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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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.


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
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 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.

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• 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**

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

Note: On local and residential collector streets (less than 4000 ADT), lesser radii may be 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

<table>
<thead>
<tr>
<th>Design Speed V (Mph)</th>
<th>F (friction factor)</th>
<th>Low Speed Urban Street Design</th>
<th>High Speed Urban Street Design</th>
<th>Minimum Stopping Sight Distance (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20(^{(1)})*</td>
<td>0.3</td>
<td></td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>25(^{(2)})*</td>
<td>0.25</td>
<td></td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>30</td>
<td>0.22</td>
<td>0.16</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>0.15</td>
<td></td>
<td>325</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>0.14</td>
<td></td>
<td>475</td>
</tr>
</tbody>
</table>

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

\[
R_{\text{min}} = \frac{V^2}{15 (e+f)}
\]

where, \(R_{\text{min}}\) – Centerline Radius of roadway.

\(V\) – Design Speed

\(e\) – 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.

\(^{\text{(1)}}\)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.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Downtown</th>
<th>Outside Downtown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major arterial</td>
<td>1/3 mile (1,760')</td>
<td>½ mile (2,640')</td>
</tr>
<tr>
<td>Minor arterial</td>
<td>1/4 mile (1,320')</td>
<td>1/3 mile (1,760')</td>
</tr>
<tr>
<td>Commercial collector</td>
<td>600 feet</td>
<td>800 feet</td>
</tr>
<tr>
<td>Residential collector/</td>
<td>400 feet</td>
<td>400 feet</td>
</tr>
<tr>
<td>local</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>200 feet</td>
<td>200 feet</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>TYPE</th>
<th>FIRE SPRINKLERS</th>
<th>WIDTH (1) FEET</th>
<th>CURB REQ'D</th>
<th>BULB DIAMETER (FEET)</th>
<th>MAX CUL-DE-SAC LENGTH (FEET)</th>
<th>MAX LOTS SERVED</th>
<th>MAX ADT</th>
<th>BIKE LANE</th>
<th>SIDEWALK BOTH SIDES (FEET)</th>
<th>RIGHT-OF-WAY WIDTH (5) FEET</th>
<th>PUE EACH SIDE (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared Driveway, Alleys and permanent Emergency Access</td>
<td>Yes</td>
<td>18</td>
<td>26</td>
<td>34</td>
<td>Optional</td>
<td>1000</td>
<td>Hammer-head or 86</td>
<td>102</td>
<td>12</td>
<td>N/A</td>
<td>No</td>
</tr>
<tr>
<td>Shared Driveway, Alleys and Permanent Emergency Access</td>
<td>No</td>
<td>20</td>
<td>28</td>
<td>36</td>
<td>Optional</td>
<td>600</td>
<td>Hammer-head or 86</td>
<td>102</td>
<td>8</td>
<td>N/A</td>
<td>No</td>
</tr>
<tr>
<td>Local Street</td>
<td>Yes</td>
<td>N/A</td>
<td>26</td>
<td>34</td>
<td>L</td>
<td>1000</td>
<td>Hammer-head or 86</td>
<td>102</td>
<td>100</td>
<td>1000</td>
<td>No</td>
</tr>
<tr>
<td>Local Street</td>
<td>No</td>
<td>N/A</td>
<td>28</td>
<td>36</td>
<td>L</td>
<td>400</td>
<td>Hammer-head or 86</td>
<td>102</td>
<td>100</td>
<td>1000</td>
<td>No</td>
</tr>
<tr>
<td>Collector St.</td>
<td>N/A</td>
<td>28</td>
<td>35</td>
<td>43</td>
<td>L</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>8000 (2)</td>
<td>Option (7)</td>
</tr>
</tbody>
</table>

### With Parkway Strips

<table>
<thead>
<tr>
<th>TYPE</th>
<th>FIRE SPRINKLERS</th>
<th>WIDTH (1) FEET</th>
<th>CURB REQ'D</th>
<th>BULB DIAMETER (FEET)</th>
<th>MAX CUL-DE-SAC LENGTH (FEET)</th>
<th>MAX LOTS SERVED</th>
<th>MAX ADT</th>
<th>BIKE LANE</th>
<th>SIDEWALK BOTH SIDES (FEET)</th>
<th>RIGHT-OF-WAY WIDTH (5) FEET</th>
<th>PUE EACH SIDE (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Yes</td>
<td>N/A</td>
<td>26</td>
<td>34</td>
<td>L</td>
<td>1000</td>
<td>86</td>
<td>102</td>
<td>100</td>
<td>1000</td>
<td>No</td>
</tr>
<tr>
<td>Local</td>
<td>No</td>
<td>N/A</td>
<td>28</td>
<td>36</td>
<td>L</td>
<td>400</td>
<td>102</td>
<td>102</td>
<td>100</td>
<td>1000</td>
<td>No</td>
</tr>
<tr>
<td>Collector</td>
<td>N/A</td>
<td>28</td>
<td>35</td>
<td>43</td>
<td>L</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>8000 (2)</td>
<td>Option (7)</td>
</tr>
</tbody>
</table>

(1) All widths measured from front face of curb to front face of curb (EOP to EOP when no curb is present).
(2) 4000 maximum ADT with lots having access.
(3) Public Works stubs and services must extend beyond right-of-way, sidewalk, or PUE, whichever is greater.
(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).

(7) Bike lanes require additional 5' of pavement and right-of-way per lane.
(8) Deviations from above standards for addition of medians or wider planting strips in commercial areas shall require prior approval of the City Engineer.
(9) ADA requires a passing space at intervals not to exceed 200' or sidewalk must be 5' wide.
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 permitee 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.
   b) Pass-by Trip Reductions.
      i. Must be approved on a case-by-case basis for traffic studies.
   c) Level-of-Service Analysis.
      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).
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 \( D_{50} \) 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.

<table>
<thead>
<tr>
<th>#1 Vertical Displacement</th>
<th>Vertical Displacement. 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 &amp; gutter or not. However, curb &amp; gutter will be evaluated with regard to storm drain capabilities.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side View</td>
<td>h=height</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#2 Horizontal Displacement</th>
<th>Horizontal Displacement. 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). Note: Also included are longitudinal cracks that appear to impede the function of the gutter pan.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side View</td>
<td>w=width</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#3 Holes</th>
<th>Holes. 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. (Patching as an alternative may be allowed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side View</td>
<td>d=diameter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#4 Missing Portions</th>
<th>Missing Portions. A missing portion of sidewalk, curb &amp; 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. Note: Missing portion should be one-half inch in depth or greater.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird’s-Eye View</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#5 Spalling</th>
<th>Spalling. Spalling (missing surface fragments) over 50% of the surface of a sidewalk or curb &amp; gutter. Curb &amp; 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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird’s-Eye View</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#6 Cracking</th>
<th>Cracking. Cracking over 50% of the surface of a sidewalk or curb &amp; gutter section. Note: Spider web cracks or surface cracks that have not opened are not included.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird’s-Eye View</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#7 Sloping</th>
<th>Sloping. Sloping is an abrupt change in the slope of the sidewalk or curb &amp; gutter of one-half inch per foot or more.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side View</td>
<td>l=length</td>
</tr>
<tr>
<td></td>
<td>h=height</td>
</tr>
<tr>
<td></td>
<td>slope=height/length</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#8 Protrusions</th>
<th>Protrusions. 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.</th>
</tr>
</thead>
</table>

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.

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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 that 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 backflow 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

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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
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
8.0 - SANITARY SEWER SYSTEM

8.1. DESIGN CRITERIA
The following design criteria shall govern the design of sewage collection systems to be dedicated to the City. The intent of these criteria is to provide safe, adequate and dependable sewage service without excessive maintenance costs. All design shall comply with the latest edition of NRS and NAC regulations.

- **Flow Determination** - The average flow from residential unit shall be based on an average daily residential rate of 345 gallons and an hourly peak factor of 3.0. All 8” sanitary sewer lines shall use a daily sewage rate of 345 gallons per day (gpd) and an hourly peak factor of 3.0. All 10” sanitary sewer lines and larger shall use a daily sewage rate of 250 gallons per day (gpd) and an hourly peak factor of 3.0. For calculations of all commercial/industrial accounts, the applicant must provide Public Works with expected usage volume information certified by a registered civil engineer in the State of Nevada with an approved, stamped set of drawings.

- **Pipe Size** - The minimum size of collector sewers shall be 8-inches. Service laterals, which serve single residences, shall be a minimum of 4-inches in diameter. All other lines shall be sized using accepted hydraulic analysis techniques. Such sizing analysis shall be performed using peak hour flows.

- **Pipe Slope** - The minimum pipe slope is the slope at which the cleaning velocity is at least 2.0 feet per second when flowing half full. In general, slopes which permit sewage velocities in excess of 10 feet per second will not be permitted. Minimum pipe slopes tabulated by pipe size are provided in the Recommended Standards for Wastewater Facilities (latest edition).

- **Depth of Flow** - The depth of flow in the sanitary sewer pipes shall not exceed 0.75D where D is the nominal diameter of the pipe.

- **Capacity** - When sizing a sewage collection system for a given area, the system shall be sized so that it will adequately carry the design flow from the entire tributary area, even though it is not within the project boundaries. Capacity and velocity calculations shall be submitted.

8.2. SANITARY SEWER REPORT
All developments of land shall submit for approval, unless waived by Public Works, a sanitary sewer report signed and stamped by a Nevada Registered Civil Engineer in accordance with Public Works standards. The sanitary sewer report shall be submitted with the, or prior to the submittal of, improvement plans. The following criteria shall be considered for a Sanitary Sewer Report.

8.2.1 TITLE PAGE
- a) Project Name.
- b) Preparer’s name, firm, date.
- c) Professional engineer’s seal of preparer and signature.

8.2.2 INTRODUCTION
- a) Site location.
- b) Proposed project description.
8.2.3 SEWER SYSTEMS
   a) Design parameters utilized and assumptions made.
   b) Existing sewer system.
   c) Proposed sewer system.
      i. Sewer line layout (w/ pipe sizes, slopes, material types, etc.).
         a. Direction of flow.
         b. Cumulative flows.
         c. Public vs. private piping.
      ii. Existing sewer system upgrades required.
      iii. Non-domestic waste (if applicable).
         a. Industrial process waste.
         b. Product cooling waters.
         c. Pretreatment techniques and equipment.
         d. Industrial pre-treatment permit.
      iv. National Pollutant Discharge Elimination System Permit NPDES (if applicable).
      v. Additional information used for flow determination.
         a. Hospitals, schools, large office buildings, etc.

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

8.2.5 APPENDICES
   a) Calculations.
      i. Flow and velocity calculations.
      ii. Predicted average and peak flows.
      iii. Design Calculations.
   b) Visual Aids.
      i. Plans.
      ii. Maps.
      iii. Drawings.

8.3. DEPTH
All collection systems shall be designed at a depth to comply with the following requirements:
   a) Lateral and side sewer installations with a minimum of three (3) feet of cover at the curb (if appropriate) and/or property line (when curb is absent), and with a slope of 2% to the back 1/3 of each parcel. The invert elevation at the property line shall be shown on the plans. Where 3 feet of cover cannot be maintained cement-mortar lined ductile iron pipe may be used for laterals.
   b) Avoid conflict with existing and proposed utilities.
   c) Clearances between all utilities shall be in accordance with the Public Works Standard Detail Sheets and NAC445A.67155.
d) Provide a minimum of 42 inches of cover over all collector sewers to be dedicated to the City.

e) Buoyancy of sewers shall be considered, and flotation of the pipe shall be prevented with appropriate design and construction where high groundwater conditions are anticipated.

8.4. PIPE SIZE AND MATERIAL

Collector sewers, mains, interceptors, and laterals shall be sized using accepted hydraulic analysis techniques for design peak hourly flows, but in no case shall be less than 8 inches in diameter for collector sewers, mains, interceptors, and 4 inches in diameter for laterals which serve a single family residence.

The following material types are acceptable for gravity sewer mains, force mains and laterals:

a) PVC Pipe shall be solid wall polyvinyl chloride plastic pipe, SDR 35, in accordance with ASTM D3034, for all gravity pipe except where minimum clearances not maintained.

b) Force mains shall be cement-lined Ductile Iron Pipe in accordance with AWWA C150 and C151, or C900 pressure-rated PVC. If Class 150 PVC pipe is used, it shall be green in color.

Pipe shall be designed for the internal and external loads that will be applied. The Marston’s formula, as outlined in ASCE Manual of Engineering Practice No. 60 “Gravity Sanitary Sewer Design and Construction”, shall be used to determine the load placed on the pipe by the backfill. For flexible conduits the maximum load allowable shall be determined by pipe deflections computed by the Iowa Deflection Formula (Or Spangler’s Formula). Flexible conduits shall be designed not to exceed a maximum deflection of five (5) percent of the nominal pipe diameter under the installation conditions. The five (5) percent deflection shall not be exceeded at thirty (30) days after completion of backfill.

No change in pipe material will be allowed between manholes.

8.5. PIPE SLOPE

Pipe slope shall not be less than the slope at which the flow velocity is at least 2 feet per second when flowing half full using a Manning “n” of 0.012. All pipes flowing less than half full shall be designed to achieve a minimum velocity of 1.8 feet per second but in no case shall slopes be less than those shown in Table 8.1. Sewer pipe slopes which permit sewage velocities in excess of 10 feet per second are not allowed. Sewers shall have a continuous, minimum, positive slope between manholes.

Dead end sewers shall end in a manhole. Dry sewers which will be extended at a future date and installed with a manhole shall be surveyed for line and grade by a Nevada licensed professional engineer or land surveyor prior to backfill. Refer to Section 8.9, Manholes, for requirements for installation of a stub for dry sewers. The Engineer-of-Record shall place a note in a prominent location on each plan/profile sheet indicating the as-built requirement.

Oversized sewers may be approved by Public Works to allow the use of flatter slopes. If the proposed slope is less than the minimum slope of the smallest pipe which can accommodate the design peak hourly flow at a depth of 0.75D, the actual depths and velocities at design average flow, design maximum day flow, and design peak hourly flow for each design section of the sewer shall be calculated by the Engineer-of-Record and be included with the sewer report and main analysis.
Table 8.1
Minimum Slopes for Sewer Pipe.

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Number of Equivalent Dwelling Units Served</th>
<th>Minimum Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot; (1), (3)</td>
<td>10 or less</td>
<td>1.00%</td>
</tr>
<tr>
<td>8&quot; (2), (3)</td>
<td>11-20</td>
<td>.60%</td>
</tr>
<tr>
<td>8&quot; (2)</td>
<td>Above 20</td>
<td>.40%</td>
</tr>
<tr>
<td>10&quot;</td>
<td></td>
<td>.30%</td>
</tr>
<tr>
<td>12&quot;</td>
<td></td>
<td>.22%</td>
</tr>
<tr>
<td>15&quot;</td>
<td></td>
<td>.15%</td>
</tr>
<tr>
<td>18&quot; and larger</td>
<td></td>
<td>2 fps @ 1/2 full</td>
</tr>
</tbody>
</table>

Deviations from this table shall be applied for as a variance and special provisions may be required by Public Works.

