IRRIGATION NETWORK DESIGN CRITERIA

DUBAI DESIGN MANUAL

JANUARY 1, 2024

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General Concept of The Irrigation Design Shall Be as Follows:

Water requirement for the plantation shall be as follows:

Plant Type	Water requirement
Palm trees	120-150 lit/day/plant
Ornamental trees	60-80 lit/day/plant
Shrubs & hedges	15 lit/day/plant
Shrubs (Mass Planting)	18 lit/day/Sq.m
Ground covers and succulents	12 lit/day/Sq.m
Seasonal Flowers & creepers	12 lit/day/Sq.m
Lawn	10 lit/day/Sq.m

Maximum Daily Operation timing for Irrigation system to be as follows:

Plant Type	Maximum Daily Operation
Palm trees	20 minutes
Ornamental Trees, Shrubs, Hedges	2 Hour
Ground covers, Creepers, Succulents	1 Hour
Seasonal Flowers	36 minute
Lawn Area (Popup Sprayers)	14 minute
Lawn Area (Popup Sprinklers)	1 Hour

- Daily Operation time:
  - for the proposed irrigation system **shall not exceed 10 hours**.
- For pipe sizing mean velocity of flow in Main or lateral pipes:
  - shall **not exceed 1.5 m/sec**.
  - The total head loss in Main line **not to exceed 4.0 meter**.
- Contractor to provide ring Main with suitable no. of isolation valves to the approval of the Engineer
- Total Friction loss from the far end of the lateral up to solenoid valve shall not exceed 2.5 meter. **The total head loss in solenoid valve assembly not to exceed 3.0 meter**.

- The total head loss in **Pump/filtration complex not to exceed 5.0 meter**. Pump Station/ Filtration Station Manifolds shall be of Epoxy coated steel schedule 80.
- All crossings across major roads/dual carriageways and U-turns shall be either through ducts or no dig method.

Dubai Irrigation Supply System:

Transmission Pipelines:

- Transmission pipelines transfer water from production sources (wastewater treatment plants) to areas of concentrated demand or large storage facilities, and have limited direct consumer connections.
- Transmission pipelines are distinct from distribution pipelines in size (**typically transmission pipelines are larger than 500mm in diameter**), arrangement, and operation. Transmission pipelines should be designed such that the bulk transfer of water to each district or demand cluster can be independently controlled.

Distribution Pipelines:

- A distribution pipeline is defined as a pipeline **between 150mm diameter up to 500mm diameter**.
- Pipelines that are smaller than 150mm in diameter are typically landscaping feeder lines or are individual consumer connections. These pipelines run over short distances and can be categorized as service laterals.

Irrigation Water Demand:

Irrigation Rates:

Peak Daily Water Demand for different Vegetation:

Plant Type	Average Spacing	Water requirement
Palm trees	15 m	150 litres/day/plant
Ornamental trees	15 m	100 litres/day/plant
Shrubs and Hedges	-	15 litres/m^2/day
Ground Cover, Flowers	-	10 litres/m^2/day
Grass	-	15 litres/m^2/day

Irrigation Demand:

Roads and Junctions Landscaping:

- In the absence of specific vegetation type information and subject to DM approval, **an irrigation demand of 12.6 litres/m^2/day can be used** for roads and junctions considering mixed vegetation type.
- Based on these factors, one of the following landscaping regimes shall be selected for roads and junctions, which will then be used to estimate the irrigation water demand:
  - **Maximum water demand** - full (100% landscape area covered) planting with maximum use of the available landscape corridor/ junction.
  - **Average water demand** – moderate (50-75% landscape area covered) planting and use of the landscape corridor/ junction.
  - **Minimum water demand** - minimum (up to 50% landscape area covered) planting with minimum occupancy of the landscape corridor/ junction.

Parks:

- In the absence of specific vegetation type information and subject to DM approval, **an irrigation demand of 12.6 liters/m^2/day can be used** for park landscaping considering mixed vegetation type.

Government Institution Landscaping:

- Government institution includes:
  - Government establishments,
  - Government schools,
  - Sports clubs,
  - Mosques,
  - Horse stable etc.
  - In addition the Rulers Family palaces are also considered under this category.
- In the absence of specific vegetation type information and subject to DM approval, **an irrigation demand of 15 liters/m^2/day can be used** considering mixed vegetation type.

Private Consumers and Farms:

- In the absence of relevant data from private developers and for future developments, irrigation water demand can be calculated based on following criteria:
  - Landscape area = 15% of development plot area
  - Irrigation water demand = 15 liters/m^2/day

Design of Irrigation System:

In general Dubai Irrigation System is designed as pressurized ring mains of transmission and distribution pipelines having **two pumped supply sources (i.e. Jabel Ali STP and Al Awir STP TSE pumping stations)** without intermediate storage and/ or booster pumping stations. There are some localized areas of low-pressure zones where booster pumping stations are installed to meet the pressure requirement.

Pipe sizing

- The head loss can be determined based on the applied friction head-loss model (**Hazen-Williams etc.**).
- Design Guidelines for Pipelines:

Parameter	Limits
Velocity	Lowest maximum = 0.50 m/s
	Maximum = 3.00 m/s
Friction unit head-loss	3 - 10 m/km for pipe diameter < 300 mm dia.
	3 m/km for pipe diameter > 300 mm dia.

Hazen-Williams Equation

The Hazen Williams formula will be used in the hydraulic design. In SI units, the flow velocity v is given by:

$$v = 0.849 * C * R^{0.63} * S^{0.54}$$

and

$$S = \frac{H_L}{L}$$

Where:

v = flow velocity (m/s) C = coefficient of roughness (dimensionless),

R = hydraulic radius (m) S = slope of energy grade line (m/m)

H_L = hydraulic loss (m) L = Total length of the main (m)

In terms of the flow rate Q, can be expressed as below in SI units:

$$Q = 0.278 * C * D^{2.63} * S^{0.54}$$

Where:

Q = flow rate (m^3/s) D = Pipe diameter (m)

Recommended coefficient of roughness (C) valve:

Pipe material	C value
uPVC/ AC	130
GRP/ PE	140

Working Pressure

- The **minimum working pressure** available at any connection point in the irrigation network should not be less than **3.5 bars** considering downstream valves, strainer, piping, and irrigation devices (i.e. sprinkler etc.) head losses.
- The **maximum pressure** in the transmission and distribution network shall be limited to **7.0 bars**.

Pipe Material

Pipe Size	Pipe Material
Up to 315 mm	uPVC/ PE/ GRP
> 315 mm	GRP

Pipes Slope and Minimum Depth of Cover

- The **minimum pipe gradient** should be **3-5 mm/m**.
- Cover above the pipe:
  - The **minimum depth of cover** is **1.2m**.
  - If circumstances require installation of pipes with cover of less than 1.2m or where pipes are crossing roads, **a concrete slab or a concrete surround is required**.

Utility crossings

- **A minimum vertical clearance of 300 mm** should be maintained between irrigation pipeline and other services at crossings.
- In case of irrigation pipeline crossing the potable water pipeline, **potable pipeline should always be kept on top of irrigation line**.

TSE Storage Tanks/ Reservoirs

In order to meet the contingencies as well as hourly and daily variations the recommended volume of storage should be **0.75 to 1.0 times of average daily demand**.

Irrigation Pumping Stations

References: Link