Part XV
MINIMUM DESIGN REGULATIONS

§1501 PURPOSE

These regulations are intended to ensure that new public water systems and substantial modifications to existing public water systems are capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to public health. All such facilities shall be designed to function properly in compliance with the NNSDWA and the NNPDWR. These design regulations establish minimum requirements only and do not diminish the duty of owners and operators to comply with applicable statutes and regulations and industry standards and to provide adequate system design and performance. However, the Director will find that a proposed design that complies with the regulations in this Part is "satisfactory" for purposes of §2551 (A)(2) of the NNSDWA.

§1502 APPLICABILITY

These regulations apply to all new public water systems and substantial modifications to existing public water systems. In addition, §§1506 and 1509 apply to bottled water systems where specifically provided. The PWSSP will take these regulations into account when reviewing applications for and issuing construction permits. In addition, the Director may require an existing public water system up upgrade to meet the requirements of this Part if the public water system is consistently violating the NNSDWA and the NNPDWR and posing significant risks to the public health and the Director determines that the modification is necessary to bring the public water system into compliance and protect the public health. The Director will propose the upgrade pursuant to the permit modification procedures in Uniform Rules §§204(C), 205(C) and 207-214.

§1503 LOCATION REQUIREMENTS

To the extent practicable, a new water system or substantial modification to an existing water system shall be geographically located to avoid a site which is:

A. Subject to a significant risk from earthquakes, floods, fires, or other disasters which could cause a breakdown of the public water system or portion thereof; or

B. Within the flood plain of a 100-year flood or of highest flood level experienced in the past if the 100-year flood plain has not been defined, except for intake structures, properly protected wells and properly designed wash, creek and river crossings.

§1504 WATER CONSUMPTION

For community water systems and non-transient non-community water systems, the water usage rate, defined as gallons per home per day (gphd) or gallons per capita per day (gpcd), is used to determine the amount of water that will be utilized by the water system. The Engineer shall determine the total usage through engineering analyses that use operating data from the existing system or other guidelines and parameters accepted by the engineering community of the Navajo Nation, and shall submit documentation of that calculation in the Engineering Report that is submitted to the Director pursuant to Part XVI of these regulations. The water usage rate shall in no case be less than 200 gphd.

§1505 WATER SUPPLY

A water supply shall be provided which is capable of providing for the average daily system demand for the design population (as defined in §104) of the system in approximately 12 hours or less. This criterion is also applicable to booster stations. For duplex stations, only the capacity of one pump should be considered for meeting the 12 hour-average daily design demand requirement. It is permissible for pump capacity to be less than the 12 hour-average daily design demand requirement, when justified. Variable speed boosters and other types of boosters may also be used in the system if they are equivalent to above booster requirements or better. Water supply is rated in gallons per minute (gpm) and pumping cycle in hours per day.

§1506 WATER SOURCES

The Engineer shall provide all necessary information to the Director to ensure that the source(s) selected are of satisfactory quality, or shall be treated to meet the requirements of the NNPDWR and meet/exceed the demand of the system. The best available source of water that is both economically and technically feasible shall be utilized for the water supply. All water systems should identify an alternative source of supply in case of an emergency, when the primary source cannot be used, pursuant to §2545 of the NNSDWA.

A. The PWSSP shall classify all existing or new water sources as either:

1. Surface water or groundwater under the direct influence of surface water, or as

2. Groundwater not under the direct influence of surface water.

The groundwater under the direct influence of surface water, which may be a ground water well or a spring, shall meet all the treatment requirements of the surface water.

B. All new/existing drinking water sources, that have not previously been analyzed, shall be analyzed as initial water quality by a certified laboratory (as defined in §402) for the following factors and results shall be provided to the Director for review:

1. Physical properties (refer to Table 1800.1);

2. Inorganic Chemicals (refer to Table 200.1 and Table 1800.1);

3. Synthetic Organic Chemicals (refer to Table 200.3);

4. Volatile Organic Chemicals (refer to Table 200.2);

5. Bacteriological contaminants (refer to Table 200.5); and

6. Radionuclides (refer to Table 200.10).

C. Surface Water Sources:

1. Quality:

An engineering evaluation shall be made considering all factors, both natural and man-made, which may affect the quality of the source water. The evaluation shall include, but not be limited to:

a. Projection of possible future uses of impoundments or reservoirs;

b. Assessing degree of hazard to the source from the accidental spillage of materials that may be toxic, harmful or detrimental to treatment processes;

c. Obtaining samples over a sufficient period of time (covering all four seasons of a year) to assess the microbiological, physical, chemical and radiological characteristics of the water and their variation;

d. Assessing the capability of the proposed treatment process to comply with the NNPDWR; and

e. Consideration of currents, wind and ice conditions, and the effect of tributary streams at their confluence.

