

***TABLES AT THE BACK OF REPORT***

Table 4.1.1 River Water Quality

Location No.	Date of Sampling	Time Hrs	Flow Rate (m <sup>3</sup> /sec)	Temp (°C)	pH	DO (mg/l)	Cond (µS/cm)	Odor (TON)	Turb. (NTU)	Color (TCU)	BOD <sub>5</sub> (mg/l)	COD (mg/l)	TSS (mg/l)	OkG (mg/l)	T-N (mg/l)	E-Coli (MPN/100ml)	As (ppb)	Cu (ppm)	Cr (ppm)	Cd (ppm)	Pb (ppm)	Zn (ppm)	
National Environmental Quality Standards																							
1	04/04/00	1230	0.1	25.4	7.3	3.8	560.0	64.0	49.0	70.0	60.1	101.3	16,154.0	ND	12.3	18+							
F-8/2 Before Faizma Jimnah Park,																							
2	04/04/00	1400	0.5	18.2	7.4	5.7	210.0	4.0	13.7	0.0	6.8	25.6	4,041.0	ND	ND	18+							
E-8 Near Navy House Karakoram Road																							
3	04/05/00	1000	0.1	16.0	7.4	5.8	200.0	1.0	9.3	0.0	17.0	18.4	107.0	ND	ND	0.0							
F-6/2 Near Akhizar Mosque Margalla Road																							
4	04/05/00	1100	0.1	18.8	7.6	4.6	230.0	4.0	11.4	1.0	12.2	20.9	42.0	ND	ND	18+							
F-5/2 Near Azad Jamun Kashmiri Secretariat																							
5	04/06/00	1000	0.5	17.5	7.8	6.5	590.0	1.0	4.0	10.0	16.3	19.3	47.0	ND	ND	18+							
Near American Embassy																							
6	04/06/00	1145	0.1	22.3	7.6	2.2	850.0	16.0	6.4	70.0	31.3	58.2	146.0	ND	1.7	18+							
I-10 Pirwadhai crossing, Peshawar Road																							
7	04/07/00	1100	2.1	20.8	7.9	0.5	930.0	16.0	6.4	70.0	57.6	83.7	355.0	ND	10.1	18+	<10.0	<0.5	<0.1	<0.1	<0.2	<0.2	<0.2
I-10 Pirwadhai crossing, Nullah 1																							
8	04/07/00	1200	7.1	20.4	7.4	0.8	910.0	16.0	18.5	70.0	59.5	114.3	89.0	ND	3.4	18+	<10.0	<0.5	<0.1	<0.1	<0.2	<0.2	<0.2
I-10 Pirwadhai crossing, Nullah 2																							
9	04/07/00	1300	2.7	20.3	7.6	0.1	960.0	16.0	17.0	70.0	34.2	81.0	210.0	ND	5.1	18+	<10.0	<0.5	<0.1	<0.1	<0.2	<0.2	<0.2
I-10 Pirwadhai crossing, 200M after Joining																							
10	04/07/00	1500	0.8	20.8	8.1	6.1	600.0	1.0	0.5	0.0	14.2	34.8	43.0	ND	ND	18+							
Chattar Park																							
11	04/10/00	1330	10.8	23.8	7.1	0.3	1,320.0	64.0	41.5	70.0	139.1	357.5	284.0	ND	6.7	18+	<10.0	<0.5	<0.1	<0.1	<0.2	<0.3	<0.3
Nallah Leh Near Guwalmondi Bridge.																							
12	04/10/00	1445	7.8	24.4	7.1	0.1	1,340.0	64.0	65.1	70.0	139.3	215.4	272.0	ND	5.6	18+							
Jahanda Chichi, Air Port Road																							
13	04/11/00	1025	9.6	24.2	7.6	2.1	1,590.0	64.0	59.3	50.0	81.7	147.1	255.0	ND	51.0	18+	<10.0	3.0	<0.5	<0.1	0.3	0.3	0.3
Nallah Leh before joining River Swan																							
13*	04/11/00																						
Nallah Lai before joining River Swan																							
14	04/11/00	1245	10.1	26.3	8.2	7.6	770.0	4.0	6.1	20.0	26.9	45.6	94.0	ND	ND	18+							
River Swan before Swan Bridge																							
15	04/11/00	1130	10.5	25.4	7.6	5.4	1,140.0	16.0	43.5	20.0	42.6	68.7	22.0	ND	5.0	18+	<10.0	0.5	<0.5	<0.1	0.2	0.2	0.2
Mix of Swan and Nallah Lai																							
16	04/13/00	1220	1.2	19.8	7.8	6.0	410.0	1.0	2.6	10.0	ND	7.0	106.0	ND	ND	18+							
Rawal Dam																							
17	04/12/00	1300	1.9	26.9	7.6	2.4	58.0	4.0	22.6	70.0	10.9	15.8	77.0	ND	ND	18+							
Stream water Korang Nallah Lehtar road																							
18	04/13/00	400	0.0	20.5	7.7	0.7	760.0	16.0	9.9	10.0	58.0	89.3	50.0	ND	18.5	18+							
E-7 Hill Side Road opp St:16																							
19	04/12/00	1015	1.2	27.6	8.1	4.8	680.0	2.0	7.7	0.0	16.0	18.4	36.0	ND	ND	18+	<10.0	<0.5	<0.1	<0.1	<0.2	<0.2	<0.2
Nallah Kura, Shahrahe-Islamabad																							
19*	04/12/00																						
Nallah Kura, Shahrahe-Islamabad																							
20	04/13/00	1045	8.6	30.0	7.3	1.9	1,260.0	64.0	64.5	70.0	118.8	209.6	127.0	ND	37.5	18+							
Nallah Leh at Gulistan Colony line-1																							

