Appendix B-6

Mechanical Equipment Design Calculation

APPENDIX B.6 Mechanical Equipment Calculation

1. Design Conditions

(1) Design Flow

	M3/day	M3/hour	M3/min	M3/sec
Design Maximum Daily Flow	136,000	5,666.7	94.44	1.574
Design Maximum Hourly Flow	200,000	8,333.3	138.89	2.315

(2) Influent Sewage Characteristics

Influent sewage characteristics for designing treatment facilities are as follows.

ITEM	Characteristic value	Primary Sedimentation		Effluent		Total Removal Rates
		Removal Rates	Effluent	Removal Rates	Effluent	
BOD	170 mg/l	30%	119mg/l	83.2%	20mg/l	88%
SS	210 mg/l	40%	125mg/l	84.1%	20mg/l	90%

2. Inflow Tank

2.1 Inlet Chamber Gate

(1) Design Conditions

Design Maximum Hourly Flow: 200,000 m3/day

Electric Motor Sluice Gate

Quantity: 1

(2) Specifications

Type: Electric Motor Sluice Gate

Diameter: Φ1,400

Power Requirement: 2.2 kW

Quantity: 1

2.2 Bypass Gate

Bypass Gate shall be installed before the temporary pump station for diversion of sewage.

(1) Design Conditions

Design Maximum Hourly Flow: 100,000 m3/day

Electric Motor Sluice Gate

Quantity: 1

(2) Diameter

Flow velocity is assumed to be 1.0 m/sec with the diameter of the gate is 2.0m.

1.157 m3/sec / $\pi \times 2.0^2 \div 4 = 0.37$ m/sec

(3) Specifications

Type:　Electric Motor Sluice Gate

Diameter: φ2,000 ㎜

Power Requirement: 5.5 kW

Quantity: 1

3. Influent Pump Station

3.1 Chamber Gate

(1) Design Conditions

Design Maximum Hourly Flow: 200,000 m3/day

Motor Driven

Quantity: 3

(2) Specifications

Type:　Motor Driven

Diameter: W1.68m×H2.0m

Power Requirement: 0.4 kW

Quantity: 3

3.2 Fine Screen

The principal role of screening is to remove fine materials from influent sewage.

(1) Design Conditions

Automatic Cleaning Bar Screening

Design Maximum Hourly Flow: 200,000 m3/day

Opening of Screen: 6mm

(2) Scale of Chamber

1.68m(Width)×2.0m(Depth)

(3) Specifications

Type:　Mechanically Cleaning Bar Screen

Power Requirement: 0.75 kW

Quantity: 3

3.3 Influent Pumps

The principal role of main pumps is to transfer sewage from reservoir to grit chamber.

(1) Design Conditions

Vertical Shaft Type Mixed Flow Pump

Design Maximum Hourly Flow: 200,000 m3/day (138.89 m3/min)

Quantity: Three Large-Scale Pumps (One is for standbys), Two Medium-Scale Pumps

(2) Capacities of Pumps

Large-Scale Pumps: 54m3/min

Medium-Scale Pumps: 27m3/min

Total Capacity: 54×2＋27×2＝162 m3/min

(138.89 m3/min ＜ 162 m3/min ･･･ OK)

(3) Diameter

Flow velocity is designed to be between 1.5 m/sec and 3.0 m/sec.

Large-Scale Pumps: $146\sqrt{\frac{54m^3/min}{(1.5\sim3)}}$ ＝619～876 ㎜ → φ700 ㎜

Medium-Scale Pumps: $146\sqrt{\frac{27m^3/min}{(1.5\sim3)}}$ ＝438～619 ㎜ → φ450 ㎜

(4) Total Pump Head

Actual Pump Head H1

Pump Pit +338.1

-) Inlet Chamber +348.92

10.82 m

Head Loss in Pipe H2 2.5 m

Total Head H3 H3 = H1 + H2 = 10.82 + 2.5 = 13.32 m → 15 m

(5) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

Large-Scale Pumps:

$$= \frac{0.163 \times 54 \times 15 \times 1}{0.8}(1+0.15)$$

= 189.8 → 200kW

Medium-Scale Pumps

$$= \frac{0.163 \times 27 \times 15 \times 1}{0.77}(1+0.15)$$

= 98.6 → 110kW

(6) Specifications

Large-Scale Pumps

Type: Vertical Shaft Type Mixed Flow Pump

Discharge Capacity: 54 m3/min

Total Head: 15 m

Power Requirement: 200 kW

Quantity: 2 (1 Standby)

Medium-Scale Pumps

Type: Vertical Shaft Type Mixed Flow Pump

Discharge Capacity: 27 m3/min

Total Head: 15 m

Power Requirement: 110 kW

Quantity: 2

3.4 Sump Drainage Pumps

Floor Drain Pumps remove miscellaneous sewage in drain pits .

(1) Design Conditions

Removal Submersible Pump

Quantity: 2

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

Actual Pump Head H1

Drain Pit +334.1

-) Piping Level +346.0

11.9 m

Head Loss in Pipe H2 2 m

Total Head H3 H3 = H1 + H2 = 11.9 + 2.0 = 13.9 m → 15 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 15 m

Power Requirement: 1.5 kW

Quantity: 2

3.5 Temporary Pumps

Temporary Pumps deliver sewage from temporary pump station to grit chamber during the rehabilitation works of existing influent pump station.

(1) Design Conditions

The capacity should meet the present inflow volume of 100,000 m3/day.

Removal Submersible Pump

Quantity: 3

(2) Capacities of Pumps

$$Q = \frac{100,000}{3 \times 24 \times 60} = 23.15 \rightarrow 25 \text{ m3/min}$$

(3) Diameter

Flow velocity is assumed to be 1.5～3.0 m/sec.

$$146\sqrt{\frac{25\text{m}^3/\text{分}}{(1.5\sim3)}} = 596\sim421 \rightarrow \phi 500 \text{ mm}$$

(4) Total Pump Head

Actual Pump Head H1

Pump Pit +339.00

-) Piping Level +348.93

9.93 m

Head Loss in Pipe H2: 1.8 m

Total Head H3: H3 = H1 + H2 = 9.93 + 1.8 = 11.73 m → 14 m

(5) Power Requirement

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 25 \times 14 \times 1}{0.7}(1+0.15)$$

= 93.725 → 110kW

(6) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 25 m3/min

Total Head: 14 m

Power Requirement: 110 kW

Quantity: 3

3.6 Exhaust Fan

Exhaust fan ventilates inside the reservoir.

(1) Ventilation Capacity

(π × 242/4) × 5 mH ÷ 2 × 3 times/hr × 1/60 = 56.52 m3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 60 m3/min

Pressure: 0.15kpa

Power Requirement: 0.75 kW

Quantity: 1

3.7 Air Intake Fan (1)

Air Intake Fan (1) intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 24^2/4) \times 5$ mH $\div 2 \times 3$ times/hr $\times 1/60 = 56.52$ m^3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 60 m3/min

Pressure: 0.15kpa

Power Requirement: 0.75 kW

Quantity: 1

3.8 Air Intake Fan (2)

Air Intake Fan (2) intakes air in the motor room.

(1) Ventilation Capacity

Heat yielded by motors should be considered.

$18 \times 24 \times 12$ mH $\times 3$ times/hr $\times 1/60 = 259.2$ m^3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 260 m3/min

Pressure: 0.15kpa

Power Requirement: 3.7 kW

Quantity: 1

3.9 Air Intake Fan (3)

Air Intake Fan (3) intakes air in the underground pump room.

(1) Ventilation Capacity

$(\pi \times 24^2/4) \times 5$ mH $\div 2 \times 3$ times/hr $\times 1/60 = 56.52$ m^3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 60 m3/min

Pressure: 0.15kpa

Power Requirement: 0.75 kW

Quantity: 1

4. Grit Chamber

4.1 Inlet Gate

Inlet gates are installed for separate each chamber respectively.

Design Conditions

Design Maximum Hourly Flow: 200,000 m3/day

Quantity: 2

Scales of Gates

Tangential velocity is to be designed about 1.0 m/sec/

2.31 m3/sec/（1.2 x1.0 x 2）＝0.8m/sec

(3) Specifications

Type: Electric Motor Sluice Gate

Scale: 1.2 m x 1.0 m

Power Requirement: 1.5 kW

Quantity: 2

4.2 Bypass Gate

(1) Design Conditions

Design Maximum Hourly Flow: 200,000 m3/day

Quantity: 1

(2) Diameter

Flow velocity is assumed to be 1.0 m/sec with the diameter of the gate is 2.0m.

$1.157\ m3/sec / \pi \times 1.5^2 \div 4 = 0.66\ m/sec$

(3) Specifications

Type: Electric Motor Sluice Gate

Scale: 1.5mDia

Power Requirement: 2.2 kW

Quantity: 1

4.3 Grit Collectors

Grit collectors collect and assemble grit to the center of the chamber with mixing.

Design Conditions

Type of Grit Collectors: Vortex-Type

Quantity: 2

Scales of Grit Chambers

4.4 Grit Pumps

Grit Pumps remove grit from the bottom of grit chamber.

(1) Design Conditions

Type of Pumps: Discharge Pump

Volume of grit is estimated form 0.0005 to 0.05 m3 per 1,000 m3 of sewage.

(2) Capacities of Pumps

$$136{,}000\ m3/day \times \frac{0.0005 \sim 0.05}{1000} = 0.068 \sim 6.8\ m3/day$$

Pumps remove daily maximum grit in two hours. The grit density is expected to be 5 %.

$$\frac{0.068 \sim 6.8}{2hr/day \times 60 \times 2set} \times \frac{100}{5} = 0.0057 \sim 0.57\ m3/min$$

The diameter of pump should be larger than φ80. And the normal discharge capacity is 0.45～0.70 m3/min. The capacity of pumps shall be 0.5m3/min × 2.

(3) Total Pump Head

Actual Pump Head H1

Grit Chamber +348.8

-) Piping Level +352.7

3.9 m

Head Loss in Pipe H2

2.9 m

Total Head H3

H3 = H1 + H2 = 3.9 + 2.9 = 6.8 m → 8 m

(4) Specifications

Type: Discharge Pump

Diameter: φ80 mm

Discharge Capacity: 0.5 m3/min

Power Requirement: 3.7 kW

Quantity: 2

4.5 Grit Scrubber

Grit Separator cleans and separates grit conveyed by grit pumps.

(1) Design Conditions

Volume of grit is 0.068～6.8 m3/day

(2) Separation Capacity

Separator shall be operated for one hour automatically two times a day.

$$\frac{0.068\sim6.8}{1\ \text{hr/day}\times 2\,times\times 2\text{set}} = 0.034\sim1.7\ \text{m3/hr}$$

The capacity of the grit separator shall be 2.0 m3/hr.

(3) Specifications

Type: Screw Grit Conveyor

Separation Capacity: 2.0 m3/hr

Power Requirement: 1.5kw (conveyor)

2.2kw ×2 (mixer)

Quantity: 1

4.6 Scum Screen

Scum Separator separates scum conveyed from primary sedimentation tanks.

(1) Design Conditions

Disk Screen Type

(2) Specifications

Type: Disc Screen

Scale: 0.5 m3/min. or over

Clear Spacing between Bars: 3.0 mm

Power requirement: 0.4kw

Quantity: 1

5. Primary Sedimentation Tank

5.1 Sludge Collectors

(1) Design Conditions

Type of Sludge Collectors: Circumference Drive

Quantity: 8

(2) Scale of Sedimentation Tanks

28 m (diameter) x 3.5 (depth) x 8

(3) Specifications

Type: Circumference Drive

Scale: dia28 m

Power Requirement: 1.5 kW

Quantity: 8

5.2 Primary Sludge Pumps

Primary Sludge Pumps remove primary sludge from the bottom of primary sedimentations and transfer the sludge to gravity thickener.

(1) Design Conditions

Sludge Volume: 655 m3/day

Type of Pumps: Non-Clogging Sludge Pump

Dia-100 x 1.0 m3/min

Quantity: 2 (2 Standby)

(2) Capacities

Operation Time: 655 m3 /min x 1 /60 x 1/2 = 5.46 hr

(3) Total Pump Head

Actual Pump Head H1

Primary Sedimentation +347.41

-) Distribution Level +345.13

-2.28 m

Head Loss in Pipe H2: 9.9m

Total Head H3

H3 = H1 + H2 = -2.28 + 9.9= 7.62 m → 9 m

(3) Specifications

Type： Non-Clogging Pump

Discharge Capacity: 1.0 m3/min

Total Head: 9.0 m

Power Requirement: 5.5 kW

5.3 Scum Pumps

(1) Scum Inflow

Q = 1.838 BH3/2 (m3/sec)

B: Width of Weir (m)

H: Overflow Depth (m)

= 1.838 × 1.5 × 0.023/2 × 60 = 0.4678 m3/min

(2) Pump Discharge Capacity

0.4678 × 1 pond = 0.4678 hr → 0.5m3/min

(3) Total Pump Head

Actual Pump Head H1

Scum Pit +346.0

-) Piping Level +351.0

5.2 m

Head Loss in Pipe H2: 6.4m

Total Head H3

H3 = H1 + H2 = 5.2 + 6.4 = 11.6 m → 12 m

(4) Specifications

Type: Non-Clogging Pump

Discharge Capacity: 0.5 m3/min

Diameter: φ80

Total Head: 12.0 m

Power Requirement: 3.7 kW

5.4 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

(π × 72/4) × 5.5 mH × 3 times/hr × 1/60 = 10.58 m3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 12 m3/min

Pressure: 0.15kpa

Power Requirement: 0.2 kW

Quantity: 1

6. Blower House

6.1 Air Blower

Blower is designed to supply air to aeration device in Aeration Tank.

6.2 Air Requirements

(1) Actual Oxygen Requirements (AOR)

Db = A x (Ci - Co)Qn x 10-３}＝8,078（kgO2/day）

A: Oxygen Requirement for unit BOD Removal（0.6kgO2/kgBOD）

Ci: BOD of Effluent Sewage（119mg/L）

Co: BOD of Treated Water (20mg/L)

Qn: Effluent Flow (136,000m3/day)

Dn = C x (Ck1×10-３×Qn)－(Ck2×10-３×Qn)

－{(ａ×93×10-３＋ｂ×90×10-３－ｃ×0.333×MLSS×10-３)

×Ｑn×Ｎx}＝13,407（kgO2/day）

C: Oxygen Requirements for Nitrification (4.57kgO2/kgN)

Ｃk1: K1-N Concentration of Influent Sewage (35mg/L)

Ck2: K1-N Concentration of Effluent Water (5mg/L)

A: Gross Yield Coefficient of Dissolved BOD (0.5gMLSS/gBOD)

b: Gross Yield Coefficient of Suspended Solid (0.95gMLSS/gBOD)

c: Reduce Coefficient of Endogenous Respiration of Activated Sludge Organisms(0.4L/d)

Nx: Nitrogen Concentration of Waste Activated Sludge (8％)

Ｄe = Ｂ×0.333×Ｑn×（MLSS×10-３×0.8）= 7,246（kgO2/day）

B: Oxygen Requirements of Endogenous Respiration of Unit MLSS (0.1kgO2/kgMLSS)

Actual Oxygen Requirements (AOR)

AOR = Ｄb＋Ｄn＋Ｄe

= 8,078＋13,407＋7,246

= 28,731 kg-O_2/day

Db: Oxygen Requirements for Organic Oxidation (kg-O_2/day)

Dn: Oxygen Requirements for Nitrification (kg-O_2/day)

De: Oxygen Requirement for Endogenous Respiration(kg-O_2/day)

(2) Standard Oxygen Requirements (SOR)

SOR = AOR・C_{sw}・r /{$1.024^{(T2-T1)}$・α・(β・C_{sw}・r − C_A)}×760/ P

SOR: Oxygen Supply Capacity at 20 Centigrade Degrees (kg-O_2/day)

AOR: Actual Oxygen Requirements(kg-O_2/day)

C_{sw}: Concentration of Oxygen Saturation in at 20 Centigrade Degrees(8.84 mg/L)

r : Calibration Coefficient of C_s in accordance with Diffuser Depth

1/2×(10.332＋4/10.332＋1) ＝ 1.19

H: Diffuser Depth(Depth - 0.3 = 4.0 - 0.3 = 3.7m)

C_s : Concentration of Oxygen Saturation in at T Centigrade Degrees(8.84 mg/L)

T1: Standard Water Temperature (20℃)

T2: Mixed Liquid Temperature (20℃)

C_A: DO Concentration of Mixed Liquid (1.5 mg/L)

α : Calibration Coefficient of K1a (0.83)

β : Calibration Coefficient of Oxygen Saturation Temperature(0.95)

P: Atmosphere Pressure(760 mm Hg)

SOR = 28,731×8.84×1.19/{$1.024^{(20-20)}$×0.83(0.95×8.84×1.19−1.5)}×760/760＝39,957 kg-O_2/day

Gs＝SOR/Ea×ρ×Ow/100＝1,024,620 Nm3/day

Temperature Calibration

1,024,620 Nm3/day×273＋20℃/273＝1,099,683.7 m3/day

SOR: 39,957 kg-O_2/day

Ea: Oxygen Transfer Efficient (13%)

ρ : Air Density (1.293kgAirNm3)

Ow: Oxygen Content in Air (0.232kgO2/kg)

6.3 Blower Capacity

(1) Design Conditions

① Quantity: 5 (2 standby)

1,099,683.7 m3/day÷24÷60÷3 units＝254.5m3/min・unit

(2) Diameter

Sanction speed is designed to be 20～30m/sec.

$$D = 146\sqrt{\frac{255}{20\sim30}}$$

$= 521\sim425$

For sanction φ450, for discharge φ400

(3) Electric Motor Power

Design Conditions

Air Feed Volume: 255 m3/min

Sanction Pressure Plg: -200 mmAq

Discharge Pressure P2g: 4,800 mmAq

Sanction Absolute Pressure P1 = 10,333 – 200 = 10,133 mmAq

Discharge Absolute Pressure P2 = 10,333 + 4,800 = 15,133 mmAq

(Atmospheric Pressure: 10,333 mmAq)

Sanction Air Volume Q1 = $255\times\frac{10333}{10133}$ = 260 m3/min

Insulating Electric Motor Power L1

L1 = $\frac{255\times10{,}333}{6{,}120\times\frac{1.4-1}{1.4}}\left\{\left(\frac{15{,}133}{10{,}333}\right)^{\frac{1.4-1}{1.4}}-1\right\}$ = 179kw

Required Electric Motor Power L2

L2 = $\frac{179}{0.70}$ = 256kw

Total Insulating Efficiency: 70%

The minimum temperature is assumed to be minus –20^{o}C (Mean temperature in winter is –16.1deg according to Master Plan of Astana City by J ICA).

L2 = $256\times\left(\frac{293}{273-20}\right)$ = 296kw

Electric Motor Power L2

L0 = 296×（1＋0.05）＝311kw → 315kw

(4) Specifications

Type: Multistage Turbo Blower

Diameter: Sanction φ450 × Discharge φ400

Supplied Air Flow: 255m3/min

Pressure: 50kpa

Power Requirement: 315 kW

Quantity: 3 (2 standby)

6.4 Clear Water Supply Pump

Design Conditions

Clear Water Supply Volume: 0.052m3/min/unit

0.052m3/min×3units =0.156m3/min → 0.3m3/min

(2) Specifications

Type: Volute Pump

Discharge Capacity: 0.3 m3/min

Diameter: φ65

Total Head: 20 m

Power Requirement: 2.2 kW

Quantity: 1 (1 standby)

7. Secondary Sedimentation Tank

7.1 Sludge Collectors

(1) Design Conditions

Type of Sludge Collectors: Circumference Drive

Quantity: 12

(2) Scale of Sedimentation Tanks

28 m (diameter) × 3.5 (depth) × 12

(3) Specifications

Type: Circumference Drive

Scale: dia28 m

Power Requirement: 1.5 kW

Quantity: 12

8. Return Sludge Pumps

8.1 Return Sludge Pumps

Return Sludge Pumps return activated sludge from the bottom of secondary sedimentations to reactors.

(1) Design Conditions

① Pump capacities should meet 100% of daily maximum sewage flow.

② Type of Pumps: Vertical Shaft Type Mixed Flow Pump

Quantity: 3 (2 standby)

(2) Capacities

$$Q = \frac{136,000 \times 100\%}{3\text{units} \times 100 \times 24\text{hour} \times 60\text{min}}$$

$= 31.48 m^3/min \rightarrow 32 m^3/min$

(3) Diameter

$$D = 146\sqrt{\frac{Q}{V}} = 146\sqrt{\frac{32}{1.5 \sim 3}}$$

$= 477 \sim 674 \rightarrow \phi 500$

(4) Total Pump Head

Actual Pump Head H1

Sanction Level +345.08

-) Inlet Pipe for Distribution Tank +349.0

3.92 m

Head Loss in Pipe H2: 1.8m

Total Head H3

H3 = H1 + H2 = 3.92 + 1.8 = 5.72 m → 6 m

(5) Power Requirement

$$D = \frac{0.163 \times 32 \times 6 \times 1}{0.75}(1 + 0.15)$$

$= 47.99 \rightarrow 55$ kW

(6) Specifications

Type: Vertical Shaft Type Mixed Flow Pump

Discharge Capacity: 32 m3/min

Diameter: φ500

Total Head: 6 m

Power Requirement: 55 kW

Quantity: 3 (2 standby)

8.2 Waste Sludge Pump

Waste Activated Sludge Pumps transfer waste activated sludge from the bottom of secondary sedimentations to the Waste Activated Sludge Storage Tank.

(1) Design Conditions

Type of Pumps: Non-Clogging Pump

Sludge Volume: 3,322 m3/day

Pump Discharge Rate: 4.7 m3/min

Quantity: 1 (standby 1)

(2) Capacities

Pump Operation Time

3,322/4.2m3/min × 1 /60 = 11.78 hours

(3) Diameter

$$D = 146\sqrt{\frac{Q}{V}} = 146\sqrt{\frac{4.7}{1.5\sim3}}$$

= 183～258 → ϕ200

(4) Total Pump Head

Actual Pump Head H1

Sanction Level +345.08

-) Inlet Pipe Level +344.3

-0.78 m

Head Loss in Pipe H2: 9.1m

Total Head H3

H3 = H1 + H2 = -0.78 + 9.1 = 8.32 m → 10 m

(5) Power Requirement

$$D = \frac{0.163\times4.7\times10\times1}{0.45}(1+0.15)$$

$$= 19.58 \rightarrow 22\ kW$$

(6) Specifications

Type: Non-Clogging Pump

Discharge Capacity: 4.7 m3/min

Diameter: 200mm

Total Head: 10 m

Power Requirement: 22kW

Quantity: 1 (1 standby)

8.3 Sump Drainage Pumps

(1) Design Conditions

Removal Submersible Pump

Quantity: 1 (1 Standby)

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

Actual Pump Head H1

Drain Pit +343.4

-) Piping Level +348.35

4.95 m

Head Loss in Pipe H2: 2 m

Total Head H3: H3 = H1 + H2 = 4.95 + 2.0 = 6.95 m → 10 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 10 m

Power Requirement: 1.5 kW

Quantity: 1 (1 Standby)

9 Discharge Pump Station

9.1 Discharge Pump

(1) Design Conditions

Vertical Shaft Volute Type Mixed Flow Pump

Design Maximum Hourly Flow: 200,000 m3/day (138.89 m3/min)

Quantity: Three Large-Scale Pumps (One is for standbys), Two Medium-Scale Pumps

(2) Capacities of Pumps

Large-Scale Pumps: 54m3/min

Medium-Scale Pumps: 27m3/min

Total Capacity: 54×2＋27×2＝162 m3/min

(138.89 m3/min ＜ 162 m3/min … OK)

(3) Diameter

Flow velocity is designed to be between 1.5 m/sec and 3.0 m/sec.

Large-Scale Pumps: $146\sqrt{\frac{54m^3/min}{(1.5\sim3)}}$ ＝619～876 ㎜ → φ800 ㎜

Medium-Scale Pumps: $146\sqrt{\frac{27m^3/min}{(1.5\sim3)}}$ ＝438～619 ㎜ → φ600 ㎜

(4) Total Pump Head

Actual Pump Head H1

Pump Pit +340.2

-) Outlet Pipe +349.0

8.8 m

Head Loss in Pipe H2: 4.22m

Total Head H3

H3 = H1 + H2 = 8.8 + 4.22= 13.02 m → 15 m

(5) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

Large-Scale Pumps:

$$= \frac{0.163 \times 54 \times 15 \times 1}{0.8}(1+0.15)$$

= 189.8 → 200kW

Medium-Scale Pumps

$$= \frac{0.163 \times 27 \times 15 \times 1}{0.8}(1+0.15)$$

= 94.89 → 110kW

(6) Specifications

Large-Scale Pumps

Type: Vertical Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 54 m3/min

Total Head: 15 m

Power Requirement: 200 kW

Quantity: 2 (1 Standby)

Medium-Scale Pumps

Type: Vertical Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 27 m3/min

Total Head: 15 m

Power Requirement: 110 kW

Quantity: 2

9.2 Inlet Chamber Gate

(1) Design Conditions

Design Maximum Hourly Flow: 200,000 m3/day

Electric Motor Sluice Gate

Quantity: 1

(2) Specifications

Type: Electric Motor Sluice Gate

Diameter: φ1,500 ㎜

Power Requirement: 3.7 kW

Quantity: 1

9.3 Temporary Pumps

Temporary Pumps deliver treated water during the repairing works of existing effluent pump station.

(1) Design Conditions

The capacity should meet the present inflow volume of 100,000 m3/day.

Removal Submersible Pump

Quantity: 3

(2) Capacities of Pumps

$$Q = \frac{100,000}{3 \times 24 \times 60} = 23.15 \rightarrow 25 \text{ m}^3\text{/min}$$

(3) Diameter

Flow velocity is assumed to be 1.5～3.0 m/sec.

$$146\sqrt{\frac{25\text{m}^3/\text{分}}{(1.5\sim3)}} = 596\sim421 \rightarrow \phi 500 \text{ mm}$$

(4) Total Pump Head

Actual Pump Head H1

Pump Pit +340.10

-) Piping Level +349.00

8.90 m

② Head Loss in Pipe H2: 2.87 m

③ Total Head H3: H3 = H1 + H2 = 8.9 + 2.87 = 11.77 m → 15 m

(5) Power Requirement

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 25 \times 15 \times 1}{0.7}(1+0.15)$$

$= 100.4 \rightarrow 110$kW

(6) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 25 m3/min

Total Head: 15 m

Power Requirement: 110 kW

Quantity: 3

9.4 Air Intake Fan (1)

Air Intake Fan (1) intakes air in the underground motor room.

(1) Ventilation Capacity

Heat value of electric motors shall be taken into consideration.

$18 \times 24 \times 12\text{mH} \times 3\ \text{times/hr} \times 1/60 = 259.2\ \text{m}^3/\text{min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 260 m3/min

Pressure: 0.15kpa

Power Requirement: 3.7 kW

Quantity: 1

9.5 Air Intake Fan (2)

Air Intake Fan (2) intakes air in the underground pump room.

(1) Ventilation Capacity

Heat yielded by motors should be considered.

$(\pi \times 24^2 / 4) \times 5\ \text{mH} \div 2 \times 3\ \text{times/hr} \times 1/60 = 56.52\ \text{m}^3/\text{min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 60 m3/min

Pressure: 0.15kpa

Power Requirement: 0.75 kW

Quantity: 1

10. Gravity thickener

10.1 Thickened Sludge Collector

Thickened Sludge Collectors bring together sediment sludge from the bottom of in sludge thickener to sludge pit.

(1) Design Conditions

Type of Sludge Collectors: Center Drive

Quantity: 2, that is correspond to the number of sedimentation tanks.

(2) Scale of Sedimentation Tanks

20 m (diameter) x 3.5 (depth) x 2

(3) Specifications

Type: Center Drive

Scale: dia20 m

Power Requirement: 0.75 kW

Quantity: 2

10.2 Thickened Sludge Pumps

Thickened Sludge Pumps transfer thickened sludge from the bottom of thickeners to thickened sludge reservoirs.

