have established local short wastewater networks or single house connections discharging to the trunk line. None of the existing ways of discharge respects aspects of the protection of the environment. Therefore a general modification and upgrade of the corresponding infrastructure is necessary to protect the environment, the health of the population and the natural resources. Currently the residents suffer from bad odours from the wastewater flowing in the open channel and from time to time overflows of local collection tanks and seepage into the soil from leaking cesspits. The flow of the sewage in the streets and gardens of the houses represents a hazard to the health of the population and restricts the possibility of use of the open spaces and reduces the attractiveness of the area.

#### 2.2.4 Geographical area to be covered

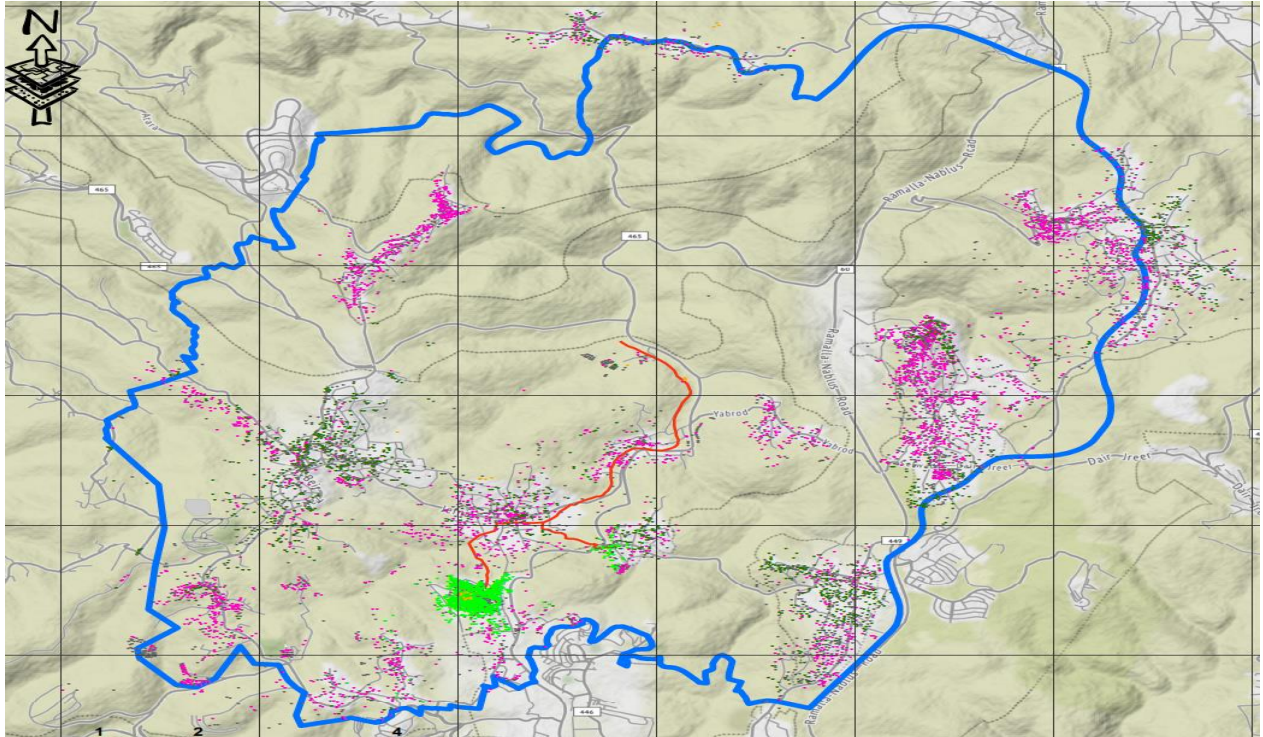
The project area includes 14 municipalities, villages and camps ( Table ).

Table presents the adopted population Growth rates and assessed number of residents of the localities for the entire design horizon in steps of 5 years.

Table 12: Adopted Growth Rate of the population Development

No.	Locality	Future G. R.		Population Projection in Year						
		2020-2030	2031-2050	2020	2025	2030	2035	2040	2045	2050
1	Ein Siniya	3,31%	2,28%	1.020	1.200	1.412	1.581	1.770	1.981	2.218
2	Jifna	6,11%	3,50%	3.487	4.692	6.311	7.496	8.903	10.574	12.558
3	Surda	3,03%	1,50%	1.431	1.661	1.929	2.078	2.239	2.412	2.598
4	Birzeit	3,28%	1,50%	6.475	7.609	8.941	9.632	10.377	11.179	12.042
5	Abu Qash	5,42%	3,50%	2.621	3.414	4.445	5.280	6.271	7.448	8.845
6	Atara	2,00%	1,56%	2.645	2.920	3.224	3.484	3.764	4.068	4.396
7	Yabrud	2,00%	1,50%	610	674	744	801	863	930	1.002
8	Ein Yabrud	2,00%	1,50%	2.669	2.947	3.253	3.505	3.776	4.068	4.382
9	AlJalazun RC	1,11%	0,50%	8.477	8.958	9.466	9.705	9.950	10.202	10.459
10	Dura AlQari'	2,00%	1,08%	3.218	3.552	3.922	4.139	4.367	4.608	4.863
11	Silwad	2,00%	1,50%	6.730	7.431	8.204	8.838	9.521	10.257	11.050
12	Silwad RC	2,42%	1,85%	490	552	622	682	747	819	897
13	AlMazra'a Ash Sharqiya	2,00%	1,50%	4.312	4.760	5.256	5.662	6.100	6.571	7.079
14	Jilijliya	2,00%	1,50%	671	740	818	881	949	1.022	1.101
	<b>Total =</b>	<b>2,76%</b>	<b>1,77%</b>	<b>44.855</b>	<b>51.110</b>	<b>58.549</b>	<b>63.764</b>	<b>69.597</b>	<b>76.138</b>	<b>83.491</b>

