

**100% DRAFT  
CITY OF WILLITS**

**DESIGN AND CONSTRUCTION STANDARDS**



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**CITY OF WILLITS**

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**CITY OF WILLITS**  
**STANDARD SPECIFICATIONS AND STANDARD PLANS**

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## **A.1 - State Standard Specifications**

## SECTION 1: DEFINITIONS AND TERMS

### 1-1.01 GENERAL

#### 1-1.01A Referenced Specifications

Public improvements within the City of Willits shall be constructed in accordance with the most recent version of the Standard Specifications of the State of California, Department of Transportation, Division of Highways, which specifications are hereinafter referred to as the State Standard Specifications, and in accordance with the following modifications and revisions, and City of Willits Standard Plans.

Whenever in the State Standard Specifications the terms State of California, Department of Transportation, Director, Division of Highways or Engineer are used, the following terms shall be understood and interpreted to mean and refer to such substituted terms as follows:

For State of California substitute City of Willits.

For Department--The Public Works Department of the City of Willits.

For Director--The City Engineer of the City of Willits.

For Division of Highways--The Public Works Department of the City of Willits.

For Engineer--The City Engineer, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.

In the event of discrepancy between contract documents, the order of precedence from highest to lowest shall be as follows: (1) Contract Change Order, (2) Permits from other agencies, as may be required by law, (3) Special Provisions, (4) Plans, (5) Standard Plans, (6) The modifications and revisions contained herein, and (7) State Standard Specifications.

Specifications pertaining to the administration of City contracts will be contained in the Special Provisions for the contract.

City Standards shall mean City of Willits Standard Specifications and Standard Plans. ASTM shall mean American Society for Testing and Materials latest edition of the specifications. Standard Specifications for Public Works Construction (commonly called the "Green Book"), shall mean the latest edition of the Standard Specifications written and promulgated by the Southern California Chapter, American Public Works Association and the Southern California District, Association General Contractors of California, a Joint Cooperation Committee.

## SECTION 4: SCOPE OF WORK

### **4-1.02 FINAL CLEANING UP**

Attention is directed to Section 4-1.02 of the State Standard Specifications.

Before final inspection of the work, the Contractor shall clean the construction site and all ground occupied by him in connection with the work, of all rubbish, excess materials, false work, temporary structures and equipment. All parts of the work shall be left in a neat and presentable condition.

Nothing herein shall require the Contractor to remove warning, regulatory, and guide signs prior to formal acceptance by the Engineer.

### **4-1.06 CONSTRUCTION LIMITATIONS**

The contractor will be expected to conduct his operations in a manner that causes minimum damage to the natural vegetation and landscape. Ingress and egress for all off road work shall be via the existing driveways. Care shall be exercised to avoid hazards that may cause injury to persons, animals or property either during working hours or after work hours, which will include dust control, noise control, signage and striping, backfilling trenches immediately following pipe laying and temporary fencing as required.

Prior to working in the City right-of-way, the Contractor shall obtain an encroachment permit from the City. Work by City contract does not require an encroachment permit. A copy of the permit shall be kept on site at all times.

The Contractor will be responsible for obtaining permission from the property owners for any construction outside of the work site or easements as shown on the plans. Equipment will be restricted to the immediate area of construction. Pipe trenches will be backfilled as soon as possible.

Receptacles for construction residue, including oil, cleaning fluids and litter will be covered. Such residues will be disposed of in a proper manner.

Dust control and prohibition of burning of waste construction materials or vegetation will be enforced for all construction activity.

All construction activity, except for emergency situations, will be confined to Monday through Friday, between the hours of 7 a.m. and 7 p.m., to minimize nuisances to local businesses or residences, unless approved otherwise by the City Engineer.

Mufflers and/or baffles will be required on all construction equipment.

Construction activity within the existing right-of-way will be scheduled to minimize traffic inconvenience and safety hazards to motorists, pedestrians and cyclists.

## SECTION 5: CONTROL OF WORK

### **5-1.02 PLANS AND WORKING DRAWINGS**

When shop drawings or other drawings are required by the Plans and Specifications, or requested by the Engineer, they shall be prepared in accordance with current Engineering practice and at the Contractor's expense. Drawings shall be of a size and scale to clearly show necessary details and shall be transmitted by letter to the Engineer for approval or correction within at least fifteen (15) days of the Contract award.

Materials shall not be furnished or fabricated, nor any work done for which drawings are required before approval of the drawings.

When first submitted by the Contractor, each drawing shall be a good quality transparency accompanied by two prints. If approved without change or correction, three approved copies on paper will be furnished to the Contractor. If extensive additions or corrections are required, the Engineer will return one marked up copy together with a transparency to the Contractor for correction and resubmission. Approved transparencies will be retained by the Engineer. Approval of drawings by the Engineer shall not relieve the Contractor of the responsibility for errors or omissions in the drawings or from deviation from the contract documents, unless such deviations were those specifically called to the attention of the Engineer, and in the letter of transmittal submitted with the drawings. The Contractor shall be responsible for the correctness of the drawings for shop fits and fuel connections and for the results obtained by use of such drawings.

Drawings required for conventional stock pumps, motors and all other manufactured equipment may be brochures or catalogue sheets submitted in quadruplicate and shall show all necessary dimensions required for the proper location and installation of tie down bolts, brackets, plumbing and other appurtenant detail.

When required by the Special Provisions, assembly drawings, parts lists, nomenclature lists or diagrams shall be furnished.

#### **5-1.02A Excavation Safety Plans**

In accordance with the latest requirements of the California Occupational Safety and Health Act (Cal-OSHA) and all such similar legislation, the Contractor shall submit to the Engineer for reference in advance of excavation a Cal-OSHA approved detailed plan showing the design, shoring, bracing, sloping or other provision to be made for work or protection from the hazard of caving ground during the excavation of such trench or trenches located in the public right-of-way. If such plan varies from the shoring system standards, the plan shall be prepared by a Registered Civil or Structural Engineer.

The plan shall be kept on the job site at all times. The Contractor shall have a competent person, conversant with the plan on site at all times.

Nothing in this section shall be deemed to allow the use of shoring, sloping or protective system less effective than that required by the Cal-OSHA.

Nothing in this section shall be constructed to impose tort liability on the City or Engineer.

## SECTION 6: CONTROL OF MATERIALS

### **6-3.01 GENERAL**

California Test 231 (Nuclear Gage Determination of In-Place Density) is amended as follows:

In-place density and relative compaction may be determined on the basis of individual test sites in lieu of the area concept, at the discretion of the Engineer.

#### **6-3.01A Relative Compaction (Field Density)**

ASTM D 2922-81 amended as follows:

- A. Gage calibration will be based on the six California Transportation Laboratory Master Standard Density Blocks (CTLMSDB), located in Sacramento, California. These blocks are the Standard Reference blocks for the California Department of Transportation.
- B. Percent Relative compaction shall be calculated using lab curves for each individual test location unless otherwise permitted by the Engineer. If permitted by the Engineer, composite samples may be taken for certain manufactured or otherwise uniform materials according to California test method 231 - Part II "METHODS OF APPLYING THE AREA CONCEPT AND DETERMINING PERCENT RELATIVE COMPACTION".

The use of sand cone methods (such as ASTM 1556 or CT 216) for determining field densities will not be allowed as a substitute.

#### **6-3.01B Statistical Testing**

Statistical means will not be used for determination of specification compliance. Whenever both individual test results and moving average requirements are specified in these specifications, the moving average requirements shall apply to the individual test results.

## SECTION 7: LEGAL RELATIONS AND RESPONSIBILITY

### **7-1.11 PRESERVATION OF PROPERTY**

The Contractor shall notify Underground Service Alert (USA) for marking the locations of existing underground facilities.

The existing underground facilities in the area of work may include telephone, television and electrical cables, gas mains, water mains, sewer pipe and drainage pipe. The various utility companies shall be notified before trenching begins and at such other times as required to protect their facilities. Underground facilities shall be located and exposed ahead of trenching to prevent damage to the facilities, and to determine the depth and character of all facilities that cross or infringe on the trench prism. The Contractor shall immediately notify the City Engineer in writing of any facilities found to differ from those shown on the drawings. If damage should occur to the existing facilities, the utility company and the City shall be notified immediately in writing and repairs acceptable to the utility company shall be made at the Contractor's expense.

The locations of the existing facilities are typically compiled from the best information available during design. However, the locations of the underground facilities shown on the drawing are approximate only and should not be taken as final or all inclusive. The Contractor is cautioned that the drawings may be incomplete and the Contractor shall repair all damage done to existing facilities at his own expense.

Existing facilities shall not be intentionally disturbed and shall be supported and protected against injury and maintained in good operating condition at the expense of the Contractor for the entire duration of the contract. Any proposed disruption of the existing facilities shall be approved by and coordinated with the Engineer.

## SECTION 12: CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

### **12-1.01 DESCRIPTION**

The site of the work shall be enclosed by suitable barricades, signs and lights to warn and protect vehicle, bicycle and pedestrian traffic effectively and shall be in accordance with those procedures as set by the State of California Department of Transportation Manual on Uniform Traffic Control Devices (California MUTCD). The Contractor shall submit to the Engineer for review and approval traffic control plans prior to beginning construction. The Contractor shall have a copy of the approved traffic control plans on site at all times.

Excavation shall be backfilled before leaving the work for the night. All trenching in the travel-way shall be plated with non-skid plates or paved (temporary or permanent) before leaving the work for the night. Flasher barricades or illuminated cones shall be placed adjacent to the trench plates if required by the Engineer.

All detours and traffic control shall be between 8:00 a.m. and 5:00 p.m.; unobstructed two-way traffic shall be maintained daily between 5:00 p.m. and 8:00 a.m. Any work within Caltrans right-of-way will require a separate encroachment permit from Caltrans.

Adequate traffic control, flag persons, signing and barricades shall be provided by the Contractor at all times as approved by the Engineer.

If at any time, work continues for more than one working day, advance warning signs affixed to 4" x 4" wooden posts anchored to the ground shall be used. At no time shall construction signs be attached in any way to power or light poles.

The Contractor shall be responsible for keeping the police, fire department and the local schools informed of obstructions to either private or public roads caused by reason of his operations. The Contractor shall make provisions for the safe passage of pedestrians around the area of work at all times.

## SECTION 16: CLEARING AND GRUBBING

### **16-1.01 DESCRIPTION**

The following shall apply in lieu of Section 16-1.01 of the State Standard Specifications: This work shall consist of removing all objectionable material within the limits shown on the plans and as directed by the Engineer. Clearing and grubbing shall be performed in advance of grading operations and in accordance with the requirements of these specifications.

### **16-1.02 PRESERVATION OF PROPERTY**

All existing street designation and traffic control signs and posts within the aforementioned limits of work shall be carefully removed, cleaned of excess earth and delivered to the City Corporation Yard, except those required for traffic control as determined by the Engineer.

### **16-1.03 CONSTRUCTION**

The area to be cleared and grubbed shall be the area shown on the plans, unless otherwise specified in the Special Provisions.

All stumps, large roots and other objectionable material shall be removed to a depth of three feet below finished grade in the area between the curbs, and to a depth of 12 inches below finished grade in the area between curb and property line. The resulting spaces shall be backfilled with suitable material placed and compacted in accordance with the applicable provisions of Section 19-6.02 of the State Standard Specifications.

### **16-1.04 REMOVAL AND DISPOSAL OF MATERIALS**

Burning within the limits of the project will not be allowed. Combustible debris shall be disposed of away from the site of the work.

### **16-1.05 TREE PRESERVATION**

The Contractor shall comply with all requirements of the tree preservation plan if one is included as part of the Improvement Plans.

All trees to be removed shall be marked in the field. A representative of the City must field review the trees to be removed prior to removal.

### **16-1.06 SITE DEVELOPMENT**

The Contractor shall comply with all Site Development Regulations of the City of Willits, Title 17 – Zoning, as contained in the Land Use & Development Code, anytime there is grading work conducted.

## SECTION 17: WATERING

### **17-1.01 DESCRIPTION**

The Contractor shall be responsible for providing all water necessary for construction and testing.

## SECTION 19: EARTHWORK

### 19-1.01 DESCRIPTION

Earthwork shall conform to the provisions of Section 19 of the State Standard Specifications.

### 19-1.02 PRESERVATION OF PROPERTY

When it is necessary to excavate adjacent to existing trees, shrubs or hedges, the Contractor shall use all possible care to avoid injury to the trees, shrubs or hedges and their roots. Roots or limbs two (2) inches or larger in diameter shall not be cut without the express approval of the Engineer. All roots two (2) inches in diameter and larger left in place shall be wrapped with burlap to prevent scarring and excessive drying. When it is necessary to cut limbs and branches of trees to provide clearance for equipment used in construction, the Contractor shall make pruning cuts just beyond the branch bark ridge. All cuts through ½-inch or larger roots and limbs shall be hand-trimmed and cleanly cut before being repaired.

### 19-1.03 GRADE TOLERANCE

Immediately prior to placing subsequent layers of material thereon, the grading plane shall conform to one of the following.

- A. When aggregate subbase or aggregate base are to be placed on the grading plane, the grading plane shall not vary more than 0.05' above or 0.1' below the grade established by the Engineer.
- B. When asphalt concrete base is to be placed on the grading plane, the grading plane shall not vary more than 0.05' above or below the grade established by the Engineer.

### 19-1.05 TRENCH EXCAVATION

The Contractor shall perform all excavations of every description and all substances encountered to the depth indicated on the drawings. During excavation, that material suitable for backfilling shall be deposited in an orderly manner a sufficient distance from the banks for the trench to avoid overloading and to prevent slides or cave-ins. All excavated material not required or suitable for backfill shall be removed and disposed of outside the streets right-of-way. The Contractor shall first obtain a written permit from the property owner on whose property the disposal is to be made and he shall file with the City Engineer said permit, together with a written release from the property owner absolving the City from any and all responsibility in connection with the disposal of material on said property. Material shall not be disposed of within any floodway in the City of Willits or County of Mendocino, or within the normal channel of any river, creek, stream, ditch, canal, swale or other watercourse and within portions of same as required to efficiently carry the flood flow as determined by the Engineer.

Trenches shall be the necessary width for proper laying of the pipe, and the banks shall be as nearly vertical as practicable. The bottoms of the trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on the prepared pipe bedding at every point along its entire length. Trenches shall be excavated to the depth indicated on the drawings and care shall be taken not to excavate beyond the depth indicated or required, unless directed otherwise by the Engineer.

The Contractor shall at all times furnish, install and maintain sufficient bracing and shoring in trenches to ensure the safety of workmen and to protect and facilitate the work. All such bracing and shoring shall be removed from the trench as backfilling proceeds.

The Contractor shall furnish, install and operate such pumps or other devices as may be necessary for removing water from the trenches during construction.

#### **19-1.06 SAMPLES FOR APPROVAL**

Representative samples of all material to be imported shall be provided sufficiently in advance of installation operations for testing and approval of the Engineer. All costs associated with testing shall be paid by the Contractor. Imported material shall not be installed until it has been so approved.

Tests will be made in accordance with the following standards:

1. Grading--ASTM C114 and C136
2. Plasticity Index--ASTM D424
3. Sand Equivalent Value--Test Method No. Calif. 217 (CALTRANS)

#### **19-2 ROADWAY EXCAVATION**

##### **19-2.01 DESCRIPTION**

Roadway excavation shall conform to the applicable provisions of Section 19 of the City Specifications. Roadway excavation shall include all excavation, embankment construction, disposal of excess material, and other work as specified herein.

Removal of existing bituminous pavement and base materials will be paid for as roadway excavation and no additional allowance made therefor.

Excess materials from the excavation shall become the property of the Contractor and shall be disposed of by him, at his expense.

##### **19-2.02 UNSUITABLE MATERIAL**

The following shall apply in lieu of Section 19-2.02 of the State Standard Specifications:

Material below the natural ground surface in embankment areas and basement material below the grading plane in excavation areas that is determined by the Engineer to be unsuitable for the planned use shall be excavated and disposed of or stabilized as directed or approved by the Engineer.

When unsuitable material is removed and disposed of, the resulting space shall be filled with material suitable for the planned use. Such suitable material shall be placed and compacted in layers as hereinafter specified for constructing embankments.

Stabilization of unsuitable material shall comply with the following provisions:

- A. Unsuitable material may be processed in place, may be excavated and placed on the grade or other locations suitable for further processing, or may be partially excavated and partially processed in place.
- B. Processing may consist of drying to provide a stable replacement material or mixing with hydrated lime or granular quicklime.
- C. Stabilized material shall be placed and compacted in layers as hereinafter specified for constructing embankments.

**19-2.06 SURPLUS MATERIAL**

Excess trench material shall be removed promptly and disposed of elsewhere by the Contractor at his own expense. The Contractor shall not dump material on any private property without the permission of the owner thereof.

**19-2.02 UNSUITABLE MATERIAL**

**19-2.02A Subgrade Stabilization**

Unsuitable material shall be stabilized per Section 19-2.02 of the Standard Specifications with the following additions:

In the event that the subgrade material is unstable and cannot be made stable by drying the top 6 inches as determined by the Engineer, then the Contractor shall excavate an additional 6 inches, install soil stabilization fabric and install 6 inches of Class 4 aggregate sub-base.

Prior to placement of soil stabilization fabric, the Contractor shall remove all loose dirt as left from excavation operations.

Soil stabilization fabric shall be installed per manufacturer's recommendations and shall meet or exceed the following specifications:

Grab Tensile Strength	290 lb.
Mullin Burst Strength	500 psi
Trapezoid Tear Strength	120 lb.
Modulus (Load at 10% Elongation)	120 lb.
Equivalent Opening Size	40-70 Sieve
Water Permeability Coefficient(K)	.003 cm/sec.

Soil stabilization fabric shall be Mirafi 600-X, Supac 6WS, Fibretex TEN-5, or equal.

Aggregate sub-base shall be Class 4 with a minimum sand equivalent value of 21, a minimum R-value of 50 and shall conform to the following gradings:

<u>Sieve Size</u>	<u>Percent Passing</u>
2"	100
1-1 ½"	90-100
¾"	50-85
#4	25-45
#200	2-11

The material contained on the #4 screen shall consist of 100 percent (100%) crushed particles.

Aggregate sub-base shall be end-dumped on the soil stabilization fabric without disrupting fabric or basement soil as directed by the Engineer. Rolling shall commence immediately after spreading of the damp material and before the material has dried sufficiently to allow separation between the fine and coarse particles. Compactor shall be a non-vibratory type and compaction shall be to 92 percent (92%) R.C.

### **19-3 STRUCTURE EXCAVATION AND BACKFILL**

#### **19-3.01 DESCRIPTION**

A trench is defined as an excavation in which the depth is greater than the width of the bottom of the excavation.

Excavations for appurtenant structures including, but not limited to, manholes, transition structures, junction structures, vaults, valve boxes, catch basins, thrust blocks, and boring pits shall also be considered trench excavation and subject to the requirements of this section.

Excavation shall include the removal of all water and materials of any nature, which interfere with the construction work. Placement of spoil materials on adjacent asphalt pavement shall not be allowed without a valid City of Willits Encroachment Permit or written permission of the City Engineer. Such permissions shall not be granted unless, in the opinion of the City Engineer, no other reasonable option exists. In no instance (including subdivisions under construction) shall stockpiling or material storage be permitted over City sidewalks, curbs or gutters.

Excavation for the installation of conduit or pipes shall be by open trench methods unless otherwise specified or shown on the drawings. Tunneling or boring and jacking shall be allowed only with the prior written approve of the City Engineer.

#### **19-3.02 EXCAVATION FOR CULVERTS**

##### **19-3.02A Maximum Length of Open Trench**

The maximum length of open trench at any given time shall be the distance in which pipe can be completely installed in a single day. Installed shall be defined as pipe laying, appurtenance construction, backfilling and compacting, and temporary paving, complete in place. Installation of underground pipes and conduits shall be performed in one continuous operation. In no instance shall the length of open trench exceed 300 linear feet. The use of steel plates as open trench covers shall not be allowed without prior approval of the City Engineer. If steel plates are approved, they shall not remain for a period longer than 2 weeks. During this time the contractor is required to maintain the plates in a safe manner with temporary conforms of road mixed asphalt surfacing.

The requirements of this Section shall not apply to new construction sites which are closed to the public in a manner acceptable to the City Engineer.

**19-3.02B Maximum and Minimum Width of Trench**

The maximum clear width of the trench at the top of the pipe shall not be more than the outside diameter of the pipe at any point plus 2 feet. Greater width of trench at the top of the pipe shall be permitted only on written approval by the City Engineer. In no case shall the free working space on each side of the pipe be less than 6 inches.

If the maximum trench width is exceeded, the contractor shall provide additional bedding, backfill, another type of bedding, and/or a higher strength of pipe than that shown on the plans. Any such deviation shall be subject to the approval of the City Engineer.

**19-3.025 CULVERT BEDDING**

Bedding shall be defined as that material supporting and surrounding the pipe. Bedding shall be placed as shown in the City of Willits Standard Plans.

If soft, spongy, unstable, or similar other material is encountered upon which the bedding material or pipe is to be placed, this unsuitable material shall be removed to a depth ordered by the Engineer and replaced with bedding material suitably densified.

Bedding material shall first be placed and compacted so that the pipe is supported for the full length of the barrel with full bearing on the bottom segment of the pipe equal to a minimum of 40 percent of the outside diameter of the barrel. The remainder of the bedding shall be carefully placed to the proper depth.

Where pipe is to be installed in a new embankment (fill area), the embankment shall first be constructed and compacted to subgrade, after which the trench shall be excavated with sides nearly vertical and the pipe installed.

When water is encountered, the trench shall be kept dry until laying and jointing of the pipe and placing of the bedding material has been completed, inspected, and approved. The contractor shall over-excavate and place a minimum of 6 inches of permeable material or de-water the trench in a manner which has received prior approval of the City Engineer.

Pipe bedding for slopes less than or equal to 8% shall have a minimum sand equivalent value of 30 and shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing</u>
1"	100
3/4"	90-100
3/8"	65-100
#4	30-100
#200	0-15

Pipe bedding for slopes greater than 8% shall have a minimum sand equivalent of 30 and shall conform to the following grading:

<u>Sieve Size</u>	<u>Percent Passing</u>
1"	100
3/4"	90-100
3/8"	65-100
#4	30-100
#30	10-100
#200	0-15

### **19-3.06 STRUCTURE BACKFILL**

Except for structure backfill placed at specific locations described and enumerated in Sec. 19-3.06 of the State Standard Specifications, structure backfill material specifications and compaction requirements shall be as follows:

Structure backfill shall have a Sand Equivalent of not less than 30 and shall conform to the following grading:

<u>Sieve Size</u>	<u>Percentage Passing</u>
3"	100
No. 4	40-100

Structure backfill shall be compacted to not less than 90 percent relative compaction, except that when placed under any roadbed, relative compaction shall not be less than 95 percent within three feet of finished grade, as determined by California Tests 216 and 231.

### **19-3.06A Trench Backfill**

Trench backfill shall be defined as that material which lies above the pipe bedding or conduit bedding and below the street section or ground surface.

Trench backfill, for all underground pipes and conduits Class 2 aggregate base and shall start at the surface upon which the base of the structure rests.

Except where the pipe must remain exposed for force main leakage tests and subject to the provisions herein, the contractor shall proceed as soon as possible with backfilling operations. Care shall be exercised so that the pipe or conduit will not be damaged or displaced.

The Contractor shall not place trench backfill against or over the top of any concrete structures for a period of seven days after concrete has been poured. After the seven day period backfill may be placed provided that two suitable samples have been laboratory tested to a minimum of 3000 psi or 90 percent of the specified 28 day strength, whichever is greater.

Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, the voids remaining after the removal of the buried objects shall be excavated vertically to the ground surface, backfilled, and compacted with Class 2 A.B. as specified herein, or as otherwise approved by the City Engineer.

All trenches shall be backfilled that same day. In paved areas temporary pavement shall be installed. Permanent paving must be installed within one month of trench excavation.

**19-3.06B Drain Rock**

Drain rock shall be washed coarse aggregate conforming to one of the following gradings:

1-1/2 Inch Grading:

<u>Sieve Size</u>	<u>Percent Passing</u>
2"	100
1-1/2"	90-100
1"	20-55
3/4"	0-15

3/4 Inch Grading:

<u>Sieve Size</u>	<u>Percent Passing</u>
1"	100
3/4"	90-100
1/2"	60-85
3/8"	20-55

**19-3.062 SLURRY CEMENT BACKFILL**

Slurry cement backfill shall be a mixture of Portland cement, sand and 1" maximum coarse aggregate, air entraining agent and water, batched by a ready-mixed concrete plant and delivered to the jobsite by means of transit mixing trucks. Slurry cement backfill may also contain Class F pozzolan (fly ash). Slurry cement backfill shall be free of asphaltic material.

**19-3.062A Materials**

Cement shall meet the standards as set forth in ASTM C-150, Type II cement.

Fly ash shall meet the standards as set forth in ASTM C-618, for Class F pozzolans. The fly ash shall not inhibit the entrainment of air.

Aggregate size: 1" maximum

Sand Equivalent: 30 minimum

**19-3.062B Mix Proportions**

The mix proportions shall be determined by the producer of the slurry cement backfill to produce a flowable fill mixture which will not segregate. Each yard shall contain not less than 50 pounds of Portland cement and not less than a total of 100 pounds of cementitious material. The Contractor shall supply a mix design two weeks prior to any use of slurry cement backfill.

### **19-3.062C Mixture Properties**

Compressive Strength: 75 – 200 psi at 28 days

Slump: 3 – 9 inches

The consistency of slurry cement backfill shall be such that all trench voids are filled with minimum rodding or vibrating but not so wet as to cause excessive shrinkage.

### **19-3.062D Paving**

Permanent pavement may be placed directly upon the slurry cement backfill as soon as it has consolidated for the surface to withstand the process of paving without displacement. The surface of the slurry cement backfill shall be firm and unyielding. Any visible movement vertically or horizontally of the slurry cement backfill under the action of construction equipment or other maximum legal axle loads shall be considered as evidence that the slurry cement backfill does not meet this requirement. The Contractor shall provide trench plates to allow traffic flow for all locations until slurry cement backfill is ready to be paved.

## **19-4 DITCH EXCAVATION**

Ditch excavation shall conform to the applicable provisions of Section 19 of the Standard Specifications.

### **19-4.01 DESCRIPTION**

Ditches shall be constructed in conformance to the details and at the locations as shown on the plans, as directed by the Engineer, and as specified herein.

### **19-5.03 RELATIVE COMPACTION (95 PERCENT)**

The following shall apply in lieu of Section 19-5.03 of the State Standard Specifications.

Relative compaction of not less than 95 percent shall be obtained for a minimum depth of 0.5-foot below the grading plane for the full width of the planned structural section, whether in excavation or embankment.

Any area of the subgrade determined by the Engineer to be unstable, as evidenced by excessive deflection under the movement of equipment, shall be brought to satisfactory stability by additional rolling, reworking, removal and replacement of unsuitable material, or stabilization with lime, as directed by the Engineer.

Lime-treated materials shall be compacted to not less than 95 percent relative compaction in accordance with the provisions of Section 24, except when lime is used to stabilize unsuitable material as specified in Sec. 19-2.02 of the State Standard Specifications.

Relative compaction of not less than 95 percent shall be obtained for embankment under bridge and retaining wall footings without pile foundations within the limits established by incline planes sloping 1.5:1 out and down from lines one foot outside the bottom edges of the footing.

### **19-5.04 RELATIVE COMPACTION (90 PERCENT)**

The following shall apply in lieu of Section 19-5.04 of the State Standard Specifications.

Relative compaction of not less than 90 percent shall be obtained in all materials in embankment

except as specified herein to be 95 percent. Material placed in accordance with the provisions of Sec. 19 2.02, "Unsuitable Materials," of the State Standard Specifications shall be compacted to not less than 90 percent relative compaction.

**19-7.02 IMPORT BORROW**

Imported borrow shall be free of any regulated hazardous materials.

## SECTION 24: LIME STABILIZATION

### **24-1.01 DESCRIPTION**

The following shall apply in lieu of Sec. 24-1.01 of the State Standard Specifications.

This work consists of stabilizing basement soil, mixing in place material, lime and water, and spreading and compacting the mixture to the lines, grades and dimensions shown on the plans and as specified in these Specifications and the Special Provisions.

Where designated by the Engineer, basement soil below the planned lime-treated subgrade shall be stabilized in the following manner:

The material shall be excavated to the lines and grades specified by the Engineer and spread in a uniform layer over another portion of the grade.

Dry lime in the amount specified by the Engineer shall be spread and mixed into the material as provided in Sec. 24-1.06, "Mixing" of the State Standards. The material shall then be used to backfill the original excavation in 6" compacted layers. Each layer below a plane 12" below the grading plane shall be compacted to not less than 90 percent relative compaction. Each successive 6" layer up to the bottom of the planned lime-treated subgrade shall be compacted to not less than 92 percent relative compaction.

### **24-1.02 MATERIALS**

When permitted by the Engineer in writing, and when accompanied by an adequate safety program to be proposed by the Contractor, granular quicklime conforming to the specifications of ATSM Designation C51 may be used in lieu of commercial hydrated lime. Hydrated lime shall be used only when permitted by the Engineer in writing.

When sampled by the Engineer at the point of delivery, the sample of quicklime shall contain not less than 90 percent calcium oxide (CaO), as determined by ATSM: C25-67.

When granular quicklime is used, initial mixing shall continue until the quicklime is uniformly distributed throughout the material. Water shall be added as required to provide sufficient moisture for hydration. The mixture shall be cured for not less than 16 hours prior to final mixing.

The Contractor shall provide a grade checker to ensure mixing to the full depth as specified. Water shall be added during the final mixing operations until the water content of the mixture is approximately two percent above the test optimum moisture content.

### **24-1.07 COMPACTION**

Lime-treated material shall be compacted to not less than 95 percent, as determined by Test Method No. California 216 and 231. The sample of lime-treated soil used for determining the maximum wet density shall be obtained from the test site at the time of testing.

### **24-1.09 CURING**

The curing seal requirement may be waived at the discretion of the Engineer when it can be shown that placement of a subsequent layer of aggregate base or asphalt concrete can proceed within 24 hours after the completion of final rolling.

## SECTION 25: AGGREGATE SUBBASES

### 25-1.01 DESCRIPTION

Aggregate Subbase shall be Class 4.

### 25-1.02 MATERIALS

Aggregate Subbase--Class 4 shall have a minimum sand equivalent of 21, a minimum R value of 50 and shall conform to the following grading:

<u>Sieve Size</u>	<u>Percent Passing</u>
3"	100
1½"	90-100
¾"	50-90
#4	25-55
#200	2-11

The material retained on the #4 screen shall consist of 100% crushed particles.

Representative samples of all material to be imported shall be supplied sufficiently in advance of installation operations for testing and approval of the Engineer. All costs associated with testing shall be paid by the Contractor. Tests for sieve analysis, R-value, sand equivalent and relative compaction shall be per Caltrans Standards.

### 25-1.04 SPREADING

#### 25-1.04A Grade Tolerance

The subgrade to receive aggregate subbase, immediately prior to spreading, shall not vary more than 0.05-foot above or 0.10-foot below the grade established by the Engineer.

### 25-1.05 COMPACTING

The surface of finished aggregate subbase shall be firm and unyielding. Any visible movement vertically or horizontally of the aggregate subbase under the action of construction equipment or other maximum legal axle loads shall be considered as evidence that the aggregate subbase does not meet this requirement.

## SECTION 26: AGGREGATE BASES

### 26-1.01 DESCRIPTION

Aggregate Base shall be Class 2, and the combined aggregate shall conform to either of the grading specified in Sec. 26-1.02B of the State Standard Specifications, "Class 2 Aggregate Base."

