

**CITY OF FERNLEY
DEPARTMENT OF PUBLIC WORKS**

DESIGN STANDARDS & REVIEW GUIDELINES

for

**STREETS, POTABLE WATER, SEWER
STORM DRAINS, & ALTERNATIVE WATER**

MAY 2008

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APPENDIX A – STANDARD DETAILS

1.0 - GENERAL INFORMATION

1.1. INTRODUCTION

The City of Fernley Department of Public Works hereinafter referred to as “Public Works”, will review all developments located within the City Public Works boundaries to evaluate the feasibility of integrating the development, presently or in the future, with Public Works systems. Once a project has been determined feasible, complete design and improvement plans are required for Public Works review. A copy of all Public Works Ordinances and Regulations presently in effect can be obtained from the office of Public Works.

This document is meant to assist the consulting engineer with the preparation of the required design and improvement plans. It is impossible to cover all contingencies and possible situations within a single document. Conditions and situations not covered in these Standards and Guidelines shall be designed in accordance with acceptable standards for engineering practice with approval by Public Works. If there is a dispute or problems arise during any phase of a project, it is the director of Public Works responsibility to interpret Design Standards. Comments or suggested revisions to the Design Standards can be dropped off at the City of Fernley Public Works Department. The revision suggestions will be reviewed during a designated Design Standard review process.

Following any Public Works policy changes, design criteria or design standard revisions, Public Works shall post at both the City Hall and the Builder’s Association at least one month prior to implementation.

1.2. DEFINITIONS

The following definition shall apply when the term is used in these Guidelines:

- Average Daily Flow - The average daily flow for a residence is 345 gallons per day.
- City – City of Fernley, Nevada
- Cleanout - Above ground access to sewer service for cleaning purposes.
- Collector Sewer – A sewer line that collects sewage from individual sewer laterals and conveys the sewage to an interceptor sewer.
- County – The County of Lyon, State of Nevada.
- Customer Sewer Lateral – The sewer pipe transporting sewage from the residence or building to the collector sewer.
- Dedication – The act of offering to Public Works any land, facilities, easements, rights-of-way, or water rights.
- Deep Manhole - Any manhole which is greater than five (5) feet from rim to invert.
- Design Standards – The latest edition of “City of Fernley Design Standards”.
- Detail Sheets – The latest edition of the Public Work’s Detail Sheets must be attached to any drawings on Public Works improvements in the Public Works System.
- Developer – A person, persons, firm, partnership, corporation, or combination thereof, involved in creating a subdivision or other development which contains Public Works infrastructure to be dedicated to the City.
- Development – The act or process of any construction on properties, including subdivision improvements and division of land.
- Discharge Permit - A National Pollutant Discharge Elimination System (NPDES) permit is issued by the Nevada Department of Environmental Protection for any sewage facility that generates more than 5,000 gallons of sewage effluent per day. This permit imposes limits on the facility’s effluent. Where industrial and commercial facilities require a discharge permit, the developer shall pay all fees and obtain a discharge permit. Industrial pre-treatment permits may be required and are administered by Public Works.

- Engineer – Any person or persons, firm, partnership or corporation, legally authorized to practice engineering in the State of Nevada, who prepares or submits improvement plans and specifications to Public Works for Approval (also “Engineer-of-Record”).
- E-One - On site alternative sewer pumping station and low pressure force main.
- Equivalent Residential Capacity Unit (ERC) - That portion of an industrial or commercial development which is equivalent to a single residence in terms of either water or wastewater flow. For water, a demand value of 1000 gallons per day per residence is a single ERC. For sewer, an ERC has 23 fixture units and is assumed to generate 345 gallons of sewage per day. The minimum ERC, for billing purposes, must not be less than 1 (one) ERC.
- Force Main – Sewer pressure main that is the discharge line from a sewer lift station.
- Geotech – The firm or persons responsible for the preparation of the original approved Geotechnical soils report.
- Infiltration - Groundwater which enters sewers and building connections through defective joints and cracks in pipes and manholes.
- Inflow - The unauthorized discharge of water into service connections and sewer pipes from roof drains, foundation drains, air conditioners and unpolluted discharges from businesses and industries.
- Interceptor Sewer - A sewer line that receives flow from a number of collector sewers and conveys such sewage to a point for treatment or disposal.
- Lift station - Sewer pumping station for transferring sewer flows to a higher elevation via a force main.
- Nevada Department of Transportation - Regulatory Agency authorizing Encroachment Permits for construction projects within State Right-of-Way hereinafter referred to as NDOT.
- North Lyon County Fire Prevention District - Regulatory Agency authorizing construction of fire prevention devices within the City service area, hereinafter referred to as Fire District.
- Owner – A person, persons, firm, partnership, corporation, or combination thereof, involved in creating a subdivision or other development which contains infrastructure to be dedicated to the City, or his designee.
- Public Works – City of Fernley Department of Public Works hereinafter referred to as PWD.
- Public Works Standards – The latest edition of the “City of Fernley- Design Standards”.
- Public Works Systems – All sewer, potable water, alternative water, street and storm drain infrastructure that falls under the jurisdiction of Public Works.
- Quality Assurance Manager – The Public Works Director of the City of Fernley or his designee.
- Sewer Backwater Valve – Valve designed to prevent sewer from the public system from entering private houses.
- Standard Specifications - The latest edition of “Standard Specifications for Public Works Construction” (The Orange Book).
- Truckee Carson Irrigation District - Operations and Maintenance Division of the Bureau of Reclamation relating to authorization of permits to construct projects within Bureau of Reclamation Right-of-Way, hereinafter referred to as TCID.

1.3. ABBREVIATIONS

Wherever the following abbreviations are used, the intent and meaning shall be as follows:

- ADA - Americans with Disabilities Act
- ADT - Average Daily Traffic
- APWA - American Public Works Association

- ASCE - American Society of Civil Engineers
- AASHTO - American Association of State Highway and Transportation Officials
- ASTM - American Society for Testing and Materials
- AWWA - American Water Works Association
- DRI - Desert Research Institute
- ERC/U – Equivalent Residential Capacity/Unit
- GIS - Geographic Information System
- GPS - Global Positioning System
- ITE - Institute of Transportation Engineers
- MUTCD - Manual on Uniform Traffic Control Devices
- NAC – Nevada Administrative Code
- NEC - National Electric Code
- NRCS - Natural Resources Conservation Service
- NRS - Nevada Revised Statutes
- OSHA – Occupational Safety and Health Administration
- UBC – Uniform Building Code
- IBC - International Building Code
- UFC – Uniform Fire Code
- IFC - International Fire Code
- IMC - International Mechanical Code
- UPC – Uniform Plumbing Code
- IPC - International Plumbing Code
- IRC - International Residential Code

1.4. LEGAL COMPLIANCE

The developer and the engineer shall comply with all applicable Federal and State laws, County ordinances, City ordinances, The American Disabilities Act and regulations that affect the design of water, alternative water, wastewater systems, storm drainage and street improvements.

1.5. AGENCY APPROVALS

It is the responsibility of the developer and/or Engineer-of-Record to obtain the approvals of any required public agency prior to submitting improvement plans to Public Works for approval, as Public Works will require copies of all permits, approvals, correspondence and/or requirements from other agencies directly associated with the development.

Agencies which may be involved in approval of water, alternative water, wastewater, storm drainage and street improvement plans include:

- Local Public Utilities
- Nevada Division of Environmental Protection (NDEP)
- Nevada Department of Transportation (NDOT)
- Bureau of Health Protection Services (BHPS)
- Nevada Department of Conservation and Natural Resources Division of Water Resources (DWR)
- Nevada Department of Fish and Game

- Nevada Department of Forestry (NDF)
- North Lyon County Fire Protection District (NLCFPD)
- Truckee Carson Irrigation District (TCID)
- Bureau of Reclamation (BOR)
- Bureau of Land Management (BLM)
- City of Fernley Department of Community Development (CDD)

Public Works requires written notice of approval by the appropriate review agency. The Department of Community Development of the City of Fernley may require a Special Use Permit (SUP) for above ground structures such as tanks and pump station buildings. The Engineer-of-Record must verify such requirements.

1.6. APPROVED PLANS

Complete designs and plans for water, alternative water, wastewater systems, storm drainage and street improvements including any necessary dedications, easements, and rights-of-way, shall be submitted to and approved by Public Works prior to the start of the project or final subdivision map being approved.

1.7. FACILITIES AND PUBLIC LAND

All Public Works facilities shall be either on or within land owned by Lyon County, the City of Fernley, or within public easements.

1.8. WARRANTY

All public improvements shall be warranted for a period of one-year, following the issuance of a certification of completion, as stated in the City of Fernley Development Code Section 48.070. Any defective or unsatisfactory improvements will be replaced or reconstructed without delay and at the owners expense.

2.0 - IMPROVEMENT PLANS

2.1. PLANS BY ENGINEER

All plans, specifications, calculations, reports, easements, and rights-of-way submitted to Public Works shall be prepared, stamped, and signed by the Engineer-of-Record in accordance with NRS 625. All submittals must be wet stamped by a Civil Engineer registered in the State of Nevada. Any improvement plans submitted to Public Works that is not stamped by a Civil Engineer registered in the State of Nevada will be cause for rejection and re-submittal.

2.2. IMPROVEMENT PLAN SUBMITTAL

The initial submittal of improvement plans to Public Works shall consist of the following:

- Five (5) sets of blue line or black line (OCE) plans, complete and in accordance with these Design Standards, along with any required specifications, computations, test data, reports, studies, analysis and other material requested by Public Works. Site Plans and Utility Plans shall be prepared in accordance with current Drafting Standards and shall be on the Public Works GIS Database or they will be rejected. The GIS Database information can be obtained digitally from Public Works. A GIS Request Form is available at Public Works and this form must be provided with the request. The digital information will be provided within three days of receipt of the request.
- The name, address and telephone number of the Owner and the Engineer-of-Record to be contacted concerning the plans.

Public Works will review the plans within thirty (30) calendar days of receipt. If alterations or revisions are required to the plans as submitted, Public Works will return one red-lined improvement plan set with the corrections marked or indicated. If the improvement plans submitted are not prepared in accordance with these Review Guidelines or in keeping with the standards of the profession, Public Works may return them unmarked and unapproved. Public Works will not, under any circumstances, provide design by review. It is the Engineer-of-Record's responsibility to ensure proper engineering principles are incorporated in each design.

2.3. IMPROVEMENT PLAN RESUBMITTAL

Plans being resubmitted shall consist of a minimum of five (5) complete sets of plans and the returned redlined markup. Additional sets may be required by Public Works. Plans being resubmitted that contain revisions or alterations other than those required by Public Works shall be identified as to the revisions made, and will be treated as an initial submittal.

2.4. APPROVED PLANS

Once the Public Works Director and the City Engineer approve the plans, the signed set of approved plans will then be returned by Public Works to the Engineer-of-Record with the latest Public Works Standard Detail Sheets included in Appendix A of this document (See Section 2.12). All other pertinent review/approval agencies must provide authorization (signatures) prior to submitting to Public Works for approval. Once all signatures are obtained (including the City of Fernley Department of Community Development, City of Fernley Building Division, North Lyon County Fire Protection District (NLCFPD) and Truckee Carson Irrigation District (TCID) if applicable), one set of approved plans will be retained by Public Works. Improvement Plans shall be approved by Public Works before the Final Subdivision Map or Final Parcel Map is approved and before construction begins. All construction shall be in accordance with the approved plans. During construction, approved plans having an original wet signature must be onsite. Any required revisions to the approved plans shall be submitted by the Engineer-of-Record and approved by Public Works prior to construction.

2.5. PROJECT INSPECTION

The developer is responsible for securing a qualified inspector and to provide Public Works with inspector contact information in writing. The Inspector must appear on the Public Works List of Approved Inspectors. The list is included in Appendix A of this document. If an Inspector does not appear on the list, the Inspector must provide a resume or document qualifications with a list of references for Public Works approval. Public Works reserves the right to inspect the project at any time and to require replacement of the inspector used. Inspection guidelines are included in Appendix A of this document.

The Public Works Inspector will provide periodic inspection of all public works facilities under construction. This representative of Public Works shall report to Public Works the status of progress of each project and shall have the authority to approve field changes and interrupt construction progress. This Inspector will not replace independent inspections. The Developer shall provide independent inspection for the duration of the project; however, the City Public Works Inspector shall provide inspections as necessary to assist Public Works in maintaining current status of all projects and assisting the independent inspectors. See Section 12 of this document for Inspection Guidelines.

2.6. BONDING REQUIREMENTS

All development projects are required to be bonded prior to project commencement unless the Final Map is to be filed after completion and acceptance of the improvements. The bond shall require posting of a surety bond, cash or other improvement security with Public Works to guarantee the satisfactory completion of any improvements to Public Works System. The surety bond shall be equivalent to 110% of the estimated construction costs including a 10% contingency as identified in the Bond Fee Estimate Form provided by the Engineer-of-Record. All bonds or sureties must comply with Chapter 48 of the City of Fernley Development Code (Adopted December 3, 2003).

2.7. PRE-CONSTRUCTION MEETING

A pre-construction meeting will be conducted by the developer prior to **project commencement**. A representative of Public Works, the Contractor, City Public Works Inspector, Testing firm and Engineer-of-Record/Independent Inspector is required to be present at the pre-construction meeting. The Engineer-of-Record must schedule the pre-construction meeting and shall provide at least 1-week prior notice to Public Works of the date and time of the meeting. Upon completion of the Pre-Construction Meeting, a Construction Permit will be issued by Public Works.

2.8. REVISIONS AFTER APPROVAL

Should revisions to the approved plans become necessary, the Engineer-of-Record shall submit two (2) sets of plans showing the proposed revisions. Once the plans are approved, Public Works will send a letter of approval. Major project changes or revisions require approval by Public Works prior to incorporating the change in the field. Any major revisions to the project that are not approved by Public Works prior to implementation shall result in removal of the work associated with the change and replacement. All removal and replacement work required shall be at the developer's expense.

2.9. CONFLICTS, ERRORS AND OMISSIONS

Excepted from approval are any features of the plans that are contrary to, in conflict with, or do not conform to Nevada State Law, City Development Code or Resolution, Public Works Standards, conditions of approval, or generally accepted good engineering practice in keeping with the standards of the profession, even though such error, omissions or conflicts may have been overlooked in the Public Work's review of the plans.

2.10. PARTIAL PLANS

Where the improvement plans submitted cover only a portion of the ultimate development, the plans submitted shall be accompanied by the approved tentative plans for the entire project. Where no approved tentative plan exists, a conceptual project plan that adequately shows project improvements, topography, and other pertinent features shall be submitted. All phased boundaries shall be clearly identified on the plans.

2.11. PLAN SHEET REQUIREMENTS

All improvement plans shall be on bound sheets measuring **24" x 36"**. All water and sewer improvement plans require plan and profile for proposed and existing conditions unless waived by Public Works. Plan and profile sheets shall have a horizontal scale of 1" = 20', 40', or 50'; and a vertical scale of 1" = 2', 4', 5' or 10'. Each sheet shall be drafted in a neat and legible manner. Every professional consideration shall be given to these plans. All improvement plans shall have a title sheet containing the following information:

- Project name
- Name, address and telephone of the Owner, Developer and Engineer-of-Record
- Location Map
- Legal Description
- Parcel Numbers
- List of quantities of all Public Works System improvements (an affidavit stating that the quantities are not to be used by the contractor for purchasing is acceptable).
- Index of Sheets
- Abbreviations
- Legend of Symbols
- Signature lines for Public Works, Community Development, City Engineer, North Lyon County Fire Prevention District, and Truckee-Carson Irrigation District approval and any other entity approvals.
- General notes (a standard list of general notes as shown in the Details Section in Appendix A).

