

**County of Los Angeles
Department of Public Works**

**PROJECT PREPARATION
INSTRUCTION MANUAL
FOR DRAINAGE FACILITIES**



February 1988

**Thomas A. Tidemanson
Director of Public Works**

COUNTY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS

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For Drainage Facilities

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TABLE OF CONTENTS

SECTION A

GENERAL PROCEDURE

<u>SUBSECTION</u>	<u>PAGE</u>
A-1 PROJECT CONCEPT-----	a-1
A-2 DEPARTMENT FURNISHED DATA-----	a-1
-2.1 General-----	a-1
-2.2 Storm Drains-----	a-1
-2.3 Pump Stations-----	a-1
-2.4 Debris Basins-----	a-1
-2.5 As-Built Drawings-----	a-1
A-3 DESIGN CRITERIA-----	a-2
A-4 COST ESTIMATES-----	a-2
A-5 PERMITS-----	a-2
A-6 ENVIRONMENTAL IMPACT REPORT-----	a-2
A-7 DEVIATIONS FROM PROJECT CONCEPT-----	a-2
-7.1 General-----	a-2
-7.2 Hydrologic Data-----	a-3
-7.3 Right of Way Costs-----	a-3
-7.4 Preparation of Report-----	a-3
-7.5 Supporting Data-----	a-4
A-8 BETTERMENTS-----	a-4
A-9 SCHEDULE OF SUBMITTALS-----	a-5
A-10 CHECKING AND REVIEW OF DRAWINGS AND SUPPORTING DATA-----	a-5
-10.1 By the Engineer-----	a-5
-10.2 By the Department-----	a-5
-10.3 Revised Final Drawings-----	a-5

SECTION B

PRELIMINARY DATA

B-1 GENERAL-----	b-1
B-2 SURVEY NOTES AND SUPPORTING DATA-----	b-1
-2.1 General-----	b-1
-2.2 Horizontal Control Surveys-----	b-2

Table of Contents - continued

<u>SUBSECTION</u>	<u>PAGE</u>
-2.3	Vertical Control Surveys----- b-3
-2.4	Design Surveys----- b-4
B-3	SUBSURFACE INVESTIGATION AND GEOTECHNICAL REPORT----- b-5
-3.1	General----- b-5
-3.1.1	Subsurface Exploration----- b-5
-3.1.2	Report----- b-5
-3.2	Spacing, Location and Depths of Exploratory Borings----- b-6
-3.2.1	General----- b-6
-3.2.2	Spacing----- b-6
-3.2.3	Location----- b-6
-3.2.4	Depths----- b-7
-3.3	Logs of Borings----- b-8
-3.4	Samples----- b-8
-3.5	Laboratory Analysis----- b-8
-3.6	Groundwater----- b-10
-3.7	Observation Wells----- b-10
-3.8	Submittal of Data----- b-10
-3.9	Use of Existing Exploratory Boring Data----- b-11
-3.10	Shoring Parameters----- b-11
B-4	ENGINEERING GEOLOGY INVESTIGATION REPORT----- b-11
-4.1	General----- b-11
-4.2	Detailed Information----- b-12
-4.2.1	In-Situ Rock and Surficial (Unconsolidated) Deposits----- b-12
-4.2.2	Structural Features (e.g. faults, shears, folds, joints, foliation, schistosity)----- b-13
-4.2.3	Surface and Ground Water Conditions----- b-13
-4.2.4	Geologic Features of Special Significance----- b-13
-4.2.5	Excavation Problems----- b-13
-4.2.6	Placement of Fill----- b-14
-4.2.7	Recommendations for Additional Subsurface Testing, Exploration and Inspection----- b-14
-4.2.8	Special Construction Problems----- b-15
B-5	PROPOSED MULTI-USE AND ESTHETIC OR LANDSCAPING CONCEPTS----- b-15
B-6	PUMP STATIONS----- b-15
-6.1	General----- b-16
-6.2	Site Development Plan----- b-16
-6.3	Floor Plan and Elevation----- b-16
-6.4	Outline Layout----- b-16
-6.5	Utility Services Sketch----- b-16

Table of Contents - continued

<u>SUBSECTION</u>	<u>PAGE</u>
B-7 DEBRIS BASINS-----	b-16
-7.1 General-----	b-16
-7.2 Site Development Plan-----	b-16
-7.3 Details-----	b-16
B-8 RAILROAD CROSSINGS-----	b-16
-8.1 General-----	b-16
-8.2 Drawings and Details-----	b-17

SECTION C

DESIGN CRITERIA

C-1 GENERAL-----	c-1
C-2 DEVIATIONS FROM DESIGN CRITERIA-----	c-1
C-3 COVERED STORM DRAIN CONDUITS-----	c-1
-3.1 General-----	c-1
-3.2 Box Conduits-----	c-1
-3.2.1 Box Alternates-----	c-1
-3.2.2 Box Only-----	c-1
-3.3 Tunnels-----	c-1
-3.4 Others-----	c-2
C-4 ALIGNMENT-----	c-2
-4.1 General-----	c-2
-4.2 Landscaping Removals-----	c-2
-4.3 Working Area and Traffic-----	c-2
-4.4 Utilities-----	c-2
-4.5 Existing Structures-----	c-2
-4.6 Slides and Other Earth Movements-----	c-2
-4.7 P.C.C. Pavement Joints-----	c-2
C-5 UTILITIES (INCLUDING SEWERS AND STORM DRAINS)-----	c-3
-5.1 General-----	c-3
-5.2 Locating and Potholing-----	c-3
-5.3 Disposition of Interfering Utilities-----	c-3
-5.3.1 Subsurface Utilities-----	c-3
-5.3.2 Surface Utilities-----	c-4
-5.4 Protection for Non-Interfering Utilities-----	c-4
C-6 MAINTENANCE AND ACCESS-----	c-5
-6.1 General-----	c-5
-6.2 Open Channels-----	c-5

Table of Contents - continued

<u>SUBSECTION</u>	<u>PAGE</u>
C-6.2.1	Access Roads----- c-5
-6.2.2	Invert Access Ramps----- c-6
-6.2.3	Low Flow Channels----- c-6
-6.2.4	Steps and Gates----- c-6
C-7	FENCING----- c-6
-7.1	General----- c-6
-7.2	Channels----- c-6
C-8	HANDICAPPED RAMPS----- c-6
C-9	TREES----- c-6
C-10	EXISTING PAVEMENT AND RESTORATION----- c-7
-10.1	Determining Existing Pavement----- c-7
-10.1.1	General----- c-7
-10.1.2	Base Material----- c-7
-10.1.3	Coring----- c-7
-10.2	Resurfacing Except for Streets Under Caltrans or Los Angeles County Jurisdiction----- c-8
-10.2.1	Bituminous Paving----- c-8
-10.2.2	Concrete Paving----- c-8
-10.2.3	Combination Portland Cement Concrete-Bituminous Paving----- c-8
-10.2.4	Deficient Pavements----- c-8
-10.2.5	Modern Pavement Design Substitution----- c-9
-10.3	Resurfacing for Streets and Highways Under Caltrans Jurisdiction----- c-9
-10.4	Resurfacing for Streets Under Los Angeles County Jurisdiction----- c-9
C-11	PERMANENT RIGHT OF WAY REQUIREMENTS----- c-9
-11.1	Covered Sections----- c-9
-11.2	Open Channels----- c-9
-11.3	Debris Basins----- c-9
-11.4	Catch Basins----- c-10
-11.5	Verification of Street Widths----- c-10
C-12	FILL EASEMENTS----- c-10
C-13	TEMPORARY CONSTRUCTION EASEMENTS----- c-10
-13.1	General----- c-10
-13.2	Drain in Rights of Way Other Than Public Streets----- c-10
-13.3	Drain in Public Streets----- c-11
C-14	SANITARY SEWERS----- c-11

Table of Contents - continued.

<u>SUBSECTION</u>		<u>PAGE</u>
<u>SECTION D</u>		
FINAL SUPPORTING DATA		
D-1	GENERAL-----	d-1
D-2	CALCULATIONS-----	d-1
-2.1	General-----	d-1
-2.2	Calculation Sheets-----	d-1
D-2.3	Main Line Hydraulic-----	d-1
-2.4	Catch Basin-----	d-1
-2.5	Structural-----	d-2
D-3	COST ESTIMATES-----	d-2
-3.1	General-----	d-2
-3.2	Multiple Lines-----	d-2
-3.3	Comparative Cost Estimates to Justify Utility Relocations-----	d-2
-3.4	Railroad Crossings-----	d-2
-3.5	Revised Drawings-----	d-2
D-4	SPECIFICATIONS DATA-----	d-3
-4.1	General-----	d-3
-4.2	Standard Specifications-----	d-3
-4.3	Local Ordinances-----	d-3
-4.4	Manufactured Items-----	d-3
-4.5	Street Closures and Detours-----	d-3
-4.6	Trees-----	d-3
-4.7	Esthetic Treatment-----	d-3
-4.8	Pump Stations-----	d-3
D-5	APPROVALS BY UTILITY COMPANIES AND OTHER AGENCIES-----	d-4
-5.1	General-----	d-4
-5.2	Revenue Producing Utilities (Water, Gas, Telephone, Etc., Except Railroads)-----	d-4
-5.3	Non-Revenue Producing Utilities (Storm Drains, Sewers, Street Lights, etc.)-----	d-4
-5.4	Railroads-----	d-4
-5.5	Other Agencies-----	d-4

SECTION E

PREPARATION OF FINAL DRAWINGS

E-1	GENERAL-----	e-1
-1.1	Standard Sheets-----	e-1
-1.2	Alternates-----	e-1
-1.3	Duplicate Tracings-----	e-1
-1.4	Work by District-----	e-1

Table of Contents - continued.

<u>SUBSECTION</u>	<u>PAGE</u>
E-2	GUIDE DRAWINGS----- e-1
E-3	DRAFTING STANDARDS----- e-2
-3.1	General----- e-2
-3.2	Drafting Aids----- e-2
-3.3	Lettering and Size----- e-2
-3.4	Detail Scale----- e-2
-3.5	Use of Sheet Space----- e-2
E-4	TITLE SHEET----- e-2
-4.1	General----- e-2
-4.2	Location Map----- e-2
-4.3	Vicinity Map----- e-2
-4.4	Index----- e-2
-4.5	Standard Drawings----- e-3
-4.6	General Notes----- e-3
-4.7	Abbreviations and Symbols----- e-3
-4.8	Title Block----- e-3
-4.9	Engineer's Signature Block----- e-3
-4.10	Agency's Signature Block----- e-3
-4.11	References----- e-3
E-5	PLAN AND PROFILE FOR STORM DRAINS----- e-3
-5.1	General----- e-3
-5.1.1	Stationing----- e-3
-5.1.2	Cross Section----- e-3
-5.1.3	Bench Marks----- e-4
-5.1.4	Underground Facilities----- e-4
-5.2	Plan----- e-4
-5.2.1	Scale----- e-4
-5.2.2	North Arrow----- e-4
-5.2.3	Main Line Storm Drain and Appurtenances----- e-4
-5.2.4	Catch Basins and Connector Pipes----- e-4
-5.2.5	Street Right of Way and Centerlines----- e-4
-5.2.6	Right of Way and Easement Lines----- e-4
-5.2.7	Railroad Property Lines and Tracks----- e-4
-5.2.8	Abandoned Street Car Tracks----- e-5
-5.2.9	Location of Test Borings----- e-5
-5.2.10	Utilities (including Sewers and Storm Drains)----- e-5
-5.2.11	Street Lighting System----- e-5
-5.2.12	Traffic Signal Systems----- e-5
-5.2.13	Curbs, Gutters, and Driveways----- e-5
-5.2.14	Handicapped Ramps----- e-5
-5.2.15	PCC Pavement Joints----- e-6
-5.2.16	Trees----- e-6
-5.2.17	Existing Culture in Right of Way----- e-6
-5.2.18	Abbreviations----- e-6
-5.3	Profile----- e-6
-5.3.1	Scale----- e-6
-5.3.2	Grid Elevations and Stations----- e-6

Table of Contents - continued.

<u>SUBSECTION</u>		<u>PAGE</u>
E-5.3.3	Ground Line-----	e-6
-5.3.4	Main Line Storm Drain and Appurtenances-----	e-7
-5.3.5	Main Line Elevations and Slopes-----	e-7
-5.3.6	Size of Main Line Conduit-----	e-7
-5.3.7	Hydraulic Components-----	e-7
-5.3.8	Utilities (including Sewers and Storm Drains)-----	e-8
-5.3.9	Street Lighting-----	e-8
E-6	LOGS OF BORINGS (SUBSURFACE INVESTIGATION DRAWINGS)-----	e-8
E-7	STRUCTURAL DETAILS-----	e-8
E-8	CROSS SECTIONS-----	e-9
E-9	SANITARY SEWERS-----	e-9
-9.1	General-----	e-9
-9.2	Scale-----	e-9
-9.3	Existing Sewers and Utilities-----	e-9
-9.4	House Connections-----	e-9
-9.5	Approvals-----	e-10
E-10	PUMP STATIONS-----	e-10
E-11	DEBRIS BASINS-----	e-10

SECTION F

DRAWINGS AND WORK TO BE FURNISHED AFTER RECEIPTS OF BIDS

F-1	"CHANGE OF PLAN" DRAWINGS-----	f-1
F-2	SHOP DRAWINGS-----	f-1

SECTION G

APPENDIX

G-1	GENERAL NOTES-----	g-1
G-2	FIGURES TO BE USED AS GUIDE DRAWINGS-----	g-4
	Figure 1 - Typical Connector Pipe Profile-----	g-4
	Figure 2 - Typical Modification of Street Lighting Conduit-----	g-5
	Figure 3 - Resurfacing Schedule-----	g-6

SECTION A

GENERAL PROCEDURE

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GENERAL PROCEDURE

A-1 PROJECT CONCEPT

The Department will furnish the Engineer the project concept, and representatives of the Department will meet with the Engineer to discuss the purpose, scope and pertinent details of the project, including the location, limits and type of structures required.

If the alignment of the project lies within privately-owned land subject to future development, golf courses and public parks or in rights of way involving extensive removal of landscaping or other culture, the Engineer shall arrange for the Department to conduct joint meetings with interested parties to resolve the alignment to the mutual satisfaction of all. It is very important that this be done early in order to avoid the necessity for redesign and consequent delay in construction.

A-2 DEPARTMENT-FURNISHED DATA

A-2.1 General. The Department will furnish the following data to the Engineer prior to the Design Start Date.

A-2.2 Storm Drains.

1. Plan and profile of the project showing design Q's determined by the Department with preliminary conduit sizes and grades.
2. Hydrology, including a drainage map, showing main line design Q's and subarea peak Q's to be used for catch basin design.

Discrepancies in drainage area boundaries with those furnished by the Department or other hydrologic problems shall be discussed with the Department's Design Division.

A-2.3 Pump Stations. In the case of new pump stations or existing pump stations with major structural revisions or additions, the Department will furnish reproducible drawings showing design Q's and conceptual design details determined by the Department.

A-2.4 Debris Basins. The Department will furnish the hydraulic data and the required debris capacity.

A-2.5 As-Built Drawings. As-built drawings of county facilities and of other agency and utility facilities that the District may have on file will be made available at no cost to the Engineer. In the case of other agency and utility as-builts, the Engineer must verify their accuracy and validity. The Department will assume no responsibility in this regard. All other required as-built drawings shall be obtained by the Engineer at his expense.

