Section 1 - **Drainage**

1.1 General

This Section is formulated to clearly define acceptable drainage analysis and design criteria for development in the City. Drainage materials and or facilities not covered in this Section shall conform to the Caltrans Highway Design Manual, Reclamation District's 833 and 2056 requirements (depending on which Reclamation District (RD) the project drains to), and good engineering practice.

Storm water quality design calculations and an operations and maintenance plan shall be included in the drainage report.

Drainage improvements include: culverts, drop inlets, lined and unlined channels, manholes, stormwater quality control measures, outlet and inlet structures, detention and retention facilities, pump stations, and storm drain pipe. These improvements shall be installed in accordance with the approved improvement plans and these Standards.These Standards shall apply to the public right of way and easements and private on-site drainage improvements. Several items within this section shall apply to on-site improvements and in conformance to stormwater quality requirements.

Storm Water Pollution Prevention Plans (SWPPP's), as defined by the State, shall not be required for projects with a disturbed area smaller than 1 acre in size, provided the project is not part of a larger project. An erosion and sediment control plan shall be required as part of the project improvement plan submittal that identifies temporary Best Management Practices (BMP's) to be used during construction.

1.2 City Policies and Requirements

All residential lots shall have minimum pad elevations of one foot above the 100-year, 24-hour duration water surface elevation and all commercial sites shall have minimum finished elevations of one foot above the 100-year, 24-hour duration water surface elevation. The consulting engineer shall submit an analysis determining the 100-year, 24-hour duration water surface elevation assuming failure of the underground drainage system serving that area to be developed. This requires the Consulting Engineer to show that the project will provide an overland release for all projects for the 100-year, 24-hour duration storm frequency (1% exceedance probability).

The overland release path shall be constructed in a manner to transport the peak rate runoff from the 100-year, 24-hour duration storm through the site or street assuming all underground storm drains are inoperative, all upstream areas are fully developed, and that the antecedent runoff condition (ARC) of the tributary watershed is ARC II. Streets, parking lots, playgrounds, pedestrian areas, pedestrian walkways, utility easements, and other open space areas may be considered compatible uses within the overland release path.

Except for single family or duplex residential lots, site drainage shall be collected on-site and conveyed via an underground storm drain system to an approved, existing storm drainage system without flowing into existing street gutters or existing roadside ditches.

Peak flows for a 10-year and 100-year, 24-hour duration rainfall events shall not be increased downstream of the project at that location the undeveloped (existing) project site discharges. The Consulting Engineer shall show that the project will not increase 10 and 100-year, 24-hour

storm duration peak flows. Unless regional storm water mitigation devices are available, project specific mitigation shall be required, shall be located on-site, and shall be maintained by the landowner unless otherwise mutually agreed to be dedicated to the City for maintenance by the City and Developer. Any features that are to be dedicated to the City may only be done so through the creation of a maintenance assessment district. Mitigation devices include, but are not limited to, surface and subsurface detention basins, and retention basins. A hydromodification report will be required to demonstrate to the City no increase in runoff is incurred from development with the proposed mitigation devises.

The City of Gridley is a participant in the National Flood Insurance Program (NFIP) and all development in the City shall comply with the regulations of the Federal Emergency Management Agency (FEMA).

1.3 Drainage Diversions

The diversion of natural drainage is allowable only within the limits of the proposed improvement. All drainage must enter and leave the improved area at its original horizontal and vertical alignment unless an agreement, approved by the City Attorney, has been executed with the affected property owners. Temporary drainage diversions during construction shall be approved by the City Engineer and shall be located and constructed in such a fashion as to permit their removal when necessary for the prevention of damage to adjoining properties.

1.4 Drainage Easements

Publicly owned drainage conduits and channels will not be allowed on private property unless they lie within a dedicated public drainage easement. Where minor improvement of an existing channel falls on adjacent property (such as day lighting a ditch profile) a notarized right-of-entry from the property owner(s) for such construction shall be required. A copy of the document which grants such approval, shall be submitted to the City Engineer prior to the approval of the improvement plans.

Easements for closed conduits shall meet the following width criteria:

1. All easements for closed conduits shall have a minimum width in feet equal to the required trench width according to the standard detail for unshored trenches and excavation backfill plus two (2') additional feet of width for every foot of depth as measured from the bottom of the pipe to finish grade. All conduits shall be centered within their easements.
2. Minimum width of any easement for closed conduit shall be 15 feet.

Easements adjacent to property lines shall be located entirely on one parcel.

Drainage easements for open channels shall have significant width to accommodate the following criteria:

3. Contain the channel and channel slopes.
4. Provide for fencing, where required.
5. A 15-foot wide service road and maintenance access ramps.

A service road may not be required where the channel bottom is lined and a suitable access ramp is provided. Dedication of easements shall be completed and submitted to the City Engineer with copies of deeds or title reports for the affected properties before improvement plans will be approved.

Open channels (natural or man-made) with a drainage area that exceeds 300 acres shall have the 100-year, 24-hour water surface elevation limits dedicated to the City in-fee or as a Flood Water Conservation Easement.

1.5 Drainage Capacity/Design

All drainage systems shall be designed to accommodate the ultimate development of the entire upstream watershed. The 10-year 24-hour duration peak storm discharge shall be used in the design of local drainage systems. In addition, other facilities such as streets, bridges, open channels, and buildings have requirements that relate to the 100-year peak storm discharge. The Consulting Engineer shall calculate the 10 & 100-year peak discharge for a 24-hour duration storm and submit these calculations along with the plans for all proposed drainage systems.

1.6 Design Peak Discharge Methods

The acceptable method for the determination of runoff peak flows and volumes for the 10, & 100-year, 24-hour duration storms is the United States Department of Agriculture Natural Resource Conservation Service's Technical Release 55 (TR-55), Urban Hydrology for Small Watersheds. The following shall apply in developing the hydrologic calculations:

The Tabular Hydrograph Method shall be used in the analysis. The graphical peak discharge method is not allowed.

The regional rainfall time distribution used shall be Type 1A.

The Antecedent Runoff Condition (ARC) used in the hydrologic analysis shall be the average ARC.

Tables 2-2b and 2-2c, Runoff curve numbers for cultivated agriculture lands and Runoff curve numbers for other agriculture lands shall be used in determining Runoff Curve Numbers (RCN) for existing (undeveloped) conditions.

Table 2-2a, Runoff curve numbers for urban areas, shall be used in determining RCN's for developed conditions.

The Consulting Engineer may use other methods for determining peak flows and volumes and developing hydrographs with the approval of the City Engineer.

1.7 Hydraulic Standards for Drainage Systems

All storm drain pipelines and open channels shall be designed to convey the maximum design peak runoff calculated per these Standards and shall conform to the following requirements:

A. Hydraulic Grade Line

The hydraulic grade line for the 10-year discharge shall be a minimum of one foot below all inlet grates, manhole covers, and all other drainage structures in the system. The hydraulic grade line shall be shown on the plans when it is above the top of the pipe.

B. Manning's Formula

Manning's formula shall be used to compute capacities of all open and closed conduits other than culverts. A minimum "n" value of 0.015 shall be used for sizing conduits.

Minimum velocity in closed conduits shall be 2 feet per second. Maximum velocity shall be 12 feet per second.

1.8 Street Inundation Requirements

City streets are allowed to convey runoff for storm events larger than the 10-year 24 hr event. The standards for street inundation are specified in the following Table. The Consulting Engineer shall provide calculations and an exhibit showing that these standards are met. Street inundation calculations will assume the pipe system is fully functional.