The following comments apply to the balance of the plan set:

- Each sheet within the set of drawings shall have a title block showing the sheet title, page number, date, scale and the Engineer's name, signature and stamp.
- The stationing on plan and profile sheets shall read from left to right. Plans shall be arranged with the North Arrow pointing towards the top or upper portion of the sheet, insofar as practical. Bench marks and datum shall be clearly identified on the plans as to location, description, and elevations. All benchmark datum and elevations shall be tied to City established monuments and clearly stated as such on the plans. Plans which are submitted to Public Works for review which are not tied to City established benchmarks will be returned for correction. Public Works will provide all GIS Database information in digital format at the Engineer-of-Record's request. Standard blocks and layers are available from the City Engineer. Public Works will provide a GIS request form. All GIS digital information provided by Public Works will be provided upon request.
- Show all water and sewer services and sizes to each proposed lot. Verify that the manhole stationing, elevations and pipe slopes match. Proper alignment, depths of bury, spacing clearances, separations and type of pipe are also required. Public Works will not act as the engineer's quality control.
- In addition to the plan and profile sheets, water and wastewater systems shall be shown in an overall layout plan on one sheet. All details not shown on Public Works Detail Sheets and required for construction of the project shall be shown on supplemental detail sheet(s).
- All grading plans shall conform to the approved hydrology study and indicate as such on the plans.

- Show all driveway locations on plan and profile sheets.
- Show all Street Light locations.
- Special facilities such as water tanks, pumping stations, and sewer lift stations shall be shown on separate sheets and clearly indicate all relevant elevations, existing utilities or structures, brand and model numbers.

2.12. PUBLIC WORKS DETAIL SHEETS

Public Works maintains its own Detail Sheets that are required for every approved set of plans and any other work done within the City. A copy is included in Appendix A of this document. Notify Public Works of the quantity required at least 2 days before picking up the set(s). Standard Orange Book details for Lyon County will be used for issues not covered or resolved by the City Standard Detail Sheets.

2.13. RECORD DRAWINGS

Upon completion of construction and prior to City of Fernley acceptance of the work, the Engineer-of-Record shall submit one blue-line or black-line hard copy and a digital Autocad compatible electronic copy of the Record drawings. In the event of hand drawn revisions to the hardcopy of the Record drawing, the original with its hand drawn revisions, must be scanned and that scan must be included with the submission of the digital AutoCad compatible electronic copy of the Record drawing. The AutoCad compatible digital submission shall be accurately located within the Nevada State Plane Coordinate System, NAD 83, West Zone in compliance with the City of Fernley base mapping and regional standards. Any Grid to Ground modifier applied to the digital file coordinates of the project must either be a part of the digital submission or clearly stated on accompanying paperwork.

All modifications to the original design shall be clouded on the pertinent sheet and clearly marked and noted in the revision block of that plan sheet. Major revisions shall constitute reprinting of the revised plan. Minor revisions may be hand rendered, clouded, and recorded in the Revisions Block on the plans. Record Drawings must be submitted to Public Works prior to final acceptance walk of subdivision. Failure to provide these Record Drawings will delay subdivision acceptance. Record Drawings shall be based on surveying information as much as possible. Contractor Redline Plans and an Engineer's Certification of Project shall be submitted with Record Drawings.

The Record Drawings shall be a print of the modified construction plans and shall be identified as "Record Drawings" on all sheets. The drawings shall be of the same format shown in Section 2.11 (Plan Sheet Requirements)

3.0 - STREETS

3.1. GENERAL

3.1.1. STANDARD REQUIREMENTS

Unless otherwise specified by City of Fernley (Public Works or Community Development) adopted standards, Standard Specifications and Details for Public Works Construction or items in this chapter, design of all streets and related improvements shall conform to the following: "Guidelines For Urban Major Street Design," published by the Institute of Transportation Engineers (ITE), and American Association of State Highway Transportation Officials (AASHTO) "A Policy on Geometric Designs of Highways and Streets", and SSPWC latest editions. The more restrictive standard shall prevail for design.

3.1.2. RIGHT-OF-WAY REQUIREMENTS

Street widths and alignments shall generally conform to these Review Guidelines and the Standard Details for Public Works Construction and elements thereof. All streets and alleys within a subdivision or development, shall be improved and conform to Public Works standards. Additional right-of-way shall be provided near intersections as required by Public Works in order to facilitate turning movements and ADA accessibility.

3.1.3. PAVEMENT DESIGN AND IMPROVEMENT REQUIREMENTS

Street design shall conform to standard details and be based on the design sub grade resilience modulus (MR), R-value or California Bearing Ratio (CBR), provided in a soils (geotechnical) report prepared by a Nevada registered Civil Engineer and traffic data provided in the project traffic report prepared by a Nevada registered Traffic Engineer, submitted with the improvement plans. All soils report recommendations are to be incorporated into the design of the improvements. The minimum existing pavement condition index (PCI) accepted with improvement plans shall be 60.

3.1.4. BORING AND TEST PIT LOGS

All boring and test pit logs shall be shown on the plans. Where ground water is encountered, the elevation of ground water shall be indicated in all profiles.

3.2. DESIGN CRITERIA:

3.2.1. STREET GRADES

All streets shall have a minimum grade of 0.40% unless approved otherwise by Public Works. Commercial collector, arterial and expressway streets shall have a maximum grade of 6.0%. It is desirable to have a maximum grade of 6.0% on residential collector and local streets. However, streets with a northern exposure are allowed a maximum grade of 10.0% and streets with a southern exposure a maximum grade of 12.0%. The following criteria shall also apply to street grades.

Grades in excess of 8.0% shall be limited to a horizontal tangent length of 400 feet. Grades in excess of 10.0% shall be limited to a horizontal tangent length of 200 feet. Grades in excess of 8.0% shall be provided with landings on both sides of the steeper section of grade 6.0% or less, 100 feet in length.

On long grades, the steeper grades shall be provided near the bottom of the ascent wherever possible, with shallower grades near the top of the ascent.

Street intersections shall not be allowed when the grade on the primary street exceeds 6.0% on streets with a northern exposure and 8.0% on streets with a southern exposure.

"Roller-coaster" and "Hidden-dip" patterns may only be permitted on local streets.

Sharp horizontal curvature shall not be introduced at or near the top of a pronounced crest vertical curve or near the bottom of a pronounced sag vertical curve.

Maximum grade on a cul-de-sac shall be 6%.

Cul-de-Sac's shall not be permitted at the bottom of an incline unless otherwise approved by Public Works.

3.2.2. INTERSECTION GRADES

Street grades on the minor legs of intersections shall not exceed 4% for a minimum distance of 50 feet measured from the extension of the face of curb of the primary street through the intersection (improved to full Public Works standards). Additional criteria are as follows:

Street intersections of two local streets in a stop condition do not require a vertical curve at the intersection of the crown section with the street grade.

All other street intersections shall require a vertical transition at the intersection of the crown section with the street grade. Note: A local street is defined as having a maximum average daily traffic volume of 1,000 trips or, serving a maximum of 100 single family lots.

3.2.3. STREET CROWN

Street Crown - The street crown shall be 2.0% from the centerline to the lip of gutter, with a minimum of 1.0% and a maximum of 4.0%. Unless approved otherwise, the crown shall be at the centerline of the traveled way. Through streets shall maintain the centerline crown at all intersections.

3.2.4. VERTICAL CURVES

Vertical curves shall be provided wherever the algebraic difference between two intersecting grades is 2% or more, excluding intersections. Such curves shall be of sufficient length to provide the minimum sight and stopping distances as established by the AASHTO, for minimum design speeds of 30 MPH for local and collector streets, 40 MPH for minor arterial streets and 50 MPH for major arterial and expressway streets.

3.2.5. HORIZONTAL CURVES

Minimum horizontal curve radii shall be as specified in the following table:

***Minimum Horizontal Centerline Design
Radii for Streets***

Street Classification	Minimum Design Speed	With Normal Crown	With 2% Super Elevation -	With 4% Super Elevation -
Local Streets:				
Serving less than 20 lots	20mph	100 ft		
Serving between 20 & 50 lots	25mph	185 ft		
Serving more than 50 lots	30mph	300ft	250 ft	230 ft
Collector Streets	30 mph	430 ft	335 ft	300 ft
Minor Arterial Streets	40mph	820ft	630ft	565ft
Major Arterial & Expressway Streets	50 mph	1,390 ft	1,045 ft	925 ft

Note: On local and residential collector streets (less than 4000 ADT), lesser radii maybe permitted by special alternate designs approved by Public Works which include traffic calming, short tangent sections and short radii to restrict the normal driver from exceeding posted speed. In no instance shall such reduced radius be less than 60 feet. Traffic calming alternatives are currently being considered by Public Works. Public Works will make the final determination on which alternative will be used on a case-by-case basis.

Minimum Stopping Sight Distance for City Streets

Design Speed V (Mph)	F (friction factor)		Minimum Stopping Sight Distance (ft)
	Low Speed Urban Street Design	High Speed Urban Street Design	
20 ^{(1)‡}	0.3		150
25 ^{(2)‡}	0.25		150
30	0.22	0.16	200
40		0.15	325
50		0.14	475

The minimum design radius shall be determined using the following formula:

$$\text{where, } R_{\min} = \frac{V^2}{15(e+f)}$$

V – Design Speed

R – Centerline Radius of roadway.

e – Rate, decimal (For a normal crown section, e is assumed negative for adverse side). Super-elevation may be required by the City Engineer on higher speed streets. Maximum allowable super-elevation shall be four (4) percent.

f – Friction factor from the above table.

‡Notes: Horizontal curves on local streets:

- (1) serving 20 lots or less may be designed at 20 mph and posted at 15 mph; and
- (2) 50 lots or less at 25 mph, unless otherwise approved by Public Works. (Lots shall include existing and future development.)

Curves on any street, except local streets, shall be separated by a tangent of not less than one hundred 100 feet. Unless specifically approved in a tentative map or other public review, no local street in a residential district shall have a tangent of greater than six hundred (600) feet or the distance of twelve (12) lots on one side of the street, whichever is less, unless it can be demonstrated that the tangent is visually broken by a vertical curve or that a longer tangent is necessary to preclude a traffic hazard.

3.2.6. DRIVEWAY GEOMETRY

Unless specifically approved or conditioned alternatively, public street, private street, and driveway sections (widths) shall be per the Public Works Standard Details. Alternate street sections may be used when approved by Public Works. Driveway access from single-family dwellings shall not be permitted on collector streets which are anticipated to carry more than four thousand (4,000) average daily vehicle trips.

All driveway locations are to be shown on improvement plans.

3.2.7. STREET SPACING

Street spacing and intersection placement shall be as follows:

Minimum distance between intersections unless otherwise approved by Public Works.

Classification	Downtown	Outside Downtown
Major arterial	1/3 mile (1,760')	½ mile (2,640')
Minor arterial	1/4 mile (1,320')	1/3 mile (1,760')
Commercial collector	600 feet	800 feet
Residential collector/ local	400 feet	400 feet
Local	200 feet	200 feet

3.2.8. MEDIAN OPENINGS

Median openings on arterial streets that have continuous raised center medians will not normally be permitted unless all of the following conditions exist:

The property to be served has been determined by traffic analysis to significantly impact existing traffic patterns and has a minimum continuous frontage of 600 feet along the major street, or access easements are recorded to allow use of the opening by a minimum of two properties which combined has been determined by traffic analysis to significantly impact existing traffic patterns to warrant the opening.

The median opening is not less than 700 feet from an intersection with an arterial street.

The median opening is not less than 400 feet from an intersection with a collector or local street.

The median opening is not less than 600 feet from any other existing or planned mid-block median opening.

Sight distance is adequate for the design speed of the major street.

All costs such as base material, pavements, safety lighting, traffic signals, landscaping, irrigation, reconstruction or Public Works relocation required by a mid-block opening will be borne by the requesting party.

The design of median openings shall be subject to the requirements and approval of the Public Works Director including storage lengths and tapers to AASHTO requirements.

**RESIDENTIAL STANDARDS
FOR COLLECTOR STREETS, LOCAL STREETS, ALLEYS,
PERMANENT EMERGENCY ACCESS, AND SHARED DRIVEWAYS
WITHOUT PARKWAY STRIPS**

TYPE	FIRE SPRINKLERS	WIDTH (1) FEET			CURB REQ'D L=TYPE 1 CURB	MAX CUL- DE-SAC LENGTH (FEET)	BULB DIAMETER (FEET)		MAX LOTS SERVED	MAX ADT	BIKE LANE	SIDE- WALK BOTH SIDES (FEET) (9)	RIGHT-OF-WAY WIDTH (5) (FEET)			PUE EACH SIDE (FEET) (3)
		W/O PARKING (A)	WITH PARKING ONE SIDE (B)	WITH PARKING BOTH SIDES (C)			W/O PARKING (A)	WITH PARKING ONE SIDE (B)					WITH PARKING BOTH SIDES (C)			
Shared Driveway, Alleys and permanent Emergency Access	Yes	18	26	34	Optional	1000	Hammer-head or 86	102	12	N/A	No	Optional	20	28	36	7.5 or as required
Shared Driveway, Alleys and Permanent Emergency Access	No	20	28	36	Optional	600	Hammer-head or 86	102	8	N/A	No	Optional	22	30	38	7.5 or as required
Local Street	Yes	N/A	26	34	L	1000	86	102	100	1000	No	4	N/A	36	44	10
Local Street	No	N/A	28	36	L	400	102	102	100	1000	No	4	N/A	38	46	10
Collector St.	N/A	28	35	43	L	N/A	N/A	N/A	N/A	8000 (2)	Option (7)	4	N/A	52	60	10

WITH PARKWAY STRIPS

TYPE	FIRE SPRINKLERS	WIDTH (1) FEET			CURB REQ'D L=TYPE 1 CURB	MAX CUL- DE-SAC LENGTH (FEET)	BULB DIAMETER (FEET)		MAX LOTS SERVED	MAX ADT	BIKE LANE	SIDE- WALK BOTH SIDES (FEET) (9)	RIGHT-OF-WAY WIDTH (5) (FEET)			PUE EACH SIDE (FEET) (3) (6)
		W/O PARKING (A)	WITH PARKING ONE SIDE (B)	WITH PARKING BOTH SIDES (C)			W/O PARKING (A)	WITH PARKING ONE SIDE (B)					WITH PARKING BOTH SIDES (C)			
Local	Yes	N/A	26	34	L	1000	86	102	100	1000	No	4	N/A	53	53	10
Local	No	N/A	28	36	L	400	102	102	100	1000	No	4	N/A	53	53	10
Collector	N/A	28	35	43	L	N/A	N/A	N/A	N/A	8000 (2)	Option (7)	4 or 8 one side	60	60	60	10 (4)

- (1) All widths measured from front face of curb to front face of curb (EOP to EOP when no curb is present). (7) Bike lanes require additional 5' of pavement and right-of-way per lane.
- (2) 4000 maximum ADT with lots having access. (8) Deviations from above standards for addition of medians or wider planting strips in commercial areas shall require prior approval of the City Engineer.
- (3) Public Works stubs and services must extend beyond right-of-way, sidewalk, or PUE, whichever is greater. (9) ADA requires a passing space at intervals not to exceed 200' or sidewalk must be 5' wide.
- (4) If 8' path option exercised, add 4' on one side.
- (5) Additional right-of-way or easement may be required for parallel roadway drainage.
- (6) PUE shall be Public Utility Easement/Public Use Easement (sidewalk).