Source: NE Ramallah Feasibility Study



**Fig. 6: North East Ramallah Sewage Project - Geographic Area**

### **2.3 Objectives of the consultancy Services**

The objective of this consultancy service is to prepare the conceptual engineering design and the tender documents for the implementation of the two WWTPs at Tulkarm and North East Ramallah and associated infrastructure installations as e.g. but not limited to the collection tank and inflow lifting station, etc.

### **2.4 Available Studies and list of Standards and Codes**

#### **2.4.1 Studies to be provided by the Client**

##### **Activity 1: Tulkarm WWTP**

In connection with the partnership between PWA, KFW, WZJSC, UNDP, several studies have been elaborated between 2008 and 2022, which have resulted in the determination of the main characteristics of the sanitation in Tulkarm Governorate and reuse of treated wastewater from Tulkarm and Nablus West WWTPs. The Documents listed below shall be considered as bases for the execution of the project. These documents shall be provided to the awarded consultant

- Feasibility study for the Tulkarm Wastewater Treatment 2008
- Detailed design study for the first stage of the project (2014, PWA)
- Revision of the existing feasibility study for Tulkarm
- Road map for the development of Tulkarm wastewater treatment plant (2022)
- Prefeasibility study for treated wastewater transfer for Tulkarm, and Nablus West WWTPs

The Documents listed below shall be considered as bases for the execution of the project:

1. Preparing assessment report and road map for the development of Tulkarm wastewater treatment plant;
2. Regional Wastewater Disposal Tulkarm - Consultancy Services for Review of Feasibility Study, Preparation of Final Design and Tender Documents, Assistance to PEA in Tendering and Contracting - Environmental Impact Assessment Report;
3. Regional Wastewater Disposal Tulkarm - Consultancy Services for Review of Feasibility Study, Preparation of Final Design and Tender Documents, Assistance to PEA in Tendering and Contracting-Feasibility Study Report;
4. Regional Wastewater Disposal Tulkarm - Consultancy Services for Review of Feasibility Study, Preparation of Final Design and Tender Documents, Assistance to PEA in Tendering and Contracting- Short Mission;
  - Treated Wastewater Reuse Strategy for the West Bank – Feasibility Study Report and final report;

The Feasibility Studies recommend the implementation of structure as follows:

- WWTP located close to the Border (defined as S4 location)
- Wastewater conveyance partially pressurized partially gravimetric pipeline from TWWTP passing by West Nablus WWTP and combining the effluents of the two WWTPs to the Jordan River Valley.

#### **Activity 2: NERWWTP**

Two studies have been elaborated that relate at least in part to the project area in coordination, cooperation and partnership between PWA, EIB, JWU, UNDP and KFW. They have led to the determination of the main features and requirements of the sanitation system in North East Ramallah area. The Documents listed below shall be considered as bases for the execution of the project. These documents will be provided to the awarded consultant.

- Feasibility Study For North East Ramallah Villages Wastewater Collection And Treatment System” – TA 2017177 PS FTF
- Wastewater Master Plan for JWU Jurisdiction Areas

### **3 Scope of Services**

The scope of services of this contract is to prepare the complete tender documents for the design, construction and operation of the WWTP (Design -Build -Operate). The works to be executed by a consultant include but are not limited to;

#### **For Tulkarm WWTP:**

- The conceptual design for all structures for the new WWTP including:
- The collection tank at the site of actually operating WWTP (lagoons), pumping station and diversion pipeline of the raw wastewater to the acceptance structure of the new WWTP.
- The constructions on the site of the lagoons for later use of the site (after shut down of the lagoons) including the rehabilitation of the site.
- Construction drawings.
- Bill of quantities.
- Technical specification of the constructions, earthworks etc.
- Mechanical and electrical equipment.
- Tender documents of the WWTP.

**For North East Ramallah WWTP:**

- conceptual design of the WWTP for the design horizon 2035 taking into account the need for the upgrading of the capacity of the WWTP to the expected 2050 pollution load.
- construction drawings,
- bill of quantities,
- technical specification of the constructions, earthworks etc.,
- mechanical and electrical equipment
- tender documents of the WWTP (Using Standard procurement documents of potential donor (eg EIB, EU)

The scope of work is to prepare a design that meets the standards of the effluent, performance, durability and functionality, which are required for long-term operation. In the long term, the WWTP and its facilities shall be operated by JWU. For a fixed minimum period of 2 years, the Contractor for the design and build will have to operate the plant.

The conceptual design shall be the basis for the tender documents and shall include all necessary information and details for the design, construction and operation of the project facilities.

The awarded consultant shall also determine the optimal procurement approach for the construction (e.g. number of stages, pre/post qualifications), operation, and maintenance of the system, based on the consultant's assessment for appropriate modality.

The scope of work is to prepare a design that meets standards of performance, durability and functionality, which are required for long-term operation.