STREET	10-YEAR STORM	100-YEAR STORM
Minor Residential At continuous grade, uphill, anddownhill At Sag Points	Traveled lanes remain clear and do not carry storm water. Storm water elevation does not exceed top backof curb or back of sidewalk. Maximum depth in traveled way is 6". Centerline shall be dry	Maximum depth at gutter flow line shall not exceed 4" above the top –back-of-curb or a max.of 10". Max. depth at centerline is 4" Storm water is a maximum of one foot below building pads. Ponding does not exceedmore than 120' from inlet along any street

Collector/Industrial At continuous grade, uphill anddownhill	Traveled way remains clear and does not carrystorm water.	Storm water flow is contained within theright-of-way. The center12 feet of roadway shall remain clear of stormwater.
		Storm water flow is contained within theright-of-way. The center12' of roadway shall remain clear of stormwater. **Note:** If the roadway is separated by a median, then each half of theroadway shall maintain a 12' clear path of travel.
At Sag Points	Storm water elevation does not exceed top backof curb or sidewalk. Maximum depth in traveled way – 6". Centerline shall be dry.	
Arterials At continuous grade, uphill anddownhill, or at sag points		All travel lanes are clearof storm water flow. Bike lanes are allowed tobe inundated. Storm flow contained within the right-of-way.

1.9 Closed Conduits

The specific type of pipe or alternate pipe to be used in any development shall be shown on the approved plans. If the Consulting Engineer proposes to use any type of pipe not shown on the approved plans, the plans shall be resubmitted to the City Engineer for approval.

A. Size and Material

Drainage systems to be maintained by the City shall have a minimum pipe diameter of 12 inches. Private, onsite drainage systems that are reviewed by the City shall have a minimum pipe diameter of 8 inches. The types of pipe materials that are allowed are stated later in these standards.

B. Cover Requirements

A minimum cover of 36 inches and a maximum cover of 60 inches shall be maintained as measured from the outside bell of the pipe to the pavement or final grade.

In fill areas, or in areas with poor soil conditions where it is anticipated that a good, firm, vertical-walled trench cannot be constructed, the Consulting Engineer shall design the pipe structural requirements in accordance with good engineering practice and manufacturers recommendations. If trench conditions are uncertain, a note shall be placed on the plans making it the Contractor's responsibility to work with the Consulting Engineer to determine and place the proper strength pipe if poor trench conditions are encountered.

C. Alignment

Pipelines for storm drainage shall have a constant slope between manholes, junction boxes, and/or catch basins. Minimum radius of horizontal curvature shall be 200 feet. In no case shall the radius of curvature be less than the manufacturer's recommendations for the particular pipe size under consideration.

Drainage pipelines shall be located in the street whenever possible. The location of storm drainage pipelines in the streets shall be 5 feet north or west of and parallel with the street centerline. A minimum angle of 90 degrees shall be accommodated for downstream flow around bends, tees, and connection points.

When storm drainage pipes are to be placed in existing streets, factors such as curbs, gutters, sidewalks, traffic conditions, pavement conditions, future street improvement plans, and existing utilities shall be considered.

Open ditches, lined channels, swales, and floodplain areas shall be maintained as nearly as possible in their existing alignment. When an open ditch is to be constructed parallel to an existing roadway, the ditch shall be constructed outside the proposed right-of-way of the ultimate street development.

1.10 Manholes

Standard precast concrete manholes shall be constructed as required. Where special manholes or junction boxes are required, the City Engineer must accept the design. In no case will junction boxes or manholes be allowed which are smaller than 48 inches inside diameter. Manholes shall be located at junction points, angle points, changes in gradient, changes in conduit size, end of curves and beginning of curves. Manholes or junction boxes will not be required for reach of pipe less than 80 feet in length that is to be connected to a 36 inch or larger diameter pipe, subject to approval of the City Engineer. For straight alignment, the spacing of manholes shall not exceed 500 feet. The spacing of manholes shall be nearly equal whenever possible. On curved pipe, spacing of manholes shall be as specified in Table 1-1:

Table 1-1 Manhole Spacing

RADIUS	PIPE DIAMETER	SPACING
400' OR LESS	ALL	300'
GREATER THAN 400'	24" OR LESS	400'
GREATER THAN 400'	GREATER THAN 24"	500'

A. Covers

All manholes and junction boxes, other than inlets, shall have standard manhole covers per the Standard Drawings. No pipe will be allowed to enter a manhole into the transition portion of the manhole cone. Manholes will not be allowed in gutter flow line except where approved by the City Engineer. Slotted manhole covers may be used to pick up minor drainage in non-traffic areas.

1.11 Inlets

Drop inlets in streets shall be located on property lines in residential subdivisions except at intersections, where they shall be placed at curb returns. Inlets shall be such that the length of the flow in the gutter does not exceed 500 feet. The depth of flow in the gutter at the inlet shall not exceed 4.0 inches in a 10-year storm and shall not encroach into the traveled ways as specified in Table 10- 6 for other design storms. The design runoff flow rate shall include any flow that bypasses upstream inlets.

All inlets located with the right-of-way or easements shall conform to the City Standards. Inlets may be modified for use without curb sections for on-site drainage. Where an inlet is proposed in public streets and sidewalk is not constructed adjacent to the back of curb, a concrete collar shall be placed behind the inlet.

Drop inlets draining public streets may be connected directly to a trunk line 36 inches in diameter or larger by means of a lateral not exceeding 15 inches in diameter and 80 feet in length. Connections to the pipe shall be cored and a boot is required for a water tight seal.

1.12 Inlet and Outlet Structure

The requirements for these facilities are as follows:

A. Headwalls, Wingwalls, and Endwalls

All headwalls, wingwalls, endwalls, preformed end sections, guard rails and bank protection shall be considered individually and shall be, in general, designed in accordance with the Standard Specifications and Standard Plans of the California Department of Transportation and City Standards.

Metal beam guardrails or chain link fencing may be required by the CityEngineer at culverts, headwalls, box culverts, and steep side slopes.

B. Trash Racks and Access Control Racks

Trash racks shall be provided where they are necessary to prevent clogging of culverts, storm drains, and to eliminate hazards. Access Control Racks shall be required on all pipes, 24 inches or larger in diameter. Trask Racks located within vaults shall be automated and self-cleaning.

1.13 Drainage Pumps

Drainage pumps shall be avoided whenever possible and used only with specific approval of the City Engineer. If the use of drainage pumps is permitted, the drainage system shall be designed to provide for gravity outfall during the summer months and other periods of low water stages. If a low stage gravity outfall is impossible or impractical, an alternative pump of a smaller capacity for low stage flow may be used provided the City Engineer grants specific approval.

1.14 Channels and Outfall Design

Drainage shall be conveyed in an open channel if the drainage area exceeds 300 acres. Residential lots adjacent to open channels shall have minimum pad elevations of two feet above the 100-year water surface elevation. Non-residential lots shall have the lowest ground elevation adjacent to the building foundation at least two feet above the 100-year water surface elevation.

A. Open Channel Design Requirements

Channels shall be constructed to a typical cross section. Fully lined channels shall be designed with side slopes of 1:1 or flatter. Channels with unlined sides shall be designed with side slopesof 3:1 or flatter, or as specified by the Geotechnical Engineer based on existing soil conditions. Lined channels shall have a minimum bottom width of 6 feet. Lined channels shall be finished concrete, sacked concrete, or doweled and sacked concrete. The minimum weight of sacked concrete shall be 60 pounds per bag. Unlined channels shall be designed with a minimum "n" value of 0.065.

All open channels shall be designed to carry the 100-year frequency design storm. The hydraulic grade line of the 10 and 100-year storms shall be calculated and plotted on all channel profiles. Freeboard shall be a minimum of one foot for the 100-year event and two feet when the drainage area exceeds 300 acres. The velocity range shall be 2.5 to 6.0 feet per second in unlined open channels and 3.0 to 12.0 feet per second in lined open channels. All computations shall be clearly documented and submitted to the City Engineer for approval.