### 26-1.02 MATERIALS

#### 26-1.02A Class 2 Aggregate Base

Quality Requirements: The minimum sand equivalent value shall be not less than 30 for any individual test. The resistance (R-value) shall not be less than 78 for any individual test. The durability index shall not be less than 35 for any individual test unless specifically approved by the City Engineer.

### 26-1.03 SUBGRADE

Subgrade shall be smooth and uniform, and true to the required grade cross-section, and shall be within the tolerance specified in these Specifications or as shown on the plans. The Contractor shall repair at his expense any damage to a prepared subgrade caused by his operations or by use of public traffic. No material shall be placed upon the prepared subgrade until the subgrade is in the condition meeting the requirements specified.

Subgrade that does not conform to the above requirements shall be reshaped to conform to the specified tolerances and recompacted, all at the Contractor's expense.

### 26-1.05 COMPACTING

The surface of the finished aggregate base shall be firm and unyielding. Any visible movement vertically or horizontally of the aggregate base under the action of construction equipment or other maximum legal axle loads shall be considered as evidence that the aggregate base does not meet this requirement.

### 26-1.08 SHOULDER BACKING

This work shall consist of constructing shoulder backing adjacent to the edge of the new surfacing in accordance with the details shown on the plans and these special provisions.

The material for shoulder backing shall consist of material of which at least 60% by weight shall be crushed particles as determined by California Test 205 and shall conform to the following grading:

<u>Sieve Sizes</u>	<u>Percentage Passing</u>
1"	100
3/4"	87-100
#4	30-74
#200	7-23

Shoulder backing shall meet all quality requirements as mentioned in Section 26-1.02 of these Specifications.

The areas where shoulder backing is to be constructed shall be cleared of all weeds, grass and debris. Removed weeds and grass shall be disposed of outside the highway right-of-way in accordance with the provisions in Section 7-1.13 of the State Standard Specifications.

Shoulder backing material shall be watered and rolled to form a smooth, firmly compacted surface. Watering shall conform to the provisions in Section 17, "Watering," of the State Standard Specifications.

Shoulder backing material shall not be deposited on the new surfacing prior to placing it in final position, nor shall it be bladed onto the new surfacing during mixing, watering and blading operations.

Shoulder backing construction shall be completed along the edges of any portion of new surfacing within five days after completion of that portion of the new surfacing. Until such time as the Contractor is able to complete shoulder backing along any portion of new surfacing, he shall furnish and place portable delineators and C31a "No Shoulder" signs off of and adjacent to the new surfacing. A portable delineator and a C31A sign shall be placed at the beginning of the drop-off in the direction of travel on the adjacent lane, and at the following maximum intervals along the drop-off:

C31A signs--2,000 feet  
Portable Delineators:  
on tangents--500 feet  
on curves--200 feet

The portable delineators and C31A signs shall be maintained in place at each location until shoulder backing operations are completed at that location. Portable delineators and signs shall conform to the requirements in Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications, except that the base material for the signs shall not be plywood and the signs may be set on temporary portable supports or in barricades.

## SECTION 39: ASPHALT CONCRETE

### 39-1.01 DESCRIPTION

A minimum of two weeks prior to the placement of any asphalt concrete, the Contractor shall notify the Engineer of which asphalt plant will be used to supply the mix. For any job, asphalt concrete shall be supplied from a single plant, unless approved otherwise by the Engineer.

### 39-2.01 ASPHALTS

Asphalt binder to be mixed with aggregate for asphalt concrete surface, leveling, base, or open graded courses shall be AR-8000 grade paving asphalt, or as specified by the engineer at the time of paving.

Liquid anti-stripping agent (LAS) shall be added to the asphalt binder at a rate of 0.5% by weight of asphalt binder. The LAS shall be AD-here LOF 65-00 or equivalent, and shall be stored, measured, and blended with the asphalt binder in accordance with the anti-stripping agent manufacturer's recommended practice. The LAS can be added at the asphalt plant or at the refinery. When added at the asphalt plant, the equipment shall indicate and record the amount of LAS added. If added at the refinery, the shipping ticket from the refinery shall certify the type and amount of LAS added.

### 39-2.02 AGGREGATE

The asphalt concrete mixture, for asphalt concrete surface and asphalt concrete base, shall conform to the following requirements:

Minimum tensile strength ratio (TSR) of 70, and a minimum dry tensile strength of 65 pounds per square inch, based on California Test Method 371.

The aggregate grading of the various types of asphalt concrete shall conform to one of the following as directed by the Engineer:

Surface Course .....	Type A-- $\frac{1}{2}$ " Maximum, Medium or Coarse
Leveling Course .....	Type A-- $\frac{3}{4}$ " Maximum, Coarse
Asphalt Concrete Base .....	Type A or B-- $\frac{3}{4}$ " Maximum, Medium
Open Graded .....	$\frac{3}{8}$ " Maximum

At any time during the first 12 months from the time of placement of the asphalt concrete, the surface shall be visually inspected by the City. If signs of stripping of binder from aggregate or loss of aggregate is apparent, the City will core the asphalt concrete surface. The core samples will be tested for TSR. Asphalt concrete with a TSR less than 70 shall be remediated as required by the City Engineer.

### 39-3.07 HAUL VEHICLES

Prior to loading asphalt concrete, the bed of the haul vehicle shall be clean and free from all soil, sand, gravel and other deleterious substances.

All haul vehicles shall be equipped with tarps that are in working order. Tarps shall be used on haul vehicles unless prior approval is obtained from the City Engineer.

When spraying diesel or other parting agents in the bed of the haul vehicle, the minimum amount necessary to moisten the surface shall be used. In no instance will the parting agent be allowed to accumulate in the bed of the vehicle.

#### **39-4.01 SUBGRADE**

The subgrade to receive asphalt concrete or asphalt concrete base immediately prior to applying prime coat shall not vary more than 0.05-foot above or below the grade established by the Engineer.

#### **39-4.02 PRIME COAT AND PAINT BINDER (TACK COAT)**

Tack coat shall be diluted SS1 or CSS1, or undiluted RS-1 or CRS-1 type asphalt emulsion.

#### **39-4.03 PAVEMENT REINFORCING FABRIC**

Those areas to receive the reinforcing fabric will be marked in the field by the Engineer and shall consist of the following materials and shall be applied in accordance with those procedures outlined below:

The fabric and placement of fabric shall conform to the provisions of Section 88 of the State Standard Specifications and these Special Provisions.

Prior to placing the fabric, the existing pavement to receive the fabric shall be cleaned of all materials such as, but not limited to, leaves, sand, dirt, gravel, water and vegetation.

Placement of the fabric shall be made only under the following conditions:

1. The ambient air temperature is above 50 degrees Fahrenheit and rising.
2. The pavement is dry and the pavement temperature is above 40 degrees Fahrenheit and rising.

The surface area to receive the fabric shall be sprayed with steam-refined paving asphalt type AR-8000 at the rate of 0.22 - 0.28 gallons per square yard. The Contractor's attention is directed to Section 92-1.04, "Applying", of the State of California Standard Specifications. The exact rate of application will be determined by the Engineer. The asphalt shall be sprayed with a suitably metered truck and the truck must have been recently calibrated by test method California No. 399A. The temperature of the asphalt binder must be spread between 290 degrees F. and 365 degrees F.

The width of asphalt application will be the fabric width plus 4 inches. Paving asphalt shall be applied no farther in advance of the fabric than the distance the Contractor can maintain free of traffic. The paving operation shall closely follow fabric placement and no more fabric than can be covered up with the hot mix that working day shall be placed.

The fabric shall overlap 2-6 inches at all joints. No joints shall be lapped with more than two layers of fabric. Transverse joints shall be shingled in the direction of the paving to prevent edge pickup by the paver.

The fabric shall be placed on the asphaltic binder with a minimum of wrinkles and broomed or

squeegeed to remove any bubbles prior to the binder cooling. The equipment for placing the fabric shall be mechanized and capable of handling full rolls of material and shall be capable of laying the fabric without forming excessive wrinkles and/or folds. As directed by the Engineer, if folds or wrinkles ½ inch in height or greater exist, the fabric shall be slit and allowed to lay flat. Brooming will maximize fabric contact with the pavement surface. The equipment used to place the fabric is subject to approval by the Engineer.

At all utility covers which could be covered with fabric, the fabric shall be neatly cut around the cover to allow for raising the cover to finished grade.

Turning of the paving machine or other vehicles should be gradual and shall be kept to a minimum to avoid damage to the membrane. Should equipment tires stick to the fabric during pavement operations, small quantities of asphaltic concrete shall be broadcast ahead to prevent sticking.

### **39-5.01 SPREADING EQUIPMENT**

The asphalt concrete shall be deposited from the haul vehicle into the hopper of the paving machine.

The practice of depositing the material on the roadbed in a windrow and subsequently using a pick-up machine to deposit the material in the hopper of the asphalt paver will not be allowed.

### **39-5.02 COMPACTING EQUIPMENT**

Compaction rollers shall be either two-axle steel-tired rollers, pneumatic-tired rollers or approved double-drum vibratory rollers. Steel-tired static compaction rollers shall weigh not less than 12 tons.

Double-drum vibratory rollers shall be operated at a maximum speed of 135-feet per minute (approximately 1.5 mph). Double-drum vibratory rollers shall have a minimum frequency of 2400 VPM and the amplitude shall be field-adjustable.

All pneumatic-tired rollers shall be equipped with an approved wind skirt unless otherwise permitted by the Engineer. Pneumatic-tired rollers used for compaction of asphalt concrete base shall be so equipped that the air pressure in all tires may be regulated uniformly by the operator while the roller is in motion.

Finish rollers shall be two-axle steel-tired tandem rollers weighing not less than eight tons.

## **39-6 SPREADING AND COMPACTING**

### **39-6.01 GENERAL REQUIREMENTS**

Asphalt concrete shall not be placed on any roadbed until all utility construction beneath the roadbed has been completed, sewer and water lines have been tested and water lines chlorinated. The surface course of asphalt concrete shall not be placed until final utility connections have been made unless otherwise permitted by Engineer.

Asphalt concrete shall not be placed less than thirty (30) minutes before sunset, as established by weather bureau, except as otherwise authorized the Engineer.

Asphalt concrete or asphalt concrete base shall not be placed during rainy weather or on a wet surface. Asphalt concrete shall not be placed when the atmospheric temperature is below fifty (50) degrees Fahrenheit or conditions indicate it will drop below fifty (50) degrees Fahrenheit before the material can be satisfactorily compacted. Asphalt concrete base shall not be placed when the atmospheric temperature is below forty (40) degrees Fahrenheit or conditions indicate it will drop below forty (40) degrees Fahrenheit before the material can be satisfactorily compacted. Material that cannot be placed in compliance with these requirements shall be rejected.

The compacted thickness of asphalt concrete layers shall be as directed by the Engineer. The normal minimum and maximum compacted lift thickness for asphalt concrete surfacing are 0.17' and 0.25' respectively.

### **39-6.03 COMPACTING**

The temperature of the asphalt concrete shall be specified by the Engineer. Unless lower temperatures are specified by the Engineer, all mixtures shall be spread and the first coverage of initial or breakdown compaction shall be performed when the temperature of the mixture is not less than 200°F at mid-depth. Additional rolling equipment shall be required or the rate of spread shall be reduced to permit compliance with this requirement.

#### **A. Asphalt concrete surface course and leveling courses.**

##### **1. Equipment required:**

If production in any one hour exceeds the limits set forth below, the Contractor shall cease his paving operation until additional rolling equipment has arrived on the project.

##### **a. 125 tons per hour or more.**

The Contractor will be required to furnish a minimum of two approved double-drum vibratory rollers and one eight-ton tandem finish roller for each roller. A pneumatic roller may be substituted for one of the vibratory rollers if approved by the Engineer.

##### **b. 50-125 tons per hour.**

The required minimum rolling equipment specified above may be reduced to one approved double-drum vibratory roller and one eight-ton tandem roller for each asphalt paver, with a separate operator for each roller when the compacted thickness is not less than 0.17'.

##### **c. 50 tons per hour or less, at any location.**

The required minimum rolling equipment specified above may be reduced to one approved double-drum vibratory roller, weighing not less than 12 tons, for each paving machine.

##### **2. Compaction requirements:**

Compaction rolling shall consist of a minimum of four complete vibratory coverages with an approved double-drum vibratory roller. Finish rolling shall consist of one or more coverages with an eight-ton tandem roller immediately following completion of compaction rolling.

B. Asphalt Concrete Base.

1. Equipment required:

The Contractor shall be required to furnish one approved double-drum vibratory roller and a minimum of one pneumatic-tired roller, with a separate operator for each roller. An approved double-drum vibratory roller may be substituted for the pneumatic-tired roller specified above.

2. Compaction requirements:

Compaction rolling shall consist of the following: a minimum of two complete vibratory coverages with an approved double-drum vibratory roller and two complete coverages with a pneumatic-tired roller. The order of rolling shall be specified by the Engineer. Final rolling shall consist of one coverage with the vibrating units turned off.

Approval of vibratory rollers: The Engineer may approve initial use of a double-drum vibratory roller not previously approved on the basis of tests by other agencies or other information provided by the Contractor.

Approval for subsequent use of the roller shall be based on cores taken from test sections designated by the Engineer and compacted with different numbers of coverages.

Test sections shall be compacted under the following conditions:

1. Asphalt concrete temperature at mid-depth shall be between 270 and 280 degrees Fahrenheit at the beginning of rolling. Rolling shall not continue after the mix temperature has dropped to 200 degrees Fahrenheit. The compacted thickness shall be between 2" and 3.5".
2. The Contractor or manufacturer's representative shall specify the operating conditions of frequency and amplitude.

The basis for approval shall be the attainment of 97% relative compaction and satisfactory surface condition following final rolling. The number of coverages required shall be the minimum number required to obtain 97% relative compaction.

The mix will be sampled during paving of the test sections, and the test maximum density will be the average density of specimens compacted in accordance with California Test 304. The in-place density for each test section shall be the average of three core densities. Relative density will be the ratio of in-place density to test maximum density.

**39-8.03 COMPENSATION ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS**

The provisions of this section shall apply only to the asphalt concrete surface and asphalt concrete base contract items, and for projects with over 50 tons of asphalt concrete.

The compensation payable for asphalt concrete surface and asphalt concrete base, will be increased or decreased in conformance with the provisions of this section for paving asphalt price fluctuations exceeding 5 percent ( $I_u/I_b$  is greater than 1.05 or less than 0.95) which occur during performance of the work.

The adjustment in compensation will be determined in conformance with the following formula when the item of asphalt concrete surface and/or asphalt concrete base is included in a monthly estimate:

- A. Total monthly adjustment =  $AQ$
- B. For an increase in paving asphalt price index exceeding 5 percent:  
 $A = 0.90 (I_u/I_b - 1.05) I_b$
- C. For a decrease in paving asphalt price index exceeding 5 percent:  
 $A = 0.90 (I_u/I_b - 0.95) I_b$
- D. Where:
  - A = Adjustment in dollars per ton of paving asphalt binder used to produce asphalt concrete surface and asphalt concrete base rounded to the nearest \$0.01.
  - $I_u$  = The California Statewide Paving Asphalt Price Index which is in effect on the first business day of the month within the pay period in which the quantity subject to adjustment was included in the estimate.
  - $I_b$  = The California Statewide Paving Asphalt Price Index for the month in which the bid opening for the project occurred.
  - Q = Quantity in tons of paving asphalt binder that was used in producing the quantity of asphalt concrete surface and asphalt concrete base shown under the Current Quantity column on the monthly estimate.

The adjustment in compensation will also be subject to the following:

- A. The compensation adjustments provided herein will be shown separately on payment estimates. The Contractor shall be liable to the City for decreased compensation adjustments and the Engineer may deduct the amount thereof from any moneys due or that may become due the Contractor.
- B. Compensation adjustments made under this section will be taken into account in making adjustments in conformance with the provisions in Section 4 1.03B, "Increased or Decreased Quantities," of the Standard Specifications.
- C. In the event of an overrun of contract time, adjustment in compensation for paving asphalt included in estimates during the overrun period will be determined using the California Statewide Paving Asphalt Price Index in effect on the first business day of the month within the pay period in which the overrun began.

The California Statewide Paving Asphalt Price Index is determined each month on the first business day of the month by the California Department of Transportation using the median of posted prices in effect as posted by Chevron, Mobil, and Unocal for the Buena Vista, Huntington Beach, Kern River, Long Beach, Midway Sunset, and Wilmington fields. In the event that the companies discontinue posting their prices for a field, the Department will determine an index from the remaining posted prices. The Department reserves the right to include in the index determination the posted prices of additional fields. The California Statewide Paving Asphalt Price Index is available at the Division of Engineering Services website:

[http://www.dot.ca.gov/hq/ese/oe/asphalt\\_index/astable.html](http://www.dot.ca.gov/hq/ese/oe/asphalt_index/astable.html)

## **39-9 ROADWAY REHABILITATION**

### **39-9.01 GENERAL**

Roadway rehabilitation shall consist of removing and disposal of existing asphalt concrete, and base if necessary, to the specified depth by cold planing or other approved methods.

Digouts on roadways designated to be milled shall be performed after the cold planing operation is completed. Depth of the digouts shall then be based on the remaining thickness of asphalt concrete after cold planing.

### **39-9.02 CONSTRUCTION**

#### **Asphalt Concrete Digouts and Remove and Replace Areas**

The pavement areas designated to be replaced shall be removed to a uniform depth as specified, and may be removed either by cold planing or by full depth sawcutting and mechanical removal. Sawcutting is not necessary if the pavement is removed by cold planing. Any broken or damaged pavement edges shall be re-cut prior to paving. All removed material shall be cleared from the site.

The excavated areas shall be graded as shown on the plans as necessary to provide a uniform pavement thickness. The base rock or native soil shall be compacted to 95% relative compaction. All segregated or loose material shall be removed.

On areas where the underlying material appears to be wet or soft or where it deflects under wheel loads, the Contractor shall employ excavation and work techniques that do not worsen the subgrade condition.

Prior to placing aggregate base or asphalt concrete, each pavement replacement area shall be proof-rolled with a loaded construction vehicle, preferably a ten cubic yard dump truck or equivalent. The compacted surface shall not visibly yield or deflect. Soft, yielding, unstable, or unsuitable areas shall be removed and replaced with base rock or asphalt concrete. If the areas were caused or significantly worsened by the Contractor's operations, these areas shall be replaced at the Contractor's expense.

In the event that the underlying material is soft, yielding, unstable, or unsuitable, it shall be excavated to a depth of 0.5 feet below the depth required above and disposed of in accordance with City of Willits Standards. The limits of removal shall be designated by the Engineer. The resulting space shall be filled with a single lift of asphalt concrete.

Unsuitable material is defined as material the Engineer determines to be:

- A. Of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content, or
- B. Too wet to be properly compacted and circumstances prevent in-place drying prior to incorporation into the work, or
- C. Otherwise unsuitable for the planned use.

After compaction of the subgrade, aggregate base shall be placed and compacted to 95% relative compaction. All vertical edges of existing pavement or concrete shall receive a tack coat immediately prior to paving. Additional tack may be necessary between asphalt concrete courses. No prime coat shall be required. A tack coat between layers of asphalt concrete shall be required if not paved on the same day or if the surface has been contaminated or soiled. Any contamination or soiling shall be thoroughly cleaned and a tack coat placed between layers immediately prior to paving.

Care shall be taken to assure compaction of the inside corners of the first lift. Ramping shall not be allowed on the course placed immediately prior to the surface course.

A minimum of two lifts shall be used for each replacement area or digout with a depth greater than three inches. The surface course shall be 1/2 inches maximum thickness.

The repaired areas shall conform with the level of the surrounding pavement so that no elevation variation is evident. The surface shall have a maximum variation from high to low of 0.01 feet maximum when measured with a twelve-foot level. Variation at the edges shall not exceed 0.01 feet maximum. When matching existing pavement, the finished surface shall not inhibit drainage. The upslope edge of the digout or replacement shall be 0.00 feet high to 0.01 feet low. On the downslope edge of the digout or replacement, the finished surface shall be 0.01 feet high to 0.00 feet low. Any resulting variations shall be corrected to the satisfaction of the Engineer.

### **39-9.03 SIDE STREET CONFORMS**

Side street conforms shall conform to the requirements of City Standard 216, “Side Street and End of Overlay Conform” of the City of Willits Standard Plans, with the following modifications: The side street structural section shall be 3.5 inches of asphalt concrete base and 2.5 inches of asphalt concrete surfacing between the limits of the main street and the conform line. Beyond the conform line the existing asphalt shall be removed and replaced as directed by the Engineer to provide a smooth transition.

## SECTION 39A: ASPHALT CONCRETE TRENCH PAVING

### **39A-1.01 DESCRIPTION**

Asphalt concrete surfacing and asphalt concrete base and the placing thereof shall conform to the requirements of the Standard Specifications and Section 39 of the City Specifications.

### **39A-2.01 ASPHALTS**

Asphalt thickness for final asphalt surfacing shall conform to City Standard 222, "Standard Trench Detail" of the City of Willits Standard Plans, or as shown on the plans.

For temporary paving, use ½-inch maximum, medium grade aggregate and SC 3000 asphalt for use the same day, or SC 250 for use over a one week period.

The amount of asphalt binder to be mixed with the aggregate will be specified by the Engineer at the time of paving. A different asphalt binder content may be specified for each lift and each location.

### **39A-5.01 SPREADING EQUIPMENT**

When trench width is three feet or less, the asphalt concrete used for trench paving may be deposited directly from the haul vehicle into the trench. The asphalt shall then be raked smooth prior to compaction.

### **39A-6 SPREADING AND COMPACTING**

#### **39A-6.01 GENERAL REQUIREMENTS**

The contractor shall provide compaction of backfill and base material as the job progresses, each day. Temporary paving (2 inches minimum) will be placed each day over the work, leaving not more than 25 feet unpaved. The balance of the trench shall be covered with steel plates, capable of sustaining normal traffic loads. Temporary A.C. paving shall be used around all edges of steel plates.

Finished asphalt trench paving shall be even, smooth riding and have an appearance that is compatible to the surrounding surface.

Upon placement of the last lift of Class 2 aggregate base as shown for on City Standard 222, "Standard Trench Detail" of the City of Willits Standard Plans, the Contractor shall cut the edges of pavement in a neat manner to the locations shown on said City Standard 222.

## SECTION 51: CONCRETE STRUCTURES

### **51-1.02A Curb Inlets**

Curb inlets to be installed shall be in conformance with the City of Willits Standard Plans and the details shown on the plans and as directed by the City Engineer.

### **51-1.02B Storm Drain Manholes**

Storm drain manholes shall consist of a precast unit or a cast-in-place unit in conformance with Section 51 of the State Standard Specifications, City Standards, or a combination thereof.

Manholes shall be fitted with either an eccentric cone or a flat "reducer" slab. Manholes shall be adjusted to match the finished grade with no less than two precast grade rings fitted with a cast iron frame and cover not less than 24" in diameter.

The inside diameter of the manhole shall be of such size that it accommodates the outside diameter of the largest adjoining pipe, however, in no case shall the inside diameter of any manhole be less than 48 inches. All pipe ends shall be rounded and all joints grouted. No pipe ends shall extend into the barrel of the manhole.

When the flowline of the manhole is over seven (7) feet below the top of the cover the inside of the manhole will be no less than 60 inches in any direction.

## SECTION 63: CAST-IN-PLACE CONCRETE PIPE

### **63-1.01 DESCRIPTION**

Cast-in-place concrete pipe shall conform to Section 63 of the State Standard Specifications

### **63-1.02 MATERIALS**

Consistency of the concrete shall be determined in accordance with ASTM C-143. Maximum slump shall be 2 inches.

#### **63-1.02A Structures**

Where shown on the plans, inlet and outlet structures shall be constructed or installed in connection with cast-in-place concrete pipe. Where such structures are constructed or installed, the ends of pipes shall be placed flush or cut off flush with the structure face, unless otherwise directed by the Engineer.

A starter section shall be used at the beginning of each run of cast-in-place concrete pipe, and a closing section shall be used where a run cannot be completed because of lack of clearance ahead in the trench. Starter sections shall be six feet in length and of the same inside diameter as the cast-in-place concrete pipe. Manhole bases may be formed by opening and troweling the cast-in-place concrete pipe on continuous runs.

Storm drain manholes shall be standard four or five foot diameter precast manholes as detailed in the Standard Plans. Storm drain manhole barrels and taper sections shall be precast concrete sections using Type II Portland Cement complying with ASTM C-150.

Catch basins shall be constructed as shown in the Standard Plans. Concrete for cast-in-place catch basins shall be Class B. Bar reinforcing steel shall conform to and be placed in accordance with the provisions of Section 52 of the State Standard Specifications and details shown on the City of Willits Standard Plans.

Connections to existing storm drain structures shall be made with care to avoid unnecessary damage to any existing curb and gutter or sidewalk. Any damaged section of curb and gutter or sidewalk shall be removed and replaced in accordance with City Standards and as approved by the Engineer. Pipe connections to the existing structures shall be sealed with cement mortar.

### **63-1.04 EARTHWORK**

The following shall apply in lieu of Section 63-1.04 of the State Standard Specifications.

Backfill shall be placed in accordance with Standard 222, "Standard Trench Detail" of the City of Willits Standard Plans, except that the pipe bedding specifications shall not apply.

### **63-1.06 CURING AND PROTECTING CONCRETE**

The following shall apply in lieu of Section 63-1.06 of the State Standard Specifications.

Curing and protecting concrete shall comply with the following requirements:

Hand spraying of the curing compound will be permitted. During the period following the

placement of the concrete, the ends of the pipeline shall be covered with suitable material to maintain a humid condition within the pipe for a minimum of seven days.

Initial backfill placement shall be made immediately after the concrete has hardened sufficiently to prevent injury to the pipe during backfill operations.

The concrete pipe shall be protected as provided in Section 90-8, "Protecting Concrete" of the State Standard Specifications.

After the pipeline has been completed, but not prior to seven days following the placement of the concrete, the Contractor shall backfill the pipe trench in accordance with the requirements of City Standard 222, "Standard Trench Detail" of the City of Willits Standard Plans.

In all cases, the Contractor shall be responsible for correcting any damage to cast-in-place concrete pipe caused by premature or excessive loading prior to the end of a seven day curing period.

#### **63-1.07 VIDEO INSPECTION**

A closed-circuit television inspection of all newly constructed storm sewers shall be conducted in accordance with Section 64-1.10 of these Specifications.

## SECTION 64: PLASTIC PIPE

### 64-1.01 DESCRIPTION

Plastic storm drain pipe (ADS N-12) shall conform to the provisions of Section 64, "Plastic Pipe" of the State Standard Specifications. Plastic pipe shall be Type S corrugated polyethylene pipe with a smooth inner lining and corrugated outer wall.

### 64-1.05 EARTHWORK

Excavation and backfill shall be as shown on City Standard 222, "Backfill and Resurfacing in Paved Areas" of the City of Willits Standard Plans.

### 64-1.07 LAYING PIPE

No pipe shall be laid which is damaged or which, in the opinion of the Engineer, is unsuitable for use.

### 64-1.10 VIDEO INSPECTION

The Contractor shall hire an independent television inspection service to perform a closed-circuit television inspection of all newly constructed storm sewers. A video tape of the television inspection shall be produced and delivered to the City in color DVD format on a compact disc, together with a typed log of their inspection.

The following Conditions shall exist prior to the television inspection:

- A. All storm sewer lines shall be installed, backfilled and compacted;
- B. All structures shall be in place, all channeling complete and all pipelines accessible from structures;
- C. All other underground facilities, utility piping and conduit within two feet of the storm sewer main, shall be installed;
- D. All compaction required shall be completed;
- E. Immediately before the television inspection, run fresh water into the storm sewer until it passes through the downstream manhole.
- F. No more than 1" deep water will be present at all times during video inspection.

When the above work has been completed, the Contractor shall notify the City 48 hours in advance of the date for television inspection. During this inspection, the Contractor or his authorized representative shall be present to observe the video pictures as provided by the television camera. Cameras shall be pointed upstream and all video inspections shall run upstream.

The following video tape observations shall be considered defects in the construction of the storm sewer pipelines and will require corrections prior to acceptance:

- A. Off grade – 0.08 foot, or over, deviation from grade.
- B. Joint separations – over  $\frac{3}{4}$ ";
- C. Offset joints;
- D. Chips in pipe ends – none more than  $\frac{1}{4}$ " deep;

- E. Cracked or damaged pipe or evidence of the presence of an external object bearing upon the pipe (rocks, root, etc.);
- F. Infiltration;
- G. Debris or other foreign objects;
- H. Other obvious deficiencies when compared to Approved Plans and Specifications, these Standards and Standard Drawings.

The Contractor shall be notified in writing of any deficiencies revealed by the television inspection that will require repair, following which the Contractor shall excavate and make the necessary repairs and request a television re-inspection. Television re-inspection shall be at the Contractor's expense.

## SECTION 65: REINFORCED CONCRETE PIPE

### **65-1.01 DESCRIPTION**

Reinforced concrete pipe shall be either Class III, Class IV, or Class V, as shown on the plans and shall conform to the provisions of ASTM C-76.

### **65-1.03 EARTHWORK**

Excavation and backfill shall be as shown on City Standard 222, "Standard Trench Detail" of the City of Willits Standard Plans.

### **65-1.04 STRUCTURES**

Storm drain manholes shall be standard four or five foot diameter precast manholes as detailed in the Standard Plans. Storm drain manholes barrels and taper sections shall be precast concrete sections using Type II Portland Cement complying with ASTM C-150.

Catch basins shall be constructed as shown in the Standard Plans. Concrete for cast-in-place catch basins shall be Class B. Bar reinforcing steel shall conform to and be placed in accordance with the provisions of Section 52 of the State Standard Specifications.

Connections to existing storm drain structures shall be made with care to avoid unnecessary damage to any existing curb and gutter or sidewalk. Any damaged section to be removed and replaced in accordance with City Standards and as approved by the Engineer. Pipe connections to the existing structures shall be sealed with cement mortar.

### **65-1.07 LAYING PIPE**

No pipe shall be laid which is cracked, checked, spalled, or damaged and which in the opinion of the Engineer is unsuitable for use.

### **65-1.11 VIDEO INSPECTION**

A closed-circuit television inspection of all newly constructed storm sewers shall be conducted in accordance with Section 64-1.10 of these Specifications.

## SECTION 66: CORRUGATED METAL PIPE

### **66-1.01 DESCRIPTION**

Corrugated metal pipe shall conform to the provisions of Section 66-3, "Corrugated Steel Pipe" of the State Standard Specifications. Corrugated metal pipe shall not be used in the street right-of-way.

### **66-1.05 LAYING PIPE**

Excavation and backfill shall be as shown on City Standard 222, "Standard Trench Detail" of the City of Willits Standard Plans.

No pipe shall be laid which is damaged or which, in the opinion of the Engineer is unsuitable for use.

### **63-1.08 VIDEO INSPECTION**

A closed-circuit television inspection of all newly constructed storm sewers shall be conducted in accordance with Section 64-1.10 of these Specifications.

## SECTION 71: SEWERS

### 71-1.01 MATERIALS

Sewer pipe shall be polyvinyl chloride pipe or ductile iron pipe.

#### 71-1.01A Polyvinyl Chloride (PVC) Pipe

PVC solid wall sewer pipe and fittings for gravity sewers shall be made of all new, rigid, unplasticized polyvinyl chloride in accordance with ASTM Standard Specifications D3034 and F-679 and shall have a wall thickness of at least SDR 35. Joints shall consist of an integral thickened bell-and-rubber ring and shall conform to ASTM D3212. Gaskets shall conform to ASTM E477. Joints shall be assembled using only manufacturers recommended lubricant.

All pipe shall have a home mark to indicate full penetration of the spigot when the joint is made.