2. Intake Structures:

The design of intake structures shall provide for:

a. Withdrawal of water from more than one level if quality varies with depth;

b. Lowest inlet port located above the bottom, but at sufficient depth to be kept submerged at low water levels;

c. Separate facilities for release of less desirable water held in storage;

d. Occasional cleaning of the inlet line;

e. Screens or gratings over the inlet to protect the pumps; and

f. A means for periodic cleaning of the screens or gratings.

3. Impoundments:

The design of an impoundment reservoir shall provide for, where applicable:

a. Removal of brush, trees, and stumps to the high water level; and

b. Protection from floods during construction.

D. Ground Water - Wells:

1. Location

a. The location of the public water well shall be at least one hundred (100) feet from all potential pollution sources except where the professional engineer or the professional geologist can justify a lesser distance based in part on hydrogeological conditions or special well construction techniques or where the pollution source is designed in such a manner as to prevent the release of contaminants to the environment.

A greater pollution free radius shall be required where water from water table aquifers will be used.

A Wellhead Protection Area Inventory must be performed based on the location and expected yield of the proposed well. Refer to Part XVII of these regulations for details.

b. The proposed well site must:

i. be readily accessible for cleaning, testing, monitoring, and maintenance;

ii. have the finished grade sloped away from the well to prevent any surface runoff from collecting or ponding;

iii. Be located up-slope and away from potential contaminants; and

iv. Be fenced to prevent unauthorized access.

2. Well Materials, Design and Construction:

a. Well casings, drop pipes, well screens, coatings, adhesives, pumps, switches, electrical wire, sensors and all other equipments or surfaces which may be in contact with drinking water must comply with ANSI/NSF Standard 61.

All substances introduced into the well during construction or development shall comply with ANSI/NSF Standard 60. This requirement applies to drilling fluids (biocides, clay thinners, defoamers, foamers, lubricants, oxygen scavengers, viscosifiers, weighting agents) and regenerants. This requirement also applies to well grouting and sealing materials which may come in direct contact with the drinking water.

b. Permanent steel casing pipe shall:

i. Be new steel casing pipe meeting AWWA Standard A-100, ASTM or API specifications;

ii. Be capable of withstanding forces to which it is subjected;

iii. Have full circumferential welds or threaded coupling joints; and

iv. Project at least 18 inches above the anticipated final ground surface. At sites subject to flooding, the top of the well casing shall terminate at least 36 inches above or the well shall be provided with water tight cap and a vent terminating 36 inches above the 100-year flood level or the highest known flood elevation where the 100-year flood level has not been established.

c. The use of any non-ferrous material for a well casing shall require prior approval from the Director. Thermoplastic water well casing pipe shall meet ANSI/ASTM Standard F480-76 and shall bear the logo NSF-wc indicating compliance with NSF Standard 14 for use as well casing.

d. Screens:

The use of well screens is recommended where appropriate and, if used, they shall:

i. Be constructed of material resistant to damage by chemical action of groundwater or cleaning operations;

ii. Have openings sized based on sieve analysis of water bearing formations or gravel pack materials;

iii. Have sufficient diameter to provide adequate specific capacity and low aperture entrance velocities; and

iv. Be provided with a bottom plate or washdown bottom fitting of the same material as the screen.

e. Casing Perforations:

The placement of perforations in the well casing shall:

i. Be located so as to permit as far as practical the uniform collection of water around the circumference of the well casing; and

ii. Be of dimensions and size to restrain the water bearing soils from entrance into the well.

f. Gravel Pack Wells:

The gravel pack material shall be well rounded particles, 95 percent siliceous that are smooth and uniform, free of foreign material, properly sized, washed and then disinfected immediately prior to or during placement as per AWWA standard C654. The gravel pack shall be placed in one uniform continuous operation.

g. Well Plumbness and Alignment:

Well plumbness and alignment shall be tested in accordance with the AWWA Standard A-100. The completed well shall be sufficiently plumb and straight so that there will be minimal interference with installation, alignment, operation, or removal of the test or permanent pumps.