For all channels, either realigned, or natural, the following shall be shown on the improvement plans in addition to the information heretofore required:

1. The profile of existing channels shall be shown for a minimum of 1000 feet at each end of the development on the construction plan to establish a minimum profile grade.

2. Typical sections and cross sections.

B. Interceptor Ditches

Interceptor ditches or approved alternates shall be placed at the top of the cut or bank where deemed necessary by the City Engineer to prevent erosion of the channel bank. Runoff shall not be allowed to sheet flow over the top of banks.

C. Outfall Profiles

All drainage outfalls shall be shown both in the plan and profile view, on the improvement plans for 1000 feet or until a definite "daylight" condition is established. All drainage ditches upstream of the improvement shall be shown on the plan and profile sheets for a distance of at least 500 feet or until an average profile grade through the improvement is established. The profiles shall include ditch flow line and top of bank elevations.

When improvements have more than one unit, the drainage outfall shall be shown as extending to the property boundary and beyond if required, althoughit may not be constructed with the current unit development. All temporary outfalls shall be shown both in plan and profile view, on the improvement plans.

D. Fencing

Channels exceeding three (3) feet in depth and with side slopes steeper than 3:1 shall be fenced with a six (6) foot high chain link fence per the Caltrans Standards. In all other areas, fencing shall be placed as specified the City Engineer. Fences shall be located 6 inches inside the drainage easement lines and a minimum of 12 inches from the top bank. No fencing shall be allowed within the limits of the 100-year floodplain of an open watercourse without the approval of the City Engineer. Special requirements shall be specified by the City Engineer for fencing within the 100-year floodplain of any open watercourse.

Drive gates shall be provided with a minimum width of 12 feet. A minimum 4- foot wide walk gate shall also be provided.

E. Access Roads

An all-weather access road consisting of six (6) inches of compacted AB shall be provided adjacent to all channels and outfall ditches to the satisfaction of the City Engineer. Access roads shall have a minimum width of 12 feet and shall provide a bulb at end for turning movements.

1.15 Cross Culvert and Bridges

This section specifies criteria for relatively short circular or box culverts and bridges for transverse crossings (typically road or railroad embankments). Cross culverts shall be of the same material as allowed for closed conduits.

Cross culvert profiles will be determined on an examination of the channel for a minimum distance of 1000 feet on each side of the installation.

Driveway culverts shall be approved by the City for size, grade, alignment and type. Driveway culverts will not be allowed unless the City has agreed to deter the construction of the curb and gutter unless it is for the temporary construction access.

New culverts or bridges for roadways that cross the floodplain shall incorporate provisions for the installation of permanent stream measuring equipment. This shall be comprised of a 10’ x 10’ flat pad near the 100-year water surface elevation with vehicle access. A two (2) inch diameter electrical conduit from the pad to the flow line of the channel will be installed.

A. Design Storm

Cross culvert size shall be determined on the basis of runoff as specified in the hydrology portion of this section. Cross culverts shall be sized for the 100-year storm with a minimum of one foot of freeboard below the lowest travel lane. They shall also be sized such that no serious damage will be incurred due to ponding as a result of a 100-year event. A flood easement shall be provided for all areas impacted due to upstream ponding in the 100-year event. The minimum diameter of cross culverts shall be 18 inches.

To account for debris collection, a clogging factor of 150% shall be applied to the design storm in the design of bridges or culverts that cross a channel or stream with a drainage area that exceeds 300 acres.

B. Hydraulics

Inlet or outlet conditions control flow in transverse culverts. In culverts operating under inlet control, the cross-section area of the culvert barrel, the inlet geometry and the amount of headwater at the entrance are of primary importance. Outlet control involves the

additional consideration of the elevation of the tailwater in the outlet channel and the slope, roughness and length of the culvert barrel.

Anticipated downstream flow depth and allowable headwater depth govern the available head on culverts. The type of flow under which a culvert will operate may be determined from a given set of conditions.

In the analysis of transverse culverts, the United States Federal Highway Administration (FHWA) methods for hydraulic design as detailed in the FHWA's Hydraulic Design Series Number 5 shall be used.

1.16 Detention and Retention Basins

Detention and retention basins that are intended to be dedicated to the City shall minimize its maintenance time and cost. This will be key factor in the approval of the basin's O&M Plan by the City Engineer.

1.17 Access for Maintenance

These facilities may include, but are not limited to bridges, culverts, headwalls, lined and unlined channels/ditches, sand/oil separators, manholes, detention basin, retention basins and drain inlets. The access way shall be a minimum 12 feet wide and include six (6) inches of ¾ inch aggregate base(95% relative compaction) over six (6) inches of processed, native soil (95% relative compaction. Upon the City Engineer's request, four (4) inches of asphalt concrete shall be added to the section and/or a cul-de-sac with a minimum diameter of 75 feet

1.18 Submittal Requirement for all Drainage Studies

The Consulting Engineer will submit the signed and sealed drainage study for review and approval by the City Engineer in PDF format. The study shall include the following:

- Title sheet with the project name, developers name and contact information, and the Consulting Engineer's name and contact information.
- Location map
- Site plan
- Preliminary grading and drainage plan
- Existing conditions catchment map
- Developed conditions catchment map
- Methodology section describing both existing and developed conditions assumptions and inputs
- Results section with summary tables of peak flows for both existing and developed conditions
- Hydromodification study (if required) to demonstrate no increase in peak runoff
- Conclusion

The Consulting Engineer shall electronically submit all models and results developed for the project.

1.19 Drop Inlet Installation

Drop inlet installations shall conform to Standard Details, these standards, and the most recent of Caltrans Standard Specifications. The interior of the drop inlet shall have a troweled finish; rock pockets shall be grouted and brushed; exposed top surfaces shall have a Class I Surface Finish. Within all City streets and easements and within all commercial sites and private residential subdivisions, a fish stamp conforming to the Standard Details shall be placed adjacent to all drop inlets. If the storm drain system is active and open to discharges, then immediately following installation, all storm drain inlets shall be protected with sediment control protection until construction no longer poses a risk of sediment discharges. Drop Inlets shall conform to ASTM C913. Otherwise, unused knockouts shall be grouted to wall thickness dimension.

1.20 Manhole Installation

A. Precast

Precast concrete structures shall be of approved design and sufficient strength to withstand the loads to be imposed upon them. Precast concrete walls for catch basins shall be 6 inch thickness except at knockouts where the minimum thickness shall be 2 inches. Precast bases shall be placed on a foundation of 3⁄4 inch minus crushed rock or class 2 aggregate base, a minimum of 6 inches thick, compacted to 95 percent relative compaction. Elevation

differentials of inlets and outlets shall conform to the approved improvement plans. Openings in the base shall align true with all inlet and outlet pipes. Stub out or couplings provided in precast bases shall be of the same material as the pipe to which they connect, unless otherwise approved by the City's Inspector. Precast bases shall be furnished with cutouts or knockouts. Unused knockouts shall be submitted to City Engineer prior to construction. Pipes shall be installed only in factory knockouts unless otherwise approved by the City Engineer. Maximum Knockout or cutout hole-size shall not be greater than the sum of the outer pipe diameter plus the catch basin wall thickness.

B. Cast-in-Place Base

The cast-in-place base portion shall not be placed higher than 6 inches above the outside tops of the main incoming and outgoing pipes.

The wall thicknesses for the top of the cast-in-place base sections shall conform to the following table:

Manhole Diameter (inches)	Minimum Wall Thickness (inch)
48	4
60	6
72	7
84	8
96	9

Inside diameters of cast-in-place base portions shall equal the inside diameter of the manhole specified. Standard precast manhole riser sections and/or cones shall be placed above the cast-in-place section to bring the manhole rim to finish grade. Upon pouring the concrete base, the top surface of the cast in place base barrel shall be stamped with a rigid impression ring in order to match it up with the above, precast barrel section. As an alternate, a maximum 1 foot barrel section may be stacked when it is determined that the concrete for the base is adequately stiff.

