2018

DESIGN AND CONSTRUCTION PRACTICES MANUAL

Anchorage Water and Wastewater Utility

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SUMMARY OF CHANGES - DCPM Revisions 2012 to 2018

Revision	Section	Description
1	-	Update all sheets referencing DCPM 2012 to DCPM 2018
2	-	AutoCAD 2009 was updated through out the document to be AutoCAD 2015
3	TOC	Update based on changes
4	10.01	MASS was recently updated and AWWU currently does not have any MASS details. The text in the 3rd paragraph was changed to reflect this and to add a caveat about future changes to MASS details
5	20.01	Made the overall development plan submittal to a higher standard
6	20.03.01	1st bullet, added geotechnical data to research requirements
7	20.03.01	4th bullet, formalize and align inspection and reporting requirements with public works
8	20.03.02	Aligned with the requirement in 20.03.01
9	20.03.03	Aligned this section with requirements in the PD agreement
10	20.04.01	Paragraph 3 was modfied to match current practice of AWWU authorizing permit extentions
10	20.04.02	Corrected "connections" to "construction"
11	**20.04.03**	**NEW SECTION:** Formalize permitting industrial construction discharges to the AWWU system. IMPORTANT - ADDED DNR Approval
12	20.04.04	ROW pavement cut requirements are updated.
13	20.04.04.01	ADOT recently requested notification of work within ADOT ROW. This requirement was captured here
14	20.04.04.02	MOA ROW requires and engineered pavement structural section detail on all plans with work within the ROW. This requirement was captured here
15	20.04.05	ADEC approval was broaded because of recent regulatory interpertive changes. In addition, requirments of ADEC approval are further made clear.
16	20.04.06	Minor gramitical changes
17	20.04.07	AWWU does not provide the wetland maps, so the wording was changed to direct DCPM users to the correct wetland map holders
18	20.04.08	This section was updated to match MASS and to provide IMPORTANT clarification that AWWU may require a temporary system when the service is crtical to human health
19	20.05.02	Paragraph 4 was added to required plan appearance
20	20.05.03	The plan set number requirement is extended to all related project sheets. AWWU is now keeping all project sheets
21	20.05.04	Minor gramitical changes
22	20.05.06	Minor gramitical changes
23	20.05.07	Plan View - requirements for tabular data and pavement structural section added. Clarification to contours, added items to show such as buildings
24	20.05.07	Profile View - added requirements to show parallel utilities. Clarified requirements to show on the required bore logs, clarified pipe length labeling requirements. Clarified requirements of relationship between plan and profile views
25	20.05.08	Added requirement for stationing starting points
26	20.06.01	Location requirements were updated to add ADEC separation requirements and reference to the new Guidence on separation waivers
27	20.06.01	Added requirement for all sewer lines to end in a manhole.This was the requirement prior to this addition, but the logic to get there was less than straight forward. This clearly defines the requirement
28	20.06.02	Made changes to clarify that utility poles need 15' of separation and water mains rather than water lines need separation to water services
29	20.06.03	Updated the access road requirements to be more specific
30	20.06.03	ADEC - waiver guidence flow chart provided

SUMMARY OF CHANGES - DCPM Revisions 2012 to 2018

Revision	Section	Description
31	20.07.01	Due to a few design engineers objecting to a request for additional geotechnical data per the requirements in the 2012 DCPM in this section, all projects are required to obtain geotechnical information assocated with the water and sewer lines being installed. Substitution with required building geotechnical information or historic information in the general area will no longer ber accepted.
32	20.07.03	Required quality control testing for backfill has been clarified
33	20.08.01	Moved requirements of bedding from 20.08 to this section. Added alternate bedding material requirments to facilitate dewatering.
34	20.08.02	Revised the exceptions requirement
35	20.08.03	Revised the term "unstablized" to soft and yielding and move acceptance from the Engineer to AWWU
36	20.08.04	Strength requirement for plug material is reduced from 500 psi to 100 psi based on project experience
37	20.10.02	Updated PE encasement requirement to match MASS and clarified when an anode is required and PE encasement is not
38	20.10.04	Clarified joint bonding and anode installation
39	20.10.06	title bonded coatings on all metallic pipe is required unless the engineer can prove goundwater will not saturate the soils around the pipe. This is hard to prove than the lower requirement of coating is not required if ground water was not encountered.
40	20.12.02	Removed allowance for leakage allowance during testing to match MASS. Reduced AWWU's exposure to claims for valves we own and maintain.
41	20.13	Added definition of private line and added requirement to use MOA ROW rather than ADOT&PF ROW for connections
42	20.13.01	Engineered plan requirements relocated here from 20.13.05
43	20.13.02	Added the separate connection requirements found in Tariff
44	20.13.03	Relocated branch connections from 20.13.17
45	20.13.05.04	Connection per building is updated to match the intended service methodology of extension/branch connection
46	20.13.05.06	Commercial building section was added
47	20.13.06	Relocated non-conforming from 20.13.02
48	20.14.03	Removed the requirement for the Owner to notify AWWU and assigned it to the Engineer
49	20.14.07	Added notification requirements
50	20.14.08	Service connection inspection added
		Sewer Section
51	30.2.02.01	Added options for Arctic protection to provide more guidence on acceptable mthodes of freeze protection. Removed an allowance for less than 10' of cover over pressure pipe.
52	30.02.02.03	Removed the requirement to keep 4' of cover over the stand pipe on a deep service riser
53	30.02.03.01	Added requirement to bring manholes to grade IAW MASS
54	30.02.03.02	Added requirement for minimum diameter by the inner measurement for manholes. Also streesed that Type A manholes may not be sufficient for maintenance and that AWWU may require bigger manholes
55	30.02.03.04	Clarified when a sewer service may connect into a manhole.
56	30.02.03.08	Manholes in highwater requirements were changed to match the local producer of manholes limitations
57	30.02.05	Sewer crossings updated to match 18 AAC 72.
58	30.03.03	Added sewer testing requirement for private systems

SUMMARY OF CHANGES - DCPM Revisions 2012 to 2018

Revision	Section	Description
59	30.03.05.01	Reduce the angle change that can take place in a control manhole to support pretreatment sampling equipment.
60	30.03.05.03	Private lift station requirements updated
61	30.03.07	Service connection abandonment updated with a trenchless option.
62	30.04.14	Added an electronic copy being required for all manual submittals
		Water Section
63	40.02.03	Updated thrust block requirements for PVC (bullet 5) to remove the requirement for small angle changes.
64	40.02.03	clarified deflection limits by separating bell and spigot deflection to fitting to pipe deflection limits.
65	40.02.03	Added the two PVC pipe products that do not require over insertion stops
66	40.02.03	Added the no-lead rule
67	40.02.05	Updated the pipe selection chart
68	40.02.07	Added new section on dead ends
69	40.02.08.04	Fire flows - Fire Area Table updated to match the most recent adopted code
70	40.02.09.01	Reference to ADEC flow chart on waiver requirements added
71	40.02.09.02	Reference to ADEC flow chart on waiver requirements added and added expanded insulation
72	40.02.10	Removed the requirement to locate valves at the property line extended and made it at the tee or fitting
73	40.02.10	Increased the size of acceptable gate vavles. Increased from 12" to 16"
74	60.01	Updated title blocks to all figures provided
75	60.04	All notes have been updated
76	60.05	Updated title blocks
77	60.07.02	Provided example of acceptable private system lift station for commercial project
78	60.10	Removed the anode detail as it is in MASS. Updated the title blocks on the remaining details

Changes Made After Public Outreach

1	10.01	Delete paragraph about MASS details modified by the DCPM as no MASS details are being modified
2	20.05.07	Profile view requirements state "pipe" rather than "main" in the "Plan and Profile Views" portion to make this requirement applicable to more than main lines
3	30.02.02	Depth of Cover - heavily modified with the general intent unchanged
4	30.02.02.01	added requirements for flow consideration to the depth of cover requirements.
5	30.02.06.05	The ARRC provided guidence to provide a more accurate statement as to the requirements when installing water/sewer on ARRC property.
6	30.03.05.03	Move requirements for temporary lift stations and pressure sewer from other sections to here and added exceptions for dual lines
7	30.04.23	Moved section about private lift station to 30.03.05.03
8	30.05.05	Removed "service" from title as it has been made a requirement to follow in the appropriate section of 30.03.05.03. Move exception of two service lines to the section on 30.03.05.03 as well
9	40.02.03	5.f - removed "with" after "fittings"
10	40.02.07	Added clarification as to what qualifies as a water quality discharge point

SUMMARY OF CHANGES - DCPM Revisions 2012 to 2018

Revision	Section	Description
11	40.02.08.01	Clarified easement requirements and added requirement for access to a public hydrant
12	40.02.08.05	Added long standing requirment that fire lines are to be fully restrained.
13	40.02.09.05	The ARRC provided guidence to provide a more accurate statement as to the requirements when installing water/sewer on ARRC property.
14	40.02.11	Added safety requirements to live taps for the engineer's and contractor's information.
15	50.07	Modified this section to help clarify intent and requirements
16	50.08	Added another responsible party for getting information items encountered.
17	60.14	Remove inactive and soon to be changed link to provide direction to find it on the AWWU website
18	70.01	Added DCPM

10.00 GENERAL REQUIREMENTS

10.01 Purpose

The purpose of this manual is to consolidate the rules, regulations and guidelines covering the design and construction of water and wastewater facilities within the service areas of the Anchorage Water and Wastewater Utility (AWWU). The complexity of our system necessitates standardizing design practices which will provide a consolidated guideline to facilitate proper maintenance of the system.

It is not the intention of this manual to limit or hinder new or innovative ideas or procedures. AWWU recognizes there will be cases in which connections to or extensions from existing mains may require a deviation from the criteria required in this manual. AWWU will consider variances provided the design reflects good engineering practices and does not violate Municipal, State and federal codes.

AWWU's objective is to provide long-range service and minimal costs to AWWU's rate payers. By standardizing designs, construction materials and methods we can increase the longevity of our infrastructure and reduce the cost of maintenance, thereby minimizing the cost to the rate payers.

10.02 Acronyms, Abbreviations and Definitions

Acronyms and abbreviations for general design standards and terms are found in Section 70.01 of this manual. Definitions are found in Section 70.02 of this manual. Construction terminology can be found in Section 10 of the Standard General Provisions Division of the current Municipality of Anchorage Standard Specifications (MASS).

10.03 Materials and Workmanship

All materials, workmanship and construction methods used are to conform to the current MASS as modified by special provision, plans, and this manual. If the developer requests use of a new type of material or construction method and/or special conditions warrant exception from the standards, there must be prior approval in writing from the MOA, Municipal Engineer and the AWWU Engineering Division Director.

10.04 Engineer's Certification

All plans and documents stipulating construction requirements, soil reports and other similar documents must be stamped and signed by a registered professional engineer licensed to practice in the State of Alaska. This certification is to signify that the engineer (or a person under direct supervision of the engineer) prepared the documents in accordance with the laws of the State of Alaska governing such practice.

10.05 Laws, Regulations and Studies

10.05.01 General

AWWU recommends that developers, engineers and contractors become knowledgeable on the latest edition of applicable State laws and regulations, Municipal ordinances, rules, regulations and/or reports of all authorities having jurisdiction over construction of the project. AWWU is providing the following list as an aid:

- Anchorage Wastewater Utility Tariff - Certificate 126
- Anchorage Water Utility Tariff - Certificate 122
- AWWU Design and Construction Practices, most current addendum
- Anchorage Municipal Code (AMC)
- CFRs including, but not limited to, the Environmental Protection Agency Regulations

- Municipality of Anchorage ordinances related to AWWU
- Municipality of Anchorage Standard Specifications,(MASS) with current addendum
- Recommended Standards for Water Works and/or Recommended Standards for Sewage Works, most current edition, commonly called "The 10 State Standards"
- State of Alaska Statutes and Regulations
- Water Pollution Control Federation Manual of Practice No. 9
- Anchorage 2020, Anchorage Bowl Comprehensive Plan
- Eagle River - Chugiak Comprehensive Plan
- Turnagain Arm Comprehensive Plan
- Hillside Wastewater Management Plan
- International Building Code with local amendments
- International Fire Code with local amendments
- International Mechanical Code with local amendments
- International Residential Code with local amendments
- Uniform Plumbing Code with local amendments

10.05.02 Sanitary Sewer and Water Studies

The latest editions of the following reports and studies are available for use by engineers and are used by AWWU when reviewing designs by engineers:

1. Anchorage Wastewater Master Plan with current addendum
   1.1. Addendum #1, Vitrified Clay Pipe Study
   1.2. Addendum #2, Northern Communities Wastewater Study
2. Anchorage Water Master Plan
   2.1.Addendum #1, Northern Communities Water Study
3. Eagle River to Eklutna Wastewater Facilities Plan

20.00 REQUIREMENTS APPLICABLE TO WATER AND WASTEWATER

20.01 General

This section is dedicated to requirements that are applicable to both water and wastewater projects. DCPM requirements specific to wastewater are found in Section 30 and DCPM requirements specific to water are found in Section 40.

Typical development/re-development projects include agencies and departments outside of AWWU control and authority. As such it is the responsibility of the developer to become familiar with the entire development process.

- The complete regulations governing land subdivision and development are in Titles 21 and 24 of the AMC
- Where the improvement plans submitted cover only a portion of the ultimate development, the plans must be accompanied by an overall development plan, or a study showing the overall development.
- Concept approvals will be given by AWWU provided Project ID numbers and appropriate reimbursable numbers have been established.
- The Municipality of Anchorage and the Alaska Department of Transportation and Public Facilities (ADOT/PF) must approve plans for any work in the Municipal and ADOT/PF ROW.

20.02 Developers

Developers are people or organizations requesting a change to the AWWU system outside of AWWU's own capital improvement program. When required by this manual to produce engineered drawings, the developer(s) is required to engage an engineer to provide plans meeting the requirement of this manual.

20.03 Engineer's Responsibility

The engineer is responsible for researching existing data, writing design reports, developing plans, writing project specific specifications and many other duties. Depending on the project, AWWU requires differing levels of engineering involvement. The requirements listed below are the minimum expected level. Due to the variability of project complexities or special circumstances the engineer may be requested to complete additional items not listed here.

20.03.01 General

All projects requiring an engineered plan at a minimum will provide and/or complete the following:

- The engineer shall be conscientious in obtaining and reviewing record drawings, geotechnical data, consult with AWWU about the proposed development, and comply with the requirements of this manual
- The engineer will be responsible for compilation of record (as-constructed) information and preparation of record drawings
- Installation and construction problems are to be coordinated with the AWWU Division having approval authority of the engineered plans. Major proposed changes (e.g. alignment, grade, pipe material) to the approved plans during the construction phase must receive written AWWU approval prior to installation of the change
- The engineer or a representative designated by the engineer is required to be at the site for periodic inspection of the work. Inspection frequency is development type dependent. Inspections are to be recorded on an inspection report form acceptable to the Utility.

    - Private Systems that require engineered plans – One report documenting periodic inspection of the water and/or sewer construction and any required testing results.
    - Private Development – During active water and sewer utility construction, daily inspections are required. On a weekly basis the Engineer is to provide to AWWU a report of construction activity. The report is to include, at a minimum, a summary statement, backup daily inspection reports, quality acceptance testing results, and laboratory testing results. The reports are to be turned into AWWU at the beginning of each week.
- Prior to final acceptance of any public improvement by MOA, a final inspection will be conducted as provided for in MASS, with the additional requirement that AWWU is represented.
- Requests for final inspection are to be accompanied by the engineer's statement that the work is complete and constructed in accordance with applicable standards.
- Final inspections by AWWU will not be performed unless test and daily inspection reports are current and satisfactory. Preparation of final utility checklists are to be done in conjunction with the final inspection process.
- The engineer must be available throughout the warranty period to effect, through the contractor, correction of warranted deficiencies.
- Provide the subsurface investigation data at the time of initial plan review
    - Private systems that do not require engineered plans do not require subsurface investigations.
- Provide AWWU copies of other agency permits associated with the construction of either water or sewer.

20.03.02 Private Systems

- Comply with bullet items above
- Where Engineered Plans are required, the engineer must submit record drawings and all quality control testing reports
- The engineer is to submit laboratory testing results required by MASS and/or AWWU.

20.03.03 Main line extensions by a Developer

- Comply with the bullet items above
- The developer must enter into a mainline extension agreement with AWWU
- The developer designated engineer must provide a written statement to AWWU indicating their engineering services will be provided until the end of the warranty period
- The engineers and/or their firm must notify AWWU immediately if employment is terminated or if the scope of employment is reduced to the point that they can no longer perform the services described
- The engineer is required to issue and have AWWU co-sign a "Notice to Proceed" to the construction contractor prior to the start of construction for all private developments under agreement with AWWU and capital improvement projects.
- The engineering firm will designate the Engineer, as defined in Article 10.01 of MASS, and must be co-signed by AWWU
- The engineer, or a representative designated by the engineer, must be at the site to inspect the work on a daily basis during active construction. The engineer will provide to the

AWWU Project Manager written daily reports documenting the progress of the work, including soils encountered, test results and action taken on the basis of test results, and special utility checklists as required by the technical provisions of MASS. Inspection reports are due to AWWU by Tuesday at 8am unless formally changed

- The engineer is responsible for adherence to the quality control program approved for the project. Testing of water and sanitary sewer mains and services required by MASS, project specific specifications and/or private development agreement are to be scheduled with AWWU
- Provide all required submittals as stated in the main line extension agreement
- Provide the cost of removal for any AWWU infrastructure to the AWWU Finance Division. The submitted information must be in a form acceptable to the AWWU Finance Division
- Release of performance guarantees may be made by AWWU after all inspection reports are received to the satisfaction of AWWU, the project has passed final inspection, the project has passed final acceptance by other agencies and as provided for by the particular agreement

20.03.04 AWWU Capital Improvement Projects

- Comply with the AWWU contract requirements and provisions
- Comply with general engineer responsibilities
- Where reimbursement by MOA is involved, contract pay quantities must be coordinated with AWWU Engineering Division. Periodic and final payment estimates are to denote reimbursable portions and be concurred with by MOA

20.04 Approvals and/or Permits

20.04.01 AWWU Permits For New Construction

It is unlawful for any person to install or repair any portion of a service connection or extension without first obtaining a permit from AWWU. AWWU utility work will not be allowed prior to permit issuance.

Where multiple structures are to be served, a separate permit is required for each structure.

Every connection or extension permit issued by AWWU Customer Service Division expires on December 31 of the year issued. If the permit is allowed to expire, the owner must re-apply, pay for and receive a new permit prior to the resumption of work. The owner must supply the name of their contractor and each time the contractor changes after the permit has been issued.

The owner and/or their contractor must obtain all other necessary permits prior to commencement of work..

20.04.02 AWWU Permits for Repairs

All on-property service extension repairs or replacements require an on-property permit and are to follow the same standards that apply to new construction. Repairs less than 10’ in length may be completed with materials matching the existing installation.

20.04.03 AWWU Construction Water Discharges into the Sewer System

AWWU may permit discharges to the sewer system from a groundwater source after receipt of a temporary use of water (TWP) authorization from the Alaska Department of Natural Resources, Division of Mining, Land and Water, Water Resources Section. In addition

AWWU will require the submittal of the ground water treatment plan and may require laboratory testing of the effluent prior to issuing a permit. Additional treatment may be required based on laboratory testing of the discharge water.

AWWU will not issue construction dewatering permits for Girdwood without approval from the General Manager.

AWWU will also issue permits and/or approvals for Sanitary Sewer Flow Control operations. Sanitary Sewer Flow Control operations are to meet the requirements of MASS.

20.04.04 Work within Rights-of-Way and Easements (ROW)

Work within a ROW will require a separate permit from the governing ROW agency. The contractor must not allow any other person to do, or cause to be done, any work under a permit secured by the permittee, except persons in their employ.

For main line taps affecting roadways, the contractor is not to start the excavation for the main tap until a partial or full road closure permit is obtained.

The contractor must not dig up or occupy with materials any portion of the Municipal street or ROW than is absolutely necessary. Travel is not to be obstructed unnecessarily and must cause as little inconvenience as possible to occupants of abutting property and to the general public. Convenient access to driveways, houses, stores and buildings along the streets must be maintained wherever possible.

Pavement must be saw cut and removed such that replacement pavement is placed upon a minimum of 12” of undisturbed existing pavement structural section. The pavement cut must not leave narrow unstable panels of asphalt. Pavement cuts across the direction of travel are to be skewed a minimum of 15° to alleviate snow removal equipment blades from catching on the width of the pavement cut line. Where a pavement cut is running with the direction travel, the cut is to be parallel to and take place at the edge or center of the travel lane. Before replacing permanent pavement, the sub-grade must be restored and compacted to ninety-five (95%) percent of maximum density.

The final grade in non-paved areas must match existing grades at construction limits without producing drainage problems. Restoration of grass, shrubs, and other vegetation shall be done in conformance with construction contract documents. Tree damage is to be repaired according to good horticultural practice

20.04.04.01 State Highways and State Maintained Roads

Any water and/or sanitary sewer construction within the State of Alaska’s ROW requires a DOT/PF permit. This permit will be issued after the AWWU permit is issued. The engineer is to submit the ADOT/PF permit to AWWU. Failure to provide the ADOT/PF permit is grounds to issue a stop work order. The Contractor is to notify ADOT&PF when work is going to begin, when it is complete and for any other stop points required by them.

The developer, or a designated representative, is responsible for coordinating and resolving any review comments with ADOT/PF. ADOT/PF requires an engineered street cross section within the plans.

20.04.04.02 Municipal Roads and Easements

Any water and/or sanitary sewer construction within the Municipality of Anchorage's ROWs or easements requires a MOA issued ROW permit prior to an AWWU issued permit. AWWU will forward a copy of the original plans that show work within a Municipal road or

easement to MOA for review comments. The MOA requires an engineered street cross section within the plans. The developer is responsible for resolving any review comments with MOA.

The developer or their designee must coordinate with appropriate Municipal departments for plan review, approval and permits associated with non-utility (water and sewer) work located on private property.

20.04.04.03 Maintaining Traffic and Road Closures

The engineer or contractor must submit and obtain approval of a traffic control plan with ADOT/PF or MOA permit offices for working in existing traveled State and Municipal ROWs prior to working in the ROW.

20.04.05 ADEC Water and Wastewater Approvals

ADEC approvals are required for changes to the water and sewer systems in accordance with 18 AAC Chapter 72 and Chapter 80. This includes, but is not limited to, water and sanitary sewer service services as well as mainline extension, replacement, rehabilitation and modifications.

An ADEC Construction and Operation Certificate for Public Water Systems, "Approval to Construct" is required for water main line extensions and an "Approval to Operate" is required before AWWU will issue connection or extension permits.

ADEC delegated plan review authority to AWWU for all developer funded main and service connections as of April 5, 1984. The delegation did not cover waiver approvals, such as separation waivers. A guidance flow chart for waiver needs can be found in the appendices.

When construction is completed and documentation provided to AWWU in conformance with the plans and AWWU requirements, AWWU will submit, on behalf of the developer, the application for approval to operate to ADEC. The developer will be responsible for resolution of all items to obtain final certifications from ADEC.

Upon modification or revocation of the plan review delegation agreement, AWWU may require the permitee to obtain approvals by ADEC that is separate from the AWWU review, approval and permit issuance.

The Contractor is to permit through ADEC all construction dewatering activities.

20.04.06 Non-Conforming Services

AWWU prohibits any person to construct, repair or modify a service considered non-conforming, including bootlegged services. Any service that is not in compliance with MOA codes or AWWU tariffs and practices is considered non-conforming.

AWWU is not to be held liable for non-conforming services and is not obligated to perform any maintenance, repairs or rerouting because of non-conforming services freezing, breaking, or otherwise failing.

AWWU will not allow the reconnection of a bootlegged service encountered or severed during repairs, rehabilitation or main extension.

20.04.07 Other Permits/Approvals

Developments that encroach upon designated wetlands require a wetlands permit issued by the Army Corps of Engineers or MOA if designated as developable wetlands. The

Municipality of Anchorage maintains lists and maps of known wetlands which can be found with the Department of Public Works, Watershed Management Section.

A typical project will require multiple permits. Those permits may be issued or reviewed by, but not necessarily be limited to the following:

- Anadromous/Fish Habitat Waters -- Alaska Department of Fish and Game
- Alaska Railroad Rights-of-Way -- Alaska Railroad
- Building – MOA
- Building Board of Examiners and Appeals -- MOA
- Environmental Issues -- Environmental Protection Agency, ADEC
- Flood Hazard Permits/Floodplain Ordinance -- MOA
- Geotechnical Engineering/Material Testing -- MOA
- Gravel Extraction -- MOA , AK - DNR
- Injection wells (a.k.a., dry wells) -- Environmental Protection Agency; Mayor Appointed Task Forces -- Mayor's Office
- Planning and Zoning Commission-- MOA Community Planning & Development
- Plats/Platting Issues -- MOA Community Planning & Development
- ROW/Street permits or road closure permits -- MOA (Local), ADOT/PF (State)
- Storm water Protection Permits -- MOA , ADEC
- Water Wells/Single-Family -- MOA Health & Human Services
- Water Wells/Multi-Family -- Alaska Department of Environmental Conservation
- Water Rights -- Alaska Department of Natural Resources
- Zoning/Rezoning/Appeals -- MOA Community Planning & Development
- Wetlands, US Army Corps of Engineers

20.04.08 Planned interruption of water and sewer service

Water and sewer interruptions must be minimized. All planned interruptions require notifying affected property owners and residents a minimum of seventy-two (72) hours and a maximum of one-hundred forty-four (144) hours in advance of the interruption. Each interruption requires a separate notification. Multiple interruptions to one service are to be spaced a minimum of forty-eight (48) hours apart. Interruptions not started within the planned interruption period require a new notice and waiting period. The AFD is to be notified for all water interruptions and the MOA health department is to be notified for water and/or sewer interruptions to food and health care establishments. The contractor is responsible for all notifications.

If the water service is interrupted in excess of six (6) hours or without notice, the Contractor is to pay the Utility Company fifty dollars ($50) for each impacted residential or business unit for each hour beyond the initial six hour period or the start of an interruption without notice. If the interruption surpasses twenty four (24) hours without reestablishing water service, then the Utility Company at its discretion will take action to make repairs to reinstate water service, back charge the Contractor and other responsible parties to reinstate water service. The Utility Company may take further action by limiting the Contractor from working on Utility Company piping and Utility Company controlled services in the future.

Temporary systems will be required for all planned interruptions in excess of six (6) hours, that AWWU considers to pose an imminent health hazard, or for any sewer service/main interruption. Alternative arrangements to the above for temporary utility service may be made with affected property owners and residents and must be documented. Documentation

at a minimum will require a written statement of when utility service interruption will begin and end, form and/or amount of compensation for impacts, responsible party twenty-four (24) hour contact information, indemnification of MOA and AWWU, and signatures of both the responsible party representative and of the affected party to the agreement. A copy of the documentation is to be provided to AWWU prior to the interruption.

Property managers/owners of buildings that potentially have fire sprinkler/alarm systems are to be notified of pending outages in addition to residence/occupants of such spaces. The property manager is to be given three working days to take necessary precautions to mitigate any potential effects to the sprinkler/alarms system.

The AWWU project manager is to ensure procedure AWWUP 15-4 – Customer Notification for Scheduled or Emergency Water Service Outages is followed.

20.05 Standard Engineered Plan Submittals

20.05.01 General

Plans submitted to AWWU are to comply with the drafting standards found in this and later sections. AWWU may reject plan submittals based solely on non-adherence to our drafting and appearance standards. Standardization of plans allows for better records and quicker review times.

Submitted plans are to be provided with pertinent information to allow for a thorough review of the proposed work. AWWU may request plan sheets that do not directly relate to the proposed water and sewer work, such as, but not limited to, storm drain, street improvements, electrical and mechanical plans.

Record drawings of the engineered plans must be submitted and conform to the requirements of Section 50.00. Water for domestic use will not be turned on until after AWWU has accepted the record drawings.

All engineered plans will be:

- Based on a survey completed by a professional land surveyor registered in the State of Alaska
- Drafted with a computer aided design and drafting (CADD) program capable of producing graphics found in this manual
- Designed by a professional engineer or someone under their direct supervision
- Sealed, signed and dated by a professional engineer registered in the State of Alaska

20.05.02 Standard Sheets and Scales

Plans submitted on sheets that are 22" x 34" (Size D) in size will be accepted. Other sizes are unacceptable and subject to rejection. Ensure plans are legible when reduced to 11” x 17”.

Scales in order of preference are 1"= 50' horizontal and 1"= 5' or 10' vertical. For small congested areas a scale of 1"= 20' horizontal may be used. Use of an alternate scale from the aforementioned requires written approval of the AWWU plan reviewer.

All drawings are to be accurate, legible, clear, and properly detailed (suitable for microfilming or scanning).

Plans must be computer generated, drawn in permanent black ink. Computer generated drawings for private lines and private development main line extensions must be consistent in appearance with the criteria found in Section 60. All other projects that require engineered plans are to comply with all portions of the DCPM drawing standards.

20.05.03 Title Block

All plan sheets, at a minimum, are to include a title block with the following tiems:

- Sheet title
- Sheet number
- Total number of sheets
- Horizontal and vertical scale
- Engineering firm's name, address and telephone number
- Engineer's stamp, signature and date of signature
- Date
- Appropriate scale with a scale bar and written scale
- MOA grid number(s)
- AWWU Project ID number and Plan Set number
- ADOT/PF ROW permit number
- Project name
- Legal description of property
- Record drawing stamp
- Show "AWWU PLAN SET NO. XXXX", with the "XXXX" being substituted with the AWWU assigned plan set number, on each sheet of the plans, including sheets without water or sewer (Reference AWWU CAD Standard templates). The plan set number is to be placed as close to the upper right hand corner of the drawing as possible, inside of the border.

20.05.04 Cover Sheet

All plans with more than two sheets of design, including survey, are to have a cover sheet (see Section 60.00 of this manual) that must show:

- Vicinity Map -- include a map showing location of the project using a scale appropriate for identifying the project.
- Project name. Capital project names are to be as assigned by AWWU
- An index of sheets
- Engineering firm's name, address and phone number
- The date
- AWWU's Project ID number and Plan Set number
- Owner's name, address, telephone number and signature are required for all plans except for AWWU capital project plans.
- Record Drawing Stamp

20.05.05 Information Sheet

A general informational sheet should be included with all sets of plans and is required for most projects. For large subdivisions, locate the general information on the second sheet of the set; for smaller projects, put the information on an additional sheet or wherever space permits. Include the following on all sets of plans: (See Section 60.00 of this manual.)

- General Legend -- symbols used to denote existing and proposed items on the plans.
- Abbreviations--list of all abbreviations in plans with definitions.
- General Construction Notes; Sanitary Sewer Construction Notes; Water Construction Notes and General Survey Notes.--maintain the published sequence of the applicable notes from Section 60.04, followed by project specific notes.

- Specify the type of service to be provided (i.e., residential-single family; zero lot line; townhouse; condominium; mobile home park; public utility district; commercial-office building or retail store; or, industrial).
- Drainage Boundary Map -- show the drainage boundary on the key map of the area served for projects involving sanitary sewer improvements. The engineer shall submit copies of all pertinent computations of the design of the sanitary sewers and sewerage facilities. Include the expected population densities, acreage, zoning, and other pertinent information. The engineer should coordinate with AWWU on modeling.
- Key Map(s) -- include individual water and sewer key maps showing all proposed and existing utilities within five hundred (500') feet of the proposed development. At a minimum, the key maps must include; subdivision names, tract names, lot and block numbers, street names, water mains, water main valves, fire hydrants, sanitary sewer mains, manholes, sanitary sewer drainage boundaries, pressure zone boundaries and municipal grid boundaries.
- When space is available, provide design general detail drawings such as trench section, compaction, etc., on the information sheet. Show any specific details on the sheet where it applies. If necessary, provide a separate sheet showing the details.
- Provide a trench cross section designed by a registered engineer for projects requiring work within an existing or proposed ROW. At a minimum specify side slopes, compaction, etc. within the cross section.

20.05.06 Survey Control Sheet

Provide a survey control drawing for each project that requires an engineered plan that shows the specific legal location of the project based on record plat information and legal descriptions such as aliquot parts, or in some cases, metes and bounds descriptions. The control sheet is to include the record monuments on which the survey location and proposed improvement are based. Provide on the survey control sheet the basis of bearing and how the basis of bearing was derived.. Include a list of the record document information as reference for future work on the project.

1. Drawing coordinates must be North American Datum (NAD) 83, Alaska State Plane (ASP) Zone 4 coordinate determined from National Geodetic Survey (NGS), (CORS96), Epoch: 2003 datum or the latest NGS adjustment utilized by the Continuously Operating Receiver Stations (CORS)
2. A recovered monument or set project control monument near the project mid-point shall have a coordinate value expressed in U.S. Survey feet and be the basis of the project coordinate system. For this monument, a note on the Survey Control sheet shall provide ADOT&PF Bowl 2000 translation parameters.
3. Project vertical control must be based on the Municipal Bench Mark Network and include the Bench Mark name, description and published elevation. Bench marks, temporary bench marks, and survey control datum shall be clearly indicated on the plans and include location, description, and elevation. The vertical control datum is to be based on the 1972 National Geodetic Survey Datum or latest official update.

Any and all disturbed or damaged markers must be replaced by a licensed land surveyor.

Engineered plans for private systems do not require a separate plan sheet for survey control. However the plans are to show sufficient survey control information to locate and construct the water and sewer improvements.

20.05.07 Plan and Profile Sheets

Plans must be provided in the AWWU standard format and accurately depict both existing and proposed utility, street, and site improvements. Include, at a minimum, the following on all plan and profile sheets: (See Section 60.00 of this manual.)

Plan View

- Existing water, sanitary sewer and storm drains labeled with type and diameter of pipes
- Proposed water and sanitary sewer and storm drains labeled with type, class, diameter, length and bearing of pipe
- Where tabular data is used to provide data, the table should be on the same sheet as the object being referenced in the table. E.g. a pipe table providing the required slope, length, bearing, diameter, and material properties, would be located on the same sheet as the pipe.
- Trench section detail showing at a minimum:
    - ◊ Surface restoration
    - ◊ Pavement structural section
    - ◊ Pipe bedding
    - ◊ Pipe foundation
    - ◊ Insulation (where needed)
    - ◊ trace wire and locator tape
    - ◊ compaction requirements
- Dimension
    - ◊ ROW lines (from center to edges)
    - ◊ Service connection end (Property/Easement Line) to nearest property corner
    - ◊ Service line to the nearest building corner when the service line enters a building
    - ◊ Easement widths
    - ◊ Temporary construction easements
    - ◊ Property lines; section lines and corners
    - ◊ Horizontal dimensions from utilities to center lines, edge of easement, edge of ROW
    - ◊ Separation of proposed utility to adjacent utilities
- Land grant lines
- All lot lines of the parcel(s) with associated water and sewer work
- Wells, class, separation distances
- Septic systems
- Existing and proposed building foot prints with finish floor elevation
- Subdivision names
- Street names
- Lot and block numbers
- North arrow
- Street lights
- Finish grades in easement are to be accurately depicted with the uses of proposed and existing contours or methods acceptable to AWWU
- Cross sections at a minimum of fifty foot (50’) intervals must be included where cross slopes exceed ten (10%) percent grade

- One or two foot (1'-2') contours labeled at an interval of five feet (5') where an elevation change of twenty feet (20') or greater is shown with contours , at an interval of two feet (2') where an elevation change of ten feet (10') and less is shown with contours
- Show the minimum separation distance (radii) for sanitary sewer pipe-to-well and sanitary sewer manhole/cleanout-to-well for each well within 200' of the project
- Match lines at breaks of streets or on multiple sheets

Show the following if located within thirty (30') feet of utilities:

- trees two (2") inches in diameter and larger
- fences
- retaining walls
- planters and other landscaping improvements
- buildings and/or structures
- light, utility, sign poles

Profile View

- Existing and proposed water, sanitary sewer and storm drains labeled with type, class, diameter, length and grade of pipe
- Existing utilities, such but not limited to, electrical, communication, and gas that could be or are in the trench excavation zone, assuming a trench excavation having no shoring, side slopes of 2H:1V, and a minimum 4' wide bottom.
- Existing and finish grade lines (and surface elevations at fifty (50') foot intervals for irregular surfaces and at any abrupt change or break in elevation)
- Vertical separation at all utility crossings
- Soil bore logs with the following information
    - Two letter USCS soil designation
    - Depth to groundwater
    - PID readings
    - Delineation lines showing the approximate soil strata
- Basement elevations of existing structures for sanitary sewer projects (See Section 30. of this manual)
- Other utilities and underground obstructions
- Location and length of required thrust restraint

Plan and Profile Views

- Label all utilities with existing or proposed; type of utility; type, class and diameter of pipe. Include match lines with references to utility continuations onto other sheets
- The plan and profile must be shown on the same plan sheet for each section of proposed sanitary sewer or water pipe.
- Dimensions consist of a fine solid line terminated by arrowheads with a text identifier. The spacing of dimension lines should be uniform throughout the drawing.
- Leaders are a fine solid line leading from a note or dimension and terminated by an arrowhead touching the object. A leader line should be an inclined straight line with a short horizontal line. A leader line to a circle should be radial, so that if extended it would pass through the center of the circle. If leader lines are near each other, the leader lines should be drawn parallel for a more appealing drawing. Leader lines should cross as few lines as possible and should never cross each other. Leader lines should

not be drawn parallel to nearby object/hidden lines or pass through a corner of an object. Leader lines should not be drawn at small angles to the object if possible.

- Text and numbers must not be bisected by any line
- Sewer elevations reflect invert elevation (INV) and water elevations reflect bottom of pipe elevation (BOP)
- Plan view pipe lengths break at all horizontal deflections; horizontal bends, tees and crosses
- Profile pipe length that is broken at all grade breaks; vertical bends, tees, and crosses. Hydrant legs may be omitted for this requirement
- Service connection chart—include a table with columns for the following design and record drawing information on each water and sewer sheet: Lot and block numbers; pipe station of the connection at the main; invert/bottom of pipe (BOP) elevation of the service connection at the main; invert/BOP elevation of the service connection at property line; lineal footage of the service connection; finish grade, slopes and service offset measured from the nearest property corner
- The service connection chart must be filled out with design information and change if with redline information if additional columns are not provided on the drawing. The revision is to be noted at the chart and in the title block.
- Anode location table—include labeled columns to record constructed location of each anode by pipe station and right or left side of main
- All project coordinates must be provided in the DCPM required coordinate system. When coordinates are provided they are to be in the plan view leader associated with the AWWU improvements or in a table on the sheet in which the AWWU improvements are shown
- Soil test pits, borings and soil log information
- On the plan and profile sheets, show the inverts, manhole numbering, stationing and top elevation
- The plan view and profile view are to reside on the same sheet and be aligned such that plan view is on top and profile view is on bottom.

20.05.08 Stationing and Orientation

The stationing on plans and profiles should read from beginning to end of proposed improvements where practical and must be pipe center line stationing. Arrange the plans so that the north arrow is pointed in the direction of the top or the right edge of the sheet. All plan sheets must contain a north arrow.

All plan views are to have a north arrow and be arranged such that the north arrow is pointed towards the top of the page or to the right of the page. The north arrow may be skewed 15° from vertical or horizontal to improve the orientation of pipe alignment on the sheet. Stationing is to be pipe centerline, increase in numbers from left to right, and have a station number ending in “00.00” at any of the following locations;

1. Foundation Wall
2. Property Line
3. Connection point

20.05.09 Drawing Standards

Section 60.00 of this manual contains an accompaniment and examples of the AWWU AutoCAD standard drawings. The standards and example drawings were created in AutoCAD 2015 and may not be usable in previous versions of AutoCAD or other CADD software. All 'or equal' products must have the ability to create and save files in a .DWG format. These standards were developed to establish base criteria for drawings to be used on projects that contribute to or upgrade AWWU assets. AWWU capital improvement project AutoCAD drawing submittals must have all water and sewer facilities ready for GIS asset import as stated below in this section.

All AutoCAD drawings produced for AWWU are to follow standard layer naming convention found in Section 60.00. The naming convention is a hierarchical system reflecting the most distinctive features of the drawing first, with a single character for each subsequent further definition.

Level 1 – The first letter of the layer name indicates which general type of information is contained on that layer. (i.e., plan view (P), profile view (R), and notes (N))

Level 2 – The second character of the layer names indicate the accuracy or condition of the entities represented. (i.e., proposed (P), existing (E), etc.)

Level 3 – The third character of the layer names identifies the type of AutoCAD entity that is shown. (i.e., text (T), lines (L), symbols (S), hatch (H) and points (P))

Level 4 – The fourth character identifies a general grouping for the entity. (i.e., property (P), utility (U), topo (T), etc.)

Level 5 – The last characters of the layer name are used to give specific information about the entity

Customizing Layer Names – Occasions may arise when an entity cannot be properly described using the AWWU standard layer naming convention beyond the fourth level or when additional descriptive information in the layer name may be useful. In these cases, the designer may add other information to the end of the standard name. The customized information are to be preceded by the characters "-".

GIS Asset Import Requirements

All water and sewer facilities shown in CAD drawings must adhere to the following guidelines:

- All entities representing proposed facilities must be drawn on the layers pplus, ppsus, pptus, ppluw, ppsuw, and pptuw.
- All entities representing existing facilities must be drawn on the layers pelus, pesus, petus, peluw, pesuw, and petuw.
- Entities on these layers may be lines, polylines, text, or the supplied symbols found in the template drawings.
- All point symbols must be drawn using the symbols from the template drawings (Reference Section 60).
- All lines must be drawn using the custom 'linetypes' from the template drawings.
- All lines must be snapped at endpoints leaving no gaps or overshoots.
- Lines must not be broken for text annotations or symbols.

20.06 Standard Sanitary Sewer and Water Locations

All public sanitary sewer and water utilities shall be designed and constructed in the Municipal or State ROWs. ADOT&PF may require mains in state ROW to be outside the road prism where space permits, or with the manholes and valve boxes outside of the wheel paths. AWWU will not approve sanitary sewer and water mains located in easements unless there is no feasible way to locate them in the street or traveled way (construction cost difference between ROW and easement is not a consideration). Sanitary sewer and water lines are to be located in ROW's per MASS details. Obtain exceptions to the standard horizontal location from the AWWU Engineering Division Director and the MOA Municipal Engineer, or designated representative, prior to approval of the drawings. Branched extensions or private utility lines should be installed in private traveled ways whenever possible and must be accessible for maintenance access.

20.06.01 Location in Dedicated and Implied ROW

MASS requires designing the sanitary sewer mains five to six feet (5'- 6') south or west of center line and water mains twelve (12') feet north or east of center line. There must be a minimum of ten (10') feet horizontal and eighteen (18") inches of vertical separation (measured outside of the pipes) between water and storm or sanitary sewer mains and services. Wherever it is necessary for water and storm or sanitary sewer mains and services to cross each other, the crossings are to be at an angle of approximately ninety (90°) degrees.

See the guidance flow chart for when an ADEC separation waiver is required. This flow chart was provided to ADEC for review and comment. All ADEC generated comments were addressed. The included chart is the result of AWWU's efforts to clarify when waivers are required. A waiver request to ADEC may need to also be approved by AWWU. AWWU may require a waiver to the DCPM and/or Tariff, which may have different requirements than ADEC.

A parcel will be considered served and eligible for service when the sanitary sewer and/or water mains extend along the full frontage of said parcel. Exceptions to this rule may be granted when an engineered analysis justifies less than full lot frontage (e.g., end of the distributions system, geographical constraints, etc.) and after issuance of a waiver by AWWU.

When required by AWWU and in accordance with the Utility's tariffs, all waiver requests to the standard locations must be in writing, supported by engineered analysis, and approved by the AWWU Engineering Division Director.

In a new subdivision with planned future extensions, the sanitary sewer and/or water mains are to be extended a minimum of fifteen (15') feet beyond the pavement limits. Sewer lines are to terminate with a permanently installed manhole.

Water and sewer mains located in cul-de-sacs are to be extended to within four (4') feet horizontally off the front of the curb.

20.06.02 Water and Sanitary Service Location

All service connections extend from the utility main to the property or water/sewer easement line whichever is furthest from the main. All services must be installed no closer than five (5) feet to a side lot line and must be a minimum of fifteen (15) feet from a fire hydrant, utility/power pole, signal pole or transformer pad; ten (10) feet from a water main; twenty-five (25) feet from a private well; and, a minimum of ten (10) feet from any structural foundation or other appurtenance, such as, but not limited to, light poles or electrical/telephone/cable boxes.

20.06.03 Sanitary Sewer and/or Water Easements

When AWWU allows sanitary sewer and water mains in permanent easements, AWWU requires a minimum width of thirty feet (30') for a single sanitary sewer or water main. If both sanitary sewer and water mains are located within a common easement, the easement must be a minimum of forty feet (40') wide. Easement widths must be increased and approved by the AWWU Engineering Division Director when the main is greater than twelve inches (12") in diameter.

AWWU may require permanent easements larger than mentioned above if necessary for proper operation and maintenance of the sanitary sewer and water systems. Extend easements fifteen (15') feet beyond last appurtenance.

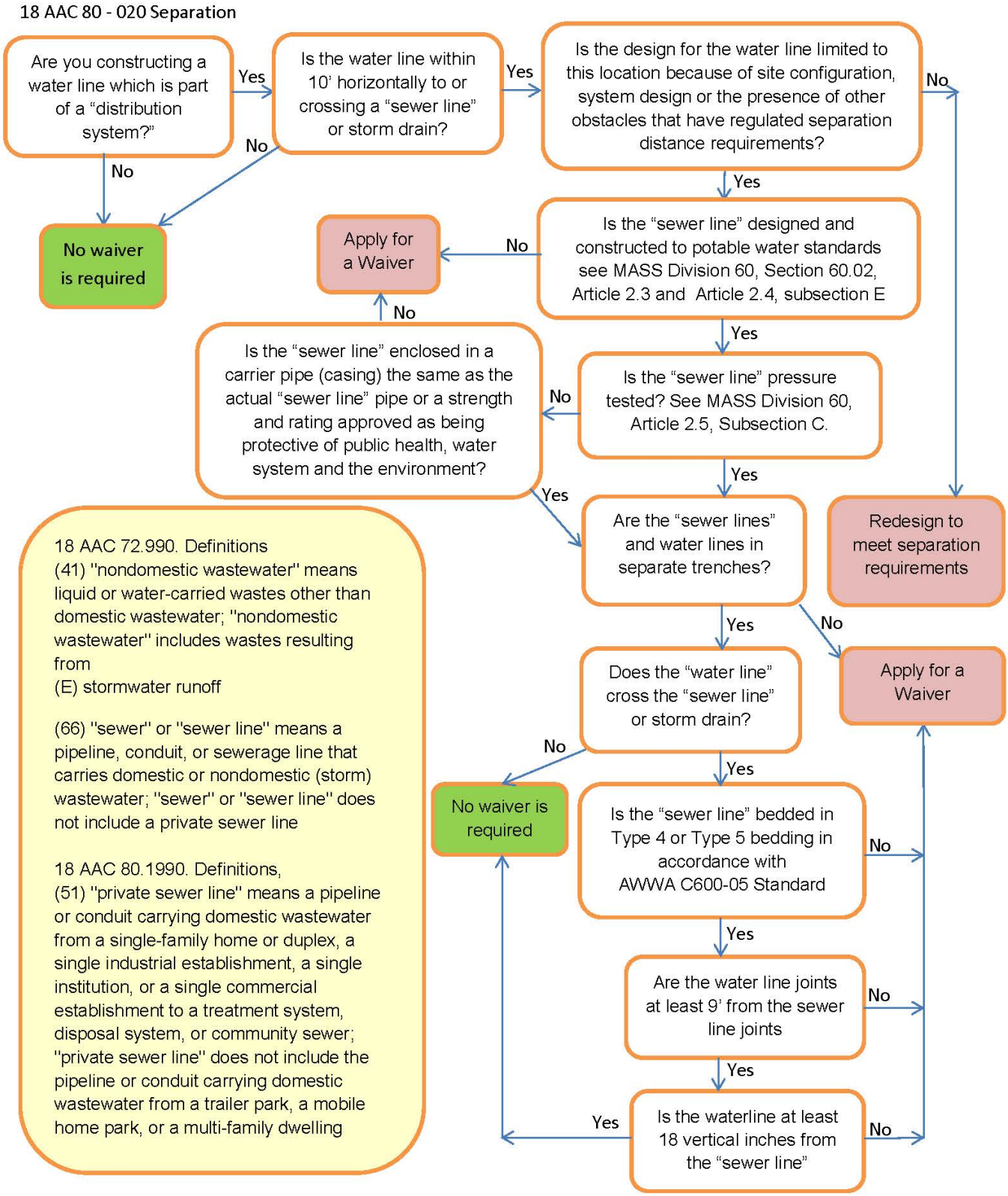
For mains larger than twelve inches in diameter, the designer must consider that AWWU requires a minimum ten (10') foot separation (measured horizontally to the outside of the pipes) between the main lines and a minimum of fifteen (15') feet from the outside of the main to each easement line.

Valves and/or manholes are to be located outside of the easement area, in an established ROW, whenever possible. AWWU will not permit sanitary sewer and water service extensions within easements if the service can be extended from a main line in a ROW.

When water or sewer mains and associated appurtenances are located in an easement, those appurtenances must have an accessible driving route for maintenance. The driving route must be capable of supporting AASHTO HS20 truck loads and allow maneuvering of a WB-40 design vehicle. Where an accessible route is not contained within the water and/or sewer easement, then the developer is to provide a dedicated access easement to AWWU to cover the additional area needed for access.

AWWU requires sanitary sewer, water and/or access easements shown on a final plat or recorded document prior to plan approval. If the easement is acquired by a document, the recorded document number will be required to be shown and labeled on the construction plans.

Guidance flow chart for when an ADEC Location Waiver is requiredfor new water pipe



20.07 Subsurface Investigations and Reports

20.07.01 Soils Data

A subsurface soils investigation is to be performed and submitted to AWWU on projects with water and sewer components. Test holes spacing and depth must be determined based on existing site conditions and project needs. In addition to the project needs, when the site is known or suspected to be on or near a former contaminated site AWWU may require additional test holes, soil testing, and groundwater analysis. Test holes and subsurface soil data must be shown on the plans. Subsurface information will include, but not be limited to; classification of soils, moisture content, grain size gradation, depth of frost (if present), depth of water table (if present), depths of different soil classifications, soil corrosivity characteristics (when required), field screening results from a photo ionization detector (PID) and other pertinent information. The Engineer must submit copies of the subsurface soil information to the MOA Soils Lab.

Projects that will install mainlines require a maximum spacing of test holes of 200', with a minimum of two test holes. Private systems have a maximum spacing of 300' with a minimum of one test hole. Test holes are to be within fifty feet (50') of the water and/or sewer line alignment. Trenchless rehabilitation with liners should have one test hole. Trenchless designs using horizontal directional drilling, auger boring or other drilling methods are to have one test hole every 100' with a minimum of two test holes.

Test holes are to reach at least fifteen feet (15') below planned finish grade and five feet below the water or sewer pipe being installed. Soil samples should be retrieved at maximum 2.5-foot intervals to 10-feet below the ground surface. Subsequent samples should be taken at 5-foot intervals or less to characterize soil stratigraphy.

Where roadway construction will take place as part of a project, the number of test holes is also to meet the minimum required in the current edition of the Municipality of Anchorage's Design Criteria Manual, currently published by the Department of Project Management and Engineering.

Soil exploration programs for projects proposing to install non-metallic water lines are required to screen for petroleum contamination utilizing a PID. PID readings greater than ten (10) ppm or projects within five hundred (500') feet of a documented contaminated site will require additional laboratory testing. Laboratory testing of soils and ground water is to include, but not be limited to, Alaska Method 101 (GRO), 102 (DRO), 103 (RRO), and EPA methods 8260 (VOC) & 8270 (SVOCs) and other tests necessary to calculate the activity of the organic contaminate. Activity is defined as:

$$a = \frac{C_w}{C_{w,m}}$$

$$a = \frac{C_v}{C_{v,m}}$$

in which a is the activity ($0 \leq a \leq 1$), C_w is the concentration in water (mg/L), $C_{w,m}$ is the solubility (saturated) in water (mg/L), C_v is the concentration in the vapor phase (mg/L), and $C_{v,m}$ is the solubility (saturated in the vapor phase (mg/L)[1].

In areas within or adjacent to known or possible contamination, provide analytical data sufficient to determine the absence or presence of contamination. If contamination is found, provide the information on the type and concentration of the contaminate(s).

Water and sewer projects that do not require engineered plans will not need to perform an initial subsurface soils exploration. The AWWU Customer Service Division may require a subsurface soils investigation as needed to ensure the integrity of the water and sewer system.

20.07.02 Permafrost Conditions

The engineer must disclose all known permafrost or ice lens areas within the limits of the project on the drawings. The engineer will recommend remedial actions to AWWU.

20.07.03 Minimum Frequency of Routine Quality Control Soil Tests

Following are the minimum construction test frequencies for projects constructing AWWU assets. Private systems should provide quality control testing. Additional testing may be necessary depending on circumstances and failure rate and must be addressed in the Engineer's quality control plan specific for the development and as required in MASS.

Mechanical Analysis on Imported Material:

Collect one sample for approval, prior to use of the following, plus regular checks as shown:

Classified backfill	one per 2000 tons
Foundation material	one per 500 L.F.
Bedding, all types	one per 500 L.F.
Leveling course	one per 1000 tons
Seal coat aggregate	one per 1000 tons

Frequency of density testing of trench backfill:

- Dedicated ROW and AWWU accessible routes: One (1) per three hundred (300') LF of trench at spring line, mid-trench and surface for a total of three (3) tests.
- Easements: One (1) per three hundred (300') LF of trench at spring line, mid-trench and surface for a total of three (3) tests.

Street and Road Construction - All work within public streets and roads are to conform to MOA and/or ADOT/PF requirements. AWWU does not provide quality control testing of soils for the developer.

Any existing utility or facility disturbed is to be backfilled and tested in accordance with new construction, as directed by the Engineer, or by a representative of the impacted utility.

20.08 Burial Requirements

Consideration must be given in the specifications and plans for the type of pipe; methods of bedding and backfill so as not to damage the pipe or its joints. The engineer shall review the soils

[1] Feng Mao, James A. Gaunt and Say Kee Ong, May 2009, Permeation of organic contaminates through PVC Pipes, Journal AWWA 101.5

data and design the bedding and trench backfill accordingly. Specify bedding material that is compatible with the type of pipe being installed (DI, HDPE, PVC etc).

Sanitary sewer and water mains must be designed to prevent damage from superimposed loads. Where necessary to withstand extraordinary superimposed loading, special bedding, concrete cradling or special construction shall be used. Installation specifications must contain appropriate requirements based on the criteria, standards and requirements established by industry in technical publications and according to MASS.

Allowance for future loads on the mains must be made considering the width and depth of trench and planned projects. Future loads must be estimated based on final grades obtain from MOA or ADOT/PF prior to establishing the depth of bury. The engineer is encouraged to review the MOA AMATS and the State of Alaska STIP planning documents for future road projects in the vicinity of the planned development. Final and future street grades are to be shown and labeled on the drawings

Under no circumstances will water or sewer mains or services be constructed over frozen material, organic matter or other unstable or unsuitable materials. The following are typical bedding and trench backfill standards.

20.08.01 Bedding

Bedding is to consist of Class E bedding as outlined in MASS. The bedding is to be uniformly placed the full extent of the ditch and completely cover the pipe a minimum of 6-inches above and below the pipe and one foot (1') to each side of the pipe. Bedding must be laid the full width of the ditch and compacted to ninety-five percent (95%) of the maximum density.

Exceptions to the requirement to use Class 'E' Bedding material will be considered by AWWU based on the pipe manufacturer's recommendation, engineering judgement, loading of the pipe, and the requirements of ASTM D2321 and D2774. AWWU will not approve or allow the use of "pea gravel" as pipe bedding. For the purpose of this manual, "pea gravel" is considered a poorly or gap graded gravel product that that has anything other than angular faces.

The engineer for projects with engineered plans must submit pipe manufacture bedding recommendations that correlate to, soil gradation of and proctor test results of the proposed alternate bedding material to AWWU for consideration. Approval of alternate bedding must come from an AWWU supervisor in the Engineering Division or a Customer Service Division, Field Services Supervisor.

Where dewatering is anticipated to use pipe bedding as a type of french drain and the use of an alternate bedding material to the required Class 'E' bedding is requested to facilitate the flow of water, the alternate bedding material is to consist of crushed aggregate. Crushed aggregate is to consist of fractured rock particles with at least one fractured face, sharp edges and rough surfaces. The gradation of the crushed aggregate is to have 100% pass the 3/4" sieve, no less than 50% pass the No. 4 sieve and no more than 12% pass the No. 200 sieve measured by weight. When crushed aggregate is used as bedding, it is be separated from surrounding soils with the use of MASS Type A non-woven geotextile with a permeability greater than that of the native material. The geotextile material may be omitted if the gradation of the pipe bedding and surrounding soils meet the requirements to prevent migration as outlined is ASTM D2321 X1.8. Trench plugs may be required to prevent draining of other areas.

Projects that do not require an engineered plan may use alternate bedding material approved by Customer Service Division Field Services on a case by case basis.

20.08.02 Trench Backfill

Trench backfill must be placed in accordance with MASS.

- Trench backfill is to be material obtained from trench excavation if the material is suitable and conforms to the specifications for backfill as defined in MASS. Debris, broken bituminous pavement, Portland Cement Concrete, frozen material, large clods or stones, organic matter, and other unstable or unsuitable materials must not be used for backfill. All backfill shall be compacted to ninety-five (95%) percent of maximum density as defined in MASS.
- Trench backfill must be placed in a manner to avoid disturbance to pipe bedding and alignment.
- Compaction of backfill must not disturb, move, or affect the pipe. It is recommended that bedding above a sound base be compacted with the use of “jumping-jack” compactors until a minimum of 12” of cover over the pipe is in place and compacted. Between 12”to 36” small vibratory, “turtle” is recommended, and above 36” of cover standard large vibratory compactors, hydrohammers, and hoe-pacs can be used.

Exceptions will be reviewed and approved when presented to the AWWU Engineering Division Director or their designated representatives in writing on a case-by-case basis. Final decisions will be provided in writing to the requesting party.

20.08.03 Foundation Material

Under no circumstances will water or sewer mains or services be constructed over frozen material, organic matter or other unstable or unsuitable materials. This material may include peat, roots, large rocks, soft or yielding soil, cesspools, privy pits, or any other material, which in the opinion of AWWU is objectionable.

If the trench material at the bottom of bedding does not furnish a suitable foundation, the contractor shall remove the unsuitable material to whatever depth the MASS Engineer determines, and replace with foundation material as specified in MASS. Foundation material must be placed the full width of trench, in lifts not to exceed twelve (12") inches in thickness and compacted to a minimum of ninety-five percent (95%) of maximum density.

