

## PART I

### 1.0 WATER MAINS

#### 1.01 Water Distribution System Basis of Design

- a) A water distribution system basis of design shall be submitted with construction plans for approval by the Authority's Engineer. The basis of design shall include an area map indicating the areas and zoning district for each area to be served, including any off-site areas. The basis of design will reflect proposed developmental phasing.
- b) In general, water distribution systems shall be designed in accordance with the *Recommended Standards for Water Works* by the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers ("Ten State Standards").
- c) Residential developments shall consider a design population of at least 2.6 persons per dwelling unit, with an annual average daily water demand of 100 gallons per capita per day (gpcd).

In non-residential developments, flow estimates shall be based on water use records from similar facilities, as may be provided by petitioner and approved by the Authority's Engineer, or an estimate of proposed water demand in accordance with the residential equivalent user (REU) schedule.

- d) For the purpose of network analysis and water main design, maximum daily demands will be computed as no less than twice the average daily demand. Peak hourly flows will be computed as no less than four times the average daily demand.
- e) Water main shall be designed to provide fire protection (rates and durations) based on the recommendations of the Insurance Services Office (ISO) for projected land use and building types.
- f) Water main shall be sized to meet peak hourly demands and to meet maximum daily demands plus fire flow. The petitioner shall provide a network analysis based on a model acceptable to the Authority Engineer. The Authority Engineer shall be consulted during development of the model to determine appropriate assumptions regarding water supply, pipe roughness characteristics, and the appropriate scenarios for modeling.
- g) Distribution mains shall be a minimum of 8-inch in diameter. Transmission mains of 12-inch diameter or greater may be required if future area development plans dictate such sizing.

1.02 Water Main Layout

- a) All sites developing an on-site water main network shall be serviced by two sources of water or shall be planned for service from an adjacent site by extending the water main to one or more property lines.
- b) All water mains shall be carried to the limits of the development for future extension by neighboring properties. Water main in excess of 1,600 lineal feet between interconnections may be required to be oversized at the developer's expense. The Township and/or Authority may also require, at its expense, that any water main in the system be oversized.
- c) Dead-end mains may not exceed 600 feet in a single-family, residential neighborhood, nor 500 feet in a multiple-family, residential neighborhood.
- d) Hydrants shall be a maximum of 500 feet on center along the water main on a dedicated street or approved fire lane. Additional hydrants may be required at locations selected by the Fire Marshal. A reduction in this standard must be approved by the Authority Engineer or Utility Director.
- e) Hydrant assemblies less than 25-feet from the main may be connected to the water main with 6-inch pipe. Hydrant assemblies greater than 25-feet from the main shall be connected with 8-inch pipe. This 8-inch pipe may be reduced down to a 6-inch pipe within 25-feet from the hydrant.
- f) Buildings shall be covered within a 250-foot radius of a hydrant and within no more than 400 feet of hose laid to any part of the structure. No hydrant shall be placed within 20 feet of a building/structure. In single-family, residential areas, the hydrant coverage may be increased to 350-foot radius with the approval of the Fire Marshal and Authority Engineer. The radii of coverage may be reduced in industrial areas at the discretion of the Fire Marshal.
- g) Fire hydrants shall be placed in such a way that no more than two hydrants have to put out of service when isolating a section of water main.
- h) Valves shall be placed at each junction of water main, and in such a way that no more than three valves have to be closed to isolate a branch of water main. Water mains 16-inch and greater shall use butterfly valves, rather than gate valves. Butterfly valves shall be placed in gate wells. Gate valves located outside of paved areas shall be installed with concrete aprons. The

maximum distance between valves shall be 1000 feet. This distance can be exceeded for transmission lines with the approval of the Utility Director and/or Engineer.