The engineering design shall be based on basic data from the previous studies and information provided by PWA (refer to Section 2.4.1- Studies of this ToR), plus additional data to be developed for this purpose. The design shall be carried out and incorporated, but not necessarily limited to the following:

**3.1 Review of existing Feasibility Study and validation of the design criteria.**

**For Tulkarm WWTP:**

The Consultant shall review the Assessment Report and Road Map for the Development of Tulkarm Wastewater Treatment Plant and the preliminary design that had been done as part of the above mentioned feasibility studies.

**For North East Ramallah WWTP:**

The Consultant shall review the Feasibility study carried out by EIB for "North East Ramallah Villages Wastewater Treatment and Collection system" as well as the proposed preliminary alignment of the Trunk Mains and layouts, "regional WWTP".

**3.2 Validation of design criteria**

The Design criteria for all infrastructure components have been extensively discussed at the feasibility stage. Therefore, the Consultant shall validate all used design criteria and parameters or to propose adjustments if required due to substantial change in the context and to verify and validate the calculations. The consultant shall also validate the preliminary choices of treatment process, equipment and material for the facilities that shall be built.

### **3.3 Review of relevant documents**

Review, evaluate and update the available information and all relevant documents (Studies 1 to 5) or any other related documents with regard to the adequacy of the design of the project components and the completeness of information with regard to efficient design, constructability, environmental concerns and operation and maintenance of the projected facilities, and identify and fill in any missing data required to complete the design.

### **3.4 Validation of the wastewater treatment plant outline design**

An outline design of the wastewater treatment plant was prepared in the Feasibility Study (Tulkarm WWTP: Feasibility Study No. 1 and No.3, and for North East Ramallah WWTP: the recommended variant No. 1) including process selection, determination of the capacities of the facilities and layout. The Consultant shall validate the feasibility design, propose adjustments if required or present different technical options to determine "least cost" solutions for the different sub-projects, including "alternative technologies", sites of structures, construction and pipe materials, dimensions, etc.

### **3.5 Topographic surveys, mapping and geotechnical foundation**

The consultant shall carry out all necessary topographic surveys, mapping, geotechnical foundation and soil investigations at the selected site of the WWTP. The conceptual engineering design shall include the WWTP and all related facilities and infrastructure on the site of the WWTP.

### **3.6 Electrical Power Consumption**

The consultant shall calculate the electrical power requirements of all project facilities, including reserve, of the various units outside and inside the different buildings. The consultant shall also design the electrical substation and stand-by generator.

### **3.7 SCADA**

The consultant shall design, size and specify the System Control and Data Acquisition SCADA system for central operation of the works, registration of operation parameters (like e.g. flows, volumes, operation hours and energy consumption of the equipment, pH, temperature, water levels, etc.).

A software for the management of the maintenance of equipment (preventive, reactive, regular works) and history shall be specified and included to the standard software package.

### **3.8 Cost estimates**

The consultant shall compile current unit rates and prices and prepare up-to-date cost estimates of the project components.

## **4 Specific Activities**

The Specific Activities for the preparation of the Tender Documents of the WWTP which are required are as follows:

## **4.1 Topographic and Geotechnical Surveys**

The Consultant shall carry out all the required topographical surveys and geotechnical investigations of the site to the extent that is necessary to carry out the preliminary design. The consultant shall produce comprehensive data including the necessary topographical, meteorological, hydrological, geological and hydro-geological data. The cost for these investigations shall be included in the Consultant's financial proposal. A working plan for topographical survey and geotechnical investigation shall be submitted in the inception report.

The field investigations (topographical survey, geotechnical investigation) shall be conducted by independent and authorized firms that shall produce comprehensive reports to present the results of the works and explain the execution of works like e.g. the field investigations, applied methods, analysis, conclusions and recommendation in sufficient manner to be used to complete the preliminary design of the WWTP, the proposed structures and any relevant infrastructure.

Reference of the topographical survey specification and accuracy shall be made to the Palestinian Grid system. GPS or Total Station may be used for carrying out the topographical survey.

The survey shall include the establishment of survey control points referenced to fixed features and documented by reference numbers, sketches, and photographs.

### **4.1.1 Surveying and Field investigation at the treatment plant site**

The field investigation at the treatment plant site area shall include:

- Surveying in squares 10x10 m
- preparation of the topographic (digital format) map of the site;
- Determination of coordinates for all components in sufficient details for land acquisition, detailed design and as a basis for the execution of the works.
- Placing permanent markers on the ground in sufficient number to identify boundaries and alignments of all phase 1 works;
- Geotechnical investigations and collection of soil samples at 20 boreholes for laboratory analysis; interpretation and conclusions of the soil and underground analyses (to be specified in detail when the location of different process units have been decided), in order to determine excavation conditions, foundation and backfilling requirements;
- Prepare legal survey for the site of the WWTP.

### **4.1.2 Surveying and Field investigations at the pumping station**

The field investigations at site of the effluent pumping station shall include the Geotechnical investigations and sampling, laboratory analysis, interpretation and conclusions for the location of the lifting station detail design, in order to determine excavation conditions, foundation and backfilling requirements.

