WASA

LAHORE

Questionnaire

Water Supply Business

For WASA Lahore

Japan International Corporation Agency

Table of Contents

Questionnaire on the Water Supply Business
Questionnaire 1: Information of WASA in Punjab Province

1. City information 都市の情報

1-1. Name of water supply organization that performs water supply service 水道事業者名称

Water and Sanitation Agency, Lahore Development Authority, Lahore

1-2. Name of city that performs water supply service 水道事業を行う都市の名称

Lahore, Punjab, Pakistan

1-3. Population of water service area (person in Million) 給水都市の人口(人)

2011	2012	2013	2014
5.47 [illegible]	5.61 [illegible]	5.75 [illegible]	5.89 [illegible]

2015 = 6.5

1-4. City area (km^2) 都市の面積(km^2)

Total area	Water supply area
1772 km^2	350 km^2

1-5. Number of service connection (number of water meter) 給水(契約)戸数(戸、水道メータ数)

2011	2012	2013	2015
590,185	609,318	619,532	636,338

1-6. Population served by water supply as percentage of total population (%) 水道普及率(%)

2011	2012	2014	2015
89	[illegible]	89.23	90.1

2. Water resource / Water treatment 水源／浄水

2-1. Water resource (m^3/day) 水源(m^3/日)

Surface (River / Dam)	Groundwater	Seawater	Other
N/A	435 MGD	N/A	N/A

2-2. Method of water intaken 取水方式

Ground Water from Tube wells

2-3. Number and capacity of Water Treatment Plant (number, m^3) 浄水場数と処理能力(箇所、m^3)

Number of WTP	Total capacity (m^3/day)
N/A	N/A m^3/day

No.	WTP Name	Built year	Capacity	Treatment volume (average)
	N/A		m^3/day	m^3/day

2-4. Name and dosing rate of coagulant (mg/L) 凝集剤名称および注入率(mg/L)

Name of coagulant	Dosing rate of coagulant (mg/L)
N/A	mg/L

2-5. Type of sedimentation and filtration 沈殿・ろ過の種類

Type of sedimentation	N/A
Type of filtration	N/A

2-6. Filtration speed rate (m/day) ろ過速度(m/day)

Slow sand filter	Rapid sand filter
N/A	N/A

2-7. Name and dosing rate of disinfection (mg/L) 消毒剤名称および注入率(mg/L)

Name of disinfection	Dosing rate of disinfection (ppm)
Sodium Hypo-Chloride Solution	0.1 - 0.2 ppm

2-8. Number and capacity of distribution reservoir (number, m^3) 配水池数と容量(箇所、m^3)

Number	Total capacity (m)	Minimum reservoir (m^3)	Maximum reservoir (m^3)
4	1,000,000 Gallons	250,000 Gallons	250,000 Gallons

2-9. Production cost of water treatment (PHP/m^3) 造水コスト(PHP/m^3)

PHP/m^3	USD/m^3
N/A	N/A

Price of Sodium Hypo-chloride is Rs. 28,679/metric ton

2-10. Number of items of water quality inspection (number) 水質検査項目数(数)

Everyday	Every week	Every month	Every year
30 samples/day			

2-11. Hour of water suspension and supply turbidity water(times, hour/year)断水・濁水時間(時間/年)

	Number of times	Total hours
Water suspension	N/A	N/A
Supply turbidity water	N/A	N/A

2-12. Describe the problem about water treatment 浄水処理の問題点の記述

Problem in disinfection system due to unavailability of appropriate chlorinators.

3. Organization 組織体制

3-1. Total number of KCWN staff member (person) 職員数(人)

2011	2012-13	2013 – 14 (All Staff)	2014 – 15 (All Staff)
N/D	5,737	5,655	6,562

3-2. Total number of engineer staff member (person) 技術職員数(人)

2011	2012	2013	2014-15
N/D	N/D	N/D	146

3-3. Proportion of staff member according to staff's age (%) 職員年齢構成(%)

10's – 20's	30's	40's	50's –
N/D %	N/D %	N/D %	N/D %

3-4. Proportion of staff member's business experience of water supply (%) 職員経験年数構成（%）

– 5 years	5 – 10 years	10 – 20 years	20 – 30 years	30 years –
N/D %	N/D %	N/D %	N/D %	N/D %

3-5. Hour of staff's training (times/person, hour/year/person) 職員研修時間(回／人、時間／人)

	Inner training (exclude OJT)		Outsourcing	
	Times/person	Total hour/person	Times/person	Total hour/person
Engineer	N/D	N/D	N/D	N/D
Exclude engineer	N/D	N/D	N/D	N/D

4. Water tariff 水道料金

4-1. Price and consumption of domestic and commercial use (PHP, m^3, average per month)

家事・業務用水道料金・使用水量(PHP/m^3：平均額)

	Price	Average Consumption
Domestic and Commercial	Rs. 364/Connection	Detailed Data is available
Commercial use	Rs. 1035/ Connection	Detailed Data is available

4-2. Collection frequency (month) 水道料金徴収間隔(月)

Rs. 267.599M (Aug'15) Rs. 187.496M(Jul'15)

4-3. Collection rate of water charge (%) 水道料金徴収率(%)

Domestic use & Commercial use
65% regularly paying, 20% irregularly paying

Domestic and commercial data regarding collection rate is jointly calculated but it can be calculated separately, if required.

4-4. Describe/Attach the water tariff table 水道料金表の記載

Tariff Attached (Annexure – 1)

Remarks:

Money exchange rate: 1 US Dollar (USD) = ______ Pakistani rupee (PKR) on April 2015

If no data, answer is "N/D", else if no answer or non-applicable, answer is "N/A".

Note: N/D or No Data means information is available but data has to be calculated or extracted.

N/A means Not Applicable or Not exists so far.

Questionnaire on the Water Supply Business
Questionnaire 2: Leakage Prevention Work of WASA

1. Organization 組織

1-1. Name of organization for leakage prevention 漏水対策を担当する組織名称

Leak Detection Cell (LDC) Water and Sanitation Agency, Lahore Development Authority, Lahore

1-2. Number of person in organization (person) 漏水対策を担当する組織の人員数(人)

2011	2012	2013	2014
10	11	10	11

1-3. Annual training time for leakage prevention (person, person x hours)

漏水対策に関する年間研修時間(人×時間)

	2013	2014
Person	N/D	N/D
Person X Hours	N/D	N/D

2. Leakage Detection 漏水調査

2-1. Number of leakage survey team (number) 調査チーム数(数)

2011	2012	2013	2014
48	48	52	52

2-2. Number of person in one survey team (person) 1チーム当りの人数(人)

3 (Pipe Fitter = 1, Assistant Pipe Fitter = 2)

2-3. Number of days of leakage survey (person x days / year) 年間漏水調査日数(人×日／年)

2011	2012	2013	2014
56	56	62	62

2-4. Number of hours of average leakage survey (person x hours / month) 調査平均時間(人×時間／月)

9.6

2-5. Length of leakage survey (km / year) 年間漏水調査延長(km／年)

2011	2012	2013	2014
11.10 km	11.20 km	9.50 km	9.10 km

2-6. Number of surface leakage detection (number / year) 年間地上漏水発見数(箇所／年)

2011	2012	2013	2014
2800	2900	2750	2700

2-7. Number of underground leakage detection (number / year) 年間地下漏水発見数(箇所／年)

2011	2012	2013	2014
330	350	320	300

2-8. Breakdown of number of underground leakage detection by Acoustic rod, Leakage detector, Correlative leak detector, and other in 2011 (number)

地下漏水発見数の内訳：音聴棒、漏水探知機、相関式探知機、その他

Acoustic rod	Leakage detector	Correlative leak detector	Other (Manual Inspection)
N/A	N/D	N/A	330

2-9. Number of reparation of leakage site (number / year) 年間漏水箇所修理数(箇所)

2011	2012	2013	2014
3130	3250	3070	3000

2-10. Average time to repair from leakage detection and the longest hours (hour)

漏水発見から修理までに要する平均時間(時間)

Average	Longest
2 hours	8 hours

2-11. Number of leakage reports from public (number) 市民からの漏水の通報数(数)

2011	2012	2013	2014
3100	3200	3000	2950

2-12. Have you done Minimum Night Flow Measure method? 夜間最小流量測定を行ったことがあるか？

N/A

3. Equipment of Leakage Detection 漏水調査機材

3-1. Number of Acoustic rod/bar and Amplified acoustic rod (number)

単純アンプ内蔵型/アンプ内蔵型音聴棒の本数(数)

Acoustic rod/bar	Amplified acoustic rod
N/A	N/A

3-2. Number of set of Correlative leak detector (number) 相関式漏水探知機のセット数(数)

N/A

3-3. Number of set of Leak zone detector or Leak noise correlator (number)

音圧式漏水探知機のセット数(数)

N/A

3-4. Number of sensor of Leak zone detector or Leak noise correlator (number)

音圧式漏水探知機のセンサー数(数)

01 Leak Noise Detector

3-5. Number of Metal pipe locator (number) 金属管探査機の台数(数)

01

3-6. Number of Resin pipe locator (number) 樹脂管探査機の台数(数)

N/A

3-7. Number of Distance measuring equipment (number) 距離測定装置の台数(数)

N/A

3-8. Number of Water meter measuring for MNFM (number) 夜間最小流量測定用水量メータの台数(数)

N/A

3-9. Number of vehicles used for leakage survey (number) 漏水対策に用いる車両台数(台)

N/A

3-10. Name of other leakage detector その他の漏水探知機

N/A

4. Water Distribution Analysis 配水量分析

Data in this table is □01□. 下表のデータは 20___年の水量。

<table>
<tr><td rowspan="9">□ystem
□nput
□olime
配水量</td><td rowspan="4">Authori□ed
□onsumption
認定使用水
量
AFW□61□</td><td rowspan="2">Revenue
Water
有収水量
□9□</td><td rowspan="2">□illed
Authori□ed
□onsumption
請求消費量
□9□</td><td>□illed Metered □onsumption
(incuding □ater e□ported)
検針による料金徴収</td><td>□7□</td></tr>
<tr><td>□illed Non-metered
□onsumption
検針に拠らない料金徴収</td><td>□□</td></tr>
<tr><td rowspan="7">Non-Revenue
Water (NRW)
無収水量
□1□</td><td rowspan="2">□nbilled
Authori□ed
□onsumption
非請求消費量
□3□</td><td>□nbilled Metered □onsumption
請求せず(検針あり・調停)</td><td>0 □</td></tr>
<tr><td>□nbilled Non-metered
□onsumption
請求せず(検針なし・事業用)</td><td>0 □</td></tr>
<tr><td rowspan="5">Water
□osses
損失水量
□FW□39□</td><td rowspan="2">Apparent
□osses
商業的(見か
け)損失量
10□</td><td>□nauthori□ed □onsumption
不正規消費(盗水・不明水)</td><td>10□000 to 1□□000 connections are detected each year</td></tr>
<tr><td>Metering □naccuracies
水道メーター検針エラー</td><td>N/D □</td></tr>
<tr><td rowspan="3">Real □osses
実質損失量
8□</td><td>□eakage on □ransmission and/or Disribution Mains
総配水管からの漏水</td><td>N/D □</td></tr>
<tr><td>□eakage and □verflo□s at □tilities □trage □anks
貯水槽からの溢水、漏水</td><td>N/D □</td></tr>
<tr><td>□eakage on □ervice □onnections up to □ustomers□ Meters
戸別メータまでの給水管からの漏水</td><td>N/D □</td></tr>
</table>

□-11. Distributed Water (m³ / year) 年間総配水量(m³/年)

□011	□01□	□013	□01□
39□.□M□D	38□.33 M□D	414 MGD	410 MGD

2015 435MGD

□-1□. Water tariff (Revenue Water) (m³ / year) 水道料金対象水量(有収水量)(m³/年)

□011	□01□	□013	□01□
Water Tariff is attached as an attachment (Annexure – 1)			

□-13. Revenue Water (m³ / year) その他の徴収料金対象水量(有収水量)(m³/年)

□01□	□013	□01□	□01□
N/D m³	N/D m³	N/D m³	**234(MGD)** □8.□□

□-1□. Meter loss (Non-Revenue Water) (m³ / year) 水道メータ損失水量(無収水量)(m³/年)

□011	□01□	□013	□01□

N/D m^3	N/D m^3	N/D m^3	N/D m^3

□-1□. □tolen □ater (Non-Revenue Water) (m^3 / year) 盗水損失水量(無収水量)(m^3/年)

□011	□01□	□013	□01□
N/D m^3	N/D m^3	N/D m^3	N/D m^3

□-16. □npaid □ater (Non-Revenue Water) (m^3 / year) 未納水量(無収水量)(m^3/年)

□011	□01□	□013	□01□
N/D m^3	N/D m^3	N/D m^3	N/D m^3

□-17. □eakage □ater (Non-Revenue Water) (m^3 / year) 漏水量(無収水量)(m^3/年)

□011	□01□	□013	□01□
N/D m^3	N/D m^3	N/D m^3	N/D m^3

□-18. Water□orks usage volume (Non-Revenue Water) (m^3 / year) 水道工事使用水量(無収水量)(m^3/年)

□011	□01□	□013	□01□
N/D m^3	N/D m^3	N/D m^3	N/D m^3

□-19. □nkno□n □ater (Non-Revenue Water) (m^3 / year) 不明水量(無収水量) (m^3/年)

□011	□01□	□013	□01□
N/D m^3	N/D m^3	N/D m^3	N/D m^3

□-□0. Non-Revenue Water (□verall) (m^3 / year) その他の無収水量(m^3/年)

□01□	□013	□01□	□01□
N/D m^3	N/D m^3	N/D m^3	166M□D (□1.□□)

5. DMA / Leakage Survey Scale DMA/漏水調査メッシュ

□-1. □o make up meshes or blocks for leak detection. (□f make up meshes or blocks□DMA is replaced □ith the meshes or blocks.)

漏水調査用のブロックやメッシュを構成しているか(構成している場合は、以下のDMAは読み替える)

N/A

□-□. Number of DMA block (number) DMAブロック数(数)

N/A

□-3. Number of connection in DMA (connection) □Average of all DMA / Minimum / Ma□imum□

DMA内給水戸数(戸)[全ブロックの平均/最小/最大]

Average	N/A	Minimum	N/A	Ma□imum	N/A

□-□. Number of □ourly Factor in DMA □Average of all DMA / Minimum / Ma□imum□

DMA内時系数(ー)[全ブロックの平均/最小/最大]

Average	N/A	Minimum	N/A	Ma□imum	N/A

□-□. Water supply average volume in DMA (m^3 / day) □Average of all DMA / Minimum / Ma□imum□

DMA内日平均給水量(m^3)[全ブロックの平均/最小/最大]

Average	N/A m^3	Minimum	N/A m^3	Ma□imum	N/A m^3

□-6. Water supply ma□imum volume in DMA (m^3 / day) □Average of all DMA / Minimum / Ma□imum□

DMA内日最大給水量(m^3)[全ブロックの平均/最小/最大]

Average	N/A m^3	Minimum	N/A m^3	Ma□imum	N/A m^3

□-7. Water pressure in DMA (M□a) □Average of all DMA / Minimum / Ma□imum□

DMA内給水圧(MPa)[全ブロックの平均/最小/最大]

Average	N/A M□a	Minimum	N/A M□a	Ma□imum	N/A M□a

□-8. Number of valves formed DMA area (number) □Average of all DMA / Minimum / Ma□imum□

DMAを構成する(区切る)仕切弁数(数)[全ブロックの平均/最小/最大]

Average	N/A	Minimum	N/A	Ma□imum	N/A

□-9. Number of valves in DMA (number) □Average of all DMA / Minimum / Ma□imum□

DMA内仕切弁数(数)[全ブロックの平均/最小/最大]

Average	N/A	Minimum	N/A	Ma□imum	N/A

□-10. Number of hydrant in DMA (number) □Average of all DMA / Minimum / Ma□imum□

DMA内消火栓数(数)[全ブロックの平均/最小/最大]

Average	N/A	Minimum	N/A	Ma□imum	N/A

□-11. □i□e of mesh (□f make up meshes or blocks) (km □km)

漏水調査用メッシュがある場合、メッシュの大きさ(km×km)

N/D km □ N/D km

□-1□. Number of valve in distribution net□ork (number) 総仕切弁数(数)

67□119 (□luice □alves)

□-13. Number of hydrant in distribution net□ork (number) 総消火栓数(数)

N/A

□-1□. Number of another valve in distribution net□ork (number) その他の調整弁等の総数(数)

N/D

□-1□. Number of □ater suspension (number / year) 年間断水回数(数／年)

N/A number / year

□-16. □he total number of connection of □ater suspension (connection / year) 年間断水のべ戸数(戸／年)

N/A connection / year

□-17. Water suspension time per one time (hour / time) □Average / Ma□imum□

断水1回当りの継続時間(時間/回)[平均/最大]

N/A	N/A

□-18. Describe the leakage repair flo□chart 漏水修繕フロー図の記述

On Received of Water Leakages Complaint, the Water Supply Staff i.e. Fitter and Fitter Cullies are deputed for its Removal. Surrounding Valves are closed, Pit is excavated, and effected pipe is either repaired or replaced. After repair of Pipes, dig portion is back filled.

6. Distribution pipeline laying 管路布設

6-1. Ne□ installation pipeline length (km) 新規布設管路延長(km)

□011	□01□	□013	□01□
99.□7□ km	□3.939 km	9.7□ km	□3.07□ km

6-□. Replacement pipeline length (km) 送配水管更新(入替)延長(km)

□011	□01□	□013	□01□
77.063 km	1□8 km	13.□6□ km	66.3 km

6-3. Rehabilitation pipeline length (km) 更生管路延長(km)

□011	□01□	□013	□01□
27.5	76.82	14.68	12.276

6-□. Removal pipeline length (km) 撤去管路延長(km)

□011	□01□	□013	□01□
77.06	127.8	13.5	66.3

6-□. □uspended pipeline length (km) 休止管路延長(km)

□011	□01□	□013	□01□
N/A			

7. Distribution / Service Pipe material 送配給水管種別

7-1. Ductile □ron □ipe (D□□) length (km) ダクタイル鉄管(DIP)延長(km)

Distribution □ □ervice	3□6.□ □m

7-□. □ast □ron □ipe (□□□) length (km) 鋳鉄管(CIP)延長(km)

Distribution □ □ervice	□□9.6 □m

7-3. □teel □ipe (□□) length (km) 鋼管(SP)延長(km)

Distribution	N/A □m	□ervice	N/A km

7-□. □tainless □teel □ipe (□□□) length (km) ステンレス鋼管(SUS)延長(km)

Distribution	N/A □m	□ervice	N/A km

7-□. □oncrete (□ume) □ipe (□□) length (km) コンクリート管(HP)延長(km)

Distribution	N/A □m

7-6. Asbestos □ement □ipe (A□□) length (km) アスベスト管(ACP)延長(km)

Distribution □ □ervice	3900.□ □m

7-7. □olyvinyl □hloride □ipe (□□□) length (km) 硬質塩化ビニル管(PVC)延長(km)

Distribution □ □ervice	□□3.6 □m

7-8. □igh □mpact □inyl □ipe (□□□□) length (km) 高強度塩化ビニル管(HIVP)延長(km)

Distribution	N/A □m	□ervice	N/A km

7-9. □olyethylene □ipe (□□□) length (km) ポリエチレン管(PEP)延長(km)

Distribution	N/A □m	□ervice	N/A km

7-10. □alvani□ed □teel □ipe (□□) length (km) 亜鉛メッキ鋼管(GP)延長(km)

Distribution	N/A □m	□ervice	N/A km

7-11. □ead □ipe (□□) length (km) 鉛管(LP)の延長(km)

Distribution	N/A □m	□ervice	N/A km

7-1□. □upper □ipe (□□) length (km) 銅管(CP)の延長(km)

□ervice	N/A km

7-13. □ther □ipe length (km) その他の管の延長(km)

□ipe material name	Distribution	□ervice
HDPE	□69 km	km

7-1□. □ransmission □ipeline length (km) 送水管延長(km)

□011	□01□	□013	□01□
3264.5	3297.5	3304.8	3322.1

7-1□. Distribution □ipeline length (km) 配水管延長(km)

□011	□01□	□013	□01□
3264.5	3297.5	3304.8	3322.1

7-16. □ervice □ipeline length (km) 給水管延長(km)

□011	□01□	□013	□01□
5568.82	5601.78	5634	5662

(□ransmission □ Distribution)

Note□□otal length of Water □upply lines including Distribution and □ervice lines □ □□□□.7□1□m

8. SCADA/Mapping system 水道情報データ管理／マッピングシステム

8-1. Describe the name of digital data filing 電子データ化している業務名

□□ADA □ystem is currently installed □ith arsenic removal filtration plants

8-□. □roportion of filing system of business management document (□) 事業文書の管理割合(%)

□aper filing	Digital filing
N/D □	N/D □

Most of the documents are digitally filled in each department or sub division but not centrali□ed controlled.

8-3. □roportion of filing system of □ater facilities□dra□ing (□) 水道工事図面の管理割合(%)

□aper filing	Digital filing
N/D □	N/D □

Dra□ings are updating using □□□ mapping.

9. Water meter and maintenance 水道メータ･修繕

9-1. Number of installed □ater meter (number) 水道メータ設置数(数)

Diameter	13mm	□0mm	□□mm	mm	mm	Mi□ed 13mm and □0mm	□otal
Number	N/D	N/D	N/A	N/A	N/A	29,929	29,929

9-□. □eriod of service of □ater meter (year) 水道メータ使用期間(年)

10-1□ □ear

9-3. Number of annual purchase of □ater meter (number) 水道メータ年間購入数(数)

□011	□01□	□013	□01□
–	–	–	–

Meters □ere bought before □011.

9-□. □imes of usage of maintained e□piry □ater meter (times)

満期水道メータの修理後の繰り返し使用回数(回)

□pare parts are usually not available in market

9-□. Number of damaged □ater meter (number) 破損水道メータ数(数)

□011	□01□	□013	□01□
3156	1169	960	429

9-6. Number of intentional damaged □ater meter (number) 故意に破損された水道メータ数(数)

□011	□01□	□013	□01□
N/D			

9-7. Describe the reason of damaged/broken □ater meter 水道メータの破損理由の記述

Reasons of damaged and broken are as under□ 1. Frequent moving of gears inside mechanical meter may cause damage of meter. □. Rusting in meter parts may cause defect in mechanical meters.

10. Procurement / Stock management 資材調達・資材管理

10-1. Describe the procedure of procurement of □ater supply material 材料調達手段の記述

□rocurement is being done by follo□ing □□RA Rules (□ublic □rocurement Regulatory Authority). For small purchases the procedure is follo□ed by the concerned □D□s and for larger purchases the procedure is follo□ed by the □rocurement/ □tores section. All procurement is being done by the tender issuance.

10-□. Describe the management of spare parts 予備材料の管理方法

□pare parts are notes in registers. □ach equipment has its o□n register □hich is filled manually. □ntry of ne□ items are mentioned and accumulates □hile issuance of material is being done by the approval of the competent authorities i.e. Deputy Managing Directors.

Remarks□

□ □ransmission pipeline defines the pipeline bet□een □ater treatment plant and distribution reservoir□also bet□een t□o distribution reservoirs.

□ DMA defines District Metered Area as same as District Metered □one (DM□).

□ □he □ourly Factor defines non-dimension value □hich hourly ma□imum consumption volume divides hourly average one.

□ □f no data□ans□er is □N/D□□else if no ans□er or non-applicable□ans□er is □N/A□

□ □ressure unit□

	M□a	kgf/cm□	□ar	□□□
M□a	1	10.□0	9.869	1□□.0
kgf/cm□	0.0981	1	0.9678	1□.□□
□ar	0.1013	1.033	1	1□.70
□□□	0.0069	0.0703	0.0680	1

Questionnaire on the Water Supply Business
Questionnaire 3: Tube Well

Name of organization: Water and Sanitation Agency Lahore

Please provide data for tube well as follows:

Q1 How many tube well are there in your town?
Answer: Total = 503
Detailed List of Tube Wells is attached.

Q2 Do you have the inventory of tube well?
Answer:
Yes. List attached. (Annexure – 3.1)

Q3 Do you have information of each tube well regarding well location, installation year, screen depth, maintenance record, operational hours, specification of pumps ?
Answer:
Partially yes. Data regarding total tube wells, location, installation year and capacity is available. (Annexure – 3.2)

Annexure contains the details of Location, Capacity and Installation year of tube wells in each Town.

Operational Hours (Summer): 16-18 hours/day
(Winter):14-16 hours/day

Questionnaire on the Water Supply Business
Questionnaire 4: Sewerage and Drainage

Name of organization: Water and Sanitation Agency Lahore

A. Documents or information related to sewerage and drainage system in WASAs

(1) Please provide following maps.

- Location Plan of the City (including Area Boundary)
  Answer: Plan is under preparation but map for location is attached as an annexure – 4.1
- Topography and Levels (N/D, Master Planning is being done by MMP and data will available after the completion of master planning)
- Served and Unserved Areas (Annex 4.4 & Annex 4.5)
- WASA administration Zones Boundary (Annex 4.2)
- Location of Disposal stations (Annex 4.3)
- Layout Plan of Existing Sewer System (Annex 4.4)
- Layout Plan of Existing Drainage System (Annex 4.5)
- Existing Drainage Route and Point of Final Disposal (Annex 4.5)
- Proposed or planed Sewers and Drainages System (N/A, Plan is under preparation)
- Major Ponding Areas (Available in hard form)

(2) Please provide following rainfall data.

- Rainfall intensity (15, 30, 60 120 minutes, 3,6,9,12 hours duration) (Annex 4.6)
- Fitted Intensity Duration Curve (N/D)

B. Organization and finance

(1) Please provide an actual organization chart of WASAs especially Sewers and Drainages cleaning (Engineers, Equipment operators, Sewer man, etc)

Directors = 7

XEN = 14

SDOs = 34

Sub Engineers = 69

Sewer Men = 1739

Designations\Town ->	Ravi	ST&ABT	GBT	GT	IT	NT	Drainage	Total
Directors	1	1	1	1	1	1	1	7
XEN's	3	2	2	1	2	2	2	14
SDO's	6	5	4	3	6	4	6	34
Sub-Engineers	9	16	12	8	8	5	11	69
Sewer Man	310	270	246	180	231	143	359	1739

(2) Please furnish an annual budget and disbursement in the WASAs and its brea□down for the last □years especially Sewers and Drainages cleanings.

□□□endit□re□	□□□□□□	□□□□□□	□□□□□□	□□□□□□
□ota□	□7□□.6	73□4.93	□7□3.772	□9□6.□7
□□□	1□97.6	1□4□.913	61□.173	7□□.□4□

□urther brea□up of □epair and Maintenance which include sewerage and water supply system is placed as an anne□ure 4.12

(3) Please e□plain the schedule and budget allocation for the implementation of the cleanings (operation□maintenance of the sewage and drainage system).

□n□□er□□leaning □Desilting of Sewers □Drains is carried out through WASA □egular □Wor□ □harge Sanitation Wor□er. □owever, it is also made through out sourcing for which budget provision to the tune of □s.1□.□□□Million is □ept in □udget.

Desilting of Drain / Sewer A/C-328-D (Amount in Million)	15.000
Budget Provision for (R&M) of Drains A/C-328-A	40.000
Budget Provision for (R&M) of Sewer Lines A/C-328	140.000

□. □□□i□□ent□□ ac□iner□

(1) Please provide a list of equipment□machinery owned by WASAs as tabulated below (type of equipment, model, year of manufacturing, name of manufacturer and country, running hour□□m, wor□ing condition, maintenance method, present location).

Equipment	Model (Main Spec.)	□ear	Manufacturer□ □ountry	□unning hour□□m	Wor□ing □ondition	Maintenance method	□ocation
Wheel E□cavator	P□2□□	199□	□omatsu □apan	6□□□hr	□nder repair	Need overhaul	Motor pool

Placed as an anne□ure 4.7

(2) E□isting facilities or equipment for maintenance service available at the wor□shop of WASA

□n□□er□□epair and maintenance is carried out through outsource

(3) Procedure of machine maintenance and process of daily□routine maintenance activity and preparation of activity□s record□report.

□n□□er□Wor□ regarding repair and maintenance started immediately. Event report is prepared by SDO and forwarded to Deputy Managing Director □Operation □ Maintenance (DMD □ O□M) through the counter signs of XEN and Director O□M. □ost estimate is prepared for that wor□. A technical committee chec□ed the estimate and forwarded to DMD (O□M). □pto □s. 2□□,□□DMD (O□M) have the authority to approve the funds but above □s. 2□□,□□□approval of Managing Director is mandatory.

(4) □aws□□egulations of gas emission control for vehicles and construction equipment.

□n□□er□Nil

(□) Average field wor□ing hours per day for Sewers and Drainages cleanings.

□n□□er□□hours

(6) □urrent dredging method.

□n□□er□□1 E□cavator □□lamshell□ □4 Dump □ruc□s □ □□Drivers and □□Sewer Men

(7) □urrent sludge removal wor□from sewage pipes.

□n□□er□□3 Sewer Men (One in Manhole, One Outside Manhole for Pulling □uc□et and One for Emphyting Silt □uc□et away from Manhole).

(□) □ecord of the accidents of construction equipment□machinery for the last □years (E.g. overhead wire cutting, fall to channel, fuel shortage etc.) (N□D)

(9) With regard to disposal stations, the following information will be required (refer to □ormat□1)□ (Anne□ure 4.□)

- Name of disposal stations
- Established Year
- Pump Type
- Pump quantity
- Capacity of each pump (flow rate)
- Motor Power
- Operation hours per day
- Total capacity of disposal station (flow rate)
- Status of pump
- Final Discharge Point

□ormat□1

Anne□ure 4.9

No.	Name of Lift Station	Establis hed	Pump Type*[1]	Number and Capacity of Pumps	Motor Power	Opera-ti on hour	Total Capacity	Status of Pump	Final Discharge Point

		Year		(nos.)		(kw)	(m^3/s)	(kw)	(hr/day)	(Cfs)	(m^3/s)		
SHAHDARA WWT AREA													
1	Maqbra More	1985	H	1	x	2	(0.06)			2	(0.06)	ok	River Ravi
2	Barkat Town	1989	H	1	x	4	(0.12)			7	(0.21)	ok	Farakhabad DS
			H	1	x	3	(0.09)						
3	Shahdara	1990	H	4	x	6	(0.17)			24	(0.68)	ok	River Ravi
4	Saeed Park	1995	H	1	x	4	(0.12)			7	(0.21)	ok	River Ravi
			H	1	x	2	(0.06)						
			H	1	x	1	(0.03)						
5	Faisal Park	1995	H	1	x	2	(0.06)			5	(0.15)	ok	Irrigation Distributary
			S	1	x	2	(0.06)						
			H	1	x	1	(0.03)						
6	Fazal Park	1996	H	2	x	6	(0.17)			18	(0.4)	ok	River Ravi
			S	1	x	4	(0.12)						
			S	1	x	2	(0.06)						
MEHMOOD BOOTI WWT AREA													
7	Madina Chowk	2008	S	3	x	10	(0.29)			38	(1.11)	ok	Shalimar Escape Drain
			S	2	x	4	(0.12)						
8	Dars Baray	1982	H	2	x	2	(0.06)			4	(0.12)	ok	Shalimar Escape
9	Toheed Park	1992	H	2	x	2	(0.06)			4	(0.12)	ok	Shalimar Escape
10	Shah Kamal	1992	H	2	x	2	(0.06)			4	(0.12)	ok	Shalimar Escape
11	Shalimar Link	1984	H	3	x	6	(0.17)			18	(0.51)	ok	Shalimar Escape
12	Lal Pul	1998	S	3	x	2	(0.06)			20	(0.47)	ok	Shalimar Drain
			S	1	x	4	(0.12)						
			H	1	x	4	(0.12)						
			H	1	x	6	(0.17)						
13	Fayaz Park	2001	S	1	x	2	(0.06)			6	(0.12)	ok	Shalimar Drain
			H	1	x	2	(0.06)						
			H	1	x	2	(0.06)						
14	Taj Bagh	2008	S	2	x	6	(0.17)			12	(0.34)	ok	Shalimar Escape
15	B-Block	2008	S	1	x	4	(0.12)			10	(0.29)	ok	Shalimar Drain
			S	1	x	6	(0.17)						
16	Tajpura Main	1990	S	1	x	25	(0.71)			75	(2.13)	ok	Shalimar Drain
			H	2	x	25	(0.71)						

Note: *1 V:Vertical Axial Flow Pump, H:Horizontal Axial Flow Pump, S:Submersible Pump

Summary of Drainage networ□is placed as an anne□ure 4.1□

Summary of water supply and sewerage networ□is placed as an anne□ure 4.11

Questionnaire on the Water Supply Business

Questionnaire 5-Lahore

Management, Finance and Organization

Name of organization: Water and Sanitation Agency Lahore

□□ anage□ ent

Please answer the following questions and provide financial reports in recent three (3) years, current tariff tables and your organization chart to support your answers.

	□uestions	Please write your answers.	□eference document
□ision, strategy	E□istence of a long□term□plan	Answer□No □omments□ Master plan is under preparation. Previous one has e□pired.	
□inance	□evenues□	□ear 2□12 □13 actual (□4□7.34), 2□13 □14 actual (6269.□□7), 2□14 □1□ actual (727□.761), 2□1□□16 estimated (□□□1.1□), 2□16 planning (N□D)	
	□osts	□ear 2□12 □ 13 actual (□9□6.7□), 2□13 □14 actual (□7□3.772), 2□14 □1□ actual (73□4.937), 2□1□□ 16 estimated (□7□□6), 2□16 planning (N□D)	
	□nvestment (ADP □ NON□ADP)	□ear 2□12 13 actual (6□1.996), 2□13 □14 actual (792.6□□), 2□14 □1□actual (671□.741), 2□1□□16 estimated (42□3.619), 2□16 planning (N□D)	
	Main finance sources	Water and Sewerage collection □harges. Subsidy from □overnment	
□uture e□pansion	What is your future e□pansion plan□ Master plan is under preparation. Previous one has e□pired.		
Administration and organization	Organization chart	Number of staff in each division by grade. □otal □,6□□ (Detailed □ist Attached as an Anne□ure □1)	
	□ecruitment	□ear 2□12 actual (334), 2□13 actual (2), 2□14 actual (□), 2□1□ estimated (□), 2□16 planning (146)	N□D
	□etirements	□ear 2□12 actual (□□), 2□13 actual (114), 2□14 actual (1□□), 2□1□estimated (11□), 2□16 planning (6□)	N□D
	□ommunication among divisions	Do you have a regular cross□division meeting (e.g. once a month, once a wee□)□ Answer (□es, once or twice in a month)	

	Pipe distribution network map	Do you have a pipe distribution network map of your city? Answer: Yes (Attached. Annexure -2)	
	Inventory List	Do you have a list of inventory, machinery and other fixed assets? Answer: Data is not centralized but can be collected.	
	Customer database	Do you have a customer database? Answer: Yes. Computerized data, maintained in Oracle.	
Training	Training program (actual)	What training have you conducted? Answer (Multiple trainings in each section)	Annex-3
	Necessary Training in the future	What training do you need in the future?	
	Guidelines	Do you have textbooks or guidelines to give a lecture to your staff? Answer: Yes, No, Comments (No)	
	Budget for the training	How much is your annual budget for the training? Answer (1 Million 2015-16)	
Relation with customers	Communication with customers	Do you have a regular meeting with customers (e.g. once a month, once a week)? Answer: Yes, No, Comments (Yes, In case of serious complaints)	
	Complaints from customers	Do you keep recording customer complaints? Answer: Yes. Complaint Management Centre has been formed for this purpose.	
Relation with other organizations: WASAs, Government, and donors	Relation with other WASAs, suppliers	Do you have a regular meeting with other WASAs or suppliers (e.g. once a month, once a week)? Answer: Yes, No, Comments (Yes)	
	Relation with the State Government	Do you have a regular meeting with the State Government (e.g. once a month, once a week)? Answer: Yes, No, Comments (Yes) Regular meetings are conducted on the issues of Pension and Inquiry in the office of Secretary Housing and any instructions issued by the	

		□o□ernment are circ□□ated immediate□y	
	□elation with □ehsil Municipal Administrations	Do you provide some training for □ehsil Municipal Administrations□ Answer□□es, No, □omments (N□D)	

□□□ ater □□□□□

□he □□NE□ is □nternational □enchmar□ing Networ□ for Water and Sanitation □tilities, issued by the World □an□. □would appreciate if you answer the following questions, in reference to the data as of year 2□1□ on the web or data from the □□□A report in □uly 2□14.

□uestions	□ear 2□□6 data	□ear 2□1□ data	Source	Please write current situations.
□ahore population	□,3□7,□□□	6,□11,□□□ (year 2□1□)	□□NE□	6,311,□□□
□overage with water service	□1.23□	□9.□2□(□,3□1,□□□)	□□NE□	9□.1□, with respect to □otal population in W□S operator area of responsibility
□overage with sewage	□4.□□□	□□.99□	□□NE□	9□.44□
Water treatment capacity (m3□day)			N□A	N□A
Actual average treatment volume (m3□day)			N□A	N□A
Number of connections		□79,7□1	□□NE□	636,33□
Networ□ length (□m)		3,4□□	□□NE□	□,□44.721
Water production	13□.67lpcd	34□.2□lpcd	□□NE□	319 lpcd
□otal water consumption	7□.□7lpcd	191.17 lpcd	□□NE□	196 lpcd
□esidential consumption		1□□.14pcd	□□NE□	196 lpcd
□osses in m3□□m of the networ□ a day	□□.□3 m3□□m	243.33 m3□□m	□□NE□	133.□4
□osses in □	42.□9□	4□.11□	□□NE□	41.□□
□evenues, □S□, □s per M3 sold	□.2□ □	□.□9 □7(□ □s)	□□NE□	□otal = 29.232 M□
□osts, □S□ per M3 sold	□.□2 □	□.12 □	□□NE□	□.1□□
Operation cost coverage	□.□4	□.73	□□NE□	□.419
□evenue collection ratio	□□.19□ (2□□7)	63.63□	□□NE□	□in □2□ / Phy 6□□ / □in 73□ / Phy 6□□
□abor costs vs. operation costs		3□□	□□NE□	□□.□□
Electrical energy costs		3□□	□□NE□	44.3□□

vs. operation costs				
□ontracted or service costs vs. operation costs		22□	□□NE□	□□.□□
□otal staff number		6,□ll persons (year 2□ll)	□□□A	□□□□□ **ater □taff□□7221** **□□ota□□taff□□□□ne □□□□**
Staff per 1,□□□ connections		11.1 staff per 1,□□□ connections (2□11)	□□□A	□.□□□□**ne** □□□□
Water supply hours a day		14□1□ hours a day (2□11)	□□□A	14□1□ hours a day
Water meter installation ratio		13□ (2□11)	□□□A	13.32□
Average monthly tariff		2□□□s (2□11)	□□□A	361.□1
□evenue collection ratio		73□(2□11)	□□□A	□2□
New connection installation fee		4□□ □s(2□11)	□□□A	□ariff is attached as an anne□ure
Annual costs per a connection (□s)		2,33□□s(2□11)	□□□A	□s. 233□
Annual □omplaints		17□,67□ complaints(2□11)	□□□A	16□,7□□complaints

□□□e□age

□uestions	□ear 2□11 data	Source	Please write current situations.
□overage with sewage	□□□	□□□A	□□.□□□, □une 2□1□
Sewage capacity (m3□day)		N□A	Anne□ 4.□ contains list of each Disposal Station
Actual average sewage volume (m3□day)		N□A	1□□□□usec
Sewage networ□length (□m)	4,94□□m	□□□A	4214.9□□
Drainage networ□length (□m)	212 □m	□□□A	4□3.9□(Primary □ Secondary□□oad side□□ertiary)
Drainage pump stations□ □ift Stations	Main 12 stations, inter □7	□□□A	Main 12 stations, □ift Station □7 (Anne□ 4.9 contains detail of each)
Sewage plants	□ero, planning 6 plants	□□□A	□ero

□han□you for your answers.

List of Annexures

Lahore

Annex-1

EXTRAORDINARY ISSUE REGISTERED No. L-7532

The Punjab Gazette

PUBLISHED BY AUTHORITY

LAHORE WEDNESDAY APRIL 14, 2004

LAHORE DEVELOPMENT AUTHORITY, LAHORE.

The 7th April ' 2004.

NO. MD/ 2090 Lahore Development Authority in exercise of powers conferred under section 28 of the Lahore Development Authority Act,1975 (Act No.XXX of 1975) with previous consent of the District Government and Provincial Government prescribes the following rates and fees in respect of its water supply and sewerage operations w.e.f. 1st May' 2004 (May-June Billing).

1. **WATER RATES :**

a). **Unmetered Connections (Domestic)** — **Rate per month (Rs.)**

ARV Slabs

	ARV Slabs	Rate per month (Rs.)
1.	Upto Rs. 400	58.10
2.	401 - 500	89.60
3.	501 - 720	152.60
4.	721 - 1000	266.00
5.	1001 - 1500	375.20
6.	1501 - 2388	394.80
7.	2389 - 4370	420.00
8.	4371 - 4499	439.60
9.	4500 & Above	(84% of ARV)

NOTE :

1. All New connections shall be sanctioned as metered.

2. Annual Rental Values for all existing unmetered connections will remain frozen except bills issued on Proposed (Area) Rental Value.

Annex-1

b). **Metered Connections (Domestic)**

Consumption Slabs per Month	Rs. per 1000 Glns
i) Upto 5,000 Gallons	12.88
ii) 5,001 to 20,000 Gallons	20.86
iii) 20,001 Gallons and above	27.30

c). **Metered Connections (Commercial/Industrial/Non-Residential)**

Consumption Slabs per Month	Rs. per 1000 Glns
i) Upto 5,000 Gallons	27.34
ii) 5,001 to 20,000 Gallons	48.85
iii) 20,001 Gallons and above	70.67

2. **SEWERAGE / DRAINAGE:**

a). **Unmetered Water Connections (Domestic)**

ARV Slabs	Rate per month (70 % of Water) (Rs.)
1. Upto Rs. 400	40.67
2. 401 - 500	62.72
3. 501 - 720	106.82
4. 721 - 1000	186.20
5. 1001 - 1500	262.64
6. 1501 - 2388	276.36
7. 2389 - 4370	294.00
8. 4371 - 4499	307.72
9. 4500 & Above	(70 % of water)

b). **Metered Water Connections (Domestic)**

Consumption Slabs per Month	Rs. per 1000 Glns
i) Upto 5,000 Gallons	9.02
ii) 5,001 to 20,000 Gallons	14.60
iii) 20,001 Gallons and above	19.11

c). **Metered Connections (Industrial etc.)** — **Rs. per 1000 Glns**

Industrial including Service Station, Carpet Washing Addas, Commercial, Govt. and Semi-Govt. Organisations, Corporate Bodies etc.	29.82

d). **Commercial / non-residential** — **Rs. per 1000 Glns**

i)	Upto 5,000 Gallons	19.14
ii)	5,001 to 20,000 Gallons	34.19
iii)	20,001 Gallons and above	49.48

e). **SEWERAGE / DRAINAGE FOR PRIVATE TUBEWELLS: (Non-Residential)** — **Rate per month**

	(Rs.)
- 1 Cusec	7700
- 1/2 Cusec	3850

Rates to increase or decrease in proportion to the rate of One cusec.

f). **DRAINAGE ;** — **Rs. per acre per annum**

For industries, commercial, Non-Residential Govt. & Semi Govt. organizations, Corporate Bodies not directly connected with WASA Water / Sewerage system but disposing sewage through drainage system.	1,663

3. **TARIFF FOR QUAID-E-AZAM TOWN (TOWN SHIP) : ***

3.1. WATER RATES :

a) Unmetered Connections (Domestic) — **Rate per month**

		(Rs.)
i)	5 – Marlas	51.59
ii)	7 – Marlas	77.77
iii)	10 – Marlas	130.90
iv)	1 – kanal	223.30
v)	Above 1-kanal	311.08

Annex-1

b) Unmetered Connections (for construction)

		Rate per month (Rs.)
i)	5 – Marlas	297.22
ii)	7 – Marlas	485.10
iii)	10 – Marlas	672.98
iv)	1 – kanal	1,216.60
v)	Above 1-kanal	1,760.22

c) Unmetered Connections (commercial)

		Rate per month (Rs.)
i)	5 – Marlas	297.22
ii)	7 – Marlas	485.10
iii)	10 – Marlas	672.98
iv)	1 – kanal	1,216.60
v)	Above 1-kanal	1,760.22

d) All new connections will be sanctioned as metered and billed as per following Tariff.

(i) Metered Connections (domestic)

		Rate per 1000 gln (Rs.)
(i)	Upto 5,000 Gallons.	11.33
(ii)	5,001 to 20,000 Gallons.	18.02
(iii)	20,001 Gallons and above.	23.10

(ii)Metered Connections (Com, Indus, Non-Residential)

(i)	Upto 5,000 Gallons.	21.03
(ii)	5,001 to 20,000 Gallons.	37.58
(iii)	20,001 Gallons and above.	54.36

Note

Bill in respect of d(i & ii) will be based on monthly average consumption of 10, 15, 20, 30 and 40 thousand gallons for 5, 7, 10, 20 and above 20 marlas respectively in case meter is not available

3.2. SEWERAGE RATES :

a) Unmetered Connections (Domestic)

		Rate per month (60% of Water) (Rs.)
i)	5 – Marlas	30.95
ii)	7 – Marlas	46.66
iii)	10 – Marlas	78.54
iv)	1 – kanal	133.98
v)	Above 1-kanal	186.65

b) Unmetered Connections commercial)		**Rate per month (Rs.)**
i)	5 – Marlas	178.33
ii)	7 – Marlas	291.60
iii)	10 – Marlas	403.79
iv)	1 – kanal	729.96
v)	Above 1-kanal	1,056.13

(c) All new sewerage connections will be billed on following rates: -

Sewerage (Domestic)		**Rs. Per 1000 Glns. (60% of Water)**
(i)	Upto 5000 Gallons.	6.80
(ii)	5,001 to 20,000 Gallons.	10.81
(iii)	20,001Gallons and above.	13.86

Sewerage (Commercial Non-Residential)		
(i)	Upto 5000 Gallons.	12.62
(ii)	5,001 to 20,000 Gallons.	22.54
(iii)	20,001Gallons and above.	32.62

3.3 SEWERAGE / DRAINAGE FOR PRIVATE TUBEWELLS: (Non-Residential)

	Rate per month (Rs.)
- 1 Cusec	7,700
- 1/2 Cusec	3,850

Rates to increase or decrease in proportion to the rate of One cusec.

DRAINAGE :	**Rs. per acre per annum**
For industries, commercial, Non-Residential Govt & Semi Govt. organizations, Corporate Bodies not directly connected with WASA Water / Sewerage system but disposing sewage through drainage system.	1,663

4. **Metered Connections (Commercial/Industrial/Non-Residential & Residential)**

Subject to minimum of:

- 1/2" size of meter = 5,000 Gallons p/month.
- 3/4" size of meter = 20,000 Gallons p/month.
- 1" size of meter = 33,334 Gallons p/month.

Above 1" minimum consumption to increase in proportion to 1" size of meter (both for at Sr.1 b & c).

Annex-1

5. **RELIGIOUS AND CHARITABLE INSTITUTIONS:** Half of domestic rate.

6. **METER R&M**

Size of meter	Rate per month (Rs.)
1/2 "	12.00
3/4 "	14.00

Meter rent to increase in proportion to ½" rent for higher size. Owner's Meter to be charged half of the rent.

7. **SULLAGE RATE :**

Rs. Per acre per half year 105.00 (Auction subject to minimum) (Rs.)

8. **SECURITY OF NEW CONNECTION :** 50.00

9. **MISCELLANEOUS FEES :**

(a). New Connection Fees (Water)

		(Rs.)
i)	1/4 "	300.00
ii)	3/8 "	600.00
iii)	1/2 "	1,200.00
iv)	3/4 "	1,500.00
v)	1 "	3,600.00
vi)	Above 1" (fee for higher sizes to be in proportion to 1" size).	

	(Rs.)
- Disconnection fee on consumer's request	100.00
- Reconnection fee on consumer's request	150.00
- Reconnection fee (Defaulter's connection)	200.00
Ferrule shifting fee	100.00
- Ferrule cleaning fee	75.00
- Meter testing fee	50.00

(b). New Connection Fees (Water)
QUAID-E-AZAM TOWN:

		(Rs.)
i)	1/4 "	250.00
ii)	3/8 "	560.00
iii)	1/2 "	1,050.00
iv)	3/4 "	1,500.00
v)	1 "	3,600.00
vi)	Above 1" (fee for higher sizes to be in proportion to 1" size).	

- Disconnection fee on consumer's request	100.00
- Reconnection fee on consumer's request	150.00
- Reconnection fee (Defaulter's connection)	200.00
- Ferrule shifting fee	90.00
- Ferrule cleaning fee	60.00
- Meter testing fee	50.00

(c). New Connection Fee Sewer (For all): **(Rs.)**

- Domestic connection **400.00**

- Industrial and Commercial

- General Stores, Cloth Merchants, Tailoring Shops, Sanitory & Harware Stores, Electric Shops, Vegetable & Meat Shops, Books & Stationery Shops, Beauty Parlours, Godowns, Photograph Studios & Laboratories, Clinics / Laboratory, Lohar Khana/Electric Parts Manufacturing, Lath Machine Workshops, Nonby shops, printing Press, Barber Shop without bath, Petrol Pumps without service stations, Pan/Cigarettes shops, Dying shops, Sweet manufacturers and Bakeries, Scooter / Riskshaw repair shops (without service facilities), Milk Shop,. Shoes Shops. Tea Stalls, Plastic Stores, Kubab Tikka Shops. Chemists/Druggists. Offices having one Tap/Washroom, Academies, Private Schools less than 100 students, Show room having one wash room. Any small business activity where water is not used for as material manufacturing but used in washrooms only. — 500.00

	(Rs.)
- Restaurants including Chargha Houses (without air conditioning), Plastic Inudstries, Shoes Industries, Power Loom Industries, Pharamaceautical industries, Match Factory, Soap Factory, Nickle and Polish factory, Gujjars with less than 20 animals, Hamams with one or two baths, Cement Jali factory, Dhobi Ghates (upto two ghats).	7,500.00
- Plazas, Commercial Markets, Shopping Centres etc.	9,000.00
- Hotel (B-Class), Restaurant, Ice Cream manufacturers, , Foundry steel mills, Hamams with three or more baths, Gujjar with more than twenty animals, Chemical and Rubber factories.	12,000.00
- Carpet washing and dying addas, Petrol Pumps or workshops with service station, Hotel (A-Class), Ice factories, Cement Pipe factories, Ghee Mills, Dairy farms, Dhobi Ghats (more than three ghats), Private Hospital, Beverage factories.	15,000.00

5. **SURCHARGE FOR LATE PAYMENT :**

10% surcharge if payment is not made by the due date specified in the bill.

6. Government Notification NO.M.D/78 dt.11.02.1998 has been withdrawn w.e.f 01-05-2004.

16-4-2004

DIRECTOR GENERAL
ON BEHALF OF
LAHORE DEVELOPMENT AUTHORITY

Detail of Working Tubewells

Sr. No.	B. #	REFRENCE	M.F	WASA SUB-DIVISION	WASA TOWN	TYPE	LOCATION	Installed Load	CFS	TRF	SANC. LOAD
1	24	111110150701	20	RAVI ROAD	G.B.TOWN	T/W	Sharif Park Sanda	80	2 CFS	46	61
2	24	111119000400	40	RAVI ROAD	G.B.TOWN	T/W	Nehru Park	150	4 CFS	46	135
3	24	111119000701	80	RAVI ROAD	G.B.TOWN	T/W	Chuhan Road	150	4 CFS	45	113
4	24	111119000900	20	RAVI ROAD	G.B.TOWN	T/W	Akram Park	80	2 CFS	46	61
5	24	111119001000	40	ISLAM PURA	G.B.TOWN	T/W	Takia Mehmood Shah	80	2 CFS	46	61
6	24	111119001600	40	ISLAM PURA	G.B.TOWN	T/W	Patwar Khana	150	4 CFS	46	116
7	24	111119904004	40	RAVI ROAD	G.B.TOWN	T/W	rafi darbar suggian	80	2 CFS	45	61
8	24	111120004400	40	ISLAM PURA	G.B.TOWN	T/W	E-Block Gulshan Ravi	150	4 CFS	46	113
9	24	111120004500	40	ISLAM PURA	G.B.TOWN	T/W	New Grave Yard Sanda	150	4 CFS	46	113
10	24	111122621296	40	ISLAM PURA	G.B.TOWN	T/W	G-Block Gulshan Ravi	150	4 CFS	46	112
11	24	111122621303	40	ISLAM PURA	G.B.TOWN	T/W	Moon Market	150	4 CFS	45	112
12	24	111129001302	40	ISLAM PURA	G.B.TOWN	T/W	Zubair Park G Blk	150	4 CFS	45	113
13	24	111129621322	40	ISLAM PURA	G.B.TOWN	T/W	A-Block Gulshan Ravi	150	4 CFS	46	116
14	24	111129621323	40	ISLAM PURA	G.B.TOWN	T/W	B-Block Gulshan Ravi	150	4 CFS	46	116
15	24	111139000700	40	ISLAM PURA	G.B.TOWN	T/W	Muhajir Abad	150	4 CFS	45	132
16	24	111139001201	40	ISLAM PURA	G.B.TOWN	T/W	Qaisar Park S.Abad	150	4 CFS	46	113
17	24	111139001301	40	ISLAM PURA	G.B.TOWN	T/W	Firdous Colony	150	4 CFS	46	114
18	24	111139001302	40	ISLAM PURA	G.B.TOWN	T/W	Usman Park	150	4 CFS	45	113
19	24	111139001401	40	ISLAM PURA	G.B.TOWN	T/W	Rustam Park	150	4 CFS	45	115
20	24	111139001501	40	ISLAM PURA	G.B.TOWN	T/W	Naunarian	150	4 CFS	46	112
21	24	111142621303	40	ISLAM PURA	G.B.TOWN	T/W	High School babu sabu	150	4 CFS	45	113
22	24	111142621365	40	ISLAM PURA	G.B.TOWN	T/W	shabli town	80	2 CFS	45	61
23	24	111142621419	1	ISLAM PURA	G.B.TOWN	T/W	60' Feet Road	80	2 CFS	46	61
24	24	111142621745	40	ISLAM PURA	G.B.TOWN	T/W	UC 84, BUND ROAD	80	2 CFS	46	60
25	24	111149000998	2	ISLAM PURA	G.B.TOWN	T/W	Jafferia Colony	150	4 CFS	46	114
26	24	111159000200	40	SAMANABAD	A.I.TOWN	T/W	Bakkar Mandi	150	4 CFS	46	113
27	24	111159000203	80	SAMANABAD	A.I.TOWN	T/W	C Block Sabzazar	15	4 CFS	45	113
28	24	111159000400	40	SAMANABAD	A.I.TOWN	T/W	Jhuggian Shahab Din	150	4 CFS	46	62
29	24	111159003000	40	SAMANABAD	A.I.TOWN	T/W	Pir Budden Shah	150	4 CFS	45	116
30	24	111159003001	40	SAMANABAD	A.I.TOWN	T/W	Dholan Wal	150	4 CFS	45	112
31	24	111159003103	40	SAMANABAD	A.I.TOWN	T/W	BAKAR MANDI	150	4 CFS	45	112
32	24	111159004400	40	SABZAZAR	A.I.TOWN	T/W	D-Block Sabzazar	80	2 CFS	46	62
33	24	111159004401	60	SABZAZAR	A.I.TOWN	T/W	B-Block Sabzazar	80	2 CFS	46	61
34	46	111210001800	1	FARKHABAD	RAVI TOWN	T/W	Faisal Park	80	2 CFS	12	37
35	24	111212408300	80	FARKHABAD	RAVI TOWN	T/W	Match Factory	150	4 CFS	46	112
36	24	111222621181	40	FARKHABAD	RAVI TOWN	T/W	vandala road	150	4 CFS	12	112
37	24	111229000100	4	FARKHABAD	RAVI TOWN	T/W	Aziz Colony	150	2 CFS	46	113
38	24	111229002600	40	SHAHDARA	RAVI TOWN	T/W	G.T ROAD SHAHDARA	80	2 CFS	46	130
39	24	111242400161	20	FARKHABAD	RAVI TOWN	T/W	KPS SCHOOL BEGUM KOT	80	2 CFS	12	60
40	24	111242400660	20	FARKHABAD	RAVI TOWN	T/W	Shaukat Colony B/Kot	80	2 CFS	45	61
41	24	111310004700	40	SHAHDARA	RAVI TOWN	T/W	Takia Khusrian Wala/UC-6	80	2 CFS	45	112
42	24	111319000600	40	SHAHDARA	RAVI TOWN	T/W	Old Shahdara Town	150	4 CFS	45	112

43	24	111319004300	40	SHAHDARA	RAVI TOWN	T/W	Qazi Park	150	4 CFS	45	113
44	24	111319004400	40	SHAHDARA	RAVI TOWN	T/W	Qaisar Town	150	4 CFS	45	113
45	24	111319005600	40	SHAHDARA	RAVI TOWN	T/W	Saeed Park Old G.T Road	150	4 CFS	45	116
46	24	111319008300	120	SHAHDARA	RAVI TOWN	T/W	Ravi Cricket Ground	150	4Cfs	45	112
47	24	111319008501	20	SHAHDARA	RAVI TOWN	T/W	Paracha Colony	50	1 cfs	45	37
48	24	111319008700	1	SHAHDARA	RAVI TOWN	T/W	Majeed Park/UC-6	50	1 cfs	45	37
49	24	111319009000	40	SHAHDARA	RAVI TOWN	T/W	Takia Khusrian Wala B.K BAGH	150	4 CFS	45	113
50	24	111319014900	40	SHAHDARA	RAVI TOWN	T/W	ravi flour mill area	80	2 CFS	45	61
51	24	111322400701	2	FARKHABAD	RAVI TOWN	T/W	Farakha Abad New	150	4 CFS	45	116
52	24	111322400860	60	FARKHABAD	RAVI TOWN	T/W	Jia Musa	80	2 CFS	45	63
53	24	111322401270	20	FARKHABAD	RAVI TOWN	T/W	Yousaf Park	80	2Cfs	45	61
54	24	111322401430	2	FARKHABAD	RAVI TOWN	T/W	Kamran Park	80	2 CFS	45	61
55	24	111322401950	120	FARKHABAD	RAVI TOWN	T/W	Gulshan-e-Hayat	150	4 CFS	45	113
56	24	111322402510	20	FARKHABAD	RAVI TOWN	T/W	Bara Dari Road	80	2 CFS	45	61
57	24	111330007801	40	RAVI ROAD	G.B.TOWN	T/W	Kasoor Pura	150	4 CFS	45	116
58	24	111330008301	60	RAVI ROAD	G.B.TOWN	T/W	National Ravi No. □	150	4 CFS	45	116
59	24	111330008401	40	RAVI ROAD	G.B.TOWN	T/W	National Ravi No.□	150	4 CFS	45	116
60	24	111330008900	60	RAVI ROAD	G.B.TOWN	T/W	Shafi□abad	80	2 CFS	45	67
61	24	111339907100	120	RAVI ROAD	G.B.TOWN	T/W	Adda Bajri Wala	150	4 CFS	45	114
62	24	111339919500	40	RAVI ROAD	G.B.TOWN	T/W	Amin Park No-□	80	2 CFS	45	61
63	24	111340006002	40	CITY	RAVI TOWN	T/W	Tehsil Garden DUAL CONNECT□ON F□LTER PLANT	100	2 CFS	46	116
64	24	111340008101	60	RAVI ROAD	G.B.TOWN	T/W	Yasin Road	80	2 CFS	45	133
65	24	111340008601	40	RAVI ROAD	G.B.TOWN	T/W	Bagh munchi ladha tubewell	150	4 CFS	45	112
66	24	111340009501	80	RAVI ROAD	G.B.TOWN	T/W	Salamat Mohallah	150	4 CFS	45	116
67	24	111341010200	40	RAVI ROAD	G.B.TOWN	T/W	Karim Park	150	4 CFS	45	113
68	24	111349009602	40	RAVI ROAD	G.B.TOWN	T/W	Karim Park Block No.□	150	4 CFS	45	116
69	24	111349009700	40	RAVI ROAD	G.B.TOWN	T/W	Rehmat Floor Mill	150	4 CFS	45	116
70	24	111349009800	40	RAVI ROAD	G.B.TOWN	T/W	Alah Wali Masjid	150	4 CFS	45	116
71	24	111349009900	40	CITY	RAVI TOWN	T/W	Ali Park Fort Road	150	4 CFS	45	113
72	24	111410073004	40	CITY	RAVI TOWN	T/W	Timber Market	150	2Cfs	45	112
73	24	111410085001	60	CITY	RAVI TOWN	T/W	Al- Madad Park	80	2Cfs	45	61
74	24	111410090003	80	CITY	RAVI TOWN	T/W	□egitable Market	150	2Cfs	45	112
75	24	111410110009	40	CITY	RAVI TOWN	T/W	Old Ravi 4 Fruit Market	150	2Cfs	45	112
76	24	111410112000	20	CITY	RAVI TOWN	T/W	NAWAZ SHAR□F Nabi Park	80	2 CFS	45	61
77	24	111410117002	80	CITY	RAVI TOWN	T/W	□□ba Park □S□orts Com□le□	150	4Cfs	45	116
78	24	111419056005	40	CITY	RAVI TOWN	T/W	Old Ravi No-□	150	2 CFS	45	383
79	24	111419200001	20	CITY	RAVI TOWN	T/W	Qila Muhammadi	80	2Cfs	45	61
80	24	111419815500	40	CITY	RAVI TOWN	T/W	Larry Adda New	150	4 CFS	45	113
81	24	111419815900	80	CITY	RAVI TOWN	T/W	Shahi Qila	150	4 CFS	45	113
82	24	111419816100	40	CITY	RAVI TOWN	T/W	Timber Market new	150	4 CFS	45	113
83	24	111420002901	40	RAVI ROAD	G.B.TOWN	T/W	M.O.Fall □Old□	150	4 CFS	45	112
84	24	111429000500	40	RAVI ROAD	G.B.TOWN	T/W	Sardar Cha□□al	80	2 CFS	45	111
85	24	111429000800	40	RAVI ROAD	G.B.TOWN	T/W	□brahim Road	80	2 CFS	46	62
86	24	111429001000	40	RAVI ROAD	G.B.TOWN	T/W	Masoom Gunj □M.H□	150	4 CFS	45	112

87	24	111429001800	40	RAVI ROAD	G.B.TOWN	T/W	Umer Park	80	2 CFS	45	60
88	24	111429003700	40	RAVI ROAD	G.B.TOWN	T/W	Bilal Gunj Girls Degree College	80	2 CFS	45	67
89	24	111429003800	120	RAVI ROAD	G.B.TOWN	T/W	Sheesh mahal/Mohni Road	150	4 CFS	45	113
90	24	111429003802	40	RAVI ROAD	G.B.TOWN	T/W	Riaz Colony	80	2 CFS	45	61
91	24	111429005500	40	RAVI ROAD	G.B.TOWN	T/W	DCO Office	80	2 CFS	45	61
92	24	111430002101	40	CITY	RAVI TOWN	T/W	Masti Gate	150	4 CFS	45	113
93	24	111439002800	40	CITY	RAVI TOWN	T/W	Sheranwala Gate DUAL CONNECT□ON F□LTER PLANT	150	4 CFS	45	116
94	24	111439002801	40	CITY	RAVI TOWN	T/W	Kashmiri GATE	150	4 CFS	45	113
95	24	111440001801	40	RAVI ROAD	G.B.TOWN	T/W	Firdous Park	150	4 CFS	45	112
96	24	111440001901	40	ANARKALI	G.B.TOWN	T/W	Cattle Park	80	2 CFS	46	60
97	24	111440002102	40	CITY	RAVI TOWN	T/W	Bhatti Gate	150	4 CFS	45	117
98	24	111440002710	40	CITY	RAVI TOWN	T/W	Mori Gate New	150	4 CFS	45	113
99	24	111440003301	20	ANARKALI	G.B.TOWN	T/W	Nasir Bagh	80	2 CFS	46	61
100	24	111449000902	40	CITY	RAVI TOWN	T/W	Chomala DUAL CONNECT□ON F□LTER PLANT	80	2Cfs	45	48
101	24	111449000903	40	CITY	RAVI TOWN	T/W	TE□AL□GATE New	150	4 CFS	45	113
102	24	111449001600	40	CITY	RAVI TOWN	T/W	Lohari Gate	150	4Cfs	45	114
103	24	111440004101		RAVI ROAD	RAVI TOWN	T/W	DE□SMAGE ROAD	150	4Cfs	45	114
104	24	111452612404	60	CITY	RAVI TOWN	T/W	Fowara Chowk DUAL CONNECT□ON F□LTER PLANT	80	2Cfs	45	61
105	24	111452612405	80	CITY	RAVI TOWN	T/W	Shahalam Gate	150	4Cfs	45	116
106	24	111510049000	60	DATA NAGAR	RAVI TOWN	T/W	Qaddafi Colony	150	4 CFS	45	113
107	24	111519026015	40	DATA NAGAR	RAVI TOWN	T/W	Hanif Park	150	4 CFS	45	114
108	24	111519026020	2	DATA NAGAR	RAVI TOWN	T/W	Khokhar Road No.□	150	2 CFS	45	114
109	24	111519026025	40	DATA NAGAR	RAVI TOWN	T/W	Siddi□ue Pura	150	4 CFS	45	114
110	24	111519026046	60	DATA NAGAR	RAVI TOWN	T/W	Hussain Park	60	2CFS	45	61
111	24	111519026047	80	DATA NAGAR	RAVI TOWN	T/W	Chah Motia Wala	150	4 CFS	45	113
112	24	111519026048	20	DATA NAGAR	RAVI TOWN	T/W	NEW HAN□F PARK	80	2 CFS	45	60
113	24	111519036021	20	DATA NAGAR	RAVI TOWN	T/W	Khokher Road	80	2 CFS	45	61
114	24	111519036022	40	DATA NAGAR	RAVI TOWN	T/W	Ali Pura	112	4 cfs	45	112
115	24	111520059003	60	SHADBAGH	RAVI TOWN	T/W	Children □ark	80	2Cfs	46	145
116	24	111520061009	40	SHADBAGH	RAVI TOWN	T/W	Nabi Bu□Park	150	2 CFS	46	216
117	24	111520090004	20	SHADBAGH	RAVI TOWN	T/W	Scheme No. □	80	2Cfs	45	60
118	24	111520123005	40	DATA NAGAR	RAVI TOWN	T/W	Kholo Ghar	150	4 CFS	45	114
119	24	111520141003	40	DATA NAGAR	RAVI TOWN	T/W	Khokhar Road No.□	150	4 CFS	45	116
120	24	111520142002	40	DATA NAGAR	RAVI TOWN	T/W	Khokhar Road No.□	150	4 CFS	45	116
121	24	111520145000	40	SHADBAGH	RAVI TOWN	T/W	Akram Park	150	4 CFS	45	113
122	24	111520147000	20	SHADBAGH	RAVI TOWN	T/W	Hamad Colony	80	2 CFS	45	61
123	24	111520149000	40	SHADBAGH	RAVI TOWN	T/W	S.B. Wealth Centre No.□	150	4Cfs	45	114.14
124	24	111520150000	80	SHADBAGH	RAVI TOWN	T/W	S.B. Wealth Centre No.□	150	4Cfs	45	114.14
125	24	111520151000	40	DATA NAGAR	RAVI TOWN	T/W	S.B. Wealth Centre No.□	150	4Cfs	45	114.14
126	24	111520152000	40	SHADBAGH	RAVI TOWN	T/W	S.B. Wealth Centre No.4	150	4Cfs	45	114.14
127	24	111530004504	20	SHADBAGH	RAVI TOWN	T/W	Lady Sofia Park	80	2 CFS	45	61
128	24	111530018007	2	SHADBAGH	RAVI TOWN	T/W	Sofia Park	150	4 CFS	46	114

