

CITY COUNCIL MEETING
May 15, 1991

PUBLIC HEARING REGARDING PUBLIC
IMPROVEMENT DESIGN STANDARDS

RESOLUTION NO. 91-92 ADOPTED

CC-6 Notice thereof having been published according to law, an
CC-158 affidavit of which publication is on file in the City
CC-300 Clerk's office, Mayor David Hinchman called for the public
hearing regarding Public Improvement Design Standards.

The matter was introduced by Assistant City Engineer Richard Prima who advised the City Council that on February 21, 1991, draft design standards for public improvements were sent out for comment to nearly 50 engineers and developers plus the City Council and Planning Commission. This draft is a complete rewrite of the standards adopted in 1976. The Introduction, Storm Drainage and Miscellaneous sections were written by City staff. The Water section was written by City staff based on information supplied in the Water Master Plan by Psomas & Associates. TJKM (streets) and Black & Veatch (wastewater) prepared recommended design standards as part of their work on the respective Master Plans. Their work was somewhat revised and edited by City staff to conform to the organization of the other sections.

Major changes from the 1976 standards were outlined. Some changes were made in the draft since February 21, partly based on comments received at a public meeting held March 12 at which one engineer and two developers attended. No other comments were received. A few errors have been corrected.

The standards were reviewed at a Council "shirtsleeve" meeting on April 9 where an additional change regarding sight distance and right-of-way fences was described.

The standards do not include the following items which the Council may wish to direct staff for future action:

Fences and Landscaping - The Standards were silent as to criteria for landscaping and reverse frontage fences whether publicly or privately owned and maintained. Staff feels that this should be specifically addressed in the project approval stage. If written minimum requirements are desired, they should be developed with SPARC and/or the Planning Commission and added to the Standards at a later date. The fact that these issues are not included was specifically added to Section 1.301, General Design.

Parkways - A standard street section incorporating trees and a landscaped parkway between the curb and sidewalk in new subdivisions has been discussed. Such a standard would either:

- ° Require substantially more right-of-way, thereby

CITY COUNCIL MEETING
May 15, 1991

increasing the cost of new homes; or

- ° Require a change in the zoning code to provide for reduced front yard setbacks (except for garages). Staff feels this should be addressed by the Planning Commission.

Addressing the City Council regarding the matter was:

- a) Melissa Harmuth Joshi, State of California,
Department of Transportation.

There being no other persons wishing to address the City Council regarding the matter, the public portion of the hearing was closed.

On motion of Council Member Sieglock, Pinkerton second, the City Council adopted Resolution No. 91-92 entitled, "A Resolution of the Lodi City Council Adopting Design Standards for Public Improvements".



CITY OF LODI

COUNCIL COMMUNICATION

AGENDA TITLE: Public Hearing Regarding Public Improvement Design Standards

MEETING DATE: May 15, 1991

PREPARED BY: Public Works Director

RECOMMENDED ACTION: That after conducting a public hearing, the City Council adopt a resolution adopting design standards for public improvements.

BACKGROUND INFORMATION: On February 21, 1991, draft design standards for public improvements were sent out for comment to nearly 50 engineers and developers plus the City Council and Planning Commission. This draft is a complete rewrite of the standards adopted in 1976. The Introduction, Storm Drainage and Miscellaneous sections were written by City staff. The Water section was written by City staff based on information supplied in the Water Master Plan by Psomas & Associates. TJKM (streets) and Black & Veatch (wastewater) prepared recommended design standards as part of their work on the respective Master Plans. Their work was somewhat revised and edited by City staff to conform to the organization of the other sections.

Major changes from the 1976 standards are described in Exhibit A. Some changes were made in the draft since February 21, partly based on comments received at a public meeting held March 12 at which one engineer and two developers attended. No other comments were received. A few errors have been corrected.

The standards were reviewed at a Council "shirtsleeve" meeting on April 9 where an additional change regarding sight distance and right-of-way fences was described.

The standards do not include the following items which the Council may wish to direct staff for future action:

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Parkways - A standard street section incorporating trees and a landscaped parkway between the curb and sidewalk in new subdivisions has been discussed. Such a standard would either:

APPROVED: _____

THOMAS A. PETERSON
City Manager

CC-1

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- ° Require substantially more right-of-way, thereby increasing the cost of new homes; or
- ° Require a change in the zoning code to provide for reduced front yard setbacks (except for garages). Staff feels this should be addressed by the Planning Commission.

A draft Resolution adopting these Standards is attached as Exhibit B.

FUNDING: None required.



Jack L. Ronsko
Public Works Director

Prepared by Richard C. Prima Jr., Assistant City Engineer

JLR/RCP/mt

Attachment

cc: Assistant City Engineer
Senior Civil Engineer
Street Superintendent
Water/Wastewater Superintendent

DRAFT DESIGN STANDARD CHANGES

- 1 The introduction has been greatly expanded in an attempt to cover legal issues and on-site responsibility. The section on "Authority" is new and assumes the Design Standards will be adopted by Resolution with the guidelines for changes by the City Engineer.
- 2 The sections on submittals contained in each major section have been written to work with the proposed Growth Management Plan and correspond to three stages of development:
 Development Plan
 Tentative Map or Master Plan
 Improvement Plans.
- 3 Section 1.200 on Design Volumes is new. The consultants who prepared the Circulation Study provided recommended volume ranges and design speeds for the various street classifications. This will provide a more rational basis for selecting the proper street widths in new developments. The classifications are consistent throughout these Standards.
- 4 The Traffic Studies section is new and consists of material taken from the circulation study and past practice.
- 5 In Section 1.301, (Street) General Design, the requirement that lots fronting arterials do not require exiting vehicles to back out (ie, they must have on-site turn-around space, is new as recommended in the Circulation Plan.
- "Standard" cul-de-sacs has been deleted. Radius and other criteria remains, allowing various shaped cul-de-sacs as have been permitted in the past. The maximum length has been increased from 500 ft. to 750 ft. (provided design volumes limits are met) to provide more flexibility in design.
- The requirement for temporary curbing on boundary streets is new, although it has been required on many projects in the past.
- 6 Section 1.302, "Cross Slope" includes much more discussion of pavement cross slope relating to driveways and scraping problems. This criteria has been developed on recent overlays with good success.
- 7 The section on sight distance is new although the proposed criteria have been used on specific projects in the past.
- 8 The vertical curve criteria contains much more detail than the previous standards and is consistent with applicable Caltrans criteria and other references.
- 9 The table of curb return grades is new and consists of extrapolations of past practice.
- 10 All the text on median grades (§1.304) and design (§1.306) is new. Some came from the circulation study, the remainder, in-house.
- 11 The section on horizontal curves increases most of the required minimum radii, except that for minor residential streets is reduced from 250 ft. to 220 ft. Additional references to Caltrans standards are provided.
- The minimum requirement for separation of opposing streets is the same, however, additional separation may be required on certain streets as described in §1.305.
- 12 The driveway standards include new requirements for spacing from curb returns per the Circulation Study and additional criteria for the use of special driveways (those with a radius instead of a curb transition) in certain locations. Upgrading of existing driveways may be

required upon change in land use. (Most redevelopment involves new or relocation of driveways anyway.)

- ¹³ §1.410, Driveway Slope is new and consists of material taken from the driveway study on E. Tokay Street and subsequent overlay projects.
- ¹⁴ §1.501 regarding curb & gutter contains a new requirement that prohibits new ditches and swales across residential frontage.
- ¹⁵ The sidewalk section (§1.503) contains more requirements related to clearances and additional width at obstructions per past practice.
- ¹⁶ §1.504 contains new requirements for wheelchair ramp installations (retrofit) with new projects, both City and private.
- ¹⁷ The requirements for back of sidewalk treatment are new in the Design Standards but are per recent practice.
- ¹⁸ §1.600 contains much more pavement structural design information than the previous standards consistent with recent practice.
- The requirement for removal and replacement of existing pavement clarifies past practice and includes one new condition - ends of existing streets. The ends are rarely constructed as well as the rest of the street and are often damaged with the new work.
- ¹⁹ The entire Wastewater section has been rewritten and taken primarily from the Wastewater Master Plan done by Black & Veatch.
- ²⁰ Design wastewater flows and peak factors have been revised as recommended by Black & Veatch; while the average flows have been reduced, higher peak factors result in only minor overall change from past design standards.
- ²¹ The minimum wastewater line size is increased from 6" to 8" (except for dead-end lines) as recommended by Black & Veatch.
- ²² The design depth of flow in wastewater lines is as recommended by Black & Veatch. The previous standards called for designs based on full pipe for all sizes.
- ²³ A new Standard Plan describing State Department of Health Services requirements for water main clearances to sanitary hazards is being developed by City staff.
- ²⁴ Black & Veatch recommended VCP only for industrial and commercial areas. Present practice requires VCP in industrial areas. This draft provides some flexibility based on actual land use.
- ²⁵ §2.600 on pump stations is new per Black & Veatch with a few minor modifications and generally conforms to past practice.
- ²⁶ The storm drainage section has been completely rewritten and follows the format and organization of the wastewater section. Additional design flow information is provided; many of the design concepts are comparable to the new San Joaquin County Design Standards.
- ²⁷ Environmental Protection Agency (EPA) regulations governing storm water discharge are being issued in 1990/91. As of this draft, it is unclear how they will affect specific City Standards. The proposed wording allows some flexibility in dealing with these new requirements through a permit process.
- ²⁸ The hydraulic grade line calculations for new developments as they check into existing trunk lines (third paragraph) is new.

- 29 The storm drain pipe slope table and velocity discussion has been greatly expanded in §3.303.
- 30 §3.305 states that storm drains are considered wastewater lines when looking at clearances to water lines. This is per State Department of Health Services interpretations of existing regulations.
- 31 Asbestos cement pipe has been deleted as an acceptable storm drain material in §3.306. The joints are often are not installed properly. Also, the material is not commonly used since PVC is available. PVC pipe use is restricted as described.
- 32 §3.307 limits the use of mortar joints in storm drain pipe. Due to workmanship, exfiltration and root problems, rubber gaskets are now required.
- 33 The section on storm drain services (§3.400) has been entirely rewritten mainly following existing practice and policies. The requirements for parcels less than one acre are new.
- 34 The portion of §3.501 regarding omitting manholes and allowing direct ties to mains has been revised to limit the number of situations in which direct ties are allowed.
- 35 Section 3.700, Detention Basins includes past sections on private basins but now requires Council approval for all private and/or temporary basins.
- 36 The Water section has been completely rewritten and follows the format and organization of the wastewater section. Much more design information is provided in the area of fire flows and requirements for checking water main sizes.
- 37 The 4" minimum water main (where there is no hydrant service) is new per the Water Master plan by Psomas.
- 38 §4.306 on water main pipe includes present restrictions on PVC with a slight modification. The proposed standard encourages the installation of fire services in new developments, thus there should be less need for subsequent taps.
- 39 The section on Maps and Easements is new, but essentially is present practice.
- 40 Section 5.200 regarding improvement plans is a compilation of recent practice and incorporates new requirements in the Design Standards. The job site sign and well abandonment timing requirements are new.
- 41 Section 5.300 regarding "as-built" plans is entirely new. It is intended to relieve the City from some development related work. It will be more equitable in that projects with problems or other special circumstances will have less of an effect on the City's costs which are passed on to all developers in engineering fees. The monument certification is required by the State Subdivision Map Act §66497.
- 42 Section 5.400 regarding traffic control is new and reflects changes in the Caltrans Traffic Manual regarding traffic control plans and problems the City has had with projects affecting existing streets.
- 43 Section 5.500 regarding soils reports is new. Soils reports are commonly being done in new developments and the Map Act requires that they be on file (§66434.5). This section summarizes other portions of the Design Standards which refer to needed soil work.
- 44 Section 5.600 regarding grading is new. While the City has adopted Chapter 70 "Grading and Excavation" of the Uniform Building Code, there is no process or criteria for issuing grading permits. The proposed Design Standards provide some basis for reviewing potential problems.

mainly differences in grade at the property line. The proposed requirement for concrete or block retaining walls/curbs is new.

The sections regarding dust and erosion control are new. The Standards are not specific at this time and reflect the uncertainty involved with draft regulations as noted in the text. Both problems involve significant public complaints and cost to the developer.

- ⁴⁵ The trench design section (§5.700) is based on the standards for wastewater pipe installation proposed by Black & Veatch. They have been rewritten and significantly expanded upon in this separate section to apply to all pipe installation. Black & Veatch recommended crushed rock embedment for all pipe. Based on local experience and comments from Kleinfelder and the fact that soils reports will be required, the draft standards do not follow Black & Veatch's recommendation. Also, crushed rock embedment should be designed with a soil filter (either a fabric or graded material). The requirement would unnecessarily add to project cost and consume a resource that is becoming more difficult to obtain. The draft standards allow various bedding designs per the applicable ASTM standards. Appropriate City Standard Plans are still being developed.
- ⁴⁶ The checklist is a revised version of the checklist from the old Design Standards. The requirement that a completed copy be submitted with the plans is new and will hopefully cut down on plan processing time.
- ⁴⁷ The bid item list has been expanded and a requirement that private contracts bid aggregate base and asphalt concrete by the ton instead of by square footage is new. (square footage prices encourage the Contractor to use less material)
- ⁴⁸ The listing of references is new and is part of the attempt to better document the Design Standards and provide sources of additional material for cases not covered by the Standards.

D R A F T

RESOLUTION NO. 91-
=====

A RESOLUTION OF THE LODI CITY COUNCIL
ADOPTING DESIGN STANDARDS FOR PUBLIC IMPROVEMENTS

=====

WHEREAS, the Lodi City Council on November 17, 1976 adopted Resolution No. 42-90, establishing certain Design Standards for public improvements; and

WHEREAS, such Design Standards have been amended from time to time since that date; and

WHEREAS, it has become desirable to update such Design Standards on a unified basis; and

WHEREAS, a public hearing before the Lodi City Council was held on _____, 19____;

NOW, THEREFORE, BE IT RESOLVED, that:

1. The Lodi City Council adopts the Lodi Public Improvement Design Standards contained in Exhibit A attached hereto and incorporated by reference as if fully set forth herein to implement the various sections of the Lodi Municipal Code and General Plan goals and policies;
2. All previously adopted Design Standards for public improvements are declared repealed and void;
3. Any and all other resolutions in conflict herewith are repealed to the extent of such duplication or conflict; and
4. Pursuant to this resolution, the City Engineer shall be empowered and authorized to interpret and make decisions applying the Design Standards adopted herein, and to make periodic updates consistent with the General Plan, Municipal Code and other ordinances, resolutions and policies affecting such Design Standards.

Dated:

=====

I hereby certify that Resolution No. was passed and adopted by the Lodi City Council in a regular meeting held by the following vote:

Ayes: Council Members -

Noes: Council Members -

Absent: Council Members -

Alice M. Reimche
City Clerk

RESOLUTION NO. 91-92

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Dated: May 15, 1991

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Ayes: Council Members -

Noes: Council Members -

Absent: Council Members -

Alice M. Reimche
City Clerk

DECLARATION OF MAILING

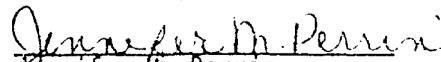
On May 2, 1991 in the City of Lodi, San Joaquin County, California, I deposited in the United States mail, envelopes with first-class postage prepaid thereon, containing a copy of the Notice attached hereto, marked Exhibit "A"; said envelopes were addressed as is more particularly shown on Exhibit "B" attached hereto.

There is a regular daily communication by mail between the City of Lodi, California, and the places to which said envelopes were addressed.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 2, 1991, at Lodi, California.

Alice M. Reimche
City Clerk


Jennifer M. Perrin
Deputy City Clerk



CITY OF LODI
CARNEGIE FORUM
305 West Pine Street, Lodi

NOTICE OF PUBLIC HEARING

Date: May 15, 1991

Time: 7:30 p.m.

For information regarding this Public Hearing
Please Contact:

Alice M. Reimche
City Clerk
Telephone: 333-6702

NOTICE OF PUBLIC HEARING

May 15, 1991

NOTICE IS HEREBY GIVEN that on Wednesday, at the hour of 7:30 p.m., or as soon thereafter as the matter may be heard, the City Council will conduct a public hearing to consider the following matter:

- a) Public Improvement Design Standards

All interested persons are invited to present their views and comments on this matter. Written statements may be filed with the City Clerk at any time prior to the hearing scheduled herein, and oral statements may be made at said hearing.

If you challenge the subject matter in court, you may be limited to raising only those issues you or someone else raised at the Public Hearing described in this notice or in written correspondence delivered to the City Clerk, 221 West Pine Street, at or prior to the Public Hearing.