A-3 DESIGN CRITERIA

Design criteria shall be in accordance with Section C.

A-4 COST ESTIMATES

Cost estimates made in connection with engineering and economic studies shall be based on the data contained in the Cost and Quantity Estimating Manual and in accordance with requirements of subsection D-3.

A-5 PERMITS

The Engineer will not be required to obtain any permits required for construction of the project. He shall, however, be required to obtain any permits required for the design of the project such as permits that might be required for conducting any subsurface investigations.

A-6 ENVIRONMENTAL IMPACT REPORT

If an Environmental Impact Report for the proposed project is required due to federal, state, or local ordinances, it will be prepared by the County and will not be the responsibility of the Engineer, unless otherwise agreed to.

A-7 DEVIATIONS FROM PROJECT CONCEPT

A-7.1 General. When it appears that a change of alignment, limits or type of structure from that shown in the project concept should be made, a written request for such change shall be submitted prior to submittal of final drawings and data. The request shall transmit a report and appropriate supporting data, as described in more detail below, recommending approval of the change. Prior to proceeding with any such request, however, the Engineer shall discuss the proposed request with the District. If the District feels that the proposed request has merit, it will direct the Engineer to proceed with agreed upon additional compensation.

The Department will use the report to evaluate the proposed change in alignment, limits or types of structures in accordance with the following guidelines:

1. The drain as realigned must serve the drainage areas at least as well as on the Department's alignment.
2. The change will provide the most effective control of storm waters consistent with good engineering practice and sound economics.
3. The change is required in order to coordinate with the plans of another agency. However, the cost to the Department should not exceed that of the drain in the project concept.

When a change in alignment or limits is being considered, which it is felt will meet the above criteria, it is suggested that it be discussed with the Department prior to submittal.

A-7 Cont.

For changes of alignment, Department representatives will meet with the Engineer in the field to assist in the determination of the alignment insofar as can be done by field inspection. It should be noted that shifting the alignment within the boundaries of a street in which the project was originally aligned does not constitute a change of alignment.

In the event the Department should choose to modify the project concept to address a new development or mitigate an unforeseen circumstance, the Engineer will be directed to proceed with any required modifications with agreed upon additional compensation.

A-7.2 Hydrologic Data. Prior to submitting the report, the revised hydrologic data for the new alignment should be requested by letter from the Department if it appears that the design "Q's" will be significantly changed. The request should be accompanied by a sketch showing the revised alignment.

A-7.3 Right of Way Costs. If there is a change in right of way requirements or a change in type of channel from open to closed or vice versa, estimates of cost of right of way for both the new design and that in accordance with the project concept should be requested by letter from the Department.

A sketch or sketches showing the rights of way in question in enough detail so that they may be located in the field and showing right of way dimensions and areas in square feet shall accompany the request. Sufficient cross-sections shall be submitted where right of way is required for cut and fill slope areas. All required temporary construction easements shall also be shown (see C-13).

A-7.4 Preparation of Report. The report recommending the change in alignment, limits or types of structures should cover the following points, as applicable, as well as any others that may be pertinent:

1. A specific description of the proposed revision.
2. A comparison between the proposed revised design and the design in accordance with the project concept as regards drainage protection to the tributary area, including, in the case of open versus closed conduit, the interception of storm flows by the closed section.
3. A summary of comparative costs for the alternate design. These costs shall include construction costs based on the unit prices shown in the Cost and Quantity Estimating Manual and, where applicable, costs of right of way as provided by the Department.
4. A listing and discussion of all known significant factors in support of and against the alternative design. These may involve, but may not necessarily be limited to, problems of traffic, access to residences or businesses, future development, cooperation with other public construction, or esthetics.

A-7 Cont.

Upon request the Department will furnish the Engineer, if available, a sample of a report for a modification of a project similar to that proposed.

A-7.5 Supporting Data. Supporting data to accompany the report shall include the following for the alternate design:

1. Plan and profile in sufficient detail to enable the Department to evaluate the proposal. The scale of the drawings shall be at the Engineer's option. Generally, 1" = 200' scale plan and profile drawings similar to those furnished by the Department will be satisfactory to show an alternate alignment.
2. Hydraulic calculations.
3. Comparative cost estimates.
4. Any pertinent letters or other documentation.
5. A reproducible 8-1/2-inch by 11-inch sketch showing a map of the proposed realignment.

A-8 BETTERMENTS

Betterments consist of items included in the construction contract which are not necessary in order to construct the project as designed in accordance with Department criteria or to replace existing improvements required to be removed as a result of the construction. Some examples of betterments are construction of street improvements beyond the limits of removal required for construction of the project, the replacement of a removed street improvement with one of higher quality, and the additional cost of providing a stronger structural design than required by the design criteria for the structure.

The additional cost of the engineering and construction of the betterment must be borne by the benefiting party. Where betterments are approved, an agreement will be negotiated between the Department and the party involved, which will require the latter to deposit the estimated cost of the betterment with the Department prior to advertising of the project plans and specifications for bids. In order to avoid delay due to the time required to prepare and execute betterment agreements, it is essential that drawings, quantities, cost estimates and other related materials be submitted to the Department at the earliest possible date (with preliminary data if possible).

The Department will consider the inclusion of betterments in the project when it definitely can be shown to be in the best interests of the Department and the public.

A-9 SCHEDULE OF SUBMITTALS TO THE DEPARTMENT

The preliminary data and final drawings and final supporting data shall be submitted to the Department on or before the scheduled dates mutually agreed upon between the Department and the Engineer. A change of a scheduled date by either party must be proposed as soon as possible and must be mutually agreed upon to be in effect.

All submittals must include a letter of transmittal in which the submitted data is itemized. All supporting data must be bound separately.

A-10 CHECKING AND REVIEW OF DRAWINGS AND SUPPORTING DATA

A-10.1 By the Engineer. The Engineer shall be held solely responsible for the correctness of all data, drawings and calculations submitted to the Department. All work shall be independently checked and initialed by the Engineer, except the hydrological work when it is performed by the Department.

A-10.2 By the Department. The Department will review the submitted preliminary data (Section B), final supporting data and calculations (Section D) and final drawings (Section E) for approval and payment of engineering fees.

A-10.3 Revised Final Drawings. The drawings and a check set of prints, with Department comments noted thereon, will be returned to the Engineer who shall then make the requested changes and resubmit the drawings to the Department as revised final drawings. Any and all check sets of prints shall be returned with the revised final drawings.

SECTION B

PRELIMINARY DATA

SECTION B

PRELIMINARY DATA

B-1 GENERAL

The following data, as applicable, shall be submitted to the Department after the scheduled Design Start Date and on or prior to the date scheduled for its submittal.

1. Preliminary Plans. Submit one set of reproducible drawings showing horizontal and vertical alignments on same scales required for final drawings (see E-5.2.1 and E-5.3.1).
2. Survey Notes.
3. Subsurface Investigation and Geotechnical Report.
4. Engineering Geology Investigation Report (When Required in the Engineering Agreement).
5. Proposed Multi-use, Esthetic or Landscaping Concepts.
6. Pump Station Schematics and Calculations.
7. Debris Basin Plan and Details.
8. Railroad Crossing Data.

Furnish two complete sets of all data except as otherwise indicated. The data shall be bound in separate folders with title on cover, pages numbered, and indexed. The cover of each folder shall bear the signature and number of a registered civil engineer, land surveyor, geotechnical engineer or engineering geologist, as applicable, responsible for the data. Each sheet of data shall be dated and have name or initials of individuals making and reviewing the data.

B-2 SURVEY NOTES AND SUPPORTING DATA

B-2.1 General. Submit copies of original survey notes and all supporting data used by the Engineer in the design of the project.

Survey notes and supporting data shall consist of, but are not limited to, the following:

- a. Survey Notes.
 - Horizontal Control Surveys (B-2.2) --- 2 copies
 - Vertical Control Surveys (B-2.3) --- 2 copies
 - Design Surveys (B-2.4) --- 1 copy
- b. Support Data.
 - Traverses and closures of survey lines. --- 1 copy
 - Traverse and closures of the project alignment into survey control. ----- 1 copy
 - Recorded Street center line notes. ----- 2 copies

B-2.1 cont.

Recorded and private survey street centerline tie notes. -----	2 copies
Recorded tract, parcel, record of survey, right of way maps, etc. -----	1 copy
Bench Mark listing. -----	1 copy

All surveys performed must be in accordance with recognized good surveying practice.

All Horizontal Control surveys must show proof of closure by traverse or remeasurement of recorded surveys.

All Vertical Control surveys must show proof of closure by differential level circuit.

All proposed project alignments must show closure by traverse into existing horizontal control.

All survey notes must be neat, technically correct, accurate, legible, and clear enough to be reproduced. Notes should include sketches oriented by a north arrow, preferably pointing up the page. Date of survey, field book page number, party's personnel, and cross references to adjoining pages must be shown.

Survey notes shall be submitted on 8- $\frac{1}{2}$ -inch by 11-inch sheets with one-inch binding space on the left hand side (11-inch side), and a clear space of $\frac{1}{2}$ -inch at the top for indexing. Copies must be made by a permanent process.

Horizontal control, vertical control, and design survey notes shall be submitted on separate pages.

B-2.2 Horizontal Control Surveys. In general all surveys must show references to points and lines used and for methods of establishment.

Field notes shall show all the necessary elements of the field survey with lengths between points, angular values, angles to intersecting streets pertinent to the project layout, and reference ties (outside of construction disturbance) to all key points.

Control points must be tied out sufficiently to enable the Department to find and use them at the time the drain is constructed. Tie points must exist at the time the surveys are submitted and be sufficient to enable the Department to re-establish points that may be destroyed prior to construction.

Where distances between P.I.'s or angle points are excessive, P.O.T.'s should be established at reasonable intervals.

All survey monuments discovered shall be shown in the notes and tied into the surveys when location is such that they must be destroyed by construction operations.

B-2.2 cont.

The two most common horizontal control situations are:

a. Established street center line:

Where the proposed storm drain is to be within street right of way and said street has an established street center line, the engineer shall furnish the Department two copies of all pertinent original (city, county, state) street center line notes and ties, plus any additional ties made by the private surveyor. Also furnish tie distances between the street center line and the proposed storm drain. These tie distances should be shown on the plans in the form of a tangent offset, with distances shown along center line and offsets to controlling points along the proposed drain such as E.C.'s, B.C.'s, center line intersections, and angle points, etc.

If space will not allow showing the ties directly on the plan view, a small detail sketch showing the required data may be placed in a neat and orderly fashion elsewhere on the plan sheet.

Established street center lines, city or county, will be accepted as found, and measurements shown on the official survey notes will be accepted provided no error in excess of 1 part in 5000 is found by a remeasure check.

b. Without an established center line:

Where the proposed drain is to be in right of way or easement or within public streets without an established center line, either of the following methods will be acceptable:

1. Establish the center line of the drain by survey, tying out working points on the alignment such as angle points, B.C.'s, E.C.'s, and P.I.'s sufficient to enable the Department to recover the alignment for construction.
2. Establish a control line or transit line in close proximity of the proposed drain, and show tie distance from the control line to the proposed drain in the same manner as stated in street right of way ties.

Tie out working points on the transit line, such as angle points and P.O.T.'s, sufficient to enable the Department to recover the line for construction.

B-2.3 Vertical Control Surveys. Primary Bench Mark control levels shall be run using conventional differential level methods, and a minimum of two established bench marks shall be used as a basis for the survey, one bench mark to be used as the originating bench mark, the other to be used as the closing bench mark. Additional bench marks used as intermediate check points is highly desirable. The error of closure in loop or section shall not exceed an amount in feet equal to .05 times the square root of miles: (0.05 Dist. Miles). In hilly terrain, this error may be doubled.

The datum used must be based upon Mean Sea Level (U.S.C. & G.S.) and is to be included in the bench mark descriptions.

B-2.3 cont.

The Department maintains complete records of bench mark descriptions throughout the County. It is recommended that the Engineer contact the Department's Survey Section and obtain bench mark descriptions and datum prior to commencing vertical control surveys. Only Department-furnished or Department-approved benches shall be used for control bench marks.

Bench mark level notes shall be submitted to the Department for approval prior to commencing design surveys, since past experience has shown that costly redesign may thus be minimized.

The level notes must be original or xerox-photo type permanent copies of the originals which contain the back sights, fore sights, bench marks, and temporary bench marks (TBM's) found or set.

Bench marks shall be established in positions where they will be undisturbed by the construction of the project. Markers in curbs, headwalls or permanent structures, buried pipe, monuments, etc., are satisfactory.

Bench marks in wooden structures, fences, and poles and bench marks established on fire hydrants are not satisfactory.

All bench marks shall be completely described in the original notes in such a manner that recovery cannot be in doubt. Bench mark descriptions shall be clear, concise, and accurate. Submit sketch showing location of bench marks in relation to storm drain alignment.

In addition, the bench marks shall be located and described on the final plan and profile sheets as indicated in subsection E-5.1.3.

Bench marks for construction purposes shall be established at reasonable intervals along the project site and in the vicinity of proposed construction; however, bench mark intervals shall not exceed 1,000 feet, with a minimum of two bench marks for any storm drain or line or portion thereof.

Secondary vertical control leveling for the purposes of cross sections, profiles, determining elevations on structures, and for general design purposes shall conform to good standard engineering practice for such work. Notes shall clearly show all results obtained, identify items thoroughly, and be supplemented with sketches when necessary.

B-2.4 Design Surveys. Where possible the Engineer shall make a vertical and horizontal field determination of the planned join of the existing drain to the proposed project.

Invert elevations shall be obtained by exploratory excavations or by survey in sewer manholes on all sewers that cross or otherwise interfere with the proposed drain. The Engineer should be careful to investigate the existence of drop manholes and make sure that inlet and outlet elevations correctly indicate the sewer grade.

B-2.4 cont.

Design surveys shall be extended sufficiently to accurately locate permanent improvements such as curbs, gutters, sidewalks, etc., so that they can be restored to existing line and grade if they are subject to removal or damage by construction operations.

Where the radial survey method is used for the location of permanent improvements the field notes and a reproducible scale drawing (20 or 40 scale) must be submitted.

Where topographic maps are used for quantity take-off, said maps shall be furnished to the Department's Survey Division.

B-3 SUBSURFACE INVESTIGATION AND GEOTECHNICAL REPORT

B-3.1 General. Two copies of the subsurface investigation and geotechnical report (the original and duplicate) prepared in accordance with the following requirements shall be furnished to the Department for review. A copy of the preliminary plans showing the alignment and profile of the proposed construction shall be submitted with the reports.

The purpose of a subsurface investigation and geotechnical report is to obtain sufficient exploratory borings and sample analyses to permit the Engineer to assess the geotechnical problems which will affect the design, construction, and operation and maintenance of the project.

B-3.1.1 Subsurface Exploration. The subsurface exploration shall be planned and supervised by a registered geotechnical engineer, and when appropriate, an engineering geologist. The equipment used on the exploration shall be capable of drilling borings of sufficient diameter to obtain suitable undisturbed and bulk samples, accurately locating interfaces between soil strata, and attaining the depth of boring required hereinafter. The use of continuous flight helical auger-type drilling equipment is not permitted.

B-3.1.2 Report. The Geotechnical Engineer must sign, stamp and indicate the date of his registration expiration on the report. The report shall list all the following items and shall contain findings and supporting information pertaining thereto:

1. The relative compaction, type and extent of material which may be encountered.
2. Excavation problems.
3. Location, and extent of overexcavation required.
4. Location, nature, extent and hardness of bedrock.
5. The stability of slopes and excavations.
6. The bearing capacity and settlement or expansive characteristics of the subgrade materials.