### **4.1.3 Surveying and Field investigations along the proposed conveyance pipelines**

The field investigations along the conveyance pipelines shall include:

- Surveying of the conveyance pipeline route in intervals of 50 m;
- Identifying the final route of the conveyance pipeline and clarification of land ownership along the route;

- Geotechnical investigations along the route of the conveyance pipeline in intervals of 1000 m and interpretation and conclusions of the investigations, in order to determine excavation conditions, foundation and backfilling requirements

#### **4.1.4 Surveying and Field investigations at the proposed reservoir site (if recommended)**

The field investigations at the proposed reservoir site (if recommended) shall include:

- Surveying in squares 10 x 10 m and preparation of the topographical (digital format) map of the site of an area 200 x 200 m;
- Establishing coordinates in sufficient details for the land acquisition, detail design and as a basis for the execution of the works
- Establishing durable benchmarks on ground in sufficient number to identify boundaries and location of the reservoir;
- Geotechnical investigations and sampling, laboratory analysis, interpretation and conclusions in 20 points (to be specified in detail when the location of the reservoir has been decided), in order to determine excavation conditions, foundation and backfilling requirements;
- Prepare zoning map and legal survey map for the reservoir site.

Bulk samples must be collected for laboratory testing and the stratification described. Standard Penetration Tests (SPT) or an equivalent test shall be performed. The laboratory test shall include sieve analysis of the soil samples and determination of the Atterberg limits for the material passing No.4 sieve. In addition, chemical tests for the soil and groundwater encountered and the determination of the water table level shall be carried out. Additionally, the consultant should be responsible to perform any other required soil investigations according to the requirement of the project.

## **4.2 Preliminary Design Drawings**

The Consultant shall prepare the preliminary design of all project items, with special emphasis on the conceptual design of the wastewater treatment. The design shall include a functional description of each facility, identifying materials, dimensions, and capacities for the components of the project as follow:

- Identification of the physical points of the connection for power and water supply, access roads
- The Consultant shall identify physical points of the connection for power supply, water supply and access roads
- Provision of the detailed design to all related infrastructure works, including power supply, water supply, access roads, fencing, landscaping, etc. of the WWTP, reservoirs, the pumping stations for treated wastewater and lifting stations for wastewater.
- Establishing of an implementation programme for the project phases and packages. The programme shall allow an operative and efficient implementation of the project components, phases and packages for minimizing disruption to the work activities.
- Provision of monitoring and control mechanisms of the treatment process, plans for process start-up and process verification and an assessment of the required technical assistance. It shall also include the design criteria and design parameters, including mass balance and hydraulic profile. (The Calculations and drawings shall be produced by computer software. Digital and hardcopies shall be submitted in original format. Digital copies shall be provided in pdf- and workable format.

The Consultant shall then prepare drawings, as follows:

- For linear items (pipes): layout with alignment of the pipe and position of manholes, longitudinal profile with indication of distances, diameter, invert levels, depths and slopes, flow capacity with the given parameters, expected flow and flow velocity;
- For non-linear items: schematic layout with electrical and hydraulic equipment, equipment guide drawings (Location, Site layout, Plan views, Single line diagram, etc.); For all facilities including the WWTP and Solar Panels): Plan views, Sections, Hydraulic profile, Equipment guide drawing, dimensions of the structures, etc.).
- An index listing all drawings shall be provided. Drawings shall be of high standard and submitted in originals. Appropriate professional scale and size for drawings of each type of facilities shall be submitted by the Consultant for the approval of the client's representative.

The Draft Preliminary Design report and Drawings shall be submitted not later than **22 weeks** from the commencement date and the final Preliminary Design shall be submitted not later than **28 weeks** allowing for **6 weeks** of review and modification taking into account any comments by the Employer and Stakeholders.

#### **4.3 Preparation of design of the WWTP**

The Consultant shall prepare a detailed Conceptual Design of the wastewater treatment plant, once the expected outputs for Activity 4.1 & 4.2 have been approved by PWA. The Consultant shall elaborate the preliminary design to enable the preparation of the complete tender and contract/s documents.

In the preliminary design, the Consultant shall prepare a detailed description of each project item. It shall include details on materials to be used and identification of special equipment and fittings for all project components (pipes, pumping stations, WW and Sludge treatment facilities, tanks, reservoirs etc.). The Consultant shall also provide technical specifications for each equipment item.

The preliminary design report shall cover and explain the following topics:

- Design criteria
- Design standards
- Detailed design of all facilities, with justification of used design assumptions. Calculation notes for hydraulic, structural, process, mechanical. HVAC and electrical design calculations shall also be included
- Detailed description of each facility with detailed specifications of the mechanical equipment, instrumentations, electrical and automation equipment and
- Description of the operation and command sequences.

Specifications: shall be comprehensive and up to date, General and particular technical specifications shall be provided for all civil works and mechanical, electrical and HVAC works, ICA works and all other related works, to the best of current knowledge based on internationally accepted standards such as ISO, EN, DIN, BS or other standards as appropriate and sufficient for the procurement, installation and construction works.

#### **4.4 Preparation of drawings**

The Consultant shall prepare all necessary plans and drawings for each project item. An indicative list of drawings is presented below:



#### **4.4.1 Wastewater treatment plant:**

- Location drawing
- Site layout
- Internal piping (on-site wastewater, storm water, potable water, supernatant, etc.)
- Hydraulic profile.
- Hydraulic analysis (hydraulic longitudinal sections)
- Electrical cable layout
- Road access and parking areas
- Landscaping
- Excavation drawing
- Architectural drawings: plan views, sections and details
- Mechanical and Equipment drawings: plan views, sections and details
- HVAC drawings: plan views, sections and details
- Formwork drawings: plan views and sections
- Electrical drawings: plan views, sections and details
- PID for each facility
- Single line diagram for power and automation

#### **4.4.2 Pumping Stations**

- Location drawing;
- Site layout;
- Excavation drawings;
- Cross sections;
- Hydraulic analysis;
- Mechanical and Equipment drawings: plan views, sections and details;
- HVAC drawings: plan views, sections and details.

