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CITY OF MESA, ARIZONA

EAST SIDE STORMWATER DRAINAGE STUDY FOR THE CITY OF MESA

Project No. 81-04

YOST AND GARDNER ENGINEERS
Phoenix, Arizona

May 1, 1981

Nº 28

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CITY OF MESA, ARIZONA

EAST SIDE STORMWATER DRAINAGE STUDY FOR THE CITY OF MESA

Project No. 81-04

FLOOD CONTROL DISTRICT
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YOST AND GARDNER ENGINEERS

Phoenix, Arizona

May 1, 1981

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May 1, 1981

Mr. Peter L. Peterson, City Engineer
City of Mesa
55 North Center Street
Mesa, Ariz. 85201

Re: Mesa Project No. 81-04

Dear Mr. Peterson,

Submitted with this letter is our report of studies with recommendations for future storm drain construction in portions of Mesa and its environs east of the Roosevelt Water Conservation District Canal. In accordance with our agreement, dated June 27, 1980, we have given detailed attention to the area between McDowell and Baseline Roads west of the Central Arizona Project Canal. More general coverage is given the area between the CAP Canal, the Pinal County line, and between McDowell Rd. extended and Baseline Rd.

We recommend a system of trunk drains located on the principal east-west arterial streets. The drains would begin west of the CAP Canal and carry runoff to discharge points in the RWCD Floodway which is currently under design and construction by the Soil Conservation Service. We recommend that a low-flow channel be constructed within the RWCD Floodway north of Guadalupe Rd., preferably as a part of original construction by the Soil Conservation Service. The floodway would be extended as a storm drain as far north as McKellips Rd. The low-flow channel is the preferred method of discharging trunk drains into the RWCD Floodway. An alternate method would require seven discharge structures similar to that detailed on Figure 37. If it is necessary to adopt the alternate method a retention basin would also be required at McKellips and Greenfield Roads, as shown on Plate II.

Proposed storm drains in the region west of the CAP Canal can all be built within existing public right-of-way except for the channel along the RWCD Canal from McKellips Rd. to the floodway.

The system shown is planned to handle 10-year runoff from arterials and 2-year runoff from interior areas in accordance with past drainage design policy of the City of Mesa. It is also assumed that the current on-site retention policies continue to apply and are effectively enforced.

The design presupposes that the floodway will be available for storm drain discharge (there are no good alternatives). It is also assumed that the Spook Hill flood control structures and the easterly extensions to that system which remain to be constructed will effectively divert runoff from the Usery and Goldfield Mountains.

East of the CAP Canal there are problems of drain alignment because in most cases where there has been subdivision development no easements or street rights of way follow the natural drainage channels. We have indicated alignments for drains in this area but no detailed calculations for size determinations have been made. The lack of direct routes for drainage means that drains will be longer and larger in diameter than would otherwise be required. More seriously, it also means that damage from runoff in excess of the 2-year storm is to be expected. We would urge that reviewers of subdivision plats and development plans insist that there either be no obstruction of natural paths for runoff or that adequate equivalents are provided.

The design of the CAP Canal south of Adobe Rd. provides for a series of collection ditches and overchute structures to carry runoff across the canal at 13 locations in the study area. The structures will be at or near existing ground levels so there is no way that future trunk drains can discharge to them without pumping and, of course, the canal is too deep to be crossed by gravity drains. Our recommendation for these locations is a series of detention basins deep enough to receive the drains and large enough to accept total design runoff. The basins would be pumped out after storms. Basins would not be built until drains become necessary but sites should be acquired as soon as possible.

The cost of the system between the RWCD Floodway and the CAP Canal is estimated at $33,765,500. using January, 1981 construction costs. No estimates were made for work east of the CAP Canal.

We appreciate having been entrusted with the responsibility for this study and trust that it will be useful to your office in planning and administering the development of the area. We want also to acknowledge and thank you for the help given us by Wallace Haws and others of your department.

Sincerely,

Yost and Gardner Engineers

By

John E. Schaefer

Registered Professional Engineer (Civil)
CERTIFICATE NO. 1517
JOHN E. SCHAEFER
Date Signed 4/25/81
ARIZONA, U.S.A.

JES/jr

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1. Background

The 1980 Census has again substantiated what has long been general knowledge in our area: that the influx of new residents to Arizona continues unabated and that most of these people continue to settle in and around the major metropolitan centers of the State. Mesa, like other Salt River Valley communities, has felt the impact of this growth since the 1940's. Fig. 1 shows how Mesa's growth compares with nearby cities. The momentum of growth and the fact that it has been sustained for so long and is still accelerating makes any abrupt diminution seem unlikely, barring some nationally catastrophic event.

It appears that population growth has not been accompanied by any substantial degree of densification of our cities. Fig. 1 has a plot of the population per square mile of incorporated area, which shows a tendency of most Valley communities to approach a level between 2000 and 3000 persons per sq. mi. This is really very low. Areas zoned for single family housing on 10,000 square foot lots could be expected to have a population of 7000 to 9000 persons per sq. mi.

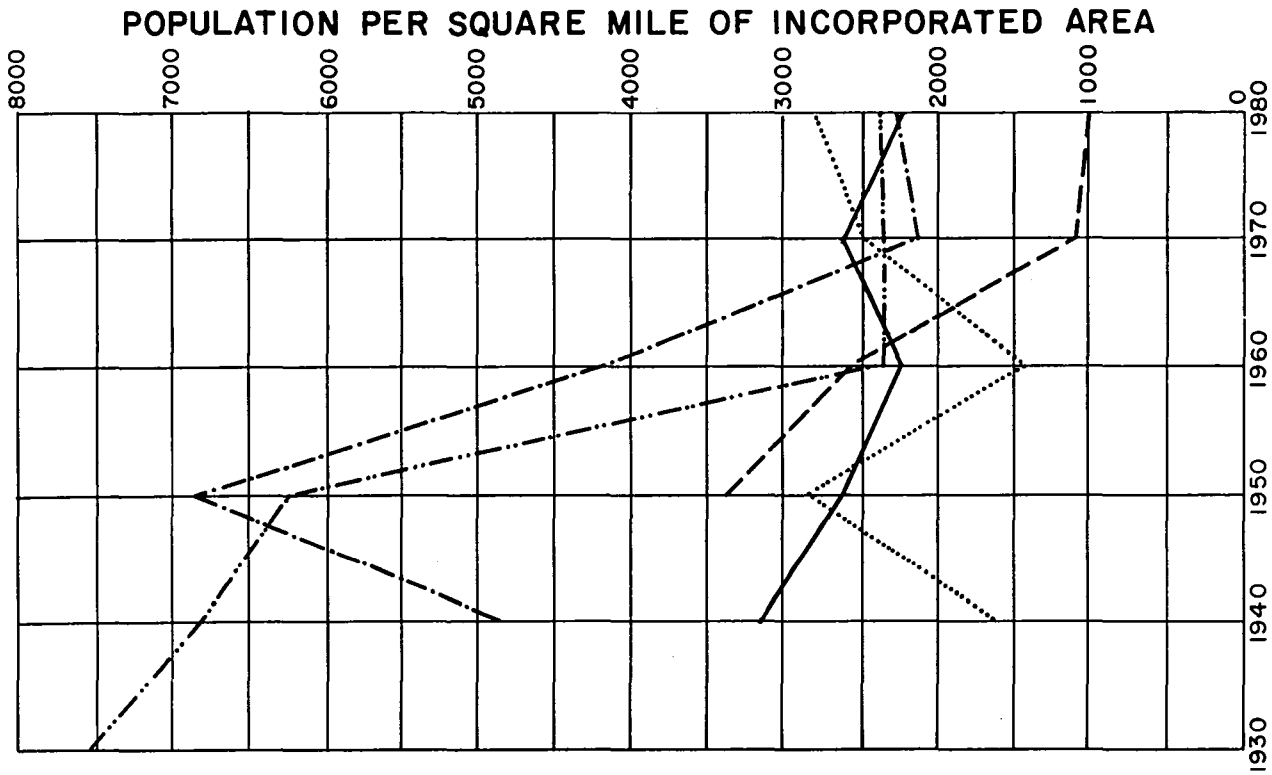
The open, uncrowded lifestyle is part of the appeal of the Southwest. This is one of the things new residents want and what they seem willing and able to pay for. As long as land is available and the economics permit it, developers will provide what is wanted. It is true there has been a recent trend toward "infilling" through the construction of townhouses and condominiums and, in Mesa especially, extensive mobile home park developments. Generally there is still enough open space remaining and provided as a feature of new development to keep the overall density low. While open space is esthetically desirable, it also has

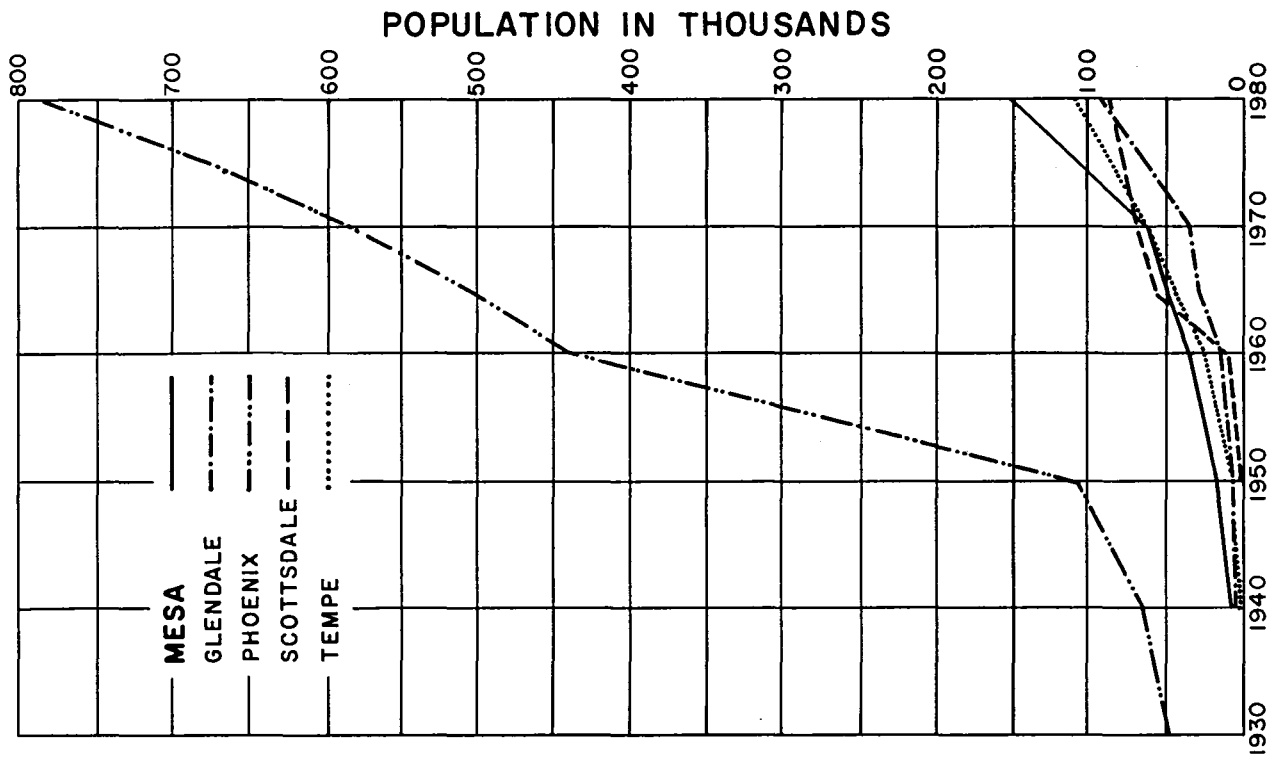
important implications for storm drainage since, with proper planning, open areas may be used for the control and disposition of runoff. Certain existing mobile home parks in the Mesa and Apache Junction areas were installed with no provisions for detention of runoff and will need individual attention in the planning of drains.

The principal impact of the new population has been on the agricultural and desert lands surrounding the urbanized areas. Farms and groves are being converted to residential uses, mobile home parks, shopping centers, cultural and educational complexes, and commercial and industrial developments. Desert land is affected the same way. One effect of such development is to aggravate drainage problems and create new ones where none existed before. Rain continues to fall on such areas with the same frequency and intensity as always but the amount and rate of runoff is substantially increased (See Fig. 2) at the same time that the tolerability of ponding and flowing water is sharply reduced.

Urbanization requires many things other than storm drainage. Utilities, street pavements and walks, sanitation, flood protection, fire prevention, law enforcement and a whole host of administrative, regulatory, educational, cultural, and commercial services are necessary for people to live in cities. The City of Mesa by virtue of its annexations has indicated its purpose to provide or facilitate the provision of these essentials as the need develops and as it becomes feasible to do so.

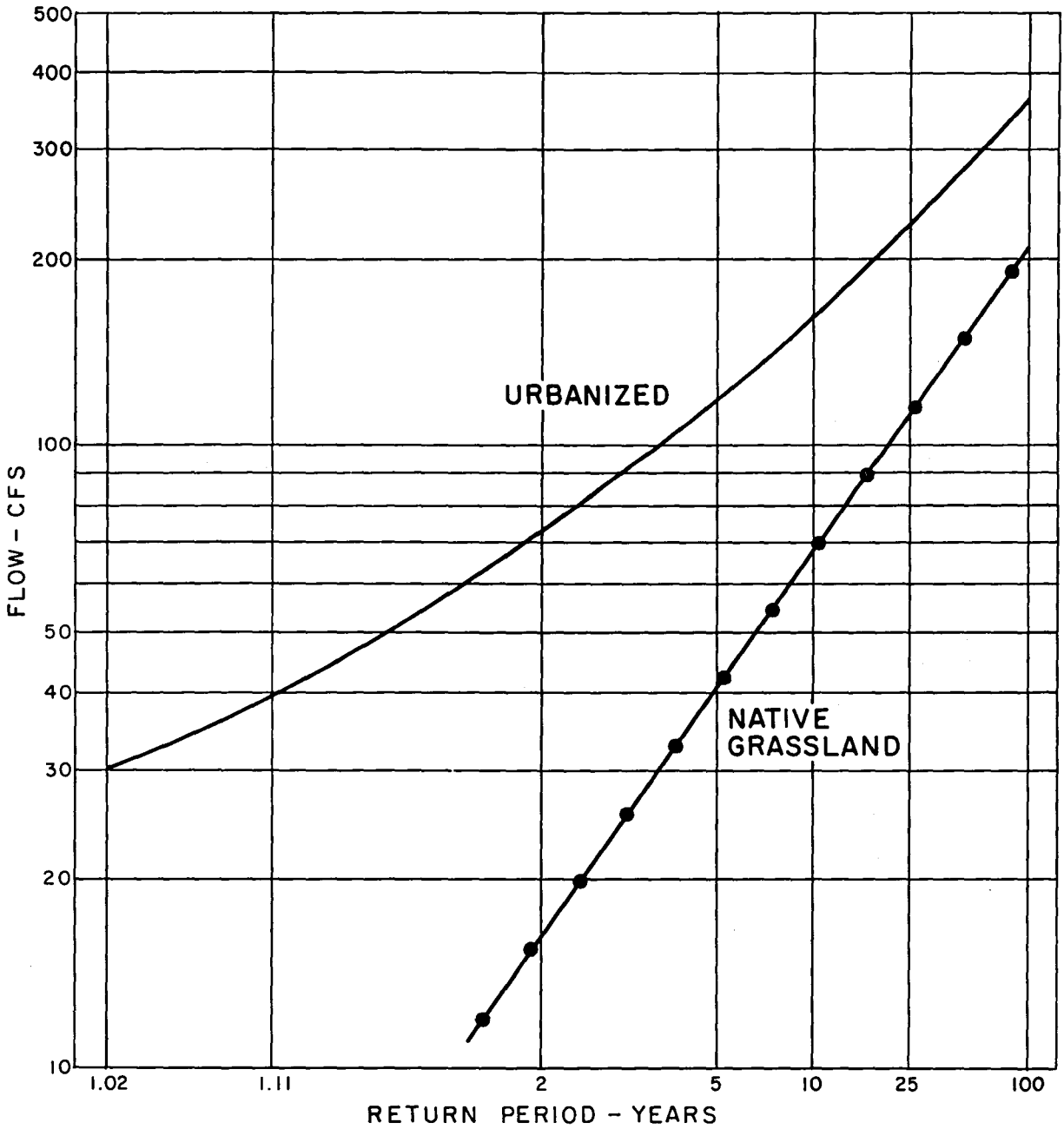
Advanced planning is necessary if these essential facilities of services are to be provided in a timely, orderly, and economic fashion. It is important to know well in advance what costs will be so that City operating and capital improvement budgets may be adequately funded.





POPULATION AND POPULATION DENSITY OF MESA AND NEARBY COMMUNITIES

FIGURE 1



CHANGE IN PEAK FLOWS
100 ACRE SINGLE FAMILY RESIDENTIAL SITE

Redrawn from: Flood Hazard News, Volume 10, Number 1, September, 1980, Drainage and Flood Control District, Denver, Colorado.

EFFECT OF URBANIZATION ON RUNOFF

FIGURE 2

It is essential that there be a clear and consistent policy outlining requirements the City will impose on developers. Storm drainage facilities, being generally the deepest and most massive of subsurface installations, should either be installed before paving and other utilities or should be provided for when other systems go in.

Major structures such as the Central Arizona Project Canal, floodwater retarding dams and floodways, and the Superstition Freeway all have a profound effect on the ultimate storm drainage system (See Fig. 3). Generally, such works can not be crossed by storm drains so they set limits to the areas served by elements of the drainage system. It is convenient to be able to terminate drains at the floodway channels but there are serious practical difficulties if the floodway is not deep enough to receive them. For several reasons storm drains are necessarily deep, generally having a minimum of 8 ft. of cover over trunk drains. It would be helpful if the floodway designer took this into account but he can probably not be expected to be aware of the problem unless some advanced planning has been done on the drainage system.

Similarly, where the CAP Canal is not protected by floodwater retarding structures immediately adjacent, canal plans show provisions for passing storm runoff over the canal at a number of concentration points. These will inevitably effect the storm drainage system design at or near these points. It would be helpful if the designs of the two systems could be co-ordinated to eliminate the concentrated discharge, perhaps by providing detention storage with controlled release through the storm drainage system.

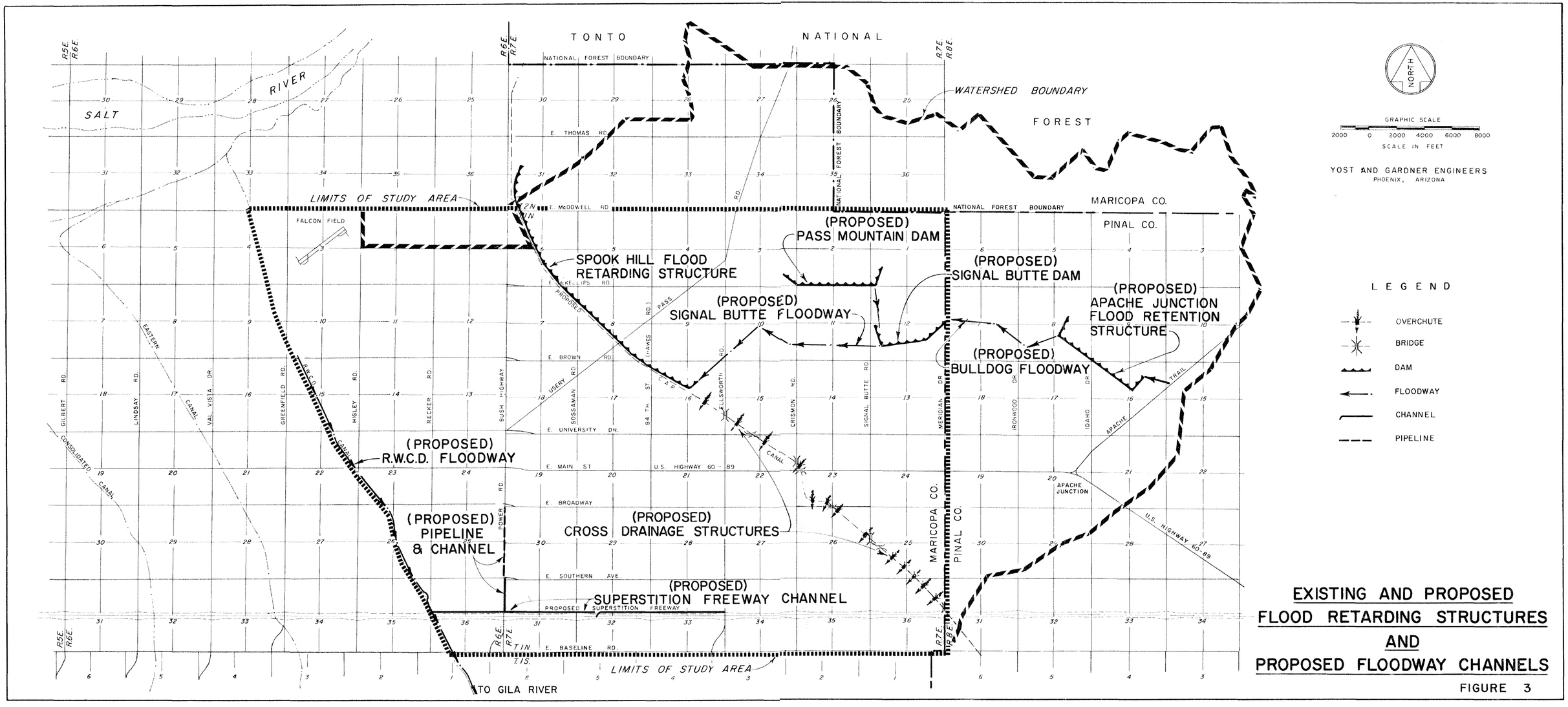
Watershed limits don't often follow political boundaries. What can

be done in cases where most of a drainage basin lies in another jurisdiction from the outlet, the location where damage occurs and protective measures are most necessary? The first step obviously is to define the drainage areas, determine how much runoff to expect, and locate the principal channels. Measures for coping with discharges can be considered and the best solutions formulated. The jurisdictional problem can then be considered separately.

As far as the Superstition Freeway is concerned, the City of Mesa and the Arizona Dept. of Transportation have an excellent precedent for a co-ordinated drainage design in the facilities provided west of the Roosevelt Water Conservation District Canal. Because of underpasses and depressed roadway sections, the freeway has its own drainage requirements. Because freeway structures interrupt natural waterways, substitute artificial facilities are necessary. In an economical overall design these facilities are integrated with the system planned to serve the entire area. This requires that planning for both purposes should be at least roughly contemporaneous.

Finally, it is appropriate to re-examine the drainage standards and criteria of the City of Mesa to see if they should be applied in an area that is fairly remote from the area for which they were developed. Because of the higher elevations new hydrologic data may be applicable. Because of steeper ground slopes hydraulic capacities of streets, channels, and conduits will be greater. High velocities may limit the distance water can be carried in gutters. Steep ground slopes may make on-site retention infeasible.

All of these matters provide the reasons for the studies summarized

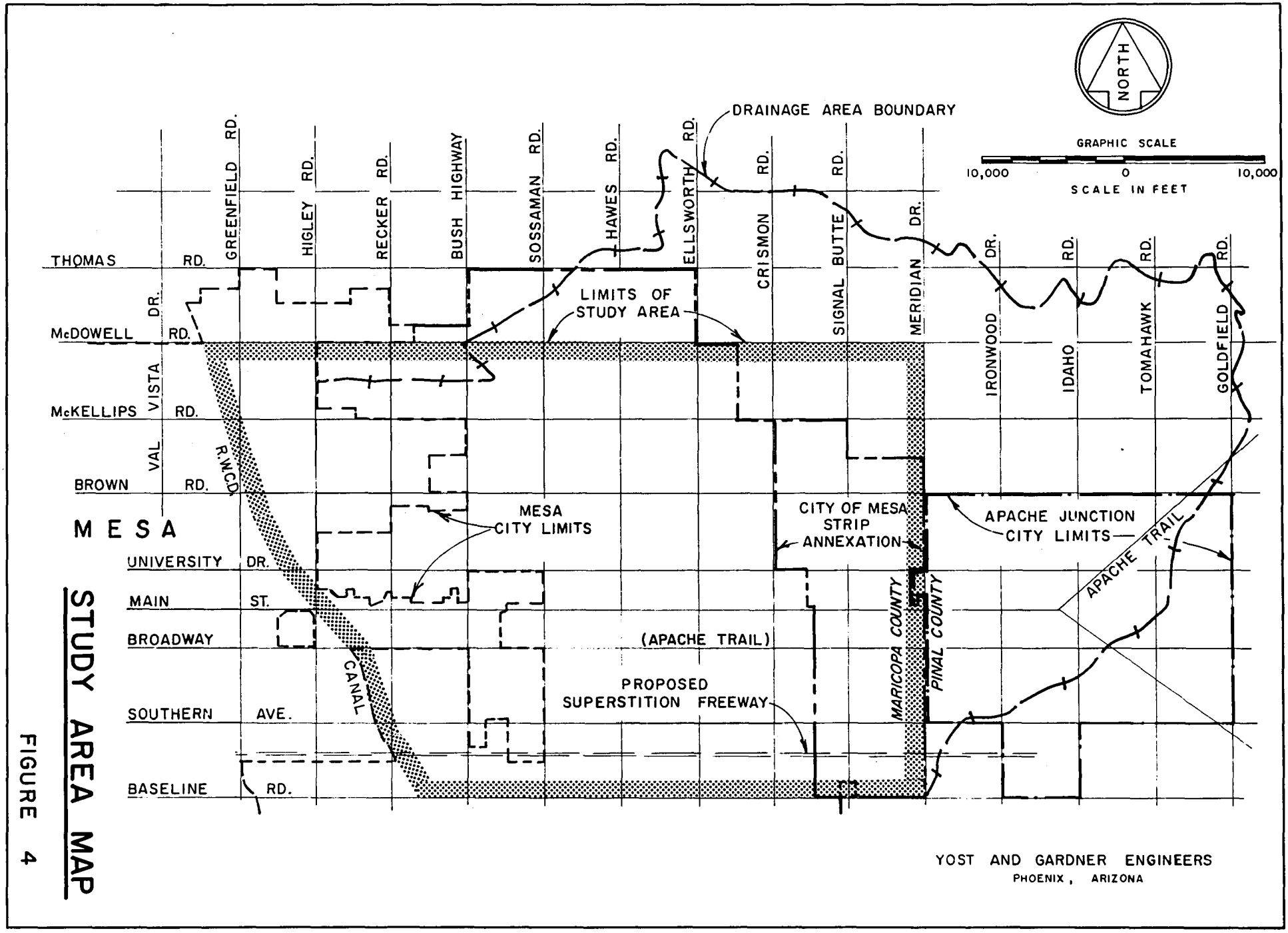


EXISTING AND PROPOSED FLOOD RETARDING STRUCTURES AND PROPOSED FLOODWAY CHANNELS

FIGURE 3

in this report which was authorized under a contract awarded by the City of Mesa on June 27, 1980. The objective is to provide a detailed Master Storm drainage plan for the area between the CAP Canal and the RWCD Floodway between McDowell Rd. and Baseline Rd. More general coverage is given to the area above the CAP Canal south of McDowell Rd. and west of the Pinal County line. Attention is necessarily given to the entire watershed that contributes to the study area. Fig. 4 shows the area in relation to the City of Mesa and other near-by communities.

This report is intended to be supplementary to a previous study made for the City of Mesa in 1973 covering an area west of the RWCD Canal (Ref. 1). The general approach and methodology are similar. The rational basis for these has been described there and will not be repeated. We will try to discuss fully all aspects that are peculiar to the area of this study which is in some respects substantially different. The report does not include all the field data and design information because of their bulk and limited interest, however the data will be kept on file in our office and are available for inspection by interested parties.



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PHOENIX, ARIZONA

STUDY AREA MAP

FIGURE 4

2. The Study Area

The area shown in Fig. 4 covers nearly 50 sq. mi. The portion within the corporate limits of Mesa amounts to 9 sq. mi. with most of the remainder included in the Mesa planning area which has been enclosed by strip annexation. A small portion (25 ac.) is in the City of Apache Junction.

2.1 Boundaries

The study area is bounded on the north by McDowell Rd. and its easterly extension. McDowell Rd. as a thorofare does not exist east of Usery Pass Rd. The eastern boundary is Meridian Dr. which is also the Maricopa/Pinal County line in this region. Baseline Rd. and its extension east of Crismon Rd. form the south boundary and the Roosevelt Water Conservation District Canal limits the area on the west.

The RWCD Canal and its proposed adjacent floodway mark the low edge of the area. The floodway which begins 230 ft. north of Brown Rd. and slopes toward the Southeast is being designed by the Soil Conservation Service to handle 100-year discharges. In the two miles between Brown Rd. and McDowell Rd. some sort of storm drainage channel or conduit will be necessary and this can discharge into the SCS channel.

Although it is an artificial boundary, McDowell Rd. corresponds closely to the divide between the Salt River and the Gila River drainages in the 1½ mi. between the RWCD Canal and Higley Rd. East of Higley to the Spook Hill Retarding Structure just east of the Bush Highway, the divide follows the mid-section line between McDowell and McKellips Rds. Continuing eastward, the drainage divide rises to the ridge of the Usery Mountains, forms Usery Pass, and then follows the crest of the Goldfield

Mountains easterly to a point about 4 mi. east of the Maricopa/Pinal County Line. The western limit of the Weekes Wash basin forms the eastern and southeastern edge of the watershed contributing to the study area.

The watershed and the study area are not identical. The watershed consists of 77 sq. mi. of which only 49.4 sq. mi. are in the study area. An additional 1.1 sq. mi. of study area are in a separate watershed contributing to the Salt River.

2.2 Study Area Divisions

The CAP Canal, presently under construction, will cut diagonally across the study area from northwest to southeast, dividing it into two parts that will be treated separately in this report. The 33.2 sq. mi. south and west of the canal are already 36 percent developed (Feb. 1979) and have an estimated population of 31,875-(1975). This portion is given detailed attention and a complete system of trunk drains is planned for it. The 16.7 sq. mi. above the CAP Canal is expected to develop more slowly and is treated in more general fashion. Topographically, this area is different from that below the canal: ground slopes are steeper and there are scattered outlying hills interrupting the surface and complicating the drainage pattern. The proposed floodways and dams break it up still farther. The area between the proposed dam and floodway system and the CAP Canal presents a special problem because there is no convenient place to terminate drains.

2.3 Population

1980 Census data are not available as this is written. If they were, it is unlikely that they would be sufficiently detailed for our

purpose since enumeration districts are large. Plate I shows our estimates of the population distribution, by sections, in the years 1975 and 2000. Population distribution for 1975 is based on 1975 Socio-Economic Data for MAG Urban Planning Area (Ref. 9). Populations for zones larger than 1 section were distributed based on a house count made on a recent aerial photo. Population for the year 2000 is based on MAG Population and Employment Data (Ref. 10). Projected year 2000 population for the four Municipal Planning districts encompassing the study area were proportioned by sections, based on projected land use, and current population.

A drainage system could be designed to be physically adequate without taking population into account. Given existing and projected land use information and the necessary hydrologic and topographic data we have what we need without worrying any further about numbers of people or where they are located. The purpose of storm drains, however, is to improve conditions for people. Normally drains should be built first where the greatest numbers of people benefit. There may be occasional exceptions such as when a drain is installed as part of a major paving project. Generally, construction priorities should be determined by population and it is for that purpose that Fig. 5 is included and that is how it has been used in this study.

2.4 Land Use

How the use of land affects drainage design has been discussed in Ref. 1. Recapitulating briefly, there is a relationship between land use and the extent to which the ground surface is made impervious by pavements and buildings, and this in turn affects the amount of runoff generated by any given amount of rainfall. Because of City ordinances

requiring on-site detention of drainage water the relationship is not straightforward but it does apply in areas developed before the ordinances became applicable.

Because a drainage system cannot be readily enlarged once it is installed, it should be built as needed but designed for runoff rates that may be expected to occur when the area served has been fully developed. For this reason it is necessary to project what land use will be at that time. The best sources for such information are the projections made by the planning departments of the City of Mesa and Maricopa County and these have provided the basis for the year 2000 projections shown in Fig. 5. We have simplified the use categories and generalized somewhat in adapting the information for the purpose of runoff computation.

2.5 Drainage Pattern and General Topographical Characteristics

Although the northwest extremity of the study area extends to within one mile of the Salt River bed, nearly the entire area would, under natural conditions, drain to the Gila River, 22 miles away to the southwest. The exception is a strip ½ mile wide along the south side of McDowell Rd. between Higley Rd. and the Bush Hwy.

The rocky outcroppings and talus slopes of the Usery and Goldfield Mountains occupy a band about one mile wide and seven miles long along the northern limit of the watershed. The entire remainder is part of a vast alluvial plain sloping toward the west and south on a gradually diminishing gradient. In the upper portions, where ground slopes are 5 percent or better, natural drainage channels are well defined and permanent, often having become so deeply entrenched that their hydraulic capacity exceeds any flow that may occur. As slopes flatten in the flow

direction channels become less distinct, tending to drift laterally from time to time, and finally disappear entirely. Runoff reaching these areas spreads out in the form of sheet flow and rapidly filters into the ground. Under natural conditions it was probably only in the rarest of cases that surface runoff originating in the study area would flow all the way to the Gila River (Ref. 2).

Human intervention has changed and is continuing to change this situation materially. Canals, highway construction and agricultural land levelling operations interrupt the natural pattern and cause concentrations that would not normally occur. The Spook Hill flood retarding structure and its tributary system, to extend east beyond Apache Junction (Fig. 3) will intercept runoff from 30 sq. mi. of mountainous area and divert it into the Salt River.

2.5.1 Sources of Topographic Information

Existing ground contours shown in Plate II are reproduced by courtesy of the U.S. Geological Survey from film positives at 1:24,000 scale for the Buckhorn and Apache Junction quadrangles. Contours have been modified at the Spook Hill retarding basin using construction plan information. The contours are based on topographic measurements made in 1955.

Contour information from the maps was supplemented by extensive field surveys made to get detailed data on existing drainage structures, to ascertain runoff patterns on existing streets where this was not obvious from contour maps, and to determine ground profiles and depths of sub-surface features at critical locations along the routes of the trunk drains proposed in this report. Figs. 20 through 23 show existing surface drainage patterns.

We have attempted to refer all elevations in the profiles to the City of Mesa datum. The datum used for the U.S.G.S. contours appears to be about 1.65 feet lower. A list of bench mark locations and elevations and an analysis of the differential between datums is included as Appendix V.

2.5.2 Land Subsidence

A region of known land subsidence extends through much of the area between the CAP and the RWCD Canals. There appear to be three centers of maximum subsidence: One near Broadway and Power Rd., one near Baseline and Crismon Rds., and the other near Baseline Rd. and Meridian Dr., but the phenomenon is widespread. Fig. 24 shows the extent of subsidence as indicated by data derived from level surveys by various agencies over the past 10 years.

Since piped storm drains can act as pressurized conduits and since available fall for drains ranges upward from 0.5 percent, it is not likely that subsidence will have a serious general adverse effect on the storm drainage system in the next 25 years unless the rate is substantially above that indicated in the past decade. Settlement of deep alluvium has been accompanied by fissure formation in nearby areas, some times with vertical displacements of a foot or more. If such a condition developed across the line of a storm drain, there would of course be local damage, but repairs should restore the functional capability of the drain.

The profiles of Figs. 27 through 33 show ground surface elevations derived from level surveys made for this report. Levels re-run at the time construction plans for any of the trunk drains are drawn would reveal

if there has been any subsidence in the interim. If there has been, appropriate adjustments should be made in the invert profiles. If slope changes are necessary, the pipe sizes should be recomputed and adjusted as necessary to provide the hydraulic capacity required.

2.5.3 Natural Drainage Areas

There are no important natural drainage basins below the CAP Canal. As has been mentioned, the region is one of alluvial deposits on a relatively moderate gradient. Such areas in their natural state are characterized by many closely spaced small washes running parallel, sometimes for miles, in the direction of maximum fall. When a street grid is superimposed on this kind of terrain and the area is developed either for agriculture or urban uses all traces of the natural pattern are lost. Runoff will then follow the streets until a storm severe enough to overtax them occurs when it will revert to its natural direction, often to the consternation of residents.

Above the CAP Canal ground contours show indications of distinct watersheds, generally becoming more clearly defined as one proceeds upward. The more important washes have been indicated from contour information on Fig. 10. The flood control projects shown on the figure have been planned to intercept these and they will not need to be considered in the design of the drainage system below the floodways unless there is a change in plans on the part of the Flood Control District of Maricopa County (See Section 3).

2.5.4 Artificial Drainage Features

The use of street pavements as drainage facilities has been discussed previously and the runoff pattern generated by the street system is shown

in Fig. 20 through 23. In addition to the streets, there are drainageways that have been built in a number of places. These are also shown on Figs. 20 to 23. For the most part they are trapezoidal ditches directed south and west toward the RWCD Canal. A portion of one such ditch on Broadway Road is lined with concrete but most of the others are of unlined earth. Channels for which design information is available are sized to carry peak runoff from the 25-year storm. The others are of similar proportions and could be expected to handle 10 to 25-year flows. Culverts have been installed where the ditches and principal roadways intersect.

The RWCD Floodway is a large, unlined channel designed by the Soil Conservation Service to intercept floodwaters arriving at the Roosevelt Water Conservation District Main Canal and carry them southerly to the Gila River. The floodway has been designed to carry 100-year runoff with discharges ranging from 1,200 cfs at Brown Rd. (the point of beginning) to 4,500 cfs at Guadalupe Rd. The channel is being built in stages beginning at the Gila River. Completion had been anticipated by 1986 under past federal funding practices.

The Spook Hill Flood Retarding Structure and it's easterly extensions shown in Fig. 10 are likewise a Soil Conservation Service project and were also scheduled for completion in 1986. The Spook Hill structure and it's spillway to the Salt River have already been built. The effect on these projects of the reappraisal of federal spending policy currently underway is not known at this time.

Finally, the Central Arizona Project Canal will have a series of 13 structures designed to pass flood water in the reach between Brown Road

and the Superstition Freeway. These are also shown on Fig. 10.

All of these facilities affect the planning of a storm drainage system for the area. The extent and nature of the interrelationship will be discussed in detail in Section 5 of this report.

2.6 Soils Characteristics

Surface soils in the study area have recently been classified and mapped by the Soil Conservation Service (Ref. 3 & 4). The same agency has evaluated the capacity of the soils to absorb surface water in order to determine irrigation requirements (Ref. 5 & 6). It is this characteristic that we are particularly interested in when computing runoff rates. Fig. 6 is reproduced from SCS sources and shows the distribution of soils classified solely by infiltration capacity throughout the study area. The information from Fig. 6 was used to arrive at a weighted value for each quarter section in the study area for use in computing infiltration rates. These values are posted in Fig. 7.

Since the study area is almost entirely in alluvium, geological aspects are relatively unimportant. There is only one major rock outcrop (Twin Knolls in Secs. 20 and 21) in the portion below the CAP Canal and it is less than 75 acres in extent. There are two rocky hills in the upper portion below the floodways but again they are of limited extent and, aside from causing minor deflections in the courses of nearby washes, have little influence on drainage.

3. Previous Studies and Pertinent Documents

It has been mentioned that this report is an extension of previous work for the City of Mesa (Ref. 1). There have been several other studies relating to our study area and adjacent areas. Most of these deal with flood control rather than storm drainage but all are of interest. The ones we were able to find are listed and summarized briefly below. Those that have a direct bearing on our work for this report have been listed among the references.

1. Flood Control District of Maricopa County, Arizona, Comprehensive Flood Control Program Report, 1963.

A general survey of flood problem areas in Maricopa County with cost/benefit analyses and recommendations for a comprehensive program of flood control projects. Proposed Buckhorn-Mesa (Spook Hill, Signal Butte, Apache Jct., Weekes Wash retarding structures and associated floodways) and RWCD floodway projects.

2. U.S. Dept. of Agriculture, Soil Conservation Service, Watershed Work Plan, Buckhorn-Mesa Watershed, Maricopa and Pinal Counties, Arizona, January 1963.

Outlines a project consisting of 4 floodwater retarding structures, a debris basin, and 8 miles of floodway channel designed to handle 100 year runoff and capable of draining in 10 days.

The floodwater retarding structures include those named Spook Hill, Signal Butte, Apache Junction, and Weekes Wash. They would be connected by floodways to convey the runoff at controlled rates to the Salt River. Planned to be just above the Central Arizona Project Canal to intercept runoff from the Usery and Goldfield Mountains,

they greater simplify the drainage problems of the western portion of our study area, effectively dividing it into two independent parts.

3. U.S. Dept. of Agriculture, Soil Conservation Service, Watershed Work Plan, Apache Junction-Gilbert Watershed, Maricopa and Pinal Counties, Arizona, January 1963

Describes the proposed Powerline Dam and Floodway and the RWCD Floodway designed to handle the 100-year flood and drain in 6 days. The RWCD Floodway will form the western boundary of our study area. It will provide the terminal channel for all the drains we propose in this report west of the CAP Canal. Drainage entering the RWCD will ultimately reach the Gila River.

(NOTE: The SCS watershed work plans are conceptual studies made for the purpose of defining a project and evaluating its feasibility from the benefit/cost ratio standpoint. They leave latitude for refinement and revision. Projects actually constructed may differ in detail from those outlined in the work plans.)

4. Board of Supervisors, Maricopa County, Storm Drainage and Flood Control Study, Southeastern Maricopa County, Boyle Engineering Corporation and L.H. Bell and Associates, joint ventures, June, 1973.

Outlines a system of channels and drains for 100-year return period floods to serve a 244 sq. mi. area west of the RWCD Floodway, discharging to the Gila River two miles south of the Maricopa/Pinal County line. Suggests implementation by procurement of right of way and arrangements with the Corps of Engineers and the Soil Conservation Service for detailed planning, funding and construction.

5. U.S. Army Corps of Engineers, Los Angeles District, Summary Report for Flood Control, Gila Floodway, Maricopa and Pinal Counties, Arizona, September, 1977

A study to determine the feasibility of additional structural measures to convey floodwaters from populated areas in the Mesa/Tempe-Gilbert areas below (west of) the RWCD Floodway. The report concludes that no structural measures are warranted. The Corps study area includes all of our current study area, however, and the report includes useful general information.

6. Flood Control District of Maricopa County, Preliminary Design Report, Gila Drain, Coe & Van Loo Consulting Engineers, Inc. Phoenix (draft report dated 3/30/79).

Establishes drainage channel locations, design flows, channel sections, and profiles for the area of Items 4 and 5 above.

7. U.S. Dept. of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study and Flood Insurance Rate Map, Maricopa County, Arizona, Unincorporated Areas, Panels 1300 and 1600 of 2600, Community No. 040037, May, 1979, Effective date July 2, 1979.

Classifies entire area of this study as Zone B except for a band about 1000 ft. wide adjacent to and east of the RWCD Canal which is Zone A.

8. Mesa-1990-The General Plan, Gruen Associates, February, 1971

A general planning guide for two decades, 1970-1990. Recommends a system of trunk drains at one mile intervals designed for 5-year frequency in the commerical area between Broadway and University

Drive, with 2-year coverage else where. Areas east of the RWCD Canal to discharge into the SCS floodway.

9. Development Regulations, Zoning Code, Subdivision Procedures, Chapter 21, Flood plain Regulations, City of Mesa, May, 1980.

Defines flood plain, floodways, and related terms, regulates floodplain development.

10. Procedures for Developers & Engineers Chapter VI, Storm Drainage Policy. City of Mesa, Rev. June, 1980.

Provides for on-site retention of 50-year, 24-hour rainfall falling within the boundaries of residential subdivisions and on-site for commercial and industrial developments. Facility for draining basins within 36 hours must be provided. Outlines drainage design methodology.

11. U.S. Dept. of Agriculture, Soil Conservation Service, Final Environmental Impact Statement, Roosevelt Water Conservation District Floodway, Arizona, June, 1978

Description of proposed RWCD Floodway including typical cross-sections and a tabulation of channel geometry and water depth from Brown Rd. to the Gila River. Evaluation of costs and benefits and adverse and favorable environmental impacts. We note that design water depths are generally between 7 and 8 feet and that the design water surface will be kept near existing ground levels. This will impose difficulties in designing piped trunk drain entrances into the channel.

12. Arizona Dept. of Transportation, Highways Division, Highways Plans Services, Design Concept Report for the Superstition Freeway, State Route 360, Gilbert Road to U.S. Route 60-70-89, June 2, 1975

Sets forth a concept for the horizontal and vertical alignment, roadway cross-section, drainage, and interchange layout for the easterly extension of the Superstition Freeway. Proposes a parallel drainage channel west of Ellsworth Road to discharge into the RWCD Floodway. East of Ellsworth Road surface drainage would be passed through along existing channels.

13. Report on drainage for the Superstition Freeway east of the RWCD Floodway, Southwest Computing Inc., Phoenix, Arizona. (in preparation).

GENERAL COMMENTS

The Spook Hill Floodwater Retarding Structure and its appurtenant spillway are the only construction actually completed to date that resulted from the aforementioned studies. The Signal Butte Floodway and other Flood Control District projects to the east are planned for construction in the years 1981-1985. Construction of the RWCD Floodway began in August, 1980 and completion is expected in 1986. Construction of the Superstition Freeway east of the RWCD Floodway is not scheduled to begin for at least 5 years.

4. Hydrology

The modified rational formula for computing runoff rates and the methods utilized in Ref. 1 were used again in this study. A check of the rainfall intensity - duration - frequency data for Mesa and Apache Junction indicated that no change in the curves was warranted so Fig. 2.7 of Ref. 1 has been adopted for our present purposes and presented herein as Fig. 15. Figs. 11 - 14, 16, and 19, which were used in the calculations are likewise reproduced from Ref. 1. A re-evaluation of pervious/impervious area ratios for the various categories of land use in the study area, based on presently developed portions, resulted in minor modifications from those previously used. Percentages used are indicated in Table 1.

As before we have again had to differentiate between areas having on-site detention and those in which stormwater is allowed to drain immediately into the streets. Based on visual inspection of areas already developed, we have determined where detention is practiced and where it is not. Major existing basins are shown in Figs. 20 through 23. As far as presently undeveloped areas are concerned, both above and below the CAP Canal, we assume that the City of Mesa policy requiring on-site detention will continue to operate and that such areas will be annexed and come under City control as development occurs.

Soils characteristics and infiltration rates have been discussed in Sec. 2.6.

Using the data referred to above and the tabular computation methods adopted for Ref. 1 expected peak flows were calculated for each of 143

Table - 1 - Pervious/Impervious Factors for Various Land Uses - Design Values

Land Use	Zoning Categories	Percent Pervious	Percent Impervious
Residential - Low Density (to 5 units per acre)	Mesa: R1-6, R1-7, R1-9, R1-15, R1-35, SR Apache Junction: CR-1, CR-2, SR, SH, GR Maricopa County: Rural-43, Rural-70, R1-8, R1-10, R1-18, R1-35	65	25
Residential - Medium Density (5 to 10 units per acre)	Mesa: R-2 Apache Junction: CR-3, TH Maricopa County: R1-6	60	35
Residential - High Density (over 10 units per acre)	Mesa: R-3, R-4 Apache Junction: CR-4, CR-5, TR Maricopa County: R-3, R-4, R-5	50	40
Parks & Park-like	Various	10	10
Farmlands, groves	Mesa: AG	5	5
Commercial	Mesa: C-1, C-2, C-3, R-S Apache Junction: C.A.R., CB-1, CB-2 Maricopa County: C-S, C-1, C-2, C-3	0	90
Industrial	Mesa: M-1, M-2 Apache Junction: C1-1, C1-2 Maricopa County: Ind-1, Ind-2	30	70

Note: The sum of pervious and impervious percentages is less than 100 percent for some categories because it is assumed that a portion of the area cannot contribute.

concentration points distributed uniformly over the study area below the CAP Canal. The average drainage area for these collection points is 160 ac. Peak flows and their locations are plotted on Plate II. Calculations are contained in Appendix 4.1.

5. General Aspects of Drainage Design

Some of the general criteria applying to the design and construction of storm drains are discussed in this section. While one of the purposes for doing this is to recommend high standards for what is probably the most expensive item of underground construction in city streets (barring subways) and certainly the most expensive to replace in case of failure, another purpose is to define just what the City may expect to get for the costs set forth in the estimates which follow.

New materials and construction methods will be developed in the future and some of these may possibly be as good or better on a "life-cycle"cost basis than those traditionally used heretofore. Needs and policies may also change and likely will. There is no expectation that these criteria will be rigidly adhered to, rather that good judgement will be used in applying or deviating from them.

5.1 Degree of Protection

The same criteria used previously for the City of Mesa west of the RWCD Canal (Ref. 1) were followed in the present study. Arterial streets are considered to require 10-year protection, that is, two lanes in each direction should be capable of carrying traffic free of ponded water under 10-year storm conditions. In undeveloped and unplanned areas, arterials are assumed to occupy at least 5 acres in each quarter section that is situated so as to contribute runoff directly into the drains without detention. This includes interior streets and presently developed area that does not have detention storage. We assume again that all new development will be required to provide temporary storage for 50-year on-site runoff.

5.2 On-Site Detention

The policy of requiring on-site detention of runoff in new developments has been discussed in Ref. 1 and there is little that needs to be added here except that it becomes an increasingly onerous requirement when the average ground slope becomes steeper. The volume of the wedge of earth that must be removed above the design water surface plane in a detention basin varies directly with the slope. At 10 or 11 percent ground slope this volume becomes as great as the volume of additional material to be excavated to provide room for storage. On the other hand, street gutters and drains become more effective with increasing slopes. The hydraulic capacity of any given cross-sectional area of waterway increases as the square root of the slope; and a gutter at 10 percent will carry over 3 times as much water as the same gutter at 1 percent.

These considerations lead to the suggestion that the on-site detention requirement be dropped for regions having good average ground slopes. Just where to make the distinction is not obvious but it would seem that 6 or 8 percent would be a reasonable point.

Very little of the present study area has slopes over 8 percent. Except for a few small outliers all of it is in the mountainous areas northeast of the Spook Hill flood retarding system. The maximum slopes encountered in the detailed study area are 1.7 percent.

5.3 Surface, Pipe, and Channel Flow

Runoff from the uppermost portions of the drainage system, the "twigs" of the dendritic runoff pattern, are necessarily carried on the streets, and gutters are usually provided for this purpose. When gutters

run full the usefulness of the street for its primary function is impaired so catch basins and pipes become necessary. Limits of gutter capacity are determined by cross-sectional geometry and the slope of the street. Fig. 18 shows capacities for typical Mesa pavement sections.

Pipe capacities depend on diameter and slope, (ignoring surface roughness, a minor factor). Fig. 19 shows the relationship. The amount of flow that can be handled in pipes is limited by available sizes. Locally the largest readily avaliable centrifugally spun storm drain pipe diameter is 96 in. Fortunately ground slopes are steep enough that no pipe larger than 78 in. will be needed. For very large flows, however, it becomes necessary to use open channels when pipes become impractical.

Why use pipes at all? Why not go directly from gutters to open ditches, particularly where ditches are already in place that can carry more water than the pipelines proposed to replace them? (See sections of Fig. 9).

The open ditch solution works well for rural areas but, as development increases, it becomes less and less desirable. More and more street and driveway crossings will have to be built as streets are put in, and these make entry and exit to the major roadway awkward if not hazardous. Problems are encountered when sanitary sewers, particularly house sewer connections, are installed. The open ditches require more maintenance when there are more people around to fill them with litter and more people to complain about their appearance. Finally, as traffic volumes increase, wider streets become necessary and the space required by open ditches can no longer be spared.

Another aspect of the problem of existing ditches has to do with the nature of the pipe system that is being proposed (to be discussed in the following section). It extends several miles east of the area presently served by ditches. The pipes will collect flow and bring it westerly. They will be 12 to 16 ft. below the surface. Most of the existing ditches are not over 6 ft. deep and thus too shallow to provide a point of discharge for the drains.

What, then, is to be done about the ditches? With the Spook Hill Retarding Structure and other proposed major flood control works in place, and when the pipe system recommended herein is installed, the need for many of the ditches will have passed and they can be eliminated. Some, particularly those that run from north to south and have their own outlets (independent of east to west ditches) can continue in use and will be helpful in disposing of runoff in excess of the capacity of the storm drainage system. Since the large storm drains run from east to west and are deep, there will be no problems at the crossings of the two systems.

The large ditches that run from east to west are another matter. These have been built in the road right-of-way parallel to and on the north side of existing pavements. The Brown Rd. and Broadway Rd. ditches are examples. The roadway is cross-sloped to drain directly into the ditch and overland drainage from the north is also permitted to enter the ditch directly. Installation of trunk drains in such streets is again no particular problem since the pipe will be well below the ditch. The problems of inlet types, locations, and collector pipe layout will have to be dealt with, however, and this will mean redesign of the street cross-section and, probably, elimination of the ditch.

5.4 Trunk Drain Locations and Depths

Because of their size and cost per foot, trunk drains are best located in streets with wide right of way width and on the most direct alignment possible. This means in arterial streets and, in our area, on section lines. The general slope is such that they could be run from north to south or from east to west, but slopes are steeper in the east-west direction and the distances are shorter. The result is that smaller pipe can be used and the most economical arrangement is achieved with an east-west system of trunk drains.

There has been some discussion of depths previously in this report and in Ref. 1. The minimum cover requirement of 8 feet for trunk drains should continue to be applied. Some tempering may be allowable at terminations where it is necessary to meet the invert of a receiving channel and where the need for long lateral drains no longer exists.

5.5 Other General Criteria

Materials for drainage systems, design standards, construction methods, the relation of storm drains to other underground systems, the use of detention basins, standards for basins, etc. have been discussed in Ref. 1.

6. Proposed Drainage System

The objective of these studies is: a) to make specific recommendations for a system of trunk drains for the area between the CAP and RWCD Canals and between McDowell and Baseline Roads, and, b) to outline a general concept for drainage of the area above the CAP Canal which is tributary to the area first mentioned. The latter area is divided into two parts that will require different treatment since the portion between the CAP Canal and the Spook Hill flood control system has no convenient place to accept drain discharge.

6.1 Area below CAP Canal

Plate II shows the proposed system for the 34 sq. mi. region between the CAP and RWCD Canals. The basis for the design of this system is described in the following paragraphs.

6.1.1 Drainage Areas

A broad, nearly featureless alluvial plain, this region lends itself to a regular pattern of mains with watersheds that are defined by man-made features such as street pavements, fields, and groves on artificially levelled lands, and ditches for conveyance of irrigation and tail water. Where no such development exists, drainage areas may be arbitrarily delineated, bounded by the section and quarter section lines that may reasonably be expected to become the centerlines of future street pavements.

For the purposes of computation, the area was divided into 143 subsidiary areas, generally 160 acres or smaller. The areas and their identifying symbols are shown in Fig. 8.

6.1.2 Runoff Computations

The appropriate data for each of the subsidiary drainage areas have been entered in the forms presented in Appendix II. The surface flow concentration time and the peak runoff for a 10-year recurrence interval from arterial streets and 2-year interval from other impervious areas are computed directly on the forms by methods outlined in Ref. 1. No runoff is anticipated from pervious areas at the low rainfall intensities associated with the 2-year recurrence interval.

Individual area contributions merge along the path of the trunk drains shown in Plate II. Summation of flows is not algebraic but allowance is made for diminishing intensities associated with longer collection times and larger tributary areas, again using the methods of Ref. 1. Appendix III gives the calculations which are also made in a standard format as described in Ref. 1.

6.1.3 Trunk Drain System

The reasons for the east-west alignment of drains and for locating them on the routes of arterial streets have been discussed previously. Seven trunk drains are required to serve the area. They are designated Lines A through H on Plate II, which also indicates design flow capacities and required pipe sizes. The branch drains designated A-1, C-1, F-1, and F-2 are considered a part of the trunk drain system. In addition to the trunk drains, the plan requires the extension of the RWCD Floodway from Brown Rd. to McKellips Rd. This extension is designated "New Low-Flow Channel" on Plate II.

The interval between drains is one mile except for the drain on Main Street (U.S. 60-80) which is necessary because of the concen-

tration of impervious areas (commercial developments and mobile home parks). The proposed freeway channel is assumed to become part of the system west of Ellsworth Rd. East of Ellsworth, where pass-through drainage is contemplated for the freeway design (Ref. 11), the Baseline Rd. trunk drain shown on Plate II is sized to accomodate the area between Southern Ave. and Baseline Rd.

Suggested profiles for the drains are given in Figs. 27 through 33. A profile for the floodway extension north of Brown Rd. is shown in the left hand portion of Fig. 35. Invert elevations have been chosen to clear all known existing underground lines as shown in the profiles. There are two exceptions. In order to avoid large volumes of additional excavation, two sanitary sewer lines would be passed through the storm drain in the manner shown in Fig. 36. The locations are the McKellips/ Greenfield and the Main/Higley intersections.

Future sanitary interceptor sewers proposed in the MAG 208 Plan (Ref. 12) will cross the drain system in a number of places but no information on the depths of the sewers is presently available. Table 2 lists the points at which crossings will occur and gives proposed storm drain depths and pipe sizes. The designer of the first system to be built should anticipate future construction of the other system at these locations.

Table 2 - Trunk drain and interceptor sewer crossings

Location Power Rd. at	Storm Drain Size	Storm Drain Cover	Interceptor Sewer Size*
University	48 in.	11.5 ft.	10 in.
Main	54 in.	11.0 ft.	15 in.
Broadway	66 in.	14.5 ft.	15 in.
Southern	66 in.	11.5 ft.	18 in.
Baseline	48 in.	11.5 ft.	18 in.

* Ref. 12, Plates IV-1 and IV-2

Termination of the trunk drains in the RWCD Floodway presents a problem in that the invert elevation of the floodway as shown on preliminary plans furnished by the Soil Conservation Service (Ref. 13) at the proposed entry points is from 1.5 to 7 ft. above the storm drain inverts. The simplest solution would be to deepen a portion of the floodway channel to permit gravity drainage of the storm drains. Other alternatives are:

a) provide a detention basin and pumping installation with discharge to the RWCD Floodway or Canal at the end of each storm drain.

b) provide a separate outfall drain parallel to the floodway to carry drainage to the Salt River.

c) extend drains through (under) the floodway and the canal to connect to drains on the west.

Fig. 34 shows the concept of a low flow channel suggested for construction within the floodway. Also shown is the way storm drain pipes would enter this channel and the measures to be taken to control erosion at entry points. Ideally, a low flow channel could be built as an integral part of the floodway. The entry structures and protective lining could then be installed later as a part of a storm drain construction contract. If it is impractical to modify floodway construction plans, the low flow channel could be built later as a separate project.

The low flow channel shown as a part of the floodway would extend from Brown Rd. to just north of Guadalupe Rd., a length of 35,000 feet. North of Brown Rd. it would be extended as a separate storm drainage (not flood control) project to McKellips Rd. as indicated in Plate II. The hydraulic capacity of the low flow channel is not important since any excess flow would simply spill over into the floodway. The invert elevation is important, however, in order that the trunk drains will drain completely. From Baseline Rd. north, the drains will determine

the invert profile of the low flow channel: south of Baseline Rd. it can be carried at a minimal slope to the point where it intersects the main floodway bottom profile. Fig. 35 shows the channels and the northerly extension to McKellips Rd. in profile.

The floodway plans presently at hand do not show what is to be done where bridges will cross the floodway. It is not expected that there need be any conflict between the low flow channel and bridge construction since the maximum width of the trapezoidal low flow section would be 50 feet which should be narrow enough to fit between bridge piers. Since hydraulic capacity is immaterial, however, a rectangular channel section or even a pipe could be used if there is a problem of getting the low flow channel past a bridge.

No detailed analysis has been made of the alternatives to a low flow channel mentioned above. The following comments seem called for, however.

a) The use of detention basins and pumps requires an investment in land and equipment, and a continuing cost for maintenance, energy, and depreciation that would not otherwise be required. There are no visible offsetting gains.

b) The notion of a third waterway parallel to the RWCD Canal and Floodway is distasteful. Over 8 mi. of pipe would be required to carry discharge to the Salt River. About 20 ft. of adverse gradient would have to be overcome which means trench depths approaching 50 ft. near the north end of the line.

c) Extending drains across the canal and floodway is impractical because it would mean exacerbating an already difficult situation west of the RWCD Canal. The flatter slopes that prevail to the west make water more difficult to handle there. The plan for drainage of the area (Ref. 1) does not contemplate flows arriving from east of the floodway and trunk drain sizes and detention basin volumes previously recommended would have to be substantially increased.

6.1.4 Lateral Drains

Extension of the drainage system shown in Plate II into tributary

areas will be done by smaller diameter laterals, inlets, and street gutters. Such systems are beyond the scope of this study. In areas presently undeveloped this work would probably be done as a part of the street paving program. The runoff calculations and other data in this report should be helpful in designing such systems.

Drainage problems in areas already built up are generally of a nature such that the extension of a system designed for 2 and 10-year recurrence intervals into the area cannot provide substantial relief. The difficulties that exist are usually due to the obliteration of natural waterways, erosion due to increased runoff because of the paving of large areas and consequent higher flow velocities in the channels that remain, etc. The storm drains proposed herein and new lateral extensions will alleviate these situations to some extent but should not be looked upon as the ultimate solution. This aspect will be discussed further in Section 6.2.

There is a unique situation in the southwest corner of the area known as Falcon Estates subdivision, immediately east of the RWCD Canal and north of Brown Rd. This area has been flooded by water impounded temporarily by the canal and roadway embankments. In retrospect it might also be argued that floor levels in more vulnerable locations were simply set too low. An existing earth ditch built to serve the area apparently does not have a continuous falling grade because ponded water has been observed to stand over the 6-inch curb on Princess Street 2 or 3 days after a storm. This area will be helped by the proposed storm drains because some surface flow from the northeast which normally enters the area will have been intercepted and an outlet will have been provided for a separate local storm drain project.

6.2 Area Above CAP Canal.

The portion of the study area lying north and east of the Central Arizona Project Canal, being more remote from Mesa and lagging the remainder of the study area in rate of development, was studied in a more general way. This portion, exclusive of watersheds outside the study area, embraces slightly over 17 sq. mi. Except for a few outlying rocky hills it, too, is of alluvial origin, but slopes are steeper and the natural washes more distinct and more deeply entrenched.

The area will eventually be divided by the proposed flood retention and diversion works being planned by the Soil Conservation Service and the Flood Control District of Maricopa County. These include the Signal Butte Floodway, the Pass Mountain Dam, the Signal Butte Dam, the Bulldog Floodway, and the Apache Junction Flood Retention Structure. Another portion of the system, the Spook Hill Dam and Spillway to the Salt River have already been constructed. The remainder is presently scheduled for completion by 1986. The two portions are discussed separately below.

6.2.1 Area between Spook Hill System and the CAP Canal

There are about 7.5 sq. mi. of the study area between the Spook Hill retention system and the CAP Canal but another slightly larger region outside the study area contributes runoff that needs to be considered. Plate II shows the area. Ten of the principal natural watersheds have been outlined. The boundaries of these watersheds have been taken from Ref. 14.

Storm drainage for these areas is complicated by the fact that there are no convenient places to terminate drains. The U.S. Water and Power Resources Service, which is planning the CAP Canal, is providing

13 overchute structures in the reach between the southerly end of the Spook Hill Dam and the Superstition Freeway alignment. These struc- will be designed to pass 100-year flows. Surface runoff arriving at the canal will be directed to overchutes by means of collective dikes along the edge of the canal right of way. The overchute invert elevations will be near or at existing ground elevations and there is no way that storm drain pipes may be discharged into them.

Most of the drainage areas above the CAP Canal are large enough that pipe trunk drains will eventually be required and these will have the same cover requirements as storm drains elsewhere. The proposed scheme for terminating these drains is to build detention basins as shown on Plate II. These basins would be large enough to store 2 and 10-year discharges, the required volumes being given in Table 3. Basins should be located near the CAP Canal right-of-way but must be protected from any inflow other than that coming through the storm drain. Basins would be drained by pumping into a small diameter force main which would conduct water to the Spook Hill system, to storm drains west of the CAP Canal, or to another convenient disposal point. A common force main could serve several or even all the detention basins.

The only purpose for detention basins is to provide termination points for trunk drains. Basins should not be built until the associated trunk drain becomes necessary. The sites for the basins should be acquired as soon as possible, however, and they could well be put to some temporary secondary use until it becomes necessary to build the basins.

The rectilinear street plan that predominates in the development of this area so far does not lend itself to an efficient arrangement of

Table - 3 - Retention Basin Dimensions

Location *	Bottom Width "W"**	Bottom Length "L"**	Total Depth "D"**	Water Depth "d"**	Surface Acres Required
C.A.P. Canal - Area 1	45	90	7.0	5.0	0.74
C.A.P. Canal - Area 2	115	230	10.0	5.0	2.31
C.A.P. Canal - Area 3	125	250	10.0	5.0	2.53
C.A.P. Canal - Area 4	175	350	12.0	6.0	4.19
C.A.P. Canal - Area 5	165	330	11.0	5.0	3.69
C.A.P. Canal - Area 5a	85	170	7.0	5.0	1.30
C.A.P. Canal - Area 6	255	510	12.0	6.0	6.74
C.A.P. Canal - Area 7	300	600	12.0	7.0	8.42
C.A.P. Canal - Area 8	425	850	12.0	7.0	14.08
C.A.P. Canal - Area 9	80	160	7.0	5.0	1.22

* See Figure 10 for Area Locations

** Dimension in feet

drains. Plate II shows, by dashed lines, the trunk drains required to carry runoff from the approximate point where street capacity first becomes inadequate in each area. Those areas for which no trunk drain is shown are small enough to depend entirely on street flow.