h. Well Grouting:

All permanent well casing for drinking water wells shall be grouted to a depth of at least 50 feet below ground surface or firm bedrock whichever is less. However, where bedrock is encountered at less than 20 feet, casing shall be grouted to at least 20 feet depth. Sufficient annular opening shall be provided to permit a minimum of 2 inches of grout between the permanent casing and the drilled hole, taking into consideration any joint couplings. If a carrier casing is left in place, the casing shall be grouted so as to ensure contact with the native formations. The carrier casing may be perforated if the Engineer desires. Protection shall be provided to prevent leakage of grout into the screen or the gravel pack.

3. Well Development:

Every well shall be developed to remove the native silts and clays, drilling mud or finer fraction of the gravel pack. Development should continue until the expected maximum capacity is obtained from the well.

4. Well Testing for Performance:

The pumping test shall not be conducted until the well has been adequately developed. Both the step-drawdown and constant-rate tests shall be conducted to determine well capacity, type of pump and the time-drawdown characteristics meeting requirements of AWWA standard A-100. The engineer shall submit detailed procedures and specifications of these tests and analyses in the application package for the construction permit.

The following records shall be kept of the tests along with weather conditions and other pertinent information and submitted to the Director for review:

a. Date and time of starting and ending the test;

b. Name of the person(s) conducting the test.

c. Pumping rate and water level measurements with time;

d. Depth of water level increase with time after stopping the pumping test to evaluate well recovery; and

e. Analysis and interpretation of the test results;

5. Well Disinfection:

All new, modified, or reconditioned wells, including pumping equipment, shall be disinfected according to AWWA Standard C654 before being placed into service for drinking water use. Bacteriological water samples shall be collected according to the standard and

analyzed by EPA-certified laboratory. The chlorine residual readings at the time and place of the bacteriological samples must also be submitted.

6. Well Abandonment:

Abandonment of wells shall conform to the followings:

a. Test wells and groundwater sources which are to be permanently abandoned shall be sealed by such methods as necessary to restore the controlling geological conditions which existed prior to construction.

b. Wells to be abandoned shall be sealed to prevent undesirable exchange of water from one aquifer to another. Preference shall be given to using a neat cement grout. Where fill materials are used, which are other than cement grout or concrete, they shall be free of foreign materials and shall not contaminate the ground water.

c. Complete and accurate records shall be kept for the entire abandonment procedure and shall be submitted to the Director.

7. Well Head Piping and Pumping Facilities:

a. General Requirements:

i. A sanitary seal or pitless unit must be provided on the top of the well casing. A pressure gauge and air line or other method for readily measuring the water level in the well shall also be provided;

ii. A casing vent shall be provided. The vent must be elbowed downwards and screened to prevent entry of insects;

iii. A check valve shall be provided in the pump discharge line. For jet pumps, no check valve is required in the main line but a back-flow/back-siphonage device must be provided on blow offs and sample cocks;

iv. A sampling tap must be provided for raw water sampling downstream of the check valve and prior to any chemical injection point. It must be equipped with a vacuum breaker device to prevent back-flow/back-siphonage;

v. A flow meter shall be provided on each well;

vi. Adequate support for the well pump and drop pipe must be provided;

vii. An hour meter shall be provided to record the elapsed run time of each well pump;

viii. A manual control switch shall also be provided for each well pump; and

ix. All electrical wiring shall be in conduit and meet the requirements of the National Electric Code.

b. Well Head Piping:

The discharge piping shall:

i. Be designed so that the friction loss will be low;

ii. Be protected against surge or water hammer;

iii. Have control valves located above the pump house floor; and

iv. Have all exposed piping valves and appurtenances protected against physical damage and freezing.

E. Ground Water - Springs:

Springs vary greatly in their characteristics and they should be observed for some time prior to development to determine any flow and quality variations. They must be determined whether or not they are “under the direct influence of surface water.” The springs determined to be under the direct influence of surface water will have to be given “surface water treatment.”

The development of springs shall comply with the following requirements:

1. The spring collection device, whether it be collection tile, perforated pipe, imported

gravel, infiltration boxes or tunnels, must be covered with a minimum of ten feet of relatively impervious soil cover. Such cover must extend a minimum of 15 feet in all horizontal directions from the spring collection device.