All PVC pipe entering or leaving a concrete structure shall have a standard manhole gasket, as supplied by the pipe manufacturer, firmly clamped around the pipe exterior and cast into the structure base or near the structure wall center as a water-stop.

After pipe installation and placement and compaction of backfill, but prior to placement of pavement, all pipe shall be cleaned and then mandrel to measure for obstructions. Obstructions shall included, but not be limited to deflections, joints offsets and lateral pipe intrusions. A rigid mandrel, with an effective circular cross section having a diameter of at least 95% of the specified base inside diameter shall be pulled through the pipe by hand. The minimum length of the circular portion of the mandrel shall be equal to the nominal diameter of the pipe. All obstructions encountered by the mandrel shall be corrected by the Contractor.

Obstructions due to deflection shall be corrected by replacement of the over-deflected pipe, not by re-rounding in place.

If a section of pipe fails to meet the mandrel test and is reinstalled and fails the second time, said section(s) of pipe shall be replaced with an approved rigid pipe material.

The manufacturer shall furnish to the City a 5% deflection mandrel and proving ring as shown on the District Standards for the City's retention and use.

The average inside diameter for PVC Solid Wall Sewer Pipe shall be the "Average Outside Diameter" (see ASTM D3034 and F679 minus 2.12 time the "Minimum Wall Thickness" (see ASTM D3034 and F619).

The Contractor shall retest the solid wall pipe using a mandrel with an effective circular cross section having a diameter of at least 95% of the specified average inside diameter eleven (11) months after recordation of Notice of Completion of a City contract or after the acceptance by the City Council of a subdivision. Any pipe which fails to pass the mandrel test shall be replaced at the expense of the Contractor. The City reserves the right to determine the longitudinal limits of any pipe that is required to be replaced. Pipe replacement shall be guaranteed by the project maintenance bond.

Lateral wyes added after pipe installation shall be solvent welded saddles, not mechanically connected wyes.

### **71-1.01B Ductile Iron Pipe (DIP)**

Ductile iron pipe shall be cement lined, new pipe conforming to ANSI A21.51-1976 or most recent issue, if any, as sponsored by the American Water Works Association for thickness class 50 Ductile Iron Pipe. The pipe shall be furnished with bell and spigot ends, "Tyton Joints", or mechanical joints except where specifically specified on the plans.

All ductile iron pipe buried underground shall be encased in polyethylene film in the tube form. Polyethylene material and installation procedure for the encasement shall conform to ANSI/AWWA C105/A21.5-82 or most recent issue, if any. Installation Method "A" as described in aforementioned specification shall apply.

Couplings for connection to the sewer main shall be of a type approved by the City.

### **71-1.02 EXCAVATION AND BACKFILL**

Excavation and backfill shall be as shown on Std. Dwg. 300, "Standard Trench Detail" of the City of Willits Standard Drawings.

All stumps and large roots encountered during trenching operations shall be removed to the satisfaction of the City. The trench shall be opened sufficiently ahead of the pipe laying operations to reveal obstructions. Trench crossings shall be provided as necessary to accommodate public travel and to provide convenient access to adjacent properties. Flow shall be maintained in any sanitary sewers, storm drains, water lines or water courses encountered in trenching.

All cutting, handling and disposal of asbestos cement pipe shall be done in accordance with the Contractor's State Licensing Law and all applicable laws and regulations.

### **71-1.03 EXISTING MANHOLES**

Existing manholes and cleanouts located within the street right of way shall be adjusted to conform to finished pavement grades in accordance with the details shown on the plans.

Prior to the removal of an existing manhole frame, a platform shall be constructed in the manhole above the top of the sewer to prevent any dirt or debris from falling into the sewer. The platform shall remain in place until all work on the manhole has been completed and the asphalt concrete has been placed around the manhole. Prior to the removal of the platform from the manhole, all dirt and debris shall be removed.

Lowering of the manhole ring and cover shall be accomplished by the removal of existing concrete grade rings below the manhole ring or by removing the upper section of manhole barrel and substituting therefore a shorter section of barrel.

At the Contractor's option, in lieu of removing and replacing barrel sections as above provided, the top of the existing upper barrel section may be trimmed and the taper section replaced on such trimmed surface provided, however, that such trimming shall not crack or otherwise damage the remaining portion of the barrel section.

In the event that the portion of barrel section to remain is cracked or damaged or otherwise made unsuitable for use by such trimming, the entire section shall be removed and replaced with a new section of barrel. Trimming of taper sections will not be permitted.

All sections of the manhole shall be set in cement mortar or in approved gasket material. Trim excess gasket material and plaster inside joints smoothly, Manhole sections set in cement mortar shall be smoothly plastered inside and out.

After placing the surface course of asphalt concrete, all manholes and cleanouts shall be located and marked with white paint before the close of that work day.

Within two working days of paving, all manholes and cleanouts shall be adjusted to grade and inspected.

#### **71-1.04 PIPE LAYING**

Where ground water occurs, pumping shall continue until backfilling has progressed to a sufficient height to prevent floatation of the pipe. Water shall be disposed of in such a manner as to cause no property damage or not be a hazard to public health or the environment.

Where projects consist of construction or new mains or extensions of existing mains, contractor must make provisions to keep flow from entering the sewer collections system. This shall include the installation of a positive sealing plug on the outlet of the new mains closest manhole to the existing main. Additionally, if any new laterals enter the new main between the existing main and the closest manhole on the new main, each lateral shall be individually plugged with a positive sealing plug. The Contractor shall be held responsible to periodically check that all plugs are holding tight. The Contractor shall ensure that the water contained in the new main is not contaminated with human or hazardous waste, prior to removal of any plugs. The Contractor shall make provisions to dewater the new mains without disposal into the sewer collection system and without cause of property damage or hazard to the public health or environment. Failure to comply may result in penalties.

Where construction consists of construction a new main or extension of an existing main, the downstream end of the new main shall be securely closed with a tight fitting plug until the construction is accepted by the City.

If the new sewer main is connection to an existing main at a location other than an existing manhole, the Contractor shall pothole the existing sewer main to verify invert grades and locations.

Sewer pipe shall be installed on the alignment and grade as shown on the plans and in accordance with the Standard Specifications, or as directed by the Engineer. Existing sewer laterals shall be removed and replaced at the locations shown on the plans, or as directed by the Engineer.

Sewer pipe shall be laid in straight lines and on uniform rates of grade between points where changes in alignment or grade are shown on the plans. The interior of the pipe shall be free of foreign matter before lowering into the trench.

The pipe manufacturer's written instructions covering the installation of his pipe shall be closely followed unless otherwise directed by the Engineer or there Special Provisions. The Trench shall not be backfilled until authorized by the Engineer. Pipe laying shall proceed upgrade with the spigots pointing in direction of flow.

Electro-optical grade setting devices must be used and shall be operated by a person proficient in its operation.

Any section of pipe found to be defective or which has had grade or joints disturbed shall be re-laid by the Contractor at his expense.

Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and efficient execution of the work. All pipe, fittings and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. The pipe and accessories shall be inspected for visible defects prior to lowering into trench. Any visibly defective or unsound pipe shall be replaced.

The line and grade of existing utilities shall not be altered. Any leakage caused in existing utilities by reason of the Contractor's operations shall be immediately repaired at the Contractor's expense.

Existing storm drains shall be supported or removed and replaced at the Contractor's option. In any case, the Contractor shall be responsible for maintaining the existing line and grade of the storm drain.

Existing water lines shall be supported in place with service maintained during construction. The Contractor shall be responsible for any damage resulting from improper backfilling.

Existing Sewer lines shall be supported in place with service maintained during construction. The Contractor may, at his option, remove and replace any sewer laterals which are not in use during construction. The Contractor shall be responsible for damage to sewer lines during construction and any damage resulting from improper backfilling.

#### **71-1.05 SEWER LATERALS AND SERVICES**

Sewer lateral inverts shall be set above the mid point of the sewer main.

##### **71-1.05A Grades and Alignment**

Service sewers shall be run in practical alignment at a uniform slope of not less than  $\frac{1}{4}$  inch per foot toward the main sewer; provided that where it is impractical due to the depth of the main sewer or to the structural features or the arrangement of any building or structure, to obtain a slope of  $\frac{1}{4}$  inch per foot, any such piping may have a slope of not less than  $\frac{1}{8}$  inch per foot when approved by the Engineer.

##### **71-1.05B Pipe Cover and Clearance**

Lateral sewer shall be installed at sufficient depth to serve the parcel involved, but in no case less than three (3) feet clear cover at the property line.

Building sewers shall have a clear cover of eighteen (18) inches minimum from finished grade. Where clear cover is less than eighteen (18) inches, cast iron pipe shall be used. Where building sewers are located in or cross driveways, ductile iron pipe shall be used.

#### **71-1.06 SEWER STRUCTURES**

Manholes shall be standard precast concrete manholes as detailed in Std. Dwg. 301. Mains larger than 18" in diameter or deeper than eight feet require 60" diameter manholes.

Manhole bases may be poured-in-place concrete on undisturbed earth. The bases shall be poured full thickness against the side of the manhole excavation or to dimensions shown on the plans; the manhole excavation site shall be dewatered before pouring.

Precast manhole bases, conforming to City Standard in dimensions and the requirements outlined below for materials may be used. Such pre-cast bases shall be placed on a minimum 12-inch thick cushion of drain rock, as specified in Std. Dwg. 301. The drain rock shall extend a minimum of 6 inches beyond the outside edges of the base.

Concrete for manhole bases shall be Class A Portland cement concrete conforming to the applicable requirements. The Portland Cement shall be Type V conforming to ASTM Designation" C 150 or low-alkali-Type II cements meeting the requirement for Type V cement.

Where steel reinforcement is required in manhole base construction, such reinforcement shall be furnished and placed as shown on the plans and in accordance with the applicable provisions.

The base slab and initial riser section shall be connected with integrally poured concrete to create a watertight joint. Flow channels shall be constructed as shown on the plans. Changes in size or grade shall be made gradually and changes in direction by smooth curves. All finished surfaces shall be smoothly troweled with a steel trowel. All manhole barrels and taper section shall be precast concrete sections using Type V Portland cement complying with ASTM Designation: C 150 or low-alkali Type II cement meeting the requirements for Type V cement.

The 48-inch and 60-inch diameter barrels and taper sections shall be constructed in accordance with the applicable provisions of ASTM Designation: C 478 and shall be inspected by the City to determine that the interior surfaces are smooth and free of pockets or depressions. The inside face of all barrels, tapers and rings shall be aligned with and flush to adjacent sections.

Manhole frames and covers shall be in accordance with City Std. Dwg. 303.

At locations where sewer is to be installed into or out of existing manholes, the manhole wall and base shall be shipped to accept the new size of pipe and to form a flow channel in the manhole base. The Contractor shall dry pack around the pipe between the pipe and the chipped out opening. The Contractor shall also backfill the area around the pipe with concrete to insure a watertight connection.

Mainline cleanouts shall be installed per Std. Dwg. 307 at the locations shown on the Plans.

All joints in manholes shall be sealed by means of a performed, self-bonding, self-sealing plastic gasket, such as "Ram-Nek", manufactured by the K.T. Snyder Company, Houston, Texas, or

approved equal. Joints seals shall be installed in full compliance with the manufacture's current recommendations. All manholes shall be water tight prior to grouting.

After placing the surface course of asphalt concrete, all manholes and cleanouts shall be located and marked with white paint before the close of that work day.

Within 48 hours of paving, all manholes and cleanouts shall be adjusted to grade and inspected.

#### **71-1.07 TESTING OF SEWERS**

Testing of all portions of the sewer including manholes will be required.

For either exfiltration or infiltration test, the maximum leakage shall not exceed 50 gallons per inch of pipe diameter per mile per 24 hours as measured over a period of 30 minutes minimum. Should the leakage exceed the maximum allowable rate, the Contractor shall repair, overhaul, or rebuild the defective portion of the sewer line to the satisfaction of the City at no additional cost to the City. After repairs have been completed by the Contractor, the line shall be retested as specified above, all at no cost to the City.

The test shall be performed after the line has been laid and all backfill placed and compacted as specified elsewhere in these specifications. The Contractor, at his option, may test the line at any time during construction. However, the final test for acceptance shall be made only after all backfill is in place and compacted.

In the event that the exfiltration test prescribed above is impractical due to wet trench conditions, these portions of the sewer line where such conditions are encountered will be tested for infiltration. The Engineer shall determine whether the exfiltration or infiltration test will be used. Even though the test for leakage is within the prescribed limits, the Contractor shall repair any obvious leaks.

Low pressure air testing may be used in lieu of water testing at the option of the Contractor. Water testing may be required by the City. The following procedure shall be used for air testing.

1. Clean pipe to be tested by propelling a snug fitting inflated rubber ball through the pipe with water. Remove any debris.
2. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
3. If the pipe to be tested is submerged in ground water, Inspector may require that gauge pressure be increased to compensate for groundwater hydrostatic.
4. Add air slowly to the portion of the pipe installation under test until the internal pressure is raised to 4.0 psig.
5. Check exposed pipe and plugs for abnormal leakage by coating with a soap solution. If any leakage is observed, bleed off air and make necessary repairs.
6. After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
7. After the two minute period, disconnect the air supply.

8. When pressure decreases to 3.5psig, start stop watch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. The minimum allowable time in seconds shall be based on the diameters and lengths of pipe under test. The Contractor will be allowed to manually bleed air as required to drop the internal pressure to 3.5 psig to start test.

Air test data sheets and nomograph with directions for computing the specification time are available at the office of the City Engineer.

The Contractor shall hire an independent television inspection service to perform a closed-circuit television inspection of all newly constructed sewers. A DVD video of the television inspection shall be produced and delivered to the City of Willits in color video, DVD format, together with a typed log of their inspection.

The following conditions exist prior to the television inspection:

- A. All sewer lines shall be installed, backfilled and compacted.
- B. All structures shall be in place, all channeling complete and all pipelines accessible from structures; all other underground facilities, utility piping and conduit within two feet of the sewer main, shall be installed.
- C. All compaction required shall be completed.
- D. Pipelines to be inspected shall be balled, flushed and mandrel tested.
- E. The final air or water test shall have been completed.
- F. Immediately before the television inspection, run fresh water into the sewer until it passes through the downstream manhole.
- G. No more than 1" deep water will be present at all time during video inspection.

When the above work has been completed, the Contractor shall notify the City 48 hours in advance of the date for television inspection. During this inspection, the Contractor or his authorized representative shall be present to observe the video pictures as provide by the television camera. Cameras shall be pointed upstream and all video inspections shall run upstream.

The following video tape observations shall be considered defects in the construction of the sewer pipelines and will require corrections prior to acceptance:

- A. Off grade- 0.08 foot, or over, deviation from grade;
- B. Joint separations- over  $\frac{3}{4}$  inch;
- C. Offset joints;
- D. Chips in pipe ends- no more than  $\frac{1}{4}$ " deep;
- E. Cracked or damaged pipe or evidence of the presence of an external object; bearing upon the pipe (rock, root, etc)
- F. Infiltration;
- G. Debris or other foreign objects;
- H. Other obvious deficiencies when compared to Approved Plans and the Specifications, these Standards and Standard Drawings;

The Contractor will be notified in writing of any deficiencies revealed by the television inspection that will require repair, following which the Contractor shall excavate and make the necessary repairs and request a television re-inspection. Television re-inspection shall be at the Contractor's expense.

**71-1.08 TRENCH RESURFACING**

Trench resurfacing shall be as shown on Std. Dwg. 222 "Standard Trench Detail".

## SECTION 73. CONCRETE CURB, GUTTER AND SIDEWALK

### **73-1.01 DESCRIPTION**

Concrete curb, gutter and sidewalks shall conform to Section 73 of the State Standard Specifications. The following shall apply in lieu of Section 73-1.01 of the State Standard Specifications.

This work shall consist of constructing curbs, sidewalks, gutter, depressions, island paving, and driveways of the form and dimensions shown on the plans, and as specified in these specifications and the Special Provisions. The concrete shall attain a minimum compressive strength of 3000 psi at 28 days, and shall contain not less than six sacks of cement per cubic yard. Maximum slump of the concrete shall be 4 inches, as determined in accordance with ASTM C-143.

All miscellaneous concrete shall meet the above criteria unless directed otherwise by the City Engineer.

A pedestrian ramp shall be constructed in all curb returns in accordance with City Standard 209, "Pedestrian Ramp Details", of the City of Willits Standard Plans.

Reinforcement shall conform to the provisions in Section 52, "Reinforcement" of the State Standard Specifications.

### **73-1.02 SUBGRADE PREPARATION**

The subgrade shall be constructed true to grade and cross section, as shown in the plans or directed by the Engineer. It shall be watered and thoroughly compacted, and unsuitable material removed and replaced, to provide a stable grade with above optimum moisture content for a minimum depth of 0.5-foot.

Base material under curb and gutter and sidewalk shall comply with the provisions of Section 26, "Aggregate Bases" of these Standard Specifications and shall be a minimum of 4 inches in compacted thickness.

Sidewalks constructed across driveways, and driveway ramps constructed between curb and edge of sidewalk, shall be six inches thick.

The completed subgrade shall be tested for grade and cross section by means of a template supported on the side forms, and shall not project into the planned concrete cross section at any point. The subgrade and forms shall be wet immediately in advance of placing concrete.

### **73-1.05 CURB CONSTRUCTION**

Attention is directed to City Standard 205, "Curb, Gutter and Sidewalk", of the City of Willits Standard Plans.

Weakened plane joints shall be constructed at 15-foot intervals, except that when Portland Cement concrete pavement is adjacent thereto, the joints shall coincide with the weakened plane joints in the adjacent pavement. The joints shall be constructed to a minimum depth of 1½ inches

by scoring with a tool which will leave the corners rounded with a ¼ inch radius and insure a free movement of the concrete at the joint.

Expansion joint filler strips shall have the top edge placed and securely held ¼ inch below the surface. Expansion joints shall be edged with an edging tool having a radius of ¼ inch.

The finished surface of the top of the curb shall not vary more than 0.01 foot above or below the staked grade.

**73-1.06 SIDEWALK, GUTTER DEPRESSION, ISLAND PAVING, CURB RAMP (WHEELCHAIR RAMP) AND DRIVEWAY CONSTRUCTION**

The surface of sidewalks shall be marked into rectangles per City Standard 205, "Curb, Gutter and Sidewalk" of the City of Willits Standard Plans.

Weakened plane joints shall be constructed to a minimum depth of one inch with a tool which will leave the corners rounded with a ¼ inch radius and insure a free movement of concrete at the joint.

Expansion joint filler strips shall have the top edge placed and securely held ¼ inch below the surface. Expansion joints shall be edged with an edging tool having a radius of ¼ inch. Scoring lines shall be made with jointer tools having a radius of ¼ inch.

## SECTION 81: MONUMENTS

### **81-1.01 DESCRIPTION**

The following shall apply in lieu of Section 81 of the State Standard Specifications.

This work shall consist of furnishing and installing cast-in-place survey monuments at the locations shown on the plans and in accordance with City Standard. 219, "City Monument" of the City of Willits Standard Plans.

The exact location of the monuments will be established by the City Engineer for City contracts and by the sub divider's Engineer for subdivisions, and upon completion, the monuments will be checked and the center point stamped by the City Engineer of the sub divider's Engineer/Surveyor.

Standard City brass markers shall be furnished by the Contractor. They shall be placed in survey monuments before the concrete block has acquired its initial set and shall be firmly bedded in the concrete. The concrete block shall be so located that when the marker is installed, the reference point will fall within a one-inch circle in the center of the marker.

## SECTION 99: WATER MAIN CONSTRUCTION

### 99-1.01 DESCRIPTION

All water mains and related appurtenances shall be constructed in accordance with the City of Willits Water System Design Standards.

### 99-1.02 PIPE

The pipe, except where otherwise specified on the plans, can either be Ductile Iron or Polyvinyl Chloride (PVC), all in accordance with the following:

- A. Ductile Iron Pipe shall be cement lined, new pipe conforming to ANSI A 21.51 1976 or most recent issue, in any, as sponsored by the American Water Works Association for thickness Class 50 Ductile Iron Pipe. The pipe shall be furnished with either Bell and Spigot ends, "Tyton Joints" or Mechanical Joints except where otherwise specified on the plans.
- B. Polyvinyl Chloride (PVC) Pipe 4-inch shall be minimum class 150, or as shown on the plans and conforming to the requirements of AWWA C900 "Standard for Polyvinyl Chloride Pressure Pipe, 4-inch through 12-inch for Water" and shall be furnished with either bell ends or couplings designed to effect an elastomeric pressure seal. PVC pipe greater than 12-inch shall be Class 235 (DR18) unplasticized polyvinyl conforming to AWWA C905 and ASTM D2241.

Each and every length of pipe and coupling shall be marked with the manufacturer's name, lot number and the date the pipe was tested. The pipe shall be tested in accordance with the most recent American Water Works Standard Specifications and amendments thereto for the pipe furnished. The testing shall be performed in a State licensed materials testing laboratory where the testing standards meet or exceed State of California testing standards.

Accompany or preceding each load of pipe delivered, a certificate shall be furnished to the City certifying that the pipe which is (to be) delivered has been tested and meets the requirements of the American Water Works Association Standard Specifications. The certificate shall identify the pipe by manufacturer's name, lot number and date tested by a State certified materials testing laboratory.

A number 10 insulated copper wire shall be laid on top of and long the entire length of all non-metallic service laterals and mains and shall be extended to the surface at all valve, blow-off and meter box locations sufficiently for locator equipment to be attached.

### 99-1.03 SERVICE TUBING

All water service tubing shall be Polyvinyl Chloride (PVC) C200 conforming to the latest AWWA standards as described in ANSI/AWWA or the latest revision and with ASTM D2241.

#### **99-1.04 FITTINGS**

All fittings shall be new grey iron or ductile iron fittings conforming to ASNI/AWWA C110/C153 or latest revision and shall have the proper type of ends to match the type of pipe used. Gray iron fittings shall be coated inside and outside with a petroleum asphaltic coating conforming to AWWA C110 and shall meet or exceed the pressure rating of the pipe to be installed.

Ductile iron fittings shall be cement mortar lined in accordance with AWWA C104 or latest revision and shall have a petroleum asphaltic coating conforming to AWWA C110. Ductile iron fittings shall have a minimum pressure rating of 250 psi and shall otherwise meet or exceed the pressure rating of the pipe to be installed and shall have a minimum Class 53 thickness rating.

#### **99-1.05 GATE VALVES**

Gate valves shall conform to AWWA Standard C504 or latest revision and shall be the resilient seat type with non-rising stem, opening counter-clockwise with O-ring stem seal and suitable ends for connections to type of pipe or fitting used. The working pressure rating of gate valves shall meet or exceed the pressure rating of the pipe specified on the plans. External bolts and nuts shall be 304 stainless or poly wrapped.

#### **99-1.06 BUTTERFLY VALVES**

Butterfly valves shall conform to AWWA Standard C504 or latest revision and shall be of the rubber seat type. Valve discs shall rotate 90 degrees for the full open position to the tight shut position. The valve seat shall provide a tight shutoff at a pressure differential of 150 psi upstream and 0 psi downstream in either direction. The valve operator shall be the traveling nut type. Valve shall open with a counter-clockwise rotation of the operating nut.

#### **99-1.07 VALVE BOXES**

Each gate valve shall be covered by a precast 8" valve box set flush with street surface with cast iron ring and cover marked "WATER". The valve boxes are to be Christy G5, VG8, or approved equal.

#### **99-1.08 FIRE HYDRANT AND LATERAL ASSEMBLY**

At the location(s) shown on the plans, the Contractor shall provide and install a fire hydrant and lateral assembly per Std. Dwg. 502.

No bends will be allowed in fire hydrant laterals without approval of the City Engineer.

Fire hydrants shall conform to the list of approved fire hydrants shown on the Engineer's Approved List.

Fire hydrants will have two 2 ½ inch outlets and one 4 ½ inch outlet.

All hydrants shall be painted in accordance with the specifications shown on Std. Dwg. 502.

All hydrants shall be installed plumb.

After placement, the fire hydrant shall be covered with a bag until accepted into service.

Before a fire hydrant may be placed in service, a high velocity flushing of the hydrant lateral shall be witnessed and approved by City personnel.

#### **99-1.09 ASBESTOS CEMENT PIPE**

The installation of asbestos cement pipe is prohibited. All cutting, handling and disposal of asbestos cement pipe shall be done in compliance with the Contractor's State Licensing Law and all applicable laws and regulations.

#### **99-1.10 EXCAVATION AND BACKFILL**

Excavation and Backfill of the water pipe shall be as shown on Std. Dwg. 300.

Excess Materials from excavation shall become the property of the Contractor and shall be disposed of to the satisfaction of the City Engineer.

Prior to disposal of any materials or operation of any equipment on sites provided by the Contractor for disposal of excess trench excavation owned by him, the Contractor shall submit to the City Engineer written authorization for such disposal of materials and entry permission signed by the owners of the disposal site and the required permits.

#### **99-1.11 LAYING AND HANDLING PIPE MATERIALS**

Proper implements, tools and facilities satisfactory to the City Engineer shall be provided and used by the Contractor for safe, convenient and workmanlike prosecution of the work. All pipe fittings and valves shall be carefully lowered into the trench in such a manner as to prevent damage to pipe coatings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. Before lowering and while suspended, the pipe shall be inspected for defects and the cast iron pipe rung with a light hammer to detect cracks. Any defective, damaged or unsound pipe shall be rejected and sound material furnished. Cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to pipe. All pipe stockpiled on the job shall be stored with the ends covered to prevent the entrance of foreign matter.

Whenever it is necessary, either in the vertical or horizontal plane, to avoid obstructions, or when long radius curves are permitted, the amount of deflection shall not exceed the maximum recommended by the pipe manufacturer or that required for satisfactory jointing.

Each length of pipe shall be free of any visible evidence of contamination, dirt and foreign material before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying of pipe. At times when pipe laying is not in progress, the open ends of any pipe which have been laid shall be closed by approved means to prevent the entrance of small animals or foreign material. Trench water shall not be permitted to enter the pipe.

#### **99-1.12 LAYING PVC PIPE**

Individual pieces of pipe, valves and fittings shall be joined by placing the rubber rings on the machined ends of the pipe and pulling the couplings, valves or fittings in accordance with the manufacturer's recommendations. The rings shall be checked to be sure they are in the proper position after the coupling is in place. Care shall be taken to insure proper seating of the rings, and adapters shall be utilized for connections as required by the manufacturer.

Fittings for PVC pipe shall be either the mechanical joint type or the push-on type.

PVC pipe shall be as specified in and installed per AWWA C900 or latest revision and in accordance with the manufacturer's recommendations.

#### **99-1.13 LAYING OF DUCTILE IRON PIPE (DIP)**

The flame cutting of pipe by means of oxyacetylene torch shall not be allowed.

Ductile iron pipe shall be as specified in and installed per AWWA C600 or latest revision and in accordance with the manufacturer's recommendations.

#### **99-1.14 THRUST BACKING**

All tees, bends and plugs shall be provided with thrust backing and/or harness as shown on the plans or in accordance with Std. Dwg's. 519- 520.

#### **99-1.15 HYDROSTATIC TEST**

The test shall be performed after the line has been laid and all backfill placed and compacted as specified elsewhere in these specifications. The Contractor, at his option, may test the line at any time during construction. However, the final test for acceptance shall be made only after all backfill is in place. Each valve section of pipe, or combined sections, as approved by the City Engineer, shall be subjected to a hydrostatic pressure of not less than 200 psi for 15 minutes, then 150 for 30 minutes for a total duration of 45 minutes. Valves on existing mains in services required to be operated in connection with this job shall be operated only by City personnel. Each section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, all necessary apparatus, gauges and measuring devices shall be furnished by the Contractor. The Contractor shall make the taps into the pipe and shall furnish all necessary assistance for conducting the test. Before applying the test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at the points of the highest elevation, and afterward tightly plugged.

Suitable means shall be provided by the Contractor so that the City can determine the quality of water leakage under the test pressure. No pipe installation will be accepted until all leakage is stopped. The Contractor shall, at his own expense, locate the cause and repair any leakage.

#### **99-1.16 CHLORINATION OF PIPELINE**

Chlorine may be applied by any of the standard methods indicated in AWWA C651, subject to the approval of the City. The point of application of the chlorination agent shall be at the beginning of the pipe extension, or any valve section of it, and through a corporation stop inserted in the newly laid pipe.

Water from the existing distribution system shall be controlled to flow very slowly in the newly laid pipe during the application of chlorine. Valves on existing mains in service shall be operated only by City personnel. The rate of chlorine feed shall be in such proportion to the rate of water entering the pipe that the chlorine dose applied to the water entering the newly laid pipe shall be at least 100 ppm. Precautions shall be taken to prevent back pressure causing a reversal flow into treated pipe.

Treated water shall be retained in the pipe for a period of twenty-four hours. After the chlorine treated water has been retained for the required time, the chlorine residual at the pipe extremities and at representative points shall be at least five (5) parts per million. In the process of chlorinating, all valves and other appurtenances on the newly laid main shall be operated.

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe line. The water throughout its length shall, upon test, be proven both chemically and a bacteriological equal to the water quality serving the public from the existing water supply system.

Should the initial treatment, in the opinion of the City prove ineffective, the chlorination procedure shall be repeated until confirmed test show that the water sampled from the newly laid pipe conforms to the aforementioned requirements.

Care shall be taken, and if necessary provisions shall be made by the Contractor to insure no highly chlorinated water from treated pipelines enters any natural surface waters either directly or by way of any storm drainage system.

There shall be a 34-hour waiting period after blowing off the main prior to taking bacteria samples. The initial bacteria test shall be of the 28-hour duration type, in accordance with the State Department of Health Services requirements. If the initial bacteria test fails, two consecutive passing bacteria test must be obtained prior to making the tie-in. The first of these two subsequent tests shall be of the 24-hour duration type, and the second shall be of the 72-hour duration type. Bacteria test are valid for only 30 days. If there is more than a 30-day lapse between a passing bacteria test and the applicable tie-in, the bacteria test must be repeated prior to water main tie-in. Contractor shall be responsible for reimbursing the City for all cost associated with performing sample gathering and testing.

#### **99-1.17 WATER MAIN TIE INS**

Water main tie-ins are not permitted on Fridays or days preceding a holiday except as authorized by the City Engineer.

The Contractor shall notify the Engineer 24 hours prior to individual mainline shutdowns required to facilitate his tie-in operations. Tie-ins will not be scheduled until a written passing bacteria test has been received by the Engineer. All shutdowns and valve turning operations shall be performed by City personnel only. A City inspector must be present during all tie-in operations. No tie-ins shall be performed without prior authorization of the Engineer.

Pipe and fittings furnished for tie-ins shall be no smaller than the existing water main to which each tie-in is made.

Contractor or parties who fail to keep field appointments may be billed for scheduled City personnel waiting or standby time which was used and the Contractor shall bear the costs incurred by the City for re-notification of its customer.

Interruption of service to commercial customers shall, as much as practical, be coordinated with the customer's needs. The Contractor will contact the customer, consider the customer's interest and inform the City accordingly.

After hours work or weekend work is to be avoided whenever possible and any overtime cost shall be borne by the contractor requesting such after hours work. Normal working hours are: 8 a.m. to 5 p.m. Monday through Friday.

Contractors or parties requiring work on any kind by the City shall request such services a minimum of 24 hours in advance of the time such services are desired. Work requests, which will involve City personnel for more than 8 hours and/or extensive number of City supplied parts, including installation of new meters, shall be requested a minimum of 7 calendar days in advance.

If it is necessary to terminate service to any customer, the contractor shall make the request for such work an additional 72 hours (three additional working days for total of five working days advance notice) in advance of the time such services are desired, to allow the customers affected to have a minimum of 72 hours notice.