(1) Design Conditions

Sludge Volume: 236 m3/day

Type of Pumps: Non-Clogging Pump

Diameter: 100 mm (prevention against clogging considered)

Discharge Capacity: 1.0 m3/min

Quantity: 1 (standby 1)

(2) Capacities

Operation Time

$$236/1\ \text{m3/min} \times 1/60 \times 1/1 = 3.93\text{hour}$$

Diameter

$$D = 146\sqrt{\frac{Q}{V}} = 146\sqrt{\frac{1}{1.5\sim3}}$$

$$= 84.3 \sim 146 \rightarrow \phi 100$$

Power Requirement

$$D = \frac{0.163\times1\times5\times1}{0.4}(1+0.15)$$

$$= 2.34 \quad \rightarrow \quad 3.7\ \text{kW}$$

(3) Total Pump Head

Actual Pump Head H1

Water Level of Thickener +345.4

-) Pipe Level +345.8

0.4 m

Head Loss in Pipe H2: 3.6m

Total Head H3: H5 = H1 + H2 = 0.4 + 3.6 = 4.0m → 5.0 m

(4) Specifications

Type: Non-Clogging Pump

Discharge Capacity: 1.0 m3/min

Diameter: 100mm

Total Head: 5 m

Power Requirement: 3.7 kW

Quantity: 1 (1 standby)

10.4 Exhaust Fan

Exhaust fan ventilates the sludge pump room.

(1) Ventilation Capacity

$(\pi \times 7^2/4) \times 5.5$ mH $\times$ 3 times/hr $\times$ 1/60 = 10.58 m^3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 12 m^3/min

Pressure: 0.15kpa

Power Requirement: 0.2 kW

Quantity: 1

11. Digester ＆ Pump House

11.1 Sludge Pump

(1) Design Conditions

Mixing Method: Pump Mechanical Stirring

Digester Capacity: 1,950 m3/tank

(2) Mixing Capacity

Q＝1,950 m3×4 times/24×1/60＝5.42 → 5.5 m3/min

(3) Total Pump Head

Actual Pump Head H1

Water Level of Digester +351.3

-) Pipe Level +355.5

4.2 m

Head Loss in Pipe H2: 6.7 m

Total Head H3: H5 = H1 + H2 = 4.2 + 6.7 = 10.9 m → 12.0 m

(4) Specifications

Type: Non-Clogging Pump

Diameter: 250 mm

Discharge Capacity: 5.5 m3/hr

Head: 12 m

Power Requirement: 22 kW

Quantity: 1 (1 standby)

11.2 Gas Holder

(1) Design Conditions

Generated Gas Volume: 9,839 m3

Storage Time: 6 hours

(2) Tank Capacity

9,839 m3×64/24×2 units＝1,229 m3 → 1,300 m3

(3) Specifications

Type: Wet Type Gas Holder

Treatment Capacity: 1,300 m3/hr

Quantity: 2

11.3 Desulfurizer

(1) Design Conditions

Treatment Gas Volume: 10,968 m3/d = 457 m3/hr

= 7.62 m3/min = 0.1269 m3/sec

Type: Wet Type Desulfurizer

(2) Treatment Capacity

10,968 m3/d×1/24 = 457 m3/hr → 460 m3/hr

(3) Diameter

Velocity of Gas Flow = 0.04～0.05m/sec

D＝√4×Q÷π×V

＝√4×0.1269÷π×0.04～0.05

＝2.01～1.798

→ 2.0 m/sec

(4) Height

Absorption Reaction Time: 1 min

$H = Q \times t \div \pi/4 \times D^2 = V \times 60 \times t$

$= 0.05 \times 60 \times 1.0^2 = 3.0m$

(5) Water Supply Volume

$q = a \times Q$ （m3/min）

a : Gas-Liquid Contact Ratio 0.8

Q : Gas Generation Volume.62m3/min

$q = 0.8 \times 7.62 = 6.093$ m3/min

(6) Specifications

Type: Wet Type Desulfurizor

Treatment Capacity: 460 m3/hr

Quantity: 1

11.4 Air Intake Fan

Air Intake Fan intakes air in the underground pump room and piping room.

(1) Ventilation Capacity

$(\pi \times 7^2/4) \times 18.0mH \times 3$ times/hr $\times 1/60 = 34.62\ m^3/min$

$4.1 \times 3.1 \times 13.0mH \times 2 \times 3$ times/hr $\times 1/60 = 16.52\ m^3/min$

$= 51.143\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 26 m^3/min

Power Requirement: 1.5 kW

Quantity: 2 (2 standby)

12. Sludge Treatment Building

12.1 Mechanical Thickener

Mechanical Sludge Thickening Equipment thickens activated sludge transferred from secondary sedimentation tanks.

(1) Design Conditions

Operation Time: 24 hours per day

Type: Screw Press

Sludge Volume: 3,322 m3/day

Thickening Capacity: 75m3/hour (25m3/m2/hr x 3.0 m2/unit)

(2) Quantity

3,322m3/day×(７/７)×(1/24)/75m3/hr

＝1.85 → 2 units

(3) Specifications

Type: Screw Press

Thickening Capacity: 75m3/hour

Power Requirement: 1.5 kW + 0.75 kW + 0.75 kW

Quantity: 2 (1 standby)

12.2 Waste Sludge Feed Pumps

Sludge Supply Pumps transfer activated sludge from sludge reservoirs to thickening equipment.

(1) Design Conditions

Sludge Supply Volume: 3,322 m3/d = 138.4 m3/hour

Type of Pumps: Progressing Cavity Pump (quantitative advantages considered)

Discharge Capacity: 50%～150% of Dewatering Capacity (taking into consideration of operational fluctuation)

Quantity: 2 (standby 1)

(2) Discharge Capacity

Thickener capacity 3,322 m3/d

$$Q = \frac{3,322 \times 0.5 \sim 1.5}{24} \times \frac{1}{2} = 34.4 \sim 103.8\text{m3/hr}$$

(3) Total Head

20m for Progressing Cavity Pump

(4) Specifications

Type: Progressing Cavity Pump (gear changeable)

Discharge Capacity: 34～104m3/hr

Diameter: 200mm

Total Head: 20 m

Power Requirement: 30 kW

Quantity: 2 (1 standby)

12.3 Thickened Sludge Pumps

Thickened Sludge Pumps transfer thickened sludge from the thickened sludge reservoirs to digesters.

(1) Design Conditions

Sludge Volume: 548 m3/day

Type of Pumps: Non-Clogging Pump

Diameter: 100 mm × 1.0 m3/min (prevention against clogging considered)

Quantity: 1 (standby 1)

(2) Capacities

Operation Time

548/ 1 m3/min× 1 /60 = 9.13 hour

(3) Total Pump Head

Actual Pump Head H1

Water Level of Digester +355.0

-) Pipe Level +341.2

13.8 m

Head Loss in Pipe H2: 7.1 m

Total Head H3: H5 = H1 + H2 = 13.8 + 7.1 = 20.9 m → 22.0 m

(4) Specifications

Type: Non-Clogging Pump

Discharge Capacity: 1.0 m3/min

Diameter: 100mm

Total Head: 22 m

Power Requirement: 11 kW

Quantity: 1 (1 standby)

12.4 Polymer Tanks

Chemical Dissolving Tanks reserve and dissolve chemicals supplied by supply equipment.

(1) Design Conditions

Chemical Feeding Rate: 1.0%

Chemical Dissolving Concentration: 0.2%

Plural Dissolving Tanks: 2 (alternative operation)

Capacity: Unit capacity meets 2 hour dewatering capacity

(2) Chemical Volume

$$\frac{16,612\text{kg}\cdot\text{ds/day}\times 7\text{day/week}\times 1.0\%}{7\text{day/week}\times 100}=166.1\ \text{kg/day}$$

(3) Capacities of Tanks

$$V=Q\times 10^{-3}\times\frac{t}{T}\times\frac{100}{C}=166.1\times 10^{-3}\times\frac{2\text{hour}}{24\text{hour/day}}\times\frac{100}{0.2}$$

$=6.92m^3 \rightarrow 7m^3$

(4) Specifications

Type: Vertical Cylindrical Tank

Capacity: 7.0m3

Power Requirement: 3.7 kW

Quantity: 2

12.5 Polymer Feeder

Chemical Supply Equipment reserve chemical and supply water and chemical to chemical dissolving tanks determinately and continuously.

(1) Design Conditions

Chemical (Flocculant) Density: 0.6

Supply Time: 15min

Chemical Dissolving Concentration: 0.2%

(2) Supply Volume

$$Q = V \times \frac{C}{100} \times \frac{1}{t} \times \frac{1}{r} \times 10^3$$

$$= 7.0 \times \frac{0.2}{100} \times \frac{1}{15} \times \frac{1}{0.6} \times 10^3 = 1.56\text{m3/min} \rightarrow 2000\text{ cc/min}$$

V: Chemical Dissolving Tank Capacity 7.0m^3

Q: Chemical Supply Volume L/min

C: Chemical Dissolving Concentration 0.2%

t : Supply Time 15min

r : Chemical (Flocculants) Density 0.6

(3) Specifications

Type: Positive Displacement Supplier

Supply Capacity: 2000 cc/min

Power Requirement: 0.4 kW

Quantity: 2

12.6 Polymer Feed Pumps

Chemical Supply Pumps supply chemical dissolved liquid to dewatering equipment determinately.

(1) Design Conditions

Type of Pumps: Progressing Cavity Pump (quantitative advantages considered)

Sludge Volume: 3,322 m3/day

Chemical Dissolving Concentration: 0.2%

Chemical Feeding Rate: 1.0% of solid in feed

Waste Sludge Density: 0.5%

Supply Fluctuation: 50～150%

Quantity: 2

(2) Supply Volume

$$Q = \frac{r \times C_0 \times Q \times K}{100 \times C}$$

$$= \frac{1.0 \times 0.5 \times 350 m^3/hr}{100 \times 0.2} \times 1/(24 \times 2)$$

Co: Sludge Density 0.5%

C: Polymer Density 0.2%

$\times (0.5 \sim 1.5) = 0.875 \sim 2.625\ m^3/hr$

(3) Total head

20m for Progressing Cavity Pump

(4) Specifications

Type: Progressing Cavity Pump (gear changeable)

Discharge Capacity: 0.8～2.7 m3/min

Diameter: 40mm

Total Head: 20 m

Power Requirement: 1.5 kW

Quantity: 2 (1 standby)

12.7 Air Compressors

Air Compressors supply compressed air to chemical supply equipment and air roll valve.

(1) Air Volume

Chemical Supply Equipment: 100 L/min × 2

Air Roll Valve: 35 L/min × 2

Total 270 L/min

Allowance is assumed to be 50%.

270 × 1.5 = 405 → 600 L/min

(2) Specifications

Type: Pressure Control Switch Type

Discharge Capacity: 600 L/min

Presque: 0.83 MPs

Power Requirement: 5.5 kW

Quantity: 1 (1 standby)

12.8 Dewatering Machines

Sludge Dewatering Machines dewater digested sludge from digesters.

(1) Design Conditions

Operation Time: 24 hours per day

Type: Screw Press

Feed Digested Sludge Volume: 16,452 m3/day (3.0% of sludge density)

Thickening Capacity: 450kg/hour

(2) Quantity

16,452 m3/day×(７/７)×(1/24)/450kg/hr

＝1.52 → 2 units

(3) Specifications

Type: Screw Press Dewatering Machine

Thickening Capacity: 450 kg/hr

Power Requirement: 3.7 kW +1.5 kW

Quantity: 2 (1 standby)

12.9 Sludge Feed Pumps

Sludge Feed Pumps transfer digested sludge from digester to sludge dewatering machines.

(1) Design Conditions

Sludge Supply Volume: 450kg/hour/3.0/100×10^{-3}＝15m3/hour

Type of Pumps: Progressing Cavity Pump (quantitative advantages considered)

Discharge Capacity: 50%～150% of Dewatering Capacity (taking into consideration of operational fluctuation)

Quantity: 3 (standby 1)

(2) Discharge Capacity

Dewatering capacity15m3/hr: Ｑ＝15 x (0.5～1.5)＝7.5～22.5 kg/hr

(3) Total Head

20m for Progressing Cavity Pump

(4) Specifications

Type: Progressing Cavity Pump (gear changeable)

Discharge Capacity: 7.5 ～22.5 m3/hr

Diameter: 125mm

Total Head: 20 m

Power Requirement: 7.5 kW

Quantity: 2 (1 standby)

12.10 Polymer Tanks

Chemical Dissolving Tanks reserve and dissolve chemicals supplied by supply equipment.

(1) Design Conditions

Chemical Feeding Rate: 1.4%

Chemical Dissolving Concentration: 0.2%

Plural Dissolving Tanks: 2 (alternative operation)

Capacity: Unit capacity meets 2 hour dewatering capacity

(2) Chemical Volume

$$\frac{16{,}452\text{kg}\cdot\text{ds/day}\times 7\text{day/week}\times 1.4\%}{7\text{day/week}\times 100} = 230.3\ \text{kg/day}$$

(3) Capacities of Tanks

$$V = Q\times 10^{-3}\times\frac{t}{T}\times\frac{100}{C} = 230.3\times 10^{-3}\times\frac{2\text{hour}}{24\text{hour/day}}\times\frac{100}{0.2}$$

$$= 9.56\text{m}^3 \quad \rightarrow 10\text{m}^3$$

(4) Specifications

Type: Vertical Cylindeical Tank

Capacity: 10m3

Power Requirement: 5.5 kW

Quantity: 2

12.11 Polymer Feeder

Chemical Supply Equipment reserve chemical and supply water and chemical to chemical dissolving tanks determinately and continuously.

(1) Design Conditions

Chemical (Flocculant) Density: 0.6

Supply Time: 15min

Chemical Dissolving Concentration: 0.2%

(2) Supply Volume

$$Q = V\times\frac{C}{100}\times\frac{1}{t}\times\frac{1}{r}\times 10^3$$

$$= 10\times\frac{0.2}{100}\times\frac{1}{15}\times\frac{1}{0.6}\times 10^3 = 2.2\text{m3/min} \quad \rightarrow \quad 4000\text{cc/min}$$

V: Chemical Dissolving Tank Capacity 10m^3

Q: Chemical Supply Volume L/min

C: Chemical Dissolving Concentration 0.2%

t : Supply Time 15min

r : Chemical (flocculant) Density 0.6

(3) Specifications

Type: Positive Displacement Supplier

Supply Capacity: 4000cc/min

Power Requirement: 0.4 kW

Quantity: 2

12.12 Polymer feed Pumps

Chemical Supply Pumps supply chemical dissolved liquid to dewatering equipment determinately.

(1) Design Conditions

Type of Pumps: Progressing Cavity Pump (quantitative advantages considered)

Chemical Dissolving Concentration: 0.2%

Chemical Feeding Rate: 1.4% of solid in feed

Digested Sludge Density: 3.0%

Supply Fluctuation: 50～150%

Quantity: 2

(2) Supply Volume

$$Q = \frac{r \times C_0 \times Q \times K}{100 \times C}$$

$$= \frac{1.4 \times 3.0 \times 15m^3/hr}{100 \times 0.2} \times (0.5 \sim 1.5)$$

$$= 1.575 \sim 4.725m^3/hr$$

Co: Sludge Density 3.0%

C: Polymer Density 0.2%

r : Feeding Rate 1.4%

K: Fluctuation 0.5～1.5

(3) Total head

20m for Progressing Cavity Pump

(4) Specifications

Type: Progressing Cavity Pump (gear changeable)

Discharge Capacity: 1.5～4.8m3/hr

Diameter: 65mm

Total Head: 20 m

Power Requirement: 2.2 kW

Quantity: 2 (1 standby)

12.13 Polymer Container

(1) Quantity

Required Capacity:

Thickener: 166.12 kg/day

Dewatering Machine: 230.33 kg/day

Total: 396.45 kg/day

$$\frac{0.39645m^3/day}{0.5(density)} = 0.7929m3/day$$

Storage Period: 10 days

Quantity:

$$\frac{0.7929m^3/day \times 10}{1.0m3(Container)} = 7.929$$

→ 1.0 m3 × 8

12.14 Sewage Pumps

Miscellaneous Used Water Drain Pumps drain water from reservoir to grit chamber.

(1) Design Conditions

Miscellaneous Used Water Volume

Thickener Effluent :3,007 m3/day

Dewatering Machine Effluent: 474 m3/day

Total 3,481 m3/day

Type of Pumps: Non-Clogging Pump

Quantity: 2 (1 Standby)

(2) Capacities of Pumps

$$\frac{3,481}{60 \times 24} = 2.417m3/日$$

→ 3.0 m3/min

(3) Total Pump Head

Actual Pump Head H1

Reservoir Level +341.2

-) Piping Level +350.2

9.0 m

Head Loss in Pipe H2: 6.6 m

Total Head H3: H3 = H1 + H2 = 9.0 + 6.6 = 15.6 m → 17 m

(4) Specifications

Type: Non-Clogging Pump

Discharge Capacity: 3.0 m3/min

Diameter: 200 mm

Total Head: 17 m

Power Requirement: 22 kW

Quantity: 1 (1 Standby)

12.15 Scrubber

Scrubber is designed to be Biological type.

(1) Newly Supply Water

Newly Supply Water Ration: 1.5～2.0L/Nm3

Water Quantity: Q = 273／293×90 m3/min×1.5～2.0

＝125.82～167.76 L/min

→170 L/min

12.16 Odor Fan

Odor fan ventilates the sludge treatment building.

(1) Ventilation Capacity

90 m^3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 90 m^3/min

Pressure: 2.5kpa

Power Requirement: 5.5 kW

Quantity: 1

12.17 Deodorization Volume

(1) Sludge Dewatering Machine

(2 m3 × (1-0.5)×2 times/hr)÷60min = 0.033→ 2 m3/min・unit

3 units×2 m3/min＝ 6 m3/min

(2) Mechanical Thickener

(2 m3 × (1-0.5)×2 times/hr)÷60min = 0.033→ 2 m3/min・unit

3 units×2 m3/min＝ 6 m3/min

(3) Excess Sludge Reservoir

4.7 m3/min（Excess Sludge Pump Capacity）×1.1 ＝5.17m3/min

(4) Thickened Sludge Reservoir

(21 m2 ×3 m3/m2･hr)÷60 min＝1.05→２m3/min･unit

２units×２m3/分･unit ＝4 m3/min

(5) Digested Sludge Reservoir

(27 m2 ×3 m3/m2･hr)÷60 min＝1.35→２m3/min･unit

２units×2 m3/min･unit ＝4 m3/min

(6) Sludge Cake Hopper

(15 m3 ×(1-0.5) ×７ times/hr)÷60 min＝0.875 m3･unit→２m3/min･unit

6units×2 m3/min･unit ＝12 m3/min

(7) Sludge Cake Conveyor

(5 m3 ×7 times/hr)÷60 min＝0.58 m3･unit→２m3/min･unit

3units×2 m3/min･unit ＝6 m3/min

(8) Miscellaneous Used Water Reservoir

(56 m3 ×3 m3/m3･hr)÷60 min＝2.8 →2.8 m3/min･unit

2.8 units×1 m3/min･unit ＝2.8 m3/min

(9) Gravity Thickener

(314m2×3 m3/m3･hr)÷60 min＝15.7 m3/min･unit

15.7×2 unit → 31.4 m3/min･unit

(10) Digester Sludge Distribution

(4.5×3.5×3m3/m3･hr)÷60 min＝0.788 m3/min

3units×2 m3/min･unit ＝6 m3/min

(1)～(10) Total = 83.37 m3/min

→ 90 m3/min

12.18 Elutriation Water Pumps

Water Elutriation Pumps elutriate offensive odor generated from sludge treatment process.

(1) Design Conditions

Horizontal Shaft Volute Type Pump

Quantity: 1 (1 Standby)

(2) Capacities of Pumps

According to calculation for deodorization equipment the feed water capacity is assumed to be 170 l/min.

(3) Total Pump Head

Actual Pump Head H1

Reservoir Level +340.0

-) Inlet Pipe for Deodorizer +348.0

8.0 m

Head Loss in Pipe H2: 6.0m

Head Loss in Auto Strainer H3: 1.0m

Discharge Pressure H4: 10.0m

Total Head H5: H5 = H1 + H2 + H3 +H4 = 8.0 + 6.0 +1.0 + 10.0 = 25 m

(4) Specifications

Type: Horizontal Shaft Volute Type Pump

Discharge Capacity: 0.17 m3/min

Total Head: 25 m

Power Requirement: 3.7 kW

Quantity: 1 (1 Standby)

Desulfurization Equipment Feed Pumps feed water for desulfurization equipment as elutriation usage.

12.19 Treated Water Supply Unit

Treated Water Supply Unit feed water for Sludge Suction Pipe and grit chamber.

(1) Design Conditions

Pressure Tank Type

Quantity: 1 (1 Standby)

(2) Capacities of Pumps

Total capacity of pumps designed to be ten times of grit volume.

The volume of grit is assumed to be 0.034～1.7m3/hr.

0.034～1.7m3/hr × 10 × 1/60 = 0.0057～0.28 m3/min

→ 0.3 m3/min

(3) Total Pump Head

Actual Pump Head H1

Reservoir Level +340.0

-) Pipe Level +352.2

12.2 m

Head Loss in Pipe H2: 10.5m

Head Loss in Auto Strainer H3: 1.0m

Total Head H4: H5 = H1 + H2 + H3 = 12.2 + 10.5 +1.0 = 23.7 m → 25 m

(4) Specifications

Type: Pressure Tank Type

Discharge Capacity: 0.3 m3/min

Total Head: 25 m

Power Requirement: 3.7 kW

Quantity: 1 (1 Standby)

12.20 Desulfurize Pumps

Desulfurization Equipment Feed Pumps feed water for desulfurization equipment as elutriation usage.

(1) Design Conditions

Horizontal Shaft Volute Type Pump

Quantity: 1 (1 Standby)

(2) Capacities of Pumps

According to calculation for digester equipment the feed water capacity is assumed to be 6.1 m3/min.

(3) Total Pump Head

Actual Pump Head H1

Reservoir Level +340.0

-) Pipe Level +348.5

8.5 m

Head Loss in Pipe H2: 2.4m

Head Loss in Auto Strainer H3: 1.0m

Discharge Pressure H4: 10.0m

Total Head H5: H5 = H1 + H2 + H3 +H4 = 8.5 + 2.4 +1.0 + 10.0 = 21.9m → 23m

(4) Specifications

Type: Horizontal Shaft Volute Type Pump

Discharge Capacity: 6.1 m3/min

Total Head: 23 m

Power Requirement: 45 kW

Quantity: 1 (1 Standby)

12.21 Water Supply Unit

Water Supply Unit feed water for Polymer Tank and Influent Pump Discharge Pump.

(1) Design Conditions

Pressure Tank Type

Quantity: 1 (1 Standby)

(2) Capacities of Pumps

Total capacity of pumps designed to be ten times of grit volume.

The volume of Water Demand Immediate Demand

1,328L/min

1.328m3/min → 2.2 m3/min

(3) Total Pump Head

Actual Pump Head H1

Reservoir Level +340.0

-) Pipe Level +352.2

12.2 m

② Head Loss in Pipe H2: 10m

③ Head Loss in Auto Strainer H3: 1.0m

Discharge Pressure H4: 10 m

⑤ Total Head H5: H5 = H1 + H2 + H3 +H4 = 12.2 + 10 +1.0+10 = 33.2 m → 40 m

(4) Specifications

Type: Pressure Tank Type

Discharge Capacity: 2.2 m3/min

Total Head: 40 m

Power Requirement: 15 kW

Quantity: 1 (1 Standby)

12.22 Capacities of Reservoirs

(1) Drain Pit

Thickener Effluent: 3, 007 m3/day

Dewatering Machine Effluent: 474 m3/day

Chemical Dissolving Water: 200 m3/day

Total: 3,681 m3/day

Storage Time: 1hr

Capacity Required: 3,681 × 1/24 = 153 m3

(2) Excess Sludge Reservoir

Excess Sludge: 3, 322 m3/day

Storage Time: 3hr

Capacity Required: 3,322 × 3/24 = 415 m3

(3) Thickened Sludge Reservoir

Thickened Sludge: 316 (Dewatering machine) + 233(Thickener)

= 549 m3/day

Storage Time: 3hr

Capacity Required: 549 × 3/24 = 69 m3

(4) Digested Sludge Reservoir

Digested Sludge: 549 m3/day

Storage Time: 3hr

Capacity Required: 549 × 3/24 = 69 m3

(5) Purified Water Reservoir

Water Demand: 85 (Chemical Dissolving) + 115 m3/day

= 200 m3/day

Storage Time: 1～2 hr

Capacity Required: 200 ×1～2/24 = 9～17 m3

(6) Filtered Water Reservoir

Mechanical Thickener Elutriation Water: 30 L/min

Dewatering Machine Elutriation Water: 135 L/min

Elutriation Time: 1 hr/time × 8 times/day

Storage Time: 1～2 hr

Required Water Volume: (30 × 3 + 135 × 3)× 8hr × 1/1000 = 240 m3/day

Capacity Required: 240 × 1～2/24 = 10～20 m3

Water Demand

Item	① Installation No.	② Unit Demand (L/min)	③ Operation Time (Hr)	④ Effective Rate (%)	A Immediate Demand (L/min)	B Maximum Demand (m^3/hr)	C Hourly Ave.Demand (m^3/hr)	D Daily Average Demand (m^3/d)	Supply System Purified	Supply System Filtered	Remarks
Influent Pimps											
Sealing Water (1)	2	20	24	40	40	2.4	0.96	23.0	○		
Sealing Water (2)	2	20	24	40	40	2.4	0.96	23.0	○		
Sprinkler	1	50	1	10	50	3	0.30	0.3	○		
Grit Chamber											
Grit Elutriation	1	300	24	40	300	18	7.20	172.8		○	
Final Sedimentation Equipment											
Return Sludge Pump	4	15	24	100	60	3.6	3.60	86.4	○		
Blower Equipment											
Blower Cooling Water	4	52	24	50	208	12.48	6.24	149.8	○		
Sprinkler	1	50	1	10	50	3	0.30	0.3	○		
Effluent Pump Equipment											
Sealing Water (1)	2	20	24	40	40	2.4	0.96	23.0	○		
Sealing Water (2)	2	20	24	40	40	2.4	0.96	23.0	○		
Sprinkler	1	50	1	10	50	3	0.30	0.3	○		
Mechanical Thickener											
Thickener Elutriation	2	40	24	50	40	2.4	1.20	28.8	○		
Chem. Dissolved Water	1	100	24	50	100	6	3.00	72.0	○		
Digester Equipment											
Steam Boiler (1)	1	40	1	50	40	2.4	1.20	1.2	○		
Steam Boiler (2)	2	75	24	50	150	9	4.50	108.0	○		
Desulfurizor	1	6100	24	100	6100	366	366.00	8784.0		○	
Sludge Dewatering Equipment											
Machine Elutriation	2	110	0.15	50	220	13.2	6.60	1.0	○		

Item	Installation No.	Unit Demand	Operation Time	Effective Rate	Immediate Demand	Maximum Demand	Hourly Ave.Demand	Daily Average Demand	Supply System		Remarks
		(L/min)	(Hr)	(%)	(L/min)	(m^3/hr)	(m^3/hr)	(m^3/d)	Purified	Filtered	
Chem. Dissolved Water	1	150	24	5	150	9	0.45	10.8	○		
Conveyor Elutriation	2	50	8	100	100	6	6.00	48.0		○	
Sprinkler	1	50	1	10	50	3	0.30	0.3	○		
Deodorization Equipment											
Wash Water	1	170	24	100	170	6	10.2	244.8		○	
Total Purified Water Demand					1,328	102	43	654			
Total Filtered Water Demand					6,670	384	373	8,957			

A＝①×②,　B＝A×60,　C＝B×　,　D＝C×

Effective Rate = Actual Operation Time／Operation Time

13. Hopper House

13.1 Cake Hopper

(1) Design Conditions

Type: Motor Driven cut Gate

Sludge Cake Volume: 74.0 m3/day

Storage Time: 0.5 day

Hopper Capacity: 15m3

Voidage of sludge cake in loose condition: 30 percent

Sludge density: (100-30)/100=0.7

(2) Quantity

74.0m3/day × 0.5 × 1/0.7 × 1/15

＝3.524 → 4 units for duty 2 dewatering units considering allowance for holiday

(3) Specifications

Type: Motor Driven cut Gate

Hopper Capacity: 15m3

Power Requirement: 2.2 kW×2

Quantity: 4 (2 standby)

14. Boiler House

14.1 Boiler

(1) Design Conditions

Total Thermal Volume: ｑ0＝1,510,000kcal/hr (From the thermal calculation of digester)

(2) Amount of Evaporation

Actual Amount of Evaporation: W = ｑ0÷Ｉ2－Ｉ3 （kg/hr）

I2: Enthalpy of Generated Vapor in Common Pressure 649.5kcal/kg

I3: Enthalpy of Digested Sludge 35kcal/kg

W＝1,510,000÷(649.5-35)＝2,457 kg/hr

Relative Amount of Evaporation:

I0: Evaporation Heat for Water at 100 degree: 538.8 kcal/kg

I1: Enthalpy of Boiler at the entrance: 5 kcal/kg

W0＝2,457*(649.5－5)／538.8＝2,939 kg/hr

(3) Specifications of Boiler

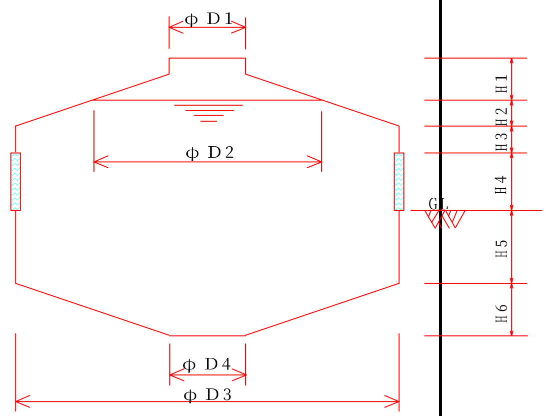
Quantity: 2

W＝2,939 kg/hr + heating = 4,000 kg/hr

Actual Amount of Evaporation Coal boiler 4,000 kg/hr × 2

Gas boiler 2,000 kg/hr × 1

Required Capacity of Water Tube Coal Boiler for Digester (1/4)

Item	symbol	t= -35 degree(minimum temp)	t= -16.1 degree(average temp)
Model		Water tube coal boiler	Water tube coal boiler
Digester configuration			
		D_1 = 3.4 m D_2 = 17 m D_3 = 17 m D_4 = 1 m H_1 = 1.2 m H_2 = 2.35 m H_3 = 0 m H_4 = 0 m H_5 = 8 m H_6 = 2.1 m	D_1 = 3.4 m D_2 = 17 m D_3 = 17 m D_4 = 1 m H_1 = 1.2 m H_2 = 2.35 m H_3 = 0 m H_4 = 0 m H_5 = 8 m H_6 = 2.1 m
Sludge flow rate Dry solid Water content	q	548 m3/d (27.4 DS-t/d 95 %)	548 m3/d (27.4 DS-t/d 95 %)
Required Heat Energy	Q_1	$C \times q \times (T_D - T_S) \times 10^3 \times \frac{1}{24}$ = 1,096,000 kcal/hr	$C \times q \times (T_D - T_S) \times 10^3 \times \frac{1}{24}$ = 1,096,000 kcal/hr
Specific heat value of sludge	C	1 kcal/l·℃	1 kcal/l·℃
	T_D	53 degree	53 degree

Required Capacity of Water Tube Coal Boiler for Digester (2/4)

Item	symbol	t= -35 degree(minimum temp)	t= -16.1 degree(average temp)
Sludge Temp. in winter	T_S	5 degree(winter)	5 degree(winter)
Heat Radiation of a Digester	Q_2	$\{(K_1 \times A_1 + K_2 \times A_2 + K_3 \times A_3 + K_4 \times A_4 + K_5 \times A_5) \times (T_D - T_A) + K_6 \times A_6 \times (T_D - T_{B1}) + K_7 \times A_7 \times (T_D - T_{B2})\} \times 1.2$	
		= 60,809 kcal/hr/tank	= 58,013 kcal/hr/tank
Heat flow rate			
Steel Top cover	K_1	5.17 kcal/m2/hr/degree	5.17 kcal/m2/hr/degree
Gas reservoir under the ceiling	K_2	0.345 kcal/m2/hr/degree con 250mm, mortar 30mm, perlite 100mm	0.345 kcal/m2/hr/degree
Sludge reservoir under the ceiling	K_3	0 kcal/m2/hr/degree	0 kcal/m2/hr/degree
Side wall on the GL	K_4	0 kcal/m2/hr/degree	0 kcal/m2/hr/degree
Heat retention Side wall	K_5	0 kcal/m2/hr/degree	0 kcal/m2/hr/degree
Side wall under the GL	K_6	1.089777 kcal/m2/hr/degree	1.089777 kcal/m2/hr/degree
Bottom slab	K_7	1.784197 kcal/m2/hr/degree	1.784197 kcal/m2/hr/degree
Area			
Steel Top cover	A_1	$\frac{3.1416}{4} \times D_1^2$ = 9.1 m^2	$\frac{3.1416}{4} \times D_1^2$ = 9.1 m^2
Gas reservoir under the ceiling	A_2	$\pi \times \sqrt{H_1^2 + \left(\frac{D_2}{2} - \frac{D_1}{2}\right)^2} \times \left(\frac{D_2}{2} + \frac{D_1}{2}\right)$ = 221.2678 m^2	$\pi \times \sqrt{H_1^2 + \left(\frac{D_2}{2} - \frac{D_1}{2}\right)^2} \times \left(\frac{D_2}{2} + \frac{D_1}{2}\right)$ = 221.2678 m^2

Required Capacity of Water Tube Coal Boiler for Digester (3/4)

Item	symbol	t= -35 degree(minimum temp)	t= -16.1 degree(average temp)
Sludge reservoir under the ceiling	A_3	$\pi \times \sqrt{H_1^2 + \left(\frac{D_3}{2} - \frac{D_2}{2}\right)^2} \times \left(\frac{D_3}{2} + \frac{D_2}{2}\right)$ = 64.1 m^2	$\pi \times \sqrt{H_1^2 + \left(\frac{D_3}{2} - \frac{D_2}{2}\right)^2} \times \left(\frac{D_3}{2} + \frac{D_2}{2}\right)$ = 64.1 m^2
Side wall on the GL	A_4	$\pi \times D_3 \times H_3$ = 0 m^2	$\pi \times D_3 \times H_3$ = 0 m^2
Heat retention Side wall	A_5	$\pi \times D_3 \times H_4$ = 0 m^2	$\pi \times D_3 \times H_4$ = 0 m^2
Side wall under the GL	A_6	$\pi \times D_3 \times H_5$ = 427.3 m^2	$\pi \times D_3 \times H_5$ = 427.3 m^2
Bottom slab	A_7	$\pi \times \sqrt{H_5^2 + \left(\frac{D_3}{2} - \frac{D_4}{2}\right)^2} \times \left(\frac{D_3}{2} + \frac{D_4}{2}\right)$ = 233.9 m^2	$\pi \times \sqrt{H_5^2 + \left(\frac{D_3}{2} - \frac{D_4}{2}\right)^2} \times \left(\frac{D_3}{2} + \frac{D_4}{2}\right)$ = 233.9 m^2
Design Temperature			
Temp. in open air	T_A	-35 ℃	-16.1 ℃
Under ground at Side wall depth	T_{B1}	6 ℃	6 ℃
Under ground at Bottom slab depth	T_{B2}	10 ℃	10 ℃
Heat requirement	Q3	$(Q_1 + Q_2 \times N_D) \times 24$ = 29,222,819 kcal/d	$(Q_1 + Q_2 \times N_D) \times 24$ = 29,088,614 kcal/d
Quantity of Tanks	N_D	2 units	2 units
Radiation from Hot Water pipeline	Q4	$K_8 \times D \times \pi \times L \times (T_S - T_A) \times 1.2$ = 18,373 kcal/hr	$K_8 \times D \times \pi \times L \times (T_S - T_A) \times 1.2$ = 15,442 kcal/hr
Heat Flow Rate of pipeline	K_8	0.952 kcal/m2/hr/deg	0.952 kcal/m2/hr/deg
Pipeline diameter including lagging	D	0.216 m	0.216 m

Required Capacity of Water Tube Coal Boiler for Digester (4/4)

Item	symbol	t= -35 degree(minimum temp)	t= -16.1 degree(average temp)
Pipeline length	L	200 m	200 m
Temp. of Water	T_S	83.5 ℃ Inlet 72deg, Outlet 95deg, Average83.5deg	83.5 ℃ Inlet 72deg, Outlet 95deg, Average83.5deg
Open air Temp.	T_A	-35 ℃	-16.1 ℃
Quantity	N	2 units	2 units
Required heat capacity	qN	Q1 + Q2 = 29,241,191 kcal/d → 29,240,000 kcal/d	Q1 + Q2 $\left(\frac{Q_3}{t}+Q_4\right)\times\frac{1}{I-I'}\times\frac{I-I_1}{1}$ = 29,104,057 kcal/d → 29,100,000 kcal/d
Operation time	t	24 hr/d	24 hr/d
Rating output	q	qN／(t ×ηB×ηE) = 1,508,772 kcal/hr = 1,510,000 kcal/hr	qN／(t ×ηB×ηE) = 1,501,548 kcal/hr = 1,500,000 kcal/hr
Efficiency of boiler	η B	0.85	0.85
Efficiency of Heat exchanger	η E	0.95	0.95

13. Intermediate Pump Stations

13.1. PS No.1

13.1.1 Fine Screen

The principal role of screening is to remove coarse materials from the flow streams.

(1) Design Conditions

① Automatic Cleaning Bar Screening

② Design Maximum Hourly Flow: 1,600 m3/hr

(2) Scale of Chamber

0.6m(Width)×0.6m(Depth)

(3) Specifications

Type: Mechanically Cleaning Bar Screen

Power Requirement: 1.5 kW

Installation Number: 1

13.1.2 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 1,600 m3/hr (26.7m3/min)

(2) Capacities of Pumps

14m3/min

Total Capacity: 14×2＝28 m3/min

(26.7 m3/min ＜ 28 m3/min ··· OK)

(3) Total Pump Head

① Actual Pump Head H1

6.2m

② Head Loss in Pipe H2

2.949m

③ Total Head H3

H3 = H1 + H2 = 6.2 + 2.949 = 9.149 m → 10 m **(Refer to B-6-74 to 76, hereinafter)**

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 14 \times 10 \times 1}{0.70}(1 + 0.15)$$

= 37.49 → 45kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 14 m3/min

Total Head: 10 m

Power Requirement: 45 kW

Installation Number: 2 (2 Standby)

13.1.3 Sump Drainage Pumps

Floor Drain Pumps settled in drain pits drain miscellaneous used wastewater.

(1) Design Conditions

① Removal Submersible Pump

② Installation Number: 2

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

15 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 15 m

Power Requirement: 1.5 kW

Installation Number: 2

13.1.4 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 16^2/4) \times 1/2 \times 10\text{ mH} \times 3\text{ times/hr} \times 1/60 = 50.24\text{ m}^3\text{/min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 55 m3/min

Power Requirement: 3.7 kW

Installation Number: 1

13.1.5 Air Intake Fan

Air Intake Fan (1) intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 16^2/4) \times 10\text{ mH} \times 3\text{ times/hr} \times 1/60 = 100.48\text{ m}^3\text{/min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 105 m3/min

Power Requirement: 5.5 kW

Installation Number: 1

13.2. PS No.2

13.2.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 900 m3/hr (15m3/min)

(2) Capacities of Pumps

7.5m3/min

Total Capacity: 7.5×2＝15 m3/min

(15 m3/min ＜ 15 m3/min ・・・ OK)

(3) Total Pump Head

Actual Pump Head H1

4.57m

Head Loss in Pipe H2

2.075m

Total Head H3

H3 = H1 + H2 = 4.57 + 2.075 = 6.645 m → 7 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 7.5 \times 7 \times 1}{0.52}(1 + 0.15)$$

= 18.93 → 22kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 7.5 m3/min

Total Head: 7 m

Power Requirement: 22 kW

Installation Number: 2 (1 Standby)

13.2.2 Sump Drainage Pumps

Floor Drain Pumps settled in drain pits drain miscellaneous used wastewater.

(1) Design Conditions

① Removal Submersible Pump

② Installation Number: 1

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

15 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 15 m

Power Requirement: 1.5 kW

Installation Number:1

13.2.3 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 9^2/4) \times 1/2 \times 4\ \text{mH} \times 3\ \text{times/hr} \times 1/60 = 6.36\ \text{m}^3/\text{min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 8 m3/min

Power Requirement: 0.4 kW

Installation Number: 1

13.2.4 Air Intake Fan

Air Intake Fan intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 9^2/4) \times 7\ \text{mH} \times 3\ \text{times/hr} \times 1/60 = 11.13\ \text{m}^3/\text{min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 14 m3/min

Power Requirement: 0.75 kW

Installation Number: 1

13.3. PS No.3

13.3.1 Fine Screen

The principal role of screening is to remove coarse materials from the flow streams.

(1) Design Conditions

③ Automatic Cleaning Bar Screening

④ Design Maximum Hourly Flow: 2,400 m3/hr

(2) Scale of Chamber

0.6m(Width)×0.6m(Depth)

(3) Specifications

Type: Mechanically Cleaning Bar Screen

Power Requirement: 1.5 kW

Installation Number: 2

13.3.2 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

⑤ Horizontal Shaft Volute Type Mixed Flow Pump

⑥ Design Maximum Hourly Flow: 2,400 m3/hr (40m3/min)

(2) Capacities of Pumps

14m3/min

Total Capacity: 14×3＝42 m3/min

(40 m3/min ＜ 42 m3/min ･･･ OK)

(3) Total Pump Head

Actual Pump Head H1

4.52m

Head Loss in Pipe H2

4.22m

Total Head H3

H3 = H1 + H2 = 4.52 + 4.22 = 8.74 m → 9 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 14 \times 9 \times 1}{0.72}(1 + 0.15)$$

= 32.8 → 37kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 14 m3/min

Total Head: 9 m

Power Requirement: 37 kW

Installation Number: 3 (2 Standby)

13.3.3 Sump Drainage Pumps

Floor Drain Pumps settled in drain pits drain miscellaneous used wastewater.

(1) Design Conditions

⑦ Removal Submersible Pump

⑧ Installation Number: 1

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

15 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 15 m

Power Requirement: 1.5 kW

Installation Number: 1

13.3.4 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 16^2/4) \times 1/2 \times 10\ mH \times 3\ times/hr \times 1/60 = 50.24\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 55 m3/min

Power Requirement: 3.7 kW

Installation Number: 1

13.3.5 Air Intake Fan

Air Intake Fan (1) intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 16^2/4) \times 10\ mH \times 3\ times/hr \times 1/60 = 100.48\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 105 m3/min

Power Requirement: 5.5 kW

Installation Number: 1

13.4. PS No.4

13.4.1 Fine Screen

The principal role of screening is to remove coarse materials from the flow streams.

(1) Design Conditions

① Automatic Cleaning Bar Screening

② Design Maximum Hourly Flow: 900 m3/hr

(2) Scale of Chamber

1.2m(Width)×1.2m(Depth)

(3) Specifications

Type: Mechanically Cleaning Bar Screen

Power Requirement: 1.5 kW

Installation Number: 1

13.4.2 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 900 m3/hr (15m3/min)

(2) Capacities of Pumps

7.5m3/min

Total Capacity: 7.5 ＝15 m3/min

(15 m3/min ＜ 15 m3/min ・・・ OK)

(3) Total Pump Head

① Actual Pump Head H1

4.15m

② Head Loss in Pipe H2

2.336m

③ Total Head H3

H3 = H1 + H2 = 4.15 + 2.336 = 6.486 m → 7 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 7.5 \times 7 \times 1}{0.52}(1 + 0.15)$$

= 18.93 → 22kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 7.5 m3/min

Total Head: 7 m

Power Requirement: 22 kW

Installation Number: 2 (1 Standby)

13.4.3 Sump Drainage Pumps

Floor Drain Pumps settled in drain pits drain miscellaneous used wastewater.

(1) Design Conditions

① Removal Submersible Pump

② Installation Number: 2

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

15 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 15 m

Power Requirement: 1.5 kW

Installation Number: 2

13.4.4 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 12^2/4) \times 1/2 \times 4\ mH \times 3\ times/hr \times 1/60 = 11.3\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 13 m3/min

Power Requirement: 0.75 kW

Installation Number: 1

13.4.5 Air Intake Fan

Air Intake Fan (1) intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 12^2/4) \times 1/2 \times 7\ mH \times 3\ times/hr \times 1/60 = 19.8\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 22 m3/min

Power Requirement: 1.5 kW

Installation Number: 1

13.5. PS No.6

13.5.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 3,200 m3/hr (53.33m3/min)

(2) Capacities of Pumps

27m3/min

Total Capacity: 27×2＝54 m3/min

(53.33 m3/min ＜ 54 m3/min ··· OK)

(3) Total Pump Head

① Actual Pump Head H1

3.977m

② Head Loss in Pipe H2

5.977m

③ Total Head H3

H3 = H1 + H2 = 3.977 + 5.977 = 9.954 m → 10 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 27 \times 10 \times 1}{0.74}(1 + 0.15)$$

= 68.39 → 75kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 27 m3/min

Total Head: 10 m

Power Requirement: 75 kW

Installation Number: 2 (2 Standby)

13.5.2 Sump Drainage Pumps

Floor Drain Pumps settled in drain pits drain miscellaneous used wastewater.

(1) Design Conditions

① Removal Submersible Pump

② Installation Number: 2

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

15 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 15 m

Power Requirement: 1.5 kW

Installation Number:2

13.5.3 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 12^2/4) \times 1/2 \times 4\ mH \times 3\ times/hr \times 1/60 = 11.3\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 13 m3/min

Power Requirement: 0.75 kW

Installation Number: 1

13.5.4 Air Intake Fan

Air Intake Fan intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 12^2/4) \times 7\ mH \times 3\ times/hr \times 1/60 = 19.8\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 22 m3/min

Power Requirement: 1.5 kW

Installation Number: 1

13.6. PS No.7

13.6.1 Fine Screen

The principal role of screening is to remove coarse materials from the flow streams.

(1) Design Conditions

① Automatic Cleaning Bar Screening

② Design Maximum Hourly Flow: 5,700 m3/hr

(2) Scale of Chamber

1.0m(Width)×1.0m(Depth)

(3) Specifications

Type: Mechanically Cleaning Bar Screen

Power Requirement: 1.5 kW

Installation Number: 2

13.6.2 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Vertical Shaft Type Mixed Flow Pump

② Horizontal Shaft Volute Type Mixed Flow Pump

③ Design Maximum Hourly Flow: 5,700 m3/hr (95m3/min)

(2) Capacities of Pumps

27m3/min× 2 (1 standby)

14m3/min× 2

7.5m3/min× 2

Total Capacity: 27×2 + 14×2+7.5×2 ＝ 97 m3/min

(95 m3/min ＜ 97 m3/min ･･･ OK)

(3) Total Pump Head

① Actual Pump Head H1

5.69m

② Head Loss in Pipe H2

4.892m

③ Total Head H3

H3 = H1 + H2 = 5.69 + 4.892 = 10.582 m → 11 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 27 \times 11 \times 1}{0.77}(1+0.15)$$

= 72.3 → 75kW

$$= \frac{0.163 \times 14 \times 11 \times 1}{0.72}(1+0.15)$$

= 40.1 → 45kW

$$= \frac{0.163 \times 7.5 \times 11 \times 1}{0.52}(1+0.15)$$

= 29.74 → 30kW

③ Specifications

Type: Vertical Shaft Type Mixed Flow Pump

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 27 m3/min

14 m3/min

7.5 m3/min

Total Head: 11 m

Power Requirement: 75kw

45kw

30 kW

Installation Number: 2 (1 Standby)

2

2

13.6.3 Sump Drainage Pumps

Floor Drain Pumps settled in drain pits drain miscellaneous used wastewater.

(1) Design Conditions

① Removal Submersible Pump

② Installation Number: 2

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

15 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 15 m

Power Requirement: 1.5 kW

Installation Number: 2

13.6.4 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 24^2/4) \times 5\text{ mH} \div 2 \times 3\text{ times/hr} \times 1/60 = 56.52\text{ m}^3\text{/min}$

(2) Specifications

Type: Sirocco Fan

Air Flow Capacity: 60 m3/min

Pressure: 15 mmAq

Power Requirement: 0.75 kW

Installation Number: 1

13.6.5 Air Intake Fan (1)

Air Intake Fan (1) intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 24^2/4) \times 5\text{ mH} \div 2 \times 3\text{ times/hr} \times 1/60 = 56.52\text{ m}^3\text{/min}$

(2) Specifications

Type: Sirocco Fan

Air Flow Capacity: 60 m3/min

Pressure: 15 mmAq

Power Requirement: 0.75 kW

Installation Number: 1

13.6.6 Air Intake Fan (2)

Air Intake Fan (2) intakes air in the motor room.

(1) Ventilation Capacity

Heat yielded by motors should be considered.

$18 \times 24 \times 12\text{ mH} \times 3\text{ times/hr} \times 1/60 = 259.2\text{ m}^3\text{/min}$

(2) Specifications

Type: Turbo Fan

Air Flow Capacity: 260 m3/min

Pressure: 15 mmAq

Power Requirement: 3.7 kW

Installation Number: 1

13.6.7 Air Intake Fan (3)

Air Intake Fan (3) intakes air in the underground pump room.

(1) Ventilation Capacity

$(\pi \times 24^2/4) \times 5\text{ mH} \div 2 \times 3\text{ times/hr} \times 1/60 = 56.52\text{ m}^3\text{/min}$

(2) Specifications

Type: Sirocco Fan

Air Flow Capacity: 60 m3/min

Pressure: 15 mmAq

Power Requirement: 0.75 kW

Installation Number: 1

13.7. PS No.10

13.7.1 Fine Screen

The principal role of screening is to remove coarse materials from the flow streams.

(1) Design Conditions

① Automatic Cleaning Bar Screening

② Design Maximum Hourly Flow: 1,350 m3/hr

(2) Scale of Chamber

0.8m(Width)×0.8m(Depth)

(3) Specifications

Type: Mechanically Cleaning Bar Screen

Power Requirement: 1.5 kW

Installation Number: 1

13.7.2 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 1,350 m3/hr (22.5m3/min)

(2) Capacities of Pumps

7.5m3/min

Total Capacity: 7.5×3＝22.5 m3/min

(22.5 m3/min ＜ 22.5 m3/min ･･･ OK)

(3) Total Pump Head

Actual Pump Head H1

4.93m

Head Loss in Pipe H2

5.852m

Total Head H3

H3 = H1 + H2 = 4.93 + 5.852 = 10.782 m → 11 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 7.5 \times 11 \times 1}{0.52}(1 + 0.15)$$

= 29.74 → 30kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 7.5 m3/min

Total Head: 11 m

Power Requirement: 30 kW

Installation Number: 3 (2 Standby)

13.7.3 Sump Drainage Pumps

Floor Drain Pumps settled in drain pits drain miscellaneous used wastewater.

(1) Design Conditions

① Removal Submersible Pump

② Installation Number: 2

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

15 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 15 m

Power Requirement: 1.5 kW

Installation Number: 2

13.7.4 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 16^2/4) \times 1/2 \times 10\ mH \times 3\ times/hr \times 1/60 = 50.24\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 55 m3/min

Power Requirement: 3.7 kW

Installation Number: 1

13.7.5 Air Intake Fan

Air Intake Fan (1) intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 16^2/4) \times 10\ mH \times 3\ times/hr \times 1/60 = 100.48\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 105 m3/min

Power Requirement: 5.5 kW

Installation Number: 1

13.8. PS No.11

13.8.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 228 m3/hr (3.8m3/min)

(2) Capacities of Pumps

1.9m3/min

Total Capacity: 1.9×2＝3.8 m3/min

(3.8 m3/min ＜ 3.8 m3/min ･･･ OK)

(3) Total Pump Head

Actual Pump Head H1

3.97m

Head Loss in Pipe H2

3.822m

Total Head H3

H3 = H1 + H2 = 3.97 + 3.822 = 7.792 m → 8 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 1.9 \times 8 \times 1}{0.35}(1 + 0.15)$$

= 8.14 → 11kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 1.9 m3/min

Total Head: 8 m

Power Requirement: 11 kW

Installation Number: 2 (1 Standby)

13.8.2 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 6^2/4) \times 1/2 \times 4$ mH $\times$ 3 times/hr $\times$ 1/60 = 2.83 m^3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 4 m3/min

Power Requirement: 0.4 kW

Installation Number: 1

13.8.3 Air Intake Fan

Air Intake Fan intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 6^2/4) \times 1/2 \times 7\text{ mH} \times 3\text{ times/hr} \times 1/60 = 4.95\text{ m}^3\text{/min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 6 m3/min

Power Requirement: 0.4 kW

Installation Number: 1

13.9. PS No.15

13.9.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 500 m3/hr (8.33m3/min)

(2) Capacities of Pumps

4.2m3/min

Total Capacity: 4.2×2＝8.4 m3/min

(8.33 m3/min ＜ 8.4 m3/min ･･･ OK)

(3) Total Pump Head

Actual Pump Head H1

4.00m

Head Loss in Pipe H2

6.427m

Total Head H3

H3 = H1 + H2 = 4.00 + 6.427 = 10.427 m → 11 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 4.2 \times 11 \times 1}{0.52}(1 + 0.15)$$

= 16.65 → 18.5kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 4.2 m3/min

Total Head: 11 m

Power Requirement: 18.5 kW

Installation Number: 2 (1 Standby)

9.2 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 6^2/4) \times 1/2 \times 4\ mH \times 3\ times/hr \times 1/60 = 2.83\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 4 m3/min

Power Requirement: 0.4 kW

Installation Number: 1

13.9.3 Air Intake Fan

Air Intake Fan intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 6^2/4) \times 1/2 \times 7\ mH \times 3\ times/hr \times 1/60 = 4.95\ m^3/min$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 6 m3/min

Power Requirement: 0.4 kW

Installation Number: 1

13.10. PS No.16

13.10.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 160 m3/hr (2.67m3/min)

(2) Capacities of Pumps

1.4m3/min

Total Capacity: 1.4×2＝2.8 m3/min

(2.67 m3/min ＜ 2.8 m3/min ･･･ OK)

(3) Total Pump Head

Actual Pump Head H1

5.3m

Head Loss in Pipe H2

18.141m

Total Head H3

H3 = H1 + H2 = 5.3 + 18.141 = 23.441 m → 24 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 1.4 \times 24 \times 1}{0.52}(1 + 0.15)$$

= 12.1 → 15kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 1.4 m3/min

Total Head: 24 m

Power Requirement: 15 kW

Installation Number: 2 (1 Standby)

13.10.2 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 6^2/4) \times 1/2 \times 4$ mH $\times$ 3 times/hr $\times$ 1/60 = 2.83 m^3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 4 m3/min

Power Requirement: 0.4 kW

Installation Number: 1

13.10.3 Air Intake Fan

Air Intake Fan intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 6^2/4) \times 1/2 \times 7$ mH $\times$ 3 times/hr $\times$ 1/60 = 4.95 m^3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 6 m3/min

Power Requirement: 0.4 kW

Installation Number: 1

13.11. PS No.17

13.11.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 250 m3/hr (4.17m3/min)

(2) Capacities of Pumps

4.2m3/min

Total Capacity: 4.2×1＝4.2 m3/min

(4.17 m3/min ＜ 4.2 m3/min ･･･ OK)

(3) Total Pump Head

Actual Pump Head H1

4.9m

Head Loss in Pipe H2

12.375m

Total Head H3

H3 = H1 + H2 = 4.9 + 12.375 = 17.275 m → 18 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 4.2 \times 18 \times 1}{0.52}(1 + 0.15)$$

= 27.3 → 30kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 4.2 m3/min

Total Head: 18 m

Power Requirement: 30 kW

Installation Number: 1 (1 Standby)

13.11.2 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 3^2/4) \times 1/2 \times 4\ \text{mH} \times 3\ \text{times/hr} \times 1/60 = 0.7065\ \text{m}^3\text{/min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 1 m3/min

Power Requirement: 0.2 kW

Installation Number: 1

13.11.3 Air Intake Fan

Air Intake Fan intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 3^2/4) \times 1/2 \times 7$ mH $\times$ 3 times/hr $\times$ 1/60 = 1.24 m^3/min

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 1.5 m3/min

Power Requirement: 0.2 kW

Installation Number: 1

13.12. PS No.21

13.12.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 200 m3/hr (3.33m3/min)

(2) Capacities of Pumps

3.3m3/min

Total Capacity: 3.3×1＝3.3 m3/min

(3.3 m3/min ＜ 3.3 m3/min ・・・ OK)

(3) Total Pump Head

Actual Pump Head H1

10.22m

Head Loss in Pipe H2

8.613m

Total Head H3

H3 = H1 + H2 = 10.22 + 8.613 = 18.833 m → 19 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 3.3 \times 19 \times 1}{0.50}(1 + 0.15)$$

= 23.5 → 30kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 3.3 m3/min

Total Head: 19 m

Power Requirement: 30 kW

Installation Number: 1 (1 Standby)

13.12.2 Sump Drainage Pumps

Floor Drain Pumps settled in drain pits drain miscellaneous used wastewater.