- i) All curb stops shall be brought up to final grade. Curb stops shall not be located within any driveways, walkways or cement sidewalks. Curb stops shall be placed no closer than 20 feet from a building footing.
- j) All unnecessary utility crossings shall be avoided. A minimum 10-foot horizontal and 18-inch vertical clearance shall be maintained from sanitary and storm sewers. Water main shall be placed no closer than 20 feet from any building footing.
- k) Water main shall be placed in the R.O.W. and outside the roadway surface where possible, in general accordance with approved typical street cross-sections (see Details). Water main may be placed in easements if approved by the Authority Engineer. Where placement in easements is approved, a minimum 25-foot-wide permanent easement is required. The easement must be maintained as accessible to Authority personnel and equipment for maintenance and repair.
- l) All water main 8-inches and greater shall be profiled in the construction drawings. Top of pipe elevations, rim elevations, final grade elevations, utility crossings, stationing, and backfill requirements shall be shown in the profile view.
- m) HDPE pipe may be installed by the horizontal boring method for special applications when approved by the Authority Engineer or Utility Director. Special applications may include:
  - Surface water crossings
  - Highway crossings
  - Wetlands
  - Unstable soil areas
  - Areas that would require high restoration costs due to conventional construction
- n) A valve shall be provided on each side of all critical crossings, such as surface water crossings. In addition, a valve manhole with corporation stops on each side of the valve shall be installed for purposes of future chlorination, sampling, and leak testing.

- o) Where the use of HDPE pipe is used in conjunction with ductile iron pipe, the inside diameter of the HDPE pipe shall be equal or greater than the inside diameter of the ductile iron pipe. HDPE pipe shall be manufactured from high density PE 3408 polyethylene resin, having a dimension ratio (DR) of 11 or less. The DR is calculated as the outside diameter of the pipe divided by the minimum wall thickness. The Construction Drawings shall note if the HDPE pipe will be ductile iron pipe sizes (DIPS) or iron pipe sizes (IPS) and shall specify the dimension ratio (DR) rating.
- p) Tracer wire shall be included on all water main distribution lines. Refer to Section 15070, Pressure Process Piping for details.
- q) Tracing wire systems shall terminate in Rhino TriView Flex™ Tracing Wire Stations. Terminals shall be external and blue for water main systems. Terminals should also be located at valves, if possible.
- r) In projects where there are multiple units within one building, such as a site condominium, one (1) service lead shall be provided to the building. Once the water service lead is within the building, the lead may be split to service individual units. Each unit must be metered and accessibility by the Authority to the meter(s) must be maintained at all times.

#### 1.03 Depth of Water Main

- a) Water main shall be buried with a minimum of 5.5-foot cover over the pipe, and maximum cover of 8.5-foot cover. Where water main is installed in undeveloped areas, or areas subject to future grading, probable finished grades will be considered.
- b) If water main is constructed in areas where pavement will be constructed in the future, granular backfill shall be used.

#### 1.04 Joint Restraint

- a) All water main or process piping shall be designed with mechanical restraint of joints in accordance with Section 15070 of the Standard Technical Specifications and Details.
- b) Concrete thrust blocks are not permissible.

#### 1.05 Meters

- a) All buildings using Authority water shall be metered. In general, water meters shall be placed in basements, utility rooms, boilers, or mechanical rooms. Water meters must be in a heated

area that is accessible at all times. When necessary, meters may be placed in a well-drained meter pit upon approval of an authorized Authority Representative.

- b) Fire lines (4-inch diameter or greater) may bypass the meter, provided the fire system is alarmed in accordance with BOCA and DFPA latest editions.
- c) The Livingston County Building Department will require that calculations for limited area sprinkler systems be presented as a hydraulically calculated model rather than pipe schedule when the fire flow passes through the meter.

## **2.0 SANITARY SEWERS**

### **2.01 Sanitary Sewer Basis of Design**

- a) A sanitary sewer basis of design shall be submitted with construction plans for approval by the Authority Engineer. The basis of design shall include an area map indicating the areas and zoning district for each area to be served, including any off-site areas. The basis of design will reflect proposed developmental phasing.
- b) Residential developments shall consider a design population of at least 2.6 persons per dwelling unit, with wastewater generation of 100 gallons per capita per day (gpcd).