It is not apparent on the ground that there has been any consistent policy requiring developers to keep natural drainageways open by means of easements or street rights of way. If there had been, the trunk drains could follow the natural routes, providing the shortest and steepest alignments and, consequently, the most economical systems. Furthermore the drainage system is only designed for 2-year storms and only for impervious area runoff. Planning must provide routes for flows that overtax the drains and this can only be done by requiring drainage easements of adequate size or by the proper routing of streets that are also planned as waterways for drainage. Where the hydraulic capacity of the natural waterway is adequate and if it is preserved intact, trunk drains can be eliminated altogether. In this case lateral drains can discharge into the natural channels.

A complication in this area results from the fact that several of the drainages extend across the common boundary of the cities of Mesa and Apache Junction (which corresponds closely to the Maricopa/Pinal County line). At the eastern edge only the detention basin will be in Mesa, with practically all of the drain in Apache Junction. This is not a new situation for Mesa. The City has had successful previous experience in co-operating with another agency, namely the Arizona Department of Transportation, in the design and construction of facilities that are mutually beneficial. When the facilities that extend into both cities become necessary some sort of agreement for sharing construction

and operating costs should be entered into.

6.2.2 Area above Spook Hill System

The situation above the Spook Hill Flood Retarding Structure and its extension eastward is similar to that for the area between this system and the CAP Canal which was discussed in the previous section. The principal difference is that, since drains can discharge to the basins and channels of the flood control works, no detention basins and evacuation systems are necessary. Another difference is that the complication of drainages lying in two different municipalities does not exist (although they extend across the present Mesa City limits).

Plate II shows individual drainage areas as determined from the countour maps. The same difficulty of a rectangular street grid and a diagonal natural pattern of drainage exists as in the area between the flood control project and the CAP Canal but, since the natural drainages are narrower, the problem of routing trunk drains is worse. The dashed lines in this region in Plate II again show suggested trunk drain alignments beginning approximately at the point where flows are expected to be too great to be handled by street pavements. The locations of such points are not amenable to precise determination without detailed field information. They depend on land use, among other things. In some of the drainage areas a portion lies within the national forest and will presumably never be developed and never have on-site retention. The need to maintain natural channels is particularly important here. The scheme shown should be reconsidered and altered if it seems advisable.

6.3 Priorities for Construction

The recommended order of construction set forth below is based primarily on the present population density or state of development in each area. The listing presupposes that the low flow channel in the RWCD Floodway will be built first and is available to accept discharge from the drains listed.

Table - 4 - Priorities for Trunk Drain Construction

Priority	Line Designation on Plate II	Alignment	Reach
1	D	Main Street	Entire line
2	C	University Dr.	Floodway to Bush Hwy.
3	E	Broadway Rd.	Entire line
4	A	McKellips Rd.	Entire line
5	B	Brown Rd.	Entire line
6	F	Southern	Floodway to Hawes Rd.
7	H	Baseline Rd.	Floodway to ½ mi. west of Hawes Rd.

The remainder of the trunk line construction should be built as development makes it necessary. The need for the system above the CAP Canal seems at this writing to be too remote to require prioritizing. We would reiterate, however, that where basins will eventually be required, acquisition of sites should be accomplished as soon as possible.

7. Cost Estimates

The following estimates are based on Phoenix area labor, material and equipment cost prevailing in January, 1981. For the purposes of future adjustment, it is noted that the Engineering News-Record construction cost index stood at 3370.73 at that time. Costs include allowances for all appurtenant items necessary to build a functionally complete trunk drain within the limits of the street or right-of-way it occupies. They include the costs of gutter inlets and small diameter (15 to 24-in.) connecting piping. Costs of lateral drains extending from the trunk drain into tributary areas are not included. Unit costs for pipelines are developed first and used for estimating project costs in Section 7.2. No estimates were made for work outside the detailed study area, that is, work north and east of the CAP Canal. The estimates are predicated on the availability of the RWCD Floodway as a terminus for all drains.

7.1 Unit Costs

Unit costs for pipe drains in Table 5 were developed for pipe sizes ranging from 30 to 78 inches. The column headed "TOTAL COST, BEST CONDITIONS" represents the cost of lines in streets where no pavement replacement is required, where soil conditions are normal, and where there is no unusual conflict with other utilities. Normally extensive amounts of pavement cut and replacement and some utility relocation will be required. The very worst conditions which require cutting through concrete paving, moving of parallel utility lines, or other abnormal conditions will cost more than the column headed "TOTAL COST IN BUILT-UP AREAS". In the estimates that follow the higher unit cost was cost used because

it is assumed that the "built-up" condition will normally be the case by the time the storm drain is built.

7.2 Project Costs

Assuming that each trunk line will be constructed as a separate project, the costs for each are given below using pipe sizes and quantities from Plate II and unit prices from Table 5. No right-of-way costs are included except for the new low flow channel north of the proposed RWCD Floodway.

Head :t & :17%)	Sales Tax (9)	TOTAL BEST COND.	Pvmt. Cut & Repl. (10)	Utility Reloc- ation (11)	Sales Tax	TOTAL COST IN BUILT-UP AREAS	Pipe I.D. Ins.
66	1.91	75.27	13.33	13.00	0.68	102.28	30
54	2.06	81.46	14.17	13.00	0.71	109.34	33
15	2.17	85.78	14.72	13.00	0.72	114.22	36
65	2.26	89.32	15.56	13.00	0.74	118.62	39
91	2.49	98.24	16.94	13.00	0.78	128.96	42
43	2.77	109.86	19.44	13.00	0.84	142.54	48
84	3.19	126.00	21.94	13.00	0.91	161.85	54
30	3.63	143.34	24.44	13.00	0.96	181.74	60
81	4.08	161.06	26.67	13.00	1.03	201.76	66
65	4.41	174.08	27.78	13.00	1.06	215.92	72
92	5.00	197.16	29.44	13.00	1.10	240.70	78

Estimated Construction Costs

Trunk Lines

	Pipe Size in.	Length ft.	Unit Cost	Total Cost
Line A - E. McKellips Road				
	30	1,200	$102.	$122,400.
	33	2,640	109.	287,800.
	39	2,640	119.	314,200.
	42	2,640	129.	340,600.
	48	2,640	143.	377,500.
	54	2,640	162.	427,700.
	66	1,100	202.	222,200.
Subtotal for pipe				2,092,400.
Outlet structure and lining				16,000.
Sewer crossing structure				4,000.
Total contract cost				2,112,400.
Engineering and contingencies				422,500.
Total construction cost - Line A				$2,534,900.
Line A-1 - No. Greenfield Road				
	36	5,280	$114.	$601,900.
Total contract cost				601,900.
Engineering and contingencies				120,400.
Total construction cost - Line A-1				$722,300.
Line B - E. Brown Road				
	33	2,640	$109.	$287,800.
	42	2,640	129.	340,600.
	48	7,920	143.	1,132,600.
	54	1,650	162.	267,300.
Subtotal for pipe				2,028,300.
Outlet structure and lining				16,000.
Total contract cost				$2,044,300.
Engineering and contingenices				408,900.
Total construction cost - Line B				$2,453,200.
Line C - E. University Drive				
	30	2,650	$102.	$270,300.
	33	2,650	109.	288,900.
	42	2,640	129.	340,600.
	48	5,230	143.	747,900.
	54	5,280	162.	855,400.
	60	2,640	182.	480,500.
	66	1,800	202.	363,600.
Subtotal for pipe				3,347,200.
Outlet structure and lining				16,000.
Total contract cost				3,363,200.
Engineering and contingencies				672,600.
Total construction cost - Line C				$4,035,800.

	Pipe Size in.	Length ft.	Unit Cost	Total Cost
Line C-1 - No. Recker Road				
	36	1,320	$114.	$150,500.
	39	1,320	119.	157,100.
Total contract cost				307,600.
Engineering and contingencies				61,500.
Total construction cost - Line C-1				$369,100.
Line D - E. Main Street				
	30	1,320	$102.	$134,600.
	36	2,640	114.	301,000.
	42	2,640	129.	340,600.
	48	5,280	143.	755,000.
	54	10,490	162.	1,699,400.
	60	5,400	182.	982,800.
Subtotal for pipe				$4,213,400.
Outlet structure and lining				16,000.
Sewer crossing structure				4,000.
Total contract cost				$4,233,400
Engineering and contingencies				846,700.
Total construction cost - Line D				$5,080,100.
Line E - E. Broadway				
	30	1,320	$102.	$134,600.
	42	2,640	129.	340,600.
	48	5,300	143.	757,900.
	54	2,650	162.	429,300.
	60	5,290	182.	962,800.
	66	10,380	202.	2,096,800.
	72	800	216.	172,800.
Subtotal for pipe				4,894,800.
Outlet structure and lining				17,000.
Total contract cost				4,911,800.
Engineering and contingencies				982,400.
Total construction cost - Line E				$5,894,200.
Line F - E. Southern Avenue				
	30	2,640	$102.	$269,300.
	36	2,640	114.	301,000.
	48	2,640	143.	377,500.
	54	5,280	162.	855,400.
	60	2,650	182.	482,300.
	66	7,930	202.	1,601,900.
	72	3,960	216.	855,400.
	78	2,440	241.	588,000.
Subtotal for pipe				5,330,800.
Outlet structure and lining				17,000.
Total contract cost				5,347,800.
Engineering and contingencies				1,069,600.
Total construction cost - Line F				$6,417,400.

	Pipe Size in.	Length ft.	Unit Cost	Total Cost
Line F-1 - S. 96th Street				
	36	2,640	$114.	$301,000.
Total contract cost				301,000.
Engineering and contingencies				60,200.
Total construction cost - Line F-1				$361,200.
Line F-2 - S. Ellsworth Road				
	36	1,320	$114.	$150,500.
	39	1,320	119.	157,100.
Total contract cost				307,600.
Engineering and contingenices				61,500.
Total construction cost - Line F-2				$369,100.
Line H - E. Baseline Road				
	30	2,640	$102.	$269,300.
	33	5,310	109.	578,800.
	36	5,320	114.	606,500.
	39	7,950	119.	946,100.
	42	5,320	129.	686,300.
	48	2,640	143.	377,500.
	54	900	162.	145,800.
Subtotal for pipe				$3,610,300.
Outlet structure and lining				16,000.
Total contract cost				3,626,300.
Engineering and contingencies				725,300.
Total construction cost - Line H				$4,351,600.

Estimated Construction Costs

Complete Low-Flow Channel

	Amount	Unit	Unit Cost	Total Cost
Excavation	183,000	C.Y.	$ 1.50	$274,500.
Rock Lining	12,300	S.Y.	25.00	307,500.
72" Dia. Rein. Concrete Pipe	700	L.F.	175.00	122,500.
Rein. Concrete Headwalls	2	Ea.	10,000.	20,000.
6' Chain Line Fence	10,200	L.F.	10.00	102,000.
Right-of-Way	13	Acres	8,000.	104,000.
Miscellaneous (Utility Relocation etc.)	L.S.	1 Job	50,000.	50,000.
Total Contract Cost				$ 980,500.
Engineering and Contingencies				196,100.
Total Construction Cost - Complete Low-Flow Channel				$1,176,600.

NOTE:

Complete Low-Flow Channel extends from McKellips Road to just north of Guadalupe Road.

Estimated Construction Costs

Portion of Low-Flow Channel

North of Brown Road

	Amount	Unit	Unit Cost	Total Cost
Excavation	82,000	C.Y.	$ 1.50	$123,000.
72" Dia. Rein. Concrete Pipe	700	L.F.	175.00	122,500.
Rein. Concrete Headwalls	2	Ea.	10,000.	20,000.
6' Chain Link Fence	10,200	L.F.	10.00	102,000.
Right-of-Way	13	Acres	8,000	104,000.
Total Contract Cost				$471,500.
Engineering and Contingencies				94,300.
Total Construction Cost				$565,800.

NOTE:

The Low-Flow Channel from north of Brown Road to McKellips Road is an extension of the Low-Flow Channel in the R.W.C.D. Floodway. Costs for this portion are given in the event that the Retention Basin at McKellips and Greenfield Roads is constructed, then the cost for this portion of the Low-Flow Channel could be deducted from the cost for the 'Complete Low-Flow Channel,' and the cost for the Retention Basin added.

Estimated Construction Costs

Alternate Discharge System

Retention Basin:	Amount	Unit	Unit Cost	Total Cost
Excavation	112,000	C.Y.	$ 2.75	$308,000.
Pump and Controls	1	Ea.	30,000.	30,000.
Inlet Structure	1	Ea.	10,000.	10,000.
Outlet Structure	1	Ea.	25,000.	25,000.
6' Chain Link Fence	2,700.	L.F.	10.00	27,000.
Total Contract Cost				$400,000.
Engineering and Contingencies				80,000.
Total Construction Cost				$480,000.
Discharge Structures:				
Structures	6	Ea.	$25,000.	$150,000.
Pumps and Controls	6	Ea.	30,000.	180,000.
Total Contract Cost				$330,000.
Engineering and Contingencies				66,000.
Total Construction Cost				$396,000.

Total Construction Cost-Retention Basin & Discharge Structures $876,000. *

* Total cost for construction only-does not include pump maintenance and replacement or pumping power costs.

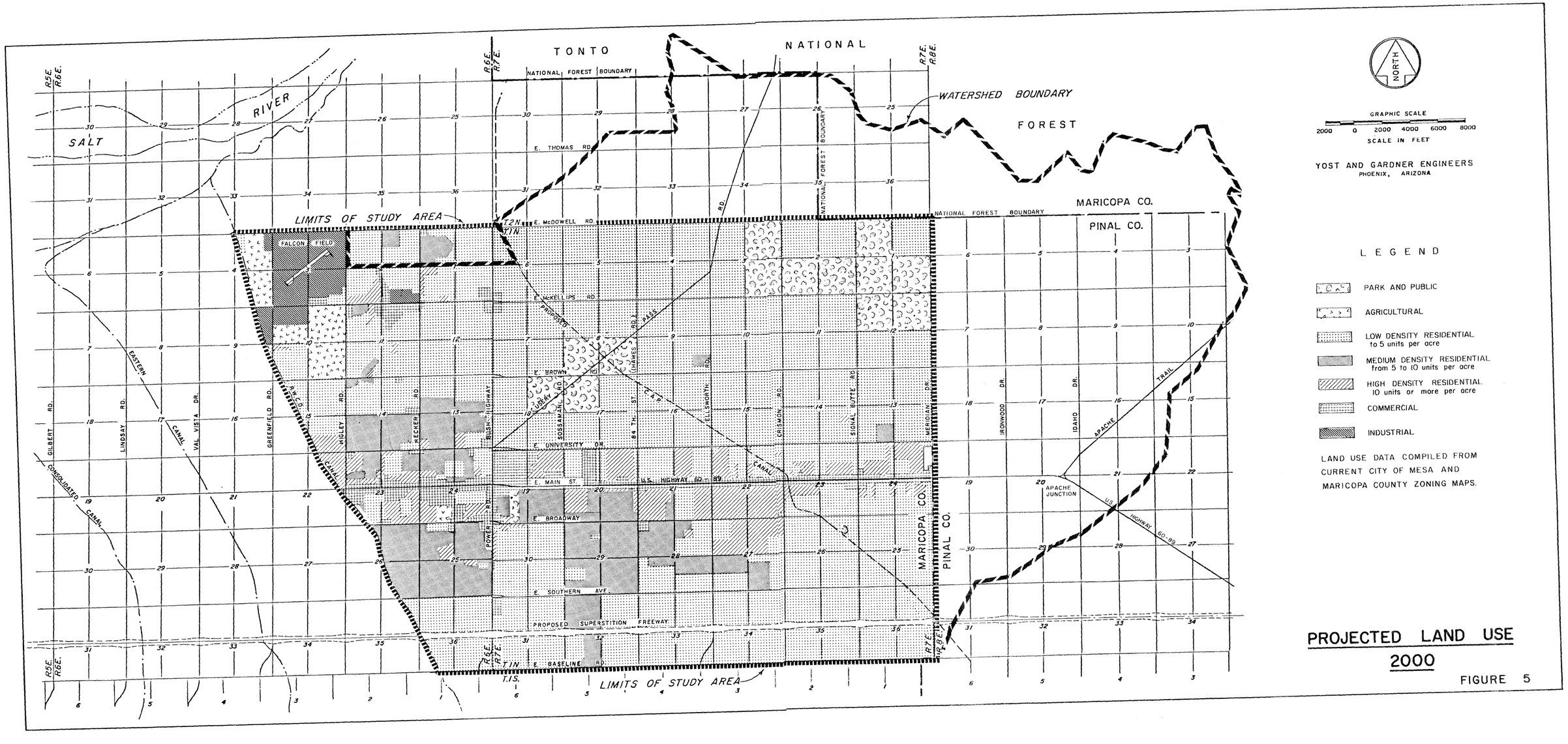
Recapulation

Estimated Construction Costs

Line Designation	Location	Total Construction Cost
A	E. McKellips Road	$2,534,900.
A-1	No. Greenfield Road	722,300.
B	E. Brown Road	2,453,200.
C	E. University Drive	4,035,800.
C-1	No. Recker Road	369,100.
D	E. Main Street	5,080,100.
E	E. Broadway	5,894,200.
F	E. Southern Avenue	6,417,400.
F-1	S. 96th Street	361,200.
F-2	S. Ellsworth Road	369,100.
H	E. Baseline Road	4,351,600.
Complete Low-Flow Channel	E. of R.W.C.D. Canal	1,176,600.
	Total Project Cost	$33,765,500.

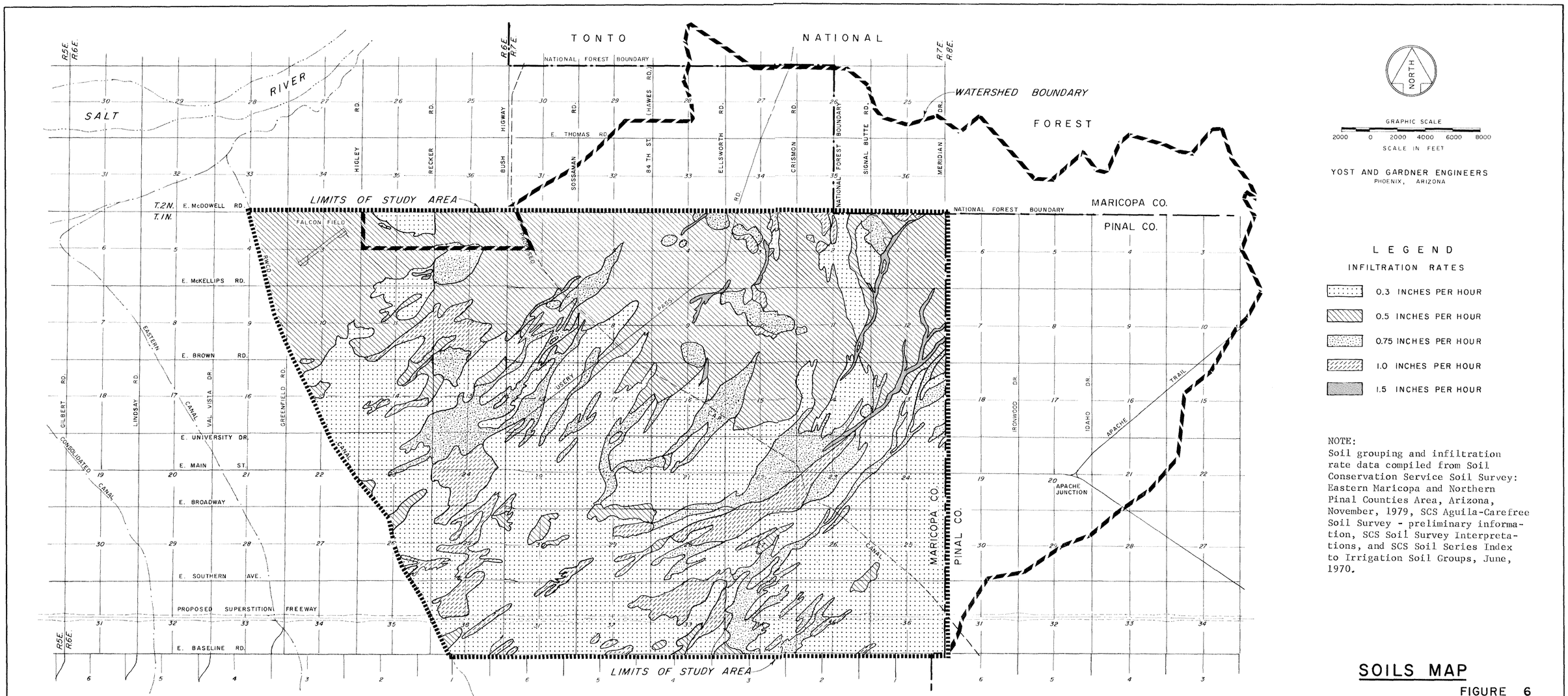
NOTE:

1. Construction costs developed for improvements in area west of the C.A.P. Canal only.
2. Construction cost computed at prices prevailing in January, 1981.
3. Complete Low-Flow Channel extends from McKellips Road to just north of Guadalupe Road.



PROJECTED LAND USE
2000

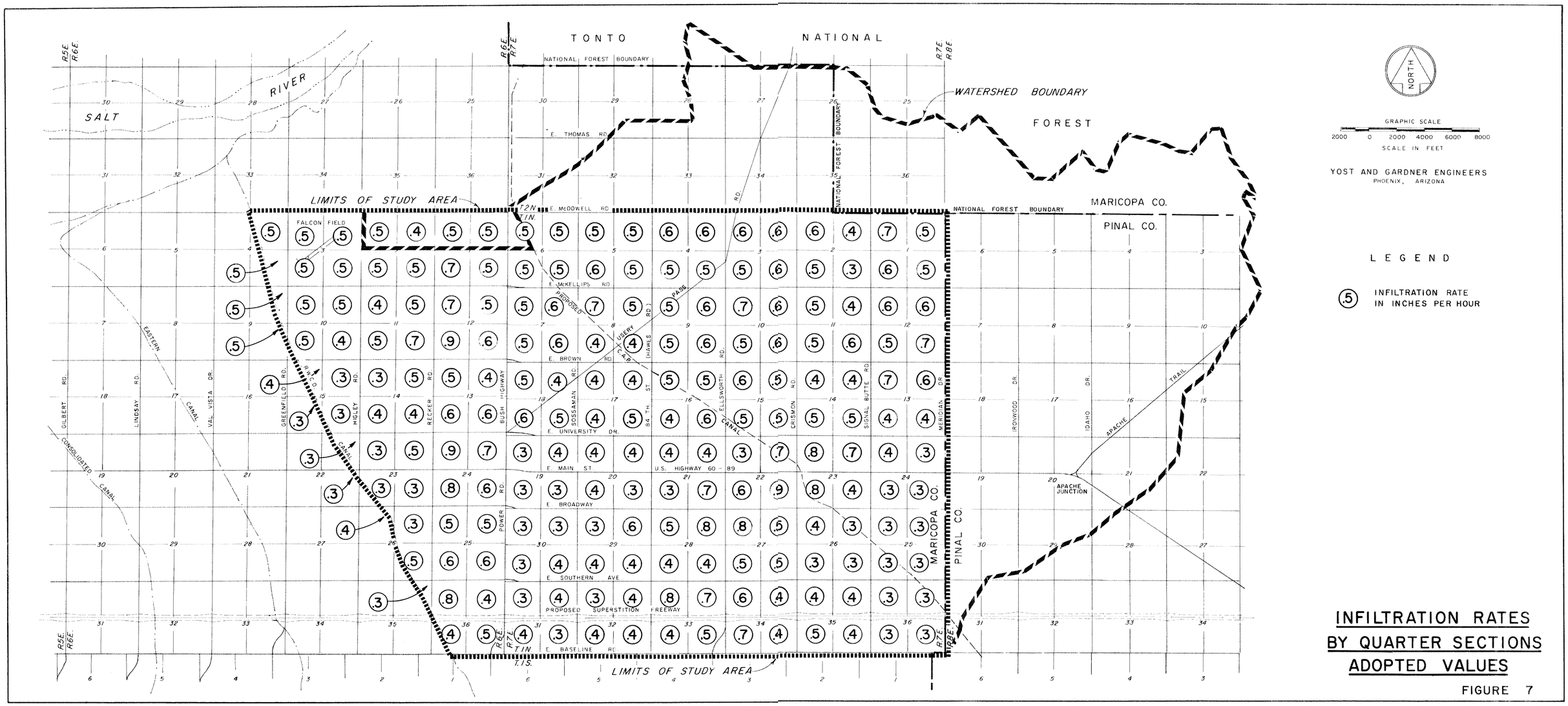
FIGURE 5



NOTE:
Soil grouping and infiltration rate data compiled from Soil Conservation Service Soil Survey: Eastern Maricopa and Northern Pinal Counties Area, Arizona, November, 1979, SCS Aguila-Carefree Soil Survey - preliminary information, SCS Soil Survey Interpretations, and SCS Soil Series Index to Irrigation Soil Groups, June, 1970.

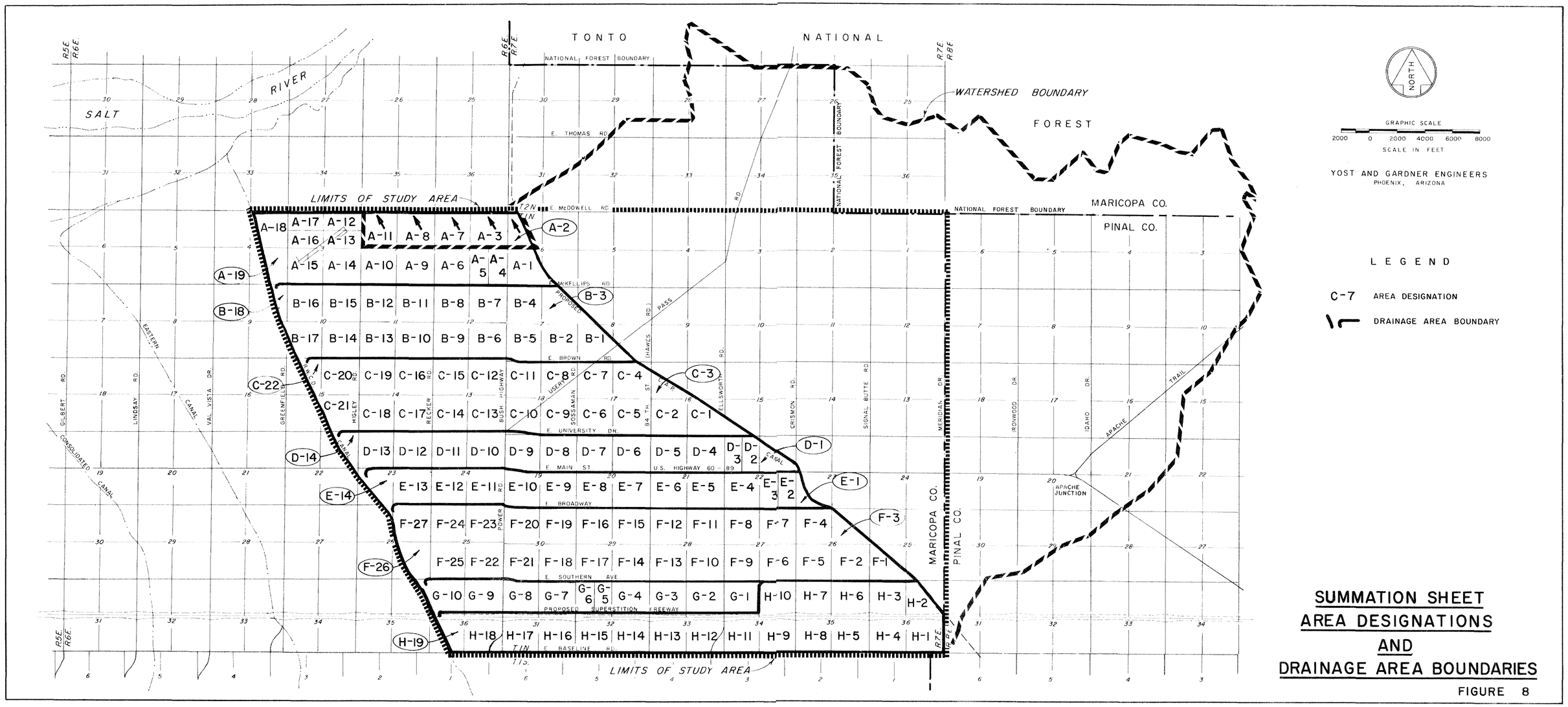
SOILS MAP

FIGURE 6



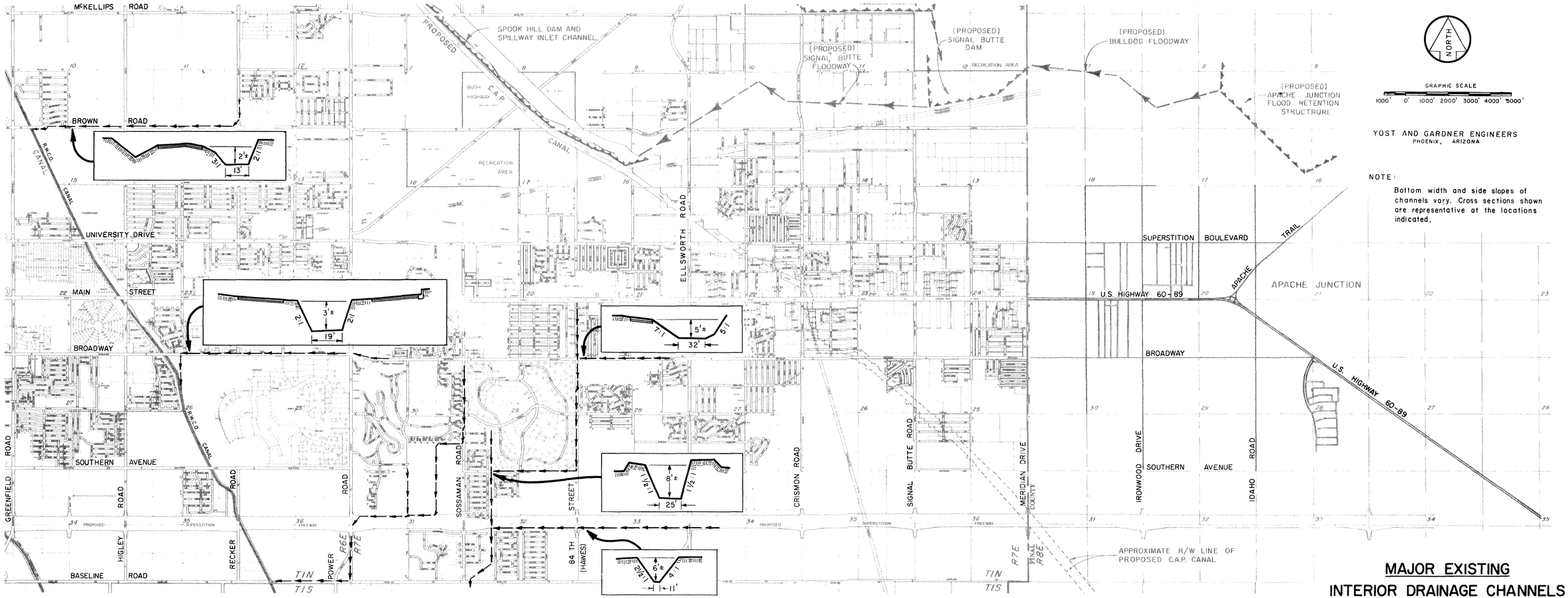
INFILTRATION RATES BY QUARTER SECTIONS ADOPTED VALUES

FIGURE 7



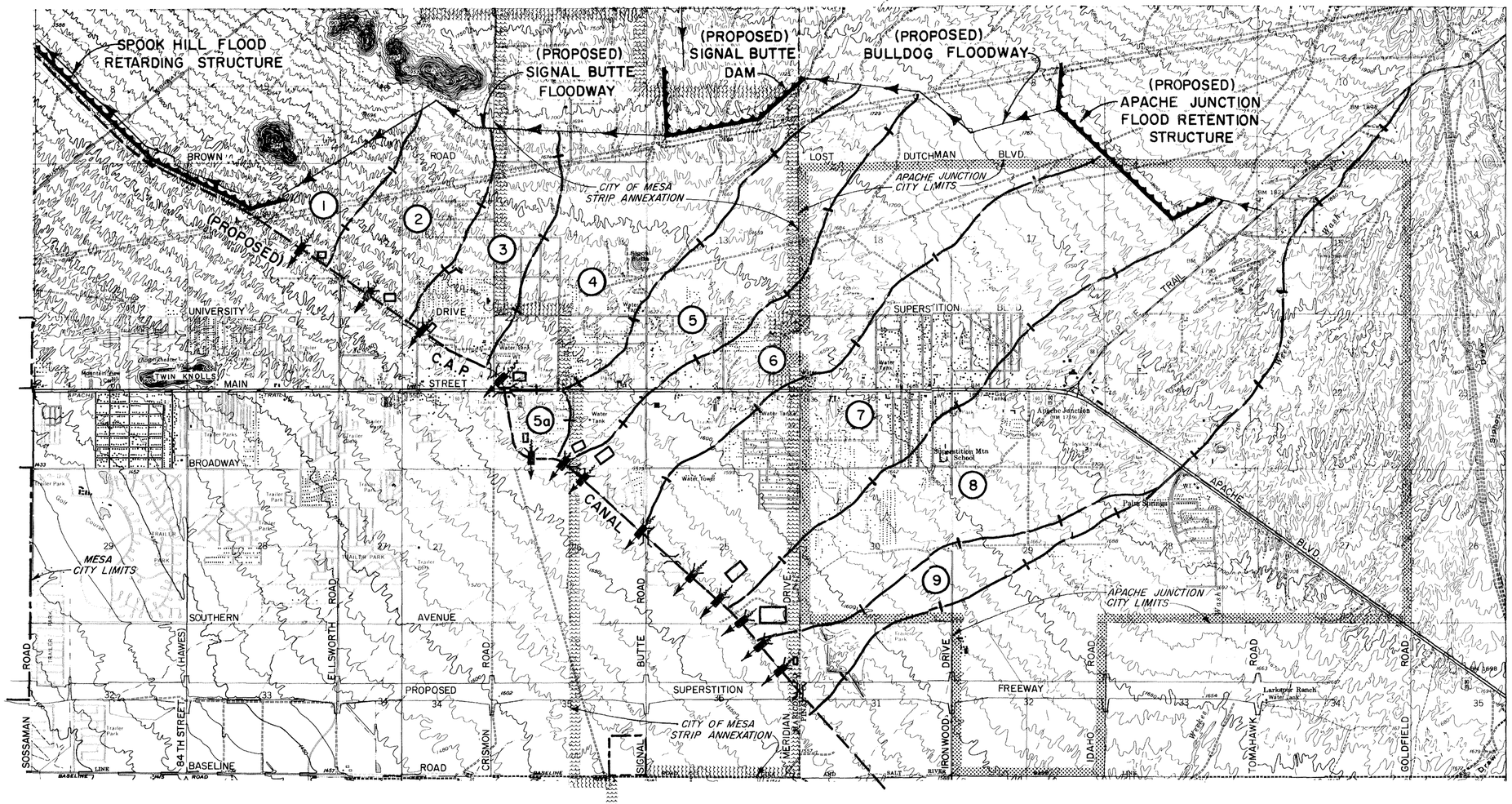
SUMMATION SHEET
AREA DESIGNATIONS
AND
DRAINAGE AREA BOUNDARIES

FIGURE 8



MAJOR EXISTING INTERIOR DRAINAGE CHANNELS

FIGURE 9



GRAPHIC SCALE

2000 0 2000 4000 6000

SCALE IN FEET

YOST AND GARDNER ENGINEERS
PHOENIX, ARIZONA

LEGEND

- OVERCHUTE
- BRIDGE
- DAM
- FLOODWAY
- DRAINAGE BOUNDARY
- (2) DRAINAGE AREA DESIGNATION
- FUTURE RETENTION BASIN

AREA DESIGNATION	AREA (IN SQ. MILES)
1	0.40
2	0.82
3	0.76
4	1.73
5 5a	1.48 , 0.19
6	2.26
7	3.10
8	3.99
9	0.62

PROPOSED C. A.P. CANAL STRUCTURES FUTURE RETENTION BASINS CONTRIBUTING DRAINAGE AREAS

FIGURE 10

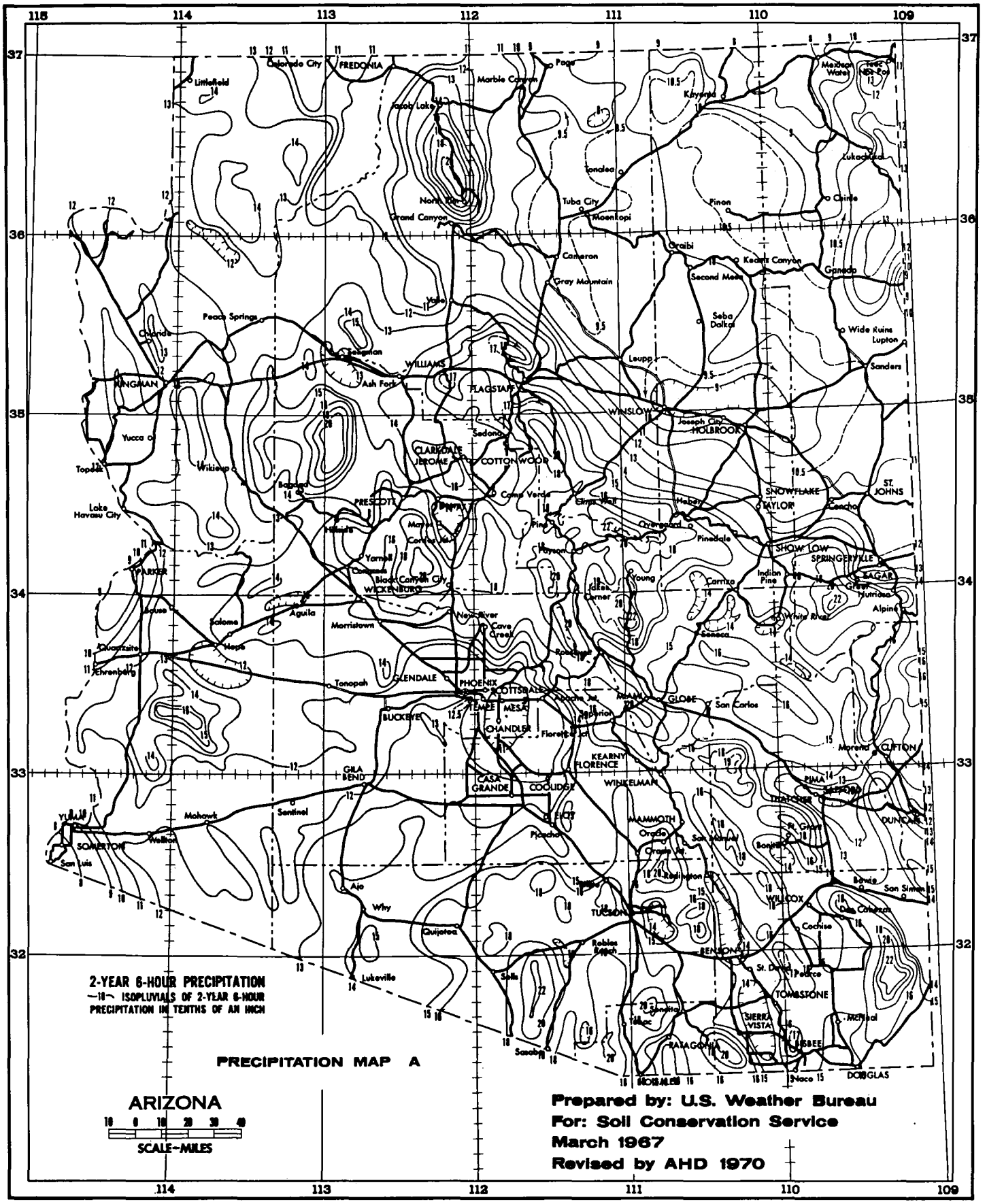

2-YEAR 6-HOUR PRECIPITATION
—10— ISOPLUVIALS OF 2-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP A
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
FREDONIA
Colorado City
Marble Canyon
Page
Kayenta
Tonalea
Tuba City
Moenkopi
Pinon
Chinle
Cameron
Gray Mountain
Oraibi
Keams Canyon
Second Mesa
Ganado
Peach Springs
Seligman
Ash Fork
WILLIAMS
FLAGSTAFF
Leupp
Seba Dalkai
Wide Ruins
Lupton
Sanders
KINGMAN
Yucca
Topock
Wikieup
WINSLOW
Joseph City
HOLBROOK
Sedona
CLARKDALE
JEROME
COTTONWOOD
Camp Verde
Clints Well
Heber
SNOWFLAKE
TAYLOR
ST. JOHNS
Concho
Lake Havasu City
PRESCOTT
Prescott Jct.
Paulden
Chino Valley
Pine
Overgaard
Pinedale
Hayden
SHOW LOW
SPRINGERVILLE
EAGAR
Greer
Nutrioso
Alpine
PARKER
Yarnell
Congress
Black Canyon City
WICKENBURG
Aguila
Salome
Morristown
New River
Cave Creek
Young
Carrizo
Indian Pine
White River
Seneca
Quartzsite
Ehrenberg
Mesa
Tonopah
GLENDALE
PHOENIX
SCOTTSDALE
TEMPE
MESA
CHANDLER
Superior
MIAMI
GLOBE
San Carlos
Morenci
CLIFTON
BUCKEYE
GILA BEND
CASA GRANDE
COOLIDGE
KEARNY
FLORENCE
WINKELMAN
PIMA
SAFFORD
THATCHER
DUNCAN
YUMA
SOMERTON
San Luis
Wellton
Mohawk
Sentinel
Ajo
Why
Quijotoa
Lukeville
Pisinemo
MAMMOTH
Oracle
San Manuel
Redington
Benson
Bonita
Bowie
San Simon
WILLCOX
Dos Cabezas
Cochise
TUCSON
Robles Ranch
BENSON
St. David
Pearce
TOMBSTONE
Sonoita
Elgin
SIERRA VISTA
Mescal
PATAGONIA
BISBEE
Sasabe
NOGALES
Naco
DOUGLAS

FIGURE 11

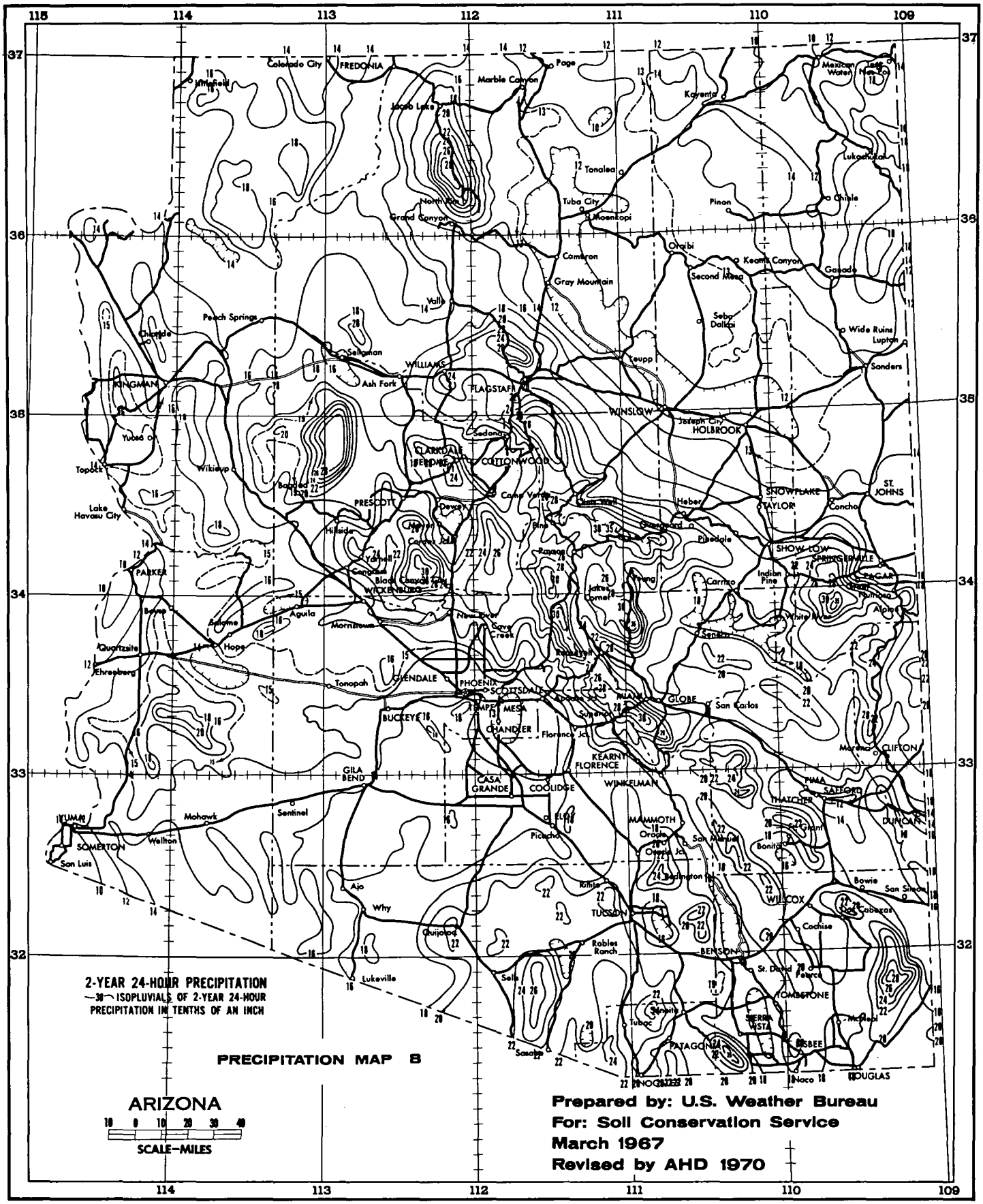

2-YEAR 24-HOUR PRECIPITATION
—30— ISOPLUVIALS OF 2-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP B
ARIZONA
SCALE—MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
FREDONIA
Colorado City
Page
Marble Canyon
Kayenta
Tonalea
Tuba City
Moenkopi
Pinon
Chinle
Grand Canyon
Cameron
Gray Mountain
Oraibi
Keams Canyon
Second Mesa
Ganado
Sanders
Wide Ruins
Lupton
Peach Springs
Seligman
Ash Fork
WILLIAMS
FLAGSTAFF
Teupp
KINGMAN
WINSLOW
Joseph City
HOLBROOK
Sedona
CLARKDALE
COTTONWOOD
Yucca
Topock
Wikieup
Lake Havasu City
PRESCOTT
Camp Verde
Heber
SNOWFLAKE
TAYLOR
ST. JOHNS
Concho
Pinedale
SHOW LOW
SPRINGERVILLE
EAGAR
Alpine
PARKER
Bagdad
Yarnell
Congress
Black Canyon City
WICKENBURG
Aguila
Morristown
New River
Cave Creek
Rimrock
Rancho
Young
Carrizo
Indian Pine
Quartzsite
Ehrenberg
Hope
Tonopah
GLENDALE
PHOENIX
SCOTTSDALE
TEMPE
MESA
CHANDLER
Florence Jct.
Superior
MIAMI
GLOBE
San Carlos
Morenci
CLIFTON
BUCKEYE
GILA BEND
CASA GRANDE
COOLIDGE
KEARNY
FLORENCE
WINKELMAN
PIMA
SAFFORD
THATCHER
DUNCAN
YUMA
SOMERTON
San Luis
Mohawk
Sentinel
Welton
ELOY
Picacho
MAMMOTH
Oracle
San Manuel
Bonita
Bowie
San Simon
Cochise
Aja
Why
Ajo
Kinsley
TUCSON
WILCOX
Cabezas
Quijotoa
Robles Ranch
BENSON
St. David
Pearce
Lukeville
Sells
TOMBSTONE
Tubac
Nogales
SIERRA VISTA
McNeal
PATAGONIA
BISBEE
Sasabe
Naco
DOUGLAS

FIGURE 12

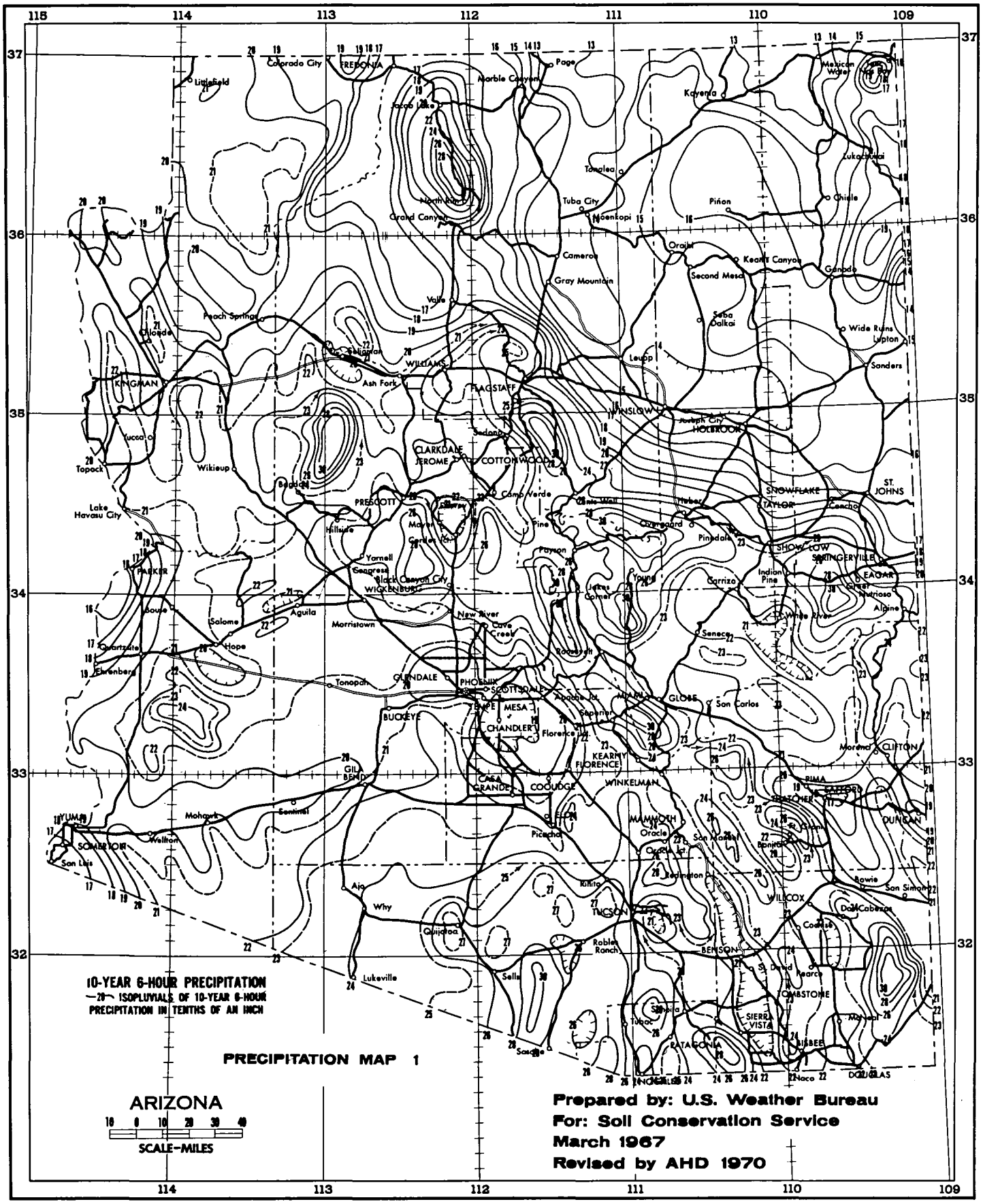

10-YEAR 6-HOUR PRECIPITATION
—20— ISOPLUVIALS OF 10-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 1
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

FIGURE 13

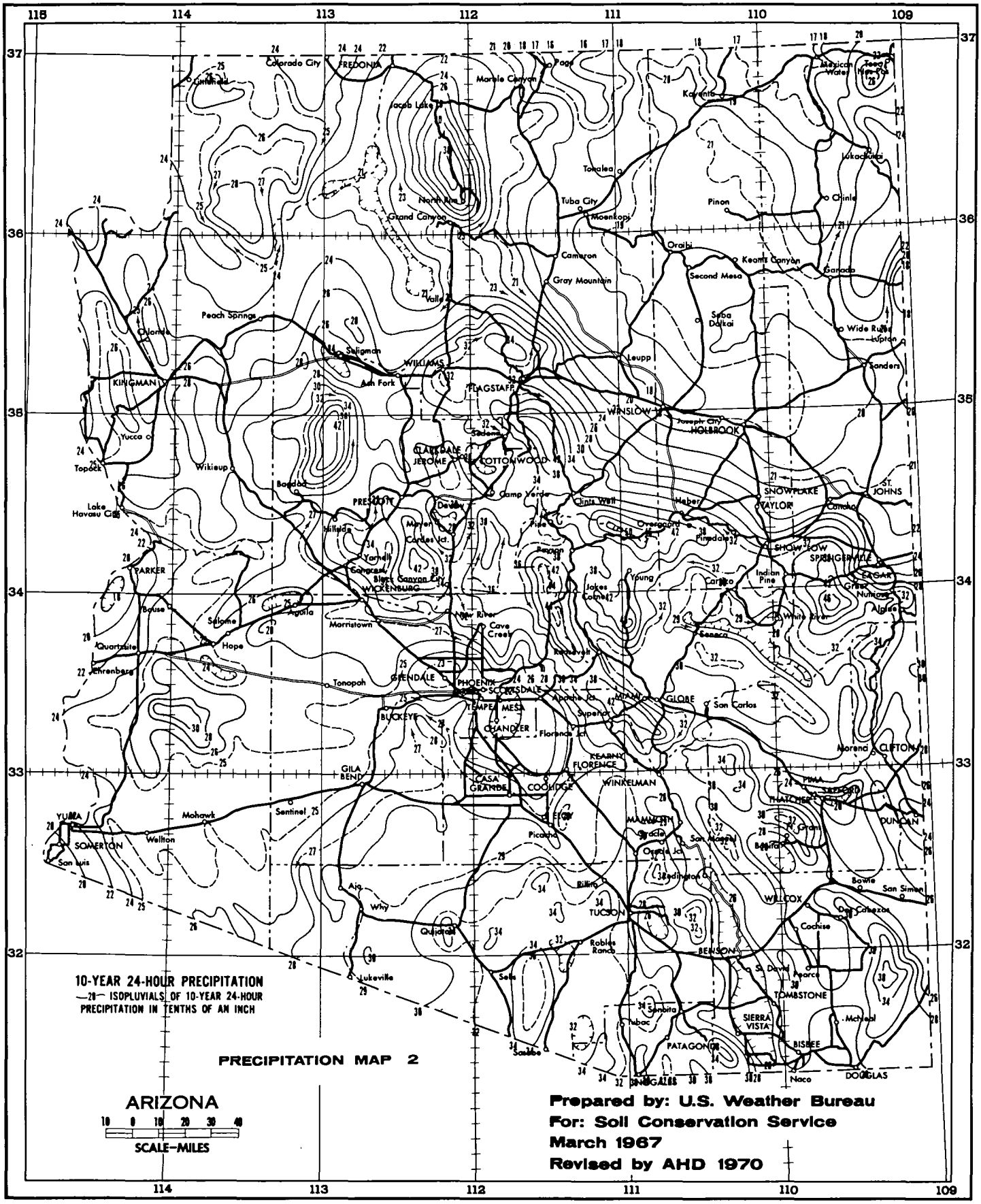
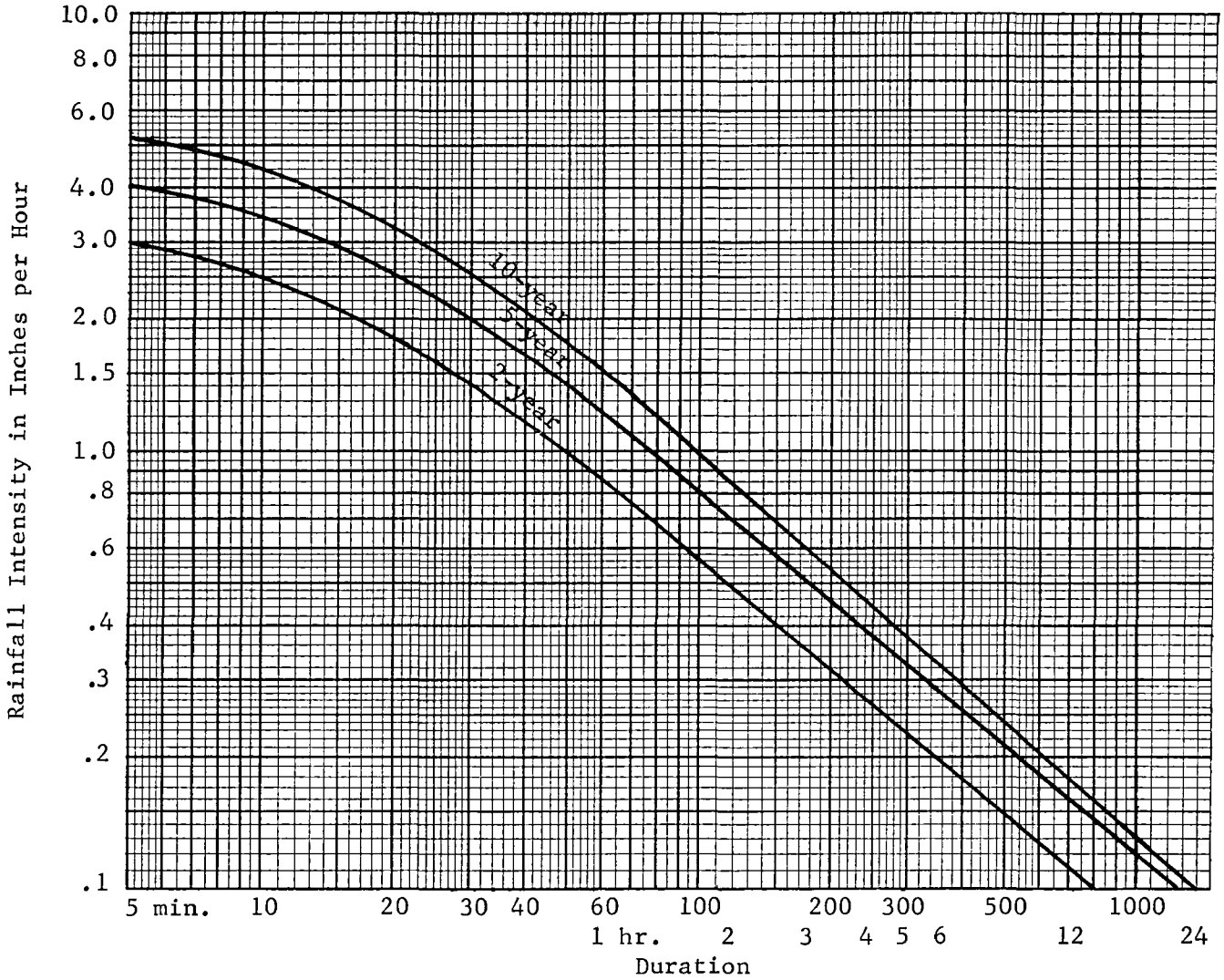

10-YEAR 24-HOUR PRECIPITATION
—20— ISOPLUVIALS OF 10-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 2
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970
Colorado City
FREDONIA
Page
Marble Canyon
Jacob Lake
North Rim
Grand Canyon
Tonalea
Tuba City
Moenkopi
Kayenta
Mexican Water
Teec Nos Pos
Lukachukai
Chinle
Pinon
Oraibi
Keams Canyon
Second Mesa
Ganado
Cameron
Gray Mountain
Valle
Peach Springs
Seligman
WILLIAMS
Ash Fork
FLAGSTAFF
KINGMAN
Yucca
Topock
Wikieup
Leupp
Wide Ruins
Lupton
Sanders
WINSLOW
Joseph City
HOLBROOK
Sedona
CLARKDALE
JEROME
COTTONWOOD
Bagdad
PRESCOTT
Camp Verde
Clints Well
Heber
SNOWFLAKE
TAYLOR
ST. JOHNS
Concho
Lake Havasu City
Hillside
Mayer
Cordes Jct.
Dewey
Pine
Overgaard
Pinedale
SHOW LOW
SPRINGERVILLE
EAGAR
Greer
Nutrioso
Alpine
PARKER
Yarnell
Congress
Black Canyon City
WICKENBURG
Bouse
Salome
Aguila
Morristown
New River
Cave Creek
Rainbow
Jakes Corner
Young
Carrizo
Indian Pine
White River
Seneca
Quartzsite
Hope
Kirkenberg
Roosevelt
Tonopah
GLENDALE
PHOENIX
SCOTTSDALE
Apache Jct.
MIAMI
GLOBE
San Carlos
TEMPE
MESA
BUCKEYE
CHANDLER
Superior
Florence Jct.
Morenci
CLIFTON
KEARNY
FLORENCE
GILA BEND
CASA GRANDE
COOLIDGE
WINKELMAN
PIMA
SAFFORD
THATCHER
DUNCAN
YUMA
Mohawk
Sentinel
Wellton
SOMERTON
San Luis
Eloy
Picacho
MAMMOTH
Oracle
San Manuel
Oracle Jct.
Redington
Bapchule
Bowie
San Simon
Aja
Why
Ajo
Quijotoa
Pisinimo
TUCSON
WILCOX
Dos Cabezas
Cochise
Robles Ranch
BENSON
Lukeville
Sells
S. David
Pearce
TOMBSTONE
Sonoita
Tubac
SIERRA VISTA
McNeal
BISBEE
PATAGONIA
Sasabe
Naco
DOUGLAS

FIGURE 14

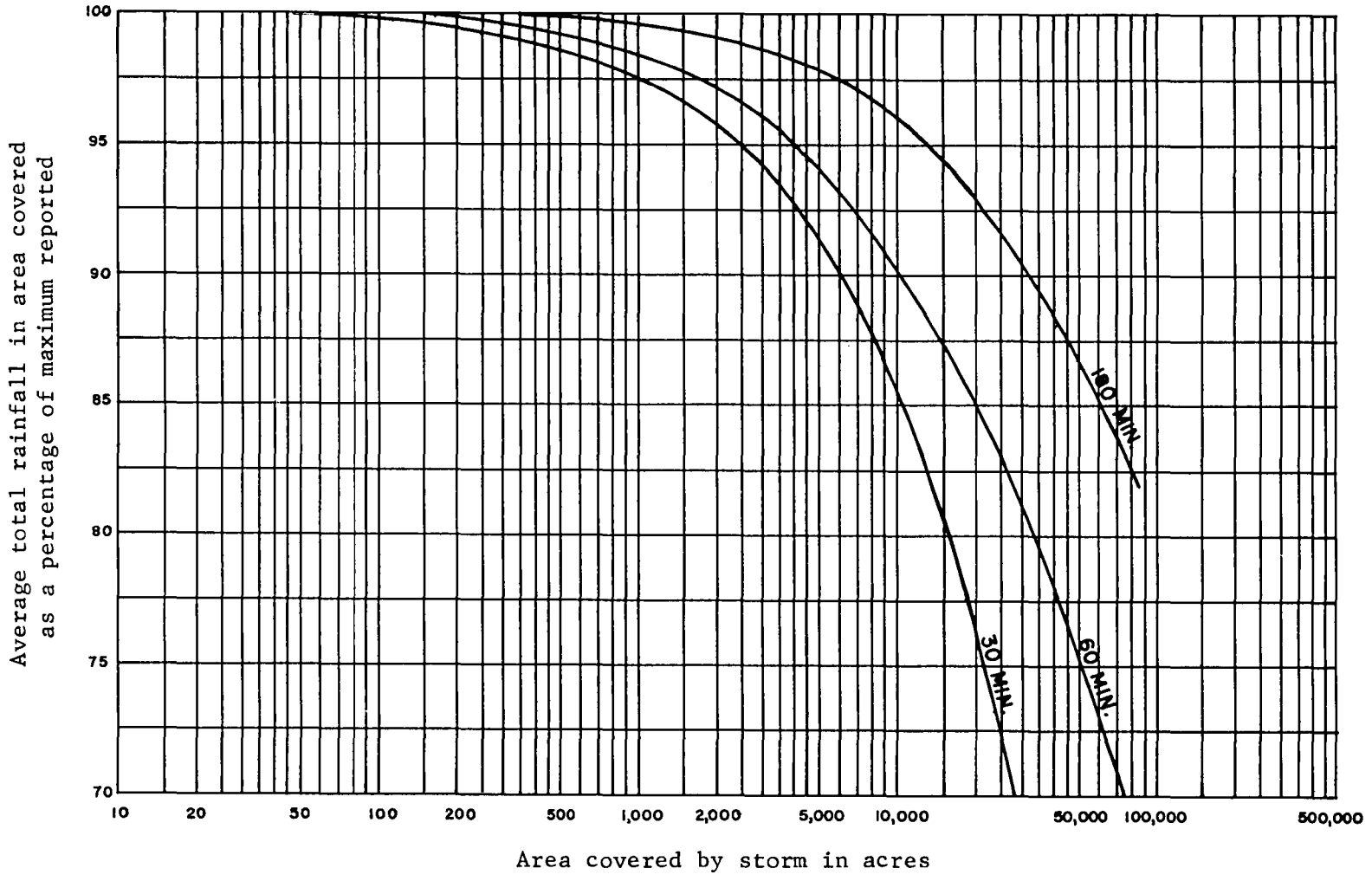


RAINFALL INTENSITY - DURATION - FREQUENCY RELATION
FOR MESA, ARIZONA

(Partial Duration Series)

Curves are based on methods of U.S. Weather Bureau Technical Paper No. 40, Technical Memorandum WBTM WR-44, and rainfall data from pages 37c through 39 of the Arizona Highway Department Hydrologic Design Manual (1970 Revision).

