



1

DEPARTMENT OF
PUBLIC WORKS

CITY OF SACRAMENTO
CALIFORNIA

1391-35TH AVENUE
SACRAMENTO, CA
95822-2911

DIVISION OF
FLOOD CONTROL AND SEWERS
May 8, 1990

916-449-5271

Budget and Finance Committee
Sacramento, California

Honorable Members in Session:

SUBJECT: ADOPTING A MEMORANDUM OF UNDERSTANDING WITH THE COUNTY OF SACRAMENTO TO DEVELOP A DRAINAGE MANUAL AND APPROPRIATING ADDITIONAL FUNDS FROM THE STORM DRAINAGE FUND

SUMMARY

It is recommended that the Budget and Finance Committee forward to the City Council, with a recommendation for approval, the attached resolution that adopts the Memorandum of Understanding with the County of Sacramento to jointly develop a County-wide Hydrology (Drainage) Manual. The City and County are to share equally all costs, with the City's share not to exceed \$110,000. The resolution appropriates an additional \$35,000 from the Storm Drainage Fund Contingency Reserve (425-710-7012-4999) to the Flood Control and Sewers Division Administration operations budget for 1989-90 (425-310-3161-4252).

BACKGROUND INFORMATION

The majority of local natural drainage courses passing through the City of Sacramento originate in Sacramento County, and development in the County has affected and will continue to affect drainage conditions in the City. The recitals incorporated in the attached Memorandum of Understanding (MOU), executed by the Board of Supervisors of the County of Sacramento on March 6, 1990, describe the need to update and standardize hydrologic (drainage) design criteria and procedures. The MOU also defines the roles of the City and County in a joint effort to accomplish this essential task, part of a continuing effort to coordinate drainage improvement plans.

The hydrology criteria now used by the County are incorporated in a manual developed in the 1960's. Considerable additional hydrologic data are now available and the County wishes to update its hydrology manual. The hydrology criteria currently used by the City were established long ago and differ greatly from the County's. The City's objectives in participating in the development of an updated manual with the County are:

- A) To standardize and improve hydrology methods.
- B) To formulate basin-wide plans to identify and mitigate incremental impacts of development.
- C) To continue progress toward common practices and policies relating to:
 - o channel project mitigation measures and channel maintenance standards, and
 - o water quality, erosion control, and grading permit requirements.

D) Through the above efforts, to:

- o provide for long-range, cost-effective planning of needed locally-funded and federally-assisted flood control projects, and
- o adopt policies and procedures for orderly, consistent review of developments (as an alternative to relying on case-by-case CEQA-process comments and uncoordinated subdivision plan checks).

In early 1988, the City allocated funds for one-half of the cost of developing a County-wide Hydrology/Hydraulics Manual (hereafter called the Drainage Manual). County funding became available in 1989, and the City and County have selected an engineering consultant to develop the manual. The negotiated scope of work (attached with draft agreement) will address all of the City's objectives to the extent practical within the intended scope of this project. The manual will also include hydraulic design aids which should expedite review of development submittals, as well as simplifying the analyses required for preparation of submittals. The manual will be developed to be consistent with adopted City and/or County Improvement Standards. The section of the manual addressing Storm Water Quality will be prepared by the consultant now under contract to manage the City's stormwater quality and permitting (NPDES) program. Once completed in draft form, the manual will be submitted to the governing bodies for review and adoption.

FINANCIAL DATA

The 1989-90 operations budget of the Division of Flood Control and Sewers includes funding of \$75,000 for joint City/County development of a hydrology and hydraulics (drainage) manual. Maximum consultant costs to complete the manual are \$220,000. It is proposed that a further \$35,000 be appropriated from the Storm Drainage Contingency Reserve (425-710-7012-4999) to provide for the maximum City cost share of \$110,000, by amending the 1989-90 operating budget of Flood Control and Sewers Administration. As of April 23, 1990, there is a fund balance of \$654,273 in the Storm Drainage Fund Contingency Reserve.

POLICY CONSIDERATIONS

The actions requested conform to City policies that consultant contracts (or City contributions to contracts by other entities) above \$25,000 be approved by the City Council and that appropriations from contingency reserves be approved by the City Council.

MBE/WBE EFFORTS

City MBE/WBE policies are not applicable. The consultant will contract directly with the County of Sacramento; therefore, County procedures for consultant selection were followed.

RECOMMENDATION

It is recommended that the Budget and Finance Committee forward to the City Council with a recommendation for approval the attached resolution that:

1. adopts the Memorandum of Understanding with the County of Sacramento to reimburse the County a maximum of \$110,000 for one half the cost of developing a County-wide Hydrology (Drainage) Manual.

2. appropriates funds in the amount of \$35,000 from the Storm Drainage Fund Contingency Reserve (425-710-7012-4999) to the Flood Control and Sewers Division Administration operations budget for 1989-90 (425-310-3161-4252).

Respectfully submitted,

Gr: Albert E. McCollam, Jr.
Albert E. McCollam, Jr.
Division Manager

RECOMMENDATION APPROVED:

Jack R. Crist
Jack R. Crist
Deputy City Manager

APPROVED:

Melvin H. Johnson
Melvin H. Johnson
Director of Public Works

Contact Person:
Craig E. Crouch
Senior Engineer, Division of Flood Control & Sewers
449-1250

May 8, 1990
All District

RESOLUTION NO.

ADOPTED BY THE SACRAMENTO CITY COUNCIL

ON DATE OF _____

RESOLUTION TO ADOPT A MEMORANDUM OF UNDERSTANDING WITH THE COUNTY OF SACRAMENTO TO DEVELOP A HYDROLOGY MANUAL AND TO APPROPRIATE FUNDS FROM THE STORM DRAINAGE FUND CONTINGENCY RESERVE

BE IT RESOLVED BY THE CITY COUNCIL OF SACRAMENTO THAT:

1. The Memorandum of Understanding with the County of Sacramento is hereby adopted to reimburse the County a maximum of \$110,000 for one half the cost of developing a County-wide Hydrology (Drainage) Manual.
2. Funds in the amount of \$35,000 are appropriated from the Storm Drainage Fund Contingency Reserve (425-710-7012-4999) to the Flood Control and Sewers Division Administration operations budget for 1989-90 (425-310-3161-4252).

MAYOR

ATTEST:

CITY CLERK

FOR CITY CLERK USE ONLY

RESOLUTION NO.: _____

DATE ADOPTED: _____

39



COUNTY OF SACRAMENTO

DEPARTMENT OF PUBLIC WORKS

COUNTY ADMINISTRATION BUILDING • ROOM 304 • 827 SEVENTH STREET
SACRAMENTO, CALIFORNIA 95814 TELEPHONE: (916) 440-6581

March 6, 1990

APPROVED
BOARD OF DIRECTORS

Water Agency # 0901

MAR 06 1990

Douglas M. Fraleigh
By _____
Clerk of the Board

Honorable Board of Directors
Sacramento County Water Agency
County of Sacramento
State of California

Members in Session:

**SUBJECT: MEMORANDUM OF UNDERSTANDING WITH THE CITY OF SACRAMENTO
TO DEVELOP A HYDROLOGY MANUAL**

RECOMMENDATION:

It is recommended that your Board approve the Resolution which authorizes the Chairman to execute a Memorandum of Understanding between the Sacramento County Water Agency and the City of Sacramento to retain a consultant to develop a Hydrology Manual.

DISCUSSION:

Both the County and City of Sacramento have adopted hydrologic procedures based on a study made in 1961. That study, performed by George S. Nolte Consulting Civil Engineers, Inc., has served both agencies well, but current development and flooding potential require much more detailed, up-to-date procedures. The MOU provides for up to \$100,000 from each party, for a maximum total of \$200,000, equally shared between the parties, to retain a consultant to perform the study. In addition, an additional \$20,000 is provided, \$10,000 from each party, for possible unforeseen services which may be released by the City Manager and the County Executive. Total price ceiling with contingency is \$110,000 for the Agency. The Agency will be the lead agency. The project is to be funded from Zone 13 funds of the Water Agency Budget. County Counsel has approved the MOU as to form.

Respectfully submitted,

Douglas M. Fraleigh

Douglas M. Fraleigh
Agency Engineer

On MAR 0 6 1990

Dated MAR 0 7 1990

Clerk of Said Board of Directors

By Haley A. Donaldson
Deputy Clerk

COUNTY OF SACRAMENTO

RESOLUTION NO. WA-098

MEMORANDUM OF UNDERSTANDING
WITH THE CITY OF SACRAMENTO FOR HYDROLOGY MANUAL

BE IT RESOLVED AND ORDERED that the Chairman of the Board of Directors be and is hereby authorized and directed to execute a Memorandum of Understanding, in the form attached hereto, on behalf of the SACRAMENTO COUNTY WATER AGENCY, a political subdivision of the State of California, with the CITY OF SACRAMENTO, a municipal corporation of the State of California, to retain a consultant to develop a Hydrology Manual, and to do and perform everything necessary to carry out the purpose and intent of this resolution.