(1) Design Conditions

① Removal Submersible Pump

② Installation Number: 1

(2) Capacities of Pumps

0.3 m3/min

(3) Total Pump Head

15 m

(4) Specifications

Type: Removal Submersible Pump

Discharge Capacity: 0.3 m3/min

Total Head: 15 m

Power Requirement: 1.5 kW

Installation Number: 1

13.12.3 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 6^2/4) \times 1/2 \times 4\ \text{mH} \times 3\ \text{times/hr} \times 1/60 = 2.83\ \text{m}^3/\text{min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 4 m3/min

Power Requirement: 0.4 kW

Installation Number: 1

13.12.4 Air Intake Fan

Air Intake Fan intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 6^2/4) \times 1/2 \times 7\ \text{mH} \times 3\ \text{times/hr} \times 1/60 = 4.95\ \text{m}^3/\text{min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 6 m3/min

Power Requirement: 0.4 kW

Installation Number: 1

13.13. PS No.24

13.13.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Horizontal Shaft Volute Type Mixed Flow Pump

② Design Maximum Hourly Flow: 80 m3/hr (1.33m3/min)

(2) Capacities of Pumps

1.3m3/min

Total Capacity: 1.3×1＝1.3 m3/min

(1.3 m3/min ＜ 1.3 m3/min ･･･ OK)

(3) Total Pump Head

Actual Pump Head H1

6.54m

Head Loss in Pipe H2

8.25m

Total Head H3

H3 = H1 + H2 = 6.54 + 8.25 = 14.79 m → 15 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 1.3 \times 15 \times 1}{0.48}(1 + 0.15)$$

= 7.62 → 11kW

(5) Specifications

Type: Horizontal Shaft Volute Type Mixed Flow Pump

Discharge Capacity: 1.3 m3/min

Total Head: 15 m

Power Requirement: 11 kW

Installation Number: 1 (1 Standby)

13.13.2 Exhaust Fan

Exhaust fan ventilates the screen chamber.

(1) Ventilation Capacity

$(\pi \times 4^2/4) \times 1/2 \times 5\text{ mH} \times 3\text{ times/hr} \times 1/60 = 1.57\text{ m}^3/\text{min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 2 m3/min

Power Requirement: 0.2 kW

Installation Number: 1

13.13.3 Air Intake Fan

Air Intake Fan intakes air in the underground screen chamber.

(1) Ventilation Capacity

$(\pi \times 4^2/4) \times 1/2 \times 8\text{ mH} \times 3\text{ times/hr} \times 1/60 = 2.51\text{ m}^3/\text{min}$

(2) Specifications

Type: Centrifugal Fan

Air Flow Capacity: 3 m3/min

Power Requirement: 0.2 kW

Installation Number: 1

13.14. PS No.28

13.14.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Submersible non-clog Type Vortex Flow Pump

② Design Maximum Hourly Flow: 80 m3/hr (1.3m3/min)

(2) Capacities of Pumps

1.3m3/min

Total Capacity: 1.3×1＝1.3 m3/min

(1.3 m3/min ＜ 1.3 m3/min ・・・ OK)

(3) Total Pump Head

Actual Pump Head H1

2.6m

Head Loss in Pipe H2

24.56m

Total Head H3

H3 = H1 + H2 = 2.6 + 24.56 = 27.16 m → 28 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 1.3 \times 28 \times 1}{0.35}(1 + 0.15)$$

= 19.49 → 22kW

(5) Specifications

Type: Submersible non-clog Type Vortex Flow Pump

Discharge Capacity: 1.3 m3/min

Total Head: 28 m

Power Requirement: 22 kW

Installation Number: 1 (1 Standby)

13.15. PS No.34

13.15.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(2) Design Conditions

① Submersible non-clog Type Vortex Flow Pump

② Design Maximum Hourly Flow: 50 m3/hr (0.833m3/min)

(2) Capacities of Pumps

0.84m3/min

Total Capacity: 0.84×1＝0.84 m3/min

(0.833 m3/min ＜ 0.84 m3/min ･･･ OK)

(3) Total Pump Head

Actual Pump Head H1

2.0m

Head Loss in Pipe H2

12.556m

Total Head H3

H3 = H1 + H2 = 2.0 + 12.556 = 14.556 m → 15 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 0.84 \times 15 \times 1}{0.35}(1 + 0.15)$$

= 6.74 → 7.5kW

(5) Specifications

Type: Submersible non-clog Type Vortex Flow Pump

Discharge Capacity: 0.84 m3/min

Total Head: 15 m

Power Requirement: 7.5 kW

Installation Number: 1 (1 Standby)

13.16. PS No.37

13.16.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(3) Design Conditions

① Submersible non-clog Type Vortex Flow Pump

② Design Maximum Hourly Flow: 50 m3/hr (0.833m3/min)

(2) Capacities of Pumps

0.84m3/min

Total Capacity: 0.84×1＝0.84 m3/min

(0.833 m3/min ＜ 0.84 m3/min ･･･ OK)

(3) Total Pump Head

Actual Pump Head H1

2.5m

Head Loss in Pipe H2

11.874m

Total Head H3

H3 = H1 + H2 = 2.5 + 11.874 + = m → 30 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 0.84 \times 30 \times 1}{0.30}(1 + 0.15)$$

= 15.74 → 18.5kW

(5) Specifications

Type: Submersible non-clog Type Vortex Flow Pump

Discharge Capacity: 0.84 m3/min

Total Head: 30 m

Power Requirement: 18.5 kW

Installation Number: 1 (1 Standby)

13.17. PS No.IH

13.17.1 Sewage Pumps

The principal role of pumps is to rise up and transfer wastewater from sewer to treatment process.

(1) Design Conditions

① Submersible non-clog Type Vortex Flow Pump

② Design Maximum Hourly Flow: 50 m3/hr (0.833m3/min)

(2) Capacities of Pumps

0.84m3/min

Total Capacity: 0.84×1＝0.84 m3/min

(0.833 m3/min ＜ 0.84 m3/min ・・・ OK)

(3) Total Pump Head

Actual Pump Head H1

4.18m

Head Loss in Pipe H2

10.203m

Total Head H3

H3 = H1 + H2 = 4.18 + 10.203 = 14.383 m → 15 m

(4) Electric Motor Power

$$D = \frac{0.163 \times Q \times H \times r}{\gamma}(1 \times \alpha)$$

$$= \frac{0.163 \times 0.84 \times 15 \times 1}{0.35}(1 + 0.15)$$

= 6.74 → 7.5 kW

(5) Specifications

Type: Submersible non-clog Type Vortex Flow Pump

Discharge Capacity: 0.84 m3/min

Total Head: 15 m

Power Requirement: 7.5 kW

Installation Number: 1 (1 Standby)

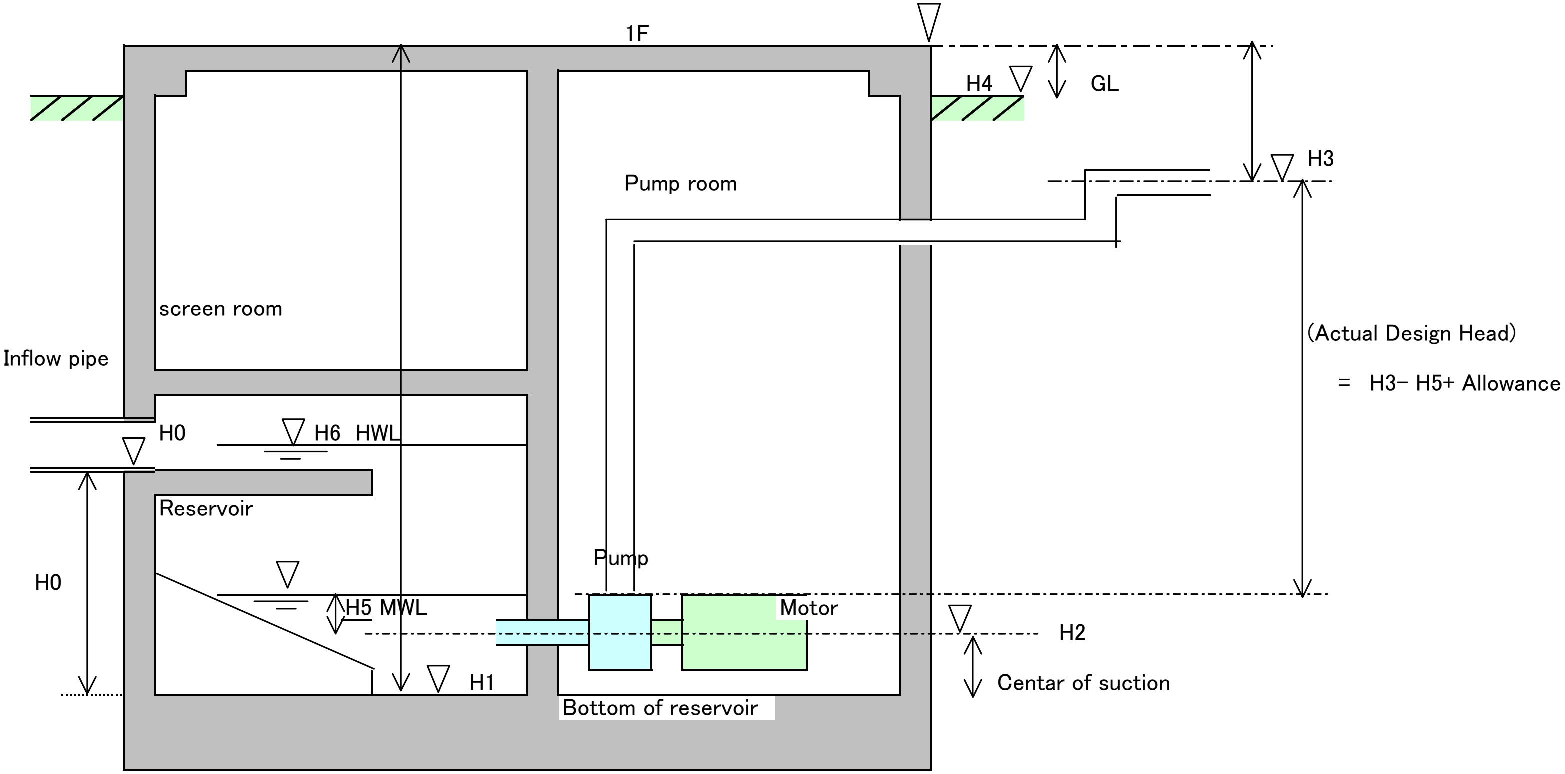
Table B-6-1 Elevation of pumping station, floors and etc.

No.	No. of PS and GL	Diameter of Inflow pipe *4)	Suction Diameter and necessary wl for start(H5)		H0	H1	H2	H3	H4	H5	H6	MWL	Head	allowanc	Actual Design Head
				>2.5D or >0.75m *2)	assumed inflow pipe invert level *1)	From 1F floor to bottom	From center of suction to bottom	From 1F floor to center of pressureline	From 1F floor to GL	From H2 to water level for start *3)	HWL determined by H0 +d/2	H5 WL	H1-H2-H3-H5		
		m	m											m	m
	1	0.600	0.400	1.000	2.20	9.77	0.87	2.70	0.10	1.00					
1	344.00				336.53	334.33	335.20	341.40	344.10	336.20	336.83	336.20	5.20	1.00	6.20
	2	0.350	0.300	0.750	2.20	7.67	0.60	2.50	0.10	1.00					
2	347.30				341.93	339.73	340.33	344.90	347.40	341.33	342.11	341.33	3.57	1.00	4.57
	3	0.600	0.400	1.000	2.20	7.82	0.60	2.70	0.00	1.00					
3	346.00				340.38	338.18	338.78	343.30	346.00	339.78	340.68	339.78	3.52	1.00	4.52
	4	0.800	0.300	0.750	2.20	7.82	0.92	3.00	0.00	0.75					
4	352.00				346.38	344.18	345.10	349.00	352.00	345.85	346.78	345.85	3.15	1.00	4.15
	6	0.600	0.500	1.250	2.20	4.927	0.95	−0.25	0.50	1.25					
5	343.80				341.57	339.37	340.32	344.55	344.30	341.57	341.87	341.57	2.98	1.00	3.98
	7	1.000	0.700	1.750	3.50	10.58	1.07	5.07	0.20	1.75					
6	347.00				340.12	336.62	337.69	342.13	347.20	339.44	340.62	339.44	2.69	3.00	5.69
	10	0.800	0.3	0.75	2.20	8.02	0.87	3.47	0.00	0.75					
7	352.80				346.98	344.78	345.65	349.33	352.80	346.40	347.38	346.40	2.93	2.00	4.93
	11	0.300	0.15	0.75	1.80	6.47	0.3	2.45	−0.35	0.75					
8	351.02				346.00	344.20	344.50	348.22	350.67	345.25	346.15	345.25	2.97	1.00	3.97
	15	0.300	0.25	0.75	1.80	6	0.3	2.45	−0.76	0.75					
9	348.20				343.24	341.44	341.74	344.99	347.44	342.49	343.39	342.49	2.50	1.50	4.00
	16	0.250	0.15	0.75	1.80	7.27	0.47	1.75	0.30	0.75					
10	351.40				346.23	344.43	344.90	349.95	351.70	345.65	346.36	345.65	4.30	1.00	5.30
	17	0.300	0.25	0.75	1.80	5.12	0.47	0	0.50	0.75					
11	346.90				344.08	342.28	342.75	350.10	347.40	343.50	344.23	343.50	3.90	1.00	4.90
	21	0.200	0.2	0.75	1.80	6.44	0.47	−4.0	0.10	0.75					
12	348.10				343.56	341.76	342.23	352.20	348.20	342.98	343.66	342.98	9.22	1.00	10.22
	24	0.200	0.15	0.75	1.80	6.89	0.60	0.00	0.10	0.75					
13	349.80				344.81	343.01	343.61	349.90	349.90	344.36	344.91	344.36	5.54	1.00	6.54
	MH28	0.150	−	−	−	7.20	1.25	2.45	0.20	0.90					
14	360.35				355.50	353.35	354.6	357.9	360.55	355.50	−	355.50	2.40	0.20	2.60
	MH34	0.150	−	−	−	4.70	0.9	1	0.20	0.80					
15	345.30				342.50	340.8	341.7	344.3	345.50	342.50	−	342.50	1.80	0.20	2.00
	MH37	0.200	−	−	−	5.00	0.9	1.5	0.20	0.80					
16	346.70				343.60	341.9	342.8	345.2	346.90	343.60	−	343.60	1.60	0.90	2.50
	MH IH	0.300	−	−	−	7.10	0.9	1.18	0.20	0.84					
17	356.76				351.60	349.86	350.76	355.58	356.96	351.60	−	351.60	3.98	0.20	4.18

*1) Value is height from bottom to inflow invert, that was determined by obtained sample standard drawing
*2) Value was set on the basis of Japanese Standard
*3) The lowest water level for pump start
*4) The diameter is assumed from measurement and existing inflow valve specification

Schematic diagram of elevation of pumping station

＊Excluding newly constructed manhole type pumping stations



＊ Inflow pipe diameter is assumed by specification of inflow valve

＊ H1, H2 and H4 is measured on the site respectively

＊ Inflow pipe level from bottom (H0) is assumed by standard design in the archive of ASA as follows;

Large : 3.5m Medium : 2.2m Small : 1.8m

Hydraulic design of pumping equipment

No.	No. of PS	Shaft Dia.	Pressure/ Gravity	flow rate1	Pipeline Dia.	Pipeline ns.	Pipeline Length	GL	Actual head	flow rate 1 velocity	friction loss	in/out loss	peripheral loss	Total loss	Additional pressure	Adopted value
		m		m3/min	mm	LS	m	m	m	m/s	m	m	m	m		m
1	1	16	pressure	26.67	600 800	1 1	700 700	344.00	6.2	0.566	0.930	0.019	2	9.149	0.000	10.0
2	2	9	pressure	15.00	1000	1	500	347.30	4.57	0.318	0.069	0.006	2	6.645	0.000	7.0
3	3	16	pressure	40.00	500	2	300	346.00	4.52	1.698	2.051	0.169	2	8.740	0.000	9.0
4	4	12	pressure	15.00	500	1	60	352.00	4.15	1.273	0.241	0.095	2	6.486	0.000	7.0
5	6	12	pressure	53.33	600	2	800	343.80	3.977	1.572	3.832	0.145	2	9.954	0.000	10.0
6	7	24	pressure	95.00	800	2	800	347.00	5.69	1.575	2.746	0.146	2	10.582	0.000	11.0
7	10	16	pressure	22.50	500 400	1 1	1600 1600	352.80	4.93	1.165	3.772	0.080	2	10.782	0.000	11.0
8	11	6	pressure	3.80	250	2	700	351.02	3.97	0.645	1.798	0.024	2	7.792	0.000	8.0
9	15	6	pressure	8.33	250	1	100	348.20	4.00	2.829	3.957	0.470	2	10.427	0.000	11.0
10	16	6	pressure	1.33	150 req. 100	1	1000	351.40	5.3	1.258	16.048	0.093	2	23.441	0.000	24.0
11	17	3	pressure	4.17	200	1	310	346.90	4.9	2.210	10.088	0.287	2	17.275	0.000	18.0
12	21	6	pressure	3.33	250	1	900	348.10	10.22	1.132	6.538	0.075	2	18.833	0.000	19.0
13	24	4	pressure	1.33	100	1	50	349.80	6.54	2.829	5.780	0.470	2	14.790	0.000	15.0
14	MH28	2.5	pressure	1.33	150	1	1400	360.35	2.6	1.258	22.467	0.093	2	27.160	0.000	28.0
15	MH34	2.5	pressure	0.83	150	1	1564	345.30	2.0	0.786	10.520	0.036	2	14.557	0.000	15.0
16	MH37	2.5	pressure	0.83	100	1	200	346.70	2.5	1.768	9.691	0.183	2	14.375	15.000	30.0
17	MH IH	2.5	pressure	0.83	100	1	165.5	356.76	4.18	1.768	8.020	0.183	2	14.383	0.000	15.0

flow rate1: only duty pumps operation

formula: Hazen 1.00+0.15 1.5m

Additional pressure : In case of Multiple pressure line

Appendix B-7

List of Mechanical Equipment

APPENDIX B.7　MECHANICAL EQUIPMENT LIST

APPENDIX B.7 -1
Sewage Treatment Plant Mechanical Equipment List

Facility/Equipment List	Tag No.	Quantity Duty	St` d-by	Specification		Motor (kw)
S01:Inflow Tank						
Inlet Chamber Gate	S01 MG 01	1	0	Electric Motor Sluice Gate	1,400mmdia	2.2
Bypass Gate	S01 MG 02	1	0	Electric Motor Sluice Gate	2,000mmdia	5.5
S02:Influent Pump Station						
Fine Screen	S02 MS 11to31	3	0	Mechanically Cleoning Bar Screen	1.68mW×2.0mH×6mm	0.75
Channel Gate	S02 MG 11to31	3	0	Motor Driven	1.68mW×2.0mH	0.4
Influent Pump A	S02 IP 10to30	2	1	Vertical Shaft Type Mixed Flow Pum	54.0m3/min×15m	200
Influent Pump B	S02 IP 11/21	2	0	Vertical Shaft Type Mixed Flow Pum	27.0m3/min×15m	110
Check Valve A	S02 CV 10to30	2	1	Swing Type Check Valve	700mmdia	-
Delivery Valve A	S02 MV 11to31	2	1	Motorized Butterfly Valve	700mmdia	0.75
Check Valve B	S02 CV 21/22	2	0	Swing Type Check Valve	450mmdia	-
Delivery Valve B	S02 MV 41/51	2	0	Motorized Butterfly Valve	450mmdia	0.4
Suction Valve A	S02 MV 12to32	2	1	Motorized Gate Valve	800mmdia	3.7
Suction Valve B	S02 MV 42/52	2	0	Motorized Gate Valve	500mmdia	1.5
Connection Valve	S02 MV 13to43	4	0	Motorized Gate Valve	800mmdia	3.7
Bridge Crane	S02 MC 01	1	0	Elecrtically Operated	5.0 ton	4.6+0.75+0.4×2
Temporary Pump	S02 TP 11to31	3	0	Removable Submersible Pump	25.0m3/min×14m	110
Sump Drainage Pump	S02 DP 01/02	2	0	Removable Submersible Pump	0.3m3/min×15.0m	1.5
Hoist Block (Container)	S02 HH 01	1	0	Elecrtically Operated	2.0ton	1.5
Hoist Block	S02 HH 02	1	0	Geared Trolley Chain Block	2.0ton	-
Screen Container	S02 SC 11to31	3	3	Container	1.0m3	-
Exhaust Fan	S02 EF 01	1	0	Centrifugal Fan	60m3/min×0.15kpa	0.75
Air Intake Fan (1)	S02 IF 01	1	0	Centrifugal Fan	60m3/min×0.15kpa	0.75
Air Intake Fan (2)	S02 IF 02	1	0	Centrifugal Fan	260m3/min×0.15kpa	3.7
Air Intake Fan (3)	S02 IF 03	1	0	Centrifugal Fan	60m3/min×0.15kpa	0.75
All Piping		-	-	Ductile Pipe/Valve	-	-
S03:Grit Chamber						
Inlet Gate	S03 MG 01/02	2	0	Electric Motor Sluice Gate	1.2mW×1.0mH	1.5
Bypass Gate	S03 MG 03	1	0	Electric Motor Sluice Gate	1.5mDia	2.2
Grit Collector	S03 GC 01/02	2	0	Vortex Type	2.0m Dia	1.5
Grit Pump	S03 GP 01/02	2	0	Centrifugal pump	0.5m3/min×8.0m	3.7
Grit Chamber Outlet Gate	S03 MG 04/05	2	0	Electric Motor Sluice Gate	1200mmDia	1.5
Grit Scrubber	S03 GS 01	1	0	Screw Grit Conveyor	2.0m3/hr	1.5+2.2×2
Grit Container	S03 HC 11to41	2	2	Container	1.0m3	-
Scum Screen	S03 SS 01	1	0	Automatic Disc Screen	0.5m3/min×OP 3mm	0.4
Piping(Grit)		-	-	Steel Pipe/Valve	-	-
S05:Primary Sedimentaion Tank						
Distribution Tank Weir	S05 HW 01to08	8	0	Adjustable Weir	0.9mW	-
Sludge Collector	S05 SC 01/02	2	0	Circumference Drive	28.0m Dia×3.5mL	1.5
Sludge Collector (Repair)	S05 SC 03to08	6	0	Circumference Drive	28.0m Dia×3.5mL	1.5
Suction Sludge Valve	S05 MV 01to08	8	0	Motorized Eccentric Valve	150mm	0.4
Primary Sludge Pump	S05 SP 01to04	2	2	Non-Clog Sludge Pump	1.0m3/min×9m	5.5
Delivery Valve	S05 MV 51/61	2	0	Motorized Gate Valve	150mm Dia	0.4
Sump Drainage Pump	S05 DP 01/02	2	0	Submersible Sewage Pump	0.1m3/min×15m	0.75
Scum Pump	S05 SP 05to08	2	2	Non-Clog Sludge Pump	0.5m3/min×12m	3.7
Suction Scum Valve	S05 MV 11/41	4	0	Motorized Eccentric Valve	100mm	0.2

Mechanical Equipment List

Facility/Equipment List	Tag No.	Quantity Duty	Quantity St` d-by	Specification		Motor (kw)
Hoist Biock	S05 HH 01	1	0	Geared Trolley Chain Block	1.0ton	-
Exhaust Fan	S05 EF 01/02	2	0	Centrifugal Fan	12m3/min×0.15kpa	0.2
Piping(Sludge/Scum)		-	-	Ductile Pipe/Valve	-	-
S08:Blower House						
Air Blower	S08 AB 01to05	3	2	Multistage Turbo Blower	255m3/min×50kpa	315+0.4
Air Filter	S08 AF 01to05	3	2	Automatic Air Filter	255m3/min	0.2
Delivery Valve	S08 MV 01to05	3	2	Motorized Gate Valve	400mm Dia	0.75
Clear Water Supply Pump	S08 WP 01/02	1	1	Volute Pump	0.3m3/min×20m	2.2
Hoist Block	S08 MC 01	1	0		5.0 ton	4.6+0.75+0.75×2
Sump Drainge Pump	S08 DP 01	1	0	Submersible Sewoge Pump	0.1m3/min×7.0m	0.4
Cleor Water Tank	S08 WT 01	1	0	PVC Tank	5 m3	-
All Piping		-	-	Ductile Pipe/Valve	-	-
S10:Secondary Sedimentation tank						
Return Sludge Inlet Weir	S10 HW 01to12	12	0	Adjustable Weir	0.6mW	-
Distribution Tank Weir	S10 HW 13to24	12	0	Adjustable Weir	0.9mW	-
Sludge Collector	S10 SC 01/02	2	0	Circumference Drive	28.0m Dia×3.5mH	1.5
Sludge Collector (Repair)	S10 SC 03to12	10	0	Circumference Drive	28.0m Dia×3.5mH	1.5
S11:Return Sludge pump Station						
Return Sludge pump	S11 SP 01to05	3	2	Vertical Shaft Type Mixed Flow Pum	32m3/min×6m	55
Waste Sludge pump	S11 SP 06/07	1	1	Non-Clog Sludge pump	4.7m3/min×10m	22
Delivery Valve	S11 MV 01to05	3	2	Motorized Gate Valve	500mm Dia	0.75
Suction Valve	S11 MV 06to10	3	2	Motorized Gate Valve	600mm Dia	1.5
Partition Valve	S11 MV 11to14	4	0	Motorized Butterfly Valve	900mm Dia	3.7
Check Valve	S11 CV 01to05	5	0	Swing Type Check Valve	500mmDia	-
Bridge Crane	S11 MC 01	1	0	Elecrtically Operated	5.0 ton	4.6+0.75+0.4×2
Sump Drainage Pump	S11 DP 01/02	1	1	Removable Submersible Pump	0.3m3/min×10m	1.5
Connection Valve A	S11 MV 15/16	2	0	Motorized Gate Valve	1100mmDia	5.5
Connection Valve B	S11 MV 17	1	0	Motorized Gate Valve	1200mmDia	7.5
All Piping		-	-	Ductile Pipe/Valve	-	-
S12:Discharge Pump Station						
Inlet Chamber Gate	S12 MG 01	1	0	Electric Motor Sluice Gate	1,500mmDia	3.7
Discharge Pump A	S12 CP 01to03	2	1	Vertical Shaft Type Mixed Flow Pum	54.0m3/min×15m	200
Discharge Pump B	S12 CP 04/05	2	0	Vertical Shaft Type Mixed Flow Pum	27.0m3/min×15m	110
Suction Valve A	S12 MV 06to08	2	1	Motorized Gate Valve	800mmDia	3.7
Suction Valve B	S12 MV 09/10	2	0	Motorized Gate Valve	500mmDia	1.5
Check Valve	S12 CV 01to03	2	1	Swing Type Check Valve	700mmDia	-
Check Valve	S12 CV 04/05	2	0	Swing Type Check Valve	450mmDia	-
Delivery Valve A	S12 MV 01to03	2	1	Motorized Butterfly Valve	700mmDia	0.75
Delivery Valve B	S12 MV 04/05	2	0	Motorized Butterfly Valve	450mmDia	0.4
Connection Valve	S12 MV 11to14	4	0	Motorized Gate Valve	800mmDia	3.7
Bridge Crane	S12 MC 01	1	0	Elecrtically Operated	5.0 ton	4.6+0.75+0.4×2
Sump Drainage Pump	S12 DP 01/02	1	1	Removable Submersible Pump	0.3m3/min×10.0m	1.5
Temporary Pump	S12 TP 01to03	3	0	Removable Submersible Pump	25.0m3/min×15m	110
Air Intake Fan A	S12 IF 01	1	0	Centrifugal Fan	260m3/min×0.15kpa	3.7
Air Intake Fan B	S12 IF 02	1	0	Centrifugal Fan	60m3/min×0.15kpa	0.75
All Piping		-	-	Ductile Pipe/Valve	-	-
S21:Gravity Thickene						
Inlet Weir	S21 HW 01/02	2	0	Adjustable Weir	0.6mW	-
Thickener Sludge Collectar	S21 GS 01/02	2	0	Center Drive	20.0m Dia×3.5mH	0.75

