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ภาคผนวก

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

รายการคำนวณที่ ผ.1 ความเร็วในการตกตะกอนของอนุภาคคอลลอยด์ แบบโตด

จากกฎของสโตก (Stoke's law) ของอนุภาคทรงกลมที่ตกตะกอนแบบโตด (discrete settling) สามารถประยุกต์ได้สมการดังนี้

$$V_s = \{g(p_s - p)d^2\} / (18 u)$$

โดยที่ V_s = ความเร็วในการตกตะกอนของอนุภาค ม./วินาที

g = ความเร่งจากความโน้มถ่วง, 9.81 ม./วินาที²

P_s = ความหนาแน่นของอนุภาค, กก./ม³

p = ความหนาแน่นของของไหล, กก./ม³

d = เส้นผ่านศูนย์กลางของอนุภาค, ม.

u = ความหนืดสมบูรณ์, นิวตันวินาทีต่อตารางเมตร

อนุภาคคอลลอยด์ มีขนาด 1 ไมครอน และมีความหนาแน่น 2400 กก./ม³ โดยประมาณ

น้ำที่อุณหภูมิ 29°ซ $u = 0.81835 \times 10^{-3}$ นิวตัน-วินาที/ม²

$p = 995.97$ กก./ม³

$$\begin{aligned} V_s &= \{9.81(2400 - 995.97)(1 \times 10^{-6})^2\} / \{18(0.81835 \times 10^{-3})\} \\ &= 9.35 \times 10^{-7} \text{ ม./วินาที} \\ &= 8.07 \text{ ซม./วัน} \end{aligned}$$

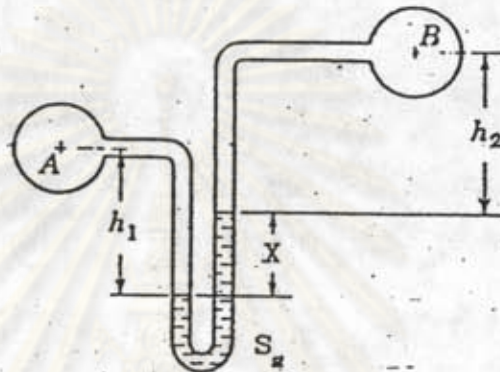
เพราะฉะนั้นใน 24 ชั่วโมง อนุภาคคอลลอยด์ขนาด 1 ไมครอน ตกตะกอนได้ ความลึก 8.07 ซม.

รายการคำนวณที่ภาคผนวกที่ 2

ค่าเกรเดียนต์ความเร็ว และเวลากักน้ำในท่อบรรจุกรวด ที่อัตราการนำไหลหนึ่ง

ที่อัตราการนำไหล 4×10^{-3} ม³/นาที ขนาดท่อ 0.024 ม. ความพรุนของตัวกลาง
กรวด 0.48 ความเร็วนำไหลในท่อ 0.307 ม./วินาที

๖ น้ำที่อุณหภูมิ 29 °ซ. = 0.8394×10^{-6} ม²/วินาที



คิฟเฟอเรนเชียล มาโนมิเตอร์

จากสมการมาโนมิเตอร์ของคิฟเฟอเรนเชียล มาโนมิเตอร์

$$H_f = X (S_g - 1)$$

โดยที่ H_f = ความสูญเสียหัวน้ำเนื่องจากความเสียดทาน, ม.

X = ค่าระดับแตกต่างของความสูงปรอท ซึ่งเกิดจากความแตกต่างของ
ความกดดันภายในที่ตำแหน่ง A และ B, ม.

S_g = ความถ่วงจำเพาะของปรอท, 13.6

ที่อัตราการนำไหล 4×10^{-3} ม³/วินาที

$$X = 0.025 \text{ ม.}$$

$$S_g = 13.6$$

$$H_f = 0.025 \text{ (13.6-1)}$$

$$= 0.315 \text{ ม.}$$

จากสมการที่ (3.3)

$$G = (gvH_f / \nu L)^{0.5}$$

โดยที่ $G =$ เกรเดียนต์ความเร็ว, วินาที⁻¹

$g =$ ความเร่งเนื่องจากความโน้มถ่วง, 9.81 ม./วินาที²

$\nu =$ ความหนืดจลน์ของของไหล, ม³/วินาที

$L =$ ความยาวของท่อ, ม.

$v =$ ความเร็วจริงของน้ำในท่อ, ม./วินาที

ที่อัตราน้ำไหล 4×10^{-3} ม³/นาที $v = 0.307$ ม./วินาที

$$H_f = 0.315 \text{ ม.} \quad L = 0.02 \text{ ม.}$$

$$G = \{(9.81 \times 0.307 \times 0.315) / (0.8394 \times 10^{-6}) (0.02)\}^{0.5}$$

$$= 7517 \text{ วินาที}^{-1}$$

จากสมการที่ (3.4)

$$T = L/v$$

โดยที่ $T =$ เวลาที่น้ำ, วินาที

ที่อัตราน้ำไหล 4×10^{-3} ม³/นาที $L = 0.02$ ม. $v = 0.307$ ม./วินาที

$$T = 0.02/0.307$$

$$= 0.065 \text{ วินาที}$$

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



รายการข้อมูลการทดลองที่ ๘.3

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Type 1. (Gravel Dia.=2-3 mm., Pipe Length =2 cm.)
 OFR.=1.90 m/hr.

Q l/min	C mg/l	H1 cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	2.5	0.315	7517	0.307	0.065	490	27.0	46.0
8	5	5.5	0.693	15769	0.614	0.033	514	19.0	62.0
12	5	10.5	1.323	26684	0.921	0.022	579	19.0	62.0
16	5	16.0	2.016	38035	1.228	0.016	619	17.0	66.0
20	5	20.5	2.583	48135	1.535	0.013	627	25.0	50.0
4	10	2.5	0.315	7517	0.307	0.065	490	10.0	80.0
8	10	5.5	0.693	15769	0.614	0.033	514	6.8	86.4
12	10	10.5	1.323	26684	0.921	0.022	579	6.7	86.6
16	10	16.0	2.016	38035	1.228	0.016	619	4.0	92.0
20	10	20.5	2.583	48135	1.535	0.013	627	6.8	86.4
4	15	2.5	0.315	7517	0.307	0.065	490	5.9	88.2
8	15	5.5	0.693	15769	0.614	0.033	514	3.2	93.6
12	15	10.5	1.323	26684	0.921	0.022	579	3.2	93.6
16	15	16.0	2.016	38035	1.228	0.016	619	2.1	95.8
20	15	20.5	2.583	48135	1.535	0.013	627	6.2	87.6
4	20	2.5	0.315	7517	0.307	0.065	490	5.7	88.6
8	20	5.5	0.693	15769	0.614	0.033	514	3.8	92.4
12	20	10.5	1.323	26684	0.921	0.022	579	3.3	93.4
16	20	16.0	2.016	38035	1.228	0.016	619	2.6	94.8
20	20	20.5	2.583	48135	1.535	0.013	627	6.8	86.4
4	30	2.5	0.315	7517	0.307	0.065	490	9.2	81.6
8	30	5.5	0.693	15769	0.614	0.033	514	7.7	84.6
12	30	10.5	1.323	26684	0.921	0.022	579	6.8	86.4
16	30	16.0	2.016	38035	1.228	0.016	619	4.7	90.6
20	30	20.5	2.583	48135	1.535	0.013	627	8.2	83.6

OFR.=0.95 m/hr.

Q l/min	C mg/l	H1 cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	2.5	0.315	7517	0.307	0.065	490	17.0	66.0
8	5	5.5	0.693	15769	0.614	0.033	514	17.0	66.0
12	5	10.5	1.323	26684	0.921	0.022	579	16.0	68.0
16	5	16.0	2.016	38035	1.228	0.016	619	16.0	68.0
20	5	20.5	2.583	48135	1.535	0.013	627	19.0	62.0
4	10	2.5	0.315	7517	0.307	0.065	490	6.3	87.4
8	10	5.5	0.693	15769	0.614	0.033	514	5.5	89.0
12	10	10.5	1.323	26684	0.921	0.022	579	5.2	89.6
16	10	16.0	2.016	38035	1.228	0.016	619	3.2	93.6
20	10	20.5	2.583	48135	1.535	0.013	627	5.7	88.6
4	15	2.5	0.315	7517	0.307	0.065	490	4.2	91.6

8	15	5.5	0.693	15769	0.614	0.033	514	2.9	94.2
12	15	10.5	1.323	26684	0.921	0.022	579	2.7	94.6
16	15	16.0	2.016	38035	1.228	0.016	619	1.7	96.6
20	15	20.5	2.583	48135	1.535	0.013	627	4.9	90.2
4	20	2.5	0.315	7517	0.307	0.065	490	3.3	93.4
8	20	5.5	0.693	15769	0.614	0.033	514	3.1	93.8
12	20	10.5	1.323	26684	0.921	0.022	579	2.7	94.6
16	20	16.0	2.016	38035	1.228	0.016	619	1.7	96.6
20	20	20.5	2.583	48135	1.535	0.013	627	5.1	89.8
4	30	2.5	0.315	7517	0.307	0.065	490	3.4	93.2
8	30	5.5	0.693	15769	0.614	0.033	514	3.8	92.4
12	30	10.5	1.323	26684	0.921	0.022	579	3.1	93.8
16	30	16.0	2.016	38035	1.228	0.016	619	2.3	95.4
20	30	20.5	2.583	48135	1.535	0.013	627	5.9	88.2

DFR.=0.63 m/hr.

Q	C	Hl	Hf	G	V	T	GT	Turbidity	Turbidity
l/min	mg/l	cm	m	s ⁻¹	m/s	sec		NTU	Removal(%)
4	5	2.5	0.315	7517	0.307	0.065	490	15.0	70.0
8	5	5.5	0.693	15769	0.614	0.033	514	14.0	72.0
12	5	10.5	1.323	26684	0.921	0.022	579	14.0	72.0
16	5	16.0	2.016	38035	1.228	0.016	619	14.0	72.0
20	5	20.5	2.583	48135	1.535	0.013	627	15.0	70.0
4	10	2.5	0.315	7517	0.307	0.065	490	5.1	89.8
8	10	5.5	0.693	15769	0.614	0.033	514	4.8	90.4
12	10	10.5	1.323	26684	0.921	0.022	579	4.6	90.8
16	10	16.0	2.016	38035	1.228	0.016	619	3.1	93.8
20	10	20.5	2.583	48135	1.535	0.013	627	5.1	89.8
4	15	2.5	0.315	7517	0.307	0.065	490	2.6	94.8
8	15	5.5	0.693	15769	0.614	0.033	514	2.7	94.6
12	15	10.5	1.323	26684	0.921	0.022	579	2.7	94.6
16	15	16.0	2.016	38035	1.228	0.016	619	1.6	96.8
20	15	20.5	2.583	48135	1.535	0.013	627	3.1	93.8
4	20	2.5	0.315	7517	0.307	0.065	490	2.1	95.8
8	20	5.5	0.693	15769	0.614	0.033	514	2.1	95.8
12	20	10.5	1.323	26684	0.921	0.022	579	1.6	96.8
16	20	16.0	2.016	38035	1.228	0.016	619	1.3	97.4
20	20	20.5	2.583	48135	1.535	0.013	627	2.9	94.2
4	30	2.5	0.315	7517	0.307	0.065	490	1.7	96.6
8	30	5.5	0.693	15769	0.614	0.033	514	2.1	95.8
12	30	10.5	1.323	26684	0.921	0.022	579	1.4	97.2
16	30	16.0	2.016	38035	1.228	0.016	619	0.8	98.4
20	30	20.5	2.583	48135	1.535	0.013	627	2.2	95.6

Type 2. (Gravel Dia.=2-3 mm., Pipe Length =4 cm.)
 OFR.=1.90 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	5.0	0.630	7517	0.307	0.130	979	24.0	52.0
8	5	11.0	1.386	15769	0.614	0.065	1027	18.0	64.0
12	5	21.0	2.646	26684	0.921	0.043	1159	17.0	66.0
16	5	32.0	4.032	38035	1.228	0.033	1239	17.0	66.0
20	5	41.0	5.166	48135	1.535	0.026	1254	24.0	52.0
4	10	5.0	0.630	7517	0.307	0.130	979	8.5	83.0
8	10	11.0	1.386	15769	0.614	0.065	1027	6.5	87.0
12	10	21.0	2.646	26684	0.921	0.043	1159	6.3	87.4
16	10	32.0	4.032	38035	1.228	0.033	1239	3.8	92.4
20	10	41.0	5.166	48135	1.535	0.026	1254	6.7	86.6
4	15	5.0	0.630	7517	0.307	0.130	979	5.8	88.4
8	15	11.0	1.386	15769	0.614	0.065	1027	3.0	94.0
12	15	21.0	2.646	26684	0.921	0.043	1159	2.9	94.2
16	15	32.0	4.032	38035	1.228	0.033	1239	1.8	96.4
20	15	41.0	5.166	48135	1.535	0.026	1254	5.4	89.2
4	20	5.0	0.630	7517	0.307	0.130	979	5.0	90.0
8	20	11.0	1.386	15769	0.614	0.065	1027	3.3	93.4
12	20	21.0	2.646	26684	0.921	0.043	1159	3.3	93.4
16	20	32.0	4.032	38035	1.228	0.033	1239	2.3	95.4
20	20	41.0	5.166	48135	1.535	0.026	1254	5.5	89.0
4	30	5.0	0.630	7517	0.307	0.130	979	8.8	82.4
8	30	11.0	1.386	15769	0.614	0.065	1027	6.8	86.4
12	30	21.0	2.646	26684	0.921	0.043	1159	6.6	86.8
16	30	32.0	4.032	38035	1.228	0.033	1239	1.3	97.4
20	30	41.0	5.166	48135	1.535	0.026	1254	7.0	86.0