#### **4.4.3 Reservoirs (if recommended)**

- Location drawing;
- Site layout;
- Excavation drawings;
- Cross sections.
- 

An index listing all drawings shall be provided as well as notes, legends and lists of abbreviations. Drawings shall be of high standard and submitted in originals (printouts) and electronic version (pdf-files, workable version (ACAD or equivalent)). Appropriate professional scale and size for drawings of each type of facilities will be proposed by the Consultant and be subject of approval by PWA.

Prior to the preparation of the final drawings the approval of the Employer's representative shall be obtained on the preliminary design.

All calculation spread sheets, measurements, inputs and outputs and execution documents shall be submitted with the detailed design in electronic and paper form.

These shall involve the preparation of final design drawings for each sub-project. Detailed construction drawings of water pipes, treatment and disposal system, to suitable scales, plans 1: 1000 and profiles, 1: 1000 horizontal and 1: 100 vertical scale; for structural, architectural, mechanical and electrical etc. plans and details, scale 1: 100 or 1 :50, 1 :25 to be used.

The drawings shall present the exact location of all structures. Details of chambers, manholes and other appurtenances shall be given at suitable scales.

#### **4.5 Technical Specifications:**

The Consultant shall prepare technical specifications for the implementation of the project works in accordance with International Standards. These include but are not limited to the following:

- a. Technical specifications for all materials and work included in the civil works component.
- b. Technical specifications for all plants and equipment to be incorporated in the project works.
- c. General obligations of the contractors.
- d. The tests and measurements to be carried out prior to, during and upon completion of the Project, test and certifications of equipment and supplies at the place of manufacture or fabrication before shipment to OT. The Technical Specifications shall specify tests and procedures in detail; and
- e. Specifications of all vehicles, plants, mechanical, electrical and piloting equipment, pipes and fittings, laboratory equipment, reagents and furniture, office equipment and furniture, workshop equipment and tools needed for an adequate operation of the system and plants, additional to any existing facilities.
- f. Recommended stocks for the operation of the works
- g. Any other necessary and required implementation guideline

#### **4.6 Bill of Quantity and Cost estimates**

##### **4.6.1 Preparation of work packages**

The Consultant shall prepare one work package for Tendering for each WWTP including:

- For NERWWTP: Construction of the WWTP including mechanical, biological and chemical treatment with: Inlet pump station, fine screening, aerated sand trap, anaerobic selector tank, aeration basin, denitrification tank, final sedimentation tank, return and excess sludge pumping station, disinfection unit, faecal sludge acceptance and storage facility, excess sludge dewatering, blower station, administration house with laboratory and workshop, etc, Renewable energy system based on engineering calculation.
- For TWWTP: in addition to the details mentioned above for the WWTP; collection tank at the site of the existing ponds to combine all current flows and the future pressure pipe (from the Irtah pump station), the pumping station at the site of the existing ponds to pump the received water (all streams) to the new WWTP, the rehabilitation of the site of the existing ponds for preparation for future use; the effluent reservoir at the site of the existing ponds, and the sludge storage at the site of the existing ponds, Renewable energy system based on engineering calculation
- other structures that the consultants deems to be necessary
- O&M for two years including the Defects Liability Period (DNP) with the option for the extension of the operation of the WWTP for another three years.

##### **4.6.2 Preparation of detailed priced Schedule**

A detailed BOQ shall be provided by the Consultant for the construction of the WWTP. The cost estimate shall be based on actual market prices. Duties, taxes and contingencies have to be shown separately as far as applicable. The Consultant shall also prepare cash flow estimates for expenditure in foreign and national currency for the construction of the works.

Based on the final design drawings, the Consultant shall calculate:

- The quantities for construction, in particular, the earthworks quantities

- The estimated unit prices, based on detailed price breakdowns, using the same template to be provided within the tender
- The coefficients (estimate) of the price adjustment formula based on the detailed breakdown of prices
- An estimate of the weight of the price revision within the estimated amount of work, given the timing of the proposed implementation. The Consultant will provide a rationale for the selected indicators and their prediction of evolution during the estimated implementation period of the works
- An estimate of the amount of contingencies, substantiated by the risks related to the various components of the works

The bill of quantities shall be prepared in computer format using standard software. Additionally, the consultant is responsible for cost estimations, as well as the preparation of a financing plan for the period of works execution

The Consultant shall prepare confidential priced Bills of Quantities, with the accurate unit and/or lump sum rates, whichever is applicable, which in total shall equal the cost estimate in the above paragraph. The cost estimate shall identify both local and foreign currency costs associated with the construction drawings.

The Consultant shall also prepare cost estimates for the operations of all works over their intended life cycle.

## **5 Assessment of Private Sector Participation Options**

The consultant shall assess private sector participation options for the construction, operation, and maintenance of the WWTP to determine an approach that is viable and provides optimal value for money. The assessment shall consider the option of operation and maintenance for 2 year after plant commissioning and a maybe extension of the operation for 3 more.