Where it is impossible to achieve the ten feet of relatively impervious soil cover, an impermeable liner may be used, provided:

a. The liner has a minimum thickness of at least 10 mils;

b. All seams in the liner are folded or welded to prevent leakage;

c. The liner is certified as complying with ANSI/NSF Standard 61; and

d. A minimum of two feet of relatively impervious soil cover is placed over the impermeable liner.

2. Each spring collection area shall be provided with at least one collection box to permit spring inspection and testing.

3. All junction boxes and collection boxes must be provided with access manholes, air vents and overflow piping. Lids of these spring boxes shall be fitted with sanitary gaskets.

4. The spring collection area shall be surrounded by a fence located a distance of 50 feet (preferably 100 feet if conditions allow) from all collection devices on land at an elevation equal to or higher than the collection device, and a distance of 15 feet from all collection devices on land at an elevation lower than the collection device. The elevation datum to be used is the surface elevation at the point of collection.

   In remote areas where no grazing or public access is possible, the fencing requirement may be waived by the Director.

   In populated areas, a six-foot high chain link fence with three strands of barbed wire may be required.

5. All vegetation which has a deep root system shall be removed from the fenced area.

6. Surface water runoff must be diverted away from the spring collection area by constructing a diversion channel or berm around the fence.

7. A permanent flow measuring device shall be installed. Flow- measurement devices such as critical depth meters or weirs shall be properly housed and otherwise protected.

8. The spring shall be developed as thoroughly as possible so as to minimize the possibility of excess spring water ponding within the collection area. Where the ponding of spring water is unavoidable, the excess water shall be collected by shallow piping or french drain and be routed beyond and down grade of the fenced area required above, whether or not a fence is in place.

§1507 WATER STORAGE

For community water systems and non-transient non-community water systems, water storage shall be provided to ensure that safe, potable water is available for both normal and emergency situations, such as pipeline breaks, equipment failures, or natural disasters. For single-source systems, five-days storage plus any fire flow reserve should be provided. The single-source storage requirements can be reduced to three-days storage plus any fire flow reserve if the system is provided with an emergency standby pump. For multi-source systems, storage requirement should be at least 1.5 days-storage plus any fire flow reserve plus a volume determined by subtracting from one day’s storage the volume of water that the remaining water sources can provide in 18 hours if the largest source is out of service.

Adequate controls shall be provided to maintain levels in distribution system storage structures. Also, storage structures shall be designed so they can be isolated from the distribution system for the purpose of draining, maintenance and repair.

A. Ground-level/Elevated Storage Tanks and Standpipes:

The materials and design of storage structures shall provide stability and protection of the stored water. Storage structures shall be designed in accordance with appropriate current AWWA Standards whenever applicable.

The ground-level/elevated storage tanks and standpipes shall:

1. Be sized to meet the pressure requirements in the distribution system;

2. Be structurally competent and constructed of materials that are acceptable to the Director;

3. Be readily accessible at all times for inspection and maintenance;

4. Be tightly secured within a fenced area to prevent any unauthorized access, vandalism, contamination or sabotage;

5. Have suitable watertight roofs which exclude birds, animals, insects, and dust. The roof shall have vents, which shall be screened with appropriate non-corrodible mesh;

6. Be provided with adequately sized drains;

7. Be provided with an overflow pipe of sufficient diameter to permit the discharge of water equal to or greater than the filling rate. The overflow pipe shall be brought down to below 24 inches above the ground surface or piped to daylight, be screened with appropriately sized non-corrodible mesh and discharge over a splash pad to prevent ground erosion.

8. Be provided with access ladders, ladder guards, balcony railings, and safely located entrance. The outside ladder shall be provided with a safety cage complying with the latest OSHA Standards.

9. Be designed to remain functional in extremely cold weather.

10. Be designed to give proper protection to metal surfaces by paints or other protective coatings, by cathodic protective devices, or by both. All paint coatings which come into contact with drinking water shall be certified as meeting the specifications of the ANSI/NSF Standard 61, Drinking Water System Components - Health Effects.

11. Be disinfected in accordance with current AWWA Standard for the Disinfection of Water Storage Facilities.

12. Meet applicable Occupational Safety and Health Administration (OSHA) Standards.

B. Clearwell:

1. Clearwell storage shall be sized, in conjunction with distribution system storage, to relieve the filters from having to follow fluctuations in water use;

2. When finished water storage is used to provide the contact time for chlorine, special attention shall be given to size and baffling;

3. An overflow shall be provided; and

4. Finished water must not be stored or conveyed in a compartment adjacent to unsafe water when the two compartments are separated by a single wall.

