資料6 参考資料
（5） 水道メータの調達・設置技術

水道メータの調達・設置技術

1. パンジャブ州におけるメータ調達の動向

2018 年 9 月、パンジャブ州政府は、5 つの WASA に対して、メータ調達のために 15 億 PKR の予算を確保する旨の発表をした。しかし、その後、PPP でのメータ調達の議論が活発化し、開発事業（ADP）の予算に当該予算は計上されたまま、凍結されている。図 1 に PPP と ADP 調達のイメージを示す。

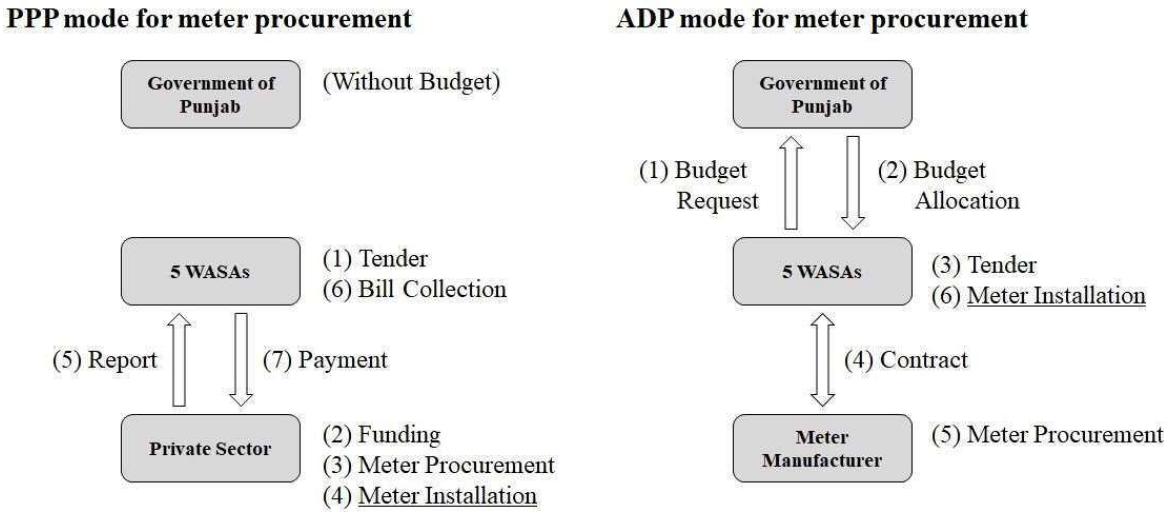


図 1　PPP と ADP によるメータ調達のイメージ

従来の ADP スキームでは、毎年、WASA がメータ調達に掛かる予算を申請する。予算が州政府によって承認されると、予算が WASA へ配分される。その予算の範囲内で、WASA は、必要な数量のメータを直接、調達できる。従って、WASA が主導しながら、きめ細かにメータの仕様を定め、調達することができる。

PPP スキームでは、民間セクターはメータ調達のみならず、メータ設置まで含めた資金を調達する。民間セクターがメータを設置した地区を、WASA は従量制に切り替え、水道料金の増収分を民間セクターに支払う。そのため、本スキームでは、州政府の支出が不要となることから、州政府にとっては好ましいスキームである。

パンジャブ州において、ラホール上下水道局（WASA-L）が PPP スキームを適用し、700,000 個のメータ調達の発注を検討している。WASA-L と民間セクターの契約期間は、10 年程度を想定している。他の WASA は PPP でのメータ調達に向けた実質的な動き出しはしておらず、WASA-L の動向を静観している状況である。

2. 水道メータの設置技術

WASA-F は、M/P プロジェクトのパイロット活動で作成された給水装置設置マニュアルに基づき、2 か所のパイロット地区に水道メータを設置し、さらに、全市への水平展開も図られている。そのため、給水装置設置に関して、十分な技術を WASA-F は保有している。

3. WASA-F によるメータ調達への提言

本プロジェクトによって、給水量および給水圧の増加によって給水サービスの向上が見込まれる。また、WASA-F はメータを調達し、従量制へ移行することを計画している。従量制へ移行されると、収入が増加し、財務改善が期待できる。

WASA-F によるメータ調達は、PPP スキームあるいは ADP スキームのいずれかになる。いずれの場合も、安定したサービスの提供および継続的な技術革新を目的とし、給水装置設置技術やメータ仕様などを検討できる組織体制の形成を提言する。

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX

2020, December

Organizational Information

Signer of the G/A (Recipient)	Person in Charge (Designation) Contacts Address: Phone/FAX: Email:
Executing Agency	**WASA Faisalabad** Person in Charge Mr. xxxx xxxx, (Designation) Contacts Address: Near Allied Hospital, Jail Road Faisalabad, Pakistan Phone/FAX: +92 41 921 0049 / 0054 Email: info@wasafaisalabad.gop.pk
Line Ministry	**Ministry of Economic Affairs** Person in Charge Mr. XXXX XXXX, (Designation) Contacts Address: Block C, Pak Secretariat, Islamabad Pakistan Phone/FAX: Email:

General Information:

Project Title	The Project for Improvement of Water Treatment Plant and Water Distribution System in Faisalabad
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY mil. Government of Pakistan:

1: Project Description

1-1 Project Objective

Living environment in Faisalabad is improved through an improvement of the water supply capacity by renewing and expanding the existing WTP and development of transmission and distribution facilities.

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

Higher-level objectives:
Water supply facilities are developed according to M/P Project through the financial improvement of WASA-F as a result of an increase in income by an increase in a number of the customers and the tariff collection rate.

Situation of the target groups:
Water supply demand has been increased by an increase in population. Consequently, it is expected that the (maximum) daily demand for Faisalabad in 2023 will exceed the current water supply capacity by approximately 30%. Furthermore, improper segmentation of the service area and inadequate water distribution management have caused low water pressure and intermittent water supply limited for about six hours per day in the area.

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr 2020)	Target (Yr 2027)
Production volume by WTP*1	6,800 m^3/day	14,800 m^3/day
Distribution pressure	approximately 0 - 8 m (average: 1.7 m) *2	25 m or higher*3

Qualitative indicators to measure the attainment of project objectives

- Improvement of living environment and public health for citizens, and contribution in promoting infection control measures by improving water supply services such as water supply hours
- Improvement of WASA-F's financial status by increasing a number of customers and the income from water tariff

Note:
*1: Average of production volume by WTP without closing period of RBC approximately for 3 weeks per year
*2: Average of maximum pressure at tap surveyed in 2019-20
*3: Measurement at flowmeter room of OHR

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
Construction of WTP and transmission / distribution facilities	i) Old JK WTP, ii) Abudulah Pur, and iii) Madina Town in Faisalabad	

2-2 Scope of the work

Components	Original *(proposed in the outline design)*	Actual
1. Construction of Intake (10 MGD)	- Intake mouth, branch valve chamber - Raw water pump station	
2. Construction of Water Treatment Plant (5 MGD) (Applicable to expand the capacity to 10 MGD)	- Receiving and distribution tank - Mixing tank - Flocculation tank - Settling tank - Rapid sand filter - Clear water reservoir - Transmission pump station - Waste water and sludge tank - Sludge thickener - Sludge extraction pump house - Sludge drying bed - Chemical building - Administration building - Power receiving and transforming, and generator house - Electricity meter house	
3. Construction of Distribution Center	- Ground reservoir (2 ponds) - Overhead reservoir (2 ponds)	
4. Construction of Transmission and Distribution Main (Applicable to transmit a capacity of 10 MGD partially)	- Transmission main (4.1 km) - Distribution primary main (1.2 km) - Distribution secondary main (1.9 km)	

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	***(at the time of signing the Grant Agreement)***	
Cabinet Approval	12/2020		
E/N	2/2021		
G/A	2/2021		
Consultant Contract	3/2021		
Detailed Design	3/2021 - 9/2021		
Prequalification	10/2021		
Bidding	12/2021		
Contract with Contractor	1/2022		
Construction	1/2021 - 5/2024		
Soft component	4/2024 - 9/2024		

Defect Liability Period	4/2025		
Project Completion	4/2025		

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant (Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components		Cost (million PKR)	
Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
Rehabilitation of Raw Water Reservoir A		59.38	
Dismantling of Existing Facilities		29.97	
Relocation of WASA-F and FDA Staff		19.98	
Electrical Works		22.29	
Total		131.62	

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = 105.74 JPY

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)* - Name: Water and Sanitation Agency Faisalabad - Role: To provide water supply, sewerage and drainage services to citizen of Faisalabad - Financial situation: The financial sources for the development and the non-development budget of WASA-F are subsidy from the provincial government and the income from water tariff, etc. The income from water tariff has been increased as a result of the pilot activities on the Master Plan Project. - Institutional and organizational arrangement (organogram): The organization is headed by MD and formed by three DMDs sectionalized in i) finance & revenue, ii) engineering, and iii) services. - Human resources (number and ability of staff): Total number of staff is 2,567. The staff of WDM is responsible and properly working for the operation of WTP and distribution management.
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spare parts, etc.)

Original *(at the time of outline design)* Operator/Maintenance Engineer (2), Process Engineer (1), Plant Operator (3), Mechanic / Helper Mechanic (3), Electrician / Helper Electrician (3), Laboratory specialist / Assistant (4), Plumber / Helper Automation (3)
Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and income by water tariff

Original *(at the time of outline design)* O&M cost and income from water tariff at water transmission of 20,450 m^3/d are projected as follows: - O&M cost: 101 million PKR/year - income from water tariff at collection rate of 40%: 113 million PKR
Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks (*at the time of outline design)*

Potential Risks	Assessment
1. Air Pollution	Probability: High/(Moderate)/Low
	Impact: High/(Moderate)/Low
	Analysis of Probability and Impact:
	<u>During Construction</u> Temporary deterioration of air quality is expected due to operation of construction machineries and vehicles.
	Mitigation Measures:
	- Use of construction equipment with exhaust gas emission control - Careful operation and self-regulation of speed of construction machineries and vehicles - Watering to prevent dust
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. Water Pollution	Probability: High/(Moderate)/Low
	Impact: High/(Moderate)/Low
	Analysis of Probability and Impact:
	<u>During Construction</u> Due to construction of the intake facility, temporary water pollution such as soil runoff downstream is expected.
	Mitigation Measures:
	- Control of soil flown out to RBC from the working area of intake facility - Preventive maintenance of construction machineries and vehicles - Wastewater control at accommodation for workers

	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. Solid Waste	Probability: High/(Moderate)/Low
	Impact: High/(Moderate)/Low
	Analysis of Probability and Impact:
	<u>During Construction</u> Generation of construction debris and waste materials is expected. <u>During Operation</u> Sludge will be generated from the water treatment plant, and the generated sludge is planned to be transported to the waste treatment plant as waste.
	Mitigation Measures:
	- Proper waste handling at waste disposal site and treatment plant - Guidance to workers on construction site cleaning
	Action required during the implementation stage:
	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

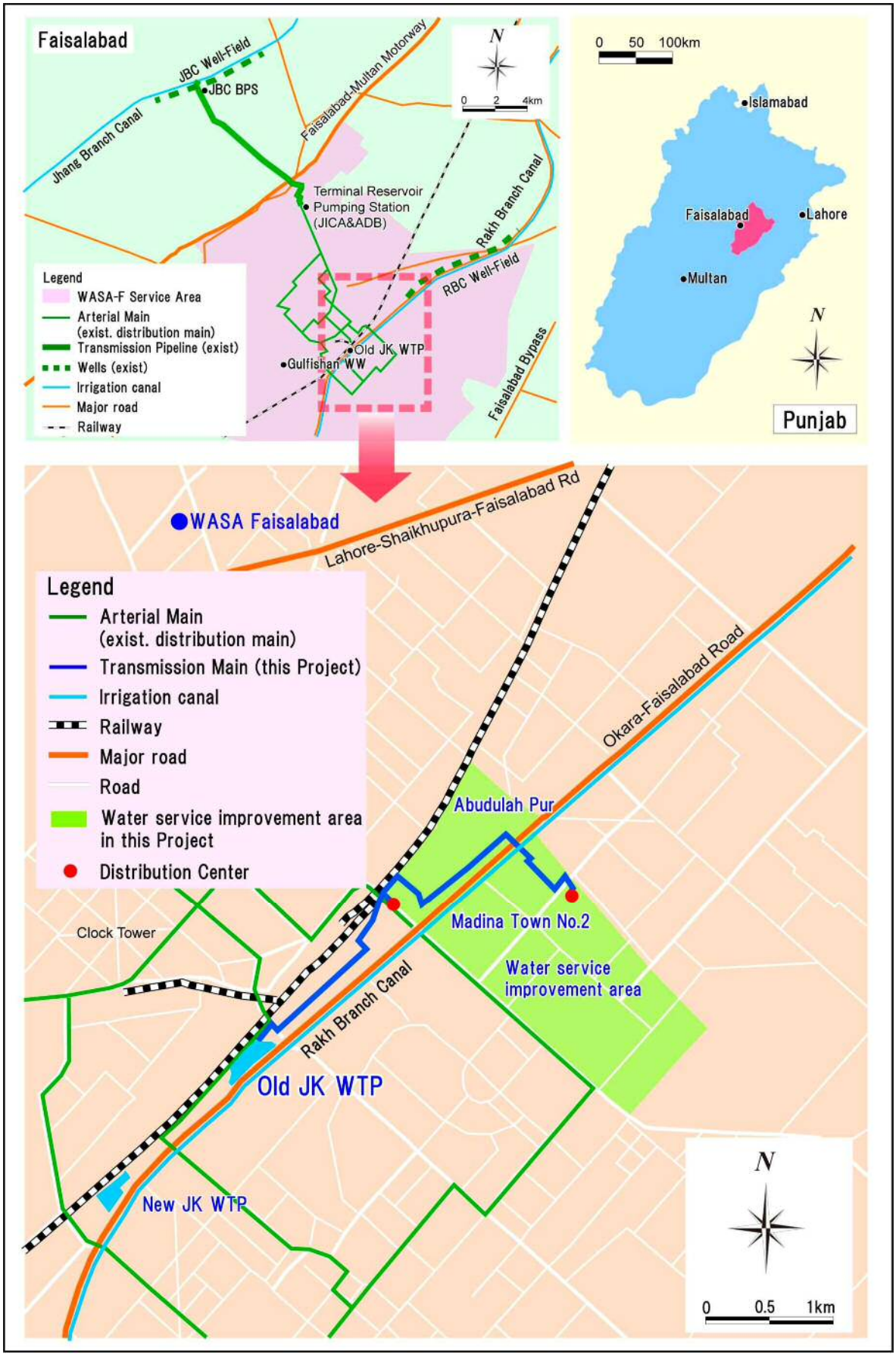
The production volume by WTP and the distribution pressure are monitored and recorded in SCADA installed at WTP.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant (not available in current version)

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment) (not available in current version)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only) (not available in current version)
9. Equipment List (PMR (final)only) (not available in current version)
10. Drawing (PMR (final)only) (not available in current version)
11. Report on RD (After project) (not available in current version)



Location Map

Specific obligations of the Government of Pakistan ("the Recipient" of the Grant) which will not be funded with the Grant

(1) Before the Bidding

No	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open bank account (B/A)	within 1 month after the signing of the G/A	WASA-F	―	
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract	WASA-F	6,000 JPY/each issue 4,000 JPY/each amendment	
3	To approve IEE/EIA(Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation.	before the announcement of tender	WASA-F	1.5 million PKR (for entire period until "After the Project")	
4	To complete the relocation of WASA-F and FDA officials living around the distribution centers of Abudulah Pur and Madina Town No. 2 where the overhead reservoirs will be demolished for the Project	before the signing of the G/A	WASA-F	19.98 million PKR	
5	To secure and clear the following lands 1) Site for Old JK WTP (existing rapid sand filter, storage etc.) 2) Site for the distribution centers of Abudulah Pur and Madina Town No. 2	before the announcement of tender	WASA-F	29.97 million PKR	
6	To rehabilitate the raw water reservoir A	before the announcement of tender	WASA-F	59.38 million PKR	
7	To bring power to Old JK WTP and distribution centers of Abudulah Pur and Madina Town No. 2	before the announcement of tender	WASA-F	22.29 million PKR	
8	To submit Project Monitoring Report (with the result of Detailed Design)	before the announcement of tender	WASA-F	―	
9	To establish Project Implementation Unit and assign WASA-F staff	soon after Detailed Design starts	WASA-F	1.25 million PKR/month	
10	To coordinate and acquire permission/approval from relevant agencies/organizations when any types of permission are required for construction under the Project	before preparation of bidding document(s)	WASA-F	16 million PKR	

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Suppliers (s).	within 1 month after the signing of the contract(s)	WASA-F	6,000 JPY/each issue 4,000 JPY/each amendment	
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A			—	
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	WASA-F	6,000 JPY/each issue 4,000 JPY/each amendment	
	2) Payment commission for A/P	every payment	WASA-F	0.1% of every payment	
3	To handle duty (tax) exemption procedures and to take necessary measures as well as provide requisite legal and/or administrative documentations for customs clearance to the customs broker/forwarder to be employed by the Supplier(s) at the port of disembarkation for the materials and equipment imported for the Project as well as sending back of any defective equipment and/or spare parts to the manufacturer for repair at the factory or replacement and importation thereof into the country of the Recipient during the implementation and warranty periods of the Project.	during the Project	EAD WASA-F	—	
4	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work.	during the Project	EAD WASA-F	—	
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted. (with regard to the internal taxes, the total percentages of rates of the sales tax imposed on the said purchase shall be zero percent (0%) or the sales tax imposed on the said purchase shall be exempted.)	during the Project	EAD WASA-F	—	
6	To arrange the maximum countermeasures and ensure the appropriate security of the whole Project sites and of the Japanese and other foreign nationals assigned to the Project, with deployment of city police through its Administration & Security Branch in addition to the private security arrangement by the Suppliers(s). 1) To arrange security around the Project sites with the police. 2) To arrange security around the accommodation(s) of the Suppliers(s) with the police. 3) To arrange escort guard with the police during movements between the accommodation(s) of the Supplier(s) and the Project sites. 4) To install monitoring cameras at Old JK WTP and distribution centers of Abudulah Pur and Madina Town No. 2.	prior to the commencement of and during implementation of the Project	WASA-F through District Police	10 million PKR	

	5) To repair the wall around distribution centers of Abudular Pur.				
7	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s).			—	
	1) Electricity The distributing line to the site including utilization of electricity for trial operation	before start of the construction	WASA-F		
	2) Water Supply The city water distribution main to the site including utilization of water for trial operation and construction works such as cleaning sites and facilities, pressure test, etc.	before start of the construction	WASA-F		
	3) Drainage The city drainage main (for storm, sewer and others) to the site including utilization of drainage main for trial operation and construction works such as wastewater from cleaning sites and facilities, pressure test, etc.	before start of the construction	WASA-F		
8	To provide necessary working spaces for the Project Office of the Suppliers(s).	during the Project	WASA-F		
9	To bear all the expenses, other than those to be covered by the Grant, necessary for the implementation of the Project.	during the Project	Govt. of Punjab & WASA-F	—	
10	To implement EMP and EMoP	during the construction	WASA-F	—	
11	To submit results of environmental and social monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	WASA-F	—	
12	To take necessary measures on controlling traffic and/or detouring traffic for securing safety to workers and all types of the traffic	during the construction	WASA-F	—	
13	1)To submit Project Monitoring Report	every month	WASA-F	—	
	2)To submit Project Monitoring Report (final)	within 1 month after issuance of Certificate of Completion for the works under the contract(s)	WASA-F	—	
14	To submit a report concerning completion of the Project	within 6 months after completion of the Project	WASA-F	—	

(Suppliers(s): suppliers, contractors and/or consultants)

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP	WASA-F	―	
2	To submit results of environmental and social monitoring to JICA, by using the monitoring form, semiannually - The period of environmental and social monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental and social monitoring will be decided based on the agreement between WASA-F and JICA.	for three years after the Project	WASA-F	―	
3	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Allocation of additional staff for operation and maintenance 3) Routine check/Periodic inspection	After completion of the construction	WASA-F	―	

Environmental and Social Monitoring Form (Draft)

(1) Pollution Control Measures

1) Air Pollution: During Construction

a) Observation

Monitoring Item	Remarks
Dust generated at construction site	Construction site, Four times/year, Physical observation (existence of dust)

b) Measurement (Environmental Standard)

Item (Unit)	Measured Value (Mean)	Measured Value (Maximum)	Local Standard	Japanese Standard	Remarks (Measurement point, frequency, method)
CO (mg/m^3)			<5	<11.5	Air quality measurement around construction site, Four times/year, Air quality measurement
SO_2 ($\mu g/m^3$)			<120	<105	
NOx ($\mu g/m^3$)			<80	—	
PM_{10} ($\mu g/m^3$)			<150	<100	

2) Water Pollution (Effluent/Drinking Water Quality Standard): During Construction

Item (Unit)	Measured Value (Mean)	Measured Value (Maximum)	Local Standard	Japanese Standard	Remarks (Measurement point, frequency, method)
COD (mg/L)			<150	≤160	Effluent quality measurement around construction site, Twice/year, Water quality analysis
SS (mg/L)			<200	≤200	
pH			6.5-8.5	5.8-8.6	Drinking water quality downstream of construction site at intake facility, Twice/year, Water quality analysis
Odour			NO	NO	
Taste			NO	NO	
Colour (Pt-Co)			≤15 TCU	≤5 CU	
Turbidity (NTU)			<5	≤2	
Total Hardness (mg/L)			< 500	≤ 300	
TDS (mg/L)			<1000	≤500	
Cl (mg/L)			< 250	≤200	
CN (mg/L)			≤0.05	≤0.01	
F (mg/L)			≤ 1.5	≤0.8	
NO_2^- (mg/L)			≤3	≤0.04 (as N)	
NO_3^- (mg/L)			≤ 50	≤10 (NO_3^--N + NO_2^--N)	
Phenol (mg/L)			—	≤0.005	
Residual Cl (mg/L)			0.2-0.5	—	
Al (mg/L)			≤ 0.2	≤0.2	
Pesticides (mg/L)			—	—	
Cd (mg/L)			0.01	≤0.003	
Cu (mg/L)			2	≤1.0	

Item (Unit)	Measured Value (Mean)	Measured Value (Maximum)	Local Standard	Japanese Standard	Remarks (Measurement point, frequency, method)
Cr (mg/L)			≤ 0.05	≤0.02 (Cr^{6+})	
Hg (mg/L)			≤ 0.001	≤0.0005	
Sb (mg/L)			≤ 0.005	—	
Ni (mg/L)			≤ 0.02	—	
Zn (mg/L)			5.0	≤1.0	
As (mg/L)			≤ 0.05	≤0.01	
Ba (mg/L)			0.7	—	
Mn (mg/L)			≤ 0.5	≤0.05	
B (mg/L)			0.3	≤1.0	
Pb (mg/L)			≤ 0.05	≤0.01	
Se (mg/L)			0.01	≤0.01	
Total Coliforms			0/100ml	≤100/1ml (Common bacteria)	
Faecal Coliforms			0/100ml	Not to be detected (E. Coli)	

3) Solid Waste

a) During Construction

Monitoring Item	Remarks
• Proper waste handling at disposal site and treatment plant • Cleaning of construction site by workers	Construction site and disposal site, Once/month, Physical observation (proper disposal, cleaning situation)

b) During Operation

Monitoring Item	Remarks
Proper removal and disposal of generated sludge	Water treatment plant, Once/month, Physical observation (status of sludge removal and disposal)

4) Soil Contamination: During Construction

Monitoring Item	Remarks
Proper storage and disposal of fuel, soil etc.	Construction site, Once/month, Physical observation (status of fuel and oil storage and disposal.)