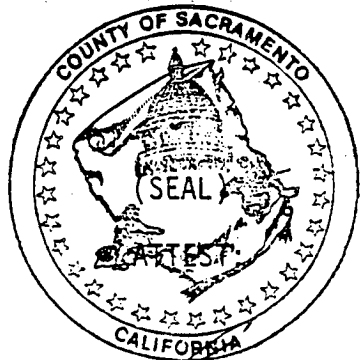
ON A MOTION BY Director T. JOHNSON, seconded by Director I. COLLIN, the foregoing was passed and adopted by the Board of Directors of the Sacramento County Water Agency, State of California, this 6th day of March, 1990, by the following vote, to wit:

AYES: DIRECTORS Collin, T. Johnson, Streng

NOES: DIRECTORS None

ABSENT: DIRECTORS Smoley, G. Johnson

Montisand J. Jensen
Chairman of the Board of Directors
Sacramento County Water Agency



Dorenda A. Williams
Clerk of the Board of Supervisors

Dorenda A. Williams
Clerk of the Board of Supervisors

FILED

MAR 0 6 1990

MAR 0 6 1990

BOARD OF DIRECTORS

In accordance with Section 25103 of the Government Code of the State of California a copy of this document has been delivered to the Chairman of the Board of Supervisors, County of Sacramento on

By Haley A. Donaldson
Deputy Clerk, Board of Supervisors

**MEMORANDUM OF UNDERSTANDING FOR
DEVELOPING A HYDROLOGY MANUAL TO
STANDARDIZE HYDROLOGIC PRACTICES IN
THE CITY AND COUNTY OF SACRAMENTO
AND THE SACRAMENTO COUNTY WATER AGENCY**

This Memorandum of Understanding ("MOU") is made and entered into this 6th day of March, 1990, by the City of Sacramento ("City"), and the Sacramento County Water Agency ("Agency").

RECITALS

WHEREAS, there is a need in the City of Sacramento and the Sacramento County Water Agency to update and standardize hydrologic design criteria and procedures to reflect available hydrologic records and the state of engineering practices; and

WHEREAS, continuing urbanization of the Sacramento region requires new and expanded flood control and drainage facilities; and

WHEREAS, prudent expenditure of private and public capital improvement funds can be aided by master planning of entire drainage basins for ultimate projected land uses; and

WHEREAS, drainage quantity and quality impacts resulting from development may be most economically mitigated by a combination of conveyance and detention facilities; and

WHEREAS, the natural and man-made channels of the region are increasingly regarded as environmentally significant resources; and

WHEREAS, the continuing effectiveness of drainage and flood control facilities is effected by maintenance procedures which may be influenced by State and Federal agencies; and

WHEREAS, coordination of all these concerns is essential to properly manage flood waters passing into and through the geographic boundaries and territory of the County; and

WHEREAS, mechanisms are needed for equitable funding of drainage improvements within each drainage basin; and

WHEREAS, the Agency procured the services of Gill Water Resources Engineering to jointly draft with Agency staff a request for proposal and scope of work for a hydrology study ("Study"), and to obtain City concurrence, which was done, and is attached hereto as Exhibit "A", and incorporated herein by reference; and

WHEREAS, the Agency is empowered to make contracts to do all acts necessary for the full exercise of its purposes and powers, including the power to adopt and carry out any definite plan or system for accomplishing, facilitating or financing all work which may lawfully be accomplished by the Agency; and

WHEREAS, the City and the Agency desire to retain a consultant to perform the services described in the Study.

AGREEMENT

NOW, THEREFORE, THE PARTIES AGREE as follows:

1. The study shall be conducted in substantial compliance with Exhibit "A", except as the scope of work is modified by this Memorandum of Understanding ("MOU"), the final consultant agreement, or in accordance with the provisions of paragraph 5(d) hereinbelow.

2. The Agency shall have responsibility for the administration of the Study which shall include the following duties:

(a) Negotiating and contracting with the consultant to provide the services required by this MOU;

(b) Monitoring the performance of the consultant to assure conformance with the scope of work;

(c) Coordination of meetings between the consultant, City staff and Agency staff; and

(d) The recording and retention of pertinent financial information.

3. The consultant to perform the services required by this MOU shall be selected by a panel. The panel shall consist of one member from the City, one member from the Placer County Water Agency and any other agency not a party to this Agreement; and two members from the Agency. The selection procedures for the consultant, which comply with the City and Agency contracting policy and requirements, are as follows:

a. The solicitation and screening of Statements of Qualifications;

b. The review and rating of written proposals submitted by prospective consultants;

c. The interviewing of selected prospective consultants;

d. The selection of a consultant.

4. An advisory committee shall be established to review draft reports and progress reports prepared by the consultant; to receive periodic presentations by the consultant; and provide advisory direction and comments to the consultant and/or the Agency, as the responsible administrator, during the consultant's performance of the Study. The advisory committee shall be composed of one City employee appointed by the City Manager, and one County employee appointed by the County Executive.

5. Payment for the Study shall be as follows:

(a) Except for any additional fees and expenses permitted by paragraph 5(d), the City shall pay to the Agency no more than One Hundred Thousand and no/100 Dollars (\$100,000) for the Study, including consultant fees and expenses.

(b) Except for any additional fees and expenses permitted by paragraph 5(d), the Agency shall pay to the consultant no more than One Hundred Thousand and no/100 Dollars (\$100,000) for the Study, including consultant fees and expenses.

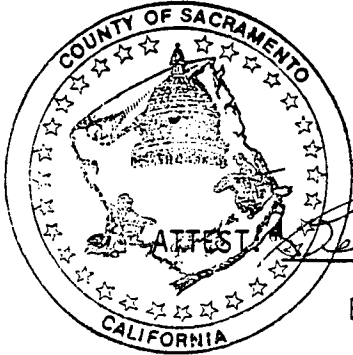
(c) The fees and expenses to be paid by the City and Agency shall be equally apportioned between both entities. The City shall pay its pro rata share to the Agency within forty-five (45) days of the receipt of an invoice detailing the total amount owed to the consultant.

(d) The City Manager and the County Executive are authorized and may jointly make changes in the scope of work to be performed by the consultant, and jointly authorize the payment of any additional costs, including consultant fees related to said changes, provided that the total cost for any and all changes does not exceed Twenty Thousand and no/100 Dollars (\$20,000) of which the Agency and City shall share equally.

6. Performance of this MOU shall commence upon its execution by the authorized representatives of City and Agency, and shall continue until the scope of work is completed in accordance with the Study, or as modified by this Memorandum of Understanding, the final consultant agreement or pursuant to the terms of paragraph 5(d), hereinabove; and until the payment of any and all fees

and expenses. The parties may mutually agree to terminate this MOU at any time provided that any and all fees and expenses incurred pursuant to this MOU have been paid in full prior to its termination.

IN WITNESS WHEREOF, the parties hereby execute this Agreement as of the date and year first above written.



Denise A. Williams
Clerk of the
Board of Directors

SACRAMENTO COUNTY WATER AGENCY

By *Debra Collins*
Vice Chairperson, Board of Directors

"AGENCY"

CITY OF SACRAMENTO, a municipality

By _____
Mayor

"CITY"

ATTEST: _____
City Clerk

APPROVED AS TO FORM:

Steve P. Kubiak
Deputy County Counsel

Deputy City Attorney

SACRAMENTO COUNTY HYDROLOGY
REQUEST FOR PROPOSALS

Lead Agency

The Sacramento County Water Agency (herein referred to as the "Agency", and which is acting on behalf of Sacramento County) and the City of Sacramento ("City") are jointly interested in developing a "Hydrology Manual" and standardizing hydrologic practices in this region. For purposes of this proposal the Agency will be considered the Lead Agency. However, all proposal items are addressed as joint interest (Agency and City). Selection of the consultant will be by staff from the Agency, City and an outside party.

General Information

Agency and City request proposals from pre-qualified engineering consulting organizations to conduct hydrologic studies and prepare manuals and procedures for the computation and management of storm runoff, control facilities and programs. Selected engineering firms are invited to submit a technical proposal in reference to this Request for Proposals.

Sacramento is situated at the confluence of the Sacramento and American Rivers and has experienced flooding problems from its beginning. When the levee system was constructed in the early 1900s to control the rivers, development increased and has continued until the present day where Sacramento is currently in the midst of dramatic growth. With this development comes increased responsibility to maintain an acceptable level of flood protection. Although flooding from the rivers is controlled by the levee and reservoir system, local flooding, or flooding from the smaller watersheds that course through the County and are tributary to the rivers, still occurs. In some locations the flooding is more complex because of the levees. This Request For Proposals addresses local flooding in the County and City of Sacramento and will be funded by both the Agency and City.

Previous Studies

A Master Drainage Plan was prepared for the County of Sacramento in 1961 by Nolte & Associates and was adopted for use. This regional plan was based on an analysis of nine stream gaging stations in and adjacent to the County and provided the means for estimating peak discharges and volumes throughout the County. The US Army Corps of Engineers performed a study in 1975 of several basins in the County using the unit hydrograph method.

Reconstitution of historical storm events were made to determine loss rate values, and design storms incorporating rainfall frequency data were used to determine peak discharges for various frequencies. This study formed the basis for the original FEMA maps. Two additional hydrologic studies performed by the Corps were made on the Morrison Stream Group in 1985 and Dry Creek in 1988. These reconnaissance level studies provided useful information for the two areas and have been used extensively by developers in meeting FEMA requirements. The unit hydrograph method was again used although the design storms were different.

The Nolte study (1961) provided what was to prove to be conservative estimates of peak discharge. It was based on a frequency analysis of stream gages of limited years of record, however, and was developed before the advent of the personal computer. The Nolte method provides peak discharge and volume information at a point. It does not provide hydrographs (discharge-time information) and can not analyze complicated watersheds where pumps, retention basins, culverts, etc. are present.

The Corps studies used the HEC-1 computer program, which is available on the personal computer, and can analyze complicated watersheds. The HEC-1 program is flexible and has gained wide acceptance. It is proposed herein that the HEC-1 program be adapted to information developed specifically for use in Sacramento County and City.