C. Hydropneumatic (Pressure) Tanks:

Hydropneumatic (pressure) tanks shall:

1. Not be used in a public water system with more than 10 service connections unless the system is provided with a separate storage tank along with it to meet the storage requirements;

2. Be deemed inadequate for protection from fire and the storage of water;

3. Be completely housed and, except as authorized by the Director, located above the ground level;

4. Meet the pressure requirements of the distribution system;

5. Have interior paint coatings meeting the specifications of the ANSI/NSF Standard 61, Drinking Water Systems Components - Health Effects;

6. Be provided with a bypass piping to facilitate repair or painting without removing well(s) or booster pump(s) from service; and

7. Be provided with all necessary appurtenances such as isolation valves, sample tap, pressure gauge, air make-up system (except for bladder tanks), pressure relief valve, and pressure operated start and stop controls for the pump.

§1508 DISTRIBUTION

The Engineer shall ensure that the distribution system of the public water system is adequate to deliver sufficient volumes of water of appropriate quality and pressure to the area of service within the public water system. Prior to installing or replacing appurtenances, such as, but not limited to, valves, hydrants, and pipes, it must be ensured that the components are fully functional without any breaks, splits or other defects and that all foreign materials and objects are removed. During the construction of a distribution system, any opening in unfinished piping or appurtenances must be sealed at the end of each working day in such a manner so as to prevent the entry of any rodents and other animals, dirt, trench water and other sources of pollution or contamination.

A. Distribution System Materials:

The Engineer shall ensure that the pipes, fittings, and valves used in the public water distribution system are appropriate given the soil and pressure conditions throughout the system. Acceptable types of piping materials include, but are not limited to, Polyvinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), Ductile Iron, Stainless Steel, and Cast Iron. These pipes, fittings, packing and jointing materials shall conform to the appropriate AWWA and ASTM standards. All materials or products which come into contact with drinking water shall be certified as meeting the specifications of the ANSI/NSF Standard 61, Drinking Water System Components - Health Effects. The certifying party shall be accredited by the American National Standards Institute. The pipes, fittings, solder, or flux used in the installation or repair of the public water system must be lead-free pursuant to §201 of the Navajo Nation Safe Drinking Water Act. Asbestos cement pipe shall not be used except in the repair of existing asbestos cement lines. Thermoplastic pipe shall not be used above grade.

B. Hydraulic Analysis:

The Engineer shall size all water mains after a hydraulic analysis of the distribution system based on flow demands and pressure requirements. The distribution system shall be designed to maintain and shall maintain a minimum pressure of 20 pounds per square inch at ground level at all points in the distribution system under all conditions of flow. However, the Director may allow the minimum pressure between 15 and 20 psi for the modification of existing systems on a case-by-case basis if the engineer can demonstrate that no backflow/back-siphonage situation can arise. The maximum pressure, measured at the user’s meter, shall not exceed 70 pounds per square inch. If the calculations needed to conduct this hydraulic analysis are complex, a computerized network analysis shall be performed to verify that the distribution system will be capable of meeting the minimum pressure requirements. Where improvements will upgrade more than 25% of an existing distribution system, or where a new distribution system is proposed, a hydraulic analysis of the entire system shall be prepared and submitted to the Director for review.

The diameter of water mains not connected to fire hydrants must have a nominal size of at least 2 inches. The minimum diameter of a water main serving a fire hydrant lateral shall be at least 6-inches unless a hydraulic analysis indicates that required flow and pressures can be maintained by smaller lines.

C. Installation of Water Mains and Service Lines:

Piping for the distribution system shall be designed and laid in a manner such that appropriate consideration is given to frost depth, type of backfill and surface loads while undertaking trenching, bedding, and refills. Construction specifications shall incorporate the provisions of appropriate AWWA and ASTM standards and/or manufacturer’s recommended installation procedures.