By Order Of the Lodi City Council:

Jennifer M. Perrin
for Alice M. Reimche
City Clerk

Dated: May 1, 1991

Approved as to form:

B W McNatt
Bobby W. McNatt
City Attorney

TIE GIANNONI ORGANIZATION
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JEFF KIRST
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LODI, CA 95240

BAUMBACH-PIAZZA
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LODI, CA 95240

DILLON ENGINEERING
PO BOX 2180
LODI, CA 95241

WENELL MATTHEIS BOWE
222 W LOCKEFORD ST #9
LODI, CA 95240

ENGINEERING FEE UPDATE MAILING LIST, 4/19/91

Design Stds

RESOLUTION NO. 91-92

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Dated: May 15, 1991

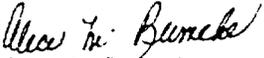
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I hereby certify that Resolution No. 91-92 was passed and adopted by the Lodi City Council in a regular meeting held May 15, 1991 by the following vote:

Ayes: Council Members - Pennino, Pinkerton, Sieglock, Snider
and Hinchman (Mayor)

Noes: Council Members - None

Absent: Council Members - None


Alice M. Reimche
City Clerk

MEMORANDUM, City of Lodi, Public Works Department

TO: City Council
City Manager

FROM: Public Works Director

DATE: May 13, 1991

SUBJECT: Public Improvement Design Standards

Attached is a final copy of the Public Improvement Design Standards which will be the subject of a public hearing at the May 15 City Council meeting.

This copy is the same as the draft presented at the April 9 shirtsleeve meeting with the following exceptions:

1. On Page 4, Section 1.301 General Design (Streets), third paragraph, "and major collectors" was added after "arterial streets" to be consistent with the circulation element of the General Plan.
2. The sight distance figure on Page 6 has been revised to include a "preferred" driver's eye distance from the face of curb as described at the shirtsleeve meeting.
3. A short section regarding pavement transitions has been added to Page 8.
4. Minor editorial changes.
5. Typographical corrections.


Jack L. Ronsko
Public Works Director

JLR/RCP/mt
Lg

Attachment

cc: Baumbach-Piazza



CITY OF LODI
DEPARTMENT OF PUBLIC WORKS



"Building A Better Community"

Public Works
Department

Public Improvement
Design Standards

May 1991

City of Lodi Public Improvement Design Standards

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City of Lodi
Public Improvement Design Standards
Introduction

I - 1 Purpose and Scope

These Design Standards are published as required by the City of Lodi General Plan to provide standards for public improvements constructed within the City. They are to be used in conjunction with City Standard Construction Specifications and Standard Plans (hereafter referred to in total as "Standards"). They shall apply to all new and reconstructed public improvements done as part of private development, public and private utility work within right-of-way and public utility easements (PUE) and City projects. However, they do not include traffic signal and other minor, informal standards used by the City in the design of publicly funded projects and in the analysis of existing problems.

These Standards also apply to street, storm drainage, wastewater and water system improvements which are to be owned and maintained by the City of Lodi, except as noted below. The design of lighting and electrical facilities is not included in these Standards and shall be in accordance with rules and regulations of the City of Lodi Electric Utility Department.

Although intended for public improvements, these Standards affect the design of private, on-site facilities. In some cases, other City Departments refer to these Standards for their on-site requirements under separate authority. Generally, such cases are specifically identified in the appropriate sections.

Nothing in these Design Standards is intended to reduce or modify applicable Federal, State or Local laws nor to create a standard to be applied retroactively to existing improvements except where specifically noted.

I - 2 Design

These Standards are not a "Code" nor are they a replacement for engineering design and judgement. The design of each project is in itself a special case and these Standards should not be construed to be the maximum (or minimum) required design on a project. In some cases, it may be impractical to meet these Standards. The design engineer is encouraged to meet with City engineering staff to review design problems early to avoid reworking plans where deviations are not permitted. Legal requirements must be met; such requirements are noted "(legal min.)".

This document does not attempt to repeat all the various agency, professional and industry standards used in engineering design. Rather it cites acceptable references and sets desired standards for the normal range of work anticipated in Lodi based on expected local conditions. Names of references noted are abbreviated; full names and comments on them are included in Appendix A-5.

I - 3 Authority

These Standards are adopted by Resolution #91-92 of the City Council and implement various sections of the Lodi Municipal Code and General Plan goals and policies. Resolution #91-92 provides that the City Engineer shall interpret and make decisions concerning these Design Standards. The City Engineer is also empowered to update the Standards consistent with the General Plan and City Ordinances, Resolutions and policies affecting these Standards.

Section 1 - Streets

1.100 General

1.101 Scope

All public streets shall be designed in accordance with acceptable engineering principles and shall conform to these Standards. Primary references for supplemental information and/or details include the Caltrans Highway Design Manual, the Transportation Engineering Handbook, "A Policy on Geometric Design of Highways and Streets (the AASHTO "Green" Book) and "Design of Urban Streets".

Private streets and parking lots shall be designed according to applicable development approvals, City Codes and Standards and accepted engineering principles.

1.102 Submittals

The sequential requirements listed below are based on projects subject to the City's Growth Management Plan. Developers and design engineers of projects not subject to the Plan should consult with the City Engineer to determine applicable and appropriate timing of submittals.

Development Plan Stage (preliminary plan for entire parcel/development)

Development plan submittals shall include a map showing the proposed project, existing streets (rights-of-way, medians, number of lanes and regulatory traffic controls) in the vicinity (400 ft. minimum) of the project and new street rights-of-way proposed for the project. At least one map showing right-of-way and lot lines shall be submitted at a scale of 1" = 200'.

Lot lines and sight-distance triangles per §1.303 shall also be shown at the following locations:

- intersections at reverse frontage lots;
- intersections at curved streets;
- intersections with adjacent building setbacks less than 20 feet.

A table showing land use categories and acreage, trip generation and total traffic shall be provided.

Project Master Plan Stage (detailed plan for entire parcel/development)

A detailed street master plan for an entire project may be required by the City Engineer for projects involving extension of streets through adjacent property or to assure that the layout of the approved development plan will meet these Standards.

Improvement Plan Stage (specific improvement plans for portion being developed)

Improvement plans shall include the information listed in §5.200 and Appendix A-1.

1.200 Design Volumes

1.201 General

Unless otherwise designated in the Street Master Plan or approved development plan, the design volumes shall be used to determine required street classifications and shall be approved by the City Engineer. For projects less than 100 acres, volumes may be estimated using these Design Standards in consultation with City Engineer; however, a traffic study may be required at locations with access, capacity or other traffic problems. Larger projects and those requesting

significant changes to the General Plan shall have a traffic study as required as part of the development approval process.

The following table relates street classification and design volume and design speed.

<u>Street Classification</u>	<u>R/W, Curb-</u>		<u>Standard</u>	<u>Design</u>	<u>Daily Traffic</u>	
	<u>Curb Width</u>		<u>Configuration</u>	<u>Speed</u>	<u>Volume Range</u>	
Minor Residential	50	34	2 lanes	25	0	500
Standard Residential	55	39	2 lanes	30	500	4,000
Minor Collector	60	44	2 lanes	35	4,000	10,000
Major Collector	68	52	2 lanes with LT lane/median	40	10,000	14,000
Industrial (Local)	66	52	2 lanes	40	0	14,000
Secondary Arterial	80	64	4 lanes	50	14,000	22,000
Minor Arterial	94	76	4 lanes with LT lane/median	55	22,000	24,000
Major Arterial	118	102	6 lanes with LT lane/median	60	24,000	36,000

See §1.302 regarding cross sections.

1.202 Traffic Studies

Traffic studies shall only be conducted after consultation with the City Engineer regarding scope of work, assumptions, computer programs and models to be used and other parameters.

Institute of Transportation Engineers (ITE) average trip generation rates shall be used as approved by the City Engineer. For mixed use development projects, individual building rates shall be added. For example, in a commercial development consisting of a large retail space with detached building pads, shopping center rates may be used for the large retail space and fast food, bank or other appropriate rates used for the pads. "Pass-by" reductions in rates shall be approved by the City Engineer.

Minimum trip generation rates per gross acre or other units are shown in the following table:

<u>Land Use Type</u>	<u>Peak Hr. Rate</u>	<u>Daily Rate</u>	<u>Units</u>
Single Family Residential	1.1	10	TE/DU
Duplex Residential	0.9	8	TE/DU
Multi-Family Residential	0.7	6	TE/DU
Office	18	128	TE/Acre
Light Industrial	11	65	TE/Acre
Heavy Industrial	7	40	TE/Acre
Light Commercial	15	150	TE/Acre
General Commercial	30	300	TE/Acre
Shopping Center	30	300	TE/Acre
Public Offices & Civic Center	16	160	TE/Acre
Park & Public Facilities	0.4	4	TE/Acre
Elementary & Middle School	0.11	1.1	TE/Student
High School	0.25	2.5	TE/Student
Hospital	15	150	TE/Acre

TE = Trip End DU = Dwelling Unit

1.300 Street Design

1.301 General Design

Minor and Standard Residential streets shall be designed to discourage through traffic. Incorporation of moderately curved streets, cul-de-sacs, knuckles, and "T" intersections in the site plan is encouraged. Maximum length of continuous straight streets should not exceed 1,000 feet. Continuous straight streets with residential frontage, between two collector or arterial streets, are prohibited.

Block lengths shall not exceed 1300 feet.

On-site improvements on lots fronting arterial and major collector streets shall be designed such that exiting vehicles do not have to back out onto the street. (Use circular or hammerhead driveways, on-site circulation, etc.)

Cul-de-Sacs

A cul-de-sac shall be constructed on all permanent dead-end streets. Cul-de-sacs are discouraged in commercial and industrial developments and shall be specifically approved by the Planning Commission or City Council. The maximum design volume on a cul-de-sac shall be 500 vehicles per day. The maximum length of a cul-de-sac regardless of volume shall be 750 feet.

Permanent cul-de-sac streets shall have a turn-around at the closed end with a minimum right-of-way radius of 50 feet. The reversing curves at the beginning of the turn-around shall also have a 50-foot R/W radius except in short cul-de-sacs (bulbs) where they would intersect the curb return at the entrance. In such cases, the design shall be specifically approved by the City Engineer. Asymmetrical configurations are permitted.

Temporary cul-de-sacs on dead-end streets that are to be extended may be required for Fire Department turn-around depending on the length of the street and location of fire hydrants.

Alleys

New public alleys are not allowed unless specifically approved by the City Council, however, developments with private streets may be designed to minimize the number of access points onto arterials.

Landscaping & right-of-way fences

Requirements for roadside or median landscaping or "hardscaping" and right-of-way (reverse frontage) fences are not included in these Standards and shall be determined on a case-by-case basis by the City Engineer subject to project conditions of approval.

Miscellaneous

"Knuckles" on residential streets are to provide proper lot width at the setback line and shall conform to Standard Plan 133.

Lot lines should follow subdivision boundary lines unless specifically approved otherwise on the development plan. Streets shall be fully improved within tract boundaries.

1.302 Cross Section

Cross sections for standard street classifications are shown on Standard Plan 101. These cross sections may be modified by the City Engineer based on specific plans, traffic study requirements for project access lanes or other development approvals.

Streets along tract boundaries (half-streets) shall have a minimum 32-foot improved travelled way. If "No Parking" is approved by the City Council prior to approving the plans, the width may be reduced to 24 feet. Temporary curbing shall be provided at the unimproved edge of the pavement.

The standard cross slope of the street shall be 2.5%. Where necessary to match existing facilities, the cross slope on new streets may vary between 1% and 4%. Replacement of existing travel lanes in order to meet cross slope criteria may be required. Intersection, cul-de-sac and knuckle cross slopes should be 2% maximum, 0.75% minimum.

Upon approval of the City Engineer, the cross slope may be increased to 9% for overlays, shoulder work or other special circumstances. Grinding is normally required to minimize the effects of overlays and may include double passes, the first 6 feet wide, adjacent to the gutter at constant depth, with a second, tapered transition pass next to the first. (See §1.410, Driveway slope for additional criteria at driveways)

1.303 Intersection/Driveway Sight Distance

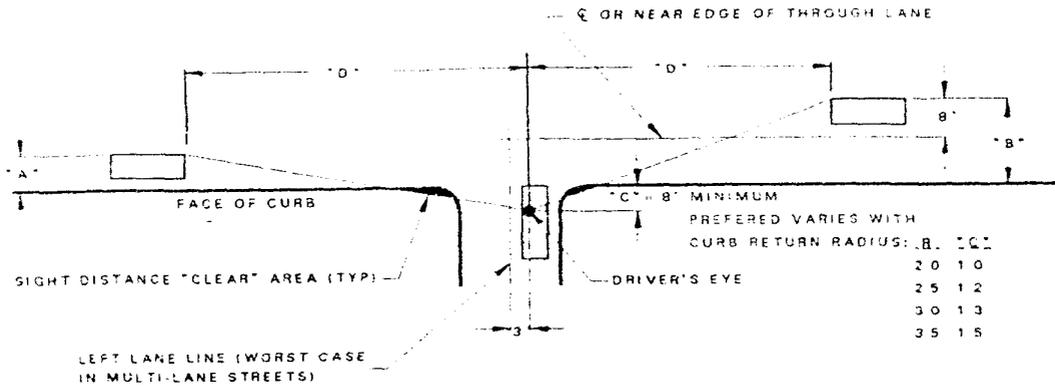
Minimum requirements for intersection and driveway sight distances are shown in the "Sight Distance Requirements" table and are based on stopping sight distances for traffic on the major (through) street and **stop control on the intersection/driveway**. Preferred distances are from ITE Handbook Table 19-8 "Suggested Corner Sight Distances at Intersections" which are intended to allow opposing traffic to cross the major street without requiring approach traffic to reduce speed. These longer distances will normally be required for new streets and may be required in other circumstances depending on available setback or other considerations.

Planned intersection controls shall be considered in determining the appropriate sight distance. For example, where a traffic signal is planned, and the intersection will be initially controlled with a two-way stop, the minimum sight distance may be provided at the "stop" legs of the intersection.

Sight distance shall also be provided at median openings as appropriate.

Right-of-way or sight distance easements shall be provided at new reverse frontage fences, signs or other obstructions as appropriate. The "clear" area shall not contain shrubbery, mounds, signs or other obstructions over 30" high. Poles and trees shall be spaced far enough apart to provide adequate sight and tree limbs shall be at least 7 feet above the ground. (This section is not intended to preempt the zoning code with regard to front yard fences in residential areas.)

Sight Distance Requirements



Major St. Classification	Design Speed	"A"	"B"	"D" (ft.)	
				Minimum	Preferred
Minor Residential	25	14	25	150	250
Standard Residential	30	16	27	200	300
Minor Collector	35	19	30	250	350
Major Collector	40	17	34	300	400
Industrial	40	23	34	300	400
Secondary Arterial	50	17	40	430	500
Minor Arterial	55	17	52	500	550
Major Arterial	60	15	68	580	600

The above "A" and "B" distances (in feet) assume new standard cross sections per Standard Plan 101. Existing streets shall be checked using the worst case of existing or future striping and the higher of the design speed or existing 85th percentile speed.

1.304 Vertical Alignment

Vertical Curves

Vertical curves are rarely required in Lodi due to the flat terrain. Thus the following standards are brief and only describe minimum requirements. The design engineer is referred to the references cited for additional design criteria where compound curves are needed such as canal crossings.

Where the algebraic difference in longitudinal slope exceeds 1%, a parabolic vertical curve shall be used. The minimum length of vertical curve shall be per the following:

$$L = KA \quad \text{where} \quad L = \text{length of vertical curve, ft}$$

$$K = \text{constant per Table below}$$

$$A = \text{algebraic difference in grades, \%}$$

Vertical Curve K Values

Design Speed	Crest Curve	Sag Curve
25	20	30
30	30	40
35	50	50
40	80	70
50	160	110
55	220	130
60	310	160

The above table is based on stopping sight distance per Table V-2 of the AASHTO "Green" Book. In arterial streets where passing is permitted, higher K values per Table V-3 shall be used.

The minimum length of vertical curve shall be 200 ft. for design speeds below 40 mph and 400 ft. for design speeds of 40 mph and above. Where the calculated length is below the minimum, the curve may be approximated by an intermediate straight segment(s).

Top of Curb and Flowline Grades

Flowline grades shall not be less than 0.25% and not greater than 6%. A normal design minimum of 0.30% is recommended to minimize birdbaths. (Note gutter flowline tolerances in the Construction Specifications.) Where matching existing improvements, the minimum grade may be reduced with the approval of the City Engineer. With the specific approval of the City Engineer, curb height may be varied from a minimum of 4" to a maximum of 7".

The minimum top of curb elevations shall be 1-foot above the design maximum water surface of the Master Plan Storm Drainage Basin to which the proposed improvement is tributary. This minimum elevation is listed in §3.703.

A minimum top-of-curb elevation of 1-foot above the calculated hydraulic grade line shall be maintained.

Grades on opposite sides of the street shall be the same wherever practical.

Grades on Curves

On cul-de-sacs, knuckles and other curves (except curb returns) where the curb radius is less than 100 feet, the flowline grade shall be 0.30% minimum.

Curb Return Grades

Top of curb fall (in feet) around returns shall be per the following table:

Radius	Retrofit	New Construction	
	Minimum	Minimum	Maximum
15	0.12	0.20	0.50
20	0.16	0.20	0.60
25	*	0.25	0.80
30	*	0.30	0.90
35	*	0.35	1.00
40	*	0.40	1.10
45	*	0.45	1.20
50	*	0.50	1.30

*Special Determination

At returns where the curb type changes, differences in curb height shall be taken into account in the design so as not to reduce the flowline fall.