The proposed work effort includes establishment of a data base for precipitation, stream runoff, and climate data; hydrologic analysis and the development and testing of computational procedures and methodologies; recommendation and adaptation of procedures and method objective for use in Sacramento City and County; preparation of a hydrology manual; development of flood hydrology for one of the County's major streams in support of a County program to master plan major streams; and development of standards, policies and procedures for management and financing of the storm drainage program.

SCOPE OF WORK

The scope of work is divided into four phases.

1. Hydrologic Analysis
2. Hydrology Manual
3. Hydrology for Master Plan
4. Institutional/Financial Recommendations

Work on the four phases should proceed concurrently as much as possible. For example the hydrology for the major stream in support of the County's master planning can be initiated after acceptance of the methodology by the Agency and City and not wait for formal reports and the manual to be completed. Analysis and recommendations on institutional and financial aspects can proceed concurrently with hydrologic work.

1. HYDROLOGIC ANALYSIS

The County/City hydrologic data base shall be updated with the assistance of County personnel. The existing data the County has developed including mapping, computer files, and gage information shall be reviewed. Major stream basins shall be delineated on a watershed map and sub-basins plotted. Preparation of the watershed map shall use U.S.G.S. quad maps with a scale of 1 inch = 2000 feet as a base map. The drainage basin boundaries to be used in the analysis will be furnished by the County Water Resources Division.

Maps shall be printed on mylar and shall be prepared using good quality drafting standards with title block information as directed by the Agency and City. A work map in reproducible form may be used during the study period with the final map submitted after acceptance of the draft final report.

Precipitation data shall be compiled for use in latter analyses. The County has compiled extensive precipitation data and conducted analyses with its consultant. These data will be made available to the contractor for use in the hydrology study. Depth-duration-frequency data have been compiled for 30 gages in the study area. Precipitation data shall be reviewed and used in the hydrology as appropriate.

All precipitation gage recording and non-recording stations that are used in the study shall be located on a map. The base map used for the watershed map shall be used for the precipitation station map.

An average annual rainfall map for Sacramento County shall be

prepared based on the furnished gage data.

A review shall be made to identify streamflow gages now in use to analyze the reliability of their measurements and to compile historical data for use in analysis. Stream flow gages that may not be in use at the present time but have a significant period of record that will be useful in analysis shall also be identified and the information compiled and reviewed.

Streamflow gages to be used in confirmation studies of the rainfall-runoff model shall be identified and hourly data obtained for selected major runoff events. The storms selected for analysis shall have dependable stream flow gage records and corresponding precipitation records.

A map showing locations of streamflow gaging stations shall be prepared using the same base map as was used for the watershed and precipitation station maps.

Soils information shall be compiled for use in the hydrologic analysis. The U.S. Soil Conservation Service Soil Survey of Sacramento County is expected to be released soon and should be reviewed as the possible basis for determination of soil categories.

Soil types for Sacramento County shall be generalized into a number of runoff classifications. A map shall be prepared delineating these soil classifications.

Land use data for the present and for future conditions shall be compiled for use in runoff computations. Future projected land use shall be based on best estimates projected to the year 2050. Land use data should be generalized on a map with sufficient detail for use in the development of runoff characteristics. The study contractor shall consult with Sacramento County Planning and Water Resources Departments in the preparation of land use projections.

Precipitation Analysis

The rainfall analysis shall develop depth-duration-frequency relationships. The analysis of gage data shall be used to subdivide the County and City into hydrologic areas with depth-duration-relationships developed for each area.

Design storms shall be formulated for appropriate durations. The design storms shall be consistent with the gage data and the adopted depth-duration-frequency relationships and shall be suitable for use with rainfall runoff models. The design storms shall be based on historic and meteorologically possible storms. They shall include provision for including "nested" maximum intensities for durations from 5 minutes to 24 hours (or the storm

duration). Design storm(s) when used in the rainfall-runoff models shall result in peak flow-frequency and runoff volume-frequency for the frequency events studied. Procedures must include small subdivision computations and computations for basin-wide studies which will require design storms to be developed for short duration cloudburst type storms, twenty four hour storms, and several day duration general storms.

Rainfall Loss Analysis

Rainfall-runoff model calibration supplemented with soil data and land use information shall be the basis for determining classifications for use in estimating precipitation losses. The procedure developed for estimation of loss rates shall take into account soil cover, hydrologic conditions, and antecedent moisture conditions. Procedures should be adjusted for various levels of development and be applicable in a manner to be used within the rainfall runoff model.

Unit Hydrograph Analysis

The study contractor shall recommend the computational procedures for use in the computation of Sacramento hydrology. If a unit hydrograph approach is selected then hydrographs should be derived from analysis of individual storms at competent stream flow gage locations. The use of an S curve graph would be preferred because it is more suitable for use in the direct computer application. If sufficient data can be identified as suitable for derivation of unit hydrograph parameters directly for Sacramento County and City then this would be the appropriate methodology. If review shows insufficient data other procedures should be proposed by the study contractor. Such procedures may include modification of existing Corps of Engineers "S" graphs. The contractor shall propose the recommended procedures and the justification for the selection to the Agency Project Manager for discussion and approval prior to initiation of the detailed analysis.

The Agency and City are receptive to suggestions of other appropriate procedures especially if data is insufficient for some of the more rigorous computational procedures.

Rainfall Runoff Modeling

A rainfall-runoff modeling approach, preferably utilizing the Corps of Engineers computer program HEC-1 shall be used for individual sub-basin modeling for derivation of unit hydrographs and to develop models of major stream basins. The hydrologic analysis shall develop the parameters for the models and develop the sub-basin modeling necessary to reconstruct historical storms and

calibrate the model at known stream flows. Hydrograph parameters and design storms shall be utilized in a manner to facilitate use by engineers and applicants with a minimum of computational effort. To accomplish this it is desired that a pre-processor program be developed and written that will minimize entry of data. The parameters computed by the pre-processor will be capable of direct input to HEC-1. It is envisioned that a program similar to the Corps of Engineers Los Angeles District pre-processor, LAPRE1, will be developed.

Calibrations and Adequacy of Results

Calibrations of the rainfall/runoff model shall be made to adequately reproduce: (1) hydrographs from actual storms, (2) peak discharges from discharge frequency curves developed for selected gage locations, and (3) volumes from volume frequency curves developed for selected gage locations. Values of model parameters developed in the calibrations shall be regionalized for use throughout the County and City.

Statistical evaluations shall be made of the calibration results to indicate how closely the model results duplicate the gage data (levels of confidence).

Small Watershed Computations

Hydrologic procedures should be developed for small watersheds that utilize basic computational procedures and/or families of curves to determine peak runoff rate for the frequencies events. Such procedures may use the rational method either in direct computations or as the basis for developing runoff curves.

Small watershed computations shall transition smoothly to the computational scheme for larger basins. The overlap or transition in procedures as watershed area increases shall not cause any discontinuity or unreasonable changes in runoff for small changes in shed area.

The procedure recommended shall include a tabular form for submittal of information by the engineer that correctly utilizes the recommended procedure and furnishes sufficient data for easy checking by Agency and City staff. Nomographs and or families of curves may be used to facilitate use of the recommended procedure. Intensity-duration-frequency curves prepared in the precipitation analysis should be used for the small watershed computations.

Detention Storage Analysis

Procedures shall be developed for evaluation of detention storage

facilities. Procedures should include the larger flow through type of facility and the off channel flow-by type of facility. Hydrologic routing procedures should be comprehensive but may be generalized and not include specific design solutions. Care should be taken in the procedures or in the presentations of the results to evaluate a proposed storage design based on the actual design of the inlet and outlet controls, i.e., to indicate what portion of the original hydrograph is being detained and for how long. In line areas that are primarily extended channel storage shall be analyzed using appropriate stream flow routing procedures.

Comparison with Procedures of Adjacent Counties

The consultant shall review hydrologic procedures of adjacent Counties that have storm runoff flow into or out of Sacramento County. Primary among these is the Placer County Stormwater Management Manual Draft. Recommendations are to be made as to resolving discrepancies.

Report on Hydrologic Analysis

An engineering report shall be submitted outlining the analysis, the recommended procedures and methodology, and the reasons for recommendations. The report will be reviewed by Agency and City staffs and the methodology accepted by both bodies prior to preparation of the Hydrology manual.

2. HYDROLOGY MANUAL

The purpose of the hydrology manual will be to provide both a comprehensive approach to solution of hydrologic design problems in Sacramento County and City and the presentation of these procedures in a form that is readily usable by project engineers. The hydrology manual will allow a coordinated approach to computation of runoff hydrographs and will ensure that submittal made to either the County or the City will utilize common procedures and be in a uniform format to simplify the review and approval process.

The manual will be based on hydrologic procedures and methodology developed and approved in the first phase of this study. The presentation of the manual shall be in a clear, easy to use format. Computational aids such as families of curves, computer programs, nomographs, tables and worksheets shall be clear and precise, fully developing the hydrologic analysis. The chapters of the manual shall relate to the work tasks of the hydrologic analysis. Organization of the manual may be developed as best fits the

authors presentation but should include at a minimum the following:

1. General discussion of hydrology manual and methodology.
2. Precipitation analysis.
3. Runoff analysis (unit hydrographs if applicable).
4. Loss rate analysis
5. Streamflow routing procedures
6. Procedures for analyzing drainage pump stations and local runoff storage
7. Rainfall runoff modeling.
8. Detention Basin Storage Analysis
9. Computation of runoff hydrographs for large basins.
10. Computation and runoff analysis for small basins.
11. Impact of local development on major streams.

