PART V - STORM DRAIN DESIGN CRITERIA

A. Hydrology Studies and Hydraulic Analyses

1. Drainage area master plans and calculations are to be submitted with all subdivision improvement plans, permit improvement plans for storm drains, street improvements and with all grading plans. The plans should include the following information:

   a. For the on-site drainage, a scaled Engineering topographic map shall be used. A second map of appropriate scale, preferably 1”= 100’ scale, used to show large off-site drainage basins.

   b. Delineated and labeled project site plan showing all existing drainage basins, both before and after development.

   c. The area in acres and the flow (Q) in CFS of all drainage entering and leaving the site prior to development, as well as after development.

   d. Drainage area and design flows for all the drainage facilities to be constructed.

2. The objective of section is to maintain post development peak runoff rates, and average volume of runoff, similar to existing, pre-development levels. This will minimize the impact to downstream drainage systems, eliminating scour and erosion.

3. Hydraulic calculations shall accompany the plans as follows:

   a. Show the amount of run-off determined for each of the areas for the 100 year storm.

   b. Show the peak flow of the pipes and inlets, energy grade lines (EGL), and pipe slopes of the proposed drainage system.

   c. The project shall make provisions for storage and release of storm water at a rate which will not exceed previously existing conditions release shall be provided to a publicly maintained street or storm drain.

   d. The amount of post development storage can be determined using the Synthetic Unit Hydrograph or other means satisfactory to the City Engineer. (See attachment “O”).

   e. Using the Rational Method may be satisfactory for small drainage areas (< 5 acres); larger areas may require more sophisticated methods, as approved by the City Engineer.
B. Size Criteria

1. Closed conduits should be designed for the full flow condition. They may be allowed to operate under pressure, provided the hydraulic gradient is 0.50 feet below the intake lip of any inlet, which may be affected after allowance for settlement. In no event shall the energy gradient rise above the lip of the intake.

2. Use the Manning Formula for determining the flow in pipes, with the minimum "n" value of 0.013 for RCP or PVC; "n" = 0.024 for CMP, and other values as recommended by King's "Handbook" for miscellaneous conduit shapes.

3. Match soffits unless pipes are submerged, whereby it is OK to match inverts. Minimum design velocity shall be 2.0 fps for the design flow.

4. For areas less than 200 acres, to determine peak-flow, use rational formula Q=CIA. See Attachment "G" for the IDF Curve to determine the rainfall intensity, using the 100-year storm. Runoff coefficients shall be as follows:

<table>
<thead>
<tr>
<th>&quot;C&quot; Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30</td>
<td>Parks and Open Areas</td>
</tr>
<tr>
<td>0.50</td>
<td>Residential (R-1) Areas</td>
</tr>
<tr>
<td>0.70</td>
<td>Multiple Dwelling and Single-Family Attached Areas</td>
</tr>
<tr>
<td>0.90</td>
<td>Paved Areas</td>
</tr>
<tr>
<td>0.95</td>
<td>Roof Area and Driveway Area of Townhouses Bordering Streets</td>
</tr>
</tbody>
</table>

   (For combined paved and unpaved areas, a "weighted" C-factor shall be used.)

   The initial time of concentration may be estimated from the equation below:

   \[ T_c = 10 + 0.0078 \left( \frac{L^{3/2}}{H^{1/2}} \right)^{0.77} \]

   where: \( L \) = the maximum length of travel, in feet.

   \( H \) = the difference in elevation along the effective slope line, in feet.

   \( T_c \) = the time of concentration, in minutes.

5. For losses in bends and structures, use the following formula:

   \[ H = K \frac{V^2}{2g} \]

   where \( K = 1.25 \) for 90° bends, \( K = 0.75 \) for bends between 45° and 90°, and \( K = 0.50 \) for structures and bends 0° - 45°.

6. Minimum size pipe for publicly-maintained systems shall be 12" in diameter.
C. Alignment

1. Conduits 24 inches or less in diameter should be laid on straight alignment and uniform grade between consecutive manholes.