3.2.9. STREET INTERSECTING ANGLE

Any street or highway intersecting any other street or highway, shall intersect at an angle as near to a right angle as is practicable, unless otherwise approved by Public Works.

3.2.10. CUL-DE-SAC AND DEAD END STREET REQUIREMENTS

Cul-de-sacs and dead end streets shall conform to latest adopted edition of the International Fire Code (IFC) requirements. Shared driveways may be terminated in a hammerhead. The minimum lot frontage on cul-de-sac streets shall be thirty (30) feet. "No Outlet" signs shall be posted on cul-de-sacs with length greater than 100'.

3.2.11. PRIVATE STREET REQUIREMENTS

Private streets shall be designed to City standards as directed in this manual, including horizontal and vertical alignment. Storm drain and sanitary sewer systems located within a private street shall be constructed to City standards. Gated private streets shall provide a means to turn around if gates are closed. All gates shall be accessible to the Fire District. Maintenance of the gates shall be by the private development. Signs shall be posted stating "Private Street, Not Maintained by City".

3.2.12. SHARED DRIVEWAYS

Shared driveways shall be structurally designed and paved with a minimum of 2½ inches of asphalt concrete pavement placed over an engineered base of not less than 6" of Type 2, Class B aggregate base.

3.2.13. PAVEMENT STRUCTURAL SECTION DESIGN CRITERIA

Design of the structural section for Asphalt Concrete Pavement for both public and private streets shall conform to the procedures as set forth in the current Asphalt Institute Manual Series No. 1 (MS-1) or American Association of State Highway and Transportation Officials (AASHTO) Design Guide, based on subgrade strength values determined by Resilient Modulus (MR) Value, Resistance (R) value or California Bearing Ratio (CBR), and traffic data provided in the approved traffic study for the project. Sufficient tests shall be made to fully evaluate each different soil type in the project. Major Arterial, Minor Arterial, Industrial and Commercial Streets shall be a Type 2 AC-20P asphalt concrete (AC) pavement mix design with hydrated lime (mineral filler) added at one and one-half percent of the weight of the dry aggregates. Collector and Local/Residential Streets shall be a Type 3 AC-20 asphalt concrete (AC) pavement mix design with hydrated lime (mineral filler) added at one and one-half percent of the weight of the dry aggregates. The minimum design life of the structural section shall be 20 years. Minimum street structural sections for both public and private streets shall be 3" AC on 6" of Type 2, Class B aggregate base for local/residential streets, 3" AC on 6" Type 2, Class B aggregate base for minor arterial, industrial, commercial and collector streets, and 4" AC on 6" Type 2, Class B aggregate base for expressways and major arterial streets. All streets, both public and private, which are to be utilized by construction vehicles during development, shall be designed to carry the maximum anticipated loads. Concrete streets may be permitted upon approval of structural designs by Public Works.

3.2.14. ASPHALT TEST CORE HOLES

Asphalt test core holes shall be plugged with 4,000 PSI non-shrink concrete grout per the Standard Specifications for Public Works.

3.2.15. CUL-DE-SACS AND KNUCKLES

Minimum grades around Cul-de-sacs and Knuckle-type intersections shall be 0.5%. The normal street crown with such a development may be increased to a maximum of 4.0% from the centerline to the lip of gutter. Knuckle turnouts are not allowed on streets serving more than 20 lots without prior approval by the Public Works. Cul-de-sac lengths shall be measured from the front face of curb (or edge of pavement where no curb is present) of the intersecting street to the radius point of the bulb turnaround, unless provided with an emergency access designed to Public Works standards. The minimum right-of-way for the bulb shall be 6" beyond the sidewalk.

3.2.16. TEMPORARY CUL-DE-SACS

Temporary cul-de-sacs shall be constructed with a minimum of 2½ inches asphalt concrete pavement on an engineered base when located within the development. When located within an adjacent future developable area it shall conform to temporary emergency access road standards within an access easement. All temporary cul-de-sacs shall be a minimum 48 foot radius to right-of-way. Final approval for temporary cul-de-sacs will be required from the Fire District.

3.2.17. EMERGENCY ACCESS ROADS

Emergency access roads shall be a minimum 24 feet in width with a structural pavement section design to support a tandem axle load of 25 tons, unless otherwise approved by the Fire District. Grades shall not exceed the maximum for street grades unless otherwise approved by the Fire District and Public Works. It is intended that emergency access roads be open and usable at all times. Where required, access to emergency roadways at each entrance shall be controlled by an "Emergency Access Control Gate", shall be posted "For Emergency Vehicles Only", and shall be accessible to the Fire District. Maintenance of the gates shall be by the private development.

Temporary emergency access roads shall be surfaced with a minimum of 2½ inches of Type 2, Class B Aggregate Base with and application of a minimum of 0.08 gallon per square yard of a non-latex emulsion asphalt seal coat, such as SS-1h, and adequate roadside drainage shall be provided.

Permanent emergency access roads shall be paved with a minimum of 2½ inches of asphalt concrete pavement on an engineered base and adequate roadside drainage shall be provided. Unless otherwise approved by Public Works, all improved accesses shall provide for vehicles to enter traffic "nose first".

3.2.18. MAINTENANCE ACCESS

Vehicular access for maintenance of City-owned sanitary sewer and storm drain facilities and their related appurtenances are to be constructed to a minimum un-encroached width of 12 feet, structurally designed to support a tandem axle loading of 25 tons, with adequate

roadside drainage, and are not to exceed 12% in grade. Dead-end access roads in excess of 150 feet shall require termination in a hammerhead, turnaround or 'Y' -turn.

Temporary maintenance access roads shall be surfaced with a minimum of 2½ inches of Type 2, Class B aggregate base, and adequate roadside drainage shall be provided.

Permanent maintenance access roads shall be paved with a minimum of 2½ inches of asphalt concrete pavement on an engineered base and adequate roadside drainage shall be provided. Unless otherwise approved by Public Works, all improved accesses shall provide for vehicles to enter traffic "nose first".

3.2.19. TEMPORARY PATCHES

Temporary patches on public streets are to be a minimum of 2" thick and compacted, and shall not deviate more than 3/4 inch above the existing pavement grade when measured from the bottom of a straight edge laid two feet beyond the patch on both sides of the existing pavement. In no case shall the elevation of the patch be lower than the existing adjacent pavement elevation. All loose material shall be removed from the temporary patch site immediately after completion of the patch. It will be the responsibility of the excavation and encroachment permittee to maintain the temporary patch until the permanent patch is completed and signed off by the Public Works.

Street excavation on streets which permanent surfacing is less than five (5) years old is subject to a penalty fee. The penalty fee shall be 300% and reduce to 0% over 5 years from the date of acceptance of the surfacing. The penalty fee will start at 300% of the permit fee and reduce by 60% each year on the annual anniversary of the date of the surfacing acceptance. The fee will therefore be flat at 300% the first year, 240% the second year, 180% the third year, 120% the fourth year and 60% the fifth year.

3.2.20. ASPHALT SURFACE OR MATERIAL DEFECTS

"Rock Pockets" in the final surface of the asphalt and asphalt air voids or compaction deficiencies shall be addressed with Type II or Type III Slurry Seal, if applicable, or by patching or reconstruction as designated by Public Works.

3.2.21. LANDSCAPE MEDIAN

Where applicable, the use of raised landscape medians is preferred over the use of striped double left turn treatments.

3.2.22. ALTERNATIVE PAVING SURFACES

Alternative paving surfaces such as stamped concrete or pavers may be considered on a case-by-case basis. Alternate paving surfaces shall be approved by Public Works.

3.3. TRAFFIC TECHNICAL REPORTS

Copies of technical analyses associated with street design and traffic device improvements are required by Public Works if improvements are going to generate 100 peak hour trips or more. Public Works may require a traffic study regardless of the number of trips generated by improvements, due to the improvement type and location. All traffic reports must reflect

all cumulative impacts and mitigations of previously approved projects. An incomplete traffic report will result in a submittal rejection.

The following criteria shall be considered for a Traffic Report.

3.3.1 TITLE PAGE

- a) Project name.
- b) Preparer's name, firm, date.
- c) Professional engineer's seal of preparer and signature.

3.3.2 INTRODUCTION

- a) Site location.
- b) Proposed project description.

3.3.3 TRAFFIC ANALYSIS

- a) Trip Generation.
 - i. To be calculated using Section 3.4, "Recommended Procedure for Estimating Trip Generation" in the latest edition of the I.T.E. Trip Generation Manual, or from an trip analysis of identical project.
- b) Pass-by Trip Reductions.
 - i. Must be approved on a case-by-case basis for traffic studies.
- c) Level-of-Service Analysis.
 - i. Calculations shall be based on the latest edition of the Highway Capacity Manual.
 - ii. Provide mitigation measures for intersection which operate at a level-of-service of D or less. Possible measures can be, but not limited to, signalization, channelized medians, turning lanes, storage lane increase, restricted turns and/or additional lanes. Advantages and disadvantages need to be included with mitigation measures.
- d) Warrant Analysis / Progression Analysis for Traffic Signals.
- e) Left/Right-Turn Storage Analysis.
 - i. Storage bay analysis must be performed at all study intersections and project driveways identified in the traffic study scope. Storage at signalized intersections is to be calculated utilizing the Poisson Method with a 95% confidence and a 3-minute wait. Storage at unsignalized intersections is to be calculated utilizing the uniform arrival rate with a 2-minute wait.
 - ii. Use existing and committed improvement lane configurations in the analysis.
 - iii. For phased improvements, the study will address improvements to be constructed with each phase and the associated participation for each phase.
- f) Traffic Accident Analysis.
 - i. Pedestrian and Traffic accident data shall be evaluated at intersections, median openings and mid-block locations for a minimum period of 3

years. The accident potential is to be analyzed with mitigation measure recommendations.

- g) Figures.
 - i. Vicinity map.
 - ii. Site plan map.
 - iii. Directional distribution.
 - iv. Peak hour site only volumes.
 - v. Existing peak hour traffic volumes (current within 12 months).
 - vi. Future background traffic volumes.
 - vii. Future background with site traffic volumes.
 - viii. Existing geometrics and control.
 - ix. Recommended geometrics and control.
 - x. School walking routes for residential developments.
 - xi. Site plan or project boundary superimposed on aerial photograph.

3.3.4 CONCLUSION

- a) Improvement Impacts
 - i. Benefits.
 - ii. Adverse effects with solutions for mitigation.

3.3.5 APPENDICES

- a) Planning Commission / City Council conditions.
- b) Site Plans (24" x 36" and 11" x 17").
 - i. Buildings with total area.
 - ii. Drive aisles
 - iii. Public and Private Street names.
 - iv. Medians.
 - v. Right-of-way.
 - vi. Opposing / Adjacent driveways.
 - vii. Gated entries.
- c) NDOT's Access Management System and Standards Statement of Conformance (if applicable).c
- d) Calculations.

3.4. SIDEWALKS, CURB AND GUTTERS, DRIVEWAY APPROACHES, CURB-CUTS, ALLEYS AND BIKEWAYS:

3.4.1. SIDEWALK AND CURB AND GUTTER REQUIREMENTS

Public sidewalks, curbs and gutters shall be installed or existing improvements replaced when deteriorated or displaced, including paving between street cut and gutter line on all streets, except sidewalks may only be omitted where the sidewalk has been waived by Public Works. In no instance, shall sidewalks be less than 4 feet in width. When required, in commercial/industrial developments sidewalks shall not be less than 6 feet in width. Pedestrian ways shall be provided from all public sidewalks to the entrance of buildings as

required by Public Works. Necessary right-of-way shall be dedicated or easement granted as required by Public Works. In new developments, sidewalk requirements shall be determined at time of tentative map or parcel map approval, typically on both sides of all streets, public and private, unless another means of pedestrian access is approved, or if sidewalk is impractical or is unnecessary for pedestrian access purposes as determined by Public Works. Sidewalks in commercial or industrial developments may be deferred until a building permit is issued. Sidewalks, Curbs and gutters and pedestrian ramps shall be constructed with 4,000 PSI fiber-reinforced Portland Cement Concrete, per Public Works standards. Glue-down curbs are not permitted at edge of pavement. Volumetric Concrete Mixers shall be certified as Ready Mixed Concrete Plant Facility by National Ready Mixed Concrete Association (NRMCA). Sidewalks shall meet the required 2.0% maximum cross slope per the Americans with Disabilities Act Accessibility Guidelines (ADAAG).

3.4.2. UNUSED DRIVEWAYS

Unused driveways shall be replaced with new curb, gutter and sidewalk.

3.4.3. PEDESTRIAN RAMPS FOR THE DISABLED

"Pedestrian Ramps for the Disabled" shall be provided at all curb returns in accordance with Public Works standards. A minimum of one mid-block ramp shall be provided at "T"-intersections. Pedestrian Ramps at mid-block are not required within residential developments, unless requested by City Engineer. Alignment of ramps shall provide for minimum pedestrian exposure to traffic during crossing of streets. Truncated domes are required on all new and reconstructed pedestrian ramps to meet ADA compliance.

3.4.4. PROPERTY LINES AT INTERSECTIONS

Property lines at intersections shall accommodate the installation of the "Pedestrian Ramps for the Disabled" and additional required sidewalk entirely within the right-of-way. Property lines at "T"-intersections shall accommodate the installation of the mid-block ramp and additional required sidewalk entirely within the right-of-way.

3.4.5. CURB RETURN RADIUS

Unless specifically approved otherwise, curb returns shall have minimum face of curb radii of 20 feet on local streets, 25 feet on collector streets, 30 feet on minor arterial streets and 40 feet on major arterial and expressway streets.

3.4.6. DRIVEWAY SPACING

Spacing between commercial driveways, or from the edge of a driveway to the adjacent intersection corner, shall be a minimum of 235 feet on major arterials, 150 feet on minor arterials and 50 feet on commercial collectors.

Minimum spacing between driveways on local/residential streets shall be 10 feet from low point to low point of the driveway taper, based on a minimum of 5 feet from property line. The maximum grade for residential driveways shall be 14%.

3.4.7. BIKEWAY DESIGN CRITERIA

The design of bikeways shall conform to the AASHTO "Guide for Development of New Bicycle Facilities", latest edition, unless otherwise specified by City ordinance, Standard Specifications and Details for Public Works Construction, or items in this section.

The structural section for bicycle and pedestrian path facilities shall be based on a soils report recommendation. The minimum structural section shall be 2½ inches of Type 2 or Type 3 asphalt concrete pavement over 6 inches of Type 2 Class B aggregate base, except where they are integrated with adjoining pavement for vehicular access, the associated minimum street structural section shall apply.