B-3.1.2 cont.

7. The suitability of excavated materials (including bedrock) for use as fill, backfill, or bedding.
8. The soil parameters and loads required to design excavation shoring systems (see B-3.10).
9. The compaction characteristics of the individual soil types relative to their use as fill and backfill.
10. The groundwater condition.
11. The presence of substances in groundwater or in the native soils deleterious to concrete, steel, or other construction materials.
12. Pavement structure requirements (see C-6.2.1 and C-10).

Specific and detailed recommendations with supporting data shall be presented for all special problems such as, but not limited to, construction in expansive, organic, collapsing, liquefiable or diatomaceous soils; slope stability where overconsolidated clay is encountered; settlement beneath proposed fills; water control during and after construction; excavation in bedrock; use of project excavation material which contains excess moisture for fill and backfill; jacking or tunneling; use of piling; and location of old fills and landslides.

Field observations of items which can affect the construction operations, such as surface water flows, bedrock outcroppings, trash dumps, hazardous waste disposals, large concrete blocks, etc., shall be recorded.

The Department will analyze and use information from the subsurface investigation report in reviewing plans and preparing specifications for construction.

B-3.2 Spacing, Location and Depths of Exploratory Borings.

B-3.2.1 General. A location map shall be included in the report, using a scale of not less than 1" = 600', to show the location of each boring along the length of the proposed storm drain.

Exploratory borings shall be identified with the numbering sequence increasing upstream, with each line of a project having its own sequence of numbers.

B-3.2.2 Spacing. Borings shall be spaced at intervals not to exceed 660 feet. The intent of this spacing is that no part of the project shall be more than 330 feet from a boring. This spacing does not apply to tunnel or jacking construction. On these types of construction, spacing will be determined on an individual project basis. The Department will make the final determination after consulting with the geotechnical engineer.

B-3.2.3 Location. One boring shall be located at the downstream end of a project line or at its confluence with another line of the project. The interval between borings shall be reduced as necessary so as to locate borings in areas in which topography or other evidence indicates a probability of soil conditions differing from those of surrounding areas, or so as to locate borings

B-3.2.3 cont.

adjacent to existing structures where special construction measures may be necessary or in areas where future fill will be placed or bedrock encountered. For a line less than 600 feet in length (except when a project outlet is on the beach) only one boring will be required if, in the consultant's opinion, this boring will furnish sufficient information. The one boring should be spaced approximately equidistant from each end of the line, rather than at the downstream end. A boring shall be placed in each sump along the alignment of the project (see B-3.7)

When a project outlet is on a beach, a boring shall be located at both the downstream and upstream ends of the project reach within the beach area. In order to portray actual subsurface conditions, one or more additional borings will be required between these two borings if strata continuity between the borings cannot be determined. In addition, both the summer and winter profiles must be considered in the design.

Borings shall be located so as to be representative of materials which will be encountered by the proposed construction. So long as this is accomplished, boring locations may be selected at any point within the right-of-way or easements in which the conduit or structure is to be located; borings need not be located in paved street areas, but may be located in back of the curbs in the parkway area.

B-3.2.4 Depths. In order that stability of the foundation may be adequately determined, borings shall be drilled to the following depths:

1. Where no groundwater is encountered, borings shall be carried to a depth of at least 5 feet below the proposed storm drain invert.
2. Where groundwater is encountered in vicinity of subgrade, or above, borings shall be carried to a depth of 10 feet or twice the structure width, whichever is greater, below the proposed storm drain invert (see B-3.7).
3. If unsuitable material for support of the drain is encountered near subgrade, test holes shall be carried through to the bottom of the unsuitable material or to a depth of 10 feet below the proposed invert, whichever is less.
4. Where the construction will involve structural foundations such as footings or piles, the borings shall be carried sufficiently below the footing subgrade or pile tip elevation to furnish bearing capacity and settlement information for proper design of the foundation.
5. In areas where fill is to be placed, the borings shall be continued a sufficient depth below invert to allow determination of probable settlement.
6. In the event a project is so redesigned subsequent to the soil consultant's report that the subgrade is lowered or the alignment is

B-3.2.4 Cont.

changed, additional borings shall be made as necessary to conform to the above requirements for those portions of the alignments which have been redesigned.

B-3.3 Logs of Borings. The logs of borings shall show Unified Soil Classification descriptions and Group Symbols, together with all pertinent observations such as date of drilling, water elevations, seepage, approximate percent rock encountered, ease of drilling, type and depth of soil or rock sample taken, caving, running sands, trash, sanitary fills, and any other information which will be of help to the contractor. All pertinent information indicated in Column 6 of LACFCD Standard Drawing 2-D 413 shall be included. Descriptions and Group Symbols shall be consistent with results of laboratory classification tests. Group Symbols selected during logging but changed as a result of laboratory test data shall be noted in the report but not shown on the logs of borings. The invert elevation of the proposed storm drain shall be shown graphically on the log. (See subsection E-6.)

B-3.4 Samples. Representative undisturbed and bulk soil samples shall be taken from all soil strata 3 feet or greater in thickness encountered in each boring. In cases where all or most of the soil in a boring is of one type, where there is only one stratum 3 feet or more in depth, or where there is no soil stratum 3 feet thick, there shall be no less than two representative undisturbed and bulk soil samples taken from each boring. When a very firm soil or large rock mass (not boulders) which cannot be penetrated by normal soil boring equipment is encountered, core samples shall be provided.

Disposal of soil samples shall be left to the discretion of the geotechnical consultant. Core samples of rock, however, shall be delivered to the Department for pre-bid observation by contractors.

B-3.5 Laboratory Analyses. Laboratory analyses shall be made on the soil samples as indicated in the table on page b-9 and in accordance with the following NOTES referred to in the table:

1. Particle size analysis shall be performed on representative portions of bulk samples. At least one mechanical analysis shall be made for each major soil type encountered. The analysis of predominant non-plastic soil types shall be repeated in alternate borings. Should the sample obviously contain less than 10 percent silt and clay, the hydrometer portion of the analysis may be omitted. Gradation curves shall be furnished for the soils tested.
2. Sand equivalent determinations shall be made on representative portions of bulk samples of coarse-grained soils (except for group symbols "SC" and "GC") occurring in strata 3 feet and more in thickness.
3. Sufficient laboratory compaction tests shall be performed to enable the calculation of a relative compaction by the consultant for each undisturbed soil sample taken. The laboratory maximum dry density of the same materials may be correlated. However, no laboratory maximum dry density may be applied to any sample taken farther than 1300 feet from the boring where the material for the laboratory maximum dry density was taken.

LABORATORY ANALYSES

TYPE	METHOD	PURPOSE
Particle Size Analysis (See NOTE 1)	ASTM D422	Evaluation of project excavation material for use as fill, backfill and bedding.
Sand Equivalent Determinations (See NOTE 2)	ASTM 2419	
Expansion Index	UBC 29-2	
Atterberg Limits	ASTM D4318	
Compaction Test (See NOTE 3)	California Test 216, Part II (See NOTE 5)	Establishing relative compaction and the in situ soil dry density of major soil types which may be encountered.
In Situ Dry Density and Moisture Determination	(See NOTE 4)	
Strength Characteristics (See NOTE 6)	ASTM D3080 or ASTM D2166 or ASTM D2850 (See NOTE 7)	Evaluation of bearing capacity, slope stability, tunnel and retaining structures loads.
Consolidation Characteristics (See NOTE 8)	ASTM D2435	Evaluation of the degree of compression, collapse, or expansion of soils which may occur during the construction period and over long periods.
Chemical Analyses (See NOTE 9)	Analyses of a distilled water extract of soil (1 part soil: 5 parts water by weight) or the groundwater in accordance with: ASTM D512 - Chloride ASTM D516 - Sulfate ASTM D1293 - pH	Determination of pH and the presence of sulfates and chlorides in groundwater or in the native soil (as percent dry weight of soil) which are deleterious to concrete, steel, and other materials. (See NOTE 10)

B-3.5 cont.

4. Relative compaction =
$$\frac{\text{In situ dry density} \times 100}{\text{Laboratory maximum dry density}}$$
5. When soil samples are taken in private property, the method for testing shall be per ASTM D1557, Method D.
6. Ultimate values of shear strength ϕ and C, not peak values, shall be furnished for each major soil type encountered. Residual values of ϕ and C shall be furnished for overconsolidated clay. The plot of values shall be furnished (at least three points are required for each plot). Shear values of soils below the invert shall be included so the Department can determine the soil parameters for penetrating shores.
7. Projects where major structures, such as pump stations, dams, tunnels, etc., are to be constructed, may require Triaxial Compression Testing.
8. Sample shall be inundated during the test and the effect plotted. Undisturbed samples need not be trimmed in diameter prior to test.
9. A minimum of one determination per alternate boring when groundwater is not encountered, and on determination in each boring where groundwater is encountered.
10. Where the presence of organic materials are encountered, the organic content of the soil shall be determined as required by the Department.

Should additional tests be necessary, in the opinion of the Department, they shall be performed by the Engineer when requested in writing by the Department.

B-3.6 Groundwater. The logs of the exploratory borings shall indicate elevations of seeps and the ground or perched water table as of the date the boring was made. If no water was encountered, a statement to that effect shall be included in the logs of borings. When water is encountered the length of time and the depths to which, and from which, the water rose shall be noted on the log of the boring.

B-3.7 Observation Wells. Where groundwater is encountered in any test boring, the Engineer shall notify the Department. The Department will determine the locations and requirements for installation of observation wells to monitor groundwater levels. This work shall be done by the Engineer with agreed upon additional compensation.

B-3.8 Submittal of Data. All field, laboratory, and office information shall be submitted on 8- $\frac{1}{2}$ x 11 sheets or on sheets folded to that size. Boring locations shall be given in terms of direction and distances from street center lines, curbs, or other permanent improvements, and shall not be located by storm drain stationing. The elevation of the ground surface at each boring location, the date each boring was drilled, type of equipment used and method of drilling shall be given.

B-3.9 Use of Existing Exploratory Boring Data. In many locations, exploratory boring data have been taken previously for the soil information required in the design of storm drains, sanitary sewers, bridge foundations, or other structures. This information, where available, and in the opinion of the Department adequate for the purpose, may be used in lieu of new exploratory boring data, except for the determination of the existing groundwater table. These existing exploratory data shall comply with all the conditions set forth in subsections B-3.4 and B-3.5 above. In the event that the existing exploratory data do not fully meet all of the requirements herein outlined, new exploratory boring information will be required to supplement the existing data. Groundwater tables must, however, in all cases, be up-to-date where the water table may influence the design or affect the contractor's operations.

B-3.10 Shoring Parameters. The following minimum information regarding the soil parameters and loads required to design excavation shoring systems shall be furnished for the soils encountered during the subsurface investigation:

1. The coefficients of active earth pressure (K_a) and passive earth pressure (K_p).
2. The lateral earth pressure distribution above the subgrade elevation as determined by the Rankine Theory.
3. The location and magnitude of any external load(s) that may affect the design and/or performance of the shoring systems.

B-4 ENGINEERING GEOLOGY INVESTIGATION REPORT

B-4.1 General. Two copies of the engineering geology report (original and duplicate) prepared by, or under the supervision of, a registered geologist certified in engineering geology, in accordance with the following requirements shall be furnished to the Department.

Sufficient surface and subsurface engineering geological exploration shall be made to substantiate geologic conditions and to make an adequate assessment of geological problems which may be encountered during project construction. The report shall be accompanied by an independently prepared geological map, prepared on a topographic base map of sufficient scale to show detail, but not too detailed that the areal extent of coverage is limited and important geologic features in close proximity to the project are excluded. A sufficient number of geologic cross sections should be submitted with the map to show correlation of all surface and subsurface data from test borings and other sources. All test borings shall extend a minimum of 5 feet below the proposed storm drain invert and, in tunnels, not less than one-half the diameter of the tunnel.

B-4.1 cont.

The location of all subsurface data shall be indicated in the text of the report and on all maps and cross sections. In addition, a copy of the geologic logs for each test boring, trench or other sources of subsurface data shall be included in the text or appendix.

Geologic logs of borings shall contain a lithologic description of each stratum, the depths at which changes in the character of materials are observed, the thickness of the strata, hardness, planar features, extent of weathering, moisture content and depth to water (where applicable).

The text of the engineering geology report shall contain findings and supporting information for, but not limited to, the following:

1. Type and extent of in-situ rock and/or unconsolidated surficial deposits to be encountered.
2. Structural features.
3. Surface water and groundwater conditions.
4. Other geologic features of special significance to the project.

In addition, the report should contain comments relative to:

5. Excavation problems.
6. Placement of fill.
7. Needs for additional subsurface data.
8. Special construction problems.

B-4.2 Detailed Information. In accordance with the above noted general requirements, the following includes a detailed, though not necessarily complete, list of topics that ordinarily should be considered in geologic reports submitted to the Department. It is recognized that the scope, length and organization of reports will be highly dependent upon the physical situation of the project. Therefore, most of the following comments are intended to serve as a general guide and check list for those who prepare and use geological reports, rather than a rigid framework of requirements.

B-4.2.1 In Situ Rock and Surficial (Unconsolidated) Deposits.

1. Identification, distribution, depth and general physical characteristics.
2. Special physical characteristics or chemical features, distribution of weathered zones, and significant differences between fresh and weathered material.
3. Response to natural surface and near surface processes (e.g. mass movement, raveling, gullying, etc.)

B-4.2.2 Structural Features (e.g., faults, shears, folds, joints, foliation, schistosity).

1. Occurrence, distribution and special effects upon the in situ rock.
2. Special features of faults (e.g., zones of gouge and breccia, nature of offsets, active, potentially active or inactive).
3. Seismic (earthquake) consideration (e.g., historical recordings, anticipated forces, etc.)

B-4.2.3 Surface and Ground Water Conditions.

1. Distribution and occurrence (e.g., streams, ponds, swamps, perched water, springs, seeps, subsurface basins).
2. Relation to topography and geologic features (e.g., pervious strata, faults, fractures).
3. Effect of water on the properties of in situ materials.
4. Water rights, existing rights, potential effects of proposed construction on ground water regimen.

B-4.2.4 Geologic Features of Special Significance.

1. Slump and slide masses within in situ bedrock and/or unconsolidated deposits; distribution, geometric characteristics, correlation with topographic and geologic features, age and rates of movement; analysis of slide stability relative to the project.
2. Indications of subsidence or settlement (e.g., scarplets, fissures, crack patterns, topographic bulges, tilted reference features, historic records and measurements).
3. Features indicative of accelerated erosion (e.g., cliff re-entrants, badlands, advancing gully heads).
4. Identification of geologic environments where collapsing soils may be present.

B-4.2.5 Excavation Problems

1. Prediction of what materials and structural features will be encountered.
2. Prediction of slope stability.
3. Rippability estimates for unusually hard or massive rock (e.g., classification as to rippable, marginally rippable and non-rippable based on average seismic velocity of materials).

B-4.2.5 cont.

4. Recommendations for reorientation or repositioning of cuts, reduction of cut slope ratio and height, development of compound cut slopes, special stripping above daylight lines, buttressing, protection against erosion, handling of seepage water, setbacks for structures above cuts, etc.
5. Excessive ground water flows.
6. Problems caused by features or conditions in adjacent properties.