2. Horizontal and vertical curves are not recommended. However, in cases where justification can be shown, limited use of such designs will be considered. A design report or letter report will be required from the design engineer to document the justifications for utilizing a curved alignment.

3. Radii of curvature must be of sufficient length to limit deflections to \( \frac{1}{2} \) the manufacturer's recommended allowable deflection. Complete and accurate details shall be furnished, including: the exact location of such curved sewers, length of curve, radius of curvature, and stationing of curve points.

4. Where curved alignments are utilized, the City may require the following:
   
   a. Slope greater than minimum slope for the size of pipe.
   
   b. Manhole spacing of less than 300 feet.
   
   c. Provide a licensed professional land surveyor or engineer to continuously monitor installation of the curved pipe during construction.
   
   d. Video inspection of curved pipes prior to final acceptance.

5. The following are common locations required for manholes/drainage structures:
   
   a. Where two or more conduits join,
   
   b. At intermediate points on long pipe runs, maximum spacing of 300 feet,
   
   c. Where the conduit changes in size,
   
   d. At sharp curves or angle points in excess of 10 degrees, and
   
   e. Points where an abrupt change of the grade occurs.

6. Minimum horizontal clearance to other utilities shall be five feet.

7. Minimum vertical clearance from other utilities shall be one foot.

8. Minimum cover from top of pipe to surface shall be three feet.

9. The maximum angle from in-going pipe to outgoing pipe shall be 90 degrees.

10. Minimum horizontal clearance from any structure shall be based on the criteria of keeping the bottom of the trench clear of the "1 to 1" plane from the bottom of the structural footing (Attachment "F").
D. **Materials**

1. Materials shall be Reinforced Concrete pipe for pipes 12” in diameter and larger, and PVC for pipes less than 12” conforming to the requirements of the City’s Standard Technical Specifications. Minimum "D" Load values for RCP shall be 1350.

2. Trench load calculations shall be provided where depth of cover is less than three feet and greater than 20 feet.

3. For plastic pipe the maximum allowable deflection shall be 3%.

E. **Storm Drain Design for Private Street Systems**

1. All concentrated run-off shall be carried into an on-site stormwater treatment facility.

2. The minimum pipe diameter is eight inches. Minimum velocity is 2 fps for the design flow.

3. All downspouts from buildings shall be shown with their relationship to the storm drain system. In no case shall the downspouts be permitted to discharge over walkway or a sidewalk or porch, or patio.

4. Parking bays should drain to a grass/vegetated swale, then into the concrete gutter of the private street.

5. Water from valley gutter and drainage devices shall be intercepted by an appropriately sized stormwater treatment facility and piped to the nearest storm drain in the street.

6. Inlets shall be sized such that the minimum inside width of the structure is 1 foot larger than the inside diameter of the out-going pipe.

7. Inlets over 4 feet deep shall have a minimum opening of 24" x 30", with steps to allow access.

F. **NPDES Permit Requirements**

1. Every project must have a completed ‘NPDES Permit Compliance Checklist” (Attachment "R").

2. The checklist shows the requirements needed in order to prevent stormwater pollution as part of the County-wide Stormwater Pollution Prevention Program (STOPPP).

3. In addition to erosion control plans, the applicant will have to provide for permanent source control measures selected from the City’s “Model List of Source Control Measures".
4. Group I Projects (over 1 acre of impervious surface) will need to obtain a Notice of Intent (NOI) with the State Water Resources Control Board, and must prepare a Stormwater Pollution Prevention Plan (SWPPP). In 2006, projects over 10,000 SF of impervious surface will need NOI’s and SWPPP’s.

5. Developers will be asked to sign an Operations and Maintenance Agreement for any new permanent stormwater treatment control measures.

6. Plans will need to be approved by the San Mateo County Mosquito Abatement District. See the County’s Vector Control Plan for guidance on how to address potential mosquito breeding habitat.

7. Group I projects in the hillside area, will require hydrograph modification per City’s SWPPP.