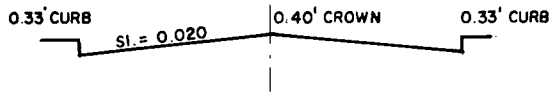
FIGURE 15



RAINFALL AREA-DEPTH CURVES

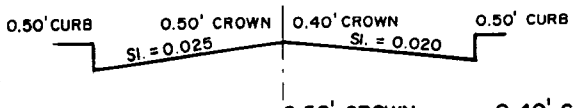
FROM U.S. WEATHER BUREAU TECHNICAL PAPER NO. 40, FIG. 15

FIGURE 16



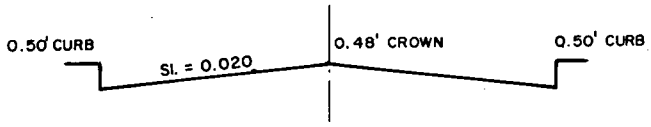
AREA TO TOP OF CURB	5.45 SQ. FT.
WETTED PERIMETER	33.66 FT.
HYDRAULIC RADIUS	0.162 FT.

40 FT. STREET
(4" CURB)



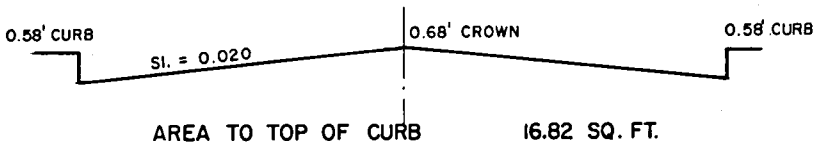
	0.50' CROWN	0.40' CROWN
AREA TO TOP OF CURB	10.0 SQ. FT.	12.0 SQ. FT
WETTED PERIMETER	41.0 FT.	41.0 FT.
HYDRAULIC RADIUS	0.244 FT.	0.293 FT.

40 FT. STREET
(6" CURB)



AREA TO TOP OF CURB	11.52 SQ. FT.
WETTED PERIMETER	48.96 FT.
HYDRAULIC RADIUS	0.235 FT.

48 FT. STREET



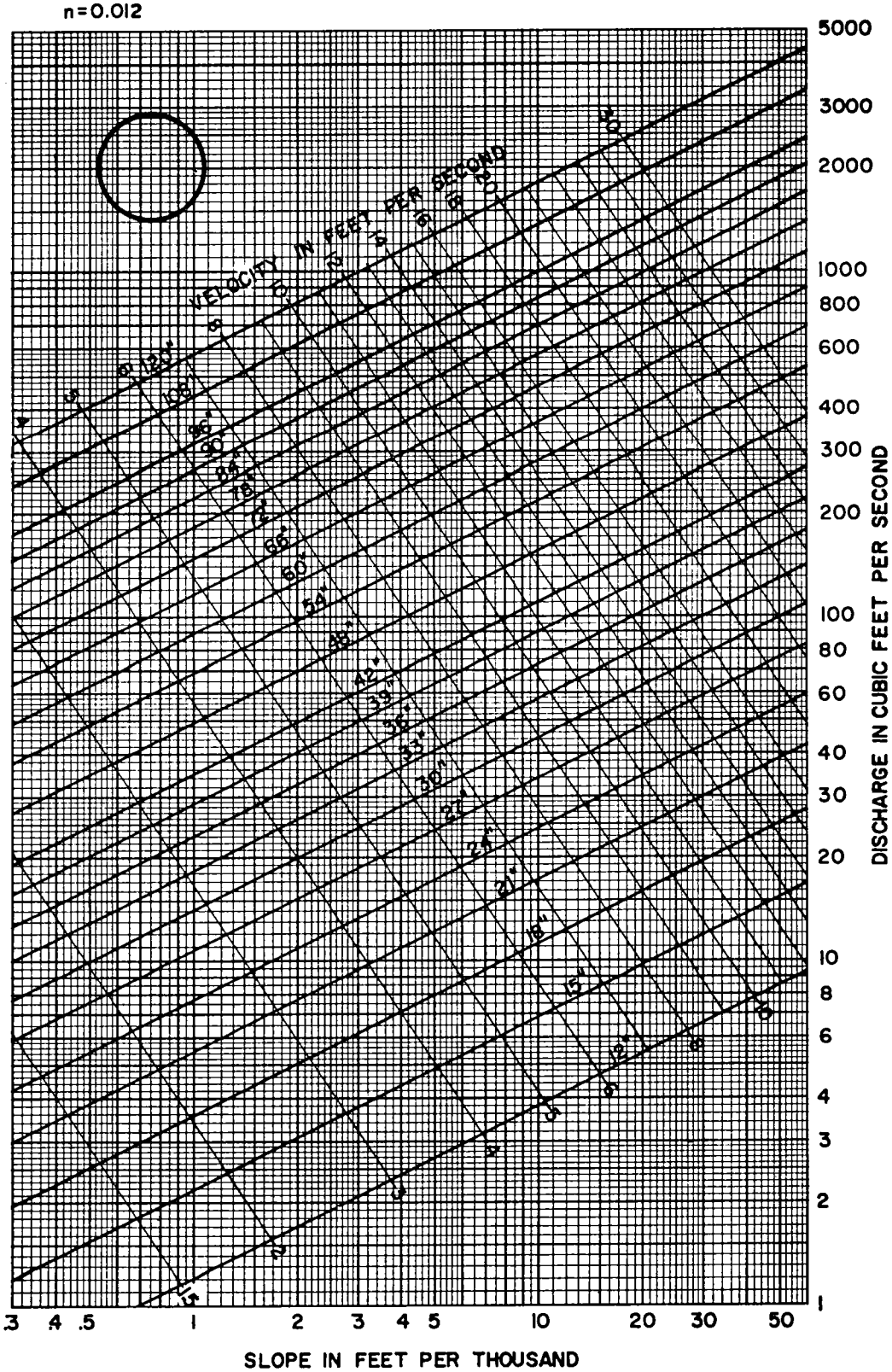
AREA TO TOP OF CURB	16.82 SQ. FT.
WETTED PERIMETER	59.16 FT.
HYDRAULIC RADIUS	0.284 FT.

68 FT. STREET

HYDRAULIC PROPERTIES OF TYPICAL STREET SECTIONS

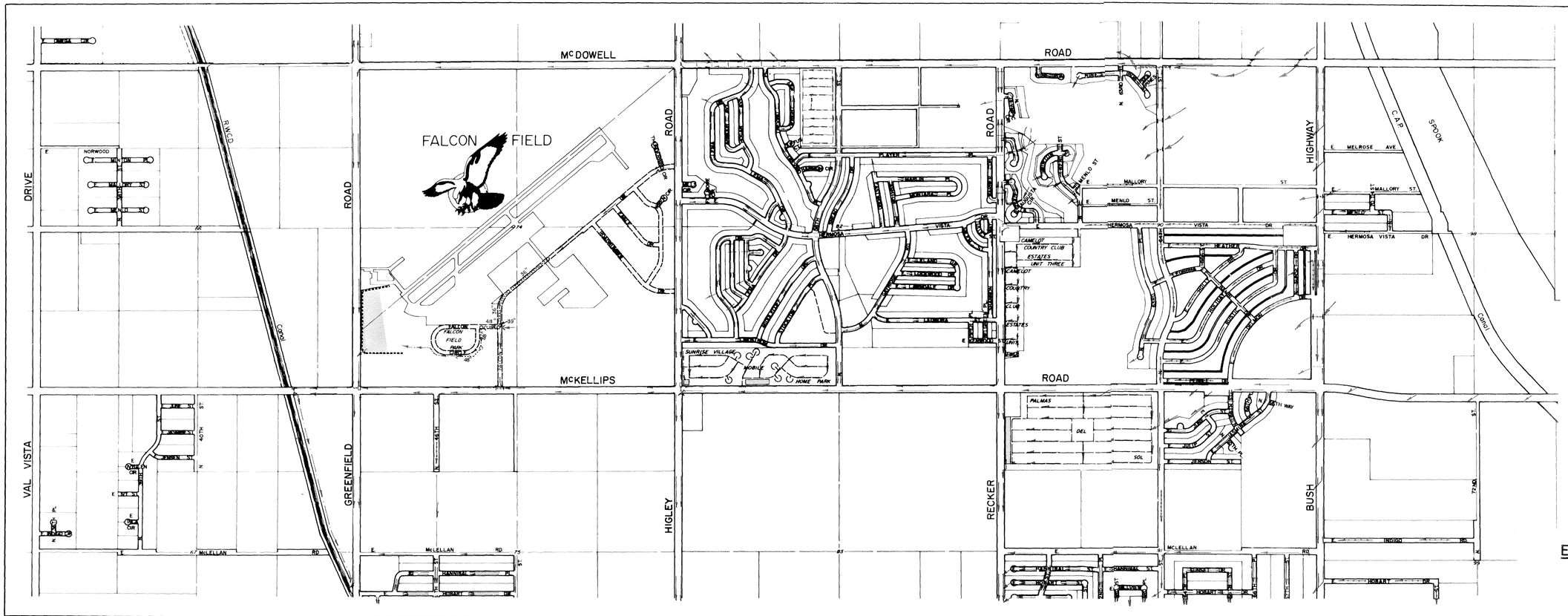
FIGURE 17

COMPUTED FROM MANNING'S FORMULA
n=0.012



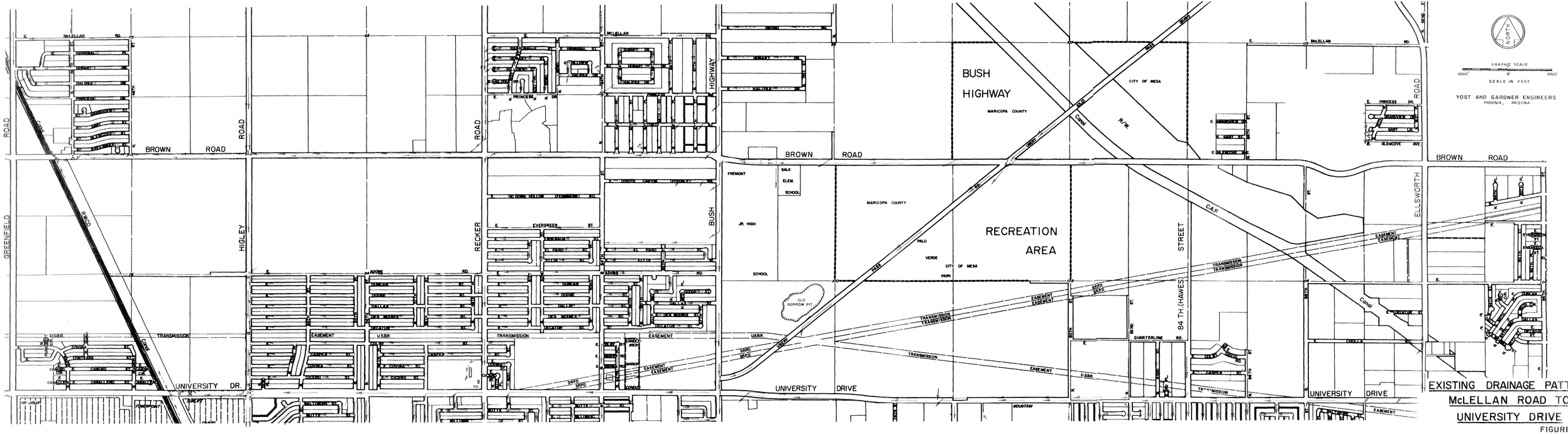
PIPE CAPACITIES FLOWING FULL

FIGURE 19



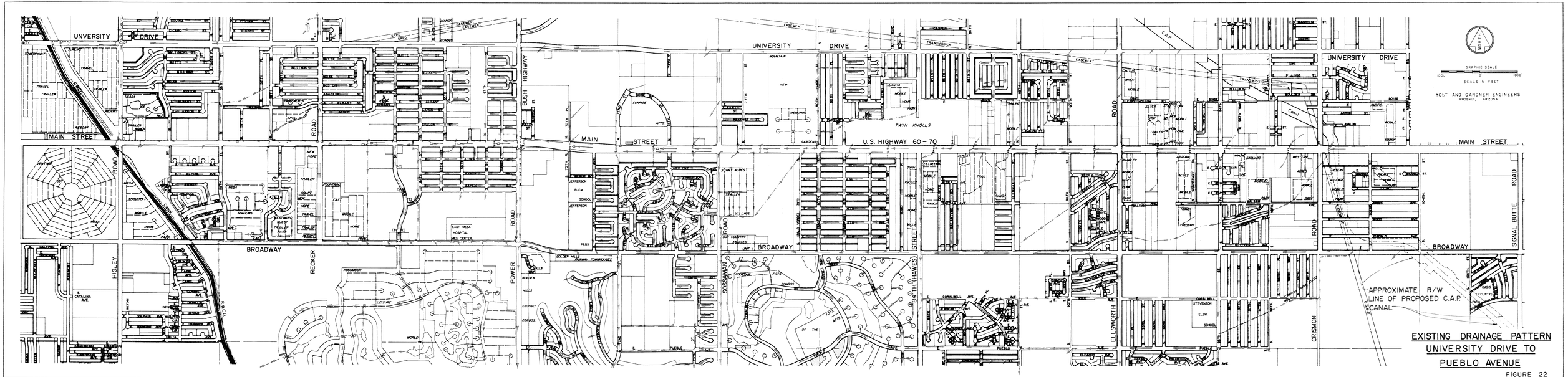
EXISTING DRAINAGE PATTERN
McDOWELL ROAD TO
McLELLAN ROAD

FIGURE 20



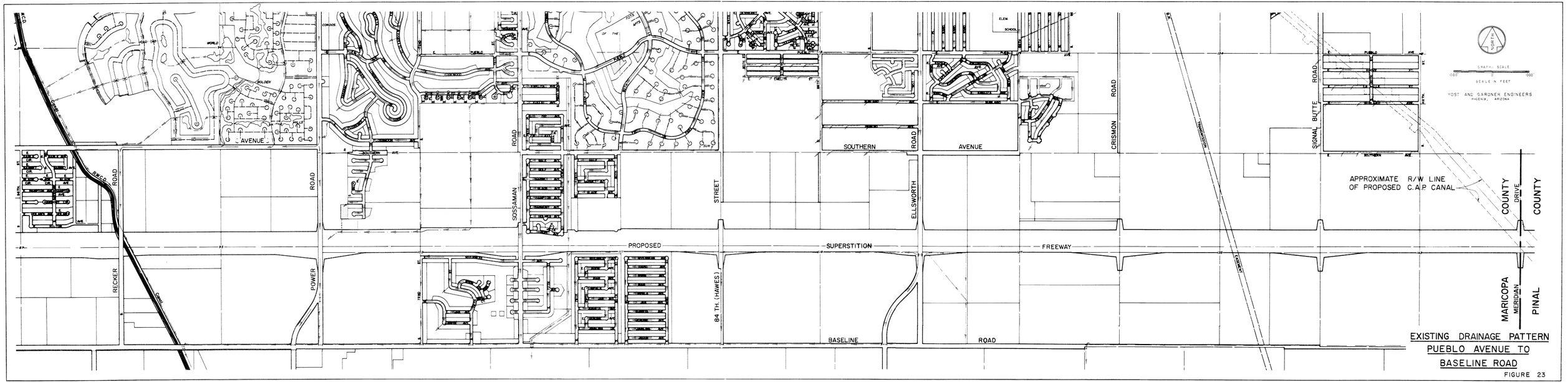
EXISTING DRAINAGE PATTERN
McLELLAN ROAD TO
UNIVERSITY DRIVE

FIGURE 21



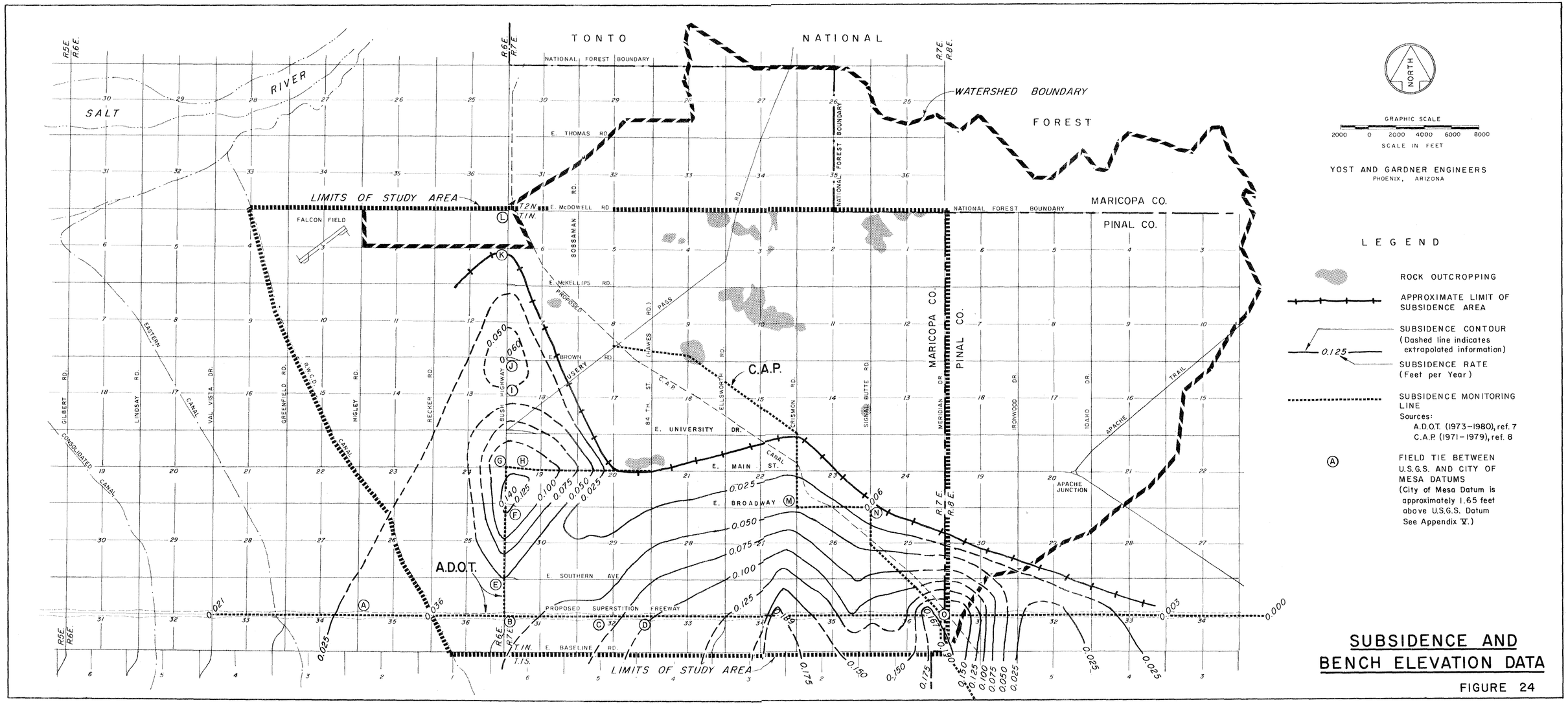
EXISTING DRAINAGE PATTERN
UNIVERSITY DRIVE TO
PUEBLO AVENUE

FIGURE 22



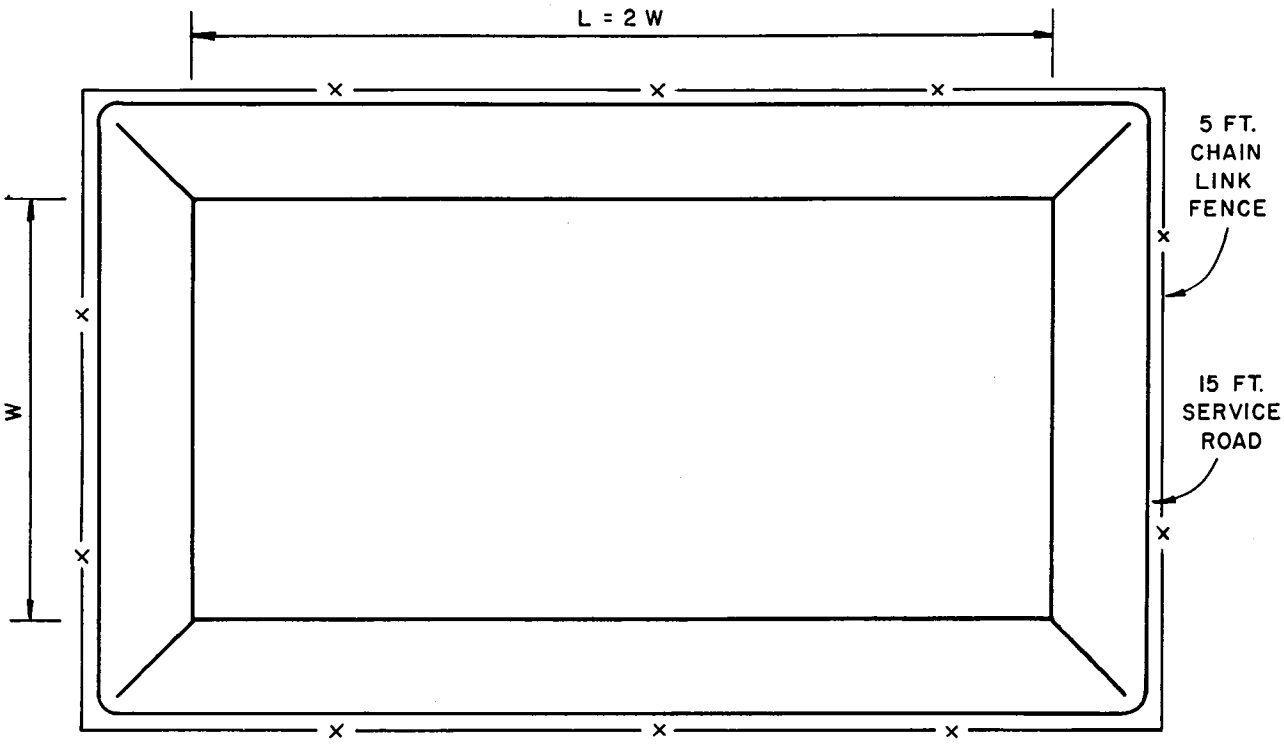
EXISTING DRAINAGE PATTERN
PUEBLO AVENUE TO
BASELINE ROAD

FIGURE 23

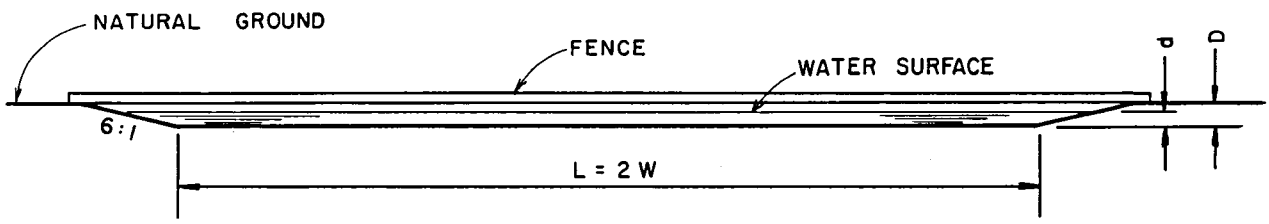


SUBSIDENCE AND BENCH ELEVATION DATA

FIGURE 24



PLAN

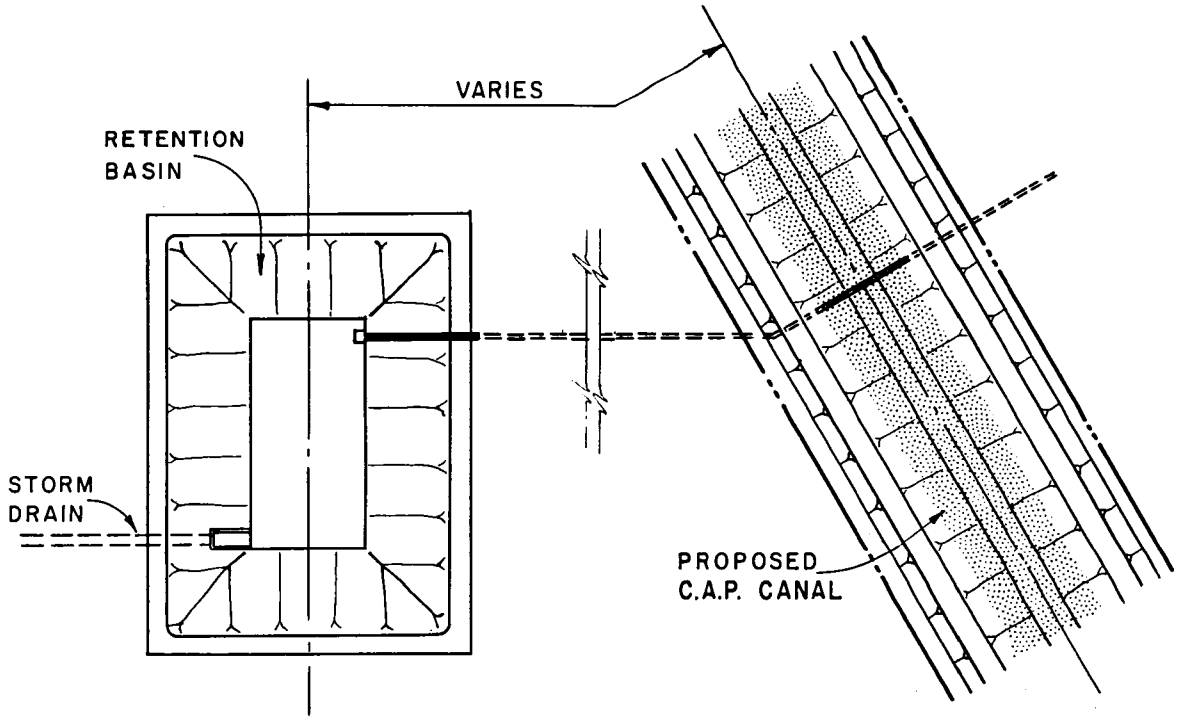


SECTION

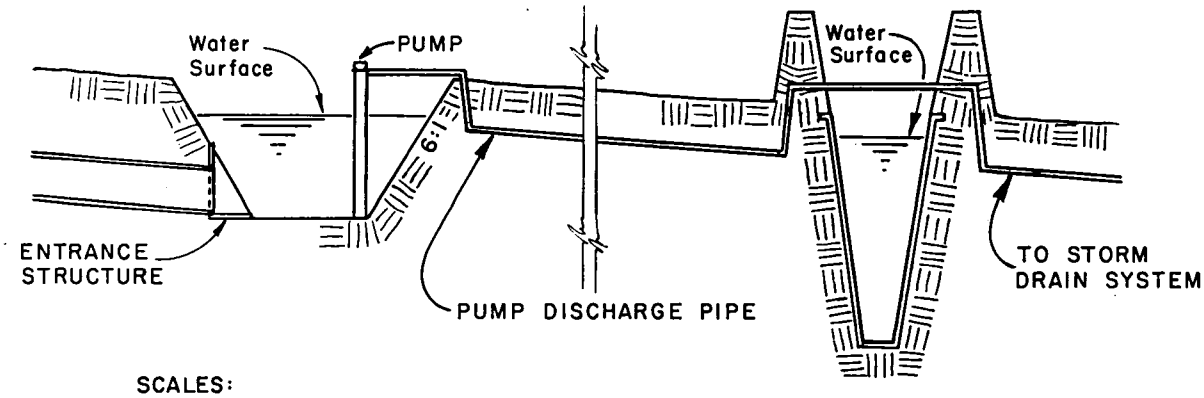
BOTTOM	WIDTH	"W"	VARIES	45	FT.	TO	425 FT.
BOTTOM	LENGTH	"L"	VARIES	90	FT.	TO	850 FT.
TOTAL	DEPTH	"D"	VARIES	7	FT.	TO	12 FT.
WATER	DEPTH	"d"	VARIES	5	FT.	TO	7 FT.

TYPICAL FUTURE RETENTION BASIN FOR AREAS ABOVE C.A.P. CANAL

FIGURE 25



PLAN



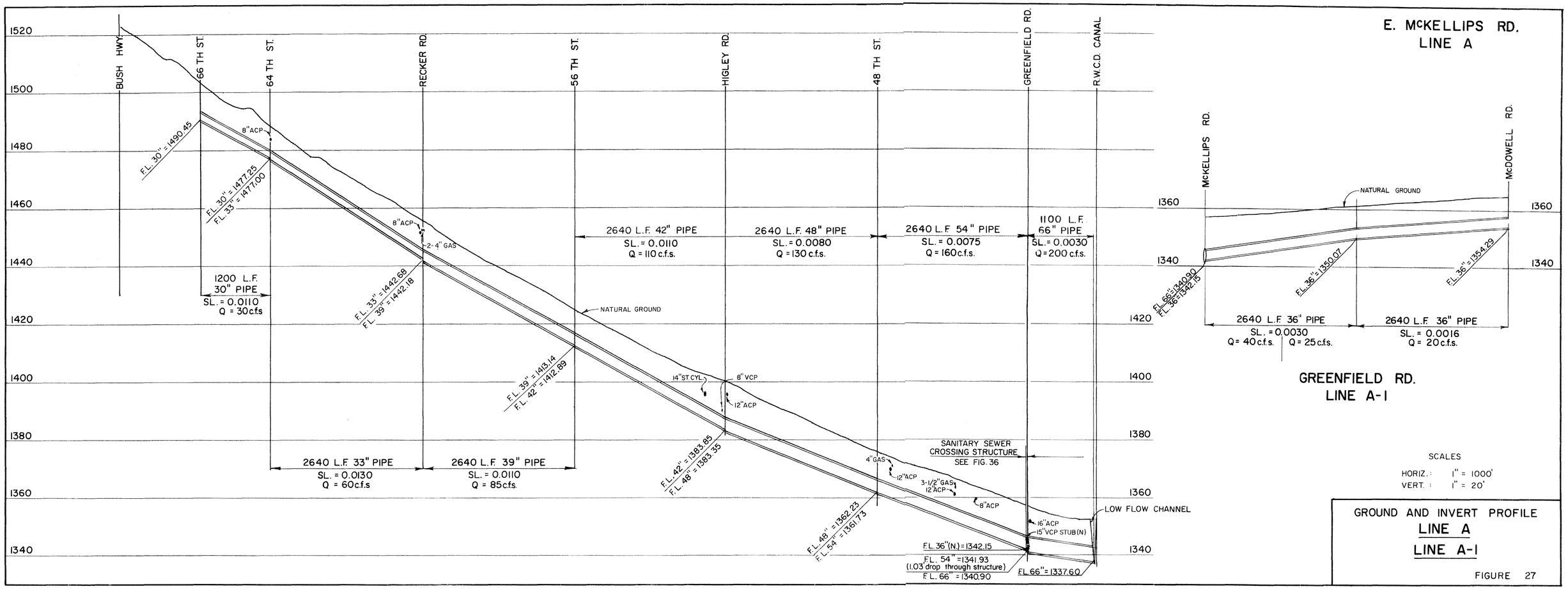
SCALES:
Horiz.: 1" = 150'
Vert.: 1" = 15'

SECTION

NOTE:
Orientation of basin to proposed C.A.P. Canal may be altered to make best use of available land.

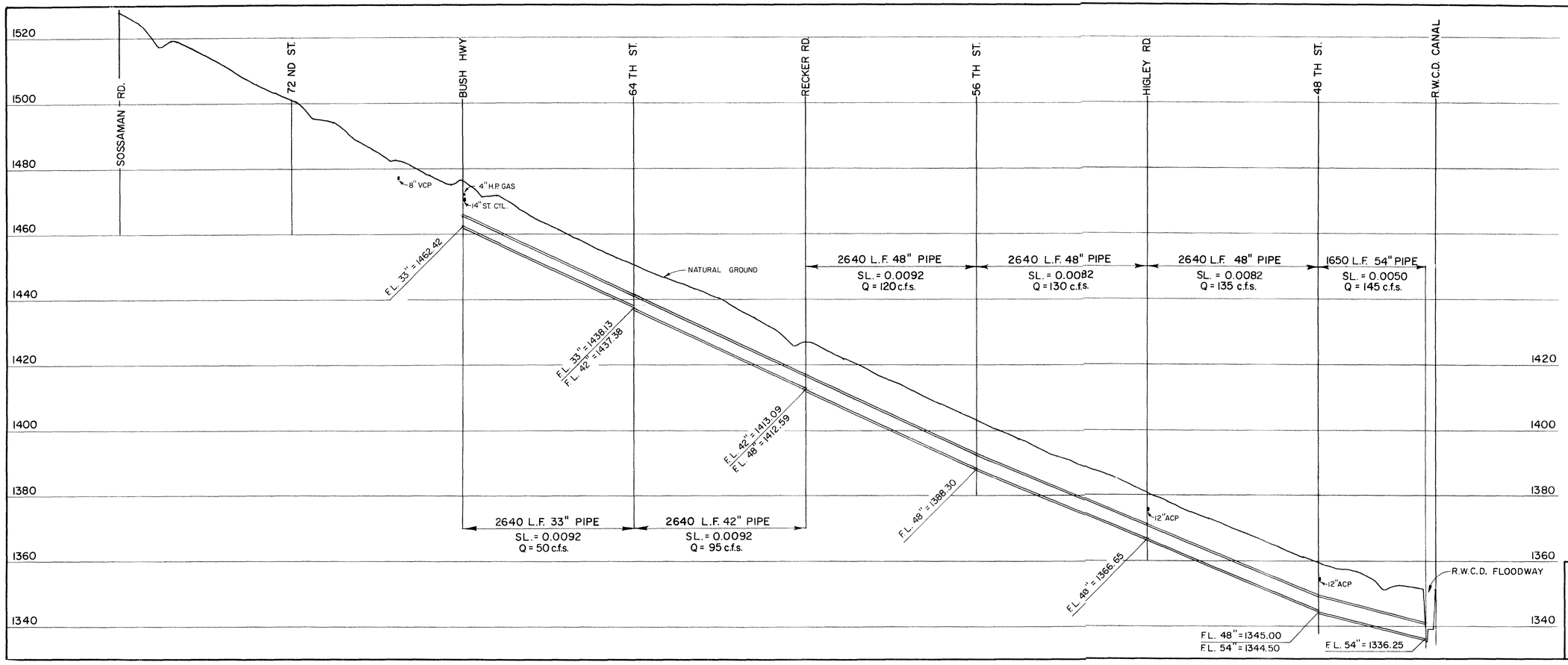
TYPICAL RETENTION BASIN DISCHARGE SYSTEM FOR AREAS ABOVE C.A.P. CANAL

FIGURE 26



GROUND AND INVERT PROFILE
LINE A
LINE A-1

FIGURE 27



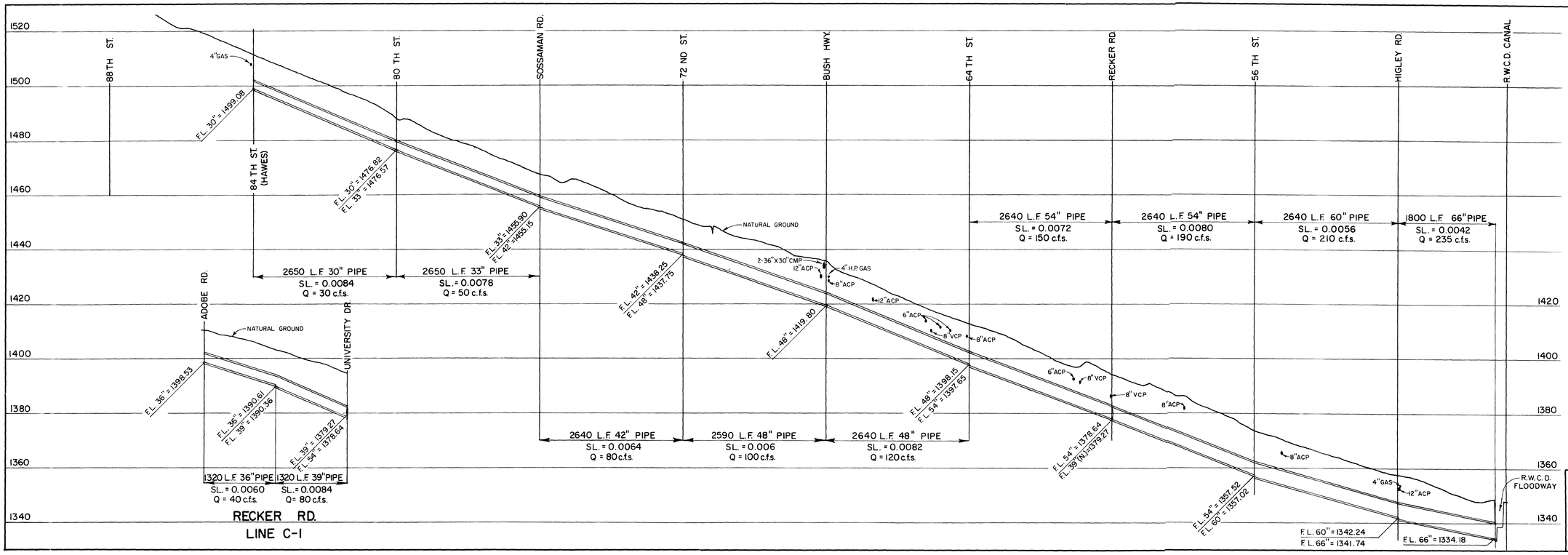
SCALES

HORIZ. : 1" = 1000'
VERT. : 1" = 20'

GROUND AND INVERT PROFILE

LINE B

FIGURE 28


E. UNIVERSITY DR.
LINE C
1520
1500
1480
1460
1440
1420
1400
1380
1360
1340
88 TH ST.
84 TH ST. (HAWES)
80 TH ST.
SOSSAMAN RD.
72 ND ST.
BUSH HWY.
64 TH ST.
RECKER RD.
56 TH ST.
HIGLEY RD.
R.W.C.D. CANAL
4"GAS
F.L. 30" = 1499.08
F.L. 30" = 1476.82
F.L. 33" = 1476.57
F.L. 33" = 1459.90
F.L. 42" = 1458.16
F.L. 42" = 1438.25
F.L. 48" = 1437.75
F.L. 48" = 1419.80
F.L. 48" = 1398.15
F.L. 54" = 1397.65
F.L. 54" = 1378.64
F.L. 39"(N) = 1379.27
F.L. 54" = 1357.52
F.L. 60" = 1357.02
F.L. 60" = 1342.24
F.L. 66" = 1341.74
F.L. 66" = 1334.18
NATURAL GROUND
2-36"X30"CMP
12"ACP
4" H.P. GAS
8"ACP
12"ACP
6"ACP
8"VCP
8"ACP
6"ACP
8"VCP
8"VCP
8"ACP
8"ACP
4"GAS
12"ACP
2640 L.F 54" PIPE
SL. = 0.0072
Q = 150 c.f.s.
2640 L.F 54" PIPE
SL. = 0.0080
Q = 190 c.f.s.
2640 L.F. 60" PIPE
SL. = 0.0056
Q = 210 c.f.s.
1800 L.F 66" PIPE
SL. = 0.0042
Q = 235 c.f.s.
2650 L.F 30" PIPE
SL. = 0.0084
Q = 30 c.f.s.
2650 L.F. 33" PIPE
SL. = 0.0078
Q = 50 c.f.s.
2640 L.F 42" PIPE
SL. = 0.0064
Q = 80 c.f.s.
2590 L.F. 48" PIPE
SL. = 0.006
Q = 100 c.f.s.
2640 L.F 48" PIPE
SL. = 0.0082
Q = 120 c.f.s.
ADOBE RD.
UNIVERSITY DR.
NATURAL GROUND
F.L. 36" = 1398.53
F.L. 36" = 1390.61
F.L. 39" = 1390.36
F.L. 39" = 1379.27
F.L. 54" = 1378.64
1320 L.F 36" PIPE
SL. = 0.0060
Q = 40 c.f.s.
1320 L.F 39" PIPE
SL. = 0.0084
Q = 80 c.f.s.
RECKER RD.
LINE C-1
R.W.C.D. FLOODWAY
SCALES
HORIZ. : 1" = 1000'
VERT. : 1" = 20'
GROUND AND INVERT PROFILE
LINE C
LINE C-1
FIGURE 29

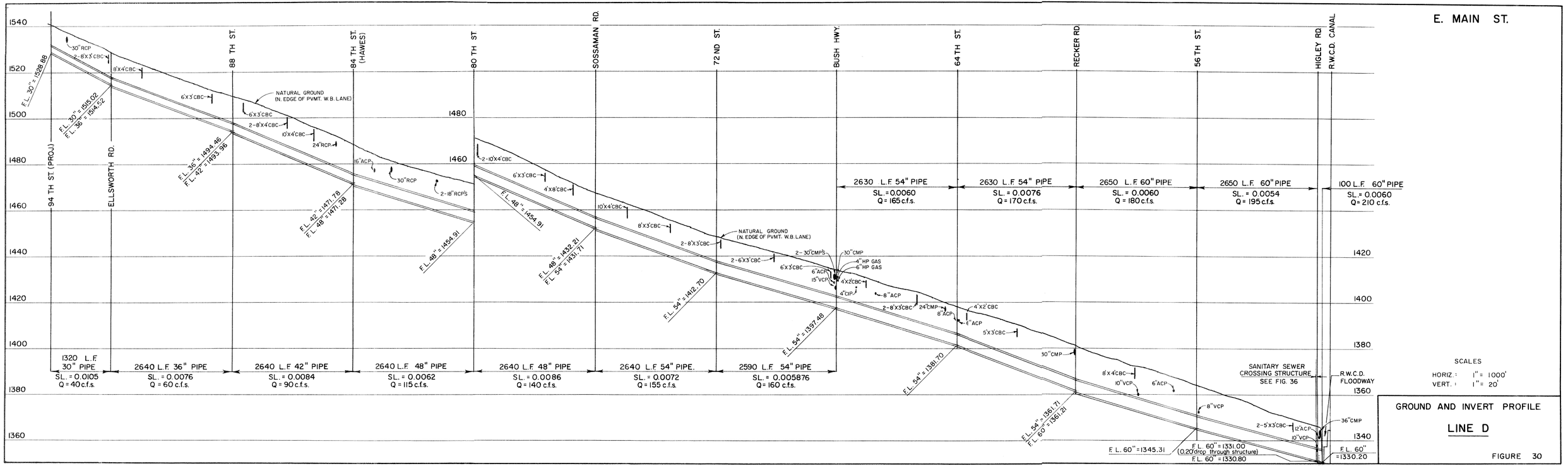
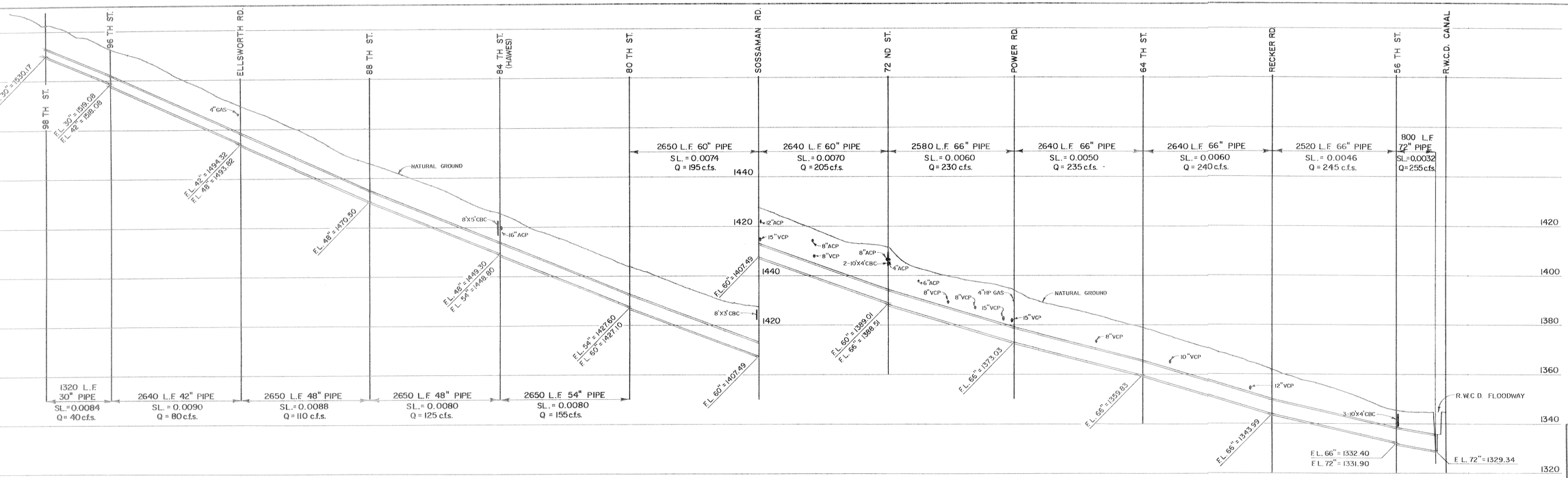

E. MAIN ST.
94 TH ST. (PROJ)
ELLSWORTH RD.
88 TH ST.
84 TH ST. (HAWES)
80 TH ST
SOSSAMAN RD.
72 ND ST.
BUSH HWY.
64 TH ST.
RECKER RD.
56 TH ST.
HIGLEY RD.
R.W.C.D. CANAL
1540
1520
1500
1480
1460
1440
1420
1400
1380
1360
1340
1320 L.F 30" PIPE
SL. = 0.0105
Q = 40 c.f.s.
2640 L.F. 36" PIPE
SL. = 0.0076
Q = 60 c.f.s.
2640 L.F 42" PIPE
SL. = 0.0084
Q = 90 c.f.s.
2640 L.F 48" PIPE
SL. = 0.0062
Q = 115 c.f.s.
2640 L.F 48" PIPE
SL. = 0.0086
Q = 140 c.f.s.
2640 L.F 54" PIPE.
SL. = 0.0072
Q = 155 c.f.s.
2590 L.F 54" PIPE
SL. = 0.005876
Q = 160 c.f.s.
2630 L.F 54" PIPE
SL. = 0.0060
Q = 165 c.f.s.
2630 L.F 54" PIPE
SL. = 0.0076
Q = 170 c.f.s.
2650 L.F 60" PIPE
SL. = 0.0060
Q = 180 c.f.s.
2650 L.F 60" PIPE
SL. = 0.0054
Q = 195 c.f.s.
100 L.F 60" PIPE
SL. = 0.0060
Q = 210 c.f.s.
F.L. 30" = 1528.88
F.L. 30" = 1515.02
F.L. 36" = 1514.32
F.L. 36" = 1494.46
F.L. 42" = 1493.96
F.L. 42" = 1471.78
F.L. 48" = 1471.28
F.L. 48" = 1454.91
F.L. 48" = 1454.91
F.L. 48" = 1432.21
F.L. 54" = 1431.71
F.L. 54" = 1412.70
F.L. 54" = 1397.48
F.L. 54" = 1381.70
F.L. 54" = 1361.71
F.L. 60" = 1361.21
F.L. 60" = 1345.31
F.L. 60" = 1331.00
(0.20' drop through structure)
F.L. 60" = 1330.80
F.L. 60" = 1330.20
30" RCP
2-8'X3' CBC
8'X4' CBC
6'X3' CBC
NATURAL GROUND
(N. EDGE OF PVMT. W.B. LANE)
6'X3' CBC
2-8'X4' CBC
10'X4' CBC
24" RCP
16" ACP
30" RCP
2-18" RCP'S
2-10'X4' CBC
6'X3' CBC
4'X8' CBC
10'X4' CBC
8'X3' CBC
2-8'X3' CBC
NATURAL GROUND
(N. EDGE OF PVMT. W.B. LANE)
2-6'X3' CBC
6'X3' CBC
2-30" CMP'S
30" CMP
4" HP GAS
6" HP GAS
6" ACP
15" VCP
4'X2' CBC
4" CIP
8" ACP
2-8'X3' CBC
24" CMP
8" ACP
4'X2' CBC
4" ACP
5'X3' CBC
30" CMP
8'X4' CBC
10" VCP
6" ACP
8" VCP
2-5'X3' CBC
12" ACP
10" VCP
36" CMP
SANITARY SEWER
CROSSING STRUCTURE
SEE FIG. 36
R.W.C.D.
FLOODWAY
SCALES
HORIZ.: 1" = 1000'
VERT.: 1" = 20'
GROUND AND INVERT PROFILE
LINE D

FIGURE 30



SCALES

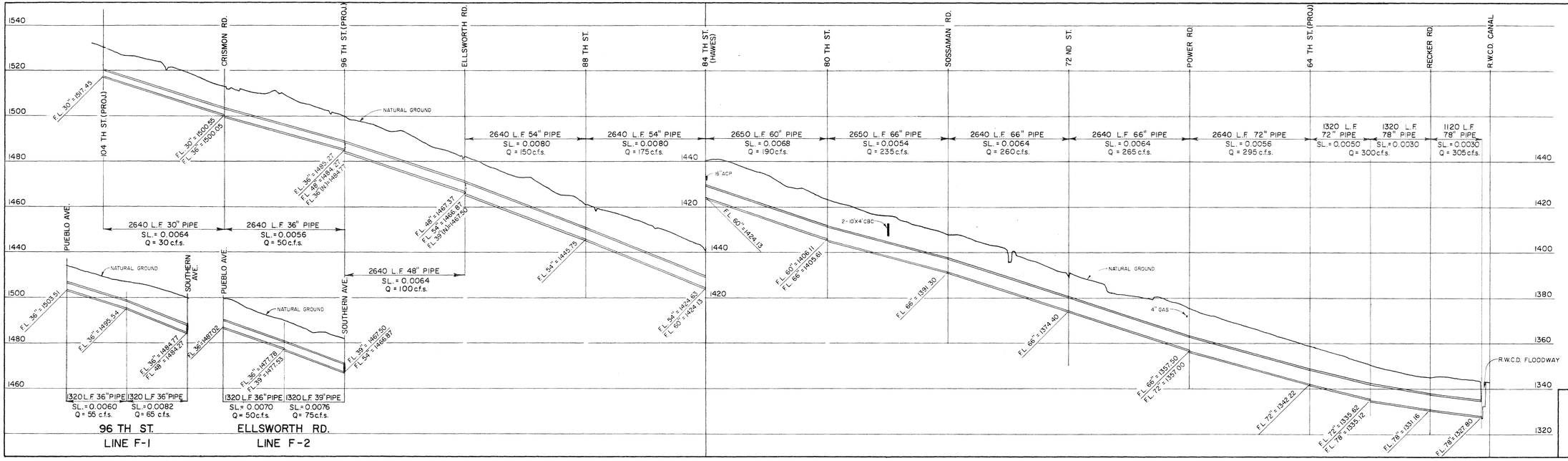
HORIZ. : 1" = 1000'

VERT. : 1" = 20'

GROUND AND INVERT PROFILE

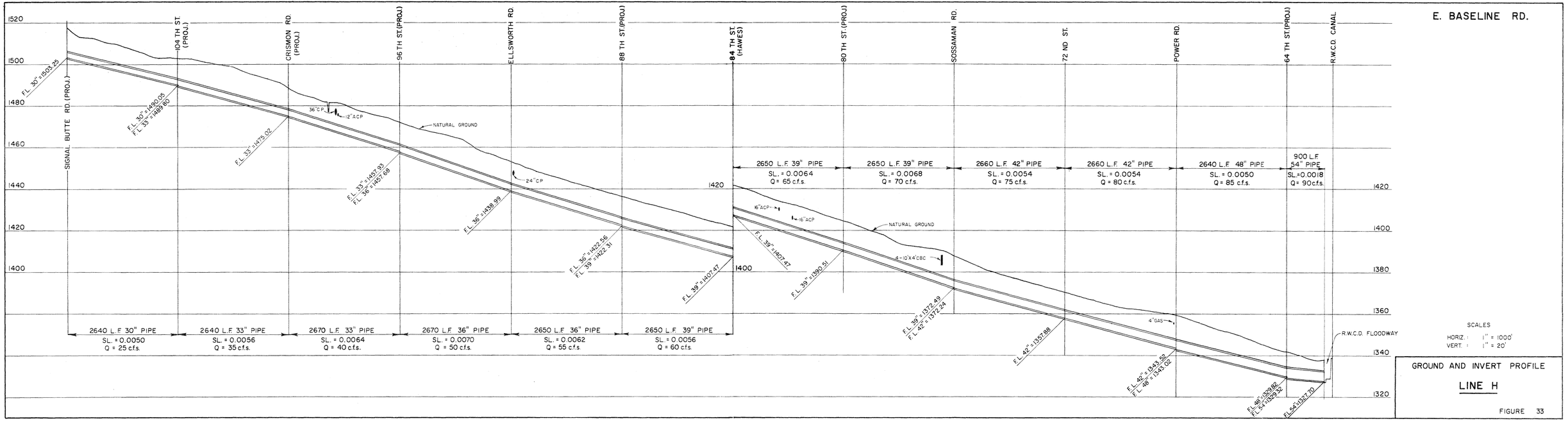
LINE E

FIGURE 31



GROUND AND INVERT PROFILE
LINE F
LINE F-1
LINE F-2

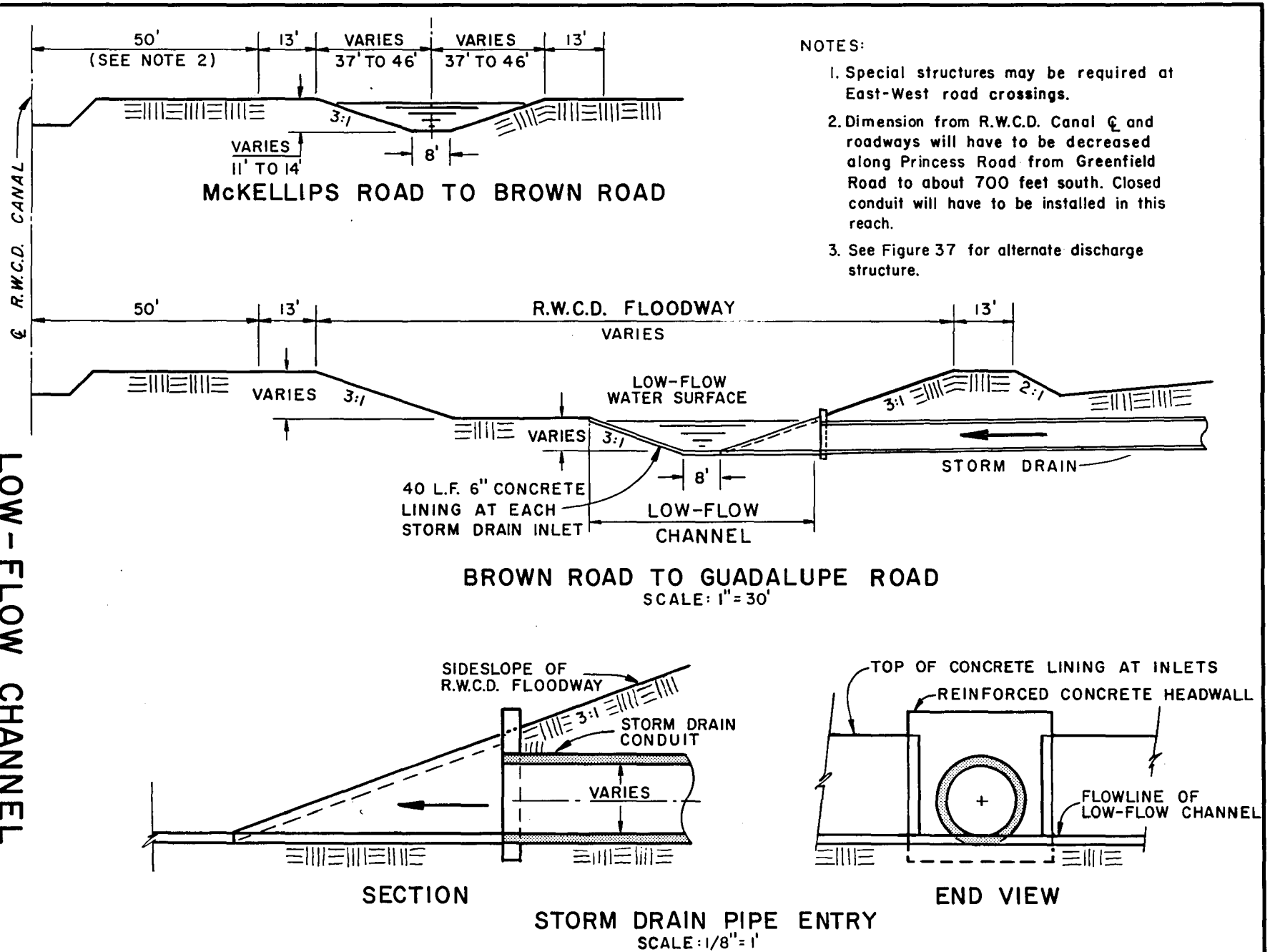
FIGURE 32



GROUND AND INVERT PROFILE

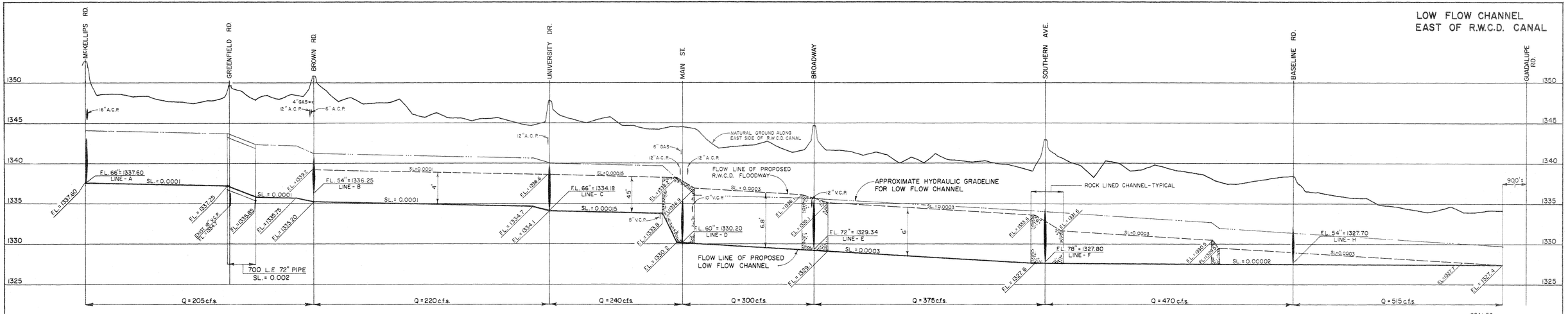
LINE H

FIGURE 33



LOW-FLOW CHANNEL
IN R.W.C.D. FLOODWAY

FIGURE 34



SCALES

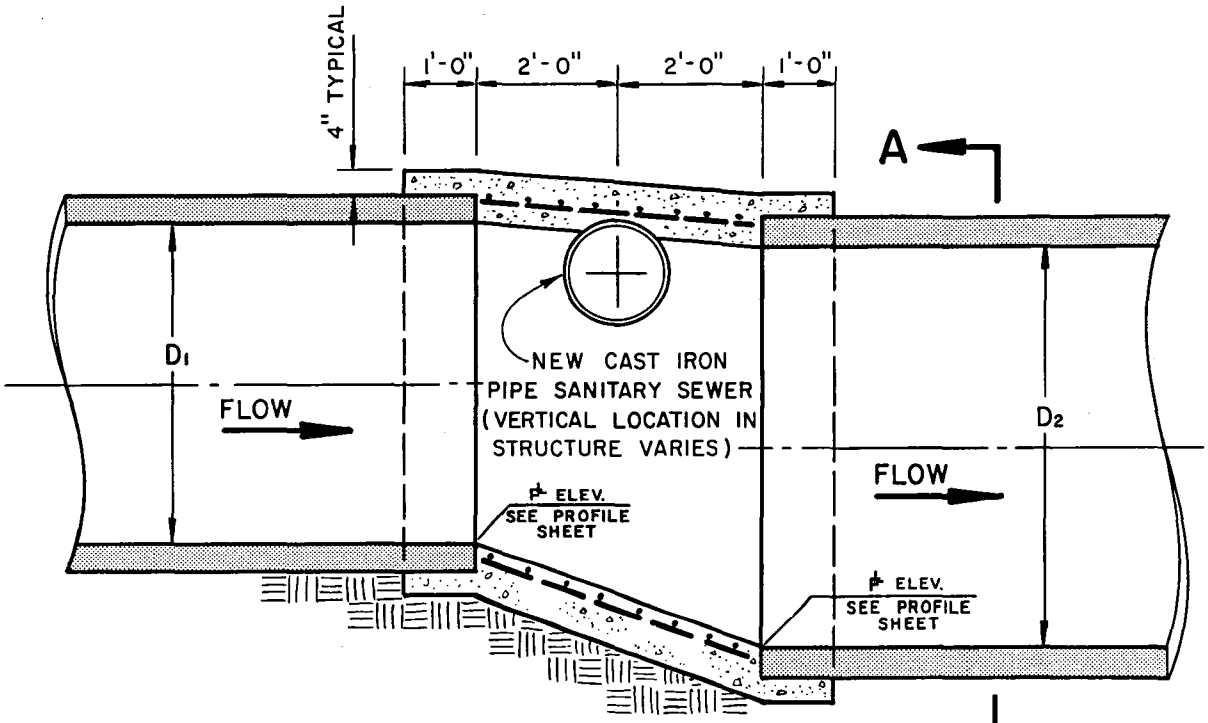
HORIZ. : 1" = 1000'
VERT. : 1" = 5'

NOTES:

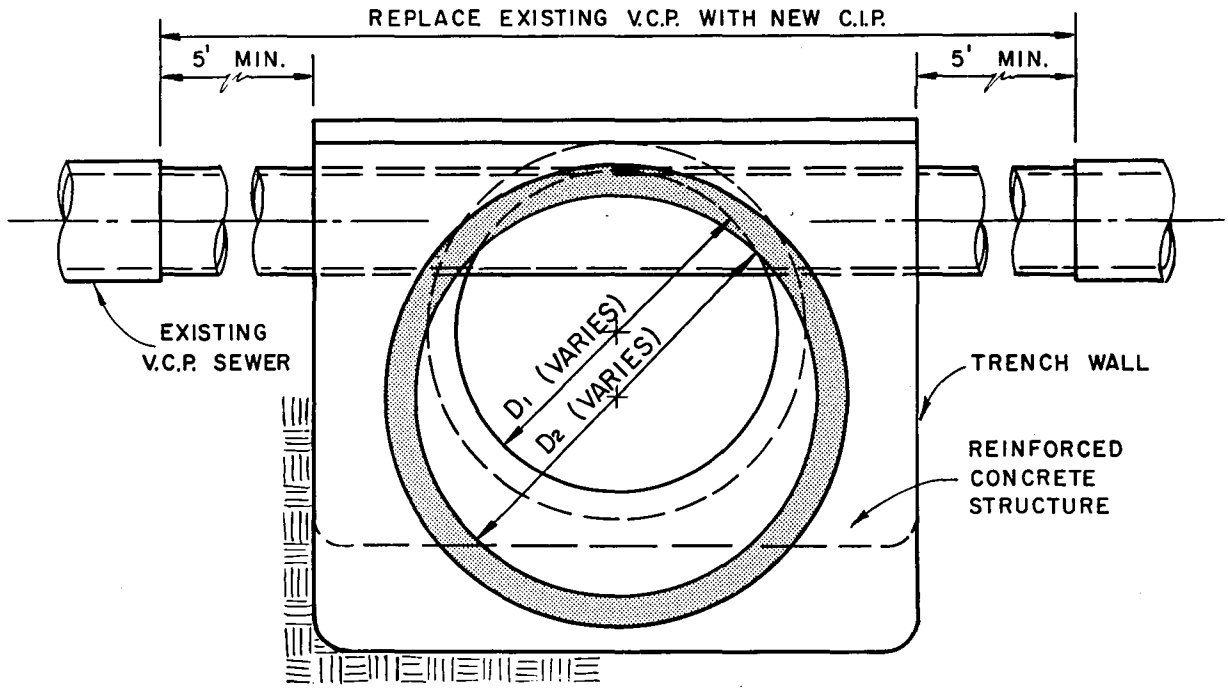
1. SEE FIGURE 37 FOR ALTERNATE DISCHARGE SYSTEM.
2. FLOW LINE FOR PROPOSED R.W.C.D. FLOODWAY RAISED 1.65' = TO REFLECT DIFFERENCE IN DATUM.
3. STRUCTURAL SUPPORTS WILL BE REQUIRED FOR THE 2 SANITARY SEWER CROSSINGS SHOWN.

