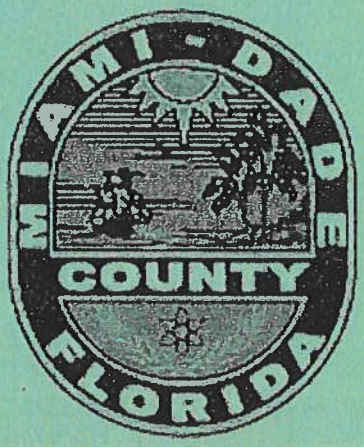
PUBLIC WORKS MANUAL

PART 2

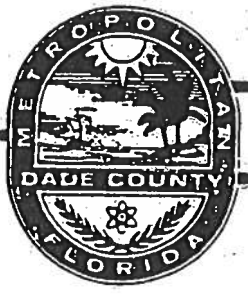
DESIGN AND CONSTRUCTION



PUBLIC WORKS DEPARTMENT

PUBLIC WORKS MANUAL

PART 2 DESIGN AND CONSTRUCTION



PUBLIC WORKS DEPARTMENT
METROPOLITAN DADE COUNTY

MIAMI-DADE COUNTY

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PUBLIC WORKS MANUAL

PART II - DESIGN AND CONSTRUCTION

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INFORMATION TO ENGINEERING CONTRACTORS

A PORTION OF

PART 2 - PUBLIC WORKS MANUAL

SECTION C1 - INFORMATION TO ENGINEERING CONTRACTORS

C1.01 - GENERAL

It is the intent of this section of the Public Works Manual to inform those persons concerned with the construction of Public Works facilities of the general requirements necessary to insure that such work is performed and controlled in the best interest of the public.

All work performed under contract with Dade County shall comply with contract or permit documents for the particular project. All other public works construction shall comply with the requirements set forth in the Public Works Manual, the approved construction plans and with the applicable codes, regulations, and ordinances of Dade County.

C1.02 - INFORMATION CONCERNING CERTIFICATION OF ENGINEERING CONTRACTORS

1. WHO MUST BE CERTIFIED

All individuals or firms engaged in the business of engineering contracting or acting in the capacity of an engineering contractor in Dade County must be certified pursuant to Chapter 10 of the Code of Metropolitan Dade County, hereinafter referred to as the Code.

2. QUALIFICATIONS FOR CERTIFICATION

Any individual or firm proposing to engage in engineering contracting within Dade County must be qualified in and have full knowledge of the particular category or categories of work in which he desires certification.

An individual may obtain certification for work to be performed under his supervision. A firm can obtain certification through a qualifying agent employed by the firm.

3. HOW TO OBTAIN CERTIFICATION

An individual or firm proposing to obtain an engineering contractors certificate of competency should contact the Office of the Secretary of the Construction Trades Qualifying Board (at the Dade County Public Works Department) either in person, by mail, or by telephone and secure the necessary application forms. When the application, together with all supporting documents, is complete, it should be submitted to the Secretary of the Construction Trades Qualifying Board, hereinafter referred to as the Board. The application will be presented to the Board at its next regular meeting.

Section C1 - Information to Engineering Contractors

The Board will determine whether or not the applicant is qualified by experience, and or education to take the written examination in the category or categories for which he is applying. The applicant will be notified as to the action of the Board.

Satisfactory completion of the written examination will qualify the applicant for a certificate of eligibility. Satisfactory completion will mean a grade of 70% or greater on the written examination, unless the passing grade is established as some other grade in the examination notice posted pursuant to Section 10-12 of the Code.

An individual with a certificate of eligibility may then apply for a certificate of competency for himself or a firm. After review and approval of the application the Board will issue a certificate of competency to the firm or individual. An individual may qualify only one firm at a time, however, a firm may have more than one qualifying agent.

4. RENEWAL OF CERTIFICATE

A certificate of competency or eligibility is valid (unless suspended or revoked) during the County fiscal year from October 1st through September 30th. Unless there is some reason why a certificate shall not be renewed, an engineering contractor may have a certificate renewed by completing and returning the renewal application and paying the required renewal fee. The renewal application will be mailed to him from the computer biennially in the odd-numbered years.

Since an engineering contractor must maintain a valid insurance policy, as required by Section 10-19 of the Code throughout the duration of the certificate, it will be beneficial to have the insurance policy run concurrently with the certificate of competency.

An engineering contractor permitting his insurance coverage to lapse or expire will be subject to an immediate and automatic suspension of his certificate of competency.

5. FEES (Application)

The following schedule of fees must be paid at the time of filing application for the purpose indicated:

a.	Initial application and examination . . .	$100.00
b.	Re-examination	$100.00
c.	Company certification	$150.00
d.	Qualifier's change of affiliation	$150.00
e.	Renewals (2 years) . . . . . Certificates of competency & eligibility for each qualifier; certificate of eligibility for each nonaffiliated tradesman.	$ 20.00 each

SECTION C1 - INFORMATION TO ENGINEERING CONTRACTORS

Payment of fees should be made by check or money order payable to the Dade County Public Works Department.

No examination fee will be refunded unless refund is requested in writing prior to the deadline set for confirming the applicant's presence at the examination.

C1.03 CATEGORIES OF ENGINEERING CONTRACTORS

A certificate of competency may be issued to an individual or firm in one or any combination of the follwing categories:

Category No.	Category Title
1.	General Engineering (This category includes categories 2, 3, 4, 5, 7)
2.	Plant Construction
3.	Pipelines
3A (No Exam-Cert. of Comp. reqd.)	Pipelines limited to inspection & sealing
4.	Structural
4A	Seawalls and Small Docks
4B	Pile Driving and Foundations
4C	Concrete Work
5.	Paving
5A	Asphalt Sealing limited to the protective sealing of existing asphalt surfaces excl. roadway pavement.
5B	Soil Compaction and Tamping
7.	Excavation and Grading
7A	Land Clearing and Grubbing
7B (No Exam-Cert. of Comp. reqd.)	Lot Clearing (limited to platted residential lots)
8.	Railroad Construction
9.	Underground Electrical and Communications Conduit
9A	Direct Cable Burial (CATV)
10.	Fuel Transmission and Distribution Lines

C1.04 - INSURANCE

All engineering contractors shall maintain insurance coverage as prescribed by Section 10-19 of the Code. (In the case of work under contract with Dade County. the insurance shall be as required by the contract specifications).

Section C1 - Information to Engineering Contractors

C1.05 - PERMITS AND FEES (Refer to Sections 2-103.1 through 2-103.6 of the Code)

1. PERMITS

A permit issued by the Dade County Public Works Department is required for all construction, excavation, alteration, repair, installation, and relocation of public works facilities within easements or road and canal rights-of-way.

A person or firm contracting for any of the above work without a valid certificate of competency is subject to the penalties prescribed in the Code.

The purpose of the permit is to provide a means for controlling the construction and installation of public works facilities and to assure that such construction conforms with existing standards and specifications and does not endanger the health, welfare or safety of the general public.

2. FEES (Permit)

A fee will be charged for each permit except when waived for governmental agencies. Appendix "A" (attached) is an excerpt from the Code relating to permit fees.

3. WHERE PERMITS ARE OBTAINED

Permits for public works construction, excavation, alteration, repair, installation, and relocation may be obtained at the Office of the Public Works Department.

C1.06 - TESTING OF MATERIALS

All materials that will become part of a public works facility are subject to tests to insure compliance with the standard specifications.

C1.07 - INSPECTION

All work performed pursuant to a permit issued by the Public Works Department will be subject to inspection during its progress. The engineering contractor shall request an inspection at the time specified by the following:

1. CONCRETE WORK

   a. After reinforcement and forms are in place and ready to receive concrete.

   b. During concrete placing (structural concrete members only).

   c. After concrete is poured and finished.

2. UNDERGROUND INSTALLATIONS OTHER THAN DRAINAGE

   a. After excavation has been completed and underground facility has been placed, but prior to backfilling.

   b. After excavation is backfilled.

   c. After surface has been restored.

3. DRAINAGE STRUCTURES

   a. Normally after the location of the structure has been established.

   b. If concrete work is involved, same as No. 1 above.

   c. If excavation for pipe installation is required, same as No. 2 above.

4. STREET PAVING

   a. After clearing and removal of undesirable material.

   b. After subgrade has been brought to grade and compacted.

   c. After the base course has been placed and bonded.

   d. After the prime coat has been placed.

   e. During and at the completion of asphaltic concrete surface course.

5. CANAL EXCAVATIONS

   a. Normally after the location of the canal has been established.

   b. After canal has been dug to the required cross section.

   c. At any other time where changing conditions may necessitate inspection.

The request for inspection should be made at least twenty-four hours before the inspection is to be performed.

Inspections should be requested only when it is definite that the work has progressed to a point where inspection is necessary.

The responsibility for establishing correct line and grade for all work under permit with the Public Works Department shall rest upon the owner or developer through a registered engineer or registered land surveyor.

Section C1 - Information to Engineering Contractors

The County's inspection shall be for the purpose of assuring the work conforms with specifications and proper standards of construction. If it is determined at a later date, even after final acceptance that an error is made in line or grade, the owner or his contractor will be responsible for any necessary corrections.

If at any time, before or after final acceptance of the work by Dade County, the inspector finds defects in either materials or workmanship, the contractor shall correct such defects immediately regardless of findings of previous inspections.

C1.08 - FINAL CLEANING UP

Upon completion of the work covered by the permit and before its acceptance, the engineering contractor shall restore the entire area disturbed or affected by his work (both public and private property) to the same or equal condition that existed prior to the work.

The restoration of the area shall include, but is not limited to, the removal of surplus or unused materials, rubbish, and temporary structures. Disposal of such materials shall not be made in a manner that will violate any portion of the Code of Metropolitan Dade County. If the project is of a size which makes it impracticable to wait for a final inspection prior to cleaning up, the inspector may require the engineering contractor to perform restoration to areas where the work has already been completed.

C1.09 - SAFETY PRECAUTIONS (Refer to Section 21-30 of the Code)

An engineering contractor shall take the utmost precautions to assure complete protection to public health, welfare, and safety. Adequate protection and warning devices shall be placed at locations surrounding the work to prevent injury to persons and property. Particular emphasis must be placed on safety devices for vehicular traffic. Any work that may create a hazard at night shall be well lighted from sunset to sunrise with lamps or lanterns visible from all approaches.

