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Sanitary Sewer and Water

DESIGN STANDARDS

April 2015

NOTE TO USER:

The following design standards apply to water improvements in Marion, Howell, Oceola and Genoa Townships. The sanitary sewer design standards only apply to improvements in Genoa and Oceola Townships.

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PART I – DESIGN STANDARDS

1.0 WATER MAINS

1.01 Water Distribution System Basis of Design

a) All publicly owned and operated system components require construction plan review and permitting, as outlined in Section 3 of the Connection Manual for Systems Operated by the MHOG Utility Department (Connection Manual). All 8-inch and greater water main, fire hydrants, system valves, and booster stations are considered publically owned. Fire suppression lines can be private if there are no hydrants connected to them. All water main shall be shown in both plan and profile view on the construction plans.

b) 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. Developments with proposed usage larger than 100 residential units shall go through the Impact Determination requirements in Section 3 of the Connection Manual.

c) 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 States Standards").

d) 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.

e) 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.

f) 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.

g) Water main shall be sized to meet peak hourly demands and to meet maximum daily demands plus fire flow. The Authority Engineer shall model the distribution network. The petitioner is responsible for providing the onsite size, layout and necessary information for model development.

h) All municipal water distribution mains shall be a minimum of 8-inch in diameter. Transmission mains of greater diameter may be required if future area development plans or the impact determination process 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. The impact determination process will determine if looping of the water main is required. Looping of the water main may be required to increase the pressure or fire flow. Looping also provides the benefit of redundancy, and for end users in which water is critical to operation looping may be required for redundancy.

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 water main oversizing or additional water main improvements based on the impact determination processs.

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. 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 and valves shall be placed in such a way that no more than two hydrants and valves in total have to be 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 1,000 feet. This distance can be exceeded for transmission lines with the approval of the Utility Director and/or Engineer.

i) Service lead locations shall be approved by MHOG during the construction plan reivew process. All curb stops shall be adjusted to final grade. Curb stops within any driveways, walkways or cement sidewalks shall be placed in a valve box as outlined in 22 11 13. Curb stops shall be placed no closer than 10 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 right-of-way 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 petitioner should work with the Township to secure the necessary easements.

l) All water main 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) Water main shall be ductile iron pipe. HDPE or PVCpipe may be installed in special situations 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
- Corrosive soils or anode beds.

n) A valve shall be provided on each side of all critical crossings, such as surface water crossings.

o) Where 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 will be ductile iron pipe sizes (DIPS) HDPE pipe shall be manufactured from high density PE 3408 polyethylene resin, having a dimension ratio (DR) of 11 or less, the DR rating shall be specified on the plans.. The DR is calculated as the outside diameter of the pipe divided by the minimum wall thickness.

p) Tracer wire shall be included on all water main distribution lines. Refer to Section 22 11 13, Water Distribution Piping for details.

q) Tracing wire systems shall terminate in Rhino TriView Tracing Wire Stations or a tracer wire box. The tracer wire box shall have a concrete housekeeping pad in developed areas. .

r) Valves shall be located a minimum of 5 feet from roadway.

s) When a residential development is constructed in phases, a valve must be installed between each phase to ensure the subsequent phases can be isntalled tested during construction without disturbing water service to the existing phases.

1.03 Depth of Water Main

a) Water main shall be buried with a minimum of 5.5 feet of cover over the pipe, and maximum 8.5 feet of cover. Where water main is installed in undeveloped areas, or areas subject to future grading, probable finished grades will be considered.

b) Water main shall be buried with a minimum 5.5 feet of cover under roadway.

c) 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 22 11 13 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.

b) Fire lines (4-inch diameter or greater) may bypass the meter, provided the fire system is alarmed in accordance with applicable building and fire codes.

2.0 SANITARY SEWERS

2.01 Sanitary Sewer Basis of Design

a) All publicly owned and operated system components require construction plan review and permitting, as outlined in Section 3 of the Connection Manual for Systems Operated by the MHOG Utility Department (Connection Manual). 8-inch gravity sanitary sewer, manholes, force main, air release structures, and pump stations are considered public components of the sanitary sewer system.

b) 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. Developments with proposed usage larger than 100 residential units shall go through the Impact Determination requirements in Section 3 of the Connection Manual.

c) In general, water distribution systems shall be designed in accordance with the *Recommended Standards for Wastewater Facilities* by the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers ("Ten States Standards").

d) 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.

e) Sanitary sewers shall be designed to carry peak flow at their 0.90 capacity line while maintaining scouring velocities at minimum flows. Peak flows shall be calculated in accordance with Ten State Standards.

f) All sanitary sewer pipe shall be a minimum of 8 inches in diameter.

g) 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 (Inches)	**Minimum Slope (Feet per 100 Feet)**	**Maximum Slope (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

h) Proposals for sanitary sewage pumping stations are to be discussed in detail with the Authority Engineer and the Authority prior to submittal of site plans. All alternatives to eliminate a new pump station must be considered.

i) All sanitary sewer testing shall be in compliance with technical specification section 22 13 13, Sanitary Sewers.

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 right-of-way 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:

BURIAL DEPTH (ft)	**EASEMENT WIDTH (ft)**
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 and five feet of cover under roadway. 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 an as 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.

j) 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.

k) All manholes and cleanouts shall be brought up to final grade prior to the authority accepting operational responsibility.

l) All manholes in roadway shall be wrapped with WrapidSeal™.

m) Interior manhole coating will be required for forcemain discharge into proposed or existing manholes.

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, dishwashers, and food prep sinks. All non-food service wastewater drains shall be separated from the grease interceptor and connect to the public sewer lead downstream 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. See grease interceptor detail.

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

Proposals for sanitary sewage pumping stations are to be reviewed in concept with the Authority Engineer and the Utility Director prior to submittal of site plans. If a new pump station is approved for the site, the municipality shall reserve the right to design the proposed pump station. A project specific specification book will be generated for each proposed pump station or pump station upgrade project. The following design guidelines will be used by the municipality for all future pump station upgrades:

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 include but not be limited to the following information:

a) Service area for the proposed pump station, including the lowest invert elevation

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 States 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 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 with 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 Oceola 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 backup dialer. Station shall be controlled by PLC and have a digital level controller

Pump stations shall be adaptable to the following generator plug:

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

k) Wetwell coating may be required for force main discharge into proposed or existing wetwells.

2.07 Pressure Sewers Systems

Proposals for pressure sewer systems are to be reviewed in concept with the Authority Engineer and Utility Director prior to submittal of site plans. All alternatives to provide a gravity sewer system shall be explored. The following design guidelines should be used for private or public grinder pumps. :

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 22 13 13, Sanitary Sewers 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.

g) Force main shall be buried with a minimum of 5.5 feet of cover over the pipe, and maximum of 8.5 feet of cover. Where force main is installed in undeveloped areas, or areas subject to future grading, probable finished grades will be considered.

h) Force main shall be buried with a minimum 5.5 feet of cover under roadway.

i) Air releases shall not be placed in a residential yard or driveway.

j) Grinder pumps shall be Environment One. Additional information and details on the acceptable materials for various components of the grinder pump are shown on the Standards Detail sheet.