Median Grades

Median grades shall follow street grades. Minor variation in top of median curb grades on opposite sides of the median is permitted depending on the width and nature of landscaping. For aesthetic reasons, the maximum variation at noses or other medians less than 6 feet wide should be 0.15 ± ft. Median noses and other areas with solid fill in between curbs shall be sloped to drain.

1.305 Horizontal Alignment

Street Curvature

Design of curved arterial and collector streets shall be based on criteria in the Caltrans Highway Design Manual. The minimum radius of curvature of centerline for all streets shall be per the following table:

<u>Street Classification</u>	<u>Minimum Horizontal Curve Radius</u>		<u>Notes</u>
	<u>Design Speed</u>	<u>Radius (ft.)</u>	
Minor Residential	25	220	
Standard Residential	30	250	1
Minor Collector	35	500	1
Major Collector, Industrial	40	550	1
Secondary Arterial	50	850	1, 2
Minor Arterial	55	1000	1, 2
Major Arterial	60	1150	1, 2

Notes:

1. Minimum radius is below that indicated in Caltrans Highway Design Manual Figure 203.2 "Comfortable Speed on Horizontal Curves" for the standard cross slope. While this is acceptable on residential and industrial streets, larger radii, superelevation or reduced design speed should be considered on collector and arterial streets.
2. Minimum radius assumes no sight obstructions. Figure 201.6 "Stopping Sight Distance on Horizontal Curves" of the above reference should be checked when walls or other obstructions are planned within 20 ft. of the right-of-way.

There shall be a tangent between reversing curves of at least 150 feet on arterial and collector streets, and 50 feet on all other streets.

Transitions

Length of pavement transitions affecting travel lanes shall be designed per applicable Caltrans Standards (Hwy. Design Manual §206). At ends of curb & gutter, the minimum transition length shall be based on a 45° pavement transition. Longer distances will be required where a driveway is located at the end of the curb & gutter.

Intersection Angle

Streets shall intersect at right angles (± 5 degrees). Curved residential streets shall have at least 50 feet of centerline perpendicular (± 5 degrees) to the projected curb line of the intersecting street. Longer perpendicular distances may be required on collector and arterial streets.

Curb Returns

Curb return radii for various street types shall be as shown on Standard Plan 611.

Angle Points

Angle points of 5 degrees or less are allowed on residential street centerlines with approval of the City Engineer. In such cases, the curb face shall be designed with a 100-foot radius curve.

Opposing Streets

All streets entering upon opposite sides of any given street shall have their centerlines directly opposite each other or separated by at least 150 feet. Cross streets are to be avoided unless one or more legs are cul-de-sacs. Greater distances may be required on collector and higher classification streets based on anticipated turning volumes. Intersections that are to be signalized shall be four-way.

The minimum distance between streets entering a restricted access street shall be as provided by a Specific Plan adopted by the Planning Commission and City Council.

The location of any new intersection between a local street and an arterial shall be reviewed by the City Engineer to determine safety and compatibility for signal progression. The City may restrict access to right-turn-only if necessary.

1.306 Medians

Medians and median openings shall be constructed at locations shown on Specific Plans or as required as part of project approval. See §1.301 regarding landscaping.

Design geometrics for parabolic median curb transitions, flares and left-turn-in-only median openings are shown in the Standard Plans.

Median curb heights shall be 8" with a minimal reverse gutter provided. Due to excessive pavement deterioration from watering, interior drainage at landscaped medians shall be provided.

1.400 Driveways

1.401 General Requirements

The following driveway standards are not applicable to State Highway or controlled access streets where access is limited by deed or map restrictions or other development restrictions. If driveways are approved at such locations, the applicable design requirements shall be used. New driveways on restricted access streets (most of Cherokee Lane and other streets per map or deed restrictions) require City Council approval.

The number, location and width of permitted driveways is regulated by the Public Works Department and shall be based on the demonstrated needs of the parcel being served. They shall not be excessively detrimental to the abutting street capacity, safety, and/or efficiency.

The City Engineer may modify any of the following standards in order to provide better traffic movements or because of special or unusual conditions. The ITE publication "Guidelines for Driveway Design & Location" contains additional design guidelines.

"Commercial" driveways per Standard Plan 114 shall be used on all driveways serving 4 or more parking stalls and other locations where trucks, including garbage trucks, are anticipated. Where land use changes affect existing driveways proposed for reuse, the City Engineer may require upgrading of the driveway to commercial standards.

"Common" driveways straddling a property line to serve two or more parcels, are permitted provided applicable width and clearances are met.

1.402 Special Driveways

Special driveways are those with a depressed back of driveway at the property line and a radius instead of a curb transition and are used to provide improved access at high volume driveways and minimize capacity reduction on collectors and arterials. Design geometrics are shown on Standard Plan 111.

Special driveways shall be used when the driveway peak hour volume exceeds 300 vehicles per hour and may be required at lower volume driveways at critical locations.

Depth of flow in the gutter is limited to 3 inches, see §3.502.

1.403 Width

Maximum driveway width shall be 35 feet for standard driveways and 56 feet for special driveways unless specifically approved otherwise by the City Engineer for high truck volumes or other factors.

The total width of commercial and industrial driveways shall not exceed 60% of the frontage.

The minimum width of a single driveway shall be 12 feet and 24 feet for a driveway serving a parking lot with a two-way aisle. Additional driveway width may be required on collectors and arterial streets particularly where there is no parking and a travel lane is adjacent to the curb.

Standard driveway width is measured at the curb line and includes only the depressed section. Special driveway width is measured between curbs behind the property side. Width of a raised medians separating in and out traffic is not included in the width.

1.404 Distances from Curb Returns

Commercial, industrial or other high volume driveways on arterials and major collectors shall be located as far as practical from the nearest curb return and may be prohibited within 100 feet where the intersection is signalized, is planned for signalization, or intersection capacity is critical. At other locations, the top of the driveway transition shall be at least 10 feet from the nearest curb return provided the return meets current standards for radius and location. At streets to be widened or improved, the above distances shall be measured from the ultimate location of the curb return.

At alleys the driveway transition shall be permitted no closer than 10 feet from the projected intersecting alley curb face, and no closer than 2 feet from the nearest alley curb return.

1.405 Distances From Utility or Safety Devices

Driveway transitions shall clear all public facilities such as street light and traffic signal standards, utility poles, fire hydrants, and street trees by a minimum of 3 feet. Greater distances from fire hydrants is recommended. Any relocation of public facilities required to maintain such clearance shall be at the expense of the party requesting the driveway.

1.406 Distance Between Driveways

A minimum of 4 feet of full curb height shall be maintained between the top of transitions of adjoining driveways. No driveway shall be constructed which results in a curb length between transitions in excess of 14 feet, unless the curb length is at least 22 feet in length. Where practical, the total space between driveway transitions shall be in multiples of 22 feet plus 4 feet. (Spacing = $22X + 4$)

1.407 Distances From Property Line

A minimum of 2 feet of full curb height shall be maintained between the property line and the top of the driveway transition except where common use driveways have been permitted.

1.408 Removal

Any abandoned driveway shall be completely removed and replaced with standard curb, gutter and sidewalk. Driveways are considered abandoned when on-site development, fencing or other use demonstrates that the driveway is no longer needed.

1.409 Parking Lot Driveways

Parking lot driveways shall be designed in such a manner as to preclude the use of the abutting public street for vehicular circulation solely related to the parking lot. The driveway shall be commercial type per Standard Plan 114. Design of the lot shall conform to Standard Plan 134.

1.410 Driveway Slope

Driveways shall be designed to minimize vehicles scraping the pavement in front of the driveway or high-centering at the back of the driveway.

In new work, the driveway grade measured at a point 10 feet behind the flowline shall not exceed 0.75 feet above the flowline.

In designing overlays or driveway replacements, the deflection angle at the flowline determined by a point on the pavement 4 feet out from the flowline and a point on the driveway 10 feet behind the flowline should not exceed 9.75°.

1.500 Curb, Gutter and Sidewalk

1.501 General Requirements

Curb, gutter and sidewalk shall be installed in all new developments unless specifically deferred or otherwise waived. Curb and gutter may be required to be extended across adjacent parcels for drainage purposes. New ditches or swales are not permitted across residential frontages.

1.502 Curb and Gutter Type

Curb and gutter with a vertical "barrier" type curb shall be installed along frontages conforming to any of the following criteria:

- Collector, arterial or higher classification streets;
- Multi-family residential frontage;
- Commercial or industrial frontage;
- School, church, park or other public use frontage;
- Any curb where the street centerline radius is less than 200 feet unless specifically determined otherwise by the City Engineer;
- All curb returns;
- Installations where driveways are existing or known as part of an approved development plan unless specifically determined otherwise by the City Engineer;
- Other areas designated by the Planning Commission or City Council.

Roll "mountable" type curb and gutter per Standard Plan 136 may be installed on streets within new single-family developments. Valley gutters (Standard Plan 116) will be allowed only at intersections of cul-de-sac streets which provide access to fewer than 10 lots.

Various designs of curb and gutter have been used in the City. For minor repairs of existing improvements, the type of curb and gutter shall match existing. In replacing curb returns or over ½ of a block face, vertical or rolled curb & gutter per Standard Plan 135 & 136 shall be used as appropriate. Existing curb & gutter should be considered for replacement where ponding extends into the pavement. In replacement projects, curb height may be varied from 4" to 7" to match existing improvements.

Four foot transitions with weakened plane joints at each end shall be used to separate different curb & gutter types.

1.503 Sidewalk

The minimum widths of sidewalk shall be 4.5 feet in residential streets, 4 feet in local industrial streets, 7.5 feet in commercial areas, or as noted on the Specific Plan. The above widths do not include the curb width.

Widths shall be increased by at least one foot where fences, walls or other similar clearance obstacles to pedestrians are constructed.

At poles, trees and other small structures, the minimum clear width provided shall be four feet. Upon specific approval of the City Engineer, the minimum width may be reduced to three feet (legal min.) in extreme cases. The "obstacle course" effect of closely spaced poles and other street hardware on opposite sides of the sidewalk shall be avoided.

New poles or other devices placed in the sidewalk on the curb side shall have a minimum distance from the face of curb of one foot.

Back of walk transitions necessary to accomplish the above clearances shall have smooth reversing curves or angle points with deflection angles not exceeding 30 degrees.

1.504 Wheelchair Ramps

Wheelchair ramps shall be installed in all new curb returns per Standard Plan 132 (legal min.). Ramps may also be required at "T" intersections or knuckles at a lot line on the side opposite the curb return.

Wheelchair ramps shall be retrofit at curb returns where the adjacent street pavement is being reconstructed or new buildings are being constructed on corner lots.

Handicapped access shall be included at appropriate locations in medians, parking lots and other improvements (legal min.).

1.505 Back of Sidewalk

Improvement of the space between the back of sidewalk and the right-of-way (normally 2½ ft.) shall be consistent with the proposed land use and minimal City maintenance. Where this space is incorporated into on-site landscaping, maintenance is the responsibility of the owner/developer.

At reverse frontage fences, the space shall be filled with additional sidewalk or approved hardscaping except where approved otherwise in the development plan.

1.600 Structural Section

The structural section shall be asphalt concrete (AC) pavement with aggregate base designed in accordance with the procedures contained in the "Flexible Pavement Structural Section Design Guide for California Cities and Counties" and these Standards. Full depth asphalt concrete may be specified as an alternate. The City has a computer spreadsheet to make the necessary calculations which is available to consulting engineers. The calculation includes a variable safety factor applied to the AC on high volume streets.

The soils report shall be a guide for determining the limits of appropriate R-values for design of structural sections. The limits shall be approved by the City Engineer prior to design. The R value used in design shall not exceed 60. Upon approval of the City Engineer, the plans may be prepared based on

preliminary R-values with appropriate notes for timely retesting during construction for determination of final design values.

The Traffic Index shall be established by the City Engineer with a minimum of 2% trucks. The following table provides some minimum values and can be used as a guide in determining appropriate structural sections within a residential development.

<u>Street</u>	<u>Maximum ADT</u>	<u>T.I.</u>	<u>Minimum Section</u>	<u>Lowest R-Value*</u>
Minor Residential	200	4.0	0.20' AC/0.30' AB or 0.35' AC	30
Minor Residential	500	4.5	0.20' AC/0.30' AB or 0.35' AC	40
Standard Residential	1000	5.0	0.20' AC/0.30' AB or 0.35' AC	47
Standard Residential	2300	5.5	0.20' AC/0.30' AB or 0.35' AC	53
Standard Residential	4000	6.0	0.20' AC/0.30' AB or 0.35' AC	58
Minor Collector	4200	6.0	0.20' AC/0.30' AB or 0.35' AC	58
Minor Collector	8200	6.5	0.25' AC/0.30' AB or 0.40' AC	60
Minor Collector	10000	7.0	0.25' AC/0.35' AB or 0.40' AC	60

* "Lowest R-value" is the minimum value necessary to allow use of the minimum structural section.

Minimum subgrade compaction of native material shall be 8" @ 92% relative compaction (R.C.) for residential streets and 6" @ 95% R.C. (removed and replaced material), over 6" @ 90% R.C. compacted original ground on industrial, collector and arterial streets. Any fill or disturbed material below shall also be compacted to 90% R.C.

These Design Standards are to be conservatively applied to developments to provide pavement that will have at least a 20-year design life.

Upon approval, transitions and other temporary pavements may be designed for a shorter life.

New development may be required to remove and replace existing pavement as necessary to provide a high quality connection between existing and new improvements. Examples include:

- ravelled edges of existing pavement;
- additional pavement to meet cross slope standards;
- ends of streets being extended;
- flares at shoulders;
- transitions

The City may require that the developer install a reduced pavement section in anticipation of excessive street cuts for utility services to the lots. In such cases, the developer shall pay the City the difference in cost between the full section and the reduced section and the City will be responsible for the installation of the future additional pavement.

Trench structural sections shall be as shown on Standard Plan 506 unless approved otherwise and shown on the Improvement plans.

Pavement cuts may be prohibited in new or recently overlaid streets. In cases where such cuts are permitted, pavement "T" cuts or other special trench replacement sections may be required.

Design criteria and specifications for jacking or boring are not included in these Standards and are to be determined on a case-by-case basis.

Section 2 - Wastewater

2.100 General

2.101 Scope

These standards apply to all public wastewater facilities designed for installation within a public right-of-way or PUE in the City and are limited to sewer mains and laterals 15 inches or less in diameter. Standards and requirements for larger sizes will be determined by the City Engineer as needed. Except where specifically noted in these Standards or as required as part of project approval, all wastewater facilities installed on private property for private use and ownership shall be designed and constructed in accordance with the provisions of the Uniform Plumbing Code, as adopted by the City.

Wastewater lines shall be designed in accordance with acceptable engineering principles, California OSHA Standards (legal min.), and State of California Title 22 requirements (legal min.), and shall conform to City Standards. Storm water collection facilities shall not be connected to a wastewater line. Industrial waste sources may be connected or discharged into a wastewater line with approval of the City Engineer.

These Standards do **not** cover all the applicable City, State and Federal requirements for wastewater quality and monitoring. (See Lodi Municipal Code and the Water/Wastewater Superintendent for applicable requirements.)

2.102 Submittals

The requirements listed below are based on projects subject to the City's Growth Management Plan. Developers and design engineers of projects not subject to the Plan should consult with the City Engineer to determine applicable and appropriate timing of submittals.

Development Plan Stage (preliminary plan for entire parcel/development)

Development plan submittals shall include a map showing the proposed project, existing septic systems, wastewater mains in the vicinity of the project and new mains, 12" and larger proposed for the project.

A table showing land use categories and acreage and average and peak flows shall be provided. (average flow in mgd, peak flow in cfs)

Project Master Plan Stage (detailed plan for entire parcel/development)

Prior to preparation of improvement plans for the first construction phase of the project, a wastewater master plan for the entire project shall be submitted for approval by the City Engineer.

The preliminary design submittal shall include the following items:

- A plan, 1" = 100' scale, showing the proposed system, preliminary pipe sizes, tributary subareas, existing and future tributary areas outside the project limits, zoning, projected land use, and any features affecting the system.
- Design flows at major junction points including flows coming from outside the project limits. A calculation sheet is provided in the Appendix which may be reproduced by the consulting engineer.
- A description and preliminary sketches of any pump stations including: number and size of pumps, wetwell volume and operating levels, provisions for standby power or energy operations, and maintenance access.

- Where the design includes additional tributary areas outside the project as required by the City and the developer wishes to obtain reimbursement for oversized pipes, the Engineer shall submit additional calculations and design for the project only in order to estimate the reimbursable portion.

Improvement Plan Stage (specific improvement plans for portion being developed)

Improvement plans shall include the information listed in §5.200 and Appendix A-1.