The manual may be an expandable document so that allowance should be made for including chapters on additional subjects, such as water quality and best management practices. Work on these additional subjects, however, is not included in this scope of work.

The manual shall be presented in a loose leaf binder format with computer disks and map exhibits enclosed in cover pockets. The draft manual in a completed and finished form shall be presented in 12 copies (six each) for review by Agency and City staff and drainage engineers active in the Sacramento area. At least one workshop shall be presented by the consultant and Agency staff to demonstrate use of the manual.

3. HYDROLOGY FOR STREAM MASTER PLANS

Agency and City desire to prepare master plans for each of its major streams. The hydrology component for one major stream, Arcade Creek, will be completed. This analysis shall utilize the procedures developed and recommended and shall serve as both a test case of the recommended methodologies and a demonstration of its use.

These plans will be prepared in accordance with the standards of the Water Resource Division consistent with the criteria set down by the Board of Supervisors in their natural streams standards. Hydrologic analysis shall be in complete detail and shall develop the flows and runoff hydrographs necessary for use by the Division in preparation of a master plan.

This phase of the work shall be done concurrently with other work of the hydrologic analysis and preparation of a hydrology manual in so far as the data compilation and analysis shall be complete

and the methodology of the hydrologic analysis accepted by the Agency and City. The actual preparation of the major stream basin hydrology can proceed concurrently with the finalization and adoption of the recommended hydrologic procedures. The preparation of the major stream basin hydrology shall be in a completely documented report that will serve the dual functions of being used in the master planning process and will serve as a demonstration of the application of procedures recommended. The report shall be submitted within 90 days after the completion of the hydrologic analysis phase of the work and the acceptance of the recommended procedures by the Agency and City.

Hydrology for Arcade Creek will be developed by the consultant for use by the Agency/City in a Master Plan Study of the Arcade Creek watershed.

4. INSTITUTIONAL/FINANCIAL RECOMMENDATIONS

Adoption of new procedures for master planning streams, submittal of drainage plans, and publication of a hydrology manual will conflict in some areas with historical practice. Coordination between the County and City and the adoption of common procedures will create situations not before encountered. The consultant working closely with County and City staff, will identify potential conflicts or issues and identify management actions or policies to best implement the new procedures. Examples of potential conflicts include technical changes that result in higher or lower design flows in certain locations than previously adopted, solutions such as upstream detention storage that have watershed-wide benefits, allocation of costs especially between County and City, and financing of costs.

Recommendations are to be made concerning standards for hydrologic levels of protection for the various streams or stream reaches as well as for detention/retention basins. The consultant should also review recent projects undertaken by the County and City to propose a common position on channel mitigation due to development for use in negotiating with resource agencies. The recently proposed DFG memorandum of agreement on channel mitigation and maintenance should be evaluated for its impact on the lifetime costs of the project.

REPORTING, REVIEW AND SCHEDULE

Review of completed work and concurrence of the Agency and City prior to continuing in each phase is essential. Formal review will be made after the data computation and review period, after recommendation of the appropriate hydrologic procedures, after completion of the hydrologic analysis, and upon completion of draft of each section of the manual. A review will be made of the draft manual, the draft of the stream basin hydrology and the draft recommendations regarding institutional procedures and financing.

A monthly brief progress report shall be submitted and the Consultant's project manager shall maintain close liaison with the Agency/City project managers. It is anticipated that the hydrologic analysis will be completed in six months and that all work will be completed in twelve months.

PROPOSAL

Each of the four phases of the work shall be addressed in the proposal: hydrologic analysis, hydrology manual, selected stream basin hydrology, and recommendations regarding institutional and financial needs to implement the new procedures and methodology. The proposal shall outline the approach to each work task and estimate the professional staff hours of work for each task. A proposed format of the Hydrology manual shall be included. A schedule shall be included that shows intermediate dates for preliminary submittals and review by Agency and City.

The proposal shall include a project organizational chart and a statement of qualifications of key personnel to be assigned to the project. Descriptions of projects of a similar nature these personnel have worked on should be included.

"Not to exceed" cost estimates (for each of the four work phases) shall be included in the proposal.

AGREEMENT FOR CONSULTING SERVICES

The agreement with the consultant will include a provision for payment for the consultant's services at his prevailing rates and costs as specified in his proposal, but with a total expense not to exceed the amount stated in the agreement. Any consulting services requested by the Agency or City not included in the Request for Proposal or the consultant's proposal will be paid for on a time and material basis in accordance with the consultant's schedule of hourly rates for personnel and expenses. All such

requests must be in written form and responses from the consultant addressed in written form prior to any payment for services rendered on these additional requests.

SUBMITTAL OF PROPOSAL

Eight copies of the proposal shall be submitted. All proposals shall be submitted by 5:00 p.m. on March 19, 1990, at the following address:

County of Sacramento
Department of Public Works
Water Resource Division
827 7th Street, Room 301
Sacramento, CA 95814

ADDENDA

If it becomes necessary to revise any part of this RFP, an addendum to the RFP will be provided to all consultants invited into this stage of the selection process.

REJECTION OF PROPOSAL

It is recognized that each consultant may have developed their own typical methods of proposal writing. It is not the Agency/City's intention to disqualify a consultant due to variations in proposals that do not affect quality and/or performance. Any proposal offering a higher level of service, higher quality and performance to that requested, which provides the necessary service, will receive full consideration of the selection process.

The Agency/City reserves the right to reject any and all proposals received by reason of this request, or to negotiate separately with any source whatsoever in any manner necessary to serve the best interest of the Agency/City. **THE AGENCY/CITY MAY OR MAY NOT AWARD A CONTRACT SOLELY ON THE BASIS OF THIS REQUEST FOR PROPOSAL AND WILL NOT PAY FOR THE INFORMATION SOLICITED OR OBTAINED.** The information obtained will be used in determining the proposal that best meets the Agency/City's needs.

Non-acceptance of any proposal will be devoid of any criticism of the proposal and of any implication that the proposal was deficient. Non-acceptance of any proposal will mean that another proposal or alternative was deemed to be more advantageous to the Agency/City.

All material submitted which is not proprietary information becomes the property of the Agency/City and may be returned only at the Agency/City's option.

Proposals submitted become the property of the Agency/City and may be reviewed and evaluated by any person at the discretion of the Agency/City.

CONSULTANTS COST

Cost and fee for developing proposals are entirely the responsibility of the consultant and shall not be chargeable in any manner to the Agency/City.

USE OF RFP IDEAS

The Agency/City reserves the right to use any or all consultant ideas presented. Selection or rejection of the proposal does not affect this right.

ACCEPTANCE OF PROPOSAL

Any consultant submitting a proposal shall, by the placing of such a proposal, thereby automatically agree to each and all of the terms, conditions, provisions, and requirements set forth and contemplated in this Request For Proposal and other contract documents.

LATE PROPOSALS

Any proposal received after the specified due date will be rejected.

DRAFT

COUNTY OF SACRAMENTO
DEPARTMENT OF PUBLIC WORKS
AGREEMENT
FOR CITY/COUNTY DRAINAGE MANUAL

THIS AGREEMENT is made and entered into this _____ day of _____, 1990, by and between SACRAMENTO COUNTY WATER AGENCY, a political subdivision of the State of California, hereinafter referred to as "AGENCY", and HDR ENGINEERING, INC., a California corporation, hereinafter referred to as "CONSULTANT".

W I T N E S S E T H

WHEREAS, AGENCY desires to develop a Drainage Manual which would update and standardize hydrologic and drainage facility design criteria and procedures for the City of Sacramento and County of Sacramento to reflect available hydrologic records and state of the art engineering practices; and

WHEREAS, development of institutional and financial policies and procedures are required for proper implementation of the new Drainage Manual by the City and County; and

WHEREAS, AGENCY desires the development of hydrology for Arcade Creek to serve as an example of the new hydrologic procedures and which would be used by others in developing a master plan; and

WHEREAS, CONSULTANT by reason of his qualifications, experience and facilities for performing the type of services contemplated herein has proposed to provide the requested services; and

NOW, THEREFORE, in consideration of the mutual promises hereinafter set forth, AGENCY and CONSULTANT agree as follows:

I. RETENTION OF CONSULTANT

AGENCY hereby retains CONSULTANT for performance of the services described herein and CONSULTANT hereby accepts such retention at the compensation described herein.

II. SCOPE OF SERVICE

The scope of the services covered by this Agreement are those services identified in Exhibit A, Exhibit B, and Exhibit C attached hereto and by this reference incorporated herein. Exhibit A consists of AGENCY's request for proposal dated February 21, 1990. Exhibit B consists of CONSULTANT's Proposal dated March 19, 1990. Exhibit C consists of CONSULTANT's revised scope of work and cost estimate dated April 17, 1990. Exhibit C takes precedence over Exhibit B and the basic agreement takes precedence over all.

III. TERM OF AGREEMENT

This agreement shall be effective as of the date first written above and shall remain in effect until all services covered by this Agreement are completed.

IV. SCHEDULE FOR PERFORMANCE

CONSULTANT shall perform the services as follows: In accordance with Exhibits A, B and C. An advisory committee will be established composed of one City of Sacramento employee appointed by the City Manager, and one Agency employee appointed by the County Executive. The advisory committee may negotiate with the CONSULTANT mutually agreeable changes in work products and work schedules.