APPENDIX "A"

PERMIT FEES FOR PUBLIC WORKS CONSTRUCTION
DADE COUNTY, FLORIDA

The Dade County Public Works Department shall charge and collect fees for the items and rates listed in the following schedules:

(A) Fees for public works construction, under permit issued by the Public Works Department, in canal, road and street rights of way and easements in the unincorporated area of Dade County and in rights of way of canals, roads and streets located within municipalities that are maintained by Dade County are fixed as follows:

(1) For installation or repair of sanitary and storm sewers, waterlines, gas lines, and other underground utilities:

For 100 lineal feet or less	$28.00
For each additional 100 lineal feet or fraction thereof ..	$12.50

(2) For french drains, consisting of catch basin and seepage trench or slab covered trench:

For the installation consisting of one or two catch basins, and seepage trench or soakage pit of lengths not to exceed 100 lineal feet	$25.00

(3) For installation of poles or down guys for overhead utilities:

For each pole or unit	$10.00

(4) For construction or replacement of sidewalks, curb and gutter:

For 100 lineal feet or less	$25.00
For each additional 100 lineal feet or fraction thereof ..	$12.50

(5) For construction of driveways:

For driveway width of 20 feet or less	$10.00
For driveway width greater than 20 feet but less than 40 feet: (each driveway)	$20.00
For driveway width greater than 40 feet: (each driveway)..	$40.00

(6) For construction of street pavements:

(a) One lane or two lane pavements (width of pavement 0 to 24 feet)

For 100 lineal feet or less $75.00

For each additional 100 lineal feet or fraction thereof $25.00

(b) Three or more lanes of pavement (aggregate width greater than 24 feet):

For 100 lineal feet or less $100.00

For each additional 100 lineal feet or fraction thereof $50.00

(7) For paving of parkways and shoulders:

For 100 lineal feet or less $50.00

For each additional 100 lineal feet or fraction thereof ... $25.00

(8) For construction of curb separators:

For 100 lineal feet or less $25.00

For each additional 100 lineal feet or fraction thereof ... $10.00

(9) For erection of street name signs:

For each sign $5.00

(10) For construction of bridges:

For bridge roadway area of 1000 square feet or less $200.00

For each additional 100 square feet $50.00

(11) For installation of permanent-type traffic barricades, guardrails and guide posts:

For each 100 lineal feet or less $25.00

(12) For construction of street or driveway culvert crossing of canals and drainage ditches: (not controlled by DERM) See Appendix "B" for DERM Permit Fees.

For each lineal foot pipe ..... $2.00 per foot of pipe diameter or fraction thereof.

A permit fee for a multiple-pipe culvert shall be determined by regarding the aggregate lengths as one continuous pipe.

(B) Penalty Fees

When work for which a permit is required is commenced prior to obtaining a permit, a penalty fee will be imposed.

The penalty fee will be $25.00 plus double the original permit fee.

The payment of such penalty fee shall not relieve any person, firm, or corporation from fully complying with all of the requirements of all applicable regulations and codes, nor shall it relieve them from being subject to any of the penalties therein.

SECTION C2

TRAFFIC MAINTENANCE AND DETOUR REGULATIONS

A PORTION OF

PART 2 - PUBLIC WORKS MANUAL

PART 2 - CONSTRUCTION

SECTION C-2 TRAFFIC MAINTENANCE AND DETOUR REGULATIONS

C2.01 GENERAL

Traffic safety and traffic control devices shall be employed on all private and public construction work within the public right of way. Such measures shall be established and provided in conformance with these regulations and in conformance with Section C1.09 (information to Engineering Contractors), of the Dade County Public Works Manual.

C2.02 INFORMATION CONCERNING TRAFFIC MAINTENANCE AND DETOUR PLANS AND SPECIFICATIONS

1. WHO MUST HAVE CONSTRUCTION PLANS REVIEWED

   All private and public agencies, their contractors or representatives shall submit to the Dade County Public Works Department two sets of plans for construction work within the public right of way, for review by the Department of Traffic and Transportation.

2. PROVISIONS OF TRAFFIC MAINTENANCE OR DETOUR PLANS AND SPECIFICATIONS

   a. Upon such review the Dept. of Traffic and Transportation may, at its discretion, specify use of an applicable traffic maintenance plan and specifications shown in Standard Details No.R-19, Public Works Manual. Review of projects requiring traffic detours shall include the selection of a suitable route plus a sketch showing the plan and specifications to be used.

   b. Traffic maintenance and detour plans, specifications and provisions for extensive construction projects involving arterial streets rights-of-ways, may be supplied on a site to site basis by the Department of Traffic and Transportation.

   c. The Traffic Engineering Branch may specify special traffic maintenance or detour plans, specifications and provisions if, in its opinion, such plans, specifications and provisions shown in Standard Details No.R-19, Public Works Manual, are not applicable to a given project.

3. RESPONSIBILITY FOR PROVIDING, INSTALLING AND MAINTAINING TRAFFIC CONTROL AND WARNING DEVICES

   All traffic control and warning devices so specified, shall, unless otherwise specified by the Department of Traffic and Transportation, be furnished, installed according to the Dade County Public Works Manual, Part I, Standard Details (No.R-19 series), and maintained by the agency or contractor involved. Supervision of traffic control and safety by a Uniformed Police Officer, when specified, shall be furnished by the agency or contractor, without

cost to the County. Further, any and all additional traffic measures deemed necessary by such officer shall be carried out by the agency or contractor without cost to Dade County.

C2.03 PRE-CONSTRUCTION NOTICE REQUIREMENTS

1. Advance Notice to Department of Traffic and Transportation

Minimum advance notice periods, as specified below, shall be required for all construction projects at sites involving traffic or pedestrian signal installations. Such notice shall be given by direct contact with the Traffic Flow Interruption Section, Department of Traffic and Transportations.

a. Projects requiring physical modifications of existing facilities - two (2) weeks notice.

b. Projects not requiring physical modifications - forty-eight (48) hours notice.

2. Advance Notice to Law Enforcement and Fire Protection Services

When traffic detours are used, law enforcement and fire protection services shall be notified by the agency or contractor involved, twenty-four (24) hours in advance of the detour date. Such notification, in connection with emergency construction work, shall be given immediately.

C2.04 TRAFFIC MAINTENANCE OR DETOUR REGULATIONS FOR EMERGENCY CONSTRUCTION PROJECTS

Traffic maintenance or detour measures shall be employed during emergency work on or within a roadway. Such measures shall be based, insofar as possible, upon the applicable plans and specifications shown in Standard Details No.R-19, Public Works Manual.

C2.05 LIMITATION ON BEGINNING CONSTRUCTION WORK

Construction on all projects, or the portions thereof, requiring traffic maintenance or detour provisions shall not begin without implementation of such plans and specifications authorized by the Department of Traffic and Transportation.

C2.06 STORAGE OF MATERIALS ON PAVEMENT

If excavated or other material is permitted to be stored adjacent to or partially upon a roadway pavement, such material shall be adequately marked for traffic safety at all times.

C2.07 PERMITS REQUIRED BY OTHER GOVERNMENTAL AGENCIES

The procedures or requirements stated in this section shall not be construed as relieving any agency or contractor of responsibility in obtaining required traffic permits issued by other governmental agencies. Such additional permits, when their stipulated regulations are more restrictive than those herein contained, shall have precedence, except that traffic may not be detoured without authorization by the Department of Traffic and Transportation.

SECTION C-3

REQUIREMENTS FOR FILLING LAND

A PORTION OF

PART 2 - PUBLIC WORKS MANUAL

Rev. 3/9/66

SECTION C3

REQUIREMENTS FOR FILLING LAND IN UNINCORPORATED DADE COUNTY

C3.01 GENERAL INFORMATION

1. PURPOSE

The following requirements are set forth as a means of controlling the quality and placement of fill necessary to bring land, including tidal areas, to the proper elevation. The information contained herein supplements Section 28-15(b)(4), 33-4, and 2-103 of the Code of Metropolitan Dade County.

2. GENERAL

The quality and placement of fill in the unincorporated areas of Dade County (including subdivisions and tidal areas) shall be in accordance with these requirements. The final fill, after settlement, shall be to an elevation no less than the approved elevation of the crown of the road fronting the property to be filled, or to an elevation no less than the elevation shown on the Dade County flood criteria maps, whichever is higher. Such elevations shall be referred to mean sea level, U.S. Coast and Geodetic Datum.

If the area to be filled is tidal or bay bottom, steps must be taken prior to the filling operation to acquire title to the land and obtain permits from the U.S. Army Corps of Engineers, the Trustees of the Internal Improvement Fund, and the County Commission.

If the area to be filled is within a subdivision, the fill material must be placed and accepted prior to recording the plat of the subdivision or a bond must be filed with the Public Works Department, in an amount approved by the Director of Public Works (not to exceed 110% of the estimated cost of the fill) to insure satisfactory completion of the fill, before the plat of the subdivision will be accepted for recording. Refer to Section 28-16(e) of the Code.

C3.02 QUALITY AND PLACEMENT OF FILL FOR PRIVATE LANDS

1. REMOVAL OF OVERBURDEN FROM EXISTING SURFACE

The removal of organic material or other undesirable overburden may be required by the Public Works Department prior to filling. Factors affecting the decision for removal will include; depth and quality of undesirable overburden, depth of fill to be placed above overburden, and proposed use of the area to be filled.

2. FILL MATERIAL FOR AREAS WHERE DEPTH OF FILL WILL BE MORE THAN TWO FEET

a. Acceptable Fill Material

(1) A sand and rock mixture is considered to be the most desirable material for fill.

(2) In lieu of sand and rock for the total fill, portions of the fill may be composed of reinforced concrete rubble masonry provided the largest dimension does not exceed three feet nor two-thirds the depth of fill, whichever is smaller. The reinforcing steel from reinforced concrete rubble shall not protrude more than twelve inches nor shall it project above the finished surface of the fill.

b. Unacceptable Fill Material

Peat, muck, wood, tree stumps, roots and branches, metal products or other material that will not readily compact into an unyielding mass shall not be used as fill.

3. FILL MATERIAL FOR AREAS WHERE DEPTH OF FILL WILL BE TWO FEET OR LESS OR FOR THE UPPER TWO FEET OF A FILL THAT WILL BE GREATER THAN TWO FEET

a. Acceptable Fill Material

Same as for fills greater than two feet, except that a percentage of the fill in lawn or park areas may be peat or muck sufficient to provide a good quality top soil.

b. Unacceptable Fill Material

Same as for fills greater than two feet, except for the peat or muck content, as described in a. above.

4. PLACEMENT OF UPPER THREE FEET OF FILL

In addition to the above requirements, the upper three feet of fill shall be of such quality that when placed it will provide natural surface seepage of an infiltration rate of one-inch per hour after saturation.

5. FILL PROTECTION

The extremities of an embankment that has been placed in accordance with these requirements and is not protected by bulkheading shall be protected against excessive erosion by rip-rapping or other acceptable preventive measures.

C3.03 FILLING OF AREAS DEDICATED OR PROPOSED TO BE DEDICATED AS PUBLIC RIGHT-OF-WAY FOR ROADS

All areas dedicated or proposed to be dedicated as public right-of-way for

road purposes shall be filled in accordance with the requirements as set forth in Section 30 of the Dade County Standard Road Specifications entitled "Excavation and Embankment."

C3.04 CONTROL OF WORK

All filling operations made pursuant to these requirements shall be performed under continuous supervision of an engineer, registered in the State of Florida. A certification from this engineer may be required at the completion of the work as an assurance that the fill has been placed in accordance with these requirements. A subdivision bond involving fill will not be released without such certification.

C3.05 BUILDING FOUNDATION

It is not to be construed that fill placed in accordance with these requirements will produce a foundation suitable for a building structure of any type. The foundation requirements for buildings are covered in Articles 2402.1, 2402.2, 2403.1, 2403.2, 2403.3, and 2403.4 of the South Florida Building Code. Building permits issued by Dade County for structures to be located on fill require an engineer's certification as to the bearing value of the soil at the building site. When the building site is known prior to filling, it would be advisable to place the building foundation in a manner that will satisfy the Building Code concurrent with filling the surrounding area.

C3.06 FILL PERMITS

Section 2-103.2 of the Code of Metropolitan Dade County requires that a permit issued by Public Works Department will be secured before placing fill on tidal or bay bottom land. The fee for such permit is specified in Section 2-103.2(b) of the Code.