5) Noise and Vibration: During Construction/During Operation

Item (Unit)	Measured Value (Mean)	Measured Value (Maximum)	Local Standard	Japanese Standard	Remarks (Measurement point, frequency, method)
Noise Level (dB)			<75	<85	During construction: Daytime industrial area surrounding construction site, Twice/year, Sound level meter During operation: Daytime industrial area surrounding water treatment plant. Every 6 months, Sound level meter

(2) Natural Environment

Hydrological Conditions: During Construction

Monitoring Item	Remarks
Water level near intake mouth	Around intake, Once/week, Water level measurement

(3) Social Environment

1) Local Economy (Livelihood, Employment, etc.): During Construction

Monitoring Item	Remarks
Efficient traffic regulation to reduce impact on local economy	Around construction site, Once/week, Inquiries to relevant persons (residents, local businesses, shop owners, etc.) and physical observation (conducting of traffic control and installation of signboards)
Economic impact on shops and offices due to reduced access due to the construction	Around construction site, Once/week, Inquiries to relevant persons (residents, local businesses, shop owners, etc.) and physical observation (existence of temporary closure of shops and offices)

2) Water Use and Water Rights

a) During Construction

Monitoring Item	Remarks
Fluctuations in water quantity and quality in canal due to the construction of intake facility	Canal downstream the intake of WTP Once/week, Inquiries to relevant person and physical observation (fluctuation in water quantity and quality in canal)

b) During Operation

Monitoring Item	Remarks
Changes in amounts of irrigation water to downstream agricultural lands especially during drought periods	Agricultural lands downstream the intake of WTP, Quarterly, Physical observation and inquiries to the Irrigation Department (change in amount of irrigation water)

3) Existing Social Infrastructures and Social Services: During Construction

Monitoring Item	Remarks
Traffic obstacles and reduced access to existing infrastructures	Around construction site, Once/week, Inquiries to relevant persons and physical observation (existence of traffic obstacles and reduced access to existing infrastructure)

4) Landscape: During Construction

Monitoring Item	Remarks
Changes in landscape around construction site	Around construction site, Once/month, Physical observation (change in landscape)

5) Infectious Diseases such as HIV/AIDS : During Construction

Monitoring Item	Remarks
Implementation of guidance on prevention of infectious diseases	In the construction site, Once/month, Physical observation (execution status of guidance)

6) Working Conditions: During Construction

Monitoring Item	Remarks
Execution of occupational safety and health guidance and periodic safety meetings	In the construction site, Once/week, Physical observation (execution status of guidance and meetings) and reports on workshops and safety meetings

7) Accidents: During Construction

Monitoring Item	Remarks
Installation of safety mesaures such as fences and warning signs	Around construction site, Once/week, Inquiries to relevant persons and physical observation (Installation of safety measures)

8) The Poor: During Operation

Monitoring Item	Remarks
Impact from water tariff system to household economy of poverty group	In the project site, Every 6 months, Inquiries to relevant persons (impact from water tariff system to the poverty group)

Attachment 6

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C－D	Price (Increased) F=C＋D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
（Actual Expenditure by Construction and Equipment each）

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

資料 - 7　その他の資料・情報

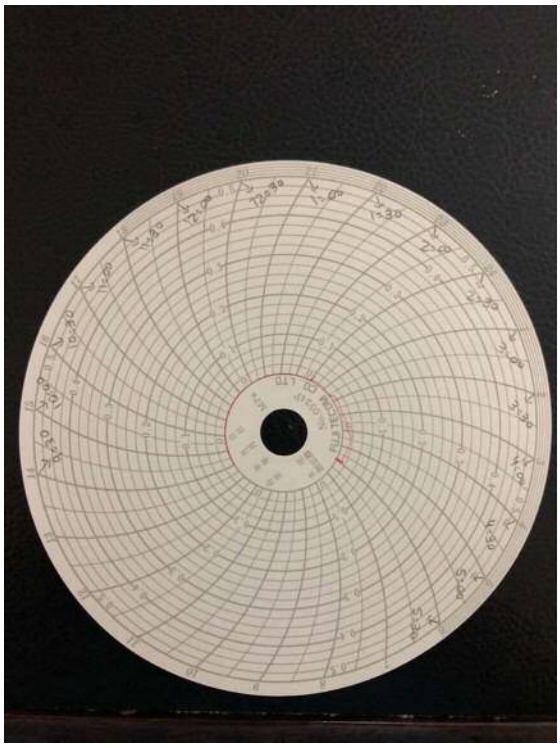
資料7 その他の資料・情報
(1) 配水圧調査結果

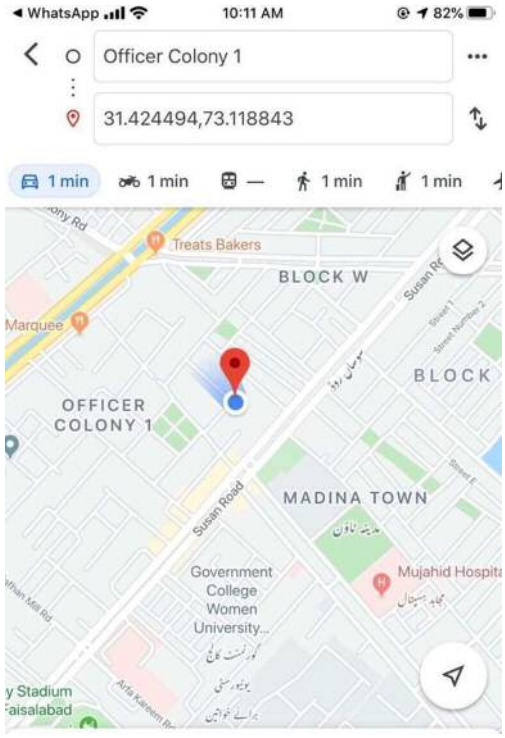
Water Pressure Records on Water Servise Pipes

One day for each point from Oct 2019 to Mar 2020

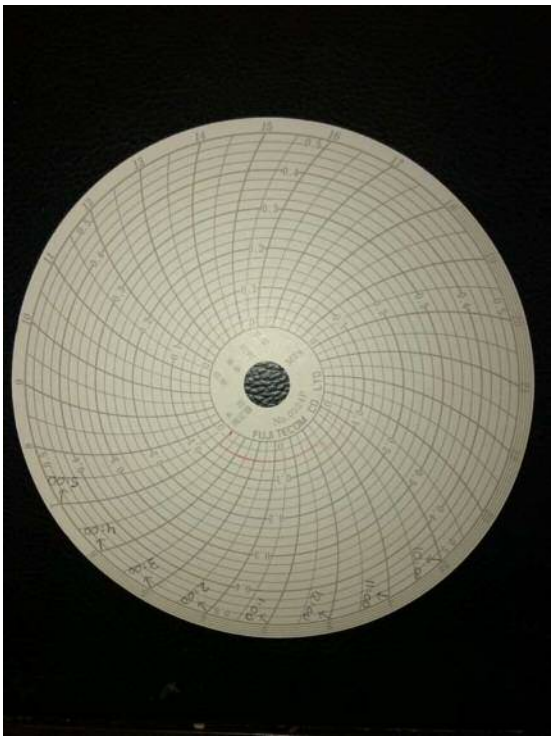
Sr#	DMA	Measuring Time			Pressure (bar)		Supply Time	
		Date	From	To	Lower	Ave/Upper	A.M.	P.M.
1	DMA-II-1	22-1-2020	9:30 AM	5:30 PM	0.15	0.24	5:30 to 7:30	4:30 to 6:30
2	DMA-II-1	11-2-2020	10:00 AM	5:00 PM	0.50	0.77	5:30 to 7:30	4:30 to 6:30
3	DMA-II-1	12-2-2020	10:00 AM	5:00 PM	0.10	0.20	5:30 to 7:30	4:30 to 6:30
4	DMA-II-1	13-2-2020	11:50 AM	5:00 PM	0.12	0.12	5:30 to 7:30	4:30 to 6:30
5	DMA-II-1	17-2-2020	10:00 AM	5:00 PM	0.00	0.00	5:30 to 7:30	4:30 to 6:30
6	DMA-II-1	18-2-2020	10:30 AM	5:00 PM	0.10	0.40	5:30 to 7:30	4:30 to 6:30
7	DMA-II-2	19-2-2020	10:20 AM	5:00 PM	-	0.10	5:30 to 7:30	4:30 to 6:30
8	DMA-II-2	21-1-2020	10:20 AM	5:30 PM	-	0.25	5:30 to 7:30	4:30 to 6:30
9	DMA-II-2	4-2-2020	10:25 AM	5:00 PM	-	0.00	5:30 to 7:30	4:30 to 6:30
10	DMA-II-2	5-2-2020	10:00 AM	5:00 PM	0.23	0.38	Tube well timing	
11	DMA-II-2	21-10-2019	10:15 AM	5:45 PM	0.00	0.23	-	4:00 to 6:00
12	DMA-II-2	10-2-2020	10:20 AM	5:30 PM	-	0.00	5:30 to 7:30	4:30 to 6:30
13	DMA-II-3	23-1-2020	9:30 AM	6:30 PM	0.15	0.24	5:30 to 7:30	4:30 to 6:30
14	DMA-II-3	27-1-2020	9:40 AM	5:45 PM	0.00	0.14	5:30 to 7:30	4:30 to 6:30
15	DMA-II-3	28-1-2020	11:10 AM	5:00 PM	-	0.00	5:30 to 7:30	4:30 to 6:30
16	DMA-II-3	29-1-2020	10:00 AM	5:10 PM	-	0.00	5:30 to 7:30	4:30 to 6:30
17	DMA-II-3	30-1-2020	10:00 AM	5:30 PM	-	0.20	5:30 to 7:30	4:30 to 6:30
18	DMA-II-3	3-2-2020	9:45 AM	5:00 PM	-	0.18	5:30 to 7:30	4:30 to 6:30
19	DMA-II-4	25-2-2020	10:10 AM	5:00 PM	-	0.00	5:30 to 7:30	4:30 to 6:30
20	DMA-II-4	24-2-2020	10:10 AM	5:00 PM	0.00	0.10	5:30 to 7:30	4:30 to 6:30
21	DMA-II-4	20-2-2020	10:20 AM	5:00 PM	-	0.10	5:30 to 7:30	4:30 to 6:30
22	DMA-II-4	30-10-2019	9:45 AM	5:15 PM	0.00	0.27	-	4:00 to 6:00
23	DMA-II-4	4-11-2019	10:00 AM	5:00 PM	0.06	0.10	-	4:00 to 6:00
24	DMA-II-4	6-11-2019	10:00 AM	5:30 PM	0.00	0.03	-	4:00 to 6:00
25	DMA-I-1	22-10-2019	9:30 AM	5:30 PM	0.20	0.23	-	4:00 to 6:00
26	DMA-I-1	3-3-2020	10:20 AM	5:00 PM	0.14	0.30	5:30 to 7:30	4:30 to 6:30
27	DMA-I-1	2-3-2020	10:00 AM	5:00 PM	-	0.10	5:30 to 7:30	4:30 to 6:30
28	DMA-I-1	27-2-2020	10:20 AM	5:00 PM	0.20	0.50	5:30 to 7:30	4:30 to 6:30
29	DMA-I-1	26-2-2020	10:25 AM	5:00 PM	-	0.12	5:30 to 7:30	4:30 to 6:30
30	DMA-I-1	24-10-2019	10:00 AM	5:30 PM	-	0.22	-	4:30 to 6:30
31	DMA-I-2	29-10-2019	9:30 AM	5:30 PM	0.00	0.03	-	4:00 to 6:00
32	DMA-I-2	9-3-2020	10:15 AM	5:00 PM	-	0.12	5:30 to 7:30	4:30 to 6:30
33	DMA-I-2	5-3-2020	10:15 AM	5:00 PM	-	0.00	5:30 to 7:30	4:30 to 6:30
34	DMA-I-2	4-3-2020	10:20 AM	5:00 PM	0.10	0.30	5:30 to 7:30	4:30 to 6:30
35	DMA-I-2	31-10-2019	10:00 AM	5:15 PM	0.00	0.10	-	4:00 to 6:00
36	DMA-I-2	5-11-2019	10:00 AM	5:30 PM	0.00	0.08	-	4:30 to 6:30
				min	0.00	0.00		
				ave	0.10	0.17		
				max	0.50	0.77		

1 22-1-2020 (Consumer Comments: low pressure problems, use pumps for fill up tanks)

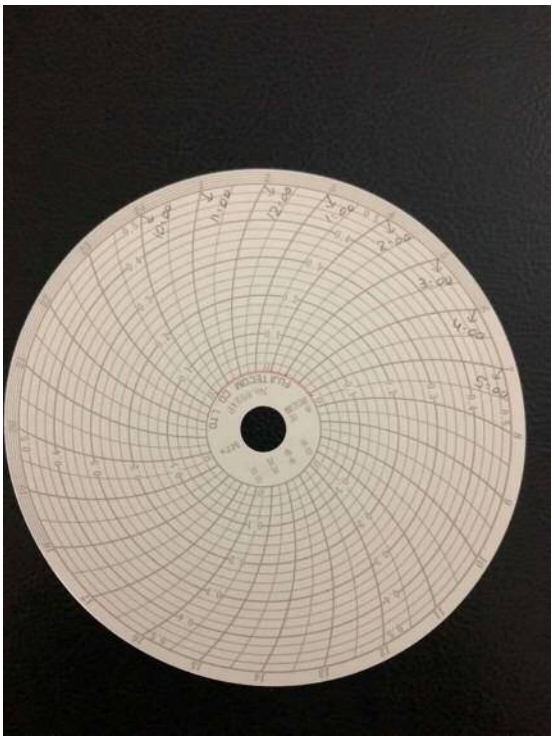


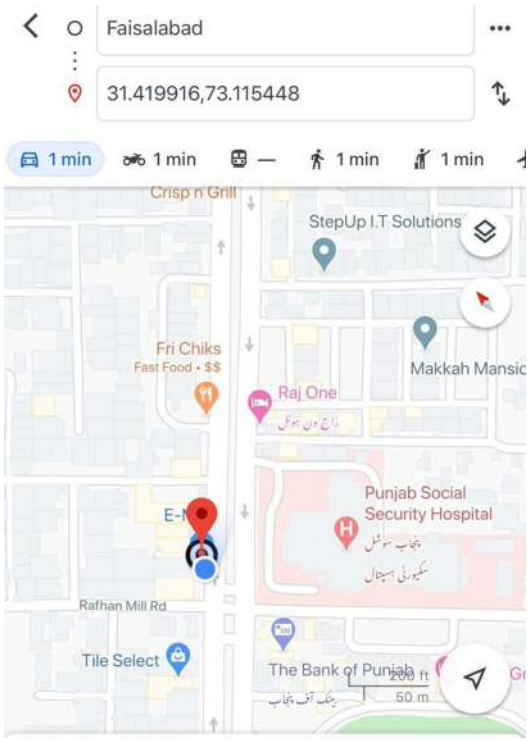


2 11-2-2020 (Consumer Comments: Water pressure good due to water supply from tubewells)

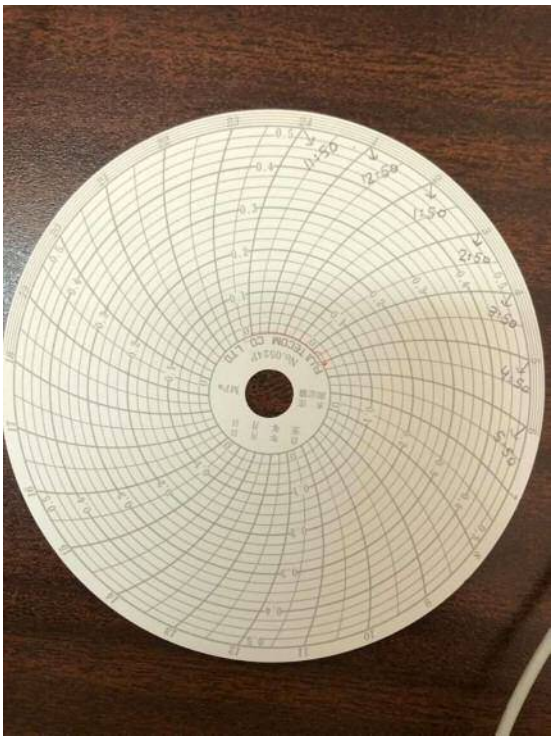


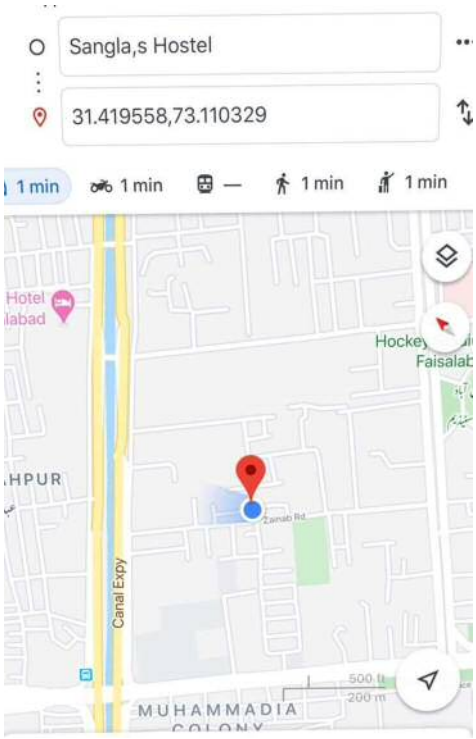
3 12-2-2020 (Consumer Comments: Water pressure low)



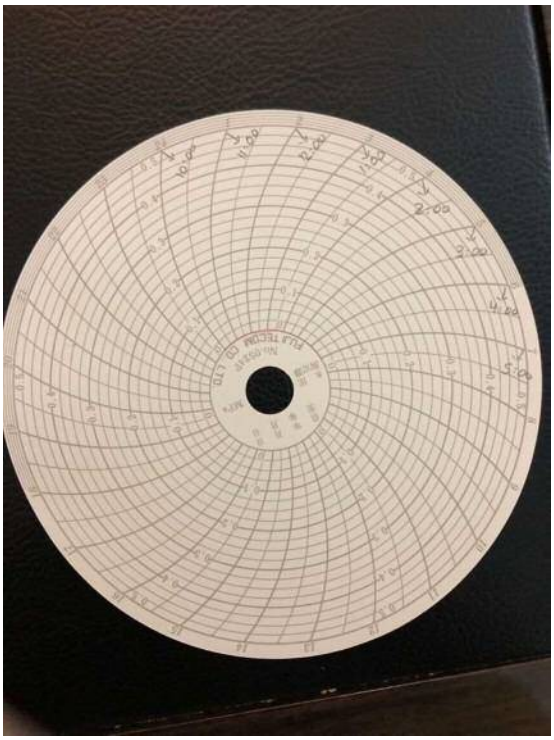


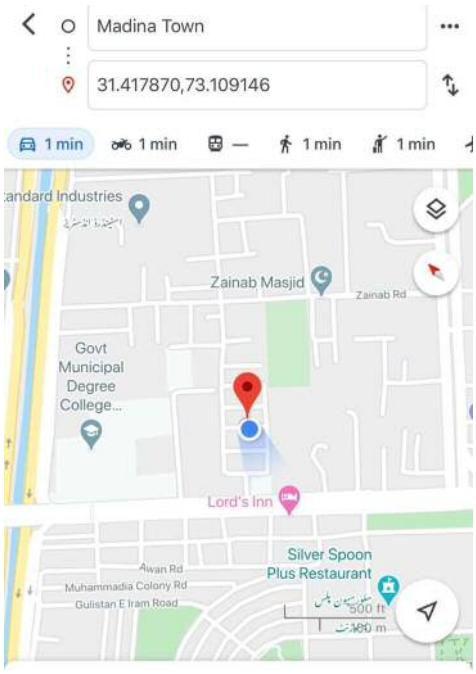
4 13-2-2020 (Consumer Comments: Water pressure low)