Notes:
(1) When 10 or less EDU’s are served, such as a blind cul-de-sac or other location where no extension of the sewer is possible, Public Works may allow a 6-inch pipe with a minimum slope of 1.00%.
(2) When 8 inch pipe cannot be laid at the required minimum slope, an engineered system may be allowed where calculations demonstrate the ability of the system to meet a flow velocity of at least 1.5 fps. Engineered systems will be allowed only with prior written approval from Public Works taking into consideration the calculations submitted and signed by a Nevada licensed professional engineer and the alternatives presented including, but not limited to, the availability to increase the slope of the pipe, the length of the sewer line, the location of the sewer line, the feasibility and accessibility for maintenance and cleaning of the sewer line and other criteria which would be of impact on the City or sewer purveyor once the sewer line has been constructed and accepted.
(3) Minimum pipe slope for dead end sewers, whether temporary or permanent, shall be five tenths (0.5%) of a percent unless it can be shown by calculations that the velocity in the pipe is 2 feet per second or greater.

8.6. STEEP SLOPE PROTECTION
Sewers designed at 20 percent slopes or greater shall be anchored securely with concrete, or equal, anchors spaced as follows:
1. Not over 36 feet center to center on grades 20 percent and up to 35 percent;
2. Not over 24 feet center to center on grades 35 percent and up to 50 percent; and
3. Not over 16 feet center to center on grades 50 percent and over.

8.7. PIPELINE BEDDING
Graded bedding shall comply with the requirements of Table 8.2 for dry trenches (no free standing water), and Table 8.3 for wet trenches (free-standing water).
Dry trenches shall have a minimum of four inches of bedding material, and wet trenches shall have a minimum of six inches of bedding material under the pipe. In wet trenches, low permeability cutoff walls shall be constructed to prevent the piping of water in the bedding material, and the native soil conditions shall be evaluated to determine if a filter fabric wrap of the bedding material is needed to prevent migration of native soils into the bedding material. The design of the cutoff walls shall be submitted to Public Works with the improvement plans.
Each lift shall be compacted by an approved method. Bedding material shall be used for collector sewers, mains, interceptor sewers, and laterals. Typical trench sections shall be as shown in the Standards Details.

Table 8.2
Bedding Material for Dry Trenches Only

<table>
<thead>
<tr>
<th>U.S. Standard Sieve Size</th>
<th>Percent by Weight Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2”</td>
<td>100%</td>
</tr>
<tr>
<td>No. 4</td>
<td>90-100%</td>
</tr>
<tr>
<td>No. 16</td>
<td>30-75%</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10%</td>
</tr>
</tbody>
</table>

Table 8.3
Bedding Material for Wet or Dry Trenches

<table>
<thead>
<tr>
<th>U.S. Standard Sieve Size</th>
<th>Percent by Weight Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2”</td>
<td>100%</td>
</tr>
<tr>
<td>1”</td>
<td>50-90%</td>
</tr>
<tr>
<td>3/4”</td>
<td>30-70%</td>
</tr>
<tr>
<td>3/8”</td>
<td>10-40%</td>
</tr>
<tr>
<td>No. 4</td>
<td>5-25%</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10%</td>
</tr>
</tbody>
</table>

Public Works may consider modifications from the specified bedding gradations if requested prior to construction. The review of proposed modifications to the bedding gradations will take into account the proposed bedding gradation and the conditions and gradation of the surrounding natural soils. Modifications, if approved by Public Works, will not relieve the developer or contractor from the responsibility of providing and guaranteeing a proper installation per the revised plans.

8.8. LOCATION AND ALIGNMENT

All sanitary sewers shall be placed within rights-of-way dedicated for public streets unless the use of easements is specifically approved by Public Works. Unless waived by Public Works, there shall be a minimum horizontal clearance between parallel water and sanitary sewer lines of ten (10) feet pursuant with NAC 445A. Where water lines are at least 18 inches above or below the sewer line, the minimum horizontal separations must be six (6) feet, per the Public Works Standard Detail Sheets. Location of sewer lines in public rights of way shall conform to “Typical Public Works Main Locations” in the Standard Details for Public Works Construction.

When sanitary sewers are to be installed in existing streets, factors such as curbs, gutters, drainage ditches, sidewalks, traffic conditions, pavement conditions, future street improvement plans, and existing utilities, shall be considered.

The minimum width of permanent utility easements shall be ten (10) feet. Factors such as side slopes and structures within the easement may require additional width. All easements shall be dedicated to the City.

Horizontal alignment shall be parallel to the street centerline wherever possible. Curved sanitary sewers will be permitted on a case-by-case basis. Minimum radius for curved sewers shall be based on PVC manufacturer's recommendations. A larger radius shall be used wherever practical.
or where necessary to avoid joint deflection in excess of the pipe manufacturer’s recommended maximum.

There shall be a constant slope between manholes. The use of vertical curves will be allowed only when approved by Public Works. Drop manholes are preferred to vertical curves and require approval from Public Works. In such cases, elevations shall be shown at ten-foot intervals throughout the length of the vertical curve. The maximum deflection shall be two percent at each joint. Inverted siphons are not allowed.

Where curved sewers are used, the plans shall have a note specifying TV inspection of the sewer from manhole to manhole of any reach containing curved sewers. The note shall specify that prior to acceptance by Public Works, the contractor shall perform a TV inspection of the curved sewer.

8.9. MANHOLES

Manholes shall be placed at the intersections of all sanitary sewer lines; all angle points and grade changes in straight line sewers. Cleanouts or manholes, in accordance with the Public Works Standard Detail Sheets, are required at the terminal end of all collector lines. Maximum spacing of manholes shall be 400 feet for all straight lines of 12-inch diameter or less and 500 feet for straight lines greater than 12-inch diameter. A line with a radius greater than 400 feet shall be considered as straight for the purposes of this section. Manhole spacing shall be 200 feet on lines that are on a continuous curve of 400-foot radius. Manhole spacing on curved lines of radius between 200 and 400 feet, or where only a portion of the line is curved, shall be adjusted proportionately. Reverse curves require a manhole at the point of the reverse curve. Manholes are also required at the tangent points for curves with a radius less than 400 feet.

The invert elevation at the exit of the manhole must be at least 0.10 foot below the invert elevation of the entrance pipe into the manhole. For two intersecting pipes of different diameters, the crown elevations of each of the two pipes shall match where they enter the manhole.

All manholes sections shall be constructed of precast reinforced concrete conforming to ASTM Designation C478. All joints between precast sections shall use two applications of Con Seal, Ramnek, or other approved jointing compound with a primer as recommended by the manufacturer. All manholes shall be watertight. All manholes shall be vacuum-tested pursuant with the standard detail and ASTM C1244. When groundwater is encountered during installation of newly constructed sanitary sewer manholes, or when manhole bases are poured-in-place, hydrostatic testing may be required. Hydrostatic testing shall consist of filling the manhole with water and adding water to account for absorption. The amount of water reduction measured over one hour shall not exceed six (6) inches. Manhole connections shall be watertight. A watertight seal shall utilize a flexible elastomeric gasket material capable of accommodating the differential expansion and contraction between the sewer pipe and concrete manhole. All pipe stubs or fittings shall have approved elastomeric seals conforming to ASTM F-477 or ASTM C923. Approval by Public Works of alternate methods shall not relieve the contractor of the responsibility to provide water tight connections.

All bases shall be precast. Poured-in-Place bases shall be allowed only with the approval of Public Works. Precast bases shall have reinforced concrete manhole sections with connection port elastomeric seals precast into the manhole base. Inverts shall be formed directly in the concrete of the manhole base and shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer sections. At the top of the pipe elevations, the manhole bottoms shall retain a slope of 6:1. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer and entering branches shall have a true curve radius as large as the manhole will permit. Manholes shall have a minimum interior diameter of four feet (4’). Larger manholes may be required for pipe in excess of fifteen inches (15”) diameter. Manholes with an angle between the entering sewer main and the exiting sewer main less than 75 degrees shall have a minimum interior diameter of five feet (5’) and maintain two-
tenths of a foot of fall. Pipe invert channels shall extend completely to the manhole interior faces.

Excavation for manholes shall be made to a vertical plane at least one foot (1’) outside of the manhole walls to provide proper work space. Asphalt concrete pavement, Portland cement concrete driveways, valley gutter or curb and gutters shall be saw cut to a rectangular shape with minimum dimensions of two feet greater than the outside dimension of the manhole to be installed. Bedding under the manhole base shall be 12-inches of 3/4-inch drain rock.

A twenty-four inch (24”) diameter clear opening cast iron frame and cover which is manufactured from gray cast iron conforming to ASTM Specification No. A-48 Class 30, and designed for a minimum HS-20 traffic loading shall be used. The frame and cover shall have matching machined seating surfaces, one (1) pick hole and one (1) centrally located one-inch (1”) dig hole, and shall have no “through” holes. Frames and covers shall be self-sealing with a continuous pre-installed gasket to prevent surface inflow. All manholes shall be identified as “Sanitary Sewer” clearly displayed on the cover. No more than twelve (12) inches of grade rings will be allowed between the frame and cone.

A minimum 6-inch thick concrete collar shall be installed around the frame and cover and shall be a minimum of five feet in diameter. Collars shall not protrude more than 0.02 feet above manhole covers. All concrete shall conform to the requirements for freeze-thaw environments in accordance with the “Standard Specifications for Public Works Construction.”

Manholes five (5) feet deep or greater shall be an eccentric cone Type I-A as shown in Public Works Standard Detail Sheets with the vertical wall on the inflow side. Water-tight sealing manhole covers shall be used on manholes located in areas subject to flooding as required by Public Works. The frames on all manholes located in unimproved areas shall be set between twelve (12) and eighteen (18) inches above finished grade. All manholes five (5) feet deep or greater shall have steps installed on the inflow side of the manhole. The manhole steps shall be rust resistant and equal to those provided by MA Industries. Manholes less than five (5) feet deep may be Type I as shown in the Public Works Standard Detail sheets and do not have step or orientation requirements.

Drop manholes shall be Type III Manholes as shown in the Public Works Standard Detail Sheets. A drop manhole shall be used if the difference in elevation between the outlet invert and the highest inlet invert is twenty-four (24) inches or greater.

8.10 LATERALS

Laterals shall conform to Public Works Standard Details. As a minimum, the lateral shall extend from the sewer main or collector to the edge of public right-of-way or easement and at least five (5) feet beyond the edge of any pavement. A plan and profile of any lateral shall be supplied to Public Works upon request. The laterals shall be designed and installed at a minimum slope of 2%. All service laterals must have a locating wire or equally effective means of marking the location of each nonconductive underground facility, from the customer’s property line clean out to the main, within the public right-of-way.

Residential lateral size is four (4) inches. Six (6) inch or larger service sewers shall serve schools, commercial establishments and other developments expected to contribute high sewer flows. In addition, the service sewer shall be sized according to requirements of the most current adopted edition of the International Plumbing Code (IPC) and determinations by Public Works. All service laterals larger than six (6) inches require a manhole at the main unless waived by Public Works. Long private services will require additional cleanouts every 100 feet. The standard depth of the lateral at the property line is three (3) feet. The Engineer-of-Record shall verify the adequacy of the standard lateral depth to serve the intended parcel. Whenever greater depth is required, the Engineer-of-Record shall designate the invert elevation of the lateral at the property line.
If the service has less than three (3) feet of cover measured from the gutter flow line, or drainage ditch invert, Ductile Iron pipe or other high strength pipe approved by Public Works shall be used. In all other cases, the service shall be SDR 35 PVC pipe or approved equivalent. All ductile iron pipe and fittings shall be cement-mortar lined in accordance with AWWA C104. The buried exterior of DI shall be wrapped with 8 mil polyethylene film and sealed in accordance with AWWA C105.

When sanitary sewers are constructed as part of subdivision improvements, a lateral shall be constructed to each lot. For lots with greater than a two (2) percent cross slope the sewer lateral shall be installed on the low side. Otherwise the lateral shall be located at the center of the lot. If the property is located such that service is available from both a collector line located in an easement and a collector line located in a right-of-way, the lateral shall be placed in the latter location unless otherwise approved by Public Works. No service sewer shall be located such that future onsite construction will result in the line being in such proximity to a water well, water main or service that applicable health standards will be violated.

Clean outs shall be provided in locations and at a spacing as required by the most current adopted edition of the International Plumbing Code (IPC). All residential, commercial and industrial services are required to provide a sewer clean-out within 12 inches of the property, on the right-of-way side of the property line. In addition to a clean out, a sewer lateral observation tee shall be installed at the property line for all commercial or industrial services. Clean outs within the right-of-way, or which otherwise may be subjected to traffic shall include a box and cover rated for HS-20 traffic loading.

8.11 INTERCEPTORS, AND SEPARATORS
Interceptors, (including grease, oil, and sand separators, etc.) shall be provided when, in the judgment of Public Works, they are necessary for the proper handling of liquid wastes containing grease, flammable wastes, sand, solids, acid or alkaline substances, or other ingredients harmful to the building drainage system, the public or private sewers or to public or private sewage disposal. The size, type and location of these units shall be in accordance with Chapter 10 of the most current adopted edition of the International Plumbing Code and constructed in accordance with the Public Works Standard Details.

8.12 SEWER BACKWATER VALVES
Approved sewer backwater valves shall be installed per the most current adopted edition of the IPC and are the sole responsibility of the property owner. They should be installed in a lateral when the flood level rim in the house is below the elevation of the next upstream Public Works sewer manhole cover. The backwater valves shall be located where they will be accessible for inspection and repair by the owner at all times. The plans shall clearly delineate the valves and include a disclaimer regarding Public Works’ responsibility for maintenance and repair.

8.13 STREAM AND DITCH CROSSINGS
Crossing details of pipe, piers, anchorage, transition coupling, etc., shall be shown on a large scale detail sheet. For line sizes sixteen (16) inches and smaller, cement-lined Ductile Iron pipe shall be used under the full stream width, and ten (10) feet on each side of the ditch bank. For line sizes larger than sixteen (16) inches, pipe used shall be as approved by Public Works. Concrete encasement may also be required. Special care shall be taken to provide a firm base for the pipe bedding. The plans shall specify that all soft or organic material within the stream banks shall be replaced with select imported backfill. If the pipe must cross above the stream, reinforced concrete piers of adequate depth shall be located as necessary for adequate support of the pipe. The pipe shall be held in cylindrical cradles, formed in the tops of the pier and held down by Grade 304 stainless steel straps, with Grade 304 stainless steel anchor bolts of
adequate size. Cushion material shall be placed between the pipe, clamps, and support. Special consideration shall be given to protecting the pipe during stream flooding.