PROFILE
R.W.C.D. FLOODWAY
LOW FLOW CHANNEL

FIGURE 35



LONGITUDINAL SECTION
SCALE : 3/8" = 1'-0"



SECTION A-A
SCALE : 3/8" = 1'-0"

SANITARY SEWER CROSSING STRUCTURE

FIGURE 36

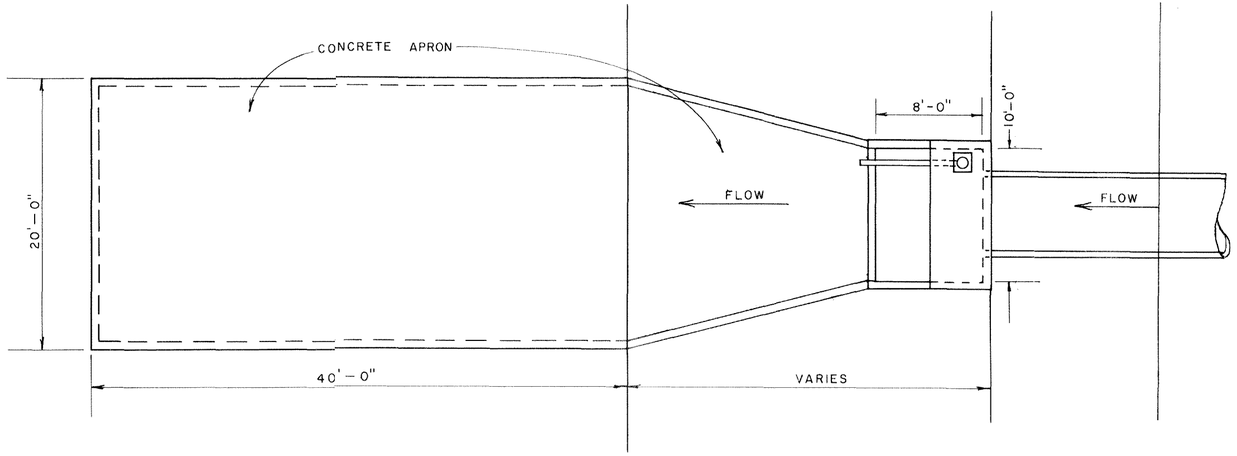
GENERAL NOTES

1. The alternate plan is presented to bring storm drain conduits into the invert of the proposed R.W.C.D. Floodway, without the construction of the low-flow channel.

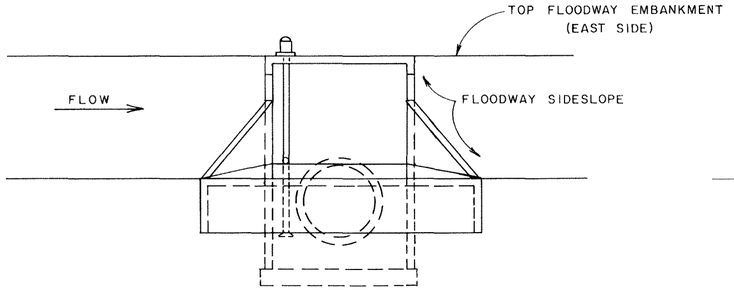
2. The alternate plan of storm drain discharge would also require a retention basin at Mc Kellips and Greenfield Roads. The basin would be pumped out into the R.W.C.D. Canal.

3. Structures similar to the one shown would be required for storm drains at the R.W.C.D. Floodway and the following locations:

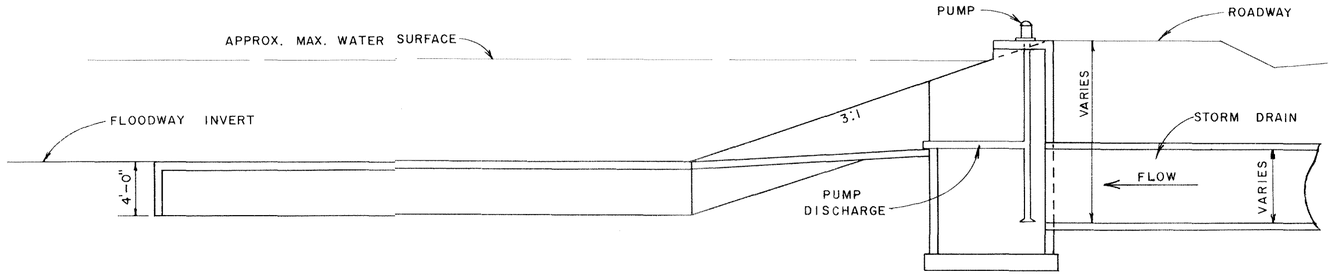
   a. Brown Road
   b. University Drive
   c. Main Street
   d. Broadway
   e. Southern Avenue
   f. Baseline Road



PLAN



END VIEW



ELEVATION

TYPICAL ALTERNATE DISCHARGE STRUCTURE AT R.W.C.D. FLOODWAY

FIGURE 37

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Area Number 1 (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 9 acres

Required Volume = CIA = (0.95) (1.4/12) (9) = 1.0 acre-feet

Total Depth 7 feet

Water Depth 5 feet

Basin Length = Width (2):

$$2\,w^2 = \frac{(1.0)\ (43{,}560)}{5}$$

$$w = 66 \text{ ft.}$$

Sideslopes 6:1

Bottom of Basin	45	ft.	90	ft.
Top of Basin	129	ft.	174	ft.
Top (including roadways)	159	ft.	204	ft.

Storage Volume Furnished:

$$5\ \frac{(75)\ (120)}{43{,}560} = 1.0 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(159)\ (204)}{43{,}560} = 0.74 \text{ acres}$$

Total excavation 3,500 cu.yds.

Chain Link Fence 730 lin. ft.

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Area Number 2 (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 37 acres

Required Volume = CIA = (0.95) (1.4/12) (37) = 4.1 acre-feet

Total Depth 10 feet

Water Depth 5 feet

Basin Length = Width (2):

$$2\ w^2 = \frac{(4.1)\ (43{,}560)}{5}$$

$$w = 137 \text{ ft.}$$

Sideslopes 6:1

Bottom of Basin	115	ft.	230	ft.
Top of Basin	235	ft.	350	ft.
Top (including roadways)	265	ft.	380	ft.

Storage Volume Furnished:

$$5\ \frac{(145)\ (260)}{43{,}560} = 4.3 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(265)\ (380)}{43{,}560} = 2.31 \text{ acres}$$

Total excavation 20,100 cu.yds.

Chain Link Fence 1,290 lin. ft.

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Area Number 3 (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 42 acres

Required Volume = CIA = (0.95) (1.4/12) (42) = 4.7 acre-feet

Total Depth 10 feet

Water Depth 5 feet

Basin Length = Width (2):

$$2\ w^2 = \frac{(4.7)\ (43{,}560)}{5}$$

$$w = 143 \text{ ft.}$$

Sideslopes 6:1

Bottom of Basin	125	ft.	250	ft.
Top of Basin	245	ft.	370	ft.
Top (including roadways)	275	ft.	400	ft.

Storage Volume Furnished:

$$5\ \frac{(155)\ (280)}{43{,}560} = 5.0 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(275)\ (400)}{43{,}560} = 2.53 \text{ acres}$$

Total excavation 22,600 cu.yds.

Chain Link Fence 1,350 lin. ft.

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Area Number 4 (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 98 acres

Required Volume = CIA = (0.95) (1.4/12) (98) = 10.9 acre-feet

Total Depth 12 feet

Water Depth 6 feet

Basin Length = Width (2):

$$2\ w^2 = \frac{(10.9)\ (43{,}560)}{6}$$

$$w = 199 \text{ ft.}$$

Sideslopes 6:1

Bottom of Basin	175	ft.	350	ft.
Top of Basin	319	ft.	494	ft.
Top (including roadways)	349	ft.	524	ft.

Storage Volume Furnished:

$$6\ \frac{(211)\ (386)}{43{,}560} = 11.2 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(349)\ (524)}{43{,}560} = 4.19 \text{ acres}$$

Total excavation 48,600 cu.yds.

Chain Link Fence 1,750 lin. ft.

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Area Number 5 (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 71 acres

Required Volume = CIA = (0.95) (1.4/12) (71) = 7.9 acre-feet

Total Depth 11 feet

Water Depth 5 feet

Basin Length = Width (2):

$$2\ w^2 = \frac{(7.9)\ (43{,}560)}{5}$$

$$w = 185 \text{ ft.}$$

Sideslopes 6:1

Bottom of Basin	165	ft.	330	ft.
Top of Basin	297	ft.	462	ft.
Top (including roadways)	327	ft.	492	ft.

Storage Volume Furnished:

$$5 \quad \frac{(195)\ (360)}{43{,}560} = 8.1 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(327)\ (492)}{43{,}560} = 3.69 \text{ acres}$$

Total excavation 39,100 cu.yds.

Chain Link Fence 1,640 lin. ft.

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Area Number 5a (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 22 acres

Required Volume = CIA = (0.95) (1.4/12) (22) = 2.4 acre-feet

Total Depth 7 feet

Water Depth 5 feet

Basin Length = Width (2):

$$2\ w^2 = \frac{(2.4)\ (43{,}560)}{5}$$

$$w = 102 \text{ ft.}$$

Sideslopes 6:1

Bottom of Basin	85	ft.	170	ft.
Top of Basin	169	ft.	254	ft.
Top (including roadways)	199	ft.	284	ft.

Storage Volume Furnished:

$$5\ \frac{(115)\ (200)}{43{,}560} = 2.6 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(199)\ (284)}{43{,}560} = 1.30 \text{ acres}$$

Total excavation 7,500 cu.yds.

Chain Link Fence 970 lin. ft.

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Area Number 6 (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 195 acres

Required Volume = CIA = (0.95) (1.4/12) (195) = 21.6 acre-feet

Total Depth 12 feet

Water Depth 6 feet

Basin Length = Width (2):

$$2\ w^2 = \frac{(21.6)\ (43{,}560)}{6}$$

$$w = 280 \text{ ft.}$$

Sideslopes 6:1

Bottom of Basin	255	ft.	510	ft.
Top of Basin	399	ft.	654	ft.
Top (including roadways)	429	ft.	684	ft.

Storage Volume Furnished:

$$6 \quad \frac{(291)\ (546)}{43{,}560} = 21.9 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(429)\ (684)}{43{,}560} = 6.74 \text{ acres}$$

Total excavation 86,900 cu.yds.

Chain Link Fence 2,230 lin. ft.

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Line Designation 7 (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 315 acres

Required Volume = CIA = (0.95) (1.4/12) (315) = 34.9 acre-feet

Total Depth 12 feet

Water Depth 7 feet

Basin Length = Width (2):

$$2\ w^2 = \frac{(34.9)\ (43{,}560)}{7}$$

$$w = 330 \text{ ft.}$$

Bottom of Basin	300	ft.	600	ft.
Top of Basin	444	ft.	744	ft.
Top (including roadways)	474	ft.	774	ft.

Storage Volume Furnished:

$$7\ \frac{(342)\ (642)}{43{,}560} = 35.2 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(474)\ (774)}{43{,}560} = 8.42 \text{ acres}$$

Total excavation 113,400 cu.yds.

Chain Link Fence 2,500 lin. ft.

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Area Number 8 (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 599 acres

Required Volume = CIA = (0.95) (1.4/12) (599) = 66.4 acre-feet

Total Depth 12 feet

Water Depth 7 feet

Basin Length = Width (2):

$$2\ w^2 = \frac{(66.4)\ (43{,}560)}{7}$$

$$w = 454 \text{ ft.}$$

Sideslopes 6:1

Bottom of Basin	425	ft.	850	ft.
Top of Basin	569	ft.	994	ft.
Top (including roadways)	599	ft.	1024	ft.

Storage Volume Furnished:

$$7\ \frac{(467)\ (892)}{43{,}560} = 66.9 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(574)\ (974)}{43{,}560} = 14.08 \text{ acres}$$

Total excavation 206,000 cu.yds.

Chain Link Fence 3,250 lin. ft.

RETENTION BASIN COMPUTATIONS

Location Area above C.A.P. Canal

Area Number 9 (See Fig. 10)

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 19 acres

Required Volume = CIA = (0.95) (1.4/12) (19) = 2.1 acre-feet

Total Depth 7 feet

Water Depth 5 feet

Basin Length = Width (2):

$$2\ w^2 = \frac{(2.1)\ (43{,}560)}{5}$$

$$w = 96 \text{ ft.}$$

Sideslopes 6:1

Bottom of Basin	80	ft.	160	ft.
Top of Basin	164	ft.	244	ft.
Top (including roadways)	194	ft.	274	ft.

Storage Volume Furnished:

$$5 \quad \frac{(110)\ (190)}{43{,}560} = 2.4 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(194)\ (274)}{43{,}560} = 1.22 \text{ acres}$$

Total excavation 6,900 cu.yds.

Chain Link Fence 940 lin. ft.

RETENTION BASIN COMPUTATIONS

Location McKellips Road at RWCD Canal (Required only if alternate discharge system is used.)

Line Designation A

Design Recurrence Interval 2-Year Interior Areas, 10-Year Arterials

Total Impervious Area 295 acres

Required Volume = CIA = (0.95) (1.4/12) (295) = 32.7 acre-feet

Total Depth 16 feet

Water Depth 10 feet

Basin Length = Width (2):

$$2\,w^2 = \frac{(32.7)\ (43{,}560)}{10}$$

$$w = 267 \text{ ft.}$$

Bottom of Basin	225 ft.	450 ft.
Top of Basin	417 ft.	642 ft.
Top (including roadways)	447 ft.	672 ft.

Storage Volume Furnished:

$$10\,\frac{(285)\ (510)}{43{,}560} = 33.4 \text{ ac.-ft.}$$

Surface Area Required:

$$\frac{(447)\ (672)}{43{,}560} = 6.90 \text{ acres}$$

Total excavation 109,320 cu.yds.

Chain Link Fence 2,240 lin. ft.

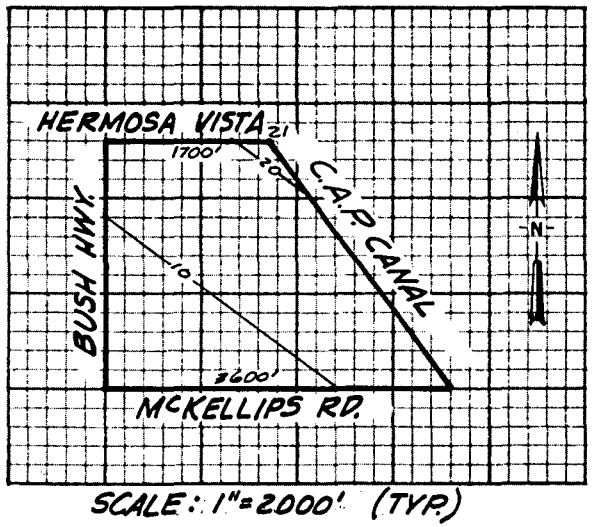
Done by D.N.S.

Date 10/80

Drainage Area A-1

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	152	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	10	0	0	9	1		
Industrial							
Total Acres	162	0			1		

Mean land slope N-S .006 E-W .0125

Flow conveyance 40' Streets

Flow velocity N-S 3.0 ft./sec. min./mile 180 ft./min.

E-W 4 ft./sec. min./mile 240 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	50		.31	2.50	1.0	2.50					2.07	0.6	
20	160		.99	1.80	.997	1.79					1.43	1.42	
21	162		1	1.75	.996	1.74					1.39	1.39	
20	3		3	3.20	1.0	3.20					2.70	8	
													9 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
Comm. = 90%

LINE A

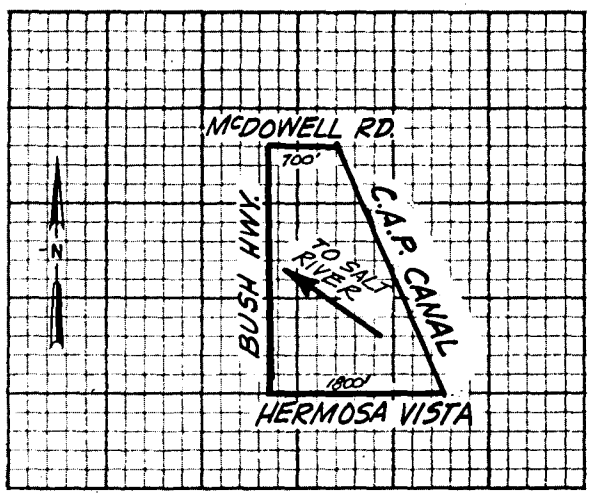
Done by D.N.S.

Date 10/80

Drainage Area A-2

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	79	10	8	4	3		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	79		8		3		

Mean land slope N-S .007 E-W .017

Flow conveyance 40' Streets

Flow velocity N-S 3.25 ft./sec. min./mile 195 ft./min.

E-W 4.7 ft./sec. min./mile 282 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs	
10	79		3	2.50	1.0	2.50					2.07	6		
10	3		3	3.20	1.0	3.20					2.70	8		
													14	Max.

Future Dev. = 84%

Yost and Gardner Engineers

LINE A

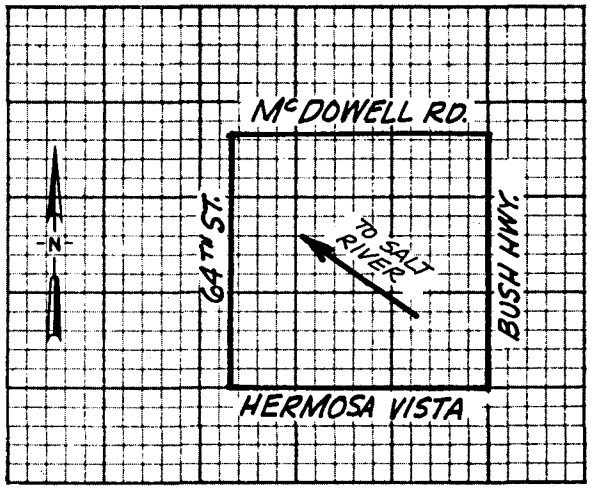
Done by D.N.S.

Date 10/80

Drainage Area A-3

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	2	3	1	2		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		3		2		

Mean land slope N-S .0038 E-W .017

Flow conveyance 40' Streets

Flow velocity N-S 2.4 ft./sec. _____ min./mile 144 ft./min.

E-W 5.0 ft./sec. _____ min./mile 300 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs	
10	160		2	2.50	1.0	2.50					2.07	4		
10	5		5	4.40	1.0	4.40					3.78	19		
													23	Max.

Yost and Gardner Engineers

Future Dev. = 97%

LINE A

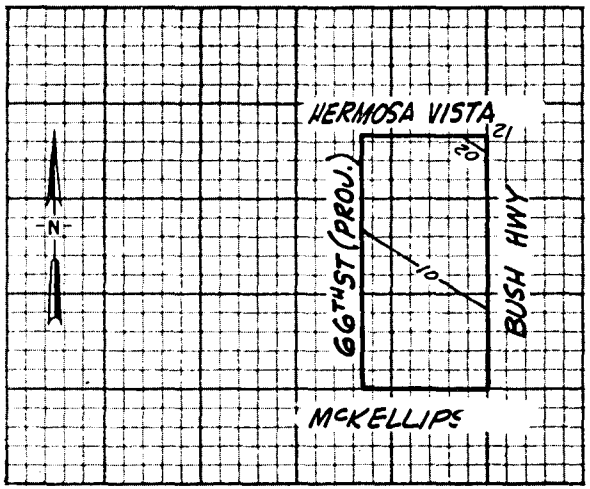
Done by D.N.S.

Date 10/80

Drainage Area A-4

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	60	26	16	15	9		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	20	0	0	0	0		
Industrial							
Total Acres	80		16		9		

Mean land slope N-S .005 E-W .014

Flow conveyance 40' Streets

Flow velocity N-S 2.7 ft./sec. min./mile 162 ft./min.

E-W 4.5 ft./sec. min./mile 270 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	37		4	2.50	1.0	2.50					2.07	8	
20	79		9	1.80	1.0	1.80					1.43	13	
21	80		9	1.75	1.0	1.75					1.40	13	
20	2.5		2.5	3.20	1.0	3.20					2.70	7	
													20 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 40%
Comm. = 100%

LINE A

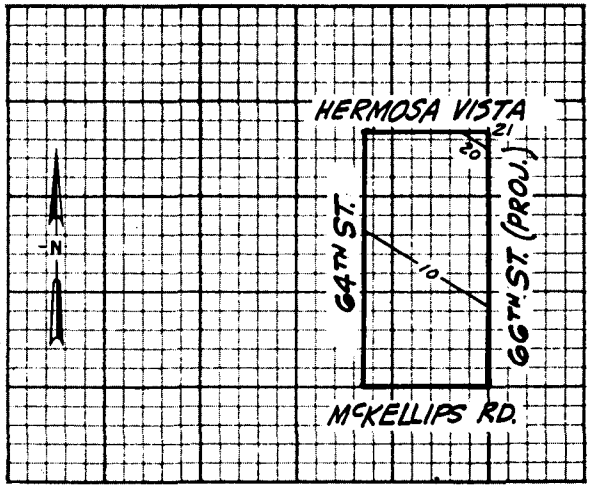
Done by D.N.S.

Date 10/80

Drainage Area A-5

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	80	59	47	23	18		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	80		47		18		

Mean land slope N-S .005 E-W .014

Flow conveyance 40' Streets

Flow velocity N-S 2.7 ft./sec. min./mile 162 ft./min.

E-W 4.5 ft./sec. min./mile 270 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	37		8	2.50	1.0	2.50					2.07	17	
20	79		18	1.80	1.0	1.80					1.44	26	
21	80		18	1.75	1.0	1.75					1.40	25	
20	2.5		2.5	3.20	1.0	3.20					2.70	7	
													33 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 10%

LINE A

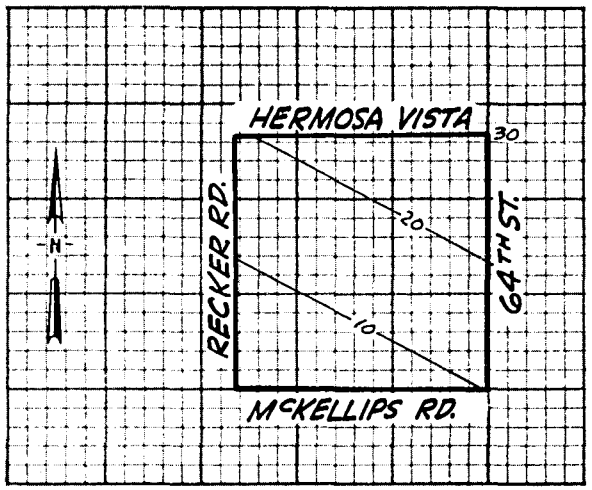
Done by D.N.S.

Date 10/80

Drainage Area A-6

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential	38	35	13	28	11		
Parks & park-like	118	10	12	10	12		
Farmlands, groves							
Commercial	2	0	0	0	0		
Industrial							
Total Acres	158		25		23		

Mean land slope N-S .0035 E-W .013

Flow conveyance 40' Streets

Flow velocity N-S 2.3 ft./sec. min./mile 138 ft./min.

E-W 4.4 ft./sec. min./mile 264 ft./min.

Hydrologic soil group Assumed infiltration cap. in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	42		6	2.50	1.0	2.50					2.07	12	
20	122		18	1.80	.998	1.80					1.44	26	
30	158		23	1.40	.996	1.39					1.07	25	
20	5		5	3.2	1.0	3.20					2.70	14	
													40 Max.

Yost and Gardner Engineers

Future Dev.
High Dens. = 30%
Comm. = 100%

LINE A

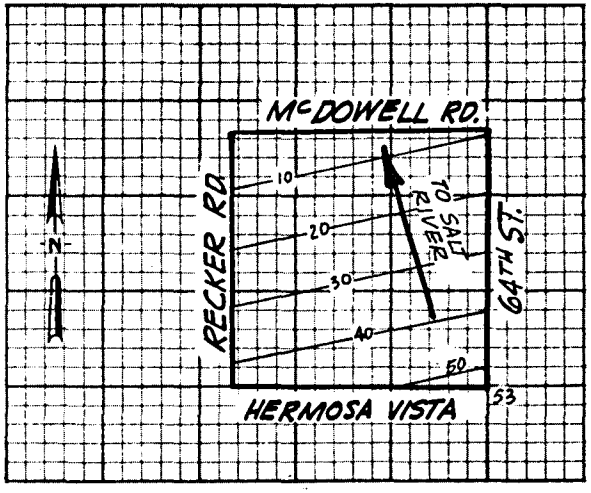
Done by T.B.G.

Date 1/81

Drainage Area A-7

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	57	13	7	5	3		
M.D. Residential	98	18	18	7	11		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	3	0	0				
Industrial							
Total Acres	158		25		14		

Mean land slope N-S .0005 E-W .015

Flow conveyance 40' Streets

Flow velocity N-S 1.0 ft./sec. min./mile 60 ft./min.

E-W 4.7 ft./sec. min./mile 282 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	19		2	2.50	1.0	2.50					2.07	4	
20	56		5	1.80	1.0	1.80					1.44	7	
30	93		8	1.40	1.0	1.40					1.08	9	
40	130		12	1.16	0.998	1.16					0.86	10	
50	156		14	0.98	0.996	0.98					0.70	10-	
53	158		14	0.95	0.996	0.95					0.67	9	
40	5		5	2.06	1.0	2.06					1.67	8	
													18 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 80%
Med. Dens. = 70%
Comm. = 100%

LINE A

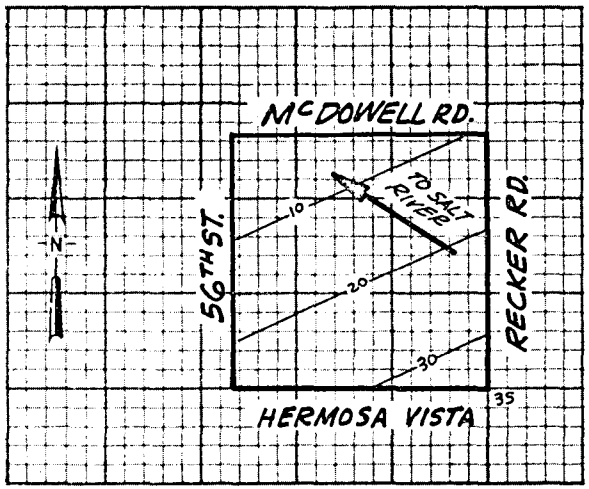
Done by D.N.S.

Date 10/80

Drainage Area A-8

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	120	43	52	17	20		
M.D. Residential	40	0		0			
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		52		20		

Mean land slope N-S .002 E-W .012

Flow conveyance 40' Streets

Flow velocity N-S 1.75 ft./sec. min./mile 105 ft./min.

E-W 4.2 ft./sec. min./mile 252 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	30		4	2.50	1.0	2.50					2.07	8	
20	94		12	1.80	1.0	1.80					1.44	17	
30	152		19	1.40	.997	1.40					1.08	21	
35	160		20	1.27	.996	1.26					.95	19	
30	2		2	2.50	1.0	2.50					2.07	4	
													25 MAx.

Yost and Gardner Engineers

Future Dev.
Low Dens. = 33%
Med. Dens. = 100%

LINE A

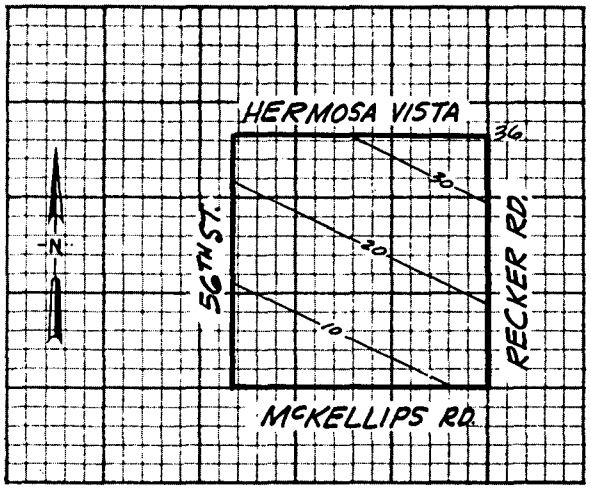
Done by D.N.S.

Date 10/80

Drainage Area A-9

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	111	65	72	25	28		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	11	0	0	14	2		
Industrial	38	6	2	14	5		
Total Acres	160		74		35		

Mean land slope N-S .002 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 1.75 ft./sec. min./mile 105 ft./min.

E-W 3.8 ft./sec. min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	27		6	2.50	1.0	2.50					2.07	12	
20	93		20	1.80	1.0	1.80					1.44	29	
30	149		33	1.40	.997	1.40					1.08	36	
36	160		35	1.24	.996	1.24					0.94	33	
30	5		5	2.50	1.0	2.50					2.07	10	
													46 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens: = 0%
Comm. = 85%
Indust. = 80%

LINE A

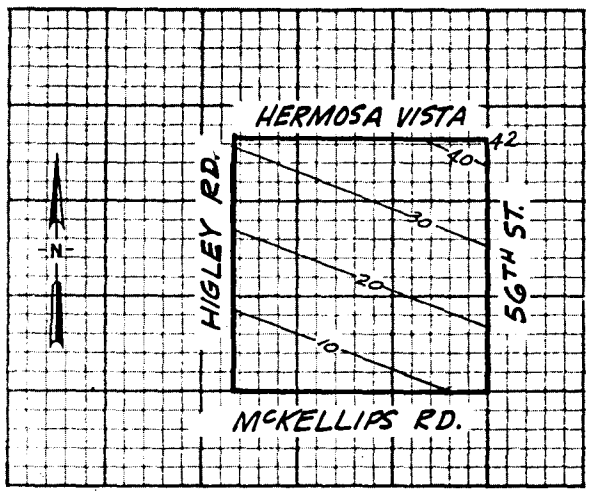
Done by D.N.S.

Date 10/80

Drainage Area A-10

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	98	65	64	25	25		
M.D. Residential							
H.D. Residential	56	5	3	4	2		
Parks & park-like							
Farmlands, groves							
Commercial	6	0	0	81	5		
Industrial							
Total Acres	160		67		30		

Mean land slope N-S .0013 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 1.4 ft./sec. min./mile 84 ft./min.

E-W 3.8 ft./sec. min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	22		4	2.50	1.0	2.50					2.07	8	
20	72		14	1.80	1.0	1.80					1.44	20	
30	123		23	1.40	1.0	1.40					1.08	25	
40	158		30	1.16	.996	1.16					0.86	26	
42	160		30	1.12	.996	1.12					0.83	25	
40	5		5	2.06	1.0	2.06					1.67	8	
													34 Max.

Yost and Gardner Engineers

Future Dev.
Low Dens. = 0%
High Dens. = 90%
Comm. = 10%

LINE A

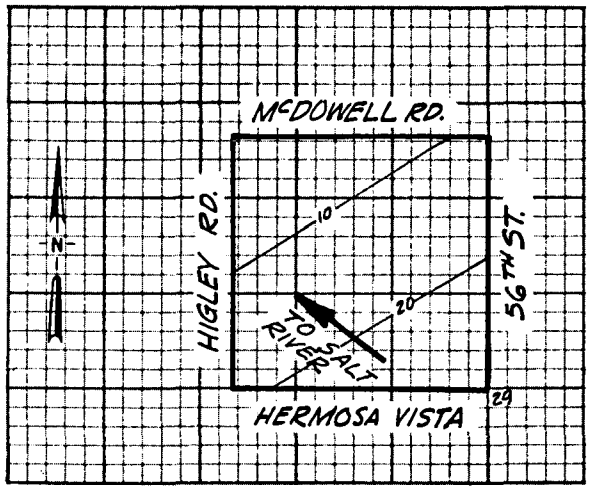
Done by D.N.S.

Date 10/80

Drainage Area A-11

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	65	104	25	40		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		104		40		

Mean land slope N-S .004 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 2.4 ft./sec. _____ min./mile 144 ft./min.

E-W 3.8 ft./sec. _____ min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	38		10	2.50	1.0	2.50					2.07	21	
20	125		31	1.80	1.0	1.80					1.44	45	
29	160		40	1.43	.996	1.42					1.10	44	
20	5		5	3.20	1.0	3.20					2.70	14	
													59 Max.

Future Dev. = 0%

Yost and Gardner Engineers

LINE A

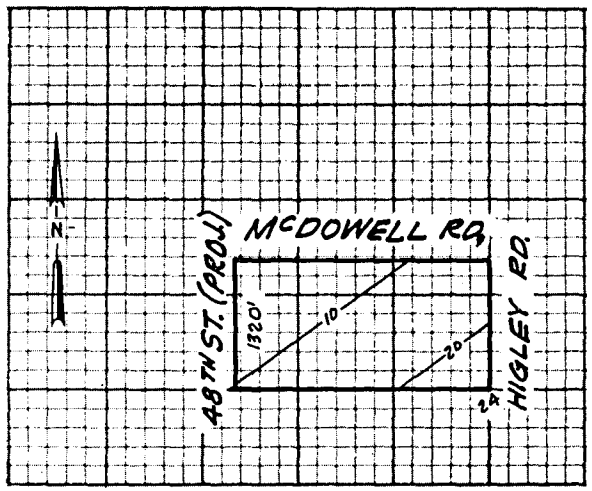
Done by T.B.G.

Date 2/81

Drainage Area A-12

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial	80	6	5	14	11		
Total Acres	80		5		11		

Mean land slope N-S .0030 E-W .0064

Flow conveyance 40' Streets

Flow velocity N-S 2.15 ft./sec. min./mile 129 ft./min.

E-W 3.1 ft./sec. min./mile 186 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	28		4	2.50	1.0	2.50					2.07	8	
20	72		10	1.80	1.0	1.80					1.44	14	
24	80		10	1.75	1.0	1.75					1.40	14	
20	1		1	3.20	1.0	3.20					2.70	3	
													17 Max.

Yost and Gardner Engineers

Future Dev.: = 80%

LINE A

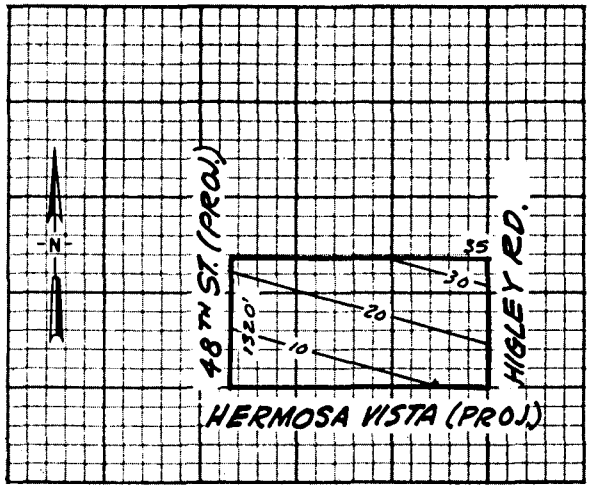
Done by T.B.G.

Date 2/81

Drainage Area A-13

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial	80	6	5	14	11		
Total Acres	80		5		11		

Mean land slope N-S .0010 E-W .0087

Flow conveyance 40' Streets

Flow velocity N-S 1.0 ft./sec. min./mile 60 ft./min.

E-W 3.6 ft./sec. min./mile 216 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	15		2	2.50	1.0	2.50					2.07	4	
20	50		7	1.80	1.0	1.80					1.44	10	
30	77		11	1.40	1.0	1.40					1.08	12	
35	80		11	1.27	1.0	1.27					0.96	11	
30	1		1	2.50	1.0	2.50					2.07	2	
													14 Max.

Yost and Gardner Engineers

80% of area provided for by existing storm drain

LINE A

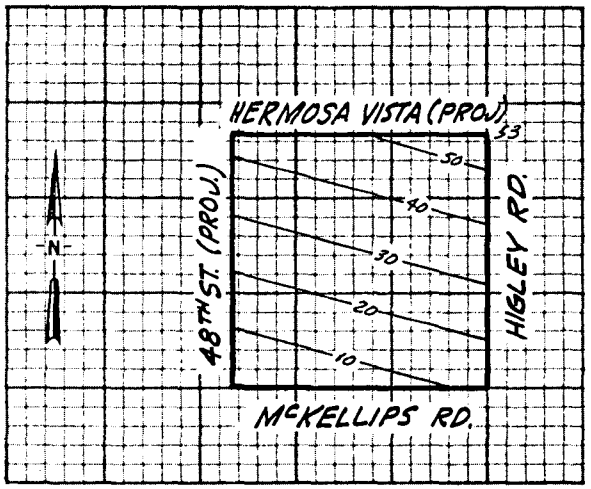
Done by D.N.S.

Date 10/80

Drainage Area A-14

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	19	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	18	0	0	27	5		
Industrial	123	15	18	35	43		
Total Acres	160		18		48		

Mean land slope N-S .0008 E-W .009

Flow conveyance 40 ' Streets

Flow velocity N-S 1.0 ft./sec. _____ min./mile 60 ft./min.

E-W 3.7 ft./sec. _____ min./mile 222 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	15		5	2.50	1.0	2.50					2.07	10	
20	50		15	1.80	1.0	1.80					1.44	22	
30	90		27	1.40	1.0	1.40					1.08	29	
40	130		39	1.16	1.0	1.16					0.86	34	
50	155		47	0.98	1.0	0.98					0.70	33	
40	3		3	2.06	1.0	2.06					1.67	5	
													39 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
Comm. = 70%
Indust. = 50%

LINE A

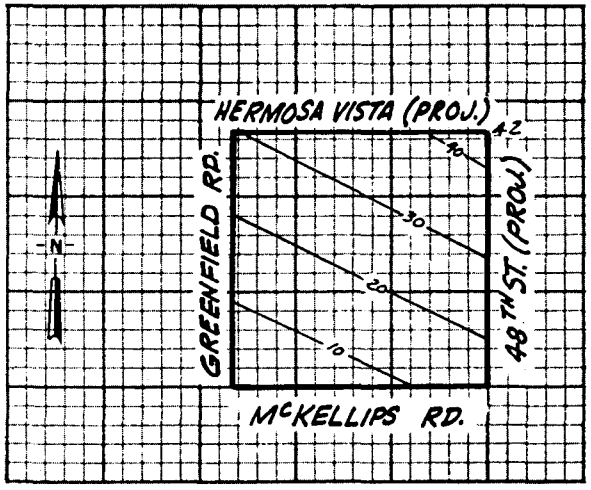
Done by D.N.S.

Date 10/80

Drainage Area A-15

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial	160	15	24	35	56		
Total Acres	160		24		56		

Mean land slope N-S .0015 E-W .0063

Flow conveyance 40' Streets

Flow velocity N-S 1.5 ft./sec. min./mile 90 ft./min.

E-W 3.1 ft./sec. min./mile 186 ft./min.

Hydrologic soil group Assumed infiltration cap. in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	19		7	2.50	1.0	2.50					2.07	14	
20	70		25	1.80	1.0	1.80					1.44	36	
30	122		43	1.40	1.0	1.40					1.08	46	
40	158		55	1.16	.998	1.16					0.86	47	
42	160		56	1.12	.997	1.12					0.83	46	
40	3		3	2.06	1.0	2.06					1.67	5	
													52 Max.

Yost and Gardner Engineers

Future Dev. = 50%

LINE A

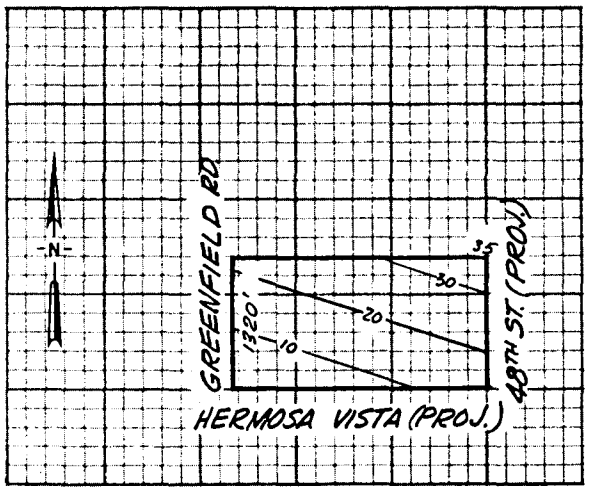
Done by T.B.G.

Date 2/81

Drainage Area A-16

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial	80	4.5	4	10.5	8		
Total Acres	80		4		8		

Mean land slope N-S 0.001 E-W 0.0067

Flow conveyance 40' Streets

Flow velocity N-S 1.0 ft./sec. min./mile 60 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	13		1	2.50	1.0	2.50					2.07	2	
20	48		5	1.80	1.0	1.80					1.44	7	
30	76		8	1.40	1.0	1.40					1.08	9	
35	80		8	1.27	1.0	1.27					0.96	8	
30	1		1	2.50	1.0	2.50					2.07	2	
													11 Max.

Yost and Gardner Engineers

Future Dev.: = 85%

LINE A

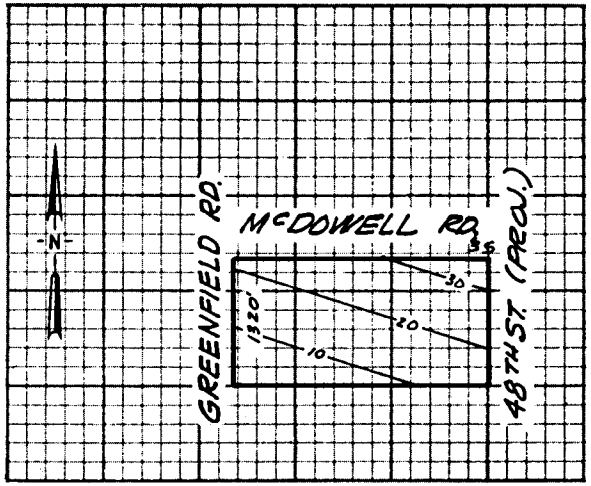
Done by T.B.G.

Date 2/81

Drainage Area A-17

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial	80	0	0	0	0		
Total Acres	80		0		0		

Mean land slope N-S .001 E-W .0067

Flow conveyance 40' Streets

Flow velocity N-S 1.0 ft./sec. min./mile 60 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	32		0									0	
20	78		0									0	
21	80		0									0	
20	1		1	3.20	1.0	3.20					2.70	3	
													3 Max.

Yost and Gardner Engineers

Future Dev.: = 100%

LINE A

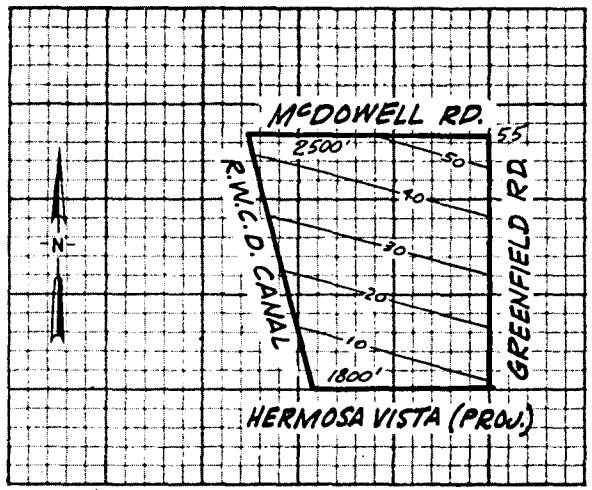
Done by D.N.S.

Date 10/80

Drainage Area A-18

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	13	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves	97	5	5	5	5		
Commercial							
Industrial	20	0	0	0	0		
Total Acres	130		5		5		

Mean land slope N-S .001 E-W .0075

Flow conveyance 40' Streets

Flow velocity N-S 1.0 ft./sec. min./mile 60 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	13		1	2.50	1.0	2.50					2.07	2	
20	39		2	1.80	1.0	1.80					1.44	3	
30	66		3	1.40	1.0	1.40					1.08	3	
40	96		4	1.16	1.0	1.16					0.86	3	
50	126		5	0.98	1.0	0.98					0.70	4	
50	3		3	1.74	1.0	1.74					1.39	4	
													8 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE A

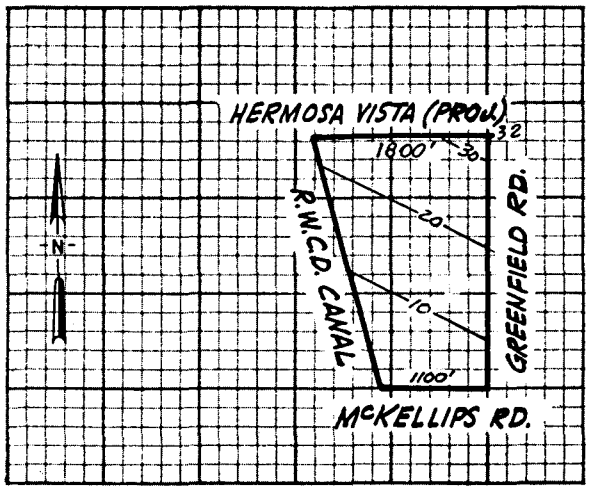
Done by D.N.S.

Date 10/80

Drainage Area A-19

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves	88	5	4	5	4		
Commercial							
Industrial							
Total Acres	88		4		4		

Mean land slope N-S .0023 E-W .0083

Flow conveyance 40' Streets

Flow velocity N-S 1.8 ft./sec. min./mile 108 ft./min.

E-W 3.5 ft./sec. min./mile 210 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	23		1	2.50	1.0	2.50					2.07	2	
20	58		3	1.80	1.0	1.80					1.44	4	
30	86		4	1.40	1.0	1.40					1.08	4	
32	88		4	1.34	1.0	1.34					1.03	4	
30	2		2	2.5	1.0	2.5					2.07	4	
													8 Max.

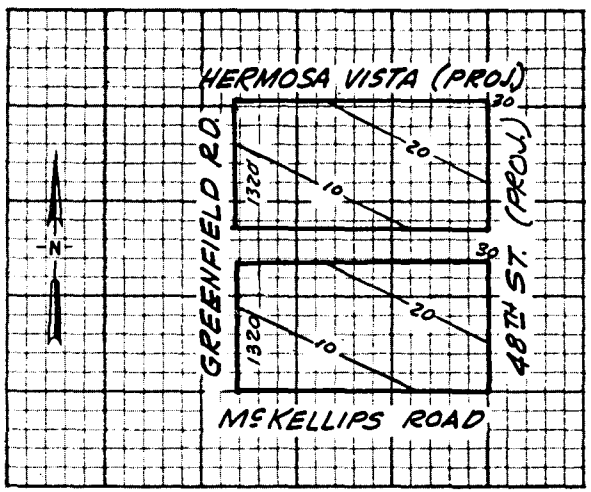
Yost and Gardner Engineers

LINE A

Done by T.B.G.

Date 3/81

Drainage Area Line A-1
N½ A-15 & S½ A-15



URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial	80	15	12	35	28		
Total Acres	80		12		28		

Mean land slope N-S .0015 E-W .0063

Flow conveyance 40' Streets

Flow velocity N-S 1.5 ft./sec. min./mile 90 ft./min.

E-W 3.1 ft./sec. min./mile 186 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	19		7	2.50	1.0	2.50					2.07	14	
20	62		22	1.80	1.0	1.80					1.44	32	
30	80		28	1.40	1.0	1.40					1.08	30	
20	1		1	3.20	1.0	3.20					2.70	3	
													35 Max.

Yost and Gardner Engineers

NOTE: N½ & S½ of A-15 are similar

Future Dev.: = 50%

LINE A-1

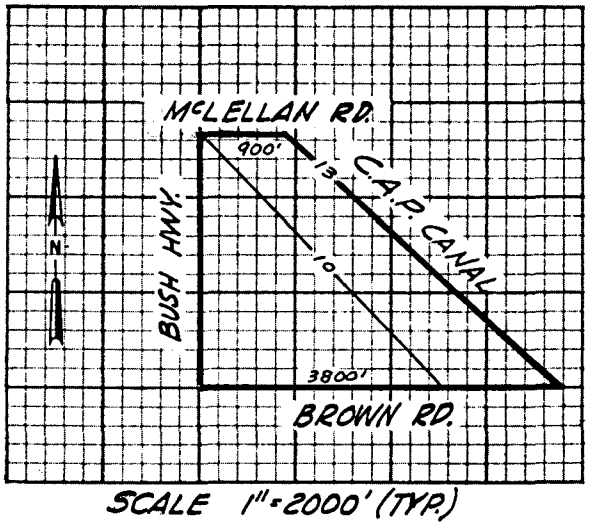
Done by D.N.S.

Date 10/80

Drainage Area B-1

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like	142	10	14	10	14		
Farmlands, groves							
Commercial							
Industrial							
Total Acres	142		14		14		

Mean land slope N-S .013 E-W .011

Flow conveyance 40' Streets

Flow velocity N-S 4.4 ft./sec. min./mile 264 ft./min.

E-W 4.05 ft./sec. min./mile 243 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	74		7	2.50	1.0	2.50					2.07	14	
13	142		14	2.22	1.0	2.22					1.82	25	
13	3		3	4.00	1.0	4.00					3.42	10	
													35 Max.

Yost and Gardner Engineers

LINE B

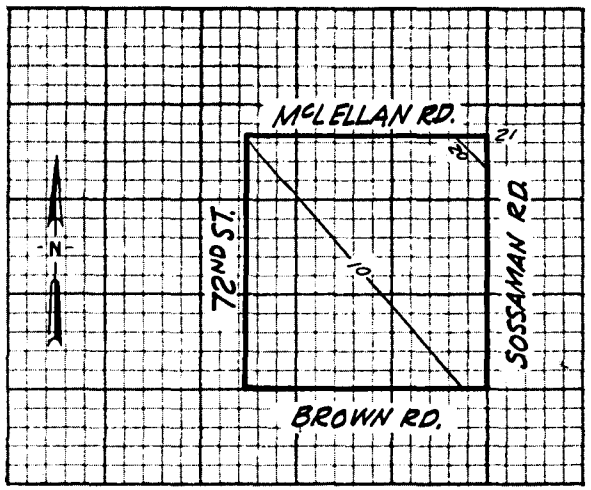
Done by D.N.S.

Date 10/80

Drainage Area B-2

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .012 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 4.2 ft./sec. min./mile 252 ft./min.

E-W 3.8 ft./sec. min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	66		0									0	
20	156		0									0	
21	160		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE B

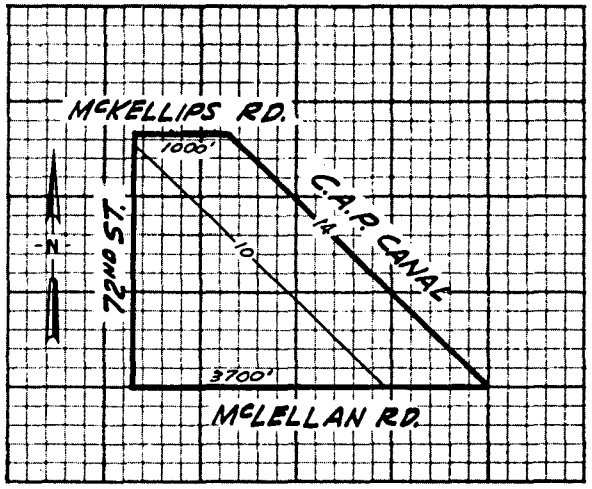
Done by D.N.S.

Date 10/80

Drainage Area B-3

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	141	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	141	0	0	0	0		

Mean land slope N-S .012 E-W .013

Flow conveyance 40' Streets

Flow velocity N-S 4.2 ft./sec. min./mile 252 ft./min.

E-W 4.4 ft./sec. min./mile 264 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	76		0									0	
14	141		0									0	
14	3		3	3.86	1.0	3.86					3.29	10	
													10 Max.

Yost and Gardner Engineers

Future Dev. = 100%

BINE B

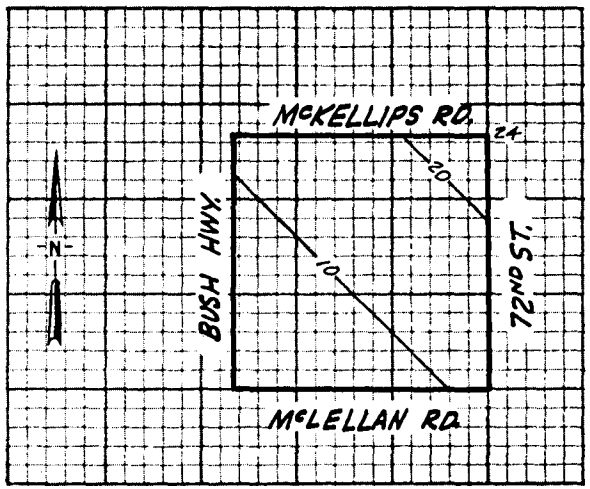
Done by D.N.S.

Date 10/80

Drainage Area B-4

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	150	3	5	1	2		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	10	0	0	0	0		
Industrial							
Total Acres	160		5		2		

Mean land slope N-S .009 E-W .009

Flow conveyance 40' Streets

Flow velocity N-S 3.7 ft./sec. min./mile 222 ft./min.

E-W 3.7 ft./sec. min./mile 222 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	57		0.7	2.50	1.0	2.50					2.07	1	
20	150		1.9	1.80	.997	1.79					1.43	3	
24	160		2	1.62	.996	1.61					1.27	3-	
20	5		5	3.20	1.0	3.20					2.70	14	
													17 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 95%
Comm. = 100%

LINE B

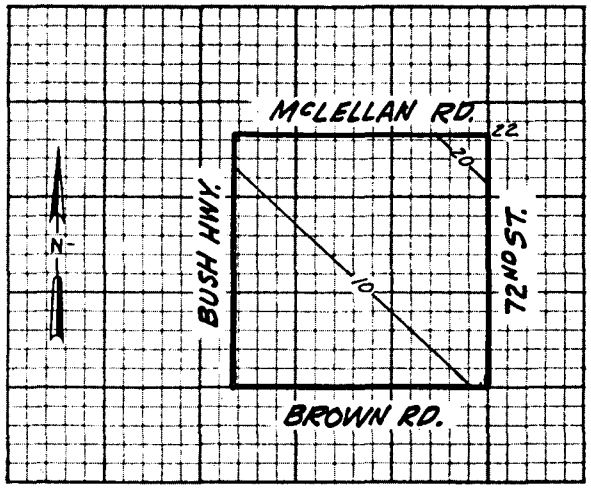
Done by D.N.S.

Date 10/80

Drainage Area B-5

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	7	11	3	5		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		11		5		

Mean land slope N-S .0095 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 3.75 ft./sec. min./mile 225 ft./min.

E-W 3.8 ft./sec. min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	59		2	2.50	1.0	2.50					2.07	4	
20	154		5	1.80	.996	1.79					1.43	7	
22	160		5	1.70	.996	1.69					1.34	7-	
20	5		5	3.20	1.0	3.20					2.70	14	
													21 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. 90%

LINE B

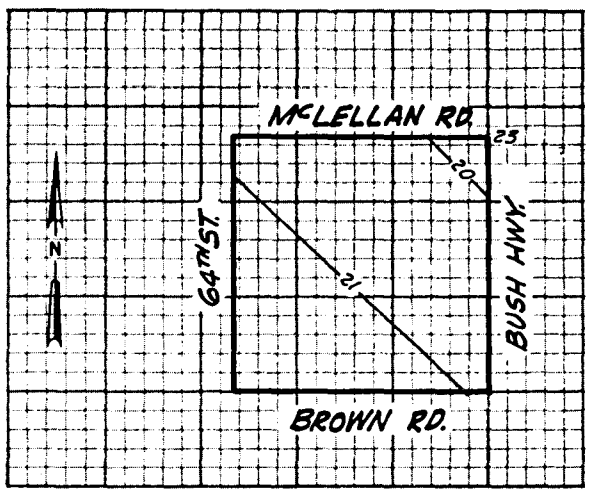
Done by D.N.S.

Date 10/80

Drainage Area B-6

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	59	94	23	37		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		94		37		

Mean land slope N-S .0095 E-W .011

Flow conveyance 40' Streets

Flow velocity N-S 3.75 ft./sec. min./mile 225 ft./min.

E-W 4.05 ft./sec. min./mile 243 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	63		15	2.50	1.0	2.50					2.07	31	
20	155		36	1.80	.997	1.79					1.43	52	
23	160		37	1.66	.996	1.65					1.31	48	
20	5		5	3.20	1.0	3.20					2.70	14	
													66 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE B

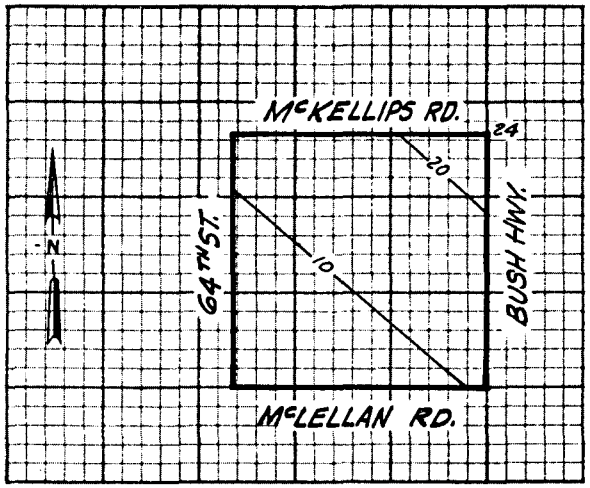
Done by D.N.S.

Date 10/80

Drainage Area B-7

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	3	4	1	2		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	12	0	0	9	1		
Industrial							
Total Acres	160		4		3		

Mean land slope N-S .007 E-W .011

Flow conveyance 40' Streets

Flow velocity N-S 3.25 ft./sec. min./mile 195 ft./min.

E-W 4.05 ft./sec. min./mile 243 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	54		1	2.50	1.0	2.50					2.07	2	
20	151		3	1.80	.997	1.79					1.43	4	
14	160		3	1.62	.996	1.61					1.27	4 -	
20	5		5	3.20	1.0	3.20					2.70	14	
													18 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 95%
Comm. = 90%

LINE B

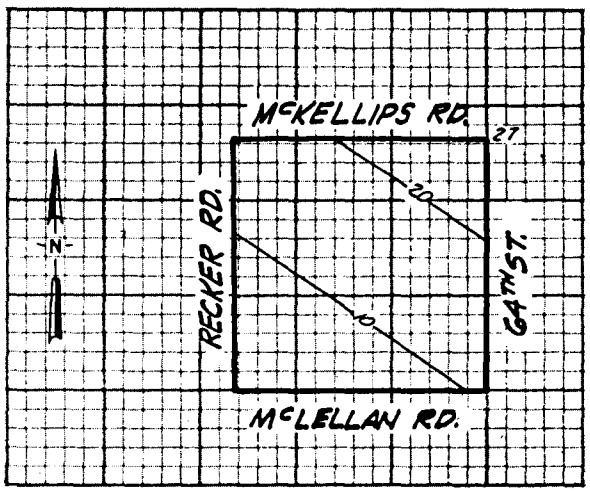
Done by D.N.S.

Date 10/80

Drainage Area B-8

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	156	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	4	0	0	90	4		
Industrial							
Total Acres	160		0		4		

Mean land slope N-S .0053 E-W .011

Flow conveyance 40' Streets

Flow velocity N-S 2.8 ft./sec. _____ min./mile 168 ft./min.

E-W 4.05 ft./sec. _____ min./mile 243 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	47		1	2.50	1.0	2.50					2.07	2	
20	140		4	1.80	1.0	1.80					1.44	6	
27	160		4	1.46	.996	1.45					1.13	5	
20	5		5	3.20	1.0	3.20					2.70	14	
													20 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
Comm. = 0%

LINE B

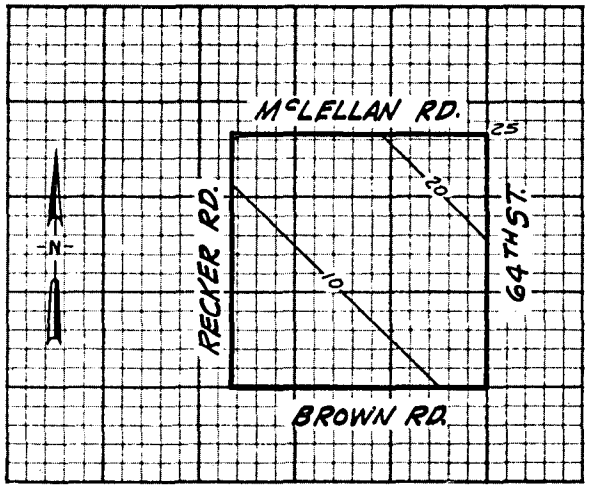
Done by D.N.S.

Date 10/80

Drainage Area B-9

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	29	46	11	18		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		46		18		

Mean land slope N-S .0072 E-W .009

Flow conveyance 40' Streets

Flow velocity N-S 3.3 ft./sec. _____ min./mile 198 ft./min.

E-W 3.7 ft./sec. _____ min./mile 222 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a-0.2	Q_i cfs	Q_t cfs
10	51		6	2.50	1.0	2.50					2.07	12	
20	145		16	1.80	1.0	1.80					1.44	23	
25	160		18	1.58	.996	1.57					1.23	22	
20	5		5	3.20	1.0	3.20					2.70	14	
													37 Max.

Yost and Gardner Engineers

Future Dev. = 55%

LINE B

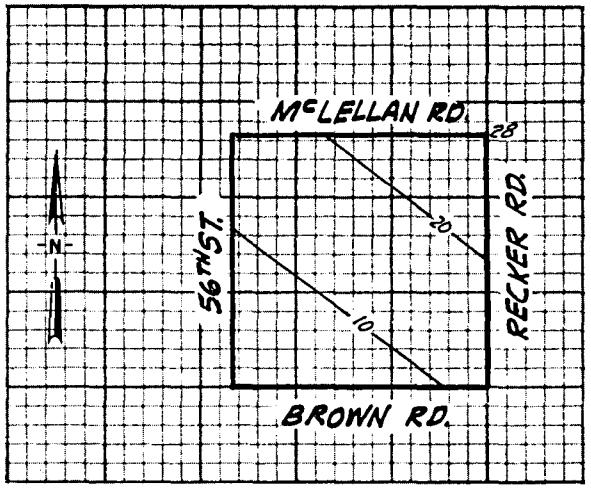
Done by D.N.S.

Date 10/80

Drainage Area B-10

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	152	7	11	3	5		
M.D. Residential							
H.D. Residential	8	0	0	0	0		
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		11		5		

Mean land slope N-S .005 E-W .009

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.7 ft./sec. min./mile 222 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	42		1	2.50	1.0	2.50					2.07	2	
20	135		4	1.80	1.0	1.80					1.44	6	
28	160		5	1.46	.996	1.45					1.13	6 -	
20	5		5	3.20	1.0	3.20					2.70	14	
													20 Max.

Yost and Gardner Engineers

Future Dev.
Low Dens. = 90%
High Dens. = 100%

LINE B

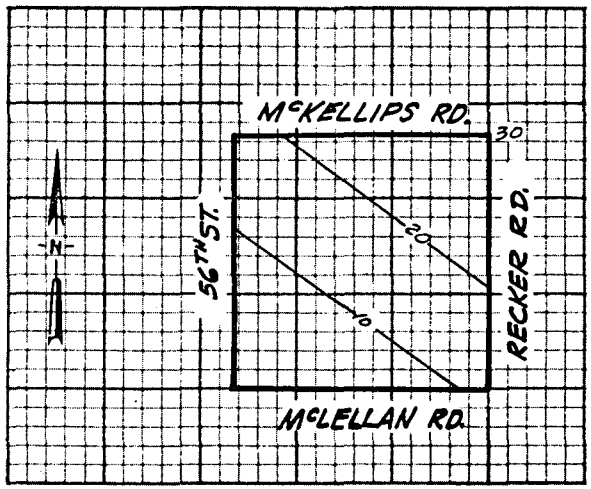
Done by D.N.S.

Date 10/80

Drainage Area B-11

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	100	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	60	0	0	0	0		
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .005 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. _____ min./mile 165 ft./min.

E-W 3.8 ft./sec. _____ min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	43		0	2.50	1.0	2.50					2.07	0	
20	121		0	1.80	1.0	1.80					1.44	0	
30	160		0	1.40	.996	1.39					1.07	0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE B

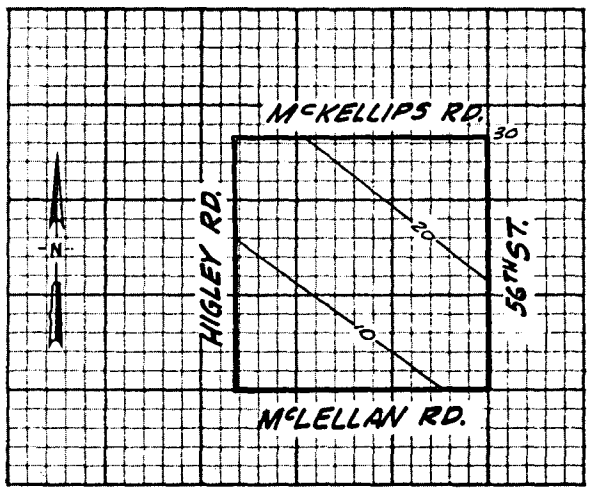
Done by D.N.S.