Water mains shall be:

1. Properly bedded and covered with a sufficient amount of earth or insulation to prevent freezing;

2. Installed with at least 42" of cover over the piping or at least 12 inches below frost depth, whichever is deeper (unless otherwise specified);

3. Located at least 15 feet away from any existing structure such as a house or building unless written permission or a signed waiver is obtained from the owner; and

4. Installed so that they do not pass through, under, or come into contact with any part of a sewer manhole.

Water service lines shall:

1. Be properly bedded and covered with a sufficient amount of earth or insulation to prevent freezing;

2. Be installed with at least 36" of cover over the top of the pipe; and

3. Have at least one corporation stop and one curb stop or meter stop.

Areas which have been disturbed due to the installation of pipes within the distribution system shall be brought to true grades. All excess debris shall be properly disposed of. Marker posts shall be installed at all road crossings, water valves, points of intersection and bends and in other pertinent areas.

D. Separation of Water Lines and Sewers:

Water and sewer lines shall be separated in order to protect public water systems from possible contamination. For the purpose of this section, the term “lines” shall include mains, laterals and service lines for both water and sewer.

1. Parallel Installation: When sewer and water lines are parallel to each other the water line must be in a separate trench and:

   a. Located at least 10 feet away from the sewer line as measured horizontally from the exterior walls of the pipes.

   b. If the 10 feet requirement is unattainable due to existing structures or other physical conditions, deviations may be allowed by the Director if supported by data from the design engineer, provided the water line is:

      i. Located at least 5 feet away from the sewer line as measured horizontally from the exterior walls of the pipes; and

      ii. At least 12 inches higher than the sewer line as measured vertically from the exterior walls of the pipes.

2. Crossings: When sewer and water lines must cross each other, the water line must be:

   a. Located at least 12 inches above the sewer line as measured vertically from the exterior walls of the pipes; or

   b. Located at least 12 inches below the sewer line as measured vertically from the exterior walls of the pipes if and ONLY if the water line cannot be located above the sewer line.

   The water line must be continuous and free from any joint within 10 feet of crossing a sewer line on either side. Backfill of the trenches shall be compacted to provide adequate support to prevent settling of the lines.

3. Sewer Manholes: No water line shall pass through or come in contact with any part of a sewer manhole. The minimum horizontal separation between water lines and manholes shall be 10 feet, measured from the center of the manhole.

4. Sewage Disposal Systems: Water lines shall not be laid less than 10 feet horizontally from a septic tank, 25 feet from a drain field, or 50 feet from an outhouse. Also water lines shall not be installed within 100 feet of the perimeter fence of an individual lagoon, or within 500 feet of the perimeter fence of a community lagoon.

E. Separation of Water Lines and Other Buried Utilities:

When water lines are laid parallel to other buried utilities such as electric or gas lines, the horizontal separation distance between the water line and utilities shall be as per the requirements of the respective utility authorities. In the absence of such requirements by the utility authorities, a minimum separation of 10 feet shall apply.

F. Fire Hydrants and Fire Flow Requirements:

The project engineer shall contact the Navajo Nation Fire Department for the fire flow requirements. If fire flow is to be provided, fire hydrants shall be installed on 6-inch or larger diameter mains and the pipe network shall be designed so that it meets the fire flow requirements while maintaining a minimum water pressure of 20 psi at all times and at all points in the distribution system. As a minimum, the flows to be assumed during a fire-flow analysis shall be the “peak day demand” plus the fire flow requirement. The fire hydrants shall conform to AWWA C502 and C503 Standards. A gate valve and a valve box shall be installed adjacent to the fire hydrant.

G. Valves:

All buried valves within the distribution system shall be installed with valve boxes. The top of the valve box shall be slightly above the finished grade so as to provide drainage away from the structure. A 2-foot by 2-foot by 4-inch concrete pad shall be poured around the valve box and the valve size, the type of valve and the direction of flow through the valve shall be clearly indicated on the concrete pad before it hardens.

1. Flush Valves:

   A distribution system shall be designed, to the extent possible, so as to form a grid system or arterial loops to minimize the number of dead ends. If a dead end cannot be eliminated, the line shall terminate with a flushing device if it exceeds 500 feet in length.

2. Isolation Valves:

   Water mains must contain a sufficient number of isolation or gate valves in order to minimize any inconvenience to customers and sanitary hazards resulting from repairs.

   The Engineer shall locate isolation valves in such a manner as to minimize the number of houses that will be taken out of service by the isolation of a particular portion of the service area.