Stream crossings and construction methods shall be in conformance with, and be approved by, the appropriate agency Nevada Division of Environmental Protection, Nevada Department of Fish and Game, Nevada State Lands, and the Corps of Engineers.

8.14 BORING OR JACKING

All pipe which is bored or jacked shall be placed in a welded steel conductor pipe of sufficient diameter to allow adequate space for both jacking the carrier pipe into the conductor and for allowing adjustment of the carrier pipe to grade. Normally, an inside diameter of conductor pipe of six (6) inches greater than the outside diameter of the couplings of the carrier pipe is sufficient. (Refer to the Public Works Standard Detail Sheets, Appendix A of this document). The method used for installing the carrier pipe in the conductor shall be specifically approved by Public Works.

Welded steel conductor pipe shall have a minimum wall thickness of 3/8-inch per Public Works Standard Detail Sheets. Thickness verification calculations shall be submitted to Public Works for review and approval.

City of Fernley encroachment, State of Nevada encroachment, B.O.R. encroachment, UPRR encroachment, site improvement, or right-of-way occupancy permits shall be obtained for all boring or jacking work within or under the respective agency’s right-of-way.

8.15 LOCATING TAPE

All buried transmission, distribution and service pipes shall have a detectable locating tape installed per the Public Works Standard Detail Sheets. The detectable locating tape shall consist of a metallic layer sandwiched between two layers of inert plastic. The tape shall bear a continuous message “Caution - Sewer Line Buried Below” or words of a similar nature.

8.16 TESTING

The Engineer-of-Record shall be responsible for ensuring that all required tests are performed and submitted to Public Works. The Engineer-of-Record shall notify Public Works, in writing, a minimum of two working days prior to all tests on sewer lines.

The contractor shall furnish all necessary labor, materials and equipment and shall perform specified tests for each and every length of sewer and appurtenant construction as outlined below, and in accordance with the “Standard Specifications for Public Works Construction.” When other underground utilities are to be installed as a part of the construction or as a part of a larger project or subdivision related to the sewer installation, testing shall be conducted after all other utilities have been installed, and all compaction has been completed, in the area of the new sewer main and laterals. This does not preclude the contractor from also conducting testing at earlier times to insure that the mains were acceptably installed prior to other Public Works work in the area. All tests shall be performed under the direct observation of the Engineer-of-Record or a certified inspector approved by Public Works. All remedial work required to correct construction deficiencies discovered as a result of tests or inspections by the Engineer-of-Record shall be accomplished by the contractor in a manner approved by Public Works and at the sole expense of the contractor. Portions of the original construction which require remedial work shall be completely retested and/or re-inspected following the attempted correction or repair by the contractor.

Prior to final acceptance by Public Works, all sewer mains and appurtenances shall be subjected to a test or tests to determine their degree of air tightness and a test or tests to ascertain the
correctness of their horizontal and vertical alignment. Before a test is performed, the pipe installation shall be cleaned.

The contractor shall furnish an inflatable spherical rubber ball of a size that will inflate to fit snugly into the pipe to be tested. The ball shall be placed in the uppermost manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris or a damaged pipe shall stop the ball, the contractor shall remove the obstruction and/or make necessary repairs. Debris shall not be washed into existing sewer mains, but shall be pumped or vacuumed and disposed of at an approved location.

8.17 SEWER MAIN TELEVISION INSPECTION

All sewer mains shall have a color television inspection prior to acceptance by Public Works and prior to paving. The Quality Assurance Firm must be present during all video inspection. All sewer mains and manholes shall be clear of debris prior to televising. Debris shall not be washed into existing sewer mains, but shall be pumped or vacuumed and disposed of at an approved location. The contractor or developer shall furnish Public Works with a color VHS recording or CD of the television inspection and a listing of the distance from the nearest downstream sanitary sewer manhole to each wye or lateral and manhole.

8.18 DEFLECTION TEST

The contractor must conduct a deflection test on all sewer lines except laterals prior to paving. The deflection test limit shall be 5 percent of the pipe base inside diameter of the pipe for pipes 12 inches or less in diameter and 4 percent of the pipe base inside diameter for pipes greater than 12 inches in diameter. This test shall be observed by the Engineer-of-Record or a certified inspector approved by Public Works and shall be conducted using a properly sized “go no-go” deflection mandrel constructed in accordance with ASTM specification D 3034. The mandrel shall be furnished by the contractor and be approved by the Engineer-of-Record or a certified inspector approved by Public Works. The mandrel shall be hand pulled through the pipe. No devices except the tow rope shall be utilized to assist the mandrel through the pipe. Public Works will also allow a ball flush and mandrel test. Locations with excessive deflection shall be repaired. Allowable deflection and Mandrel sizes shall conform to those listed in Table 8.4.

<table>
<thead>
<tr>
<th>Pipe Size (Inches)</th>
<th>Base Inside Diameter (Inches)</th>
<th>Allowable Deflection (percent)</th>
<th>Mandrel Diameter (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>5.742</td>
<td>5</td>
<td>5.455</td>
</tr>
<tr>
<td>8</td>
<td>7.665</td>
<td>5</td>
<td>7.282</td>
</tr>
<tr>
<td>10</td>
<td>9.563</td>
<td>5</td>
<td>9.085</td>
</tr>
<tr>
<td>12</td>
<td>11.361</td>
<td>5</td>
<td>10.793</td>
</tr>
<tr>
<td>15</td>
<td>13.898</td>
<td>4</td>
<td>13.342</td>
</tr>
<tr>
<td>18</td>
<td>16.976</td>
<td>4</td>
<td>16.297</td>
</tr>
<tr>
<td>21</td>
<td>20.004</td>
<td>4</td>
<td>19.204</td>
</tr>
</tbody>
</table>
8.19 AIR TEST

The contractor shall conduct an air test, following the alignment test and deflection test. All compaction shall be completed prior to conducting the air test.

The contractor shall furnish the necessary equipment and be responsible for conducting all low pressure air tests. The contractor shall be responsible for repair work on sections that do not pass the test. No sealant shall be used in newly installed sewer. The Engineer-of-Record or a certified inspector approved by Public Works shall witness all low pressure air tests and verify the accuracy and results of the test, and acceptability of the equipment utilized. To facilitate test verification by the Engineer-of-Record, all air used shall pass through a single, above ground control panel.

The above-ground air control equipment shall include a shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge and a continuous monitoring pressure gauge having a pressure range from 0 to at least 10 psi and an accuracy of plus or minus 0.04 psi.

Two (2) separate hoses shall be used to: (1) connect the control panel to the sealed line for introducing low-pressure air and; (2) a separate hose connection for constant monitoring of air pressure build-up in the line. This requirement greatly diminishes the chance for over-pressurizing the line.

After a manhole to manhole reach of pipe has been backfilled to final grade and is ready for testing, plugs shall be placed in the line at each manhole (and the end of each lateral if necessary) and secured.

Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of groundwater above the pipe, but not greater than 9.0 psig.

When necessary, the depth of groundwater above the pipe shall be determined by the installation of shallow groundwater wells in the pipe trench. The number of wells shall be specified by Public Works and the contractor’s design approved by Public Works prior to start of construction. In the event that the contractor desires to use a different method to determine the depth of groundwater, Public Works shall be consulted and approve the method.

After a constant pressure of 4.0 psig (greater than the average groundwater back pressure) is reached, the air supply shall be throttled to maintain that internal pressure for at least two (2) minutes.

When temperatures have been equalized and the pressure stabilized at 4.0 psig (greater than the average groundwater back pressure) the air hose from the control panel to the air supply shall be shut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig (greater than the average back pressure of groundwater over the pipe. At a reading of 3.5 psig to 4.0 psig (greater than the average groundwater back pressure) timing shall commence with a stop watch or other accurate timing device.

The section of pipe has passed the air test, if the time shown in Table 8.5 (or in Table 8.6) for the designated pipe size and length has elapsed before the air pressure drops 1.0 psig (or 0.5 psig for Table 8.6).

The section of pipe has failed the test if the pressure drops 1.0 psig (or 0.5 psig for Table 8.6) before the appropriate time shown in Table 8.5 (or in Table 8.6) has elapsed.

No test section shall be accepted if it loses more than 0.0015 cubic feet per minute per square foot of internal pipe surface area for a portion containing less than six hundred twenty-five (625) square feet internal pipe surface area. The general test time formula is as follows:

\[ T = 0.085 DK Q \]
Where:

\[ T = \text{Shortest time, in seconds, allowed for the air pressure to drop 1.0 psig.} \]

\[ K = 0.000419 \ DL, \text{ but not less than 1.0} \]

\[ L = \text{Length of pipe being tested in feet.} \]

\[ Q = 0.0015 \text{ cubic feet per minute per square feet of internal surface.} \]

\[ D = \text{Nominal pipe diameter in inches.} \]

All lateral sewers within the right-of-way shall be included in the air test. When lateral sewers are included in the test, their lengths may be ignored for computing required test times.

In the event a test section having a total internal surface area less than six hundred twenty-five (625) square feet fails to pass the air test when lateral sewers have been ignored, the test time shall be recalculated to include all lateral sewers using the following formula:

\[
T = \frac{0.085(l)^2 L(1) + D(2)^2 L(2) + \ldots + D(n)^2 L(n)K}{D(1)L(1) + D(2)L(2) + \ldots + D(n)L(n)Q}
\]

Where:

\[ n = \text{respective pipes with different pipe diameters.} \]

\[ T = \text{Shortest time, in seconds, allowed for the air pressure to drop 1.0 psig.} \]

\[ K = 0.000419 \ (D(1)L(1) + D(2)L(2) + \ldots + D(n)L(n)), \text{ but not less than 1.0}. \]

\[ Q = 0.0015 \text{ cubic feet per minute per square feet of internal surface.} \]

\[ D(1), D(2), \text{ etc.} = \text{nominal diameters of the different size pipes being testing.} \]

\[ L(1), L(2), \text{ etc.} = \text{respective lengths of the different size pipes being tested.} \]

The section of pipe has passed the air test, if the recalculated test time based on the above formula has elapsed before the air pressure drops 1.0 psig (or 0.5 psig).

<table>
<thead>
<tr>
<th>1 Pipe Diameter (in.)</th>
<th>2 Minimum Time (Min:Sec.)</th>
<th>3 Length for Minimum Time (ft)</th>
<th>4 Time for Longer Length (Sec.)</th>
<th>Specification Time for Length (L) Shown (min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>100 ft</td>
<td>150 ft</td>
</tr>
<tr>
<td>4</td>
<td>3:46</td>
<td>597</td>
<td>0.380 L</td>
<td>3:46</td>
</tr>
<tr>
<td>6</td>
<td>5:49</td>
<td>394</td>
<td>0.854 L</td>
<td>5:40</td>
</tr>
<tr>
<td>8</td>
<td>7:34</td>
<td>298</td>
<td>1.520 L</td>
<td>7:34</td>
</tr>
<tr>
<td>18</td>
<td>17:00</td>
<td>133</td>
<td>7.692 L</td>
<td>17:00</td>
</tr>
</tbody>
</table>

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### Table 8.6

**SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP**

FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

<table>
<thead>
<tr>
<th>1 Pipe Diameter (in.)</th>
<th>2 Minimum Time (Min:Sec.)</th>
<th>3 Length for Minimum Time (ft)</th>
<th>4 Time for Longer Length (Sec.)</th>
<th>Specification Time for Length (L) Shown (min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 ft</td>
</tr>
<tr>
<td>10</td>
<td>4:43</td>
<td>239</td>
<td>1,187 L</td>
<td>4:43</td>
</tr>
<tr>
<td>12</td>
<td>5:40</td>
<td>199</td>
<td>1,709 L</td>
<td>5:40</td>
</tr>
<tr>
<td>15</td>
<td>7:05</td>
<td>159</td>
<td>2,671 L</td>
<td>7:05</td>
</tr>
</tbody>
</table>

8.20 **MANHOLE VACUUM TESTING**

The manhole vacuum test shall pass if pressure drop from 10 inches of mercury to 9 inches of mercury does not exceed the time limit for manhole size and depth indicated per ASTM C1244-93, as can be seen below.

<table>
<thead>
<tr>
<th>MINIMUM VACUUM TEST TIME FOR VARIOUS MANHOLE DIAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPTH (FT)</td>
</tr>
<tr>
<td>0.0</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>22</td>
</tr>
<tr>
<td>24</td>
</tr>
<tr>
<td>26</td>
</tr>
<tr>
<td>28</td>
</tr>
<tr>
<td>30</td>
</tr>
</tbody>
</table>

8.21 **ENCROACHMENT PERMIT**

The improvement plans shall clearly indicate that all work in public rights-of-way requires an encroachment permit. The encroachment permits are issued by appropriate agencies including but not limited to: Public Works Department, the Union Pacific Railroad, and NDOT. Encroachment permits are required for all work done in a public right-of-way.
8.22 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, specified in the City of Fernley Development Code Section 44.130, 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.
9.0 - WASTEWATER PUMP STATIONS AND FORCE MAINS

9.1 GENERAL

One (1) copy of the pump station structural design plans, geotechnical investigation and supporting calculations, all stamped by a registered civil engineer and electrical engineer, shall be submitted to Public Works for approval. Construction shall not start on the pump station prior to Public Works approval of the submittal. Design calculations should include a hydraulic analysis and a map of the tributary area. NDEP approval is required prior to Public Works approval. 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.

9.2 WET WELL

Wastewater pump stations shall have a wet well with submersible pump configuration unless waived by Public Works. Wastewater pump stations with a wet well/dry well configuration may be considered only by Public Works. Due consideration shall be given to the selection of materials because of the presence of hydrogen sulfide and other corrosive gases, greases, oils, and other components present in sewage.

Wet wells shall be equipped with submersible pumps installed on vertical guide bars, which are installed and removed through the use of chains and/or cables. The wet well layout shall allow for removal of the wastewater pumps through a hatch at the ground level over each pump. All facility telemetry equipment shall be installed within weather-proof control panels.

Small packaged lift stations for single users may be considered by Public Works for special circumstances. Currently E-One grinder pumps are used and approved by Public Works (see Section 9.13).

The wet well size and control setting shall be such that each pump cycles within a range of six to ten times in one hour under any condition. Septic conditions due to excessive detention times shall be avoided. The wet well shall be constructed of concrete.

Wet well design calculations shall account for high groundwater level during construction and during normal operating conditions. A soil report, including well logs and soil bearing calculations, shall be provided.

9.3 PUMPS

At least two pumps shall be provided for each pump station. The Engineer-of-Record and/or Public Works shall determine a minimum number of pumps based on the Average Daily Flow. All pumps shall have the same capacity. Pumping capacity will be such that the station can handle peak sewage flows, as determined per Section 8.2, with one pump out of service. All pumps shall have premium efficiency motors unless otherwise approved by Public Works.