129	24	111530019006	40	SHADBAGH	RAVI TOWN	T/W	Takia Ujagar Shah	150	2Cfs	46	112
130	24	111530020003	40	SHADBAGH	RAVI TOWN	T/W	Shahab Stadiam	150	4Cfs	46	116
131	24	111530220001	40	SHADBAGH	RAVI TOWN	T/W	Chah Miran	150	4Cfs	46	113
132	24	111530220005	40	MISRISHAH	RAVI TOWN	T/W	Dilawar road wasa	80	2 CFS	45	61
133	24	111540260389	40	SHADBAGH	RAVI TOWN	T/W	Piran Wala	80	2Cfs	45	60
134	24	111540260397	40	DATA NAGAR	RAVI TOWN	T/W	Raheem Road	150	2 CFS	45	116
135	24	111540260410	40	SHADBAGH	RAVI TOWN	T/W	Shamshad Park	150	4 CFS	45	113
136	24	111550260044	40	MISRISHAH	RAVI TOWN	T/W	Ahata Thanedar	80	2 CFS	46	60
137	24	111550260045	20	MISRISHAH	RAVI TOWN	T/W	FA□Z BAGH/□SLAM□A H□GH SCHOOL	80	2 CFS	45	61
138	24	111550260059	40	MISRISHAH	RAVI TOWN	T/W	Chamra Mandi	150	4 CFS	46	113
139	24	111550260064	40	MISRISHAH	RAVI TOWN	T/W	Sultani Park	150	4 CFS	45	113
140	24	111550260388	80	SHADBAGH	RAVI TOWN	T/W	Elahi Park	150	4 CFS	45	133
141	24	111550260395	80	SHADBAGH	RAVI TOWN	T/W	Taj Pura Ground	150	4Cfs	45	114
142	24	111550260396	80	SHADBAGH	RAVI TOWN	T/W	Nazimabad	150	4 CFS	45	113
143	24	112119004600	30	JOHAR TOWN	A.I.TOWN	T/W	Cam□us □iew Town □B-□-□0□	80	2 CFS	10	45
144	24	112119004700	80	JOHAR TOWN	A.I.TOWN	T/W	F-□Block	80	2 CFS	46	131
145	24	112119008624	20	JOHAR TOWN	A.I.TOWN	T/W	E-□Block	80	2 CFS	46	61
146	24	112119018300	60	JOHAR TOWN	A.I.TOWN	T/W	Shoukat Ali	80	2 CFS	45	112
147	24	112119020700	40	JOHAR TOWN	A.I.TOWN	T/W	D-□Block	150	4 CFS	45	112
148	24	112119020800	40	JOHAR TOWN	A.I.TOWN	T/W	E Block	150	4 CFS	45	112
149	24	112119411480	40	JOHAR TOWN	A.I.TOWN	T/W	G-1 Block	150	4 CFS	45	113
150	24	112120013900	40	GREEN TOWN	NISHTER TOWN	T/W	4-C-□□New	150	4 CFS	46	112
151	24	112122414100	20	GREEN TOWN	NISHTER TOWN	T/W	Bhatta Colony	80	2 CFS	12	61
152	24	112122414200	20	GREEN TOWN	N TOWN	T/W	BAG□RA□AN	60	□ CFS	45	61
153	24	112122414302	20	GREEN TOWN	N TOWN	T/W	OUKAF COLONY	60	□ CFS	45	61
154	24	112122414405	20	GREEN TOWN	NISHTER TOWN	T/W	Baggrian Pind	80	2 CFS	46	60
155	24	112123038900	20	GREEN TOWN	NISHTER TOWN	T/W	□ C-□□	80	2 CFS	45	61
156	24	112131020801	20	GREEN TOWN	NISHTER TOWN	T/W	5-D-I	80	2 CFS	45	30
157	24	112131020900	80	GREEN TOWN	NISHTER TOWN	T/W	□-D-□	150	4 CFS	46	112
158	24	112131020901	30	GREEN TOWN	NISHTER TOWN	T/W	4-D-II	40	2cfs	46	30
159	24	112131021000	20	GREEN TOWN	NISHTER TOWN	T/W	□-D-□ K Plaza	80	2 CFS	45	60
160	24	112131021100	40	GREEN TOWN	NISHTER TOWN	T/W	□-D-□□	150	4 CFS	45	113
161	24	112131021400	40	GREEN TOWN	NISHTER TOWN	T/W	□-D-□	150	4 CFS	45	116
162	24	112131021500	20	GREEN TOWN	NISHTER TOWN	T/W	□-C-□	80	2 CFS	45	61
163	24	112131021600	1	GREEN TOWN	NISHTER TOWN	T/W	□-D-□□ New	80	2 CFS	46	60
164	24	112131021601	20	GREEN TOWN	NISHTER TOWN	T/W	□-D-□□/G Town	80	2 CFS	45	60
165	24	112131021700	40	GREEN TOWN	NISHTER TOWN	T/W	□-D-□□	150	4 CFS	45	120
166	45	112141511006	1	INDUSTRIAL AREA	NISHTER TOWN	T/W	2-A-II	80	2 CFS	45	31
167	24	112142106900	40	TOWNSHIP	NISHTER TOWN	T/W	Pindi Sto□	150	4 CFS	46	116
168	24	112142107701	40	TOWNSHIP	NISHTER TOWN	T/W	Raj□utan	150	4 CFS	45	113
169	24	112149101950	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	6-A-□□ Town Shi□	150	4 CFS	46	96
170	24	112149102100	1	GREEN TOWN	NISHTER TOWN	T/W	□-B-□ Town Shi□	80	2 CFS	46	60
171	24	112149102700	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	4-A-□□ Town Shi□	150	4 CFS	46	116
172	24	112149103100	40	GREEN TOWN	NISHTER TOWN	T/W	6-B-□ Town Shi□	80	2 CFS	46	112
173	24	112150023211	40	JOHAR TOWN	NISHTER TOWN	T/W	A BLOCK JOHAR TOWN		4 CFS		

174	24	112152404600	40	GREEN TOWN	NISHTER TOWN	T/W	□-C-□□	150	4 CFS	46	113
175	24	112159100300	40	JOHAR TOWN	A.I.TOWN	T/W	A-□, Block	80	2 CFS	46	131
176	24	112159100400	20	GREEN TOWN	NISHTER TOWN	T/W	□6 B-□	80	2 CFS	45	61
177	24	112159100500	20	GREEN TOWN	NISHTER TOWN	T/W	□-C-□	80	2 CFS	45	61
178	24	112159102600	60	GREEN TOWN	NISHTER TOWN	T/W	□□-B-□oTwn Shi□	150	4 CFS	46	116
179	24	112159103150	20	GREEN TOWN	NISHTER TOWN	T/W	□□-B-□oTwn Shi□	80	2 CFS	46	61
180	24	112159104100	20	GREEN TOWN	NISHTER TOWN	T/W	□-B-□□eNw	80	2 CFS	46	61
181	24	112159104421	60	JOHAR TOWN	A.I.TOWN	T/W	SHAKHI CHOWK	150	4 CFS	46	113
182	24	112159158000	20	GREEN TOWN	N TOWN	T/W	BLOCK □B □TOWN SH□P	60	□ CFS	45	61
183	24	112162102201	40	TOWNSHIP	NISHTER TOWN	T/W	Akbar Shaheed Road	150	4 CFS	45	113
184	24	112162102600	40	TOWNSHIP	NISHTER TOWN	T/W	R-Bock OLD	150	4 CFS	46	114
185	24	112162102700	40	TOWNSHIP	NISHTER TOWN	T/W	R BLOCK NEW	150	4 CFS	46	113
186	24	112162103300	40	TOWNSHIP	NISHTER TOWN	T/W	S-Block M. T.	150	4 CFS	46	112
187	24	112162103400	40	TOWNSHIP	NISHTER TOWN	T/W	NASRAT ROAD	150	4 CFS	46	113
188	24	112162107509	20	TOWNSHIP	NISHTER TOWN	T/W	Nadeem Park	80	2 CFS	45	60
189	24	112162108100	40	TOWNSHIP	NISHTER TOWN	T/W	Al-Badar Hos□ital	150	4 CFS	46	113
190	24	112162108301	20	TOWNSHIP	NISHTER TOWN	T/W	Cricket Ground	80	2 CFS	45	61
191	24	112170007701	80	JOHAR TOWN	A.I.TOWN	T/W	G-4, Block	150	4 CFS	46	131
192	24	112179008603	2	JOHAR TOWN	A.I.TOWN	T/W	H-□, Block	150	4 CFS	46	112
193	24	112179010300	40	JOHAR TOWN	A.I.TOWN	T/W	J-□, Block	150	4 CFS	46	112
194	24	112179010400	51	JOHAR TOWN	A.I.TOWN	T/W	L-Block	150	4 CFS	46	113
195	24	112179018100	40	JOHAR TOWN	A.I.TOWN	T/W	J BLOCK PARK	150	4 CFS	45	112
196	24	112311534401	40	A.I.T	A.I.T	T/W	Chenab Block □ark	150	4 CFS	45	113
197	24	112311534404	40	A.I.T	a.i.t	T/W	asif block	150	4 CFS	45	112
198	24	112311534701	40	A.I.T	A.I.T	T/W	Huma Block No.□□New□	150	2 CFS	46	113
199	24	112311535400	40	A.I.T	A.I.T	T/W	Jehanzaib Block	80	2 CFS	46	112
200	24	112319000500	40	A.I.T	A.I.T	T/W	NEELAM BLK	150	4 CFS	46	115
201	24	112319000700	40	A.I.T	A.I.T	T/W	Pak Block	150	4 CFS	46	113
202	24	112319002000	20	A.I.T	A.I.T	T/W	NEW HUNZA BLK	80	2 CFS	46	62
203	24	112319002100	40	A.I.T	A.I.T	T/W	College Block	150	4 CFS	45	114
204	24	112319002600	40	A.I.T	A.I.T	T/W	Clifton Colony	150	2 CFS	46	114
205	24	112329000601	40	A.I.T	A.I.T	T/W	Mehran Block	150	4 CFS	45	113
206	24	112329000800	40	A.I.T	A.I.T	T/W	Kharik MULTAN	150	4 CFS	45	113
207	24	112329002902	40	A.I.T	A.I.T	T/W	Fruit Mandi	150	4 CFS	45	113
208	24	112331535200	60	A.I.T	A.I.T	T/W	NEW NARGIS BLK	150	4 CFS	46	115
209	24	112331537008	40	A.I.T	A.I.T	T/W	Nishter Block	80	2 CFS	45	61
210	24	112339004300	80	A.I.T	A.I.T	T/W	Karim Blk□Old□	150	2 CFS	45	114
211	24	112339004301	20	A.I.T	A.I.T	T/W	Karim Blk□New□	80	2 CFS	45	61
212	24	112339004306	40	A.I.T	A.I.T	T/W	Raza Block	150	2 CFS	45	113
213	24	112339004308	40	A.I.T	A.I.T	T/W	Kamran Block	150	4 CFS	45	113
214	24	112349003708	120	mustafa town	A.I.TOWN	T/W	Mustafa Town	150	4 CFS	45	130
215	24	112359001701	40	mustafa town	A.I.TOWN	t/w	c block jubilee town	150	4 CFS	45	112
216	24	112360009600	40	SABZAZAR	A.I.TOWN	T/W	Awan Town	150	4 CFS	46	116
217	24	112369003001	40	SABZAZAR	A.I.TOWN	T/W	Kharik MULTAN	150	4 CFS	45	120
218	24	112369003100	40	SABZAZAR	A.I.TOWN	T/W	duban Pura		4 CFS	45	112

219	24	112412600286	40	ISLAM PURA	G.B.TOWN	T/W	Zubair Park	150	4 CFS	45	112
220	24	112412600305	40	ISLAM PURA	G.B.TOWN	T/W	Rewaz Garden	150	4 CFS	46	114
221	24	112412600307	40	ISLAM PURA	G.B.TOWN	T/W	Bilal Park	150	4 CFS	46	114
222	24	112412600330	20	ISLAM PURA	G.B.TOWN	T/W	Muslim Park	80	2 CFS	46	64
223	24	112419600310	40	ISLAM PURA	G.B.TOWN	T/W	Raffle Range	150	4 CFS	46	114
224	24	112429001200	60	RAVI ROAD	G.B.TOWN	T/W	Lia□at Abad Sanda Road	150	2 CFS	46	116
225	24	112429001400	40	RAVI ROAD	G.B.TOWN	T/W	Krishan Nagar	150	4 CFS	46	131
226	24	112429001402	60	RAVI ROAD	G.B.TOWN	T/W	□SLAMPURA	150	4 CFS	45	113
227	24	112429001403	2	ISLAM PURA	G.B.TOWN	T/W	Jahangir Park New	150	4 CFS	45	112
228	24	112429001701	40	RAVI ROAD	G.B.TOWN	T/W	M.C. High School	150	2 CFS	46	116
229	24	112429002702	40	ANARKALI	G.B.TOWN	T/W	Lady Maclagun School	150	4 CFS	45	116
230	24	112439000800	60	SAMANABAD	A.I.TOWN	T/W	N-Block	150	4 CFS	46	112
231	24	112439000900	40	SAMANABAD	A.I.TOWN	T/W	Khizra Masjid	150	4 CFS	46	116
232	24	112439001100	40	ICHRA	A.I.TOWN	T/W	Kubra Mos□ue	150	4 CFS	46	112
233	24	112439001201	60	ICHRA	A.I.TOWN	T/W	Nadeem / Rahat Park	150	4 CFS	46	113
234	24	112439003801	40	ICHRA	A.I.TOWN	T/W	Takia Lehri Shah	150	4 CFS	46	115
235	24	112449000802	40	SAMANABAD	A.I.TOWN	T/W	Zubaida Park New	150	4 CFS	45	112
236	24	112449001101	40	SAMANABAD	A.I.TOWN	T/W	□ttehad Colony	150	4 CFS	46	116
237	24	112449001602	40	SAMANABAD	A.I.TOWN	T/W	New Nawan Kot	150	4 CFS	46	113
238	24	112449002103	20	SAMANABAD	A.I.TOWN	T/W	Ghulam Nabi Colony	80	2 CFS	45	61
239	24	112449002300	40	SAMANABAD	A.I.TOWN	T/W	Kacha Umar Park	150	4 CFS	46	113
240	24	112449002900	40	SAMANABAD	A.I.TOWN	T/W	Chah Jihan Wala	150	4 CFS	45	115
241	24	112449267702	40	SAMANABAD	A.I.TOWN	T/W	Pakki Thatti	150	4 CFS	46	64
242	24	112450004399	20	SABZAZAR	A.I.TOWN	T/W	K-Block Sabzazar	80	2 CFS	46	61
243	24	112459001100	20	SABZAZAR	A.I.TOWN	T/W	sabzazar scheme	80	2 CFS	45	60
244	24	112459001400	40	SABZAZAR	A.I.TOWN	T/W	Shah Fareed Chowk	150	2 CFS	45	112
245	24	112459002001	40	SABZAZAR	A.I.TOWN	T/W	E-Block Sabzazar	80	2 CFS	46	112
246	24	112459002100	20	SABZAZAR	A.I.TOWN	T/W	G-Block Sabzazar	80	2 CFS	46	61
247	24	112459002400	20	SABZAZAR	A.I.TOWN	T/W	Block P sabzazar	80	2 CFS	45	61
248	24	112459005700	20	SABZAZAR	A.I.TOWN	T/W	H-□Block Sabzazar	80	2 CFS	46	60
249	24	112459007300	20	SABZAZAR	A.I.TOWN	T/W	A-Block Sabzazar	80	2 CFS	46	61
250	24	112459007500	40	SABZAZAR	A.I.TOWN	T/W	H-□Block Sabzazar	150	4 CFS	46	113
251	24	112510051105	20	ICHRA	A.I.TOWN	T/W	fazal elahi road	80	2 CFS	45	61
252	24	112510776604	80	MOZANG	Gulberg Town	T/W	Ahatta Moolchand-□	150	4 CFS	45	116
253	24	112510819403	20	MOZANG	Gulberg Town	T/W	Ahatta Moolchand-□□	80	2 CFS	46	61
254	24	112511094103	20	MOZANG	Gulberg Town	T/W	Donge Ground Fazlia Colony	80	2 CFS	46	66
255	24	112519000000	2	MOZANG	Gulberg Town	T/W	Shah Jamal	150	4 CFS	46	114
256	24	112519000200	20	ICHRA	A.I.TOWN	T/W	Mehboob Park	150	4 CFS	45	113
257	24	112519002700	40	ICHRA	A.I.TOWN	T/W	□chhra More	80	2 CFS	45	114
258	24	112519003000	2	ICHRA	A.I.TOWN	T/W	Windser Park	80	2 CFS	46	114
259	24	112519003200	20	ICHRA	A.I.TOWN	T/W	New Windser Park	80	2 CFS	46	61
260	24	112520000102	2	SHIMLA HILL	Gulberg Town	T/W	Anand Road □S.MERC□BLE-□00□□	100	2 CFS	46	111
261	24	112520005021	20	MOZANG	Gulberg Town	T/W	Apwa College (S.MERCIBLE)	100	2 CFS	45	61
262	24	112520018006	2	SHIMLA HILL	Gulberg Town	T/W	Zaman Park	150	4 CFS	46	134
263	24	112520021005	40	MOZANG	Gulberg Town	T/W	Shadman Market	150	2 CFS	45	134

264	24	112520037003	20	SHIMLA HILL	Gulberg Town	T/W	Baggay Shah	80	2 CFS	46	62
265	24	112520050009	120	SHIMLA HILL	Gulberg Town	T/W	Basti Saidan Shah	150	4 CFS	45	112
266	24	112520084009	2	MOZANG	Gulberg Town	T/W	Shadman-□Rehmania Park	80	2 CFS	46	116
267	24	112520129000	40	SHIMLA HILL	Gulberg Town	T/W	Scoth Corner	150	2 CFS	46	113
268	24	112520129001	40	SHIMLA HILL	Gulberg Town	T/W	khawaja bihari	150	4cfs	45	113
269	24	112520131010	40	MOZANG	Gulberg Town	T/W	GANDA NALA (S.MERCIBLE)	100	2 CFS	45	61
270	24	112520131011	40	MOZANG	Gulberg Town	T/W	Mental Hospital (S. MERCIBLE)	100	2 CFS	45	61
271	24	112520138000	20	SHIMLA HILL	Gulberg Town	T/W	Lare□Colony	80	2 CFS	46	61
272	24	112521270100	20	MOZANG	Gulberg Town	T/W	Pityala House	100	2 CFS	45	61
273	24	112529000800	40	MOZANG	Gulberg Town	T/W	Shadman Mental Tanki	80	2 CFS	45	136
274	24	112529075000	80	GULBERG	Gulberg Town	T/W	4-Jail Road WASA HEAD OFF□CE	150	4 CFS	45	114
275	24	112529075006	20	MOZANG	Gulberg Town	T/W	lawrance raod gate no.□bagh-e-jinnah	80	2 CFS	45	61
276	24	112530015600	20	MOZANG	Gulberg Town	T/W	puchwara mozang	80	2 CFS	45	61
277	24	112530015781	40	ANARKALI	G.B.TOWN	T/W	□-Farid Kot Road □S.MERC□BLE□	100	2 CFS	45	131
278	24	112530015783	80	ANARKALI	G.B.TOWN	T/W	Mozang Adda	150	4 CFS	46	134
279	24	112530015794	40	MOZANG	Gulberg Town	T/W	Roza Abu □sha□	80	2 CFS	46	60
280	24	112530015798	80	MOZANG	Gulberg Town	T/W	Lytton Road	80	2 CFS	46	113
281	24	112530025003	40	MOZANG	Gulberg Town	T/W	Queens Road	150	4 CFS	45	112
282	24	112539905302	40	MOZANG	Gulberg Town	T/W	Kot Abdullah	150	4 CFS	45	113
283	24	112539905304	40	MOZANG	Gulberg Town	tw	Mozang Adda chowk school	150	4 CFS	45	113
284	24	112540039000	1	MOZANG	Gulberg Town	T/W	Masson Road	80	2 CFS	46	61
285	24	112540098002	20	MOZANG	Gulberg Town	T/W	Waris Road	100	2 CFS	45	61
286	24	112549000700	80	MOZANG	Gulberg Town	T/W	Saddi Park	80	2 CFS	45	131
287	24	112549001200	40	MOZANG	Gulberg Town	T/W	Fasih Road	150	4 CFS	46	112
288	24	112549001300	40	MOZANG	Gulberg Town	T/W	Mian Aslam □□bal	150	4 CFS	45	113
289	24	112549001301	40	MOZANG	Gulberg Town	T/W	Data Gunj Buksh	80	2 CFS	45	61
290	24	112549001600	40	ICHRA	A.I.TOWN	T/W	Rasool Park	150	4 CFS	45	113
291	24	112549001900	40	ICHRA	A.I.TOWN	T/W	Punj Pir Road	80	2 CFS	45	61
292	24	112549002050	20	ICHRA	A.I.TOWN	tw	rasool □ark garden	80	2 CFS	45	61
293	24	112549052200	40	ICHRA	A.I.TOWN	T/W	NEW LOS	150	2 CFS	46	113
294	24	112549900400	20	MOZANG	Gulberg Town	T/W	Aibak park	80	2 CFS	45	61
295	24	112549901300	2	MOZANG	Gulberg Town	T/W	Hamoon Shah Park	150	4 CFS	46	114
296	24	113119901051	40	BAGHBANPURA	S.T/A.B.T	T/W	Ahmed Town	□□0	4 CFS	45	112
297	24	113119902400	20	BAGHBANPURA	S.T/A.B.T	T/W	MomanPura	□□0	□ CFS	46	61
298	24	113120284400	20	Fateh Gerh	S.T/A.B.T	T/W	Gowala Colony	80	□ CFS	45	61
299	24	113120284401	40	Fateh Gerh	S.T/A.B.T	T/W	Kotli Ghasee	80	□ CFS		60
300	24	113139901600	120	BAGHBANPURA	S.T/A.B.T	T/W	Baba Gandi Shah	□□0	4 CFS	46	113
301	24	113149002301	6	BAGHBANPURA	S.T/A.B.T	T/W	Dhobi Ghatt	□□0	4 CFS	46	116
302	24	113149002302	60	BAGHBANPURA	S.T/A.B.T	T/W	NasirAbad/□akistan mint	□□0	□ CFS	46	116
303	24	113149002303	2	BAGHBANPURA	S.T/A.B.T	T/W	Siraj Pura □b□/sd/st/804-08 dt- □4-0□-□4 new connection bore□	80	□ CFS	46	136
304	24	113149002308	40	BAGHBANPURA	S.T/A.B.T	T/W	Near Saad Mill	□□0	4 CFS	46	113
305	24	113150001502	80	MUGHALPURA	S.T/A.B.T	T/W	Kotli Pir Abdul Raheem	□□0	4 CFS	46	112.94
306	24	113150001600	120	MUGHALPURA	S.T/A.B.T	T/W	QAD□R BUKSH PARK	□□0	□ CFS	45	61
307	24	113150001601	40	Fateh Gerh	S.T/A.B.T	T/W	Nadia Ghee Mill new	□□0	4 CFS	45	112

308	24	113150001700	40	MUGHALPURA	S.T/A.B.T	T/W	Muslim Colony	□□0	4 CFS	53	112
309	24	113159008601	40	Fateh Gerh	S.T/A.B.T	T/W	gulshan □ark	□□0	4 CFS	46	114
310	24	113159905700	30	MUGHALPURA	S.T/A.B.T	T/W	FA□SAL PARK	80	□ CFS	46	61
311	24	113159906200	40	Fateh Gerh	S.T/A.B.T	T/W	maskeen □ura	80	□ CFS	45	113
312	24	113159906300	40	MUGHALPURA	S.T/A.B.T	T/W	Mushta□Colony	80	□ CFS	45	61
313	24	113312409300	20	ANARKALI	G.B.TOWN	T/W	New Dhobi Mandi /Old Anarkali	80	2 CFS	46	60
314	24	113319403300	80	ANARKALI	G.B.TOWN	T/W	PATYALA GROUND	150	4 CFS	46	132
315	24	113319403800	80	ANARKALI	G.B.TOWN	T/W	Nila Gumbad□D/S	150	4 CFS	46	112
316	24	113320019007	80	ANARKALI	G.B.TOWN	T/W	Circular Road	150	4 CFS	46	112
317	24	113320019008	40	ANARKALI	G.B.TOWN	T/W	Adda Crown Bus	150	4 CFS	45	113
318	24	113329018000	40	ANARKALI	G.B.TOWN	T/W	□□-Nisbat Road	150	4 CFS	46	113
319	24	113329019002	40	ANARKALI	G.B.TOWN	T/W	Katcha Nisbat Road	150	4 CFS	45	113
320	24	113330025001	40	ANARKALI	G.B.TOWN	T/W	N□SAR SCHEEM	150	4 CFS	46	112
321	24	113339000202	20	ANARKALI	G.B.TOWN	T/W	Railway Road □S.MERC□BLE□	100	2 CFS	45	61
322	24	113339000300	40	SHIMLA HILL	Gulberg Town	T/W	Tegor Park	150	4 CFS	46	112
323	24	113339000605	40	ANARKALI	G.B.TOWN	T/W	Q□LA GUJJAR S□NGH/ BAST□BHAWAN	80	2 CFS	45	71
324	24	113339266000	40	ANARKALI	G.B.TOWN	T/W	ROYAL PARK	150	4 CFS	46	112
325	24	113340013003	80	SHIMLA HILL	Gulberg Town	T/W	Muhammad Nagar	150	4 CFS	46	135
326	24	113340013006	40	SHIMLA HILL	Gulberg Town	tw	bibi □aak daman	80	2 CFS	45	61
327	24	113340017008	20	SHIMLA HILL	Gulberg Town	T/W	Garhi Shahu	80	2 CFS	46	61
328	24	113340025008	40	ANARKALI	G.B.TOWN	T/W	Usmania Colony	150	4 CFS	45	111
329	24	113340025009	40	ANARKALI	G.B.TOWN	T/W	Abdul Karim Road	80	2 CFS	45	60
330	24	113340033010	40	ANARKALI	G.B.TOWN	T/W	Nilcholoson Road	150	4 CFS	45	114
331	24	113340034006	118	SHIMLA HILL	Gulberg Town	T/W	Children Park	150	4 CFS	46	112
332	24	113340034010	40	SHIMLA HILL	Gulberg Town	T/W	Gari Shahoo	150	4 CFS	45	112
333	24	113340075006	2	SHIMLA HILL	Gulberg Town	T/W	Habib Ullah Road	150	4 CFS	46	112
334	24	113350019100	40	CITY	RAVI TOWN	T/W	New Yakki Gate/R.T.	150	4 CFS	45	113
335	24	113350022001	40	ANARKALI	G.B.TOWN	T/W	Landa Bazar	150	4 CFS	45	113
336	24	113350022003	40	CITY	RAVI TOWN	tw	mochi gate □ark	150	4 CFS	45	112
337	24	113350050903	40	CITY	RAVI TOWN	T/W	Akbari Gate OLD	80	2 CFS	45	61
338	24	113359050301	40	CITY	RAVI TOWN	T/W	Akbari Gate	150	4Cfs	46	114
339	24	113419000200	12	MUSTAFABAD	S.T/A.B.T	T/W	□nfatry Road	□□0	4 CFS	46	120
340	24	113419000800	20	MUSTAFABAD	S.T/A.B.T	T/W	Canal Bridge	80	□ CFS	46	114
341	24	113419001200	2	MUSTAFABAD	S.T/A.B.T	T/W	Gulistan Colony	□□0	4 CFS	46	114
342	24	113419002800	20	MUSTAFABAD	S.T/A.B.T	T/W	Tari□Colony	80	□ CFS	46	61
343	24	113419002900	3	MUSTAFABAD	S.T/A.B.T	T/W	Ahatta Makhan Singh	□□0	4 CFS	46	113
344	24	113419004400	120	MUSTAFABAD	S.T/A.B.T	T/W	Darbar Mian Mir	□□0	4 CFS	45	113
345	24	113419004600	30	MUSTAFABAD	S.T/A.B.T	T/W	Director O□ near chubacha	80	□ CFS	45	61
346	24	113419004800	30	MUGHALPURA	S.T/A.B.T	T/W	Masjid Taj Din	80	□ CFS	45	61
347	46	113420483702	1	MUGHALPURA	S.T/A.B.T	T/W	baba Bari Peer		□ CFS	46	30
348	24	113429003905	40	MUGHALPURA	S.T/A.B.T	T/W	Baghichi Sathaa Wali	□□0	4 CFS	45	112
349	24	113429004400	3	MUGHALPURA	S.T/A.B.T	T/W	Sansi Quarters/usman abad	□□0	4 CFS	46	80
350	24	113429004500	3	MUGHALPURA	S.T/A.B.T	T/W	Mila□Street	□□0	4 CFS	46	114
351	24	113429005000	100	MUGHALPURA	S.T/A.B.T	T/W	Achant Garah New	80	□ CFS	46	60.82
352	24	113429005101	20	MUGHALPURA	S.T/A.B.T	T/W	Jamilabad	80	□ CFS	45	61

353	24	113429005300	20	MUGHALPURA	S.T/A.B.T	T/W	Azeem Ground	80	□ CFS	46	61
354	24	113429005302	20	MUGHALPURA	S.T/A.B.T	T/W	Lal School Kacthi Abadi dars Baray Mian	80	□ CFS	45	61
355	24	113429005400	30	MUGHALPURA	S.T/A.B.T	T/W	Saher Road	□□0	□ CFS	46	61
356	24	113429006000	20	MUGHALPURA	S.T/A.B.T	T/W	Baja Line	80	□ CFS	46	61
357	24	113439000300	2	MUGHALPURA	S.T/A.B.T	T/W	Sahuwari Old	80	□ CFS	46	64
358	24	113439000400	40	MUGHALPURA	S.T/A.B.T	T/W	Sahuwari New D□SP	□□0	□ CFS	46	112
359	24	113439000700	40	MUGHALPURA	S.T/A.B.T	T/W	Shah Kamal	□□0	4 CFS	46	113
360	24	113439000800	40	MUGHALPURA	S.T/A.B.T	T/W	MUJAH□DABAD/JAHANG□R ROAD	□□0	4 CFS	46	112
361	24	113439003600	2	MUGHALPURA	S.T/A.B.T	T/W	Gosha Angori	□□0	4 CFS	46	112
362	24	113439004600	2	MUGHALPURA	S.T/A.B.T	T/W	Dars Baray Mian □SDO OFF□CE□	□□0	4 CFS	46	112.46
363	24	113439004800	1	MUGHALPURA	S.T/A.B.T	T/W	Angori Bagh Sch-□	80	□ CFS	46	61
364	24	113439006000	20	MUSTAFABAD	S.T/A.B.T	T/W	Dry Port Aziz Bhatti Town	80	□ CFS	46	62
365	24	113449001100	80	MUGHALPURA	S.T/A.B.T	T/W	Fayyaz Park	□□0	4 CFS	46	116
366	24	113449001200	40	Fateh Gerh	S.T/A.B.T	T/W	Punj Pir	□□0	4 CFS	46	114
367	24	113449003901	40	Fateh Gerh	S.T/A.B.T	T/W	Qalandar Pura	80	□ CFS	45	62
368	24	113449062000	2	Fateh Gerh	S.T/A.B.T	T/W	Muslim Abad	□□0	4 CFS	46	113
369	24	113449064000	2	TAJPURA	S.T/A.B.T	T/W	Taj Bagh	80	□ CFS	46	60
370	24	113450002401	40	Fateh Gerh	S.T/A.B.T	T/W	Salamat Pura No.□	□□0	□ CFS	46	112
371	24	113450002402	40	Fateh Gerh	S.T/A.B.T	T/W	Kareem Nagar	□□0	4 CFS	46	113
372	24	113450003801	4	Fateh Gerh	S.T/A.B.T	T/W	Salamt Pura Takia	□□0	4 CFS	46	116
373	24	113450003900	80	Fateh Gerh	S.T/A.B.T	T/W	Shalimar Housing Scheem	□□0	4 CFS	10	180
374	24	113450003901	60	Fateh Gerh	S.T/A.B.T	T/W	Shah Din Park	□□0	□ CFS	46	113
375	24	113450008302	27	Fateh Gerh	S.T/A.B.T	T/W	Fateh Garh Dis□encry	80	□ CFS	46	61
376	24	113450008303	40	Fateh Gerh	S.T/A.B.T	T/W	Pully Fateh Ger	□□0	4 CFS	45	113
377	24	113450008702	2	Fateh Gerh	S.T/A.B.T	T/W	□ftkhar Park	□□0	4 CFS	46	113
378	24	113519004100	40	SHADBAGH	RAVI TOWN	T/W	Yasrab Colony	150	4Cfs	46	115
379	24	113519006600	40	SHADBAGH	RAVI TOWN	T/W	Khuda Buksh Park	150	4Cfs	46	113
380	24	113519006700	40	SHADBAGH	R TOWN	T/W	AHMAD PARK Noshahi Road	60	□ CFS	45	61
381	24	113520002400	80	MISRISHAH	RAVI TOWN	T/W	Kot Kh. Saeed □New□	150	4 CFS	46	112
382	24	113529002702	60	MISRISHAH	RAVI TOWN	T/W	singh □ura	150	4 CFS	45	113
383	24	113529002703	40	MISRISHAH	RAVI TOWN	T/W	Singh□ura	80	□ CFS	45	61
384	24	113529003607	40	MISRISHAH	RAVI TOWN	T/W	Jamil □ark Gujjar Pura	150	4 CFS	45	112
385	24	113529003700	60	MISRISHAH	RAVI TOWN	T/W	Gujar Pura Block-A	150	4 CFS	46	111
386	24	113529003701	40	MISRISHAH	RAVI TOWN	T/W	Gujar Pura Block-B	150	4 CFS	46	113
387	24	113529003801	40	MISRISHAH	RAVI TOWN	T/W	Gujar Pura Block-D	150	4 CFS	46	111
388	24	113529003802	60	BAGHBANPURA	S.T/A.B.T	T/W	Gulshan Park	□□0	4 CFS	46	113
389	24	113529007000	40	MISRISHAH	RAVI TOWN	T/W	bhogiwal	150	4 CFS	46	134
390	24	113530000405	40	MISRISHAH	RAVI TOWN	T/W	Sawami Nagar	150	4 CFS	46	112
391	24	113530000406	40	MISRISHAH	RAVI TOWN	T/W	Swami nagar	60	2 CFS	45	79
392	24	113530260041	80	MISRISHAH	RAVI TOWN	T/W	Jinah Park	150	4 CFS	46	149
393	24	113539000107	40	MISRISHAH	RAVI TOWN	T/W	Tezab Ahata □New□	150	4 CFS	46	113
394	24	113539000110	40	MUGHALPURA	S.T/A.B.T	T/W	Para Shioot Colony	80	2 CFS	45	61
395	24	113539006101	40	MISRISHAH	RAVI TOWN	T/W	Shah Badar Dewan	150	4 CFS	46	113
396	24	113539006601	40	MISRISHAH	RAVI TOWN	T/W	Begum Pura New	150	4 CFS	45	112
397	24	113539006700	80	MISRISHAH	RAVI TOWN	T/W	Kanji House	150	4 CFS	46	116.17

398	24	113549001102	40	BAGHBANPURA	S.T/A.B.T	T/W	surriya jabeen □ark g.t road	□□0	4 CFS	12	112
399	24	113549003400	40	BAGHBANPURA	S.T/A.B.T	T/W	Madhu Lal Hussain	□□0	4 CFS	46	116.17
400	24	113549003401	40	BAGHBANPURA	S.T/A.B.T	T/W	Dy. Ya□oob Colony	□□0	4 CFS	46	113
401	24	113549005501	40	BAGHBANPURA	S.T/A.B.T	T/W	Near Mehmood Booti	□□0	4 CFS	46	113
402	24	113549005502	4	BAGHBANPURA	S.T/A.B.T	T/W	sukh neher	□□0	4 CFS	46	116.18
403	24	113559002000	80	BAGHBANPURA	S.T/A.B.T	T/W	Shah Gohar Abad	□□0	4 CFS	46	116
404	24	113559002001	40	BAGHBANPURA	S.T/A.B.T	T/W	Q□LA T□BBA KHAZNA	60	□ CFS	45	61
405	24	113559003801	40	BAGHBANPURA	S.T/A.B.T	T/W	mehmood booti	□□0	4 CFS	45	113
406	24	113559003802	40	BAGHBANPURA	S.T/A.B.T	T/W	Mehmood Booti	□□0	4 CFS	45	113
407	24	113559004200	40	BAGHBANPURA	S.T/A.B.T	T/W	Mehmood Booti No.□	□□0	4 CFS	46	116.18
408	24	115112107600	20	GARDEN TOWN	NISHTER TOWN	T/W	Ahmad Block	80	2 CFS	46	61
409	24	115112108503	60	GARDEN TOWN	NISHTER TOWN	T/W	Usman Block □N□	150	4 CFS	46	112
410	24	115112109000	40	GARDEN TOWN	NISHTER TOWN	T/W	Ali Block	150	4 CFS	46	112
411	24	115119002600	4	GARDEN TOWN	NISHTER TOWN	T/W	N-Block	80	2 CFS	46	114
412	24	115119002900	3	GARDEN TOWN	NISHTER TOWN	T/W	L-Block	150	4 CFS	46	116
413	24	115119003305	40	GARDEN TOWN	NISHTER TOWN	T/W	M-Block M.T.E	150	4 CFS	46	112
414	24	115119004601	20	GARDEN TOWN	NISHTER TOWN	T/W	Fiasal Town	150	2 CFS	45	61
415	24	115119005600	3	GARDEN TOWN	NISHTER TOWN	T/W	P-Block	150	4 CFS	46	114.14
416	24	115119009200	20	GARDEN TOWN	NISHTER TOWN	T/W	B-Block	80	2 CFS	46	61
417	24	115119009720	40	GARDEN TOWN	NISHTER TOWN	T/W	D-Block	150	4 CFS	46	113
418	24	115121520301	40	ICHRA		T/W	Kernal Pura	150	4 CFS	50	112
419	24	115121520305	4	ICHRA	A.I.TOWN	T/W	Shah Kamal New	150	4 CFS	46	132
420	24	115121520505	40	ICHRA	A.I.TOWN	T/W	Karam Abad Rehman□ura	150	4 CFS	46	113
421	24	115121520506	20	ICHRA	A.I.TOWN	T/W	New Rehman Pura□s.mercible□	100	2 CFS	45	61
422	24	115121521100	100	ICHRA	A.I.TOWN	T/W	A-Block Rehman Pura	150	4 CFS	46	113
423	24	115131001100	40	ICHRA	A.I.TOWN	T/W	A-Block Muslim Town	150	2 CFS	46	114
424	24	115131001305	40	ICHRA	A.I.TOWN	T/W	Ayubia Market Muslim	80	2 CFS	45	61
425	24	115131001600	40	GARDEN TOWN	NISHTER TOWN	T/W	Abu Bakar	150	4 CFS	46	113
426	24	115131004200	60	ICHRA	A.I.TOWN	T/W	Wahdat Road	80	2 CFS	46	61
427	24	115131004300	40	ICHRA	A.I.TOWN	T/W	C-Block Muslim Town	150	2 CFS	46	131
428	24	115131005902	40	GARDEN TOWN	N TOWN	T/W	SH□R SHAH BLOCK GARDON TOWN	□□0	4CFS	45	113
429	24	115131008601	20	GARDEN TOWN	NISHTER TOWN	T/W	Tari□Block	80	2 CFS	46	61
430	24	115131008800	40	TOWNSHIP	NISHTER TOWN	T/W	Q-Block M.T.E	80	2 CFS	46	61
431	24	115131008801	40	TOWNSHIP	NISHTER TOWN	T/W	nuth house	80	2 CFS	12	60
432	24	115159001600	2	GULBERG	Gulberg Town	T/W	Henery K.E. G-□□	80	2 CFS	46	60
433	24	115159003800	40	GULBERG	Gulberg Town	T/W	F.C.C. Gulberg	150	4 CFS	46	114
434	24	115159013800	40	GULBERG	Gulberg Town	T/W	Khan Colony Kachi Abadi	80	2 CFS	46	61
435	24	115159250041	40	GULBERG	Gulberg Town	T/W	B-C-Block, G-□□	150	4 CFS	46	113
436	24	115159250042	40	GULBERG	Gulberg Town	T/W	H-Block, G-□□	150	4 CFS	46	113
437	24	115159250052	40	GULBERG	Gulberg Town	T/W	P-Block, G. N.	80	2 CFS	46	61
438	24	115159250071	20	GULBERG	Gulberg Town	T/W	Qurban Line Kachi Abadi	80	2 CFS	46	61
439	24	115159250073	20	GULBERG	Gulberg Town	T/W	Nisar Press G-□□	80	2 CFS	46	61
440	24	115159250161	20	GULBERG	Gulberg Town	T/W	FCC Katchiabadi	80	2 CFS	45	61
441	24	115169004200	2	GULBERG	Gulberg Town	T/W	T-Block	150	4 CFS	46	60
442	24	115169006500	40	GULBERG	Gulberg Town	T/W	Macca Colony Old	150	4 CFS	46	116

443	24	115169007200	2	GULBERG	Gulberg Town	T/W	B.Block G-□□New	150	4 CFS	46	135
444	24	115169010800	2	GULBERG	Gulberg Town	T/W	Saint Marry Clony G-III	80	2 CFS	46	115
445	24	115169015000	2	GULBERG	Gulberg Town	T/W	Sharif Colony G-□□□	150	4 CFS	46	112
446	24	115169019800	2	GULBERG	Gulberg Town	T/W	Q-Block G-□□	150	4 CFS	46	113
447	24	115169027500	40	GULBERG	Gulberg Town	T/W	G-Block G-□/□ttehad Colony Kachi Abadi	80	2 CFS	46	61
448	24	115169027600	40	GULBERG	Gulberg Town	T/W	J-Block	20	2 CFS	46	61
449	24	115169027700	40	GULBERG	Gulberg Town	T/W	Gurumangat Road	80	2 CFS	46	61
450	24	115169042900	20	GULBERG	Gulberg Town	T/W	Jinnah Park	80	2 CFS	50	61
451	24	115169044200	40	GULBERG	Gulberg Town	T/W	D-□block C-ii	150	4 CFS	45	112
452	24	115169045100	20	GULBERG	Gulberg Town	T/W	Ghalib market Gulberg-□	80	2 CFS	45	60
453	24	115219400600	1	MUSTAFABAD	S.T/A.B.T	T/W	Gulshan Colony	80	□ CFS	46	60
454	24	115219763000	20	MUSTAFABAD	S.T/A.B.T	T/W	Gousia Colony	80	□ CFS	46	61
455	24	115219763500	40	MUSTAFABAD	S.T/A.B.T	T/W	L.D.A Quarter Walton	80	□ CFS	45	61
456	24	115229007700	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	Qanchi Amar Sidhu	150	4 CFS	46	114
457	24	115229950704	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	Sitara Colony	150	4 CFS	46	116
458	24	115311000292	2	INDUSTRIAL AREA	NISHTER TOWN	T/W	Bank Sto□M.F.H. Colony	150	4 CFS	46	116
459	24	115311000293	2	INDUSTRIAL AREA	NISHTER TOWN	T/W	Ghulam M. Bhatti Colony	150	4 CFS	46	116
460	24	115311000295	40	GREEN TOWN	NISHTER TOWN	T/W	Gawala Colony	80	2 CFS	45	60
461	24	115311000296	20	GREEN TOWN	NISHTER TOWN	T/W	Gawala Colony	80	2 CFS	45	61
462	24	115331000002	20	INDUSTRIAL AREA	NISHTER TOWN	T/W	New General	60	2 CFS	45	61
463	24	115331000003	2	INDUSTRIAL AREA	NISHTER TOWN	T/W	Irrigation Colony	150	4 CFS	46	116
464	24	115331000035	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	Nishter Colony	80	2 CFS	45	62
465	24	115331000037	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	Nishter Colony Near Tanki	80	2 CFS	46	62
466	24	115340008502	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	Baba Farid Colony	150	4 CFS	46	116
467	24	115340008504	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	Farid Colony PR□NT□NG PRESS	150	4 CFS	46	116
468	24	115349000560	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	General Hos□ital	150	2 CFS	46	112
469	24	115349000570	40	INDUSTRIAL AREA	NISHTER TOWN	T/W	Awami Colony	150	4 CFS	46	116
470	24	115349007502	20	INDUSTRIAL AREA	NISHTER TOWN	T/W	□ttefa□colony	80	2 CFS	45	61
471	24	115431748205	40	TAJPURA	S.T/A.B.T	T/W	Taj□ura GROUND	□□0	4 CFS	45	113
472	24	115431748216	40	TAJPURA	S.T/A.B.T	T/W	Data Park	80	□ CFS	45	61
473	24	115431748700	80	TAJPURA	S.T/A.B.T	T/W	D-Block	□□0	4 CFS	45	112
474	24	115431751001	30	TAJPURA	S.T/A.B.T	T/W	A-Block	80	□ CFS	46	61
475	24	115431751004	30	TAJPURA	S.T/A.B.T	T/W	SDO Office	80	□ CFS	46	61
476	24	115431751007	40	TAJPURA	S.T/A.B.T	T/W	Subhan Park	□□0	4 CFS	45	112
477	24	115431751500	40	TAJPURA	S.T/A.B.T	T/W	E-Block Taj Pura	80	□ CFS	46	60
478	24	115440399205	30	TAJPURA	S.T/A.B.T	T/W	Pind Pir Naseer	80	□ CFS	45	60
479	24	115441747904	40	TAJPURA	S.T/A.B.T	T/W	□shfa□chowk herbance	□□0	4 CFS	45	112
480	24	115441751700	80	TAJPURA	S.T/A.B.T	T/W	Jorrey Pull c. □ani	□□0	4 CFS	45	114
481	24	115450902530	3	TAJPURA	S.T/A.B.T	T/W	Al-Faisal Town	□□0	4 CFS	46	113
482	24	115451750700	40	TAJPURA	S.T/A.B.T	T/W	Burji No. □	80	□ CFS	46	45
483	24	115451750701	40	TAJPURA	S.T/A.B.T	T/W	Pakora Sto□□B-□□□	60	□ CFS	12	60
484	24	115451751200	40	TAJPURA	S.T/A.B.T	T/W	Ghaziabad Bus Sto□	□□0	□ CFS	45	131
485	24		40	TAJPURA	S.T/A.B.T	T/W	Ghaziabad Bus Sto□	80	□ CFS	45	61
486	24	115451790702	40	TAJPURA	S.T/A.B.T	T/W	Usman nagar	60	□ CFS	12	60

NISHTER TOWN

Tube well Detail

1 . Green Town Sub-division					
S.#	**Name of Tube well**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	4-C-II	2000	4-cfs	3.25-cfs	4-cfs
2	Bhatta No. 1, 2	2009	2-cfs	1.9-cfs	2-cfs
3	Hakim Town	2012	2-cfs	2-cfs	2-cfs
4	Auqaf Colony	2012	2-cfs	1.6-cfs	2-cfs
5	Baggrian Village	2005	2-cfs	1.9-cfs	2-cfs
6	5-C-II	2009	2-cfs	1.9-cfs	2-cfs
7	5-D-I Kir Kalan	2003	2-cfs	1.6-cfs	2-cfs
8	3-D-I	1998	4-cfs	3.25-cfs	4-cfs
9	4-D-II	2005	2-cfs	1-cfs	2-cfs
10	5-D-I Karachi Plaza	2006	2-cfs	1.5-cfs	2-cfs
11	3-D-II	2002	4-cfs	3.25-cfs	4-cfs
12	2-D-I	1998	4-cfs	3.25-cfs	4-cfs
13	3-C-I	2006	2-cfs	1.5-cfs	2-cfs
14	5-D-II (New)	2012	2-cfs	1-cfs	2-cfs
15	5-D-II (Old)	2001	2-cfs	1.5-cfs	2-cfs
16	1-D-II	2009	4-cfs	3.25-cfs	4-cfs
17	2-B-I	2012	2-cfs	2-cfs	2-cfs
18	6-B-I	2008	4-cfs	1.5-cfs	4-cfs
19	2-C-II	2003	4-cfs	3.25-cfs	4-cfs
20	16-B-I	2009	2-cfs	1.8-cfs	2-cfs
21	1-C-I	2009	2-cfs	1.9-cfs	2-cfs
22	13-B-I	1998	4-cfs	3.25-cfs	4-cfs
23	11-B-I	2002	2-cfs	1.75-cfs	2-cfs
24	1-B-II (Old)	2003	4-cfs	1.5-cfs	4-cfs
25	1-B-II (New)	2012	2-cfs	2-cfs	2-cfs
26	Gawala Colony No.1	1980	2-cfs	1-cfs	2-cfs
27	Gawala Colony No. 3	2008	2-cfs	1.8-cfs	2-cfs

2. Garden Town Sub-division					
S.#	**Name of Tubewell**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity of Tubewell**
1	Ali Block Garden Town	2012	4-Cfs	4-Cfs	4-Cfs
2	Usman Block New	2006	4-Cfs	3.5-Cfs	4-Cfs
3	Tariq Block	2007	2-Cfs	2-Cfs	2-Cfs

4	L-Block Model Town Exten	1996	4-Cfs	3-Cfs	4-Cfs
5	M-Block Model Town Exten	2006	4-Cfs	3.5-Cfs	4-Cfs
6	Ahmad Block	1998	2-Cfs	1-Cfs	2-Cfs
7	N-Block Model Town Exten	2007	2-Cfs	2-Cfs	2-Cfs
8	Abu-Bakar Block	2006	4-Cfs	3-Cfs	4-Cfs
9	P-Block Model Town Exten	1993	2-Cfs	2-Cfs	2-Cfs
10	C-Block Faisal Town	2009	2-Cfs	2-Cfs	2-Cfs
11	D-Block Faisal Town	2006	4-Cfs	3.5-Cfs	4-Cfs
12	Sher-Shah Block New Garden	2012	4-Cfs	2-Cfs	4-Cfs
13	B-Block New Faisal Town	2012	2-Cfs	2-Cfs	2-Cfs

3. Industrial Area subdivision					
S.#	**Name of Tube well**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity of Tube well**
1	Quanchi Stop Tube well	2012	04-Cfs	4-Cfs	04-Cfs
2	General Hospital Tube well Near Emergency	2014	04-Cfs	4-Cfs	04-Cfs
3	Baba Farid Colony near main Idress Dera	2002	04-Cfs	3- Cfs	04-Cfs
4	Baba Farid Colony Near Jail	2000	04-Cfs	2- Cfs	04-Cfs
5	Irregation Colony	2011	04-Cfs	4 Cfs	04-Cfs
6	Bank Stop Main Fazal Haq Colony	2000	04-Cfs	2-Cfs	04-Cfs
7	Ghulam Muhammad Bhatti Colony	2000	04-Cfs	3 Cfs	04-Cfs
8	Nishter Colony Near Police Station	1990	02-Cfs	2-Cfs	02-Cfs
9	Nishter Colony Near Tanki	1990	02-Cfs	1.5- Cfs	02-Cfs
10	Koh-E-Noor Housing Society (Awami Colony)	2014	04-Cfs	4-Cfs	04-Cfs
11	Sittara Colony Tube well	2005	04-Cfs	3-Cfs	04-Cfs
12	Block No.6 Sector A-II Town Ship	2000	04-Cfs	3-Cfs	04-Cfs
13	Block No.4 Sector A-II Town Ship	1996	04-Cfs	1.5- Cfs	2- Cfs
14	Block No.2 Sector A-II Town Ship	2009	02-Cfs	2 Cfs	02-Cfs
15	Chungi Amar Sadhu Near Caltex Petrol Pump	2009	2-Cfs	1.5 Cfs	02-Cfs
16	Ittefaq Colony Tube well	2012	2-Cfs	1.75-Cfs	2-Cfs

4. Township Subdivision					
S.#	**Name of Tube well**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity of Tube well**
1	Pindi Stop, Moulana Shoukat Ali Road.	1999	4-Cfs	3-Cfs	4-Cfs
2	Ali Park Pindi Rajputan New T/W.	2012	4-Cfs	4-Cfs	4-Cfs
3	Akbar Shaheed Road Near Akbar Shaheed Darbar.	2010	4-Cfs	4-Cfs	4-Cfs
4	Q-Block Model Town in front of Liaqatabad Police Station.	2004	2-Cfs	2-Cfs	2-Cfs
5	S-Block Near Dil Kusha Garden Scheme, Model Town Extension.	1996	4-Cfs	2-Cfs	2-Cfs
6	R-Block (New) Near Ideal Bakari Model Town Extension.	2007	4-Cfs	4-Cfs	2-Cfs
7	R-Block (Old) Near Govt Girls High School, Model Town Extension.	1989	4-Cfs	2-Cfs	2-Cfs
8	Al-Badar Hospital Near Ayub Road Kot Lakhpat.	2003	4-Cfs	2-Cfs	4-Cfs
9	Nasrat Road Near Graveyard Bahar Colony No. 1, Kot Lakhpat.	2007	4-Cfs	3-Cfs	4-Cfs
10	Ittefaq Cricket Ground in front of Sattu Kattla Drain Old F & V Market.	2009	2-Cfs	2-Cfs	2-Cfs
11	Nadeem Park on Peco Road near Kot Lakhpat Railway Station.	2012	2-Cfs	2-Cfs	2-Cfs
12	Bhatti Colony Near S.D.O. Township Office.	2012	2-Cfs	2-Cfs	2-Cfs

GUNJ BUCKSH TOWN

Tube well Detail

1.Anarkali Sub-division					
Sr. No	**Tube well Name**	**Year of installation**	**Design Discharge (Cfs)**	**Actual Discharge (Cfs)**	**Capacity (Cfs)**
1	Lady Mclegan T/well	2009	4	4	4
2	Napier Road T/well	2009	2	2	2
3	Cattle Park T/well	2009	2	1	4
4	Dhobi Mandi T/well	2008	2	2	2
5	Farid Court House T/well	2009	2	1	2
6	Mozang Adda T/well	1999	2	2	4
7	Royal Park T/well	1994	4	2	4
8	Patyala Ground T/well	2009	2	1	2
9	Nisar Scheme T/well	2009	4	4	4
10	Circular Road T/well	1986	4	2	4
11	Mela Ram Park T/well	1983	2	1	1
12	Usmania Colony T/well	2009	4	4	4
13	Haji Camp T/well	2009	4	4	4
14	Adda Crown Bus T/well	2009	4	4	4
15	Mohallah Gowallian T/well	2009	4	4	4
16	Katcha Nisbet Road T/well	2009	4	4	4
17	Rashi Bhawan T/well	2009	2	2	2
18	Railway Road T/well	2009	2	2	2
19	Landa Bazar T/well	2009	4	4	4
20	Nasir Bagh T/well	2002	2	2	2

2.Ravi Sub-Division					
Sr. No	**Tube well Name**	**Year of installation**	**Design Discharge cfs**	**Actual Discharge cfs**	**Capacity cfs**
1	Liaqat Abad	1998	2	2	2
2	Sanda Road Takoni Ground	2009	4	4	4
3	M.C. High School Sanda	2003	2	3	2
4	Corporation Colony Chohan Park	2009	4	4	4
5	Krishan Nagar, Islampura	1991	4	3	4
6	Nehru Park	2007	4	4	4
7	Commissioner Officer	1990	4	3	4
8	Firdous Park	2009	4	4	4
9	Masoom Gung (Ibrahim Road)	2007	2	2	2

10	Sardar Chappal	1993	2	2	2
11	Umar Park (Old)	1991	2	1	2
12	Umar Park (New)	2008	2	2	2
13	Shesh Mehal	2009	4	4	4
14	Salamat Mohallah Mohni Road	1998	4	3	4
15	Bagh Munshi Ladha	1986	4	2	4
16	Rehmat Floor Mill	2006	4	4	4
17	Karim Park Goal Ground	2009	2	2	2
18	Karim park Block No. 3	1986	2	1	2
19	Yasin Raod	1987	2	2	2
20	Allah Wali Mosque	2006	4	4	4
21	Qasoor Pura	1990	4	2	4
22	National Ravi No.1	2004	4	4	4
23	National Ravi No.2	2004	4	4	4
24	Bajri Addah T/W	2008	4	4	4
25	Gulshan-e-Riaz	2010	2	2	2
26	Munshi Hospital	1991	4	2	4
27	Main Outfall - Old	1992	4	2	4
28	M.O.Fall New	2012	4	4	4
29	Rafiabad (old)	2006	2	2	2
30	Shafique-Abad	2006	2	2	2
31	Akram Park Sanda	1990	2	1	2
32	D.C.O. Office	2009	4	2	4
33	Amin Park Gulshan-e-Riaz	2010	2	2	2
34	Rafaibad (New)	2014	4	4	4
35	Karim park Block No. 3 (WAPDA Office)	2014	4	-	4

3.Islam pura /Krishan Nagar					
Sr. No	**Tube well Name**	**Year of installation**	**Design Discharge (Cfs)**	**Actual Discharge (Cfs)**	**Capacity (Cfs)**
1	Riwaz Garden	1992	4	4	4
2	Muslim Park Rajgarh	1992	2	2	2
3	Bilal Park Sham Nagar	1993	4	4	4
4	Rile Range	1993	4	4	4
5	B-Block Gulshan-e-Ravi.	1998	2	2	2
6	E-Block Gulshan-e-Ravi.	2002	4	4	4

7	Zubair Road Rajgarh	2012	4	4	4
8	Malik Munir Road.	2002	4	4	4
9	Takiya Mehmood Shah	1990	2	2	2
10	Patwar Khana Sanda	1997	4	4	4
11	Jahangir Town	2008	4	4	4
12	Tee No.05 Across Bund	2012	2	2	2
13	Ghulam Hussain Colony	2008	2	2	2
14	G-Block Gulshan-e-Ravi	1983	4	4	4
15	60ft Road Shara Kot	2004	2	2	2
16	Babu Sabu School	2008	4	4	4
17	Jaffaria Colony	1991	4	4	4
18	Umer Park Sodiwal	2009	2	2	2
19	Nounarian	1998	4	4	4
20	Muhajarabad Sodiwal	1993	4	4	4
21	Rustam Park	1994	4	4	4
22	A-Block Gulshan-e-Ravi	1998	4	4	4
23	Moon Market Gulshan-e-Ravi	1987	4	4	4
24	Zubair Park G-Block Gulshan-e-Ravi	2009	4	4	4
25	Firdous Colony	1993	4	4	4
26	Usman Park Gulshan-e-Ravi	2009	4	4	4
27	WASA Colony	1976	4	4	4
28	Sikandaria Colony	2008	4	4	4

GULBERG TOWN

Tube well Detail

1.Mozung Subdivision					
S.#	Name of Tube well	Year of Installation	Design Discharge	Actual Discharge	Capacity
1	Lytton Road	2000	2-Cfs	2-Cfs	2-Cfs
2	Roza Abu Ishaq	1998	2-Cfs	2-Cfs	2-Cfs
3	Queens Road	1998	4-Cfs	2-Cfs	4-Cfs
4	Saddi Park	1998	2-Cfs	1-Cfs	2-Cfs
5	Kot Abdullah Shah	2000	4-Cfs	4-Cfs	4-Cfs
6	Masson Road	2000	2-Cfs	1.5-Cfs	2-Cfs
7	Shadman Market	1998	2-Cfs	2-Cfs	2-Cfs
8	Shadman Ganda Nala	2013	2-Cfs	2-Cfs	2-Cfs
9	Shadman Mental Tanky	1996	2-Cfs	1-Cfs	2-Cfs
10	Shah Jamal	1998	4-Cfs	2-Cfs	4-Cfs
11	Ahatta Molchand-I	2002	4-Cfs	2-Cfs	4-Cfs
12	Ahatta Molchand-II	2002	2-Cfs	1-Cfs	2-Cfs
13	Shadman -I Rehmania Park	1998	2-Cfs	2-Cfs	2-Cfs
14	Dongi Ground Fazilia	2008	2-Cfs	2-Cfs	2-Cfs
15	Mian Aslam Iqbal Park	2005	4-Cfs	4-Cfs	4-Cfs
16	Fasih Road	2002	4-Cfs	4-Cfs	4-Cfs
17	Ayasha Park Shadman	2011	2-Cfs	2-Cfs	2-Cfs
18	Apwa Collage	2002	2-Cfs	2-Cfs	2-Cfs
19	Waris Road	1998	2-Cfs	2-Cfs	2-Cfs
20	Patyala House	2010	2-Cfs	2-Cfs	2-Cfs
21	Abik Park	2005	2-Cfs	2-Cfs	2-Cfs
22	Lawerance Garden	2014	2-Cfs	2-Cfs	2-Cfs
23	Chah Pichwara	2013	2-Cfs	2-Cfs	2-Cfs
24	Bagh Gul Bagum	2014	2-Cfs	2-Cfs	2-Cfs
25	Kot Abdullah Shah Booster	1998	2-Cfs	1-Cfs	1-Cfs
26	Hamoon Shah Park	2013	4-Cfs	4-Cfs	4-Cfs

2. Shimla Hill					
Sr.#	Tubewll Name	Year of installation	Design discharge (cfs)	Actual Discharge (cfs)	Capacity (cfs)
1	Muhammad Nagar	1986	4	2	4
2	Baghichi BiBi Pak Daman	2013	2	2	2
3	Main Bazar Ghari Shahu	2005	2	2	2
4	Larex Colony	2004	2	2	2
5	Anand Road Upper Mall	2009	2	2	2

6	Baghay Shah	1982	2	2	2
7	Tegor Park	1982	4	4	4
8	Children Park	1983	4	2	4
9	Zaman Park	2006	4	4	4
10	Scortch Corner Upper Mall	2002	4	2	4
11	Habib Ullah Road	1997	4	4	4
12	Basti Saidan Shah	2006	4	4	4
13	Khwaja Behari Darbar	2013	4	4	4
14	Tariq Road Police Station	2008	4	4	4

3. Gulberg Subdivision					
Sr. #	**Tube well Name**	**Year of installation**	**Design discharge**	**Actual Discharge**	**Capacity**
1	Jail Road Gulberg-V	1995-96	4-Cfs	2-Cfs	4-Cfs
2	B-Block Gulberg-II	2007	4-Cfs	4-Cfs	4-Cfs
3	FCC Block Gulberg-IV	2013	2-Cfs	2-Cfs	2-Cfs
4	G-Block Gulberg-II	2007	4-Cfs	4-Cfs	4-Cfs
5	Q-Block Gulberg-II	2003	4-Cfs	3-Cfs	4-Cfs
6	Qurban Line Gulberg-II	2007	2-Cfs	1-Cfs	2-Cfs
7	Jinnah Park Gulberg-II	2012	2-Cfs	2-Cfs	2-Cfs
8	T-Block Gulberg-II	2007	2-Cfs	1 1/2-Cfs	2-Cfs
9	B-I Block Gulberg-III	1988	4-Cfs	1/2-Cfs	4-Cfs
10	Gurumanget Gulberg-III	2006	4-Cfs	4-Cfs	4-Cfs
11	C-II Block Gulberg-III	2012	4-Cfs	4-Cfs	4-Cfs
12	C-III Park Gulberg-III	2012	4-Cfs	4-Cfs	4-Cfs
13	H-Block Gulberg-III	1998	4-Cfs	2-Cfs	4-Cfs
14	Makkah Colony Main Bazar	1998	4-Cfs	1 1/2-Cfs	4-Cfs
15	Makkah Colony St No.22	2006	2-Cfs	1 1/2-Cfs	2-Cfs
16	Nisar Art Press Gulberg-III	2006	2-Cfs	1 1/2-Cfs	2-Cfs
17	Itthad Colony Gulberg-III	2006	2-Cfs	1 1/2-Cfs	2-Cfs
18	K-Block Gulberg-III	2006	2-Cfs	1 1/2-Cfs	2-Cfs
19	Saint Marry Colony Gulberg-III	2007	2-Cfs	1 1/2-Cfs	2-Cfs
20	E-I Block Katchi Abadi Gulberg-III	2009	2-Cfs	1 1/2-Cfs	2-Cfs
21	Nawaz Sharif Colony (Ferpzopur Rd)	2006	4-Cfs	4-Cfs	4-Cfs
22	P-Block Gopal Nagar Gulberg-III	2006	2-Cfs	1 1/2-Cfs	2-Cfs
23	Khan Colony Gulberg-III	2013	2-Cfs	2-Cfs	2-Cfs
24	Henery Katchi Abadi Gulberg-III	2007	2-Cfs	1 1/2-Cfs	2-Cfs
25	Ghalib Market Gulberg-III	2014	2-Cfs	2-Cfs	2-Cfs

WASA

LAHORE

ALLAMA IQBAL TOWN

Tubewell Detail

1. Samnabad Sub-division					
Sr. No	**Tubewell Name**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	Zubaida Park **(New)**	2014	04-Cfs	04-Cfs	04-Cfs
2	Ittehad Colony	1992	04-Cfs	04-Cfs	04-Cfs
3	Pakki Thatti	2000	04-Cfs	04-Cfs	04-Cfs
4	New Nawan Kot	2000	04-Cfs	04-Cfs	04-Cfs
5	N- Block	1986	04-Cfs	04-Cfs	04-Cfs
6	Khizra Masjid	2013	04-Cfs	04-Cfs	04-Cfs
7	Bakkar Mandi **(New)**	2013	04-Cfs	04-Cfs	04-Cfs
8	Jhuggian Shahbab Din	1985	04-Cfs	04-Cfs	04-Cfs
9	Pir Budden Shah	1992	04-Cfs	04-Cfs	04-Cfs
10	Jinnah Colony (Katcha Umer Park)	2008	04-Cfs	04-Cfs	04-Cfs
11	Mushtaq Town	2008	04-Cfs	04-Cfs	04-Cfs
12	Chah Janne Walla	2009	04-Cfs	04-Cfs	04-Cfs
13	Gulam Nabi Colony	2009	02-Cfs	02-Cfs	02-Cfs
14	"C" Block Sabzazar	2009	04-Cfs	04-Cfs	04-Cfs
15	Dispencary School Dholanwal	2013	04-Cfs	04-Cfs	04-Cfs

2. Sabzazar Subdivision					
S. #	**Tubewell Name**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	A-Block Sabzazar	2004	2-Cfs	2-Cfs	2-Cfs
2	A/2 Block Sabzazar	2012	4-Cfs	4-Cfs	4-Cfs
3	B-Block Sabzazar	2003	2-Cfs	1.50Cfs	2-Cfs
4	D-Block Sabzazar	1987	2-Cfs	1.50CFs	2-Cfs
5	E-Block Sabzazar	2003	2-Cfs	2-Cfs	2-Cfs
6	G-Block Sabzazar	2010	2-Cfs	2-Cfs	2-Cfs
7	H1-Block Sabzazar	2014	4-Cfs	4-Cfs	4-Cfs
8	H2-Block Sabzazar	2010	2-Cfs	2-Cfs	2-Cfs
9	K-Block Sabzazar	2002	2-Cfs	1.50Cfs	2-Cfs
10	N- Block Sabzazar	2012	2-Cfs	2-Cfs	2-Cfs
11	Awan Town	1999	4-Cfs	3.50Cft	4-Cfs
12	Kharak	2008	4-Cfs	3.50 Cfs	4-Cfs
13	P-Block Sabzazar	2012	2-Cfs	2-Cfs	2-Cfs
14	Mehr Pura	2014	4-Cfs	4-Cfs	4-Cfs

3. Johar town Subdivision					
Sr. No	**Tubewll Name**	**Year of installation**	**Design discharge (Cfs)**	**Actual Discharge (Cfs)**	**Capactiy cfs**
1	Campus View Town	2008	1	2	1
2	F-I, Block Johar Town	1994	4	4	4
3	E-I, Block Johar Town	2005	2	1.5	2
4	Shah Dee Khoyee	2008	2	1.75	2
5	D-2 Block Johar Town	2012	4	4	4
6	E Block Johar Town	2012	4	4	4
7	G-1 Block Johar Town	2010	4	4	4
8	A-3, Block Johar Town	2014	4	4	4
9	SHAKHI CHOWK	2008	4	4	4
10	G-4, Block Johar Town	1994	4	3.5	4
11	H-3, Block Johar Town	2003	4	2	4
12	J-3, Block Johar Town	2008	4	4	4
13	L-Block Johar Town	2007	4	4	4
14	J BLOCK Johar Town	2011	4	3.6	4
15	A -Block Johar Town	2014	4	4	4

4. Mustafa Town sub-division					
Sr. #	**Tube well Name**	**Year of installation**	**Design discharge**	**Actual Discharge**	**Capacity**
1	Mustafa	-	4 cusec	3 cusec	4 cusec

5. Ichra Sub-division					
S. #	**Tubewell Name**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	Kubra Masjid	2002	4-CFS	3-Cfs	4-CFS
2	Rahat Park /Nadeem Park	2003	4-CFS	3.5-Cfs	4-CFS
3	New Takia Lehri Shah	2008	4-CFS	4-Cfs	4-CFS
4	Mehboob Park	2014	4-CFS	4-Cfs	4-CFS
5	Ichhra More	1991	2-CFS	2-Cfs	2-CFS
6	Windser Park	1983	4-CFS	2-Cfs	4-CFS
7	New Windser Park	2014	2-CFS	2-Cfs	2-CFS
8	New L.O.S	2014	4-CFS	4-Cfs	4-CFS
9	Shah Kamal New	2006	4-CFS	4-Cfs	4-CFS
10	Karma abad	2006	4-CFS	4-Cfs	4-CFS

11	A-Block Rehmanpura	2014	2-Cfs	2-Cfs	2-Cfs
12	A-Block Muslim Town	1993	4-Cfs	4-Cfs	4-Cfs
13	Wahdat Road	2004	2-CFS	1.5-Cfs	2-CFS
14	C-Block Muslim Town	1982	4-CFS	3-Cfs	4-CFS
15	Green Belt F-Block Rehmanpura	2009	2-CFS	2-Cfs	2-CFS
16	Ayubia Market	2009	4-CFS	2-Cfs	4-CFS
17	Punj Pir Tubewell	1986	2-CFS	2-Cfs	2-CFS
18	Karnal Pura Shah Kamal	2012	4-CFS	4-Cfs	4-CFS
19	Rasool Park (Old)	1976	4-CFS	2-Cfs	4-CFS
20	Rasool Park (New)	2014	2-Cfs	2-Cfs	2-Cfs

6. Allama Iqbal Town Sub-Division					
S.#	**Tubewell Name**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	Clifton Colony	1996	4Cfs	2Cfs	2Cfs
2	Pak Block	1986	4Cfs	3Cfs	3Cfs
3	College Block	1993	4Cfs	3Cfs	3Cfs
4	Karim Block	1996	4Cfs	2Cfs	2Cfs
5	Ravi Block	2011	4Cfs	4Cfs	4Cfs
6	Huma Block	2007	4Cfs	4Cfs	4Cfs
7	Jehanzaib Block	1986	4Cfs	2Cfs	2Cfs
8	Hunza Block	2008	2Cfs	2Cfs	2Cfs
9	Neelam Block	2008	4Cfs	3Cfs	3Cfs
10	Nargis Block	2008	4Cfs	4Cfs	4Cfs
11	Raza Block	2009	4Cfs	4Cfs	4Cfs
12	Karim Block No.2	2004	2Cfs	2Cfs	2Cfs
13	F & V Market No.2	2009	4Cfs	4Cfs	4Cfs
14	Chenab Block No.2	2009	4Cfs	4Cfs	4Cfs
15	Nishter Block No.2	2009	2Cfs	2Cfs	2Cfs
16	Kamran Block	2010	4Cfs	4Cfs	4Cfs
17	Mehran Block (New)	2011	4Cfs	4Cfs	4Cfs
18	Asif Block	2013	4Cfs	4Cfs	4Cfs

RAVI TOWN

Tube well Detail

Annex-[illegible]