During the work, the Contractor shall exercise all necessary precautions to prevent the entrance of trench water or any other foreign material into the water main and shall conduct all operations in accordance with the most stringent sanitation practices. The interior of all appurtenances being installed shall be thoroughly swabbed with a strong HTH solution prior to installation.

#### **99-1.18 WATER SYSTEM COMPONENT REPORTING**

The Contractor shall submit the material type, manufacture and model number of all water system components to the City prior to final testing.

#### **99-1.19 CONSTRUCTION WATER**

Construction water shall be obtained from the City only at the point(s) designated by the City.

Hydrant meters shall only be connected to hydrants which have been accepted by the City.

A refundable deposit for each meter will be required.

Contractors are prohibited from operating gate valves or fire hydrants on the City system. Acquisition of water through appropriation at un-metered fire hydrants or other facilities is a violation of City Ordinances and State Law. Use of construction water from sources other than the City Water System must be approved by the City.

## SECTION 124: MATERIAL RECYCLING

### **124-1.01 DESCRIPTION**

In accordance with Willits Municipal Code Section 8.09 “Construction Demolition and Recycling” the Contractor shall dispose of all portland cement concrete and asphalt concrete, generated from removal or demolition activities on the project, at a recycler for these materials. The Contractor shall provide receipts verifying delivery and approximate quantity (in tons) of the material delivered to a material recycler.

All other excess materials from the project shall become the property of the Contractor and shall be disposed of by him, at his expense.

STREET DESIGN SPECIFICATIONS

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## STREET DESIGN SPECIFICATIONS

### I. DEFINITIONS

"**Alley**" means any unnamed street contained in the public right-of-way twenty-four feet or less in width, used primarily for vehicular service access to the back or side of properties.

"**All weather surface**" means any surface that provides unobstructed access to conventional drive vehicles, including sedans and fire engines, is capable of supporting a 40,000 pound load during wet weather conditions. The surface treatment must be either concrete or paving unless otherwise approved by the city engineer and the Willits Fire Protection District.

"**Arterial street**" shall mean a street whose primary purpose is to carry through traffic and means a fast or heavy street of considerable continuity which is used primarily as a traffic way to facilitate movement of heavy traffic between major residential areas or major residential areas and commercial areas.

"**Bike lane**" means those on-street bikeways that are part of the normal street section and provide marked bike lanes that delineate the separate rights-of-way assigned to bicyclists and motorists.

"**Bike path**" means a separate, off-street bike path or trail that is not part of the normal street section.

"**Collector street**" shall have the primary purpose of intercepting traffic from intersecting minor streets and handling traffic to the nearest arterial street or intercepting traffic from one collector street and handling traffic to another collector street. It shall serve as an access to abutting properties.

"**Cul-de-sac street**" shall have the primary purpose of serving abutting land use and connecting to the nearest minor street or collector street. It is not intended to pass traffic through to another street and is a local street with only one outlet.

"**Curb cut**" shall mean an opening or depression in the street curb installed and intended for pedestrian or vehicular use. Curb cuts shall be measured across the "flat bottom" width of the opening or depression.

"**Dead end road**" means any road that has only one point of vehicular ingress/egress. Dead end roads shall include Cul-de-sacs.

"**Development**" means and includes, but is not limited to, the subdivision of land into two or more parcels, the construction of new structures or buildings, and changes in or renovations to existing structures or buildings and the attendant construction of improvements, either of public or private nature, for which approval by the City of Willits is required prior to commencement.

"**Driveway**" for the purposes of single family detached housing, "driveway" means a way or place in private ownership for vehicular traffic providing access to two or fewer residential units

or buildings less than 50 feet from a public roadway over a common parcel or easements(s), primarily by the owners or occupants of the common parcel or easement(s), and necessary service and emergency vehicles, but from which the general public may be excluded, and which are not maintained by a public agency. Driveways shall meet all provisions, as adopted, of the Uniform Fire Code with respect to Fire Department access. Access to driveways shall be via a curb cut per City Standard 210.

**“Fire Department access road”** means an access road reserved for emergency vehicles and the conduct of fire fighting or rescue operations, or as designated by the fire department, and posted in accordance with Vehicle Code section 22500.1.

**"Hillside"** shall mean properties or portions of properties that have an average cross-slope of 10 percent or greater.

Properties or portions of properties to which this definition applies or which have other demonstrated hillside characteristics qualify for consideration for use of hillside design standards. Determination of the appropriateness of use of such standards shall rest with the City Engineer.

**"Industrial street"** shall have the primary purpose of handling industrial and manufacturing type business traffic. It is a street that provides access to or through an industrial zone, commercial zone, or an area of high truck and other large vehicle traffic.

**"Minor street"** shall have the primary purpose of serving abutting land use and handling traffic to the nearest collector street.

**"Pathway (equestrian)"** shall mean a public or private paved or rock-surfaced path, excluding sidewalks, for the use of pedestrians and horses.

**"Pathway (mixed use)"** shall mean a public or private paved or rock-surfaced path, excluding sidewalks, for the use of pedestrians, horses, and bicycles.

**"Pathway (pedestrian)"** shall mean a public or private paved or rock-surfaced path, excluding sidewalks, for the use of pedestrians.

**"Private road or street"** means a way for vehicular traffic providing access to lots or units over a common parcel, primarily by the owners or occupants of the common parcel, and necessary service and emergency vehicles, but from which the general public may be excluded, and which is not maintained by a public agency.

Such roads or streets may be designed and constructed to different standards than public streets in the following areas: width, pavement, street lighting, signing and entry islands. Private streets should not connect two or more public streets (except when necessary for internal circulation or emergency vehicle access) and shall be designed and constructed to the standards of private roads or streets as defined within these standards in terms of minimum width, structural section, curb, gutter, sidewalk, and all other aspects not specifically referenced above or in this section. No City enforcement of "no parking" signs or other such regulatory signs shall be provided for such streets.

**"Public street"** means a way for vehicular traffic, whether designated as a minor street, collector street, arterial thoroughfare, freeway, or other designation, which is improved to City standards, dedicated for general public use, and maintained by a public agency. The term "street" shall include alleys as defined above.

**"Public way"** shall mean any street, channel, viaduct, subway, tunnel, bridge, easement, right-of-way, or other way in which a public agency has a right of use.

**"Sidewalk"** shall mean a Portland Cement Concrete (PCC) surfaced area for pedestrian usage located within the public or private street right-of-way or sidewalk easement and included as a standard element of a street section.

**"Street right-of-way"** width shall mean the shortest distance between the lines delineating the right-of-way of a street.

**"Street width"** means the distance between the curb faces of a street or edge of pavement where a curb face may be omitted by approval of the City Engineer.

**"Turnout"** means a widening on a roadway to allow vehicles to pass. All turnouts shall be per city standard and shall be intervisible.

## **II. GENERAL**

- A. For purposes of street layout and design, streets shall be classified as:
  - 1. Arterial Streets
  - 2. Industrial Streets
  - 3. Collector Streets
  - 4. Minor Streets
  - 5. Cul-de-sac Streets
  - 6. Alleys
  - 7. Driveways
- B. Street design standards shall be used for the design and construction of all private and public streets and for flatland streets and hillside streets.
- C. Deviations from these standards may be granted by approval of the City Engineer.
- D. The standards are considered minimum and do not preclude the City use to a higher standard.

## **III. REQUIREMENTS FOR SUBMITTAL OF IMPROVEMENT PLANS**

The City has requirements for submittal of Improvement Plans and Parcel Maps/Final Maps. Submittal forms shown in Figures A and B contain minimum submittal requirements. Submittal forms, which have been filled out and signed by the engineer or surveyor, must be included with all submittals. Current submittal forms may be obtained from the City of Willits.

#### IV. Street Design

##### A. Geometric Standard Cross Sections

<b>Item</b>	<b>Minimum Width</b>	<b>Street Classification</b>
Travel lane	14 feet	Industrial
	12 feet	Arterial, Collector
	10 feet	Minor, Cul-de-sac, Alley
Parking lane or shoulder	8 feet	Collector streets
Parking lane or shoulder	7 feet	Minor streets
Curb lane (no parking)	2 feet increase face of curb	All streets
Bike lane	6 feet against curb	When required
	6 feet against parking	Arterial streets
Curb radius for Cul-de-sac	60 feet Residential	Cul-de-sac
	75 feet Commercial (see Std. #212)	
One-way loop, hillside street	20 feet width	Minor - 100 ft $\varnothing$ radius
One-way loop, flatland street	20 feet width	Minor - 200 ft $\varnothing$ radius
Maximum length of cul- de-sac street measured from projected curb or edge of pavement line of inter- secting street to center of turnaround.	600 feet (or as approved by City Engineer)	Cul-de-sac
Length of streets allowed with no Cul-de-sac	150 feet from the projected curb or edge of pavement line of the cross street to end of dead end street	All Streets
Sidewalk	6 feet	All Streets (widen at obstructing locations to provide 4-foot minimum clear sidewalk)
Sidewalk - meandering (where permitted by Std.)	6 feet	Where applicable

<b><u>Item</u></b>	<b><u>Minimum Width</u></b>	<b><u>Street Classification</u></b>
Sidewalk easement	To back of sidewalk	All streets where required
Public utility easement	5 feet in back of property line or as required	All streets where required
Double left turn lane	Two 12-foot lanes	All streets where required
Single left turn lane	12 feet	All streets
2-Way left turn lane	14 feet	All streets
Right turn lanes	12 feet	All streets

**B. Access to Public Right-of-Way - Curb Cuts**

1. Each vehicular passageway to any parking or loading facility to or across a public right-of-way shall comply with the following requirements:
  - a. Curb cuts shall be a maximum of 40 feet in width for non-residential uses. The width is not to exceed 35 percent of each lot frontage, except as otherwise approved. Min. width of 20 feet for each legal lot of record.
  - b. Driveway widths, within residential areas, shall be a minimum of 12 feet in width for single driveways, a minimum of 16 feet for double or triple driveways up to a maximum of 24 feet, except as otherwise approved.
  - c. Wherever feasible, curb cuts serving adjacent uses shall be combined to minimize the number of entrances onto a public right-of-way on any block. No curb island is allowed when it is less than 10 feet between uses.
  - d. Only one curb cut may be installed for any parking or loading facility, except that one or more additional curb cuts may be allowed if the City Engineer determines that each such additional curb cut is necessary for the efficient operation of the facility and will not significantly reduce street capacity and traffic safety. Twenty (20) feet top to top on the curb island is required between driveways on a single parcel.
  - e. Any curb cut in a residential area on a corner lot shall be located at the farthest point possible from the curb return and outside of the sight vision triangle. Curb cuts shall be located a minimum of 10 feet from curb returns, except as otherwise approved by the City Engineer.
  - f. In commercial/industrial area, a minimum of 200 feet required separation between driveway and the intersection of two arterial,

industrial and/or collector streets except as otherwise approved by the City Engineer. At no time shall a curb cut be located closer than 20 feet from a curb return or 30 feet from a crosswalk whichever distance is greater.

- g. Except as otherwise approved by the City Engineer, curb cuts for any circular or "through" residential driveway must meet the following requirements:
  - 1. The curb cuts for such driveway shall be at least twenty feet apart top to top and a minimum of 10 feet from the side property line.
  - 2. Property frontage of 50' or less shall be limited to one driveway with not more than two driveways to be provided to any single property frontage.

## V. STREET ALIGNMENT

A. Streets shall be aligned with adjacent existing streets by continuations of the centerlines thereof, or by adjustment by curves, and shall be laid out for the most advantageous development of the entire area.

1. Minimum centerline horizontal curve radii shall be as follows:

a. Arterial Streets	500 feet
b. Collector & Industrial Streets	300 feet
c. Minor Streets (flatland)	200 feet
d. Cul-de-sac Streets	200 feet
e. Minor Streets (hillside)	100 feet

2. Lesser radii may be used only when sufficient evidence is presented to the City Engineer to show that the radii described above are not practicable. Any deviations require specific City Engineer's approval.

3. Super elevations are required on curves for the design of all arterial streets and for any other street with a design speed above 25 miles per hour, except as otherwise approved by the City Engineer.

B. Where necessary to give access to or permit satisfactory future subdivision of adjoining land, streets shall extend to the boundary of the property and resulting dead-end streets greater than 150 feet (measured from the projected curb or edge of pavement line of the cross street) shall have a temporary turnaround. Design of turnarounds other than the standard temporary turnarounds in the standard drawings requires specific approval by the City Engineer.

## VI. STREET GRADES

A. All street grades shown on the improvement plans shall refer to City of Willits benchmarks as established in the City of Willits. Assumed benchmark elevations will not be allowed.

1. All arterial and industrial streets shall have no grade rate in excess of 7 percent.
2. Collector, minor, and Cul-de-sac streets in the flatland shall have no grade rate in excess of 10 percent, except as specifically approved by the City Engineer.
3. Collector, minor, and Cul-de-sac streets in the hillside shall have no grade rate in excess of 15 percent unless specifically approved by the City Engineer.
4. Minimum grade rate for all streets shall be 0.5 percent.
5. Minimum valley gutter slope shall be 0.5 percent.
6. The grade of the pavement surface across an intersection shall not be more than 7 percent, except as approved by the City Engineer.
7. The gradient of each street entering an intersection shall not be more than 7 percent within a distance of 25 feet from the near curb line of the crossing street, except as approved by the City Engineer.
8. Vertical parabolic curves shall be used to connect grade profiles where the algebraic difference in grade rates exceeds one percent. The length of vertical curve required shall be determined by the following:

	<b>Minimum Stopping Sight Distance</b>	<b>Minimum Length of Curve</b>
Arterial and Industrial Streets	350 feet	200 feet
Collector Streets	200 feet	100 feet
Minor Streets	100 feet	100 feet
Cul-de-sac	100 feet	100 feet

9. Minimum cross-slopes for all streets shall be 2 percent. Maximum cross-slopes shall be 5 percent.
10. Maximum cross slopes in Cul-de-sac bulbs shall be 5 percent in flatland and 8 percent in hillside.
11. Driveway, private road, and fire department access road grades shall conform to the requirements of minor streets.
12. Exceptions to this section require specific approval by the City Engineer.

**VII. INTERSECTIONS**

- A. All streets entering upon any given street shall have their centerlines directly opposite each other or separated by at least 200 feet, except as otherwise authorized by the City Engineer.
- B. All streets shall intersect at right angles, or along radial lines when the intersection is within a curve, and shall have at least 50 feet of centerline tangent adjacent to the intersection, except as specifically approved by the City Engineer.
- C. Curb return radius:
 

Arterial/Industrial/Commercial	35 feet
Collector	30 feet
Residential	20 feet

At all intersections, the curb return radius to be utilized will be determined by the highest street classification (e.g., a minor-arterial street intersection will require 35-foot radius).

## **VIII. TYPICAL SECTIONS**

- A. Typical sections for the improvement of streets and alleys shall be shown on the Improvement Plans. Curb and gutter sections, curb return radii, parking strip widths, and sidewalk widths may be modified where these improvements have been constructed in a portion of a block to other than the sections shown. However, any modifications require the specific approval of the Engineer.

## **IX. PAVEMENT DESIGN**

Design of the structural section for all streets shall be in accordance with the following criteria:

- A. Traffic Index
  - 1. Street classification shall be determined by the City Engineer.
  - 2. Within subdivisions for residential and residential collector streets, use Standard Drawing No. 201, "Traffic Index Chart for Flexible Pavements". For all other streets, the T.I. will be determined by the City Engineer.
  - 3. In no instance will the T.I. be less than the following:
    - (1) Arterial & Industrial Streets a minimum T.I. of 7.0
    - (2) Collector Streets a minimum T.I. of 5.5
    - (3) Minor & Cul-de-sac Streets a minimum T.I. of 4.5
  - 4. For all street design use Standard Drawing No. 202, "Structural Design Chart for Flexible Pavements" and these "Street Standard Specifications and Design Standards".
- B. Soils Reports
  - 1. Resistance "R" Values
    - a. A qualified Soils Engineer shall obtain sufficient soil samples within the proposed street right-of-way to permit the determination of the R-Value of the various materials that lie immediately under the planned structural section. The cost of sampling and testing shall be at the Owner's expense.
    - b. The basement soil shall be tested according to California Test 301 "Method for Determination of the Resistance "R" Value of Treated and Untreated Bases, Subbases, and Basement Soils by the Stabilometer" in use by the California Department of Transportation, Transportation Laboratory. Design of the structural section for a particular street will normally be based on the lowest R-Value material encountered.

- c. If the Engineer elects to utilize an "R" Value of 5, then R-Value tests will not be required.
- d. The Owner's Soils Engineer shall submit to the City a Materials Report showing the location and elevation of sampling points and R-Value data. The Owner's Soils Engineer may be required to make a field survey of soil conditions when rough sub grade has been cut to verify data presented in the Materials Report. The cost of any additional sampling and testing shall be at the Owner's expense.

2. Material Testing

- a. A minimum of one sample of asphalt shall be tested for all developments installing public street improvements to ensure that the asphalt is meeting with city specifications. If developments are installing in excess of 500 tons of asphalt, one test shall be required for every 500 tons used.

C. Gravel Equivalents

- 1. Structural sections are to be determined using the following formula applied to determine the G.E. of the cover required over the basement soil and intermediate structural section layers.

$$GE = 0.0032 (TI)(100-R)$$

where:

GE = gravel equivalent in feet

TI = traffic index

R = R-Value of the material to be covered.

- 2. Structural sections using aggregate base shall have the gravel equivalent of the asphalt concrete layer increased by 0.20 feet.
- 3. In no instance shall a structural section be less than as follows:

Arterial & Industrial Streets: 0.37 feet asphalt concrete  
1.00 feet Class 2 aggregate base

Collector Streets: 0.27 feet asphalt concrete  
0.80 feet Class 2 aggregate base

Minor & Cul-de-Sac Streets: 0.25 feet asphalt concrete  
0.50 feet Class 2 aggregate base

D. Gravel Equivalent Factors & R-Values

- 1. The gravel equivalent factor for asphalt concrete surface courses shall be obtained from the following equation:  $G_f = 2.5 (5.14/T.I.)^{0.5}$

In no case shall the gravel equivalent factor exceed 2.5.

2. Gravel factors and R-Values for design shall be as follows:

<u>Materials</u>	<u>Gravel Equivalent</u>	<u>R-Value</u>
Class 2 A.B.	1.1	78
Class 4 A.S.B.	1.0	50

E. Improvement Plan Notation

1. All Improvement Plans shall include the design "R" Value and the Traffic Index. This information shall be included in the typical section or in a note or table on the same sheet as the typical sections.

**X. REQUIREMENTS FOR EMERGENCY ACCESS DURING CONSTRUCTION**

A. Sub grade Conditions

	<b>Good</b>	<b>Poor</b>
Summer April 1 - Sept. 30	Excavated & Drained Sub grade	Excavated & Drained Sub grade
Winter October 1 - March 31	6 inches rock	6 inches rock & fabric

1. For structures with a ridge line of at least 35 feet above adjacent rough fire access grade, or for structures with three or more stories, 1½ inches of asphalt base over 4 inches of aggregate base shall be provided in all proposed and approved fire access areas from the structure out 150 feet.
2. Winter conditions shall take effect and be enforced by the City Engineer on October 1. The City Engineer shall have the authority to move this date up as early as September 1, depending on the particular season's rainfall and projections.
3. Sub grade defined as native soil at bottom of street section (base and paving), excavated to the approximate lines and grades shown on the project grading plan, and provided with a discharge for collected water, as approved by the City Engineer.
4. Base shall be Class 2 aggregate base or alternative recommended by Soils Engineer and approved by the City Engineer.
5. Poor sub grade defined as R-Value 10 or less.
6. Base shall be placed only on an unyielding excavated and drained sub grade, and to be compacted to at least 90 percent relative compaction.
7. Fabric to be a ground stabilization fabric such as Mirafi 600X or equivalent.

## **XI. REQUIREMENTS FOR DRIVEWAYS, PRIVATE ROADS, AND FIRE DEPARTMENT ACCESS ROADS**

- A. Private driveways shall be in conformance with City Standard 209 with a maximum length of 150 feet from a public road and serve a maximum of two residential buildings. The width of driveways serving one residential building shall be a minimum of 12 feet and a maximum of 24 feet. Driveways serving two residential buildings shall have a minimum width of 24 feet.
- B. Private driveways serving one residential building that has a distance greater than 150 feet from a public road shall be considered a Fire Department Access Road and shall have a minimum width of 24 feet.
- C. Any driveway or access road serving more than 2 residential buildings shall be considered a private road.
- D. The structural section of all private roads, driveways, and fire department access roads shall be constructed in conformance with City Standards and shall have a minimum designed live-load capacity of HS 20.
- E. Any private road serving more than one parcel shall be required to be named.
- F. Fire Department Access Roads shall have an all weather access road surface width of not less than 20 feet and an unobstructed vertical clearance of not less than 15 feet. The widths and clearances required by this section shall be increased when the fire chief or city engineer determines that such widths and clearances are not adequate under the particular circumstances to provide fire apparatus access.
- G. The turning radius of either a Fire Department Access Road or private road shall be a minimum of 25 feet.
- H. All private roads and fire department access roads shall have intervisible turnouts.
- I. No private road, fire department access road, or driveway shall have a maximum grade in excess of twenty percent (20%).
- J. No fire department access road or private road shall have a vertical curve whose length is less than one hundred (100) feet.
- K. No private road, driveway, or fire department access road shall have a horizontal inside radius of curvature of less than fifty (50) feet.
- L. When a bridge is required to be used as access for a private driveway, private road, or fire department access road, it shall be constructed and maintained in accordance with the applicable sections of the Building Code and the Standard Specifications for Highway Bridges, and using designed live loading sufficient to carry the imposed loads of fire apparatus. The minimum designed live load capacity shall be HS 20, as defined by the American Association of State Highway and Transportation Officials. All bridges shall have appropriate signing identifying bridge capability, including weight and vertical clearance limits.
- M. The required roadway width of a fire department access road shall not be obstructed in any manner, including parking of vehicles. Minimum required widths and clearances established under this section shall be maintained at all times. No owner, lessee, or other person in charge or control of any premises shall, after receiving notice thereof, permit or allow any activity, practice, or condition to occur or exist on the premises which lessens, obstructs, or impairs the access required under this section.

- N. When required, approved signs or other approved notices shall be provided and maintained for fire department access roads to identify such roads and prohibit the obstruction thereof or both. When used, "NO PARKING" signs shall comply with the provisions of the California Vehicle Code. Where curbs exist adjacent to hydrants located along the roadway of a fire department access road, the curbs shall be painted red or otherwise appropriately marked by the owner, lessee, or other person in charge or control of the premises to prohibit parking for a distance of fifteen (15) feet in either direction from any such hydrant.
- O. Parking of vehicles on a fire department access road may be prohibited when the fire chief determines that it is necessary to keep the roadway clear and unobstructed. In such case, the chief may require the owner, lessee, or other person in charge or control of the premises to paint the curbs red or install signs or other appropriate notice to the effect that parking is prohibited by order of the fire department. It shall be the property owners' responsibility to maintain in good condition the signs or paint. When a fire department access road is marked or signed as provided herein, no person shall park or leave standing any vehicle on the roadway.

PROJECT ADDRESS	APN	FILE NO.
PROJECT NAME	NO. OF PROPOSED LOTS	RELATED FILES
APPLICANT'S NAME	ADDRESS	PHONE
PROPERTY OWNER'S NAME (PRINT)	ADDRESS	PHONE
ENGINEER & LICENSE NO.	MAILING ADDRESS	PHONE
Improvement Plans must be prepared by a California Registered Civil Engineer. All submitted plans and calculations must be signed and stamped. Incomplete submittals will not be accepted.		

**SUBMITTAL REQUIREMENTS**

- \_\_\_\_\_ FINAL MAP (Associated with these plans)
- \_\_\_\_\_ PARCEL MAP (Associated with these plans)
- \_\_\_\_\_ NO MAP (Associated with these plans)
- \_\_\_\_\_ If a rezoning or zoning permit is associated with these Improvement plans, has that rezoning been approved by the City?  
Yes \_\_\_\_\_ No \_\_\_\_\_

**NUMBER OF COPIES**

- ( ) Eight blue-line or black-line copies (24" x 36"). (DO NOT SUBMIT ORIGINAL DOCUMENTS UNTIL REQUESTED BY THE CITY ENGINEER).

**GENERAL**

- ( ) 1. North arrow (to be upward facing if practical) and sheet number (all sheets).
- ( ) 2. Scale, written and graphic (all sheets).
- ( ) 3. Location Map
- ( ) 4. Benchmark (established City, or County USGS benchmark).
- ( ) 5. Symbols Legend.
- ( ) 6. Abbreviation legend.
- ( ) 7. Index to drawings including reference to sheet numbers.
- ( ) 8. General Notes with reference to City Standard 100.
- ( ) 9. City Engineer approval block.
- ( ) 10. Title block (all sheets):
  - ( ) A. Name of Engineering firm.
  - ( ) B. R.C.E. seal, signature, and expiration date.
  - ( ) C. Date prepared.
  - ( ) D. Title of project.
- ( ) 11. Clear and distinct delineation of project boundaries.
- ( ) 12. Nature and dimension of existing and proposed easements.
- ( ) 13. Typical section of all streets.
  - ( ) A. Width of street, right-of-way, easements, curb, gutter, sidewalk and landscape parcels (if required).
  - ( ) B. Crown and centerline location.
  - ( ) C. Pavement and base type and thickness, traffic index and R-value.
  - ( ) D. Cut and fill slopes (maximum & minimum and limits).
  - ( ) E. Saw cut line 1' minimum into existing paving.
- ( ) 14. City Standards applicable to construction.

**STREETS**

- Plan View:
- ( ) 15. Centerline data (submit calculations).
  - ( ) 16. Street names, widths (including right-of-way widths).
  - ( ) 17. Property lines and lot numbers.
  - ( ) 18. Centerline stationing:
    - ( ) B. Conform to existing stationing if previously set.
    - ( ) B. All B.C.'s, E.C.'s and grade breaks, driveways, etc.
  - ( ) 19. Gutter slopes and flow arrows showing magnitude and direction between grade breaks and around curb returns, cul-de-sacs and knuckles.
  - ( ) 20. Flow arrows showing slope and direction from roadway crown or center of intersection to ¼ points of curb returns, cul-de-sacs and knuckles.
  - ( ) 21. Direction of flow arrows.
  - ( ) 22. Top of curb elevations and stationing at curve points, grade breaks, and lot lines.

- 23. Required sidewalk and handicap ramps.
- 24. Monument location at all E.C.'s, B.C.'S and street intersections
- 25. Existing improvements (shown in dashed lines).
- 26. Length and location of all transitions in curb and gutter.
- 27. Redwood headers and barricades.
- 28. Radius, length and delta of all curb returns, centerline curves and curves at face of curb.
- 29. Driveway gradients.
- 30. Striping, Signing and Lighting Plan. (Shown on a separate sheet from street and utility improvements).

## Profile View:

- 31. Existing ground surface at centerline of streets (100' each direction beyond improvements, 200' for major streets).
- 32. Profile of improvement:
  - C. Stationing and elevation at all grade breaks.
  - C. Vertical curve data.
- 33. Cross sections every 25 feet for all half streets with future x-sections, see 31 above.
  - C. Stationing.
  - C. Existing and proposed elevations.
  - C. Existing and proposed cross-slopes.
  - C. Centerline, existing edge of pavement (conform) and top of curb elevations.
  - C. Scale - vertical - maximum of 1" = 5'; horizontal - maximum of 1" = 50'.
- 34. Street centerline slope.

**STORM DRAINAGE**

## Plan View:

- 35. Direction of flow arrows.
- 36. Stationing of all drainage structures within streets.
- 37. Specified size/type for all drainage structures.
- 38. Inlet and manhole numbers corresponding to profile view.
- 39. Pipe diameter and length (radius for curved section).
- 40. Pipe material (may be specified instead in general note or shown on profile) and class of pipe.
- 41. Open channels or swales:
  - C. Flowline elevation at the beginning, end and all grade breaks.
  - C. Slope of swale.
  - C. Typical section.
  - C. Existing and proposed improvements clearly delineated as such.

## Profile View:

- 42. Invert grades/flowlines at all drainage structures.
- 43. Inlet/manhole numbers corresponding to plan view.
- 44. Existing ground surface and finished grade.
- 45. Pipe diameter and length.
- 46. Pipe slopes.
- 47. Utility crossings (show with clearance).
- 48. Profile open channels.

**UTILITIES**

- 49. Existing and proposed utilities (sewer, water, street lighting, etc.).
  - C. Location.
  - C. Type, size, length, class, and slope.
  - C. Material (can specify in General Note).
  - C. Clear delineation between public and private utilities.

**SEWER**

- 50. Plan:
  - C. Manhole/cleanout numbers corresponding to profile view.
  - C. Stationing of structures within street right-of-way.
  - C. Direction of flow arrows.
  - C. Lateral locations (include invert at upstream end of lateral for other than 2% slope or where cover is critical).
- 51. Profile:
  - C. Existing and finished grade over the line.
  - C. Invert elevations (in and out) and slopes.
  - C. Manhole cleanout numbers corresponding to plan review.

**WATER**

- 52. Plan View: (Profile only necessary when conflicts occur).
  - C. Applicable City standards (500 series) & depth of pipe note.
  - C. Valve size and locations, valve boxes.
  - C. Fire hydrants and service lateral information.

**STREET LIGHTING**

- ( ) 53. Plan:
  - ( ) F. Compliance with City Standards.
  - ( ) F. Light locations, stationing and standard.
  - ( ) F. Pull box location and standard when not located adjacent to light pole.
  - ( ) F. conduit location; size and type.
  - ( ) F. service point location.
- ( ) 54. Exact horizontal & vertical location of all existing high pressure gas line(s) shown every 100 ft.

**GRADING**

- ( ) 55. Existing and finished contours (and grade elevations at all grade breaks).
- ( ) 56. Existing and proposed (if known or required) structures (i.e., houses, wells, septic systems, etc.).
- ( ) 57. Flow arrows, drainage plan.
- ( ) 58. Existing trees noted as to whether to be saved or removed (base elevations for trees to be saved).
- ( ) 59. Typical cross-section and conform grades at all property lines.
- ( ) 60. Erosion and sediment control measures proposed (show on separate plan for grading).
- ( ) 61. Creek cross-sections to establish setback per City ordinance.
- ( ) 62. Provisions for lot drainage, lot-to-lot drainage is not allowed.
- ( ) 63. Provisions for accepting off-site drainage.
- ( ) 64. Top of curb elevation and stationing of property lines.
- ( ) 65. Slope rounding details for top of cuts.
- ( ) 66. Retaining wall details and engineering calculations (2 copies if applicable).
- ( ) 67. Specify soils engineer's control of grading in compliance with Chapter 70 U.B.C. and soil's investigation (note on grading plan).
- ( ) 68. Provisions for pad drainage when exterior grades are higher.
- ( ) 69. Existing structures and dimensions from new lot lines to structures to be saved.
- ( ) 70. Typical lot drainage details.
- ( ) 71. Quantities of cut and fill.
- ( ) 73. Elevation of pads, including property corners.
- ( ) 1. Sidewalk drains (minimum 1 per lot).