The pumps shall be placed so that they will operate under a positive suction head during normal operation unless waived by Public Works. A shutoff valve shall be located on the suction line of the pump. A check valve and shutoff valve shall be located on the discharge line of the pump.

One set of manufacturer recommended spare parts shall be supplied to Public Works upon dedication.

Pumps shall be of the non-clog centrifugal type and shall have pump suction and discharge openings at least four-inches (4") in diameter, be designed to handle sewage, and shall not operate in excess of 1750 revolutions per minute (RPM), unless otherwise approved by Public Works. Pumps shall be capable of passing spheres of at least 3 inches in diameter, unless
otherwise approved by Public Works. Pumps shall be equipped with mechanical seals, inspection and clean out ports on the suction piping immediately prior to the front head of the pump and on the discharge portion of the volute, and a bleed valve assembly to the highest portion of the volute or seal housing. One extra set of all mechanical seals shall be provided to Public Works upon completion of the project and prior to acceptance by the City. Pneumatic ejectors will not be permitted. Suction line velocities shall not exceed 5 fps and discharge piping velocities shall not exceed 8 fps.

The pump station improvement plans shall identify the following operating conditions and performance criteria:

- Operating System Functional Description
- Depth of Wet Well
- 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 Starters and/or VFD
- Meter Sizing Determination
- Air-Vacuum Valve Sizing Determination
- Discharge Piping Sizing Determination

9.4 PIPING

Piping shall be ductile iron with grooved or flanged joints. All fasteners used for joining pipes shall be stainless steel. Pump isolation valves shall be eccentric or full port plug valves. Swing check valves with external levers shall be provided on each pump discharge. The individual pump discharge shall connect into the main header horizontally to prevent grit buildup in the check valve.

Sewage air relief valves shall be provided at high points in the sewer force main and approved for use by Public Works.

9.5 OVERFLOW PREVENTION

Satisfactory means shall be provided to prevent overflows due to wet weather or power failures. As a minimum both of the following shall be incorporated:
Storage – The Engineer-of-Record shall submit a calculation of the maximum storage in the collection system at peak flow, before sewage reaches the top of the lowest manhole in the system for review by Public Works.

Stand-by Generator – A stand-by engine generator shall be provided with automatic starting and load transfer equipment to operate the entire pump station load during power failure, unless automatic overflow into a gravity sewer line can be provided at an elevation that insures no back-ups. Consideration shall be given to control of odors and noise. The generator shall be located in a weather-protective, sound-proof, and 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 tamper-proof storage tank and concrete pad for secondary containment, or by natural gas as approved by Public Works. The storage tank shall have capacity to provide a 24-hour continuous run time. The generator engine block shall be equipped with a block heater and thermostat that will allow for instantaneous start-up at temperatures as lows as -10 degrees F. 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 its charge when idle.

Alternative pumping ability utilizing an alternate fuel-driven pump can be used in lieu of a stand-by generator. The alternative fuel-driven pump must meet the same pumping capacity requirements for the lift station.

9.6 ELECTRICAL

Electrical systems and components (motors, lights, cables, conduits, switch boxes, control circuits, etc.) in raw sewage wet wells, or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors may be present, shall comply with the National Electrical Code Requirements for Class I, Group D, Division I locations. In addition, equipment located in the wet well shall be suitable for use under corrosive conditions.

Each flexible cable shall be provided with watertight seal and separate strain relief. A fused disconnect switch located above ground shall be provided for all pumping stations. When such equipment is exposed to weather, it shall meet the requirements of weatherproof equipment.

A Nevada registered electrical engineer shall stamp drawings, which involve electrical and control systems.

9.7 CONTROLS AND ALARMS

Sewage monitoring and control systems shall consist of a complete radio telemetry system to monitor the status of the pumping facilities. All telemetry equipment shall be installed within weather-proof control panels. Control systems shall have a pressure transducer for level measurement with float switches for backup, or as directed by Public Works. Control systems shall be configured to allow inspection, service, repair or replacement from the ground surface through the wet well hatch or lid, without confined space or wet well entry. The controls shall be located away from the turbulence of incoming flow and pump suction. In all stations, provisions shall be made to automatically alternate the pumps in use. Control panels shall be equipped with start counters and hour meters for all pumps. Alarm systems shall be provided for pumping stations. The alarm shall be activated to indicate high and low wet well level. The alarm shall be telemetered by radio to a receiver located at Public Works control panel and shall activate an auto dialer. Backup power shall be supplied to the control system.

The discharge and suction side of the pump shall have direct read pressure gauges located at the same height with the ability to transmit a 4 - 20 mA signal to the telemetry system. Pressure gauges shall be installed in accordance with the manufacturer’s recommendations.
Typical functions to be monitored include:
1) Pump Status
2) Pump Alarms
3) High Motor Temperature
4) Successive Starts
5) Over-Voltage or Over-Amp draw
6) Suction and Discharge Pressure
7) Wet Well Levels
8) Intrusion alarms
9) Sewage Flow Rate
10) Operating Voltage (for each phase leg)
11) Operating Amp Draw (for each phase leg)

9.8 FORCE MAINS
A minimum flow velocity of three (3) feet per second shall be maintained in the force main during pump operation. A dual automatic air relief valve assembly designed for operations in sanitary sewage systems shall be placed at high points in the force main to prevent air locking. Provisions for odor control at the air relief valve may be required in applications where the force-main empties as part of normal operation sequence. Vacuum relief valves shall be provided as necessary to relieve negative pressures on force mains. The force main configuration and head conditions shall be evaluated to determine the need for and placement of vacuum relief valves. The plans shall call for a water pressure test at a pressure of 150 psi in accordance with the requirements for testing water lines. The plans shall also call for a magnetic locating tape printed with “SANITARY SEWER FORCE MAIN” to be installed in the trench one (1) foot above the pipe. The force main shall be constructed of either cement-lined Ductile Iron Pipe in accordance with AWWA C150 and C151 or PVC Pipe in conformance with AWWA C900. If PVC pipe is used, it shall be green in color. Trenching and installation of the force main shall be as required for water mains including thrust blocks and tracer wire. Force mains shall enter the gravity sewer at a point not more than 2 feet above the flow line of the receiving manhole. All force main cleanouts shall utilize threaded connections and caps. In-line valve spacing shall be similar to potable water mains, unless otherwise determined to be necessary at a different spacing.

9.9 FLOW METERING
The pump station shall have one magnetic flow meter with a 4-20 milli-amp (mA) output (remote readout) installed on the force main in a water-tight vault. The flow meter shall include a submergibility kit, and shall be capable of operating in continuously submerged conditions. The vault shall be equipped with a sump pump and flood alarms (remote readout).

9.10 FLOOD PROTECTION
Pumping station structures, access to all spaces, electrical panels, mechanical equipment, and motors shall be at an elevation of at least 1 foot above the 100 year base flood elevation.
9.11 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. The developer shall also provide training of Public Works operators.

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

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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.

9.12 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 force 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
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
9.13 APPROVED ALTERNATIVE SEWER SYSTEMS

9.13.1 E-ONE GRINDER PUMP SYSTEM

Use of E-One alternative sewer systems must first be requested by the Engineer-of-Record and approved by Public Works prior to submitting improvement plans to Public Works for review. Public Works requires gravity systems at any and all locations if at all possible. E-One systems will only be considered by Public Works if the Engineer-of-Record has exhausted all possibilities of incorporating a gravity system. If an E-One system is to be used, they should be selected based on the following:

<table>
<thead>
<tr>
<th>Table 1</th>
<th>RECOMMENDED GRINDER PUMP SELECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Occupancy</strong></td>
<td><strong>Use Model</strong></td>
</tr>
<tr>
<td>Single Family</td>
<td>GP 2010</td>
</tr>
<tr>
<td>Multi-Family/Multiple Homes</td>
<td></td>
</tr>
<tr>
<td>2 Units</td>
<td>GP 2012</td>
</tr>
<tr>
<td>3 to 6 Units</td>
<td>GP 2014</td>
</tr>
<tr>
<td>10 Units</td>
<td>GP 2015</td>
</tr>
<tr>
<td>12 Units</td>
<td>GP 2016</td>
</tr>
<tr>
<td>Mobile Homes</td>
<td></td>
</tr>
<tr>
<td>1 to 2</td>
<td>GP 2010</td>
</tr>
<tr>
<td>3</td>
<td>GP 2012</td>
</tr>
<tr>
<td>4 to 6</td>
<td>GP 2014</td>
</tr>
<tr>
<td>Motel/Hotel</td>
<td></td>
</tr>
<tr>
<td>Resident</td>
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</tr>
<tr>
<td>1 to 4 Rooms</td>
<td>GP 2010</td>
</tr>
<tr>
<td>5 to 6 Rooms</td>
<td>GP 2012</td>
</tr>
<tr>
<td>7 to 8 Rooms</td>
<td>GP 2014</td>
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<tr>
<td>Transient</td>
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<tr>
<td>1 to 12 Rooms</td>
<td>GP 2010</td>
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<tr>
<td>13 to 18 Rooms</td>
<td>GP 2012</td>
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<tr>
<td>19 to 24 Rooms</td>
<td>GP 2014</td>
</tr>
<tr>
<td>Large Restaurants, Strip Malls</td>
<td>GP 2015</td>
</tr>
<tr>
<td>Laundromats, Businesses with Constant Flows</td>
<td>GP 2016</td>
</tr>
<tr>
<td>Campers and Recreation Vehicles</td>
<td>*</td>
</tr>
</tbody>
</table>

* Since these vehicles vary widely in size and accommodations, design flows must be based on a specific type. Loading can then be selected based on the peak flow handling capacity of anticipated overhaul periods, whichever is limiting.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>MAXIMUM NUMBER OF GRINDER PUMP CORES OPERATING DAILY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Number of Grinders Pump Cores Connected</td>
<td>Daily Number of Grinders Pump Cores Operating Simultaneously</td>
</tr>
<tr>
<td>1</td>
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</tr>
<tr>
<td>2-3</td>
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</tr>
<tr>
<td>4-9</td>
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<tr>
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<td>34</td>
</tr>
<tr>
<td>972-1004</td>
<td>35</td>
</tr>
</tbody>
</table>

9.13.2 E-ONE CALCULATIONS

The engineer of record is required to submit stamped engineering calculations of the E-One system intended with the improvement plans for approval by Public Works. The calculations must include proposed sewer flows and number of units requiring E-One.
stations. The calculations must include the brand name, rating, size and type of E-One system to be used on each residence. The calculations must also include sizing of the small diameter force main.

9.13.2.1 E-ONE PERFORMANCE CRITERIA
The following figures display the pump performance of the E-One Grinder Pumps.
### Table 7

**SCHEDULE 40 PVC PIPE**

| N  | V  | H1 | V  | H2 | V  | H3 | V  | H4 | V  | H5 | V  | H6 | V  | H7 | V  | H8 | V  | H9 | V  | H10 | V  | H11 | V  | H12 | V  | H13 | V  | N  |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1  | 2.28| 1.74| 1.73| 0.82| 1.05| 0.24|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 2  | 4.72| 6.28| 3.47| 2.97| 2.10| 0.89| 1.47| 0.37|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 3  | 7.28| 13.31| 5.28| 5.29| 3.54| 1.98| 2.21| 0.79|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 4  | 10.84| 12.71| 7.21| 4.21| 3.39| 1.49| 1.91| 0.46|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 5  | 14.40| 14.83| 9.21| 5.33| 3.65| 2.02| 2.39| 0.79|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 6  | 17.96| 18.73| 11.24| 6.41| 4.23| 2.63| 2.87| 0.99|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 7  | 21.52| 22.78| 13.27| 7.41| 7.57| 3.34| 3.31| 1.94| 0.36|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 8  | 25.08| 26.50| 15.29| 8.48| 8.63| 3.92| 3.92| 1.68| 2.22| 0.45|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 9  | 28.64| 30.01| 17.31| 9.54| 9.65| 4.43| 4.30| 2.08| 2.49| 0.56|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 10 | 32.20| 33.53| 19.33| 10.59| 10.70| 4.93| 4.79| 2.77| 2.98| 0.66|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 11 | 35.76| 37.06| 21.35| 11.63| 11.75| 5.43| 5.22| 3.32| 3.51| 0.76|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 12 | 39.32| 40.56| 23.37| 12.68| 12.80| 5.92| 5.64| 3.85| 4.03| 0.87|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 13 | 42.88| 44.01| 25.39| 13.72| 13.85| 6.41| 6.12| 4.38| 4.54| 0.98|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 14 | 46.44| 47.53| 27.41| 14.76| 14.90| 6.90| 6.59| 4.90| 5.06| 1.09|   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

#### Head Loss Calculations

*From Modified Hazen-Williams Formula*

\[
H_f = \frac{100}{C} \left( \frac{1.852 \cdot V^2}{C^{1.852}} \right) \cdot \frac{d^{4/3}}{A} \cdot \frac{q}{A}
\]

\[V = \frac{3208 \cdot q}{A}
\]

\[A = \frac{d^2 \cdot \pi}{4}
\]

\[q = \text{flow in gallons per minute}
\]

\[d = \text{I.D. of pipe in inches} \quad (\text{average O.D. - 0.1 in. min. wall thickness})
\]

\[C = 150
\]

\[N = \text{Number of pumps operating at 11 gpm}
\]

\[V = \text{Flow velocity in ft/sec}
\]

\[H_f = \text{Friction head loss in ft/100 of pipe}
\]
9.13.3 E-ONE IMPROVEMENT PLANS

The improvement plans must include the depth of bury and horizontal location of the force main in relation to other existing utilities and/or proposed utilities, primarily, potable water. The plans must also show the proposed location of the E-One units, which will be field verified, and sizes of all force mains. The force mains shall include sewage air-vacuum valves at all high points and isolation valves every 1000 feet. Check valves must be included where necessary.

Cleanouts must be installed at all isolation valves for access to the low-pressure force main for cleaning, if necessary. Cleanouts shall incorporate threaded caps to preclude force main pressure removal of the caps. The E-One control/alarm panel is to be placed to ensure serviceability. Never should the control/alarm panel be placed within the backyard of the residence. All E-One’s supply and discharge lines shall be green in color and installed with tracer wire.

9.13.4 E-ONE START UPS

At the time the developer purchases the E-One unit (core, pump, etc.) the pump is delivered to Public Works for storage. The Engineer-of-Record must provide a letter of acceptance to Public Works after successful start-up indicating the time, date, residence address, and specifics of the start-up. The specifics must include pump operation in relation to the level controls. The level controls and proper operation of alarms must also be indicated in the start-up report prior to acceptance by Public Works. Public Works requires a representative from Public Works and the E-One Company for start-up certification and acceptance of the installations.

9.13.5 E-ONE RECORD DRAWING

The Record Drawings must include location of E-One units in relation to the residence or commercial building being served and the adjacent street(s) on 8½ X 11 sketches. The Record Drawings must also include any fencing, sidewalks, landscaping, or other structures preventing or hindering access by Public Works to the unit. Public Works will only issue acceptance of the E-One system upon acceptance of the Record Drawing and certification from an E-One Representative.