V. COMPENSATION

The compensation to be paid by AGENCY to CONSULTANT for the services rendered herein shall be on a "not to exceed" \$199,960.00 and shall be charged at rates stated in Exhibit C. In the event the cost to complete all services stated in this agreement exceeds this not to exceed amount, consultant agrees to complete all tasks at no additional cost to Agency. Additional work may be directed by the Agency Engineer after concurrence by the County Executive and City Manager and shall be paid for on a unit rate basis at rates stated in Exhibit C. The cost of any additional work shall not exceed \$20,000.00. The total price ceiling for this agreement is \$219,960.00.

AGENCY shall make no payment to CONSULTANT for any additional services unless such services and payment therefore have been mutually agreed to and this Agreement has been formally amended in accordance with Section XV.

VI. INVOICING, PAYMENT, NOTICES

CONSULTANT shall submit invoices, not more frequently than monthly, for the services rendered during the preceding period. Invoices shall describe the services performed and shall be based upon the works completed to date. AGENCY may require reasonable documentation to support invoices amounts. AGENCY shall pay, within thirty (30) days of receipt and approval, invoiced amounts that are undisputed. The parties agree to exercise good faith and diligence in the resolution of any disputed invoiced amounts.

Invoices and any notices concerning this Agreement shall be transmitted to AGENCY as follows:

Sacramento County
Department of Public Works
827 7th Street, Room 301
Sacramento, California 95814

Payments on invoices amounts and any notices concerning this Agreement shall be transmitted to CONSULTANT as follows:

HDR Engineering, Inc.

4922 Robert J. Mathews Parkway

El Dorado Hills, California 95630-5700

VII. INDEPENDENT CONTRACTOR

In the performance of the services hereunder CONSULTANT shall be an independent contractor and not an employee of AGENCY. CONSULTANT shall have the sole authority to control and direct the performance of the details of the work. CONSULTANT shall have no authority to act on behalf of AGENCY in any capacity whatsoever as agent, nor to bind AGENCY to any obligation whatsoever.

VIII. AUTHORITY OF CONSULTANT

It is understood that CONSULTANT is to provide information, research, advice, recommendations and consultation services to AGENCY. CONSULTANT shall possess no authority with respect to any AGENCY decision. AGENCY is responsible for and shall make all governmental decisions related to work by CONSULTANT.

IX. ASSIGNMENT AND SUBCONTRACTING

CONSULTANT's obligations authorized under this Agreement are not assignable or transferable, and CONSULTANT agrees not to subcontract any work authorized hereunder, beyond that indicated in Proposal, without the prior written approval of AGENCY.

X. OWNERSHIP OF WORK PRODUCT

All technical data, analysis, maps, manuals, reports or other work products of CONSULTANT provided hereunder shall become the property of AGENCY and shall be delivered to AGENCY upon completion of the services authorized hereunder. CONSULTANT may retain copies thereof for its files and internal use.

Publication of the information directly derived from work performed or data obtained in connection with services rendered under this Agreement must first be approved in writing by AGENCY.

XI. INDEMNIFICATION AND INSURANCE

CONSULTANT, by execution of this Agreement, specifically agrees to hold harmless and indemnify the AGENCY, the City of Sacramento and the County of Sacramento against all loss, liability, damage and expense caused by sole negligent acts or omissions of CONSULTANT in performing the services provided for in this Agreement. CONSULTANT agrees to maintain \$1,000,000 public liability and property damage insurance coverage for the duration of the performance of the work covered by this Agreement. AGENCY may require CONSULTANT to submit evidence of insurance coverage.

XII. PROFESSIONAL SERVICES

CONSULTANT agrees that the work hereunder shall be performed and completed in a professional manner. All services shall be performed in the manner and according to the professional standards observed by a competent practitioner of the profession in which CONSULTANT is engaged. CONSULTANT shall not, either during or after the term of this Agreement, disclose to any third party any confidential information relative to the work of AGENCY without the prior written consent of AGENCY.

XIII. RECORDS

CONSULTANT shall maintain records, books, documents and other evidence directly pertinent to the performance of work under this Agreement in accordance with generally accepted accounting principles and practices consistently applied. Such records shall be retained for a period of four (4) years after completion of all services covered in this Agreement.

CONSULTANT agrees to provide AGENCY or any of its authorized representatives or agents with access to and right to examine and photocopy records and documentation. AGENCY shall provide CONSULTANT with reasonable notice of intent to exercise said access rights.

XIV. EMPLOYMENT PRACTICES

CONSULTANT, by execution of this Agreement, certifies that it does not discriminate against any person upon the basis of race, color, creed, national origin, age, sex, disability or marital status in its employment practices.

XV. AMENDMENTS

Modifications or amendments affecting the work hereunder shall be in writing and executed by both parties.

XVI. ENTIRE AGREEMENT

This instrument and any attachments hereto constitute the entire Agreement between the AGENCY and CONSULTANT concerning the subject matter hereof.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be duly executed as of the day and year first written above.

SACRAMENTO COUNTY WATER AGENCY,
a political subdivision of the
State of California

By _____
Chairman, Board of Directors
"AGENCY"

HDR Engineering, Inc.,
a California corporation

By _____
"CONSULTANT"

Approved as to Form

County Counsel

Distribution: Contract Desk
Auditor-Controller
Consultant

DMF:PH:p1:0418



PH

April 17, 1990
07018001.003

Mr. Pete Hall
Associate Engineer
Department of Public Works
827 Seventh Street
Sacramento, CA 95814

RE: DRAINAGE MANUAL - REVISED SCOPE OF WORK AND ENGINEERING COST ESTIMATE
DATED APRIL 17, 1990

Dear Mr. Hall:

Based on your telephone call today, we have revised the Scope of Work accordingly. This revised scope along with our engineering cost estimate are enclosed for your use in developing a contract. Please call me if you require further scope revisions.

Sincerely,

A handwritten signature in cursive script that reads "Robert B. Williams".

Robert B. Williams, Vice President

A handwritten signature in cursive script that reads "Bert A. Brown".

Bert A. Brown, Project Manager

RBW:jw

Enclosure

cc: Ms. Paula M. Arsenault, HDR

**COUNTY AND CITY OF SACRAMENTO
DRAINAGE MANUAL
SCOPE OF WORK/ENGINEERING COST ESTIMATE
Revised April 17, 1990**

SCOPE OF WORK

The Scope of Work for this project is organized into four phases and further subdivided into tasks within those phases as follows:

Phase I: Hydrologic Analysis

- Task 1.1: Data Collection and Review
- Task 1.2: Precipitation and Stream Gage Review/Recommendations
- Task 1.3: Base Map Preparation
- Task 1.4: Precipitation Data Analysis
- Task 1.5: Rainfall/Runoff Analysis
- Task 1.6: Unit Hydrograph Development
- Task 1.7: HEC-1 Model Input Development
- Task 1.8: HEC-1 Model Calibration
- Task 1.9: Small Watershed Runoff Computations
- Task 1.10: Hydrologic Analysis Report Preparation

Phase 2: Drainage Manual

- Task 2.1: Hydraulic Design Aids/Criteria/Procedures
- Task 2.2: Water Quality Considerations
- Task 2.3: Outline and Draft Manual Preparation
- Task 2.4: Workshop
- Task 2.5: Final Manual Preparation

Phase 3: Hydrology for Stream Master Plan - Arcade Creek

- Task 3.1: Data Collection and Review
- Task 3.2: Model Development and Calibration
- Task 3.3: Arcade Creek Hydrology Report Preparation

Phase 4: Institutional/Financial Considerations

- Task 4.1: Review of City/County Standards and Policies
- Task 4.2: Identification of Potential Conflicts and Issues
- Task 4.3: Recommendations/Report Preparation

Within this Scope of Work, the Sacramento County Water Agency and the City of Sacramento are referred to as the Agency and the City, respectively.

Phase 1: Hydrologic Analysis

The hydrologic analysis serves as the cornerstone of the manual and the case study for Arcade Creek watershed. A critical aspect of this task is the thorough analysis of available data and the development of realistic and reasonable relationships between rainfall, flow/water level and return period.

Task 1.1: Data Collection and Review--

The first step in completing the area-wide hydrologic analysis for the Sacramento County area will be to review available data bases for precipitation, flow and water surface level for Agency and City maintained gages. In addition, available drainage maps will be reviewed for use in developing base maps and generating basin characteristic inputs to HEC-1. Gage data (water elevation, flow and rainfall) stored on City and Agency computer systems will be obtained for analysis. Information regarding historical flooding, trouble calls or maintenance problems will be obtained from City and Agency staff, including maintenance crews. This type of information is often useful in model calibration and design storm selection, because it provides a cross-check of mathematical and modeling estimates.

The Agency maintains two systems for storing and cataloging rainfall and stream level data, and both of these are based on personal computers. Historic rainfall data, primarily for gages which are no longer operable or have operated noncontinuously, are stored on a DBase III Plus system. These data were, in general, recorded on stripcharts and then extracted for entry onto the computer system. Dbase III software has been written which will search, sort and summarize precipitation data collected at several location. The second system is automated and was established by Sierra-Misco, which provided the software and hardware for the Agency's ALERT system. The system sends signals to the County building and records the rainfall depth and water surface elevation signals as appropriate, on a personal computer. The gages which are a part of this system record a signal when the depth of rainfall in the gage bucket reaches .04 inches, a relatively detailed level of accuracy. Rainfall is then converted by the software from the signal codes to depth when a user makes an inquiry.