SECTION D4

WATER CONTROL

A PORTION OF

PART 2 - PUBLIC WORKS MANUAL

FOREWORD

The Public Works Department was authorized by the Code of Metropolitan Dade County to prepare the Public Works Manual. The attached Water Control Design Manual, is a portion of Part 2 of the Public Works Manual entitled "Design and Construction".

References are made herein to Standard Details and to Standard Specifications. Standard Details are contained in Part 1 of the Public Works Manual, which has been published. Standard Specifications will be in Part 3 of the Public Works Manual. "Storm Drainage Specifications", consisting of Sections 310, 320, 340, 350, 355, 360, and 361 have been published.

METROPOLITAN DADE COUNTY
PUBLIC WORKS DEPARTMENT

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D4.01 GENERAL INFORMATION

1. PURPOSE

Sections 28-13 and 24 of the County Code require that in new subdivisions adequate provision be made for the disposal of storm water in accord with standards prescribed in the Manual of the Public Works Department and the Department of Environmental Resources Management. Sec. 33-123 requires approval of the Public Works Department of all drainage plans submitted to the Building and Zoning Department for issuance of building permits. This Water Control Section of the Design Manual sets minimum standards for disposal of storm water, design of drainage facilities, prevention of salinity intrusion, and conservation of water; and it establishes procedures for preparing, checking, and approving plans for drainage and drainage structures.

2. AUTHORITY

The authority for the preparation and use of this Section of the Design Manual is based on the Code of Metropolitan Dade County, Florida:

a. Article XIV which describes the functions, powers, and duties of the Public Works Department.

b. Section 7-1 which, under authority of Florida State Laws Chapter 22935, Special Acts 1945, established a water conservation district embracing the entire county, gave the county broad powers to regulate water elevations, and established a salt barrier line.

c. Chapter 28 which regulates the subdivision of land in Dade County.

d. Section 24-58 which establishes permitting procedures.

3. SCOPE

The provisions of this manual apply, but are not limited, to land development and subdivision. Their application to works on private property such as parking lots extends only to items under the direct control of the Public Works Department and D.E.R.M. such as permitting connections to County Canals.

They apply to those Water-Control facilities that:

a. Are to be maintained or operated by the County.

b. Have a connection with, County canals or canals of the South Florida Water Management District.

c. Are located or to be built within new subdivisions.

d. Are within dedicated rights-of-way in the unincorporated area including proposed dedications as defined in Sec. 2-103.1 of the Dade County Code, and within rights-of-way maintained by Dade County within the municipalities.

e. May cause or prevent intrusion of salt water.

f. Are within applicable tax districts established under Chapter 18 of the Code.

4. OTHER REQUIREMENTS

Drainage facilities shall also comply with the requirements of the following agencies or regulations whenever applicable:

a. County or Municipal Zoning
b. South Florida Water Management District
c. Corps of Engineers, U. S. Army
d. South Florida Building Code
e. State Road Department of Florida
f. Department of Public Health
g. The Federal Housing Administration
h. The Veterans Administration
i. Department of Environmental Regulation
j. Dade County D.E.R.M.

D4.02 DESIGN CRITERIA

1. GENERAL

The following criteria will be used by the Public Works Department in review of drainage plans submitted for approval. The Department will be more concerned with the manner in which all factors fit together to make a consistent and reasonable drainage plan than the exactness with which a single factor meets these criteria. Definition and applicability of terms such as "feasible", "normal", "significant", "may", and the like will be determined by the Public Works Department.

2. FLOOD CRITERIA

Resolution No. 4120 of October 27, 1959 established Flood Criteria Elevations. Later maps showing elevations currently required are filed in the Public Records. These are minimum allowable elevations for crowns of streets and for land surface as required by Chapter 28 of the Code. These elevations are subject to continual review and will be revised as drainage improvements become effective. In addition, Chapter 33 of the Code limits use of land below flood criteria elevations. Reasonable protection from flood damage will result only from proper combinations of filling, grading, and installation of drainage facilities. Changes in County Flood Criteria require approval by the County D.E.R.M.

3. SALT WATER INTRUSION

Protection of fresh-water supply from contamination by salt water is of major importance, and maintaining reasonably high elevations of fresh water is required for this purpose.

Section 7-1 of the County Code fixes a salt barrier line which constitutes "the westerly limit beyond which no new uncontrolled canals, channels, or continuous excavations from any salt contaminated area easterly thereof shall be excavated or constructed." The map showing location of this salt barrier line is filed in Plat Book 71 at Page 61. More detailed location information is shown on enlarged Public Works Department maps which are available for public inspection.

Provisions for controls and control structures for such canals are subject to approval by the Public Works Department and D.E.R.M. One requirement for control is an unexcavated "buffer zone" (sometimes set at 300 feet) between the salt barrier line and any interior excavations.

4. GRADING

Flood Criteria Elevations noted above establish minimum elevations for land to be developed. Land filled to such elevations must be carefully graded and shaped. Slopes must trend away from structures or areas to be protected. The area must be properly graded to direct surface runoff into whatever drainage system is provided. For swales, both the direction and degree of slope are to be carefully considered. All unpaved areas within the street right-of-way are to be grassed (solid sod). Impervious fill materials are not to be used in swale areas except where stabilized shoulders are required. Section C 3 of the Manual sets forth requirements for filling land.

5. DEGREE OF PROTECTION--STORM FREQUENCY AND LIMITS OF FLOODING

"Frequency" as used herein refers to rainfall frequency or to storm frequency and not to flood frequency unless specifically stated. The design frequency to be used will depend on a balance between cost of a drainage facility and the damage it will prevent. After preliminary selection of drainage facility sizes, evaluation should be made of the damage that would be caused by flooding resulting from more intense, and less intense, storms.

In selection of design frequency consideration is to be given to future conditions, and to the design frequency used for other facilities within the same system.

Table I, following, is a guide for selection of design frequency. Frequencies given are to be considered as minimum, and more intense rains may be used at the discretion of the designer. Less intense rains may be approved by the Public Works Department. In review of drainage plans the Public Works Department will give consideration to the duration of flooding, and also to the extent of flooding as listed in the table. The frequencies listed are for the design of local drainage facilities, and exceptions for culverts in the County secondary canal system are noted.

The standards set forth in this table are not to be confused with flood criteria elevations covered elsewhere. The flood criterion is the minimum prescribed ground level or crown of road elevation (mostly for new subdivisions in low areas) based on an estimate of the highest water level expected to occur once in 10 years; whereas, these standards are drainage "tests" applied to determine economical sizes of local facilities, and are based directly on runoff from a rainstorm of a frequency selected to prevent undue amount and duration of damage to buildings, and inconvenience to persons and traffic. These standards are applicable in all areas, including areas that may be entirely above flood-criteria elevations and yet could be unduly damaged by even a 3- or 5-year storm because of flat slopes and lack of positive outlet facilities. For those areas which are not fully developed and can be altered, combinations of ground levels, grading, and drainage facilities must be provided to obtain a proper economical balance. The standards presented here shall apply to both the developed and undeveloped portions of any area affected by a land development plan.

TABLE I

DESIGN STORM FREQUENCIES AND FLOOD LIMITS		
Type of Area	Rainfall Frequency	Flood Limit
1. Residential and Commercial Areas	5-year	To crown of street, or to within 15' of a dwelling or other occupied building, whichever is lower
2. 2-Lane roads in Residential and Commercial Areas	5-year, except 10-year for a bridge or culvert in the canal system	To crown of street
3. 4-Lane roads in high density, high traffic areas	10-year	To outer edge of traffic lanes
4. Private parking lots and similar paved areas	2-year	(See South Florida Building Code 4611)

6. DESIGN RUNOFF

Where runoff is to be computed by the rational method Design Standards WC 1.3 and WC 1.1 may be used. A value K is determined from the alignment chart WC 1.3 by connecting the known value of the slope "S" and the roughness factor "n" to find the pivot point, then connecting the pivot point with length "L". The chart is constructed to yield $K=.83(L.n)^{.6}/S^{.3}$ and the lines on WC 1.1 denote the relation $i=K/t_c^{.6}$. Together they represent $t_c=.93(L.n)^{.6}/i^{.4}\ S^{.3}$ from which it is seen that the time of concentration depends on the intensity. This formula is based upon a study by Robert M. Ragan and J: Obiukwu Duru in Vol. 98 No. HY 10 Oct. 1972 of the Journal of the Hydraulics Division, proceedings of the American Society of Civil Engineers; the alignment chart and the plot of $i=K/t_c^{.6}$ on WC 1.1 were developed by the Water Control Division.

After K is determined from WC 1.3, both the average rainfall intensity and the time of concentration (for overland flow) are read off WC 1.1, by projecting horizontally for the intensity and vertically for the time of concentration from the point of intersection of the curve of frequency and the K-line corresponding to the predetermined value of K. The set of curves shown on WC 1.1 labelled by frequency shows rainfall intensities for the Miami, Florida area for 5-minute to 24-hour durations. (Maximum intensities of record are also shown in the table). When additional times of concentration are obtained (for example by adding the time of overland flow to the first inlet to the flow time within the system) the intensity is read off by projecting first vertically along the line corresponding to the duration to an intersection with the curve of desired frequency, and then horizontally to the average intensity.

For areas where the conventional approach to use of rainfall and runoff coefficients and formulas does not appear usable, infiltration tests may be used, or required, as a direct basis of computation or as a check on runoff coeffi-

cients. In such cases the FHA Standard test method for making infiltration tests with concentric rings will be used. The development of this procedure locally is set forth in FHA Manual "Storm Drainage for FHA-Insured Residential Subdivisions in Dade County, Florida", including Appendix E.

Design Standard WC 1.2 represents a continuation of the rainfall intensity data on Standard WC 1.1. It shows Miami's rainfall depths and frequencies for durations of 1/2 day, 1 day, 2 days, 3 days, and 30 days. The sources of data for these rainfall charts include reference material from the U.S. Weather Bureau, U.S. Army Corps of Engineers, U.S. Department of Agriculture, Florida Board of Conservation, and American Society of Civil Engineers, and the County's own compilation and analysis of rainfall records extending over many years. Use of other curves or data from equally reliable sources may be acceptable to the Public Works Department. The charts presented will be used for the Public Works Department's own computations and checking purposes except for State Department of Transportation projects for which that Department's standards are prescribed.

7. DESIGN WATER ELEVATION

a. For Seepage Drainage Facilities

The capacity of seepage drains depends on the difference in elevation between ponded water and design groundwater elevation. (See Standard Details SD 1.1 and SD 1.2,

and Article D4.04) Design levels for surface water and ground water will be subject to approval of Department of Environmental Resources Management. In general, the design water table will be somewhat above the annual average level although not as high as the highest month which is October. Water table levels may be determined from the U.S. Geological Survey maps included as Design Standards WC 2.1 though WC 2.5, inclusive.

b. For Culverts

Section D6 "Bridges and Culverts" requires that crowns of culverts and design water elevations be established by the Public Works Department. (See also Table I.) Normal requirements are that:

(1) The culvert be set low enough that it will flow full and thus take advantage of its maximum head loss at somewhat less than design water level.

(2) The crown be set high enough above the water elevation that will persist for a large part of the time in order that debris and trash will flow through the culvert without obstruction for much of the year.

(3) In tidal areas the culvert invert be set at approximately the lowest water level (low tide or somewhat lower) so that clean-out velocity will occur at low tide.

(4) The depth of cover between crown and roadway surface be sufficient to allow the culvert to safely sustain the design load.