9.13.6 E-ONE WARRANTY

The E-One Units and force main piping installation and equipment will remain on warranty for a period of two (2) years from the date of installation or twenty-seven (27) months from the date of shipment, with the manufacturer(s) and developer. The E-One Manufacturer representative can be reached at (925)-485-9720 ext. 15, Don Reppond of Shape Incorporated, 7020 Knoll Center Pkwy, Pleasanton, CA, 94566. Warranty and E-One usage information must be provided to the Public Works Department.

9.13.7 E-ONE SERVICE

Public Works responds to service calls and reinstalls pumps for the homeowner. Public Works maintains E-One units and force mains. Fernley Electric responds to electrical repairs.
9.13.8 HOMEOWNER NOTIFICATION AND RESPONSIBILITY

The Homeowner must be provided all warranty information, operations and maintenance information, and contract information with the CCR's. The homeowner is required to provide complete and absolute access to all E-One Units and service panels at all times by signing an affidavit. Public Works will not be responsible for any damage to private property during service calls. "Homeowner Agreements" are available at the office of Public Works.
10.0 - STORMWATER DRAINAGE

10.1 GENERAL

10.1.1 DRAINAGE REPORT
All developments of land shall submit for approval, unless waived by Public Works, a drainage report signed and stamped by a Nevada Registered Civil Engineer in accordance with Public Works standards.

(1) Permits:
   (a) Where the permit relates to coverage of 10,000 or more square feet of impervious surface within the property.
   (b) Where development is in a critical drainage area as defined by the City Engineer.
   (c) Grading permit which entails 20,000 sq. ft. or greater.

(2) Improvement plans.

(3) Where required by Public Works.

The drainage report shall be based on current zoning, the proposed development, or Master Plan whichever process produces the greater runoff.

10.1.2 RETENTION/DETENTION
Whenever a drainage report indicates that the 5-year storm runoff from a development cannot be handled by the existing onsite retention system, the developer is to upgrade the existing system to accommodate the runoff; or provide on-site detention and controls for acceptable disbursement into the system; or provide an on-site infiltration or retention system verified by the Engineer-of-Record to be adequate to accommodate the increase in runoff. Infiltration systems shall require a minimum percolation test rate of sixty (60) minutes per inch as basis of design. The operation and maintenance of such a system is the responsibility of the property owner or homeowner’s association. Prior to Improvement Plan approval, an operations and maintenance agreement must be signed by property owner or homeowner’s association.

Multi-use ponds such as detention ponds that also serve as parks or soccer fields are encouraged. The slopes and depths must be consistent with public health and safety concerns. Such basins will be reviewed on a case-by-case basis.

10.1.3 MAXIMUM CAPACITY
Discharge of storm drain waters into a major drainage facility or natural water course when added to the 100-year peak flow of storm drainage runoff must not exceed the existing capacity of said drainage facility or natural water course. For consideration by Public Works, the Engineer-of-Record must provide conclusive proof in the drainage report that any increase in peak flow will not adversely affect or cause damage to any property along said drainage facility or water course now or in the future, based on existing zoning, the proposed development, or the master plan and elements thereof, whichever is more restrictive.

10.1.4 IMPACTS ON EXISTING DRAINAGE
Development of property shall not adversely affect any natural major drainage facility or natural water course. Natural facilities shall remain in as near to the natural state as is practicable, with any modification proposed, including any erosion mitigating measures, addressed in the drainage report and drainage plan.
10.1.5 SAFETY
Fencing shall be provided to prevent public access to drainage facilities when the flows, velocity, or side slope indicate a potential safety issue, as determined by the Drainage Report.

10.1.6 DRAINAGE FACILITY DELINEATION
All storm drainage relating to a subdivision or development shall be collected on-site by facilities to accommodate the storm drain waters for the 5-year return frequency storm flow, both entering the site and generated on-site and piped in accordance with Public Works standards to an existing adequate public storm drain system, major drainage facility or natural watercourse. Where by reason of terrain or other circumstances, Public Works determines that piping storm drain waters is inappropriate or unnecessary, alternative methods of transporting such waters may be approved in lieu of piping.

Storm drain waters generated within the boundaries of a subdivision or development which discharge from a public drain system onto and across private property require that a permanent easement for access and maintenance be dedicated to the City from the subdivision or development boundary to the point of discharge into an existing public storm drain system, major drainage facility or natural water course. The easement shall be adequately fenced on both sides at the time of construction of the drainage feature. The drainage feature shall be constructed of an impermeable, permanent surface in which private fencing cannot interrupt the feature and the feature cannot be removed or filled in by Homeowners. The drainage feature, if terminating onto a public street, shall be gated such that unauthorized personnel, including off-road vehicles cannot enter. Locks for the gates must be provided to Public Works at final acceptance of the work.

10.2 DRAINAGE REPORT
The following criteria shall be considered for a Drainage Report. A drainage report will be required with the submittal, or prior to the submittal of, improvement plans.

Standards for Drainage Report - The report is required to identify problems and present solutions with engineering documentation. Tabulated data on maps is preferred to lengthy written descriptions except for unusual items such as detention, complex hydrologic analysis, etc.

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

10.2.2 INTRODUCTION
a) Site location:
   i. Street location, assessor's parcel number(s), and section reference.
   ii. Adjacent developments.
b) Site description:
   i. Topography, ground cover, etc.
   ii. Existing drainage facilities, major drainage facilities, flood hazard areas, TCID drainages or irrigation ditches, and other site conditions that must be considered.
c) Proposed project description.
d) Other previous studies relevant to site.
10.2.3 HISTORIC DRAINAGE SYSTEM (DISCUSS THE FOLLOWING)

a) Major basins:
   i. Relationship to major drainage facilities.
   ii. Major basin drainage characteristics (topography, runoff, cover, use, erosion, etc.).

b) Sub-basin and site drainage (i and ii may be tabulated on map):
   i. Minor (5-year) and major (25-year) storm flows for each sub-basin affecting the site.
   ii. Existing drainage patterns: channelized or overland flow, point of discharge, etc.
   iii. Effect of historic flows on adjacent properties.

10.2.4 PROPOSED (DEVELOPED CONDITION) DRAINAGE SYSTEM (DISCUSS EACH OF THE FOLLOWING)

a) Criteria:
   i. Size of major basins and tributary sub-basins.
   ii. Hydrologic method to be used for analysis (Rational, SCS, HEC, etc.).
   iii. Design storm intensities for minor (5-year, 6-hour duration) and major (25-year, 6-hour duration) events or as required by the City Engineer.

b) Runoff:
   i. Historic storm flow rates and paths.
   ii. Developed condition storm flow rates and paths for minor and major storms.

c) Piping:
   i. Design the storm drain system to pass the 5-year, 6-hour storm including all downstream improvements.
   ii. Verify storm flows from inlets to ultimate outlets of the drainage system.

d) Detention of 25-year, 6-hour storm(s) is required based on unconstrained conditions downstream. For example, if the downstream piped system cannot convey the 5-year flow, the peak outflow shall be controlled to match the downstream system capacity. In addition, if the overland flow or downstream drainage channels cannot convey flows in excess of the 5-year storm, additional detention or downstream controls may be required as determined by the City Engineer.

   Provide discussion on each of the following:
   i. Volume required and provided for zero increase in peak flows.
   iii. Passage of storms exceeding the 5-year up to and including the 25-year.
   iv. Provide for an emergency overflow which will not cause a direct impact to neighboring sites.
   v. Engineer-of-Record to provide detailed description of downstream constraints (or none) and design calculations on how to mitigate the problem.
   vi. Need for detention shall be clearly identified in the preliminary or schematic report and the necessary detention area shall be identified on preliminary plans.

c) Streets (This information may be shown on the plans):
   i. Depth and velocity of flow for major and minor storms.
ii. Drainage system.

f) Open channel flow (This information may be shown on the plans.):
   i. Type.
   ii. Depth and velocity.
   iii. Freeboard.

g) Storm drains and culverts (Show all data on plans.)

10.2.5 AREAS WITHIN FLOOD HAZARD ZONE WHEN APPLICABLE
   a) Impacts.
   b) Protection.
   c) Compliance with Federal Emergency Management Administration (FEMA) requirements and RMC 12.24, "Flood Hazard Areas".

10.2.6 CONCLUSIONS - DISCUSS IMPACT OF IMPROVEMENTS
   a) Benefits.
   b) Adverse effects with solution to mitigate adverse impacts.

10.2.7 APPENDICIES
   a) Hydrologic and hydraulic computations:
      1) List and explain basic assumptions and input factors used:
         a) Tabularized and/or discussed as necessary.
         b) Indicate any sensitivity analysis performed.
         c) Include source tables and references for parameters, such as soils groups, SCS curve numbers, C values, n values, etc.
      2) Historic runoff:
         a) Off-site.
         b) On-site.
      3) Developed runoff:
         a) Off-site.
         b) On-site.
      4) Detention for up to and including the 25-year, 6-hour storm.
      5) Hydraulic computations:
         a) Hydraulic grade line (HGL) minor storm.
         b) Hydraulic grade line (HGL) major storm.
         c) Inlet/outlet calculations.
   b) Drainage plan:
      1) Site location map - On a USGS map or larger, as appropriate, show relation of site to major drainage basin and sub-basin. Show flood hazard areas if applicable and off-site flows through project. Show SCS soils map and applicable soil descriptions where appropriate.
      2) Site drainage plan:
         a) Show the existing and proposed contours at least 100 feet beyond property line.
b) The site drainage plan should be at the same scale as the grading plan. Show all sub-drainage areas per catch basin or channel and tabulate existing and proposed drainage showing length, assumed velocity and time of concentration on various runs of grass, gutters, etc., cumulative time of concentration, average rainfall intensity, area, runoff coefficient (adjusted if necessary), and peak flows for 5- and 25-year, 6-hour storms.

c) All inlets and manholes shall be labeled to correspond to tabular numbering system. Pipe sizes, grades, velocities, peak flows and hydraulic grade lines shall be shown for all parts of the system in a tabular form on the plans.

d) Both location plan (overall drainage) and sub-drainage plan shall be signed and sealed by a Nevada Registered Civil Engineer and shall be included in the construction plans for the subdivision/development. Tables detailing design data of rational formula and inlet and pipe and channel design to be shown on plan.

e) On grading plans show peak flows for 5- and 25-year storms at inlets, in pipes and other sub-basin points of concentration and at discharge points and in channels. Show peak flows entering and leaving the site; trace path leaving site to nearest major drainage facility without adverse impact to downstream owners.

f) On plan and profile sheets, show peak flows for 5- and 25-year storms at all inlets and in pipes as per above, and in pipes show slope, velocity, and capacity, and hydraulic grade line if above top of pipe.

3) Bench marks - To be shown on plans with description and elevation.

4) Existing and proposed property lines.

5) Existing and proposed drainage easements.

6) Street names, grades, widths and rights-of-way or easements.

7) Routing and cumulative flows at the upstream and downstream ends of the site and at various critical points on-site for both minor and major runoff. Inflow and outflow for both storms for all sub-basins.

8) Street cross sections showing 100-year flood elevations.

9) Existing and proposed major drainage facilities.

10) Open channel flow in major channels shall be provided with the following information on plans:
    a) Channel and hydraulic grade line (HGL) profiles.
    b) Cross sections and required rights-of-way at 100 foot intervals.
    c) Location and size of all existing and proposed structures.
    d) Channel section and lining details.
    e) Freeboard for 100-year flows.
    f) Channel capacity and storm flows, 5- and 25-year flows and velocities.

11) Storm sewers (show on plans):
    a) Hydraulic grade line (HGL) profiles.
    b) Location and size of all existing and proposed structures.
    c) Proposed materials.
    d) Pertinent elevations and slopes.
    e) Pipe capacity and 5- and 25-year flows and velocities.
10.3 DESIGN REQUIREMENTS (PUBLIC AND PRIVATE)

10.3.1 MANNING’S ROUGHNESS COEFFICIENT

Manning’s Formula is to be used in computing capacities of all open channels and closed conduits with the following minimum values for roughness coefficient "n":

- PVC or ABS ................................................................. 0.012
- Concrete Pipe............................................................... 0.014
- Corrugated Metal Pipe (100% paved).............................. 0.015
- Corrugated Metal Pipe (paved invert)............................. 0.019
- Corrugated Metal (plain) .............................................. 0.024
- Open channels with gunite lining ................................ 0.019
- Open channels with paved bottom ................................ 0.025
- Earth channels (no rock or gravel)............................... 0.030
- Rock or gravel per approved Engineers Manual based on size and placement of materials.

10.3.2 METHODS

The Rational Method may be used in computations for the rate of runoff for urban and small watersheds 100 acres or less. The SCS method, SCS TR-55 "Urban Hydrology for Small Watersheds" and HEC may be used for small or larger watersheds. Watersheds in excess of 500 acres shall utilize HEC-1 method only. In addition to the criteria described herein, all development shall provide emergency flow paths for a storm event with a 100-year return period, 6-hour duration.

10.3.2.1 THE RATIONAL METHOD

a) The design flow for the Rational Method is expressed as:

\[ Q = C_i A \]

where:

- \( Q \) = peak rate of runoff, cubic feet per second
- \( C \) = runoff coefficient
- \( i \) = average rainfall intensity, inches per hour
- \( A \) = watershed area, acres

b) The following listed runoff coefficients, depending on future use, shall be used:

NOTE: An adjusted C value may be required in special conditions such as very small lots with large houses or duplexes.
RUNOFF COEFFICIENTS "C"

<table>
<thead>
<tr>
<th>Land Use Type</th>
<th>Runoff Coefficient &quot;C&quot;</th>
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<tbody>
<tr>
<td>Rural</td>
<td>0.25-0.35</td>
</tr>
<tr>
<td>Single Family Residential</td>
<td>0.45-0.60</td>
</tr>
<tr>
<td>Multi-Residential</td>
<td>0.60-0.70</td>
</tr>
<tr>
<td>Neighborhood Commercial</td>
<td>0.85</td>
</tr>
<tr>
<td>Community Commercial</td>
<td>0.85</td>
</tr>
<tr>
<td>Tourist Commercial</td>
<td>0.85</td>
</tr>
<tr>
<td>Office</td>
<td>0.85</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.85-0.90</td>
</tr>
<tr>
<td>Distribution and Warehousing</td>
<td>0.85-0.90</td>
</tr>
<tr>
<td>Public Facility</td>
<td>0.50-0.85</td>
</tr>
<tr>
<td>Pavement and Concrete Surfaces</td>
<td>0.90-0.95</td>
</tr>
<tr>
<td>Park</td>
<td>0.25</td>
</tr>
<tr>
<td>Open Space</td>
<td></td>
</tr>
<tr>
<td>(0-5% grade - vegetated)</td>
<td>0.20-0.30</td>
</tr>
<tr>
<td>Open Space</td>
<td></td>
</tr>
<tr>
<td>(0-5% grade - no vegetation)</td>
<td>0.30-0.40</td>
</tr>
<tr>
<td>Open Space</td>
<td></td>
</tr>
<tr>
<td>(5-15% grade - vegetated or unvegetated)</td>
<td>0.40-0.50</td>
</tr>
<tr>
<td>Open Space</td>
<td></td>
</tr>
<tr>
<td>(Over 15% grade - sparsely vegetated, rock or clay soils)</td>
<td>0.40-0.60</td>
</tr>
</tbody>
</table>

c) The rainfall intensity curve included in this Guideline on page SD-14 shall be used for determining the average intensity. The time of concentration, with a minimum build up time of 10 minutes is expressed as:

\[ t_{ci} = 10 \text{ or } \frac{L}{V \times 60} \], whichever is greater

where:

- \( t_{ci} \) = time of concentration at initial inlet, minutes
- \( L \) = length from uppermost point of watershed inlet, feet
- \( V \) = channel or overland velocity, feet per second

Given the time of concentration at a design point, the time of concentration at the next design point is determined by adding travel time, expressed as:

\[ t = \frac{L}{V \times 60} \]

where:

- \( t \) = travel time, minutes
- \( L \) = length of channel or conduit between design points, feet
- \( V \) = channel or conduit velocity, feet per second
10.3.3 VELOCITY
Minimum design velocity shall be 3 feet per second for storm drains.