We have had the opportunity to gain experience with the Agency's data base system. Based on our firsthand review of the computer systems and other Agency information, such as maps and gage catalogs, the data base information appears to be quite organized and well maintained in a readily available format. Since we plan to perform our statistical analyses, modeling and documentation on a personal computer, data could be easily transferred from the Agency's telemetry/data base system to our computers for analysis.

The City of Sacramento maintains several level gages at pumping stations throughout the City boundary area. We will collect and evaluate all available gages for selected calibration events. The National Weather Services maintains a precipitation gage in Sacramento with a long-term records. These data will be obtained from NOAA in computer disk format.

Other relevant information we will obtain and review include:

- Existing flood and drainage studies
- Current general plans (current and future land use conditions)
- Soil Conservation Service and other available soils surveys
- Flood Insurance Studies (FEMA flood maps) for the Sacramento and surrounding area
- Existing HEC-1 and HEC-2 input data from previous investigations
- Data or reports for previous or ongoing Corps of Engineers studies
- History of flooding (City and Agency reports and maintenance records)
- Photographic records of site visits

The objective of the data collection and review effort is to make maximum use of information and studies that have been performed for the county-wide area.

Another important aspect of this task will be the review of stormwater management manuals developed by adjacent counties. Placer County Flood Control and Water Conservation District recently issued its Draft Stormwater Management Manual. Several of the elements included in this manual, particularly the approach to design storm development, may be useful for application to the Sacramento County area. Although El Dorado County has not yet developed a drainage manual, we will

interview County Department of Transportation staff to examine the methods being used for drainage design.

Task 1.2: Precipitation and Stream Gages Review/Recommendations--

A comprehensive review of Agency and City precipitation and stream level gages will be performed. Appropriate use of data is the key to developing an accurate, reliable and reasonable Drainage Manual for application to public facilities and private developments.

Rating curves (depth or elevation versus flow) will be developed for the Agency's stream level gages in order to generate a flow data base for these locations. Flow rate is necessary for model calibration to check hydrologic and hydraulic model parameters. Preferably, the rating curves will be developed from actual flow measurements. If the gaged drainage channels and streams are dry during the course of the project, then a curve will be derived using a field survey of the channel cross-sections at the gage locations, HEC-2 model runs, and actual depth measurements for storm events. Since the rating curves and data reduction must be performed at the outset of the project, the currently identified schedule cannot accommodate delays until the 1990/1991 wet season to develop these rating curves. We will provide procedures to the Agency for updating the rating curves as flow measurements become available during future wet seasons.

In addition to developing rating curves, the stream gages will be evaluated as to their placement and accuracy. The existing stream gages will be reviewed and recommendations made where necessary, on modifications and additions to the current gaging system. Areas where supporting hydraulic gage data are lacking or incomplete will be determined.

A key effort in this task will be the evaluation of the Agency and City's precipitation gages. Each gage will be inspected in the field and evaluated for siting conditions and accuracy in order to answer the questions: Is the exposure of the gage proper for allowing accurate measurement? Is the gage overly subjected to high winds? Is the gage affected by obstacles, resulting in inaccurate measurement? The field investigation will allow us to determine the

basins or regions which are represented by each gage, and whether the differences in gage measurement are caused by climatic influences or instrument placement.

This information will then be used, along with statistical analysis results, to determine whether the county-wide hydrologic criteria should be uniform (represented by one set of frequency curves and criteria), or divided into regions (e.g. foothill areas versus valley areas).

Following field investigations and hydrologic analyses, recommendations on necessary modifications, relocations, and additions to the existing precipitation gage system within the county area will be formulated. A separate technical memorandum will be prepared to address the existing precipitation/stream gaging system. This document will serve as a master plan for the Agency's stream monitoring system and will include recommended improvements (gage locations, procedures for the development of rating curves, necessary instrumentation, and quantities) to ensure accurate hydrologic/ hydraulic data are collected for future updates of the Manual.

Task 1.3: Preparation of Base Maps--

Base maps will be prepared using United States Geological Survey 7-1/2 minute quadrangle maps. Based on our review of the study area, 29 quad maps are involved in the effort. Drainage basin boundaries will be obtained from the Agency and the City for transposing to the base maps. We propose to utilize maps from the USGS or other suitable vendors in digital form for use on our AutoCADD system. We understand that the Agency is considering automating their mapping and design documents with AutoCADD. The use of digitized topographic maps allows for the greatest amount of flexibility and choice with regard to scale, layering of features, and information identified on the maps.

The City of Sacramento has digitized topography maps of the City and HDR will incorporate these maps into the base mapping for cost estimation purposes. We have assumed that the remaining County area maps in digital form will be provided to HDR for use in this study.

In addition to the topographic and other information (i.e. streams, county boundaries, city boundaries, etc) contained on the base maps, we will add basin boundaries, isohyetal lines for average annual rainfall, City and Agency precipitation and stream gages, land use (current and future) and SCS soil type classifications. We will coordinate closely on the presentation and format for these features, selecting the proper combinations of AutoCADD "layers" for plotting purposes. Agency standards for title blocks, borders, symbols and legends will be used on all of the maps. A draft and a final version of the maps will be developed for review and production purposes, and the final version of the maps in AutoCADD formatted disks and mylar printout (laser jet) will be delivered to the Agency.

Task 1.4: Analysis of Precipitation Data--

The objective of the precipitation analysis is to develop depth-duration-frequency curves for the county area. These curves will provide for "nested" or inclusive maximum intensities for durations from 5 minutes to 24 hours. The analysis will first address the question of whether the county area should be divided into regions (for example, lower versus higher elevations) or whether a single set of curves are appropriate for the entire region.

While the measurements for individual short-duration (period of record) gages may be different, an analysis of statistics (depth-duration-frequency relationships) for long-term gages may indicate that there are only minor differences between the gages. We will present the results of the analysis along with our recommendations regarding regionalization of rainfall criteria in a separate technical memorandum for review. At this point, a collective discussion can be conducted regarding results, prior to the final analysis.

Our evaluation will include the examination of long-term statistics developed to date for Sacramento. Our experience with computer plotting of assumed probability distributions, like those used by the Department of Water Resources, require careful examination and comparison of actual data, especially for extrapolated return periods.

Based on the results of the preliminary statistical analyses, we will generate the final depth-duration-frequency curves. An important aspect of this analysis is the creation of "realistic" results, i.e historically and meteorologically possible events.

Another part of this task will be the selection of criteria for defining "large" or "small" basins/subbasins, and whether different methods should be applied to the two classes of basin size. A modified rational formula method was developed to handle hydrologic calculations for the smaller watersheds in Placer County in order to reduce the number of unit hydrographs developed for the county and to simplify computations required by land developers. For the larger basins, a Kinematic wave approach was used. We will consider the use of a similar approach for the Sacramento area by investigating the various approaches applicable to Sacramento, including unit hydrographs, S-curves and the rational formula (or modifications thereof). The results will be presented in discussion in the technical memorandum generated for this task.

Task 1.5: Analysis of Rainfall-Runoff Relationships--

The rainfall-runoff analysis will allow us to develop unit hydrographs and to establish hydrologic parameters for urban areas. An objective is to determine whether runoff parameters should be uniform or regionalized within the county area.

Once rating curves are developed for gages and high water mark locations, comparisons can be made between simulated and observed flows for the gages in the Agency network. A calibration procedure will be used for developing actual unit hydrographs or S-curves for basins.

The results of the precipitation analysis along with the Corps of Engineers' HEC-1 model will be used to derive rainfall-runoff relationships for the area. The product of this task will be curves relating peak flow to frequency and runoff volume to frequency for the design events studied. A desirable approach for determining the setup for the HEC-1 model and developing of unit hydrographs would be based on the analysis of individual storms at stream level gage locations.

Task 1.6: Development of Unit Hydrographs--

For the Sacramento area, we recommend the use of a unit hydrograph method for the large basins. These will be generated from stream gage data where the data have been determined reliable and accurate. Our review and analysis of the gage data will influence the actual approach taken, particularly if insufficient streamflow data are available for analysis.

Task 1.7: Development of HEC-1 Model Inputs--

The HEC-1 model will be used to develop rainfall-runoff relationships. Inputs will be developed based on the data collection and review tasks and the precipitation analysis. This task also includes the development of a preprocessor model for the HEC-1 Model. The Corps of Engineers' LAPRE1 preprocessor model and a similar model will be reviewed as a possible candidate. We will examine other preprocessor type models (such as those we developed for the Seattle area) for applicability to this Manual. We will then develop a similar model subject to approval by the City and Agency and instructions for incorporating into the Manual.

Task 1.8: Calibration of HEC-1--

Model calibration will be performed to ensure the model accurately simulates the major watersheds in the county relative to peak flow, hydrograph shape and volume for actual storm events. Calibration events will be selected following the reduction and review of the gage data. Model input parameters will be regionalized based on watershed or regional criteria.

Task 1.9: Small Watershed Computations--

As described in Task 1.4, we propose to develop two classes of watersheds for the area and present options for small watershed methodology. The sizing criteria for differentiating small and large basins will be determined during the analysis of precipitation data. During this task, the selected methodology will be translated into the development of computational (families of curves) and graphical (nomograph) procedures for generating design storm peak flows for small basins, using the final intensity-duration-frequency curves developed in Task 1.4. Use of the rational method, or a modification thereof, will be considered.

A critical element of this task is to ensure consistency between the two selected methods, i.e. between the unit hydrograph or S-Curve method applied to larger watersheds and another method (perhaps rational formula) for the smaller basins. The continuity between the two approaches for resulting peak flow values should be as smooth as possible.