3.4.8. SIDEWALK AND GUTTER OBSTRUCTION REQUIREMENTS

No obstructions (i.e., power poles, street lights, signal poles and controls, water meter boxes, pull boxes, mail boxes, fire hydrants, etc.) shall be allowed to be located within public sidewalks or pedestrian ways, or within sight triangle, except as may be allowed by Public Works where obstructions exist within existing improvements. A minimum unobstructed clearance of 36" shall be maintained from any obstacle. Additional right-of-way or easement shall be provided where required.

The use of permanent curb ramps of any type, in the public right-of-way, for vehicle transition from the street over the curb is prohibited. A removable, non-permanent ramp may be used to assist a vehicle over the curb, but shall be removed after each use.

3.4.9. CUT AND FILL SLOPES STABILIZATION

Cut and fill slopes are to be set back a minimum of 1 foot from the back of the sidewalk. If no sidewalk exists the setback shall be a minimum of 5 feet from back of curb.

All slopes between 3:1 and 2:1 shall be stabilized by approved mechanical stabilization or landscape materials. If rock riprap is approved by Public Works or City Engineer for slope stabilization it shall contain a minimum of four fractured faces with a minimum D₅₀ of 6 inches placed to a minimum depth of 12 inches.

All constructed slopes steeper than 2:1 shall be reviewed by Public Works on a case-by-case basis, with solutions to stabilize the slope and mitigate the visual impacts.

3.4.10. CURB CUTS FOR DRIVEWAYS

Where car storage or access for motor vehicles is desired in business, commercial, or industrial districts, provision shall be made for a driveway. All driveway approaches shall enter properties via a standard curb-cut.

3.4.11. ALLEY REQUIREMENTS



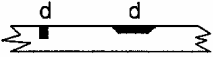


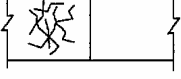
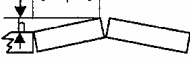
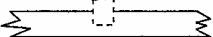
Alleys required to serve a development shall be installed or existing improvements replaced when deteriorated. The minimum structural section shall be 2-1/2 inches of asphalt concrete pavement on 6 inches of Type 2, Class B aggregate base. Alleys shall be constructed or reconstructed to full width. Longitudinal grades in alleys shall conform to standards for streets, with a cross slope of 2.0% minimum from the property line toward the center of the alley. Off-site alley improvements may be required by Public Works for provision of safe and adequate access to the subject site.

3.4.12. ADA COMPLIANT

All sidewalks, curb and gutters, driveway approaches, curb cuts, alleys and bikeways shall be ADA Compliant as specified by Public Works.

3.4.13. SIDEWALK MAINTENANCE & REPAIR

Guidelines for the determination of deteriorated sidewalks, curbs and gutters are shown in the following table.

<p>#1 Vertical Displacement</p>  <p>Side View h=height</p>	<p><u>Vertical Displacement.</u> Sidewalk, Curb and Gutter, Driveway Approach. Any displacement greater than one inch shall be removed and displaced. This criteria applies to all sidewalks, whether adjacent to the curb & gutter or not. However, curb & gutter will be evaluated with regard to storm drain capabilities.</p>
<p>#2 Horizontal Displacement</p>  <p>Side View w=width</p>	<p><u>Horizontal Displacement.</u> Horizontal displacement or crack equal to one inch or more for 50% or more of the gutter pan in the transverse direction (perpendicular to the sidewalk).</p> <p>Note: Also included are longitudinal cracks that appear to impede the function of the gutter pan.</p>
<p>#3 Holes</p>  <p>Side View d=diameter</p>	<p><u>Holes.</u> Holes equal to one inch or more in diameter, and one-half inch or more in depth, located such that they create an unsafe condition.</p> <p>(Patching as an alternative may be allowed)</p>
<p>#4 Missing Portions</p>  <p>Bird's-Eye View</p>	<p><u>Missing Portions.</u> A missing portion of sidewalk, curb & gutter section, nine square inches or greater in area. (A section is defined as an area between any two consecutive construction joints, expansion joints, or score marks.</p> <p>Note: Missing portion should be one-half inch in depth or greater.</p>
<p>#5 Spalling</p>  <p>Bird's-Eye View</p>	<p><u>Spalling.</u> Spalling (missing surface fragments) over 50% of the surface of a sidewalk or curb & gutter. Curb & gutter sections must be spalled to a depth of one-half inch or greater. Sidewalk sections must be spalled to a depth of 3/16 inch or greater.</p>
<p>#6 Cracking</p>  <p>Bird's-Eye View</p>	<p><u>Cracking.</u> Cracking over 50% of the surface of a sidewalk or curb & gutter section.</p> <p>Note: Spider web cracks or surface cracks that have not opened are not included.</p>
<p>#7 Sloping</p>  <p>Side View</p>	<p><u>Sloping.</u> Sloping is an abrupt change in the slope of the sidewalk or curb & gutter of one-half inch per foot or more.</p> <p>l=length h=height slope=height/length</p>
<p>#8 Protrusions</p>  <p>Side View</p>	<p><u>Protrusions.</u> Any abnormal protrusions, depression or inclusion which creates an unsafe condition. As an example, the figure to the left displays a portion of pipe extending from the sidewalk. Patching as an alternative may be allowed.</p>

Note: The above figures only use views of sidewalk sections for simplicity to portray guideline concepts.

Note: Minimum sections to be replaced shall be from score mark or construction joint to the next score mark or construction joint. Curb and gutter replacement shall be 10 foot minimums.

As dictated by Nevada Revised Statute (NRS) 278.02313, the property owner is responsible for the following:

1. General maintenance of a sidewalk in the public right-of-way that abuts the owner's property, including, without limitation, sweeping, removal of snow/ice/weeds, and maintenance of any grass, shrubs and trees which encroach on the sidewalk.
2. The repair and reconstruction of a sidewalk in the public right-of-way that abuts the property of the owner if the owner caused the need for such repair or reconstruction.

3.4.14. CONSTRUCTION DEBRIS

All public streets are to be kept free and clean of construction debris. If debris is accumulated throughout the work day, it is to be removed prior to leaving the site. Failure to clean construction sites may result in work stoppage until issue is addressed.

3.5. TRAFFIC DEVICES, CONSTRUCTION TRAFFIC CONTROL, AND TRAFFIC CALMING:

3.5.1. MUTCD COMPLIANCE

The application, design, and installation of traffic control devices shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), latest edition, published by the Federal Highway Administration.

3.5.2. INSTALLATION AND REMOVAL OF TRAFFIC CONTROL DEVICES

Traffic control devices shall be installed or modified if warranted as determined by and approved traffic study/analysis for new development projects, and/or as directed by Public Works.

Traffic calming devices shall be considered in traffic studies/analyses.

3.5.3. STREET NAME SIGNAGE

Street name signs to Public Works standards shall be installed at all intersections, and may be required on arterial streets in advance of intersections. Where private streets intersect public streets, standard signs that say, "Private Street Not Maintained by City" shall be installed.

3.5.4. SPEED LIMIT SIGNAGE

Speed limit signs shall be installed in proximity to all arterial or collector street intersections, and on local streets having a different speed limit than the intersecting street. Posted speeds on City streets shall be 25 MPH on local and collector streets, 35 MPH on minor arterial streets and 45 MPH on major arterial streets, unless designated otherwise by Public Works or to maintain consistency with City policies or law. Speed limit signage shall be installed on all streets where the limit changes from one speed to another.

3.5.5. SPEED CONTROL SIGNAGE ON CURVES

When the design speed of a curve falls below the posted speed limit, curve warning signage with an advisory speed plate and 4 inch double solid yellow centerline striping shall be installed from beginning of curve to end of curve.

3.5.6. NO OUTLET SIGNAGE ON CUL-DE-SAC

A "No Outlet" sign shall be installed at the entrance to any cul-de-sac exceeding 100 feet in length.

3.5.7. ONE WAY STREET SIGNAGE AND STRIPING

At driveways on minor street intersections with one-way or median-divided streets, "One Way" and/or "Right (Left) Turn Only" signs shall be installed. Corresponding pavement markings may also be required.

3.5.8. PARKING CONTROL SIGNAGE AND STRIPING

Parking control signs shall be installed and curbs painted at street intersections, at fire hydrants, adjacent to driveways, and other locations as required. Curb colors are red for parking prohibited, yellow for restricted parking, and blue for handicapped parking. The top and face of the curb shall be painted with standard traffic paint. Parking is prohibited within 15 feet centered on the fire hydrant; Fire District policy establishes locations for required hydrant markers.

3.5.9. PARKING METERS

Installation of parking meter poles and parking space marking may be required. Installation of parking meters shall only be performed by the City. Meter bags may be obtained from the Community Development Department.

3.5.10. STRIPING

All longitudinal striping shall be NDOT Type II waterborne paint applied in two coats. The pavement surface shall be cleaned and dry prior to the application of the paint striping.

When half street improvements are constructed abutting existing pavement, the entire width of the street and adjacent transition areas shall be striped in accordance with applicable MUTCD and Public Works standards. Existing, conflicting pavement markings shall be removed by grinding. Blacking out markings is not an approved removal method

3.5.11. STOP AND YIELD MARKINGS

Stop bars, yield lines and word symbols shall be thermoplastic material, beads shall be required. Only stop bars and yield lines are required on local/resident streets, unless it is a four-way stop condition or the local/residential street abuts a collector street. The pavement surface shall be cleaned and dry prior to the application of the paint striping.

3.5.12. SCHOOL TRAFFIC DEVICES

School-related traffic devices shall be installed, relocated, or removed as required, and as consistent with the applicable "safe route to school plan". New or updated "safe route to school plans" shall be required in conjunction with the development of new schools or expansion of existing schools. The "Nevada School Traffic Safety Handbook" establishes guidelines for the application of school-related traffic devices.

3.5.13. END OF ROAD WARNING SIGNS

Type 3 barricade end of roadway markers shall be installed at the end of streets (except fully improved residential cul-de-sacs). For street ends where there is a significant elevation change adjacent or there is a need to control access, barrier rail, guardrail, or barricades may also be required.

3.5.14. MEDIAN STRIPING AND MARKERS

When triangular islands are constructed at street or driveway intersections, the curb shall be painted white and reflective markers installed at the corners. The ends of center medians shall be painted yellow and reflective markers installed at the ends and along the median.

3.5.15. REPLACEMENT OR RELOCATION OF EXISTING TRAFFIC SIGNALS

When new construction affects elements of an existing traffic signal, or as determined by an approved traffic analysis, relocation and/or replacement is required. Public Works will coordinate replacement or relocation of existing traffic signals.

3.5.16. NEW TRAFFIC SIGNALS OR MODIFICATIONS TO EXISTING

Installation of new traffic signals or modification of existing signals shall comply with the Standard Specifications for Public Works and the City of Fernley Development Code.

Traffic Signals shall be controlled by a loop detection system only. Video-detection shall only be used when approved by Public Works. A Traffic Signal Cabinet shall contain a controller, Battery Backup System (BBS) and conflict monitor. The controller shall be a NAZTEC 980 TS2 Controller with EEPROM Module, or approved equal. The BBS and conflict monitor shall all be NEMA compliant and shall be compatible with the specified controller. Traffic Signals must be installed with an Optical Preemption Detector and Optical Signal Processor (OSP). The Traffic Signals shall be installed with timing coordination through Global Positioning System (GPS) synchronizing equipment and wireless connectivity.

Traffic Lights and Turning Signals shall have 12 inch LED modules. Pedestrian Signals shall have a 16 inch Full Symbol Hand/Man indicator. Pedestrian push-buttons shall be ADA Compliant and must be installed with a 9 x 12 inch informational sign bezel above push-button.

Public Works requires all new Traffic Signal installations to provide a minimum of four (4) hours training for Public Works employees. Training shall include all signal operations, controller programming and timing coordination. In addition to employee training, controller timing sheets, conflict monitor certification and a comprehensive hard and

electronic copy of all controller programming and signal configuration plans shall be submitted to Public Works prior to final acceptance.

3.5.17. SIGHT DISTANCE

Prior to the dedication of any public rights-of-way, adequate sight distance shall be demonstrated at all intersections. The design of all new commercial driveways shall provide for adequate sight distance. All above ground features, such as transformer boxes, shall be located or relocated so as to not adversely affect sight distance in proximity to street intersections and driveways.

3.5.18. BICYCLE LANES

Traffic signs and/or pavement markings shall be installed on all street segments within or adjacent to a development to designate bicycle routes or bicycle lanes, as directed by Public Works or Community Development.

3.5.19. TRAFFIC CALMING

The design and placement of speed humps or other traffic calming improvements on new or existing streets shall be considered by Public Works on a case-by-case basis, as identified in an approved traffic analysis.

3.5.20. STREET LIGHTS

All improvement plans are required to show streetlight locations.

3.6. TRAFFIC POLICIES, MATERIALS AND EQUIPMENT STANDARDS:

Traffic policies, materials and equipment standards must comply with the applicable provisions of the MUTCD and Standard Specifications for Public Works Construction. It is the responsibility of the user of this manual to obtain the most current edition of those manuals.

4.0 - POTABLE WATER SYSTEM DISTRIBUTION AND TRANSMISSION FACILITIES

4.1. DESIGN CRITERIA

The following design criteria shall govern the design of water distribution and transmission facilities that are to be dedicated to the City. The intent of these criteria is to promote water system designs that will provide safe, adequate, and dependable potable water service without excessive maintenance costs. The requirements set forth in NAC 445A, NRS 445A and these guidelines, regarding water distribution systems shall be used as design and review guidelines. Improvement plans for water systems and facilities must be reviewed and approved by Public Works.

4.1.1. WATER SUPPLY PRESSURE

Distribution system pressure shall meet the requirements of NAC 445A.6711. Public Works will provide the maximum-day pressure at a desired delivery location for design purposes. Under maximum-day demand conditions, normal operating pressures of not less than 40 psi no more than 100 psi shall be maintained at the meter inlet for all service connections. Peak-hour pressures shall be maintained between 30 psi and 100 psi. Maximum-day pressures during a fire event shall be maintained between 20 psi and 100 psi. Pressure reducing stations are not allowed unless otherwise noted. Private individual pressure reducing valves shall be installed and maintained by the owner, on private property, in accordance with the most current adopted edition of the International Plumbing Code (IPC). Use of booster pumping stations to increase pressures in localized areas may be permitted on a case-by-case basis. Private individual booster pumping stations may be installed and maintained by the owner, on private property, in accordance with the IPC. Calculations of onsite system operating pressures, by the engineer should include any required backflow prevention devices, in accordance with Public Works Detail Sheets. Copies of the backflow prevention program and rules and regulations are available from Public Works.

4.1.2. WATER DEMAND RATES

Demand values of 1000 gallons per day (gpd) per residence, which is equivalent to one (1) Equivalent Residential Connection/Unit (ERC/U) for a metered system, shall be utilized when determining total number of will-serves for a specific development. A peaking factor of 2.0 shall be used to determine the peak hour demand.

4.1.3. REQUIRED FIRE FLOWS

Fire flows shall be as required by the Fire District. Minimum residential fire flow has been determined by the Fire District to be 1000 gpm for 2 hours. A residual pressure of 20 psi shall be maintained at any point in the system during a fire flow event. Calculations to determine the residual pressure and available fire flows shall assume the maximum day demand is occurring in the system. All fire flow demands shall be met from storage and not groundwater pumping stations.