A 24-hour minimum curing time is required before manhole stacking is allowed.

All inlets and outlets with a 30 inch inside diameter or smaller, connecting to existing manholes, shall be core bored.

Concrete in the cast-in-place portion shall be placed against undisturbed earth. All loose material shall be removed from the excavation prior to installation.

C. Cones

Cone tops shall be placed within 18 inches of final street grade. Where depth is insufficient for cones, flat slab tops shall be used. Flat Top slabs shall only be used when shallow pipe does not permit use of a tapered dome, and requires approval by the City Engineer. Lifting rings in precast cones shall be plugged with dry packed mortar.

D. Joints

Joints in precast manhole sections shall be made with either mortar or plastic sealing compound.

Mortar Application - All joint surfaces and the face of the manhole baseshall be thoroughly cleaned and wetted. before applying mortar. Both the inside and outside of mortared joints shall be plastered with mortar, and the inside surfaces brushed to a smooth finish with a wet brush. Special precautions shall be taken to ensure that the entire joint space is filled withmortar and is water tight.

Plastic Sealing Compound Application - All joint surfaces and the face of the manhole base shall be thoroughly cleaned before applying plastic sealing compound. The sealing compound shall be protected from dirt during application. Ends of the compound shall be joined end-to-end and not joined by overlapping. Sufficient compound shall be used to cause a visual "squeeze-out" of the compound material when adjacent sections are seated.

Squeeze-out material on the inside of the manhole shall be neatly trimmed flush with the inside surface.

E. Connections

Pipe connections to drainage manholes shall be made so that the pipe is flush with the inside face of the manhole. These connections shall be finished so that entrances are smooth. Unless the manhole is cast around the pipe, connections shall be made with dry packed cement mortar inside and a 12 inch by 12 inch minor concrete collar outside. Pipe connections shall not be made into the cone section of the manhole unless shown on the approved plans.

F. Grade Rings

Grade adjustments shall be made using precast grade rings. Precast rings shall be a minimum of 3 inches in height. The total height of thegrade rings, frame, and cover casting shall not exceed 18 inches.

G. Frame and Covers

The tops of frames and covers shall be set no more than 1/8th inch below finish grade pavement in the street and 6 inches above finish grade in landscape areas and 12-18 inches in unimproved, isolated areas unless otherwise shown on the approved plans. Per the Standard Details, a 12 inch deep by 12 inch wide concrete collar shall be placed around the casting, either covered by 3 inches of asphalt concrete paving in a street area, or be placed flush with the finished surface using minor concrete with a medium broom finish with pattern perpendicular to travel direction. The concrete collar shall be in conformance to minor concrete of Caltrans Standard specifications. All joints between the frame, grade rings, dome, barrels and base shall be sealed with non-shrink mortar, or an approved plastic sealing material. Inside the manhole, all joints where the sealing material is not flush with the inside wall shall be grouted with non-shrink mortar and finished/wet- brushed.

H. Adjusting Existing Manhole Frames

The frame shall be supported above the grade ring or dome by spacers, or by suspending with timber and wires. After the concrete collar is poured, any space between the frame and grade ring and dome shall be filled with non-shrink mortar, and the inside wall of the riser finished/wet-brushed.

1.21 Pipe Bedding

Pipes shall be placed on a firm bed of imported granular material with less than 10% passing No. 8 sieve,; 100% passing ½" sieve for all pipe or 85 to 90% Passing ½" sieve and 100%

passing ¾" sieve. Prior to placing pipe bedding, the trench bottom shall be free of any loose material.

1.22 Pipe Installation

All drainage improvements shall conform the followingrequirements:

A. Laying Pipe

The pipe shall be laid up-stream with the bell end of the pipe placed up-stream. The interior of the pipe shall be kept clean as the work progresses. There shall not be a change in pipe material or manufacturer between storm drain structures.

Handling, Laying and Backfill of Polyvinyl Chloride (PVC), HighDensity Polyethylene Pipe (HDPE), Steel Reinforced High Density Polyethylene Pipe (SRHDPE), and Polypropylene Pipe –The pipe shall be handled in accordance with the manufacturer's published recommendations. Laying and backfill shall conform to Caltrans Standard Specifications, the manufacturer's recommendations, ASTM D-2321 and Standard Details, with the following modifications:

Due to the lightweight characteristic of the pipe, extreme care shall betaken to avoid displacing the pipe during the backfilling operation.

Following placement of the pipe on the required bedding and to the required grade, the pipe shall be stabilized in place with ballast. At a minimum, this shall be accomplished by loading the pipe down slowly and carefully with small piles of embedment material to a minimum of 1foot above the pipe on each joint and midway on each length. The pipe shall be kept centered in the trench during this operation. Every precaution shall be taken to avoid flooding the trench prior to placing backfill. The City's Construction Inspector may require dewatering the trench to confirm pipe grade, and to retest the integrity of the pipe following trench flooding.

The trench shall be backfilled with embedment material 12 inches above the pipe, prior to continuing with the trench backfill.

Pipe material or manufacturer shall not change between manhole structures or between the last structure and the discharge/inlet opening.

The pipe run between the last structure and the discharge/inlet openingshall be reinforced concrete. Pipe stub runs from storm drain mains into commercial sites shall also be reinforced concrete.

No pipe, conduit or any other appurtenance shall be located within any existing or newly constructed storm drainpipe or culvert. Each run of storm drainpipe and culvert shall also be 100% clear and unobstructed the total length.

B. Non-Rigid (PVC/HDPE/SRHDPE/Polypropylene) Pipe Testing

A mandrel test shall be conducted following completion of subgrade processing and compaction for curb gutter and sidewalk and asphalt concrete pavement. Placement of curb, gutter and sidewalk and asphalt concrete pavement (and related aggregate base) shall not occur until the City Inspector has confirmed the passing of the mandrel test. The City's Inspector shall be present through the duration of the mandrel testing.

The allowable deflection (reduction in vertical inside diameter) for all non-rigid pipes shall be 7.5% maximum. The deflection shall be tested by pulling a mandrel which is 92.5% of the inside pipe diameter through all installed pipe. The mandrel shall be the "go/no-go:" type and shall be pulled per the manufacturer's recommendations without mechanical assistance. Prior to the mandrel test, the pipe shall be thoroughly flushed and cleaned, (See Subsection "J" below). Obstacles in the pipe shall be removed. At each location in which the mandrel cannot pass, the cause shall be ascertained. If it is found the deflection exceeds 7.5 % or that a gasket has been improperly installed, or that the pipe has been damaged due to construction activities, then the respective section of pipe shall be repaired and retested. Pipe section repair operations may require rebedding pipe, replacing pipe, or both as needed to properly repair pipe section. Watertight repair couplings shall be used in repair. A passing mandrel retest is required.

At the contractor's discretion, any sections of non-rigid pipe not passing the mandrel test may be televised to evaluate the problem.

C. Pipe Laying Tolerances

The pipes shall be laid true to line and grade withallowed tolerances of 0.03 foot above or below the design grade and 0.10 foot left or right of the design alignment.

D. Cast-in-Place Concrete Pipe

Cast-in-place concrete pipe shall conform to provisions in the most recent edition of the Caltrans Standard Specifications. Where excavations for other utilities undermine installed cast in-place pipe, that excavation shall be backfilled to the spring line of the cast- in-place pipe with 2 sack slurry per these Standards.

E. Pavement Cutting and Repaving

When the trench line is in an existing pavement area, the pavement shall be sawed or scored and broken ahead of trenching operations.