The Consultant shall therefore undertake the following:

- a. **Baseline Market Analysis:** Identify historical trends in usage and revenue of existing services in the water sector to determine the size of the potential customer base.
- b. **Legal, Regulatory and Institutional Analysis:** Identify any relevant legal, regulatory, and institutional bottlenecks that may negatively impact the viability of the project and/or the ability of the private sector to deliver the proposed water services. Subject to this analysis, recommend necessary changes/mechanisms to the legal, regulatory and/or institutional environment that would be needed in order to enable private sector participation in the project.
- c. **Financial Analysis:** Using relevant technical information and cost estimates, and taking into account baseline market analysis, develop a financial model that assesses the financial viability of the various private sector participation options during operation, and maintenance.
- d. **Develop Project Structure:** Based on the financial analysis undertaken, develop a proposed PPP project structure(s), including an indicative project risk allocation and payment mechanism.
- e. **Market Sounding:** Socialize the proposed project structure with potential bidders as a way of assessing bidder appetite and further informing the proposed project structure(s).
- f. **Public Sector Comparator:** Assess whether the proposed PPP project structure(s) provides better value for money than public procurement and implementation of the project.

## **6 Project Management**

### **6.1 Responsible body**

The Contracting Authority for the design of the WWTPs will be the Palestinian Water Authority.

The PWA Contract Manager will be inter alia responsible for:

- Supporting the consultant obtaining required permits, information, and approvals.
- Reviewing work plans
- Reviewing and monitoring progress and giving directions
- Taking appropriate measures for coordinating the activities
- Reviewing and approving all reports studies and designs (Reports, studies, drawings and any other documents).
- Reviewing and approving tender documents.

Coordination: All studies and design and other activities of the Consultant shall be conducted in close coordination with PWA

PWA will ensure close coordination and co-operation with the local authorities for technical and general contractual and coordination matters. A detailed coordination mechanism between the PWA and the Consultant shall be discussed during the signing of the contract.

### **6.2 Management structure**

A Steering Committee formulated and headed by PWA will ensure the overall supervision of the assignment and will provide approval of the Consultant's work. The Steering Committee will be composed of:

- two representatives from the PWA
- a representative of the Ministry of Finance
- a representative from Tulkarm WZJSC (For TWWTP\_ Activity 1)
- a representative from Jerusalem water Undertaking JWU (for NERWWTP \_ Activity 2)
- a representative from Ministry of Agriculture
- a representative of the Environment Quality Authority
- a representative of the Donor

### **6.3 Meetings**

As a minimum, the following meetings should be organized for each Wastewater Treatment Plan (one for TWWTP and one for NERWWTP):

- Kick-off meetings within one week after the commencement date
- Inception Workshop 4 weeks after the Kick off meeting
- Proposal for WWTP technical options
- Draft Design Report meeting: one week after the submission of the Draft Design Report
- Upon Request meetings
-

## **7 Logistics and Timing**

### **7.1 Project Location**

The operational base of the Consultant shall be located in the West Bank. The location should be approved by the Contracting Authority. The Consultancy Service will be implemented in the year 2023-2024.

### **7.2 Commencement date & Period of execution**

The envisaged commencement date of the Consultancy Service is December 2023. The period of execution of the tasks identified in this Terms of Reference is (12) months from the Commencement Date. This Time frame is applied to the both Activities (TWWTP and NERWWTP), the consultant should consider assignment implementation for both activities in parallel. He should provide all the required resources to complete the assignment within the specified implementation period (12 months from the commencement date).

## **8 Requirements**

### **8.1 Qualification of the Firm**

General Experience of the firm:

- A consulting firm specialized in water and wastewater with at least 15 years' Experience.

Specific experience of the firm:

- Experience in the field of water and sanitation, especially in the conceptual and detail design of medium and large scale WWTPs
- preparation of tender documents

Records proofing the qualification must be presented in the documents with the Expression of Interest (list presented should not exceed 10 relevant projects). The firm should have a proven track record of previous experience implementing similar assignments/studies in the same or related field and should have successfully completed at least one similar assignment, study in the last 5 years, preferably with the activated sludge technology, continuous flow, SBR or MBR

### **8.2 Personnel**

All experts that the selected Consultant wants to include in its team will be subjected to approval by the Contracting Authority before the start of the implementation. This Terms of Reference contain expert profiles and the Consultant will have to demonstrate in its offer that it has access to experts with the required profiles. All employees or other personnel provided by the Consultant to provide services or carry out any obligations under this contract are preferable, for purposes of this Contract, to be employees of the Consultant.

The Consultant shall be responsible for the professional and technical competence of its employees and will select reliable and competent individuals who will perform effectively in the implementation of this Contract, who will respect the local customs and who will conform to a high standard of moral and ethical conduct.

### 8.2.1 Qualifications:

The required qualifications of the Consultant's staff are outlined below. In all positions mentioned, fluency in English is required. With expatriate personnel overseas experience is considered advantageous. All experts who have a crucial role in implementing the contract are referred to as "Key Experts". The profiles of the "Key Experts" for this contract shall be:

### 8.2.2 Key Experts

#### 8.2.2.1 Project Manager:

Qualifications and skills:

- Minimum M.Sc. degree in civil, hydraulic or sanitary engineering or equivalent;
- Good command of written and spoken English;
- General professional experience: Minimum 15 years.