Date 10/80

Drainage Area B-12

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	109	0	0	0	0		
M.D. Residential	20	0	0	0	0		
H.D. Residential	13	0	0	0	0		
Parks & park-like							
Farmlands, groves							
Commercial	18	0	0	0	0		
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .0045 E-W .0087

Flow conveyance 40' Streets

Flow velocity N-S 2.6 ft./sec. min./mile 156 ft./min.

E-W 3.6 ft./sec. min./mile 216 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	39		0	2.50	1.0	2.50					2.07	0	
20	128		0	1.80	1.0	1.80					1.44	0	
30	160		0	1.40	.996	1.39					1.07	0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE B

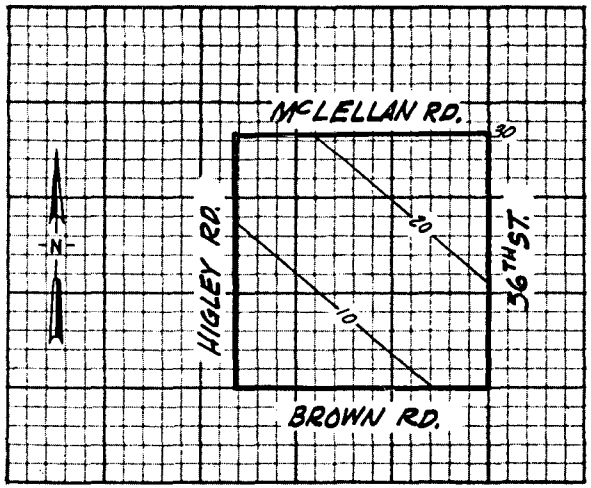
Done by D.N.S.

Date 10/80

Drainage Area B-13

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	139	0	0	0	0		
M.D. Residential	16	0	0	0	0		
H.D. Residential	5	0	0	0	0		
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .005 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	39		0	2.50	1.0	2.50					2.07	0	
20	129		0	1.80	1.0	1.80					1.44	0	
30	160		0	1.40	.996	1.39					1.07	0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE B

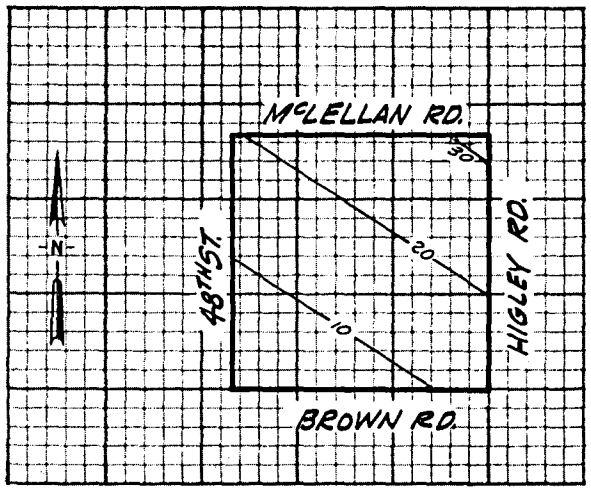
Done by D.N.S.

Date 10/80

Drainage Area B-14

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves	160	5	8	5	8		
Commercial							
Industrial							
Total Acres	160		8		8		

Mean land slope N-S .0034 E-W .0083

Flow conveyance 40' Streets

Flow velocity N-S 2.3 ft./sec. min./mile 138 ft./min.

E-W 3.5 ft./sec. min./mile 210 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	33		2	2.50	1.0	2.50					2.07	4	
20	114		6	1.80	1.0	1.80					1.44	9	
30	158		8	1.40	.996	1.39					1.07	9 -	
32	160		8	1.34	.996	1.33					1.02	8	
20	5		5	3.20	1.0	3.20					2.70	14	
													23 Max.

Yost and Gardner Engineers

LINE B

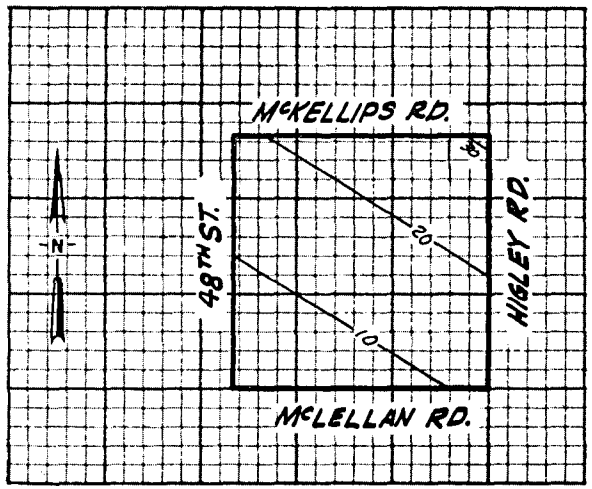
Done by D.N.S.

Date 10/80

Drainage Area B-15

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves	160	5	8	5	8		
Commercial							
Industrial							
Total Acres	160		8		8		

Mean land slope N-S .0034 E-W .009

Flow conveyance 40' Streets

Flow velocity N-S 2.3 ft./sec. min./mile 138 ft./min.

E-W 3.7 ft./sec. min./mile 222 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	38		2	2.50	1.0	2.50					2.07	4	
20	142		7	1.80	1.0	1.80					1.44	10	
30	160		8	1.40	.996	1.39					1.07	9	
20	5		5	3.20	1.0	3.20					2.70	14	
													24 Max.

Yost and Gardner Engineers

LINE B

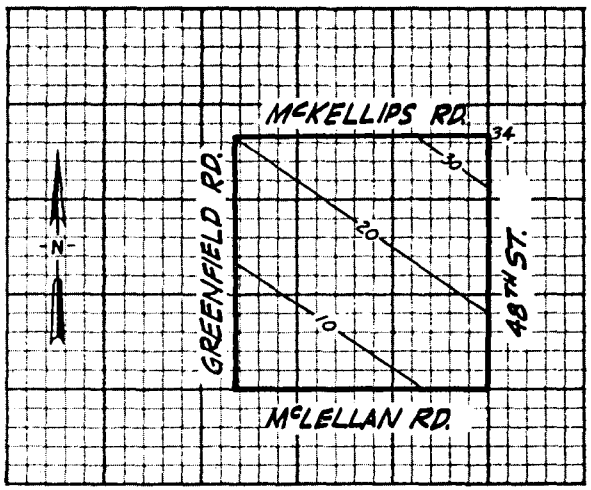
Done by D.N.S.

Date 10/80

Drainage Area B-16

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves	80	5	4	5	4		
Commercial							
Industrial	80	18	14	42	34		
Total Acres	160		18		38		

Mean land slope N-S .003 E-W .007

Flow conveyance 40' Streets

Flow velocity N-S 2.15 ft./sec. min./mile 129 ft./min.

E-W 3.25 ft./sec. min./mile 195 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	29		7	2.50	1.0	2.50					2.07	14	
20	105		25	1.80	1.0	1.80					1.44	36	
30	156		37	1.40	.996	1.39					1.07	40	
34	160		38	1.30	.996	1.29					0.98	37	
30	5		5	2.50	1.0	2.50					2.07	10	
													50 Max.

Yost and Gardner Engineers

Future Dev. = 40%

LINE B

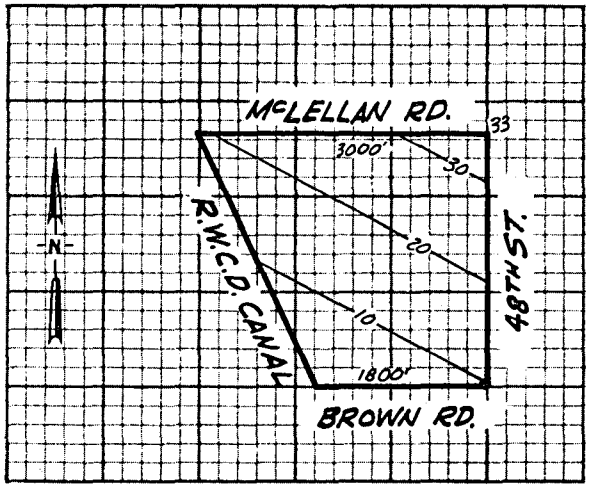
Done by D.N.S.

Date 10/80

Drainage Area B-17

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	133	52	69	20	27		
M.D. Residential							
H.D. Residential	11	40	4	3	1		
Parks & park-like							
Farmlands, groves							
Commercial	1	0	0	90	1		
Industrial							
Total Acres	145		73		29		

Mean land slope N-S .0034 E-W .007

Flow conveyance 40' Streets

Flow velocity N-S 2.25 ft./sec. min./mile 135 ft./min.

E-W 3.25 ft./sec. min./mile 195 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	26		5	2.50	1.0	2.50					2.07	10	
20	97		19	1.80	1.0	1.80					1.44	27	
30	140		28	1.40	1.0	1.40					1.08	30	
33	145		29	1.32	.996	1.31					1.00	29	
30	3		3	2.50	1.0	2.50					2.07	6	
													36 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 20%
High Dens. = 20%
Comm. = 100%

LINE B

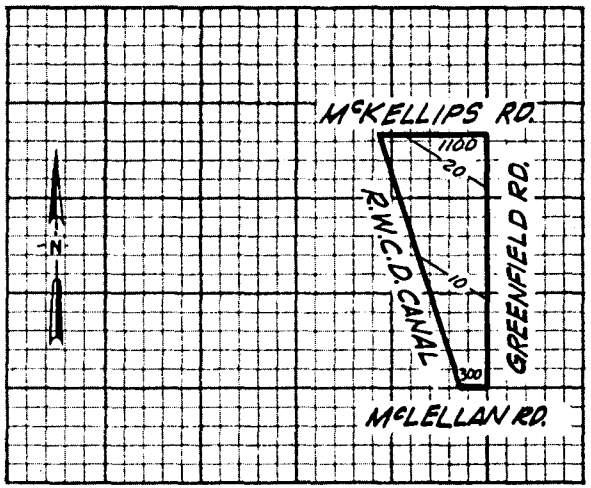
Done by D.N.S.

Date 10/80

Drainage Area B-18

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial	42	0	0	0	0		
Total Acres	42		0		0		

Mean land slope N-S .0034 E-W .008

Flow conveyance 40' Streets

Flow velocity N-S 2.25 ft./sec. min./mile 135 ft./min.

E-W 3.45 ft./sec. min./mile 207 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	13		0	2.50	1.0	2.50					2.07	0	
20	37		0	1.80	1.0	1.80					1.44	0	
25	42		0	1.58	1.0	1.58					1.24	0	
20	2		2	3.20	1.0	3.20					2.70	5	
													5 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE B

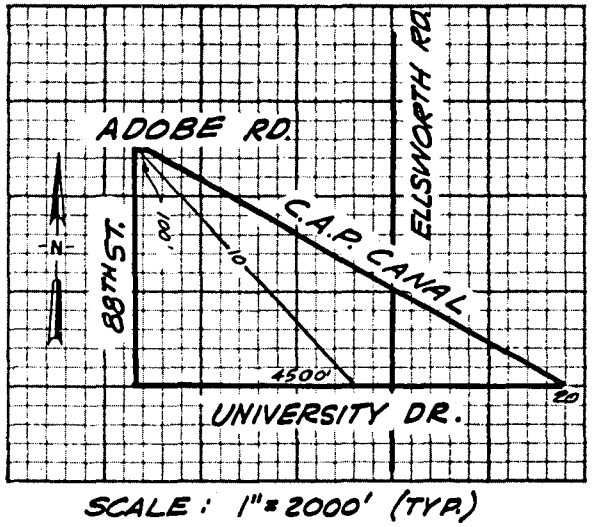
Done by T.B.G.

Date 11/80

Drainage Area C-1

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	139	7	10	3	4		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	139		10		4		

Mean land slope N-S .012 E-W .009

Flow conveyance 40' Streets

Flow velocity N-S 4.2 ft./sec. min./mile 252 ft./min.

E-W 3.7 ft./sec. min./mile 222 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	64		2	250	1.0	2.50					2.07	4	
20	139		4	1.80	1.0	1.80					1.4	6	
20	4		4	3.20	1.0	3.20					2.70	11	
													17 Max.

Yost and Gardner Engineers

Future Dev. = 90%

LINE C

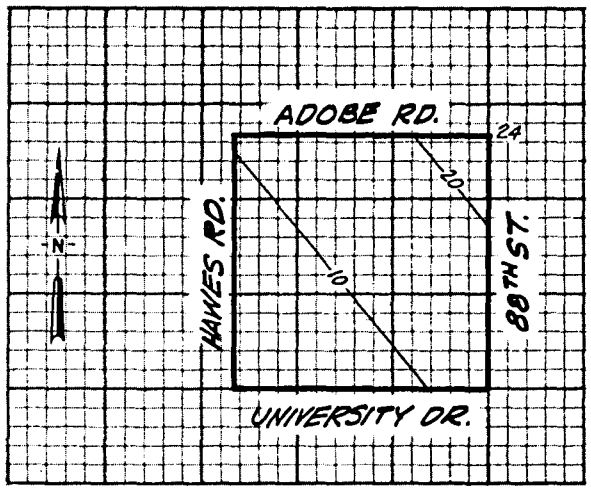
Done by T.B.G.

Date 11/80

Drainage Area C-2

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	1	2	1	2		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		2		2		

Mean land slope N-S .011 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 4.05 ft./sec. min./mile 243 ft./min.

E-W 3.30 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	55		1	2.50	1.0	2.50					2.07	2	
20	151		2	1.80	.996	1.79					1.43	3	
24	160		2	1.62	.996	1.61					1.27	3-	
20	4		4	3.20	1.0	3.20					2.70	11	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 98%

LINE C

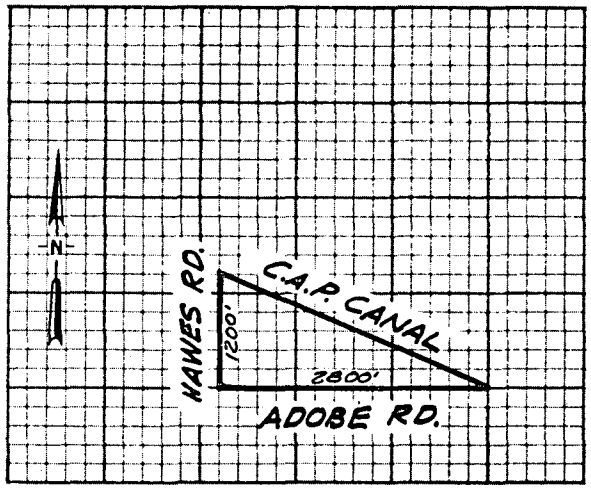
Done by T.B.G.

Date 11/80

Drainage Area C-3

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	55	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	55		0		0		

Mean land slope N-S .015 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 4.7 ft./sec. min./mile 282 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs	
10	55		0									0		
10	2		2	4.40	1.0	4.40					3.78	8		
													8	Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE C

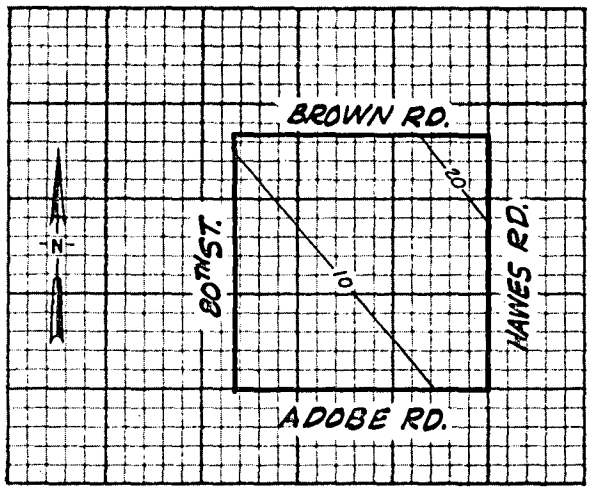
Done by T.B.G.

Date 11/80

Drainage Area C-4

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	149	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	149		0		0		

Mean land slope N-S .011 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 4.05 ft./sec. min./mile 243 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	57		0									0	
20	149		0									0	
20	4		4	3.20	1.0	3.20					2.70	11	
													11 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE C

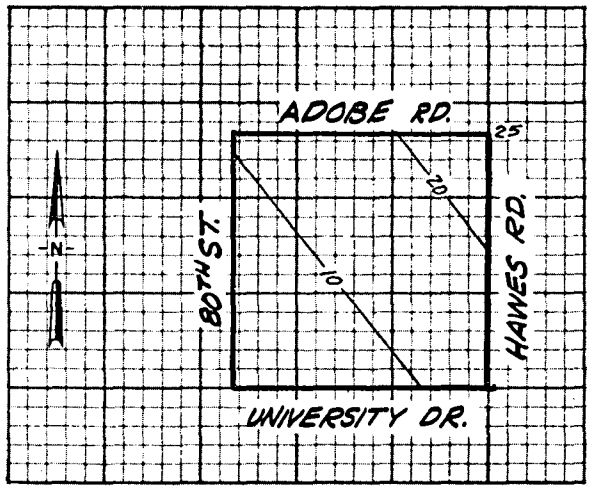
Done by T.B.G.

Date 11/80

Drainage Area C-5

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	7	11	3	5		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		11		5		

Mean land slope N-S .0106 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 3.96 ft./sec. min./mile 238 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	52		2	2.50	1.0	2.50					2.07	4	
20	146		5	1.80	.996	1.79					1.43	7	
25	160		5	1.58	.996	1.57					1.23	6	
20	5		5	3.20	1.0	3.20					2.70	14	
													21 Max.

Future Dev. = 90%

Yost and Gardner Engineers

LINE C

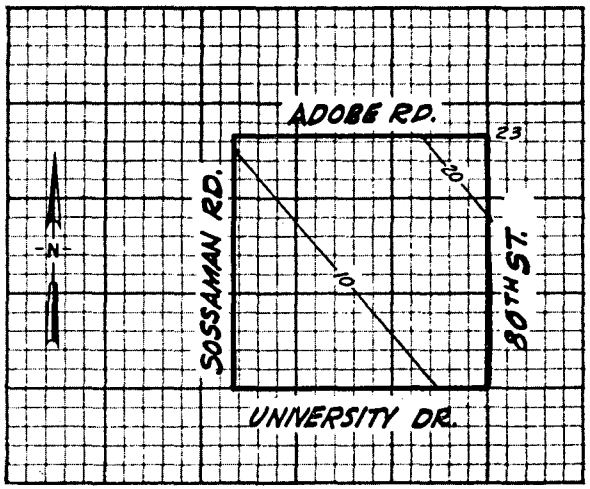
Done by T.B.G.

Date 11/80

Drainage Area C-6

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	158	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	2	0	0	0	0		
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .011 E-W .0083

Flow conveyance 40' Streets

Flow velocity N-S 4.05 ft./sec. min./mile 243 ft./min.

E-W 3.5 ft./sec. min./mile 210 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	59		0									0	
20	153		0									0	
23	160		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE C

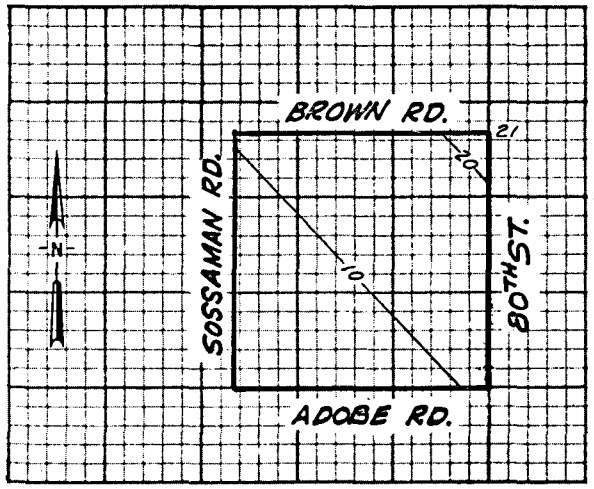
Done by T.B.G.

Date 11/80

Drainage Area C-7

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like	160	10	16	10	16		
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		16		16		

Mean land slope N-S .011 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 4.05 ft./sec. _____ min./mile 243 ft./min.

E-W 3.8 ft./sec. _____ min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	64		6	2.50	1.0	2.50					2.07	12	
20	157		16	1.80	.996	1.79					1.43	23	
21	160		16	1.75	.996	1.74					1.39	22	
20	5		5	3.20	1.0	3.20					2.70	14	
													37 Max.

Yost and Gardner Engineers

LINE C

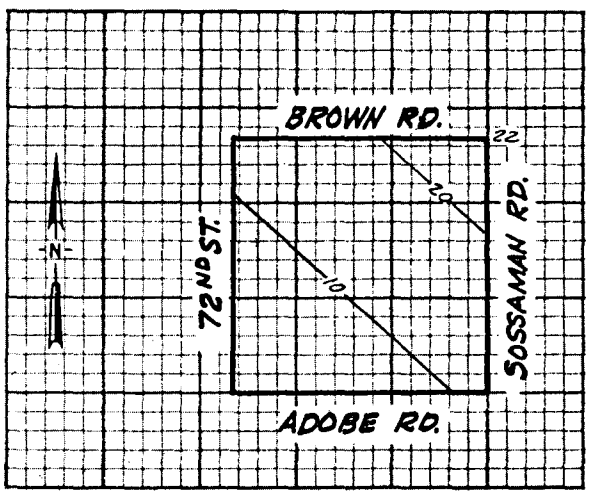
Done by T.B.G

Date 11/80

Drainage Area C-8

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like	160	10	16	10	16		
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		16		16		

Mean land slope N-S .0076 E-W .009

Flow conveyance 40' Streets

Flow velocity N-S 3.4 ft./sec. min./mile 204 ft./min.

E-W 3.8 ft./sec. min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	53		5	2.50	1.0	2.50					2.07	10	
20	147		15	1.80	.996	1.79					1.43	21	
27	160		16	1.50	.996	1.49					1.16	19	
20	5		5	3.20	1.0	3.20					2.70	14	
													35 Max.

Yost and Gardner Engineers

LINE C

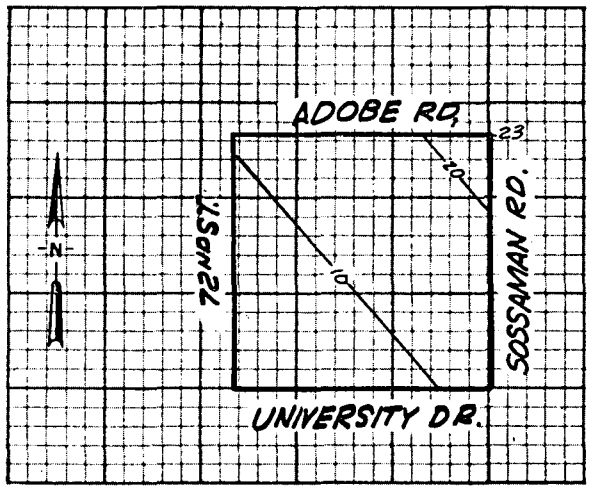
Done by T.B.G.

Date 11/80

Drainage Area C-9

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .011 E-W .008

Flow conveyance 40' Streets

Flow velocity N-S 4.05 ft./sec. min./mile 243 ft./min.

E-W 3.45 ft./sec. min./mile 207 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	I_a-f_c	0.8 I_a-f_c	Q_p cfs	0.9 $I_a-0.2$	Q_i cfs	Q_t cfs
10	58		0									0	
20	154		0									0	
23	160		0									0	
20	3		3	3.20	1.0	3.20					2.70	8	
													8 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE C

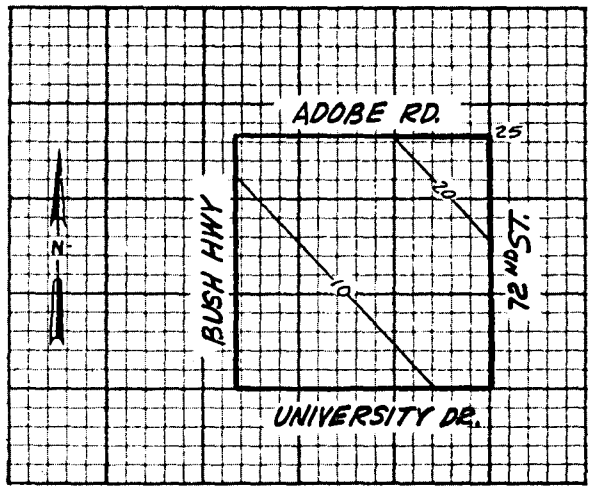
Done by T.B.G.

Date 11/80

Drainage Area C-10

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .0095 E-W .008

Flow conveyance 40' Streets

Flow velocity N-S 3.75 ft./sec. min./mile 225 ft./min.

E-W 3.45 ft./sec. min./mile 270 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	53		0									0	
20	147		0									0	
25	160		0									0	
20	4		4	3.20	1.0	3.20					2.70	11	
													11 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE C

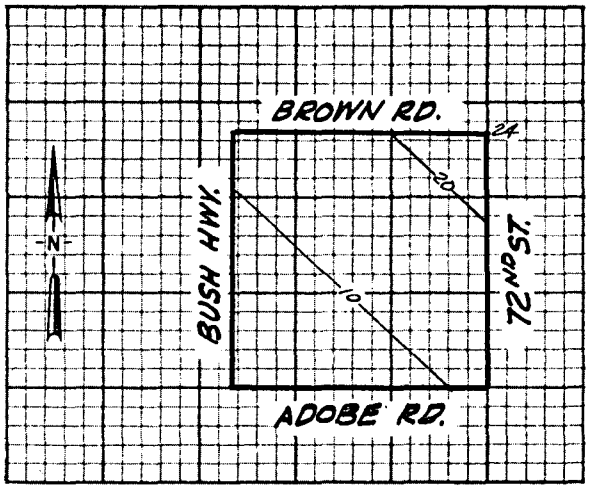
Done by T.B.G.

Date 11/80

Drainage Area C-11

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	33	53	13	21		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		53		21		

Mean land slope N-S .0076 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 3.4 ft./sec. min./mile 204 ft./min.

E-W 3.8 ft./sec. min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	53		7	2.50	1.0	2.50					2.07	14	
20	149		20	1.80	.997	1.79					1.43	29	
24	160		21	1.62	.996	1.61					1.27	27	
20	5		5	3.20	1.0	3.20					2.70	14	
													43 Max.

Future Dev. = 50%

Yost and Gardner Engineers

LINE C

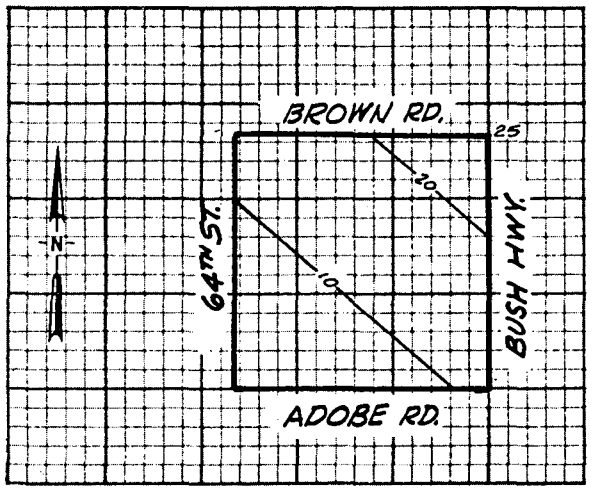
Done by T.B.G.

Date 11/80

Drainage Area C-12

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	120	7	8	3	4		
M.D. Residential	40	60	24	35	14		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		32		18		

Mean land slope N-S .007 E-W .010

Flow conveyance 40 ' Streets

Flow velocity N-S 3.25 ft./sec. min./mile 195 ft./min.

E-W 3.8 ft./sec. min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a-0.2	Q_i cfs	Q_t cfs
10	51		6	2.50	1.0	2.50					2.07	12	
20	146		16	1.80	.997	1.79					1.43	23	
25	160		18	1.58	.996	1.57					1.23	22	
20	5		5	3.20	1.0	3.20					2.70	14	
													37 Max.

Yost and Gardner Engineers

Future Dev.=
Low Dens. = 90%
Med. Dens = 0%

LINE C

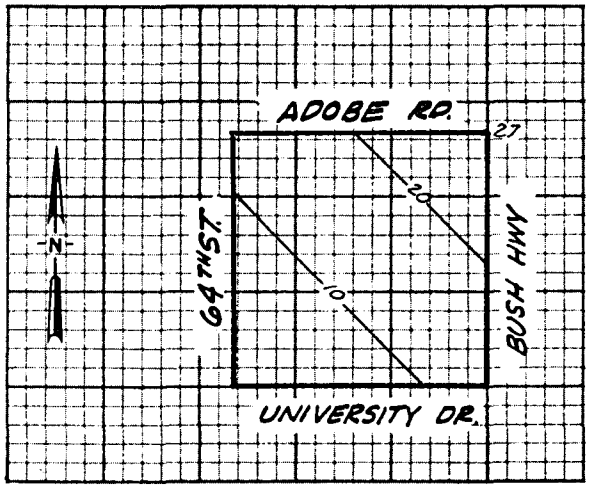
Done by T.B.G.

Date 11/80

Drainage Area C-13

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	54	26	14	10	5		
M.D. Residential	68	60	41	35	24		
H.D. Residential	22	25	6	20	4		
Parks & park-like							
Farmlands, groves							
Commercial	16	0	0	5	1		
Industrial							
Total Acres	160		61		34		

Mean land slope N-S .007 E-W .007

Flow conveyance 40' Streets

Flow velocity N-S 3.25 ft./sec. min./mile 195 ft./min.

E-W 3.25 ft./sec. min./mile 195 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	44		9	2.50	1.0	2.50					2.07	19	
20	138		29	1.80	1.0	1.80					1.44	42	
27	160		34	1.50	.996	1.49					1.16	39	
20	5		5	3.20	1.0	3.20					2.70	14	
													56 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 60%
Med. Dens. = 0%
High Dens. = 50%
Comm. = 95%

LINE C

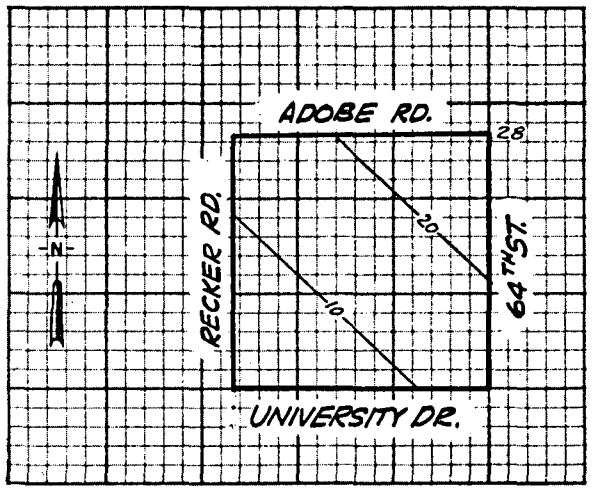
Done by T.B.G.

Date 11/80

Drainage Area C-14

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	150	39	59	23	35		
H.D. Residential	8	50	4	40	3		
Parks & park-like							
Farmlands, groves							
Commercial	2	0	0	90	2		
Industrial							
Total Acres	160		63		40		

Mean land slope N-S .006 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 3.0 ft./sec. min./mile 180 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	42		11	2.50	1.0	2.50					2.07	23	
20	136		34	1.80	1.0	1.80					1.44	49	
28	160		40	1.46	.996	1.45					1.13	45	
20	5		5	3.20	1.0	3.20					2.70	14	
													63 Max.

Yost and Gardner Engineers

Future Dev.:
Med. Dens. = 35%
High Dens. = 0%
Comm. = 0%

LINE C

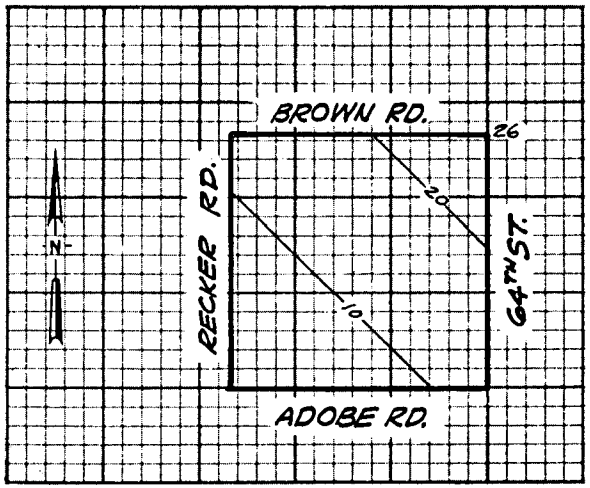
Done by T.B.G.

Date 11/80

Drainage Area C-15

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	100	0	0	0	0		
M.D. Residential	60	60	36	35	21		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		36		21		

Mean land slope N-S .0068 E-W .008

Flow conveyance 40' Streets

Flow velocity N-S 3.2 ft./sec. min./mile 192 ft./min.

E-W 3.45 ft./sec. min./mile 207 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	46		6	2.50	1.0	2.50					2.07	12	
20	143		19	1.80	.997	1.79					1.43	27	
26	160		21	1.54	.996	1.53					1.20	25	
20	5		5	3.20	1.0	3.20					2.70	14	
													41 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
Med. Dens. = 0%

LINE C

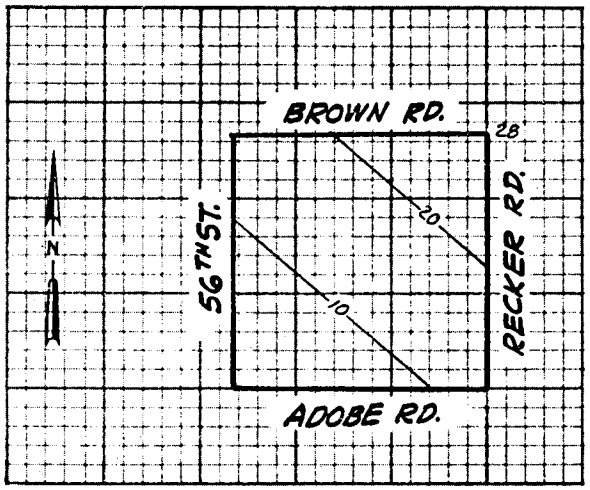
Done by T.G.B

Date 11/80

Drainage Area C-16

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	147	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	13	0	0	0	0		
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .0057 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.9 ft./sec. min./mile 174 ft./min.

E-W 3.3 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	40		0									0	
20	133		0									0	
28	160		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
Comm. = 100%

LINE C

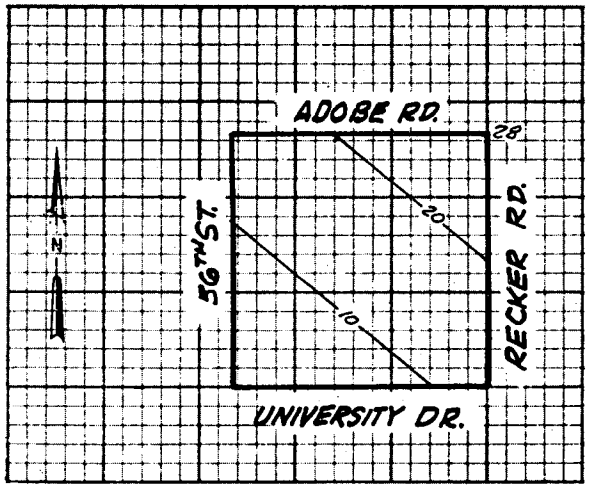
Done by T.B.G

Date 11/80

Drainage Area C-17

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	20	0	0	0	0		
M.D. Residential	140	60	84	35	49		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		84		49		

Mean land slope N-S .0057 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 2.9 ft./sec. min./mile 174 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	41		13	2.50	1.0	2.50					2.07	27	
20	134		41	1.80	1.0	1.80					1.44	59	
28	160		49	1.46	.996	1.45					1.13	55	
20	5		5	3.20	1.0	3.20					2.70	14	
													73 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
Med. Dens. = 0%

LINE C

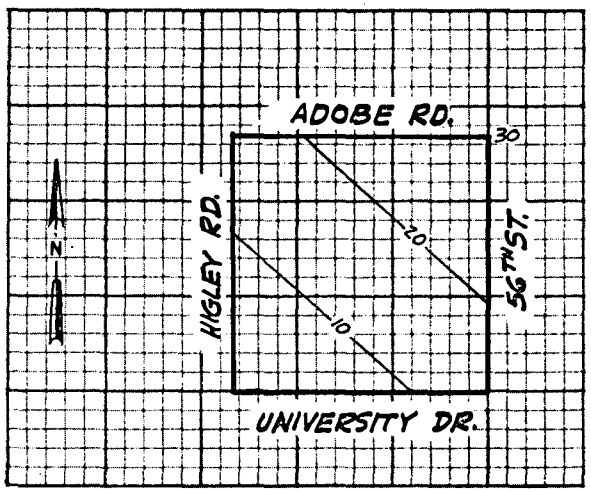
Done by T.B.G

Date 11/80

Drainage Area C-18

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	160	60	96	35	56		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		96		56		

Mean land slope N-S .005 E-W .006

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.0 ft./sec. min./mile 180 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	34		12	2.50	1.0	2.50					2.07	25	
20	121		42	1.80	1.0	1.80					1.44	60	
30	160		56	1.40	.996	1.39					1.07	60-	
20	5		5	3.20	1.0	3.20					2.70	14	
													74 Max.

Yost and Gardner Engineers

Future Dev. = 0%

LINE C

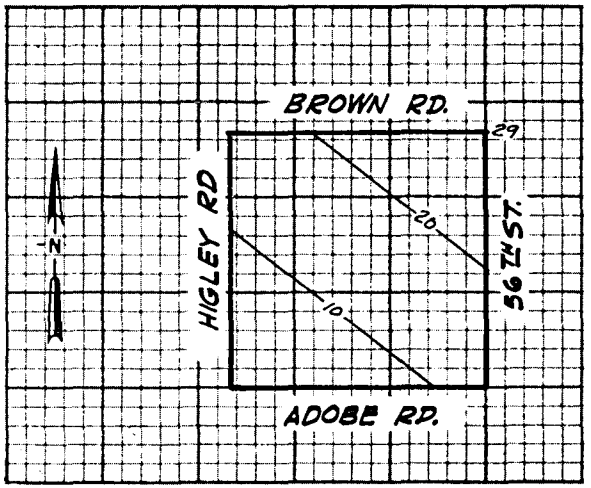
Done by T.B.G

Date 11/80

Drainage Area C-19

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	146	0	0	0	0		
M.D. Residential	14	0	0	0	0		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .005 E-W .008

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.45 ft./sec. min./mile 207 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	39		0									0	
20	130		0									0	
29	160		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE C

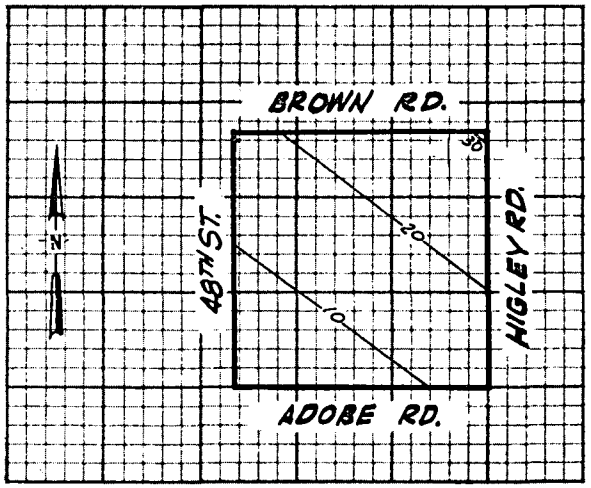
Done by T.B.G

Date 11/80

Drainage Area C-20

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .004 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	34		0									0	
20	120		0									0	
30	160		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE C

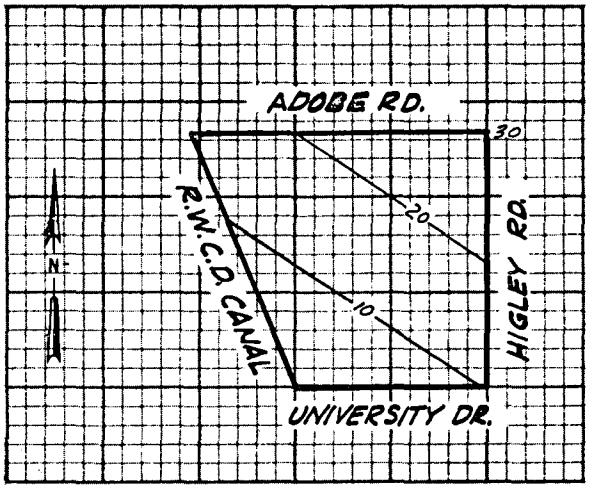
Done by T.B.G

Date 11/80

Drainage Area C-21

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	85	0	0	0	0		
M.D. Residential							
H.D. Residential	68	0	0	0	0		
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	153		0		0		

Mean land slope N-S .005 E-W .007

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.25 ft./sec. min./mile 195 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	38		0									0	
20	123		0									0	
30	153		0									0	
20	4		4	3.20	1.0	3.20					2.70	11	
													11 Ma.

Future Dev. = 100%

Yost and Gardner Engineers

LINE C

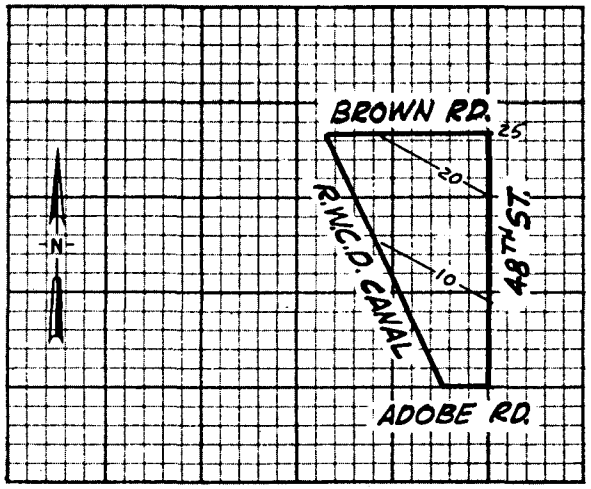
Done by T.B.G

Date 11/80

Drainage Area C-22

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	66	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	66		0		0		

Mean land slope N-S .004 E-W .008

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 3.45 ft./sec. min./mile 207 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	21		0									0	
20	54		0									0	
25	66		0									0	
20	3		3	3.20	1.0	3.20					2.70	8	
													8 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE C

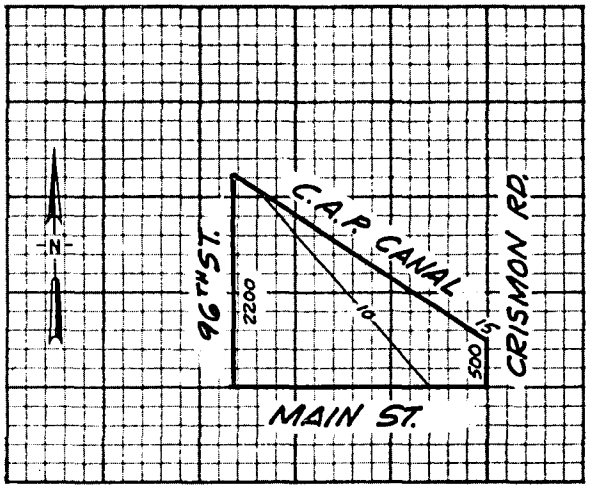
Done by T.B.G.

Date 11/80

Drainage Area D-1

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



SCALE: 1"=2000'(TYP.)

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	46	10	5	4	2		
M.D. Residential							
H.D. Residential	16	15	2	12	2		
Parks & park-like							
Farmlands, groves							
Commercial	20	0	0	45	9		
Industrial							
Total Acres	82		7		13		

Mean land slope N-S .010 E-W .0076

Flow conveyance 49' Streets

Flow velocity N-S 3.8 ft./sec. _____ min./mile 228 ft./min.

E-W 3.4 ft./sec. _____ min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	52		8	2.50	1.0	2.50					2.07	17	
15	82		13	2.09	1.0	2.09					1.70	22	
15	2		2	3.73	1.0	3.73					3.18	6	
													28 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 85%
High Dens. = 70%
Comm. Dev. = 50%

LINE D

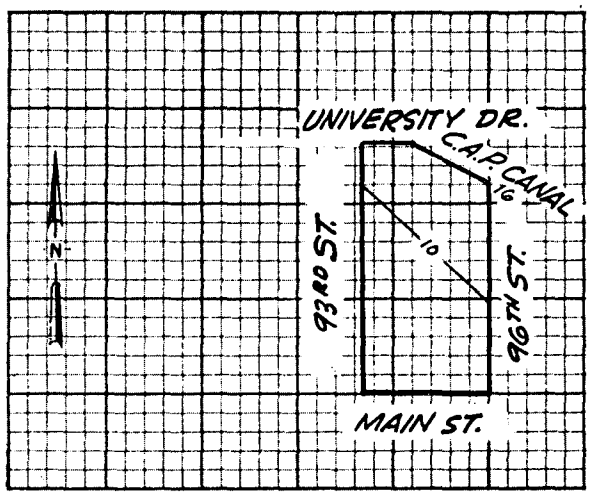
Done by T.B.G.

Date 2/81

Drainage Area D-2

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	55	1	1	1	1		
M.D. Residential							
H.D. Residential	11	36	4	21	2		
Parks & park-like							
Farmlands, groves							
Commercial	10	0	0	45	5		
Industrial							
Total Acres	76		5		8		

Mean land slope N-S .0087 E-W .0105

Flow conveyance 40' Streets

Flow velocity N-S 3.6 ft./sec. min./mile 216 ft./min.

E-W 3.95 ft./sec. min./mile 237 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	48		5	2.50	1.0	2.50					2.07	10	
16	76		8	2.02	1.0	2.02					1.64	13	
16	2.5		2.5	3.60	1.0	3.60					3.06	8	
													21 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 98%
High Dens. = 40%
Comm. = 50%

LINE D

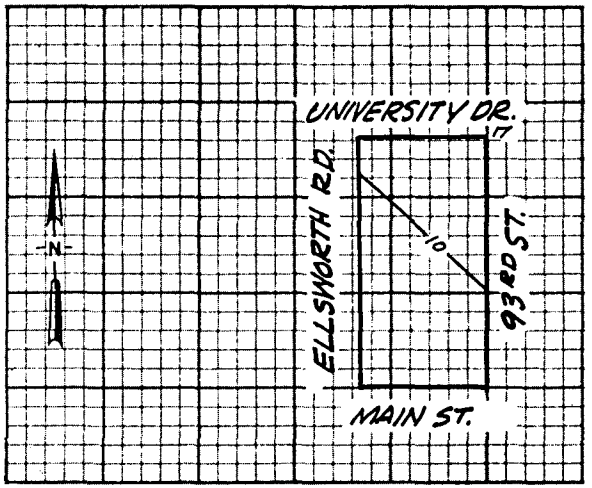
Done by T.B.G.

Date 2/81

Drainage Area D-3

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	13	0	0	0	0		
M.D. Residential							
H.D. Residential	57	25	14	20	11		
Parks & park-like							
Farmlands, groves							
Commercial	10	0	0	54	5		
Industrial							
Total Acres	80		14		16		

Mean land slope N-S .0087 E-W .0105

Flow conveyance 40' Streets

Flow velocity N-S 3.6 ft./sec. min./mile 216 ft./min.

E-W 3.95 ft./sec. min./mile 237 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	48		10	2.50	1.0	2.50					2.07	21	
17	80		16	1.96	1.0	1.96					1.58	25	
17	2.5		2.5	3.50	1.0	3.50					2.47	7	
													32 Max.

Yost and Gardner Engineers

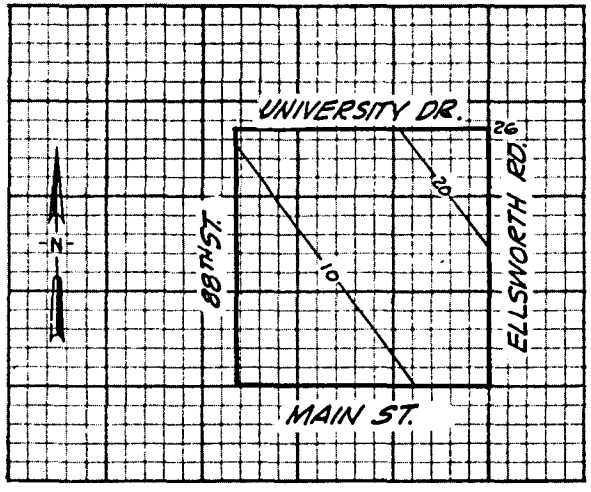
Future Dev.:
Low Dens. = 100%
High Dens. = 50%
Comm. = 40%

LINE D

Done by T.B.G.

Date 11/80

Drainage Area D-4



URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	70	0	0	0	0		
M.D. Residential							
H.D. Residential	70	45	32	36	25		
Parks & park-like							
Farmlands, groves							
Commercial	20	0	0	18	4		
Industrial							
Total Acres	160		32		29		

Mean land slope N-S .011 E-W .0064

Flow conveyance 40' Streets

Flow velocity N-S 4.05 ft./sec. min./mile 243 ft./min.

E-W 3.1 ft./sec. min./mile 186 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	52		9	2.50	1.0	2.50					2.07	19	
20	147		27	1.80	.997	1.79					1.43	39	
26	160		29	1.54	.996	1.53					1.20	35	
20	5		5	3.20	1.0	3.20					2.70	14	
													53 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
High Dens. = 10%
Comm. = 80%

LINE D

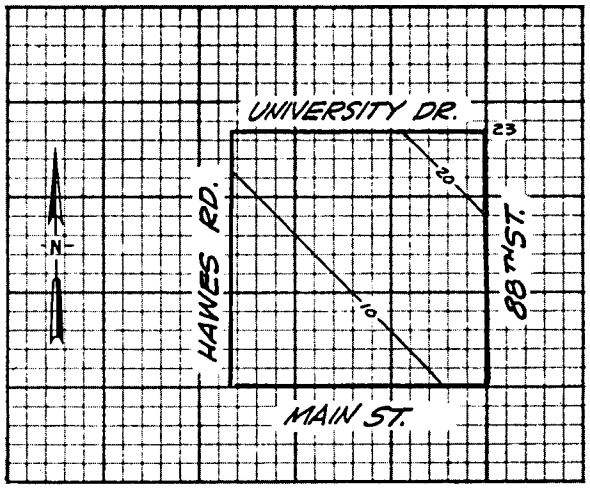
Done by T.B.G.

Date 11/80

Drainage Area D-5

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	140	42	59	16	22		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	20	0	0	27	5		
Industrial							
Total Acres	160		59		27		

Mean land slope N-S .009 E-W .0087

Flow conveyance 40' Streets

Flow velocity N-S 3.7 ft./sec. min./mile 222 ft./min.

E-W 3.6 ft./sec. min./mile 216 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	55		9	2.50	1.0	2.50					2.07	19	
20	152		26	1.80	.996	1.79					1.43	37	
23	160		27	1.66	.996	1.65					1.31	35	
20	5		5	3.20	1.0	3.20					2.70	14	
													51 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 35%
Comm. = 70%

LINE D

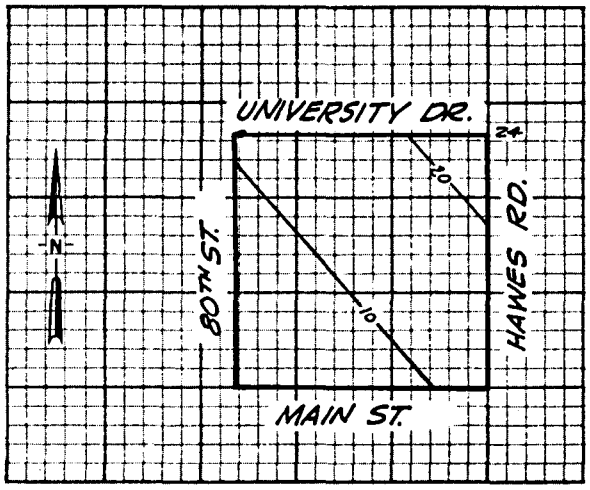
Done by T.B.G.

Date 11/80

Drainage Area D-6

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	24	39	9	15	4		
M.D. Residential							
H.D. Residential	112	30	34	24	27		
Parks & park-like							
Farmlands, groves							
Commercial	2	0	0	18	4		
Industrial							
Total Acres	160		39		35		

Mean land slope N-S .0105 E-W .0077

Flow conveyance 40' Streets

Flow velocity N-S 3.95 ft./sec. min./mile 237 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	56		12	2.50	1.0	2.50					2.07	25	
20	152		33	1.80	.997	1.79					1.43	47	
24	160		35	1.62	.996	1.61					1.27	44	
											2.70	14	
20	5		5	3.20	1.0	3.20							61 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 40%
High Dens. = 40%
Comm. = 80%

LINE D

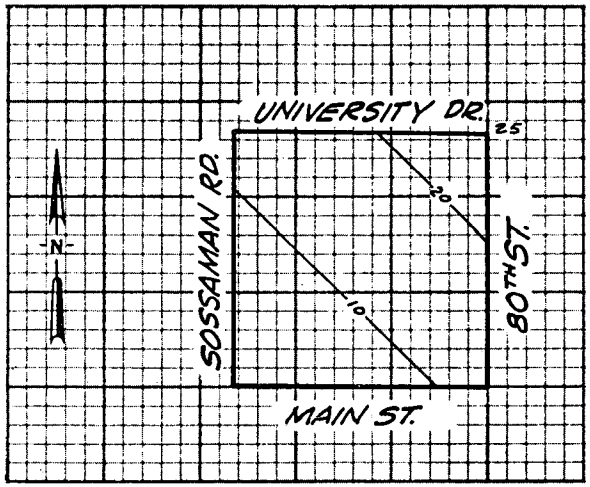
Done by T.B.G.

Date 11/80

Drainage Area D-7

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	62	13	8	5	3		
M.D. Residential							
H.D. Residential							
Parks & park-like (Com)	80	10		10	8		
Farmlands, groves							
Commercial	18	0	0	72	13		
Industrial							
Total Acres	160		8	24			

Mean land slope N-S .0083 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 3.5 ft./sec. min./mile 210 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	49		7	2.50	1.0	2.50					2.07	14	
20	145		22	1.80	.997	1.79					1.43	31	
25	160		24	1.58	.996	1.57					1.23	30	
20	5		5	3.20	1.0	3.20					2.70	14	
													45 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 80%
Comm. = 20%

LINE D

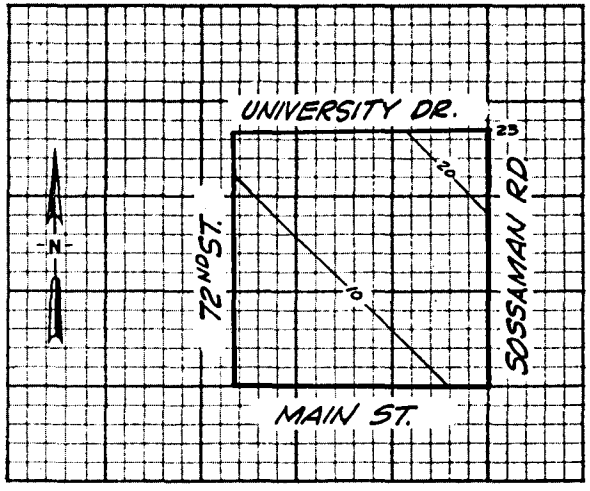
Done by T.B.G.

Date 11/80

Drainage Area D-8

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential	100	1	1	1	1		
Parks & park-like							
Farmlands, groves							
Commercial	60	0	0	2	1		
Industrial							
Total Acres	160		1		2		

Mean land slope N-S .009 E-W .009

Flow conveyance 40' Streets

Flow velocity N-S 3.7 ft./sec. min./mile 222 ft./min.

E-W 3.7 ft./sec. min./mile 222 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	57		1	2.50	1.0	2.50					2.07	2	
20	152		2	1.80	.997	1.79					1.43	3	
23	160		2	1.66	.996	1.65					1.31	3 -	
20	5		5	3.20	1.0	3.20					2.70	14	
													17 Max.

Yost and Gardner Engineers

Future Dev. = 98%

LINE D

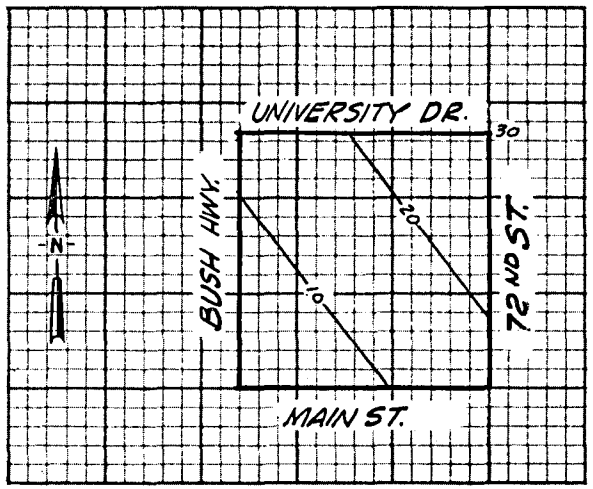
Done by T.B.G.

Date 11/80

Drainage Area D-9

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	157	0	0	1	2		
Industrial							
Total Acres	157		0		2		

Mean land slope N-S .008 E-W .0047

Flow conveyance 40' Streets

Flow velocity N-S 3.45 ft./sec. min./mile 207 ft./min.

E-W 2.65 ft./sec. min./mile 159 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	38		1	2.50	1.0	2.50					2.07	2	
20	124		2	1.80	1.0	1.80					1.44	3	
30	157		2	1.40	.996	1.39					1.07	2	
20	5		5	3.20	1.0	3.20					2.70	14	
													17 Max.

Yost and Gardner Engineers

Future Dev. = 99%

LINE D

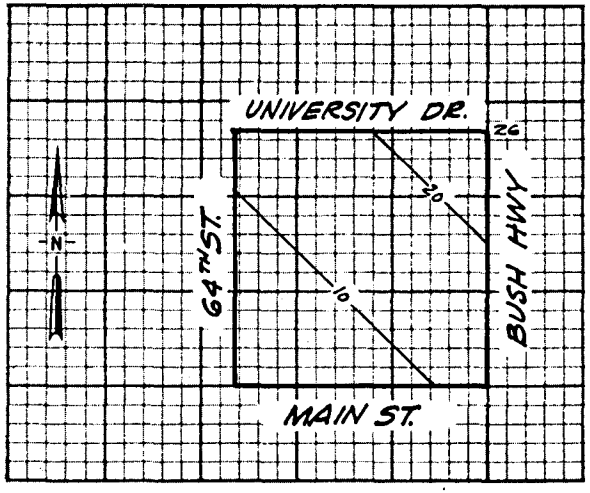
Done by T.B.G.

Date 11/80

Drainage Area D-10

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	65	26	17	10	7		
M.D. Residential	51	24	12	14	7		
H.D. Residential	6	0	0	0	0		
Parks & park-like							
Farmlands, groves							
Commercial	38	0	0	27	10		
Industrial							
Total Acres	160		29		24		

Mean land slope N-S .0076 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 3.4 ft./sec. _____ min./mile 204 ft./min.

E-W 3.4 ft./sec. _____ min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	48		7	2.50	1.0	2.50					2.07	14	
20	144		22	1.80	.997	1.79					1.43	31	
26	160		24	1.54	.996	1.53					1.20	29	
20	5		5	3.20	1.0	3.20					2.70	14	
													45 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 60%
Med. Dens. = 60%
High Dens. = 100%
Comm. = 70%

LINE D

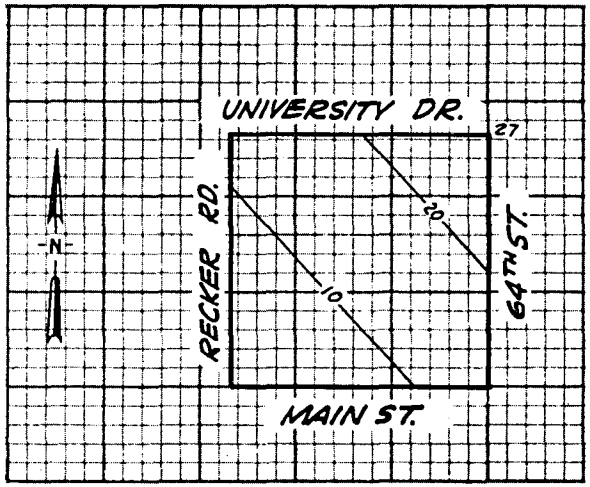
Done by T.B.G.

Date 11/80

Drainage Area D-11

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	20	52	10	20	4		
M.D. Residential	99	60	59	35	35		
H.D. Residential	12	40	5	32	4		
Parks & park-like							
Farmlands, groves							
Commercial	29	0	0	50	15		
Industrial							
Total Acres	160		74		58		

Mean land slope N-S .0076 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 3.4 ft./sec. _____ min./mile 204 ft./min.

E-W 3.2 ft./sec. _____ min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	45		16	2.50	1.0	2.50					2.07	33	
20	139		50	1.80	1.0	1.80					1.44	72	
27	160		58	1.50	.996	1.49					1.16	67	
20	5		5	3.20	1.0	3.20					2.70	14	
													86 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 20%
Med. Dens. = 0%
High Dens. = 20%
Comm. = 45%

LINE D

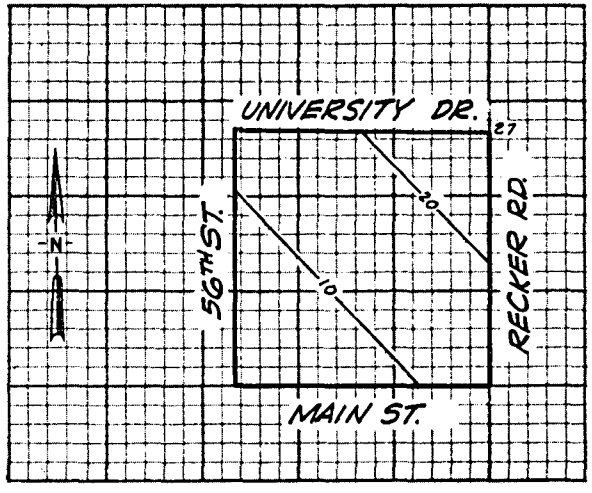
Done by T.B.G.

Date 11/80

Drainage Area D-12

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	40	0	0	0	0		
M.D. Residential	32	57	18	33	11		
H.D. Residential	60	25	15	20	12		
Parks & park-like							
Farmlands, groves							
Commercial	28	0	0	63	18		
Industrial							
Total Acres	160		33		41		

Mean land slope N-S .0072 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 3.3 ft./sec. min./mile 198 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	44		11	2.50	1.0	2.50					2.07	23	
20	138		35	1.80	1.0	1.80					1.44	50	
27	160		41	1.50	.996	1.49					1.16	48	
20	5		5	3.20	1.0	3.20					2.70	14	
													64 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
Med. Dens. = 5%
High Dens. = 50%
Comm. = 30%

LINE D

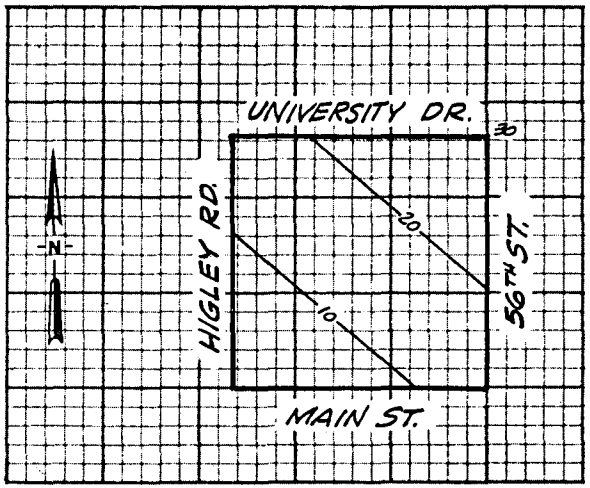
Done by T.B.G.

Date 11/80

Drainage Area D-13

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	74	54	40	32	24		
H.D. Residential	61	40	24	32	20		
Parks & park-like							
Farmlands, groves							
Commercial	25	0	0	63	16		
Industrial							
Total Acres	160		64		60		

Mean land slope N-S .005 E-W .007

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. _____ min./mile 165 ft./min.

E-W 3.25 ft./sec. _____ min./mile 195 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	37		14	2.50	1.0	2.50					2.07	29	
20	125		47	1.80	1.0	1.80					1.44	68	
30	160		60	1.40	.996	1.39					1.07	64	
20	5		5	3.20	1.0	3.20					2.70	14	
													82 MAX.