(5) The crown of a culvert designed to allow passage of recreational or maintenance boats would normally be set relative to mean high water or a mean navigational stage determined by D.E.R.M. (See following section on Bridge Clearances.)

c. For Bridges

The Department of Environmental Resources Management will select the design water elevation based on the needs of the primary and secondary water control systems, with careful consideration given to:

(1) Water elevation at design discharge and at higher discharges, and possible damage to the bridge at high flows and scouring velocities.

(2) Head loss (backwater) at design and at higher discharges, and accumulative effects of other existing and proposed crossings of the canal.

(3) Bridge clearances, horizontal and vertical, as required to meet navigational needs including passage of maintenance boats and amphibious DUKWs. The S.F.W.M.D. Criteria Manual for use of works of the District, latest issue, will be applied to bridges in the County's secondary water control system insofar as appears feasible to the D.E.R.M. A clearance of 3.5. feet above conservation stage (optimum water level) may be taken as the normal minimum value for County secondary canals provided however, a minimum clearance of 6 feet above the conservation stage will be used whenever possible.

(4) Bridge clearances for S.F.W.M.D. canals must meet their standards referred to above, unless the District officially allows modification of such requirements.

d. Tide Elevation

For drainage facilities overflowing to tide water, the design water elevation for the west side of Biscayne Bay is to be taken as 1.0 foot msl. For the Bay side of Key Biscayne 0.8 foot should be used; and for the Card Sound-Barnes Sound area design levels varying from about 0.9 foot at the Arsenicker Keys area to 0.6 foot at Manatee Bay (U. S. No. 1 Highway) should be used. Other factors affecting coastal drainage facilities include flood criteria elevations of 5' to 6 1/2' msl along the coast, and conservation stages, considerably higher than 1.0' msl, held behind salinity dams. Relative datum plans of the bay and Ocean are set forth in Standard Detail G 1.1.

D4.03 LOCAL GRADING

1. GENERAL

An acceptable grading plan must be prepared prior to determination of best means of disposal of storm runoff. A proper relation must be established between inlet sites at points of concentration of flood flow from the basin and the direction and degree of slopes which are provided to bring the water to these sites.

Closely related to grades and slopes is the selection and distribution of material used for fill. Impervious fill material is not to be used in swales except where road shoulders must be stabilized. All swale areas are to be solid sodded. To allow for sodding, swales are to be rough-graded to two inches below the elevation shown in Standard Road Details.

Some portions of the drainage system may be established below flood criteria elevations. For example, swales, gutters, and specific waterways may be set below flood criteria as indicated in Part 1, Standard Details, provided that a maximum of 6 inches is not exceeded.

Each grading and drainage plan submitted to the Public Works Department shall establish by plans, cross sections, diagrams, and notes a definite grading pattern. Such drainage plans shall be of broad enough scope to coordinate the pattern details with drainage of adjacent surrounting areas. In cases of extremely flat slopes, paving of swales may be required.

a. Grading for Street Drainage

Generally proposed grades will conform reasonably well with the natural land contours. The intent of establishing flood criteria is to prevent frequent and periodic flooding in low areas and they are not to be used as a basis for making excessive cuts or steep grade which would concentrate the collection of flood waters to an unacceptable extent. Deep cuts and resulting steep grades in areas above flood criteria will not be allowed. (A cut of about 2 feet would be considered a deep cut.)

Grades and disposal facilities may be designed for on site retention with an emergency overflow, or for disposal within the subdivision by adjustment of trades and on-site disposal facilities. In some cases initial seepage installations must be designed for future adaptation to use in an emergency outfall drainage system.

As a guideline a .2% minimum grade should be provided, with flatter grades being allowed only when justified by infiltration tests. However, consideration will be given to varying such grades to allow for condition of swales, adjacent existing and proposed points of collection for drainage, and effects of curb and gutter if to be provided. Flexibility will be allowed in determining minimum grades as related to maximum distance from which water is to be with maximum distances being related to allowable depth of water at chosen low points. See SD 3.5 for curb and gutter sections. Careful attention must be given to effects on existing surroundint areas when planning grades for draining at new development. Special attention must be given to avoid flooding of adjacent properties.

Generally an inlet, collection or seepage structure, or outfall is required at low points in the street drainage system, it being preferable to provide an onsite retention system. Where full on site retention cannot be provided, then an emergency overflow may be permitted provided the first inch of runoff is fully retained on site. Permits are required from the Department of Environmental Resources Management for any overflow into any waterbody in Dade County. (See SD 1.1 and SD 1.2.) Seepage drains can be provided based on favorable infiltration or percolation test results even though the proposed facility may be in a part of the County where tests have not previously revealed high rates. In some areas, even where such tests may show no seepage facilities are required, a sum may be included in the subdivision bond for potential installation of a drainage structure if proved necessary later by excessive ponding.

2. STORM DRAINAGE DETAILS FOR STREETS AND DRIVEWAYS

As stated in the preceding paragraphs the guideline for minimum street grading is .2% with some variations allowed depending on the type of system used for removal of flood water. This guideline, the maximum length of continuous fall from one grade point to another, and related standards discussed herein must be allowed to vary somewhat, particularly in "transition areas" where because of existing adjacent subdivisions or older streets constructed under prior standard, it will not be practical to adhere exactly to these standards. Developers and contractors should check closely with the Public Works Department and its inspectors whenever such conditions are anticipated in order to prevent problems of this type.

a. Swale Sections in Rock or Marl Areas (Including Driveways)

These sections will be constructed as a straight-line slope from the inside edge of the sidewalk to the edge of pavement or valley gutter (indicated on R 14.6, and also as to driveways on R 12.3, R 12.5, and R 12.6). In certain estate zones where sidewalks are not required the elevation at the property line will not be lower than the crown of the street and this grading standard will prevent ponding where percolation is unsatisfactory.

b. Swale Sections in Sandy Areas (Excluding Driveways)

In areas (generally north of Flagler Street) where infiltration tests show good infiltration the swale section will be constructed (depressed 6 to 9 inches) in accord with R 1.1, R 2.1, R 3.1, R 8.1, R 9.1, R 9.2, and R 11.1. This type swale (between driveways only) will be used for infiltration including runoff from driveways as explained in the following paragraph.

c. Driveways to be Built Without Depressed Swale

All driveways will be graded to conform with R 12.3, R 12.5, and R 12.6, the grade being a straight line from the inside (back) edge of the sidewalk to the edge of the street pavement or valley gutter. In all right-of-way widths without curb and gutter the County standards set the back of the sidewalk at about the same level as the crown of the street or higher. This design provides for driveway runoff directly to the edge of the pavement or valley gutter from whence the normal .2% minimum allowable street grade should carry the water to the point of disposal.

D4.04 DRAINAGE FACILITIES AND STRUCTURES

1. GENERAL

a. Dade County Water Control Plan

The elements of the Dade County Water Control Plan are shown on a map filed in the Public Records. This plan is under continuous study and is revised from time to time. The latest such map is filed in Plat Book 77, Page 42. It shows approximate locations of all existing and proposed canals, levees, dams, control structures, pumping stations, drainage divides, and other drainage features of the water control system of Dade County and the South Florida Water Management District. All additional drainage facilities must be consistent with this over-all Water Control Plan.

A design chart (WC 3.1) for preliminary and tentative hydraulic computations and estimates is included herein. The design of canals and culverts installed locally by

Federal, State, and County agencies over the past 20 years conform generally to the design relations shown on it.

b. Separate Storm Drainage Systems

Storm sewers and sanitary sewers are to be separate systems.

c. Variation from Standard Details

There is no intent to limit design or construction to the particular materials and arrangements shown in the Standard Storm Drainage Details. Use of other materials and details that will provide equivalent results more efficiently may be approved by the Public Works Department, due regard being given to durability as well as performance.

d. Fill as Flood Protection

Protection from floods may be provided by filling an area, but fill is not included in this article as a drainage facility. It is one effective means of lowering flood damage, but protection by fill alone is costly and the size of the area that can be protected by fill alone is limited.

2. DISPOSAL DRAINAGE FACILITIES AND STRUCTURES

a. General

Disposal systems are termed positive drainage systems or seepage systems. Positive systems include canals and storm sewers that drain through a continuous outfall to the bay or ocean or an inland waterway; whereas seepage systems drain into the ground water.

In general, all land and streets should be graded to drain to or toward the nearest catchment or disposal structure, utilizing storm sewers, paved swales, and solid sodded V-type gutter ditches, meeting however other requirements set forth in the Public Works Manual. Seepage facilities will be relied upon as the preferable type of disposal system.

b. Overflow Storm Water Disposal Systems

(1) Closed Conduits

The minimum diameter pipe to be used for storm sewers is 15 inches.

The hydraulic gradient for determining the design capacity shall be computed for full flow without pressure, although the head used may be considered as the difference between an upstream elevation equal to the level of the inlet grate and a downstream elevation which may be taken at a similar downstream grated location, provided however that where the conduit empties into a canal or river the gradient at that point will be the level corresponding to discharge in that stream of the same frequency as the design discharge for the closed conduit; and provided further that the downstream elevation in coastal areas along the west side of Biscayne Bay will (with certain exceptions) be taken as 1.0' msl, as explained elsewhere.

Values of Manning's "n" will be those usually applied, common values being .011 for concrete pipe and .024 for corrugated metal pipe. In the design proper allowances will be made for ground water infiltration into the pipe system. Flap gates or other controls will be provided as necessary to prevent excessive tidal flooding or movement of salt water into uncontaminated areas, and to prevent excessive loss of fresh water--all such facilities being subject to approval of the Public Works Department.

Manholes are required at all significant changes in direction and slopes, and at junctions; also at maximum distances of 400' for pipes 24 to 48' in diameter, and 300' for pipes 24" or smaller in diameter. For specifications see Sections 310, 320, 340, 350, and 355.

All pipes and closed conduits subject to traffic loads shall be designed for H 20 loading, with due regard to depth of cover. Standard Details of storm drainage facilities are given in Part 1 of the Manual.

(2) Canals and Open Channels

(a) Location--In general, the County canal system has been laid out to conform with the natural glade topography, however the water control plan may be modified to a minor extent by changing canal alignment,

introducing new channels, or eliminating some planned canals during the development of new areas. This is to allow for economy in land use, in right-of-way acquisition, and in locating roads and bridges.

Open channels are not to be located adjacent to roads except in areas where it is not feasible to separate them due to the extent of existing development. In relatively undeveloped areas consideration will be given to relocating existing open channels to provide a minimum usable lot depth between the channel and the nearest road.

(b) Right-of-Way--Where canals and roads are to parallel each other and lie between two land ownerships or along section and quarter-section lines, efforts shall be made to balance the right-of-way by taking the same amount of land from each owner or from each side of the section line.

Minimum channel right-of-way and canal maintenance easements (by instrument or plat dedication) will be provided in accord with Table II following. Where a road and canal are adjacent and are parallel, the minimum combined right-of-way will be determined in accord with Table II, and Standard Details R 20.6 and R 9.2, provided however that where the following criterion indicates a greater right-of-way width requirement, then said greater width will normally be used:

A minimum maintenance-of-way (for road shoulder, traffic safety, and canal maintenance) 5' greater than the width of maintenance easement shown in Table II, Column 3, shall be provided between the road right-of-way line and the canal top-of-bank line, except where a canal is less than 43' wide and where at least a 20-foot maintenance easement is provided on the far side of the canal away from the roadway, in which case the 15' minimum of Standard Detail R 9.2 would still apply.