1. Shahdara Sub-Division					
Sr. No.	**Tube well Name**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	Saeed Park Tubewell	1998	4-Cfs	3-Cfs	4-Cfs
2	Majeed Park	1992	2-Cfs	3-Cfs	2-Cfs
3	Old G.T. Road	1990	2-Cfs	1.5-Cfs	2-Cfs
4	Qazi Park	2003	4-Cfs	4-Cfs	4-Cfs
5	Takia Khusrianwala	1983	2-Cfs	1-Cfs	2-Cfs
6	Ravi Cricket Ground	2001	4-Cfs	4-Cfs	4-Cfs
7	Qaiser Town	2003	4-Cfs	4-Cfs	4-Cfs
8	Paracha Colony	2014	2-Cfs	2-Cfs	2-Cfs
9	Begum Bagh	2009	4-Cfs	4-Cfs	4-Cfs
10	Shahdara Town	2003	4-Cfs	4-Cfs	4-Cfs
11	Floor Mill Area	2013	2-Cfs	2-Cfs	2-Cfs

2. Shadbagh Subdivision					
S.No.	**Tubewell Name**	**Year Of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	Elahi Park New T/WELL	2005	4 - Cfs	-	4 - Cfs
2	Noshahi Road T/WELL	2011	2 - Cfs	-	2 - Cfs
3	Khuda Bukah Park T/WELL	2003	4 - Cfs	-	4 - Cfs
4	Lady Sofia Park Old T/WELL	1992	4 - Cfs	-	2.5 - Cfs
5	Shad Bagh Well Center No.1	1997	4 - Cfs	-	3 - Cfs
6	Shad Bagh Well Center No.2	1997	4 - Cfs	-	3 - Cfs
7	Shad Bagh Well Center No.4	1997	4 - Cfs	-	3 - Cfs
8	Taj Pura Ground	1995	4 - Cfs	-	3 - Cfs
9	Akram Park T/WELL	2011	4 - Cfs	-	4 - Cfs
10	Chah Miran Old T/WELL	1998	4 - Cfs	-	sand blown
11	Children Park T/WELL	1987	2 - Cfs	-	1 - Cfs
12	Nabi Bukah Park T/WELL	2011	4 - Cfs	-	4 - Cfs
13	Scheme No.2 T/WELL	2005	2 - Cfs	-	2 - Cfs
14	Shahab Staduim T/WELL	1998	4 - Cfs	-	3 - Cfs
15	Yasrab Colony T/WELL	1994	4 - Cfs	-	2.5 - Cfs
16	New Chah Miran T/WELL	2006	4 - Cfs	-	4 - Cfs
17	Piran Walla Wassan Pura	2011	2 - Cfs	-	2 - Cfs
18	Hammad Colony T/WELL	2011	2 - Cfs	-	2 - Cfs
19	New Lady Sofia Park T/WELL	2011	2 - Cfs	-	2 - Cfs
20	Nazamabad T/WELL	2012	4 - Cfs	-	4 - Cfs
21	Shamshad Park T/WELL	2012	4 - Cfs	-	4 - Cfs

3. Misrishah Subdivision					
Sr. No	**Tubewell Name**	**Year of installation**	**Design discharge (cfs)**	**Actual Discharge (cfs)**	**Capactiy (cfs)**
1	Dilawar road wasa	-	2	2	2
2	Ahata Thanedar	2007	2	2	2
3	Faiz bagh/islamia high school	-	2	2	2
4	Chamra Mandi	2002	4	3	4
5	Sultani Park	2009	4	4	4
6	Kot Kh. Saeed (New)	-	4	3	4
7	Jamshed park	2009	4	3	4
8	Usman park	2009	2	1.5	2
9	Jamil park Gujjar Pura	2007	4	4	4
10	Gujar Pura Block-A	2009	4	4	4
11	Gujar Pura Block-B	2009	4	2	4
12	Gujar Pura Block-D	2009	4	2	4
13	bhogiwal	2010	4	4	4
14	Sawami Nagar old	-	4	1.5	4
15	Swami nagar new	-	2	2	2
16	Jinah Park	-	4	4	4
17	Tezab Ahata (New)	2007	4	4	4
18	Shah Badar Dewan	2006	4	3	4
19	Begum Pura New	-	4	4	4
20	Kanji House	2000	4	2	4

4. Farakhabad Subdivision					
Sr. #	**Tubewell Name**	**Year Of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	Farrakhabad Bari Dari	2010	2 CFS	2 CFS	2 CFS
2	Shoukat Colony	2008	2 CFS	2 CFS	2 CFS
3	Kamran Park	2007	2 CFS	2 CFS	2 CFS
4	Faisal Park	2009	2 CFS	2 CFS	2 CFS
5	Ghulshan Hayat Park	2009	2 CFS	2 CFS	2 CFS
6	Jia Moosa	2003	2 CFS	2 CFS	2 CFS
7	Latif Chowk	1995	4 CFS	2 CFS	4 CFS
8	Kashmir park	2007	2 CFS	2 CFS	2 CFS
9	Match Factory	2001	2 CFS	2 CFS	2 CFS
10	Targar	1998	4-CfS	4 CfS	4-CfS
11	Aziz Colony	2003	4 CFS	3 CFS	4 CFS
12	Yousaf Park	2011	4 CFS	4 CFS	4 CFS
13	KPS Begum Kot	Sep-13	4 CFS	4 CFS	4 CFS

5. City Subdivision					
Sr. #	**Tubewell Name**	**Year of installation**	**Design discharge**	**Actual Discharge**	**Capacity**
1	New Ali Park	2008	4cfs	3.5	4cfs
2	New Iqbal Park No. 3	2002	4cfs	4	4cfs
3	Shahi Qilla	2002	4cfs	2.75	4cfs
4	Masti Gate	2008	4cfs	3.5	4cfs
5	New Tehsil Garden	2010	2cfs	1.75	2cfs
6	New Taxali Gate	2009	4cfs	4	4cfs
7	Choomala	2000	2cfs	1	2cfs
8	Bhatti Gate	2013	4cfs	2.75	4cfs
9	Sheranwala Gate	2014	4cfs	4	4cfs
10	Al-Madad Park Colony	2006	2cfs	1.25	2cfs
11	Shahalam Gate	1995	4cfs	2	4cfs
12	Akbari Gate	1990	4cfs	0.75	4cfs
13	New Akbari Gate	2010	2cfs	1.75	2cfs
14	Sabzi Mandi	1992	4cfs	1.75	4cfs
15	Mori Gate	2009	4cfs	4	4cfs
16	Old Ravi 3	1980	4cfs	1.75	4cfs
17	Old Ravi 4`	1980	4cfs	1	4cfs
18	Timber Market	1990	4cfs	2	4cfs
19	Qillah Muhammadi	2004	2cfs	1.5	2cfs
20	Lohari Gate	2006	4cfs	3	4cfs
21	Kashmiri Gate	2009	4cfs	4	4cfs
22	Shahalam Market	2008	2cfs	1.5	2cfs
23	Yakki Gate	2008	4cfs	3	4cfs
24	DO North Office	2009	4cfs	3.5	4cfs
25	Nawaz Sharif Pakr, NABI Park	2012	2cfs	2	2cfs
26	Mochi Gate	2014	4cfs	4	4cfs

6. Data Nagar Sub division					
SR. No .	**Tubewell Name**	**Years of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	Hanif park	1991	04-Cfs	3-Cfs	4-Cfs
2	Saddique Pura	1995	4-Cfs	2.5 -Cfs	4-Cfs
3	Khokhar Road No.1	2007	4-Cfs	3.5 Cfs	4-Cfs
4	Khokhar Road No.2	2007	4-Cfs	4. Cfs	4-Cfs
5	Khokhar Road No.3	1993	4-Cfs	1 Cfs	2-Cfs
6	Chah Motia	2010	4-Cfs	4-Cfs	4-Cfs
7	Hussain park	2002	2-Cfs	1.25 Cfs	2-Cfs
8	Qaddafi Colony	2003	4-Cfs	3.25 Cfs	4-Cfs

9	Raheem Road	2002	4-Cfs	1.5 Cfs	2-Cfs
10	Kohloo Ghar	2008	4-Cfs	4-Cfs	4-Cfs
11	Shad Bagh No.3	2004	4-Cfs	4-Cfs	4-Cfs
12	Hanif Park Street No.6 (New)	2010	2-Cfs	2-Cfs.	2-Cfs
13	Khokhar Road No.,4	2012	2-Cfs	2-Cfs	2-Cfs
14	Ali Pura	2012	4-Cfs	4-Cfs	4-Cfs

Shalimar & ABT TOWN

Tubewell Detail

1. Bhagbanpura Sub-Division					
Sr. No.	**Tube well Name**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	MOMIN PURA	2003	2 Cfs	2 Cfs	2 Cfs
2	BABA GADHI SHAH	2006	4 Cfs	2.2 Cfs	4 Cfs
3	DHOBI GHATT	1996	4 Cfs	2.2 Cfs	4 Cfs
4	NEAR SAAD MILL	2006	4 Cfs	3 Cfs	4 Cfs
5	SIRAJ PURA	2014	4 Cfs	4 Cfs	4 Cfs
6	GULSHAN-E-SHALIMAR	2006	4 Cfs	3 Cfs	4 Cfs
7	SUREYA JABEEN PARK	2014	4 Cfs	4 Cfs	4 Cfs
8	MADHU LAL HUSSAIN	1998	4 Cfs	2.2 Cfs	4 Cfs
9	NEAR MEHMOOD BOOTI	2006	4 Cfs	3 Cfs	4 Cfs
10	ALIA TOWN	2007	4 Cfs	3 Cfs	4 Cfs
11	DY: YAQOOB COLONY	2006	4 Cfs	2.5 Cfs	4 Cfs
12	SHAH GOHER ABBAD	1996	4 Cfs	2.2 Cfs	4 Cfs
13	ROAD PEER	2007	4 Cfs	2.5 Cfs	4 Cfs
14	MEHMOOD BOOTI NO.2	2008	4 Cfs	2.5 Cfs	4 Cfs
15	MEHMOOD BOOTI NO.3	2008	4 Cfs	2.5 Cfs	4 Cfs
16	AHMED TOWN	2012	4 Cfs	3.5 Cfs	4 Cfs
17	TIBA KILLA KHAZANA	2012	2 Cfs	2 Cfs	2 Cfs
18	PAK MINT GHATE	2012	4 Cfs	3.5 Cfs	4 Cfs

2. Fateh garh Sub-division					
Sr. No	**Tubewell Name**	**Year of installation**	**Design discharge**	**Actual Discharge**	**Capactiy**
1	Nadia Ghee Mill New	2013	4 CFS	3.5-CFS	4 CFS
2	Gulshan Park	1996	2 CFS	1.5-CFS	2 CFS
3	Punj Pir	1995	2 CFS	1-CFS	2 CFS
4	Muslim Abad	2006	4 CFS	2.5-CFS	4 CFS
5	Fateh Gerh Pul	2011	4 CFS	3.5-CFS	4 CFS
6	Iftikhar Park	2006	4 CFS	3.5-CFS	4 CFS
7	Gowala Colony	2009	2CFS	1-CFS	2CFS
8	Shah Din Park	2001	4 CFS	1.5-CFS	4 CFS
9	Salamat Pura No.5	2004	2CFS	1-CFS	2CFS
10	Maskeen Pura Nehar	2010	4 CFS	3.5-CFS	4 CFS
11	Fateh Gerh Dispancery	2004	2 CFS	1-CFS	2 CFS
12	Qalander Pura	2012	2 CFS	2-CFS	2 CFS
13	Shalimar Housing Scheme	2011	4 CFS	4-CFS	4 CFS
14	Salamat Pura Takkia	2014	4 CFS	4-CFS	4 CFS
15	Kareem Nagar	2007	4 CFS	3-CFS	4 CFS
16	Kotly Ghasi	2013	2 CFS	2-CFS	2 CFS

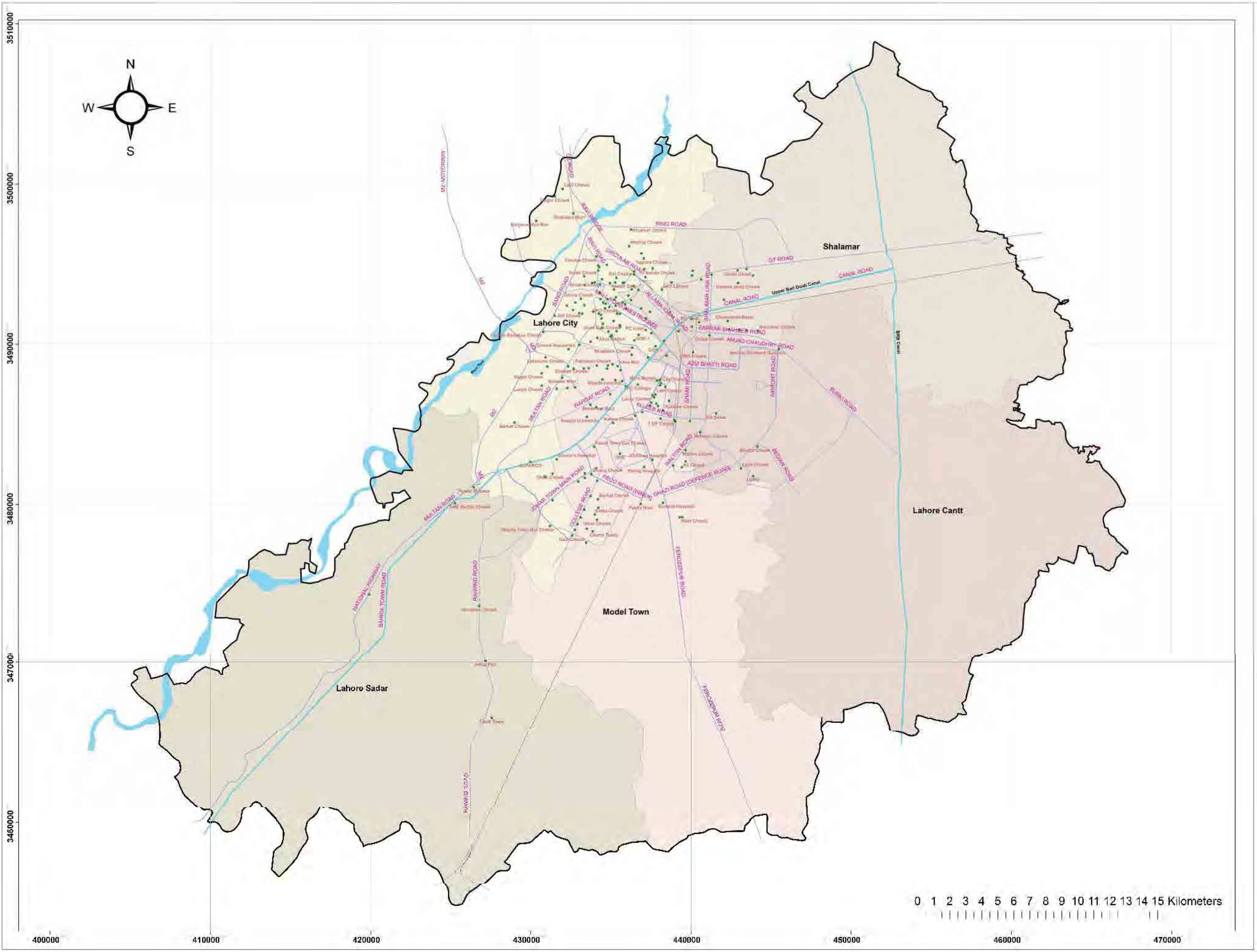
3. Mughal Pura Sub-division					
Sr No,	**NAME OF TUBEWELL**	**Installation Year**	**Design Discharge (CFS)**	**Actual Discharge (CFS)**	**Capacity (CFS)**
1	Kotli Pir Abdul Rehman	1996	4	2.2	4 Cfs
2	Gosa-e-Angoori (NEW)	2005	4	3.5	4 Cfs
3	Jhangir Road	1994	4	105	2 Cfs
4	Sansi Quarter	1996	4	2.5	4 Cfs
5	Fayyaz Park	1997	4	2.5	4 Cfs
6	Shah Kamal Road	1997	4	2.5	4 Cfs
7	Dars Baray Mian	1997	4	2.2	4 Cfs
8	Baghichi Saithan (NEW)	2013	4	4	4 Cfs
9	Millap Street	1994	4	2.5	4 Cfs
10	BTH Drainge	2013	4	4	4 Cfs
11	Mushtaq Colony	2009	2	1.2	2 Cfs
12	Baja Line	2004	2	1.5	2 Cfs
13	Achant Ghar	2002	2	1	2 Cfs
14	Azeem Ground	2013	2	2	2 Cfs
15	Shauwari Takkia	2004	2	1	2 Cfs
16	Faisal Childern Park	2007	2	1.5	2 Cfs
17	Qadir Buksh Park	2012	2	2	2 Cfs
18	Jamilabad	2008	2	1.5	2 Cfs
19	Masjid Taj Din	2012	2	2	2 Cfs
20	Angoori Schemme No2	2001	2	1.5	2 Cfs
21	Sunny View Park	2012	2	2	2 Cfs
22	Lal School	2012	2	2	2 Cfs
23	Parashot Colony	2013	2	2	2 Cfs
24	Sahar Road	2004	2	1.2	2 Cfs
25	Baba Beri Pir	1990	1	0.8	1 Cfs

4. Mustafa abad Subdivision					
Sr. No	**Tube Well Name**	**Year of Installation**	**Design Discharge**	**Actual Discharge**	**Capacity**
1	GULISTAN COLONY	25-02-2005	4-Cfs	2.50-Cfs	4-Cfs
2	TARIQ COLONY	25-05-2012	2-Cfs	2-Cfs	2-Cfs
3	DRY PORT	17-07-2007	2-Cfs	2-Cfs	2-Cfs
4	CHOBACHA STOP	15-07-2013	2-Cfs	2-Cfs	2-Cfs
5	INFANTRY ROAD	15-09-2006	4-Cfs	3-Cfs	4-Cfs
6	AHATA MAKHAN SING	16-01-2003	4-Cfs	3-Cfs	4-Cfs

7	MIAN MIR DARBAR	20-05-2008	4-Cfs	3-Cfs	4-Cfs
8	CANAL BRIDGE	26-03-1992	2-Cfs	1.50-Cfs	2-Cfs
9	GULSHAN COLONY	16-02-1993	2-Cfs	2-Cfs	2-Cfs
10	GHOUSIA COLONY	25-02-2005	2-Cfs	2-Cfs	2-Cfs
11	LDA QUARTERS	16-06-2009	2-Cfs	2-Cfs	2-Cfs

5. Tajpura Subdivision					
Sr.No	**Tubewll Name**	**Year of installation**	**Design discharge**	**Actual Discharge**	**Capacity**
1	Subhan Park	2013	4-CFS	4-CFS	4-CFS
2	Al-Faisal Town C-Block	2003	4-CFS	3-CFS	4-CFS
3	Ishfaq Chowk	2007	4-CFS	3-CFS	4-CFS
4	Tajbagh	2006	2-CFS	1.5-CFS	2-CFS
5	Pir Naseer	2007	2-CFS	1.5-CFS	2-CFS
6	Jorry Pull	1980	4-CFS	1.5-CFS	4-CFS
7	Tajpura Pind	2007	4-CFS	2-CFS	4-CFS
8	E-Block Tajpura Scheme	1986	2-CFS	2-CFS	2-CFS
9	A-Block	2006	2-CFS	1-CFS	2-CFS
10	Data park	2009	2-CFS	1-CFS	2-CFS
11	Burji No.9	1980	2-CFS	1-CFS	2-CFS
12	Pakora Stop	2008	2-CFS	1-CFS	2-CFS
13	Gaziabad Bus Stop No.1	1980	2-CFS	0.5-CFS	2-CFS
14	Gaziabad Bus Stop No.2	2008	4-CFS	1-CFS	2-CFS
15	Iqbal park	2009	2-CFS	1-CFS	2-CFS
16	S.D.O Office	2006	2-CFS	1-CFS	2-CFS
17	D-Block Tajpura	1986	4-CFS	2-CFS	4-CFS

District Lahore Base Map



Legend

- Landmarks
- Major Roads
- Rail_Road
- Canals
- River Ravi
- Lahore Cantt
- Lahore City
- Lahore Sadar
- Model Town
- Shalamar
- District Lahore Boundary

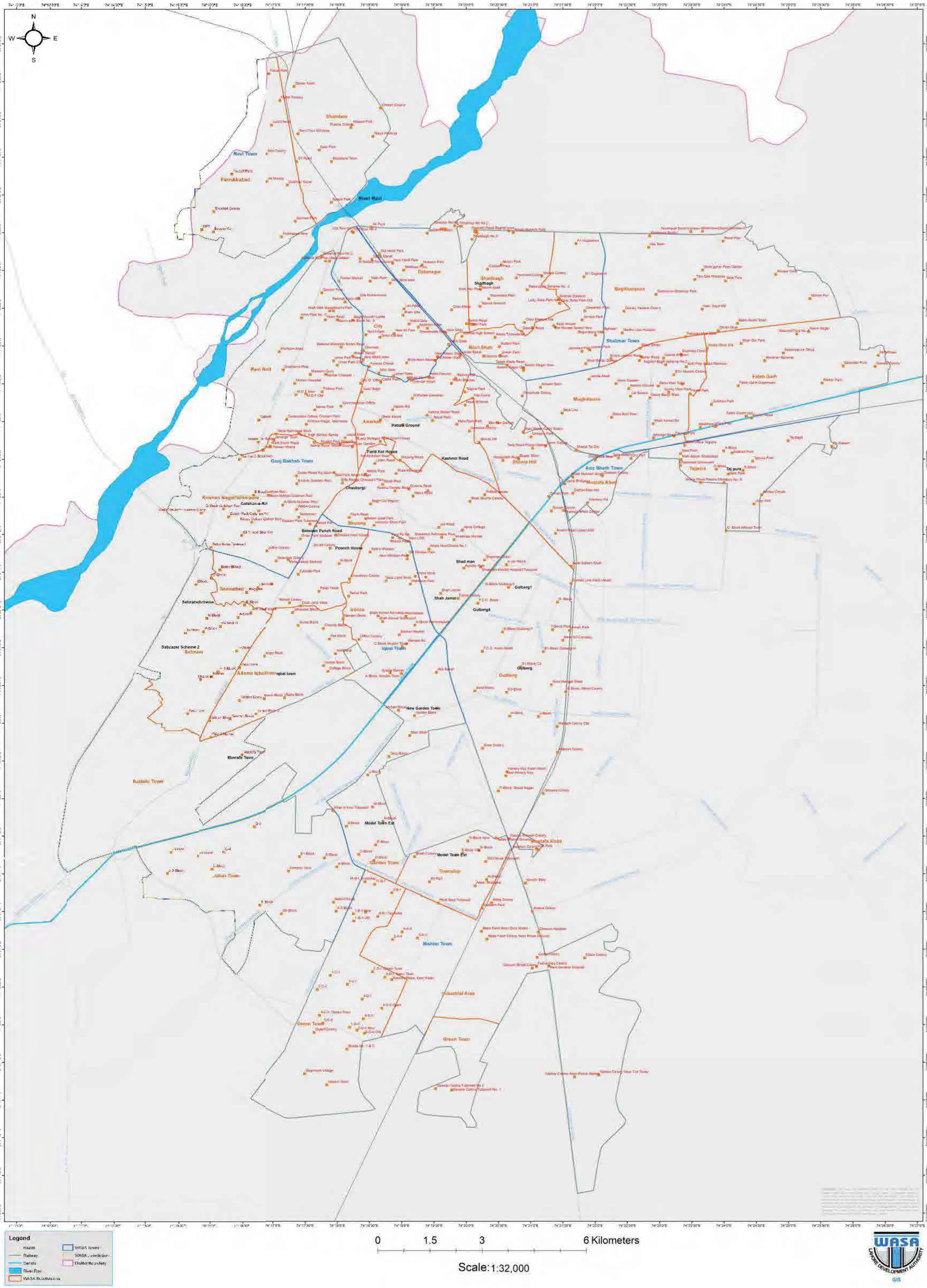
Index

Coordinate System:WGS 84 UTM Zone 43N
Projection: Transverse Mercator
Datum: WGS 84
Units: Meter
Map Scale: 1:80,000

Credits:
Map Prepared By GIS Unit,
P&E Directorate, WASA, LDA.

WASA Lahore Tubewells Map

Anne- 4.



Water Supply Network WASA Lahore

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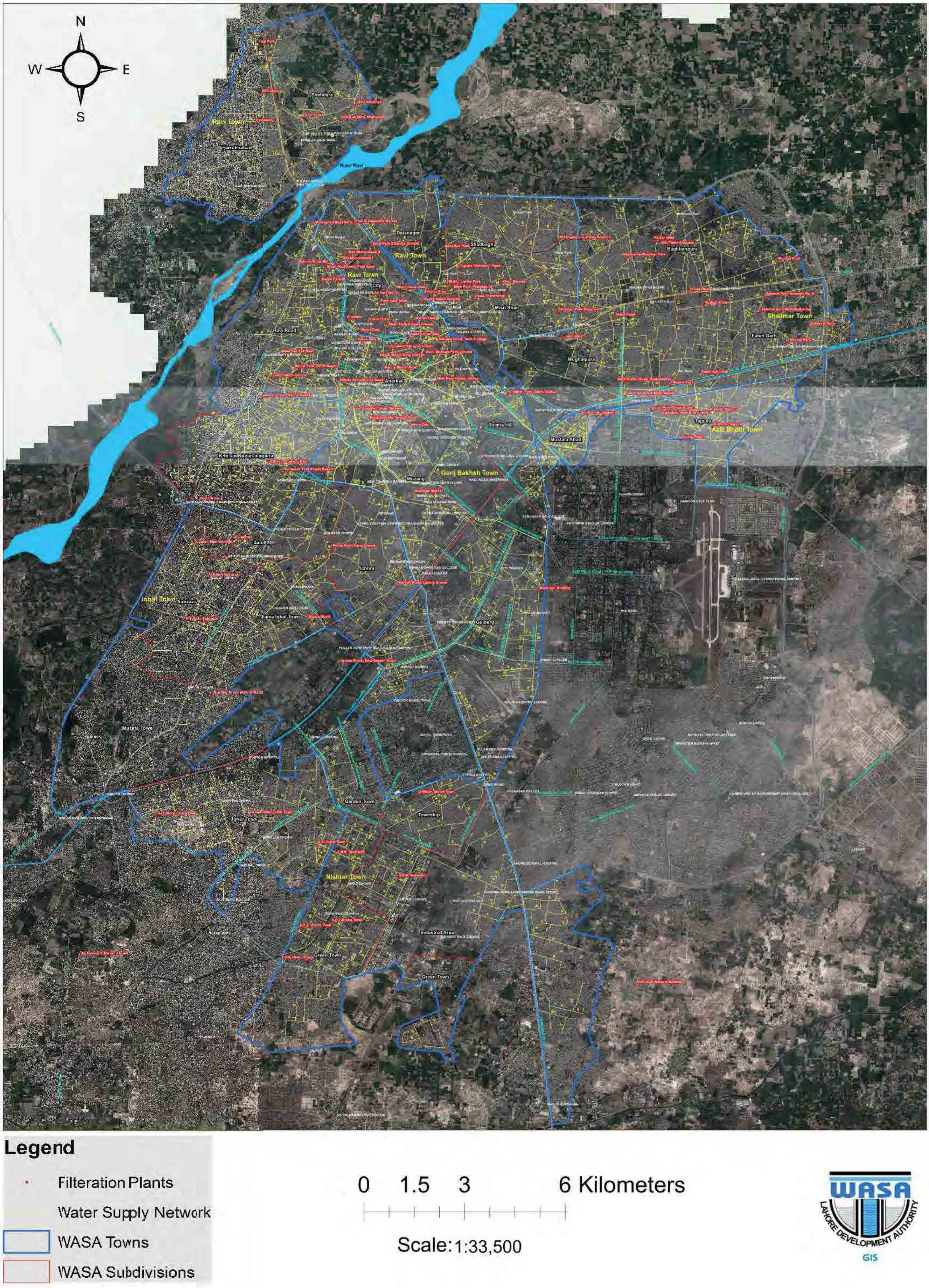
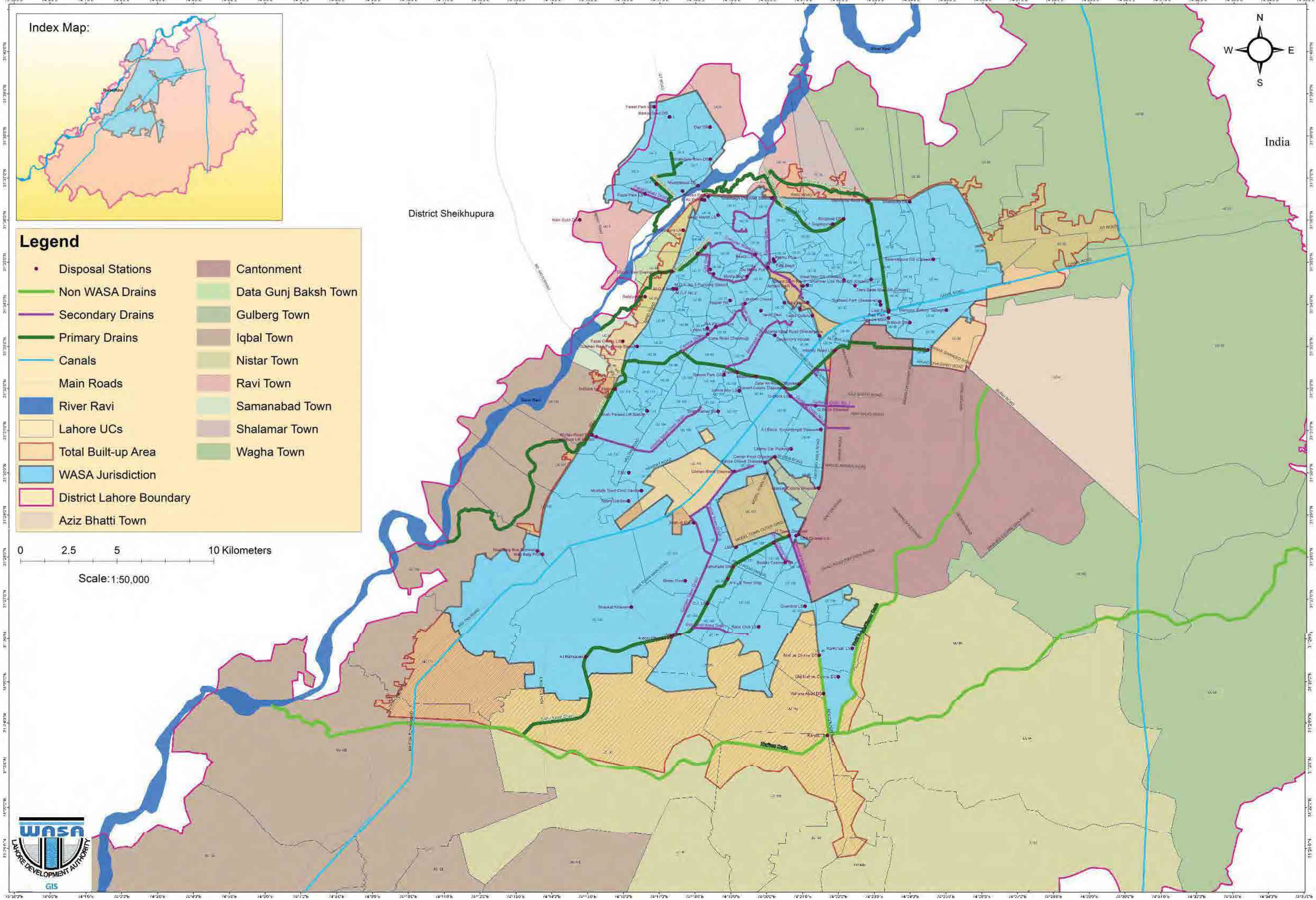
Filteration Plants & Water Supply Map, WASA Lahore

Annex- 4.




Anne - 4.
Drainage System WASA Lahore
Index Map:
Legend
Disposal Stations
Non WASA Drains
Secondary Drains
Primary Drains
Canals
Main Roads
River Ravi
Lahore UCs
Total Built-up Area
WASA Jurisdiction
District Lahore Boundary
Aziz Bhatti Town
Cantonment
Data Gunj Baksh Town
Gulberg Town
Iqbal Town
Nistar Town
Ravi Town
Samanabad Town
Shalamar Town
Wagha Town
0 2.5 5 10 Kilometers
Scale: 1:50,000
District Sheikhupura
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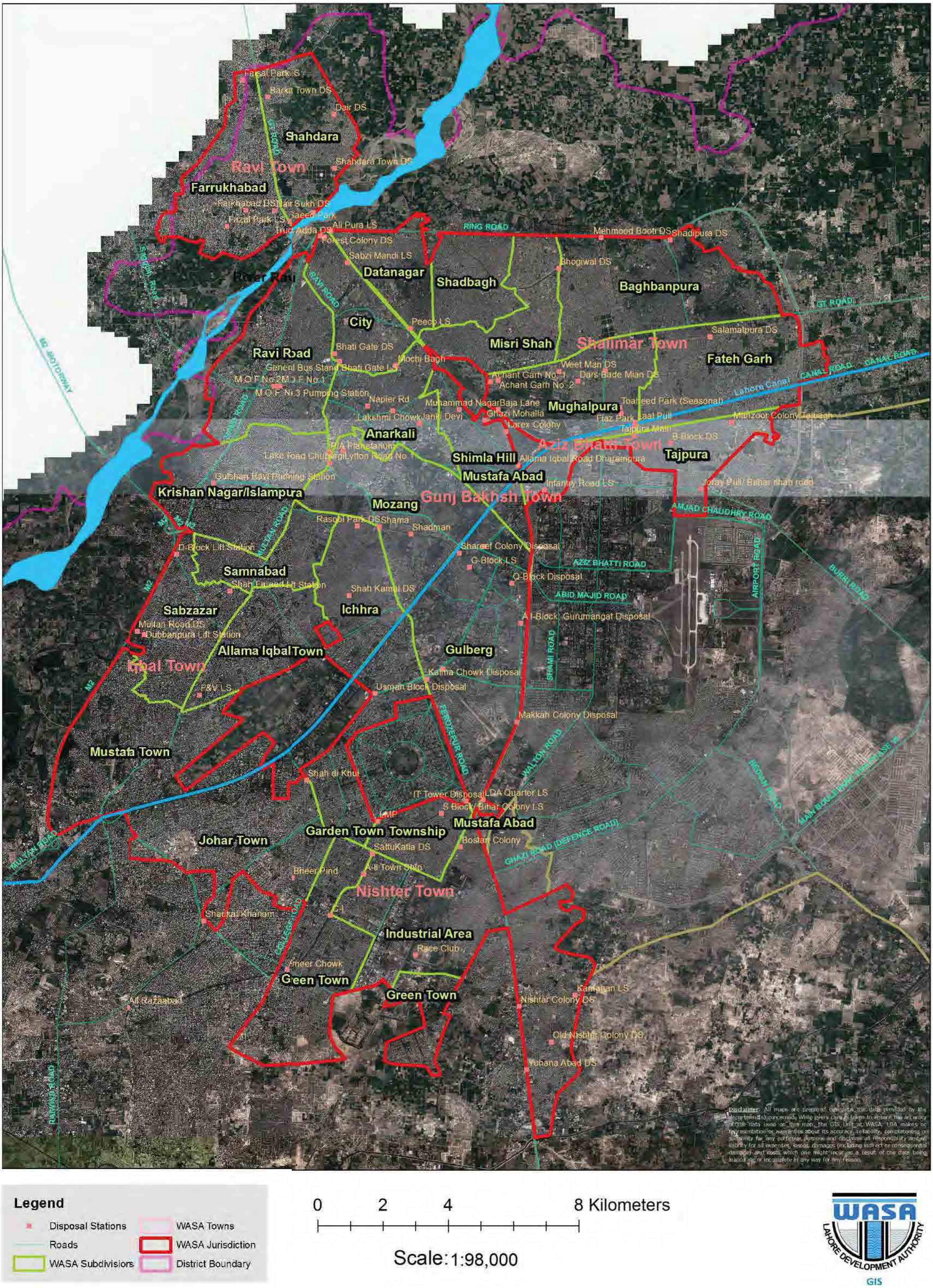
WASA
LAHORE DEVELOPMENT AUTHORITY
GIS

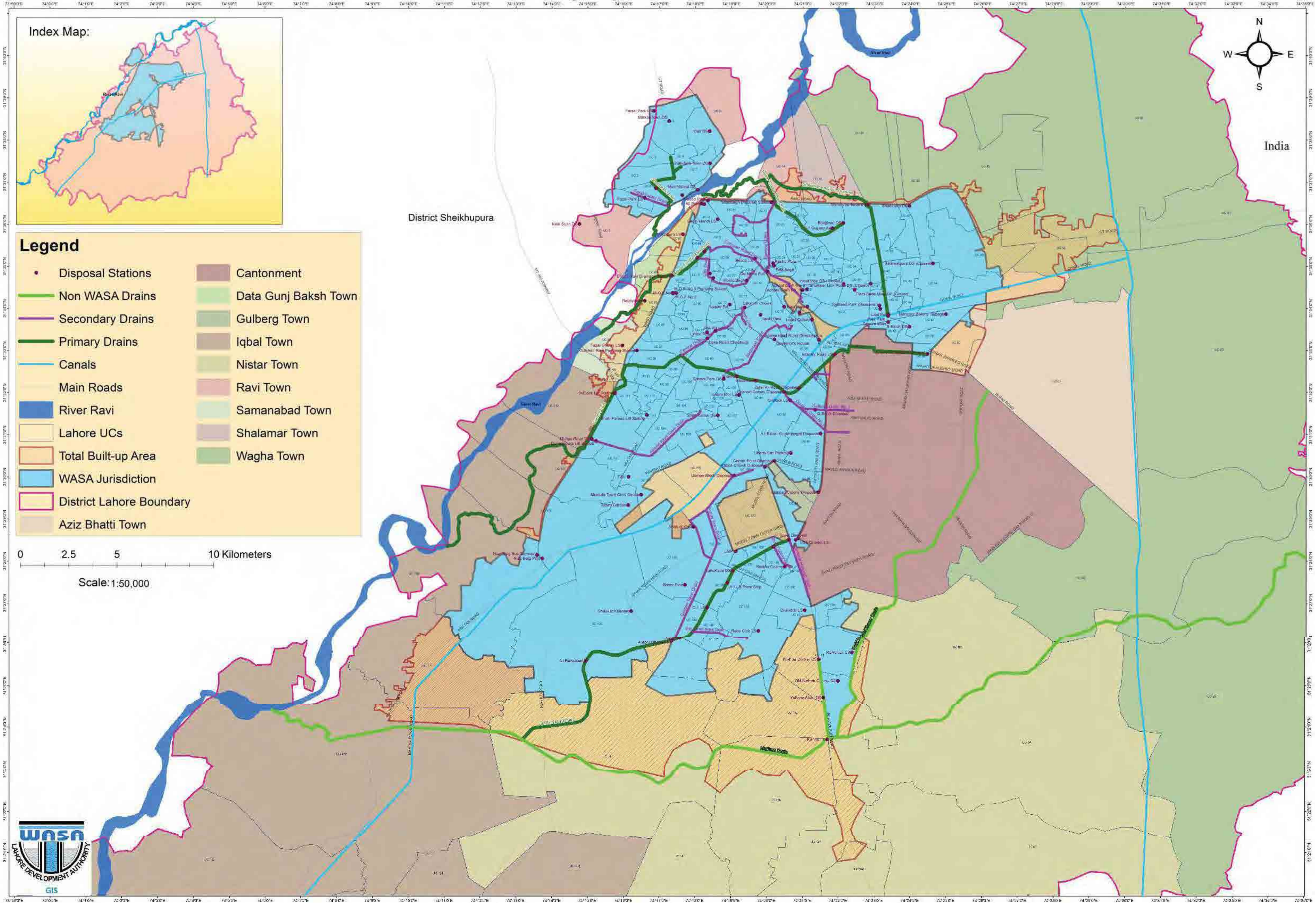
WASA Lahore Disposal Stations Map

Anne- 4.



Drainage System WASA Lahore

Annex



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MONTH WISE SUMMARY OF RAIN RECORDED FOR THE YEAR OF 2012 (IN M.M)

Month	Jail Road (mm)	Airport (mm)	Farrukhabad Shahdra (mm)	Pani Wala Talab (mm)	Chowk Nakhuda (mm)	Uppar Mall (mm)
JANUARY	18.6	19.2	5.2	9.2	10.2	9.0
FEBRURY	6.8	8.7	-	2.0	-	-
MARCH	10.0	7.2	-	-	-	-
APRIL	49.9	37.5	19.5	28.0	24.5	30.5
MAY	0.2	0.5	-	-	-	-
JUNE	13.2	4.2	-	-	-	17.4
JULY	37.7	53.3	11.0	7.0	18.0	31.0
AUGUST	197.1	187.6	256.0	220.0	289.0	190.0
SEPTEMBER	199.4	166.2	192.0	185.0	229.0	154.5
OCTOBER	28.8	20.3	-	-	-	-
NOVEMBER	0.2	-	-	-	-	-
DECEMBER	21.0	23.2	-	-	-	-
Total	**582.9**	**527.9**	**483.7**	**451.2**	**570.7**	**432.4**

Annex

MONTH WISE SUMMARY OF RAIN RECORDED FOR THE YEAR OF 2013 (IN M.M)

Month	Jail Road (mm)	Airport (mm)	Farrukhabad Shahdra (mm)	Pani Wala Talab (mm)	Chowk Nakhuda (mm)	Uppar Mall (mm)
JANUARY	13.3	16.2	37.0	42.0	25.0	8.0
FEBRURY	71.1	75.0	76.5	91.0	74.8	71.0
MARCH	19.2	15.1	5.0	5.0	15.0	12.0
APRIL	7.4	17.5	-	-	-	-
MAY	1.4	6.0	-	-	-	-
JUNE	135.4	161.4	156.4	162.0	153.0	100.0
JULY	242.2	221.5	224.4	277.0	268.0	221.0
AUGUST	353.7	513.2	308.0	359.0	338.0	360.0
SEPTEMBER	30.3	168.3	11.0	7.0	14.0	11.0
OCTOBER	17.4	37.6	-	-	-	-
NOVEMBER	5.0	0.1	-	-	-	-
DECEMBER	7.0	11.0	-	-	-	-

Annex

MONTH WISE SUMMARY OF RAIN RECORDED FOR THE YEAR OF 2014 (IN M.M)

Month	Jail Road (mm)	Airport (mm)	Farrukhabad Shahdra (mm)	Pani Wala Talab (mm)	Chowk Nakhuda (mm)	Uppar Mall (mm)
JANUARY	4.3	6.1	-	-	-	-
FEBRURY	22.4	25.9	-	-	-	10.0
MARCH	32.4	49.5	-	-	-	5.0
APRIL	65.1	115.5	56.0	80.0	84.0	43.0
MAY	29.4	33.8	23.0	16.0	10.0	17.0
JUNE	56.1	87.5	66.0	67.0	98.0	83.0
JULY	36.7	46.2	92.0	75.0	82.0	29.0
AUGUST	75.6	62.6	112.0	125.0	94.0	57.0
SEPTEMBER	430.1	557.0	584.0	561.0	580.0	382.0
OCTOBER	3.2	0.4	-	-	-	-
NOVEMBER	29.1	23.1	17.0	17.0	20.0	27.0
DECEMBER	-	-	-	-	-	-
Total	**784.4**	**1,007.6**	**950.0**	**941.0**	**968.0**	**653.0**

Month	Airport (mm)	Jail Road (mm)	Pani Wala Talab (mm)	Chowk Nakhuda (mm)	Uppar Mall (mm)	Farrukhabad Shahdra (mm)	Head Office WASA	Lakshami Chowk	Mughalpura SDO Office	Tajpura SDO Office	Nishter Town Director Office	Gulshan-e-Ravi	A.I.T Director Office	Samanabad SDO Office	Johar Town SDO Office
JANUARY	25.0	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-
FEBRUARY	93.1	61.6	96.0	112.0	52.0	107.0	-	-	-	-	-	-	-	-	-
MARCH	1.4	142.5	116.0	123.0	100.0	108.0	-	-	-	-	-	-	-	-	-
APRIL	8.5	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-
MAY	8.5	31.7	20.0	25.0	2.0	4.0	-	-	-	-	-	-	-	-	-
JUNE	98.4	45.9	78.0	70.0	54.0	85.0	-	-	-	-	-	-	-	-	-
JULY	297.2	328.9	261.5	247.3	234 0	245.2	-	-	-	-	-	-	-	-	-
AUGUST	194.5	93.8	118.2	90.1	71.3	110.1	107.1	34.1	31.3	43.2	144.0	93.0	103.2	72.1	250.0
Total	**726.6**	**729.7**	**689.7**	**667.4**	**513.3**	**659.3**	**107.1**	**34.1**	**31.3**	**43.2**	**144.0**	**93.0**	**103.2**	**72.1**	**250.0**

Sr.No.	Name of Machinery	Total Machinery in Towns						Total
		RT	ST	GBT	NT	IT	Drain	
1	Muck Sucker	12	6	11	8	10	3	50
2	Jetting Unit	11	6	12	8	9	3	49
3	Water Bouzers	4	3	5	4	3	2	21
4	Tractor Trolly	4	6	6	4	5	9	34
5	Crane	3	3	1	2	1	-	10
6	Dump Trucks	1	-	1	-	-	69	71
7	Backhoe Tractors	1	-	-	-	-	29	30
8	Excavator (Case Poclan)	-	-	-	-	-	15	15
9	Trencher	-	-	-	-	-	2	2
10	Front-End Loader	-	-	-	-	-	5	5
11	Wheel Loader	-	-	-	-	-	2	2
12	Mazda Truck	1	1	1	1	-	-	4
13	Tractor	1	-	1	-	-	-	2
14	Dewtering set	-	-	343	-	-	-	343
15	Generators	38	41	67	19	29	4	198
16	Vench Machine	4	2	1	1	3	0	11
	TOTAL	80	68	449	47	60	143	847

Annex

SR. NO.	LOCATION	Subdiv name	No. of pumps	Capacity of pump	Total Capacity	Transformer		Generator		Feeder
						Capacity (KVA)	Status	Capacity (KVA)	Status	
1	Farakhabad	Farakh abad	3	15	45	600	OK	1000	OK	Double
			3	20	60					
			2	25	50					
			2	13	26					
				Total	181					
2	Shad Bagh	ShadBagh	6	40	240	1500	OK	1000	OK	Double
3	Khokhar Road	ShadBagh	3	56	168	1500	OK	1000	OK	Double
						1500	OK			
4	Bhatti gate		4	25	100	1250	OK	500	Ok	Double
5	Mehmood Booti	S&ABT	4	56	224	1500	OK	1000	Ok	Double
						1500	OK			
6	M.O.Fall NO.3 (Lakshami Drain)	Ravi Road	3	25	75	630	OK	625	OK	Double
			2	6	12					
				Total	87					
7	M.O.Fall No.2 (Karim Park)	Ravi Road	2	26	52	630	OK	625	OK	Double
			2	25	50					
				Total	102					
8	M.O.Fall No.1	Ravi Road	1	40	40	630	OK	500	OK	Double
			3	15	45					
			2	15	30					
			2	25	50					
			2	8	16					
				Total	181					
9	Multan Road D/S	Sabzazar	6	40	240	1500	OK	1000	OK	Double
						1500				
10	Gulsion-e-Ravi	Islam pura	14	40	560	100	OK	1000	OK	Double
						1500		500		
						1000				
				Total	560					
11	L.M.P. Block	Township	3	20	60	630	OK	1000	OK	Double
			2	25	50					
			1	15	15					
				Total	125					
12	Nishter Colony (Main)	Nishter	1	15	15	630	OK	300	OK	Double
			1	8	8					
			3	13	39					
			1	25	25					
			2	12	24					
				Total	111					

Shalimar & ABT

Lift Stations (Detail)

Annex[illegible]

	1. Bhagbanpura Subdivision							
S. #	Name	Pump Sr. No.	Avg. Running Hours (Per Day)	Pumping Rating (Cfs)	Motor Rating (Kw)	Actual Flow (Cfs)	Design Flow (Cfs)	Design Head (Ft)
1	Shadipura	Shadipura No.1	7	25	141	20	25	40
		Shadipura No.2	7	25	141	20	25	40
		Shadipura No.3	7	25	141	20	25	40
		Shadipura No.4	7	25	141	20	25	40
		Shadipura No.5	7	25	90	20	25	33
		Shadipura No.6	7	25	90	20	25	33
		Shadipura No.7	10	20	90	20	20	33
2	Bhogiwal	Bhogiwal No.1	6	10	60	10	10	45
		Bhogiwal No.2	6	10	60	10	10	45
		Bhogiwal No.3	4	10	60	10	10	45
		Bhogiwal No.4	6	15	80	14	15	45
		Bhogiwal No.5	12	15	80	14	15	45
		Bhogiwal No.6	6	15	80	13	15	45
		Bhogiwal No.7	6	15	80	15	15	45
		Bhogiwal No.8	12	25	141	24	25	45

2. Mustafaabad sub-division								
S. #		Pump Sr. No.	Avg. Running Hours Per Day	Pumping Rating (Hp)	Motor Rating (Hp)	Actual Flow (Cfs)	Design Flow (Cfs)	Design Head (Ft)
1	Infantry Road	Infantry Rd No.1	3	80	80	2.8	6	40
		Infantry Rd No.2	2	80	80	2.7	6	40
		Infantry Rd No.3	7	50	50	6	6	35
		Infantry Rd No.4	7	50	50	6	6	35
2	LDA Qtr	LDA Qtr No.1	8	60	60	3	4	35
		LDA Qtr No.2	8	80	80	1.6	6	35
		LDA Qtr No.3	4	80	80	2.2	6	35

3. Fateh Garh sub-division
There is no Lift Station in Fateh Garh Sub division

4. Mughalpura Subdivision								
S. #	Location	Pump Serial No.	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (If Measured) (Cusec)	Desiign Flow (Cusec)	Design Head (Feet)
1	Achant Gerh	1	8	20	20	2	2	30
		2	8	20	20	1.5	2	30
2	Baja Line	1	8	20	20	2	2	30
		2	8	20	20	2	2	30
3	Achant Garah No.1	1	2	40	40	3	4	30
		2	2	60	60	3.5	4	30
		3	4	20	20	2	2	30
		4	4	20	20	2	2	30
4	Fayyaz Park MGP	1	8	20	20	1.5	2	35
		2	8	40	40	3	4	35
5	Lal Pul	1	7	20	20	2	2	33
		2	7	60	60	4	4	33
		3	7	60	60	2.5	4	33
		4	7	40	40	2	4	33
		5	7	20	20	2	2	33
		6	7	40	40	3	4	33

5. Tajpura Sub-division								
S. #	Name	Pump Sr. No.	Avg. Running Hours Per Day	Pump Rating (Hp)	Motor Rating (Hp)	Actual Flow (Cfs)	Design Flow (Cfs)	Design Head (Ft)
1	Tajpura	1	4	150	150	25	25	35
		2	10	150	150	20	25	30
		3	5	80	80	8	8	30
		4	8	150	150	20	25	35
		5	16	80	80	10	10	35
		6	8	80	80	10	10	35
2	Jorrey pull	1	8	80	80	2.4	5	35
		2	7	80	80	1.3	5	35

3	B-Block	1	Operated in Rain	80	80	10	10	30
		2	Operated in Rain	80	80	10	10	30
		3	Operated in Rain	60	60	6	6	25
		4	Operated in Rain	40	40	4	4	30
		5	Operated in Rain	150	150	25	25	30
4	Tajbagh	1	14	80	80	1.9	6	35
		2	Stand By	80	80	6	6	35

Nishter
Lift Stations (Detail)

	1. Garden **Sub-division**							
S. #	Name	Pump Sr. No.	Avg. Running Hours (Per Day)	Pumping Rating (Cfs)	Motor Rating (Kw)	Actual Flow (Cfs)	Design Flow (Cfs)	Design Head (Ft)
1	Garden Town	1	8	8-Cfs	80-Hp	6	8	40
		2	2	6-Cfs	60-Hp	5	6	40
		3	6	4-Cfs	40-Hp	3	4	40
		4	4	6-Cfs	60-Hp	5	6	60
		5	2	2-Cfs	20-Hp	2	2	30
		6	7	13-Cfs	100-Hp	13	13	60
		7	7	13-Cfs	100-Hp	13	13	60

2. Township **Sub-division**								
S. #	Name	Pump Sr. No.	Avg. Running Hours (Per Day)	Pumping Rating (Cfs)	Motor Rating (Hp)	Actual Flow (Cfs)	Design Flow (Cfs)	Design Head (Ft)
1	Satto Kattla Lift Station	1	5		150	20	25	
		2	18		150	20	25	
		3	8		80	7	8	
		4	18		150	20	25	
2	Bahar Colony Lift Station	1	8		80	8	8	
		2	18		40	6	6	

3. Green Town Sub-Division								
Sr No.	Location	Pump Serial No.	Average Running Hours	Pump Rating	Motor Rating Hp	Actual Flow cfs	Design Flow (Cusec)	Design Head (Feet)
1	C-I Disposal Station Sadiq Chowk	1	20	15-Cfs	100	15-Cfs	15-Cfs	30
		2	10	13-Cfs	150	13-Cfs	13-Cfs	30
		3	4	6-Cfs	80	6-Cfs	6-Cfs	30
2	C-II Disposal Station Muslim Chowk Town	1	22	15-Cfs	100	15-Cfs	15-Cfs	30
		2	22	15-Cfs	100	15-Cfs	15-Cfs	30
		3	8	13-Cfs	150	13-Cfs	13-Cfs	30
3	Ameer Chowk Disposal Station	1	12	7.5-Cfs	60	7.5-Cfs	7.5-Cfs	35
		2	12	7.5-Cfs	60	7.5-Cfs	7.5-Cfs	35
		3	4	7.5-Cfs	60	7.5-Cfs	7.5-Cfs	35
		4	4	7.5-Cfs	60	7.5-Cfs	7.5-Cfs	35

4. Industrial Area Sub Division							
Sr No.	Location	Pump Serial No.	Average Running Hours	Pump Rating Hp	Actual Flow (Cusec)	Design Flow (Cusec)	Design Head (Feet)
1	Nishter Colony Old Disposal Station	1	18	-	6	6	25
		2	20	-	4	4	25
2	Hadyara Drain (Rohi Nala)	1	8	-	6	6	30
		2	6	-	6	6	30
3	A-Ii Disposal	1	14	-	6	6	20
4	Chandray Road Lift Station	1	20	-	2	2	20
5	Youhanabad	1	14	-	4	4	30
6	Boostan Colony	1	20	-	4	4	20
		2	8		4	4	20
7	Race Club	1	6		2	2	20
8	Kamahan Disposal Station	1	10		10	10	30
		2			10	10	30
		3	10		6	6	30
		4			6	6	30
		5			4	4	30

Gunj Baksh Town

Lift Stations (Detail)

1. Anarkali subdivision								
Sr No	Location	Pump Serial No.	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (Cusec)	Design Flow (Cusec)	Design Head (Feet)
1	Napier Road	1	11	150	150	4	Horizontal	30
2	Mochi Bagh	1	10	60	60	4	Submersible	30
		2	10	50	80	8		30
		3	10	40	40	2		30
		4	10	150	150	16	Horizontal	35
3	Janki Devi	1	10	10	10	1 1/2	Horizontal	30
		2	10	10	10	1 1/2		30
4	Lakshmi Chowk	1	11	150	150	25	Horizontal	30
		2	11	150	150	25		30
		3	11	100	100	10		30
5	Pia Planetarium	1	10	100	100	10	Submersible	35
		2	10	100	100	10		35
		3	10	60	60	6		35
6	Lakshmi Mension B/ Pump	1	11	20	20	1	1	10
7	Ghandi Square B/ Pump	1	11	25	25	1	1	15

2. Islam Pura Sub division								
Sr. No.	Name	Pump Serial No.	Avg. Running Hours (Per Day)	Pump Rating (Hp)	Motor (Hp)	Actial Flow (Cusec)	Design Flow (Cusec)	Design Head (Ft)
1	Fazal Colony Lift station	1	16		20-Kw	2	2-Cfs	30
		2	17		20-Kw	2	2-Cfs	30

3. Ravi Road **Sub-division**								
Sr. No.	Name	Pump Serial No.	Avg. Running Hours (Per Day)	Pump Rating (Hp)	Motor (Hp)	Actual flow (Cusec)	Design Flow (Cusec)	Design Head (Ft)
1	Bagh Munchi Ladha	1	16	988	75	8	10 Cfs	45
		2	16	988	75	8	10 Cfs	45
		3	18	988	120	15	20 Cfs	45
		4	18	988	75	8	10 Cfs	45
		5	17	988	120	15	20 Cfs	45
		6	15	988	115	12	15 Cfs	45
2	Kallay Wali Pully	1	19	1400	40	2	2 Cfs	20
		2	18	1400	60	2	2 Cfs	20
3	Merzi Pura	1	18	1400	40	2	2 Cfs	20
		2	18	1400	60	4	6 Cfs	25
		3	18	1400	20	2	2 Cfs	20

Gulberg Town
Lift Stations (Detail)

1. Mozung **Sub-division**							
Sr.#	Location	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (Cusec)	Desiign Flow (Cusec)	Design Head (Feet)
1	Shadman Bridge	20	6-Cfs 6-Cfs 10-Cfs	80 80 100	6-Cfs 6-Cfs 10-Cfs	6-Cfs 6-Cfs 10-Cfs	60
2	Lytton Road	20	6-Cfs 6-Cfs	80 80	6-Cfs 6-Cfs	6-Cfs 6-Cfs	60
3	Shama	20	4-Cfs 6-Cfs	40 60	4-Cfs 6-Cfs	4-Cfs 6-Cfs	60 75
4	Choburgi	12	2-Cfs 4-Cfs	20 40	2-Cfs 4-Cfs	2-Cfs 4-Cfs	60

2. Shimla Hill Sub-division								
Sr No	Location	Pump Serial No.	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (Cusec)	Desiign Flow (Cusec)	Design Head (Feet)
1	Muhammad Nagar	1	12	60	60	6	6	35
2	Ghazi Muhallah	1	10	20	20	2	2	30
		2	6	40	40	4	4	30
		3	0	60	60	6	6	30
3	Larex Colony	1	12	20	20	2	2	20
		2	8	60	60	6	6	45
		3	0	50	50	2	2	45
4	Bird Market Disposal	1	8	100	100	10	10	48
		2	8	100	100	10	10	48
		3	3	175	175	20	20	48

3. Gulberg **Sub-division**								
S.#	Location	Pump Serial No.	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (Cusec)	Desiign Flow (Cusec)	Design Head (Feet)
1	Zafar Ali Road	1	8	60	60	7	8	20
2	Sharif Colony	1	8	60	60	7	8	20
		2	6	20	20	6	6	20
3	Q-Block Disposal	1	8	150	150	25	25	25
		2	2	40	40	8	8	25
4	G-Block	1	5	150	150	22	25	40
		2	5	150	150	22	25	40
		3	5	175	175	25	25	Submersible
		4	5	80	80	8	8	Submersible
5	Gurumanget A-I Block	1	14	150	150	15	15	40
		2	12	150	150	25	25	40
		3	8	150	150	15	15	40
6	Makkah Colony	1	20	60	60	8	8	40
		2	20	60	60	8	8	40
		3	6	150	150	25	25	40
7	Center Point	1	16	60	60	8	8	40
		2	8	45	45	6	6	40
8	Liber Car Parking	1	0	45	45	8	8	40
		2	0	45	45	8	8	40
9	Nawaz Sharif Colony	1	6	15	15	1	1	Submersible
		2	6	15	15	1	1	Submersible
10	I.T Park	1	6	150	150	25	25	30
		2	6	150	150	25	25	30
		3	6	100	100	10	10	Submersible
11	Kalma Chowk	1	6	40	40	4	4	Submersible
		2	6	40	40	4	4	Submersible
		3	6	40	40	4	4	Submersible

RAVI TOWN

Lift Stations (Detail)

1. City Sub-division						
Sr.#	Location	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (Cusec)	Desiign Flow (Cusec)
1	Peco Badami Bagh	14	6+1 Cfs	60+20	6+1 Cfs	6+1 Cfs
	Vegetable Market	15	2-Cfs	150	2-Cfs	2-Cfs
2	Forest Colony	22	10+10 +6+6+ 6cfs	100+ 100+80+ 80+80	10+10+6 +6+6cfs	10+10+6+6 +6cfs
3	Sabzi Mandi	15	4+4+4 +2 Cfs	4+4+40	4+4+4+2 0 Cfs	6+6+ 6+6 Cfs
5	Track Stand Ravi Road	12	4+4+2 +2 Cfs	40+40+2 0+20	4+4+2+2 Cfs	4+4+2+2+ Cfs

2. Data Nagar Subdivision							
Sr. No	Pump Serial No. / Name	Avg. Running Hours (Per Day)	Pump Rating (Hp)	Motor Rating (Hp)	Actual Flow (Cusec)	Design Flow (Cusec)	Design Head (Ft)
1	Peco Road Lift Station	14	1460	80+ 60+60	4+4+4	6+6+6	27 Feet
2	Ali Pura Disposal Station	14	1460	60+30 +20	4+3+2	6+4+2	20-Feet

3. Shadbagh Subdivsion							
Sr.#	Location	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (If Measure d) (Cusec)	Desiign Flow (Cusec)	Design Head (Feet)
There is no Lift Station in Shadbagh							

4. Farakhabad Sub-division							
Sr.#	Location	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (Cusec)	Desiign Flow (Cusec)	Design Head (Feet)
1	Faisal Park	24 Hours	4+2+1	80+20+10	5	7	40
3	Fazal Park (B-Ii-10)	24 Hours	2+4+4+4	20+40+80+60	11	14	30

5. Misrishah Sub-division							
Sr.#	Location	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (If Measured) (Cusec)	Desiign Flow (Cusec)	Design Head (Feet)
1	Kachu Pura (B-Ii-10)	12	4+2	60+20	4+2	4+2	15
2	Faiz Bagh (B-Ii-10)	16	4+2	60+20	4+2	4+2	15
3	Domoria Pul (B-Ii-10)	15	4+4+5	50+50+60	4+4+5	4+4+5	35

6. Shahdara Sub-division								
Sr.#	Location	Pump Serial No.	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (If Measured) (Cusec)	Desiign Flow (Cusec)	Design Head (Feet)
1	Barket Town (B-Ii-10)	1,2,3	16,16,16,	4,4,2	20,60,60,	7	2,4,4	40,40,40
2	Maqbara More (B-Ii-10)	1	14	2	20	2	2	30
3	Shahdara Town (B-Ii-12)	1,2,3,4,5	24	6,6,6,6,13	80,80,80,80,150	37	37	40
4	Saeed Park (B-Ii-10)	1,2,3	14	2,4,6	20,40,80	12	12	40,40,40
5	Dheer Disposal	1	12	6	80	6	6	40

ALLAMA IQBAL TOWN

Lift Stations (Detail)

1. Sabzazar Subdivision								
	Location	Pump Serial No.	Average Running (Hours)	Pump Rating (Cfs)	Motor Rating (Hp)	Actual Flow (Cfs.)	Design Flow (Cfs).	Design Head (Ft.)
1	Douban Pura (Lift Station)	06/01	12	6	60	4.8	6	35
		06/02	11	6	60	4.8	6	35
		06/03	8	6	60	4.8	6	35
2	Babu Sabu Drainage Station	25/01	-	25 Cfs.	150	18	25	40
		25/02	-	25 Cfs.	150	18	25	40
		25/03	-	25 Cfs.	150	18	25	40
		25/04	-	25 Cfs.	150	18	25	40
		25/05	-	25 Cfs.	150	18	25	40
		25/06	-	25 Cfs.	150	18	25	40
		25/07	-	25 Cfs.	150	18	25	40
3	D - Block (Lift Station)	06/01	9	06 Cfs.	60	4.8	6	30
		06/02	10					
4	Shah Fareed (Lift Station)	06/01	12	06 Cfs.	60	4.8	6	30
		06/02	12					

2. Johar Town subdivision								
S. #	Name	Pump Sr. No.	Avg. Running Hours (Per Day)	Pumping Rating (Cfs)	Motor Rating (Kw)	Actual Flow (Cfs)	Design Flow (Cfs)	Design Head (Ft)
1	Shoukat Khanam	1	14	12	75	10	12	40
		2	14	8	75	6.5	8	35
		3	12	8	75	6.5	8	35
		4	12	8	75	6.5	8	35
		5	12	12	45	9	12	40
		6	14	12	75	10	12	40
		7	12	25	112	20	25	55
2	Bheer Village	1	10	6	141	4	6	30
		2	10	6	30	4	6	30
		3	10	10	40	9	10	40
3	Ali Razabad	1	8	6	30	6	6	35
		2	8	6	30	6	6	35
		3	6	6	30	6	6	35

3. Mustafa Town subdivision								
Sr no	Location	Pump Serial No.	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (Cusec)	Design Flow (Cusec)	Design Head (Feet)
1	Main Market Mustafa Town	1	10			4		
		2				4		
		3				4		
2	Azam Garden		12	40		4		

4. Ichra Sub-division								
Sr no	Location	Pump Serial No.	Aver. Runnin g Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (Cusec)	Design Flow (Cusec)	Design Head (Feet)
1	Rasool Park	1	18	80		6	45	10
		2		80		6	45	10
		3		80		8	45	35
		4		115		25	45	35
		5		–			45	25
2	Shah Kamal	1	19	80		6	45	25
		2		60		6	45	25
3	Ichra More	1	18	80		6		25
		2		80		6		25

5. AIT Subdivision								
Sr no	Name	Pump Serial No.	Aver. Running Hours	Pump Rating Hp	Motor Rating (Hp)	Actual Flow (Cusec)	Design Flow (Cusec)	Design Head (Feet)
1	AIT Lift station		20		20, 30	864000 G /Day	1,1	20

6. Samnabad Subdivision
There is no Lift Station in Samnabad Subdivision

Drainage Directorate

Primary Drains:

Total No. of Primary Drains: 6 Nos

Total length of Primary Drains: 55.70 Km

Secondary Drains:

Total No. of Secondary Drains: 12 Nos

Total length of Secondary Drains: 38.56 Km

Sludge Carriers:

Total No. of Sludge Carriers: 07 Nos

Total length of Sludge Carriers: 23.64 Km

Road Side/Tertiary Drains:

Total No. of Road Side/Tertiary Drains: 67 Nos

Total length of Road Side/Tertiary Drains: 366.05

Disposal Station:

Total: 1 No at North Drainage Division with 3 pumps of 6cfs

Infrastructure at a glance

No of Towns: 6 No.   Served population =6.5 Million   Water production=435MGD

Tube wells detail:

Town	S& ABT	Ravi	GBT	Gulberg	Nishter	AIT	Total
4 cfs	48	64	53	27	35	60	286
2 cfs	39	41	31	38	33	23	205
Total	87	105	83	65	68	83	491

Major Disposal Station details:

Town	S& ABT	Ravi	GBT	Gulberg	Nishter	AIT	Total
No of DS	1	4	4	0	2	1	12
Design Capacity cfs	224	589	930	0	236	240	2219

Lift Stations detail:

Town	S& ABT	Ravi	GBT	Gulberg	Nishter	AIT	Drainage	Total
No of LS	13	16	11	19	14	13	1	86

Length of water supply Line & sewerage Network:

	Total (KM)
W/S	5544.721
Sewerage	4214.980

No of Generators

Town	S& ABT	Ravi	GBT	Gulberg	Nishter	AIT	Total	O&M figures
	38	36	33	32	20	30	189	194

No of Filtration plants

Town	S& ABT	Ravi	GBT	Gulberg	Nishter	AIT	Total
No.	36	N.A	N.A	N.A	9	19	N.A

Total means Data is Sum Up that was collected by P&E for each town.

O&M figures means the figure which O&M is showing in its presentations.

Shalimar & Aziz Bhatti Town

No of Sub-divisions: 5 No.

Tube wells detail:

Subdivision	Bhagbanpura	Fatehgarh	Mughalpura	Mustafabad	Tajpura	Total
4 cfs	16	11	10	4	7	48
2 cfs	2	5	15	7	10	39
Total	18	16	25	11	17	87

Major Disposal Station details:

Subdivision	Bhagbanpura	Fatehgarh	Mughalpura	Mustafabad	Tajpura	Total
Name of D/S	Mehmood booti	Nill	Nill	Nill	Nill	1
Capacity cfs	224	Nill	Nill	Nill	Nill	224 cfs

Lift Stations detail:

Subdivision	Bhagbanpura	Fatehgarh	Mughalpura	Mustafabad	Tajpura	Total
No of L/S	2	Nill	5	2	4	13

Length of water supply Line & sewerage Network :

	Total (KM)
W/S	838.581
Sewerage	581.050

No of Generators

Subdivision	Bhagbanpura	Fatehgarh	Mughalpura	Mustafabad	Tajpura	Total
	10	6	8	4	10	38

No of Filtration plants

Subdivision	Bhagbanpura	Fatehgarh	Mughalpura	Mustafabad	Tajpura	Total
No. of FP						36

Ravi Town

No of Sub-divisions: 6 No.

Tubewells detail :

Subdivision	Shahdara	Shadbagh	Misrishah	Farakhabad	DataNagar	City	Total
4 cfs	6	5	5	8	11	19	64
2 cfs	5	6	15	5	3	7	41
Total	11	21	20	13	14	26	105

Disposal Station details :

Subdivision	Shahdara	Shadbagh	Misrishah	Farakhabad	DataNagar	City	Total
Name of DS	Nill	i)Shadbagh, ii)khokarRd	Nill	Farakhabad	Nill	Bhatti	4
Capacity cfs	Nill	i)240,ii)168	Nill	181	Nill	100	589

Lift Stations detail:

Subdivision	Shahdara	Shadbagh	Misrishah	Farakhabad	DataNagar	City	Total
No of L/S	5	nill	3	2	2	4	16

Length of water supply Line & sewerage Network :

Subdivision	Total (KM)
W/S	996.710
Sewerage	953.600

No of Generators

Subdivision	Shahdara	Shadbagh	Misrishah	Farakhabad	DataNagar	City	Total
	6	4	4	6	5	11	36

No of Filtration Plants

Subdivision	Shahdara	Shadbagh	Misrishah	Farakhabad	DataNagar	City	Total
	5	N.A	N.A	N.A	4	N.A	N.A

Nishter Town

No of Sub-divisions: 4 No.