Source : 3 cities investigation of Air & Water Quality June 2001

Pakistan Environmental Protection Agency, Japan International Cooperation Agency

Remark : Water quality is analyzed at HBP's Environmental Monitoring Laboratory. (HBP: Hagler Bailly Pakistan)

But in 13\*, 19\*, water quality is analyzed by Laboratories of PCSIR or NUST.

PCSIR : Pakistan Council of Scientific and Industrial Research

NUST : National University of Science and Technology

ND : Not detected



Table 5.1.2 Availability of Short-time Rainfall Data during Main Rainstorms

Year	Date	Chaklala		Islamabad		RAMC		Saidpur	
		3-Hourly	Hourly	3-Hourly	Hourly	3-Hourly	Hourly	3-Hourly	Hourly
1970	13-Aug	A							
1970	24-Aug	A							
1971	26-Aug	A							
1972	16-Sep	A							
1972	9-Dec	A							
1973	26-Jul	A							
1974	15-Jul	A	A						
1975	4-Jul	A							
1975	18-Jul	A							
1976	2-Sep	A	A						
1977	6-Jul	A							
1978	30-Jun	A							
1979	15-Sep	A							
1980	21-Mar	A	A						
1981	14-Jul	A							
1982	10-Aug	A							
1983	26-Aug	A							
1984	28-Jun	A		A					
1984	8-Jul	A		A					
1984	17-Jul	A		A					
1985	8-Jul	A		A					
1985	14-Jul	A		A					
1986	10-Feb	A		A					
1986	11-Jul	A		A					
1986	18-Jul	A		A					
1986	14-Aug	A		A					
1987	13-Aug	A		A					
1987	18-Aug	A		A					
1987	24-Aug	A		A					
1988	1-Aug	A		A					
1988	14-Aug	A		A					
1989	30-Jul	A		A		A	A		
1989	20-Aug	A		A		A	A		
1990	9-Aug	A		A					
1990	29-Aug	A		A					
1991	9-Aug	A		A					
1991	6-Sep	A		A					
1992	10-Sep	A		A					
1993	24-Mar	A		A					
1993	10-Aug	A		A					
1994	3-Jul	A		A					
1994	10-Aug	A		A					
1995	24-Jul	A		A					
1996	29-Jul	A		A					
1996	8-Aug	A		A					
1996	16-Aug	A		A					
1997	27-Aug	A		A		A	A		
1998	24-Feb	A		A					
1998	16-Jul	A		A		A	A		
1998	3-Aug	A		A					
1998	10-Aug	A		A		A	A		
1999	17-Jul	A		A					
1999	29-Sep	A		A					
2000	21-Aug	A		A					
2001	23-Jul	A		A	A	A		A	