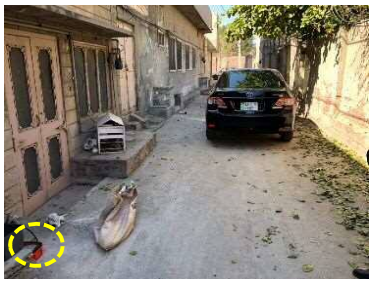




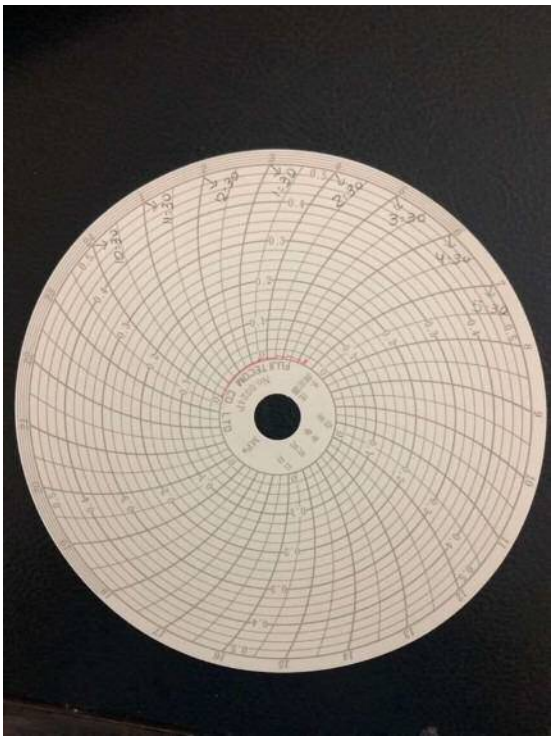
5 17-2-2020 (Consumer Comments: Water pressure too low, consumers not using water due to low pressure)



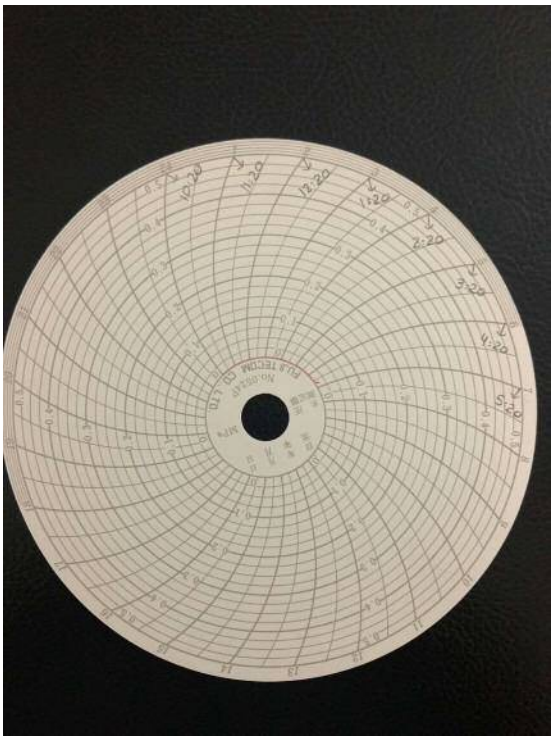




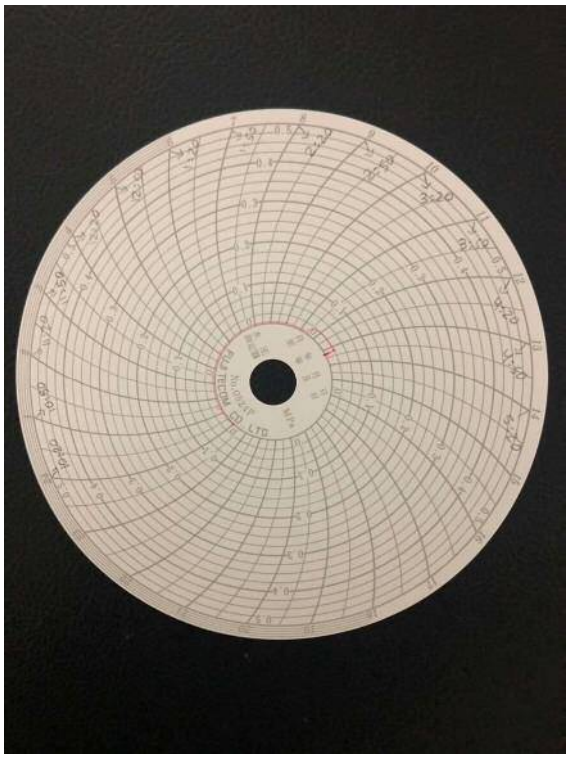
6 18-2-2020 (Consumer Comments: Water pressure too low, Consumers not satisfy with pressure)



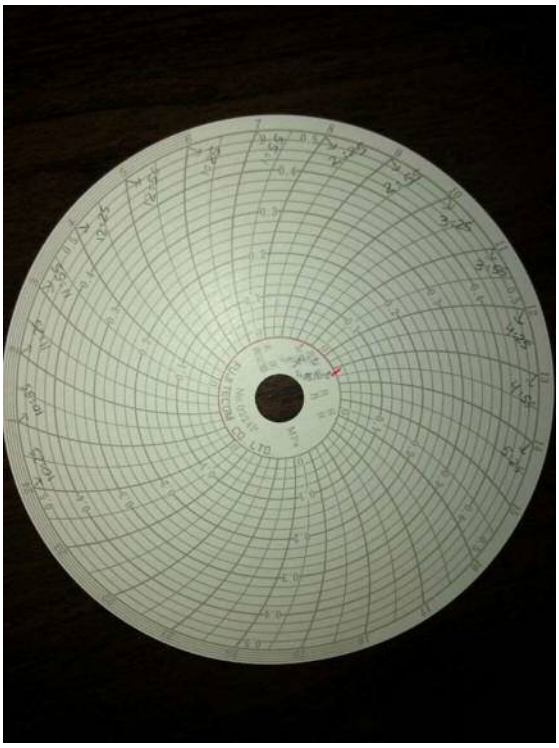
7 19-2-2020 (Consumer Comments: Poor water pressure)

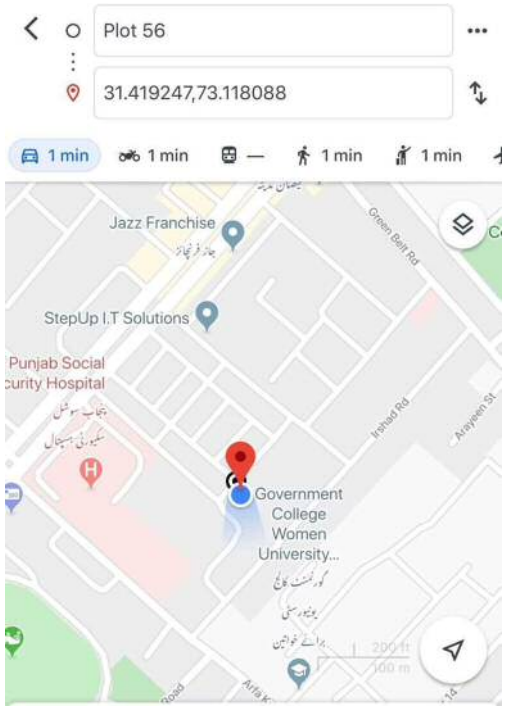


8 21-1-2020 (Consumer Comments: (pressure is not good)



9 4-2-2020 (Consumer Comments: very low pressure)





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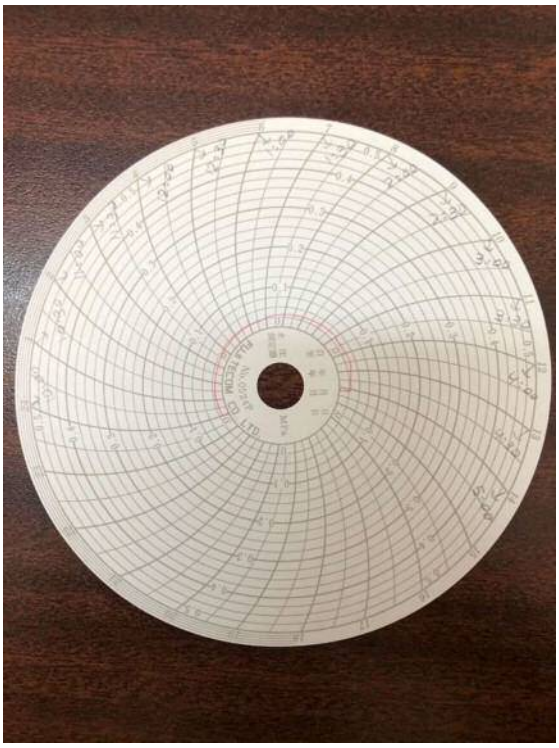
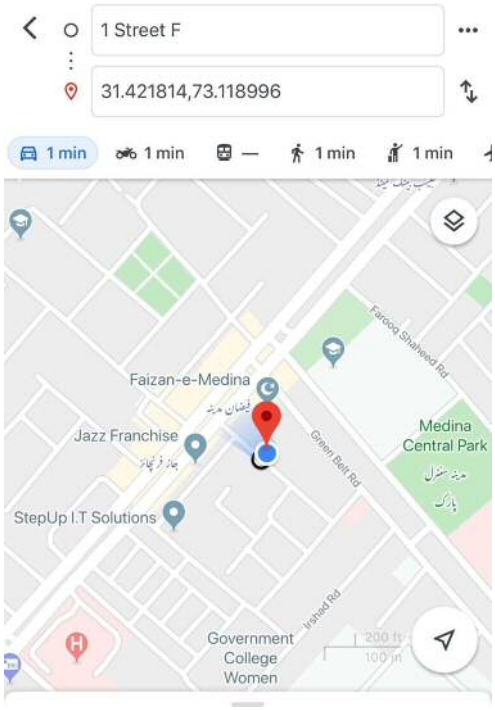
10 5-2-2020 (Consumer Comments: pressure is good due to direct supply from tube wells of 8" line)





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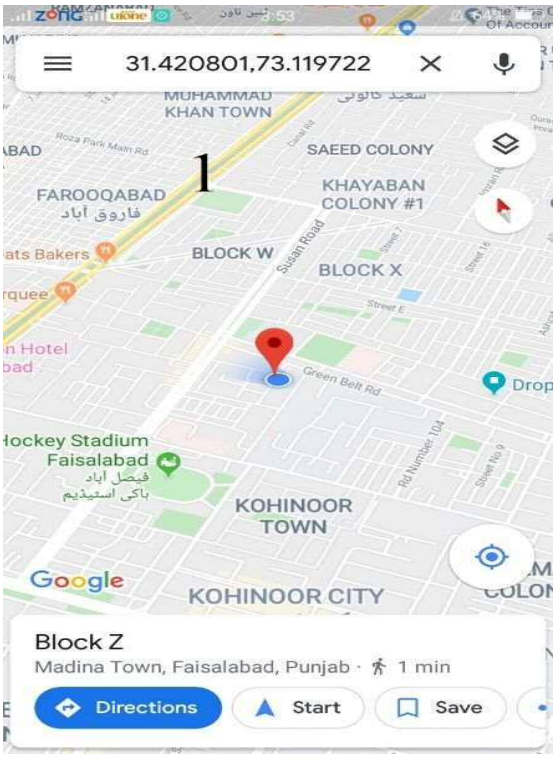
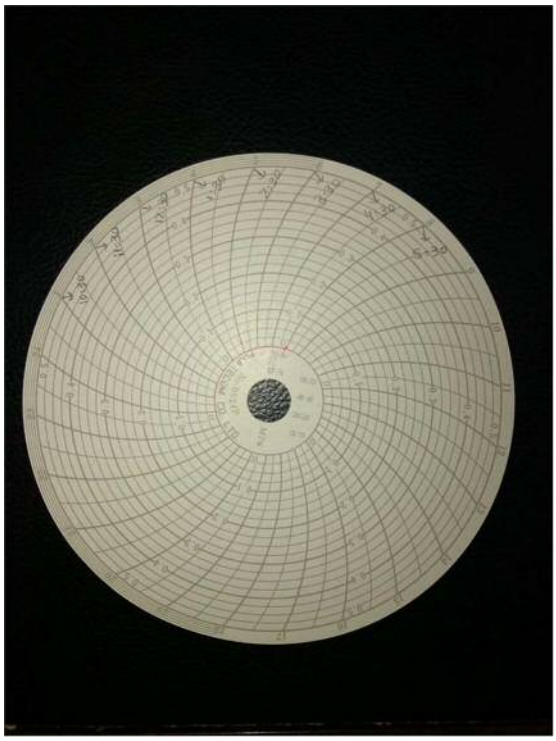
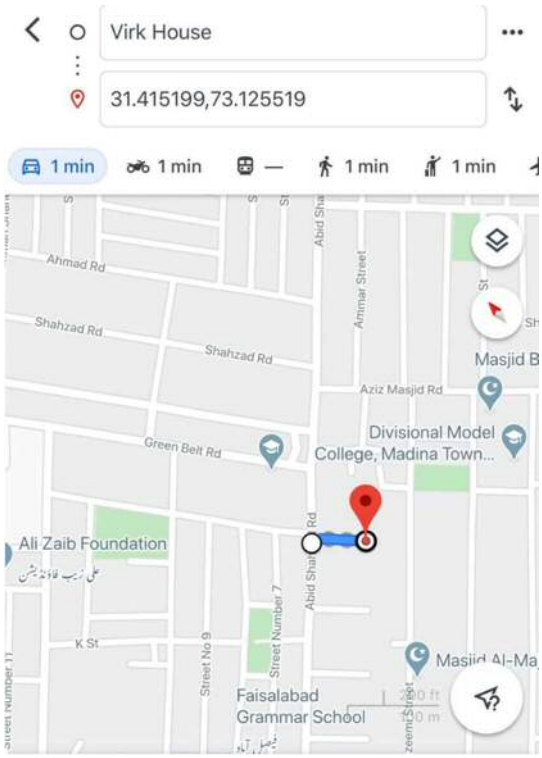
11 21-10-2019(Consumer Comments: low pressure problems)

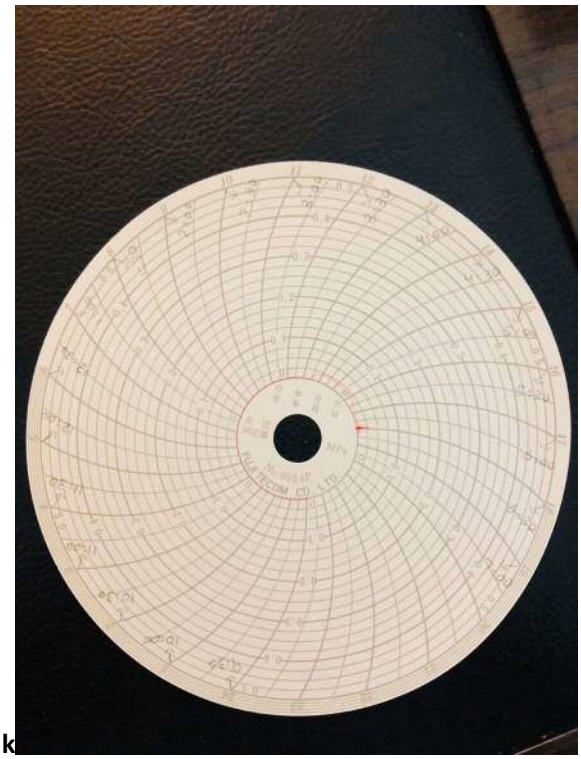


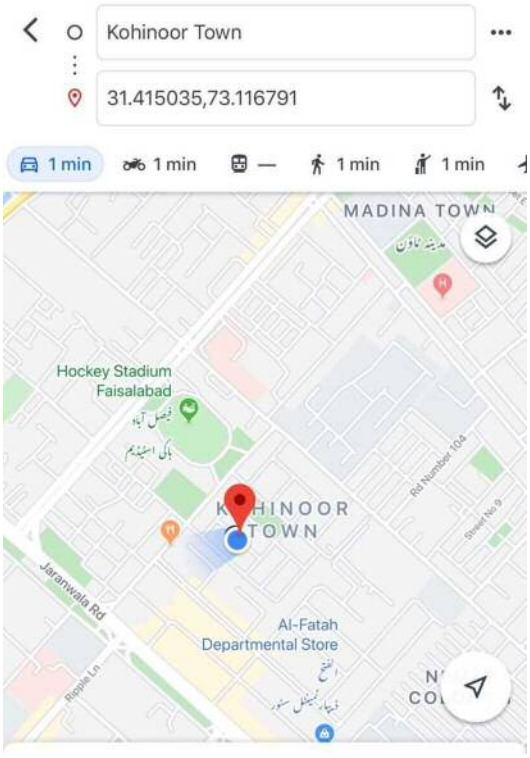
12 10-2-2020 (Consumer Comments: Water pressure very low)



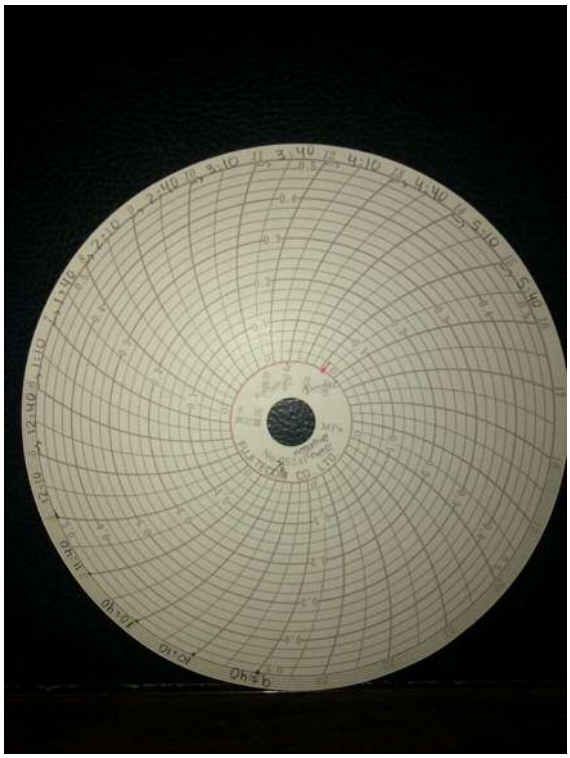


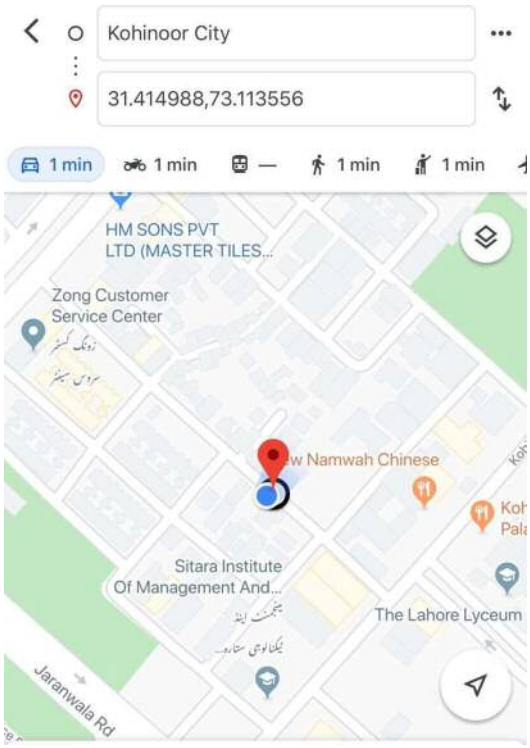
13 23-1-2020 (Consumer Comments: low pressure problems, use pumps)



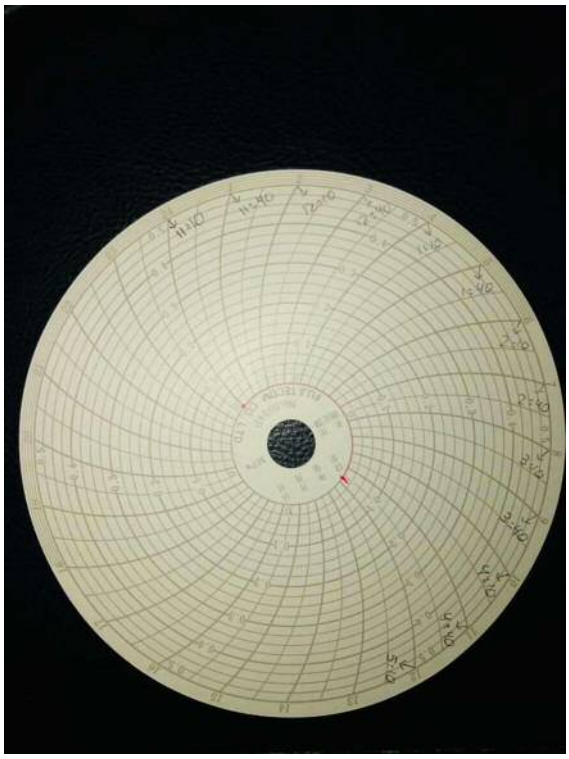


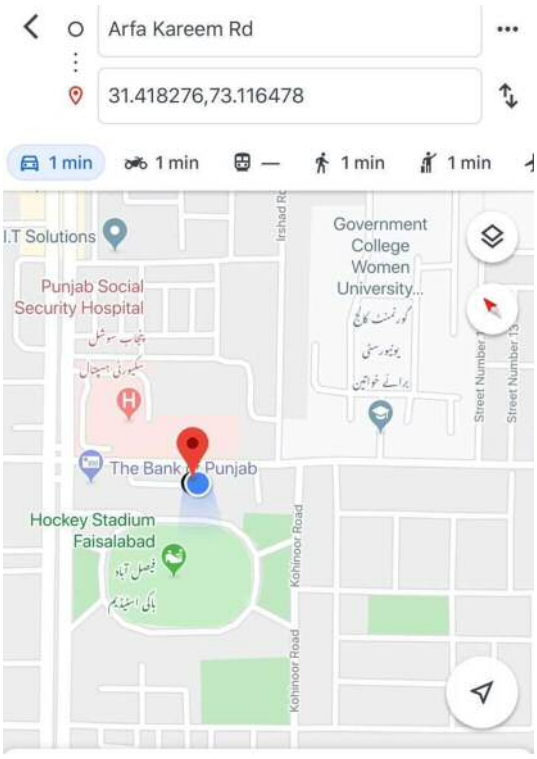
14 27-1-2020 (Consumer Comments: Pressure is not good)

