



Winchester Municipal Utilities

DEVELOPMENT MANUAL
FOR
WATER DISTRIBUTION SYSTEM AND WASTEWATER
COLLECTION SYSTEM EXTENSIONS

PREPARED BY
WINCHESTER MUNICIPAL UTILITIES
WINCHESTER, KY

July, 2003

The contents of this manual are written in conformance with existing design criteria of the Kentucky Department of Environmental Protection, Division of Water (KYDOW). In certain instances, the design criteria and construction standards of WMU exceed the requirements of KYDOW. However, KYDOW review of plans and specifications for additions or modifications to either the water distribution system or the wastewater collection system is mandatory, and requirements in addition to those of WMU may be stipulated by KYDOW.

Preparation of this manual has been financed by WMU. Mention of trade names or commercial products in this manual does not constitute endorsement of the product.

TABLE OF CONTENTS

Title

Introduction

Preface
Purpose
Glossary

Administrative Requirements For Water, Sanitary Sewer and/or Fire Line Extensions

Section

General	1-101
Preliminary Plan Submittal	1-102
Winchester/Clark County Fire Department Approval	1-103
WMU Design Approval	1-104
Kentucky Department of Natural Resources and Environmental Protection Cabinet (KYDOW)	1-105
Easements	1-106
Construction Inspections	1-107
Dedication of Facilities	1-108
Plan and Specification Review: Water, Sanitary Sewer and/or Fire Line Extensions (Policy 401.1)	Figure 1-1
Application For Extension (Policy 401.1)	Figure 1-1.1
Winchester Fire Department Plan Review For WMU Water Line Extensions	Figure 1-2
Clark County Fire Department Plan Review For WMU Water Line Extensions	Figure 1-2
Example Letter of Design Approval	Figure 1-3
Water, Sanitary Sewer, and/or Fire Line Easements (Policy 412.1)	Figure 1-4
Example Easement	Figure 1-5
Allowable Leakage Test and Disinfection	Figure 1-6
WMU Sanitary Sewer Air Test Certification Form	Figure 1-7
Camera Inspection Log	Figure 1-8
Example Punch List	Figure 1-9
Example Developer's Letter of Dedication	Figure 1-10
Engineer's Certification Form For WMU's Water and Sanitary Sewer Extensions	Figure 1-11
Contractor's Certification Form For WMU's Water and Sanitary Sewer Extensions	Figure 1-12
Example Reproducible Drawing	Figure 1-13
Example Record Plat	Figure 1-14
Water, Sanitary Sewer, and/or Fire Line Observation Fees (Policy 403.1)	Figure 1-15
Water System Development Charge (Policy 406.1)	Figure 1-16

Wastewater System Development Charge (Policy 407.1)	Figure 1-17
Warranty Bond For Water, Sanitary Sewer, and/or Fire Line Extensions	Figure 1-18
Example Irrevocable Line of Credit	Figure 1-19
Example Project Final Cost Sheet	Figure 1-20

**Design Requirements for Water, Sanitary Sewer,
And/or Fire Line Extensions**

	<u>Section</u>
General	2-101
Drafting and Media Requirements	2-102
Sheets Required	2-103
Title Sheet	2-103.1
Plan Index Sheet	2-103.2
Plan and Profile Sheet(s)	2-103.3
Special Details	2-103.4
Standard Details	2-103.5
Design Guidelines	2-104
General Location	2-104.1
Horizontal Alignment	2-104.2
Vertical Alignment	2-104.3
Stationing	2-104.4
Line Designations	2-104.5
Flooding and Ponding Areas	2-104.6
Minimum Clearances	2-104.7
Railroad Crossings	2-104.8
Highway Crossings	2-104.9
Benchmarks	2-105
Plat Contents	2-106
Record Drawings	2-107

Design Submittals

	<u>Figure</u>
Policy 402.1 Minimum Level of Service for Water, Sanitary Sewer and Fire line Extensions	2-1
Policy 405.1: WMU Development Manual Purchase Fee	2-2
Policy 411.1: Backbone Sanitary Sewer Infrastructure Extensions	2-3

Construction Specifications For Water Line Extensions

	<u>Section</u>
General	3-101
Design Criteria	3-102
Pipe and Fittings	3-103
Gate Valves	3-104
Butterfly Valves	3-105

Tapping Sleeve and Tapping Valve	3-106
Combination Air and Vacuum Valve	3-107
Valve Boxes	3-108
Fire Hydrants	3-109
Mechanical Joint Anchor Couplings	3-110
Encasement Pipe	3-111
Casing Pipe for Water Service Lines	3-111.1
Concrete	3-112
Valve Box Concrete Pads	3-112.1
Plastic Wrap for Fittings	3-113
Installation	3-114
Excavation for Trenches	3-114.1
Laying Depths for Water Mains	3-114.2
Dewatering	3-114.3
Unauthorized Excavation	3-114.4
Pipe Bedding	3-114.5
Pipe Laying	3-114.6
Anchorage of Bends, Tees, Plugs, Hydrants & Valves	3-114.7
Jointing	3-114.8
Backfilling Pipeline Trenches	3-114.9
Connection to Existing Mains	3-114.10
Water Mains Crossing Under State Maintained Roads or Railroads	3-114.11
Hydrostatic Testing	3-115
Restrictions	3-115.1
Pressurization	3-115.2
Allowable Leakage	3-115.3
Disinfection	3-115.4
Bacteriological Test	3-116

Water Standard Detail Drawings (SDW)

Figure

General Notes	SDW-01
Thrust Block Schedule	SDW-02
Thrust Block Detail	SDW-03
Thrust Block Detail (Double Pipes)	SDW-04
Thrust Block Detail Sec. (Double Pipes)	SDW-05
Typical Meter Setting	SDW-06
Water Service Connections	SDW-07
Typical Gate Valve Setting	SDW-08
Typical Tapping Sleeve and Tapping Valve	SDW-09
Straight Pipe Anchor	SDW-10
Typical Fire Hydrant Setting	SDW-11
Fire Hydrant & Anchor tee	SDW-12
Retainer Gland (Mega - Lug)	SDW-13
Water Line Encasement Detail	SDW-14

Typical Creek Crossing	SDW-15
Water Service Conduits	SDW-16
Air Release Valve	SDW-17
Fire Protection Vault (Plan View)	SDW-18
Fire Protection Vault (Elevation View)	SDW-19
Fire Protection Vault (Section View)	SDW-20
Fire Protection Vault (Top View)	SDW-21
Typical Section Through Trench	SDW-22
Pavement Replacement	SDW-23

**Construction Specifications for Sanitary Sewer
Line Extensions**

	<u>Section</u>
General	3-201
Pipe	3-202
Force Main Pipe	3-203
Ductile Iron Pipe	3-203.1
Polyethylene Pipe	3-203.2
Encasement Pipe	3-203.3
Watertight Joint Materials	3-204
Manholes	3-205
Castings	3-205.1
Drop Inlets	3-205.2
Stubs	3-205.3
Sewer Appurtenances	3-206
Branches and Fittings	3-206.1
Detectable Mylar Tape	3-206.2
Plugs	3-206.3
Combination Sewage Air and Vacuum Valve with Odor Control	3-206.4
Installation	3-207
Concrete Cap	3-208
Testing (General)	3-209
Manhole Air Vacuum Test	3-210
Testing	3-210.1
Safety Precautions	3-211
Force Main Testing	3-212

Sanitary Sewer Standard Detail Drawings (SDS)

	<u>Figure</u>
General Notes	SDS-01
Manhole Frame and Cover	SDS-02
Boltdown Manhole Frame and Cover	SDS-03
Standard Precast Manhole	SDS-04
Standard Precast Outside Drop Manhole	SDS-05

Standard Precast Inside Drop Manhole	SDS-06
Standard Junction Manhole	SDS-07
Standard Precast Shallow Manhole	SDS-08
Concrete Top Slab for Shallow Manhole	SDS-09
Standard Set Over Manhole	SDS-10
Expansion Bolt and Grout Detail	SDS-11
Water Stop and Lateral Indicator	SDS-12
Typical Clean Out Detail	SDS-13
Typical Deep Clean Out Detail	SDS-14
Typical Concrete Clean Out Column	SDS-15
Typical Sewer Lateral	SDS-16
Concrete Encasement and Cap	SDS-17
Typical Section Through Trench	SDS-18
Backfill Detail	SDS-19
Pavement Replacement	SDS-20
Sewer Anchor Detail	SDS-21
Combination Sewage Air and Vacuum Valve with Odor Control	SDS-22

Construction Specifications For Prefabricated Lift Stations

	<u>Section</u>
General	3-301
Sanitary Pump Station Plan Submittal Procedures	3-302
Concept Plan Submittal	3-302.1
Preliminary Plans	3-302.2
Sanitary Pump Station Plan Submittal Procedures	3-303
Final Design Plans and Specifications	3-303.1
Design Approach	3-304
Design Criteria	3-305
Wet Well Design	3-306
Force Main Design	3-307
System Head Curve	3-308
Buoyancy	3-309
Force Main Pressure and Water Hammer Calculations	3-310
Odor Control	3-311
Pump Station Concepts	3-312
Pump Control	3-313
Pump Station Electrical Criteria	3-314
Emergency Power	3-315
Pump Station Heat and Ventilation	3-316
Flow Monitoring	3-317

INTRODUCTION

PREFACE

The manual is divided into three (3) major sections: Administrative, Design, and Technical. The Administrative section includes all required submittals and documentation, a glossary of terms, and a basic overview of expectations of WMU and the WMUC. The Design section includes all design criteria and design considerations required at the design phase. The Technical section includes standard detail drawings and technical specifications for water line, fire line, sanitary sewer line, sanitary sewer lift stations, and other related appurtenant structure construction.

This manual provides WMU and the developer the necessary information to prepare and review the project design, oversee construction, and accept constructed facilities for ownership and maintenance by WMU. With proper guidance from design-to-construction and construction-to-ownership, it is the intent of WMU to mitigate existing problems, prevent future problems, and enhance the environment and quality of life in the areas served by WMU.

INTRODUCTION

PURPOSE

The purpose of this manual is to establish procedures and standards for the design and construction of water and sanitary sewer infrastructure that are compatible with the overall development plan of Winchester Municipal Utilities (WMU), set forth by the Winchester Municipal Utilities Commission (WMUC). This manual will guide you through each phase of the development process.

The contents of this manual are written in conformance with existing design criteria of the Kentucky Department of Environmental Protection, Division of Water (KYDOW), and WMU. In certain instances, the design criteria and construction standards of WMU exceed the requirements of KYDOW. However, KYDOW review of plans and specifications for additions or modifications to either the water distribution system or the wastewater collection system is mandatory, and requirements in addition to those of WMU may be stipulated by KYDOW.

The manual is divided into three (3) major sections: Administrative, Design, and Technical. The Administrative section includes all required submittals and documentation, a glossary of terms, and a basic overview of expectations of WMU and the WMUC. The Design section includes all design criteria and design considerations required at the design phase. The Technical section includes standard detail drawings and technical specifications for water line, fire line, sanitary sewer line, sanitary sewer lift station, and other related appurtenant structure construction.

This manual provides WMU and the developer the necessary information to prepare and review the project design, oversee construction, and accept constructed facilities for ownership and maintenance by WMU. With proper guidance from design-to-construction and construction-to-ownership, it is the intent of WMU to mitigate existing problems, prevent future problems, and enhance the environment and quality of life in the areas served by WMU.

GLOSSARY

(A)

Abandoned- To cease from maintaining, practicing, or using.

Air Release Valve- a continuously active valve in a water line that is set at the high point of elevation and is used for the purpose of releasing pockets of air once the line is filled and under working pressure.

A.S.T.M.- American Society for Testing and Materials. They are a not-for-profit organization that provides a global forum for the development and publication of voluntary consensus standards for materials, products, systems, and services.

(B)

Backfill- To refill (as an excavation), usually with excavated material, to restore the original slope.

Backflow- (1) The backing up of water through a conduit or channel in the direction opposite to original flow. (2) A reverse flow condition created by a difference in water pressures that causes water to flow back into the distribution pipes of a drinking water supply from any source other than the one intended. Also known as *Back Siphonage*.

Backflow Preventer- A device that allows liquids to flow in only one direction in a pipe.

Barrel (Manhole)- The vertical portion of a manhole used to gain access to a sewer.

Base (Manhole)- The bottom, or supporting structure, on which the manhole barrel rests.

Basin- A geographic area drained by a single major stream. Consists of a drainage system comprised of streams and often natural or man-made lakes.

Bedding- The earth or other materials on which a sewer line, water line, or other structure is supported.

Bell- The recessed, over enlarged, female end of a pipe into which the male or spigot end fits.

Blow Off- A waste gate or device for discharging accumulated solids or for emptying a depressed sewer.

Branch, Y (Wye)- A pipe joined to another pipe, usually at 60 degrees with alignment of the other, molded together and manufactured as a whole unit.

Bulkhead- A partition closing off an opening, usually constructed of timber, brick, or concrete.

Bury Line- A line on a fire hydrant that signifies the area where finishing grade should be.

(C)

Capacity- The amount of flow in terms of cubic feet per second that a conduit can or will discharge. Capacity depends on factors such as velocity, coefficient of roughness, size, shape, and slope of conduit.

Castings- Metallic objects (normally Cast Iron) formed of molten metal in a mold, such as manhole lids and manhole frames.

Catch Basin (Storm Sewer)- A sieve-like device at the entrance to a storm sewer to stop/capture matter that could possibly block up the storm sewer.

Chamfer- A flat surface created by slicing off a square edge or corner. Also Known as *Bevel*.

Chlorination- The application of chlorine or one of its compounds to water for the purpose of disinfecting.

Collar- A cylindrical ring typically pre-cast concrete, secured upon the cone or barrel of a manhole in which the frame will rest.

Collector System- A network of lateral and branch sewers in a defined area, which collects and transports sewage into a larger sewer.

Compaction- The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

Conduit- A piping or passage system used for protecting the transportation of water to services under roadways.

Contaminant- A physical, chemical, or biological substance that is not normally present in water.

Contract Documents- The Agreement, Bonds, General Conditions, Special Provisions, Specifications, and Drawings as the same or more specifically identified in the Agreement, together with all Amendments, Modifications, and Supplements issued on or after the effective date of the Agreement for the purpose of completion of desired work.

Control Point- A physical or monumental structure that is used as a reference or station when surveying.

Corporation Stop- A water shut-off valve in the main line used for connecting water service lines, pressure testing of water lines, chlorination of water lines.

Cradle- Type of bed, usually a type of gravel or concrete, being laid upwards from the trench bottom to the spring line of the pipe.

Crown- The highest inside part of a conduit.

Cross Connection- A physical connection through which a supply of potable water could become contaminated.

Cubic Feet Per Second (Ft³/sec.)- A unit of measurement expressing rate of discharge.

Cul-de-sac- An alley or street having no outlet at one end, usually having an area at its dead end for turning around.

Culvert- A closed conduit of pre-cast pipe or monolithic structure of sufficient length for the passage of water other than sewage under roadways, driveways, railways, or other obstructions.

Curb Stop- A water shut-off valve located in a water service pipe near the curb and between the water main and the building.

(D)

Datum- The agreed standard point or plane of stated elevation.

Dead End- A end of a water main which is not connected to the other parts of the distribution system.

Dedication- The act of accepting a development or project into the distribution system by an entity or entities for ownership and maintenance purposes.

Design Capacity- The volume of water or sewage that a pipe, line, or system is able to convey.

Disinfect- To kill or render harmless microbiological organisms that cause disease.

Discharge- The rate of flow, or volume of water flowing therein at a given place and within a given period of time.

Distribution System- Any combination of pipes, pumps, tanks and so forth that delivers water from water sources or reservoirs to the consumer. Also known as a *delivery system*.

Ditch- A long narrow trench or furrow designed for the placement of water and/or sanitary sewer lines.

Diversion- An arrangement of pipes, conduits, gates and/or gate valves that allow flow to be passed around a hydraulic structure or appurtenance.

Division of Water (DOW)- An entity whose function is to manage, protect, and enhance water and sanitary sewer lines and resources (Natural Resources and Environmental Cabinet).

Drop Inlet- A contrivance of pipe fittings that are utilized when an incoming sewer is considerably higher than the out-going sewer.

(E)

Easement- A legal instrument used to enable the selling, giving, or taking of certain land or water rights without transfer of title, such as passage for utility passage. An affirmative easement gives the owner of the easement the right to use land for a stated purpose. A negative easement is an agreement with a property owner to limit the development of land in specific ways.

Effluent- Water or wastewater that flows from a Basin, treatment process or treatment plant.

Elevation- The variation of the earth's surface as measured by the vertical distance from known point(s).

Encasement- Usually steel or monolithic concrete that is used to enclose the periphery of a pipe.

(F)

Flow- rate of water discharged from a source given in volume with respect to time.

Force Main- A pipe under internal pressure created by being on the discharge side of a pumping station.

(G)

Gage (Gauge)- An instrument that is used to measure pressure and velocity of flowing water.

Gasket- A rubber "O" ring that is used in the installation of pipe in order to make a joint water-tight.

Gate Valve (Isolation Valve)- a valve that operates either fully opened or fully closed. It functions as a shut-off for water flow from the water distribution system.

Grade- The inclination or slope of a stream channel, conduit or natural ground surface. It is usually expressed in terms of the ratio or percentage of vertical rise or fall per 100 feet of horizontal distance.

Ground Water- Subsurface water occupying the zone of saturation.

(H)

Hydrant- A discharge pipe with a valve and a spout at which water may be drawn from a water main.

(I)

Invert- The floor, bottom or lowest portion of the internal cross-section of a sewer or manhole.

Interceptor (Sewer)- A sewer which receives flow from a number of collector sewers or outlets transported for treatment or disposal.

(J)

Joint (Bell-and-Spigot)- A form of pipe which has a straight end on one side (Spigot), and an enlarged end on the other (Bell). The spigot fits inside the bell and made tight with a gasket or rubber "O" ring.

(L)

Lateral (Sanitary Sewer Service Line)- A service line that extends from the main sanitary sewer line to the building served or consumer(s) system.

(M)

Main- A relatively large pipe in a distribution system for drinking water or in a collection system for municipal wastewater.

Manhole- An opening by which a man may enter or leave a sewer, conduit, or other closed structure for inspection, cleaning, and other maintenance operations closed by a removable cover.

Monolithic- Cast in place, rather than pre-cast.

(O)

Outfall- conduit leading to a discharge stream through which effluent flows.

(P)

Pipe (Vitrified Clay)- Pipe made of clay that is burned in a kiln with surfaces glazed for water tightness.

Potable Water- Water that is drinkable and meets the quality standard set forth by the Kentucky Division of Water and the Environmental Protection Agency.

PPM- Parts Per Million. Measure of the weight of a substance per unit of volume.

Pre-cast- That which is formed in a mold or form and distributed by the manufacturer as a complete form.

Pressure- Force per unit area.

Pressure Gauge- An instrument, graduated in any units desired, for registering the pressure of gases, liquids, and solids.

Pretreatment- Any process used to reduce pollution before the wastewater is introduced into a sanitary sewer system for further treatment.

Property Service Connection- That portion of a water system or a sanitary sewer system located within an easement or right of way which transports sewage from private property to the main sewer.

Proposed- That which is to have immediate consideration for construction.

Pump- A device which moves, compresses, or alters the pressure of a fluid being conveyed through a natural or artificial channel.

(R)

Raw Water- Water that is direct from the source, ground or surface water, that is untreated or domestic.

Residual Chlorine- The level of chlorine remaining in a distribution system after chlorination at a drinking water treatment plant.

Riser- An concrete device used for the vertical extension of a manhole, typically for bringing to grade.

(S)

Sanitary Sewer- A pipe or network of pipes that transports only municipal, residential, commercial, or industrial wastewater (sewage) and not rain or storm waters from streets.

Service Area- The geographic land area that is served by a distribution system of water and/or sewer agency.

Service Line- The pipeline extending from sanitary sewer and water mains to the buildings served or consumer(s) system.

Sewage (Sanitary)- Largely the water supply of a community after it has been fouled by various uses. From the standpoint of carried wastes from residences, businesses and institutions, together with those from commercial and industrial establishments, and with such groundwater, surface water and storm water as may be present.

Sewer- A pipe or conduit that carries wastewater or drainage water.

Sewer (Branch)- A sewer which receives sewage from lateral sewers and discharges into a larger sewer.

Sewer (Main)- The principal sewer to which branch (collector) discharge, and are transported to a Trunk Sewer.

Sewer (Sanitary)- A sewer which primarily carries sewage, and to which storm, surface, and ground waters are not intentionally admitted.

Sewer (Trunk)- A sewer which receives many tributary branches and which serves a large area.

Slope- The inclination of the invert of a conduit expressed in a decimal or as feet per stated length measured horizontally in feet.

Sounding- Method used to ascertain the depth of rock.

Spring line- The inner edge of the inclined or horizontal base where the arch of a pipe begins.

Sub-grade- The bottom of a trench or other excavation that is somewhat below the predetermined elevation of the bottom of the final excavation or structure. The intervening space between back filled with some special material such as sand, gravel, broken stone, tamped earth, or impervious lining. The term is also applied to the elevation of such bottom.

Surcharge- A condition where a sewer is inadequate to discharge the total amount of flow when it is just filled or flowing at the planned depth or head. The amount of surcharge is measured by the volume or rate of excess flow or by the excess height of the hydraulic grade line.

(T)

Transition- A short section of a conduit used as a conversion section to unite two conduits having different hydraulic elements.

(V)

Velocity (Self-Cleaning)- The minimum velocity in sewers necessary to keep solids in suspension and prevent their deposition and the subsequent nuisances from stoppages and odors on decomposition.

(W)

Wastewater- The spent water of a community or water that has been used.