A: Available

Table 5.1.3 Annual Maximum Basin Mean Rainfall

Serial	3-hourly rainfall			6-hourly rainfall			9-hourly rainfall			12-hourly rainfall		
	Date and Time (PST)	Rainfall (mm)	Ranking	Date and Time (PST)	Rainfall (mm)	Ranking	Date and Time (PST)	Rainfall (mm)	Ranking	Date and Time (PST)	Rainfall (mm)	Ranking
1	1970/8/24 2:00	51.8	25	1970/8/13 8:00	69.3	21	1970/8/13 8:00	70.6	23	1970/8/13 11:00	71.9	24
2	1971/8/26 11:00	115.6	5	1971/8/26 11:00	132.3	7	1971/8/26 14:00	133.6	10	1971/8/26 17:00	133.6	11
3	1972/9/16 5:00	46.2	30	1972/9/16 8:00	48.3	31	1972/9/16 11:00	48.3	32	1972/9/16 14:00	48.3	32
4	1973/7/26 2:00	104.1	8	1973/7/26 5:00	105.9	13	1973/7/26 8:00	105.9	15	1973/7/26 11:00	105.9	15
5	1974/7/15 8:00	128.6	4	1974/7/15 11:00	143.8	5	1974/7/15 14:00	155.2	7	1974/7/15 14:00	160.5	6
6	1975/7/19 8:00	58.4	21	1975/7/4 20:00	59.7	24	1975/7/4 23:00	67.3	24	1975/7/5 2:00	67.3	26
7	1976/9/2 14:00	101.6	10	1976/9/2 17:00	114.0	10	1976/9/2 20:00	118.0	13	1976/9/2 23:00	118.0	14
8	1977/7/6 8:00	81.3	13	1977/7/6 8:00	133.6	6	1977/7/6 11:00	157.3	6	1977/7/6 14:00	157.3	7
9	1978/6/30 5:00	58.4	21	1978/6/30 8:00	68.6	22	1978/6/30 11:00	113.1	14	1978/6/30 14:00	129.6	12
10	1979/9/15 14:00	60.0	19	1979/9/15 17:00	62.0	23	1979/9/15 20:00	63.8	27	1979/9/15 23:00	63.8	28
11	1980/3/21 20:00	47.5	29	1980/3/21 23:00	59.2	25	1980/3/22 2:00	59.2	28	1980/3/22 5:00	59.2	29
12	1981/7/14 5:00	101.8	9	1981/7/14 8:00	123.8	9	1981/7/14 11:00	123.8	12	1981/7/14 14:00	123.8	13
13	1982/8/10 8:00	156.1	2	1982/8/10 8:00	179.2	2	1982/8/10 14:00	265.3	2	1982/8/10 14:00	288.4	2
14	1983/8/26 17:00	105.0	7	1983/8/26 20:00	155.8	4	1983/8/26 20:00	171.5	3	1983/8/26 20:00	173.5	4
15	1984/7/17 8:00	47.8	28	1984/7/17 14:00	57.5	27	1984/6/28 11:00	67.3	24	1984/6/28 14:00	74.9	21
16	1985/7/8 8:00	110.8	6	1985/7/8 8:00	128.2	8	1985/7/8 8:00	136.8	8	1985/7/8 8:00	140.5	9
17	1986/7/11 20:00	40.9	31	1986/7/11 23:00	49.4	30	1986/7/12 2:00	49.4	31	1986/7/12 5:00	49.4	31
18	1987/8/24 5:00	31.6	32	1987/8/24 14:00	45.0	32	1987/8/24 14:00	54.2	30	1987/8/24 14:00	85.8	18
19	1988/8/14 11:00	64.4	17	1988/8/14 11:00	85.1	16	1988/8/14 14:00	85.1	18	1988/8/14 17:00	85.1	19
20	1989/7/30 2:00	71.9	15	1989/8/20 8:00	79.6	17	1989/7/30 5:00	81.4	19	1989/7/30 8:00	84.9	20
21	1990/8/9 8:00	77.7	14	1990/8/9 8:00	113.1	11	1990/8/9 11:00	135.8	9	1990/8/9 14:00	136.7	10
22	1991/9/6 5:00	63.3	18	1991/9/6 5:00	72.5	19	1991/9/6 8:00	74.0	20	1991/9/6 11:00	74.0	22
23	1992/9/9 23:00	66.2	16	1992/9/9 23:00	104.0	14	1992/9/9 23:00	128.8	11	1992/9/9 23:00	153.7	8
24	1993/8/10 5:00	55.8	23	1993/8/10 8:00	57.2	28	1993/8/10 11:00	57.2	29	1993/8/10 14:00	57.2	30
25	1994/7/3 17:00	150.2	3	1994/7/3 17:00	164.3	3	1994/7/3 17:00	166.0	4	1994/7/3 20:00	166.5	5
26	1995/7/24 11:00	81.8	12	1995/7/24 14:00	89.4	15	1995/7/24 17:00	89.7	16	1995/7/24 20:00	89.7	16
27	1996/7/29 5:00	50.8	27	1996/7/29 8:00	77.2	18	1996/7/29 11:00	87.2	17	1996/7/29 14:00	87.2	17
28	1997/8/27 8:00	87.8	11	1997/8/27 8:00	111.4	12	1997/8/27 8:00	164.5	5	1997/8/27 8:00	192.1	3
29	1998/8/3 5:00	59.2	20	1998/8/3 8:00	59.2	25	1998/8/10 11:00	70.8	22	1998/2/24 20:00	73.7	23
30	1999/7/17 8:00	54.3	24	1999/7/17 8:00	71.3	20	1999/7/17 11:00	71.3	21	1999/7/17 14:00	71.3	25
31	2000/8/21 8:00	51.0	26	2000/8/21 11:00	55.8	29	2000/8/21 14:00	64.6	26	2000/8/21 17:00	64.6	27
32	2001/7/23 14:00	239.3	1	2001/7/23 14:00	349.4	1	2001/7/23 14:00	400.8	1	2001/7/23 17:00	444.3	1