20.08.04 Trench Plugs

Trench plugs are required to prevent the draining of wetlands, lakes, streams, the movement of contaminates and from creating french drains in low permeable in-situ soils. Trench plugs, when required, are to be placed a maximum of three hundred feet (300') apart. Clay or weak (100psi - 1,500 psi) cementitious material should be used to construct trench plugs. The designer must consider the effects of trench plugs, such as, but not limited to, the buildup of hydrostatic pressure that may cause ground surface failures, flooding of floors, slope failure, pipe failure and infiltration.

20.09 Rigid Board Insulation

Rigid board insulation required for frost protection of water and sanitary sewer mains and services must be high density extruded or expanded polystyrene, minimum sixty (60) PSI compressive strength, equivalent to R-20 per four (4”) inch thick insulation meeting ASTM C578 Type VII.

When groundwater is encountered or is suspected to exist during design data acquisition the designer must take into consideration the impacts that groundwater may have on the insulation R-factor properties over time.

20.10 Corrosion Control

All material proposed for incorporation into the construction of water and wastewater systems must be designed to protect against corrosion.

This section discusses the corrosion control design criteria required to be used on new or retrofitted AWWU pipelines, including fittings and services. The corrosion control portion of the design includes pipe materials selection, cathodic protection and coating selection.

20.10.01 Standards

1. American Water Works Association (AWWA)
2. National Association of Corrosion Engineers (NACE International)
3. Steel Structures Painting Council (SSPC)
4. Ductile Iron Pipe Research Association (DIPRA)

20.10.02 Materials Selection

Material selection for corrosion control requires that the overall system be evaluated for the intended service and environment that the piping is being installed.

If non-metallic materials are installed, such as HDPE or PVC piping, cathodic protection (CP) and protective coatings are not required on the pipe. Ferric fittings with the installation of the non-metallic pipes must be epoxy coated and cathodically protected,. The installation of a polyethylene(PE) encasement(barrier) with Vbio™ is not required on epoxy coated ferric fittings when installed as part of non-ferric pipe system.

If metallic piping is installed (including reinforced concrete pipe), the pipelines must have an adequate corrosion control systems. Adequate corrosion control systems must include installation of a barrier or protective coating and bonded joints with a CP system. The use of PE barrier may not be used on lines that are periodically or consistently submerged in ground water. In cases of lines being installed in periodically or consistently submerged in ground water, the pipe must have a tightly bonded coating along with a CP system.

20.10.03 Corrosivity Evaluation

A soil corrosivity evaluation should be performed to determine the corrosion control requirements. The designer may use an AWWU recommend CP and pipe system found in the following section, in lieu of the corrosivitiy evaluation.

A NACE certified corrosion or CP specialist must be responsible for the evaluation and determine which soil characteristics need to be included in the evaluation and the number of tests that are required. The NACE specialist generating the report must be given for review and must incorporate information from the following items:

1. The subsurface soils investigation and report that includes test hole logs that indicate soil type and ground water elevations.
2. Geotechnical information pertaining to if contaminated soils exist at or near the project location.
3. The proposed pipe diameter and thickness
4. The carrier material (water or sewer)
5. The expected pipeline pressure
6. The pipe materials being considered (DIP, steel, PVC, HDPE, copper)

7. Any proposed pipe corrosion barriers, linings or coatings (see 20.10.04 Protective Coatings for definitions)

Soil characteristics to be considered may include, but are not limited to, soil strata, resistivity, pH, redox potential, stray current, chlorides, sulfates, sulfides and moisture content. At a minimum, resistivity, soil type, groundwater depth, and pH must be evaluated. One sample must be collected per one thousand (1000') feet of pipe, or two (2) samples minimum for projects with less than one thousand (1000') feet of pipe. Samples must be collected at the proposed pipe invert elevation, and must be collected at separate locations on the project. Samples are to be sealed and original moisture preserved. Soil resistivity measurements are to be done with a soil resistance meter and a soil resistivity box per ASTM G57. Measurements must be recorded "as received" and saturated in distilled water. Soil pH must be measured in accordance with ASTM G51. A map showing the sample collection locations and the distance between the samples must be submitted with the evaluation, along with soil photos taken during the soil sampling and analysis. A discussion of any potential stray current sources and proposed mitigation measures must be included in the evaluation, and the location of the stray current source(s) must be shown on the map.

As a result of the soil corrosivity evaluation, a report of the soil corrosivity and proposed corrosion control design and construction recommendations must be submitted to AWWU for approval at the time of the first submittal for plan review

Recommendations for non-metallic pipe materials, pipe coatings, and all pipe gaskets may require additional soil testing to ensure that the soils are free of permeating and/or dissolving compounds. See section 20.07-Subsurface Investigation and Reports for further information.

A soil corrosivity evaluation and report must be performed by a NACE certified corrosion or cathodic protection (CP) specialist when an AWWU standard is not used. Based upon the results of the corrosivity evaluation, materials must be proposed and approved by AWWU prior to final design submittal.

Non-corrosive soils are to be defined by the corrosion or CP specialist in their corrosivity evaluation/report as those soils that will allow a metallic pipeline, fittings and services to have a minimum service life of 70 years without corrosion protection. Supporting calculations are required.

20.10.04 Cathodic Protection

The cathodic protection (CP) requirements for all new metallic piping are as follow:

- All joints must be bonded and high potential prepackaged magnesium anodes must be installed at every joint per the standard MASS detail 60-20 for metallic pipelines less than twenty (20") inches in nominal diameter . The pipe must include PE encasement with Vbio™ or a tightly bonded coating, as recommended by the corrosivity evaluation. Other cathodic protection materials may be evaluated by a NACE certified corrosion or CP specialist and submitted for AWWU approval. This would include changing the number, type and weight of the anodes. The evaluation must include calculations showing a 70 year pipe service life.
- All joints are to be bonded and high potential magnesium ribbon anodes must be installed in conjunction with a tightly bonded coating per section 40.02.14 Large Diameter Transmission Mains for metallic pipelines equal to twenty (20") inches in nominal diameter or greater. The number and weight of ribbon anodes must be calculated and determined in the design phase of the project and must be performed by

the corrosion or CP specialist. Calculations must be submitted to AWWU for approval. Other cathodic protection materials may be evaluated by a NACE certified corrosion or CP specialist and submitted for AWWU approval. The pipe and CP system must be designed for a minimum 70 year service life. The CP system must be designed by a cathodic protection specialist that must also co-stamp the cathodic protection drawing and detail sheets. An Alaska registered professional engineer that is competent in cathodic protection design is to also co-stamp the cathodic protection drawings and detail sheets.

If the soil corrosivity evaluation determines a non-corrosive soil condition, the NACE certified corrosion or cathodic protection specialist may submit a recommendation, for AWWU approval, to waive the requirement for a cathodic protection system provided that calculations are submitted to show the pipe will have a minimum 70 year service life. An example of where this requirement could be waived pending AWWU review and approval would be the use of reinforced concrete cylinder pipe for large diameter water or sewer applications.

If a non-metallic water main is installed, copper water services and corporation stops must be coated with a tightly bonded coating and a high potential magnesium anode (20-lb bare weight) must be installed at the key boxes. In all other circumstances when a metallic water main is installed, the copper service and corporation stop must be wrapped with a dielectric tape for a minimum clear distance of ten (10) feet away from the water main pipe in accordance with AWWA C105.

When making a connection or intertie to an existing metallic pipeline (DIP or CIP), the new pipe must be joint bonded to the old pipe with two exothermic weld connections per MASS details. Additionally, two (2) anodes (in addition to the MASS detail showing an anode every 18 feet and/or corrosivity evaluation recommendations) must be provided at the pipe connection(s), placing one anode on each side of the pipe at the joint per the MASS details. The anode connections should be made to the existing pipe(s).

More often than not, a connection to an existing pipe will be done with a new valve for water, in which case the new valve must also be joint bonded to both the new and old pipes with two #2 HMWPE joint bond wires. No exothermic weld connections will be allowed on the valve. A 1/8-inch thick 316 stainless steel flat bar connector plate with a wire ring connector must be used for this connection (see DCPM detail 60-20).

All cathodic protection systems must have a design life in excess of fifty (50) years and conform to AWWU standard cathodic protection details and color-coding schemes.

Impressed current cathodic protection systems are not authorized for use on and/or with AWWU pipelines, unless prior approval of an impressed current C/A system is obtained from the AWWU Engineering Division Director. Installation of impressed current cathodic protection systems by other operators must be coordinated with AWWU personnel to ensure stray currents are not adversely affecting AWWU pipelines.

20.10.05 Protective Coatings

Each buried metallic pipeline system component must have an external protective coating or barrier designed to mitigate corrosion. Polyethylene (PE) encasement is defined as a barrier, it is not a coating. Tightly bonded coatings or PE encasements must be used as recommended in the soil corrosivity evaluation. The use of CP in conjunction with polyethylene (PE) encasement(barrier) must be determined in the soil corrosivity evaluation. If it is deemed

unacceptable to use CP with PE encasement, a tightly bonded coating must be installed on the pipe in conjunction with the CP system..

Acceptable forms of tightly bonded coatings for buried applications include plural component polyurethane per AWWA C222, fusion bonded epoxy per AWWA C116 and C213, cement mortar coating per AWWA C205 and tape coating per AWWA C209 and C214. Polyethylene encasement is a barrier, it is not accepted as a tightly bonded coating.

Wax tape per AWWA C217 and heat shrink sleeves per AWWA C216 are acceptable forms of tightly bonded joint coating protection typically used at joints. Zinc coated pipe is considered a tightly bonded coating for underground piping systems.

Metallic components exposed to the atmosphere must be coated with a tightly bonded coating system.

In cases where the pipe coating is to be submerged in an environment with hydrocarbon contaminated soils, the coating manufacturer must provide a chemical resistance chart and a letter certifying that the coating will perform successfully in the environment.

Additional quality assurance requirements are outlined in Section 20.11 Industrial Coating Standards.

20.10.06 Standardized Corrosion Protection

In recognition of AWWU's commitment to ensure the longevity of our underground pipe assets while creating efficiencies in the design and construction of those assets; the requirement for a corrosivity evaluation will be removed when the design includes the following items:

1. Anodes installed on all metallic water/sewer main line & water services
2. Non-metallic water mains and apparatuses must have an anode on all metallic fittings with the limit that one anode may serve fittings and fire hydrants within 20' of the anode with the exception of EBAA Iron Mega-Stop™ which does not require an anode.
3. Anodes installed at a regular interval of eighteen feet (18') or less on sixteen inch diameter (16"∅) or smaller ductile iron pipe
4. Two zinc ribbon anodes with test stations installed on either side of sixteen inch diameter (16"∅) or greater ductile iron pipe. Ribbon anodes must be properly detailed and sized for the soil conditions.
5. Electrical continuity is installed and tested for all ductile iron pipe
6. Epoxy coating is specified for all fittings
7. Require protective tightly bonded coatings on all metallic pipe unless the engineer can demonstrate that groundwater is not present at the proposed burial depth of the pipeline during the life of the pipe.
8. Stainless steel bolts are specified for all bolts used to construct valves
9. Stainless steel bolts or blue bolts are specified for water fittings
10. Stainless steel operating rods for copper water services

20.11 Industrial Coatings Standards

The design of structures that include reservoirs, buried and above ground piping and appurtenances, pressure reducing equipment, booster pumps, wells, metering equipment, sewage lift pumps, and electrical equipment and controls, must include specifications for industrial coatings. These specifications must include quality assurance requirements, surface preparation requirements, primers, surface coatings, number of coats, and dry film thickness of applied product and will address both interior linings as well as exterior coatings. Typical facilities to which this applies to include all buried metallic piping, pressure reducing stations, booster stations, well houses, meter facilities, submerged and atmospherically exposed concrete, lift station, and pump stations.

Surfaces to be coated include:

- All piping and appurtenances within facilities
- All galvanized metal surfaces
- All other ferrous metal surfaces
- All other surfaces are to be coated per this section, except potable water storage reservoirs and submerged concrete structures other than manholes, for which the designer must confer directly with AWWU Engineering.

20.11.01 Quality Assurance

Specify that the Contractor must provide a NACE Level 3 Certified Coatings Inspector to examine any and all phases of the work to be performed during the surface preparation and coating application as outlined for the project. The contractor must be responsible for furnishing access to prepared and painted surfaces sufficiently to allow the inspector to verify the product meets the requirements of the specifications.

The inspector shall supply to the Engineer report(s) that include these minimum elements on a daily basis when surface preparation and coating work is taking place: Environmental conditions, wet and dry bulb temperatures, steel temperatures, surface profiles, dew points, humidity, tests, dates and times of work performed, wet and dry coating thickness (mils), pre-cleaning preparation, holiday testing procedures and results coating problems, and a final PA2. The contractor must be required to remedy all deficiencies identified by the inspector and all rework must be subject to re-inspection and testing.

20.11.02 Coatings and Application Schedule

The designer must specify coating “systems” that include minimum requirements for surface preparation (cleaning, profile), primers, and intermediate and top coat film thickness. While there are many coatings system available in the market place, the following outlines basic guidance on coating selections for various environments.

- For submerged metal in municipal sewage specify SP-5 cleaning criteria and polyamide or coal tar epoxies
- For submerged metal in potable water applications specify SP-5 cleaning criteria and NSF-61 approved epoxy.
- For exposed metal in highly corrosive environments or in exterior applications specify SP-10 cleaning criteria, epoxy undercoats and aliphatic polyurethane topcoats for UV resistance, durability, and color and gloss retention.
- For exposed metals in non-corrosive environments specify SP-10 cleaning criteria, all-purpose primers, and alkyd enamel topcoats.

- For inside valve bodies and other in-line appurtenances specify NSF-61 approved fusion-bonded epoxies or elastomeric linings suitable for the intended service. See other standards in this manual regarding the selection of materials for these in-line appurtenances.
- For galvanized and non-ferrous (copper, alloys) metal surfaces meet cleaning criteria recommended by the coating manufacturer including any recommended wash primers and use epoxies, (poly)urethanes, or alkyd enamels as dictated by the service conditions.
- Concrete coatings must be application specific and be approved by AWWU Engineering.
- For wood and gypsum wallboard meet cleaning criteria recommended by coating manufacturer, use primer appropriate to the substrate, and apply semi-gloss acrylic latex or alkyd enamel topcoats.

The designer may propose alternative coatings systems on an application specific basis. AWWU will review these alternatives to ensure they meet or exceed the performance of the systems and applications described above. The designer may propose only those alternatives that have a proven track record under similar service conditions.

20.11.03 Surface Preparation

In general, specify the surface preparation requirements recommended by the coating manufacturer that conform to the standards of the Steel Structures Painting Council (SSPC). However, the minimum SSPC cleaning criteria is to be as noted above. Surface preparation specifications must address treatment of surface defects (pits, weld spatter, etc.) removal of oils and similar foreign substances, the abrasion-blast criteria, and the desired surface profile.

Some surfaces require the use of nonabrasive cleaning techniques during the cleaning process. This may include solvent cleaning, high-pressure water with surfactants, and acid etching. Specify those combinations of methods appropriate to the substrate, the coating, and the ultimate service conditions.

20.11.04 Coating Application

The coatings manufacturer publishes product information specific to the various products it markets. It is essential that the designer be aware of the environmental conditions, application rates, time between coats, time to cure, pot life, shelf life, thinners, and other elements affecting the application process. Also, conditions during the cure period vary for solvent and water-borne coatings – this must be addressed in the specifications. Refer to any special ventilation or personal protective equipment (PPE) required by federal, state, or local regulations.

The designer must also address those surfaces not intended to receive coatings, such as factory finished motors, rotating-equipment, data nameplates, electrical enclosures, stainless alloys, etc. Protection of this equipment during coating application is essential to project quality standards and the specifications must be developed describing how the Contractor is to tape, cover, or otherwise protect these surfaces from being coated.

Address the qualifications of the applicator in performing work under conditions similar to those anticipated during construction. Address touch-up of holidays and post-application defects, as well as proper handling, storage, cleanup, and disposal of coatings and the related materials.

Project specifications must also indicate that spare coating materials must be provided for touchup and re-coating by the facility Owner. Finish coat colors must be coordinated with the facility Owner to provide a uniform appearance with other AWWU facilities.

20.12 Mainline Connections to Existing Facilities

The contractor shall provide an OSHA compliant trench for AWWU crews to perform a main line tap and inspections. The trench must be compliant with AWWU safety requirements. All cost associated with complying with OSHA and/or AWWU safety requirements is to be borne by the contractor performing the work.

20.12.01 Sewer

Connections to existing manholes must be made by core drilling the new penetration into the manhole and providing a NPC Kor-N-Seal pipe to manhole connector to produce a water tight seal. The use of impact tools to form new penetrations is prohibited.

Connections to existing sewer trunks must be made by core drilling the new penetration into the pipe and installing a tapping saddle centered over the hole. The use of impact tools to form new penetrations is prohibited.

Connections to existing cleanouts must be made by removing the cleanout and installing a manhole.

20.12.02 Water

Connections to existing water mains must utilize existing stubs, tees, crosses and valves. New valves may not be installed within close proximity of existing valves unless an active service or branch exists downstream of the existing valve or is required for a service line. Existing valves found to be unacceptable for use must be removed and replaced with a new valve supplied by AWWU. AWWU will not be responsible for direct or ancillary costs associated with the replacement of the unacceptable valve. A live tap will be required where an existing point of connection does not exist on the main.

20.13 Private Systems

Private Systems are water or sanitary sewer connections and extensions (also known as a private line or branched extension) that are privately owned and maintained.

A private line is a water and/or sewer service connection and extension that connects to the AWWU distribution/collection system and is intended to serve a single or multi-family dwelling, single industrial establishments, single institution, or single commercial establishment

Except where excluded, all private systems must be designed by an engineer registered in the State of Alaska.

Private Systems are to be constructed and tested in accordance with testing procedures identified in MASS as if the private system lines were main lines.

Private systems are to be connected to mains in a MOA ROW or easement that fronts the parcel being served. If it is not possible to serve a parcel from the MOA ROW or easement, then the owner will be required to substantiate the claim prior to being allowed to obtain service from a main in an ADOT&PF ROW

AWWU will not issue a connection permit until a MOA ROW permit is obtained and presented with the application for the water and/or sewer permit.

ADOT/PF requires AWWU to issue a connection permit prior to issuing an ROW permit.

20.13.01 Private Systems Engineered Plans

Engineered Plans are required by AWWU for all modifications, extensions, repairs and alterations to water and sewer systems outside of the building. AWWU may waive engineered plans for repairs if the repair is limited to ten (10') linear feet or less and for single family and duplex structures.

At a minimum, engineered plans must show all information required in Sections 20.05.04, 20.05.06, utilizing applicable standard symbols and construction notes provided in Section 60 and the following:

1. The intended use of the building(s) being served and the building(s) foundation foot print with building dimension are to be shown on the plans.
2. Provide horizontal dimensions to existing AWWU facilities (i.e., fire hydrants, valves, manholes).
3. Owner's name, address, telephone number and signature are required to be shown on the plan set using the AWWU signature block.

All submittals of plans are to include three (3) sets of drawings that are sealed and signed by a Professional Engineer registered in the State of Alaska. Private system plans are to be submitted to the AWWU Customer Service Division, Permit Section for review.

For all sanitary sewer projects the applicant must complete and submit for approval to AWWU the "Notice of Intent to Discharge Industrial Wastewater" form.

20.13.02 Separate Connections

Every parcel is to have a separate service connection. Generally a lot is limited to a single service connection. Multiple service connection to one lot, will only be allowed with just cause and with the approval of the AWWU general manager. The size of the connection is dependent upon the development plan with a minimum diameter for water being one inch (1") and four inches (4") for sanitary sewers. Where a branch extension can be used, a second connection will not be allowed.

AWWU prohibits services crossing property lines; except as outlined in Tariff. Lease lines are treated as if they are property lines.

If the lot is subdivided the owner must relocate the service connections or extend main lines to comply with AWWU standards.

On each applicable engineered plan sheet showing more than one service, provide a Service Connection Chart in accordance with the DCPM Standard Drawing Submittal requirements. The Engineer and Construction contractor are to update the Service Connection Chart at the completion of the project and included in the record drawing information.

It is prohibited to inter-tie two or more buildings into a single and/or common service connection except for branched extensions approved by AWWU Field Services.

20.13.03 Branched Extensions

Branched extensions are all services that are private lines that generally have branched collection and distribution lines that connect to the municipal systems. AWWU Customer Service Division, Permit Section will determine if the system is a branched extension. All applications for water and sewer service connections and extensions that are classified as branched extensions must provide engineered plans in accordance with private systems.

The minimum size of a branched sanitary sewer extension is six (6) inches and is to be large enough to carry maximum flows. Branches off of the extension are to be installed from on-site manholes or mechanical wyes; as service saddles will not be permitted.

The minimum diameter of branched water extensions is six (6”) inches, with a minimum of eight (8”) inches if fire hydrants are required. If HDPE pipe is used, the sizes are to be increased to eight (8”) inches and ten (10”) inches respectively.

All branched extensions are to be designed, constructed and inspected and pass the same testing procedures as main line extensions. Water extensions must be pressure tested to the curb stop or valve in accordance with MASS. Any proposed changes to the approved plans during construction must receive AWWU approval prior to installation of the change

The Engineer shall furnish AWWU copies of recorded easements and/or any AWWU, MOA, ADOT/PF, or ADEC required submittals, prior to final approval and/or service availability.

20.13.04 Repairs or Replacement

Existing materials must be brought up to current standards, except that existing cast iron pipe and fittings may be replaced with like material where the repair is less than 10 linear feet. Replacement of portions longer than ten feet (10') may be require engineered plans for approval of the repair.

20.13.05 Type of Structure Served

20.13.05.01 Single Family Residence

Each building structure on a single-family lot must have individual service connections.

20.13.05.02 Townhouses

Townhouses that have property lines passing through the structure must have an individual sanitary sewer and water service connections for each unit.

20.13.05.03 Zero Lot Lines

Zero lot line dwellings are treated in the same manner as townhouses. Structures classified or lots designed as zero lot line are to have individual services to each lot. The services cannot cross adjoining lot lines in order to receive service.

20.13.05.04 Condominiums

Condominiums are permitted one service extension or branch per building regardless of the number of units. The Home Owner's Association or condominium by-laws are to maintain the on-property service/branch service. When constructing a condominium development, the following stipulations must be met:

1. The developer shall submit engineered drawings, sealed, signed, and dated by a professional engineer registered in the State of Alaska, to AWWU for review and approval.
2. The service is to tie into an AWWU main with a single service connection and be branched on-property. The Home Owner’s Association is to maintain the entire branched service extension.
3. Services to each building are to be extended from the branched service extension on-property. The number of fixture units in each building will determine the size of the service. Each building must have a separate service and be required to have an on-property permit. Services running under buildings tying two (2) or more buildings

together is not allowed. All services will be inspected by AWWU. Water main taps greater than two (2) inches in diameter will be performed by AWWU personnel.

4. It must state in the Home Owner's Association Bylaws that the home owners will be responsible for maintaining the on-property (private) system and funds are to be allocated for repairs. A copy of the bylaws must be submitted to AWWU when the Association applies for billing.
5. All on-property mains will be clear of any permanent ground level obstructions for maintenance access. It is desired these mains be in traveled ROW's.
6. During and upon completion of the project, the lines are required to be inspected by AWWU.
7. After the project is complete, record drawings must be submitted in accordance with Section 50.00.

20.13.05.05 Mobile Home Parks

Mobile home parks, as defined by and in accordance with MOA Zoning Ordinance, are to have privately maintained water distribution and sewer collection systems where only one sanitary sewer and water connection are made into AWWU systems. This will be approved only if the connection is made into a manhole and the size of the connection is at least eight (8) inches in diameter. The water connection is to be metered with a backflow prevention device and sized to meet both domestic and fire flow requirements. Mobile Home Park plans must be reviewed and approved in accordance with this manual.

20.13.05.06 Commercial Building

A commercial building is building that is used for commercial use. Types can include office buildings, warehouse, tri-plex and larger living dwellings, or retail. A commercial service will be allowed only one service connection per lot and then branch the service extension to accommodate more than one building. More than one service connection is possible with approval by the AWWU General Manager and proof of just cause.

20.13.06 Non-Conforming Services

AWWU prohibits any person to construct, repair or modify a service considered non-conforming (a.k.a., bootlegged). Any service that is not in compliance with MOA codes or AWWU tariffs and practices is considered non-conforming.

AWWU cannot be held liable for non-conforming services and will not be obligated to perform any maintenance, repairs or rerouting because of non-conforming services freezing, breaking, or otherwise failing.

AWWU will not allow the reconnection of a bootlegged service encountered or severed during repairs, rehabilitation or construction of new mains.

20.14 Sanitary Sewer and Water Inspections

20.14.01 General

Arrangement for AWWU inspections are the responsibility of the applicant and/or permitee. AWWU may inspect any and all work to AWWU facilities whether or not prior arrangements have been made. AWWU will inspect water/sewer utility work within the Municipal ROW (or easements) and on property without exception. Service taps are not to be made by any permittee without the AWWU inspector being present.

The AWWU inspector must be allowed access to all parts of the work at all times and be furnished with every reasonable facility for ascertaining whether or not the work is

performed in accordance with the requirements and intent of MASS, this document, the approved plans and specifications. Inspections that require entry into confined spaces or excavations must meet AWWU safety requirements at no additional cost to AWWU.

The contractor's responsibility for work performed shall be in accordance with the contract, permit stipulations, and MASS. The presence or absence of an inspector will not relieve the contractor of deficiencies in work performed.

Unless specified separately and approved by the MOA ROW agent, the contractor shall replace any existing materials damaged within the road prism (i.e., utilities, insulation, fabric material, etc.) with an equal or better material. The contractor shall restore any existing surface features disturbed during construction.

The contractor shall abide by any special conditions required by the permitting agencies (i.e., ADOT/PF, ADF&G, ACOE, ARRC, etc.)

Inspectors are authorized to inspect all work done and materials furnished. Such inspection may extend to all or any part of the work and to the preparations, fabrication or manufacture of the materials to be used. The inspector will not be authorized to alter or waive the provisions of the contract, permit stipulations, this document or MASS. The inspector will not be authorized to issue instructions contrary to the plans and specifications, or to act as foreman for the contractor.

When connecting to a sanitary sewer line, the contractor shall take precautions to allow no sewage to enter the new sanitary sewer line until it has been inspected, tested, and accepted for operation and maintenance by AWWU.

Water, sewer, storm drain main and service trenches must be substantially backfilled and compacted prior to witness of testing by AWWU.

20.14.02 Substantial Completion Inspection

Upon substantial completion of all work involved, the owner’s engineer shall notify the AWWU inspector of substantial completion and request a pre-final inspection of the project. This inspection should be performed in the presence of representatives of the owner, the design engineer, and the contractor.

AWWU will accept substantial completion testing after deficiencies have been corrected.

20.14.03 Final Inspection

Upon completion of all work involved, the owner’s engineer shall notify the AWWU inspector of completion and request a final inspection of the project. This inspection should be performed in the presence of representatives of the owner, the design engineer, and the contractor.

When all corrective action has been completed, the owner must notify the AWWU inspector and another inspection will be performed. When the results of this inspection verify correction of the listed deficiencies and any additional noted deficiencies, the engineer may accept requests for a Final Pay Estimate.

Final inspections will not be performed unless test and daily inspection reports are current and approved by the AWWU Project Manager. Preparation of final utility checklists will be done in conjunction with the final inspection process.

20.14.04 Deficiencies

Any deficiencies found during inspections will be listed and furnished to the contractor for corrective action. When all corrective actions have been completed, the contractor must notify AWWU for an inspection of the corrected deficiencies. When the re-inspection verifies correction of all deficiencies, the inspector will approve the appropriate step of construction.

20.14.05 Partial Utilization

Partial utilization is the use of a facility prior to substantial completion as defined in MASS. Request for partial utilization must be submitted in writing to the AWWU Engineering Division Director. Approval of a partial utilization request will not constitute substantial completion nor mark the beginning of the Warranty described in MASS Division 10, Article 3.7, Contractor's Warranty, or the specific Private Development Agreement. Maintenance of the facility for which partial utilization is designated remains the responsibility of the contractor and/or developer.

20.14.06 Warranty Period on Connects

For permits issued other than through a Subdivision or Private Development Extension Agreement, a one (1) year warranty period on main line taps begins when construction has been completed and inspection approved by AWWU. Permits must be signed off by AWWU at completion and acceptance of main line tap.

20.14.07 Private Systems Inspections & Notices

AWWU will not approve any service connection and/or extension that is not in accordance with the current edition of the Uniform Plumbing Code, as amended by M.O.A. Title 23, MASS or this manual. The inspection permit must be at the project location and available for review to the scheduled inspection.

The permitee and/or contractor must notify AWWU a minimum of twenty-four (24) hours prior to any inspection. Inspectors are available Monday through Friday by advance appointment between 8:30 am and 4:00 pm. After-hour inspections will be performed on a reimbursable basis upon the permitee's approval and at their expense. All time associated with the arrangement of personnel, departure, return and after hours inspection will be charged to the reimbursable account in the permitee's name and is additive to the permit fee.

No private system or part thereof is to be covered, concealed or put into use until it has been inspected and accepted by AWWU or their designated representative. Excavations with standing water must be pumped out and maintained in a dewatered state prior to and during inspections.

Any private system or part thereof which is installed, covered or concealed before being inspected and approved as prescribed in MASS and this manual must be uncovered for inspection after notice to uncover the work has been issued by AWWU to the responsible person.

Prior to placement of the backfill, an authorized representative of AWWU must inspect all installations.

- Any installations not inspected by an AWWU authorized representative will not be accepted by AWWU for service.
- Failure to comply will result in notification of failure to the Municipal Building Department. A registered letter will be sent to the Property Owner of Record and the

excavation contractor. Water service will not be provided (physically tuned on by AWWU to any property until sewer service has passed all inspections.

- Upon correction of deficiencies, a letter noting correction of the deficiencies will be sent to the above mentioned departments, Owner of Record, and the excavation Contractor.

The owner will assume all liabilities and costs of inspections, administrative costs, filing and recording fees and other fees that are fair and just.

20.14.08 Service Connection Inspections

Without exception, an inspector of AWWU must be present when the initial tap is made to an existing AWWU line.

The main line tap inspection includes, but is not limited to, the necessary excavation, pipe laying to the main, backfilling, compacting, and resurfacing of the roadway and easements to equal or better than original condition (as existed prior to excavation).

AWWU will not approve any main line tap which is not in accordance with UPC and MASS.

The main tap permit must be on site prior to the excavation for the main line tap. If the proper main line tap permit is not at the job site, a "stop work order" will be placed into effect until the permit is made available by the contractor. The cost incurred by the "stop work" order is borne by the contractor. The contractor cannot hold AWWU responsible for any reimbursements.

The contractor performing the excavation for a main line tap is fully liable and responsible for restoring property disturbed by construction to a condition similar or equal to that which existed prior to construction. The contractor shall at all times keep the construction area free from accumulations of waste materials. Prior to completion of work, any waste material is to be removed from the construction site. At the completion of the project, the construction site must be clean, neat and in satisfactory condition.

20.15 Abandoning Sanitary Sewer and/or Water Mains and/or Services

The Planning Section of AWWU Engineering Division will review and approve any sanitary sewer or water main proposed for abandonment.

Any sanitary sewer or water abandonment work in a Municipal ROW or easement must be permitted by MOA Community Development or by ADOT/PF when in the State of Alaska's ROW.

The abandon in place method for sanitary sewer or water mains typically includes the following: placing one foot of concrete at the beginning of the pipe, calculating the total internal volume of the pipe, filling the pipe with sand slurry equal to the total calculated volume, and placing one foot of concrete at the end of the pipe. The concrete plugs the pipe and the slurry fills the pipe. Work is typically started on the downhill end of the pipe. The total lineal footage of the sanitary sewer and water mains abandoned in place must be shown on the record drawings.

Any sanitary sewer or water service connection proposed for abandonment will require a disconnect permit from AWWU Customer Service Division and conform to any special requirements requested by AWWU Operations and Maintenance Division (refer to Sections 30.03 and 40.03).

30.00 DESIGN AND CONSTRUCTION OF WASTEWATER FACILITIES

30.01 General

Sanitary sewers must be designed to remove domestic sewage from the lowest elevation of houses, business buildings, and other public and private establishments. Sanitary sewers must not be designed to collect any runoff from precipitation or ground water intrusion. Non-polluted cooling waters must be kept out of sanitary sewers. Any deviation of this policy requires approval from the AWWU Engineering Division Director.

Improvements to the sanitary sewer trunk and/or interceptor systems are made primarily through the Capital Improvements Program (CIP). If a developer desires to proceed ahead of the CIP, the developer must finance the cost of the portion of the CIP project required to reach and front the desired property to be served. The size of the sanitary sewer trunk and/or interceptor lines and/or associated pumping stations will be determined by a facility and/or master plan adopted by AWWU. If the required size exceeds the needs of the development, AWWU will participate in oversizing when the funds for the specified CIP project are available.

Sanitary sewer systems are to be designed to handle future loads that may reasonably be expected within a period of thirty (30) to fifty (50) years.

30.02 Standard Sanitary Sewer Design Elements

30.02.01 Pipe Material and Size Design Requirements

30.02.01.01 Design Capacity

Sanitary sewer capacities must be designed for the ultimate tributary population, except in parts of the systems that can be readily increased in capacity.

Consideration should be given to the maximum anticipated capacity of institutions, industrial parks, etc. When programming future relief sanitary sewers, economic analysis of alternatives must accompany initial permit applications.

Consider the following factors when determining the required capacities of sanitary sewers:

- Maximum hourly domestic sewage flow
- Additional maximum sewage or waste flow from industrial plants
- Inflow and ground water infiltration
- Topography of area
- Location of sewage treatment plant
- Depth of excavation
- Pumping requirements

The basis of design for all sanitary sewer projects must accompany the design documents.

30.02.01.02 Design Flow

The basis of design for new sanitary sewer systems is an average per capita flow of sewage of not less than one hundred fifty (150) gallons per day. This figure is assumed to cover normal infiltration and does not include commercial or industrial usage. Commercial and industrial flow estimates are based upon the building usage and planned future development.

For existing sanitary sewer systems, actual daily per capita flows must be used with an additional per capita allowance made where the average annual flow exceeds the above value.

It is prohibited to discharge any storm water, surface water, surface runoff, groundwater, roof runoff, subsurface drainage, cooling water or other similarly polluted water to the Municipal sanitary sewer system.

30.02.01.03 Peak Design Flow

Design new sanitary sewers on a peak design flow basis using the ratio of peak to average daily flow or the values established from an infiltration and/or inflow study approved by AWWU.

Use of other values for peak design flow will be considered if justified on the basis of supporting documentation.

The following table is provided as a guideline to calculate peak flow calculations. As a general rule, estimate a discharge of one hundred fifty (150) gallons per person per day and take that value times a peaking factor of two (2). Then, calculate the total number of people per acre of the entire development drainage cell and multiply by the estimated discharge (including the peaking factor), then convert the gallons per acre to cubic feet per second.

WASTEWATER SYSTEMS BASIS OF DESIGN FOR FUTURE DEVELOPMENT

ZONING	UNITS/ ACRE	PEOPLE/ UNIT	PEOPLE/ ACRE	CFS/ ACRE*
SINGLE	1 -- 2	4.0	8	.0037
FAMILY	3 -- 6	3.5	21	.0097
MULTI-FAMILY	7 -- 10	3.3	33	.0153
(MEDIUM DENSITY)	11 -- 20	3.0	60	.0278
MULTI-FAMILY	21 -- 35	2.8	98	.0455
(HIGH DENSITY)	> 35	2.5	> 120	> .0557
COMMERCIAL	N/A	N/A	N/A	.0097
HOTEL/MOTEL	N/A	N/A	N/A	.0005/Room
INDUSTRIAL	N/A	N/A	N/A	.0196
UNKNOWN	3 -- 3.5	3.0	10	.0046

*The CFS/ACRE includes a peaking factor of 2

30.02.01.04 Sanitary Sewer Main & Larger Services Slope

All sanitary sewer mains must be designed and constructed to give mean velocities, when flowing full, of not less than two (2.0) feet per second based on the following Manning equation using an "n" value of 0.013:

$$Q = (0.46316/n) * D^{2.67} * S^{0.5}$$

Where:

Q	=	Flow rate, cfs
n	=	Manning Roughness Coefficient
D	=	Pipe Diameter, ft
S	=	Pipe Slope

The following are the minimum slopes and minimum number of homes, with approximate design capacities (at 2/3 full) and a minimum velocity of two (2.0) feet per second, which should be provided. However, slopes greater than these are desirable.

Pipe Size	Slope / 100 Ft	2/3 full (CFS)	Min. # Homes
8 inch	0.40	0.65	N/A
10 inch	0.28	0.86	0071
12 inch	0.22	1.26	0102
14 inch	0.17	1.69	0153
15 inch	0.15	1.92	0192
16 inch	0.14	2.21	0198
20 inch	0.10	3.42	0338
24 inch	0.08	5.01	0492
30 inch	0.058	7.77	0760
36 inch	0.046	11.28	1101
42 inch	0.037	15.27	1489

Slopes slightly less than those required for the two (2.0) feet per second velocity when flowing at peak capacity will be permitted only with written approval from ADEC. Such decreased slopes will be considered only where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are selected, the design engineer must furnish a report of computations of the anticipated flow velocities of average and daily or weekly peak flow rates. The pipe diameter and slope must be selected to obtain the greatest practical velocities to minimize settling problems. Oversizing sewers will not be approved to justify using flatter slopes.

Where soil conditions so warrant, sanitary sewer on slopes in excess of twenty (20%) percent must be secured through the use of concrete anchor walls or other anchor protection. For slopes of twenty (20%) to thirty-five (35%) percent, anchors are to be placed at least every thirty-five (35') feet. The design engineer shall review the soils conditions and design the anchors accordingly. For slopes in excess of thirty-five (35%) percent, the engineer shall submit to AWWU design calculation justifying a recommendation for anchor spacing.

Energy dissipation is required when the maximum slope exceeds fifteen (15%) percent. The design engineer shall consider a means of energy dissipation at the manholes and secure approval from AWWU Engineering Division.

30.02.01.05 Sanitary Sewer Services Connection and Extension Slope

Each run of pipe is to be laid at a uniform grade between appurtenances. The minimum slope for a four (4") inch service is two (2%) percent from the structure to the service stub or main line. The minimum slope for a six (6") inch service is one (1%) percent. For larger sanitary sewer services the minimum slope is equivalent to the requirements of mainlines.

30.02.01.06 Minimum Pipe Size

Gravity Sewer Mains

Gravity sanitary sewer mains minimum size is eight (8") inches nominal diameter.

Force Sewer Mains

Force sanitary sewer mains minimum size is four (4") inches nominal diameter.

Private Sewer Lines

The minimum size of the gravity service is four (4") inches. Commercial and industrial connects are to be sized based on calculation of the maximum available use of the building or planned development. Residential connects must conform to the following table::

Connect to Main	Living Units
4" service connect --	0-4
6" service connect --	5-29

Connect to Manhole	Living Units
8" service connect --	30-106
10" service connect --	107-187
12" service connect --	188 -328

The engineer is required to receive approval from AWWU Engineering Division and MOA Building Safety for sizes other than those listed above.

Private force sewer services minimum size is two inches (2") in diameter.

30.02.01.07 Sewer Authorized Materials and Fittings

Sewer mains, sewer service connections and sewer extensions are to be constructed with authorized materials and fittings listed in this section. Sanitary sewer service connections and service connections must be installed and tested in accordance with MASS.

Pipe Materials

- Ductile Iron with "Tyton" joints, Class 50 (DIP CL50)
    a. May be used for all sewer piping
- Zinc coated Ductile Iron Class 52 pipe (DIP CL52)
    a. DIP for pressure mains and services only
- HDPE (High Density Polyethylene) pipe
    a. may be used for pressure mains and services only
    b. manufactured in accordance with AWWA C906
    c. outside diameters conforming to iron pipe size (IPS).
    d. manufactured from PE4710 polyethylene compounds that meet or exceed ASTM D3350
    e. SDR 11 or SDR 9
    f. material cell classification of 445574.
    g. HDPE pipe and fitting material compound must contain color and ultraviolet (UV) stabilizer meeting or exceeding the requirements of code C per ASTM D3350.
    h. Electrofusion fittings must comply with ASTM F1055. All fittings must have pressure class ratings not less than the pressure class rating of the pipe to which they are joined.
- PVC Polyvinyl Chloride (PVC) pipe
    a. may be used for gravity and pressure sewer systems
    b. must meet requirements of AWWA C900. C900 Polyvinyl Chloride pipe is to be DR 18
    c. must meet requirements of AWWA C905. C905 PVC pipe is to be DR 21

d. must have a minimum two hundred (200) psi pressure rating
e. All bends are to be constructed with ductile iron fittings and have restrained joints and concrete thrust blocks (pressure only)
f. Gravity sewer bends may be made of PVC for sewer services. Bends and fittings to construct sewer cleanouts must be restrained
g. standard length is twenty feet (20'), shorter lengths will be permitted on smaller (4"-6") services
h. C905 Pipe is to be iron pipe size equivalent (IPS)
i. C900 Pipe is to be iron pipe size equivalent (IPS)
j. PVC pipe are to be blue or green in color
k. The pipe must have certifying markings at regular intervals identifying the AWWA standard C900 or C905
l. Bending and/or deflecting of PVC Pipe is not allowed. All changes in direction must use metallic fittings, deflection couplings or manholes.
m. All fittings and apparatus attachments must be restrained in cleanout and pressure pipe construction

- Copper, Type K pipe
  a. may only be used on pressure single family residential sewer systems
  b. be a minimum size of two inches (2")
  c. polyethylene coated and wrapped with denso paste and tape to make repairs of the polyethylene coating

Fittings

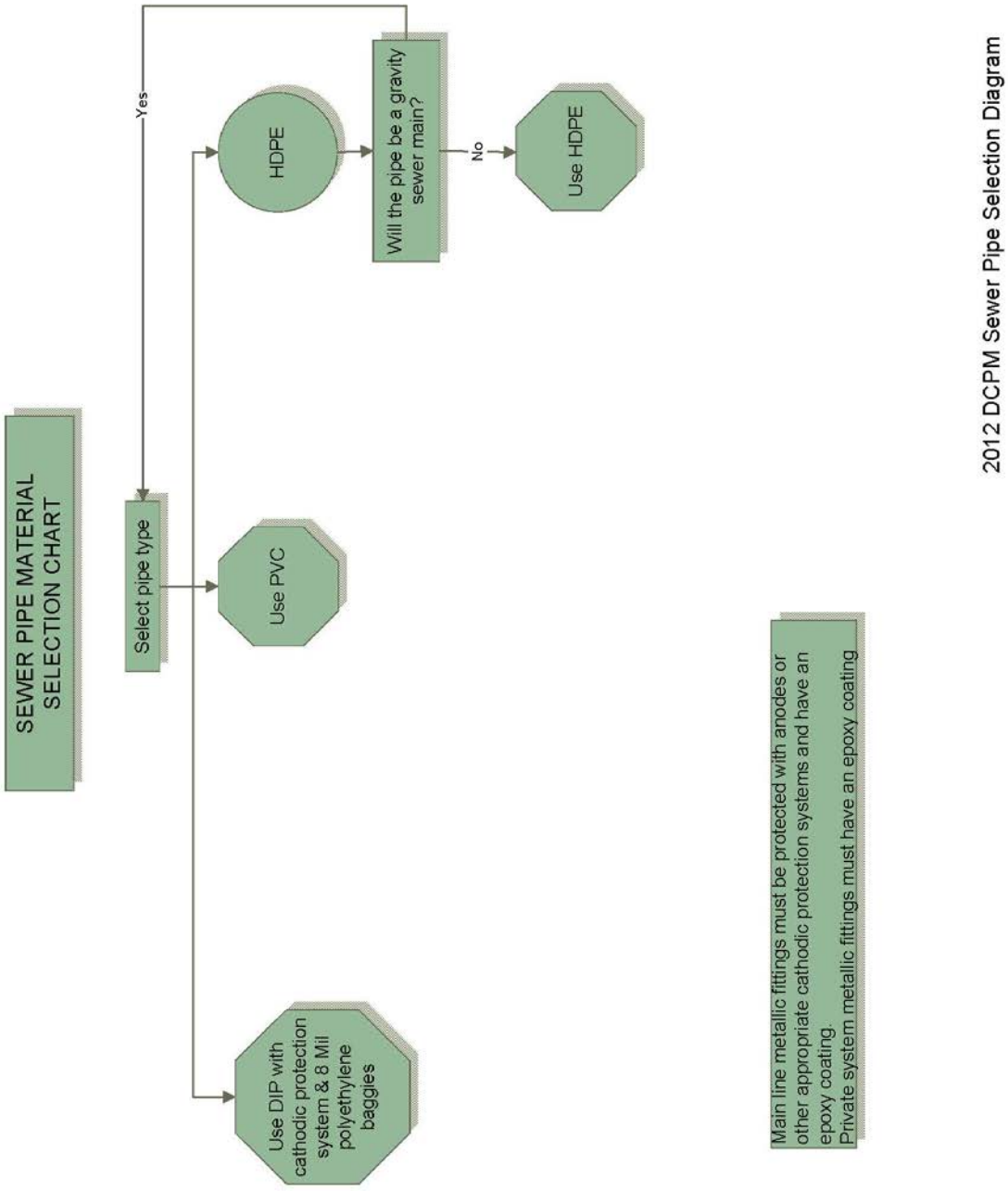
1. Romac 501 coupling or equal where the type of pipe changes
2. Romac CB sewer saddle or equal
3. Romac repair clamps(SS1) or equal where the pipe type does not change
4. PVC fittings with gaskets meeting AWWA C907 for AWWA C900 pipe or equal for non-pressurized systems
5. MJ Sleeve w/ Romac MJxSDR35 gasket for PVC/DIP connection to CI
6. 4"&6" PVC cleanout wye with a groove on the vertical riser for Certa-Lok C900/RJ pipe by CertainTeed manufactured by specified fittings or equal

A soil corrosion evaluation will be required when the design engineer proposes corrosion protection that is different from the AWWU standard. The soil corrosion evaluation must be performed prior to pipe material selection and submitted with the initial engineered plan review. Pipe material recommendations shall contain an engineered analysis supporting the pipe material selection and corrosion protection system that must indicate an expected 70-year design life of the pipe.

Detectable underground warning tape is required for installation of all pipe types. Warning tape must not be less than five (5) mil, foil backed, six inches (6") wide vinyl tape, colored green, with "Caution Buried Sewer Line Below" continuously printed in black along the tape length. The warning tape must be continuously laid with the pipe and be at least eighteen inches (18") above the pipe.

Tracer wire must be installed on all non-metallic pressure sewer main. Tracer wire must be continuous, suitable for direct bury, 10 AWG and with 30-mil HDPE jacket colored green. When allowed by the Engineer, splices are to use a Copperhead Industries, LLC connector, part #3WB-01 or equal. Tracer wire must be brought to the surface near sewer structures.

30.02.01.08 Pipe Material Selection Flow Chart



30.02.01.09 Unauthorized Materials and Fittings

- Cast Iron with "Ty-seal" joints
- Cast Iron with "No-hub" joints.
- ABS (Acrylonitrile-Butadiene-Styrene)
- Aluminum or steel corrugated metal pipe
- Asbestos cement
- Concrete cylinder
- Galvanized or black iron pipe
- Mild steel or seamless conduit
- Orange-burg
- Vitrified clay
- Wood stave
- Caulder type couplings
- Non-gasketed PVC pipe

Pipe types and fittings not listed here may only be incorporated into a design or work after the product has received approval from the AWWU Engineering Division Director.

30.02.02 Standard Depth of Cover

Sewer service connections and sewer mains are to have a depth of cover of a least eight feet (8') to the furthest serviceable point of the area that may be developed or served, be sufficiently deep to receive sewage from basements and to prevent freezing. The area being developed or served may include areas outside of the project area and as such AWWU planning may require consideration for those areas. All sewer pipes are to meet the minimum depth of cover.

The designer should considered future and/or re-development of a parcel prior to designing service extensions.

This depth is to be maintained providing the system meets minimum flow requirements.

30.02.02.01 Minimum Depth of Cover

If the standard of eight feet (8') of burial is unattainable, AWWU will allow a depth of cover to five and one-half (5½) feet without insulation. From five and one-half (5½') feet to four and one-half (4½') feet, sanitary sewer must be installed with arctic protection and enough warm sewer flow to maintain a thawed state. If the minimum depth of cover cannot be achieved then a lift station is required.

Arctic protection may be one of the following options:

- Arctic insulated pipe that consists of an outside jacket pipe that provides a minimum three inches (3") of annular space that is completely filled with low-density rigid closed cell urethane foam. The inner core pipe is to meet the requirements of this section and the outer jacket pipe is to be strong enough to prevent damage to the insulation from external earth loading and typical construction handling.
- 4" thick insulation board that is a minimum width of 2' beyond the outside diameter with 2" of insulation a minimum of 4' beyond the outside of the pipe. The 4" thick insulation must be constructed of two pieces of insulation board with joints offset. The insulation is to be between 6" and 12" above the top of the pipe, laid flat.

- 4” of insulation board above the pipe that is a minimum width of 2’ beyond the outside diameter and another 4” of insulation laid vertical on both sides of the pipe to at least 6” below the pipe. All horizontal insulation board is to be between 6” and 12” from the pipe wall and must be close fitting. Vertical insulation is to be set at the edges of the horizontal insulation.
- Arctic protection approved by the AWWU Engineering Director

Sewer flow considerations

- Is the anticipated sewer flow occurring on a regular and daily basis? Irregular flows can be problematic as the pipe and trapped air can go below freezing temperature and cause the sewer flow to freeze without enough sewer flow adding heat on a regular basis.
- Does the sewer flow consist of heated water such as from dishwashers, showers, food preparation areas? AWWU water temperature is in the low 40°F from the main and does not add a lot of heat to the sewer system by itself.
- Is the shallow pipe flowing at 2/3 full and/or at a minimum of two feet per second (2ft/sec) on a regular basis? Low and/or slow flows may lose heat too quickly and freeze.
- Is the building heated at all times? Warm air from the building may exchange with cold air coming in from the sewer vents. This warm air may heat the air in the sewer line. If a building is not heated, then this source of heat and having a possible source of cold air coming in from a vent may cause the sewer pipe to freeze
- Is there equipment discharging low volume flows, such as condensers from high efficient furnaces? Trickle flows may cause glaciation within the pipe. The glaciation will continue until the sewer pipe is frozen solid.

The minimum depth of bury for all pressure sewer pipes is ten feet (10’). Connection to the gravity sewer system will be per MASS standard details..

30.02.02.02 Maximum Depth of Cover

Pipe manufacturers supply the mathematical formulas for determining the necessary pipe thickness for a given combination of internal pressure and external load. They also supply graphs for the quick determination of pipe thickness for various combinations of standard conditions. Pipe may not be buried deeper than recommended by the pipe manufacturer.

30.02.02.03 Deep Service Risers

Deep service risers may be installed where the sanitary sewer is in excess of twelve (12’) feet deep and eight (8’) feet of cover can be maintained over the service and service riser (see MASS, Standard Details). Deep service risers are to be fully restrained. A maximum of two (2) sanitary sewer service connections per service riser will be allowed.

30.02.03 Manholes

30.02.03.01 Location

Mainline manholes must be installed at the end of each line; at all changes in grade, size, or alignment; and at all intersections. Manholes are to be brought to finish grade as indicated in MASS. The distance between mainline manholes will not be greater than four hundred (400’) feet for sanitary sewer mains less than thirty (30”) inches in diameter. The distance between

private system manholes must not be greater than three hundred feet (300'). AWWU may allow distances up to five hundred feet (500') for sewer mainlines, on a case by case basis, provided the sanitary sewer is designed with greater than minimum slope. In some cases, the Contractor may be required to provide a CCTV inspection report to verify grade and alignment.

Greater spacing may also be permitted for larger sanitary sewers on a case by case basis.

Any user discharging nondomestic pollutants into the municipal sewerage system shall, construct and maintain an on-property control manhole to allow inspection, control and flow measurement of each wastewater discharge.

30.02.03.02 Diameter

The minimum inner diameter of manholes is forty-eight (48") inches. The minimum access diameter is twenty-five (25") inches.

Sanitary sewer manhole Type A (see MASS Standard Details) is required for sanitary sewer mains with diameters eight (8") inches to twenty-four (24") inches. Type B manholes may be required by AWWU based on the connecting pipe configuration, fittings, location, or other factors. Two examples where a Type B manhole would be required are for an internal drop connect and for fitting clearances for special manholes with sealed pipes and cleanouts.

Sanitary sewer manhole Type B (see MASS Standard Details) is required for sanitary sewer mains with diameters thirty (30") inches to thirty-six (36") inches. .

30.02.03.03 Flow Channel

Flow vectors for the main and lateral connecting to a manhole will be at or less than ninety (90°) degrees to prevent opposing flow conditions. Where this condition cannot be avoided, the lateral must enter the manhole through an outside drop connection. The flow channel is to be constructed through the manholes to conform in shape and slope to that of the sanitary sewers.

When the slopes of the inlet and outlet sanitary sewer are equal, the slope through the manhole must also be the same, allowing the pipe to be run straight through the manhole. The invert of a third or fourth pipe penetrating a manhole is to enter at an elevation at least 0.05 feet higher than the outlet inverts. When the slopes of the inlet and outlet are not equal, the minimum drop through the manhole must be 0.05 feet. In manholes where lateral sanitary sewers are intercepted by mains, trunks or interceptors, the lateral sanitary sewers must be laid such that under normal flow conditions in the interceptor sanitary sewer there will be no backing up of sewage in the lateral sanitary sewer. All smaller sanitary sewers must match crowns of larger sanitary sewers. In some cases, the invert of the smaller sanitary sewer may be required to match the crown of the larger.

30.02.03.04 Connection into manholes

Use a NPC Kor-N-seal or approved equal, pipe to manhole connector when connecting into existing manholes. Core drill new penetrations when connecting into manholes in a neat workman like manner. Adjust ladder rungs (removed/replaced/moved) to a location that is not above a pipe penetration.

New manhole pipe connections must meet the requirements of MASS.

Sewer services may not connect into a mainline manhole unless they are 8" in nominal diameter or greater.

Where branched sanitary sewer service extensions are permitted, a service extension connecting into an on-property manhole may be smaller in diameter than the branched extension.

30.02.03.05 Drop Connection

Construct drop connection manholes with an outside drop connection as required and shown in MASS.

Inside drop connections require approval from AWWU Engineering and must be installed in a Type B or larger manhole. Secure the drop connect to the interior wall of the manhole and ensure access to the drop connect is achievable for cleaning. See MASS for additional requirements.

30.02.03.06 Beaver Slides

AWWU requires beaver slides where the invert of the connecting sanitary sewer is above the crown of the receiving sanitary sewer and the drop into the manhole is short enough not to require a drop connection. Beaver slides are to be called out on the plans and shown in the profile view. Avoid beaver slides wherever possible. See MASS, Standard Details for typical beaver slide.

30.02.03.07 Watertight Manholes (Inside protective well radius)

Manholes within the protective radius of a well must be designed and constructed to prevent groundwater contamination. Use of the special manhole and cleanout detail as well as a locking watertight manhole frame and cover as described in MASS is a standard protective practice, but is not a guarantee of plan approval.

Flow channels within watertight manholes must be constructed of pipe and fittings that are mechanically restrained or flanged in accordance with MASS.

An approved ADEC waiver of separation is required for AWWU to approve construction plans not meeting the separation distances required under 18 AAC 80.020 – Minimum Separation Distances.

30.02.03.08 Manholes in a high water table

For manholes installed in Girdwood or where the static groundwater table is known to be within four feet (4’) of the ground surface, the manhole must have a minimum of base and barrel joints. The base cast with the first barrel section is be the minimum of six feet (6’) in height unless it is required to be less to set a twenty four inch (24”) tall eccentric cone. The manhole base is to be monolithic, either being solidly cast, or having a cold-joint with an approved water-stop product.
All manhole and chimney joints will be externally sealed with CCI Pipeline Systems WrapidSeal product or equal.

All frames and covers must have Parson Environmental - SSI Manhole inserts, Cretex – Inflow Dish, or approved equal installed between the frame and cover. Drain holes in manhole inserts are not allowed.

30.02.03.09 Locking Manholes

Locking, watertight manhole covers are to be used in the construction of manholes that tops may be flooded by street runoff or high water table or where needed for security purposes.

30.02.04 Cleanouts

Cleanouts will not be approved as substitutes for manholes on sewer mainline, but manholes may be substituted for cleanouts.

The horizontal distance between a manhole and a mainline cleanout must not exceed one hundred fifty (150') feet in length.

Sanitary sewer services require a cleanout:

- Per one hundred feet (100') of constructed service line without a manhole
- At grade breaks
- At a single bend that is greater than 45 degrees (horizontal)
- combination of bends within an interval not greater than ten feet (10') that is greater than forty five degrees (45°) (horizontal)
- Within twenty-four inches (24") of the building structure

All cleanout fittings (both stand pipe and wye) must be restrained and wrapped with at least one layer of 8 mil thick polyethylene sheeting and tape wrapped at the top, middle and bottom. The cleanout at the structure is required to meet the latest MOA adopted version of the Uniform Plumbing Code (UPC).

30.02.05 Joints

Pipe joints are to be bell and spigot manufactured for use with rubber gaskets. Connection of new pipe to existing pipe where utilizing a spigot is not feasible, a gasketed repair clamp or coupling must be used.

Approved gasket materials are Styrene Butadiene Rubber (SBR), Nitrile Butadiene Rubber (NBR) and Viton flouroelastomer (FKM) compounded for sewer service.

30.02.06 Crossings

Sanitary sewers crossing water mains must be laid to provide a minimum vertical separation of eighteen (18") inches between the outside of the water main and the outside of the sanitary sewer main. In cases where the water main is either above or below the sanitary sewer, the crossing will be arranged such that the sanitary sewer joints will be equidistant (a minimum of nine (9') feet) and as far as possible from the existing water main joints. Where both water and sewer are being installed, the joints for both lines are to nine feet (9') from the crossing point. In addition to AWWU requirements, sanitary sewer and water crossings must be in accordance with ADEC regulations.

30.02.06.01 Creek Crossings

The top of all sanitary sewers crossing streams must be at a sufficient depth below the natural bottom of the stream bed to protect the sanitary sewer line. The following cover requirements must be met:

- A minimum of one (1') foot of cover is required where the sanitary sewer is located in rock.
- A minimum of three (3') feet of cover is required in other material. In major streams, more than three (3') feet of cover plus rip rap may be required and the scour depth of the stream should be considered in the design.

Less than the minimum cover will be considered only if the proposed sanitary sewer crossing will not interfere with any future improvements to the stream channel. Other reasons for requesting lesser cover will be considered on a case-by-case basis.

Sanitary sewer pipe in creek beds must be encased in concrete where the cover is less than three (3') feet below scour depth.