In non-residential developments, flow estimates shall be based on water use records from similar facilities, as may be provided by petitioner and approved by the Authority Engineer, or an estimate of proposed wastewater generation in accordance with REU Schedule. Flow estimates shall be expressed in terms of residential equivalent users (260 gpd per REU).

- c) Sanitary sewers shall be designed to carry peak flow at their 0.90 capacity line while maintaining scouring velocities at minimum flows.
- d) All sanitary sewer pipe shall be a minimum of 8 inches in diameter.

- e) Minimum design velocity shall be 2 feet/sec for sewers 42 inches and less in diameter and maximum design velocity shall be 10 feet/sec. The allowable pipe slopes are shown in the following table:

| Pipe Diameter<br>(Inches) | Minimum Slope<br>(Feet per 100 Feet) | Maximum Slope<br>(Feet per 100 Feet) |
|---------------------------|--------------------------------------|--------------------------------------|
| 8                         | 0.40                                 | 10.00                                |
| 10                        | 0.28                                 | 7.00                                 |
| 12                        | 0.22                                 | 5.30                                 |
| 15                        | 0.15                                 | 3.90                                 |
| 18                        | 0.12                                 | 2.90                                 |
| 21                        | 0.10                                 | 2.32                                 |
| 24                        | 0.080                                | 1.92                                 |
| 27                        | 0.067                                | 1.64                                 |
| 30                        | 0.058                                | 1.44                                 |
| 36                        | 0.046                                | 1.12                                 |
| 42                        | 0.037                                | 0.92                                 |

- f) Proposals for sanitary sewage pumping stations are to be discussed in detail with the Authority Engineer and the Authority prior to formalization of plans. A preliminary basis of design shall be submitted for review and approval prior to submittal of construction plans.
- g) All sanitary sewer testing shall be in compliance with technical specification section 02720, Sewers, and section 15070, Pressure Process Piping.

## 2.02 Sewer Location

- a) Sanitary sewers shall be located in general conformance with the approved typical street cross-sections (see Details section). Sewer shall be placed in public street R.O.W. whenever practicable. Placement in easements will be permitted upon approvals of Authority Engineer *and* the Township.
- b) Where sewer placement in easements is approved, a permanent easement will be required, the width of which will be determined by the Authority Engineer. In all cases, the sewer easement

shall be maintained as accessible to Authority personnel and equipment for maintenance and repairs. Easement size shall be determined by the following table:

| <b>BURIAL DEPTH<br/>(ft)</b> | <b>EASEMENT WIDTH<br/>(ft)</b> |
|------------------------------|--------------------------------|
| 5 – 7                        | 20                             |
| 7.1 – 12                     | 30                             |
| 12.1 – 17                    | 40                             |
| > 17.1                       | 50                             |

#### 2.03 Depth of Sewers

- a) In general, sanitary sewers shall be installed sufficiently deep to receive wastewater from basements and to prevent freezing. In no case shall sewer be placed with less than four feet of cover to the top of the pipe. Where sewer is placed in undeveloped areas or areas subject to future grading, probable future grades will be considered.
- b) Where future development plans call for construction of pavement along or across the sanitary sewer route, granular backfill will be used.
- c) All sanitary sewer 8-inches and greater shall be profiled in the construction drawings. Top of pipe elevations, rim elevations, final grade elevations, utility crossings, stationing, and backfill requirements shall be shown in the profile view.

#### 2.04 Manholes

- a) Manholes shall generally be placed at intervals not to exceed 400 feet; at every change of grade, direction, and pipe size; and at each junction of sewers.
- b) Exterior drop manhole connections shall be used whenever a sewer enters a manhole at an elevation more than 18 inches above the manhole invert. Interior drop manhole connections may be used as an alternative if approved by the Authority Engineer and/or Utility Director.
- c) When pipe sizes change, the larger sewer shall be dropped so that the 0.8 depth line or the pipes match.
- d) An allowance of at least 0.10 foot shall be made between all inlet and outlet pipes within manholes with a horizontal change in direction of the sewer.