B-4.2.6 Placement of Fill. Recommendations for keying and benching of fill, positioning of fill masses, reduction of fill slopes, special preparation of ground to be loaded with fill, provision for underdrainage, buttressing, special protection against erosion, setbacks for structures near edges of fill prisms, etc.

B-4.2.7 Recommendations for Additional Subsurface Testing, Exploration, Inspection or Analysis

1. Cuts and test holes needed for additional geologic information.
2. Program of subsurface exploration and testing, based upon geologic considerations, that is most likely to provide data needed by the geotechnical engineer for stability analyses of cut and fill slopes and for structures.
3. Geologic inspection needed during construction.
4. Landslides which may affect the project shall be explored and include:
 - a. Verification of the slide plane(s) by downhole inspection (to be done by a registered engineering geologist) unless otherwise approved by the Department.
 - b. Subsurface exploration to define the three dimensional geometry and parameters of the slide.
 - c. Sampling and testing to define shear strength values for stability analysis.
 - d. Drilling to a sufficient depth to verify penetration of all slide planes and geologic conditions of underlying materials.
 - e. Analysis provided by a geotechnical engineer of slide stability relative to the project based upon criteria approved by the Department.

B-5 cont.

B-4.2.8 Special Construction Problems.

1. Areas to be left as natural ground.
2. Removal or buttressing of existing slide masses.
3. Problems to be encountered in tunnel sections.
4. Protection from wave erosion along shorelines.
5. Problems of ground water circulation.
6. Position of structures with respect to active faults.
7. Geologic factors which influence temporary stability of construction excavations.

B-5 PROPOSED MULTI-USE AND ESTHETIC OR LANDSCAPING CONCEPTS

If an agency other than this Department proposes multi-use of the project or any esthetic or landscaping considerations for the project, descriptions shall be submitted along with the other preliminary supporting data.

Such activities as recreational uses or joint use of Department access roads will be considered, provided that such uses do not conflict with Department activities, and responsibility for damages and liability is guaranteed by the sponsoring agency. All costs for design, installation, or maintenance of any facilities necessary for such uses must be paid by the sponsoring agency.

Special design treatment and/or landscaping to screen or improve the appearance of projects will also be considered and, upon approval by the Department, may be included in the project construction contract. Examples of esthetic concepts that may be approved are alternatives to chain link headwall and channel fencing, screen planting at pump stations or on debris basin slopes, and colored concrete on large exposed surfaces.

The description of proposed esthetic treatment should include estimates showing the additional cost of the proposals, sufficient details concerning materials and design to permit evaluation, and pictorial representations where appropriate.

The descriptions will be required on all projects extending in undeveloped or partially developed areas, or when projects change the existing features of areas (e.g. an existing ditch is to be replaced by open channel or box conduit).

The treatments which are considered but rejected for various reasons shall be so stated and included in the description.

B-6 PUMP STATIONS

B-6.1 General. Based upon the Department furnished drawings and Pump Station Design Manual, the Engineer shall prepare and submit the drawings and supporting data as stated herein.

B-6 Cont.

B-6.2 Site Development Plan. Site development plan with suitable survey ties and indicating automotive equipment ingress and egress to pump station and parking facilities.

B-6.3 Floor Plan and Elevation. Floor plan and elevation drawings of pump station in sufficient detail to permit the Department to evaluate the size, utility, and appearance of the facility; hydraulic configuration of sump; inlet and discharge line elevations; arrangement of pumps; motor room floor openings and sump access system.

B-6.4 Outline Layout. Outline layout of pumps and driving machinery with complete calculations sufficient to substantiate the selections. The calculations shall include: system curves and pump selections and equipment sizing calculations.

B-6.5 Utility Services Sketch. Utility services sketch indicating availability of serving agencies' facilities and alignments to pump station.

B-7 DEBRIS BASINS

B-7.1 General. Based upon Department-furnished hydraulic data and required debris capacity and guided by the Debris Dams and Basins Design Manual, the Engineer shall prepare and submit the drawings and supporting data as stated herein.

B-7.2 Site Development Plan. Site development plan with suitable survey ties and indicating plan of earth fill dam or equivalent structure, outlet facilities, access road for cleanout purposes, and parking facilities at crest of dam. The information must be on a topographic map showing existing utilities and all the culture and the trees by size and type. Contour interval shall be 2 feet; however, 5-foot intervals may be used on steep slopes. Scale of topographic map shall be appropriate to the size of the project (smallest scale acceptable: 1" = 40').

B-7.3 Details. Profiles of spillway, dam and outlet works with pertinent elevations, slopes, etc., dimensions of spillway, and sufficient detail to permit the District to evaluate the hydraulic capacities of the designed dam, spillway, and outlet works.

B-8 RAILROAD CROSSINGS

B-8.1 General. Data for railroad crossings shall be submitted along with the other preliminary data or as soon thereafter as is reasonably possible, but in any case prior to submittal of final plans and data.

The Department will obtain approvals from railroads for the design and method of construction of the conduit across railroad right of way. If the span and angle of crossing is such as to require a temporary trestle the Department will arrange meetings with the Engineer and railroads to coordinate the design plans. In such cases the Department's Design Division shall be contacted.

B-8 Cont.

B-8.2 Drawings and Details. Transparencies of drawings on standard size sheets shall be submitted showing plan, profile, and sections at crossings; vicinity sketch; and structural details of the conduit within the railroad right of way. The structural details for structures outside the railroad right of way need not be shown. Two sets of structural calculations pertaining to the section across railroad rights of way shall also be submitted.

SECTION C

DESIGN CRITERIA

SECTION C

DESIGN CRITERIA

C-1 GENERAL

Criteria for design shall be as contained in the following Los Angeles County Flood Control District and Department manuals.

1. Project Preparation Instruction Manual
2. Hydraulic Design Manual
3. Structural Design Manual
4. Pump Station Design Manual
5. Debris Dams and Basins Design Manual

C-2 DEVIATIONS FROM DESIGN CRITERIA

Any condition not covered, or deviations from Department design criteria as given in the above manuals, shall be submitted to the Department for approval prior to use.

C-3 COVERED STORM DRAIN CONDUITS

C-3.1 General. All covered storm drains shall be of reinforced concrete pipe and/or acceptable alternate conduits as stated herein.

C-3.2 Box Conduits. When the cover over a box exceeds 10' an alternate design for wide trench condition may be required. Contact the Design Division's Structural Section for requirements.

C-3.2.1 Box Alternates. If the design requires pipe conduit in diameters from 84 inches through 114 inches, provide and show on the drawings hydraulically equivalent reinforced concrete box sections as an alternate type of construction. The Department reserves the right, however, to eliminate either the pipe or box alternate if such is in the best interest of the Department.

C-3.2.2 Box Only. If the design requires pipe conduits diameters in excess of 114 inches, provide hydraulically equivalent box conduits only.

Shallow head room may dictate the use of a wide, flat box in lieu of pipe conduit.

Also, lack of space between utilities where utility relocation costs may be prohibitive, may dictate the use of a tall, narrow box section in lieu of pipe conduit.

C-3.3 Tunnels. The economics of very deep open cuts versus tunneling may dictate the use of tunnel sections. This shall be investigated for conduits 60 inches or greater in diameter when the cover is 30 feet or greater for a length

C-3.3 cont.

of 400 feet or more. Also, conduits under freeways, buildings, etc., where jacking may not be feasible or permitted, may require the use of a tunnel section. The tunnel section shall be determined in conference with representatives of the Department.

C-3.4 Others. Special circumstances may dictate the use of other type conduits. The Engineer shall contact the Department for clearance prior to their use.

C-4 ALIGNMENT

C-4.1 General. In planning the alignment of the project, careful consideration should be given to the following factors.

C-4.2 Landscaping Removals. Removal of trees and other significant vegetation shall be held to a minimum. Consideration shall also be given to potential tree root damage by the construction of the storm drain, which could result in subsequent loss of trees. Excavation encroaching within the "drip line" of a tree is considered to be hazardous to its life.

C-4.3 Working Area and Traffic. Alignment shall be such as to provide sufficient area for the contractor's operations and to maintain traffic in accordance with the jurisdictional agency's requirements. The contractor will require an area adjacent to the trench at least 15 feet wide for the operation of cranes in pouring concrete, placing pipe, etc. A crane operating in a 15-foot strip area would still intermittently block traffic as the rear overhang on some cranes extends over 7 feet on the swing, e.g., Northwest Model Crawler No. 6 extends 7'-2". Where factors are present which preclude adherences to agency requirements, such conflicts shall be resolved with the agency.

C-4.4 Utilities. Where possible avoid relocation of utilities and alignments in close proximity to highly volatile or old utilities. Vibrations and earth movements caused by construction activities can easily rupture or damage adjacent utilities.

C-4.5 Existing Structures. Where feasible, the alignment shall be such as to avoid proximity to residences, apartments, buildings, and other structures which might be damaged by construction activities.

C-4.6 Slides and Other Earth Movements. Alignment shall be such as to minimize the potential for slides and other earth movements, particularly in hillside streets and steep canyons and where fills are to be built.

C-4.7 P.C.C. Pavement Joints. It should be noted that when the removal limits of PCC pavement fall within 3 feet of a joint, the entire width of pavement to the joint must be removed. The drain should be aligned so as to keep the removal limits of PCC pavement to a minimum.

C-5 UTILITIES (INCLUDING SEWERS AND STORM DRAINS)

C-5.1 General. A search must be made to locate all utilities, including sewers and storm drains, within the street or right of way in which the project is to be located. The record location and vertical position of all utilities must be shown on the plan and profile sheets of the drawings.

A DETERMINATION MUST BE MADE WHETHER ANY UTILITY IS HIGHLY EXPLOSIVE.

In the event the Engineer is unable to obtain a needed response from a particular agency or utility, and the Department is satisfied that every effort therefor has been made, the Department will assist the Engineer in obtaining the needed response.

Comparative cost estimates to justify utility relocations and approvals from utility companies are required in accordance with Section D.

C-5.2 Locating and Potholing. Where the record location of any telephone or power duct or conduit or other utility 3 inches or larger in diameter, including sewers but not house connections, crossing the main line conduit is within 24 inches below or above either the subgrade or top surface of the conduit, the numerical elevation of the utility shall be determined. The numerical elevation shall be obtained by exploratory excavations except as stated for sanitary sewers hereinbelow.

To obtain the actual elevation, the Engineer shall request the utility to pothole and the Engineer shall obtain the elevation. If the utility refuses or is unable to pothole, the Engineer shall contact the Department. If the Department is unsuccessful with the utility, it will inform the Engineer to arrange for the potholing and obtain the elevation upon agreement of additional compensation.

Potholing done by utilities with prior rights will be billed to the Department. Potholing done by utilities without prior rights will be their responsibility.

The flow line elevations of main line sewers crossing the storm drain or appurtenances may be determined by means of a survey of the flow line in sewer manholes on each side of the storm drain and by interpolating between surveyed elevations. Compare the computed sewer elevations by checking against sewer construction plans.

C-5.3 Disposition of Interfering Utilities

C-5.3.1 Subsurface Utilities. The note "to be abandoned" is nearly always applicable in describing the disposition of interfering subsurface pipelines. It is not applicable when the affected utility company wishes to salvage the interfering portions of a utility; in such a case the correct note is: "To be removed and reinstalled by others". This latter note is not normally applicable to subsurface pipelines as it is most often uneconomical for a utility company to salvage and reuse a line. The correct disposition of interfering

C-5.3.1 cont.

utilities cannot be verified until such time as the Department has completed its negotiations with the utility companies. Therefore, General Note 24, as shown in the Appendix under subsection G-1, shall be placed in the General Notes on the drawings:

"Utilities designated by the symbol "*" will be abandoned in place and the owner will install a new section of the affected utility at a location in close proximity to, but which does not physically interfere with, the proposed storm drain conduit and appurtenant structures.

The symbol indicated in the above note should be shown for each interfering subsurface pipeline even though in a few cases it will be incorrect. The Department will verify the correct disposition of interfering utilities and will make any minor last minute changes on the drawings which may be necessary.

House connections interrupted by the proposed storm drain will require remodeling in accordance with APWA-AGC Standard Plan No. 223-* or agency requirements. In cases where the location of the proposed drain precludes the remodeling to the existing sewer, a parallel sewer will have to be designed and constructed under the contract and the house connections reconnected thereto.

C-5.3.2 Surface Utilities. Telephone and power poles, fire hydrants, water meters and other surface utilities which interfere with construction will be removed and reinstalled by others, except water and gas meters which are covered by the provisions of subsection 5-4, as amended, of the standard specifications (see subsection D-4.2). In these instances, General Note 25, as shown in the Appendix under subsection G-1, shall be shown on the drawings:

"Utilities designated by the symbol "=" will be removed by the owner and the owner will reinstall a new section of the affected utility at a location in close proximity to, but which does not physically interfere with, the proposed storm drain conduit and appurtenant structures.

C-5.4 Protection for Non-Interfering Utilities. Utilities crossing over the storm drain may be of such type or size to require some form of support, both temporary and permanent. Sanitary sewers and house connections will always require a support in accordance with APWA-AGC Standard Plan No. 224. Also, some types of utilities crossing under and in close proximity to the storm drain may require some form of protection. Generally, the utility company will indicate its requirements during the approval process of subsection D-5.

Sanitary sewers crossing under and within 18 inches of the bottom of the proposed storm drain will require protection per APWA-AGC Standard Plan No. 225 or in accordance with agency requirements.

* NOTE: The last number of American Public Works Association - Associated General Contractors (APWA-AGC) Standard Plans for Public Works Construction referred to herein is omitted. It refers to the revision number of the standard and shall be the latest one in use.

C-6.1 cont.

C-6 MAINTENANCE AND ACCESS

C-6.1 General. The spacing of manholes for covered conduits shall be in accordance with Subsection B-4 of the Hydraulic Design Manual.

The need for the following shall be determined by the Engineer in conjunction with the Department's Flood Maintenance Division:

1. Vehicular access structures or special 36-inch clear opening manholes.
2. Paved vehicular access to inlet and outlet structures.
3. Vehicular access to manholes and any other structure that may require inspection or maintenance.
4. Type of access road surfacing, paved or unpaved.

C-6.2 Open Channels

C-6.2.1 Access Roads. For open channels with a top width of less than 30 feet, an access road shall be provided on one side only. For channels 30 feet or more in width, an access road shall be provided on both sides, except when prior Department approval is obtained for a single access road.

The grade on the access road shall not exceed 15 percent. Minimum centerline turning radius shall be 40 feet. Minimum width shall be 12 feet, except if no side room for the "swing" of a track crane is available, the width shall be increased to 16 feet. A cross slope of 2 percent toward the channel shall be indicated.

In most cases, access road pavement will be asphalt concrete designed for an axle load of 18,000 pounds, unless otherwise directed by the Department. The Department's Flood Maintenance Division shall be consulted for an estimate of traffic volume. The pavement structure thickness must be designed by the evaluation of soil parameters obtained by laboratory testing soil samples taken from exploratory borings. Where no base material is used, the subgrade must be sterilized with herbicides.

Turnarounds shall be provided when the access road exceeds 500 feet in length and dead ends. The turnaround area must be at least 40 feet by 40 feet.

Access shall be provided to the access roads from all cross streets. Double-drive gates and commercial driveways with a minimum flat width of 14 feet are required at all street crossings. On heavily traveled streets, gates shall be set back a minimum of 25 feet from the street so that a vehicle may be parked off the traveled roadway while the gates are being opened. In residential areas there shall be no setback; gates shall be placed along the property line.