2.200 Design Flow

Wastewater lines shall be designed on a peak flow basis. Design peak flows shall be estimated by applying the appropriate peaking factor to the average flow.

For analysis of existing lines or where existing land use is higher than the zoning, flow shall be calculated based on an average sewage flow of 100 gallons per capita per day with a population of 3.0 capita per single family dwelling unit and 2.0 capita per multiple family dwelling unit.

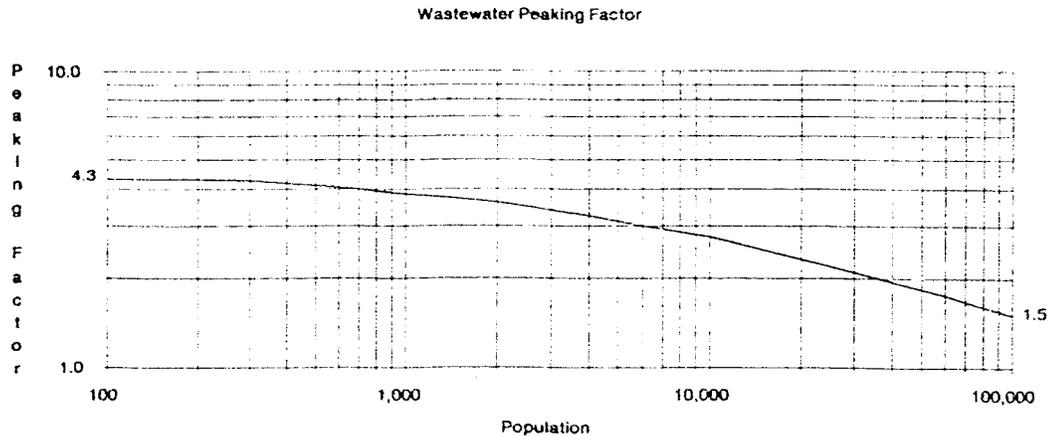
For lines serving new areas or where existing land use is lower than the zoning, the City zoning map and/or general plan shall be used to estimate average flow. The following table summarizes this criteria:

<u>Zoning</u>	<u>Land Use</u>	<u>Pers/unit</u>	<u>Units/acre</u>	<u>Pers/acre</u>	<u>Flow</u>
R-1	Residential	3.0	4	12	0.00186 cfs/acre
R-2	Residential	3.0	6	18	0.00279"
R-GA	Garden Apt.	2.0	20	40	0.00619"
R-MD	Medium Density Residential	2.0	30	60	0.00928"
R-HD	High Density Residential	2.0	40	80	0.01238"
PR	Planned Residential (unspecified)	2.6	7	18.2	0.00282"
PR/LD	Planned Residential (low density)	2.75	5	13.75	0.00213"
PR/MD	Planned Residential (medium density)	2.25	12	27	0.00418"
PR/HD	Planned Residential (high density)	2.00	24	48	0.00743"
			<u>gal./acre/day</u>		
xCx	Commercial		2500		0.00387"
Mxx	Industrial		2000		0.00309"
n/a	Institutional (Schools, etc.)				0.000039 cfs/attendant

The above values are average figures based on the assumptions shown. At locations where a specific use is proposed for which the flow would exceed these figures, the higher value shall be used.

Peak flow shall be obtained by multiplying the average flow by the following peak factors. These peak factors include an allowance for infiltration/inflow. The peak flow factor shall be 3.0 for commercial and institutional flows and 2.0 for industrial flow.

Peaking factors for residential flow shall be selected from the figure below based upon total upstream service population.



2.300 Pipe Design

2.301 Minimum Size

New gravity wastewater lines shall be 8 inches or greater in nominal diameter, except the most upstream manhole-to-manhole reach of a main sewer having no potential for further extension may be 6 inches in nominal diameter.

2.302 Design Depth of Flow

Main wastewater lines (8 through 10 inches in diameter) shall be designed to flow a maximum of one-half full at peak design flow. Trunk wastewater lines (12 inches and larger in diameter) shall be designed to flow a maximum of three-fourths full at peak design flow.

2.303 Slope

All sewers shall be designed to use the available slope to give peak flow velocities of not less than 2.0 feet per second based on Manning's formula using an "n" value of 0.013. Minimum slopes and the corresponding design capacity based on §2.302 and §2.303 are

Size	Minimum Slope (ft/ft)	Design Cap. (cfs)	Full Cap. (cfs)
6	0.0048	0.20	0.39
8	0.0033	0.35	0.70
10	0.0025	0.55	1.10
12	0.0019	1.45	1.56
15	0.0014	2.25	2.42

It is understood that it is impractical to meet these velocity standards at upstream ends of the collection system and they are waived in such cases. Designs in which downstream mains do not meet these velocity standards shall be specifically approved by the City Engineer.

Maximum velocity shall not exceed 10 feet per second at peak flow. Sewers shall be designed with uniform slope between manholes.

2.304 Vertical Alignment

The minimum cover for wastewater lines shall be 3 feet from the existing or planned final grade, whichever is lower, to the top of the sewer pipe. Laterals shall have a nominal cover of 2½ feet at the property line or at a point 5 feet outside the curb face or edge of paving, whichever is the greater distance from the roadway centerline. See §2.401 for additional information regarding service lateral cover and §5.701 for structural considerations.

When crossing a water main, the wastewater line shall be installed below the water main with a clearance of at least 12 inches. Where this separation cannot be maintained, the City Engineer may approve reduced clearances based on Standard Plan 415. A minimum vertical clearance of at least 3 inches shall be maintained between a wastewater line and a storm drain. Separation distances shall be measured from the nearest edges of the facilities.

At points of convergence of pipes of various sizes, the pipe crown of the inflowing pipe(s) shall be no lower in elevation than the crown of the outflowing pipe. See §2.502 regarding drop manholes for additional information.

2.305 Horizontal Alignment

Wastewater Lines shall be placed within street rights-of-way unless placement in an easement is specifically approved by the City Engineer. Alignment shall be parallel to the street centerline whenever possible.

The horizontal alignment of wastewater lines in new streets, easements and private streets shall be as shown on the appropriate City of Lodi Standard Plan. In existing streets and other special cases (such as looped streets in which the utilities may be located concentrically to avoid crossings), the alignment may vary from the Standard Plans, but in no case shall there be less than 10 feet horizontal clearance to a water main, except as specifically approved by the City Engineer in accordance with State Department of Health Services policies.

Curved sewers are allowed. However, joint deflections or pipe curvature shall not exceed the pipe manufacturer's recommendations. The following table may be used as a conservative guide. If a shorter radius is desired, the appropriate design information (i.e. short pipe lengths, radius fittings, etc.) shall be shown on the plans.

Minimum Radius of Bending Circle (ft.)

<u>Pipe Size</u>	<u>Ductile Iron</u>	<u>PVC</u>	<u>VCP</u>
4	190	160	200
6	190	160	200
8	190	210	200
10	190	270	200
12	190	320	200
15	n/a	390	260

Wastewater lines, including laterals, or other sanitary hazards shall not be constructed adjacent to any existing or proposed well site. California State Department of Health Services requirements shall be the minimum required separation, however these may be increased where the well location is not fixed or redrilling is planned.

2.306 Pipe Materials

The following standard pipe materials shall be used for gravity flow wastewater line construction and shall conform to the appropriate American Society of Testing and Materials (ASTM) and American Water Works Association (AWWA) specifications (latest revision):

<u>Pipe Material</u>	<u>Specification</u>
Ductile iron pipe	ASTM A746
w/polyethylene lining & polyethylene encasement*	ASTM D1248, Class C, 30 mil thickness
PVC sewer pipe and fittings	AWWA C105
Vitrified clay pipe	ASTM D3034 SDR 35
	ASTM C700 (extra strength)
laterals only:	
Cast iron soil pipe (4" & 6")	ASTM A74, service weight

* polyethylene encasement may be omitted if a corrosivity soils report provided per Appendix A of AWWA C105 indicates encasement is not needed. Alternate linings may be approved on a case-by-case basis.

New main sewers and/or laterals servicing exclusively industrial and commercial development may be limited to vitrified clay pipe depending on the proposed use.

Trench and pipe strength design shall be shown on the improvement plans per §5.700.

2.307 Joints and Fittings

Joints and fittings shall be selected and installed to minimize infiltration and to prevent the entrance of roots throughout the life of the system. Ductile iron pipe joints and fittings shall conform to AWWA C110 or other approved joint for wastewater applications. Joints for PVC pipe shall be flexible elastomeric type conforming to ASTM D3212. Solvent welded joints for PVC pipe are not permitted. Joints for vitrified clay pipe shall conform to ASTM C245.

Joining of pipe sections of unlike materials shall be accomplished using approved flexible band seals. Other joining methods shall not be used unless approved by the City Engineer.

2.400 Services

2.401 General

One service is allowed per parcel being served. Additional services may be specifically approved by the City Engineer in order to eliminate the need for on-site pumps or in other extreme circumstances.

The minimum diameter for services (lateral sewers) shall be 4 inches.

A lateral sewer installed concurrently with a main sewer shall be of the same type and class of pipe material as the sewer main except where land use, cover or water main separation requirements indicate otherwise. For new services on existing mains, the lateral sewer may be of any approved pipe material as specified in §2.306.

Size and depth of services is to be determined by the design engineer for the parcel being served subject to minimums contained in City Standards. Particular attention should be given to large, deep parcels. On-site lift stations may be necessary at upstream ends of mains, particularly on the east side of the City at the Central California Traction railroad.

2.402 Monitoring Structures

A monitoring structure or sampling manhole/riser shall be installed per City standards near the back of walk where required by the City Engineer. It shall be in a location accessible to City personnel at all times and may be considered as a cleanout in lieu of a separate required cleanout.

2.403 Traps and Waste Interceptors

Appropriate traps and waste interceptors shall be installed on services or on-site as determined by the City Engineer in conformance with the Lodi Municipal Code.

2.500 Manholes and Miscellaneous Structures

2.501 Manholes

Manholes shall be located in areas accessible to cleaning equipment and at:

- the end of each line;
- all changes in pipe grade, size, or alignment;
- all junctions of sewer mains and/or laterals 6 inches or greater in diameter;
- distances not greater than 500 feet in continuous paved areas.
- Where access to manholes is restricted, the pipe and accessible manholes shall be located such that there is a hose lay of no greater than 500 feet from an unrestricted access point to all portions of the sewer.

24" diameter risers may be used in lieu of standard 48" manholes where the depth to the invert is less than 42 inches.

Manholes/risers may be required for inspection purposes at the end of stubs exceeding 25 feet in length.

2.502 Drop Manholes

Drop manholes per Standard Plan 301 shall be provided where the inflowing pipe crown elevation is more than 2 feet above the crown elevation of the outflowing pipe.

2.600 Lift Stations

2.601 General

Lift stations shown on the Wastewater System Master Plan shall be designed per the following standards. Other lift stations shall be specifically approved by the City Engineer after consideration of all reasonable gravity flow alternatives. Design standards for temporary stations shall be determined on a case-by-case basis.

Lift station structures and electrical and mechanical equipment shall be located and designed such that they are protected from physical damage by the 100-year flood and will remain fully operational and accessible during the design storm.

The lift station shall be located off the travelled way of streets and alleys and shall be provided with paved vehicular access and appropriate security as required by the City Engineer.

2.602 Design

The lift stations shall be Ecodyne, Smith and Loveless Custom Series.

Impressed current cathodic protection is required and shall be designed by a qualified corrosion control engineer.

California OSHA standards shall be observed in the design of all pumping station access structures.

Pumps

At least two pumps shall be provided for each pumping station.

If only two units are provided, they shall have the same capacity. Each shall be capable of handling the peak flow. Where three or more units are provided, they shall be designed to fit actual flow conditions and must be of such capacity that with any one unit out of service, the remaining units will have capacity to handle maximum sewage flows.

Design pumping rate shall be the peak inflow for the ultimate tributary area. For Master Plan Stations, initial lower flow rates shall be considered in the design. It may be appropriate to provide an interim design with fewer or smaller capacity pumps. However, the station and site should be designed for ultimate conditions.

Wetwells

The wetwell size and control setting shall be appropriate to avoid heat buildup in the pump motor due to frequent starting and to avoid septic conditions due to excessive detention time. Total pump starts shall be limited to no more than 10 per hour.

Wetwells shall be reinforced concrete with coal tar epoxy lining (Tnemec Hi-Build Tneme-Tar 46H-413, two coats; or approved equivalent).

The wetwell floor shall have a minimum slope of 1 to 1 to a hopper bottom. The horizontal area of the hopper bottom shall not be greater than necessary for proper installation and function of the pump inlet.

Ancillary Equipment

Ancillary equipment such as air release or other valve pits shall be provided as necessary including adequate ventilation and corrosion protection.

Electrical Equipment

All wetwell electrical equipment shall be explosion proof and meet National Electrical Code Class 1, Division 2, Group D requirements. All drywell electrical equipment shall be NEMA 4.

Telemetry equipment identical to the City's latest SCADA equipment shall be provided. Alarms shall be activated in cases of high water, power failure, pump failure, use of the lag pump, unauthorized entry, or any cause of pump station malfunction.

Standby Power

Pump stations of greater than 0.25 mgd peak flow capacity (which include those shown on the Master Wastewater Collection System Plan) shall include permanent installation of standby power. Engines shall be provided with silencing equipment appropriate for the adjacent land use per zoning and General Plan standards.

Smaller capacity stations, where approved, shall either provide standby power or dual, manually switchable electrical feeds from separate transformers.

Water supply

Potable water supply with a reduced pressure backflow prevention device (Febco Model 825) is required for all pump stations.

Instructions and Equipment

Three complete sets of operational instructions (including emergency procedures and maintenance schedules), special tools, and such spare parts (i.e., mechanical seals, wear rings, filters, etc.) as may be necessary shall be provided for all pump station equipment.

2.603 Force Mains

At average pump flow, a velocity of at least 2 feet per second shall be maintained.

An automatic air relief valve shall be placed at high points in the force main to prevent air locking.

Force mains shall enter the gravity sewer system at a point not more than 1 foot above the flow line of the receiving manhole.

Cleanouts and other special fittings shall be provided as required by the City Engineer.

The force main and fittings, including thrust blocking, shall be designed to withstand normal pressure and pressure surges (water hammer).

The following standard pipe materials shall be used for force-main construction and shall conform to the applicable ASTM or AWWA specification (latest revision).

<u>Pipe Material</u>	<u>Specification</u>
Ductile iron pipe	AWWA C151
w/polyethylene lining & polyethylene encasement*	ASTM D1248, Class C, 30 mil thickness
PVC Plastic Pipe	AWWA C105
	AWWA C900

*polyethylene encasement may be omitted if a corrosivity soils report provided per Appendix A of AWWA C105 indicates encasement is not needed. Alternate linings may be approved on a case-by-case basis.

Pipe strength (Class) shall be determined by accepted engineering principles and the pipe specification based on the design pressure.

Trench design shall be shown on the plans per §5.700.

Friction losses through force mains shall be based on the Hazen and Williams' formula with a value for "C" equal to 120.

Separation from Water Mains

Force main separation from water mains shall conform to applicable State Dept. of Health Services regulations (legal min.), City Standards and appropriate construction details shall be shown on the plans.

Section 3 - Storm Drainage

3.100 General

3.101 Scope

These standards apply to all public stormwater facilities designed for installation within a public right-of-way or PUE in the City. Except where specifically noted in these Standards or as required as part of project approval, all stormwater facilities installed on private property for private use and ownership shall be designed and constructed in accordance with the provisions of the Uniform Plumbing Code, as adopted by the City.

Stormwater lines shall be designed in accordance with acceptable engineering principles and California OSHA Standards (legal min.), and shall conform to City Standards. Storm water collection facilities shall not be connected to a wastewater line except where specifically required by the City Engineer. Industrial waste sources shall not be connected or discharged into a stormwater line without a specific discharge permit.

These Standards do not cover all the applicable City, State and Federal requirements for storm quality and monitoring. (See §5.603 for additional discussion.)

3.102 Submittals

The requirements listed below are based on projects subject to the City's Growth Management Plan. Developers and design engineers of projects not subject to the Plan should consult with the City Engineer to determine applicable and appropriate timing of submittals.

Development Plan Stage (preliminary plan for entire parcel/development)

Development plan submittals shall include a map showing the proposed project, existing storm drains in the vicinity of the project and new storm drains, 30" and larger proposed for the project.

A table showing land use categories and acreage, C-factors and 100 year storm volume (in acre-feet) shall be provided.

Project Master Plan Stage (detailed plan for entire parcel/development)

Prior to preparation of improvement plans for the first phase, a storm drain master plan for the entire project shall be provided for approval by the City Engineer.