OFR.=0.95 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	5.0	0.630	7517	0.307	0.130	979	17.0	66.0
8	5	11.0	1.386	15769	0.614	0.065	1027	16.0	68.0
12	5	21.0	2.646	26684	0.921	0.043	1159	17.0	66.0
16	5	32.0	4.032	38035	1.228	0.033	1239	13.0	74.0
20	5	41.0	5.166	48135	1.535	0.026	1254	17.0	66.0
4	10	5.0	0.630	7517	0.307	0.130	979	6.1	87.8
8	10	11.0	1.386	15769	0.614	0.065	1027	5.2	89.6
12	10	21.0	2.646	26684	0.921	0.043	1159	5.2	89.6
16	10	32.0	4.032	38035	1.228	0.033	1239	3.2	93.6
20	10	41.0	5.166	48135	1.535	0.026	1254	5.5	89.0

4	15	5.0	0.630	7517	0.307	0.130	979	3.1	93.8
8	15	11.0	1.386	15769	0.614	0.065	1027	2.6	94.8
12	15	21.0	2.646	26684	0.921	0.043	1159	2.4	95.2
16	15	32.0	4.032	38035	1.228	0.033	1239	1.7	96.6
20	15	41.0	5.166	48135	1.535	0.026	1254	4.5	91.0
4	20	5.0	0.630	7517	0.307	0.130	979	3.1	93.8
8	20	11.0	1.386	15769	0.614	0.065	1027	2.7	94.6
12	20	21.0	2.646	26684	0.921	0.043	1159	2.5	95.0
16	20	32.0	4.032	38035	1.228	0.033	1239	1.7	96.6
20	20	41.0	5.166	48135	1.535	0.026	1254	4.8	90.4
4	30	5.0	0.630	7517	0.307	0.130	979	3.3	93.4
8	30	11.0	1.386	15769	0.614	0.065	1027	3.0	94.0
12	30	21.0	2.646	26684	0.921	0.043	1159	2.7	94.6
16	30	32.0	4.032	38035	1.228	0.033	1239	2.5	95.0
20	30	41.0	5.166	48135	1.535	0.026	1254	5.4	89.2

DFR.=0.63 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	5.0	0.630	7517	0.307	0.130	979	16.0	68.0
8	5	11.0	1.386	15769	0.614	0.065	1027	14.0	72.0
12	5	21.0	2.646	26684	0.921	0.043	1159	14.0	72.0
16	5	32.0	4.032	38035	1.228	0.033	1239	13.0	74.0
20	5	41.0	5.166	48135	1.535	0.026	1254	15.0	70.0
4	10	5.0	0.630	7517	0.307	0.130	979	4.9	90.2
8	10	11.0	1.386	15769	0.614	0.065	1027	4.5	91.0
12	10	21.0	2.646	26684	0.921	0.043	1159	4.7	90.6
16	10	32.0	4.032	38035	1.228	0.033	1239	2.9	94.2
20	10	41.0	5.166	48135	1.535	0.026	1254	4.7	90.6
4	15	5.0	0.630	7517	0.307	0.130	979	2.5	95.0
8	15	11.0	1.386	15769	0.614	0.065	1027	2.4	95.2
12	15	21.0	2.646	26684	0.921	0.043	1159	2.3	95.4
16	15	32.0	4.032	38035	1.228	0.033	1239	1.5	97.0
20	15	41.0	5.166	48135	1.535	0.026	1254	3.4	93.2
4	20	5.0	0.630	7517	0.307	0.130	979	1.8	96.4
8	20	11.0	1.386	15769	0.614	0.065	1027	1.9	96.2
12	20	21.0	2.646	26684	0.921	0.043	1159	1.6	96.8
16	20	32.0	4.032	38035	1.228	0.033	1239	1.1	97.8
20	20	41.0	5.166	48135	1.535	0.026	1254	1.8	96.4
4	30	5.0	0.630	7517	0.307	0.130	979	1.7	96.6
8	30	11.0	1.386	15769	0.614	0.065	1027	1.5	97.0
12	30	21.0	2.646	26684	0.921	0.043	1159	1.3	97.4
16	30	32.0	4.032	38035	1.228	0.033	1239	1.1	97.8
20	30	41.0	5.166	48135	1.535	0.026	1254	1.3	97.4

Type 3. (Gravel Dia.=2-3 mm., Pipe Length =6 cm.)
 OFR.=1.90 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	7.5	0.945	7517	0.307	0.195	1469	25.0	50.0
8	5	16.5	2.079	15769	0.614	0.098	1541	19.0	62.0
12	5	31.5	3.969	26684	0.921	0.065	1738	17.0	66.0
16	5	48.0	6.048	38035	1.228	0.049	1858	16.0	68.0
20	5	61.5	7.749	48135	1.535	0.039	1881	24.0	52.0
4	10	7.5	0.945	7517	0.307	0.195	1469	8.0	84.0
8	10	16.5	2.079	15769	0.614	0.098	1541	6.0	88.0
12	10	31.5	3.969	26684	0.921	0.065	1738	5.9	88.2
16	10	48.0	6.048	38035	1.228	0.049	1858	3.9	92.2
20	10	61.5	7.749	48135	1.535	0.039	1881	6.4	87.2
4	15	7.5	0.945	7517	0.307	0.195	1469	5.7	88.6
8	15	16.5	2.079	15769	0.614	0.098	1541	2.9	94.2
12	15	31.5	3.969	26684	0.921	0.065	1738	2.8	94.4
16	15	48.0	6.048	38035	1.228	0.049	1858	1.6	96.8
20	15	61.5	7.749	48135	1.535	0.039	1881	5.2	89.6
4	20	7.5	0.945	7517	0.307	0.195	1469	5.5	89.0
8	20	16.5	2.079	15769	0.614	0.098	1541	4.5	91.0
12	20	31.5	3.969	26684	0.921	0.065	1738	3.1	93.8
16	20	48.0	6.048	38035	1.228	0.049	1858	2.1	95.8
20	20	61.5	7.749	48135	1.535	0.039	1881	5.8	88.4
4	30	7.5	0.945	7517	0.307	0.195	1469	11.0	78.0
8	30	16.5	2.079	15769	0.614	0.098	1541	8.5	83.0
12	30	31.5	3.969	26684	0.921	0.065	1738	6.9	86.2
16	30	48.0	6.048	38035	1.228	0.049	1858	4.4	91.2
20	30	61.5	7.749	48135	1.535	0.039	1881	8.6	82.8

OFR.=0.95 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	7.5	0.945	7517	0.307	0.195	1469	17.0	66.0
8	5	16.5	2.079	15769	0.614	0.098	1541	16.0	68.0
12	5	31.5	3.969	26684	0.921	0.065	1738	15.0	70.0
16	5	48.0	6.048	38035	1.228	0.049	1858	14.0	72.0
20	5	61.5	7.749	48135	1.535	0.039	1881	17.0	66.0
4	10	7.5	0.945	7517	0.307	0.195	1469	5.6	88.8
8	10	16.5	2.079	15769	0.614	0.098	1541	5.2	89.6
12	10	31.5	3.969	26684	0.921	0.065	1738	5.2	89.6
16	10	48.0	6.048	38035	1.228	0.049	1858	3.6	92.8
20	10	61.5	7.749	48135	1.535	0.039	1881	5.4	89.2
4	15	7.5	0.945	7517	0.307	0.195	1469	4.0	92.0

8	15	16.5	2.079	15769	0.614	0.098	1541	2.5	95.0
12	15	31.5	3.969	26684	0.921	0.065	1738	2.2	95.6
16	15	48.0	6.048	38035	1.228	0.049	1858	1.6	96.8
20	15	61.5	7.749	48135	1.535	0.039	1881	3.6	92.8
4	20	7.5	0.945	7517	0.307	0.195	1469	3.4	93.2
8	20	16.5	2.079	15769	0.614	0.098	1541	2.9	94.2
12	20	31.5	3.969	26684	0.921	0.065	1738	2.4	95.2
16	20	48.0	6.048	38035	1.228	0.049	1858	1.7	96.6
20	20	61.5	7.749	48135	1.535	0.039	1881	5.2	89.6
4	30	7.5	0.945	7517	0.307	0.195	1469	3.6	92.8
8	30	16.5	2.079	15769	0.614	0.098	1541	3.1	93.8
12	30	31.5	3.969	26684	0.921	0.065	1738	2.9	94.2
16	30	48.0	6.048	38035	1.228	0.049	1858	2.1	95.8
20	30	61.5	7.749	48135	1.535	0.039	1881	5.7	88.6

OFR.=0.63 m/hr.

Q	C	H _i	H _f	G	V	T	GT	Turbidity	Turbidity
l/min	mg/l	cm	m	s ⁻¹	m/s	sec		NTU	Removal(%)
4	5	7.5	0.945	7517	0.307	0.195	1469	16.0	68.0
8	5	16.5	2.079	15769	0.614	0.098	1541	13.0	74.0
12	5	31.5	3.969	26684	0.921	0.065	1738	14.0	72.0
16	5	48.0	6.048	38035	1.228	0.049	1858	12.0	76.0
20	5	61.5	7.749	48135	1.535	0.039	1881	15.0	70.0
4	10	7.5	0.945	7517	0.307	0.195	1469	5.0	90.0
8	10	16.5	2.079	15769	0.614	0.098	1541	4.5	91.0
12	10	31.5	3.969	26684	0.921	0.065	1738	4.6	90.8
16	10	48.0	6.048	38035	1.228	0.049	1858	2.9	94.2
20	10	61.5	7.749	48135	1.535	0.039	1881	4.7	90.6
4	15	7.5	0.945	7517	0.307	0.195	1469	3.5	93.0
8	15	16.5	2.079	15769	0.614	0.098	1541	2.4	95.2
12	15	31.5	3.969	26684	0.921	0.065	1738	2.0	96.0
16	15	48.0	6.048	38035	1.228	0.049	1858	1.6	96.8
20	15	61.5	7.749	48135	1.535	0.039	1881	2.6	94.8
4	20	7.5	0.945	7517	0.307	0.195	1469	2.1	95.8
8	20	16.5	2.079	15769	0.614	0.098	1541	2.0	96.0
12	20	31.5	3.969	26684	0.921	0.065	1738	1.6	96.8
16	20	48.0	6.048	38035	1.228	0.049	1858	1.2	97.6
20	20	61.5	7.749	48135	1.535	0.039	1881	2.2	95.6
4	30	7.5	0.945	7517	0.307	0.195	1469	1.7	96.6
8	30	16.5	2.079	15769	0.614	0.098	1541	1.6	96.8
12	30	31.5	3.969	26684	0.921	0.065	1738	1.6	96.8
16	30	48.0	6.048	38035	1.228	0.049	1858	1.0	98.0
20	30	61.5	7.749	48135	1.535	0.039	1881	1.9	96.2

Type 4. (Gravel Dia.=2-3 mm., Pipe Length =8 cm.)
 DFR.=1.90 m/hr.

Q l/min	C mg/l	H _i cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	10.0	1.260	7517	0.307	0.261	1959	23.0	54.0
8	5	22.0	2.772	15769	0.614	0.130	2054	18.0	64.0
12	5	42.0	5.292	26684	0.921	0.087	2318	17.0	66.0
16	5	64.0	8.064	38035	1.228	0.065	2478	15.0	70.0
20	5	82.0	10.332	48135	1.535	0.052	2509	21.0	58.0
4	10	10.0	1.260	7517	0.307	0.261	1959	9.2	81.6
8	10	22.0	2.772	15769	0.614	0.130	2054	6.3	87.4
12	10	42.0	5.292	26684	0.921	0.087	2318	4.7	90.6
16	10	64.0	8.064	38035	1.228	0.065	2478	3.6	92.8
20	10	82.0	10.332	48135	1.535	0.052	2509	7.4	85.2
4	15	10.0	1.260	7517	0.307	0.261	1959	7.5	85.0
8	15	22.0	2.772	15769	0.614	0.130	2054	4.5	91.0
12	15	42.0	5.292	26684	0.921	0.087	2318	2.8	94.4
16	15	64.0	8.064	38035	1.228	0.065	2478	2.5	95.0
20	15	82.0	10.332	48135	1.535	0.052	2509	5.6	88.8
4	20	10.0	1.260	7517	0.307	0.261	1959	7.5	85.0
8	20	22.0	2.772	15769	0.614	0.130	2054	5.3	89.4
12	20	42.0	5.292	26684	0.921	0.087	2318	3.9	92.2
16	20	64.0	8.064	38035	1.228	0.065	2478	2.5	95.0
20	20	82.0	10.332	48135	1.535	0.052	2509	7.2	85.6
4	30	10.0	1.260	7517	0.307	0.261	1959	13.0	74.0
8	30	22.0	2.772	15769	0.614	0.130	2054	10.0	80.0
12	30	42.0	5.292	26684	0.921	0.087	2318	7.5	85.0
16	30	64.0	8.064	38035	1.228	0.065	2478	5.0	90.0
20	30	82.0	10.332	48135	1.535	0.052	2509	10.0	80.0

DFR.=0.95 m/hr.