C-6.2.2 cont.

C-6.2.2 Invert Access Ramps. Ramps shall be placed at approximate 5-mile intervals and at the downstream and upstream limits of the open channel and shall be large enough to accomodate construction equipment. The channel must have at least 10 feet vertical clearance at any overhead structure and should be at least 20 feet wide, otherwise the ramps should be omitted.

The ramp shall be paved and have a maximum grade of no more than 15 percent and be at least 12 feet wide.

Design of ramps to soft bottom channels shall take into consideration the fact that tracked equipment is used for maintenance. This equipment is hauled to the site on trailers with extremely low clearance, therefore, access to the top of the ramp shall be carefully studied. There shall be no abrupt changes of grade, low head clearances or any other condition that would prevent delivery of the equipment to the bottom of the channel.

C-6.2.3 Low Flow Channels. All low flow channels shall be at least 6- $\frac{1}{2}$ feet wide across the bottom to allow equipment to clean out the channel.

C-6.2.4 Steps and Gates. Steps and walk-in gates shall be installed on the open section of a channel where open channel joins a covered section (not just a crossing) or wherever a closed drain connects and no manhole is within 100 feet of the channel.

C-7 FENCING

C-7.1 General. All rights of way owned in fee by the Department shall be fenced in accordance with APWA-AGC Standard Plan No. 600.

C-7.2 Channels. Channel wall fencing shall be 4 feet high on a side adjacent to an access road and 5 feet high on a side where there is no access road. Right of way fencing 5 feet high shall be provided adjacent to access roads. Where the right of way may be used by equestrians, the adjacent channel fence shall be 5 feet high.

C-8 HANDICAPPED RAMPS

If any construction of the project will require removal of the sidewalk between the curb returns, a ramp for the handicapped must be constructed. If there is no sidewalk, a ramp is not required. The standard plan of the agency having jurisdiction shall be used.

C-9 TREES

If trees must be removed, contact the jursidictional agency for replacement requirements.

C-10.1.1 cont.

C-10 EXISTING PAVEMENT AND RESTORATION

C-10.1 Determining Existing Pavement

C-10.1.1 General. It is extremely important that the limits, types, and thicknesses of existing pavements be determined. Incorrect information shown on the drawings result in extra work payments when the pavement is thicker than shown and inflated bid prices when less thick than shown. It has also occurred that when the existing pavement was less thick than shown and failed during construction operations, contractors have successfully argued that, if the proper thickness had been indicated, either they would have used equipment or procedures which wouldn't have caused the failure or that they would have anticipated the failure and included restoration in its bid price.

The limits and thickness of existing pavement in those areas in which bituminous pavement has been placed over portland cement concrete pavement or where the portland cement concrete pavement was constructed with reinforcing steel should be accurately determined. For the purposes of depicting such information accurately, it should be noted that records of the street maintenance agencies often supply data as to capping and resurfacing performed subsequent to the original paving. Also, the data obtained from soil borings taken in roadways should be used as a check against the data obtained.

Instances have also occurred where an old pavement has been abandoned in place, the street surface raised by placing earth fill and a new pavement placed over the fill. Diligence should be exercised in searching records for this condition. Where it occurs, the old pavement should be shown on the plans and in the cross-sections.

It has been the Department's experience, however, that not all information on file accurately depicted actual conditions found in the field during construction. Particular attention should be directed to streets which show a normal thickness for that particular type street but would have been subjected to one or more cappings, such as streets in commercial and industrial areas and streets in older areas, or such streets that have a high crown or have gutters paved over, or such streets which previously had street car lines.

C-10.1.2 Base Material. Base material is considered to be a part of the existing pavement. The type, limits and thickness of existing pavement as indicated on the drawings is not considered complete unless base material, if existing, is also noted.

C-10.1.3 Coring. To confirm the thicknesses obtained from records and documents, pavement cores shall be taken along the center line of the drain, at least one per block and at a maximum spacing of 300 feet, and the locations thereof shall be shown on the plans. In addition to the above, where a "major" street (60 or more feet curb to curb) crosses the proposed drain, a coring shall be taken on the center line of the drain within 8 feet of the center line of the crossing street.

C-10 cont.

C-10.2 Resurfacing Except for Those Streets Under Caltrans or Los Angeles County Department of Public Works Jurisdiction.

C-10.2.1 Bituminous Paving

1. Existing bituminous pavement up through 5 inches in thickness shall be replaced with bituminous pavement one inch greater in thickness.
2. Existing bituminous pavement greater than 5 inches in thickness shall be replaced with bituminous pavement of equal thickness.

C-10.2.2 Concrete Paving

1. 5 inches: Replace with 6 inches
6 inches: Replace with 6 inches
7 inches: Replace with 8 inches
8 inches: Replace with 8 inches
2. Existing portland cement concrete pavement 8 inches and greater in thickness shall be replaced with portland cement concrete pavement of equal thickness.

C-10.2.3 Combination Portland Cement Concrete - Bituminous Paving

1. Existing combination of portland cement concrete and bituminous pavement totaling up through 5 inches in thickness shall be replaced with bituminous pavement one inch greater in thickness.
2. Existing combinations of portland cement concrete and bituminous pavement totaling up to greater than 5 inches in thickness shall be replaced with bituminous pavement equal in thickness to that of the combination.

C-10.2.4 Deficient Pavements. If during the design of the project, it appears that the replacement pavement as stated above may be insufficient to carry the existing traffic loads, the owner of the street shall be notified by letter of this circumstance. Where various pavement types and thicknesses exist on the project, the owner may decide to upgrade deficient pavements and downgrade other pavements to the extent that the overall pavement costs that would be required by the replacement schedule listed above is not exceeded. If this is not possible, then the owner shall be approached regarding entering a betterment agreement to provide for the additional cost of upgrading deficient pavements. In any event a copy of a letter from the street owner regarding his decision on any deficient pavements shall be sent to the Department.

C-10.2.5 Modern Pavement Design Substitution. Where it appears desirable from the standpoint of modern pavement design to construct a combination of pavement surface and base in lieu of replacing the existing old paving, such combination not being more expensive than replacing the existing pavement as provided above, a written request together with substantiating cost estimates from the street owner shall be submitted to the Department for approval.

C-10.3 Resurfacing for Streets and Highways Under Caltrans Jurisdiction. Use Standard Drawing 2-D187. Caltrans shall be contacted regarding their limits of jurisdiction in surface streets where on and off ramps are located (see D-5.5).

C-10.4 Resurfacing of Streets Under County Department of Public Works Jurisdiction. In the case of resurfacing to be done in streets under the jurisdiction of the Department, the thickness of resurfacing must be one inch greater than existing in accordance with Section 16.06.200 of the Highway Permit Ordinance, Division 2 of Title 16, Los Angeles County Code. This will apply for any existing surfacing of any thickness; however, in no event shall resurfacing be less than two inches in thickness.

Certain cities are "contract" cities with the Department and the Department requirements apply. Contact the Department for those cities.

C-11 PERMANENT RIGHT OF WAY REQUIREMENTS

C-11.1 Covered Sections. Covered sections shall have a width of right of way equal to the maximum outside dimension of the box or pipe conduit plus 3 feet on each side of the conduit, but in no case, a total width of less than 10 feet.

C-11.2 Open Channels. Open channels will require widths of right of way to meet ground surface conditions and access road requirements.

1. When the inside top width of a channel section is less than 30 feet, the width of right of way shall be equal to the inside top width plus 18- $\frac{1}{2}$ feet (2- $\frac{1}{2}$ feet on one side of the channel and 16 feet on the other side for an access road) and such additional width as may be necessary for cut or fill slopes to daylight (cut slopes 1- $\frac{1}{2}$:1 and fill slopes 2:1 unless soil conditions require flatter slopes).
2. When the top width of a channel section is 30 feet or more, an additional 13- $\frac{1}{2}$ feet over the width shown in 1 above is required in order to provide for access roads on both sides of the channel.
3. When a parallel dedicated street is adjacent to the right of way, thereby providing access for maintenance of the channel, each of the total widths shown in 1 and 2 above may be reduced.

C-11.3 Debris Basins. See A-8 of the Debris Dams and Basins Design Manual.

C-11 cont.

C-11.4 Catch Basins. Catch basins shall be located within street right of way unless otherwise approved by the Department. The Department can legally acquire rights of way for catch basins outside a dedicated street only if such location is necessary to intercept storm waters under existing conditions. Lacking such necessity, construction of catch basins outside dedicated streets, as for a future widening, will be permitted provided that the jurisdictional agency making the request acquires the rights of way in its own name. Furthermore, the Department must receive a letter of certification from the jurisdictional agency which states that they have obtained the necessary rights of way to accommodate the construction of the proposed catch basins and that the latter will perform any street remodeling work necessary to make the basins function properly as soon as possible after completion of construction. These catch basins will be listed in the specifications as deletable items, and if the above certification is not received prior to construction, the basins will be deleted from the contract.

The above procedure shall be adhered to on all projects for which agreements to dedicate catch basin right of way have not been submitted to the Department.

C-11.5 Verification of Street Widths. The street widths indicated on the design drawings shall be checked against the appropriate County Index Map. Where differences occur, they shall be substantiated with a copy of the deed, the city resolution or any other applicable instrument.

C-12 FILL EASEMENTS

Where permanent fills are to be placed which extend beyond permanent rights of way, a fill easement beyond the rights of way sufficient to encompass a 2:1 fill slope should be shown on the drawings. The Department will acquire such easements.

C-13 TEMPORARY CONSTRUCTION EASEMENTS

C-13.1 General. Where permanent rights of way do not provide sufficient area or access to perform the construction, temporary easements must be acquired. The easements required shall be determined and shown on the drawings by the Engineer and then will be acquired by the Department.

C-13.2 Drain in Rights of Way Other Than Public Streets. Where feasible, the outside limit of the main temporary easement should be parallel to and 30 feet from the outside limit of the storm drain. On the storm drain side opposite the main temporary easement, temporary easements of lesser width shall be provided for shoring operations and working area. Where feasible, the outside limits of this lesser temporary easement should be parallel to and 6 feet from the outside limit of the storm drain. Unusual soil conditions or other factors may dictate even wider temporary easements. Temporary construction easements shall be provided as necessary to encompass a sloped excavation of 3/4:1 (or flatter where the safe angle of repose is less steep) in conformance with the "Construction Safety Orders" of the State Department of Industrial Relations.

C-13 cont.

C-13.3 Drain in Public Streets. Alignments within street rights of way which are near the property line also require the lesser width temporary construction easements for the above-mentioned reasons and, in addition within residential areas, for public "sidewalk-type" access. The "sidewalk-type" access will be separated from the work area with 5-foot chain link safety fencing. However, temporary construction easements adjoining street rights of way should be avoided where it might involve the removal of trees, walls or other substantial improvements, extensive damage to well-developed landscaping, or the grading of terraced lots in order to make the easement suitable for use.

C-14 SANITARY SEWERS

If major reconstruction of sanitary sewers is required, the Engineer shall contact the owner agency and design the sewer in accordance with its criteria.

SECTION D

FINAL SUPPORTING DATA

SECTION D

FINAL SUPPORTING DATA

D-1 GENERAL

The final supporting data to be submitted with final drawings on or before the agreed upon data are as follows:

- 1. Calculations (1 set each)
 - a. Main line hydraulics
 - b. Catch basin
 - c. Structural
- 2. Cost estimates (2 sets)
- 3. Data for inclusion in specifications (2 sets)
- 4. Approvals by utility companies and other agencies (2 sets)
- 5. Right of way requirements (2 sets)
- 6. All additional data required together with any unsubmitted or unfinished preliminary data noted under Section B (2 sets)

The Department will review the submitted final supporting data for approval and for payment of the engineering fee.

D-2 CALCULATIONS

D-2.1 General. Furnish one complete set of all calculations. The calculations shall be bound in separate folders with the title on the cover and the pages numbered and indexed. The cover of each folder shall bear the signature and number of a registered civil engineer responsible for the calculations. Each sheet of calculations shall be dated and have the name or initials of the individuals making the calculations. Calculations shall be checked and each sheet shall show the initials of the checker.

D-2.2 Calculation Sheets. All calculations shall be on 8- $\frac{1}{2}$ " x 11" sheets. Computer sheets or other special forms shall be reduced to 8- $\frac{1}{2}$ " x 11" unless such reduction renders the sheets unreadable. Calculations processed by electronic computers shall be by use of the Department's computer programs. The Department shall be consulted if use of non-Department programs are contemplated.

All calculations shall be original or legible copies of original made by a permanent process.

D-2.3 Main Line Hydraulic. Furnish hydraulic grade line calculations based on the final alignment and stationing of the project.

D-2.4 Catch Basin. Furnish catch basin and connector pipe sizes and "V" depth calculations in accordance with Section D of the Department's Hydraulic

D-2.4 cont.

Design Manual. Also furnish profiles to scale for all connector pipes showing street surface, main line drain, and the record or potholed location of all crossing utilities, sewers and storm drains.

D-2.5 Structural. Furnish structural calculations for all designed structures.

D-3 COST ESTIMATES

D-3.1 General. The prices shown in the Cost and Quantity Manual must be used for estimating the cost of the project. Any deviation therefrom or prices needed which are not shown in the manual shall be determined by conference with the Department.

All construction cost estimates must be submitted on the Department's Estimate Summary Sheets, accompanied by the Department's appropriate Quantity Survey Sheets unless otherwise approved by the Department. All appropriate items on the Estimate Summary Sheets and Quantity Survey Sheets must be filled out, including the column on the Estimate Summary Sheet which has been provided for reference to the appropriate Quantity Survey Sheet.

Quantities shall be prepared and independently checked by the Engineer. Quantities and cost estimates should be submitted to the Department in duplicate. All submitted information must be neat and legible.

D-3.2 Multiple Lines

D-3.3 Comparative Cost Estimates to Justify Utility Relocations. Economic studies shall be made with respect to the cost of relocation or reconstruction of existing street or other surface improvements, utilities, sanitary sewers, and storm drains. Where the alignment is such as to require the relocation of a utility or where a special structure is required to avoid one or more utilities crossing the storm drain alignment and the estimated cost for relocation or reconstruction of a utility is approximately equal to or greater than the estimated construction cost for the storm drain designed so as to avoid the utility, the utility shall be avoided except where impractical from a construction or hydraulic standpoint. Comparative cost estimates shall be furnished to the Department with the final drawings where it is proposed to relocate a utility or modify the storm drain section.

D-3.4 Railroad Crossings. The construction cost of the project should be increased by costs incurred by railroad companies in connection with the construction of projects crossing railroad property. This cost will be furnished upon request by the Department's Design Division.

D-3.5 Revised Drawings. If revisions to drawings result in changed quantities, revised cost and quantity estimates shall be submitted with the revised drawings.

D-4.1 cont.

D-4 SPECIFICATIONS DATA

D-4.1 General. Upon receipt of revised final drawings, the Department will write the specifications, including the Schedule of Prices, incorporating specific requirements and other special data to be furnished by the Engineer as indicated herein. Submit two sets of such requirements and data.

D-4.2 Standard Specifications. The Department's standard specifications consist of the current edition of the "Standard Specifications for Public Works Construction" ("Green Book") and all supplements thereto as published by Building News, Inc. and Los Angeles County Flood Control District's "Part C, General Provisions; Part D, Additions and Amendments to Standard Specifications for Public Works Construction; Parts E through M, Additional Provisions" ("Gray Book").