The preliminary design submittal shall include the following items:

- A plan, 1" = 100' scale, showing the proposed system, preliminary pipe sizes, tributary subareas, existing and future tributary areas outside the project limits, zoning, projected land use, and any features affecting the system.
- Hydrology and hydraulic calculations together with assumptions, charts, tables, references and methods used. A calculation sheet is provided in the Appendix which may be reproduced by the consulting engineer.
- A plan, preferably 1" = 100' scale, showing proposed street system, existing and proposed drainage system, tributary sub-areas (including offsite drainage), and peak flow in all pipes.
- A plan showing the hydraulic grade line (HGL), the proposed storm drain including slopes and sizes and top of curb in profile. Elevations should be shown at all changes in slope of the HGL, proposed storm drain and top of curb.
- Where the design includes additional tributary areas outside the project as required by the City and the developer wishes to obtain reimbursement for oversize pipes, the Engineer shall submit additional calculations and design for the project only in order to estimate the reimbursable portion.

Improvement Plan Stage (specific improvement plans for portion being developed)

Improvement plans shall include the information listed in §5.200 and Appendix A-1.

3.200 Design Flow

The Rational Method ($Q = CiA$) shall be used to determine runoff flow (Q) for areas less than 160 acres. Larger areas require special consideration and should be discussed with the City Engineer prior to design.

Minimum values for the coefficient of runoff (C) and time of concentration are as follows:

<u>Land Use</u>	<u>C Factor</u>	<u>T_c (minutes)</u>
Parks	0.20	30
R-1 and R-2 (Residential)	0.40	25
R-GA, R-MD and R-HD (Apartments)	0.50	20
Schools and Churches	0.50	20
Commercial	0.80	10
Industrial	0.90	10
<u>Surface</u>		
Pavement	0.95	
Roofs	0.80	
Compacted earth (no gravel)	0.75	
Lawn & Open Area	0.20	

Where a specific project is proposed, a composite C factor may be determined based on a weighted average of the surface C factors.

Values for rainfall intensity (i) for corresponding time of concentration shall be taken from Standard Plan 606 or computed from the formula shown.

The area (A) shall be the tributary drainage area in acres.

Preliminary estimates of detention volume (V) for development plan submittals shall be calculated based on V (acre-feet) = $0.4CA$. (0.4 feet of rain = 100 yr, 48 hr. storm)

3.300 Pipe Design

3.301 Minimum Size

The minimum size for storm drain mains shall be 12-inch diameter.

All new catch basin laterals shall have a minimum diameter of 12 inches, except where an on-site service is connected to the catch basin. In such cases, the lateral shall be one size larger than the service.

3.302 Design Depth of Flow (Hydraulic Grade Line)

Manning's formula shall be used to calculate design flow, slope, velocity and pipe diameter relationships. The friction factor, "n", shall be 0.013 for all types of pipe.

Normally, due to the hydraulic grade line determined by the trunk line or downstream basin, storm drains are surcharged.

The starting hydraulic grade line and assumed flow will be provided by the City at the downstream master plan line or intervening system if calculations are available. If the proposed project's flow is 5% or more above the assumed flow, the new calculations shall be extended downstream until the difference is less than 5% or a basin or pump station is reached.

All storm drains shall be designed for the peak flow entering the catch basin at the point of concentration and shall have a minimum of 1 foot of freeboard between the top of curb and the hydraulic grade line.

Note: The design does not need to check each catch basin. Flows may be calculated at manholes. However, the following catch basins are to be checked:

- the most upstream catch basin;
- the lowest catch basin;
- catch basins with on-site services;
- other potentially critical catch basins as designated by the City Engineer.

3.303 Slope

Storm drains shall have minimum slopes per the following table:

<u>Size (in.)</u>	<u>Minimum Slope (ft/ft)</u>
12	0.0019
15	0.0014
18	0.0011
21	0.0009
24	0.00075
30	0.00055
36	0.00044
42	0.00035
48+	0.00030

The above slopes are intended to provide a velocity of 2.0 feet per second when flowing half full regardless of the slope of the hydraulic grade line. (In the City's surcharged system, velocities based on the design hydraulic grade line are well below 2 feet per second except in trunk lines.)

Pipes with lower velocities shall use available fall and shall be specifically approved by the City Engineer.

Maximum velocity shall not exceed 10 feet per second.

Storm drains shall be designed with uniform slope between manholes.

Siphons are not be permitted (See §3.501 regarding separation manholes).

Catch basin laterals shall have a minimum fall of 0.10 foot between the catch basin and manhole. Desirable fall is 0.30 foot or more.

3.304 Vertical Alignment

The minimum cover on main line storm drains shall be 2 feet in residential streets and 2½ feet in all other streets. See §5.701 for structural considerations.

A minimum vertical clearance of 3 inches shall be maintained between a wastewater lines and other underground utilities. Clearances to water mains shall be the same as that for wastewater lines. (§2.304; Standard Plan 415)

In general, at points of convergence of pipes of various sizes, the top of pipe elevations shall match, or, when approved by the City Engineer, the maximum difference in flow lines shall be less than 4 feet. This does not apply to catch basin laterals.

3.305 Horizontal Alignment

Horizontal alignment of storm drains shall be per the applicable requirements for wastewater lines (§2.305; Standard Plan 415).

Required clearances to water mains shall be the same as wastewater lines.

Curved storm drains are allowed. However, joint deflections or pipe curvature shall not exceed the pipe manufacturer's recommendations. The following table may be used as a conservative guide. If a shorter radius is desired, the appropriate design information (i.e. short pipe lengths, radius fittings, etc.) shall be shown on the plans.

Minimum Radius of Bending Circle (ft.)

<u>Pipe Size</u>	<u>Ductile Iron</u>	<u>PVC</u>	<u>VCP</u>	<u>Conc.*</u>
12	190	320	200	200
15	n/a	390	260	240
18	n/a	n/a	n/a	290
21	n/a	n/a	n/a	340
24	n/a	n/a	n/a	390
27	n/a	n/a	n/a	440
30	n/a	n/a	n/a	480

* Concrete pipe figures assume 6 ft pipe length and 3/8" joint pull; plans should indicate required dimensions and require manufacturer's certification.

3.306 Pipe Materials

The following standard pipe materials shall be used for storm drain construction and shall conform to the appropriate American Society of Testing and Materials (ASTM) and American Water Works Association (AWWA) specifications (latest revision):

<u>Pipe Material</u>	<u>Specification</u>
Concrete pipe	ASTM C14
Ductile iron pipe	ASTM A746
w/cement lining & polyethylene encasement*	AWWA C104, std. thickness
PVC sewer pipe and fittings**	AWWA C105
Reinforced concrete pipe	ASTM D3034 SDR 35
Vitrified clay pipe	ASTM C76
	ASTM C700 (extra strength)

* polyethylene encasement may be omitted if a corrosivity soils report provided per Appendix A of AWWA C105 indicates encasement is not needed.

** PVC pipe is not allowed as a main in commercial and industrial areas or in arterial streets.

Cast-in-place concrete pipe, 30 inches and larger, may be used when specifically approved by the City Engineer. Cast-in-place pipe will not normally be permitted in existing streets.

Easement lines shall pass the same leakage tests as wastewater lines.

Trench and pipe strength design shall be shown on the plans per §5.700.

3.307 Pipe Joints

Storm drain joints shall be designed and installed to minimize infiltration and to prevent the entrance of roots throughout the life of the system.

Joints for concrete pipe shall be rubber gasketed joints per ASTM C443. Mortar joints shall be used only when specifically approved by the City Engineer.

Joints for vitrified clay pipe shall conform to ASTM C245. Joints for PVC pipe shall be flexible elastomeric type conforming to ASTM D3212.

Joining of pipe sections of unlike materials shall be accomplished using approved flexible band seals. Other joining methods shall not be used unless approved by the City Engineer.

3.400 Services

3.401 General

In general, only one storm drain service is to be provided per parcel served. Additional services may be approved by the City Engineer depending on the on-site layout, available mains and land use/monitoring requirements.

Storm drain services are provided to improve public health and safety and minimize inconvenience created by on-site drainage running over the sidewalk and in the gutter. Services carrying process, wash or other wastewater shall be specifically approved by the City Engineer in conformance with the Lodi Municipal Code.

Parcels over 1 acre (net) shall have an on-site collection system connected to the public system.

Industrial and commercial parcels under 1 acre shall utilize on-site drains or thru-the-curb drains to minimize drainage over the sidewalk.

It is recommended that roof drains of large buildings (carrying only drainage) be pipe thru-the-curb or connected to an underground system at the property line downstream of any required monitoring device or trap.

Underground services shall connect to the public system at a manhole or catch basin. A direct tie may be approved where a suitable on-site access structure is provided and the criteria per §3.501 are met.

3.402 On-site Design Requirements

For industrial land use and commercial uses involving potential water quality hazards (including, but not limited to: automotive service, gas stations, and car washes) the following requirements shall apply:

- All storm drainage shall be picked up in an on-site drainage system, unless approved otherwise.
- The on-site drainage system shall be tied to the City's storm drain system, either at the back of a City catch basin or at a storm drain manhole on the City's system.
- An approved sand and oil trap shall be constructed on new storm drain discharge lines. The City may also require a sand and oil trap on existing storm drain discharge lines or through-the-curb drains.
- All sand and oil traps shall be readily accessible and on the street side of all fences and gates and not in the sidewalk area.

- No storm drainage will be allowed to flow over the curb, gutter, and sidewalk into the street. Roof drainage may be tied directly to a "through-the-curb drain" per Standard Plan 129. Exceptions are driveway approaches and landscaped areas adjacent to sidewalks.
- With approval from the City Engineer, smaller industrial parcels may be allowed to drain through the curb face. This approval shall depend upon existing street conditions, the location of City storm drain facilities, and the size and use of the parcel. On-site drainage must still flow through a sand and oil trap.

Also, see §5.603 regarding erosion control.

3.500 Manholes and Miscellaneous Structures

3.501 Manholes

Manholes shall be placed at the intersections of all storm drains including laterals, at all locations where there is a change in size, change in horizontal or vertical alignment and at the ends of all permanent lines.

Manhole spacing shall conform to the following limits:

<u>Diameter</u>	<u>Maximum Spacing</u>
12" to 30"	500 feet
33" to 54"	750 feet
60" and over	1000 feet

Manholes will not be required at laterals where all the following conditions are met:

- maximum size of catch basin lateral is 15 inches, and;
- the main storm drain has a diameter of 48 inches or larger, and;
- the maximum top of curb to invert depth at the catch basin is 4 feet, and;
- no other existing or future manhole is within 100 feet along the main storm drain centerline, and;
- connection is made in conformance with Standard Plan 305.

24" diameter risers may be used in lieu of standard 48" manholes where the depth to the invert is less than 42 inches. Where the main is over 42 inches in diameter or where large pipes intersect such that a standard 48" manhole is not practical, a special design, usually using standard, prefabricated sections, shall be shown on the plans. On cast-in-place pipe, saddle manholes per Standard Plan 302 may be used.

Manholes/risers may be required for inspection purposes at the end of stubs exceeding 50 feet in length.

Special "separation" manholes may be designed where wastewater and storm lines intersect due to grade restrictions. Criteria and details are to be approved by the City Engineer on a case-by-case basis.

3.502 Catch Basins

Side inlet catch basins (SICB) shall be located at all gutter low points and shall be spaced in such a manner that design storm flows will not encroach into the travel lanes or exceed the curb height. In addition, at special driveways the depth of flow shall not exceed 3 inches. Standard Plan 608 provides a Hydraulic Street Capacity Chart for use in determining whether the design flows encroach into the travel lanes.

The total gutter run contributing to any catch basin shall not exceed 1,000 feet. It is desirable to locate catch basins on the BCR or ECR which will intercept the most runoff and also keep the main pedestrian crossing as dry as possible.

Drop inlet catch basins may be constructed only in alleys, parking lots or as temporary installations on unimproved streets where curb and gutter has not yet been installed. In gutters where a new driveway is being installed that conflicts with an existing side inlet catch basin, upon approval of the City Engineer, a drop inlet catch basin may be installed as a junction box and the SICB must be relocated.

3.600 Pump Stations

The only pump stations permitted are those included in the Master Storm Drain system and private, on-site stations serving single parcels.

Master Storm Drain system stations shall be custom designed for the particular project.

Private systems shall be designed according to the applicable Building, Plumbing, Mechanical and Electrical Codes adopted by the City.

3.700 Detention Basins

3.701 General Requirements

The Master Storm Drain system is based on the use of large, publicly owned and maintained detention basins in order to meet discharge flow limitations to downstream facilities or receiving waters. Privately owned and maintained drainage basins are prohibited except in the following circumstances:

- temporary facilities approved by the City Council, in which the design is planned for ultimate connection to the City system;
- permanent facilities specifically approved by the City Council;
- facilities in existence at the time of annexation until the property is developed or otherwise improved and falls under City development requirements.

3.702 Temporary Basins

Basins Serving Single Parcels

If approved, temporary basins on private property to serve single, one-ownership parcels shall be designed with the following criteria:

- A 48-hour, 10-year storm, total rainfall of 3.3 inches shall be used if a reasonable outlet is provided. If no disposal other than evaporation, percolation or irrigation is provided, a 48-hour, 100-year storm, total rainfall of 4.8 inches, shall be used.
- The maximum water surface of the basin shall be 1 foot below the elevation of the top of curb at the lowest catch basin inlet within the tributary area and a maximum of 1 foot above the design hydraulic grade line at the basin.
- Fencing shall be provided around all basins greater than 3 feet in depth.
- Adequate all-weather access shall be provided.
- The tributary drainage system shall be designed to connect to the City's future storm drainage system.
- Any additional requirements placed as a condition of approval shall be incorporated into the design.

Basins Serving Multiple Parcels

For temporary basins serving multiple parcels, the following criteria should be considered in its design. The final design shall be as approved by the City Engineer in accordance with City Council requirements of approval.

- The area cannot be reasonably served by a public storm drainage system.
- The Developer shall pay the City for maintaining and operating the storm water drainage system and appurtenances.
- The basin may be deeded to the City as long as the area is used as a ponding basin. When the City of Lodi storm drain system is expanded to serve the area, the parcel of land reverts back to the developer's ownership and shall be restored back to original condition by the owner.
- A minimum 10-foot wide access road shall be provided around the basin.
- The maximum side slope shall be 6:1.
- Six-foot chain link fencing with redwood lath filler shall be provided around the basin with double 8-foot vehicle gates and one 3-foot personnel gate.
- The basin shall store a 10-year, 48-hour storm (3.3 inches) for the service area.
- Facilities shall be provided to enable the basin to be pumped or drained into a public permanent system within a 48-hour period. The pump station shall have 50% standby and a minimum of 2 pumps.
- The maximum design water surface of the basin shall be a minimum of 1 foot below the elevation at the top of curb of the lowest catch basin inlet within the tributary area and a maximum of 1 foot above the design hydraulic grade line at the basin.
- The tributary drainage system shall be designed to connect to the City's future storm drainage system.

3.703 Permanent Basins

Permanent basins, including fencing and other details, shall be specifically designed to the site, using the above criteria for basins serving multiple parcels except that a 48-hour, 100-year storm, 4.8 inches total rainfall, shall be used. The design shall be compatible with the Storm Drain Master Plan. The following table summarizes hydraulic design criteria for the basins:

<u>Drainage Area/Basin</u>	<u>Elevation of:</u>	
	<u>Maximum Water Surface</u>	<u>Design Hydraulic Grade Line</u>
A-1 Kofu Park	37.0	36.0
A-2 Beckman Park	33.0	32.0
B-1 Vinewood Park	35.0	34.0
B-2 Graves Park	36.0	35.0
C Pixley Park	47.0	46.0
D Salas Park	39.2	38.2
E Westgate Park	34.5	33.5
F (future)	27.0	26.0
G DeBenedetti Park	27.0	26.0
H (drains to Mokelumne River, see below)		
I (future)	23.0	22.0

Existing outfalls for areas tributary to the Mokelumne River have been designed under various standards. Recently installed outfalls have been designed on the basis of a River hydraulic grade line one foot below the 100 year flood elevation. However, since the design and installation of these outfalls, newer FEMA flood studies have raised this flood elevation. Since no new outfalls are contemplated under the Storm Drain Master Plan, new standards have not been developed. Hydraulic design criteria for new storm drains lines in the H area shall be determined on a case by case basis by the City Engineer.

SECTION 4 - Water

4.100 General

4.101 Scope

These standards apply to all public water facilities designed for installation within a public right-of-way or PUE in the City and are limited to mains and services 12 inches or less in diameter. Standards and requirements for larger sizes will be determined by the City Engineer as needed. In residential developments, on-site mains and hydrants for fire protection shall be public. Other on-site facilities, unless specifically noted in these Standards or as required as part of project approval, shall be private and shall be designed and constructed in accordance with the provisions of the Uniform Plumbing Code, as adopted by the City. (See §4.401 re services)

Water lines shall be designed in accordance with acceptable engineering principles, California OSHA Standards (legal min.), and California Department of Health Services Regulations, Title 22, Chapter 16, California Waterworks Standards (legal min.), and shall conform to City Standards.

4.102 Submittals

The requirements listed below are based on projects subject to the City's Growth Management Plan. Developers and design engineers of projects not subject to the Plan should consult with the City Engineer to determine applicable and appropriate timing of submittals.