- h) In industrial developments, and as required by the Authority Engineer, a sampling manhole shall be constructed along the on-site sewer. The sampling manhole shall be located along a straight run of pipe and shall have a vertical drop of six inches from inlet to outlet along a poured flow channel.
- i) All manholes and cleanouts shall be brought up to final grade prior to the authority accepting operational responsibility.

#### 2.05 Service Connections

- a) Sanitary sewer services shall be connected to the sewer through wye fittings. Connections of manholes require approval of the Authority Engineer.
- b) Food service facilities and other buildings as required by the Authority and their Engineer shall be serviced by grease traps. Traps shall be located outside of the building below ground and of sufficient size to provide 30-minute detention of the peak wastewater flow. The minimum size is 1,000 gallons and maximum size is 2,000 gallons. Each trap shall contain an interior baffle to prevent grease from reaching the public water system. Grease interceptors shall be constructed of impervious material capable of withstanding abrupt changes in temperature. They shall be of substantial construction, watertight, and equipped with removable covers that are gastight and watertight. The interceptor must be easily accessible for pumping and inspection. A cleanout should be provided on the discharge line downstream of the grease interceptor. The grease interceptor shall be connected to all food service drains including kitchen floor drains, mop sinks, dish washers, and food prep sinks. All non-food service wastewater drains shall be separated from the grease interceptor and connect to the public sewer lead down stream of the grease interceptor. A low flow, minimum grease producing food service facility may utilize interior “under sink” grease traps if they are protective of all food service drains as listed above and approved by the Authority Engineer and/or Director.
- c) No footing drains or other storm or groundwater drainage facilities shall be connected to sanitary sewer.
- d) Sanitary sewer laterals shall have a minimum diameter of 6-inches.
- e) Cleanouts should be provided at all bends and for every 100 feet of a sanitary service lateral.

#### 2.06 Submersible Wastewater Pump Stations



Submersible wastewater pump stations shall be designed to pump the flow generated from the proposed development to which it is located. The flow expected at the pump station shall be shown in a basis of design as determined in Section 2.01 (Sanitary Sewer Basis of Design). The basis of design shall be submitted with the construction drawings for review by the Authority Engineer and shall include but not be limited to the following information:

- a) Service area for the proposed pump station.
- b) Design population, design average flow (gpm), design peak flow (gpm). The design peak flow shall be determined per the requirements stated in the "Ten State Standards."
- c) Design firm pumping capacity. The firm pumping capacity shall be equal to the pumping capacity of the pump station with the largest pump out of service.
- d) The primary pump control method shall be level transducer. Float switches shall be used as a back-up system.
- e) Maximum and minimum system curves. If the force main is cement-lined ductile iron pipe, the maximum system curve shall use a 'c' value of 120, and the minimum system curve shall use a 'c' value of 140. If PVC or HDPE force main is used, the 'c' values shall be 130 and 160, respectively.
- f) Wet wells shall be sized such that the operational volume allows a maximum filling time during average flow of not greater than 30 minutes. The minimum operational volume of the wet well shall be based on the maximum number of pump cycles (starts/stops) allowed by the pump or motor manufacturer per hour. The maximum number of pump cycles will occur when the influent sanitary flow is exactly half of the pumping capacity; therefore, the minimum wet well volume may be calculated by the following equation:

$$V_{\min} = (Q_p \times T) / 4$$

Where,

$V_{\min}$  = Minimum Wet Well Volume (gallons)

$Q_p$  = Pump Capacity (gpm)

$T$  = Cycle Time (min) = 60 minutes/maximum # of pump starts

- g) To allow Operators time to respond to emergencies, pumping station wet wells shall be of sufficient size to permit a minimum of two (2) hours of storage, at average design flow, above

the high water alarm elevation prior to any basement being flooded or wastewater overflowing from any structure.