It is desired that the maximum use be made of the various sections of the Department's standard specifications; however, the specifications of the agency having jurisdiction over sanitary sewers, paving, traffic signals and striping, curbs, gutters, sidewalks, street lighting, landscaping, etc., may be used. In such instances, specific references to sections, chapters, and paragraph number of specifications to be used, must be furnished.

D-4.3 Local Ordinances. Furnish specific references to City or County ordinances which will affect the Contractor's operations.

D-4.4 Manufactured Items. Furnish specifications for manufactured items written in terms broad enough to permit competitive bidding and should, whenever possible, be written in such a manner that the item can be obtained locally. Should it be impossible to obtain a manufactured item locally, then information as to where it may be obtained shall be furnished.

D-4.5 Street Closures and Detours. Furnish requirements for street and traffic lane closures and detours, bearing in mind the fact that traffic consideration is an integral part of the project design. Reasonable requirements for street closures, detours, width of traffic lanes, clearances, and other traffic problems must be specified considering working room for construction equipment and other construction requirements as well as those for flow of traffic. Where possible whenever pipe conduit is to be constructed, one 15-foot lane shall be provided adjacent to the trench.

A copy of the traffic requirements shall be sent to the jurisdictional agency during the approval process of subsection D-5.

D-4.6 Trees. Furnish requirements covering removal, trimming, and replacement of trees, where required, and specifications for trees to be replanted, including species and size.

D-4.7 Esthetic Treatment. Furnish specifications for esthetic treatment.

D-4.8 Pump Stations. Furnish entire specifications for pump stations. Specifications of previously constructed pump stations are available at the District.

D-5 APPROVALS BY UTILITY COMPANIES AND OTHER AGENCIES

D-5.1 General. Except as otherwise indicated, the Engineer shall transmit as soon as practicable two sets of prints of the final drawings to all affected utilities and agencies, requesting comments on completeness and accuracy of their facilities as shown on the drawings.

Two copies each of the letters of transmittal and the letters in answer thereto shall be submitted to the District in a bound folder with other final supporting data (see C-5.1).

D-5.2 Revenue Producing Utilities (Water, Gas, Telephone, etc., Except Railroads). Where interference exists, the utility should be required to provide an estimate of the cost of relocating the utility. The Department assumes the responsibility for all negotiations with utility companies under such circumstances. Notes indicating "To be abandoned in place" or "To be removed and reinstalled by others" should be placed on the plans in accordance with subsection C-5.3.

Questions concerning procedure in respect to utility relocations should be directed to the Department's Construction Division.

D-5.3 Non-Revenue Producing Utilities (Storm Drains, Sewers, Street Lights, etc.). Coordination of design with this class of owner and agency is the responsibility of the Engineer and not of the Department.

D-5.4 Railroads. For information concerning railroads, see subsection B-8.

D-5.5 Other Agencies. The following is a list, not necessarily complete, of jurisdictional agencies that may be affected by a project.

1. Incorporated Cities, including all agencies under cities' jurisdiction.
2. City of Los Angeles (call 485-4584 for number of sets of drawings required)
3. County Department of Parks and Recreation
4. County Sanitation Districts
5. Corps of Engineers, United States Army, Los Angeles District
6. California Department of Parks and Recreation
7. Metropolitan Water District
8. County Department of Public Works, including all divisions. Contact Program Manager for number of sets.

D-5.5 cont.

9. California Department of Transportation (Caltrans).
Where storm drains are proposed to be constructed in State Highways and/or in streets that have freeway ramp entrances and/or exits, the Engineer shall submit two sets of plans to:

Flood Control Coordinator
California Department of Transportation (Caltrans)
120 South Spring Street
Los Angeles, CA 90012
Telephone: (213) 620-4874

Contacts with Caltrans should be made through their Flood Control Coordinator.

SECTION E

PREPARATION OF FINAL DRAWINGS

SECTION E

PREPARATION OF FINAL DRAWINGS

E-1 GENERAL

E-1.1 Standard Sheets. The drawings shall be prepared on Department standard sheets, which will be furnished by the Department at no charge. All sheets will have the Department title block thereon and will be available in half plan and half profile, plain and 10 x 10 cross section. The overall size of sheet is 24 inches wide by 36 inches long, with a 1½-inch border on the left side and 1/2-inch borders on the top, right side, and bottom. The usable area is 22 inches wide by 34 inches long measured inside of borders. All Department furnished sheets, including plan and profile, cross sections and plain, will be polyester tracing film (matte both sides).

The Department also has sheets for presenting structural details for single and double box conduits and open rectangular channels, for showing access shaft details and for showing debris basin outlet works.

E-1.2 Alternates. Sheets other than polyester tracing film, such as tracing cloth or those used in photographic techniques, may be furnished by the Engineer and will be acceptable, provided they are of the standard size and format listed above and are of equivalent quality and durability.

E-1.3 Duplicate Tracings. Duplicate tracings, such as cronoflex shall be made of all drawings which utilize "paste-ons". The duplicate tracings will be required at the time of revised final drawings submittal.

E-1.4 Work by Department. The Department will place circles and brackets on the drawings, as indicated in General Notes 1 and 2 in the Appendix, and do such other drafting work as may be required for designation of items of work.

E-2 GUIDE DRAWINGS

Upon advance request, and if available, the Department will furnish a set of prints of a previously designed, similar type project to be used as a general guide in the preparation of project drawings insofar as drafting standards and general layout are concerned; however, the detailed instructions contained hereinafter are to be followed. It shall be understood that in event of conflict between the detailed instructions and the data contained on the referenced drawings, the detailed instructions shall prevail except when otherwise permitted by the Department.

Reference is made to Section G for indicating:

1. Connector Pipe Grade Breaks. (Also see E-5.2.4)
2. Electrolier Lighting. (Also see E-5.2.9)
3. Street Resurfacing. Show type, thickness and limits of existing pavement and proposed resurfacing to sufficient scale that the details are readily discernible. Use Figure 3 on page g-6 of the appendix as a guide only. The pavement types and thickness shall comply with subsection C-10.

These details may be shown on any sheet where space permits.

E-3 DRAFTING STANDARDS

E-3.1 General. Drafting shall be done in accordance with the Department's Drafting Standards Manual (except that dashed dimension lines indicated therein may be solid, continuous lines) and the following requirements.

Inked drawings are preferred, however, plastic lead pencil on polyester tracing film is acceptable.

E-3.2 Drafting Aids. Drafting aids such as typed notes, decals and paste-ons, tabling of structural details, etc., may be used wherever practicable.

E-3.3 Lettering and Size. Since contract drawings are reduced to half-scale for inclusion in the specifications for Department and agency use, all lettering on such drawings should be equivalent to or larger in size than Braddock Lettering Triangle No. 5 or setting "5" on the A. E. Olson (Ames, Iowa) lettering guide. Typewritten notes shall use a type size at least 0.10-inch high. "Orator" type font, 10-pitch, or similar is preferred. Lettering may be freehand if done neatly.

E-3.4 Detail Scale. Detail all structures not covered by standard drawings to not less than $3/8" = 1'-0"$ scale and with sufficient details for construction purposes.

E-3.5 Use of Sheet Space. As much of each sheet as possible should be utilized, however, not to the extent that overcrowding of notes and details would occur.

E-4 TITLE SHEET

E-4.1 General. The first sheet of the drawings shall be the title sheet and shall have shown thereon the following. If all information listed cannot be shown on the title sheet, the list of standard drawings, general notes abbreviations and symbols and references may be placed on the second sheet.

E-4.2 Location Map. In the upper right hand corner of the title sheet, include a map which shows the entire County of Los Angeles and circle thereon the general location of the project site. A paste-on of this map is available from the Design Division's Technical Services Section. In the lower left hand corner of this map, indicate the Thomas Bros. Maps page numbers and grids in which the project is located.

E-4.3 Vicinity Map. Draw a map showing the location of the drain or facility to an appropriate scale. If a drain indicate the reach covered by each plan and profile sheet. Include a north arrow and show both numerical and graphic scales. Also indicate and identify all streets within the vicinity and all city boundaries.

E-4.4 Index. Provide an index to all sheets of the drawings, giving an appropriate description of the information to be found on each particular sheet. For plan and profile sheets, give the station limits for each sheet.

E-4 cont.

E-4.5 Standard Drawings. List Department standard drawings, APWA-AGC Standard Plans for Public Works Construction and other agency standard plans to be used by number and title.

E-4.6 General Notes. See Section G, Appendix, for a listing of generally applicable general notes. Delete those not applicable and add any others as needed.

E-4.7 Abbreviations and Symbols.

E-4.8 Title Block. The title block should not include the words "Title Sheet", but should contain the project name and a description of the information shown thereon, such as "Location and Vicinity Maps, Index and General Notes." The Department will furnished the project name to be placed in the title block.

E-4.9 Engineer's Signature Block. The Engineer shall place his firm's name in a block adjacent to the title block. Within the block the civil engineer in charge of the project shall place his signature along with an imprint of his professional engineer's license stamp.

E-4.10 Agency's Signature Block. If the project is located in an incorporated city, the Engineer shall contact the city to determine if a city official is required to sign the drawings as part of its approval process. If required, the Engineer shall provide an appropriate signature block. The Department will obtain the signature.

When a specific design is incorporated into the plans for the construction or reconstruction of another agency's facilities in conjunction with the construction of the project, the procedure stated above for cities shall be followed except that the Engineer shall obtain the signature if required (see E-9.5).

E-4.11 References. The Engineer shall list all recorded reference material, (survey field books, tract maps, topomaps, etc.), used in the design of the project so that present construction and future work can easily be combined with the original level datum and horizontal control.

E-5 PLAN AND PROFILE FOR STORM DRAINS

E-5.1 General.

E-5.1.1 Stationing. Plans and profiles shall be stationed upstream from left to right and each sheet shall be platted with limits identical with no overlap on adjacent sheets.

E-5.1.2 Cross Section. On each plan and profile sheet show at least one cross section at a particular station (taken facing upstream) drawn to appropriate scale to give the relative location of surface and underground improvements with respect to the proposed storm drain. Indicate size, type, and other pertinent data for all improvements. Do not show pay lines.

E-5 cont.

E-5.1.3 Bench Marks. On each plan and profile sheet, show the location of the bench marks that fall within that reach. In addition give the bench mark descriptions and elevations, including in the descriptions the datum for the elevations shown.

E-5.1.4 Underground Facilities. Show all utilities and indicate disposition of interfering utilities as stated in subsection C-5.3. Show outlines of existing or proposed footings of bridges, subways, tunnels or other structures which may affect or be affected by the construction of the storm drain.

ALL UTILITIES OF A HIGHLY EXPLOSIVE NATURE MUST BE CLEARLY IDENTIFIED AS SUCH.

E-5.2 Plan. Indicate the following:

E-5.2.1 Scale. Use 1" = 40' and show numerically and graphically.

E-5.2.2 North Arrow.

E-5.2.3 Main Line Storm Drain and Appurtenances. Show outline of main line conduit and other appurtenant structures with all supplemental data as required by standard drawings. Show center line of main line conduit with appropriate ties to center line of street, survey control line, property lines or right of way lines. On the conduit center line, mark every even 100-foot station and number at least every fifth station, i.e., 5, 10, 15, etc.

E-5.2.4 Catch Basins and Connector Pipes. Show size and location of catch basins and tie catch basin center lines (as shown on standard drawings) to curb returns, if existing; otherwise, tie to street center lines. Indicate size, length and D-load of pipes from catch basins to main conduit.

Sufficient investigation and exploration shall be made, as required in Subsection D-2.4, so as to accurately ascertain if connector pipes from catch basins can be constructed over or under utilities with the exception of sanitary sewers for which no exploration is required. When it is known that a grade break in catch basin connector pipe will be required to avoid interference with a utility, indicate a grade break on the drawings and also indicate whether the connector pipe will go over or under the utility. Reference is made to page g-4 of the Appendix.

E-5.2.5 Street Right of Way and Centerlines. Also identify all streets and alleys and show storm drain station at intersection of centerline of a cross street with centerline of storm drain.

E-5.2.6 Right of Way and Easement Lines. Existing storm drain easements are to be designated as "Existing Easement" (or abbreviation), and right of way to be acquired identified as "Required right of way" (or abbreviation). Do not shade or cross hatch drawings. Show temporary construction easement lines and required right of way in pencil; reference is made to subsections C-11, C-12 and C-13.

E-5.2.7 Railroad Property Lines and Tracks.

E-5 cont.

E-5.2.8 Abandoned Street Car Tracks.

E-5.2.9 Location of Test Borings.

E-5.2.10 Utilities (Including Sewers and Storm Drains).

1. Indicate the type, size and ownership of all existing utilities. Tie to street or right of way centerline or to street property line. Show traces of sewer house connections from the property line to the main line sewer.
2. Indicate size and location of proposed sanitary sewers and make proper cross reference to the project sewer drawings.
3. Indicate portions of existing main line sewers that are "to be abandoned" because of storm drain construction.
4. When meters or utility service connections, except house connection sewers, occupy space to be occupied by catch basins or other structures, they shall be shown on the plan. Those not interfering should not be shown.

E-5.2.11 Street Lighting System. Indicate all electrolier street light (ELC) facilities which may interfere with the construction of the storm drain and appurtenances.

When reconstruction of ELC on side streets is required due to catch basin construction, show the electroliers or pull boxes (or indicate the distances to the electroliers or pull boxes) on both sides of the catch basins so that the quantity of electrolier lighting cable and pull boxes required in the reconstruction process can be calculated.

If reconstruction of ELC facilities is required due to the construction of the storm drain or appurtenances, indicate the type of ELC reconstruction using Figure 2 on page g-5 of the Appendix as a guide.

E-5.2.12 Traffic Signal Systems. Indicate all traffic signals (TS) traffic signal conduits (TSC) and inductive loop detectors (ILD) which may interfere with the construction of the storm drain and appurtenances.

Loop detectors can generally be detected by the saw cuts in the pavement, which indicate their locations. In some cases, however, these cuts may have been paved over and, consequently, would not be visible. Therefore, wherever there is a signalized intersection, and especially where there are left turn arrows, and no saw cuts are visible, the Engineer shall contact the owner of the street to determine if any loops exist. Damage to any one loop requires the replacement of all the loops in a series.

E-5.2.13 Curbs, Gutters, and Driveways.

E-5.2.14 Handicapped Ramps.

E-5 cont.

E-5.2.15 PCC Pavement Joints. Show accurately all joints in portland cement concrete surfacing that are parallel to the main line storm drain and within 5 feet of the outside limits of the excavation line. The storm drain should be located in such a position that when removal requirements of the strip between edge of trench and the longitudinal joints are considered, the required removal and replacement of portland cement concrete surfacing is held to a minimum.

E-5.2.16 Trees. Show all trees which must be removed or protected in order to construct the storm drain and appurtenances. Also indicate by an appropriate symbol or general note those trees to be replaced. Where feasible, trees should be protected in place and not removed.

Show on the drawings all trees in close proximity to the storm drain and appurtenances which would affect the contractor's operations.

Indicate on the drawings the approximate size (diameter of trunk measured 3 feet above ground) and species of trees shown thereon.

E-5.2.17 Existing Culture in Right of Way. Show all culture within right of way or easement lines and all culture adjacent thereto which could be affected by the construction as a result of cave-in, slides, or other causes.