Yost and Gardner Engineers

Future Dev.:
Med. Dens. = 10%
High Dens. = 20%
Comm. = 30%

LINE D

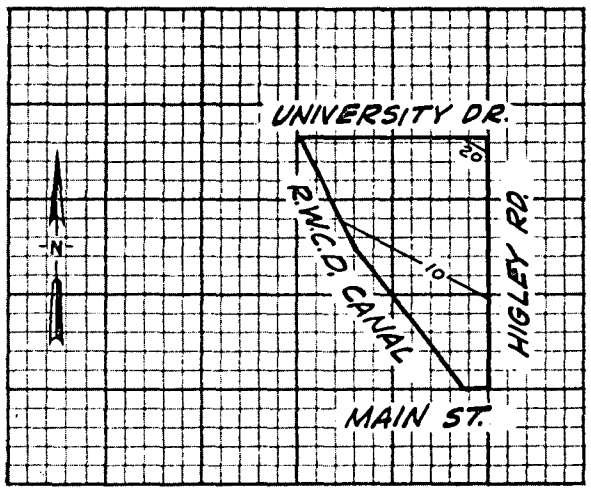
Done by T.B.G.

Date 11/80

Drainage Area D-14

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential	69	0	0	0	0		
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	69		0		0		

Mean land slope N-S .005 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	21		0									0	
20	69		0									0	
20	2		2	3.20	1.0	3.20					2.70	5	
													5 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE D

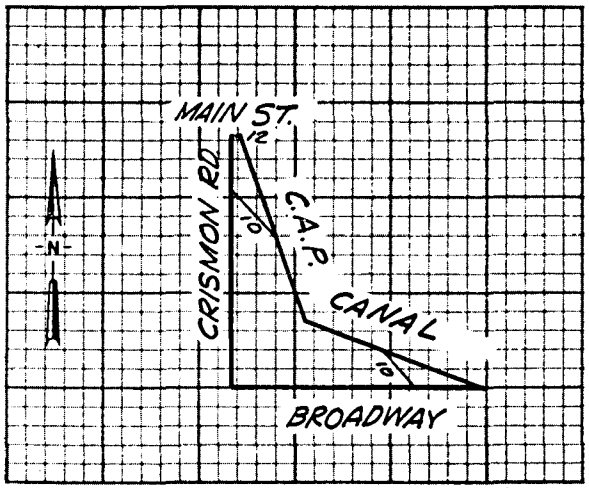
Done by D.N.S.

Date 12/80

Drainage Area E-1

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



SCALE: 1" = 2000' (TYP.)

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	31	0	0	0	0		
M.D. Residential							
H.D. Residential	8	25	2	20	2		
Parks & park-like							
Farmlands, groves							
Commercial	2	0		63	1		
Industrial							
Total Acres	41		2		3		

Mean land slope N-S .0076 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 3.4 ft./sec. min./mile 204 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	35		3	2.50	1.0	2.50					2.07	6	
12	41		3	2.30	1.0	2.30					1.89	6 -	
10	2		2	4.40	1.0	4.40					3.78	8	
													14 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
High Dens. = 50%
Comm. = 30%

LINE E

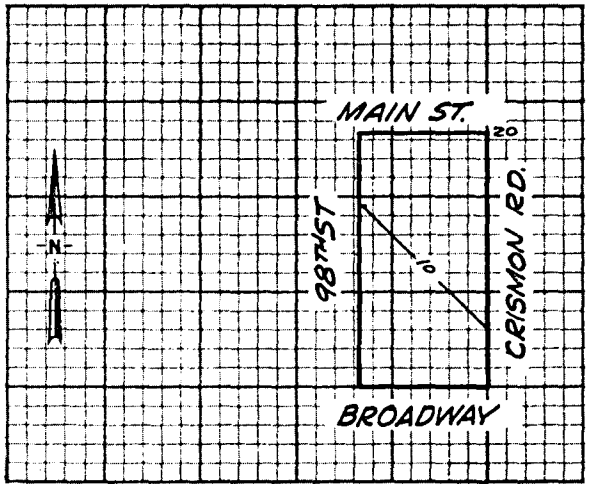
Done by T.B.G.

Date 1/81

Drainage Area E-2

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential	70	20	14	16	11		
Parks & park-like							
Farmlands, groves							
Commercial	10	0	0	36	4		
Industrial							
Total Acres	80		14		15		

Mean land slope N-S .0068 E-W .007

Flow conveyance 40' Streets

Flow velocity N-S 3.2 ft./sec. min./mile 192 ft./min.

E-W 3.3 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	38		7	2.50	1.0	2.50					2.07	14	
20	80		15	1.80	1.0	1.80					1.44	22	
20	2.5		2.5	3.20	1.0	3.20					2.70	7	
													29 Max.

Yost and Gardner Engineers

Future Dev.:
High Dens. = 60%
Comm. = 60%

LINE E

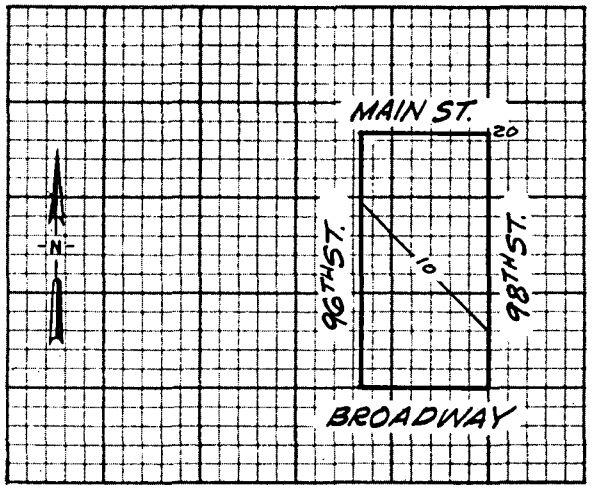
Done by T.B.G.

Date 1/81

Drainage Area E-3

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential	72	40	29	32	23		
Parks & park-like							
Farmlands, groves							
Commercial	8	0	0	54	4		
Industrial							
Total Acres	80		29		27		

Mean land slope N-S .0068 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 3.2 ft./sec. min./mile 192 ft./min.

E-W 3.3 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	38		13	2.50	1.0	2.50					2.07	27	
20	80		27	1.80	1.0	1.80					1.44	39	
20	2.5		2.5	3.20	1.0	3.20					2.70	7	
													46 Max.

Yost and Gardner Engineers

Future Dev.:
High Dens. = 20%
Comm. = 40%

LINE E

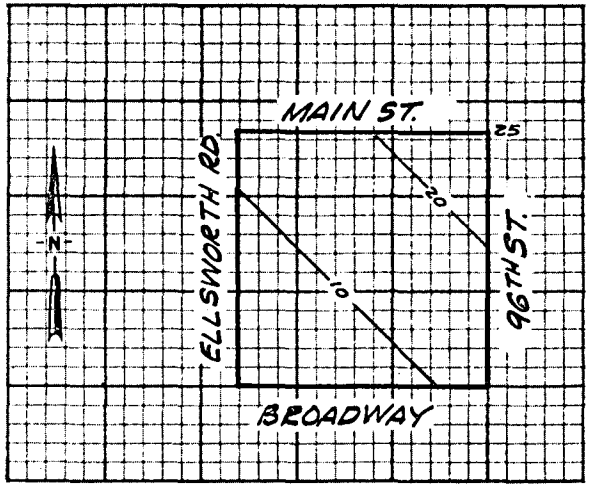
Done by D.N.S.

Date 12/80

Drainage Area E-4

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential	145	20	29	16	23		
Parks & park-like							
Farmlands, groves							
Commercial	15	0	0	54	8		
Industrial							
Total Acres	160		29		31		

Mean land slope N-S .0076 E-W .008

Flow conveyance 40' Streets

Flow velocity N-S 3.4 ft./sec. min./mile 204 ft./min.

E-W 3.45 ft./sec. min./mile 207 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	48		9	2.50	1.0	2.50					2.07	19	
20	143		28	1.80	.997	1.79					1.43	40	
25	160		31	1.58	.996	1.57					1.23	38	
20	5		5	3.20	1.0	3.20					2.70	14	
													54 Max.

Yost and Gardner Engineers

Future Dev. = 60%
Comm. = 40%

LINE E

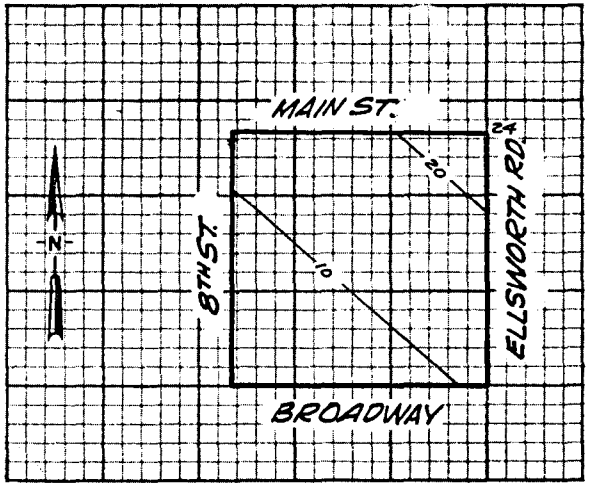
Done by D.N.S.

Date 12/80

Drainage Area E-5

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	72	0	0	0	0		
M.D. Residential							
H.D. Residential	73	25	18	20	15		
Parks & park-like							
Farmlands, groves							
Commercial	15	0	0	18	3		
Industrial							
Total Acres	160		18		18		

Mean land slope N-S .008 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 3.45 ft./sec. min./mile 207 ft./min.

E-W 3.8 ft./sec. min./mile 228 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	54		6	2.50	1.0	2.50					2.07	12	
20	151		17	1.80	.997	1.79					1.43	24	
24	160		18	1.62	.996	1.61					1.27	23	
20	5		5	3.20	1.0	3.20					2.70	14	
													38 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
High Dens. = 50%
Comm. = 80%

LINE E

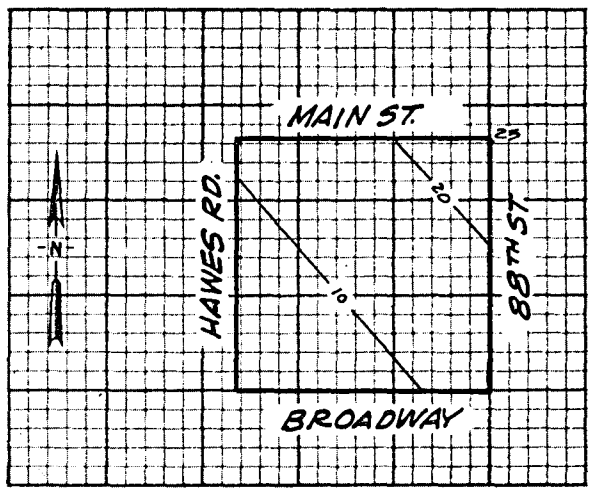
Done by D.N.S.

Date 12/80

Drainage Area E-6

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	26	51	13	30	8		
H.D. Residential	118	25	30	20	24		
Parks & park-like							
Farmlands, groves							
Commercial	16	0	0	36	6		
Industrial							
Total Acres	160		43		38		

Mean land slope N-S .009 E-W .007

Flow conveyance 40' Streets

Flow velocity N-S 3.7 ft./sec. min./mile 222 ft./min.

E-W 3.25 ft./sec. min./mile 195 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	50		12	2.50	1.0	2.50					2.07	25	
20	147		35	1.80	.997	1.79					1.43	50	
25	160		38	1.58	.996	1.57					1.23	47	
20	5		5	3.20	1.0	3.20					2.70	14	
													64 Max.

Yost and Gardner Engineers

Future Dev.:
Med. Dens. = 15%
High Dens. = 50%
Comm. = 60%

LINE E

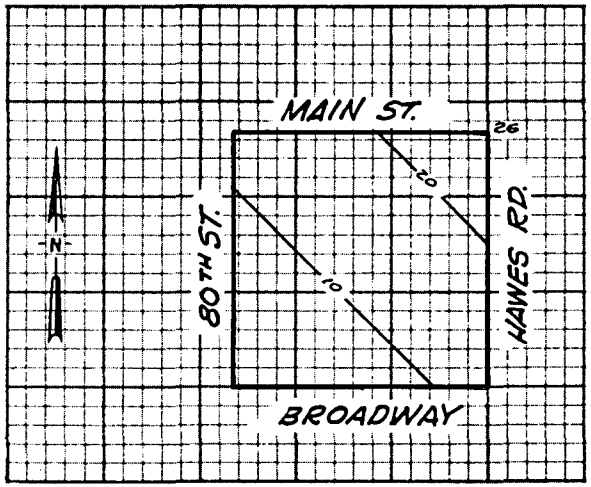
Done by D.N.S.

Date 12/80

Drainage Area E-7

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	135	54	73	32	43		
H.D. Residential	20	50	10	40	8		
Parks & park-like							
Farmlands, groves							
Commercial	15	0	0	45	7		
Industrial							
Total Acres	160		83		58		

Mean land slope N-S .008 E-W .008

Flow conveyance 40' Streets

Flow velocity N-S 3.45 ft./sec. min./mile 207 ft./min.

E-W 3.45 ft./sec. min./mile 207 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	49		18	2.50	1.0	2.50					2.07	37	
20	143		52	1.80	.997	1.79					1.43	74	
26	160		58	1.54	.996	1.53					1.20	70	
20	5		5	3.20	1.0	3.20					2.70	14	
													88 Max.

Yost and Gardner Engineers

Future Dev.:
Med. Dens. = 10%
High Dens. = 0%
Comm. = 50%

LINE E

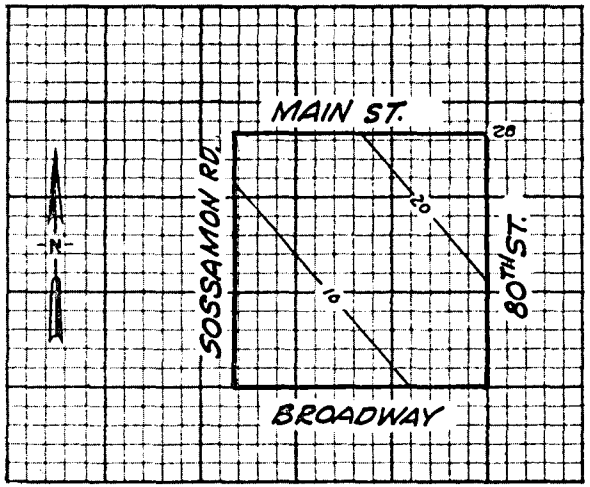
Done by D.N.S.

Date 12/80

Drainage Area E-8

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	79	18	14	11	9		
H.D. Residential	66	30	20	24	16		
Parks & park-like							
Farmlands, groves							
Commercial	15	0	0	9	1		
Industrial							
Total Acres	160		34		26		

Mean land slope N-S .008 E-W .006

Flow conveyance 40' Streets

Flow velocity N-S 3.45 ft./sec. min./mile 207 ft./min.

E-W 3.0 ft./sec. min./mile 180 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	43		7	2.50	1.0	2.50					2.07	14	
20	136		22	1.80	.997	1.79					1.43	31	
28	160		26	1.46	.996	1.45					1.13	29	
20	5		5	3.20	1.0	3.20					2.70	14	
													45 Max.

Yost and Gardner Engineers

Future Dev.:
Med. Dens. = 70%
High Dens. = 40%
Comm. = 90%

LINE E

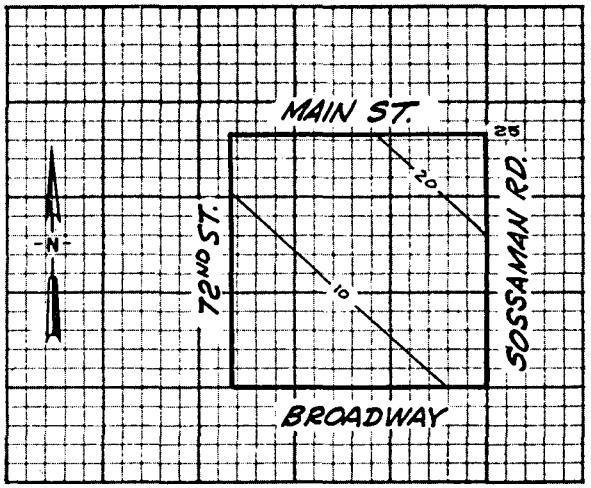
Done by D.N.S.

Date 12/80

Drainage Area E-9

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	145	60	87	35	51		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	15	0	0	9	1		
Industrial							
Total Acres	160		87		52		

Mean land slope N-S .007 E-W .009

Flow conveyance 40' Streets

Flow velocity N-S 3.25 ft./sec. _____ min./mile 195 ft./min.

E-W 3.7 ft./sec. _____ min./mile 222 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	50		16	2.50	1.0	2.50					2.07	33	
20	146		47	1.80	.997	1.79					1.43	67	
25	160		52	1.58	.996	1.57					1.23	64	
20	5		5	3.20	1.0	3.20					2.70	14	
													81 Max.

Yost and Gardner Engineers

Future Dev.:
Med. Dens.= 0%
Comm. =90%

LINE E

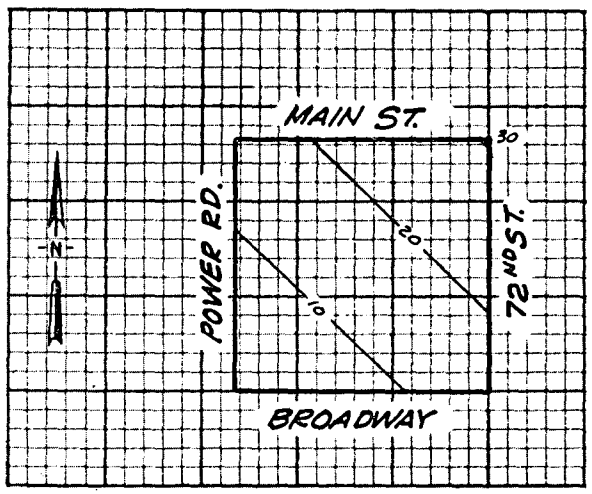
Done by D.N.S.

Date 12/80

Drainage Area E-10

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	62	30	19	18	11		
H.D. Residential	6	0	0	0	0		
Parks & park-like	35	10	4	10	4		
Farmlands, groves							
Commercial	57	0	0	27	15		
Industrial							
Total Acres	160		23		30		

Mean land slope N-S .0053 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 2.8 ft./sec. min./mile 168 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	34		6	2.50	1.0	2.50					2.07	12	
20	121		23	1.80	1.0	1.80					1.44	33	
30	160		30	1.40	.996	1.34					1.07	32	
20	5		5	3.20	1.0	3.20					2.70	14	
													47 Max.

Yost and Gardner Engineers

Future Dev.:
Med. Dens. = 50%
High Dens. = 100%
Comm. = 70%

LINE E

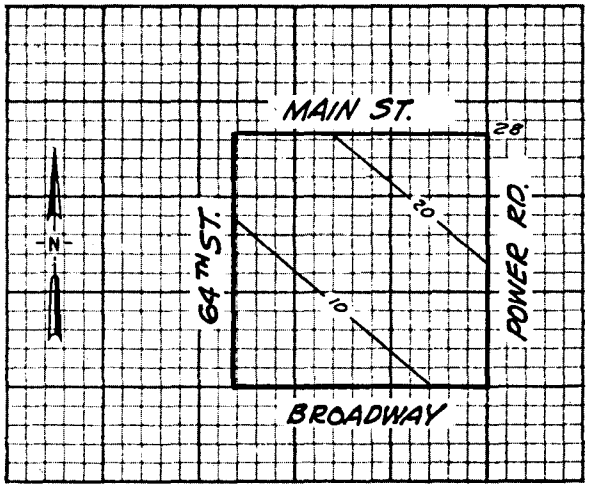
Done by D.N.S.

Date 12/80

Drainage Area E-11

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	49	59	28	23	11		
M.D. Residential							
H.D. Residential	28	0	0	0	0		
Parks & park-like							
Farmlands, groves							
Commercial	85	0	0	23	20		
Industrial							
Total Acres	160		28		31		

Mean land slope N-S .0057 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 2.9 ft./sec. min./mile 174 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	41		8	2.50	1.0	2.50					2.07	17	
20	135		26	1.80	.997	1.79					1.43	37	
28	160		31	1.46	.996	1.45					1.13	35	
20	5		5	3.20	1.0	3.20					2.70	14	
													51 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 10%
High Dens. = 100%
Comm. = 75%

LINE E

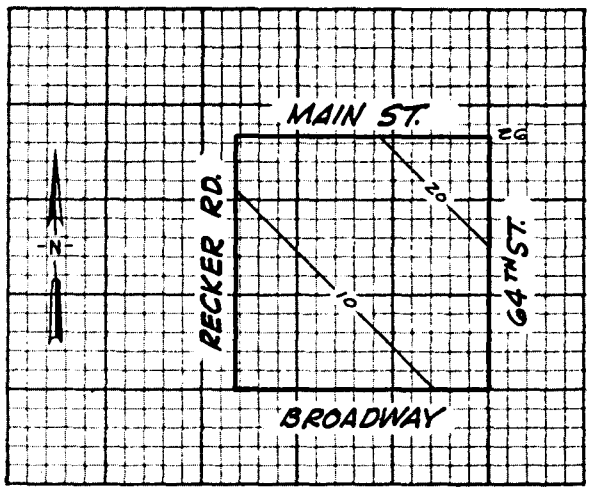
Done by D.N.S.

Date 12/80

Drainage Area E-12

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential							
H.D. Residential	44	50	22	40	18		
Parks & park-like							
Farmlands, groves	29	0	0	0	0		
Commercial	87	0	0	9	8		
Industrial							
Total Acres	160		22		26		

Mean land slope N-S .0076 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 3.4 ft./sec. min./mile 204 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	48		8	2.50	1.0	2.50					2.07	17	
20	145		24	1.80	.997	1.79					1.43	34	
26	160		26	1.54	.996	1.53					1.20	31	
20	5		5	3.20	1.0	3.20					2.70	14	
													48 Max.

Yost and Gardner Engineers

Future Dev.:
High Dens. = 0%
Comm. = 90%

LINE E

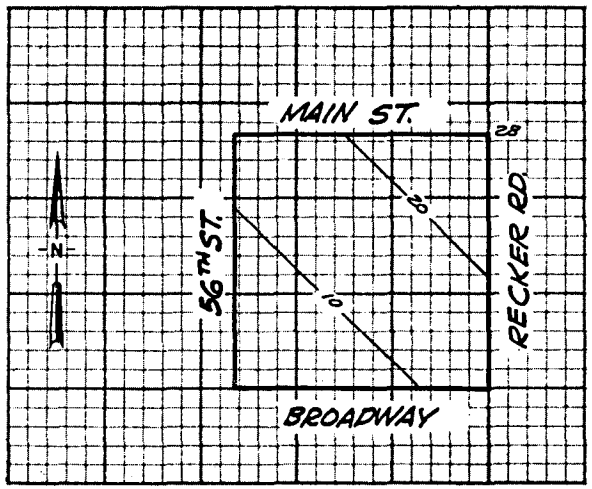
Done by D.N.S.

Date 12/80

Drainage Area E-13

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	20	65	13	25	5		
M.D. Residential							
H.D. Residential	93	45	42	36	33		
Parks & park-like							
Farmlands, groves							
Commercial	47	0	0	5	2		
Industrial							
Total Acres	160		55		40		

Mean land slope N-S .0064 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 3.1 ft./sec. min./mile 186 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	41		10	2.50	1.0	2.50					2.07	21	
20	134		34	1.80	.997	1.79					1.43	49	
28	160		40	1.46	.996	1.45					1.13	45	
20	5		5	3.20	1.0	3.20					2.70	14	
													63 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 0%
High Dens. = 10%
Comm. = 95%

LINE E

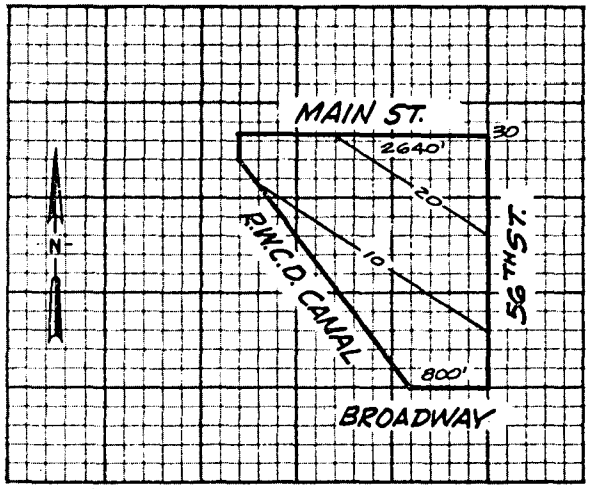
Done by D.N.S.

Date 12/80

Drainage Area E-14

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2 - 10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	67	52	35	20	13		
M.D. Residential	3	0	0	0	0		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	40	0	0	5	2		
Industrial							
Total Acres	110		35		15		

Mean land slope N-S .0068 E-W .0045

Flow conveyance 40' Streets

Flow velocity N-S 3.2 ft./sec. min./mile 192 ft./min.

E-W 2.6 ft./sec. min./mile 156 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	36		5	2.50	1.0	2.50					2.07	10	
20	90		12	1.80	1.0	1.80					1.44	17	
30	110		15	1.40	1.0	1.40					1.08	16	
20	3		3	3.20	1.0	3.20					2.70	8	
													25 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 20%
Med. Dens. = 100%
Comm. = 95%

LINE E

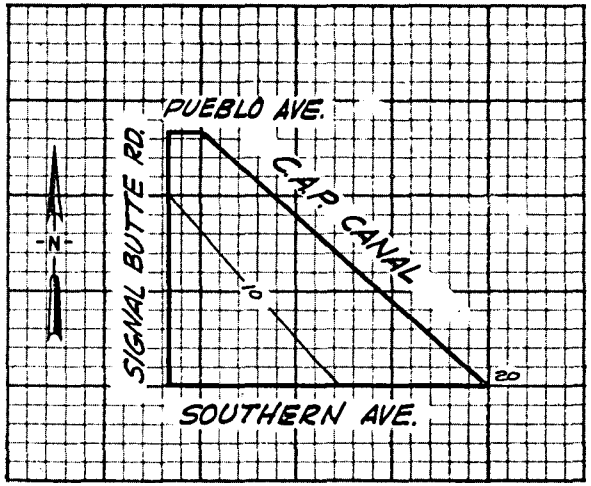
Done by T.B.G

Date 11/80

Drainage Area F-1

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



SCALE: 1"=2000' (TYP.)

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	112	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	112		0		0		

Mean land slope N-S .0067 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 3.2 ft./sec. min./mile 192 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	38		0									0	
20	112		0									0	
20	3		3	3.20	1.0	3.20					2.70	8	
													8 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE F

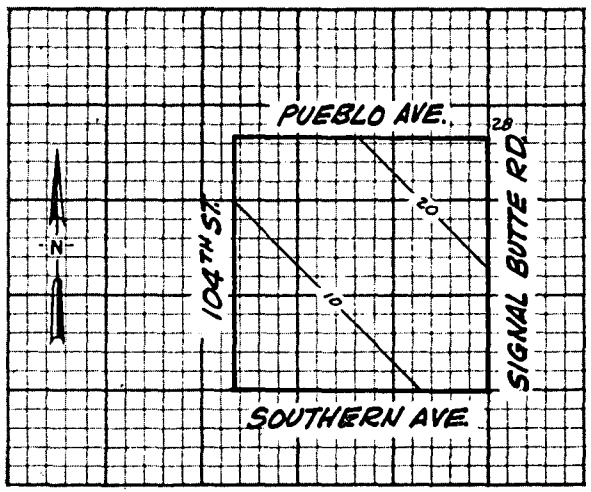
Done by T.B.G

Date 11/80

Drainage Area F-2

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .0068 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 3.2 ft./sec. min./mile 192 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	42		0									0	
20	137		0									0	
28	160		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE F

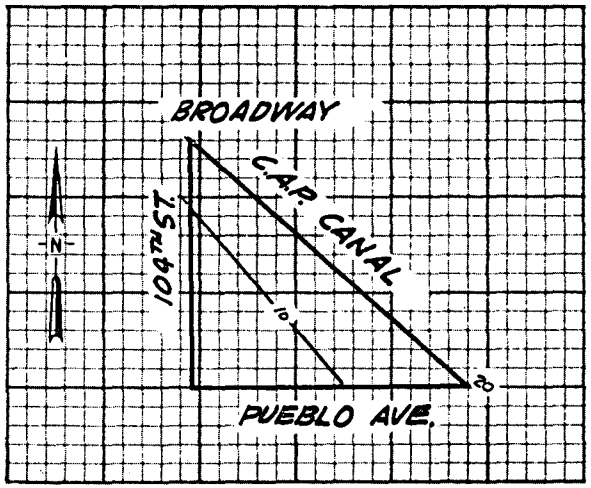
Done by T.B.G

Date 11/80

Drainage Area F-3

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	91	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	91		0		0		

Mean land slope N-S .0068 E-W .0053

Flow conveyance 40' Streets

Flow velocity N-S 3.2 ft./sec. min./mile 192 ft./min.

E-W 2.8 ft./sec. min./mile 168 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	37		0									0	
20	91		0									0	
20	3		3	3.20	1.0	3.20					2.70	8	
													8 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE F

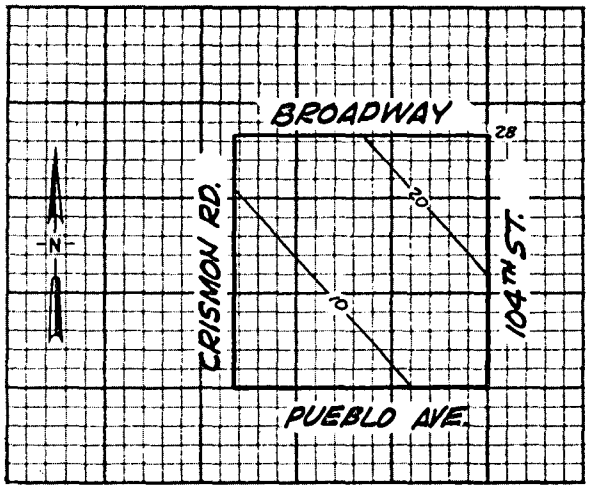
Done by T.B.G

Date 11/80

Drainage Area F-4

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		0		0		

Mean land slope N-S .0076 E-W .006

Flow conveyance 40' Streets

Flow velocity N-S 3.4 ft./sec. min./mile 204 ft./min.

E-W 3.0 ft./sec. min./mile 180 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	42		0									0	
20	138		0									0	
28	160		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE F

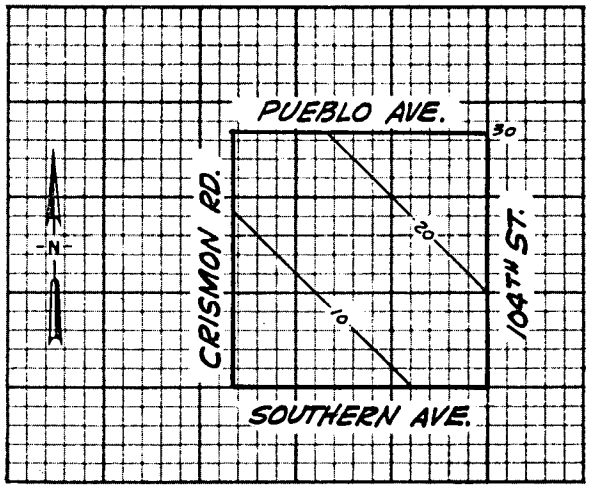
Done by T.B.G

Date 11/80

Drainage Area F-5

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160	0	0		0		

Mean land slope N-S .006 E-W .006

Flow conveyance 40' Streets

Flow velocity N-S 3.0 ft./sec. min./mile 180 ft./min.

E-W 3.0 ft./sec. min./mile 180 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	37		0									0	
20	127		0									0	
30	160		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE F

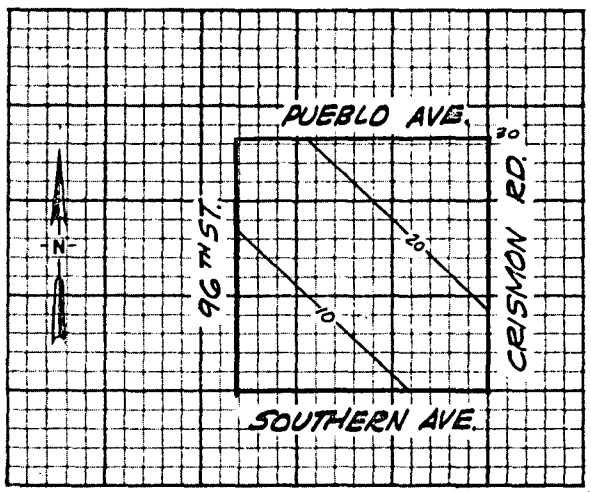
Done by T.B.G.

Date 11/80

Drainage Area F-6

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	86	0	0	0			
M.D. Residential	74	30	22	18	13		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		22		13		

Mean land slope N-S .005 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	33		3	2.50	1.0	2.50					2.07	6	
20	122		10	1.80	1.0	1.80					1.44	14	
30	160		13	1.40	.996	1.39					1.07	14-	
20	5		5	3.20	1.0	3.20					2.70	14	
													28 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
Med. Dens. = 50%

LINE F

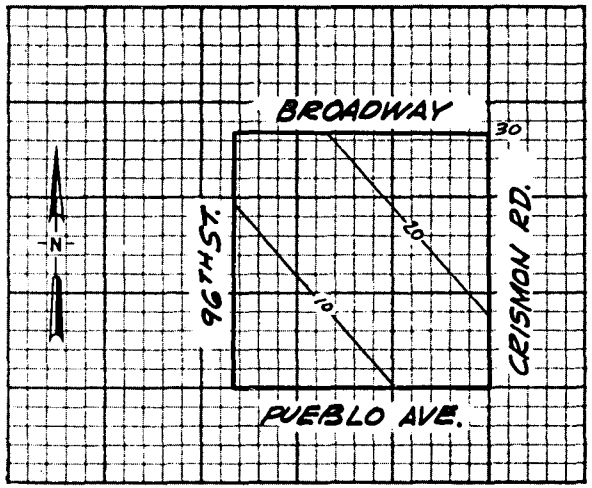
Done by T.B.G

Date 11/80

Drainage Area F-7

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	40	0	0	0	0		
M.D. Residential							
H.D. Residential	120	40	48	32	38		
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		48		38		

Mean land slope N-S .0064 E-W .005

Flow conveyance 40' Streets

Flow velocity N-S 3.1 ft./sec. min./mile 186 ft./min.

E-W 2.75 ft./sec. min./mile 165 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	35		8	2.50	1.0	2.50					2.07	17	
20	123		29	1.80	1.0	1.80					1.44	42	
30	160		38	1.40	.996	1.39					1.07	41	
20	5		5	3.20	1.0	3.20					2.70	14	
													56 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
High Dens. = 20%

LINE F

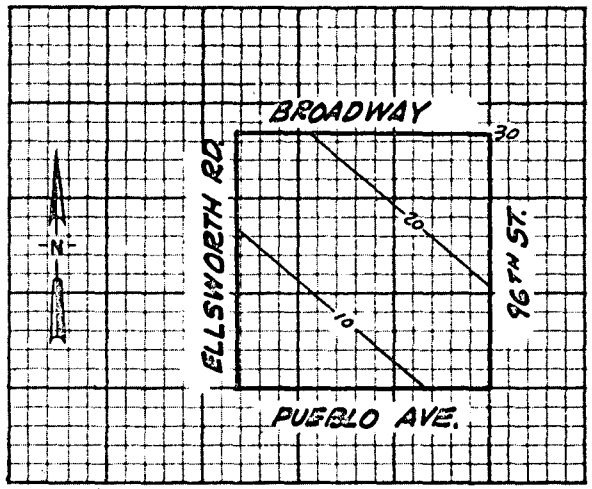
Done by T.B.G

Date 11/80

Drainage Area F-8

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	40	0	0	0	0		
M.D. Residential							
H.D. Residential	120	35	42	28	34		
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		42		34		

Mean land slope N-S .005 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.3 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	38		8	2.50	1.0	2.50					2.07	17	
20	126		27	1.80	1.0	1.80					1.44	39	
30	160		34	1.40	.996	1.39					1.07	36	
20	5		5	3.20	1.0	3.20					2.70	14	
													53 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
High Dens. - 30%

LINE F

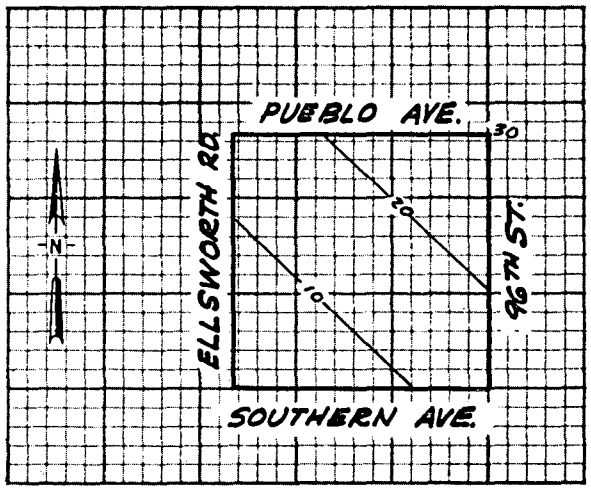
Done by T.B.G

Date 11/80

Drainage Area F-9

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	80	0	0	0	0		
M.D. Residential	80	60	48	35	28		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		48		28		

Mean land slope N-S .0057 E-W .0064

Flow conveyance 40' Streets

Flow velocity N-S 2.9 ft./sec. min./mile 174 ft./min.

E-W 3.1 ft./sec. min./mile 186 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	37		6	2.50	1.0	2.50					2.07	12	
20	128		22	1.80	1.0	1.80					1.44	32	
30	160		28	1.40	.996	1.39					1.07	30	
20	5		5	3.20	1.0	3.20					2.70	14	
													46 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. =100%
Med. Dens. = 0%

LINE F

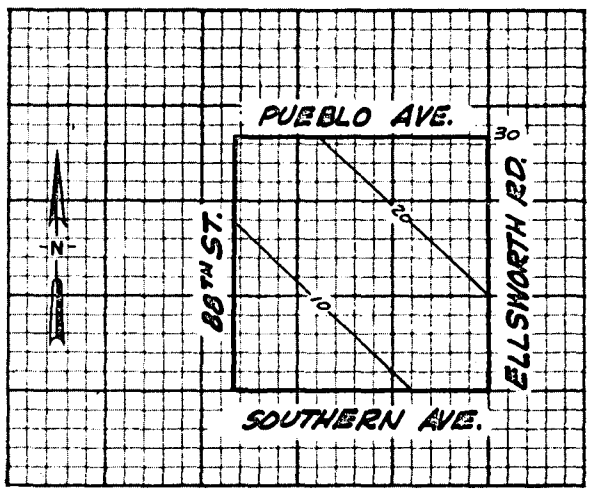
Done by T.B.G

Date 11/80

Drainage Area F-10

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	80	33	26	13	10		
M.D. Residential	80	27	22	16	13		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		48		23		

Mean land slope N-S .0057 E-W .0064

Flow conveyance 40' Streets

Flow velocity N-S 2.9 ft./sec. min./mile 174 ft./min.

E-W 3.1 ft./sec. min./mile 186 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	37		5	2.50	1.0	2.50					2.07	10	
20	126		18	1.80	1.0	1.80					1.44	26	
30	160		23	1.40	.996	1.39					1.07	25	
20	5		5	3.20	1.0	3.20					2.70	14	
													40 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 50%
Med. Dens. = 55%

LINE F

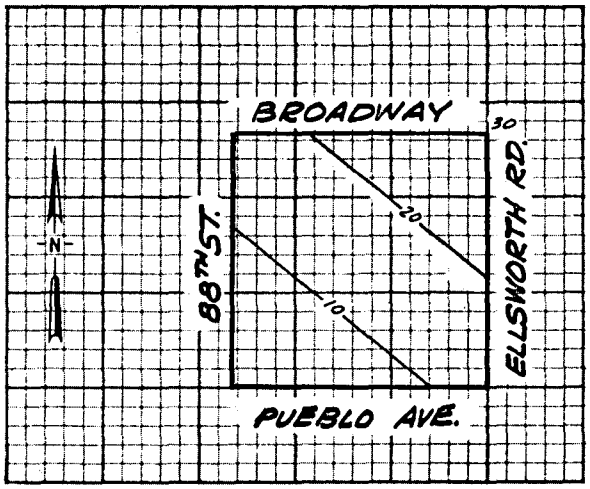
Done by T.B.G

Date 11/80

Drainage Area F-11

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	120	20	24	8	10		
M.D. Residential	30	0	0	0	0		
H.D. Residential	10	40	4	32	3		
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		28		13		

Mean land slope N-S .005 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	39		3	2.50	1.0	2.50					2.07	6	
20	128		10	1.80	1.0	1.80					1.44	14+	
30	160		13	1.40	.996	1.39					1.07	14-	
20	5		5	3.20	1.0	3.20					2.70	14	
													28 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 70%
Med. Dens. = 100%
High Dens. = 20%

LINE F

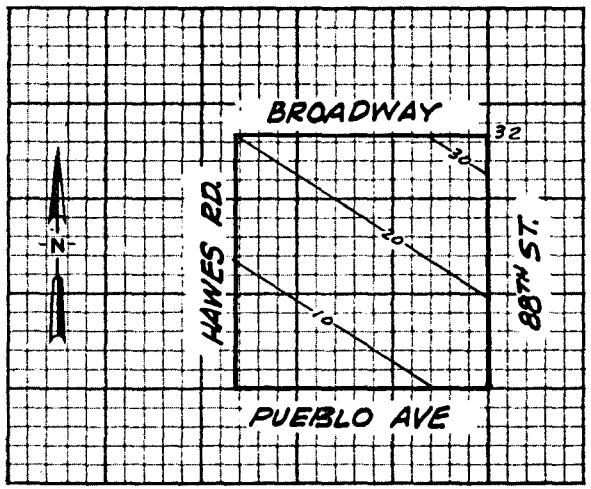
Done by T.B.G

Date 11/80

Drainage Area F-12

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	150	18	27	11	17		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	10	0	0	0	0		
Industrial							
Total Acres	160		27		17		

Mean land slope N-S .003 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 2.15 ft./sec. min./mile 129 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	30		3	2.50	1.0	2.50					2.07	6	
20	107		11	1.80	1.0	1.80					1.44	16	
30	157		17	1.40	.996	1.39					1.07	18	
33	160		17	1.32	.996	1.31					1.00	17	
30	5		5	2.50	1.0	2.50					2.07	10	
													28 Max.

Yost and Gardner Engineers

Future Dev.:
Med. Dens. = 70%
Comm. =100%

LINE F

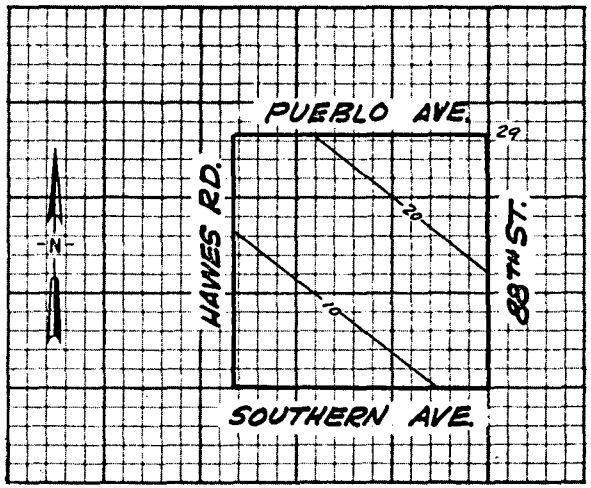
Done by T.B.G

Date 11/80

Drainage Area F-13

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	130	0	0	0	0		
M.D. Residential	30	42	13	25	8		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		13		8		

Mean land slope N-S .005 E-W .0083

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.5 ft./sec. min./mile 210 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	40		2	2.50	1.0	2.50					2.07	4	
20	130		7	1.80	.997	1.79					1.44	10	
29	160		8	1.43	.996	1.42					1.10	9	
20	5		5	3.20	1.0	3.20					2.70	14	
													24 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 100%
Med. Dens. = 30%

LINE F

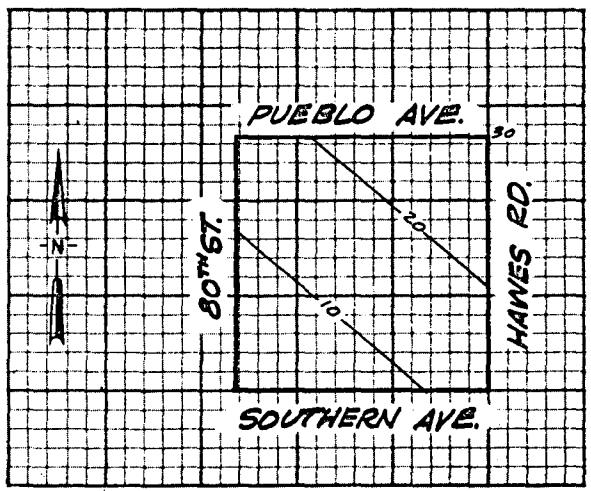
Done by T.B.G

Date 11/80

Drainage Area F-14

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	160	39	62	23	37		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		62		37		

Mean land slope N-S .005 E-W .007

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.25 ft./sec. min./mile 195 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	37		9	2.50	1.0	2.50					2.07	19	
20	125		29	1.80	1.0	1.80					1.44	42	
30	160		37	1.40	.996	1.39					1.07	40	
20	5		5	3.20	1.0	3.20					2.70	14	
													56 Max.

Yost and Gardner Engineers

Future Dev. = 35%

LINE F

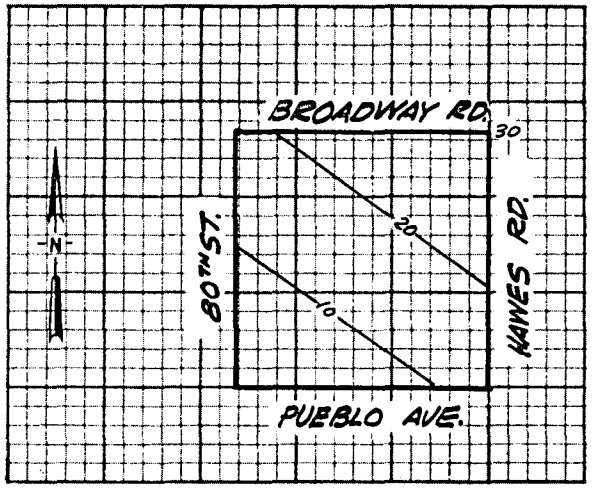
Done by T.B.G.

Date 11/80

Drainage Area F-15

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	160	51	82	30	48		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		82		48		

Mean land slope N-S .004 E-W .0076

Flow conveyance 40' Steets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	34		10	2.50	1.0	2.50					2.07	21	
20	120		36	1.80	1.0	1.80					1.44	52	
30	160		48	1.40	.996	1.39					1.07	52-	
20	5		5	3.20	1.0	3.20					2.70	14	
													66 Max.

Yost and Gardner Engineers

Future Dev. = 15%

LINE F

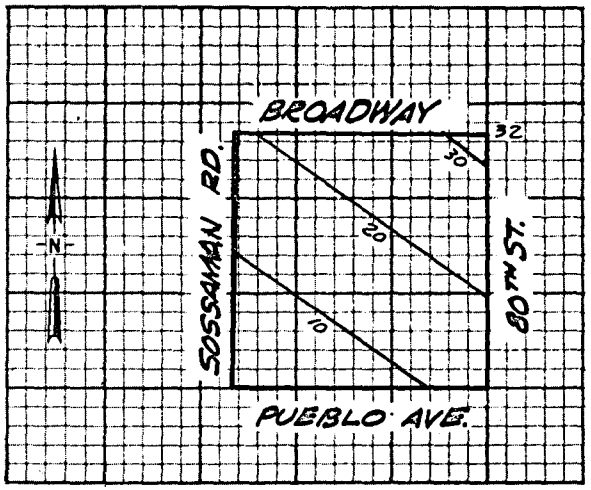
Done by T.B.G

Date 11/80

Drainage Area F-16

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	155	24	37	14	22		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	5	0	0	0	0		
Industrial							
Total Acres	160		37		22		

Mean land slope N-S .0034 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.3 ft./sec. min./mile 138 ft./min.

E-W 3.30 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	31		4	2.50	1.0	2.50					2.07	8	
20	113		16	1.80	1.0	1.80					1.44	23	
30	158		22	1.40	.996	1.39					1.07	24	
32	160		22	1.34	.996	1.33					1.02	22	
30	5		5	2.50	1.0	2.50					2.07	10	
													34 Max.

Yost and Gardner Engineers

Future Dev.:
Med. Dens. = 60%
Comm. = 100%

LINE F

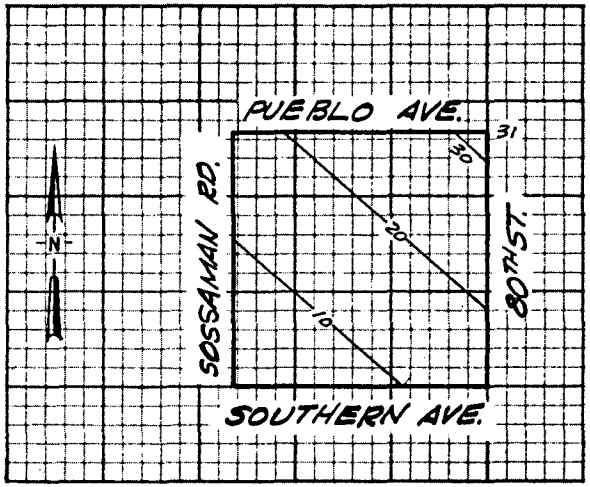
Done by T.B.G

Date 11/80

Drainage Area F-17

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	28	42	12	16	4		
M.D. Residential	132	21	28	12	16		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		40		20		

Mean land slope N-S .0045 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 2.6 ft./sec. min./mile 156 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	31		4	2.50	1.0	2.50					2.07	8	
20	114		14	1.80	1.0	1.80					1.44	20	
30	159		20	1.40	.996	1.39					1.07	21+	
31	160		20	1.37	.996	1.36					1.04	21-	
30	5		5	2.50	1.0	2.50					2.07	10	
													31 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 35%
Med. Dens. = 65%

LINE F

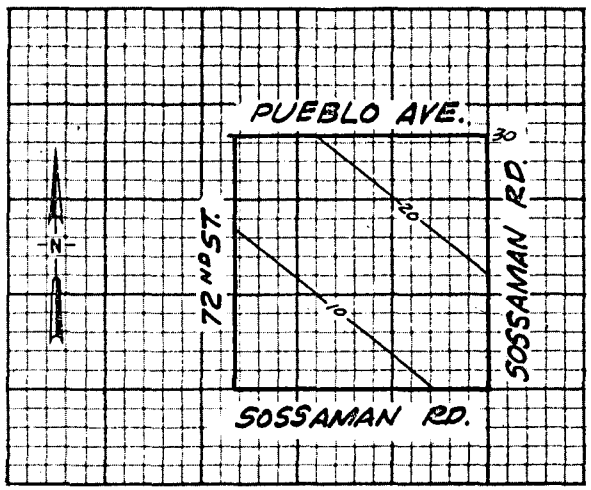
Done by T.B.G

Date 11/80

Drainage Area F-18

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	16	26	6	10		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		26		10		

Mean land slope N-S .005 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	39		2	2.50	1.0	2.50					2.07	4	
20	130		8	1.80	1.0	1.80					1.44	12	
30	160		10	1.40	.996	1.39					1.07	11	
20	5		5	3.20	1.0	3.20					2.70	14	
													26 Max.

Yost and Gardner Engineers

Future Dev. = 75%

LINE F

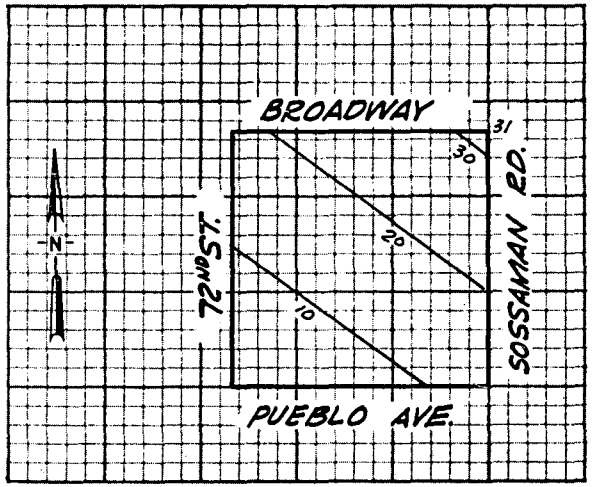
Done by T.B.G

Date 11/80

Drainage Area F-19

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	160	16	26	6	10		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		26		10		

Mean land slope N-S .004 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 3.30 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	33		2	2.50	1.0	2.50					2.07	4	
20	115		7	1.80	1.0	1.80					1.44	10	
30	159		10	1.40	.996	1.39					1.07	11	
31	160		10	1.37	.996	1.36					1.04	10	
30	5		5	2.50	1.0	2.50					2.07	10	
													21 Max.

Yost and Gardner Engineers

Future Dev. = 75%

LINE F

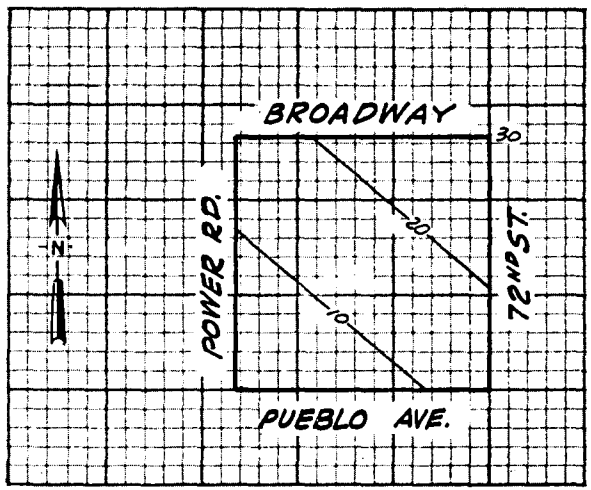
Done by T.B.G

Date 11/80

Drainage Area F-20

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	74	59	44	23	17		
M.D. Residential							
H.D. Residential	26	40	10	32	8		
Parks & park-like	60	10	6	10	6		
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		60		31		

Mean land slope N-S .0053 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.8 ft./sec. min./mile 168 ft./min.

E-W 3.3 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	38		7	2.50	1.0	2.50					2.07	14	
20	126		24	1.80	1.0	1.80					1.44	35	
30	160		31	1.40	.996	1.39					1.07	33	
20	4		4	3.20	1.0	3.20					2.70	11	
													46 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 10%
High Dens. = 20%
Adjusted for Golf Course = 45%

LINE F

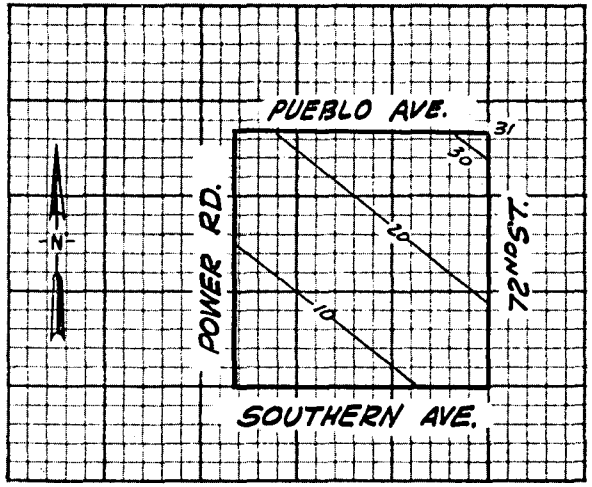
Done by T.B.G

Date 11/80

Drainage Area F-21

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	110	59	65	23	25		
M.D. Residential							
H.D. Residential							
Parks & park-like	47	10	5	10	5		
Farmlands, groves							
Commercial	3	0	0	90	3		
Industrial							
Total Acres	160		70		33		

Mean land slope N-S .004 E-W .0064

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 3.1 ft./sec. min./mile 186 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	31		6	2.50	1.0	2.50					2.07	12	
20	116		24	1.80	1.0	1.80					1.44	35	
30	159		33	1.40	.996	1.39					1.07	35+	
31	160		33	1.37	.996	1.36					1.04	34	
30	4		4	2.50	1.0	2.50					2.07	8	
													43 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 10%
Comm. = 0%
Adjusted for Golf Course = 30%

LINE F

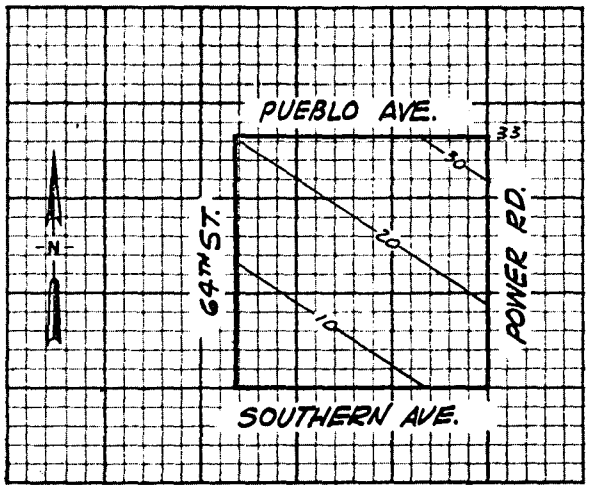
Done by T.B.G

Date 11/80

Drainage Area F-22

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	5	65	3	25	1		
M.D. Residential	116	60	70	35	41		
H.D. Residential	9	50	5	40	4		
Parks & park-like	30	10	3	10	3		
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		81		49		

Mean land slope N-S .003 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 2.15 ft./sec. min./mile 129 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	28		9	2.50	1.0	2.50					2.07	19	
20	105		32	1.80	1.0	1.80					1.44	46	
30	156		48	1.40	.996	1.39					1.07	51	
33	160		49	1.32	.996	1.31					1.00	49	
30	2		2	2.50	1.0	2.50					2.07	4	
													55 Max.

Yost and Gardner Engineers

NOTE: Area F-22 Drains to On-site Lakes.

Future Dev. = 0%
Adjusted for Golf Course=20%

LINE F

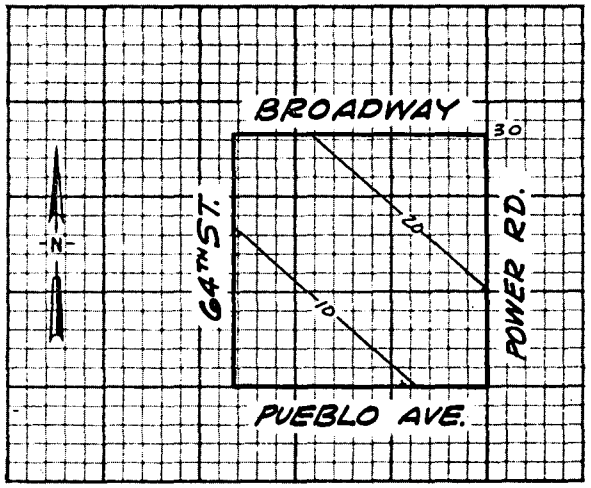
Done by T.B.G

Date 11/80

Drainage Area F-23

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	118	60	71	35	41		
H.D. Residential							
Parks & park-like	13	10	1	10	1		
Farmlands, groves							
Commercial	29	0	0	0	0		
Industrial							
Total Acres	160		72		42		

Mean land slope N-S .0053 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 2.8 ft./sec. min./mile 168 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	37		10	2.50	1.0	2.50					2.07	21	
20	127		33	1.80	1.0	1.80					1.44	48	
30	160		42	1.40	.996	1.39					1.07	45	
20	2		2	3.20	1.0	3.20					2.70	5	
													53 Max.

Yost and Gardner Engineers

NOTE: Area F-23 Drains to On-site Lakes.

Future Dev.:
Med. Dens. = 0%
Comm. =100%
Adjusted for Golf Course = 10%

LINE F

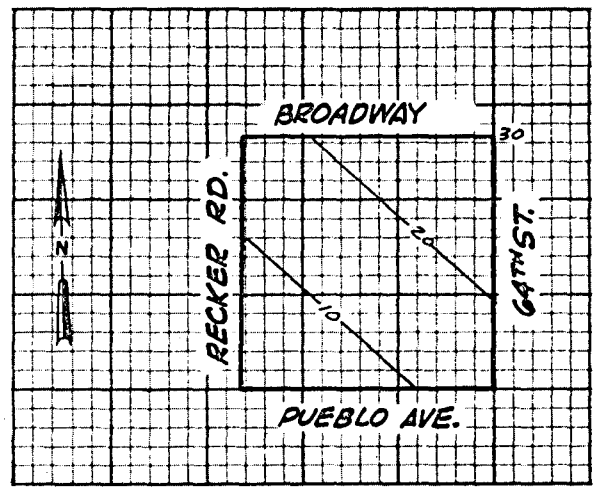
Done by T.B.G

Date 11/80

Drainage Area F-24

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	22	13	3	5	1		
M.D. Residential	74	24	18	14	10		
H.D. Residential	25	0	0	0	0		
Parks & park-like	31	10	3	10	3		
Farmlands, groves							
Commercial	8	0	0	0	0		
Industrial							
Total Acres	160		24		14		

Mean land slope N-S .005 E-W .006

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.0 ft./sec. min./mile 180 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	34		3	2.50	1.0	2.50					2.07	6	
20	123		11	1.80	1.0	1.80					1.44	16	
30	160		14	1.40	.996	1.39					1.07	15	
20	2		2	3.20	1.0	3.20					2.70	5	
													21 Max.

Yost and Gardner Engineers

NOET: Area F-24 Drains to On-site Lakes.

LINE F

Future Dev.:
Low Dens. = 80%
Med. Dens. = 60%
High Dens. = 100%
Comm. = 100%
Adjusted for Golf Course = 30%

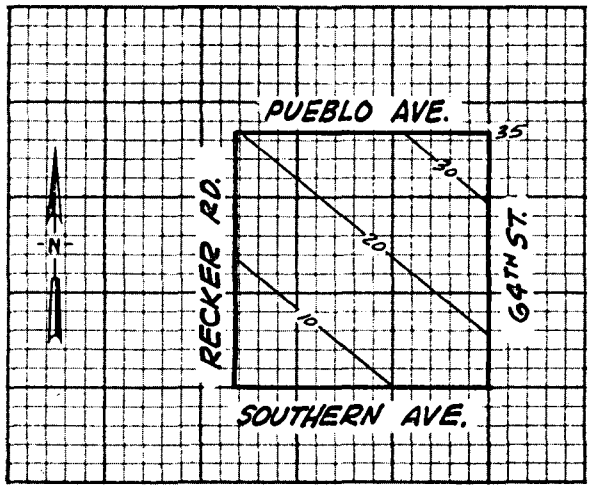
Done by T.B.G.

Date 11/80

Drainage Area F-25

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	64	42	27	25	16		
H.D. Residential							
Parks & park-like	96	10	10	10	10		
Farmlands, groves							
Commercial							
Industrial							
Total Acres	160		37		26		

Mean land slope N-S .0034 E-W .0053

Flow conveyance 40' Streets

Flow velocity N-S 2.3 ft./sec. min./mile 138 ft./min.

E-W 2.8 ft./sec. min./mile 168 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	27		4	2.50	1.0	2.50					2.07	8	
20	99		16	1.80	1.0	1.80					1.44	23	
30	153		25	1.40	.997	1.40					1.08	27	
35	160		26	1.27	.996	1.26					0.95	25	
30	2		2	2.50	1.0	2.50					2.07	4	
													31 Max.

Yost and Gardner Engineers

NOTE: Area F-25 Drains To On-site Lakes

Future Dev.:
Med. Dens. = 30%
Adjusted for Golf Course = 60%

LINE F

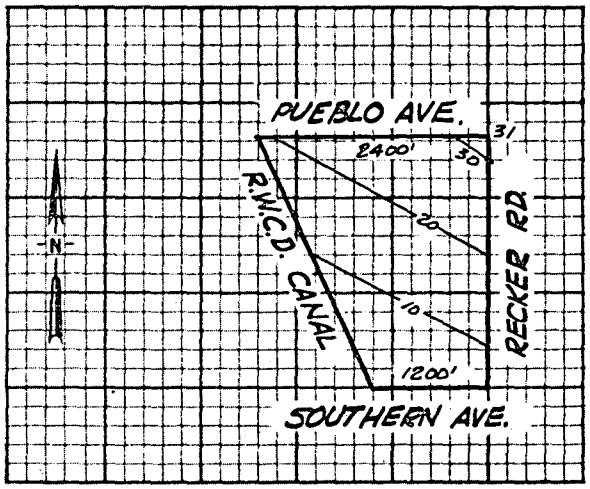
Done by T.B.G

Date 11/80

Drainage Area F-26

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	110	0	0	0	0		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	110		0		0		

Mean land slope N-S .003 E-W .006

Flow conveyance 40' Streets

Flow velocity N-S 2.15 ft./sec. min./mile 129 ft./min.