Table 5.1.4 Estimation of Annual Maximum Basin Mean Daily Rainfall

Year	Date	Daily Rainfall (mm)				
		Saidpur	Islamabad	RAMC	Chaklala	Basin Mean
1944	1-Sep				120.7	120.7
1945	18-Aug				104.1	104.1
1946	25-Jul				88.9	88.9
1947	22-Aug				31.5	31.5
1948	6-Aug				150.6	150.6
1949	20-Sep				66.6	66.6
1950	23-Aug				96.3	96.3
1951	17-Aug				312.4	312.4
1952	28-Jul				80.5	80.5
1953	23-Aug				205.7	205.7
1954	10-Sep				69.6	69.6
1955	14-Sep				86.4	86.4
1956	8-Aug				223.5	223.5
1957	13-Aug				71.1	71.1
1958	14-Sep				90.7	90.7
1959	4-Jul				140.2	140.2
1960	18-Aug				69.3	69.3
1961	2-Sep				64.8	64.8
1962	10-Aug				90.9	90.9
1963	17-Aug				87.1	87.1
1964	29-Jul				71.6	71.6
1965	1-Apr				84.8	84.8
1966	26-Jul				73.9	73.9
1967	6-Aug				101.9	101.9
1968	12-Jul				87.4	87.4
1969	12-Aug				82.3	82.3
1970	13-Jul				69.1	69.1
1971	27-Aug				125.7	125.7
1972	18-Oct				53.3	53.3
1973	26-Jul				105.9	105.9
1974	15-Jul				133.9	133.9
1975	23-Aug				116.8	116.8
1976	3-Sep				120.0	120.0
1977	6-Jul				133.6	133.6
1978	30-Jun				113.1	113.1
1979	21-Feb				78.7	78.7
1980	22-Mar				60.0	60.0
1981	14-Jul				123.8	123.8
1982	10-Aug				181.3	181.3
1983	26-Aug		172.2		173.5	172.4
1984	28-Jun		81.8		112.5	86.4
1985	8-Jul		150.1		86.0	140.5
1986	11-Feb		54.0		58.1	54.6
1987	8-May		86.7		49.9	81.2
1988	21-Jul		135.9		62.2	124.8
1989	31-Jul		135.7	65.5	116.8	124.7
1990	9-Aug		120.4	74.1	76.7	110.0
1991	20-Aug		88.2	42.4	4.6	73.9
1992	10-Sep		207.7	192.3	223.4	207.3
1993	8-Jul		88.8	65.5	40.0	80.9
1994	4-Jul		174.8	177.4	115.0	169.2
1995	2-Aug	87.0	107.9	105.0	119.0	102.5
1996	29-Jul		62.0	114.0	163.0	78.9
1997	27-Aug	180.0	199.8	207.0	200.0	194.7
1998	15-Feb	97.5	81.5	80.0	64.5	84.3
1999	12-Aug	141.2	80.9	53.0	45.0	91.7
2000	1-Aug	52.5	66.2	65.0	70.0	62.4
2001	24-Jul	227.2	591.9	359.0	200.0	411.4
Tiessen Coefficient	4 Stations	0.30	0.47	0.12	0.11	1.00
	3 Stations		0.77	0.13	0.10	1.00
	2 Stations		0.85		0.15	1.00
	1 Station				1.00	1.00

Daily Rainfall : Total rainfall between 0800 PST of the previous day and 0800 PST of the day

Table 5.2.1 (1/3) Land Use and Curve Number by Sub-basin (2001)