**SUPPORTING DATA**

- ( ) 2 copies of the Resolution of Approval.
- ( ) 2 copies of the Soils Report
- ( ) 2 copies of the Engineer's Estimate
- ( ) 2 copies of the design calculations (structural sections, walls, etc.).
- ( ) 1 copy of fire flow calculations.
- ( ) 1 copy of sewer demand calculations.
- ( ) 1 copy of house fire sprinkler and water service demand calculations for water meter sizing.
- ( ) 1 copy curb and centerline calculations of all streets.
- ( ) 1 copy of any necessary off-site letters of permission.
- ( ) 2 copies of on-site easements/rights-of-way deeds and plats (if map is not included).
- ( ) 2 copies of all required off-site easements/rights-of-way deeds and plats.
- ( ) 2 copies of Arborist's Report.
- ( ) 4 sets of Site Lighting Plans (if applicable).
- ( ) 4 sets of Site Parking and Signing Plans (if applicable).
- ( ) Copies of transmittal letters to:
  - ( ) A. County of Mendocino
  - ( ) B. P G & E.
  - ( ) C. Pacific Bell / AT&T.
  - ( ) D. Corps of Engineers (as necessary).
  - ( ) E. Caltrans (as necessary).
  - ( ) F. Other

**I HAVE READ THE FOREGOING AND HAVE SUPPLIED ALL OF THE INFORMATION REQUESTED (OR HAVE PROVIDED A WRITTEN EXPLANATION WHICH ACCOMPANIES THIS CHECKLIST WHICH EXPLAINS ANY OMISSIONS) AND HAVE SIGNED AND STAMPED ALL SUBMITTALS OTHER THAN NORMAL CORRESPONDENCE.**

**SIGNATURE AND STAMP OF ENGINEER \_\_\_\_\_ DATE**

**FIGURE B**

**CHECK LIST  
PARCEL MAP/FINAL MAP**

**CITY OF WILLITS**

PROJECT ADDRESS	APN	FILE NO.
NAME OF PROPOSED PROJECT	NO. OF PROPOSED LOTS	RELATED FILES
APPLICANT'S NAME	ADDRESS	PHONE
PROPERTY OWNER'S NAME (PRINT)	ADDRESS	PHONE
SURVEYOR/ENGINEER & LICENSE NO.	MAILING ADDRESS	PHONE
NOTE: Final Maps and Parcel Maps must be prepared by a person licensed in California to perform land surveying. All submittals must be signed and stamped. Incomplete submittals will not be accepted.		

**SUBMITTAL REQUIREMENTS**

**Number of Copies**

( ) Five (5) blue-line or black-line copies (18" x 26") showing the proposed division clearly and legibly with accurate dimensions and including the following information (check, or mark as not applicable): **DO NOT SUBMIT ORIGINAL DOCUMENTS UNTIL REQUESTED BY THE CITY ENGINEER.**

**CERTIFICATES AND ACKNOWLEDGEMENTS**

(Required on the first sheet or sheets)

- ( ) 1. Owner's certificate and acknowledgement (individual/partnership/corporate).
- ( ) 2. City Clerk's Certificate.
- ( ) 3. Trustee (if such exists) certificate and acknowledgement.
- ( ) 4. Engineer's or Surveyor's statement and seal.
- ( ) 5. Owner's of interest certificate (if applicable).
- ( ) 6. City Engineer's statement.
- ( ) 7. City Treasurer's certificate
- ( ) 8. County Tax Collector's certificate.
- ( ) 9. County Clerk's certificate.
- ( ) 10. Public Utility Easement Statement.
- ( ) 11. Improvement certificate.
- ( ) 12. County Recorder's certificate.
- ( ) 13. Planning Commission certificate

Note: All certificates shall be in accordance with state law and in the format kept on file in the offices of the City Engineer.

**TITLE BLOCK**

Required on all sheets:

- ( ) 14. Title block located in lower right hand corner of drawing.
- ( ) 15. Assessor's parcel number(s).
- ( ) 16. Name of project or parcel map number.
- ( ) 17. Total number of lots.
- ( ) 18. Total number of common parcels (if applicable).
- ( ) 19. Total project acreage (to the nearest 0.01 acre).
- ( ) 20. Date prepared.
- ( ) 21. Sheet number and number of sheets (if more than one sheet is required).
- ( ) 22. Name of party (company) responsible for preparing the map.

**GENERAL INFORMATION**

Required on all sheets:

- ( ) 2. Sheet size 18" x 26" (outside dimensions).
- ( ) 24. 1" blank margin all around the edge of the sheet.
- ( ) 25. No use of ditto marks.

**CITY OF WILLITS**

<p>Required on Specific Sheets:</p> <p><input type="checkbox"/> 26. Key map (if more than two map sheets are required).</p> <p><input type="checkbox"/> 27. Location map (to be located on the first map sheet or the key map, if one is required, and to be oriented in the same direction as the parcel/final map).</p> <p><input type="checkbox"/> 28. Title company name, located inside the border in the lower left corner of the first sheet only.</p> <p style="text-align: center;"><b>MAP REQUIREMENTS</b></p> <p>General Requirements (Required on all Map sheets):</p> <p><input type="checkbox"/> 29. North arrow (to be upward facing, if practical).</p> <p><input type="checkbox"/> 30. Scale (written and graphic).</p> <p><input type="checkbox"/> 31. Symbols legend.</p> <p><input type="checkbox"/> 32. Basis of bearings with tie shown to the subdivision.</p> <p><input type="checkbox"/> 33. The exterior boundary of the subdivision designated by a distinctive border.</p> <p><input type="checkbox"/> 34. Reference to adjoining tracts or lots (record data).</p> <p><input type="checkbox"/> 35. Reference to adjoining map sheets (if more than one map sheet is required).</p> <p><input type="checkbox"/> 36. Reference to adjoining railroads and highways.</p> <p><input type="checkbox"/> 37. Existing easements (on-site and off-site):</p> <p style="padding-left: 20px;"><input type="checkbox"/> B. Locations and dimensions.</p> <p style="padding-left: 20px;"><input type="checkbox"/> B. Noted with deed reference.</p> <p style="padding-left: 20px;"><input type="checkbox"/> B. Purpose and nature (public or private).</p> <p><input type="checkbox"/> 38. Proposed easements.</p> <p style="padding-left: 20px;"><input type="checkbox"/> B. Locations and dimensions.</p> <p style="padding-left: 20px;"><input type="checkbox"/> B. Noted with deed reference.</p> <p style="padding-left: 20px;"><input type="checkbox"/> B. Purpose and nature (public or private).</p> <p><input type="checkbox"/> 39. Each lot shown entirely on one sheet.</p> <p><input type="checkbox"/> 40. All dimensions in feet and hundredths.</p> <p><input type="checkbox"/> 41. Pertinent record data shown in parenthesis or per legend designation (next to measure data).</p> <p><input type="checkbox"/> 42. Existing monuments shown along with relevant information (found, set, retagged, or removed).</p> <p><input type="checkbox"/> 43. Monuments to be set shown and labeled with relevant information (size, location, type and tag).</p> <p><input type="checkbox"/> 44. Reference to additional map sheets.</p> <p>Street Requirements:</p> <p><input type="checkbox"/> 45. Approved names.</p> <p><input type="checkbox"/> 46. Existing and proposed street widths.</p> <p><input type="checkbox"/> 47. Distance from centerline to edge of right-of-way.</p> <p><input type="checkbox"/> 48. Centerline monuments.</p> <p><input type="checkbox"/> 49. Distance between centerline monuments.</p> <p><input type="checkbox"/> 50. Centerline bearing.</p> <p><input type="checkbox"/> 51. Centerline curve data (delta, radius, and length).</p> <p><input type="checkbox"/> 52. Right-of-way curve data.</p> <p><input type="checkbox"/> 53. Private streets designated as such.</p> <p>Lot Requirements:</p> <p><input type="checkbox"/> 54. Lots numbered (beginning with number 1 or letter A and continuing consecutively without duplication or omission. No circles or other figures shall be placed around lot numbers except for the last number where such placement shall be optional).</p> <p><input type="checkbox"/> 55. Lot line dimensions.</p> <p><input type="checkbox"/> 56. Lot line bearings.</p> <p><input type="checkbox"/> 57. Lot line curve data (delta, radius, and length).</p> <p><input type="checkbox"/> 58. Survey tie to boundary (for planned unit developments or condominium "footprints").</p> <p>"Designated Remainder" and "Remaining Lands":</p> <p><input type="checkbox"/> 59. "Designated remainder" - Government Code Sections 66424.6 and 66434(e) shall be treated as follows:</p> <p style="padding-left: 20px;"><input type="checkbox"/> B. If greater than or equal to 5 acres in size, shown by deed reference.</p> <p style="padding-left: 20px;"><input type="checkbox"/> B. If less than 5 acres in size, shown as part of the survey.</p> <p><input type="checkbox"/> 60. "Remaining Lands" (future phases) labeled with a document number, and if less than 5 acres in size, shown as part of the survey.</p> <p>Additional Map sheet:</p> <p><input type="checkbox"/> 61. Net acreage to the nearest square foot (0.01 acre for lots over 1 acre in size).</p> <p><input type="checkbox"/> 62. Soils report notation.</p> <p><input type="checkbox"/> 63. Area(s) subject to inundation identified as such.</p> <p><input type="checkbox"/> 64. Building setback lines.</p> <p><input type="checkbox"/> 65. Building envelope with survey tie to lot line or boundary (if applicable).</p> <p><input type="checkbox"/> 66. Vehicular access restriction notation (if applicable).</p> <p><input type="checkbox"/> 67. Seismic setback lines (if applicable).</p> <p><input type="checkbox"/> 68. Archaeological sites (if applicable).</p> <p><input type="checkbox"/> 1. Creek setback lines (if applicable).</p>
---

**SUPPORTING DATA**

- 70. One (1) Copy of Tentative Map.
- 71. One (1) Copy of Resolution of Approval.
- 72. One (1) copy of Preliminary Title Report (issued within the most recent three months).
- 73. Two (2) copies of computer printout documenting survey closure calculations for the following:
  - C. Blocks
  - C. Lots
  - C. Street centerlines
  - C. Survey ties
  - C. Proposed easements (when not parallel to property lines)
- 74. One (1) copy of records referenced and used to prepare the survey (Examples: record of survey, filed maps, recorded deeds, and easements, etc.).
- 75. Two (2) copies of the legal descriptions and plats for all dedications performed by separate instrument(on-site and off-site).
- 76. Two (2) copies of project conditions, covenants, and restrictions.
- 2. Additional submittals involving condominium and townhouse projects:
  - C. Two (2) copies of condominium and townhouse plans.
  - C. One (1) copy of architectural drawings.
  - C. One (1) copy of computer printout establishing the location of the building footprint(s) within the subdivision.

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## **A.2 – Sanitary Sewer Standard Specifications**

SANITARY SEWER STANDARD SPECIFICATIONS

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## SANITARY SEWER STANDARD SPECIFICATIONS

### I. CONNECTION TO AN EXISTING PUBLIC SEWER

- A. A proposed sewer design must show a point of connection to an existing public sewer main. It is common for a project on one property to require the construction of sewer on an adjacent property before it can connect to the public sewer. Sewer system designs shall incorporate the design of any off-site sewer that is required for the connection to the public main. Appropriate portions of the City approved designs shall be included in the plans unless the mains have been accepted for maintenance by the City.

### II. MATERIALS

- A. Gravity sewer mains shall be Polyvinyl Chloride (PVC) SDR 26 or SDR 35 with City Engineers approval, or Ductile Iron Pipe.
- B. Large diameter gravity mains may be concrete cylinder pipe or reinforced concrete pipe with City Engineer approval.
- C. If a gravity sewer main is installed outside of a paved roadway, Ductile Iron Pipe is required.
- D. All Ductile Iron Pipe shall be polyethylene encased.
- E. Use of Asbestos Cement Pipe is not allowed under **any** circumstance.
- F. Sewer force mains shall conform to the materials requirements for water mains. Non-metallic pipes require tracer wire in accordance with Std. Dwg. 500.

### III. ALIGNMENT

- A. Follow the State of California, Department of Health Services, "Criteria for the Separation of Water and Sanitary Sewer Main".
- B. Public sewer mains outside the public street shall be kept to a minimum.
- C. Horizontal separation from storm drains shall be a minimum five feet clear.
- D. Horizontal separation from other utilities, such as gas, underground electric, underground television cable, etc., shall be a minimum of four feet clear between the pipes.
- E. Horizontal and vertical curves in gravity sewer mains will not be allowed unless specifically authorized by the City Engineer.
- F. In general, public sewer mains run parallel to street centerline.

### IV. MANHOLE AND CLEANOUTS

- A. A manhole is required at every horizontal or vertical change in alignment.
- B. Maximum distance between manholes is 300 feet.
- C. A manhole is required at the end of every main.
- D. Cleanouts may be installed in lieu of manholes at the end of a sewer main where the distance is less than 200 feet to the nearest manhole and the main size is 8" or less.
- E. Minimize the number of manholes.

- F. 60" diameter manholes are required for mains larger than 18" in diameter or deeper than 8' (indicate manhole diameter on plans).
- G. Private sewer mains must connect to the public main at a manhole.
- H. Provide sufficient drop through the manhole to compensate for energy loss caused by changes of alignment. A minimum drop of 0.10 foot is required for deflection angles greater than 30°.
- I. When pipe size increases, set inlet crown at least as high as the outlet crown.

## **V. DROP MANHOLES**

- A. Minimize the number of manholes.
- B. Standard drop manhole installations are required when the drop in the manhole is greater than 2 feet.

## **VI. ACCESSIBILITY**

- A. All-weather vehicle access is required to every manhole.
- B. Sewer easements are to be a minimum of 15' in width.
- C. All access roads must be a minimum 12' in width.
- D. Acceptable types of access roads are:
  1. 6" blue shale for slopes up to 10%.
  2. 2" of AC on 6" of aggregate base for slopes in excess of 10%.
- E. All access roads longer than 100' must have an approved turn-around.

## **VII. SIZE**

- A. Mains shall be sized to provide adequate capacity and a minimum 2 feet per second velocity.
- B. The minimum public main is 8" in diameter.
- C. The minimum private main is 6" in diameter.

## **VIII. COVER**

- A. Minimum cover for all gravity sewers is 24".
- B. Where cover is less than 36", Ductile Iron Pipe must be used.
- C. Definition of cover: distance from the top of the pipe to finished grade.

## **IX. SLOPE**

- A. Design all gravity sewers to achieve a minimum velocity of 2 feet per second. Use  $n=0.013$  for new pipe and  $n=0.015$  for existing systems.
- B. A minimum slope for 8" sewers is 0.5% or 1/2" per 100'.
- C. Maximum slope for gravity sewers is 15% or 15' per 100'.

## **X. SEWER LATERALS**

- A. Each lot should be served by one lateral.

- B. When more than one residential or commercial lot is served by a single lateral, the lateral must meet the private main standards.
- C. All laterals must connect to the main with a wye connection, see Detail310.
- D. Minimum slope of sewer laterals is 2% or ¼” per foot, unless otherwise approved by the City Engineer.

## **XI. LIFT STATIONS**

### General Requirements:

- A. Pressure reducing valves are installed to maintain overall system balance.
  - 1. Lift stations will not be allowed where an alternative gravity route exists.
  - 2. Design the lift station to serve the entire tributary at build-out densities conforming to the General Plan (Submit flow calculations).
  - 3. Lift stations must be of the wet-well, above ground lift station type. Submersible pump lift stations may not be used.
  - 4. Lift stations are not allowed within the street right-of-way.
  - 5. Provide a paved access road to allow service vehicles to be parked off the street and clear of the sidewalks. Turn-around may be required for stations constructed along heavily traveled streets. Provide service vehicle access to wet-well.
  - 6. Provide a reinforced concrete base slab sized adequately to counteract buoyancy. Provide supporting design calculations.
  - 7. Wet-well to be a minimum of 60” diameter. Provide resilient seat gate valve on-line into we-well.
  - 8. Provide a wet-well vent system. Venting through a grated sewer manhole cover will not be allowed.
  - 9. Provide water service with reduced pressure backflow preventer.
  - 10. Provide a spare air release valve prior to acceptance.
  - 11. Provide calculations to determine the need for hydrogen sulfide suppression in force main.
- B. Pumping Equipment.
- C.
  - 1. Lift station standard is 6’x 6’ diameter, above underground lift station by Gorman-Rupp.
  - 2. All pumps, motors, internal valves and piping, level indicators, control switches, ladders, alarms, blower and dehumidifier shall be manufactured and assembled as a package. Supply and warranty shall be through one company.
  - 3. The pumps shall be self-priming, horizontal, centrifugal, sewage pumps. Pumps shall pass a maximum solid, 2 ½” diameter sphere.
  - 4. Provide two pumps and controls to alternate lead and lag pump.
  - 5. Provide a spare rotation mechanism to replace either pump.
  - 6. Provide one set of routine service replacement parts for the pumps.
  - 7. Provide calculations used to determine the capacity of the wet-well and specifications for the pump.

8. Provide hour meters for each pump.
9. Provide an echo processing liquid level control system wired into the Gorman-Rupp control panel at the factory. Level control standard is Milltronics Hydro-Ranger 1.
10. Provide for automatic pump alternation.
11. Provide an automatic dialing remote monitoring system. City Standard is RACO Verbatis VSS-4C, 4-channel auto dialer wired at the factory into the control panel.
12. Provide the following:
  - a. Alarm horn
  - b. Alarm light
  - c. Station light
  - d. Pump sequence selector switch
  - e. Hand-off-auto switch
  - f. High pump temperature protection
  - g. Pump run lights
  - h. Elapsed time indicator
  - i. Duplex ground fault interrupting receptacle
  - j. Motor overload re-setter
  - k. Ventilator fan
13. Provide a 10-year warranty for the pump enclosure.
14. Provide a 5-year warranty for all pumps, equipment, apparatus and parts.

D. Electrical Service.

1. Provide electrical service required by the pump station manufacturer.
2. All electrical circuitry shall be designed and installed in accordance with the Uniform Electrical Code and National Electric Code.
3. Provide a telephone service for the auto-dialer.

E. Details Required on Improvement Plans.

1. Site Plan: Location of power pole, wet-well, ground slab, driveway, fencing, water service.
2. Wet-well: influent piping (standard inside drop manhole); suction piping (min. 6" off bottom of manhole; emergency suction line; water/alarm levels (pump on, pump off, low level, high level), redundant high water float switch.
3. Force Main Discharge Manhole: Inverts, channelization.

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## **A.2 - Storm Drain Design Specifications**

# STORM DRAIN DESIGN SPECIFICATIONS

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## **STORM DRAIN DESIGN SPECIFICATIONS**

### **I. GENERAL**

- A. These standards provide design criteria and the methodology used to estimate peak flows for drainages within the City of Willits.
- B. These Standards are based on information provided by the National Weather Service, the USDA Natural Resources Conservation Service, the California Department of Water Resources, and the California Department of Transportation.
- C. These standards are minimum standards and do not preclude the use of a higher standard.

### **II. WATERWAYS DEFINED**

- A. A "waterway" is defined as being a natural or artificial channel or depression in the surface of the earth or an underground conduit system which provides a course for water flowing as a consequence of storm water runoff. For the purpose of design criteria contained herein, waterways are divided into three classifications:

- 1. Major Waterways - having a tributary drainage area of four (4) square miles or more; shall require a design frequency of reoccurrence of once in 100 years.
- 2. Secondary Waterways - having a tributary drainage area of between one (1) and four (4) square miles; shall require a design frequency of reoccurrence of once in 25 years.

Secondary or minor waterways out-letting into major or secondary downstream waterways shall be designed to operate against a twenty-five or ten-year flow respectively in the major or secondary downstream waterway, provided that the ground elevation along the secondary or minor system shall be above the 100-year water surface elevation in the major or secondary downstream waterway.

If a secondary or minor waterway is placed in a closed conduit, sufficient additional surface routes for flood flows shall be made available to carry the added flow increment up to the 100-year design discharge with no more than nuisance damage to improvements or projected improvements and with no inundation of present or future buildings. If such surface routes cannot be made available, the secondary or minor waterway shall be designed to carry the 100-year design discharge.

- 3. Minor Waterways - having a tributary drainage area less than one (1) square mile; shall require a design frequency of reoccurrence of once in 10 years.
- B. A given waterway will be classified as minor in its upper reaches, then change to the secondary classification at a point where the drainage area exceeds one square mile, and then change again to the major classification at a point where the drainage area exceeds four square miles.

### III. HYDROLOGIC DESIGN

- A. Hydrologic design shall be predicated upon ultimate development of the tributary watershed. Flat valley areas and gently to moderately sloping uplands, which are undeveloped at the time of design, shall be assumed to be fully developed as single and two-family residential zones (lots under 1/4 acre in size) unless a publicly proposed development, precise zoning, or the General Plan indicates a different land density or intensity. In flat areas, drainage basin boundaries shall be verified with those for other adjacent developments to eliminate gaps or overlaps and maintain consistency. Only areas which do not flow towards the proposed development may be excluded. The design must demonstrate that the excluded areas do not flow into the proposed development.
- B. Areas of steep terrain shall be assumed to be developed fully to an intensity of use compatible with the nature of the terrain; such use may be for residential development in lots larger than 1/2 acre, unless precise existing zoning or the General Plan indicates a different density or intensity. Steep terrain is defined as terrain whose general average slope is in excess of 20%. Undeveloped areas whose average ground slope is between fifteen and twenty percent may be assumed as being developed into residential subdivisions with lot size of 1/4 to 1/2 acre, unless existing development, existing zoning or the General Plan indicates a different density or intensity.
- C. It is the intent that these Standards be utilized for estimating flows in minor waterways (drainage areas less than one square mile) with time of concentrations of less than two hours. For larger drainage areas, we recommend the use of more detailed calculations and/or models, such as TR-20, TR-55, HEC-1 and HEC-HMS.
- D. Design flows for Minor Waterways should be determined by the use of the Rational Method Formula:

$$Q = C \cdot I \cdot A \cdot K$$

Where:

- Q = design discharge in cubic feet per second, cfs
- C = runoff coefficient based on full development
- I = rainfall intensity in inches per hour
- A = drainage area in acres
- K = coefficient of intensity (1.0)

- E. Rainfall intensity (I) shall be obtained from the Intensity/Duration/Frequency (IDF) curves published by the California Department of Water Resources. Standard Detail 416 provides the IDF curves for Willits.
- F. Time of concentration shall be based on an initial time of seven minutes for commercial or similar areas, ten minutes for lots smaller than 1/2 acre, and fifteen minutes for lots of 1/2 acre and larger.
- G. Rational Method Runoff Coefficients (C) shall be based upon the hydrologic soil group and type of ultimate development (i.e., land use) for the drainage area from Table 1 below:

Land Use	Average Slope (%)			
	0 – 2	>2 – 7	>7 – 15	>15
Residential – Suburban (R-S)	0.40	0.43	0.46	0.50
Residential – Low Density (R-L)	0.50	0.56	0.64	0.70
Residential – Medium Density (R-M)	0.75	0.80	0.85	0.90
Commercial – General (C-G)	0.90	0.90	0.90	0.90
Industrial – General (M-G)	0.90	0.90	0.90	0.90
Public Service (PS)	0.90	0.90	0.90	0.90
Open Space – Recreational (O-R)	0.30	0.35	0.41	0.45
Agricultural – General (A-G)	0.30	0.35	0.41	0.45
Conservation – Floodway (FW)	0.30	0.35	0.41	0.45
Historical Resources (H)	0.90	0.90	0.90	0.90

Impermeable Areas: For impermeable areas use C = 0.9.

Coefficients for developments with more than one land use should be weighted in proportion to the areas of each land use using either the values from the table above or the following formula in on-site design calculations. Off site design calculations shall use the values from the runoff coefficients table above.

$$C = C_v \left( \frac{A_v}{A_t} \right) + 0.90 \left( \frac{A_p}{A_t} \right)$$

Where:

Ap = Impermeable area (includes building roof area, paving, gravel, rock)

At = Total Area

Av = Area planted or vegetated

Cv = Coefficient of runoff for vegetated areas (City Standard 417)

- H. Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. Hydrologic soil groups are identified by the letters A, B, C and D. The runoff coefficients in Table 1 correspond to a hydrologic soil group C. Soil characteristics associated with each group are given in Table 2 below:

Soil Group	Description
A	Deep sand; deep loess; aggregated silts
B	Shallow loess; sandy loam
C	Clay loams; shallow sandy loam; soils low in organic content; soils usually high in clay
D	Soils that swell significantly when wet; heavy plastic clays; certain saline soils

Runoff coefficients in Table 1 may be adjusted based on site-specific soil characteristics provided in a soils report, and as approved by the City Engineer.

**IV. HYDRAULIC DESIGN CRITERIA**

- A. For hydraulic design the design engineer shall provide specific references, model study reports, or prototype test results, as necessary to confirm the hydraulic design. Design engineers shall submit design calculations for all public storm drain facilities. As a minimum, the submittal shall include the items listed in Part XX of this specification and the Improvements Plan Checklist.
- B. Secondary waterways discharging into major downstream waterways shall be designed to operate while discharging into a 25-year flow in the major downstream waterways. Minor waterways discharging into secondary downstream waterways shall be designed to operate while discharging into a 10-year flow in the secondary downstream waterways. In such cases, the ground elevation along the secondary or minor system shall be above the 100-year water surface elevation in the major or secondary downstream waterway.
- C. If a closed conduit (i.e., pipe or culvert) is used as a secondary or minor waterway, sufficient additional surface routes for flood flows shall be made available to carry the added flow increment up to the 100-year design flow with no more than nuisance damage to improvements or proposed improvements and with no flooding of finished floor of present and proposed future buildings. If such surface routes cannot be made available, the secondary or minor conduit shall be designed to carry the 100-year design flow.
- D. Storm drains shall be designed for a minimum velocity of 2.5 feet per second at design flow rates unless otherwise specifically authorized by the City Engineer.
- E. If the Manning Equation is used for hydraulic design of storm drainage facilities, the following Manning roughness coefficient "n" shall be used:

<b>Table 3: Manning roughness coefficients</b>	
<b>Material</b>	<b><i>n</i></b>
Plastic pipes, smooth wall	0.012
Concrete, steel troweled or smooth-form finish	0.013
Concrete pipe, precast or cast-in-place	0.014
Concrete, wood float or broomed finish, pneumatically applied mortar	0.017
Asphaltic concrete	0.017
Corrugated metal pipe (non-spiral)	0.024
Sack concrete riprap	0.030
Grouted rock riprap	0.030
Loose rock riprap	0.035
Grassed channels	0.035
Constructed Natural Waterways	0.050 (Minimum)

- F. For materials other than those stated above, "n" values shall be those presented in the latest edition of the *Handbook of Hydraulics* by King and Brater, or other hydraulic design reference manual approved by the City Engineer. The use of n= 0.012 may be allowed for smooth walled high-density polyethylene pipe (HDPE) design purposes when the construction drawings clearly indicate the pipe material

shall be HDPE and there is no suitable substitute.

G. Open Channels:

Constructed open channels and waterways shall be designed to carry the quantity of flow determined as set forth above with minimum freeboard between design water surface and the top of bank of 1.50 feet or 0.2 of the specific energy, whichever is greater. Where this minimum freeboard does not provide the necessary differential head to allow adequate gravity drainage for projected development of the tributary areas, the design water surface shall be lowered sufficiently to allow such areas to drain to the channel by gravity, except where levees are permitted. Levees are generally unacceptable; specific exception to allow levees may be granted in tidal areas or in other situations of extreme difficulty only after a specific determination by the City Engineer that the proposed levee is the only feasible method of providing adequate flood protection.

For natural waterways and constructed natural waterways design flow may be allowed in an overflow area above the defined banks provided, however, the flow must be contained within a defined overflow area and freeboard provided as specified above between the water surface and adjacent ground elevation or finished grade elevation within lots or areas in which improvements are to be constructed. Less than 1.50-feet of freeboard may be considered for small natural swales and creeks through open space such as parks and golf courses. In any event, freeboard shall be adequate to provide for reduced capacity due to weed growth and 100-year flow within the right-of-way.

For computing the required freeboard, superelevation of the water surface on curves shall be determined with references noted and the design water surface adjusted therefor. Open channels shall not be designed with a slope in the range of plus or minus 20% of critical slope unless added freeboard for instability waves is provided. Channels designed for supercritical flow shall have their sequent depth below top of bank.

Channels shall be designed taking into account the energy losses due to existing and projected road crossings or other obstructions to be placed within the channel. Energy losses for bridge piers, interior walls in multiple box culverts, or other obstructions within the channel, shall be predicated upon the entrance obstruction width plus 2.0-feet of debris allowance on each side of each obstruction. For bridge piers or multiple box culverts, in lieu of the 2.0-feet of debris allowance on the full height of the pier or interior walls, such piers or walls may be extended upstream on a 2:1 downward slope to the channel invert. A debris width of 2.0-feet on each side of the downward sloping wall shall be considered for the upper quarter of the bridge or culvert depth except that the minimum height of debris shall be 2.0-feet. In lieu of debris allowance at small pipes and groups of small pipes, a flared entrance section or a debris trap must be used.

Bridges, culverts, and utility crossings which span major and secondary open channels and which are existing, planned or projected at the time of channel design shall have a minimum clearance from soffit to design water surface of 1.0-foot and shall cause no encroachment on the specified minimum freeboard in the

upstream channel or waterway. Channels shall be designed with proper allowances for hydraulic losses for all such planned or projected future crossings to maintain clearance and freeboard as specified above. In the case that a crossing is proposed over an existing channel where the hydraulic effect of the crossing was not considered in design of the channel, minor encroachment on freeboard may be permitted provided that it can be shown that such encroachment would not adversely affect gravity drainage of adjacent tributary areas. Modification of the existing channel and special attention to the design of piers or other obstructions placed in the channel may be required to keep any encroachment on freeboard at an acceptable magnitude.

The water surface profile shall be computed and plotted through all crossing structures. Culverts of all types providing crossings of minor waterways shall be designed hydraulically in accordance with entrance criteria contained in Section H for minor waterway closed conduit systems.

Constructed natural waterways shall be excavated as required to pass the design discharge under interim and ultimate conditions of natural plant and tree growth and of other natural channel characteristics. Trees and other plants and grass shall be planted as a part of initial construction to promote and encourage ultimate natural appearance. Willows and other phreatophytes shall be planted along the low flow water line as a part of initial construction.

The ultimate constructed natural waterway shall satisfy the freeboard requirements in this Chapter. The constructed natural waterway may be utilized in any situation where right-of-way space can be provided and temporary unvegetated appearance can be tolerated prior to growth and generation of natural amenities.

The gradients for constructed open unlined channels in secondary waterways shall not exceed 4.0% and shall be a minimum of 1.0%. The gradient for lined or paved ditches shall not be less than 0.5%.

H. Closed Conduits:

Major and secondary waterways placed within a closed conduit system shall have a minimum 1-foot clearance between the design water surface and the soffit of the conduit. The design depth in circular conduits shall not exceed 0.80 of the diameter of the conduit for major and secondary waterways. Minor waterways placed in closed conduit systems may be designed for full conduit capacity and, if necessary, pressure flow. The hydraulic entrance condition at a closed conduit minor waterway shall be such that the 10-year discharge will have the specified freeboard in the upstream channel or waterway and that the 100-year discharge will be contained within the banks of the upstream waterway or within drainage easements. The entrance to the closed conduit minor waterway may be submerged provided that the above criteria are satisfied. At inlets and non-pressure-type manholes within a closed conduit system, a hydraulic gradeline shall be not less than 1-foot below the gutter or inlet surface elevation or such that free weir flow will be assured at inlets. At locations where conduits are stubbed out for future extension, the design hydraulic gradeline shall be low enough to allow proper

drainage of the tributary area, with a minimum of 1.5-feet below general existing ground level. For conduits designed for supercritical flow, the energy gradeline shall not be above ground level at inlets and non-pressure- type manholes.

Energy losses due to debris load caused by splitting flow at entrance to or within a closed conduit system shall be computed in the same manner as obstruction losses in open channels. In addition to normal friction losses, energy losses due to entrance and exit conditions, bends and transitions shall be computed and considered.

Velocities in conduits shall be a minimum of 2.5 feet per second at the design flow to give a self-cleaning action to prevent siltation.