Where freezing conditions are anticipated, frost protection and/or arctic insulated pipe must be used. Only passive freeze protection systems will be acceptable.

30.02.06.02 Aerial Crossings

Provide support for all joints in pipes utilized for aerial crossings. Design pipe supports to resist frost heave, overturning and settlement.

Precautions against freezing, such as insulation and increased slope, will be considered. Expansion joints must be provided between above-ground and below-ground sanitary sewers.

For aerial stream crossings, the impact of flood waters and debris must be considered. The bottom of the pipe must be placed no lower than the estimated elevation of the one hundred (100) year flood plain plan established by the MOA Planning Department.

30.02.06.03 Inverted Siphons

Inverted siphons must be installed with no less than two (2) parallel mains, with a minimum pipe size of six (6") inches and be provided with necessary appurtenances for convenient flushing and maintenance. The influent and effluent manholes must have adequate clearances for rodding. Sufficient head is to be provided and pipe size selected to secure velocities of at least three (3.0) feet per second for average flows. The inlet and outlet details must be so arranged that the normal flow is diverted to one (1) main, and that either main may be isolated from service for cleaning. The vertical alignment must permit cleaning and maintenance.

30.02.06.04 Storm Drain Crossings

Where the sanitary sewer main crosses the storm drain, a vertical separation of three (3') feet is to be maintained. If this minimum cannot be maintained, then four (4") inches of insulation (high density extruded polystyrene board stock or equivalent as defined in MASS) is required between the lines. When the storm drain is within three (3') feet of a manhole, the ladder in the manhole must be rotated opposite the storm drain or insulation placed between the storm drain and sanitary sewer manhole to prevent icing on the manhole ladder.

The minimum horizontal separation between sanitary sewer mains and storm sewer mains is three (3') feet measured from the outside of the pipes when the pipes are at the same elevation. When the sanitary sewer mains and storm sewer mains are at different elevations, the horizontal separation distance must be such that neither pipe is located within the trench cross section of the other pipe. The cross section to use shall be OSHA compliant without the use of shoring or sheeting.

30.02.06.05 Railway Crossings

When sewer pipe controlled by AWWU enters lands controlled by the Alaska Railroad Corporation (ARRC), the pipe installation must meet the requirements outlined in ARRC's Technical Standards for Roadway, Trail, and Utility Facilities in the ARRC Right-of-Way and be permitted by the ARRC...

30.02.07 Sanitary Sewer Mains and Services in Relation to Water Mains and Services

A minimum ten (10') foot horizontal and eighteen (18") inch vertical separation (measured from the outside of pipe) between sanitary sewer and water mains and services is required.

30.02.08 Wells

All wells located within two hundred (200') feet of the project limits must be clearly and accurately shown on the plans. The State of Alaska Department of Environmental Conservation (ADEC) well classification (A, B, C, Private Water Source), and the minimum separation distance (radii) for sanitary sewer pipe-to-well and sanitary sewer manhole/cleanout-to-well is to be graphically shown for each well.

The minimum separation distances must be in accordance with the State of Alaska Wastewater Disposal Regulations 18 AAC 72, and the State of Alaska Drinking Water Regulations 18 AAC 80.020, Table A, or as specified by MOA, Department of Health and Human Services.

All wells within two hundred (200') feet of the project limits should be located by a field survey.

If the minimum separation distances cannot be maintained, the engineer is required to prepare all necessary waiver requests for submittal to ADEC. AWWU is requiring review and concurrence of the waiver request prior to the engineer submitting to ADEC. The engineer will be required to comply with all conditions of approval.

30.03 Sanitary Sewer Services

30.03.01 General

Sanitary sewer service lines must be laid in straight runs, except for the beginning sweeps, unless prior approval in writing is received from AWWU Engineering Division in concurrence with AWWU Customer Services Division.

Sanitary sewer service connections extend from the sanitary sewer main to the property line or easement. Sanitary sewer extensions extend from the sewer service connection to the terminus of the service.

In new development, where the mainline sewer and sewer connections are constructed by one entity and a different entity will most likely construct the sewer service extension, AWWU may allow a portion of the sewer service extension to be constructed in conjunction with the sewer service connection. The purpose of the partial sewer service extension construction is to extend the sewer service extension beyond planned and/or constructed adjacent utilities, sidewalks, pathways and/or other permanent surface improvements to limit reconstruction/disruption of newly installed improvements. The development team must submit such requests in writing during the review and approval process.

30.03.02 Connections

Service connections are typically located five (5') to fifteen (15') feet from the property corner in the downhill one-third of the lot. Service connections are be stubbed out to the furthest extent of AWWU maintenance requirements which is typically at the property and/or easement line of each lot that the proposed sanitary sewer main extension serves.

It is the responsibility of the developer to properly size the sewer service line for current and/or future development plans. The designer must coordinate with AWWU to ensure that the capacity of the sewer main is acceptable for the planned and/or future flows.

Sanitary sewers should be sufficiently deep to receive sewage from basements and to prevent freezing. If the standard depth of cover cannot be achieved to the furthest extent of the lot being served, then the service must come off the main at minimum slope to the property line.

30.03.02.01 Off-Property Connection (Main Line Taps)

An epoxy coated Romac Style “CB” sewer saddle or equal must be used when connecting a service to the main. The manufacturer’s installation instructions must be followed. Special care is to be taken to open the correct size hole in the sewer main and it must be no larger than one-eighth (1/8”) inch greater than the outside diameter of pipe to be inserted or the inside diameter of the gasket saddle

Adjoining taps to the main line are not to be closer than three (3’) feet.

Service connections into the sewer main that are closer than five feet (5’) to the mainline manhole will not be accepted and the service must be relocated. Service connections must not be closer than one (1’) foot from a pipe joint.

Service connections are to end with a bell at or past the property line fronting the mainline. If a pressure test of the main or service is required, a pipe pup with plug and connection marker is to be installed. Upon connection to the stub, the contractor is to remove the pup, plug and marker and utilize the existing bell.

30.03.02.02 Service Connection Markers

Services stubbed to the property line or beyond for future use must be marked at the end of the service with a 2" X 4" X 8' marker, protruding three (3’) feet above grade, painted green, and stenciled with the word "SEWER" in white two (2”) inch high letters.

30.03.03 On-Property Service (Extension)

The contractor shall verify the alignment and grade of the existing stub out from the main. Contractor shall make sure the line is free and clear of any obstruction prior to connecting with the service extension. If the contractor notes any deficiencies, AWWU must be notified immediately.

- The lines must be laid in straight runs between fittings
- Each run is to be laid at a uniform grade
- Sanitary sewer cleanout(s) are to be constructed (see cleanout section)
- A control manhole may substitute for a building sanitary sewer cleanout if the control manhole is located within five (5’) feet of the building.
- Romac coupling (or equal) is to be used at any joint where the type of piping changes
- There must be a minimum of five (5’) feet of pipe upstream of the building cleanout and the next fitting.
- Sewer service lines must be tested in accordance with MASS between manhole structures. Where a service line is not bound by two manholes then the exfiltration/infiltration testing will not be required. Line and grade checking procedures will be modified as needed where only one manhole is provided. The modification may require the use of CCTV to locate bellies.

30.03.04 On-Property Service (Extension-stub)

In new development, where the mainline sewer and sewer connections are constructed by one entity and a different entity will most likely construct the sewer service extension, AWWU may allow a portion of the sewer service extension to be constructed in conjunction with the sewer service connection.

The purpose of the partial sewer service extension construction is to extend the sewer service extension beyond planned and/or constructed adjacent utilities, sidewalks, pathways and/or

other permanent surface improvements to limit reconstruction/disruption of newly installed improvements.

Sewer extension stubs must meet the following list of requirements:

- The end of the stub must be plugged and clearly marked with a service connect marker
- Stubs must be pressure tested with the sewer main and sewer service connection
- The design plans, contractor redlines, and record drawings are to provide the planned and constructed location and elevation of the stub at the property line and at the end of the stub.
- Stubs must be a minimum of 10’ in length measured from the property line
- Stubs must not change in direction from the service connection until past the planned improvements
- Stubs are to be terminated with a bell and pup w/plug (for pressure testing).
- Upon connection to the stub, the contractor is to remove the pup and plug and utilize the existing bell

The development team is to submit stub extension requests to AWWU in writing during the review and approval process. The development team installing the sewer mainline and service connections shall also be responsible for the construction, maintenance and warranty of the stubs under the same terms and conditions as stated in the mainline extension agreement.

30.03.05 Sanitary Sewer Extension Appurtenance

30.03.05.01 Control Manholes

On-property control manholes are required for all commercial and industrial structures discharging sewage containing industrial waste into AWWU's system. The control manhole must be installed on existing or new sanitary sewer extensions to facilitate observation, sampling, and measurement of wastes. The manhole must be constructed in accordance with AMC 26.50.130 and private system plans approved by AWWU. The design plans, at a minimum, must include the horizontal location and vertical dimensions of the control manhole. Flow channel construction through a control manhole may not change the direction of flow by more than fifteen degrees (15°) unless approved on a case by case basis by Customer Service Division, Permit Section and Treatment Division, Pre-treatment section.

Control manholes are to be installed on the service extension by the owner(s) at the owner's expense and be maintained by them so as to be safe and accessible at all times.

Control manholes must not be installed in easements, ROW's or within a protective well radius.

AWWU requires the owner to submit a "Notice of Intent to Discharge Industrial Wastewater" form to the Customer Service Division prior to approval of plans. A determination of the necessity of control manhole will be made based on information provided on the form (see AMC Section 26.50.120, or Anchorage Ordinance No. 86-118).

30.03.05.02 Backwater Valves

AWWU tariff and the UPC require a backwater/check valve to be installed within the structure when the lowest outlet is below the elevation of the top of the upstream manhole nearest to the service connection. The backwater/check valve is the responsibility of the owner of the structure.

Sewer backwater/check valves are installed within the limits of a structure and therefore they are the responsibility of the Municipal Building Department for review, permitting, and inspection. AWWU may require installation of a backwater valve within existing structures that have a history of backups.

30.03.05.03 Private Sewage Lift Stations

Where practicable, all plumbing fixtures should be drained to public sanitary sewer. Where a parcel is served by an AWWU gravity sewer main, but the sewer main is too shallow to provide a gravity service, a private lift station may be used. All private lift stations exterior to a building is approved by AWWU and may require submittal to MOA building safety for approval

The service and pumping mechanism(s) must be provided and maintained by the property owner. All costs related to the installation, operation and maintenance of private sewage lift stations are the sole responsibility of the property owner.

Unless otherwise stated by written agreement, a developer of a subdivision requiring a temporary lift station (until gravity sanitary sewer is available) is to be responsible for operation and maintenance of the lift station and all sanitary sewer lines leading into and away from the lift station to the point of connection to public sanitary sewer.

The provisions for pressure mains apply to all on-property, private sanitary sewers and private systems

Administrative authority is to be in accordance with the latest edition of the UPC and local amendments thereto.

- If the lift station is located inside the foundation wall of the structure, the administrative authority rests with the MOA Building Official.
- If the lift station is for a single family residential use and located on private property but outside the foundation wall, and if liquid waste is discharged to a private treatment system, the administrative authority rests with MOA Department of Health and Human Services.
- If the lift station is for a commercial use and located on private property but outside the foundation wall, and if liquid waste is discharged to a private treatment system, the administrative authority rests with the Alaska Department of Environmental Conservation.
- If the lift station is located on private property but outside the foundation wall and if liquid waste is discharged to a public wastewater collection system, the administrative authority rests with AWWU Customer Service Division, Field Service Section.

The owner of a lift station and plumbing system approved by AWWU may be requested to file with the AWWU Operations and Maintenance Division all plans and literature that pertain to the lift station. This information will be used to compile a reference library.

Engineers must submit detailed plans for lift stations for review prior to installation. These plans are to include all the following information:

- A drawing showing the dimensions and capacity of the lift station tank (wet well), and the specific level of the "pump on", "pump off", and "high water alarm";
    - For tri-plex and greater, commercial, and industrial dischargers, the lift station will require duplex pumps.
    - Where duplex pumps are required the installation of two force service lines will be required.
- Construction materials, manufacturing details, insulation details (where applicable), and corrosion protection;
- The make and model of the pump, and the criteria or data used in sizing the pump for the specific application;
    - Grinder pump is required where a S.T.E.P. system is not installed and for lift stations serving commercial business and industrial sites
    - Pump(s) is/are to be retrievable and replaceable from the surface.
- Control panel with;
    - Explosion proof rating
    - Duplex pump operation (where duplex pumps are used)
    - High level alarm must be visual and auditory
- Electrical controls protection from corrosive environments and/or weather;
- The high water alarm located inside the structure being served and on a circuit separate from the pump.
- Lift stations must be protected from damage, including but not limited to, traffic loading, and snow clearing;
- Estimated flows and storage capacity.
- Two force service lines are not required for single to quad complex residential structures, but they are recommended. Two force service lines are the standard for other service lines.

30.03.05.04 Grease Traps

Administrative authority for the use and maintenance of grease traps is with AWWU in accordance with AMC 26.50.150 Wastewater Pretreatment Facilities. Grease traps must be installed in accordance with the AMC 26.50.150D.

30.03.06 Abandonment of Private Disposal Systems

Every abandoned on-property disposal system (cesspool, septic tank, seepage pit, drain field, etc.) must comply with the UPC Appendix K. The contractor shall schedule inspection of the abandoned systems with AWWU Field Service office. The abandoned disposal system must be shown on the record drawings.

30.03.07 Service Connection Abandonment

The abandonment method for disconnection of a sanitary sewer service connect must include one of the following:

- Open Cut Excavation
    i. Service must be disconnected at the property line
    ii. Cut pipe and plug with a watertight cap or end plug
    iii. Install a sanitary sewer service connection marker
    iv. Provide AWWU a record drawing of the abandoned service connection
- Trenchless

i. The service line must be surface located with the use of a sonde locator device within the pipe

ii. The trenchless plug is to be set at the property line.

iii. The service is to be pre-CCTV'd and post CCTV'd to confirm trenchless plug is secure and located at the property line. All video is to be turned over to AWWU.

A disconnect permit will be required from AWWU. The contractor shall schedule inspection with AWWU and furnish the following information:

- Date when disconnect was made
- Where disconnect was made, including but not limited to lot, block, subdivision, address, swing ties, depth, type of pipe and size
- Who disconnected the service
- Owners name, address, and telephone number

An AWWU inspector must observe the disconnection to ensure quality.

30.04 Sanitary Sewage Lift Station

30.04.01 General

This section contains information relevant for designing lift stations and pump stations with a capacity of commonly less than one million gallons per day (MGD). The design and installation of these stations must conform to AWWU requirements and all work is to be in accordance with the latest editions of IBC, IMC, UPC and NEC, all as revised and accepted by MOA. AWWU has created specification templates for use in the design of lift stations that are to be owned and operated by AWWU.

Stations larger than 1 MGD require special design considerations (e.g., generators, fuel facilities, etc.). Design of these stations is to be coordinated through AWWU Engineering Division and conform to MASS, IMC, UPC and NEC, all as revised and accepted by MOA.

30.04.02 Design

30.04.02.01 Equipment Removal

Provisions must be made to facilitate removal of pumps, motors, and other mechanical and electrical equipment.

30.04.02.02 Accessibility and Access

The pumping station must be readily accessible by maintenance vehicles during all weather conditions. The facility must not be located in traffic ways. Where necessary the station must be in a dedicated easement. Stations must not be located in a ditch or snow storage area. The top elevation of the lift station and the elevation of the electrical junction box must be sufficiently above surrounding ground and be protected from any water runoff or any accumulation of infiltration.

Suitable and safe means of access must be provided into dry wells, and to wet wells containing mechanical equipment requiring inspection or maintenance. All controls, sensors and pumps must be removable without entering the wet well.

Plan references will be made to all local, State, and federal safety codes with the most stringent code taking precedence.

30.04.02.03 Construction Materials

Due consideration must be given to the selection of materials because of the presence of hydrogen sulfide and other corrosive gases, greases, oils, and other constituents frequently present in wastewater.

30.04.03 Pumps

All pumps are to be three (3) phase. Where three (3) phase power is not available, a frequency drive unit will be required to add the third phase.

30.04.03.01 Multiple Units

Each station must be designed with at least two wastewater pumps. A minimum of three (3) pumps must be provided for stations handling flows greater than one (1) MGD.

When only two (2) units are provided, they are to have the same capacity. Each unit must be capable of handling maximum flows based on project population and existing data. Where three (3) or more units are provided, they must be designed to fit actual flow conditions and be of such capacity that, with the largest unit out of service, the remaining units must have capacity to handle maximum sewage flows.

30.04.03.02 Pump Openings

Pumps must be capable of passing spheres of at least three (3") inches in diameter. Pump suction, discharge and piping is to be at least four (4") inches in diameter.

30.04.03.03 Priming

Pumps must be of the self-priming type.

30.04.03.04 Electrical Equipment

Electrical systems and components (e.g., motors, cables, conduits, switch boxes, control circuits, etc.) in raw sewage wet walls, or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors may be present, must comply with the National Electrical Code (NEC) requirements for Class 1, Group D, Division I locations. In addition, equipment located in the wet well must be suitable for use under corrosive conditions. Each flexible cable must be provided with watertight seal and separate strain relief. A fused disconnect switch located above ground is to be provided for all pumping stations.

Electrical panels and equipment not located in the wet wells or confined spaces do not need to meet Class I, Division 1, NEC. When such equipment is exposed to weather, it must meet the requirements of weatherproof equipment (NEMA Type 4).

30.04.03.05 Intake

Each pump must have an individual intake. Turbulence should be avoided near the intake. Intake piping must be as straight and short as possible.

30.04.04 Level Controls

In all wet wells, install a US Filter D-153 Duplex Level Controller using the A1000 Level Transducer, or equal. Any substitution to transducer or controller equipment will require review and approval by both AWWU's Engineering and Operations and Maintenance Divisions. The transducer must have the capacity to control pumps, regulate speed drives (if necessary), and indicate and telemeter liquid levels. A typical two (2) pump station requires

low wet well alarm high wet well alarm with redundant high wet well float, lead pump start/stop, lag pump start/stop.

30.04.04.01 Location

The control system must be located away from the turbulence of incoming flow and pump suction.

30.04.04.02 Alternation

In stations designed to handle flows of less than one (1) MGD, provisions are to be made to automatically alternate the pump in use.

30.04.05 Valves

30.04.05.01 Suction Line

Shut-off valves must be placed on the suction line of each pump for a dry pit operation. A wet pit with submersible pump does not require valves on the suction.

30.04.05.02 Discharge Line

Mueller spring and lever type check valves (Model A-2600-6-02 or equivalent) and Mueller non-rising stem gate valves (Model A-2370-6 with hand wheel or equivalent) must be placed on the discharge line of each pump. The check valve is to be located between the shut-off valve and the pump. Check valves are to be suitable for the material being handled and must be capable of withstanding normal pressure and water hammer, and be of the spring and level type to allow manual back flushing of pumps. The gate valve and check valves must be designed for installation above wet pit liquid levels during normal operation.

30.04.06 Wet Wells

30.04.06.01 Size

The wet well size and control setting must be appropriate to avoid heat build-up in the pump motor due to frequent starting and to allow a minimum of two (2) hours detention time at peak flows. In cases where the drainage area is larger than the current number of homes to be served, the station must be designed for both maximum density and current service area.

To size wet wells in residential areas, multiply the maximum number of homes in the service area of the lift station by fifty (50). This value plus the discharge piping drainage will be the total volume in gallons required for the wet well. The wet well controls will then be adjusted for current number of homes in the service area. For business, commercial or industrial areas, the wet well is to be designed to handle the peak flows with two (2) hour retention. Deviation will require justification by the design engineer and approval by the AWWU Engineering Division Director.

30.04.06.02 Floor Slope

The wet well floor must have a minimum slope of one (1) to one (1) to the pump suction. The horizontal area of the hopper bottom must not be greater than necessary for proper installation and function of the inlet.

30.04.07 Ventilation

Adequate ventilation is to be provided for all pump stations. Where the pumps are located in a dry pit, mechanical ventilation is required.

Wet wells must not be mechanically vented. Wet wells are to have a stand pipe for air ventilation. No mechanical or powered ventilation is to be installed in the wet well portion

of the station. All exterior ventilation piping is to be Schedule 40, steel pipe primed and painted to match exterior color of the facility, or forest green as approved by AWWU. The exterior end of the ventilation piping is to be screened with a minimum of one-quarter (1/4") inch stainless steel screen.

30.04.08 Water Supply

There must not be a physical connection between any potable water supply and a sewage pumping station in order to prevent contamination of the potable water supply. If a potable water supply is brought to the station, it must comply with all applicable standards and codes.

30.04.09 Suction Lift Pumps

Sewage suction lift pumps are prohibited.

30.04.10 Submersible Pump Stations

30.04.10.01 Construction

Submersible pumps and motors are to be designed and supplied by the same manufacturer specifically for raw sewage use, including totally submerged operation during a portion of each pumping cycle. The motor must be of squirrel-cage type design without brushes or other arc-producing mechanisms.

30.04.10.02 Pump Removal

Submersible pumps must be readily removable and replaceable without dewatering, disconnecting any piping, or personnel entry.

30.04.11 Electrical

30.04.11.01 Power Supply and Control

Electrical supply and control and alarm circuits must be designed to provide strain relief and to allow disconnection from outside the wet well. Terminals and connectors are to be protected from corrosion by location outside the wet well or through use of watertight seals. If located outside, weatherproof equipment is to be used.

30.04.11.02 Controls

The motor control center is to be located outside the wet well and protected by a conduit seal, or other appropriate measures meeting the requirements of NEC, to prevent the atmosphere of the wet well from gaining access to the control center. The seal must contain two spare conductors as a backup so the seal will not need to be broken should a conductor fail. The seal must be located so that the motor can be removed and electrically disconnected without disturbing the seal. The location of the wet well junction box is to be identified at the motor control center.

30.04.11.03 Power Cord

Pump motor power cords are to be designed for flexibility and serviceability and must meet the requirements of the Mine Safety and Health Administration for trailing cables. Power cord terminal fittings must be corrosion-resistant and constructed to prevent the entry of moisture into the cable, be provided with strain relief appurtenances, and are to be designed to facilitate field connection. Power cords are to have the ability to be disconnected without entering the wet well or submerged station. This will require construction of an external junction box vault.

30.04.12 Alarm Systems

Electrical contacts, as specified by AWWU Operations and Maintenance Division, must be provided in addition to electrical interfacing specific to the project.

30.04.13 Emergency Operation

Pumping stations and collection systems must be designed to prevent or minimize bypassing of raw sewage. A four (4") inch female cam lock fitting is to be provided on the discharge piping to facilitate emergency by-passing. For use during possible periods of extensive power outages, mandatory power reductions, or uncontrolled storm events, consideration should be given to providing a controlled, high-level wet well overflow to supplement alarm systems and emergency power generation. This will prevent backup of sewage into basements, or other discharges that may cause severe adverse impacts to public interests, including public health and property damage. Where a high level overflow is utilized, consideration must also be given to the installation of storage and/or detention tanks, or basins, which is to be made to drain to the station wet well. Where such overflows affect public water supplies, surface water or waters used for culinary or food processing purposes, storage and/or detention basin, or tanks, are to be provided having two (2) hour detention capacity at the anticipated overflow rate.

30.04.14 Equipment Nameplates and Manuals

For each sanitary sewage lift station and pumping station, provide thee (3) complete sets of operation and maintenance manuals and one electronic copy that matches the paper copies. In addition to the record drawings of the facility, provide a record drawing of all the electrical schematics and drawings (see Section 50.0l). Each operation and maintenance manual must include: operational procedures to be followed in case of blockage, power outage, circuit overload, or emergency; station shut down and start up procedures, including lock out/tag out requirements; routine maintenance tasks and a schedule for all equipment and assemblies; a list of any special tools required to operate or maintain the station; and mechanical and electrical drawings of the facility.

In addition to the facility manuals, provide six (6) complete sets of equipment manuals for each item of equipment and each instrument panel in the facility. Each equipment manual , at a minimum, must contain:

Summary showing:

- Make, model, style, serial number, description, manufacturer's specifications, and location in the construction.
- Full names and addresses of manufacturer, vendor, prime contractor and installer.

Manufacturer's literature properly marked to identify the specific item. The literature is to include:

- Instruction for installation, operation, maintenance, and repair.
- Shop drawings, wiring diagrams, and system layouts, where such drawings are required in other sections of the specifications.
- Each piece of major equipment in the station must have nameplates affixed in an accessible location which includes make, model, serial number, manufacturer and power requirement.

30.04.15 Station Cover

Station cover must be of a suitable material for each application, (e.g., reinforced steel meeting H-loading requirements for vehicle traffic, aluminum for standard no load applications). Lid must be sized large enough to allow straight pulls for removing and resetting pumps.

30.04.16 Electric Disconnects

There must be an electrical disconnect within twelve (12') feet of the station.

30.04.17 Control Panels

All panels exposed to weather must be NEMA Type 4 (or equal) lockable enclosures. Panels are to be self-supporting pad mounted or electrical pole mounted and approximately five (5') feet at center elevation. All frost susceptible materials under pad location must be removed to a minimum depth of four (4') feet and replaced with a non-frost susceptible material with a fine granular texture containing material not larger than one-half (½") inch in diameter. This material must be compacted to a minimum of ninety-five percent (95%) maximum density compaction. The control panel's meter base must be located as close as possible to the wet well in order to comply with NEC regulations and eliminate the need for a wet well mounted disconnect switch.

30.04.18 Sensors

Displacement type liquid level sensors should be of Flygt Company manufacture (or equal) and is to consist of a mercury switch in a smooth chemical resistant casing. The sensors must detect low wet well and high wet well. The sensors is to be suspended by cable from a stainless steel hanger securely mounted in the wet well. The hanger must be accessible from the hatch.

30.04.19 Wet Well Lighting

Each wet pit control panel is to have at least one grounded twenty (20) amp duplex outlet. AWWU will supply portable lighting to the station. Lights and outlets are forbidden from the wet well environment.

30.04.20 Corrosion

All equipment in manholes and/or wet wells is to be water-tight and corrosion-protected as defined in the specifications for the project and the manufacturer's specifications for equipment.

The designer should anticipate the presence of hydrogen sulfide and bacteria that consume hydrogen sulfide to produce sulfuric acid. Structures associated with pressure mains and lift stations should account for lower PH levels on the walls, ceilings, and floors of the structure.

30.04.21 Controls

The fluid level controls are to be adjustable so that a minimum restart time of five (5) minutes for the pumps may be obtained.

Each facility must be equipped with dry contacts to accommodate AWWU's Supervisory Control And Data Acquisition (SCADA) system. Additional dry contact criteria may be obtained from the AWWU Engineering Division.

30.04.22 Supervisory Control And Data Acquisition (SCADA)

All lift stations must be designed and constructed with SCADA equipment that is compatible with AWWU's SCADA equipment. Section 70.04 lists the minimum necessary SCADA equipment.

The designer is to verify that the telemetry equipment has the following:

- Minimum RSSI value of -78dB at 1 Watt
- Radio Path Analysis (AWWU will provide to the developer, upon request)
- Consideration for future build-out based on current zoning and development of the land between the radio communication system and the receiver.
- Easements to secure a clear radio shot (developer acquired if need be)
- Permits for construction and operation of the radio communication system

AWWU will limit tower height to a maximum of thirty-five feet (35') located such that an AWWU bucket truck can access the full height of the tower.

30.05 Pressure Sanitary Sewer (Force) Mains

30.05.01 Size of Pipe

The minimum size for DIP, HDPE and PVC piping is four inches (4"). Copper pipe must be used for pipes 3" or smaller. Designs using HDPE and PVC material must show through calculations or manufacturer data that the pipe material will not fatigue to the point of failure because of cyclical loading for the life of the pipe. The type of pipe selected for force mains is to comply with the authorized material list.

All bends are to be restrained and be capable of withstanding water hammer created by the wastewater pumps and other sources. Where the pressure mains enter or exit a manhole or other collection or discharge area, it is to be secured to prevent separation from such area.

30.05.02 Continuity Straps

All ductile iron pressure sanitary sewer mains are to have continuity straps installed as directed by AWWU (e.g. thawing, cathodic protection, or future connections to cathodic protection). Straps must be installed in accordance with standard specification for water systems. A continuity test will be made on the completed system. On-property DIP and copper pressure sanitary sewer systems must have continuity for purposes of thawing.

30.05.03 Testing

Pressure sanitary sewer mains are to be hydrostatic pressure tested. The hydrostatic pressure test will be one hundred fifty (150) psi, or fifty (50) psi above the surge rate for the wastewater pump, whichever is greater.

30.05.04 Draining of Force Main

Where applicable to prevent sewage from becoming septic, pressure mains must be designed to backflow into the wet well. The wet well pump discharge line is to have a spring and lever type check valve which can be manually operated once the pumping stops. The wet well is be sized to handle the backflow sewage from the force main in addition to the normal sizing.

30.05.05 Force Main

At least two force mains are to be provided for all stations. The second force main is to be used for maintenance, alternating flows and emergencies.

Both force mains must have the capacity to handle maximum sewage flows when one or the other is out of service. Plans and record drawings are to include the pipe type, pipe class, size horizontal dimension between pipes, horizontal dimension to easement lines, lot lines, ROW, and etc.

30.05.06 Air-Relief Device

All high points of the force main are to have an appropriate air relief device. Plans must include the horizontal location and vertical elevation of all air relief devices. Record drawings are required to include manufacturer, make and model of all air relief devices.

30.06 Wastewater Treatment

30.06.01 General

Each plant is subject to such requirements as the AWWU Engineering Division Director may indicate based upon locale, degree of treatment, safety, layout, auxiliary equipment required for proper operation and maintenance, access, or any other item peculiar to that plant which may be required by AWWU.

30.06.02 Treatment Plant

AWWU operates and maintains wastewater treatment plants for the following service areas: Eagle River, Anchorage Bowl and Girdwood/Alyeska.

30.06.03 Pretreatment Facilities

All public sanitary sewer users must meet requirements as stated in AMC Chapter 26.50, Sewer Service; federal Pretreatment Requirements (40 CFR Part 403) and federal Categorical Pretreatment Standards.

Specifically, the following articles within AMC Chapter 26.50 apply.

AMC 26.50.050 Prohibited acts
AMC 26.50.060 Specific discharge limitations
AMC 26.50.090 Dilution of discharge as substitute for pretreatment is specifically prohibited
AMC 26.50.120 Notice of intent for non-domestic discharges
AMC 26.50.130 Control manhole required for non-domestic discharges
AMC 26.50.150 Wastewater pretreatment facilities required
AMC 26.50.170 Industrial Management Practice plans required
AMC 26.50.200 Requirement to obtain wastewater discharge permit
AMC 26.50.410 Recovery of costs incurred by the utility

Subject to review, AWWU may require equalization units to prevent peak flow conditions from adversely affecting operation of the sanitary sewer system. Said equalization or holding unit must have a capacity suitable to serve its intended purpose and be equipped with acceptable outlet control facilities to provide flexibility in operation and accommodate changing conditions in the waste flow.

It is the responsibility of the customer to install and satisfactorily operate and maintain pretreatment units at the owner's expense (AMC 26.50.150).

40.00 DESIGN AND CONSTRUCTION OF WATERWORKS

40.01 General

All property desiring water service from MOA must be located within AWWU's service area as certified by the Regulatory Commission of Alaska (RCA), unless a special exception is authorized by the RCA.

The developer or a designated design engineer shall submit water demands for the development and AWWU will model the projected demands. If the existing water distribution system is not adequate to serve the proposed development, the project will not be approved for construction until the capacity of the distribution system has been augmented.

Improvements to the transmission main system are made primarily through AWWU's Capital Improvements Program (CIP). If a developer desires to proceed ahead of the CIP, the developer must finance the cost of the portion of the CIP project required to reach and front the property. The size of the water line or pumping station will be determined by a facility or master plan adopted by AWWU. If the required size exceeds the needs of the development, the participation of oversizing will be available when the funds for the specific CIP project are available.

Estimate water use requirements in accordance with UPC, AWWA and sound civil engineering practice. The Fire Prevention Division of the Anchorage Fire Department shall determine the minimum fire flow requirements.

40.02 Standard Water Design Elements

40.02.01 Design Data

Water main design data and calculations may be required by the AWWU Engineering Division. The design data and computations for water typically include: average and peak demands, fire demand, future requirements, probable pressures, losses, calculations, computations for determining pipe sizes, project cost estimates, and proposed construction schedule.

40.02.02 Distribution System

Design of new water extensions will need to ensure that it is compatible with the existing grid network of the established transmission and distribution system. Interties to the existing system will be required wherever possible to establish loops. Refer to the large diameter water transmission mains section for additional requirements.

When evaluating the existing system for flow and pressure, the following criteria is to be used:

1. The Hazen-Williams equation where C = 100.
2. Hydrant flow test data, orifice size, and assumed coefficient of discharge.
3. Fire flow available at twenty (20) pounds per square inch residual pressure.
4. Minimum and maximum pressures as defined in the AWWU Water Tariff and the latest edition of the AWWU Water Master Plan.

40.02.03 Authorized Materials and Fittings

The following materials are approved for water mains and services and must be installed and tested in accordance with MASS.

1. Ductile Iron, Class 52 pipe
    a. must have a cement mortar lining
    b. must conform to the requirements of AWWA C-150 ("Thickness Design of DIP")

   c. must conform to the requirements of AWWA C-151 ("Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids")
2. "Tyton" joints (for ductile iron)
3. Type K seamless copper tubing
   a. with a 26 Mil thick (minimum) polyethylene coating (Aqua Shield or equal) or
   b. with a field applied Denso Tape and Denso Paste coating or
   c. with an coating system equal to or better than a or b and approved by the AWWU Engineering Division Director.
   d. Flare joints or silver soldered copper joints
4. HDPE (High Density Polyethylene) pipe
   a. must conform to the requirements of AWWA C906
   b. must be manufactured from PE4710 polyethylene compounds that meet or exceed ASTM D3350 Cell Classification 445574
   c. must have a minimum two hundred (200) psi pressure rating
   d. must be certified by the NSF for potable water service
   e. must contain color and ultraviolet (UV) stabilizer meeting or exceeding the requirements of Code C per ASTM D3350
   f. electrofusion fittings must comply with ASTM F1055
   g. fittings must have pressure class ratings not less than the pressure class rating of the pipe to which they are joined
   h. outside diameters must conform to iron pipe size (IPS)
   i. HDPE pipe will not be allowed for use at sites with contaminates or have the potential to have soils with contaminates above the most stringent ADEC cleanup levels
   j. minimum size must be four inches (4”)
   k. inner diameter must be approximately the same as Class 52 DIP (e.g. 10” HDPE SDR 11 pipe would be used to replace 8” CL 52 pipe)
5. PVC Polyvinyl Chloride (PVC) pipe
   a. must conform to the requirements of AWWA C900 or C905
   b. that meets AWWA C900 and have a DR of 18
   c. that meets AWWA C905 PVC have a DR of 18
   d. PVC pipe must have a minimum two hundred (200) psi pressure rating
   e. All bends must be constructed with ductile iron fittings and have restrained joints
   f. Concrete thrust blocks are to be used at all fittings that change the direction of water flow by more than 5° in addition to the restraint requirements.
   g. Standard length should be twenty feet (20’), shorter lengths may be permitted for 4” and 6”pipe
   h. C900 & C905 Pipe must have an outside diameter equivalent to DIP sizes
   i. must be blue in color
   j. must not be bent or flexed
   k. must not be deflected at a bell and spigot
   l. must be deflected through the use of ferric fittings and deflection couplings, including PVC deflection couplers. Deflection within in the joint may take place at a metallic fitting at 80% of the manufacturers recommend deflection allowance.
   m. must not be over stabbed
   n. over-insertion devices must be used. EBAA Iron Mega-Stop™ or equal must be used to prevent over-insertion. North American Specialties Products Certa-Lok®

pipe and IPEX Terrabrute® CR pipe do not need permanent over-insertion protection as the built in pipe restraint system prevents over insertion.

   o. all fittings and apparatus attachments must be restrained

6. Pipe gaskets must be selected based on the service environment of the pipe
7. Mechanical joints
8. All appurtenant piping materials must conform to the requirements of MASS or as specified within this manual
9. All pipes and fittings must be NSF 61 certified for potable water systems
10. AWWA C110 & C153 fittings
11. Brass components in contact with potable water are to comply with Public Law 111-380 (No Lead Rule).

A soil corrosion evaluation will be required when the design engineer proposes corrosion protection that is different from the AWWU standard. The soil corrosion evaluation must be performed prior to pipe material selection and submitted with the initial engineered plan review. Pipe material recommendations shall contain an engineered analysis supporting the pipe material selection and corrosion protection system that must indicate an expected 70-year design life of the pipe.

All designers submitting plans for water projects must, at a minimum, review the Alaska Department of Environmental Conservation (ADEC) Division of Spill Prevention and Response maintained data base of Contaminated Sites for nearby contaminated sites and perform soil data collection as described in Section 20.

Engineered plans for projects in areas of known or suspected hydrocarbon, semi-volatile organic compounds, or volatile organic compound contamination are to be submitted with an engineered analysis supporting the pipe, coating and gasket material selection.

Metallic pipe is to have two (2) electrical continuity straps installed on each side of every joint for all pipe diameters. Straps are to be welded to a clean, dry surface. Each exothermic wire weld connection is to be protected with one (1) field applied Royston Handy Cap IP or equal. Uncoated surfaces are to be coated with coal tar pitch to the satisfaction of the Engineer. Split bolts or mechanical bolt connection of the wires will not be allowed.

Detectable underground warning tape is required for installation of all pipe types. Warning tape must not be less than five (5) mil, foil backed, six inches (6”) wide vinyl tape, colored blue, with “Caution Buried Water Line Below” continuously printed in black along the tape length. The warning tape must be continuously laid with the pipe and be at least eighteen inches (18”) above the pipe.

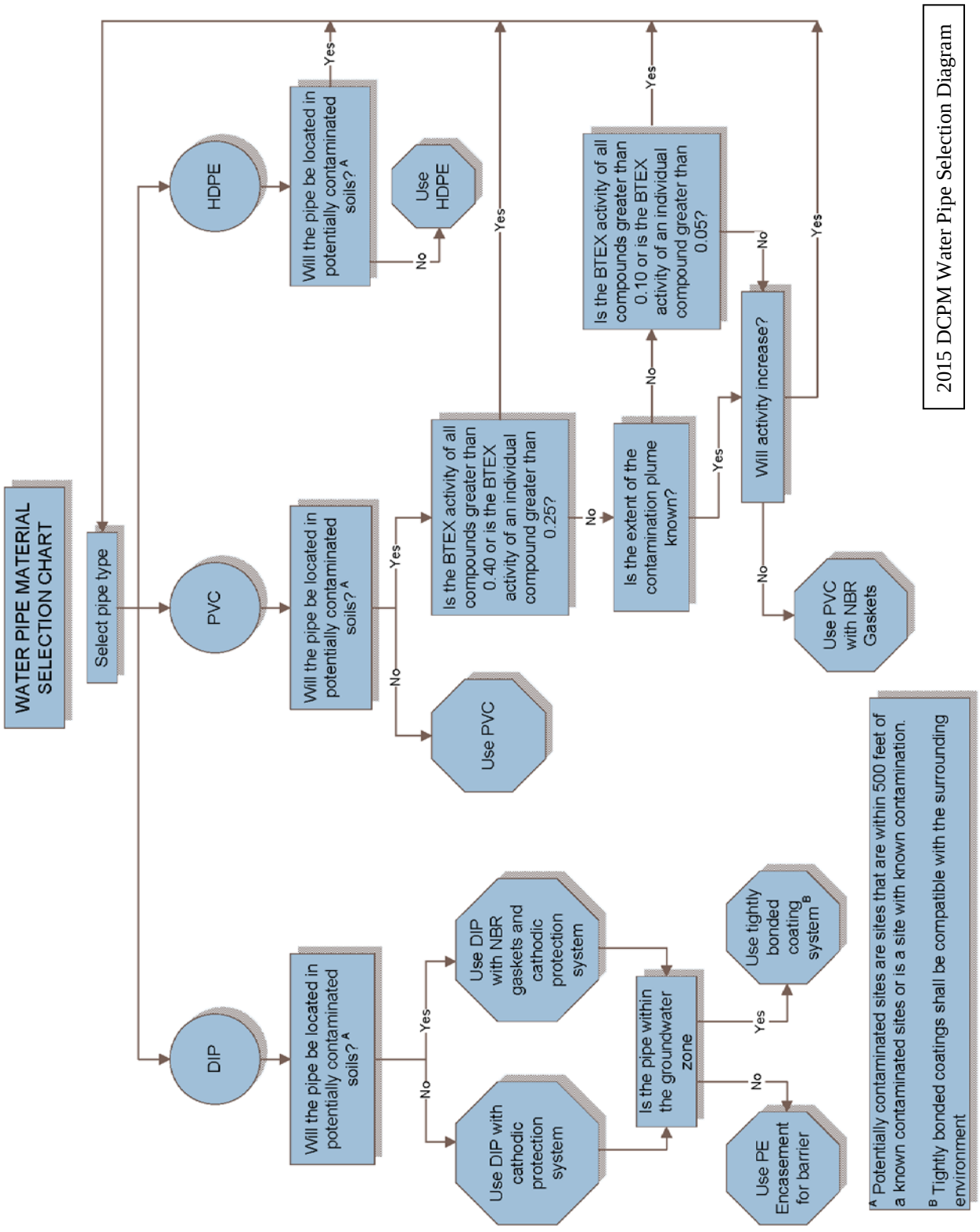
Tracer wire must be installed on all non-metallic water mains. Tracer wire must be suitable for direct bury and be 10 AWG with 30-mil HDPE jacket colored blue. Trace wire must be continuous. When allowed by the Engineer, splices must use Copperhead Industries, LLC connector, part #3WB-01 or equal.

40.02.04 Unauthorized Material and Fittings

1. ABS (Acrylonitrile Butadiene-Styrene)
2. Aluminum or steel corrugated metal
3. Galvanized or black iron pipe
4. Mild steel or seamless conduit
5. Smaller than four inch (4”) HDPE and PVC Pipe for water services

6. Concrete Pipe
7. Transite
8. Wood stave
9. Lead or non-silver solder.

40.02.05 Pipe Material Selection Flow Chart



40.02.06 Minimum Size

40.02.06.01 Main lines

The minimum diameter of water mains for providing fire protection and serving fire hydrants must be equivalent to eight (8") inch diameter Class 52 ductile iron pipe (DIP). Larger size mains will be required if necessary to allow the withdrawal of required fire flow while maintaining minimum residual pressure of twenty (20) psi at ground level at all points in the distribution system.

For commercial and industrial districts, mains on collector streets are to be a minimum equivalent to twelve (12") inch diameter Class 52 DIP. A minimum of an eight (8") inch diameter Class 52 DIP may be used on streets designated smaller than collector if fire flows permit.

Smaller mains may be allowed for cul-de-sacs and dead end mains, as justified by hydraulic analysis. No water main is to be less than the equivalent of six (6") inch diameter Class 52 DIP.

If AWWU desires mains larger than the maximum development needs including fire protection requirements, AWWU may pay oversizing costs as described in the current AWWU Water Utility Tariff.

40.02.06.02 Commercial and industrial service connections and extensions

The minimum size service for commercial and industrial connects is to be based on the planned and future use of the site. On-site fire hydrants and building fire protection systems should be included in calculating the size of the water service.

40.02.06.03 Residential service connections and extensions

The minimum size of residential service connections and extensions is one (1) inch. All service connections must be sized in accordance with the latest edition of the UPC. Supporting information used to determine the size of the service may be required for plan approval.

The following guideline for service connections and extensions should be used:[2]

1 - 2 living units: one (1") inch service connect

3 - 4 living units: one and one-half (1 ½") inch service connect

5 or more living units, industrial, commercial, or business serving twenty-five (25) or more employees or the general public at a minimum is to be sized based on the submitted engineering recommendation. AWWU may require a larger service based upon potential lot development.

Existing service connections must be upgraded to meet the current edition of the Uniform Plumbing Code when;

- calculated peak velocities within the water service connection and extension exceeds ten feet per second (10ft/sec). Required flows is to be based upon fixture counts and engineering judgment

[2] This guideline is based upon typical development needs. Larger than average structures, fire suppression systems, large building setback from water main and other needs may require an increase in service size.

- less than 15 psi of residual pressure can be maintained at the furthest fixture
- the MOA building official requires a service extension size greater than the service connection.

The owner and/or applicant can request a waiver from this requirement. All waiver requests must be in writing, supported by engineered analysis, and be approved by the AWWU Engineering Division Director.

40.02.07 Depth of bury

Standard depth of bury is ten feet (10') to the top of pipe. Deviations with less than the standard depth will require prior approval of the AWWU Engineering Division. When cover on existing pipe becomes less than the standard due to road improvements that cause a permanent grade change, grading within easements, erosion, etc., the existing water line is to be lowered or insulated, as directed by AWWU. Additional depth of bury is recommended in cul-de-sacs and other permanent dead end situations to protect against freezing.

The maximum sustained depth of cover (longer than 20') is twelve (12') feet for water services and mains.

The use of vertical grade breaks is required when lowering existing shallow water mains to attain standard depth of cover. Four (4") inches of 60 psi rated insulation board must be used over the transition area from shallow main to standard depth main.

40.02.07 Dead Ends

The designer must consider water turnover and impacts dead ends have on water quality. Water quality discharge points are to be installed at the end of every dead end main. Water quality discharge points are sized based on the size of the dead end main. Water quality discharge point for a typical dead main in a cul-de-sac may have a minimum of two service connections within 6' of the end of the line. Fire hydrants may be an acceptable water quality discharge point.. The discharge point is to be called out for and placed into the design. All water quality discharge points must be reviewed and approved by AWWU.

40.02.08 Fire Hydrants and Flow requirements

40.02.08.01 General

The Anchorage Fire Department must approve the location (whether installed in the street or on the premise, number and performance requirements of fire hydrants connected to the water supply for the purpose of providing fire protection (delivering fire flow). Typical spacing between fire hydrants is five hundred (500') feet in residential areas. Reference the current edition of the International Fire Code, Appendix C, Table No. C105.1, as amended by the AMC, for required number and distribution of fire hydrants. The table on the next page represents minimum number of fire hydrants and average spacing between fire hydrants. This table is provided by AWWU for assistance in design and stationing of fire hydrants. Consult the Anchorage Fire Department for updates or additions to this table or current codes.

The Anchorage Fire Department approves all fire hydrant locations. Permits will not be issued and plans will not be approved without approval of fire hydrants from the fire department. The engineer must submit approved plans with original fire department signatures to AWWU. A connection permit will not be issued prior to AWWU and AFD approval.

FIRE-FLOW REQUIREMENTS (gpm)	MINIMUM NO. OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS[a,b,c] (FEET)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT[d]
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more [e]	200	120

For SI: 1 foot = 304.8mm, 1 gallon per minute = 3.785 L/m

a. Reduce by one hundred (100') feet for dead-end streets or roads

b. Where streets are provided with median dividers that can be crossed by firefighters pulling hose lines, or arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing is to average five hundred (500') feet on each side of the street and be arranged on an alternating basis up to a fire flow requirement of 7,000 gallons per minute and four hundred (400') feet for higher fire flow requirements.

c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants are to be provided at spacing not to exceed one thousand (1,000') feet to provide for transportation hazards.

d. Reduce by fifty (50') feet for dead-end streets or roads.

e. One hydrant for each one thousand (1,000) gallons per minute or fraction thereof.

Fire hydrants are to be placed at common lot lines five (5') feet inside the ROW from the property line and shown as such on the plans. State whether the fire hydrant is a single or a double pumper. Plans must provide a horizontal dimension measured from the property line to the fire hydrant. Plans must provide the pipe type, size, class and bearing of the fire hydrant leg. Plans must provide the lineal footage of the fire hydrant leg as measured horizontally from the center of the fire hydrant to the center of the tee. Valves for the fire hydrants must be installed on all fire hydrant leads per MASS Standard Details.

Hydrants and fittings must be installed a minimum of fifteen (15') feet from power poles or transformer pads and a minimum of ten (10') feet from any structural foundation or other appurtenance such as sanitary sewer lines, storm drains, footing drains, light poles, or electrical/telephone/cable boxes.

Hydrants must not be placed within sidewalks, proposed or existing drives, or within other utilities' easements without an encroachment permit. When Municipal maintained fire hydrants are placed outside of the Municipal ROW, a permanent maintenance easement around the hydrant must be provided. In addition to the maintenance easement around the fire hydrant, an access easement must be provided to the hydrant. The maintenance easement is to be a minimum of twenty feet (20') wide, centered on the hydrant lead and extending five (5') feet beyond the back side of the hydrant. Access easements are to be of sufficient size and width to remove and replace the hydrant and hydrant leg.

All single-pumper hydrant leads are to be six (6") inches in diameter and installed on both eight (8") and ten (10") inch water mains.

All double-pumper hydrant leads are to be eight (8”) inches in diameter and installed on mains twelve (12”) inches and larger. Exception may be granted in residential areas where fire flows do not require double pumper and the main has been oversized for distribution.

All fire hydrant legs must be insulated with a minimum of R-20 per four (4”) inch thickness of extruded polystyrene rigid board insulation.

Hydrants must be readily accessible to the Fire Department at all times. During construction, material or equipment must not be placed within five (5’) feet of an active fire hydrant.

Hydrant barrels must be wrapped with Denso Tape and Denso paste or equal with three layers of polyethylene baggies or wrap over the Denso Tape from the hydrant shoe to the finish grade.

40.02.08.02 Private Fire Hydrant

Any fire hydrant located on private property will be classified as a private fire hydrant. These hydrants are owned by, and are the responsibility of, the owners of the property. AWWU will provide a winter check and servicing to private hydrants for operational readiness. Any repair work or other major service may be provided pursuant to written agreement with AWWU on a cost reimbursement basis. All private fire hydrants must be adjusted to grade in accordance with MASS. The adjustment to grade may be done by the owner with AWWU inspection or adjusted by AWWU on a reimbursable basis.

40.02.08.03 Fire Hydrant Guard Posts

Guard posts or equivalent protection must be installed around each fire hydrant in accordance with MASS Details. The only exception will be in a residential development where the fire hydrant is placed behind the curb and sidewalk areas and the location is approved by AWWU.

40.02.08.04 Fire Flows

Fire flow must be sustained for the duration listed in Appendix B, Table No. B105.1 of the current edition of the International Fire Code, as amended by the AMC. The Fire Prevention Division of the Anchorage Fire Department will make the final determination of the specific fire flow required. In most cases, the fire flow duration cannot come from a single well source. Therefore mains and reservoirs may be required.

The minimum fire flow requirements for one (1) and two (2) family dwellings having a fire area that does not exceed 3,600 square feet shall be one thousand (1,000) gallons per minute. Fire flow and flow duration for dwellings having a fire area in excess of 3,600 square feet must not be less than that specified in Table B105.1 of the International Fire Code, including any local amendments.

The following table was extracted and is reprinted from Appendix B, Table B105.1 of the current edition of the International Fire Code, as currently amended by the MOA. Consult the Anchorage Fire Department for updates or additions to this table or current codes.

FIRE AREA (square feet)					FIRE FLOW (gallons per minute) [b]	FLOW DURATION (hours)
TYPE IA and IB[a]	TYPE IIA and IIIA[a]	TYPE IV and V-A[a]	TYPE IIB and IIIB[a]	TYPE V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	
22,701-30,200	12,701-,17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	2
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,400-21,800	11,301-13,400	3,000	
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	3
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-23,600	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	23,601-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	4
----	----	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
----	----	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
----	----	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
----	----	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
----	----	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
----	----	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
----	----	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
----	----	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.
[a] Types of construction are based upon the International Building Code
[b] Measured at twenty (20) psi

40.02.08.05 Fire Lines

Fire lines must be sized for fire flow requirements of sprinkler systems, fire hydrants, and domestic services if provided. Fire lines are to be installed in accordance with MASS. Newly constructed fire lines that fail testing procedures as defined in MASS cannot be repaired with a bell repair clamp. Repairs must be made with mechanical joint sleeves rated at a minimum of two hundred (200) psi. Fire lines are to be fully restrained.

40.02.09 Crossings

40.02.09.01 Sanitary Sewer Lines

In the planning and design of a water main extension, encountering existing sanitary sewer mains is possible and probable. Many of the existing sanitary sewer systems will be of construction materials other than ductile iron pipe.

Existing sanitary sewer mains above water mains being installed, that are less than twenty-four (24") inches in diameter and are fabricated of material that typically have pipe segments shorter than eighteen feet (18') must be replaced. The crossing is to conform to the MASS and AWWU modified MASS detail for water line lowering. The replacement pipe is to extend ten (10') feet on both sides of the water crossing, with the joints equidistant and as far as possible from the water main joints. Water mains are to be designed and constructed to provide a minimum of eighteen (18") inches vertical separation, measured outside to outside of pipe.

Survey the existing sanitary sewer main inverts upstream and downstream of the proposed crossing to ensure that a minimum of eighteen inches of vertical separation is maintained between the planned water and existing sewer. If the water main is calculated to be within twenty-four (24") inches of the sewer main or if the water pipe bedding material is within eighteen (18") inches of the sewer main, then the sewer main must be exposed and surveyed to confirm that eighteen (18") inches of vertical separation is achieved.

Existing sanitary sewer mains twenty-four (24") inches and greater in diameter will be reviewed individually by the AWWU Engineering Division for replacement requirements.

Where a water main crosses under an existing sanitary sewer, adequate structural support must be provided for the sanitary sewer to prevent damage to the sanitary sewer main. Sanitary sewer and water crossings must be in accordance with ADEC regulations (18AAC 80.20.f.3.D & 18AAC 72.20.g.2.D). The more stringent of the ADEC or AWWU requirements will govern. Use the provided ADEC waiver flow chart in section 20 to figure out if an ADEC separation waiver would be required.

40.02.09.02 Storm Drains

Water lines crossing storm drains require a minimum vertical separation of three (3') feet. If this minimum cannot be attained, then four (4") inches of extruded or expanded polystyrene insulation is required between the lines. Eighteen (18") inches is the minimum insulated separation distance. If eighteen (18") inches cannot be obtained, the water line will have to be relocated. The more stringent of the ADEC or AWWU requirements will govern. Use the provided ADEC waiver flow chart in section 20 to figure out if an ADEC separation waiver would be required.

40.02.09.03 Rivers/Streams

Water lines crossing streams with a top width greater than ten (10') feet require valves on each side of the crossing. Valves will be located back from the banks to prevent damage from lateral bank migration.

40.02.09.04 ADOT/PF Crossings

Water facilities and public facilities located within ADOT/PF rights-of-way must be installed in accordance with ADOT/PF permits.

40.02.09.05 Railway Crossings

When water pipe controlled by AWWU enters lands controlled by the Alaska Railroad Corporation (ARRC), the pipe installation must meet the requirements outlined in ARRC's Technical Standards for Roadway, Trail, and Utility Facilities in the ARRC Right-of-Way and be permitted by the ARRC.

40.02.10 Valves

Valves requirements for four inch (4") and larger services and mains are as follows:

General:

- Valves are to have the same diameter as the pipe on which they are installed.
- A sufficient number of valves must be installed so that a break or other failure will not affect more than one thousand (1000') feet of main.
- Valves should be installed on the loop network at such places as to isolate branch sections as may be necessary.
- A minimum of two (2) valves must be installed at tees and a minimum of three (3) valves at crosses, with one valve on the downstream side of the fitting.
- Three (3) valves are required at tees, and four (4) valves are required at crosses where water may be supplied from more than one direction. Tees and crosses installed for a single user or fire hydrant will not be subject to this requirement.
- Valves in street intersections are to be set at the fitting, such as a tee or cross.
- Valves are to be located inside the paved area where pavement exists.
- All valve cans material must be wrapped with a minimum of one layer eight (8)-mils of polyethylene encasement.
- Existing valves intended to serve new extensions are to be used unless unserviceable. New valves must not be installed in sequence with existing valves except where active services exist downstream of the existing valve.

Valves on Fire Hydrants:

- Valves must be installed on all fire hydrant leads and in all cases must be tied back to the main with restrained joints. Refer to MASS details for location.

Valves on Stub Outs:

- Provide a valve at the main for stub outs with continuity straps installed, and restrained joints placed the entire length from the main to the plug at the end of the stub out.
- A valve will be required at the end of the service connection for the on property portion of the service when:
  a. a valve does not exist at the main
  b. the valve at the main is in a road classified as an arterial (major or minor) or higher designation as provided in the MOA Official Streets and Highways Plan
  c. the permit holder and/or contractor want to separate new construction from existing pipe for the purpose of pressure testing

Gate Valves:

- All water pipe between four inches (4") to sixteen inches (16") in diameter must have resilient seat gate valves furnished and installed in accordance with MASS.

Butterfly Valves:

- Butterfly valves are to be installed on all mains larger than sixteen (16”) inches.
- Butterfly valves are to be installed with the operating nut located on the side of the main to the nearest property line and must be furnished in accordance with MASS.

40.02.11 Mainline Live Taps

Main line taps two (2”) inches and smaller are to be done by a licensed and bonded contractor. The mainline tap must be accomplished with an appropriate tapping or drilling machine which has the appropriate capability of drilling, threading, and inserting a corporation stop under pressure with a minimal loss of water. Tapping saddles are to be used for taps two inches (2”) and smaller with the exception that one (1”) inch taps into ductile iron pipe can be direct taps. Stainless steel tapping sleeves are to be used for taps larger than two inches (2”). Taps larger than two (2”) inches and smaller than twelve inches (12”) must be done by AWWU personnel (prior arrangements for reimbursements are needed). Main line branch connections larger than twelve inches (12”) in diameter require the installation of a fully restrained tee or cross in the existing main, unless AWWU approves use of a twelve (12”) inch live tap with a reducer to connect to the new main line branch.

Taps are to be made at sufficient distances from other each other, tees, bells and other areas to prevent compromising the structural integrity of the pipe being tapped. The engineer should provide direction based on manufacturer’s information and construction industry standards on the plans. In lieu of direction given on the plans, taps are not to be made any closer than three feet (3’) to each other or to a bell, with the exception of ductile iron pipe, where taps may be made at twelve inches (12”) apart.

All connects require a permit issued by the AWWU Permit Office. Live taps completed by a contractor must be witnessed by an AWWU inspector on a cost reimbursement basis. The Contractor is to schedule live taps to be performed by AWWU through the AWWU Maintenance Division a minimum forty-eight hours in advance of the anticipated need. Live taps proposed on mains larger than twelve inches (12”) may require additional time for ordering and receiving of parts.

The contractor who pulled the live tap permit is responsible for all trench excavation, shoring, bracing, backfill and compaction to achieve an acceptable live tap trench when AWWU personnel complete the live taps. For the safety of Utility Company personnel, trenching and excavation is to be completed such that it meets the more stringent requirements of OSHA and the Utility Company’s safety program. When shoring is used, the shoring certificates and/or engineered shoring designs (stamped by a registered engineer) are to be on-site and available for review.