In addition to the foregoing qualifications in the use of Table II (in connection with the problem of roads and canals lying adjacent and parallel), the optional modifications shown in Figure 1 may be made where canals are excavated in stable rock and with vertical sides to the channel.

The Standard Details referred to above are intended to provide reasonable safety standards to protect the public against drownings.

TABLE II

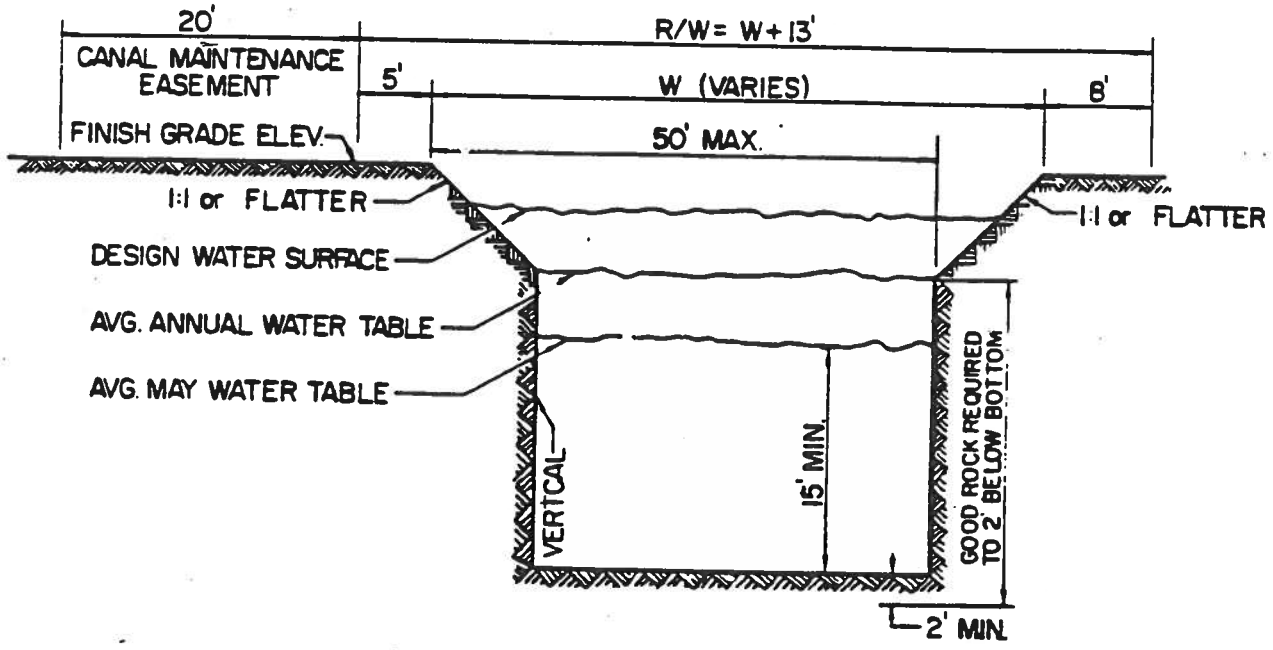
CANAL RIGHT-OF-WAY

Width[1] (W_c)	Right-of-Way[2] (W_c+10')	Maintenance Easement	Total Width
6' - 43'	16' - 53'	20' 1 bank	36' - 73'
44' - 80'	54' - 90'	25' Ea. bank	104' - 140'
81' & up	91' & up	30' Ea. bank	151' & up

NOTES:

(1) Top of bank width at min. elev. of flood criteria or approved higher ground level.

(2) Public ownership with spoil rights. Allows for 5' overbank each side of channel.



SKETCH FOR OPTIONAL MODIFICATION OF TABLE II VALUES
FOR CANALS WITH VERTICAL SIDES
EXCAVATED IN STABLE ROCK
(NOT TO SCALE)

FIGURE I.

(c) Canal Cross Section--In order to avoid excessive maintenance, County canals are normally dug to provide at least 12 feet of water during a fairly low water table. The USGS water table chart for the month of May should be as a guide for determining this minimum depth.

With reference to side slopes, borings or soil tests may be required to determine the steepest slope that would remain stable during construction and thereafter. Slopes must be flat enough to remain stable, or a supporting wall must be provided to hold the bank. (See also paragraph (d) following.)

Excavation of new canal banks on a slope steeper than one horizontal to one vertical between the average water table elevation and finished top of bank elevation will be considered as creating an unwarranted hazard.

Bottom width of about 10' is considered to be the minimum that can be provided with ordinary dragline equipment, although a lesser bottom width may be accepted.

Gradual transition shall be made in canal sections at bridges or culverts where restrictions are allowed, the angle or transition being to provide for proper velocity and elimination of dead or stagnant areas.

(d) Bank Erosion and Protection--Measures shall be taken to avoid erosion of canal banks, and they may include any of the following:

Provide adequate ground cover with proper vegetation.

Flatten bank slopes above water level.

Construct bulkheads or riprapping, also headwalls at appropriate sites.

Use adequate inlets, conduits, or spillways to control storm water entering the canal.

Prevent eroding velocities in all channels.

Select proper fill material to provide for any necessary bank repairs or modifications.

(e) Canal Permits--Excavation of canals is subject to the permit requirements set forth in County Code, Chapter 24-58. In case the requested permit includes excavation or construction in tidal or bay bottom lands, a Coastal Permit will be required from the Department of Environmental Resources Management. Additional permits may be required from the State Department of Environmental Regulation and the U. S. Army Corps of Engineers.

Any application for permit concerning extending, widening, deepening, or altering existing canals where salt-water intrusion may result, must be submitted to the Department of Environmental Resources Management and the County Commission for consideration (Section 7-1 of the Code).

Approval of the South Florida Water Management District is required for the canals under their jurisdiction, and a permit is required from the U. S. Army Corps of Engineers in any waterways over which they exercise navigation jurisdiction.

(f) Utility Crossing--Permits must be obtained from the Department of Environmental Resources Management for all crossings involving county right-of-way (Chapter 24-58 of the County Code).

In general, gravity lines will be required to run under the canal bottom with a clearance of 2' below the ultimate design bottom elevation, and pressure lines may run over or under the canals.

Overhead crossings normally will be subject to the same clearance requirements as for bridges, except that telephone and power lines must have a 40'-minimum clearance above ground surface.

(g) Water Structures--Permits must be obtained from the D.E.R.M. Department for any waterway structures to be built in areas under the direct jurisdiction of Dade County, the authority and procedure for handling such permits being set forth in County Code, Section 24-58 (Class 3 Permits).

(h) Fences--Permits for fencing must be obtained from the County Building and Zoning Department. The Public Works Department maintains canals from the maintenance easement, and desires it to be kept free of encroachments such as trees, large shrubbery, barbecue pits, and buildings of all kinds; however, removable-type fencing may be allowed on the maintenance easement provided it is built in sections not to exceed 10 feet in length and all posts are set in concrete sockets. Each 10' section must be removable as a unit. (See Part, Standard Detail, G 5.2).

c. Seepage Storm Drainage Disposal Systems

Seepage drains, trenches, wells, and similar facilities are required as the preferred type of solution for full on site retention,

(1) where the USGS-PWD Slug Test referred to hereafter under Design Constructions shows the availability of acceptable trench capacity,

(2) when considered by the Department of Environmental Resources Management to be essential for water conservation or prevention of pollution.

Where public right-of-way such as streets are a part of the area drainage problem, the County will consider combining County and private efforts for providing the highest feasible standard of storm water disposal. Drainage of on-site private facilities may be combined with the street drainage system only if approved by the Public Works Department. Seepage drainage facilities may be permitted on private or public property. Assembling of adequate information to deal with proposals for combining drainage from private and public areas must be a joint responsibility of the land owner and County.

(1) Design Construction--The acceptability of seepage trenches depends considerably on runoff, hydraulic missivity of the subsurface which is to receive storm water. Design must be supported by data from special tests made to determine seepage characteristics, one such acceptable test being the USCS-PWD Slug Test developed by the U. S. Geological Survey and the Public Works Department. Copies of this test procedure are available from the Public Works Department and the Department of Environmental Resources Management.

Seepage trenches may be combined with an emergency overflow into any body of surface water provided and storage of the system is sufficient to retain on site the volume generated by the first inch of runoff from the contributing drainage areas. Special structures such as weirs and grease traps will be required in order to guarantee the 1" retention and removal of oil and grease prior to the overflow.

Seepage trenches (Standard Detail SD 1.2 may be used for the same purposes as a closed conduit. When used for a seepage trench the catch basin requirements stated above for seepage drains will apply.

Drainage wells must comply with the requirements for Class V wells as a stipulated in Chapter 17-28 of the Florida Statutes. Drainage wells require County approval and permits from the State Department of Environmental Regulation. The use of drainage wells is limited to locations where total dissolved solids of the aquifer is such that the potential for its use as a source of drinking water is minimal and therefore the discharge of storm water into it will not be a cause for contamination or pollution of drinking water.

Rock-fill trenches are not recommended and will be considered for strictly temporary use only. Special permission is required for their use.

3. OTHER DRAINAGE FACILITIES

a. Inlets

Standard inlets are shown in Standard Details SD 3.1 and SD 3.2. Inlets prescribed as standard by other governmental agencies may be acceptable in applicable areas. Inlets in driveways are to be located as shown in Standard Detail SD 2.4. Inlets in swales, but not in driveways, are to have the surrounding area paved as in Standard Detail SD 2.5.

Where inlets are on a continuous slope and are not at a low point, the inlet grate shall be so sloped and the swale or gutter so shaped as to best intercept the storm flow. For sloping streets the most efficient grates are those with longitudinal bars (parallel to flow) since they allow a larger percentage of small debris to enter than those with transverse openings. For streets having little or no slope and where inlets are installed in sumps, gutters may be pitched slightly from both directions toward the inlets. Combination inlets may be used to reduce flooding which may occur from clogging. Grates in sumps will be assumed to function as orifices for which the total area of opening is far more important than size and arrangement of bars.

The capacity of inlets, grates, or openings must at least equal the capacity of the outlet pipe. Where no test data are at hand to determine the capacity of grates, the orifice formula ($Q=CA\sqrt{2gh}$) shall be used with a coefficient of discharge of 0.7. Clogging is apt to cause ponding of intakes placed in sumps, therefore such inlets shall be over-designed, i.e., the minimum area computed by

the orifice formula shall be increased by at least 50%, the excess over 50% to depend on anticipated local conditions.

b. Catch Basins

Catch basins are shown in Standard Details SD 2.1 and SD 2.2. Catch basins of other materials and types of construction will be accepted subject to evidence of durability and performance.

Catch basins in driveways are to conform with Standard Detail SD 2.4. Catch basins in swales but not in driveways are to be surrounded with paving as shown in Standard Detail SD 2.5.

c. Culverts

Drainage structures (stream crossings) of less than 20-foot span will be considered as culverts. The Public Works Department (Water Control Division) will establish the design water elevation and also the elevation of the crown of culvert, as indicated in D4.02, 7.b. herein. Normally the design head will be set at about .25' at design flow and the pipe will be sized accordingly; however, the Department will require use of a smaller head in those cases where accumulated head loss for a given reach of canal is approaching the limit as determined by the canal design for flood control.