Tubewells detail :

Subdivision	Township	Garden	Green	Industrial	Total
4 cfs	8	7	9	11	35
2 cfs	4	6	18	5	33
Total	12	13	27	16	68

Disposal Station details :

Subdivision	Township	Garden	Green	Industrial	Total
Name of D/S	LMP	Nill	Nill	Nishter	2
Capacity cfs	125	Nill	Nill	111	236

Lift Stations detail:

Subdivision	Township	Garden	Green	Industrial	Total
No of L/S	2	1	3	8	14

Length of water supply Line & sewerage Network :

	Total (km)
W/S	1310
Sewerage	546.900

No of Generators

Subdivision	Township	Garden	Green	Industrial	Total
	2	6	3	9	20

No of Filtration Plant

Subdivision	Township	Garden	Green	Industrial	Total
	4	2	2	1	9

Gulberg Town

No of Sub-divisions: 3 No.

Tubewells detail :

Subdivision	Mozung	Gulberg	Shimlahill	Total
4 cfs	7	11	9	27
2 cfs	19	14	5	38
Total	26	25	14	65

Disposal Station details :

Subdivision	Mozung	Gulberg	Shimlahill	Total
Name of D/S	Nill	Nill	Nill	Nill
Capacity cfs	Nill	Nill	Nill	Nill

Lift Stations detail:

Subdivision	Mozung	Gulberg	Shimlahill	Total
No of L/S	4	11	4	19

Length of water supply Line & sewerage Network :

Subdivision	Total(km)
W/S	509.380
Sewerage	593.680

No of Generators

Subdivision	Mozung	Gulberg	Shimlahill	Total
	16	10	6	32

No of Filtration plants

Subdivision	Mozung	Gulberg	Shimlahill	Total
		3		

Gunj Buksh Town

No of Sub-divisions: 3 No.

Tubewells detail :

Subdivision	Anarkali	Ravi	Islampura	Total
4 cfs	10	21	21	52
2 cfs	10	14	7	31
Total	20	35	28	83

Disposal Station details :

Subdivision	Anarkali	Ravi	Islampura	Total
Name of D/S	Nill	i) MOF-I ii)MOF-II iii)MOF-III	Gulshan Ravi	4
Capacity cfs	Nill	i)181, ii)102, iii)87	560	930

Lift Stations detail:

Subdivision	Anarkali	Ravi	Islampura	Total
No of L/S	7	3	1	11

Length of water supply Line & sewerage Network :

Subdivision	Total
W/S	888.160
Sewerage	761.050

No of Generators

Subdivision	Anarkali	Ravi	Islampura	Total
	10	13	10	33

No of Filtration Plants

Subdivision	Anarkali	Ravi	Islampura	Total
	N.A	6	2	N.A

Allama Iqbal Town

No of Sub-divisions: No.

Tubewells detail :

Subdivision	Samnabad	Sabzazar	Johartown	Mustafa	Ichra	AIT	Total
4 cfs	14	5	12	1	13	15	60
2 cfs	1	9	3	0	7	3	23
Total	15	14	15	1	20	18	83

Disposal Station details :

Subdivision	Samnabad	Sabzazar	Johartown	Mustafa	Ichra	AIT	Total
Name of D/S	Nill	Multan Rd	Nill	Nill	Nill	Nill	1
Capacity	Nill	240	Nill	Nill	Nill	Nill	240

Lift Stations detail:

Subdivision	Samnabad	Sabzazar	Johartown	Mustafa	Ichra	AIT	Total
No of L/S	Nill	4	3	2	3	1	13

Length of water supply Line & sewerage Network :

	Total
W/S	1001.890
Sewerage	778.700

No of Generators

Subdivision	Samnabad	Sabzazar	Johartown	Mustafa	Ichra	AIT	Total
50 KVA	5	6	5	0	10	4	30

No of Filtration Plants

Subdivision	Samnabad	Sabzazar	Johartown	Mustafa	Ichra	AIT	Total
	4	3	3	1	6	2	19

DETAIL OF NON-DEVELOPMENT BUDGET (EXPENDITURE)

(Rs. In million)

SR. NO	A/C. Code	Description	2014-15 Budget Estimates	2014-15 Revised Estimates	2015-16 Budget Estimates
1	2	3	4	5	6
	320	***REPAIR AND MAINTENENCE:***			
15	321	R & M - DISPOSAL STATIONS' BLDGS.	17.000	15.410	15.000
16	321-A	R & M - T/WELL CHAMBERS/RESERVIORS	14.400	11.430	15.000
17	322	R & M - TUBEWELLS	129.600	112.798	129.600
18	322-A	REPLACEMENT OF T/WELL MACHINERY	14.400	10.490	15.000
19	322-B	DRILLING & BORING OF TUBEWELLS	50.000	41.721	50.000
20	323	R & M - PUMPING STATIONS	70.000	43.529	50.000
21	323-A	DEWATERING	15.000	12.403	12.000
22	323-B	REPL./REHAB. OF D/STATION MACHINERY	15.000	6.620	10.000
23	324	R & M - MOBILE EQUIP./MISC. MACHINERY	50.000	37.884	45.000
24	324-A	R & M - GENERATORS	100.000	27.500	60.000
25	326	R & M - METERS / INSTALLATION OF METER CHARGES	5.000	-	15.000
26	327	R & M - WATER SUPPLY LINES	50.000	75.190	85.000
27	328	R & M - SEWER LINES	140.000	176.798	155.000
28	328-A	R & M - DRAINS	40.000	36.530	40.000
29	328-B	SEASONAL STAFF	50.000	50.000	50.000
30	328-C	ARBORICULTURE	1.500	0.500	1.000
31	328-D	DESILTING OF DRAINS / SEWER	15.000	10.973	15.000
32	329	OTHERS- PY LIABILITIES, ETC.	423.000	258.102	150.000
		SUB TOTAL:	1,199.900	927.878	912.600
	330	MATERIAL & STORES:			
33	331	MATERIAL FOR R & M	85.000	83.624	85.000
34	333	CHLORINATION	100.000	34.411	100.000
		SUB TOTAL:	185.000	118.035	185.000
		TOTAL REPAIR & MAINTENANCE	1,384.900	1,045.913	1,097.600

DETAIL OF NON-DEVELOPMENT BUDGET (EXPENDITURE)

(Rs. In million)

SR. NO.	A/C. Code	Description	2013-14 Budget Estimates	2013-14 Revised Estimates	2014-15 Budget Estimates
1	2	3	4	5	6
	320	REPAIR AND MAINTENENCE:			
15	321	R & M - DISPOSAL STATIONS' BLDGS.	14.400	12.752	17.000
16	321-A	R & M - T/WELL CHAMBERS/RESERVIORS	14.400	9.843	14.400
17	322	R & M - TUBEWELLS	129.600	84.500	129.600
18	322-A	REPLACEMENT OF T/WELL MACHINERY	14.400	1.146	14.400
19	322-B	DRILLING & BORING OF TUBEWELLS	50.000	4.750	50.000
20	323	R & M - PUMPING STATIONS	84.000	47.800	70.000
21	323-A	DEWATERING	21.600	5.400	15.000
22	323-B	REPL./REHAB. OF D/STATION MACHINERY	7.200	4.567	15.000
23	324	R & M - MOBILE EQUIP./MISC. MACHINERY	50.400	32.700	50.000
24	324-A	R & M - GENERATORS / HIRING 09 GENERATORS ON RENT	180.000	21.300	100.000
25	326	R & M - METERS	7.200	0.170	5.000
26	327	R & M - WATER SUPPLY LINES	72.000	35.103	50.000
27	328	R & M - SEWER LINES	144.000	125.000	140.000
28	328-A	R & M - DRAINS	57.600	13.770	40.000
29	328-B	SEASONAL STAFF	90.000	23.000	50.000
30	328-C	ARBORICULTURE	1.200	-	1.500
31	328-D	DESILTING OF DRAINS / SEWER	14.400	1.768	15.000
32	329	OTHERS- PY LIABILITIES, ETC.	90.000	56.500	423.000
		SUB TOTAL:	1,042.400	480.069	1,199.900
		EXPENDITURE AGAINST PCGIP FUNDS:			
33	327	R & M - WATER SUPPLY LINES	-	36.672	117.505
34	328-A	R & M - DRAINS	-	9.230	143.550
35	331	MATERIAL FOR R & M	-	14.922	156.678
		SUB TOTAL:	-	60.824	417.733
	330	MATERIAL & STORES:			
36	331	MATERIAL FOR R & M	120.000	51.828	85.000
37	333	CHLORINATION	96.000	22.452	100.000
		SUB TOTAL:	216.000	74.280	185.000
-	-	TOTAL REPAIR & MAINENANCE	1,258.400	615.173	1,802.633

DETAIL OF NON-DEVELOPMENT BUDGET (RECEIPTS)

(Rs. in million)

Sr. No.	A/C. Code	Description	2012-13 Budget Estimates	2012-13 Revised Estimates	2013-14 Budget Estimates
1	2	3	4	5	6
18	531	*III. UIP TAX SHARE:*	520.000	926.469	850.000
19	531-A	*IV. EEPs, PCGIP (WORLD BANK)*	-	-	385.000
		IV. MISCELLANEOUS INCOME :			
20	591	MARK-UP INCOME	78.000	85.000	90.000
21	554-571	OTHERS:			
i	554	Ferrule shifting fee	0.010	0.010	0.010
ii	555	Re-opening fee	0.100	0.100	0.100
iii	557	Sale of Book-lets	0.090	0.090	0.090
iv	558	Sale of Tender Forms	10.000	4.375	10.000
v	559	Sale of Scrap	17.500	7.009	10.000
vi	561	Fines to consumers	0.500	0.500	0.500
vii	562	Fines to Contractors	0.150	1.002	0.150
viii	563	Rent	4.500	6.376	6.400
ix	565	Enlistment/Renewal fee	1.300	5.206	5.400
x	566	Change of name	0.050	0.050	0.050
xi	569	Miscellaneous:Disc. Fee, Staff loans, etc.	1.500	0.727	1.500
xii	570	** 15% Collection charges of S/Fee (Est.100 M)	15.000	14.550	15.000
xiii	571	Departmental Charges on deposit works	10.000	8.000	10.000
		Total Others	60.700	47.995	59.200
22		TOTAL MISC. INCOME: *(20+21)*	138.700	132.995	149.200
23		RECEIPTS FOR THE YEAR:- *(17..19+22)*	3,758.700	3,308.537	4,602.200
24		*GRANT BY THE GOVERNMENT :*			
	i	- SUBSIDY FOR LESCO POWER BILLS	1,730.000	2,151.000	2,200.000
	ii	- SUBSIDY FOR POL	-	27.811	-
		TOTAL :	1,730.000	2,178.811	2,200.000
25		TOTAL RECEIPTS :- *(23+25)*	5,488.700	5,487.348	6,802.200
26		BALANCE BROUGHT FORWARD	(1,511.230)	684.433	185.206
27		GRAND TOTAL *(25+26)*	3,977.470	6,171.781	6,987.406

' WASA is collecting Sanitation fee w.e.f.1st July'2003 on behalf of District Government for SWM on which 15% deduction is made on account of collection harges as admissible. The Budget estimates FY: 2012-13 was set to Rs. 100.000 millions out of which Rs.97.000 millions has been collected on behalf of WM.The 15% charges calculated against total collection is Rs. 14.550 millions, which is considered as income of WASA. The Budget estimates FY: 2013-14 re set at Rs. 100.000 million on which 15% i.e. Rs. 15.000 million is estimated FY: 2013-14 as income of WASA.

WASA
RAWALPINDI

Questionnaire

Water Supply Business

For WASA Rawalpindi

Japan International Corporation Agency

Table of Contents

Questionnaire on the Water Supply Business
Questionnaire 1: Information of WASA in Punjab Province

1. City information 都市の情報

1-1. Name of water supply organization that performs water supply service 水道事業者名称

Water and Sanitation Agency, Rawalpindi

1-2. Name of city that performs water supply service 水道事業を行う都市の名称

Rawalpindi excluding Cantonment, Bahria Town, DHA and Private Housing Schemes

1-3. Population of water service area (person) 給水都市の人口(人)

2011	2012	2013	2014
1,072,409	1,097,095	1,613,573	1,650,330

1-4. City area (km^2) 都市の面積(km^2)

Total area	Water supply area
872 km^2	276km^2

1-5. Number of service connection (number of water meter) 給水(契約)戸数(戸、水道メータ数)

2011	2012	2013	2014
D -> 83,742	85,185	102,620	105,529
C -> 8,204	8402	8903	9,126

1-6. Population served by water supply as percentage of total population (%) 水道普及率(%)

2011	2012	2013	2014
90	90	80	84

2. Water resource / Water treatment 水源／浄水

2-1. Water resource (m^3/day) 水源(m^3／日)

Surface (River / Dam)	Groundwater	Seawater	Other
23 + 6 = 29MGD	39MGD	N/A	N/A

2-2. Method of water intaken 取水方式

Surface Water from Rawal Dam and Khanpur Dam. Ground Water from 362 Tube wells

2-3. Number and capacity of Water Treatment Plant (WTP) (number, m^3) 浄水場数と処理能力(箇所、m^3)

Number of WTP	Total capacity (m^3/day)
1	28 MGD

No.	WTP Name	Built year	Capacity	Treatment volume (average)
1	Rawal Lake	1912	28 MGD	m^3/day

2-4. Name and dosing rate of coagulant (mg/L) 凝集剤名称および注入率(mg/L)

Name of coagulant	Dosing rate of coagulant (mg/L)
Alum	8 mg/L

2-5. Type of sedimentation and filtration 沈殿・ろ過の種類

Type of sedimentation	Circular and Rectangular
Type of filtration	Rapid, Single media

2-6. Filtration speed rate (m/day) ろ過速度(m/day)

Slow sand filter	Rapid sand filter
N/A	110-130 G/ft^2/hr

2-7. Name and dosing rate of disinfection (mg/L) 消毒剤名称および注入率(mg/L)

Name of disinfection	Dosing rate of disinfection (mg/L)
Chlorine	1-2 mg/L

2-8. Number and capacity of distribution reservoir (number, m^3) 配水池数と容量(箇所、m^3)

Number	Total capacity (m)	Minimum reservoir (m^3)	Maximum reservoir (m^3)
36 (OHR)	2.77 MG	1,000 G	0.3 MG

2-9. Production cost of water treatment (PHP/m^3) 造水コスト(PHP/m^3)

Ground Water (Per Thousand Gallons) - Rs. 25-30 Surface Water (Per Thousand Gallons) – Rs. 8(Rawal Dam), Rs. 35 (Khanpur Dam)	USD/m^3

2-10. Number of items of water quality inspection (number) 水質検査項目数(数)

Everyday	Every week	Every month	Every year
16			
6-10 (Rawal Lake WTTP)	4 days at least		

2-11. Hour of water suspension and supply turbidity water (times, hour/year) 断水・濁水時間(時間/年)

	Number of times	Total hours
Water suspension	N/A	N/A
Supply turbidity water	N/A	N/A

2-12. Describe the problem about water treatment 浄水処理の問題点の記述

> 1. Mixing of waste water into surface water due to settlements at the upstream of Rawal Dam
> 2. Plant age is about 50 years so Repair and Maintenance of some section is required

3. Organization 組織体制

3-1. Total number of KCWN staff member (person) 職員数(人)

2011	2012	2013	2014
1069	1068	1153	1183

3-2. Total number of engineer staff member (person) 技術職員数(人)

2011	2012	2013	2014
24	25	24	21

3-3. Proportion of staff member according to staff's age (%) 職員年齢構成(%)

10's – 20's	30's	40's	50's –
Nil %	25 %	60 %	15 %

3-4. Proportion of staff member's business experience of water supply (%) 職員経験年数構成（%）

– 5 years	5 – 10 years	10 – 20 years	20 – 30 years	30 years –
5%	10 %	10 %	30 %	15 %

3-5. Hour of staff's training (times/person, hour/year/person) 職員研修時間(回/人、時間/人)

	Inner training (exclude OJT)		Outsourcing	
	Times/person	Total hour/person	Times/person	Total hour/person
Engineer	No Organized training is occurring			
Exclude engineer				

4. Water tariff 水道料金

4-1. Price and consumption of domestic and commercial use (PHP, m³, average per month)
家事・業務用水道料金・使用水量(PHP/m³：平均額)

	Price	Average Consumption
Domestic use	Tariff attached (Annexure 1.1)	N/D m³/month
Commercial use		N/D m³/month

4-2. Collection frequency (month) 水道料金徴収間隔(月)

2 □onths

4-3. Collection rate of □ater charge (□) 水道料金徴収率(%)

Domestic use	Commercial use
□□ □	□□ □

4-4. Descri□e/Attach the □ater tariff ta□le 水道料金表の記載

□ ater Tariff attached as an annexure to this document (Annexure 1.1)

□emar□s□

□ □oney exchange rate□1 □□ Dollar (□□D) □ ______ Pa□istani rupee (P□□) on April 2□1□

□ □f no data□ans□er is □N/D□□else if no ans□er or non-applica□le□ans□er is □N/A□.

Questionnaire on the Water Supply Business
Questionnaire 2: Leakage Prevention Work of WASA

1. Organization 組織

1-1. Name of organi□ation for lea□age prevention 漏水対策を担当する組織名称

□ea□age repairing is □eing done □y each □D□ of his region

1-2. Num□er of person in organi□ation (person) 漏水対策を担当する組織の人員数(人)

2□11	2□12	2□13	2□14
35	35	45	45

1-3. Annual training time for lea□age prevention (person□person x hours)
漏水対策に関する年間研修時間(人×時間)

	2□13	2□14
Person	Nil	
Person □ □ours		

2. Leakage Detection 漏水調査

2-1. Num□er of lea□age survey team (num□er) 調査チーム数(数)

2□11	2□12	2□13	2□14
12	12	15	15

2-2. Num□er of person in one survey team (person) 1チーム当りの人数(人)

2-3

2-3. Num□er of days of lea□age survey (person x days / year) 年間漏水調査日数(人×日/年)

2□11	2□12	2□13	2□14
Every day			

2-4. Num□er of hours of average lea□age survey (person x hours / month) 調査平均時間(人×時間/月)

□ffice hour

2-□. □ength of lea□age survey (□m / year) 年間漏水調査延長(km/年)

2□11	2□12	2□13	2□14
2□□ □m	2□□ □m	3□□ □m	3□□ □m

2-□. Num□er of surface lea□age detection (num□er / year) 年間地上漏水発見数(箇所/年)

2□11	2□12	2□13	2□14
1,975	1,801	975	640

2-□. Num□er of underground lea□age detection (num□er / year) 年間地下漏水発見数(箇所／年)

2□11	2□12	2□13	2□14
Nil	Nil	Nil	Nil

2-□. □rea□do□n of num□er of underground lea□age detection □y Acoustic rod□□ea□age detector□ Correlative lea□detector□and other in 2□11 (num□er)

地下漏水発見数の内訳：音聴棒、漏水探知機、相関式探知機、その他

Acoustic rod	□ea□age detector	Correlative lea□detector	□ther
N/A	N/A	N/A	N/A

2-□. Num□er of reparation of lea□age site (num□er / year) 年間漏水箇所修理数(箇所)

2□11	2□12	2□13	2□14
All the registered complaints are rectified as soon as possible			

2-1□. Average time to repair from lea□age detection and the longest hours (hour)

漏水発見から修理までに要する平均時間(時間)

Average	□ongest
1 day	□days

2-11. Num□er of lea□age reports from pu□lic (num□er) 市民からの漏水の通報数(数)

2□11	2□12	2□13	2□14
880	801	680	225

2-12. □ave you done □inimum Night □lo□ □easure method□ 夜間最小流量測定を行ったことがあるか？

No

3. Equipment of Leakage Detection 漏水調査機材

3-1. Num□er of Acoustic rod/□ar and Amplified acoustic rod (num□er)

単純アンプ内蔵型/アンプ内蔵型音聴棒の本数(数)

Acoustic rod/□ar	Amplified acoustic rod
N/A	N/A

3-2. Num□er of set of Correlative lea□detector (num□er) 相関式漏水探知機のセット数(数)

N/A

3-3. Num□er of set of □ea□□one detector or □ea□noise correlator (num□er)

音圧式漏水探知機のセット数(数)

N/A

3-4. Num□er of sensor of □ea□ □one detector or □ea□ noise correlator (num□er)
音圧式漏水探知機のセンサー数(数)

N/A

3-□. Num□er of □etal pipe locator (num□er) 金属管探査機の台数(数)

N/A

3-□. Num□er of □esin pipe locator (num□er) 樹脂管探査機の台数(数)

N/A

3-□. Num□er of Distance measuring equipment (num□er) 距離測定装置の台数(数)

N/A

3-□. Num□er of □ater meter measuring for □N□□ (num□er) 夜間最小流量測定用水量メータの台数(数)

N/A

3-□. Num□er of vehicles used for lea□age survey (num□er) 漏水対策に用いる車両台数(台)

N/A

3-1□. Name of other lea□age detector その他の漏水探知機

N/A

4. Water Distribution Analysis 配水量分析

Data in this ta□le is 2□____. 下表のデータは 20____年の水量。

□ystem □nput □olime 配水量 24□□2□□ □□	Authori□ed Consumption 認定使用水量 □□-□□□	□evenue □ater 有収水量	□illed Authori□ed Consumption 請求消費量	□illed □etered Consumption (incuding □ater exported) 検針による料金徴収	N/A □
				□illed Non-metered Consumption 検針に拠らない料金徴収	□□-□□□
		Non-□evenue □ater (N□□) 無収水量	□n□illed Authori□ed Consumption 非請求消費量	□n□illed □etered Consumption 請求せず(検針あり・調停)	N/A □
				□n□illed Non-metered Consumption 請求せず(検針なし・事業用)	N/D □
	□ater □osses 損失水量 4□-4□□		Apparent □osses 商業的(見かけ)損失量	□nauthori□ed Consumption 不正規消費(盗水・不明水)	2□ □
				□etering □naccuracies 水道メーター検針エラー	N/A □
			□eal □osses 実質損失量	□ea□age on Transmission and/or Disri□ution □ains 総配水管からの漏水	N/D □
				□ea□age and □verflo□s at □tilities □trage Tan□s 貯水槽からの溢水、漏水	N/D □
				□ea□age on □ervice Connections up to Customers□□eters 戸別メータまでの給水管からの漏水	N/D □

4-11. Distri□uted □ ater (□□□) 年間総配水量

2□11	2□12	2□13	2□14
20,805	21,535	24,090	24,820

4-12. □ ater tariff (□evenue □ ater) (m^3 / year) 水道料金対象水量(有収水量)(m^3/年)

2□11	2□12	2□13	2□14
11□3□□	11,820	13,469	14,117

4-13. □ther (□evenue □ ater) (m^3 / year) その他の徴収料金対象水量(有収水量)(m^3/年)

2□11	2□12	2□13	2□14
N/A	N/A	N/A	N/A

4-14. □eter loss (Non-□evenue □ ater) (m^3 / year) 水道メータ損失水量(無収水量)(m^3/年)

2□11	2□12	2□13	2□14
N/A			

4-1□. □tolen □ater (Non-□evenue □ ater) (m^3 / year) 盗水損失水量(無収水量)(m^3/年)

2□11	2□12	2□13	2□14
1,632	1,792	1,780	1,745

4-1□. □npaid □ater (Non-□evenue □ ater) (m^3 / year) 未納水量(無収水量)(m^3/年)

2□11	2□12	2□13	2□14
2□332	2,499	3,038	3,277

4-1□. □ea□age □ater (Non-□evenue □ ater) (m^3 / year) 漏水量(無収水量)(m^3/年)

2□11	2□12	2□13	2□14
□4□□	5,372	5,803	5,621

4-1□. □ ater□or□s usage volume (Non-□evenue □ ater) (m^3 / year) 水道工事使用水量(無収水量)(m^3/年)

2□11	2□12	2□13	2□14
□.□	0.6	0.7	0.7

4-1□. □n□no□n □ater (Non-□evenue □ ater) (m^3 / year) 不明水量(無収水量) (m^3/年)

2□11	2□12	2□13	2□14
m^3	m^3	m^3	□□.3 m^3

4-2□. □ther (Non-□evenue □ ater) (m^3 / year) その他の無収水量(m^3/年)

2□11	2□12	2□13	2□14
N/A	N/A	N/A	N/A

5. DMA / Leakage Survey Scale DMA/漏水調査メッシュ

□-1. To ma□e up meshes or □loc□s for lea□ detection. (□f ma□e up meshes or □loc□s□D□A is replaced □ith the meshes or □loc□s.)

漏水調査用のブロックやメッシュを構成しているか(構成している場合は、以下のDMAは読み替える)

N/A

□-2. Num□er of D□A □loc□ (num□er) DMAブロック数(数)

N/A

□-3. Num□er of connection in D□A (connection) □Average of all D□A / □inimum / □aximum□

DMA内給水戸数(戸)[全ブロックの平均/最小/最大]

Average N/A	□inimum	□aximum

□-4. Num□er of □ourly □actor in D□A □Average of all D□A / □inimum / □aximum□

DMA内時系数(ー)[全ブロックの平均/最小/最大]

Average N/A	□inimum	□aximum

□-□. □ater supply average volume in D□A (m^3 / day) □Average of all D□A / □inimum / □aximum□

DMA内日平均給水量(m^3)[全ブロックの平均/最小/最大]

Average N/A	□inimum m^3	□aximum m^3

□-□. □ater supply maximum volume in D□A (m^3 / day) □Average of all D□A / □inimum / □aximum□

DMA内日最大給水量(m^3)[全ブロックの平均/最小/最大]

Average N/A	□inimum m^3	□aximum m^3

□-□. □ater pressure in D□A (□Pa) □Average of all D□A / □inimum / □aximum□

DMA内給水圧(MPa)[全ブロックの平均/最小/最大]

Average N/A	□inimum □Pa	□aximum □Pa

□-□. Num□er of valves formed D□A area (num□er) □Average of all D□A / □inimum / □aximum□

DMAを構成する(区切る)仕切弁数(数)[全ブロックの平均/最小/最大]

Average N/A	□inimum	□aximum

□-□. Num□er of valves in D□A (num□er) □Average of all D□A / □inimum / □aximum□

DMA内仕切弁数(数)[全ブロックの平均/最小/最大]

Average N/A	□inimum	□aximum

□-1□. Num□er of hydrant in D□A (num□er) □Average of all D□A / □inimum / □aximum□

DMA内消火栓数(数)[全ブロックの平均/最小/最大]

Average N/A	□inimum	□aximum

□-11. □i□e of mesh (□f ma□e up meshes or □loc□s) (□m x □m)

漏水調査用メッシュがある場合、メッシュの大きさ(km×km)

N/A □m x □m

□-12. Num□er of valve in distri□ution net□or□ (num□er) 総仕切弁数(数)

N/D

□-13. Num□er of hydrant in distri□ution net□or□ (num□er) 総消火栓数(数)

N/A

□-14. Num□er of another valve in distri□ution net□or□ (num□er) その他の調整弁等の総数(数)

N/A

□-1□. Num□er of □ater suspension (num□er / year) 年間断水回数(数／年)

N/A num□er / year

□-1□. The total num□er of connection of □ater suspension (connection / year) 年間断水のべ戸数(戸／年)

N/A connection / year

□-1□. □ ater suspension time per one time (hour / time) □Average / □aximum□

断水1回当りの継続時間(時間/回)[平均/最大]

Average N/A hour / time	□aximum hour / time

□-1□. Descri□e the lea□age repair flo□chart 漏水修繕フロー図の記述

Annexure 3.1

6. Distribution pipeline laying 管路布設

□-1. Ne□ installation pipeline length (□m) 新規布設管路延長(km)

2□11	2□12	2□13	2□14
2 □m	2 □m	4 □m	□ □m

□-2. □eplacement pipeline length (□m) 送配水管更新(入替)延長(km)

2□11	2□12	2□13	2□14
12 □m	14 □m	3□ □m	42 □m

□-3. □eha□ilitation pipeline length (□m) 更生管路延長(km)

2□11	2□12	2□13	2□14
N/A □m	N/A □m	N/A □m	N/A □m

□-4. □emoval pipeline length (□m) 撤去管路延長(km)

2□11	2□12	2□13	2□14
N/A □m	N/A □m	N/A □m	N/A □m

□-□. □uspended pipeline length (□m) 休止管路延長(km)

2□11	2□12	2□13	2□14
N/A □m	N/A □m	N/A □m	N/A □m

7. Distribution / Service Pipe material 送配給水管種別

□-1. Ductile □ron Pipe (D□P) length (□m) ダクタイル鉄管(DIP)延長(km)

Distri□ution	3.4□□ □m	□ervice	□m

□-2. Cast □ron Pipe (C□P) length (□m) 鋳鉄管(CIP)延長(km)

Distri□ution	3.□ □m	□ervice	□m

□-3. □teel Pipe (□P) length (□m) 鋼管(SP)延長(km)

Distri□ution	3□ □m	□ervice	□m

□-4. □tainless □teel Pipe (□□□) length (□m) ステンレス鋼管(SUS)延長(km)

Distri□ution	N/A □m	□ervice	□m

□-□. Concrete (□ume) Pipe (□P) length (□m) コンクリート管(HP)延長(km)

Distri□ution	13.□ □m

□-□. As□estos Cement Pipe (ACP) length (□m) アスベスト管(ACP)延長(km)

Distri□ution	22□ □m	□ervice	□m

□-□. Polyvinyl Chloride Pipe (P□C) length (□m) 硬質塩化ビニル管(PVC)延長(km)

Distri□ution	11□ □m	□ervice	□m

□-□. □igh □mpact □inyl Pipe (□□□P) length (□m) 高強度塩化ビニル管(HIVP)延長(km)

Distri□ution	N/A □m	□ervice	□m

□-□. Polyethylene Pipe (P□P) length (□m) ポリエチレン管(PEP)延長(km)

Distri□ution	N/A □m	□ervice	□m

□-1□. □alvani□ed □teel Pipe (□P) length (□m) 亜鉛メッキ鋼管(GP)延長(km)

Distri□ution	2□ □m	□ervice	□m

□-11. □ead Pipe (□P) length (□m) 鉛管(LP)の延長(km)

Distri□ution	N/A □m	□ervice	□m

□-12. Cupper Pipe (CP) length (□m) 銅管(CP)の延長(km)

□ervice	□m

□-13. □ther Pipe length (□m) その他の管の延長(km)

Pipe material name	Distri□ution	□ervice
HDPE	1□□ □m	□m

□-14. Transmission Pipeline length (□m) 送水管延長(km)

2□11	2□12	2□13	2□14
□m	2□ □m	N/D	N/D

□-1□. Distri□ution Pipeline length (□m) 配水管延長(km)

2□11	2□12	2□13	2□14
□m	□m	N/D	N/D

□-1□. □ervice Pipeline length (□m) 給水管延長(km)

2□11	2□12	2□13	2□14
□m	12□ □m	N/D	N/D

8. SCADA/Mapping system 水道情報データ管理／マッピングシステム

□-1. Descri□e the name of digital data filing 電子データ化している業務名

□ □□ □ased system is under development

□-2. Proportion of filing system of □usiness management document (□) 事業文書の管理割合(%)

Paper filing	Digital filing
mostly	□nder preparation

Currently all documents are manually maintained on papers. Consultants are □or□ing on it and after completing the soft□are they □ill hand over it to □ A□A

□-3. Proportion of filing system of □ater facilities□dra□ing (□) 水道工事図面の管理割合(%)

Paper filing	Digital filing
mostly	□nder preparation

9. Water meter and maintenance 水道メータ・修繕

No meter installed so far. (N/A)

□-1. Num□er of installed □ater meter (num□er) 水道メータ設置数(数)

Diameter	13mm	2□mm	2□mm	mm	mm	□ther	Total
Num□er	N/A	N/A	N/A	N/A	N/A	N/A	N/A

□-2. Period of service of □ater meter (year) 水道メータ使用期間(年)

N/A □ear

□-3. Num□er of annual purchase of □ater meter (num□er) 水道メータ年間購入数(数)

2□11	2□12	2□13	2□14
N/A	N/A	N/A	N/A

□-4. Times of usage of maintained expiry □ater meter (times)

満期水道メータの修理後の繰り返し使用回数(回)

N/A

□-□. Num□er of damaged □ater meter (num□er) 破損水道メータ数(数)

2□11	2□12	2□13	2□14
N/A	N/A	N/A	N/A

□-□. Num□er of intentional damaged □ater meter (num□er) 故意に破損された水道メータ数(数)

2□11	2□12	2□13	2□14
N/A	N/A	N/A	N/A

□-□. Descri□e the reason of damaged/□ro□en □ater meter 水道メータの破損理由の記述

N/A

10. Procurement / Stock management 資材調達・資材管理

1□-1. Descri□e the procedure of procurement of □ater supply material 材料調達手段の記述

PP□A (Pu□lic Procurement □egulatory Authority)□□ules□Pun□a□2□14 are follo□ed.

□s. 1 - 1□□□□□□ □y comparison of three quotations

□s. 1□□□□□1 □2□□□□□□□ □y giving advertisement on PP□A □e□site

□s. 2□□□□□□□1 and a□ove □y giving advertisement on PP□A □e□site and Ne□s Paper

□equest is generated □y relevant □D□ and after follo□ing proper channel it is presented to □D for approval. After Approval from □D□concerned DD follo□ the concerned clause of PP□A □ule for procurement.

1□-2. Descri□e the management of spare parts 予備材料の管理方法

□anagement is done □y each section □y itself.

□emar□s□

□ Transmission pipeline defines the pipeline □et□een □ater treatment plant and distri□ution reservoir□ also □et□een t□o distri□ution reservoirs.

□ D□A defines District □etered Area as same as District □etered □one (D□□).

□ The □ourly □actor defines non-dimension value □hich hourly maximum consumption volume divides hourly average one.

□ □f no data□ans□er is □N/D□□else if no ans□er or non-applica□le□ans□er is □N/A□.

□ Pressure unit□

	□Pa	□gf/cm^2	□ar	P□□
□Pa	1	1□.2□	□.□□□	14□.□
□gf/cm^2	□.□□□1	1	□.□□□□	14.22
□ar	□.1□13	1.□33	1	14.□□
P□□	□.□□□□	□.□□□3	□.□□□□	1

Questionnaire on the Water Supply Business
Questionnaire 3: Tube Well

Name of organization: WASA Rawalpindi

Please provide data for tube well as follows:

Q1 How many tube well are there in your town?
Answer: 366

Q2 Do you have the inventory of tube well ?
Answer:
Yes.
Annexure A of "Master Plan Study Report B WASA Rawalpindi" and Annexure 3.1

Q3 Do you have information of each tube well regarding well location, installation year, screen depth, maintenance record, operational hours, specification of pumps ?
Answer: Yes.

Location,	Annexure 3.1
Installation year,	Annexure 3.1
Screen depth,	Annexure 3.1
Maintenance record,	Annexure 3.1
Operational hours,	12–14 hours
Specification of pumps	Annexure 3.1

Questionnaire on the Water Supply Business
Questionnaire 4: Sewerage and Drainage

Name of organi□ation□□ ater and □anitation Agency□□a□alpindi

A. Documents or information related to sewerage and drainage system in WASAs

(1) Please provide following maps.

- Location Plan of the City (including Area Boundary)
  (Annexure 4.1)
- Topography and Levels (Page 44 of Master Plan Study Report B WASA Rawalpindi)
- Served and Unserved Areas
  (Annexure 4.2, not separated available but can be see)
- WASA administration Zones Boundary
  (Annexure 4.1)
- Location of Disposal stations (N/A)
  Layout Plan of Existing Sewer System (Annexure 4.2)
- Layout Plan of Existing Drainage System (N/D)
- Existing Drainage Route and Point of Final Disposal (N/D)
- Proposed or planed Sewers and Drainages System (N/D)
- Major Ponding Areas
  (Annexure 4.3 contains the most vulnerable areas in which water remains till the high water level in Drain Lai. When level of drain drops down then water also move to Drain Lai by itself.)

(2) Please provide following rainfall data.

- Rainfall intensity (15, 30, 60 120 minutes, 3,6,9,12 hours duration) (Figure 2,4 and 8 of Master Plan Study Report B WASA Rawalpindi)
- Fitted Intensity Duration Curve (N/D)

B. Organization and finance

(1) Please provide an actual organization chart of WASAs especially Sewers and Drainages cleaning (Engineers, Equipment operators, Sewer man, etc)

Annexure 5.1 & 5.2

(2) Please furnish an annual budget and disbursement in the WASAs and its breakdown for the last 5 years especially Sewers and Drainages cleanings.

Annexure 5.□contains the details (Submitted as hard copy)

(□) Please explain the schedule and budget allocation for the implementation of the cleanings (operation□maintenance of the sewage and drainage system).

Annexure 5.□contains the details (Submitted as hard copy)

□. □□ui□ment□□ac□inery

(1) Please provide a list of equipment□machinery owned by WASAs as tabulated below (type of equipment, model, year of manufacturing, name of manufacturer and country, running hour□km, working condition, maintenance method, present location).

Equipment	□odel (□ain Spec.)	□ear	□anufacturer□ □ountry	Running hour/km	Working Condition	Maintenance method	Location
Wheel Excavator	PC200	1998	Komatsu Japan	6000hr	Under repair	Need overhaul	Motor pool

Annexure 4.4 contains the list of special vehicles

(2) Existing facilities or equipment for maintenance service available at the workshop of WASAs.

(3) Procedure of machine maintenance and process of daily/routine maintenance activity and preparation of activity's record/report.

Fault or abnormality is reported by the driver / supervisor. Relevant Assistant Director reviews the issue and report to the Motor Transport Officer (MTO). He further proceed or solve the issue.

(4) Laws/Regulations of gas emission control for vehicles and construction equipment.

Environmental Protection Agency Act is followed.

(5) Average field working hours per day for Sewers and Drainages cleanings.

8 hours

(6) Current dredging method.

Only for Nala Lai: two excavator + two dump trucks

(7) Current sludge removal work from sewage pipes.

In case of manual work: two worker for manhole + 2 helpers

In case of Mechanical work: One Driver + One Operator + 2 helpers

(8) Record of the accidents of construction equipment/machinery for the last 5 years
(N/A) WASA Rawalpindi outsource the construction work

(9) With regard to disposal stations□the following information will be required (refer to Format□1):

N/A

Questionnaire on the Water Supply Business
Questionnaire 5-Rawalpindi
Management, Finance and Organization

Name of organization: __Rawalpindi WASA_

1) Management

Please answer the following questions and provide financial reports in recent three (3) years□current tariff tables and your organi□ation chart to support your answers.

	□uestions	Please write your answers.	Reference document
□ision□ strategy	Existence of a long□term□plan	Answer: □es□ Master Plan 1996 □2016 prepared by Provincial □overnment	
Finance	Revenues:	□ear 2012 actual (913.968)□ 2013 actual (1193.563)□ 2014 actual (1188.288)□ 2015 estimated (1320.657)□ 2016 planning (2187.292)	
	Costs	□ear 2012 actual (849.409)□ 2013 actual (1187.660)□ 2014 actual (1158.943)□ 2015 estimated (1330.372)□ 2016 planning (3029.930)	
	Investment	□ear 2012 actual (30.793)□ 2013 actual (26.580)□ 2014 actual (27.873)□ 2015 estimated (15.148)□2016 planning (□)	
	Main finance sources	What is your main finance source□e.g. water charge collection□ subsidy□ government finance (PC□1)□assistance from donors□ Answer (Water collection Charges)	
Future expansion	What is your future expansion plan□ Master Plan is under preparation by M/S Osmani □ Co. (Pvt.) Ltd. New water treatment plant ( ) New sewage plant ( ) Rehabilitation ( ) How much do you need to implement the above plans□( )		Master Plan Study Report C WASA RWP
Administration and organi□ation	Organi□ation chart	Number of staff in each division by grade (Annexure 5.1)	
	Recruitment	□ear 2012 actual (□)□2013 actual (□)□2014 actual (□)□2015 estimated (25)□2016 planning (50)	
	Retirement	□ear 2012 actual (8)□2013 actual (8)□2014	

		actual (11)□ 2015 estimated (10)□ 2016 planning (15)	
	Communication among divisions	Do you have a regular cross□division meeting (e.g. once a month□once a week)□ Answer ( )	
	Pipe distribution network map	Do you have a pipe distribution network map of your city□ Answer: □es.	
	Inventory List	Do you have a list of inventory□machinery and other fixed assets□ Answer: Partially yes. Study MP Study Report □ contains all available inventories	
	Customer database	Do you have a customer database□ Answer: □es.	
Training	Training program (actual)	What training have you conducted□ Answer (No Organi□ed Trainings are being conducted)	
	Necessary Training in the future	What training do you need in the future□ Answer: (□IS□Integrated Water Resource Management□Technical Trainings for □EN□DD□SDO□AD and SE)	
	□uidelines	Do you have textbooks or guidelines to give a lecture to your staff□ Answer: No.	
	□udget for the training	How much is your annual budget for the training□ Answer ( )	
Relation with customers	Communication with customers	Do you have a regular meeting with customers (e.g. once a month□once a week)□ Answer: □es□No□Comments ( )	
	Complaints from customers	Do you keep recording customer complaints□ Answer: □es.	
Relation with other organi□ations: WASAs□□overnment□and donors	Relation with other WASAs□suppliers	Do you have a regular meeting with other WASAs or suppliers (e.g. once a month□once a week)□ Answer: □es□No□Comments ( )	
	Relation with the State □overnment	Do you have a regular meeting with the State □overnment (e.g. once a month□ once a week)□ Answer: □es□No□Comments ( )	

	Relation with Tehsil Municipal Administrations	Do you provide some training for Tehsil Municipal Administrations□ Answer: No.	

□) □ ate□□□□□□

The I□NET is International □enchmarking Network for Water and Sanitation Utilities□issued by the World □ank. I would appreciate if you answer the following questions□in reference to the data as of year 2010 on the web or data from the JICA report in July 2014.

□uestions	□ear 2006 data	□ear 2009 data	Source	Please write current situations.
Rawalpindi population	946□000	1□250□000	I□NET	1□500□000□1□600□000
Coverage with water service	61.73□	90□ (1□125□000)	I□NET	85□
Coverage with sewerage	34.99□	35.04□	I□NET	40□
Water treatment capacity (m3/day)			N/A	□□ □ □ □
Actual average treatment volume (m3/day)			N/A	N/D
Number of connections		90□000	I□NET	115□000
Network length (km)		1□150 km	I□NET	1200km (approximate)
Water production	295.55 lpcd	228.92lpcd	I□NET	40□pcd
Total water consumption	152.00 lpcd	150.99 lpcd	I□NET	N/D
Residential consumption		87.67 lpcd	I□NET	N/D
Losses in m3/km of the network a day	79.71 m3/km	76.24 m3/km	I□NET	N/D
Losses in □ (Non Revenue Water)	48.57□	34.04□	I□NET	30 □40 □
Revenues□ US□□ Rs per M3 sold	0.10 □	0.05 □	I□NET	65□70□
Costs□US□per M3 sold	0.15 □	0.09 □	I□NET	
Operation cost coverage	0.68	0.61	I□NET	
Revenue collection ratio	173.57□ (2007)□ 155.14□ (2008)	176.28□	I□NET	
Labor costs vs. operation costs		19□	I□NET	
Electrical energy costs vs. operation costs		37□	I□NET	40 □50 □

Contracted or service costs vs. operation costs		45□	I□NET	
Total staff number		1□282 staff (2011)	JICA	1□282
Staff per 1□000 connections		13.9 staff per 1□000 connections (2011)	JICA	11
Water supply hours a day		8 hours a day (2011)	JICA	2□4
Water meter installation ratio		N/A	JICA	□ero
Average monthly tariff		135 Rs (2011)	JICA	
Revenue collection ratio		67□ (2011)	JICA	65□75□
New connection installation fee		2□500 Rs (2011)	JICA	
Annual costs per a connection (Rs)		200 Rs (2011)	JICA	
Annual Complaints		10□220 complaints (2011)	JICA	Online Complaint System + manual complaints in each regional office by phone or by visiting office

□) □e□age

□uestions	□ear 2011 data	Source	Please write current situations.
Coverage with sewage	35□	JICA	40□
Sewage capacity (m3/day)		N/A	
Actual average sewage volume (m3/day)		N/A	
Sewage network length (km)	250 km	JICA	250km (Approximate)
Drainage network length (km)	N/A	JICA	
Drainage pump stations	□ero	JICA	□ero
Sewage plants	□ero□ One (Under planning)	JICA	NO WWT facility

Thank you for your answers.

List of Annexures

Rawalpindi

Annex-1

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LAHORE TUESDAY SEPTEMBER 15, 2009

WATER AND SANITATION AGENCY (RDA) RAWALPINDI

NOTIFICATION

MD/DG/RDA/Tariff 2007-08/206 dated 4-9-09

In exercise of powers conferred in the Rawalpindi Development Authority under section 27(I)(ii) of the Punjab Development of Cities Act. 1976 (Act No.XIX of 1976) the rates and fees in respect of its water supply and sewerage operations as fixed w.e.f 01.07.2006 vide Punjab Gazette Notification No.L-7532 dated 09.03.2007 are modified / revised with previous consent of the Govt. as under w.e.f next Quarter after date of issuance of notification.

WATER TARIFF RATES

	Categories	Existing rates	New rates
A.	BULK WATER SUPPLY	RATE/1000 GALLONS	RATE/1000 GALLONS
1	Military Engineering Services (MES)	17.00	17.00
2.	National Institute of Health (NIH)	11.00	11.00
3.	National Agricultural Research Council (NARC)	17.00	17.00
B.	DOMESTIC METERED SUPPLY	RATE/1000 GALLONS	RATE/1000 GALLONS
1	Upto 5000	21.00	30.00
2.	5001-1000	29.00	40.00
3.	10001-15000	35.00	50.00
4.	15001-20000	43.00	60.00
5.	Over 20000	50.00	70.00

Annex-1

C.	COMMERCIAL CONNECTIONS METERD	RATE/1000 GALLONS	RATE/1000 GALLONS
	Consumption Slab (gallons)		
1.	Up to 5000	29.00	50.00
2.	5001-10000	35.00	65.00
3.	10001-2000	50.00	80.00
4.	Over 20,001	56.00	100.00

D.	DOMESTIC CONNECTIONS UN-METERD	Flat rate/mth/connection	Flat rate/mth/connection
1.	Up to 5 Marlas	78.00	98.00
2.	Above 5 upto 7 Marlas	128.00	160.00
3.	Above 7 upto 10 Marlas	176.00	220.00
4.	Above 10 Marlas & upto 15 Marlas	200.00	250.00
5.	Above 15 Marlas & upto 20 Marlas	300.00	375.00
6.	Above 20 Marlas & upto 25 Marlas	500.00	625.00
7.	Above 25 Marlas & upto 30 Marlas	550.00	688.00
8.	Above 30 Marlas & upto 2 kanal	636.00	795.00
9.	More than 2 kanal	706.00	883.00

Note: Above 200 Sq Feet of plot size falling in higher category will be charged in the lower category

	COMMERCIAL CONNECTIONS UN-METERED	Flat rate/mth/connection	Flat rate/mth/connection
1.	Petrol Pump / CNG with service station	7063.00	8829.00
2.	Petrol Pump / CNG without service station	1413.00	1766.00
3.	Service Station	5650.00	7063.00
4.	Cinema House	2825.00	3531.00
5.	Laundry / Dry Cleaners (Small)	706.00	883.00
6.	Laundry / Dry Cleaners (Large)	2000.00	2500.00
7.	Dyers	424.00	530.00
8.	Barber Shop with Hamam (up to two hamams)	424.00	530.00
9.	Barber Shop with more than two hamams	706.00	883.00
10.	Barber shops without Hamam	213.00	266.00
11.	Gents Parlors	1000.00	1250.00
12.	Beauty Parlors (In House)	350.00	438.00
13.	Beauty Parlors (In Shop)	1000.00	1250.00
14.	Bakery, Dairy and Sweet Shops	300.00	375.00
15.	Bakery, Dairy, Sweet and Confectionary with Factories	1500.00	1875.00
16.	Bottle Factories, Soda water/Ice cream	1695.00	2119.00

Annex-1

19	Concrete Pre-casting 'Pipe Factories / Marble Factories	2825.00	3531.00
20	Other factories / Mills	1500.00	1875.00
21	Other commercial & industrial concern using water for manufacturing/business purposes	848.00	1060.00
22.	Banks	1500.00	1875.00
23.	Plazas		
	(a) Per connected Shop	150.00	188.00
	(b) Per connected Residential flat	175.00	219.00
		250.00	313.00
	(c) Per connected office	125.00	156.00
	(d) Per connected single residential room		
24.	Cattle Farm		
	a Up to 10 cattle	706.00	883.00
	b 11 to 20 cattle	1059.00	1324.00
	c more than 20 cattle	1413.00	1766.00
25	Printing press	283.00	354.00
26	Warehouses / Stockests	495.00	619.00
27.	Traders / Wholesale dealers	530.00	663.00
28	Others Commercial Shops	176.00	220.00
29.	Car dealers / Rent a car	494.00	618.00
30	Auto workshops	565.00	706.00
31.	Commercial institutions / Organizations / Agencies	700.00	875.00
32.	Snooker Clubs / Video Game shops / Internet clubs	424.00	530.00
33.	Photography / color labs	424.00	530.00
F.	HOTELS/RESTAURANTS UN-METERES	Per room/Per month	Per room/Per month
1	Centrally Air conditioned (per room / per month)	213.00	266.00
2.	Air conditional (per room/per month)	141.00	176.00
3.	Without AC (per room/per moth)	106.00	133.00
4.	Restaurants (Air conditioned)	3000.00	3750.00
5.	Restaurants (Without Air conditioned)	848.00	1060.00
6.	Hotel & Restaurant (common)	Rate of higher category	
7	Tea stalls/ Cafetrias	248.00	310.00
8.	Sarai cum Restaurants (Common	706.00	883.00
9.	Corner food stall	424.00	530.00
10	Small restaurant / refreshment corner	600.00	750.00
11.	Fast food Restaurants	1060.00	1325.00
12.	Marriage Halls (Air conditioned)	3000.00	3750.00
13	Marriage Halls (Without Air conditioned)	2000.00	2500.00

Annex-1

G.	GOVT. OFFICES/ PRIVATE OFFICES	Flat rate/mth/connection	Flat rate/mth/connection
1	Upto 10 persons	283.00	354.00
2	11 - 25 persons	424.00	530.00
3	26 - 50 persons	565.00	706.00
4	Over 50 persons	848.00	1060.00
5	Post Offices	283.00	354.00
H.	SCHOOL / COLLEGES	Flat rate/mth/connection	Flat rate/mth/connection
1	Primary (Govt./Welfare)	141.00	176.00
2	Primary (Pvt) Fee upto Rs. 500/-	283.00	354.00
3	Primary (Pvt.) Fee above Rs.500/-	1500.00	1875.00
4	Above primary & up to Matric (Govt./Welfare)	213.00	266.00
5	Above primary & up to Matric (Pvt.)	424.00	530.00
(6)	Above primary & up to Matric (Pvt.) Fee above Rs.500/-	3000.00	3750.00
7	College & Universities (Govt)	706.00	883.00
8	College & Universities (Pvt)	3000.00	3750.00
9	Academy / Coaching / Tuition Centers	283.00	354.00
J.	HOSPITALS / NURSING HOMES	Flat rate/mth/connection	Flat rate/mth/connection
1	Non-Commercial/ Charity/ Welfare	141.00	176.00
2	Pvt. Nursing Homes/Hospitals(per bed/per month)	213.00	266.00
3	Homeopathic/Hikmat practitioners/Dispensaries	283.00	354.00
4	Dental / Private Clinics (Consultancy Fee upto Rs.100/-)	400.00	500.00
5	Medical Center (Specialist)	1500.00	1875.00
6	Private Clinics with Consultancy Fee Above Rs. 100/-	1000.00	1250.00
7	Clinical / Medical / Ultrasound / X-ray Labs	1000.00	1250.00
8	Collection Points of Labs	500.00	625.00
K.	SUPPLY THROUGH WATER TANKERS	PER TANKER	PER TANKER
1	Domestic	300.00	375.00
2	Commercial	500.00	625.00
3	Tanker filling charges (from WASA filling point)	200.00	250.00

Annex-1

Note: -

Change of connection would be allowed only after clearance of all dues in respect of first connection.

M.	MISCELLANEOUS FEES	Domestic	Commercial
1	Disconnection on consumer's request	883.00	1236.00
2.	Ferrule Cleaning fee	173.00	266.00
3.	Ferrule Shifting fee (change of connection)*	883.00	1235.00
4.	Change of Ownership fee	438.00	704.00
5.	Regularization Fee for Illegal Water Connection	New Connection fee along with one year bill of existing category	New Connection fee along with one year bill of existing category
6.	Surcharge on late payment	10%	10%
7.	Miscellaneous charges bill	10.00	10.00
8.	Installment Charges	10.00	10.00

Note:-

Change of connection would be allowed only after clearance of all dues in respect of first connection.

N.	MISCELLANEOUS	Flat Rates /Month	Flat Rates/ Month
1.	Mosques/Religious Buildings/institutions	Free of Cost (EXISTING)	Free of Cost (NEW)
2.	Deserving Widows (Only For Domestic Consumers)	25% Exemption from Total Bill	25% Exemption from Total Bill
3.	Bus stand /Wagon stand/ Coach stand	706.00	883.00
4.	Commercial Business without WASA connection but utilized WASA water through Filtration Plant / Water Point	-	50% of actual category
5.	Tube wells (Aquifers charges)	6000.00	7500.00
6.	Shallow Well/ open well /hand pump) for Domestic only	141.00	176.00
7.	Public Toilets (Per Seat)	706.00	883.00
8.	Nurseries	706.00	883.00
9.	Public Parks	1413.00	1766.00
10.	Vegetable /Fruit farms	1413.00	1766.00
11.	Libraries	141.00	176.00
12.	Hatchery /Poultry Farms	706.00	883.00
13.	Social welfare org/ institutions per '½"' Connection	141.00	176.00
14.	Hostels (upto 10 rooms)	1000.00	1250.00
15.	Hostels (More than 10 rooms)	1500.00	1875.00
16.	Cooking / Catering Shops	750.00	938.00
17.	Bore hole (Aquifer Charges) Below 8" (For commercial / More than 01 kanal residential)	625.00	781.00
18.	a. N.O.C fee for installation of private Tubewell (Bore hole more than 8")	-	16000.00 (one time only)
	b. N.O.C fee for private commercial boring les than 8"	-	5000.00 (one time only)

Annex-1

SEWERAGE TARIFF RATES

S.No	CATEGORY	FLAT RATE PER MONTH
1	Sewerage rate	50% of water rate of respective consumer category except for commercial categories of "petrol pump with service station" and, "only service station" for which monthly sewerage rate would be Rs 1500 & 1000 respectively
2.	Connection Fee	ONCE ONLY
	(a) Domestic	
	Plot up to 10 marlas	300.00
	Plot More than 10 Marlas	500.00
	(b) Commercials	2500 00
3	Suckers Machine Charges	1500.00 per hour

Notes:-

1. For domestic/ non –commercials connection ferrule size of not more than ½" dia is allowed
2. For existing ferrules bigger than ½ " dia, in the commercials tariff categories the rates charged will be as under
   - a) For ¾" dia ferrule — Double the rate of 1/2" dia ferrule for respective consumer category
   - b) For 1" dia ferrule — Four times the rate of ½" dia ferrule for respective consumer category
3. Extraction of water from ground water in WASA's Controlled area through private tubewell installation is not allowed except in exceptional circumstances with prior permission of Managing Director ,WASA on payment of monthly aquifer charges besides initial charges under an agreement with WASA on specified terms and conditions.
4. Treated water from WASA system shall not be used for watering to vegetable/ fruit farms/ gardens and other wasteful uses.
5. Making water connection from WASA system without approval of WASA is unauthorized and an offence. Such cases shall be treated as theft of water and shall be liable to punishment under the law The plumber/ persons found instrument in making or having connivance such illegal connection shall be proceeded against under the law.
6. Restoration of connection disconnected due to default of the consumers or due to offence as mentioned at Sr. No "5" above, shall be allowed after fulfilling all the formalities as prescribed for a new connection with full recovery of arrears, surcharges and fine etc.
7. Installation of suction pump/donkey pump directly on WASA's water supply lines is an offence and offenders in such cases shall be liable to be proceeded under law and to fine which shall not be less than four times the actual water bill. The water pumps so recovered and removed by WASA enforcement staff shall be confiscated without any right of returning to the defaulters.

Annex-1

8. New individual connection installation for commercial/residential/Plazas/Flats may be provided on individual ownership bases. In case of multiple owners of building either connection would be allotted to first owner or multiple connections would be provided accordingly to number of owners.
9. The water & Sewerage rates for domestic connections are applicable upto two storey buildings. Consumer will be required to pay ½ of basics rate for every additional storey.
10. Change of water connection from one to the other WASA line, if available in the street / road, would only be allowed after clearance of up data dues in respect of water and sewerage charges on account of the first connection.
11. No new water connection would be installed in the premises already having a water connection under default for domestic/ commercial consumers.
12. Disconnection made due to default of the consumer, the water bill of each quarter/ session for the period of disconnection will have to be paid by the consumer along with the fine decided/ imposed by the Senior Special Magistrate, WASA/RDA.
13. In case of non-payment of water bill after due date, late fee (surcharges) would be charged @ 10% of current / due amount.
14. Any complaint regarding water supply /sewerage and non-delivery of bill in the past would not be considered as a valid reason for non-payment of bill.
15. In case of change /transfer of ownership, it is the sole responsibility of the new owner to make sure that there is no pending liability in respect of water and sewerage charges thereon from the original owner otherwise the new owner shall be responsible for clearance of all upto date dues of respective premises.
16. Challan for New Sewerage Connection/Re-connection will be issued by the Sewerage Directorate and after Installation of Sewerage Connection, the data / record will be communicated to Revenue Directorate.
17. Full Sewerage rates would be charged in case consumer has laid down a private sewerage line and connected it to WASA sewerage network.

25/7/09

(Muhammad Makeen Shahbaz)
Director General
Rawalpindi Development Authority
Rawalpindi

3.11.16. *SOP for Leak Detection and Repair*

Purpose

This SOP describes the steps to be taken by the RWASA to reduce water leakage. It outlines the procedure to be deployed by the staff to detect and repair leaks within the transmission lines, distribution lines and in the customer service lines.

Responsibility/Accountability

The Zonal Assistant Director at the RWASA is responsible leak detection and repair.

Procedure

Procedure for Leak Detection:

1- The Zonal Assistant Director establishes a mechanism to encourage the general public to report leaks.
2- The Zonal Assistant Director forms a leak detection team comprising Technicians, Meter Readers and zones Sub Engineer.
3- The Zonal Assistant Director confirms the leaks reported by the general public, customers or press, by using the leak detection team.
4- The Zonal Assistant Director inspects bulk meter readings of established leaks and sends leak detection team to verify.
5- The team detects underground leaks when and where appropriate.
6- The team records every leak in the Leak Detection Form and Leak Office Register on daily basis.

Procedures for Leak Repair:

For pipes up to 80 mm, the Sub Engineer:

1- Sub Engineer Prepares a Job Card.
2- Visits the site and with help of Technician exposes the leaking pipe.
3- Assesses the leak and with approval of the Zonal Assistant Director requisitions the materials required.
4- Repairs the leak and flushes the pipeline.
5- Completes the Job Card and submits to the Zonal Assistant Director for endorsement and records.

Leakage repair instruction for pipes (80 – 200) mm, the Sub Engineer:

1- Sub Engineer Prepares a Job Card.
2- Visits the site and with help of technician exposes the leaking pipe.
3- Assesses the leak and with approval of the Zonal Assistant Director requisitions the materials required.
4- Isolates the fault section and drains it.
5- Repairs the leak and flushes the pipeline.
6- Ensures that the water service is restored.

7- Completes the Job Card Form submits it to the Zonal Assistant Director for endorsement and records.

Leakage repair instruction for pipes more than 200 mm, the Technician:

1- Sub Engineer Prepares a Job Card.
2- Visits the site and with help of Technician expose the leaking pipe.
3- Assesses the leak and with approval of the Zonal Assistant Director requisitions the materials required.
4- If the pipe line is a raising main, pump shut down procedures by pump operator must be followed.
5- Isolates the fault section and drains the main pipeline.
6- Fixes the leak, flushes the pipe section and disinfects the pipeline according to applicable standard procedures.
7- .Switches on the pump with the assistance of the Pump Operator according to starting procedures.
8- Ensures that the water service is restored.
9- Completes the Job Card Form signs and submits it to the Zonal Assistant Director for endorsement and records.

Pipe manufacturer's recommendations should be followed during execution of the works.

Performance Indicators

Performance Indicators are the measures which communicate that the procedure is being followed and is working.

The indicators to be used to measure the performance of this SOP are:

a. Job Card Form

b. Materials Requisition Form

Annex - 3.1

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.

WASA Rawalpindi

Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values			
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
Detail List of Tube Wells West Zone, Sector-I UC (1-9)																								
1	73-A	1	Choki Muhallah Ratta Amral	318,642	3,720,477	Submersible	K S B	8,000	300	25	25	Yes	Yes	No				2004	10	80,000				
2	74	1	Near Lai Pull Ratta Amral	318,935	3,720,624	Submersible	K S B	7,000	210	25	50	Yes	Yes	No				1999	8					
3	74-A	1	Chungi Ratta Amral	318,625	3,720,232	Submersible	K S B	6,000	260	30	50	Yes	Yes	Yes				1999	17					
4	74-B	1	Near Railway Police Line Railway Godaam Road Ratta Amral	318,371	2,720,197	Submersible	K S B	8,000	150	30	50	Yes	Yes	Yes				1994	18					
5	74-C	1	Near Street no. 22 Ratta Amral	318,685	3,720,249	Submersible	FLOW PAK			30	50	No	No	No				2014						
6	75	1	Bhusa Godaam	318,347	3,720,814	Submersible	K S B	7,000	260	25	50	Yes	Yes	Yes				1992	10					
7	75-B	1	Near Girls College Melaad Nager Dhoke Ratta	318,441	3,720,835	Submersible	K S B	7,000		25	25	No	No	No				2010	8					
8	75-C	1	Kachi Abadi Bhusa Godaam	318,173	3,720,781	Submersible	FLOW PAK			25	25	No	Yes	No				2014	10					
9	76-A	1	Near Utility Store Melaad Nager Dhoke Ratta	318,547	3,720,745	Submersible	K S B	4,000	270	20	25	No	Yes	No				2004	7					
10	76-B	1	Near Pull Dhoke Ratta	318,625	3,720,591	Submersible	K S B	5,000	250	25	50	No	Yes	Yes				2002	10					
11	77	2	Dhoke Ratta Dispensary	318,603	3,721,013	Submersible	K S B	5,000	260	15	50	Yes	Yes	Yes				1988	12					
12	78	2	Toheedi Road Dhoke Ratta	318,385	3,721,051	Submersible	K S B	6,000	260	25	50	Yes						1988	Abundant					
13	78-A	2	Tanga Stand Dhoke Ratta	318,402	3,720,940	Submersible	K S B	5,000	260	25	50	No	No	No				1997	8					
14	78-B	2	Near scheme No.7 Railway Workshop Road	318,359	3,721,384	Submersible	H M A	5,000	270	20	50	Yes	Yes	No				1997	10					
15	79-A	2				Submersible		5,000	190	20	50							1998	Abundant					
16	79-C	2	Babu Laal Husain Road Dhoke Ratta (Tanki)	318,699	3,721,132	Submersible	MAK	7,000	270	25	Public	No	No	Yes				1998	8					
17	79-D	2	Near Boys High School Babu Laal Husain Road	318,710	3,721,232	Submersible	FLOW PAK			20	25	No	No	No				2012	8					
18	80-B	2	Ahata Zubair Butt Dhoke Ratta	318,572	3,721,322	Submersible	K S B	7,000	260	25	25	Yes	No	No				2005	8					
19	78-C	3	Madni Market Railway Workshop Road	318,536	3,721,396	Submersible	K S B	5,000	190	20	50	No	No	No	No	3	No	1998	10					
20	80-A	3	Near Khajur Wala Medan Hazara Colony	318,289	3,721,685	Submersible	K S B	6,000		20	25	Open	No	Yes	No	4	No	2004	12					
21	81	3	Hazara Colony	318,723	3,721,893	Submersible	K S B	7,000	200	20	50	Yes	Yes	No				1984	10					
22	81-A	3	Umar Abad Hazara Colony	318,850	3,721,940	Submersible	K S B	6,000	260	20	50	Yes	Yes	No				2004	12					
23	81-B	3	Madrasa Usmania Hazara Colony	318,827	3,721,432	Submersible	FLOW PAK			20	50	No	No	No				2007	6					
24	81-C	3	Ahata Manzir Hazara Colony	318,908	3,721,572	Submersible	K S B			20	50	No	No	No				2012	8					
25	82-A	3	Kiran Road Hazara Colony	318,650	3,721,501	Submersible	FLOW PAK	3,000	270	20	25	No	No	No				2007	12					
26	82-B	3	Near Pulli Hazara Colony	318,751	3,721,993	Submersible	FLOW PAK	5,000		20	50	Yes	No	No				2014	10					

Annex - 3.1

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.
WASA Rawalpindi

Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values			
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
27	83	4				Submersible	K S B	4,000	170	25	50							1988	Abundant					
28	83-A	4	Boring Road (Tanki)	318,075	3,722,228	Submersible	MAK	5,000	280	25	25	Yes	Yes	Yes	No	3	No	2008	9					
29	84	4				Submersible	K S B	5,000	190	25	50							1984	Abundant					
30	84-A	4				Submersible		6,000	260	20	25							2005	16					
31	84-B	4	Khawaja Abad	318,619	3,722,093	Submersible	K S B	7,000		25	50	Open	No	No	No	3	No	2010	10					
32	84-C	4	Muhallah Farooqia Girls School Dhoke Mangtal	318,178	3,722,051	Submersible	FLOW PAK	4,000		25	50	Open	No	Yes	No	4	No	2013	10					
33	84-D	4	Muhallah Khatekan Dhoke Mangtal	318,207	3,722,209	Submersible	K S B	7,000		30	50	Open	No	No	No	4	No	1998	10					
34	85	4				Submersible	K S B	7,000	160	25	50							1992	Abundant					
35	85-A	4	Near Pull Boring Road	318,177	3,722,230	Submersible	K S B	7,000	180	30	50	Yes	Yes	No	No	4	No	1998	9					
36	87	5	Aalim Abad Dhoke Hasuu	317,404	3,722,259	Submersible	K S B	6,000	260	25	50	Yes	Yes	Yes	No	4	No	1990	10					
37	87-B	5	Near Graveyard Aalim Abad Dhoke Hasuu	317,488	3,722,230	Submersible	K S B	7,000	260	25	50	Yes	Yes	Yes	No	4	No	2007	10					
38	87-C	5	Aalim Abad Dhoke Hasuu	317,386	3,722,339	Submersible	K S B			25	50	No	No	No	No	3	No	2014	10					
39	88	5	Model Colony Dhoke Hasuu	318,004	3,722,500	Submersible	K S B	6,000	180	25	50	Yes	Yes	Yes	No	4	Yes	1991	5					
40	88-A	5	Mehar Abad Dhoke Hasuu	317,955	3,722,530	Submersible	FLOW PAK			30	50	Yes	No	No	No	3	No	2013	8					
41	89-A	5	Dhoke Darzian Dhoke Hasuu	317,650	3,722,420	Submersible	Mak	6,000	180	25	25	Yes	Yes	Yes	No	4	Yes	1999	14					
42	86	6	Gulshan Data Dhoke Hasuu	317,315	3,722,620	Submersible	FLOW PAK	6,000	170	30	50	Yes	Yes	Yes	Yes	4	Yes	1985	12					
43	87-A	6	Waqeel Abad Dhoke Hasuu	317,228	3,722,749	Submersible	H M A	5,000	260	25	50	Yes	Yes	Yes	Yes	4	Yes	1999	8					
44	89	6	Gulshan Fatima Dhoke Hasuu	317,153	3,722,908	Submersible	K S B	6,000	180	25	50	Yes	Yes	Yes	No	3	Yes	1988	12					
45	90	6	Near Tawar Aalam Abad Dhoke Hasuu	317,226	3,722,302	Submersible	H M A	7,000	290	20	50	Yes	Yes	Yes	No	6	Yes	1986	10					
46	91-B	7	Awan Colony Perwadai	318,161	3,722,563	Submersible	LOWARA	6,000	270	25	50	No	No	No	No			2007	10					
47	91-C	7	Akab Anarkali Hotel Perwadai	318,323	3,722,697	Submersible	K S B	5,000	270	30	50	No	No	No	No		No	2007	10					
48	92	7	Awan Colony Perwadai	318,118	3,722,738	Submersible	K S B	6,000	170	25	50	Yes	Yes	No	Yes			1995	12					
49	143-A	7	Muslim Abad	318,597	3,722,449	Submersible	K S B	6,000	180	30	50	Yes	Yes	No	No			1997	14					
50	143-B	7	Quaid Abad (Tanki)	318,772	3,722,333	Submersible	K S B	6,000	180	25	50	Yes	Yes	Yes	No			2007	14					
51	143-C	7	Near Chhati Ghali Muslim Abad	318,493	3,722,525	Submersible	LOWARA	6,000	280	30	50	Yes	Yes	No	No			2007	14					
52	91	8	Mehar Colony Perwadai	317,968	3,722,852	Submersible	K S B	6,000	180	25	50	Yes	Yes	Yes	No		Yes	1988	8					
53	91-A	8	Bokra Road Perwadai	318,078	3,722,852	Submersible	K S B	6,000	180	25	50	No	No	Yes	No			1999	9					

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.