Mechanical Equipment List

Facility/Equipment List	Tag No.	Quantity Duty	Quantity St` d-by	Specification		Motor (kw)
Thickened Sludge pump	S21 SP 01/02	1	1	Non-Clog Sludge Pump	1.0m3/min×5m	3.7
Suction Sludge Valve	S21 MV 01/02	2	0	Motorized Eccentric Valve	150mm Dia	0.2
Sump Drainage Pump	S21 DP 01	1	0	Submersible Sewage Pump	0.1m3/min×7m	0.4
Hoist Block	S021 HH 01	1	-	Geared Trolley Chain Block	1ton	-
Exhaust Fan	S21 EF 01	1	-	Centrifugal Fan	12m3/min×0.15kpa	0.2
Piping(sludge)		-	-	Ductile Pipe/Valve	-	-
S23:Digester & Pump House						
Sludge Pump	S23 SP 01/02	1	1	Non-Clog Sludge Pump	5.5m3/min×12m	22
Desulfurizer	S23 DF 01	1	0	Water Spray Type	460m3/hr	-
Sump Drainage Pump	S23 DP 01	1	0	Submersible Sewoge Pump	0.3m3/min×15.0m	1.5
Sludge Valve	S23 MV 01to05	5	0	Motorized Gate Valve	250mm Dia	0.4
Inhalation Fan	S23 IF 01to04	2	2	Centrifugal Fan	40m3/min	1.5
Piping(sluge)		-	-	Ductile Pipe/Valve	-	-
S24:Sludge Treatment Building						
Waste Sludge Mixer	S24 SM 01/02	2	0	Vertical Propeller Mixer	Dia.2,000mm	7.5
Waste Sludge Feed Pump	S24 SP 03to05	2	1	Progresive Cavity Type	34~104m3/hr×20m	30
Mechanical Thickener	S24 MT 01to03	2	1	Screw Press Thickener	75m3/hr (3.0m2)	1.5+0.75+0.75
Polymer Feeder	S24 PF 01/02	2	0	Constant Chemical Feeder	2,000cc/min	0.4
Polymer Tank	S24 PT 01/02	2	0	Vertical Cylindrical Tank	7m3	3.7
Polymer Feed Pump	S24 PP 01to03	2	1	Progresive Cavity Pump	0.8^2.7m3/hr×20m	1.5
Thickened Sludge Mixer	S24 SM 03/04	2	0	Vertical Propeller Mixer	Dia.1,500mm	7.5
Thickened SludgePump	S24 SP 01/02	1	1	Non-Clog Sludge Pump	1.0m3/min×22m	11
Siudge Grinder	S24 SG 01	1	0	In-Pipeline Type	1.5m3/min	3.7
Air Compressor	S24 AC 01/02	1	1	Control Switch Type	600L/min×0.83Mpa	5.5
Air Dryer	S24 AD 01	1	0	Refrigerating Type	600L/min	0.2
Hoist Block	S24 HH 01to03	3	0	Geared Trolley Chain Block	2.0t	-
Digested Sludge Mixer	S24 SM 05/06	2	0	Vertical Propeller Mixer	Dia.2,000mm	7.5
Sludge Feed Pump	S24 SP 06to08	2	1	Progresive Cavity Type	7.5^23m3/hr×20m	7.5
Dewatering Machine	S24 DM 01to03	2	1	Screw Press Type	450kg-ds/hr	3.7+1.5
Polymer Feeder	S24 PF 03/04	2	0	Constant Chemical Feeder	4,000cc/min	0.4
Polymer Tank	S24 PT 03/04	2	0	Vertical Cylindrical Tank	10m3	5.5
Polymer Feed Pump	S24 PP 04to06	2	1	Progresive Cavity Pump	1.5^4.8m3/hr×20m	2.2
Polymer Container	S24 PC 01to08	8	0	Polymer Container	1.0m3	-
Waste Water Mixer	S24 SM 07	1	0	Vertical Propeller Mixer	Dia.2,000mm	7.5
Waste Water Pump	S24 SP 09/10	1	1	Non-Clog Sludge Pump	3.0m3/min×17.0m	22
Hoist Block	S24 HH 04	1	0	Geared Trolley Chain Block	3Ton	-
Hoist Block Dewateing	S24 HH05to07	3	0	Geared Trolley Chain Block	3.0t	-
Hoist Block	S24 HH 08/09	2	0	Geared Trolley Chain Block	0.5t	-
Sump Drainage Pump	S24 DP 01to04	2	2	Submersible Sewage Pump	0.3m3/min×10.0m	1.5
Scrubber	S24 BS 01/02	1	0	Biological Scrubber	90m3/min	-
Odor Fan	S24 EX 01to04	1	1	GRP Centrifugal Fan	90m3/min×2.5kpa	5.5
Mist Separator	S24 HS 01/02	1	0	Mist Separator	180m3/min	-
Elutriation Water Pump	S24 OP 01/02	1	1	Volute Pump	0.17m3/min×25.0m	3.7
Treated Water Supply Unit	S24 SU 01/02	1	1	Pressure Tank Type	0.3m3/min×25m	3.7
Desulfurize Pump	S24 VP 01/02	1	1	Volute Pump	6.1m3/min×23m	45
Water Supply Unit	S24 SU 03/04	1	1	Pressure Tank Type	2.2m3/min×40m	15
Strainer Odor Scrubber	S24 AS 01	1	0	Automatic Backwashing Type	0.34m3/min	0.4
Strainer Grit Scrubber	S24 AS 02	1	0	Automatic Backwashing Type	0.3m3/min	0.4
Strainer Desulfurizer	S24 AS 03	1	0	Automatic Backwashing Type	6.1m3/min	0.4
Treated Water Valve	S24 CV 01	1	0	Motorized Butterfly Valve	Dia.400mm	0.4

Mechanical Equipment List

Facility/Equipment List	Tag No.	Quantity Duty	Quantity St` d-by	Specification		Motor (kw)
Piping(sludge)		-	-	Ductile Pipe/Valve	-	-
Piping(Polymer)		-	-	PVCLining Steel Pipe/Valve	-	-
S25:Hopper House						
Cake Conveyor	S25 CC 01to03	2	1	Belt Conveyor	600mmW×19mL	1.5
Cake Hopper	S25 CH 01to06	4	2	Motor Driven Cut Gate Type	15m3	2.2×2
Cake Tripper	S25 CT 01to03	2	1	Motor Driven		0.4
S26:Gas Holder						
Gas Holder	S26 GH 01/02	2	0	Wet Type Gas Holder	1300m3	-
S27:Boiler Building						
Coal Boiler	S27 CB 01/02	1	1	-	4.5ton/hr	11
Coal Grinder	S27 CG 01/02	1	1	Two Axis Grinder	-	11
Coal Conveyor	S27 CO 01	1	0	Tilt10m,Level28m	-	22
Ash Conveyor (1)	S27 AO 01	1	0	Belt Conveyor	28mL	1.5
Ash Conveyor (2)	S27 AO 02	1	0	Belt Conveyor	31mL	1.5
Clear Water Tank	S27 WT 01	1	0	PVC Tank	10m3	-
Watar Supply Pump	S27 SP 01/02	1	1	Volute Pump	0.2m3/min	5.5
Water Softening Unir	S27 HS 01/02	1	1		0.22m3/min	200w
Soft Water Pump	S27 SP 03/04	1	1	Multistage Pump	2.2m3/min	45
Generator	S27 WW 01	1	0		12m3	-
Heating Pump	S27 SP 05/06	1	1		0.9m3/min	11
Heat Exchanger	S27 HE 01	1	0		0.9m3/min	-
Exhaust Fan	S27 EF 01	1	0			0.75
Piping(Steam/Wayer)		-	-	Steel Pipe/Valve	-	-

APPENDIX B.7 -2

Intermediate Pump Stations Mechanical Equipment List

Facility/Equipment List	Tag No.	Quantity Duty	St` d-by	Specification		Motor (kw)
S51:PS No.1						
Inflow Valve	S51 MV 01	1	0	Motorized Gate Valve	600mmdia	1.5
Fine Screen	S51 MS 01	1	0	Mechanically Cleoning Bar Screen	0.6mW×0.6mH×25mm	1.5
Sewage Pump	S51 SP 01to04	2	2	Horizontal Shaft Volute Type Mixed Flow Pump	14.0m3/min×10m	45
Screening Grinder	S51 SG 01	1	0	Motorized overlapping double axis layered cutter type Valve	0.4m3/hr	7.5
Sump Drainage Pump	S51 DP 01/02	2	0	Removable Submersible Pump	0.3m3/min×15.0m	1.5
Hoist Block	S51 HH 01/02	2	0	Geared Trolley Chain Block	3.0ton	-
Exhaust Fan	S51 EF 01	1	0	Centrifugal Fan	55m3/min	3.7
Air Intake Fan	S51 IF 01	1	0	Centrifugal Fan	105m3/min	5.5
S52:PS No.2						
Sewage Pump	S52 SP 01/03	2	1	Horizontal Shaft Volute Type Mixed Flow Pump	7.5m3/min×7m	22
Screening Grinder	S52 SG 01	1	0	Motorized overlapping double axis layered cutter type Valve	0.4m3/hr	7.5
Sump Drainage Pump	S52 DP 01	1	0	Removable Submersible Pump	0.3m3/min×15.0m	1.5
Hoist Block	S52 HH 01	1	0	Geared Trolley Chain Block	2.0ton	-
Exhaust Fan	S52 EF 01	1	0	Centrifugal Fan	8m3/min	0.4
Air Intake Fan	S52 IF 01	1	0	Centrifugal Fan	14m3/min	0.75
S53:PS No.3						
Inflow Valve	S53 MV 01/02	2	0	Motorized Gate Valve	600mmdia	1.5
Fine Screen	S53 MS 01/02	2	0	Mechanically Cleoning Bar Screen	0.6mW×0.6mH×25mm	1.5
Sewage Pump	S53 SP 01to05	3	2	Horizontal Shaft Volute Type Mixed Flow Pump	14.0m3/min×9m	37
Screening Grinder	S53 SG 01/02	2	0	Motorized overlapping double axis layered cutter type Valve	0.4m3/hr	7.5
Sump Drainage Pump	S53 DP 01/02	1	0	Removable Submersible Pump	0.3m3/min×15.0m	1.5
Hoist Block	S53 HH 01	1	0	Motor driven hoist	3.0ton	1.5
Hoist Block	S53 HH 02	1	0	Geared Trolley Chain Block	1.0ton	-
Exhaust Fan	S53 EF 01	1	0	Centrifugal Fan	55m3/min	3.7
Air Intake Fan	S53 IF 01	1	0	Centrifugal Fan	105m3/min	5.5
S54:PS No.4						
Inflow Valve	S54 MV 01	1	0	Motorized Gate Valve	800mmdia	2.2
Fine Screen	S54 MS 01	1	0	Mechanically Cleoning Bar Screen	1.2mW×1.2mH×6mm	1.5
Sewage Pump	S54 SP 01to03	2	1	Horizontal Shaft Volute Type Mixed Flow Pump	7.5m3/min×7.0m	22
Screening Grinder	S54 SG 01	1	0	Motorized overlapping double axis layered cutter type Valve	0.4m3/hr	7.5
Sump Drainage Pump	S54 DP 01/02	2	0	Removable Submersible Pump	0.3m3/min×15.0m	1.5
Hoist Block	S54 HH 01	1	0	Geared Trolley Chain Block	2.0ton	-
Exhaust Fan	S54 EF 01	1	0	Centrifugal Fan	13m3/min	0.75
Air Intake Fan	S54 IF 01	1	0	Centrifugal Fan	22m3/min	1.5
S55:PS No.6						
Inflow Valve	S55 MV 01/04	4	0	Motorized Gate Valve	600mmdia	1.5
Sewage Pump	S55 SP 01to04	2	2	Horizontal Shaft Volute Type Mixed Flow Pump	27m3/min×10m	75
Sump Drainage Pump	S55 DP 01/02	2	0	Removable Submersible Pump	0.3m3/min×15.0m	1.5
Hoist Block	S55 HH 01	1	0	Motor driven hoist	5.0ton	5.5
Exhaust Fan	S55 EF 01	1	0	Centrifugal Fan	13m3/min	0.75

Mechanical Equipmen

Facility/Equipment List	Tag No.	Quantity Duty	Quantity St` d-by	Specification		Motor (kw)
Air Intake Fan	S55 IF 01	1	0	Centrifugal Fan	22m3/min	1.5
S56:PS No.7						
Inflow Valve	S56 MV 01	1	0	Motorized Gate Valve	1000mmdia	3.7
Fine Screen	S56 MS01/ 02	2	0	Mechanically Cleoning Bar Screen	1.0mW×1.0mH×25mm	1.5
Sewage Pump	S56 SP 01/02	2	1	Vertical Shaft Type Mixed Flow Pum	27.0m3/min×11m	75
Sewage Pump	S56 SP 03/04	2	0	Horizontal Shaft Volute Type Mixed Flow Pump	14m3/min×11m	45
Sewage Pump	S56 SP 05/06	2	0	Horizontal Shaft Volute Type Mixed Flow Pump	7.5m3/min×11m	30
Delivery Valve	S56 MV 02/03	2	0	Motorized Gate Valve	400mmdia	0.75
Delivery Valve	S56 MV 04	1	0	Motorized Gate Valve	500mmdia	1.5
Connection Valve	S56 MV 05/06	2	0	Motorized Gate Valve	800mmdia	3.7
Screening Grinder	S56 SG 01/02	2	0	Motorized overlapping double axis layered cutter type Valve	0.4m3/hr	7.5
Sump Drainage Pump	S56 DP 01/02	2	0	Removable Submersible Pump	0.3m3/min×15.0m	1.5
Bridge Crane	S56 MC 01	1	0	Elecrtically Operated	5.0 ton	4.6+0.75+0.4×2
Exhaust Fan	S56 EF 01	1	0	Centrifugal Fan	60m3/min	0.75
Air Intake Fan	S56 IF 01	1	0	Centrifugal Fan	60m3/min	0.75
Air Intake Fan	S56 IF 02	1	0	Centrifugal Fan	260m3/min	3.7
Air Intake Fan	S56 IF 03	1	0	Centrifugal Fan	60m3/min	0.75
S57:PS No.10						
Inflow Valve	S57 MV 01	1	0	Motorized Gate Valve	800mmdia	2.2
Fine Screen	S57 MS 01	1	0	Mechanically Cleoning Bar Screen	0.8mW×0.8mH×6mm	1.5
Sewage Pump	S57 SP 01to05	3	2	Horizontal Shaft Volute Type Mixed Flow Pump	7.5m3/min×11m	30
Screening Grinder	S57 SG 01	1	0	Motorized overlapping double axis layered cutter type Valve	0.4m3/hr	7.5
Connection Valve	S57 MV 02/05	4	0	Motorized driven Gate Valve	600mmdia	0.75
Sump Drainage Pump	S57 DP 01/02	2	0	Removable Submersible Pump	0.3m3/min×15.0m	1.5
Hoist Block	S57 HH 01/02	2	0	Geared Trolley Chain Block	3.0ton	-
Exhaust Fan	S57 EF 01	1	0	Centrifugal Fan	55m3/min	3.7
Air Intake Fan	S57 IF 01	1	0	Centrifugal Fan	105m3/min	5.5
S58:PS No.11						
Sewage Pump	S58 SP 01to03	2	1	Horizontal Shaft Volute Type Mixed Flow Pump	1.9m3/min×8.0m	11
Hoist Block	S58 HH 01	1	0	Geared Trolley Chain Block	1.0ton	-
Exhaust Fan	S58 EF 01	1	0	Centrifugal Fan	4m3/min	0.4
Air Intake Fan	S58 IF 01	1	0	Centrifugal Fan	6m3/min	0.4
S59:PS No.15						
Sewage Pump	S59 SP 01to03	2	1	Horizontal Shaft Volute Type Mixed Flow Pump	4.2m3/min×11m	18.5
Hoist Block	S59 HH 01	1	0	Geared Trolley Chain Block	1.0ton	-
Exhaust Fan	S59 EF 01	1	0	Centrifugal Fan	4m3/min	0.4
Air Intake Fan	S59 IF 01	1	0	Centrifugal Fan	6m3/min	0.4
S60:PS No.16						
Sewage Pump	S60 SP 01to03	2	1	Horizontal Shaft Volute Type Mixed Flow Pump	1.4m3/min×24m	15
Hoist Block	S60 HH 02	1	0	Geared Trolley Chain Block	1.0ton	-
Exhaust Fan	S60 EF 01	1	0	Centrifugal Fan	4m3/min	0.4
Air Intake Fan	S60 IF 01	1	0	Centrifugal Fan	6m3/min	0.4

Mechanical Equipmen

Facility/Equipment List	Tag No.	Quantity Duty	Quantity St` d-by	Specification		Motor (kw)
S61:PS No.17						
Sewage Pump	S61 SP 01/02	1	1	Horizontal Shaft Volute Type Mixed Flow Pump	4.2m3/min×18m	30
Hoist Block	S61 HH 01	1	0	Geared Trolley Chain Block	1.0ton	-
Exhaust Fan	S61 EF 01	1	0	Centrifugal Fan	1m3/min	0.2
Air Intake Fan	S61 IF 01	1	0	Centrifugal Fan	1.5m3/min	0.2
S62:PS No.21						
Sewage Pump	S62 SP 01/02	1	1	Horizontal Shaft Volute Type Mixed Flow Pump	3.3m3/min×19m	30
Sump Drainage Pump	S62 DP 01	1	0	Removable Submersible Pump	0.3m3/min×15.0m	1.5
Hoist Block	S62 HH 01	1	0	Geared Trolley Chain Block	1.0ton	-
Exhaust Fan	S62 EF 01	1	0	Centrifugal Fan	4m3/min	0.4
Air Intake Fan	S62 IF 01	1	0	Centrifugal Fan	6m3/min	0.4
S63:PS No.24						
Sewage Pump	S63 SP 01/02	1	1	Horizontal Shaft Volute Type Mixed Flow Pump	1.3m3/min×15m	11
Hoist Block	S63 HH 01	1	0	Geared Trolley Chain Block	1.0ton	-
Exhaust Fan	S63 EF 01	1	0	Centrifugal Fan	2m3/min	0.2
Air Intake Fan	S63 IF 01	1	0	Centrifugal Fan	3m3/min	0.2
S64:PS No.28						
Sewage Pump	S64 SP 01/02	1	1	Submersible non-clog Type Vorute Type Flow Pump	1.3m3/min×28m	22
Screenings Cage	S64 HH 01/02	2	0	Box shape with chain	5mm, type 316	-
S65:PS No.34						
Sewage Pump	S65 SP 01/02	1	1	Submersible non-clog Type Vorute Type Flow Pump	0.84m3/min×15m	7.5
Screenings Cage	S65 HH 01/02	2	0	Box shape with chain	5mm, type 316	-
S66:PS No.37						
Sewage Pump	S66 SP 01/02	1	1	Submersible non-clog Type Vorute Type Flow Pump	0.84m3/min×30m	18.5
Screenings Cage	S62 HH 01/02	2	0	Box shape with chain	5mm, type 316	-
S67:PS No.IH						
Sewage Pump	S67 SP 01/02	1	1	Submersible non-clog Type Vorute Type Flow Pump	0.84m3/min×15m	7.5
Screenings Cage	S67 HH 01/02	2	0	Box shape with chain	5mm, type 316	-

Appendix B-8

Sewer Pipeline List

APPENDIX B-8 **Sewer Pipeline List in ASTANA City**

1 Summary of the existing pipelines

TOTAL LENGTH	**226578.42**	m	100.0%
asbestos-cement	**45461.51**	m	20.1%
cast-iron	**85380.96**	m	37.7%
ceramics	**32574.45**	m	14.4%
ferroconcrete	**27929.7**	m	12.3%
polyethylene	**2240**	m	1.0%
steel	**32264.8**	m	14.2%
other	**727**	m	0.3%

2 Manhole numbers

N= **5279**

3 Detailed List of Ppelines and Manholes

No.1	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1973	AL	Abai St.	117-a	150	asbestos/cement	63.8	5	
	1976	SA	Abai St.	88	200	asbestos/cement	77		
	1987	AL	Abai St.	115	150	asbestos/cement	102	7	
	1991	AL	Abai St.	138	150	asbestos/cement	122.9	6	
	1988	AL	Abai St.	187	150	asbestos/cement	77.4	2	
	1988	AL	Abai St.	187	200	asbestos/cement	88.3	2	
	1988	AL	Abai St.	187	250	asbestos/cement	36.6	4	
	1965	AL	Abai St.	197	250	asbestos/cement	312.5		Abai St 199,201,203,205,207, Sembinov St 44,45, Lomonosov 55
	1965	AL	Abai St.	197	200	asbestos/cement	83.9		Abai St 199,201,203,205,207, Sembinov St 44,45, Lomonosov 55
	1991	SA	Abai St.	322	100	asbestos/cement	15	1	
	1972	AL	Abai St.	121-a	150	asbestos/cement	60.8	4	
	1991	AL	Abai St.	221/2	150	asbestos/cement	60.3	4	
	1986	AL	Abylai-Khan	19/1.	150	asbestos/cement	109.5	5	
	1992	AL	Abylai-Khan	28/4.	200	asbestos/cement	175.1	7	
	1990	AL	Abylai-Khan	5/3.	150	asbestos/cement	139.9	6	
	1983	AL	Abylai-Khan	2	200	asbestos/cement	108.4	4	
	1984	AL	Abylai-Khan	5	200	asbestos/cement	150	8	
	1984	AL	Abylai-Khan	7	300	asbestos/cement	89.5	2	
	1984	AL	Abylai-Khan	7	200	asbestos/cement	30.8	3	
	1988	AL	Abylai-Khan	9	150	asbestos/cement	18.8		
	1986	AL	Abylai-Khan	10	150	asbestos/cement	42.5	2	
	1983	AL	Abylai-Khan	22	300	asbestos/cement	68	2	
	1991	AL	Abylai-Khan	39	150	asbestos/cement	80.4	5	
	1989	AL	Abylai-Khan	10/2.	150	asbestos/cement	22.5	2	
	1988	AL	Abylai-Khan	17/2.	150	asbestos/cement	39.9	2	
	1987	AL	Abylai-Khan	21/2.	300	asbestos/cement	76.1	1	
	1987	AL	Abylai-Khan	21/2.	200	asbestos/cement	43.8	1	

No.2	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1987	AL	Abylai-Khan	21/2.	150	asbestos/cement	109.1	7	
	1986	AL	Abylai-Khan	24/1.	200	asbestos/cement	82.5	4	
	1986	AL	Abylai-Khan	25/2.	150	asbestos/cement	39.3	5	
	1987	AL	Abylai-Khan	27/3.	250	asbestos/cement	129.3	11	
	1993	AL	Abylai-Khan	28/3.	200	asbestos/cement	58.4	2	
	1993	AL	Abylai-Khan	28/3.	150	asbestos/cement	166.1	9	and house 28/6
	1986	AL	Abylai-Khan	29/3.	250	asbestos/cement	13.5		
	1991	AL	Abylai-Khan	3/2.	150	asbestos/cement	12	1	
	1991	AL	Abylai-Khan	33/2	150	asbestos/cement	76.3	4	
	1990	AL	Abylai-Khan	39/1	250	asbestos/cement	180	8	
	1987	AL	Abylai-Khan	8/1.	150	asbestos/cement	114	5	
	1994	SA	Agrogorodok	18	150	asbestos/cement	136.3	7	
	1994	AL	Al-Farabi	2	150	asbestos/cement	33.9	2	
	1989	AL	Al-Farabi	14	200	asbestos/cement	145.5	4	
	1989	AL	Al-Farabi	14	150	asbestos/cement	148.9	8	
	1991	AL	Al-Farabi	15	250	asbestos/cement	60.9	1	
	1991	AL	Al-Farabi	15	200	asbestos/cement	52	6	
	1991	AL	Al-Farabi	35	150	asbestos/cement	132	7	
	1992	AL	Al-Farabi	41	200	asbestos/cement	134.9	5	
	1994	AL	Al-Farabi	42	150	asbestos/cement	48.5	3	
	1994	AL	Al-Farabi	42	200	asbestos/cement	39	2	
	1997	AL	Al-Farabi	62	150	asbestos/cement	50.7	2	
	1997	AL	Al-Farabi	81	150	asbestos/cement	24.7	2	
	1997	AL	Al-Farabi	81	150	asbestos/cement	24.9	2	
	1991	AL	Al-Farabi	1/1.	150	asbestos/cement	38.1	3	
	1991	AL	Al-Farabi	1/1.	200	asbestos/cement	62.7	1	
	1990	AL	Al-Farabi	41/1.	150	asbestos/cement	33.9	5	
	1993	AL	Al-Farabi	5/1.5/2	200	asbestos/cement	25	1	
	1993	AL	Al-Farabi	5/1.5/2	150	asbestos/cement	116.8	4	
	1998	AL	Al-Farabi	81/1	150	asbestos/cement	128.4	5	
	1994	AL	Al-Farabi	p. 11-b	150	asbestos/cement	74.3	4	
	1994	AL	Al-Farabi	p. 11-b	200	asbestos/cement	221.1	2	
	1962	SA	Auezov St	117	150	asbestos/cement	39.5	1	
	1990	SA	Auezov St	54/1	150	asbestos/cement	64.8	5	
	1981	SA	Auezov St	56	150	asbestos/cement	100.3	7	
	1980	SA	Auezov St	116	200	asbestos/cement	194	6	
	1976	SA	Auezov St	132-a	150	asbestos/cement	50.6	2	
	1976	SA	Auezov St	132-a	200	asbestos/cement	173.8	4	
	1976	SA	Auezov St	132-a	250	asbestos/cement	195.2	6	
	1976	SA	Auezov St	132-a	300	asbestos/cement	96	3	
	1992	SA	Baitursynov St	109	150	asbestos/cement	105.8	3	
	1992	SA	Baitursynov St	109	200	asbestos/cement	33.3	2	
	1997	SA	Begeldinov St	41	200	asbestos/cement	27.5	3	
	1997	SA	Begeldinov St	41	300	asbestos/cement	406.4	13	

B-8-3

No.3	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1998	SA	Begeldinov St	41	200	asbestos/cement	40		
	1978	SA	Begeldinov St	70-a	150	asbestos/cement	21	2	
	1961	SA	Begeldinov St	5	150	asbestos/cement	47	6	
	1963	SA	Bejbitshilik and Monin St.		200	asbestos/cement	799	17	from the corner of 9 May St to "Malaya"
	1987	SA	Bogembai	1/1.	200	asbestos/cement	281.9	9	
	1965	SA	Ualihanov		200	asbestos/cement	480	16	
	1988	SA	Vodoprovodnaya	11	150	asbestos/cement	129	6	
	1950	SA	Vokzalnaya	6	100	asbestos/cement	29.8	3	
	1976	SA	Vokzalnaya	10	150	asbestos/cement	71.9	6	
	1977	SA	Vokzalnaya	10/1.	200	asbestos/cement	70.6	4	
	1977	SA	Vokzalnaya	10/1.	100	asbestos/cement	52.2	6	
	1980	SA	Vokzalnaya	10/2.	150	asbestos/cement	132.9	9	
	1978	SA	Vokzalnaya	5/1.	150	asbestos/cement	99.6	7	
	1965	SA	Vokzalnaya		200	asbestos/cement	330	18	
	1984	AL	Gastello	1	150	asbestos/cement	121.5	4	
	1966	AL	Kindergarden No 49		200	asbestos/cement	96.3	5	Mozhajski St, 5
	1987	AL	Kindergarden No 70		150	asbestos/cement	131.4	12	
	1983	AL	Kindergarden No 1		150	asbestos/cement	219.7	13	in "Molodezhny" micro-district
	1966	AL	Kindergarden No 49		150	asbestos/cement	164	12	Mozhajski St, 5
	1963	AL	Kindergarden No 51		150	asbestos/cement	320	10	per. Minsky
	1987	AL	Kindergarden No 70		200	asbestos/cement	84.7	3	
	1987	AL	Kindergarden No 70		300	asbestos/cement	181	5	
	1990	AL	Kindergarden No 73		150	asbestos/cement	262.2	16	microdistrict 5, house 30
	1986	AL	Kindergarden No 8		250	asbestos/cement	27	2	microdistrict 3
	1967	AL	Kindergarden No 50		200	asbestos/cement	73.6	5	Zhangildin 24
	1965	SA	Delagatskaya St		200	asbestos/cement	250	6	from Kenesary 73 (former Trust) to Abai St
	1991	SA	Zhambyl	79	200	asbestos/cement	110	5	
	1963	SA	Zhangildin	500	600	asbestos/cement	2073		from Bejbitshilik to Pobeda, via swamp to pump station 1
	1970	SA	Drizge	1	150	asbestos/cement	44.2	2	
	1970	SA	Drizge	1	200	asbestos/cement	48.8	2	
	1976	SA	Drizge	19	150	asbestos/cement	45.1	2	
	1980	AL	DUOD		300	asbestos/cement	266.2	2	
	1965	SA	Zheltoksan	30	150	asbestos/cement	102	6	
	1986	SA	Zheltoksan	73	200	asbestos/cement	101.8	7	
	1986	SA	Zheltoksan	73	200	asbestos/cement	101.8	7	
	1965	SA	Zheltoksan	29-a	150	asbestos/cement	64.5	4	
	1965	SA	Zheltoksan	29-a	100	asbestos/cement	43.1	2	
	1965	SA	Zheltoksan		200	asbestos/cement	780	18	from Medical Institute to Zhangildin
	1964	SA	Zheltoksan		250	asbestos/cement	134	5	from the kid hospital to the sewer collector
	1989	AL	Zhukovsky	53	200	asbestos/cement	287.2	12	
	1991	AL	Zhukovsky	35/1	200	asbestos/cement	141.2	5	
	1990	SA	Zavodskoy		300	asbestos/cement	171.8	10	
	1972	AL	Imambayeva	88	200	asbestos/cement	97.9	6	
	1989	AL	Internacionalnaya	5	150	asbestos/cement	171	6	