E-5.2.18 Abbreviations. The following abbreviations shall be placed directly on the drawn line representing an underground facility:

Water line	-W-
Natural Gas	-G-
Sanitary sewer	-SS-
Electrolier conduit	-ELC-
Traffic signal	-TS-
Oil line	-O-
Other lines	Suitable symbols

E-5.3 Profile.

E-5.3.1 Scale. Use 1"=4' vertical and 1"=40' horizontal and indicate numerically. A vertical scale of 1" = 8' may be used when the steepness of terrain or depth of drain below ground surface makes a scale of 1" = 4' impractical. A change in scale within a set of drawings shall be clearly "flagged" or noted directing attention to the change.

E-5.3.2 Grid Elevations and Stations. Denote every even 100-foot station immediately under the bottom line of the profile.

Label every even 10-foot elevation interval on each end of the main line conduit.

E-5.3.3 Ground Line. Show ground line over center line of drain and, in the case of open channels, show ground lines along both right of way lines.

E-5.3.4 cont.

E-5.3.4 Main Line Storm Drain and Appurtenances. Show both inner and outer surfaces of the top and bottom of the main line conduit at the grade line (invert), including manholes, transition structures and any special structures that are part of the main line conduit.

The grade line shall be clearly labeled "Invert". (The invert shall also be indicated on the structural section.)

Under usual design conditions, the invert for pipe and box conduits and the invert for rectangular and trapezoidal open channels without low flow channels shall be defined as being at the center line of the drain (the center line of the barrel for multi-barrel boxes).

For drains with low flow channels, the invert shall be defined as being at the top of the low flow channel.

In special cases, exceptions to the above may be made with Department approval.

On the main line conduit, indicate the diameter and station of each connector pipe and the direction from which the connector pipe enters the main line conduit. Also, give any elevation that may be required by the Hydraulic Design Manual.

E-5.3.5 Main Line Elevations and Slopes. Give elevations along the grade line at the beginning and end of each sheet, at all grade changes, and as required by the standard drawings for manholes and transition structures. Also give the stations at these locations.

Show the slope along the grade line.

Where a covered drain is located in an unpaved area, show the elevations at the tops of manholes. In such areas the tops of manholes should extend 3-4 inches above adjacent ground for easy location by maintenance personnel.

E-5.3.6 Size of Main Line Conduit. Across the bottom of the profile, indicate the size and reach of the main line conduit. Indicate the D-load of pipe and section designation for box. In case of alternate designs (pipe or box), indicate both.

The height of box conduits shall be defined as the vertical distance from the defined invert to the soffit.

The height of rectangular and trapezoidal open channels shall be defined as the vertical distance from the base of the wall to the top of the wall.

E-5.3.7 Hydraulic Components. Show hydraulic grade line in pencil. The water surface shall be shown in the case of open channels.

Across the top of the sheet, indicate the main line design Q and frequency.

E-5 cont.

E-5.3.8 Utilities (including Sewers and Storm Drains). Indicate the correct position of the utility at its intersection with the storm drain center line. Show actual elevations where required as stated in subsection C-5.

By means of dashed lines, indicate and identify utilities which lie within the proposed storm drain trench and are more or less parallel with the storm drain and all parallel existing or proposed sewers, whether within the proposed storm drain trench or not.

Indicate any supports that may be required (see C-5.4).

Indicate the disposition of all interfering utilities in accordance with the requirements of subsection C-5.3.

E-5.3.9 Street Lighting and Traffic Signal Conduits. Indicate all ELC and TSC crossing the proposed storm drain.

Where existing ELC or TSC parallels the proposed storm drain construction and lies within the proposed excavation limits for the construction of the storm drain, show the ELC or TSC in dashed lines and indicate that it will be abandoned in place as discussed in subsection C-5.3.

E-6 LOGS OF BORINGS (SUBSURFACE INVESTIGATION DRAWINGS)

The logs of the borings shall be plotted on separate standard size sheets showing all information given in the logs from the subsurface investigation and geotechnical report. On each boring log the grade line or invert for the proposed drain shall be indicated and the ground water level indicated (if encountered). The stationing and offset of each boring shall be noted along with the surface elevation of each boring. Also indicate on the log the type and location of soil samples.

Notes shall be placed on these drawings giving the following information:

1. The boring number of those borings in which groundwater was encountered or, if groundwater was not encountered, a statement that groundwater was not encountered in any of the borings shown.
2. A statement that the group symbols and soil descriptions are according to the Unified Soil Classification System shown on Standard Drawing 2-D 413.
3. The type and size of drilling equipment used to drill the borings.
4. The dates the borings were drilled.

The logs of borings from the subsurface investigation and geotechnical report may also be reproduced on standard size sheets by photographic means (duplicate tracings).

E-7 STRUCTURAL DETAILS

Structural details for box conduits and open channels shall be presented in tabular form. The Department's Technical Services Section of Design Division

E-7 cont.

has sheets for single and double boxes and rectangular open channels with details, tables and structural notes which will be furnished at no charge.

Details for special structures shall be drawn to a scale of not less than $3/8" = 1'$.

All applicable structural notes, as required by the Structural Design Manual, shall be listed on the structural details sheet.

When joining into an existing structure, "breakout" notes and/or details shall be provided as necessary.

E-8 CROSS SECTIONS

Use a scale of not less than $1" = 10'$.

When the storm drain is not located in a street, sufficient cross sections based upon recent field survey shall be furnished so that earthwork quantities may be accurately calculated and the Department can determine where fill permits are necessary outside of permanent right of way or easement lines. All cross sections at locations where slopes or fill easements are required shall be delineated on the drawings prior to their submittal to the Department for right of way acquisition.

In the case of open channels, cross sections shall be at maximum 100-foot stations and at all grade breaks.

Do not show pay lines.

E-9 SANITARY SEWERS

E-9.1 General. When the design of the proposed storm drain requires major reconstruction of sanitary sewers, the design of the sewer shall be drawn on separate plan and profile sheets.

A trace of the proposed storm drain shall be indicated on both plan and profile and a cross reference made to the appropriate storm drain drawing(s).

E-9.2 Scale. Use a horizontal scale of $1" = 40'$ and a vertical scale of $1" = 4'$. A change in scale within a set of drawings shall be unmistakably "flagged" or noted, directing attention to the change.

E-9.3 Existing Sewers and Utilities. Indicate the existing sewer and denote portions to be abandoned. Also, show all utilities crossing the sewer and any other facilities to be affected by the construction of the sewer.

E-9.4 House Connections. Show the elevations of existing sewer house connections at correct elevations in profile at the center line of the proposed main line sanitary sewer construction. On each of these house connections, indicate by symbol or note, how to remodel, reconstruct, support, blanket, encase, abandon or otherwise provide for and maintain sewer service in accordance with the owner's requirements.

E-9 cont.

E-9.5 Approvals. Provide a signature block for and obtain required signatures from the owner agency. If the sewer eventually outlets into a trunk sewer under jurisdiction of the County Sanitation Districts, an approving signature may also be required from that agency.

E-10 PUMP STATIONS

Complete detail drawings shall be submitted including structural, mechanical, electrical and other engineering working drawings plus full provisions for heating, electrical, lighting, water, sewer, gas, telephone, acoustical work and all other work normally appurtenant to such a facility and as set forth in the Department's Pump Station Design Manual.

E-11 DEBRIS BASINS

Complete detail drawings shall be submitted as required by the Department's Debris Dams and Basins Design Manual.

A duplicate tracing of typical outlet tower and outlet drain details is available from the Department.

SECTION F

DRAWINGS AND WORK TO BE FURNISHED
AFTER RECEIPTS OF BIDS

SECTION F

DRAWINGS AND WORK TO BE FURNISHED AFTER RECEIPT OF BIDS

F-1 "CHANGE OF PLAN" DRAWINGS

Make studies and prepare drawings for "change of plan" as may be required to provide for unforeseen conditions, conditions not covered in the project drawings, construction difficulties or necessary revisions disclosed during construction of the project.

In general, these changes are required due to problems that arise suddenly during construction. The "change of plan" drawings shall be reproducible drawings and should be submitted to the Department as soon as possible after the request has been made. The change in alignment calculations shall be checked for completeness and accuracy by the project engineer and initialed to indicate that such check has been made.

F-2 SHOP DRAWINGS

Check shop drawings and contractor's working drawings when requested by the Department. No check of reinforcing steel schedule will be required.

This work should be done as soon as possible after a request has been made, since the contractor's schedule will probably require an early review.

SECTION G

A P P E N D I X

G-1 GENERAL NOTES

1. NUMBERS IN CIRCLES INDICATE ITEMS UNDER WHICH PAYMENT WILL BE MADE.
2. NUMBERS AND LETTERS IN BRACKETS, SUCH AS [3] OR [A-3], IDENTIFY STRUCTURES FOR CONTRACT ADMINISTRATION PURPOSES.
3. ELEVATIONS SHOWN ARE IN FEET ABOVE THE U.S.G.S. MEAN SEA LEVEL DATUM, BASED ON (AGENCY & YEAR) ADJUSTMENT.
4. STATIONS SHOWN ON THE DRAWINGS ARE ALONG CENTER LINE OF CONDUIT OR ON A LINE NORMAL TO CENTER LINE OF CONDUIT.
5. STATIONS AND INVERT ELEVATIONS OF PIPE INLETS SHOWN ON THE PROFILES ARE AT THE INSIDE FACE OF THE CONDUIT, UNLESS OTHERWISE SHOWN.
6. PIPE CONNECTIONS TO STORM DRAIN SHALL CONFORM TO STANDARD DRAWING NO. 2-D 191 [OR] [2-D 193] UNLESS OTHERWISE SHOWN.
7. ALL PIPE IN OPEN TRENCH SHALL BE BEDDED ACCORDING TO STANDARD DRAWING NO. 2-D 177, CASE III, EXCEPT BELL AND SPIGOT PIPE WHICH SHALL BE CASE II BEDDING, UNLESS OTHERWISE SHOWN. "W" VALUES SHALL BE AS SPECIFIED ON STANDARD DRAWING NO. 2-D 177 FOR CASE III BEDDING, NOTES 3(a), 3(b), AND 3(c). IF THE "W" VALUE AT THE TOP OF THE PIPE IS EXCEEDED, THE BEDDING SHALL BE MODIFIED AND/OR PIPE OF ADDITIONAL STRENGTH SHALL BE PROVIDED. THE PROPOSED MODIFICATION SHALL BE APPROVED BY THE DEPARTMENT.
8. CONCRETE BACKFILL SHALL BE PROVIDED AROUND PIPE 21 INCHES IN DIAMETER OR LESS WHERE THE COVER IS EQUAL TO OR LESS THAN 2'-0", AROUND PIPE GREATER THAN 21 INCHES IN DIAMETER BUT LESS THAN 39 INCHES WHERE THE COVER IS LESS THAN 1'-3", AND FOR PIPE 39 INCHES OR GREATER WHERE THE COVER IS LESS THAN 1'-0". THE CONCRETE BACKFILL SHALL BE AS SPECIFIED ON STANDARD DRAWING NO. 2-D 177, NOTE 3.
9. LOCATIONS OF CATCH BASIN CONNECTOR PIPE JUNCTIONS WITH CATCH BASINS AS SHOWN ON THE DRAWINGS ARE SCHEMATIC. IT IS INTENDED THAT SUCH JUNCTIONS BE LOCATED AT THE DOWNSTREAM ENDS OF THE CATCH BASINS, UNLESS SPECIFICALLY INDICATED OTHERWISE. IN ALL CASES, THE EXACT LOCATIONS WILL BE DETERMINED IN THE FIELD BY THE ENGINEER TO MEET FIELD CONDITIONS.
10. MONOLITHIC CATCH BASIN CONNECTIONS SHALL BE CONSTRUCTED, WHERE APPLICABLE, PER APWA-AGC STANDARD PLAN NO. 308-0.
11. FOR LOCAL DEPRESSIONS, APWA-AGC STANDARD PLAN NO. 313-0 SHALL BE USED. H SHALL EQUAL 4 INCHES FOR CASES A, B, C, AND D AND 2 INCHES FOR CASES E, F, AND G UNLESS OTHERWISE NOTED ON THE PROJECT DRAWINGS.
12. CURB FACE SHALL BE 8 INCHES AT THE ENDS OF LOCAL DEPRESSIONS WHERE THERE IS NO EXISTING CURB.

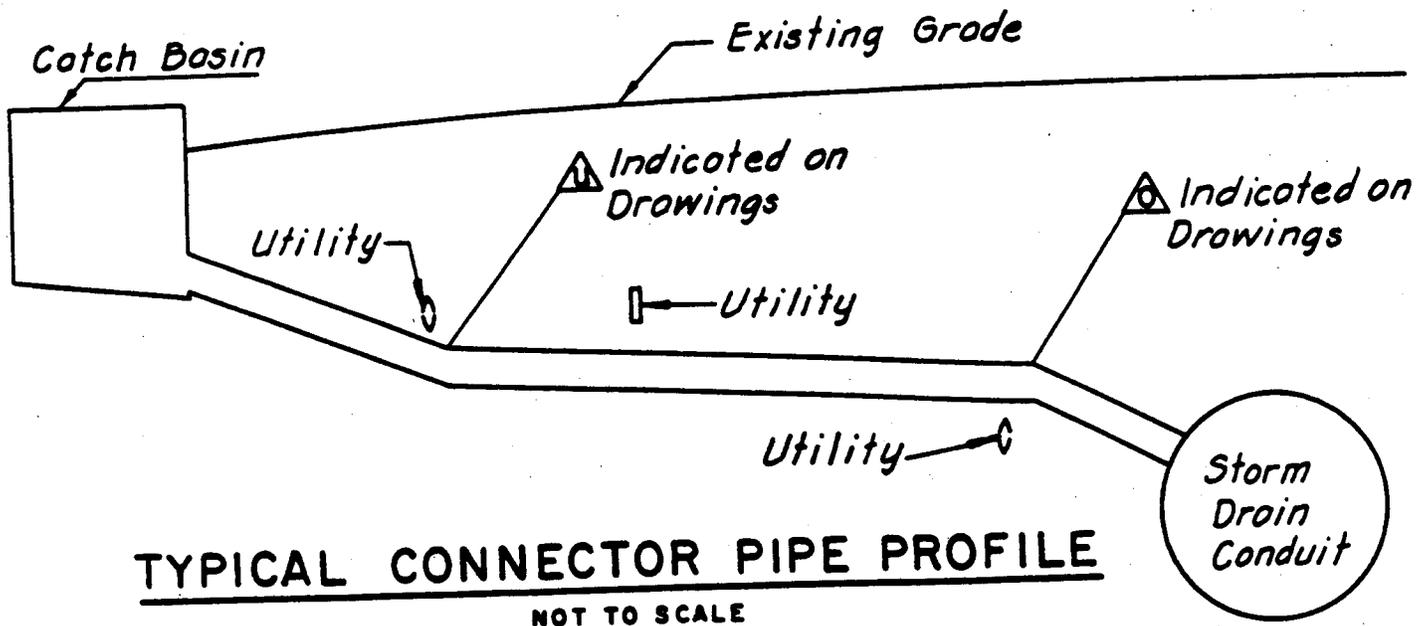
G-1 cont.