3. Pressure Reducing Valves:

   Due to large changes in elevation throughout the Navajo Nation, pressures within the distribution system can become excessive. Therefore, it is necessary to provide pressure reducing valves so that the pressure limitations of the network of pipelines are not exceeded and the need for installing individual pressure reducing valves is minimized. The Engineer shall examine the alternatives and consider the potential for future expansion prior to installing a pressure reducing valve on a main line. Pressure reducing valves should be provided based on the hydraulic analysis results and the pressure requirements in §1508B.

4. Air Relief Valves:

   Air relief valves shall be provided in water mains in areas where air tends to accumulate. Automatic air relief valves shall not be used in situations where flooding may occur.

H. Thrust Blocking:

Where appropriate, all tees, bends, plugs, crosses and fire hydrants in the distribution system shall be provided with reaction/thrust blocking, tie rods or other approved restraining methods to prevent movement. The thrust blocking shall not block weep holes or obstruct access to the joints of the pipe or fittings.

I. Surface Water Crossings:

1. Above-water crossings: The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.

2. Underwater crossings: Underwater crossings shall be installed at a depth greater than 6 feet below the wash bottom. Wash crossings constructed of PVC, ductile iron or HDPE are acceptable. PVC may be installed across minor washes given that the burial depth is appropriate. Whereas, HDPE may be preferred for major and/or flowing washes. Blue marker posts shall be located on both sides of the wash crossing to indicate the point at which the type of pipes differ. Also, gate valve shall be provided at least to the upstream side of water crossings so that the section can be isolated for testing or repair. The valves shall be accessible and not subject to flooding.

J. Road Crossings:

General requirements:

1. Permission must be obtained from the appropriate road authorities prior to excavation or boring;

2. The road crossing shall be open-cut and at 90E to the road centerline or as permitted by the road authority except for paved highway crossing, which may require utilizing boring equipment to avoid cutting the pavement;

3. The water line shall be buried at a minimum depth of 42" below the ditch line;

4. A gate valve shall be installed with a valve box on the upstream side of the road crossing; and

5. Upon placement of the pipe, the road shall be restored to its original condition and excess materials or debris shall be removed from the construction site.

Additional requirements for roads which are maintained dirt school bus routes:

1. Pipes shall be Class II ductile iron pipe;

2. The limits of the ductile iron pipe shall be 10 feet outside the apparent ditch line, unless circumstances dictate greater lengths; and

3. Marker posts shall be placed over each side of the road where the transition occurs between the ductile iron pipe and PVC pipe.

Additional requirements for roads which are gravel roads with platted right-of-ways and paved highways:

1. Pipes shall be PVC or ductile iron pipe cased within a steel conduit;

2. The limits for crossing encasement shall be from right-of-way line to right-of-way line; and

3. Marker posts shall be placed at the highway right-of-way lines over the pipe.

K. Pressure and Leakage Testing:

All newly installed water lines shall be pressure tested and leakage tested in accordance with appropriate AWWA Standards. Other methods of testing may also be acceptable subject to the prior approval of the Director. The Engineer should provide details of the test procedure and specification while applying for the construction permit.

L. Disinfection:

All new water lines shall be properly disinfected and the evidence provided to the Director prior to placing them into use for water conveyance. For purposes of this subsection, “new” water lines shall not include repaired or replaced lines. Specifications shall include detailed procedures for the adequate flushing, disinfection and microbiological testing of all new water mains, laterals or service lines. Samples for coliform analyses shall be collected after disinfection is complete and the system is refilled with potable water. The use of water for culinary purposes shall not commence until the bacteriological tests indicating the water to be free from contamination has been reviewed and approved by the Director.

M. Booster Pumps:

Booster pumps shall be located or controlled so that they will not produce negative pressure in their suction lines and have a device for automatic control which prevents excessive cycling. If necessary, the Engineer shall ensure that a bypass is available for use.

All water systems that rely in whole or in part on a booster pump station shall be equipped with onsite back-up power facilities, or at least with the ability to readily obtain a portable generator. The primary intent for recommending back-up power is to assure that the distribution system is pressurized at all times to minimize contamination due to backflow and backsiphonage.

§1509 CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION

A. The Engineer shall ensure that there are no unprotected connections between the supplies of water, systems for pumping, storage and treatment of water, and distribution system of the public water system and any source of pollution or contamination pursuant to which any unsafe water or other degrading material can be discharged or drawn into the public water system as a result of backsiphonage or backflow.

B. The distribution system including service connections must have an assembly for the prevention of backflow as per the requirements of part XX of these regulations.