10.3.4 OVERLAND FLOW
Overland flow is to be provided for and channelized within dedicated easements or public right-of-way to protect structures from flood during periods of rainfall-intensity storms that exceed the 5-year storm, up to and including the 25-year return frequency storm.

10.3.5 MAINTENANCE ACCESS
Easements with improved vehicular access in accordance with City standards shall be provided to publicly owned storm drain manholes, storm drain inlets and outlets, channels, storm drain ponds and to associated structures not located within an improved street section. Access shall include fencing on both sides of the easement, access gate and lock, and permanent, impervious surface.

Easements for access to and maintenance of the 25-year storm floodway associated with a major drainage facility or natural water course are to be provided to the City. Improved vehicular access in accordance with Public Works standards shall be provided when determined necessary by Public Works. Access shall include fencing on both sides of the easement, access gate and lock, and permanent, impervious surface.

10.3.6 LOCATION
Surface drainage from any developed area shall not cross any property line except by way of a natural watercourse, major drainage facility, an approved drainage system within a public storm drain easement, or a permanent surface drainage easement.

Existing surface drainage from adjoining property shall be perpetuated through the development, or other means of disposal provided, acceptable to Public Works.

10.3.7 FUTURE DEVELOPMENT
Storm drain facilities shall be extended with in a subdivision or development to adjacent undeveloped properties for future extensions in accordance with approved drainage plans, unless otherwise approved by Public Works.

Drainage shall not be diverted from one major drainage facility to another.

10.3.8 SEPARATE CONVEYANCE
Irrigation waters and public storm drain waters shall be conveyed by separate systems, unless specifically approved by TCID. All plans adjacent to or containing an irrigation ditch shall require the signature of TCID on the plans.

10.3.9 CHANNEL LINING
Lining for drainage channels shall conform to the following requirements:
   a. Major drainage channels within easements or to detention facilities shall either be piped or concrete.
   b. Minor channels may be earthen or of a material suitable to Public Works.
   c. Access road to be constructed when required.
Storm drain waters piped to a major drainage facility shall extend, at a minimum, to the 25-year flood line and be rip-rapped from the outlet to the bottom of the channel in the direction of flow. Channel modifications for erosion control shall be designed so that the receiving channel or entering channel will contain the flows without erosion.

10.3.10 PIPING REQUIREMENTS

Constructed public drainage facilities with design flows of 60 cubic feet per second or less shall be piped in accordance with Public Works standards. Constructed drainage facilities with flows exceeding 60 cubic feet per second may be open channel construction in accordance with Public Works standards, when approved by Public Works.

10.3.11 PIPE CLASS

All storm drain piping 36" and larger in diameter located within the City right-of-way shall be a minimum of RCP Class III or the appropriate class when design requires higher pipe support strength. Storm drain piping smaller than 36" shall be RCP Class III or solid wall plastic pipe with a minimum stiffness of 46 psi as specified in the Orange Book. Individual catch basin leads may be constructed of un-reinforced concrete pipe, Class III or solid wall plastic pipe with minimum stiffness of 46 psi as specified in the Orange Book.

Corrugated metal pipe (CMP) for public improvements may be used only at specific locations approved by Public Works. Headwalls or culvert extensions with rip-rap shall be required on CMP culverts. (See Section 10.3.13)

10.3.12 PIPE DIAMETER

Minimum pipe diameter for any public storm drain shall be 12-inch except for individual catch basin leads not exceeding 80 feet in length which may be 10-inch minimum diameter. Driveway culverts shall be 12-inch minimum CMP or RCP per specific review and approval by Public Works. Headwalls will be required on all driveway culverts.

10.3.13 HEADWALLS

Standard headwalls shall be placed on the inlet and outlet of all public pipe culverts; flared end sections may be used only with approval of Public Works. For pipes up to and including 72 inches in diameter: the design, size, and material used shall comply in all cases with Public Works standards. Headwalls for pipes exceeding 72 inches require special design approved by Public Works. A minimum three steel "C"-shaped tie-backs per joint shall connect the last two pipe segments and the flared end section. Holes are to be grouted and tie-backs encased in concrete.

10.3.14 TRASH RACKS

Trash racks shall be provided at the upstream and downstream end of all closed public conduits as approved by Public Works.

10.3.15 SWALES

Reinforced concrete interceptor swales are to be provided along the top of retaining walls and cut slopes to intercept drainage. Discharge shall be into an approved drainage facility. All backlot drainage shall utilize reinforced concrete swales to intercept drainage from adjacent property and shall include easements, fencing, and gates.
10.3.16 MANHOLES
Manholes for public improvements shall be located at junction points, changes in horizontal or vertical alignment exceeding the maximum allowable pipe deflection, changes in conduit size and at the end of public lines unless approved otherwise by Public Works. When permitted by Public Works, pipe may be placed on curves (horizontal and vertical) and shall meet manufacturer's recommendations for curved alignment. All curves, radii, length of pipe joints, and types of pipe shall be shown on the plans. Manholes shall be spaced at intervals not greater than 350 feet for pipe sizes of 21 inches and smaller and at 600 feet maximum spacing for pipe sizing of 24 inches and larger, unless otherwise approved by Public Works. When permitted by Public Works, pipe may be placed on curves (horizontal and vertical) and shall meet manufacturer's recommendations for curved alignment. All curves, radii, length of pipe joints, and types of pipe shall be shown on the plans. Manholes shall be spaced at intervals not greater than 350 feet for pipe sizes of 21 inches and smaller and at 600 feet maximum spacing for pipe sizing of 24 inches and larger, unless otherwise approved by Public Works. All manholes with a barrel diameter greater than 48 inches shall require installation of a 36 inch diameter lid. Concrete collars shall be placed around all manholes, valves or other appurtenances within any right-of-way or easement. Such collars shall encircle all casting with a minimum width of one foot. Manhole collars shall conform to standard details; all others shall extend to a minimum depth of one foot.

10.3.17 CATCH BASINS
Catch basins shall be installed at low points of roadways and/or vertical curves, at all major street intersections, and at sufficient intervals to intake the peak flow for the 5-year storm runoff such that flows will not interfere with traffic or flood adjoining property. In no instance shall the flow of water from the 5-year storm extend more than halfway onto the lane adjacent from the curb. Streets without parking lanes will require more frequent inlet locations. Laterals from catch basins are to tie into manholes or into the main storm drain line in the direction of flow. Catch basins shall not tie into each other unless otherwise approved by Public Works. Flow along gutters and into inlets shall be computed by the Rational Method using coefficients based on zoning and ultimate future development. “Sur-trap” grease traps or an approved equal shall be installed within all catch basins. Alternate means of sediment and petroleum control, such as sand oil separators, "Storm-ceptor", etc., may be approved in lieu of a “sur-trap” grease traps.

10.3.18 STRUCTURES
Drainage structures under and/or through all streets shall be designed to carry the runoff generated by the 25-year storm from fully developed conditions within the watershed, based on maximum density and in accordance with current zoning.

10.3.19 EASEMENTS
Storm drain easements for public improvements shall be a minimum width of 10 feet. The final easement width shall be determined by pipe width, required trench clearance, and excavated trench side slopes not less than 1:1 horizontal to vertical, unless approved Public Works.

10.3.20 VALLEY GUTTERS
Reinforced concrete valley gutters for public improvements may be placed at street intersections only when approved by Public Works.

10.3.21 CURB AND GUTTER
All impermeable on-site private drainage shall be contained by Portland Cement concrete curb and gutter or longitudinal valley gutter to Public Works standards.
10.3.22 EMBANKMENTS
Embankments shall not be placed within the 100-year flood plain of a major drainage facility without prior approval by Public Works. Where such approval is given, the embankment shall be faced with riprap to a minimum of 1 foot above the 100-year flood line.

10.3.23 NDEP APPROVAL
Any work which requires fill intended to be placed within the "waters of the State of Nevada" shall receive permission from the State Department of Environmental Protection prior to beginning construction. Public Works shall receive a copy of this permission prior to issuance of any permit.

The U.S. Army Corps of Engineers may require permitting for projects involving “waters of the State of Nevada and/or the United States”.

Contractors will be required to prepare Storm Water Pollution Prevention Plans (SWPPP) for all disturbances in excess of one acre.

10.3.24 NDOT PERMIT
Prior to issuance of any permit for any facility encroaching on state right-of-way, and for disposal of any drainage onto state right-of-way, the approved NDOT encroachment permit shall be furnished to Public Works.

10.3.25 SAND-OIL SEPARATORS
At the direction of Public Works, sand-oil separators will be required for storm drainage installations that drain parking lots or other areas that have the potential to contribute sediment or oil to the storm water runoff. The separators shall be constructed in accordance with Public Works Standard Details.

10.4 LOT DRAINAGE SWALES (PRIVATE)

10.4.1 REQUIREMENTS
Surface drainage swales collecting runoff from the area of 2 or more lots are to be concrete in accordance with Public Works standards and are to be fenced and gated at the time of construction of the swale. The swale shall be maintained and perpetuated by the property owners. Paving is not required for common side lot swales serving only 2 adjacent lots.

10.4.2 EASEMENTS
Easements for rear lot drainage swales shall be established by a note on the official plat substantially as follows:
The rear 5.0 feet of Lots _____, _____, _____, etc., shall be subject to a permanent private and reciprocal drainage swale easement.

-- When Appropriate Add --
Which easement shall be further reciprocal with all lots the rear lot lines of which abut such easement.
10.4.3 DESIGN
Standard lot line drainage swales are to be designed to carry the waters generated by a 25-year 6 hour frequency storm, with a maximum of 6 lots contributing run-off to the swale. Discharge from swales shall be conveyed to a central drainage facility. Should it be necessary to provide for drainage from more than 6 lots and/or to exceed the maximum horizontal or vertical alignment, a modified design capable of conveying the run-off from the 25-year 6 hour storm may be submitted for consideration by Public Works.

10.5 WATER SUPPLY/DRAINAGE DITCHES

10.5.1 NON-PERMITTED DISCHARGE
No storm drainage runoff shall be allowed to flow or discharge into any TCID/BOR water supply ditch. Authorization for discharge into drainage facilities from urban or agricultural sources shall only be granted to established governmental entities like cities and counties and quasi-governmental entities upon approval by TCID/BOR.

10.5.2 LOCATION
Where water supply ditches are located within or adjacent to a subdivision/development, improvements and access as required for the operation and maintenance of the ditch shall be provided to TCID. Any improvements within TCID easements are subject to TCID approval.

10.5.3 FENCING
Property abutting or adjoining any water supply ditch shall have 54-inch fencing approved by Public Works.
11.0- ALTERNATIVE WATER

11.1 GENERAL

11.1.1 APPLICABILITY
All civil improvement plans shall include for approval, unless waived by Public Works, an alternative water configuration signed and stamped by a Nevada Registered Civil Engineer in accordance with Public Works standards.

11.2 DESIGN CRITERIA

11.2.1 PIPING CONFIGURATIONS
Piping will follow potable water system piping configuration and design unless specifically identified in Section 11.0 – Alternative Water.
A dry alternative water distribution main is required in all new streets as well as entire property frontage if improvements are made within the public right-of-way. The minimum diameter for alternative water distribution mains shall be eight (8) inches. If an alternative water main exists in the street frontage of any project including civil improvement plans, the project shall be conditioned to connect to said main.
This piping will only be utilized for non-potable use and must be located within public rights-of-way or public utility easements with a minimal of 10 feet of horizontal separation from potable water lines. Non-potable warning tape and trace wire shall be utilized.

11.2.2 COLOR - CODING
All pump motors, piping, metering, and valving will be coated with a purple epoxy (2 coats). All air vac valve assemblies, flush valve assemblies, vault lids, and associated appurtenances shall be coated with purple epoxy. All buried piping shall be purple PVC or ductile iron. All non-purple piping including valving and fittings shall be entirely bagged in purple-colored polyethylene film and sealed. Non-potable water mains shall be installed at nominal depths of 36 inches below finished grade.

11.2.3 CROSS - CONNECTIONS
Potable cross-connections and hose bib connections are not permitted. Overspray of the irrigation system will not be permitted on public drinking fountains and areas of land use not designated to receive non-potable water.
Public workshops and notifications to homeowners will be conducted for public awareness of potential public health hazards with ingestion or physical contact with non-potable water.

11.2.4 METERS
Each individual lot shall incorporate residential water meter boxes with purple lids unless a larger service is required. The meter boxes shall be located on opposite property lines from potable water meters.

11.2.5 SPRINKLER SYSTEM
The sprinkler system shall be designed to preclude overspray onto land uses not suitable for non-potable water applications. The sprinkler system must be designed to preclude breeding of insects and creation of odors or unsightly deposits. Sprinkler systems shall
be designed to apply non-potable water at a rate that does not exceed the infiltration rate to preclude run-off. Location of drinking fountains must be shown on the irrigation plans. Sprinkler over-spray will not be permitted on drinking fountains. Proper signage shall be included in the design indicating “CAUTION: NON-POTABLE WATER – DO NOT DRINK” at intervals not to exceed 50 feet.

11.2.6 QUICK COUPLERS

Quick couplers shall be constructed of brass with a purple snap-on cover and shall have a ¾-inch or 1-inch inlet. All non-potable water quick couplers shall be installed below grade in a round box designed for irrigation use. The cover shall have a warning label identifying non-potable water and be purple in color.

11.2.7 FINAL INSPECTION

Final alternative water system inspection is required prior to final acceptance by Public Works.