The proper tools and equipment shall be used in marking and removal of the pavement such that it is cut accurately to a neat and parallel line on either sideof the trench width required, in conformance with the Trench Cut Ordinance. All cuts in Portland cement concrete pavements shall be sawcut with equipment approved by the City's Inspector.

F. Cleaning of Storm Drain System –

The storm drain system shall be cleaned to the satisfaction of the City's Inspector upon completion. If flushing is utilized, then the discharge shall not be routed into the existing City system. The downstream manhole shall be plugged and the discharge fluid shall be disposed of in a manner satisfactory to the City's Inspector.

1.23 Channel Lining Installations

Channel lining installations shall conform to the following.

A. Surface Preparation

The surfaces of the areas to be lined shall be evenly graded to the lines and grade and sections as indicated on the approved plans.The surfaces shall be moistened thoroughly to prevent moisture from being drawn from the freshly placed lining.

All surfaces on which lining is to be placed shall be free from water, mud and debris and shall be firm enough to prevent contamination of the fresh lining byearth or other foreign material. Prior to placing any lining, the Contractor shallverify line and grade of the excavated channel.

B. Reinforcement

Welded wire fabric shall be embedded in the concrete so that it will be a minimum of 1 inch clear from either face of the concrete, unless otherwise noted.

C. Joints

Construction Joints – Shall be square and edged with a ¼ inch radius- edging tool. The edge shall be thoroughly wetted before the next section of lining is placed. Construction joints shall be constructed whenever the operation is halted for a period exceeding 30 minutes. Welded wire fabric reinforcing shall extend through the construction joint.

Deep Tool Joints - Transverse deep tool joints shall be constructed at 10 foot intervals. The aggregate shall be separated with the joint tool a minimum of 2 inches deep. Immediately following application of the deep tool joint, a ¼ inch grooving tool shall be applied to the surface to seal the joint.

D. Weep Holes

On channels with side lining extending more than 18 inches vertically above the channel toe, weep holes shall be constructed at intervals of10 feet, midway between contraction joints on each side of the channel. The weep hole elevation shall be 12 inches above the adjacent toe of slope.

The holes shall be backed by a minimum of 1 cubic foot of aggregate material tied in a burlap bag.

The aggregate shall extend at least 6 inches above and below and to each side of the weep hole, and at least 10 inches into the side slope. The side and back ofthe burlap sack shall be protected from being coated by mortar or concrete during the lining placing operation. On the day following the lining placement, each weep hole shall be rodded to assure it has not been blocked. The weep hole shall then be cut to fit the channelslope.

E. Cutoff Walls

Cutoff walls shall be constructed around the perimeter at eachend of the channel lining and at all locations where the new lining meets structures or existing lining, and at all other locations shown on the approved plans. The cutoff walls shall be a minimum of 6 inches thick and 18 inches in depth, as measured from the surface of the lining. The welded wire fabric shallbe bent down into the cutoff walls.

F. Geotextile Linings

Linings shall follow the manufacture's recommendations for preparation of soil, seed bedding, blanket orientation, anchoring details, and appropriate seed blend and application rates.

1.24 Abandoning Storm Drains

In newer construction, storm drain stubs and services to be abandoned shall be either removed to the main or manhole of origin or filled solid with concrete slurry, at the discretion of the

City Engineer. The abandonment of existing storm drain stubs shall be removed or left in place as directed by the City and or as shown on the approved plans.

Temporary storm drain plugs may be used when short term blockage is necessary at either the stub or lateral run to prevent storm water from entering/existing the stub or lateral run. Material for plugs may be a combination of 6 mil plastic and rigid plywood. For longer term plugs, and at the discretion of the City Inspector, 6 mil plastic and 1 foot thick of 2 sack concrete is required. In both cases, the plug shall be marked with a 4x4 temporary post.

1.25 Material

A. Drop Inlets

All drop inlets shall conform to the Standard Details or the most recent edition of the Caltrans specifications. Concrete shall conform to these standards.

B. Manholes

All precast manhole barrels, risers, cones, flat tops and grade rings shall conform to ASTM Designation C478.

Bases - Bases shall be either precast or cast-in-place. Precast bases shall conform to ASTM Designation. Cast-in-place bases shall be of minor concrete with cementitious content of not less than 505 pounds per cubic yard, with a maximum size aggregate not greater than 1 inch or smaller than 3/8 inch, per the Caltrans Standard. Slump shall not exceed 4 inches as determined by the slump cone method of ASTM Designation C143 or an equivalent slump as determined by CTM533.

Barrels - Manhole barrels shall conform to dimensions of Jensen Precast Products or approved equal, and shall conform to ASTM Designation C478.

Cones - All cones shall be concentric (unless otherwise shown on the approved improvement plans), Jensen Precast Products and conform to ASTM Designation C478.

C. Joints/Mortar

Joints shall be made with either non-shrinking mortar orwith a plastic sealing compound conforming to Federal Specification. Mortar shall consist of 1 cubic foot of Portland cement to 2 cubic feet of concrete sand.

D. Manhole Frames and Covers

All manhole frames and covers shall be of cast iron or ductile iron and conform to ASTM Designation A48, C478 or ASTM A536 for Ductile Iron or Class 30. Refer to the Standard Details for a list of recommended manufacturers and models.

E. Storm Drain Pipe

High Density Polyethylene Pipe (HDPE) - HDPE shall be type “S”, conforming to the most recent edition of Caltrans Standard Specifications. Joint connections shall be watertight, rubber ring gasketed. HDPE shall be Hancor (Sure-Lok F477), ADS, Inc. (N-12 Pro Link Ultra) or approved equal.

Polyvinyl Chloride Pipe (PVC) - PVC shall conform to the following standards based on pipe diameter:

Pipe Diameter (in)	ASTM Designation
12 -15	D3034, SDR 35
18-27	F794, F2241, SDR 51
30-48	F794

All PVC pipe joints shall be integral wall bell and spigot configuration,factory formed. All rubber rings shall conform to ASTM Designation F477.

Steel Reinforced High Density Polyethylene Pipe (SRHDPE) – SRHDPE shall be manufactured in accordance with ASTM F2562 "Standard Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage". SRHDPE shall be manufactured from high density polyethylene stress rated resins conforming to the minimum requirements of cell classification 345464 C per ASTM D3350 "Standard Specification for Polyethylene Plastic Pipes and Fittings Material". Joints shall be watertight to an internal water pressure of 15 psi when tested in accordance with ASTM D3212 "Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals". SRHDPE shall be CONTECH (DuroMaxx) or approved equal.

Polypropylene Pipe - Pipe 12 inch – 60 inch Diameter shall conform to ASTM F2736 (12-30 inch diameters) and ASTM F2881 (36-60 inch diameters). Joints must be watertight in accordance to ASTM D3212 with gaskets meeting the requirements ASTM F477. Minimum cover shall be 36 inches cover from top of pipe bell to bottom of roadway structural section. Maximum cover exceeding 20 feet and unpaved surfaces will be approved on a case-by-case basis at the discretion of the City Engineer. Polypropylene Pipe shall be ADS N-12 HP Pipe, or Prinsco GOLDPRO Storm Dual Wall HP Pipe, or approved equal.

Reinforced Concrete Pipe - Shall conform to ASTM designation C76 for Class I ,II, III, IV, or V. The class of pipe shall be based on the designation conforming to the approved plans. Joints for RCP shall be bell and spigot with rubber gasket. The gasket shall conform to the Caltrans Standards.

F. Stormwater Treatment Devices

The use of on-site storm water treatment devices are strictly limited to smaller development projects with limited space where bio-retention facilities are not functional, at the discretionof the City Engineer.

Inlet and Outlet Structures - All inlet and outlet structures shall conform to the Construction Standard Details for drainage.

Slurry Cement Backfill - Slurry cement backfill shall conform to the requirements of the most recent Caltrans Standard Specifications containing 188 pounds of cement.