For Placer County, this was successfully achieved by developing a modified rational method which utilizes coefficients that account for both runoff and lag time, depending on the basin size and location. This approach is currently being incorporated into Placer County's Stormwater Management Manual.

Task 1.10: Hydrologic Analysis Report Preparation--

This engineering report will embody the efforts of our Phase 1 analysis, and will describe the analysis, recommend procedures and methodology, and provide justification for our recommendations. Because we will be preparing brief technical memoranda throughout the analysis for City and Agency review and coordinating closely at each step, this report can be efficiently prepared. At this point in the study, the engineering report will contain information which has been thoroughly discussed with and reviewed by the City and the Agency. Once the draft version has been reviewed, comments will be incorporated for producing a final "accepted" version. Twelve (12) draft copies and twelve (12) final Hydrologic Analysis Reports will be submitted to the City and the Agency.

Phase 2: Drainage Manual

The Drainage Manual will provide a comprehensive and consistent approach to solving stormwater control problems in the County area. The key to developing the Manual is "usability"; information, graphics, tables and computer models will be presented in a clear, concise, easily usable format for both municipal and private engineers (developers, consultants). The Manual will then allow for the City and Agency to approach stormwater management, including flood control, pollutant control, and financing considerations in a consistent fashion.

Task 2.1: Hydraulic Design Aids/Criteria/Procedures--

Hydraulic considerations can have a significant impact on the routing of peak flows through a drainage basin. In order to properly and uniformly assess hydraulic issues, a section of the Manual will be dedicated to these issues. Specifically, street drainage, storm inlets, storm sewers and appurtenances, culvert and bridge hydraulic design, open channel flow, and other structure hydraulics will be included in the Manual.

A focus of this task will be the analysis of detention storage. This task involves the preparation of procedures for sizing various types of detention facilities for small and large watersheds. Procedures will include "inline" and "offline" types of facilities, and will account for inlet and outlet control structures and operation.

An important consideration in this evaluation will be the incorporation of pollutant control methods into the detention basin sizing analysis. As previously mentioned, the City and County of Sacramento are in the process of obtaining a joint NPDES permit for stormwater outfalls discharging to the American River and Sacramento River. The permitting process includes the development of a stormwater management plan, which we understand will focus primarily on best management practices. Future detention facility design could consider the incorporation of pollutant control criteria, such as the capture of the first one-half inch of rainfall into the basin. We will use our experience in addressing "dual" flood/pollutant control design criteria during this task, and will develop design criteria options for the Agency and City for discussion.

Meetings will be held with the City and Agency to collect data and reference documents on improvement standards, design practices, and other procedures relating to hydraulic structures. Differences found to exist between the City and Agency practices will be isolated and resolved, if possible. The objective is to combine existing drainage facility design criteria with the hydrologic results of Phase 1 to formulate a complete Manual where City and Agency practices differ, subsections will be created to identify criteria which are specific to the Agency or City.

We will also generate recommendations for modifying the existing Agency and City drainage criteria, where appropriate.

Task 2.2: Water Quality Considerations--

Stormwater management facility design involves pollutant issues as well as flow and volume control. The objective of this task is to collect information and document experiences in planning and designing water quality control structures. For instance, recommended design criteria for stormwater detention facilities will consider dual objectives: mitigating flood (high recurrence interval), and water quality (low recurrence interval) impacts of development.

Following information collection and review, we will develop recommendations for the inclusion of pollutant control measures into the Manual. An outline for a section (or several) will be developed for the Manual specifically addressing stormwater pollutant management design issues.

Task 2.3: Outline and Draft Manual Preparation--

In order to establish an appropriate structure for the Manual, a detailed outline will be developed early on and reviewed by the City and Agency. In order to develop such an outline, previous manuals which HDR as well as other consultants and agencies have prepared will be reviewed. Elements from these documents will be included where appropriate, into the Sacramento County and City Manual outline. A preliminary outline of the Manual, shown as Figure 1, has been developed to illustrate the general proposed format. As the study progresses, we will modify or add items to address particular elements of the project area which are unique.

Prior to any specific work on the Manual, the detailed manual outline with examples and previously adopted hydrologic technical memoranda (Phase 1) will be submitted to the Agency and the City for review and approval. This document will serve as a preliminary Draft Manual and concurrence will be reached before initiating detailed work on the manual. A level of effort will be agreed upon for each section of the Manual along with the exact format for tables and figures.

FIGURE 1
SACRAMENTO AGENCY AND CITY
DRAINAGE MANUAL
-PRELIMINARY OUTLINE-

- I) Introduction
- II) Watershed Characteristics
- III) Precipitation
- IV) Infiltration
- V) Runoff
- VI) Street Drainage
- VII) Storm Inlets
- VIII) Storm Sewers and Appurtenances
- IX) Culvert and Bridge Hydraulic Design
- X) Open Channel Flow
- XI) Structures
- XII) Storage
- XIII) Drainage Plan Requirements
- XIV) Case Study (Arcade Creek)
- XV) Appendix

Twelve (12) copies of the Manual will be developed and submitted to the City and Agency for review. The draft manual will be complete with all figures, tables, and text present, and will follow the approved outline format and include a case study (Arcade Creek watershed).

The Manual will be a "stand-alone" document with the necessary documentation to enable project engineers to develop runoff hydrographs which are realistic and consistent for basins in the County area.

Task 2.4: Workshop--

We will conduct a workshop to demonstrate the use of the Manual for an actual subbasin in the County, Arcade Creek. Notes will be taken of that workshop and modifications made, as necessary, to the draft Manual to reflect any required changes. These changes will be submitted and approved by the City and Agency.

Task 2.5: Final Manual Preparation--

Comments received during the workshop secession and from City and Agency staff will be incorporated into a final Manual. The Manual will be contained in a loose leaf binder with appropriate computer disks and map exhibits enclosed in corner pockets. The final Manual is currently scheduled for completion in the eleventh month of the study. Twelve (12) copies of the final Manual will be submitted.

Phase 3: Hydrology for Stream Master Plans (Arcade Creek)

Task 3.1: Data Collection and Review - Arcade Creek--

During the data collection and review effort associated with Phase 1, specific information on Arcade Creek will be collected and evaluated. Sufficient data will be gathered for Arcade Creek watershed in order to develop a complete hydrologic analysis for use by the City and Agency in developing a master drainage plan. It is anticipated that most of the information required for the Arcade Creek evaluation will be assembled and evaluated during Phase 1.

Task 3.2: Model Development and Calibration - Arcade Creek--

A HEC-1 model analysis will be performed for the entire Arcade Creek watershed. The preliminary HEC-1 computer model input file that we have already developed will be expanded to cover the entire drainage area of Arcade Creek in greater detail.

During the development of the model, both the City and Agency will be contacted and a set of likely alternatives for flood protection on Arcade Creek formulated. The preliminary formulation of these alternatives will be necessary in order to ensure that the model is set up to generate a sufficient number of hydrographs. Adequate coverage of the basin is necessary to accurately simulate peak discharge and flood hydrograph volumes at proposed improvement locations within the watershed.

Once the model has been developed, it will be calibrated, if possible, against hydrographs from actual storms or peak discharges from discharge-frequency curves developed for selected gage locations. Hydrograph volumes will also be checked against any known or probable hydrographs.

Task 3.3: Arcade Creek Hydrology Report Preparation--

A separate hydrology report will be developed for the Arcade Creek watershed. This report will provide the City and Agency the necessary hydrologic evaluations to develop a complete master drainage plan for Arcade Creek. The hydrologic methodology developed in Phase 1 of the study will be utilized in this report. Additionally, this report will serve as an example case for the Manual, and a summary of the model's development will be included in the Manual (Phase 2). The final hydrology report for Arcade Creek will be complete in the eighth month of the study. Twelve (12) copies of the Arcade Creek Hydrology Report will be submitted to the Agency.

Phase 4: Institutional/Financial Recommendations

Task 4.1: Review of City/Agency Standards and Policies--

Agency and City policies and standards will be reviewed periodically throughout the study effort to determine areas where conflicts are likely. During the ninth month of the study, a formal review will be conducted by the project team. Policies and standards will be reviewed in light of newly proposed practices in the Manual.

Task 4.2: Identification of Potential Conflicts and Issues--

Areas where potential conflicts are likely to occur as a result of adoption of new policies for master planning streams, drainage plans, and the Manual will be discussed in detail with the City and Agency.

A survey utilizing existing records of other California communities will also be conducted where unincorporated areas adjacent to incorporated cities have experienced rapid growth. Officials from these survey areas may be contacted and information collected on the types of conflicts that have occurred and how they were resolved.

Task 4.3: Recommendations/Report Preparation--

A separate report will be prepared that summarizes the findings and recommendations associated with institutional and financial aspects of the adoption of new hydrologic policies and procedures. Recent projects undertaken jointly by the Agency and City will be reviewed from a financial policy/cost sharing standpoint. Results of the survey of other California communities who have experienced similar growth and resulting drainage problems will also be summarized in the report. Twelve (12) copies of this report will be submitted to the Agency.