Subbasin	Area by Land Use (km2)								Sub-basin Average Curve Number
	Agricultural Area (CN=70)	Residential Area /Densely Populated (CN=90)	Residential Area /Ordinarily Populated (CN= 75)	Residential Area /Suburb (CN= 70)	Forest Area (CN=70, 65)	Green and Grass Area (CN=65 )	Water Body (CN=100)	Total	
SB1	0.0	0.0	7.9	0.3	7.9	5.1	0.0	21.2	71
SB2	0.0	0.0	2.9	0.0	0.0	0.6	0.0	3.5	73
SB3	0.0	0.0	3.2	0.0	8.7	4.6	0.0	16.6	70
SB4	0.7	0.0	16.1	0.0	0.5	5.7	0.0	23.1	72
SB5	0.7	0.0	0.1	0.0	6.0	3.1	0.0	9.9	68
SB6	7.9	0.0	0.0	0.4	6.4	5.1	0.0	19.7	69
SB7	8.2	0.0	8.0	3.8	2.3	17.2	0.0	39.5	69
SB8	1.6	0.0	4.1	0.0	0.0	4.7	0.4	10.8	71
SB9	12.1	1.5	2.9	0.0	0.0	4.4	0.0	20.9	71
SB10	0.0	4.4	0.1	0.0	0.0	0.4	0.3	5.2	88
SB11	1.4	3.4	2.3	0.0	0.0	4.1	0.0	11.2	75
SB12	0.4	1.1	5.3	1.6	0.0	2.4	0.0	10.8	73
SB13	0.0	5.9	0.2	0.0	0.0	0.4	0.3	6.8	88
SB14	0.0	13.5	0.1	0.0	0.0	9.0	0.2	22.8	80
SB15	0.5	1.4	0.0	0.0	3.1	7.4	0.4	12.8	69
Total	33.6	31.2	53.2	6.0	35.0	74.3	1.6	234.8	72

Note: Under normal antecedent moisture condition (AMC II)

Table 5.2.1 (2/3) Land Use and Curve Number by Subbasin (2012)

Subbasin	Area by Land Use (km2)								Sub-basin Average Curve Number
	Agricultural Area (C=70)	Residential Area /Densely Populated (C=90)	Residential Area /Ordinarily Populated (C= 75)	Residential Area /Suburb (C= 70)	Forest Area (C=70, 65)	Green and Grass Area (C=65 )	Water Body (C=100)	Total	
SB1	0.0	0.0	8.1	0.4	7.1	5.6	0.0	21.2	71
SB2	0.0	0.0	3.0	0.0	0.0	0.5	0.0	3.5	74
SB3	0.0	0.0	3.7	0.0	8.3	4.6	0.0	16.6	70
SB4	0.0	0.0	17.3	0.0	0.5	5.3	0.0	23.1	73
SB5	1.0	0.0	0.5	0.0	5.5	2.9	0.0	9.9	69
SB6	9.3	0.0	0.0	0.7	6.2	3.6	0.0	19.7	69
SB7	6.9	0.0	17.7	3.3	2.3	9.3	0.0	39.5	71
SB8	0.2	0.0	7.0	0.0	0.0	3.2	0.4	10.8	73
SB9	9.5	3.0	3.0	0.0	0.0	5.4	0.0	20.9	72
SB10	0.0	4.4	0.1	0.0	0.0	0.5	0.3	5.2	88
SB11	1.4	5.0	1.4	0.0	0.0	3.3	0.0	11.2	78
SB12	0.8	2.3	4.4	1.2	0.0	2.1	0.0	10.8	75
SB13	0.0	5.9	0.2	0.0	0.0	0.4	0.3	6.8	88
SB14	0.0	13.8	0.1	0.0	0.0	8.7	0.2	22.8	80
SB15	0.0	2.3	0.6	0.0	2.6	6.9	0.4	12.8	71
Total	29.1	36.6	67.1	5.6	32.5	62.4	1.6	234.8	73

Note: Under normal antecedent moisture condition (AMC II)

Table 5.2.1 (3/3) Land Use and Curve Number by Subbasin (2030)

Subbasin	Area by Land Use (km2)								Sub-basin Average Curve Number
	Agricultural Area (C=70)	Residential Area /Densely Populated (C=90)	Residential Area /Ordinarily Populated (C= 75)	Residential Area /Suburb (C= 70)	Forest Area (C=70, 65)	Green and Grass Area (C=65 )	Water Body (C=100)	Total	
SB1	0.00	0.00	8.06	0.66	6.76	5.69	0.00	21.17	70.56
SB2	0.00	0.00	2.95	0.00	0.00	0.52	0.00	3.47	73.54
SB3	0.00	0.00	2.58	0.00	8.11	5.91	0.00	16.59	69.00
SB4	0.00	0.00	16.83	0.00	0.46	5.79	0.04	23.12	72.43
SB5	1.65	0.00	0.46	0.00	5.44	2.32	0.00	9.87	69.06
SB6	5.08	0.00	4.43	0.39	6.08	3.76	0.00	19.74	70.17
SB7	1.54	0.00	27.40	0.00	2.30	8.34	0.00	39.59	72.41
SB8	0.00	0.00	7.85	0.00	0.00	2.59	0.38	10.82	73.50
SB9	1.82	1.50	13.01	0.00	0.00	4.63	0.00	20.97	73.43
SB10	0.00	4.44	0.09	0.00	0.00	0.46	0.25	5.24	88.03
SB11	0.59	6.35	2.45	0.00	0.00	1.75	0.00	11.14	81.72
SB12	0.78	2.32	4.67	1.16	0.00	1.86	0.00	10.78	75.60
SB13	0.00	5.86	0.24	0.00	0.00	0.42	0.28	6.80	88.35
SB14	0.00	15.33	0.46	0.00	0.00	6.77	0.22	22.79	82.37
SB15	0.00	3.08	2.09	0.00	2.61	4.60	0.40	12.77	73.74
Total	11.46	38.89	93.56	2.20	31.76	55.42	1.58	234.87	73.65