Entrance and exit losses shall be calculated using the loss coefficients in Table 4.

<b>Table 4. Box Width in Feet</b>								
<b>Kx/Ke</b>	<b>1.0'</b>	<b>1.5'</b>	<b>2.0'</b>	<b>2.5'</b>	<b>3.0'</b>	<b>4.0'</b>	<b>5.0'</b>	<b>6.0'</b>
8"-12"	0.23/0.16	0.59/0.41	0.76/0.53	0.84/0.59	0.89/0.62	0.94/0.65	0.96/0.67	0.97/0.68
15"	0.03/0.02	0.40/0.23	0.63/0.44	0.76/0.53	0.83/0.58	0.90/0.63	0.94/0.63	0.96/0.67
18"		0.23/0.16	0.50/0.35	0.66/0.46	0.76/0.53	0.86/0.60	0.91/0.64	0.94/0.65
24"			0.23/0.16	0.44/0.31	0.59/0.41	0.76/0.59	0.84/0.59	0.89/0.62
30"				0.23/0.16	0.40/0.28	0.63/0.44	0.76/0.53	0.83/0.58
36"				0.06/0.04	0.23/0.16	0.50/0.35	0.66/0.46	0.76/0.53
42"					0.08/0.06	0.36/0.25	0.55/0.39	0.68/0.47
48"						0.23/0.16	0.44/0.31	0.59/0.41
54"						0.11/0.08	0.33/0.23	0.50/0.35
60"						0.03/0.02	0.23/0.16	0.40/0.28
66"							0.13/0.09	0.13/0.22
72"							0.06/0.04	0.23/0.16

Definitions:

Kx = Exit Loss coefficient  
Exit loss for an outlet into a creek = 1.0

Ke = Entrance Loss coefficient  
Loss coefficients are to be applied to the velocity head to determine the minor loss.

## V. DETENTION BASINS

- A. Detention basins are natural or constructed basins that receive and hold storm water runoff to reduce downstream peak flows for flood control purposes and/or

to enhance water quality. Detention basins are allowed only with the approval of the City Engineer. Publicly maintained storm water ponds with permanent pools of water are prohibited. However, approval may be granted provided the applicant/developer executes a binding agreement to provide funding, in perpetuity, for the maintenance costs associated with these facilities.

- B. Detention basins should be designed to be multipurpose wherever possible and designed to enhance storm water quality. Detention basins whose primary purpose is water quality enhancement will be considered during planning for storm drain system improvements and in accordance with the City's "Low Impact Design (LID) Guidelines for Stormwater Management," unless approved otherwise by the City Engineer. Flows in excess of the detention basin design flows will be diverted around the detention basin.
- C. Publicly maintained detention facilities for flood control purposes may be permitted, with the approval of the City Engineer, when it is more cost-effective than providing storm drains. An analysis, which justifies the financial need for the detention basin by presenting both the estimated capital cost and the estimated annual operation and maintenance costs of the basin as well as comparable costs for an underground closed conduit storm drain system, shall be prepared under the direction of a civil engineer and submitted for approval by the City Engineer prior to approval of a tentative map with the City Community Development Department. The City Engineer may prohibit or restrict the use of detention basins based on specific site conditions such as insufficient depth to bedrock; extreme community disruption; need for extensive relocation of existing improvements and utilities; or lack of sufficient, available, suitable land.
- D. The design of detention basins for flood control purposes shall be based on the size of the basin; the maximum allowable depth of temporary ponding; the recurrence interval of the storm being considered; the peak rate, total volume, and timing of the inflow; the maximum allowable outflow rate; and the length of time water is allowed to remain in the basin. The design shall be accomplished through the development of three items: an inflow hydrograph, a depth-storage relationship, and a depth-outflow relationship. These three items shall be combined in a routing routine to obtain the outflow rate, depth of stored water, and volume of storage at any specific time as the design storm flow passes through the detention basin. The design considerations and procedures are discussed in Design and Construction of Urban Stormwater Management Systems, Chapter 6, WEF Manual of Practice FD-20, 1992. Pumped discharges from publicly maintained detention facilities are prohibited.
- E. The design considerations cited above determine the detention basin volume required for flood control purposes only. Design of detention basins should also take into consideration other benefits that can be achieved, such as water quality enhancement, recreational opportunities, and open space aesthetic enjoyment. Public health and safety needs should be priority considerations, such as the need for vector control and fencing in particular applications. Detention basin designs must promote personal safety by locating basin along public streets to assure visual access to basin area. Site, street and basin design should be coordinated to orient buildings and streets for good surveillance of basin area.
- F. The geometry of the basin should be designed to reduce dead zones and increase detention times. Inlet and outlet structures must be carefully designed to reduce

turbulence that could re-suspend settled solids. Consideration should be given to installation of energy dissipaters, stilling basins, berms, and separation walls.

- G. To prevent erosion during large storm flows, unprotected side slopes should be no steeper 3:1 (horizontal:vertical). Steeper banks will only be allowed with the approval of the City Engineer and shall be protected by vegetation and/or rip rap.
- H. Detention basins shall be designed and constructed for easy access to the basin itself and all inlet and outlet structures. Access to the bottom of the basin is necessary. Basins to be maintained by City staff must meet City accessibility criteria discussed below.

## **VI. ROADWAY DESIGN**

- A. Roadway drainage design is a matter of properly balancing technical principles and data with the environment giving due consideration to other factors such as safety and economics. Drainage features to remove runoff from the roadway and to convey surface and stream waters originating upstream of the roadway to the downstream side should be designed to accomplish these functions without causing objectionable backwater, excessive velocities or unduly affecting traffic safety. Chapters 800 to 890 of the Caltrans Highway Design Manual should be used for drainage design of public roadways within the City of Willits. The following minimum design standards apply to the City of Willits.
- B. Bridges/Major Culverts:  
Design in conformance with Chapter 820 of the Highway Design Manual. For Major Waterways and streams that are included in the Flood Insurance Study (FIS), a 100-year flood should be used for design purposes. Bridges over streams included in the FIS may not increase the base flood elevation more than one foot. If a floodway is present, the bridge may not encroach on the floodway or must be designed with no increase the base flood elevation.
- C. Arterial and Collector Roadways:  
Cross culverts should be designed for a 25-year flood event with headwater six inches below the edge of the traveled way. A 100-year event should be used if the drainage is defined as a Major Waterway. Drainage along the roadway (i.e., gutter flow) should be designed for a 25-year event with flow contained within the shoulder or parking lane. Roadside ditches should be designed for a 25-year flood event with six inches of freeboard. The 100-year event should be contained within the roadway.
- D. Local Roadways:  
Cross culverts must be designed for a 10-year flood event with headwater six inches below the edge of the traveled way. Secondary and Major Waterways should be designed for the corresponding recurrence interval.  
  
Drainage along the roadway (i.e., gutter flow) should be designed for a 10-year event with flow contained within the shoulder or parking lane. Roadside ditches should be designed for a 10-year flood event with six inches of freeboard. The 100-year event should be contained within the roadway.
- E. Gutter Flow:  
Design depth of flow in gutters shall not exceed 0.4-foot for the 10-year flow. Roadside ditches, when allowed, shall not be used where the design flow is

greater than that which could be carried in a standard gutter flowing 0.4 foot deep on the same slope as the road profile slope. Where the discharge exceeds gutter capacity, a closed conduit system shall be provided. Roadside ditches shall be designed so that the water surface of the design discharge will be at or below the outside edge of the road shoulder such that there is no flood water in the normal travel-way of the road and below adjacent ground level.

- F. In the event of sheet flooding occurring in the area of a bridge or culvert, exceptions to the above standards will be considered on a case-by-case basis.

## **VII. CONNECTION TO THE EXISTING STORM DRAIN SYSTEM**

- A. New storm drain systems must connect to an existing City or County of Mendocino storm drain facility, a channel or creek maintained by the County of Mendocino, or an approved natural waterway. Storm drain designs shall incorporate the design of any off-site storm drain improvements required to accommodate flow from the storm drain system for the proposed development. A structure must be installed at each connection (i.e., no "blind" connections) except as otherwise approved by the City Engineer.
- B. Where public storm drains must traverse private property, inlets necessary to drain the private property are permitted to connect to the public storm drain. These inlets and connecting pipes shall be clearly delineated as private on the improvement plans.
- C. Sump pumps for non-residential or mixed land uses shall not discharge to gutters or sidewalk drains. Sump pumps shall discharge into closed conduit systems or open channels, if permitted by the North Coast Regional Water Quality Control Board. Sump pumps for non-residential land uses shall discharge at a structure (i.e., no blind connections). Sump pumps which may discharge liquids other than uncontaminated water (e.g., oil, grease, solvents, etc.) shall discharge to sanitary sewers, if approved by the City Engineer; industrial pretreatment of these discharges may be required. Sump pumps for single-family residences shall be allowed to discharge to sidewalk drains or gutters by gravity flow only (For instance, by pumping to a box and then allowing the water to gravity flow through curb into the gutter.).
- D. Concentrated drainage flows in pipe systems from private property shall not flow over public sidewalks. Sidewalk drains or other means of collection and conveyance to a proper discharge location shall be provided.

## **VIII. MATERIALS**

- A. Storm drain pipes 15-inches in diameter or larger shall be reinforced concrete pipe (RCP), cast-in-place concrete pipe (CIPP) or annular high density polyethylene (HDPE) pipe, as required by the Engineer and shown on the approved plans.
- B. RCP shall be Class III, IV, or V as specified in Part A.1 State Standard Specifications, Section 65, "Reinforced Concrete Pipe," of these standards. Typical total effective loads on buried pipe, expressed in pounds per linear foot of pipe, are shown in Table 5. The design engineer shall determine the D-load for the depth and diameter of pipe from the table and select the class of RCP with a D-load rating equal to or greater than the value in Table 5. The design engineer shall

- interpolate between the values in Table 5 for conditions not presented in the table.
- C. Designers see Section 63, “Cast-In-Place-Concrete Pipe,” of these standards, and Section 63 of the Standard Specifications for Special Inspections for use with CIPP.
  - D. HDPE pipe shall be smooth interior, corrugated exterior pipe with bell-and-spigot joints, Type S, per AASHTO Designation M294. HDPE pipe shall only be used in sizes of 36-inch or smaller diameter with cover of less than 30 feet. The design engineer shall determine flotation restraint per manufacturer’s recommendations. Minimum cover over pipe shall be 12 inches from the outside top of pipe to subgrade. HDPE pipe shall only be used under pavement areas.
  - E. Storm drain laterals shall be PVC, SDR35, HDPE or RCP as approved by the Engineer.

Table 5. Loads on Buried Pipes (pounds per linear foot)																			
in feet	15	18	21	24	27	30	36	42	48	54	60	66	72	78	84	90	96	102	108
1	*	*	*	*	*	*	*	*	*	2919	2310	2475	2310	2169	2048	1944	1852	1778	1705
2	1632	1592	1549	1516	1491	1471	1474	1289	1148	1039	952	881	822	772	729	692	659	633	607
3	931	893	859	834	814	798	827	814	797	784	731	688	652	622	596	573	553	540	524
4	857	816	780	753	733	716	760	742	723	709	699	691	685	658	636	616	599	589	576
5	878	832	794	766	744	726	784	763	742	726	715	706	699	693	687	683	667	660	647
6	921	874	833	803	780	762	835	812	789	771	759	749	741	735	729	724	719	727	720
7	974	924	883	852	828	809	897	872	848	829	816	806	798	790	784	779	775	782	778
8	1029	978	935	904	880	861	964	939	913	893	880	869	861	853	847	842	837	846	842
9	1087	1036	993	961	937	918	1037	1011	985	964	951	940	932	924	918	913	908	918	914
10	1141	1090	1047	1015	992	973	1108	1082	1055	1034	1021	1011	1002	995	989	984	979	991	987
11	1191	1141	1098	1067	1043	1026	1177	1151	1123	1103	1090	1080	1072	1065	1059	1054	1050	1063	1059
12	1236	1187	1145	1115	1092	1075	1242	1217	1190	1170	1157	1148	1140	1134	1128	1124	1120	1135	1131
14	1315	1269	1229	1201	1181	1166	1365	1343	1317	1297	1287	1279	1272	1267	1263	1260	1257	1275	1272
16	1380	1338	1301	1276	1259	1247	1477	1458	1434	1417	1409	1403	1398	1395	1393	1391	1389	1411	1409
18	1433	1396	1363	1341	1327	1318	1578	1564	1543	1528	1523	1519	1517	1516	1516	1516	1516	1542	1542
20	1477	1445	1415	1397	1386	1380	1670	1661	1643	1631	1629	1629	1630	1631	1633	1635	1637	1668	1669
24	1542	1519	1496	1485	1482	1483	1828	1830	1820	1816	1821	1828	1835	1842	1850	1857	1863	1903	1908
28	1585	1570	1554	1550	1553	1560	1955	1969	1969	1973	1987	2002	2016	2030	2043	2056	2068	2118	2126
32	1613	1605	1595	1597	1606	1619	2058	2085	2094	2107	2130	2153	2175	2196	2216	2235	2253	2313	2326
36	1632	1629	1624	1631	1646	1664	2141	2180	2198	2220	2253	2285	2315	2343	2371	2396	2420	2490	2509
40	1644	1645	1644	1656	1675	1698	2208	2258	2286	2317	2359	2399	2437	2474	2508	2540	2571	2651	2675

Allowable Loads:

Class III 1,350 pounds/linear foot

Class IV 2,000 pounds/linear foot

Class V 3,000 pounds/linear foot

The area within the heavy black line indicates situation where Class III RCP is acceptable.

\* Exceeds the capacity of Class V RCP. Special design required to be submitted to City Engineer.

Reference: Ameron Reinforced Concrete Pressure Pipe, 1971, for covers of 2 feet or greater. Loads are interpolated for covers of 1 foot.

## IX. SIZE

- A. Storm drain pipe diameters within the public right-of-way, including driveway culverts, shall be 15 inches or larger, except sidewalk drains shall be per City Standard 409.
- B. In new portions of the storm drain system, pipe sizes shall not decrease in the downstream direction.

## X. ALIGNMENT

- A. Storm drains shall be located within public streets unless otherwise authorized by the City Engineer.
- B. Storm drains traversing private property shall be straight between manholes (i.e., no horizontal curves) except when installed in a private street parallel to the centerline of the private street.
- C. In general, storm drains shall be installed parallel to the centerline of the street or right-of-way.
- D. Horizontal separation of storm drain line from sanitary sewer shall be a minimum of 5-feet clear (i.e., outside of pipe to outside of pipe), except at pipe crossings.
- E. Horizontal separation from water mains and other utilities, gas, underground electric, underground television cable, etc., shall be a minimum of 4-feet clear.
- F. Vertical curves are not allowed unless specifically authorized by the City Engineer.
- G. Horizontal curves with a minimum radius of 300-feet for RCP and CIPP shall be provided at catch basins installed at curbs and gutters so as to locate as much of storm drain as possible under asphaltic concrete paving rather than concrete curbs and gutters.
- H. Horizontal curves concentric with public or private street centerlines may be permitted with RCP provided the radius is 300-feet or greater. The minimum allowable radius used with 20 foot sections of HPDE pipe is 765 feet.
- I. Horizontal curves can be installed in RCP by pulling pipe joints if the resulting deflections are not greater than the pipe manufacturer's recommendations. The design engineer shall use the following equation in designing horizontal curves for RCP with a diameter over 48-inches:

$$R = \frac{L}{2 \cdot \tan\left(\frac{1}{2} \cdot \frac{\Delta}{N}\right)}$$

Where:

- R = radius of curvature of the centerline of the pipeline in feet
- L = laying length of pipe section in feet, measured along centerline
- $\Delta$  = total deflection angle of curve in degrees
- N = number of pipe sections with pulled joints
- $\Delta/N$  = deflection angle of each pipe in degrees

## **XI. SLOPE**

- A. Maximum slope for storm drains shall be 15% or 15-feet per 100-feet.

## **XII. COVER**

- A. Minimum cover over storm drains shall be 12 inches (Class III RCP, HDPE and CIPP). Cover is defined as the distance from the outside top of the pipe to the final subgrade (bottom of the structural section) in paved areas or finished grade in unpaved areas. See Table 5.

## **XIII. MANHOLES AND STRUCTURES**

- A. A manhole is required at every horizontal or vertical change in alignment and at every change in pipe size.
- B. Maximum distance between manholes and/or accessible structures is 300-feet.
- C. A manhole is required at the end of every main.
- D. Sufficient drop shall be provided through manholes and accessible structures to compensate for energy loss caused by change of alignment.
- E. Minimize the number of manholes.
- F. Manholes shall be 48-inches in diameter with storm drain pipes of 36- inches diameter or less, and shall be 60-inches in diameter with storm drain pipes larger than 36-inches in diameter or manholes deeper than 7-feet (indicate manhole diameter on plans). Manholes shall be designed to be large enough to accommodate all pipes connected to manhole with a minimum of 3-inches of manhole wall on both sides of all pipes.
- G. When pipe size increases, set inlet crown at least as high as the outlet crown.
- H. An accessible structure shall be provided to connect private storm drains to the public storm drains (i.e., no blind connections) except as otherwise approved by the City Engineer. Structures shall be installed on the private side of the property line to distinguish the public system from the private system. Public and private storm drain facilities shall be clearly identified on the improvement plans. For residential land uses only, no structure is necessary for sump pump connections to public storm drain systems. Accessible structures are required for sump pump connections from nonresidential land uses.
- I. Headwalls or structures shall be provided where open ditches, channels, and creeks discharge into closed pipe conduits. Refer to Caltrans Standard Plans.

## **XIV. Catch Basins**

- A. Catch basins shall be the curb opening type (Standard 404 and 405) except as listed below or as otherwise approved by the City Engineer. Galleries per Standard 406 may be used on the upstream side of a catch basin to increase inlet interception capacity or if their use reduces the number of catch basins requiring maintenance.
- B. Catch basins shall be installed at the following locations:
  - Such that gutter flows do not cross intersections except where valley gutters

are allowed.

- Upstream of bridge abutments.
- The beginning of every roadway superelevation that reverses the cross-slope of the pavement.
- The sags (i.e., bottoms) of vertical curves
- The low points of downhill cul-de-sacs
- As required so that water depth in gutter does not exceed 0.4 feet during the design storm event.
- As required to maintain the following number of 8-foot-wide traffic lanes unimpeded by flowing or standing water during a design storm:
  - Two lanes for all regional streets.
  - One lane for transitional and industrial streets. This lane may be in the middle of the road, spanning the crown. This requirement does not apply to local streets.
  - One lane in each direction for transitional streets that are divided roads or roads with a median strip.
- As required so that carry over flows (bypassing catch basins) shall not exceed 2 cubic feet per second.
- At a maximum spacing of 400-feet from another catch basin or manhole.

C. Catch basin size and spacing shall be computed by the methods in Drainage of Highway Pavements, Federal Highway Administration, Hydraulic Engineering Circular No. 12, March 1984.

## **XV. EASEMENTS**

- A. An easement must be provided over any public storm drain when it is installed outside a public right-of-way.
- B. The easement must be a minimum of 15' wide if it only contains a publicly maintained storm drain or 20' wide (or wider) if it contains another facility, such as water, sewer, or other utility. The easement will be dedicated as a "public drainage easement" if it contains storm drain only. It will be dedicated as a "public utilities easement" if it contains other facilities as well.
- C. Easements must be configured to encompass all publicly-maintained appurtenances and will be generally centered over the facility. Separate access easements may be required depending on site conditions. When storm drains are to be installed along a property line the easement will be wholly contained on one parcel.
- D. All property restrictions placed as a result of dedication of easements will be so noted on the supplemental sheet of the Subdivision Map, or on the Easement Deed if the easement is not dedicated as part of a subdivision. Typical required notes as applicable are:
  - 1. No structures may encroach on, above, or below the surface of the ground in any public easement. This includes footings of foundations, eaves from the roof of any adjacent structure, pools, ponds or outbuildings on slabs or foundations.
  - 2. No trees may be planted in a public storm drain easement without first

obtaining approval of the Director of Public Works. Trees may be allowed to the extent that damage to the drainage system does not occur from root intrusion and adequate access can be provided for maintenance and repair vehicles.

3. The Public Works Department will take due caution when performing maintenance or repair of drainage systems in easements, but will not be responsible for repairs or replacement of trees, landscaping or structures not specifically approved by the Director of Public Works.

## **XVI. ACCESS ROADS**

- A. Clear access must be provided and maintained to all public structures on the drainage system.
- B. All-weather vehicle access roads are required to every structure on the storm drain system. Access roads must be a minimum of 12-feet in width and must be provided with turnarounds per City Standard 210 when the back-up distance for any maintenance vehicle exceeds 100-feet.
- C. The design of access roads must be included with the drainage system design plans. Include adequate drainage measures in the design to prevent damage to the access roads from storm water.
- D. Gates must be provided for access through any fence crossing a public storm drain easement. Where vehicular access is required for maintenance, minimum 4-foot wide gates must be provided with sliding gates preferred. Where vehicular access is not required, 4-foot wide gates for pedestrian access must be provided and will be located to permit visual access between storm drain structures.
- E. The maximum grade allowed at any point on an access road is 15%. The maximum cross-slope for any access is 5%.

## **XVII. MAINTENANCE**

- A. Storm drains that convey public water, are designed and constructed to City Standards, and are in a dedicated public easement or right-of-way accepted by the City shall be maintained for hydraulic capacity by the City. All other storm drains, including driveway culverts, shall be privately maintained.
- B. Sidewalk drains shall be privately maintained by the owners of the frontage property.

## **XVIII. WATER QUALITY REQUIREMENTS**

- A. Source controls designed or constructed to reduce the discharge of pollutants from the storm water conveyance system should be designed and maintained in accordance with the Low Impact Design Guidelines for Stormwater Management.

## **XIX. OTHER REQUIREMENTS**

- A. Discharge of drainage waters are subject to State Water Quality Control Board (SWQCB) standards, which include project, and regional discharge permits (such as NPDES) which must be adhered to. Furthermore, alterations to drainage

- courses both in stream and upland are regulated by the California Department of Fish & Game (CDF&G).
- B. Installation of Drainage Structures are regulated by CDF&G and the National Oceanic and Atmospheric Administration (NOAA Fisheries), in some instances, through 1600 agreements and Army Corps of Engineers 404 permits respective. CDF&G publishes "California Salmonid Stream Habitat Restoration Manual" and NOAA Fisheries publishes "Guidelines for Salmonid Passage at Stream Crossings".
  - C. Sanitary sewer laterals and industrial process or waste pipelines shall not be connected to storm drains or allowed to discharge to waterways. Sanitary sewer laterals and industrial waste pipelines shall be connected to sanitary sewers in conformance with the latest edition of the City's Sewer Standards; pretreatment of industrial wastes may be required.
  - D. Driveway culverts shall be designed under the direction of a civil engineer to convey anticipated flow from future development and ensure hydraulic adequacy.

## **XX. SUBMITTAL REQUIREMENTS**

- A. Drainage Report:  
For the purpose of review by the City, hydrology, hydraulic (closed conduit backwater and open channel backwater), and gutter and inlet capacity calculations will be required. The calculations must be signed and stamped by a California Registered Civil Engineer.
- B. Assumptions:  
Assumptions used in preparing calculations shall be itemized.
- C. Design Aids and References:  
The design aids and references which are used in support of the calculations for design of drainage improvements shall be listed. Supply the City with copies of reference data. If computers are used, the input and output sheets provided shall be sufficient to allow easy checking.
- D. Hydrology Maps:  
Hydrology map(s) shall be provided for both on and off-site drainage areas. The maps shall be of sufficient scale and detail to show drainage areas. Drainage areas shall be numbered and outlined to facilitate checking and with arrows to show drainage problems. The area of each drainage area shall be shown on the hydrology map. A separate 100 year flood map delineating the escape-route shall be provided.
- E. Calculations:  
Hydrologic and hydraulic calculations showing beginning hydraulic gradeline, energy losses at junctions, bends, structures, friction slopes, etc. shall be submitted.
- F. Hydraulic and Energy Gradeline:  
In addition to the calculations, the hydraulic gradeline, and the energy gradeline shall be shown for all open or closed drainage improvements except gutters.
- F. Plans:  
Plan views, profiles, cross-sections, and details of all drainage facilities including a lot grading plan showing how each lot will drain shall be submitted.

- G. Inlets and Gutters:  
Entrance capacity and gutter depth calculations shall be submitted for all drainage inlets.
- H. Storm water Treatment Facilities:  
Filtration of runoff before discharge to a water body may be required pursuant to the standards and conditions established by the appropriate agency(ies). Exact specifications for storm water treatment facilities are beyond the scope of these road standards.
- I. Additional information may be required as determined by the City Engineer.

## **XXI. TESTING AND ACCEPTANCE**

- A. All storm drain lines shall be cleaned of construction debris and sediment before final inspection.
- B. Prior to acceptance by the City, all storm drain lines shall be video taped as required in Part A.1 Section 64 of the City Standards.

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## **A.2 – Water System Standard Specifications**

WATER SYSTEM STANDARD SPECIFICATIONS

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## **WATER SYSTEM STANDARD SPECIFICATIONS**

### **I. MATERIALS**

- A. Service laterals shall be Polyvinyl Chloride (PVC) C200, SDWR, CTS SDR#9.
- B. 8” and 12” water mains shall be Polyvinyl Chloride (PVC) C900, Class 150, minimum, or Ductile Iron Pipe, C151, Class 50, minimum.
- C. 14”, 16”, 18” diameter water mains shall be Ductile Iron Pipe or PVC C905, 165 psi or as shown on plans and specifications.
- D. 20” and larger water mains shall be Concrete Cylinder pipe, Wrapped Steel pipe, or Ductile Iron Pipe.
- E. Asbestos Cement Pipe shall not be allowed under any circumstance.
- F. If Ductile Iron Pipe needs to be encased with polyethylene tubing and have cathodic protection, the City Engineer will determine if applicable on a case by case situation.
- G. Mains outside of paved roadway or crossing a delineated fault zone ( see Section XII-B) must be Ductile Iron Pipe unless the City Engineer approves an alternative.
- H. Where the normal mainline static pressure exceeds 100 psi, Ductile Iron Pipe or Class 200 PVC must be used.

### **II. ALIGNMENT**

- A. Public water mains outside the public street are not allowed without special permission from the City Engineer.
- B. Minimum allowable radius for 8” diameter water mains is 250 feet and for 12” diameter water mains is 350 feet.
- C. New mains must match the grade and centerline offset of existing water mains when and where possible.
- D. Maintain a constant distance from centerline wherever possible.
- E. Conform to the State of California Department of Health Services “Criteria for the Separation of Water Main and Sewers”.
- F. Install felt expansion material between pipes with 1” or less vertical clearance.
- G. Minimum horizontal separation from existing gas, electrical, and telephone lines shall be 3 feet between pipes.
- H. Minimum clear horizontal separation from a metallic pipe line with an induced current shall be 5 feet.
- I. Minimum clear horizontal separation from a storm drain shall be 5 feet.

### **III. SIZE**

- A. Water mains must be sized to meet minimum Fire Code requirements. (See Section VIII)
- B. For residential/commercial installations, public and private mains shall be 8” minimum.

- C. For industrial installations, looped system shall be a minimum 8" in diameter, and a dead end system requires a minimum of 12" diameter pipe.
- D. The minimum main size for all new projects is 8".
- E. Water mains must be sized to meet minimum Fire Code requirements.

#### **IV. COVER**

- A. Definition: Cover is the distance from the top of the pipe to finished grade.
- B. Standard installation shall be in accordance with Standard No. 500 Note 3.
- C. Where cover is greater than 32", but less than standard cover, Class 50 Ductile Iron Pipe is required.
- D. Where cover exceeds 8', special permission from the City Engineer is required.
- E. Service laterals must have minimum cover in accordance with the approved standards.

#### **V. CONNECTION TO AN EXISTING MAIN**

- A. In most major streets, or in new streets, the new water main must be bored and jacked into place. Conditions should be verified with the City Engineer.
- B. For connection 2" diameter pipes and smaller, use a hot tap.
- C. For connections pipes 4"- 12" in diameter, a hot tap or a cut-in tee may be done in conformance with the provisions of Standard 500, Note 26.
- D. Cut-in tee must be used if additional valves are required on the existing main. If the new lateral is larger than the existing main, the tee shall be the size of the new lateral and reduced to size of the existing main.
- E. Size-on-size taps are allowed up to 8" in accordance with the approved standards.
- F. 12" size-on-size taps are allowed only under emergency situations and with the specific approval of the City Engineer.
- G. A mechanical joint tapping sleeve must be used in accordance with approved City Standards.

#### **VI. VALVING**

- A. Valving at intersections shall be in accordance with the following:
  - Tee- 3 valves
  - Cross- 4 valves
- B. Main line valves within 250' of an intersection may be considered as part of the intersection.
- C. All hydrants must be on separately valve sections of the public main.

#### **VII. SERVICE LATERALS AND WATER METERS**

- A. Size of water meter shall be determined by the Designer using the current AWWA guidelines.
- B. Maintain a minimum 5' separation from the sewer lateral.

- C. All meter must be located within public right-of-way. Meters (including backflow detection meters) can only be installed outside of the right-of-way upon approval by the City Engineer.
- D. Residential (single unit)
  - 1. One meter per lot.
  - 2. Individual 1" services, 1" meter/
  - 3. Rubber seated check valves shall be required to separate the domestic and the fire systems on the site.
- E. Apartments (2-6 units)
  - 1. May be master metered with the size based on the total demand.
  - 2. Individual meters must be clustered and located within the public right-of-way.
- F. Apartments (7 or more units) and Mobile Home Parks.
  - 1. Must be master metered with the size based on the total demand.
  - 2. Separate irrigation meters are required.
  - 3. This may require a combination water service.
  - 4. Mobile Home Park owners my sub-meter to the tenants at their own expense.
- G. Condominiums
  - 1. Shall be individually metered.
  - 2. Individual meters must be clustered and located within the public right-of-way.
  - 3. A maximum of six meters per manifold.
  - 4. Separate irrigation meters for common areas are required.
  - 5. Combination of water services may be required.
- H. Commercial
  - 1. Size of the meter and service are based on calculations by the Designer in accordance with AWWA standards.
  - 2. A separate irrigation meter is required.
  - 3. A minimum 1" service shall be required for office use.
  - 4. A minimum 2" service lateral for a shell building or light industrial if the lot is greater than ½ acre.
  - 5. A minimum 8" service for industrial lots and shopping centers on lots of 12 acres or larger.
  - 6. Most commercial installations will require backflow prevention. (See Section IX).

I. Combination Services

1. 8” laterals are the minimum required for most installations.
2. Combination services are required in commercial subdivisions per Std. Drawing 513.

J. Irrigation

1. Separate irrigation meters must be provided for all commercial users, master metered condominiums, P.U.D.s, apartment complexes and mobile home parks.
2. All irrigation services must have reduced pressure backflow devices.
3. Irrigation meter size shall be determined by the maximum flow required at any one control valve.
4. Sizing of irrigation meters shall be coordinated with the City Engineer.
5. Backflow devices specified on the current USC Approved List of Devices.

K. Private Fire Systems.

1. Private fire systems must be installed per NFPA 24.
2. Before combustible materials may be stored or constructed on site, the Fire District must approve fire flow and access. Before a fire hydrant may be placed in service, a high velocity flush of the fire hydrant shall be witnessed and approved by City Personnel.
3. Lateral size must be the same or larger than the size required for the sprinkler system or the private hydrant system.
4. All private fire systems require backflow prevention assemblies in accordance with City Standards.
5. Reduced pressure backflow assemblies are required if fire systems are used with chemical additives such as:
  - a. Antifreeze
  - b. Auxiliary water supply (well) exists on site.
  - c. A health hazard exists on site.
6. On residential systems, rubber seated check valve assemblies approved by the Fire District must be installed where fire system connection to the domestic water system.
7. Fire Department connection location must be approved by the Fire District or at a location approved by the Fire Chief.
8. A fire hydrant shall be installed within 50’ of a Fire Department connection or at a location approved by the Fire Chief.
9. The maximum length of a fire hydrant lateral from a private main to the hydrant bury is 40’.
10. Private fire line installation must keep joints exposed until after inspection and pressure testing is complete.