11.3 ONSITE GENERATED NON-POTABLE WATER (GRAY WATER)

11.3.1 DESIGN SUBMITTAL

Alternative water supply for residential irrigation such as gray water systems shall be submitted to Public Works and the Building Department for review on a case-by-case basis. A study conducted by a licensed engineer must accompany submittals for consideration. The study must show that water production will be of sufficient quantity to sustain vegetative growth. The analysis must also show that production of water will be suitable for discharge onto the soil.

11.3.2 NON-IRRIGATION DISCHARGE

The residential irrigation systems must be capable of providing adequate water during irrigation months and delivery of water to the public sewer during non-irrigation months. The water system must be capable of managing deposit of solids and prevention of septic conditions in the water collection chamber. The system application rate must be less than or equal to the infiltration rate of the soil to preclude runoff.
12.0 - INSPECTION, TESTING, VERIFICATION, AND QUALITY ASSURANCE PROGRAM (QAP)

12.1. INTRODUCTION
It is the intent of this section to set forth the requirements and responsibilities of those parties involved in the inspection, testing, verification, and acceptance of public improvements and other new construction and to provide consistent and satisfactory quality of such improvements. 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 handled in a professional manner with final approval by Public Works.

The QAP elements contained herein shall be applied to the following:
1. All public improvements in subdivisions, parcel maps, maps of dedication, record of survey, and easements related to subdivision of land; and
2. Other major public improvements as required by the City.

All construction as noted above shall have a Quality Assurance Firm (QAF) retained by the owner and reporting to the City’s Quality Assurance Manager. The contractor shall not retain the QAF unless he is the owner. The QAF shall not be the contractor. The QAF shall be responsible for all inspection, testing and verification of the constructed improvements as to compliance with this chapter, the improvement plans of record and the Fernley Municipal Code. All new construction requiring a QAF shall have a Testing Firm responsible to the QAF and reporting to the QAF. The QAF is not responsible for means, methods, techniques, sequences or procedures of construction, nor safety of the construction site.

12.2. RESPONSIBILITIES
This section outlines the responsibilities of the parties subject to the QAP. All parties shall comply with all applicable Federal and State laws, City ordinances, and regulations, which affect the design and construction of City of Fernley public improvements.

12.2.1. OWNER
1. Shall retain the services of a QAF.
2. Shall retain the services of a Testing Firm which shall be responsible and shall report to the QAF.
3. Shall make every reasonable effort to retain, as the QAF, the services of the Engineer of Record.
4. Shall make every reasonable effort to retain, as the Testing Firm, the services of the Geotech.
5. Shall retain the services of a contractor and notify said contractor of the requirements of this chapter.
6. Shall be responsible to the City for the adequacy of completed work covered under this chapter. Any defective material, equipment, or workmanship, or any unsatisfactory work which may be discovered before final acceptance, or within one year thereafter, shall be corrected immediately upon the requirement of the QAF, EOR, or the City, without
extra charge, notwithstanding that it may have been overlooked in previous inspections. Failure to ensure adequate inspection of the work shall not relieve the owner from any obligation to perform sound and reliable work.

7. Shall designate a representative with authority to act on behalf of the owner for all work performed.

8. The owner acknowledges the need for continuing involvement of the firms or persons responsible for the preparation of the approved project soils report and the approved improvement plans of record during construction. In the event the QAF is different from the above-mentioned firms or persons, the owner agrees to be financially responsible for services provided by said firms or persons as requested by the QAF.

12.2.2. QUALITY ASSURANCE FIRM (QAF)

1. Shall initiate and conduct a pre-construction conference for construction of improvements at least one week in advance of initial construction. Representatives of the owner, contractor, affected utility companies, City, QAF, and Testing Firm shall attend.

2. Shall submit for review, prior to initiation of the preconstruction conference, the qualifications of the Testing Firm, testing technicians, and field inspectors for the project. Said qualifications shall meet the minimum as specified in this chapter.

3. Shall provide a written summary of the pre-construction conference to the owner, contractor, and the City, and will also notify the participants of any significant changes in writing at least two working days in advance of the changes.

4. Shall make inspection of workmanship and materials in accordance with this chapter. No work or materials will be accepted by the City without such inspection. The QAF will make every reasonable effort to perform inspection and testing services in a manner which will accommodate the construction schedule.

5. Shall provide to the City’s Quality Assurance Inspector (QAI), on a weekly basis, copies of the daily inspection/testing reports for the previous week. These reports need only refer to activities and improvements subject to the QAP.

6. Shall immediately notify the City and the EOR of any proposed changes from the approved improvement drawings of record. Should the City determine that the proposed change is major in nature, such change shall require prior approval by the City. The City will not be liable for any delays caused by the review and approval of such changes.

7. Shall arrange as part of his contract with the owner to confer and coordinate with the firms or persons responsible for the preparation of the approved project soils report and the improvement plans of record throughout the construction of the project to evaluate compliance with the requirements of this chapter. In the event that the firms or persons responsible for the preparation of the approved project soils report or drawings of record are not available for consultation, the QAF shall notify the City of such prior to commencement of construction. In this event, the QAF and the City shall agree to an alternate arrangement for
providing the necessary soils report and improvement plans of record interpretations prior to commencement of construction.

8. If during the course of construction, the QAF finds that defective materials or workmanship not meeting City requirements have been constructed and not satisfactorily corrected by the contractor within one week of verbal notification to the contractor, shall notify in writing the owner, contractor and City. The written notification shall be supported by field reports and/or test results.

9. Shall be familiar with this document, the approved improvement plans and soils report, and the latest revisions of the Design Manual, Standard Detail Sheets and Standard Specifications for Public Works Construction. The QAF and associated field personnel shall also be familiar with AWWA, UPC, NAC, and NRS documentation as related to the installation of public improvements.

10. Shall upon completion of construction of improvements, sign and wet-stamp, or cause to be signed and wet-stamped by a Nevada Registered Civil Engineer, all drawings of record, reports, and test data, and shall provide to the City with:
   • A letter verifying the adequacy of improvements and that construction, inspection, and testing were performed in compliance with this chapter, improvement plans of record and City standards.
   • A complete packet of daily inspection/testing reports.
   • As-Built Record Drawings as outlined in Section 2.13, or a statement that no changes were made from the approved improvement plans of record.

The final completion and acceptance of all such improvements, including recommendations of release and return of any security shall be subject to the approval of the City.

11. Shall notify the City of the date and hour that the following types of work are expected to begin:
   • Grading, excavation, and fill operations within public right-of-way.
   • Laying of sewer lines, drainage lines, or appurtenances.
   • Backfilling of sewer lines, drainage lines, or appurtenances.
   • Placing of reinforcing steel, forms and falsework for concrete structures.
   • Placing concrete for curbs, gutters, sidewalks, alleys, valley gutters, headwalls, or structures.
   • Placing of any type of base course.
   • Tacking bituminous or concrete surfaces.
   • Placing asphalt concrete or Portland cement concrete pavement.
   • Sealing asphalt concrete or Portland cement concrete pavement.

Notification shall be given not less than 24 hours in advance or as otherwise provided in City standards; and, if thereafter conditions develop to delay the start of work, the QAF shall notify the City of the delay not less than two hours before the work is to begin.
12.2.3. CITY OF FERNLEY

1. Shall assign a primary contact to the QAF who shall serve as the City’s representative during construction of public improvements. This primary contact shall be known as the City’s Quality Assurance Inspector (QAI). The qualifications of the QAI, as a minimum, will meet the qualifications of a Public Works Construction Inspector. The QAI, with the City’s Quality Assurance Manager’s approval, shall have the authority to issue a stop work order for non-compliance with the QAP.

2. Shall review the qualifications of the QAF to determine their compliance with minimum requirements of this chapter. If it is determined that the QAF does not meet said minimum requirements, the owner shall retain a QAF meeting the qualifications of this chapter.

3. Shall review the qualifications of the QAF field inspection personnel and the Testing Firm field personnel to determine their compliance with the minimum requirements of this chapter.

4. Shall attend the preconstruction conference initiated by the QAF.

5. Shall check and evaluate that adequate inspection personnel are on-site during the construction of bonded improvements. Should the QAI determine that adequate personnel are not available on-site for inspection, the QAI shall immediately advise the QAF and the Quality Assurance Manager of the situation and so record the incident.

6. Shall keep a daily log of sites visited and document any discrepancies noted including pertinent conversations with the QAF.

7. Shall, on a weekly basis, review the daily inspection/testing reports submitted by the QAF. Any unsatisfactory test results shall be called to the attention of the QAF who shall take immediate action to correct the deficiency.

8. Shall review final submittance package by QAF to ensure all inspection reports are included in the package. Should QAI determine that package is lacking reports, the QAI shall immediately advise the QAF to submit missing reports.

9. Shall evaluate the performance of the QAF’s field inspection personnel. The City shall have the authority to reject the selection of the testing firm, testing technicians or field inspection personnel for the project. The City shall also have the authority to reject the field inspection personnel or testing technician and direct substitute personnel in the event of unsatisfactory performance by said personnel in the opinion of the Quality Assurance Manager.

12.2.4 CONTRACTOR

1. Shall be responsible for construction of improvements. This responsibility shall include the means, methods, techniques, sequence, and procedures of construction and safety of the construction site. All such construction shall conform to the requirements of both the most recently adopted version of the Standard Specifications for Public Works Construction (SSPWC) and the requirements of this chapter.

2. Shall attend the pre-construction conference initiated by the QAF. The contractor shall present a proposed construction schedule including construction milestones, and designate a representative who has the authority to resolve issues during construction.
3. Shall provide accessibility and exposure of all construction work subject to inspection until inspected by the QAF. Neither the City nor the QAF shall be liable for expenses entailed in the removal or replacement of any material required to allow inspection.

4. Shall notify the QAF two working days in advance of initiating construction of items outlined in Section 12.2.2 of this chapter.

5. Shall notify the QAF two working days in advance of initiating construction or resuming construction after any unscheduled interruptions.

6. Shall coordinate all sub-contractors for required inspections and testing.

12.3. INSPECTION REQUIREMENTS
For the purpose of implementing the requirements of this chapter, full-time inspection shall mean the QAF or his field inspector shall be present at all times to observe the operations of the contractor during the designated construction activity. The following tests will be under the direction of the assigned Engineer of Record for the project. The City reserves the right to require additional testing and/or inspections at its discretion and the costs of which shall be the responsibility of the owner.

12.3.1 GRADING, EXCAVATING, AND FILL
Inspection of all materials, native or imported, to evaluate their compliance with City standards; that the subgrade is prepared according to City standards; that all subgrade materials encountered are as expected according to the approved soils report, or if not, are appropriately addressed by over-excavation and stabilization with suitable material or as otherwise recommended in the approved soils report or by redesign of the pavement section. The QAI may assist the QAF in identification of material that is not in compliance with City standards, however, the QAI will not solely identify the limits of the substandard material. This is the responsibility of the QAF, Owner, EOR or Geotech. Full-time inspection is required for any placement of fill (trench backfill, mass grading, etc.) within existing or proposed rights-of-way.

12.3.2 STREET
Inspection by survey, hand level or string line to determine that alignment and grade of sub-grade, base grade and finish grade of the street conforms to the improvement plans of record. QAI shall be notified for string-line, survey or hand-level to check for subgrade.

12.3.3 UNDERGROUND UTILITIES
1. Inspection of pipe materials and bedding prior to the placing of any pipe to evaluate conformance with City standards. Collection of applicable manufacturer's certifications.

2. Inspection of installation of pipe laid to grade, mortar jointed or gasketed pipe prior to placing any material around or above pipe to evaluate conformance with City standards.

3. The QAF, in the presence of utility personnel, shall verify all valves are "on" prior to paving, and shall provide documentation of inspection to QAI a minimum of 48 hours prior to paving.
4. Inspection of construction and/or installation of manholes, catch basins, and drop inlets to evaluate compliance with City standards.
5. Inspection of alignment and elevations to evaluate compliance with the improvement plans of record and specifications.
6. Videotaping Lines: The interior of all sanitary sewer lines with inside diameters of 48” or less shall be inspected with a video camera. Prior to videotaping, water shall be introduced into the sanitary sewer, but not more than 24 hours in advance. The videotaping shall be performed after the ball and mandrel test, with an acceptable video tape submitted prior to paving and as described hereinafter.
   a. The QAF shall be present for all videotape inspections. The QAF shall direct the videotape operations throughout the entire inspection process. The absence of voice-over by the QAF shall be grounds for rejection.
   b. All pipes shall be clean and free of standing water prior to videotaping.
   c. All manholes, catch basin laterals, and sewer laterals will be identified using the numbering system from the approved plan set.
   d. Each segment videotaped will begin with a voice-over by the QAF stating the date, project name (detailed enough to identify similarly named projects), starting point, ending point, direction of travel, pipe type, and pipe size.
   e. The camera used shall have an articulated head and be adjustable for height in order to have the camera centered in the pipe being televised. The camera shall have an adequate illumination system, be capable of taking color still photos and provide visibility to the entire inside diameter of the pipe.
   f. The camera shall be stopped at all defects encountered and a still photo taken of the defect. The QAF shall not authorize paving activities until said defects have been satisfactorily corrected and meet the applicable City standards as identified via additional video taping following correction of the defects.
   g. The QAF will submit the video tape to the City, along with a written report of the findings or other notes, what deficiencies were encountered, how they were corrected, still photos, all plans used to produce the report and a set of as-built drawings identifying all lines that were video taped. Said report and drawings shall be submitted to the Quality Assurance Inspector.
   h. With the submittal of the video tape and written report by the QAF, the Contractor will be notified by the QAF to proceed with paving operations.
   i. If, in the opinion of the QAF, review of the submitted video tape by the QAI is necessary prior to paving, the QAF will notify the Contractor that paving operations will not proceed without said review.
7. Vacuum testing shall be required on all newly constructed sanitary sewer manholes per the requirements of ASTM C-1244. These tests shall be performed in the presence of the assigned QAF or his representative. These tests shall be performed, as applicable, prior to any paving
operations. The QAF shall not authorize paving unless the tests are satisfactorily passed. A report summarizing the results of the applicable test will be forwarded to the QAI.

8. Ball and Mandrel Test - A ball and mandrel operation shall be required on all newly constructed sewer mains. The tests shall be performed in the presence of the assigned QAF or his representative. A report which includes and summarizes the results of this test will be forwarded to the QAI.

9. Sanitary sewer or storm drain facilities shall be recommended for acceptance to the City Council by the Quality Assurance Manager based on the information contained in the reports of the previously mentioned tests and the verification of the QAF.

10. Inspection for pipe installation, not including backfill, by utility company shall be the responsibility of the appropriate utility.

12.3.4 AGGREGATE BASE COURSES FOR STREETS, CURBS, GUTTERS, SIDEWALKS AND ALLEYS
Inspection of all material brought to the site to evaluate uniformity with tested and approved samples; inspection of placement and compaction of aggregate base to evaluate compliance with City standards and to confirm that grades conform to those specified in the improvement plans of record.