The live tap trench must be long enough and of sufficient width at the bottom to allow installation of the valve and live tap connection. Typical live taps require a minimum of seven feet (7’) from the face of the main being taped and a minimum clearance of one foot (1’) around the remainder of the water main being tapped. The minimum trench width is four feet (4’) when the tapping machine is centered in the tapping trench. The contractor is to excavate for live tap connections in such a manner that the excavation is ninety degrees (90°) to the main water line. Different configurations may be acceptable to AWWU personnel, but they must be approved by the tapping crew foreman.

The Utility Company will provide the staff, tapping machine, tapping saddle, connection valve and valve box (top section, riser and bottom section). The contractor is responsible for installing all parts and providing other items necessary to pass inspection. The Contractor shall provide all necessary equipment and manpower to assist Utility Company personnel in

moving piping, valves, tapping machines and miscellaneous items into and out of the trench during the entire time Utility Company personnel are working to complete the installation of the water live tap.

Taps will not be permitted on reinforced concrete cylinder pipe, wood stave, and some classes of asbestos cement pipe unless approved by the AWWU Engineering Division. Live taps on pipe with a Cured in Place Pipe (CIPP) liner are to be done by AWWU personnel.

40.02.12 Thrust Restraint

Thrust Restraints:

- Bends, tees, crosses, fire hydrant legs and dead-ends must have designed and installed thrust restraint.
- It is the responsibility of the engineer to review soil conditions and design the thrust restraint applicable for the project. Poor soil conditions will require special consideration.
- For DIP, thrust restraint must be provided through the use of mechanical thrust restraint devices such as EBAA Iron MEGALUG® fittings (or equal) on all mechanical joints and U.S. Pipe FIELD LOK® gaskets (or equal) on all push-on joints. The engineer is to calculate and show on construction plans the total distance from the fitting that will require restraint. Use of a computer model such as DIPRA Computer Restraining model is recommended. The profile view is to show the beginning and end stationing of the calculated length of pipe that is to be restrained.
- The constructed location of thrust restraint must be shown on the record drawings.
- Thrust blocks must be installed behind the existing main for all live taps.
- The engineer is to provide thrust restraint calculations for HDPE and connections of HDPE to existing pipe.
- All pipe types will require thrust restraint if tied into existing nonrestrained pipe The engineer must calculate the total distance from the connection that will require restraint and provide thrust restraint recommendations.
- Concrete thrust blocks are to be installed in addition to mechanical restraint systems on all PVC pipe installations.
- Pipe sections less than ten feet (10’) in length cannot be incorporated into the work, unless required for alignment changes. .

40.02.13 Special Structures

Special structures, such as pumping stations, storage tanks, diversion valves, meter vaults, PRV, etc., are subject to special thrust restraint consideration and must be designed in close coordination with AWWU.

40.02.14 Large Diameter Transmission Mains

The following includes general guidelines for large diameter transmission mains and is not all inclusive. These systems, defined as pipelines twenty (20”) inches in nominal diameter and larger, must be specifically designed by qualified engineers experienced in the design and construction of large diameter pipelines in Alaska. This experience, at a minimum, should include seismic, corrosion, thermal, water surges/transient analysis, and materials considerations for transmission piping. Information in this section that is contrary to information in other sections overrides the information furnished in those other sections.

Accepted pipe materials for large diameter transmission mains are limited to welded steel pipe, concrete pressure pipe, and ductile iron pipe as the corrosion analysis (see Section 20.10) allows. Alternate materials must be approved in writing by the AWWU Engineering Division Director.

The system must be designed in accordance with the following AWWA manuals:

AWWA M9 Concrete Pressure Pipe Design
AWWA M11 Steel Pipe Design
AWWA M41 Ductile-Iron Pipe and Fittings

The design needs to include pipe bedding and backfill material, thrust restraint, pipe wall thickness, fittings, freeze protection and depth of bury, pressure ratings of fittings and appurtenances, test heads and connections for pressure and disinfection testing, utility crossings, surge/transient analysis, soil corrosivity evaluation, coatings and cathodic protection systems, linings, blowoffs and combination air release valve assemblies (CARVs) for draining and filling the line, pipe locations markers, cathodic protection test stations, easement and TCP width, access manways and other O&M access concerns, future connections, surface restoration, dewatering plans, and erosion control and stormwater pollution and prevention plans.

Thrust restraint on steel and CCP is to be done through the use of double fillet welds or CJP butt welds. Thrust restraint with DIP is to be done with U.S. Pipe TR-FLEX® (or equal), as U.S. Pipe FIELD LOK® gaskets (or equal). EBAA Iron MEGALUG® fittings (or equal) are not acceptable for thrust restraint on large diameter pipelines, unless given prior written approval through AWWU. Thrust blocks and thrust collars will be considered on a case by case basis, and must receive prior approval through AWWU.

A soil corrosivity evaluation (Section 20.10) must be done as part of the design and include both AC and DC stray current analysis. As a result of the soil corrosivity evaluation, a report of the evaluation and proposed corrosion control design and calculations must be submitted to AWWU for approval. At a minimum, the pipe system must be designed with a sacrificial anode cathodic protection system with test stations and must be installed in conjunction with a tightly bonded coating system. The pipe and CP system must be designed for a combined minimum 70 year service life. The CP system must be designed by a cathodic protection specialist that must co-stamp the cathodic protection drawing and detail sheets.

Acceptable forms of tightly bonded coatings for buried applications include plural component polyurethane per AWWA C222, fusion bonded epoxy per AWWA C116 and C213, cement mortar coating per AWWA C205 and tape coating per AWWA C209 and C214. Polyethylene (PE) encasement is a barrier and is not an acceptable coating system. Wax tape per AWWA C217 and heat shrink sleeves per AWWA C216 are acceptable forms of tightly bonded joint coating protection for coating joints.

All large diameter transmission main design and installations must follow the coating requirement in section 20.11 Industrial Coating Applications and section 20.10.04 Protective Coatings.

40.03 Water Services

40.03.01 General

The criteria in this section apply to service connections and extensions.

All water services connections extend from the water main to the property line or to the edge of the easement whichever is greater from the mainline. Copper water services are to have a key box installed at the end of the connection (i.e. - property or easement line). Larger service connects typically have a valve near the main with a plug at the property or easement lines.

Care must be taken to construct services that are free of scrapes, nicks, gouges, dents, or kinks. Copper thaw wires must not contact copper service lines. Trench excavation is to be done in such a manner as to prevent damage to the service line, and backfill will be of material outlined in MASS. The service lines must achieve minimum depth and be bedded with material to prevent damage to the service line.

- The service connections must be laid in straight runs, perpendicular to the property line.
- Copper pipe within the ROW and/or easement must be continuous. Use of three (3) part unions is prohibited unless otherwise approved by the AWWU representative.
- The lines must be set at a uniform grade except where grade changes are necessary to maintain minimum/maximum cover, maximum depth of keybox and/or to avoid other underground utilities.
- Extend copper services a minimum of five feet (5') inside the footings at ten feet (10') of depth. Four inch and larger services may terminate closer than five feet (5') with arctic protection.
- One inch (1") copper service lines are to have an anode connected to the key box and have electrical continuity to the copper pipe and curb stop.
- Larger than one inch (1") copper service lines are have an anode connected to the copper service extension within 1' of the keybox with the use of a bronze ground clamp listed for direct bury.
- Services constructed of material other than copper, such as DIP, must be cathodically protected.

40.03.02 Meters

Any water service extension that requires a meter per AWWU's water tariff must have a meter installed.

Install water meters in accordance with the UPC, best plumbing practices and the requirements of this section. Water meters are mandatory for four (4) plex and larger apartments and all commercial buildings. Water meter sizing is based on expected (average daily) demands which is nominally fifty (50%) percent of maximum flows (demand). Selection of meter size will be determined by AWWU based on the expected demand and maximum flows supplied by the Owner or Engineer.

The following table represents maximum meter flows:

Size (Displacement Meter)	**Max Normal Flows (GPM)**
5/8-inch	20
3/4-inch	30
1-inch	50
1 ½-inch	100
2-inch	160
Size (Compound Meter)	**Max Normal Flow (GPM)**
2-inch	200

3-inch	450
4-inch	1000

Selection of meter size will be based on expected demand, regardless of service extension diameter, and is subject to approval of the AWWU Customer Service Division.

All water supplies must have an acceptable means of metering the finished water.

Meters are to be installed in a horizontal position and located ahead of any branched lines.

Meters must be installed in a dry, frost proof and easily accessible open area not concealed by appliances, furnace, water heater, building materials or storage items. Meters three (3") inches and larger in diameter are to be installed with at least three (3) times the pipe diameter clearance, measured from the extremity of the meter to any other piping, wall, etc. and is to be at least one (1') foot above the floor measured from the top of the floor to the bottom of the meter. Meters one and one-half (1½") and two (2") inches in diameter must be installed with at least six (6") inches of clearance measured from the extremity of the meter to any other piping, wall, etc. and must be at least six (6") inches above the floor measured from the top of the floor to the bottom of the meter. Meters one (1") inch in diameter and smaller must be installed with at least three (3") inches of clearance measured from the extremity of the meter to any other piping, wall, etc. and is to be at least three (3") inches above the floor measured from the top of the floor to the bottom of the meter. All meters are to have at least eighteen (18") inches of clearance above the meter. Meters are to be installed no higher than forty-two (42") inches above the floor without an approved platform.

Meters may be installed in a crawl space provided the depth of the crawl space as measured vertically from the ground to the bottom of the floor joists is a minimum of forty (40") inches. The crawl space must be illuminated and have a permanent ladder installed. The meter must be within ten (10') feet of the access to the crawl space. The entry to the crawl space must not be blocked and be a minimum of twenty-four (24") inches wide by thirty (30") inches long. Otherwise, the meter must be installed above the finish floor or the crawl space access dimensions must be approved by AWWU Customer Service prior to installation of the meter.

Meters must not be installed in a pit environment. When used to meter manufactured mobile offices, meters must be installed above the finish floor and not in the 'skirted' area below the office.

All compound and turbine meters must have a length of horizontal pipe that is no less than five (5) times the diameter of the meter size immediately before the meter strainer and a length of horizontal pipe that is also no less than five (5) times the diameter of the meter size immediately after the meter. Any and all valves, fittings, taps, etc, must be installed before and after the horizontal pipes that are connected to the meter and strainer assembly.

40.03.03 Water Connections into Transmission Mains

Water service connections less than six (6") inches in diameter are prohibited from connecting to water transmission mains. AWWU may allow connection into a transmission main with a six (6") inch or larger service connection if no other source of service is available.

To minimize damage by future construction, it is expected that the first customer to install a transmission main connection will install the service connection to the adjoining lot. There will be no reimbursement for the installation to the adjoining lot.

40.03.03.01 Procedures

Any proposed water service connection to an AWWU transmission main must be approved by the AWWU Engineering Division Director.

All requests for connections are to be in writing from the legal owner of the parcel. Requests will be reviewed on a case by case basis with a written response for approval or denial.

Eligibility for connections will be limited to parcels having no alternative solution or source of service. For example, corner lots where a lateral main can extend in another ROW will be denied direct connection to the transmission main and will require a lateral extension.

Connections will be limited to transmission mains with adequate pressure and type of material suitable for tapping (i.e., DIP or CIP). Method of tapping into an HDPE pipe will be assessed on a case by case basis and requires prior approval from AWWU.

The owner of the parcel requesting service will be liable for all costs in permitting, assessing, constructing (including the live-tap cost), and inspecting the connection. NOTE: Because of warehouse limitations, AWWU may not have the tap materials on hand. Therefore, some lead time may be required for ordering the materials.

40.03.04 Service Connect Markers

Services stubbed to and/or on property for future use must be marked with a wooden 2" x 4" a minimum of eight feet (8’) long protruding above the ground three (3’) feet, painted blue and stenciled with the word "WATER" in white two (2”) inch high letters.

40.03.05 On-Property Service (Extension)

40.03.05.01 General

The contractor is to ensure that the key box is in good working condition prior to installing the service extension. If the key box is not in good condition, the contractor must not tie the extension on to the key box, AWWU is to be notified immediately.

40.03.05.02 Property and Easement Line Fittings

Property line fittings must be consistent with material outlined in the standard details of MASS.

AWWU will require larger services (typically services other than copper) to install a gate valve at the property/easement line when the gate valve installed during a live tap will be in a major arterial as defined in the MOA Official Streets and Highways Plan.

40.03.06 On-Property Service (Extension-stub)

In new development, where the mainline water and water connections are constructed by one entity and a different entity will most likely construct the water service extension, AWWU may allow a portion of the water service extension to be constructed in conjunction with the water service connection.

The purpose of the partial water service extension construction is to extend the water service extension beyond planned and/or constructed adjacent utilities, sidewalks, pathways and/or other permanent surface improvements to limit reconstruction/disruption of newly installed improvements.

Water extension stubs must meet the following list of requirements:

- The keybox must be installed at the standard location.

- Stubs are to maintain minimum cover from planned and/or existing grades, whichever provides the deepest cover to the point of terminus and then extend vertically to a minimum of three feet (3') above ground for flushing and testing
- Stubs are to be pressure tested with the main and service connection
- The end of the stub must be clearly marked with a service connect marker
- The design plans, contractor redlines, and record drawings are to provide the planned and constructed location and elevation of the stub at the property line and at the end of the stub.
- Stubs must be a minimum of 10' in length measured from the property line
- Stubs must not change in direction from the service connection until past the planned improvements
- Connection to the stubs for the completion of the service extension is to be accomplished by making a clean cut in the copper pipe one foot (1') from the vertical bend and joining the copper pipe with a flared 3-part union or swaged silver solder joint.
- The curb stop used to complete the pressure test cannot be used as the union.
- The existing stub is to be flushed prior to connection of the remaining portion of the extension by utilizing the service keybox.

The development team is to submit stub extension requests to AWWU in writing during the review and approval process. The development team installing the water mainline and service connections shall also be responsible for the construction, maintenance and warranty of the stubs under the same terms and conditions as stated in the mainline extension agreement.

40.03.07 Keyboxes

Keyboxes with a curb stop are required to be installed at the property line or easement line, whichever is a greater distance from the water mainline. The keybox typically designates where AWWU responsibility for maintenance and repairs stops. The key box must not be installed closer than ten feet (10') to a known or proposed structure. Keyboxes located within pavement or concrete are to be adjusted to finish grade and installed in a valve box adjustment sleeve per MASS details. Adjustment of keyboxes is to be accomplished by removing the keybox lid, installing a black iron pipe coupling, installing a section of black iron pipe, and replacing the keybox lid at the finish grade.

Keyboxes are to be telescoping, furnished with a lid, have an arch pattern base and may be constructed of cast or ductile iron. The operating rod and connection pin are to be constructed of stainless steel alloy type 304 or 316. The connection pin is to be a minimum of 3/16"Ø by two inches (2") long.

40.03.08 Service Connection Abandonment

AWWU requires the contractor to obtain a disconnect permit and allow AWWU to inspect the disconnect to ensure quality. Contractors performing the work are required to provide the following information to AWWU:

- When disconnect is scheduled

- Where disconnect will be made, including, but not limited to, lot, block, subdivision, address, swing ties; and pipe depth, type, and size
- Who disconnected the service
- Obtaining a right-of –way permit

The abandonment method for disconnection of a copper water service at the main line will include the following:

1. Turn off corporation stop
2. Cut or disconnect copper
3. For three-quarter (¾") and one (1") inch services, placement of a solid copper retainer disc (Mueller Co. Catalog No. H-15535 or equal) on the end of the corporation stop and securely tighten with the flair nut
4. For greater than one (1") inch services, cut copper pipe within one (1') foot of corporation stop, crimp cut end of copper and securely tighten the flair nut
5. Cut or disconnect thaw wire
6. Remove keybox and operating rod
7. Record drawing of the abandoned service connection

Abandonment of larger services requires that the service line must be capped and or blind flanged at or cut out of the main. This may include, but not be limited to, removal and replacement of water main pipe, blind flanging tapping sleeves, capping tees. This work will most likely require a water turnoff.

40.04 Well and Pumping Plants

40.04.01 General

Criteria related to well and pumping plant design can be found in "Improving Well and Pump Efficiency", Otto J. Helweg, Scott, Verne H., and Scalmanini, Joseph C., 1983, published by the American Water Works Association and the "Recommended Standards for Water Works" (a.k.a. "10 States Standards"), Great Lakes-Upper Mississippi River Board of State Sanitary Engineers, current edition. By reference, the above documents, or an alternate approved in writing by AWWU, are made a part of this manual.

40.04.02 Pump Design

Consideration is to be given to the existing and future service area when designing pumping equipment. When areas are not at maximum development, pumps are to be designed to meet the ratio-to-peak flows for the current users.

40.05 Booster Stations

All booster station facilities shall be designed as above ground structures to maintain the sanitary quality of pumped water. Subsurface package stations, pits or pump rooms and inaccessible installations are to be avoided. Use of a subsurface station requires written approval from the AWWU Engineering Division Director.

The design and installation of these stations shall conform to the latest edition of MASS and all work is to be in accordance with the latest editions of IBC, IMC, UPC and NEC. (All, as amended and accepted by MOA).

40.05.01 Location Considerations

The station must be located so that the proposed site will meet the requirements for sanitary protection of water quality, hydraulics of the system and protection against interruption of service by fire, flood or any other hazard. Additional design considerations are:

- Functional aspects of the building layout
- Provisions for future building expansion
- Site grading and drainage elevated to a minimum of three feet above the highest recorded flood elevation, or protected to such elevation
- Graded around the station so as to lead surface drainage away from the station
- Designed with a site plan to include secondary access roads with level parking for maintenance trucks and equipment and with access to the doors of the station and related walkways
- Compatibility with surrounding architectural designs
- Exterior fencing
- A site for snow storage

40.05.02 Building Layout

Design must provide for:

- Adequate space for the installation of additional units if needed, and for the safe servicing of all equipment
- Durable construction, fire and weather resistant, with outward-opening doors
- A floor elevation of at least six (6") inches above finished grade and drained in such a manner that the quality of potable water will not be endangered. Floors must slope at least three (3") inches in every ten (10') feet to a suitable drain
- A suitable outlet for drainage from pump glands without discharging onto the floor
- Accessibility of equipment for operation, servicing, and removal
- Hydro-pneumatic tanks

40.05.03 Standby Power

If power failure results in cessation of minimum essential service, power supply must be provided from at least two (2) independent sources, a standby or an auxiliary source may be required by AWWU.

Standby power may be required by AWWU. If not, the station is to be wired for external hook up for a portable generator. Electrical supply and control and alarm circuits are to be designed to provide strain relief and to allow disconnection from outside the booster station. Terminals and connectors must be protected from corrosion and located outside the booster station. When located outside, weatherproof equipment is to be used. The booster station must have a disconnect switch with a manual transfer switch including an external plug to match portable generation. Contact AWWU Operations and Maintenance Division for correct generator receptacle connection. The electrical disconnect and transfer switch must be within twelve (12') feet of the station.

40.05.04 Meters

When required by AWWU, booster stations are to have meters installed per AWWU and MASS details and meet SCADA requirements.

40.05.05 Equipment Nameplates and Manuals

For each station, provide six (6) complete sets of operation and maintenance manuals. Each operation and maintenance manual must include: operational procedures to be followed in case of blockage, power outage, circuit overload, or emergency; station shut down and start up procedures, including lock out/tag out requirements; routine maintenance tasks and

schedule for all equipment and assemblies; a list of any special tools required to operate or maintain the station; and mechanical and electrical drawings of the facility.

In addition to the facility manuals, provide six (6) complete sets of equipment manuals for each item of equipment and each instrument panel in the facility. Each equipment manual must contain:

Summary showing:

- Make, model, style, serial number, description, manufacturer's specifications, and location in the construction.
- Full names and addresses of manufacturer, vendor, prime contractor and installer.

Manufacturer's literature properly marked to identify the specific item. The literature must include:

- Instruction for installation, operation, maintenance and repair.
- Shop drawings, wiring diagrams, and system layouts, where such drawings are required in other sections of the specifications.

Each piece of major equipment in the station is to have nameplates affixed in an accessible location which includes make, model, serial number, manufacturer, and power requirement.

40.05.06 Equipment Servicing

AWWU Operations and Maintenance Division will review and approve all equipment necessary for servicing a booster station. At a minimum, booster stations must be provided with:

1. Crane-ways, hoist beams, eyebolts, or other adequate facilities for servicing or removal of pumps, motors, or other heavy equipment
2. Openings as needed (i.e. roof penetration) for removal of heavy or bulky equipment (largest)
3. A convenient tool board or other facilities as needed, for proper maintenance of the equipment

40.05.07 Heating

Stations must have a natural gas heater as the primary heat source with an electric heater for back-up heating. Heating equipment must meet all applicable codes.

40.05.08 Ventilation and Dehumidification

Ventilation and dehumidification must conform to existing local, state and/or federal codes. All ventilation switches are to be located at the entryway.

40.05.09 Lighting

Pump stations must have adequate lighting for installation, removal and maintenance of all equipment. All electrical work is to conform to NEC.

40.05.10 Pumps

At least two (2) pumping units are to be provided. More than two pumps may be required to meet all flow conditions. With any pump out of service, the remaining pump or pumps must be capable of providing the maximum daily pumping demand of the system. The pumping units are to be approved by AWWU and:

1. Have ample capacity to supply the peak demand without dangerous overloading

2. Be driven by a prime mover able to operate against the maximum head and air temperature which may be encountered
3. Be low maintenance pumps
4. Have any unique spare parts or tools readily available

40.05.11 Booster Pumps

Booster pumps must be located or controlled so that:

1. They will not produce negative pressure in the suction lines
2. The intake pressure must be at least twenty (20) psi when the pump is in normal operation
3. Automatic cutoff pressure must be at least ten (10) psi in the suction line
4. Automatic or remote control devices is to have a range between the start and cutoff pressure which will prevent excess cycling
5. A bypass is available

40.05.11.01 In-line Booster Pumps

In addition to the other requirements of this section, in-line booster pumps must be accessible for servicing and repairs.

40.05.12 Supervisory Control And Data Acquisition (SCADA)

All stations must be designed and constructed with SCADA equipment compatible to AWWU which will report data from the station in both operation and out of service modes. All stations must be electrically-operated and controlled and have a signaling apparatus of proven performance. Installation of electrical equipment is to conform to the applicable State and local electrical codes and the National Electric Code. Section 70.04 of this document lists the minimum SCADA equipment necessary. Telemetry requirements in the sanitary sewer lift station must also be met.

40.05.13 Appurtenances

40.05.13.01 Valves

Pumps are to be adequately valved to permit satisfactory operation, maintenance and repair of the equipment. Each pump is to have a positive-acting pressure reducing valve on the pump discharge prior to the shut-off valve. All valves are to be epoxy coated. The valve harness design must be determined by AWWU.

40.05.13.02 Piping

In general, piping must:

- Be designed so that the friction losses will be minimized
- Not be subject to contamination
- Have watertight joints
- Be protected against surge or water hammer
- Be such that each pump has an individual suction line have a manifold ensures similar hydraulic and operating conditions
- Adequate vibration dampers
- Paint coating per Section 20.11 of this manual

44.05.13.03 Gauges

Each pump is to have standard pressure gauges on the suction and discharge lines and telemetry lines to measures and discharge (when required by AWWU) flows. All gauges are

to be high quality four (4") inch glycerin filled with one-quarter (¼") inch national pipe threads (Ashcroft or equal). The pressure range of the gauges must be specific so that the normal system working pressure does not exceed sixty (60%) percent of the pressure range of the gauge.

44.05.13.04 Water Seals

Water seals must not be supplied with water of a lesser sanitary quality than that of the water being pumped. Where pumps are sealed with potable water and are pumping water of lesser sanitary quality, the seal must:

- Be provided with a break tank open to atmospheric pressure
- Have an air gap of at least six (6") inches or two (2) pipe diameters, whichever is greater, between the feeder line and the spill line of the tank.

44.05.13.05 Controls

Pumps, their prime movers and accessories must be controlled in such a manner that they will operate at rated capacity without dangerous overload and should provide for lead/lag operation of multiple pumps. Where two (2) or more pumps are installed, provision must be made for independent alternation. Provisions are to be made to prevent energizing the motor in the event of a backspin cycle. Electrical controls must be located above grade.

44.05.13.06 Water Pre-lubrication

When automatic pre-lubrication of pump bearings is necessary and an auxiliary power supply is provided, the pre-lubrication line must be provided with a valved bypass around the automatic control so that the bearings can, if necessary, be lubricated manually before the pump is started.

40.05.14 Painting

All booster stations must be completely painted inside and outside including, but not limited to, all walls, piping, equipment, appurtenances, etc. The facility must be painted in accordance with the best building practices of the International Building Codes. (Reference Section 20.11 of this manual)

40.06 Pressure Regulating Valve (PRV) Stations

40.06.01 General

PRV stations must be designed to maintain the sanitary quality of the water system. Inaccessible installation must be avoided. The PRV station must be generally an above ground facility so located that the proposed site will meet the requirements for sanitary protection of water quality, hydraulics of the system and protection against interruption of service. No PRV station shall be subject to flooding. The design and installation shall conform to the latest edition of MASS and all work shall be in accordance with the latest editions of IBC, IMC, UPC and NEC. (All, as amended and accepted by MOA).

All PRV stations shall be designed with the same considerations as provided in Section 40.05 of this manual. Underground vaults shall only be designed on special conditions approved by the AWWU Engineering Division Director.

40.06.02 PRV Station Design

The station shall be:

1. Readily accessible at all times
2. Graded around the station so as to lead surface drainage away from the station

3. Designed with a site plan to include level parking of maintenance trucks and equipment, including a site for snow storage
4. Protected to prevent vandalism and entrance by unauthorized persons or animals
5. Designed with adequate space for the installation of additional units if needed, and for the safe servicing of all equipment
6. Of a pre-fabricated or cast in place durable construction, weather-resistant and waterproofed as required by AWWU. Precast manhole sections may not be considered as an acceptable alternate by AWWU
7. Provided with sump pumps, crane-ways, hoist beams, eyebolts, or other adequate facilities for servicing heavy equipment
8. Completely painted inside and outside including, but not limited to, all walls, piping, equipment, appurtenances, etc
9. Key locked entries
10. Sump pumps and discharge lines
11. Stairway access when ever possible.

40.06.03 Stairways, Ladders and Bilco Hatches

When a PRV station is approved as a vault, stairways, ladders and lockable "Bilco" hatches must:

1. Be provided in pits or compartments which must be entered
2. Have handrails on both sides, and treads of non-slip material
3. Be designed per IBC

Stairs are preferred in areas where there is frequent traffic. They must have risers not exceeding nine (9”) inches and treads wide enough for safety.

40.06.04 Heating

Provisions must be made for heating in accordance with the IBC, UPC and NEC. Whenever possible, install gas heating. In PRV stations not occupied by personnel, only enough heat need be provided to prevent freezing of equipment or treatment process.

40.06.05 Ventilation

Ventilation must conform to existing local, State and/or federal codes. Adequate ventilation must be provided for all PRV stations. Forced ventilation of at least six (6) changes of air per hour shall be provided for:

1. All compartments, pits and other enclosures below ground floor
2. Any area where an unsafe atmosphere may develop or where excessive heat built up
3. Ventilation switched at the access entry of the facility

Ventilation plans are to be submitted with the preliminary station design plans.

40.06.06 Dehumidification

In areas where excess moisture could be hazardous to human safety or could cause damage to equipment, means for dehumidification are to be provided.

40.06.07 Lighting and Electrical

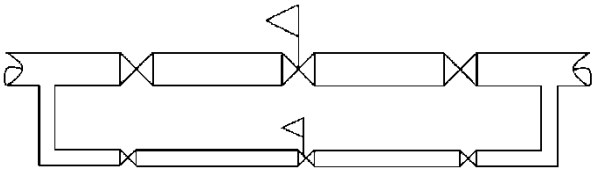
PRV stations are to be adequately lighted throughout. All electrical work is to conform to the requirements of any related agency and to the relevant local, State and/or federal codes. Lighting and electrical plans must be submitted with preliminary design plans.

40.06.08 Dual Valve Installation

Isolating butterfly valves are required to service the reducing valves.

The battery or compound installation is desirable when a wide range of flows is required. Usually the smaller valve is adjusted for a discharge pressure setting of three (3) to five (5) psi above the setting of the large valve so that the small valve will handle the low flow requirements. The large valve opens only when the demands exceed the capacity of the smaller valve and pressure drops to the pressure setting of the large valve. While initially more expensive, savings in maintenance costs make this a more economical installation over the long run.

LARGE REDUCING VALVE
(Handles High Flows)



SMALL REDUCING VALVE
(Handles Low Flows)

Advantages:

1. Reduces maintenance costs and noise which result from a large valve operating at low flows
2. Avoids hunting action of a single large valve operating at low flows and the resulting pressure fluctuations
3. Provides uninterrupted service while servicing or replacing one of the reducing valves

40.06.09 Design Check List for Reducing Valve

1. Have the inlet and outlet pressures been determined?
2. Have the maximum and minimum flow rates been determined?
3. Is there adequate differential pressures for proper valve action (ten (10) psi for four (4") and six (6") inches, five (5) psi for eight (8") inches and larger)?
4. Are there quick acting valves in the system? (This may require a separate cushioning device.)
5. Design maximum continuous line velocity at fifteen (15) fps.
6. If a single reducing valve is used, is a manual bypass installed?
7. Does wide range of flows call for dual installation (large and small valve in parallel)?
8. Does a high differential or low flow rate call for special trim materials (i.e., stainless steel)?
9. Does high differential and low outlet pressure make cavitations likely?
10. Is valve sized properly for differential pressure and flow rates (not necessarily line size)?
11. Is the valve properly supported (under flanges and not under bottom cap)?
12. Is there adequate clearance above and around the valve to facilitate servicing?
13. Are there inlet and outlet pressure gauges?
14. Proper gauges and telemetry devices?

40.06.10 Sizing Reducing Valve

The correct sizing of a pressure regulating valve depends on several factors: differential pressure, maximum and minimum flow rates, anticipated future requirements, etc. Each application must be investigated using its own conditions.

The maximum flow rates are intended to limit the line velocity to approximately fifteen (15) fps. The valve should be capable of passing larger quantities of water for relatively short periods of time.

All valves (when in good operating condition) must be capable of drip-tight shut-off. Wide fluctuations in flow are best handled by using the dual valve installation illustrated in Section 40.06.08 of this manual.

40.06.11 Supervisory Control And Data Acquisition (SCADA)

All PRV's must be designed and constructed with SCADA equipment compatible to AWWU which will report data from the PRV both operation and out of service modes. All PRVs must be electrically-operated and controlled and have a signaling apparatus of proven performance. Installation of electrical equipment is to conform to the applicable State and local electrical codes and the National Electric Code. Section 70.04 of this document lists the minimum SCADA equipment necessary. Telemetry requirements for the PRV is to meet the same requirements as stated in the section covering sanitary sewer lift stations

50.00 RECORD DRAWINGS AND FINAL DOCUMENT SUBMITTALS

50.01 General

AWWU requires approved record drawings, survey notes and contractor field installation notes as a condition of final acceptance for all constructed or partially constructed sanitary sewer and water improvement projects. All record drawings to be submitted should be done so in accordance with the procedures set forth in this section. Furthermore, record drawings must also be in accordance with those regulations as set forth by the State of Alaska Department of Environmental Conservation for both wastewater and/or water systems (Wastewater Disposal Regulations 18 AAC 72 and Drinking Water Regulations 18 AAC 80, latest editions). Submitted record drawings not meeting ADEC regulations will not be considered approved.

50.02 Record Drawing Information

Record drawing information required in the submittal for acceptance includes a complete set of drawings, construction contractor's field installation notes of the facilities as-constructed, engineer's inspection reports, all lab and on-site materials testing reports/results, original construction field survey notes, and the original copy of the approved "Certificate of Construction for Domestic Wastewater Systems" and/or "Construction and Operation Certificate for Public Water Systems" as required by State of Alaska Department of Environmental Conservation.

50.03 Drawings

Record drawings submitted for acceptance are to be of good quality original single matte film with a minimum thickness of three (3) mil, legibly printed and rendered to provide for clear blue line copies and microfilm slides and prints. The record drawing reproducible single matte film must contain the same data shown on the construction contractor’s field installation notes, appropriate symbols and identifiers of data provided by the construction contractor, and data provided by the engineer.

Record drawings are to identify or include:

1. Construction Contractor's name.
2. Engineering firm's name and address.
3. All certifications or professional seals as required by the State of Alaska Department of Environmental Conservation's regulations as stated in the foregoing.

50.04 Procedures for Changes to Original Drawings

All revised work must be in a permanent drafting style black ink and in size, type and scale of the original drawing. AWWU will reject record drawing done with ball point and non-black ink pens. A straight line must be drawn through any changes in stationing, elevations and other notes that have been revised. The correction must be in italic and show any changes, deletions or omissions, and must be followed with the appropriate symbol. Any utility line or construction note that has been deleted or relocated must be crosshatched with the original information remaining legible.

The scale and line weight of new utilities, as-built information or new construction must conform to the scale of original drawings.

Reference information used in preparation of record drawings, such as inspector's prints and field installation books, must be noted on drawings.

Profile changes must be made with elevations or stationing only. The original profile line need not be modified unless the change is greater than one (1’) foot.

50.05 Revisions

Revisions to drawings are defined as all changes made between the dates the project plans are approved by AWWU and the date the record drawings are accepted as complete by AWWU.

The particular area of the drawing where a major revision has been made must be clouded, and the appropriate revision number placed in a triangle must be shown in that location. The clouded area must not be shaded or in any form of grey tones.

Revisions must be listed in the title block of the drawing and show:

1. The revision number in a triangle (revisions must be consecutively numbered on each drawing beginning with number one (1))
   Note: A particular set of revisions which may affect several drawings will not necessarily be identified with the same revision number, depending on the number of prior revisions made to each particular drawing.
2. The date the revision was made on the drawing
   Note: A particular set of revisions which may affect several drawings must be assigned the same date even though the actual work involved may take several days to complete.
3. The initials of the person making the revision
4. A brief description of the revision

50.06 Survey and Field Installation Notes

Construction surveys must be accomplished by a surveyor licensed in the state of Alaska and the notes must include:

1. Contractor's name and address
2. Line and grade survey notes
3. Surveyor’s firm's name and address
4. Construction survey notes

Field installation notes from the Contractor must contain the horizontal and vertical location information as constructed including, but not limited to:

1. Manholes and cleanouts, horizontal station and vertical elevations;
2. Valves, fire hydrants, key boxes, PRV's and mechanical joint fittings;
3. Make, model and location of all thrust restraint fittings and total footage of pipe restrained;
4. Service connections at the mains and stationing;
5. Special fittings;
6. All encountered utilities, any pipe or street insulation and limits of all fabric material;
7. Changes in pipe size, slope or type; and,
8. Service locations at property lines swing-tied to above-ground facilities, such as fire hydrants, houses, light poles, or water key boxes. For sanitary sewer, give the invert elevation of the connection at the property line or easement line.

50.07 Record Drawing Submittal and Acceptance

Final acceptance of the development will not occur until the Record Drawing has been approved by AWWU. Continual service will not commence until Record Drawings have been approved by AWWU and have met the requirements of ADEC Regulations 18 AAC 72 and 18 AAC 80.

50.08 Buried or Unmarked Appurtenances

Buried or unmarked appurtenances are not justifiable reasons for not submitting Record Drawings. If necessary, in order to provide the proper information, the developer, contractor or engineer shall, at their expense, uncover or expose the appurtenances and all utilities encountered

to effect survey measurements required for proper records. The Record Drawings should state who provided the record information.

50.09 Sanitary Sewer and Water Record Drawings

Minimum record drawing information to be obtained is as follows:

1. Vertical and horizontal location on all tees, bends, valves, restrained piping and fittings, hydrants, manholes, cleanouts, changes in alignment, and ends of pipe. Vertical and horizontal location at minimum intervals of three hundred (300') feet on extended runs without alignment change or fittings.
2. Lineal footage of pipe installed, including revisions to stationing and elevations.
3. Vertical and horizontal location on all existing utilities exposed by the trench excavation. Horizontal location may be relative to the line being installed.
4. Horizontal location on new surface features such as valves, hydrants, key boxes, manholes, cleanouts, any repair coupling, etc. This information should be relative to street center lines and/or property lines. Key boxes and sanitary sewer service connections are to be measured from property corners.
5. Horizontal location or stationing from the nearest feature at any change in pipe material (i.e., transite to ductile, change in pipe class, etc.).
6. Areas where foundation material is used and/or where bedding material is imported.
7. Water and sewer service connection chart data.
8. Vertical elevation of the service connection at the main and at the property line. Horizontal offset measurement of the service connection to the property line on the plan view.
9. Information on subsurface soil conditions encountered in trenches every three hundred (300') feet or where significant changes occur. Particular emphasis must be placed on native materials at the bottom of the trench. Show and delineate areas of over-excavation and foundation material installation.
10. Subsurface soil data should be forwarded to the MOA Soils Lab.
11. Location and stationing of all pipe abandonment. Include both length of pipe removed and pipe abandoned in place.
12. Horizontal and vertical location of any approved sanitary sewer or water service connection Pig-Tail(s).
13. Location size and type of all cathodic protection devices.
14. Horizontal dimensions of building foot prints.
15. Horizontal dimensions of all easements.

Any changes authorized in the field shall be shown and noted as "field change".

50.10 As-Constructed Survey Notes

Post-construction survey shall be performed by a surveyor licensed in the state of Alaska and shall include the items addressed in this section and Division 65.00 of MASS. The post construction survey notes, the construction contractor's field installation notes, the engineer's daily inspection notes, and the record drawings shall be submitted to AWWU for review and approval.

50.11 Engineer's Responsibility on Record Drawings

At a minimum, the engineer shall transfer to the original single matte film the following information:

- The construction contractor's redline drawings of the facilities as-constructed.
- The field installation notes from the line and grade books.

- Station and elevation of all utilities encountered in the trench.

The engineer shall certify that the record drawing reflects accurate as-constructed information. The engineer shall resolve any errors in the calculations with the construction contractor prior to submittal to AWWU for approval.

The engineer shall put all numbers for permits issued during design and construction (i.e., ADOT/PF, ROW, Wetlands, Recorded Easements, etc.) on the record drawing.

The engineer shall verify that any waivers acquired either during the design or construction are noted on the record drawings.

50.12 Horizontal and Vertical Attribute Values

The engineer or contractor shall submit horizontal and vertical attribute values in accordance with Section 70.03 of this document.

60.00 DESIGN TYPICAL AND SUPPLEMENTARY INFORMATION

This section deals with information that may provide the designer with additional useful information in preparing plans for AWWU review submittals.

Use of standard symbols, acronyms, abbreviations, etc., can reduce the chances of misunderstandings and therefore serve to reduce review time and possibly the need for field design changes. Use of the following details is strongly recommended.

60.01 Standard Symbols

60.01.01 Standard Symbols-1 of 5

SYMBOL			LAYER NAME	LINE WIDTH (inches)	
EXISTING (E)	PROPOSED (P)		(*) = (E)(P)	(E)	(P)
		CENTERLINE	P*LRCL	.010	.022
		PROPERTY LINE	P*LPP	.012	.022
		EASEMENT LINE	P*LPE	.010	.014
		SECTION LINE	P*LPS	.011	.014
		UNPAVED (GRAVEL) EDGE OF ROAD	PELRG	.005	.014
		EDGE OF PAVEMENT	P*LRP	.005	.014
		PAVEMENT/DRIVEWAY REMOVAL	PPLRPDR		.005
		TYPE 1 CURB & GUTTER	P*LRC	.005	.014
		TYPE 2 CURB & GUTTER	P*LRC	.005	.014
		TYPE 1 CURB & GUTTER REMOVAL	PPLRCR		.005
		TYPE 2 CURB & GUTTER REMOVAL	PPLRCR		.005
		SIDEWALK REMOVAL	PPLRWE		.005
25	25	RADIUS TO BACK OF CURB	P*TRCB	.005	.010
		DRAINAGE SWALE	P*LT?	.005	.014
		DRAINAGE ARROW	P*ST?	.005	.022
		P.C.C. VALLEY GUTTER	P*LT-VG	.005	.022
		DITCH	P*LTD	.005	.014
		BLUFF AREA / EARTHWORK SLOPE	P*LRS-	.005	.014
		CULVERT	P*SUV	.008	.022
		FENCE (AS NOTED)	P*LTF	.005	.014
		TREE (BUSH)/SPRUCE	PESTV-	.005	.014
		VEGETATION & BRUSH	PESTV	.005	.014
		GUARDRAIL	P*SRU-GR	.005	.014
		HANDRAIL	P*SRU-HR	.005	.014
		STREET SIGN (1S, 2S)	P*SRI-	.005	.022
		HANDICAPPED PARKING	PPSRI-HCP		.022
		TEST BORING OR TEST HOLE	P*STO	.005	.014
		RAILROAD TRACKS	PELTRR	.005	
⊔ M.B.	■ M.B.	MAILBOX	P*STB	.005	.014

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2018 DESIGN AND CONSTRUCTION PRACTICES

STANDARD SYMBOLS

STANDARD SYMBOLS 1 OF 5

REVISED		Date
12/2002	PM&E	MAR 2017
03/2008	AWWU	Scale
3/2012	AWWU	NTS
3/2017	AWWU	Sheet
		1 of 5

60.01.02 Standard Symbols-2 of 5

SYMBOL EXISTING (E)	SYMBOL PROPOSED (P)	PLAN LEGEND	LAYER NAME (*) = (E)(P)	LINE WIDTH (inches) (E)	LINE WIDTH (inches) (P)	PLINE WIDTH
		HOUSE OR STRUCTURE	P*STS	.008		
		LAKE OR POND	PELTR	.008		
-123-	123	CONTOUR LINE	P*LTC-	.005	.022	
SPT FL. SPT EL.	SPT EL. SPT EL.	SPOT ELEVATION	VARIES	.008	.014	
IP		IRON PIN (REBAR) / IRON PIPE	PESPZ	.008		
		BENCHMARK	PESPZ	.008		
		TEMPORARY BENCHMARK	PESPZ	.008		
		BRASS CAP MONU./BLM CORNER	PESPZ	.008		
		PK NAIL, SPIKE OR CONCRETE NAIL	PESPZ	.008		
		ALCAP OR PLASTIC CAP	PESPZ	.008		
		FILL SLOPE LIMITS	PPLRSF		.022	
		CUT SLOPE LIMITS	PPLRSC		.014	
		RETAINING WALL	P*SRE	.014	.009	
SD	SD	STORM DRAIN LINE	P*LUD	.005	PLINE	1.5
S	S	SANITARY SEWER LINE	P*LUS	.005	PLINE	1.5
W	W	WATER LINE	P*LUW	.005	PLINE	1.5
S	S	SANITARY SEWER GRAVITY MAIN LINE	P*LUS	.005	PLINE	1.5
S	S	SANITARY SEWER PRESSURIZED MAIN	P*LUS	.005	PLINE	1.5
S	S	SANITARY SEWER LATERAL LINE	P*LUS	.005	PLINE	1.5
W	W	WATER MAIN LINE	P*LUW	.005	PLINE	1.5
W	W	WATER SERVICE LATERAL LINE	P*LUW	.005	PLINE	1.5
W	W	WATER HYDRANT LATERAL LINE	P*LUW	.005	PLINE	1.5
C		GAS LINE	P*LUG	.005		
UG/E		UNDERGROUND ELECTRIC LINE	P*LUE-UG	.005		
OH/E		OVERHEAD ELECTRIC LINE	P*LUE-OH	.005		
UG/T		UNDERGROUND TELEPHONE LINE	P*LUT-UG	.005		
OH/T		OVERHEAD TELEPHONE LINE	P*LUT-OH	.005		
UG/C		UNDERGROUND CABLE TV LINE	P*LUC-UG	.005		
OH/C		OVERHEAD CABLE TV LINE	P*LUC-OH	.005		

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REVISED	Date
12/2002 PM&E	MAR 2017
03/2008 AWWU	Scale
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03/2017 AWWU	Sheet
	2 of 5

60.01.03 Standard Symbols-3 of 5

SYMBOL EXISTING (E)	SYMBOL PROPOSED (P)	PLAN LEGEND	LAYER NAME (*) = (E)(P)	LINE WIDTH (inches) (E)	LINE WIDTH (inches) (P)	PLINE WIDTH
—LG/FO—		UNDERGROUND FIBER OPTIC	P*LUC-FO	.005		
		STORM DRAIN MANHOLE	P*SUD	.005	.022	
		CATCH BASIN MANHOLE	P*SUD	.005	.022	
		CATCH BASIN	P*SUD	.005	.022	
		SANITARY SEWER MANHOLE	P*SUS	.005	.022	
C.O.	C.O.	SANITARY SEWER CLEANOUT	P*SUS	.005	.022	
		SEWER SERVICE CONNECTION	P*SUS	.005	.022	
CP	CP	CESSPOOL / SEPTIC TANK	P*SUS-	.005	.022	
		WATER WELL	P*SUW	.005	.022	
W	W	WATERTIGHT MANHOLE	P*SUS	.005	.022	
		WATER KEY BOX/VALVE MARKER	P*SUW-KB	.005	.022	
		WATER VALVE BOX	P*SUW-VB	.005	.022	
		FIRE HYDRANT	P*SUW	.005	.022	
		DRY WELL	P*SUW	.005	.022	
		STUBOUT	P*SU?	.005	PLINE	1.5
		CAPPED OR PLUGGED END	P*SU?	.005	PLINE	1.5
		GAS VALVE	P*SUG	.005		
G.M.		GAS METER	P*SUG	.005		
U.E.		UNDERGROUND ELECTRIC PEDESTAL	P*SUE-UG	.005		
E		ELECTRICAL HANHOLE / J- BOX	P*SUE	.005	.022	
OEM	EM	ELECTRIC METER	P*SUE	.005	.022	
		JUNCTION BOX (TYPE I, II, & III)	P*SUE	.005	.022	
E	E	ELECTRICAL VAULT / MANHOLE	P*SUE	.005	.022	
		LUMINAIRE	P*SUE	.005	.022	
		UTILITY POLE	P*SUE	.005	.022	
		GUY POLE	PESUE	.005		
		GUY ANCHOR	P*SUE	.005		
		CONTROLLER OR ATR CABINET	P*SUE	.005	.022	
		LOAD CENTER	P*SUE	.005	.022	

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STANDARD SYMBOLS

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REVISED	Date
12/2003 AWWU	MAR 2017
03/2008 AWWU	Scale NTS
03/2012 AWWU	
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60.01.04 Standard Symbols-4 of 5

SYMBOL		PLAN LEGEND	LAYER NAME	LINE WIDTH (inches)	
EXISTING (E)	PROPOSED (P)		(*) = (E)(P)	(E)	(P)
SC		SWITCH CABINET	P*SUE	.005	
		ELECTRIC TRANSFORMER	P*SUE	.005	
		JOINT USE POWER & TELE. POLE	P*SUE	.005	.022
T		TELEPHONE HANDHOLE	P*SUT	.005	
UT.		UNDERGROUND TELE. PEDESTAL	P*SUT	.005	
UC.		UNDERGROUND TV CABLE PEDESTAL	P*SUC-UG	.005	
WM	WM	WATER METER	P*SUW	.005	.022
		DEEP SERVICE RISER	P*SUW	.005	.022
		AIRVALVE STATION	P*SUW	.005	.022
		BLOWOFF	P*SUW	.005	.022
		PRV VAULT	P*SUW	.005	.022
		REDUCER	PESUW	.005	.022
		CUT PIPE (DETAIL)	PESUW	.005	.022
MM		MAGNETIC METER	P*SUW	.005	.022
PM		PROPELLER METER	P*SUW	.005	.022
		BACKFLOW PREVENTER	P*SUW	.005	.022
		TEE	P*SUW	.005	.022
V-III		EQUIPMENT NO. (SEE SCHEDULE)	P*SUW	.005	.022
		PRESSURE REDUCING VALVE	P*SUW	.005	.022
		PRESSURE REGULATING VALVE	P*SUW	.005	.022
		AIR RELEASE & AIR VACUUM ASSEMBLY	P*SUW	.005	.022

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12/2003	AWWU	MAR 2017
03/2008	AWWU	Scale NTS
03/2012	AWWU	
03/2017	AWWU	Sheet 4 of 5

60.01.05 Standard Symbols-5 of 5

SYMBOL EXISTING (E)	SYMBOL PROPOSED (P)	PROFILE LEGEND	LAYER NAME (*) = (E)(P)	LINE WIDTH (Inches) (E)	LINE WIDTH (Inches) (P)	PLINE WIDTH
		CENTER LINE (R.O.W.)	R*LRCL	.010	.010	
		PROPERTY LINE	R*LPP–	.008	.008	
	0.00%	GRADE OF PAVEMENT AT ℄	R*LRP	.005	PLINE	1.5
		EXISTING GROUND OVER PIPE	RELTG–	.005		
	0.00%	PIPE	R*SUS	.005	.022	
	0	PIPE	R*SUS	.005	.022	
		STORM DRAIN MANHOLE	RESUD	.005		
		CATCH BASIN OR CATCH BASIN MANHOLE (PAVING PROFILE)	RESUD	.005		
		WATER LEVEL	RESTG	.005		
		STORM DRAIN MANHOLE & STORM DRAIN PIPE	R*SUD	.005	.022	
GM/93% Pt		SOILS CLASSIFICATION & % PASSING 200	REDTO	.005		
		INSULATION	R*SU?I	.XX	.XX	
		CONCRETE	R*STN	.XX	.XX	
		GRAVEL	R*STO	.XX	.XX	
		COMPACTED SOIL	R*STO	.XX	.XX	
		NATURAL SOIL	R*STO	.XX	.XX	
		METAL GRATING	R*STS	.XX	.XX	
		LEFT FINISH GRADE	RELPPL		.010	
		RIGHT FINISH GRADE	RELPPR		.010	
		CENTER LINE FINISH GRADE	RELPC		.010	

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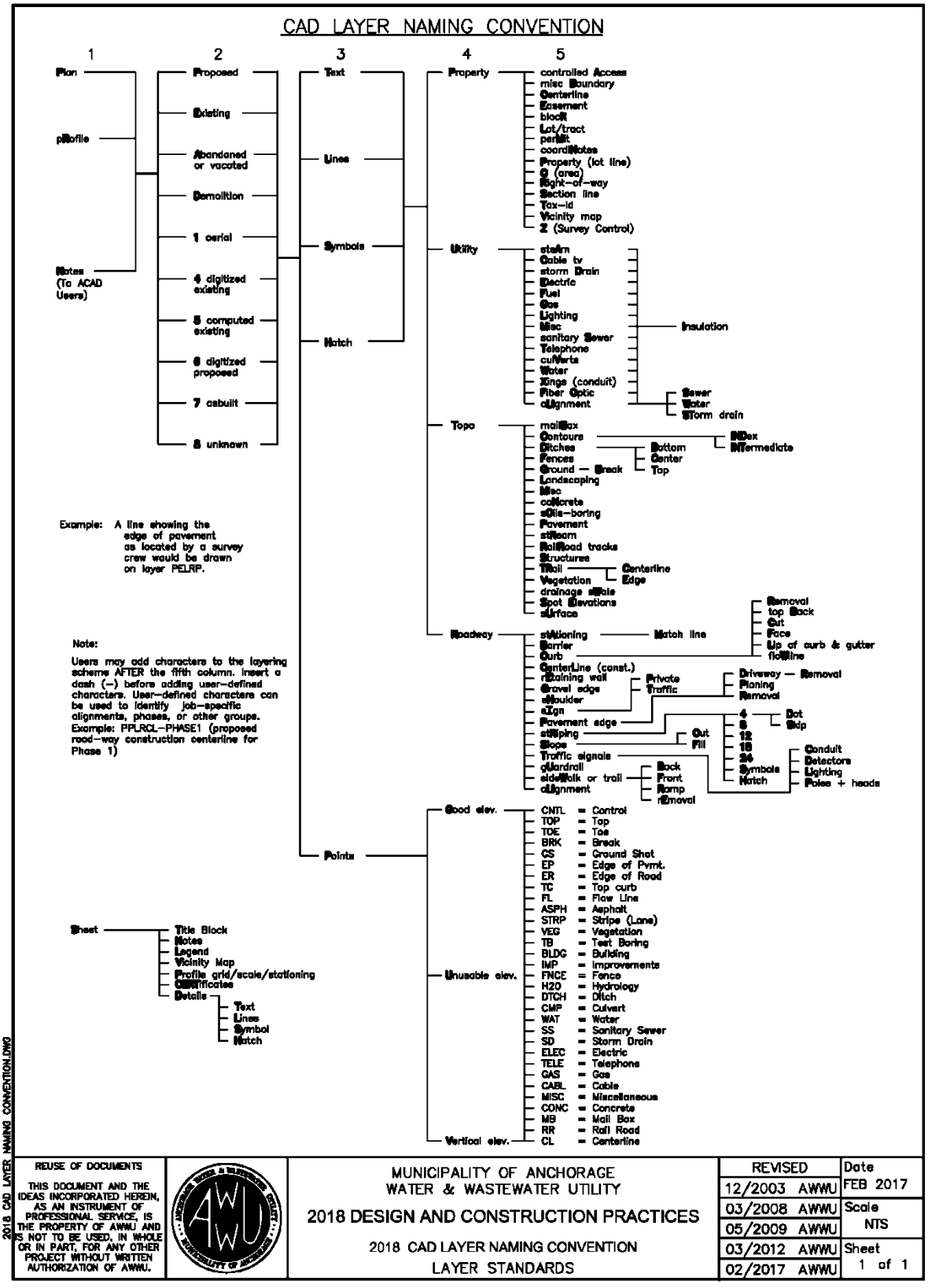
12/2003 AWWU	MAR 2017
03/2008 AWWU	Scale
03/2012 AWWU	NTS
03/2017 AWWU	Sheet
	5 of 5

60.02 AutoCAD Layer Naming Convention

60.02.01 Layer Standards

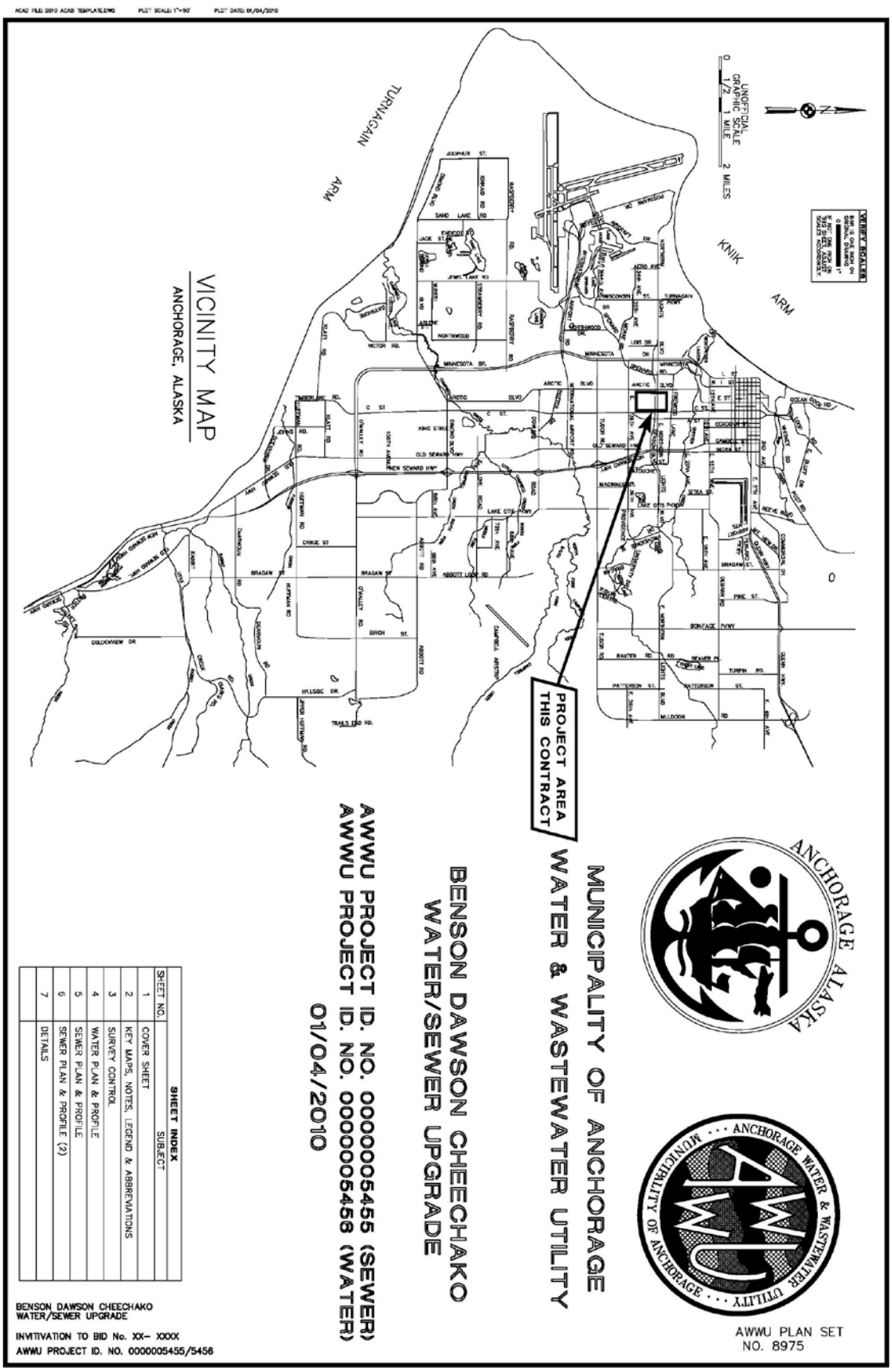


60.03 Standard Drawing Sheets

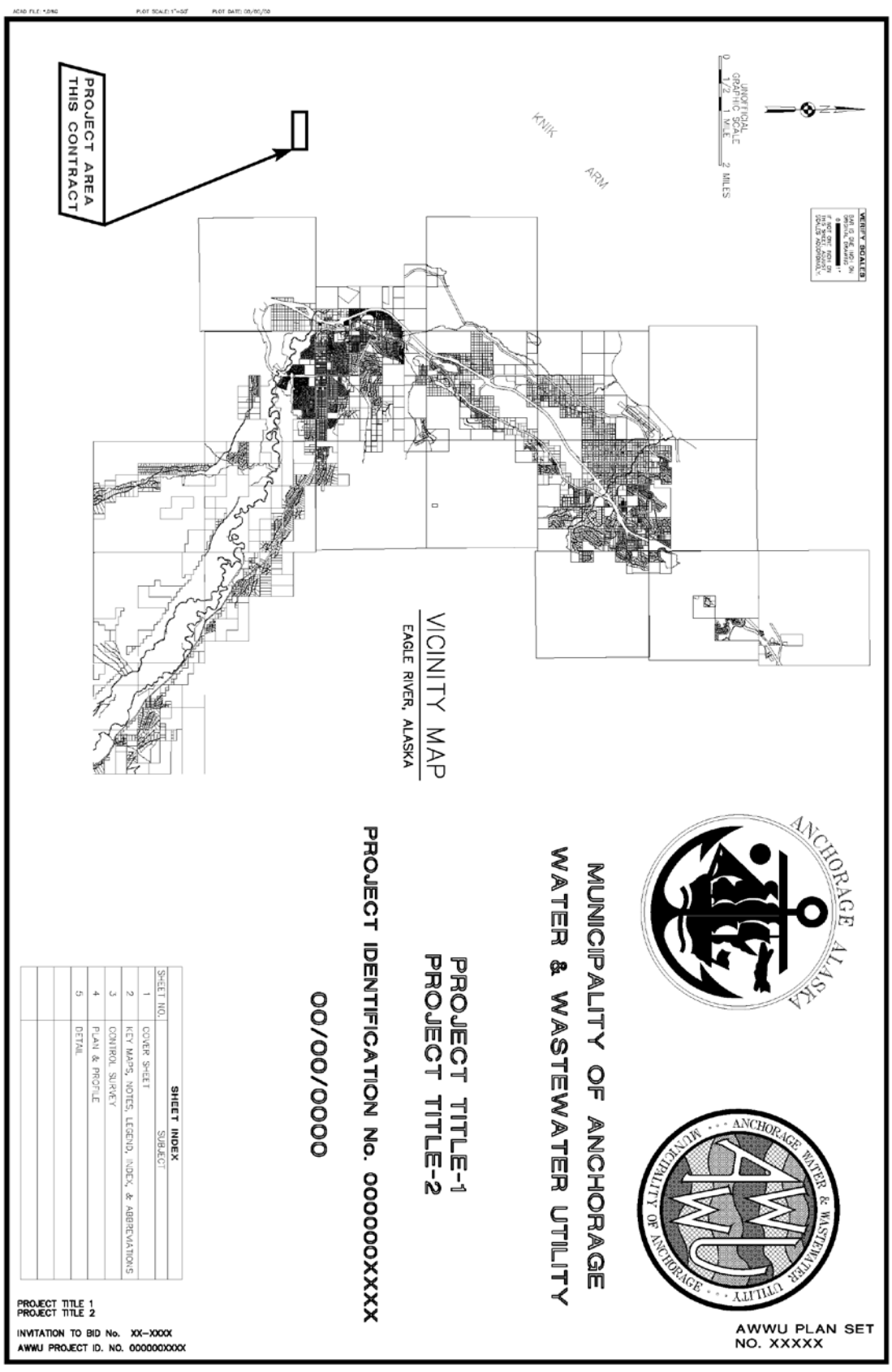
60.03.01 Capital Projects

The following drawings are an example of how all deliverables should look for capital project horizontal plant drawings. Vertical plant drawings shall use the same title block as shown below and follow AWWU standard symbols, lettering, and layering where applicable. Maximo location IDs and Equipment IDs shall be shown for all equipment as defined in the AWWU *Maximo Vertical Plant Manual*.