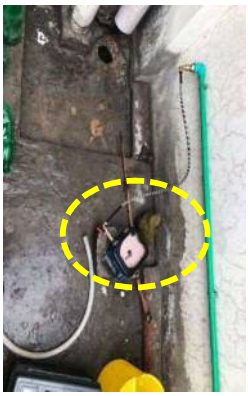




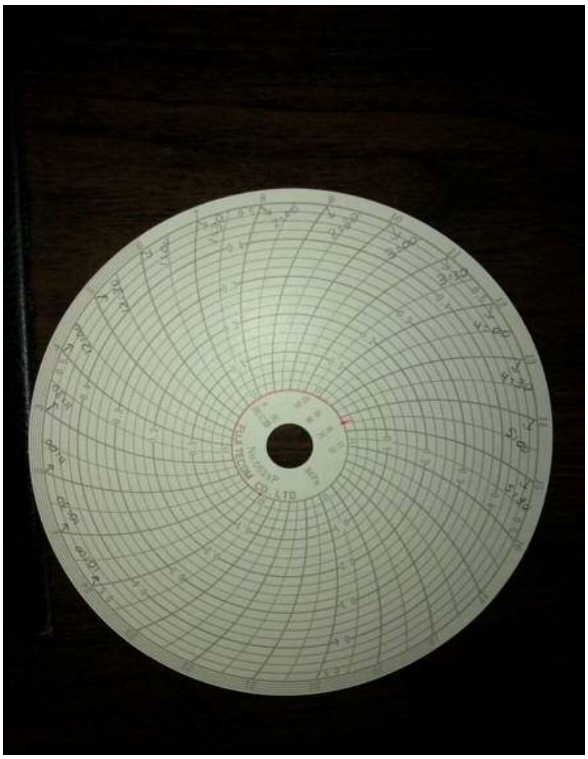
15 28-1-2020 (Consumer Comments: very low pressure)



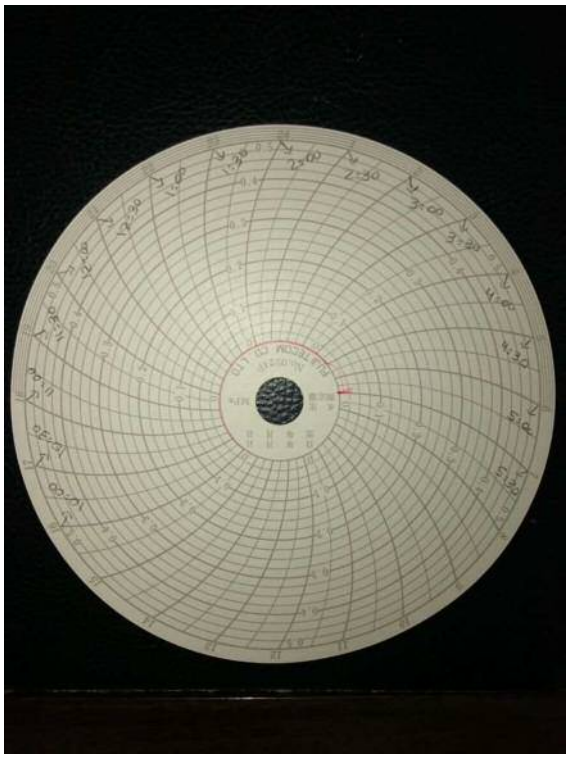


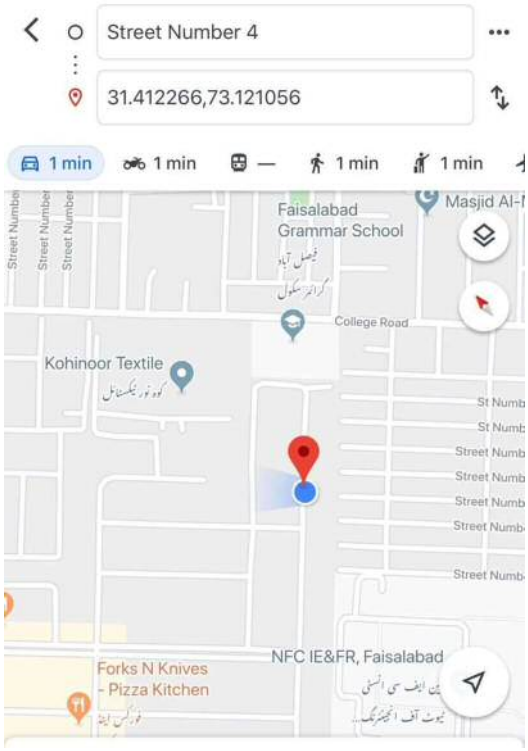


16 29-1-2020 (Consumer Comments: very low pressure)

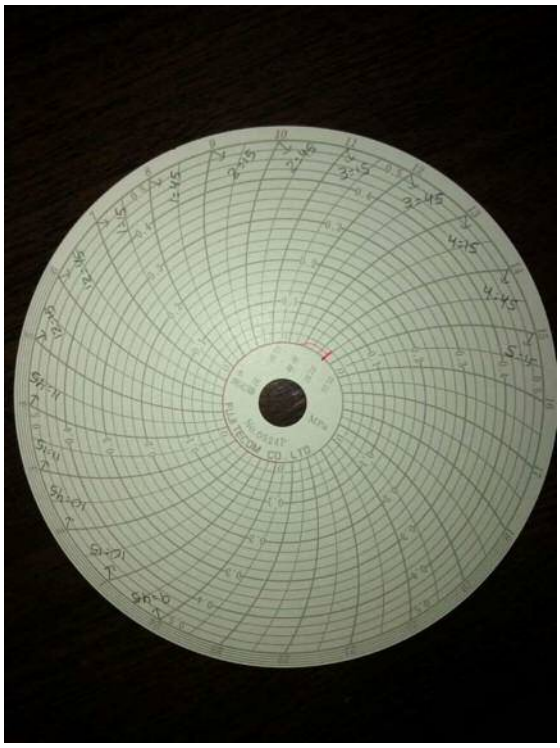


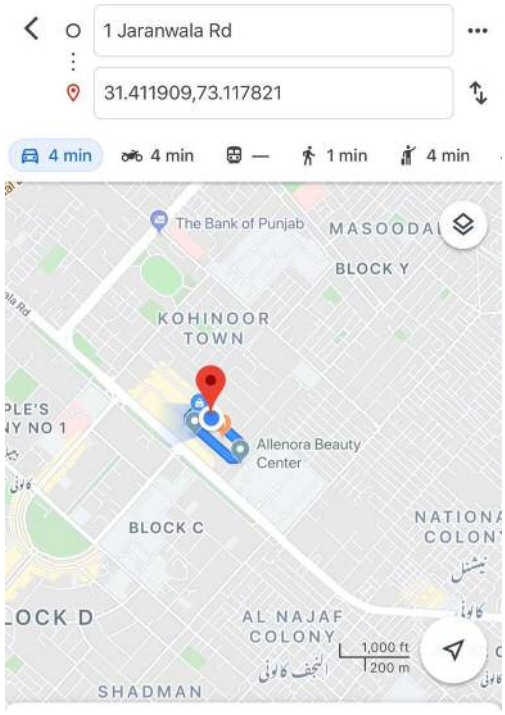
17 30-1-2020 (Consumer Comments: (pressure is not good)



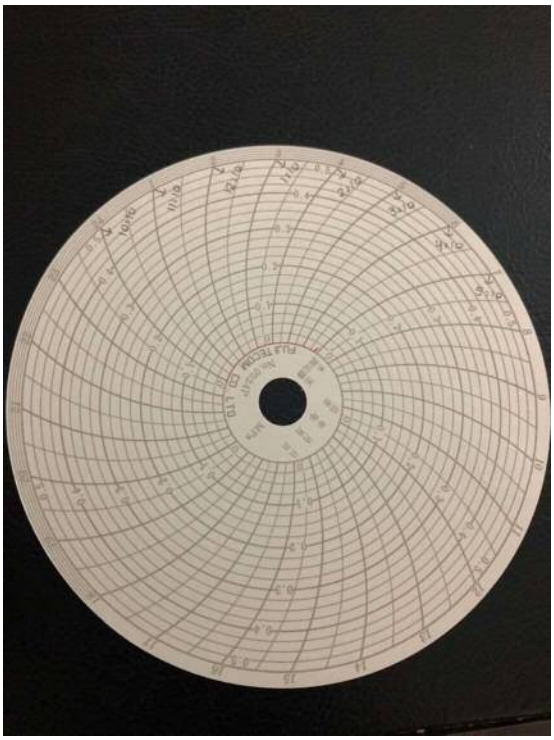


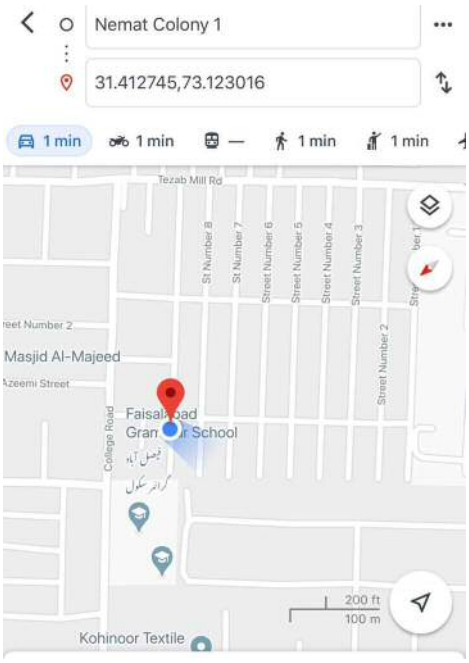
18 3-2-2020 (Consumer Comments: low pressure problems, use pumps for fill up tanks)



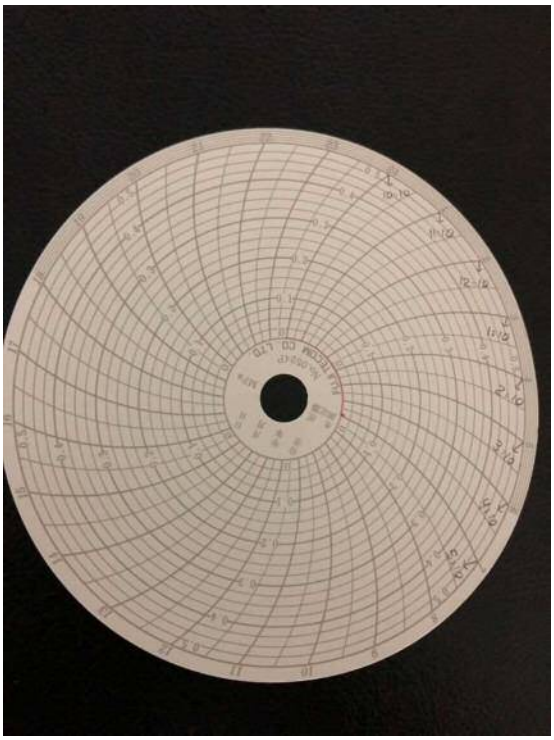


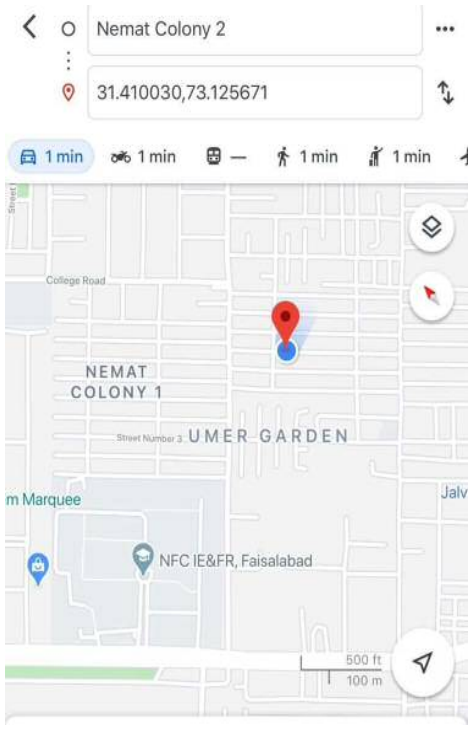
19 25-2-2020 (Consumer Comments: Poor water pressure, not using water due to very low pressure)



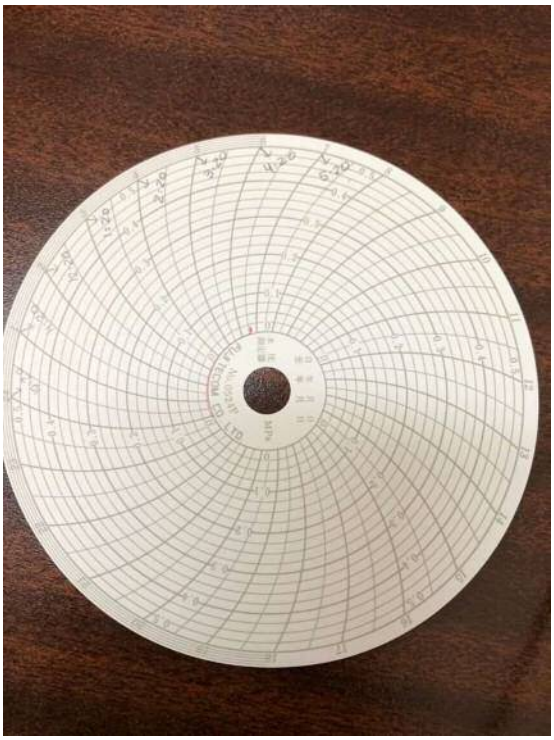


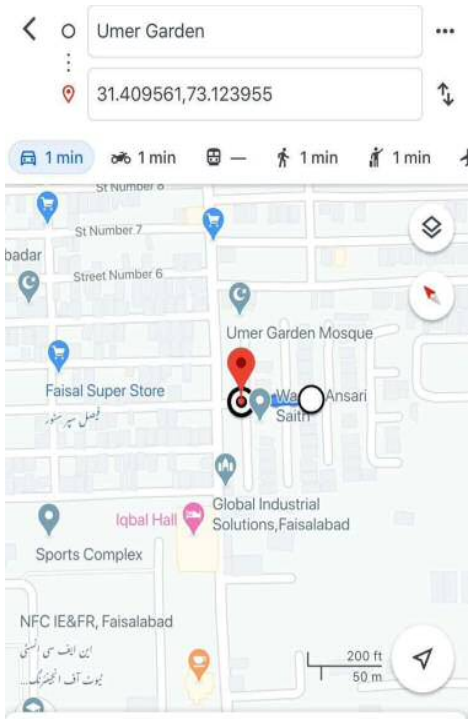
20 24-2-2020 (Consumer Comments: Poor water pressure)



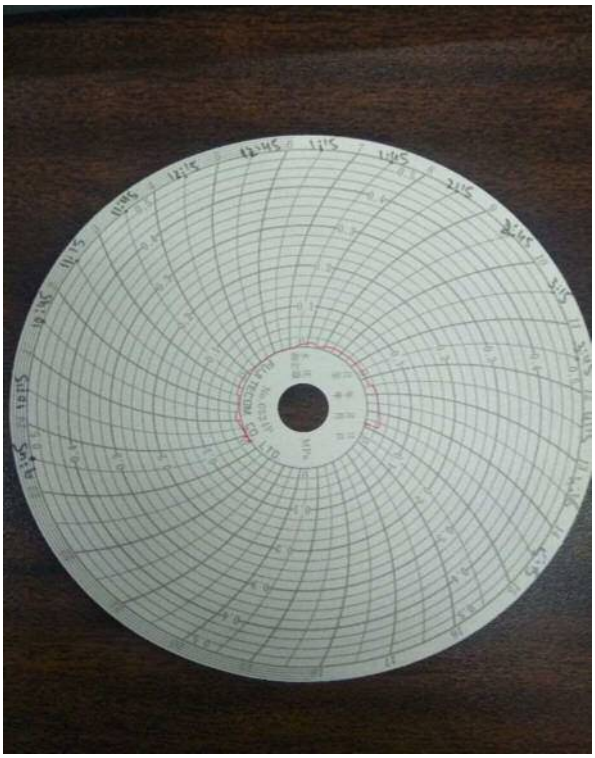


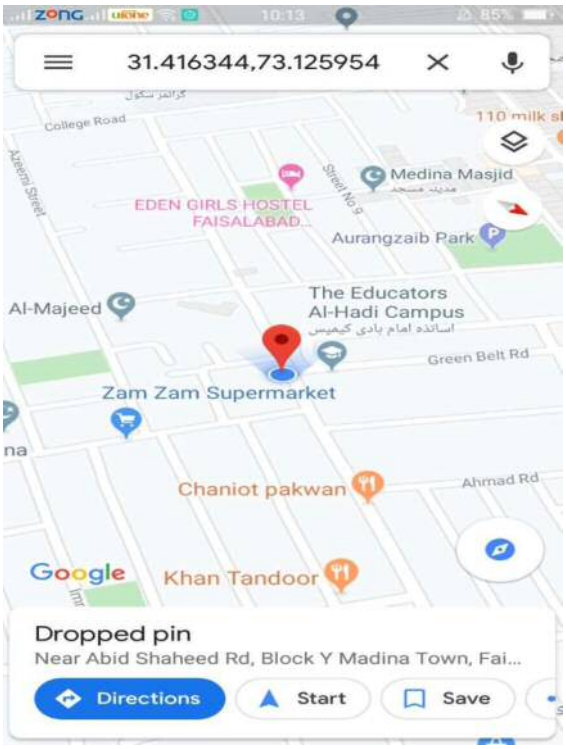
21 20-2-2020 (Consumer Comments: Poor water pressure)



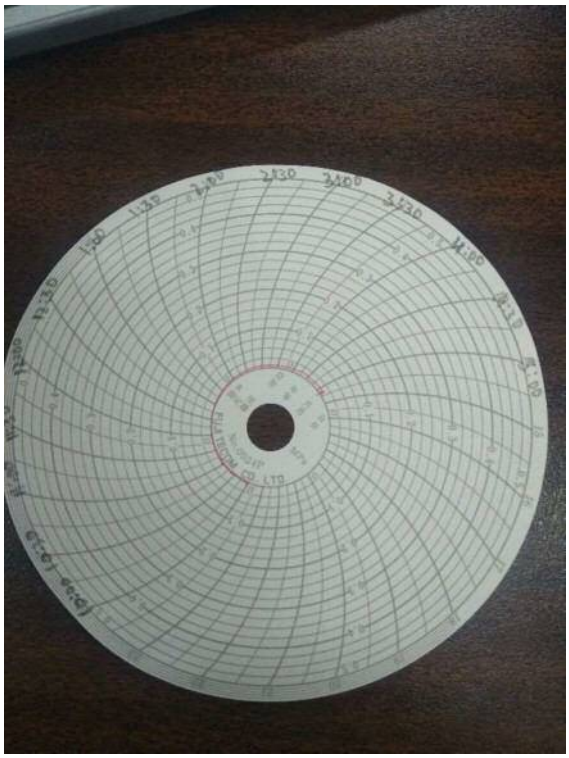


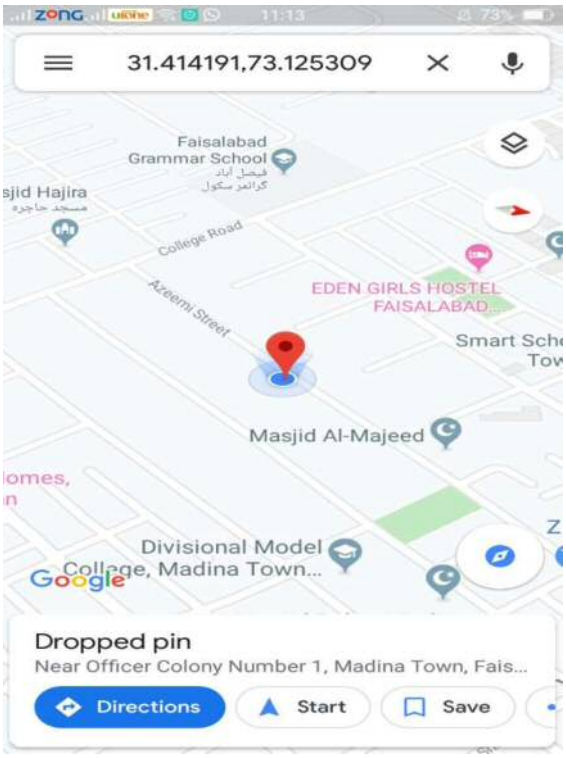
22 30-10-2019(Consumer Comments: Pressure is satisfying due to nearest point of Main Line)



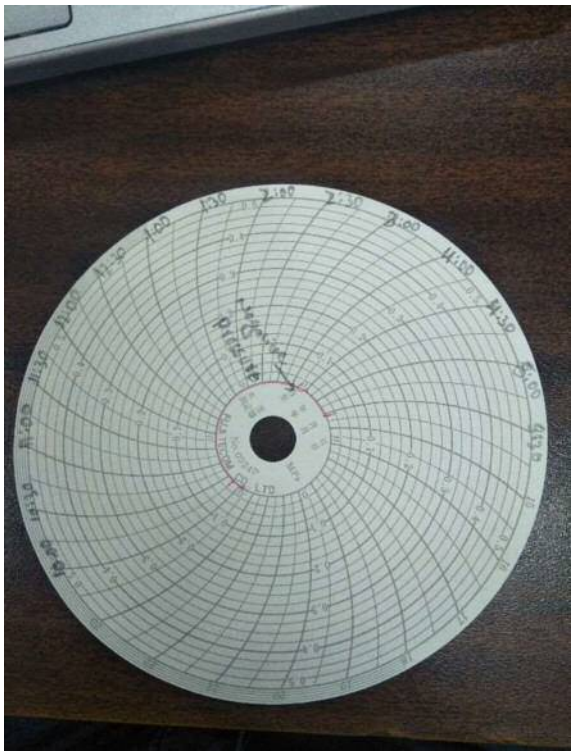


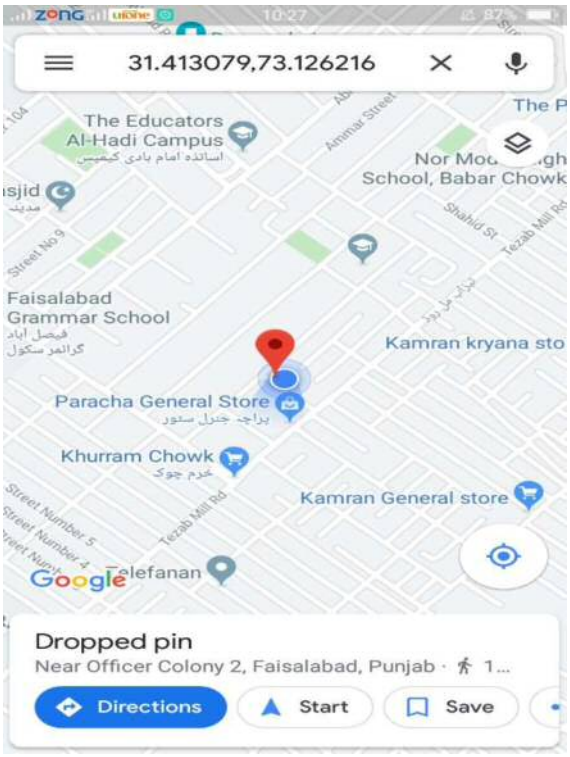
23 4-11-2019(Consumer Comments: Very low pressure)