Note: Under normal antecedent moisture condition (AMC II)

Table 5.2.2 (1/2) Estimated Flood Inundation Depth and Area ( 2001 Flood)  
(km<sup>2</sup>)

Inundation Depth	Case 1-1 Reproduction of 2001 Flood			Case 1-2 after Completion of ADB		
	Islamabad	Rawalpindi	Total	Islamabad	Rawalpindi	Total
0.3m - 1m	0.22	1.57	1.79	0.26	1.57	1.84
1m - 2m	0.35	2.20	2.54	0.30	1.54	1.84
2m - 3m	0.17	1.46	1.63	0.15	1.11	1.26
3m - 4m	0.14	1.09	1.23	0.13	0.81	0.94
greater than 4m	0.38	1.66	2.04	0.34	0.98	1.31
Total	1.25	7.98	9.23	1.18	6.01	7.18

Table 5.2.2 (2/2) Estimated Flood Inundation Depth and Area ( Design Rainfall)

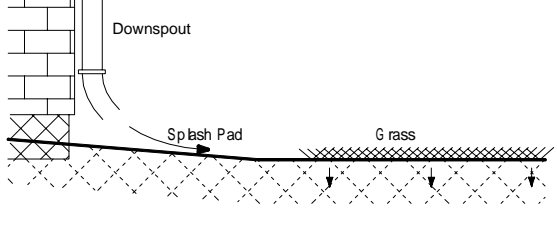
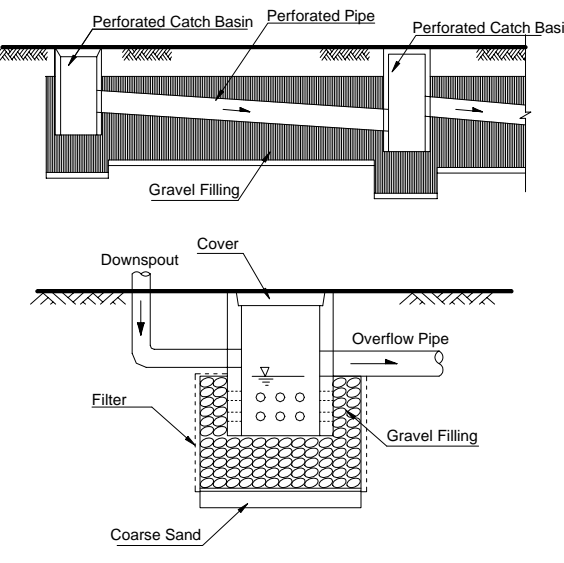
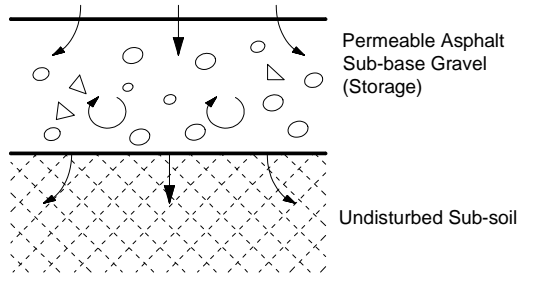
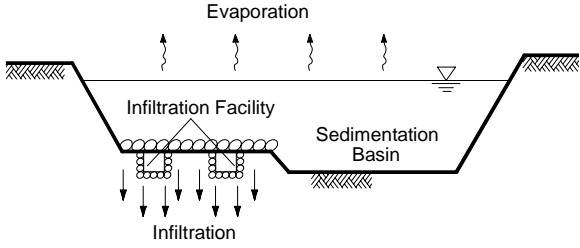
Inundation Depth	Case 2-1 100yr Flood			Case 2-2 50yr Flood			Case 2-3 25yr Flood		
	Islamabad	Rawalpindi	Total	Islamabad	Rawalpindi	Total	Islamabad	Rawalpindi	Total
0.3m - 1m	0.32	1.67	1.98	0.12	0.92	1.04	0.13	0.68	0.81
1m - 2m	0.23	1.52	1.74	0.16	1.17	1.33	0.16	0.69	0.85
2m - 3m	0.17	1.20	1.37	0.16	0.77	0.93	0.08	0.45	0.53
3m - 4m	0.15	0.92	1.07	0.12	0.56	0.68	0.06	0.31	0.38
greater than 4m	0.26	1.17	1.42	0.09	0.48	0.58	0.00	0.03	0.03
Total	1.12	6.46	7.59	0.65	3.90	4.54	0.43	2.17	2.59