- h) All pump stations with motors of 10 HP or greater or serving 25-units or more shall be provided with a stand-by generator (diesel or natural gas) housed in a weather and vandal resistant enclosure or masonry building, designed to start and operate sufficient pumps to pump the station design capacity in the event of utility power failure. Power shall transfer to the generator by means of an Automatic Transfer Switch. Each pump station shall also be provided with a manual transfer switch and a generator receptacle to enable a portable generator to be substituted for the permanently installed generator in the event of problems occurring to the generator. Generators shall be manufactured by Kohler, Cummins, Caterpillar or Authority approved alternate, and shall include all safety features, alarm lights, and accessories.
- i) Submersible pump stations for Genoa and Ocala Township shall be Gorman Rupp or Flygt.
- j) All pump stations with motors of 10 HP or greater or serving 25-units or more shall be connected to the current telemetry system that is maintained by the Authority. All SCADA system improvements shall be installed with an uninterruptible power source (UPS) and a back up dialer.

Pump stations shall be adaptable to the following generator plug:

- Three Phase, 480, Crouse Hines  
APJ-10487-S22, 100A, 3W, 4p

## 2.07 Pressure Sewers Systems

Developer should explore all alternatives to provide a gravity sewer system. Pressure sewer systems should only be proposed after demonstrating to the satisfaction of the Authority Engineer that a gravity system is not practical and/or cost-effective.

The following criteria should be used as a minimum when designing a pressure system:

- a) Maintain a minimum of 2 feet per second in the force main.
- b) Maximum pump head shall not exceed 104 feet.

- c) Easements shall be dedicated the entire length of the service lateral from the grinder pump to the property line.
- d) Tracer wire shall be included on all low-pressure force mains. Refer to Section 15070, Pressure Process Piping for details.
- e) Valves shall be placed at each junction of force main, and in such a way that no more than two valves have to be closed to isolate a branch of force main for repairs.
- f) All flushing connections and air releases shall be brought up to final grade prior to the authority accepting operational responsibility.

### **3.0 CONSTRUCTION PROCESS**

The following is the recommended procedure for the submittal and approval of Construction Drawings for all publicly owned utilities. The procedure lists the general process and the responsible party from the initial submittal to the Authority through construction and final acceptance of operational responsibility by the Authority.

#### **1. SUBMIT CONSTRUCTION PLANS TO MUNICIPALITY**

- a. For extensions of the sanitary sewer system, the municipality is to forward construction plans to Authority Engineer and appropriate staff/ department.
- b. For extensions of the water main system, the municipality is to forward construction plans to Authority Engineer and appropriate staff/ department.

#### **2. CONSTRUCTION PLAN APPROVAL FROM MUNICIPALITY**

- a. Determine what is necessary before construction of the improvements can start.
- b. Determine when and how many models can be constructed.
- c. Determine when the builder(s) can start home construction.
- d. Determine whether a performance guarantee or surety is required for the proposed improvements.

#### **3. CONSTRUCTION PLAN APPROVAL FROM AUTHORITY ENGINEER**

- a. Authority Engineer shall review drawings for conformance to MHOG SWATH and GO SWATH design standards. A letter of approval from the Authority Engineer will be issued when construction drawings are complete.

- b. Developer's Engineer shall submit a completed electronic copy of the necessary Michigan Department of Environmental Quality construction permit applications for Authority Engineers review. Once permit is approved by the Authority Engineer, they will request that the utility system Owner sign the permit application.
- c. Authority Engineer will submit approved construction drawings and completed permit application to the Michigan Department of Environmental Quality for the necessary construction permit.

#### 4. PERMITS

- a. Developer to secure construction permits from appropriate governmental agencies including, but not limited to, land use permit, soil erosion and sedimentation control permit, and road commission permit.
- b. Developer to secure required easements.
- c. No public utilities can be constructed until MDEQ permits, as described in Section 3, are received.