G. Lined Channels

All lined channels shall conform to these standards and the following materials:

Air Blown Mortar - Air blown mortar shall conform to provisions in "Shotcrete" Section of the most recent edition of Caltrans Standard Specifications.

Concrete - Concrete shall be either "Minor Concrete" with Type II cement,sacked concrete, or doweled and sacked concrete per Caltrans specifications.

Curing Compound - Curing Compound shall conform to provisions in the most recent edition of Caltrans Standard Specifications and these Design and Construction Standards.

Grouted Cobbles - Ground cobbles shall be set in 6 inches of "Minor Concrete" with pea gravel concrete. The top surface of the concrete shall be flush with adjacent finish grade. Cobbles shall be 4 to 10 inches in size, with1/3 exposed above the concrete surface, per Caltrans Specifications. Base for concrete shall be undisturbed native soil. If the soil is disturbed or undercut, it shall be processed to 90% relative compaction.

Weep Holes - All weep holes shall be 2 inches in diameter and made of: galvanized steel pipe, schedule 40 or greater; PVC pipe, schedule 40 or greater; or ABS pipe, schedule 40 or greater.

Welded Wire Fabric Reinforcement - Welded wire fabric reinforcement to conform to ASTM Designation A185.

H. Metal Storm Drain Marker

"No Dumping" public notices are required at all storm drain inlets within the City limits, public and private storm drain improvements. Where conditions do not warrant as defined in the Standard Details, metal storm drain markers may be substituted as approved by the City Inspector. Metal markers shall be Almetek Industries Marker, stainless steel storm drain marker model SDM-SS "No Dumping Drains to Creek" with "fish" symbol and blue background or approved equal. Installation methods shall be per manufactures' recommendations and approved by the City.

Section 2 - **Grading**

2.1 General

This section specifies design, improvement requirements and plan submittal requirements of Grading Plans for private developments. It includes items pertinent for the City's review and reflects established professional engineering practice for preparation of Grading Plans. Questions and clarifications regarding this Section should be directed to the City Engineer.

Grading improvements shall include but are not limited to: excavation and embankment work for channels, pads and roadways, erosion control measures and retaining walls. These improvements shall be installed in accordance with the approved improvement plans, these Standards, the latest edition of the California Building Code, (CBC), the SWRCB Construction General Permit No. CAS000002, (WQ ORDER No. 99-08-DWQ), and the latest edition of the Caltrans Standard Specifications.

For properties which are not located within a specific plan area, the City's authority for regulating grading is provided by Chapter 33 & 18 of the California Building Code (CBC). The CBC requires that a Grading Permit be obtained from the City prior to beginning any grading work unless the work meets certain exemptions specified in the CBC. This is necessary to ensure that on-site drainage adequately accommodated, off-site drainage is conveyed through the project, the proposed grading is compatible with adjacent property topography and adequate erosion and sedimentation control measures are addressed.

Two (2) types of Grading Plans are reviewed by the City: Finished Grading Plans and Rough Grading Plans.

Finished Grading Plans shall be submitted as part of the Improvement Plans for a project. Finished grading requirements are specified in Section 2.4.

Rough Grading Plans are submitted separately from and may be accepted prior to Improvement Plans. The plans should detail only the preliminary grading of a site. The design shall not allow for construction of any improvements (storm drains, streets, curbs, gutters, etc.) and shall indicate positive drainage flow except in those instances provided on the plans for erosion and/or sedimentation control. Rough gradingrequirements shall be as specified in Section 9-5.

2.2 Fees and Bonds

Plan review and permit fees for grading shall be in accordance with Chapter 33 of the California Building Code (latest edition as adopted by the City). 50 percent of the plan review fees will be required at the time of submittal. The amount of the bond shall be equivalent to ten (10) percent of the cost of the grading and all erosion and sediment control measures, but not less than $500.00.

2.3 Plan Preparation

All Grading Plans shall be prepared by or under the direction of a Registered Civil Engineer. All Sheets shall be stamped and signed by a Registered Civil Engineer licensed in the State of California.

2.4 Finished Grading Plan Requirements

Grading Plans for all developments shall be submitted as part of the Improvement Plans and shall detail the following minimum requirements:

- Slope symbols for all slopes 4:1 or steeper.
- Typical lot grading details.
- Proposed spot and/or pad elevations. All lot corner elevations shall be shown on the Grading Plan.
- Flow directional arrows both on-site and off-site and perimeterelevation at the property line.
- Existing spot elevations and contour lines on-site and off-site around the perimeter of the development. Contour lines shall be shown in increments of one (1) foot. The spot elevations or contour lines shall be extended off-site for a minimum distance of 50 feet.
- Existing trees (variety, size and elevation at the base of all trees six (6) inches in diameter or larger).
- A Certificate of Compliance of Grading with signature blocks for both the Registered Civil Engineer and the Geotechnical Engineer licensed in the State of California shall be provided stating the following:

CERTIFICATE OF COMPLIANCE

I hereby certify that the grades shown on these plans and approved by the Development Services Department have been constructed to within 1/10th of one (1) foot of their indicated elevation for all lot pads and improvements shown.

-

Project Engineer PE Number Date

I hereby certify that the pads for the following lots for this project have been tested for compaction in accordance with generally accepted test methods and based upon the results of these tests the compaction of said pads conforms to the recommendations of this projects geotechnical report:

Lots:

I also state that our firm observed the grading operation to a sufficient extent to evaluate conformance with the project's geotechnical report as approved by the City, and further state that based upon our observations, the grading for this subdivision conforms with the recommendations of said soil report.

-

Geotechnical Engineer PE Number Date

- Back of sidewalk elevations at property lines, curb returns, high and low points, and other areas deemed necessary by the City Engineer.
- All existing and proposed surface and subsurface drainage facilities including drain inlets, underground pipes, surface swales, and any other drainage improvement proposed to be constructed with, or as a part of, the proposed work.
- Location of existing and proposed buildings or structures on the site, including proposed pad and/or finished floor elevation. Proposed residential plot plans should not be shown on the Grading Plans.
- Location of existing and proposed buildings or structures on the land of adjacent owners which are within fifteen (15) feet of the propertyand which may be impacted by the proposed grading operations.
- Location of all existing and proposed retaining walls.
- Typical sections across side yard property lines where the difference in finish pad elevations exceeds on (1) foot.
- Names of adjacent subdivisions.
- Off-site intersecting property lines.
- For all projects involving the export of soil material:
- Location of spoiled disposal. If spoil area is within the City, a separate Conditional Use Permit is required for that site.
- Spoil areas shall meet all the requirements of these standards.
- Silt retention and erosion control details as necessary and specified in these Standards.

- Location of temporary protective fencing for environmentally sensitive areas such as: creeks, wetlands, vernal pools, perennial streams, and preserve areas.

2.5 Rough Grading Plan Requirements

Grading Plans for subdivisions and all developments located within the City shall conform to the same requirements as those specified for Finished Grading Plans excepting the following:

A. Improvements

Only existing improvements such as utilities, curbs, gutters, etc. shall be shown. Utilities and streets to be constructed with the Improvement Plans shall not be shown as part of the Rough Grading Plans.

B. Drainage

All rough plans shall provide for positive surface drainage flow except in those instances provided on the plans for erosion and/or sedimentation control.

2.6 Design Requirements

A. Boundary Grading

Special attention shall be given to grading adjacent to the exterior perimeter property line of a development. All adverse effects to off-site properties adjacent to new developments shall be kept to an absolute minimum. Fills and cuts adjacent to the exterior perimeter property line shall be designed in accordance with the following:

When grading along existing residential property, the grade should be, held equal to or lower than the existing property grades, unless otherwise approved by the City Engineer. When grades are to be raised higher than existing adjacent residential lots, a masonry retaining wall shall be used, regardless of the difference in elevation. The wall shall be located as close to the property line as is feasible for construction. If permission can be obtained from the adjacent property owner(s), the wall should be placed on the property line or onto the lower lot and the fence relocated to the top of the wall.