Q l/min	C mg/l	H _i cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	10.0	1.260	7517	0.307	0.261	1959	16.0	68.0
8	5	22.0	2.772	15769	0.614	0.130	2054	15.0	70.0
12	5	42.0	5.292	26684	0.921	0.087	2318	13.0	74.0
16	5	64.0	8.064	38035	1.228	0.065	2478	14.0	72.0
20	5	82.0	10.332	48135	1.535	0.052	2509	17.0	66.0
4	10	10.0	1.260	7517	0.307	0.261	1959	6.5	87.0
8	10	22.0	2.772	15769	0.614	0.130	2054	5.4	89.2
12	10	42.0	5.292	26684	0.921	0.087	2318	4.5	91.0
16	10	64.0	8.064	38035	1.228	0.065	2478	3.0	94.0
20	10	82.0	10.332	48135	1.535	0.052	2509	5.9	88.2

4	15	10.0	1.260	7517	0.307	0.261	1959	4.2	91.6
8	15	22.0	2.772	15769	0.614	0.130	2054	3.0	94.0
12	15	42.0	5.292	26684	0.921	0.087	2318	2.2	95.6
16	15	64.0	8.064	38035	1.228	0.065	2478	1.7	96.6
20	15	82.0	10.332	48135	1.535	0.052	2509	4.4	91.2
4	20	10.0	1.260	7517	0.307	0.261	1959	4.1	91.8
8	20	22.0	2.772	15769	0.614	0.130	2054	3.6	92.8
12	20	42.0	5.292	26684	0.921	0.087	2318	2.5	95.0
16	20	64.0	8.064	38035	1.228	0.065	2478	1.9	96.2
20	20	82.0	10.332	48135	1.535	0.052	2509	5.4	89.2
4	30	10.0	1.260	7517	0.307	0.261	1959	4.2	91.6
8	30	22.0	2.772	15769	0.614	0.130	2054	5.2	89.6
12	30	42.0	5.292	26684	0.921	0.087	2318	3.0	94.0
16	30	64.0	8.064	38035	1.228	0.065	2478	2.4	95.2
20	30	82.0	10.332	48135	1.535	0.052	2509	6.2	87.6

OFR.=0.63 m/hr.

Q	C	H1	Hf	B	V	T	GT	Turbidity	Turbidity
l/min	mg/l	cm	m	s ⁻¹	m/s	sec		NTU	Removal(%)
4	5	10.0	1.260	7517	0.307	0.261	1959	14.0	72.0
8	5	22.0	2.772	15769	0.614	0.130	2054	13.0	74.0
12	5	42.0	5.292	26684	0.921	0.087	2318	12.0	76.0
16	5	64.0	8.064	38035	1.228	0.065	2478	12.0	76.0
20	5	82.0	10.332	48135	1.535	0.052	2509	14.0	72.0
4	10	10.0	1.260	7517	0.307	0.261	1959	5.8	88.4
8	10	22.0	2.772	15769	0.614	0.130	2054	5.2	89.6
12	10	42.0	5.292	26684	0.921	0.087	2318	4.0	92.0
16	10	64.0	8.064	38035	1.228	0.065	2478	2.7	94.6
20	10	82.0	10.332	48135	1.535	0.052	2509	5.0	90.0
4	15	10.0	1.260	7517	0.307	0.261	1959	3.3	93.4
8	15	22.0	2.772	15769	0.614	0.130	2054	2.9	94.2
12	15	42.0	5.292	26684	0.921	0.087	2318	2.1	95.8
16	15	64.0	8.064	38035	1.228	0.065	2478	1.6	96.8
20	15	82.0	10.332	48135	1.535	0.052	2509	2.9	94.2
4	20	10.0	1.260	7517	0.307	0.261	1959	2.3	95.4
8	20	22.0	2.772	15769	0.614	0.130	2054	2.3	95.4
12	20	42.0	5.292	26684	0.921	0.087	2318	1.8	96.4
16	20	64.0	8.064	38035	1.228	0.065	2478	1.3	97.4
20	20	82.0	10.332	48135	1.535	0.052	2509	2.5	95.0
4	30	10.0	1.260	7517	0.307	0.261	1959	2.2	95.6
8	30	22.0	2.772	15769	0.614	0.130	2054	1.8	96.4
12	30	42.0	5.292	26684	0.921	0.087	2318	1.7	96.6
16	30	64.0	8.064	38035	1.228	0.065	2478	1.3	97.4
20	30	82.0	10.332	48135	1.535	0.052	2509	1.9	96.2

Type 5. (Gravel Dia.=4-5 mm., Pipe Length =2 cm.)
 QFR.=1.90 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	2.2	0.277	6775	0.283	0.071	478	26.0	48.0
8	5	5.0	0.630	14445	0.567	0.035	510	19.0	62.0
12	5	9.5	1.197	24386	0.850	0.024	574	19.0	62.0
16	5	15.0	1.890	35383	1.134	0.018	624	16.0	68.0
20	5	20.0	2.520	45679	1.417	0.014	645	24.0	52.0
4	10	2.2	0.277	6775	0.283	0.071	478	9.9	80.2
8	10	5.0	0.630	14445	0.567	0.035	510	6.6	86.8
12	10	9.5	1.197	24386	0.850	0.024	574	6.6	86.8
16	10	15.0	1.890	35383	1.134	0.018	624	3.9	92.2
20	10	20.0	2.520	45679	1.417	0.014	645	6.6	86.8
4	15	2.2	0.277	6775	0.283	0.071	478	5.8	88.4
8	15	5.0	0.630	14445	0.567	0.035	510	3.1	93.8
12	15	9.5	1.197	24386	0.850	0.024	574	3.1	93.8
16	15	15.0	1.890	35383	1.134	0.018	624	2.0	96.0
20	15	20.0	2.520	45679	1.417	0.014	645	6.0	88.0
4	20	2.2	0.277	6775	0.283	0.071	478	5.6	88.8
8	20	5.0	0.630	14445	0.567	0.035	510	3.7	92.6
12	20	9.5	1.197	24386	0.850	0.024	574	3.2	93.6
16	20	15.0	1.890	35383	1.134	0.018	624	2.5	95.0
20	20	20.0	2.520	45679	1.417	0.014	645	6.6	86.8
4	30	2.2	0.277	6775	0.283	0.071	478	9.0	82.0
8	30	5.0	0.630	14445	0.567	0.035	510	7.6	84.8
12	30	9.5	1.197	24386	0.850	0.024	574	6.6	86.8
16	30	15.0	1.890	35383	1.134	0.018	624	4.6	90.8
20	30	20.0	2.520	45679	1.417	0.014	645	8.0	84.0

QFR.=0.95 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	2.2	0.277	6775	0.283	0.071	478	17.0	66.0
8	5	5.0	0.630	14445	0.567	0.035	510	16.0	68.0
12	5	9.5	1.197	24386	0.850	0.024	574	15.0	70.0
16	5	15.0	1.890	35383	1.134	0.018	624	15.0	70.0
20	5	20.0	2.520	45679	1.417	0.014	645	19.0	62.0
4	10	2.2	0.277	6775	0.283	0.071	478	6.2	87.6
8	10	5.0	0.630	14445	0.567	0.035	510	5.4	89.2
12	10	9.5	1.197	24386	0.850	0.024	574	5.1	89.8
16	10	15.0	1.890	35383	1.134	0.018	624	3.2	93.6
20	10	20.0	2.520	45679	1.417	0.014	645	5.6	88.8
4	15	2.2	0.277	6775	0.283	0.071	478	4.1	91.8

8	15	5.0	0.630	14445	0.567	0.035	510	2.8	94.4
12	15	9.5	1.197	24386	0.850	0.024	574	2.6	94.8
16	15	15.0	1.890	35383	1.134	0.018	624	1.6	96.8
20	15	20.0	2.520	45679	1.417	0.014	645	4.8	90.4
4	20	2.2	0.277	6775	0.283	0.071	478	3.2	93.6
8	20	5.0	0.630	14445	0.567	0.035	510	3.0	94.0
12	20	9.5	1.197	24386	0.850	0.024	574	2.6	94.8
16	20	15.0	1.890	35383	1.134	0.018	624	1.7	96.6
20	20	20.0	2.520	45679	1.417	0.014	645	4.9	90.2
4	30	2.2	0.277	6775	0.283	0.071	478	3.3	93.4
8	30	5.0	0.630	14445	0.567	0.035	510	3.7	92.6
12	30	9.5	1.197	24386	0.850	0.024	574	3.1	93.8
16	30	15.0	1.890	35383	1.134	0.018	624	2.3	95.4
20	30	20.0	2.520	45679	1.417	0.014	645	5.8	88.4

DFR.=0.63 m/hr.

Q	C	H1	Hf	G	V	T	GT	Turbidity NTU	Turbidity Removal (%)
l/min	mg/l	cm	m	s ⁻¹	m/s	sec			
4	5	2.2	0.277	6775	0.283	0.071	478	14.0	72.0
8	5	5.0	0.630	14445	0.567	0.035	510	13.0	74.0
12	5	9.5	1.197	24386	0.850	0.024	574	13.0	74.0
16	5	15.0	1.890	35383	1.134	0.018	624	13.0	74.0
20	5	20.0	2.520	45679	1.417	0.014	645	14.0	72.0
4	10	2.2	0.277	6775	0.283	0.071	478	4.9	90.2
8	10	5.0	0.630	14445	0.567	0.035	510	4.7	90.6
12	10	9.5	1.197	24386	0.850	0.024	574	4.5	91.0
16	10	15.0	1.890	35383	1.134	0.018	624	3.1	93.8
20	10	20.0	2.520	45679	1.417	0.014	645	4.9	90.2
4	15	2.2	0.277	6775	0.283	0.071	478	2.5	95.0
8	15	5.0	0.630	14445	0.567	0.035	510	2.6	94.8
12	15	9.5	1.197	24386	0.850	0.024	574	2.6	94.8
16	15	15.0	1.890	35383	1.134	0.018	624	1.5	97.0
20	15	20.0	2.520	45679	1.417	0.014	645	3.0	94.0
4	20	2.2	0.277	6775	0.283	0.071	478	2.1	95.8
8	20	5.0	0.630	14445	0.567	0.035	510	2.1	95.8
12	20	9.5	1.197	24386	0.850	0.024	574	1.5	97.0
16	20	15.0	1.890	35383	1.134	0.018	624	1.3	97.4
20	20	20.0	2.520	45679	1.417	0.014	645	2.8	94.4
4	30	2.2	0.277	6775	0.283	0.071	478	1.7	96.6
8	30	5.0	0.630	14445	0.567	0.035	510	2.1	95.8
12	30	9.5	1.197	24386	0.850	0.024	574	1.5	97.0
16	30	15.0	1.890	35383	1.134	0.018	624	0.8	98.4
20	30	20.0	2.520	45679	1.417	0.014	645	2.2	95.6

Type 6. (Gravel Dia.=4-5 mm., Pipe Length =4 cm.)
 QFR.=1.90 m/hr.

Q l/min	C mg/l	H1 cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	4.4	0.554	6775	0.283	0.141	956	23.0	54.0
8	5	10.0	1.260	14445	0.567	0.071	1019	18.0	64.0
12	5	19.0	2.394	24386	0.850	0.047	1147	17.0	66.0
16	5	30.0	3.780	35383	1.134	0.035	1249	16.0	68.0
20	5	40.0	5.040	45679	1.417	0.028	1289	23.0	54.0
4	10	4.4	0.554	6775	0.283	0.141	956	8.3	83.4
8	10	10.0	1.260	14445	0.567	0.071	1019	6.4	87.2
12	10	19.0	2.394	24386	0.850	0.047	1147	6.2	87.6
16	10	30.0	3.780	35383	1.134	0.035	1249	3.7	92.6
20	10	40.0	5.040	45679	1.417	0.028	1289	6.6	86.8
4	15	4.4	0.554	6775	0.283	0.141	956	5.7	88.6
8	15	10.0	1.260	14445	0.567	0.071	1019	3.0	94.0
12	15	19.0	2.394	24386	0.850	0.047	1147	2.9	94.2
16	15	30.0	3.780	35383	1.134	0.035	1249	1.7	96.6
20	15	40.0	5.040	45679	1.417	0.028	1289	5.3	89.4
4	20	4.4	0.554	6775	0.283	0.141	956	4.9	90.2
8	20	10.0	1.260	14445	0.567	0.071	1019	3.2	93.6
12	20	19.0	2.394	24386	0.850	0.047	1147	3.2	93.6
16	20	30.0	3.780	35383	1.134	0.035	1249	2.3	95.4
20	20	40.0	5.040	45679	1.417	0.028	1289	5.4	89.2
4	30	4.4	0.554	6775	0.283	0.141	956	8.6	82.8
8	30	10.0	1.260	14445	0.567	0.071	1019	6.6	86.8
12	30	19.0	2.394	24386	0.850	0.047	1147	6.5	87.0
16	30	30.0	3.780	35383	1.134	0.035	1249	3.9	92.2
20	30	40.0	5.040	45679	1.417	0.028	1289	6.8	86.4

QFR.=0.95 m/hr.