WASA Rawalpindi

Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values			
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
54	92-A	8	Dhoke Awan Street No 1	317,064	3,723,107	Submersible										Abundant								
55	92-B	8	Street No. 10 Fuji Colony	317,390	3,723,084	Submersible	K S B	5,000	270	25	50	Yes	Yes	Yes		3	Yes	2007	13					
56	92-C	8	Street No. 18 Fuji Colony	317,473	3,722,832	Submersible	KERSELF	7,000	280	20	50	Yes	Yes	No	No	4	No	2007	13					
57	92-D	8	Near Street No.1 Dhoke Awan Fuji Colony	317,022	3,723,137	Submersible	K S B	6,000		25	25	Open	No	No	No	3	No	2014	12					
58	93-B	8	Street No. 29 Fuji Colony	317,867	3,723,082	Submersible	MAK			25	50	No	No	No	No			2012	8					
59	93	9	Fair Barged Perwadai	318,198	3,722,943	Submersible	K S B	6,000	150	20	50	Yes	Yes	Yes	No	3	No	2015	9					
60	93-A	9	Near Muhammadia Shopping Center Perwadia (Moru Wala)	318,093	3,723,088	Submersible	H M A	6,000	280	20	25	Open	No	No	No	4	No	2005	9					
61	94	9	Bus Stand Perwadai (Tanki)	318,494	3,723,069	Submersible	FLOW PAK	6,000	170	25	50	No	No	No	No	4	No	1989	13					
62	94-A	9	Baghish Colony Medan	318,348	3,723,131	Submersible	K S B	7,000	260	25	50	Yes	Yes	Yes	No	3	No	1999	11					
63	95-A	9	Badar Colony	317,838	3,723,465	Submersible	K S B	7,000	260	25	50	Yes	Yes	Yes	Yes	4	No	2002	13					
64	95-B	9	Near Pull Badar Colony	318,104	3,723,744	Submersible	FLOW PAK			25	25	Open	No	No	No	3	Yes	2009						
65	96	9	Near Ghosia Masjid Banghish Colony	318,171	3,723,315	Submersible	FLOW PAK	7,000	200	30	50	Yes	Yes	Yes	Yes	4	Yes	1994	9					
66	96-A	9	Near Imam Bargah Banghish Colony	318,170	3,723,425	Submersible	H M A	6,000	240	25	50	Yes	Yes	No	No	4	No	2005	10					
67	96-B	9	Park Baghish Colony (Tanki)	318,224	3,723,316	Submersible	H M A	6,000	260	20	50	Yes	Yes	No	No	4	No	2005	16					
68	97	9	Zia-up-Haq Colony	318,732	3,722,738	Submersible	FLOW PAK	6,000	160	25	50	Yes	Yes	Yes	Yes	4	No	1986	2					
69	97-A	9	Near Wegen Stand Perwadai	318,532	3,722,788	Submersible	K S B	6,000	270	20	50	Yes	Yes	No	No	4	Yes	2007	9					
70	97-B	9	Islam Pura Perwadai	318,644	3,722,782	Submersible	FLOW PAK			20	50	No	No	No	No	3	No	2013						
Detail List of Tube Wells Khaya Ban-e-Sir Syed Rawalpindi UC (10,11, 12)																								
71	102	10	Sector 2 Akab Awan Market	318,558	3,723,918	Submersible	K S B	5,000	160	20	50		Yes	No				1988	12					
72	102-A	10	Sector 2 Akab Awan Market	318,558	3,723,918	Submersible	K S B	8,000	180	20	50		Yes	No				1996	12					
73	103	10	Sector 3 Near Baraf Khana Chowk	318,945	3,723,203	Turbine	K S B	4,000	160	25	25		Yes	Yes				1980	14					
74	160-A	10	Sector 2 Awan Market	318,477	3,723,708	Submersible	MAK	10,000	280	25	50		No	No				2013	12					
75	164-A	10	Sector 2 Tanki	318,672	3,723,437	Submersible	KSB	7,000	240	30	50		Yes	Yes				2002	12					
76	164-B	10	Sector 2 Melaad Pak	318,550	3,723,485	Submersible	GRU FAS	7,000	180	20	25		Yes	No				2006	12					
77	168	10	Sector 2 Allama Iqbal Park	318,366	3,723,585	Submersible	K S B	8,000	240	25	25		Yes	Yes				1988	12					
78	168-A	10	Sector 2 Disposal No. 2	318,500	3,723,327	Submersible	MAK	8,000	280	25			No	No				2014	5					
79	103-A	11	Sector 3	318,721	3,723,096	Submersible	FLOW PAK	8,000	280	25	50		No	No				2012	12					

Annex - 3.1

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WASA Rawalpindi

Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values			
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
80	103-B	11	Sector 3	319,023	3,723,089	Submersible	FLOW PAK	6,000	280	25	50		No	No				2013	12					
81	162-A	11	Sector B.4 Near Mora Shareef Darbar	319,293	3,722,947	Submersible	KSB	7,000	240	20	50		No	Yes				2005	12					
82	162-B	11	Sector B.4 Near Mora Shareef Darbar	319,218	3,722,924	Submersible	MAK	7,000	280	20	25		Yes	No				2008	12					
83	162-C	11	Sector B.4 Near Mora Shareef Darbar	319,343	3,722,781	Submersible	FLOW PAK	8,000	280	25	50		No	No				2013	12					
84	165-A	11	Sector B.4 Near D.H.O	319,020	3,723,295	Submersible	MAK	7,000	220	20	50		Yes	No				2009	12					
85	166	11	Sector B.4 Ayesha Park	319,278	3,723,109	Submersible	GRU FAS	8,000	180	20	50		Yes	Yes				1994	12					
86	166-A	11	Sector 3 Muslim Park	319,097	3,722,842	Submersible	MAK	6,000	280	30			Yes	Yes				1997	12					
87	166-B	11	Sector 3	319,116	3,722,794	Submersible	K S B			25	50	No	No	No	No	3	No	2015						
88	167-A	11	Sector 3 Muslim Park	318,897	3,722,752	Submersible	KSB	3,000	230	20	50		Yes	Yes				2007	12					
89	167-B	11	Sector 3 Girls School	318,935	3,722,650	Submersible	MAK	3,500	240	25	50		No	No				2013	12					
90	100	12	Khaya Ban-E-Sir Syed	318,703	3,724,138	Submersible	KSB	6,000	180	20			Yes	No				1979	12					
91	100-A	12	Sector A.4 Dhoke Naju	319,135	3,724,349	Submersible	GRU FAS	7,000	250	20	50		Yes	Yes				1999	14					
92	101	12	Sector 1 Near Goal Tanki	318,797	3,724,008	Submersible	KSB	6,000	150	20	50		Yes	No				1993	12					
93	101-A	12	Sector 1 Goal Tanki	318,764	3,723,931	Submersible	KSB	7,000	180	30	50		Yes	Yes				1995	12					
94	104	12	Sector A.4 Service Road	319,014	3,724,325	Submersible	GRU FAS	5,000	180	20	50		Yes	No				1993	12					
95	104-A	12	Sector A.4 Main Town	319,367	3,724,521	Submersible	MAK	7,000	220	20	25		Yes	No				2008	12					
96	104-B	12	Sector A.4 Main Town	319,300	3,723,196	Submersible	MAK	8,000	280	25	50		No	No				2013	12					
97	105	12	Sector A.4 Near Graveyard	319,117	3,723,768	Submersible	KSB	7,000	180	20	50		Yes	Yes				1993	12					
98	105-A	12	Sector A.4 Dhoke Naju	319,296	3,723,663	Submersible	GRU FAS	3,500	180	20	25		Yes	No				2008	12					
99	105-B	12	Sector A.4 Near Noorani Masjid	319,220	3,723,857	Submersible	FLOW PAK	7,000	280	25	50		No	No				2013	12					
100	159-A	12	Sector 01 Near Goal Tanki	318,781	3,723,827	Submersible	FLOW PAK	7,000	280	25	50		No	No				2013	12					
101	163-A	12	Sector A.4 Tanki	319,053	3,723,833	Submersible	GRU FAS	7,500	180	25	25		Yes	No				2008	12					
102	163-B	12	Sector A.4 Near Masjid Shah Najaf	318,985	3,723,947	Submersible	FLOW PAK	8,000	280	25	50		No	No				2013	12					
Detail List of Tube Wells West Zone -II (UC's 13-20)																								
103	1-C	13	New Katarian	319,838	3,724,712	Submersible	H M A	5,000	240	30	50	No	No	No	No			2004	8					
104	2	13	Katarian	319,717	3,724,758	Submersible	KSB	8,000	140	25	50	Yes	Yes	Yes	Yes			1992	10					
105	5	13	Quaid Park	320,157	3,724,820	Turbine	KSB	8,000	140	30	50		Yes	No				1989	7					

Annex - 3.1

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WASA Rawalpindi

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																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
106	6	13	Chishtia abad	320,401	3,724,440	Turbine	KSB	8,000	140	30	50		Yes	No				1990	7					
107	6-A	13	Hunza Colony	320,232	3,724,683	Submersible	G/F	5,000	240	20	50		Yes	No				1996	7					
108	108	13	Holly Family	319,655	3,724,095	Submersible	KSB	5,000	280	20	50	Yes	No	No	Yes	3	No	1998	16					
109	111-B	13	Holy Family	319,704	3,723,691	Submersible	K S B	6,000		25	50	No	No	No	No	3	No	1998	8					
110	169	13	Katarian Market	319,918	3,724,382	Submersible	MAK	8,000	240	30	50	No	No	Yes				2009	10					
111	1	14	Katarian Market	319,987	3,724,438	Submersible	KSB	8,000	140	30	50	Yes	Yes	No	Yes			1987	8					
112	1-A	14	New parian	319,855	3,724,314	Submersible	KSB	7,000	240	30	25	Yes	Yes	No	No			2004	8					
113	1-B	14	Katarian Market	319,908	3,724,471	Submersible	FLOW PAK	5,000	240	20	50	No	No	No	No			2004	8					
114	106	14	Muhallah R Sultan	319,629	3,723,298	Turbine	KSB	8,000	140	30	50	No	No	Yes	No	4	No	1988	15					
115	108-A	14	Holly Family	319,654	3,723,863	Submersible	KSB	5,000	130	25	50	Yes	Yes	No	No	4	No	1988	12					
116	108-B	14	Holly Family Road Ghosia Masjid	319,707	3,724,303	Submersible	FLOW PAK	8,000		30	50	No	No	No	No			2013	8					
117	3	15	Katarian Chungi	319,915	3,724,862	Submersible	KSB	8,000	280	25	50	Yes	Yes	No	Yes			1998	10					
118	4	15	Chenar Park	320,114	3,724,643	Turbine	KSB	7,000	150	25	50	Yes	Yes	Yes	No			1981	12					
119	109	15	TMA Nursery	320,159	3,722,843	Submersible	KSB	7,000	140	25	50	No	No	No	No	3	No	1985	5					
120	109-A	15	TMA Nursery	320,197	3,723,076	Turbine	K S B	7,000		25	50	yes	Yes	No	No	4	No	1975	5					
121	110	15	Jamia Park	320,123	3,722,940	Turbine	KSB	7,000	140	30	50	Yes	No	Yes	No	3	No	1987	8					
122	110-B	15	Dispensary			Submersible	G/F	5,000	240	20	50		Yes	No				2003	7					
123	111	15	Holly Family	320,013	3,723,633	Submersible	KSB	6,000	210	30	50	Yes	No	No	No	3	No	2010	8					
124	111-A	15	RDA R.Sultan	319,953	3,723,331	Submersible	G/F	8,000	240	40	50	Yes	Yes	Yes	No	4	No	1988	9					
125	112-B	15	Safaid Tanki	320,241	3,723,248	turbine	G/F	5,000	240	20	50	Yes	Yes	No	No	4	No	2004	8					
126	107	16	Phagwari	319,114	3,723,409	Submersible	G/F	5,000	280	20	25	Yes	Yes	No	No	4	No	2004	10					
127	107-A	16	Commerce College	319,420	3,723,408	Submersible	KSB	5,000	240	25	50	Yes	Yes	Yes	No	4	No	2004	15					
128	107-B	16	Near Commerce College	319,442	3,723,200	Submersible	K S B	7,000		25	100	No	No	No	No	3	No	2012	14					
129	110-A	16	Abbasia Masjid			Turbine	KSB	7,000	130	60	50		Yes	No				1988	5					
130	147	16	Eid Gah	319,818	3,722,782	Submersible	KSB	5,000	240	25	50		Yes	No				2003	9					
131	147-A	16	Eid Gah	319,595	3,722,570	Submersible	G/F	5,000	240	25	50		Yes	Yes				2003	9					
132	147-B	16	Eid Gah	319,858	3,722,886	Submersible	G/F	5,000	240	25	50		Yes	Yes				2003	9					

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.
WASA Rawalpindi

Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values			
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
133	12	17	Pindora			Turbine	KSB	6,000	150	30	50		Yes	No				1985	11					
134	13	17	Pindora	320,848	3,724,939	Submersible	KSB	10,000	240	40	50		Yes	No				1985	14					
135	13-A	17	Pindora	321,220	3,724,966	Submersible	G/F	5,000	240	25	50		Yes	No				2001	8					
136	13-B	17	Pindora			Submersible	G/F	5,000	280	25	50			No				2007	8					
137	13-C	17	Benazir Chowk PD			Submersible	G/F	7,000	250	25	50		No	No				2009	7					
138	6-B	18	Milia Park	320,112	3,724,309	Submersible	FLOW PAK	5,000	240	20	50	Yes	Yes	No	No			2010	7					
139	7	18	Pindora Chungi	320,520	3,725,242	Turbine	KSB	8,000	130	30	50		Yes	No				1986	12					
140	7-A	18	Pindora Maka CNG			Submersible	G/F	5,000	280	20	50		Yes	No				2006	10					
141	8	18	Punlic Park	321,439	3,724,865	Submersible	KSB	8,000	140	25	50	No	No	No	No	4	No	2014	7					
142	8-A	18	Double Road	321,465	3,725,142	Submersible	Mak	5,000	280	25	50	No	Yes	No	No	4	Yes	2007	6					
143	10	18	Gulshan Dadan	322,126	3,725,492	Submersible	KSB	9,000	280	25	50	No	No	No	No	3	Yes	1988	10					
144	11	18	Dh. Babu Irfan	321,337	3,725,587	Turbine	KSB	8,000	140	30	50		Yes	Yes				1989	11					
145	11-A	18	Mehmood abad	320,940	3,725,434	Submersible	KSB	7,000	240	30	50		Yes	No				1994	11					
146	11-B	18	IGP Road			Submersible	G/F	5,000	240	20	50							2003	11					
147	14	19	Siddique Chowk	320,472	3,724,377	Turbine	KSB	7,000	160	25	50		Yes	No				1986	9					
148	14-A	19	7Th Road			Submersible	G/F	5,000	240	20	50		No	Yes				2002	8					
149	115-A	19	Degree College	320,442	3,723,685	Submersible	KSB	5,000	240	25	50	No	No	No	No	4	No	2005	6					
150	116	19	Masjid Al Furqan	321,311	3,724,078	Submersible	FLOW PAK	8,000	140	40	50	Yes	Yes	Yes	No			1990	8		Physical Site Condation Does Not Allow to Calculate Flow			
151	116-A	19	D-Block	321,133	3,724,094	Submersible	KSB	5,000	240	40	50	Yes	Yes	No	Yes			2002	9		10500	0.8446	647 , 647	65 R
152	117	19	DSP Office	320,794	3,723,974	Turbine	KSB	11,000	140	40	50	Yes	Yes	Yes	No			1988	8					
153	117-A	19	DSP Office	320,743	3,723,910	Submersible	FLOW PAK	5,000	240	20	50	No	No	No	No			2009	8					
154	119	19	Siddique Chowk			Turbine	KSB	10,000	20	25	W		No	No				1988	15					
155	119-A	19	Muzaffar Masjid	320,561	3,723,976	Submersible	K S B	6,000		25	50	Yes	Yes	Yes	Yes			2011	8					
156	120	19	Siddique Chowk			Turbine	KSB	10,000	20	30	W		No	No				1988	15					
157	124	19	Ali Masjid	320,573	3,723,481	Submersible	KSB	7,000	140	40	50	Yes	Yes	No	No			2011	9					
158	121	20	C Market	321,196	3,723,644	Submersible	KSB	8,000	240	40	Public	No	Yes	No	Yes			1986	13		Physical Site Condation Does Not Allow to Calculate Flow			
159	122	20	C Market	321,141	3,723,503	Submersible	KSB	8,000	240	20	50	Yes	Yes	No	No			1989	12		Physical Site Condation Does Not Allow to Calculate Flow			

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.
WASA Rawalpindi

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																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
160	125	20	Muslim H School	320,578	3,722,855	Turbine	KSB	6,000	140	30	50	Yes	Yes	Yes	No	6	No	1986	6					
161	125-A	20	Muslim H School	320,356	3,723,012	Submersible	G/F	5,000	240	20	50	Yes	Yes	No	No	4	Yes	2004	12					
162	126	20	Asghar Mall Sch	320,864	3,722,811	Submersible	KSB	7,000	140	25	50	Yes	Yes	No	No	4	Yes	1988	12					
163	126-A	20	Johar Abad	321,023	3,722,792	Submersible	PEC	7,000	130	25	50	No	No	Yes	No	4	No	1990	7					
164	126-B	20	Asghar Mall Sch	320,933	3,722,672	Submersible	K S B	8,000		25	50	No	No	No	No	3	No	2015	8					
165	127	20	Kali Tanki	320,412	3,723,276	Submersible	HMA	10,000	150	30	200	No	No	No	No	3	No	1985	16					
166	128	20	Kali Tanki	320,349	3,723,343	Submersible	KSB	10,000	130	30	200	No	No	No	No	4	No	1985	16					
167	129	20	Kali Tanki	320,391	3,723,341	Submersible	KSB	10,000	130	30	200	Yes	No	No	No	4	No	1984						
168	129-A	20	Kali Tanki	320,304	3,723,284	Submersible	KSB	12,000	240	40	200	No	No	No	No	4	No	1992	16					
169	130	20	Asghar Mall Sch	320,786	3,722,577	Submersible	KSB	6,000	130	25	30	Yes	Yes	No	Yes	4	No	1988	6					
	Detail List of Tube Wells East Zone -1 + Sohan																							
170	15	21	New DPS Shamas abad	322,265	3,725,147	Submersible	K.S.B	5,000	270	25	50	Yes	Yes	Yes	No			2004	10					
171	15-A	21	Near Blind School Shamasabad	322,476	3,725,094	Submersible	FLOW PAK	5,000	270	25	50	Yes	Yes	Yes	No			2000	10					
172	15-B	21	G Girls College Shamasabad	322,653	3,724,984	Submersible	M.A.K	8,000	180	25	50	No	Yes	No	No			2013	10					
173	15-D	21	Main Bazar Dh. Kala Khan	322,705	3,725,188	Submersible	MAK	5,000	290	25	50	No	No	No	No			2012	8					
174	18	21	Madina Town DH.Kala Khan	322,354	3,725,460	Submersible	M.A.K	7,000	230	25	50	No	No	No	No			1986	7					
175	18-A	21	Near Ohjri Camp	322,367	3,725,542	Submersible	K.S.B	6,000	240	25	50	Yes	No	Yes	No			2003	12					
176	17	21	Near High Way	323,152	3,725,485	Submersible	M.A.K	8,000	290	30	50	Yes	Yes	No	No			1988	12					
177	17-A	21	Awan Colony Dh. Kala Khan	328,821	3,725,506	Submersible	G FOS	5,000	240	25	50	No	No	No	No			2006	8					
178	17-C	21	Near Raja Tajamal House	322,905	3,725,515	Submersible	M.A.K	5,000	290	25	50	No	No	No	No			1986	Abundant					
179	18-B	21	Near Raja Tajamal House	322,930	3,725,544	Submersible	MAK	10,000	180	30	50	Open	No	No	No			2013	10					
180	18-C	21	Gulistan e Jinnah	322,562	3,726,064	Submersible	F/PAK	8,000	180	25	50	No	No	No	No			2013	8					
181	15-C	22	Taxi Stand DH. Kala Khan	322,754	3,724,971	Submersible	F/PAK	8,000	290	25	50	Open	No	No	No			2012	10					
182	16	22	Qayyum abad Dh. Kala Khan	323,003	3,725,034	Submersible	K.S.B	9,000	190	30	50	Yes	Yes	Yes	No			1984	13					
183	16-A	22	Murree Hazara Colony	323,381	3,725,037	Submersible	PECO	8,000	160	30	50	Yes	Yes	Yes	Yes			1988	12					
184	16-B	22	Farooq E Azam Road	323,040	3,724,540	Submersible	M.A.K	8,000	180	30	50	No	No	No	No			2013	7					
185	17-D	22	Jinnah Town Dh. Kala Khan	323,245	3,725,251	Submersible	F/PAK	5,000	290	25	50	No	No	No				2012	12		Physical Site Condation Does Not Allow to Calculate Flow			

Annex - 3.1

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.

WASA Rawalpindi

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																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
186	24-C	22	Model Colony Dh. Kala Khan	323,209	3,724,710	Submersible	K.S.B	8,000	240	25	50	Yes	Yes	Yes	No			2005	11					
187	7	23	A-Block Gunj Bakhsh Road	321,993	3,724,375	Submersible	MAK	5,000		25	50	Yes	Yes	Yes	No			2000	9					
188	7-A	23	A-Block Gunj Bakhsh Road	322,039	3,724,332	Submersible	M.A.K	5,000	270	25	50	Yes	Yes	Yes				2000	9					
189	19	23	Kiyani Bazar	322,300	3,724,223	Submersible	G FOS	9,000	240	25	50	No	Yes	No				1996	8					
190	19-B	23	Magistrate Colony	321,991	3,723,739	Submersible	F/PAK	9,000	280	25	50	No	No	No	No			2012	10					
191	20	23	Dh. Piracha OHR	322,182	3,723,906	Submersible	M.A.K	5,000	220	25	50	Yes	Yes	No	No			1990	10					
192	174	23	Dh. Kashmiri an	322,811	3,724,236	Turbine	PECO	8,000	160	30	50	Yes	Yes	Yes	No			1992	12					
193	175	23	Bilal Colony Service Road	322,522	3,724,711	Submersible	K.S.B	9,000	180	30	50	Yes	Yes	No	No			1988	13					
194	175-A	23	Bilal Colony	322,694	3,724,501	Submersible	G FOS	5,000	250	25	50	Yes	Yes	Yes	No			2006	11					
195	17-B	24	Ali Abad	322,685	3,723,872	Submersible	K.S.B	8,000	180	30	50	Yes	Yes	Yes	No			1992	10					
196	23	24	DK PunNoo	322,805	3,723,592	Turbine	K.S.B	8,000	180	25	50	Yes	Yes	Yes	No			1992	9					
197	23-A	24	Dh. Ali Akbar	323,134	3,723,751	Submersible	K.S.B	8,000	270	25	50	No	No	No	No			2013	6					
198	24	24	Ilyas Town Khana Kak	323,295	3,724,240	Submersible	G FOS	5,000		25	50	Yes	Yes	No	Yes			2006	11					
199	24-A	24	Khana Kak	323,645	3,724,185	Submersible	M.A.K	9,000	260	25	50	Yes	Yes	No				1992	14					
200	24-B	24	Ilyas Town Khana Kak	323,649	3,724,122	Submersible	MAK	5,000	230	25	50	Yes	Yes	Yes	No			1992	14					
201	24-D	24	Shair Ahmad Rd Khana kak	323,368	3,723,971	Submersible	FLOW PAK	8,000	180	25	50	No	No	No	No			2013	6					
202	25	24	Khajoor Wali Gali	322,767	3,723,601	Turbine	K.S.B	9,000	170	25	50	Yes	Yes	Yes	No			1993	9					
203	19-A	25	Shaheen Colony	322,161	3,723,702	Submersible	K S B	5,000	290	25	50	No	No	No	No			2010	10					
204	25-A	25	Muhallah Choudrian S/Road	322,535	3,723,815	Submersible	G FOS	5,000	200	25	50	No	No	No	No			2006	11					
205	26	25	Sadiq abad Muhammadi Masjid	322,251	3,723,447	Submersible	G FOS	8,000	180	25	50	Yes	Yes	Yes	Yes			1994	14					
206	26-A	25	Ghazali Road	321,918	3,723,443	Submersible	K S B			25	50	No	No	No	No			2014	10					
207	21	26	A-Block 6th Road	321,859	3,724,037	Submersible	G FOS	5,000		40	100	No	Yes	No	No			2004	12					
208	22	26	A-Block 6th Road	321,841	3,724,049	Turbine	Siemens	8,000		40	100	No	No	No	No			2004	12					
209	35	26	Afandi Colony	321,851	3,722,838	Submersible	F/PAK	6,000		30	50	Yes	Yes	No	No			2006	10					
210	35-A	26	Afandi Colony	321,998	3,722,812	Submersible	G FOS	6,000		30	50	Yes	Yes	Yes	No			2011	10					
211	36	26	C-Block	321,788	3,723,052	Submersible	K.S.B			30	50	Yes	Yes	Yes	Yes			1995	10					
212	36-A	26	Bangreel Masjid	322,228	3,723,258	Submersible	M.A.K			25	50	Yes	Yes	No	No			2004	8					

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.
WASA Rawalpindi

Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values: Discharge (Gln/Hour)	Flow Meter Values: Velocity (m/sec)	Flow Meter Values: Signal Strength Value (S)	Flow Meter Values: Signal Quality (Q)
213	36-B	26	C-Block D. Kaku Shah	321,585	3,722,811	Submersible	M.A.K			25	50	No	Yes	No	No			2000	10					
214	170	26	Arshi Masjid	321,675	3,723,402	Submersible	M.A.K	6,000		25	50	No	Yes	No	No			2013	12					
215	27	27	Muhammedi colony muslim town	323,371	3,723,092	Submersible	K S B	7,500		25	50	Yes	Yes	Yes	No	4	Yes	1987	16		6040	1.172	808 , 812	70 R
216	27-A	27	Mohammedi colony	323,268	3,723,574	Submersible	F/PAK	5,000		30	50	Yes	Yes	No	No	3	Yes	1986	16		3818	1.4234	761 , 762	65 R
217	28	27	Azher Satti Plat	323,012	3,723,081	Submersible	HMA	6,000		25	50	Yes	Yes	Yes	No	4	Yes	2007	10		5060	0.9716	765 , 766	90 R
218	28-A	27	Haji chowk muslim town	323,160	3,723,153	Submersible	K S B	6,000		25	50	Yes	Yes	No	No	4	No	2013	12		Physical Site Condation Does Not Allow to Calculate Flow			
219	28-B	27	Osmani Masjid Muslim Town	322,952	3,722,790	Submersible	HMA			25	50	No	No	No	No	3	Yes	1998	16		3244	1.197	803 , 805	80
220	29	27	Muslim town behind PAF flates	323,375	3,723,147	Turbine																		
221	29-A	27	Capt Riaz Mehmood	323,084	3,723,042	Submersible	FLOW PAK			25	50	No	No	No	No	3	No	2012	6		3478	1.2793	847 , 850	65 R
222	New-4	27	Yousif colony muslim town	323,232	3,723,932	Submersible	MAK			25	50	No	No	No	No	3	No	2014	7		Physical Site Condation Does Not Allow to Calculate Flow			
223	188	27	Haji chowk muslim town street No.10	322,767	3,722,853	Submersible	K S B			25	50	No	No	No	No	4	No	2008	10		6660	1.288	841 , 842	70
224	31	28	Muslim town streer No.2-B	322,404	3,722,530	Submersible		7,000		25	50	Yes	Yes	Yes				1985	18					
225	31-A	28	Raja qadeer street	322,055	3,722,649	Submersible	K S B	6,000		25	50	Yes	Yes	Yes	No	4	No	2004	10					
226	30	28	Service road muslim town	322,641	3,722,423	Submersible	MAK	5,000		30	50	Yes	Yes	Yes	Yes			1988	15					
227	30-A	28	Front area of azam hotel chaudhery street	322,665	3,722,931	Submersible	F/PAK	6,000		25	50	Yes	No	No	No			2003	12					
228	31-B	28	Gali No. 05	322,569	3,722,666	Submersible	K S B			25	50	No	No	No	No			2013	8					
229	31-C	28	Gali No. 03 Muslim Town(New)	322,512	3,722,864	Submersible				25	50	No	No	No	No			2014	8					
230	32	29	Bahari colony tanki	323,170	3,722,679	Submersible	Vicyoria	5,000		25		Open	Yes	Yes	No	3	No	2014	12		2250	0.834	774 , 778	84
231	32-A	29	Allah wala chowk near chongi No.8 M.Town	323,199	3,722,402	Submersible	K S B	7,000		25	50	Yes	Yes	No	No	4	Yes	2005	14		4730	0.9178	757 , 758	80
232	32-B	29	Behari Colony Park	323,292	3,722,721	Submersible	K S B	6,000		25	50	Open	No	No	No	4	No	2009	10		Physical Site Condation Does Not Allow to Calculate Flow			
233	33-C	29	Khurram Colony	323,040	3,722,264	Submersible	HMA	4,000		20	50	Yes	Yes	Yes	No	4	Yes	2011	14		4590	0.8986	800 , 801	82
234	32-D	29	Khuram Colony Near Zahid KS.	323,148	3,722,128	Submersible	K S B			25	50	Open	No	No	No	3	No	2014	6		4490	1.67	884 , 885	82
235	33	29	Masjid sultan muslim town	323,226	3,722,332	Turbine	K S B	6,000		25	50	Yes	Yes	No	Yes	6	No	1988	11		10800	0.8733	800 , 801	82
236	33-A	29	Khurram colony street No.28	322,941	3,722,096	Submersible		5,000		25	50	Open	No	No	No	4	No	1999	12		Physical Site Condation Does Not Allow to Calculate Flow			
237	34	29	Khurram Colony	322,965	3,722,497	Submersible	Peco			25	50	No	No	No	No	4	No	2013	13		Physical Site Condation Does Not Allow to Calculate Flow			
238	New-5	29	Khurram colony chungi No.8 muslim town	323,043	3,722,321	Submersible																		
239	37	30	Kuri road chah sultan	321,397	3,722,396	Submersible		8,000		25	50	No	No	Yes	No	3	Yes	2009	12					

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.
WASA Rawalpindi

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																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
240	40	30	Chamrah godam	321,521	3,721,883	Submersible		6,000		20	50	No	Yes	No	Yes	4	No	1988	10					
241	New-20	30	Ammarpura Chowk	321,057	3,722,108	Submersible																		
242	37-A	30	Raja Israr	321,615	3,722,214	Submersible	FLOW PAK	6,000		25	50	No	No	No	No	3	No	2011	11					
243	38	30	Amur Pura	321,081	3,722,127	Submersible		6,000		25	50	No	Yes	No	No	4	Yes	2007	12					
244	38-A	30	Amur Pura	321,249	3,722,153	Submersible	HMA	6,000		25	50	No	No	Yes	No	4	Yes	2011	12					
245	39	31	Bund khana road	321,665	3,722,217	Submersible		7,000		25	50	No	Yes	No	No	3	No	1985	11					
246	39-A	31	Tamasab abad	321,898	3,721,938	Submersible		6,000		20	50	No	Yes	Yes	No	3	No	2006	10					
247	45	31	Hukam Dad Muhallah	321,669	3,721,660	Submersible	K S B	7,000		25	50	Yes	Yes	No	No	4	Yes	2004	12					
248	45-A	31	Dhok hukam dad	321,324	3,721,455	Submersible	DST	6,000		25	50	No	No	Yes	No	4	Yes	2007	10					
249	45-B	31	New Ishtiaq Mirza House	321,580	3,721,425	Submersible	FLOW PAK	6,000		20	50	Open	No	No	No	3	Yes	2012	12					
250	New-18	31		321,340	3,721,435	Submersible																		
251	37-B	31	Lala Israr	321,743	3,722,068	Submersible	MAK	6,000		25	50	No	No	No	No	3	No	2013	4					
252	43	32	Waris Khan Sarfraz Road	320,741	3,721,629	Submersible		6,000		25	50	Yes	Yes	Yes	No	4	No	1988	12					
253	44	32	Dhoke Hukam Daad	321,329	3,721,641	Submersible		5,000		25	50	Yes	Yes	No	No	4	Yes	1986	12					
254	42	32	Ammar pura	321,086	3,721,755	Submersible	K S B	5,000		25	50	No	No	No	No	4	No	2012	12					
255	43-A	32	Zuffar-Ul-Haq Road	320,899	3,721,536	Submersible	K S B	6,000		15	50	Yes	No	Yes	No	3	No	2012	10					
256	43-B	32	Waris Khan Sarfraz Road	320,740	3,721,555	Submersible		6,000		25	50	Open	No	No	No	3	Yes	2013	10					
257	44-A	32	Muhallah New Amar Pura	321,406	3,721,731	Submersible		5,000		25	50	No	No	No	No	3	No	2010	10					
258	1	Sohan	Sohan Village	323,939	3,726,204	Submersible	M.A.K	16,000	130	40	200	Yes	Yes	Yes	No			2012	10					
259	1-A	Sohan	Sohan Village	323,916	3,726,287	Submersible	M.A.K	16,000	150	40	200	Yes	Yes	No	No			2010	6					
260	2	Sohan	Sohan Village	324,009	3,726,080	Submersible	M.A.K	16,000	100	40	200	Yes	Yes	No	No			1973	6					
261	4	Sohan	Sohan Village	323,991	3,726,327	Submersible	TSK	16,000	140	40	200	Yes	Yes	No	No			1973	6					
262	7	Sohan	Sohan Village	324,066	3,725,923	Submersible	TSK	16,000	150	40	50	Yes	Yes	No	No			2000	6					
263	8	Sohan	Sohan Village	324,273	3,725,884	Submersible	TSK	16,000	150	40	50	Yes	Yes	No	No			2000	6					
264	9	Sohan	Sohan Village	324,226	3,725,743	Submersible	TSK	16,000	150	40	50	Yes	Yes	No				2000	6					
265	10	Sohan	Sohan Village	324,179	3,726,097	Submersible	TSK	16,000	150	40	50	Yes	Yes	No	No			2000	6					
266	11	Sohan	Sohan Village	324,245	3,726,094	Submersible	TSK	16,000	150	50	50	Yes	Yes	No	No			2000	6					

Annex - 3.1

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.

WASA Rawalpindi

Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values			
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
267	12	Sohan	Sohan Village	324,298	3,726,121	Submersible	TSK	16,000	150	40	50	Yes	Yes	No	No			2000	6					
268	5	Sohan	Sohan Village	323,787	3,726,205	No	No	No	No	No	50	Yes	No	No				1973	Abundant					
269	6	Sohan	Sohan Village	323,660	3,726,414	No	No	No	No	No	50	Yes	No	No				1973	Abundant					
	Detail List of Tube Wells Zone East-I, UC (33, 34, 35)																							
270	131	33	Kohati Bazar	320,541	3,722,167	Submersible	MAK	6,000	210	25	50	Yes	Yes	Yes	Yes	3	No	1992	3					
271	131-A	33	Mohallah Feroozpura	320,755	3,722,248			6,000	270	25	50	No	Yes	Yes	No	3	Yes	1988	6					
272	132	33	Kohati Bazar	320,515	3,722,080	Turbine	K S B	7,000	190	25	50	Yes	Yes	Yes	Yes	3	Yes	1999	6					
273	133	33	Banni Chowk	320,244	3,721,878	Submersible	K S B	7,000	320	25	50	No	Yes	Yes	No	3	No	2015	4					
274	133-B	33	Angat Pura Near Sheikh Tikka	320,180	3,722,387	Submersible	K S B	7,000	260	25	50	No	No	No	No	3	No	2012	6					
275	148-B	33	Asghar Mall Road Near Hayat Wali Clinic	320,656	3,722,517	Submersible	K S B	6,000	270	25	50	Open	No	No	No	3	No	2012	4					
276	148	34	Abdul Rauf S/O Shahzada Khan (R) 0300-5209352	320,236	3,722,133	Submersible	K S B	5,000	270	30	50	Yes	Yes	Yes	Yes	3	Yes	1990	6					
277	148-A	34	Mohalla Hari Pura	320,224	3,722,126	Submersible	MAK	5,000	240	25	50	Yes	No	Yes	No	4	Yes	1985	6					
278	154	35	Doshera Ground	319,591	3,722,291	**Abundant**																		
279	154-B	35	Eid Gah Scheme	319,709	3,722,355							Open						2007						
280	154-C	35	Dusra Ground	319,604	3,722,262				370									2007	8					
281	155	35	Imam Bargh Road	319,958	3,722,171				300										4					
282	155-A	35	Janglaat Road	320,100	3,722,129	Submersible	K S B	4,000	240	20	50	Yes	Yes	Yes	No	3	Yes	2004	4					
	Detail List of Tube Wells West Zone, Sector-I UC (35-38)																							
283	71	36	Near Dispensary Mohan Pura	319,337	3,720,386	Submersible	K S B	6,000	250	25	50	Yes	Yes	Yes	No	4	No	1995	4					
284	71-A	36	Arjun Nagar	319,318	3,720,052	Turbine	K S B	6,000	180	30	50	Yes	Yes	No	No	4	No	1998	3					
285	72-A	36	Girls College Mohan Pura	319,253	3,720,615	Submersible	K S B	7,000	260	25	50	Yes	Yes	Yes	Yes	4	No	2001	12					
286	140	37	Gulshan Abad Akaal Garr	319,243	3,721,820	Submersible	K S B	5,000	260	25	50							1991	12					
287	142	37	Murgi Mandi Bhagh Sardraa	319,357	3,722,060	Submersible	KSB	6,000	260	20	50							1995	7					
288	142-A	37	Kashmiri Colony Bhagh Sardraa	319,247	3,721,954	Submersible	FLOW PAK	7,000	270	20	25							2007	6					

Annex - 3.1

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.

WASA Rawalpindi

Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values			
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
289	143	37	Safdar Abad Girls High School	318,909	3,721,995	Submersible	FLOW PAK	7,000	190	20	50	Yes	Yes	No				1986	8					
290	144-A	37	Near Nullah Lai Safdar Abad	319,081	3,722,015	Submersible	FLOW PAK			20	50	No	No	No				2013	6					
291	145	37				Submersible	K S B	5,000	250	20	50							1988	Abundant					
292	145-A	37	Zayarat Buduh Shah Bhagh Sardraa	319,315	3,722,134	Submersible																		
293	146	37	shagufta Colony Dhoke Dalal	319,067	3,722,380	Turbine	K S B	6,000	190	25	50	Yes	Yes	No				1989	10					
294	146-A	37	Near Graveyard Dhoke Dalal	319,349	3,722,521	Submersible	K S B	7,000	260	20	50	Yes	Yes	No				2007	8					
295	72-B	38	Sagri Scheme Akab Nawlti Cinema	319,103	3,720,879	Submersible	FLOW PAK	6,000	260	20	25	Yes	Yes	No				2007	6					
296	140-A	38	Tire Bazar Near Khursheed Cinema	319,558	3,721,400	Submersible	PECO	5,000	190	30	25							1999	4					
297	140-B	38	Near Police Station Gang Mandi	319,123	3,721,401	Submersible	K S B	6,000	270	20	50							2007	8					
298	141	38	Ghaznawi Road Bhagh Sardraa	319,525	3,721,729	Submersible	K S B	6,000	170	40	50							1989	12					
299	141-A	38	Near Nullah Lai Muhallah Akaal Garr	319,101	3,721,838	Submersible																		
	Detail List of Tube Wells Zone East-I, UC (39-46)																							
300	135-A	39	Committee Chowk					3,500		25									6					
301	136-A	39	Chatia Hatia	320,218	3,721,160	Submersible	K S B	5,000	240	25	50	No	Yes	Yes				2003	12					
302	151	39	Bhabra Bazar	320,244	3,721,351	Submersible	K S B	6,000	260	25	50	No	Yes	Yes				1986	12					
303	152-A	39	Landa Bazar	320,081	3,721,131	Submersible	K S B	6,000	260	20	50	No	No	No				2005	12					
304	137-A	40	Klam Bazar	319,814	3,721,441	Submersible	K S B	7,000	260	25	20	No	No	No	No	3	No	2005	18					
305	138-A	40	Prona Qalia	319,814	3,721,441	Submersible	K S B	2,000	250	25	25	Yes	No	Yes	No	3	No	1999	4					
306	138-B	40	Bhabra Bazar	320,073	3,721,426	Submersible	K S B	7,000	280	25	25	No	No	No				2008	16					
307	152	40	Lal Havailee	319,862	3,721,200	Submersible	K S B	5,000		20	25	No	Yes	No	No	3	Yes	1984	12					
308	152-B	40	Mission School Raja Bazar	319,750	3,721,035	Submersible	FLOW PAK	6,500	280	25	50	Yes	No	No	No	4	Yes	2010	7					
309	133-A	41	Said Pur Gate	320,182	3,721,854	Submersible	K S B	7,000		25	25	No	No	No	No	4	No	1998	10					
310	150	41	Shah Nazar Pull	319,842	3,721,684	Submersible	MAK	7,000	260	25	50	No	Yes	Yes	No	4	Yes	1988	11					
311	150-A	41	Mohallah Naharia	320,084	3,721,735	Submersible	HMA	6,000	260	20	25	Open	Yes	Yes	No	4	Yes	2010	4					
312	46	42	Millat Colony	320,889	3,721,129	Submersible	K S B	6,000	260	25	50	Yes	Yes	Yes				1988	14					
313	46-B	42	Zafar UL Haq Road	320,599	3,721,231	Submersible	K S B	6,000	260	25	50	No	Yes	Yes				2007	12					
314	50-A	42	Rawal Hotal	320,728	3,720,919	Submersible	K S B	7,000	220	25	25	No	No	Yes				2015	8					
315	52-A	42	Umer Road	320,772	3,720,533	Submersible	K S B	6,000	250	25	25	No	No	No				1990	16					
316	56-A	42	Dh. Elahi Bakhsh	320,901	3,720,713	Submersible	K S B	5,000	240	25	50	Yes	Yes	No				2001	12					
317	56-B	42	Shah De Talian	320,624	3,720,633	Submersible	K S B	7,000	270	25	50	No	No	No				2005	12					

Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.
WASA Rawalpindi

Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values			
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
318	47-A	43	Qasim Abad	321,166	3,721,022	Submersible	FLOW PAK	6,000	240	20	50	No	No	No				2010	16					
319	48-A	43	Talab Tailian	321,022	3,721,317	Submersible	K S B	8,000	250	25	50	Yes	Yes	Yes				1992	14					
320	51	43	National Town Dhoke Khaba	321,668	3,721,001	Submersible	MAK	6,000	250	30	50	Yes	Yes	No	Yes	3	Yes	1985	10					
321	51-A	43	National Town Dhoke Khaba	321,592	3,720,815	Submersible	K S B	6,000	270	25	50	Yes	Yes	No	No	3	No	2007	10					
322	53	43	Qasim Abad	321,712	3,721,233	Submersible	K S B	6,000	300	25	50	Yes	Yes	No	Yes	3	No	1988	12					
323	53-A	43	Qasim Abad	321,392	3,721,261	Submersible	K S B	6,000	290	25	50	Yes	Yes	Yes	Yes	3	No	2005	12					
324	54-B	43	Gullberg Town	321,691	3,720,615	Submersible	K S B	5,000		25	25	Open	No	No	No	4	No	2007	5					
325	47	44	Zeenat Sikandria School	321,071	3,720,980	Submersible	K S B	4,000	240	25	50	Yes	Yes	Yes				1988	14					
326	50-B	44	Bilal Masjid Umer Road	320,914	3,720,883	Submersible	K S B	4,000		25	50	No	No	No				2007	8					
327	52	44	Dhoke Elahi Bakhsh	321,032	3,720,410	Submersible	K S B	6,000	270	25	25	No	Yes	Yes				2014	14					
328	52-B	44	Bilal Masjid Umer Road	321,072	3,720,283	Submersible	K S B	6,000	270	25	50	No	No	No				2012	14					
329	54	44	Dhoke Farman Ali	321,499	3,720,372	Submersible	Abundant	5,000	290	25	50	Yes	Yes	No	Yes	3	No	1990	Abundant					
330	54-A	44	Dhoke Farman Ali	321,582	3,720,581	Submersible	K S B	6,000	270	25	25	Open	No	No	No	4	No	2007	15					
331	54-C	44	Fazal Abad Gali No.3	321,364	3,721,507	Submersible	FLOW PAK	7,000	270	25	50	No	No	No	No	3	No	2012	15					
332	58	45	Ariya Mohalla	321,012	3,720,204	Submersible	K S B	7,000	240	30	50	Yes	Yes	Yes				1995	14					
333	58-B	45	Islamia High School	320,665	3,719,950	Submersible	K S B	8,000	260	25	50	Yes	No	No	No	3	No	2008	4					
334	60	45	Ghalla Godam	321,147	3,719,727			6,000	300	25									10					
335	60-A	45	Nighat Abad	321,119	3,719,308			6,000	260	25									12					
336	60-B	45	Moti Mehal	320,678	3,719,638			5,000	260	25									12					
337	60-C	45	Milad Chowk Chaman Zar Colony	320,912	3,719,387			6,000	280	25									8					
338	61	45	Hakeem Abid	321,438	3,720,167			6,000	270	25									12					
339	61-A	45	Muslim Colony	321,167	3,720,055			7,000	260	25									12					
340	61-B	45	Muslim Colony	321,327	3,719,975			6,000	270	25									10					
341	61-C	45	Javed Colony Tipu Road					6,000	270	25									10					
342	67	45	Civil Line	320,736	3,718,341	Submersible	K S B	6,000	280	30	50	Open	No	No	No	3	Yes	2014	8					

Annex - 3.1

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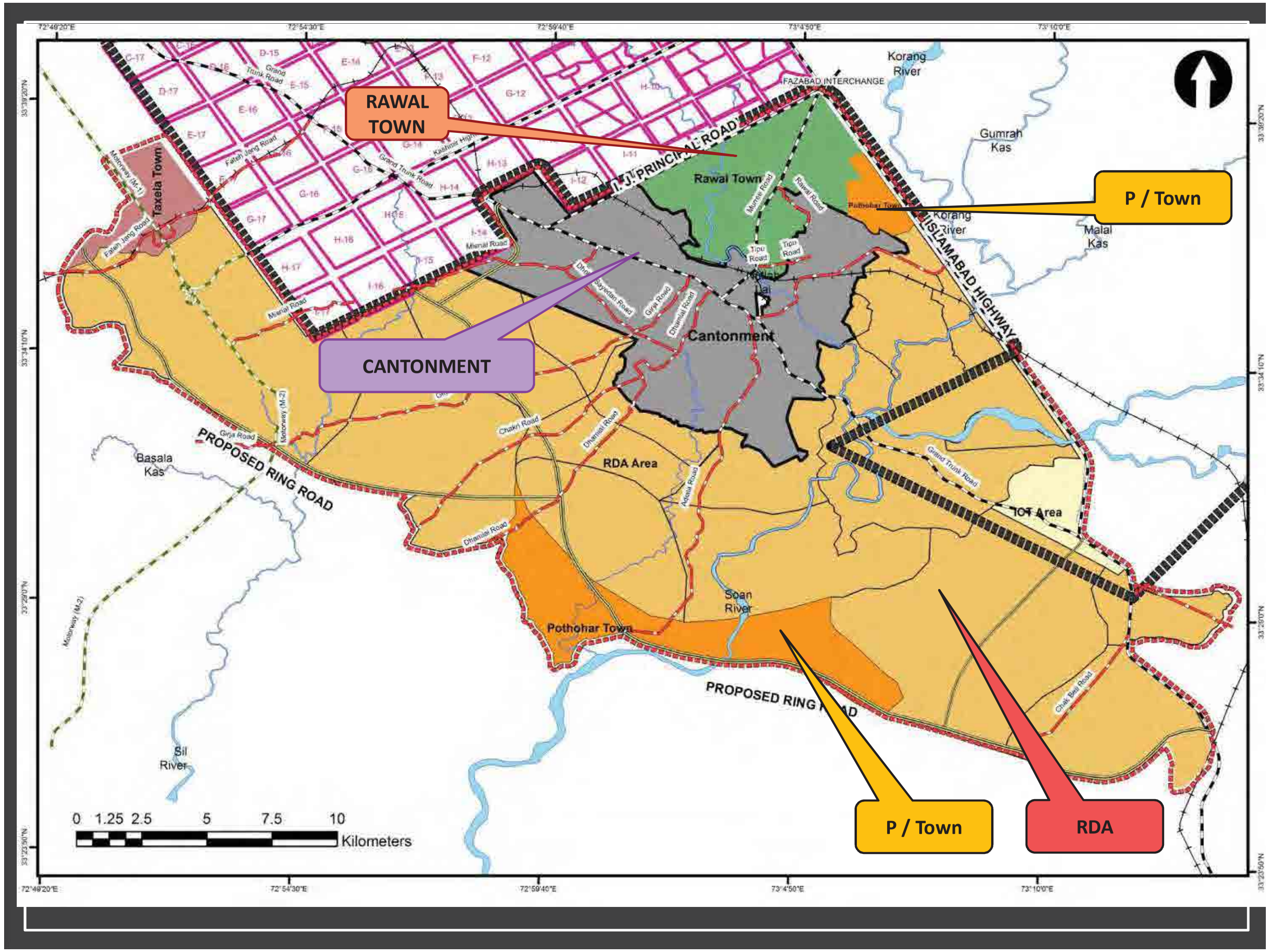
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
343	67-A	45	New Civil Line	320,658	3,718,691	Submersible	K S B	6,000	270	25	50	No	No	No	No	3	No	2012	10					
344	62	46	Complaint Office Liaquat Bagh					8,000		25														
345	62-A	46	Opp . Garden College Liaqat Road	320,281	3,720,290	Submersible	K S B	7,000		25	50	Open	No	Yes	No	4	Yes	2001	16					
346	64	46	Near TMA Office Liaquat Road	320,152	3,720,336	Submersible	MAK	6,000	260	25	50	Yes	Yes	Yes	Yes	4	Yes	1983	18					
347	64-A	46	DAV College Road	320,115	3,720,670	Submersible	HMA	7,000	290	20	50	No	Yes	Yes	No	4	No	1999	14					
348	64-B	46	Near Moti Masjid Liaquat Road	319,937	3,720,577	Submersible	K S B	6,000	240	25	25	Yes	Yes	Yes	No	4	No	2004	13					
349	64-C	46	College Chowk	320,206	3,720,773	Submersible	K S B	7,000	290	20	25	No	No	Yes	No	4	No	2012	12					
350	69	46	Chachi Mohallah Tanki	320,366	3,720,805	Submersible	K S B	7,000	260	25	100	Yes	Yes	Yes	Yes	4	No	1994	12					
351	69-A	46	Muree Road	320,521	3,720,479	Submersible	K S B	6,000	300	25	50	Yes	Yes	Yes	No	4	Yes	2007	16					
352	70	46	Fowara Chowk	319,624	3,720,847	Submersible	HMA	7,000		25	50	No	No	No	No	4	No	1992	14					
353	70-A	46	Usman Pura	319,622	3,720,561	Submersible	K S B	7,000	270	25	50	Yes	Yes	Yes	No	4	No	1992	10					
354	70-D	46	Nia Mohallah	320,022	3,720,859	Submersible	K S B	7,000	290	20	50	No	No	Yes	No	4	No	2012	12					
LIST OF TUBEWELLS IN NEWLY ADDED UC'S																								
355	Nil	74	Nemat Muhallah Haroon Chowk Shakrial	323,366	3,723,717	Submersible				15	50	Yes	No	Yes	No	4	No	2007	12		5975	1.1625	738 , 739	77
356	Nil	75	Muhallah Islam Nagar Near Al-Ghani Service Station	324,356	3,723,432	Submersible				25	30	Steel Cage	No	No	No	4	Yes	2004	14		6455	1.25	789 , 793	64
357	Nil	75	Said Pur Town Shakrial	324,307	3,723,507	Submersible	Siemens			15	25	Yes	No	No	Yes	4	Yes	2003	13		Physical Site Condation Does Not Allow to Calculate Flow			
358	Nil	76	AlNoor Colony Sector-I Satti CNG	324,042	3,722,542	Submersible				30	50	Steel Cage	No	No	No	4	No	2007	10		8250	1.6	783 , 784	89
359	Nil	76	Abdullah Masjid Street Gali No.2	324,265	3,722,784	Submersible				30	25	Steel Cage	No	No	No	4	Yes	2013	12		Physical Site Condation Does Not Allow to Calculate Flow			
360	Nil	76	Raja Town Tarali Adda	324,399	3,722,745	Turbine	Siemens			30	25	No	No	No	No	4	No	2010	13		Physical Site Condation Does Not Allow to Calculate Flow			
361	Nil	76	Masjid Saida Ayisha Anwar Colony	324,433	3,722,876	Submersible				30	50	Yes	No	No	No	4	Yes	2006	13		6996	1.35	793 , 792	82
362	Nil	76	Wasa Complaint Office AlNoor Colony	324,227	3,722,474	Turbine	K S B			30	50	Yes	No	Yes	No	6	No	1993	16		9100	1.71	728 , 729	72
363	Nil	76	Mir Pur Housing Scheme III AlNoor Colony	324,465	3,722,452	Submersible	K S B			30	50	Yes	No	No	Yes	4	No	2004	12		8335	1.625	741 , 742	90
364	Nil	76	Pir Jamsheed Colony Jandad Town	324,542	3,722,181	Turbine				30	50	Yes	No	No	No	4	No	1994	16		9020	0.72	788 , 789	79
365	Nil	77	New Abadi Dhoke Ganghal Graveyard	324,844	3,721,597	Submersible	Siemens			20	25	No	No	No	No	3	No	2004	16		2690	1.96	806 , 808	76
366	Nil	77	Dhoke Lalihal	325,295	3,721,046	Submersible	HMA			20	50	Yes	No	No	No	4	Yes	1999	8		5900	1.14	767 , 768	88
367	Nil	77	Azeem Town Dhoke Lalihal	325,469	3,721,002	Submersible				30	50	Yes	No	No	No	4	No	1989	4		2690	1.96	806 , 808	76
368	Nil	77	Gulzar e Qaid	326,131	3,719,502	Turbine	Siemens			25	25	Steel Cage	No	No	No	4	No	2006	16					
369	Nil	78	Shaheen Town	325,629	3,720,675	Submersible				25	25	Yes	No	No	No	4	No	2005	16					

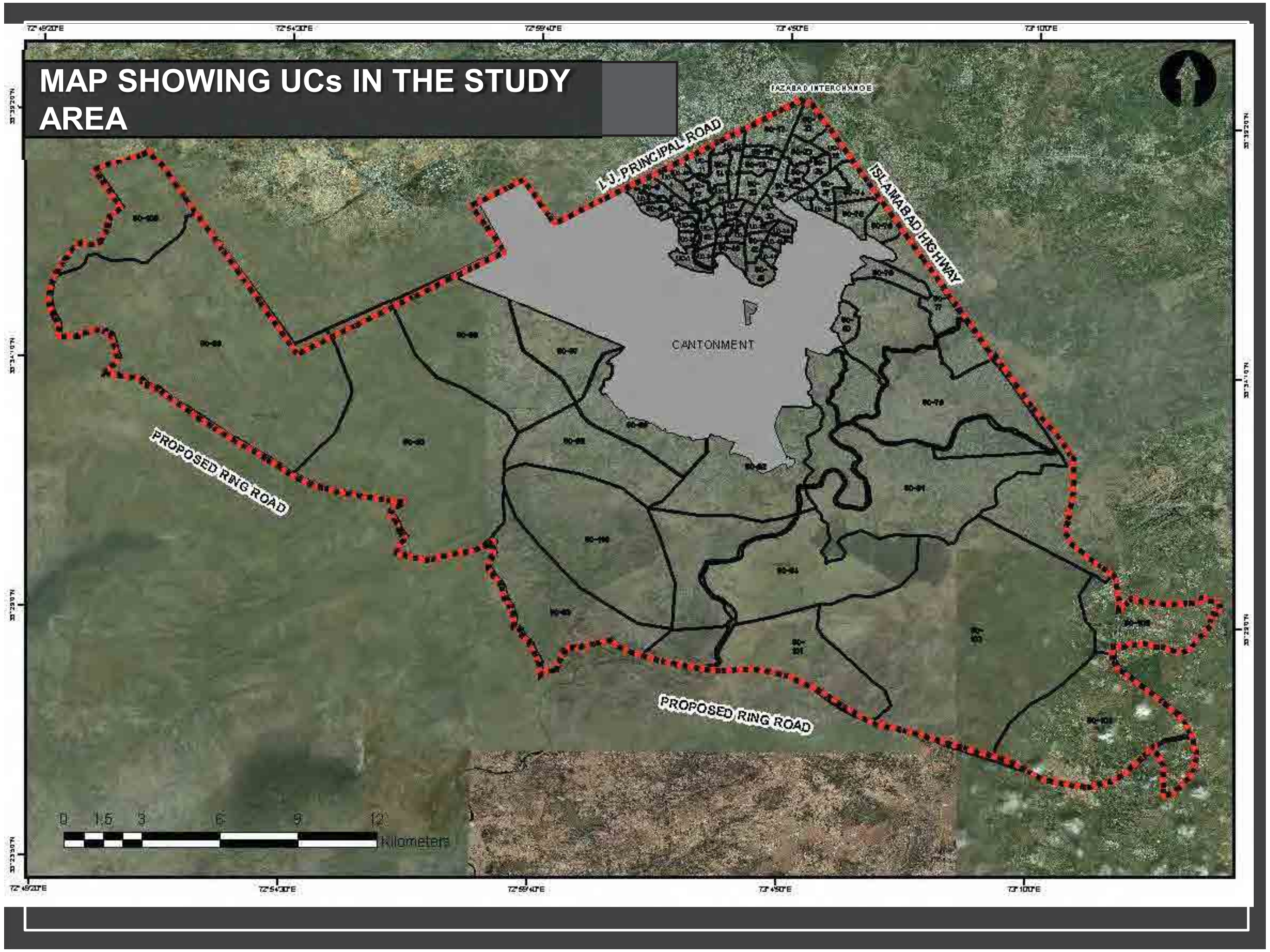
Comprehensive Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi.

WASA Rawalpindi

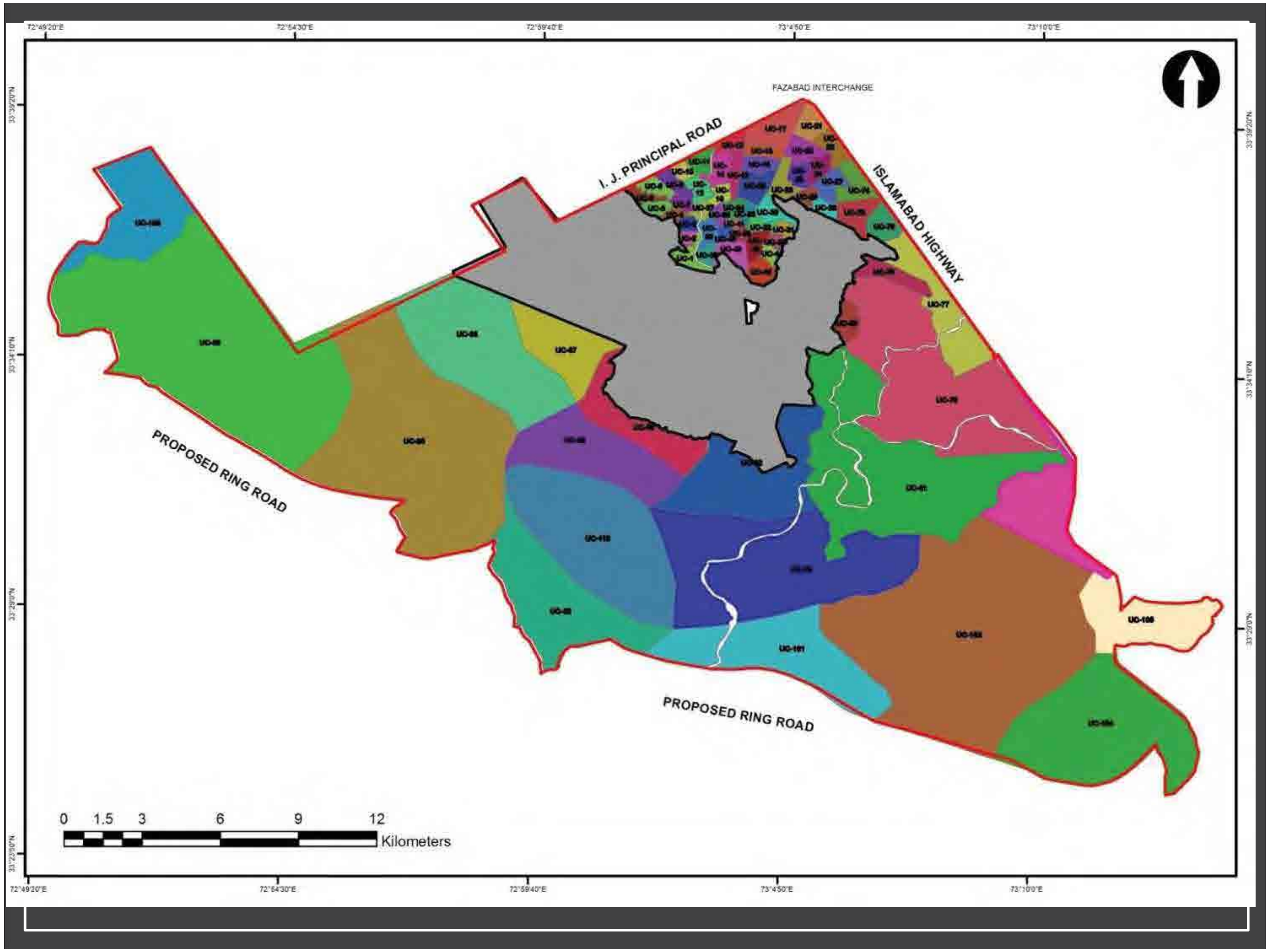
Sr. No.	TW. No.	UC. No.	Location	Easting (m)	Northing (m)	Pump Type	Make	Discharge (Gln)	Pump Setting (ft)	Motor (BHP)	Transformer (KVA)	Pump House	Chlorinator	Filtration Plant	Strata Chart	Delivery Pipe Dia (Inch)	Pressure Gauge	Year of Construction	Total Pumping Hours		Flow Meter Values			
																					Discharge (Gln/Hour)	Velocity (m/sec)	Signal Strength Value (S)	Signal Quality (Q)
370	Nil	78	Gangal West	325,506	3,720,625	Submersible				20	25	Yes	No	No	No	4	No	2006	16					
371	Nil	78	Chaklala Scheme	324,364	3,719,654	Submersible	HMA			20	50	Yes	No	No	Yes	4	Yes	2007	16					
372	Nil	79	Ghosia Colony	324,573	3,719,285	Submersible					25	Yes	No	No	No	3	Yes	2009						
373	Nil	79	New Afzal Town Gali No.02	324,189	3,718,357	Submersible				25	25	No	No	No	No	3	No	2007	16					
374	Nil	ISB	Gouri Town Phase III Gali No 2	326,258	3,721,248	Submersible				25	25	Yes	No	No	No	4	Yes	2006	16					
375	Nil	ISB	Gangal East	326,151	3,721,121	Turbine	Siemens			50	100	Yes	Yes	No	No	6	Yes	2002	16					
376	Nil	ISB	Gangal East-II	366,086	3,721,219	Submersible					100	Yes	No	No	No	6	No	2004						

Annex - 4.1


RAWAL TOWN
P / Town
CANTONMENT
P / Town
RDA
Rawal Town
Cantonment
RDA Area
Pothohar Town
Taxela Town
ICT Area
I. J. PRINCIPAL ROAD
ISLAMABAD HIGHWAY
PROPOSED RING ROAD
FAZABAD INTERCHANGE
Korang River
Gumrah Kas
Malal Kas
Soan River
Basala Kas
Sil River
0 1.25 2.5 5 7.5 10 Kilometers


MAP SHOWING UCs IN THE STUDY AREA
FAZABAD INTERCHANGE
I.J. PRINCIPAL ROAD
ISLAMABAD HIGHWAY
CANTONMENT
PROPOSED RING ROAD
PROPOSED RING ROAD
0 1.5 3 6 9 12
Kilometers

Annex - 4.1


FAZABAD INTERCHANGE
I. J. PRINCIPAL ROAD
ISLAMABAD HIGHWAY
PROPOSED RING ROAD
PROPOSED RING ROAD
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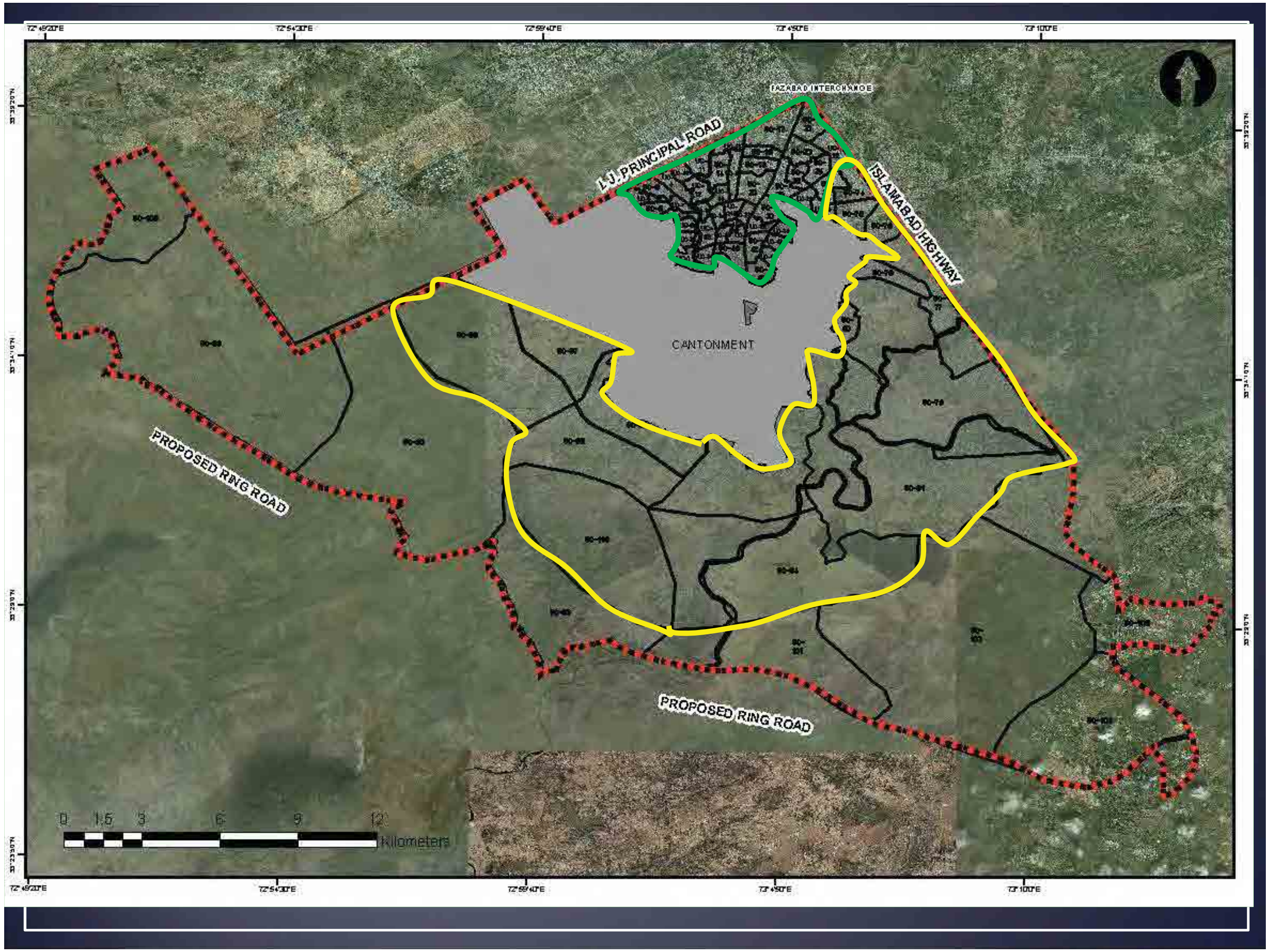
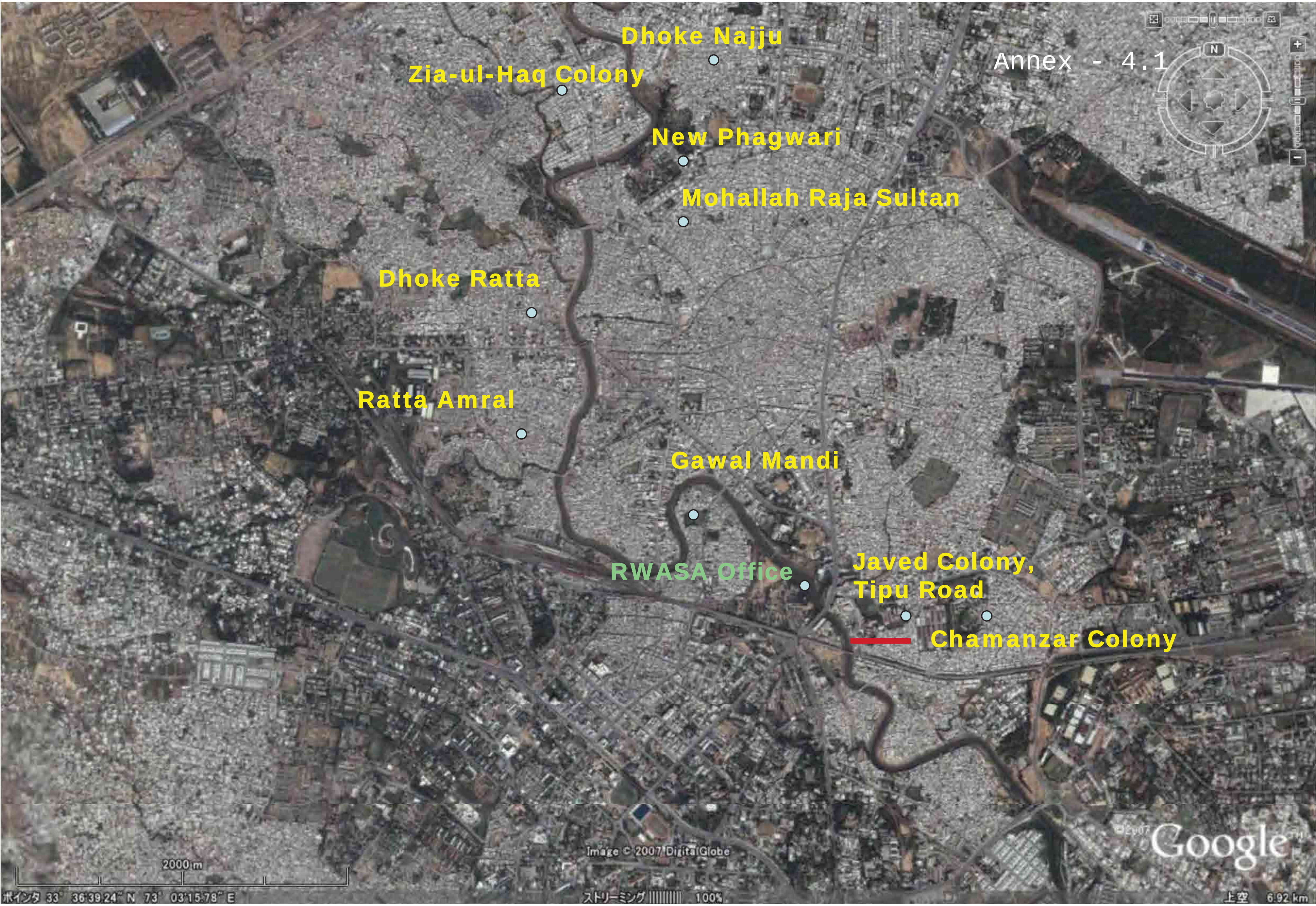
Kilometers

Annex - 4.1



I.J. PRINCIPAL ROAD
FAZABAD INTERCHANGE
ISLAMABAD HIGHWAY
CANTONMENT
PROPOSED RING ROAD
PROPOSED RING ROAD
0 1.5 3 6 9 12
Kilometers

Annex - 4.1


Dhoke Najju
Zia-ul-Haq Colony
New Phagwari
Mohallah Raja Sultan
Dhoke Ratta
Ratta Amral
Gawal Mandi
RWASA Office
Javed Colony,
Tipu Road
Chamanzar Colony
Image © 2007 DigitalGlobe
2000 m
Google

MOST VULNERABLE AREAS OF RAWALPINDI

□ □□e following low la□ing □□lo□e to □ai N□lla□ area□ of Rawalpindi □it□ are □n□□□all□ affe□ted □□ t□e □ai N□lla□ flood□ re□□lting in lo□□ of □□man life□ livestock, and property etc.