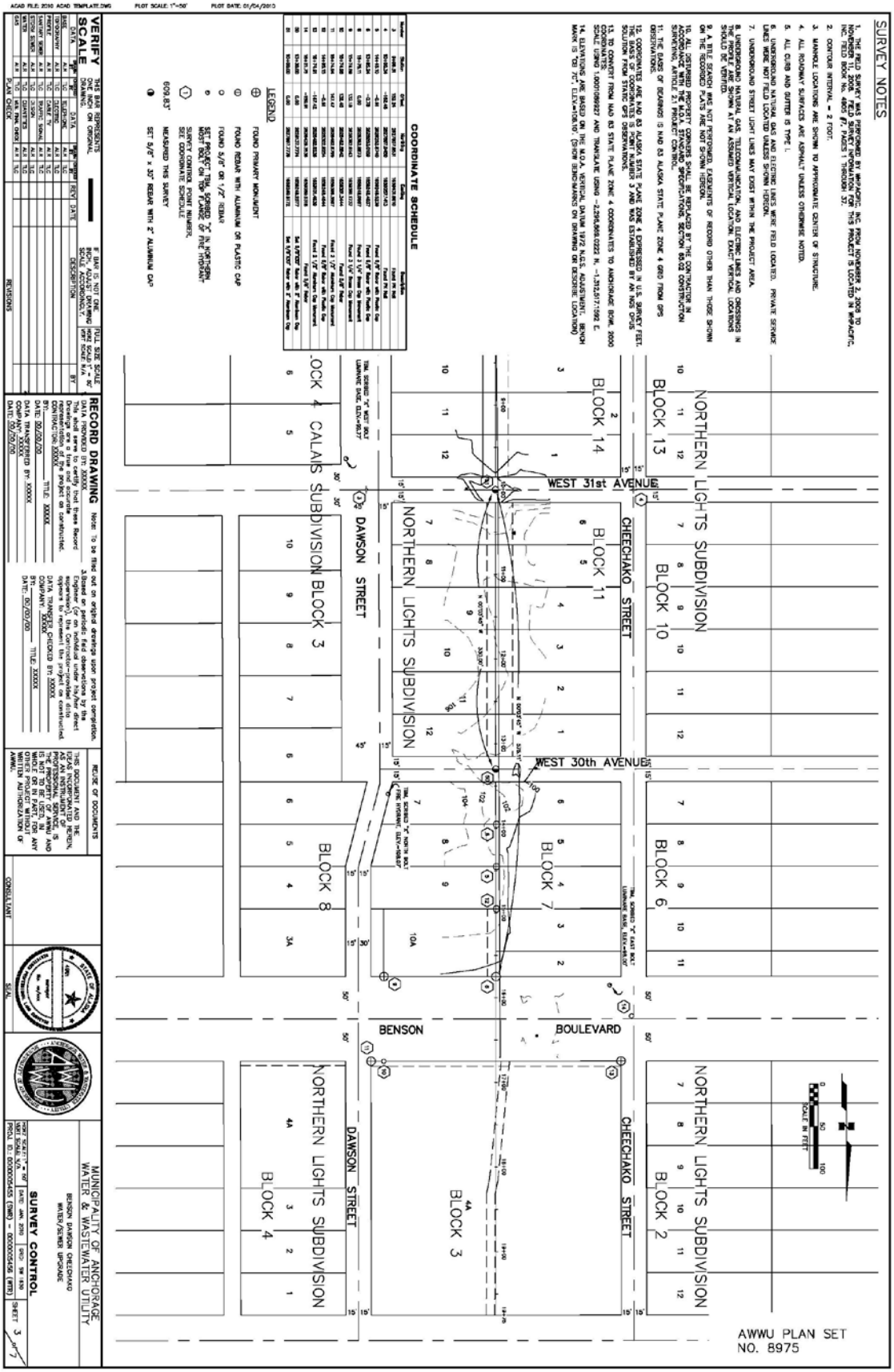
60.03.01.01 Cover Sheet - Anchorage



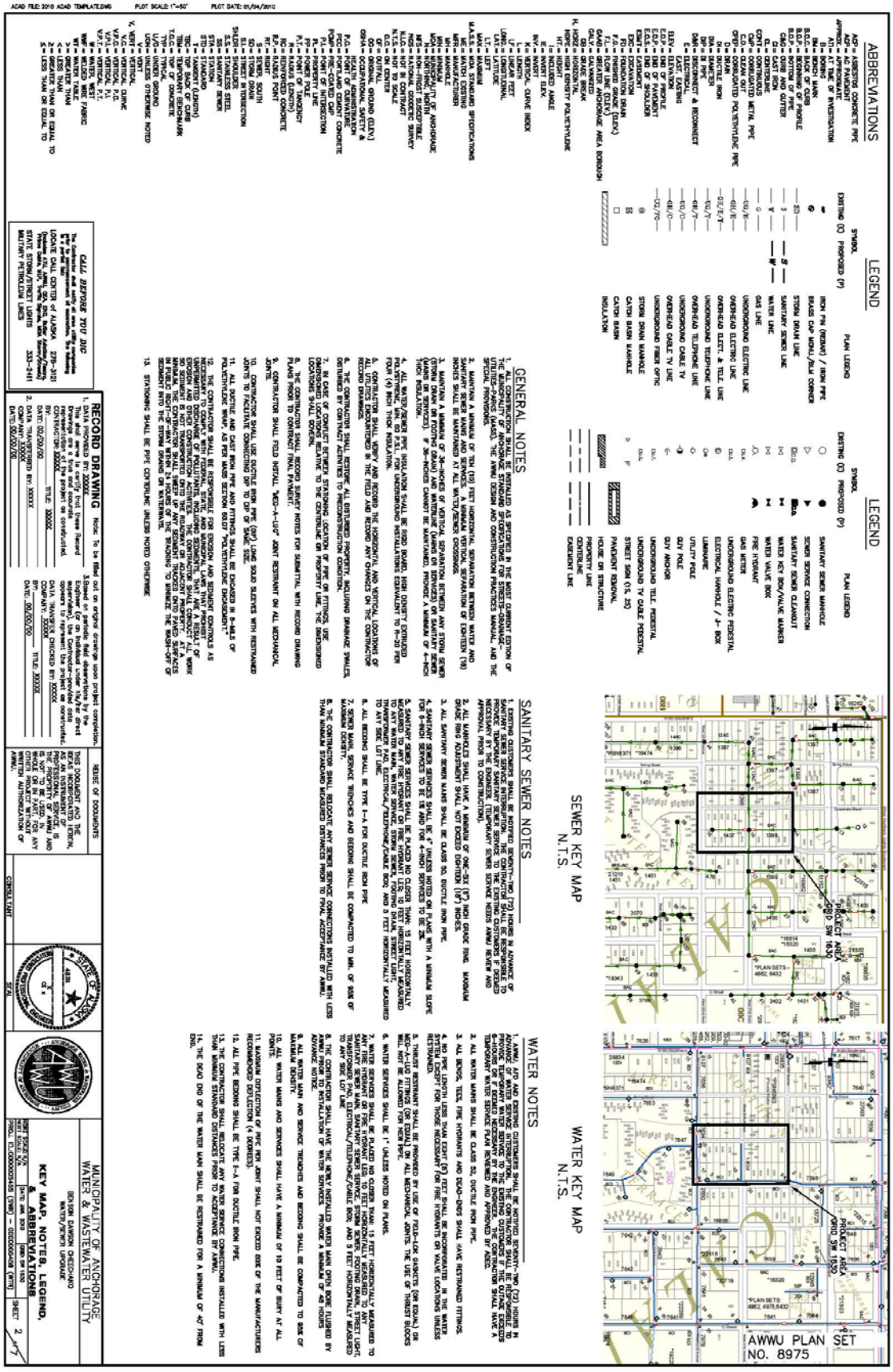
60.03.01.02 Cover Sheet – Eagle River



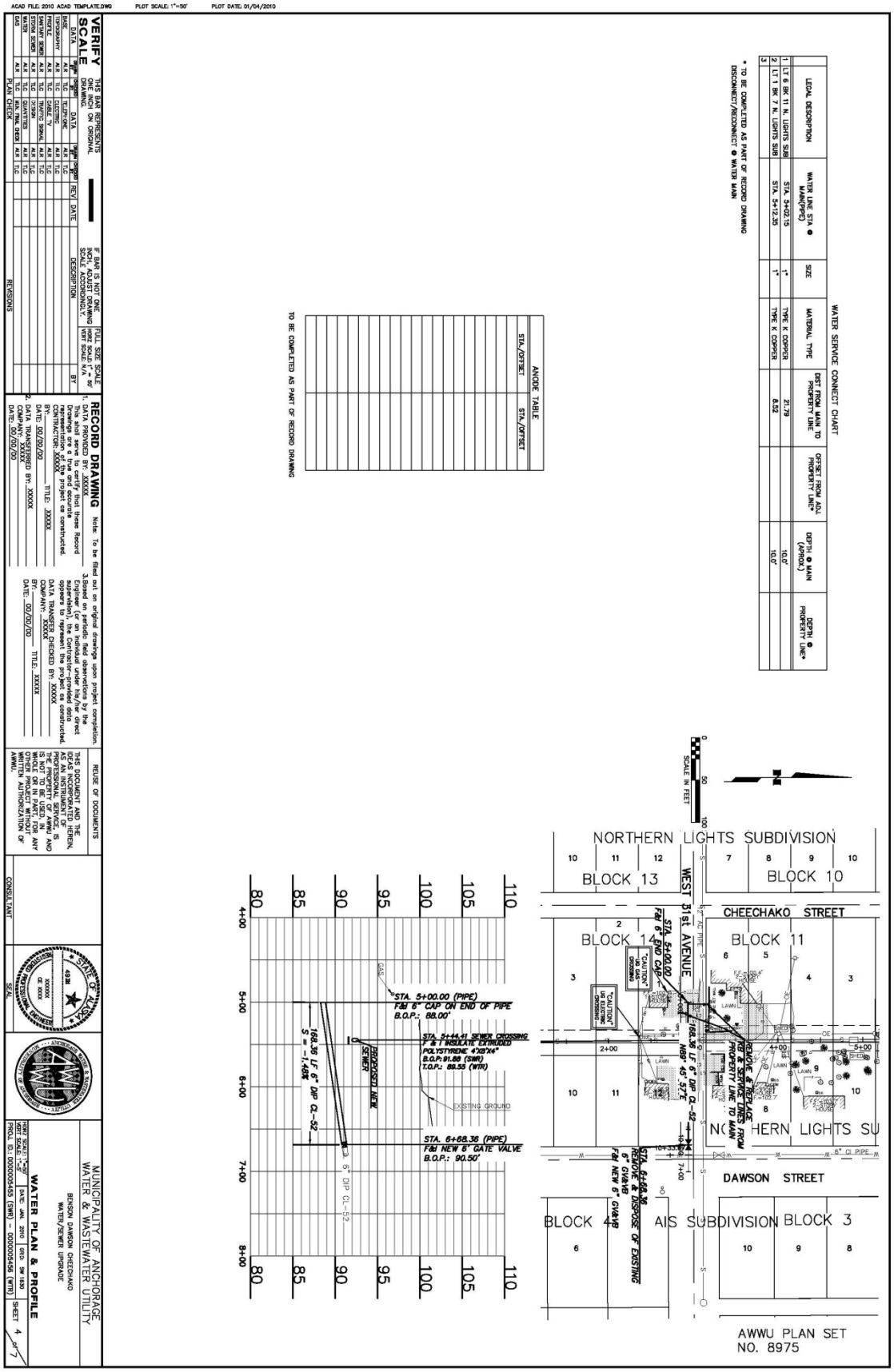
60.03.01.03 Control Sheet



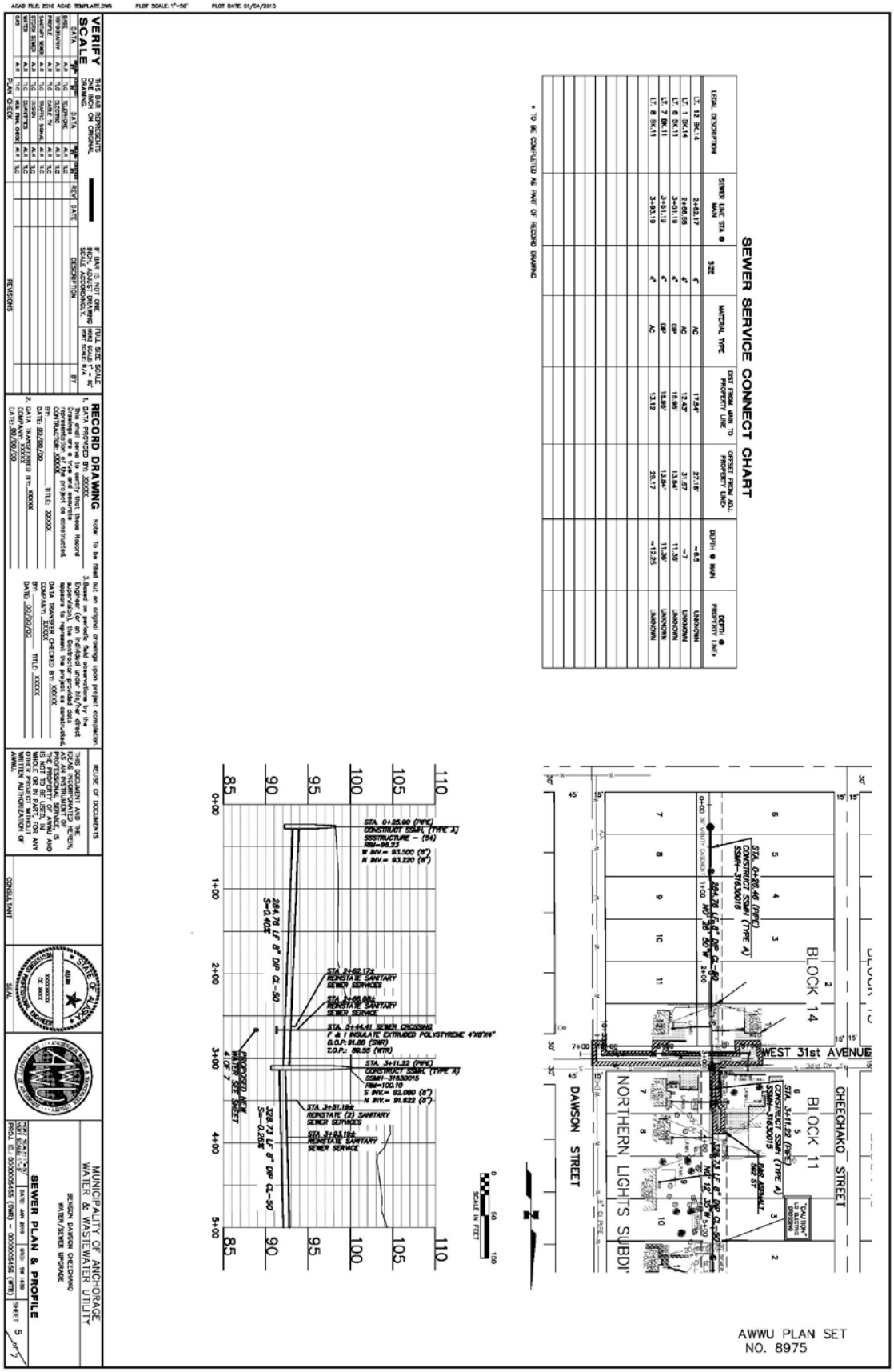
60.03.01.04 Key Map Sheet

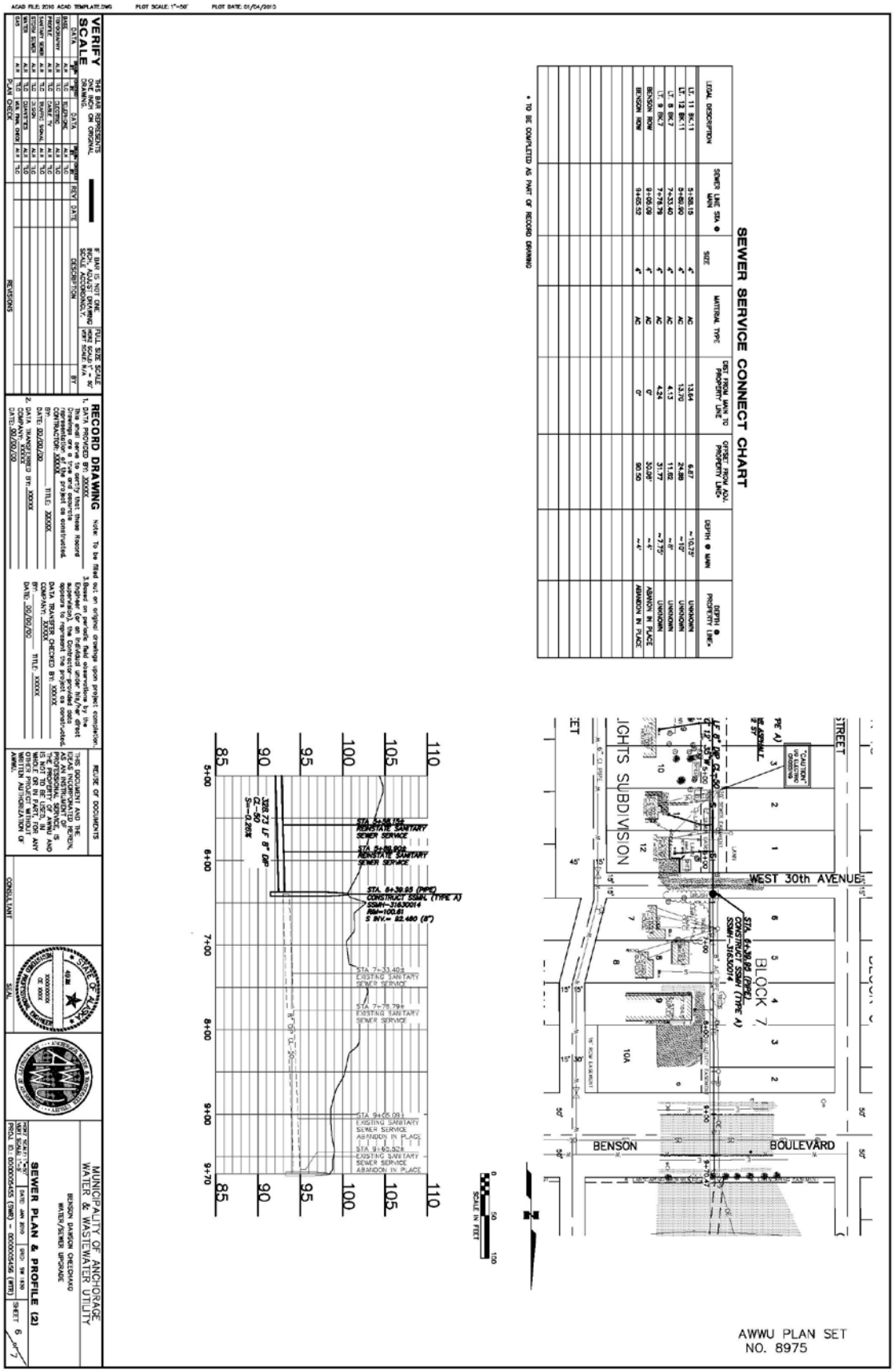


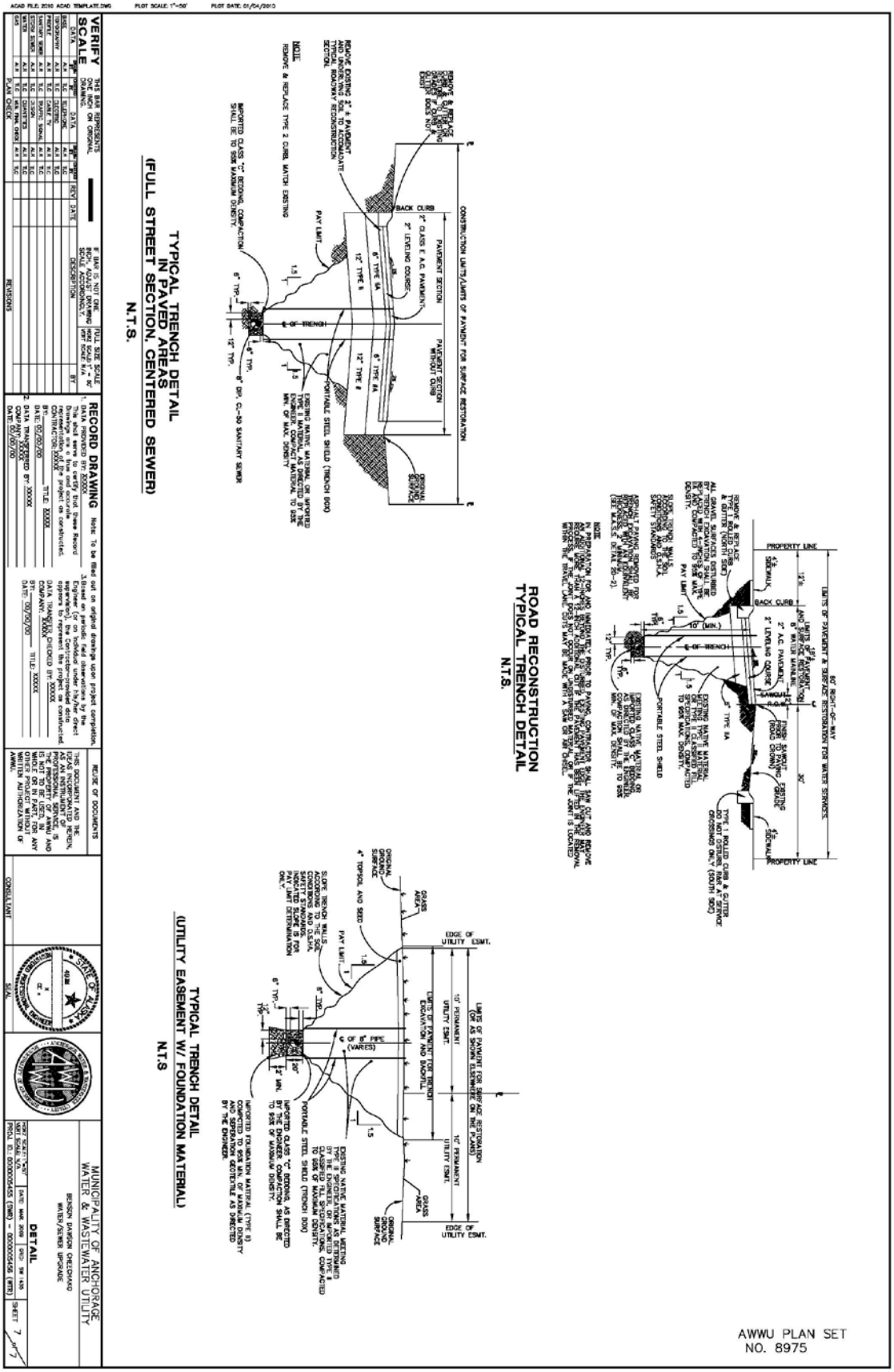
60.03.01.05 Plan and Profile Sheet 1



60.03.01.06 Plan and Profile Sheet 2



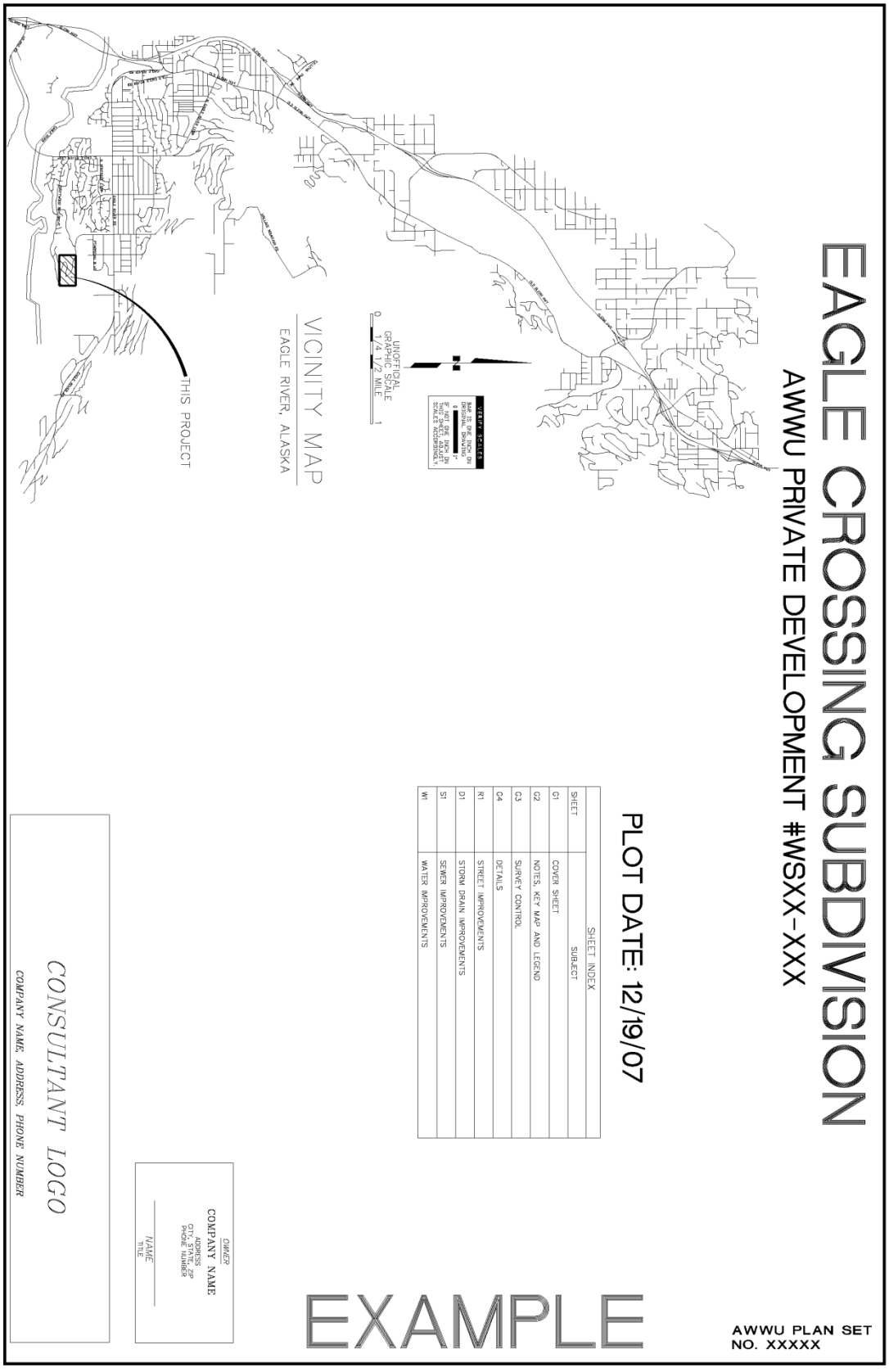

SEWER SERVICE CONNECT CHART
* TO BE COMPLETED AS PART OF RECORD DRAWING
LEGAL DESCRIPTION
SEWER LINE STA. @ MAIN
SIZE
MATERIAL TYPE
DIST. FROM MAIN TO PROPERTY LINE
OFFSET FROM ASM. PROPERTY LINE*
DEPTH @ MAIN
DEPTH @ PROPERTY LINE*
LT. 11 BLK.11
LT. 12 BLK.11
LT. 8 BLK.7
BENSON ROW
BRINSON ROW
9+38.15
9+80.30
7+33.40
7+76.79
9+05.09
9+65.59
4"
AC
13.54
13.70
4.13
4.34
0'
0'
6.67
24.88
11.82
31.77
30.09'
90.50
~10.79'
~10'
~8'
~7.75'
~4'
~4'
UNKNOWN
UNKNOWN
UNKNOWN
UNKNOWN
ABANDON IN PLACE
ABANDON IN PLACE
STA. 9+38.15± REINSTATE SANITARY SEWER SERVICE
STA. 9+80.90± REINSTATE SANITARY SEWER SERVICE
STA. 8+39.85 (PIPE) CONSTRUCT SSMH (TYPE A) SSMH-31630014 RIM=100.61 S INV.= 92.460 (8")
328.72 LF 8" DIP @=0.50 S=-0.25%
STA. 7+33.40± EXISTING SANITARY SEWER SERVICE
STA. 7+76.79± EXISTING SANITARY SEWER SERVICE
STA. 9+65.09± EXISTING SANITARY SEWER SERVICE ABANDON IN PLACE
STA. 9+80.30± EXISTING SANITARY SEWER SERVICE ABANDON IN PLACE
5+00
6+00
7+00
8+00
9+00
9+70
85
90
95
100
105
110
STREET
WEST 30th AVENUE
BLOCK 7
JGHTS SUBDIVISION
BENSON
BOULEVARD
SCALE IN FEET
AWWU PLAN SET NO. 8975
VERIFY
THIS BAR REPRESENTS ONE INCH ON ORIGINAL DRAWING.
SCALE
IF BAR IS NOT ONE INCH, ADJUST DRAWING SCALE ACCORDINGLY.
REVISIONS
TITLE SIZE SCALE
RECORD DRAWING
Note: To be filled out on original drawings upon project completion.
REUSE OF DOCUMENTS
THIS DOCUMENT AND THE IDEAS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF AWWU AND SHALL NOT BE USED, IN WHOLE OR IN PART, FOR ANY PROJECT WITHOUT WRITTEN AUTHORIZATION OF AWWU.
CONSULTANT
SEAL
MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY
BENSON DAMSON CHELSHAKO
WATER/SEWER UPGRADE
SEWER PLAN & PROFILE (2)
HORZ. SCALE: 1"=50'
VERT. SCALE: 1"=5'
PROJ. ID: 8000005455 (SWD) - 8000005456 (WTR)
DATE: JAN 2020
SHEET 6 of 7


TYPICAL TRENCH DETAIL
IN PAVED AREAS
(FULL STREET SECTION, CENTERED SEWER)
N.T.S.
ROAD RECONSTRUCTION
TYPICAL TRENCH DETAIL
N.T.S.
TYPICAL TRENCH DETAIL
(UTILITY EASEMENT W/ FOUNDATION MATERIAL)
N.T.S
AWWU PLAN SET
NO. 8975

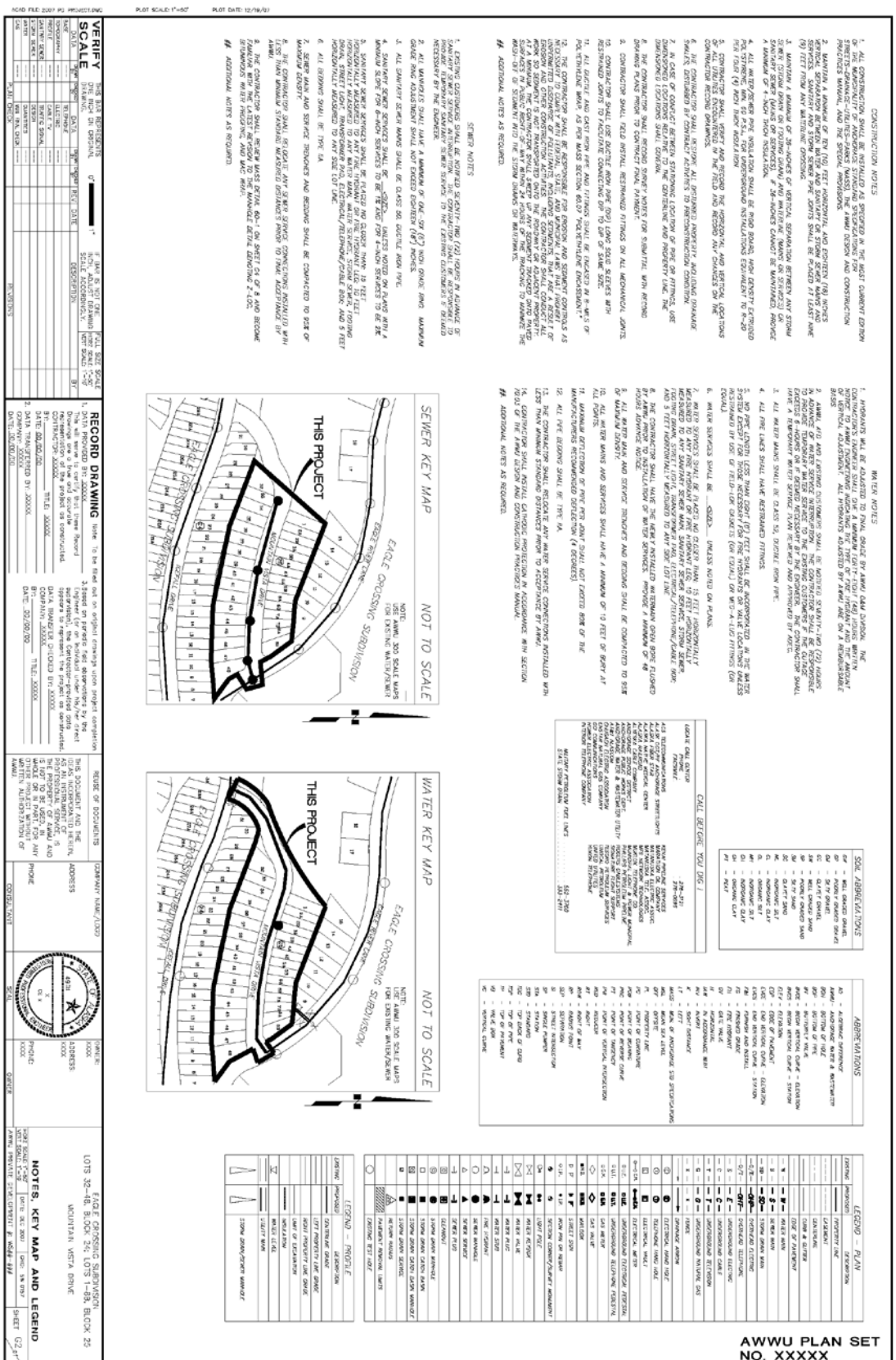
60.03.02 Private Development Projects

The following drawings are an example of how all deliverables should look for private development project horizontal plant drawings. Vertical plant drawings shall use the same title block as shown below and follow AWWU standard symbols, lettering, and layering where applicable. Maximo location IDs and Equipment IDs shall be shown for all equipment as defined in the AWWU *Maximo Vertical Plant Manual*.