Specific professional experience:

- Successful completion of 2 assignments, as Team Leader/Project Manager for 2 WWTP design projects including WWTP sludge treatment with investment costs over €10 million.
- Successful experience in developing bidding documents for large scale works for design build operate of WWTP.

#### 8.2.2.2 Wastewater Process Planning and Design expert

Qualifications and skills:

- Minimum M.Sc. degree in process or sanitary engineering or equivalent;
- Good command of English, written and spoken;
- General professional experience: Minimum 12 years.

Specific professional experience:

- Successful completion of 2 design assignments as Process Engineer (or equivalent), preferably in activated sludge WWTP projects for minimum 50,000 PE<sub>60</sub> or wastewater volume  $Q > 5,000$  m<sup>3</sup>/d influent.

#### 8.2.2.3 Structural Engineer

Qualifications and skills:

- Minimum B.Sc. in structural or civil engineering or equivalent;
- Good command of English, written and spoken;
- General professional experience: Minimum 10 years;

Specific professional experience:

- Successful completion of 1 design assignment for 1 concrete water/wastewater reservoir of at least  $V = 2,000$  m<sup>3</sup> capacity or earth dam reservoir of at least  $V = 100,000$  m<sup>3</sup>;
- Successful completion of 2 design assignments as Structural Engineer (or equivalent), in activated sludge process WWTP projects for a minimum load of 30,000 PE<sub>60</sub> or a wastewater volume  $Q \geq 4,000$  m<sup>3</sup>/d influent.

#### 8.2.2.4 Hydraulic Engineering expert

Qualifications and skills:

- Minimum B.Sc. in Hydraulic Engineering or Civil engineering (or equivalent);
- Good command of English, written and spoken;

- General professional experience: Minimum 10 years.

Specific professional experience:

- Successful completion of 2 design assignment including Water supply trunk line/ WW, or treated WW pile with investment costs over € 2 million or diameter over 400 mm and length of  $L \geq 10$  km.

#### 8.2.2.5 Electrical Engineer

Qualifications and skills:

- Minimum B.Sc. in Electrical Engineering (or equivalent);
- Good command of English, written and spoken;
- General professional experience: Minimum 10 years of relevant experience.

Specific professional experience:

- Successful completion of 2 similar assignments in infrastructure projects (WWTP) including Solar panels.

#### 8.2.2.6 Mechanical Engineer

Qualifications and skills:

- Minimum B.Sc. in Mechanical Engineering (or equivalent)
- Good command of English, written and spoken
- General professional experience: Minimum 10 years of relevant experience

Specific professional experience:

- Successful completion of 2 similar assignments in infrastructure projects including pumping stations.

- \*\*\*Other experts, support staff & backstopping (Non-Key experts)

\*Quantity Surveyor

Qualifications and skills:

- Minimum B.Sc. in QS; or Engineering with relevant experience in quantity surveying
- Good command of English, written and spoken.

General professional experience:

- Minimum 8 years of relevant experience (quantity surveyor of infrastructure and similar projects)

\*Procurement & Tender Documents Specialist

Qualifications and skills:

- Minimum B.Sc. in procurement (or equivalent);
- Good command of English, written and spoken.

General professional experience:

- Minimum 10 years of relevant experience in preparing Bidding Documents of Design Build Operate for large scale WWTP
- Experience in developing bidding document for large scale projects according to World Bank Guidelines

\*Lead surveyors will be responsible for the topographic surveys for both TWWTP & NERWWTP

Qualifications and skills:

- The Surveyor shall have minimum Diploma in Surveying from accredited surveying institute
- The Surveyor shall be certified with survey license in Palestine

General professional experience:

- The Surveyor is expected to have preferably ten (10) years' experience but not less than seven (7) years post graduate professional experience covering surveying of Water & wastewater infrastructure

Specific professional experience:

- He / She shall have previous experience as license Surveyor of at least five (5) years, and has conducted surveying for minimum of two similar infrastructure projects.

CVs for experts other than the key experts should not be submitted in the tender. The Consultant shall select and hire other experts as required according to the needs. The selection procedures used by the Consultant to select these other experts shall be transparent, and shall be based on pre-defined criteria, including professional qualifications, language skills and work experience.

All experts must be independent and free from conflict of interest in the responsibilities they take on.

The costs for backstopping and support staff, as needed, shall be included in the tenderer's financial offer.

The Consultant shall select and hire other experts as required throughout the project phases. These profiles must indicate whether they are to be regarded as long-term/short-term, local/international and senior/junior.

The proposals shall be supported by the respective CV's and the accuracy of which shall be certified by the consultant, all the forms shall be organized and presented in the original format of CV used by the consultant.

The total estimated level of effort for completion of this assignment is 67 Man Months for Key experts. Non-key expert shall be also be considered in the consultant team; including administrative and technical experts, i.e. GIS, CAD, etc.

## **9 Facilities to be provided by the Consultant**

### **9.1 Office accommodation**

The Consultant shall provide a furnished office and accommodation for its staff and all experts working on the contract. The corresponding costs shall be included in the financial proposal.

The Consultant shall ensure that experts are adequately supported and equipped. In particular it must ensure that there is sufficient administrative, secretarial and interpretation provision to enable experts to concentrate on their primary responsibilities. It must also transfer funds as necessary to support their work under the contract and to ensure that its employees are paid regularly and in a timely fashion.

The Consultant shall provide its experts with transportation means to access the study area as required.