#### 5. INSPECTION FEES AND ESCROWS

- a. For water systems:
  - i. Authority Engineer will request escrow amounts for the following:
    - 1. Authority's Engineer construction inspection fees.
    - 2. Flushing Fees
    - 3. Conforming to Construction Contingency (Escrow for this item will be used only if conforming to construction records are not provided to the Authority's Engineer within 3 months of the water main being installed.)
    - 4. Authority's Engineer fees for updating the GIS Utility Website and the MHOG water model.
- b. For sanitary sewer systems:
  - i. Authority Engineer will request escrow amounts for the following:
    - 1. Authority Engineer construction inspection fees.
    - 2. Authority Engineer fees for updating the GIS Utility Website.
    - 3. Conforming to Construction Contingency (Escrow for this item will be used only if conforming to construction records are not provided to the Authority's Engineer within 3 months of the water main being installed.)
- c. Once requested escrow amounts are received by the Township/Authority, authorization will be given to the Engineer to proceed with the construction phase engineering services.

## 6. DETERMINATION OF CONSTRUCTION INSPECTION AND TESTING RESPONSIBILITIES

- a. Who will be responsible for inspection of the following:
  - i. Sanitary Sewer (including pumping stations) – typ. Authority engineer
  - ii. Water Main – typ. Authority engineer
  - iii. Well House Facility – typ. Authority engineer
  - iv. Storm Sewer and Stormwater Basins – typ. developers engineer
  - v. Roads – typ. developers engineer
  - vi. Survey (setting controls and construction staking) – typ. developers engineer
- b. Who will be responsible for the following construction testing:
  - i. Television Inspection (Sanitary Sewer) – developer
  - ii. Ring Deflection Testing (Sanitary Sewer) – developer
  - iii. Air Testing (Sanitary Sewer and Water Main) – developer
  - iv. Infiltration/Exfiltration Testing (Sanitary Sewer) – developer
  - v. Hydrostatic Testing (Water Main) – developer
  - vi. Hydrant Testing (Water Main) – developer
  - vii. Disinfection (Water Main) – developer
- c. All sanitary tests shall be witnessed by Authority engineer.
- d. All water main tests shall be witnessed by Authority engineer.

## 7. PRECONSTRUCTION MEETING

- a. Developer's Contractor to provide insurance naming the Authority and the Authority's Engineer as additional insured's.
- b. A preconstruction conference between the Owner of the utility system, Township, Township/Authority Engineer, Developer's Engineer, Developer's underground contractor and private utilities with an interest in the project is required prior to construction start.

## 8. SHOP DRAWINGS

- a. The Developer's Contractor shall submit shop drawings to the Authority's Engineer for review.
- b. No construction will be allowed to start on any improvements without approved shop drawings.

## 9. NOTICE TO PROCEED ISSUED BY THE MUNICIPALITY FOR CONSTRUCTION

- a. Contractor's certificate of insurance submitted and approved.
- b. Performance guarantee submitted to Township/Authority.
- c. Necessary information submitted to Township/Authority for start of construction.

#### 10. START CONSTRUCTION

- a. Developer's contractor to contact Township/Authority engineer for inspection of sewer/water installation.

#### 11. POST-CONSTRUCTION

- a. Construction Engineer to finalize 'red-line' Conforming to Construction Record (As-Built) Drawings and submit to Developer's Design Engineer.
- b. Developer's Design Engineer to incorporate 'red-line' comments on the Conforming to Construction Record Drawings.
- c. Construction Engineer to finalize project file including lead sheets and daily reports.

#### 12. FINAL CONSTRUCTION ACCEPTANCE

The Authority will accept the construction only after the following have been submitted:

- a. Acceptance by Utility Director or authorized representative of the Authority following completion of project.
- b. The Construction Phase Closure Checklist is completed. Checklist is attached to this Section and shall be completed by Township/Authority Engineer.
- c. Warranties and guarantees for a period of 1 year from acceptance by Authority. Amount to be determined by Utility Director.
- d. Waivers of liens
- e. Signed easements
- f. Dedication of utilities
- g. Written confirmation by Engineer that the construction has been performed in general conformance with the approved construction documents shall be obtained prior to placing municipal facilities in service.