60.03.02.01 Cover Sheet



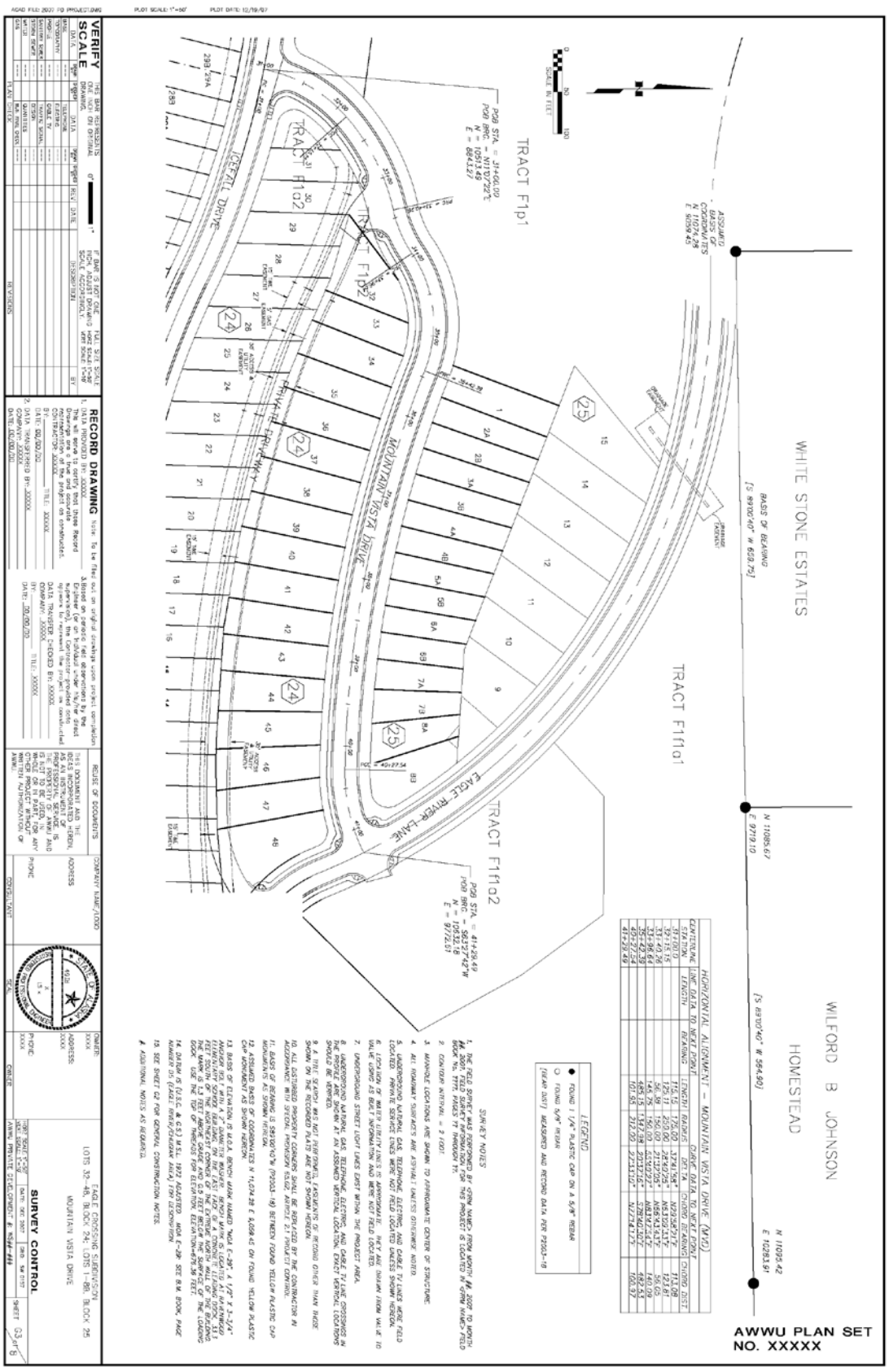
60.03.02.02 Notes, Key Map, and Legend



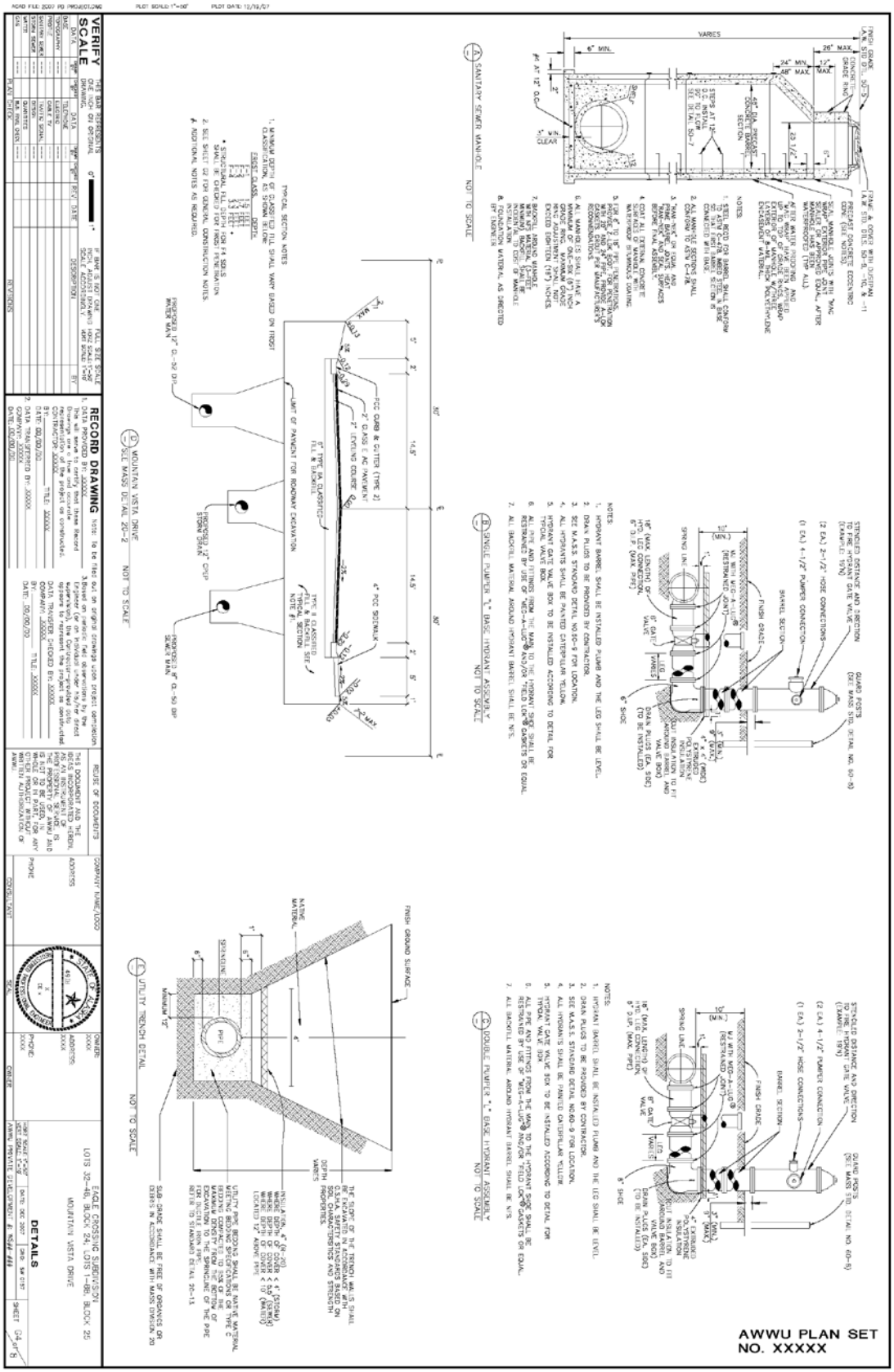
- 110 -

AWWU 2018 DESIGN AND CONSTRUCTION PRACTICES MANUAL

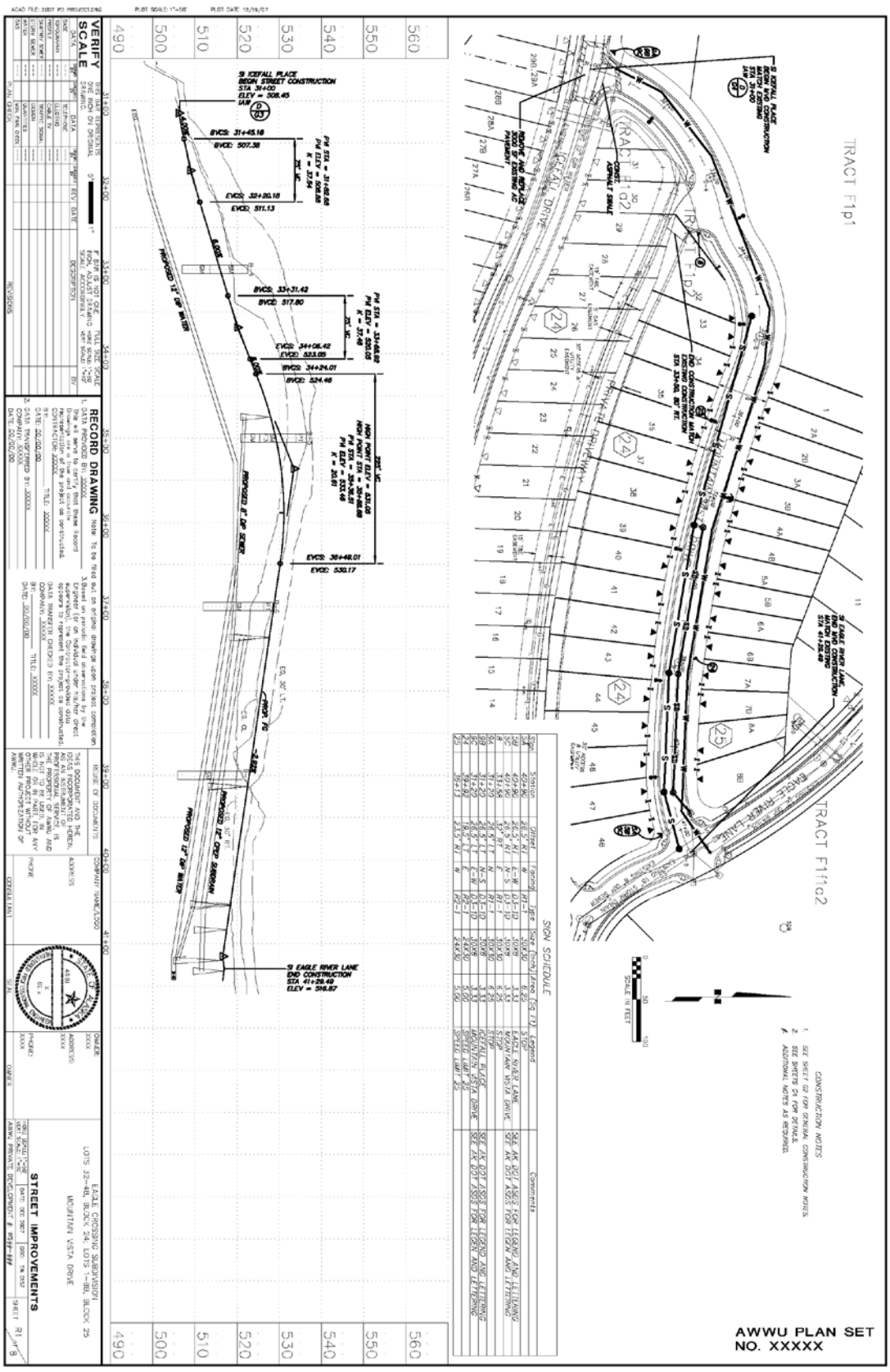
60.03.02.03 Survey Control



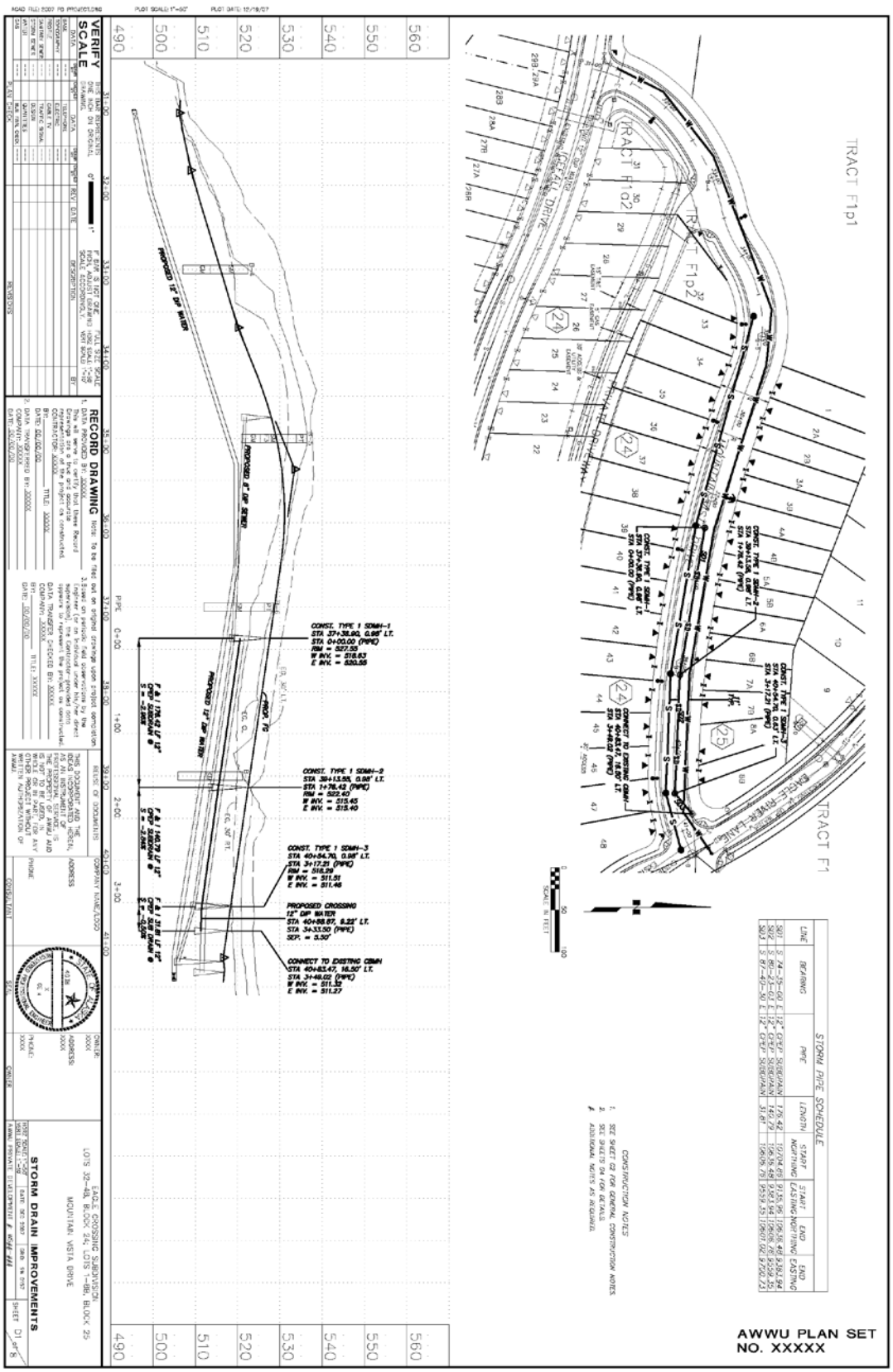
60.03.02.04 Details



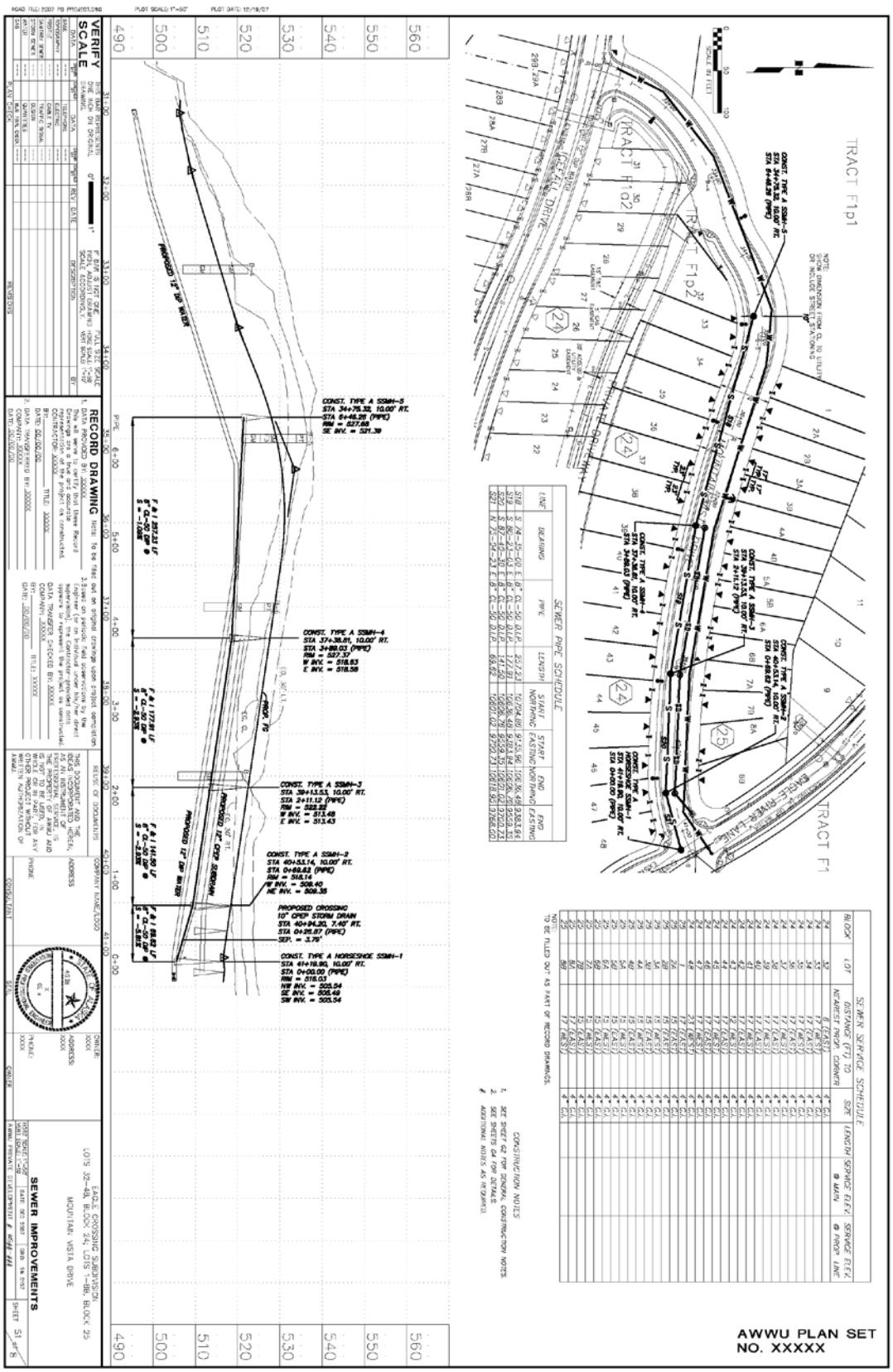
60.03.02.05 Street Improvements



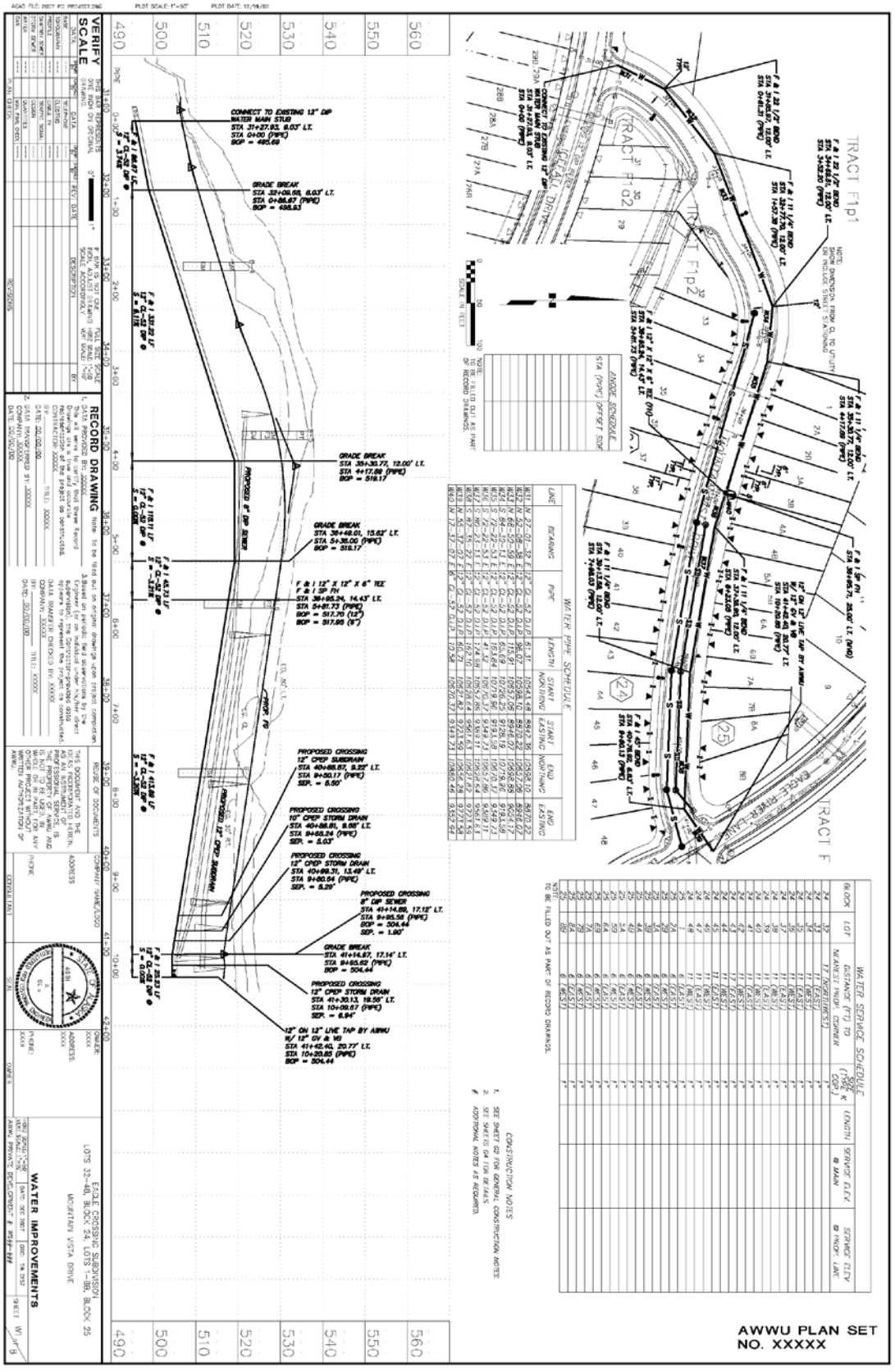
60.03.02.06 Storm Drain Improvements



60.03.02.07 Sewer Improvements



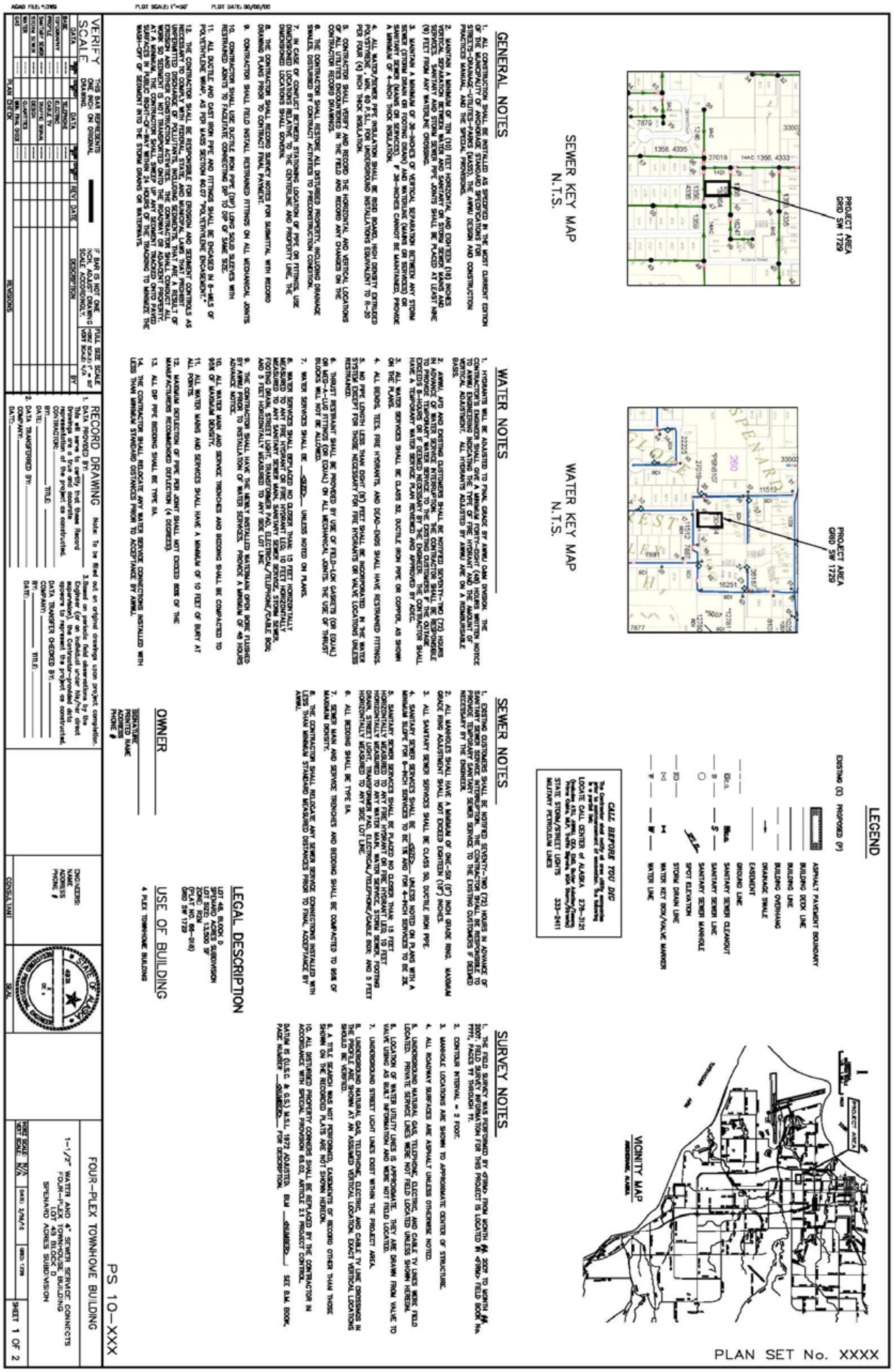
60.03.02.08 Water Improvements



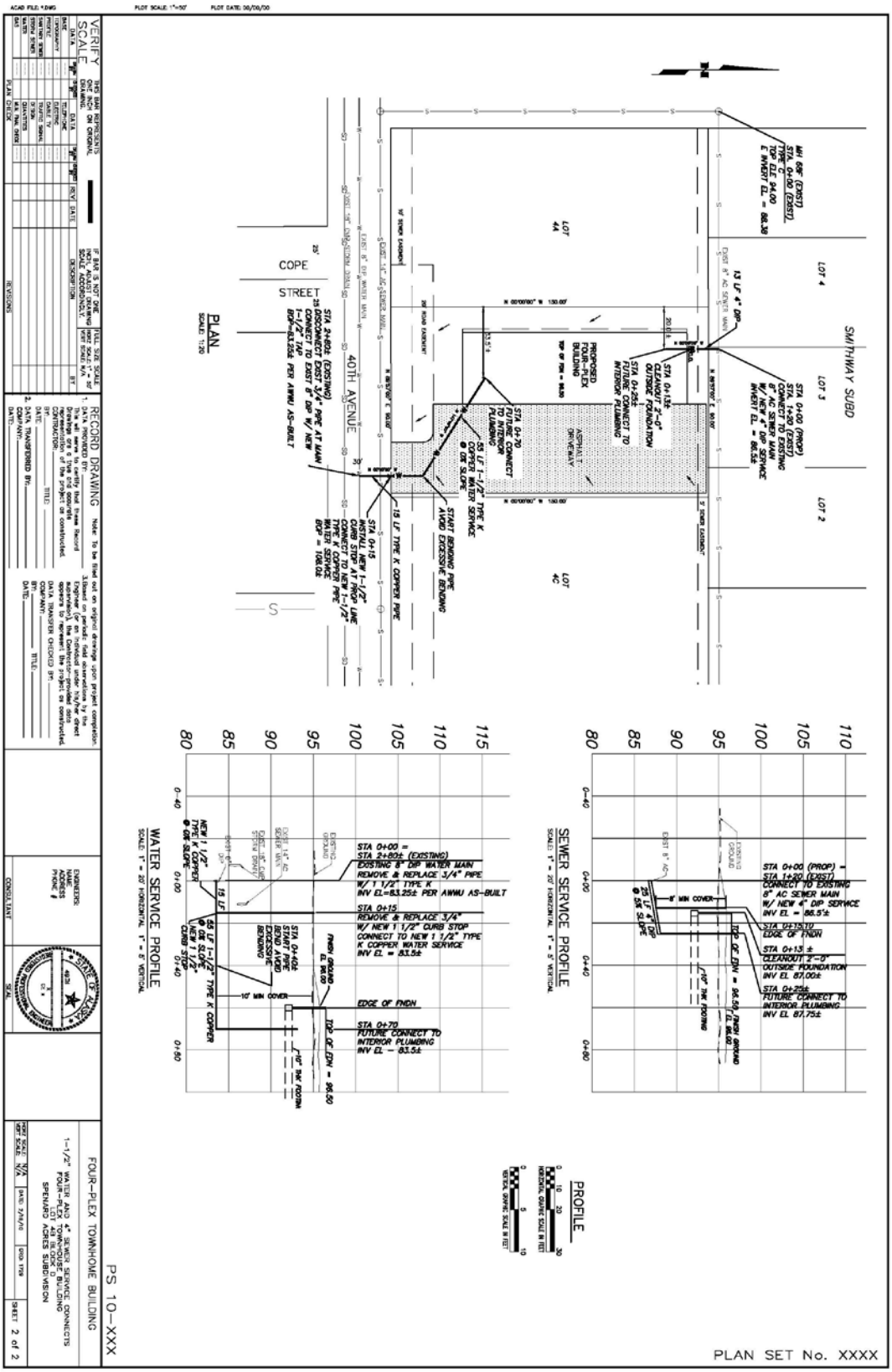
60.03.03 Private System Projects

The following drawings are an example of how all deliverables should look for private system project horizontal plant drawings.

60.03.03.01 Notes, Key Map, and Legend



60.03.03.02 Plan and Profile



60.04 Basic Construction Notes

The following general, sanitary sewer and water construction notes along with the general survey notes are examples of what shall be used on the drawings. All applicable notes shall be included in the published sequence, followed by project or contract specific notes. The groups of notes shall not be combined or mixed.

60.04.01 General Construction Notes

WHEN APPLICABLE THE FOLLOWING NOTES ARE TO BE USED ON AS GENERAL CONSTRUCTION NOTES.

1. ALL CONSTRUCTION SHALL BE INSTALLED AS SPECIFIED IN THE MOST CURRENT EDITION OF THE MUNICIPALITY OF ANCHORAGE STANDARD SPECIFICATIONS FOR STREETS–DRAINAGE–UTILITIES–PARKS (MASS), THE AWWU DESIGN AND CONSTRUCTION PRACTICES MANUAL, AND THE SPECIAL PROVISIONS.

2. MAINTAIN A MINIMUM OF TEN FEET (10') OF HORIZONTAL SEPARATION BETWEEN THE OUTSIDE OF PIPES FOR WATER TO SANITARY SEWER OR STORM DRAIN. WITH THE INSTALLATION OF FOUR INCHES (4") OF INSULATION BETWEEN THE PIPES, THE MINIMUM VERTICAL SEPARATION IS EIGHTEEN INCHES (18"). INSULATION MAY BE OMITTED WHEN THE VERTICAL SEPARATION IS GREATER THAN THIRTY–SIX INCHES (36"). WHERE STORM OR SEWER CROSS A WATER LINE, THE JOINTS OF ALL PIPES ARE TO HAVE A MINIMUM SEPARATION OF NINE FEET (9') FROM THE CROSSING.

3. ALL WATER/SEWER PIPE INSULATION SHALL BE RIGID BOARD, HIGH DENSITY POLYSTYRENE, MIN. 60 P.S.I., FOR UNDERGROUND INSTALLATIONS EQUIVALENT TO R–20 PER FOUR (4) INCH THICK INSULATION.

4. CONTRACTOR SHALL VERIFY AND RECORD THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL UTILITIES INSTALLED OR ENCOUNTERED IN THE FIELD AND RECORD ANY CHANGES ON THE CONTRACTOR RECORD DRAWINGS.

5. THE CONTRACTOR SHALL RESTORE ALL DISTURBED PROPERTY, INCLUDING DRAINAGE SWALES, DISTURBED BY CONTRACT ACTIVITIES TO PRECONSTRUCTION CONDITION OR AS INDICATED ON THE PLANS.

6. IN CASE OF CONFLICT BETWEEN STATIONING OR DIMENSIONED LOCATION OF PIPE OR FITTINGS, USE DIMENSIONED LOCATIONS.

7. THE CONTRACTOR SHALL RECORD SURVEY NOTES IN A FORMAT SIMILAR TO THAT SHOWN IN MASS DIVISION 65 FOR SUBMITTAL WITH RECORD DRAWING PLANS PRIOR TO CONTRACT FINAL PAYMENT.

8. CONTRACTOR MUST USE FIELD INSTALL RESTRAINED FITTINGS ON ALL MECHANICAL JOINTS.

9. CONTRACTOR IS TO USE DUCTILE IRON PIPE (DIP) LONG SOLID SLEEVES WITH RESTRAINED JOINTS TO FACILITATE CONNECTING DIP TO DIP OF SAME SIZE.

10. NON–TIGHTLY BONDED COATED DUCTILE AND CAST IRON PIPE AND FITTINGS SHALL BE ENCASED IN 8–MILS OF POLYETHYLENE WRAP THAT IS TO INCLUDE A VBIO FILM SYSTEM INCORPORATING CORROSION CONTROL ADDITIVES AND MIC CONTROL ADDITIVES AS PROVIDED BY US PIPE OR APPROVED EQUAL.

11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR EROSION AND SEDIMENT CONTROLS AS NECESSARY TO COMPLY WITH FEDERAL, STATE, AND MUNICIPAL LAWS THAT PROHIBIT UN–PERMITTED DISCHARGE OF POLLUTANTS, INCLUDING SEDIMENTS, THAT ARE A RESULT OF EROSION AND OTHER CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL CONDUCT ALL WORK SO SEDIMENT IS NOT TRANSPORTED ONTO THE ROADWAY OR ADJACENT PROPERTY. AT A MINIMUM, THE CONTRACTOR SHALL SWEEP UP ANY SEDIMENT TRACKED ONTO PAVED SURFACES IN PUBLIC RIGHT–OF–WAY WITHIN 24 HOURS OF THE TRACKING TO MINIMIZE THE WASH–OFF OF SEDIMENT INTO THE STORM DRAINS OR WATERWAYS.

2018 BASIC CONSTRUCTION NOTES.DWG

MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY

2018 DESIGN AND CONSTRUCTION PRACTICES

BASIC CONSTRUCTION NOTES

GENERAL CONSTRUCTION NOTES

REVISED	Date
12/2003 AWWU	MAR 2017
03/2017 AWWU	Scale NTS
	Sheet 1 of 4

60.04.02 Sanitary Sewer Construction Notes

WHEN APPLICABLE THE FOLLOWING NOTES ARE TO BE USED ON AS SEWER CONSTRUCTION NOTES.

1. THE CONTRACTOR IS TO NOTIFY THE ENGINEER AND PROPERTY OWNERS SEVENTY–TWO (72) HOURS IN ADVANCE OF ANY INTERRUPTION TO SANITARY SEWER SERVICE. THE CONTRACTOR MUST PROVIDE TEMPORARY SERVICE DURING THE PERIOD OF INTERRUPTION

2. ALL MANHOLES SHALL HAVE A MINIMUM OF ONE–SIX (6") INCH GRADE RING. MAXIMUM GRADE RING ADJUSTMENT SHALL NOT EXCEED EIGHTEEN (18") INCHES.

3. ALL SANITARY SEWER MAINS SHALL BE CLASS 50, DUCTILE IRON PIPE OR POLYVINYL CHLORIDE (PVC) C–900, DR–18.

4. SANITARY SEWER SERVICES SHALL BE __<SIZE>__ UNLESS NOTED ON PLANS WITH A MINIMUM SLOPE FOR 6–INCH SERVICES TO BE 1% AND FOR 4–INCH SERVICES TO BE 2%.

5. SANITARY SEWER SERVICES SHALL BE PLACED NO CLOSER THAN: 15 FEET HORIZONTALLY MEASURED TO ANY FIRE HYDRANT OR FIRE HYDRANT LEG; 10 FEET HORIZONTALLY MEASURED TO ANY WATER MAIN, WATER SERVICE, STORM SEWER, FOOTING DRAIN, STREET LIGHT, TRANSFORMER PAD, ELECTRICAL/TELEPHONE/CABLE BOX AND UTILITY POLE; AND 5 FEET HORIZONTALLY MEASURED TO ANY SIDE LOT LINE.

6. ALL SEWER MAIN AND SERVICE BEDDING IS TO BE CLASS 'E' AND ALL BACKFILL COMPACTED TO A MINIMUM OF 95% OF MAXIMUM DENSITY..

7. THE CONTRACTOR SHALL RELOCATE ANY SEWER SERVICE CONNECTIONS INSTALLED WITH LESS THAN MINIMUM STANDARD MEASURED DISTANCES PRIOR TO FINAL ACCEPTANCE BY AWWU.

2018 BASIC CONSTRUCTION NOTES.DWG

MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY

2018 DESIGN AND CONSTRUCTION PRACTICES

BASIC CONSTRUCTION NOTES

SANITARY SEWER CONSTRUCTION NOTES

REVISED	Date
12/2003 AWWU	MAR 2017
03/2017 AWWU	Scale NTS
	Sheet 2 of 4

60.04.03 Water Construction Notes

WHEN APPLICABLE, THE FOLLOWING NOTES ARE TO BE USED AS WATER CONSTRUCTION NOTES.

1. HYDRANTS WILL BE ADJUSTED TO FINAL GRADE BY AWWU O&M DIVISION ON A REIMBURSABLE BASIS. THE CONTRACTOR IS TO PROVIDE WRITTEN NOTICE TO THE MASS ENGINEER AND THE AWWU INSPECTOR A MINIMUM OF SEVEN (7) DAYS PRIOR TO THE NEED FOR FINAL HYDRANT ADJUSTMENT. THE WRITTEN NOTICE IS TO CONTAIN AT A MINIMUM, THE MANUFACTURER, MODEL NUMBER OF THE HYDRANT AND VERTICAL ADJUSTMENT NEEDED IN SIX INCH (6") INCREMENTS.

2. AWWU, ANCHORAGE FIRE DEPARTMENT AND WATER CUSTOMERS SHALL BE NOTIFIED ABOUT WATER SERVICE INTERRUPTIONS AND BE PROVIDED TEMPORARY WATER IN ACCORDANCE WITH MASS.

3. UNLESS OTHERWISE LABELED ON THE PLANS, ALL PIPE AND FITTINGS ARE TO BE RESTRAINED. REGARDLESS OF NOTES DELINEATING RESTRAINT, ALL PIPES EIGHT (8') FEET IN LENGTH AND LESS ARE TO BE RESTRAINED.

4. THRUST RESTRAINT SHALL BE PROVIDED BY USE OF FIELD-LOK GASKETS (OR EQUAL) OR MEG-A-LUG FITTINGS (OR EQUAL) ON ALL MECHANICAL JOINTS. THE USE OF THRUST BLOCKS WILL NOT BE ALLOWED FOR DUCTILE IRON PIPE, BUT ARE REQUIRED FOR PVC PIPE (DIP FITTINGS).

5. WATER SERVICES SHALL BE __<SIZE>__ UNLESS NOTED ON PLANS.

6. WATER SERVICES SHALL BE PLACED NO CLOSER THAN: 15 FEET HORIZONTALLY MEASURED TO ANY FIRE HYDRANT OR FIRE HYDRANT LEG; 10 FEET HORIZONTALLY MEASURED TO ANY SANITARY SEWER MAIN, SANITARY SEWER SERVICE, STORM SEWER, FOOTING DRAIN, STREET LIGHT, TRANSFORMER PAD, ELECTRICAL/TELEPHONE/CABLE BOX AND UTILITY POLE; AND 5 FEET HORIZONTALLY MEASURED TO ANY SIDE LOT LINE

7. THE CONTRACTOR SHALL PROVIDE ALL SETUP AND TEAR DOWN REQUIRED TO OPEN BORE FLUSH NEWLY INSTALLED WATER PIPE. AWWU WILL PROVIDE FLUSH WATER FROM THE AWWU WATER DISTRIBUTION SYSTEM. THE CONTRACTOR MUST REQUEST WATER AT LEAST 48 HOURS PRIOR TO OPEN BORE FLUSHING. OPEN BORE FLUSHING MUST TAKE PLACE PRIOR TO INSTALLATION OF WATER SERVICES.

8. ALL WATER MAIN AND SERVICE BEDDING IS TO BE CLASS 'E' AND ALL BACKFILL COMPACTED TO A MINIMUM OF 95% OF MAXIMUM DENSITY.

9. ALL WATER MAINS AND SERVICES SHALL HAVE A MINIMUM OF 10 FEET OF BURY AT ALL POINTS.

10. MAXIMUM DEFLECTION OF PIPE PER JOINT SHALL NOT EXCEED 80% OF THE MANUFACTURERS RECOMMENDED DEFLECTION (4 DEGREES) FOR DIP. PVC PIPE SHALL NOT BE DEFLECTED AT PIPE TO PIPE JOINTS, BUT MAY BE DEFLECTED UP TO 80% OF THE MANUFACTURERS RECOMMENDED DEFLECTION LIMITS IN FITTINGS AND COUPLERS.

11. THE CONTRACTOR SHALL RELOCATE ANY WATER SERVICE CONNECTIONS INSTALLED WITH LESS THAN MINIMUM STANDARD DISTANCES PRIOR TO ACCEPTANCE BY AWWU.

2018 BASIC CONSTRUCTION NOTES.DWG

MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY

2018 DESIGN AND CONSTRUCTION PRACTICES

BASIC CONSTRUCTION NOTES

WATER CONSTRUCTION NOTES

REVISED	Date
12/2003 AWWU	MAR 2017
03/2017 AWWU	Scale NTS
	Sheet 3 of 4

60.04.04 General Survey Notes

THE FOLLOWING NOTES ARE AN EXAMPLE OF WHAT SHOULD BE USED ON GENERAL SURVEY NOTES.

1. THE FIELD SURVEY WAS PERFORMED BY ASCG, INC. FROM MONTH ##, 200? TO MONTH ##, 200?. FIELD SURVEY INFORMATION FOR THIS PROJECT IS LOCATED IN ASCG, INC. FIELD BOOK NO. ????, PAGES ?? THROUGH ??.

2. CONTOUR INTERVAL = 2 FOOT.

3. MANHOLE LOCATIONS ARE SHOWN TO APPROXIMATE CENTER OF STRUCTURE.

4. ALL ROADWAY SURFACES ARE ASPHALT UNLESS OTHERWISE NOTED.

5. UNDERGROUND NATURAL GAS, TELEPHONE, ELECTRIC, AND CABLE TV LINES WERE FIELD LOCATED. PRIVATE SERVICE LINES WERE NOT FIELD LOCATED.

6. LOCATION OF WATER UTILITY LINES IS APPROXIMATE. THEY ARE DRAWN FROM VALVE TO VALVE USING AS BUILT INFORMATION AND WERE NOT FIELD LOCATED.

7. UNDERGROUND STREET LIGHT LINES EXIST WITHIN THE PROJECT AREA.

8. UNDERGROUND NATURAL GAS, TELEPHONE, ELECTRIC, AND CABLE TV LINE CROSSINGS IN THE PROFILE ARE SHOWN AT AN ASSUMED VERTICAL LOCATION. THE CONTRACTOR IS RESPONSIBLE FOR THE LOCATING, PROTECTION AND REPAIRING OF UTILITIES.

9. A TITLE SEARCH WAS NOT PERFORMED, EASEMENTS OF RECORD OTHER THAN THOSE SHOWN ON THE RECORDED PLATS ARE NOT SHOWN HEREON.

10. ALL DISTURBED PROPERTY CORNERS SHALL BE REPLACED BY THE CONTRACTOR IN ACCORDANCE WITH SPECIAL PROVISION 65.02, ARTICLE 2.1 PROJECT CONTROL.

DATUM IS (U.S.C. & G.S.) M.S.L. 1972 ADJUSTED. BLM __<NUMBER>__: SEE B.M. BOOK, PAGE NUMBER __<NUMBER>__ FOR DESCRIPTION.

2018 BASIC CONSTRUCTION NOTES.DWG

MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY

2018 DESIGN AND CONSTRUCTION PRACTICES

BASIC CONSTRUCTION NOTES

GENERAL SURVEY NOTES

REVISED	Date
12/2003 AWWU	MAR 2017
03/2017 AWWU	Scale NTS
	Sheet 4 of 4

ITEM	FONT STYLE	TEXT HEIGHT		LINE WEIGHT
		FULL	HALF	
FIELD BOOK NUMBER	SIMPLEX	.08	.04	.010
DATUM INFORMATION	SIMPLEX	.08	.04	.010
PROJECT TITLE	SIMPLEX	.12	.06	.010
AREA OR STREET NAME	**SIMPLEX**	**.175**	**.0875**	**.022**
SECTION OF PROJECT	SIMPLEX	.14	.07	.010
SCALE	SIMPLEX	.08	.04	.010
DATE	SIMPLEX	.08	.04	.010
GRID NUMBER	SIMPLEX	.08	.04	.010
ACCOUNT NUMBER	SIMPLEX	.10	.05	.010
PROFESSIONAL ENGINEER'S NUMBER	SIMPLEX	.08	.04	.010
SHEET NUMBER	SIMPLEX	.14	.07	.014
FILE NUMBER	**SIMPLEX**	**.24**	**.12**	**.022**
REVISIONS	SIMPLEX	.08	.04	.010

NOTES:

All lettering in title block shall be vertical and SIMPLEX font.
For lettering, use text height and pen weight recommended in these standards.

2018 LETTERING LEGEND.DWG

MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY
2018 DESIGN AND CONSTRUCTION PRACTICES
LETTERING LEGENDS
LETTERING LEGEND 1 OF 3

REVISED	Date
12/2003 AWWU	FEB 2017
03/2008 AWWU	Scale NTS
03/2012 AWWU	
01/2017 AWWU	Sheet 1 of 3

60.05.02 Lettering Legend-2 of 3

ITEM	FONT STYLE	TEXT HEIGHT		LINE WEIGHT
		FULL	HALF	
SUBDIVISION NAME	SIMPLEX	.24	.12	.014
BLOCK NUMBER	SIMPLEX	.24	.12	.014
LOT NUMBERS	SIMPLEX	.12	.06	.014
STREET NAMES	SIMPLEX	.175	.0875	.014
100' STATION TEXT	SIMPLEX	.08	.04	.014
STREET WIDTHS	SIMPLEX	.10	.05	.010
SPECIFIC ELEVATIONS	SIMPLEX	.10	.05	.010
PROPERTY AND EASEMENT NOTES	SIMPLEX	.08	.04	.010
EXISTING FEATURES AND UTILITY SYMBOLS	SIMPLEX	.05	.025	.010
CONSTRUCTION NOTES	SIMPLEX	.10	.05	.014
GENERAL NOTES	SIMPLEX	.10	.05	.014
SHEET REFERENCE	SIMPLEX	.12	.06	.014
EXISTING UTILITY LINE LABEL	SIMPLEX	.10	.05	.005
PROPOSED UTILITY LINE LABEL	SIMPLEX	.12	.06	.022
TABLES (COORDINATE, CURVE DATA, ETC)	SIMPLEX	.12	.06	.014

NOTES:

1. All lettering in plan view directly related to new design or proposed construction shall have an oblique angle of 15.

2. For lettering, use font style, text height, and pen weight recommended in these standards.

2018 LETTERING LEGEND.DWG

MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY

2018 DESIGN AND CONSTRUCTION PRACTICES

LETTERING LEGENDS

LETTERING LEGEND 2 OF 3

REVISED	Date
12/2003 AWWU	FEB 2017
03/2008 AWWU	Scale NTS
03/2012 AWWU	
02/2017 AWWU	Sheet 2 of 3

60.05.03 Lettering Legend-3 of 3

ITEM	FONT STYLE	TEXT HEIGHT FULL	TEXT HEIGHT HALF	LINE WEIGHT
STATIONING SCALE	SIMPLEX	.12	.06	.014
ELEVATION SCALE	**SIMPLEX**	**.24**	**.12**	**.022**
℄ STATIONING	**SIMPLEX**	**.08**	**.04**	**.022**
℄ & ℄ REFERENCE	SIMPLEX	.10	.05	.014
CONSTRUCTION NOTES	SIMPLEX	.10	.05	.014
SOILS CLASSIFICATION	SIMPLEX	.10	.05	.010
GRADE & VERTICAL CURVE DATA	SIMPLEX	.10	.05	.014
EXISTING UTILITY DATA	SIMPLEX	.10	.05	.010
PLAN SET #	**SIMPLEX**	.20	.10	.014
COVER SHT.	**H350**	**.35**	**.175**	**.022**
PROJ. NAME	**H290**	**.29**	**.145**	**.022**
CONTOURS	SIMPLEX	.10	.05	.010

NOTES:

1. All lettering in profile view directly related to new design or proposed construction shall have an oblique angle of 15°.
2. For lettering, use font style, text height and pen weight recommended in these standards.

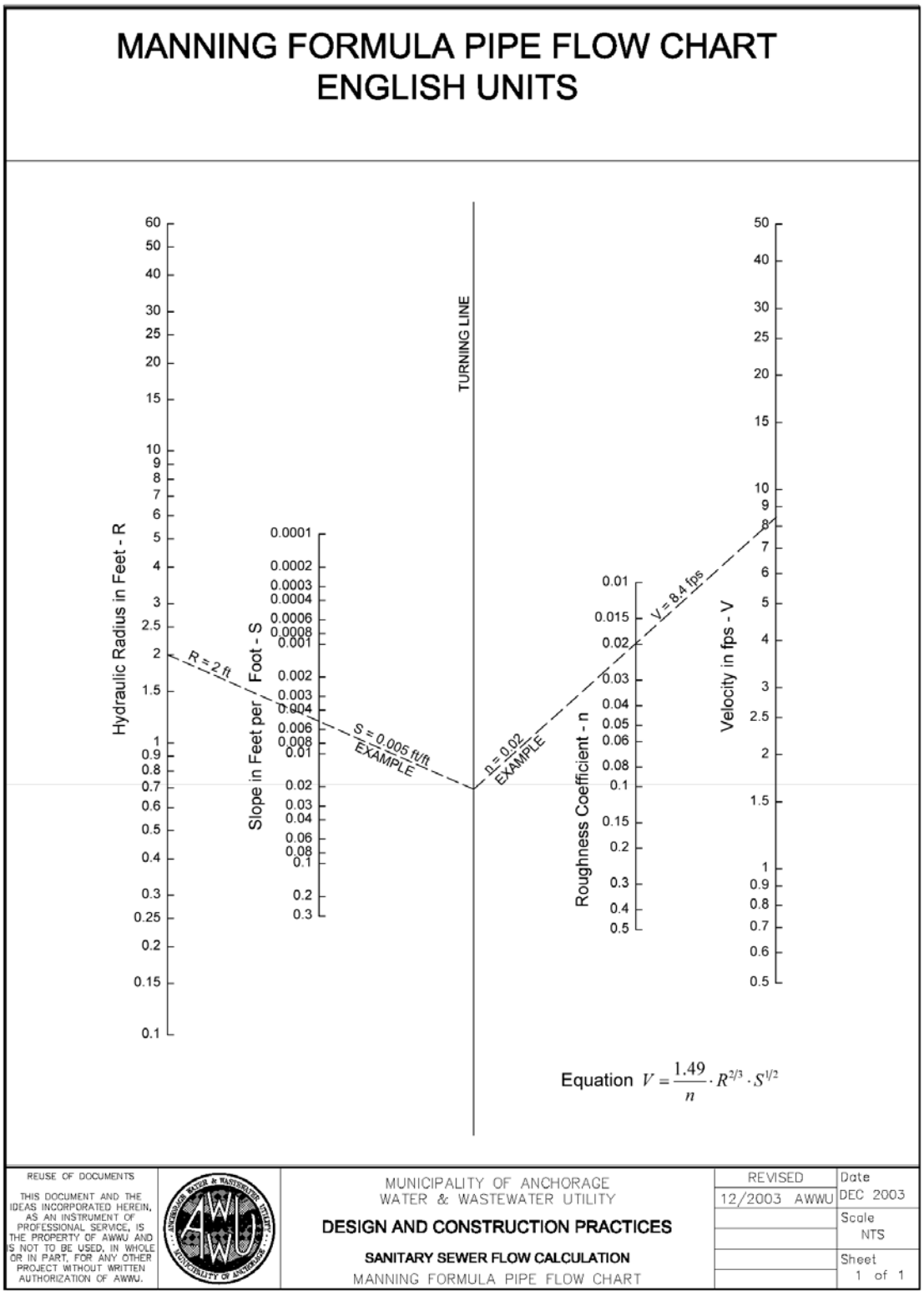
2018 LETTERING LEGEND.DWG

MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY
2018 DESIGN AND CONSTRUCTION PRACTICES
LETTERING LEGENDS
LETTERING LEGEND 3 OF 3

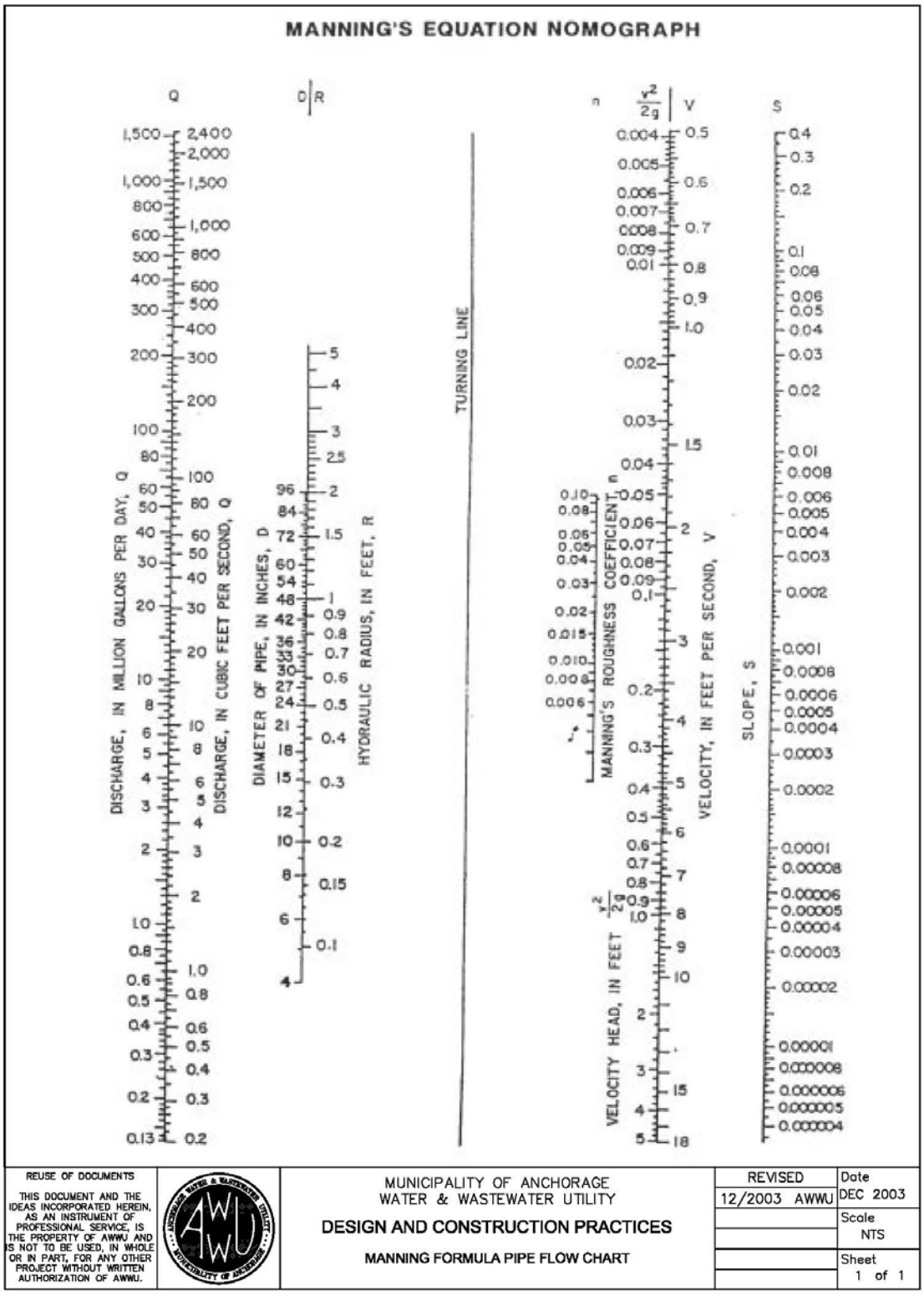
REVISED	Date
12/2003 AWWU	FEB 2017
03/2008 AWWU	Scale NTS
03/2012 AWWU	
02/2017 AWWU	Sheet 3 of 3

60.06 Sanitary Sewer Flow Calculation

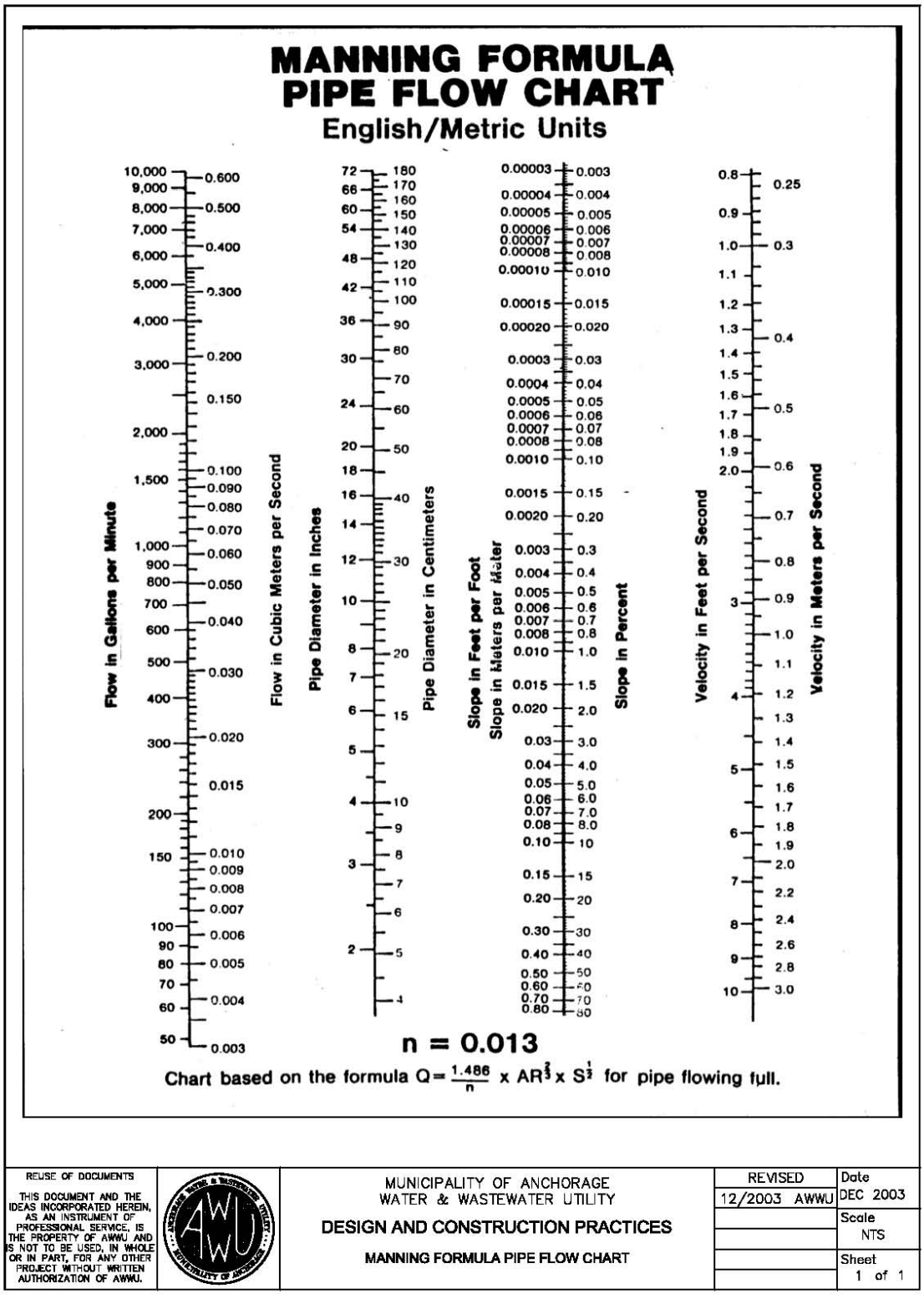
60.06.01 Manning Formula Pipe Flow Chart 1



60.06.02 Manning Formula Pipe Flow Chart 2



60.06.03 Manning Formula Pipe Flow Chart 3



MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY

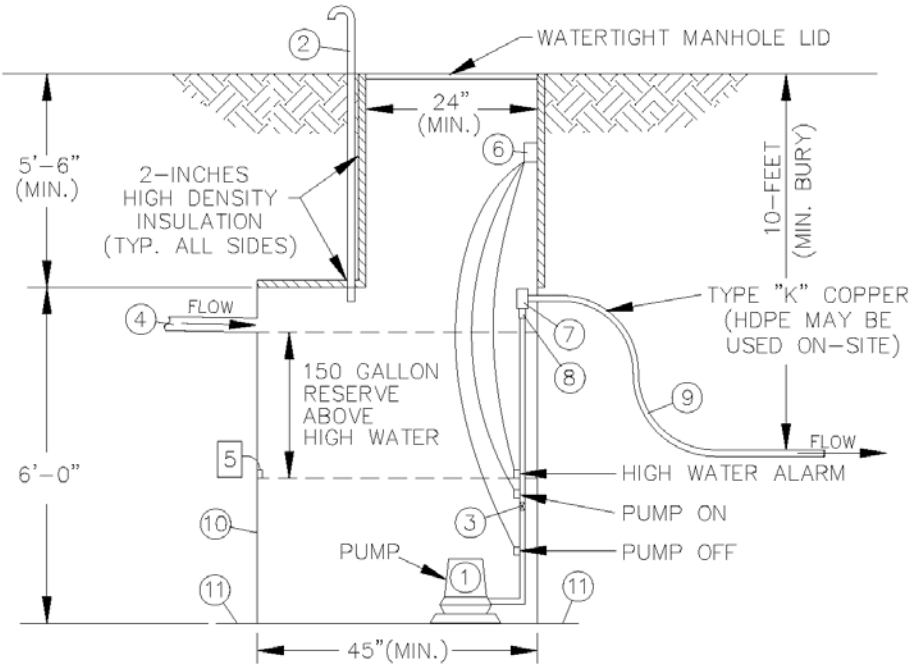
DESIGN AND CONSTRUCTION PRACTICES

MANNING FORMULA PIPE FLOW CHART

REVISED	Date
12/2003 AWWU	DEC 2003
	Scale NTS
	Sheet 1 of 1

60.07 Private Lift Station

60.07.01 Residential Private Lift Station Detail



THIS LIFT STATION IS THE MINIMUM SIZE FOR RESIDENTIAL USE.
ACTUAL SIZE WILL VARY WITH USE AND DESIGN REQUIREMENTS.

1. EFFLUENT GRINDER PUMP, MINIMUM 2 HP., 240 V. (BARNES MODEL SGV2022L).
2. LIFT STATION SHALL BE EXTERNALLY VENTED.
3. CHECK VALVE (OPTIONAL–DELETE IF OWNER DESIRES SYSTEM TO DRAIN BACK TO TANK).
4. INFLUENT CONNECTION (4–INCH DIAMETER MINIMUM).
5. ALARM SYSTEM (SHALL BE ON A SEPARATE CIRCUIT FROM PUMP CONTROLS).
6. JUNCTION BOX (SHALL BE EXPLOSION PROOF AND SEALED FROM EXTERNAL POWER SOURCE).
7. PITLESS ADAPTER.
8. REDUCER, IF NECESSARY.
9. 2–INCH DISCHARGE LINE (IF BURIED LESS THAN 10 FEET DEEP IT MUST BE ARCTIC PIPE OR COVERED WITH 4–INCHES X 4 FEET WIDE OF HIGH DENSITY INSULATION.
10. TANK (MINIMUM 500 GALLON CAPACITY, MADE OF HDPE OR 12–GUAGE STEEL COATED ON INTERIOR AND EXTERIOR WITH BITUMASTIC ENGARD 1812 OR EQUAL).
11. ANCHOR RING, IF NECESSARY TO PREVENT BUOYANCY.

MUNICIPALITY OF ANCHORAGE
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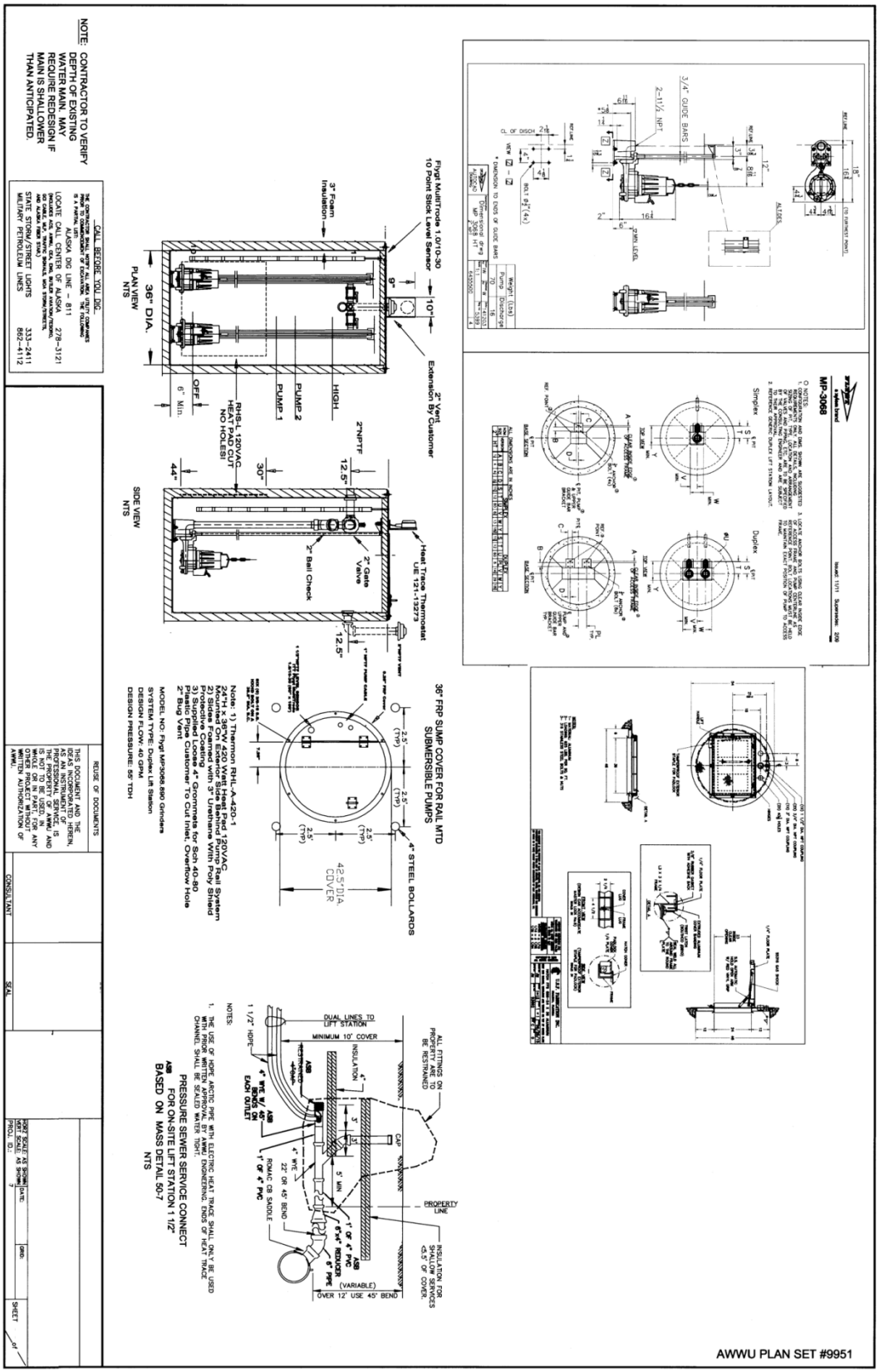
DESIGN AND CONSTRUCTION PRACTICES

PRIVATE LIFT STATION

PRIVATE LIFT STATION DETAIL

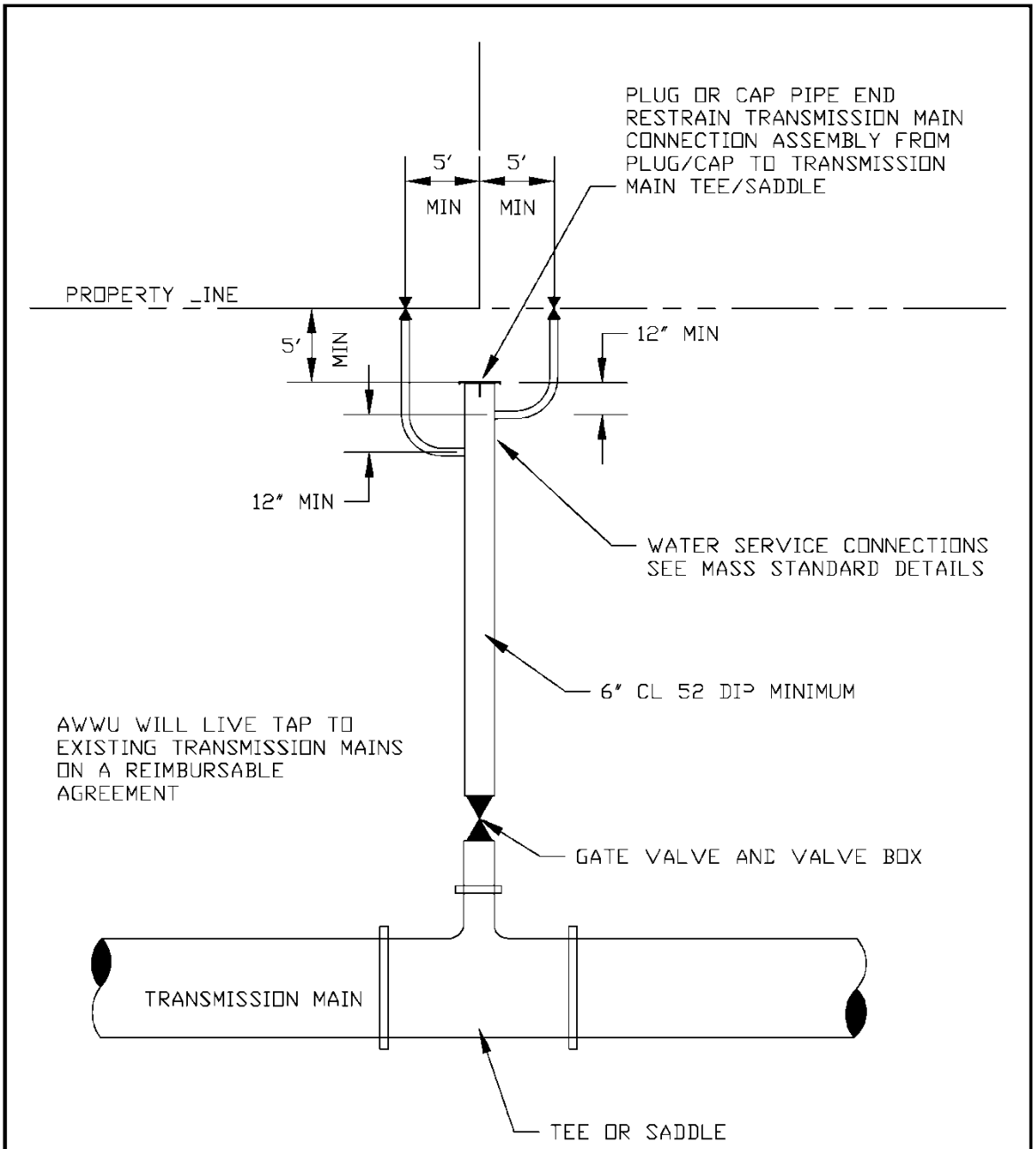
REVISED	Date
12/2003 AWWU	DEC 2003
	Scale NTS
	Sheet 1 of 1

60.07.02 Commercial Private Lift Station Example



60.08 Transmission Main Connect

60.08.01 Transmission Main Connect Detail



NOTES:
1. ONLY 2 SERVICES MAY BE TAPPED OFF EACH TRANSMISSION MAIN CONNECTION
2. INSTALL 6" CL 52 DIP MIN. PER MASS DIVISION 60
3. MAINTAIN MINIMUM OF 10 FEET OF COVER
4. ALL NEWLY INSTALLED DIP AND FITTINGS WILL BE ENCASED IN POLYETHYLENE 8-MILS THICK

2018 Transmission Main Connect.dwg

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2018 DESIGN AND CONSTRUCTION PRACTICES

TRANSMISSION MAIN CONNECT

TRANSMISSION MAIN CONNECT DETAIL

REVISED	Date
12/2003 AWWU	MAR 2017
03/2017 AWWU	Scale NTS
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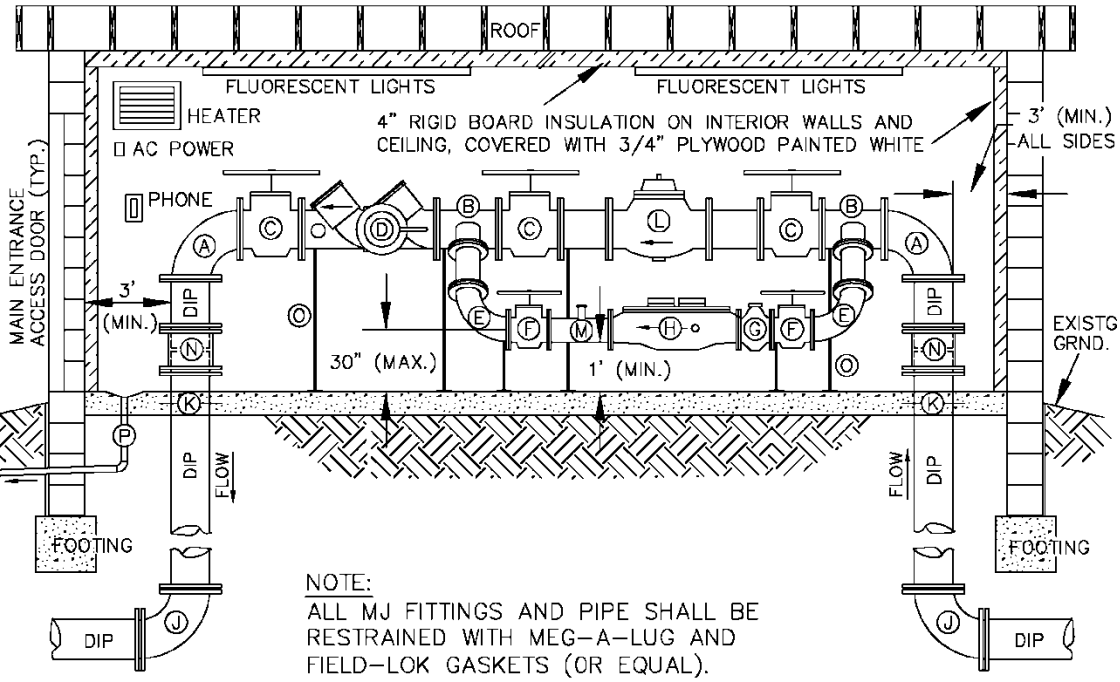
60.09 Typical Meter Facility

60.09.01 Meter Facility Detail



Ⓐ 8-INCH 90° BEND, FL/FL
Ⓑ 8"x 6" TEE, FL/FL
Ⓒ 8-INCH BUTTERFLY VALVE, FL/FL
Ⓓ 8-INCH REDUCED PRESSURE BACKFLOW PREVENTER, FEBCO MODEL 825, FL/FL
Ⓔ 6-INCH 90° BEND, FL/FL
Ⓕ 6-INCH BUTTERFLY VALVE, FL/FL
Ⓖ 6-INCH NEPTUNE STRAINER (OWNER FURNISHED), FL/FL
Ⓗ 6-INCH NEPTUNE TRU/FLO COMPOUND METER (OWNER FURNISHED), FL/FL
Ⓙ 8-INCH 90° BEND, MJ/MJ W/ MEG-A-LUGS
Ⓚ 8-INCH WALL SLEEVE, PE/PE
Ⓛ PRESSURE REDUCING VALVE
Ⓜ 6"x 2" TEE, FL/FL/FL
Ⓝ 8-INCH D.I.P. LONG SOLID SLEEVE W/ MEG-A-LUGS
Ⓞ PIPE SUPPORTS BOLTED TO FLOOR AND ATTACHED TO THE PIPE (TYP.)
Ⓟ FLOOR DRAIN CONNECTION TO STORM DRAIN, DRY WELL OR SEWER

NOTE:

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE UNIFORM BUILDING CODE. STRUCTURE DIMENSIONS, PIPE SIZES AND CONFIGURATION WILL VARY DEPENDING UPON WATER MAIN LINE PIPE SIZING AS APROVED BY AWWU ENGINEERING.

2018 TYPICAL METER FACILITY.DWG

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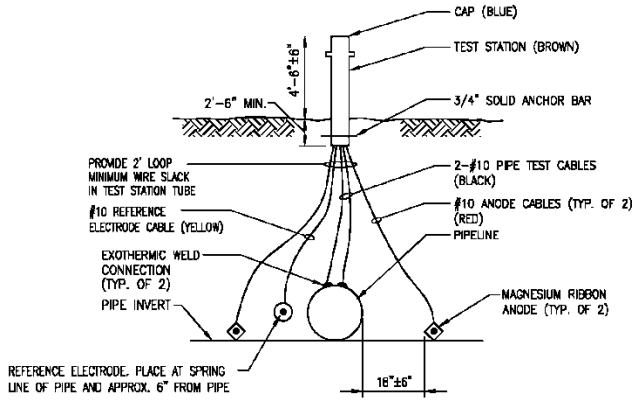
WATER & WASTEWATER UTILITY
2018 DESIGN AND CONSTRUCTION PRACTICES
TYPICAL METER FACILITY
METER FACILITY DETAIL

REVISED	Date
12/2003 AWWU	MAR 2017
03/2017 AWWU	Scale NTS
	Sheet 1 of 1

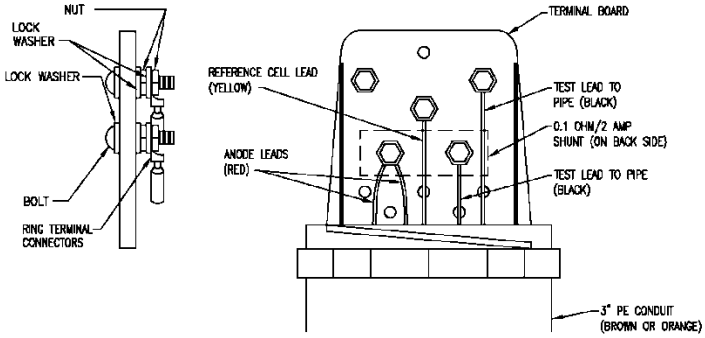
60.10 Corrosion Control Typical Details

60.10.01 Magnesium Ribbon Anode Installation Detail



TEST STATION AND MAGNESIUM RIBBON ANODE INSTALLATION

NTS



TEST STATION TERMINAL BOARD

NTS

NOTES:

1. MAGNESIUM RIBBON ANODES SHALL BE 3/8" X 3/4" AND WEIGH AN AVERAGE OF 0.24LBS./FT. ANODES SHALL BE EXTRUDED AND HAVE A 0.135-INCH DIAMETER STEEL CORE. ALL ANODES SHALL BE OF HIGH POTENTIAL MAGNESIUM ALLOY. MAGNESIUM RIBBON SHALL BE INSTALLED ALONG THE ENTIRE LENGTH OF THE PIPELINE. MAGNESIUM ANODES SHALL BE CONNECTED TO AN ANODE LEAD CABLE. THE ANODES SHALL MAKE CONTACT WITH THE STRUCTURE ONLY THROUGH THE TEST STATIONS. THE CONNECTION BETWEEN THE ANODE LEAD WIRE AND THE MAGNESIUM RIBBON STEEL CORE SHALL BE MADE WITH COPPER CRIMP CONNECTORS. THE SPLICE SHALL BE ENCAPSULATED.