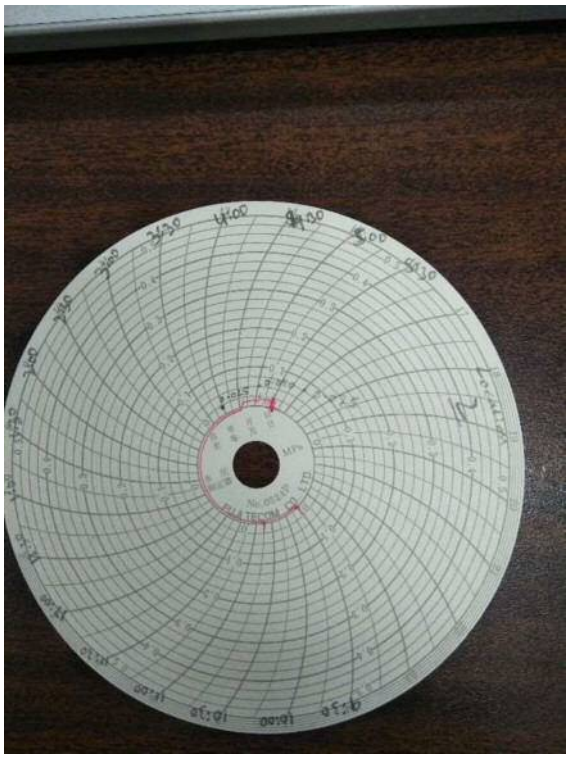


24 6-11-2019(Consumer Comments: Very low pressure)

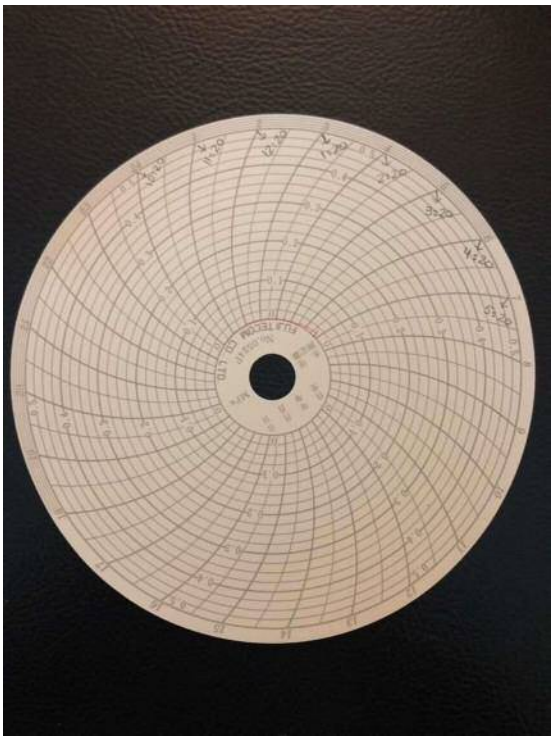


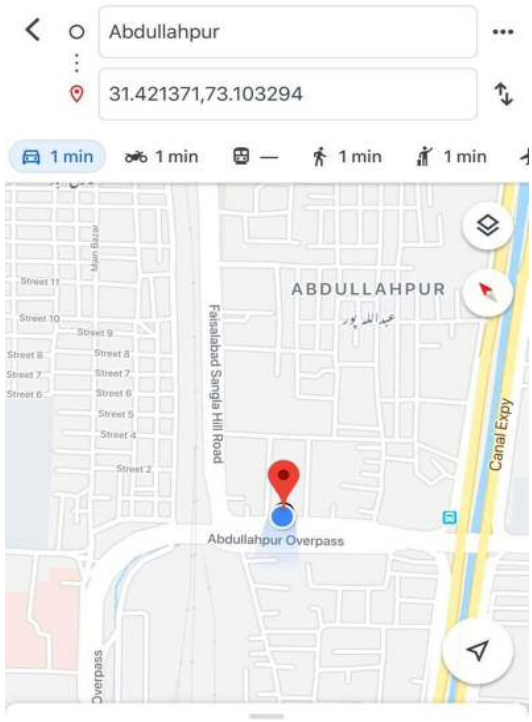


25 22-10-2019(Consumer Comments: Pressure is very low)

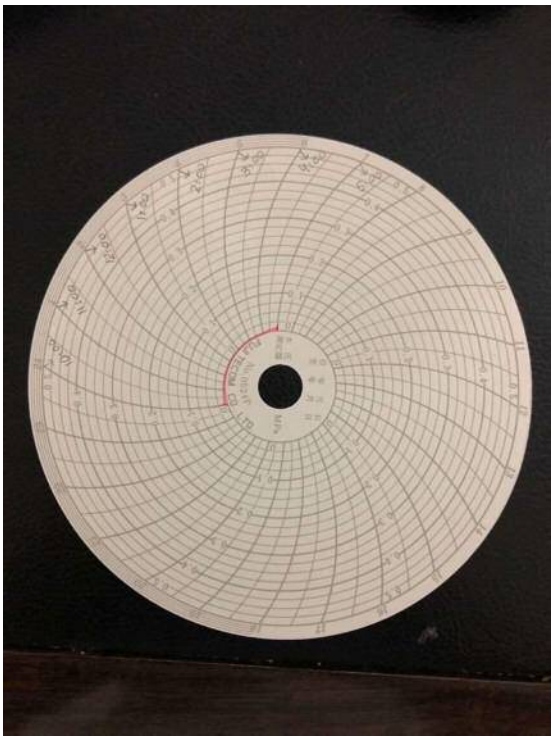


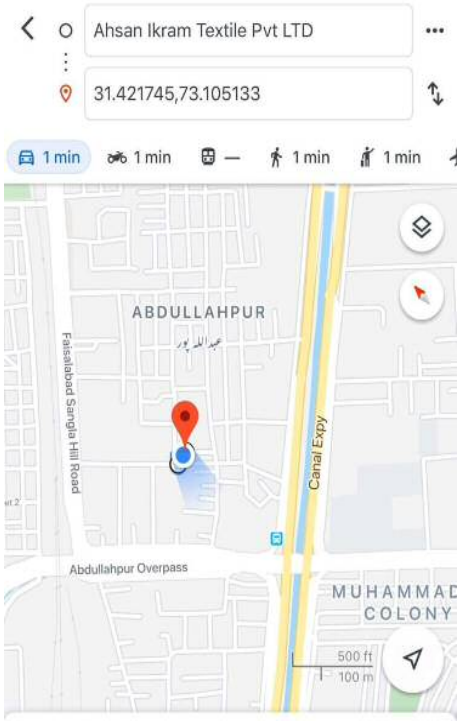
26 3-3-2020 (Consumer Comments: low water pressure, use without motor)

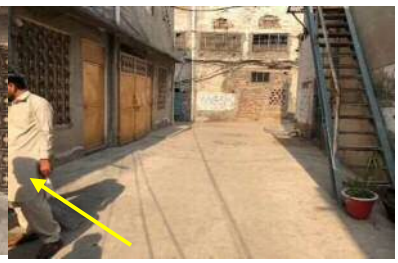




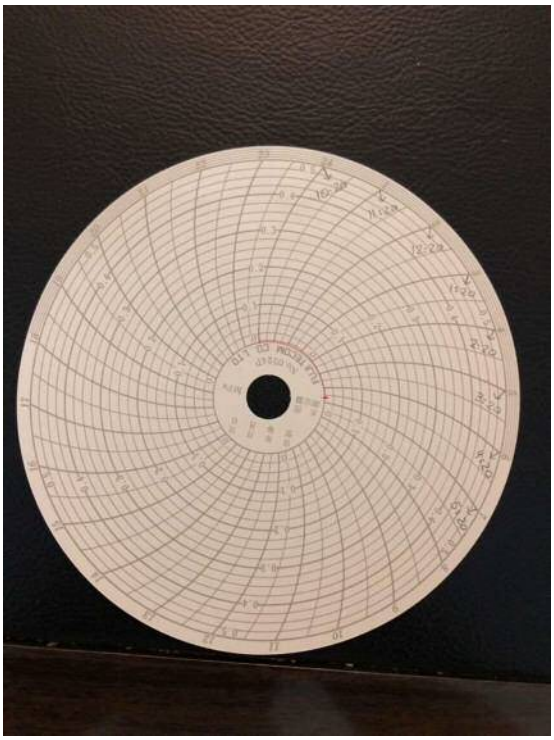
27 2-3-2020 (Consumer Comments: low water pressure, mixing of sewerage water complain)



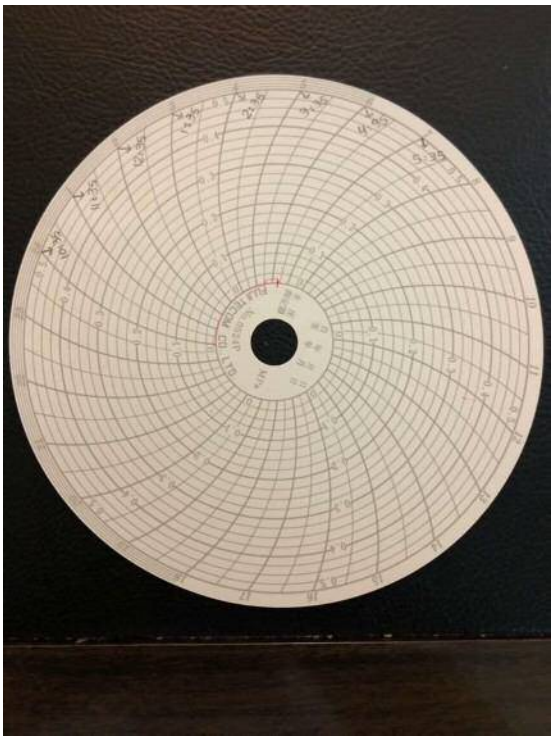


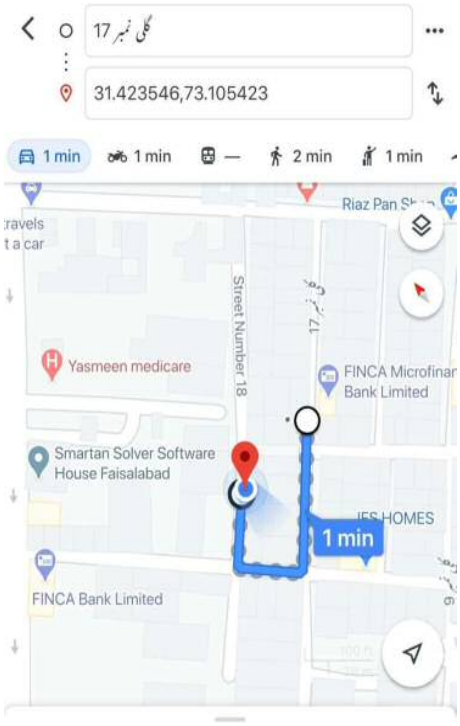


28 27-2-2020 (Consumer Comments: low water pressure, use water by pumping)

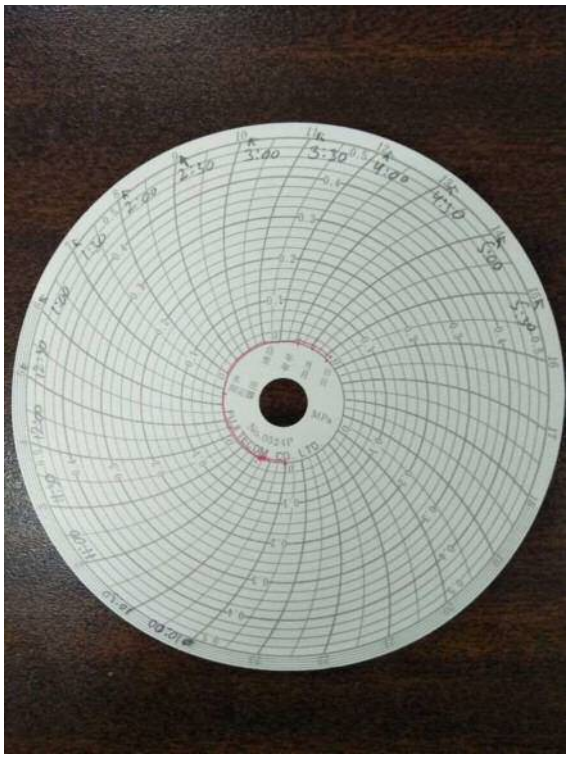


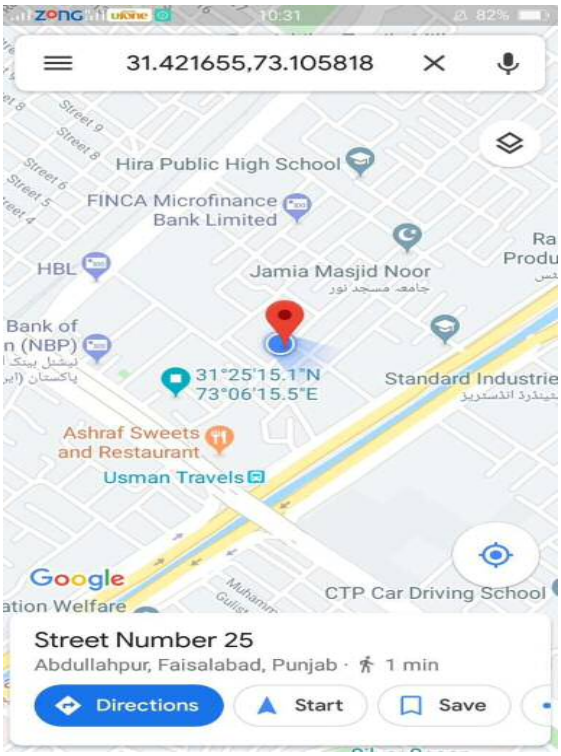
29 26-2-2020 (Consumer Comments: low water pressure, use water by pumping)



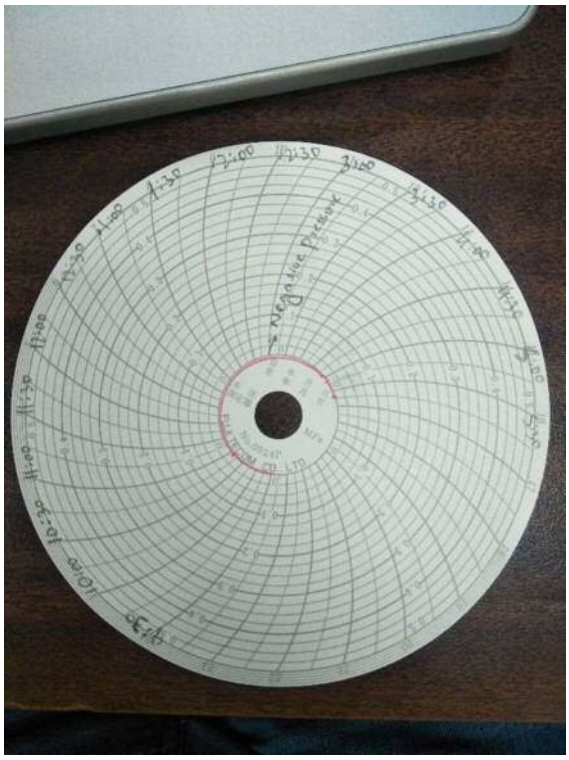


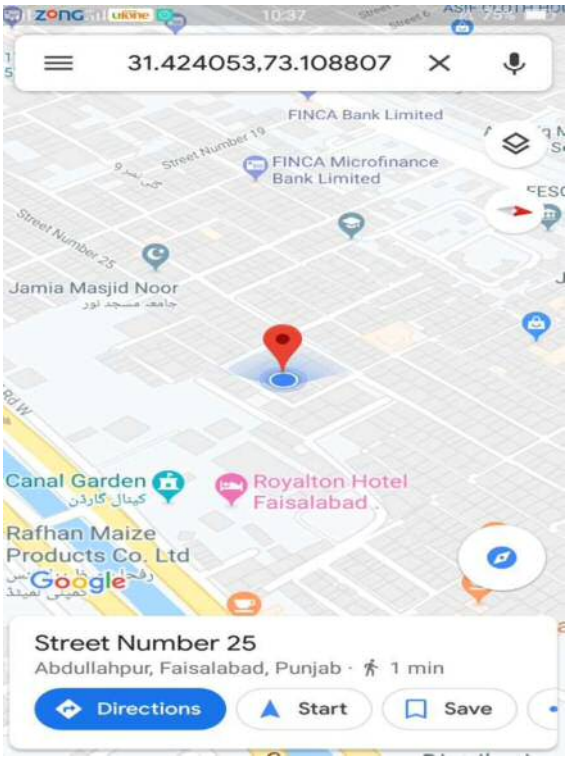
30 24-10-2019(Consumer Comments: Pressure is very low and water quality problem)

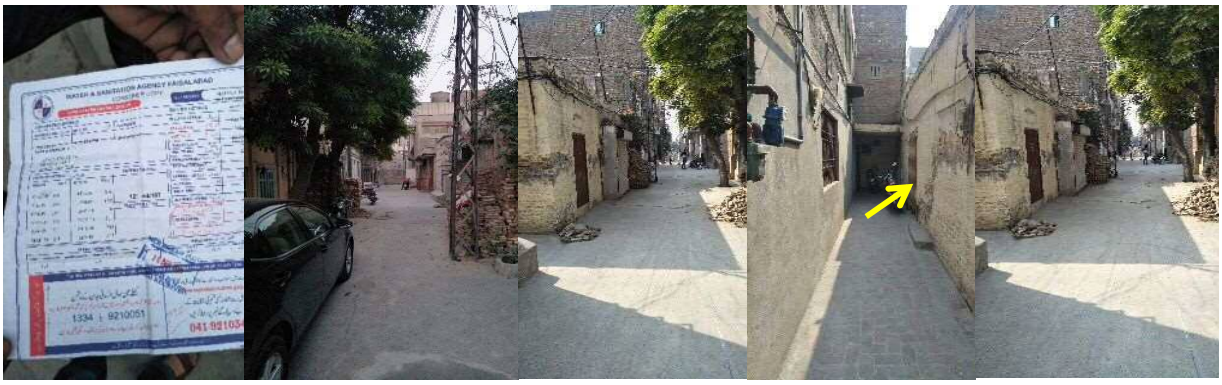




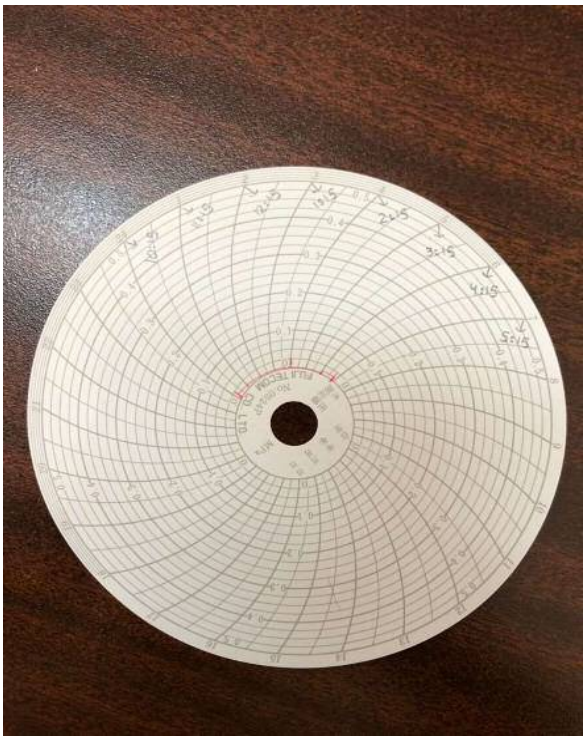
31 29-10-2019(Consumer Comments: water not come whole day)