4.1.4. MAXIMUM VELOCITIES

Sizing of distribution and transmission mains shall be such that water velocity during all conditions of flow, other than fire flow, does not exceed 6.5 feet per second (fps). Under fire flow conditions with maximum day water demand the water velocity shall not exceed 10 fps.

4.1.5. WATER SYSTEM MODEL REPORT

Public Works is required by NAC 445A to report to the Bureau of Health Protection Services regarding the System's delivery capabilities to the new developments. Public Works will model all distribution and transmission lines, pumping facilities and storage tanks to evaluate the performance of the proposed facilities and their impact on existing facilities. If the Engineer-of-Record requests that a model of the particular development be constructed to assist in the design of the distribution system prior to developing improvement plans, a preliminary model may be developed. The Engineer-of-Record must submit to Public Works a base map which includes proposed topography, street and lot configuration, and piping layout including a model fee determined by the "Application for a City of Fernley Water Model". Public Works will include the proposed facilities in the City's water model and provide feedback on required water line sizes, pumping facility capacities, storage tank sizes, locations and other related items.

4.2. TRANSMISSION MAINS

Dedicated transmission mains are mains used solely for filling water tanks. It is preferred to design transmission mains that tie into distribution systems en-route to a water tank. In addition to limiting maximum velocities, when pumping is involved, the transmission main shall be the most economical size considering costs and the present worth of the incremental pumping costs associated with the pipe diameter under evaluation. This analysis shall be for a twenty (20) year period with an interest rate of ten (10) percent. Transmission main pipe shall be either cement-mortar-lined DI or PVC. PVC pipe shall be in conformance with AWWA C900 for diameters between 4 and 12 inches, and C905 for diameters larger than 12 inches. All ductile iron pipe and fittings shall be cement-mortar lined in accordance with AWWA C104. The exposed (non-buried) exteriors of DI shall be epoxy coated to 10 mils (minimum) of Federal Safety Blue and the buried exterior of DI shall be wrapped with 8 mil polyethylene film and sealed in accordance with AWWA C105. The transmission main shall be pressure rated for the maximum working pressure including surge pressures resulting from an instantaneous valve closure. A transient surge analysis is required for all pump station designs.

4.2.1 PIPELINE OVERSIZING

Pipeline oversizing may be required by Public Works to account for future growth. Oversizing will be determined by Public Works based on water modeling analysis. The pipeline size required for the development will be determined by the analysis as well as the pipeline oversizing. Oversizing agreements will be as defined in Chapter 17 of the Community Development Code.

4.3. DISTRIBUTION SYSTEM PIPING

Distribution mains shall be sized to deliver required flows at the pressures specified in Section 4.1.1. The minimum size for distribution piping shall be eight (8) inches. All mains shall be adequately looped and networked to provide alternate flow routes. Distribution piping shall be DI in accordance with AWWA C150 and C151 or PVC in accordance with AWWA C900 or C905. The distribution main shall be pressure rated for the maximum working pressure and must include surge allowances. The pipe shall be designed for the internal and external loads placed on it. Minimum pipe rating shall be Pressure Class 150 for DI, Class 150 for C900 PVC and Class 160 for C905 PVC (Public Works may require higher classes for special circumstances). Seismic design shall be incorporated in all areas where the transmission main crosses a fault. Fault mapping shall be submitted if applicable.

A Public Works representative must be present during a tie-in (TI) from any new water system (new development, upgrades, etc.) to the City's existing water distribution system.

4.3.1.MAIN LOCATION

All water mains shall be installed in public rights-of-way or public easements. Minimum easement width shall be 10 feet. Per NAC 445A, unless approved by the Bureau of Health Protection Services, water mains shall not be installed in public utility easements on private property. Minimum cover over a water main shall be three and one half (3.5) feet. Location of water mains in public right of way shall conform to the Public Works Standard Details. Unless waived by Public Works, all extension mains shall run along the entire frontage of the developer's lot or parcel. Public Works may require that mains extend to the edge of the property deemed appropriate by Public Works for future development. Mains must be aligned in such a way that minimizes other Public Works conflicts. Minimum separations and clearances should be maintained whenever possible. If minimum separations cannot be maintained, alternatives permitted by the Bureau of Health Protection Services are indicated on the Public Works Standard Detail Sheets.

4.3.2. STREAM AND DITCH CROSSINGS

Crossing details and profiles of pipe, piers, anchorage, transition couplings, etc. shall be shown on the improvement drawings. Ductile iron pipe with bolted flange fittings or restrained joint piping shall be used under the full stream or ditch width, and ten (10) feet on each side. All stream and ditch crossings shall have a minimum clearance of 5 feet between the stream bottom and top of pipe, and shall be enclosed in a pipe sleeve. Consideration shall also be given to protecting the pipe during stream flooding and scour. A scour analysis shall be provided as required by Public Works. Stream crossing and construction methods shall be approved by the appropriate agency (Nevada Division of Environmental Protection, Nevada Department of Fish and Game, Nevada State Lands, Nevada Bureau of Health Protection Services, and the Corps of Engineers - see NAC 445A).

4.3.3.TRANSMISSION AND DISTRIBUTION VALVES

Valves shall be installed at minimum intervals of 1,000 feet on transmission mains and 500 feet on distribution mains. The valves shall be located so that any section of main can be shut down without going to more than three locations to close valves. As a minimum, there shall be at least two valves at every tee fitting and three valves at every cross fitting on pipe ten (10) inch in diameter and smaller. For pipe larger than 10-inches there shall be three valves at every tee fitting and four valves at every cross fitting. Valves 12-inch and smaller shall be resilient-seated gate valves installed with ASTM B-132 bronze valve stems and shall be designed such that if excessive input torque is applied, stem failure shall occur above the stuffing box. The stem material must provide a minimum 70,000psi tensile strength. Two-piece stem collar valves are not acceptable. Valves larger than 12-inch shall be butterfly valves, with the valve seat located on the valve body. The butterfly valves shall also have shaft seals to be designed to allow replacement without removing the valve shaft. Valves shall be in conformance with AWWA C509 and C504. Valves shall be provided with a shop-applied fusion bonded epoxy coating 10 mils thick on interior and exterior surfaces. All unburied valves shall be over-coated with 3 mils of Federal Safety Blue epoxy. Valve shafts shall be solid 18-8 Type 304 stainless steel.

Valves shall include valve boxes that are set at the same elevation as the existing grade, either in a traveled way or untravelled way. Valve boxes shall incorporate concrete collars in all installations per the Public Works Standard Details.

All distribution control-valving shall be designed for installation in Public Works-approved below-ground vaults or above-ground enclosures. Valve applications shall be approved by Public Works and in accordance with manufacturer's recommendations.

Valves shall be Mueller valves unless otherwise met by criteria stated above and approved by Public Works.

4.3.4.FIRE HYDRANTS

In all areas where fire hydrants are required along roadways, the spacing between adjacent hydrants shall be determined by NLCFPD, but shall not exceed 500 feet in residential areas and 300 feet in institutional, commercial, and industrial areas. Hydrant spacing shall be measured along the shortest route within the traveled way of streets that connect the hydrants. Wherever possible, hydrants shall be located at street intersections. Fire hydrants shall not be located in cul-de-sacs unless specified by the NLCFPD hydrants shall be located a minimum of 12-inches behind back-of-sidewalk. All other hydrants along roadways shall be located at the intersection of property lines with the street right-of-way boundaries. No parcel shall be more than 250 feet away from a fire hydrant.

The appropriate fire prevention district shall determine the spacing between adjacent fire hydrants in areas and locations other than along roadways.

All hydrants shall be freeze-proof dry barrel hydrants and shall comply with the Public Works Standard Details.

The hydrant lateral, which interconnects the distribution main and the hydrant, shall be not less than six (6) inches in size. A 6-inch gate valve shall be installed in all hydrant laterals. The shut-off valve shall be located on the water main with a flanged tee.

All hydrants shall be installed with a Harrington, 5-inch, Storz fittings with cap and cable (Harrington Part No. HPHA50-45NH) and shall be enameled with Sherwin-Williams B54R38 paint per Public Works Detail Sheets.

Hydrants that are permanently inoperable shall be painted black including nozzle caps, tops, barrels, and all visible parts. Hydrants that are temporarily out-of-service shall be wrapped and valved off-line.

4.3.5.POTABLE WATER SERVICES

All services shall be metered. Whenever possible, double meter boxes shall be located on property lines between lots with a single service line from the main to the meter box. In other situations, the meter box location shall be within the public right-of-way or easement adjacent to an existing or proposed curb line. In alleys or easements, meter boxes shall be located at a point as close as practicable to the property line near the water main location. Meter boxes shall be installed at a maximum of 4 feet behind back of walk or at distances from back of walk as identified on the Public Works Standard Details. Under no circumstance shall meter boxes be located inside fenced yards or within driveways, driving surfaces, and other areas where access for operation and maintenance may be restricted.

There shall be no obstructions within three (3') feet of meter boxes.

Minimum service line size is ¾-inch for service to a single meter and 1-inch to double meters. Water meters shall be Sensus SR2 TRPL (Touch Read), or approved equal, remote-read meters with remote read disks located in the meter box lid. The meters, meter boxes, meter setters, curb stops, service lines, and radio-read module MXU units shall be installed in accordance with Public Works Standard Detail Sheets. MXU units must not be placed

within 3 feet of a power source. Commercial and industrial services shall be designed by a registered engineer and submitted for Public Works review prior to approval.

Services shall also incorporate a “customer valve” located on the customer side of the meter box and shall be as defined on the Public Works Standard Details. A valve riser and cap shall be provided for the customer valve.

Water services in subdivisions will be marked at the curb with an approved permanent method.

4.3.6.FLUSH VALVE ASSEMBLIES

A temporary flush valve assembly (FVA) will be permitted at a “dead-end” main (or cul-de-sac) on a case-by-case basis. A permanent FVA will not be permitted. A fire hydrant will serve as FVA or to purge air if located at the end of a water line where there is a planned future extension. FVA calculations (using a minimum velocity of 2 fps in the main during flushing and 15 fps in the FVA) must be provided for pipe sizes greater than 12 inches. Temporary FVA’s shall be installed in accordance with the Public Works Standard Detail Sheets.

4.3.7.AIR AND VACUUM VALVES AND AIR-RELEASE VALVES

Air and vacuum valves and air-release valves shall be installed at all high points in the water mains, water pumping stations, and where required by Public Works. Air and vacuum valves and air-release valves shall be tested and approved in accordance with AWWA C512 Standard for Air-Release, Air/Vacuum, and Combination Air valves for Water Works Service.

4.3.8.PRESSURE REDUCING VALVES

Pressure reducing valves (PRV) may be provided on distribution mains as necessary so that the system pressure will not exceed 80 psi static pressure at the lowest ground elevation of a pressure zone. Pressure reducing valves shall be installed in concrete vaults. Concrete vaults shall be rated for H-20 traffic and shall be equipped with a spring assisted weatherproof double hatch cover. The installation shall include bypass piping and a secondary PRV including isolation valves to allow removal of either of the pressure reducing valves.

Pressure reducing valve stations must be designed by an engineer and all calculations must be submitted to Public Works for review and approval. Differential pressure across the valve must not exceed manufacturer’s recommendations to preclude cavitation. Pressure reducing stations must be designed for locations that minimize the number of stations involved with the maximum amount of benefit to services. Pressure reducing stations may be incorporated in booster pumping station design.

4.3.9.CROSS-CONNECTION

The term “cross-connection” shall mean any unprotected actual or potential connection, auxiliary intake, bypass, or other piping arrangement between a public water supply and any other source through which it is possible to introduce industrial fluid, gas, or other substance from a source which does not comply with the Primary or Secondary Drinking Water Standards by back-siphonage and/or backpressure and used water. Unprotected cross-connections with the public water supply are prohibited.

Per the Public Works Standard Details, an approved backflow prevention assembly shall be installed on each service line to a customer’s water system at or near the property line or immediately inside the building being served; but in all cases, before the first branch line leading off the service line wherever the following conditions exist:

1. In the case of premises having an auxiliary water supply which may not be of safe bacteriological or chemical quality and which is not acceptable as an additional source by Public Works, the auxiliary water system shall not be directly (physically) connected to the municipal water system.
2. In the case of premises on which industrial fluids or other objectionable substances are handled in such a fashion as to create an actual or potential hazard to the public water system, the public system shall be protected against backflow from the premises by installing an approved backflow prevention assembly in the service line appropriate to the degree of hazard.
3. In the case of premises having (1) internal cross-connection that cannot be permanently corrected or controlled, or (2) intricate plumbing and piping arrangements or where entry to all portions of the premises is not readily accessible for inspection purposes, making it impracticable or impossible to ascertain whether or not dangerous cross-connections exist, the public water system shall be protected against backflow from the premises by installing an approved backflow prevention assembly in the service line.

4.3.10. BACKFLOW PREVENTION DEVICES

4.3.10.1. VACUUM BREAKERS

An atmospheric vacuum breaker or pressure vacuum breaker shall be used only for protection against pollution or contamination under conditions of backsiphonage. Vacuum breakers (AVB, PVB or SVB) may be used for irrigation systems, including systems for irrigation of median strips.

4.3.10.1.1. ATMOSPHERIC VACUUM BREAKER (AVB)

An atmospheric vacuum breaker is an assembly that contains an air inlet valve, a check seat, and an air inlet port(s). The following must be met for AVB installations:

1. The vacuum breaker must be installed not less than 6 vertical inches above the highest point of downstream piping.
2. Any associated shutoff valve must be located upstream from the vacuum breaker.
3. The vacuum breaker must not be subjected to operating pressure for more than 12 hours in any 24-hour period.

4.3.10.1.2. PRESSURE VACUUM BREAKER (PVB)

A pressure vacuum breaker is an assembly that contains an independently operating internally loaded check valve and an independently operation loaded air inlet valve located on the discharge side of the check valve. The following conditions must be met for PVB installations:

1. The PVB must be installed upstream from the terminal shutoff valve.
2. The PVB must be installed not less than 12 vertical inches above the highest point of the downstream outlet, valve or piping.

4.3.10.1.3. SPILL RESISTANT PRESSURE VACUUM BREAKER (SVB)

A spill resistant pressure vacuum breaker is an assembly that contains an independently operation loaded air inlet valve located on the discharge side of the check valve. The following conditions must be met for SVB installations:

1. The SVB shall be installed upstream from the terminal shutoff valve.

2. The SVB must be installed not less than 12 vertical inches above the highest point of the downstream outlet, valve or piping.
3. The SVB must not be installed at a location where backpressure will occur.

4.3.10.2. DOUBLE CHECK VALVE ASSEMBLY

A double check valve assembly means an assembly that:

1. Is composed of two independently acting, approved check valves;
2. Has tightly closing, resilient seated shutoff valves attached at each end;
3. Is fitted with properly located, resilient seated test cocks; and
4. Has been tested and approved in accordance with American Water Works Association Standard C511, by an approved backflow testing laboratory.

Double check valve assemblies are required in the following:

1. A building that has multiple stories and booster pumps or elevated tanks to distribute potable water.
2. A building that exceeds 40 Feet in height, as measured from the service connection to the highest water outlet.
3. Class 1, Class 2, or Class 3 fire sprinkler system.
4. Irrigation system, including a system for irrigating median strips.