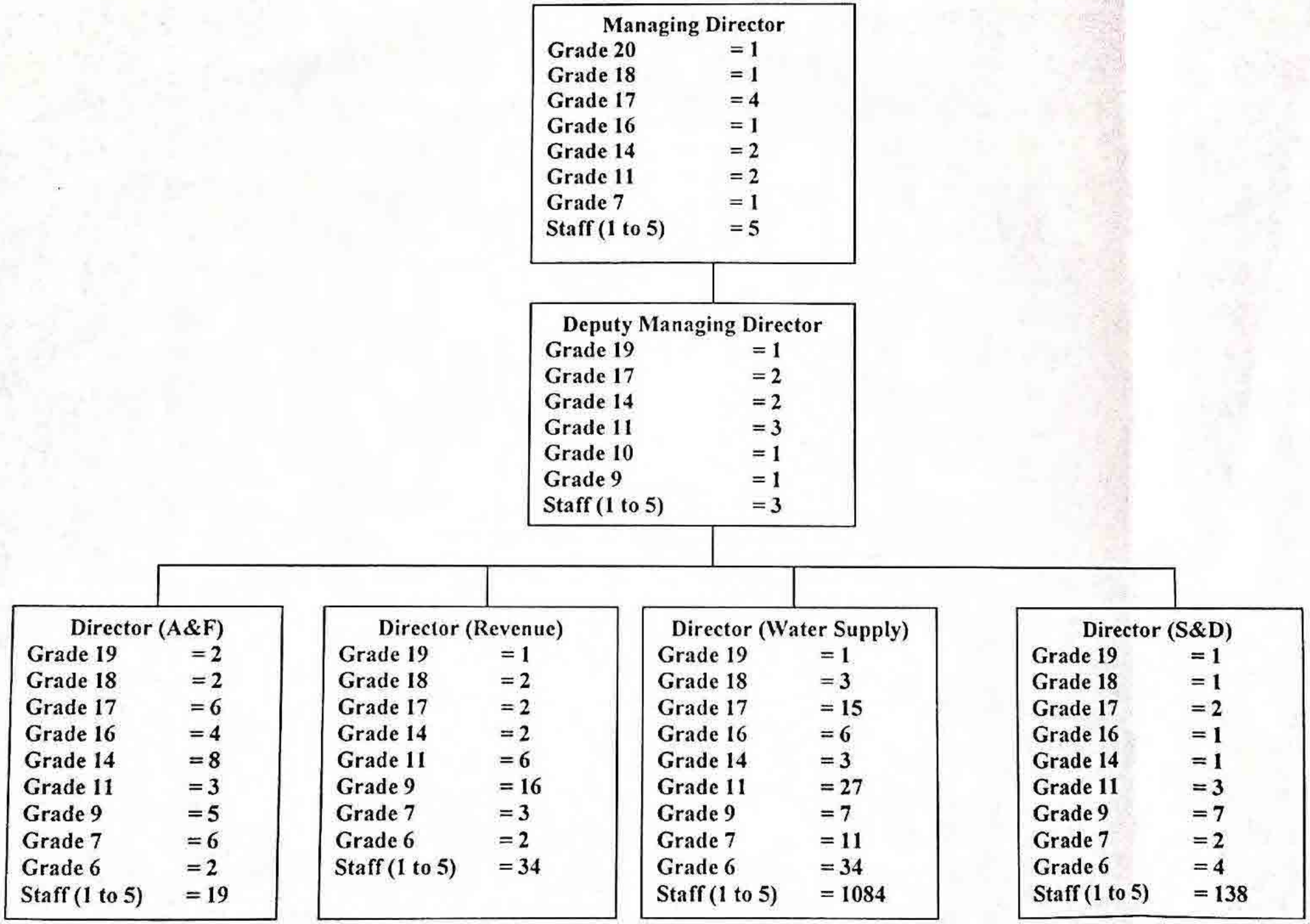
- Dhoke Najju
- Zia ul Haq Colony
- Dhoke Ratta
- Ratta Amral
- Javed Colony, Chamanzar, Tipu Road
- New Phagwari
- Mohallah Raja Sultan
- Dhoke Ellahi Bakhash

SPECIAL VEHICLES WITH RWASA

	MACHINERY	Qty
1.	Jetting Machine	05 Nos.
2.	Sucker Machine	06 No.
3.	Tractor Sucker Machine	01 No.
4.	Tractor Trolley	02 Nos.
5.	Trolley Mounted sewer Roding machine	04 No.
6.	Dewatering sets	05 No.
7.	Water Bouzers	24 Nos

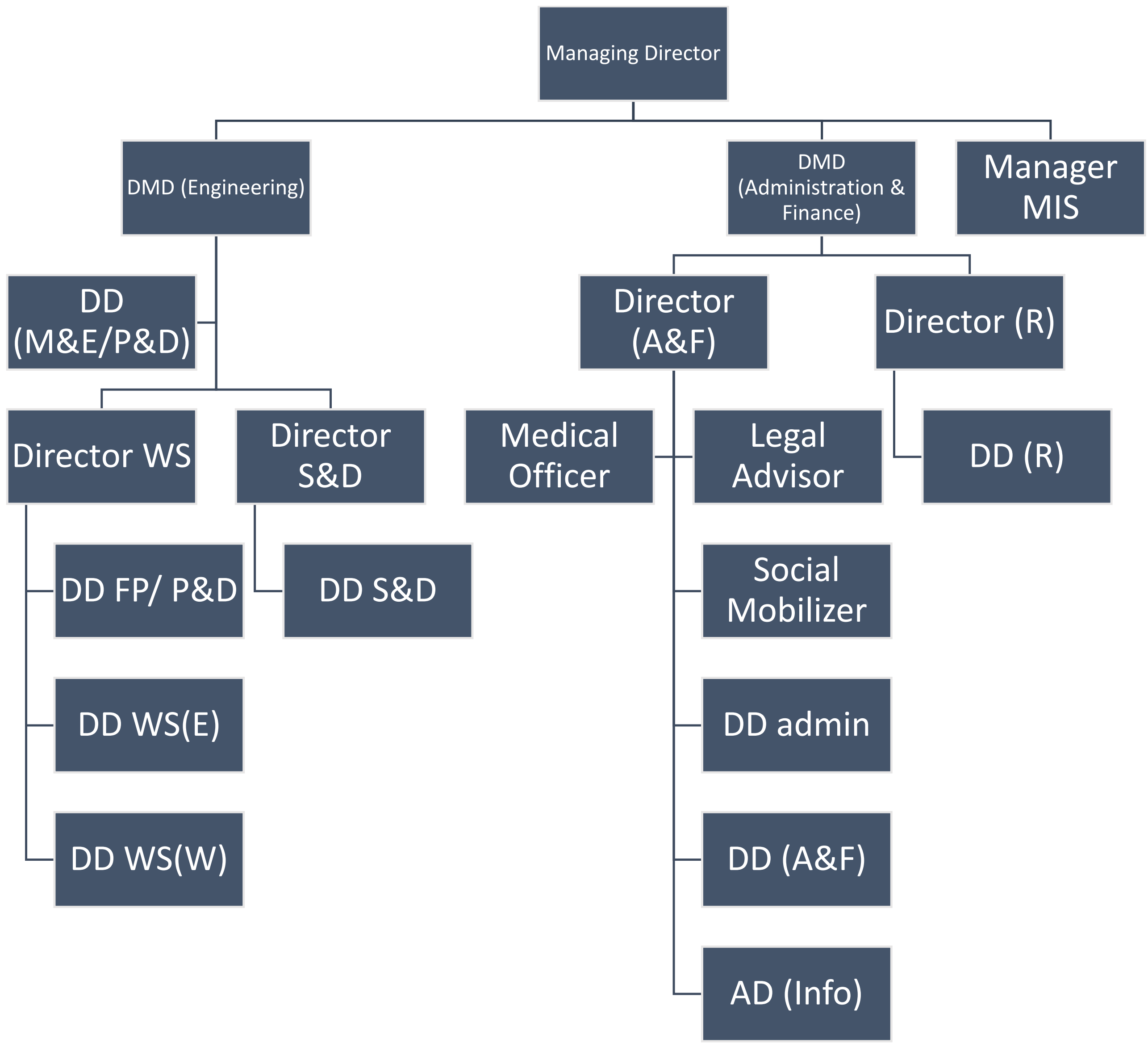
Annex - 5.1

ORGANIZATION CHART- WASA, RDA

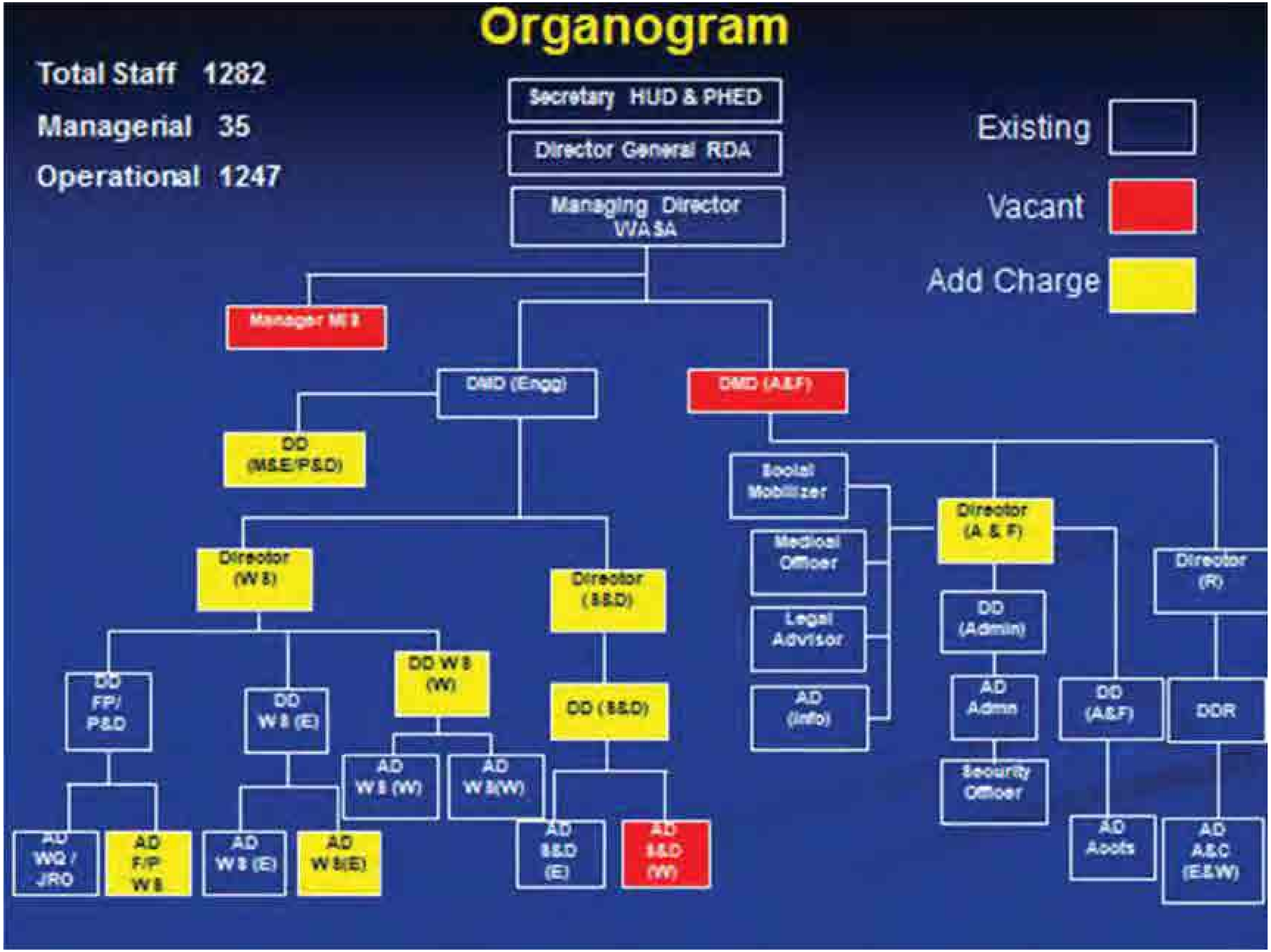


Annex - 5.1

ORGANOGRAM



ORGANOGRAM

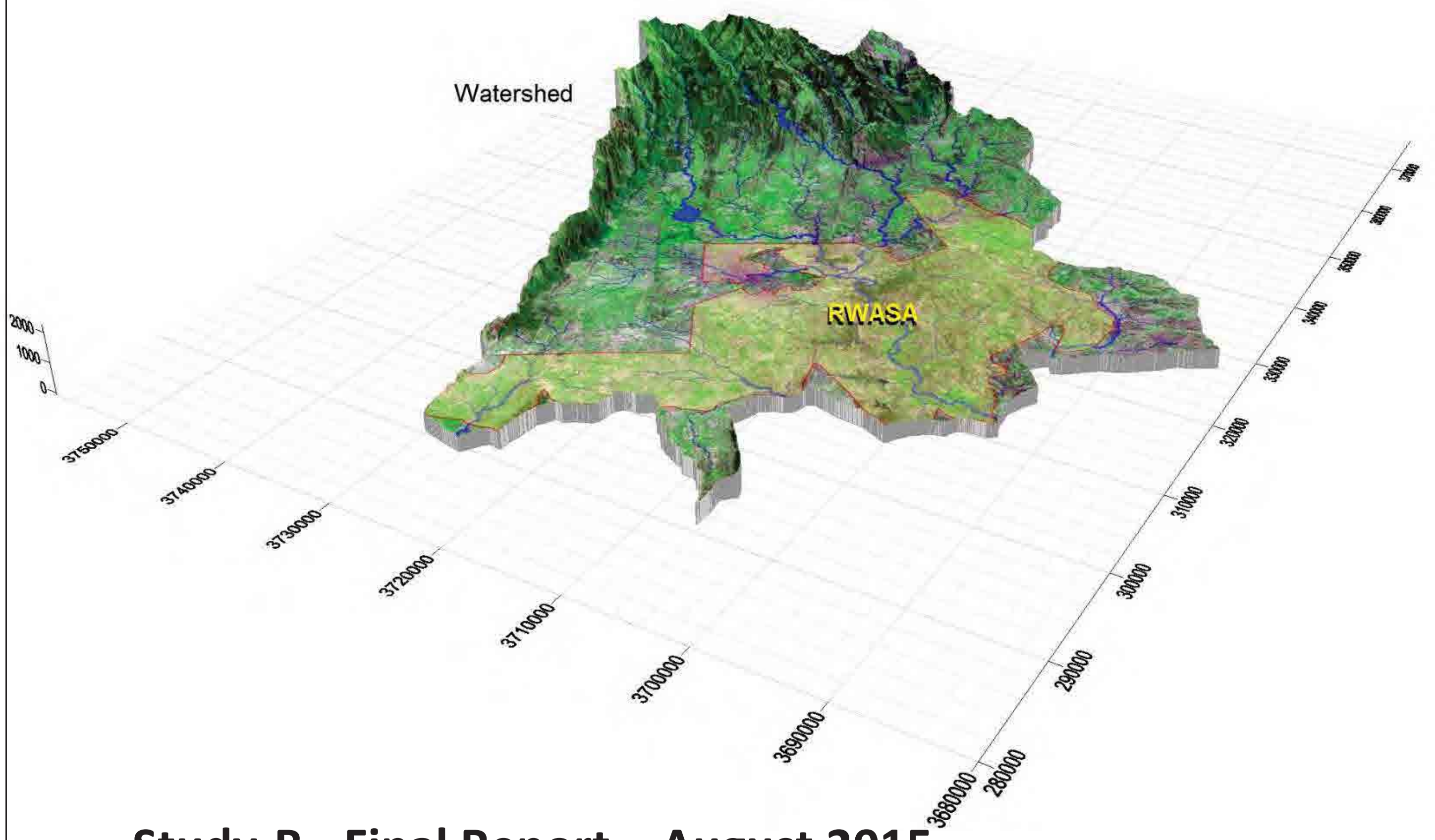

Organogram
Total Staff 1282
Managerial 35
Operational 1247
Existing
Vacant
Add Charge
Secretary HUD & PHED
Director General RDA
Managing Director WASA
DMD (Engg)
DMD (A&F)
DD (M&E/P&D)
Director (W S)
Director (S&D)
DD FP/ P&D
DD W S (E)
DD W S (W)
DD (S&D)
AD WQ / JRO
AD F/P W S
AD W S (E)
AD W S(E)
AD W S (W)
AD W S(W)
AD S&D (E)
AD S&D (W)
Social Mobilizer
Medical Officer
Legal Advisor
AD (Info)
Director (A & F)
DD (Admin)
AD Admn
Security Officer
DD (A&F)
AD Accts
Director (R)
DDR
AD A&C (E&W)

WASA
RAWALPINDI

WASA
RAWALPINDI

Annex - 5.4

Study on Water Resources, Develop Environmental & Social Guidelines/Protocols for Development Schemes I/C Strategies for Climate Change and Energy Conservation



Study-B - Final Report – August 2015

OSMANI & Co. (Pvt.) Ltd
Consulting Engineers, Pakistan

OSMANI
Engineering - Architecture - Planning - Mapping - Technology

Table of Contents

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STUDY-B

Study on Water Resources, Develop Environmental & Social Guidelines/Protocols for Development Schemes I/C Strategies for Climate Change and Energy Conservation

Executive Summary

This report gives out the conceptual elements for a fully sustainable plan for water supply, sewerage and storm water drainage in Rawalpindi urban and peri-urban areas. The plans are based upon a comprehensive analysis of the region's ability to support an estimated population of up to 6 million. The plans presented here fully factor-in the important elements of: environmental sustainability; energy use and efficiency; control and prevention of pollution; risk mitigation and management; projected population until year 2040; and, climate change. The plans are developed with a fully integrated contemporary approaches based on the general principles of integrated water resources management (IWRM), water sensitive urban design (WSUD) and integrated urban water management (IUWM). The plans also lead to achieving financial self-sustainability and provision of 24/7 water supply. Risk assessment for drought, hydrological hazards (especially flooding) and use of water against fire is also factored-in.

Resource Sustainability: The report begins with an overall review of the natural conditions in the study area with particular reference to the availability of renewable water in the study area. A basic principle of sustainability dictates that if water usage within a given area exceeds the natural capacity of the ecosystem to renew water within that area, the water usage could become unsustainable. This implies that either the natural storage (both surface and groundwater) will start depleting, or water will have to be imported from a distant source. Either of the two situations may be deemed unsustainable. The estimation of total renewable water in the study area, therefore, becomes the lynchpin for sustainable water management. The availability of renewable water, in other words, would also dictates the sustainable limits of growth for Rawalpindi's urban and peri-urban areas.

Integrated Resource Management: Various principles and practices of IWRM can be optimally applied at regional and sub-regional scales if the watershed boundaries are used as the administrative boundaries for managing water resources. The boundaries of RWASA jurisdiction, though, are not perfectly aligned with the regional or sub-regional watershed boundaries in the region. RWASA area lies almost entirely within the watershed of Soan River. For the sake of integrated water resources evaluation and management, this study evaluates the upper watershed of Soan River as shown in Figure 1. The watershed is defined by Margalla Ridge in the northwest, Murree Hills in the north and then the less conspicuous ridgelines to the east and west which generally define the upper watershed boundaries of Soan River. The watershed boundary in the south is defined by cut off points of Soan River and its tributaries flowing down stream of the RWASA jurisdiction. The watershed boundaries enclose Islamabad and surrounding hills in the north and Rawalpindi and its surrounding peri-urban areas in the south. The current configuration of water shed vis-à-vis the administrative boundaries makes RWASA jurisdiction the lower riparian while Islamabad and surrounding hills as the upper riparian. Total of area of the water shed is 2763 square kilometer while that of RWASA jurisdiction, as highlighted in Figure **1**, is 873 square kilometre. This water shed was analyzed in the study for evaluation of water resources, including the development of a regional groundwater model.

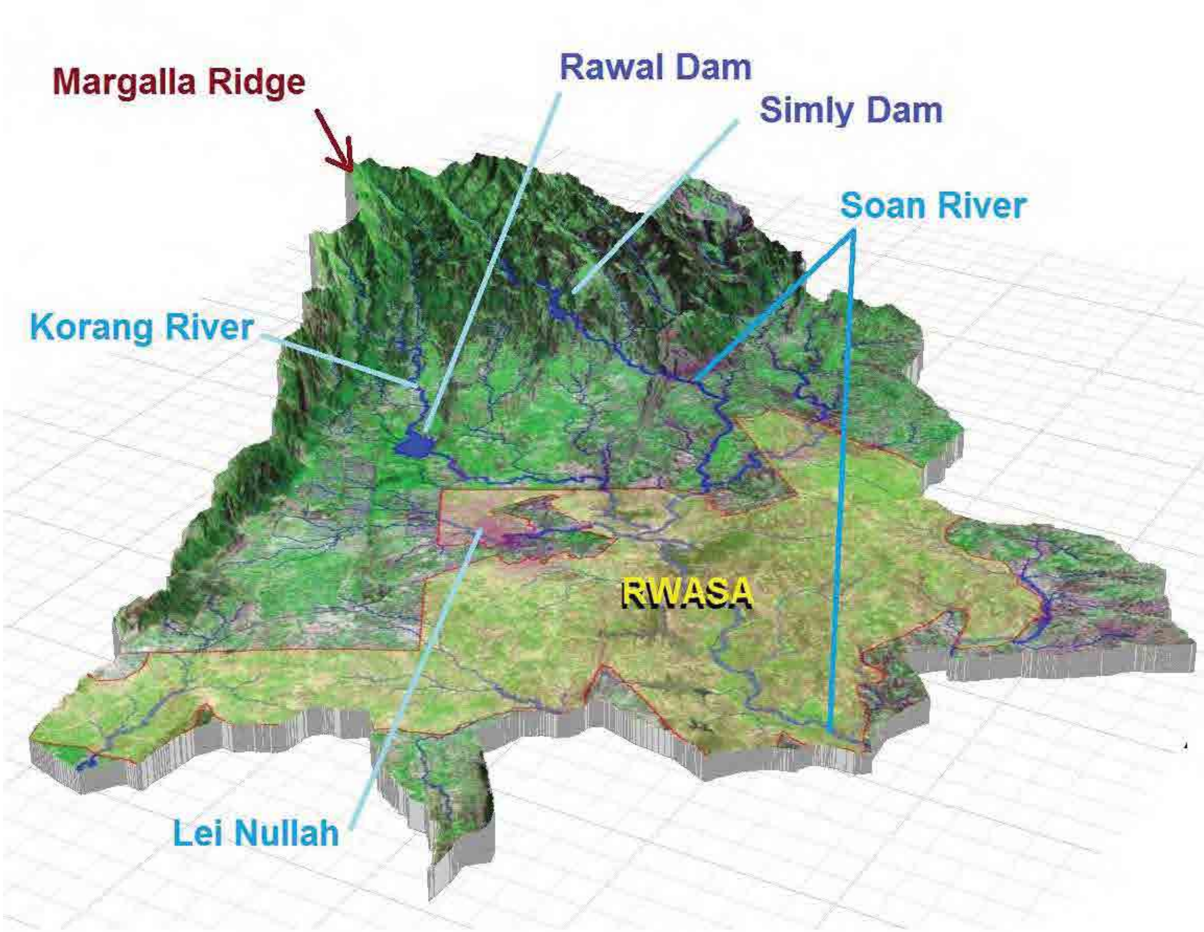

Figure 1: 3D representation of watershed. The RWASA jurisdiction is demarcated which lies in the southern part of the watershed.

Population Projection: The combined population of Rawalpindi and Islamabad (the twin cities), as per 1998 census, was 1.94 million. Projected at the current growth rates, the combined population of the twin cities could exceed 11 million by 2040 as estimated by Ministry of Finance[1], while that of RWASA jurisdiction will be close to 5.8 million. This estimate may look on the higher side as the fertility rates are on the decline, however, with increasing trend of urban migration to Rawalpindi and Islamabad (with a trend of lots of housing schemes being promoted in the area), this estimate may even exceed. For the sake of planning water requirements within RWASA Jurisdiction for the planning horizon, a population of 6 million has been assumed.

Water Demand: Water supply at the rate of 40 gallons per capita per day (0.5 cubic meters per person per day) has been envisaged for the residents of RWASA jurisdiction as already approved in Rawalpindi Master Plan (1996-2016) [2] . The annual water requirement for the planning year 2040 for an estimated population of 6 million comes out to be 398 million cubic meter (MCM). Daily water demand for RWASA for the planning horizon then comes out to be 1.1 MCM per day or 242 million gallons per day (mgd).

Renewable Water within the Water Shed: Rainfall is the main source of renewable freshwater in the area. All other renewable resources in the area are directly or indirectly driven by rainfall. This makes measurement and management of rainfall as one of the most important elements of sustainable development of water resources. Estimates of rainfall distribution over the watershed were made based on the annual rainfall data acquired from Pakistan Meteorological Department. Water flowing in the rivers/streams, storages in natural and artificial lakes, and groundwater (aquifers), all comes through this precipitation within the watershed. The mean total annual rainfall in the watershed varies from more than 1554 mm in the mountains in the north to 1052 mm in the plateaus in the south as shown in Figure 2. Total mean annual rainfall over the watershed is averaged at 1296 mm, bringing in an average annual volume of water equal to 3571 MCM which drives the hydrological cycle of the watershed.

[1] Ministry of Finance http://www.finance.gov.pk/survey/chapter_10/16_Population.pdf
[2] Rawalpindi Master Plan 1996-2016, Government of the Punjab, Local Government and Rural Development Department, No. So, 111(LG) 7-12/98 dated 25 Sept 1998

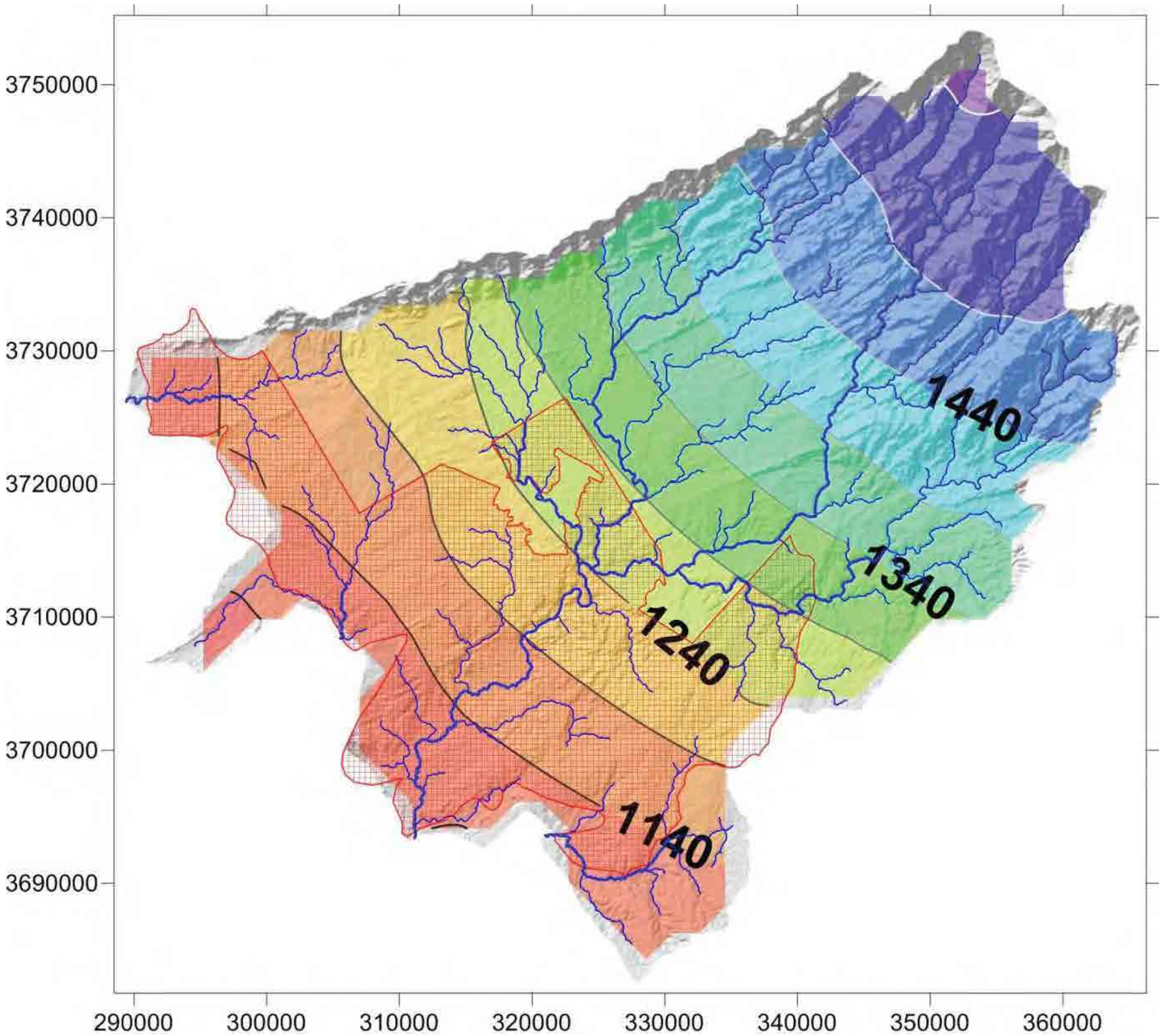

Figure 2 **Variation of mean annual rainfall in millimeters over the watershed. RWASA boundary is also shown where rainfall average is lower than the northeastern part of the watershed**

Evapotranspiration (ET) estimates for the study area were obtained from Bastiaanssen et. al. (2012)[3], based on NOAA/MODIS satellite data of the Indus Basin as shown in Figure 3. ET in the study area varies from 461 mm/year to 750 mm/year. For the planning purposes, it was taken as 700 mm/year, leaving behind 596 mm/year which renews water in the rivers, streams, lakes and aquifers. The mean annual renewable volume of water thus becomes 1645 MCM, which is reckoned as the total annual renewable water in the watershed.

[3] Bastiaanssen, W.G.M., Cheema, M.J.M., Immerzeel, W.W., Miltenburg, I.J. and Pelgrum, H. (2012). Surface energy balance and actual evapotranspiration of the transboundary Indus Basin estimated from satellite measurements and the ETLook model. *Water Resources Research 48:*

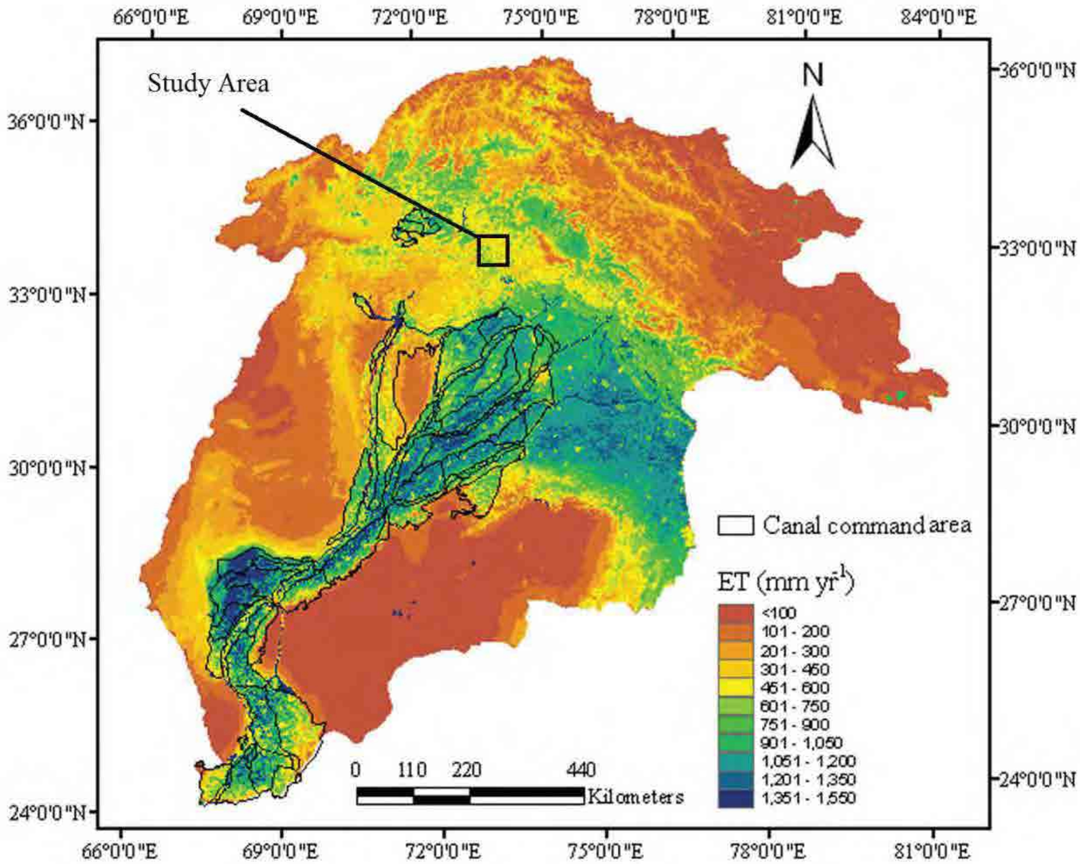

Figure 3 Evapotranspiration estimate from MODIS/NOAA satellite data (Betiaanssen et al 2012)

Renewable Water for RWASA Jurisdiction: Mean annual rainfall within RWASA jurisdiction is 1176 mm, which translates to annual volume of 1027 MCM. Excluding 700 mm loss in evapotranspiration, estimated renewable water from rainfall in RWASA jurisdiction is 417 MCM. Since RWASA jurisdiction is lower-riparian, it also receives overland flow (primarily river runoff) from the upper riparian areas and boundary flow into its underlying aquifer. Several datasets were analysed from the studies undertaken by CENTO[4] before the construction of Simly and Rawal Dams in the region. From these data sets it was estimated that mean annual river runoff, excluding the baseflow, is approximately 18% of annual rainfall. Using regional groundwater model for the area, analysis of

[4] The Role of Science in Developing Natural Resources With Particular Reference to Pakistan Iran and Turkey, Ist Edition, Pergamon Press, London, 1964, Part 4 "Surface Water Resources of the Federal Capital Area" pp . 163-176

hydrogeological data available from USGS[5] , and further analysis of data incorporating ET estimates, water balance components were derived for RWASA as shown in Figure 4:

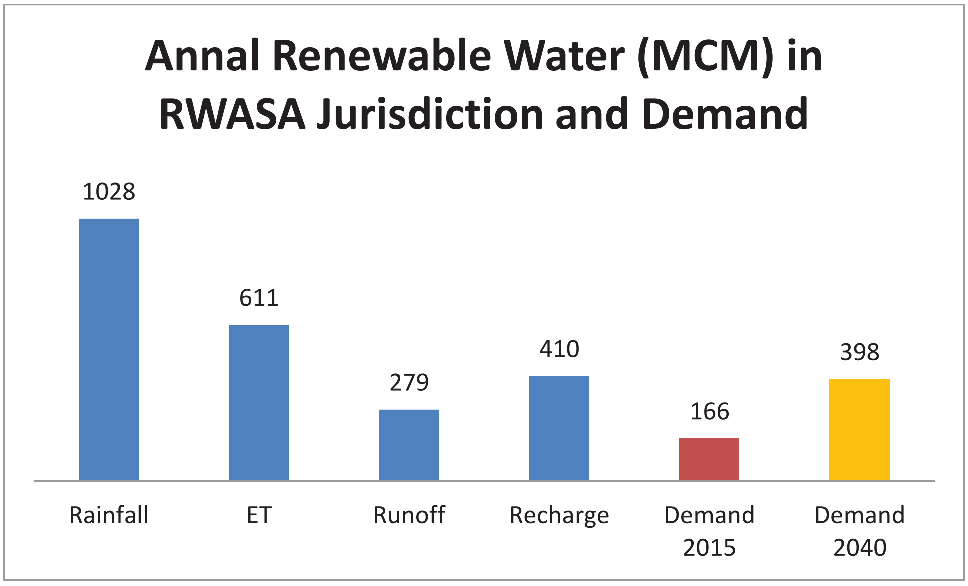

Figure 4 **Water balance components for annual renewable water (in million cubic meter) versus current and future demand**

From the regional level study presented in this report, the above figures point towards the potential of groundwater recharge in the RWASA jurisdiction which exceeds the total demand for 2040. However, at this point in time, the simplistic conclusion that current recharge rates are enough to meet the future demand may not be drawn. It should be noted that this figure for recharge is spread over an area of 873 square kilometres and also includes the boundary flow entering RWASA jurisdiction from up-slopes of Islamabad and surroundings. The area is full of irregularities and local geological variability which must be analysed in detail to exploit and/or manage this potential. This study, therefore, only highlights the potential and possibilities of managed recharge to meet future demands while concludes that there is enough renewable water (689 MCM, both surface water and groundwater), flowing though the area to meet future demands (398 MCM).

Future Water Works: The future water works required to exploit the potential of total renewable water within RWASA jurisdiction, as shown in Table 1, include important elements of water sensitive urban designs for storm water management, rain water harvesting (at local, municipal and regional scales), management and treatment of waste water, computer controlled well fields with high

[5] Environmental Geology of the Islamabad-Rawalpindi Area, Northern Pakistan. USGS Bulletin 2078G, U.S Department of Interior, U.S. Geological Survey

capacity well clusters, recovery and rehabilitation of right of ways of natural water courses, additional construction by-laws (to include water used efficiency and WSUD), and solid waste management etc. If the potential of renewable water as shown in the table is successfully exploited, it will bring perpetual sustainability of water resources to meet current and future demands.

Table 1 Annual Water Demand Compared to Renewable Water in the Study Area

Component	Quantum
Mean available renewable water per year	689 MCM
Yearly demand by 2040	398 MCM
Yearly demand as % of available renewable water in 2040	75%
Current yearly demand	166 MCM
Current yearly demand as % of available renewable water	31%

24/7 Water Supply: The plan presented here takes advantage of water resources within the area and has the potential to develop water resources and distribution systems to cater for 24/7 water supply.

Risk Management and Protection from Droughts: An estimation of aquifer capacity was also made. Based on the geological information, most of the area within the RWASA jurisdiction is capable of holding water within the top 200 meter of regolith. Given the mean specific yield at 0.17, the storage capacity for extractable groundwater in the aquifer is estimated at 3000 MCM. Once the aquifer is filled to its capacity, it can store 7.5 years' worth of water to meet the 2040 demand projections. In other words, managing the aquifer at 3000 MCM means a protection against total drought for more than 7 years. This in-built safety against droughts is one of the major highlights of the master plan being presented in this project.

Rainwater Harvesting: Based on above figures, this study proposes a plan for water supply by exploiting the most abundant and local resource of water within the study area, i.e., rainfall. The study proposes state-of-the-art rainwater harvesting infrastructure which can be gradually build within RWASA jurisdiction by setting aquifer recharge/rainwater-harvesting targets for phase-wise development. The rainwater harvesting targets will begin at 16% and will gradually rise to 33%.

Paradigm Shift from Surface to Groundwater: All previous reports and studies, as analysed in Study A, have mostly emphasized on exploitation of surface water resources and proposed construction of more dams and/or proposed import of water from the distant resources outside the study area. All such solutions are unsustainable in the long run (energy costs, silting of dams etc.). Unfortunately, no previous study has looked into the huge potential offered by rainfall and available aquifer storage within the study area. This study, however, carried out a comprehensive analysis of the combined potential of rainwater and natural aquifer systems in the study area and concludes that it is possible to meet all water demands, in a fully sustainable manner, by proper management of rainwater and aquifers.

A Touch of Future: The proposals made in this study are based on contemporary concepts and principles of Integrated Water Resources Management (IWRM), Urban Strom Water Drainage (USWD), Waster Sensitive Urban Design (WSUD) and Holistic Catchment Management. Using these modern-day tools and best management practices, a conceptual framework for water supply, sewerage, drainage and waste water treatment systems in Rawalpindi has been envisaged in this study, which is fully integrated with environmental protection, climate change and energy efficiency. The conceptual framework targets sustainability in all aspects of environmental, economic and social elements. Both hard and soft solutions for holistic water management have been proposed in the study which are built around Education, Enforcement and Engineering. The hard solutions generally include engineering designs and infrastructure and are strongly linked to economic and environmental sustainability. The soft solutions include institutional restructuring and capacity building for RWASA staff, other operations/maintenance staff, and law enforcement staff. Awareness campaigns for public are also suggested to achieve full social sustainability in the system.

Regional Master Plan: The last Master Plan for Rawalpindi was made for the period of 1996 to 2016[6] and was approved in 1998. An update on Master Plan beyond 2016 has not yet been made. This study focusing on Master Planning for Water Supply, Sewerage, Drainage and Waste Water Treatment System in Rawalpindi up to year 2040, therefore, is being done in the absence of an overall Master Plan for the same planning horizon. The plan presented in this study would, therefore, be subject to revision as and when future/updated Master Plan of Rawalpindi beyond 2016 is adopted by Rawalpindi Development Authority (RDA).

[6] Rawalpindi Master Plan 1996-2016, Government of the Punjab, Local Government and Rural Development Department, No. So, 111(LG) 7-12/98 dated 25 Sept 1998

Background

Rawalpindi is an older and much larger city and is a centre of industrial, commercial, and military activity. It lies along the ancient trade route from Persia and Europe across the Khyber Pass to India. The area has been a cultural meeting place and invasion route for millennia and was visited by Alexander the Great, Genghis Khan, the Mogul conquerors, and other prominent historical figures. Rawalpindi itself was settled around 1765 and grew to importance during the late 1800's, when it became an important staging ground for the British Afghan campaigns. Today it remains the site of a major military cantonment and headquarters of the Pakistan Armed Forces.

Rapid growth of both Islamabad and Rawalpindi to a combined population exceeding 3 million has made ever-increasing demands on natural resources and caused adverse effects on the environment. Some of the major concerns are the degradation in the quality of water resources, unsustainable withdrawal of groundwater, ever increasing demand of water in all sectors, and pollution of both surface and groundwater resources due to improper disposal of both solid and liquid waste.

Increasing stress on the available water resources in the search for improved economic well-being and concerns for the pollution of surface water and groundwater have highlighted the central role of hydrology in all water and environment initiatives. Hydrology forms the basis for water resources assessment and management and the solution of practical problems relating to water consumption by humans, floods, droughts, erosion/sediment transport, environment, and pollution.

The accepted principles of integrated water resources management (IWRM) dictate that, in order to achieve environmental sustainability and economic productivity leading to social well being of citizens, the rivers must be managed at the basin level. This approach calls for integrated solutions within a watershed boundary, which may be shared between more than one political or administrative jurisdiction. The approach adopted in this study takes advantage of the latest best management practices and cutting edge methodologies of contemporary water management.

Study Area & Watershed Boundaries

The study area comprises RWASA jurisdiction which includes a total of 73 Union Councils (UCs).

The water shed boundaries surrounding the Study Area (RWASA's Jurisdiction) are generally defined by the northern water shed boundaries of Soan River. The topography is rolling down from Northeast to Southwest. Margalla Ridge in the North and Northeast forms the crest line of the watershed in the hilly terrain which receives most of the rainfall feeding the watershed. The watershed is shared between Islamabad Capital Territory (ICT) – mostly administered by Capital Development Authority (CDA), Murree-Kahuta Development Authority (MKDA) and Rawalpindi Development Authority (RDA).

The following map in Figure 5 outlines the RWASA jurisdiction within the contributing watershed on the up slopes.

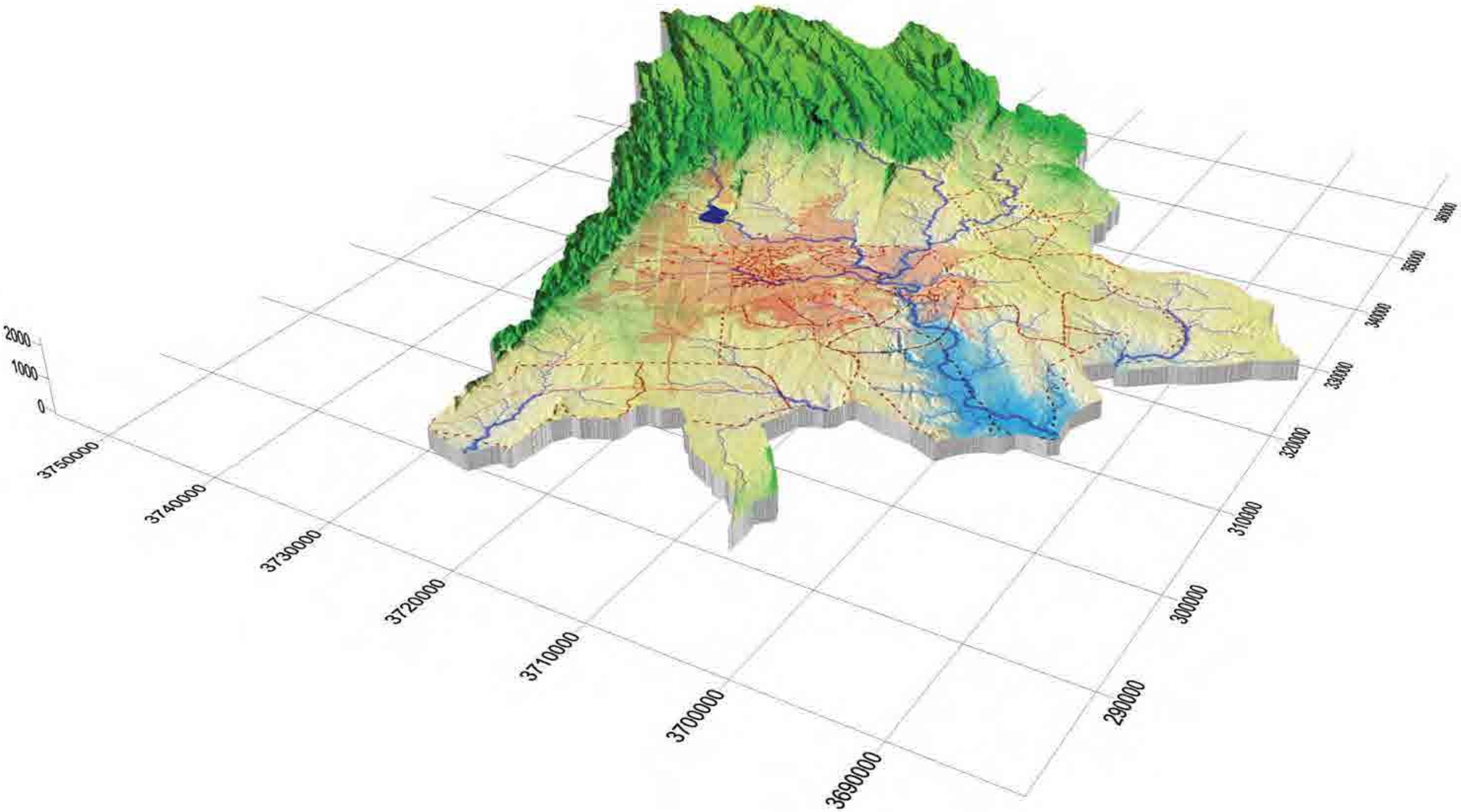

Figure 5 RWASA UC Boundaries have been shown in dotted rid lines. Lightly shaded red areas are the buildup urban areas of Rawalpindi and Islamabad.

Today, when water is perceived to be a matter of mutual concern, all stakeholders, from all the political and administrative jurisdictions within the watershed need to participate and play important roles in the process of developing a Master Plan for future, which is integrated in nature, environmentally sustainable and brings social and economic wellbeing to the residents of the watershed – irrespective of their administrative/political jurisdiction.

Many institutions and agencies within the watershed are engaged in the collection of hydrological data and information using different measurement procedures. The resulting lack of homogeneity in the observations gives rise to a lack of confidence. It is imperative, therefore, that all these partners be made aware of the manner in which the hydrological data are collected, the limitations and the reliability of the data, and how they are to be managed by the responsible organizations in the watershed. Transparency in data collection, storage and sharing is an essential element for cooperation among various users.

> In a sustainable community, resource consumption is balanced by resources assimilated by the ecosystem.

A tedious exercise and effort was required to collect and organize the datasets in GIS Format before it could be utilized in conducting the hydrological and hydrogeological studies presented in this study. A quality management framework for hydrological information was adopted while developing the protocols for GIS database. Inclusion of metadata for all GIS layers had been a part of this protocol.

The growing demand for freshwater resources has increasingly focused the attention of governments and civil society on the importance of cooperative management. Sharing the benefits of cooperation and even conflict prevention stem from a broad understanding of the principles and mechanisms through which these results can be achieved.

The risk factor in resource development for water supply, primarily due to hydrological variability was given due consideration. The risks mitigation strategies have been implemented in the conceptual design and operations proposed in this study. The mitigation strategies are primarily based on integrated management of resources.

Allocation of the resources or distribution of the benefits is essentially dependent on the knowledge of water availability and the related hydrological variability. A shared and accepted knowledge of the resources, their projected availability and the confidence in their accuracy greatly helped in assessing the feasibility and fairness of alternative management and investment scenarios presented here.

Surface water quantity and sedimentation are incessant elements of un-sustainability in the older water supply systems, as it reduces the capacity of lakes and reservoirs. It is also concerned with the measurement of sediment discharge and causes adverse environmental impacts on downstream ecology. The modern methodologies of resource development and exploitation adopted in this study forego the need for creating more surface reservoirs. It shifts focus to more sustainable and environmentally friendly approaches for managing the resources.

The sustainability of a community is largely determined by the web of resources providing its food, fibre, water, and energy needs and by the ability of natural systems to process its wastes

Groundwater is concerned with measurements from wells and the hydraulic properties of aquifers. The study has laid a huge emphasis not only on the exploitation of groundwater but also on managing recharge of the aquifer across the watershed to make groundwater exploitation a fully sustainable operation.

The development of water resources is not only constrained by their quantity but also by their quality. The study recommends and proposes methods for taking optimal advantage of ecological services for treatment and purification of both waste water and drinking water. Such approaches not only make the whole water supply and drainage operations more sustainable, but also cut down huge energy and infrastructure costs when supplemented with conventional water and wastewater treatment plants.

This study has been conducted in three parts as follows:

Part I Study of Water Resources (Hydrology and Hydrogeology)

Part II Development of Environmental and Social Assessment Guidelines and Protocols for WSS&D schemes

Part III Climate Change & Energy Conservation Strategy for RWASA

The study of water resources presented here is based on the latest, most advanced and cutting edge scientific concepts in the realm of contemporary water management. The conceptual thinking governing these concepts and interrelated science has also been explained to facilitate the readers who are not currently familiar with the latest science and best management practices of water management. For the benefit of general public as well as experts, the conceptual thinking behind this study is presented beforehand. It is generally believed, and wrongly so, that spending money on the projects related to restoration/protection of environment is less important than the development projects for human communities. The fact, however, is that if designs of development projects take advantage of ecological services through smart designs can not only save energy and infrastructure costs but also synergistically protect the environment and achieve sustainability. Ecological services can be used for aquifer recharge, decomposing pollution, improving water quality, generate renewable energy etc., thus leading to a sustainable future.

Part I

Study of Water Resources

(Hydrology and Hydrogeology)

1. Hydrology and Hydrogeology of the Study Area

For the purpose of this study, upper water shed of Soan River was analyzed for availability of water resources in the area. A comprehensive geological mapping for Islamabad and surrounding hill was conducted by USGS[7] as shown in Figure 6. The delineated boundary of the water shed covering the upper Soan watershed and RWASA jurisdiction as overlain on the USGS Geological study is shown in Figure 7.

The Soan and Kurang Rivers are the main streams draining the area. Their primary tributaries are the Ling River, draining north-westward into the Soan; Gumreh Kas, draining westward into the Kurang from the area between the Kurang and Soan; and Lei Nala, draining southward into the Soan from the mountain front and urban areas. The Kurang and Soan Rivers are dammed at Rawal and Simly Lakes, respectively, to supply water for the urban area. Extensive forest reserves in the headwaters of the Kurang and Soan Rivers benefit the quality and quantity of supply. A supplemental network of municipal and private wells as deep as 200 meters (m) produces ground water primarily from Quaternary alluvial gravels. The altitude of the water table decreases from about 600 m at the foot of the Margalla Hills to less than 450 m near the Soan River, so that the saturated zone generally follows the topography. The water tables used to be from 2-20 m below the natural ground surface in the eighties[8]. These have now dropped down to more than 100m at in the urban areas due to unsustainable exploitation of groundwater.

Lei Nala carries most of the liquid waste from Rawalpindi and contributes greatly to the pollution of the Soan River below their confluence. Solid-waste disposal practices threaten the quality of surface water and groundwater reserves.

[7] Plate A1 from Environmental Geology of the Islamabad-Rawalpindi Area, Northern Pakistan. USGS Bulletin 2078G, U.S Department of Interior, U.S. Geological Survey

[8] Ashraf, K.M., and Hanif, Mohammad, 1980, Availability of ground water in selected sectors/areas of Islamabad—Phase I and II: Pakistan Water and Power Development Administration Ground Water Investigation Report 35, 30 p

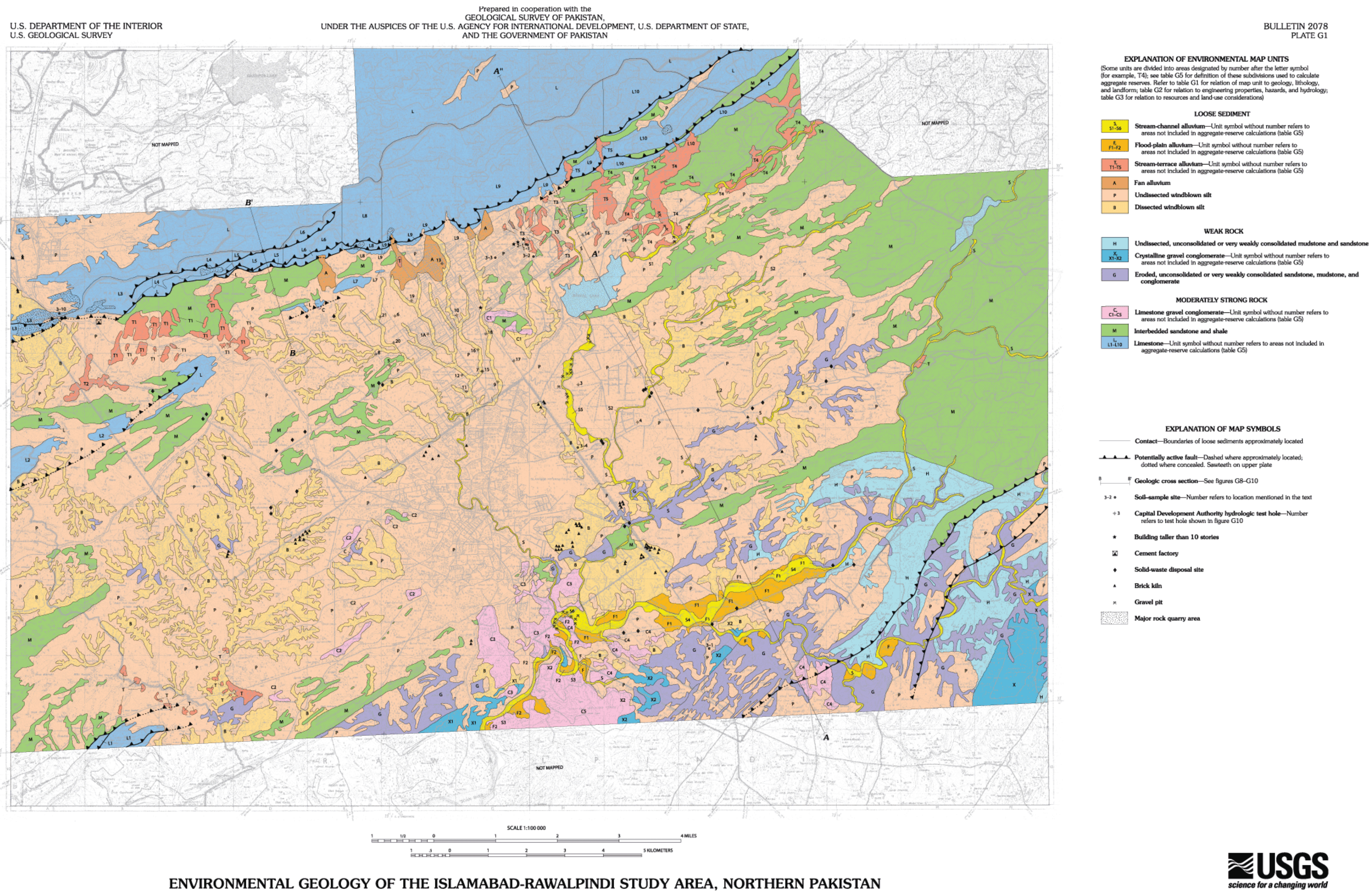

Figure 6 USGS study – Geology map for Rawalpindi Islamabad

USGS Geological Study

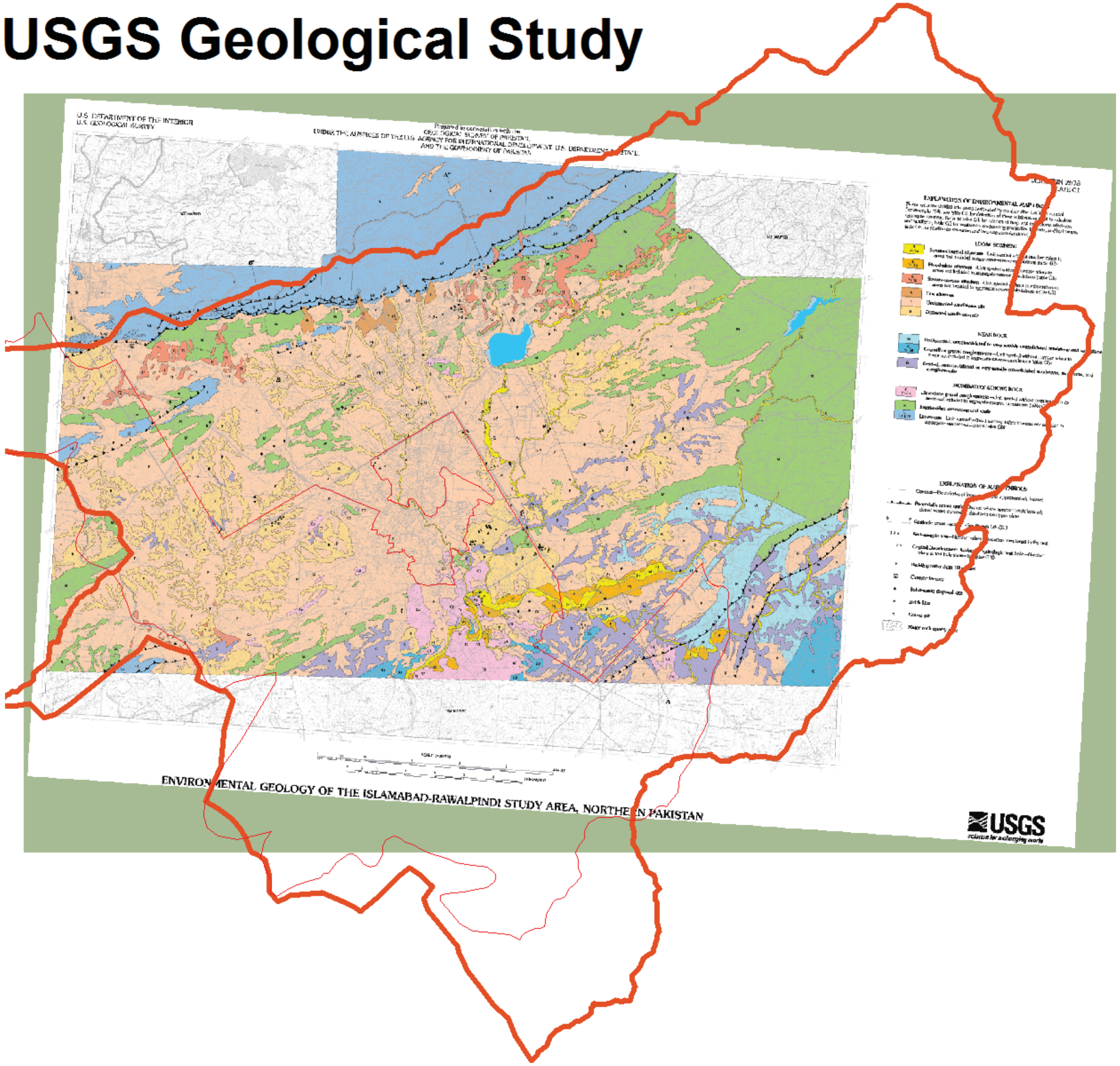

Figure 7 Study Area in the backdrop of USGS Map

1.1. Terrain & Landforms

When discussing with reference to water resources, the terrain of Rawalpindi cannot be discussed in isolation as the higher grounds to the north and north-east, mostly in the political jurisdiction of Islamabad, control the hydrology and hydrogeology of the area. The following discussion is covers the terrain and landforms of the watershed within which both Rawalpindi and Islamabad are located.

The terrain in the metropolitan area of Islamabad-Rawalpindi consists of plains and mountains whose total relief exceeds 1,175 m. Three general physiographic zones trend generally east-northeast. The northern part of the metropolitan area lies in the mountainous terrain of the Margalla Hills, a part of the lower and outer Himalayas, which also includes the Hazara and Kala Chitta Ranges. The Margalla Hills, which reach 1,600-m altitude near Islamabad, consist of many ridges of Jurassic through Eocene limestone and shale that are complexly thrusted, folded, and generally overturned.

South of the Margalla Hills is a southward-sloping piedmont bench underlain primarily by folded sandstones and shale of the Rawalpindi Group (Miocene). Although the relief of the piedmont area is generally low and dominated by extensive plains of windblown silt, the piedmont area also includes many ridges and valleys that have been buried by alluvial deposits from the hills. Buried ridges of sandstone are generally covered by inter-bedded sandy silt and limestone gravel that locally exceed 200 m in thickness; these deposits, in turn, have been dissected and then buried under a layer of eolian loess and reworked silt that locally exceeds a thickness of 40 m. The gravel and loess are especially important to the environmental geology because they form most of the building foundations and because gravel is the primary ground-water aquifer. West of Rawalpindi, plains of thick, easily eroded loess are extensively dissected into shallow badland valleys. East of Rawalpindi, the folded ridges of Rawalpindi Group rocks rise above the alluvial cover to form prominent hills. Urban development is concentrated in the piedmont bench area, which is little dissected in its northern part, where Islamabad is located, but is more deeply dissected toward the south near the Soan River, where Rawalpindi is located.

In the southernmost part of the area, the Soan River valley extends generally along the axis of the Soan syncline at an altitude of about 425 m. The Soan is incised more than 40 m below the level of extensive silt-covered plains north and south of the river. Southeast of Rawalpindi, upstream from the Grand Trunk Road Bridge, the Soan channel and flood plain extend 1.5 kilometer (km) across the valley floor. Elsewhere, the valley bottom is much narrower. Beds of fluvial sandstone, mudstone, and conglomerate of the Siwalik Group of Neogene to Pleistocene (?) age underlie the southern area and crop out along the many steep-sided stream valleys that dissect the land. The beds dip steeply on the north limb of the syncline north of the Soan River, and more gently on the south limb. The piedmont bench and Soan valley make up the northern edge of the Potwar Plateau, which extends south-westward for 150 km.

1.1.1. Depositional Landforms

Depositional Landforms in the area can be classified as follows:

Streambeds, low islands, and bars.—Low land in valley bottoms that is generally covered and reshaped by flowing water each year. These features are formed by braided or meandering streams. The surface is generally sand and gravel, and there is little or no soil development. The surface is unstable and lacks vegetation except for quick-growing grass. Slopes are less than 4 percent.

Stream flood plains.—Low benches slightly above the stream channels in valley bottoms. They are above water level most of the year but are commonly flooded whenever the streams overtop their banks. The surface is generally fine sand, silt, and clay with a relatively high organic content and fertile soil. Slopes are less than 4 percent.

Stream and fan terraces.—Lower terraces form wide benches along the sides of modern stream valleys similar to flood plains, but the terraces are higher above the stream and are seldom flooded. Higher terraces form gravel-capped ridges and flat-topped hills that never flood. Terraces are dissected relict flood plains; uplift of the old depositional surface and erosional lowering of streambeds have left the terrace surfaces above the reach of most floods. The highest terraces are along the mountain front in stream valleys and alluvial fans and generally are preserved where limestone gravel that was cemented by calcium carbonate from ground water forms hard layers resistant to erosion. Under the terrace surface, a thin layer of fine-textured soil generally overlies channel deposits of sand and gravel. The terrace surfaces generally slope less than 10 percent, but erosional scarps on the side of the terrace slope steeply.

Alluvial fans.—Fan-shaped bodies of gravel-rich alluvium deposited near the mountain front where streams emerge from steep canyons. Streams on the fan surface commonly shift their courses laterally; floods and debris flows episodically cover parts of the fan surface with water and thick layers of sediment. The time interval between major debris flows may be tens of years, so the hazard is commonly underestimated. Cemented limestone gravel in the alluvium may make excavation difficult. Slopes are less than 15 percent.

Loess plains.—Plains and gently sloping hills of fine silt and clay built up from airborne dust burying pre-existing hills and valleys. The landscape has also been smoothed by thin sheets of rainwater flowing across the surface. The soil is fertile and easily tilled but is easily eroded by water and wind. The geologic formation underlying these plains is the Quaternary Potwar Clay. Slopes are less than 15 per cent.

1.1.2. Erosional Landforms

Loess badlands and gullies.—Steep-sided but generally shallow ravines eroded in soft loess (windblown silt and clay of the Potwar Clay). These gullies tend to grow and coalesce through headward erosion. Growth of loess badlands can be controlled, and some of the land can be reclaimed through conservation measures. Loess badlands are especially extensive south and west of Rawalpindi.

Bedrock badlands and gullies.—Areas of generally parallel, deep ravines eroded in steeply dipping soft mudstone and sandstone of the Siwalik Group. Most of the gullies have formed along the strike of weakly consolidated beds separated by ridges of resistant, cemented sandstone. This landform develops from loess badlands and gullies when streams cut down through the base of the loess into steeply dipping bedrock. Such terrain is extensive west of Riwat on either side of the Soan River. Bedrock badlands are more difficult to reclaim than loess badlands. Slopes are 50–100 percent.

Gentle hill slopes with angular clasts.—Rolling hills generally sloping more than 15 percent but less than 75 percent. Some ledges of rock may crop out, but the surface generally is covered with thin soil of sand, clay, and broken rock derived from weathering of the underlying bedrock. This type of slope is generally found on low hills underlain by sandstones of the Rawalpindi and Siwalik Groups.

Gentle hill slopes with rounded clasts.—Rolling hills generally sloping more than 15 percent but less than 100 percent. Some ledges of rock may crop out, but the surface generally is covered with thin sandy soil derived from weathering of the underlying rock; the soil contains rounded cobbles

1.2. Geology

Sedimentary rocks exposed in the Islamabad area record 150 million years (Ma) of geologic history from the Middle Jurassic to the Quaternary. The period from about 150 to 24 Ma was characterized by slow, primarily marine deposition and little tectonic activity; that from 24 to 1.9 Ma by rapid, voluminous, continental deposition and slow subsidence; and that since 1.9 Ma by intense tectonism, extensive erosion, and subordinant local deposition dominated by coarse clastic continental sediment.