Pipe capacity will normally be based on design flow with both ends of the culvert submerged. Preliminary and tentative estimates may be obtained from the Water Control Chart for Hydraulic Design WC 3.1 herein; but more detailed and final design should comply with the modified nomographs taken from U.S. Bureau of Public Roads' information for hydraulic design of culverts (WC 4.1 through WC 4.7, incl.). These charts provide proper conservative design for the usual case of submerged flow as normally applied in this area. Entrance-loss coefficients to be used in conjunction with these charts should be taken from Table III following.

Other Bureau of Public Roads data for solution of pipe sizes and head losses for culverts with entrance control--for concrete pipes and boxes, and for corrugated metal pipes are contained in nomographs published in "Highway Engineering Handbook" by Woods, 12-22 through 12-32, inclusive.

The minimum allowable pipe size will be 24 inches. Some slope of the culvert pipe in the downstream direction should be provided to assist in cleaning of the pipe whenever

TABLE III

CULVERT ENTRANCE - LOSS COEFFICIENTS

(For use with Design Standards WC 4.1 through WC 4.7 incl.)

Coefficient k_e to apply to velocity head $\frac{V^2}{2g}$ for determination of head loss at entrance to a structure, such as a culvert or conduit, operating full or partly full with control at the outlet.

$$\text{Entrance head loss } H_e = k_e \frac{V^2}{2g}$$

Type of Structure and Design of Entrance	Coefficient k_e
Pipe, Concrete	
Projecting from fill, socket end (groove-end)	0.2
Projecting from fill, square cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end)	0.2
Square-edge	0.5
Rounded (radius = 1/12D)	0.2
Mitered to conform to fill slope	0.7
End-Section conforming to fill slope	0.5
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of 1/12 barrel dimension	0.2
Wingwalls at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls	
Square-edge	0.5
Mitered to conform to fill slope	0.7
End-Section conforming to fill slope	0.5

velocities are high. In tidal areas the pipe should be set with invert at low tide level or somewhat lower for the same reason. Standard details for installations, including end walls, are given in Part 1 of the manual. Design loads shall be in accord with Section D6. Culverts longer than about 300 feet may have to be designed as a storm sewers and the requirements of Part 2, Storm Drainage Specifications, as well as standards for manholes, shall be applicable.

d. Bridges

Drainage structures of greater than 20-foot span will be considered as bridges. They shall be designed in accord with Section D6, Bridges and culverts, and the hydraulic and navigation criteria will be set by the Water Control Section of the Department of Environmental Resources Management.

e. Salinity-Control Structures

In accord with Section 7-1 of the Code new canals connecting to salt water must be provided with dams to effectively prevent salt-water encroachment upstream of the structure. The design and installation of such structures are subject to the approval of the Department of Environmental Resouces Management. In addition to salt dams it may be necessary to provide for facilities such as sheet piling to cut off underground flow in some cases; and to allow for a "buffer zone" between any such dam or termination of a new canal and the beginning point of any other excavation such as a canal or lake. This "buffer strip" may be as narrow as 300 feet landward of the salt barrier line (the landward limit of new excavation connecting to salt water), although distances greater than 300 feet may be required by the Department of Environmental Resources Management if transmissivity of soil and underlying rock require it, or if the length of such proposed zone running parallel to the salt barrier line is so great that the width of the "buffer zone" must be increased to effectively prevent loss of fresh water.

f. Drainage Easements

Such easements may be required even though no drainage facility is built initially (Section 28-14 (D)-(2) of the County Code).

D4.05 MATERIALS AND TESTS

Where County standard specifications are not available concerning use of material in storm drainage structures, such material may be subject to special tests as required by the Public Works Department. Soil tests and borings may be required in reference to acceptance of canal side slopes and structure foundations. Percolation and infiltration tests may be required to justify use of seepage facilities. Infiltration tests may also be required for storm sewer design, and if they are used they will be carried out in the manner prescribed by FHA for South Florida.

D4.06 INFORMATION REQUIRED ON PLANS SUBMITTED FOR APPROVAL

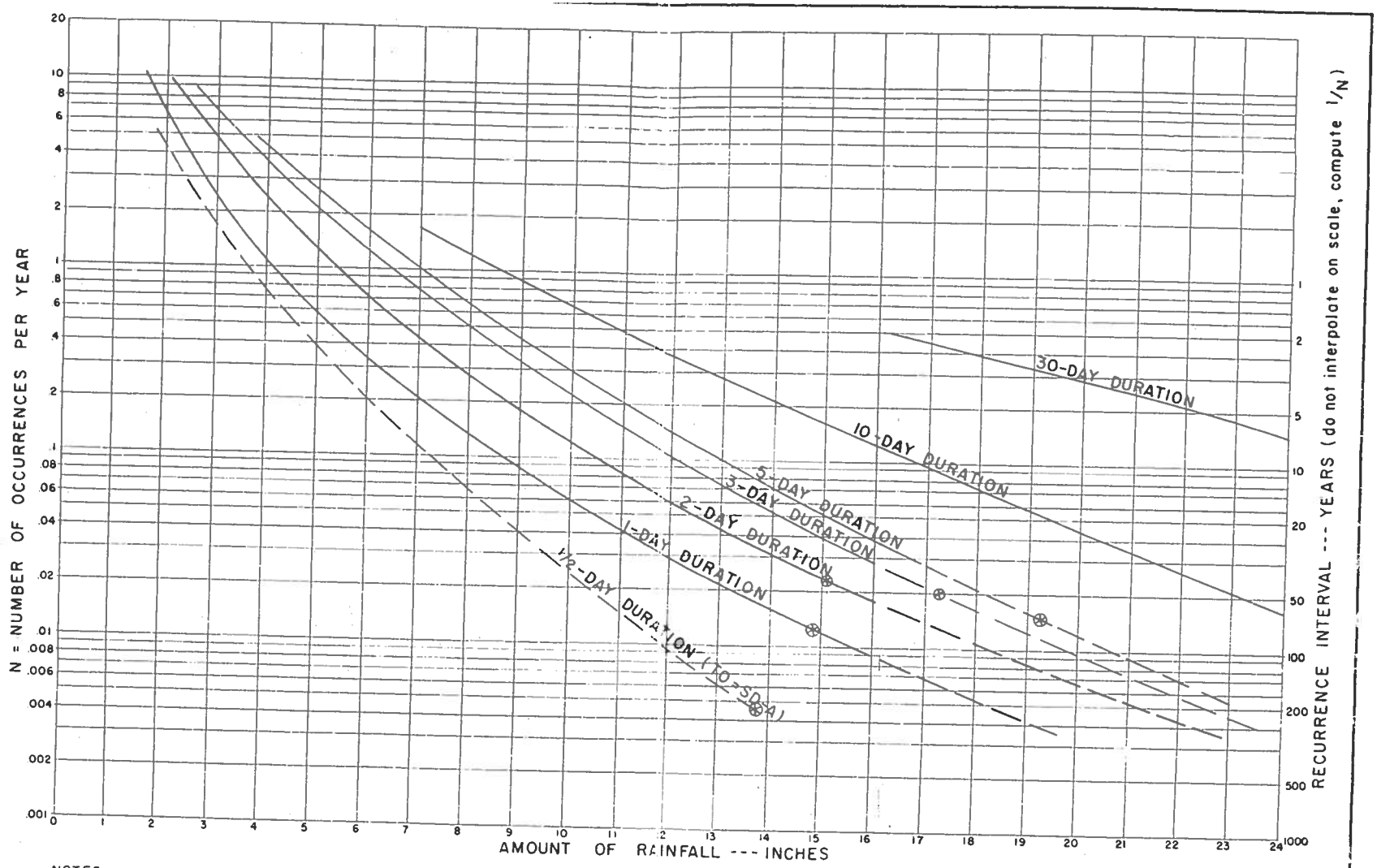
With reference to approval of final plats the detailed information to be submitted to the Public Works Department is set forth in "Engineering Policy for Subdivision Platting", a regulation of the Public Works Department on file with the Clerk of the County Commission in compliance with Section 2-3 of the Code of Dade County.

D4.07 FINAL APPROVAL OF CONSTRUCTION PLANS

The requirements applying herein are the same as those set forth in Section D5.05 through D5.09, inclusive, of the Manual.

D4.08 CONSTRUCTION PERMIT

Requirements for construction permits are set forth in Chapter 24-58 of the Dade County Code.



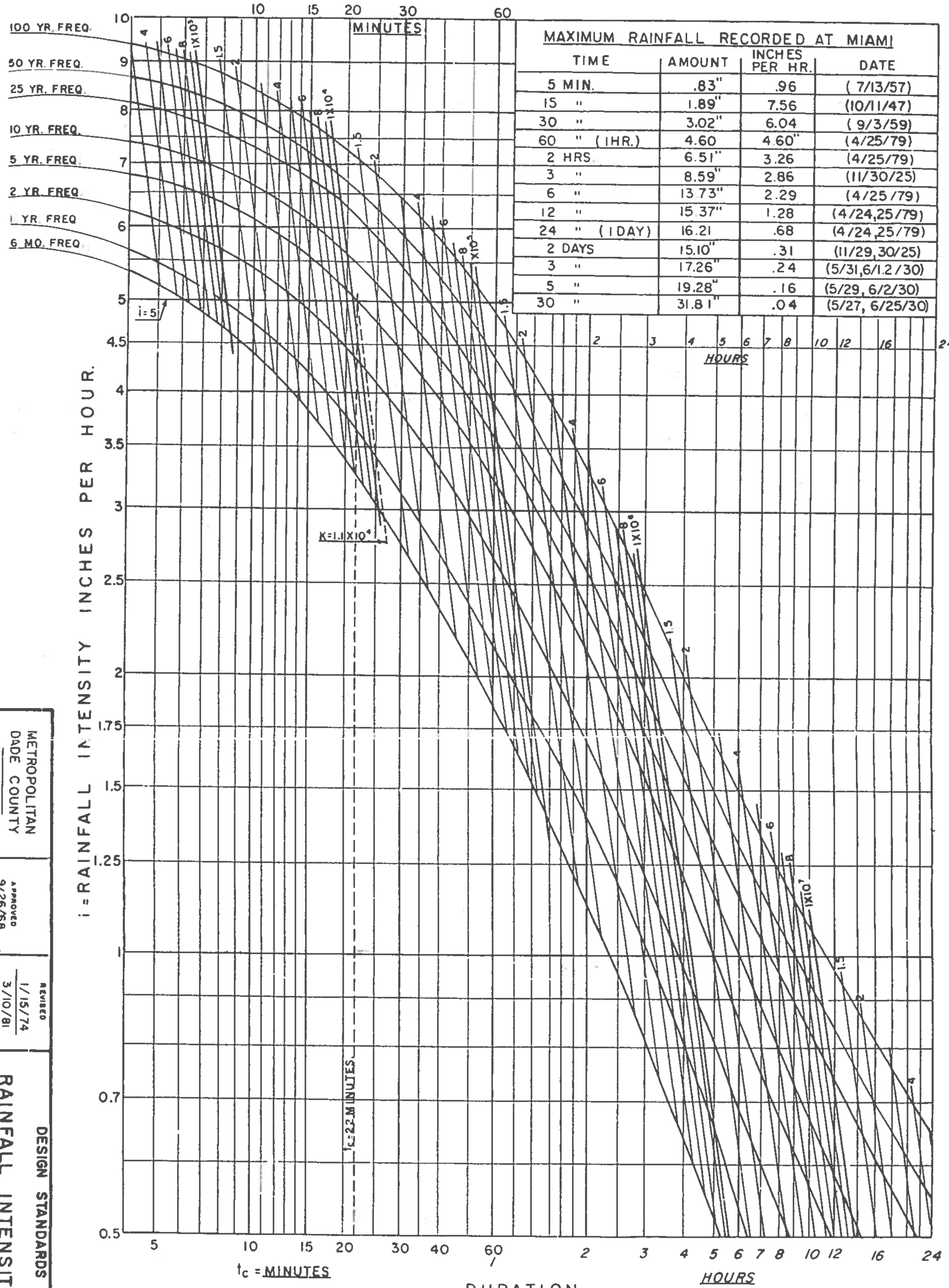
NOTES:

1. ⊗=MAXIMUM OF RECORD
2. MAXIMUM 30 DAYS = 31.81"
3. MAXIMUM CALENDAR MONTH = 27.86" (OCT. 1938).

METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 9/26/68	REVISED	DESIGN STANDARDS RAINFALL FREQUENCY -MIAMI- 1/2, 1, 2, 3, 5, 10 & 30-DAY RAINS	WC 1.2 SHEET 1 OF 1

MAXIMUM RAINFALL RECORDED AT MIAMI

TIME	AMOUNT	INCHES PER HR.	DATE
5 MIN.	.83"	.96	(7/13/57)
15 "	1.89"	7.56	(10/11/47)
30 "	3.02"	6.04	(9/3/59)
60 " (1HR.)	4.60	4.60"	(4/25/79)
2 HRS.	6.51"	3.26	(4/25/79)
3 "	8.59"	2.86	(11/30/25)
6 "	13.73"	2.29	(4/25/79)
12 "	15.37"	1.28	(4/24,25/79)
24 " (1DAY)	16.21	.68	(4/24,25/79)
2 DAYS	15.10"	.31	(11/29,30/25)
3 "	17.26"	.24	(5/31,6/1.2/30)
5 "	19.28"	.16	(5/29, 6/2/30)
30 "	31.81"	.04	(5/27, 6/25/30)



NOTES:

CURVES REVISED TO 1/74; TABLE REVISED TO 3/81

SOURCE:
DAVID YARNELL, D. B. SMITH, R. K. LINSLEY, G. E. McCURDY, U. S. CORPS OF ENGINEERS
U.S. WEATHER BUREAU, A. G. MATHEWS (FLA. CONS. DEPT.), AND OTHERS.

METROPOLITAN DADE COUNTY
PUBLIC WORKS DEPARTMENT

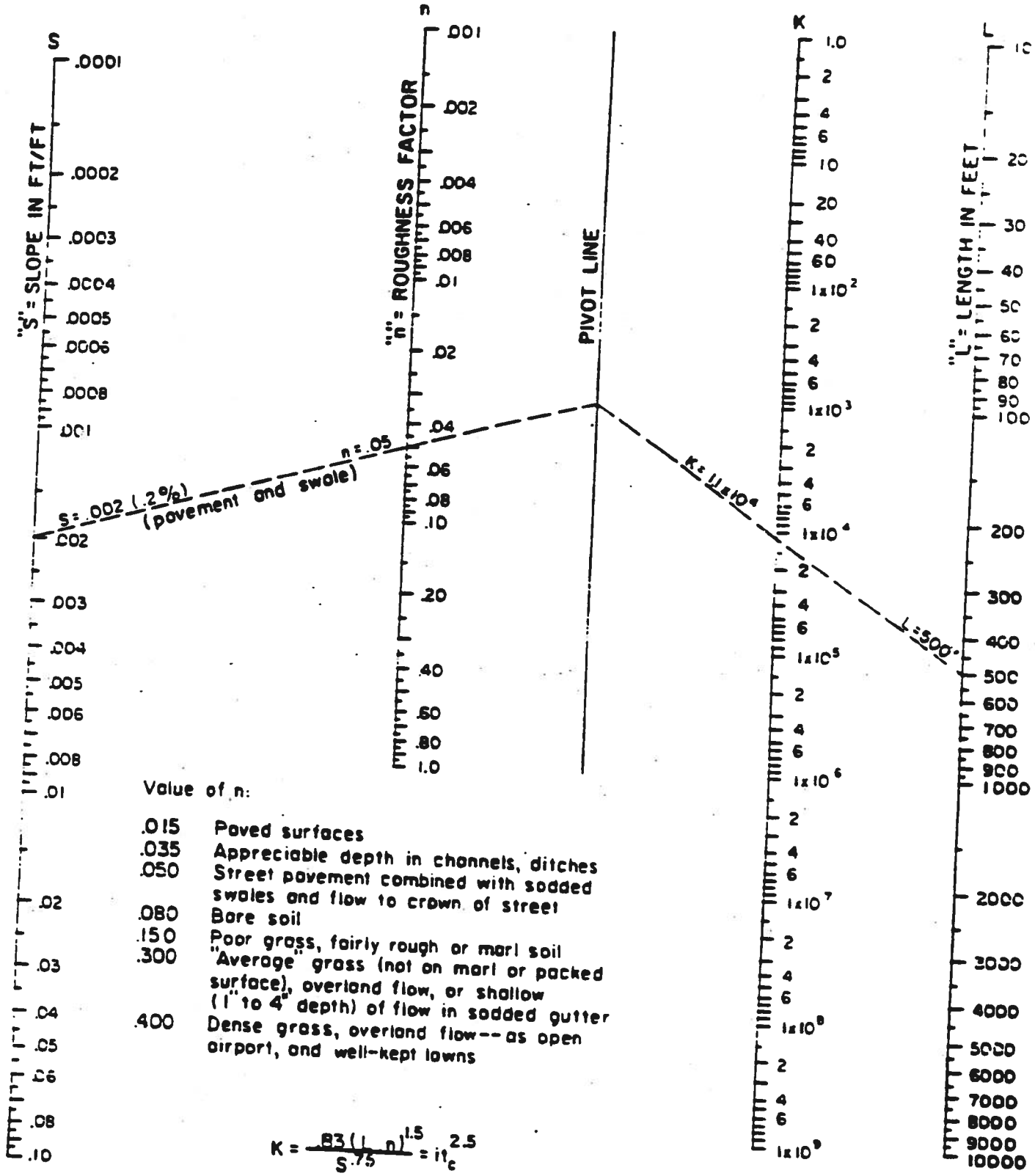
APPROVED 9/26/68

REVISED 1/15/74 3/10/81

DESIGN STANDARDS
RAINFALL INTENSITIES
-MIAMI-

WC 1.1

SHEET 1 OF 1



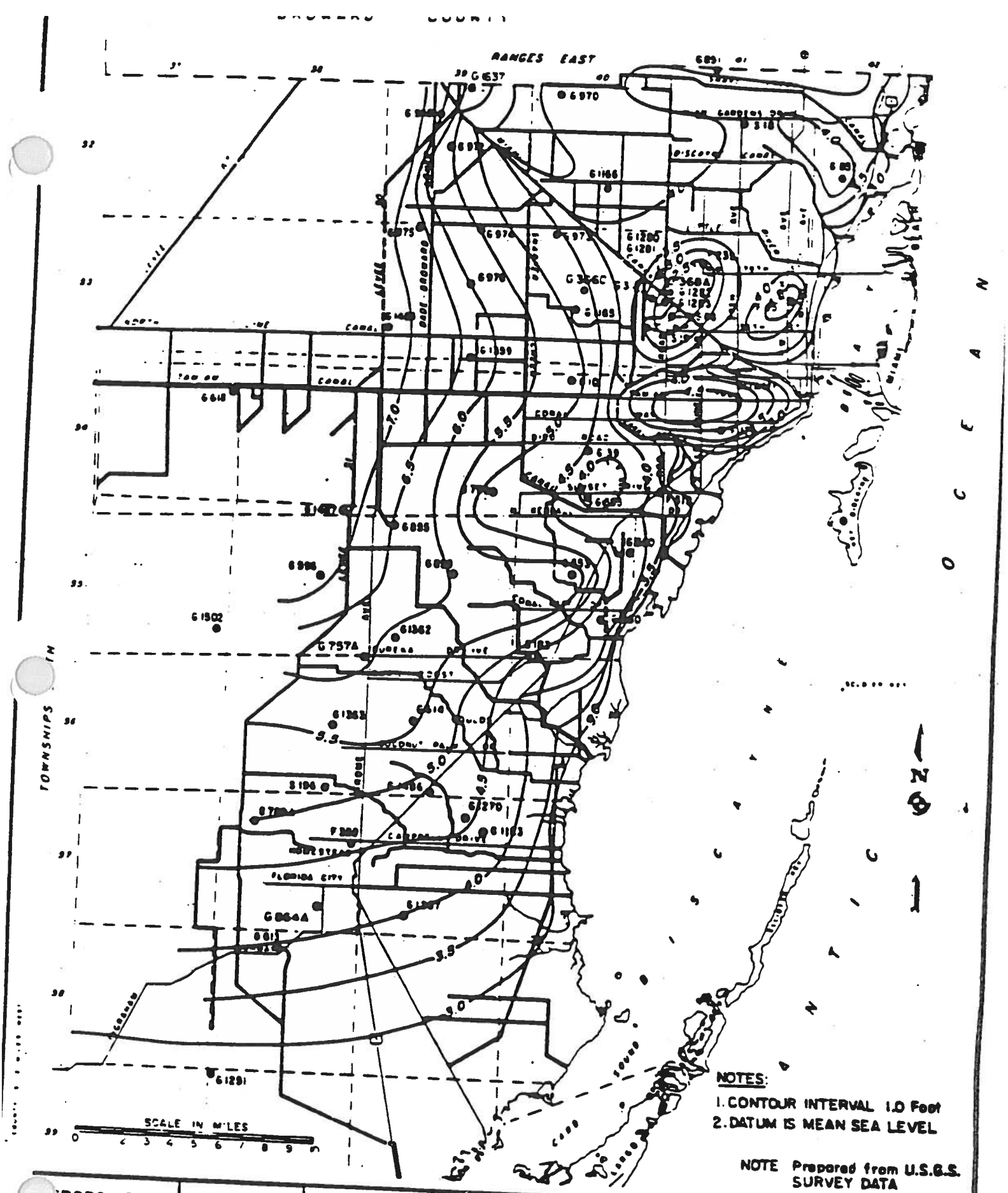
Value of n:

.015	Paved surfaces
.035	Appreciable depth in channels, ditches
.050	Street pavement combined with sodded swales and flow to crown of street
.080	Bare soil
.150	Poor grass, fairly rough or marl soil
.300	"Average" grass (not on marl or packed surface), overland flow, or shallow (1" to 4" depth) of flow in sodded gutter
.400	Dense grass, overland flow--as open airport, and well-kept lawns