4.3.10.3. REDUCED PRESSURE PRINCIPLE ASSEMBLY

A reduced pressure principle assemble means an assembly that

1. Contains:
 - a) two independently acting approved check valves; and
 - b) a hydraulically operating, mechanically independent pressure differential relief valve located between the approved check valves and below the upstream check valve;
2. Has properly located, resilient seated test cocks and tightly closing, resilient, seated shutoff valves at each end of the assembly;
3. Is designed to protect against pollution and contamination under conditions of back-siphonage or backpressure; and
4. Has been tested and approved by a back flow testing laboratory.

Reduced pressure principle assemblies are required in the following:

1. Irrigation system, including a system for irrigating median strips, if facilities have been installed for pumping, injecting or applying fertilizers, pesticides or other hazardous systems.
2. Hotel/Motel
3. Casino
4. Condominium/Townhouse/Apartments
5. Any commercial building where a specific business activity has not been identified
6. A building in which one or more sewage pumps or sewage ejectors have been installed
7. Class 4, class 5, or class 6 fire sprinkler system
8. Hydronic heating system that contains any chemical additives

9. Baptismal font of a church
10. Beverage bottling facility
11. Brewery
12. Cannery
13. Food processing facility
14. Packing house or rendering facility
15. Cold storage facility
16. Dairy processing facility
17. Restaurant or other facility in which food is served
18. Dental Clinic
19. Hospital, medical building, or clinic
20. Convalescent or nursing home
21. Sanitarium
22. Morgue, mortuary, or facility conducting autopsies
23. Laboratory, including laboratories of teaching institutions or another biological or analytical facility
24. School, college, or university
25. Motion picture production facility
26. Newspaper printing or publishing facility
27. Veterinary clinic, pet shop, or pet grooming facility
28. Laundry or dry cleaning facility
29. Dyeing facility
30. Mechanical, chemical, or electrochemical plating facility
31. Pool or spa
32. Mobile home or RV park
33. Fishery, fish hatchery, dock, marina, or any facility located on a waterfront
34. Power production facility
35. Oil or gas production, storage, or transmission
36. Radioactive material storage, handling, or processing facility
37. Sand or gravel processing
38. Any facility in which water is used to manufacture, store, compound, or process chemicals for industrial purposes; chemicals are added to water used in the compounding or processing of products; chemicals are added to the supply of water; or the supply of water is used for the transmission or distribution of chemicals
39. Aircraft or missile manufacturing facility
40. Motor manufacture, repair, or cleaning facility
41. Film processing or manufacturing facility
42. Ice manufacturing facility
43. Metal cleaning, manufacturing, or processing facility
44. Natural or synthetic rubber manufacturing facility
45. Paper or paper products manufacturing facility
46. Any other facility for manufacturing, processing, or fabricating

4.3.10.4. AIR GAP

An air gap is a physical separation between a point of free-flowing discharge from a pipe that supplies liquid to an open or non-pressurized vessel and the overflow rim of that vessel which is:

1. At least twice the effective diameter of that pipe or, if the pipe is affected by side walls, at least three times the effective diameter of that pipe; and
2. In no case less than one inch

Air gaps are required for the following:

1. Any portable spraying or cleaning equipment.
2. Sewage collection, storm drainage, or distribution of reclaimed wastewater.

Conditions not listed above, or that require special consideration, shall be evaluated on a case by case basis and the appropriate backflow protection device shall be determined by the City.

4.3.10.5. ASSEMBLY REQUIREMENTS

Backflow prevention assemblies required herein shall be a make, model and size approved by the Public Works and as shown on the Public Works Standard Details. An approved backflow prevention assembly shall mean an assembly that has been manufactured in full conformance with AWWA C510 Standard for Double Check Valve Backflow-Prevention Assembly, and AWWA C511 Standard for Reduced-Pressure Principle Backflow-Prevention Assembly, and have met completely the laboratory and field performance specifications of the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California (USC FCCCHR), as established in: "Specifications of Backflow Prevention Assemblies-Section 10 of the most current edition of the Manual of Cross-Connection Control."

4.3.10.6. TESTING REQUIREMENTS

It shall be the responsibility of the customer at the premise where backflow prevention assemblies are installed to have certified inspectors and operational tests made at the customer's sole expense at least once per year. Test results shall be submitted to the Public Works within five (5) days of completion. In those instances where the Public Works deems the hazard to be great enough, certified inspections may be required at more frequent intervals. These inspections and tests shall be performed by a tester certified by the American Water Works Association, California-Nevada Section. The customer shall notify the Public Works two (2) working days in advance when the tests are to be undertaken so that a Public Works representative may witness the tests.

All backflow prevention devices shall be tested:

1. Upon installation
2. At least annually
3. Upon relocation or repair

The City may require a more frequent testing schedule if it is determined to be necessary.

A test report in a form acceptable to Public Works shall be filed with Public Works each time a backflow prevention device is installed, repaired, relocated, or replaced. Approval from the City must be obtained before a backflow prevention device is removed, relocated, repaired, or replaced.

4.3.10.7. INSTALLATION REQUIREMENTS

Backflow devices shall be installed as described in the following sections, and as shown in the standard details. Public Works shall have the final authority in determining the required location of the backflow prevention device.

4.3.10.7.1. DOUBLE CHECK VALVE ASSEMBLY

1. Must be installed in a horizontal and level position, unless specifically designed for operation in a vertical position and tested and certified to be suitable for operation in that position by an approved backflow-testing laboratory.
2. Device should be installed as close as practical to the service connection, on the opposite side of the service connection from the public water system.
3. Device shall be above ground and, to the extent possible, not less than 12 inches or more than 36 inches above finished grade, as measured from the bottom of the assembly.
4. Device shall be easily accessible for maintenance and testing.
5. There must be no type of outlet, tee tap, take-off or connection to or from the service line between the service connection and the device.
6. Expansion tanks or pressure relief valves must be provided as appropriate for the potential threat of water hammer and thermal expansion.
7. Device may, if above-grade installation is impractical and the health authority approves, be installed in a below-grade vault such that:
 - a. The top of the check valve assembly is not more than 8 inches below grade
 - b. There is at least 12 inches of clearance between the bottom of the vault and the bottom of the device
 - c. There is at least 24 inches of clearance between the side of the vault and the side of the double check assembly with test cocks
 - a. There is at least 12 inches of clearance between the side of the vault and the other sides of the device
 - b. To the extent warranted by climatic conditions, the device is protected from freezing
 - c. The vault has adequate drainage to prevent the accumulation of water, which drains to daylight, to free-draining soil or to a sufficient amount of gravel placed under the vault to provide for free drainage and prevent the accumulation of water under the vault. A vault that does not have an integrated bottom must be placed on a layer of gravel which is not less than 3 inches deep.
 - d. The vault is protected from vandalism
 - e. The vault is not located in an area subject to vehicular traffic
8. The device may be installed indoors if the installation complies with items 1-7 inclusive, and has a clearance of:
 - a. At least 12 inches on top
 - b. At least 24 inches on the side with test cocks

- c. At least 12 inches on the other sides

4.3.10.7.2. REDUCED PRESSURE PRINCIPLE ASSEMBLY

1. Must be installed in a horizontal and level position, unless specifically designed for operation in vertical position and tested and certified to be suitable for operation in that position by an approved backflow-testing laboratory.
4. Device should be installed as close as practical to the service connection, on the opposite side of the service connection from the public water system.
5. Device shall be above ground and, to the extent possible, not less than 12 inches or more than 36 inches above finished grade, as measured from the bottom of the assembly.
6. The site shall have adequate drainage, or drain piping, for any fluid that is discharged when the assembly is activated.
7. Device shall be installed such that no part of the assembly will be submerged during normal conditions of operation and weather.
8. Device shall be easily accessible for maintenance and testing.
9. Device must not be installed below grade, in any subsurface vault, or in any vault, chamber, or pit where there is any potential that the relief valve could become submerged.
10. Device shall have a free flowing drain with an air gap.
11. There must be no type of outlet, tee, tap, take-off, or connection to or from the service line between the service connection and the device.
12. Expansion tanks or pressure relief valves must be provided as appropriate for the potential threat of water hammer and thermal expansion.
13. The device may be installed indoors if the installation complies with sections 1-10 inclusive, and has a clearance of:
 - a. At least 12 inches on top
 - b. At least 24 inches on the side with test cocks
 - c. At least 12 inches on the other sides

4.3.10.7.3. AIR GAP

1. The air gap must be located as close as practical to the service connection, on the opposite side of the service connection from the public water system.
2. All piping from the service connection to the receiving tank must be above grade and visible.
3. There must be no type of outlet, tee, tap, take-off or connection to or from the service line between the service connections and the air gap.
4. Expansion tanks or pressure relief valves must be provided as appropriate for the potential threat of water hammer and thermal expansion.

4.3.11. DISINFECTION AND TESTING

All water mains shall be disinfected and tested in accordance with AWWA C651 Standard for Disinfecting Water Mains. All water mains shall be pressure tested at 150 percent of the working pressure class or a minimum of 150 pounds per square inch; whichever is greater, in accordance with the "Standard Specifications for Public Works Construction."

4.3.12. PRESSURE TESTING

All PVC pipes shall be pressure tested in accordance with AWWA Standard C605. All ductile iron pipes shall be pressure tested in accordance with AWWA Standard C600.

4.3.13. LOCATING WIRE AND TAPE

All buried, nonmetallic transmission, distribution and service pipes shall have a blue locating wire and a locating tape. The locating wire shall be installed and secured on the top of the pipe, and the locating tape shall be installed on top of the pipe bedding envelope. The tape shall bear a continuous message "Caution - Water Line Buried Below" or words of similar nature. The ends of the locating wire shall be accessible and extend into all valve boxes or other underground vaults. The locating wire shall be a minimum 12 gauge insulated copper wire.

4.3.14. ENCROACHMENT PERMIT

The improvement plans shall clearly indicate that all work in Union Pacific Railroad, Bureau of Reclamation, and NDOT right-of-way requires an encroachment or occupancy permit from the respective entity.

4.3.15. PAVEMENT SAWCUT

Refer to Public Works Standard Details regarding cutting of paved roads. Street excavation on streets which permanent surfacing is less than five (5) years old is subject to a penalty fee. The penalty fee shall be 300% and reduce to 0% over 5 years from the date of acceptance of the surfacing. The penalty fee will start at 300% of the permit fee and reduce by 60% each year on the annual anniversary of the date of the surfacing acceptance. The fee will therefore be flat at 300% the first year, 240% the second year, 180% the third year, 120% the fourth year and 60% the fifth year. Developer must apply for a Street Cut Permit with Public Works prior to cutting an approved public street.

5.0 - WATER SUPPLY WELLS

5.1. GENERAL

This section covers the requirements for public, potable water supply wells. All design, construction, development and testing of any well to be offered for dedication to Public Works shall be coordinated with the City Engineer prior to commencement of drilling activities. Public Works may require completion of the water supply wells and storage prior to approval of a final map. It shall be the responsibility of the developer or Engineer-of-Record to notify and gain written permission from Public Works prior to initiating any well drilling or testing activities. The purpose of this notification is to ensure that the well is constructed and tested in an acceptable manner and because the City has a “Deferred-Preferred Use” through the Nevada State Engineer, within the Fernley Water Basin 5-76. Public Works shall have the final decision as to acceptability of the well for dedication. If the well is not accepted by Public Works it may not be used for public usages.

All water supply wells must comply with the Regulations for Water Well and Related Drilling, revised and adopted January 1998, as well as NAC 534 and NRS 534.

5.2. HYDROGEOLOGIC REPORT

Prior to well construction, the developer or Engineer-of-Record shall submit to Public Works a hydrogeologic evaluation of the proposed well site. The report shall be prepared by a Nevada registered engineer, geologist or hydrologist and shall contain, but not be limited to the following:

- a) A detailed map showing well location (Using a USGS 7-1/2 minute quadrangle map).
- b) A summary of available hydrogeologic information including reports, logs of nearby wells, water quality data and any other relevant information.
- c) A description of the proposed plan for exploration, testing and well construction.
- d) A statement of anticipated water production from the well.

5.3. DESIGN CRITERIA

Design criteria for water supply wells are presented in the sections that follow.

5.3.1.LOCATION

No well shall be located within 50 feet of gravity sanitary or storm sewers. No well shall be located within 150 feet of a sewer force main, sewer lift station, septic tank, absorption field, designated replacement field location, or other source of pollution or contamination

5.3.2.WATER QUALITY

The water from the well shall meet the Nevada State Drinking Water Regulations with respect to microbiological, physical, chemical and radiological qualities as adopted in Nevada Administrative Code, Chapter 445, Public Water Systems – Quality. Point of entry or point of use treatment devices shall not be allowed as a means to comply with the water quality requirements.

5.3.3.STANDARDS

The following standards shall be used in the logging, test pumping, abandonment, design and construction of water supply wells:

- 1) State of Nevada Division of Water Resources, Regulations for Drilling Water Wells.
- 2) AWWA A100 Standard for Water Wells
- 3) The State Engineer's permit under which the well is to be drilled.
- 4) NAC 445A
- 5) Bureau of Health Protection Regulations

5.3.4.CASING

Casing size shall be suitable for installing a pump, pump column or drop pipe, and a minimum of 1-inch diameter sounding tube as approved by Public Works. Casing material shall be in compliance with current standards for water well drilling and construction.

5.3.5.WELL SCREEN

Well screen may be of continuous wire wrap design, shuttered screen, and louvered screen or bar lug screen as approved by Public Works. Screen opening shall be determined using sieve analyses of the formation and gravel pack and the determination of the screen opening shall be submitted to Public Works for review and approval by Public Works.

5.3.6.GRAVEL PACK

All new wells shall include a gravel pack. The minimum gravel pack thickness shall be 4-inches between the borehole wall and casing. The gravel pack shall be placed by reverse circulation method or by a tremie pipe, raising the tremie pipe as the gravel pack is placed. All new wells shall include a gravel fill tube as part of the finished design. The gravel pack gradation determination shall be submitted to Public Works for review and approval by Public Works.

5.4. PRECONSTRUCTION SUBMITTALS

The following items must be submitted for approval or verification by Public Works prior to initiating well construction:

5.4.1.INTENT TO DRILL CARD

The contractor or engineer must submit the intent to drill card in accordance with the State Engineer's requirements.

5.4.2.WELL DESIGN

The following information regarding the well design must be submitted for approval by Public Works;

- a) E-Log- If available
- b) Drilling method and type of drilling rig.
- c) Borehole diameter
- d) Production casing diameter

- e) Screen type and slot size; Sieve analysis and screen opening size shall be submitted to Public Works for approval a minimum of two (2) working days prior to well screen installation.
- f) Gravel pack design; The gravel source and gradation shall be submitted to Public Works for approval a minimum of two (2) working days prior to installation.

5.5. WELL CONSTRUCTION

All wells shall be constructed in accordance with:

- 1) State Engineer Requirements – Regulations for Drilling Water Wells.
- 2) State of Nevada Bureau of Health Protection Services Requirements
- 3) AWWA A100 Standard for Water Wells

Additional requirements may be assessed by Public Works based on site-specific conditions. Specific items for which approval of Public Works is required prior to construction are:

The required six- (6) inch diameter exploration well shall be used as a monitoring well located within five hundred (500) feet of the proposed production well.

5.5.1. PLUMBNESS AND ALIGNMENT

All wells shall be tested in accordance with AWWA A100. Contractor shall be subject to the requirements of AWWA A100 Section 8. The tolerance requirements shall apply from the top of the well to the bottom of the casing.

