

Standards Manual

For

Ohio County Water District



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April 26, 2021

Foreword

The First Edition of the Standards Manual of the Ohio County Water District (OCWD) represents the culmination of Regulations and Specifications pertaining to new Water Mains & Appurtenances in the District's service area. The Standards Manual has been adopted by the Board of Commissioners on this date April 26, 2021. The adoption of this document has established these specifications as the basic uniform standards for the planning, design, and construction of water projects performed within the OCWD's service areas.

Use of the Standards Manual, as the basic uniform specifications should accomplish the following improvements:

- Allow common interpretation of provisions.
- Simplify the development process for Developers, Engineers, Surveyors, and Contractors.
- Provide a continuing amendment process to meet the changing demands of new technology, new materials, and improved methods.
- Reduce OCWD's expenditures associated with staff or consultant development of specifications and training of construction inspectors/observers.
- Result in decreased construction cost of water main facilities construction projects.

The OCWD has published Standard Construction Detail Drawings as a companion document to the Standards Manual, entitled "The Ohio County Water District Standard Details".

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CHAPTER 1 INTRODUCTION

1.1 MISSION STATEMENT

The Ohio County Water District (OCWD) is committed to providing our customers a safe, clean and sufficient water supply through a reliable system that meets all State and Federal standards, while delivering great value at a reasonable cost.

1.2 PURPOSE OF THE STANDARDS MANUAL

The Standards Manual is a guide for the planning, design, and construction of water distribution systems, and associated appurtenances for the OCWD. These Standards shall govern and control the construction materials and methods used in the installation of water distribution systems that are, or will become the responsibility of the OCWD, to operate and maintain as part of its system. The Standards Manual is intended to secure facilities of such quality, and design incorporated criteria, such that they will meet or exceed the requirements of the OCWD, the Commonwealth of Kentucky's Natural Resources and Environmental Protection Cabinet, and other agencies exercising control. The Standards Manual is intended primarily for private Developers, Engineers, Surveyors, and Contractors wanting to construct water distribution systems facilities within the OCWD's service area. The guidelines and general procedures are as approved by the OCWD.

This Manual:

- A. Enumerates Standards written by the OCWD, KRS 74, and 807 KAR 5:066 to facilitate the OCWD's compliance with Local, State, and Federal Regulations.
- B. Identifies submittal requirements and procedures for the review of infrastructure projects within the OCWD service area.
- C. Serves as a reference document for Developers, Professional Consultants and Contractors in the planning, design and construction of projects with the OCWD's service area.

1.3 DESCRIPTION AND USE OF THE STANDARDS MANUAL

The Standards Manual identifies a single set of Standards, submittal requirements and approval procedures to be used in the planning, design, and construction of projects within the OCWD's service area.

This Standards Manual is not intended to serve as a step-by-step design and construction methodology nor can this manual address every situation that may arise. The application of sound engineering/surveying principles combined with the information contained herein are necessary to complete the planning, design, and construction for water projects.

1.4 STRUCTURE OF THE STANDARDS MANUAL

The Standards Manual contains 10 Chapters. An index to Chapters is found at the beginning of the Standards Manual. To simplify use of the Standards Manual, a detailed table of contents can be found at the beginning of each Chapter.

The Manual is structured as follows:

- A. Chapter 2 and 3 describe the OCWD's general provisions and general planning information.
- B. Chapters 4 through 7 detail the OCWD Standards regarding drafting (manual and computer aided) Construction Drawings, Final Record Drawings, Surveying, and Easement Documents.
- C. Chapter 8 describes general planning, design, and construction elements for water distribution systems within the OCWD's service area.
- D. Chapter 9 describes detailed submittal, review, and approval procedures.
- E. Chapter 10 describes construction materials and method's specifications.

1.5 UPDATES TO THE STANDARDS MANUAL

As design criteria and construction materials and methods evolve, the Standards Manual will require revisions and improvements. As changes are made, supplements, or revisions will be sent to registered holders of the Standards Manual. It will be each registered holders' responsibility to maintain a correct Standards Manual.

Comments and suggestions concerning the context and format are welcome from the users of the Manual. Comments and suggestions should be forwarded to:

Eric Hickman, P.E.
General Manager
ehickman@ocwdky.org

The OCWD requests that all comments and suggestions be submitted electronically to ensure that the information is not misinterpreted.

1.6 RULES AND REGULATIONS FOR CUSTOMER SERVICE

1.6.1 WATER USERS CONTRACT/AGREEMENT/EASEMENT

When a customer signs for service OCWD will ask for the following information:

- a. User Name
- b. Social Security Number or Driver's License Number
- c. Service Address
- d. Billing Address
- e. Phone
- f. Emergency Contact
- g. Deed Book and Page Number
- d. Previous address, if any, of the party where OCWD service was rendered.
- f. Applicant must be at least 18 years of age.
- g. The Water Users Contract/Agreement/Easement must be completed and signed before services are rendered.

1.6.2 MEASURING WATER SERVICE

For all Customers the use of service at each point of delivery shall be metered separately. Whenever, for any reason, OCWD furnishes two or more-meter installations for a single customer, each point of metering shall be considered a separate service and be separately billed, including minimum service charges as outlined in the rate schedules.

1.6.3 RESALE OF WATER

Under no circumstances will a customer be allowed to resell or give away water except under the terms of a special contract executed by the OCWD and approved by the Public Service Commission. Failure to comply with this rule will constitute grounds for termination of service.

This provision does not apply to wholesale water contracts with utility districts and other municipalities.

1.6.4 DEPOSIT

A deposit of \$90.00 will be required of all commercial and industrial Customers and any residential Customer. Deposits form residential may be in the form of cash or letter of credit. In the case of Commercial or Industrial deposit shall be in the form of cash only.

The OCWD may require any Customer to increase the deposit if the Customer's billing becomes delinquent. Upon termination of service, deposits, plus interest, may be applied against unpaid bills of Customer and if any balance remains after such application is made, said balance shall be refunded to Customer.

OCWD may require a deposit of any other Customer before service is supplied upon the same terms and conditions as provided above.

OCWD will make a test of any meter upon written request of any customer if the request is not made more frequently than once every twelve- (12) months. The customer shall be given the opportunity to be present at the requested test. If the test shows that the meter was not more than two (2) percent fast, the utility will make a reasonable charge for the test, the amount being approved by the Public Service Commission and set out in the utility's tariff.

After having first obtained a test from the utility, any customer of the utility may request a meter test by the Public Service Commission upon written application. Such request shall not be made more frequently on one (1) meter than once every twelve- (12) months.

If upon periodic test, requested test, or complaint test, a meter in service is found to be more than two (2) percent fast, additional tests will be made to determine the average error of the meter. The tests will be made in accordance with Public Service Commission rules and regulations applicable to the type of meter involved.

If test results on a customer's meter show an average error greater than two (2) percent fast or slow, or if a customer has been incorrectly billed for any other reason, except in an instance where OCWD has filed a verified complaint with the appropriate law enforcement agency alleging fraud or theft by a customer, the OCWD will immediately determine the period during which the error has existed, and will recompute and adjust the customer's bill to either provide a refund to the customer or collect an additional amount of revenue from the underbilled customer. Any adjustment to the customer's account will be in accordance with the rules and regulations of the Public Service Commission pursuant to 807 KAR 5:066 Section 9(c).

The OCWD will readjust the account based upon the period during which the error is known to have existed. If the period during which the error existed cannot be determined with reasonable precision, the time period will be estimated using such data as elapsed time since the last meter test, if applicable, and historical usage data for the customer. If that data is not available, the average usage of similar customer loads will be used for comparison purposes in calculating the time period. If the customer and the OCWD are unable to agree on an estimate of the time period during which the error existed, the Public Service Commission will determine the issue. In all instances of customer overbilling, the customer's account will be credited or the overbilled amount refunded at the discretion of the customer within thirty (30) days after final meter test results. The OCWD will not require customer repayment of any underbilling to be made over a period shorter than a period coextensive with the underbilling.

- a. A meter test charge for a 5/8" meter will be \$45.43 per test.
- b. Meter test charge for a 1" meter will be the actual cost of the test.

E. Transfer of Deposit

Deposits may be transferred from one location to another if the applicant is the owner of the home at the location for which service is being requested. However, if the amount

already on deposit is not equal to the amount of deposit required at the time of the transfer, the homeowner must pay the difference between these two amounts. All other applicants will be required to pay the applicable security deposit in full each time an account is opened. When the previous account is terminated and all outstanding bills are paid, the previous security deposit will be returned.

F. Interest on Security Deposits

OCWD shall accrue interest on all customer security deposits retained by OCWD at interest rates as outlined in the Kentucky Revised Statutes. When an account is terminated and all outstanding bills are paid, the security deposit shall be returned along with any interest due to the customer.

1.6.5 REFUND OF SECURITY DEPOSIT AND INTEREST PAYMENT.

Interest will accrue on all deposits at the rate prescribed by law beginning on the date of the deposit. Interest accrued will be refunded to the customer or credited to the customer's bill on an annual basis, except that the utility will not be required to refund or credit interest on deposits if the customer's bill is delinquent on the anniversary of the deposit date. Upon termination of service, the deposit, any principal amounts, and interest earned and owing will be credited to the final bill with any remainder refunded to the customer.

Required deposits will be returned after one (1) year if the customer has established a satisfactory payment record for that period.

Additional deposit requirement. If a deposit has been waived or returned and the customer fails to maintain a satisfactory payment record, the utility may require that a deposit be made. The OCWD may require a deposit in addition to the initial deposit if the customer's classification of service changes or if there is a substantial change in usage.

Deposits as a condition of service. Service may be refused or discontinued if payment of requested deposits is not made.

Receipt of deposit. The OCWD will issue a receipt to every customer that pays a deposit. The receipt will show the name of the customer, location of the service or customer account number, date, and amount of deposit. If deposit amounts change, the OCWD will issue a new receipt of deposit to the customer.

Interest on deposits. Interest will accrue on all deposits at the rate prescribed by law beginning on the date of the deposit. Interest accrued will be refunded to the customer or credited to the customer's bill on an annual basis, except that the OCWD will not be required to refund or credit interest on deposits if the customer's bill is delinquent on the anniversary of the deposit date. Upon termination of service, the deposit, any principal amounts, and interest earned and owing will be credited to the final bill with any remainder refunded to the customer.

A deposit with applicable interest will be refunded by OCWD to the customer upon termination of services to the customer's premises, or at an earlier date as selected by OCWD. The utility may apply the deposit and the accrued interest to any amount owed by the customer at the time the deposit becomes refundable.

1.6.6 BILLING

Service bills will be rendered at regular intervals for all customers. OCWD makes every effort to read each meter every twenty-eight (28) to thirty-two (32) days. When OCWD is unable to read the meter after reasonable effort, the customer shall be billed for an estimated consumption based upon the best information available.

When closing an account where no billing demand is involved, bills may be rendered on the basis of estimated consumption. In the case of disconnects, no bill shall be rendered for less than the minimum charge set out in the rate.

Closing an account for service supplied for fractional billing period under rate schedules where a billing demand is involved, bills will be rendered on the basis of a thirty (30) day period prorated to the nearest whole tenth of a month.

Inquiries concerning charges for water services should be directed to OCWD Office at 24 East Washington Street, (270) 298-7704.

Bills and notices related to the utility's business will be mailed to the customer at the address listed on the Water Service Contract unless a change of address has been filed with the OCWD in writing. The OCWD will not otherwise be responsible for delivery of any bill or notice nor will the customer be excused from the payment of any bill or any performance required in the notice.

Water service will be billed monthly and mailed on or about the 25th of each month.

Bills are payable and due on the date of issuance.

Payment must be received, not postmarked, before the close of business on the 10th day of the following month; otherwise, the delinquent bill will be assessed the late payment penalty approved and on-file with the Public Service Commission

The late payment penalty will be assessed on the delinquent amount of the bill, less taxes and any prior penalty amounts. Pursuant to 807 KAR 5:006 Section 8 (3)(h), a penalty may be assessed only once on any bill for rendered services.

Delinquent bills may result in disconnection of service with the utility applying the customer's deposit against the unpaid bill. The customer shall be given at least 5 days written notice of termination, and at least 20 days shall have passed since the issuance of the original bill.

1.6.7 SERVICE CHARGES AND RECONNECTION CHARGES

The following charges will be applied by MMU to cover the cost of connecting or reconnecting a meter or service; see note 1 below:

	<u>Description of Service</u>	<u>Charge</u>
a.	Connection/Turn-on Charge: Will be assessed for new service turn-ons, seasonal turn-ons, temporary service, or transfer of service. The charge will not be made for initial installation of service where a meter connection/tap-on charge is applicable.)	\$25.21
b.	Reconnection Charge: Will be assessed to reconnect service that has been terminated for non-payment of service or for violation of OCWD or Public Service Commission rules and regulations, and will include the cost of the service trip for both the disconnection and the reconnection.	\$45.43
c.	Service Call/Investigation Charge: Will be assessed when a customer requests the onsite presence of OCWD personnel to investigate a service problem and the problem is a result of the customer's own plumbing facilities, beyond the OCWD's delivery point, or not caused by failure of utility facilities. Any maintenance and repair of facilities beyond the OCWD's delivery point is the responsibility of the customer. (during normal working hours). Minimum	\$25.21
d.	Service Call/Investigation Charge: Will be assessed when a customer requests the onsite presence of OCWD personnel to investigate a service problem and the problem is a result of the customer's own plumbing facilities, beyond the OCWD's delivery point, or not caused by failure of utility facilities. Any maintenance and repair of facilities beyond the OCWD's delivery point is the responsibility of the customer (after normal working hours). Minimum	\$52.99
e.	Processing fee for checks returned by the bank due to insufficient funds. When a check is returned to MMU by the Customer's bank, a twenty-dollar (\$20.00) service charge will be applied. If a customer has three	

returned checks within a 6-month period, the Utility has the right to refuse any further personal checks from the customer for a 12-month period. If collection trips are made, a charge of fifteen dollars (\$15.00) per trip will be applied also. Minimum..... \$20.00

f. Meter Re-read Charge (5/8 Inch Meter) will be assessed when a customer requests the utility to re-read the customer's meter and the re-read proves that the original meter reading was correct.....\$45.43

g. Meter Re-read Charge (1 Inch Meter) will be assessed when a customer requests the utility to re-read the customer's meter and the re-read proves that the original meter reading was correct.Actual Cost

h. Meter Relocation Charge: Will be assessed when a customer or other authorized person requests that a meter be relocated, changed, or modified. Those requesting a change must reimburse the utility for the cost incurred, as set forth in the rates and charges section of this tariff, including but not limited to appropriate legal, administrative, engineering, overhead, or other related costs.Actual Cost

1.6.8 TEMPORARY SERVICE CHARGES

Connection/Turn-on Charge will be assessed for temporary service. The charge will not be made for initial installation of service where a meter connection/tap-on charge is applicable.

1.6.9 NEW FACILITY CHARGES FOR WATER MAIN EXTENSIONS OF SERVICE

Normal extension. An extension of fifty (50) feet or less shall be made by a utility to its existing distribution main without charge for a prospective customer who shall apply for and contract to use service for one (1) year or more.

When an extension of the utility's main to serve an applicant or group of applicants amounts to more than fifty (50) feet per applicant, the utility may require the total cost of the excessive footage over fifty (50) feet per applicant/customer to be deposited with the utility by the applicant or the applicants, based on the average estimated cost per foot of the total extension.

When an extension of the utility's main to serve an applicant or group of applicants amounts to more than fifty (50) feet per applicant, the utility will require the

applicant(s) to sign an agreement between the utility and the property owner (applicant/customer) that specifically define the responsibilities of each party with regards to the extension.

Each customer who paid for service under such extension will be reimbursed under the following plan:

For a period of five (5) years after construction of the extension, each additional customer whose service line is directly connected to the extension installed, and not to extensions or laterals therefrom, will be required to contribute to the cost of the extension based on a re-computation of both the utility's portion of the total cost and the amount contributed by the customers. The utility will refund to those customers that have previously contributed to the cost of the extension that amount necessary to reduce their contribution to the current calculated amount for each customer connected to the extension. All customers directly connected to the extension for a five- (5) year period after it is placed in service must contribute equally to the cost of construction of the extension. In addition, each customer must pay the approved tap-on fee applicable at the time of his/her application for the meter connection. The tap-on fee will not be considered part of the refundable cost of the extension and may be changed during the refund period. After the five- (5) year refund period expires, any additional customer will be connected to the extension for the amount of the approved tap-on fee only. After the five (5) year refund period expires, the utility will be required to make refunds for an additional five (5) year period in accordance with subparagraph 1 of 807 KAR 5:066 Section 11 (2)(b).

1.6.10 RECONNECTION CHARGE

When service is disconnected for nonpayment of a bill or any violation of these service regulations, OCWD will require the customer to pay all costs of disconnection and reconnection, but not less than the applicable reconnection fee of forty-five dollars and forty-three cents (\$45.43) for meter disconnect. When a customer requests reconnection of service at the same location within twelve (12) months of disconnection of such service, the charge for reconnection shall be the applicable re-connection fee.

1.6.11 MOVING OR RELOCATING OCWD EQUIPMENT

Whenever OCWD shall make changes in its equipment or facilities for the convenience of the customer or requesting party, the cost of the work shall be billed to and paid by the contractor, customer or other agreeable party. Upon receiving such request, OCWD will render an estimate of the project cost. Should the applicant agree to proceed with the request they shall pay the cost estimate prior to commencement of work. Upon completion of the project, the customer/contractor will be invoiced actual cost. Should the estimated

cost not cover the actual work performed by OCWD, the applicant shall pay the balance due. Should the estimated cost exceed the actual expense incurred, OCWD will refund the difference.

Only authorized OCWD employees may remove facilities, cut service laterals, meters or handle facilities belonging to OCWD.

1.6.12 COST CALCULATIONS

All cost estimates for services and work to be performed will be calculated at OCWD's rates for Labor, Equipment and Materials in effect at the time of such estimate. Should the services or work to be performed extend beyond thirty (30) days after the date of the cost estimate, such estimate will be billed at the prevailing rate at the time of the performance of work.

1.6.13 NOTICE OF TROUBLE

OCWD provides 24-hour emergency service in the event of service interruptions or other problems associated with the service rendered. The Customer should call OCWD immediately if the problem is on the utility side of the demarcation point of service delivery (utility side of the metering). Customer shall notify OCWD immediately should the service be unsatisfactory for any reason, or should there be any defects, trouble, or accidents affecting the supply of water. Such notices, if verbal, should be confirmed in writing.

Customer Problem

The Customer will pay twenty-five dollars and twenty-one cents (\$25.21) during OCWD office hours and fifty-two dollars and ninety-nine cents (\$52.99) at other times for service calls to their premises if the trouble proves to be in the facilities for which the Customer is responsible.

Any condition on the customer's side of the meter, such as faulty piping, groundwater, faulty water-heater, faulty shutoff valves, etc., for which the customer shall check before calling OCWD to investigate, are subject to billing. This charge will appear on the next monthly billing. Conditions that are found to be a problem at the meter will not be subject to charges, unless tampering is the cause.

1.7 WATER RATES SCHEDULE

The OCWD publishes a document identifying current schedules and fees associated with service to customers within the OCWD service area. This document is available free of charge from the OCWD Office and located on OCWD's website.

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Chapter 2 General Information

2.1 PURPOSE

This chapter:

- A. Provides an overview of the Ohio County Water District's (OCWD) planning, design, and construction approach relating to water facilities and their related appurtenances.
- B. Defines an overview of the OCWD's process for the submittal, review, and approval of Construction Documents for water facilities.
- C. Defines information relating to area utility coordination.
- D. Provides direction relating to the development of water projects within the OCWD's service area.

2.2 DEFINITIONS

A complete listing of definitions used in this document is found in Appendix A.

2.3 STANDARD PROCEDURE

If the Developer elects to perform the construction of water facilities within and adjacent to his development, as required to connect to the OCWD's existing water facilities, the following is to be provided by the Developer:

- A. The Developer must obtain Kentucky Division of Water approval of Plans and Specifications for construction of water facilities.
- B. Employ a Registered Professional Engineer, experienced in water engineering, to prepare Construction Plans for the proposed work, and submit the Construction Plans to the OCWD for its review and approval. The Construction Plans to be submitted shall be prepared according to this manual. If a sanitary sewage pumping station is required to serve the development, complete technical specifications (design calculations, Shop Drawings, Control Drawings, and Operation and Maintenance Instructions) must be submitted to the OCWD for review and approval. The Professional Engineer shall be employed throughout the duration of the project to provide on-site construction inspection to certify that all construction materials and methods are furnished and installed according to the approved Construction Plans and Specifications. The OCWD will provide periodic on-site construction inspection during the construction phase of the project and report inconsistencies to the Professional Engineer and Developer. This periodic inspection will be in no way relieving the Professional Engineer of his responsibility for construction inspection/observation on the project.

- C. Employ an experienced Utility Contractor to perform the necessary construction work. The Contractor shall employ during its progress, a competent superintendent and any necessary assistants, all satisfactory to the OCWD. Equipment and tools shall be of adequate size and in proper condition to perform the work.
- D. The Developer shall make written application to the OCWD; if the Developer is requesting that the OCWD perform any part of the construction involved in the development of the project. The Developer shall be responsible for the cost of all construction materials involved in the installation of the proposed water distribution system. This material cost shall include all onsite improvements necessary to provide adequate flow and pressure to the development.

2.4 DESIGN APPROACH / DESIGN CRITERIA

Proposed construction or expansion of water facilities within the OCWD's service area shall be in compliance with the Recommended Standards for Water Works (commonly referenced as the Ten State Standards), the Kentucky Administrative Regulations, and guidelines defined in this Standards Manual. Any person, company, corporation, or other entity proposing to develop land, or proposing to install new or replacement water facilities within the OCWD service area must prepare, for review and approval by the OCWD, Planning and Design Documents according to the standards and requirements of this Manual. Planning and Construction Documents must be prepared and certified by a Professional Engineer, registered in the Commonwealth of Kentucky and authorized to transact business within the Commonwealth of Kentucky. The service level of proposed facilities shall be according to standards referenced in these documents. Design Standards shall be those referenced herein.

2.5 SUBMITTAL REQUIREMENTS

The Engineer may submit to the OCWD for its review and comment, a concept plan (a preliminary water plan) to aid the Engineer in preparation of the Final Construction Plans.

All Construction Documents, excluding preliminary water plans, prepared for the OCWD's review and approval must be signed and sealed by a Professional Engineer and/or Registered Land Surveyor (as appropriate), currently registered in the Commonwealth of Kentucky.

2.6 UTILITIES/AGENCIES COORDINATION

The Engineer shall coordinate the design of all water facilities improvements with all Utility Companies and/or appropriate agencies actively involved in the provision of service in OCWD's service area. Final Construction Plans shall accurately reflect the location of all existing and proposed utilities.

The OCWD should be copied on all correspondence with other utilities and agencies. A sample listing of contact persons and respective agencies is listed in Exhibit 2-1.

2.7 DEVELOPMENT RELATED FEES

The OCWD performs design review, construction observation, and other development related activities at no cost to the Developer. However, the Commonwealth of Kentucky's Natural Resources and Environmental Protection Cabinet charges a review fee for Construction Documents. Developers should contact the Division of Water for fee assignments.

2.8 SECOND HAND AND SALVAGED MATERIALS

The use of second hand or salvaged materials will not be permitted unless authorized by the OCWD.

All materials and/or equipment specified to be salvaged from existing structures shall remain the property of the OCWD. Such materials and/or equipment shall be delivered by the Contractor and stored on sites as directed by the OCWD.

2.9 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

Shop Drawings are diagrams, schedules, and other data specifically prepared for the work by the Contractor or any manufacturer, supplier, or distributor to illustrate some portion of the work. Product data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate a material, product, or system for some portion of the work: samples are physical examples that illustrate materials, equipment, or construction and establish standards by which the work shall be judged.

Before any construction begins, the Engineer shall review and approve: all Shop Drawings, product data, and samples of construction materials to be used on the project, unless the materials are purchased by the OCWD. The Engineer shall determine and verify that all materials, field measurements, and field construction criteria related thereto, are in conformance with the design criteria and construction materials specifications referenced in this Standard's Manual.

The Engineer's review is for conformance with the requirements of the Construction Documents. The Engineer shall not be relieved of responsibility for any deviation from the requirements of the Construction Documents by the Engineer's approval of the Shop Drawings unless the Engineer has specifically informed the OCWD, in writing, of such deviation at the time of submission and the OCWD has given written approval of the specific deviation.

The Contractor shall maintain "Approved" copies of all Shop Drawings, bearing the approval of the Engineer, on the job site at all times.

Two copies of all approved Shop Drawings, product data and samples shall be submitted to the OCWD before construction is to begin.

2.10 PERMITS AND REGULATIONS

Encroachment permits, easements, and licenses necessary for the prosecution of the work, shall be secured and paid for by the Developer. The Developer shall provide the OCWD copies of all permits, easements, and licenses before construction. The Developer, Engineer, and Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work, as drawn and specified.

2.11 INSURANCE REQUIREMENTS

The Contractor shall not commence work until he has obtained all insurance required under this section and such insurance has been reviewed and approved by the Engineer, nor shall the Contractor allow any Sub contractor to commence work on his Sub contract until all similar insurance required of the Sub contractor has been so obtained and approved by the Engineer.

The minimum amounts of insurance coverage to be furnished by the Contractor for all work performed are:

A.	Workers' Compensation Employer's Liability	Statutory \$100,000
B.	Comprehensive General Liability Including Coverage for the Explosion, Collapse, and Underground Hazards, Contractual Liability, Products and/or Completed Operations, Personal Injury (Employment exclusion waived), Broad Form Property Damage (No deductible clauses are acceptable for these coverage's), and Independent Contractors (Sub contractors)	
	Bodily Injury Liability	\$500,000 each occurrence
	Personal Injury Liability	\$500,000 each occurrence
	Property Damage Liability	\$100,000 each occurrence \$300,000 each policy period
C.	Comprehensive Automobile Liability, Including Hired Car and Employer's Non-ownership Liability Coverage	
	Bodily Injury Liability	\$200,000 each person \$500,000 each occurrence
	Property Damage Liability	\$100,000 each occurrence
D.	All Risk Type Builder's Risk or Installation Floater	100% of construction cost
E.	Railroad Protective Insurance Bodily Injury	As required by railroad

	Property Damage	As required by railroad
F.	Umbrella Excess Liability	\$2,000,000 each occurrence
G.	Owners Protective Liability	
	Owner to be named insured (No deductible)	
	Bodily Injury	\$500,000 each occurrence
	Personal Injury	\$500,000 each occurrence
	Property Damage	\$250,000 each occurrence

The OCWD must be provided with 30-days advance written notice of cancellation or any material change. Notice shall be provided to the OCWD and the Engineer.

2.12 CONTRACTOR’S GUARANTEE AND UNDERSTANDING

All work that has been rejected shall be repaired. If it cannot be repaired satisfactorily, it shall be removed and replaced at the Contractor’s expense. Defective materials shall be immediately removed from the site of the work. Work done without line and grade having been given, work done beyond the lines or not in conformity with the grades shown on the plans or as given, same as herein provided, work done without written authority and prior agreement in writing as to process, shall be done at the Contractor’s risk and shall be considered unauthorized and, at the option of the Engineer and the OCWD, may be ordered removed at the Contractor’s expense.

2.13 COMPLIANCE WITH LAWS

The Developer, Engineer, and the Contractor shall fully comply with all Local, State, and Federal laws, including all codes, ordinances, and regulations applicable to the work. The Developer shall secure and pay for all permits and licenses necessary for the execution of the work and shall fully comply with all their terms and conditions.

2.14 PROTECTION OF WORK AND OF PERSONS AND PROPERTY

During performance and up to the date of Final Acceptance, the Contractor shall be under the absolute obligation to protect the finished work against any damage, loss, or injury. All risk of loss or damage to the work shall be borne solely by the Contractor until completion and acceptance of all work by the Engineer and the OCWD, as evidenced by the OCWD’s issuance of a Letter of Acceptance.

The Contractor shall have the full responsibility to provide and maintain all warning devices and take all precautionary measures required by law or otherwise to protect persons and property while said persons or property are approaching, leaving, or within the work site or any area adjacent to the work site. Minimum standards for safeguarding pedestrian and vehicular traffic are contained in the “Manual of Uniform Traffic Control Devices,” Federal Highway Administration of the U.S. Department of Transportation, and the “Kentucky Manual of Uniform Traffic Control Devices,” Kentucky Transportation Cabinet.

The Contractor shall be responsible for complying with State Laws and Federal Regulations relating to trench safety.

2.15 MATERIALS AND WORKMANSHIP; WARRANTIES AND GUARANTEES

The work shall be performed according to the best modern practice with materials and construction of the required quality and suitable for the purpose. The Engineer and the OCWD shall judge and determine the Contractor's compliance with these requirements.

The Contractor shall promptly correct or replace all work rejected by the Engineer or the OCWD as defective or as failing to conform to the Construction Documents, whether observed before or after substantial completion, and whether or not fabricated, installed, or completed.

If within one (1) year of Final Acceptance by the OCWD, as evidenced by the Final Certificate of Acceptance or within such longer or shorter period as may be prescribed by law or by the terms of any other applicable special warranty on designed equipment or portions of work as required by the Construction Documents, the Contractor shall correct it promptly after receipt of a written notice from the Engineer to do so. The OCWD shall give notice promptly after discovery of such condition. The Contractor shall remove from the site all portions of the work that are defective or nonconforming which have not been corrected unless removal is waived in writing by the OCWD.

2.16 SUBSTITUTIONS

Whenever materials or equipment is specified or described in the Standards Manual by using the name of a proprietary item, or the name of a particular supplier, the naming of the item is to be intended to establish the type, function and quality desired. Unless the name is followed by words indicating that no substitution is permitted, materials and equipment of other suppliers may be accepted by the OCWD if sufficient information is submitted by the Engineer to determine that the material or equipment proposed is equivalent or equal to that named. Request for review of substitute items or material and equipment will not be accepted by the OCWD from anyone other than the Engineer. If the Engineer wishes to furnish or use a substitute item of material or equipment, the Engineer shall make written application to the OCWD for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified.

The OCWD will be the sole judge of acceptability, and no substitute will be ordered, installed, or used without the OCWD's prior written acceptance.

2.17 INSPECTION AND TESTING OF MATERIALS

The Contractor shall furnish the Engineer and the OCWD with every reasonable facility for ascertaining whether or not the work performed was according to the requirements and intent of the Construction Documents. Any work done or materials used without suitable inspection by the Engineer and the OCWD may be ordered removed and replaced at the Contractor's

expense.

The Engineer shall be responsible for all inspections of the progress of the work. The Engineer and the OCWD shall make Final Inspection of all work included in the Construction Documents, and provisions provided in the Division of Water approval letter when practicable after the work is completed and ready for acceptance. If the work is not acceptable to the OCWD at the time of such inspection, the OCWD shall inform the Engineer as to the particular defects to be remedied before Final Acceptance shall be made.

When the project is completed, the Engineer shall submit a written certification to the Division of Water that the project has been constructed and tested according to the approved Construction Plans and Specifications, and the provisions listed in the Division of Water approval letter. The certification must be sealed, signed, and dated by a Professional Engineer licensed in the Commonwealth of Kentucky. One (1) original copy of the certification shall be submitted to the OCWD.

2.18 SURVEYS / LAYOUT OF WORK

The layout of the work shall be the responsibility of the Engineer and shall be subject to checking by the OCWD. The Engineer shall establish base lines and a system of bench levels (Tied to USGS Datum) for the Contractors use as required.

Trench line stations will be set by the Engineer ahead of trenching. These stakes shall be installed at least each 100-feet of pipeline and at the locations of all pipeline accessories (valves, fire hydrants, fittings, etc.)

The Engineer shall have all property corners on the site clearly visible during construction of the work. If the Developer requests that the OCWD install the water main and appurtenances within the development, the OCWD will be responsible for construction staking.

2.19 AUTHORITY OF THE ENGINEER

All work shall be performed in a competent manner, to the satisfaction of the Engineer and the OCWD. The Engineer and the OCWD shall decide all questions that arise as to the quality and acceptability of materials furnished, work performed, the manner of performance, rate of progress of the work, sequence of the construction, and interpretation of the plans. The Engineer and the OCWD shall determine the amount and quality of work performed, materials furnished. Their decisions shall be final. The Engineer shall be responsible for certifying that the project has been constructed according to the approved Construction Document, and the provisions of the Division of Water's Approval letter(s). Deviations from the Division of Water's approved Construction Plans and Specifications shall be approved in writing by the OCWD.

2.20 AUTHORITY OF THE OCWD (Owner)

All work shall be performed in a competent manner and to the satisfaction of the OCWD. The OCWD shall provide periodic construction observations of the work in progress to

ensure that the work is being performed according to the Construction Documents and the provisions of the Division of Water approval letter(s). This observation shall not relieve the Engineer from his responsibility of inspecting the construction of the work.

2.21 SUPERVISION BY THE CONTRACTOR

The status of the Contractor is that of an independent Contractor under Kentucky Law and the work shall be under the direct charge and superintendence of the Contractor. Except where the Contractor is an individual and gives his personal superintendence to the work, the Contractor shall provide a competent Superintendent or General Supervisor on the work at all times during progress with full authority to act for him.

If the Superintendent or his General Supervisor should be or become unsatisfactory to the Engineer or the OCWD, he shall be removed by the Contractor upon written direction of the Engineer or the OCWD.

2.22 EMPLOYEES

The Contractor shall employ only competent, efficient employees and shall not use on the work any unfit person or one not skilled in the work assigned to him; and shall at all times maintain good order among his employees.

2.23 FINAL INSPECTION AND ACCEPTANCE

Whenever the improvements have been completely performed by the Contractor, the Contractor shall notify the Engineer and the OCWD that the work is ready for Final Inspection. The Engineer and the OCWD shall then make Final Inspection, and if the work is satisfactory and according to the Construction Documents, the Engineer shall provide written certification to the Kentucky NREPC that the project has been constructed in accordance with the approved Construction Plans and Specifications.

2.24 CORRECTION OF WORK

If required by the Engineer or the OCWD, the Contractor shall promptly either correct defective work, whether or not fabricated, installed or completed, or if the Engineer or the OCWD has rejected the work, remove it from the site and replace it with non-defective work.

The Contractor shall bear all direct, indirect, and consequential costs of such correction or removal made necessary hereby.

2.25 FINAL RECORD DRAWINGS

Final Record Drawings, also known as “As-Built Drawings,” shall be submitted by the Engineer before issuance of the “Letter of Acceptance” by the OCWD. These Final Record Drawings shall be prepared to ensure that all proposed water and sanitary sewer plans correctly depict the facilities as constructed. Chapter 5 of this manual describes the preparation and submittal of the Final Record Drawings in detail. Note that Final Record

Drawings shall be submitted in digital and paper format.

2.26 THE OCWD'S SERVICE AREA

The geographic boundary of the OCWD's service area is illustrated on Exhibit 2-2.

2.27 THE OCWD CONSTRUCTION PARTICIPATION

The Developer may request the OCWD install the water system within developments. The OCWD will only participate in the construction of water systems to be owned, operated, and maintained by the OCWD. The Developer should notify the OCWD during design review concerning a request for the OCWD, construction participation on the project. Additionally, the Developer's Engineer shall remain responsible for the construction inspection and project certification. The acquisition of all easements, permits, rights-of-entry, and other construction documentation shall be the sole responsibility of the Developer.

The Developer shall be responsible for furnishing and installing all casing pipe required furnishing water service.

Prior to any construction participation by the OCWD, the Developer's grading Contractor shall rough cut all rights-of-way and easements within the development to within 0.20-feet of final subgrade. The Developer shall be financially responsible for the relocation of any pipeline or related appurtenances due to revisions in the grading work on the project site.

If the OCWD participates in the installation of the water systems, no claim against the OCWD shall be made for trench settlement due to water system construction. The Developer shall be responsible for the compaction of trenches prior to the construction of drives and/or other structures along the route of the proposed improvements. The Developer will be responsible for the installation of all casing pipe and shall pay all material cost.

2.28 SEQUENCE OF CONSTRUCTION

If the Developer requests that the OCWD install the water distribution system within the development, the Developer must sequence the construction of the other infrastructure to allow for the water distribution system construction to immediately follow the sanitary sewer collection system installation. The Developer shall not allow the installation of other underground utilities (storm drainage, electric, telephone, gas, cable) that may interfere with the water main construction. All rights-of-ways shall be rough cut to within 0.20-feet of subgrade as shown on the approved paving plans prior to installation of the water and wastewater systems.

If requested, the OCWD will begin the installation of the water main and related appurtenances upon completion of the sanitary sewer system low-pressure air test (if applicable). The work shall be placed on a priority list based on who successfully completes the sanitary sewer system tests first. The OCWD will install water mains as time permits with the first responsibility to maintaining the existing distribution system.

No water service shall be provided by the OCWD until the Engineer has issued the Engineering certification stating that the water facilities have been constructed and tested in accordance with the Division of Water approved Construction Plans, specifications, and special provisions.

Utilities and Agencies Coordination

Effective date: June 16, 2003

Kentucky Statutes (KRS 367.4901 through 367.4917) require that all excavators planning excavation or demolition work shall notify all utility companies in the area and/or an Underground Protection Service such as BUD at least two (2) working days before commencing work to alert Utility Companies in the area with underground facilities of the planned excavation or demolition activities.

Prior to commencing any work, the Contractor shall have available a list of local emergency contact names and telephone numbers for all utilities within the service area.

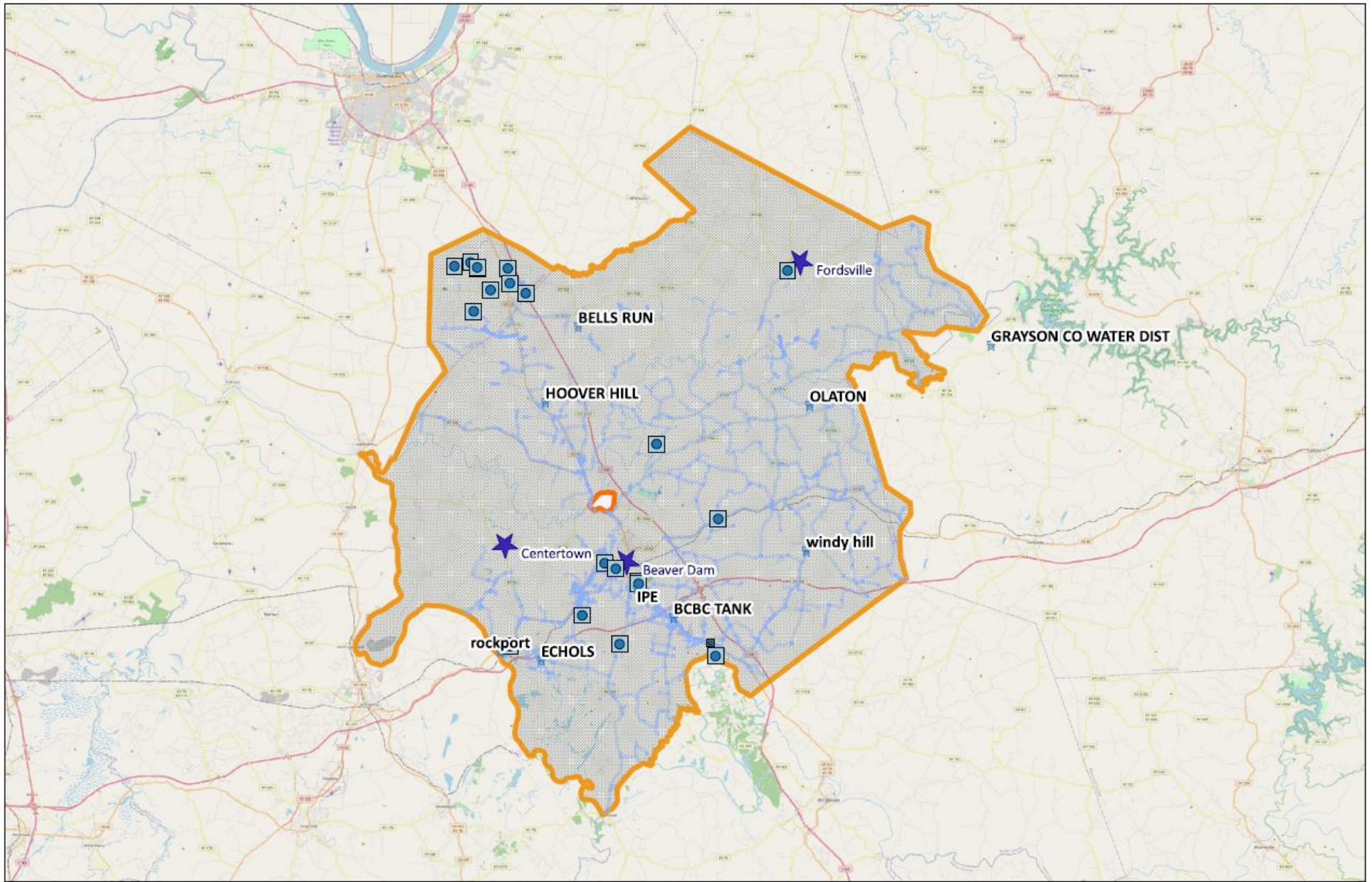


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CHAPTER 3

Drafting Standards

3.1 PURPOSE

This chapter establishes the Drafting Standards that must be followed by Developers, Engineers, and Land Surveyors for the development of Construction Plans and Record Drawings to ensure that all proposed water facility Construction Plans are correctly depict the facilities to be constructed.

3.2 GENERAL

Construction Plans for water facilities will be prepared in a neat and professional manner. All lettering and lines will be of a proper weight and well-spaced to provide overall composition of the plans. It is very important that information be presented so that it will be returned to the Developer.

All final submittals of Construction Plans shall have the original Professional Engineer seal, signature, and date on each sheet. Plans submitted without the original seal, signature, and date will be returned to the Engineer.

3.3 DRAFTING MEDIA AND STANDARDS

- A. Final Construction Plans will be on blackline or blueline drafting media, and will conform to the 24" X 36" dimension. Any drawing submitted with pencil will be returned for re-drafting.
- B. Preliminary water plans may be prepared on photo-enlargements of aerial mosaics with ink used for clarity in presentation.

The OCWD recommends a scale for Construction Plans of :

- 1" = 50' horizontal with vertical scale of 1" = 5'
 - or
 - 1" = 20' horizontal with vertical scale of 1" = 2'.
- C. Plan Sheets shall have a standard Engineer's name and title block including a north arrow.

3.4 STANDARD AND TYPICAL DRAWINGS

3.4.1 DEFINITIONS

- A. Standard Construction Details are prepared by the OCWD and furnished for inclusion in all submittals of Construction Plans. These drawings are available from the OCWD in digital format or on blackline paper at no charge to the Engineer. The OCWD may add or revise the Standard Drawings at any time. These drawings are commonly called the “The OCWD Standard Details.”

The Engineer can modify the details to meet the specific needs of a particular project with the written approval of the OCWD.

- B. The Engineer will submit sheets within the set of Construction Plans under the following format.

Description of Sheet

Title Sheet
Copy of the Final (Record) Plat
Plan Index Sheet (Optional, this information can be included on the Title Sheet)
Plan Sheet(s)*
Profile Sheet(s)
Standard Construction Details
Special Details

3.4.2 TITLE SHEET REQUIREMENTS

The following data will be shown on cover of the Construction Plans.

- A. The name of project.
B. Plan Index.
C. Name and address of the Engineer.
D. Name and address of the Developer.
E. Project (vicinity) map.

3.4.3 COPY OF THE FINAL (RECORD) PLAT

A copy of the Final Plat shall be included in the Construction Plans. If the Final Plat has not been approved by the OCWD, the Engineer will include an approved copy of the Preliminary Plat in the Construction Plans. The Final Plat, when processed, must include all onsite easements required for the maintenance and operations of all water facilities within the development.

3.4.4 PLAN INDEX SHEET REQUIREMENTS

A Plan Index Sheet will be prepared to identify the location of the work shown on each Plan and Profile Sheet. The Plan Index will include a reference to the location of the profile for the water lines on each Plan Sheet if the profile is on a separate Plan Sheet. For most projects, the Plan Index will be shown on the Project Map. If drawing space is restrictive, the Plan Index can be shown on the Vicinity Map Sheet.

3.4.5 SPECIAL DETAILS

Any proposed construction that is not covered in the OCWD's Standard Details shall be shown on Special Detail Sheets prepared by the Engineer. Details will be shown on a Standard Plan Sheet and should clearly and accurately depict the proposed construction. Special pipe bedding and pumping station design are typical examples of items that might require Special Details.

3.4.6 TITLE BLOCK REQUIREMENTS

All sheets included in the Plans, except the Title Sheet, will contain a Title Block. Information in the Title Block should include the project title indicating water plans, what type of sheet and the specific information on the sheet.

3.5 PLAN AND PROFILE FORMAT

3.5.1 GENERAL CRITERIA

The Plan View of proposed water main construction generally should be shown on the same sheet as the Profile with the Plan View at the top of the sheet and the Profile at the bottom of the sheet. If drafting efficiency can be achieved, a Profile View may be shown on a different sheet than the Plan. In this case, the Plan Sheet and the Profile Sheet shall be cross-referenced. The entire Profile for each line will be shown on one sheet when possible. A Profile Sheet with Profiles for more than one Plan Sheet will be acceptable. Profiles shown on sheets separate from the Plan Views should follow the Plan Views in a logical order. The information that appears on both the Plan and Profile Views will include, but not be limited to, the following:

- A. The location of proposed valves, fire hydrants, and meters and all associate stations will be shown.
- B. Lot numbers for all properties shall be shown and drawn parallel with the streets in the Plan View. House number for all existing homes and businesses shall be shown and drawn parallel with the streets in the Plan View.
- C. All existing pipes, culverts, and appurtenances will be hatched.
- D. The size and location of the following items will be shown:
 1. Stubs.

2. Property Service Connections.

- E. All existing pipes, culverts, conduits, and utilities of any nature crossing the proposed improvements location will be plotted and labeled in both the Plan and Profile.
- F. If the length of a line causes a Plan or Profile to cover more than one sheet, a cross-reference will be shown on each sheet to identify the location of the attendant profile or Plan Sheet.
- G. Match lines are acceptable in the Plan View with proper referencing station and attendant sheet number.
- H. One hundred -foot stations will be shown.

3.5.2 PLAN VIEW

The information to appear in the Plan View will include, but not limited to, the following:

- A. Locations of future connections.
- B. The location of the centerline of pipelines and structures will be referenced by dimensions to the easement lines and to the appropriate property lines.
- C. Benchmarks will be accurately plotted and labeled on the plans. A description and location of each benchmark, including its station and offset relative to the proposed line, will also be given. When a benchmark's location and description cannot be plotted with the plan coverage, a descriptive location and elevation shall be given on the plans in a location in close proximity to the reference marker.
- D. Houses, fences and drives will be shown for a minimum of 50-feet beyond the right-of-way or to the fronts of the houses for lines in the rights-of-way. Trees, steps, walks, and other topographical features will be shown to the extent that they may be pertinent to the improvement location or construction. These items will be field located. Trees will be shown with a designation of size and description.
- E. Property lines, lot lines, easement lines, and other boundary lines will be shown a minimum of 75-feet, beyond any proposed or existing right-of-way. In instances where additional information might be required, the limit will be extended.
- F. Property service connections for water services will be shown at the midpoint of the lot along the public right-of-way. If a specific location needs to be shown, an arrow will be added to the symbol indicating the desired location of the service and a note will be shown on the area indicating the station of the proposed property service connection.
- G. Generally, only the centerline of the pipe will be shown on the Plat View and the invert and crown lines of the pipe will be shown on the Profile. However, a thin

centerline will be shown, within these outside lines where any of the following conditions exist:

1. A distance is shown from a point or line to the centerline of the pipe.
 2. The delta angle is shown.
 3. The angle of intersection is shown.
- H. Existing ditches having a bottom width of four (4) feet or less will be indicated by drawing the centerline of the ditch. Ditches and channels having a bottom width greater than four (4) feet will be shown by drawing each side of the ditch and noting its width. Where ditch paving exists, the width of the paved area will be shown.
- I. Existing and proposed water mains and their size. The Deed Book and Page Number will be shown for existing Water Easements affected by water construction.
- J. All gas, electric, telephone conduits, fiber optic cables, and any other underground or overhead utilities will be shown with the size or primary voltage and ownership identified.
- K. Where water mains are to be in existing streets, the front dimension of each lot will be shown. When water mains are to be placed in easements and rights-of-way, property line dimensions adjacent to the proposed sewer construction will be shown.
- L. Highways, street names, alleys, and major streams and ditches will be shown with the width and type of all surfaces will be indicated.
- M. Street right-of-way widths will be shown adjacent to and after the street name.
- N. The general notes and legend of the standard symbols used throughout the Plans will be shown on the Plan Index Sheet or on the first Plan Sheet if the Plan Index is shown on the Title Sheet.
- O. Stations will be shown above each 100-foot station on 50-scale and 20-scale plans and above each 500-foot station on 100-scale plans. For example: 1+00, 5+00, etc., (water main extension plans only).

3.5.3 PROFILE VIEW

In addition to those items in Section 4.4.2, the information to appear in the profile view will include, but not be limited to, the following:

- A. The grid will be set up on a two (2) inch square basis. The vertical scale for 50-scale plans will be 1"=5' and for 20-scale plans will be 1"=2'.
- B. The limits, by station, will be shown for all concrete caps, cradles, encasements, tunnels and bored segments.

- C. When a line, in an easement, crosses a public right-of-way, the limits of the right-of-way, including its width will be shown.
- D. The water surface elevations of the 100-year flood areas will be shown.
- E. Existing ground profile including any proposed street grades or improvements will be shown.
- F. Any underground telephone conduit, water main, gas lines, etc, will be shown when crossing the proposed OCWD facilities.

3.5.4 GENERAL NOTES

General Notes are notes common to the complete set of plans and will be shown on the first Plan Sheet, if space permits, or title sheet, if necessary. The type of backfill, pipe material, and classification may be shown in the general notes if most of the pipes on a particular project have these items in common. The OCWD will provide a listing of general notes commonly used on OCWD projects, at the Engineer's request.

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CHAPTER 4

Final Record Drawings

4.1 PURPOSE

This chapter establishes the procedures that must be followed by Developers, Engineers, and Land Surveyors concerning the preparation of Final Record Drawings to ensure that all proposed water facilities Construction Plans correctly depict the facilities as constructed.

4.2 GENERAL

A record of all deviations from the Construction Plans shall be made by the Engineer who shall, upon completion of the project, generate Final Record Drawings. Final Record Drawings are generated by revising the original design information and adding the corrected data. Therefore, the Final Record Drawings will depict the constructed information.

The Engineer shall submit two (2) blackline or blueline copies of the Final Record Drawings and one (1) complete set in digital format. Digital files shall be submitted in the AutoDesk AutoCAD .dwg format.

4.3 PROCESS

Certification to the Natural Resources and Environmental Protection Cabinet by the Engineer will notify the Developer that a particular project is ready for Final Record Drawings. The completed Final Record Drawings shall be submitted to and reviewed by the OCWD's Engineering Department for verification of information. The plans are either accepted as Final Record Drawings or rejected and the above process is repeated. Final Record Drawings shall be approved by the OCWD before the OCWD will release the Letter of Credit issued to the OCWD/Hopkins County Planning Commission.

4.4 DRAWING INFORMATION

The drawings shall depict the Engineers' verification of the horizontal and vertical locations of the water system. This information should be used by the Engineer in preparing the Final Record Drawings. Each drawing shall have the following statement affixed in the lower right-hand corner of each sheet:

“I hereby certify that these Construction Drawings represent a true and accurate depiction of the As-Built conditions.”

The Engineer shall place a Professional Engineering seal on each sheet including signature and date.

4.5 CONSTRUCTION PLANS

The following construction items, at a minimum, should be reviewed and verified to produce the “Final Record Drawings”.

4.5.1 ALIGNMENT CHANGES

4.5.1.1 CHANGES IN STATION ON:

- A. Property Service Connections
- B. Fittings
- C. Valves
- D. Fire Hydrants

4.5.1.2 CHANGES IN ELEVATION FOR:

- A. Structures.

4.5.2 CHANGES IN STRUCTURES

- A. All revisions in pipe sizes, lengths, slopes, and angles.
- B. Changes in offset distances of structures.
- C. For Pump Stations:
 - 1. All revisions in pipe sizes.
 - 2. All revisions to electrical controls.
 - 3. All revisions to ventilation systems.
 - 4. Pump modifications.
 - 5. Changes in elevation for inverts and level controls.
 - 6. Equipment layout modifications.
 - 7. Building modifications.

4.5.3 GENERAL

- A. The Engineer shall stamp and sign **ALL SHEETS** of the Final Record Drawings.
- B. Any unverified data shall show +/- thereby indicating that information has not been verified.
- C. The Engineer shall affix a note on each sheet identifying the drawings as “Final Record Drawings”.

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CHAPTER 5

Surveying

5.1 PURPOSE

Private development projects requiring the OCWD approval and/or acceptance of constructed facilities should follow these guidelines. Engineers, Surveyors, and Field Survey Party Chiefs should familiarize themselves with this and all other Chapters of this Standards Manual before the start-up of any field survey effort. Familiarity with this Manual will enable the Field Survey Party to obtain the necessary field information for design and construction and reduce the occurrence of improper activities.

5.2 GENERAL

5.2.1 CONDUCT

These members of the Survey Party are normally the first representatives of a firm or organization to contact the property owner or residents along the route of the proposed improvement. It is imperative, therefore, that the Survey Party conducts themselves properly, both on the project and in the surrounding community.

5.2.2 RIGHT OF ENTRY

When the survey work will obviously require entry onto private property, the owner shall be contacted, the survey work described, and permission to enter obtained.

5.3 HORIZONTAL AND VERTICAL CONTROL

5.3.1 GENERAL

Trees are not to be used for surveying purposes except in remote areas where there is no practical alternative. No spikes, nails, etc., are to be driven into a tree except under the above-described circumstances. Trees will not be “blazed” under any circumstances, and only water-based paint may be used if marking a tree is necessary.

5.3.2 GUIDELINES

Horizontal and vertical control shall be established according to the guidelines defined by these publications:

- A. A Professional Land Surveyor, licensed in the Commonwealth of Kentucky, must complete the surveying.
- B. “Standards and Specifications for Geodetic Control Networks,” Federal Geodetic Control Committee (FGCC).
- C. “Horizontal Control,” NOAA Technical Report NOS 88 NGS 19.

- D. “Geodetic Leveling,” NOAA Manual NOS NGS 3.
- E. “Geometric Geodetic Accuracy Standards and Specifications Using GPS Relative Positioning Techniques” (or its subsequent revisions), FGCC.
- F. All pertinent statutes, laws, and regulations.

5.3.3 DATUM

All control shall be related to existing monumentation approved by the OCWD and must reference the appropriate datum as indicated below:

HORIZONTAL

All horizontal control points will be based on the North American Datum of 1983 (NAD-83). HARN State Plane Coordinates will be based on the Kentucky State Plane System (South Zone) in U.S. survey feet or as otherwise specified by the OCWD.

VERTICAL

All control points will be referenced to the North American Datum, 1988 Adjustment in U.S. survey feet or as otherwise specified by the OCWD.

5.3.4 BENCHMARKS

Project vertical control shall be referred to as “benchmarks.” Benchmarks shall be established at a maximum interval of 800-feet and must maintain a minimum distance of 50-feet from the improvement centerline. Each benchmark should be placed to avoid movement caused by construction or other activities.

All benchmarks must conform to specification for quality Code “C”, or better, as designated by NGS for preparation of NOAA Form 76-186. Sidewalks, steps (unless massive), small concrete slabs, and similar structures are not acceptable. Each project must contain at least one benchmark that conforms to NGS quality Code “B” specifications, as designated for preparation if NOAA Form 76-186.

5.3.5 LOCATION REFERENCE

All benchmarks are to be exactly defined and shall be referenced to the centerline of sewers by line designation, station and offset in addition to other field references such as lot numbers, addresses, etc., in plans and any other pertinent documents submitted.

5.4 DEGREE OF ACCURACY

5.4.1 GENERAL

The instruments used shall meet the specifications indicated in these guidelines or in

following sections. All instruments shall be certified to National Institute of Standards and Technology Standards and Manufacturers Specifications. Certification shall be performed by the previously mentioned institute, the instrument manufacturer or a certified instrument, repair facility.

5.4.2 ACCURACY CRITERIA

5.4.2.1 WATER MAINS

Horizontal surveys shall adhere to Third Order, Class I Specifications, except that adjustments may be made by either the Least Squares or Compass Rule Method.

Vertical control shall adhere to Third Order Specifications, except that the error of closure will be equal to or exceed Second Order, Class II Requirements.

5.5 FIELD PROFILE AND TOPOGRAPHY

5.5.1 FIELD PROFILE REQUIREMENTS

Profiles shall delineate existing structures, roads, streams, etc. Elevations shall be established to the nearest one-tenth of a foot on natural terrain and to one-hundredth of a foot on artificial surfaces. Profiles will not be established without an intermediate turning point between benchmarks.

Cross-sections shall be taken at critical locations when it is necessary to determine what effect open cuts or trenching might have on other facilities such as structures, utilities, pavements, fences, trees, or landscaping. Sufficient original ground elevations must be determined to establish the slopes necessary to serve the property adequately.

5.5.2 TOPOGRAPHIC REQUIREMENTS

In addition to the topographic requirements established in Chapter 4, the following information shall be obtained in the field:

- A. Topography generated from serial photography shall be identified and field checked for any errors or omissions. Omitted topography shall be located by field survey and appropriately recorded. This work is the specific responsibility of the Engineer and/or Land Surveyor. All topography within the project construction limits and/or easements and rights-of-way shall be field located.

5.6 SPECIAL SURVEYS

5.6.1 PROPERTY SURVEYS

Where the relationship of the improvements location and adjacent property line are critical, the location of existing property lines and other boundaries shall be established by a property

survey sufficient to define the easement. All property surveys shall comply with the “Minimum Standards of Practice for Land Surveying in Kentucky,” latest revision, as set forth and enforced by the Kentucky Revised Statutes. Property lines, boundary lines, easements, etc., shall be referenced by stations and offsets from the centerline or baseline to the nearest one-hundredth of the foot, by measurement of the angles at the PI with the centerline, and by other means of comparable accuracy. Surveys shall ascertain the names of owners, lessees or tenants, sources of title and date of acquisition and shall be verified from the appropriate Hopkins County records.

5.6.2 UTILITY SURVEYS

All publicly and privately-owned surface and subsurface utilities affected by the proposed improvement shall be located and identified by field survey and by use of maps supplied by the utilities. Locations, elevations, and other pertinent data as may be required for possible relocation or adjustment shall be secured for all such utilities to the limits of information currently available. Overhead power lines near the intended improvements alignment, or those that may be construction hazards should be shown on the plans using the proper symbol and labeled with their primary voltage.

5.6.3 RAILROAD AND HIGHWAY SURVEYS

When the centerline of improvements crosses a railroad or highway, all existing and proposed railroad tracks, roadways and affected structures shall be tied to the improvement’s centerline. The topography shall be provided on either side of the proposed crossing to the extent required by the affected reviewing agency.

5.7 STAKING WATER MAINS

The construction staking of the work will be the responsibility of the Engineer and will be subject to checking by the OCWD. The Engineer will stake the centerline on the proposed water main ahead of trenching. These stakes shall be set by the Engineer at least each 100-foot of pipeline and at the location of all pipeline accessories (valves, fittings, hydrants, etc).

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CHAPTER 6

Easements

6.1 PURPOSE

All water facilities to be owned, operated, and maintained by the OCWD shall be constructed in public rights-of-ways, permanent utility easements, or on the OCWD owned properties. No approval will be given for construction or improvement of any water facilities within the OCWD service area without provision of suitable public right-of-way, permanent utility easement, or deed to the OCWD. The Developer shall acquire and record all onsite and offsite easements for private development projects.

6.2 EXISTING EASEMENTS

Each existing easement to be used shall be shown on the Plans submitted for review and approval. The information shown on the Plans shall include the Deed Book and Page Number of the recorded instrument. All restrictive clauses as to the use of the easements; i.e., for utility purposes, drainage, sanitary sewers, etc., shall be noted on the Plan adjacent to the pertinent easement. Construction of water systems will not be permitted in existing exclusive gas, electric, sewer or telephone easements unless a water easement is acquired overlapping the existing easement with prior approval of the OCWD and the affected agency.

6.3 DEFINITIONS

The following terms define the methods under which the OCWD currently acquires interest in property for the purpose of constructing, operating and maintaining water facilities.

6.3.1 FEE SIMPLE TITLE

For construction major structures, the Developer shall be required to provide all rights to the required property in fee simple title with the OCWD retaining permanent ownership. This generally refers to pumping station sites and pumping station access roads.

6.3.2 WATER EASEMENTS

For constructing facilities (water distribution systems), the Developer shall acquire the right to construct facilities within the limits of easements and to have reasonable ingress and egress over each affected property to the easements for construction, operation, maintenance and reconstruction.

These easements are permanent in nature and are referred to as water main and utility easements.

The limits of water main and utility easements shall be set around permanent structures. Existing or proposed structures shall not be located within an existing or proposed easement.

A property owner is restricted from constructing any facility within the limits of water main

and utility easements that might interfere with the maintenance, operation, or reconstruction of the facility.

6.4 EASEMENT WIDTHS

Minimum widths of water main easements using trench construction methods are tabulated below, however, in no case will these guidelines be a substitute for sound engineering judgment.

Minimum Easement Width	
Size of Pipe	Water Main
6" through 12"	15'
15" through 48"	20'

The OCWD reserves the right to request easement widths at greater widths than those described in the referenced table if (a) the pipeline is installed at depths exceeding 10- vertical feet, or (b) the OCWD proposes possible future system extensions or improvements, or (c) other utilities are to be located within the easement.

Developer must provide a recorded plat showing each utility easement prior to construction of facilities.

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CHAPTER 7

Water Distribution Systems

7.1 PURPOSE

This chapter establishes the minimum standards and technical design criteria for water distribution systems in the OCWD's service area. Adherence to these will expedite review and approval of plans. Any departure from these requirements should be brought to the attention of the OCWD and discussed before the submission of plans for approval. Such departure shall be documented and justified.

7.2 BASIC ELEMENTS

The design of extensions to the water distribution system will consist of the determination of the following elements:

- A. The location of the horizontal alignment that most efficiently provides service to proposed users.
- B. The vertical restrictions on establishing the water alignment including; minimum cover, elevation of the existing and proposed sanitary sewer system, elevation of the existing or proposed storm drainage system, and conflicts with other underground facilities.
- C. The size, material, bedding, and method of construction required.
- D. The necessary appurtenances and special structures required.

7.3 GENERAL LOCATION CRITERIA

Water mains shall be located using sound engineering judgment to determine the most cost effective and environmentally sensitive alignment, which best serves, the needs of the development. Additionally, it is imperative that all alternatives worthy of consideration receive maximum and equal consideration regarding environmental impact.

When selecting the water main alignment, consideration shall be given, but shall not be limited to, the following general location criteria:

- A. Environmentally sensitive areas and constraints such as wetlands, creeks, drainage channels, trees, protected habitats, etc.
- B. Existing and proposed utilities, railroads, highways, and overhead facilities.
- C. Location of existing and proposed sanitary sewage and stormwater facilities.

- D. Existing and proposed high water elevations, including high water for appropriate design.
- E. Anticipated extension of existing streets and the potential for the development of contiguous areas.
- F. Continuity with adjacent developments.

7.4 HORIZONTAL ALIGNMENT CRITERIA

7.4.1 GENERAL

All water mains will be constructed with a straight alignment when possible.

7.4.2 STREETS

Generally, water mains shall be located five (5) feet off the back of the curb on curbed streets and five (5) feet inside the right-of-way on streets without curbs, and on the opposite side of the street from the sanitary sewer line. Consideration of possible conflicts with other utilities shall be required so the water main can be built without modification during or after construction. Consideration shall be given to locating the water main on the high side of the street.

7.4.3 STATIONING

All water mains shall be stationed. Every effort shall be made to begin the stationing of a water main with Station 10+00 at the tie into the existing water main(s). The PI stations and deflection angles and other water main appurtenances shall be shown on the plans.

7.4.4 LINE DESIGNATIONS

The designation of the primary water main feed in a distribution system shall be LINE "A". A secondary leg originating from LINE "A" shall be designated LINE "B", and the station of LINE "B" at this point shall be Station 10+00. This method shall continue throughout the distribution system and subsequent water mains shall be assigned appropriate designations by ascending letters.

7.5 VERTICAL ALIGNMENT CRITERIA

7.5.1 WATER MAIN DEPTHS

Water mains will have a minimum cover of 36-inches. Specific exemptions to these minimum requirements may be made with prior approval by the OCWD.

A minimum cover of 30-inches shall be maintained when crossing under erodible streams or drainage channels (existing or proposed). In non-erodible (rock bottom) channels, the water main shall have 12-inches of cover and shall be encased in concrete. Refer to the OCWD

Standard Details for stream crossing regiments.

Water mains shall be extended to the perimeters of the development to serve undeveloped areas and/or areas not presently served by the OCWD distribution system.

7.5.2 FLOODING AND PONDING AREAS

In general, water mains will not be located in flood prone areas.

7.5.3 MINIMUM WATER MAIN CLEARANCES

The following minimum clearances between the water main and existing or proposed sanitary sewer mains shall be used in establishing the water main alignment:

7.5.3.1 HORIZONTAL CLEARANCES

The horizontal clearance shall be 10-foot minimum measured from outside of pipe to outside of pipe. Where this is not possible, the Engineer should reference the “Ten State Standards” Section 38-31, Page 30-10.

7.5.3.2 VERTICAL CLEARANCE

The vertical clearance should be at least 18-inches measured from outside of pipe to outside of pipe. If at all possible, the sewer shall be located below the water main.

7.6 WATER MAIN DESIGN

7.6.1 PRESSURE

All water mains shall be designed to provide fire protection to the proposed development. Water mains shall be sized after the Engineer has prepared a hydraulic analysis based on flow demands and pressure requirements. The water distribution system shall be designed to maintain a minimum pressure of 30 psi on the discharge side of all meters under all conditions of flow. The normal working pressure in the proposed distribution system should be approximately 60 psi and not less than 35 psi.

7.6.2 DIAMETER

The minimum size of water mains for providing fire protection and serving fire hydrants shall be six (6) inches in diameter. Larger size mains will be required if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure of not less than 35 psi.

7.6.3 FIRE PROTECTION

The system design should be such that fire flows and facilities are in accordance with the requirements of the State Insurance Services Office.

7.6.4 DEAD ENDS

- A. In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical.
- B. Where dead end mains occur, they shall be provided with a fire hydrant and pilot valve.

7.6.5 HYDRAULIC MODELING

7.7 WATER PIPE

- A. The minimum allowable inside diameter for a water distribution main shall be six (6) inches. All residential service connections shall have a minimum inside diameter of three-fourths 3/4-inch; however, commercial or industrial connections shall be individually considered.
- B. Pipe material shall be in accordance with Chapter 12.
- C. Pipe testing and bedding requirements shall be in accordance with Chapter 12, except for unusual conditions requiring special design and specifications.
- D. Backfill classifications, materials, and methods of compaction shall be in accordance with Chapter 12, except in unusual conditions requiring special design and specifications.
- E. All water mains shall be designed to prevent damage from superimposed loads during and after construction. Proper allowance for loads on water pipe shall be made, based on trench width and depth. When standard strength water pipe is not sufficient, extra strength pipe or special construction methods shall be specified.

7.8 VALVES

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves should be located at no more than 500-foot intervals in commercial or industrial district and at not more than one block or 800-foot intervals in residential districts.

7.9 FIRE HYDRANTS

7.9.1 LOCATIONS AND SPACING

In general, fire hydrants shall be located at street intersections and near the midpoint of the block. Thoroughfares with medians and with continuous left turn lanes shall have fire

hydrants on each side of the thoroughfare.

In residential districts, fire hydrants shall be installed at no more than 500-foot intervals with each front lot corner within 250-feet of a fire hydrant.

In commercial districts, fire hydrants shall be installed at no more than 500-foot intervals with each front lot corner within 250-feet of a fire hydrant.

In industrial districts, fire hydrants shall be installed at street intersections and other midpoints deemed necessary by the OCWD or the OCWD's Fire Department as required on a case-by-case basis.

In under developed or rural areas, fire hydrants shall be installed at a minimum of 2000-foot intervals.

7.10 SERVICE CONNECTIONS

The OCWD will own, operate, and maintain service lines and connections from the water meter to the distribution main. Construction materials and methods shall be in accordance with Chapter 12.

In general, water meters shall be located on the right-of-way line at the midpoint of the front property line in residential districts.

7.11 CASING PIPE

The following criteria shall be followed whenever a casing pipe is used. Any deviation from these criteria will require prior approval from the OCWD.

- A. Steel casing pipe shall be a minimum of 10-inches in diameter and have minimum yield strength of 35,000 psi.
- B. In boring excavation, the carrier pipe shall be encased in a steel casing pipe of sufficient size to provide clearance for the proper installation of the sewer pipe. The inside diameter of the casing pipe shall be a least four (4) inches greater than the outside diameter of the bell of the carrier pipe, joints, or couplings, thus providing a clearance of at least two (2) inches between the casing pipe, and the carrier pipe.

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CHAPTER 8

Submittal Review And Approval

8.1 PURPOSE

This Chapter establishes the minimum water construction plan requirements and the OCWD procedures for submittal, review, construction inspection, and final approval of construction for private development projects. Water systems should be designed in accordance with the applicable provisions of this and other chapters of this Standards Manual. Adherence to these procedures will facilitate timely review and approval for construction.

8.2 GENERAL PROCEDURES

The design of water facilities within the OCWD's service area requires the approval of the following agencies:

- A. The OCWD.
- B. Kentucky Natural Resources and Environmental Protection Cabinet (NREPC), Department for Environmental Protection, Division of Water.

Construction within blueline streams and regulatory floodplains requires approval of and a permit by the Kentucky NREPC. U.S. Corp of Engineers approval may also be required. Work within Federal and State right-of-way requires approval and/or permits from the Kentucky Transportation Cabinet. Work within railroad rights-of-way requires approval and/or permits from the affected railroad company.

Water facilities shall be designed in accordance with the "Recommended Standards for Water Works" of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, commonly referred to as the "Ten States Standards", 2012 edition; in addition to appropriate sections of this manual.

Deviations from the "Ten States Standards" requirements and the requirements described in this manual may be approved if the applicant submits a written request for a deviation with the basis for the request. The basis for the deviation request shall be supported by current engineering practice.

In instances where construction materials and methods are not specifically referenced or are contradicting, the OCWD's decision will apply.

An infrastructure Development Flow Chart is located at the back of this chapter to aid in scheduling submittal review and approval policies and procedures.

8.3 SUBMITTALS

8.3.1 PRELIMINARY WATER PLAN REQUIREMENTS (OPTIONAL)

Property to be developed within the OCWD’s service area shall be properly served by a water distribution system. Preliminary plans for these improvements identifying proposed improvements and connection points to the existing system shall be submitted to the OCWD prior to preparation of Construction Plans. The Plan shall show the lot layout, sanitary sewer alignment (if applicable), water alignment and hydraulic calculations. It is highly recommended that the Engineer designing the improvements arrange to meet with the General Manager to discuss the preparation of the Plan. This can save an unnecessary loss of time and effort. The General Manager will complete a review of the Plan within 10 working days. The Plan shall be submitted on 24" X 36" blueline or blackline paper unless permission is obtained from the General Manager for a larger or smaller size drawing prior to submittal.

Note that the preliminary Water Plan is optional to the Developer. The Plan criteria are established to allow the Developer the flexibility to submit a Preliminary Plan for review prior to the generation of “full-blown” Construction Drawings.

8.3.2 SUBMITTAL OF CONSTRUCTION PLANS

All Construction Plans shall be submitted on 24" x 36" blackline or blueline paper. All drafting shall be in accordance with Chapter 4 of this Manual.

The submittal of the Construction Plans shall include:

<u># Rec’d.</u>	<u>Item Description</u>
1	Construction Plan Review Application filled out completely, with the original signature of the Developer and the Engineer.
2	Blackline or blueline copies of the Construction Plans.

The submittal will be reviewed by OCWD General Manager and associated staff. A listing of staff comments will be returned to the Engineer within 10 working days after receipt of a complete submittal.

8.3.3 FINAL SUBMITTAL OF CONSTRUCTION PLANS

Any Conditions of the initial submittal of Construction Plans must be addressed at the time of final submittal of the Construction Plans.

<u># Rec’d.</u>	<u>Item Description</u>
3	Blackline or blueline copies of the Construction Plan addressing each OCWD comment from the initial submittal. Note that the Engineer shall seal, sign,

and date each sheet within the Final Submittal of the Construction Plans.

The Final Submittal is reviewed by the General Manager in comparison to the original staff comments. If the submittal is complete and acceptable to the OCWD, a letter is prepared to the Kentucky NREPC stating that the Construction Plans have been reviewed and approved by the OCWD and that the OCWD water distribution system has adequate flows to provide service to the development. The letter to the Kentucky NREPC will be issued within 10 working days of receipt of a complete submittal, if the Engineer has satisfactorily addressed each OCWD comments. A final resubmittal will be required if the Construction Documents do not meet the requirements of this manual.

8.4 ADDITIONAL SUBMITTED ITEMS

8.4.1 SPECIFICATIONS AND SPECIAL PROVISIONS

All water facilities construction shall conform to the Standards Manual. Any deviations from these Standards must be noted in the Special Provisions of the Construction Documents.

8.4.2 APPROVALS AND PERMITS

Provide documentation showing that Plans and a Permit Form have been submitted to the Transportation Cabinet for construction within Federal and/or State rights-of-way (if applicable).

Provide documentation showing that the Construction Documents have been submitted to the rail company for a permit (if applicable).

Provide documentation showing that Construction Documents and Permit Forms have been submitted to the Kentucky NREPC. A permit will be required from the Kentucky NREPC if a blue line or intermittent blue line stream as shown on a 7.5-minute USGS map is affected by the construction.

8.4.3 OFF-SITE EASEMENTS (IF APPLICABLE)

Off-site easements signed and stamped by a Registered Land Surveyor must be submitted to the OCWD's Engineering Department.

8.4.4 CONSTRUCTION PERMIT APPLICATION

The OCWD requires that the Developer submit a copy of the application for a Construction Permit and supporting information to the OCWD prior to issuance of the OCWD acceptance letter. Supporting information is defined as follows:

1. The identity of who will inspect and certify that the facility under construction conforms with the Plans and Specifications approved by the Cabinet in accordance with the Kentucky Administrative Regulations, Chapter 8.

2. A construction estimate of the cost of the facilities.
3. Engineering calculations necessary for the understanding of the basis and design of the facilities.

8.5 DESIGN PLAN APPROVAL

After all the OCWD concerns are satisfied, the OCWD shall issue a letter to the Kentucky NREPC stating that the OCWD will accept operation and maintenance responsibilities for the water facilities when it is constructed.

8.6 PRECONSTRUCTION REQUIREMENTS

The Developer's Contractor shall proceed with construction when the following conditions are met:

- A. Kentucky NREPC has issued a Construction Permit.
- B. Offsite easements, if required, have been recorded at the courthouse by the OCWD. Please note that the Developer is required to prepare and execute all offsite easements and deliver them to the OCWD for filing. Developers shall pay all costs associated with the filing of easements. The Developer shall submit prepare and executed easements to the OCWD for filing.
- C. Permits have been issued for work within Federal and/or State rights-of-way, if applicable.
- D. All Shop Drawings; product data and samples have been submitted and approved in accordance with Chapter 12, unless the construction materials are purchased from the OCWD.
- E. Permits have been issued by the Transportation Cabinet for work with railroad right-of-way, if applicable.
- F. Revised Construction Documents, signed, sealed, and dated by a Professional Engineer if the Kentucky NREPC required plan revisions.

8.7 INSPECTION OF CONSTRUCTION

8.7.1 GENERAL

The Developer shall provide continuous onsite inspection for the construction of all water facilities construction for private development projects. The OCWD will assign an onsite construction observer to periodically check the quality of construction materials and methods. Neither observations by the OCWD nor inspections shall relieve the Developer's Engineer of certifying that the work has been performed in accordance with the Construction Documents.

8.7.2 INSPECTION ASSIGNMENTS

The Developer will retain a Professional Engineer to certify to the OCWD and the Kentucky NREPC that the construction materials and methods are in compliance with the approval Construction Plans, specifications, and provisions of the Kentucky NREPC approval letter. The OCWD project representative shall be present during testing.

The OCWD recommends a five (5) day notice to schedule the OCWD project representative. To schedule the OCWD project representative, please call the OCWD at (270) 824-2187, ask for the General Manger, weekdays from 7:30 A.M. to 4:00 P.M. Additionally, the OCWD shall be provided with a forty-eight-hour notice prior to testing.

8.7.3 FINAL RECORD DRAWINGS

Deviations from approved Construction Plans as a result of unexpected field conditions will require documentation to and approval by the OCWD. To obtain this approval, a marked-up print of the Plans showing the proposed revisions should be submitted by the Engineer to the OCWD for review. At the completion of construction, a Final Record copy of the Construction Plans bearing the Engineer's original seal, signature, date, and incorporating all approved changes shall be submitted to the OCWD. Final Record Drawings shall be prepared in accordance with Chapter 5.

EXHIBIT 8-1
Ohio County Water District
Infrastructure Development Flow Chart
Effective Date: April 26, 2021

- Task 1 Optional
The Developer has a Professional Engineer prepare a Preliminary Water Plan to define connection points to the existing OCWD system, and identify general locations of proposed utilities and submit same to the OCWD.
- Task 2 The OCWD reviews the Preliminary Water Plan, then prepares and transmits written review comments to the Developer.
- Task 3 The Developer has a Professional Engineer prepare Final Construction Plans and Specifications and submit the documents to the OCWD. This submittal shall also include a Water Review Application.
- Task 4 The OCWD reviews the Final Construction Plans and Specifications, then prepares and transmits review comments to the Developer. Note that the OCWD requires a minimum of 10 working days to review the documents.
- Task 5 If the Construction Documents meet the requirements of the OCWD rules and regulations, the OCWD issues a letter to the Developer stating that the OCWD will accept operation and maintenance of the facilities when constructed; and the OCWD approves the connections(s) and accepts responsibility for the additional flows.
- Task 6 The Developer prepares and transmits a Construction Permit Application and related submittal items to the Kentucky Natural Resources and Environmental Protection Cabinet (NREPC), Division of Water with one complete copy of the submittal forwarded to the OCWD offices.
- Task 7 The NREPC either approves or rejects the application.
- Task 8 Upon issuance of the Construction Permit from the NREPC, the Developer shall submit the following items to the OCWD prior to commencement of construction:
1. Offsite easements, if applicable.
 2. Permits to work within State or Federal right-of-way, if applicable.
 3. Permits to work within railroad right-of-way, if applicable.
 4. Shop Drawings.
- Task 9 The Developer shall ensure construction of the facilities are in accordance with the approved Construction Plans and Specifications with inspection and certification provided by a Professional Engineer to the OCWD and State Agencies.

- Task 10 Certification of the construction in accordance with the Construction Plans and Specifications.
- Task 11 Preparation and submittal of the Final Record Drawings by the Professional Engineer.
- Task 12 Release of the Letter of Credit by the OCWD.

EXHIBIT 8-2
Ohio County Water District
Construction Plan Review Checklist
Effective Date: April 26, 2021

Project Name _____

The applicant shall check each item to indicate it has been shown and addressed on the Construction Plans. If an item is not applicable, indicate with a N/A in the space provided.

PART 1 GENERAL

A. General

- _____ 1. Plans submitted on 24" X 36" sheets.
- _____ 2. Two sets of plans submitted.
- _____ 3. North arrow and scale of drawing on each sheet.
- _____ 4. Benchmarks shown on plans.
- _____ 5. Title blocks shown on each sheet excluding cover sheet.
 - a. Title block completely filled out.
 - b. Title agrees with the Record Plat.
- _____ 6. Commonwealth of Kentucky Licensed Engineer's seal, signature, and date on each sheet.
- _____ 7. Copy of Preliminary or Record Plat included in Plan Set.
- _____ 8. Easements shown on preliminary or Record Plat correspond with locations of proposed utility lines.
- _____ 9. All drawings and lettering must be clear and legible.

B. Cover Sheet

- _____ 1. Location map for project, include a north arrow.
- _____ 2. Index to drawings.
- _____ 3. Name, address, and telephone number of the Developer/owner
- _____ 4. Name, address, and telephone number of the Engineer.
- _____ 5. Project name identified on the right border of the cover sheet.

PART II WATER SYSTEM IMPROVEMENTS

A. Plan View

- _____ 1. Size, type, and pressure class of all proposed water mains identified.
- _____ 2. General notes for water system construction.
- _____ 3. Location and size of all on-site water mains shown.
- _____ 4. Conflicts with existing and proposed utilities shown.
- _____ 5. Names and phone numbers of utility company contracts having utilities in the area.
- _____ 6. Locations of proposed service lines and meters shown.
- _____ 7. Location of existing and proposed sanitary sewer lines.

- _____ 8. Location of existing and proposed storm drainage lines and inlets.
- _____ 9. Location of existing and proposed pavement and rights-of-way.
- _____ 10. Profiles of proposed water mains crossing channel sections.
- _____ 11. All lot and block numbers shown.
- _____ 12. Location, width, and type of easements.
- _____ 13. Water mains stubbed out to the common property line with undeveloped or un-serviced adjacent property.
- _____ 14. Proposed water main dimensioned to rights-of-ways.
- _____ 15. Legend. Identifying existing and proposed lines.
- _____ 16. Insure that the water main can be “valved” down without putting more than one fire hydrant out of service.
- _____ 17. Fire hydrants locations identified.
- _____ 18. All fire hydrants have a clear 36-inch operating radius for the top nut.
- _____ 19. Fire hydrants shall be located 2'-6" behind the pavement edge and shall not be located in the sidewalk.

B. Profile

- _____ 1. Proposed line grades are greater than the minimum established
- _____ 2. Elevation of existing and proposed ground at centerline of pipe.
- _____ 3. Fill areas noted.
- _____ 4. Length, type, and size of pipe between valves/connections.
- _____ 5. Location and elevation of water mains crossing sanitary sewer line.
- _____ 6. Locations of concrete encasements and concrete caps.
- _____ 7. Location and elevation of existing and proposed pavement sections crossed.
- _____ 8. Vertical scale of drawings.
- _____ 9. Vertical and horizontal clearance between utilities meets DOW requirements.
- _____ 10. Show 100-year water surface elevation for ultimate conditions located in flood prone areas.

C. Details

- _____ 1. The OCWD Standard Details for water mains included.
- _____ 2. Special provisions to the OCWD details shown.

EXHIBIT 8-3
Ohio County Water District
Development Review Application
Effective Date: April 26, 2021

Owner/Applicant

Design Engineer

Name

Name

Address

Address

City, State, Zip

City, State, Zip

Phone/Email

Phone/Email

Location of Property (complete as appropriate)

If located in a subdivision:

Name of Subdivision

No. of Lots

If **NOT** located in a subdivision:

Location Description

Acreage

Nature of Proposed Construction (check and complete as appropriate)

Residential Commercial Industrial

Other (specify _____)

Present status of property plat (check and complete as appropriate)

Preliminary Plat approved, Date: _____

Record Plat approved, Date: _____

The OCWD USE ONLY: Date Received: _____ Received By: _____

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Construction Standards, Testing, & Inspections

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CHAPTER 9 CONSTRUCTION STANDARDS, TESTING, AND INSPECTION

9.1 MATERIALS, STORAGE AND HANDLING

9.1.1 MANUFACTURER'S RECOMMENDATION

Care shall be exercised in the delivery, storage and handling of all materials prior to their incorporation into the work. Follow all manufacturers' recommendations for delivery and storage (except where these specifications differ.) Acceptance of questionable material shall be based solely on the Engineer's interpretation of fabrication, delivery, storage and installation practices of the material in question.

9.1.2 STORED PIPE

Contractor shall take special care to ensure that no foreign matter including, but not limited to soil, trash, trench water or other debris enters the pipe at any time. Upon arrival of pipe shipment, Contractor shall completely seal pipe openings in a manner acceptable to the Engineer.

9.1.3 STORED FITTINGS

Contractor shall take special care to ensure that no foreign matter including, but not limited to soil, trash, trench water or other debris enters pipe appurtenances at any time. Upon arrival of pipe shipment, Contractor shall completely seal pipe openings in a manner acceptable to the Engineer.

9.1.4 INSTALLED PIPE

The installed pipe in the trench shall be plugged at the close of work each day or during any prolonged break period, including anytime workers are absent from the job site (lunch breaks, etc.). The only acceptable method for plugging the installed pipe is with a watertight M.J. cap or M.J. plug.

9.1.5 FAILURE TO FOLLOW SPECIFICATIONS

Failure to take such preventative measures mentioned in these specifications, or flooding or contamination of the main for any reason, shall require the Contractor to clean the line with a hydraulically propelled foam pig (or other suitable pigging device acceptable to the Engineer) and slug chlorinate the line as specified in Subpart 4.8 of this Section. The Contractor shall also be required to take whatever other measures required by the Engineer in accordance with these specifications or AWWA C-651 to remove the contamination. All such procedures shall be fully documented and submitted for approval by the Engineer.

9.2 PRODUCTS

9.2.1 DUCTILE IRON PIPE AND FITTINGS

- A. Pipe:
 - 1. Manufactured in accordance with ANSI A21.51 (AWWA C151).
 - 2. A cement lining meeting the requirements of ASNI 21.4 (AWWA C104).
 - 3. A minimum of 1 mil thick bituminous coating on the outside surface.
 - 4. Clearly mark with manufacturer's name, D.I. or Ductile, weight, class or nominal thickness, and casting period.
 - 5. Unless otherwise specified or shown on the plans, ductile iron pipe shall be pressure class 350 for sizes up through 12-inch.
 - 6. All ductile iron pipe shall be furnished and installed with restrained joint locking gaskets, U.S. Pipe Field Lok 350 or approved equivalent.

- B. Fittings: All fittings and specials for pipe 3" in diameter and larger shall be cast or ductile iron.
 - 1. Fittings 3" – 24": Pressure rated at 350 psi meeting the requirements of ANSI 21-53/AWWA C153 for compact fittings.
 - 2. Joints meeting the requirements of ANSI 21.11/AWWA C111.
 - 3. All mechanical joint ductile iron fittings shall be equipped with mechanical joint restraint devices as specified in Subpart 3.9.

9.2.2 POLYETHYLENE ENCASEMENT

- A. All ductile iron pipe shall be furnished and installed with polyethylene encasement in accordance with the ANSI/AWWA C105/A21.5 standard. Encasement shall be low-density film with minimum thickness of 8 mils. Installation shall be per the manufacturer's instructions.

9.2.3 HIGH DENSITY POLYETHLYENE PIPE (HDPE) FOR HORIZONTAL DIRECTIONAL DRILLING

- A. HDPE pipe shall only be used for directional bores as approved by the Engineer.

- B. Pipe shall have a DR number 9 with a working pressure of 200 psi and be sized to provide inside diameter equal to or greater than the size shown on the plans.

- C. Materials: Polyethylene pipe and fittings shall be made from resin meeting the requirements of the Plastic Pipe Institute as PE 3408. The resin shall meet the requirements of ASTM D3350- 02 with a cell classification of 345464C. The

requirements of this cell classification are:

<i>HDPE Resin Specifications</i>			
Property	Specification	Unit	Typical Value
Material Designation	PPI/ASTM		PE 3408
Material Approval	NSF #14		
Material Classification	ASTM D1248		III C5 P34
Cell Classification	ASTM D3350-02		345464C
○ Density	ASTM D1505	g/cm ³	0.955
○ Melt Index	ASTM 1238	gm/10 min	0.11
○ Flexural Modulus	ASTM D790	psi	135,000
○ Tensile Strength	ASTM D638	psi	3,200
○ Slow Crack Growth			
- ESCR	ASTM D1693	hours in 100% igeval	>5,000
- PENT	ASTM F1473	hours	>100
- HDB @73 deg F	ASTM D1693	psi	1,600
- UV Stabilizer	ASTM D1603	%C	2.5%

- D. Butt Fusion Fittings: HDPE fittings shall be PE 3408, HDPE, Cell Classification of 346464C as determined by ASTM D3350-02, and approved for potable water use by the AWWA. Butt fusion fittings shall have a manufacturing standard of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using data loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the Quality Control records. All fittings shall be suitable for use as pressure conduit, and per AWWA C906, have a nominal burst value of 3.5 times the working pressure rating of the fitting.
- E. Pipe Manufacturer's Quality Control: The pipe manufacturer shall have an ongoing Quality Control program for incoming and outgoing materials. HDPE resins for manufacturing of pipe shall be checked for density, melt flow rate, and contamination. The manufacturer of the HDPE resin shall certify the Cell Classification as indicated in Subpart 3.2 C above. These incoming resins shall be approved by plant Quality Control and verified as approved by NSF before being converted to pipe. Pipe shall be checked for outside diameter, wall thickness, length, roundness and surface finish on the inside, outside and end cut.
- F. HDPE pipe shall be joined together at the transition points to other mechanical joint adapters. Mechanical joint adapters shall have a manufacturing standard of ASTM D3261. They shall have a pressure rating equal to the pipe.

- G. A minimum of 100 feet of restrained joint ductile iron pipe shall be provided on the pipe preceding and the pipe following the HDPE. Appropriate restraint methods include using restrained joints equivalent to American Flex Ring or U.S. Pipe T.R. Flex.

9.2.4 SERVICE PIPE

- A. Polyethylene Pipe:

Crosslinked Polyethylene pipe (Rehau Municipex) is acceptable for service lines from the main to the meter, and between the meter and the building in accordance with the Standard Plumbing Code. Crosslinked Polyethylene (PEXa) pipe shall meet the following criteria:

1. Manufactured using the high pressure peroxide method of crosslinking.
2. Certified to AWWA C 904 *Cross-linked Polyethylene (PEX) Pressure Pipe, ½ in. through 3 in. for Water Service* by approved testing agency. Certified to standards ASTM F876, CSA B137.5, NSF 14 and NSF 61, by approved testing agencies, with a standard materials designation code of 3306.
3. Demonstrates ability to satisfy the performance requirements of Section F.7 of Plastics Pipe Institute (PPI) Technical Report 3 (TR-3) for polyethylene materials in order to apply a 0.63 design factor resulting in a temperature/pressure rating of 200 psi @ 73.4°F (1380 kPa @ 23°C).
4. Shall be rated for 160 psi @ 73.4°F (1103 kPa @ 23°C) and 100 psi @ 180°F (690 kPa @ 82°C) per PPI TR-4.
5. Shall have co-extruded UV Shield made from UV-resistant high-density polyethylene, color Blue.
6. Shall have minimum recommended UV exposure time of one (1) year when tested in accordance with ASTM F2657, or as per manufacturer's recommendations.
7. Shall be compatible with cold-expansion compression-sleeve fittings certified to ASTM F2080 for installations as cold as -40°F.
8. Shall be approved for use with AWWA C800 fittings when using manufacturer's recommended insert.
9. Shall be approved by manufacturer for use with manual plastic pipe squeeze-off tools for temporary stoppage of flow.
10. Shall be approved by manufacturer to be repaired using hot air, if kinked in the field.
11. Shall have minimum markings: PEXa 3306, CSA B137.5, ASTM F876, F2023 and F2080, NSF-pw-g.

B. Copper Pipe:

1. Seamless copper tubing meeting the requirements of ASTM B88, Type K for 3/4" through 2". Copper tubing 1" and smaller shall be soft. Copper tubing larger than 1" may be hard or soft. All underground copper to copper connection is to be by compression coupling, no solder sweat joints.
2. Contain not less than 99.90% copper and not more than 0.04% phosphorous.
3. Suitable for use with a working water pressure of 160 psi.
4. 3/4" nominal diameter unless otherwise specified or shown on the Plans.
5. Service pipe shall be used to connect the corporation stop with the meter yoke. Use the minimum length required to make a straight-line connection including a goose neck. The minimum length of service shall be 5 feet in order to facilitate the location of the services with metallic pipe locators.
6. No 3" copper service pipe shall be allowed. No 3" piping on OCWD's side of the water meter shall be allowed.
7. All copper service piping shall be buried at a minimum depth of 24" below finished grade unless otherwise approved.

C. Ductile Iron Pipe:

For service lines 4-inches and larger, ductile iron pipe meeting the requirements set forth in Subpart 3.2 shall be used.

9.2.5 WATER SERVICE ASSEMBLIES

A. Water Meters (all water meters are issued by the Ohio County Water District (OCWD):

1. AWWA C700.
2. 5/8" x 3/4" unless otherwise specified or shown on the Plans.
3. Frost proof with a cast bronze casing and a hinged cover.
4. Direct reading register, in gallons, unless otherwise specified.
5. Disc or piston operated with magnetic drive.
6. A suitable non-corrosive strainer located over the inlet to the measuring chamber.
7. The name of the manufacturer imprinted in the lid of the register box and the meter serial number imprinted thereon.
8. Meters shall be located in non-traffic areas.
9. Water services shall be located near the center of the lot in non-traffic areas so that they are not in driveways. Water meters shall be located in a landscaped area near the property line unless otherwise approved by the Engineer.

B. Water Main Connections:

1. Tap water mains in the upper half of the pipe at a 45-degree angle.
2. Do not exceed the pipe manufacturer's recommended maximum tap size.
3. Use service saddles on all taps for PVC pipe. Water service tapping saddles for services 2" or less shall be of total brass or bronze construction with no ferrous materials. Saddles are to have double straps or extra wide single straps and shall employ a dual o-ring seal. Saddles shall be Ford or pre-approved equal.
4. Service taps on line under construction that has not been tested and inspected by the OCWD may be made by a qualified Contractor. Taps on existing OCWD mains must be made by authorized OCWD personnel unless specifically authorized by the General Manager's office.
5. For all 2" taps on ductile iron lines, a ductile iron epoxy coated body saddle with double stainless steel straps shall be furnished. For ¾" to 1" connections, ductile iron mains shall be drilled and tapped with no need for a saddle.

C. Corporation Stops/Service Valves: Corporation stops are required for all ¾" and 1" services. Services of 2" diameter shall use a 2" ball valve with a square operating nut. All corporation stops shall have a minimum rating of 200 psi. All service valves shall have a standard valve box installed and brought to grade. Corporation stops shall meet the following criteria:

1. AWWA C800
2. Cast of certified waterworks red brass, composed of 85% copper and 5% each of tin, lead, and zinc.
3. Water tight and individually tested for leaks.
4. Waterway diameter approximately equal to the nominal size of the stop.
5. Coat or cap all threads for protection prior to installation.
6. Manufactured by Ford or pre-approved equal.

D. Meter Yokes:

1. Copper tubing with an integral brace and meter stop.
2. Minimum rise of 7".
3. Provide with outlets designed for the use of polyethylene or copper service pipe.
4. Manufactured by Ford. or pre-approved equal.

E. Curb Valves: All water services less than 2" diameter must terminate with a curb ball valve immediately prior to the meter yoke location. Approved model is Ford or pre- approved equal. Curb ball valves that are buried prior to the installation of a yoke shall have a bolt or pin placed in the stop wing to prevent the ball valve from being accidentally opened during back fill.

F. Meter Boxes:

1. Water meters shall be located in a landscaped area near the property line unless otherwise approved by the Engineer.
2. The depth of the meter yoke inlet for 5/8" – 1" meters shall be 18" to 24".
3. The depth of the meter yoke inlet for 1 1/2" – 6" meters shall be 24" to 36".
4. Meter box to be of sufficient size to facilitate easy installation and removal of the water meter.
5. Where the service assemblies include a pressure reducing valve, sufficiently size box for installation of the pressure reducing valve in the meter box.

G. Pressure Reducing Valves for Service Assemblies: Pressure reducing valves are the responsibility of the customer and may be installed at any point downstream of the meter in accordance with the Standard Plumbing Code and the OCWD's "Cross Connection Control Policy and Program". Pressure reducing valves are required where the static pressure is greater than 80 psi.

H. Service Materials: No galvanized pipe, galvanized nipples, black iron, glued plastic or sweated fittings are to be used between the main and the meter yoke. Threaded brass, slip joints, mechanical joints, and bronze/brass compression fittings are allowed.

9.2.6 VALVES AND VALVE BOXES

A. Gate Valves

1. AWWA C509 or C515.
2. Iron body, resilient seat, non-rising stem type.
3. Stuffing boxes: O-ring seal type with two (2) rings in the stem located above the thrust collar.
4. 2" square wrench nut for operation of the valve.
5. Minimum design working water pressure of 200 psi for valves with diameters of 2" – 12" and 150 psi for valves with diameter of 14" – 54", unless otherwise specified or shown on the plans.
6. Joints: ANSI A21.11 (AWWA C111).
7. Bonnet or body markings: Manufacturer's name, year of casting, size, pressure rating, and open direction labeled with an arrow.
8. Epoxy coat interior and exterior in accordance with AWWA C550.
9. Shall be Mueller A-2360, M&H 7571, American Flow Control 2500 or pre-approved equal.

B. Valve Boxes:

1. Cast iron, 2-piece or 3-piece, screw type with shaft diameter of not less than 5" (Tyler/Union 6850 or equal).
2. Comply with AWWA M44.
3. Heavy roadway type equipped with a cover containing the word "WATER" in raised letters on the top.
4. Base of such size as to permit its installation without allowing it to come in contact with either the valve or the pipe.
5. In paved areas, the top of the box casting shall be made level with the adjacent pavement. In unpaved areas, the box shall be 1" above the adjacent ground and encircled with a concrete collar 4" thick and 2' in diameter. Pre-cast concrete valve collars may also be used around valve boxes.

C. Tapping Valves and Sleeves:

1. Tapping valves shall meet all the requirements of Subpart 3.5 A above and shall be Mueller T2360-16, M&H 4751-01 or pre-approved equal.
2. Tapping sleeves shall be Mueller H-304, Ford FTSS, JCM 452, Smith Blair 665, Dresser Style 630 or pre-approved equal.
3. Tapping sleeves shall be two-piece fabricated stainless steel with adjusting/tightening bolts on each side. The fabricated sleeve must contain all stainless materials and be rated for the anticipated working pressure. Sleeves must have a stainless steel outlet flange. Sleeves with ductile iron or carbon steel flanges will not be accepted. Care must be used to assure that all bolts are equally tightened. The tapping valve is to be solidly supported with brick or block and carefully bedded to prevent shifting due to settling back fill.
4. After valve is bolted to sleeve, and with valve closed, remove test plug from the tap on sleeve and air test sleeve to 100 psi prior to making tap.

9.2.7 FIRE HYDRANTS AND BLOW-OFF HYDRANTS

A. Fire Hydrants:

1. AWWA C502. Mueller Super Centurion, Kennedy Guardian K81-D, or Clow Medallion are the standard for OCWD.
2. Cast iron bodies, fully bronze mounted, designed for operation at a working water pressure of 150 psi.
3. Furnish with two 2-1/2" thread brass hose nozzles and one threaded 4-1/2" brass pumper nozzle.
4. Compression type main valve 5-1/4" diameter faced with a suitable yielding such as rubber.

5. So designed that, when it is installed, no excavation is required to remove the main valve or the movable parts of the drain valve.
6. Inside diameter of barrel: at least 120 percent of the hydrant valve size.
7. Inlet connection: minimum of 6" mechanical joint on all lines, unless otherwise specified or shown on the Plans.
8. Equipped with safety flange located not more than 10" above ground and a two-piece shaft break-away assembly.
9. Shop paint and mark in accordance with AWWA C502. Open left hydrants yellow.
10. Cast markings: manufacturer's name, size of the main valve, year of manufacture, and direction of opening.
11. Field touch-up, if the surface has been marred, with paint supplied by the manufacturer of the same color and type as that used during shop painting.
12. 4' bury hydrants are the standard. Where the line depth justifies additional depth, hydrant extensions shall be installed.
13. All hydrants shall be installed utilizing hydrant (swivel) tees. Unless otherwise shown on the plans, tees with all mechanical joint ends shall be used if field conditions require hydrant isolation valve to be placed away from the water main.
14. All hydrants shall be installed with a 6-inch isolation gate valve in valve box.
15. Fire hydrants shall not be installed on water lines less than 6-inch in diameter.
16. A fire hydrant shall not be located closer than five (5) feet from any driveway.

B. Blow-Off Hydrants:

1. Post type having cast iron bodies, fully bronze mounted and designed for operation at a working water pressure of 150 psi.
2. Furnish with either two 1-1/2" or 2-1/2" threaded brass hose nozzles.
3. Compression type main valve 2-1/8" minimum diameter faced with a suitable yielding material such as rubber, leather or balata.
4. So designed that, when it is installed, no excavation is required to remove the main valve or the movable part of the drain valve.
5. Inside diameter of the barrel: at least 3".
6. Inlet connection: 2" mechanical joint, unless otherwise specified or shown on the plans.
7. Equipped with a safety flange located not more than 2" above the ground.
8. Open on counter-clockwise operation, unless otherwise specified.
9. Cast markings: manufacturer's name, size of the main valve, year of manufacture, and direction of opening.
10. Field touch-up, if the surface has been marred, with paint supplied by the manufacturer of the same color type as that used during shop painting.
11. Type of post hydrant: Mueller A-411 or M & H (Style 33 or 233).

9.2.8 MECHANICAL JOINT RESTRAINT DEVICE

- A. Pipe restraint: It is the intention of these specifications that all mechanical joint fittings and valves be restrained at each opening with approved mechanical joint restraint devices. Restrained fittings **do not** eliminate or replace the requirement for sufficient concrete thrust blocking and/or restrained pipe joints.
- B. Ductile Iron Pipe Restraint Devices:
1. Restraint devices shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10.
 2. Devices shall have a working pressure rating of 350 psi for 3” to 16” and 250 psi for 18” and larger. Ratings are for water pressure and must include a minimum safety factor of 2:1.
 3. Restraint devices shall have torque bolts.
 4. Megalug Series 1100 produced by EBAA Iron or equal.
- C. Restraint Devices - General:
1. Gland body, wedges and wedge activating components shall be cast from grade 65-45- 12 ductile iron material in accordance with ASTM A536.
 2. Installation shall be performed using conventional tools and installation procedures as specified in AWWA C600 while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly.
 3. Proper activation of the gripping wedges shall be ensured with torque-limiting twist- off nuts.

9.2.9 CROSS CONNECTION

- A. All commercial properties must have backflow protection installed on incoming water lines (domestic, fire and irrigation). The type and location of commercial property backflow prevention devices shall be as follows:
1. Reduced Pressure Assemblies for domestic and irrigation.
 2. Double Check Assemblies (with fire meter) or Double Check Detector Assemblies (where approved by the Engineer without fire meter) for all fire systems unless the system contains chemicals or is connected to an alternate water source.
 3. Backflow prevention devices shall be installed downstream of the meter before the first branch off the main line serving the building(s). Outdoor installations require protective enclosures. Inside installations require adequate drains.
- B. **Except for fire systems**, all backflow prevention installations are required to have a strainer installed immediately upstream of the device.

9.3 EXECUTION

9.3.1 PREPARATION

- A. Follow all material storage and handling requirements in accordance with 10.2.
- B. Prior to laying pipe, prepare a suitable bedding according to the standard details and specifications.
- C. Before placing pipe in the trench, remove temporary pipe plug, field inspect for cracks or other defect; remove defective pipe from the construction site.
- D. Swab the interior of the pipe to remove all undesirable material.
- E. Prepare the bell end and remove undesirable material from the gasket and gasket recess.
- F. Locate water lines in relation to other piped utilities.

9.3.2 INSTALLING WATER LINES

- A. Install ductile iron pipe (DIP) in accordance with AWWA C600.
- B. Lay all pipe on a uniform grade and with deflections not exceeding the pipe manufacturer's recommendations.
- C. After applying gasket lubricant, take extreme care to keep the spigot end from contacting the ground.
- D. Hone the pipe with suitable tools or equipment to provide a smooth beveled edge on plain end sections or field cut sections.
- E. Closely follow the manufacturer's instruction in laying and joining pipe.
- F. Cut pipe for inserting valves, fittings, etc., in a neat and workmanlike manner without damaging the pipe so as to leave a smooth end at right angles to the axis of the pipe.
- G. Cover pipe with a watertight mechanical joint cap or plug during each installation of pipe segment and at conclusion of each day's construction activities.
- H. The location of all water mains installed under these specifications shall be marked

by the use of a continuous blue tape, minimum three inches in width, made of minimum 5 mil thick polyethylene plastic with a 0.5 mil thick aluminum metallic core or backing. The tape shall be buried in the trench, above the pipe, no more than two feet below the surface. The tape shall be marked indelibly with the words “Water Main Below” or similar wording to warn unwary excavators.

- I. An insulated minimum 12-gauge solid copper-coated steel tracer wire shall also be installed in the ditch immediately along the water line, either attached to or periodically wrapped around the line. Wire shall have HDPE insulating jacket. Care shall be taken to ensure the buried wire is not broken. The wire shall be branched off at intervals of 500' ± to connect to hydrants, valve boxes, or services to allow convenient surface access to the wire for pipe locator connection. Wire shall be terminated (unconnected) with a wire nut and enough “loose” wire to extend 24 inches outside the valve box. Tracer wire shall be installed on all water mains including ductile iron water main.
- J. The Contractor shall stamp the concrete curb with a “W” where water services are located. The end of each service stub shall be marked with a 6-foot long 4x4 wooden post or metal fence post embedded 2 feet in the ground and be marked with blue paint.
- K. Installing Crosslinked polyethylene (PEXa) municipal water service pipe: Follow manufacturer’s installation guide for handling pipe on the jobsite, preparing the trench, making connections, placing the pipe, and backfilling the trench. Install with tracer wire per Subpart 4.2 I of this specification.
- L. Installing HDPE Water Lines (directional drilling applications):
 - 1. HDPE pipe shall be assembled utilizing field-site butt fusion joints.
 - 2. Personnel performing butt fusion joining shall be certified by pipe manufacturer.
 - 3. Each piece of pipe must be held by a clamping device so it will not move.
 - 4. Pipe ends shall be faced to establish clean mating surfaces.
 - 5. Pipe profiles must be rounded and aligned with each other to prevent mismatch of pipe walls.
 - 6. Heat the ends of the pipe to the pipe manufacturer’s recommended temperature, interface pressure, and time duration.
 - 7. Keep heater faces clean to prevent molten plastic from sticking to the heater faces.
 - 8. After heating, remove heater tool and bring molten pipe ends together with sufficient pressure to form a homogenous joint.
 - 9. Hold the molten joint immobile under pressure until cooling has occurred and joint achieves strength.

10. Test line per the requirements of this Section.

9.3.3 SEPARATION OF WATER AND SEWER LINES

- A. Maintain a 10-foot horizontal separation, measured edge to edge, between any new or proposed water main and any existing or proposed sanitary sewer.
- B. Where conditions cause the required horizontal separation to be impractical, the water main may be laid closer provided it is laid in a separate trench and the elevation of the top of the sewer is at least 18 inches below the bottom of the water main.
- C. Where a sewer crosses under a water main, the top of the sewer shall be at least 18 inches below the bottom of the main.
- D. Where conditions cause the required vertical separation to be impractical, the water main shall be relocated to provide the required separation or else reconstructed with mechanical joint ductile iron pipe for a distance of 10 feet on each side of the sewer with a full joint of the water main centered over the sewer.
- E. Where sewers must be constructed over water mains or less than 18 inches below the water main, the sewer shall be designed and constructed equal to water main standards and pressure tested to assure water tightness.
- F. Additional protection such as concrete encasement shall be installed where directed by the Engineer.

9.3.4 INSTALLING APPURTENANCES

- A. Set all valves, fittings, hydrants, and other special fittings in a neat workmanlike manner. Tapping valves are to be supported with blocking and surrounding bedding carefully compacted to prevent settlement.
- B. Use thrust blocks, pipe anchors, or other approved means to prevent displacement of other fittings as shown on the Project Documents. Do not allow concrete to cover nuts and bolts on fittings. Gate valves on fire hydrant leads are to be restrained or blocked independently of the hydrant blocking so that the hydrant may be excavated and removed with the valve closed. Mechanical restraint is to be by the use of MegaLug devices or other similar devices. Underground use of galvanized all thread rod is not allowed except unless specifically approved by the Engineer. Fittings for taps made on the reverse side of the main must be restrained

joints. All mechanical joints are to be restrained with mechanical joint restraining devices as set forth in Paragraph 3.09. These restraining devices do not eliminate the requirement for sufficient concrete thrust blocking and/or restrained joint pipe.

- C. Erect hydrants to stand plumb with the pumper nozzle facing the road. Nozzles shall be installed a minimum of 18 inches above bury line.
- D. Enhance drainage of hydrants by using 6 cubic feet of gravel around base of hydrant. Do not allow concrete thrust block to obstruct drain holes.
- E. Close dead end pipe with a mechanical joint solid sleeve and plug, and equip with blow-off assemblies, where shown on the drawings.

9.3.5 CONNECTING NEW SYSTEM TO EXISTING SYSTEM

- A. Initial filling of the new line shall be made at only one point and shall be via a metered backflow prevention assembly (large sizes may not be metered at option of OCWD), installed by the Contractor, and then removed by the Contractor and returned to the OCWD after acceptance of the line. The Contractor is responsible for providing all necessary sleeves, reducers, or other fittings to install and remove the backflow assembly from the main.
- B. All connection of new main extensions to existing systems shall be valved to prevent existing customers from being included in the new system area during testing and disinfection procedures.
- C. Connections of new mains to existing mains shall normally be made by the use of a tapping valve in order to avoid disrupting service to existing customers.
- D. Any wet connections involving the shutdown of existing system valves shall be specifically approved by and coordinated with the Engineer's Office. Such coordination shall include the responsibility of the Contractor in notifying affected customers and scheduling shutdowns to minimize customer inconvenience. An authorized shutdown shall not relieve the Contractor from liabilities resulting from shutdowns such as damaged water heaters, discolored water, etc. The turning of valves shall be scheduled with the OCWD's representative.
- E. Manipulation of valves for filling or flushing lines shall be minimized to avoid accumulations of air and discolored water in the affected areas. No water valves shall be operated by anyone other than OCWD personnel.

- F. Once new systems are fully activated, following disinfection, flushing and testing, the Contractor shall inspect each valve that has been installed or manipulated to ensure that all valves are in fully open position.
- G. The Contractor will be charged for the consumption volume of water by flushing, filling, leaks, etc. that exceeds twice the volume of the installed pipe.

9.3.6 HIGHWAY AND RAILROAD CROSSINGS

- A. Perform highway crossings by the open cut method, unless otherwise shown on the Drawings or required by the appropriate authorities.
- B. Boring and jacking, tunneling, or horizontal directional drilling of crossings, if necessary, will be performed in accordance with the appropriate specification sections.

9.3.7 WATER LINE PRESSURE TEST

- A. All newly laid pipe or any valved section thereof shall be subjected to hydrostatic pressure testing. Conduct hydrostatic testing in accordance with AWWA C600 for ductile iron pipe or AWWA C605 for PVC pipe.
- B. Where practicable, pipelines shall be tested in lengths between line valves or plugs of no more than 3,000 feet.
- C. Hydrostatic testing shall be conducted only with potable water. Due to the inherent safety hazard potential associated with testing components and systems with compressed air or other compressed gases, pressure testing shall never be accomplished using compressed air.
- D. The Contractor shall furnish all gauges, recording devices, meters, pumps, pipe, connections and other equipment required to conduct the test and shall maintain said equipment in condition for accurate testing as determined by the Owner. Gauges used for pressure tests shall be oil-filled gauges.
- E. Hydrostatic test results shall be recorded on an appropriate chart recorder. The Contractor shall furnish a recording gauge and water meter for recording pressure charts and for measuring makeup water used during the hydrostatic testing. Recording pressure charts shall be submitted to the Owner at the conclusion of testing. The pressure recording device shall be suitable for outside service, with a

range from 0–300 psig, 24-hour spring wound clock, designed for 9-inch charts, and shall be approved by the Engineer. For Contractor’s information only, such pressure recording devices may be available from Foxboro Company, Foxboro, Massachusetts; Bristol Division of ACCO, Waterbury, Connecticut; or Weksler Instruments Corporation, Freeport, New York.

- F. Prior to testing, the Contractor shall place sufficient backfill to prevent pipe movement. When local conditions require that the trenches be backfilled immediately after the pipe has been laid, the testing may be carried out after backfilling has been completed but before placement of permanent surfacing. The Contractor shall ensure that thrust blocking or other types of restraining systems will provide adequate restraint prior to pressurizing the pipeline.
- G. Cross Connection Control: When existing water mains are used to supply test water, they should be protected from backflow contamination by temporarily installing a double check valve assembly between the test and supply main or by other means approved by the Engineer. Prior to pressure and leakage testing, the temporary backflow protection should be removed and the main under test isolated from the supply main.
- H. Test Pressure Requirements:
 - 1. The test pressure shall not be less than 1.25 times the stated working pressure of the pipeline measured at the highest elevation along the test section and not less than 1.5 times the stated working pressure at the lowest elevation of the test section, but not greater than 200 psi.
 - 2. The test pressure shall not exceed the thrust restraint design pressure or 1.5 times the pressure rating of the pipe or joint, whichever is less (as specified by the manufacturer).
 - 3. The test pressure shall not exceed the rated working pressure of the valves when the pressure boundary of the test section includes closed, resilient seated gate valves or butterfly valves.
 - 4. Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. A test pressure greater than the rated valve working pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests exceeding the rated valve working pressure, the test setup should include a provision, independent of the valve, to reduce the line pressure to the rated valve working pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or the valve can be fully opened if desired.

I. Test Procedure:

1. Each valved section of pipeline shall be slowly filled with potable water using a metered backflow-protected assembly. When venting air from pipelines, it is important to limit the pipeline fill rate to avoid excessive surge pressures when the water reaches the air venting opening(s).
2. Before applying the specified test pressure, air shall be expelled completely from the pipeline section under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points to expel air as the line is filled with water. After all the air has been expelled, close the corporation cocks and apply the test pressure. At the conclusion of the pressure test, remove the corporation cocks and plug or leave in place at the discretion of the Engineer.
3. The specified test pressure shall be applied using a suitable pump connected to the pipeline in a manner satisfactory to the Engineer. The specified test pressure shall be based on the elevation of the lowest point of the pipeline or section under test and corrected to the elevation of the test gauge, in accordance with test pressure requirements specified herein.
4. The pipeline shall be allowed to stabilize at the test pressure before conducting the hydrostatic test. This may require several cycles of pressurizing and bleeding trapped air prior to beginning the test. It is recommended that the line remain pressurized for a minimum of 24 hours before testing in order for joints to tighten and pockets of air to dissolve in the water.
5. The hydrostatic test shall be at least 2 hours in duration after reaching the specified test pressure where joints are exposed and at least 8 hours where joints are covered.
6. The test pressure shall not vary by more than +/- 5 psi for the duration of the test. Test pressure shall be maintained within this tolerance by adding makeup water through the pressure test pump into the pipeline. The amount of makeup water added shall be accurately measured (in gallons per hour) by suitable methods and shall not exceed the applicable testing allowance as specified herein.

J. Visual Inspection:

Any exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the hydrostatic pressure test. Any damaged or defective materials that are discovered during or following the pressure test shall be repaired or replaced at the Contractor's expense, and the test shall be repeated until satisfactory results are obtained. Water main repair and replacement shall be in accordance with Subpart 4.7 L.

K. Testing Allowance:

1. Testing allowance shall be defined as the maximum quantity of makeup water that is added into a pipeline undergoing hydrostatic pressure testing, or any valved section thereof, in order to maintain pressure within +/- 5 psi of the specified test pressure (after the pipeline has been filled with water and the air has been expelled).
2. No pipe installation will be accepted if the quantity of makeup water is greater than that determined by the following formula:

$$L = \frac{S * D * (P)^{1/2}}{148,000}$$

Where:

L = testing allowance (makeup water), in gallons per hour
S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the hydrostatic test, in pounds per square inch (gauge pressure)

3. This formula is based on a testing allowance of 10.5 gpd/mile/inch of nominal diameter at a pressure of 150 psi. Values of testing allowance at various pressures are shown in the following table. When testing against closed metal-seated valves, an additional testing allowance per closed valve of 0.0078 gal/hr/inch of nominal valve size shall be allowed. When hydrants are in the test section, the test shall be made against the main valve of the hydrant.

Hydrostatic Testing Allowance per 1,000 feet of pipeline (gallons per hour)*											
Average Test Pressure (psi)	Nominal Pipe Diameter (inches)										
	4	6	8	10	12	14	16	18	20	24	30
250	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21
225	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04
200	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87
175	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68
150	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48
125	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27
100	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03
75	0.23	0.35	0.47	0.59	0.70	0.82	0.94	1.05	1.17	1.40	1.76
50	0.19	0.29	0.38	0.48	0.57	0.67	0.76	0.86	0.96	1.15	1.43

**If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.*

- L. Acceptance of the installation shall be determined on the basis of testing allowance only. Should any test of pipe laid disclose leakage greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the

leakage is within the specified allowance. All visible leaks are to be repaired regardless of the allowance used for testing. Hydrostatic test results shall be recorded on an appropriate chart recorder as specified herein. A copy of the test chart shall be provided to the Engineer.

- M. To repair or replace damaged or defective water main pipe, the Contractor shall maintain positive pressure on the main (valves left partially open) while he excavates around and under (2' clearance) the pipe so that water can be pumped out of the excavation pit before it enters the newly constructed main during the repair process. Contractor shall have adequate pumping capacity to prevent any trench water or debris from entering the main during this process. The interior of all pipe and fittings shall be sprayed with a 1% hypochlorite solution before they are installed in the repair process. To produce this one percent hypochlorite solution, one gallon of 5% hypochlorite bleach can be diluted with four (4) gallons of water. Flooding or contamination of the main during this process shall invoke Paragraph 2.5 of Section 02713.

9.3.8 CLEANING AND DISINFECTING OF WATER LINES

- A. Disinfection Tests: Conduct disinfection tests in accordance with AWWA C-651.
1. During construction, take precautions to protect pipe interiors, fittings, and valves against contamination. Follow all Material Storage and Handling Requirements in Section 02713 Part 2.
 2. All chlorine products shall be NSF approved chlorine. Pool chlorine products shall not be used.
 3. The Granular Method shall be used as the standard disinfection method on all newly installed pipelines unless prior approval for the continuous feed or slug method is obtained from the Engineer or his representative.
 4. Granular Method (Standard Method):
 - a) Chlorine product shall be OxyChem ACL 60 Disinfecting Granules (sodium dichloroisocyanurate) with approximately 62% available chlorine or approved equal.
 - b) Place granular chlorine in the pipe at the beginning of the line, beginning of each branch line, and at 500-foot intervals (every 25 pipe joints).

- c) Place enough granular chlorine in the pipe to achieve a 25 ppm dosage in the pipeline. Contractor shall obtain granular chlorine in pre-measured bottles from the OCWD to ensure proper dosage is achieved (see Table I).
- d) Slowly fill the pipeline with water and eliminate all air pockets. Hold the disinfection solution in the pipeline for 24 hours.
- e) Flush thoroughly to clear the strong chlorine solution from the pipelines before bacteriological sampling (see Item 8 of this section).

TABLE I - GRANULAR METHOD	
GRANULAR CHLORINE DOSE SIZE FOR 500 FT OF PIPE AT 25 PPM	
Pipe Diameter (in)	Dose Size (oz)
2	0.5
4	2
6	4
8	7
10	11
12	16
16	28
24	63
30	99
36	142

- 5. Continuous Feed Method (Special Approval Required):
 - a) Granular chlorine may be placed (optional) in the pipeline during construction (see Granular Method).
 - b) Thoroughly flush the pipeline to remove all sediments and air pockets.
 - c) Add a continuous dose of chlorine while flowing water slowly into the new main until a 25 ppm chlorine concentration is reached throughout the new pipelines. Contractor shall use Sodium Hypochlorite to obtain the 25 ppm dosage (see Table II for total amount of Sodium Hypochlorite to be fed to establish 25 ppm dosage for 500 feet of pipe). In the alternative, granular chlorine can be mixed to obtain the 25 ppm concentration (see Table I for total amount of granular chlorine to be fed to establish 25 ppm concentration for 500 feet of pipe). Measure the chlorine residual at various locations to confirm proper residual has been achieved.
 - d) Hold the disinfection solution in the lines for 24 hours and confirm that the chlorine residual is at least 10 ppm after 24 hours.
 - e) Flush thoroughly to clear the strong solution from the pipelines before bacteriological sampling (see Subpart 4.8 A.8.)

TABLE II – CONTINUOUS FEED METHOD	
SODIUM HYPOCHLORITE DOSE SIZE FOR 500 FT OF PIPE AT 25 PPM	

Pipe Diameter (in)	Sodium Hypochlorite Volume (gal)		
	5.0%	6.15%	10.0%
2	0.04	0.03	0.02
4	0.16	0.13	0.08
6	0.37	0.30	0.18
8	0.65	0.53	0.33
10	1.0	0.83	0.51
12	1.5	1.2	0.73
16	2.6	2.1	1.3
24	5.9	4.8	2.9
30	9.2	7.5	4.6
36	13.2	10.7	6.6

6. Slug Method (Special Approval Required):

- a) Granular chlorine may be placed (optional) in the pipeline during construction (see Granular Method).
- b) Thoroughly flush the line to remove all sediments and air pockets.
- c) Admit water to the new main very slowly and dose with enough chlorine to produce a residual of at least 100 ppm. Contractor shall use Sodium Hypochlorite or granular chlorine according to Table III to obtain the 100 ppm concentration. The objective is to produce a column of 100 ppm chlorine solution which will move slowly as a slug through the new pipeline. The column or slug of highly chlorinated water must be long enough to contact all surfaces of the pipe interior for at least 3 hours. Measure chlorine residuals in the slug as it moves down the pipeline. The residual must be maintained over 50 ppm.
- d) For emergency line repair situations only, to be performed only by, or in the presence of, authorized OCWD personnel, and where no service connections exist, the standard 100 ppm concentration can be substituted for a 300 ppm solution and the contact time can be reduced from the standard 3 hours to 15 minutes. Table IV indicates the Sodium Hypochlorite and granular chlorine dose sizes to be used for this method. Refer to Paragraph 4.08B for appropriate situations and procedures.
- e) Flush thoroughly to clear the strong chlorine solution from the pipelines before bacteriological sampling.

TABLE III – SLUG METHOD				
CHLORINE DOSE SIZE FOR 500 FT OF PIPE AT 100 PPM (MG/L)				
Pipe Diameter (in)	Sodium Hypochlorite Volume (gal) (oz. of weight)			Granular Chlorine
	5.0%	6.15%	10.0%	62%

2	0.2	0.1	0.1	2.1
4	0.7	0.5	0.3	7.1
6	1.5	1.2	0.7	16
8	2.6	2.1	1.3	28
10	4.1	3.3	2.0	44
12	5.9	4.8	2.9	63
16	10	8.5	5.2	112
24	23	19	12	253
30	37	30	18	395
36	53	43	26	569

TABLE IV – SLUG METHOD				
CHLORINE DOSE SIZE FOR 500 FT OF PIPE AT 300 PPM (MG/L)				
Pipe Diameter (in)	Sodium Hypochlorite Volume (gal) (oz. of weight)			Granular Chlorine
	5.0%	6.15%	10.0%	62%
2	0.5	0.4	0.2	6.3
4	2.0	1.6	1.0	21
6	4.4	3.6	2.2	48
8	7.8	6.4	3.9	84
10	12	10	6.1	132
12	18	14	8.8	190
16	31	25	16	336
24	70	57	35	758
30	110	90	55	1185
36	159	129	79	1706

7. While chlorine is being applied, do not manipulate valves so that the treatment dosage will not flow back into the line that is supplying the water. Continue application of chlorine until the entire line being treated is filled with the chlorine solution.
8. Final Flushing: Conduct final flushing in accordance with AWWA C651.
 - a) After applicable retention period, flush heavily chlorinated water from the line until chlorine concentration in water leaving the main is no higher than that generally prevailing in the system, or less than 2 mg/l. Unless special approval is obtained from Engineer, all water shall be flushed through de-chlorinating diffusers rated to remove the appropriate chlorine concentration (Arden Industries' Bazooka with Liquid Calcium Thiosulfate Feed or pre-approved equal). The OCWD may, at its option, provide such devices to the Contractor while the line is flushed. The Contractor must contact the Inspector prior to flushing any water from the newly constructed line. The Inspector shall provide de-chlorinating diffuser(s) to the Contractor before flushing. If no diffusers are

available through the OCWD, the Contractor shall be required to provide diffusers. The Inspector shall approve the flushing location. The Inspector shall also check the chlorine level in the main before final flushing. If the residual chlorine level is out of the effective range of the de-chlorinating diffuser, the Inspector shall require the Contractor to wait until the residual level has dropped to within the range of the de-chlorinating diffuser before flushing.

- b) In the alternative, but only with special approval from the Engineer, neutralizing chemicals may be applied externally as the water reaches the ground. Perform such flushing only at sites where Engineer has approved. If no approved point of discharge is available, neutralizing chemicals must be applied to the water in order to neutralize the chlorine residual. The amount of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water are shown in Table V.
- c) Flushing Velocity: The velocity of water used to flush the line shall be at least 2 fps. The flow rates required to produce this velocity varies depending on pipe diameter. To approximate this velocity; refer to Table VI to select the proper number of taps or 2-1/2" Fire Hydrant Nozzles to open at the end of the line.
- d) Minimum Flushing Time: At minimum, the line shall be flushed to remove two complete volumes of water through the newly constructed pipeline, approximately 7 minutes per 500 ft. The Disinfection, Flushing, and Pressure Testing Worksheet presents the minimum flushing time for various lengths of pipe.
- e) Additional Flushing: After flushing pipe for minimum time specified in Item d, check for trapped air at Air Release Valves, Blow-offs and services at high points. Verify that all mud, air cloudiness, or other discoloration is absent from flushing stream. If such problems exist, continue to flush line until the stream is clear.
- f) Once a line has been flushed, test to make certain that the residual chlorine in the water is within acceptable limits.
- g) It must be noted that flushing is no substitute for taking preventative measures before and during the laying of water lines. Certain contaminants – especially those in caked deposits – are difficult or even impossible to remove by flushing, no matter how high the velocity. Furthermore, in pipe with diameters of 16" or more, it can be difficult to achieve even the minimum recommended flushing velocity of 2.5 fps.

**TABLE V - REQUIRED CHEMICALS TO NEUTRALIZE CHLORINE
CONCENTRATION (PER 100,000 GALLONS OF**

Residual Chlorine Concentration	Sulfur Dioxide (SO ₂) lb	Sodium Bisulfite (NaHSO ₃) lb	Sodium Sulfite (Na ₂ SO ₃) lb	Sodium Thiosulfate (Na ₂ S ₂ O ₃ ·5H ₂ O) lb
1	0.08	1.2	1.4	1.2
2	1.7	2.5	2.9	2.4
3	8.3	12.5	14.6	12.0
4	41.7	62.6	73.0	60.0

TABLE VI - MINIMUM NUMBER OF OPENINGS TO PRODUCE 2.5 FPS. (AT 40 PSI)			
Pipe Diameter (in)	Number of 1" Taps	Number of 2" Taps	Number of 2-1/2" FH Nozzles
2	1	---	---
4	1	1	1
6	---	1	1
8	---	1	1
10	---	2	1
12	---	2	2
16	---	4	2
24	---	-	4
30	---	---	6
36	---	---	8

9. Bacteriological Testing:

Contractor to coordinate with OCWD's Personnel regarding the bacteriological testing and procedure.

Section B and C below are for Authorized OCWD Personnel or Contractors working under direct supervision of Authorized OCWD Personnel.

B. Positive Pressure Method:

1. Contact 811 to have all other utilities located; notify Service Department and Water Treatment Plant of areas affected.
2. All attempts will be made to repair line under "wet" conditions to avoid or eliminate possible contaminants from entering the system.
3. Close nearest isolation valves on the downstream side of the leak. Reduce the flow from the upstream side of the leak by throttling back the remaining valve, leaving positive pressure on the line. **DO NOT OPEN ANY FIRE HYDRANTS TO REDUCE LINE PRESSURE PRIOR TO OPENING THE TRENCH TO A DEPTH OF AT LEAST 18-INCHES BELOW THE LINE.** This will prevent contaminants from entering the system. Complete the repair trench excavation.

4. After excavation of the repair trench is complete (to a depth of at least 18-inches below the line) close the remaining valve after removing the standing water to fully expose the pipe 360 degrees. Treat any standing water now remaining in the repair trench with ½ oz. of Granular Chlorine (62% purity) for every one hundred gallons of trench water to achieve a 25-ppm solution.
5. To ensure a clean repair, inspect around the pipe in and near the damaged area and remove any debris, soil, or other material from the damaged area. Swab or spray the damaged area of the pipe and interior of all repair clamps or other appropriate devices with a 1% hypochlorite solution (5.2 fluid oz. of 6.15% bleach/quart of water) before installation. Complete the repair.
6. Open the appropriate valve(s) and flush the water main toward the repair location from both directions if valve and hydrant locations permit. Continue flushing until all discolored water is eliminated and satisfactory chlorine residual is reached.
7. Before the water main is returned to full service, collect a single water sample at a point nearest the repaired section. If direction of flow can be determined, the sample should be collected from downstream of the break repair. If direction of flow cannot be determined, samples should be collected from above and below the break repair. These samples should be coded “D”. This sample is to be delivered as soon as possible to the Water Treatment Plant for bacteriological testing.
8. Check all valves to insure they have been returned to the open position.
9. If the test results are negative, the test results will serve as a record of compliance and no future work is required.
10. Fill out all appropriate forms indicating disinfection procedures.
11. If the test results are positive, then additional sampling should be undertaken immediately. A total of three (3) additional samples should be taken. The first additional sample should be taken from the original sampling location and the other two additional samples should be taken above and below the original sampling location. These three samples should be coded “R”. If all three samples are negative, then no further work is required. If any of the additional samples is positive, then follow the normal repeat monitoring procedure.

C. Dewatered Method: If it is not possible to maintain positive pressure as stated above and the pipe must be dewatered prior to opening and preparing the repair trench, then the entire section of pipe must be disinfected in accordance with Section 6 of this document (Slug Method), which is derived from Section 4.7.4 of AWWA C651-99.

1. Contact Kentucky One Call to have all other utilities located; notify the Service Department and Water Treatment Plant of areas affected.
2. Close the nearest isolation valves on all sides of main break.

3. If there are customers in the isolated area, turn off all services at the lock wing on the meter yokes. Remove the meters. This will prevent the disinfectant from entering the customer's premises.
4. In order to lessen the possibility of additional contaminants from entering the exposed line, after excavation of the repair trench is complete, pump the water down below the main line. Treat the standing water in the repair trench with ½ oz. of granular chlorine for every one hundred gallons of trench water to achieve a 25-ppm solution.
5. Clean the area around the pipe. Swab or spray the interior of all repair pipe and fittings with a 1 percent hypochlorite solution (5.2 fluid oz. of 6.15% bleach/quart of water) before installation.
6. The line should be properly disinfected by the slug method using a chlorine dosage of 100 mg/L and a contact time of at least 3 hours for areas where service connections are present.
7. In areas where no service connections exist the line can be properly disinfected by the slug method using a chlorine dosage of 300 mg/L and a contact time of at least 15 minutes.
8. After the disinfectant has been added to the line by using a sodium hypochlorite solution or calcium hypochlorite granules, an upstream valve should be opened slightly, along with an opened downstream hydrant, to allow air and highly discolored contaminated water to be removed. The slow flowing concentrated slug will gradually move through the pipe allowing all parts to be exposed to the disinfectant.
9. Once the highly discolored contaminated water has been flushed, the valve and flushing hydrant should be closed to allow for the prescribed disinfectant contact time.
10. After the prescribed contact time has been reached, prepare to treat (de-chlorinate) the highly chlorinated water to be flushed from the isolated line if there is a possibility that the discharge will cause any damage to the environment.
11. Open the upstream valve and the downstream hydrant and flush until all discolored water is eliminated, de-chlorinating the discharge if necessary. Test for highly chlorinated water remaining in the line and continue flushing if necessary until elimination is successful and the concentration is no higher than that in the prevailing water in the surrounding area.
12. Before the water main is returned to full service, collect a single water sample at a point nearest the repaired section. If direction of flow can be determined, the sample should be collected from downstream of the break repair. If direction of flow cannot be determined, samples should be collected from above and below the break repair. These samples should be coded "D". This sample is to be delivered as soon as possible to the Water Treatment Plant for bacteriological testing.

13. Open the customer's services at the lock wings and flush the service lines.
Reinstall meters.
14. Open the remaining valves in the isolated area.
15. Flush the area again at the highest hydrant in the area to insure the elimination of any discolored water.
16. If the test results are negative, the test results will serve as a record of compliance and no future work is required.
17. Fill out all appropriate forms indicating disinfection procedures.
18. If the test results are positive, then additional sampling should be undertaken immediately. A total of three (3) additional samples should be taken. The first additional sample should be taken from the original sampling location and the other two additional samples should be taken above and below the original sampling location. These three samples should be coded "R". If all three samples are negative, then no further work is required. If any of the additional samples is positive, then follow the normal repeat monitoring procedure.