## **VIII. FIRE HYDRANTS**

- A. Before combustible materials may be stored or constructed on site, the Fire Department must approve fire flow and access. Before a fire hydrant may be placed in service, a high velocity flush of the fire hydrant shall be witnessed and approved by City Personnel.
- B. Location of fire hydrants must be approved by the Fire Department.
- C. Each hydrant must be on a separate valved main line section.
- D. Whenever possible, locate hydrants at street intersections.
- E. If it's not possible to locate at an intersection, locate the hydrant near a property line or where it will minimize interference with property use.
- F. Locate hydrants a minimum of 10' from roll down of driveways.
- G. Residential areas-
  - 1. Space fire hydrants every 300' or as approved by the Fire Chief.
  - 2. Evenly distribute hydrants throughout the project.
  - 3. No building may be more than 150' from the nearest hydrant.
- H. Commercial and Industrial Areas-
  - 1. General hydrant spacing shall be every 300'.
  - 2. Evenly distribute hydrants throughout the project.
  - 3. No building may be more than 150' fro the nearest hydrant.
- I. Minimum fire flow required at all fire hydrants shall be per the requirements as specified in the Fire Code or per the following, whichever is greater.
  - 1. Residential and commercial areas- 1,000 gallons per minute with a 20 psi residual.
  - 2. Commercial areas 2,000 gallons per minute with a 20 psi residual.
  - 3. Industrial areas- 3,000 gallons per minute with a 20 psi residual.
- J. Requires water analysis study unless otherwise specified by the City Engineer.

## **IX. BACKFLOW DEVICES**

- A. Backflow devices are required to be installed by State of California Title 17.
- B. All backflow devices that are installed must be on the approved USC list.
- C. Backflow assemblies must be installed as near as possible to the water main.
- D. Where residential fire sprinklers are installed, rubber sealed check valve devices are required where the fire service connects to the domestic service. The backflow preventer must be accessible for testing and maintenance.
- E. Properties with private sewer lift stations must have reduced pressure backflow assemblies on their water systems.
- F. All irrigation services require reduced pressure backflow assemblies.
- G. Parcels with two or more water service laterals must have double check valves installed on each service.

- H. Properties using a well for irrigation must have a reduced pressure backflow preventer on the domestic service.

## **X. PRESSURE**

- A. Maximum allowable main line pressure is 150 psi measured at a fire hydrant.
- B. Maximum allowable static service pressure measured at a faucet is 80 psi.
- C. Minimum service pressure measured at the meter is 40 psi.
- D. If the service pressure exceeds the maximum of 80 psi, an individual pressure regulator will be required on the service line.
- F. Fire flows must be calculated for all projects.
- G. For calculation pressures in all water zones, calculate the minimum pressure using the elevation of the reservoir at one-half full.

## **XI. SPECIALTY ITEMS**

- A. Air relief valves.
  - 1. Air relief valves are required at locations in the system that are one pipe diameter or more, higher than the remainder of the system, such as over a hilltop. A fire hydrant may be used in place of an air relief valve at the discretion of the City Engineer.
  - 2. Air relief valves are not required in residential areas if services are installed at or near the crown within one pipe diameter vertically of the high point.
- B. Pressure reducing valves are installed to maintain overall system balance.
- C. Surge or pressure relief valves are installed where pressure could potentially reach above the maximum allowable.

## **XII. SPECIAL CONDITIONS**

- A. The need for cathodic protection will be determined by the City Engineer for each project. This may require soils reports or other additional information.
- B. Delineated fault zones
  - 1. Ductile Iron Pipe must be installed in delineated fault zones and extended to 100' outside each side of the delineated fault zone.
  - 2. Pumper connections or fire hydrants shall be installed approximately 50' outside each side of the delineated fault zone.
  - 3. Flextend assembly, as manufactured by EBAA Iron, Inc. of Eastland, Texas, or approved alternative, with valve must be installed adjacent to and on the fault side of the pumper connection or fire hydrant.
  - 4. A valve must be located between the Flextend assembly and the fire hydrant.
- C. Abandon water mains and services.

1. For water lines 1" or smaller, expose lateral at the main, close the corporation stop, disconnect the lateral and plug or cap the corporation stop.
2. For lines 1 1/2" or larger, remove the valve and plug the main.
3. Valve boxes for abandoned valves must be removed.
4. Abandoned mains, valves and risers located within the street structural section must be removed.
5. All Water mains 12" and larger, within the public right-of-way must be broken every 50' and filled with sand slurry.

D. Private water mains vs. Public water mains

1. Public water mains may not be constructed outside the street right-of-way without specific approval of the City Engineer.
2. Fire hydrants required on site to serve one lot would be private systems.
3. Water mains and fire hydrants located on site shall be private systems.
4. Normally, where the water mains are publicly maintained, the sewer mains should also be publicly maintained.
5. Fire mains must be installed per NFPA 24.

**XIII. ENGINEER'S APPROVED LIST**

(Separate attachment to be added)

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## **A.2 – Street Light Design Specifications**

STREET LIGHT DESIGN SPECIFICATIONS

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## STREET LIGHT DESIGN SPECIFICATIONS

### I. DEFINITIONS AND ABBREVIATIONS

**"Arterial Street"** shall mean a street whose primary purpose is to carry through traffic and means a fast or heavy street of considerable continuity, which is used primarily as a traffic way to facilitate movement of heavy traffic between major residential areas or major residential areas and commercial areas.

**"Average Maintained Foot-candles"** is the average level of horizontal illumination on the roadway pavement when the output of the lamp and luminaire is diminished by the maintenance factors; expressed in average foot-candles for the pavement area.

**"California Standard Plans"** shall mean the latest edition of the Standard Plans adopted by the California Department of Transportation.

**"California Standard Specifications"** shall mean the latest edition of the Standard Specifications adopted by the California Department of Transportation.

**"Candela"** is the unit of luminous intensity. Formerly the term "candle" was used.

**"Collector Street"** shall have the primary purpose of intercepting traffic from intersecting minor streets and handling traffic to the nearest major street or intercepting traffic from one collector street and handling traffic to another collector street. It shall serve as an access to abutting properties.

**"Cul-de-sac Street"** shall have the primary purpose of serving abutting land use and connecting to the nearest minor street or collector street. It is not intended to pass traffic through to another street and is a local street with only one outlet.

**"Electrolier"** is the complete street light assembly consisting of street light pole, luminaire, ballast, and lamp.

**"Foot-candle"** is the illumination on a surface one square foot in area on which there is uniformly distributed a light flux of one lumen.

**"Illumination"** is the density of the luminous flux incident on a surface; it is the quotient of the luminous flux divided by the area of the surface when the latter is uniformly illuminated.

**"Lateral Light Distribution"** is a pattern of light distributed upon a series of longitudinal and transverse roadway lines, based on the location of the luminaire as related to the area to be lighted.

**"Luminaire"** is a complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps and to connect the lamps to the power supply.

**"Minor Street"** shall have the primary purpose of serving abutting land use and handling traffic to the nearest Collector Street.

**"Public Works Department"** shall mean the Public Works Department of the City of Willits.

**"Street Light Standard Plan"** shall mean a typical standard of the Street Light Standards of the City of Willits.

**Uniformity Ratio"** is the ratio of average foot-candles of illumination on the pavement area, to the foot-candles at the point of minimum illumination on the pavement.

<b>ASTM</b>	American Society for Testing and Materials
<b>AWG</b>	American Wire Gauge
<b>HID</b>	High Intensity Discharge
<b>IESNA</b>	Illuminating Engineering Society of North America
<b>NEC</b>	National Electrical Code (NFPA 70)
<b>NEMA</b>	National Electrical Manufacturer's Association
<b>PG&amp;E</b>	Pacific Gas & Electric Company
<b>PVC</b>	Polyvinyl Chloride Conduit
<b>RGS</b>	Rigid Galvanized Steel Conduit
<b>UL</b>	Underwriter's Laboratories, Inc.
<b>U/R</b>	Uniformity Rating

## **II. GENERAL**

- A. These Street Light Standards shall be used for all street lights on public streets in the City of Willits.
- B. These standards shall apply as of the date of adoption and are not considered retroactive.
- C. Deviations from these standards shall require specific approval of the City Engineer.
- D. These standards are minimum standards and do not preclude the use of a higher standard.
- E. The purpose of the standards and specifications contained herein is to establish uniform standards for street lights on public streets in the City of Willits, installed after the date of adoption of these standards. This document is not intended or designed as, nor does it establish, a legal standard for lighting.

- F. Encroachment onto any City street, right-of-way, or public utility easement shall require an encroachment permit issued by the City of Willits.
- G. Street light spacing shall be staggered and located at edges of streets when possible. Street light designs utilizing one side, median, or opposite configurations shall require specific approval of the City Engineer.
- H. Electrical street lighting service shall conform to the requirements of Standard Plan 603.
- I. All street lighting projects are subject to approval by the City Engineer. Design shall conform to these requirements except as otherwise approved by the City Engineer.
- J. The City Engineer shall only authorize energizing after City acceptance of the installation.
- K. The following additional requirements apply to street light systems installed by private developers:
  - 1. The developer/engineer shall make arrangements with PG&E for service points. Service points shall be shown on the improvement plans. The developer shall be responsible for all costs associated therewith which shall be paid directly to PG&E. The contractor shall verify the street light service point location(s) with PG&E prior to installation. The City will request energizing from PG&E.
  - 2. The developer shall install the following in accordance with the Street Light Standard Plans: concrete foundations, galvanized steel poles, mast arms of the appropriate lengths, wiring, and standard luminaire.
  - 3. All street light systems utilizing street lamps up to, and including, 150 watts shall be designed for 120-Volt or 120/240-Volt service unless connecting to an existing system. In the latter case, the design shall conform to the system being connected to and must be specifically approved by the City Engineer. Street light systems utilizing street light lamps above 150 watts shall require 240-volt service.

### **III. ROADWAY ILLUMINATION REQUIREMENTS**

- A. Design Conformity
 

The design of all street light systems shall conform to the average maintained foot-candle and uniformity ratio requirements of these specifications.
- B. Area Classifications
  - 1. Area classifications shall be used when determining the required Illumination levels for street lighting systems. The area classification selected for designing the street light system shall be determined by the City Engineer.
    - a. "Commercial" shall mean that portion of the City in a business development where ordinarily there are large numbers of pedestrians and a heavy demand for parking space during periods of peak traffic or a sustained high pedestrian volume and a continuously heavy demand for off-street parking space during business hours. This

definition applies to densely developed business area outside of, as well as those that are within, the central part of the City.

- b. "Intermediate" shall mean that portion of the City which is outside of a downtown area but generally within the zone of influence of a business or industrial development, often characterized by a moderately heavy nighttime pedestrian traffic and a somewhat lower parking turnover than is found in a commercial area. This definition includes densely developed apartment area, hospitals, public libraries, and neighborhood recreational centers.
- c. "Residential" shall mean a residential development, or a mixture of residential and commercial establishments, characterized by few pedestrians and a low parking demand or turnover at night. This definition includes areas with single-family homes, townhouses, and/or small apartments. Regional parks, cemeteries, and vacant lands are also included.

C. Average Maintained Foot-Candle Requirements

- 1. The design of all street lighting systems shall conform to these illumination requirements. Evidence which demonstrates that the street lighting system conforms with these requirements shall be submitted to the City with the proposed design.
- 2. The below-listed chart shall be used for determining the average maintained foot-candle (Avg. Maint. FC) and Uniformity Ratio (U/R) requirements for the specific roadway and area types:

<u>Roadway Classification</u>	<u>Area Classification</u>	<u>Avg. Maint. FC</u>	<u>U/R</u>
Major	Commercial	.1.00	3:1
	Intermediate	.60	3:1
	Residential	.50	4:1
Collector	Commercial	.75	4:1
	Intermediate	.40	4:1
	Residential	.30	5:1
Local	Intermediate	.30	6:1
	Residential	.20	6:1

D. Lateral Light Distribution

- 1. Lateral light distribution patterns shall conform to Illuminating Engineering Society of North America (IESNA) lateral light distribution patterns.
  - a. Street lights mounted along Collector and Major streets: Type 3.
  - b. Street lights mounted along Local streets: Type 2.

- c. Street lights mounted at the terminus of a cul-de-sac: I.E.S. Type 4.
  - d. Street lights mounted along centerline of street: Type 1.
2. Design shall conform to these requirements except as specifically approved by the City Engineer.

#### **IV. STREET LIGHTS**

##### **A. Cobra Style Street Lights**

1. The luminaire shall be an American Electric Series 113, Hubbell RM-150, General Electric M250R2, or an approved equal.
2. Street light poles and mast arms shall be galvanized steel.
3. The street light poles shall be an Ameron Series PL, Landmark Lighting S3508, Pacific Union Metal LA 10120, or an approved equal.
4. Street light pole heights shall conform to Street Light Standards 601. Alternate pole heights shall require specific approval of the City Engineer.
5. Street light mast arm lengths shall conform to Street Light Standard 601. Alternate mast arm lengths shall require specific approval of the City Engineer.
6. Concrete pole-base footings shall conform to the requirements of Street Light Standard Plan 602 or pole/luminaire manufacturer's requirements, whichever is more stringent. In case of conflicting requirements, the street light designer shall provide City with structural calculations, sealed by a licensed California Structural Engineer, verifying the adequacy of the intended concrete pole-base footing design.
7. The wiring for the electrolier shall conform to the requirements of Street Light Standard Plan 604.
8. Cut off lenses and devices shall require specific approval of the City Engineer.

##### **B. Architectural Street Lights**

1. The luminaire shall be a Holophane Utility GranVille with lunar optics or an approved equal. Architectural street lights in residential areas shall include a house-side shield to restrict light spread into adjacent residential properties.
2. The street light poles shall be Union Metal Corporation "National" or an approved equal.
3. Street light poles and mast arms shall be manufactured from extruded aluminum.
4. Street light pole lengths shall be 8 feet in residential areas, 11 feet in intermediate areas and 14 feet in commercial areas. Alternate pole heights shall require specific approval of the City Engineer.
5. Street light mast arms may be used only in commercial areas or approved intermediate areas. Mast arms shall be limited to the double-luminaire type, shall not extend beyond pole base by more than 36 inches, and shall be installed such that the mast arm is oriented perpendicular to the flow of

street traffic. Alternate mast arm installations shall require specific approval of the City Engineer.

6. Concrete pole-base footings shall conform to the requirements of Street Light Standard Plan 602 or pole/luminaire manufacturer's requirements, whichever is more stringent. In case of conflicting requirements, the street light designer shall provide City with structural calculations, sealed by a licensed California Structural Engineer, verifying the adequacy of the intended concrete pole-base footing design.
7. The wiring for the electrolier shall conform to the requirements of Street Light Standard Plan 604.

## **V. PARKING AREAS**

- A. Luminaires within parking areas shall conform to the requirements for street lights with the following exceptions:
  1. Poles for Cobra style parking area lights shall be 27'-6" in length.
  2. Poles for Architectural style parking area lights shall be 14 feet in length.
  3. Illuminance measured at the parking area surface shall not be less than 0.10 foot-candles at any point within the parking area.
  4. Illuminance measured at the parking area surface shall not exceed 1.0 foot-candles at any point within the parking area.
  5. Concrete footings in parking areas shall protrude above the surrounding finish grade by 30 inches. Embedded depth of concrete pole base footings shall be adjusted to compensate. Provide City with structural calculations, sealed by a licensed California Structural Engineer, verifying the adequacy of the intended concrete pole-base footing design.

## **VI. WIRING**

- A. Except as noted, all wiring methods and equipment construction shall conform to the National Electric Code (NEC) and applicable sections of the California Standard Specifications.
- B. All splices shall be made with solderless and waterproof connectors.
- C. Unless authorized otherwise, all wiring shall be XHHW AWG stranded, copper only. Unless otherwise specified on the Street Light Standard Plans, all wiring shall be of the following sizes:
  1. Field wiring: #8 AWG minimum.
  2. Pull box to electrolier: #10 AWG minimum.
  3. Wire in pole: #10 AWG minimum.
  4. All wiring shall meet the sizing requirements of NEC article 310.

## **VII. PHOTOCELLS**

- A. The photocell shall be Type IV consisting of a photoelectric unit, which plugs into an EEI-NEMA twist lock receptacle integral with the luminaire and shall conform to the provisions of the California Standard Specifications. The photoelectric

controls shall be operable within a minimum voltage range between 105 and 280 volts. All photoelectric controls shall be oriented to the north.

### **VIII. CONDUIT**

- A. All conduit to be used shall be a minimum of 2-inch diameter, schedule 80 PVC, except from each street light to the adjacent pull box which may be 1-inch trade-size RGS and shall have a 2-foot minimum cover from the top of conduit to the finished grade of the sidewalk, parkway, or roadway.
- B. All steel conduit and other metal parts, including bonding bushing, shall be NEC approved parts and shall be continuously bonded and grounded per NEC requirements.
- C. All bends and/or offsets shall be made with factory sections using approved couplers per NEC requirements. All 90 degree elbows used as stub-ups shall be PVC-coats RGS conduit.
- D. All empty conduits shall have a 1/4-inch polypropylene pull rope provided inside and sealed with a duct seal, approved by the City Engineer, on both ends of the conduit.
- E. The ends of all conduits installed shall be sealed with a duct seal approved by the City Engineer. Conduits stubbed for future extension shall be capped.
- F. All conduit shall be encased in unreinforced 3000 psi concrete.
- G. All buried conduit shall be marked with metal "detectable" underground warning tape, installed no more than 15 inches above the conduit. Warning tape shall be polyethylene film, detectable, magnetic tape with a metalized foil core, 4-6 inches wide, ANSI standard Z53.1 safety red color and imprinted in black with the words "CAUTION BURIED ELECTRICAL LINE BELOW".

### **IX. PULL BOXES**

- A. Unless otherwise approved by the City Engineer, a No. 5 concrete pull box conforming to California State Standard Plan ES-8 shall be installed within 5 feet of the base of all street light poles.
- B. All pull boxes shall be installed per Street Light Standard Plan 607.
- C. Pull boxes shall not be more than 250-feet apart on long runs.
- D. Pull boxes shall not be placed where they will be subject to vehicular traffic. Exceptions shall require specific approval of the City Engineer.
- E. All pull box covers shall be inscribed with "Street Lighting" and be secured with 3/8-inch bolts, capscrews, or studs, and nuts which meet the provisions of the California Standard Specifications.

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## **A.2 – Traffic Control Specifications**

TRAFFIC CONTROL SPECIFICATIONS

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## TRAFFIC CONTROL SPECIFICATIONS

### I. DEFINITIONS

**"Public Works Department"** shall mean the Public Works Department of the City of Willits.

**"Rural District"** for the purpose of sign installations, shall mean an area where streets have unimproved shoulders without curb, gutter, sidewalks, or improved pedestrian facilities.

**"Street"** shall include avenues, highways, lanes, alleys, courts, crossings or intersections which have been dedicated and accepted according to the law or which have been in common and undisputed use by the public for a period of not less than five years next preceding, or which have been dedicated to a semi-public use.

**"Street Standard Plan"** shall mean a typical street standard of the Street Design and Construction Standards of the City of Willits.

**"Traffic Standard Plan"** shall mean a typical traffic standard of the Traffic Control Standards of the City of Willits.

**"Traveled Way"** means a way or place of whatever nature publicly maintained and open to the use of the public for purposes of vehicular travel.

**"Urban District"** for the purpose of sign installations, shall mean an area where streets have improved shoulders with curb, gutter, and sidewalk.

Refer also to Street Standard Specifications for additional definitions.

### II. GENERAL

- A. The following Traffic Standards are for use in the City of Willits and are in substantial conformance with the California Manual on Uniform Traffic Control Devices (California MUTCD), the State of California Standard Specifications, and the State of California Standard Plans, as adopted by the City of Willits, and are to be used in conjunction with the named references for any project within the public right-of-way.
- B. Deviations from these standards shall be granted only upon specific approval by the City Engineer.
- C. These standards are considered minimum and do not preclude the use of a higher standard as approved by the City Engineer.
- D. Encroachment onto any City street or right-of-way shall require an encroachment permit issued by the City of Willits.

### III. TRAFFIC SIGNS

#### A. General

1. The base metal of all signs shall conform to ASTM designation B209, of either 5052-H38 or 6061-T6 alloy, and shall conform to all other applicable current Caltrans specifications for sign material.
2. Unless otherwise specified by the City Engineer, the thickness of all signs shall be 0.080 inches, except for overhead mounted signs which shall be 0.125 inches.
3. Unless otherwise specified by the City Traffic Engineer, all regulatory and warning signs shall be constructed to the standard size and specifications of the State of California, Department of Transportation.
4. Signs larger than the standard sign may be required or may be granted approval by the City Engineer.
5. The following signs shall be constructed using High Intensity encapsulated lens sheeting and lettering: stop signs (R1), yield signs (R1-2), keep right signs (R7), no u-turn signs (R34), stop ahead signs (W17), chevron signs (W81), mast-arm mounted street name signs, advance street name signs, street name signs, and Type N markers. This sheeting and lettering shall hold a minimum warranty of 10 years. Other traffic signs may require high intensity sheeting and lettering as specified by the City Engineer.
6. Standard abbreviations shall conform to the latest version of the California MUTCD.
7. Advance street name signs shall be placed on all arterial streets and those collector streets as required by the City Engineer. Advance street name signs shall be installed in advance of the street per California MUTCD guidelines for advance placement of warning signs, condition A. No advance street name signs shall be placed where the distance between side streets curb to curb is less than 200 feet.
8. Where a median island exists and there are two or more lanes in the same direction, an advance street name sign shall be installed in the island if the width of the island will allow it. Signs in the median area shall be placed midway between curbs. These signs shall be mounted no closer than six inches to, and no farther than six feet from, the edge of the traveled way which the sign faces.

#### B. Traffic Sign Installation – Urban Areas

1. Signs shall be installed as per these specifications and facing traffic in the lane adjacent to which the sign is installed. "No Parking" signs shall be installed at a 30° angle toward the traveled way. All other signs shall be installed at an angle toward the traveled way per the sign manufacturer's reflective requirements.
2. Typical installations shall conform to the requirements of City Standard No. 701, or as specifically approved by the City Engineer.
3. The minimum mounting height for signs in urban areas shall be 7-feet

measured from the bottom of the sign to the near edge of the pavement, except as otherwise noted below, or as specifically approved by the City Engineer.

4. The height to the bottom of a secondary sign mounted below a primary sign shall be a minimum of 7-feet measured from the bottom of the sign to the near edge of the pavement.
5. In areas not subject to pedestrian traffic, the Chevron (W81) and ONE WAY (R10) signs shall be mounted at a height of three feet, measured from the bottom of the sign to the near edge of the pavement.

C. Traffic Sign Installation - Rural Areas

1. Signs shall be installed as per these specifications and facing traffic in the lane adjacent to which the sign is installed. "No Parking" signs shall be installed at a 30° angle toward the traveled way. All other signs shall be installed per the sign manufacturer's reflective requirements.
2. Typical installations shall conform to the requirements of City Standard No. 702, or as specifically approved by the City Engineer.
3. The minimum mounting height for signs in rural areas shall be five feet, measured from the bottom of the sign to the horizontal extension of the near edge of the pavement, except as otherwise noted below, or as specifically approved by the City Engineer.
4. The height to the bottom of a secondary sign mounted below a primary sign shall be a minimum of four feet, measured from the bottom of the sign to the horizontal extension of near edge of the pavement.
5. The CHEVRON (W81) and ONE WAY (R10) sign shall be mounted at a height of three feet, measured from the bottom of the sign to the horizontal extension of the near edge of the pavement.

D. Standard Street Name Sign

1. Standard street name signs shall conform to the requirements of City Standard No. 704.
2. Street name signs installed at signalized intersections shall conform to the following requirements:
  - a. Street name signs mounted to the traffic signal standard shall be by the use of a heavy-duty arm bracket for electrical mounting.
  - b. Street name signs mounted to the traffic signal mast arm shall be by the use of a double-hinged adjustable bracket.
  - c. Two sets of street name signs shall be mounted at each signalized intersection.
3. The mounting location at unsignalized intersections shall conform to Traffic Standard No. 703.

E. Pole Standard Installation

1. All poles shall be 2-inch I.D. galvanized steel, in conformance with the most current Caltrans specification for sign poles. Both ends shall be threaded.
2. In concrete or other finished surfaces, a 2½-inch diameter hole shall be rock drilled to a minimum depth of 18 inches. Upon installation, the pole shall be set using sand and cement.
3. In rural districts, an 8-inch diameter hole shall be dug to a minimum depth of 18 inches. Upon installation, the pole shall be set using concrete mix.
4. For the bolting of signs directly to the pole, 5/16-inch x 3 inch long Grade 3 bolts with a flat washer shall be used.

**IV. PAVEMENT MARKERS AND MARKINGS**

A. Raised Pavement Markers

1. Raised pavement markers shall conform to the shape, types and dimensions of State of California Standard Plan A-20A.
2. Except as indicated below, raised pavement markers shall conform to the requirements and applicable provisions of Section 85 of the State of California Standard Specifications. The following specifications shall be added to the applicable provisions:

A hot melt bitumen adhesive may be used to cement the markers to the pavement, instead of the Rapid Set Type or Standard Set Type adhesive. The bitumen adhesive material, if used, shall conform to the following:

<b>Specification</b>	<b>ASTM Test Method</b>	<b>Requirement</b>
Flash point, CCC, °F	D 92	550 Min.
Softening Point, °F	D 36	200 Min.
Brookfield Viscosity, 400°F	D 2196	7,500 cP, Max
Penetration, 100g 5 sec. 77°F	D 5	10-20 dmm
<b>Specification</b>	<b>ASTM Test Method</b>	<b>Requirement</b>
Filler Content, % by weight (insoluble in 1,1,1 Trichlorethane)	D 23711	50-75

Filler material shall be calcium carbonate and shall conform to the following fineness:

<b>Sieve Size</b>	<b>Percent Passing</b>
No. 100	100
No. 200	95
No. 325	75

Bitumen adhesive shall be indirectly heated in an applicator with continuous agitation. The adhesive shall be applied at a temperature between 400° F and 425° F. Markers shall be placed immediately after application of the adhesive.

Placement of markers using bitumen adhesive shall conform to the requirements for placing markers in Section 85-1.06 of the State of California Standard Specifications, except as follows:

- a. Markers shall not be placed when the pavement or air temperature is 50° F or less.
  - b. Blast cleaning of clean, new asphalt concrete surfaces will not be required.
3. For application of the raised pavement marker to the pavement surface, the adhesive shall completely surround the perimeter of the marker after the marker has been pressed into place.
  4. The configuration to be used in the placement of raised pavement markers shall conform to City Standard No. 705, or as specifically authorized by the City Engineer.
  5. Lane widths as shown on design documents shall be measured from centerline to centerline of adjacent striping patterns, or, from face of curb to the centerline of the striping pattern.

**B. Bike Lane Markings**

1. Bike lane markings shall conform to the requirements of City Standard No. 707.
2. Bike lane markings shall be used on all streets designated for Class II bike lanes.
3. The standard pavement markings shall be the bike lane symbol (Caltrans Standard Plan A24C) with an arrow showing the direction of travel, placed in the center of the bicycle lane.
4. The solid 6-inch bike lane line shall be dropped 96 feet in advance of the intersection, and a broken line carried to the intersection.
5. There shall be a minimum of 4-feet from the lip of the gutter to the center of the 6-inch bike lane line.
6. Bike loop detector markings (California MUTCD Figure 9C-7 and Caltrans Standard Plan A24C) shall be installed at signalized intersections at all approaches that have detection as directed by the City Engineer.
7. Design shall conform to these requirements except as otherwise approved

by the City Engineer.

C. Durable Pavement Markings (Tape)

1. At the discretion of the City Engineer, pavement markings may be required to be composed of durable pavement tape of one of two types:
  - a. General purpose high durability retro-reflective pliant polymer film,  
or
  - b. Durable retro-reflective pavement marking film.
2. General purpose high durability retro-reflective pliant polymer film shall be used for preformed longitudinal, transverse and word/symbol markings subjected to high traffic volumes and severe wear conditions such as repeated shear action from crossover or encroachment on edge and channelization lines, and stop, start, or turn movements, or where required by the City Engineer.
3. Durable retro-reflective pavement marking film shall be used for preformed markings subjected to moderate, well-channelized, free rolling traffic volumes, less severe wear, and where there is a need for higher reflectivity or where required by the City Engineer.
4. The preformed markings shall consist of white or yellow films with pigments selected and blended to conform to standard highway colors through the expected life of the film. Glass beads shall be incorporated to provide immediate and continuing retro-reflection.
5. The size, quality and refractive index of the glass beads shall be such that the performance requirements for the markings shall be met and the bead adhesion shall be such that beads are not easily removed.
6. Preformed words and symbols, and traffic striping, shall conform to the applicable shapes, sizes, and colors as outlined in the California MUTCD, or as required by the City Engineer.
7. The preformed markings shall be capable of being adhered to asphalt concrete or Portland cement by a pre-coated pressure sensitive adhesive. A primer may be used to precondition the pavement surface. The preformed marking film shall mold itself to pavement contours by the action of traffic. The pavement marking films also shall be capable of application on new, dense and open graded asphalt concrete wearing courses during the paving operation. After application, the markings shall be immediately ready for traffic. All solvents and/or primers (where necessary), equipment necessary for application, and recommendations for application that will assure the materials shall be suitable for use shall be identified to the City Engineer.
8. The general purpose high durability retro-reflective pliant polymer film, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to temperature if the pavement surface remains stable. The film shall be weather resistant and, through normal traffic wear, shall show no fading, lifting or shrinkage which will significantly impair the intended usage of

the marking throughout its useful life and shall show no significant tearing, roll back or other signs of poor adhesion.

9. The durable retro-reflective pavement marking film, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to temperature if the pavement surface remains stable. The film shall be weather resistant and, through normal traffic wear, shall show no fading, lifting or shrinkage which will significantly impair the intended usage of the marking throughout its useful life and shall show no significant tearing, roll back or other signs of poor adhesion.

#### D. Pavement Marking Paint

1. Traffic striping shall conform to the applicable provisions of Section 84 of the California Standard Specifications and as directed by the City Engineer.
2. The paint shall be lead free commercial quality, solvent or water borne paint and be applied in 2-coats to achieve the designed coverage.
3. The type of paint to be used (solvent borne or water borne) shall be determined by the City Engineer.
4. Glass beads used for reflective pavement markings shall conform to the modified California State Specification No. 8010-51j-22 (Type II).
5. Thinner shall not be mixed with paint. Paint shall dry "track free" in not less than thirty (30) minutes and not more than ninety (90) minutes.
6. All painted pavement markings shall be clean and sharp as to dimensions. Ragged ends of segments, fogginess along the sides, or objectionable dribbling along the unpainted portions of the pavement marking shall not be permitted.
7. The painted pavement marking shall have an opaque, well-painted appearance with no black or discolorations showing through.
8. Words, symbols and traffic striping shall conform to the applicable shape, sizes and colors as outlined in the California MUTCD or as required by the City Engineer.

#### E. Thermoplastic Pavement Markings

1. At the discretion of the City Engineer, pavement markings may be required to be composed of thermoplastic pavement marking material. In private developments, this requirement shall be noted on the improvement plans.
2. The furnishing and applying of thermoplastic pavement marking material shall conform to the requirements of the modified California State Specification No. 8-10-41G-21.
3. Glass beads applied to the surface of the molten thermoplastic material shall conform to the requirements of the modified California State Specification No. 8010-51J-22 (Type II).