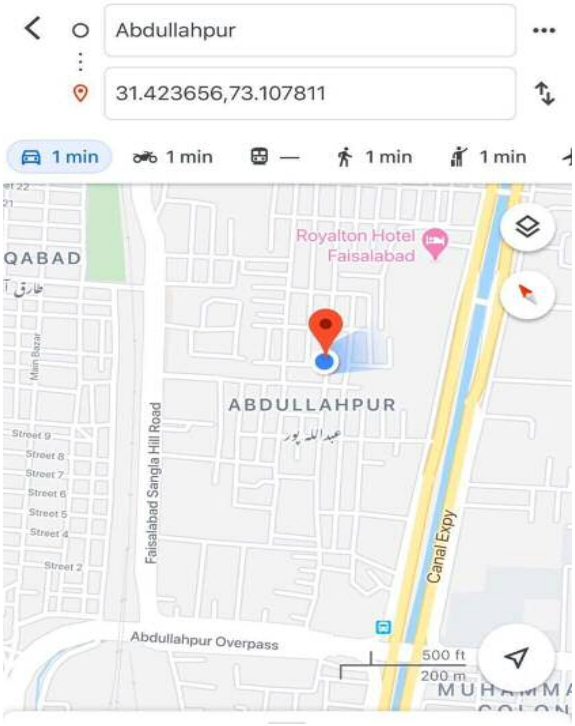




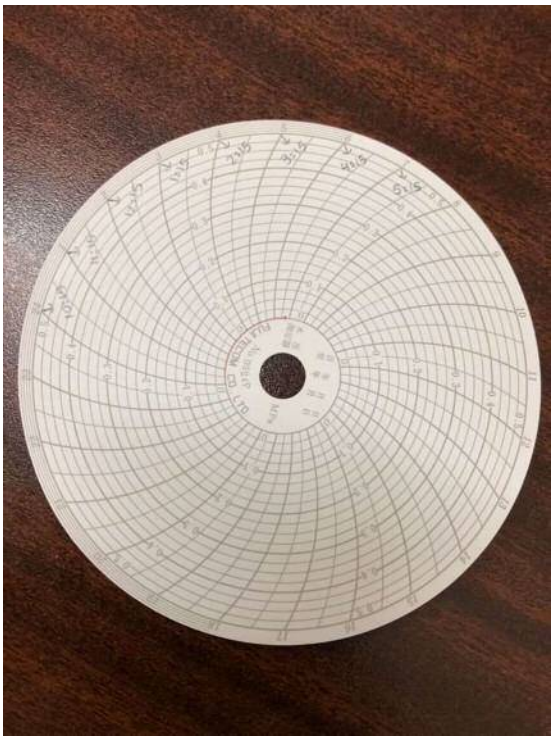


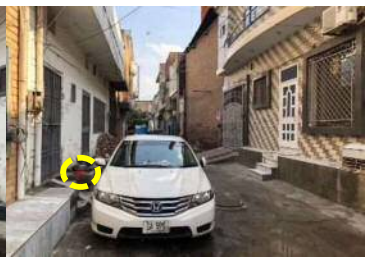
32 9-3-2020 (Consumer Comments: Low water pressure, not used daily due to low pressure)



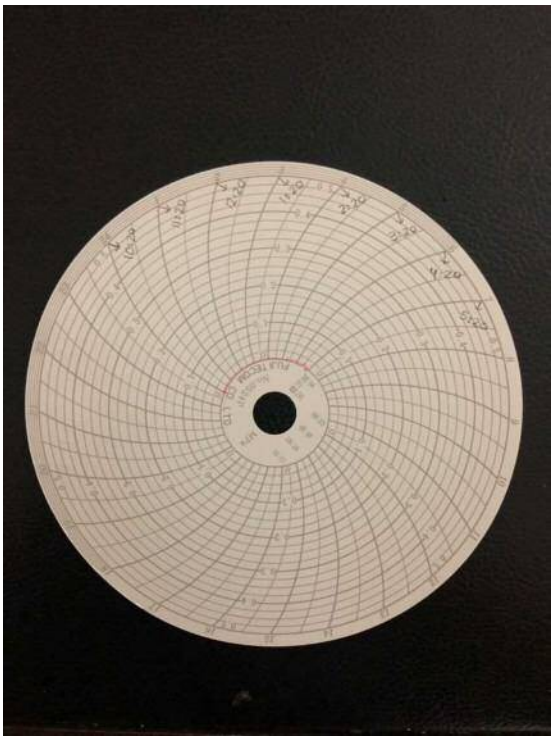


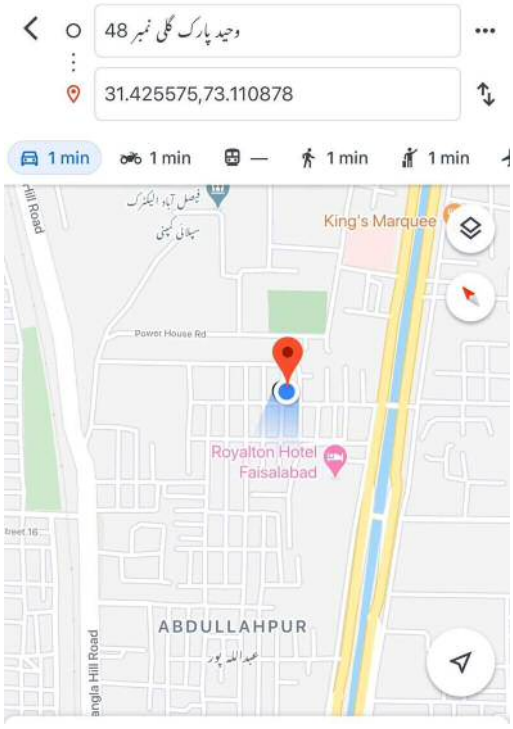
33 5-3-2020 (Consumer Comments: disconnect water connection due to low pressure)



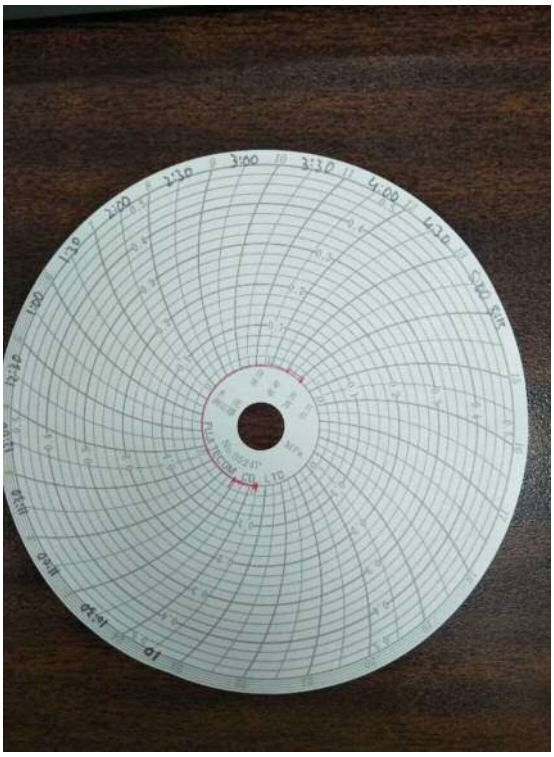


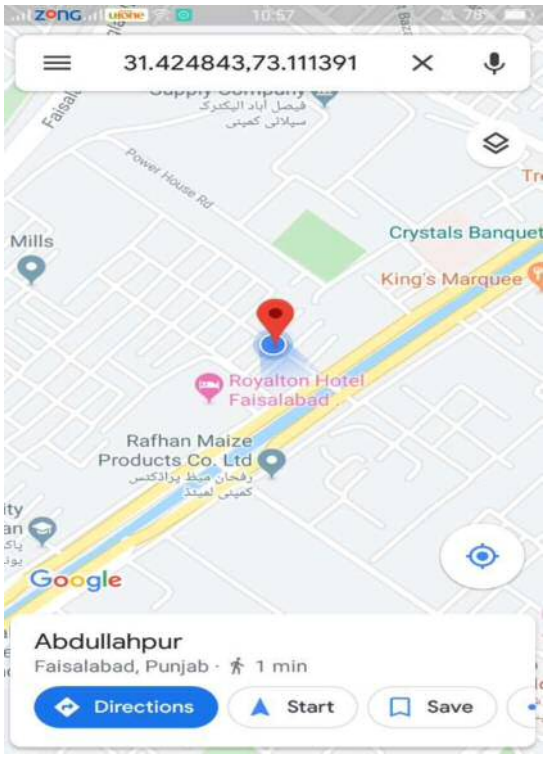
34 4-3-2020 (Consumer Comments: not using water due to low pressure and mixing with sewerage)

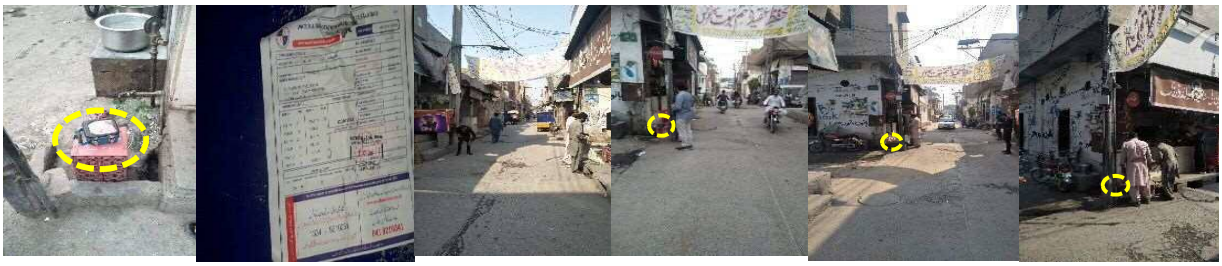




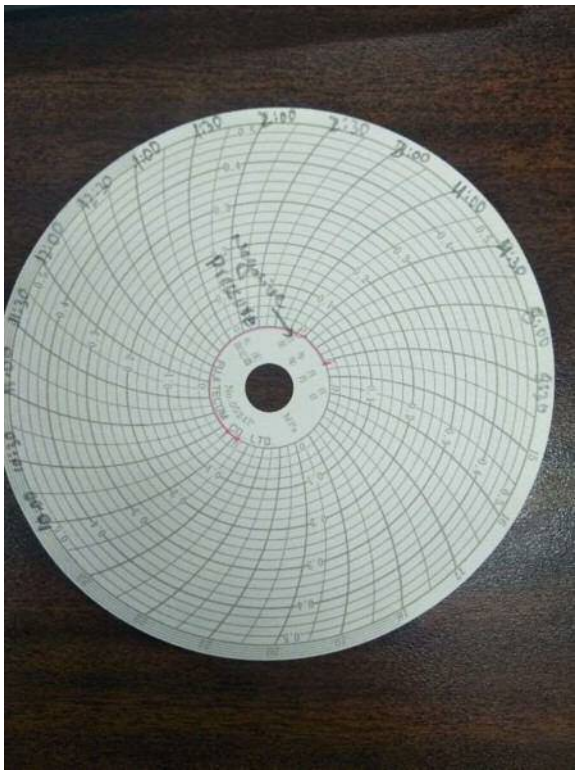
35 31-10-2019(Consumer Comments: Water pressure and water quality problem)

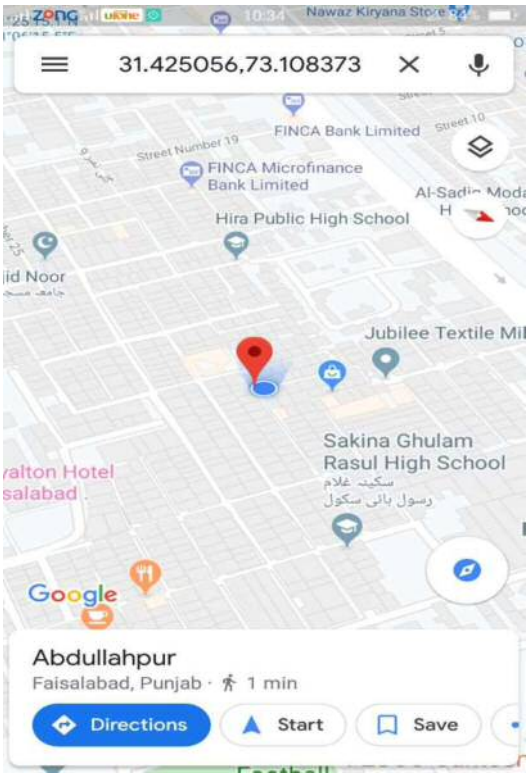




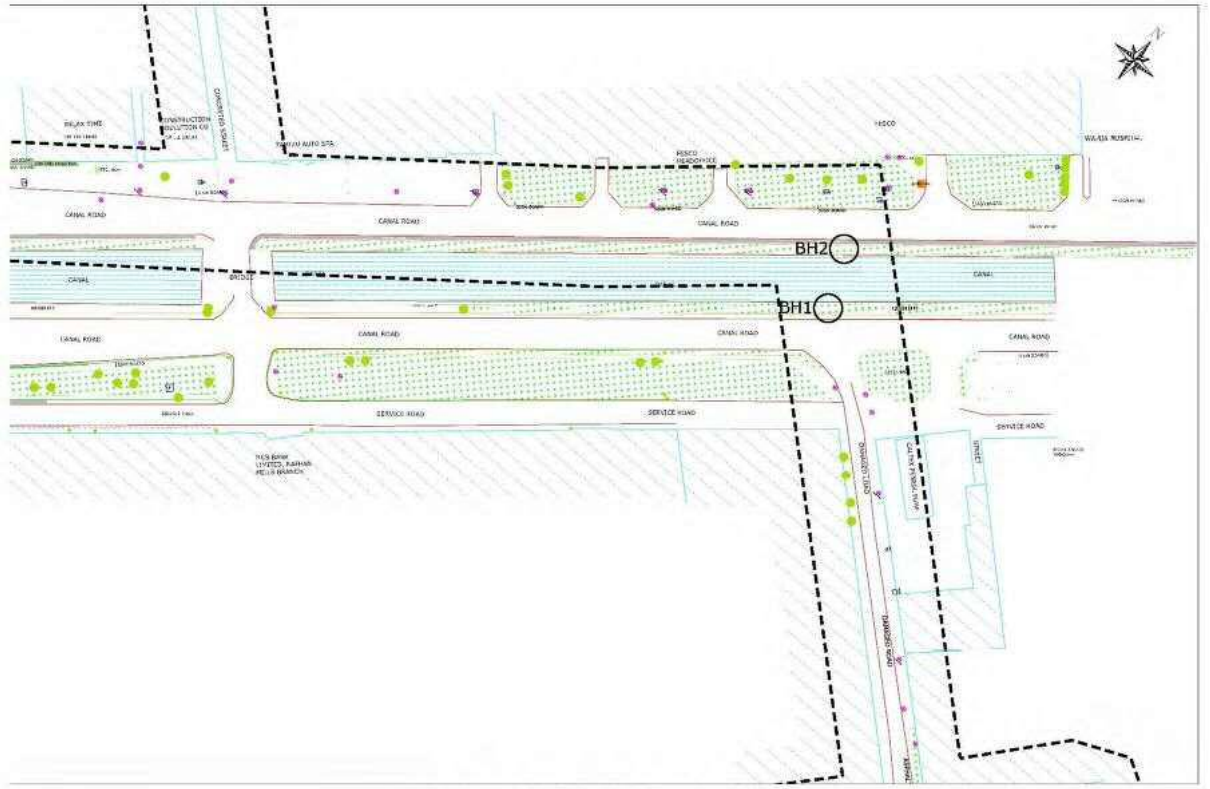


36 5-11-2019(Consumer Comments: Water has zero pressure)

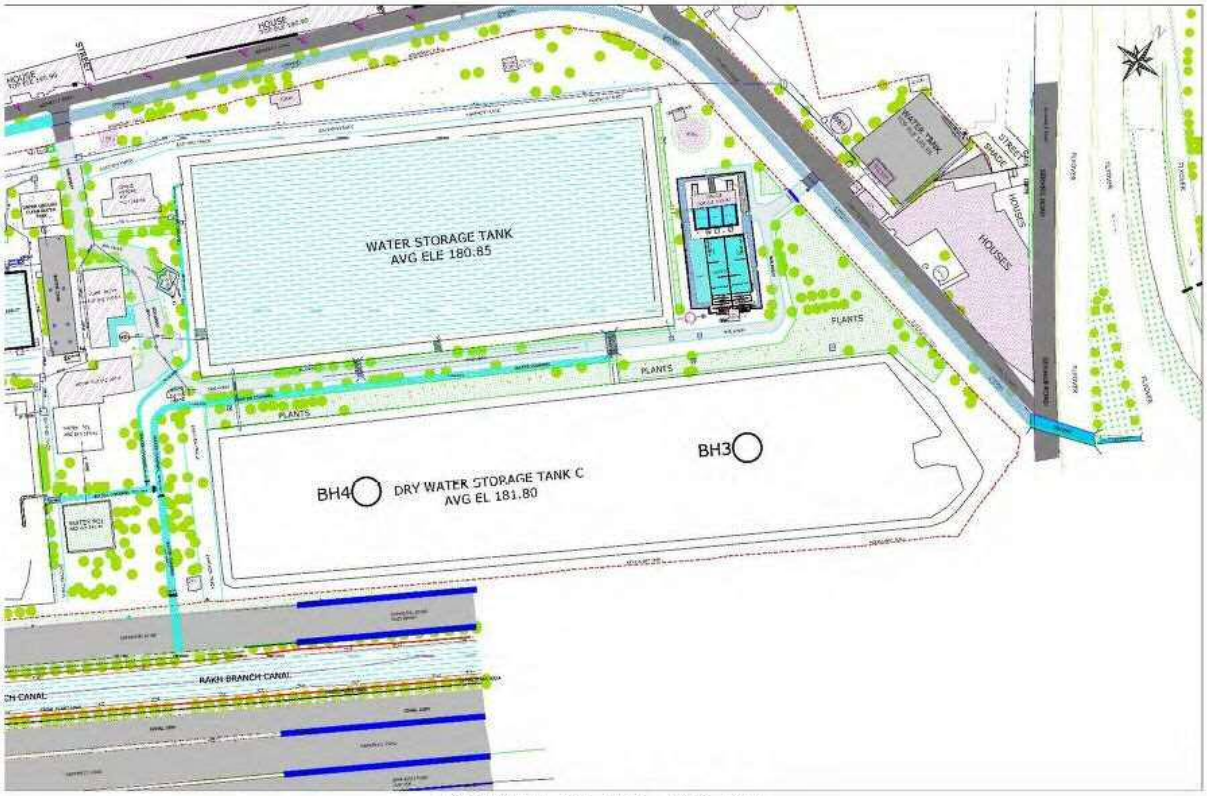




資料7 その他の資料・情報
（2） 地質調査結果



LOCATION OF BH1 AND BH2



LOCATION OF BH3 AND BH4

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	1
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	40 m	SHEET	1 of 4
LOCATION	Rakh Branch Canal, Abdullah Pur,Faisalabad	LOGGED	0.00 to 10.00 m	GROUND LEVEL	186.54 m
		START	15-May-19	WATER LEVEL	0.9 m
TYPE OF BORING	Rotary	FINISH	16-May-19		
		NORTHING	73° 6' 49.95''	EASTING	31° 25' 31.20''

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length(cm)	Recovery CR (%)	Recovery RQD (%)	Consistency	N-VALUE NV	DESCRIPTION	SOIL SYMBOL	REMARKS
1.00	SPT	-			SOFT	2	Sample washed out NB: (1)(1)(1)		
2.00	SPT	55			SOFT	2	(**CL- ML**) Brown to light Brown **SILTY CLAY**, soft, low Plasticity, moist NB: (1)(1)(1)		
3.00	UDS	-	-	-	-	-	-		
4.00	SPT	34			SOFT	3	**(CL- ML)** Brown to light Brown **SILTY CLAY**, soft, low Plasticity, moist NB: (1)(1(2)		
5.00	UDS	-	-	-	-	-	-		
6.00	SPT	34			FIRM	8	**(MC)** Brown to light Brown **CLAYEY SILT**, firm, low Plasticity, moist NB: (2)(3)(5)		
7.00	SPT	32			LOOSE	7	(**SM**) Grey to light Grey, **SILTY SANDS**, medium to fine grained, loose, moist NB: (04)(03)(04)		
8.00	SPT	30			DENSE	37	(**SW**) Grey to light Grey **Medium to Fine SANDS**, dense, moist NB: (16)(17)(20)		
9.00	SPT	35			MEDIUM DENSE	30	(**SW**) Grey to light Grey **Medium to Fine SANDS**, medium dense, moist NB: (12)(15)(15)		
10.00	SPT	30			DENSE	33	**(SW)** Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (12)(16)(17)		

C O N T I N U E N E X T P A G E

Type of Sampling

Standard Penetration Test (SPT)

UDS

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Clayey Silty

CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N-Value	Consistency	N-Value	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV	= N - Value	SW	= Sand	MC	= Clayey Silt
NMC	= Natural Moisture Content	SM	= Silty Sand		
RQD	= Rock Quality Designation	CL-ML	= Silty Clay		
NB	= Number of Blows	ML	= Silt		
UDS	= Undisturbed Sampling	CL	= Clay		

Description of strata is according to ASTM Classification

Prepared by:

Checked by:

Certified by:

Date Issued:

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	1
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	40 m	SHEET	2 of 4
LOCATION	Rakh Branch Canal, Abdullah Pur,Faisalabad	LOGGED	10.00 to 20.00 m	GROUND LEVEL	186.54 m
		START	15-May-19	WATER LEVEL	0.9 m
TYPE OF BORING	Rotary	FINISH	16-May-19		
		NORTHING	73° 6' 49.95''	EASTING	31° 25' 31.20''

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length (cm)	Recovery CR (%)	Recovery RQD (%)	Consistency	N-VALUE NV	DESCRIPTION	SOIL SYMBOL	REMARKS
11.00	SPT	29			MEDIUM DENSE	26	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, medium dense, moist NB: (11)(12)(14)		
12.00	UDS	-	-	-	-	-	-		
13.00	SPT	29			MEDIUM DENSE	30	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, medium dense, moist NB: (09)(13)(17)		
14.00	SPT	26			DENSE	31	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (10)(14)(17)		
15.00	SPT	35			MEDIUM DENSE	13	(**SM**) Grey to light Grey, **Fine grained, SILTY SANDS**, medium dense, moist NB: (08)(06)(07)		
16.00	SPT	29			MEDIUM DENSE	28	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, medium dense, moist NB: (09)(13)(15)		
17.00	UDS	-	-	-	-	-	-		
18.00	SPT	31			MEDIUM DENSE	30	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, medium dense, moist NB: (12)(14)(16)		
19.00	SPT	28			DENSE	36	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, dense, moist NB: (14)(16)(18)		
20.00	SPT	34			MEDIUM DENSE	30	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, medium dense, moist NB: (15)(16)(14)		