Development Plan Stage (preliminary plan for entire parcel/development)

Development plan submittals shall include a map showing the proposed project, existing wells, existing water mains in the vicinity of the project and new mains, 10" and larger proposed for the project.

A table showing land use categories and acreage, average and peak hour flows and maximum day plus estimated fire flow shall be provided. (all flows in gpm, except average in mgd)

Project Master Plan Stage (detailed plan for entire parcel/development)

Prior to preparation of improvement plans for the first phase, a water master plan for the entire project shall be submitted for approval by the City Engineer. The plan shall show size and location of all proposed mains.

Flow and pressure calculations are required for commercial, industrial and medium and high density residential developments. Calculations will not normally be required for low density residential developments unless there is a question regarding the need for looping.

Where the design required by the City includes capacity above that needed to serve the development **and** the developer wishes to obtain reimbursement for oversize pipes, the Engineer shall submit calculations and design for the project only in order to estimate the reimbursable portion.

Improvement Plan Stage (specific improvement plans for portion being developed)

Improvement plans shall include the information listed in §5.200 and Appendix A-1.

See §5.200 regarding timing of well abandonments and improvement plan approval.

4.200 Design Flow

Unless City of Lodi metered information or data from other agencies is provided or required, the following water demands shall be used:

<u>Land Use</u>	<u>Unit Demand</u>	<u>Peaking Factors</u>	
		<u>Max. Day</u>	<u>Max. Hour</u>
Residential	285 gpcd	2.24	3.28
Commercial/Office	2750 gpad	2.24	3.28
Industrial	2200 gpad	2.24	3.28

gpcd = gallons per capita per day
 gpad = gallons per acre per day

Per capita and density figures per §2.200 shall be used unless specific project information is available.

Fire flow for specific projects shall be as provided by the Fire Marshal. For preliminary studies, the highest applicable case of the following fire flow shall be used:

<u>Land Use</u>	<u>Fire Flow</u>
Low Density Residential	2000 gpm
Medium & High Density Residential	3000 gpm
Commercial & Industrial	4000 gpm

4.300 Pipe Design

4.301 Minimum Size

The minimum size pipe used for new water mains shall be per the following table:

<u>Location/adjacent land use</u>	<u>Size (inches)</u>
As shown in Water Master Plan	10, 12 as indicated
Commercial & Industrial	8
School, other Public Use	8
High Density Residential	8
Low & Medium Density Residential	6
Unsupported looped length exceeding 800 ft.	8
Residential dead-end with <u>no</u> fire hydrant	4

Larger sizes may be required based on required fire flow or service demand.

Permanent dead-end runs shall be no longer than 250 feet unless specifically approved by the City Engineer. Eight-inch mains shall be used on dead-end runs which serve fire hydrants.

Reasonable looping of water mains will be required; the maximum unsupported length of a main is 1300 ft..

The following table may be used as a guide for maximum length (ft.) of dead-end mains:

<u>Pipe Diameter</u>	<u>Required Fire Flow (gpm)</u>		
	<u>2000</u>	<u>3000</u>	<u>5000</u>
6" lateral	100	N/A	N/A
8"	600	275	N/A
10"	1800	850	325
12"	5000	2400	900

4.302 Design Pressure

The system shall be designed to maintain a minimum residual pressure of 20 psi at the service point or fire hydrant under the worst case of either:

- maximum day flows plus fire flow, or;
- peak hour flow.

Calculations for individual developments may assume 4000 gpm at 45 psi is available at the point of connection to an 8" or larger, looped line. Other circumstances will require a special determination by the City Engineer.

The Hazen-Williams formula should be used to calculate design flow, pressure loss, velocity and pipe diameter relationships. The coefficient of friction, "C", shall be 110 for pipes 6" and smaller, 120 for 8" and 10", and 130 for 12" and larger pipes unless loss at fittings is calculated separately using equivalent length or other approved methods. In such cases, a "C" of 130 may be used.

4.303 Slope

There are no slope requirements for water mains. However, inverts and pipe slopes shall be shown on the profile plans as required in the Appendix.

All high points within the system shall be located at fire hydrants or permanent blow-offs.

4.304 Vertical Alignment

The minimum cover on water mains shall be 3 feet. Water main depth should be kept below 5 ± feet.

When crossing a wastewater or storm line, it is desirable that the water main be installed above with a clearance of 12 inches. The minimum vertical clearance per Standard Plan 415 shall be maintained.

4.305 Horizontal Alignment

Water mains shall be installed within street rights of way unless an easement installation is specifically approved by the City Engineer. Alignment shall be parallel to the street centerline wherever possible.

Parallel lines on each side of the street may be required on major arterials or other locations where crossings are determined inappropriate by the City Engineer.

The horizontal alignment of water lines in new streets, easements and private streets shall be as shown on the appropriate City of Lodi Standard Plan. In existing streets and other special cases (such as looped streets in which the utilities may be located concentrically to avoid crossings), the alignment may vary from the Standard Plans, but in no case shall there be less than 10 feet horizontal clearance to a wastewater, storm or industrial waste line, except as specifically approved by the City Engineer in accordance with State Department of Health Services policies.

When limited right-of-way or other controls are present reduced clearances per Standard Plan 415 may be approved by the City Engineer.

Curved water mains are allowed however, joint deflections or pipe curvature shall not exceed the pipe manufacturer's recommendations. The table in §2.305 may be used as a conservative guide. If a shorter radius is desired, the appropriate design information (i.e. short pipe lengths, radius fittings, etc.) shall be shown on the plans.

4.306 Pipe

The following standard pipe materials shall be used for water main construction and shall conform to the appropriate American Water Works Association standards (latest revision):

<u>Pipe Material</u>	<u>Standard</u>
Asbestos-Cement	AWWA C400, Class 150 minimum
Ductile Iron	AWWA C151
w/cement mortar lining & seal (std. thickness)	AWWA C104
polyethylene encasement*	AWWA C105
PVC (iron pipe O.D.)**	AWWA C900, DR 18 (Class 150) minimum

* polyethylene encasement may be omitted if a corrosivity soils report provided per Appendix A of AWWA C105 indicates encasement is not needed.

** PVC mains are not allowed in industrial and commercial areas if fire services are not installed at the time of main installation due to problems with hot-tapping installed mains. It is recommended that 8" combination hydrant/fire service taps be installed with the mains due to Fire Code requirements for sprinklers on commercial and industrial buildings.

Trench and pipe strength design shall be shown on the plans per §5.700.

4.307 Joints

Joints in water mains shall match the type of pipe being used, except:

- Solvent welded PVC is not allowed;
- Mechanical joints are only allowed at fittings;
- Cast-iron repair/adaptor couplings may be used where approved by the City Engineer.

4.400 Services

4.401 General

One service is allowed per parcel being served with the following general exceptions as specifically approved by the City Engineer:

- in residential developments with on-site public mains, one standard service per dwelling unit may be provided;
- in large parcels with separate buildings, one standard service per building may be provided (individual shut-offs per unit are required)

Due to the variety of building and main configurations and backflow requirements, the above requirements/exceptions are not specific. Details of each project shall be specifically approved by the City Engineer.

All commercial and industrial water services shall be metered. Residential services shall be metered in accordance with City Policies.

4.402 Domestic Service

The minimum size service is 1 inch per Standard Plan 403. Larger diameter services shall be per Standard Plan 406 (1½" & 2") and Standard Plan 407 (4" & larger). Size of services is to be determined by the design engineer for the parcel/land use being served subject to minimums contained in City Standards.

Backflow devices shall be provided on services as required by the Lodi Municipal Code and shall conform to the appropriate Standard Plan. Sufficient space shall be provided between the service box and the first downstream tee or cross to allow future addition of a backflow device.

4.403 Fire Service

Private on-site fire protection systems include hydrants and building sprinkler systems installed per the requirements of the City Building and Fire Codes. Fire and domestic systems shall be kept separate on-site, downstream of the service box and shall be valved such that either system can be shut-down without affecting the other. These Standards cover requirements imposed by the Public Works Department in its role as a water utility, mainly in the area of backflow and cross connection prevention as required by State law. In addition, the City Fire Department requires that the minimum design requirements and construction specifications for public water mains and fire hydrants be applied to private on-site fire protection systems.

Backflow requirements vary depending on the type of on-site system and the degree of hazard to the public system. Standard classification of on-site systems is as follows:

Class I - Direct connections from domestic water mains only; no pumps or reservoir; no physical connections to other water supplies; no anti-freeze or other additives of any kind; and all sprinkler drains discharge to atmosphere.

No backflow device required.

Class II - Same as Class I, except that booster pumps are installed in the service lines from the public main. (An approved pressure sustaining valve is required on booster systems.) A connection for a fire pumper truck (Fire Dept. Connection or FDC) may be provided. The Fire Dept. shall not introduce any additives nor draft from outside water sources.

No backflow device required.

Class III - Direct connection to public water main, with on-site storage or pressure tanks. All storage facilities must only be filled by or connected to the public water supply, and the water in these facilities must be maintained in a potable condition.

Double Check Valve Assembly (DC) required.

Class IV - Directly supplied from public mains similar to Classes I & II, with an unapproved auxiliary water supply on or available to the premises, or a Fire Dept. connection for trucks with additives or an outside supply.

Reduced Pressure Principle Assembly (RP) required.

Class V - Directly supplied from public mains and interconnected with unapproved auxiliary supplies, such as: pumps taking suction from reservoirs exposed to contamination, or from rivers, ponds, wells, or other industrial water systems; or systems where antifreeze or other additives are used.

Reduced Pressure Principle Assembly required.

Class VI - Systems supplied from both an industrial water system (private system) and the public system, with or without gravity storage or pump suction tanks.

Special Determination required.

Typical types of on-site systems and the backflow requirements are described below:

		Backflow Device Required for Class:					
<u>System</u>		<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>V</u>	<u>VI</u>
	Hydrants only; no sprinklers or other supply	None*	None*	N/A	N/A	N/A	N/A
	Sprinklers only; no FDC or other supply	None*	None*	N/A	N/A	RP	N/A
	Sprinklers and; hydrants w/FDC	None*	None*	DC	DC	RP	S.D
	More than one connection to City system	DC*	DC*	DC	RP	RP	S.D

S.D. = Special Determination

(Domestic service valves not shown)

* State law prohibits backflow devices on Class I or II fire systems. Interpretation by the State Fire Marshall allow backflow devices where "special conditions" exist. These special conditions include:

- Underground fire lines with less than 10 ft parallel clearance to wastewater lines or other pipelines carrying toxic materials.
- Water for one site is (or could easily be) looped to the public system.
- Occupancy involves use, storage or handling of type and quantities of materials in a manner which could present a significant health hazard to the domestic supply.
- Premises having usually complex piping systems which already necessitate a backflow device on the domestic service.

Additional Public Works Dept. requirements are:

- Backflow devices shall be approved by the City Engineer (USC Foundation for Cross Connection Control listing required) and the Fire Marshal (UL or FM listing required).
- Detector checks (i.e., bypass meter to detect unauthorized use) are required on building sprinkler systems; not on hydrant systems.
- Domestic service may be taken from fire service lateral outside the R/W and shall be kept completely separated from the on-site fire system.
- An approved pressure sustaining valve is required on all booster pump installations.
- An Encroachment Permit is required for any work or facility to be located in the right-of-way.
- Piping adjacent wastewater lines or other "special conditions" described above may require backflow devices on Class I and II systems or higher degrees of protection on other Class systems.

Fire Dept. requirements that are related to Public Works standards and specifications include the following:

- Sufficient on-site valves shall be provided to isolate individual hydrants and any sprinkler system.
- The location of all on-site facilities shall be approved by the Fire Marshal.
- Outside stem & yoke (OS&Y) or other approved indicator valves are required on building sprinkler and other above ground valves
- Fire hydrants, mains, valves and backflow devices shall be installed in accordance with City of Lodi Public Works Construction Specifications and Standard Plans.

The above requirements are general minimums and may be increased for unusual or other high hazard conditions. Owners may install devices providing a higher degree of protection, such as an air gap separation system (AG) in place of an RP device.

4.500 Valves, Fire Hydrants and Miscellaneous Appurtenances

4.501 Valves

Valves on mains shall be spaced and located in conformance with the following criteria:

- 400-foot maximum spacing in commercial, industrial and public use or other high value areas.
- 600-foot maximum spacing in residential areas.
- Water mains shall be valved on each side of railroad, freeway and canal right-of-way crossings. (These valves shall be located outside of the right-of-way being crossed unless easy access is provided.)
- At "tees", valves are required as follows:
 - 2 valves where one leg is less than 8 inches, with one of the valves being on the smaller leg.
 - 3 valves where all legs are 8 inches or larger.
- At "crosses", valves are required as follows:
 - 3 valves where one or more legs is less than 8 inches with valves on each of the smaller legs.
 - 4 valves where all legs are 8 inches or larger.
- At ends of mains or on stubs such that future extensions will not interrupt service.
- No closer than 15 feet from a blow off.

The above valve spacing requirements assume small lot sizes and numerous connections and may be reduced where there are a minimal number of connections in-between valves.

4.502 Fire Hydrants

Fire hydrants shall be designed and installed per Standard Plan 401. Where the main is located within 15 feet of the hydrant location, the valve on the hydrant lateral shall be located at least 5 feet offset from the hydrant station and the lateral installed with a 90° elbow. (ie. no short, straight hydrant laterals.)

Fire hydrants shall be supplied from the largest available main.

Fire hydrants shall be fed from 2 directions unless specifically approved by the City Engineer and Fire Marshal.

Public fire hydrant spacing and distribution shall be determined as follows:

- At 300 feet spacing in high density, commercial, industrial zoning or high-value areas;
- At 500 feet spacing in low density residential areas;
- On arterials, the above spacing shall apply to both sides of the street;
- A fire hydrant shall be located within 200 feet of the radius point of all cul-de-sacs;
- On-street hydrant spacing may be reduced at reverse frontage locations or in coordination with on-site hydrants as approved by the Fire Marshal.

On-site private hydrants shall be located by the Fire Marshal.

4.503 Blow-offs and Temporary Connections

Blow-offs per Standard Plan 404 shall be located at the ends of all permanent dead-end mains.

Temporary blow-offs per Standard Plan 409 shall be located at the ends all dead-end mains planned for future extension and 4 inch and larger services per the appropriate Standard Plan.

The design of new mains shall include determination of the location and type (with or without meter/backflow assembly) of temporary connections per Standard Plan 409. The meter/backflow assembly shall be located to provide optimal flow for main flushing and to minimize disruption of public traffic upon device removal. The meter/backflow assembly is not required on new systems with less than 150 feet of 6 inch or larger pipe.

4.504 Thrust Blocks

Water main thrust shall be taken into account in designs. At locations planned for extension, flanged fittings may be required.

In areas with unstable soils, a special design for thrust blocks is required and shall be shown on the plans; Standard Plan 405 is sufficient in other areas.

Section 5 - Miscellaneous Requirements

5.100 Maps and Easements

5.101 Maps

Final Maps and Parcel Maps shall be prepared in conformance with State laws and City ordinances. Applicable certificates and statements shall conform to the appropriate Standard Plan. Final Maps shall be submitted to the County Surveyor for checking prior to filing with the City Engineer. Parcel Maps shall be submitted directly to the City Engineer for checking and processing.

Records of Survey shall be prepared in conformance with State laws and shall be submitted to the County Surveyor for checking and processing.

In order to expedite the review process, the City will accept maps to check easements and other City requirements prior to completion of the County technical review. Initial submittals shall consist of three copies of the map. Legal descriptions and title reports may also be required on the initial submittal. (Note, these Standards do not include all the applicable map and subdivision processing requirements, ie: improvement security, insurance, agreements, etc.)

Survey monuments shall be provided at all new lots/subdivisions per the following:

<u>Location</u>	<u>Required Monument</u>
Rear or Interior Lot Corner	5/8" dia. x 24" lg. iron rod at corner or offset if corner is obstructed.
Front (street) Lot Corner	5/8" dia. x 24" lg. iron rod at corner or chiseled cross in concrete offset from corner (show detail on map).
Street Right-of-Way	3/4" dia. x 30" lg. iron rod with surveyor's mark at angle points and points of tangency.
Street Centerline	3/4" dia. x 30" lg. iron rod with surveyor's mark in City Standard monument box at: (a) intersections of new and existing streets; (b) end of cul-de-sac; (c) points of tangency except where line of sight from other monument exists within the Right-of-Way (the intent is to reduce the number of closely spaced monuments); (d) elsewhere, where line of sight is not practical due to length of curve or other obstruction.
Subdlvision Boundary	3/4" dia. x 30" lg. iron with surveyor's mark at corners. No monument is required at the intersection of street centerline and subdivision boundary.

The above are minimum requirements and are not intended to restrict or otherwise interfere with the judgement of Professional Engineers and Licensed Land Surveyors.

5.102 Easements

Public utility easements shall be shown on maps as required in these Standards and as part of development approval. If no map is involved or where specifically approved by the City Engineer, the easement may be granted by separate deed.