2. UNDERGROUND CABLES UTILIZED FOR THE CATHODIC PROTECTION CIRCUIT SHALL BE NO. 10 AWG, STRANDED COPPER CONDUCTOR WITH HMWPE INSULATION RATED FOR 600 VOLTS AND BELOW GRADE USE. CABLE SPLICES SHALL NOT BE PERMITTED UNLESS OTHERWISE SPECIFIED OR SHOWN. CABLES SHALL BE COLOR-CODED AS SHOWN. COLOR SHALL BE IMPREGNATED IN THE INSULATION MATERIAL.

3. TEST STATIONS SHALL BE TUBE STYLE WITH A NINE LEAD TERMINAL BOARD, NICKEL-PLATED BRASS OR STAINLESS STEEL MOUNTING HARDWARE AND COME COMPLETE WITH A 3/4-INCH SOLID ANCHOR BAR. THE TUBE SHALL BE 3-INCH DIAMETER, UV STABILIZED POLYETHYLENE OR POLYCARBONATE, BROWN IN COLOR, WITH A BLUE TEST HEAD AND COMPRESSION FIT BASE. TEST STATION SHALL BE BIG FINK, AS MANUFACTURED BY COTT INDUSTRIES. CABLE TERMINAL CONNECTORS SHALL BE RING CONNECTORS WITH INSULATION GRIP.

4. REFERENCE ELECTRODES SHALL BE CU/CUSO4 TYPE AND SHALL HAVE A MINIMUM DESIGN LIFE OF 20 YEARS. THE LEAD WIRE SHALL BE NO. 10 AWG STRANDED COPPER WITH YELLOW HMWPE INSULATION. REFERENCE ELECTRODES SHALL BE STEALTH REFERENCE ELECTRODES, AS MANUFACTURED BY BORIN MANUFACTURING COMPANY OR GMC STAPERM. THE ELECTRODE SHALL NOT BE HANDLED BY THE LEAD CABLE. PLASTIC OR PAPER BAGS SHALL BE REMOVED FROM THE ELECTRODE BEFORE LOWERING INTO PLACE. SOIL FREE OF ROCKS AND CLODS SHALL BE PLACED AROUND THE ELECTRODE. DAMAGE TO THE ELECTRODE OR WIRE INSULATION WILL REQUIRE REPLACEMENT OF THE ENTIRE ASSEMBLY.

5. EXOTHERMIC WELDS SHALL BE PROVIDED FOR CABLE-TO-STRUCTURE CONNECTIONS AND MADE IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. EXOTHERMIC WELDS SHALL BE CADWELD, AS MANUFACTURED BY ERICO PRODUCTS, INC. OR APPROVED EQUAL. THE SHAPE AND CHARGE OF THE EXOTHERMIC WELD SHALL BE CHOSEN BY THE CONTRACTOR AND SHALL BE BASED ON THE FOLLOWING PARAMETERS:

- PIPE MATERIAL
- PIPE SIZE
- CABLE SIZE
- NUMBER OF STRANDS TO BE WELDED
- ORIENTATION OF WELD (VERTICAL OR HORIZONTAL)

6. MATERIALS USED TO REPAIR AND ENCAPSULATE THE EXOTHERMIC WELD AREA SHALL BE COAL TAR MASTIC OR APPROVED EQUAL.

2018 CORROSION CONTROL.DWG

MUNICIPALITY OF ANCHORAGE
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2018 DESIGN AND CONSTRUCTION PRACTICES

CORROSION CONTROL

MAGNESIUM RIBBON ANODE INSTALLATION DETAIL

REVISED	Date
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03/2017 AWWU	Scale NTS
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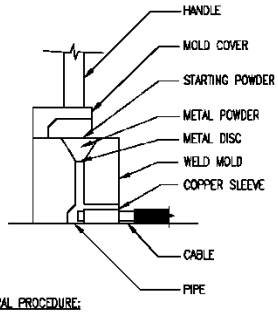
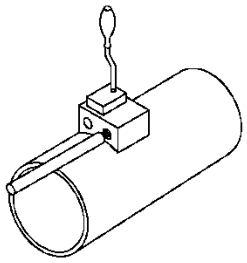
60.10.02 Exothermic Weld Details



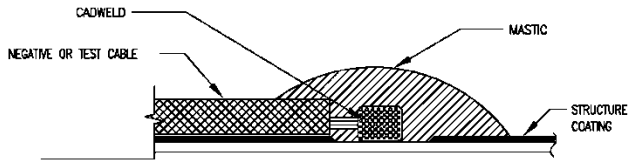


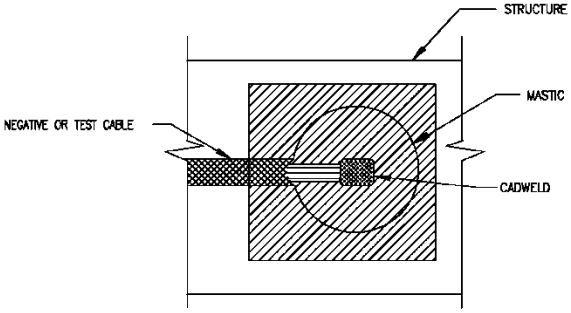
GENERAL PROCEDURE:

1. PROCEDURE IS ONLY TO BE USED AS A GENERAL GUIDE, SEE PROJECT NOTES AND MANUFACTURERS LITERATURE FOR SPECIFIC INSTRUCTIONS.
2. CLEAN & FILE STRUCTURE TO BRIGHT METAL.
3. STRIP INSULATION FROM WIRE SUFFICIENT TO CLEAR WELD MOLD, INSTALL COPPER SLEEVE.
4. HOLD FIRMLY WITH OPENING AWAY FROM OPERATOR, IGNITE POWDER.
5. REMOVE SLAG FROM CONNECTION, TEST WELD WITH SHARP HAMMER BLOW.
6. COVER ALL EXPOSED METALS AS REQUIRED.
7. EXOTHERMIC WELDS MATERIAL SHALL BE CADWELD OR APPROVED EQUAL

EXOTHERMIC WELD DETAIL

NTS





NOTES:
1. USE COAL TAR MASTIC OR APPROVED EQUAL FOR EXOTHERMIC WELD AREA REPAIRS.

EXOTHERMIC WELD COATING REPAIR DETAIL

NTS

2018 CORROSION CONTROL.DWG

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WATER & WASTEWATER UTILITY

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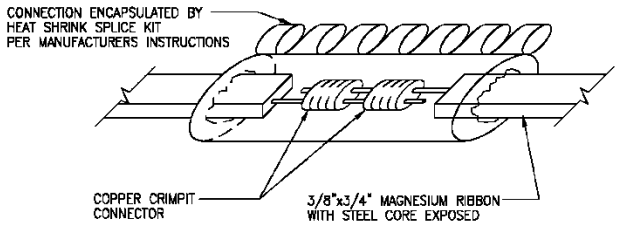
CORROSION CONTROL

EXOTHERMIC WELD DETAILS

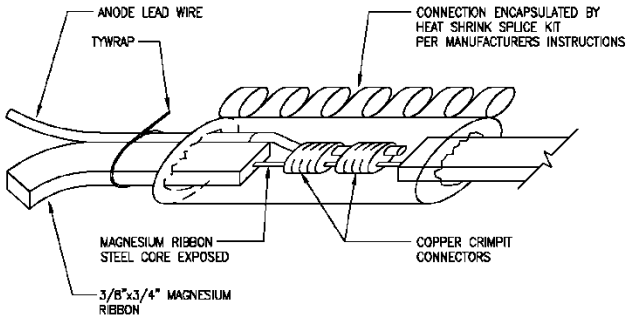
REVISED	Date
12/2003 AWWU	MAR 2017
03/2017 AWWU	Scale NTS
	Sheet 2 of 3

60.10.03 Magnesium Ribbon Splice Details



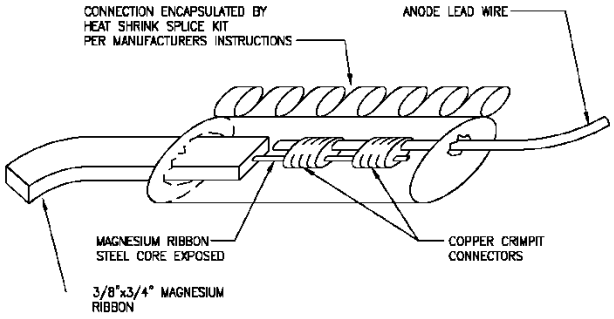
MAGNESIUM RIBBON INLINE SPLICE

NTS



MAGNESIUM RIBBON AND
ANODE LEAD WIRE TAP SPLICE

NTS



MAGNESIUM RIBBON AND
ANODE LEAD WIRE END SPLICE

NTS

GENERAL NOTES:

1. THE ANODE ENDS SHOULD BE PREPARED FOR SPLICING BY MECHANICAL MEANS ONLY. THE MAGNESIUM COULD IGNITE IF IT IS REMOVED FROM THE IRON CORE WIRE BY MELTING. THE RESULTING FLAME WOULD BE DIFFICULT TO EXTINGUISH.

2. HEAT SHRINK SPLICE ENCAPSULATION KITS SHALL BE RAYCHEM TYPE ASE OR APPROVED EQUAL.

2018 CORROSION CONTROL.DWG

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2018 DESIGN AND CONSTRUCTION PRACTICES

CORROSION CONTROL

MAGNESIUM RIBBON SPLICE DETAILS

REVISED	Date
12/2003 AWWU	MAR 2017
03/2017 AWWU	Scale NTS
	Sheet 3 of 3

60.11 Record Drawing Stamp

RECORD DRAWING

1. DATA PROVIDED

BY:_____

This will serve to certify that these Record Drawings are a true and accurate representation of the project as constructed.

CONTRACTOR: CONSTRUCTION CONTRACTOR

BY:_____ **TITLE:**_____

DATE:_____

2. DATA TRANSFERRED

BY: TRANSFEROR'S NAME – PRINTED

COMPANY: ENGINEER OR CONSULTANT COMPANY

DATE: TRANSFER DATE

3. DATA TRANSFER CHECKED

Based on periodic field observations by the Engineer (or an Individual under his/her direct supervision), the Contractor-provided data appears to represent the project as constructed.

BY:_____

COMPANY: ENGINEER OR CONSULTANT COMPANY

BY:_____ **TITLE:**_____

DATE:_____

MUNICIPALITY OF ANCHORAGE
WATER & WASTEWATER UTILITY

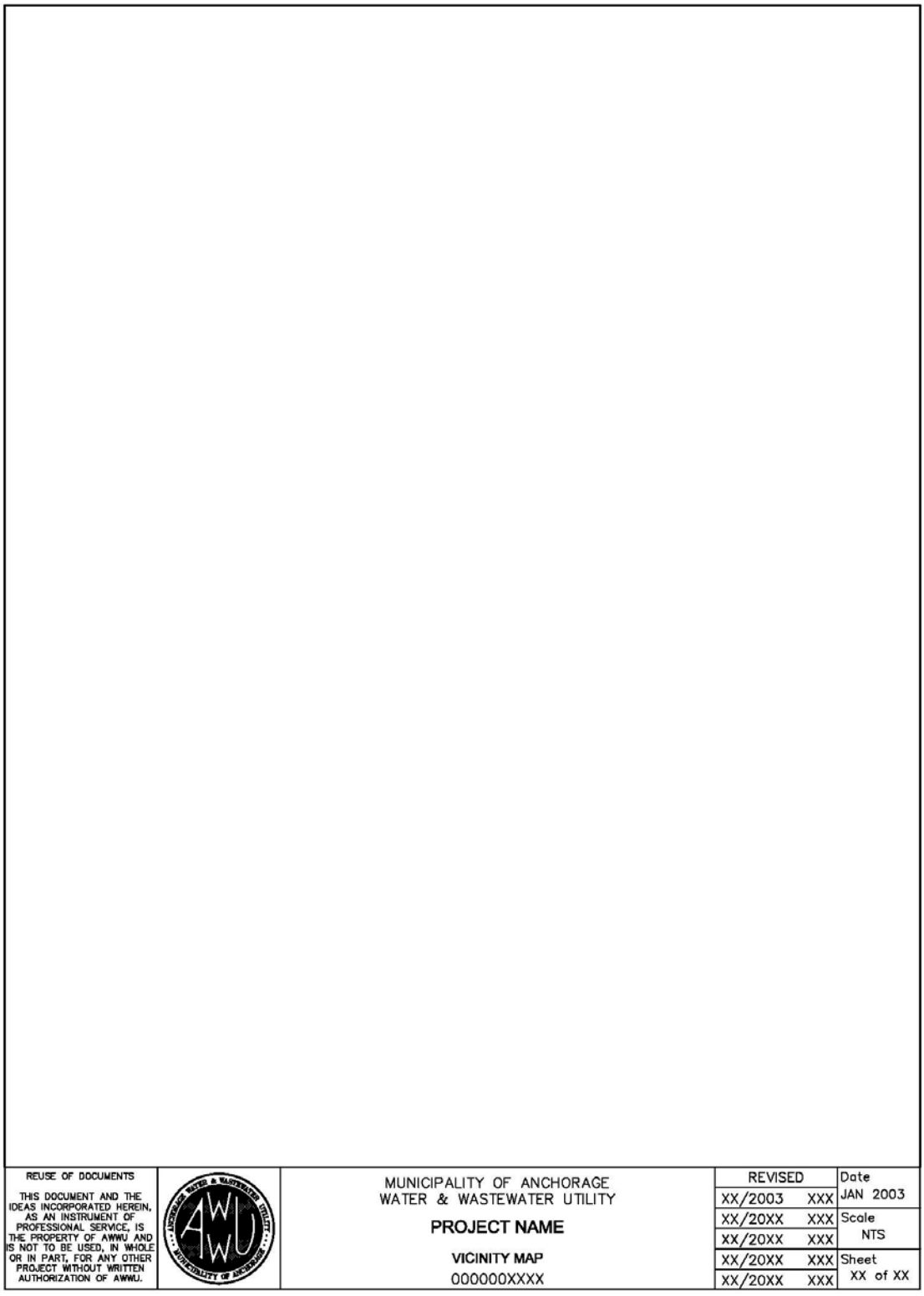
DESIGN AND CONSTRUCTION PRACTICES

STANDARD DRAWING SHEETS

RECORD DRAWING STAMP

REVISED	Date
12/2003 AWWU	DEC 2003
	Scale NTS
	Sheet 1 of 1

60.12 8.5x11 Title Block



60.13 Color-Line Width Relationships

COLOR / LINE WIDTH RELATIONSHIPS

COLOR	COLOR NO.	FULL SIZE LINE WIDTH(INCH)
RED	1	0.008
YELLOW	2	0.010
GREEN	3	0.014
CYAN	4	0.022
BLUE	5	0.009
MAGENTA	6	0.011
WHITE	7	0.010
DARK GREY/8	8	0.005
LIGHT GREY/9	9	0.003
RED/10	10	0.012

COLOR	COLOR NO.	HALF SIZE LINE WIDTH(INCH)
RED	1	0.0040
YELLOW	2	0.0050
GREEN	3	0.0070
CYAN	4	0.0110
BLUE	5	0.0045
MAGENTA	6	0.0055
WHITE	7	0.0050
DARK GREY/8	8	0.0025
LIGHT GREY/9	9	0.0015
RED/10	10	0.0060

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DESIGN AND CONSTRUCTION PRACTICES

COLOR / LINE WIDTH RELATIONSHIPS

REVISED	Date
12/2003 AWWU	AUG 2008
08/2008 JRJ	Scale NTS
	Sheet 1 of 1

60.14 AWWU CAD Template

Provided on the AWWU website.:

70.00 APPENDICES

70.01 Acronyms and Abbreviations

NOTE: When acronyms or abbreviations are used on the plans, they shall be indicated and shown in the legend.

DEFINITION	ABBR
A	
Abandoned	ABAN or ABDN
Abbreviation	ABBR
Above Finished Floor	AFF
Acoustical	ACCOUST or ACT
Acoustical Board	ACBD
Acoustical Tile	ACST
Acre	AC
Acryl-Butadiene-Styrene	ABS
Activated Biological Filter	ABF
Activated Sludge	AS
Actual	ACT
Actuators	ACC
Additional	ADDL
Additive	ADD
Adjacent	ADJ
Adjust	ADJ
Adjustable	ADJ
Adjustable Speed	AS
Adjustable Speed Manual	ASM
Aerial	AER
Aeration	AER
After Midnight	AM
Ahead	AH
Air Compressor	AC
Air Conditioning	AC
Air Handler	AH
Air Release Valve	ARV or AV or AVAR
Air Supply Unit	ASU
Air Vacuum & Air Release Valve	AVAR
Air Vacuum Relief Valve	AIRV
Air Vacuum Valve	AVAR
Air Valve	AV
Air Vault	AIRVLT
Alaska	AK
Alaska Department of Environmental Conversation	ADEC
Alaska Department of Transportation And Public Facilities	ADOT&PF
Alaska Water & Wastewater Management Association	AWWMA
Alignment	ALIGN
Alkalinity	ALKY
Alternate	ALT or ALTN
Alternating Current	AC
Altitude	AL
Altitude Valve	ALV
Aluminum	AL or ALUM
Aluminum Cap (Survey Marker)	ALCAP
Ambient	AMB
American Water Works Association	AWWA
American Wire Gage	AWG
Americans with Disabilities Act	ADA
Ammeter	A
Anchor Bolt	AB
Anchorage International Airport	AIA
Anchorage Municipal Code	AMC
Anchorage School District	ASD
Anchorage Sewer Utility	ASU
Anchorage Water & Wastewater Utility	AWWU
Anchorage Water Utility	AWU
Angle	<
Angle Point	AP
Anode	ANOD
Anodized	ANOD
Apartment	APT
Application	APP or APPLI
Approved	APPD
Approximate	APPROX
Architectural	ARCH
Area Control Console	ACC
Area Control Panel	ACP
Area Drain	AD
As Built	ASB
Asbestos Cement	AC
Asbestos Cement Pipe	AC
Asphalt Cement	AC

DEFINITION	ABBR
Asphalt Concrete	AC
Asphalted Concrete	AC
Anchorage Fire Department	AFD
Assembly	ASSY
Assembly Ordinance	AO
At	@
Auto Manual	AM
Auto Transformer Temp Switch	TSS
Automatic Sampler	SAM
Automatic Transfer Switch	ATS
Avenue	AVE
Average	AVG
Azimuth	AZ
B	
Back	BK
Back Flow Preventer	BFP
Back Of Curb	BOC
Back Pressure Valve	BPV
Back Water Valve	BWV
Ball Valve	BLV
Basement	BSMT
Basin	BSN
Bath	B
Beam	BM
Bearing	BRG
Bedroom	BDRM
Begin Curb Return	BCR
Begin Curve	BC
Begin Horizontal Curve	BHC
Begin Vertical Curve	BVC
Beginning of Pavement	BOP
Beginning of Pipe	BOP
Bell	B
Bell & Spigot	B&S
Bench Mark	BM
Between	BETW or BTWN
Between Centers	BC
Biochemical Oxygen Demand	BOD
Black	BLK
Blind Flange	BF or BLD FLG
Block	BLK
Blocking	BKG or BLKG
Blower	BLR or BLW
Blow-Off (Assembly)	BO
Board	BD
Boiler	BLR
Bollard	BOL
Bolt Circle	BC
Booster	BST
Booster Station	BSTSTN
Bore Hole	BH
Bottom	BOT
Bottom Face	BF
Bottom of Duct	BOD
Bottom of Line	BOL
Bottom of Pipe	BOP
Bottom of Slope	BOS
Boulevard	BLVD
Brake Horsepower	BHP
Brass Cap	BC
British Thermal Unit	BTU
Bubbler	BBL
Building	BLDG
Bureau of Land Management	BLM
Butterfly Valve	BFV or BV
C	
Cabinet	CAB
Cabinet Unit Heater	CUH
Cable (TV)	C
Capacity	CAP
Capital Improvement Budget	CIB
Capital Improvement Program	CIP
Carpet	CAR
Cast In Place	CIP
Cast Iron	CI
Cast Iron Pipe	CIP
Catch Basin	CB
Cathodic	CATH
Cathodic Protection Equipment	CATH
Close Circuit TV	CCTV
Ceiling	CLG
Cement Mortar Lined	CML
Cement Plastic	CEM PLAS
Center	CTR
Center Feed	CFCB
Center Line	CL
Center To Center	CC or C TO C
Centered	CTRD
Centerline	C
Centimeter	CM
Central Control System	CCS
Ceramic	CER
Ceramic Tile	CT
Chain Link	CL

DEFINITION	ABBR
Check Valve	CV or CHK V
Checked	CHKD
Checkered	CHKD
Checkered Plate	CHKD PL
Chemical	CHEM
Chemical Oxygen Demand	COD
Chlorinated Polyvinyl Chloride	CPVC
Chlorinator	CL
Chlorine	CL
Chlorine Contact	C/C
Chlorine Contact Basin	CLCB
Chlorine Gas	CL
Circuit	CKT
Circuit Breaker	CB
Circular	CIRC
Circulating	CIRC
Civil Engineer	CE
Clarifier	CLFR or CLR
Class	CL
Clay Pipe	CLP
Cleanout	C.O. or CO
Clear	CLR
Clearance	CL
Close	C
Closed Circuit Television	CCTV
Closet	CLST
Column	COL
Combination Air Vacuum Release Valve	CARV
Comminutor	COM
Commutator	COMTR
Compacted	COMP
Composite Plastic Material	CPM
Compressor	CMPR
Computed	COMP
Computer Auto Manual	CAM
Computer Manual	CM
Concentric	CONC
Concrete	CONC
Concrete Cylinder	CONC-CYL
Concrete Cylinder Pipe	CCP
Concrete Masonry Units	CMU
Concrete Pipe	CP
Conductivity	CNDCT
Conduit	C
Conference	CONF
Connection	CONN
Constant Speed	CS
Construct	CONST
Construction	CONST
Construction Joint	CJ
Construction Manual	CM
Construction Specifications Institute	CSI
Continue or Continued or Continuous	CONT
Contractor	CONTR
Control Board	CB or CFCB
Control Cable	CC
Control Joint	CJ
Control Power Transformer	CPT
Control Relay	CR
Control Relays	RELAY
Controlled Density Fill	CDF
Coordinate	COORD
Copper	CU
Copper Pipe	COP
Corner	COR
Corps of Engineers	COE
Corridor	CORR
Corrugated Metal Pipe	CMP
Countersunk	CTSK
Coupling	CPLG
Cove Base	CB
Creek	CK
Crossing	XING
Cubic	CU
Cubic Feet	CF or CU FT
Cubic Feet per Hour	CFH
Cubic Feet per Minute	CFM
Cubic Feet per Second	CFS
Cubic Yard	CY
Culvert	CULV
Curb & Gutter	C&G
Cured In Place Pipe	CIPP
Current Transformer	CT
Cylinder	CYL

D

Decant	DN
Deck	DK
Deep	D
Deflection	DEFL
Deformed Bar Anchor	DBA
Degrees	DEG
Dehumidifier	DH
Demonstration	DEMO

DEFINITION	ABBR
Delete	DEL
Demolition	DEMO
Department of Environmental Conservation	DEC
Department of Public Works	DPW or PW
Detail	DET or DTL
Design and Construction Practices Manual	DCPM
Diagonal	DIAG
Diagram	DIAG
Diameter	DIA
Diaphragm	DIAPH
Differential Measuring Equipment	DIFF
Diffuser	DIF
Digital Control Unit	DCU
Dimension	DIM
Dining	DIN
Direct Current	DC
Direction	DIR
Discharge	DISCH
Dishwasher	DW
Dispenser	DISP
Dissolved Oxygen	DO
Distance	DIST
Ditto	DO
Diversion Box	DB
Door	DR
Double	DBL
Dowel	DWL
Down	DN
Downspout	DS
Drain	DR
Drainage Pit	DP
Drawer	DRWR or DWR
Drawing	DWG
Drinking Fountain	DF
Ductile Iron	DI
Ductile Iron Pipe	DIP
DuctileIronPipe PolyethyleneLined	DIPL
E	
Each	EA
Each Face	EF
Each Way	EW
Easement	ESMT
East	E
Eccentric	ECC
Edge of Pavement	EOP
Effluent	EFF
Effluent	EFL
Ejector	EJT or EJTR
Elapsed Time Meter	ETM
Elbow	ELB or ELL
Electric	E
Electric Motor	MOTOR
Electrical	ELEC
Electromagnetic Starter	MAGST
Electronic	ELEC
Elevation	EL or ELV or ELEV
Elevator	ELEV
Emergency	E
Empty	E
Enclosure	ENCL
End Curb Return	ECR
End Curve	EC
End of Pipe	EOP
End of Project	EOP
End Vertical Curve	EVC
Energy Recovery Station	ERS
Engine	ENG
Engineer	ENGR
Environmental Protection Agency	EPA
Equal	EQ or EQL
Equally Spaced	EQL SP
Equation	EQ
Equipment	EQUIP or EQPT
Escalator	ESC
Estimate	EST
EthylenePropyleneDieneMonomer	EPDM
Excavation	EXC
Exhaust Air	E/A
Exhaust Fan	EF
Existing	EXIST or EXST
Expansion	EXP
Expansion Joint	EXP JT
Explosion Proof	EP
Extension	EXT
Exterior	EXT
External	EXT
Extra Strong	XS
F	
Fabricate	FABR
Fabricated	FABR
Fabrication	FAB or FABR
Face of Concrete	FOC
Face Of Wall	FOW
Face To Face	F TO F

DEFINITION	ABBR
Facility	F or FACIL
Factory	FCTY
Fahrenheit	F
Fail Closed	FC
Fail Last Position	FLP
Fail Open	FO
Fan	FN
Far Face	FF
Far Side	FS
Fast Off Slow	FOS
Fast Off Slow Auto	FOSA
Fast Off Slow Remote	FOSR
Feeder	FDR
Feet	FT
Feet per Minute	FPM
Feet per Second	FPS
Female Pipe Thread	FPT
Ferric	FE
Ferric Sulfate	FE
Field Book	FB
Field Change	FC
Figure	FG FIG
Finish	F or FNSH
Finish Floor	FF
Finished	FIN or FN
Finished Floor Elevation	F FL EL
Finished Grade	FG
Finished Surface	FS
Fire Alarm Equipment	FIRE
Fire Damper	FD
Fire Extinguisher	FE
Fire Extinguisher	FEXT
Fire Hydrant	FH
Fire Line Valve	FLV
Fire Retardant Panel	FRP
Fire Retardant Treated	FRT
Fire Retardant Treated Plywood	FPW
Fixture	FIXT
Flange	FLG
Flanged	FLGD
Flanged Coupling	FC
Flanged Coupling Adapter	FCA
Flashing	FLASH
Flat Bar	FB
Flat Face	FF
Flexible	FLEX
Flexible Pipe Coupling	FPC
Float Switch	FS
Flocculation	FLOC
Flocculation Basin	FLOCBSN
Floor	FLR or FL
Floor Beam	FB
Floor Drain	FD
Flooring	FLG
Flow Control Valve	FCV
Flow Indicator	FI
Flow Line	FL
Flow Measuring Equipment	FLOW
Flow Meter	FM
Flow Transmitter	FS
Fluorescent	FLUOR
Fluoride	FL or FLUOR
Foot	FT
Footing	FTG
Force Main	FM
Foresight	FS
Forged Steel	FS
Forward Off Reverse	FOR
Forward Reverse	FR
Found	FND
Foundation	FDN
Frequency Drive	FQDR
Full Voltage Reversing	FVR
Furring	FURR
Fuse	F or FU
Future	FUT
G	
Gage	GA
Gallon	GAL
Gallons per Capita per Day	GPCD
Gallons per Day	GPD
Gallons per Hour	GPH
Gallons per Minute	GPM
Galvanized	GALV
Galvanized Iron	GI
Galvanized Steel	GALVS
Galvanized Steel Pipe	GSP
Gas (Natural)	G
Gas Fired Make Up Heater	GFMUH
Gate Valve	GV
Gauge	GA
General	GEN
General Manager	GM
Generator	GEN
Geographic Information System	GIS
Glass	GL
Glass Fiber Reinforced Cement	GFRC
Global Positioning System	GPS
Globe Valve	GLBV

DEFINITION	ABBR
Government	GOV
Grab Bar	GB
Grade	GR or GRD
Grade Break	GB or GR BRK
Grade Change	GR CHG
Granular	GR
Grating	GRTG
Gravel	GVL
Gravity Belt Thickener	GBT
Gravity Thickener	GTK
Grinder	GDR
Grooved Coupling	GC
Ground	G or GND Or GRD
Ground Fault Interrupter	GFI
Ground Fault Relay	GFR
Guard Gate	GG
Guard Rail	RAIL
Gutter	G
Gypsum	GYP
Gypsum Plaster	GYP PLAS
Gypsum Wallboard	GWB
H	
Hand Held	HH
Hand Wheel Operated	HWO
Handhold	HH
Handicapped	HCP
Hand-Off-Auto	HOA
Hand-Off-Remote	HOR
Hardener	HDNR
Hardness	HDNS
Hardware	HDW
Headed Anchor Stud	HAS
Header	HDR
Heater	HTR
Heating	HTG
Heating and Ventilation	H&V
Heating, Ventilation and Air Conditioning	HVAC
Height	HGT or HT
Heritage Land Bank	HLB
High	H
High Density Polyethylene Pipe	HDPE
High Molecular Weight Polyethylene	HMWPE
High Intensity Discharge	HID
High Point	HP
High Pressure	HP
High Strength Bolt	HSB
High Water Level	HWL
Hollow Metal	HM
Horizontal	HORIZ
Horn	H
Horsepower	HP
Hose Bibb	HB
Hour	HR
Household Appliances	APPLI
Howler	H
Hub Drain	HD
Hydrant	HYD
Hydrant Improvement District	HID
Hydrant Leg	HYDL
Hydrant Valve	HYDV
Hydraulic	HYD
Hydraulic Accumulator	HA
Hydraulic Snubber	HS
Hydrogen Ion Concentration	pH
I	
Incandescent	INCAND
Inch	IN
Incineration	INC
Incinerator	INC
Incline	INCL
Include or Included	INC
Including	INC or INCL
Increase	INCR
Infiltration & Inflow	I&I or I/I
Influent	INFL
Injector	INJ
In-Place	IP
Inside Diameter	ID
Inside Face	IF
Inside Face of Vault	IFV
Install	INSTL
Instrument	INSTR
Instrumentation And Control	I & C
Insulated	INSL
Insulated Tempered Glass	ITG
Insulating	INSL
Insulation	INSUL
Integrated Systems Control	ISC
Intergovernmental Charge	IGC
International Building Code	IBC
International Fire Code	IFC
International Mechanical Code	IMC
International Residential Code	IRC
Interior	INT

DEFINITION	ABBR
Interrupting Capacity	IC
Intrusion Switch	IS
Invert	INVT
Invert Elevation	IE
Invert Elevation (Sewer), for Water, see BOP	INV
Inverted Roof Membrane Assembly	IRMA
Inverted Siphon	IVS
Iron Pipe	IP
Iron Pipe Size	IPS
Irrigation	IRRG
Irrigation Service	IS
J	
Janitor	JAN
Joint	JT
Junction	J
Junction Box	JB
Junction Terminal Box	JTB
K	
Key Interlock	K
Keybox	KB
Kilovolt-Amp	KVA
Kilowatt	KW
Kilovolt	KV
Kilowatt Hour	KWH
Kitchen	KIT
L	
Laboratory	LAB
Lag Screw	LS
Laminated	LAM
Latching Relay	LR
Lateral	LATL
Lateral Improvement District	LID
Lavatory	LAV
Left	L
Left	LT
Length	L or LG
Length of Cord	LC or LG
Length of Curve	L
Less Than	<
Level	LEV
Level Control Valve	LCV
Level Measuring Equipment	LEVEL
Lift Station	LIFTSTN or LS
Lighting	LGT
Lighting Contactor	L
Lighting Panel	LP
Lightning Arrester	LA
Limit Switch	LS
Line Of Sight	LOS
Lineal Foot or Lineal Feet	LF
Lintel	LNTL
Liquid Propane	LP
Liter	L
Loading Relay	LDR
Local at Drive Motor	LOC
Local Control Panel	LCP
Local Remote	LR
Location	LOC
Lockout Stop	LOS
Lockout Stop Pushbutton	LOS
Long	L or LG
Long Leg Vertical	LLV
Longitudinal	LONG
Low Point	LP
Low Water Level	LWL
Lower	LWR
M	
Machine Bolt	MB
Magnetic	MAG
Magnetic Contactor Coil	M
Mailbox	MB
Main	MN
Main Control Board	MCB
Main Operating Console	MOC
Main line Valve	MLV
Maintenance	MAINT
Make Up Air Unit	MA
Male Pipe Thread	MPT
Malleable Iron	MI
Manhole	MH
Manual	MAN
Manual Auto	MA
Manual of Practice	MOP
Manufacturer	MFR
Mark	MK
Masonry Opening	MO
Material	MATL or MTL
Maximum	MAX
Measured	M
Mechanical	MECH
Mechanical Joint	MJ
Mechanical Mounting Panel	MMP
Mechanical Type Coupling	MTC
Member	MBR

DEFINITION	ABBR
Men	M
Mercury Vapor	MERC
Metal	MTL
Metal Faced Plywood	MFP
Meter	M or MTR
Meter Equipment	METER
Meter Station	MS or MSTN
Metering	MTRG
Metering Vault	MV
Mile	M or MI
Milligrams per Liter	MG/L
Millimeter	MMP
Million Gallons	MG
Million Gallons per Day	MGD
Minimum	MIN
Minute	MN
Miscellaneous	MISC
Mixer	MXR
Model	M
Modify	MOD
Modulate Close	MC
Month	M or MO
Monument	MON
Mortar Lined and Coated Steel Pipe	MLCP
Motor	MTR
Motor Control Center	MCC
Motor Operated	MO
Motor Starter	MS
Motor Starter Panel	MSP
Motorized Damper	MTRD
Mounted	MTD
Mounting	MTG
Municipality of Anchorage	MOA
Municipality of Anchorage Standard Specifications	MASS
N	
Nameplate	NP
National Pipe Thread	NPT
National Pollutant Discharge Elimination System	NPDES
National Sanitation Foundation	NSF
Near Face	NF
Near Side	NS
Neutral	N
Night Light	NL
Nipple	NIP
Nominal	NOM
Nominal Pipe Size (Formerly IPS)	NPS
Non Automatic	NA
Non-Frost Susceptible	NFS
Non-Rising Stem	NRS
Normal	NORM
Normally Closed	NC
Normally Open	NO
North	N
Northeast	NE
Northwest	NW
Not Applicable or Not Available	NA
Not In Contract	NIC
Not To Scale	NTS
Number	NO
O	
Office	OFF
Oil, Water, Gas	OWG
On Center	OC
On Off	OO
On Off Auto	OOA
On Off Remote	OOR
Open Close	OC
Open Close Auto	OCA
Open Close Remote	OCR
Opening	OPNG
Open-Stop-Close	OSC
Operating	OPER
Operations and Maintenance	O&M
Operator	OPER
Operator Interface	OPIF
Opposite	OPP
Opposite Hand	OH
Oriented Stand Board	OSB
Original	ORIG
Ounce	OZ
Out To Out	O TO O
Outside Air	O/A
Outside Diameter	OD
Outside Face	OF
Outside Face of Wall	OFOW
Outside Screw & Yoke	OSY
Over	O/
Over Flow Drain	OFD
Overflow	OF or OVF
Overflow Drain	OD
Overhead	O/H or OH
Overhead Door	OHD
Overload Relay	OL
P	
Page	P or PG
PairPR	

DEFINITION	ABBR
Panel	PNL
Paper Towel Dispenser	PTD
Paper Towel Dispenser/Receptacle	PTD/R
Parts per Million	PPM
Pavement	PVMT
Pedestal	PED
Pedestrian	PED
Percent	PCT
Perforated	PERF
Petroleum, Oil and Lubricants	POL
Phase	PH
Pid Control Station	PID
Pipe	P
Pipeline	PL
Place	PL
Plain End	PE
Plan and Profile	P&P
Plans and Specifications	P&S
Plant Control Panel	PCP
Plant Indicating Panel	PIP
Plant Intercom	PIC
Plant Operations Panel	POP
Plastic	PL
Plastic Laminate	PLAM
Plastic Tubing	TUB
Plate	PL
Plug Valve	PV
Plywood	PLWD or PLYWD
Point of Beginning	POB
Point of Compound Curvature	PCC
Point of Control	POC
Point of Curvature	PC
Point of Ending	POE
Point of Intersection	PI
Point of Tangent	PT
Point of Vertical Curvature	PVC
Point of Vertical Intersection	PVI
Point of Vertical Tangency	PVT
Point on Curve	POC
Point on Line	POL
Point on Tangent	POT
Pole	P
Policy & Procedure	P&P
Polyelectrolyte	PE
Polyethylene	PE
Polymer	POLY
Polyvinyl Chloride	PVC
Porcelain Ceramic Tile	PCT
Portland Cement	PC
Portland Cement Concrete	PCC
Potential Transformer	PT
Pound	PND or LB
Pounds per Day	PPD or LB/D
Pounds per Hour	PPH
Pounds per Square Foot	PS or PSF
Pounds per Square Inch	PSI
Pounds per Square Inch Absolute	PSIA
Pounds per Square Inch Gauge	PSIG
Power Pole	PP
Precast	PRCST
Prefinished Wall Paneling	PWP
Premolded Joint Filler	PJF
Pressure	PRESS
Pressure Gauge	PG
Pressure Indicating Transmitter	PT
Pressure Main	PRESM
Pressure Measuring Equipment	PRESS
Pressure Reducing Valve	PRV
Pressure Regulating Valve	PRV
Pressure Relief Valve	PRV or PSV
Pressure Sustaining Valve	PSV
Pressure Switch	PS
Primary Clarifier	P/C or PCLFR
Process and Instrumentation Diagram	P&ID or PID
Professional Engineer	PE
Programmable Controller	PC
Programmable Logical Controller	PLC
Propeller Meter	PM
Property Line	P or PL
Pump	PMP
Pump Station	PS or PMPSTN
Push Button Switch	PB
Q	
Quadrant	QDRNT
R	
Radius	R or RAD
Railroad	RR or RAIL
Rainleader	RL
Raised Access Floor	RAF
Rehabilitation and Repair	R&R
Receptacle	RCPT
Record	REC
Record Drawing	RD

DEFINITION	ABBR
Recorded	REC
Recording Equipment	REC
Reduced Voltage Non Reversing	RVNR
Reduced Voltage Reversing	RVR
Reducer	RED or RDCR
Reducing	RED
Refer or Reference	REF
Reference Point	RP
Refrigerator	REFR
Regulating	REG
Regulatory Commission Of Alaska (Formerly APUC)	RCA
Rehabilitation	REHAB
Reinforce or Reinforced	REIN or REINF
Reinforced Concrete	RC
Reinforced Concrete Cylinder Pipe	RCCP
Reinforced Concrete Pipe	RCP
Reinforced Plastic Mortar Pipe	RPM
Reinforced Steel	RST
Remote Multiplexer	RM
Remote Telemetry Unit	RTU
Remove	REM
Remove and Replace	R&R
Required	REQD
Reserve	RESV
Reservoir	RESV
Resilient	RESIL
Resilient Seat Gate Valve	RGV
Retaining	RTG
Return Activated Sludge	RAS
Return Air	R/A
Revised	REV
Revision	REV
Revolutions per Minute	RPM
Right	R or RT
Right of Way	ROW or R/W
Rigid Steel	RS
Risers	R
Road	RD
Road Improvement District	RID
Roof	RF
Roof Drain	RD
Room	RM
Rotary Strainer	RS
Rotating Biological Contactors	RBC
Rough Opening	RO
Rubber Tire Tile	RTT
R-Value	R

S

Safety Glass	SG
Sample	SA
Sanitary Sewer	SS
Sanitary Sewer Manhole	SSMH
SCADA Equipment	SCADA
Schedule	SCH
Schedule	SCHED
Screwed	SCD
Screwed	SCR
Sealed System Manhole	SSMH
Second	S or SEC
Secondary	SEC
Secondary Clarifier	SCLRFR
Secretary	SEC
Section	SEC or SECT
Sedimentation	SED
Sedimentation Basin	SEDBSN
Septage Disposal Station	SDSTN
Seward Meridian	SMN
Sewer	S or SWR
Sewer Main	SMN
Shear Wall	SW
Sheathing	SHTG
Sheet	SH or SHT
Sheet Vinyl	SV
Sheeting	SHTG
Shelf & Pole	S/P
Ship Creek Energy Recovery Station	SCERS
Short Leg Vertical	SLV
Shower	SHWR
Shutoff	SO
Similar	SIM
Sleeve Type Coupling	STC
Sleeve Valve	SLV
Slide Gate Valve	SLGV
Slope	S or SL
Slower Faster	SF
Sludge	SL
Sluice Gate Valve	SGV
Soap Dispenser	SD
Soft Start	SFST
Solenoid Valve	SV
Solids Handling Control Board	SHCB
South	S
Southeast	SE
Southwest	SW

DEFINITION	ABBR
Spacing	SPG
Special Provisions	SP
Specifications	SPECS
Specified	SPECD
Speed Control Unit	SCU
Square	SQ
Square Feet	SF
Square Yard	SY
Stainless	STN
Stainless Steel	SS or SST or STN STL
Standard	STD
Standard Cubic Feet per Minute	SCFM
Start Stop	SS
Static Pressure	SP
Station	STA or STN
Steel	STL
Steel Pipe	ST
Stiffener	STIF
Storage	STOR
Storm Drain	SD or SDR
Straight	STR
Street	ST
Structural	STRUCT
Structure	STRUCE
Suction	SUCT
Suction Valve	SV
Sulfunator	SLF
Sulphur Dioxide	SO2
Supervisory Control And Data Acquisition	SCADA
Supervisory Set Point	SSC
Supply Air	S/A
Supply Fan	SPFN
Surge	SRG
Survey Monument	SMN
Suspended	SUSP
Suspended Acoustical Ceiling	SAC
Suspended Acoustical Tile	SAT
Suspended Solids	SSD
Switch	SW
Symbol	SYM
Symmetrical	SYM
Symmetrical	SYMM
System	SYS

T

Tack Board	TB
Tangent	T
Tangent Length	T
Tank	TK or TNK
Techite Reinforced Plastic	RP
Technical or Technician	TECH
Telegraph Pole	TP
Telephone	T or TEL
Telephone Pole	TP
Television Cable	TV
Temperature Detector Relay	TD
Temperature Indicating Transmitter	TT
Temperature Measuring Equipment	TEMP
Tempered	TEMP
Tempered Glass	TG
Temporary	TEPM
Temporary Bench Mark	TBM
Temporary Construction Permit	TCP
Terminal Board	TB
Terminal Junction Box	TJB
Test Hole	TH
Test Pit	TP
Thermometer Wall	TW
Thermostat	T
Thick	THK
Thickened Waste Activated Sludge	TWASLG
Thread	T or TRD
Thread One End	TOE
Threaded	THRD
Thrust Block	TB
Time Clock	TC
Time Delay Relay	TDR
Timer Repeat Cycle	TR
Timing Relay	TM
Tinted	T
Toilet	T
Toilet Paper	TP
Toilet Tissue Dispenser	TTD
TonT or TN	
Tongue & Groove	T&G
Tons per Day	TPD
TopT	
Top & Bottom	T&B
Top Face	TF
Top Of	TO
Top of Back-Of-Curb	TBC
Top of Concrete	TC
Top of Curb	TC or TOC
Top of Slope	TOS
Top of Steel	TST
Top of Wall	TW
Torque	TORQ

DEFINITION	ABBR
Total Suspension Solids	TSS
Traffic Control Plan	TCP
Transformer	TRANS or XFMR or XSMR
Transition	TRANS
Transmitter	TRANS
Transverse	TRANSV
Traveling Screen	TRVSC
Treads	TR
Trunk Improvement District	TID
Tunnel	TN
Turbidity	TURB
Turning Point	TP
Turnout Point of Intersection	TPI
Twisted Shielded Pair	TSP
Twisted Shielded Triad	TST
Typical	TYP
U	
Ultra Violet	UV
Ultrasonic Generator	UG
Under Voltage Relay	UVR
Underground	UG
Underground Conduit	UGC
Underlayment	UL
Underwriters Laboratory	UL
Uniform Building Code	UBC
Uniform Fire Code	UFC
Uniform Mechanical Code	UMC
Uniform Plumbing Code	UPC
Unit Heater	UH
Unknown	UNK
DEFINITION	**ABBR**
Unless Noted Otherwise	UNO
Urinal	U or UR
V	
Vacuum	V
Vacuum Relief Valve	VV
Valve	V
Valve Box	VB
Valve Box Marker	VBM
Valve Vault	VVLT
Vapor Proof	VP
Vapor Retarder	VR
Variable	VAR
Varies	VAR
Vault	VLT

DEFINITION	ABBR
Velocity	V
Vent	V or VT
Vent through Roof	VTR
Venturi Meter	VM
Vertical	V or VERT
Vertical Bond	VB
Vertical Curve	VC
Vertical Feet	VF
Vertical Point of Intersection	VPI
Vestibule	VEST
Vibration	VIB
Vibration Monitoring Equipment	VIB
Vinyl Asbestos Tile	VAT
Vinyl Covered Gypsum Wallboard	VGWB
Vinyl Tile	VT
Vinyl Wall Covering	VWC
Vitrified Clay Pipe	VCP
Volt	V
Voltmeter	V
Volume	V or VOL
W	
Wainscot	WSCT
Wall Hydrant	WH
Waste Activated Sludge	WASLG
Waste Receptacle	WR
Waste Water	WW
Waste Water Treatment Facility	WWTF
Water	H2O or W or WTR
Water Closet	WC
Water Column	WC
Water Heater	WH
Water Improvement District	WID
Water Main Line	WMN
Water Pollution Control Federation	WPCF
Water Resistant	WR
Water Resistant Gypsum Wallboard	WBWB
Water Stop	WS
Water Surface	WS
Water Tight Manhole	WTMH
Water Transmission Main	WTM
Water Treatment Facility	WTF
Waterproof	WP
Watt	W
Watthour Demand Meter	WHD
Weatherproof	WPF
Week	WK
Weight	WT
Welded Steel	WS

DEFINITION	ABBR
Welded Steel Pipe	WSP
Welded Wire Fabric	WWF
Welded Wire Mesh	WWM
Well House	WH
West	W
Wide	W
Width	WI
Wire	W
Wire Gage	WG
Wire Glass	WG
With	W or W/
Without	W/O
Women	W or WMN
Wood	WD
Wood Stave	WS
Work	WK
Work Order	WO
Work Point	WP
Y	
Yard	YD
Year	YR

70.02 Glossary

BACKWATER VALVES are valves which will provide a positive mechanical seal and remains closed except when discharging wastes.

BRANCHED SERVICE EXTENSION means two (2) or more service extensions diverging from a single service connection.

NON-CONFORMING SERVICES are lines constructed of un-approved or un-acceptable material; or constructed without permits and/or approval letters; or utilized without being accepted by AWWU, including service lines crossing adjacent property lines.

DESIGN CAPACITY is the existing measured flow plus capacity for future development.

DISTRIBUTION MAIN is a water conduit whose inside diameter may range in size from four (4) (inclusive) to twenty-four (24) (exclusive) inches.

EXTENDED SERVICE CONNECT is a connection for a lot which does not have mains currently available to provide legal service to the property.

INDUSTRIAL WASTES are wastes discharged by an industrial user, having characteristics distinct from commercial and domestic wastes, and having a BOD of two hundred fifty (250) ppm or greater and/or a TSS of two hundred fifry (250) PPM or greater.

INTERCEPTOR SEWER is the sanitary sewer conduit which carries flow from the TRUNK SEWER to the point of treatment.

LATERAL SEWER is a wastewater conduit of eight (8) inches in nominal diameter which collects flows from SERVICE CONNECTIONS and carries it to TRUNK SEWERS.

MAIN is that part of the sanitary sewer or water system intended to serve more than one (1) SERVICE CONNECTION.

ON-PROPERTY SYSTEM is a private distribution or collection system solely on private property. ON-PROPERTY SYSTEMS are not owned or operated by AWWU.

PRIVATE SYSTEM – is a water or sewer system on privately owned property that is maintained by that property owner.

RECORD DRAWING is a plan and profile reproducible drawing verified by a licensed professional engineer depicting the location of improvements constructed as reflected on survey notes, construction contractor's field installation notes, line and grade notes and/or engineer's notes (see Section 50.00 of this manual).

SERVICE CONNECTION is the sanitary sewer or water pipe and appurtenances extending from a main to a property line or easement.

SERVICE EXTENSION is the sanitary sewer or water pipe and appurtenances required to extend the SERVICE CONNECTION to the structure.

TRANSMISSION MAIN is a water conduit whose inside diameter is twenty-four (24”) inches or greater. Service connections smaller than six (6”) inches diameter will not be permitted.

TRUNK SEWER is a sanitary sewer conduit which collects flow from LATERAL SEWERS or SERVICE CONNECTIONS and carries it to the INTERCEPTOR SEWER.

70.03 Horizontal and Vertical Attribute Standards

AWWU employs a computerized work management program to track and maintain data on all of its assets. As part of each construction project, AWWU will require the Engineer and/or Contractor of each project to submit attribute values of each feature installed for both the equipment and the location of the equipment. AWWU will require values for both horizontal and vertical plant. Horizontal plant equipment is the underground piping and all the appurtenances. The vertical plant is equipment in the treatment plants, lift stations, PRVs, booster stations, and etc. In addition to the attribute values, AWWU will also require the manufacturer's name, supplier's name and any warranty dates. The attribute values shall be in a form provided AWWU and shall consist of the following.