Q l/min	C mg/l	H1 cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	4.4	0.554	6775	0.283	0.141	956	17.0	66.0
8	5	10.0	1.260	14445	0.567	0.071	1019	15.0	70.0
12	5	19.0	2.394	24386	0.850	0.047	1147	16.0	68.0
16	5	30.0	3.780	35383	1.134	0.035	1249	14.0	72.0
20	5	40.0	5.040	45679	1.417	0.028	1289	17.0	66.0
4	10	4.4	0.554	6775	0.283	0.141	956	5.9	88.2
8	10	10.0	1.260	14445	0.567	0.071	1019	5.1	89.8
12	10	19.0	2.394	24386	0.850	0.047	1147	5.1	89.8
16	10	30.0	3.780	35383	1.134	0.035	1249	3.2	93.6
20	10	40.0	5.040	45679	1.417	0.028	1289	5.4	89.2

4	15	4.4	0.554	6775	0.283	0.141	956	3.1	93.8
8	15	10.0	1.260	14445	0.567	0.071	1019	2.5	95.0
12	15	19.0	2.394	24386	0.850	0.047	1147	2.3	95.4
16	15	30.0	3.780	35383	1.134	0.035	1249	1.6	96.8
20	15	40.0	5.040	45679	1.417	0.028	1289	4.4	91.2
4	20	4.4	0.554	6775	0.283	0.141	956	3.1	93.8
8	20	10.0	1.260	14445	0.567	0.071	1019	2.6	94.8
12	20	19.0	2.394	24386	0.850	0.047	1147	2.4	95.2
16	20	30.0	3.780	35383	1.134	0.035	1249	1.6	96.8
20	20	40.0	5.040	45679	1.417	0.028	1289	4.7	90.6
4	30	4.4	0.554	6775	0.283	0.141	956	3.2	93.6
8	30	10.0	1.260	14445	0.567	0.071	1019	3.0	94.0
12	30	19.0	2.394	24386	0.850	0.047	1147	2.6	94.8
16	30	30.0	3.780	35383	1.134	0.035	1249	2.4	95.2
20	30	40.0	5.040	45679	1.417	0.028	1289	5.3	89.4

OFR.=0.63 m/hr.

Q l/min	C mg/l	H _i cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	4.4	0.554	6775	0.283	0.141	956	15.0	70.0
8	5	10.0	1.260	14445	0.567	0.071	1019	13.0	74.0
12	5	19.0	2.394	24386	0.850	0.047	1147	13.0	74.0
16	5	30.0	3.780	35383	1.134	0.035	1249	13.0	74.0
20	5	40.0	5.040	45679	1.417	0.028	1289	14.0	72.0
4	10	4.4	0.554	6775	0.283	0.141	956	4.8	90.4
8	10	10.0	1.260	14445	0.567	0.071	1019	4.4	91.2
12	10	19.0	2.394	24386	0.850	0.047	1147	4.6	90.8
16	10	30.0	3.780	35383	1.134	0.035	1249	2.8	94.4
20	10	40.0	5.040	45679	1.417	0.028	1289	4.6	90.8
4	15	4.4	0.554	6775	0.283	0.141	956	2.4	95.2
8	15	10.0	1.260	14445	0.567	0.071	1019	2.3	95.4
12	15	19.0	2.394	24386	0.850	0.047	1147	2.3	95.4
16	15	30.0	3.780	35383	1.134	0.035	1249	1.4	97.2
20	15	40.0	5.040	45679	1.417	0.028	1289	3.3	93.4
4	20	4.4	0.554	6775	0.283	0.141	956	2.0	96.0
8	20	10.0	1.260	14445	0.567	0.071	1019	1.9	96.2
12	20	19.0	2.394	24386	0.850	0.047	1147	1.5	97.0
16	20	30.0	3.780	35383	1.134	0.035	1249	1.1	97.8
20	20	40.0	5.040	45679	1.417	0.028	1289	1.8	96.4
4	30	4.4	0.554	6775	0.283	0.141	956	1.6	96.8
8	30	10.0	1.260	14445	0.567	0.071	1019	1.4	97.2
12	30	19.0	2.394	24386	0.850	0.047	1147	1.3	97.4
16	30	30.0	3.780	35383	1.134	0.035	1249	1.1	97.8
20	30	40.0	5.040	45679	1.417	0.028	1289	1.3	97.4

Type 7. (Gravel Dia.=4-5 mm., Pipe Length =6 cm.)
 OFR.=1.90 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	BT	Turbidity NTU	Turbidity Removal(%)
4	5	6.6	0.832	6775	0.283	0.212	1434	24.0	52.0
8	5	15.0	1.890	14445	0.567	0.106	1529	19.0	62.0
12	5	28.5	3.591	24386	0.850	0.071	1721	17.0	66.0
16	5	45.0	5.670	35383	1.134	0.053	1873	15.0	70.0
20	5	60.0	7.560	45679	1.417	0.042	1934	23.0	54.0
4	10	6.6	0.832	6775	0.283	0.212	1434	7.8	84.4
8	10	15.0	1.890	14445	0.567	0.106	1529	5.9	88.2
12	10	28.5	3.591	24386	0.850	0.071	1721	5.8	88.4
16	10	45.0	5.670	35383	1.134	0.053	1873	3.8	92.4
20	10	60.0	7.560	45679	1.417	0.042	1934	6.3	87.4
4	15	6.6	0.832	6775	0.283	0.212	1434	5.6	88.8
8	15	15.0	1.890	14445	0.567	0.106	1529	2.9	94.2
12	15	28.5	3.591	24386	0.850	0.071	1721	2.7	94.6
16	15	45.0	5.670	35383	1.134	0.053	1873	1.5	97.0
20	15	60.0	7.560	45679	1.417	0.042	1934	5.0	90.0
4	20	6.6	0.832	6775	0.283	0.212	1434	5.4	89.2
8	20	15.0	1.890	14445	0.567	0.106	1529	4.4	91.2
12	20	28.5	3.591	24386	0.850	0.071	1721	3.1	93.8
16	20	45.0	5.670	35383	1.134	0.053	1873	2.1	95.8
20	20	60.0	7.560	45679	1.417	0.042	1934	5.7	88.6
4	30	6.6	0.832	6775	0.283	0.212	1434	11.0	78.0
8	30	15.0	1.890	14445	0.567	0.106	1529	8.3	83.4
12	30	28.5	3.591	24386	0.850	0.071	1721	6.8	86.4
16	30	45.0	5.670	35383	1.134	0.053	1873	4.3	91.4
20	30	60.0	7.560	45679	1.417	0.042	1934	8.4	83.2

OFR.=0.95 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	BT	Turbidity NTU	Turbidity Removal(%)
4	5	6.6	0.832	6775	0.283	0.212	1434	17.0	66.0
8	5	15.0	1.890	14445	0.567	0.106	1529	15.0	70.0
12	5	28.5	3.591	24386	0.850	0.071	1721	14.0	72.0
16	5	45.0	5.670	35383	1.134	0.053	1873	13.0	74.0
20	5	60.0	7.560	45679	1.417	0.042	1934	17.0	66.0
4	10	6.6	0.832	6775	0.283	0.212	1434	5.5	89.0
8	10	15.0	1.890	14445	0.567	0.106	1529	5.0	90.0
12	10	28.5	3.591	24386	0.850	0.071	1721	5.0	90.0
16	10	45.0	5.670	35383	1.134	0.053	1873	3.5	93.0
20	10	60.0	7.560	45679	1.417	0.042	1934	5.3	89.4
4	15	6.6	0.832	6775	0.283	0.212	1434	3.9	92.2

8	15	15.0	1.890	14445	0.567	0.106	1529	2.4	95.2
12	15	28.5	3.591	24386	0.850	0.071	1721	2.2	95.6
16	15	45.0	5.670	35383	1.134	0.053	1873	1.5	97.0
20	15	60.0	7.560	45679	1.417	0.042	1934	3.5	93.0
4	20	6.6	0.832	6775	0.283	0.212	1434	3.3	93.4
8	20	15.0	1.890	14445	0.567	0.106	1529	2.8	94.4
12	20	28.5	3.591	24386	0.850	0.071	1721	2.3	95.4
16	20	45.0	5.670	35383	1.134	0.053	1873	1.6	96.8
20	20	60.0	7.560	45679	1.417	0.042	1934	5.0	90.0
4	30	6.6	0.832	6775	0.283	0.212	1434	3.5	93.0
8	30	15.0	1.890	14445	0.567	0.106	1529	3.1	93.8
12	30	28.5	3.591	24386	0.850	0.071	1721	2.9	94.2
16	30	45.0	5.670	35383	1.134	0.053	1873	2.1	95.8
20	30	60.0	7.560	45679	1.417	0.042	1934	5.6	88.8

OFR.=0.63 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	6.6	0.832	6775	0.283	0.212	1434	15.0	70.0
8	5	15.0	1.890	14445	0.567	0.106	1529	13.0	74.0
12	5	28.5	3.591	24386	0.850	0.071	1721	13.0	74.0
16	5	45.0	5.670	35383	1.134	0.053	1873	12.0	76.0
20	5	60.0	7.560	45679	1.417	0.042	1934	14.0	72.0
4	10	6.6	0.832	6775	0.283	0.212	1434	4.9	90.2
8	10	15.0	1.890	14445	0.567	0.106	1529	4.4	91.2
12	10	28.5	3.591	24386	0.850	0.071	1721	4.5	91.0
16	10	45.0	5.670	35383	1.134	0.053	1873	2.8	94.4
20	10	60.0	7.560	45679	1.417	0.042	1934	4.6	90.8
4	15	6.6	0.832	6775	0.283	0.212	1434	3.4	93.2
8	15	15.0	1.890	14445	0.567	0.106	1529	2.3	95.4
12	15	28.5	3.591	24386	0.850	0.071	1721	2.0	96.0
16	15	45.0	5.670	35383	1.134	0.053	1873	1.5	97.0
20	15	60.0	7.560	45679	1.417	0.042	1934	2.5	95.0
4	20	6.6	0.832	6775	0.283	0.212	1434	2.1	95.8
8	20	15.0	1.890	14445	0.567	0.106	1529	2.0	96.0
12	20	28.5	3.591	24386	0.850	0.071	1721	1.6	96.8
16	20	45.0	5.670	35383	1.134	0.053	1873	1.2	97.6
20	20	60.0	7.560	45679	1.417	0.042	1934	2.2	95.6
4	30	6.6	0.832	6775	0.283	0.212	1434	1.7	96.6
8	30	15.0	1.890	14445	0.567	0.106	1529	1.5	97.0
12	30	28.5	3.591	24386	0.850	0.071	1721	1.6	96.8
16	30	45.0	5.670	35383	1.134	0.053	1873	1.0	98.0
20	30	60.0	7.560	45679	1.417	0.042	1934	1.9	96.2

Type B. (Gravel Dia.=4-5 mm., Pipe Length =8 cm.)
 DFR.=1.90 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	8.8	1.109	6775	0.283	0.282	1913	23.0	54.0
8	5	20.0	2.520	14445	0.567	0.141	2039	18.0	64.0
12	5	38.0	4.788	24386	0.850	0.094	2295	16.0	68.0
16	5	60.0	7.560	35383	1.134	0.071	2497	14.0	72.0
20	5	80.0	10.080	45679	1.417	0.056	2579	21.0	58.0
4	10	8.8	1.109	6775	0.283	0.282	1913	9.0	82.0
8	10	20.0	2.520	14445	0.567	0.141	2039	6.1	87.8
12	10	38.0	4.788	24386	0.850	0.094	2295	4.6	90.8
16	10	60.0	7.560	35383	1.134	0.071	2497	3.5	93.0
20	10	80.0	10.080	45679	1.417	0.056	2579	7.3	85.4
4	15	8.8	1.109	6775	0.283	0.282	1913	7.4	85.2
8	15	20.0	2.520	14445	0.567	0.141	2039	4.4	91.2
12	15	38.0	4.788	24386	0.850	0.094	2295	2.8	94.4
16	15	60.0	7.560	35383	1.134	0.071	2497	2.4	95.2
20	15	80.0	10.080	45679	1.417	0.056	2579	5.5	89.0
4	20	8.8	1.109	6775	0.283	0.282	1913	7.3	85.4
8	20	20.0	2.520	14445	0.567	0.141	2039	5.2	89.6
12	20	38.0	4.788	24386	0.850	0.094	2295	3.8	92.4
16	20	60.0	7.560	35383	1.134	0.071	2497	2.4	95.2
20	20	80.0	10.080	45679	1.417	0.056	2579	7.0	86.0
4	30	8.8	1.109	6775	0.283	0.282	1913	13.0	74.0
8	30	20.0	2.520	14445	0.567	0.141	2039	10.0	80.0
12	30	38.0	4.788	24386	0.850	0.094	2295	7.4	85.2
16	30	60.0	7.560	35383	1.134	0.071	2497	4.9	90.2
20	30	80.0	10.080	45679	1.417	0.056	2579	10.0	80.0

DFR.=0.95 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	8.8	1.109	6775	0.283	0.282	1913	16.0	68.0
8	5	20.0	2.520	14445	0.567	0.141	2039	14.0	72.0
12	5	38.0	4.788	24386	0.850	0.094	2295	13.0	74.0
16	5	60.0	7.560	35383	1.134	0.071	2497	13.0	74.0
20	5	80.0	10.080	45679	1.417	0.056	2579	16.0	68.0
4	10	8.8	1.109	6775	0.283	0.282	1913	6.4	87.2
8	10	20.0	2.520	14445	0.567	0.141	2039	5.3	89.4
12	10	38.0	4.788	24386	0.850	0.094	2295	4.4	91.2
16	10	60.0	7.560	35383	1.134	0.071	2497	3.0	94.0
20	10	80.0	10.080	45679	1.417	0.056	2579	5.8	88.4

4	15	8.8	1.109	6775	0.283	0.282	1913	4.1	91.8
8	15	20.0	2.520	14445	0.567	0.141	2039	3.0	94.0
12	15	38.0	4.788	24386	0.850	0.094	2295	2.2	95.6
16	15	60.0	7.560	35383	1.134	0.071	2497	1.7	96.6
20	15	80.0	10.080	45679	1.417	0.056	2579	4.3	91.4
4	20	8.8	1.109	6775	0.283	0.282	1913	4.0	92.0
8	20	20.0	2.520	14445	0.567	0.141	2039	3.5	93.0
12	20	38.0	4.788	24386	0.850	0.094	2295	2.7	94.6
16	20	60.0	7.560	35383	1.134	0.071	2497	1.9	96.2
20	20	80.0	10.080	45679	1.417	0.056	2579	5.3	89.4
4	30	8.8	1.109	6775	0.283	0.282	1913	4.0	92.0
8	30	20.0	2.520	14445	0.567	0.141	2039	5.1	89.8
12	30	38.0	4.788	24386	0.850	0.094	2295	3.0	94.0
16	30	60.0	7.560	35383	1.134	0.071	2497	2.3	95.4
20	30	80.0	10.080	45679	1.417	0.056	2579	6.0	88.0