The oldest rocks exposed in the study area are Jurassic marine limestone and dolomite that were deposited on a continental shelf along the northern edge of the continental part of the Pakistan-India tectonic plate as it migrated northward before converging with the Eurasian plate. The oolitic, biomicritic, and intrasparitic types of limestone in the Samana Suk Formation indicate different amounts of energy in the various carbonate depositional environments. A short break in deposition during the Late Jurassic is represented by the unconformity between the Samana Suk and Chichali Formations. From the Late Jurassic to the Early Cretaceous, anaerobic bottom conditions and chemically reducing environments accompanied deposition of the glauconitic shale and sandstone of the Chichali Formation. During the Early Cretaceous, conditions changed to a slightly saline, shallow-water, reducing environment when the glauconitic sandstone of the Lumshiwal Formation was deposited. The calcareous facies of the Lumshiwal Formation are near shore shallow-water deposits. Emergence of the area above sea level during the mid-Cretaceous is indicated by the unconformity between the Lumshiwal and Kawagarh Formations north of the map area (the Kawagarh is missing from the study area). During the early Late Cretaceous, the sea transgressed again, and the limestone and marl of the Kawagarh Formation were deposited in shallow- to deep-marine water.

During the Late Cretaceous to Paleocene, the area rose again above sea level. The exposed surface of the marine Kawagarh Formation was first eroded and then buried beneath highly weathered continental sediments of the Hangu Formation. In the map area, the Kawagarh was entirely removed; thus, the Hangu unconformably lies on the Lumshiwal Formation. Intense lateritic and bauxitic weathering of the Hangu Formation reflects the equatorial latitude of the Pakistan-India tectonic plate during the Paleocene. Following deposition and weathering of the Hangu, marine conditions returned and persisted through the early Eocene. Calcareous and argillaceous sediments of the Lockhart Limestone, Patala Formation, Margalla Hill Limestone, and Chorgali Formation were deposited during this time. This marine depositional sequence was followed by alternate marine and continental environments during which the Kuldana Formation was deposited. During the middle Eocene, initial contact of the Pakistan-India plate with Asia elevated the region above sea level and produced the unconformity beneath the continental Murree Formation.

By Miocene time, the sea had completely receded south of the map area, and during the Miocene and Pliocene, very thick continental deposits of the Rawalpindi and Siwalik Groups accumulated in the subsiding Himalayan foredeep region. These deposits consist of sediments eroded from highlands to the north that were uplifted and deformed by tectonic forces in the zone of convergence. The south margin of the deformed zone migrated southward into the Islamabad area, where it first caused coarser sedimentation but eventually so deformed and uplifted the area that deposition drastically decreased and erosion became the predominant sedimentary process. The tectonic migration that began during the Eocene continues to the present. The estimated average rate of southward migration during the Pliocene was 3 cm/1,000 yr, and the average accumulation of mud, sand, and gravel in the subsiding foredeep region was about 28 cm/1,000 yr[9].

During the Pliocene, sedimentation was controlled by an eastward-flowing river system. The conglomerate of the Soan Formation that was deposited by that river system during the late Pliocene consisted chiefly of quartzite and metamorphic clasts eroded from the Himalayan core and are similar to clasts in modern Indus River gravels. Local sedimentation stopped between 3 Ma and 1 Ma, when the Hazara fault zone developed, when limestone of the Margala Hills was thrust up along the north border of the study area, and when the sandstone and mudstone of the Rawalpindi and Siwalik Groups were folded and faulted throughout the area. The eastward-flowing river system was disrupted and superseded by the much smaller, southward-flowing Soan River system, and locally derived limestone gravel became the dominant component of the Lei Conglomerate; this conglomerate accumulated most thickly over the Soan Formation and other upturned Siwalik Group rocks along the axis of the subsiding Soan syncline at the southern edge of the map area.

During the Quaternary, climatic fluctuations along with tectonic uplift caused periodic incision of the drainage south of the Margala Hills and alternate periodic accumulations of silt and alluvial gravel from the Margala Hills, which filled the valleys and spread laterally to form wide plains of low relief. A great influx of windblown silt probably was blown from the braided outwash channel that originated in the highly glaciated headwaters of the Indus River. This eolian silt formed the thick deposits of loess that mantle the landscape and contribute to the burial of preexisting valleys. Loess deposition was probably most rapid during the glacial maximums, but it continues despite the present interglacial climate because very large glaciers still exist in the Indus River basin and contribute large amounts of fine-grained sediment, which causes the Indus to form a braided channel below the mountain front 50 km long and 10 km wide. Calculated rates of loess accumulation during the period from 170 to 20 ka range from 6 to 27 cm/1,000 yr .

[9] Raynolds, R.G.H., 1980, The Plio-Pleistocene structural and stratigraphic evolution of the eastern Potwar Plateau, Pakistan: Hanover, New Hampshire, Dartmouth College, Ph.D. dissertation, 264 p

Strongly developed soils are scarce in the Islamabad area, perhaps because of the seasonally dry climate and the lack of stable surfaces caused by alternation of erosion and loess deposition. Some paleosols, however, are preserved within the loess.

Pleistocene stream and fan-terrace deposits along the mountain front, preserved as much as 30 m above present drainage levels, reflect stream incision and provide a measure of continued tectonic uplift of the piedmont zone since their deposition. Distant tectonic events may also have affected the balance of aggradation and degradation. Tectonic tilting and uplift across the course of the Indus River (McDougall, 1989) near the gorge at Kalabagh, 200 km to the west, have caused major shifts in the course of the Indus and affected the base level of the Soan River[10] .

Active tectonism across the area continues in the form of folding, thrust faulting, and seismicity. A very large earthquake in A.D. 25 destroyed the Buddhist community at Taxila, about 25 km west-northwest of Islamabad. A more recent earthquake in 2005 also jolted the city.

1.3. Climate and Rainfall

Rawalpindi has monsoonal climate of rainy hot summers and cool dry winters; precipitation is characteristic of the semiarid zone of Pakistan. The monsoon rains usually start in June, peak in August, and end by September. A much smaller winter monsoon peaks in March. The four monsoon summer months always have some precipitation, but any of the other months can be completely dry. Annual rainfall of only 249.1 millimetres (mm) was recorded in 1982. The high of 1,732 mm was recorded in 1983. The average for 1931–87 was 1,055 mm. The maximum recorded temperature was 45.9 degrees Celsius (°C) in June 1972, and the minimum was –3.9°C in one January before 1961. Freezing temperatures are rare and have been recorded only in November, December, and January.

The highest intensity of storm/rainfall that has been recorded in the region was on 23rd July 2001. Islamabad received 622mm and Rawalpindi received 150mm in 6 hours duration. As a result of this heavy downpour, Lai Nullah, which is a drainage channel for both the cities, had its banks over flowing in Rawalpindi area, inundating and damaging property, livestock, and above all, human life.

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[10] McDougall, J.W., 1989, Tectonically induced diversion of the Indus River west of the Salt Range, Pakistan: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 71, nos. 3–4, p. 301–307

The following map in Figure 8, generated from annual rainfall data[11], shows that annual rainfall over the region varies from 1450mm to 1140mm. Rainfall is the only ecological mechanism for renewable water in the area. It provides water to all surface water reservoirs (natural or artificial), streams and groundwater aquifers. An estimated annual rainwater volume of 3580 Million Cubic Meter (MCM) pours into the watershed.

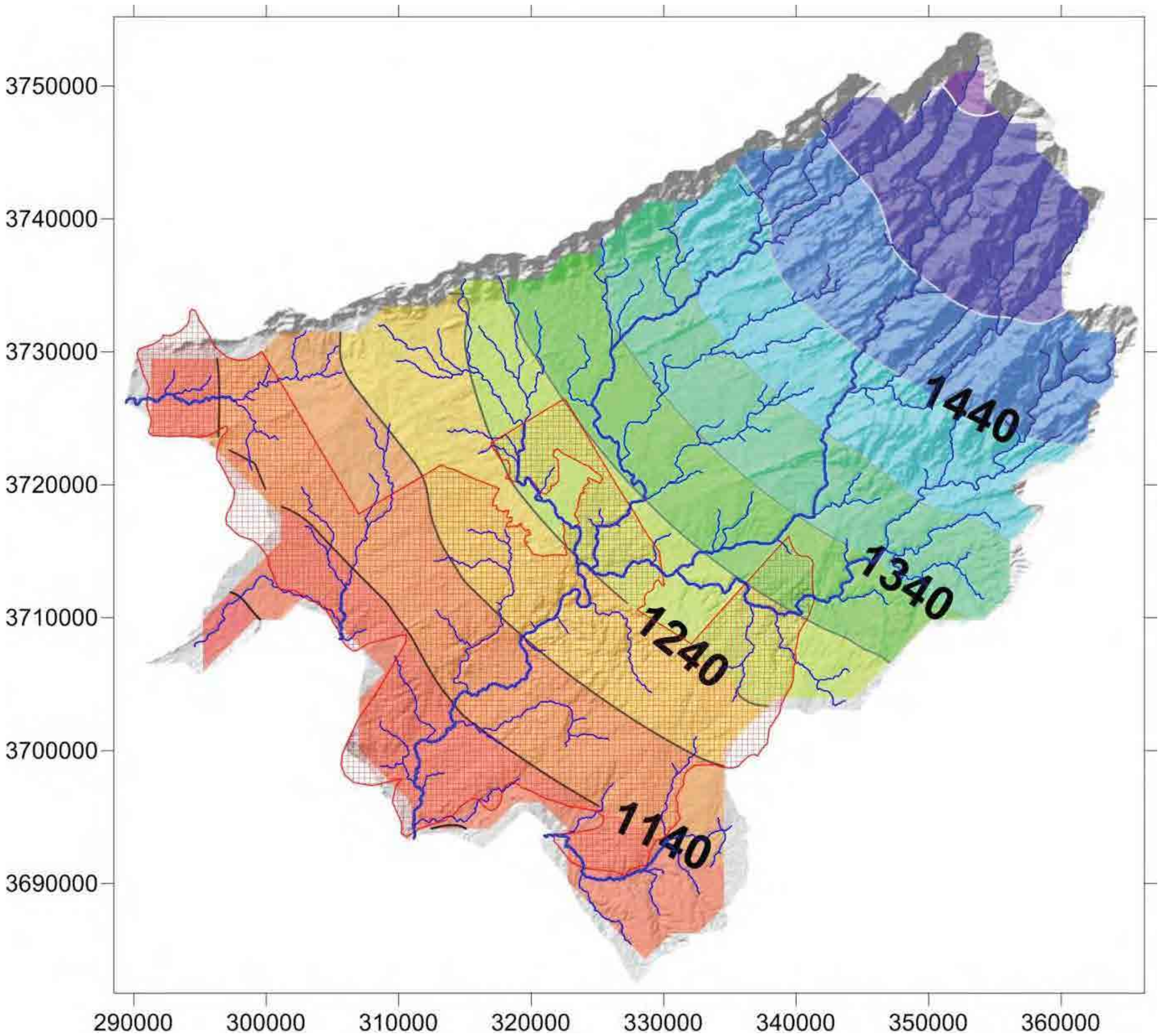

Figure 8 Map showing mean annual rainfall in upper Soan watershed. RWASA jurisdiction is shown as shaded area within the watershed.

[11] http://www.pmd.gov.pk/cdpc/Pakistan_mean_rainfall.pdf

1.4. Evapotranspiration

The surface energy fluxes and related evapotranspiration processes across the Indus Basin were estimated for the hydrological year 2007 using satellite measurements[12]. This study generated a map as shown in Figure 9. The study area lies in the ET band ranging from 450mm to 750mm per year. In order to make a conservative estimate of evapotranspiration losses, a planning figure of 700mm per year for the watershed was assumed for this study. The total estimated evapotranspiration losses for the entire watershed are estimated to be 1934 MCM.

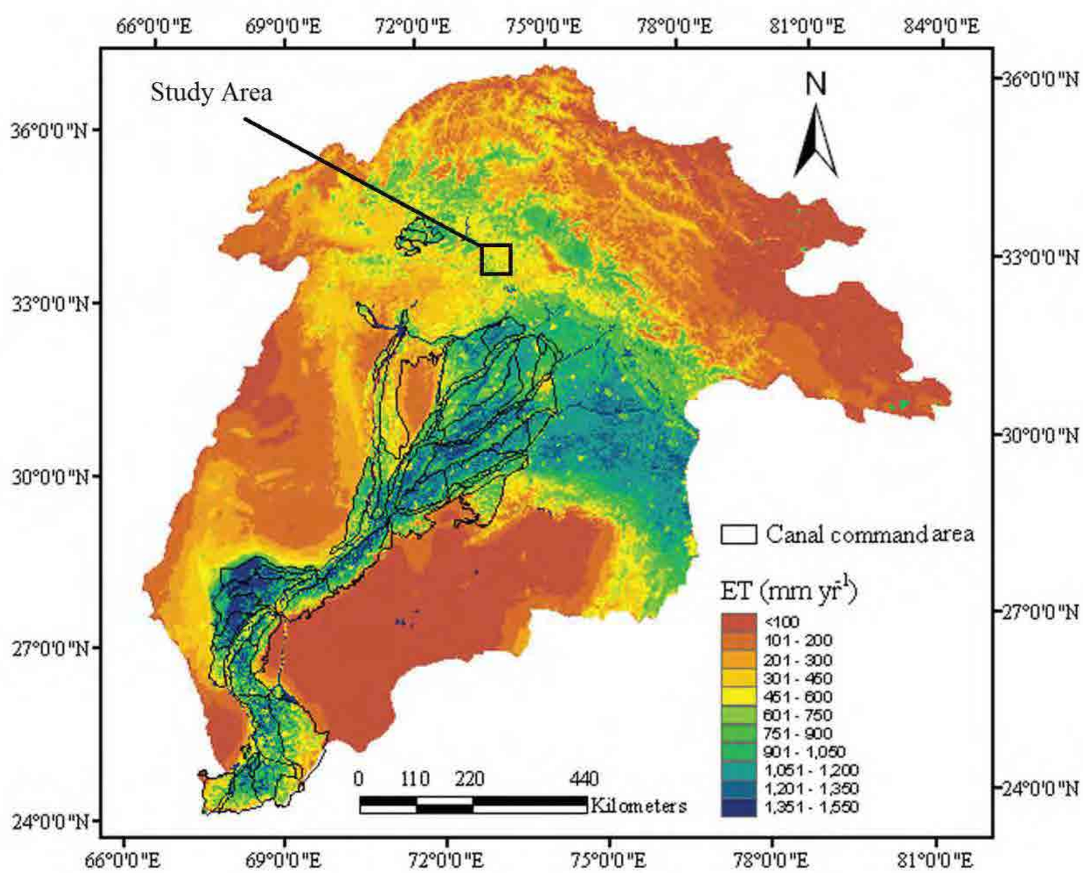

Figure 9 Evapotranspiration estimates for the entire Indus Basin using MODIS/NOAA data. The Study Area for RWASA is marked within the basin.

[12] Bastiaanssen, W. G. M., M. J. M. Cheema, W. W. Immerzeel, I. J. Miltenburg, and H. Pelgrum (2012), Surface energy balance and actual evapotranspiration of the transboundary Indus Basin estimated from satellite measurements and the ETLook model, Water Resour. Res., 48

1.5. Net Renewable Water in the Study Area

The difference between rainfall precipitation and evapotranspiration in the area is the net renewable water which is available to flow in streams and rivers and which can be stored in surface and subsurface reservoirs. Subtracting the mean annual evapotranspiration volume of 1936 MCM from the mean annual rainfall volume of 3580 MCM, the net renewable water in the area is estimated to be 1645 MCM for the entire water shed. This may be taken as the planning figure for exploitation of renewable water in a sustainable manner for the entire watershed.

1.6. State of Surface Water

The Soan and Kurang Rivers are the main streams draining the area. Their primary tributaries are the Ling River, draining northwestward into the Soan; Gumreh Kas, draining westward into the Kurang from the area between the Kurang and Soan; and Lei Nala, draining southward into the Soan from the mountain front and urban areas. The Kurang and Soan Rivers are dammed at Rawal and Simbly Lakes, respectively, to supply water for the urban area. Extensive forest reserves in the headwaters of the Kurang and Soan Rivers benefit the quality and quantity of supply. A supplemental network of municipal and private wells as deep as 200 m produces ground water primarily from Quaternary alluvial gravels. The altitude of the water table decreases from about 600 m at the foot of the Margalla Hills to less than 450 m near the Soan River, so that the saturated generally follows the topographic slopes and provides baseflow to Soan River at the dipping altitudes in the watershed. Lei Nala carries most of the liquid waste from Rawalpindi and contributes greatly to the pollution of the Soan River below their confluence. Solid-waste disposal practices threaten the quality of ground-water reserves.

1.7. State of Groundwater

The water table which used to exist in the urban areas at an average depth between 2 to 20 m in the 1980's[13] has now been reached 50 to 90 m[14]. However, regolith depth above the bedrock in most of the study area exceeds 400m. Top 35 m of the surface is overlain mostly alluvium mixed with broken rock fragments. Underneath this layer lies Lei Conglomerate formation, more than 150m

[13] Ashraf, K.M., and Hanif, Mohammad, 1980, Availability of ground water in selected sectors/areas of Islamabad—Phase I and II: Pakistan Water and Power Development Administration Ground Water Investigation Report 35, 30 p

[14] Primary data collected during this study from old 46 UCs.

thick, which forms the aquifer for most of the area. Moreover, the regolith, mostly composed of broken rocks, sandstone, and sand/gravel layers, is well capable of providing unconfined aquifer storage. If managed properly, there is huge aquifer storage space available in the study area. Un-managed exploitation of aquifer and with no managed recharge, the groundwater quality and quantity has issues at present. However, as explained in the chapter on Groundwater Model, the potential of groundwater as one of the most important available resource in the RWASA jurisdiction has been discussed in more detail.

2. GIS Mapping of Existing Infrastructure and Resources

The building of adequate databases through the monitoring of hydrological systems is a fundamental prerequisite of water resources assessment and management. This chapter reviews the adequacy of current monitoring networks and techniques in the light of a changing resource base and evolving water management philosophies related to sustainable development.

Data collection and processing will remain an incessant function throughout the project. A database structure has already been developed in GIS format. All existing/available data has been added to that database. There are both GIS and non-GIS (spatial and non-spatial) data. The database caters for both formats. At the end of the project, the complete database in its soft form will be handed over to RWASA

2.1. Existing Water Supply Infrastructure

Existing water supply infrastructure has been survey by the consultants, in collaboration with RWASA staff. All the GIS based components have been added to GIS Database. No spatial information and tabulated formats of spatial information on existing water supply infrastructure has been provided in Annexure D through H.

2.2. Existing Drainage Infrastructure

Existing drainage infrastructure within RWASA jurisdiction has been survey by the consultants, in collaboration with RWASA staff. All the GIS based components have been added to GIS Database. No spatial information and tabulated formats of spatial information on existing water supply infrastructure has been provided in Annexure D through H.

2.3. Existing Sewerage Infrastructure

Existing sewerage infrastructure within RWASA jurisdiction has been survey by the consultants, in collaboration with RWASA staff. All the GIS based components have been added to GIS Database. No spatial information and tabulated formats of spatial information on existing water supply infrastructure has been provided in Annexure D through H.

3. Water Quality

The review of various studies and periodic testing was undertaken in Study A. From the same review, following important points are drawn and explained below:

3.1. Sources of Pollution

Disposal of the large quantities of liquid and solid waste generated by the combined populations of more than 1.3 million people in Rawalpindi and Islamabad is a major problem that presently causes extensive pollution of ground water, surface water, and air. Islamabad has one of the most modern sewage treatment plants in Pakistan; sewage is carried by pipes to a disposal plant just north of Rawalpindi, where it is treated and the relatively clean effluent passes into a tributary of Lei Nala. Immediately downstream, however, waste water of all types enters Lei Nala as it passes through Rawalpindi. On the south side of Rawalpindi, Lei Nala enters the Soan River as a putrid stream covered with brown foam. Toxic waste may be part of the mixture, as Lei Nala passes through industrial areas, and the Rawalpindi area lacks an organized facility for disposal of toxic waste.

3.2. Solid Waste in Natural Water Ways

Solid waste is also dumped into Lei Nala and at various sites in the surrounding countryside. These sites are generally unsuitable for agriculture, either because of bedrock outcrops or because of gullies in the silt. The waste is spread, burned, and, in some places, covered with a thin layer of soil. These practices represent an attempt to reclaim waste land, and in a few places, crops are planted over the buried waste. Air pollution results from the burning in either case, but potential problems with pollution of surface and ground water are more severe in the bedrock outcrop areas. There is no impermeable barrier between the waste and the exposed bedding planes of steeply dipping permeable sandstone of the Murree Formation, so leachate from the waste can move rapidly into the ground-water flow system. Also, steep slopes in bedrock areas combined with lack of adequate cover material and drainage control structures allow leachate to move rapidly into surface streams. During the summer monsoon, leaching of waste is accelerated by precipitation averaging more than 250 mm/month and maximum temperatures averaging more than 34°C. Control of ground-water pollution is important because municipal and private wells are used extensively in Islamabad and Rawalpindi to supplement supplies from the Rawal and Simbly Lakes.

Potentially favorable sites for waste disposal near Rawalpindi exist in exhausted clay pits within the Postwar Clay. Compacted clay-rich silt has low permeability, and areas of silt suitable for cover can usually be found. When properly engineered, filled, and covered, the reclaimed pits may be suitable for low-intensity uses such as agriculture, storage yards, or parks and recreation.

3.3. Flooding

Lei Nala heads in the Margalla Hills and passes through the center of Rawalpindi, where homes and lives have been lost to flooding in low-lying areas. Although the stream is relatively small, it is entrenched, so floodwaters are confined to the narrow flood-plain zone at the valley bottom. This confinement increases the depth and suddenness of flooding in the small area affected but protects most of the population, who live above flood level. If continued losses are to be minimized, land use in the affected areas may have to be changed. Wide flood plains along the Soan River above the Grand Trunk Road bridge are subject to flooding but are not densely populated. Expansion of residential or industrial development onto the Soan flood plain should be carefully controlled, although dams on tributaries to the Soan help to reduce potential problems.

3.4. Waste Disposal

Disposal of the large quantities of liquid and solid waste generated by the combined populations of more than 1.3 million people in Rawalpindi and Islamabad is a major problem that presently causes extensive pollution of ground water, surface water, and air. Islamabad has one of the most modern sewage treatment plants in Pakistan; sewage is carried by pipes to a disposal plant just north of Rawalpindi, where it is treated and the relatively clean effluent passes into a tributary of Lei Nala. Immediately downstream, however, waste water of all types enters Lei Nala as it passes through Rawalpindi. On the south side of Rawalpindi, Lei Nala enters the Soan River as a putrid stream covered with brown foam. Toxic waste may be part of the mixture, as Lei Nala passes through industrial areas, and the Rawalpindi area lacks an organized facility for disposal of toxic waste.

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3.5. Rawal Lake Pollution Control

Rawal Lake is one of the major sources of drinking water for RWASA jurisdiction by it is prone to pollution due to rapidly expanding population centres in its catchment area. Most of these expansions are unplanned and unregulated and are dumping their solid waste and sewerage into the water channels leading to the Lake.

A comprehensive survey was carried out by the consultants to identify locations of pollution into the Lake. The following figure shows the point sources of pollution into the lake.

Annexure F through C give the description of each of these pollution sources and the type of pollution they are creating.

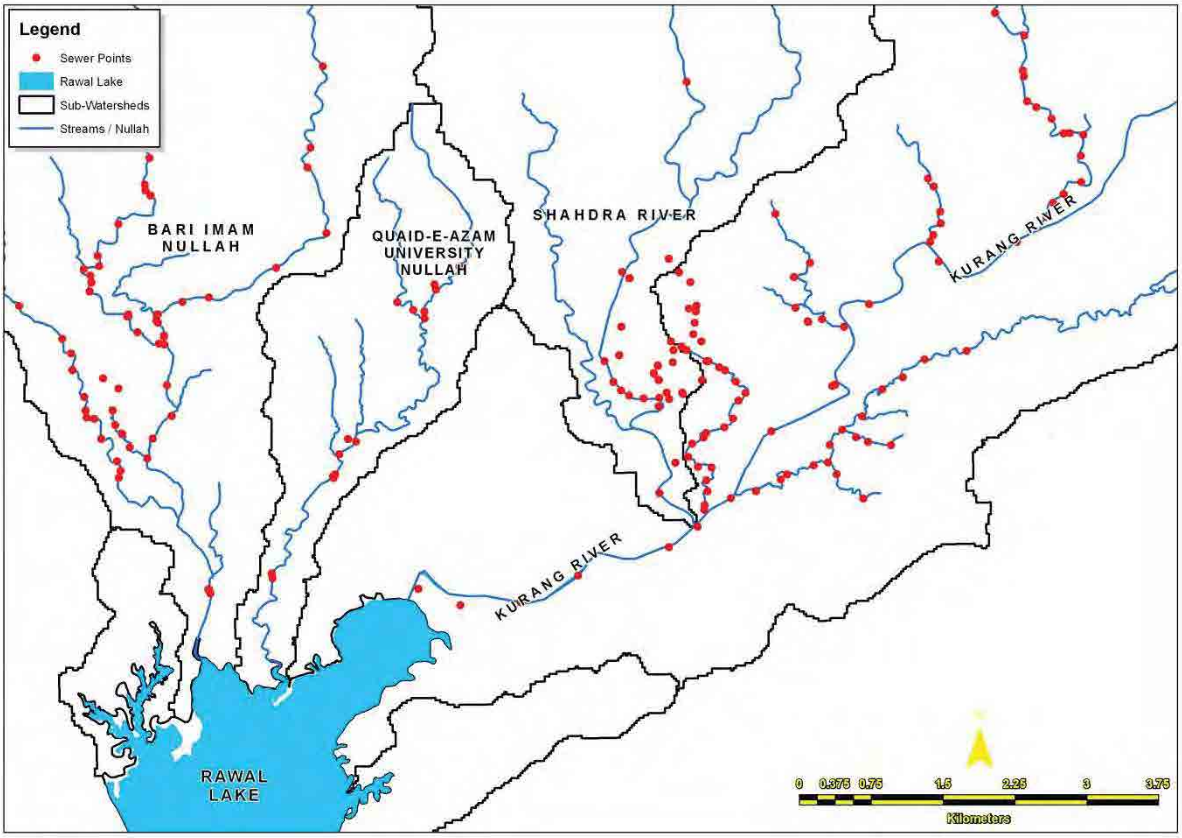

Figure 10 Sources of pollution in Rawal Lake

4. Groundwater Flow & Transport Model

The groundwater flow and transport model presented in this study was prepared using Interactive Groundwater (IGW)[15] – a numerical modeling system based on Modflow and MT3D algorithms. IGW is a finite difference groundwater flow and transport modeling system which solves the following partial differential equation within the model domain:

The partial differential equation describing flow in porous medial is usually written as

$$S_s \frac{\partial h}{\partial t} = \frac{\partial}{\partial X_i}(K_{ij} \frac{\partial h}{\partial X_j}) + q_s$$

Where S_s = the specific storage of the aquifer materials [L^{-1}],

h = the hydraulic head [L],

K_{in} = the hydraulic conductivity tensor [L/T]

X_i = the Cartesian coordinate [L], and

q_s = the source/sink term [T^{-1}].

The depth-averaged form of the equation (where depth is *b*) can be presented as follows which was used for the layered based geological layers in the model

$$S \frac{\partial h}{\partial t} = \frac{\partial}{\partial X_i}(T_{ij} \frac{\partial h}{\partial X_j}) + Q_s$$

where $S = S_s b$ = the storage coefficient [-],

$T_{ij} = K_{ij} b$ = the transmissivity tensor [L^2/T], and

$Q_s = q_s b$ = the source/sink term [L/T]

Layer based modeling was carried out for which the latter equation was solved for the model domain.

[15] IGW Reference Manual for Version 3. Copyright © 2003 by Dr. Shuguang Li and Associates at Michigan State University. All rights reserved.

4.1. Purpose of the Model

The purpose of building a numerical groundwater model was to understand the flow dynamics of the aquifer under RWASA jurisdiction and to assess the sustainable capacity of the aquifer to supply good quality potable water in RWASA jurisdiction

4.2. Conceptual Model

After studying the general layout of topography, rainfall pattern, stream flows, natural drainage network, geology and anthropological stresses, a conceptual model for RWASA jurisdiction was made as illustrated in Figure 11

4.2.1. Sources

Rainfall infiltration is reckoned as the primary source of recharge to the aquifer. Other sources include seepage from dams and large streams. Wastewater disposal in natural water ways also infiltrates in the aquifer.

4.2.2. Sinks

Groundwater abstraction is one of the major anthropogenic sink of groundwater. Natural sinks include boundary flow and baseflow.

4.2.3. Contaminant Transport

Leachate from solid waste and infiltration of waste water into the aquifer after being disposed off in the natural water courses are the major sources of contamination of groundwater.

4.2.4. Physical components of the Aquifer

The physical components of the aquifer include high infiltration zones in the higher altitudes while the infiltration is variable in the lower altitudes. Paved surfaces in the built up areas act as impervious surfaces where infiltration almost nil. The major water bearing formation is Lei Conglomerate which is approximately 150m thick. Quaternary gravel beds within Lei formation form the most productive aquifers. Beneath Lei Conglomerate is Soan Formation, approximately 250m thick, primarily composed of shale and sandstone. Above Lei Conglomerate are alluvium deposits with thickness varying from 3m to 35m. There are no well defined and continuous impervious layers which may produce confined aquifer conditions. Most of the aquifer is, therefore, unconfined within Lei and Soan formations

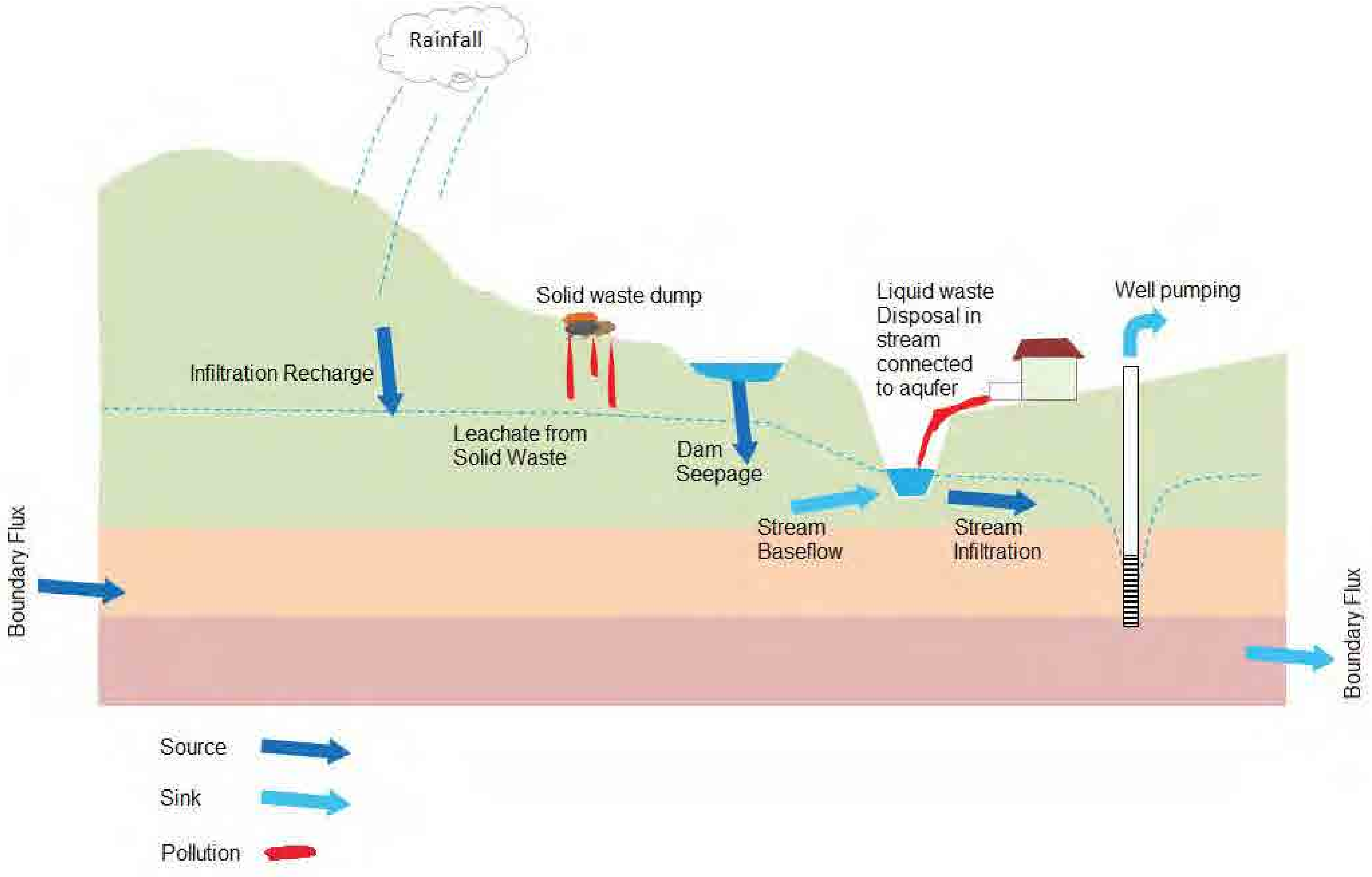

Figure 11 Groundwater conceptual model

4.3. Delineation of Model Domain

In an ideal situation, a groundwater model's boundaries should coincide with physical no-flow boundaries. However, seldom this condition is completely fulfilled. So was the case for the groundwater model presented in this study, however, an attempt was made to be as ideally close to natural no-flow boundaries around the model domain as possible.

RWASA Jurisdiction does not conform to the natural boundaries which define surface or sub-surface hydrologic regime. The model boundaries, therefore, were extended to the nearest watershed boundaries outside RWASA Jurisdiction. The following map shows RWASA boundary with respect to various watersheds in the area. Total area of RWASA jurisdiction is 873 square kilometer, whereas the model area, thus formed was 2763 square kilometer.

The model domain thus becomes the upper watershed of Soan River. The model area is typically bounded in the north and north west by well defined crest of Margalla Ridge. To the east, the model boundaries run over the less conspicuous ridge lines defining the watershed of Soan and its tributaries.

To the south, the model boundaries were truncated along the boundaries of RWASA Jurisdiction. These boundaries approximately follow the soft no-flow condition as the groundwater converges to Soan and its tributaries. It is expected, however, that model results are less certain because of this less robust boundary condition.

The model domain in shown in Figure 12 on the backdrop of a satellite image covering the entire region around RWASA Jurisdiction and the complete model domain. For better visualization of watersheds, the same image is presented in perspective view in Figure 13.

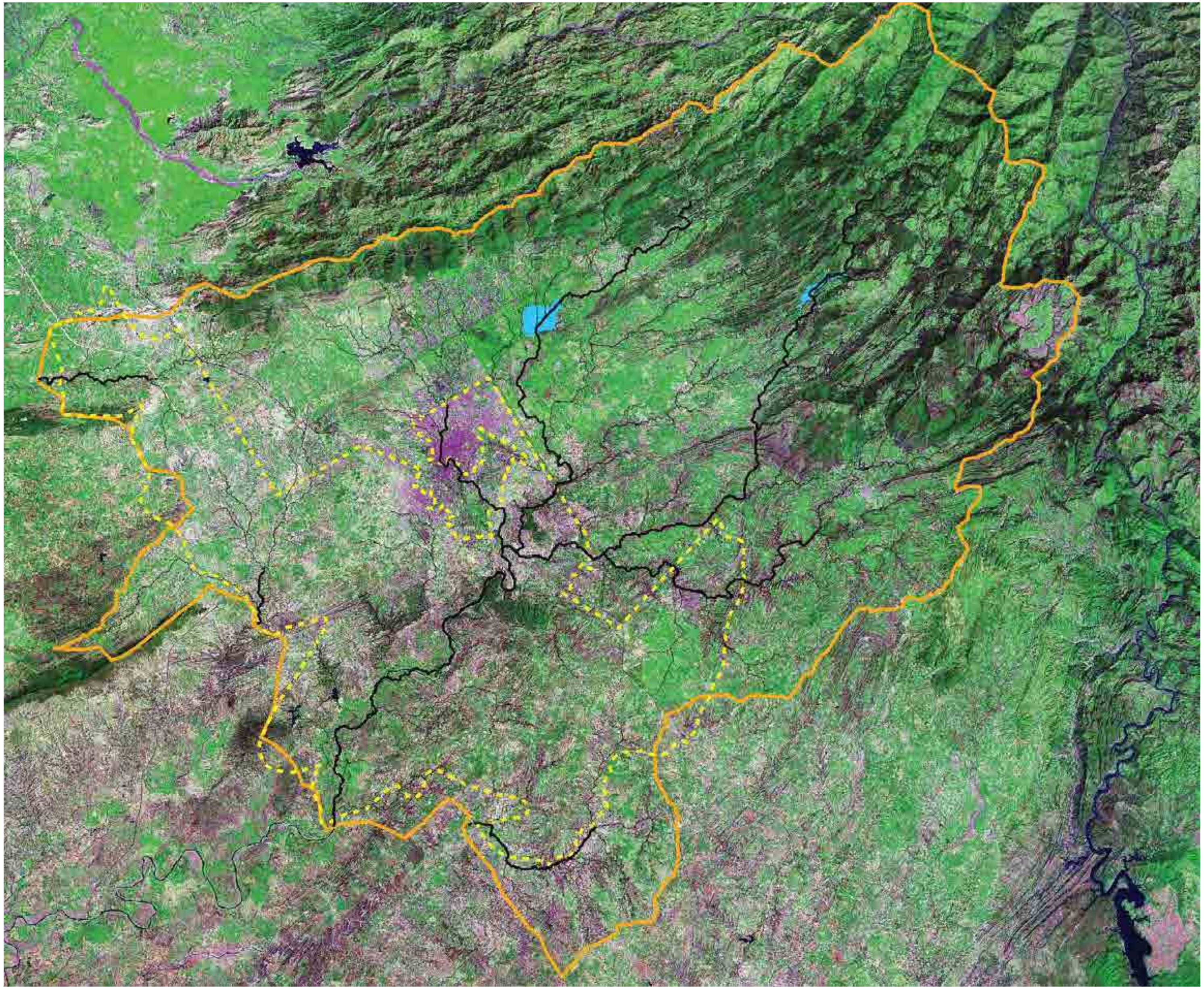

Figure 12 Model Domain

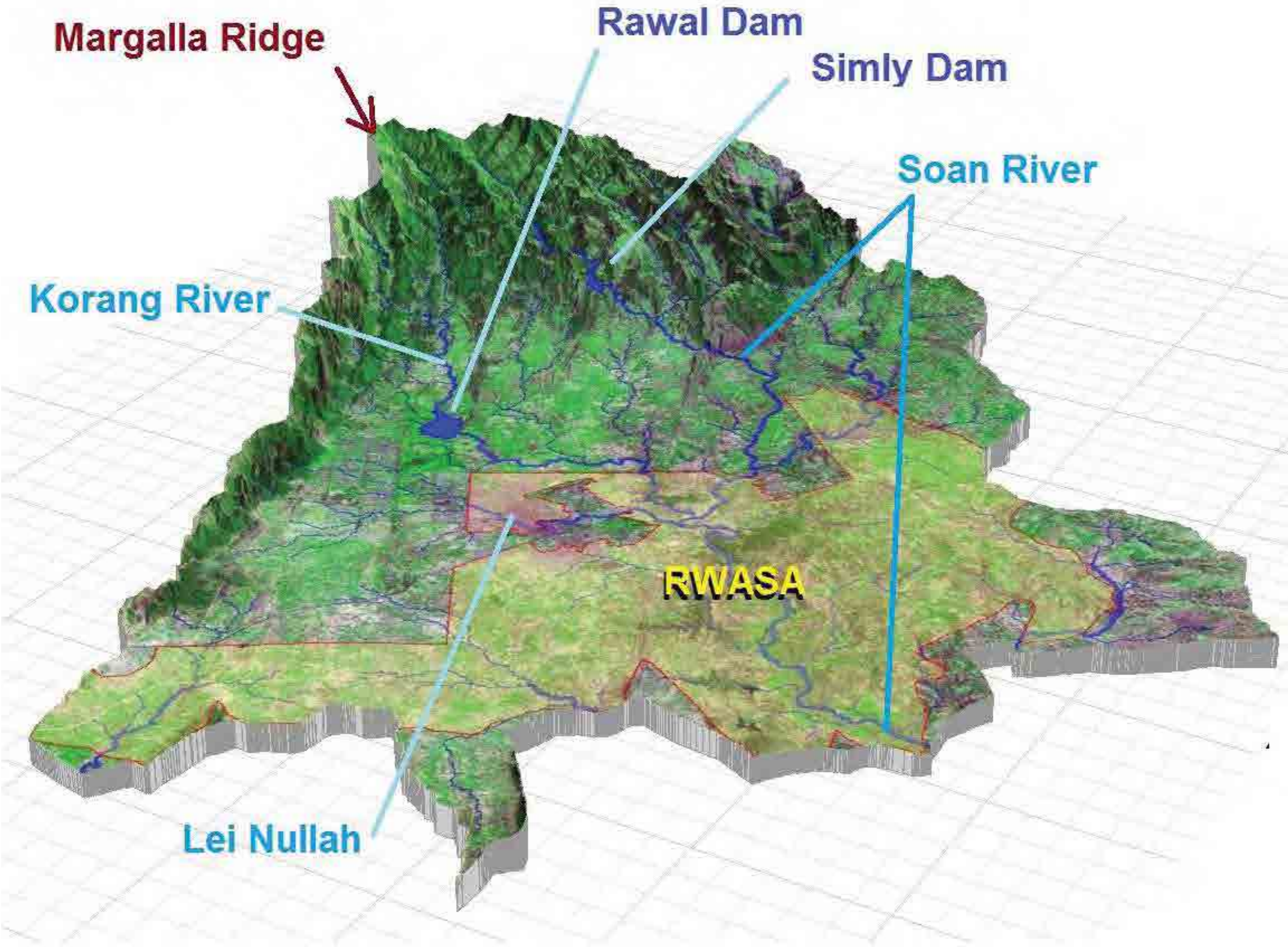

Figure 13 Model Domain, perspective view.

4.4. Model Constraints

The groundwater model presented in this study only captures the regional dynamics of the sub-surface flow system within its domain. The water balance and flow regime presented in the model delineates regional water budget and flow directions and should be used with caution if interpretation is to be made for a local area the size of a single UC (especially the old 46 UCs which have very small areas compared to newly added UCs).

The regional scale model was built using secondary data only as there were no specific provisions of physical hydrogeological investigations for the sake of groundwater model development, calibration or validation. The model interpretation, therefore, may be made within the constraints of available secondary data set (as explained in following sections) and the regional scale dynamics which were the primary focus of the model.

4.5. Data

Following data sets were employed for development of the model, its calibration and validation. The data sets are listed as follows and shown from Figure 14 through Figure 21

4.5.1. Bore Logs and Water Wells

Three sources of data on bore logs and water wells were used as follows:

- Primary data taken from RWASA wells in old 46 UCs
- Well logs from USGS geological investigations in CDA Area
- Well logs and resistivity survey data from various UCs of RWASA conducted for PHED Water Supply Scheme and other similar works[16] and shown in Annexure I

4.5.2. Hydraulic Properties of the Aquifer

Satellite images from Landsat data were used to identify vegetation and density of construction in the built-up areas

Topography was acquired from 30m DEM

Soils maps from Soil Survey of Pakistan was used to assign

[16] Various reports prepared by Zahid, et. al, Tatara Engineering, Wah Cantt, Rawalpindi

Geological subdivisions of the study area were ascertained from the Geological Maps acquired from Geological Survey of Pakistan and USGS Report on the geology of Rawalpindi and Islamabad region

Precipitation data, representing mean annual rainfall in the study area, was obtained from Pakistan Meteorological Organization

4.5.3. Hydrology

Stream network was delineated by using 30m DEM and GIS tools. In the groundwater model, 2nd and 3rd order streams were used at regional scale discretization. The former were modelled as drains while the latter was considered 2-way streams.

River flow data and rainfall/runoff relationships for the natural conditions (i.e. before the construction of Rawal Lake and Simly Dam) were acquired through extensive literature search from the archives of CENTO hydrological studies of the region.

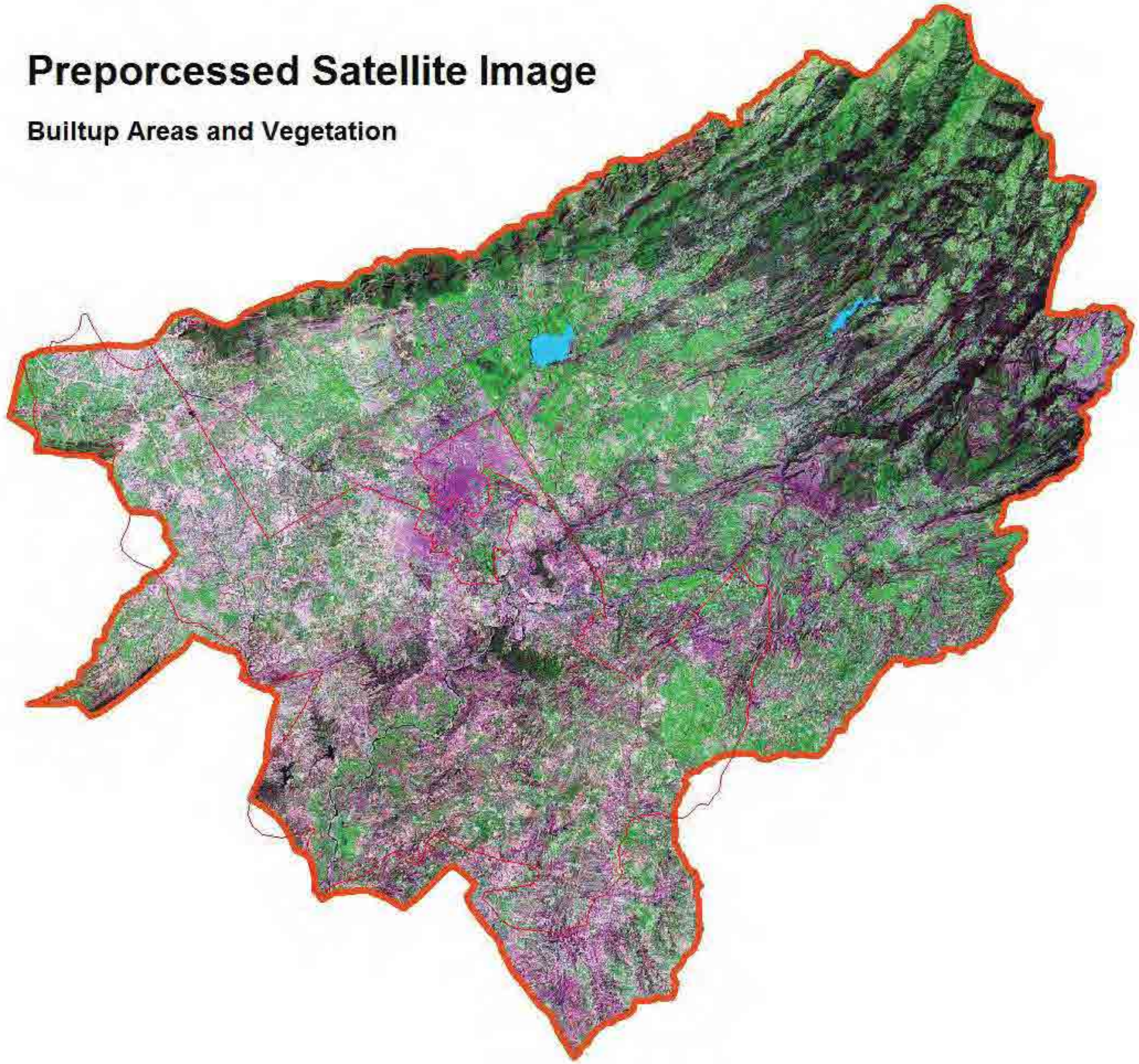

Figure 14 Preprocessed satellite image of the study area giving vegetation and built-up areas (from UC Berkley data portal)

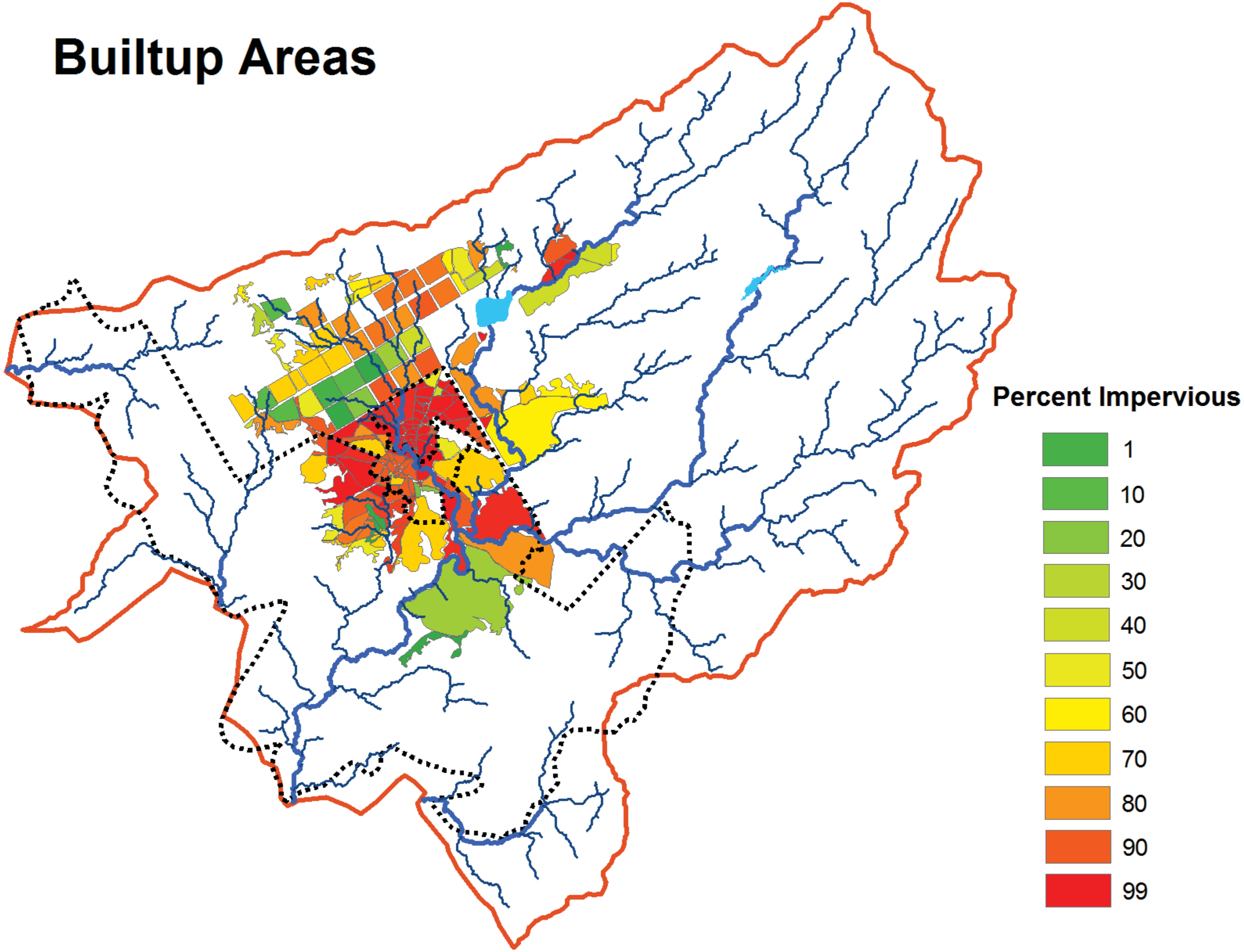

Figure 15 Density of construction in urban areas derived from satellite data

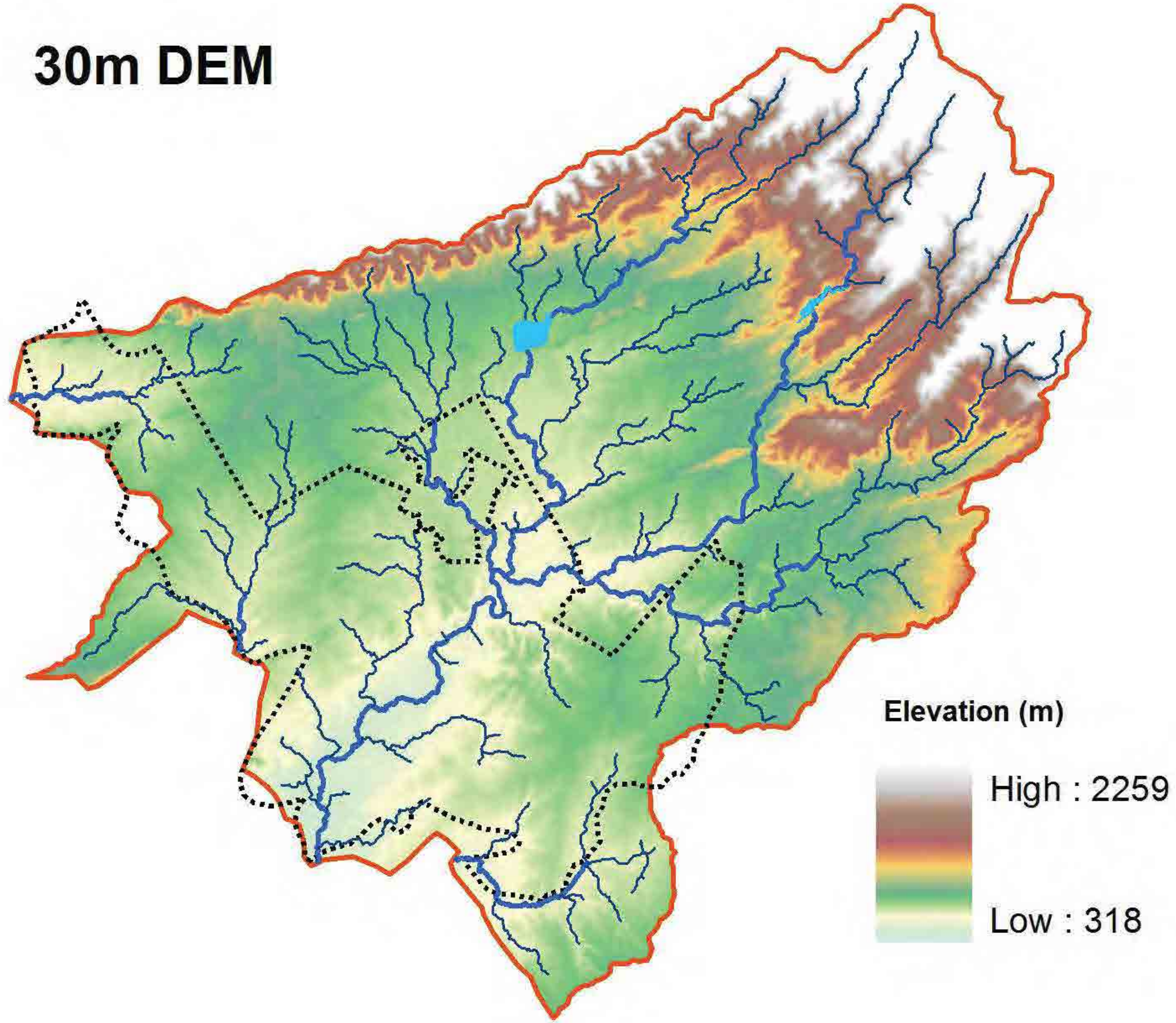

Figure 16 30m DEM for groundwater model domain

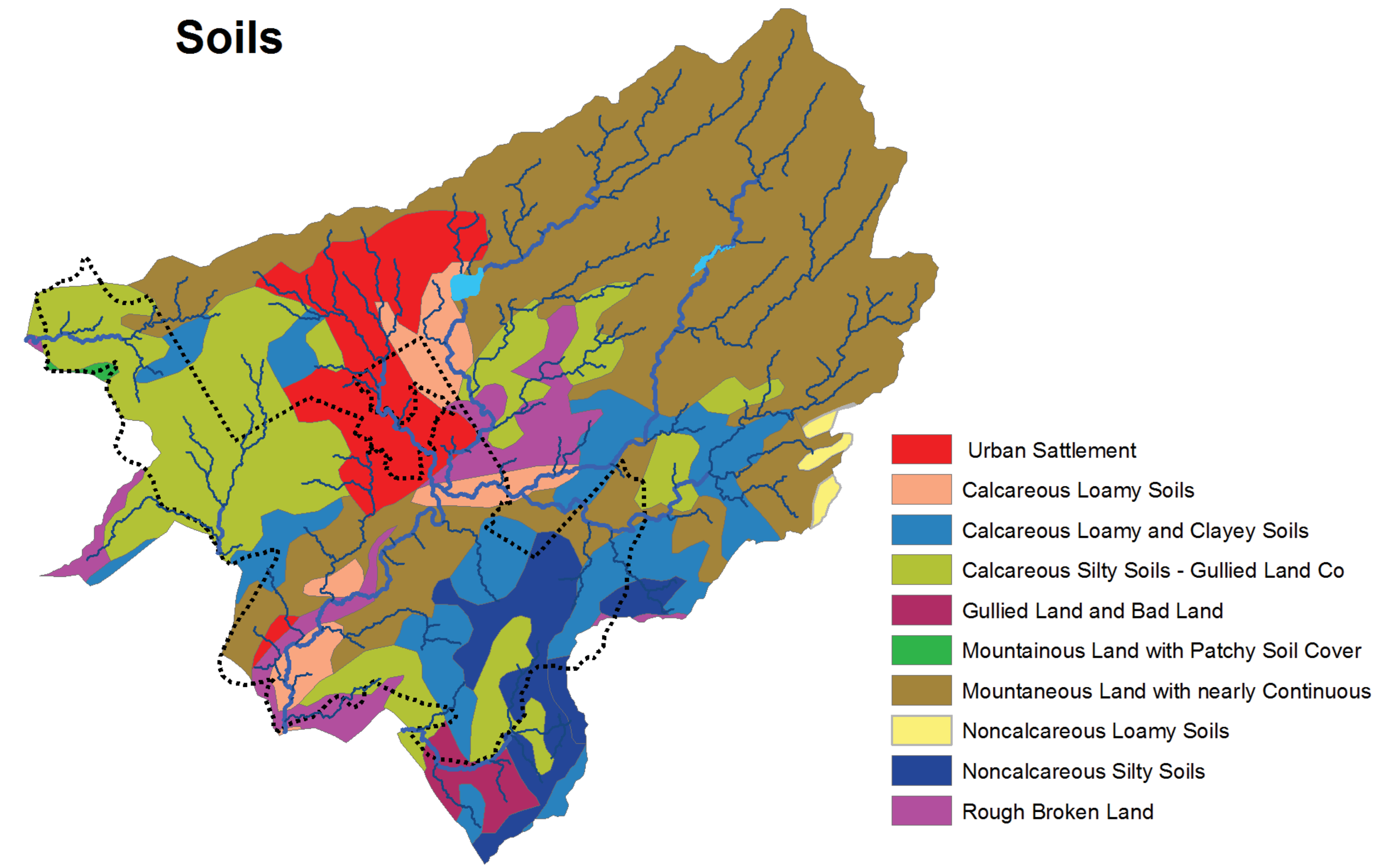

Figure 17 Types of soils in groundwater model domain

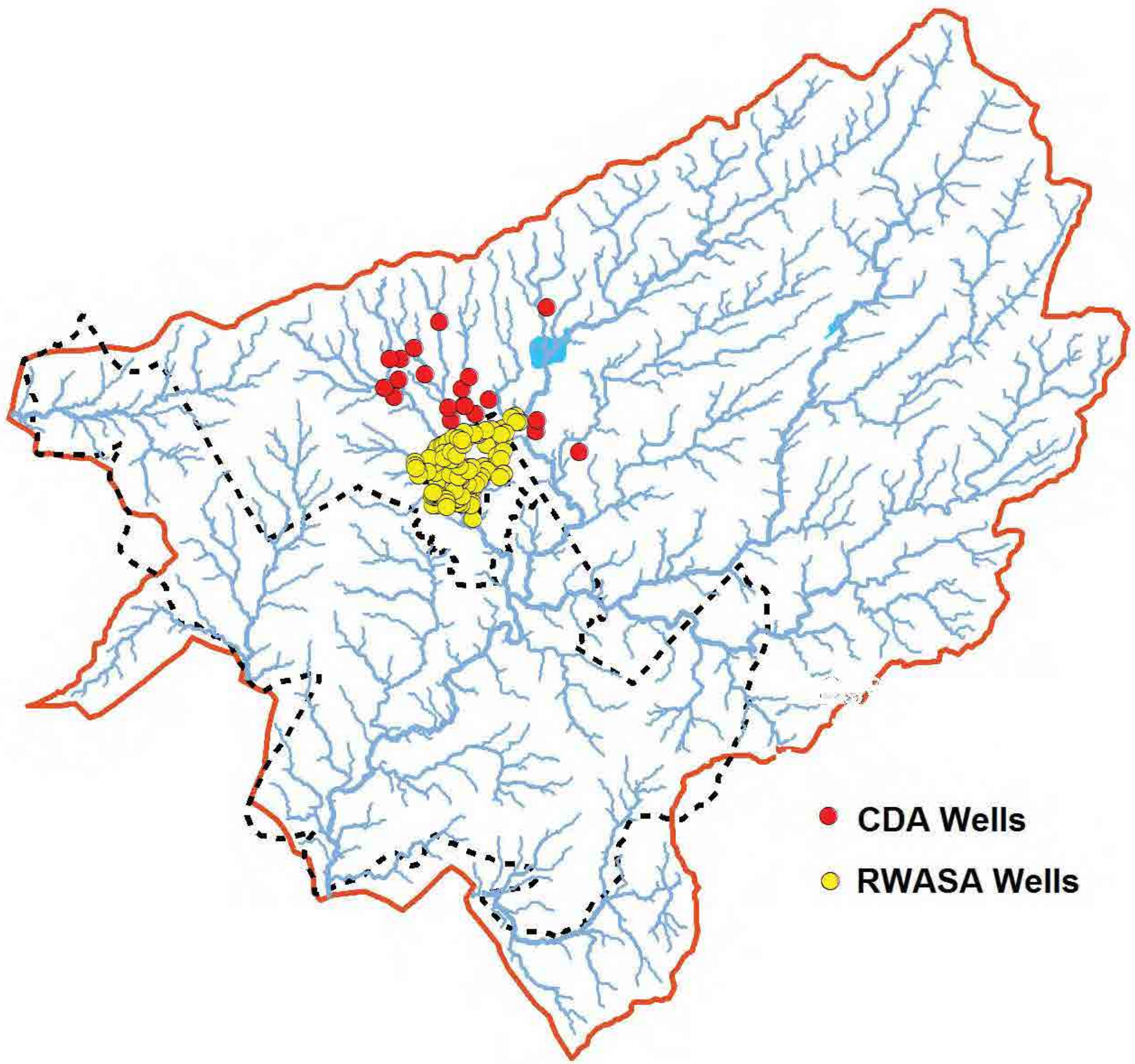

Figure 18 Wells

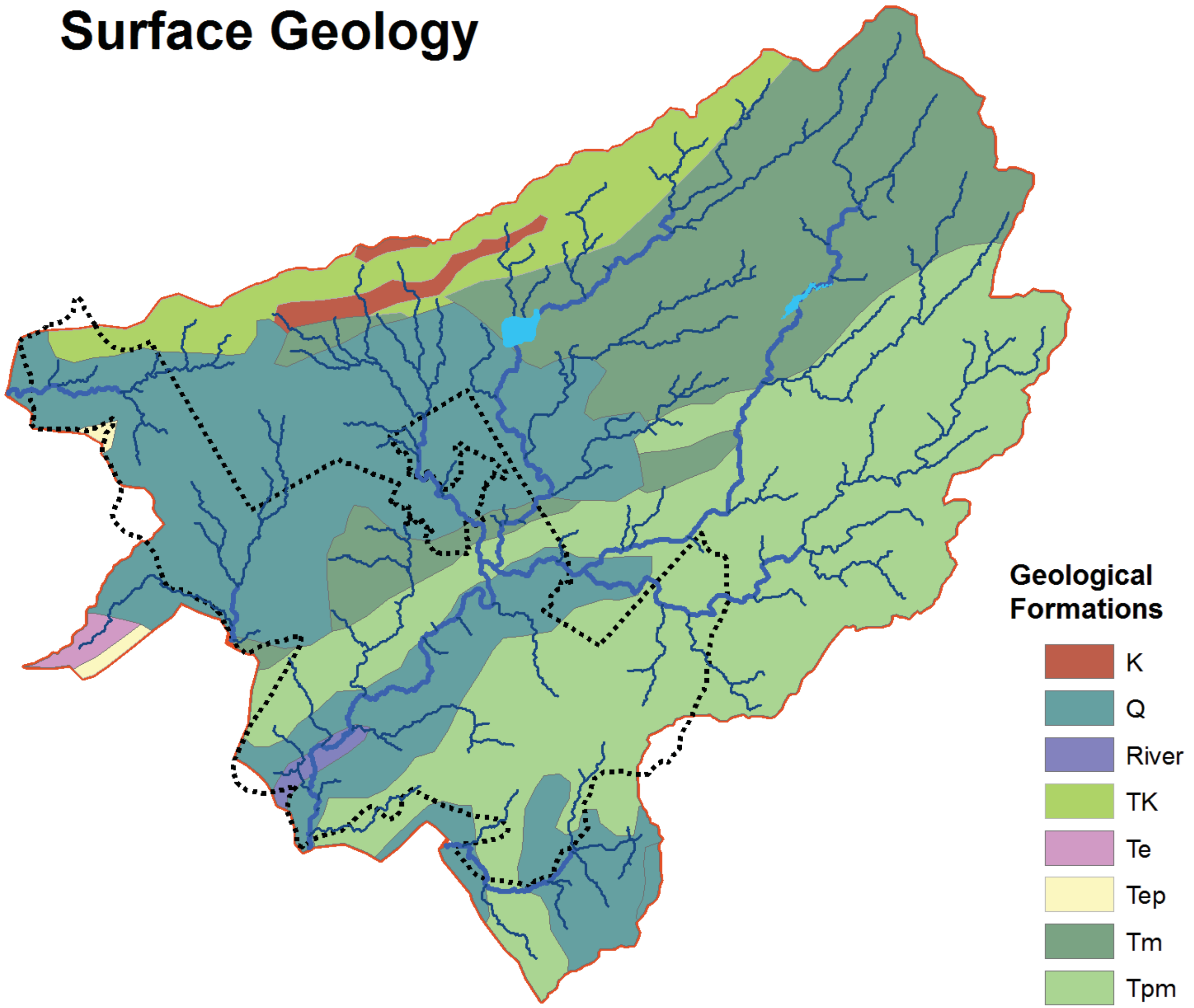

Figure 19 Geological units in groundwater model domain

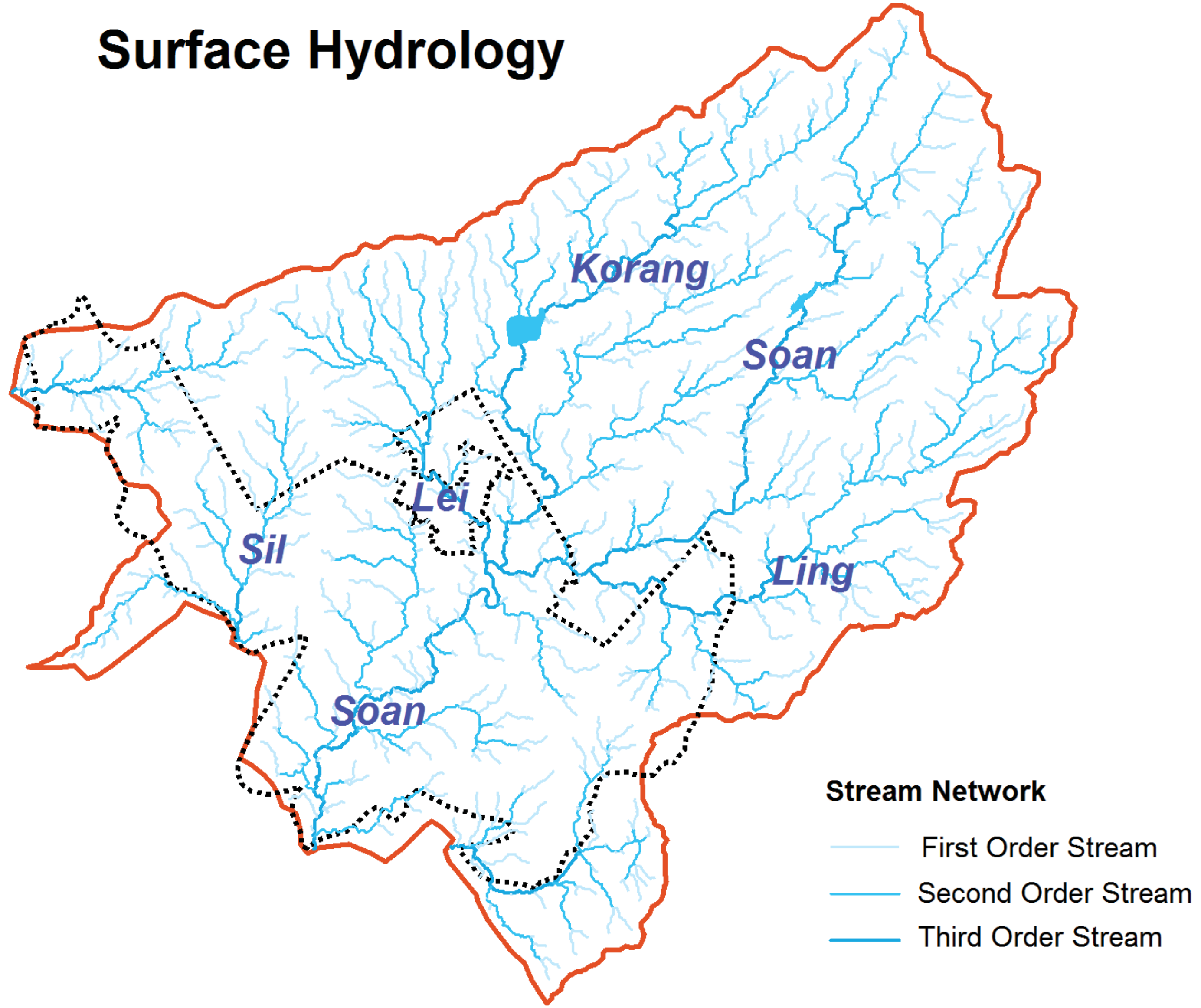

Figure 20 Surface hydrology network derived from 30m DEM

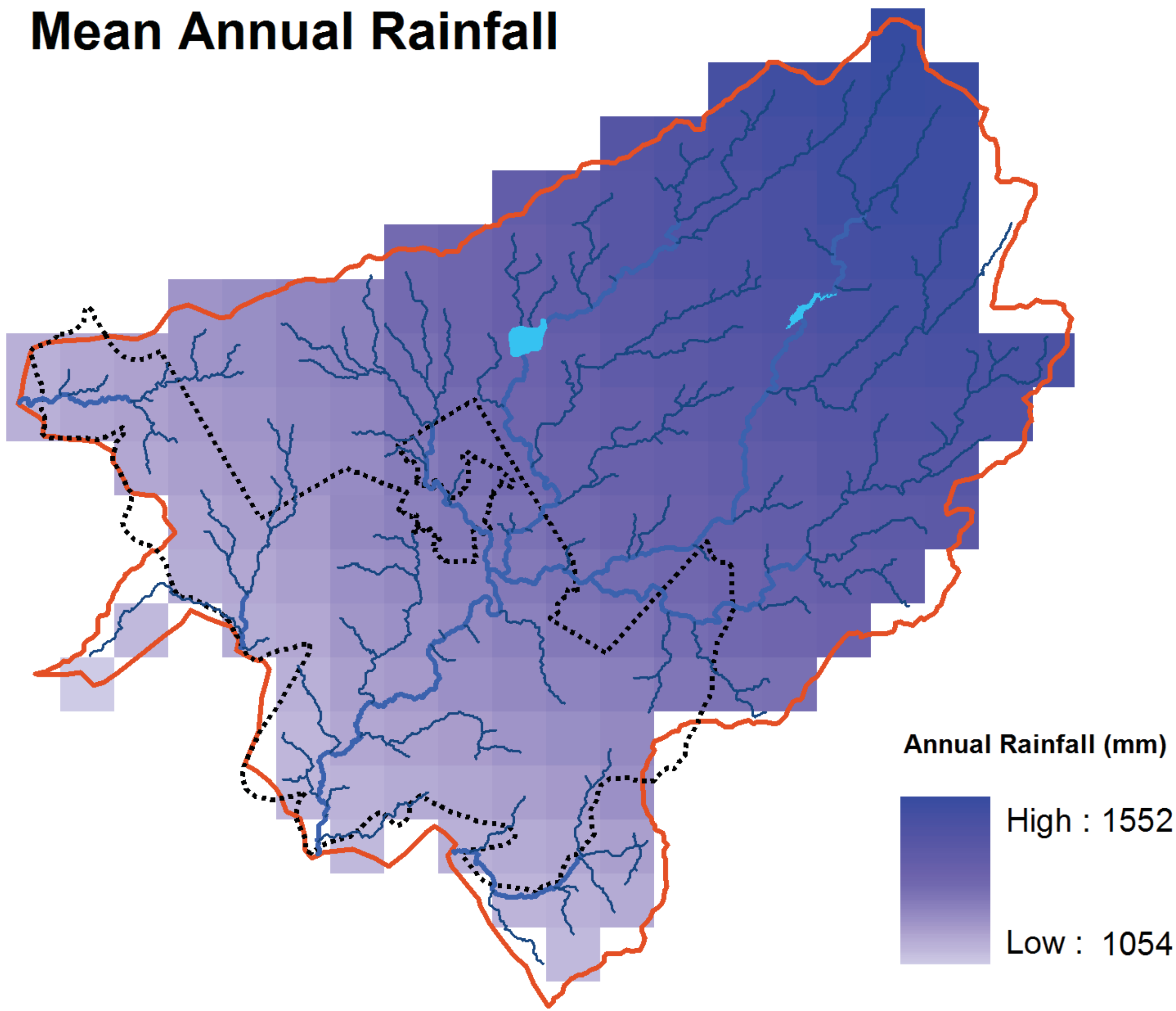

Figure 21 Mean annual rainfall distribution in groundwater model domain derived from PMO preprocessed data

Evapotranspiration Estimates were obtained from NOAA/MODIS pre-processed map for the Indus Basin. The band for the study area lies between to 450 to 750 mm per year for the study area.