Table 6.2.1 List of Bridges to be Reconstructed and Reinforced through Proposed River Channel Improvement

N0.	Name of River	Name of Bridges	Location No.*	Bridge Type	Spans	Length (m)	Width (m)	Area (m <sup>2</sup> )	Height (m)	Demolition (m <sup>3</sup> )	
										Super-structure	Sub-structure
1	Lai Nullah	Chaklala Br.-d/s	RD 6 + 251	Concrete girder	3	103	19.1	1967.3	16.9	1104	2534
	Lai Nullah	Chaklala Br.-u/s		Brick arch	5	85	12.6	1072.7	15.6	602	1382
2	Lai Nullah	Railway Br.	RD 8 + 325	Steel girder	3	79	9.2	726.8	14.6	145	936
3	Lai Nullah	Murree Road Br.	RD 8 + 628	Concrete girder	3	50	26.4	1320.0	11.9	741	1700
4	Lai Nullah	City Sadar Br.	RD 10 + 790	Concrete girder	3	71	16.4	1164.4	12.7	653	1500
5	Lai Nullah	Ratta Amral Br.	RD 11 + 780	Concrete girder	4	53	9.0	477.0	9.4	268	614
6	Lai Nullah	Gunj Mandi Br.	RD 12 + 630	Concrete girder	3	62	11.5	713.0	10.2	400	918
7	Lai Nullah	Khayaban S.S.Br.	RD 14 + 100	Concrete girder	5	117	9.0	1053.0	9.6	591	1356
8	Lai Nullah	Parrian Br.	RD 16 + 178	Concrete girder	3	45	5.5	247.5	9.0	139	319
9	Lai Nullah	Kattarian Br.	RD 17 + 210	Concrete girder	3	49	9.0	441.0	11.2	247	568
10	Saidpur Kas	S1 Br.	d/s #3 - No.6	Concrete girder	2	32	10.4	332.8	8.6	187	429

Table 6.2.2 Typical Structural Types of Flood Infiltration Facilities

Facilities	Structural Concept
<p><u>Vegetative Surface</u>                      Infiltration of stormwater through green surface is the technique that comes closest to natural infiltration of rainwater. Direct discharge of roof runoff to grass lawns by using an ejector connected to the downspout and splash pad with a slope away from the building is one of the solutions in residential areas.</p>	
<p><u>Infiltration Trench &amp; Perforated Catch Basin</u>                      Subsurface infiltration structures, soakaways, are the most common types of infiltration systems. They are basically holes in the ground filled with rubble or stones. The stormwater is stored temporarily in the cavities between the stones while it slowly percolates into the surrounding soil. They are typically long and narrow to minimize the surface area at the bottom that is supposed to clog with fines after some time, and to maximize the ratio between the effective infiltration area (the sides) and the volume.</p>	
<p><u>Permeable Pavement</u>                      Road drainage through permeable asphalt and use of the sub-base for water storage has shown to be rather efficient in connection with roads for light traffic.</p>	
<p><u>Retention Pond</u>                      During heavy rain stormwater can be stored in the basin, and slowly infiltrate through the soil layer and also slowly evaporate through water surface. This type of facilities frequently suffers severe clogging, so that proper and periodical maintenance is crucial.</p>	