If possible, all exterior slopes, fill or cut, shall be constructed off- site, with the property line being situated a minimum of two (2) feet inside the higher elevation. If a right of entry cannot be obtained, a retaining wall shall be placed as near to the property line as practicable.

A recorded notarized right of entry shall be required for all off-site fills and grading prior to plan approval.

Fill slopes adjacent to designated open spaces shall have a maximum slope of 3:1. Exceptions to this specification may be made where physical constraints restrict the use of 3:1 slopes, at the discretion of the City Engineer. The maximum slope of all other boundary grading shall be 2:1 or as specified by the Geotechnical Engineer.

All slopes steeper than 4:1 adjacent to the public right-of-way and private streets shall be protected with permanent erosion control measures.

All fill material shall achieve 90 percent relative compaction certified by a Registered Geotechnical Engineer.

When a drainage swale or ditch is proposed to run adjacent to the property line, a level area, minimum width of five (5) feet is required between the property line and the top of the slope bank.

A specific haul route shall be approved by the City Engineer when a large quantity of imported or exported soil is required. Where a haul route has not been determined at the time of plan approval, the permit shall be conditioned stating that no grading activities shall occur until a haul route has been approved by the City Engineer.

B. Interior Grading

Differences in elevations across interior property lines within a development, such that slopes or retaining walls are required, shall conform to the following:

Cross lot drainage is not allowed unless specifically approved by the City Engineer for tree preservation. All single-family residential lots shall have grading as per the Standard Details unless approved otherwise by the City Engineer. When a grading plan is proposed as part of a tentative map application for a single-family residential subdivision, the tentative grading plan showing rear lot drains shall be supplemented with an alternative plan showing the effect on the subdivision if rear lot drains are not utilized.

Retaining Walls shall be required whenever adjacent side lot elevations differ by more than ½ foot. In such cases, a minimum three (3) foot wide walk path shall be maintained adjacent to all side property lines. Where the Consulting Engineer feels that this path will be maintained without the use of a retaining wall, application for a waiver may be made by preparing and submitting a site plan scale on 8-1/2" X 11" reproducible paper for each lot which is requested to be exempted, or by submitting a standard Lot Grading and Setback Guarantee. The Lot Grading and Setback Guarantee shall specify which lots for which a waiver of the retaining wall requirement is requested, shall state the minimum setback of the proposed structure from the toe of slope, and shall state that should the minimum setback not be possible during construction, a retaining wall shall be constructed to the requirements of these Standards. Upon approval, a copy of these will be given to the Building Division to utilize in their review. Any deviation from these plans will be subject to approval by the Engineering Division.

Property lines shall be situated a minimum of 1.0 foot inside the top of fill or cut slopes when pad elevations differ by ½ foot or less. When retaining walls are used, the property lines shall be situated on the high side of the retaining wall with a minimum setback of 1.0 foot from the property line to the retaining wall. Where pad elevations differ by more than ½ foot and waiver of placement of retaining walls is required per the requirements stated above, property lines shall be situated a minimum of 2.0 feet inside the top of fill or cut slopes.

The maximum earth slopes allowed shall be 2:1 (horizontal to vertical). Minimum asphalt concrete surface slopes shall be 1% and minimum concrete cement surface slopes shall be 0.25%. All proposed slopes that are 3:1 or steeper shall be shown on the plans by some type of slope symbol delineation.

Lots on the low side of streets at sag points shall have pad elevations a minimum of one (1) foot above the 100 year water surface elevation assuming failure of all subsurface drainage systems.

C. Retaining Walls

Retaining walls, when required, shall be shown on the plans and shall include all necessary information and details for construction. All retaining walls adjacent to the public right-of-way or along the exterior boundary of the project shall be masonry. All walls higher than three (3) feet as measured from base of foundation to top of wall shall be substantiated with structural calculations stamped by a Registered Civil Engineer licensed in the State of California and a Building Permit shall be obtained from the Building Division.

D. Stormwater Pollution Prevention Plan (SWPPP)

A site specific SWPPP shall be submitted concurrently with the Improvementand/or Grading Plans when a project disturbs land. For information concerning the preparation of a SWPPP, the Consulting Engineer should refer to the County of Butte's Strom Water Program, and the California Stormwater Quality Association (CASQA). "Stormwater BMP Handbook / Construction", and the State of California NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities.

The submitted SWPPP shall match identically to that of the SWPPP submitted to the State Water Resources Control Board via their electronic SMART system, up until the time improvement plans are approved, encroachment and/or grading permits are issued, and construction commences.

SWPPPs are not required for projects under one acre, unless they are part of a larger development encompassing over one acre. For projects less than one-acre, an erosion and sediment control plan shall be submitted with the improvement plans to the City for approval. This is generally part of the Grading Plan for the development. The City will accept the erosion and sediment control plan upon review of the project. All erosion and sediment control devices shall be identified and implemented in the same fashion as projects with SWPPPs over one acre. Enforcement will be conducted similarly, with the exception to SWPPP administrative requirements.

SWPPP Site Plan Requirements - SWPPP site plan(s) shall be submitted along with other SWPPP State permit required documents.

The discharger shall ensure that the SWPPP for the project site is developed and amended or revised by a Qualified SWPPP Developer (QSD). The SWPPP shall be designed to address the following:

- All pollutants and their sources, including sources of sediment associated with construction, construction site erosion and all other activities associated with construction activity are controlled.
- All non-storm water discharges are identified, and a description ofhow they will be either eliminated, controlled, or treated.
- Site BMP's are effective and result in the reduction or elimination of pollutants in storm water discharges and authorized non-storm water discharges from construction activity to the BAT/BCT standard.
- Calculations and design details as well as BMP controls for site run-on are complete and correct.
- Stabilization BMP's are installed to reduce or eliminate pollutants after construction is completed.

- Phasing of Erosion Control Measures - The City Engineer may require phasing of the SWPPP plan(s) to ensure that all necessary erosion control measures are taken during separate phases of construction. As an example, this may require the Developer to construct sediment traps and basins during the first phase of grading operation.
- To demonstrate compliance with requirements of the SWPPP, the QSD shall include information in the SWPPP that supports the rational used in selecting BMP's including supporting soil loss calculations, if necessary, conclusions, selections, use, and maintenance of BMP's
- The discharger shall make the SWPPP available at the construction site during working hours while construction is occurring and shall be made available upon request by State or City inspectors. When the original SWPPP is retained by a crew member in a construction vehicle and is not currently at the construction site, current copies of the BMP's and map/drawing will be left with the field crew and the original SWPPP shall be made available via request by radio/telephone.

SWPPP Control Measures Requirements- The following is a list of requirements for erosion and sediment control measures, also referred to as BMPs (Best Management Practices). Thefollowing erosion and sediment control requirements shall be part of site specific SWPPPs.

- All sediment control measures (drain inlet protection, perimeter protection, stabilized construction access, etc.) shall be implemented prior to the commencement of grading operations or other construction activities or as approved by the City Engineer. Grading during the wet season should be minimized.
- An adequate supply of erosion and sediment control materials (fiber rolls, blankets, mats, straw bales, silt fencing, etc.) shall be stored onsite throughout the course of construction and made available for maintenance and repair work.
- Straw, when used, shall be broadcast, or hand distributed, at a rate of 4000 pounds per acre. Straw shall be anchored to soil surface by "punching", "pressing", or by using a tackifier.
- Slopes steeper than 4:1 and adjacent to the City right-of-way, flood plains, natural drainages, park land or designated open space shall be broadcast seeded and covered with a blanket material grade appropriate to the steepness and length of the slope. Alternative methods shall be approved by the City Engineer.
- All areas of disturbed soil, regardless of slope, shall be protected for erosion control. For measures approved by the City for erosion control, see Butte County's Storm Water Program, and the State of California NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities.