OFR.=0.63 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	8.8	1.109	6775	0.283	0.282	1913	14.0	72.0
8	5	20.0	2.520	14445	0.567	0.141	2039	13.0	74.0
12	5	38.0	4.788	24386	0.850	0.094	2295	12.0	76.0
16	5	60.0	7.560	35383	1.134	0.071	2497	12.0	76.0
20	5	80.0	10.080	45679	1.417	0.056	2579	13.0	74.0
4	10	8.8	1.109	6775	0.283	0.282	1913	5.7	88.6
8	10	20.0	2.520	14445	0.567	0.141	2039	5.0	90.0
12	10	38.0	4.788	24386	0.850	0.094	2295	3.9	92.2
16	10	60.0	7.560	35383	1.134	0.071	2497	2.6	94.8
20	10	80.0	10.080	45679	1.417	0.056	2579	5.0	90.0
4	15	8.8	1.109	6775	0.283	0.282	1913	3.2	93.6
8	15	20.0	2.520	14445	0.567	0.141	2039	2.9	94.2
12	15	38.0	4.788	24386	0.850	0.094	2295	2.1	95.8
16	15	60.0	7.560	35383	1.134	0.071	2497	1.5	97.0
20	15	80.0	10.080	45679	1.417	0.056	2579	2.8	94.4
4	20	8.8	1.109	6775	0.283	0.282	1913	2.2	95.6
8	20	20.0	2.520	14445	0.567	0.141	2039	2.3	95.4
12	20	38.0	4.788	24386	0.850	0.094	2295	1.8	96.4
16	20	60.0	7.560	35383	1.134	0.071	2497	1.3	97.4
20	20	80.0	10.080	45679	1.417	0.056	2579	2.4	95.2
4	30	8.8	1.109	6775	0.283	0.282	1913	2.2	95.6
8	30	20.0	2.520	14445	0.567	0.141	2039	1.8	96.4
12	30	38.0	4.788	24386	0.850	0.094	2295	1.7	96.6
16	30	60.0	7.560	35383	1.134	0.071	2497	1.3	97.4
20	30	80.0	10.080	45679	1.417	0.056	2579	1.9	96.2

Type 9. (Gravel Dia.=6-7 mm., Pipe Length =2 cm.)
 GFR.=1.90 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	B s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	2.0	0.252	6281	0.268	0.075	469	27	46.0
8	5	4.2	0.529	12873	0.536	0.037	480	21	59.0
12	5	8.5	1.071	22429	0.804	0.025	558	18	63.3
16	5	14.5	1.827	33826	1.072	0.019	631	17	65.4
20	5	19.0	2.394	43291	1.340	0.015	646	26	48.2
4	10	2.0	0.252	6281	0.268	0.075	469	8.6	82.7
8	10	4.2	0.529	12873	0.536	0.037	480	6.5	87.0
12	10	8.5	1.071	22429	0.804	0.025	558	6.4	87.3
16	10	14.5	1.827	33826	1.072	0.019	631	4.2	91.6
20	10	19.0	2.394	43291	1.340	0.015	646	6.9	86.2
4	15	2.0	0.252	6281	0.268	0.075	469	6.2	87.7
8	15	4.2	0.529	12873	0.536	0.037	480	3.1	93.7
12	15	8.5	1.071	22429	0.804	0.025	558	3.0	94.0
16	15	14.5	1.827	33826	1.072	0.019	631	1.7	96.5
20	15	19.0	2.394	43291	1.340	0.015	646	5.6	88.8
4	20	2.0	0.252	6281	0.268	0.075	469	5.9	88.1
8	20	4.2	0.529	12873	0.536	0.037	480	4.9	90.3
12	20	8.5	1.071	22429	0.804	0.025	558	3.3	93.3
16	20	14.5	1.827	33826	1.072	0.019	631	2.3	95.5
20	20	19.0	2.394	43291	1.340	0.015	646	6.3	87.5
4	30	2.0	0.252	6281	0.268	0.075	469	12	76.0
8	30	4.2	0.529	12873	0.536	0.037	480	9.2	81.6
12	30	8.5	1.071	22429	0.804	0.025	558	7.5	85.1
16	30	14.5	1.827	33826	1.072	0.019	631	4.8	90.5
20	30	19.0	2.394	43291	1.340	0.015	646	9.3	81.4

GFR.=0.95 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	B s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	2.0	0.252	6281	0.268	0.075	469	18	63.3
8	5	4.2	0.529	12873	0.536	0.037	480	17	65.4
12	5	8.5	1.071	22429	0.804	0.025	558	16	67.6
16	5	14.5	1.827	33826	1.072	0.019	631	15	69.8
20	5	19.0	2.394	43291	1.340	0.015	646	18	63.3
4	10	2.0	0.252	6281	0.268	0.075	469	6.0	87.9
8	10	4.2	0.529	12873	0.536	0.037	480	5.6	88.8
12	10	8.5	1.071	22429	0.804	0.025	558	5.6	88.8
16	10	14.5	1.827	33826	1.072	0.019	631	3.9	92.2
20	10	19.0	2.394	43291	1.340	0.015	646	5.8	88.3
4	15	2.0	0.252	6281	0.268	0.075	469	4.3	91.4

8	15	4.2	0.529	12873	0.536	0.037	480	2.7	94.6
12	15	8.5	1.071	22429	0.804	0.025	558	2.4	95.2
16	15	14.5	1.827	33826	1.072	0.019	631	1.7	96.5
20	15	19.0	2.394	43291	1.340	0.015	646	3.9	92.2
4	20	2.0	0.252	6281	0.268	0.075	469	3.7	92.7
8	20	4.2	0.529	12873	0.536	0.037	480	3.1	93.7
12	20	8.5	1.071	22429	0.804	0.025	558	2.6	94.8
16	20	14.5	1.827	33826	1.072	0.019	631	1.8	96.3
20	20	19.0	2.394	43291	1.340	0.015	646	5.6	88.8
4	30	2.0	0.252	6281	0.268	0.075	469	3.9	92.2
8	30	4.2	0.529	12873	0.536	0.037	480	3.3	93.3
12	30	8.5	1.071	22429	0.804	0.025	558	3.1	93.7
16	30	14.5	1.827	33826	1.072	0.019	631	2.3	95.5
20	30	19.0	2.394	43291	1.340	0.015	646	6.2	87.7

OFR.=0.63 m/hr.

Q	C	H1	Hf	G	V	T	GT	Turbidity	Turbidity
l/min	mg/l	cm	m	s ⁻¹	m/s	sec		NTU	Removal(%)
4	5	2.0	0.252	6281	0.268	0.075	469	17	65.4
8	5	4.2	0.529	12873	0.536	0.037	480	14	71.9
12	5	8.5	1.071	22429	0.804	0.025	558	15	69.8
16	5	14.5	1.827	33826	1.072	0.019	631	13	74.1
20	5	19.0	2.394	43291	1.340	0.015	646	16	67.6
4	10	2.0	0.252	6281	0.268	0.075	469	5.4	89.2
8	10	4.2	0.529	12873	0.536	0.037	480	4.9	90.3
12	10	8.5	1.071	22429	0.804	0.025	558	5.0	90.1
16	10	14.5	1.827	33826	1.072	0.019	631	3.1	93.7
20	10	19.0	2.394	43291	1.340	0.015	646	5.1	89.8
4	15	2.0	0.252	6281	0.268	0.075	469	3.8	92.4
8	15	4.2	0.529	12873	0.536	0.037	480	2.6	94.8
12	15	8.5	1.071	22429	0.804	0.025	558	2.2	95.7
16	15	14.5	1.827	33826	1.072	0.019	631	1.7	96.5
20	15	19.0	2.394	43291	1.340	0.015	646	2.8	94.4
4	20	2.0	0.252	6281	0.268	0.075	469	2.3	95.5
8	20	4.2	0.529	12873	0.536	0.037	480	2.2	95.7
12	20	8.5	1.071	22429	0.804	0.025	558	1.7	96.5
16	20	14.5	1.827	33826	1.072	0.019	631	1.3	97.4
20	20	19.0	2.394	43291	1.340	0.015	646	2.4	95.2
4	30	2.0	0.252	6281	0.268	0.075	469	1.8	96.3
8	30	4.2	0.529	12873	0.536	0.037	480	1.7	96.5
12	30	8.5	1.071	22429	0.804	0.025	558	1.7	96.5
16	30	14.5	1.827	33826	1.072	0.019	631	1.1	97.8
20	30	19.0	2.394	43291	1.340	0.015	646	2.1	95.9

Type 10. (Gravel Dia.=6-7 mm., Pipe Length =4 cm.)
 DFR.=1.90 m/hr.

Q l/min	C mg/l	H1 cm	Hf m	G s ⁻¹	V m/s	T sec	BT	Turbidity NTU	Turbidity Removal(%)
4	5	4.0	0.504	6281	0.268	0.149	938	25	50.3
8	5	8.4	1.058	12873	0.536	0.075	961	19	61.1
12	5	17.0	2.142	22429	0.804	0.050	1116	18	63.3
16	5	29.0	3.654	33826	1.072	0.037	1262	16	67.6
20	5	38.0	4.788	43291	1.340	0.030	1293	23	54.6
4	10	4.0	0.504	6281	0.268	0.149	938	9.9	80.1
8	10	8.4	1.058	12873	0.536	0.075	961	6.8	86.4
12	10	17.0	2.142	22429	0.804	0.050	1116	5.1	89.8
16	10	29.0	3.654	33826	1.072	0.037	1262	3.9	92.2
20	10	38.0	4.788	43291	1.340	0.030	1293	8.0	84.0
4	15	4.0	0.504	6281	0.268	0.149	938	8.1	83.8
8	15	8.4	1.058	12873	0.536	0.075	961	4.9	90.3
12	15	17.0	2.142	22429	0.804	0.050	1116	3.0	94.0
16	15	29.0	3.654	33826	1.072	0.037	1262	2.7	94.6
20	15	38.0	4.788	43291	1.340	0.030	1293	6.0	87.9
4	20	4.0	0.504	6281	0.268	0.149	938	6.1	83.8
8	20	8.4	1.058	12873	0.536	0.075	961	5.7	88.6
12	20	17.0	2.142	22429	0.804	0.050	1116	4.2	91.6
16	20	29.0	3.654	33826	1.072	0.037	1262	2.7	94.6
20	20	38.0	4.788	43291	1.340	0.030	1293	7.8	84.4
4	30	4.0	0.504	6281	0.268	0.149	938	14	71.9
8	30	8.4	1.058	12873	0.536	0.075	961	11	78.4
12	30	17.0	2.142	22429	0.804	0.050	1116	8.1	83.8
16	30	29.0	3.654	33826	1.072	0.037	1262	5.4	89.2
20	30	38.0	4.788	43291	1.340	0.030	1293	11	78.4

DFR.=0.95 m/hr.

Q l/min	C mg/l	H1 cm	Hf m	G s ⁻¹	V m/s	T sec	BT	Turbidity NTU	Turbidity Removal(%)
4	5	4.0	0.504	6281	0.268	0.149	938	17	65.4
8	5	8.4	1.058	12873	0.536	0.075	961	16	67.6
12	5	17.0	2.142	22429	0.804	0.050	1116	14	71.9
16	5	29.0	3.654	33826	1.072	0.037	1262	15	69.8
20	5	38.0	4.788	43291	1.340	0.030	1293	18	63.3
4	10	4.0	0.504	6281	0.268	0.149	938	7.0	86.0
8	10	8.4	1.058	12873	0.536	0.075	961	5.8	88.3
12	10	17.0	2.142	22429	0.804	0.050	1116	4.9	90.3
16	10	29.0	3.654	33826	1.072	0.037	1262	3.2	93.5
20	10	38.0	4.788	43291	1.340	0.030	1293	6.4	87.3

4	15	4.0	0.504	6281	0.268	0.149	938	4.5	90.9
8	15	8.4	1.058	12873	0.536	0.075	961	3.2	93.5
12	15	17.0	2.142	22429	0.804	0.050	1116	2.4	95.2
16	15	29.0	3.654	33826	1.072	0.037	1262	1.8	96.3
20	15	38.0	4.788	43291	1.340	0.030	1293	4.8	90.5
4	20	4.0	0.504	6281	0.268	0.149	938	4.4	91.1
8	20	8.4	1.058	12873	0.536	0.075	961	3.9	92.2
12	20	17.0	2.142	22429	0.804	0.050	1116	2.7	94.6
16	20	29.0	3.654	33826	1.072	0.037	1262	2.1	95.9
20	20	38.0	4.788	43291	1.340	0.030	1293	5.8	88.3
4	30	4.0	0.504	6281	0.268	0.149	938	4.5	90.9
8	30	8.4	1.058	12873	0.536	0.075	961	5.6	88.8
12	30	17.0	2.142	22429	0.804	0.050	1116	3.2	93.5
16	30	29.0	3.654	33826	1.072	0.037	1262	2.6	94.8
20	30	38.0	4.788	43291	1.340	0.030	1293	6.7	86.6