SCHEDULE

The schedule of work, illustrated on Figure 2, is based on the Scope of Work previously described. A total of 21 activities have been identified for the four phases of work. A significant amount of the work will occur in the first phase,

SACRAMENTO COUNTY DRAINAGE MANUAL

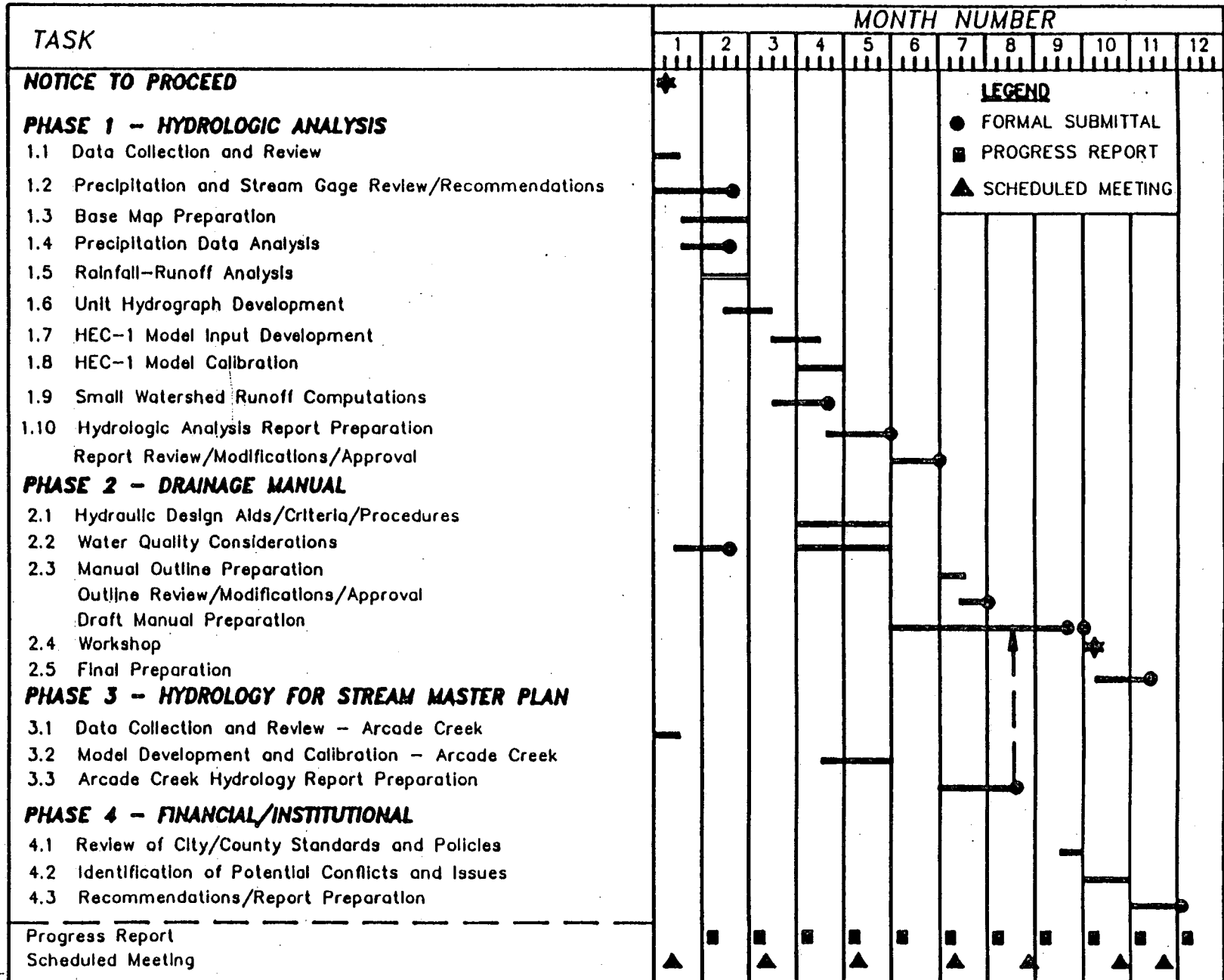


Figure 2. SCHEDULE OF WORK

Hydrologic Analysis. This initial work will provide the foundation for subsequent work in later phases. The Hydrologic Analysis phase will conclude with a draft report submitted to the Agency and City at the end of the fifth month and a final report submitted at the end of the sixth month.

The second phase of work, preparation of a Drainage Manual, will begin in the sixth month of the study after the hydrologic procedures and methodology have been reviewed and approved by the Agency and the City. However, we will initiate data collection and review, particularly for the water quality section, early in the study. The final manual will be submitted in month eleven after receiving comments on the draft manual and a workshop session.

Phase 3 of the study, Hydrology for Stream Master Plan - Arcade Creek Hydrology, will begin with data collection early in the study (first month). Model development and calibration for the Arcade Creek basin will occur concurrently with Phase 1 work. The Arcade Creek Hydrology Report will be finalized in the eighth month of the study in order to incorporate the results of the analysis into the Manual as a case study.

The finalization of Phase 4, Institutional/Financial Considerations, will occur in the 9th, 10th, and 11th month of the study following the draft Manual submittal. Ongoing discussions relevant to institutional and financially concerns, however, will informally occur throughout the study. An approach to address the concerns will be developed near the end of Phase 1 and will be continuously refined and modified if necessary, as the study progresses.

The overall project is currently scheduled to end after the 11th month of effort.

ENGINEERING COST ESTIMATE

Based on the Scope of Work and Schedule, estimated hours and costs were developed for each of the four phases of work. These estimates are based on our current understanding of the project requirements as outlined in the Request for Proposals and discussions with City and Agency personnel.

Figure 3 summaries hours and costs for each of the phases of the project study. Expenses for HDR and our subconsultants are also given. A significant amount of the total project staffing has been allocated to the hydrologic analysis phase of the study. This initial work will streamline much of the later work, particularly in Phases 2 and 3.

FIGURE 3. SACRAMENTO CITY AND COUNTY DRAINAGE MANUAL STAFFING AND COST ESTIMATE

Task No.	Task Title	HDR Engineering							Total HDR Hours	HYDMET J.Humphrey and W.Blood	Bartle Wells T.Gaffney and L.Stovall	Total Phase Labor Cost (\$)	Total Phase Expense (\$)	Total Phase Cost (\$)
		Project Manager B.Brown	Quality Control R.Nieder- geses	J.Zovne	P.Arsenault	Staff Hours								
					Staff Engineers	Drafting/ CAD	Clerical							
Phase 1 - Hydrologic Analysis														
1.1	Data Collection and Review	8			16	16			40	16				
1.2	Gage Review/Recommendations	8			56	24	80	16	184	56				
1.3	Base Map Preparation				24	24	400		448	4				
1.4	Precipitation Analysis	8	8		32	16		16	80	16				
1.5	Rainfall-Runoff Analysis	8		16	24	40			88	8				
1.6	Unit Hydrograph Development	8			24	24			56	32				
1.7	HEC-1 Model Inputs	8			32	40			80	40				
1.8	HEC-1 Model Calibration	4		16	16	16			52	16				
1.9	Small Watershed Computation	4			16	24		8	52	24				
1.10	Hydrologic Analysis Report	16	8		24		40	40	128	24		82,620	12,500	95,120
Phase 2 - Drainage Manual														
2.1	Hydraulic Design Criteria	40	24	40	48	40		16	208	40				
2.2	Water Quality Consideration	4	4	16	48	40	8	8	128	24				
2.3	Outline and Draft Manual	32	16	16	120	40	80	120	424	40				
2.4	Workshop	32			32		24	16	104	16				
2.5	Final Manual Preparation	40	8		80	40	40	80	288	16		60,100	5,000	65,100
Phase 3 - Hydrology for Stream Master Plan (Arcade Creek)														
3.1	Data Collection and Review	8			8	8			24	16				
3.2	Model Input/Calibration	16			24	24			64	24				
3.3	Hydrology Report	24	8	8	16		16	24	96	16		16,080	3,500	19,580
Phase 4 - Financial/Institutional Recommendations														
4.1	Review Standards/Policies	16			16				32	4	32			
4.2	Identification of Potential Conflicts and Issues	8	8	8	8				32	4	32			
4.3	Recommendations	16			8			8	32	4	32	17,660	2,500	20,160
Totals		308	84	120	672	416	688	352	2640	440	96			199,960

Note: Phase 1 expenses exclude the cost of USGS quadrangle maps in digital format (29 maps estimated to cost \$ 11,000). It is assumed that the Agency will provide these maps to HDR. The City already has 8 maps available in digital form, which can probably be used for this study.

RECEIVED
DEPARTMENT OF WATER RESOURCES

HDR

Date 4-20-90

Number of Pages (includes cover page) 2

Job No. 96090-200-108-03-60

Message To

Name Mr. Pete Hall Telecopy number called 447-5121

Firm Sacramento

City Sacramento State CA

If you do not receive all of the pages, please call (916) 939-4100 as soon as possible.

From

Name Best Brown Department 141

Auto Attendant No. (916) 939-4139 Ext. 269

Attached is HDR's "current Standard Rate Schedule" for 1990. These rates may be used to estimate additional costs. The monthly invoices will be based on the actual rates of the staff working on the project plus a 170 percent overhead and a 15 percent profit markup.

Best Brown

HDR Engineering, Inc.
4922 Robert J. Mathews Parkway
El Dorado Hills, California
95630-5700

Telephone
916-939-4100

Fax
916-939-4143

HDR ENGINEERING, INC.
STANDARD RATE SCHEDULE
JANUARY - DECEMBER 1990

PRINCIPALS	129.00
SENIOR MANAGERS	105.00
SENIOR ENGINEERS	95.50
SUPERVISING ENGINEERS	78.50
STAFF ENGINEERS	62.25
ENGINEERS	50.00
TECHNICIANS	54.25
DRAFTERS	39.25
SECRETARIAL	37.75

Rates include current profit and overhead rates