E. Mitigation monitoring Requirement

All mitigation measures and mitigation monitoring measures as required to mitigate environmental impacts shall be complied with. The Developer is responsible for monitoring all mitigation measures and shall submit to the Planning Department a letter certifying compliance with such measures.

F. Certifying Pad Elevations

Upon completion of the grading and prior to acceptance of the subdivision improvements or issuance of building permits by the City, the Consulting Engineer shall verify the final pad elevations. The elevations shall be verified at the center and the corners of each pad. Pad grades shall be certified to an accuracy of 0.10 feet.

A signature block, certifying that final graded elevations in the field are the same as those shown on the plans, shall be included on the grading plans. The Consulting Engineer shall sign the signature block, certifying to the above, record (as-built) Grading Plans to the City Engineer

G. Maintenance of Access to Utility Facilities

Continuous, suitable access shall be maintained during all stages of construction to any facility owned or operated by a utility/district providing essential services (i.e. sanitary sewer, water, drainage, electricity, gas, telephone,etc.).

2.7 Installation

All grading improvements shall be installed in accordance with provisions in Chapter 33 of the UBC, recommendations ofsite-specific geotechnical reports and geotechnical engineer, provisions in the Caltrans Standard Specifications, the approved improvement plans and per the following specifications:

A. Channels

All fill areas in channels shall receive suitable fill materialto be compacted to a minimum of 90 percent relative compaction. TheDeveloper's geotechnical engineer will determine suitable fill material.Unsuitable materials shall be removed from the channel and replaced with suitable backfill material based on recommendations provided bya State of California licensed geotechnical engineer.

B. Erosion Control Measures

Construction sites shall have required erosion and sediment control measures in place between October 1 and April 30. All projects shall have adequate sediment control measures in place prior to ground disturbance regardless of time of year. If construction is in progress, the Contractor shall ensure that the construction site is prepared prior to the onset of any storm. For Stormwater quality compliance information, refer to theCalifornia Stormwater Quality Association (CASQA). "Stormwater BMP Handbook / Construction", latest edition. Water ways under the jurisdiction of governmental agencies other than the City may be subject additional erosion control measures or criteria and is the responsibility of the Developer/Owner.

All bare areas, regardless of slope, within 50 feet of natural drainages and active stormwater collection systems shall be covered with straw, erosion control blankets, hydromulch, or other types of soil stabilizers suitable for elimination soil migration. A City Stormwater Inspector may require additional control measures be installed if deemed necessary.

C. Roadways

Compaction - Relative compaction of not less than 95 percent shall be obtained for a minimum depth of 0.5 feet below the subgrade grading plane for the width between the

outer edges of shoulder, including curb and gutter areas, whether in excavation, embankment or at original ground level. All other material shall be compacted to a relative compaction of 90 percent.

Grade Control - When the next layer to be placed on the subgradeis an asphalt concrete pavement, asphalt concrete base or asphalt concrete subbase, the subgrade grading plane at any point shall not vary more than 0.05 foot above or below the grade established by the project surveyor.

Stability Testing - The Contractor shall proof roll the subgrade areas with a fully loaded, 3,000 gallon water truck prior to placement of aggregate base or aggregate subbase. The City's Inspector shall approve the equipment used for proof rolling.

Unsuitable Materials - Any unsuitable material encountered within 2 feet below subgrade or 2 feet below original ground shallbe removed and replaced with a suitable backfill material. Suitable backfill materials and methods for placement are to be reviewed and approved by the on-site geotechnical engineer. Other methods for subgrade stability may be used upon review and approval of the Developer's geotechnical engineer.

2.8 Soil Testing Procedures and Frequencies

A. Field Testing

Field Density Testing - Field density test for earthwork and backfill will be performed by either the owner's Independent Testing Laboratory (ITL), or the City's Geotechnical Engineering Consultant, at the discretion of the City Engineer as follows:

Private property building areas including 10 feet outside the exterior building lines shall be tested by the property owner's Geotechnical Engineer with proper written pad certifications submitted to City Building Official prior to foundation placement.

Public Right-of-Way - All grading operations, which involve revision to existing contours for the purpose of accepting right-of-way improvements, shall require written and stamped certification from a licensed California GeotechnicalEngineer.

Test Method-In-place nuclear density, ASTM D2922 (Method B-Direct Transmission) to check conformance to requirements of Geotechnical Report, project plans, specifications, and of these Standards. In addition to testing, the field technicians shall observe ALL backfill operations to ensure methods consistent with those that achieved minimum required compaction results are used throughout the backfill process. The field technician shall record these observations in the Daily Field Reports (DFR's). The field technician shall perform additional testing when the operations deviate from proven practices even if testing at the frequencies required below has already been performed. Samples for compaction curves shall be taken at the discretion of the technician or as directed by the City's field representative.

The City expects testing at a higher frequency at the discretion of the field technician or City's Inspector if there is any reason to doubt the effectiveness of the operations or the precision of the test results, and when a material change is observed in the soil being compacted. These tests shall be recorded in theDFR.

B. Minimum Reporting Requirements

Daily Field Reports (DRF) - All testing and observations shall be recorded in a DFR. The DFR shall include all field density testing; test tables and/or plans shall show the field-recorded dry density, moisture content, reference laboratory compaction test used and any moisture offset used based on supplemental laboratory testing. All test results indicating less than minimum compaction shall be recorded in the DFR's along with the observation of corrective operations and retest results. DFR's shall also indicate where observation and soil probing was performed in between nuclear gauge testing.

C. Mass Grading Testing Frequencies

Large Area Density Testing – One test per 1,000 to 2,000 cubic yards. A separate compaction certification report is required forCity right-of-way limits.

Small Area Density Testing – One test per 500 cubic yards or each 10,000 square feet of fill.

D. Trench Backfill Testing Frequencies

Utility Installations - Observe all bedding, shading, shovel slicing, and filter fabric installation procedures for compliance with City Standards and project plans and specifications. Observations shall be documented in DFR's along with measures taken to correct noncompliant items.

Compaction Testing – Compaction Testing shall conform to Caltrans standards for frequencies and type.

Performance Specification Observation - (Deep Trenches or Rocky Material), Performance specifications shall be used to verify compaction efforts where vertical cuts or other issues prevent safe entry for nuclear gage density testing. A series of tests will be performed at the beginning of the backfill operations in a protected area of the trench to determine the minimum number of passes, acceptable equipment, moisture conditions, and maximum loose lift thickness. Once the procedure is approved, full-time observation will be performed to check that operations comply with the approved performance specifications. The field technician shall require the contractor to provide access for further testing by the field technician if, in the opinion of the City's Inspector, conditions change such that observation alone will not suffice to verify compliance or if the material or equipment used to backfill the trench changes such that re- evaluation or compaction procedures is required. Adequate compaction of material containing more than 30 percent rock larger than ¾ inch shall be verified via performance specifications. The ITL shall develop the performance specification and, if none exists, perform full-time observation of the operations to verify compliance. Field observations shall be recorded in the field technician's DFR's as described above. The DFR shall clearly reference approximate stations and elevations over which the observation of performance specification was performed.

Dry Utility Trenches - Installation of Electric Department facilities shall be according to the Gridley Electrical Department.

Manholes -Areas around manholes shall be tested every vertical foot. Testing methods and recordings shall be as described above.

Utility Services to Residences - Test at least every other lift on a minimum of 50 percent of the services.

2.9 Materials

A. Retaining Walls

Concrete/Masonry/Rock Walls - All concrete, masonry, or rock walls shall conform to materials and specifications provided bythe wall manufacturer or designing engineer.