4.6. Geologic History of the Aquifer

Un-cemented conglomerate beds are the most important ground-water aquifer in the area. The Lei Conglomerate is interpreted as an alluvial basin-fill sequence of coarse, angular gravel derived from the uplifting Margalla Hills to the north interbedded with finer sediment derived from sandstone and shale of the Rawalpindi Group and windblown silt. The unit was deposited along the axis of the subsiding Soan syncline. Cemented conglomerate beds are resistant to erosion and form ledges and hills.

By Miocene time, the sea had completely receded south of the study area, and during the Miocene and Pliocene, very thick continental deposits of the Rawalpindi and Siwalik Groups accumulated in the subsiding Himalayan foredeep region. These deposits consist of sediments eroded from highlands to the north that were uplifted and deformed by tectonic forces in the zone of convergence.

During the Pliocene, sedimentation was controlled by an eastward-flowing river system (Reynolds, 1980). The conglomerate of the Soan Formation that was deposited by that river system during the late Pliocene consisted chiefly of quartzite and metamorphic clasts eroded from the Himalayan core and are similar to clasts in modern Indus River. The eastward-flowing river system was disrupted and superseded by the much smaller, southward-flowing Soan River system, and locally derived limestone gravel became the dominant component of the Lei Conglomerate; this conglomerate accumulated most thickly over the Soan Formation.

During the Quaternary, climatic fluctuations along with tectonic uplift caused periodic incision of the drainage south of the Margalla Hills and alternate periodic accumulations of silt and alluvial gravel from the Margalla Hills, which filled the valleys and spread laterally to form wide plains of low relief.

These depositional history explained above now comprise the aquifer formations underneath the study area. A supplemental network of municipal and private wells as deep as 200 m produce ground water primarily from Quaternary alluvial gravels. The altitude of the water table decreases from about 600 m at the foot of the Margalla Hills to less than 450 m near the Soan River. Soan River and its tributaries get their baseflow from the aquifer and thus from the natural sink for the aquifer in the study area.

4.7. Characteristics of the Aquifer of Rawalpindi

The Soan and Kurang Rivers are the main streams draining the area. Their primary tributaries are the Ling River, draining north-westward into the Soan; Gumreh Kas, draining westward into the Kurang from the area between the Kurang and Soan; and Lei Nala, draining southward into the Soan from the mountain front and urban areas. The Kurang and Soan Rivers are dammed at Rawal and Simly Lakes, respectively, to supply water for the urban area. Extensive forest reserves in the headwaters of the Kurang and Soan Rivers benefit the quality and quantity of supply. Lei Nala carries most of the liquid waste from Rawalpindi and contributes greatly to the pollution of the Soan River below their confluence. Solid-waste disposal practices threaten the quality of ground-water reserves.

Lei Nala heads in the Margalla Hills and passes through the center of Rawalpindi, where homes and lives have been lost to flooding in low-lying areas. Although the stream is relatively small, it is entrenched, so floodwaters are confined to the narrow flood-plain zone at the valley bottom. This confinement increases the depth and suddenness of flooding in the small area affected but protects most of the population, who live above flood level. If continued losses are to be minimized, land use in the affected areas may have to be changed. Wide flood plains along the Soan River above the Grand Trunk Road Bridge are subject to flooding but are not densely populated. Expansion of residential or industrial development onto the Soan flood plain should be carefully controlled, although dams on tributaries to the Soan help to reduce potential problems.

Debris flows issuing from mountain canyons onto alluvial fans at the mountain front create another flooding hazard that is less easily recognized than most conventional flood hazards. Infrequent, extreme precipitation events may trigger such flash floods of mud, boulders, and water, but during the periods between events, sediment accumulates in the mountain canyons, and the longer the time between flushing events, the more violent may be the final release. Deposits from such events seem to occur in northern Islamabad in parts of Sectors F6, E8, F8, E9, F9, and E10.

4.8. Model Outputs

Model was run for steady state simulation of the mean annual hydrologic conditions. The existing pumping was also simulated in the model. After calibration and validation of the model, the final steady state water balance matched the regional water budget for rainfall, evapotranspiration and stream flow. Model out puts with water budgets are shown in Figure 22.

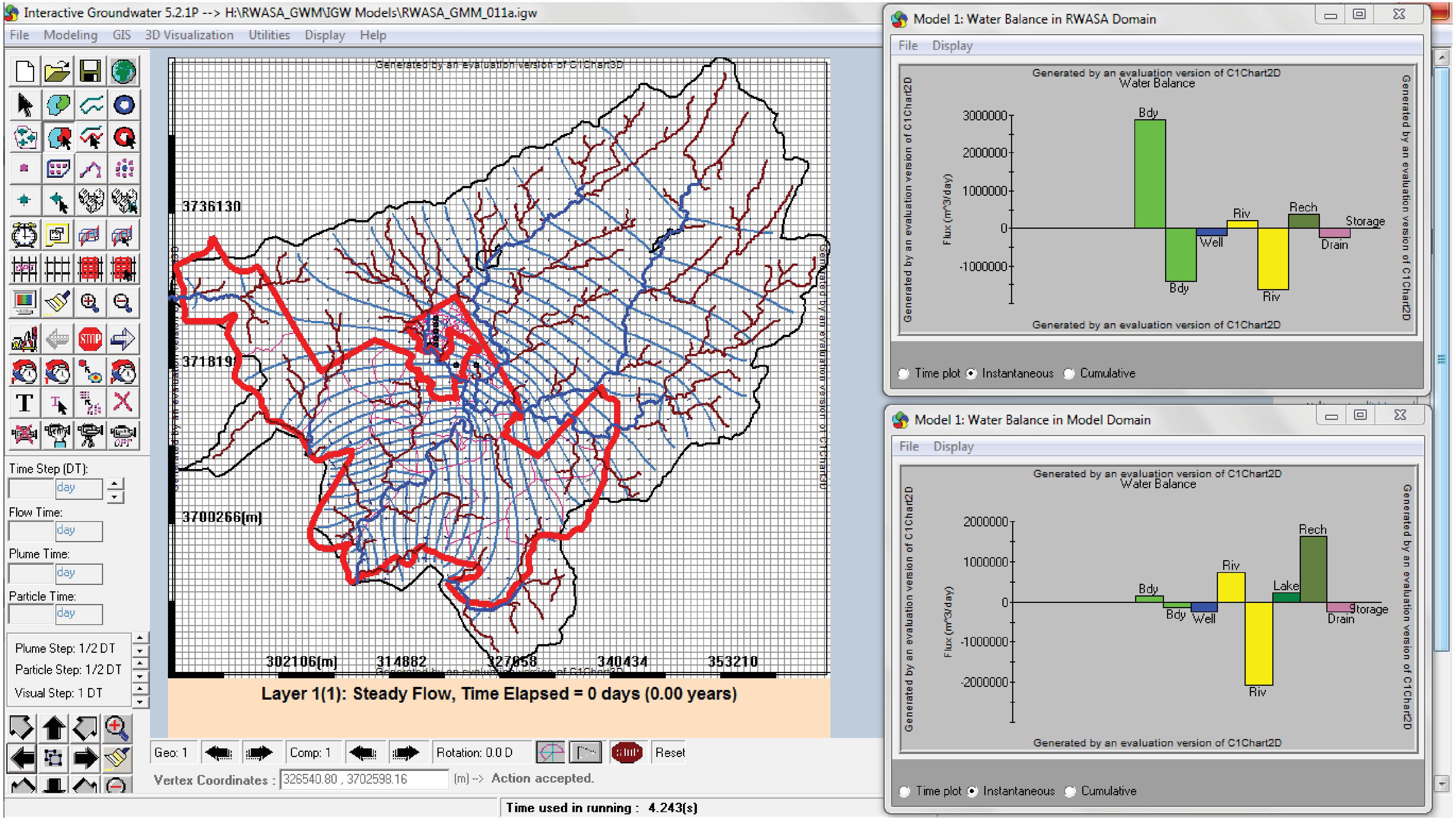

Figure 22 Steady state model out puts to simulate existing conditions of recharge and pumping.

The model explains that the groundwater regime in the water shed is receiving most of its recharge in the hilly areas of the north, especially in the zone marked by fan alluvium at the foothills of mountains. Lower Soan Basin, which mostly lies within RWASA jurisdiction, is the major discharge zone of groundwater, giving baseflow to the river, as shown in

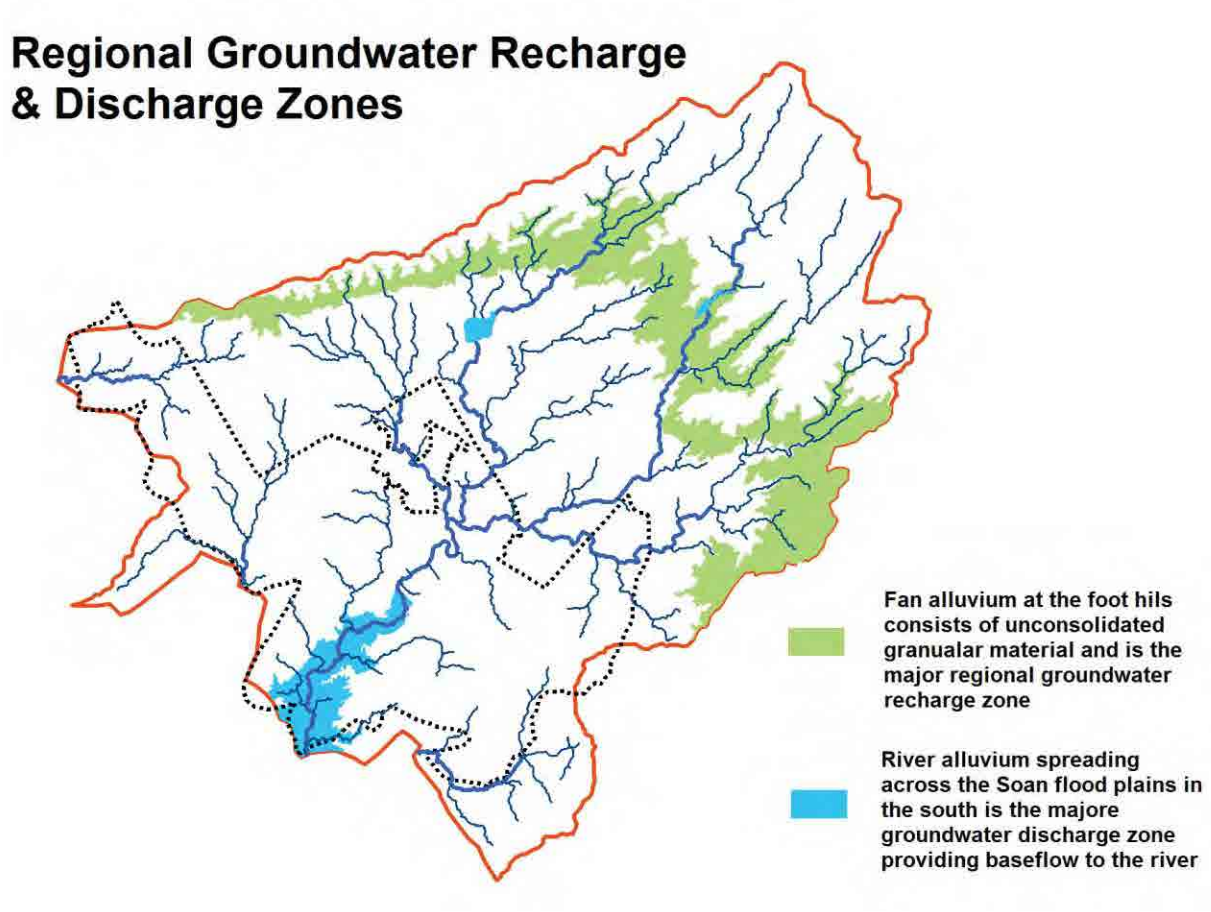

Figure 23 Major recharge and discharge zones of the groundwater regime

RWASA jurisdiction, as a consequence, is not contributing as much to the recharge of the aquifer but contributing to most of the discharge through river baseflow and municipal pumping. The water budget of the steady state model also suggests that there is a lot of groundwater flow moving into RWASA jurisdiction as boundary flow. This situation may be exploited by putting a well field in lower Soan Basin. The model was used to simulate high capacity well fields and suggested that up to 280 mgd well field, as shown in Figure 24, in the basin can be installed. However, this figure may be treated with caution because a regional scale may not capture local details for individual high capacity wells. The potential of groundwater in this area for future development, however, may be there.

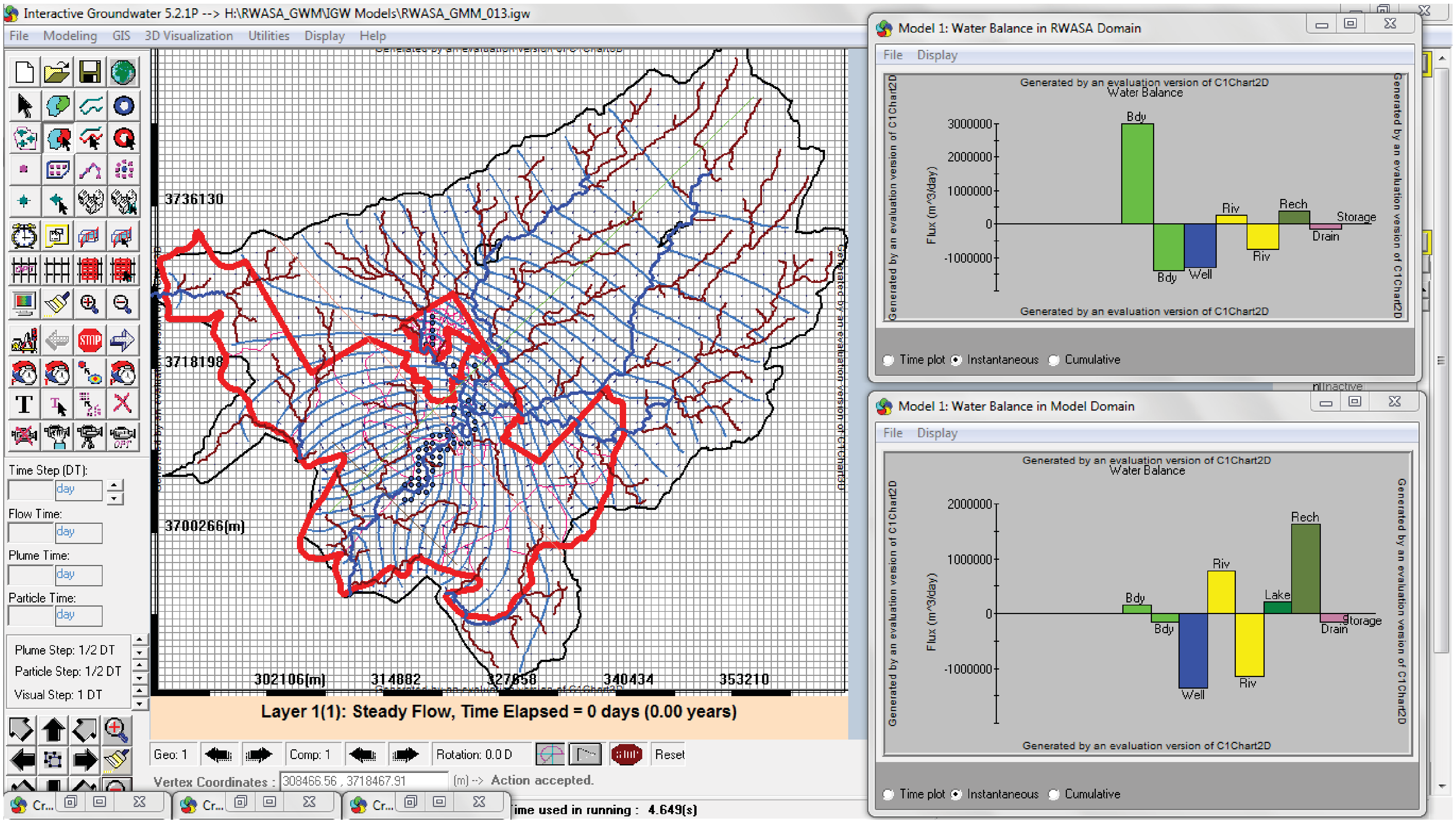

Figure 24 Steady state simulation of model with augmented recharge and 280 mgd well field closer to river in the Soan Main sub-watershed.

4.9. Recommendations from Modeling Exercise

Based on the groundwater modeling exercise in this study, following recommendations are made:

- The model has identified high recharge zones within the watershed. RWASA and other governing bodies within the modeling domain (such as CDA, ICT, etc.), may coordinate for the collective good of the shared aquifer. The cooperation may entail:
- Plans, bylaws and enforcement for the protection of sensitive aquifer recharge zones for long term sustainability and maintaining good water quality in the aquifer.
- Urban areas should be designed on the principles of IUWM / WSUD (as explained in the subsequent chapters) to enhance aquifer recharge and prevent pollution.
- Proper urban recharge management plans should be developed within the watershed.

4.10. Aquifer Potential

The preliminary groundwater modeling exercise covering the watershed scale shows a good potential of aquifer as reliable resource for future. However, it must be borne in mind that the aquifer modeling was only based on secondary data as there were no provisions within the scope of this study to carry out expensive field investigations such as deep drilling and yield tests. In the absence of such validation, specific locations of high capacity wells and detail design of well fields is not possible. It is recommended, therefore, that the areas recommended for installation of well fields may be investigated with primary data and hydrological testing.

5. Integrated Water Resources Management (IWRM)

Sustainability is the key concept on which exploitation and utilization of water resources for RWASA have been proposed in this study. The study takes advantage of the basic principles and best management practices advocated in IWRM. This section explains the conceptual elements of IWRM which have been employed in evaluation sustainable management of water resources for the future.

IWRM is about building synergy and links between various facets of water resources in order to sustainability. Since the 1970s, there has been a growing awareness that natural resources are limited and that future development must come to terms with this fact. The concept of sustainability has on the whole gained wide acceptance worldwide and may be defined as "improving the quality of human life while living within the carrying capacity of supporting ecosystems"[17].

Integrated water resources management can be interpreted at three different levels. First, it involves the systematic consideration of various dimensions of water: surface and groundwater, and quantity and quality. The key is that water represents an ecological system, containing interrelated parts. Each part can influence, and be influenced by, other parts, and therefore needs to be planned for and managed with regard to those interrelationships. At this level, attention normally is given to how to integrate considerations related to water security and water quality.

Sustainability

Improving the quality of human life while living within the carrying capacity of supporting ecosystems

At the second level, managers recognize that while water is an ecological system, it also interacts with other resource systems, ranging from terrestrial to other environmental systems. This second level is broader than the first, and turns attention to matters such as flood-plain management, drought mitigation, erosion control, irrigation, drainage, non-point sources of pollution, protection of wetlands and fish or wildlife habitat and recreational use. At this level, integration is needed

[17] IUCN/UNEP/ WWF, 1991

because many water problems are triggered by land use or other development decisions involving major implications for aquatic systems.

The third level is broader still, and directs the manager toward interrelationships among the economy, society and the environment – of which water is but one component. Here, the concern is the extent to which water can facilitate or hinder economic development, reduce poverty, enhance health and well-being and protect heritage. All three levels highlight the fact that planners and manager's deal with a mix of systems.

A community is unsustainable if it consumes resources faster than they can be renewed, produces more wastes than natural systems can process or relies upon distant sources for its basic needs

Concept of sustainability applied to water resources management would imply to assess the safe and adequate supply of good quality potable water to the inhabitants in the study area in planning horizon. However, the sustainability should be perpetual and may not fail beyond the planning horizon.

The past few decades have witnessed dramatic changes in water management. There have been two important underlying themes. First, there is a growing awareness that water is a fundamental element in the natural environment. The presence and movement of water through all biological systems is the basis of life. Water, land and biological systems must be viewed as interlinked, and monitoring of the various components of the ecosystem should be harmonized. Secondly, water is absolutely essential to all forms of economic activity, for example, agriculture and food production, for much of industrial production and for commerce related navigation. Water is also a critical factor in human health. Too much water, in the form of floods, or too little, such as drought, can lead to human and environmental disasters. But floods and droughts are natural occurrence too, and therefore, should be incorporated in risk management plans.

5.1. Watershed Management

There is general recognition that the natural management unit is the river basin. It makes sense to manage the water resources within a river basin and in a coordinated manner, as the water is often used several times as it moves from the headwaters to the river mouth. It also makes sense to manage all natural resources – vegetation, soils and the like – within the basin unit. Water demands for human activities should also be managed within the basin in an integrated manner.

Unfortunately, political boundaries do not normally coincide with basin boundaries. This adds another essential layer for trans-boundary cooperation within the watersheds. In the context of this study, the twin cities of Rawalpindi and Islamabad share the same watershed (of Upper Soan River). Rawalpindi, or RWASA Jurisdiction, constitutes the lower riparian within the watershed while Islamabad (CDA and ICT), and Murree-Kahuta Development Authority form the upper riparian areas.

5.2. Surface and Groundwater

In many regions of the world, groundwater is the major source of the flow in surface streams during the dry season. In addition, certain land-based activities, such as those causing leakage from underground storage tanks, can lead to pollution of aquifers. Other land-based activities, for instance, withdrawal, which is implemented to meet urban or agricultural needs that exceed rates of recharge, can also bring about the depletion of groundwater reserves.

Given the interconnections identified above, in order to achieve effective management of aquatic systems, it is necessary to study and manage surface water and groundwater as connected systems, particularly to ensure secure water supplies of acceptable quality. An integrated approach encourages – indeed, requires – the joint management of surface water and groundwater systems.

5.3. Ecological Services within the Watershed

Hydrologists today need a much broader view of hydrology, including ecological, biological and human-use aspects of the aquatic system. The contemporary concepts of IWRM dictate that the value of ecological services, such as pollution control, improvement in water quality, etc., provided by flowing rivers, wetlands, and aquatic ecology, also be factored-in in a synergistic way with the engineered facilities built for the same (i.e. pollution control, water treatment, storm water, aquifer recharge etc.).

In order to conserve the hydrological and ecological function of the drainage network, the physical regime of the river must not be altered or dried up. The amount of water that is needed to sustain an ecological value of an aquatic ecosystem is referred to as environmental water demand. The question of a minimum flow is particularly important in arid and semi-arid regions and must be borne in mind in river basin planning and management. An ecological minimum flow can artificially be maintained by reservoir management. To model environmental demand, a given river stretch can be assigned a minimum flow requirement that has to be met.

There have been significant socio-economic changes in many parts of the world. Rapid population growth, particularly in developing countries and in burgeoning urban centres, combined with industrialization and rising living standards have increased the demand for water. Pollution in many regions has reduced the quantities of safe drinking water. Groundwater levels have declined in many regions. Growing demand, outstripping supply, will become more common. Thus, more efficient and effective water management is imperative

5.4. Monitoring Requirements

Hydrological monitoring is also an integral element of IWRM which helps adaptive management, risk evaluation, long term record keeping, and prediction of trends – both in resource availability and consumption. Well-equipped and institutionally organized hydrologic services should continually monitor changing demands for water-related data.

Monitoring requirements are also continually evolving. They are influenced by trends in governmental policy and practice as well as new emerging sciences. What is more, they work in a rapidly evolving environment characterized by the following factors:

- Heightened global commitment to sustainable management of natural resources and the environment, combined with efforts to improve the living conditions of the poor, who generally are the most dependent on natural resources;
- An expanding emphasis on the need for integrated water resources management, as pressure on the world's water and other natural resources creates a general awareness that resources must be developed and managed in a sustainable manner;
- A seemingly inexorable increase in the impact wrought by natural disasters, particularly floods and droughts. At the same time, risk management is becoming more widely adopted;
- The impact of socio-economic trends on the day-to-day operations;
- Ever-growing use of the Internet or the web-based delivery of hydrological data and products – leading to more public awareness which necessitates more transparency in procedures and decisions taken by the water managers.

5.5. Environment, Economy and Society

Historically, water management has been dominated in developed and developing nations by three professions: engineering, agriculture and public health. As a result, engineers began focusing on structural solutions for issues ranging from water security – whether for urban, industrial or agricultural use – to water quality and flood damage. In addition, health professionals started turning their attention to the treatment and disposal of sewage and other wastes detrimental to health.

6. Resource Evaluation for Sustainable Water Supply

6.1. Population Projection

The combined population of Rawalpindi and Islamabad (the twin cities), as per 1998 census, was 1.94 million. Projected at the current growth rates, the combined population of the twin cities could exceed 11 million by 2040 as estimated by Ministry of Finance[18], while that of RWASA jurisdiction will be close to 5.8 million. This estimate may look on the higher side as the fertility rates are on the decline, however, with increasing trend of urban migration to Rawalpindi and Islamabad (with a trend of lots of housing schemes being promoted in the area), this estimate may even exceed. For the sake of planning water requirements within RWASA Jurisdiction for the planning horizon, a population of 6 million has been assumed.

6.2. Water Demand

Water supply at the rate of 40 gallons per capita per day (0.5 cubic meters per person per day) has been envisaged for the residents of RWASA jurisdiction as already approved in Rawalpindi Master Plan (1996-2016) [19] . The annual water requirement for the planning year 2040 for an estimated population of 6 million comes out to be 398 million cubic meter (MCM). Daily water demand for RWASA for the planning horizon then comes out to be 1.1 MCM per day or 242 million gallons per day (mgd).

6.3. Renewable Water within the Water Shed

Rainfall is the main source of renewable freshwater in the area. All other renewable resources in the area are directly or indirectly driven by rainfall. This makes measurement and management of rainfall is one of the most important elements of sustainable development of water resources. Estimates of rainfall distribution over the watershed were made based on the annual rainfall data acquired from Pakistan Meteorological Department. Water flowing in the rivers/streams, storages in

[18] Ministry of Finance http://www.finance.gov.pk/survey/chapter_10/16_Population.pdf

[19] Rawalpindi Master Plan 1996-2016, Government of the Punjab, Local Government and Rural Development Department, No. So, 111(LG) 7-12/98 dated 25 Sept 1998

natural and artificial lakes, and groundwater (aquifers), all comes through this precipitation within the watershed. The mean total annual rainfall in the watershed varies from more than 1554 mm in the mountains in the north to 1052 mm in the plateaus in the south as shown in Figure 2. Total mean annual rainfall over the watershed is averaged at 1296 mm, bringing in an average annual volume of water equal to 3571 MCM which drives the hydrological cycle of the watershed.

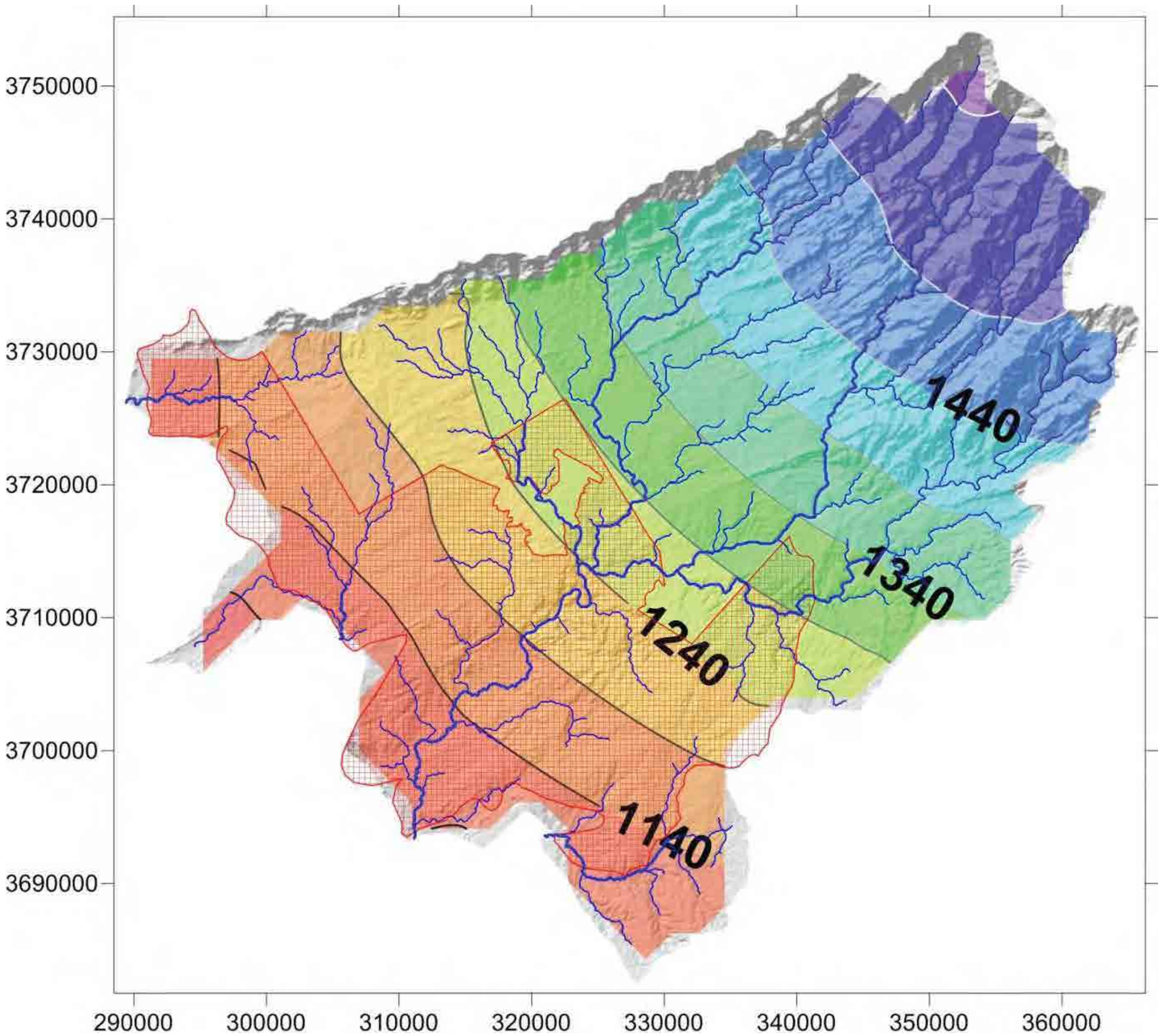

Figure 25 Variation of mean annual rainfall in millimeters over the watershed. RWASA boundary is also shown where rainfall average is lower than the northeastern part of the watershed

Evapotranspiration (ET) estimates for the study area were obtained from Bastiaanssen et. al. (2012)[20], based on NOAA/MODIS satellite data of the Indus Basin as shown in Figure 3. ET in the study area varies from 461 mm/year to 750 mm/year. For the planning purposes, it was taken as 700 mm/year, leaving behind 596 mm/year which renews water in the rivers, streams, lakes and aquifers. The mean annual renewable volume of water thus becomes 1645 MCM, which is reckoned as the total annual renewable water in the watershed.

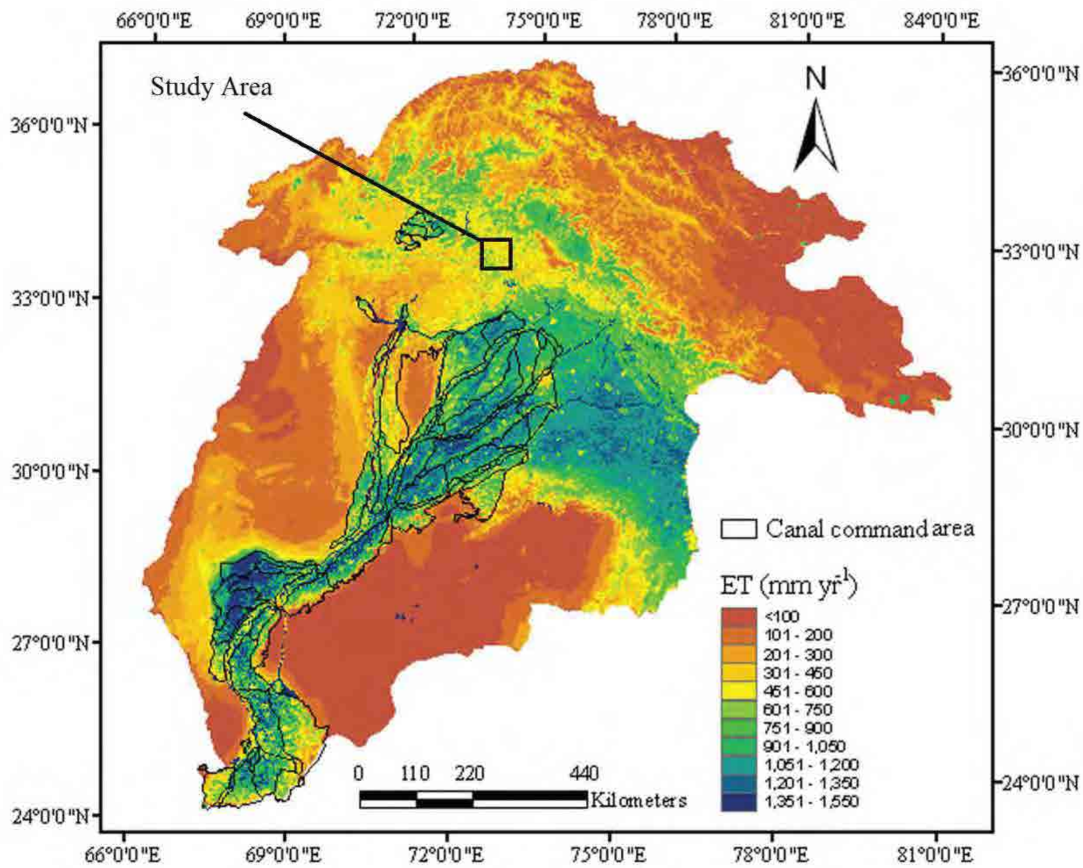

Figure 26 Evapotranspiration estimate from MODIS/NOAA satellite data (Betiaanssen et al 2012)

[20] Bastiaanssen, W.G.M., Cheema, M.J.M., Immerzeel, W.W., Miltenburg, I.J. and Pelgrum, H. (2012). Surface energy balance and actual evapotranspiration of the transboundary Indus Basin estimated from satellite measurements and the ETLook model. *Water Resources Research 48:*

6.4. Renewable Water for RWASA Jurisdiction:

Mean annual rainfall within RWASA jurisdiction is 1176 mm, which translates to annual volume of 1027 MCM. Excluding 700 mm loss in evapotranspiration, estimated renewable water from rainfall in RWASA jurisdiction is 417 MCM. Since RWASA jurisdiction is lower-riparian, it also receives overland flow (primarily river runoff) from the upper riparian areas and boundary flow into its underlying aquifer. Several datasets were analysed from the studies undertaken by CENTO[21] before the construction of Simly and Rawal Dams in the region. From these data sets it was estimated that mean annual river runoff, excluding the baseflow, is approximately 18% of annual rainfall. Using regional groundwater model for the area, analysis of hydrogeological data available from USGS[22] , and further analysis of data incorporating ET estimates, following water balance components were derived for RWASA:

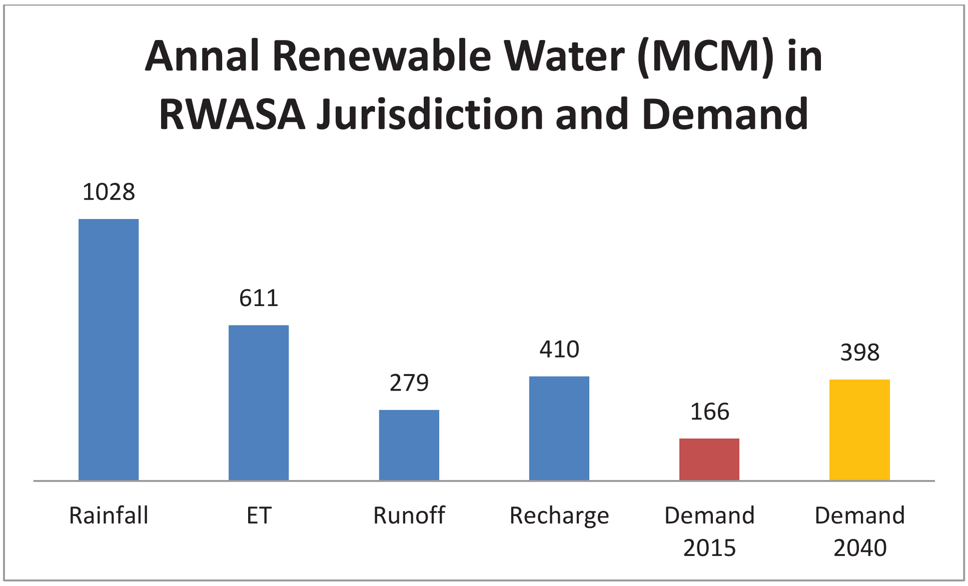

Figure 27 Water balance components for annual renewable water (in million cubic meter) versus current and future demand

From the regional level study presented in this report, the above figures point towards the potential of groundwater recharge in the RWASA jurisdiction which exceeds the total demand for 2040. However, at this point in time, the simplistic conclusion that current recharge rates are enough to

[21] The Role of Science in Developing Natural Resources With Particular Reference to Pakistan Iran and Turkey, Ist Edition, Pergamon Press, London, 1964, Part 4 "Surface Water Resources of the Federal Capital Area" pp . 163-176

[22] Environmental Geology of the Islamabad-Rawalpindi Area, Northern Pakistan. USGS Bulletin 2078G, U.S Department of Interior, U.S. Geological Survey

meet the future demand may not be drawn. It should be noted that this figure for recharge is spread over an area of 863 square kilometres and also includes the boundary flow entering RWASA jurisdiction from up-slopes of Islamabad and surroundings. The area is full of irregularities and local geological variability which must be analysed in detail to exploit and/or manage this potential. This study, therefore, only highlights the potential and possibilities of managed recharge to meet future demands while concludes that there is enough renewable water (689 MCM, both surface water and groundwater), flowing though the area to meet future demands (398 MCM).

6.5. Future Water Works

The future water works required to exploit the potential of total renewable water within RWASA jurisdiction, as shown in Table 1, include important elements water sensitive urban designs for storm water management, rain water harvesting (at local, municipal and regional scales), management and treatment of waste water, computer controlled well fields with high capacity well clusters, recovery and rehabilitation of right of ways of natural water courses, additional construction by laws (to include water used efficiency and WSUD), and solid waste management etc. If the potential of renewable water as shown in the table is successfully exploited, it will bring perpetual sustainability of water resources to meet current and future demands. The future water works

Table 2 Annual Water Demand Compared to Renewable Water in the Study Area

	RWASA Jurisdiction
Mean available renewable water per year	689 MCM
Yearly demand by 2040	398 MCM
Yearly demand as % of available renewable water in 2040	75%
Current yearly demand	166 MCM
Current yearly demand as % of available renewable water	31%

6.6. Sustainable Yield from Surface Water

It has been assessed that exploitation of surface water resources, especially by creating artificial reservoirs on rivers/streams will not be sustainable in the long run. Surface water in the area is highly prone to pollution and silting and cannot handle serous droughts. Transfer of water from the surface water resources outside the study area is both expensive in terms of infrastructure as well as operational costs. Moreover, in case of a major damage to infrastructure, e.g. earthquake, the population at risk would be difficult to manage.

6.7. Sustainable Yield from Groundwater

Regional scale groundwater model suggests that up to 280 mgd of water can potentially be sustainably abstracted from the groundwater in the study area if rainwater recharge is properly managed. However, more hydrogeological investigations will be required before making any plan for exploitation of this potential.

7. Integrated Urban Water Management

Integrated Urban Water Management (IUWM) or Water-sensitive urban design (WSUD) is a land planning and engineering design approach which integrates the urban water cycle, including storm water, groundwater and wastewater management, water recycling, and water supply, into urban design to minimise environmental degradation and improve aesthetic and recreational appeal. IUWM/WSUD is a fully integrated approach that deals with all facets of water management in the urban and peri-urban environments and involves all stake holders in the processes of planning and design.

This study uses the term IUWM or WSUD interchangeably which is similar to Low-impact Development (LID) mostly used in North America or Sustainable Urban Drainage Systems (SUDS) mostly used in United Kingdom. IUWM is mostly preferred by World Bank while WSUD is mostly used in Australia.

7.1. Rationale for Using IUWM/WSUD Approach

Storm water management has historically focussed on directing water away from properties and managing pollution, flooding and erosion problems within the drainage system. It is now widely recognised that rainwater should be used within buildings and delivered to the environment in a more sustainable fashion, replicating natural water cycles. The advantages of sustainable water management extend beyond just the environmental benefits of improved receiving water quality, because WSUD helps break the flood peaks, reduces the quantity of storm flows, recharges the groundwater, helps reduce water demand for municipal needs, integrates rainwater harvesting, and reduces the demand on the reticulated water supply.

Development, construction and maintenance costs can be reduced with an integrated series of water management techniques that utilise water as an asset rather than a nuisance. A combination of recreational, habitat and flood mitigation benefits can be gained from the same piece of land while improving the amenity of the land to the community.

The practice of sustainable water management is usually referred to as integrated water cycle management (IWCM). This is similar to IWRM but while IWRM deals with water resources management at the Watershed/River Basin Scale, IWCM is primarily concerned with smaller scale urban environments.

7.1.1. Key Benefits of Adopting IUWM/WSUD Approach

Urban water management is now on the verge of a revolution in response to rapidly escalating urban demands for water, as well as the need to make urban water systems more resilient to climate change. Growing competition, conflicts, shortages, waste and degradation of water resources make it imperative to rethink conventional concepts – to shift from an approach that attempts to manage different aspects of the urban water cycle in isolation to an integrated approach supported by all stakeholders

IUWM/WSUD fully integrates the principles and practices of IWCM and IWRM within the urban settings, and hence it may be adopted as policy in RWASA jurisdiction to address the following key benefits[23]:

- The world's towns and cities are growing rapidly. Sustainable urban development means focusing on the relationships between water, energy, and land use, and diversifying sources of water to assure reliable supply.
- IUWM/WSUD provide a framework for planning, designing, and managing urban water systems. It is a flexible process that responds to change and enables stakeholders to predict the impacts of interventions.
- IUWM/WSUD includes environmental, economic, social, technical, and political aspects of water management. It brings together fresh water, wastewater, storm water, and solid waste, and enables better management of water quantity and quality.
- IUWM/WSUD calls for aligning urban development with basin management to ensure sustainable economic, social, and environmental relations along the urban-rural continuum.
- Developing, policies and strategies supported by financing strategies, technological developments, and tools for decision-making, in cooperation with both public and private sector partners, can facilitate putting IUWM into practice at all levels.
- Urban water planners will shift from being resource users to resource managers, change their consumption patterns, waste management, and planning to better balance resource flows to and from cities.
- IUWM projects require significant funding, but public agencies in many countries have limited ability to invest in infrastructure.

[23] GWP Policy Brief (2013): Integrated Urban Water Management – Toward Diversification and Sustainability

- Improving economic service efficiency and minimising water losses involves redesigning systems and changing consumer behaviour. This will need increased cooperation with the private sector.
- Developing 'eco-cities' will enable waste products to be used to meet energy and material needs.

7.1.2. Principles of Integrated Urban Water Management

Integrated Urban Water Management calls for the alignment of urban development and basin management to achieve sustainable economic, social, and environmental goals. It brings together water supply, sanitation, storm- and wastewater management and integrates these with land use planning and economic development.

An IUWM approach integrates planning for the water sector with other urban sectors, such as land, housing, energy, and transport to avoid fragmentation and duplication in policy- and decision-making. Cross-sector relationships are strengthened through a common working culture, collective goals and benefits are better articulated, and differences in power and resources can be negotiated. It includes the urban informal sector and marginalised communities. The basic principles of IUWM/WSUD include:

- Encompass alternative water sources;
- Match water quality with water use;
- Integrate water storage, distribution, treatment, recycling, and disposal;
- Protect, conserve and exploit water resources at their source;
- Account for non-urban users;
- Recognise and seek to align formal and informal institutions and practices;
- Recognise relationships among water, land use, and energy;
- Pursue efficiency, equity and sustainability; and,
- Encourage participation by all stakeholders

Figure 28 further elaborates how integrated urban water management helps a fully coordinated planning and management of water sector with other important sectors within the planning regime of an administrative jurisdiction. The IUWM approach begins with clear national policies on integrated water resources management, backed by effective legislation to guide local authorities. A successful approach requires engaging local communities to solve the problems of water management. Collaborative approaches should involve all stakeholders in setting priorities, taking action, and assuming responsibility.

IUWM/WSUD assesses both water quantity and quality, estimates future demand, anticipates the impacts of climate change, and recognises the importance of efficiency, without which water operations cannot be sustainable. It also recognises that different water sources can be used for different purposes – fresh water for domestic use; rain/storm water for supplementing aquifer recharge; and treated wastewater for agriculture, industry, and the environment.

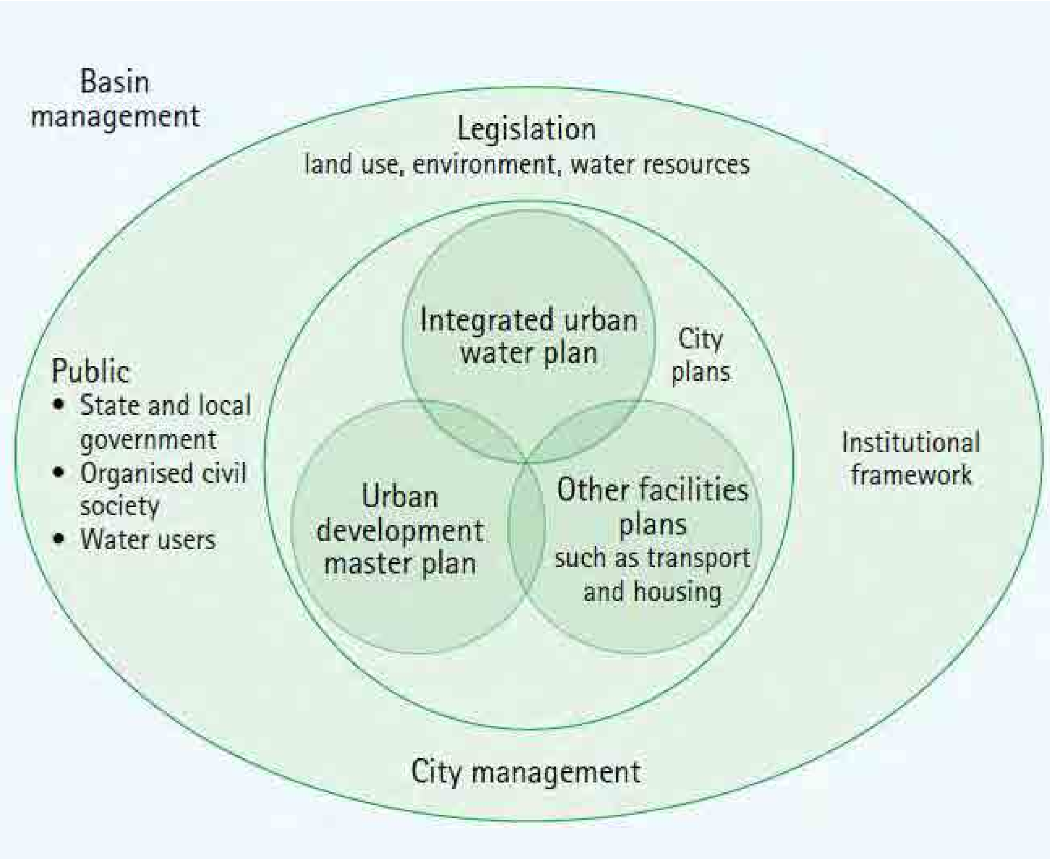

Figure 28 Integrated Urban Water Plan within the master planning of a city and a basin (GWP 2013)

7.1.3. *Economics of IUWM/WSUD*

Under IUWM, water prices and allocations reflect the costs of developing and delivering water supplies and maintaining the system. Price signals the true value of water. Accurate pricing will encourage all users to manage water wisely, consistent with an integrated urban water management strategy. Differential tariffs that account for water quality can incentivise all users to reduce surface water or groundwater consumption in favour of reclaimed water for example.

Tariffs, taxes, and subsidies can be used to distribute benefits fairly without diminishing the productivity of water resources. But if tariffs are set too low so they favour poor users and then cannot support effective operations and maintenance, the system may inadvertently contribute to greater inequality.

Pricing instruments can be designed so users pay more for higher levels of consumption or quality. Financial incentives like rebates, subsidised retrofits, water audits, and seasonal and zone pricing can also be used. Schemes under the 'polluter pays' principle, in which charges relate to the effluent that users generate, can improve the cost-effectiveness of treatment and reuse. They can even fund the construction of new infrastructure. But IUWM projects require significant levels of funding for both capital and operation and maintenance costs.

7.1.4. Policy Recommendations for RWASA to Implement IUWM/WSUD

Adopting IUWM/WSUD and its iterative processes will help RWASA jurisdiction to significantly reduce the number of people without access to water and sanitation by providing water services of appropriate quantity and quality. It is recommended that RWASA should:

Ensure their policies and strategies facilitate putting IUWM into practice at local and national levels, supported by financing strategies, technological developments, and tools for decision-making;

Take on a more central role in cities and towns so as to lead development initiatives and ensure basic needs are met;

- Incorporate climate change predictions in planning urban water supply and sanitation and install and maintain, with the participation of a wide range of stakeholders, infrastructure and services that are 'climate-proof';
- Pay special attention to supporting the informal urban sector, vital for a sustainable urban economy;
- Overcome governance fragmentation in public policy and decision-making by linking planning with the activities of other sectors;
- Build staff and institutional capacity to engage in IUWM to ensure they deliver at an optimal level;
- Engineer tariffs, taxes, and subsidies to transfer benefits to vulnerable groups, and ensure pricing policy reflects true costs;
- Consider employing the 'polluter pays' principle to improve the cost-effectiveness of treatment and reuse.

7.2. Integration with RWASA's Vision/Mission

As discussed in Study A under this project, RWASA's current vision includes modernization and compatibility with global scenarios. By adopting implementation of IUWM/WSUD as a policy within its jurisdiction, not only RWASA will achieve modernization and compatibility with global scenarios, the implementation of IUWM/WSUD will directly help the following vision/mission elements of RWASA:-

- modernization;
- achieving compatibility with global scenarios;
- reduction in un-accounted for water;
- reduction in non revenue water;
- rainwater harvesting;
- minimizing blockages and flooding;
- storm water management;
- separation of sewage and storm water; and,
- quality of waste water and its disposal.

Besides helping realize various visions/missions of RWASA, implementation of established principles and practices of WSUD will also critically help the following:

- **Prevention**: Prevention of run-off and pollution
- **Source Control**: Source control of run-off for groundwater recharge
- **Site Control**: Management of storm water towards large soak away infiltration basin for the catchments
- **Integration**: Management of run-off from several sites/areas.

The above mentioned points are discussed separately under various subsections in this chapter.

7.3. WSUD Implementation Strategy for RWASA

Current models of urban planning and water management have already failed or likely to fail from the perspective of cost effectiveness, technical performance, social equity, and environmental sustainability. More is needed than simply improving the performance and efficiency of the component parts of the water system. A paradigm shift is required at the system-wide level. Integrated Water Resources Management (IWRM) provides a framework for interventions over the entire water cycle and a reconsideration of the way water is used (and reused). And IWRM addresses tradeoffs among water users: agriculture, industry, household, and ecosystems. An integrated approach to urban water resources management calls for new objectives that recognize the mutual benefits of water resources, energy, and land use management. More governments recognise the importance of taking such an approach to address the challenges of cities. There is a growing consensus around the principles of WSUD or IUWM which include the following[24]:

Involvement of all key players: Critical to the success of the IUWM is the early and continuous integration of all stakeholders in the planning, decision making, implementation and monitoring process, in a structured way. Roles and responsibilities need to be clearly defined. The main barriers are institutional because of a highly fragmented division of responsibilities and tasks. Regulatory changes are required to avoid a sector perspective.

Considering the entire water cycle as one system: Water sources, supply, wastewater, and storm water should be contextualized within an urban water framework and a wider basin level catchment area. This allows us to understand the relationship between the components of the urban water system, as well as upstream and downstream relationships and impacts on the ecosystem.

Assessing a portfolio of water sources: A portfolio of options such as surface water, groundwater, rainwater, and storm water as well as less obvious water sources such as black water (wastewater) and grey water (wastewater other than sewage, such as sink drainage or washing machine discharge) should be considered as potential sources. The goal is to diversify sources and increase availability for different uses. When considering the demands for water, it is important to match water of a certain quality to its intended use. Consumer behaviour needs to be taken into consideration in water consumption and waste management as it can affect water resources management.

Maximizing the benefits from wastewater: By employing innovative technologies, water, energy, biogas, and nutrients can be reclaimed from waste streams and reused. Recycling and reuse can be

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[24] Global Water Partnership:
Integrated Urban Water Management, Technical Committee Background Paper 16; 2012
Towards Integrated Urban Water Management, Perspectives Paper; 2011
Managing the Other Side of the Water Cycle: Making Wastewater an Asset, Technical Committee Background Paper 13; 2009
Urban Water and Sanitation Services, an IWRM Approach, Technical Committee Background Paper 11; 2006

fostered by more decentralized systems. Low cost technologies with limited dependence on energy can contribute significantly to improving the sustainability of wastewater systems.

Designing adaptive systems: When developing an WSUD/IUWM strategy, it is important to recognize uncertainties such as climate change and its impacts. There is a need to build flexible systems that cope with uncertainty and are able to adapt to changing conditions. Such systems could be built around the following five main areas:

- **Urban Water Partnerships**: Promoting the involvement of key stakeholders in strategic planning, agreements on water allocations, pollution control measures, as well as in efficient water use, water savings, transparency issues, and a citizen's card system.
- **Urban Water Catchment Management**: Considering the entire water cycle as one system, linking the management of urban water to IWRM Plans in the broader basin context; assessing all water sources availability; assessing water demand and use; providing water fit for different purposes; regulatory changes are required to promote a more integrated approach.
- **Promoting Waste as a Resource**: Maximizing the benefits from wastewater by employing innovative technologies, condominial sewage systems, wetlands, and decentralized wastewater treatment in which water, energy, biogas and nutrients are reclaimed from waste streams and reused locally for productive use, including urban agriculture. Wastewater should not be wasted water!
- **Integrated flood management**: strengthening the resilience to climate change related extreme events and conducting vulnerability assessments.
- **Low cost, high impact solutions**: Systems do not have to be pricey to be effective, as proven by many examples around the world. Many low cost solutions are highly effective and may be used in urban environment

In recent decades, hydrological science and technology have made substantial progress and significant contributions have been made by field hydrologists to the development and management of water resources. So as to facilitate the sharing of hydrological practices among the National Hydrological Services, a technology transfer system known as the Hydrological Operational Multipurpose System (HOMS) was developed by World Meteorological Organization (WMO) and has been in operation since 1981. It offers a simple but effective means of disseminating information on a wide range of proven techniques for the use of hydrologists. HOMS transfers hydrological technology in the form of separate components. These components can take any form, such as a set of drawings for the construction of hydrological equipment, reports describing a wide variety of hydrological procedures and computer programs covering the processing and storage of hydrological data, as well as modelling and analysis of the processed data. To date, over 180 components have been made available, each operationally used by their originators, thus ensuring that every component serves its purpose and has been proved in practice. These descriptions appear in the HOMS Reference Manual (HRM)[25].

7.3.1. Prevention

One way to identify suitable BMPs for water quality improvement is to describe the target storm water pollutant(s) to be removed. Pollutant particle size grading is a useful description of the pollutant characteristics. For instance, gross pollutants are often described as particulates larger than 5mm (or 5000 microns) while soluble pollutants are described as particles smaller than 0.45 microns. Classifying storm water pollutants this way allows different pollutant types to be matched to BMPs that maximise their removal.

7.3.2. Source Control

The management of storm water runoff in conventional urban developments has been driven by an attitude that reflects the view that storm water runoff has no value as a useful resource, is environmentally benign and adds little to the amenity (aesthetic, recreation, education, etc) of an urban environment. Consequently, conventional urban storm water management has focused on providing highly efficient drainage systems to rapidly collect and remove storm water runoff using a combination of underground pipes and linear "engineered" overland flow paths (often located along the back fence line of properties to keep them out of sight). These systems kept storm water runoff "out of sight" and consequently "out of mind". The increased rates of storm water runoff associated with conventional urban development coupled with a dramatic increase in storm water runoff volume and associated contaminants such as litter, sediments, heavy metals and nutrients has caused significant degradation of the natural environments.

As part of an emerging new paradigm in urban management, the treatment of storm water runoff is no longer considered in isolation to the broader planning and design of the contributing urban area.

[25] http://www.wmo.int/pages/prog/hwrp/homs/ homs_en.html

Storm water management is considered at all stages of the urban planning and design process to ensure that site planning, architecture, landscape architecture and engineering infrastructure is provided in a manner that supports the improvement of storm water quality and the management of storm water as a valuable resource. Similarly, the storm water treatment system are adapted to the requirements of each of the other urban infrastructure elements in order for the "whole" package to function as an ecologically, socially, and economically sustainable urban system.

The success of WSUD as an urban planning and design paradigm will rest largely on the ability of the urban design industry to provide engaging and informative landscape design solutions within the public realm. The use of innovative landscape elements that show the connectivity between human activity and the urban water streams are increasingly recognised as having a powerful influence on the consciousness of individuals and recognition of their role and responsibility in the protection and enhancement of our natural water resources. By contrast, there is a distinct lack of visual connectivity between human activity, urban water streams, and receiving natural waterways with the conventional "piped" storm water system. Thus within the conventional urban setting it is difficult for individuals to see, and indeed understand, the impact of their actions on the sustainability of our natural water resources. Cooperative collaboration between the urban design professions can achieve "smarter" and more sustainable urban areas where urban landscapes engage, inform, and influence human behaviour for the benefit of the natural environment and the improvement of the social fabric. The following sections present the outcome of recent collaborations between the urban design professions in integration of storm water treatment measures into the built form.

Two of the most common storm water treatment technologies that can be readily integrated into urban design are constructed wetlands and bio retention systems.

Constructed Wetlands The use of constructed wetlands for urban storm water quality improvement is widely adopted in many Australian cities. Research and on-going refinement to practice have provided a sounder basis for sizing constructed wetlands for storm water management and for its integration into landscape design

Bio retention Systems Recent adaptations of swale systems for storm water quality treatment are directed at promoting a higher degree of storm water treatment by facilitating infiltration of storm water through a prescribed soil media. These systems are referred to as bio retention systems where a trench, filled with a "prescribed" soil of known hydraulic conductivity, is used to filter storm water.

Vegetation is a crucial component of bio retention systems. Plants roots support a wide range of micro biota (particularly bacteria and fungi) and influence characteristics of the media for several millimetres around the root (the rhizosphere) and they can significantly increase the physical trapping and biological uptake of nutrients and water by plants. Plant growth also plays an important role in maintaining the structure and hydraulic conductivity of the media. Their growth and death cycle results in macro-pore formation and maintenance, an important function in prevention of clogging of the soil media.

Recent research and monitoring of field applications have demonstrated that they present an effective "soft-technology" for removal of urban storm water pollutants (Davis et al., 2001, Lloyd et al., 2001, Kim et al., 2003). When designed with appropriate soil media and planting, these systems have long-term capacities to assimilate heavy metals washed off urban catchments

7.3.3. Site Control

Recent research into storm water treatment technology has been able to confirm the scalability of storm water treatment technologies such as constructed wetlands and bio retention systems for application in small confined areas. Through close collaboration with landscape architects and urban designers, it has been possible to incorporate many of these technologies into the urban form at a range of spatial scales.

Harvesting of roof storm water runoff can be integrated with building design. This runoff could be treated with bio retention or constructed wetland systems laid out in a roof-garden and delivered to architecturally-designed rainwater tanks that are incorporated into individual apartments for toilet flushing. Contrary to many misconceptions of roof top gardens, the entire roof space does not need to be fitted with storm water treatment measures. Often, the vegetated treatment areas (eg. bio retention systems and constructed wetlands) need only to take-up 2% to 5% of the roof area to adequately treat storm water runoff. A schematic of a building project where roof water is to be treated in a roof garden and stored in architecturally designed storage tanks within individual apartments for reuse in the hot water system.

Public building forecourts and local streetscapes represent the connecting pathways between the buildings where we live and work and the areas of sub-regional and regional public open space where we interact and recreate at a local and regional community scale. In terms of storm water runoff generation, public building forecourts and local streetscapes represent public realm areas located closest to the source of most urban storm water runoff (i.e. from impervious surfaces associated with buildings and road pavements). Integration of storm water management functionality within landscape elements associated with public building forecourts and local streetscapes allows for a number of key WSUD best management practices to be satisfied, namely: collection and treatment of storm water runoff at its source; first use of storm water runoff for watering the landscape; and visual connectivity between the built form and the urban storm water stream.

7.3.4. Management of Runoff

Precinct scale public open space areas provide an opportunity to integrate storm water collection, treatment and storage/re-use facilities within the overall landscape design of these areas. With competing uses for these spaces the scale and landscape form of the storm water management systems needs to carefully consider the other uses of the park and their potential interaction with the storm water management systems. Issues of public safety and aesthetic amenity are important design considerations requiring site analysis to determine site usage patterns, journeys, site lines, and existing landscape character in order to ensure an appropriate landscape form.

Opportunities for the innovative integration of storm water management functions within contemporary urban landscape designs at a range of scales within the public realm and private buildings were presented in this paper. A shift towards "at source" storm water management systems will further advance the development of innovative on-site, streetscape and precinct scale landscapes incorporating storm water management functionality

7.4. Groundwater Recharge

This study aimed at improved ground water recharge in the study area. It was estimated in the study that there is a huge potential of groundwater exploitation and proper recharge management. The groundwater modelling results combined with data analysis and validation exercises, revealed that all water demands can be met with the groundwater in the study area, if natural recharge zones are properly protected and urban recharge is systematically managed.

All natural water courses and water ways in the area offer excellent storm water collection systems provided by the nature. Most of these stream/water courses can turn into managed recharge systems because there is already sufficient rainwater and storm runoff. It is estimated that the aquifer can store more than 3000 million cubic meter of water within its top 200 m. This capacity, if fully exploited, can provide resilience against long droughts, as 3000 million cubic meter of water is enough to meet over seven years of water demand.

The study has followed the principles of urban storm water management and recommends that rainwater harvesting and managed recharge be planned and implemented at all scales, i.e., domestic, municipal and regional.

Groundwater modelling exercise will be used to fine tune the areas which are most ideal and suitable for building infrastructure for managed recharge to groundwater.

7.4.1. Historical Preview

Significant interest developed during the 1930s, particularly in California and New York, in the use of artificial recharge to conserve or enhance ground-water storage. In California, artificial recharge of alluvial aquifers with storm runoff by use of spreading basins began about the turn of the century, and was a widespread practice by the 1930s. However, I found no record of USGS involvement in related studies during that period. In New York, water levels in a significant area of western Long Island had been drawn down below sea level by the early 1930's due to ground-water pumpage, much of it for air conditioning. The cool ground water was used to cool air in heat exchangers, and then often discharged to waste. Legislation passed in 1933 required that ground water pumped for air conditioning be recharged, either by well injection or through spreading basins. Hydrologic and temperature effects of this recharge were analyzed by Leggette and Brashears (1938), and by Brashears (1941, 1946). Artificial recharge to conserve water was also practiced in several municipalities in northern New Jersey, as described by Barksdale and DeBuchananne (1946) [26].

In the late 1960s, separate considerations led to greatly increased interest in artificial recharge in the States of California, Texas, and New York, all of which heavily involved the USGS in artificial recharge studies. The California Water Plan was approved to import several million acre feet of water from northern to southern California each year, with the plan that much of the imported water be stored in the subsurface through artificial recharge.

Artificial recharge of storm runoff by use of spreading basins has been practiced on Long Island since the 1930s. Aronson and Seaburn (1974) evaluated the performance of the 2,124 spreading basins in existence on Long Island in 1969. Seaburn (1970) and Prill and Aaronson (1973) conducted detailed studies of the operations of three of these basins. Aronson et al. (1979) conducted a study to determine whether existing spreading basins for storm water recharge could serve the dual purpose

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[26] See bibliographical notes

of recharging treated sewage effluent. Prill et al. (1979) also constructed a spreading basin at the site of a water treatment plant in central Long Island for additional recharge experiments.

This short historical review suggests that artificial recharge of aquifers is not a new idea. The techniques and BMPs for artificial recharge have evolved over time and can be implemented in RWASA jurisdiction.

7.4.2. Some Examples of Artificial Recharge

Some examples of artificial recharge are given below to make the readers become aware of the practices of artificial recharge.

Dayton, Ohio, USA

Dayton, Ohio, is heavily dependent upon ground water to meet municipal and industrial water-supply needs. Nearly one-fourth of all ground water used in Ohio is withdrawn from wells completed in a sole-source sand and gravel aquifer that underlies the Dayton metropolitan area. Much of the water is pumped from a 30- to 75-foot thick shallow aquifer that underlies the Mad River Valley. To ensure that ground-water levels are maintained high enough to allow for large drawdowns by high-capacity wells, an artificial recharge system has been in place since the 1930's. The source of recharge is stream flow diverted from the Mad River into a series of interconnected infiltration ditches and lagoons that occupy about 20 acres on Rohrers Island.

Figure 29 High-capacity turbine pump installed on a municipal well at Rohrers Island. Recharge lagoon in background

Orlando, Florida, USA

Large volumes of reclaimed water, which has undergone advanced secondary treatment, are reused through land-based applications in a 40-square-mile area near Orlando, Florida. These applications include citrus crop irrigation and artificial recharge to the surficial aquifer through rapid infiltration basins.

Figure 30 Rapid infiltration basins of Water Conserv II facility, Orlando, Florida

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