The width of all public utility easements shall be shall be as determined by the appropriate utility. For wastewater, storm and water lines, the minimum width is 8 feet. Additional width will be required for:

- lines larger than 15 inches;
- lines deeper than 5 feet;
- locations where the easement is not entirely on one lot;
- locations where multiple lines are installed within the easement.

Appropriate easements and temporary construction easements and/or limitations and conditions shall be shown on the plans. Particular attention should be given to trench excavations and existing trees and improvements to remain and future building foundations.

5.200 Improvement Plans and Specifications

All public improvements shall be shown on plans prepared by or under the direction of a Registered Civil Engineer except for minor work done under an Encroachment Permit or other circumstances approved by the City Engineer. Privately owned improvements may be shown for information, and in some cases, may be required to be shown to avoid conflicts. Distinction between public and private improvements shall be clearly indicated.

The design engineer shall contact electric, telephone, gas, cable TV and any other applicable agencies for locations of existing utilities which shall be shown on the plans. Plans for existing underground City water, wastewater, storm and traffic facilities shall be obtained from the office of the City Engineer. The design engineer shall field verify location and elevation of any existing facility affecting the design of the new improvements.

Plans shall be drawn on ANSI D (22" x 34") size vellum or mylar with City Standard title blocks per the Standard Plans. (The City will furnish preprinted vellum or AutoCAD® file upon request.) Sheet titles and drawing numbers will be assigned by City staff.

The Appendix contains additional information and requirements for improvement plans including:

- General Notes - required on plans;
- Bid Item Order - for improvement security estimate;
- Plan Submittal Checklist - indicates required items on plans which must be filled out and signed by the Engineer upon submittal of improvement plans;
- Wastewater flow calculation sheet (an Excel® spreadsheet file is available);
- Storm drainage calculation sheet (an Excel® spreadsheet file is available).

Since the plans will refer to City Construction Specifications, it is not required that the design engineer prepare additional specifications. However, in cases where the work is not adequately covered by the City Specifications, the plans shall provide the additional information necessary. If separate specifications are prepared, they shall be submitted for review and approval.

The plans shall identify required contractor submittals. These include:

- Asphalt mix design;
- Pipe materials and trench section to be used (when alternatives are allowed);
- Other agency rights-of-entry (list);
- Electrical and mechanical equipment;
- Any other item of work where alternatives are allowed or the Contractor wishes to do the work in a fashion other than as shown on the plans or as required by the City.

The design engineer is responsible for the design and accuracy of the plans. The City check and approval does not relieve the owner/developer from changed or unforeseen conditions, errors contained in the plans or from complying with City, State, Federal or other agency requirements that may be determined to apply during the course of construction. In addition, owner/developer shall comply with any changes required by the City Engineer during the course of work that are necessary or required to complete the work in conformance with City Standards.

Rights-of-way, PUE's and construction easements shall be shown on the plans. The developer/owner is responsible for obtaining such rights-of-way and easements subject to the provisions of §66462.5 of the Subdivision Map Act. For work in the right-of-way of other agencies, the design engineer/owner shall obtain the permit or furnish the necessary information in order for the City to make the application if so required by the agency. The appropriate permit conditions shall be included in the design. The plans shall include a requirement that the Contractor obtain a right-of-entry from the agency under the terms of the permit.

Required utility relocations shall be shown or referenced on the plans as appropriate. Notes requiring the Contractor to arrange for utility relocations are discouraged since this generally delays the project.

Items to be salvaged and either reused or delivered to the City shall be clearly identified on the plans. Generally, any reusable sign, casting, metal barricade, or other item determined by the City Engineer shall be salvaged and delivered to the City per the Construction Specifications unless they are approved for reuse in the project.

Completed San Joaquin County well and septic tank abandonment permits shall be submitted prior to City approval of the plans and/or map. This requirement may be deferred upon specific approval of the City Engineer if the facilities are in use and are needed during construction.

The plans shall include a requirement for project/job-site signing on projects over 2 acres in size or as required by the City Engineer on projects involving significant disruption of roadways. The sign shall include the names and telephone numbers of the contractor, project engineer/manager and developer/owner.

It is recommended that a pre-construction conference be conducted on all but minor projects. A City representative(s) will attend and the City will provide a meeting room upon request.

5.300 As-built Plans and Certifications

The developer's engineer shall submit the following certifications, plans and other information prior to acceptance of the project:

- Certification that all monuments have been set as shown on the Final Map or Parcel Map;
- Certification that all public wastewater, storm and water lines located in public utility easements were placed within the limits of the easement as shown on the plans;
- Survey notes from a leveling survey of all benchmarks placed within the project. The survey shall start and close on the benchmark used in the design of the subdivision and shall close within 0.02 feet;
- As-built plans showing elevations of utilities and top of curb at all locations designed for future extension;

In addition, where construction problems or other indications exist that improvements are not located within the right-of-way as shown on the plans, the City Engineer may require a topographic or other survey.

The above certifications shall consist of a City Engineer approved letter, map, or other form, signed and stamped by the responsible Registered Civil Engineer or Licensed Land Surveyor, as appropriate.

5.400 Traffic Control

Applicable traffic control requirements shall be included in all plans. References to City and State of California Department of Transportation (Caltrans) specifications and standards are acceptable where the work is primarily not located with the travelled way of existing streets.

Street and lane closures will require specific details to be shown on the plans. Such details may include restrictions on the time of day and duration of work.

5.500 Soils Reports

Soils reports shall be provided for all improvements related to Final Subdivision Maps and may be required for other projects depending on the nature of the project and its location. The report shall include the following as applicable:

- Location map showing test locations and street layout;
- Statement regarding presence of critically expansive soils or other adverse soil conditions, which if not corrected, would lead to structural defects. Additional analytical work may be required depending on the initial findings;
- R-values per Caltrans test method 301; one test per 600 ± feet of street or at locations of visible changes in material, with a statement that the depth of the sample is consistent with final subgrade depth based on the grading plan;
- Optimum moisture and dry density per Caltrans Methods 216 and 226 at each R-value test location;
- Soil corrosivity tests as appropriate where buried steel structures are proposed (such as lift stations) or per Appendix A of AWWA C104 where use of ductile iron pipe is proposed;
- Trench design values and recommendations (see §5.701);
- Applicable information required per Chapter 70 of the Uniform Building Code;
- Grading recommendations and specifications if more restrictive than these Standards.

The soils report shall be signed by a Registered Geotechnical Engineer and referenced on the plans and Map (if any) and appropriate measures incorporated into the design.

5.600 Grading and Earthwork

5.601 Grading Plans

Grading plans shall show existing and proposed contours (@ 0.5 foot maximum intervals) including sufficient information on adjacent property and improvements to review the adequacy of the design. A summary of earthwork calculations shall be provided upon request.

The design shall comply with the appropriate street cross section, vertical alignment, minimum top of curb grade and driveway slope standards described in §1.300 and §1.410. As required by the Community Development Department, on-site low points (drop inlet catch basins) shall be a minimum of 6 inches above the calculated hydraulic grade line or the design maximum water surface of the Master Plan Storm Drainage Basin to which the project is tributary, whichever is higher. (See §3.703 for these elevations.)

Concrete, concrete block or other approved permanent retaining walls/curbs shall be provided where the difference in grade at the property line exceeds 6 inches. At a minimum, cut and fill requirements of the Uniform Building Code, Chapter 70 shall apply.

5.602 Dust Control

Dust control measures shall be addressed on the plans. The owner/developer is responsible for dust control throughout the project. While specific, detailed requirements have not been developed as part of these Standards, the San Joaquin County Air Pollution Control District (APCD) is in the process of developing dust control regulations which may apply to public and private improvement projects and may be implemented without formal changes to these Standards.

5.603 Erosion Control

Erosion control measures shall be addressed on the plans. The owner/developer is responsible for erosion control throughout the project. Existing streets adjacent to the project shall be kept clean. Measures such as construction vehicle access control, temporary berms/sandbags, material stockpile locations, sweeping schedules or other measures shall be shown on the plans. Specific performance requirements have not been developed as part of these Standards, however the Environmental Protection Agency (EPA) and the APCD are developing regulations which may apply to public and private improvement projects and may be implemented without formal changes to these Design Standards.

Dirt and construction debris shall be kept out of existing utility lines by plugging new connections until the new lines are cleaned. Appropriate notes and details shall be shown on the plans.

5.700 Trench and Pipe Strength Design

5.701 General

The design engineer shall coordinate the design of the trench and pipe strength with the soils investigation and the type of pipe materials proposed for the project. The design engineer may limit the number of materials for the project. Options for pipe materials and/or embedment materials may be provided, however, the plans shall clearly require the Contractor to make timely submittals on proposed materials and installation methods.

The Standard Plans for pipe material/class and embedment conditions may be referenced on the improvement plans when appropriate based on the soils report, depth of burial and other conditions. However, these Plans are very conservative in their assumptions; the design engineer may wish to submit calculations supporting less restrictive designs. (Most of the references cited show designs with significantly lower compaction requirements. These are not appropriate in streets or other areas where settlement is detrimental.) Supplementary details shall be provided on the plans as needed.

These Standards do not address construction equipment loads or compaction effort that may damage the pipe. The design engineer should review the soils report carefully for presence of material that will be difficult to compact and should consider specifying imported material in such cases. For shallow installations, specifying installation of pipe after street compaction is obtained should be considered.

The Standard Plans referenced below include the following assumptions:

- no control on maximum trench width (ie embankment soil load conditions);
- backfill weight = 130 lb/ft³
- H-20 traffic loading;
- impact load factor per the following table:

Pipe Dia (ft.)	Impact Load Factor			
	Depth of Cover (ft.)			
	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
1	1.3	1.0	1.0	1.0
2	1.3	1.0	1.0	1.0
3	1.3	1.0	1.0	1.0
4	1.3	1.15	1.0	1.0
5	1.3	1.2	1.1	1.0

The primary references for trench design, in addition to the cited Standards, are "Gravity Sanitary Sewer Design and Construction" and "Buried Pipe Design".

5.702 Soils Investigation

Prior to design, trench conditions shall be investigated by borings, soundings, or test pits along the route of the trench. This soils investigation will include, but will not be limited to, testing to determine the unconfined compressive strength (ASTM D-2573) or penetration resistance (ASTM D-1586) of the trench soils. Results shall indicate whether trench conditions are stable or unstable. A stable trench is a trench that stands without caving or sloughing and has an unconfined compressive strength (ASTM D-2573) greater than 500 pounds per square foot or a penetration resistance (ASTM D-1586) greater than 8 blows per foot. All other soils shall be considered unstable.

Soils in the pipe zone shall be classified per the Unified Soil Classification System (ASTM D2487) and per the applicable embedment material classifications described in the appropriate ASTM standard for the pipe material's proposed for use in the project.

Where crushed rock pipe embedment is to be used, native soil gradation curves and a filter design shall be prepared (or filter fabric specified).

5.703 Flexible Pipe

Flexible pipe includes plastic, ductile iron and other pipe materials which will deflect at least 2% without structural distress. The design initial deflection limit for flexible pipe is 5% except as noted otherwise. The installation design incorporates superimposed load, soil prism load, soil stiffness in the pipe zone and pipe stiffness.

Flexible pipe trench sections per Standard Plan 501A are applicable for:

- 4" (thickness class 51) and 6" thru 14" (thickness class 50) ductile iron pipe;
- 4" thru 15" PVC ASTM 3034, SDR 35 pipe; and,
- 4" thru 14" AWWA C900, Class 150 PVC pipe

without special design. Based on the soils report, the design engineer shall design the pipe trench section and provide details on the plans or appropriate references to the Standard Plan.

5.703.1 Ductile Iron Pipe

Trench and pipe class design for ductile iron gravity sewer pipe shall be per ASTM A746 and City Standards. Trench and pipe class design for ductile iron pressure pipe for water and force mains shall be per AWWA C150 and C151. Deflection for cement lined pipe shall be limited to 3%. Additional design information is contained in the Cast Iron Pipe Research Association Handbook, manufacturer's literature and other references cited in the Appendix.

5.703.2 Polyvinyl Chloride (PVC, ASTM D3034)

Trench design for PVC (SDR 35) pipe shall be per ASTM D2321 and City Standards. Additional design information is contained in the Uni-Bell Handbook of PVC Pipe, manufacturer's literature and other references cited in the Appendix.

Where the depth of cover is less than 3 feet, a special design is necessary to account for pipe flexibility and possible pavement damage.

5.703.3 Polyvinyl Chloride (PVC, AWWA C900)

Trench design for PVC C900 pipe shall be per AWWA C900 and Manual M23 and City Standards. Additional design information is contained in the Uni-Bell Handbook of PVC Pipe, manufacturer's literature and other references cited in the Appendix.

5.704 Rigid Pipe

Rigid pipe includes asbestos-cement, concrete, clay and other pipe materials in which deflection is not considered. The installation design incorporates superimposed load, pipe strength (usually three-edge bearing strength) and bedding factors. A safety factor of 1.5 is required on ultimate or crush load rated pipe; a factor of 1.0 is acceptable on 0.01 inch crack load pipe.

Special designs are required for rigid pipe with less than 3 ft. of cover. Appropriate materials and construction methods, such as special embedment, concrete encasement or requiring pipe installation after street compaction, shall be shown on the plans.

Rigid pipe trench sections per Standard Plan 501B & C are applicable for:

- 4" thru 14" AWWA C400 Class 150 asbestos cement pipe;
- 12" thru 30" ASTM C12 & C76 concrete pipe; and,
- 4" thru 30" ASTM C700 extra strength vitrified clay pipe

pipe without special design. Based on the soils report, the design engineer shall design the pipe trench section and provide details on the plans or appropriate references to the Standard Plan.

5.704.1 Asbestos Cement Pipe (AWWA C400)

Trench and pipe class design for asbestos cement water pipe shall be per AWWA C401 and City Standards. Additional design information is contained in the manufacturer's literature and other references cited in the Appendix.

5.704.2 Concrete Pipe (ASTM C14, C76)

Trench and pipe class design for concrete pipe shall be per the pipe material ASTM specification, ASTM C12 and City Standards. Additional design information is contained in Concrete Pipe Handbook and Design Manual, manufacturer's literature and other references cited in the Appendix.

5.704.3 Vitrified Clay Pipe (ASTM C700)

Trench design for extra strength vitrified clay pipe shall be per ASTM C12, C700 and City Standards. Additional design information is contained in the Clay Pipe Engineering Manual, manufacturer's literature and other references cited in the Appendix.

Appendix

A - 1 Improvement Plan Requirements

A - 1.1 General Requirements

After approval of the preliminary design, the design shall be incorporated into public improvement plans for the project. In general, the plans shall contain the following:

- Key/Title Sheet;
- Grading Plan;
- Civil Plans;
- Traffic Control and/or Striping Plans;
- Structural, mechanical, and electrical drawings for appropriate facilities;
- Specifications for materials and construction procedures for the portions of the project not already covered in the City Standard Construction specifications;
- Applicable soils investigation data;
- Required submittal list

Sheets may be combined or omitted depending on the size and complexity of the project.

Itemized quantity listings (bid items) are not required to be shown on the plans. (See §A - 2 regarding bid items)

A - 1.2 Plan Notes

The following general notes shall be included in all construction plans, modified as indicated for the particular project. Additional instructions or conditions related to contractual or other agreements between or among the owner/developer, design engineer and contractor shall be listed separately under a section titled "Special Conditions". Notes relating to specific portions of the work or special requirements shall be clearly keyed to the plan and grouped on each sheet under the heading "Construction Notes". Some typical construction notes are also shown below.

GENERAL NOTES

1. WORK SHALL CONFORM to City of Lodi Public Improvement Design Standards, Construction Specifications and Standard Plans unless specifically shown otherwise on these plans.
2. STANDARD PLANS applicable to this project include:
(list the following and any others that apply) 101, xxx
3. CONSTRUCTION STAKING for curb & gutter, wastewater lines, storm drains, water lines, street centerlines, paving edges and other public facilities as directed by the City shall be done by a Registered Civil Engineer or Licensed Land Surveyor.
4. CENTERLINE AND PROPERTY LINE DATA shall be obtained from (list City file number of final map, parcel map or record of survey as applicable).
5. EXISTING UTILITIES shall be protected. Utility agencies shall be notified and allowed to mark their utilities in the field at least 48 hours before excavation.

<<<< CALL "USA" (800) 642-2444 >>>>
6. STREET AND LOT ROUGH GRADING shall be done before underground work.
7. UNDERGROUND UTILITIES in the street and sidewalk area shall be installed before construction of curb, gutter or sidewalk. These utilities include services, fire hydrant laterals, street light conduit, electric, gas, cable TV and telephone lines.
8. EXCAVATION SAFETY REQUIREMENTS include submitting a CAL OSHA permit or letter of notification to the City before commencing excavations over five feet deep.

Refer to City Construction Specification §6-19.04 "Excavation Safety" for additional requirements.

9. ALL TESTING for leakage or overdeflection shall be witnessed by a City inspector.
10. BALLING AND CLEANING of storm drain and sanitary sewers shall be done before interior video inspection. Utilities shall be kept clean until City acceptance.
11. STREET LIGHT SYSTEM shown on these plans is for reference only. The system shall be installed according to City Electric Utility Department plans.
12. BENCH MARK MONUMENTS furnished by the City shall be installed at locations shown or as directed by the City Engineer.