5.6. DEVELOPMENT

Wells shall be developed by pumping, mechanical surging, air-lifting or other means. Development shall continue until no increase in the specific capacity is achieved and the sand production rate is less than 5 parts per million for the first three to five minutes of the start of pumping as measured with a Rossum Sand Tester or for the greatest anticipated pumping rate. The method for determining specific capacity and other proposed methods to determine sand content shall be approved by Public Works. Public Works shall have the final determination as to when development is complete and the sand production rate is acceptable. The drilling or pump contractor must make arrangements for discharging water during development in accordance with all applicable regulations.

5.7. YIELD AND EFFICIENCY TESTING

Yield and efficiency testing shall be conducted under the direct observation of an approved representative or agent of Public Works. Efficiency testing shall include a 4-step efficiency test at pumping rates of 50%, 75%, 100%, and 125% of expected capacity from the well. The duration of each step shall be a minimum of 120 minutes. Yield testing shall consist of a constant discharge-pumping test at a rate based on the step test results. Pumping duration shall be a minimum of 72 hours. If data collected during the 72 hours pumping indicate, in the opinion of Public Works, that a longer test is necessary, pumping shall continue until the safe long-term yield of the well can be determined to the satisfaction of Public Works. A 24-hour minimum recovery-monitoring period will be required at the conclusion of the constant discharge pump test.

Prior to efficiency or yield testing, the hydrologist's or engineer's proposed testing plan shall be submitted to Public Works. The testing plan shall include, but not be limited to:

- 1) A description of the pump and driving mechanism to be used, with rated capacities
- 2) A description of the method and apparatus to be used for flow rate monitoring.

- 3) A description of the method and apparatus to be used to measure water levels and drawdown (A 1-inch or larger diameter sounding tube will be required).
- 4) A proposed time schedule for testing.
- 5) A plan for disposing of the water produced during the pump test.
- 6) Approval form NDEP & Public Works regarding permission to discharge.

After testing, copies of all data collected shall be submitted to Public Works.

5.8. WATER QUALITY

Water samples shall be collected at the beginning and at 24-hour intervals during the yield testing (Four samples for a 72 hour test). Samples shall be analyzed by a certified laboratory to determine if the water is in conformance with Nevada State Drinking Water Regulation with respect to microbiological, physical, chemical, and radiological qualities as adopted in Nevada Administrative Code, Chapter 445, Public Water Systems – Quality. Water temperature and electrical conductivity are to be monitored during the pump test. The contractor will be responsible for collecting and submitting water samples to the certified lab.

5.9. DOWNHOLE COLOR TELEVISION SURVEY

After completion of the casing, sealing, and test pumping, and prior to installation of pumping equipment, a downhole color television survey shall be completed from the ground surface to the total depth of the well. The survey shall be conducted and recorded on a color VHS tape as a camera is lowered into the well. The camera shall be lowered in such a manner and speed as to allow a detailed examination of the casing interior. The color VHS tape shall be provided to Public Works as part of the Well Construction Record Report.

5.10. WELL CONSTRUCTION RECORD REPORT

Where groundwater wells are constructed, a Record Report containing the following information shall be submitted.

- 1) A location map showing the location of wells constructed.
- 2) A copy of the Well Driller's Report.
- 3) A summary and recommendation report detailing the capacity and expected long term drawdown effects (10 years) of each well constructed. The report shall include all pertinent comments related to aquifer hydraulic characteristics, sand production and water quality analyses.
- 4) Descriptions and diagrams detailing materials, borehole diameters, surface seal dimensions, screened intervals, depths, static water levels and other pertinent aspects of the well construction.
- 5) A summary describing the drilling methods, name and address of drilling contractor, name and address of hydrogeologic consultant, and well development methods.
- 6) A summary report detailing the pumping test program. The report shall include a description of the test equipment, method of measuring discharge rates, method of measuring sand content, and a table outlining the type and duration of pumping tests performed.
- 7) A report detailing the methods of analysis used and the results of analysis of test pumping data. The report shall contain a description of well efficiency at the design production rate and the aquifer parameters determined from the constant discharge pumping test.
- 8) A report detailing water quality. The report shall describe sampling methods, and the lab results of water quality and bacteriological analysis.
- 9) The submitted report shall contain appendices which shall include:
 - Geologist and driller's logs

- Electric Well Logs
 - Grain size distribution analysis of selected gravel pack
 - General materials documentation, including casing and screen invoices, gravel invoices and cement invoices
 - Required permits and logs
 - All pumping test data, including graphs and calculations
 - Water quality analysis report forms
 - Daily hydrologist logs
 - Drawing of the completed well showing all the construction features of the well
 - Color VHS video tape of well casing
- 10) Recommended equipping of the well including the following:
- Pump and Motor
 - Pump Building Enclosure
 - Recommended Treatment and Treatment Equipment
 - Recommended power (permanent and auxiliary/standby)
 - Facility Operation
 - Instrumentation and Telemetry
 - O&M estimated costs
 - Surge Tank and Equipment

6.0 - PUMPING FACILITIES

6.1. GENERAL

This section covers the requirements and equipment for pumping facilities to be offered for dedication to Public Works. Pumping facilities shall be designed by an engineer with specific related experience. Facilities shall be designed with long term operation and maintenance in mind. Electrical and mechanical designs shall accompany the design for all pumping facilities.

Operation and maintenance information shall be provided for all equipment and material and shall consist of the names and addresses of the manufacturer, the nearest representative of the manufacturer, the nearest parts supplier, as well as lubrication information, control diagrams, start-up procedures, operating procedures, preventative maintenance, overhaul instructions, parts list, and a spare parts list.

6.2. WELL PUMPS

Well pumps shall be either vertical turbine or submersible pumps. The selection of the type of pump to be used depends on the size of the motor, length of the pump column, and other considerations. In general, a submersible pump shall not be used when the motor size is larger than 100 Hp. Submersible pump facilities shall be equipped with a foot valve and pitless unit. When a submersible pump is used, the well shall be located outside the pumping facility building unless otherwise approved by the City Engineer. Wells equipped with vertical turbine pumps shall be located inside a pump building and shall be equipped with a water lubed shaft and anti-reverse ratchet. Water lubed pumps shall be equipped with suitable automatic pre-lube provisions if necessary as determined by manufacturer's recommendations. All pumps shall have premium efficiency motors. Pumps shall be constructed in accordance with AWWA C101 Standard for Vertical Turbine Pumps-Line Shaft and Submersible Types.

All well pumps shall have a water meter approved by Public Works with a pulse or 4-20ma signal for remote reading capabilities. The pumps shall also have adjustable speed check valves similar to the Clayton 81-02 and deep well pump control valves similar to the Cla-Val Model 61-02 when required by Public Works.

The pump capacity (discharge and total dynamic head) shall be matched as closely as possible with actual operating conditions. All pumps shall have premium efficiency motors unless otherwise authorized by Public Works.

The submittal for review shall include pump performance curves, system curves, pump operating ranges and sufficient literature; with detailed specifications.

The water system improvement plans shall identify the following operating conditions and performance criteria:

- Operating System Functional Description
- Casing Diameter
- Depth of Well
- Screen Location with Respect to Pump Setting
- Static Water Level
- Pumping Level
- Pump Manufacturer and Model
- Pump Materials of Construction
- Certified Pump Curve from Manufacturer
- Pump Intake Setting
- Required Pump Discharge

- Total Dynamic Head at Required Discharge
- Available Net Positive Suction Head Determination
- Maximum Pump Speed (RPM)
- Minimum Motor Horsepower
- Minimum Efficiency
- Motor Protection Features
- Motor Soft Starters and/or VFD
- Meter Sizing Determination
- Air-Vacuum Valve Sizing Determination
- Discharge Piping Sizing Determination

6.3. BOOSTER PUMPS

Booster pumps shall be vertical line shaft turbines and pump can type. Horizontal-Split Case Pumps will be considered by Public Works on a case-by-case basis. The improvement plans shall state the following operating conditions and performance criteria:

- Required Pump Discharge
- Certified Pump Curve
- System Curves
- Pump Operating Range
- Total Dynamic Head at Required Discharge
- Available Net Positive Suction Head
- Maximum Pump Speed
- Minimum Motor Horsepower
- Minimum Efficiency
- Motor Protection Features
- Additional booster pump and motor

Booster pumps shall be used to move water from a lower pressure zone to a higher-pressure zone. Maximum Day Demands shall be met with 2 pumps operating in parallel and a third pump will be utilized as a back-up. Booster pumps located adjacent to existing water storage facilities are preferred as opposed to drawing suction from distribution lines. The minimum suction pressure allowed will be 30 psi under maximum day demands. A suction supply water tank may be required for proper operation of a booster pumping station. Closed loop pumping is not allowed. Package booster stations are preferred. All pumps shall have premium efficiency motors unless otherwise authorized by Public Works. Fire flow is to be provided from storage and not from booster pumps unless waived by Public Works and/or the Fire District. All design calculations must be stamped by a licensed civil engineer and provided to Public Works for review and approval prior to construction.

PRV bypass stations may be considered at booster pumping stations on a case-by-case basis. PRV stations will be below-ground installations and all design calculations must be stamped by a licensed civil engineer and provided to Public Works for review and approval prior to construction.

6.4. SURGE TANKS

A registered professional civil engineer must perform a transient surge analysis. A report specifying maximum and minimum pressures and tank size must be provided. A surge tank must

be of the pre-inflated bladder type. The tank shall be constructed of carbon steel and withstand a working pressure of 275 psig. The maximum pressure in the discharge piping shall be damped to 150 psig and minimum pressure at 0 psig. Interior surfaces shall be epoxy coated to 15 mils minimum, NSF approved for potable water systems. Exterior surfaces shall be primed and overcoat 10 mils minimum of Federal Safety Blue epoxy only. The surge tank shall provide an inlet/outlet with an orifice plate to prevent extruding the bladder from the shell. The top of the surge tank shall be removable for access and maintenance and inspections of the bladder. Bladder material shall be constructed of heavy-duty butyl or neoprene. One spare bladder shall be furnished with the tank. The top shall be equipped with a gas charging valve and pressure gauge. All surge tanks shall have operating tank pre-charge specifications on stamped nameplate or in operation manuals.

6.5. MECHANICAL REQUIREMENTS

All pumping facilities shall have sufficient surge control to protect piping and other equipment. Pressure fluctuations shall be maintained within 15% of normal operating pressures during pump starting and stopping. Adequate provisions shall be made for pressure surges caused by power outages. Unless approved by Public Works, pressure relief valves or surge anticipator valves will not be permitted for surge protection. In addition, as determined by Public Works, pumps in excess of 25 Hp shall be equipped with "Soft Starters", unless pumps are installed with a Variable Frequency Drive (VFD). Vertical turbine pumps may be required to be equipped with pump control valves as determined by Public Works. The valves shall pump to waste upon start up, then slowly introduce flow into the system and reverse the process when the pump is signaled to stop.

All pumps shall be equipped with mechanical seals and magnetic seals.

The facilities shall also have a discharge meter and suction and discharge pressure gauges. The discharge meter shall indicate total flow and rate of flow. The discharge meter and pressure gauges (both suction and discharge) shall be suitable for remote reading and shall transmit to the stations control center. The flow meter shall provide an output signal capable of activating the chlorine chemical feed pump.

Piping shall be flanged ductile iron or welded steel piping. Adequate pipe stands shall be provided for proper support of piping and equipment.

Equipment shall be designed to operate at sound levels not exceeding the best standards established by NEMA or CBM. Provide adequate bases and vibration isolators to prevent transmission of noise. Adequate louvers, heating and ventilation shall also be provided.

6.6. CHLORINATION

All well pumping facilities shall be equipped with sodium hypochlorite (HPC) systems utilizing bulk polyethylene containers of HPC solution and solution feed pump with wall mounted shelf. The volume of the hypochlorite storage tank(s) shall be determined by Public Works. The feed pumps must be approved by Public Works. All of the system components shall be according to the manufacturer's recommendations to insure efficient chlorination system operation. The chlorine chemical feed pump must be electrically connected to the flow meter pulse signal.

The chlorination solution drums and pump shall be located in a separate room and be isolated from the rest of the pumping facility. The separating walls shall be sealed masonry block. The design of the room shall comply with the applicable requirements of the most current adopted edition of the International Building Code (IBC) and International Plumbing Code (IPC). Proper warning signage must also be installed outside the separate room. Ventilation must be activated from the outside to provide ventilation prior to entering the room and the vent duct must exhaust outside. A concrete sump sized to handle a minimum of 150 gallons (a larger sump size may be required depending on the number of drums) with a 10 gpm HPC resistant sump pump shall be located in the HPC handling room for chemical spills. The sump pump shall be mounted above

the sump flood elevation and have a 25-foot long, 1" diameter, HPC resistant discharge tube. Chlorination facilities must also include mechanical agitators. Feed line must include check valves and injectors such that the injector can be removed while the main line is under pressure. The bulk drums must be seismically restrained.

6.7. CONTROLS & TELEMETRY

Water monitoring and control systems shall consist of a complete radio telemetry system to monitor the status of the pumping facilities. The storage tank level shall control well pumps. The signal to start and stop coming from the telemetry panel. An annual controls contract will be awarded, for the design and installation of all Public Works systems. Public Works has the right to extend the contract indefinitely if needed. The contract is intended to ensure compatibility with existing control and telemetry systems. Control panels shall be equipped with start counters and hour meters for all pumps.

Typical functions to be monitored include:

- 1) Pump Status (if pumps have VFD, pump speed must be monitored)
- 2) Pump Alarms
- 3) High Motor Temperature
- 4) Successive Starts
- 5) Over-Voltage or Over-Amp draw
- 6) Water Levels in Wells
- 7) Suction and Discharge Pressure
- 8) Moisture in the Pump Room
- 9) Tank Levels
- 10) Intrusion alarms
- 11) Operating Voltage (for each phase leg)
- 12) Operating Amp Draw (for each phase leg)
- 13) Water Flow
- 14) Fire/Smoke Controls and Alarms

Well stations shall be equipped with self-generating circular chart recorders, well depth transducers, pressure indicators, and moisture detectors. Moisture detectors shall be located on the floor, in a low point, in both the pump room and the chlorine rooms.

6.8. BUILDINGS & SITE

All vertical turbine pumps, booster pumps, mechanical equipment, chlorination facilities, control equipment, electrical equipment and telemetry equipment shall be enclosed in a building. Buildings shall be masonry block (light tan color) with concrete floor and foundation. The building must comply with the applicable requirements of the most current adopted edition of the IBC. The building shall be equipped with chemical resistant fiberglass or Public Works approved coated steel doors with deadbolts keyed to Public Works specifications. The roof shall be brown in color, constructed of wood with 236 lb., Class A Fire Rated, 25-year fiberglass shingles. All wood trim shall be painted dark brown.

Where vertical turbine pumps are located within a pump building, adequate provisions shall be made for removal and replacement of the motor, column and pump. These provisions shall include locating the pump within four (4) feet of the wall with a minimum four foot by four foot (4' x 4') roof hatch for removal of the assembly or providing removable roof and/or wall sections.

Suitable ventilation shall be required. Where pumps are located within the building, the ventilation equipment shall be suitable to provide five (5) volume changes of room air per hour.