13. FOR CATCH BASINS WITHOUT LOCAL DEPRESSIONS, CURB FACE SHALL BE THAT OF ADJACENT CURB UNLESS OTHERWISE NOTED.
14. LOCATIONS SHOWN ON THE PLANS FOR EXISTING SANITARY SEWER HOUSE CONNECTIONS ARE APPROXIMATE ONLY.
15. SANITARY SEWER HOUSE CONNECTION RECONSTRUCTION AND RECONNECTION SHALL BE IN ACCORDANCE WITH APWA-AGC STANDARD PLAN NO. 223-0 [CITY OF LOS ANGELES STANDARD PLAN NO. S-111-0], AS APPLICABLE, UNLESS OTHERWISE SHOWN.
16. SANITARY SEWERS AND HOUSE CONNECTIONS CROSSING OVER THE STORM DRAIN TRENCH SHALL BE SUPPORTED IN ACCORDANCE WITH APWA-AGC STANDARD PLAN NO. 224-0. IN THE CASE OF SANITARY SEWER SUPPORTS PER CASES 1, 2, AND 4, THE SEWER SHALL BE ENCASED. THE ENCASEMENT SHALL BE A MINIMUM OF 6 INCHES WIDER ON EACH SIDE OF THE SEWER (O.D. PLUS 12 INCHES) AND A MINIMUM OF 6 INCHES ABOVE THE TOP OF THE SEWER. THE SUPPORT BEAM OR SUPPORT WALL SHALL BE WIDENED TO THE WIDTH OF THE ENCASEMENT AND SHALL BE LENGTHENED TO FULLY SUPPORT THE ENCASEMENT.
17. WHEN INDICATED ON THE DRAWINGS, SANITARY SEWERS AND HOUSE CONNECTIONS SHALL BE PROTECTED IN ACCORDANCE WITH [APWA-AGC STANDARD PLAN NO. 225-0] [STANDARD DRAWING 2-D251] [CITY OF LOS ANGELES STANDARD PLAN S-255-0].
18. ALL EXISTING UTILITIES SHOWN ON THE DRAWINGS ARE THE PROPERTY OF (APPLICABLE AGENCY), UNLESS OTHERWISE NOTED.
19. EXISTING UTILITIES SHALL BE MAINTAINED IN PLACE BY THE CONTRACTOR, UNLESS OTHERWISE NOTED.
20. THE CONTRACTOR SHALL MAKE EXPLORATORY EXCAVATIONS TO DETERMINE THE DEPTH AND LOCATION OF EXISTING UTILITIES WHERE SO INDICATED BY THE SYMBOL " ".
21. UTILITIES DESIGNATED BY THE SYMBOL "*" WILL BE ABANDONED IN PLACE AND THE OWNER WILL INSTALL A NEW SECTION OF THE AFFECTED UTILITY AT A LOCATION IN CLOSE PROXIMITY TO, BUT WHICH DOES NOT PHYSICALLY INTERFERE WITH, THE PROPOSED STORM DRAIN CONDUIT AND APPURTENANT STRUCTURES.
22. UTILITIES DESIGNATED BY THE SYMBOL "-" WILL BE REMOVED BY THE OWNER AND THE OWNER WILL REINSTALL A NEW SECTION OF THE AFFECTED UTILITY AT A LOCATION IN CLOSE PROXIMITY TO, BUT WHICH DOES NOT PHYSICALLY INTERFERE WITH, THE PROPOSED STORM DRAIN CONDUIT AND APPURTENANT STRUCTURES.
23. WHERE THE UTILITIES ARE INDICATED ON THE DRAWINGS TO BE SUPPORTED, SAID SUPPORTS SHALL BE IN ACCORDANCE WITH APWA-AGC STANDARD PLAN NO. 224-0, UNLESS OTHERWISE INDICATED.
24. ALL OPENINGS RESULTING FROM THE CUTTING OR PARTIAL REMOVAL OF EXISTING CULVERTS, PIPES OR SIMILAR STRUCTURES SHALL BE SEALED WITH 8 INCHES OF BRICK AND MORTAR OR 6 INCHES OF CONCRETE, UNLESS OTHERWISE SHOWN.

G-1 cont.

25. ALL RESURFACING, CURBS, GUTTERS, SIDEWALKS, DRIVEWAYS, AND OTHER EXISTING IMPROVEMENTS TO BE RECONSTRUCTED SHALL BE CONSTRUCTED AT THE SAME ELEVATION AND LOCATION AS THE EXISTING IMPROVEMENTS, UNLESS OTHERWISE NOTED.
26. REFER TO SHEET FOR TYPICAL CATCH BASIN CONNECTOR PIPE PROFILE.
27. STREET RESURFACING PLANS ARE SHOWN ON SHEET .
28. SOIL TEST BORINGS FOR THIS PROJECT WERE MADE (DATE).
29. TEMPORARY SUPPORTS FOR WATER LINES SHALL BE IN ACCORDANCE WITH D.W. & P. STD. PLAN A-3615A, UNLESS OTHERWISE SHOWN.
30. MANHOLES NO. 1, 2, 3, AND 4 SHALL USE THE APWA-AGC STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION 630-0 FOR THE "FRAME AND COVER" AND 635-0 FOR THE "STANDARD DROP STEP".
31. APWA-AGC STANDARD PLAN NO. 311-0 (FRAME AND GRATING FOR CATCH BASINS) SHALL HAVE A STANDARD WASHER AT EACH END OF THE TWO OUTSIDE 6-1/2" X 25-3/8" STEEL RODS IN ADDITION TO THE NUTS ON EACH END.
32. MANHOLE SHAFT SAFETY LEDGE SHALL USE APWA-AGC STANDARD PLAN NO. 635-0 FOR THE "STANDARD DROP STEP".
33. SPECIAL MANHOLES NO. 2, NO. 3, AND NO. 4 SHALL BE CONSTRUCTED PER STANDARD DRAWING NO. 2-D 184, 2-D 104 AND 2-D 113, RESPECTIVELY, EXCEPT THAT MANHOLE SHAFT, FRAME AND COVER SHALL BE PER STANDARD DRAWING NO. 2-D 427 AND 2-D 428.
34. STRUCTURAL NOTES WILL BE FOUND ON THE APPLICABLE STRUCTURAL SHEETS.
35. EXISTING TREES SHALL BE REMOVED ONLY IF SO DESIGNATED. THOSE TREES NOT INTERFERING WITH CONSTRUCTION SHALL BE PROTECTED IN PLACE.
36. RIGHT OF WAY FENCING SHALL BE PLACED 6" INSIDE THE RIGHT OF WAY LINE.
37. THE WORK SHOWN ON THESE DRAWINGS REQUIRES THE PRIME CONTRACTOR TO HAVE A VALID CLASS _____ OR _____ LICENSE ISSUED BY THE STATE OF CALIFORNIA.

G-2 FIGURES TO BE USED AS GUIDE DRAWINGS

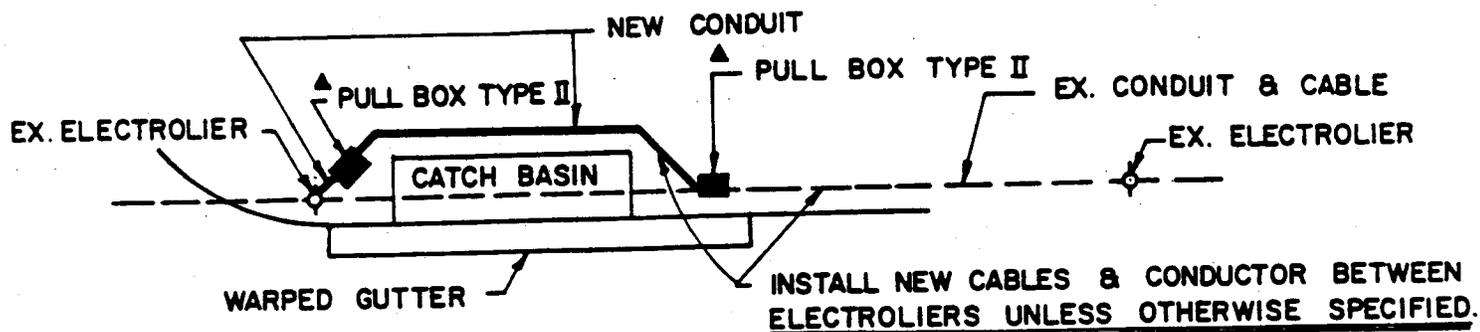
NOTES

1. The change in grade of the connector pipe may occur either over or under an existing utility. The particular utility at which the change in grade occurs, is noted on the project drawings. At locations where utility crossings are marked \triangle , the connector pipe grade will break over the utility. At locations where utility crossings are marked \triangle , the connector pipe grade will break under the utility.
2. On those connector pipes where change in grade is not indicated, it is assumed that the connector pipe can be laid on a straight grade from the catch basin to the storm drain without interference with utilities.
3. The Contractor shall make exploratory excavations to determine the exact location and depth of utilities, except sanitary sewer, which are marked \triangle or \triangle . After the exact location of a utility has been determined, the grade and alignment of the connector pipe will be staked so as to clear the utility.
4. Where connector pipe has a grade change exceeding 0.10 ft. per ft. or differs in diameter from that of existing pipe, use concrete collar as per Standard Drawing 2-D393.

FIGURE 1

G-2 cont.

▲ - PULL BOXES SHALL NOT BE INSTALLED UNLESS APPROVED BY THE ENGINEER



TYPICAL MODIFICATION OF STREET LIGHTING CONDUIT

NO SCALE

STREET LIGHTING NOTES

1. ALL WORK INDICATED & SHOWN ON THIS PLAN IN CONNECTION WITH THE ELECTROLIER LIGHTING INSTALLATION SHALL BE DONE BY THE CONTRACTOR, AND ALL THE MATERIALS SHALL BE FURNISHED TO COMPLETE THE SYSTEM, READY FOR OPERATION, ALL IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
2. AT LOCATIONS WHERE NEW ELECTROLIER LIGHTING CABLE IS REQUIRED, THE CONTRACTOR SHALL FURNISH & INSTALL IN ELECTROLIER LIGHTING CONDUIT A NO. 8 A.W.G. COPPER CONDUCTOR, INSULATED WITH U. L. APPROVED POLYETHYLENE COMPOUND RATED FOR 5000 V OPERATION.
3. ELECTROLIER LIGHTING CABLES SHALL RUN THROUGH PULL BOXES WITHOUT SPLICING, EXCEPT FOR TRANSFORMERS, ALLOWING 3' OF SLACK IN EACH CABLE, IN EACH PULL-BOX.
4. CONTRACTOR SHALL MAINTAIN SERVICE TO ANY EXISTING LAMPS, MAKE ALL NECESSARY TEMPORARY CONNECTIONS, & CONNECT ALL LAMPS AS DIRECTED BY THE STREET LIGHTING ENGINEER. WHERE CONDUIT IS DISTURBED AND FOUND UNSAFE BY THE INSPECTOR OF THE (*) (*), CONTRACTOR SHALL REPLACE CONDUIT AND CABLE.
5. WARNING: CONTRACTOR SHALL OBTAIN DAILY SAFETY CIRCUIT CLEARANCE FROM THE (*) CUTOUT PLUGS MUST BE PULLED, AND "MEN AT WORK" SIGNS POSTED AT SERVICE POINTS BEFORE ANY WORK IS DONE, OR ANY CONNECTIONS MADE INVOLVING EXISTING LIGHTING SYSTEMS.
6. $\frac{2}{250}$ INDICATES NUMBER AND TOTAL LENGTH OF WIRES TO BE REMOVED. FURNISH AND INSTALL NEW WIRES.
7. $\frac{A}{25}$ INDICATES SIZE AND LENGTH OF CONDUIT TO BE REMOVED. FURNISH AND INSTALL NEW CONDUIT.
8. $\frac{A}{A}$ INDICATES PROTECT EXISTING STREET LIGHTING FACILITIES.

* USE APPROPRIATE AGENCY.

FIGURE 2

G-2 cont.

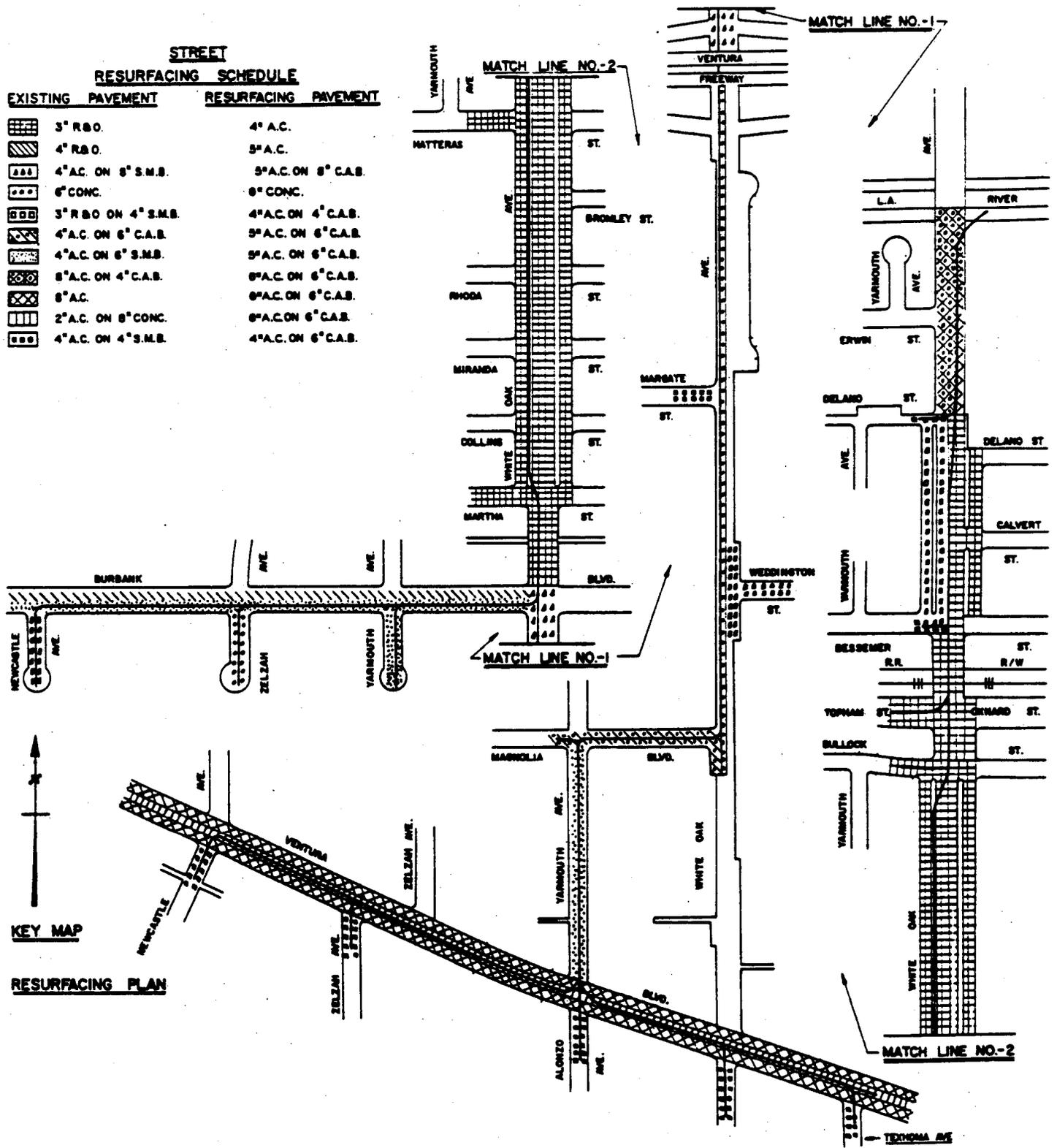


FIGURE 3