No.4	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1998	SA	Irchenko	12	300	asbestos/cement	118.4	8	
	1998	SA	Irchenko	12	400	asbestos/cement	139.4	4	
	1987	SA	Kazakhskaya	66	200	asbestos/cement	44.4	3	
	1987	SA	Kazakhskaya	66	150	asbestos/cement	71	2	
	1972	SA	Kazakhskaya	79	200	asbestos/cement	68.2	3	
	1979	SA	Kazakhskaya	81	150	asbestos/cement	87	4	
	1979	SA	Kazakhskaya	81	200	asbestos/cement	63	1	
	1989	SA	Kazakhskaya	83	150	asbestos/cement	58.5	1	
	1979	AL	Kenesary	169	150	asbestos/cement	174	9	
	1981	AL	Kenesary	167-a	200	asbestos/cement	195.5	4	
	1998	SA	Kenesary	81/1	200	asbestos/cement	195	7	
	1964	SA	Sewer collector No 2	500	600	asbestos/cement	1000		Imanov, Bukejhan, Krasnoarmejskaya, Delegatskaya, Kulturnaya
	1965	SA	Kommunisticheskaya		200	asbestos/cement	130	7	
	1965	SA	Constitution St	0	200	asbestos/cement	200	4	along Geroi Krasnodona, Constitution St to Rabochaya St
	1986	SA	Constitution St	19	100	asbestos/cement	107.8	7	
	1981	SA	Constitution St	23	300	asbestos/cement	296	9	
	1981	SA	Constitution St	23	200	asbestos/cement	30.7	3	
	1979	SA	Constitution St	28	150	asbestos/cement	144.4	15	
	1988	SA	Constitution St	30	200	asbestos/cement	56.5	6	
	1985	SA	Constitution St	6/1.	150	asbestos/cement	17.9	2	
	1983	SA	Koshkarbayev St	36	150	asbestos/cement	129	5	
	1965	SA	Krasnoarmejskaya		200	asbestos/cement	180	5	
	1985	SA	Krivoguz St	13.15	150	asbestos/cement	163	6	
	1965	SA	Krivoguz St	17.19	150	asbestos/cement	120	5	
	1965	SA	Krivoguz St	1,3,5	150	asbestos/cement	180	8	
	1965	SA	Libkneht		200	asbestos/cement	250	12	
	1989	SA	Linejnaya St	3	150	asbestos/cement	100.5	5	
	1980	SA	Linejnaya St	4	150	asbestos/cement	98.2	5	
	1979	AL	Lomonosov St	49	150	asbestos/cement	32.1	1	
	1953	SA	Luxemburg St	3.5	150	asbestos/cement	253.6	9	Luxemburg St 3,5,8,10
	1965	SA	Mametova		200	asbestos/cement	920	14	
	1965	AL	Mametova		250	asbestos/cement	134	6	from the tuberculosis hospital from Internacionalnaya to Imanov
	1990	AL	Manas	14/1.	200	asbestos/cement	15	1	
	1990	AL	Manas	14/2.	150	asbestos/cement	107.5	6	
	1986	AL	"Molodezhny" microdistrict	28	150	asbestos/cement	69.4	5	
	1992	AL	microdistrict 4	34	150	asbestos/cement	68	5	
	1987	AL	"Molodezhny" microdistrict	31	200	asbestos/cement	96.1		
	1967	AL	microdistrict 1	6.7	150	asbestos/cement	199.5	9	
	1967	AL	microdistrict 1	11	150	asbestos/cement	131.1	3	
	1973	AL	microdistrict 1	12	300	asbestos/cement	275.2	11	
	1974	AL	microdistrict 1	12	150	asbestos/cement	42.6	3	
	1977	AL	microdistrict 1	19	200	asbestos/cement	55.3	5	
	1992	AL	microdistrict 1	15/1.	1850	asbestos/cement	51.6	3	
	1979	AL	microdistrict 2	5	200	asbestos/cement	109.4	8	

No.5	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1973	AL	microdistrict 2	9	250	asbestos/cement	151.4	4	
	1973	AL	microdistrict 2	9	200	asbestos/cement	35.8	5	
	1973	AL	microdistrict 2	9	150	asbestos/cement	127.7	4	
	1977	AL	microdistrict 2	15	150	asbestos/cement	63		
	1977	AL	microdistrict 2	18	200	asbestos/cement	10.6		
	1979	AL	microdistrict 2	23	200	asbestos/cement	62.7		
	1975	AL	microdistrict 2 - microdistrict 4		300	asbestos/cement	937		between microdistricts 2 and 4
	1982	AL	microdistrict 3	4	200	asbestos/cement	82.1	2	
	1988	AL	microdistrict 3	11	150	asbestos/cement	76.2	1	
	1990	AL	microdistrict 3	12	150	asbestos/cement	46.6	4	
	1993	AL	microdistrict 3	21/1.	150	asbestos/cement	182	5	
	1991	AL	microdistrict 3	9/1.	150	asbestos/cement	101.6	6	
	1997	AL	microdistrict 4	6	150	asbestos/cement	41	2	
	1989	AL	microdistrict 4	10	200	asbestos/cement	162.2	9	
	1977	AL	microdistrict 4	12	150	asbestos/cement	66	5	
	1989	AL	microdistrict 5	9	150	asbestos/cement	35.1	2	
	1988	AL	microdistrict 5	10	150	asbestos/cement	116.9	6	
	1988	AL	microdistrict 5	12	150	asbestos/cement	77.1	4	
	1989	AL	microdistrict 5	14	150	asbestos/cement	54.9	3	
	1989	AL	microdistrict 5	15	200	asbestos/cement	213	8	
	1991	AL	microdistrict 5	21	150	asbestos/cement	131.7	7	
	1991	AL	microdistrict 5	22	150	asbestos/cement	535	6	
	1993	AL	microdistrict 5	27.28	150	asbestos/cement	102.3	8	
	1971	AL	"Alatau" microdistrict	3	200	asbestos/cement	121	7	
	1990	AL	"Al-Farabi" microdistrict	6	300	asbestos/cement	76.1	5	
	1990	AL	"Al-Farabi" microdistrict	6	150	asbestos/cement	89.1	4	
	1980	AL	"Molodezhny" microdistrict	11	200	asbestos/cement	92	4	
	1980	AL	"Molodezhny" microdistrict	11	150	asbestos/cement	19.5	2	
	1981	AL	"Molodezhny" microdistrict	15	200	asbestos/cement	94.5	9	
	1981	AL	"Molodezhny" microdistrict	15	250	asbestos/cement	42	6	
	1991	AL	"Molodezhny" microdistrict	18	150	asbestos/cement	9	1	
	1991	AL	"Molodezhny" microdistrict	18	200	asbestos/cement	132.3	6	
	1990	AL	"Molodezhny" microdistrict	22	150	asbestos/cement	94.3	8	
	1992	AL	"Molodezhny" microdistrict	26	150	asbestos/cement	90.1	6	
	1994	AL	"Molodezhny" microdistrict	27	150	asbestos/cement	109.9	6	
	1990	AL	"Molodezhny" microdistrict	28	150	asbestos/cement	103.6	5	
	1999	AL	"Molodezhny" microdistrict	29	150	asbestos/cement	29	2	
	1994	AL	"Molodezhny" microdistrict	44/1	200	asbestos/cement	56.7	4	
	1994	AL	"Molodezhny" microdistrict	44/1	200	asbestos/cement	56.7	3	
	1977	AL	"Tselinny" microdistrict	17	200	asbestos/cement	119	8	
	1988	AL	Mozhajsky St	5-a	200	asbestos/cement	85.2	6	
	1988	AL	Mozhajsky St	5-a	300	asbestos/cement	158.1	3	
	1963	SA	Monin St	27	150	asbestos/cement	97	6	
	1969	SA	Monin St	32	200	asbestos/cement	98.5	8	

No.6	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1998	SA	Monin St	13-a	150	asbestos/cement	112.8	6	
	1976	SA	Monin St	15-a	200	asbestos/cement	36.4	3	Monin 17-a
	1990	SA	Monin St	20/1.	150	asbestos/cement	109.1	6	
	1967	SA	Moskovskaya St	34	150	asbestos/cement	47.3	6	
	1968	SA	Moskovskaya St	56	200	asbestos/cement	47.4	1	
	1968	SA	Moskovskaya St	56	150	asbestos/cement	51.5	1	
	1967	SA	Moskovskaya St		200	asbestos/cement	84.8		
	1959	SA	Pressure sewer collector		300	asbestos/cement	596	16	from "Malaya" pump station to pump station 2 "Glavnaya"
	1981	AL	Cancer hospital		150	asbestos/cement	425	21	
	1985	SA	Pervomajskaya St	6	150	asbestos/cement	50	5	
	1987	SA	Pervomajskaya St	10	150	asbestos/cement	123	5	
	1988	SA	Pervomajskaya St	15	150	asbestos/cement	108	7	
	1985	SA	Pervomajskaya St	22	150	asbestos/cement	51.1	3	
	1986	SA	Pervomajskaya St	24.26	150	asbestos/cement	103	7	
	1982	SA	Pervomajskaya St	27	100	asbestos/cement	10.3	1	
	1982	SA	Pervomajskaya St	27	100	asbestos/cement	58.3	2	
	1983	SA	Pervomajskaya St	29	150	asbestos/cement	62.2	6	
	1991	SA	Pervomajskaya St	24/2.	150	asbestos/cement	152	6	
	1978	SA	Pionerskaya St	14	150	asbestos/cement	25	2	
	1965	SA	Pionerskaya St		200	asbestos/cement	220	8	
	1984	SA	Pobeda	10	150	asbestos/cement	114.7	6	
	1980	SA	Pobeda	12	150	asbestos/cement	42.5	3	
	1969	SA	Pobeda	50	150	asbestos/cement	17.9	2	
	1969	SA	Pobeda	56	150	asbestos/cement	348	35	Pobeda 58,60,62,64,66,68, Zhangildin 3,4
	1958	SA	Pobeda	106	200	asbestos/cement	94	2	Pobeda 108
	1959	SA	Pobeda	110	200	asbestos/cement	110.3	4	Pobeda 112
	1989	SA	Pobeda	59/1	150	asbestos/cement	43.31	3	
	1989	SA	Pobeda	59/1	250	asbestos/cement	57.8	1	
	1977	SA	Pobeda	81/2	200	asbestos/cement	16.1		
	1969	SA	Pobeda	81-a	150	asbestos/cement	106.1	4	
	1943	SA	Pobeda		150	asbestos/cement	300	8	from Kenesary to Abai
	1964	SA	Pobeda		300	asbestos/cement	1108		from Moskovskaya to Zhangildin
	1989	AL	Polevaya	2/1.	150	asbestos/cement	112.9	6	
	1992	AL	Polevaya	2/3.	150	asbestos/cement	71.8	5	
	1980	AL	Polevaya		250	asbestos/cement	75		
	1973	SA	Potanin St	4	200	asbestos/cement	109.9	6	
	1976	SA	Potanin St	4-a	150	asbestos/cement	117.4	6	
	1977	AL	Psihbolnica		200	asbestos/cement	1248	34	
	1977	SA	Pushkin St	17	150	asbestos/cement	93.5		
	1977	SA	Pushkin St	17	200	asbestos/cement	36.5		
	1997	SA	Pushkin St	91/1	200	asbestos/cement	114	5	
	1987	SA	Pushkin St	97/1	200	asbestos/cement	92.4	5	
	1987	SA	Pushkin St	97/1	150	asbestos/cement	46.8		
	1975	AL	Respubliki	8.16	200	asbestos/cement	139.5	8	

No.7	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1984	AL	Respubliki	10	150	asbestos/cement	86.6	6	
	1978	SA	Respubliki	15	150	asbestos/cement	135.3		
	1987	SA	Respubliki	15/2.	250	asbestos/cement	127	4	
	1987	SA	Respubliki	15/2.	300	asbestos/cement	88	4	
	1987	SA	Respubliki	15-a	150	asbestos/cement	12.7	5	
	1979	SA	Respubliki	5/1.	200	asbestos/cement	190.6		
	1984	SA	Respubliki	5/2.	150	asbestos/cement	28.3	3	
	1984	SA	Respubliki	5/2.	400	asbestos/cement	19.2	1	
	1949	SA	Sakko i Vanzetti	18	150	asbestos/cement	150	9	
	1991	SA	Sarybulakskaya	191	150	asbestos/cement	108.7	6	
	1972	SA	Sejfullin	10	150	asbestos/cement	97.6	5	
	1983	SA	Sejfullin	12	150	asbestos/cement	33.9	2	
	1985	SA	Sejfullin	69	200	asbestos/cement	69.1	5	
	1992	AL	Sejfullin	71	200	asbestos/cement	121.2	7	
	1967	AL	Sejfullin	63-a	150	asbestos/cement	268.9	10	
	1965	SA	Sejfullin		200	asbestos/cement	470	15	
	1968	SA	Networks of block 73		200	asbestos/cement	225.6	9	
	1968	SA	Networks of block 72		250	asbestos/cement	114.5	4	
	1968	SA	Networks of block 72		150	asbestos/cement	190.5	7	
	1983	SA	Skladskaya	11.13	200	asbestos/cement	49.3	4	
	1988	AL	Smakotin	94	150	asbestos/cement	63.4	3	
	1973	AL	Sorokovaya		200	asbestos/cement	3187	87	networks around the district
	1986	AL	Stroitelnaya St	1	250	asbestos/cement	229.3	16	
	1976	SA	"Orientir" centre		150	asbestos/cement	115.8	6	
	1965	AL	Tsiolkovsky St		200	asbestos/cement	1207		and block 214 and block 210
	1965	AL	Tsiolkovsky St		300	asbestos/cement	817		and block 214 and block 211
	1968	AL	engineering institute	4.5	150	asbestos/cement	155		dormitories 4,5
	1975	AL	engineering institute		150	asbestos/cement	613	26	campus Abylai-Khan 4
	1965	AL	engineering institute		150	asbestos/cement	23.5	2	campus Tsiolkovsky 2
	1968	AL	engineering institute		150	asbestos/cement	414	22	dormitories 1,2,3, cafeteria
	1975	SA	Shvernik St	3	150	asbestos/cement	100.3	3	
	1965	AL	school No 8		200	asbestos/cement	395	8	from school No 8 along Gastello to Imanov St
	1999	AL	"Miras" school		300	asbestos/cement	368	11	
	1980	AL	Yug-Vostok (South-East)	21	200	asbestos/cement	94.5	4	
	1980	AL	Yug-Vostok (South-East)	21	250	asbestos/cement	42	4	
	1980	SA	9 Maya	56	150	cast-iron	29.5	3	
	1968	SA	9 Maya	69	150	cast-iron	18	6	
	1972	SA	9 Maya	54-a	200	cast-iron	90.6	5	
	1985	SA	9 Maya	86-a	150	cast-iron	28.3	2	
	1985	SA	9 Maya	86-a	300	cast-iron	47	4	
	1965	SA	9 Maya		200	cast-iron	150	4	from Auezov St to collector No 5
	1965	SA	9 Maya		300	cast-iron	800	16	from Auezov St to collector No 5
	1965	SA	9 Maya	49	150	cast-iron	112.1	4	
	1968	SA	9 Maya	73	300	cast-iron	102.2	5	

B-8-8

No.8	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1970	AL	Abai St.	123	150	cast-iron	133.8	8	
	1973	SA	Abai St.	51	150	cast-iron	230.9	9	
	1952	SA	Abai St.	60	150	cast-iron	84.2	6	
	2000	AL	Abai St.	85	200	cast-iron	17.7	1	
	1968	AL	Abai St.	211	150	cast-iron	500	29	Abai St 213,215,217,215-a,217-a,219,215/2, Lomomosov St 50-a
	1968	AL	Abai St.	211	100	cast-iron	280	7	Abai St 213,215,217,215-a,217-a,219,215/2, Lomomosov St 50-a
	1998	SA	Abai St.	1/1.	200	cast-iron	37.4	5	Sejfullin St 13-a, 2/3
	1998	SA	Abai St.	1/1.	150	cast-iron	197.1	2	Sejfullin St 13-a, 2/3
	1964	SA	Abai St.		400	cast-iron	618	12	from Bejbitshilik St to Kolhoznaya St
	1988	SA	Abai St.	3	150	cast-iron	145	7	
	1989	SA	Abai St.	3	150	cast-iron	55.2	3	
	1985	SA	Abai St.	5	150	cast-iron	104.3	5	
	1987	SA	Abai St.	5	150	cast-iron	50	2	
	1986	SA	Abai St.	7	200	cast-iron	82.2	4	
	1986	SA	Abai St.	7	300	cast-iron	33.9	1	
	1967	SA	Abai St.	35	200	cast-iron	57.6	2	
	1967	SA	Abai St.	35	150	cast-iron	28.8	3	
	1978	SA	Abai St.	58	150	cast-iron	187	17	Kommunisticheskaya St 55, Prospect Pobedy 36, 38
	1975	AL	Abai St.	90	200	cast-iron	72		
	1977	AL	Abai St.	96	150	cast-iron	62		
	1970	AL	Abai St.	121	150	cast-iron	40.6	3	
	1991	AL	Abai St.	138	200	cast-iron	73.7	2	
	1993	AL	Abai St.	171	200	cast-iron	9	2	
	1965	AL	Abai St.	197	150	cast-iron	197.7		Abai St 199,201,203,205,207, Sembinov St 44,45, Lomonosov 55
	1989	AL	Abai St.	219/1	150	cast-iron	138.9	7	
	1992	AL	Abai St.	219/2	300	cast-iron	165.8	10	
	1987	AL	Abylai-Khan	33	150	cast-iron	985	9	
	1992	AL	Abylai-Khan	28/4.	150	cast-iron	77.4	5	
	1983	AL	Abylai-Khan	2	200	cast-iron	133.4	4	
	1983	AL	Abylai-Khan	2	300	cast-iron	243.8	7	
	1984	AL	Abylai-Khan	7	300	cast-iron	125.9	2	
	1986	AL	Abylai-Khan	12	200	cast-iron	86	6	
	1985	AL	Abylai-Khan	14	150	cast-iron	36	2	
	1986	AL	Abylai-Khan	15	150	cast-iron	5.7	1	
	1984	AL	Abylai-Khan	17	300	cast-iron	186.8	7	
	1988	AL	Abylai-Khan	20	250	cast-iron	100.7	6	
	1983	AL	Abylai-Khan	22	300	cast-iron	38	2	
	1985	AL	Abylai-Khan	22	200	cast-iron	84.6	3	
	1985	AL	Abylai-Khan	25	300	cast-iron	164	8	
	1987	AL	Abylai-Khan	29	150	cast-iron	26	6	
	1985	AL	Abylai-Khan	31	300	cast-iron	212.5	9	
	1986	AL	Abylai-Khan	33	300	cast-iron	441.2	12	
	1986	AL	Abylai-Khan	33	250	cast-iron	145.3	5	
	1991	AL	Abylai-Khan	39	400	cast-iron	383.7	10	

No.9	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1991	AL	Abylai-Khan	39	300	cast-iron	42.9	1	
	1991	AL	Abylai-Khan	39	250	cast-iron	149.7	3	
	1985	AL	Abylai-Khan	10/1.	150	cast-iron	37	3	
	1985	AL	Abylai-Khan	10/1.	100	cast-iron	36	1	
	1985	AL	Abylai-Khan	2/1.	200	cast-iron	33.3	2	
	1985	AL	Abylai-Khan	2/1.	150	cast-iron	15.3	1	
	1985	AL	Abylai-Khan	2/2.	150	cast-iron	178.3	6	
	1992	AL	Abylai-Khan	2/4.	150	cast-iron	83.91	5	
	1992	AL	Abylai-Khan	2/4.	200	cast-iron	98.7	4	
	1988	AL	Abylai-Khan	20/1.	150	cast-iron	109.2	5	
	1988	AL	Abylai-Khan	20/1.	300	cast-iron	24	1	
	1986	AL	Abylai-Khan	20/2.	150	cast-iron	125.2	5	
	1986	AL	Abylai-Khan	25/1.	200	cast-iron	104.8	5	
	1986	AL	Abylai-Khan	25/2.	200	cast-iron	6.4		
	1989	AL	Abylai-Khan	27/2.	150	cast-iron	7.7	3	
	1989	AL	Abylai-Khan	27/4.	150	cast-iron	82.4	3	
	1989	AL	Abylai-Khan	27/4.	200	cast-iron	120.8	4	
	1989	AL	Abylai-Khan	27/5.	200	cast-iron	43.3	2	
	1989	AL	Abylai-Khan	27/5.	150	cast-iron	226.1	8	
	1986	AL	Abylai-Khan	29/2.	150	cast-iron	119.2	5	
	1986	AL	Abylai-Khan	29/3.	150	cast-iron	32.5		
	1987	AL	Abylai-Khan	29/4.	200	cast-iron	153.5	8	
	1988	AL	Abylai-Khan	5/1.	150	cast-iron	64		
	1988	AL	Abylai-Khan	9/2.	150	cast-iron	24	4	
	1988	AL	Abylai-Khan	9/2.	200	cast-iron	137	2	
	1995	AL	Abylai-Khan	17/3.	150	cast-iron	78.6	3	
	1997	AL	Abylai-Khan	24/2.	150	cast-iron	28.5	3	
	1974	SA	Almatinskaya	31	150	cast-iron	65	3	
	1989	AL	Al-Farabi	1	200	cast-iron	138.5	7	
	1990	AL	Al-Farabi	2	300	cast-iron	24.4	1	
	1990	AL	Al-Farabi	2	150	cast-iron	59	2	
	1991	AL	Al-Farabi	15	300	cast-iron	62.9	1	
	1990	AL	Al-Farabi	16	150	cast-iron	62	4	
	1990	AL	Al-Farabi	22	200	cast-iron	112.5	5	
	1997	AL	Al-Farabi	22	200	cast-iron	59.8	3	
	1999	AL	Al-Farabi	22	200	cast-iron	59.8	3	
	1997	AL	Al-Farabi	55	200	cast-iron	153		
	1997	AL	Al-Farabi	55	200	cast-iron	153	8	
	1997	AL	Al-Farabi	58	150	cast-iron	132.6	12	
	1997	AL	Al-Farabi	59	150	cast-iron	76.4	3	
	1997	AL	Al-Farabi	63	150	cast-iron	23.3	3	
	1997	AL	Al-Farabi	74	150	cast-iron	79	4	
	1997	AL	Al-Farabi	77	150	cast-iron	74.3	4	
	1997	AL	Al-Farabi	77	200	cast-iron	21.1	2	

No.10	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1997	AL	Al-Farabi	78.79	150	cast-iron	181.5	6	
	1997	AL	Al-Farabi	78.79	200	cast-iron	24.4	4	
	1998	AL	Al-Farabi	16/2.	150	cast-iron	105	5	
	1993	AL	Al-Farabi	19/1.	150	cast-iron	142	6	
	1993	AL	Al-Farabi	47/3	500	cast-iron	60		
	1993	AL	Al-Farabi	47/3	250	cast-iron	38.4	2	
	1993	AL	Al-Farabi	47/3	300	cast-iron	71.9	2	
	1993	AL	Al-Farabi	47/3	100	cast-iron	91.3	4	
	1997	AL	Al-Farabi	62/1	150	cast-iron	60.5	3	
	1997	AL	Al-Farabi	62-b	150	cast-iron	60.5	3	
	1997	AL	Al-Farabi	p. 11-v	150	cast-iron	23.3	1	
	1997	AL	Al-Farabi		200	cast-iron	1528	63	networks around the "Al-Farabi" micro-district
	1958	SA	Auezov St	40	150	cast-iron	60.9	4	
	1958	SA	Auezov St	48	150	cast-iron	72	8	
	1958	SA	Auezov St	48	200	cast-iron	65.9	2	
	1958	SA	Auezov St	48	150	cast-iron	72	8	
	1958	SA	Auezov St	48	200	cast-iron	65.9	2	
	1962	SA	Auezov St	73.75	300	cast-iron	93.3	7	
	1962	SA	Auezov St	117	200	cast-iron	103.6	5	
	1962	SA	Auezov St	139	200	cast-iron	108.2	2	
	1962	SA	Auezov St	139	150	cast-iron	158.7	7	
	1994	SA	Auezov St	123-a	150	cast-iron	29.8	3	
	1994	SA	Auezov St	123-a	350	cast-iron	23.5	1	
	1987	SA	Auezov St	54/1	150	cast-iron	64.8	5	
	1980	SA	Auezov St	38	150	cast-iron	53	3	
	1965	SA	Auezov St	73.75	200	cast-iron	93.3	4	
	1984	SA	Auezov St	90	150	cast-iron	97.6	6	
	1971	SA	Auezov St	108	300	cast-iron	61.3	3	Auezov St 108,110, Pushkin St 121
	1971	SA	Auezov St	108	200	cast-iron	58	2	Auezov St 108,110, Pushkin St 122
	1971	SA	Auezov St	108	150	cast-iron	50	2	Auezov St 108,110, Pushkin St 123
	1992	SA	Baitursynov St	107	150	cast-iron	17.1	1	
	1985	AL	Barayev St	7	150	cast-iron	87.6	7	
	1984	AL	Barayev St	9	150	cast-iron	51.7	3	
	1978	SA	Begeldinov St	43	200	cast-iron	57.6		
	1985	SA	Begeldinov St	1	150	cast-iron	16	1	
	1959	SA	Begeldinov St	3	150	cast-iron	78	2	
	1961	SA	Begeldinov St	14	150	cast-iron	20.8	5	Sakko i Vanzetti 35, Sejfullin St 50
	1961	SA	Begeldinov St	14	200	cast-iron	99.25	8	Sakko i Vanzetti 35, Sejfullin St 50
	1962	SA	Begeldinov St	27	150	cast-iron	86	3	
	1961	SA	Begeldinov St	45	200	cast-iron	29.5	2	
	1989	SA	Begeldinov St	79	150	cast-iron	44.7	4	
	1958	SA	Begeldinov St	18-a	150	cast-iron	75	1	
	1989	SA	Begeldinov St	79-a	150	cast-iron	303.1	14	
	1961	SA	Begeldinov St		200	cast-iron	530	12	from Druzhba St to Zhangildin St