The equipment that is necessary to perform the services comprising of computers, software, printers, telephones, fax, internet access, copy machines, car rentals etc. shall be provided by the Consultant. The Consultant shall bear the running costs of all his equipment and materials. These costs shall be included in the financial proposal of the tenderer.

## **9.2 Equipment**

No equipment is to be purchased on behalf of the Contracting Authority / beneficiary country as part of this service contract or shall be transferred to the Contracting Authority / beneficiary country at the end of this contract. Any equipment related to this contract which is to be acquired by the beneficiary country must be purchased by means of a separate supply tender procedure.

## **9.3 Workshops**

After the review of the feasibility study report and any other studies provided by the client, the Consultant shall arrange and conduct workshops to be held in the project field office or some other place as necessary. At the workshop, the review of feasibility study findings (e.g., the technical alternative options, costs, environmental impact) will be presented and discussed. The workshop may be attended by concerned agencies, project stakeholders from the government central and field level, institutions, media, NGO's and local communities. (One workshop for TWWTP & one workshop for NERWWTP).

Other workshops shall be held in the Project area and shall be attended by community representatives in order to discuss and produce a plan to coordinate efforts on community health and well-being of the people of the Project area. After preparing the draft design, the consultant shall arrange and conduct a workshop to present the draft design, list of attendees shall be approved by the Contracting Authority.

## **10 Support by the Contracting Authority**

### **10.1 Facilities to be provided by the Contracting Authority and/or other parties**

The Client will provide and facilitate to the Consultant the following:

- Available reports, files and documents relevant to the assignment
- Access to all sites relevant to the assignment
- Coordination with other relevant institutions

## **11 Reports / Deliverables**

**The Consultant shall develop the following Reports and Deliverables per each Wastewater Treatment Plant :**

### **11.1 Requirements**

All reports shall be issued in English language and be submitted in three (3) hard copies, and in electronic form (editable format Word, Excel, ACAD and Pdf) to the client's representative . The final electronic version of drawings shall be submitted in AutoCAD and Pdf format.

The Consultant shall prepare and deliver to PWA a number of reports, documents and files covering all the work performed by him in the execution of the Consultancy services. All these submissions shall

be in English and shall be submitted in both hard and soft copies, and shall include all relevant data, maps, drawings, diagrams, reports and other documents as appropriate with information sources/references. These shall be submitted in the requisite number of copies to PWA, according to the schedule of submission of agreed the Work plan. The official date of submission shall be the date on which the reports are received by PWA. The form of printing, type of cover and binding of the reports shall be determined by mutual agreement between PWA and the Consultant.

### **11.2 Inception Report**

of maximum 20 pages: In the report the Consultant shall describe the revision of the preliminary design outputs which were produced in the feasibility studies. In addition, the Consultant shall present the first findings, the progress in collecting data, any encountered and/or foreseen difficulties, in relation to the work programme and staff mobilization. A working plan for topographical survey and geotechnical investigation shall be submitted in the inception report. The Draft inception Report shall be submitted not later than four (4) weeks from the commencement of the implementation. The Final Inception Report shall be submitted not later than 6 Weeks from the commencement date allowing for 2 weeks for review and taking comments into consideration.

### **11.3 Preliminary Design Report:**

This report shall present the state of advancement of the Design activities of the project facilities, with annexes and drawings. The Draft Preliminary Design Report shall be submitted no later than twenty two (24) weeks after the commencement date. The Final Preliminary Design Report shall be submitted not later than twenty eight (28) weeks after the commencement date, allowing for 4 weeks for review and taking comments into consideration;

### **11.4 Conceptual Design Documents**

The Draft Conceptual Design Document shall be submitted no later than thirty six (36) weeks from commencement date and shall include:

- Conceptual Design,
- Drawings
- Specifications
- Final Geotechnical Report
- Surveying Report

The Final Conceptual Design Documents shall be submitted not later than forty (40) weeks from the commencement date, allowing for 4 weeks for review and incorporating any comments received from the concerned parties on the draft report.

### **11.5 Design of PV solar System**

The Consultant shall prepare Design Report for the supply and installation of PV system based on the energy demand calculation in the conceptual report and or the available land space provided by the operator.

### **11.6 Tender and Contract Documents (Design -Build- Operate)**

The Consultant shall prepare the following main tender and contract documents for the project (each treatment Plant) according to Standard Procurement Documents and potential donor regulations (eg. World Bank for Tulkarm WWTP, and EIB North East Ramallah WWTP)

- Notice of invitation to tender;
- Instruction to Tenderers;
- Tender form and appendixes to tender;
- Contract form and general and special conditions of contract; and Technical specifications;
- Price schedules;
- Conceptual design documents and drawings.
- PV Solar System

The Final Tender and Contract Document shall be submitted not later than **48 weeks** from the commencement Date, allowing for **4 weeks** of review and modification of comments.

### **11.7 Monthly Reports**

The Consultant shall submit a Monthly Report (2-3 pages) which describes briefly progress of work, the completed **activities**, expected activities to be conducted during the next month, and any unforeseen circumstances / challenges which may arise during the implementation of the Services, and which may require immediate action by PWA or third parties, on important technical findings or the future of the Project.

### **11.8 Completion Reports**

The Consultant shall submit a Completion Report (2-3 pages) which describes briefly accomplished activities, challenges during the implementation of the Services, recommendation on important technical findings and actions to be taken.