GFR.=0.63 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	4.0	0.504	6281	0.268	0.149	938	15	69.8
8	5	8.4	1.058	12873	0.536	0.075	961	14	71.9
12	5	17.0	2.142	22429	0.804	0.050	1116	13	74.1
16	5	29.0	3.654	33826	1.072	0.037	1262	13	74.1
20	5	38.0	4.788	43291	1.340	0.030	1293	15	69.8
4	10	4.0	0.504	6281	0.268	0.149	938	6.3	87.5
8	10	8.4	1.058	12873	0.536	0.075	961	5.6	88.8
12	10	17.0	2.142	22429	0.804	0.050	1116	4.3	91.4
16	10	29.0	3.654	33826	1.072	0.037	1262	2.9	94.2
20	10	38.0	4.788	43291	1.340	0.030	1293	5.4	89.2
4	15	4.0	0.504	6281	0.268	0.149	938	3.6	92.9
8	15	8.4	1.058	12873	0.536	0.075	961	3.1	93.7
12	15	17.0	2.142	22429	0.804	0.050	1116	2.3	95.5
16	15	29.0	3.654	33826	1.072	0.037	1262	1.7	96.5
20	15	38.0	4.788	43291	1.340	0.030	1293	3.1	93.7
4	20	4.0	0.504	6281	0.268	0.149	938	2.5	95.0
8	20	8.4	1.058	12873	0.536	0.075	961	2.5	95.0
12	20	17.0	2.142	22429	0.804	0.050	1116	1.9	96.1
16	20	29.0	3.654	33826	1.072	0.037	1262	1.4	97.2
20	20	38.0	4.788	43291	1.340	0.030	1293	2.7	94.6
4	30	4.0	0.504	6281	0.268	0.149	938	2.4	95.2
8	30	8.4	1.058	12873	0.536	0.075	961	1.9	96.1
12	30	17.0	2.142	22429	0.804	0.050	1116	1.8	96.3
16	30	29.0	3.654	33826	1.072	0.037	1262	1.4	97.2
20	30	38.0	4.788	43291	1.340	0.030	1293	2.1	95.9

Type 11. (Gravel Dia.=6-7 mm., Pipe Length =6 cm.)
 OFR.=1.90 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	6.0	0.756	6281	0.268	0.224	1407	28	45.0
8	5	12.6	1.588	12873	0.536	0.112	1441	21	58.2
12	5	25.5	3.213	22429	0.804	0.075	1674	19	62.6
16	5	43.5	5.481	33826	1.072	0.056	1894	18	64.8
20	5	57.0	7.182	43291	1.340	0.045	1939	26	47.2
4	10	6.0	0.756	6281	0.268	0.224	1407	8.8	82.4
8	10	12.6	1.588	12873	0.536	0.112	1441	6.6	86.8
12	10	25.5	3.213	22429	0.804	0.075	1674	6.5	87.0
16	10	43.5	5.481	33826	1.072	0.056	1894	4.3	91.4
20	10	57.0	7.182	43291	1.340	0.045	1939	7.0	85.9
4	15	6.0	0.756	6281	0.268	0.224	1407	6.3	87.5
8	15	12.6	1.588	12873	0.536	0.112	1441	3.2	93.6
12	15	25.5	3.213	22429	0.804	0.075	1674	3.1	93.8
16	15	43.5	5.481	33826	1.072	0.056	1894	1.8	96.5
20	15	57.0	7.182	43291	1.340	0.045	1939	5.7	88.6
4	20	6.0	0.756	6281	0.268	0.224	1407	6.1	87.9
8	20	12.6	1.588	12873	0.536	0.112	1441	5.0	90.1
12	20	25.5	3.213	22429	0.804	0.075	1674	3.4	93.2
16	20	43.5	5.481	33826	1.072	0.056	1894	2.3	95.4
20	20	57.0	7.182	43291	1.340	0.045	1939	6.4	87.2
4	30	6.0	0.756	6281	0.268	0.224	1407	12	75.6
8	30	12.6	1.588	12873	0.536	0.112	1441	9.4	81.3
12	30	25.5	3.213	22429	0.804	0.075	1674	7.6	84.8
16	30	43.5	5.481	33826	1.072	0.056	1894	4.8	90.3
20	30	57.0	7.182	43291	1.340	0.045	1939	9.5	81.1

OFR.=0.95 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	6.0	0.756	6281	0.268	0.224	1407	19	62.6
8	5	12.6	1.588	12873	0.536	0.112	1441	18	64.8
12	5	25.5	3.213	22429	0.804	0.075	1674	17	67.0
16	5	43.5	5.481	33826	1.072	0.056	1894	15	69.2
20	5	57.0	7.182	43291	1.340	0.045	1939	19	62.6
4	10	6.0	0.756	6281	0.268	0.224	1407	6.2	87.7
8	10	12.6	1.588	12873	0.536	0.112	1441	5.7	88.6
12	10	25.5	3.213	22429	0.804	0.075	1674	5.7	88.6
16	10	43.5	5.481	33826	1.072	0.056	1894	4.0	92.1
20	10	57.0	7.182	43291	1.340	0.045	1939	5.9	88.1
4	15	6.0	0.756	6281	0.268	0.224	1407	4.4	91.2

8	15	12.6	1.588	12873	0.536	0.112	1441	2.8	94.5
12	15	25.5	3.213	22429	0.804	0.075	1674	2.4	95.2
16	15	43.5	5.481	33826	1.072	0.056	1894	1.8	96.5
20	15	57.0	7.182	43291	1.340	0.045	1939	4.0	92.1
4	20	6.0	0.756	6281	0.268	0.224	1407	3.7	92.5
8	20	12.6	1.588	12873	0.536	0.112	1441	3.2	93.6
12	20	25.5	3.213	22429	0.804	0.075	1674	2.6	94.7
16	20	43.5	5.481	33826	1.072	0.056	1894	1.9	96.3
20	20	57.0	7.182	43291	1.340	0.045	1939	5.7	88.6
4	30	6.0	0.756	6281	0.268	0.224	1407	4	92.1
8	30	12.6	1.588	12873	0.536	0.112	1441	3.4	93.2
12	30	25.5	3.213	22429	0.804	0.075	1674	3.2	93.6
16	30	43.5	5.481	33826	1.072	0.056	1894	2.3	95.4
20	30	57.0	7.182	43291	1.340	0.045	1939	6.3	87.5

DFR.=0.63 m/hr.

Q	C	H1	Hf	B	V	T	GT	Turbidity	Turbidity
l/min	mg/l	cm	m	s ⁻¹	m/s	sec		NTU	Removal(%)
4	5	6.0	0.756	6281	0.268	0.224	1407	18	64.8
8	5	12.6	1.588	12873	0.536	0.112	1441	14	71.4
12	5	25.5	3.213	22429	0.804	0.075	1674	15	69.2
16	5	43.5	5.481	33826	1.072	0.056	1894	13	73.6
20	5	57.0	7.182	43291	1.340	0.045	1939	17	67.0
4	10	6.0	0.756	6281	0.268	0.224	1407	5.5	89.0
8	10	12.6	1.588	12873	0.536	0.112	1441	5.0	90.1
12	10	25.5	3.213	22429	0.804	0.075	1674	5.1	89.9
16	10	43.5	5.481	33826	1.072	0.056	1894	3.2	93.6
20	10	57.0	7.182	43291	1.340	0.045	1939	5.2	89.7
4	15	6.0	0.756	6281	0.268	0.224	1407	3.9	92.3
8	15	12.6	1.588	12873	0.536	0.112	1441	2.6	94.7
12	15	25.5	3.213	22429	0.804	0.075	1674	2.2	95.6
16	15	43.5	5.481	33826	1.072	0.056	1894	1.8	96.5
20	15	57.0	7.182	43291	1.340	0.045	1939	2.9	94.3
4	20	6.0	0.756	6281	0.268	0.224	1407	2.3	95.4
8	20	12.6	1.588	12873	0.536	0.112	1441	2.2	95.6
12	20	25.5	3.213	22429	0.804	0.075	1674	1.8	96.5
16	20	43.5	5.481	33826	1.072	0.056	1894	1.3	97.4
20	20	57.0	7.182	43291	1.340	0.045	1939	2.4	95.2
4	30	6.0	0.756	6281	0.268	0.224	1407	1.9	96.3
8	30	12.6	1.588	12873	0.536	0.112	1441	1.8	96.5
12	30	25.5	3.213	22429	0.804	0.075	1674	1.8	96.5
16	30	43.5	5.481	33826	1.072	0.056	1894	1.1	97.8
20	30	57.0	7.182	43291	1.340	0.045	1939	2.1	95.8

12

Type 11. (Gravel Dia.=6-7 mm., Pipe Length =8 cm.)
 DFR.=1.90 m/hr.

Q l/min	C mg/l	H _i cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	8.0	1.008	6281	0.268	0.299	1875	25	49.4
8	5	16.8	2.117	12873	0.536	0.149	1922	20	60.4
12	5	34.0	4.284	22429	0.804	0.100	2232	19	62.6
16	5	58.0	7.308	33826	1.072	0.075	2525	17	67.0
20	5	76.0	9.576	43291	1.340	0.060	2585	23	53.8
4	10	8.0	1.008	6281	0.268	0.299	1875	10	79.8
8	10	16.8	2.117	12873	0.536	0.149	1922	6.9	86.1
12	10	34.0	4.284	22429	0.804	0.100	2232	5.2	89.7
16	10	58.0	7.308	33826	1.072	0.075	2525	4.0	92.1
20	10	76.0	9.576	43291	1.340	0.060	2585	8.1	83.7
4	15	8.0	1.008	6281	0.268	0.299	1875	8.3	83.5
8	15	16.8	2.117	12873	0.536	0.149	1922	5.0	90.1
12	15	34.0	4.284	22429	0.804	0.100	2232	3.1	93.8
16	15	58.0	7.308	33826	1.072	0.075	2525	2.8	94.5
20	15	76.0	9.576	43291	1.340	0.060	2585	6.2	87.7
4	20	8.0	1.008	6281	0.268	0.299	1875	8.3	83.5
8	20	16.8	2.117	12873	0.536	0.149	1922	5.8	88.3
12	20	34.0	4.284	22429	0.804	0.100	2232	4.3	91.4
16	20	58.0	7.308	33826	1.072	0.075	2525	2.8	94.5
20	20	76.0	9.576	43291	1.340	0.060	2585	7.9	84.2
4	30	8.0	1.008	6281	0.268	0.299	1875	14	71.4
8	30	16.8	2.117	12873	0.536	0.149	1922	11	78.0
12	30	34.0	4.284	22429	0.804	0.100	2232	8.3	83.5
16	30	58.0	7.308	33826	1.072	0.075	2525	5.5	89.0
20	30	76.0	9.576	43291	1.340	0.060	2585	11.0	78.0

DFR.=0.95 m/hr.

Q l/min	C mg/l	H _i cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	8.0	1.008	6281	0.268	0.299	1875	18	64.8
8	5	16.8	2.117	12873	0.536	0.149	1922	17	67.0
12	5	34.0	4.284	22429	0.804	0.100	2232	14	71.4
16	5	58.0	7.308	33826	1.072	0.075	2525	15	69.2
20	5	76.0	9.576	43291	1.340	0.060	2585	19	62.6
4	10	8.0	1.008	6281	0.268	0.299	1875	7.2	85.7
8	10	16.8	2.117	12873	0.536	0.149	1922	5.9	88.1
12	10	34.0	4.284	22429	0.804	0.100	2232	5.0	90.1
16	10	58.0	7.308	33826	1.072	0.075	2525	3.3	93.4
20	10	76.0	9.576	43291	1.340	0.060	2585	6.5	87.0

4	15	8.0	1.008	6281	0.268	0.299	1875	4.6	90.8
8	15	16.8	2.117	12873	0.536	0.149	1922	3.3	93.4
12	15	34.0	4.284	22429	0.804	0.100	2232	2.4	95.2
16	15	58.0	7.308	33826	1.072	0.075	2525	1.9	96.3
20	15	76.0	9.576	43291	1.340	0.060	2585	4.8	90.3
4	20	8.0	1.008	6281	0.268	0.299	1875	4.5	91.0
8	20	16.8	2.117	12873	0.536	0.149	1922	4.0	92.1
12	20	34.0	4.284	22429	0.804	0.100	2232	2.8	94.5
16	20	58.0	7.308	33826	1.072	0.075	2525	2.1	95.8
20	20	76.0	9.576	43291	1.340	0.060	2585	5.9	88.1
4	30	8.0	1.008	6281	0.268	0.299	1875	5	90.8
8	30	16.8	2.117	12873	0.536	0.149	1922	5.7	88.6
12	30	34.0	4.284	22429	0.804	0.100	2232	3.3	93.4
16	30	58.0	7.308	33826	1.072	0.075	2525	2.6	94.7
20	30	76.0	9.576	43291	1.340	0.060	2585	6.8	86.4

DFR.=0.63 m/hr.