No.11	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1997	SA	Begeldinov St		300	cast-iron	151	4	
	1997	SA	Begeldinov St		200	cast-iron	114	7	
	1997	SA	Begeldinov St		150	cast-iron	36.5	5	
	1991	SA	Belyakov St	26	150	cast-iron	62	3	
	1989	SA	Belyakov St	28	150	cast-iron	50.6	3	
	1999	SA	Bogembai	4.6	200	cast-iron	95.6	3	
	1979	SA	Bogembai	19	300	cast-iron	34.6	1	
	1979	SA	Bogembai	19	150	cast-iron	79.4	3	
	1983	SA	Bogembai	21	150	cast-iron	41	2	
	1988	SA	Bogembai	29	150	cast-iron	77.4	4	
	1988	SA	Bogembai	29	200	cast-iron	89.8	4	
	1977	SA	Bogembai	73.75	200	cast-iron	16.2		
	1977	SA	Bogembai	73.75	150	cast-iron	135.5		
	1987	SA	Bogembai	1/1.	150	cast-iron	95.6	6	
	1997	SA	Bogembai	4/1.	150	cast-iron	97.1	9	
	1980	SA	Bogembai	7/1.	150	cast-iron	317.7	10	Bogembai 9/2, 5/1, 3/1
	1980	SA	Bogembai	7/1.	300	cast-iron	317.95	10	Bogembai 9/2, 5/1, 3/1
	1999	AL	Hospital Area (Bolnichny Complex)		300	cast-iron	178.2	5	along Abylai-Khan
	1973	SA	Bukejhan	17	150	cast-iron	21.5	1	
	1999	SA	Bukejhan	12/1.	150	cast-iron	14	1	
	1999	SA	Bukejhan		200	cast-iron	108.8	7	
	1973	AL	Vishnevskoe Shosse	5	200	cast-iron	121.1	6	medical college
	1973	AL	Vnutri Ploshadnye seti tresta		200	cast-iron	256	8	
	1985	SA	Vodoprovodnaya	3	150	cast-iron	243	18	
	1995	SA	Vokzalnaya	8	150	cast-iron	88.3	7	
	1995	SA	Vokzalnaya	8/1.	100	cast-iron	9.2	2	
	1988	AL	Gabdulin	10	150	cast-iron	38.3	3	
	1976	AL	Gastello		500	cast-iron	700		from Imanov St to Zhangildin St
	1976	AL	Gastello		300	cast-iron	700		from Imanov St to Zhangildin St
	1969	SA	Gete	8	150	cast-iron	62.1	4	
	1973	SA	Gete	12	150	cast-iron	136.9	6	
	1973	SA	Gete	14.16	150	cast-iron	252.5	14	Linejnaya St 10, 12
	1980	SA	Gete	22	150	cast-iron	12.7	12	
	1980	SA	Gete	24	150	cast-iron	116.7	6	
	1966	SA	Kindergarden at "Kazakhselmash"		150	cast-iron	152	4	from the kindergarden to block 139
	1988	SA	Kindergarden No 10		150	cast-iron	190.5	5	Lesozavodskaya
	1990	AL	Kindergarden No 59		150	cast-iron	171.3	9	microdistrict 2
	1990	AL	Kindergarden No 59		200	cast-iron	61.7	2	microdistrict 2
	1990	AL	Kindergarden No 75		200	cast-iron	129.6	12	"Molodezhny" micro-district 40/1
	1997	AL	Kindergarden No 9		150	cast-iron	153.1	7	microdistrict 4
	1980	SA	Delagatskaya St	50	150	cast-iron	37	2	
	1976	SA	Delagatskaya St		400	cast-iron	400		from Revolucionnaya to Bogembai
	1976	SA	Delagatskaya St		300	cast-iron	300		from Revolucionnaya to Bogembai
	1988	SA	Zhambyl	60	150	cast-iron	27.9	2	

No.12	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1978	SA	Zhangildin	25	150	cast-iron	92		
	1975	SA	Zhangildin	28	150	cast-iron	31		
	1976	SA	Zhangildin	28	300	cast-iron	26.3		
	1999	SA	Reception House		250	cast-iron	19	1	
	1999	SA	Reception House		200	cast-iron	194	5	
	1999	SA	Reception House		300	cast-iron	43.2	2	
	1999	SA	Reception House		400	cast-iron	272.2	8	
	1970	SA	Drizge	1	250	cast-iron	30.9	2	
	1974	SA	Drizge	2	200	cast-iron	78.8	5	
	1977	SA	Druzhba	1	200	cast-iron	36		
	1970	SA	Druzhba	8	150	cast-iron	44.5	4	
	1962	SA	Druzhba	9	150	cast-iron	74.9	2	
	1962	SA	Druzhba	9	100	cast-iron	188	7	
	1980	SA	Druzhba	26.28	150	cast-iron	27	5	
	1989	SA	Druzhba	33	300	cast-iron	24	1	
	1989	SA	Druzhba	33	150	cast-iron	34.5	3	
	1985	SA	Druzhba	58	150	cast-iron	38.9	2	
	1988	SA	Druzhba	60	150	cast-iron	136.4	7	
	1986	SA	Druzhba	54-a	250	cast-iron	39.1	1	
	1986	SA	Druzhba	54-a	150	cast-iron	76.3	4	
	1998	SA	Druzhba	58/1	200	cast-iron	19.3	3	
	1998	SA	Druzhba	58/1	350	cast-iron	13.2	2	
	1998	SA	Druzhba	58/1	400	cast-iron	46.8	2	
	1987	SA	Druzhba	60/1	400	cast-iron	4.4		
	1987	SA	Druzhba	60/1	300	cast-iron	35.6	2	
	1987	SA	Druzhba	60/1	150	cast-iron	44	1	
	1998	SA	Druzhba	60/2	150	cast-iron	176.2	7	
	1998	SA	Druzhba	60/2	300	cast-iron	35.6	1	
	1975	SA	Druzhba		400	cast-iron	637		from Koshkarbayev to Pushkin
	1975	SA	Druzhba		300	cast-iron	259		from Koshkarbayev to Pushkin
	1986	SA	Dulatov	176	150	cast-iron	80.6	4	
	1975	SA	Dulatov	177	150	cast-iron	220	6	
	1981	SA	Dulatov	178	150	cast-iron	115.9	6	Dulatov 180
	1985	SA	Dulatov	184	150	cast-iron	12.2	1	
	1964	SA	Zheltoksan	2	150	cast-iron	82.4	7	
	1977	SA	Zheltoksan	9	150	cast-iron	32		
	1979	SA	Zheltoksan	11	150	cast-iron	41.9	3	
	1997	AL	Zheltoksan	16	150	cast-iron	26	1	
	1952	SA	Zheltoksan	23	150	cast-iron	49.5	2	
	1964	SA	Zheltoksan	26	150	cast-iron	112	6	
	1989	SA	Zheltoksan	33	150	cast-iron	119	4	
	1965	SA	Zheltoksan	43	150	cast-iron	10.7	1	
	1978	SA	Zheltoksan	45	150	cast-iron	11.1	1	
	1965	SA	Zheltoksan	29-a	150	cast-iron	64.5	6	

No.13	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1965	SA	Zheltoksan	29-a	100	cast-iron	43.1		
	1966	SA	Zheltoksan	41-a	150	cast-iron	44.6	3	
	1991	AL	Zhukovsky	53/2	150	cast-iron	44.5	3	
	1999	AL	Zhukovsky	8/1.	150	cast-iron	36.8	3	
	1990	SA	Zavodskoy		150	cast-iron	107	12	
	1994	SA	Zavodskoy bulevard	6	150	cast-iron	30.8	2	
	1970	AL	Imambayeva		300	cast-iron	727		
	1975	SA	Imanov	6	150	cast-iron	102.35	6	
	1975	SA	Imanov	6	200	cast-iron	27.5	2	
	1987	SA	Imanov	7	200	cast-iron	17.1	1	
	1997	SA	Internacionalnaya	3	150	cast-iron	84	7	
	1998	SA	Irchenko	12	150	cast-iron	107.5	2	
	1998	SA	Irchenko	12	200	cast-iron	109.3	8	
	1978	SA	Kazakhskaya	50	250	cast-iron	40.9	3	
	1978	SA	Kazakhskaya	68	300	cast-iron	137.1	6	
	1979	SA	Kazakhskaya	70	150	cast-iron	90	8	
	1989	SA	Kazakhskaya	83	150	cast-iron	27.8	3	
	1980	SA	Kazakhskaya	66-a	150	cast-iron	53.4	1	
	1980	SA	Kazakhskaya	66-a	250	cast-iron	27.2	1	
	1978	SA	Kazakhskaya	68/1	150	cast-iron	16	2	
	1965	SA	Kartalinskaya	3	150	cast-iron	36.5	2	
	1967	SA	Block 120		150	cast-iron	548		Bejbitshilik 29,33,35,31, Bogembai 6,8,8a,10, Zheltoksan 50,52
	1969	SA	Block 102		150	cast-iron	128		from Pobeda 85,87
	1969	SA	Block 104		150	cast-iron	1270		Moskovskaya 41,41a,39,39a,43, Pobeda103,105,101,99,97
	1969	SA	Block 105		150	cast-iron	155		from Pobeda 109 to 9 Maya
	1969	SA	Block 110		150	cast-iron	455		Monin 24,26,28,28-a, Timiryazev 8, Bejbitshilik 75,77
	1969	SA	Block 112		200	cast-iron	305		Bejbitshilik 61,63,67,69,71; 9 Maya, 72
	1967	SA	Block 117		150	cast-iron	100		Bogembai 3-a, 5-a
	1967	SA	Block 121		150	cast-iron	577		Zheltoksan 49, 29, Sejfullin 53
	1967	SA	Block 122		150	cast-iron	491		Zheltoksan 39, Zhangildin 6,6-a, Sejfullin 37, Pobeda 54,54-a
	1967	SA	Block 124		100	cast-iron	180		Zheltoksan 18,20,22
	1969	SA	Block 127		150	cast-iron	225		Zheltoksan 6, Krasnoarmejskaya 25
	1969	SA	Block 138		200	cast-iron	308		Bejbitshilik 60,62,62-a,64,64-a, 9 Maya 67,71
	1969	SA	Block 98		150	cast-iron	305		Sejfullin 14,16,18, Pobeda 49,51,53
	1991	SA	Kenesary	80	150	cast-iron	20	1	
	1975	AL	Kenesary	150	250	cast-iron	391		
	1979	AL	Kenesary	150/1	150	cast-iron	33.6		
	1981	AL	Kenesary	167-a	150	cast-iron	69.8	5	
	1960	SA	Kenesary		200	cast-iron	500	12	from the park-way to Pobeda
	1979	SA	Sewer collector		150	cast-iron	252		from WPS 1 to 134 Auezov-9 Maya
	1980	AL	Sewer collector		300	cast-iron	157.5	12	along Molodezhny microdistrict
	1980	AL	Sewer collector		400	cast-iron	467.5	21	along Molodezhny microdistrict
	1973	AL	Sewer collector		600	cast-iron	2112	48	sewer collector from Uchilishnaya to the college
	1979	SA	Sewer collector		300	cast-iron	1556	20	from PDU

No.14	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1976	SA	Sewer collector 8-a		250	cast-iron	237.6		ceramic plant collector
	1967	AL	Sewer collector No 1		200	cast-iron	1315	32	microdistrict A to the "Microdistrict A" pump station (d/u 4)
	1975	AL	Sewer collector No 14		400	cast-iron	399		from Ishim-river's damb topump station No 8
	1975	AL	Sewer collector No 14		300	cast-iron	165		from Ishim-river's damb topump station No 9
	1979	SA	Sewer collector No 7		350	cast-iron	1050		Linejnaya, Shvernik, Timiryazev
	1976	SA	Sewer collector No 8-a		200	cast-iron	199.4		ceramic plant collector
	1983	SA	Constitution St	21	150	cast-iron	58.8	4	
	1983	SA	Constitution St	21	300	cast-iron	386.3	11	
	1979	SA	Constitution St	24.26	200	cast-iron	32.5	9	
	1989	SA	Constitution St	32	150	cast-iron	97	6	
	1984	SA	Constitution St	10/1.	150	cast-iron	83	2	
	1992	SA	Constitution St	24/1.	150	cast-iron	68.8	4	
	1990	SA	Constitution St	30/1.	150	cast-iron	40.1	2	
	1992	SA	Constitution St	32-a	150	cast-iron	75.3	4	
	1985	SA	Constitution St	6/1.	200	cast-iron	59.8	1	
	1985	SA	Constitution St	8/1.	150	cast-iron	51	6	
	1979	SA	Constitution St		250	cast-iron	144.4	3	
	1979	SA	Constitution St		300	cast-iron	46.8	3	
	1989	AL	Kr. Krest St	74	150	cast-iron	120.4	6	
	1989	AL	Kr. Krest St	74	200	cast-iron	45.6	1	
	1961	SA	Krasnoarmejskaya	21	150	cast-iron	34.2	5	
	1988	SA	Kulturnaya	48/1	200	cast-iron	78.6	5	
	1981	SA	Lesozavodskaya	17/2.	200	cast-iron	164	5	
	1981	SA	Lesozavodskaya	17/2.	150	cast-iron	6.7	2	
	1985	SA	Lesozavodskaya	18/1.	150	cast-iron	221.5	9	
	1978	SA	Libkneht	4.6	100	cast-iron	81.9	3	
	1973	SA	Linejnaya St	14.16	150	cast-iron	191.4	12	Gete 18, 20
	1981	SA	Linejnaya St	22	100	cast-iron	23	1	
	1978	SA	Linejnaya St	24	150	cast-iron	216.6	11	Linejnaya 24,26,30,32,29,33
	1982	SA	Linejnaya St	27	100	cast-iron	77.7	5	
	1976	SA	Linejnaya St	35	100	cast-iron	93.4	5	
	1968	SA	Linejnaya St	34-a	150	cast-iron	61.8	3	
	1990	AL	Likhachev	69	150	cast-iron	69	3	
	1998	AL	Likhachev	69/1	200	cast-iron	136.5	5	
	1989	SA	liceum No 1		200	cast-iron	97.5	2	
	1979	AL	Lomonosov St	35	100	cast-iron	201.7	15	Lomonosov 35,37,39/1,39/2,39/3
	1991	AL	Lomonosov St	49	200	cast-iron	157.2	5	
	1967	SA	Luxemburg St	7	150	cast-iron	26	1	
	1979	SA	Luxemburg St	12	150	cast-iron	46.4	5	
	1978	SA	Luxemburg St	5/1.	150	cast-iron	124	7	
	1975	AL	microdistrict 1	4	150	cast-iron	89.5		
	1987	AL	"Molodezhny" microdistrict	31	150	cast-iron	74.7	5	
	1999	AL	"Samal" microdistrict		100	cast-iron	187.9	20	
	1981	AL	microdistrict 1	8.1	150	cast-iron	20		

No.15	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1975	AL	microdistrict 1	10	150	cast-iron	46		
	1992	AL	microdistrict 1	19	150	cast-iron	29.1	2	
	1990	AL	microdistrict 1	7/1.	200	cast-iron	117.6	3	
	1990	AL	microdistrict 1	7/1.	150	cast-iron	13.5	2	
	1975	AL	microdistrict 2	1	150	cast-iron	36.9	4	
	1975	AL	microdistrict 2	1	200	cast-iron	177.4	7	
	1981	AL	microdistrict 2	5	150	cast-iron	134.5		
	1975	AL	microdistrict 2	8	150	cast-iron	115		
	1975	AL	microdistrict 2	8	300	cast-iron	145		
	1975	AL	microdistrict 2	14	150	cast-iron	135		
	1977	AL	microdistrict 2	17	200	cast-iron	12.2		
	1993	AL	microdistrict 2-a	2	200	cast-iron	278.7	6	
	1997	AL	microdistrict 2-a	26	200	cast-iron	127.6	7	
	1978	AL	microdistrict 3	1	300	cast-iron	128.7	6	
	1979	AL	microdistrict 3	2	200	cast-iron	64.3	4	
	1979	AL	microdistrict 3	2	250	cast-iron	77.1	3	
	1982	AL	microdistrict 3	4	200	cast-iron	45.7	2	
	1982	AL	microdistrict 3	4	150	cast-iron	32	6	
	1991	AL	microdistrict 3	8	150	cast-iron	85.9	5	
	1990	AL	microdistrict 3	15	250	cast-iron	184.5	7	
	1997	AL	microdistrict 3	20	150	cast-iron	67.5	3	
	1992	AL	microdistrict 3	21	250	cast-iron	42.3	3	
	1992	AL	microdistrict 3	21	200	cast-iron	122.4	5	
	1992	AL	microdistrict 3	21	150	cast-iron	74	2	
	1996	AL	microdistrict 3	22	200	cast-iron	155.4	10	
	1999	AL	microdistrict 3	26	200	cast-iron	149.8	9	
	1999	AL	microdistrict 3	26	150	cast-iron	4.6	1	
	1987	AL	microdistrict 4	12	150	cast-iron	26.2	2	
	1988	AL	microdistrict 4	23	150	cast-iron	121	5	
	1981	AL	microdistrict 4	25	150	cast-iron	129.8	7	
	1981	AL	microdistrict 4	25	200	cast-iron	68	2	
	1985	AL	microdistrict 4	27	250	cast-iron	33.2	3	
	1977	AL	microdistrict 4	28	200	cast-iron	163.5	9	
	1989	AL	microdistrict 4	29	150	cast-iron	104.7	5	
	1988	AL	microdistrict 5	1	250	cast-iron	44.1	1	
	1988	AL	microdistrict 5	1	200	cast-iron	130.7	8	
	1988	AL	microdistrict 5	3	200	cast-iron	156.3	8	
	1988	AL	microdistrict 5	3	100	cast-iron	18	2	
	1988	AL	microdistrict 5	5	400	cast-iron	18.1	1	
	1997	AL	microdistrict 5	7	200	cast-iron	118.4	5	
	1988	AL	microdistrict 5	12	200	cast-iron	110.8	3	
	1999	AL	microdistrict 5	19	150	cast-iron	45.5	2	
	1999	AL	microdistrict 5	19	200	cast-iron	58.5	1	
	1999	AL	microdistrict 5	19	250	cast-iron	26.5	1	

No.16	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1990	AL	microdistrict 5	23	200	cast-iron	317.5	17	
	1987	AL	microdistrict 5	29	200	cast-iron	221	6	
	1987	AL	microdistrict 5	29	150	cast-iron	81.5	5	
	1990	AL	microdistrict 5	12/1.	150	cast-iron	66.6	4	
	1984	AL	"Alatau" microdistrict	5	200	cast-iron	50.9	2	
	1984	AL	"Alatau" microdistrict	5	150	cast-iron	62.8	4	
	1980	AL	"Molodezhny" microdistrict	7	150	cast-iron	60.9	2	houses 7,7-a,8,9,9-a
	1983	AL	"Molodezhny" microdistrict	7	200	cast-iron	113.5	6	
	1991	AL	"Molodezhny" microdistrict	20	200	cast-iron	105.8	4	
	1981	AL	"Molodezhny" microdistrict	23	300	cast-iron	160	9	
	1985	AL	"Molodezhny" microdistrict	29	200	cast-iron	150.7	10	
	1985	AL	"Molodezhny" microdistrict	29	400	cast-iron	151.5	3	
	1983	AL	"Molodezhny" microdistrict	32	150	cast-iron	145.4	7	
	1992	AL	"Molodezhny" microdistrict	33	150	cast-iron	25.8		
	1990	AL	"Molodezhny" microdistrict	44	150	cast-iron	29	2	
	1983	AL	"Molodezhny" microdistrict	45	150	cast-iron	80.5	4	
	1983	AL	"Molodezhny" microdistrict	45	200	cast-iron	177	6	
	1983	AL	"Molodezhny" microdistrict	45	250	cast-iron	50.4	2	
	1997	AL	"Molodezhny" microdistrict	50	300	cast-iron	20.9	1	
	1997	AL	"Molodezhny" microdistrict	50	200	cast-iron	53.2	2	
	1997	AL	"Molodezhny" microdistrict	50	150	cast-iron	100.5	5	
	1992	AL	"Molodezhny" microdistrict	27/1.	150	cast-iron	60.8	4	
	1999	AL	"Samal" microdistrict		150	cast-iron	219.5	23	Networks around the district
	1999	AL	"Samal" microdistrict		200	cast-iron	547	12	Networks around the district
	1999	AL	"Samal" microdistrict		300	cast-iron	89.2	8	Networks around the district
	1955	AL	Monin St	3	150	cast-iron	102.6	6	
	1955	AL	Monin St	5	150	cast-iron	135.1	8	
	1951	AL	Monin St	6.8	150	cast-iron	123.3	13	
	1962	AL	Monin St	12	150	cast-iron	88.4	7	
	1956	SA	Monin St	16.18	150	cast-iron	137.7	13	
	1959	SA	Monin St	20	150	cast-iron	72.9	5	
	1963	SA	Monin St	27	150	cast-iron	97	6	
	1988	SA	Monin St	16-a	150	cast-iron	182.6	8	
	1972	SA	Monin St	19-a	150	cast-iron	7	2	
	1992	SA	Monin St	31/1.	200	cast-iron	42	3	
	1990	SA	Moskovskaya St	21/1.	200	cast-iron	382.4	10	
	1987	SA	Moskovskaya St	21/1.	150	cast-iron	82.5	7	
	1987	SA	Moskovskaya St	21/1.	250	cast-iron	27.7	5	
	1987	SA	Moskovskaya St	21/1.	150	cast-iron	41.4	3	
	1964	AL	Pressure sewer collector	0	400	cast-iron	1628	8	pressure sewer from pump st 214 by cemetery, by Zhukovsky
	1974	SA	Pressure sewer collector		400	cast-iron	1253		two lines from pump station 3 to suburban sewer of zone 1
	1965	AL	Pressure sewer collector		200	cast-iron	2500	2	"Prigorodny" village
	1999	SA	Pressure sewer collector		250	cast-iron	229.1	1	from "Samal" wastewater pump station
	1979	SA	Pressure sewer collector		150	cast-iron	2400	3	from wastewater pump station Severnoe Shosse St 27/1

No.17	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1997	SA	Pressure sewer collector		100	cast-iron	980	1	from wastewater pump station of "Karaotkel" village
	1979	SA	Pressure sewer collector		200	cast-iron	586.4	6	from wastewater pump station of PDU
	1969	SA	Pressure sewer collector		200	cast-iron	2595		from WPS 29 of "Avtomatika" village - transition 7 under railway
	1974	SA	Pressure sewer collector 8-a		400	cast-iron	2336	9	from wastewater pump station 10 "Agromash"
	1965	AL	Oblastnaya bolnica (hospital)		300	cast-iron	605	7	from the hospital to sewer 3
	1964	SA	Omarov St		200	cast-iron	330		from Auezov St to Bejbitshilik St and to Abai St
	1965	AL	Omarov St		250	cast-iron	772.3	26	along Omarov and Gabdulin from KK-16 to KK-41
	1965	AL	Omarov St		300	cast-iron	283.9		along Omarov and Gabdulin from KK-16 to KK-42
	1997	AL	Omarov St		300	cast-iron	226.5	6	to 17rail-way block from KK-6 to exisiting sewer in Mira St
	1983	AL	Otyrar St	33	150	cast-iron	82.1	4	
	1983	AL	Otyrar St	33	200	cast-iron	12.3	2	
	1975	AL	Otyrar St	67	200	cast-iron	38		
	1997	SA	Parliament		300	cast-iron	194.2	7	from Parliament to Abai St
	1983	SA	Pervomajskaya St	31	150	cast-iron	88.6	5	
	1993	SA	Pervomajskaya St	22/1.	150	cast-iron	31.5	3	
	1975	SA	Pobeda	34	150	cast-iron	95.6	5	
	1972	SA	Pobeda	44	200	cast-iron	178.2	8	
	1982	SA	Pobeda	48	200	cast-iron	157.1	6	
	1968	SA	Pobeda	52	150	cast-iron	96	1	
	1975	SA	Pobeda	57	150	cast-iron	147.7		
	1969	SA	Pobeda	63	150	cast-iron	145	1	Pobeda 63-a
	1977	SA	Pobeda	71	200	cast-iron	18.7	1	
	1977	SA	Pobeda	71	150	cast-iron	87.6	8	
	1968	SA	Pobeda	83	150	cast-iron	5	2	
	1985	SA	Pobeda	86	200	cast-iron	90.3	5	
	1985	SA	Pobeda	86	250	cast-iron	59.4	4	
	1958	SA	Pobeda	106	150	cast-iron	102.5	5	Pobeda 108
	1959	SA	Pobeda	110	150	cast-iron	137.9	9	Pobeda 112
	1965	SA	Pobeda	111	200	cast-iron	93.6	4	
	1967	SA	Pobeda	119	200	cast-iron	369.1	13	Pobeda 121
	1962	SA	Pobeda	122	150	cast-iron	72.1	5	
	1998	SA	Pobeda	63/1	150	cast-iron	56.8	8	
	1998	SA	Pobeda	63/1	200	cast-iron	174.5	4	
	1981	SA	Pobeda	65/1	150	cast-iron	11.5		
	1981	SA	Pobeda	65/2	150	cast-iron	60.4		
	1988	AL	Polevaya	6	150	cast-iron	38.3	2	
	1988	AL	Polevaya	2/2.	150	cast-iron	117.7	7	
	1990	AL	Polevaya	4/1.	150	cast-iron	105.2	6	
	1990	AL	Polevaya	4/2.	200	cast-iron	88.6	5	
	1973	SA	Potanin St	39	150	cast-iron	30.2	1	
	1975	SA	Potanin St	41	150	cast-iron	36		
	1972	SA	Potanin St	10	150	cast-iron	13.5	1	
	1975	SA	Pushkin St	66	200	cast-iron	30		
	1989	SA	Pushkin St	91	250	cast-iron	36.8	5	

No.18	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1985	SA	Pushkin St	93	150	cast-iron	92.9	4	
	1985	SA	Pushkin St	106	150	cast-iron	10.9	2	
	1985	SA	Pushkin St	106	300	cast-iron	69.2	4	
	1987	SA	Pushkin St	110	200	cast-iron	120.6	6	
	1987	SA	Pushkin St	110	300	cast-iron	73.4	2	
	1969	SA	Pushkin St	159	150	cast-iron	14.6	9	
	1999	SA	Pushkin St	168	150	cast-iron	22.5	2	
	1982	SA	Pushkin St	171	150	cast-iron	31.3	2	
	1978	SA	Pushkin St	178	150	cast-iron	55.2	4	
	1980	SA	Pushkin St	132-a	300	cast-iron	83.1	3	
	1980	SA	Pushkin St	132-a	250	cast-iron	91	4	
	1982	SA	Pushkin St	171-a	150	cast-iron	31.5	2	
	1975	SA	Pushkin St		100	cast-iron	190		from Sejfullin to ceramic plant sewer
	1997	SA	Residence		300	cast-iron	168.3	9	from Abai to Begeldinov along the Residence
	1980	SA	Respubliki	1	200	cast-iron	31.2	2	
	1982	AL	Respubliki	2	150	cast-iron	10.3	1	
	1990	SA	Respubliki	11.13	200	cast-iron	94.4	5	
	1978	SA	Respubliki	15	200	cast-iron	17.5		
	1989	AL	Respubliki	18	150	cast-iron	85.3	4	
	1988	SA	Respubliki	19	150	cast-iron	30.8		
	1992	AL	Respubliki	20	200	cast-iron	61.2	3	
	1985	AL	Respubliki	62	150	cast-iron	47.7	3	
	1989	AL	Respubliki	64	200	cast-iron	74.4	6	
	1987	SA	Respubliki	15/2.	150	cast-iron	99.4	6	
	1987	SA	Respubliki	15/2.	200	cast-iron	51.5	2	
	1978	AL	Respubliki	4/1.	150	cast-iron	150		
	1984	AL	Respubliki	4/2.	200	cast-iron	143	2	
	1981	AL	Respubliki	4-a	150	cast-iron	46.3	3	
	1981	SA	Respubliki	7/1.	150	cast-iron	80	3	
	1976	SA	Respubliki	9/1.	150	cast-iron	77.3	4	
	1976	SA	Respubliki	9/1.	200	cast-iron	97	5	
	1997	SA	Respubliki	9/2.	150	cast-iron	36.5	2	
	1997	SA	Respubliki	9/2.	200	cast-iron	36.9	3	
	1977	AL	Respubliki		300	cast-iron	384		from Engels to Imanov
	1985	SA	Sakko i Vanzetti	16	150	cast-iron	60.2	6	
	1970	SA	Sakko i Vanzetti	22	150	cast-iron	1	1	
	1975	SA	Sakko i Vanzetti	42	150	cast-iron	51.8	5	
	1984	SA	gravity sewer collector		400	cast-iron	977	22	from pump station in Skladskaya St to ceramic plant sewer
	1999	AL	gravity sewer collector		600	cast-iron	1309	20	from sewerage pump station 30 "Al-Farabi" microdistrict
	1974	SA	gravity sewer collector 8-a		600	cast-iron	260	7	from the manhole of sewerage pump station 10 to Pervomajskaya
	1979	SA	Severnoe shosse	27/1.	100	cast-iron	218.2	11	
	1982	SA	Sejfullin	4	300	cast-iron	223.5	7	
	1970	SA	Sejfullin	6	200	cast-iron	69.9	5	
	1970	SA	Sejfullin	6	250	cast-iron	168.6	4	