F. Eradication of Pavement Markings

1. Pavement marking paint and thermoplastic shall be removed by sand blasting.
2. Painting over as a means of pavement marking eradication shall not be permitted.

G. Temporary Pavement Markings

1. When pavement markings have been obliterated or damaged in construction work zones, temporary pavement markings shall be installed in accordance with these specifications.
2. At the end of each day's work, temporary pavement markings shall be in place on each paving lift that is open to normal traffic flow.
3. Temporary pavement marking materials shall be approved by the City Engineer prior to installation.
4. Temporary pavement marking configurations shall be in accordance with the California MUTCD, or as specified by the City Engineer.
5. The temporary pavement markings shall be maintained and replaced by the Contractor until they are covered with the next paving course or are replaced with durable pavement markings applied on the final wearing course.
6. Temporary pavement markings shall be applied to clean, dry surfaces in accordance with the manufacturer's recommendations or a method approved by the City Engineer.

V. **CONSTRUCTION AREA TRAFFIC CONTROL**

A. General

1. All contractors, permit holders or agencies doing work in public streets or public right-of-way shall:
  - a. Obtain all necessary permits.
  - b. Install and maintain required traffic control devices.
  - c. Provide flaggers when required.
  - d. Provide adequate safeguards for workers and the general public.
  - e. Assure that survey crews and other employees working in or adjacent to a traveled roadway wear flagging garments as required for flaggers.
  - f. Patrol the construction site as required to insure that all devices are in place and operating at all times.
  - g. Remove traffic control devices when they are no longer needed.
2. A traffic control and pedestrian routing plan **shall be required** and submitted for review and approval for all requested road closures, detours, land closures or other work within the public right-of-way. Exceptions to the requirement of a traffic control plan shall require the specific approval

of the City Engineer. Such plans shall include delineator placement, type and location of all signs (construction signs, detour signs, street name plates, etc.), barricade placement, flaggers, temporary pavement markings, and any other pertinent information.

3. The latest edition of the California MUTCD shall be used as references for determining appropriate signing. Consideration shall be given to such items as bus routes and locations of bus stops, school walking routes and school crossings, and work hour restrictions such as not allowing work during peak commute hours.
4. A temporary traffic control plan may be referenced to a typical application in the California MUTCD if the work zone conditions are identical to those of the Typical Application. If more than one Typical Application is referenced, the temporary traffic control plan shall consist of a description of each work zone condition and when each of the Typical Applications shall be used. If any deviation from the Typical Application is necessary, a site specific design shall be prepared by a person knowledgeable (trained and/or certified) about the fundamental principles of Temporary Traffic Controls and the work activities to be performed, and shall be approved by the City Engineer.
5. Compliance with appropriate temporary traffic controls used in work zones shall be required when the normal operation of any City street or sidewalk is impacted by any construction and/or maintenance operation.
6. Flagging against a functioning traffic indication is prohibited.

## **VI. Traffic Signals**

### **A. General**

1. Traffic signal and safety lighting equipment shall comply with the requirements of the applicable provisions of the California MUTCD, Section 86 of the California State Specifications, Standard Plans, these traffic control standards, and as required by the City Engineer.
2. Foundations for traffic signal standards shall be constructed per the applicable California State Standard Plans and as required by the City Engineer.
3. All traffic signals shall be equipped with a Fire Department approved Opticom device, and installed and tested to the satisfaction of the Fire Marshall.

### **B. Traffic Signal Poles, Steel Pedestals and Posts**

1. Traffic signal poles, arms, and related appurtenances shall be installed per the requirements of the California State Standard Plans and as required by the City Engineer.
2. The chase outlet shown on the California State Standard Plans in the mast arm mounting plate, and in the mast arm mounting plate on the pole, shall be 1½ inch minimum diameter and shall be smoothed after galvanizing to facilitate installation of conductors without damaging the insulation.

3. Each pole shall be provided with one No. 5 pull box for wiring, located within one foot of the base and on the same side of the pole as the mast arm.
4. Design shall conform to these requirements except as otherwise approved by the City Engineer.

C. Model 170 Traffic Signal Controller

1. The controller assembly shall be a Type 170E and conform with the latest edition of Caltrans "Traffic Signal Control Equipment Specifications" and all addenda. If specified by the City Engineer, a Type 2070 controller may be required which shall conform with the latest edition of Caltrans "Traffic Signal Control Equipment Specifications" and all addenda.
2. Design shall conform to these requirements except as otherwise approved by the City Engineer.

D. Traffic Signal Controller Cabinet

1. The controller cabinet shall be Type 332 as specified by the City Engineer.
2. The controller cabinet shall be located no closer than 4-feet from the service cabinet, but no further than 10-feet.
3. The foundation for the Type 332 cabinet shall conform with the Caltrans Standard Plan ES-3C.
4. Design shall conform to these requirements except as otherwise approved by the City Engineer.

E. Traffic Signal Service Cabinet

1. The traffic signal service cabinet shall be a Type III-AF, per Caltrans Standard Plan ES-2D.
2. The service cabinet shall have a provision for reading the service meter through a window without opening any doors.
3. The cabinet shall be watertight with a weatherproof door and window.
4. The service cabinet foundation shall be Type III-A per Caltrans Standard Plan ES-2D.
5. The cabinet shall be located no closer than 6-feet from the distribution pole and no closer than 4-feet from the controller cabinet.
6. Design shall conform to these requirements except as otherwise approved by the City Engineer.

F. Conduit

1. Conduit requirements shall conform to the following:
  - a. Service run conduit shall be 2-inch minimum diameter.
  - b. Conduit under any street shall be 3-inch minimum diameter and shall have a minimum of 24-inches of cover.
  - c. Conduit under sidewalk or planter area shall have a minimum of 24-

- inches of cover.
- d. No native material shall be used as trench backfill.
  - e. Trench backfill and surfacing for trenches shall conform to City Standard No. 222.
  - f. Conduit from the main pull box to the controller shall be two (2) 3-inch diameter conduits.
  - g. Any signal run and interconnect conduit shall be 2-inch minimum diameter.
2. All conduits shall be Schedule 80 PVC, except 90-degree elbows, pole risers and stub-ups which shall be PVC coated ridged galvanized steel (RGS).
  3. All underground conduits and metal parts shall be continuously bonded and grounded.
  4. All bends and/or offsets shall be made with factory manufactured sections.
  5. All empty conduit shall have a flat, woven, lubricated soft fiber polypropylene rope provided inside along its entire length and extending 36-inches out of each end.
  6. After conduits, wire and rope have been installed, the ends of all conduits terminating in pull boxes shall be sealed with an approved type of sealing compound. Conduits stubbed for future extension shall be capped.
  7. Design shall conform to these requirements except as otherwise approved by the City Engineer.

#### G. Pull Boxes

1. All pull boxes shall be #5 concrete (Caltrans Standard Plan ES-8) except the main pull box which shall be 30 inch x 48 inch minimum size concrete pull box and shall have double covers. Covers shall be marked "Traffic Signal".
2. Traffic signal interconnect conduit shall be installed in separate concrete pull boxes and their covers shall be marked "I.C.".
3. Utility service conduit shall be installed in separate concrete pull boxes and their covers shall be marked "Electrical".
4. Pull boxes subjected to vehicular travel shall be traffic rated and installed with one-quarter inch steel plate covers (galvanized after fabrication) with a diamond-type cover surface.
5. All pull box covers shall be bolted.
6. Pull box requirements shall conform to City Standard No. 607.
7. Bottoms of pull boxes shall be grouted prior to the installation of conductors. A layer of roofing paper shall be placed between the grout and the crushed rock sump. A one inch drain hole shall be provided in the center of the pull box through the grout and the roofing paper.
8. Design shall conform to these requirements except as otherwise approved by the City Engineer.

## H. Conductors

1. All conductors for traffic signal or street lighting systems shall conform to the requirements of Section 86 of the California State Specifications, or as specified herein.
2. All conductors shall be copper and be rated for 600-volt operation.
3. All conductors shall conform to the latest requirements of the National Electric Code (NEC) and be labeled by Underwriter's Laboratories, Inc.
4. Colored stripes on conductor insulation to identify each phase of vehicle signals, pedestrian signals, pedestrian push buttons, and detectors shall be required.
5. All conductors shall be pulled by hand and shall be installed in conduit runs in one operation. The use of winches or other power actuated equipment shall not be permitted.
6. The maximum number of wires in the conduit shall conform to the specifications of the National Electric Code.
7. #14 AWG conductors shall be used for the following:
  - a. Each traffic signal lamp on each phase.
  - b. Each pedestrian signal indication on each phase.
  - c. Each pedestrian push button and pedestrian push button common installed into the controller.
  - d. Three for spares under each street.
  - e. 12-pair (branches) or 50-pair (main run), or as determined by the City Engineer, for interconnect.
8. #8 AWG conductors shall be used for the following:
  - a. Two for each safety light 120/240V.
  - b. One for equipment ground.
  - c. One neutral for traffic signal.
9. #4 AWG conductors shall be used from the utility service point to service cabinet for traffic signals and safety lights.

## I. Wiring

1. No splices of traffic signal lights, pedestrian signal lights, or pedestrian push button wires shall be allowed in any pull box. Ground wires may be spliced in pull boxes.
2. Straight splices in signal neutral and multiple lighting conductors shall be insulated in conformance with Method "A" as shown on the Caltrans Standard Plans.
3. Conductors shall be permanently identified as to function. Identification shall be placed on each conductor or each group of conductors comprising a signal phase in each pull box and near the end of conductor termination.
4. Identification shall be by tags or bands fastened to the conductors using nylon wire ties in such a manner that they will not move along the

conductors. Conductors comprising a single signal phase may be grouped together and tagged with a single band provided the band is designed to tie conductors together as well as tag them.

5. Marking on tags shall be by mechanical methods (scribing, etc.) and shall be permanent.
6. Design shall conform to these requirements except as otherwise approved by the City Engineer.

J. Loop Detector Wiring

1. Traffic signal loop detector wiring shall conform to the requirements of the Caltrans Standard Plans.
2. All head loops shall be Type D and all other loops shall be Type A in accordance with Caltrans Standard Plan ES-5B unless otherwise noted, and shall be installed in accordance with the details shown on the California State Standard Plans.
3. Each lane shall have one shielded cable pair lead-in continuous to controller.
4. No splicing of shielded cable pair lead-in shall be permitted.
5. Loop wire shall be #12 AWG stranded conductor with USEXLP insulation.
6. Detector lead-in cable shall be Type B per California State Specifications.
7. Detector lead-in cables shall be permanently and clearly marked at cabinet and pull boxes.
8. All advance loop detectors shall have their own detector lead-in cable per approach lane.
9. At the discretion of the City Engineer and when indicated on the improvement plans, sensor units shall be provided for inductive loop traffic counting equipment.
10. Detector hand holes shall be installed per Caltrans Standard Plan ES-5D.
11. Design shall comply with these requirements except as otherwise approved by the City Engineer.

K. Detector Loop Wire Sealant

1. The encapsulated shall be one-part elastomeric compound requiring no mixing, measuring or application of heat prior to or during its installation.
2. The elastomeric sealant shall be a polyurethane material of a composition that will, within its stated shelf life, cure only in the presence of moisture. Sealant shall be suitable for use in both asphalt concrete and Portland cement concrete. The cured sealant shall have the following performance characteristics:

<b>Property Results</b>	<b>Measuring Standards &amp; Conditions</b>
Hardness (indentation) 65-85	ASTM D 2240 Rex. Type A, Model 1700 77°F. (25°C) 50% relative humidity
Tensile strength-- 500 psi minimum	ASTM D 412 Die C, pulled at 20 IPM
Elongation-- 400% minimum	ASTM D 412 Die C, pulled at 20 IPM
Flex at -40°F.-- No cracks	25 mil Free Film Bend (180°) over ½ inch mandrel
Weathering Resistance-- (slight chalking)	ASTM D 822 Weatherometer 350 hours. Cured 7 days at 77°F. (25°C.) 50% relative humidity
Salt Spray Resistance-- 500 psi, minimum tensile; 400%, minimum elongation	ASTM D 117 28 days at 100°F. (38°C.) 5% NaCl, Die C, pulled at 20 IPM
Dielectric Constant-- less than 25% change over a temperature range of -30°C. to 50°C.	ASTM D 150

3. Specifications shall conform to these requirements except as otherwise approved by the City Engineer.

L. Wireless Vehicle Detector System

1. Each wireless vehicle detector system (WVDS) shall consist of one or more vehicle sensor node(s) (VSN), installed in the roadway; wireless repeater(s) (RP), as needed, mounted on standards along the roadway; one or more access points (AP), mounted on standard(s) within the roadway, and all other equipment required for a complete and operational system.
2. Each WVDS component must be new and conform to the manufacturer's recommendations. The date of manufacture, as shown by date codes or serial numbers of electronic circuit assemblies, must not be more than 6 months from the date of the installation.
3. Each VSN must consist of a magnetometer sensor, a microprocessor with firmware in non-volatile memory, a wireless transceiver and a battery within a single housing.
4. The VSN must automatically recalibrate in the event of a detector lock within 5 minutes.

5. Each VSN must be individually addressable with a unique identifier, and capable of transmitting to the AP. Each VSN must also be capable of receiving detector parameters, microprocessor firmware and other commands from the AP without loss of data.
6. Each VSN must have the following programmable detection parameters:
  - a. Onset sensitivity and delay
  - b. Off sensitivity
  - c. Holdover time
  - d. Adaptable orientation
  - e. Auto-recalibration timeout
7. The housing must be fully encapsulated to provide a minimum of 8 years of operation, over a temperature range of -37 °C to +74 °C. The housing must be capable of being installed in a cylindrical hole that is no larger than 4.00 inches in diameter and 3.00 inches high.
8. The sealant for the installation of the wireless detector sensor units must be a two component, 100 percent solids, polyurea based joint sealant and approved by the manufacturer of the wireless detector sensor. It must be a self-leveling joint sealant and will be applied at a minimum temperature of 0 °C. The surface to be bonded must be free of debris, moisture and anything else that will interfere with the sealant bond.
9. If required for proper operation, each wireless repeater (RP) and its battery shall be housed in a NEMA 4 enclosure. The enclosure with RP and battery shall be 5 inches tall by 6 inches wide by 2.5 inches deep, with a maximum weight of 5 pounds. The RP must operate continuously over a temperature range of -37°C to +74°C. The battery must have a minimum life of 8 years and field-replaceable with the use of common hand tools only. Each RP must be capable of communicating with and retransmitting data from a minimum of 16 VSN.
10. Each access point (AP) must be housed in a NEMA 4X enclosure. The enclosure with AP shall be 5 inches tall by 6 inches wide by 2.5 inches deep, with a maximum weight of 5 pounds.
11. Each AP shall operate using Power over Ethernet, at a maximum of 1.5 W.
12. The AP must operate continuously over a temperature range of -37°C to +74°C.
13. Each AP must be capable of communicating with and collecting data from a minimum of 64 VSN, either directly or via RP.
14. The supplier shall provide a limited two-year warranty on the detection system. During the warranty period, technical support shall be available from the supplier via telephone within 24 hours of the time a call is made by a user, and this support shall be available from factory-authorized personnel or factory-authorized installers. During the warranty period, standard updates to the software shall be available from the supplier without charge.
15. The supplier shall maintain a sufficient inventory of parts to provide support and maintenance of the system. These parts shall be available for delivery within 30 days of receipt of a purchase order by the supplier at the supplier's then current pricing and terms of sale.
16. The supplier shall maintain an ongoing program for customer support for

the system. This support shall be via telephone, email or personnel sent to the installation upon receipt of an purchase order at the suppliers then current pricing and terms of sale for technical support services.

17. Installation and/or training support shall be provided by a factory authorized representative.
18. All documentation shall be provided in the English language.
19. Sensys Networks, Inc. detection systems are known to meet the above minimum standards. An approved equal comparable product may be submitted for consideration.

M. Electrical Service

1. Electrical service shall be underground service and shall conform to the requirements of City Standard No. 708. Overhead service requires the specific approval of the City Engineer and shall conform to the requirements of City Standard No. 709.
2. Design shall conform to these requirements except as specifically approved by the City Engineer.

N. Pedestrian Signals

1. Pedestrian signals shall be in accordance with Caltrans Standard Specifications Section 86-4.
2. Pedestrian signal heads shall be “count-down hand-man” and shall conform to Section 4E.07 of the California MUTCD. Countdown pedestrian signals shall use the international hand and walking person symbols, illuminated by LEDs to form a solid filled shape. The numbers shall be illuminated by a double row of LEDs to create a block or bold shape. The hand and walking person symbols shall be the overlaid configuration.
3. All signal head sections shall be constructed of metal, not plastic.
4. Design shall conform to these requirements except as otherwise approved by the City Engineer.

O. In-Roadway Lights

1. In-roadway lights shall be manufactured by Lightguard, Inc., or approved equivalent, and installed in accordance with the manufacturer’s specifications and in conformance with the California MUTCD.

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## **A.2 – Erosion Control Specifications**

EROSION CONTROL SPECIFICATIONS

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## EROSION CONTROL SPECIFICATIONS

### I. Regulatory Background

In 1972, the Federal Water Pollution Control Act (also referred to as the Clean Water Act [CWA]) was amended to provide that the discharge of pollutants to waters of the United States from any point source is unlawful unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. On November 16, 1990, the U.S. Environmental Protection Agency (USEPA) published final regulations that establish storm water permit application requirements for specified categories of industries.

On December 8, 1999 Federal regulations promulgated by USEPA (40CFR Parts 9, 122, 123, and 124) expanded the NPDES storm water program to include storm water discharges from municipal separate storm sewer systems (MS4s) and construction sites that were smaller than those previously included in the program. Federal regulation 40 CFR § 122.26(b)(15) defines construction activity as including clearing, grading, and excavating that result in land disturbance of equal to or greater than one acre and less than five acres or is part of a larger common plan of development or sale. Permit applications for small construction activities are required for any project meeting those requirements, which is begun after March 10, 2003.

While Federal regulations allow two permitting options for storm water discharges (individual permits and General Permits), the California State Water Resources Control Board (SWRCB) has elected to adopt a statewide General Permit that will apply to all storm water discharges associated with construction activity. Most construction projects are permitted through the General Permit; however, the SWRCB may require an individual permit for any project at their discretion. A Storm Water Pollution Prevention Plan (SWPPP) must be prepared for projects fitting the above description and need to be based on the State of California's General Permit for Construction Activities, Water Quality Order 99-08-DWQ (General Permit No. CAS000002).

This Permit was modified in 2001 by Resolution No. 2001-046, *Modification of Water Quality Order 99-08-DWQ State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit For Storm water Discharges Associated With Construction Activity (CGP)*. The modifications to the Construction General Permit (CGP) require that a sampling and analysis strategy and sampling schedule for certain discharges from construction activity be developed and kept with the project's SWPPP. The sampling and analysis requirements are found in Section B, paragraphs 7 and 8, of the CGP. Paragraph 7 concerns monitoring for sedimentation/siltation or turbidity and Paragraph 8 concerns monitoring for pollutants that are not visually detectable in storm water. Where required, a sampling and analysis strategy and sampling schedule must be developed regardless of the time of the year that construction occurs.

The North Coast Regional Water Quality Control Board (RWQCB) has jurisdiction over activities within the City of Willits and may inspect projects at any time. Written correspondence, however, may be requested by and sent to either the State Water Resource Control Board (SWRCB) or the RWQCB, depending on the information being provided. The General Permit does not preempt or supersede the authority of local storm water management agencies to prohibit, restrict, or control storm water discharges to separate storm sewer systems

or other watercourses within their jurisdiction, as allowed by State and Federal law.

## **II. LOCAL AND STATE REQUIREMENTS**

Mendocino County has developed a Storm Water Management Program (SWMP) for the unincorporated urbanized areas of Ukiah and Fort Bragg to comply with the Federal Stormwater Phase II Final Rule (Phase II Rule), which requires operators of small municipal separate storm sewers (MS4s) to obtain a National Pollution Discharge Elimination System (NPDES) permit. The City of Willits is not currently an MS4 community and is therefore not subject to the Phase II regulations.

## **III. STORM WATER POLLUTION PREVENTION PLANS**

The State Water Resources Control Board requires contractors to prepare and implement a program to control water pollution on construction projects that result in 1 acre (ac) or more of soil disturbance. For these construction projects, contractors are required to submit a Notice of Intent (NOI) to the State Water Resource Control Board (SWRCB) and prepare a Storm Water Pollution Prevention Plan (SWPPP). When the project is complete, a Notice of Termination (NOT) must be submitted to the SWRCB.

If two (2) or more small projects incorporate less than one (1) ac of soil disturbance in the same corridor and are part of a larger common plan of development that incorporates one (1) ac or more, then these small projects are also subject to the requirements of the General Permit and need to develop and implement a SWPPP.

For construction projects submitting a NOI, the City of Willits requires that a copy of the SWPPP also be submitted as part of the City of Willits's application for an Erosion Control Permit. Detailed step-by-step procedures, instructions and templates to prepare a SWPPP can be found at <http://cfpub.epa.gov/npdes/stormwater/swppp.cfm>

All dischargers need to submit a NOI and prepare a SWPPP prior to disturbing a site equal to or greater than one acre in size. The SWPPP must be implemented to protect water quality at all times throughout the life of the project. The SWPPP must remain on the site while the site is under construction, commencing with the initial mobilization and ending with the termination of coverage under the permit.

The SWPPP has two major objectives: (1) to help identify the sources of sediment and other pollutants that affect the quality of storm water discharges and (2) to describe and ensure the implementation of Best Management Practices (BMPs) to reduce or eliminate sediment and other pollutants in storm water as well as non-storm water discharges.

To ensure that the preparation, implementation, and oversight of the SWPPP is sufficient for effective pollution prevention, individuals responsible for creating, revising, overseeing, and implementing the SWPPP must participate in applicable training programs and document such training in the SWPPP.

Section A of the General Permit details the requirements of a SWPPP. The general requirements include: (a) project information and (b) pollutant source identification combined with an

itemization of those BMPs specifically chosen to control the pollutants. Specific information needed includes:

1. A vicinity map locating the project site and show the construction site perimeter, the geographic features surrounding the site, and the general topography.
2. A site map(s) which shows the construction project in detail, including the construction site perimeter; existing and proposed buildings, lots, roadways, storm water collection and discharge points; general topography both before and after construction; and the anticipated discharge location(s) where the storm water from the construction site discharges to a municipal storm sewer system or other water body.
3. A description of potential sources which are likely to add pollutants to storm water discharges or which may result in non-storm water discharges from the construction site.
4. Drainage patterns and slopes anticipated after major grading activities are completed. Runoff from off-site areas should be prevented from flowing through areas that have been disturbed by construction unless appropriate conveyance systems are in place. Show all calculations for anticipated storm water run-on, and describe all BMPs implemented to divert off-site drainage around or through the construction project.
5. Drainage patterns into each on-site storm water inlet point or receiving water. Show or describe the BMPs that will protect operational storm water inlets or receiving waters from contaminated discharges other than sediment discharges, such as, but not limited to: storm water with elevated pH levels from contact with soil amendments such as lime or gypsum; slurry from saw cutting of concrete or asphalt ;washing of exposed aggregate concrete; concrete rinse water; building washing operations; equipment washing operations; minor street washing associated with street delineation; and/or sealing and paving activities occurring during rains.
6. Existing site features that, as a result of known past usage, may contribute pollutants to storm water, (e.g., toxic materials that are known to have been treated, stored, disposed, spilled, or leaked onto the construction site). Show or describe the BMPs implemented to minimize the exposure of storm water to contaminated soil or toxic materials.
7. Areas designated for the (a) storage of soil or waste, (b) vehicle storage and service areas, (c) construction material loading, unloading, and access areas, (d) equipment storage, cleaning, and maintenance areas.
8. Describe the BMPs for control of discharges from waste handling and disposal areas and methods of on-site storage and disposal of construction materials and construction waste. Describe the BMPs designed to minimize or eliminate the exposure of storm water to construction materials, equipment, vehicles, waste storage areas, or service areas.
9. Describe all post-construction BMPs for the project, and show the location of each BMP on the map. (Post-construction BMPs consist of permanent features designed to minimize pollutant discharges, including sediment, from the site after construction has been completed.) Also, describe the agency or parties to be the responsible party for long-term maintenance of these BMPs.
10. Show the locations of direct discharge from the construction site into a Section

303(d) listed water body. Show the designated sampling locations in the receiving waters, which represent the prevailing conditions of the water bodies upstream of the construction site discharge and immediately downstream from the last point of discharge.

11. A narrative description of pollutant sources and BMPs that cannot be adequately communicated or identified on the site map. In addition, a narrative description of preconstruction control practices (if any) to reduce sediment and other pollutants in storm water.
12. An inventory of all materials used and activities performed during construction that has the potential to contribute to the discharge of pollutants other than sediment in storm water. Describe the BMPs selected and the basis for their selection to eliminate or reduce these pollutants in the storm water discharges.
13. Include the following information regarding the construction site surface area: the size (in acres or square feet), the runoff coefficient before and after construction, and the percentage that is impervious (e.g., paved, roofed, etc.) before and after construction. Include a copy of the NOI, and the Waste Discharge Identification (WDID) number. If a WDID number not be received from the SWRCB at the time construction commences, the Contractor needs to include proof of mailing of the NOI, e.g., certified mail receipt, copy of check, express mail receipt, etc.
14. A construction activity schedule which describes all major activities such as mass grading, paving, lot or parcel improvements at the site and the proposed time frame to conduct those activities.
15. The name and telephone number of the qualified person(s) who have been assigned responsibility for pre-storm, post-storm and storm event BMP inspections; and the qualified person(s) assigned responsibility to ensure full compliance with the permit and implementation of all elements of the SWPPP, including the preparation of the annual compliance evaluation and the elimination of all unauthorized discharges.

SWPPPs are reports that are available to the public under Section 308(b) of the CWA and need to be made available to the City or the RWQCB upon request.

#### **IV. BEST MANAGEMENT PRACTICES**

##### **A. General**

Storm water pollution prevention best management practices (BMPs) are intended to be implemented on a year-round basis at an appropriate level. The BMPs must be proactively implemented whenever construction is occurring. Specific key non-structural BMPs will be discussed in Section 5.1 and specific structural BMPs to manage disturbed soil areas will be provided in Section 5.2. The main goal is to prevent erosion before it happens. Soil stabilization (hydraulic mulch, hydroseeding, erosion control blankets, etc.) is typically 90-98% effective. Soil stabilization measures should be supplemented with sediment control measures (silt fence, gravel bags, drain inlet protection, etc.) in case erosion does occur. All BMPs require routine maintenance. Once again, the City encourages contractors to use the Best Available Technology (BAT) when considering BMPs. This manual is not intended to be inclusive of every BMP possible but as general

recommendations for installation of possible BMPs.

## **B. Non-Structural BMPs**

Non-structural BMPs are generally associated with preventing erosion on construction sites. Broadly implemented non-structural BMPs are as follows:

- Scheduling
- Preservation of Existing Vegetation
- Hydro-mulching
- Geotextiles, Mats, Plastic Covers, and Erosion Control Blankets
- Landscape Management

These BMPs are described in the sections below.

### 1. Scheduling

- a. This best management practice (BMP) involves developing, for every project, a schedule that includes sequencing of construction activities with the implementation of construction site BMPs such as temporary soil stabilization (erosion control) and temporary sediment controls measures. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.
- b. Construction sequencing should be scheduled to minimize land disturbance for all projects during the rainy and non-rainy season. Appropriate BMPs should be implemented during both rainy and non-rainy seasons.

### 2. Preservation of Existing Vegetation

- a. Preservation of existing vegetation is the identification and protection of desirable vegetation that provides erosion and sediment control benefits. The goal is to preserve existing vegetation at areas on a site where no construction activity is planned or will occur at a later date. Temporary fencing should be provided prior to the commencement of clearing and grubbing operations or other soil-disturbing activities in areas. Clearing and grubbing should also be staged to preserve existing vegetation.

### 3. Hydromulching

- a. Hydraulic mulch consists of applying a mixture of shredded wood fiber or a hydraulic matrix and a stabilizing emulsion or tackifier with hydroseeding equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind.

4. Hydroseeding
  - a. Hydroseeding typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, which temporarily protects exposed soils from erosion by water and wind.
5. Geotextiles, Mats, Plastic Covers, and Erosion Control Blankets
  - a. This Best Management Practice (BMP) involves the placement of geotextiles, mats, plastic covers, or erosion control blankets to stabilize disturbed soil areas and protect soils from erosion by wind or water. This is one of several temporary soil stabilization alternatives to consider.
6. Landscape Management
  - a. All new development and redevelopment projects should consider landscape management practices that will reduce erosion, decrease sediment runoff and prevent pollution. The proper use of soil, materials and chemicals used in landscaping can decrease the discharge of pollutants and sediment into the storm drains and waterways.

### **C. Structural BMPs**

Appropriate application and integration of both non-structural and structural BMPs is typically required for effective storm water pollution prevention. The temporary sediment controls and soil stabilization specified in this section should be designed based on rainfall patterns (time frames, intensities, and amounts), general soil types, the seasons, slope inclinations, and slope lengths. Appropriate water pollution control includes the implementation of an effective combination of both soil stabilization and sediment controls.

1. Silt Fence
  - a. A silt fence is a temporary linear sediment barrier of permeable fabric designed to intercept and slow the flow of sediment-laden sheet flow runoff. Silt fences allow sediment to settle from runoff before water leaves the construction site.
2. Sediment/Desilting Basin
  - a. A sediment/desilting basin is a temporary basin formed by excavating and/or constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged.

### 3. Fiber Rolls

- a. A fiber roll consists of wood excelsior, rice or wheat straw, or coconut fibers that is rolled or bound into a tight tubular roll and placed on the toe and face of slopes to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide removal of sediment from the runoff. Fiber rolls may also be used for inlet protection and as check dams under certain situations.
- b. Natural coconut fiber logs may also be used for shoreline and stream channel applications (see coir rolls/mats diagram below). They protect the soil from run-off by collecting sediments. Those sediments in turn nourish the seedling/ or cuttings that may have been planted during installation. Plants develop their root structure in the shoreline sediment. As the log slowly biodegrades the roots retain the soil in place the root's erosion control methods to work.

### 4. Gravel Bags

- a. A gravel bag berm consists of a single row of gravel bags that are installed end to end to form a barrier across a slope to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide sediment removal. Gravel bags can be used where flows are moderately concentrated, such as ditches, swales, and storm drain inlets to filter and/or detain flows.

### 5. Strawbale Barriers

- a. A straw bale barrier is a temporary linear sediment barrier consisting of straw bales, designed to intercept and slow sediment-laden sheet flow runoff. Straw bale barriers allow sediment to settle from runoff before water leaves the construction site.

### 6. Storm Drain Inlet Protection

- a. Devices used at storm drain inlets that are subject to runoff from construction activities to detain and/or filter sediment-laden runoff prior to discharge into storm drainage systems or watercourses.

### 7. Slope Grading

- a. All new development and redevelopment projects that involve slope grading should utilize roughening or terracing techniques. This is done by creating furrows across slopes, creating stair steps, or tracking the soil surface. These techniques reduce erosion potential by decreasing runoff velocities, trapping sediment and allows in an increase in water infiltration into the soil.

8. Construction Site Entrance/Exit
  - a. A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.
  
9. Dust/Wind Erosion Control
  - a. Wind erosion control consists of applying water and/or other dust palliatives as necessary to prevent or alleviate erosion by the forces of wind. Covering of stockpiles or small areas is an alternative to applying water or other dust palliatives.

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