Q l/min	C mg/l	H _i cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	8.0	1.008	6281	0.268	0.299	1875	15	69.2
8	5	16.8	2.117	12873	0.536	0.149	1922	14	71.4
12	5	34.0	4.284	22429	0.804	0.100	2232	13	73.6
16	5	58.0	7.308	33826	1.072	0.075	2525	13	73.6
20	5	76.0	9.576	43291	1.340	0.060	2585	15	69.2
4	10	8.0	1.008	6281	0.268	0.299	1875	6.4	87.2
8	10	16.8	2.117	12873	0.536	0.149	1922	5.7	88.6
12	10	34.0	4.284	22429	0.804	0.100	2232	4.4	91.2
16	10	58.0	7.308	33826	1.072	0.075	2525	3.0	94.1
20	10	76.0	9.576	43291	1.340	0.060	2585	5.5	89.0
4	15	8.0	1.008	6281	0.268	0.299	1875	3.6	92.7
8	15	16.8	2.117	12873	0.536	0.149	1922	3.2	93.6
12	15	34.0	4.284	22429	0.804	0.100	2232	2.3	95.4
16	15	58.0	7.308	33826	1.072	0.075	2525	1.8	96.5
20	15	76.0	9.576	43291	1.340	0.060	2585	3.2	93.6
4	20	8.0	1.008	6281	0.268	0.299	1875	2.5	94.9
8	20	16.8	2.117	12873	0.536	0.149	1922	2.5	94.9
12	20	34.0	4.284	22429	0.804	0.100	2232	2.0	96.0
16	20	58.0	7.308	33826	1.072	0.075	2525	1.4	97.1
20	20	76.0	9.576	43291	1.340	0.060	2585	2.8	94.5
4	30	8.0	1.008	6281	0.268	0.299	1875	2.4	95.2
8	30	16.8	2.117	12873	0.536	0.149	1922	2.0	96.0
12	30	34.0	4.284	22429	0.804	0.100	2232	1.9	96.3
16	30	58.0	7.308	33826	1.072	0.075	2525	1.4	97.1
20	30	76.0	9.576	43291	1.340	0.060	2585	2.1	95.8

Type 13. (Gravel Dia.=8-9 mm., Pipe Length =2 cm.)
 OFR.=1.90 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	1.25	0.158	4754	0.246	0.081	387	30	41.0
8	5	3.0	0.378	10416	0.491	0.041	424	22	55.2
12	5	7.0	0.882	19487	0.737	0.027	529	20	59.9
16	5	14.0	1.764	31823	0.982	0.020	648	19	62.2
20	5	18.5	2.331	40899	1.228	0.016	666	28	43.4
4	10	1.25	0.158	4754	0.246	0.081	387	9.4	81.1
8	10	3.0	0.378	10416	0.491	0.041	424	7.1	85.8
12	10	7.0	0.882	19487	0.737	0.027	529	7.0	86.1
16	10	14.0	1.764	31823	0.982	0.020	648	4.6	90.8
20	10	18.5	2.331	40899	1.228	0.016	666	7.6	84.9
4	15	1.25	0.158	4754	0.246	0.081	387	6.7	86.5
8	15	3.0	0.378	10416	0.491	0.041	424	3.4	93.2
12	15	7.0	0.882	19487	0.737	0.027	529	3.3	93.4
16	15	14.0	1.764	31823	0.982	0.020	648	1.9	96.2
20	15	18.5	2.331	40899	1.228	0.016	666	6.1	87.7
4	20	1.25	0.158	4754	0.246	0.081	387	6.5	87.0
8	20	3.0	0.378	10416	0.491	0.041	424	5.3	89.4
12	20	7.0	0.882	19487	0.737	0.027	529	3.7	92.7
16	20	14.0	1.764	31823	0.982	0.020	648	2.5	95.0
20	20	18.5	2.331	40899	1.228	0.016	666	6.8	86.3
4	30	1.25	0.158	4754	0.246	0.081	387	13	73.8
8	30	3.0	0.378	10416	0.491	0.041	424	10	79.9
12	30	7.0	0.882	19487	0.737	0.027	529	8.1	83.7
16	30	14.0	1.764	31823	0.982	0.020	648	5.2	89.6
20	30	18.5	2.331	40899	1.228	0.016	666	10	79.7

OFR.=0.95 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	1.25	0.158	4754	0.246	0.081	387	20	59.9
8	5	3.0	0.378	10416	0.491	0.041	424	19	62.2
12	5	7.0	0.882	19487	0.737	0.027	529	18	64.6
16	5	14.0	1.764	31823	0.982	0.020	648	17	67.0
20	5	18.5	2.331	40899	1.228	0.016	666	20	59.9
4	10	1.25	0.158	4754	0.246	0.081	387	6.6	86.8
8	10	3.0	0.378	10416	0.491	0.041	424	6.1	87.7
12	10	7.0	0.882	19487	0.737	0.027	529	6.1	87.7
16	10	14.0	1.764	31823	0.982	0.020	648	4.2	91.5
20	10	18.5	2.331	40899	1.228	0.016	666	6.4	87.3
4	15	1.25	0.158	4754	0.246	0.081	387	4.7	90.6

8	15	3.0	0.378	10416	0.491	0.041	424	3.0	94.1
12	15	7.0	0.882	19487	0.737	0.027	529	2.6	94.8
16	15	14.0	1.764	31823	0.982	0.020	648	1.9	96.2
20	15	18.5	2.331	40899	1.228	0.016	666	4.2	91.5
4	20	1.25	0.158	4754	0.246	0.081	387	4.0	92.0
8	20	3.0	0.378	10416	0.491	0.041	424	3.4	93.2
12	20	7.0	0.882	19487	0.737	0.027	529	2.8	94.3
16	20	14.0	1.764	31823	0.982	0.020	648	2.0	96.0
20	20	18.5	2.331	40899	1.228	0.016	666	6.1	87.7
4	30	1.25	0.158	4754	0.246	0.081	387	4.2	91.5
8	30	3.0	0.378	10416	0.491	0.041	424	3.7	92.7
12	30	7.0	0.882	19487	0.737	0.027	529	3.4	93.2
16	30	14.0	1.764	31823	0.982	0.020	648	2.5	95.0
20	30	18.5	2.331	40899	1.228	0.016	666	6.7	86.5

OFR.=0.63 m/hr.

Q	C	Hl	Hf	G	V	T	GT	Turbidity	Turbidity
l/min	mg/l	cm	m	s ⁻¹	m/s	sec		NTU	Removal(%)
4	5	1.25	0.158	4754	0.246	0.081	387	19	62.2
8	5	3.0	0.378	10416	0.491	0.041	424	15	69.3
12	5	7.0	0.882	19487	0.737	0.027	529	17	67.0
16	5	14.0	1.764	31823	0.982	0.020	648	14	71.7
20	5	18.5	2.331	40899	1.228	0.016	666	18	64.6
4	10	1.25	0.158	4754	0.246	0.081	387	5.9	88.2
8	10	3.0	0.378	10416	0.491	0.041	424	5.3	89.4
12	10	7.0	0.882	19487	0.737	0.027	529	5.4	89.1
16	10	14.0	1.764	31823	0.982	0.020	648	3.4	93.2
20	10	18.5	2.331	40899	1.228	0.016	666	5.5	88.9
4	15	1.25	0.158	4754	0.246	0.081	387	4.1	91.7
8	15	3.0	0.378	10416	0.491	0.041	424	2.8	94.3
12	15	7.0	0.882	19487	0.737	0.027	529	2.4	95.3
16	15	14.0	1.764	31823	0.982	0.020	648	1.9	96.2
20	15	18.5	2.331	40899	1.228	0.016	666	3.1	93.9
4	20	1.25	0.158	4754	0.246	0.081	387	2.5	95.0
8	20	3.0	0.378	10416	0.491	0.041	424	2.4	95.3
12	20	7.0	0.882	19487	0.737	0.027	529	1.9	96.2
16	20	14.0	1.764	31823	0.982	0.020	648	1.4	97.2
20	20	18.5	2.331	40899	1.228	0.016	666	2.6	94.8
4	30	1.25	0.158	4754	0.246	0.081	387	2.0	96.0
8	30	3.0	0.378	10416	0.491	0.041	424	1.9	96.2
12	30	7.0	0.882	19487	0.737	0.027	529	1.9	96.2
16	30	14.0	1.764	31823	0.982	0.020	648	1.2	97.6
20	30	18.5	2.331	40899	1.228	0.016	666	2.2	95.5

Type 14. (Gravel Dia. = 8-9 mm., Pipe Length = 4 cm.)
 OFR. = 1.90 m/hr.

Q l/min	C mg/l	H ₁ cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	2.5	0.315	4754	0.246	0.163	774	27	45.7
8	5	6.0	0.756	10416	0.491	0.081	848	21	57.5
12	5	14.0	1.764	19487	0.737	0.054	1058	20	59.9
16	5	28.0	3.528	31823	0.982	0.041	1296	18	64.6
20	5	37.0	4.662	40899	1.228	0.033	1332	25	50.4
4	10	2.5	0.315	4754	0.246	0.163	774	11	78.3
8	10	6.0	0.756	10416	0.491	0.081	848	7.4	85.1
12	10	14.0	1.764	19487	0.737	0.054	1058	5.5	88.9
16	10	28.0	3.528	31823	0.982	0.041	1296	4.2	91.5
20	10	37.0	4.662	40899	1.228	0.033	1332	8.7	82.5
4	15	2.5	0.315	4754	0.246	0.163	774	8.9	82.3
8	15	6.0	0.756	10416	0.491	0.081	848	5.3	89.4
12	15	14.0	1.764	19487	0.737	0.054	1058	3.3	93.4
16	15	28.0	3.528	31823	0.982	0.041	1296	3.0	94.1
20	15	37.0	4.662	40899	1.228	0.033	1332	6.6	86.8
4	20	2.5	0.315	4754	0.246	0.163	774	8.9	82.3
8	20	6.0	0.756	10416	0.491	0.081	848	6.3	87.5
12	20	14.0	1.764	19487	0.737	0.054	1058	4.6	90.8
16	20	28.0	3.528	31823	0.982	0.041	1296	3.0	94.1
20	20	37.0	4.662	40899	1.228	0.033	1332	8.5	83.0
4	30	2.5	0.315	4754	0.246	0.163	774	15	69.3
8	30	6.0	0.756	10416	0.491	0.081	848	12	76.4
12	30	14.0	1.764	19487	0.737	0.054	1058	8.9	82.3
16	30	28.0	3.528	31823	0.982	0.041	1296	5.9	88.2
20	30	37.0	4.662	40899	1.228	0.033	1332	12	76.4

OFR. = 0.95 m/hr.

Q l/min	C mg/l	H ₁ cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	2.5	0.315	4754	0.246	0.163	774	19	62.2
8	5	6.0	0.756	10416	0.491	0.081	848	18	64.6
12	5	14.0	1.764	19487	0.737	0.054	1058	15	69.3
16	5	28.0	3.528	31823	0.982	0.041	1296	17	67.0
20	5	37.0	4.662	40899	1.228	0.033	1332	20	59.9
4	10	2.5	0.315	4754	0.246	0.163	774	7.7	84.7
8	10	6.0	0.756	10416	0.491	0.081	848	6.4	87.3
12	10	14.0	1.764	19487	0.737	0.054	1058	5.3	89.4
16	10	28.0	3.528	31823	0.982	0.041	1296	3.5	92.9
20	10	37.0	4.662	40899	1.228	0.033	1332	7.0	86.1

4	15	2.5	0.315	4754	0.246	0.163	774	5.0	90.1
8	15	6.0	0.756	10416	0.491	0.081	848	3.5	92.9
12	15	14.0	1.764	19487	0.737	0.054	1058	2.6	94.8
16	15	28.0	3.528	31823	0.982	0.041	1296	2.0	96.0
20	15	37.0	4.662	40899	1.228	0.033	1332	5.2	89.6
4	20	2.5	0.315	4754	0.246	0.163	774	4.8	90.3
8	20	6.0	0.756	10416	0.491	0.081	848	4.2	91.5
12	20	14.0	1.764	19487	0.737	0.054	1058	3.0	94.1
16	20	28.0	3.528	31823	0.982	0.041	1296	2.2	95.5
20	20	37.0	4.662	40899	1.228	0.033	1332	6.4	87.3
4	30	2.5	0.315	4754	0.246	0.163	774	5.0	90.1
8	30	6.0	0.756	10416	0.491	0.081	848	6.1	87.7
12	30	14.0	1.764	19487	0.737	0.054	1058	3.5	92.9
16	30	28.0	3.528	31823	0.982	0.041	1296	2.8	94.3
20	30	37.0	4.662	40899	1.228	0.033	1332	7.3	85.4

OFR.=0.63 m/hr.