E-W 3.0 ft./sec. min./mile 180 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	28		0									0	
20	79		0									0	
30	109		0									0	
31	110		0									0	
30	2		2	2.50	1.0	2.50					2.07	4	
													4 Max.

Yost and Gardner Engineers

NOTE: Area F-26 Drains to On-site Lakes.

Future Dev. = 100%

LINE F

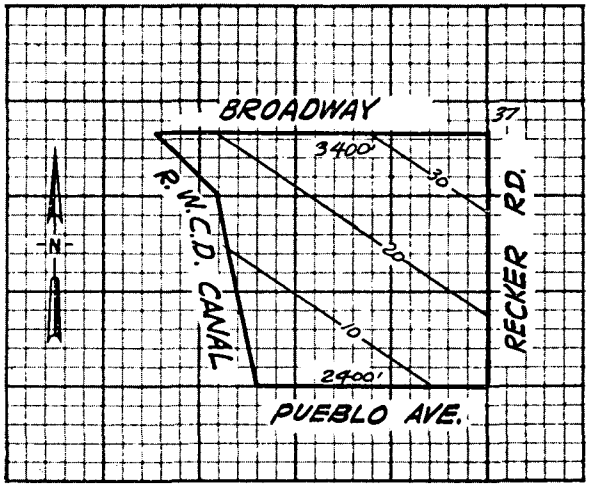
Done by T.B.G

Date 11/80

Drainage Area F-27

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	168	3	5	2	3		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	168		5		3		

Mean land slope N-S .004 E-W .005

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 2.75 ft./sec. min./mile 165 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	30		1	2.50	1.0	2.50					2.07	2	
20	107		2	1.80	1.0	1.80					1.44	3	
30	156		3	1.40	.996	1.39					1.07	3+	
37	168		3	1.22	.996	1.22					0.92	3-	
30	2		2	2.50	1.0	2.50					2.07	4	
													7 Max.

Yost and Gardner Engineers

NOTE: Area F-27 Drains to On-Site Lakes

Future Dev. = 95%

LINE F

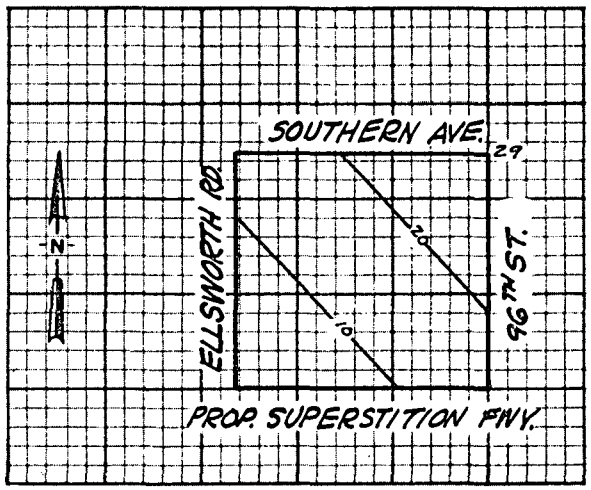
Done by D.N.S

Date 1/81

Drainage Area G-1

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



SCALE: 1"=2000' (TYP.)

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .0061 E-W .0053

Flow conveyance 40' Streets

Flow velocity N-S 3.05 ft./sec. min./mile 183 ft./min.

E-W 2.8 ft./sec. min./mile 168 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	35		0									0	
20	120		0									0	
29	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE G

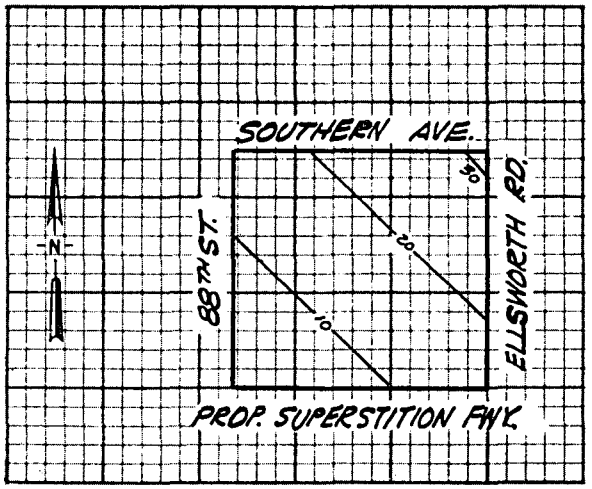
Done by D.N.S.

Date 1/81

Drainage Area G-2

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	1	1	1	1		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		1		1		

Mean land slope N-S .0049 E-W .0049

Flow conveyance 40' Streets

Flow velocity N-S 2.7 ft./sec. min./mile 162 ft./min.

E-W 2.7 ft./sec. min./mile 162 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	30		0.20	2.50	1.0	2.50					2.07	0.4	
20	112		.8	1.80	1.0	1.80					1.44	1.2	
30	148		1	1.40	.997	1.40					1.08	1	
20	5		5	3.20	1.0	3.20					2.70	14	
													15 Max.

Future Dev. = 98%

Yost and Gardner Engineers

LINE G

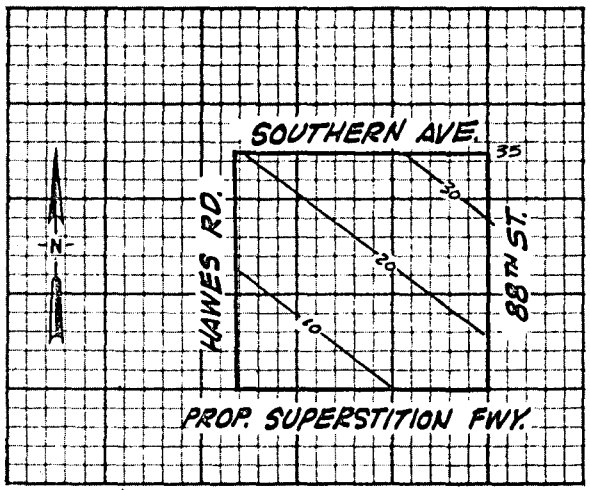
Done by D.N.S

Date 1/81

Drainage Area G-3

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .003 E-W .0053

Flow conveyance 40' Streets

Flow velocity N-S 2.1 ft./sec. min./mile 126 ft./min.

E-W 2.8 ft./sec. min./mile 168 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	24		0									0	
20	92		0									0	
30	144		0									0	
35	148		0									0	
30	5		5	2.50	1.0	2.50					2.07	10	
													10 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE G

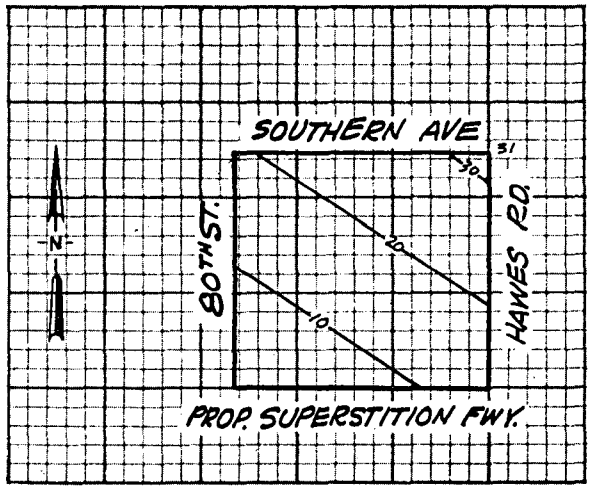
Done by D.N.S.

Date 1/81

Drainage Area G-4

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .003 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.15 ft./sec. min./mile 129 ft./min.

E-W 3.3 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	29		0									0	
20	105		0									0	
30	147		0									0	
31	148		0									0	
30	5		5	2.50	1.0	2.50					2.07	10	
													10 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE G

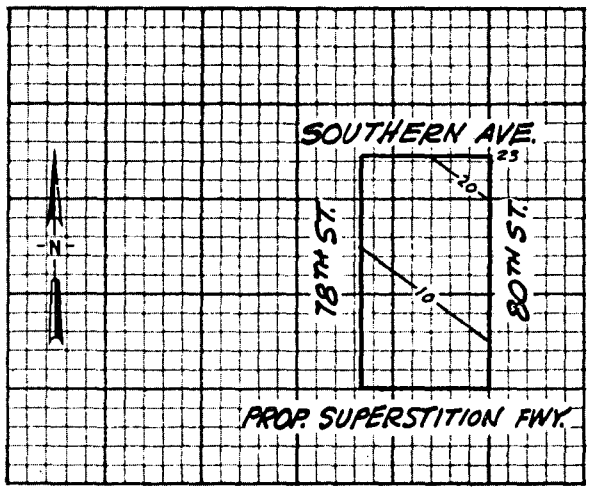
Done by D.N.S.

Date 1/81

Drainage Area G-5

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	74	6	4	4	3		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	74		4		3		

Mean land slope N-S .004 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 3.30 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	30		1	2.50	1.0	2.50					2.07	2	
20	71		3	1.80	1.0	1.80					1.44	4+	
23	74		3	1.66	1.0	1.66					1.31	4	
20	2		2	3.20	1.0	3.20					2.70	5	
													9 Max.

Yost and Gardner Engineers

Future Dev. = 90%

LINE G

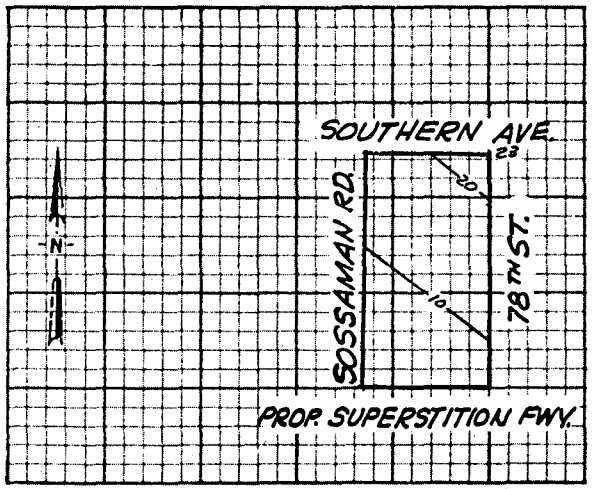
Done by D.N.S

Date 1/81

Drainage Area G-6

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential							
M.D. Residential	74	51	38	30	22		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	74		38		22		

Mean land slope N-S .004 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 3.30 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	30		9	2.50	1.0	2.50					2.07	19	
20	71		21	1.80	1.0	1.80					1.44	30	
23	74		22	1.66	1.0	1.66					1.31	29	
20	2		2	3.20	1.0	3.20					2.70	5	
													35 Max.

Future Dev. = 15%

Yost and Gardner Engineers

LINE G

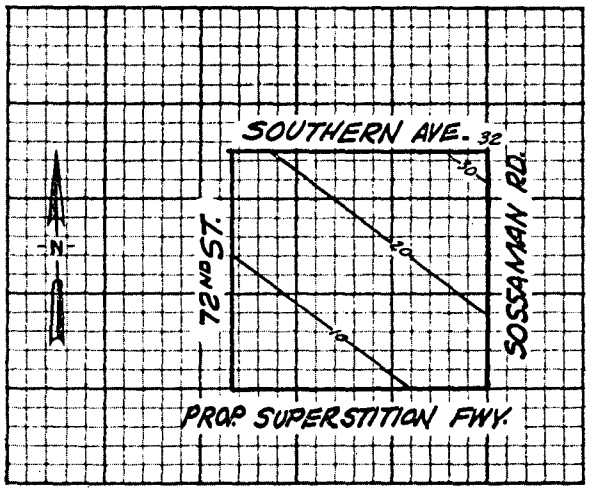
Done by D.N.S

Date 1/81

Drainage Area G-7

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .0034 E-W .006

Flow conveyance 40' Streets

Flow velocity N-S 2.3 ft./sec. min./mile 138 ft./min.

E-W 3.0 ft./sec. min./mile 180 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	29		0									0	
20	104		0									0	
30	147		0									0	
32	148		0									0	
30	5		5	2.50	1.0	2.50					2.07	10	
													10 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE G

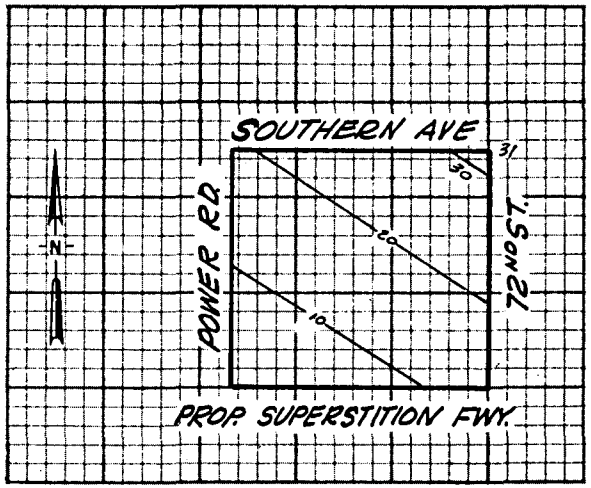
Done by D.N.S.

Date 1/81

Drainage Area G-8

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	128	6.5	8	2.5	3		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial	20	0	0	0	0		
Industrial							
Total Acres	148		8		3		

Mean land slope N-S .003 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.15 ft./sec. min./mile 129 ft./min.

E-W 3.30 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	29		0.6	2.50	1.0	2.50					2.07	1+	
20	104		2.1	1.80	1.0	1.80					1.44	3	
30	147		3	1.40	.997	1.40					1.08	3+	
31	148		3	1.37	.997	1.37					1.05	3	
30	5		5	2.50	1.0	2.50					2.07	10	
													13 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 90%
Comm. = 100%

LINE G

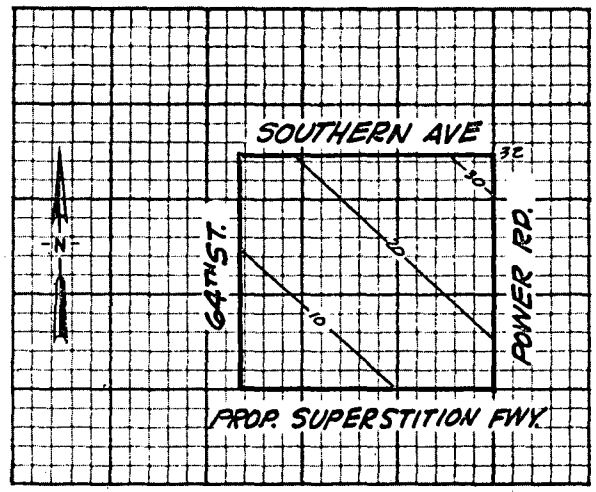
Done by D.N.S.

Date 1/81

Drainage Area G-9

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .004 E-W .005

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 2.75 ft./sec. min./mile 165 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	28		0									0	
20	102		0									0	
30	146		0									0	
32	148		0									0	
30	5		5	2.50	1.0	2.50					2.07	10	
													10 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE G

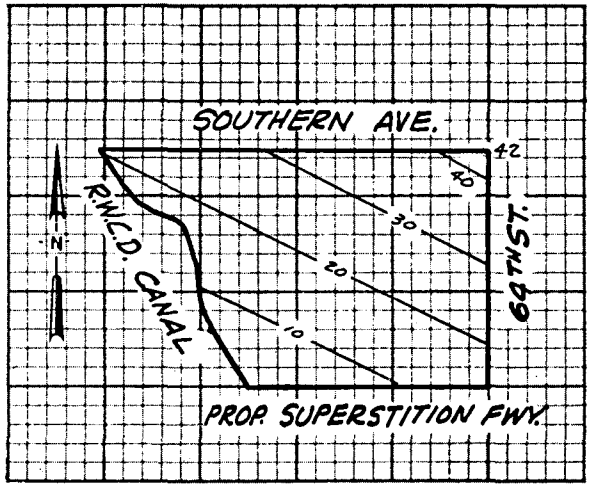
Done by D.N.S.

Date 1/81

Drainage Area G-10

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	170	1	2	1	1		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	170		2		1		

Mean land slope N-S .0025 E-W .005

Flow conveyance 40' Streets

Flow velocity N-S 1.95 ft./sec. min./mile 117 ft./min.

E-W 2.75 ft./sec. min./mile 165 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs	
10	22		0.1	2.50	1.0	2.50					2.07	0.2		
20	76		0.4	1.80	1.0	1.80					1.44	0.6		
30	137		0.8	1.40	1.0	1.40					1.08	0.9		
40	168		1.0	1.16	.996	1.16					0.86	0.9		
42	170		1.0	1.12	.996	1.12					0.83	0.8		
30	4		4	2.50	1.0	2.50					2.07	8	9	Max.

Future Dev. = 98%

Yost and Gardner Engineers

LINE G

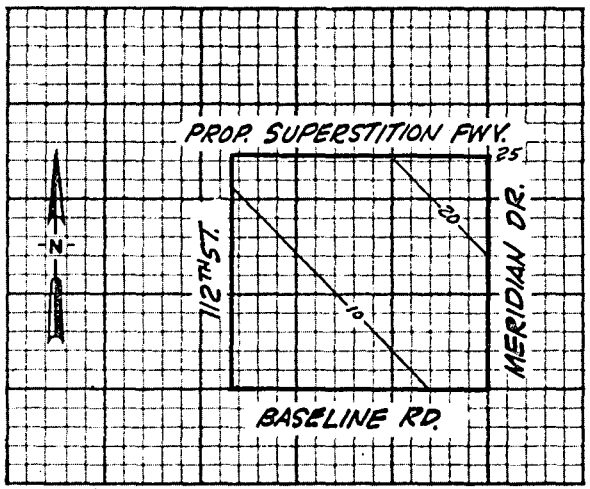
Done by T.B.G.

Date 12/80

Drainage Area H-1

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



SCALE: 1" = 2000' (TYP.)

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .0076 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 3.4 ft./sec. min./mile 204 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	48		0									0	
20	137		0									0	
25	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE H

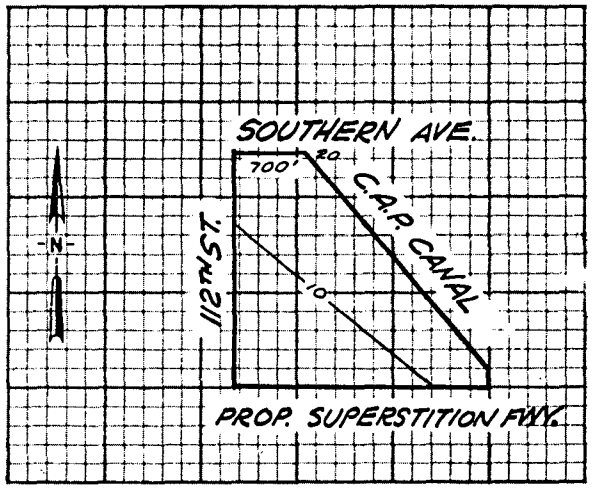
Done by D.N.S.

Date 1/81

Drainage Area H-2

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	98	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	98		0		0		

Mean land slope N-S .005 E-W .008

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 3.45 ft./sec. min./mile 207 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs	
10	39		0									0		
20	98		0									0		
20	2		2	3.20	1.0	3.20					2.70	5		
													5	Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

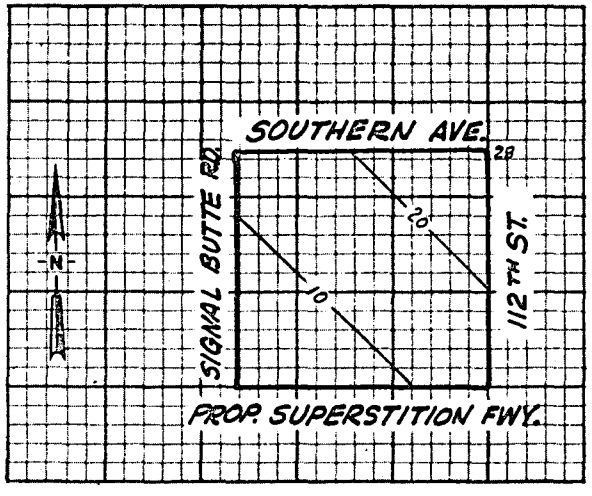
Done by D.N.S.

Date 1/81

Drainage Area H-3

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .006 E-W .0064

Flow conveyance 40' Streets

Flow velocity N-S 3.0 ft./sec. min./mile 180 ft./min.

E-W 3.1 ft./sec. min./mile 186 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	38		0									0	
20	124		0									0	
28	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

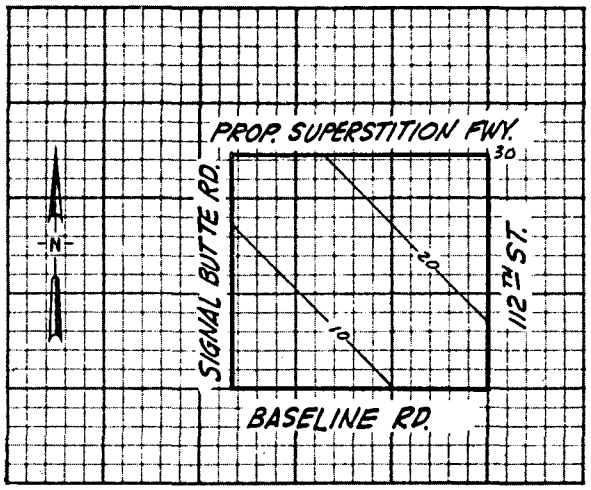
Done by T.B.G.

Date 12/80

Drainage Area H-4

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .0053 E-W .005

Flow conveyance 40' Streets

Flow velocity N-S 2.8 ft./sec. min./mile 168 ft./min.

E-W 2.75 ft./sec. min./mile 165 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	32		0									0	
20	115		0									0	
30	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

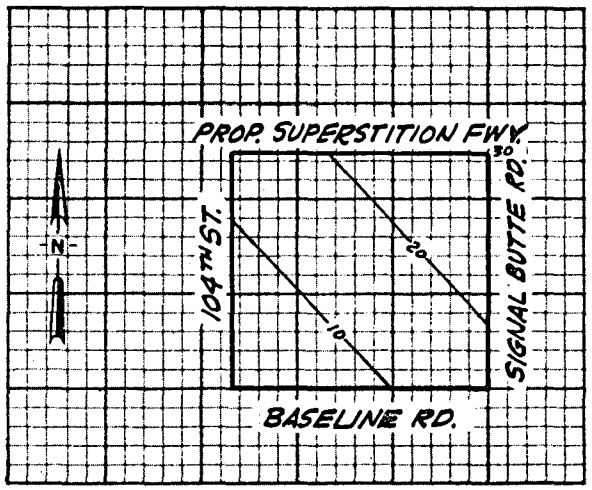
Done by T.B.G.

Date 12/80

Drainage Area H-5

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .0057 E-W .005

Flow conveyance 40' Streets

Flow velocity N-S 2.9 ft./sec. min./mile 174 ft./min.

E-W 2.75 ft./sec. min./mile 165 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	33		0									0	
20	115		0									0	
30	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

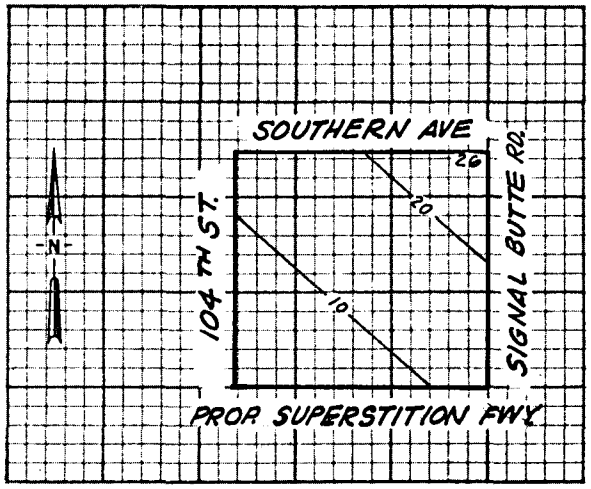
Done by D.N.S.

Date 1/81

Drainage Area H-6

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .006 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 3.0 ft./sec. min./mile 180 ft./min.

E-W 3.30 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	41		0									0	
20	131		0									0	
26	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

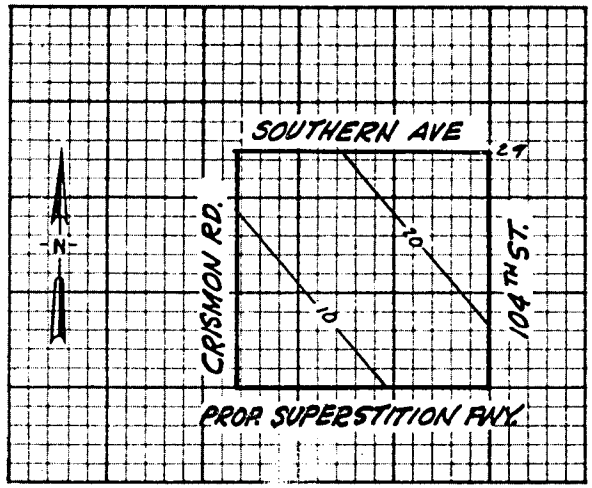
Done by D.N.S.

Date 1/81

Drainage Area H-7

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .0068 E-W .0045

Flow conveyance 40' Streets

Flow velocity N-S 3.2 ft./sec. min./mile 192 ft./min.

E-W 2.6 ft./sec. min./mile 156 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	34		0									0	
20	117		0									0	
29	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE H

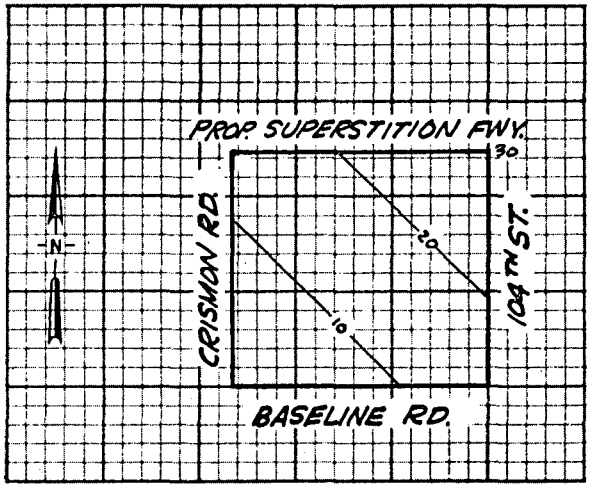
Done by T.B.G.

Date 12/80

Drainage Area H-8

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .0057 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 2.9 ft./sec. min./mile 174 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	35		0									0	
20	119		0									0	
30	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

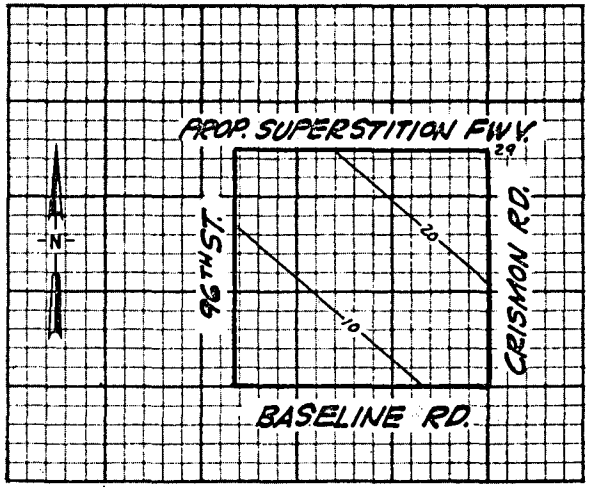
Done by T.R.C.

Date 12/80

Drainage Area H-9

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .0053 E-W .0072

Flow conveyance 40' Streets

Flow velocity N-S 2.8 ft./sec. min./mile 168 ft./min.

E-W 3.30 ft./sec. min./mile 198 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs	
10	38		0									0		
20	122		0									0		
29	148		0									0		
20	5		5	3.20	1.0	3.20					2.70	14		
													14	Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

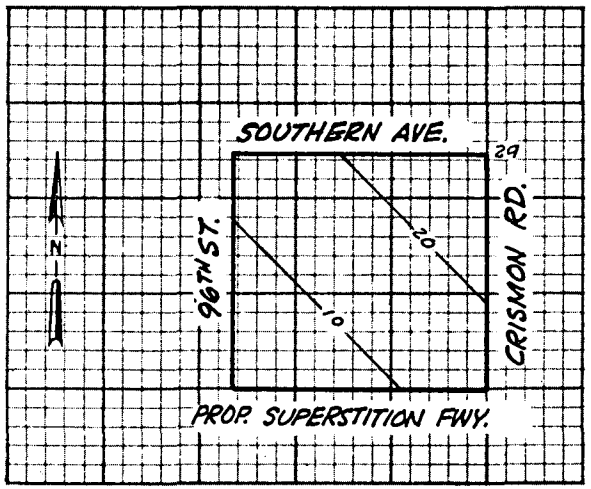
Done by D.N.S

Date 1/81

Drainage Area H-10

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .006 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 3.0 ft./sec. min./mile 180 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	36		0									0	
20	120		0									0	
29	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE H

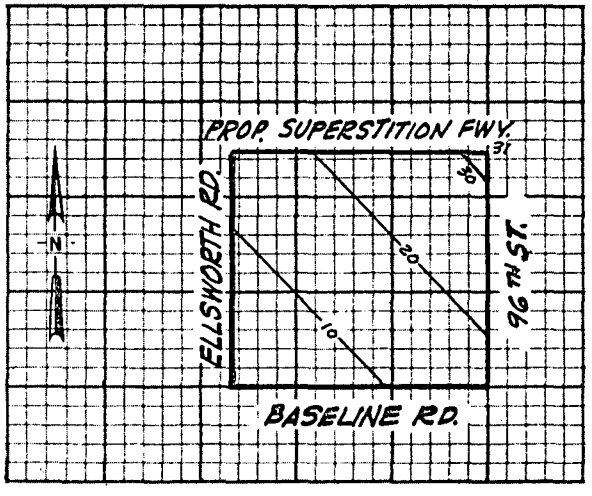
Done by T.B.G.

Date 12/80

Drainage Area H-11

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148	0	0	0	0		

Mean land slope N-S .005 E-W .0045

Flow conveyance 40' Streets

Flow velocity N-S 2.75 ft./sec. min./mile 165 ft./min.

E-W 2.6 ft./sec. min./mile 156 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	30		0									0	
20	107		0									0	
30	147		0									0	
31	148		0									0	
30	5		5	2.50	1.0	2.50					2.07	10	
													10 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

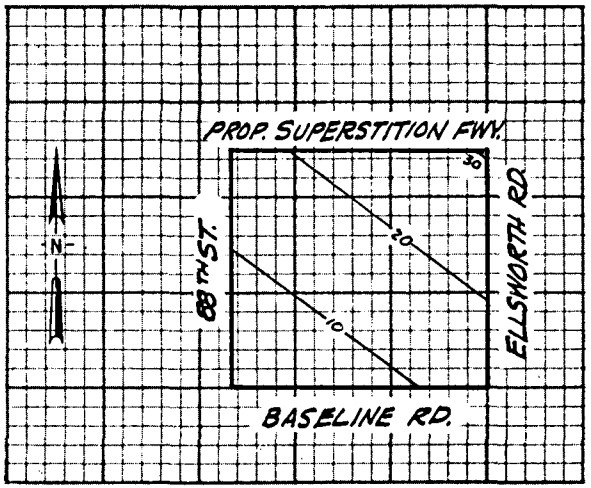
Done by T.B.G.

Date 12/80

Drainage Area H-42

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .004 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs	
10	32		0									0		
20	112		0									0		
30	148		0									0		
20	5		5	3.20	1.0	3.20					2.70	14		
													14	Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

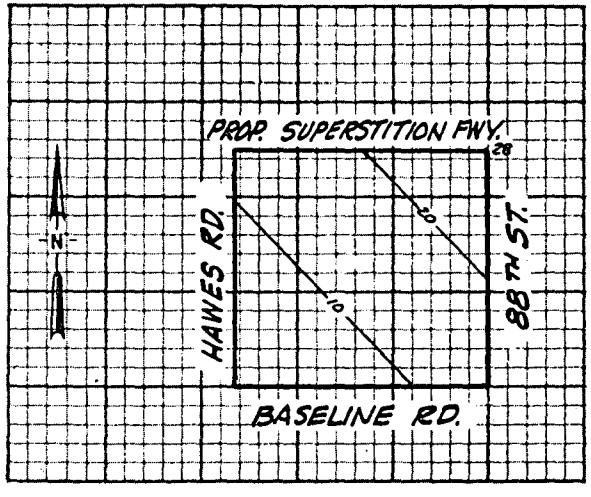
Done by T.B.G.

Date 12/80

Drainage Area H-13

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148	0	0	0	0		

Mean land slope N-S .0068 E-W .0064

Flow conveyance 40' Streets

Flow velocity N-S 3.2 ft./sec. min./mile 192 ft./min.

E-W 3.1 ft./sec. min./mile 186 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	41		0									0	
20	127		0									0	
28	148		0									0	
20	5		5	3.20	1.0	3.20					2.70	14	
													14 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

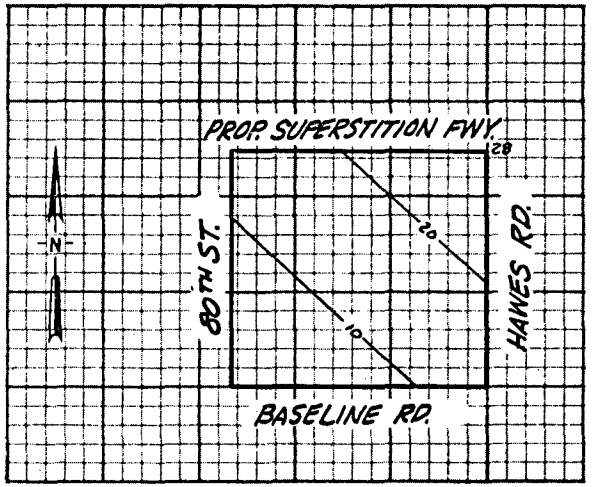
Done by T.B.G.

Date 12/80

Drainage Area H-14

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	29	43	11	16		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		43		16		

Mean land slope N-S .0057 E-W .0068

Flow conveyance 40' Streets

Flow velocity N-S 2.9 ft./sec. min./mile 174 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs	
10	38		4	2.50	1.0	2.50					2.07	8		
20	124		13	1.80	1.0	1.80					1.44	19		
28	148		16	1.46	.997	1.46					1.13	18		
20	5		5	3.20	1.0	3.20					2.70	14		
													33	Max.

Future Dev. = 55%

Yost and Gardner Engineers

LINE H

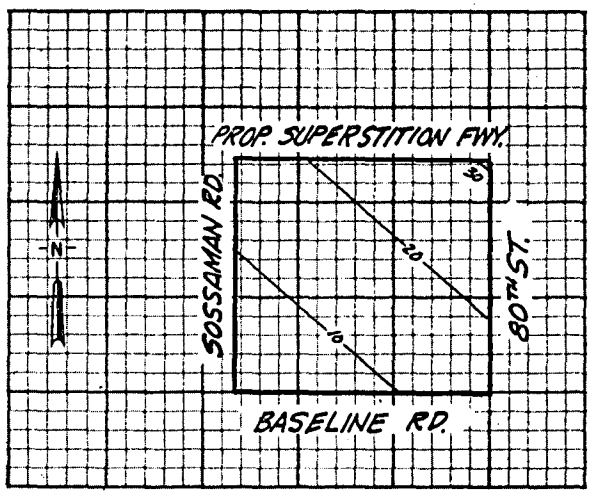
Done by T.B.G.

Date 12/80

Drainage Area H-15

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	66	39	26	15	10		
M.D. Residential	82	36	30	21	17		
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		56		27		

Mean land slope N-S .0045 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 2.6 ft./sec. min./mile 156 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	31		6	2.50	1.0	2.50					2.07	12	
20	112		20	1.80	1.0	1.80					1.44	29-	
30	148		27	1.40	.997	1.40					1.08	29+	
30	5		5	2.50	1.0	2.50					2.07	10	
													39 Max.

Yost and Gardner Engineers

Future Dev. = 40%

LINE H

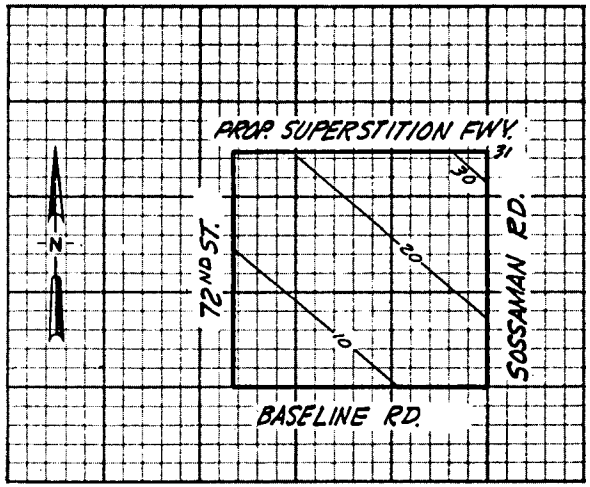
Done by T.B. G.

Date 12/80

Drainage Area H-16

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	33	49	13	19		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		49		19		

Mean land slope N-S .004 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 2.45 ft./sec. min./mile 147 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a-0.2	Q_i cfs	Q_t cfs
10	29		4	2.50	1.0	2.50					2.07	8	
20	108		14	1.80	1.0	1.80					1.44	20	
30	146		19	1.40	.997	1.40					1.08	21	
31	148		19	1.37	.997	1.37					1.05	20	
30	5		5	2.50	1.0	2.50					2.07	10	
													31 Max.

Yost and Gardner Engineers

Future Dev. = 50%
(Adjusted for Golf Course)

LINE H

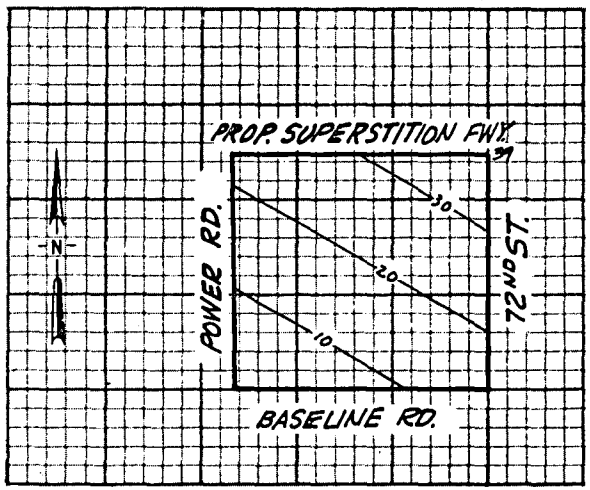
Done by T.B.G.

Date 12/80

Drainage Area H-17

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .002 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 1.7 ft./sec. min./mile 102 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	20		0									0	
20	80		0									0	
30	136		0									0	
39	148		0									0	
30	5		5	2.50	1.0	2.50					2.07	10	
													10 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

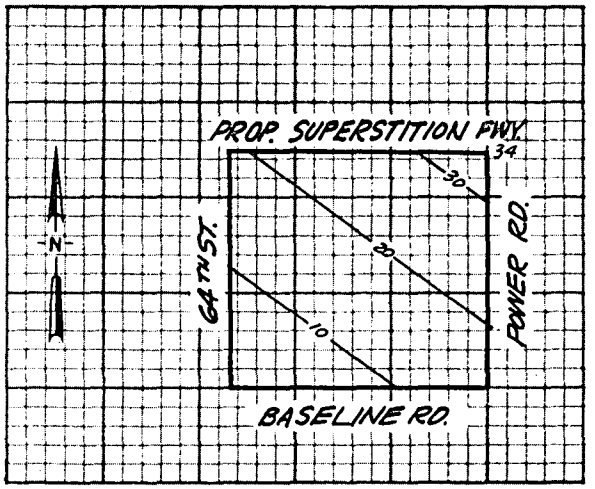
Done by T.B.G.

Date 12/80

Drainage Area H-18

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	148	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	148		0		0		

Mean land slope N-S .003 E-W .0057

Flow conveyance 40' Streets

Flow velocity N-S 2.15 ft./sec. min./mile 129 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	26		0									0	
20	98		0									0	
30	144		0									0	
34	148		0									0	
30	5		5	2.50	1.0	2.50					2.07	10	
													10 Max.

Yost and Gardner Engineers

Future Dev. = 100%

LINE H

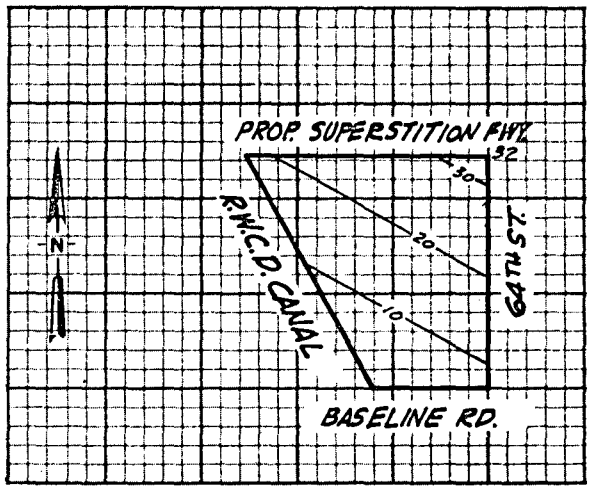
Done by T.B.G.

Date 12/80

Drainage Area H-19

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	104	0	0	0	0		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	104		0		0		

Mean land slope N-S .003 E-W .005

Flow conveyance 40' Streets

Flow velocity N-S 2.15 ft./sec. min./mile 129 ft./min.

E-W 2.75 ft./sec. min./mile 165 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	23		0									0	
20	72		0									0	
30	102		0									0	
32	104		0									0	
30	5		5	2.50	1.0	2.50					2.07	10	
													10 Max.

Future Dev. = 100%

Yost and Gardner Engineers

LINE H

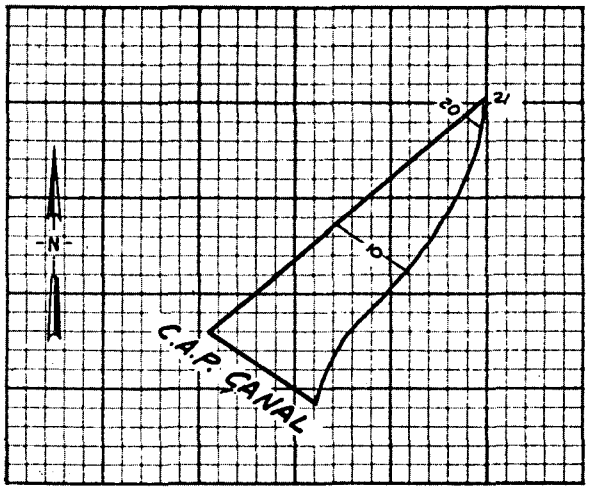
Done by C.R.S.

Date 2/81

Drainage Area 1 (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



SCALE: 1" = 6000'

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	256	1.3	3	0.5	1		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	256		3		1		

Mean land slope N-S .016 E-W .005

Flow conveyance 40' Streets

Flow velocity N-S 4.9 ft./sec. min./mile 294 ft./min.

E-W 2.25 ft./sec. min./mile 165 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	165		0.6	2.50	.995	2.49					2.06	1.2	
20	254		1.0	1.80	.990	1.78					1.42	1.4	
22	256		1.0	1.70	.990	1.68					1.33	1.3	
20	8		8	3.20	1.0	3.20					2.70	22	
													23 Max.

Future Dev. = 98%

Yost and Gardner Engineers

AREA 1

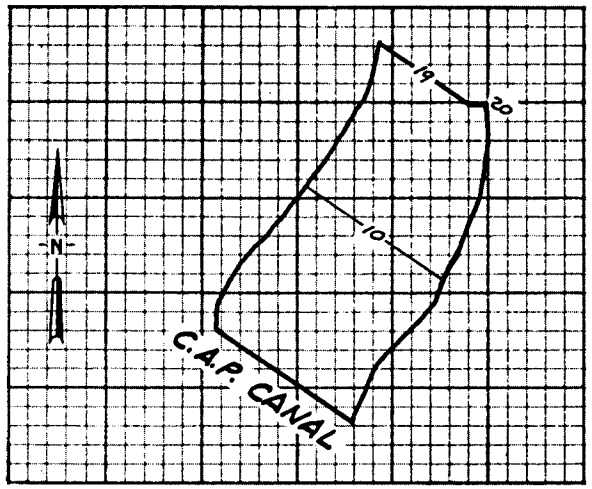
Done by C.R.S.

Date 2/81

Drainage Area 2 (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



SCALE: 1" = 6000'

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	525	11	58	4	21		
M.D. Residential							
H.D. Residential							
Parks & park-like							
Farmlands, groves							
Commercial							
Industrial							
Total Acres	525		58		21		

Mean land slope N-S .015 E-W .010

Flow conveyance 40' Streets

Flow velocity N-S 4.7 ft./sec. min./mile 282 ft./min.

E-W 3.9 ft./sec. min./mile 234 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 I_a -0.2	Q_i cfs	Q_t cfs
10	274		11	2.50	0.990	2.48					2.05	23	
19	521		21	1.85	0.985	1.82					1.46	31	
20	525		21	1.80	0.985	1.77					1.41	30	
19	16		16	3.30	1.0	3.30					2.79	45	
													76 Max.

Yost and Gardner Engineers

Future Dev. = 83%

AREA 2

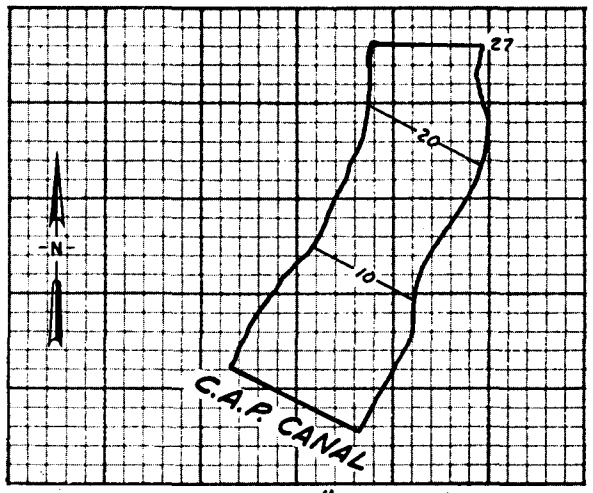
Done by C.R.S.

Date 2/81

Drainage Area 3 (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



SCALE: 1"=4000'

Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	473	13	61	5	24		
M.D. Residential							
H.D. Residential	10	0	0	0	0		
Parks & park-like							
Farmlands, groves							
Commercial	3	0	0	90	3		
Industrial							
Total Acres	486		61		27		

Mean land slope N-S .014 E-W .004

Flow conveyance 40' Streets

Flow velocity N-S 4.6 ft./sec. min./mile 276 ft./min.

E-W 2.4 ft./sec. min./mile 144 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	I_a-f_c	0.8 I_a-f_c	Q_p cfs	0.9 $I_a-0.2$	Q_i cfs	Q_t cfs
10	213		12	2.50	.995	2.49					2.06	25	
20	387		22	1.80	.987	1.78					1.42	31 +	
27	486		27	1.50	.985	1.48					1.15	32	
20	15		15	3.20	1.0	3.20					2.70	41	
													72 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 80%
High Dens. = 100%
Comm. = 0%

AREA 3

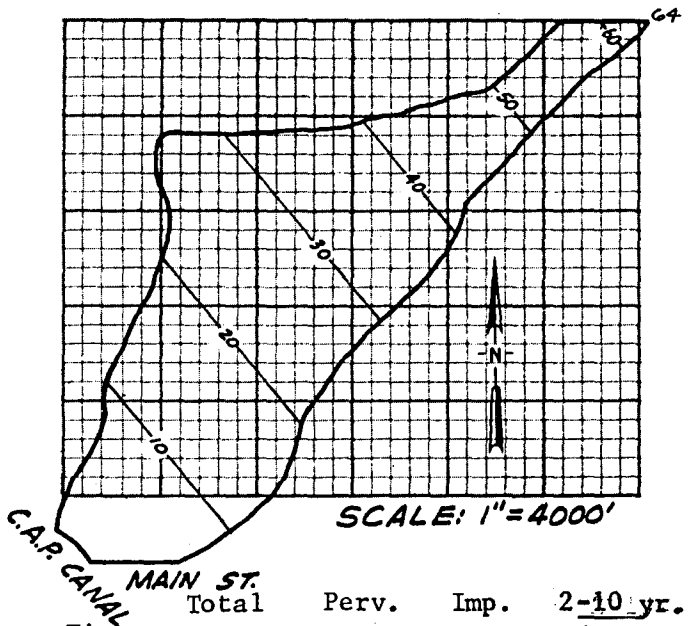
Done by C.R.S.

Date 2/81

Drainage Area 4 (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	1032	10	103	4	41		
M.D. Residential							
H.D. Residential	51	40	20	32	16		
Parks & park-like							
Farmlands, groves							
Commercial	24	0	0	27	6		
Industrial							
Total Acres	1107		123		63		

Mean land slope N-S .010 E-W .004

Flow conveyance 40' Streets

Flow velocity N-S 3.9 ft./sec. min./mile 234 ft./min.

E-W 2.45 ft./sec. min./mile 147 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	143		8	2.50	.995	2.49					2.06	16	
20	390		22	1.80	.985	1.77					1.41	31	
30	688		39	1.40	.981	1.37					1.05	41	
40	905		52	1.16	.981	1.14					0.85	44	
50	1010		57	0.98	.982	0.96					0.68	39	
60	1073		61	0.86	.984	0.85					0.59	36	
64	1107		63	0.82	.984	0.81					0.55	35	
40	35		35	2.06	1.0	2.06					1.67	58	
													102 Max.

Yost and Gardner Engineers

Future Dev. :
Low Dens. = 85%
High Dens. = 20%
Comm. = 70%

AREA 4

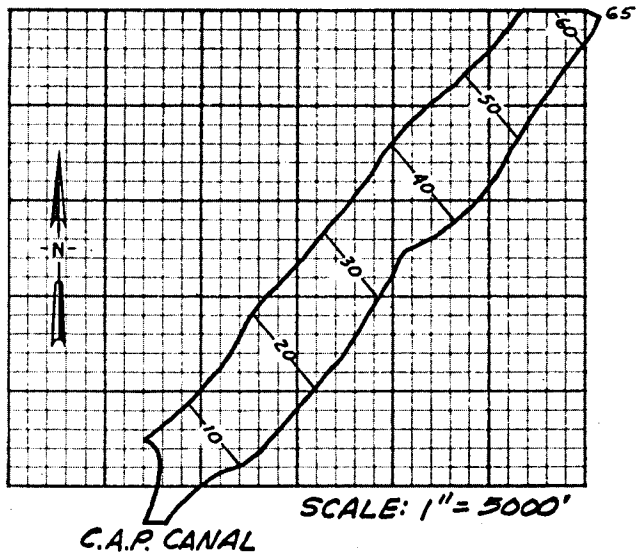
Done by C.R.S.

Date 2/81

Drainage Area 5 (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	808	3.3	27	1.3	11		
M.D. Residential	39	6	2	3.5	1		
H.D. Residential	51	40	20	32	16		
Parks & park-like							
Farmlands, groves							
Commercial	49	0	0	27	13		
Industrial							
Total Acres	947		49		41		

Mean land slope N-S .0082 E-W .0056

Flow conveyance 40' Streets

Flow velocity N-S 3.5 ft./sec. min./mile 210 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	98		4	2.50	.996	2.49					2.06	8	
20	219		9	1.80	.994	1.79					1.43	13	
30	402		17	1.40	.984	1.38					1.06	18	
40	603		26	1.16	.986	1.14					0.85	22	
50	787		34	0.98	.986	0.97					0.69	23	
60	914		40	0.86	.986	0.85					0.59	24	
65	947		41	0.81	.986	0.80					0.54	22	
60	30		30	1.52	1.0	1.52					1.19	36	
													60 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 95%
Med. Dens. = 90%
High Dens. = 20%
Comm. = 70%

AREA 5

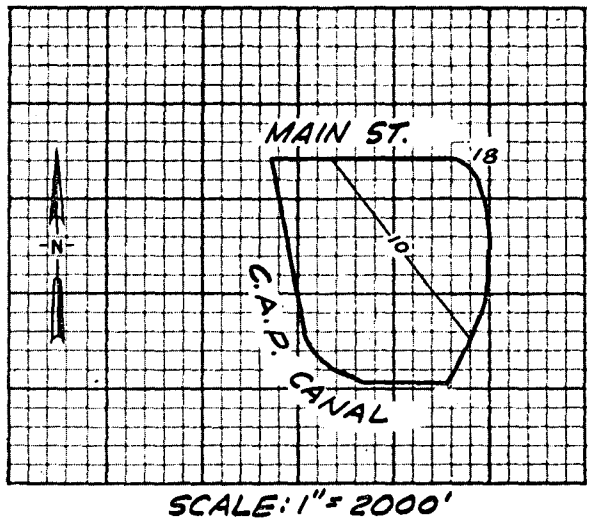
Done by C.R.S.

Date 2/81

Drainage Area 5a (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	66	32.5	21	12.5	8		
M.D. Residential							
H.D. Residential	40	20	8	16	6		
Parks & park-like							
Farmlands, groves							
Commercial	16	0	0	27	4		
Industrial							
Total Acres	122		29		18		

Mean land slope N-S .009 E-W .007

Flow conveyance 40' Streets

Flow velocity N-S 3.7 ft./sec. min./mile 222 ft./min.

E-W 3.2 ft./sec. min./mile 192 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs
10	83		12	2.50	1.0	2.50					2.07	25	
18	122		18	1.90	1.0	1.90					1.53	28	
20	4		4	3.40	1.0	3.40					2.88	12	
													40 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 50%
High Dens. = 60%
Comm. = 70%

AREA 5a

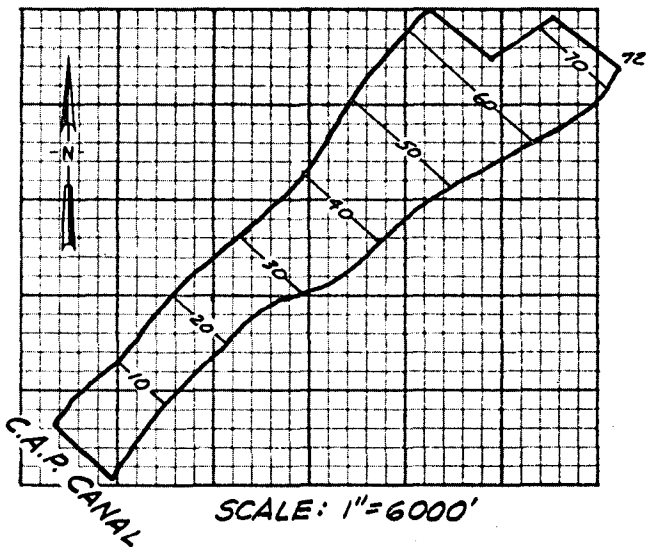
Done by C.R.S.

Date 2/81

Drainage Area 6 (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	1050	16	168	6	63		
M.D. Residential	169	30	51	18	30		
H.D. Residential	140	30	42	24	34		
Parks & park-like							
Farmlands, groves							
Commercial	87	0	0	27	23		
Industrial							
Total Acres	1446		261		150		

Mean land slope N-S .0082 E-W .0056

Flow conveyance 40' Streets

Flow velocity N-S 3.5 ft./sec. min./mile 210 ft./min.

E-W 2.9 ft./sec. min./mile 174 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	172		18	2.50	.995	2.49					2.06	37	
20	347		36	1.80	.988	1.78					1.42	51	
30	506		52	1.40	.985	1.38					1.06	55	
40	694		72	1.16	.984	1.14					0.85	61	
50	913		95	0.98	.983	0.96					0.68	65	
60	1180		122	0.86	.982	0.84					0.58	71	
70	1394		145	0.76	.981	0.75					0.50	73	
72	1446		150	0.74	.980	0.73					0.48	72	
70	45		45	1.34	1.0	1.34					1.03	46	
													119 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 75%
Med Dens. = 50%
High Dens. = 40%
Comm. = 70%

AREA 6

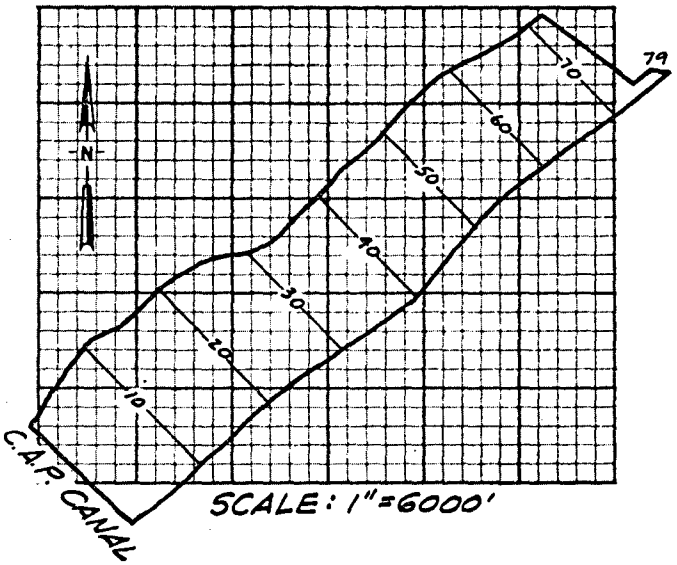
Done by C.R.S.

Date 2/81

Drainage Area 7 (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	1500	20	300	7.5	113		
M.D. Residential	233	30	70	17.5	41		
H.D. Residential	40	30	12	24	10		
Parks & park-like							
Farmlands, groves							
Commercial	161	0	0	54	87		
Industrial	50	1.5	1	3.5	2		
Total Acres	1984		383		253		

Mean land slope N-S .0062 E-W .0087

Flow conveyance 40' Streets

Flow velocity N-S 3.0 ft./sec. min./mile 180 ft./min.

E-W 3.6 ft./sec. min./mile 216 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	284		36	2.50	.990	2.48					2.05	74	
20	570		73	1.80	.984	1.77					1.41	103	
30	841		107	1.40	.978	1.37					1.05	112	
40	1088		139	1.16	.977	1.13					0.84	117	
50	1363		174	0.98	.976	0.96					0.68	118	
60	1628		208	0.86	.975	0.84					0.58	121	
70	1899		242	0.76	.975	0.74					0.49	119	
79	1984		253	0.69	.975	0.67					0.42	106	
60	62		62	1.52	1.0	1.52					1.19	74	
													195 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 70%
Med. Dens. = 50%
High Dens. = 40%
Comm. = 40%
Ind. = 95%

AREA 7

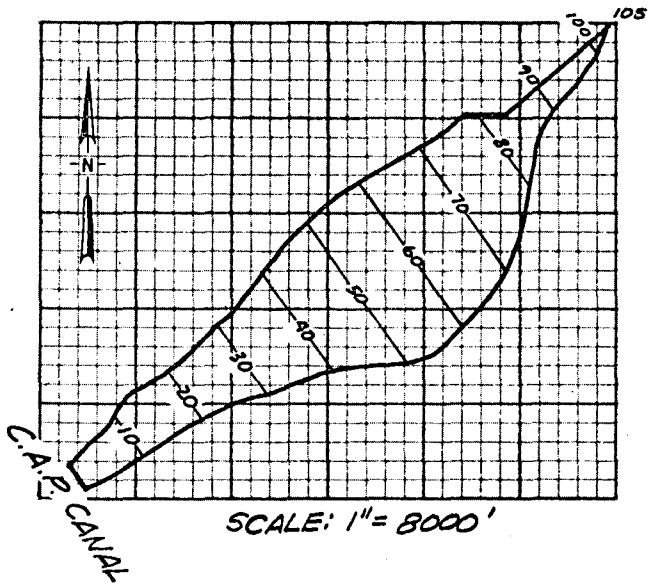
Done by C.R.S.

Date 2/81

Drainage Area 8 (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	1474	46	678	18	265		
M.D. Residential	727	36	262	21	153		
H.D. Residential	103	40	41	32	33		
Parks & park-like							
Farmlands, groves							
Commercial	250	0	0	27	68		
Industrial							
Total Acres	2554		981		519		

Mean land slope N-S .0073 E-W .0076

Flow conveyance 40' Streets

Flow velocity N-S 3.3 ft./sec. min./mile 198 ft./min.

E-W 3.4 ft./sec. min./mile 204 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	0.8 $I_a - f_c$	Q_p cfs	0.9 $I_a - 0.2$	Q_i cfs	Q_t cfs	
10	145		29	2.50	.990	2.48					2.05	59		
20	358		73	1.80	.987	1.78					1.42	104		
30	572		116	1.40	.985	1.38					1.06	123		
40	885		180	1.16	.981	1.14					0.85	153		
50	1296		263	0.98	.979	0.96					0.68	179		
60	1755		357	0.86	.975	0.84					0.58	207		
70	2153		439	0.76	.973	0.74					0.49	215		
80	2422		492	0.68	.972	0.66					0.41	202		
90	2503		509	0.62	.972	0.60					0.36	183		
100	2547		518	0.56	.975	0.55					0.32	166		
70	80		80	1.34	1.0	1.34					1.03	82	297	Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 30%
Med. Dens. = 40%
High Dens. = 20%
Comm. = 70%

AREA 8

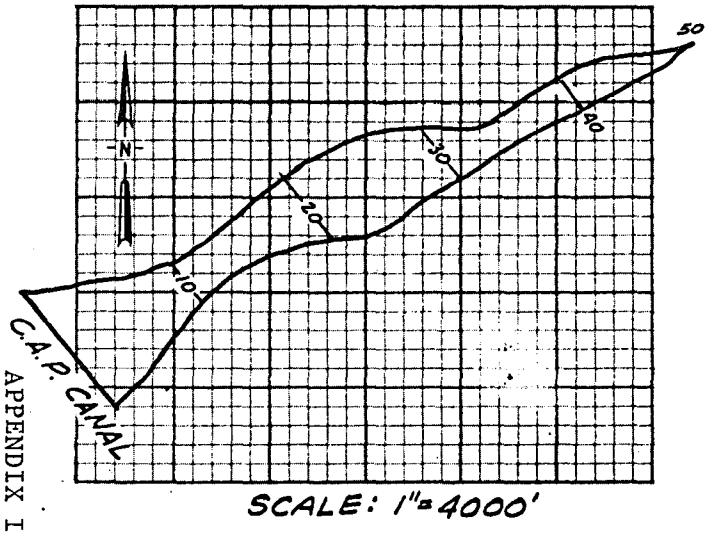
Done by C.R.S.

Date 2/81

Drainage Area 9 (See Figure 10)

URBAN RUNOFF COMPUTATION
(Modified Rational Method)

2-10 -Year
Rec. Interval



Land Use	Gross Acres	Pervious %	Pervious Acres	Impervious %	Impervious Acres	Non-contrib. %	Non-contrib. Acres
L.D. Residential	231	1.3	3	0.5	1		
M.D. Residential	159	6	10	3.5	6		
H.D. Residential	5	0	0	0	0		
Parks & park-like							
Farmlands, groves							
Commercial	2	0	0	0	0		
Industrial							
Total Acres	397		13		7		

Mean land slope N-S .0063 E-W .0083

Flow conveyance 40' Streets

Flow velocity N-S 3.1 ft./sec. min./mile 186 ft./min.

E-W 3.5 ft./sec. min./mile 210 ft./min.

Hydrologic soil group _____ Assumed infiltration cap. _____ in./hr.

Time Min.	Total area ac.	Perv. area ac.	Imp. area ac.	2-10 yr. intens. "/hr.	Area red. factor	I_a "/hr.	Infil. f_c "/hr.	$I_a - f_c$	$0.8\ I_a - f_c$	Q_p cfs	$0.9\ I_a - 0.2$	Q_i cfs	Q_t cfs
10	131		2.3	2.50	.996	2.49					2.06	4.7	
20	206		3.6	1.80	.994	1.79					1.43	5.1	
30	312		5.5	1.40	.991	1.39					1.07	5.9	
40	368		6.5	1.16	.992	1.15					0.86	5.6	
50	397		7.0	0.98	.993	0.97					0.69	4.8	
30	12		12	2.50	1.0	2.50					2.07	25	31 Max.