Fans shall be thermostatically controlled and maintain indoor air temperatures below 85 degrees Fahrenheit. Fans and louvers shall be provided with winter covers.

The building shall be provided with suitable heaters to keep the interior air temperature above 45 degrees Fahrenheit.

Floor drains shall be provided. The building floor shall slope to the drains and fall at a minimum slope of 2 percent. Slotted trench drains are permitted.

A zone change to a public facility zone may be required if the parcel is not zoned for public use. The building site shall be landscaped and provided with an irrigation system with automatic controls. The irrigation system shall have backflow prevention and shall have automatic drains to prevent freezing.

All well pumping facilities shall be fenced with six- (6) foot high fabric with 2-inch mesh, 9-gauge zinc coated wire, wood or fiberglass slatted, and topped with three (3) strands of barbed wire. Access shall be through a sixteen (16) foot wide double gate. The site access, size and layout shall provide adequate room for maintenance of the facility, including removal and reinstallation of well pumps. Ample room is required for pump pulling equipment and a stem trailer.

The site shall provide for proper access and allow for adequate site drainage.

Permits that are required for the construction of a pumping facility building shall be put in the name of the City of Fernley.

6.9. STAND-BY GENERATOR

All pumping facilities shall be provided with a stand-by engine generator and shall be provided with automatic starting and load transfer equipment (automatic transfer switch) to operate the entire pumping load during power failure unless the pumps have a v-drive backup motor with an alternative fuel source. The generator shall have a seamless transfer of power during shutdown, when commercial power is re-applied to pump motor. The generator shall be located in a weather-protective, sound-proofed, lockable housing with access to all engine and generator components for servicing and maintenance. The generator shall be fueled by diesel with an above-ground storage tank and concrete pad for secondary containment, or by natural gas as approved by Public Works. The storage tank shall have a capacity to provide 24-hour continuous run time. The generator and engine block shall be equipped with a block heater and thermostat that will allow for instantaneous start-up at -10 degrees Fahrenheit. The engine shall be protected with shutdown safeguards, gauges and indicator lamps for over-temperature, low oil pressure, over-speed and over-crank. The engine shall be equipped with an automatic battery trickle-charger, installed on the hot side of the transfer switch enabling the battery to maintain a charge when idle. The machine will include vibration isolators. All power generation units shall be sized and designed by an electrical engineer licensed in the State of Nevada.

6.10 START-UP AND OPERATION

Prior to approval or acceptance by Public Works, the developer or owner shall commission all systems including pumps, controls, and equipment to verify performance, function, and correct operation by performing procedures to activate, startup, adjust, test, and demonstrate the system in operating order in accordance with the approved plans and specifications. To insure that the work is ready for full-time operation, the developer shall include procedures for the verification, balancing, calibration, witness testing, documentation, and inspection by equipment manufacturers. Training of Public Works operators shall also be provided.

The developer shall include the following items in the start-up activities, and other items that are necessary to operate and maintain the system:

1. Perform initial lubrication of equipment and have manufacturers check and adjust equipment. Provide maintenance, lubrication and personnel as required for test operation until Public Works accepts the project.
2. Perform testing of electrical work prior to energizing electrical systems.
3. Calibrate all instruments.
4. Test-operate all equipment.
5. Public Works shall be notified in writing 10 days before complete facility operation is to occur. Under the supervision of Public Works, the developer shall start-up and operate the facility on a complete full time basis beginning on the acceptance date. At no time during this initial operation shall the developer operate any Public infrastructure without Public Works approval. The developer shall provide the Engineer-of-Record, a mechanic, electrician, instrument engineer, representatives of manufacturers of equipment, and other personnel to adjust, repair, and correct deficiencies as required to keep the facilities in continuous operation for a period of 10 days. The developer shall also furnish all mechanical and electrical personnel as required to make adjustments to and perform all required maintenance for the operating equipment until the end of the 10-day initial operation period. Maintenance of equipment shall include lubrication, adjustments, replacements, and modifications as required.
6. Following completion and approval of the 10-day initial operation period, Public Works will take over operation and maintenance duties. If continuous operation is interrupted for a period of four consecutive hours or more due to a failure of equipment or work, the 10-day initial operation period shall be restarted at day one. At the end of one year from the date of acceptance, another test will be performed by Public Works to verify efficiency and operating condition of all pertinent facilities. Any deficiencies as evidenced by the test will be corrected by the developer under warranty.
7. Submit documentation of test reports and calibration results to Public Works during the 10-day initial start-up period within 10 days of completion.
8. Prior to the 10-day initial start-up period, the developer shall submit to Public Works affidavits from the manufacturers stating that the equipment has been properly installed, tested, and adjusted. The affidavit shall contain the following wording:
“The (Name of Equipment) has been properly installed, tested, adjusted, lubricated, and calibrated, and is ready for full time operation. The installation has been inspected and been found to be in accordance with our (the manufacturer’s) standards and requirements.”
9. The developer shall provide training to Public Works operators which shall include a demonstration of the operation, maintenance, and safety procedures for all facilities. Training of Public Works operators shall be performed separate from facility start-up and commissioning.

In the event that the facility does not meet the approved plans and specifications, the owner/developer will come up with a design to meet the original approved plans and specifications. Public Works will not submit a design by review. The costs of any additional designs, equipment and implementation will be paid by the developer.

6.11 OPERATIONS AND MAINTENANCE MANUAL

Four (4) copies of an operations and maintenance manual shall be submitted to Public Works upon completion of construction and prior to acceptance of facilities or improvements, pump stations, and distribution mains. The operations and maintenance manual shall contain the following as a minimum:

- 1) Listing of emergency telephone numbers for Public Works

- 2) Priority calling list
- 3) List of abbreviations
- 4) General narrative of the facility
 - a) Introduction
 - b) Objectives of the facility
 - c) Facility design criteria
- 5) Operating instructions
 - a) Facility description
 - b) Emergency operation (discussion of potential facility failures and procedures for responding to emergency operations)
- 6) Operating records
- 7) Monitoring and treatment processes
- 8) Stand-by power operations
- 9) Maintenance instructions
 - a) General instructions
 - b) Maintenance records
 - c) Maintenance of motors and drives
 - d) Maintenance of pumps
 - e) Maintenance of treatment/process equipment
 - f) Maintenance of valves
 - g) Maintenance of instrumentation and meters
 - h) Maintenance of stand-by power
 - i) Maintenance of pressure reducing stations (if applicable)
- 10) Facility safety
 - a) General
 - b) Confined spaces
 - c) Electrical safety
 - d) Explosion hazards
 - e) Process facilities
 - f) Pump rooms
 - g) Collecting samples
 - h) Equipment set-up and performance tests
 - i) General safety considerations
- 11) Appendices and required
 - a) Permits
 - b) Figures and drawings

7.0 - WATER STORAGE TANKS

7.1. GENERAL

Additional water storage facilities may be required by Public Works. Storage facilities shall be located regionally and sized for future subdivisions where possible to eliminate multiple smaller tanks.

A design review of the storage tank and building permit will be required. A zone change to a public facility zone may be required if the parcel is not zoned for public use.

All new or existing public water storage facilities shall be in compliance with applicable Bureau of Health Protection Services Standard set forth in NAC 445A, and AWWA D100.

7.2. DESIGN CRITERIA

The following are the minimum design criteria to be used for the design of water storage facilities.

- 1) Required storage capacity for existing water systems shall be determined by a Civil engineer on the basis of historic data, engineering judgment, and network hydraulic modeling, correlating total water system capacity with present and anticipated demands while maintaining minimum pressures as described in Section 4.1.1.
- 2) Required storage for new water systems shall consist of the following: Total Storage Required = Operating Storage + Emergency Reserve + Fire Storage Capacity.
For new development to the public water system, the operating storage shall be equal to 1,000 gallons per residential equivalent based on all services being metered.
The emergency reserve must be equal to 100 percent of an average day demand of the system.
Storage requirements for fire demand shall be calculated according to requirements of the Fire Authority. In no case shall the fire flow be less than 1000 gpm for 2 hours for a fire demand of 120,000 gallons.
- 3) Booster station capacity and the total storage requirement for each pressure zone within the distribution system shall meet the maximum day requirements of that particular pressure zone. Water storage may be provided in a higher pressure zone, if an appropriate pressure regulator is approved by Public Works for installation between the zones to serve the lower pressure area, and the requirements for the higher pressure zone are not compromised.
- 4) Storage tanks shall have an overflow, and the overflow shall be sized to pass the maximum possible inflow. Tank overflows shall incorporate weir boxes and be constructed outside the tank wall. The overflow outlet shall be screened or protected with a flap gate and shall have a minimum air gap of 18-inches. The drainage path of water being discharged from the overflow pipe shall be identified on the plans. The drainage channel shall be able to handle maximum possible inflow without damage to the channel or adjacent structures or property. Public Works may require that tank drainage shall be piped in certain circumstances. The drainage channel shall be within an easement dedicated to the City. The drainage channel shall be extended to an existing storm drainage facility or storm drain system. Infiltration trenches will not be allowed for disposal of overflow.
- 5) Storage tanks shall have a drain which shall be capable of completely draining the tank. The tank drain shall direct water to the overflow channel and shall be tied to the tank overflow. The route of the overflow shall be reviewed to determine that the overflow route has the capacity to transmit the maximum overflow amount.

7.3. MATERIALS

All water storage tanks shall be welded steel tanks in accordance with AWWA D100. Other types of water storage tanks may be considered by Public Works. Bolted tanks (other than for on-site fire storage) used tanks, API steel tanks, and wood tanks will not be allowed.

7.4. APPURTENANCES

All water storage tanks shall have the following appurtenances:

- 1) Shell Manholes (30-inch diameter minimum) - 2 each (approximately two feet above the base of the tank)
- 2) Overflow Structure with Weir Box and Pipe
- 3) Outside Ladder with cage
- 4) Inside Ladder
- 5) Outside Level Indicator
- 6) Safety Devices - ladder safety cage, rest platforms, handrails or other safety devices as required.
- 7) Ladder Locking Device - prevents unauthorized access to the outside ladder.
- 8) Roof Openings - at least one bug proof and lockable water tight hatch at the access point for the inside ladder.
- 9) Vents – one J-Vent at center of tank and sidewall vents
- 10) Appropriate water level sensing and telemetering equipment.
- 11) Bolted flange gate valve to isolate tank from distribution system.
- 12) Sample tap with insulated, locking cover.
- 13) Scada telemetry and T.V. monitoring for system surveillance
- 14) Altitude valve (as required).

Altitude valves may be required at a water storage tank for proper operation of tank filling. Altitude valves will be designed by a civil engineer for below-ground installation. Calculations shall be stamped and submitted to Public Works for review and approval prior to installation.

7.5. PAINTING

The tank shall be painted in accordance with AWWA D102. The interior paint shall be a three (3) coat epoxy system in accordance with AWWA D102 Coating Steel Water-Storage Tank System Designation ICS-2-W. The interior finish coat color shall be white. The exterior paint shall be a three coat epoxy and polyurethane painting system in accordance with AWWA D102 Coating Steel Water-Storage Tank System Designation OCS-5-S. The final outside color shall be Carlsbad Canyon gray-brown. Tank coating shall include proper surface preparation and application techniques per coating manufacturer's recommendations. De-humidification during application may be required.

Paints or other coatings shall conform to AWWA D102 Coating Steel Water-Storage Tanks and NSF International Standard 61. All internal coatings shall be certified for contact with potable water. Testing for this certification shall be conducted in accordance with NSF International Standard 61 or by a third party certifications laboratory accredited by ANSI.

7.6. SITE WORK

A geotechnical investigation and foundation design shall be prepared by a Nevada registered engineer for all tank sites. The tank site shall be graded for suitable soil stability and drainage. Tank foundation shall be situated completely on cut or native material unless approved by a

Nevada registered engineer and Public Works. There shall be access to all sides of the tank on a graveled (Type 2 Class B aggregate base) road, minimum of fifteen (15) feet wide, circling the tank. The site shall be fenced with six (6) foot high fabric with 2-inch mesh; 9-gauge zinc coated wire, and topped with three (3) strands of barbed wire. Access shall be through a sixteen (16) foot wide double gate. The fence shall be painted the same color as the tank and may need to be slatted per Public Work's request.

When Public Works requires landscaping, an irrigation system with automatic controls shall be installed. The irrigation system shall have backflow prevention and shall have automatic drains to prevent freezing.

7.7. TANK SUBMITTAL.

At least three (3) copies of the tank structural design, plans, geotechnical investigation and supporting calculations shall be submitted to the Engineer-of-Record for approval. The submittal shall be made at least 30 days before construction is scheduled to start. Construction shall not start on the tank prior to approval of the tank submittal by the Engineer-of-Record.

Steel tank bottoms shall have a minimum thickness of 5/16 of an inch. The electro-conductivity of the site soils shall be determined and adjusted with soil conditioner to provide a neutral pH environment under the tank.

All tank design plans, and calculations shall be stamped by a Nevada Licensed Professional engineer and submitted for approval to Public Works.

7.8. INSPECTION AND TESTING

All tanks shall be tested and inspected in accordance with AWWA D100 Standard for Welded Steel Tanks for Water Storage. All field welds shall be inspected by an independent testing agency using the radiographic method. The Engineer-of-Record shall submit a written report, including x-ray film, in accordance with AWWA D100 Standard for Welded Steel Tanks for Water Storage to Public Works. Vacuum testing and water testing of joints shall also be performed per AWWA specifications.

Upon completion of all construction work and tank coatings, and in conjunction with the disinfection procedure, the tank shall be completely filled with water and allowed to sit for a period of 72 hours and show no leakage. Water level measurements shall be taken at the start of the leakage testing and every 24 hours thereafter until complete. The water level in the tank shall not drop by more than 0.05 feet in the 72 hour test period.

The tank shall remain off-line for a period of 6 days prior to extracting a sample for bacterial and VOC levels. Pending satisfactory results provided to Public Works, the tank may then be placed into service.

The developer shall warranty the completed work against repairs, leaks or damage for a period of one year from the acceptance of the work by Public Works. Eleven months after acceptance of the work by Public Works, the developer shall have the interior and exterior of the tank inspected by an independent testing agency and provide a written report to Public Works. Damage, leaks, or other deficiencies noted during the inspection shall be corrected by the developer within the warranty period.

The Engineer-of-Record shall be responsible for all inspections.

7.9. DISINFECTION AND VOLATILE ORGANIC COMPOUND SAMPLING AND TESTING

All tanks shall be disinfected and tested in accordance with AWWA C652 Standard for Disinfection of Water-Storage Facilities and the applicable State Health standards. After disinfection, prior to acceptance by Public Works, and prior to placing the tank into service,

water from the facility shall be tested for coliform and volatile organic compounds by an independent testing agency. The test procedures and test results shall comply with the requirements of the Nevada Division of Health Bureau of Health Protection Services and other appropriate regulatory agencies. Written test results shall be submitted to Public Works a minimum of two working days before placing the tank into service.

7.10 CONTROLS AND ALARMS

Control systems, including telemetry, shall be above ground in suitable lockable housings, or inside buildings. Telemetry shall be provided for all controls and alarms. All telemetry units shall communicate status with the Public Works main monitoring station. At a minimum, the following alarms and signals shall be provided:

1. High Level Alarm
2. Low Level Alarm
3. Radio Failure Alarm
4. Power Failure Alarm
5. Intrusion alarms