**Table 6.4.1 Equipment of FFWS**

Items	Supporting Equipment Included	Quantity (unit)
<b>1. PMD Master Control Station</b>		
(1) Telemetry Supervisory Equipment		1
(2) Radio Equipment for 5.2 GHz Wireless LAN		2
(3) Radio Equipment for 400MHz		1
(4) Antenna System		1
(5) Printer		1
(6) PC type Operation Console		1
(7) Processing System (FFWS Server)		1
(8) Display System	Visual Display Unit, Plasma Display Unit, Web Server, Client PC, Laser Printer	1
(9) Uninterruptible Power Supply & Power Regulator	Uninterruptible Power Supply (UPS), Automatic Voltage Regulator (AVR), Insulated Transformer (IT)	1
(10) Air Conditioner		2
<b>2. Monitoring Station (FFC, WASA, Jinnah Park)</b>		
(1) Radio Equipment for 5.2 GHz Wireless LAN		3
(2) Antenna System		3
(3) Display System	Visual Display Unit, Plasma Display Unit, Client PC, Laser Printer	3
(4) Uninterruptible Power Supply & Power Regulator	Uninterruptible Power Supply (UPS), Automatic Voltage Regulator (AVR), Insulated Transformer (IT)	3
(5) Emergency Power Supply (Engine Generator)		3
(6) Air Conditioner		6
<b>3. Rawalpindi Warning Control Station</b>		
(1) Warning Supervisory/Control System	Warning Supervisory/Control System, Operation Console, Serial Printer	1
(2) Radio Equipment for 5.2 GHz Wireless LAN		1
(3) Radio Equipment for 400MHz		1
(4) Antenna System		1
(5) Printer		1
(6) PC type Operation Console		1
(7) Display System	Visual Display Unit, Plasma Display Unit, Client PC	1
(8) Uninterruptible Power Supply & Power Regulator	Uninterruptible Power Supply (UPS), Automatic Voltage Regulator (AVR), Insulated Transformer (IT)	1
(9) Emergency Power Supply (Engine Generator)		1
(10) Air Conditioner		2
<b>4. Rainfall Gauging Station</b>		
(1) Remote Terminal Unit (RTU)		5
(2) Radio Equipment for 400MHz		5
(3) Antenna System		5
(4) Sensor Rainfall Gauge with Data Memory Pack		5
(5) Uninterruptible Power Supply & Power Regulator	Photovoltaic Panel, Charge Controller, Storage Battery	5
<b>5. Water Level Gauging Station</b>		
(1) Remote Terminal Unit (RTU)		5
(2) Radio Equipment for 400MHz		5
(3) Antenna System		5
(4) Sensor Water Level Gauge with Data Memory Pack		5
(5) Uninterruptible Power Supply & Power Regulator	Photovoltaic Panel, Charge Controller, Storage Battery	5
<b>6. Warning Post</b>		
(1) Warning Equipment		10
(2) Siren Equipment	Siren Control Board, Motor Siren	10
(3) Audio Amplifier		10
(4) Loud Speaker and Sound Collector	Loud Speaker, Speaker Junction Box	10
(5) Radio Equipment for 400MHz		10
(6) Antenna System		10
(7) Uninterruptible Power Supply & Power Regulator	DC Power Supply, Insulated Transformer (IT)	10
<b>7. Repeater Station (Telemetry System)</b>		
(1) Repeater Equipment		1
(2) Radio Equipment for 400MHz		2
(3) Antenna System		1
(4) Power Supply		1
<b>8. Repeater Station (Wireless LAN)</b>		
(1) Radio Equipment for 5.2 GHz Wireless LAN		4
(2) Antenna System		2
(3) Uninterruptible Power Supply & Power Regulator		2

Table 7.3.1 Construction Schedule

Item	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>A FLOOD RETARDING BASIN (COMMUNITY POND) IN JINNAH PARK</b>	1	2	3	4	5	6	7	8	9
Mobilization	Urgent Project								
DIVERSION FACILITIES									
Clearing and Grubbing									
River Improvement									
Fixed Weir (H=2.5m)									
Diversion Weir with Office (H=5.2m)									
Diversion Channel									
Miscellaneous Works									
DEFENTION FACILITIES									
Clearing and Grubbing									
Detention Bas (H=20m)									
Reservoir Excavation									
Miscellaneous Works									
FACILITIES FOR MULTIPLE USE OF COMMUNITY POND									
Public Facilities									
Sports and Recreation Facilities									
Amenity and Landscape									
Miscellaneous Works									
<b>B DIVERSION CHANNEL</b>									
Diversion Channel (Bedarawali Kas - Tenawali Kas)									
Clearing and Grubbing									
Fixed Weir									
Diversion Weir									
Diversion Channel (L=2.450m)									
Bridge									
Miscellaneous Works									
Diversion Channel (Tenawali Kas - Saidpur Kas)									
Clearing and Grubbing									
Hydraulic Drop (Tenawali Kas)									
Intake Weir (Tenawali Kas)									
Hydraulic Drop (Kantawali Kas)									
Diversion Weir (Saidpur Kas)									
Diversion Channel (L=2.150m)									
Bridge									
Miscellaneous Works									
Diversion Channel (Saidpur Kas - Kurang River)									
Clearing and Grubbing									
Hydraulic Drop (Ohri Kas 1)									
Hydraulic Drop (Ohri Kas 2)									
Diversion Channel (L=5.126m)									
Hydraulic Drop (Diversion Channel)									
Bridge									
Miscellaneous Works									
<b>C LAKE MUDLAR IMPROVEMENT</b>									
SLOPE PROTECTION									
Slope Protection									
Drainage Outlet									
Miscellaneous Works									
<b>DOWSTREAM RIVER IMPROVEMENT WITH SHORT CUT CHANNEL</b>									
Clearing and Grubbing									
Excavation and Embankment Works									
Slope Protection									
Drainage Outlet									
Miscellaneous Works									
<b>D KURANG RIVER IMPROVEMENT</b>									
Clearing and Grubbing									
Excavation and Embankment Works									
Slope Protection (Sedding)									
Drainage Outlet									
Miscellaneous Works									