C O N T I N U E N E X T P A G E

Type of Sampling

Standard Penetration Test (SPT)

uds

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Silty

CONSISTENCY

COHESIONLESS SOILS N-Value	COHESIONLESS SOILS Consistency	COHESIVE SOILS N-Value	COHESIVE SOILS Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV	= N - Value	SW	= Sand
NMC	= Natural Moisture Content	SM	= Silty Sand
RQD	= Rock Quality Designation	CL-ML	= Silty Clay
NB	= Number of Blows	ML	= Silt
UDS	= Undisturbed Sampling	CL	= Clay

Description of strata is according to ASTM Classification

Prepared by:

Checked by:

Certified by:

Date Issued:

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	1
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	40 m	SHEET	3 of 4
LOCATION	Rakh Branch Canal, Abdullah Pur,Faisalabad	LOGGED	20.00 to 30.00 m	GROUND LEVEL	186.54 m
		START	17-May-19	WATER LEVEL	0.9 m
TYPE OF BORING	Rotary	FINISH	18-May-19		
		NORTHING	73° 6' 49.95"	EASTING	31° 25' 31.20"

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length (cm)	Recovery CR (%)	Recovery RQD (%)	Consistency	N-VALUE NV	DESCRIPTION	SOIL SYMBOL	REMARKS
21.00	SPT	29			DENSE	33	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, dense, moist NB: (14)(16)(17)		
22.00	UDS	-	-	-	-	-	-		
23.00	SPT	31			DENSE	36	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, dense, moist NB: (17)(17)(19)		
24.00	SPT	42			DENSE	38	(**SW),** Grey to light Grey, **Medium to Fine SANDS**, medium dense, moist, **(CL)** Brown to light Brown **CLAY** of few centimeter NB: (20)(21)(17)		
25.00	SPT	39			DENSE	49	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (23)(24)(25)		
26.00	SPT	31			DENSE	46	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (22)(22)(24)		
27.00	UDS	-	-	-	-	-	-		
28.00	SPT	28			VERY DENSE	48	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, very dense, moist NB: (21)(23)(25)		
29.00	SPT	24			VERY DENSE	50	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, very dense, moist NB: (23)(24)(26)		
30.00	SPT	26			VERY DENSE	45	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, very dense, moist NB: (23)(24)(21)		

C O N T I N U E N E X T P A G E

Type of Sampling

- Standard Penetration Test (SPT)
- UDS

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Silty

CONSISTENCY

COHESIONLESS SOILS N-Value	COHESIONLESS SOILS Consistency	COHESIVE SOILS N-Value	COHESIVE SOILS Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV	= N - Value	SW	= Sand
NMC	= Natural Moisture Content	SM	= Silty Sand
RQD	= Rock Quality Designation	CL-ML	= Silty Clay
NB	= Number of Blows	ML	= Silt
UDS	= Undisturbed Sampling	CL	= Clay

Description of strata is according to ASTM Classification

Prepared by:
Checked by:
Certified by:
Date Issued:

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	1
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	40 m	SHEET	4 of 4
LOCATION	Rakh Branch Canal, Abdullah Pur,Faisalabad	LOGGED	30.00 to 40.00 m	GROUND LEVEL	186.54 m
		START	17-May-19	WATER LEVEL	0.9 m
TYPE OF BORING	Rotary	FINISH	18-May-19		
		NORTHING	73° 6' 49.95''	EASTING	31° 25' 31.20''

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length (cm)	Recovery CR (%)	Recovery RQD (%)	Consistency	N-VALUE (NV)	DESCRIPTION	SOIL SYMBOL	REMARKS
31.00	SPT	35			DENSE	46	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, dense, moist NB: (21)(23)(23)		
32.00	UDS	-	-	-	-	-	-		
33.00	SPT	27			DENSE	47	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, dense, moist NB: (04)(22)(25)		
34.00	SPT	26			VERY DENSE	51	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (22)(25)(26)		
35.00	SPT	25			VERY DENSE	55	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (23)(27)(28)		
36.00	SPT	40			VERY DENSE	R	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (35) (R)		
37.00	SPT	29			VERY DENSE	57	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (12)(29)(28)		
38.00	SPT	31			VERY DENSE	67	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (30)(31)(36)		
39.00	SPT	28			VERY DENSE	79	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (35)(38)(41)		
40.00	SPT	26			VERY DENSE	84	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (35)(41)(43)		

C O N T I N U E N E X T P A G E

Type of Sampling

Standard Penetration Test (SPT)

UDS

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Silty

CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N-Value	Consistency	N-Value	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV	= N - Value	SW	= Sand
NMC	= Natural Moisture Content	SM	= Silty Sand
RQD	= Rock Quality Designation	CL-ML	= Silty Clay
NB	= Number of Blows	ML	= Silt
UDS	= Undisturbed Sampling	CL	= Clay

Description of strata is according to ASTM Classification

Prepared by:

Checked by:

Certified by:

Date Issued:

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	2
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	40 m	SHEET	1 of 4
LOCATION	Rakh Branch Canal, Abdullah Pur,Faisalabad	LOGGED	0.00 to 10.00 m	GROUND LEVEL	
		START	17-May-19	WATER LEVEL	7 m
TYPE OF BORING	Rotary	FINISH	18-May-19		
		NORTHING	73° 6' 48.96"	EASTING	31° 25' 31.35"

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length(cm)	Recovery CR (%)	Recovery RQD (%)	Consistency	N-VALUE	DESCRIPTION	SOIL SYMBOL	REMARKS
1.00	SPT	16			SOFT	3	(**CL**) Brown to light Brown **CLAY**, soft, lowly Plastic, moist NB: (1)(1)(2)		
2.00	SPT	20			SOFT	2	(**CL**) Brown to light Brown **CLAY**, soft, lowly Plastic, moist NB: (1)(1)(1)		
3.00	UDS	-	-	-	-	-	-		
4.00	SPT	30			FIRM	7	(**CL-ML**) Brown to light Brown **Silty CLAY**, firm, lowly Plastic, moist NB: (3)(3(4)		
5.00	UDS	-	-	-	-	-	-		
6.00	SPT	27			STIFF	14	(**CL-ML**) Grey to light Grey **Silty CLAY**, stiff, lowly Plastic, moist NB: (5)(7)(7)		
7.00	SPT	32			MEDIUM DENSE	26	(**SM**) Grey to light Grey, **Silty SANDS**, medium dense, moist NB: (06)(11)(15)		
8.00	SPT	36			DENSE	31	(**SW**) Grey to light Grey **Medium to Fine SANDS**, dense, moist NB: (12)(14)(17)		
9.00	SPT	32			DENSE	33	(**SW**) Grey to light Grey **Fine SANDS**,dense, moist NB: (12)(16)(17)		
10.00	SPT	25			MEDIUM DENSE	30	(**SW**) Grey to light Grey **Fine SANDS**, dense, moist NB: (11)(15)(15)		

N-VALUE scale: NV 0 10 20 30 40 50 60 70 80

C O N T I N U E N E X T P A G E

Type of Sampling

- Standard Penetration Test (SPT)
- UDS

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Silty

CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N-Value	Consistency	N-Value	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV	= N - Value	SW	= Sand
NMC	= Natural Moisture Content	SM	= Silty Sand
RQD	= Rock Quality Designation	CL-ML	= Silty Clay
NB	= Number of Blows	ML	= Silt
UDS	= Undisturbed Sampling	CL	= Clay

Description of strata is according to ASTM Classification

Prepared by:
Checked by:
Certified by:
Date Issued:

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	2
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	40 m	SHEET	2 of 4
LOCATION	Rakh Branch Canal, Abdullah Pur,Faisalabad	LOGGED	10.00 to 20.00 m	GROUND LEVEL	
		START	17-May-19	WATER LEVEL	7 m
TYPE OF BORING	Rotary	FINISH	18-May-19		
		NORTHING	73° 6' 48.96"	EASTING	31° 25' 31.35"

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length (cm)	CR (%)	RQD (%)	Consistency	N-VALUE NV	DESCRIPTION	SOIL SYMBOL	REMARKS
11.00	SPT	29			MEDIUM DENSE	28	(**SW**) Grey to light Grey , **Fine SANDS**, medium dense, moist NB: (11)(13)(15)		
12.00	UDS	-	-	-	-	-	-		
13.00	SPT	26			DENSE	41	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, dense, moist NB: (04)(19)(22)		
14.00	SPT	30			MEDIUM DENSE	28	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, medium dense, moist NB: (11)(13)(15)		
15.00	SPT	29			DENSE	32	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (13)(15)(17)		
16.00	SPT	27			DENSE	33	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (15)(10)(17)		
17.00	UDS	-	-	-	-	-	-		
18.00	SPT	32			DENSE	32	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (13)(15)(17)		
19.00	SPT	28			DENSE	36	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, dense, moist NB: (14)(17)(19)		
20.00	SPT	32			MEDIUM DENSE	34	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (10)(18)(16)		

C O N T I N U E N E X T P A G E

Type of Sampling

Standard Penetration Test (SPT)

uds

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Silty

CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N-Value	Consistency	N-Value	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV	= N - Value	SW	= Sand
NMC	= Natural Moisture Content	SM	= Silty Sand
RQD	= Rock Quality Designation	CL-ML	= Silty Clay
NB	= Number of Blows	ML	= Silt
UDS	= Undisturbed Sampling	CL	= Clay

Description of strata is according to ASTM Classification

Prepared by:

Checked by:

Certified by:

Date Issued:

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	2
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	40 m	SHEET	3 of 4
LOCATION	Rakh Branch Canal, Abdullah Pur,Faisalabad	LOGGED	20.00 to 30.00 m	GROUND LEVEL	
		START	17-May-19	WATER LEVEL	7 m
TYPE OF BORING	Rotary	FINISH	18-May-19		
		NORTHING	73° 6' 48.96"	EASTING	31° 25' 31.35"

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length (cm)	Recovery CR (%)	Recovery RQD (%)	Consistency	N-VALUE (NV)	DESCRIPTION	SOIL SYMBOL	REMARKS
21.00	SPT	26			DENSE	37	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, dense, moist NB: (15)(18)(19)		
22.00	UDS								
23.00	SPT	31			DENSE	38	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, dense, moist NB: (16)(18)(20)		
24.00	SPT	29			DENSE	41	(**SW**), Grey to light Grey, **Medium to Fine SANDS**, medium dense, moist, (**CL**) Brown to light Brown **CLAY** of few centimeter NB: (18)(19)(22)		
25.00	SPT	35			DENSE	46	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (20)(22)(24)		
26.00	SPT	31			DENSE	49	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, dense, moist NB: (22)(23)(26)		
27.00	UDS								
28.00	SPT	26			VERY DENSE	53	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, very dense, moist NB: (24)(26)(27)		
29.00	SPT	33			VERY DENSE	56	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, very dense, moist NB: (25)(27)(29)		
30.00	SPT	27			VERY DENSE	62	(**SW**) Grey to light Grey, **Medium to Fine SANDS**, very dense, moist NB: (27)(30)(32)		

C O N T I N U E N E X T P A G E

Type of Sampling

- Standard Penetration Test (SPT)
- UDS

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Silty

CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N-Value	Consistency	N-Value	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV	= N - Value	SW	= Sand
NMC	= Natural Moisture Content	SM	= Silty Sand
RQD	= Rock Quality Designation	CL-ML	= Silty Clay
NB	= Number of Blows	ML	= Silt
UDS	= Undisturbed Sampling	CL	= Clay

Description of strata is according to ASTM Classification

Prepared by:

Checked by:

Certified by:

Date Issued:

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	2
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	40 m	SHEET	4 of 4
LOCATION	Rakh Branch Canal, Abdullah Pur,Faisalabad	LOGGED	30.00 to 40.00 m	GROUND LEVEL	
		START	17-May-19	WATER LEVEL	7 m
TYPE OF BORING	Rotary	FINISH	18-May-19		
		NORTHING	73° 6' 48.96''	EASTING	31° 25' 31.35''

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length (cm)	Recovery CR (%)	Recovery RQD (%)	Consistency	N-VALUE (NV)	DESCRIPTION	SOIL SYMBOL	REMARKS
31.00	SPT	29			VERY DENSE	61	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (26)(29)(32)		
32.00	SPT	32				63	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (26)(30)(33)		
33.00	SPT	29			VERY DENSE	56	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (20)(27)(29)		
34.00	SPT	29			VERY DENSE	58	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (22)(27)(31)		
35.00	SPT	26			VERY DENSE	67	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (29)(32)(35)		
36.00	UDS	-	-	-	-	-	-		
37.00	SPT	29				55	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (25)(26)(29)		
38.00	SPT	26			VERY DENSE	56	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (16)(27)(29)		
39.00	SPT	31			VERY DENSE	66	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (8)(32)(34)		
40.00	SPT	27			VERY DENSE	73	(**SW**) Grey to light Grey , **Medium to Fine SANDS**, very dense, moist NB: (29)(35)(38)		

C O N T I N U E N E X T P A G E

Type of Sampling

Standard Penetration Test (SPT)

UDS

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Silty

CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N-Value	Consistency	N-Value	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV	= N - Value	SW	= Sand
NMC	= Natural Moisture Content	SM	= Silty Sand
RQD	= Rock Quality Designation	CL-ML	= Silty Clay
NB	= Number of Blows	ML	= Silt
UDS	= Undisturbed Sampling	CL	= Clay

Description of strata is according to ASTM Classification

Prepared by:

Checked by:

Certified by:

Date Issued:

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	3
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	5 m	SHEET	1 of 1
LOCATION	Old Jhal Khanuana Water Treatment Plant	LOGGED	0.00 to 5.00 m	GROUND LEVEL	181.25 m
		START	19-May-19	WATER LEVEL	-
TYPE OF BORING	Rotary	FINISH	19-May-19		
		NORTHING	73° 5' 32.87"	EASTING	31° 24' 36.78"

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length(cm)	Recovery CR (%)	Recovery RQD (%)	Consistency	N-VALUE (NV 0 10 20 30 40 50 60 70 80)	DESCRIPTION	SOIL SYMBOL	REMARKS
1.00	SPT	28			MEDIUM DENSE	18	(**SM**) Grey to light Grey, **Fine to very Fine grained, SILTY SANDS**, medium dense NB: (05)(08)(10)		
2.00	SPT	-	-	-	-	-			
3.00	UDS	30			MEDIUM DENSE	21	(**SM**) Grey to light Grey, **Fine to very Fine grained, SILTY SANDS**, medium dense NB: (08)(09)(12)		
4.00	SPT	-	-	-	-	-			
5.00	UDS	26			MEDIUM DENSE	29	(**SW**) Grey to light Grey, **Fine to very Fine grained, SANDS**, medium dense NB: (09)(14)(15)		

Type of Sampling

Standard Penetration Test (SPT)

UDS

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Clayey Silty

CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N-Value	Consistency	N-Value	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV = N - Value
NMC = Natural Moisture Content
RQD = Rock Quality Designation
NB = Number of Blows
UDS = Undisturbed Sampling

SW = Sand
SM = Silty Sand
CL-ML = Silty Clay
ML = Silt
CL = Clay
MC = Clayey Silt

Prepared by:
Checked by:
Certified by:
Date Issued:

Description of strata is according to ASTM Classification

FINITE ENGINEERING (PVT) LIMITED				BOREHOLE NO.	4
PROJECT	Improvement of Water Treatment Plant and Water Distribution System, Faisalabad				
		TOTAL DEPTH	5 m	SHEET	1 of 1
LOCATION	Old Jhal Khanuana Water Treatment Plant	LOGGED	0.00 to 5.00 m	GROUND LEVEL	180.95 m
		START	19-May-19	WATER LEVEL	-
TYPE OF BORING	Rotary	FINISH	19-May-19		
		NORTHING	73° 5' 29.46''	EASTING	31° 24' 34.78''

PRELIMINARY BORING LOG

DEPTH (m)	TYPE OF SAMPLING	Recovery Length (cm)	Recovery CR (%)	Recovery RQD (%)	Consistency	N-VALUE NV	DESCRIPTION	SOIL SYMBOL	REMARKS
1.00	SPT	27			MEDIUM DENSE	14	(**SM**) Grey to light Grey, **Fine to very Fine grained, SILTY SANDS**, medium dense NB: (04)(07)(07)		
2.00	SPT	-	-	-	-	-			
3.00	UDS	28			MEDIUM DENSE	26	(**SM**) Grey to light Grey, **Fine to very Fine grained, SILTY SANDS**, medium dense NB: (08)(12)(14)		
4.00	UDS	-	-	-	-	-			
5.00	SPT	35			MEDIUM DENSE	30	(**SW**) Grey to light Grey, **Fine to very Fine grained, SANDS**, medium dense NB: (10)(14)(16)		

N-VALUE scale: 0 10 20 30 40 50 60 70 80

Type of Sampling

- Standard Penetration Test (SPT)
- UDS

- Sand
- Silty Sand
- Clay
- Silty Clay
- Silt
- Clayey Silty

CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N-Value	Consistency	N-Value	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

NV	= N - Value	SW	= Sand	MC	= Clayey Silt
NMC	= Natural Moisture Content	SM	= Silty Sand		
RQD	= Rock Quality Designation	CL-ML	= Silty Clay		
NB	= Number of Blows	ML	= Silt		
UDS	= Undisturbed Sampling	CL	= Clay		

Description of strata is according to ASTM Classification

Prepared by:

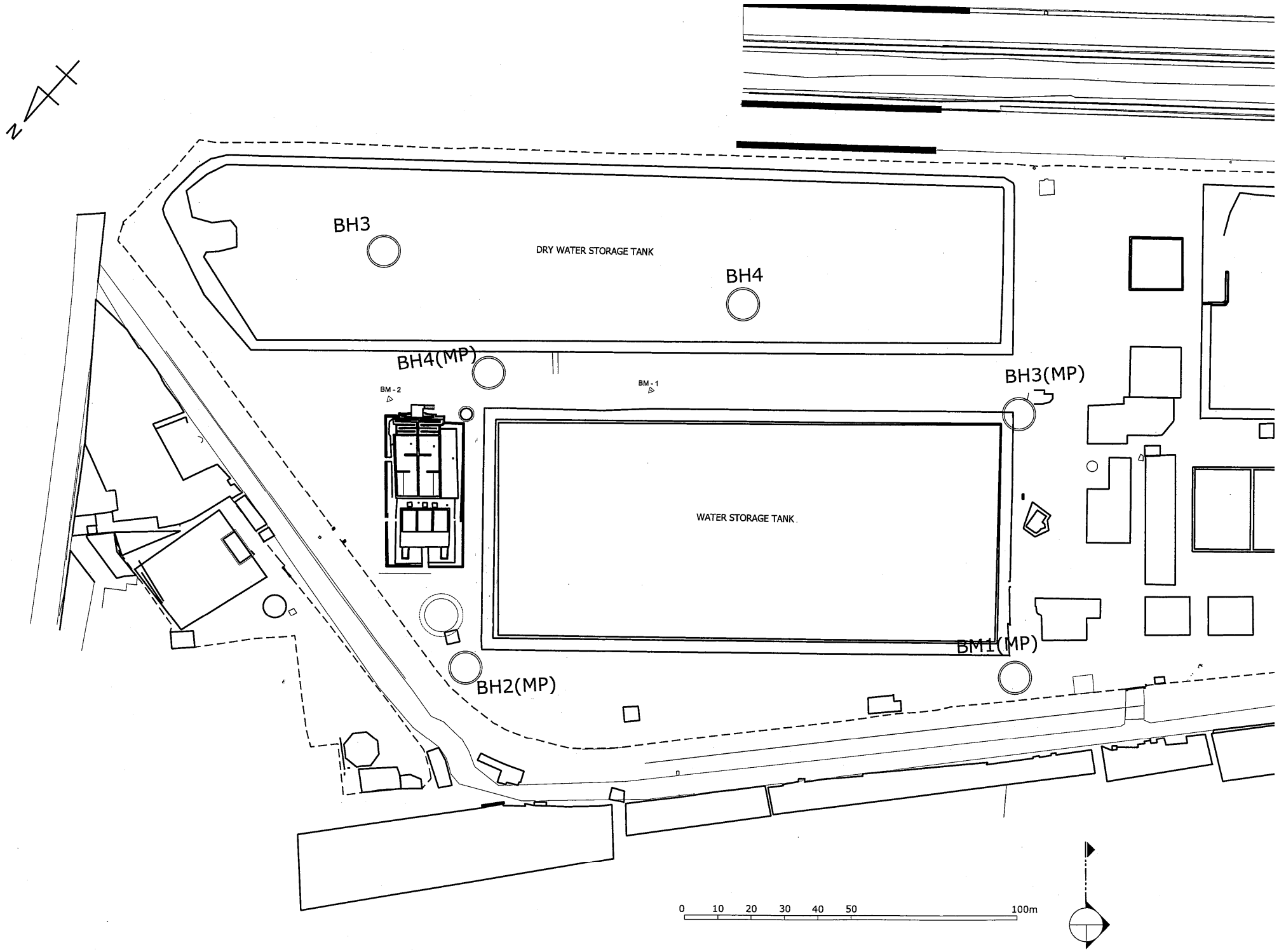
Checked by:

Certified by:

Date Issued:

Table 6: *Summary of Laboratory Results*

BH No.	Depth (m)	Sample	NMC (%)	Specific G_s	Bulk (kN/m³)	Particle Size Distribution			Particle Size Distribution			Direct Share Test	
						Gravel (%)	Sand (%)	Silt & Clay (%)	L.L (%)	P.L (%)	P.I	Cohesion (kPa)	Angle of internal Friction
BH-1	1	1 (DS)	19.3	2.68	-	0	11	89	-	-	-	-	-
	3	29 (UDS)	27.3	2.67	19.3	0	9	91	29	20	9	-	-
	5	30 (UDS)	22	2.68	20	0	10	90	27	20	7	-	-
	10	2 (DS)	14	2.65	-	0	96	4	-	-	-	-	-
	12	15 (UDS)	-	-	17.3	-	-	-	-	-	-	1.4	29
	17	16 (UDS)	-	-	17.9	-	-	-	-	-	-	0.8	30
	20	3 (DS)	10.6	2.66	-	0	97	3	-	-	-	-	-
	22	17 (UDS)	-	-	16.7	-	-	-	-	-	-	1	31
	27	18 (UDS)	-	-	18.1	-	-	-	-	-	-	0.9	32
	32	19 (UDS)	-	-	17.2	-	-	-	-	-	-	1.1	32
	40	4 (DS)	28.3	2.67	-	0	97	3	-	-	-	-	-
BH-2	1	5 (DS)	17.3	2.68	-	26	23	51	-	-	-	-	-
	3	31 (UDS)	17	2.67	18.4	0	12	88	25	20	5	-	-
	5	32 (UDS)	14.1	2.69	19.6	12	7	81	28	20	8	-	-
	10	6 (DS)	13.6	2.67	-	0	96	4	-	-	-	-	-
	12	20 (UDS)	-	-	17.3	-	-	-	-	-	-	0.4	29
	17	21 (UDS)	-	-	16.2	-	-	-	-	-	-	0.8	30
	20	7 (DS)	22.7	2.65	-	0	97	3	-	-	-	-	-
	22	22 (UDS)	-	-	17.6	-	-	-	-	-	-	1.1	32
	27	23 (UDS)	-	-	16.6	-	-	-	-	-	-	0.4	32
	36	24 (UDS)	-	-	16.9	-	-	-	-	-	-	1.2	33
	40	8 (DS)	20.1	2.66	-	12	68	20	-	-	-	-	-
BH-3	1	9 (DS)	4.7	2.69	-	0	93	7	-	-	-	-	-
	2	25 (UDS)	-	-	16	-	-	-	-	-	-	1.8	27
	3	10 (DS)	5.8	2.65	-	0	89	11	-	-	-	-	-
	4	26 (UDS)	-	-	16.6	-	-	-	-	-	-	1.6	29
	5	11 (DS)	4.8	2.66	-	0	93	7	-	-	-	-	-
BH-4	1	12 (DS)	10.1	2.67	-	0	92	8	-	-	-	-	-
	2	27 (UDS)	-	-	16.1	-	-	-	-	-	-	1.6	28
	3	13 (DS)	6.1	2.66	-	0	95	5	-	-	-	-	-
	4	86 (UDS)	-	-	16.1	-	-	-	-	-	-	1.4	29
	5	14 (DS)	4.7	2.67	-	1	92	7	-	-	-	-	-


N
BH3
DRY WATER STORAGE TANK
BH4
BH4(MP)
BM - 2
BM - 1
BH3(MP)
WATER STORAGE TANK
BM1(MP)
BH2(MP)
0 10 20 30 40 50 100m

App 7(2)-13

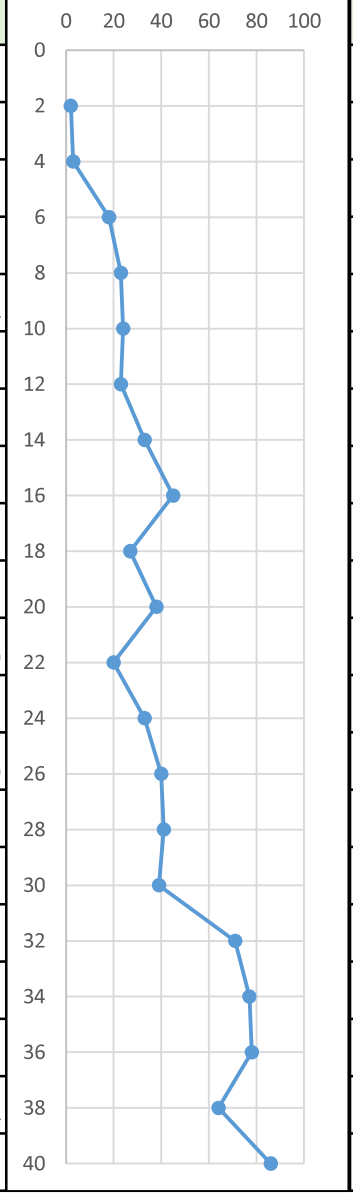
ECOS Ltd.; GEOTECHNICAL SERVICES

BORE HOLE LOG

Location: WTP- Jhal	Project: WASA Master Plan
Bore Hole No.: 01	Fig No.
Type of Boring: Rotary	Date Started: 30-11-17
Termination Depth: 40 m	Date Completed: 02-12-17
Ground Water Table: 3 m	Logger: Umer

Depth(m)	Sample Description	Classification Symbol	Legend	Sample Type	Moisture	Penetration Values 150 mm	150 mm	150 mm	N-Values	Recovery SPT (cm)	CR %	RQD %	Remarks
2	clay	CL		DS		1	1	1	2	29			
4	Silty clay	CL-ML		DS		1	1	2	3	27			
6	Silty sand	SM		DS		5	9	9	18	30			
8	Fine graind sand	SW		DS		8	11	12	23	23			
10	do	SW		DS		8	10	14	24	36			
12	do	SW		DS		9	11	12	23	33			
14	do	SW		DS		10	14	19	33	34			
16	do	SW		DS		18	22	23	45	36			
18	do	SW		DS		10	12	15	27	40			
20	do	SW		DS		17	20	18	38	38			
22	do	SW		DS		12	10	10	20	40			
24	do	SW		DS		12	12	21	33	40			
26	Silty clay	CL-ML		DS		9	13	27	40	25			
28	Silty sand	SM		DS		10	14	27	41	30			
30	Medium graind sand	SW		DS		11	19	20	39				
32	do	SW		DS		11	26	45	71	27			
34	do	SW		DS		13	27	50	77	35			
36	Med-course sand	SW		DS		14	28	50	78	28			
38	do	SW		DS		20	26	38	64				
40	do	SW		DS		30	36	50	86				

N- Profile



Checked By: _____

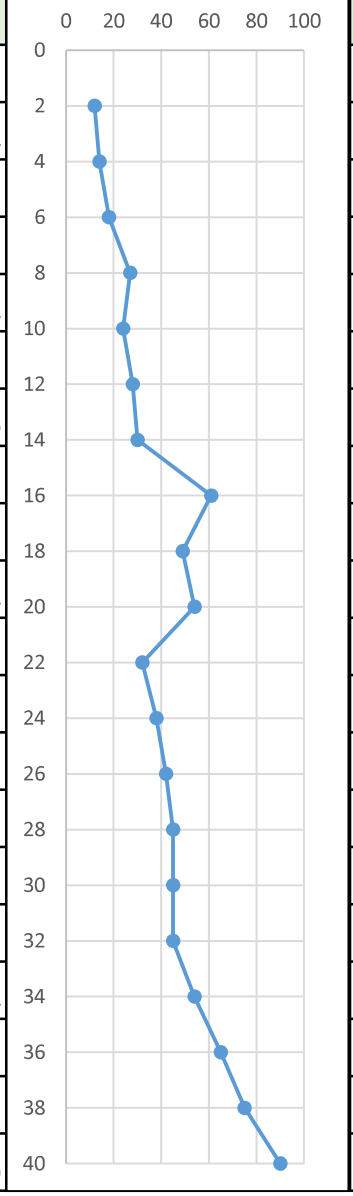
ECOS Ltd.; GEOTECHNICAL SERVICES

BORE HOLE LOG

Location: WTP- Jhal	Project: WASA Master Plan
Bore Hole No.: 02	Fig No.
Type of Boring: Rotary	Date Started: 03-12-2017
Termination Depth: 40 m	Date Completed: 04-12-17
Ground Water Table: 10 m	Logger: Umer

Depth(m)	Sample Description	Classification Symbol	Legend	Sample Type	Moisture	Penetration Values 150 mm	150 mm	150 mm	N-Values	Recovery SPT (cm)	CR %	RQD %	Remarks
2	clay	CL		DS		5	5	7	12	39			
4	Silty clay	CL-ML		DS		5	6	8	14	33			
6	Silty sand	SM		DS		6	7	11	18	36			
8	Fine graind sand	SW		DS		8	13	14	27	30			
10	do	SW		DS		9	11	13	24	29			
12	do	SW		DS		9	11	16	28	30			
14	do	SW		DS		10	14	16	30	31			
16	do	SW		DS		25	30	31	61	35			
18	do	SW		DS		20	24	25	49	34			
20	do	SW		DS		17	25	29	54	30			
22	do	SW		DS		15	16	16	32	22			
24	do	SW		DS		16	18	20	38	25			
26	do	SW		DS		8	17	25	42	32			
28	Clay	CL		DS		15	14	31	45	27			
30	Medium graind sand	SW		DS		16	19	26	45	39			
32	do	SW		DS		18	21	24	45	28			
34	do	SW		DS		22	26	28	54	38			
36	Med-course sand	SW		DS		25	30	35	65	28			
38	do	SW		DS		30	45	40	75	25			
40	do	SW		DS		40	40	50	90	14			

N- Profile



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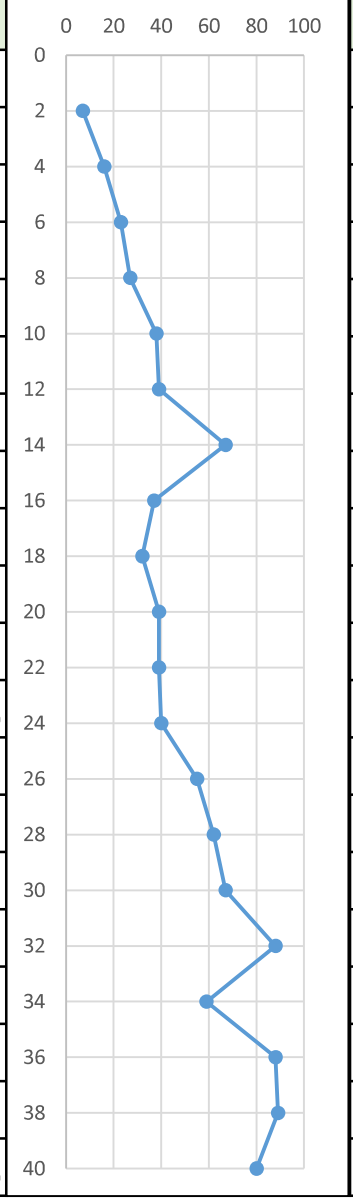
BORE HOLE LOG

Location: WTP- Jhal	Project: WASA Master Plan
Bore Hole No.: 03	Fig No.
Type of Boring: Rotary	Date Started: 05-12-2017
Termination Depth: 40 m	Date Completed: 06-12-2017
Ground Water Table: 20.6 m	Logger: Umer

Depth(m)	Sample Description	Classification Symbol	Legend	Sample Type	Moisture	Penetration Values 150 mm	150 mm	150 mm	N-Values	Recovery SPT (cm)	CR %	RQD %	Remarks
2	clay	CL		DS		2	3	4	7	30			
4	Silty Sand	SM		DS		2	6	10	16	20			
6	Silty sand	SM		DS		8	11	12	23	32			
8	Fine graind sand	SW		DS		10	12	15	27	29			
10	do	SW		DS		12	18	20	38	27			
12	do	SW		DS		12	17	22	39	29			
14	do	SW		DS		22	32	35	67	35			
16	do	SW		DS		17	17	29	37	35			
18	do	SW		DS		11	14	18	32	32			
20	do	SW		DS		22	26	23	39	32			
22	do	SW		DS		15	18	21	39	32			
24	do	SW		DS		15	19	21	40	30			
26	do	SW		DS		15	20	35	55	28			
28	Silty sand	SM		DS		23	30	32	62	35			
30	Medium graind sand	SW		DS		19	29	38	67	33			
32	do	SW		DS		14	38	50	88	30			
34	do	SW		DS		20	29	30	59	32			
36	Med-course sand	SW		DS		11	36	50	88	40			
38	do	SW		DS		20	39	50	89	35			
40	do	SW		DS		12	30	50	80	38			

N- Profile



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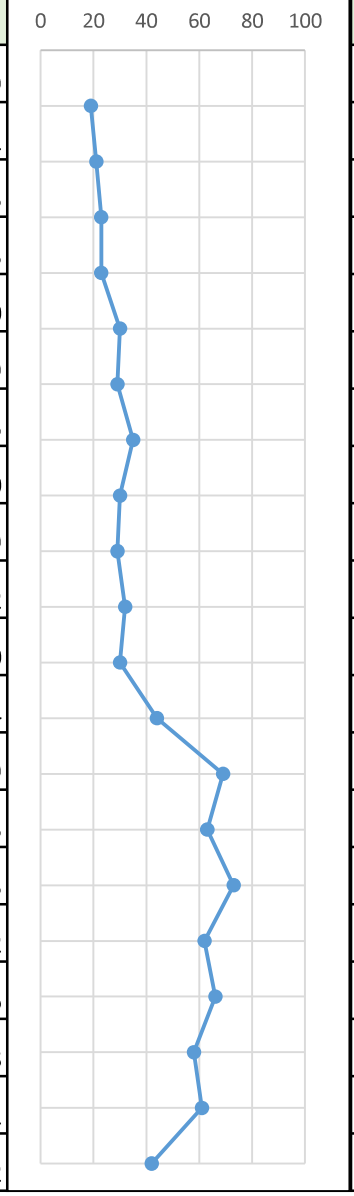
BORE HOLE LOG

Location: WTP- Jhal	Project: WASA Master Plan
Bore Hole No.: 04	Fig No.
Type of Boring: Rotary	Date Started: 07-12-2017
Termination Depth: 40 m	Date Completed: 08-12-17
Ground Water Table: 20.60 m	Logger: Umer

Depth(m)	Sample Description	Classification Symbol	Legend	Sample Type	Moisture	Penetration Values 150 mm	150 mm	150 mm	N-Values	N- Profile	Recovery SPT (cm)	CR %	RQD %	Remarks
2	clay	CL		DS		4	9	10	19		35			
4	Silty clay	CL		DS		5	9	12	21		39			
6	Silty sand	SM		DS		10	10	13	23		33			
8	Fine graind sand	SW		DS		7	11	12	23		30			
10	do	SW		DS		9	14	16	30		33			
12	do	SW		DS		11	14	15	29		33			
14	do	SW		DS		9	16	19	35		28			
16	do	SW		DS		13	15	15	30		34			
18	do	SW		DS		11	13	16	29		38			
20	do	SW		DS		17	17	15	32		28			
22	do	SW		DS		11	14	16	30		32			
24	do	SW		DS		18	21	23	44		35			
26	Silty clay	CL		DS		10	35	34	69		31			
28	Silty sand	SM		DS		24	27	36	63		32			
30	Medium graind sand	SW		DS		25	34	39	73		28			
32	do	SW		DS		11	27	35	62		25			
34	do	SW		DS		25	29	37	66		33			
36	Med-course sand	SW		DS		27	30	28	58		25			
38	do	SW		DS		25	30	31	61		33			
40	do	SW		DS		19	18	24	42		34			



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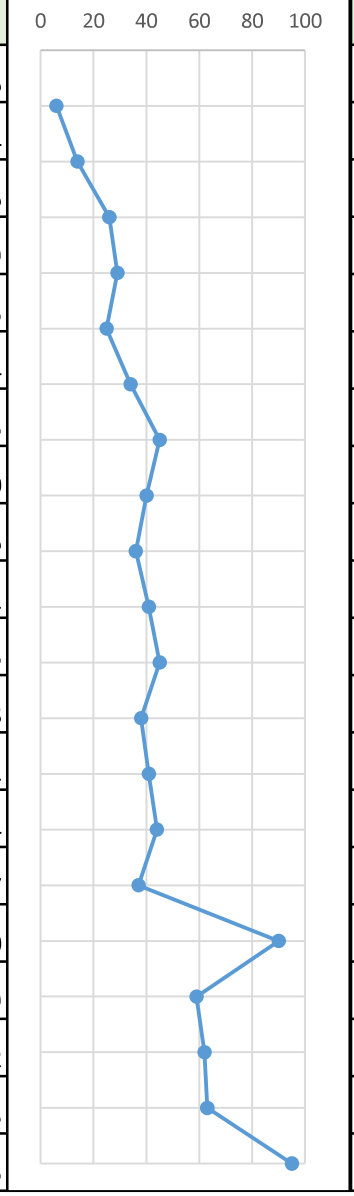
BORE HOLE LOG

Location: Abdullah Pur OHR	Project: WASA Master Plan
Bore Hole No.: 05	Fig No.
Type of Boring: Rotary	Date Started: 10-12-2017
Termination Depth: 40 m	Date Completed: 11-12-2017
Ground Water Table: 19 m	Logger: Umer

Depth(m)	Sample Description	Classification Symbol	Legend	Sample Type	Moisture	Penetration Values 150 mm	150 mm	150 mm	N-Values	N- Profile	Recovery SPT (cm)	CR %	RQD %	Remarks
2	Silty clay	CL-ML		DS		3	2	4	6		30			
4	Silty Sand	SM		DS		5	6	8	14		34			
6	Silty sand	SM		DS		8	12	14	26		32			
8	Fine graind sand	SW		DS		10	13	16	29		34			
10	do	SW		DS		11	13	12	25		30			
12	do	SW		DS		13	15	19	34		29			
14	do	SW		DS		20	22	23	45		30			
16	Claye Silt	ML		DS		16	19	21	40		35			
18	Fine graind sand	SW		DS		10	17	19	36		35			
20	do	SW		DS		7	14	27	41		33			
22	do	SW		DS		9	15	30	45		22			
24	do	SW		DS		14	22	16	38		38			
26	Silty clay	CL-ML		DS		4	15	26	41		25			
28	Silty sand	SM		DS		18	20	24	44		34			
30	Medium graind sand	SW		DS		14	15	22	37		29			
32	do	SW		DS		13	40	50	90		25			
34	do	SW		DS		10	20	39	59		29			
36	Med-course sand	SW		DS		12	33	29	62		32			
38	do	SW		DS		19	26	33	63		28			
40	do	SW		DS		30	45	50	95		32			



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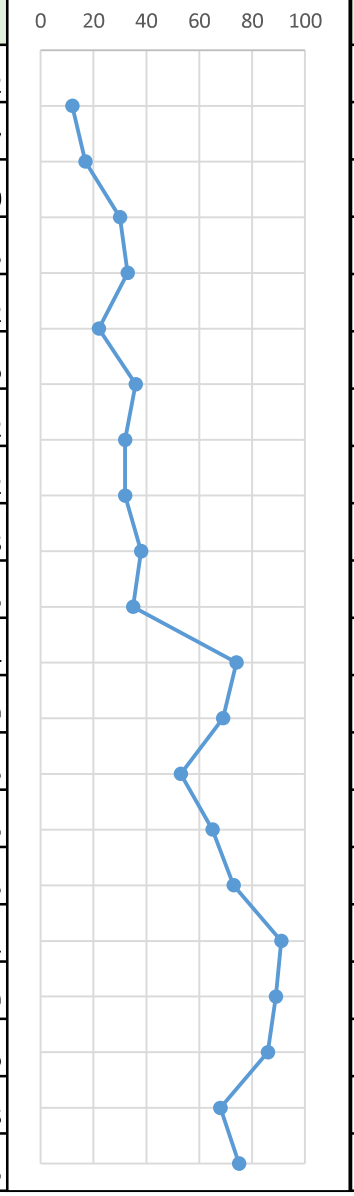
BORE HOLE LOG

Location: Madina Town OHR NO.2	Project: WASA Master Plan
Bore Hole No.: 06	Fig No.
Type of Boring: Rotary	Date Started: 13-12-2017
Termination Depth: 40 m	Date Completed: 14-12-2017
Ground Water Table: 17	Logger: Umer

Depth(m)	Sample Description	Classification Symbol	Legend	Sample Type	Moisture	Penetration Values 150 mm	150 mm	150 mm	N-Values	N- Profile	Recovery SPT (cm)	CR %	RQD %	Remarks
2	clay	CL		DS		4	5	7	12		25			
4	Clayey Silt	ML		DS		5	7	10	17		30			
6	Silty sand	SM		DS		11	14	16	30		35			
8	Silty sand	SM		DS		10	16	17	33		22			
10	Fine graind sand	SW		DS		9	10	12	22		31			
12	do	SW		DS		15	15	21	36		33			
14	do	SW		DS		11	14	18	32		28			
16	do	SW		DS		15	10	22	32		30			
18	do	SW		DS		15	17	21	38		30			
20	do	SW		DS		13	17	18	35		28			
22	do	SW		DS		9	29	45	74		27			
24	do	SW		DS		22	34	35	69		33			
26	do	SW		DS		12	18	35	53		27			
28	do	SW		DS		18	28	37	65		27			
30	Medium graind sand	SW		DS		20	31	42	73		35			
32	do	SW		DS		30	41	50	91		35			
34	do	SW		DS		29	42	47	89		48			
36	Med-course sand	SW		DS		30	37	49	86		28			
38	do	SW		DS		30	33	35	68		26			
40	do	SW		DS		32	35	40	75		22			



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University of Engineering & Technology, Lahore
Department of Civil Engineering
Geotechnical Engineering Laboratory

SUMMARY OF THE TEST RESULTS

Project: Geotechnical Investigation for WASA Master Plan, Faisalabad

Client: M/S ECOS Ltd

BH/ TP No.	Sample No	Depth (m)	NMC (%)	Bulk Density (kN/m^3)	Specific Gravity G_s
BH-01	1 (UDS)	1	21.68	19.21	2.7
	2 (UDS)	7	25.05	18.64	2.67
	3 (UDS)	14	17.96	14.55	2.65
	4 (UDS)	19	18.27	16.08	2.67
	5 (UDS)	25	24.24	20.55	2.65
	6 (UDS)	30	23.88	15.74	2.66
	7 (UDS)	35	25.17	13.48	2.69
	8 (UDS)	40	17.67	15.90	2.68
BH-02	9 (UDS)	3	9.61	20.48	2.7
	10 (UDS)	7	7.50	18.93	2.67
	11 (UDS)	15	7.32	16.97	2.67
	12 (UDS)	20	4.32	16.31	2.66
	13 (UDS)	25	17.34	19.79	2.65
	14 (UDS)	30	27.66	18.30	2.67
	15 (UDS)	35	14.41	12.48	2.67
	16 (UDS)	40	19.27	18.44	2.65

App 7(2)-20

Prepared by:

Geotech. Engg. Lab. Director Civil

Checked by: