

## Water System Design Manual (DOH 331-123) Summary of Changes and Additions

**Note:** *There have been numerous changes to the Water System Design Manual to improve your ability to understand the information in it. These changes include ones in formatting, style, and sentence structure. This summary of changes documents the significant changes in content. Other minor changes, such as updates to references, are not included in this list.*

Chapter	Section	Section Title	Summary of Change
Preface	N/A	N/A	Removed the discussion of the <i>Managerial Assessment of Water Quality and System Reliability</i> (AwwaRF, 1997).
1	1.3	Relationship with Planning Requirements	Added that the purpose of planning documents includes documenting water use efficiency measures.
1	1.12	U.S. Environmental Protection Agency Policy for Submetered Properties	Added new Section 1.12 to address submetering issue outlined in U.S. Environmental Protection Agency's policy.
1	N/A	Table 1-1: Office of Drinking Water Regional Offices	Updated contact information for the Southwest Regional Office and the Eastern Regional Office.
2	2.2.2	Planning	Added language clarifying when a water system plan amendment is required.
2	2.2.2	Planning	Modified water rights submittal information in response to implementation of Municipal Water Law and consistency with WAC.
2	2.2.8	Legal Considerations	Added description of Boundary Review Boards.
2	N/A		Deleted example <i>Water Rights Self Assessment</i> . <i>Water Rights Self Assessment</i> forms are now available on the Web.
3	3.2.1	Individual Drawing Detail Requirements	Consolidated Section 3.2.2 into 3.2.1.
4	N/A	General	Clarified requirements for when a <i>Water Rights Self Assessment</i> form needs to be submitted.
4	N/A	General	Moved checklists to Appendix A.
4	N/A	General	Forms have been removed from the <i>Water System Design Manual</i> and are on the Department of Health's (DOH) Web. Information on how to obtain the current version of forms is included in Appendix A.
4	4.3.2	Water System Plan Screening	Screening questions were divided to those for community water systems and those for nontransient noncommunity water systems.
4	4.6	Source Approval and Water Rights	Clarified that a <i>Water Rights Self Assessment Form</i> will be required.

<b>Chapter</b>	<b>Section</b>	<b>Section Title</b>	<b>Summary of Change</b>
5	5.0	Applicability	Removed reference to the Conservation Planning Requirements and streamlined the section.
5	5.1	Estimating Water System Demands	Re-titled section. Rewrote section. Added reference to meter calibration.
5	5.2	Residential Water Demand Design Criteria	Rewrote section. Emphasized actual metered use records for existing water systems vs. other approaches for new water systems. Outlined minimum requirements for source meter records. Included recommended multipliers for estimating maximum day demand from maximum month average day demands.
5	5.2.1	Maximum Day Demand	Minor change to section title. Rewrote section. Emphasized actual metered use records for existing water systems vs. other approaches for new water systems.
5	5.2.2	Average Day Demand	Minor change to section title. Rewrote section. Emphasized actual metered use records for existing water systems vs. other approaches for new water systems.
5	5.2.3	Analogous Systems	Emphasized that using analogous water system data is only applicable to the development of new water systems. Provided some more guidance on what is “analogous”.
5	5.2.4	Peak Hourly Demand	Minor change to section title. Added language to clarify that the amount of water used by a single family residential connection is an equivalent residential unit (ERU).
5	5.3	Design Criteria Based Upon Documented Water Use	New title for the section. Rewrote section.
5	5.3.1	Basic Elements of Water Demand Documentation	Minor change to section title. Rewrote section.
5	5.3.2	Anticipated Changes in Demand	Moved some information to Section 5.3.1.
5	5.3.3	Demand Estimates for Water Systems with both Full-time and Part-time Single Family Residential Users	New section.
5	5.6	Water Resource Issues	Changed section title. Added a few sentences about the Municipal Water Law.

Chapter	Section	Section Title	Summary of Change
5	5.6.1	Water Rights	Clarified that water rights must be addressed in many submittals. Deleted reference to DOH policy C.05, <i>Determination of Water Rights Adequacy in Reviewing Construction Documents and Project Reports</i> , since it has been rescinded.
5	5.6.2	Water Use Efficiency	Revised section title. Rewrote section.
5	5.7.1	System Reliability Recommendations	Revised last items under “Distribution Systems”.
6	6.2	Capacity Definitions	Revised section title. Revised definitions to be consistent with those in WAC.
6	6.4.6	ERUs and Distribution System Leakage	New section.
6	6.7.4	Step 4: Physical Capacity Based on Distribution Facilities	Added paragraph clarifying that fire flow capacity is separate from the number of ERUs that can be served by a water system.
6	6.7.5	Step 5: ERUs Based on Distribution System Leakage	New section.
7	7.0.2	Water Rights	Replaced reference to DOH policy C.05, <i>Determination of Water Rights Adequacy in Reviewing Construction Documents and Project Reports</i> , with requirements for water right self-assessment.
7	7.1.3	Seawater Intrusion	Redirected the reader to Appendix E for information on seawater intrusion; deleted reference to Appendix F document. Deleted reference to the <i>Island County Saltwater Intrusion Policy</i> .
7	7.2	Source Water Quality Protection	Added paragraph on sample tap installation requirements.
7	7.2.2	Secondary Contaminants	Deleted reference to DOH policy F.08. <i>Secondary Contaminant Treatment</i> because the policy has been rescinded.
7	7.2.6	Rainwater Collection Systems	Rewrote section.
7	7.2.7	Desalination	Minor revisions to section including reference to Chapter 12 and Appendix G.
7	7.3	Ground Water Sources (Wells)	Changed “required” to “recommended” for drawdown and recovery data (in the paragraph following the note). There is a regulatory basis for requiring drawdown (WAC 173-160-321) but none for requiring recovery.
8	8.1.4	Fire “Suppression” Flow	Updated rating percentages based upon information from the Washington Surveying and Rating Bureau.

Chapter	Section	Section Title	Summary of Change
8	8.1.6	Maximum Velocity	Updated recommendation for transient analysis when velocities in distribution system piping exceeds 10 feet per second.
8	8.2	Hydraulic Analysis	Revised the section.
8	8.2.1	Model Development	Section formerly titled “Computer Modeling”. Rewrote discussion on simplifying models for large distribution systems.
8	8.2.2	Model Calibration	Revised subsection on Criteria for Model Calibration.
8	8.2.2	Model Calibration	Table 8-1: Revised table to focus on criteria for calibrating hydraulic models for design purposes. Included more references.
8	8.2.3	Model Analysis	Section was formerly titled “Hydraulic Modeling Parameters”.
8	8.2.3	Model Analysis	New paragraph to introduce the section.
8	8.2.3	Model Analysis	Rewrote paragraphs on issues to address where fire flow demands exceed minimum requirements.
8	8.2.3	Model Analysis	Clarified that required peak hourly demand and fire flow hydraulic analysis must be done using a steady-state model.
8	8.2.3	Model Analysis	Created separate section for discussion of extended period simulation models. Added discussion of how to create a diurnal demand cure to use in an extended period simulation model.
8	8.4.4	Separation from Nonpotable Conveyance Systems	Updated section based including references to <i>Criteria for Sewage Works Design</i> . Added reference to <i>Pipeline Separation Design and Installation Reference Guide</i> , a joint publication between DOH and Department of Ecology.
9	N/A	Introduction	Added suggested design references.
9	9.0.3	Equalizing Storage	Revised paragraph on continuous pumping.
9	9.0.3	Equalizing Storage	New paragraph on multiple day demand.
9	9.5	Special Design Considerations Based on the Type of Reservoir	Added language introducing the subsequent sections and clarifying that site specific design information <b>must</b> be submitted (even if a standard design is used).
9	9.6.1	General	Clarified intent of silt-stop on the outlet pipe.
9	9.6.2	Reservoir Drains	Added recommendation to provide separate drains and outlet pipes.
9	9.6.7	Reservoir Security	New section.
9	9.9	Reservoir Water Quality	New section.
9	9.9.1	Water Circulation and Stagnation	New section.

Chapter	Section	Section Title	Summary of Change
9	9.9.2	Tank Materials in Contact with Potable Water	Moved Section 9.5.3 to Section 9.9.2.
10	10.1.2	Closed System Design Guidelines	Revised paragraph to clarify that redundancy in dedicated fire flow booster pump is not required.
11	11.1.3	Conventional Tank Design Procedures	Added portion about the six-inch water seal calculations at bottom of the section. Replaced Figure 11-1 with Table 11-2 for the multiplying factors. Revised example 11-1 to reflect use of table 11-2 for multiplying factors selection.
11	11.2	Requirements of the Department of Labor and Industries	Updated section based upon input from Department of Labor and Industries staff including rules that discontinue routine inspections for pressure tanks used for public water systems.
11	11.3	Locating Pressure Tanks	Updated section based upon input from Department of Labor and Industries staff including more clearly defining minimum clearance requirements and variances.
11	11.5	Pressure Tank Appurtenances	Added language about minimum clearance when access hatches are installed.
11	N/A	Table 11-2: Multiplying Factors for Assuring a Six Inch Water Seal Depth in a Horizontal Pressure Tank	Replaced Figure 11-1 with Table 11-2 for the multiplying factors.
12	All	N/A	Reorganized chapter, placing submittal requirements before treatment alternatives.
12	12.2	Analysis of Alternatives	Substantially revised this section. Removed references to the <i>Western States Protocol</i> and the Environmental Testing and Verification program. Added paragraph outlining DOH's perspectives on point-of-use or point-of-entry devices.
12	12.2.3	Waste Handling	Revised paragraph on filter backwash recycling requirement to reflect changes in WAC 246-290-660(4) as a result of passage of the Filter Backwash Rule.
12	12.2.3	Waste Handling	Updated references to the Department of Ecology backwash discharge and related treatment requirements.
12	12.2.5	Preliminary Cost Comparisons	Revised section with updated references.

Chapter	Section	Section Title	Summary of Change
12	12.3	Predesign Studies	Revised section to improve consistency with WAC and clarify expectations for predesign studies.
12	12.3.1	Pilot Studies	Rewrote introductory paragraph to improve consistency with WAC. Inserted new paragraph on pilot studies for proprietary processes.
12	12.3.2	Pilot Study Duration	Rewrote section to clarify expectations for the duration and objectives of pilot studies.
12	N/A	Table 12-1: Pilot Study Duration and Objectives	New Table 12-1 outlining the recommended minimum duration and objectives of pilot studies for several types of treatment processes.
12	12.3.4	Pilot Study Report	Minor revisions to the section more clearly identify information that <b>must</b> be included in pilot study reports.
12	12.4	Project Report and Final Design Considerations	Added requirements from WAC 246-290-110(4)(h).
12	12.4.3	Start-up, Testing, and Operations	New title for the section. The section was previously called “Operation and Maintenance [Reference WAC 246-290-110(4)(h)(ii)]”.
12	12.4.3	Start-up, Testing, and Operations	Rewrote section. Included discussion of operations programs for surface water treatment facilities.
12	12.4.4	Treatment System Reliability	Substantially revised section to include information from the policy in the <i>Recommended Standards for Water Works</i> on unattended operation. Added new Table 12-2 based on information from 2001 edition of the <i>Water System Design Manual</i> .
12	12.4.5	Chemical Overfeed	Pulled chemical overfeed out of previous section on reliability for clarity. Updated references on chemical overfeed incidents. Reduced number of chemical overfeed incidents to put emphasis on design recommendations.
12	12.5	Construction Documents	Revised section to clarify what <b>must</b> be submitted and referenced Chapter 3, and the checklists in Appendix A for additional requirements.
12	12.6	Construction Inspection and Final Approval	New title for the section. The section was previously called “Start-up, Testing, and Operation”.
12	12.6	Construction Inspection and Final Approval	Rewrote section. Clarified that start-up and testing <b>must</b> be addressed in project reports for water treatment projects.

Chapter	Section	Section Title	Summary of Change
12	12.7	Related Policies and Guidelines	Added reference to Appendix A.
12	12.8	Treatment Alternatives	Revised section. Removed reference to the <i>Western States Protocol</i> , which is no longer applicable and has been removed from the DOH Web.
12	12.8.1	Surface Water	Revised section.
12	12.8.1	Surface Water	Revised Table 12-3. Pilot testing recommendations moved to Sec. 12.3.2 and Table 12-1.
12	12.8.2	Disinfection	Added paragraphs for disinfection following reverse osmosis treatment for seawater and groundwater.
12	12.8.3	Fluoridation	Updated references. Added reference to upflow saturator checklist in Appendix G.
12	N/A	Table 12-4: Disinfection Treatment	Added requirement for American National Standards Institute / NSF International Standard 61 salt and raised issue of adequate hydrogen gas ventilation.
12	12.8.4	Corrosion Control	Updated reference to the <i>Revised Guidance Manual for Selecting Lead and Copper Control Strategies</i> .
12	12.8.5	Inorganic Chemicals	Rewrote section to better introduce new sections on arsenic, nitrate, and iron and manganese.
12	N/A	Table 12-5: Corrosion Control Treatment	Adjusted pH range for phosphate inhibitors to be consistent with the <i>Revised Guidance Manual for Selecting Lead and Copper Control Strategies</i> .
12	N/A	Table 12-6: Treatment Technologies for Selected IOCs	Revised table with updated information; provided references to the technologies described.
12	12.8.5.1	Arsenic	New section.
12	12.8.5.2	Nitrate and Nitrite	New section.
12	12.8.5.3	Iron and Manganese	New section.
12	12.8.6	Volatile and Synthetic Organic Chemicals	Created new section for discussion of disinfection byproducts separate from volatile organic chemicals and synthetic organic chemicals.
12	12.8.7	Disinfection Byproducts	New section.
12	12.8.8	Radionuclides	Revised section to include treatment references and outlined requirements of the Radionuclides Rule.

<b>Chapter</b>	<b>Section</b>	<b>Section Title</b>	<b>Summary of Change</b>
12	N/A	Table 12-8: Treatment Technologies for Reduction of DBPs	Clarified that enhanced coagulation treatment technique is only applicable to conventional rapid rate water treatment plants.
12	12.9	Cross-connection Control Considerations in Water Treatment Facilities	Created new subsections. 12.9.1 Treatment Chemicals 12.9.2 Premises Isolation 12.9.3 Process Water and In Plant Piping 12.9.4 Common Wall Construction in Treatment Facilities
13	13.1	Safety	Provided more information on the Department of Labor and Industries jurisdiction over safety issues.
13	13.1	Safety	Revised paragraph on “Access Hatches, formerly titled “Entry and Egress”.
13	13.1.2	Ladder Safety and Fall Protection	Revised title of the section. Revised section.
13	13.1.5	Excavation and Trench Safety Systems	Revised title of the section. Revised section.
13	13.4	Cross-connection Control	Substantially revised the section. Merged Sections 13.4 and 13.4.1 into one section which changed the numbering of subsequent subsections.
13	13.4.1	General Requirements	Substantially revised the section.
13	13.4.2	Cross-connection Control Considerations in Design of Water System Facilities	Added well pump-to-waste line as needing air gap protection.
13	13.4.3	Technical Information	Replaced addresses for organizations that publish cross connection control guidance with reference to Appendix C.
13	13.5	Seismic Design	Incorporated updates to seismic design standards from engineering consultant that specializes in seismic design for water and wastewater.
14	14.1	Construction Completion Report	Changed references to forms from Chapter 4 to Appendix A.
14	14.3	Pressure and Leakage Test	Updated references to the Washington State Department of Transportation and American Public Works Association Specifications
14	14.7	Construction Inspection	Provided introductory paragraph for subsequent subsections on different aspects of construction inspection.
Appendix	A	General	Deleted the listing of policies. Provided contact information for how to obtain a policy.
Appendix	A	General	Moved design checklists from Chapter 4 to here.

Chapter	Section	Section Title	Summary of Change
Appendix	A	Project Checklists	Minor modifications to be more consistent with WAC and related chapters.
Appendix	A	Project Checklists	Added hydraulic analysis checklist.
Appendix	B	Secondary Contaminant Treatment Requirements and Options	Revised second paragraph to be consistent with the current WAC.
Appendix	B	Secondary Contaminant Treatment Requirements and Options	Clarified American National Standards Institute / NSF International Standard 61 requirements for polyphosphate addition.
Appendix	B	Secondary Contaminant Treatment Requirements and Options	Updated recommended references.
Appendix	B	DOH/ICHD Salt Water Intrusion Policy	Deleted policy and reference to it in Chapter 7. Policy has been replaced by Island County Code.
Appendix	F	Obtaining Approval for Wells as Public Drinking Water Source	Deleted well source approval checklist. Incorporated information into source approval checklist in Appendix A.
Appendix	G	Iron/Manganese Removal Checklist	Removed reference to the Sizing Guidelines (superseded by the <i>Water System Design Manual</i> ). Added language allowing higher loading rates for filtration through solids manganese dioxide.
Appendix	G	Hypochlorination Checklist	Inserted revised hypochlorination checklist: Reorganized to put system operating parameters first, added chlorine demand, corrected minor error in concentration of feed solution, clarified that “additional required items” are really required (removed “no” as an option) and added requirement for disinfection by-products monitoring plan.
Appendix	G	Fluoride Saturator-Upflow Type – Submittal Checklist	New checklist added.
Appendix	G	Ozone Treatment of Iron/Manganese Checklist	Updated WAC references for Washington Industrial Safety and Health Act ozone safety standard, added requirement for disinfection byproducts monitoring plan.
Appendix	G	Reverse Osmosis for Desalination of Seawater or Brackish Water Checklist	Modified checklist to reduce disinfection from 3 log Giardia to 4 log virus; more emphasis on permitting; added conditions when piloting may not be needed; numerous additions based on operational history of active plants.

<b>Chapter</b>	<b>Section</b>	<b>Section Title</b>	<b>Summary of Change</b>
Appendix	I	Ultraviolet Light Disinfection for Drinking Water Applications – Executive Summary	Updated Executive Summary based upon information published with the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR).
Appendix	I	Ultraviolet Light Disinfection for Drinking Water Applications – Identification of Technical Issues	Identified Ultraviolet to comply with the LT2ESWTR and Ultraviolet as part to comply with limited alternative to filtration requirements separately from Ultraviolet used to comply with surface water treatment rule.
Appendix	I	Ultraviolet Light Disinfection for Drinking Water Applications – Reactor Validation	Updated last three paragraphs based upon information in the Environmental Protection Agency Ultraviolet Disinfection Guidance Manual and from other sources.
Appendix	I	Ultraviolet Light Disinfection for Drinking Water Applications – Public Health Criteria	Updated sections on groundwater to reflect information on viruses released with the LT2ESWTR.
Appendix	I	Ultraviolet Light Disinfection for Drinking Water Applications – Public Health Criteria	Developed new subsections for limited alternative to filtration, LT2ESWTR, and the surface water treatment rule.
Appendix	I	Ultraviolet Light Disinfection for Drinking Water Applications – Operations	Updated table for Ultraviolet Disinfection Monitoring/Reporting Elements to include “Dose” and “UVT.” Modified other reporting requirements.
Appendix	I	Ultraviolet Light Disinfection for Drinking Water Applications – Testing Matrix	Removed discussion of and suggested modifications to the NWRI validation protocol.
Appendix	I	Ultraviolet Light Disinfection for Drinking Water Applications – Ultraviolet Disinfection Checklist	New checklist for designers and reviewers.