G	C	H1	Hf	G	V	T	GT	Turbidity	Turbidity
l/min	mg/l	cm	m	s ⁻¹	m/s	sec		NTU	Removal(%)
4	5	2.5	0.315	4754	0.246	0.163	774	17	67.0
8	5	6.0	0.756	10416	0.491	0.081	848	15	69.3
12	5	14.0	1.764	19487	0.737	0.054	1058	14	71.7
16	5	28.0	3.528	31823	0.982	0.041	1296	14	71.7
20	5	37.0	4.662	40899	1.228	0.033	1332	17	67.0
4	10	2.5	0.315	4754	0.246	0.163	774	6.8	86.3
8	10	6.0	0.756	10416	0.491	0.081	848	6.1	87.7
12	10	14.0	1.764	19487	0.737	0.054	1058	4.7	90.6
16	10	28.0	3.528	31823	0.982	0.041	1296	3.2	93.6
20	10	37.0	4.662	40899	1.228	0.033	1332	5.9	88.2
4	15	2.5	0.315	4754	0.246	0.163	774	3.9	92.2
8	15	6.0	0.756	10416	0.491	0.081	848	3.4	93.2
12	15	14.0	1.764	19487	0.737	0.054	1058	2.5	95.0
16	15	28.0	3.528	31823	0.982	0.041	1296	1.9	96.2
20	15	37.0	4.662	40899	1.228	0.033	1332	3.4	93.2
4	20	2.5	0.315	4754	0.246	0.163	774	2.7	94.6
8	20	6.0	0.756	10416	0.491	0.081	848	2.7	94.6
12	20	14.0	1.764	19487	0.737	0.054	1058	2.1	95.8
16	20	28.0	3.528	31823	0.982	0.041	1296	1.5	96.9
20	20	37.0	4.662	40899	1.228	0.033	1332	3.0	94.1
4	30	2.5	0.315	4754	0.246	0.163	774	2.6	94.8
8	30	6.0	0.756	10416	0.491	0.081	848	2.1	95.8
12	30	14.0	1.764	19487	0.737	0.054	1058	2.0	96.0
16	30	28.0	3.528	31823	0.982	0.041	1296	1.5	96.9
20	30	37.0	4.662	40899	1.228	0.033	1332	2.2	95.5

Type 15. (Gravel Dia.=8-9 mm., Pipe Length =6 ca.)
 OFR.=1.90 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	3.8	0.473	4754	0.246	0.244	1161	29	43.0
8	5	9.0	1.134	10416	0.491	0.122	1272	22	56.7
12	5	21.0	2.646	19487	0.737	0.081	1587	19	61.2
16	5	42.0	5.292	31823	0.982	0.061	1944	18	63.5
20	5	55.5	6.993	40899	1.228	0.049	1998	27	45.3
4	10	3.8	0.473	4754	0.246	0.244	1161	9.1	81.8
8	10	9.0	1.134	10416	0.491	0.122	1272	6.8	86.3
12	10	21.0	2.646	19487	0.737	0.081	1587	6.7	86.5
16	10	42.0	5.292	31823	0.982	0.061	1944	4.4	91.1
20	10	55.5	6.993	40899	1.228	0.049	1998	7.3	85.4
4	15	3.8	0.473	4754	0.246	0.244	1161	6.5	87.0
8	15	9.0	1.134	10416	0.491	0.122	1272	3.3	93.4
12	15	21.0	2.646	19487	0.737	0.081	1587	3.2	93.6
16	15	42.0	5.292	31823	0.982	0.061	1944	1.8	96.4
20	15	55.5	6.993	40899	1.228	0.049	1998	5.9	88.1
4	20	3.8	0.473	4754	0.246	0.244	1161	6.3	87.5
8	20	9.0	1.134	10416	0.491	0.122	1272	5.1	89.7
12	20	21.0	2.646	19487	0.737	0.081	1587	3.5	92.9
16	20	42.0	5.292	31823	0.982	0.061	1944	2.4	95.2
20	20	55.5	6.993	40899	1.228	0.049	1998	6.6	86.8
4	30	3.8	0.473	4754	0.246	0.244	1161	13	74.7
8	30	9.0	1.134	10416	0.491	0.122	1272	9.7	80.6
12	30	21.0	2.646	19487	0.737	0.081	1587	7.9	84.3
16	30	42.0	5.292	31823	0.982	0.061	1944	5.0	90.0
20	30	55.5	6.993	40899	1.228	0.049	1998	9.8	80.4

OFR.=0.95 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	3.8	0.473	4754	0.246	0.244	1161	19	61.2
8	5	9.0	1.134	10416	0.491	0.122	1272	18	63.5
12	5	21.0	2.646	19487	0.737	0.081	1587	17	65.8
16	5	42.0	5.292	31823	0.982	0.061	1944	16	68.1
20	5	55.5	6.993	40899	1.228	0.049	1998	19	61.2
4	10	3.8	0.473	4754	0.246	0.244	1161	6.4	87.2
8	10	9.0	1.134	10416	0.491	0.122	1272	5.9	88.1
12	10	21.0	2.646	19487	0.737	0.081	1587	5.9	88.1
16	10	42.0	5.292	31823	0.982	0.061	1944	4.1	91.8
20	10	55.5	6.993	40899	1.228	0.049	1998	6.2	87.7
4	15	3.8	0.473	4754	0.246	0.244	1161	4.6	90.9

8	15	9.0	1.134	10416	0.491	0.122	1272	2.9	94.3
12	15	21.0	2.646	19487	0.737	0.081	1587	2.5	95.0
16	15	42.0	5.292	31823	0.982	0.061	1944	1.8	96.4
20	15	55.5	6.993	40899	1.228	0.049	1998	4.1	91.8
4	20	3.8	0.473	4754	0.246	0.244	1161	3.9	92.2
8	20	9.0	1.134	10416	0.491	0.122	1272	3.3	93.4
12	20	21.0	2.646	19487	0.737	0.081	1587	2.7	94.5
16	20	42.0	5.292	31823	0.982	0.061	1944	1.9	96.1
20	20	55.5	6.993	40899	1.228	0.049	1998	5.9	88.1
4	30	3.8	0.473	4754	0.246	0.244	1161	4.1	91.8
8	30	9.0	1.134	10416	0.491	0.122	1272	3.5	92.9
12	30	21.0	2.646	19487	0.737	0.081	1587	3.3	93.4
16	30	42.0	5.292	31823	0.982	0.061	1944	2.4	95.2
20	30	55.5	6.993	40899	1.228	0.049	1998	6.5	87.0

DFR.=0.63 m/hr.

Q l/min	C mg/l	H1 cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	3.8	0.473	4754	0.246	0.244	1161	18	63.5
8	5	9.0	1.134	10416	0.491	0.122	1272	15	70.4
12	5	21.0	2.646	19487	0.737	0.081	1587	16	68.1
16	5	42.0	5.292	31823	0.982	0.061	1944	14	72.6
20	5	55.5	6.993	40899	1.228	0.049	1998	17	65.8
4	10	3.8	0.473	4754	0.246	0.244	1161	5.7	88.6
8	10	9.0	1.134	10416	0.491	0.122	1272	5.1	89.7
12	10	21.0	2.646	19487	0.737	0.081	1587	5.2	89.5
16	10	42.0	5.292	31823	0.982	0.061	1944	3.3	93.4
20	10	55.5	6.993	40899	1.228	0.049	1998	5.4	89.3
4	15	3.8	0.473	4754	0.246	0.244	1161	4.0	92.0
8	15	9.0	1.134	10416	0.491	0.122	1272	2.7	94.5
12	15	21.0	2.646	19487	0.737	0.081	1587	2.3	95.4
16	15	42.0	5.292	31823	0.982	0.061	1944	1.8	96.4
20	15	55.5	6.993	40899	1.228	0.049	1998	3.0	94.1
4	20	3.8	0.473	4754	0.246	0.244	1161	2.4	95.2
8	20	9.0	1.134	10416	0.491	0.122	1272	2.3	95.4
12	20	21.0	2.646	19487	0.737	0.081	1587	1.8	96.4
16	20	42.0	5.292	31823	0.982	0.061	1944	1.4	97.3
20	20	55.5	6.993	40899	1.228	0.049	1998	2.5	95.0
4	30	3.8	0.473	4754	0.246	0.244	1161	1.9	96.1
8	30	9.0	1.134	10416	0.491	0.122	1272	1.8	96.4
12	30	21.0	2.646	19487	0.737	0.081	1587	1.8	96.4
16	30	42.0	5.292	31823	0.982	0.061	1944	1.1	97.7
20	30	55.5	6.993	40899	1.228	0.049	1998	2.2	95.7

Type 16. (Gravel Dia. = 8-9 mm., Pipe Length = 8 cm.)
 OFR = 1.90 m/hr.

Q l/min	C mg/l	H _i cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	5.0	0.630	4754	0.246	0.326	1548	26	47.6
8	5	12.0	1.512	10416	0.491	0.163	1696	21	59.0
12	5	28.0	3.528	19487	0.737	0.109	2116	19	61.2
16	5	56.0	7.056	31823	0.982	0.081	2591	17	65.8
20	5	74.0	9.324	40899	1.228	0.065	2664	24	52.1
4	10	5.0	0.630	4754	0.246	0.326	1548	10	79.0
8	10	12.0	1.512	10416	0.491	0.163	1696	7.2	85.6
12	10	28.0	3.528	19487	0.737	0.109	2116	5.4	89.3
16	10	56.0	7.056	31823	0.982	0.081	2591	4.1	91.8
20	10	74.0	9.324	40899	1.228	0.065	2664	8.4	83.1
4	15	5.0	0.630	4754	0.246	0.326	1548	8.6	82.9
8	15	12.0	1.512	10416	0.491	0.163	1696	5.1	89.7
12	15	28.0	3.528	19487	0.737	0.109	2116	3.2	93.6
16	15	56.0	7.056	31823	0.982	0.081	2591	2.9	94.3
20	15	74.0	9.324	40899	1.228	0.065	2664	6.4	87.2
4	20	5.0	0.630	4754	0.246	0.326	1548	8.6	82.9
8	20	12.0	1.512	10416	0.491	0.163	1696	6.0	87.9
12	20	28.0	3.528	19487	0.737	0.109	2116	4.4	91.1
16	20	56.0	7.056	31823	0.982	0.081	2591	2.9	94.3
20	20	74.0	9.324	40899	1.228	0.065	2664	8.2	83.6
4	30	5.0	0.630	4754	0.246	0.326	1548	15	70.4
8	30	12.0	1.512	10416	0.491	0.163	1696	11	77.2
12	30	28.0	3.528	19487	0.737	0.109	2116	8.6	82.9
16	30	56.0	7.056	31823	0.982	0.081	2591	5.7	88.6
20	30	74.0	9.324	40899	1.228	0.065	2664	11	77.2

OFR = 0.95 m/hr.

Q l/min	C mg/l	H _i cm	H _f m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	5.0	0.630	4754	0.246	0.326	1548	18	63.5
8	5	12.0	1.512	10416	0.491	0.163	1696	17	65.8
12	5	28.0	3.528	19487	0.737	0.109	2116	15	70.4
16	5	56.0	7.056	31823	0.982	0.081	2591	16	68.1
20	5	74.0	9.324	40899	1.228	0.065	2664	19	61.2
4	10	5.0	0.630	4754	0.246	0.326	1548	7.4	85.2
8	10	12.0	1.512	10416	0.491	0.163	1696	6.2	87.7
12	10	28.0	3.528	19487	0.737	0.109	2116	5.1	89.7
16	10	56.0	7.056	31823	0.982	0.081	2591	3.4	93.2
20	10	74.0	9.324	40899	1.228	0.065	2664	6.7	86.5

4	15	5.0	0.630	4754	0.246	0.326	1548	4.8	90.4
8	15	12.0	1.512	10416	0.491	0.163	1696	3.4	93.2
12	15	28.0	3.528	19487	0.737	0.109	2116	2.5	95.0
16	15	56.0	7.056	31823	0.982	0.081	2591	1.9	96.1
20	15	74.0	9.324	40899	1.228	0.065	2664	5.0	90.0
4	20	5.0	0.630	4754	0.246	0.326	1548	4.7	90.7
8	20	12.0	1.512	10416	0.491	0.163	1696	4.1	91.8
12	20	28.0	3.528	19487	0.737	0.109	2116	2.9	94.3
16	20	56.0	7.056	31823	0.982	0.081	2591	2.2	95.7
20	20	74.0	9.324	40899	1.228	0.065	2664	6.2	87.7
4	30	5.0	0.630	4754	0.246	0.326	1548	4.8	90.4
8	30	12.0	1.512	10416	0.491	0.163	1696	5.9	88.1
12	30	28.0	3.528	19487	0.737	0.109	2116	3.4	93.2
16	30	56.0	7.056	31823	0.982	0.081	2591	2.7	94.5
20	30	74.0	9.324	40899	1.228	0.065	2664	7.1	85.9

OFR.=0.63 m/hr.

Q l/min	C mg/l	Hl cm	Hf m	G s ⁻¹	V m/s	T sec	GT	Turbidity NTU	Turbidity Removal(%)
4	5	5.0	0.630	4754	0.246	0.326	1548	16	68.1
8	5	12.0	1.512	10416	0.491	0.163	1696	15	70.4
12	5	28.0	3.528	19487	0.737	0.109	2116	14	72.6
16	5	56.0	7.056	31823	0.982	0.081	2591	14	72.6
20	5	74.0	9.324	40899	1.228	0.065	2664	16	68.1
4	10	5.0	0.630	4754	0.246	0.326	1548	6.6	86.8
8	10	12.0	1.512	10416	0.491	0.163	1696	5.9	88.1
12	10	28.0	3.528	19487	0.737	0.109	2116	4.6	90.9
16	10	56.0	7.056	31823	0.982	0.081	2591	3.1	93.8
20	10	74.0	9.324	40899	1.228	0.065	2664	5.7	88.6
4	15	5.0	0.630	4754	0.246	0.326	1548	3.8	92.5
8	15	12.0	1.512	10416	0.491	0.163	1696	3.3	93.4
12	15	28.0	3.528	19487	0.737	0.109	2116	2.4	95.2
16	15	56.0	7.056	31823	0.982	0.081	2591	1.8	96.4
20	15	74.0	9.324	40899	1.228	0.065	2664	3.3	93.4
4	20	5.0	0.630	4754	0.246	0.326	1548	2.6	94.8
8	20	12.0	1.512	10416	0.491	0.163	1696	2.6	94.8
12	20	28.0	3.528	19487	0.737	0.109	2116	2.1	95.9
16	20	56.0	7.056	31823	0.982	0.081	2591	1.5	97.0
20	20	74.0	9.324	40899	1.228	0.065	2664	2.9	94.3
4	30	5.0	0.630	4754	0.246	0.326	1548	2.5	95.0
8	30	12.0	1.512	10416	0.491	0.163	1696	2.1	95.9
12	30	28.0	3.528	19487	0.737	0.109	2116	1.9	96.1
16	30	56.0	7.056	31823	0.982	0.081	2591	1.5	97.0
20	30	74.0	9.324	40899	1.228	0.065	2664	2.2	95.7



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