CONSTRUCTION NOTES (examples)

1. TV LOGS OF EXISTING MAINS will be prepared by the City of Lodi upon request of the Contractor prior to construction. Replacement of any underground mains damaged during construction of this project will be the responsibility of the Contractor.
2. R-VALUE TESTS shall be taken after grading to verify adequacy of structural section. Sections shown are based on the R-values shown on the plans and are for bidding purposes only.
3. A pre-construction conference will be held for this project. The Contractor's job superintendent (and major subcontractor, if any - identify) shall attend.
4. A project identification sign shall be installed at (describe location or show on plans) as shown below. The sign shall have (describe color, lettering - 2" high minimum - and material)

Rolling Glen Subdivision

brought to you by:

Lodi New Age Development
phone 333-3333

being built by:

Lodi Constructors International
phone 333-4444

project design by:

Lodi Engineering
phone 333-5555

A - 1.3 Checklist

Normal plan drafting and miscellaneous requirements are listed below. The list is to be checked off by the design engineer and submitted with the initial submittal of the plans, except items noted * may be added after the first check. Incomplete plans will be returned without processing. Note that incomplete topography makes it impossible to adequately design and review improvement plans. City staff field review each project as part of the review process. Plans not showing existing improvements affecting the design will be returned.

This checklist is not a repeat or a listing of City Standards. The design engineer is still responsible for complying with these Standards in the design and preparation of improvement plans.

Improvement Plan Checklist

General, all sheets:

- Sheet size and City of Lodi title block conforming to Standard Plan 604
- * RCE signature, stamp and expiration date
- North arrow (to top or right as appropriate)
- Scale (1" = 20', 1" = 40' or as needed for details and sections)
- Abbreviations and symbols conforming to Standard Plan 502 & 503
- Existing topography (including signs and striping) in project work area, field checked and accurately shown including the side of the street opposite the work to the curb (or right-of-way if no curb)
- Reference plan drawing numbers shown (ie. "Ref. 88D124" for improvements from another project)
- * Reference to adjacent sheet drawing numbers in the project set (ie. "See 91D090")
- Detail drawings as appropriate, particularly if conditions do not fit Standard Plans
- Repeated information consistent between sheets
- Grades shown consistently in percent or decimal form
- * "USA Call Before You Dig" sticker (City will furnish)
- "Construct", "install", "existing" and "future" items consistently noted
- * The phrase "work by others" is not to be used. The appropriate party should be identified and the limits of such work clearly shown
- Distinction between public and private improvements clearly noted.

Key/Title Sheet

- General Notes per §A - 1.2
- Vicinity Map:
 - o site location with major streets noted
 - o north arrow
- Key Map (1" = 100') with:
 - o project boundary, street R/W & names
 - o lot lines and lot numbers
 - o * sheet drawing # references and limits
 - o north arrow & scale
 - o reference bench mark and *ones to be installed
 - o underground mains and above ground utilities
 - o main size and direction-of-flow between manhole
 - o gutter direction-of-flow arrows and high point marker
 - o street light locations
 - o boundary fencing location & type
- Typical Cross Sections (drawn looking up-station)
 - o street sections or table w/street name and stationing limits
 - o pavement structural section including compaction
 - o street names noted
 - o back-of-walk to R/W treatment shown
 - o trench sections or table reference to Standard Plan 501
- Miscellaneous
 - o table of street segment, design R-value and traffic index
 - o submittal listing
 - o "Special Conditions" notes
 - o dust control provisions
 - o *salvage items identified

Grading Plan*

- Existing and design grades or contours including adjacent property
 - Locations of borings, R-value or other tests
 - Applicable soils report information
 - Septic tank & leach field location and abandonment information
 - Well location and abandonment information
 - Irrigation risers & standpipes, size & direction on pipes; removal notes
 - Retaining wall or other grade control details
 - Erosion control details
- Put appropriate information on key or civil sheets if no grading plan

Civil - Street Plans

- City/County/State R/W boundaries as applicable
- Name of Street or Easement shown
- Names of intersecting streets and adjacent drawing #'s shown
- R/W lines identified
- Property lines & lot numbers
- Street dimensioned at end of sheet and at transitions
- Public utility & sight easements dimensioned
- Private & public utilities shown
- Existing utility crossings shown (gas, telephone, electrical)
- Transition pavement with flares at boundary limits
- Street signs at intersections
- Centerline survey monuments
- Horizontal curve data
- Existing poles, signs and structures; any required relocation noted
- Stationing shown west to east, south to north, left to right and bottom to top; no negative stationing
- Basis of stationing from City reference noted
- Equations at stationing crossings provided
- Street name at street intersections referenced
- Match lines shown, preferably at even stations
- Stationing corresponds with subdivision map data
- Offsets shown perpendicular to base of stationing
- * Streetlights, conduit and transformers per Electric Utility Dept. plans
- Curb, gutter & sidewalk:
 - Standard Plan number for curb and gutter noted
 - gutter direction-of-flow, high points & low points shown
 - vertical to rolled 4 foot curb & gutter transition shown
 - pavement strip removal and replacement at toe of gutter dimensioned and noted
 - utility pole clearance dimensioned
 - handicap ramps
 - asphalt ramps for sidewalk transitions where no sidewalk exists
 - gutter pan detail shown if last asphalt concrete lift is postponed
 - commercial, special & common driveways noted

Civil - Street Profile

- Original ground grades shown
- Top of curb grades shown (flowline for curb & gutter replacements)
- Edge of pavement, street centerline and R/W grades shown if matching existing pavement
- Top of curb profile line
- Symbols at grade break & beginning and end of curves shown per Standard Plan 503
- Elevations shown at grade break, beginning & end of curve return, and point of intersection
- Vertical curve data

Underground Utilities Plan (General)

- Horizontal alignment of main dimensioned
- Main size and direction-of-flow between manholes shown
- Radius and stationing at main noted if not concentric with street centerline
- Services shown:
 - at corner lots and along curved right-of-way, services shall be shown and dimensioned to nearest lot line
 - for 1" water and 4" wastewater at standard location, services may shown with an abbreviated notation
 - larger services shall be shown and dimensioned to nearest lot line
- *Pipe markers installed at dead-ends or in fields
- Manholes are concentric or noted if eccentric (show orientation)

Underground Utilities Profile - General

- Main:
 - length and size between manholes noted (length computed between inside edge of structure walls)
 - direction-of-flow arrows with slope shown and invert elevations noted
- Station, length, invert @ property line and size of laterals larger than minimum noted
- Pipe invert elevations shown at manholes, grade breaks, catch basins and ends of lines
- Existing utilities shown or approximated with note "verify depth and/or location in field before start of construction"
- Crossings and horizontal alignment in accordance with City of Lodi Specifications and California State Health Standards noted
- Size, length and elevation of stubs noted
- Manholes:
 - station
 - size and type noted if other than standard diameter barrel
 - top of manhole elevation noted
 - "adjust to grade" for existing structures noted

Wastewater - Miscellaneous

- * Monitoring structures shown where required
- * Sand/grease traps shown where required

Storm Drain - Miscellaneous

- Drainage flow transition from project boundaries to existing flowline shown
- Grade break (if unavoidable) in lateral noted with distance to manhole noted
- * Sand/oil trap provided for on-site drainage per City requirements
- Catch basins installed at lot lines and 18" from curb returns

Water - Miscellaneous

- Blind flanges with stubs at cross and tee for future extensions noted
- Valve on main provided no closer than 15 feet from temporary blow-off
- No services between last valve and temporary blow-off
- No services within 15 feet of permanent dead-end blow-off
- Fire Hydrants:
 - o hydrants located per Fire Dept fire hydrant plan & Standard Plan No. 401 guidelines
 - o fire hydrant assembly or components itemization consistently shown
 - o lateral and valve oriented perpendicular to or parallel to face of curb
 - o elevations at top-of-curb or back-of-walk provided
 - o guard posts shown, if required

A - 2 Bid Item List

The following list is provided as a general guide for consistency in City projects and improvement security estimates. Items used for each project will vary, but the order and units shall be followed. "incl." means payment for the item may be included in another item of work. The order is based on the order of the Caltrans Standard Specifications with some minor exceptions. The final listing shall be numbered.

<u>Item</u>	<u>Units</u>
Dust Control	LS or Hour
Traffic Control	LS
Removal of ...(list as needed)	LS, EA or incl.
Abandon ...(well, septic system, or other; list as needed)	LS or EA
Salvage ...(list as needed)	EA
Clearing and Grubbing	LS
Rough Grading	CY
Roadway Excavation	CY
Excavation Safety	LS
Compact Original Ground (Roadway)	SF
Concrete Subgrade Compaction	SF
Imported Borrow	CY or TON
Irrigation System (system or itemize pipe, * valves*, etc)	LS, LF, or EA
Landscaping (list turf or type as appropriate)	LS or SF
Trees (list by type, size*)	EA
Clean-up or Finishing Roadway	LS or incl.
Aggregate Base (AB), Class 2	TON or SF **
Liquid Penetration Treatment	TON
Pavement Reinforcing Fabric	SY
Asphalt Concrete (AC) (list by aggregate size*, may separate type, i.e. overlay, transition, etc.)	TON or SF **
Asphalt Concrete Leveling Course	TON
Pavement Repair	SF
Pavement Grinding (list by depth, width or type per plan table)	LF or SF
Steel Structures (list as appropriate)	EA or LS
Painting (list as appropriate)	EA or LS
Storm Drain Pipe (list *)	LF
Storm Drain Manhole/Riser (list *)	EA
Sand/Oil Trap	EA
Adjust Existing SD Manhole to Grade	EA
Furnish SD Frame & Cover	EA
Wastewater Pipe (list *)	LF
Wastewater Service (list *)	EA
Wastewater Cleanout (In not included in service price)	EA
Wastewater Manhole/Riser (list *)	EA
Wastewater Trap (list *)	EA
Adjust Existing WW Manhole to Grade	EA
Furnish WW Frame & Cover	EA
Curb & Gutter (& Sidewalk) (differentiate type, width as appropriate)	LF
Sidewalk	SF
Commercial Driveway	LF or SF
Special Driveway	LF or SF
Alley Approach	SF
Tree Well	EA
Sign Post (list by height, * type)	EA
Mowstrip (or other misc. concrete items)	LF

Side Inlet Catch Basin	EA
Drop Inlet Catch Basin	EA
Survey Monument (list *)	EA
Adjust Existing Monument Frame to Grade	EA
Furnish Survey Monument Frame and Cover	EA
Water Main (list *)	LF
Water Valve (list *)	EA
Water Service (list *)	EA
Backflow Assembly (list *)	EA
Fire Hydrant (specify either assembly w/valve & lateral or by individual components)	EA
Permanent Blow-Off	EA
Temporary Blow-Off (list *)	EA
Temporary Connection (with/without meter)	EA
Adjust Existing Water Valve Frame to Grade	EA
Furnish Water Valve Frame & Cover	EA
Fence (list *)	LF
Dead-end Barricade (Fence type)	LF
Traffic Striping (list *)	LF
Traffic Legend/Marking (list *)	EA
Pavement Marker (list *)	EA
Street Light (list *)	EA
Traffic Signal and Lighting System	LS
Signs (list *)	EA

• indicate size and class/strength/type as appropriate, largest diameter or size first.

** AB and AC quantities are normally in TONS but may be in SF for minor work and subdivision improvement contracts.



CITY OF LODI
PUBLIC WORKS DEPARTMENT

PROJECT: Project Name (Limits of Project etc....)
 BY: BBB SHEET NO. 1 OF
 CHECKED BY: CMW DATE: 5/9 X'B NUMBER: 91X009

STORM DRAINAGE CALCULATIONS

A-4 Storm Drainage Calculation Sheet

Land Use, Zoning, Location, Node I.D.	Area Acres	C Factor	AC	Sum of AC	T.C. min.	I "/hr.	Q cfs	Dia. in.	HGL Slope ft./ft.	Pipe Slope ft./ft.	Length ft.	Vel. fps	Flow Time min.	HGL fall ft.	Invert Elev. up/dn ft.	HGL Elev. ft.	Top of Curb Elev. ft.	Remarks	
Ham Ln, MH A	R-1	10.0	0.40	4.0	12.0	12"	1.15'	13.8	24	0.00371	0.00075	700	4.4	2.7	2.60	29.00	33.60	35.00	Initial T.C. = 10 min. + 180 ft gutter / 1.5 fps/60 sec/min. = 12 min.
	C-2	10.0	0.80	8.0												28.48			
Ham Ln, MH B	RHD	5.0	0.50	2.5	24.9	15"	1.02'	25.3	36	0.00143	0.00044	700	3.6	3.3	1.00	27.48	31.00	36.50	[Note: Need to verify HGL is at or above top of pipe (surcharged) unless partial depth flow calculations are provided.]
	PR	20.0	0.42	8.4												27.17			
Basin																			

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Reference: City of Lodi Design Standards 13 000

A - 5 References

- Advances in Pipeline Materials, Jey K. Jeyapalan, Civil Engineering, July 1990 (This recent article raises some interesting points about the state of design practice in the United States, including soil stiffness discrepancies.)
- A Guide for the Installation of Ductile Iron Pipe, Ductile Iron Pipe Research Association, 1978
- American Society for Testing and Materials, (ASTM), various standards as cited, latest revision unless otherwise specified by the City Engineer; a list of cited standards is available from the City Engineer
- American Water Works Association, (AWWA), various standards and manuals as cited, latest revision unless otherwise specified by the City Engineer; a list of cited standards is available from the City Engineer
- A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO), 1984
- Buried Pipe Design, A.P. Moser, Mc-Graw Hill, 1990 (This is an up-to-date reference that summarizes many of cited references and contains design examples.)
- Citywide Circulation Study, TJKM Transportation Consultants, Final Report July 20, 1990
- Clay Pipe Engineering Manual, National Clay Pipe Institute, July 1982
- Concrete Pipe Design Manual, American Concrete Pipe Association, 5th printing (revised) June 1980
- Concrete Pipe Handbook, American Concrete Pipe Association, January 1980
- Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers Manual and Report on Engineering Practice - No. 37, Water Pollution Control Federation Manual of Practice - No. 9, 1969 (second printing, 1976) (Note, while the portions of this manual covering gravity pipe design are largely superceded by ASCE Manual No. 60, this manual contains applicable information on pumping facilities)
- Design and Performance of PVC Pipes Subjected to External Soil Pressure, Moser, Watkins & Shupe, Buried Structure Laboratory, Utah State University, February 1977 (This research paper contains much of the background material used in later references)
- Design of Urban Streets, Federal Highway Administration (FHWA), Report #80-204, as updated and republished by the California Institute of Transportation Studies and used in their University of California extension course of the same name
- Draft General Plan, Jones & Stokes, various documents and dates including the Draft Environmental Impact Report, April 1990 and the Draft Policy Document
- Ductile Iron Pipe and Cast Iron Pipe Handbook, Cast Iron Pipe Research Association, 4th Edition, 1976 (While this handbook contains some text on history and design considerations, it mainly consists of American National Standards Institute (ANSI) standards which may be superceded by other standards. These ANSI standards are usually conumbered as a corresponding AWWA standard.)
- Flexible Pavement Structural Section Design Guide for California Cities and Counties, League of California Cities, 1973 (Includes information and examples on calculation of traffic index from truck wheel load data)

Gravity Sanitary Sewer Design and Construction, American Society of Civil Engineers Manual and Report on Engineering Practice - No. 60, Water Pollution Control Federation Manual of Practice - No. FD-5, 1982

Guidelines for Driveway Design & Location, Institute of Transportation Engineers (ITE), Proposed Recommended Practice, ITE Technical Committee 5B-13. 1985

Handbook of PVC Pipe Design and Construction, Uni-Bell PVC Pipe Association, 2nd Edition March 1982

Highway Capacity Manual, Transportation Research Board, 1985

Highway Design Manual, California Department of Transportation (Caltrans), 4th edition & per latest updates issued by Caltrans

Introductory Soil Mechanics and Foundations, Sowers & Sowers, Macmillan, 3rd edition, 1971

Residential Streets, American Society of Civil Engineers, National Association of Home Builders and Urban Land Institute; 2nd Edition 1990 (While this reference contains useful general information on design, the various minimum design standards, particularly those for street width, are considered inappropriate for Lodi)

Review of (Draft) Sanitary Sewer Design Standards, Ron Heinzen, (Kleinfelder), correspondence January 21, 1988

Sanitary Sewer System Technical Report for the 1990 General Plan Update, Black & Veatch, 1990

Traffic Manual, California Department of Transportation (Caltrans), per latest updates issued by Caltrans

Transportation and Traffic Engineering Handbook, institute of Transportation Engineers, 2nd edition, 1982

Trip Generation, Institute of Transportation Engineers, 4th edition, 1987

Water Master Plan, Psomas & Associates, 1990

Work Area Traffic Control Handbook (WATCH Manual), BNI Books, 7th edition, 1990