Yost and Gardner Engineers

Future Dev.:
Low Dens. = 98%
Med. Dens. = 90%
High Dens. = 100%
Comm. = 100%

AREA 9

Line A
McKellips Road
66th St. to R.W.C.D.
Low-Flow Channel

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES: Total Area A *	Pervious Area A_p	Imperv's Area A_i *	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF Pervious: $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious: $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
A-1 (Int.)	160		1			20	1.80	1.79			1.43	1		
A-1 (Arts.)	3		3			20	3.20	3.20			2.70	8	9	Areas A-2, A-3, A-7, A-8 and A-11 Drain to the Salt River
A-4 (Int.)	79		9			20	1.80	1.80			1.43	13		
A-4 (Arts.)	2.5		2.5			20	3.20	3.20			2.70	7	20	
Sum (Int.)	239		10			20	1.80	1.79			1.43	14		
Sum (Arts.)	5.5		5.5			20	3.20	3.18			2.68	15	29	30 - 30" Pipe, Sl. = .0076
A-5 (Int.)	79		18			20	1.80	1.80			1.44	26		
A-5 (Arts.)	2.5		2.5			20	3.20	3.20			2.70	7	33	
Sum (Int.)	318		28			23	1.66	1.65			1.30	36		
Sum (Arts.)	8		8			23	2.95	2.92			2.45	20	56	60 - 33" Pipe, Sl. = .013
A-6 (Int.)	122		18			20	1.80	1.80			1.44	26		
A-6 (Arts.)	5		5			20	3.20	3.20			2.70	14	40	
Sum (Int.)	440		46			27	1.50	1.48			1.15	53		
Sum (Arts.)	13		13			27	2.70	2.67			2.22	29	82	85 - 39" Pipe, Sl. = .010
A-9 (Int.)	149		33			30	1.40	1.40			1.08	36		
A-9 (Arts.)	5		5			30	2.50	2.50			2.07	10	46	
Sum (Int.)	589		79			34	1.30	1.28			0.97	77		
Sum (Arts.)	18		18			34	2.30	2.27			1.86	33	110	110 - 42" Pipe, Sl. = .010
A-10 (Int.)	158		30			40	1.16	1.16			0.86	26		
A-10 (Arts.)	5		5			40	2.06	2.06			1.67	8	34	
Sum (Int.)	747		109			40	1.16	1.14			0.85	92		
Sum (Arts.)	23		23			40	2.06	2.03			1.65	38	130	130 - 48" Pipe, Sl. = .008
A-13 (Int.)	77		11			30	1.40	1.40			1.08	12		
A-13 (Arts.)	1		1			30	2.50	2.50			2.07	2	14	
A-14 (Int.)	130		39			40	1.16	1.16			0.86	34		
A-14 (Arts.)	1		1			40	2.06	2.06			1.67	2	36	
Sum (Int.)	954		159			44	1.08	1.06			0.77	122		
Sum (Arts.)	25		25			44	1.93	1.89			1.52	38	160	160 - 54" Pipe, Sl. = .006
A-15 (Int.)	158		55			40	1.16	1.16			0.86	47		
A-15 (Arts.)	3		3			40	2.06	2.06			1.67	5	52	
A-16 (Int.)	76		8			30	1.40	1.40			1.08	9		
A-16 (Arts.)	1		1			30	2.50	2.50			2.07	2	11	
Sum (Int.)	1188		222			48	1.01	0.99			0.71	158		
Sum (Arts.)	27		27			48	1.80	1.76			1.41	38	196	

Line A
McKellips Road
66th St. to R.W.C.D.
Low-Flow Channel

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES Total Area A*	Pervious Area A_p	Imperv's Area A_i*	Infiltr'n (final) in/hr f_c	Concentration Time Street Slope	Min. t_c	RAIN Point Intensity I	Average Intensity Ia	RUNOFF Pervious $(Ia-f_c).8$ = Inches	Pervious $InxA_p$ = CFS	Impervious $(Ia-0.2).9$ = Inches	Impervious $InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
A-12 (Int.)	72		10			20	1.80	1.80			1.44	14		
A-12 (Arts.)	1		1			20	3.20	3.20			2.70	3	17	
A-17 (Int.)	78		0									0		
A-17 (Arts.)	1		1			20	3.20	3.20			2.70	3	3	
Sum (Int.)	1338		232			50	0.98	0.96			0.68	158		
Sum (Arts.)	29		29			50	1.74	1.71			1.36	39	197	200 - 66" Pipe, Sl. = .0033
A-18 (Int.)	130		5			50	0.98	0.98			0.70	4		
A-18 (Arts.)	3		3			50	1.74	1.74			1.39	4	8	
A-19 (Int.)	88		4			30	1.40	1.40			1.03	4		
A-19 (Arts.)	2		2			30	2.50	2.50			2.07	4	8	
Sum (Int.)	1556		241			75	0.72	0.71			0.46	111		
Sum (Arts.)	34		34			75	1.27	1.25			0.95	32	143	205 - To New R.W.C.D. Low-Flow Channel
Line A-1 Greenfield Road McDowell Road to McKellips Road														
A-12 (Int.)	72		10			20	1.80	1.80			1.44	14		
A-12 (Arts.)	1		1			20	3.20	3.20			2.70	3	17	
A-17 (Int.)	78		0									0		
A-17 (Arts.)	1		1			20	3.20	3.20			2.70	3	3	
Sum (Int.)	150		10			20	1.80	1.80			1.44	14		
Sum (Arts.)	2		2			20	3.20	3.19			2.69	5	19	20 - 36" Pipe, Sl. = .0016
A-16 (Int.)	76		8			30	1.40	1.40			1.08	9		
A-16 (Arts.)	1		1			30	2.50	2.50			2.07	2	11	
Sum (Int.)	226		18			35	1.27	1.26			0.95	17		
Sum (Arts.)	3		3			35	2.26	2.24			1.84	6	23	25 - 36" Pipe, Sl. = .0030
A-15 (Int.) N½	62		22			20	1.80	1.80			1.44	32		
A-15 (Arts.) N½	1		1			20	3.20	3.20			2.70	3	35	
Sum (Int.)	288		40			41	1.14	1.13			0.84	34		
Sum (Arts.)	4		4			41	2.03	2.02			1.64	7	41	40 - 36" Pipe, Sl. = .0030
A-15 (Int.) S½	62		22			20	1.80	1.80			1.44	32		
A-15 (Arts.) S½	1		1			20	3.20	3.20			2.70	3	35	
Sum (Int.)	350		62			45	1.06	1.05			0.77	48		
Sum (Arts.)	5		5			45	1.90	1.88			1.52	8	56	55 - To 66" Pipe at McKellips Road

Line B
Brown Road
Sossaman Road to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES: Total Area A*	Pervious Area A_p	Imperv's Area A_i*	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF Pervious: $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious: $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
B-1 (Int.)	142		0									0		
B-1 (Arts.)	3		3			13	4.00	4.00			3.42	10	10	
B-2 (Int.)	156		0									0		
B-2 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
B-3 (Int.)	141		0									0		
B-3 (Arts.)	3		3			14	3.86	3.86			3.29	10	10	
Sum (Int.)	439		0									0		
Sum (Arts.)	11		11			20	3.20	3.16			2.66	29	29	30 - Street Flow
B-4 (Int.)	150		2			20	1.80	1.79			1.43	3		
B-4 (Arts.)	5		5			20	3.20	3.20			2.70	14	17	
B-5 (Int.)	154		5			20	1.80	1.79			1.43	7		
B-5 (Arts.)	5		5			20	3.20	3.20			2.70	14	21	
Sum (Int.)	743		7			32	1.34	1.31			1.00	7		
Sum (Arts.)	21		21			32	2.40	2.35			1.94	41	48	50 - 33" Pipe, Sl. = .009
B-6 (Int.)	155		36			20	1.80	1.79			1.43	52		
B-6 (Arts.)	5		5			20	3.20	3.20			2.70	14	66	
B-7 (Int.)	151		3			20	1.80	1.79			1.43	4		
B-7 (Arts.)	5		5			20	3.20	3.20			2.70	14	18	
Sum (Int.)	1049		46			37	1.22	1.19			0.89	41		
Sum (Arts.)	31		31			37	2.20	2.15			1.76	55	96	95 - 42" Pipe, Sl. - .0092
B-8 (Int.)	140		4			20	1.80	1.80			1.44	6		
B-8 (Arts.)	5		5			20	3.20	3.20			2.70	14	20	
B-9 (Int.)	145		16			20	1.80	1.80			1.44	23		
B-9 (Arts.)	5		5			20	3.20	3.20			2.70	14	37	
Sum (Int.)	1334		66			41	1.14	1.11			0.82	54		
Sum (Arts.)	41		41			41	2.03	1.98			1.60	66	120	120 - 48" Pipe, Sl. = .010
B-10 (Int.)	135		4			20	1.80	1.80			1.44	6		
B-10 (Arts.)	5		5			20	3.20	3.20			2.70	14	20	
B-11 (Int.)	121		0									0		
B-11 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	1590		70			45	1.06	1.03			0.75	53		
Sum (Arts.)	51		51			45	1.90	1.85			1.49	76	129	130 - 48" Pipe, Sl. = .0082
B-12 (Int.)	128		0									0		
B-12 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
B-13 (Int.)	129		0									0		
B-13 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	1847		70			49	1.00	0.97			0.69	48		
Sum (Arts.)	61		61			49	1.77	1.72			1.37	84	132	135 - 48" Pipe, Sl. = .0082

Line B
Brown Road
Sossaman Road to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES			Infiltr'n (final) in/hr f_c	Concentration Time		RAIN		RUNOFF					DESIGN FLOW AND REMARKS
	Total Area A*	Pervious Area A_p	Imperv's Area A_i*		Street Slope	Min. t_c	Point Intensity I	Average Intensity Ia	Pervious $(Ia-f_c).8$ = Inches	Pervious $InxA_p$ = CFS	Impervious $(Ia-0.2).9$ = Inches	Impervious $InxA_i$ = CFS	Total Flow CFS	
B-14 (Int.)	114		6			20	1.80	1.80			1.44	9		
B-14 (Arts.)	5		5			20	3.20	3.20			2.70	14	23	
B-15 (Int.)	142		7			20	1.80	1.80			1.44	10		
B-15 (Arts.)	5		5			20	3.20	3.20			2.70	14	24	
Sum (Int.)	2103		83			53	0.95	0.92			0.65	54		
Sum (Arts.)	71		71			53	1.67	1.62			1.28	91	145	145 - 54" Pipe, Sl. = .005
B-16 (Int.)	156		37			30	1.40	1.39			1.07	40		
B-16 (Arts.)	5		5			30	2.50	2.50			2.07	10	50	
B-17 (Int.)	140		28			30	1.40	1.40			1.08	30		
B-17 (Arts.)	3		3			30	2.50	2.50			2.07	6	36	
Sum (Int.)	2399		148			56	0.90	0.87			0.60	89		
Sum (Arts.)	79		79			56	1.60	1.55			1.22	96	185	185 - To R.W.C.D. Floodway
B-18 (Int.)	37		0									0		
B-18 (Arts.)	2		2			20	3.20	3.20			2.70	5	5	
Sum (Int.)	2436		148			56	0.90	0.87			0.60	89		
Sum (Arts.)	81		81			56	1.60	1.55			1.22	99	188	190 - To R.W.C.D. Floodway

Line C
University Drive
84th St. (Hawes Rd.) to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES: Total Area A^*	Pervious Area A_p	Imperv's Area A_i^*	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF: Pervious $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
C-1 (Int.)	139		4			20	1.80	1.80			1.44	6		
C-1 (Arts.)	4		4			20	3.20	3.20			2.70	11	17	
C-2 (Int.)	151		2			20	1.80	1.79			1.43	3		
C-2 (Arts.)	4		4			20	3.20	3.20			2.70	11	14	
C-3 (Int.)	55		0									0		
C-3 (Arts.)	2		2			10	4.40	4.40			3.78	8	8	
Sum (Int.)	345		6			25	1.58	1.56			1.22	7		
Sum (Arts.)	10		10			25	2.83	2.80			2.34	23	30	30 - 30" Pipe, Sl. = .007
C-4 (Int.)	149		0									0		
C-4 (Arts.)	4		4			20	3.20	3.20			2.70	11	11	
C-5 (Int.)	146		5			20	1.80	1.79			1.43	7		
C-5 (Arts.)	5		5			20	3.20	3.20			2.70	14	21	
Sum (Int.)	640		11			31	1.37	1.35			1.04	11		
Sum (Arts.)	19		19			31	2.45	2.41			1.99	38	49	50 - 33" Pipe, Sl. = .008
C-6 (Int.)	153		0									0		
C-6 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
C-7 (Int.)	157		16			20	1.80	1.79			1.43	23		
C-7 (Arts.)	5		5			20	3.20	3.20			2.70	14	37	
Sum (Int.)	950		27			36	1.24	1.22			0.92	25		
Sum (Arts.)	29		29			36	2.23	2.19			1.79	52	77	80 - 42" Pipe, Sl. = .007
C-8 (Int.)	147		15			20	1.80	1.79			1.43	21		
C-8 (Arts.)	5		5			20	3.20	3.20			2.70	14	35	
C-9 (Int.)	154		0									0		
C-9 (Arts.)	3		3			20	3.20	3.20			2.70	8	8	
Sum (Int.)	1251		42			40	1.16	1.14			0.85	36		
Sum (Arts.)	37		37			40	2.06	2.02			1.64	61	97	100 - 48" Pipe, Sl. = .007
C-10 (Int.)	147		0									0		
C-10 (Arts.)	4		4			20	3.20	3.20			2.70	11	11	
C-11 (Int.)	149		20			20	1.80	1.79			1.43	29		
C-11 (Arts.)	5		5			20	3.20	3.20			2.70	14	43	
Sum (Int.)	1547		62			44	1.08	1.05			0.77	48		
Sum (Arts.)	46		46			44	1.93	1.88			1.51	69	117	120 - 48" Pipe, Sl. = .007
C-12 (Int.)	146		16			20	1.80	1.79			1.43	23		
C-12 (Arts.)	5		5			20	3.20	3.20			2.70	14	37	
C-13 (Int.)	138		29			20	1.80	1.80			1.44	42		
C-13 (Arts.)	5		5			20	3.20	3.20			2.70	14	56	
Sum (Int.)	1831		107			49	1.00	.97			0.69	74		
Sum (Arts.)	56		56			49	1.77	1.72			1.37	77	151	150 - 54" Pipe, Sl. = .0074

Line C
University Drive
84th St. (Hawes Rd.) to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES: Total Area A*	Pervious Area A_p	Imperv's Area A_i*	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF Pervious: $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious: $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
C-14 (Int.)	136		34			20	1.80	1.80			1.44	49		
C-14 (Arts.)	5		5			20	3.20	3.20			2.70	14	63	
C-15 (Int.)	143		19			20	1.80	1.79			1.43	27		
C-15 (Arts.)	5		5			20	3.20	3.20			2.70	14	41	
Sum (Int.)	2110		160			53	0.95	0.92			0.65	104		
Sum (Arts.)	66		66			53	1.67	1.62			1.28	84	188	190 - 54" Pipe, Sl. = .008
C-16 (Int.)	133		0									0		
C-16 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
C-17 (Int.)	134		41			20	1.80	1.80			1.44	59		
C-17 (Arts.)	5		5			20	3.20	3.20			2.70	14	73	
Sum (Int.)	2377		201			57	0.89	0.86			0.59	119		
Sum (Arts.)	76		76			57	1.58	1.53			1.20	91	210	210 - 60" Pipe, Sl. - .0064
C-18 (Int.)	121		42			20	1.80	1.80			1.44	60		
C-18 (Arts.)	5		5			20	3.20	3.20			2.70	14	74	
C-19 (Int.)	130		0									0		
C-19 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	2628		243			61	0.85	0.82			0.56	136		
Sum (Arts.)	86		86			61	1.50	1.45			1.13	97	233	235 - 66" Pipe, Sl. = .004
C-20 (Int.)	120		0									0		
C-20 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
C-21 (Int.)	123		0									0		
C-21 (Arts.)	4		4			20	3.20	3.20			2.70	11	11	
C-22 (Int.)	54		0									0		
C-22 (Arts.)	3		3			20	3.20	3.20			2.70	8	8	
Sum (Int.)	2925		243			64	0.82	0.79			0.53	129		
Sum (Arts.)	98		98			64	1.45	1.39			1.07	105	234	240 - R.W.C.D. Floodway

Line C-1
Recker Road
University Drive to
Adobe Road

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency
(Arterials not contributing to C-1 are excluded)

C-15 (Int.)	143		19			20	1.80	1.79			1.43	27		
C-15 (Arts.)	5		5			20	3.20	3.20			2.70	14	41	40 - 36" Pipe, Sl. = 0.005
C-14 (Int.)	136		34			20	1.80	1.80			1.44	49		
C-14 (Arts.)	3		3			20	3.20	3.20			2.70	8	57	
Sum (Int.)	279		53			26	1.54	1.52			1.19	63		
Sum (Arts.)	8		8			26	2.76	2.73			2.28	18	81	80 - 39" Pipe, Sl. = 0.0084

Line D
Main Street
92nd Street (Proj.) to
R.W.C.D. Floodway

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

LOCATION	AREA IN ACRES: Total Area A*	Pervious Area A_p	Imperv's Area A_i*	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF Pervious: $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious: $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
D-1 (Int.)	82		13			15	2.09	2.09			1.70	22		
D-1 (Arts.)	2		2			15	3.73	3.73			3.18	6	28	
D-2 (Int.)	76		8			16	2.02	2.02			1.64	13		
D-2 (Arts.)	2.5		2.5			16	3.60	3.60			3.06	8	21	
Sum (Int.)	158		21			24	1.62	1.61			1.27	27		
Sum (Arts.)	4.5		4.5			24	2.90	2.89			2.42	11	38	40 - 30" Pipe, Sl. = .0105
D-3 (Int.)	80		16			17	1.96	1.96			1.58	25		
D-3 (Arts.)	2.5		2.5			17	3.50	3.50			2.97	7	32	
Sum (Int.)	238		37			27	1.50	1.49			1.16	43		
Sum (Arts.)	7		7			27	2.70	2.69			2.24	16	59	60 - 39" Pipe, Sl. = .0064
D-4 (Int.)	147		27			20	1.80	1.79			1.43	39		
D-4 (Arts.)	5		5			20	3.20	3.20			2.70	14	53	
Sum (Int.)	385		64			32	1.34	1.33			1.02	65		
Sum (Arts.)	12		12			32	2.40	2.38			1.96	24	89	90 - 42" Pipe, Sl. = .0087
D-5 (Int.)	152		26			20	1.80	1.79			1.43	37		
D-5 (Arts.)	.5		5			20	3.20	3.20			2.70	14	51	
Sum (Int.)	537		90			37	1.22	1.20			0.90	81		
Sum (Arts.)	17		17			37	2.20	2.17			1.77	30	111	115 - 48" Pipe, Sl. = .0070
D-6 (Int.)	152		33			20	1.80	1.79			1.43	47		
D-6 (Arts.)	5		5			20	3.20	3.20			2.70	14	61	
Sum (Int.)	689		123			41	1.14	1.12			0.83	102		
Sum (Arts.)	22		22			41	2.03	2.00			1.62	36	138	140 - 48" Pipe, Sl. = .0082
D-7 (Int.)	145		22			20	1.80	1.79			1.43	31		
D-7 (Arts.)	5		5			20	3.20	3.20			2.70	14	45	
Sum (Int.)	834		145			45	1.06	1.04			0.76	110		
Sum (Arts.)	27		27			45	1.90	1.87			1.50	41	151	155 - 54" Pipe, Sl. = .007
D-8 (Int.)	152		2			20	1.80	1.79			1.43	3		
D-8 (Arts.)	5		5			20	3.20	3.20			2.70	14	17	
Sum (Int.)	986		147			49	1.00	0.98			0.70	103		
Sum (Arts.)	32		32			49	1.77	1.74			1.39	44	147	160 - 54" Pipe, Sl. = .0058
D-9 (Int.)	124		2			20	1.80	1.80			1.44	3		
D-9 (Arts.)	5		5			20	3.20	3.20			2.70	14	17	
Sum (Int.)	1110		149			53	0.95	0.93			0.66	98		
Sum (Arts.)	37		37			53	1.67	1.64			1.30	48	146	165 - 54" Pipe, Sl. = .0065
D-10 (Int.)	144		22			20	1.80	1.79			1.43	31		
D-10 (Arts.)	5		5			20	3.20	3.20			2.70	14	45	
Sum (Int.)	1254		171			57	0.89	0.87			0.60	103		
Sum (Arts.)	42		42			57	1.58	1.55			1.22	51	154	170 = 54" Pipe, Sl. = .0068

Line D
Main Street
92nd Street (Proj.) to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES			Infiltr'n (final) in/hr	Concentration Time		RAIN		RUNOFF					DESIGN FLOW AND REMARKS
	Total Area A*	Pervious Area A_p	Imperv's Area A_i*	f_c	Street Slope	Min. t_c	Point Intensity I	Average Intensity Ia	Pervious $(Ia-f_c).8$ = Inches	Pervious $InxA_p$ = CFS	Impervious $(Ia-0.2).9$ = Inches	Impervious $InxA_i$ = CFS	Total Flow CFS	
D-11 (Int.)	139		50			20	1.80	1.80			1.44	72		
D-11 (Arts.)	5		5			20	3.20	3.20			2.70	14	86	
Sum (Int.)	1393		221			61	0.85	0.83			0.57	126		
Sum (Arts.)	47		47			61	1.50	1.47			1.14	54	180	180 - 60" Pipe, Sl. = .0065
D-12 (Int.)	138		35			20	1.80	1.80			1.44	50		
D-12 (Arts.)	5		5			20	3.20	3.20			2.70	14	64	
Sum (Int.)	1531		256			65	0.81	0.79			0.53	136		
Sum (Arts.)	52		52			65	1.43	1.40			1.08	56	192	195 - 60" Pipe, Sl. = .006
D-13 (Int.)	125		47			20	1.80	1.80			1.44	68		
D-13 (Arts.)	5		5			20	3.20	3.20			2.70	14	82	
Sum (Int.)	1656		303			69	0.77	0.75			0.50	150		
Sum (Arts.)	57		57			69	1.36	1.33			1.02	58	208	210 - 60" Pipe, Sl. = .0076
D-14 (Int.)	69		0									0		
D-14 (Arts.)	2		2			20	3.20	3.20			2.70	5	5	
Sum (Int.)	1725		303			70	0.76	0.74			0.49	148		
Sum (Arts.)	59		59			70	1.34	1.31			1.00	59	207	220 - To R.W.C.D. Floodway

Line E
Broadway
98th St. to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES: Total Area A*	Pervious Area A_p	Imperv's Area A_i *	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF Pervious: $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious: $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
E-1 (Int.)	35		3			10	2.50	2.50			2.07	6		
E-1 (Arts.)	2		2			10	4.40	4.40			3.78	8	14	
E-2 (Int.)	80		15			20	1.80	1.80			1.44	22		
E-2 (Arts.)	2.5		2.5			20	3.20	3.20			2.70	7	29	
Sum (Int.)	115		18			20	1.80	1.80			1.44	26		
Sum (Arts.)	4.5		4.5			20	3.20	3.20			2.70	12	38	40 - 30" Pipe, Sl. = .0084
E-3 (Int.)	80		27			20	1.80	1.80			1.44	39		
E-3 (Arts.)	2.5		2.5			20	3.20	3.20			2.70	7	46	
Sum (Int.)	195		45			23	1.66	1.65			1.31	59		
Sum (Arts.)	7		7			23	2.95	2.93			2.46	17	76	80 - 42" Pipe, Sl. = .008
E-4 (Int.)	143		28			20	1.80	1.79			1.43	40		
E-4 (Arts.)	5		5			20	3.20	3.20			2.70	14	54	
Sum (Int.)	338		73			28	1.46	1.45			1.13	82		
Sum (Arts.)	12		12			28	2.60	2.57			2.13	26	108	110 - 48" Pipe, Sl. = .009
E-5 (Int.)	151		17			20	1.80	1.79			1.43	24		
E-5 (Arts.)	5		5			20	3.20	3.20			2.70	14	38	
Sum (Int.)	489		90			32	1.34	1.32			1.01	91		
Sum (Arts.)	17		17			32	2.40	2.36			1.94	33	124	125 - 48" Pipe, Sl. = .007
E-6 (Int.)	147		35			20	1.80	1.79			1.43	50		
E-6 (Arts.)	5		5			20	3.20	3.20			2.70	14	64	
Sum (Int.)	636		125			36	1.24	1.22			0.92	115		
Sum (Arts.)	22		22			36	2.23	2.19			1.79	39	154	155- 54" Pipe, Sl. = .0076
E-7 (Int.)	143		52			20	1.80	1.79			1.43	74		
E-7 (Arts.)	5		5			20	3.20	3.20			2.70	14	88	
Sum (Int.)	779		177			40	1.16	1.14			0.84	149		
Sum (Arts.)	27		27			40	2.06	2.02			1.64	44	193	195 - 60" Pipe, Sl. = .006
E-8 (Int.)	136		22			20	1.80	1.79			1.43	31		
E-8 (Arts.)	5		5			20	3.20	3.20			2.70	14	45	
Sum (Int.)	915		199			44	1.08	1.06			0.77	154		
Sum (Arts.)	32		32			44	1.93	1.89			1.52	49	203	205 - 60" Pipe, Sl. = .008
E-9 (Int.)	146		47			20	1.80	1.79			1.43	67		
E-9 (Arts.)	5		5			20	3.20	3.20			2.70	14	81	
Sum (Int.)	1061		246			48	1.01	0.99			0.71	175		
Sum (Arts.)	37		37			48	1.80	1.76			1.40	52	227	230 - 66" Pipe, Sl. = .0057
E-10 (Int.)	121		23			20	1.80	1.80			1.44	33		
E-10 (Arts.)	5		5			20	3.20	3.20			2.70	14	47	
Sum (Int.)	1182		269			52	0.96	0.94			0.67	180		
Sum (Arts.)	42		42			52	1.70	1.67			1.32	55	235	235 - 66" Pipe, Sl. = .0056

Line E
Broadway
98th St. to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES: Total Area A*	Pervious Area A_p	Imperv's Area A_i*	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF: Pervious: $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious: $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
E-11 (Int.)	135		26			20	1.80	1.79			1.43	37		
E-11 (Arts.)	5		5			20	3.20	3.20			2.70	14	51	
Sum (Int.)	1317		295			56	0.90	0.88			0.61	181		
Sum (Arts.)	47		47			56	1.60	1.57			1.23	58	239	240 - 66" Pipe, Sl. = .0064
E-12 (Int.)	145		24			20	1.80	1.79			1.43	34		
E-12 (Arts.)	5		5			20	3.20	3.20			2.70	14	48	
Sum (Int.)	1462		319			60	0.86	0.84			0.58	185		
Sum (Arts.)	52		52			60	1.52	1.49			1.16	60	245	245 - 66" Pipe, Sl. = .0068
E-13 (Int.)	134		34			20	1.80	1.79			1.43	49		
E-13 (Arts.)	5		5			20	3.20	3.20			2.70	14	63	
Sum (Int.)	1596		353			64	0.82	0.80			0.54	191		
Sum (Arts.)	57		57			64	1.45	1.42			1.10	63	254	255 - 72" Pipe, Sl. = .0032
E-14 (Int.)	90		12			20	1.80	1.80			1.44	17		
E-14 (Arts.)	3		3			20	3.20	3.20			2.70	8	25	
Sum (Int.)	1686		365			68	0.78	0.76			0.50	183		
Sum (Arts.)	60		60			68	1.38	1.35			1.04	62	245	260 - To R.W.C.D. Floodway

Line F
Southern Ave.
104th St. (Proj.) to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES: Total Area A*	Pervious Area A_p	Imperv's Area A_i*	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF: Pervious: $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious: $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
F-1 (Int.)	112		0									0		
F-1 (Arts.)	3		3			20	3.20	3.20			2.70	8	8	
F-2 (Int.)	137		0									0		
F-2 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
F-3 (Int.)	91		0									0		
F-3 (Arts.	3		3			20	3.20	3.20			2.70	8	8	
Sum (Int.)	340		0									0		
Sum (Arts.)	11		11			20	3.20	3.17			2.67	29	29	30 - 30" Pipe, Sl. = .0064
F-4 (Int.)	138		0									0		
F-4 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
F-5 (Int.)	127		0									0		
F-5 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	605		0									0		
Sum (Arts.)	21		21			27	2.70	2.66			2.21	46	46	50 - 36" Pipe, Sl. = .0056
F-6 (Int.)	122		10			20	1.80	1.80			1.44	14		
F-6 (Arts.)	5		5			20	3.20	3.20			2.70	14	28	
F-7 (Int.)	123		29			20	1.80	1.80			1.44	42		
F-7 (Arts.)	5		5			20	3.20	3.20			2.70	14	56	
Sum (Int.)	850		39			33	1.32	1.29			0.98	38		
Sum (Arts.)	31		31			33	2.35	2.30			1.89	59	97	100 - 48" Pipe, Sl. = .0064
F-8 (Int.)	126		27			20	1.80	1.80			1.44	39		
F-8 (Arts.)	5		5			20	3.20	3.20			2.70	14	53	
F-9 (Int.)	128		22			20	1.80	1.80			1.44	32		
F-9 (Arts.)	5		5			20	3.20	3.20			2.70	14	46	
Sum (Int.)	1104		88			38	1.20	1.18			0.88	77		
Sum (Arts.)	41		41			38	2.15	2.11			1.72	71	148	150 - 54" Pipe, Sl. = .0080
F-10 (Int.)	126		18			20	1.80	1.80			1.44	26		
F-10 (Arts.)	5		5			20	3.20	3.20			2.70	14	40	
F-11 (Int.)	128		10			20	1.80	1.80			1.44	14		
F-11 (Arts.)	5		5			20	3.20	3.20			2.70	14	28	
Sum (Int.)	1358		116			42	1.12	1.09			0.80	93		
Sum (Arts.)	51		51			42	2.00	1.95			1.58	81	174	175 - 54" Pipe, Sl. = .0084
F-12 (Int.)	157		17			30	1.40	1.39			1.07	18		
F-12 (Arts.)	5		5			30	2.50	2.50			2.07	10	28	
F-13 (Int.)	130		7			20	1.80	1.79			1.44	10		
F-13 (Arts.)	5		5			20	3.20	3.20			2.70	14	24	
Sum (Int.)	1645		140			46	1.04	1.01			0.73	102		
Sum (Arts.)	61		61			46	1.86	1.80			1.44	88	190	190 - 60" Pipe, Sl. = .0064
F-14 (Int.)	125		29			20	1.80	1.80			1.44	42		
F-14 (Arts.)	5		5			20	3.20	3.20			2.70	14	56	

Line F
Southern Ave.
104th St. (Proj.) to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES: Total Area A *	Pervious Area A_p	Imperv's Area A_i *	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF: Pervious $(Ia-f_c).8$ = Inches	Pervious $InxA_p$ = CFS	Impervious $(Ia-0.2).9$ = Inches	Impervious $InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
F-15 (Int.)	120		36			20	1.80	1.80			1.44	52		
F-15 (Arts.)	5		5			20	3.20	3.20			2.70	14	66	
Sum (Int.)	1890		205			50	0.98	0.95			0.68	139		
Sum (Arts.)	71		71			50	1.74	1.69			1.34	95	234	235 - 66" Pipe, Sl. = .0054
F-16 (Int.)	158		22			30	1.40	1.39			1.07	24		
F-16 (Arts.)	5		5			30	2.50	2.50			2.07	10	34	
F-17 (Int.)	159		20			30	1.40	1.39			1.07	21		
F-17 (Arts.)	5		5			30	2.50	2.50			2.07	10	31	
Sum (Int.)	2207		247			54	0.93	0.90			0.63	156		
Sum (Arts.)	81		81			54	1.64	1.59			1.25	101	257	260 - 66" Pipe, Sl. = .0072
F-18 (Int.)	130		8			20	1.80	1.80			1.44	12		
F-18 (Arts.)	5		5			20	3.20	3.20			2.70	14	26	
F-19 (Int.)	159		10			30	1.40	1.39			1.07	11		
F-19 (Arts.)	5		5			30	2.50	2.50			2.07	10	21	
Sum (Int.)	2496		265			57	0.89	0.86			0.59	156		
Sum (Arts.)	91		91			57	1.58	1.53			1.20	109	265	265 - 66" Pipe, Sl. = .0064
F-20 (Int.)	126		24			20	1.80	1.80			1.44	35		
F-20 (Arts.)	4		4			20	3.20	3.20			2.70	11	46	
F-21 (Int.)	159		33			30	1.40	1.39			1.07	35		
F-21 (Arts.)	4		4			30	2.50	2.50			2.07	8	43	
Sum (Int.)	2781		322			61	0.85	0.82			0.56	180		
Sum (Arts.)	99		99			61	1.50	1.45			1.13	112	292	295 - 66" Pipe, Sl. = .0068
F-22 (Int.)	0		0									0		
F-22 (Arts.)	2		2			30	2.50	2.50			2.07	4	4	Drains to On-site Lakes
F-23 (Int.)	0		0									0		
F-23 (Arts.)	2		2			20	3.20	3.20			2.70	5	5	Drains to On-site Lakes
Sum (Int.)	2781		322			65	0.81	0.78			0.52	167		
Sum (Arts.)	103		103			65	1.43	1.38			1.06	109	276	300 - 72" Pipe, Sl. = .0050
F-24 (Int.)	0		0									0		
F-24 (Arts.)	2		2			20	3.20	3.20			2.70	5	5	Drains to On-site Lakes
F-25 (Int.)	0		0									0		
F-25 (Arts.)	2		2			30	2.50	2.50			2.07	4	4	Drains to On-site Lakes
Sum (Int.)	2781		322			69	0.77	0.74			0.49	158		
Sum (Arts.)	107		107			69	1.36	1.31			1.00	107	265	305 - 78" Pipe, Sl. = .0030
F-26 (Int.)	0		0									0		
F-26 (Arts.)	2		2			30	2.50	2.50			2.07	4	4	Drains to On-site Lakes
F-27 (Int.)	0		0									0		
F-27 (Arts.)	2		2			30	2.50	2.50			2.07	4	4	Drains to On-site Lakes
Sum (Int.)	2781		322			71	0.75	0.72			0.47	151		
Sum (Arts.)	111		111			71	1.32	1.28			0.97	108	259	310 - To R.W.C.D. Floodway

Line F-1
96th Street
Southern Ave to Pueblo Ave.

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts.- Arterials, 10-year frequency
(Arterials not draining to F-1 and F-2 are excluded)

LOCATION	AREA IN ACRES			Infiltr'n (final)	Concentration Time		RAIN		RUN OFF					DESIGN FLOW AND REMARKS
	Total Area A*	Pervious Area A_p	Imperv's Area A_i *	in/hr f_c	Street Slope	Min. t_c	Point Intensity I	Average Intensity Ia	Pervious $(Ia-f_c).8$ = Inches	Pervious $InxA_p$ = CFS	Impervious $(Ia-0.2).9$ = Inches	Impervious $InxA_i$ = CFS	Total Flow CFS	
F-7 (Int.)	123		29			20	1.80	1.80			1.44	42		
F-7 (Arts.)	4		4			20	3.20	3.20			2.70	11	53	55 - 36" Pipe, Sl. = 0.006
F-6 (Int.)	122		10			20	1.80	1.80			1.44	14		
F-6 (Arts.)	3		3			20	3.20	3.20			2.70	8	22	
Sum (Int.)	245		39			26	1.54	1.52			1.19	46		
Sum (Arts.)	7		7			26	2.76	2.73			2.28	16	62	65 - 36" Pipe, Sl. = 0.0082
Line F-2 Ellsworth Rd. Southern Ave. to Pueblo Ave.														
F-8 (Int.)	126		27			20	1.80	1.80			1.44	39		
F-8 (Arts.)	4		4			20	3.20	3.20			2.70	11	50	50 - 36" Pipe, Sl. = 0.006
F-9 (Int.)	128		22			20	1.80	1.80			1.44	32		
F-9 (Arts.)	3		3			20	3.20	3.20			2.70	8	40	
Sum (Int.)	254		49			26	1.54	1.52			1.19	58		
Sum (Arts.)	7		7			26	2.76	2.73			2.28	16	74	75 - 39" Pipe, Sl. = 0.0076

Line G
North side Superstition Freeway
Ellsworth Road to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES: Total Area A*	Pervious Area A_p	Imperv's Area A_i *	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF Pervious: $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious: $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
G-1 (Int.)	120		0									0		
G-1 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	15 - Street Flow
G-2 (Int.)	112		1			20	1.80	1.80			1.44	1		
G-2 (Arts.)	5		5			20	3.20	3.20			2.70	14	15	
Sum (Int.)	232		1			36	1.24	1.23			0.93	1		
Sum (Arts.)	10		10			36	2.23	2.21			1.81	18	19	20 - Street Flow
G-3 (Int.)	144		0									0		
G-3 (Arts.)	5		5			30	2.50	2.50			2.07	10	10	
Sum (Int.)	376		1			52	0.96	0.95			0.68	1		
Sum (Arts.)	15		15			52	1.70	1.69			1.34	20	21	20 - Street Flow
G-4 (Int.)	147		0									0		
G-4 (Arts.)	5		5			30	2.50	2.50			2.07	10	10	
Sum (Int.)	523		1			65	0.81	0.81			0.55	1		
Sum (Arts.)	20		20			65	1.43	1.42			1.10	22	23	25 - Street Flow
G-5 (Int.)	71		3			20	1.80	1.80			1.44	4		
G-5 (Arts.)	2		2			20	3.20	3.20			2.70	5	9	
Sum (Int.)	594		4			72	0.74	0.73			0.48	2		
Sum (Arts.)	22		22			72	1.30	1.29			0.98	22	24	25 - Street Flow to Existing Channel
Note: Areas G-1 thru G-5 Drain to Existing Channel														
G-6 (Int.)	71		21			20	1.80	1.80			1.44	30		
G-6 (Arts.)	2		2			20	3.20	3.20			2.70	5	35	
G-7 (Int.)	147		0									0		
G-7 (Arts.)	5		5			30	2.50	2.50			2.07	10	10	
Sum (Int.)	218		21			30	1.40	1.39			1.07	22		
Sum (Arts.)	7		7			30	2.50	2.49			2.06	14	36	35 To Proposed Channel
G-8 (Int.)	147		3			30	1.40	1.40			1.08	3		
G-8 (Arts.)	5		5			30	2.50	2.50			2.07	10	13	
Sum (Int.)	365		24			43	1.10	1.09			0.80	19		
Sum (Arts.)	12		12			43	1.96	1.95			1.58	19	38	40 To Proposed Channel
G-9 (Int.)	146		0									0		
G-9 (Arts.)	5		5			30	2.50	2.50			2.07	10	10	
Sum (Int.)	511		24			59	0.87	0.86			0.59	14		
Sum (Arts.)	17		17			59	1.54	1.53			1.20	20	34	35 To Proposed Channel
G-10 (Int.)	137		1			30	1.40	1.40			1.08	1		
G-10 (Arts.)	4		4			30	2.50	2.50			2.07	8	9	
Sum (Int.)	648		25			74	0.73	0.72			0.47	12		
Sum (Arts.)	21		21			74	1.29	1.28			0.97	20	32	35 To Proposed Channel

Line H
Baseline Road
Crismon Road to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES			Infiltr'n (final) in/hr	Concentration Time		RAIN		RUNOFF					DESIGN FLOW AND REMARKS
	Total Area A*	Pervious Area A_p	Imperv's Area A_i*	f_c	Street Slope	Min. t_c	Point Intensity I	Average Intensity Ia	Pervious $(Ia-f_c).8$ = Inches	Pervious $InxA_p$ = CFS	Impervious $(Ia-0.2).9$ = Inches	Impervious $InxA_i$ = CFS	Total Flow CFS	
H-1 (Int.)	137		0									0		
H-1 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
H-2 (Int.)	98		0									0		
H-2 (Arts)	2		2			20	3.20	3.20			2.70	5	5	
H-3 (Int.)	124		0									0		
H-3 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
H-4 (Int.)	115		0									0		
H-4 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	474		0									0		
Sum (Arts.)	17		17			50	1.74	1.72			1.37	23	23	25 - 30" Pipe, Sl. = .005
H-5 (Int.)	115		0									0		
H-5 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
H-6 (Int.)	131		0									0		
H-6 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	720		0									0		
Sum (Arts.)	27		27			57	1.58	1.56			1.22	33	33	35 - 33" Pipe, Sl. = .0057
H-7 (Int.)	117		0									0		
H-7 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
H-8 (Int.)	119		0									0		
H-8 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	956		0									0		
Sum (Arts.)	37		37			63	1.47	1.45			1.13	42	42	40 - 33" Pipe, Sl. = .0064
H-9 (Int.)	122		0									0		
H-9 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
H-10 (Int.)	120		0									0		
H-10 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	1198		0									0		
Sum (Arts.)	47		47			69	1.36	1.34			1.03	48	48	50 - 36" Pipe, Sl. = .007
H-11 (Int.)	147		0									0		
H-11 (Arts.)	5		5			30	2.50	2.50			2.07	10	10	
Sum (Int.)	1345		0									0		
Sum (Arts.)	52		52			74	1.28	1.26			0.95	50	50	55 - 36" Pipe, Sl. = .0062
H-12 (Int.)	112		0									0		
H-12 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	1457		0									0		
Sum (Arts.)	57		57			80	1.20	1.18			0.88	50	50	60 - 39" Pipe, Sl. = .0054
H-13 (Int.)	127		0									0		
H-13 (Arts.)	5		5			20	3.20	3.20			2.70	14	14	
Sum (Int.)	1584		0									0		
Sum (Arts.)	62		62			86	1.11	1.09			0.80	50	50	65 - 39" Pipe, Sl. = .0066

Line H
Baseline Road
Grismon Road to
R.W.C.D. Floodway

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

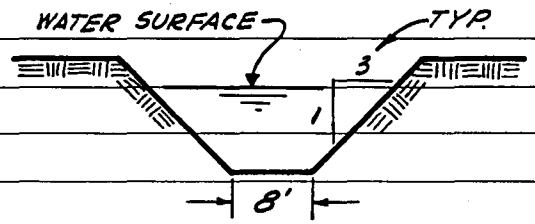
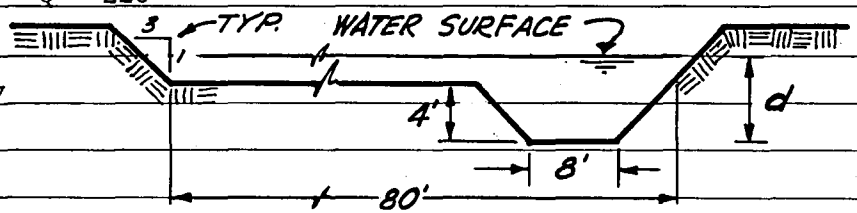
* Area contributing at corresponding t_c
Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

LOCATION	AREA IN ACRES			Infiltr'n (final) in/hr f_c	Concentration Time		RAIN		RUNOFF					DESIGN FLOW AND REMARKS
	Total Area A*	Pervious Area A_p	Imperv's Area A_i*		Street Slope	Min. t_c	Point Intensity I	Average Intensity Ia	Pervious $(Ia-f_c).8$ = Inches	Pervious $InxA_p$ = CFS	Impervious $(Ia-0.2).9$ = Inches	Impervious $InxA_i$ = CFS	Total Flow CFS	
H-14 (Int.)	124		13			20	1.80	1.80			1.44	19		
H-14 (Arts.)	5		5			20	3.20	3.20			2.70	14	33	
Sum (Int.)	1708		13			91	0.61	0.60			0.36	5		
Sum (Arts.)	67		67			91	1.07	1.05			0.76	51	56	70 - 39" Pipe, Sl. = .0070
H-15 (Int.)	148		27			30	1.40	1.40			1.08	29		
H-15 (Arts.)	5		5			30	2.50	2.50			2.07	10	39	
Sum (Int.)	1856		40			96	0.59	0.58			0.34	14		
Sum (Arts.)	72		72			96	1.01	0.99			0.71	51	65	75 - 42" Pipe, Sl. = .0058
H-16 (Int.)	146		19			30	1.40	1.40			1.08	21		
H-16 (Arts.)	5		5			30	2.50	2.50			2.07	10	31	
Sum (Int.)	2002		59			101	0.56	0.55			0.31	18		
Sum (Arts.)	77		77			101	0.97	0.95			0.67	52	70	80 - 42" Pipe, Sl. = .0046
H-17 (Int.)	136		0									0		
H-17 (Arts.)	5		5			30	2.50	2.50			2.07	10	10	
Sum (Int.)	2138		59			106	0.53	0.52			0.29	17		
Sum (Arts.)	82		82			106	0.93	0.91			0.64	52	69	85 - 48" Pipe, Sl. = .0050
H-18 (Int.)	144		0									0		
H-18 (Arts.)	5		5			30	2.50	2.50			2.07	10	10	
Sum (Int.)	2282		59			111	0.52	0.51			0.28	16		
Sum (Arts.)	87		87			111	0.88	0.86			0.59	52	68	90 - 54" Pipe, Sl. = .0028
H-19 (Int.)	102		0									0		
H-19 (Arts.)	5		5			30	2.50	2.50			2.07	10	10	
Sum (Int.)	2384		59			113	0.51	0.50			0.27	16		
Sum (Arts.)	92		92			113	0.87	0.85			0.58	54	70	95 - To R.W.C.D. Floodway

AREA DESCRIPTION Low-Flow Channel along R.W.C.D.

Floodway - McKellips to University

n = 0.011 Big Concrete Culverts
n = 0.012 Pipe Culverts 21" & Larger
n = 0.014 Concrete Lined Channels
n = 0.015 Street Paving
n = 0.020 Earth - Best
n = 0.0225 Corr. Culverts
n = 0.030 Earth - Brushy - Poor
n = 0.050 Rocky Streams

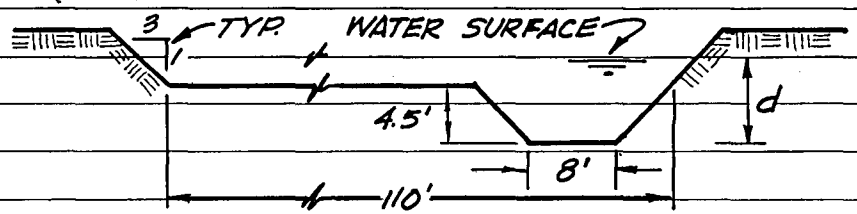
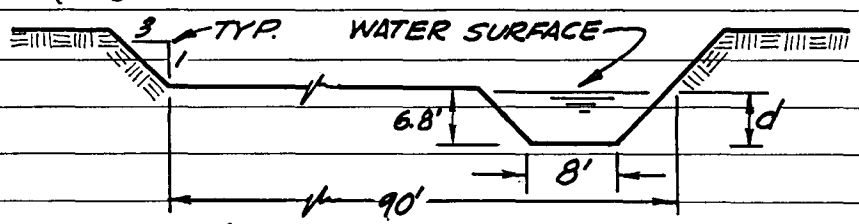
STA. OR LOCATION	WATERWAY DESCRIPTION	Rough-ness n	Slope Ft.Per 1000	Area Sq.Ft. A	p =Wet Per r = $\frac{A}{p}$	Vel. Ft./Sec V	Quant. c.f.s. Q
McKellips to Brown	Q = 205 						
	Try d = 6.6	.03	0.1	183.5	49.74 3.69	1.18	217
	Try d = 6.5	.03	0.1	178.8	49.11 3.64	1.17	209
Brown to University	Q = 220 						
	Try d = 6.0	0.3	0.1	252	93.94 2.68	0.96	242
	Try d = 5.9	0.3	0.1	242.8	93.32 2.60	0.94	228

Yost and Gardner Engineers

AREA DESCRIPTION Low-Flow Channel along R.W.C.D.

Floodway - University to Braodway

n = 0.011 Big Concrete Culverts
n = 0.012 Pipe Culverts 21" & Larger
n = 0.014 Concrete Lined Channels
n = 0.015 Street Paving
n = 0.020 Earth - Best
n = 0.0225 Corr. Culverts
n = 0.030 Earth - Brushy - Poor
n = 0.050 Rocky Streams

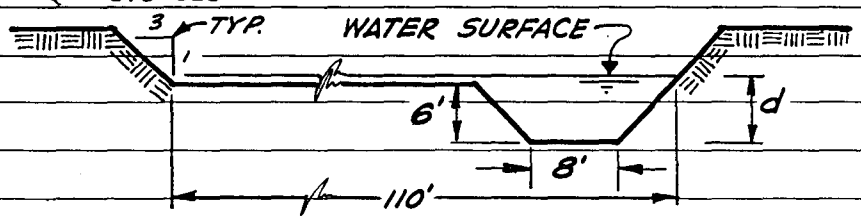
STA. OR LOCATION	WATERWAY DESCRIPTION	Roughness n	Slope Ft.Per 1000	Area Sq.Ft. A	p = Wet Per $r = \frac{A}{p}$	Vel. Ft./Sec V	Quant. c.f.s. Q
University to Main	Q = 240						
							
	Try d = 5.8'	.03	0.15	244.8	119.7 / 2.05	0.98	240
Main to Broadway	Q = 300						
							
	Try d = 6.0'	.03	0.30	156	45.95 / 3.39	1.94	303

Yost and Gardner Engineers

AREA DESCRIPTION Low-Flow Channel along R.W.C.D.

Floodway - Broadway to Southern

n = 0.011 Big Concrete Culverts
n = 0.012 Pipe Culverts 21" & Larger
n = 0.014 Concrete Lined Channels
n = 0.015 Street Paving
n = 0.020 Earth - Best
n = 0.0225 Corr. Culverts
n = 0.030 Earth - Brushy - Poor
n = 0.050 Rocky Streams

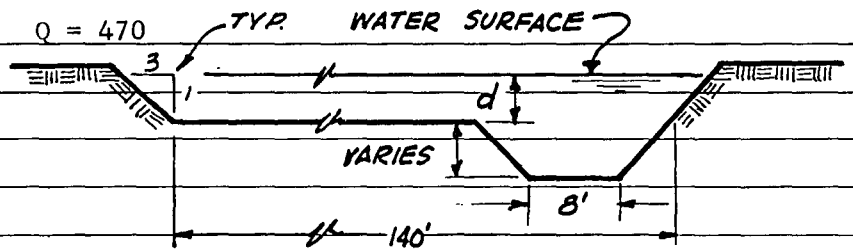
STA. OR LOCATION	WATERWAY DESCRIPTION	Roughness n	Slope Ft.Per 1000	Area Sq.Ft. A	p = Wet Per $r = \frac{A}{p}$	Vel. Ft./Sec V	Quant. c.f.s. Q
Broadway	Q = 375 cfs						
to							
Southern							
	Note: Depth in wide channel is so shallow here						
	that wetted perimeter reading is dispro-						
	portionate. Separate into 2 areas.						
	Try d = 6.5'	.03	0.30	178.8	49.1 / 3.64	2.03	363
	0.5' in wide channel (66' bottom)	.03	0.30	33.8	69.2 / 0.49	0.53	18
							381

Yost and Gardner Engineers

AREA DESCRIPTION Low-Flow Channel along R.W.C.D.

Floodway - Southern to Daylight (South of Baseline)

n = 0.011 Big Concrete Culverts
n = 0.012 Pipe Culverts 21" & Larger
n = 0.014 Concrete Lined Channels
n = 0.015 Street Paving
n = 0.020 Earth - Best
n = 0.0225 Corr. Culverts
n = 0.030 Earth - Brushy - Poor
n = 0.050 Rocky Streams

STA. OR LOCATION	WATERWAY DESCRIPTION	Roughness n	Slope Ft. Per 1000	Area Sq.Ft. A	p = Wet Per $r = \frac{A}{p}$	Vel. Ft./Sec V	Quant. c.f.s. Q
Southern to Baseline	Q = 470 						
	Effect of Low-Flow Channel is negligible						
	Try d = 2.3'	.03	0.3	337.9	154.5 / 2.19	1.45	490
Baseline to Daylight	Q = 515						
	Try d = 2.4	.03	0.3	353.3	155.2 / 2.28	1.49	526

Yost and Gardner Engineers

Low-Flow Channel along R.W.C.D. Floodway

* Area contributing at corresponding t_c

Int. - Interior Areas, 2-year frequency
Arts. - Arterials, 10-year frequency

EXPECTED FLOWS 2 Year Rainfall intensity and duration unless noted

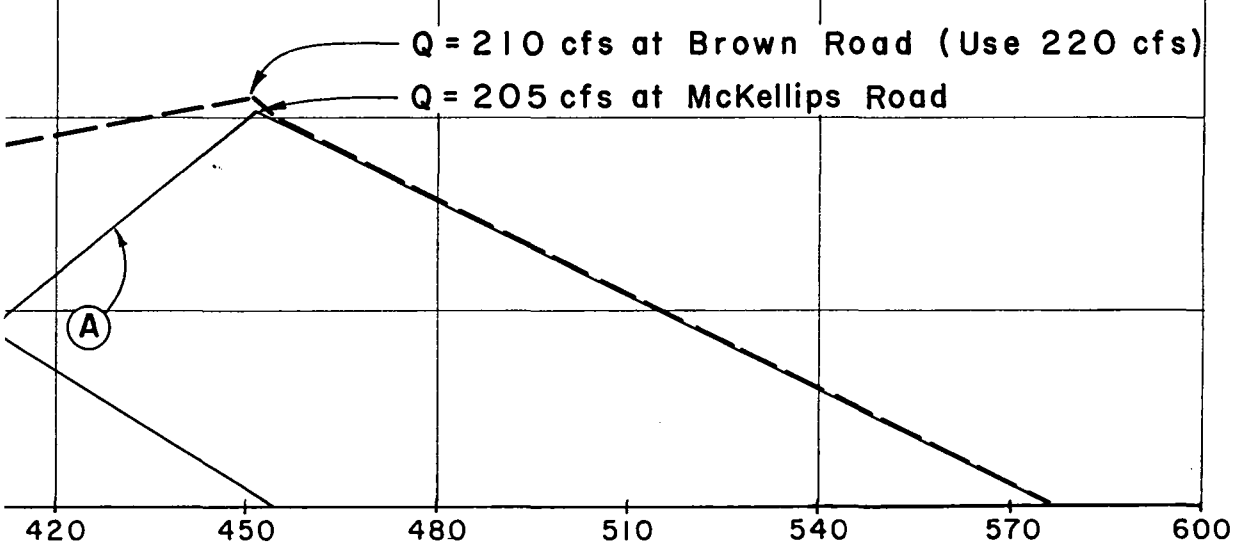
LOCATION	AREA IN ACRES: Total Area A*	Pervious Area A_p	Imperv's Area A_i*	Infiltr'n (final) in/hr f_c	Concentration Time: Street Slope	Min. t_c	RAIN: Point Intensity I	Average Intensity Ia	RUNOFF Pervious: $(Ia-f_c).8$ = Inches	$InxA_p$ = CFS	Impervious: $(Ia-0.2).9$ = Inches	$InxA_i$ = CFS	Total Flow CFS	DESIGN FLOW AND REMARKS
Line A (Int.)	1556		241			75	0.72	0.71			0.46	111		
Line A (Arts.)	34		34			75	1.27	1.25			0.95	32	143	205 McKellips
Line B (Int.)	2436		148			56	0.90	0.87			0.60	89		
Line B (Arts.)	81		81			56	1.60	1.55			1.22	99	188	190 Brown
Sum (Int.)	3992		389			153	0.39	0.38			0.16	62		
Sum (Arts.)	115		115			153	0.66	0.64			0.40	46	108	Channel flow time is so long that a peak flow is not generated by summation here.
Try Line E plus part of Line D														
Line E (Int.)	1686		365											
Line E (Arts.)	60		60											
28 minute flow time, use 40 minutes of Line D														
D-6 to D-13 (Int.)	1036		180											
D-6 to D-13 (Arts.)	37		37											
Sum (Int.)	2722		545			68	0.78	0.76			0.50	273		
Sum (Arts.)	97		97			68	1.38	1.34			1.03	100	373	375 Broadway
														Use as a base and sum flows by hydrograph.

ADJUSTED Q's

Use Q = 375 cfs at Broadway
(See Summation Sheet Appendix IV - 5)

Adjust Hydrograph Q's by this amount:
375/465 = 0.81

Baseline	Q = 635 cfs	x 0.81	=	515 cfs
Southern	Q = 580 cfs	x 0.81	=	470 cfs
Broadway	Q = 465 cfs	x 0.81	=	375 cfs
Main	Q = 370 cfs	x 0.81	=	300 cfs
University	Q = 240 cfs (min.)		=	240 cfs
Brown	Q = 220 cfs (min.)		=	220 cfs
McKellips	Q = 205 cfs (min.)		=	205 cfs



SUMMATION HYDROGRAPH FOR R.W.C.D. FLOODWAY LOW-FLOW CHANNEL

APPENDIX IV-6

EVALUATION OF DATUM DIFFERENCES

Description	City of Mesa Datum Elev. 1979 Assumed	U.S.G.S. Datum Elevation & Leveling Date	Subsidence Rate ft/yr	Subsidence corr. ft.	U.S.G.S. El. Adj. to 1979	Datum Diff. ft.
Hdwl. SE cor Higley Rd. & Southern	1320.49 (BM)					
(A) B.C. .35 mi S of Southern on Higley Rd. "1262-N"	1310.08 (Field Tie)	1308.86 (1979)	0.03*	--	1308.86	+ 1.22
Hdwl. NE cor Baseline & Power Rd.	1353.18 (BM)					
(B) B.C. in HH "E¼ cor Sec. 36"	1363.72	1362.85 (1979)	0.04*	--	1362.85	+ 0.87
T/C NE cor 82nd St. & Baseline Rd.	1422.11 (BM)					
(C) Hawes Rd. & Freeway "Bert 2"	1435.23	1433.51 (1979)	0.10*	--	1433.51	+ 1.72
T/C NE cor Sossaman & Inverness	1399.08 (BM)					
(D) Fwy ¼ mi E of Sossaman "1262-Q1"	1408.58	1406.92 (1979)	0.07*	--	1406.92	+ 1.66
T/C NW cor Power Rd. & Southern	1375.75 (BM)					
(E) B.C. SW cor Power Rd. & Southern "TL-AJ-8"	1376.72	1375.10 (1979) 1375.82 (1967)	0.05* 0.06	--	1375.10	+ 1.62
T/C SW cor Power Rd. & Broadway	1393.22 (BM)					
(F) B.C. SE cor Power Rd. & Broadway "W281 reset 1970"	1392.98	1391.27 (1979) 1393.14 (1967)	0.14* 0.16	--	1391.27	+ 1.71
T/C W Median, Main St. & Power Rd.	1414.37 (BM)					
(G) B.C. in Hdwl. NE cor Main St. & Power Rd. "1417.79"	1415.37	1413.72 (1979) 1415.55 (1967)	0.12* 0.15	--	1413.72	+ 1.65
(H) B.C. 200' S of SW cor Main St. & 70th Pl. "E22 1933"	1417.47	1420.89 (1948)	0.12*	3.72	1417.17	+ 0.30
T/C N end island @ 858 N Bush Hwy.	1462.16 (BM)					
(I) B.C. Bush Hwy. & Adobe Rd. "J269 Reset 1970"	1460.42	1459.29 (1967)	-- 0.04[1]	-- 0.48	1459.29 1458.81	+ 1.13 + 1.61
(J) B.C. E side of Bush Hwy. at Brown Rd. (Same Point)	1478.26 (BM)	1477.43 (1967) "TL-AJ-5"	-- 0.07[1]	-- 0.84	1477.43 1476.59	+ 0.83 + 1.67
T/C NE cor McKellips & Bush Hwy.	1523.83 (BM)					
(K) B.C. NW of McDowell & Bush Hwy. "TL-AJ-3"	1556.15	1554.46 (1967)	0.0 [1]	--	1554.46	+ 1.69
(L) B.C. NW of Hermosa Vista & Bush Hwy. "F-269"	1540.40	1538.75 (1967)	0.0 [1]	--	1538.75	+ 1.65
C.A.P. Subsidence Monitoring Line						
(M) B.C. in HH at Crismon Rd. & Broadway	1550.91	1549.64 (1980) "S.G.C. -12"	0.04*	--	1549.64	+ 1.27
(N) B.C. in HH at Broadway & Signal Butte Rd.	1583.23	1581.91 "S.G.C. -13"	0.01*	--	1581.91	+ 1.32
(O) B.C. in Conc. 650' SW of Meridian Dr. & C.A.P. Canal	1567.96	1567.00 "S.G.C. -17"	0.18*	--	1567.00	+ 0.96

* Subsidence Rate taken from Figure 24

NOTES: (See Figure 24)

1. City of Mesa datum appears to be 1.65 feet above U.S.G.S. datum. Of the points along the A.D.O.T. subsidence monitoring line (A-H) only points B and H vary significantly. Point H was not releveled in 1979 and difference is based on approximate subsidence since 1948. Points I thru L lie on a line last leveled in 1967. Since points K and L fall in an area of rock outcrops and shallow soil a subsidence rate of zero is assumed. Using this assumption, points K and L confirm the 1.65 foot datum difference. Approximate subsidence rates at points I and J can be calculated as follows:

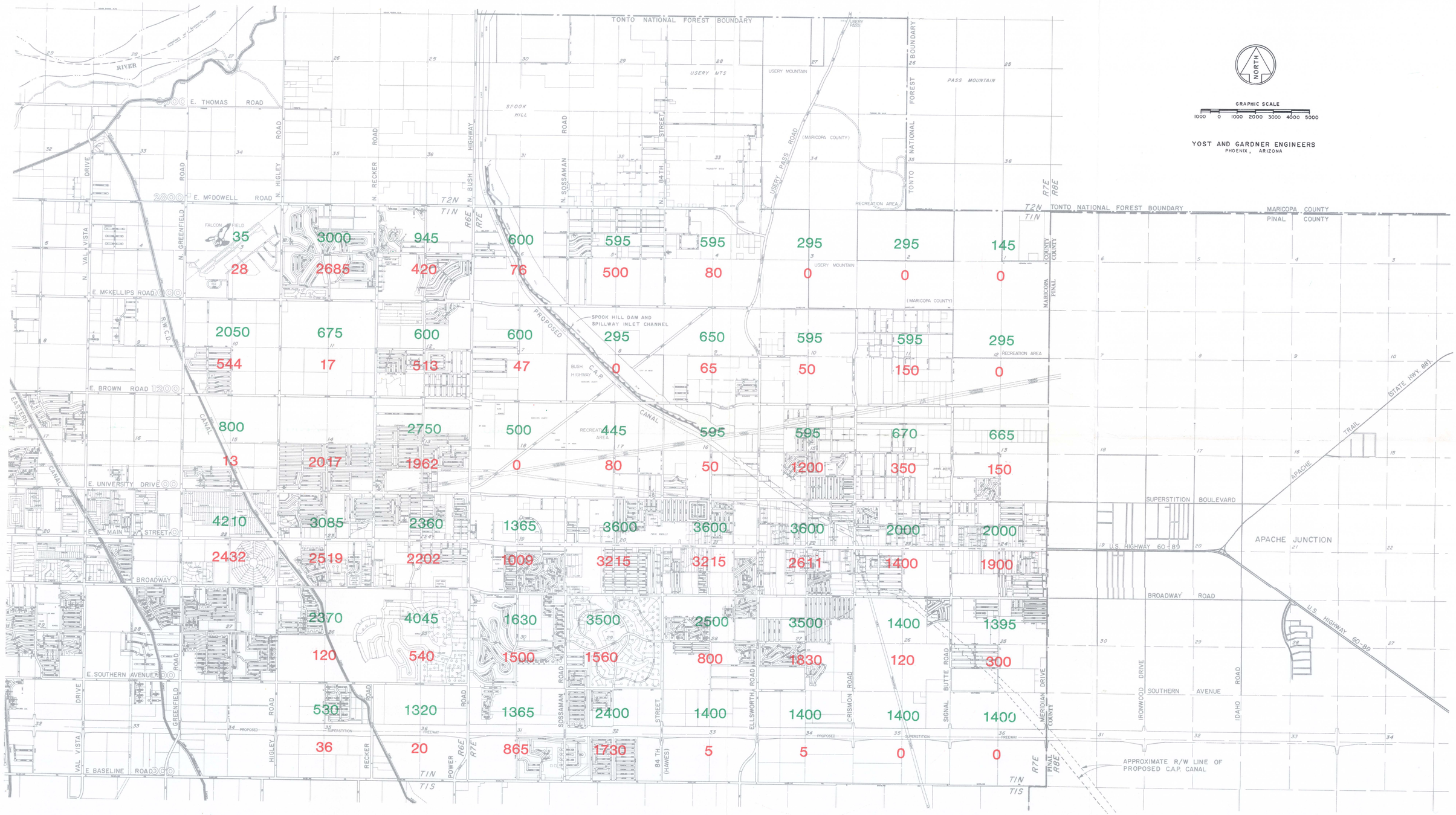
At Point I: (1.65'-1.13')/12yr = 0.04 ft/yr; At Point J: (1.65'-0.83')/12yr = 0.07 ft/yr.

The extrapolated subsidence contours north of Main St. are drawn based on the above assumptions.

2. No attempt was made to include subsidence effects when comparing recently run Mesa B.M. elevations to 1979 A.D.O.T. elevations (U.S.G.S. Datum).

3. Where U.S.G.S. elevations are known for two dates a check of subsidence rates is shown above. In these cases there is fairly good agreement between the calculated rates and the rates observed along subsidence monitoring lines. The most recent elevation was used to compute datum differences.

4. Points on C.A.P. subsidence monitoring line indicate approximately 0.3 feet difference between C.A.P. & U.S.G.S. Datums. Point O lies in an area of high subsidence making determination of datum difference difficult.



LEGEND

2519 1975 MAG POPULATION DATA

3085 2000 MAG PROJECTED POPULATION

PRESENT AND PROJECTED POPULATION DISTRIBUTION

PLATE I