70.03.01 Horizontal Plant Attribute Lists

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Access Tee					
ACCESSTE	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
ACCESSTE	WHERELOC	Where is it located?	ALN		WHERELOC
ACCESSTE	ROADINSL	Is the road insulated	ALN		Y OR N
ACCESSTE	MHDEPTH	Depth of manhole	NUMERIC	FEET	
Sanitary Sewer Cleanout					
CLEANLOC	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
CLEANLOC	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
CLEANLOC	WHERELOC	Where is it located	ALN		WHERELOC
CLEANLOC	ROADINSL	Is the road insulated	ALN		Y OR N
CLEANOUT	DEPTH	Depth	ALN	FEET	
CLEANOUT	SIZE	Size in inches	NUMERIC	INCHES	
CLEANOUT	PIPETYPE	Type of Pipe Material	ALN		PIPETYPE
CLEANOUT	INVELEV	Invert Elevation	NUMERIC	FEET	
CLEANOUT	INSULATN	Type of Insulation	ALN		INSULATN
CLEANOUT	RESTRAIN	Type of Restraint	ALN		RESTRAINT
CLEANOUT	COTYPE	Type of Cleanout	ALN		COTYPE
Fire Hydrants					
HYDRANT	OUT2HALF	Number of 2.5" outlets	NUMERIC		
HYDRANT	OUT4HALF	Number of 4.5" outlets	NUMERIC		
HYDRANT	OPENS	Opens Left or Right	ALN		OPENS
HYDRANT	SHOEPLUG	Is the Shoe Plugged	ALN		Y OR N
HYDRANT	OWNDATE	Date of ownership	ALN		
HYD_LOC	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
HYD_LOC	WHERELOC	Where is it located	ALN		WHERELOC
HYD_LOC	ROADINSL	Is the road insulated	ALN		Y OR N
HYD_LOC	WINTRFLG	Winter flag	ALN		Y OR N
HYD_LOC	HDEPTH	Depth to shoe	NUMERIC	FEET	
HYD_LOC	PIPETYPE	Type of Pipe Material	ALN		PIPETYPE
HYD_LOC	LEGSIZE	Hydrant Leg Size	NUMERIC	INCHES	
HYD_LOC	LEGLNGTH	Hydrant leg length	NUMERIC	FEET	
HYD_LOC	STEAMPIP	Steam Pipes	ALN		Y OR N
HYD_LOC	CONNTYPE	Type of connected main	ALN		PRVCONNECT
HYD_LOC	CONNSIZE	Size of connected main	NUMERIC	INCHES	
HYD_LOC	AUXVALVE AUXVALVMANF	Auxiliary Valve Manufacturer	ALN		
HYD_LOC	VALVELOC	Aux. Valve Box Location	ALN		
HYD_LOC	AUXVOPEN	Auxiliary Valve Opens	ALN		OPENS
HYD_LOC	REDTOP	Is this a Hydrant a Red Top?	ALN		Y OR N

Water Main Line Valves

MLV	SIZE	Size in inches	NUMERIC	INCHES	
MLV	OPENS	Opens Left or Right	ALN		OPENS
MLV	GATENORM	Normally Open or Closed	ALN		CORO
MLV	VALVTYPE	Type of Valve	ALN		VALVTYPE
MLVLOC	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
MLVLOC	WHERELOC	Where is it located	ALN		WHERELOC
MLVLOC	ROADINSL	Is the road insulated	ALN		Y OR N
MLVLOC	DEPTH	Depth	ALN	FEET	

Sanitary Sewer Manholes

MANHOLE	LIDSIZE	Size of lid	NUMERIC	INCHES	
MANHOLE	MHMATL	Manhole Type of Material	ALN		MHMATL
MANHOLE	SIZE	Size in inches	NUMERIC	INCHES	
MANHOLE	RUNGS	Ladder Rungs	ALN		Y OR N
MANHOLE	CONETYPE	Type of cone	ALN		CONETYPE
MHLOC	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
MHLOC	WHERELOC	Where is it located	ALN		WHERELOC
MHLOC	ROADINSL	Is the road insulated	ALN		Y OR N
MHLOC	MHDEPTH	Depth of manhole	NUMERIC	FEET	
MHLOC	WTRPROOF	Exterior is waterproof	ALN		Y OR N

Underground Pipe (Sanitary Sewer and Water)

PIPE_EQ	PSIZE	Pipe Diameter	NUMERIC	INCHES	
PIPE_EQ	PIPETYPE	Type of Pipe Material	ALN		PIPETYPE
PIPE_EQ	LENGTH	Length	NUMERIC	FEET	
PIPE_EQ	HYDLEG	Is this a Hydrant Leg?	ALN		Y OR N
PIPE_LOC	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
PIPE_LOC	WHERELOC	Where is it located	ALN		WHERELOC
PIPE_LOC	ROADINSL	Is the road insulated	ALN		Y OR N
PIPE_LOC	LENGTH	Length	NUMERIC	FEET	
PIPE_LOC	GRNDCVR2	Ground Cover -secondary	ALN		GRNDCOVR
PIPE_LOC	PRESTYPE	Pressured line	ALN		Y OR N
PIPE_LOC	FRMBASIN	From Basin	ALN		
PIPE_LOC	TOBASIN	To Basin	ALN		
PIPE_LOC	INSULATN	Type of Insulation	ALN		INSULATN
PIPE_LOC	RESTRAIN	Is This Restrained?	ALN		Y OR N
PIPE_LOC	ENCASED	Is pipe encased	ALN		Y OR N
PIPE_LOC	FROMELEV	Elevation at From Endpoint	NUMERIC	FEET	
PIPE_LOC	TOELEV	Elevation at To Endpoint	NUMERIC	FEET	

Pipe Plug

PLUG	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
PLUG	WHERELOC	Where is it located	ALN		WHERELOC

Manhole Tap

TAP	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
TAP	WHERELOC	Where is it located?	ALN		WHERELOC
TAP	ROADINSL	Is the road insulated ?	ALN		YORN
TAP	MHDEPTH	Depth of manhole	NUMERIC	FEET	
TAP	WTRPROOF	Exterior manhole is waterproof	ALN		YORN

70.03.02 Vertical Plant Attribute Lists

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Actuator					
ACTUATOR	ACCUM	# of accumulators	NUMERIC		
ACTUATOR	CAPACITY	Capacity in gallons	NUMERIC	GALLON	
ACTUATOR	LOWSETPT	Lower Setpoint	NUMERIC	PSI	
ACTUATOR	UPSETPT	Upper Setpoint	NUMERIC	PSI	
ACTUATOR	RELIEF	Pres Relief Setpoint	NUMERIC	PSI	
ACTUATOR	PHASE	PHASE	NUMERIC		
ACTUATOR	LINEVOLT	Line Voltage	NUMERIC		
ACTUATOR	CTRLVOLT	Control Voltage	NUMERIC		
ACTUATOR	ACTTYPE	Actuator Type	ALN		ECTYPE
Air Handling Unit					
AHU	TYPE	Type	ALN		
Air Compressor					
AIRCOMP	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
AIRCOMP	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
AIRCOMP	PHASE	PHASE	NUMERIC		
AIRCOMP	PRESRATE	Pressure Rating	NUMERIC	PSI	
AIRCOMP	ACTTYPE	Compressor Capacit	NUMERIC	CF/HR	
Air Conditioner					
AIRCOND	TYPE	Type	ALN		
Air Dryer					
AIRDRY	TYPE	Type	ALN		
Air Filter					
AIRFLTR	AFLTTYPE	Air Filter Type	ALN		AFLTTYPE
Analyzer					
ANALYZER	ANALTYPE	Analyzer Type	ALN		ANALYZERTYPE
ANALYZER	SCADAPPL	Scada Application?	ALN		YORN
ANALYZER	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
ANALYZER	ACDC	Type of Current	ALN		ACDC
Antenna					
ANTENNA	ANTTYPE	Antenna Type	ALN		ANTENNATYPE
ANTENNA	ANTSIZE	Antenna Size	NUMERIC	INCHES	ANTENNASIZE
Ash Handler					
ASHHANDL	TYPE	Type	ALN		
Battery Charger					
BATTCHGR	VOLTOUT	Voltage Output	NUMERIC		
Battery					
BATTERY	DC_VOLT	DC Voltage	NUMERIC	DC	
BATTERY	BATTSIZE	Battery Size	ALN		
BATTERY	BATTTYPE	Battery Type	ALN		BATTTYPE
BATTERY	BATTCONN	Battery Connection	ALN		BATTCONN
BATTERY	BATTVOLT	Battery Voltage	NUMERIC		
BATTERY	BATTAMP	Battery Ampacity	NUMERIC		

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Belt for Gravity Belt Press					
BELT_GBP	TYPE	Type	ALN		
Boiler					
BOILER	BOILTYPE	Boiler Type	ALN		BOILTYPE
BOILER	FUELTYPE	Type of Fuel Used	ALN		FUELTYPE
BOILER	BTUIN	BTU Input	NUMERIC	BTU	
BOILER	BTUOUT	BTU Output	NUMERIC	BTU	
BOILER	BOILPORT	Inspection port seal?	ALN		YORN
Bridge					
BRIDGE	BRDGTYPE	Bridge Type	ALN		BRIDGETYPE
Burner					
BURNER	BURNTYPE	Type of Burner	ALN		BURNERTYPE
BURNER	FUELTYPE	Type of Fuel Used	ALN		FUELTYPE
BURNER	BTUIN	BTU Input	NUMERIC	BTU	
BURNER	BTUOUT	BTU Output	NUMERIC	BTU	
Carbon Filter					
CARBFLTR	CARBFILT	Carbon Filter Type	ALN		CARBFILTERTYPE
CARBFLTR	CARBAMT	Carbon Amount	NUMERIC	POUNDS	
CARBFLTR	CARBDPTH	Carbon Filter Depth of Bed	NUMERIC	FEET	
Cathodic Protection					
CATHLOC	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
CATHLOC	WHERELOC	Where is it located	ALN		WHERELOC
CATHLOC	ROADINSL	Is the road insulated	ALN		Y OR N
CATHODIC	NUMUNITS	Number of Units	NUMERIC		
CATHODIC	DEPTH	Depth	ALN	FEET	
CATHODIC	WEIGHT	Weight	NUMERIC		
CATHODIC	CATHTYPE	Cathodic Protection Types	ALN		CATHTYPE
CATHODIC	ANODMATL	Anode Material	ALN		ANODMATL
CATHODIC	RECSIZE	Rectifier Size	ALN		RECTSIZE
CATHODIC	LIFEEXPT	Life Expectancy	NUMERIC	YEAR	
CATHODIC	VOLTOUT	Voltage Output	NUMERIC		
CATHODIC	AMPSOUT	Output Amperage	NUMERIC	AMPS	
CATHODIC	ACDC	Type of Current	ALN		ACDC
CATHODIC	SCADAPPL	Scada Application?	ALN		Y OR N
Cell					
CELL	DC_VOLT	DC Voltage	NUMERIC	DC	
CELL	CELLFLOW	Flow Range of Cell	ALN	CC/MIN	
CELL	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
CELL	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
CELL	CELLNUMB	Number of Cells	NUMERIC		
Chemical Feed					
CHEMFEED	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
CHEMFEED	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
CHEMFEED	PHASE	PHASE	NUMERIC		
CHEMFEED	CHFDTYPE CHEMFEEDTYPE	Chemical Feed Type	ALN		
CHEMFEED	CHFDPROD CHEMFEEDPROD	Product being Chemically Fed	ALN		

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Chemical Storage					
CHEMSTOR	CHSTTYPE	Chemical Storage Type	ALN		STORAGETYPE
CHEMSTOR	CHSTCAPA	Chemical Storage Capacity	NUMERIC	POUNDS	
CHEMSTOR	CHFDPROD	Chemical Product	ALN		CHEMFEEDPROD
CHEMSTOR	CHEMDENS	Chemical Density	NUMERIC	LBS/CF	
Chlorinator					
CHLORIN	CHLRTYPE	Chlorinator Type	ALN		AUTO_MANUAL
CHLORIN	CHLRRANG	Chlorinator Range in Feed	ALN		
Comminutor					
COMMINUT	COMMCHNL	Comminutor Channel Size	ALN		
Compressor					
COMPRSOR	TYPE	Type	ALN		
Computer					
COMPUTER	PROSPEED	Processor Speed	ALN		
COMPUTER	HARDRIVE	Hard Drive Capacity	ALN		
COMPUTER	RAMEMORY	RAM Memory	ALN		
COMPUTER	COMMCARD	Communications Card	ALN		
COMPUTER	COMPAPPL	Computer Application	ALN		COMPUTERAPPL
Condenser					
CONDENSR	CONDTYPE	Condenser Type	ALN		CONDTYPE
Controller					
CONTROL	CNTRLTYP	Controller Type	ALN		CONTROLLERTYPE
CONTROL	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
CONTROL	ACDC	Type of Current	ALN		ACDC
CONTROL	CNTRLSPN	Controller Span	ALN		
CONTROL	CONTRLIN	Controller Input	ALN		OUTPUT
CONTROL	CNTRLOUT	Controller Output	ALN		OUTPUT
CONTROL	CNTRLACT	Controller Action	ALN		ACTION
CONTROL	CONTRLI	Controller Intergal	NUMERIC		
CONTROL	CONTRLP	Controller Proportional Band	NUMERIC		
CONTROL	CONTRLD	Controller Derivative	NUMERIC		
CONTROL	SCADAPPL	Scada Application?	ALN		YORN
Conveyer and Auger					
CONV_AUG	TROUGHSZ	Trough Size	NUMERIC	CU FEET	
CONV_AUG	AUGERSZ	Auger Size	NUMERIC	INCHES	
CONV_AUG	DRVETYPE	Drive Type	ALN		DRIVETYPE
CONV_AUG	TRANSVOL	Transfer Volume	NUMERIC	CU FT/HR	
CONV_AUG	MATLTRNS	Material Transferred	ALN		TRANSMATL
CONV_AUG	BELTTYPE	Belt Type	ALN		
CONV_AUG	BELTSIZE	Belt Size	NUMERIC	INCHES	
CONV_AUG	BELTCAPA	Belt Load Capacity	NUMERIC	LBS/CF	
CONV_AUG	TAGLINE	Does it have a Tag Line?	ALN		YORN
CONV_AUG	BELTSCPR	Does it have a Belt Scrapper?	ALN		YORN
Cutter Teeth					
CUTTEETH	CUTTMATL	Cutter teeth material	ALN		MATERIALTYPE
CUTTEETH	CUTTSIZE	Cutter Teeth Size	ALN	INCHES	

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Dehumidification					
DEHUMID	RATEPPH	Rating in Pounds per Hour	NUMERIC	POUNDS	
DEHUMID	HP	Horsepower	ALN		
DEHUMID	CFM	Cubic Feet Per Minute	NUMERIC		
DEHUMID	AMPS	AMPERAGE	NUMERIC		
DEHUMID	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
DEHUMID	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
DEHUMID	PHASE	PHASE	NUMERIC		
Door					
DOOR	DIMENSN	Size in inches (H x W x D)	ALN	INCHES	
DOOR	DOORTYPE	Door Type	ALN		DOORTYPE
DOOR	DOORMECH	Door Mechanism	ALN		OPERTYPE
DOOR	DOORKNOB	Door Knob Description	ALN		
DOOR	DOORLOCK	Door Lock Description	ALN		
DOOR	DOORKICK	Door Kick Plate Description	ALN		
DOOR	DOORPANL	Door Panel Description	ALN		
DOOR	DOORGLAS	Door Glass Description	ALN		
Drive Chain					
DRVCHAIN	DRVCMATL	Drive Chain Composition	ALN		MATERIALTYPE
DRVCHAIN	DRVCSIZE	Drive Chain Size	ALN	INCHES	
Duct Work					
DUCTWORK	TYPE	Type	ALN		
Dust Collector					
DUSTCOLL	DUSTCAPA	Dust Collector Capacity	NUMERIC	CU FT/MIN	
DUSTCOLL	DUSTDIAM	Dust Colletor sock filter diam	ALN	INCHES	
DUSTCOLL	DUSTNUM	Number of sock filters	NUMERIC		
DUSTCOLL	DUSTLENG	Duct collector sock filter len	NUMERIC	INCHES	
Electrical Service					
ELECSERV	PHASE	PHASE	NUMERIC		
ELECSERV	AMPS	AMPERAGE	NUMERIC		
ELECSERV	ENCLTYPE	Enclosure Type	ALN		ENCLTYPE
ELECSERV	ESTYPE	Electrical Service Type	ALN		ESTYPE
ELECSERV	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
ELECSERV	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
ELECSERV	ELECUTIL	Electric Utility Co.	ALN		ELECUTIL
ELECSERV	ELECACCT	Electric Utility Acct. No.	ALN		
Elevator					
ELEVATOR	ELEVTYPE	Type of Elevator	ALN		ELEVATORTYPE
ELEVATOR	ELEVCAPA	Elevator Capacity	ALN	POUNDS	
Engine					
ENGINE	FUELINJC	Is it Fuel Injected	ALN		Y OR N
ENGINE	FUELTYPE	Type of Fuel Used	ALN		FUELTYPE
ENGINE	TANKSIZE	Size of Tank	NUMERIC	GALLON	
ENGINE	INT_EXT	Interior or Exterior	ALN		INTEXT
ENGINE	TANKLOC	Where is the Tank Located	ALN		TANKLOC
ENGINE	HP	Horsepower	ALN		
ENGINE	BATTVOLT	Battery Voltage	NUMERIC		
ENGINE	BATTAMP	Battery Ampacity	NUMERIC		
ENGINE	BATTSIZE	Battery Size	ALN		

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Evaporator					
EVAPORTR	EVAPCAPA	Evaporator Capacity	NUMERIC		
EVAPORTR	EVAPUNIT	Evaporator Measurement Unit	ALN		MEASUREUNIT
EVAPORTR	EVAPHTR	Evaporator Heater Type	ALN		EVAPHTRTYPE
EVAPORTR	EVAPASME	Evaporator ASME code	ALN		
Manhole in Facility					
FACILITY	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
FACILITY	WHERELOC	Where is it located	ALN		WHERELOC
Fans, Blowers & Compressors					
FANS	FANAPPL	Fan Application	ALN		APPLTYPE
FANS	AMPS	AMPERAGE	NUMERIC		
FANS	PHASE	PHASE	NUMERIC		
FANS	CFM	Cubic Feet Per Minute	NUMERIC		
FANS	DRVETYPE	Drive Type	ALN		DRIVETYPE
FANS	CLASSSP	Suitable for Classified Space	ALN		Y OR N
FANS	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
FANS	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
Fencing					
FENCING	FNCETYPE	Type of Fence	ALN		FENCETYPE
FENCING	FENCEHGT	Height - fencing	NUMERIC	FEET	
FENCING	FNCEBARB	Fencing has barbwire at top?	ALN		YORN
FENCING	LENGTH	Length	NUMERIC	FEET	
FENCING	FNCESIZE	Fence Size	ALN		
FENCING	FNCEGATE	Fence Gate Type	ALN		FENCEGATE
Fleet					
FLEET	LICENSE	License number	ALN		
FLEET	ASSIGNED	Assigned to	ALN		VHON
FLEET	MODELYR	Model year	NUMERIC		
FLEET	VEHDESC	Vehicle description	ALN		VHDC
FLEET	VEHTYPE	Vehicle Type	ALN		VHTY
FLEET	FUELTYPE	Type of Fuel Used	ALN		FUELTYPE
FLEET	GROSSWT	Gross Weight	NUMERIC	TONS	
FLEET	EMPTYWT	Empty Weight	NUMERIC	TONS	
FLEET	TIRELOC	Tire Location	ALN		
Flow Meter					
FLOMETER	FMTYPE FLOWMETERTYPE	Flowmeter Type	ALN		
FLOMETER	MULTIPLY	Multiplier	NUMERIC		
FLOMETER	SIZE	Size in inches	NUMERIC	INCHES	
FLOMETER	RANGE	Range	ALN	GPM	
FLOMETER	OUTPUT	Type of Output	ALN		OUTPUT
FLOMETER	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
FLOMETER	ACDC	Type of Current	ALN		ACDC
FLOMETER	SCADAPPL	Scada Application?	ALN		Y OR N
Flooring					
FLOORING	FLOORTYP	Type of Flooring	ALN		FLOORINGTYPE
FLOORING	DIMENSIO	Size in feet (H x W x D)	ALN	FEET	
Fuel Tanks					
FUELTANK	TANKLOC	Where is the Tank Located	ALN		TANKLOC
FUELTANK	TANKSIZE	Size of Tank	NUMERIC	GALLON	
FUELTANK	TANKUSE	Tank Usage	ALN		TANKUSE

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Gas Detctor					
GASDETEC	GASTYPE	Type of Gas to be Detected	ALN		GASTYPES
GASDETEC	MOBILITY	Equipment Mobility type	ALN		MOBILITY
GASDETEC	SCADAPPL	Scada Application?	ALN		YORN
GASDETEC	OUTPUT	Type of Output	ALN		OUTPUT
GASDETEC	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
GASDETEC	ACDC	Type of Current	ALN		ACDC
Gear Drive					
GEARDRV	GDRVBEAR	Gear Drive Bearings	ALN		
GEARDRV	GDRVOIL	Gear Drive Oil	ALN		
GEARDRV	GDRVSEAL	Gear Drive Seal	ALN		
GEARDRV	GDRVSHFT	Gear Drive Shaft	ALN		
GEARDRV	GDRVSPRO	Gear Drive Sprocket	ALN		
GEARDRV	GDRVCHAN	Gear Drive Chain	ALN		
GEARDRV	DRVETYPE	Drive Type	ALN		DRIVETYPE
GEARDRV	GDRVCAPA	Gear Drive Torque LoadCapacity		NUMERIC	POUNDS
Generators					
GENERATR	PHASE	PHASE	NUMERIC		
GENERATR	KVA		NUMERIC		
GENERATR	FUELTYPE	Type of Fuel Used	ALN		FUELTYPE
GENERATR	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
GENERATR	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
GENERATR	TANKSIZE	Size of Tank	NUMERIC	GALLON	
GENERATR	PORTABLE	Is the generator portable	ALN		Y OR N
GENERATR	INT_EXT	Interior or Exterior	ALN		INTEXT
GENERATR	TANKLOC	Where is the Tank Located	ALN		TANKLOC
GENERATR	WATTAGE	Wattage	ALN		
GENERATR	AMPS	AMPERAGE	NUMERIC		
Heaters					
HEATER	HTRTYPE	Heater type	ALN		HTRTYPE
HEATER	FUELTYPE	Type of Fuel Used	ALN		FUELTYPE
HEATER	BTU	British Thermal Units	NUMERIC		
HEATER	WATTAGE	Wattage	ALN		
HEATER	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
HEATER	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
HEATER	HTM	Heat Transfer Medium	ALN		HTM
Heat Exchange					
HEATEXCH	TYPE	Type	ALN		
Hot Water Heater					
HWHEATER	CAPACITY	Capacity in gallons	NUMERIC	GALLON	
HWHEATER	FUELTYPE	Type of Fuel Used	ALN		FUELTYPE
HWHEATER	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
HWHEATER	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
Hydroelectric Equipment					
HYDELEC	PHASE	PHASE	NUMERIC		
HYDELEC	AMPS	AMPERAGE	NUMERIC		
HYDELEC	ENCLTYPE	Enclosure Type	ALN		ENCLTYPE
HYDELEC	ESTYPE	Electrical Service Type	ALN		ESTYPE
HYDELEC	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
HYDELEC	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
HYDELEC	ELECUTIL	Electric Utility Co.	ALN		ELECUTIL
HYDELEC	ELECACCT	Electric Utility Acct. No.	ALN		

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Hydraulic					
HYDRAULC	TYPE	Type	ALN		
Incinerator					
INCNERTR	TYPE	Type	ALN		
Injector					
INJEJECT	TYPE	Type	ALN		
Internal Plant Piping					
INPLANT	PSIZE	Pipe Diameter	NUMERIC	INCHES	
INPLANT	PIPETYPE	Type of Pipe Material	ALN		PIPETYPE
INPLANT	LENGTH	Length	NUMERIC	FEET	
INPLANT	PRESTYPE	Pressured line	ALN		Y OR N
INPLANT	APPL	Type of Application	ALN		APPLTYPE
INPLANT	TYPEFITT	Type of Fitting	ALN		TYPEFITT
Instrumentation					
INSTRMNT	INSTTYPE	Type of Instrument	ALN		INSTRUMENT
INSTRMNT	INSTAPPL	Instrumentation Application	ALN		INSTAPPL
INSTRMNT	RANGE	Range	ALN		
INSTRMNT	MULTIPLY	Multiplier	NUMERIC		
INSTRMNT	CALIBDT	Last Calibrated Date	ALN		
INSTRMNT	ASSIGNED	Assigned to	ALN		VHON
INSTRMNT	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
INSTRMNT	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
Isolator					
ISOLATOR	OUTPUT	Type of Output	ALN		OUTPUT
ISOLATOR	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
ISOLATOR	ACDC	Type of Current	ALN		ACDC
ISOLATOR	SCADAPPL	Scada Application?	ALN		YORN
Lab Equipment					
LABEQUIP	LABEQTYP	Lab Equipment Type	ALN		LABEQUIPMENTTYPE
LABEQUIP	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
LABEQUIP	ACDC	Type of Current	ALN		ACDC
LABEQUIP	SCADAPPL	Scada Application?	ALN		YORN
Lift Spring					
LIFTSPRG	LFSPWIRE	Liftspring Wire Guage Size	NUMERIC		
Lighting					
LIGHTING	BALLTYPE	Ballast Type	ALN		
LIGHTING	BALLMODE	Ballast Mode	ALN		
LIGHTING	BULBMODL	Bulb/Lamp Model	ALN		
LIGHTING	MOUNTING LIGHTMOUNT	Mounting Type	ALN		
LIGHTING	LIGHTTYP	Lighting Type	ALN		LIGHTTYPE
LIGHTING	VOLTAGE	VOLTAGE	ALN		
LIGHTING	WATTAGE	Wattage	ALN		
LIGHTING	INT_EXT	Interior or Exterior	ALN		INTEXT
Locator					
LOCATOR	LOCATYPE	Locator Type	ALN		LOCATORTYPE
LOCATOR	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
LOCATOR	ACDC	Type of Current	ALN		ACDC
LOCATOR	SCADAPPL	Scada Application?	ALN		YORN

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Louver					
LOUVER	LOUVTYPE	Louver Types	ALN		LOUVERTYPE
LOUVER	LOUVSIZE	Louver Size	ALN		
LOUVER	LOUVMATL	Louver Material	ALN		MATERIALTYPE
Lube System					
LUBESYS	LUBECAPA	Lube System Reservior Capacity		NUMERIC	GALLON
LUBESYS	LUBETYPE	Lubricant Type	ALN		LUBETYPE
LUBESYS	LUBEGRDE	Lubricant Grade / Specs	ALN		
Microwave					
MICROWAV	MICROODU	Microwave Outdoor unit locate	ALN		
MICROWAV	MICROIDU	Microwave Indoor Unit Location		ALN	
MICROWAV	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
MICROWAV	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
MICROWAV	BATTVOLT	Battery Voltage	NUMERIC		
MICROWAV	NUMBATT	Number of Batteries	NUMERIC		
MICROWAV	COAXCBLE	Microwave Coax Cable Size	ALN		
MICROWAV	WAVEGUID	Microwave Waveguide	ALN		
MICROWAV	ACDC	Type of Current	ALN		ACDC
Mixer					
MIXER	MIXIMP	Mixer Impellor Type	ALN		
MIXER	HP	Horsepower	ALN		
MIXER	MIXSHLEN	Mixer Shaft Length	NUMERIC	INCHES	
MIXER	MIXSHDIA	Mixer Shaft Diameter	NUMERIC	INCHES	
MIXER	MIXNUMBL	Mixer Number of Blades	NUMERIC		
MIXER	MIXBLDSZ	Mixer Blade Size	ALN		
Mixer Motor					
MIXRMOTR	MOTMOD	Motor Model #	ALN		
MIXRMOTR	MOTMAN	Motor Manufacturer	ALN		
MIXRMOTR	PHASE	PHASE	NUMERIC		
MIXRMOTR	AMPS	AMPERAGE	NUMERIC		
MIXRMOTR	ENCLOSUR	ENCLOSURE	ALN		ENCLOSUR
MIXRMOTR	MTRTYPE	Motor Type	ALN		MTRTYPE
MIXRMOTR	IMPLRSZE	Impeller Size	NUMERIC		
MIXRMOTR	SF	Service Factor	ALN		
MIXRMOTR	CRISE	Centigrade Rise	ALN		
MIXRMOTR	FRAMESZE	Frame Size	ALN		
MIXRMOTR	SUCTION	Suction Size	NUMERIC		
MIXRMOTR	DISCHSZ	Discharge Size	NUMERIC	INCHES	
MIXRMOTR	DISCHPR	Discharge Pressure	NUMERIC	FEET	
MIXRMOTR	GPM	Gallons Per Minute	NUMERIC		
MIXRMOTR	ROTATION	Direction of Rotation	ALN		OPENS
MIXRMOTR	MIXRTYPE	Type of Mixer	ALN		
MIXRMOTR	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
MIXRMOTR	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
Modem					
MODEM	MODMTYPE	Modem Type	ALN		MODEMTYPE
MODEM	MODSPEED	Modem Speed	NUMERIC	MHZ	
MODEM	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
MODEM	ACDC	Type of Current	ALN		ACDC

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Monitor					
MONITOR	MONTYPE	Monitor/Screen Type	ALN		MONITORTYPES
MONITOR	MONSIZE	Monitor/Screen Size	NUMERIC	INCHES	MONITORSIZE
MONITOR	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
MONITOR	ACDC	Type of Current	ALN		ACDC
Motors					
MOTOR	HP	Horsepower	ALN		
MOTOR	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
MOTOR	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
MOTOR	PHASES	Phase of Motor	ALN		
MOTOR	HERTZ	Hertz	ALN		
MOTOR	AMP	Amperage	ALN		
MOTOR	RPMS	RPM	ALN		
MOTOR	FRAME	Frame ID	ALN		
MOTOR	TEMP	Temperature	NUMERIC	CELSIUS	
MOTOR	TYPE	Type	ALN		
MOTOR	CODE	Motor Code	ALN		
MOTOR	SERVFACT	Service Factor	NUMERIC		
MOTOR	SFA		ALN		
MOTOR	DUTY	Duty	ALN		DUTY
MOTOR	INSULATE	Insulation	ALN		
MOTOR	SEB	Shaft End Bearing	ALN		
MOTOR	OEB	Opp End Bearing	ALN		
MOTOR	DESIGN	Motor Design	ALN		
MOTOR	NEMA	NEMA NOM EFF	ALN		
MOTOR	ENCL	Enclosure	ALN		
Motor Start					
MTRSTART	PHASE	PHASE	NUMERIC		
MTRSTART	NEMARTNG	NEMA Rating	ALN		
MTRSTART	STARTSZ	Starter Size	NUMERIC		
MTRSTART	OVRLDHTR	Overload Heater	ALN		
MTRSTART	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
MTRSTART	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
Net Switch					
NETSWTCH	SWCHTYPE	Switch Type	ALN		
NETSWTCH	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
NETSWTCH	ACDC	Type of Current	ALN		ACDC
Outfall					
OUTFALL	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
OUTFALL	WHERELOC	Where is it located	ALN		WHERELOC
Power Supply & UPS					
POWERUPS	POWRTYPE	Power Supply/UPS Type	ALN		POWRUPSTYPE
POWERUPS	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
POWERUPS	ACDC	Type of Current	ALN		ACDC
POWERUPS	OUTPUT	Type of Output	ALN		OUTPUT
POWERUPS	SCADAPPL	Scada Application?	ALN		YORN
Pressurized Vessel					
PRESVSSL	VOLUME	Volume	NUMERIC	GALLON	
PRESVSSL	PRESRATE	Pressure Rating	NUMERIC	PSI	

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Printer					
PRINTER	PRTTYPE	Printer Type	ALN		PRINTERTYPE
PRINTER	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
PRINTER	ACDC	Type of Current	ALN		ACDC
Programmable Logic Controller					
PROGRMLC	MEMORY	Memory Quantity available	NUMERIC	BYTE	
PROGRMLC	RESOLUTN	Resolution in bits	ALN	BIT	RESOLUTIONBITS
PROGRMLC	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
PROGRMLC	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
PROGRMLC	ACDC	Type of Current	ALN		ACDC
PROGRMLC	IOMODULE	I/O Module Type	ALN		IOMODULE
PROGRMLC	SCADAPPL	Scada Application?	ALN		YORN
Pressure Reducing Valves					
PRV	SIZE	Size in inches	NUMERIC	INCHES	
PRV	FLANGE	Flange Rating	NUMERIC	PSI	
PRV	LENGTHFF	Length from Flange to Flange	NUMERIC	INCHES	
PRV	HGLSUPLY	HGL Supply	NUMERIC	FEET	
PRV	HGLDISC	HGL Discharge	NUMERIC	FEET	
PRV	PRESRED	Pressure Reducing Valve	ALN		Y OR N
PRV	PRESSUS	Pressure Sustaining Valve	ALN		Y OR N
PRV	PRESRLF	Pressure Relief Valve	ALN		Y OR N
PRV	ALVLV	Altitude Valve	ALN		Y OR N
PRV	CHECK	Check Valve	ALN		Y OR N
PRV	SURGE	Surge Function	ALN		Y OR N
PRV	CONNTYPE PRVCONNECT	Type of connected main	ALN		
PRV	PRESREDU	Pressure Reducing	NUMERIC	PSI	
PRV	PRREDUHI	Pressure Reducing (High)	NUMERIC	PSI	
PRV	ALTVALVE	Altitude Valve Number	NUMERIC	FEET	
PRV	DOWNSURG	Downstream Surge Amount	NUMERIC	PSI	
PRV	UPSUSTNG	Upstream Sustaining Number	NUMERIC	PSI	
PRV	UPRELIEF	Upstream Relief Number	NUMERIC	PSI	
PRV	DIFFER	Differential	NUMERIC	PSI	
PRVPILOT	PILOTFNC PRVPILOTFUNC	PRV Pilot Function	ALN		
PRVPILOT	VALVPOS	Normally Open or Closed?	ALN		VALVPOS
PRVPILOT	LOWERLIM	Lower Operating Limit	NUMERIC		
PRVPILOT	UPPERLIM	Upper Operating Limit	NUMERIC		
PRVPILOT	SETPTPSI	Set Point for PSI	NUMERIC	PSI	
PRVPILOT	SETPTFT	Set Point for Feet	NUMERIC	FEET	
PRVSOLEN	NO_NC	Normally Open or Closed?	ALN		CORO
PRVSOLEN	PORTSIZE	Port Thread Size	NUMERIC	INCHES	
PRVSOLEN	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
PRVSOLEN	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
PRVSOLEN	ACDC	Type of Current	ALN		ACDC

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Pumps Without Integral Motors					
PUMP	PUMPTYPE	Type of Pump	ALN		PUMPTYPE
PUMP	SUCTION	Suction Size	NUMERIC		
PUMP	DISCHSZ	Discharge Size	NUMERIC	INCHES	
PUMP	DISCHPR	Discharge Pressue in feet	NUMERIC		
PUMP	GPM	Gallons Per Minute	NUMERIC		
PUMP	ROTATION	Direction of Rotation	ALN		OPENS
PUMP	TYPEFITT	Type of Fitting	ALN		TYPEFITT
PUMP	IMPLRSZE	Impeller Size	NUMERIC		
PUMP	TDH	Total Dynamic Head in feet	NUMERIC	FEET	
PUMP	FRAME	Frame ID	ALN		
PUMP	SEALTYPE	Type of Seal	ALN		SEALTYPE
PUMP	COMPOSTN	Composition	ALN		COMPOSITION
PUMP	NPSHR	NPSH Required	NUMERIC	FEET	
PUMP	DRVETYPE	Drive Type	ALN		DRIVETYPE
PUMP	PWRSOURC	Power Source	ALN		PWRSOURCE
Pumps With Integral Motors					
PUMPINTR	PUMPTYPE	Type of Pump	ALN		PUMPTYPE
PUMPINTR	SUCTION	Suction Size	NUMERIC		
PUMPINTR	DISCHSZ	Discharge Size	NUMERIC	INCHES	
PUMPINTR	DISCHPR	Discharge Pressue in feet	NUMERIC		
PUMPINTR	GPM	Gallons Per Minute	NUMERIC		
PUMPINTR	ROTATION	Direction of Rotation	ALN		OPENS
PUMPINTR	SHAFTSZ	Shaft Size	NUMERIC		
PUMPINTR	PULLEYSZ	Pulley Size	NUMERIC		
PUMPINTR	PHASE	PHASE	NUMERIC		
PUMPINTR	AMPS	AMPERAGE	NUMERIC		
PUMPINTR	FUELTYPE	Type of Fuel Used	ALN		FUELTYPE
PUMPINTR	ENCLOSUR	ENCLOSURE	ALN		ENCLOSUR
PUMPINTR	MTRTYPE	Motor Type	ALN		MTRTYPE
PUMPINTR	IMPLRSZE	Impeller Size	NUMERIC		
PUMPINTR	SF	Service Factor	ALN		
PUMPINTR	CRISE	Centigrade Rise	ALN		
PUMPINTR	FRAMESZE	Frame Size	ALN		
PUMPINTR	MOTMAN	Motor Manufacturer	ALN		
PUMPINTR	MOTMOD	Motor Model #	ALN		
PUMPINTR	TDH	Total Dynamic Head in feet	NUMERIC		
PUMPINTR	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
PUMPINTR	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
PUMPINTR	SEALTYPE	Type of Seal	ALN		SEALTYPE
PUMPINTR	COMPOSTN	Composition	ALN		COMPOSITION
PUMPINTR	PWRSOURC	Power Source	ALN		PWRSOURCE
PUMPINTR	MOTRCODE	Motor Codes	ALN		MOTRCODE
Rabble Arm Equipment					
RABLARM	TYPE	Type	ALN		
Radio					
RADIO	RADIOTYP	Radio Type	ALN		RADIOTYPE
RADIO	FREQUNCY	Frequency / Hertz	NUMERIC		
RADIO	RADIOTRN	Radio Transmission Power	ALN		
RADIO	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
RADIO	ACDC	Type of Current	ALN		ACDC

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
RAM					
RAM	RAMFUNC	RAM Function	ALN		RAMFUNC
RAM	DIAMTRIN	Diameter in Inches	NUMERIC	INCHES	
RAM	LENGTHIN	Length in Inches	NUMERIC	INCHES	
RAM	RAMCAPA	RAM Capacity	NUMERIC	TONS	
RAM	RAMSTROK	RAM Stroke	NUMERIC	INCHES	
Recorder					
RECORDER	RECRDTYP	Recorder Type	ALN		RECORDERTYPE
RECORDER	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
RECORDER	ACDC	Type of Current	ALN		ACDC
RECORDER	RECORDIN	Recorder Input	ALN		OUTPUT
RECORDER	SCADAPPL	Scada Application?	ALN		YORN
Rectifier					
RECTFIER	VOLTOUT	Voltage Output	NUMERIC		
RECTFIER	AMPS	AMPERAGE	NUMERIC		
RECTFIER	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
Refractory					
REFRACT	REFRTYPE	Refractory Type	ALN		REFRACTORYTYPE
REFRACT	REFRASTM	ASTM required material	ALN		
Relief					
RELIEF	GRNDCOVR	Ground Cover	ALN		GRNDCOVR
RELIEF	WHERELOC	Where is it located?	ALN		WHERELOC
Reservoir					
RESERVOR	CAPACITY	Capacity in gallons	NUMERIC	GALLON	
RESERVOR	RESVPLAC	Reservoir Respective to Ground	ALN		RESVPLACE
RESERVOR	DIAMETER	Diameter	NUMERIC	FEET	
RESERVOR	HEIGHT	Height -roof at tank perimeter	NUMERIC	FEET	
RESERVOR	ELEVFLR	Reservoir Tank Floor Elevation	NUMERIC	FEET	
RESERVOR	ELEVOVER	Reservoir Overflow Elevation	NUMERIC	FEET	
RESERVOR	OUTLOC	Resv Overflow Outlet Location	ALN		INTEXT
RESERVOR	RESTYPE	Concrete,Steel (bolted/welded)	ALN		RESVTYPE
RESERVOR	INTCOAT	Interior painting system	ALN		NUMCOATS
RESERVOR	EXTCOAT	Exterior painting system	ALN		NUMCOATS
RESERVOR	INTMILLS	Interior paint thickness	NUMERIC		
RESERVOR	EXTMILLS	Exterior paint thickness	NUMERIC		
RESERVOR	ICTTYPE	Interior Coat Type	ALN		COATTYPE
RESERVOR	ECTTYPE	Exterior Coat Type	ALN		COATTYPE
RESERVOR	SUMP	Does it have a Sump Pump	ALN		YORN
RESERVOR	HATCHES	Ground level manhole access	NUMERIC		
RESERVOR	ACCLAD	Exterior Access Ladder	ALN		YORN
RESERVOR	INTPLAT	Interior Ladder Platform	ALN		YORN
RESERVOR	CATHPROT	Cathodic Protection present	ALN		YORN
RESERVOR	INTBAFF	Interior Pipe Baffling present	ALN		YORN
RESERVOR	LASTREH	Date of Last Rehab	ALN		
Roller					
ROLLER	RLRTYPE	Roller Type	ALN		
ROLLER	WIDTHIN	Width in Inches	ALN	INCHES	
ROLLER	LENGTHIN	Length in Inches	NUMERIC	INCHES	
ROLLER	RLRBRSZ	Roller Bearing Size	ALN		
ROLLER	DIAMTRIN	Diameter in Inches	NUMERIC	INCHES	
ROLLER	SHAFTSZ	Shaft Size	NUMERIC	INCHES	

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Roof					
ROOF	ROOFTYPE	Roof Type	ALN		ROOFTYPE
ROOF	ROOFPITC	Roof Pitch	ALN		ROOFPITCH
ROOF	ROOFDRN	Roof Drain	ALN		INTEXT
Router					
ROUTER	ROUTYPE	Router Type	ALN		ROUTERTYPE
ROUTER	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
ROUTER	ACDC	Type of Current	ALN		ACDC
Safety					
SAFETY	SAFETYPE	Type of Safety Equipment	ALN		SAFETYTYPE
SCADA					
SCADA	SCADATYP	Type of SCADA	ALN		SCADATYPE
Scale					
SCALE	SCALELIM	Scale Upper Limit	NUMERIC	POUNDS	
SCALE	SCALEUSE	Scale Use	ALN		SCALEUSE
SCALE	SCALETYP	Scale Type	ALN		SCALETYPE
Screen					
SCREEN	PERFSIZE	Size of Perforations	NUMERIC	INCHES	
SCREEN	PERFTYPE	Type of Perforations	ALN		SCREENPERFS
SCREEN	SCRNTYPE	Screen Type	ALN		SCREENTYPE
Scrubber					
SCRUBBER	SCBRCFM	Scrubber Air Flow	NUMERIC	CU FT/MIN	
SCRUBBER	SCBRTYPE	Scrubber Type	ALN		SCRUBBERTYPE
SCRUBBER	SCBRTRAY	Scrubber Tray	ALN		
Security					
SECURITY	SECUTYPE	Security Type	ALN		SECURITYTYPE
SECURITY	SECUSENS	Security Sensor Type	ALN		SAFETYTYPE
SECURITY	SECUMONI	Security Monitoring Company	ALN		
Sediment Basin					
SEDBASIN	TYPE	Type	ALN		
Sensor/Transmitter					
SENSXMIT	SENSTYPE	Sensor/Xmitter Type	ALN		SENSORTYPE
SENSXMIT	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
SENSXMIT	ACDC	Type of Current	ALN		ACDC
SENSXMIT	SENSORIN	Sensor/Xmitter Input	ALN		OUTPUT
SENSXMIT	SENSROUT	Sensor/Xmitter Output	ALN		OUTPUT
SENSXMIT	SENSSPAN	Sensor/Xmitter Span	ALN		
SENSXMIT	SCADAPPL	Scada Application?	ALN		YORN
Server					
SERVER	SERVTYPE	Server Type	ALN		
SERVER	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
SERVER	ACDC	Type of Current	ALN		ACDC
Shop Test					
SHOPTEST	TESTTYPE	Shop Tester Type	ALN		TESTINGINSTRUMENTS
SHOPTEST	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
SHOPTEST	ACDC	Type of Current	ALN		ACDC

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST
Sign					
SIGN	APPL	Type of Application	ALN		APPLTYPE
SIGN	MATLTYPE	Material Type	ALN		MATERIALTYPE
SIGN	SHAPE	Shape	ALN		
SIGN	DIMENSN	Size in inches (H x W x D)	ALN	INCHES	
Skimmer					
SKIMMER	TYPE	Type	ALN		
Sledge Gate					
SLCEGATE	WIDTHIN	Width in Inches	ALN	INCHES	
SLCEGATE	HEIGHTIN	Height in Inches	NUMERIC	INCHES	
SLCEGATE	SLGTTYPE	Sluicegate Operation Type	ALN		OPERTYPE
Sledge Rake					
SLDGRAKE	LENGTHIN	Length in Inches	NUMERIC	INCHES	
SLDGRAKE	SLRKMATL	Sludgerake Material	ALN		MATERIALTYPE
Softener					
SOFTENER	CAPACITY	Capacity in gallons	NUMERIC	GALLON	
SOFTENER	SFTRTYPE	Type of Softener	ALN		SOFTNRTYPE
SOFTENER	SFTRHARD	Maximum hardness	NUMERIC		
SOFTENER	SFTRRESN	Resin per tank of softener	NUMERIC	CU FEET	
SOFTENER	SFTRSALT	Salt used per softener cycle	NUMERIC	POUNDS	
SOFTENER	SFTRH2O	Water used per softener cycle	NUMERIC	GALLON	
SOFTENER	SFTRFLOW	Softener Service Flow Rate	NUMERIC	GPM	
Solid Grinder					
SOLIDGRD	LENGTHIN	Length in Inches	NUMERIC	INCHES	
SOLIDGRD	WIDTHIN	Width in Inches	ALN	INCHES	
Stationary Machinery					
STATMACH	STATMACH	Type of Stationary Machinery	ALN		STATIONARYMACHINER
Structure					
STRUCTUR	BLDGCNST	Building Construction	ALN		BLDGCNST
STRUCTUR	ROOFTYPE	Roof Type	ALN		ROOFTYPE
STRUCTUR	ROOFPITC	Roof Pitch	ALN		ROOFPITCH
STRUCTUR	FLOORS	Number of Floors	NUMERIC		
STRUCTUR	DIMENSIO	Size in feet (H x W x D)	ALN		
STRUCTUR	FOOTAGE	Square Footage	NUMERIC	SQ	
STRUCTUR	FOOTPRNT	Foot Print Square Footage	NUMERIC	SQ	
STRUCTUR	BLDGFUNC	Function of the Building	ALN		BLDGFUNC
STRUCTUR	UBCTYPE	UBC Type	ALN		UBCTYPE
STRUCTUR	UBCOCUPY	UBC Occupancy	ALN		
STRUCTUR	FIREPROT	Fire Protection?	ALN		YORN
STRUCTUR	OCCUPIED	Is it Occupied?	ALN		YORN
STRUCTUR	SECURITY	Is there Security?	ALN		YORN
STRUCTUR	SCADA	Is there SCADA	ALN		YORN
STRUCTUR	FNDATION	Foundation material	ALN		FOUNDATIONTYPE
Tank					
TANK	TANKSIZE	Size of Tank	NUMERIC	GALLON	
TANK	TANKPRES	Tank Maximimum Pressure	ALN	PSI	
TANK	TANKWALL	Tank Wall layers	ALN		NUMLAYERS
TANK	TANKMATL	Tank Constructed of Material	ALN		MATERIALTYPE
TANK	TANKUSE	Tank Usage (What's in it?)	ALN		TANKUSE

CLASSIFICATION	ASSET ATTRIBUTE	DESCRIPTION	DATA TYPE	MEASURE UNIT	VALUE LIST

Turbine					
TURBINE	RPMS	RPM	ALN		
TURBINE	TURBFLOW	Turbine design flow	NUMERIC	GPM	
TURBINE	TURBHEAD	Turbine net head	NUMERIC	FEET	
TURBINE	ROTATION	Direction of Rotation	ALN		OPENS
Valve					
VALVE	OUTLETSZ	Outlet Size	NUMERIC		
VALVE	INLETSZ	Inlet Size	NUMERIC	INCHES	
VALVE	FLANGE	Flange Rating	NUMERIC	PSI	
VALVE	VALVTYPE	Type of Valve	ALN		VALVTYPE
VALVE	ACTUMETH	Actuation Method	ALN		ECTYPE
VALVE	COMPOSTN	Composition	ALN		COMPOSITION
VALVE	TYPEFITT	Type of Fitting	ALN		TYPEFITT
VALVE	LENGTHFF	Length from Flange to Flange	NUMERIC	INCHES	
VALVE	LINED	Is it Lined	ALN		YORN
Valve with Electric Actuator					
VALVELEC	MAN	manufacturer	ALN		
VALVELEC	MODEL	Model Number	ALN		
VALVELEC	SERIAL	Serial Number	ALN		
VALVELEC	PHASE	PHASE	NUMERIC		
VALVELEC	FREQUNCY	Frequency / Hertz	NUMERIC		
VALVELEC	VOLTAGE	VOLTAGE	ALN		
Variable Frequency Drive					
VFD	PHASE	PHASE	NUMERIC		
VFD	VOLTOUT	Voltage Output	NUMERIC		
VFD	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
VFD	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
VFD	HP	Horsepower	ALN		
VFD	DIMENSN	Size in inches (H x W x D)	ALN		
Vibrator					
VIBRATOR	NP_VOLT	Nameplate Voltage	ALN		VOLTAGE
VIBRATOR	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
Video					
VIDEO	VIDEOTYP	Video Type	ALN		VIDEOTYPE
VIDEO	VIDISPLY	Video Display	ALN		VIDEODISPLAY
VIDEO	SP_VOLT	Supplied Voltage	ALN		VOLTAGE
VIDEO	ACDC	Type of Current	ALN		ACDC
VIDEO	SCADAPPL	Scada Application?	ALN		YORN
Wet Unit					
WETUNIT	TYPE	Type	ALN		
Wire Rope					
WIREROPE	DIAMTRIN	Diameter in Inches	NUMERIC	INCHES	
WIREROPE	STRENGTH	Breaking Strength	NUMERIC	TONS	
WIREROPE	WIRETYPE	Wire alloy type	ALN		WIRETYPE
WIREROPE	WIREWPS	Wires per Strand	NUMERIC		
WIREROPE	WIRESPR	Wire Strands per Rope	NUMERIC		

70.04 Instrumentation, Electrical, and Supervisory Control and Data Acquisition (SCADA)

In addition to what is provided as guidance in this section, reference the AWWU I&E Standard Specifications in CSI format. The designer and builder shall coordinate requirements in the DCPM and the AWWU I&E Standard Specifications for all projects.

The AWWU I&E Standard Specifications document can be downloaded from our web site. Where a conflict may exist, the AWWU DCPM or more stringent standard shall apply unless a variance is approved by AWWU.

70.04.01 Motor Control Centers

Installations require a compartmentalized motor control center (MCC). The MCC is to be mounted on a three and one-half (3 ½") inch housekeeping concrete pad. Sufficient pad space is to be provided to allow expansion of the MCC by twenty (20%) percent or one (1) column, whichever is greater. The logic controller is not to be housed within the MCC. The following equipment is required, at a minimum:

If not available at the facility service entrance, provide a circuit breaker as a main-disconnect.

- A one hundred twenty (120)/two hundred eight (208) volt lighting transformer in four hundred eighty (480) volt applications.
- A four (4) wire load center for building support.
- Power monitoring equipment.

70.04.02 Motor Starting and Operating Requirements

The following guidelines are to be used for determining motor starting and operating techniques. The first applicable circumstance is to be used.

Electronic Drives:

- Any application which requires regulation of the process, applied to the system load.
- Any application in which three (3) phase power is not readily available and the motor requirements exceed three horsepower.
- All applications in which the motor drives a pump used to transport sewage and three-phase power is not available requires a PWM electronic drive that is capable of producing three (3) phase power for the connected load and meets the requirements of 70.06.03.

Solid-state Starter:

- Any application having three-phase utility power and load deceleration is required to mitigate the detrimental effects of water-hammer.
- Any application having three-phase power and the connected equipment is rated as having a full load running current in excess of fourteen (14) amperes.

Conventional Across-the-Line Starter:

- All remaining single-phase applications not listed above.

All remaining three (3) phase applications not listed above.

70.04.03 Motor Starter Application

The following are requirements for each of the motor starting techniques.

Conventional Across-the-Line (single and three (3) phase applications):

- Equipment short-circuit protection is to be provided through the use of a properly applied circuit breaker.

- Each starter is to employ an appropriately rated Allen-Bradley E3 Plus DeviceNet overload relay. It is to be connected to the DeviceNet network originating from the logic controller.
- Each starter is to have connected to the load side of the circuit breaker a one hundred twenty (120) volt AC control power transformer rated no less than one hundred (100) VA and in accordance to the application. If the application requires controls for associated field equipment, the equipment is to be powered by this transformer.
- Each starter is to have a switch for locally starting and stopping the motor and in addition, the switch operator shall have contacts for signaling remote and hand operations. Provide a standard Hand-Off-Auto style switch operator. Adjacent to the switch operator, provide a green LED indicating lamp, 30MM trade size, which is on when the associated equipment is operating.
- All equipment is to be supplied from the same manufacturer.
- All field terminations are to be made at a Manufacturer's supplied terminal strip. Field terminations are not to be made at equipment terminals within the motor controller.
- See Section 70.04 of this manual for a typical across-the-line motor starter wiring schematic.

Solid-State Starter:

- Equipment short circuit protection is to be provided through the use of a properly applied circuit breaker.
- All starters are to be of the Allen-Bradley SMC Plus type with the pump control option and a shunting contactor. The starter is to be protected with fast-acting SCR fuses physically located between the shunting contactor line side taps and the electronic starter. In no case are the motor or current carrying conductors to be protected by fuses.
- Each starter is to employ a properly rated Allen-Bradley E3 Plus DeviceNet overload relay. It is to be connected to the DeviceNet network originating from the logic controller.
- Each starter is to have connected to the load side of the circuit breaker a control power transformer rated no less than one hundred (100) VA and in accordance to the application. If the application requires controls for associated field equipment, the equipment is to be powered by this transformer.
- Each starter is to have a switch for locally starting and stopping the motor and in addition the same, switch operator shall have a position for signaling remote operations, a standard Hand-Off-Auto style switch operator. Adjacent the switch operator there is to be a green LED indicating lamp, 30MM trade size, which is on when the associated equipment is operating.
- All field terminations are to be made at a Manufacturer's supplied terminal strip. Field terminations are not to be made at equipment terminals within the motor controller.
- See Section 70.04 of this manual for a typical solid-state motor wiring schematic.

Electronic Drives in three (3) phase Applications:

- Equipment short-circuit protection is to be provided through the use of a properly applied circuit breaker.
- All electronic drive units are to be manufactured by Allen-Bradley and come from the PowerFlex 700 family of drive units. They are to have the following options:
  2.1. Ethernet communications board option.
  2.2. Each installed unit is to have a HMI, which allows for local on/off and remote operation.
  2.3. Each drive unit will be controlled by a logic controller through the Ethernet interface.

Properly sized five (5%) percent line reactors are to be used in accordance with the manufacturer's recommendations if any of the following conditions exist.

3.1. Line side impedance to the first transformer is less than one (1%) percent of the total circuit impedance.
3.2. Presence of power factor correction equipment is employed at any point on the facility power system.
3.3. Installations which have short circuit current of 100,000 amperes or more and the connected load is ten (10hp) horsepower or less.
3.4. The drive is intended to operate on either a permanent or portable power generator.
3.5. Any facility having an electrical service in excess of eight hundred (800) amperes.
3.6. Line reactors are not to be used in applications where the drive is used to manufacture a third phase.

Every effort is to be made to keep the distance between the drive unit and the motor as short as possible. The following measures are to be taken when specifying and installing drive and motor support equipment.

4.1. Motor branch circuit conductors shall use cross-linked polyethylene as an insulating material. Poly-vinyl chlorite is acceptable only as a cable jacket. (For example Belden 29500).
4.2. The installer must demonstrate that the installed equipment will manage common mode currents in a fashion that will not interfere with other sensitive equipment.
4.3. The installer must demonstrate that the drive and support equipment is installed is such a way that reflective wave voltages are not impressed on adjacent systems.
4.4. A test is to be performed at the main disconnect to show that no more than five (5%) percent total harmonic distortion is present when any combination of drives are operating.

70.04.04 Transfer Switches

Transfer switches are to be members of the MCC, have a DeviceNet connection that incorporates power source availability, transfer switch position and the ability to force a transfer. The generator run request is to be wired to the transfer switch so that loss of utility power sensed at the switch will start the generator. The transfer switch is to be manufactured by ASCO, be of the 7000 series, and appropriately sized for the application.

70.04.05 Power Monitoring

Each facility is to have power monitoring accomplished through the use of an Allen-Bradley Powermonitor 3000, Bulletin 1404-M6, having an Ethernet connection to the local network. The power monitor is to be factory installed and be a member of the MCC.

70.04.06 Process Control and Communications

Each facility requiring process control and/or remote communications is to accomplish this through the use of a logic controller and the Utility's RF communications system. Communications between nodes are to use an Ethernet 10BaseT system and communicate using the TCP/IP suite of protocols.

The logic controller is to communicate with the equipment in the MCC via DeviceNet, Ethernet, or both. Hardwired connections to the logic controller from the MCC are not permitted with the exception of branch circuits, derived at the load center dedicated to provide operating power for the logic controller.

All Components within the logic controller cabinet, with the exception of the work light and duplex receptacle, are to be powered by a twenty four (24) volt Class II DC system. This power system is to have a battery backup capacity that will also power all instruments associated with the facility for no less than six (6) hours for water distribution facilities and twelve (12) hours for wastewater collection facilities.

- All physical Ethernet connections are to be made through an N-Tron 405TX-N DIN rail mounted switch powered by the twenty four (24) volt DC system.
- The RF communications network requires the following equipment.
  - 2.1. A Microwave Data Systems, Inc. EntraNet 900 Wireless IP/Ethernet Transceiver and is to be physically located in the same cabinet that houses the logic controller.
  - 2.2. Antenna, coaxial cables and fittings shall be furnished and installed by the Contractor:
    - 2.2.1. Antenna type, height, and location are site specific and will be determined by AWWU.
    - 2.2.2. All coaxial cables will have less than three (3) dB loss per one hundred (100') feet.
    - 2.2.3. Coaxial cable installations shall be unspliced.
    - 2.2.4. The Contractor shall provide a SWR test of the antenna, cabling, and connectors. The reflected power shall be less than ten (10%) percent of the forward power (= 2:1 SWR).

The system batteries are to be no smaller than one hundred eight (108) amp hours. The batteries are to be mounted six (6") inches above the floor using a stainless steel bracket and be adequately secured.

70.04.07 Logic Controllers

Logic controller model selection is determined using the following criteria.

- If the application requires redundant processing or more than two hundred fourty (240) words of memory, the Allen-Bradley ControlLogix series of controller is required.

- If the memory requirements placed on the logic controller processor by the peripheral I/O modules and DeviceNet equipment is less than two hundred forty) 240 words, a CompactLogix family of controller is to be used.
- The Utility explicitly specifies the controller family, no exceptions.
- See Section 70.04 of this manual for a typical logic controller enclosure and controller required accessories.
- The Contractor is to demonstrate connectivity between the logic controller and all field devices. The equipment is to be delivered fully functional to the manufacturer's claims.
- All programming will be done by the AWWU SCADA Department.

70.04.08 Logic Controller Peripherals

Logic controller peripheral modules required by a particular project are to be selected from the following and are dependent on controller family. This is not a complete list of the hardware required to construct a complete and operational system. It is the contractor's responsibility to identify and incorporate the materials necessary to construct a complete deliverable system. Substitutes for analog and discrete I/O modules are not allowed.

CompactLogix Series:

Central Processor	1769-L35
DeviceNet Scanner	1769-SDN
Expansion Power Supply	1769-PB4
Analog Input Module	1769-IF4
Analog Output Module	1769-OF2
Discrete Input Module	1769-IQ16
Discrete Output	1769-OB16

ControlLogix Series:

Chassis	Series B
Power Supply	1756-PB72/B
Processor and Memory	1756-L55Mxx
ControlNet Bridge	1756-CNB/D
Redundancy Module	1756-SRM/B
Ethernet/IP Bridge	1756-ENBT
Analog Input Module	1756-IF16
Analog Output Module	1756-OF8
Discrete Input Module	1756-IB16
Discrete Output Module	1756-OB16E

70.04.09 Operator Interface

Each facility building is to have an operator interface connected to the network via the Ethernet switch. The interface is to be a facility designed to carry or produce 1 MGD or more which has a stand-by generator equipped with an Allen-Bradley Panel View Plus 1000. All other facilities are required to have the Allen-Bradley Panel View Plus 700.

70.04.10 Process Instruments

Process instruments used in any project are to be of stainless steel construction, have a corrosion resistant electronics housing, produce a four (4) – twenty (20) mA linear signal and where possible be two (2) wire, loop powered devices. The transmitters are to employ the HART communications protocol and have a history of being supported by the Fluke 744 calibration instrument. See Section 70.04 of this manual for a typical pressure transmitter piping detail.

- Pressure and level transmitters are to be supplied from the following manufacturers and be of the specified model:

Endress & Hauser	Model PCM 41
Fisher-Rosemount	Model 2088
Honeywell	Model ST-3000

Temperature transmitters for process monitoring are to be supplied from the following manufacturers and be of the specified model. Thermowells and sensors are to be matched by the manufacture to produce a single transmitter unit.

Fisher-Rosemount	Model 644
Honeywell	
Endress & Hauser	

Insertion flow monitoring transmitters for process equipment shall be :

Endress & Hauser	Magphant

Wetwell level transmitter shall be U.S. Filter A1000 Submersible Level Transducer, or equal.

70.04.11 Facility Heating

The facility heating system(s) are to be controlled via the logic controller. Each room physically isolated from another shall have a separate heating system. Each heating unit is to be powered by a dedicated circuit and breaker. No other equipment is allowed to be powered by a heating circuit.

The natural gas heat is to be operated as the primary source of heat and is to have a thermostat wired in parallel with the control circuit terminated at the logic controller. This circuit is to be on the low voltage side of the heating unit. This thermostat will serve to provide heating control until the logic controller is commissioned, then operate as a backup to the logic controller.

Electric heaters shall be manufactured by Chromalox; have a twenty four (24) volt power source supplied within the heater for control; and the control circuit shall be controlled by the logic controller. Control conductors are to be members of the building support raceway system 70.06.12. When a facility has three (3) phase power and the unit heater requirement is in excess of three (3) kW, three (3) phase power is to be used. The circuits are to derive from the MCC in a bucket(s) dedicated for the purpose.

Each room physically isolated is to have a four (4) – twenty (20) mA ambient temperature transmitter connected to the logic controller. The transmitter is to provide information for control and monitoring of the facility temperature.

70.04.12 Building Support

Each building is to have the following equipment connected to the logic controller. This equipment is to be serviced by a single raceway system.

- Allen-Bradley 802T-HP limit switch having an 802MC-W2B switch operating lever at each outside door for intrusion detection. See Section 70.04 of this manual.
- General Electric 541NCRXT smoke detector powered by the twenty-four (24) volt system.
- Flood switch mounted two and one-half (2 ½) inches above the floor at the lowest level in the facility. See Section 70.04 of this manual.
- An appropriately applied voltage monitoring relay that is either an Entrelec PVN type for 3-phase applications, or an Entrelec ESS single-phase type. Operating power is to be derived from the L series terminals (lineside). The monitor is to: be connected to the first incoming power source; be protected by a circuit breaker no larger than fifteen (15) amperes; and be a member of the MCC. Upon voltage loss, the monitor is to open a discrete circuit connected to the DeviceNet network.

The ventilation system is to have a hand-off-auto switch, and wired such that when in the auto position the logic controller can start the ventilation system. No other connection between the logic controller and ventilation system is desired.

Facilities requiring a sump pump are to have a controller that meets the criteria set forth in 70.06.02. The sump float system is to employ Allen-Bradley's 840-A7 switch, 840-1AD float, and a minimum of one Contractor-supplied rod guide. Mounting and support hardware are to be constructed with stainless steel materials.

Sump pump controllers are to provide hand, auto, fault and run indication to the logic controller. The float(s) are to be wired to the motor controller's E3 plus overload relay. The logic controller will provide the sump pump run request.

In the event the sump pump is tied to the line side of the main disconnect, the E3 plus overload relay is to be omitted. The float(s) are to control the sump pump directly without intervention from the logic controller. All aforementioned contact closures are to be hardwired as discrete inputs to the logic controller.

70.04.13 Raceway Systems

The number of raceway systems is to be kept to a manageable level and will not be smaller than three-quarter (¾") inch trade size. Raceways are to be constructed using rigid metallic material with threaded fittings. The systems should follow the following guidelines and be filled in compliance to applicable codes.

Limit switches, pressure switches, pilot devices, transmitters, and the like are allowed to be connected to the appropriate raceway system using one half (½) LFMC, provided the device has no ports larger than the raceway system. The transition from LFMC to the rigid raceway is to employ a Crouse-Hinds GUA-type box. In no case is the serviced device or the LFMC to provide support for a conduit body. The GUA-type box is to be rigidly supported.

- Each motor branch circuit is to be housed in a dedicated raceway.

- All twenty four (24) volt discrete circuits, not associated with building support, are to be housed in a single raceway system.
- All one hundred twenty (120) volt discrete circuits, not associated with building support, are to be housed in a single raceway system.
- All analog signals are to be housed in a single raceway system including the ambient temperature transmitter. In no case is the raceway to be greater than one and one-quarter (1 ¼") inches trade size. When a raceway is filled to eighty (80%) percent capacity an additional system is required.

70.04.14 Wiring Practices

- All panel wiring is to be legibly marked. Each conductor is to be marked at all terminus points using a permanently marked, heat-shrunk marker.
- Field wiring is to bear the marking THHN, have a minimum of nineteen (19) strands, and be legibly marked at all terminus points using a permanently marked, heat-shrunk marker.
- All conductors are to be run from their point of origin to their terminus point without splices or taps.
- Conductors used for convenience outlets, general lighting, and bonding need not be included with 70.06.14.B.
- Non-current carrying grounded conductors sized #10 AWG or smaller are allowed to be solid.

All current carrying grounded conductors are to have an insulation jacket that is white in color. Tape is not allowed on conductors #6 AWG or smaller.70.06.15 SCADA Details

Note: Detail drawings and sample CSI format specifications are available for download from the AWWU Internet web site.

70.05 AWWU Revised MASS Details

70.05.01 General

At the time of publishing the 2018 DCPM AWWU does not have any revised MASS details. If in the future we revised any details that have not been incorporated into the most recent version of MASS, then they will be published on our website.

70.06 HDPE Pipe Drawing Details

70.06.01 General

These drawings are available for download on the AWWU DCPM internet web page.