No.19	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1983	AL	Sejfullin	171	150	cast-iron	96	3	
	1984	AL	Sejfullin	208	150	cast-iron	85.9	4	and house 210
	1977	SA	Sejfullin	15-a	150	cast-iron	188.9	7	
	1987	AL	Sejfullin	202/1	150	cast-iron	34.6	1	
	1989	AL	Sejfullin	202/2	150	cast-iron	100.5	7	
	1990	AL	Sejfullin	229/1	150	cast-iron	31.9	1	
	1973	SA	Sejfullin	39-a	150	cast-iron	135.7	8	
	1988	AL	Sembinov	48	150	cast-iron	91.7	3	
	1989	AL	Sembinov	50/1	150	cast-iron	117.2	5	
	1993	AL	Sembinov	60/1	150	cast-iron	58.2	3	
	1968	SA	Networks of block 72		150	cast-iron	150.3	7	
	1983	SA	Skladskaya	11.13	200	cast-iron	76.3	3	
	1983	SA	Skladskaya	11.13	300	cast-iron	6.1	1	
	1990	SA	Skladskaya	15	150	cast-iron	66.5	6	
	1986	SA	Smakotin	27	150	cast-iron	130.2	5	
	1983	SA	Smakotin	29	300	cast-iron	178.3	3	
	1983	SA	Smakotin	29	250	cast-iron	93.4	4	
	1994	AL	college 5		400	cast-iron	140	4	from college 5
	1984	AL	Tekstilshik	1	200	cast-iron	14.5	2	
	1980	AL	Telman	41	200	cast-iron	40		
	1980	AL	Telman	41	150	cast-iron	111.2	7	
	1981	AL	Telman	83	250	cast-iron	50		
	1981	AL	Telman	83	300	cast-iron	220		
	1971	SA	Timiryazev	13	150	cast-iron	6	2	
	1989	SA	Timiryazev	8-a	200	cast-iron	25	4	
	1990	AL	Uchilishnaya	6	200	cast-iron	63.8	3	medical college
	1981	AL	Tsiolkovsky St		150	cast-iron	267.6	24	from railway Kenesary 307,309,311, Tsiolkovsky8,10 to Kenesary
	1968	AL	engineering institute		250	cast-iron	36		dormitories 1,2,3, cafeteria
	1982	SA	Chapayev St	9	150	cast-iron	125.6	4	
	1955	SA	Shvernik St	2-a	100	cast-iron	58.5	4	
	1999	AL	school No 37		150	cast-iron	78	8	in "Al-Farabi" microdistrict
	1999	SA	Ethnopark		150	cast-iron	424.8	19	
	1999	SA	Ethnopark		300	cast-iron	172.9	5	
	1999	SA	Ethnopark		200	cast-iron	218.5	6	
	1999	SA	Ethnopark		400	cast-iron	56.3	1	
	1971	SA	9 Maya	69-a	200	ceramics	137.47	4	
	1985	SA	9 Maya	43-a	150	ceramics	10.2	1	
	1970	SA	Abai St.	37	150	ceramics	201.6	7	
	1976	AL	Abai St.	98	150	ceramics	46.4	1	
	1975	AL	Abai St.	100	150	ceramics	39.9	2	
	1970	AL	Abai St.	121	150	ceramics	129.9	8	
	1970	AL	Abai St.	121	200	ceramics	135.6	5	
	1985	AL	Abylai-Khan	8	150	ceramics	62	3	
	1983	AL	Abylai-Khan	16	150	ceramics	181	10	

B-8-20

No.20	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1983	AL	Abylai-Khan	22	300	ceramics	46	2	
	1983	AL	Abylai-Khan	22	200	ceramics	236	8	
	1986	AL	Abylai-Khan	25/2.	150	ceramics	32.9	5	
	1986	AL	Abylai-Khan	27/1.	200	ceramics	102.4	5	
	1986	AL	Abylai-Khan	27/1.	300	ceramics	68.3	2	
	1986	AL	Abylai-Khan	27/1.	150	ceramics	101.3	3	
	1985	AL	Abylai-Khan	31/1.	150	ceramics	99.2	5	
	1969	SA	Avtomatika		150	ceramics	513	23	settlement area sewerage
	1980	SA	Auezov St	41	200	ceramics	72.2	7	
	1954	SA	Auezov St	121	200	ceramics	315	13	Auezov St 121, 123
	1973	SA	Auezov St	36	150	ceramics	87	6	
	1970	SA	Auezov St	91	150	ceramics	74.9	2	
	1967	SA	Auezov St	92	150	ceramics	85.3	3	
	1953	SA	Begeldinov St	57	150	ceramics	56.6	2	
	1961	SA	Begeldinov St	45	150	ceramics	90	2	
	1972	SA	Begeldinov St	20-a	150	ceramics	29.1	1	
	1988	SA	Belyakov St	30	150	ceramics	166	7	
	1980	SA	Bogembai	19-a	150	ceramics	73.93	3	
	1980	SA	Bogembai	7/1.	250	ceramics	48.4	3	Bogembai 9/2, 5/1, 3/1
	1975	AL	Ualihanov	4	150	ceramics	117		
	1978	AL	Ualihanov	6	150	ceramics	75.8	4	
	1981	AL	Ualihanov	67	200	ceramics	262.8		
	1975	AL	Ualihanov	74	150	ceramics	133.8	8	Abai St 123
	1970	SA	Vokzalnaya	3	150	ceramics	96.5	6	
	1973	SA	Vokzalnaya	5	150	ceramics	73.7	5	
	1989	AL	Gabdulin		250	ceramics	772.3	16	from Omarov St
	1989	AL	Gabdulin		300	ceramics	283.9	10	from Omarov St
	1966	SA	Gete	4	150	ceramics	217.6	11	
	1968	SA	Gete	10	150	ceramics	136.6	9	
	1978	SA	Gete	4-a	200	ceramics	168.4	8	
	1997	SA	Kindergarden No 51		150	ceramics	226.8	13	Respubliki 15/1
	1984	SA	Kindergarden No 66		150	ceramics	98.1	5	Pobeda 69-a
	1986	AL	Kindergarden No 8		150	ceramics	174	8	microdistrict 3
	1982	SA	Delagatskaya St	62	200	ceramics	247.3	9	
	1978	SA	Zhangildin	12	200	ceramics	68	1	
	1965	SA	Zhangildin	14	150	ceramics	71	5	
	1962	SA	Zhangildin	16	150	ceramics	85	5	
	1978	SA	Zhangildin	25	250	ceramics	67		
	1975	SA	Zhangildin	4-a	150	ceramics	30		
	1977	SA	Druzhba	1	150	ceramics	60		
	1977	SA	Druzhba	1	200	ceramics	165		
	1968	SA	Druzhba	13	200	ceramics	133.3	8	
	1980	SA	Druzhba	26.28	150	ceramics	65.6	8	
	1980	SA	Druzhba	52	150	ceramics	51.4	3	

B-8-21

No.21	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1984	SA	Druzhba	54	150	ceramics	69.7	8	
	1982	SA	Druzhba	52-a	200	ceramics	18.4	1	
	1982	SA	Druzhba	52-a	150	ceramics	63	4	
	1963	AL	Kindergarden No 12		150	ceramics	83.5	5	Lomonosov 52
	1984	SA	Dulatov	182	150	ceramics	80.6	4	
	1980	AL	DUOD		200	ceramics	163.7	6	
	1980	AL	DUOD		150	ceramics	212.2	6	
	1978	SA	Kazakhskaya	50	150	ceramics	61.5	4	
	1989	SA	Kazakhskaya	83	200	ceramics	11.8	2	
	1980	SA	Kazakhskaya	66-a	300	ceramics	102.8	4	
	1951	SA	Kenesary	68	150	ceramics	38	5	
	1954	SA	Kenesary	72	150	ceramics	62.7	6	
	1997	AL	Kenesary	103	150	ceramics	80	2	
	1963	AL	Kenesary	208	200	ceramics	56.3	3	
	1999	SA	Kenesary		200	ceramics	117	4	health-rehabilitating centre
	1963	SA	Sewer collector No 6		300	ceramics	882		from VRZ to pump station No 2
	1959	SA	Constitution St	13.11	100	ceramics	95	7	
	1987	SA	Constitution St	25	150	ceramics	108.8	4	
	1959	SA	Constitution St	2-b	150	ceramics	33	4	Constitution 2-b, 6-a, 8-a
	1989	AL	Kr. Krest St	76	150	ceramics	97.3	7	
	1989	AL	Kr. Krest St	76	200	ceramics	39.9	3	
	1989	AL	Kr. Krest St	721	200	ceramics	57.7	1	
	1989	AL	Kr. Krest St	72/1	150	ceramics	69.8	1	
	1985	SA	Krivoguz St	9.11	150	ceramics	195.5	7	
	1980	AL	Kujbyshev St	71	150	ceramics	89.5		
	1990	AL	Likhachev	11	200	ceramics	137	4	
	1988	AL	Lomonosov St	57	200	ceramics	185	8	Sembinov 48/1, 48/2
	1991	AL	Manas	14/6.	150	ceramics	44.6	2	
	1990	AL	"Alatau" microdistrict	2	150	ceramics	237	8	
	1975	AL	"Alatau" microdistrict	12	200	ceramics	58		
	1975	AL	microdistrict 1	1.2	200	ceramics	201.2		
	1975	AL	microdistrict 1	3	150	ceramics	152		
	1975	AL	microdistrict 1	4	150	ceramics	143		
	1969	AL	microdistrict 1	12	200	ceramics	95.9	7	
	1981	AL	microdistrict 1	13	200	ceramics	114.4		
	1975	AL	microdistrict 1	14	125	ceramics	132.8		
	1981	AL	microdistrict 1	15	150	ceramics	6.6		
	1977	AL	microdistrict 1	16	200	ceramics	68		
	1974	AL	microdistrict 1	17	200	ceramics	129.4	7	
	1978	AL	microdistrict 1	20	150	ceramics	277.3		
	1978	AL	microdistrict 1	21	150	ceramics	218.2		
	1981	AL	microdistrict 1	28	150	ceramics	71.4	5	
	1975	AL	microdistrict 2	2	200	ceramics	58		
	1975	AL	microdistrict 2	2	150	ceramics	126.1		

No.22	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1975	AL	microdistrict 2	4	150	ceramics	85		
	1975	AL	microdistrict 2	6.7	150	ceramics	269		
	1975	AL	microdistrict 2	10	150	ceramics	66.3		
	1975	AL	microdistrict 2	11	150	ceramics	104		
	1978	AL	microdistrict 2	16	150	ceramics	23.2		
	1977	AL	microdistrict 2	17	150	ceramics	31.8		
	1980	AL	microdistrict 2	20	150	ceramics	128.3	6	
	1975	AL	microdistrict 2	29	150	ceramics	210.8		
	1975	AL	microdistrict 2 - microdistrict 4		300	ceramics	300		between microdistricts 2 and 4
	1993	AL	microdistrict 2-a	8	250	ceramics	114.2	5	
	1993	AL	microdistrict 2-a	8	300	ceramics	73.3	2	
	1986	AL	microdistrict 3	6	300	ceramics	528.3	20	
	1986	AL	microdistrict 3	10	200	ceramics	68.3	6	
	1989	AL	microdistrict 4	16	150	ceramics	71.9	2	
	1989	AL	microdistrict 4	16	200	ceramics	51.5	3	
	1982	AL	microdistrict 4	20	300	ceramics	178.8	7	
	1985	AL	microdistrict 4	21	200	ceramics	190.4	7	
	1986	AL	microdistrict 4	24	200	ceramics	111.6	5	
	1985	AL	microdistrict 4	27	150	ceramics	69	3	
	1985	AL	microdistrict 4	27	200	ceramics	97.7	4	
	1983	AL	microdistrict 4	31	150	ceramics	106.8	8	
	1983	AL	microdistrict 4	31	200	ceramics	206.1	5	
	1992	AL	microdistrict 4	35	150	ceramics	21.4	9	
	1988	AL	microdistrict 5	5	150	ceramics	102.8	6	
	1988	AL	microdistrict 5	13	150	ceramics	75.1	4	
	1989	AL	microdistrict 5	17	200	ceramics	106.8	4	
	1989	AL	microdistrict 5	17	150	ceramics	78	2	
	1969	AL	"Alatau" microdistrict	1	200	ceramics	74	5	
	1969	AL	"Alatau" microdistrict	4	150	ceramics	92	6	
	1969	AL	"Alatau" microdistrict	6,8,10	150	ceramics	310.1	15	
	1981	AL	"Molodezhny" microdistrict	5	200	ceramics	135	6	
	1980	AL	"Molodezhny" microdistrict	7	200	ceramics	266.35	17	houses 7,7-a,8,9,9-a
	1980	AL	"Molodezhny" microdistrict	10	150	ceramics	100	5	
	1980	AL	"Molodezhny" microdistrict	13	150	ceramics	88	5	
	1983	AL	"Molodezhny" microdistrict	27	150	ceramics	69.5	4	
	1983	AL	"Molodezhny" microdistrict	33	150	ceramics	48.3	4	
	1981	AL	"Molodezhny" microdistrict	34	150	ceramics	163	7	
	1982	AL	"Molodezhny" microdistrict	35	200	ceramics	80	3	
	1983	AL	"Molodezhny" microdistrict	36	150	ceramics	108	5	
	1982	AL	"Molodezhny" microdistrict	37	150	ceramics	137.4	6	
	1985	AL	"Molodezhny" microdistrict	38	200	ceramics	42.2	1	
	1985	AL	"Molodezhny" microdistrict	42	150	ceramics	101.6	4	
	1983	AL	"Molodezhny" microdistrict	43	150	ceramics	76.5	4	
	1983	AL	"Molodezhny" microdistrict	43	200	ceramics	68.2	1	

No.23	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1984	AL	"Molodezhny" microdistrict	44	150	ceramics	112.4	6	
	1988	AL	Mozhajsky St	5-a	150	ceramics	200	12	
	1955	SA	Monin St	15	150	ceramics	123.6	7	
	1957	SA	Monin St	17	200	ceramics	302.8	20	Monin St 17,19,21
	1957	SA	Moskovskaya St	50	150	ceramics	90	9	
	1957	SA	Moskovskaya St	50	300	ceramics	141.2	2	
	1964	SA	Moskovskaya St	62.54	150	ceramics	202.5	2	
	1964	SA	Moskovskaya St	62.54	200	ceramics	177.2	1	
	1967	SA	Moskovskaya St	82	200	ceramics	63.9	5	
	1983	AL	Naberezhnaya St	46	150	ceramics	165.3	9	
	1969	SA	Pressure sewer collector		250	ceramics	1200	2	from wastewater pump station 28 "Avtomatika" village
	1969	SA	Omarov St	53	150	ceramics	134.3	6	
	1981	AL	Cancer hospital		200	ceramics	66.5	10	
	1970	AL	Otyrar St	69	150	ceramics	5.8	1	
	1985	SA	Pervomajskaya St	8	150	ceramics	85	5	
	1961	SA	Pionerskaya St	13	150	ceramics	42.4	3	
	1982	SA	Pionerskaya St	31	200	ceramics	67	4	
	1980	SA	Pobeda	12	150	ceramics	42.5	3	
	1981	SA	Pobeda	65/3	150	ceramics	81.6		
	1981	SA	Pobeda	65/3	300	ceramics	52.4		
	1963	SA	Pobeda		200	ceramics	877	20	from the corner of Moskovskaya to "Malaya" pump station
	1982	AL	Polevaya	2	150	ceramics	51.1	3	
	1980	AL	Polevaya		150	ceramics	159	12	
	1971	AL	Polevaya		150	ceramics	96	4	to KaragandaGIIZ
	1972	SA	Potanin St	6	150	ceramics	32.4	7	
	1976	SA	Potanin St	20-a	150	ceramics	90.5		
	1965	AL	Promyshlenny		150	ceramics	1888.9	62	
	1982	SA	Pushkin St	171	200	ceramics	23	2	
	1982	SA	Pushkin St	171-a	200	ceramics	48	1	
	1987	SA	Pushkin St	97/1	200	ceramics	92.4	3	
	1987	SA	Pushkin St	97/1	150	ceramics	46.8	2	
	1978	AL	Respubliki	4	200	ceramics	97.3		
	1978	AL	Respubliki	4	150	ceramics	6.4		
	1983	AL	Respubliki	6	150	ceramics	65.8	5	
	1977	AL	Respubliki	14	150	ceramics	60.9	4	
	1977	AL	Respubliki	14	200	ceramics	86.3	5	
	1979	SA	Respubliki	19	150	ceramics	34		
	1979	AL	Respubliki	16/1.	150	ceramics	115	5	
	1979	AL	Respubliki	16/1.	150	ceramics	16	1	
	1980	SA	Respubliki	3/1.	150	ceramics	97.5	8	
	1982	AL	Respubliki	4-b	150	ceramics	42.5	2	
	1979	SA	Respubliki	5/1.	200	ceramics	34.2		
	1976	AL	Rechnaya	40-a	150	ceramics	100		
	1974	SA	Sejfullin	32	150	ceramics	62		

No.24	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1989	AL	Sembinov	61	250	ceramics	256.5	5	
	1968	SA	Networks of block 72		150	ceramics	852.1	42	
	1988	AL	Smakotin	94	150	ceramics	49		
	1969	AL	Smakotin	107	150	ceramics	279	8	
	1973	AL	Sorokovaya		400	ceramics	1520	38	from Sorokovaya station to "Al-Farabi" microdistrict
	1973	AL	Sorokovaya		600	ceramics	2076.6	57	from Sorokovaya station to "Al-Farabi" microdistrict
	1984	AL	Stroitelej St	1/1.	200	ceramics	219.4	7	
	1986	AL	Stroitelnaya St	1	150	ceramics	308.9	10	
	1986	AL	Stroitelnaya St	1	200	ceramics	147	10	
	1984	AL	Tekstilshik	1	150	ceramics	48.1	1	
	1984	AL	Tekstilshik	1	200	ceramics	84.9	2	
	1978	AL	Telman	83	150	ceramics	105	11	
	1981	AL	Telman	83	200	ceramics	45		
	1967	SA	Shvernik St	1	150	ceramics	123.8	5	
	1966	SA	school No 23		200	ceramics	366.5	12	Kurskaya 17
	1969	AL	school No 28		150	ceramics	191.5	6	microdistrict 1
	1969	AL	school No 28		200	ceramics	109.9	4	microdistrict 1
	1976	AL	school No 31		200	ceramics	313.2	12	Kenesary 139
	1970	AL	Zagorodnyy samotechny c-r		1500	ferroconcrete	6300		second sewerage zone
	1965	SA	Zagorodnyy samotechny c-r		1500	ferroconcrete	2221		from the "Avarijnaya" manhole to the pump station 6
	1970	AL	Sewer collector No 1		1000	ferroconcrete	1430		along Gastello Per. Asfaltovy to collector 10
	1970	AL	Sewer collector No 10		1000	ferroconcrete	600		from KK-67 to pump station No 7334
	1970	AL	Sewer collector No 10		1000	ferroconcrete	590		from PK-0 to PK 20+048
	1973	AL	Sewer collector No 10		1000	ferroconcrete	1510		from PK-0 to PK -20+40.6
	1971	AL	Sewer collector No 11		800	ferroconcrete	740		from the engineering institute
	1971	AL	Sewer collector No 11		800	ferroconcrete	800		from the engineering institute
	1973	AL	Sewer collector No 11		700	ferroconcrete	300		from PK-59 to PK-24 from the engineering institute
	1970	AL	Sewer collector No 12		1000	ferroconcrete	855.5	67	from KK-1 to KK 67
	1973	AL	Sewer collector No 12		700	ferroconcrete	2695		
	1964	SA	Sewer collector No 2	700	800	ferroconcrete	3176		Imanov, Bukejhan, Krasnoarmejskaya, Delegatskaya, Kulturnaya
	1975	SA	Sewer collector No 5		600	ferroconcrete	1474		from Delegatskaya to Rabochaya (from the hoisting unit)
	1974	SA	Sewer collector No 6		800	ferroconcrete	311		along Pervomajskaya to Constitution St
	1974	SA	Sewer collector No 6		800	ferroconcrete	430		from Constitution by Rabochaya, Novaya, Orenbur to PS No 3
	1974	SA	Sewer collector No 6		1000	ferroconcrete	1555		from Constitution by Rabochaya, Novaya, Orenbur to PS No 4
	1988	AL	Lomonosov St	56	200	ferroconcrete	62.2	4	
	1998	SA	Pressure sewer collector		800	ferroconcrete	1620		from pump station 1-A
	1999	SA	Pressure sewer collector		800	ferroconcrete	660		syphon transition from wastwater pump station 6
	1974	SA	Pushkin St		500	ferroconcrete	366		
	1974	SA	Pushkin St		300	ferroconcrete	234		
	1987	AL	Abylai-Khan	3	150	polyethylene	113	7	
	1998	SA	Pressure sewer collector		100	polyethylene	827	7	sports complex on the left riverbank
	1999	SA	Pressure sewer collector		150	polyethylene	1300	3	from wastwater pump station of the Reception House
	1990	SA	Abai St.	1	150	steel	66.9	5	
	1990	SA	Abai St.	1	200	steel	189.7	8	

No.25	Year of construction	District	Location	House No.	Diameter	Pipe material	Pipe length	Manhole number	Description
	1969	SA	Avtomatika		100	steel	1262.5	42	settlement area sewerage
	1994	AL	Engineering Institute (AISI)		300	steel	100	3	
	1965	AL	Alluvij		100	steel	73.2		area-internal networks
	1981	SA	Pressure sewer collector		600	steel	600		from pump station 1 to the sewer of zone1
	1970	SA	Pressure sewer collector	0	600	steel	3200	12	pressure collector from pump station 6 to sewer of zone 1
	1964	AL	Pressure sewer collector	0	300	steel	400	3	pressure sewer from pump st 214 by cemetery, by Zhukovsky
	1965	SA	Pressure sewer collector		400	steel	1670		from pump station 1 to "Avarijnaya" manhole
	1964	SA	Pressure sewer collector		400	steel	2285		from pump station 2 to "Avarijnaya" manhole
	1965	SA	Pressure sewer collector		400	steel	1985		from pump station 1 to "Avarijnaya" manhole
	1965	SA	Pressure sewer collector		400	steel	2512		from pump station 9 to "Avarijnaya" manhole
	1964	SA	Pressure sewer collector		400	steel	2512		from pump station 9 to "Avarijnaya" manhole
	1970	AL	Pressure sewer collector		600	steel	2900		from pump station 7 - 2nd sewerage zone with syphon
	1965	AL	Pressure sewer collector		200	steel	1200		pump station 214 to Imanov St. (sewer 2)
	1963	SA	Pressure sewer collector		200	steel	118		from pump station VRZ to sewer 6
	1963	SA	Pressure sewer collector		350	steel	1100		from pump station VRZ to sewer 6
	1974	SA	Pressure sewer collector		400	steel	147		two lines from pump station 3 to suburban sewer of zone 1
	1981	SA	Pressure sewer collector		700	steel	1460		from pump station 1 to the sewer of zone1
	1993	SA	Pressure sewer collector		500	steel	1100		from pump station 3 to pump station 6
	1984	SA	Pressure sewer collector		100	steel	1051.5		from pump station (in Skladskaya St) to ceramic plant sewer
	1986	SA	Pressure sewer collector		150	steel	1036	2	from "Kazahtranstehmontazh" pump station to the manhole
	1998	SA	Pressure sewer collector		700	steel	102		from pump station 1-A
	1999	AL	Pressure sewer collector		325	steel	1380		from wastewater pump station 30 "Al-Farabi" microdistrict
	1999	AL	Pressure sewer collector		500	steel	370	5	from wastewater pump station 30 "Al-Farabi" microdistrict
	1999	SA	Pressure sewer collector		200	steel	384	3	from wastwater pump station of Ethnopark - two lines
	1999	SA	Pressure sewer collector		900	steel	390	2	syphon transition from wastwater pump station 6
	1966	SA	Pressure sewer collector		400	steel	2670		from pump station 2 to "Avarijnaya" manhole
	1970	AL	Imambayeva				727		
	1997	AL	microdistrict 2-a	1					inlets to the existing network
	1993	AL	microdistrict 3	11					inlets to the existing network
	1998	AL	Respubliki	22					inlets to the existing net
	1984	AL	Respubliki	4/2.				2	inlet to the existing network with two manholes installment
	1989	AL	Sembinov	48/3				1	
								5279	

TOTAL LENGTH	**226578.42**
asbestos-cement	45461.51
cast-iron	85380.96
ceramics	32574.45
ferroconcrete	27929.7
polyethylene	2240
steel	32264.8
other	727

Appendix B-9

Site Confirmation of Siphon Structure and Culverts at the Taldy Kol Reservoir

APPENDIX B-9 Site Confirmation of Siphon Structure of the Taldy kol Reservoir and Culverts under the Road

The Whole view

Figure B.9.1

2siphons on the dyke

φ1200×2

Figure B.9.2

2siphons and air valves

Air Valves

Figure B.9.3

2siphons and air valves

In winterseason

Figure B.9.4

Flap valve

Figure B.9.5

2siphons into Taldykol

Figure B.9.6

2culvert under the road

ϕ1200×2

Figure B.9.7

7culvert under the road

ϕ800×7

Figure B.9.8

Appendix B-10

Examination of Sludge Dewatering Process

APPENDIX B-10 Examination of Sludge Dewatering Process

B.10.1 Object

1) To clarify the most suitable dewatering unit for the STP
2) To compare the advantage and disadvantage between Screw Press and Filter Press

B.10.2 Condition of examination

1) Sludge volume is the same with main report. Characteristic of the sludge is digested sludge.

・Dry Solids=16.452 t/day ・Sludge Volume=548 m3/day ・Sludge Concentration=3.0%

2) Operation time is as follows:

(1) Screw Press 24 hours/day, 7days/week (Continuous Operation)

(2) Filter Press 8hours/day, 6days/week (Consecutive Batch Operation during the working hours)

3) The specification and numbers of the dewatering machine is as follows:

(1) Screw Press 450kg/hr/unit, 3 units (100%) including 1 reserve

(2) Filter Press 150m2/unit, 12 units(400%) including 2 reserves

B.10.3 Examination

Items for this examination are advantage, disadvantage and construction cost as shown in Table B.10.1. Advantage of Filter Press is limited only in water content of sludge that is 70%. On the other hand, it has so much problem of size of the facility (200%), numbers of the equipment (400%), numbers of the operation personnel (600%), and construction cost (170%). Filter press is not recommendable from the viewpoint of technical, maintenance and cost.

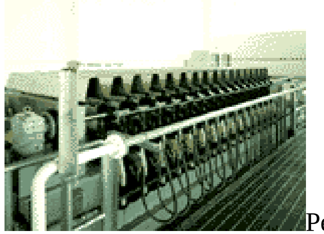
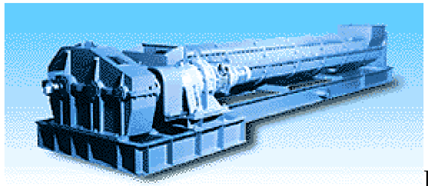
Furthermore, the height of the building is 3m higher than that of screw press, maintenance points and break down frequency are much more and odour problem is bigger.

Screw press type is using motor to rotate the screw inside the casing, however the rotation speed is only 1~2 rpm that never cause vibration and noise. The capacity of the motor is very low (3.7kw).

B.10.1 Conclusion

Screw press type is strongly recommended.

Table B-10-1 Comparison of Filter Press and Screw Press

Item Type	Recessed-plate Filter Press	Screw Press
Schematic Illustration	 Personnel: 6 for 12 equipment (400%) ×	 Personnel: 1 for 3 equipment (100%) ○
Outline of the method	The sludge is fed between filter plates through cloth filters and a filter press reduces the water content by pressing the filter plates.	The sludge is conveyed by a rotating screw inside and dewatered while passing through an opening gradually reduced between body and screw.
Advantages	1. Lowest water content of cake (70%) ○	1. Low construction cost (100%) 2. Low maintenance cost 3. Full automated continuous operation 4. No odour emission 5. Easy maintenance 6. High safety 7. Low noise 8. Compact 9. Minimum personnel required 10. Low water content of cake (75~80%) ◎
Disadvantages	1. High construction cost (170%) 2. High maintenance cost (Increased personnel) 3. No continuous operation (Batch operation) 4. Odour emission from sludge remove stage 5. Bigger size of the building (200%) 6. More breakdown frequency and maintenance points ×	1. Higher water content than the FP(+5~10% up) △
Construction Cost	Building 9,200,000	Building 5,300,000
	Equipment 10,300,000	Equipment 6,000,000
	Total 19,500,000(173%) ×	Total 11,300,000(100%) ◎
Final Evaluation	NOT RECOMMENDED ×	RECOMMENDED ◎