12.3.5 REINFORCING STEEL, FORMS AND FALSEWORK
Inspection of reinforcing steel, forms, and falsework prior to placement of concrete to evaluate compliance with the improvement plans of record, specifications, shop drawings and City standards.

12.3.6 PORTLAND CEMENT CONCRETE
Full-time inspection of all exposed concrete pours including curb, gutter, sidewalks, driveway apron, alleys, valley gutters, structures, headwalls, slope paving, roadway pavement and manhole, valve and monument collars to evaluate compliance with the improvement plans of record, specifications, details, and City standards.

Defects requiring immediate replacement are the same as the requirements for sidewalk maintenance and repair in Section 3.4.13 of these Design Standards.

Any defects not explicitly listed in Section 3.4.13 of these Design Standards may remain in place, with monitoring provided by the QAF, until the warranty period has run. At the end of the warranty period all defects must be replaced.

12.3.7 ASPHALT CONCRETE
1. Full-time inspection to evaluate compliance with the improvement plans of record, details, specifications, and City standards.
2. Full-time inspection of the installation of all traffic control asphalt markings for compliance to the manufacturer's specification for each product, contract drawings, MUTCD and City standards
3. Asphalt materials shall be sampled, tested, and reported per Standard Specifications for Public Works Construction.
4. A bituminous mixing plant inspection shall be required for each day of asphalt pavement placement or portion thereof. The requirements of the
plant inspection are to be determined by the QAF and must at least include:

a. Collection of asphalt binder sample to be archived by the QAF until the associated improvement is accepted by the City.
b. Verification of lime addition to the mix.
c. Verification of temperature of mix leaving plant.
d. Verification of asphalt binder type and obtainment of refinery certification.

Should an obvious problem be observed, the engineer of record shall be informed immediately, and the engineer of record shall require corrective action.

12.3.8 PRIME COAT, TACK COAT, SEAL COAT AND SURFACE TREATMENT
Sufficient inspection to evaluate compliance with City standards.

12.3.9 STRIPING
Provide adequate inspection to insure proper striping placement.

12.3.10 LANDSCAPING AND IRRIGATION
Sufficient inspections to evaluate compliance with City standards within the City Right-of-way or within public improvement easements, the improvement plans of record, and specifications. No public landscaping or irrigation shall be accepted for maintenance by the City without a memo from the Parks Department. Prior to acceptance of improvements within the project, the Engineering Division will notify the Parks Division and make arrangements for an on-site inspection of the landscaping to make sure that the landscaping is healthy and that the irrigation system is in a good state of repair and meets City of Fernley code requirements. The Engineering Division will notify the developer of any necessary plant replacements or irrigation repairs that are necessary prior to acceptance. Following any replacements or repairs, the Engineering Division will arrange another on-site inspection with the Parks Division. When everything is acceptable and the developer has submitted drawings of record, then the Engineering Division will notify the Parks Division of the date when the City accepts the improvements and becomes responsible for maintenance.

12.3.11 TRAFFIC CONTROL
Sufficient inspection of the construction traffic control is required in active streets to assure compliance with the City-issued encroachment permit traffic control plans. If the contractor is working in the City right-of-way in violation of such encroachment permit or without said permit, the QAF shall immediately notify the QAI.

12.3.12 TRAFFIC SIGNALS
Traffic signal loop detection shall be laid out in the field by the contractor per the design plans. The City of Fernley Traffic Signal Maintenance staff will verify installation and accept the traffic signal only after the QAF has provided the following:

1. A complete inspection of the signal installation by experienced personnel.
2. Signal phasing and timing patterns.
3. Proof of completion by the QAF prior to signal turn-on.
4. A copy of the building permit for the electrical service with a sign off by the City's electrical inspector.
5. Copies of non-standard parts approvals, warranties, instruction manuals, etc.

The signal will be turned on only after City of Fernley signal maintenance staff have made a final walk-thru and have approved that the signal installation is complete. Where any development disturbs existing City of Fernley facilities, said facilities shall be relocated by the developer to current standard detail locations.

12.3.13 ASPHALT PATCHES

The quantity, if any, of asphalt patches that have occurred prior to final acceptance of a street, will be examined by the City. All patches occurring after final paving and before final acceptance must be removed and replaced with full-width street improvement along their entire length. The City will accept a performance bond in lieu of immediate repair if prohibitive weather conditions exist at the time of substantial completion.

12.3.14 OTHER SPECIFIED ITEMS

The QAF shall witness, test or approve as appropriate the following items in addition to those listed in Section 12.3:

1. Witness delivery of critical equipment such as valve components, manhole components, hot-tap components and other critical components prior to installation, to assure that no damage is experienced during delivery.
2. Approve construction aggregates for compliance with applicable standards.
3. Water and Sewer services are appropriately marked on the curb with either a “W” or an “S” as appropriate.
4. Verify that metal surfaces on underground valves are liberally coated with mastic.
5. Verify that there are no common trenches between water/sewer and other utilities
6. Verify that sewer manholes have been allowed to cure seven days prior to leaving the supplier. The QAF may require a core test to verify integrity.
7. Verify that utility relocations are approved by the EOR prior to relocation. Field drawings approved by the EOR of as-built locations may be required by the QAF or the QAI prior to the relocation.

12.4 TESTING REQUIREMENTS

Shall comply with the requirements set forth in the latest revision of City standards.

12.5 REPORTING REQUIREMENTS

This section outlines the reporting requirements and responsibilities for the QAF and Testing Firm.

12.5.1 DAILY FIELD REPORT CONTENTS

The minimum required information to be submitted in daily field reports includes:
1. Name of Inspector and Contractor.
2. Equipment in operation.
3. Hours of utility installation work.
4. Date
5. Time on the job site by field personnel.
6. Significant progress made by Contractor since the Inspector’s previous site visit including description and verification of the following work:

**GENERAL:**
- Bedding compaction using 250-foot minimum increments in utility trenches and under pavement sections, sidewalks, and buried concrete structures/vaults.
- Compaction of each lift of backfill using 250-foot minimum increments. Equipment such as valve components, manhole components, hot-tap components and other critical components prior to installation.
- Placement of concrete collars around manholes and valve boxes.
- Placement of proper valve box and manhole lids.
- Horizontal separations between water and sewer/storm drain.
- Vertical clearances and or concrete encasement of sewer or storm drain at water / sewer / storm drain crossings.
- Placement of water and sewer services including meters and markers.
- Material type and quality.

**WATER:**
- Proper size and type of piping.
- Placement of chlorine tablets.
- Placement of thrust blocks.
- Placement of anchorage into thrust blocks.
- Placement of warning tape and locator wire.
- Depth of water main below finished grade.
- Alignment of fire hydrants.
- Placement of Storz fittings on all hydrants.
- Valve assemblies prior to burial.
- Placement of air valve assemblies.
- Placement of bollards around assemblies.
- Placement of customer valves on all meter assemblies.
- Proper placement of meter boxes and meter sets including insulation blankets.
- Placement of backflow prevention assemblies including testing.
- Hydrostatic testing of piping systems.
- Bacteria testing of water lines.
- Full-time inspection during hot-tap operations.

**SEWER:**
- Proper size and type of gravity and force main piping.
- Slope of gravity sewer lines once for every 100-feet of line.
- Location and type of manholes.
- Proper coring of existing manholes.

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- Pressure testing of gravity and sewer force mains.
- Vacuum testing of manholes.
- Ball-and-flush testing of gravity sewer lines.
- TV inspection of sewer mains.
- Testing of E-One facilities.
- In-Line valves and cleanouts on low-pressure sewer force mains.
- Placement of corp. stops and check valves on all low-pressure sewer force mains.
- Placement of sewer air valve assemblies on sewer force mains.
- Placement of bollards around assemblies.
- Placement of sand-oil separators.
- Bedding for pipe (specifications).
- Clearances from other utilities (10’ lateral/18” Horizontal).
- Sanitary Sewer Manholes throat depth.
- Manhole type.
- Manhole vacuum testing.
- SS pipe tests for infiltration/ex-filtration.
- Manhole base bedding.
- SS lateral at 5’ behind curb and sidewalk.
- Locating tape presence.
- Trench compaction.

STORM DRAINS:
- Proper size and type of storm drain piping.
- Proper slopes on all piping.
- Location and type of manholes;
- Placement of catch basins.
- Placement of sidewalk cross-drains.
- Placement of driveway culverts.
- Proper size and type of culverts.
- Placement of drainage channels.
- Proper size and configuration of drainage channels.
- Placement of concrete lining and fencing of drainage channels
- Proper size, location, and configuration of Detention Basin.
- Proper alignment and height of Detention Basin overflow spillway.

STREETS:
- Proper alignment and configuration of Right-of-Way.
- Radii of cul-de-sacs.
- Proper thickness and type of AC pavement.
- Core samples of pavement sections.
- Verify maximum slopes with a smart level.
- Gutter pan flow testing.
- Placement of ADA pedestrian ramps.
- Placement of valley gutters and aprons.
- Placement of stop bars, stop and street signs, striping, and painting of curbs adjacent to fire hydrants.
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- Placement of survey monuments.
- Placement of barricades.

7. Field compaction data with the ASTM D1557 proctor curve being used.
8. Dated signature of field personnel and contractor.
9. Special inspections relating to sewer lift stations, groundwater wells, water well and booster pumping stations, water tanks, etc. shall be conducted on a case-by-case basis.

12.5.2 FIELD REPORT FORMAT
Weekly inspection reports may be faxed or hand delivered to the QAI. The preferred format of a Daily Field Report is a legible report written in the hand of, and signed by, the field personnel responsible for performing the inspection. Reports may be scanned and emailed in PDF format to the QAI at qualityassurance@cityoffernley.org as well. Photos may be sent via fax or email in JPG format.

12.5.3 FIELD REPORT PHOTOGRAPHS
Photographs may be taken at the discretion of QAF field personnel. Public Works recommends that photographs be taken during key phases of the utility construction, installation of major utility improvement apparatuses and of defective and/or substandard materials and installations. Each photo should have a written description including the approximate location of the photo’s subject. The use of a numbering system is preferred. The photos should be 3” x 5”. Public Works recommends the use of a digital camera for record photos as they may be transmitted and stored electronically.

12.5.4 FINAL REPORT FORMAT
The final inspection report is a compilation of the weekly field reports. It shall be in an appropriate format, have a cover page, a table of contents, and appendices for test results and photographs. References to corrective actions must accompany all daily reports that refer to substandard materials or installation.

12.5.5 AS-BUILT RECORD DRAWINGS
The QAF shall review the as-built drawings to ensure accuracy. As-built record drawings must be submitted to Public Works prior to the acceptance walk-through, but no more than thirty days after the completion of construction.

12.6 PERSONNEL QUALIFICATIONS
This section outlines the minimum qualifications of the parties subject to the QAP. Quality Assurance Firms, Testing Firms, and associated field personnel who wish to perform their duties under the Quality Assurance Program submit a list of qualifications. After review, qualified firms and individuals will be placed on an approved list. If any firm or individual is not performing satisfactorily, the Quality Assurance Manager reserves the right to remove the firm or individual’s name from the list.

12.6.1 QUALITY ASSURANCE FIRM
A Quality Assurance Firm who is retained as a consultant by the owner is required to be legally authorized to practice civil engineering in the State of
Nevada in accordance with NRS Chapter 625, and maintain a valid City of Fernley business license.

A firm, a copartnership, a corporation or joint-stock association may engage in the practice of Quality Assurance Firm in the City of Fernley, if the member or members of the firm, copartnership, corporation or joint-stock association immediately responsible for engineering work performed in the City of Fernley are Nevada registered professional civil or geological engineers in accordance with NRS Chapter 625.

Every office or place of business of any firm, copartnership, corporation or joint-stock association engaged in the practice of Quality Assurance Firm in the City of Fernley shall have a registered professional civil engineer in residence and in direct responsible supervision of the work needed to satisfy the requirements of this chapter conducted in such office or place of business.

A Quality Assurance Firm shall be familiar with City standards and all associated testing procedures.

12.6.2 FIELD INSPECTORS AND TESTING TECHNICIANS
The Field Inspector and Testing Technician qualifications shall include sufficient education and experience to assure understanding of the quality control principles and the ability to implement the procedures related to their assigned duties. The City of Fernley does not require that individuals performing acceptance or field testing and sampling be certified in accordance with the Nevada Alliance for Quality Transportation Construction (NAQTC), unless specified in writing by the City Engineer or the Engineer of Record. The education and experience requirements specified below shall not be treated as absolute when other factors provide reasonable assurance that a person can competently perform a particular task. One factor may be "demonstrated capability" in a given job through previous performance.

To be considered qualified as a City of Fernley approved field inspector, a candidate must meet the general requirements as mentioned above and satisfy at least one of the following requirements:
1. High school graduate plus at least one year of construction quality control experience in testing, examination or inspection activities.
2. Completion of college level work leading to an associates degree or four-year college degree in a related discipline.

All new personnel shall submit a resume to the City of Fernley Quality Assurance Inspector. All field inspectors shall be familiar with City standards and this chapter, as well as all associated testing procedures.

12.6.3 TESTING FIRM
The testing services of the testing firm shall be under the direction of a registered Civil or Geological Engineer in the State of Nevada who is a full-time employee of the firm and has at least 5 years engineering experience in the inspection and testing of soil, concrete, and asphalt. The testing firm shall maintain a City of Fernley business license.
The testing firm is responsible for laboratory testing of soil, concrete and asphalt and shall have suitable test equipment and laboratory facilities for storing, preparing and testing samples. The firm shall have the capability of performing all laboratory testing associated with its intended functions according to governing procedures and shall have the facilities and equipment required for all laboratory testing performed. If at any one time equipment or expertise in the performance of a specialized test is not available in-house, the services of a qualified subconsultant or his equipment may be utilized.

The firm shall make available information (as applicable) describing its procedural systems (procedures which directly affect the quality of services offered). In addition, the firm shall maintain documentation which provides evidence of compliance with the requirements of its procedural systems. The agency's procedural systems shall include the following:

1. Equipment calibration programs.
2. Standardization of methods of test, measurement, and determination.
3. Data recording, processing, and reporting.

As evidence of its competence to perform the required tests or inspections, the Testing Firm shall have its laboratory procedures and equipment inspected at intervals of not more than three years by a qualified authority in accordance with a recognized plan. For initial acceptance into this Quality Assurance Program as a qualified Testing Firm, a current quality assurance manual must be submitted to the City for review along with a copy of the Testing Firm’s current certification by a qualified authority. In lieu of a current certification, the City may accept the current quality assurance manual, perform periodic review of the Testing Firm’s laboratory, and commission independent third party referee sampling and testing at the prospective Testing Firm’s expense. The “in lieu of” qualification of the Testing Firm will be allowed for a period of not more than two years from the Testing Firm’s initial application for qualification as a Testing Firm under this Quality Assurance Program.