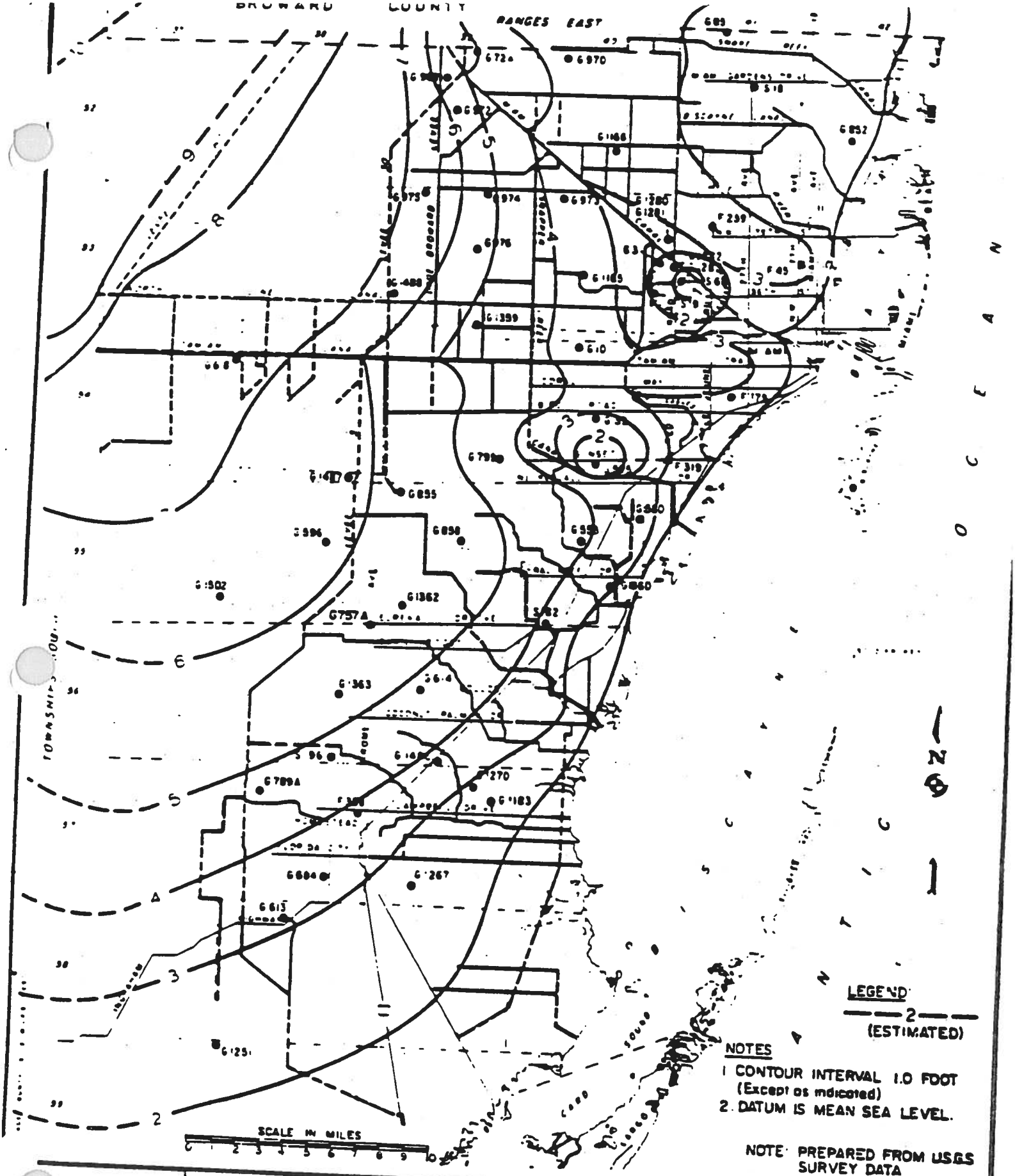
$$K = \frac{.83(1.1-n)^{1.5}}{S^{.75}} = it_c^{2.5}$$

NOTE: USE THIS CHART AND WC 1.1 FOR RATIONAL RUNOFF COMPUTATIONS

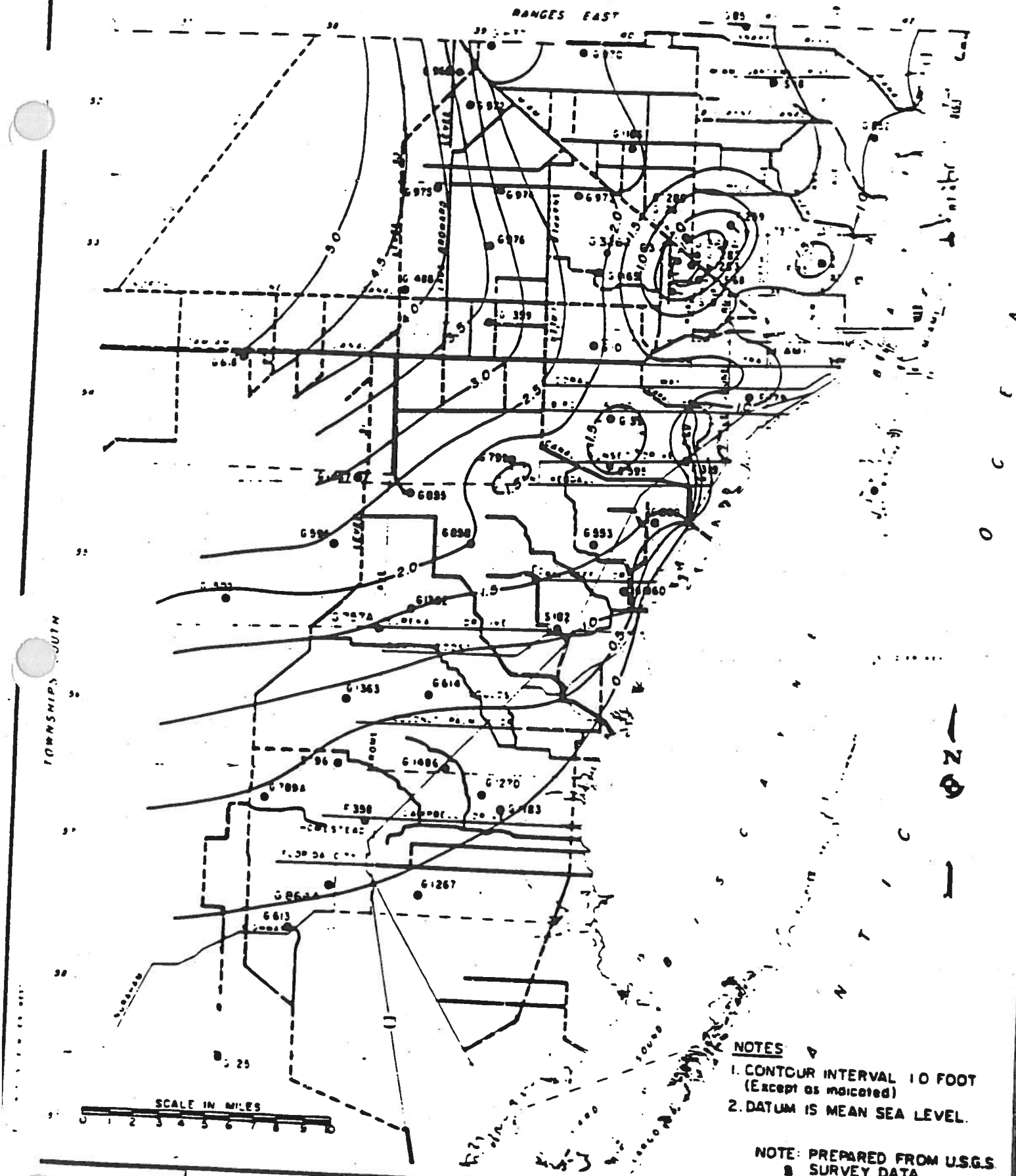
METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 9/26/68	REVISED 1/16/74	DESIGN STANDARDS t_c FOR OVERLAND FLOW NOMOGRAPH FOR K	WC 1.3



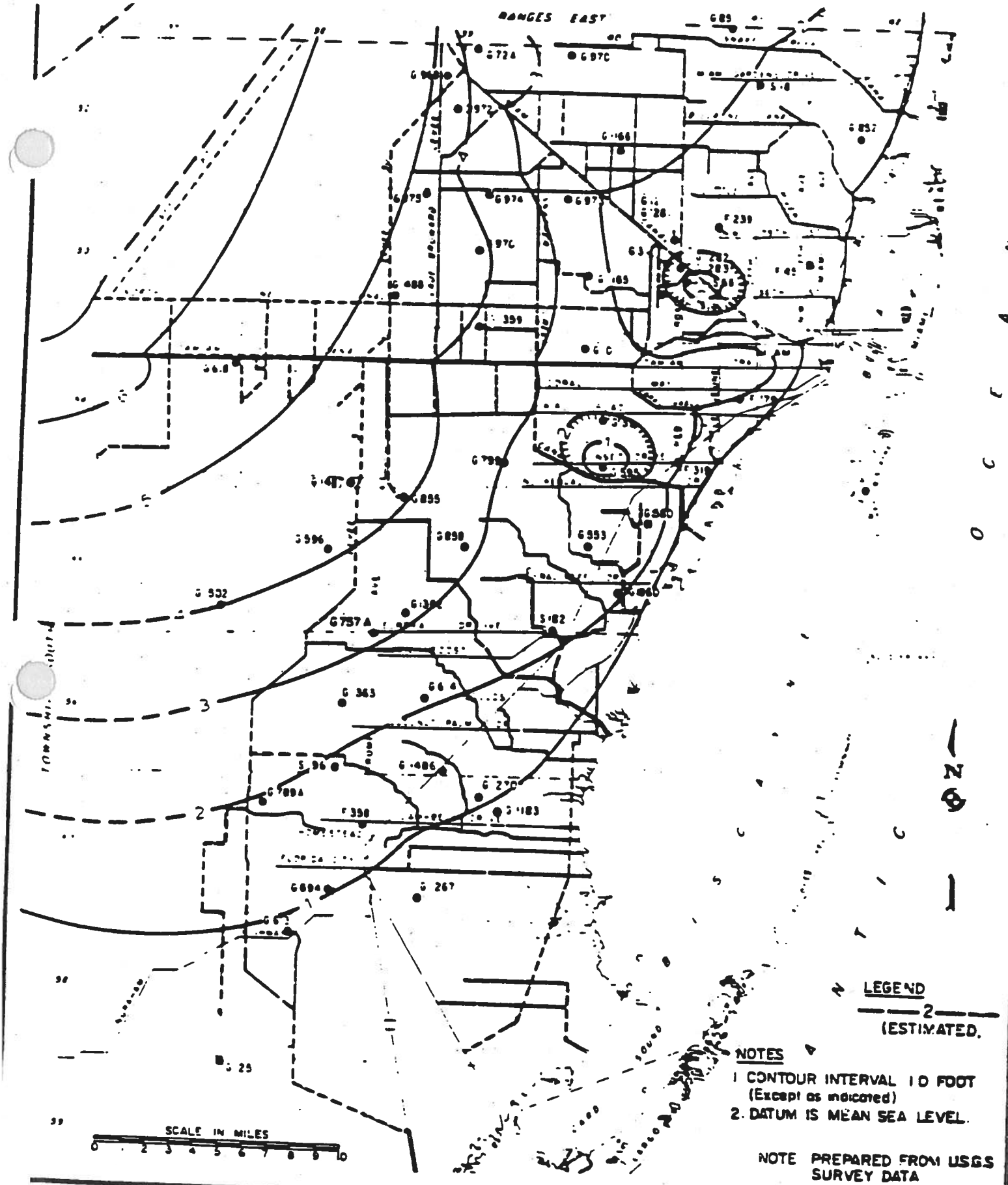
ROPOLITAN DE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 6/5/72	REVISED 2/19/75 4/14/77 2/7/83	DESIGN STANDARDS AVERAGE YEARLY HIGHEST GROUND WATER LEVEL 1965 - 78	W.C. 2.1 SHEET 1 OF 1



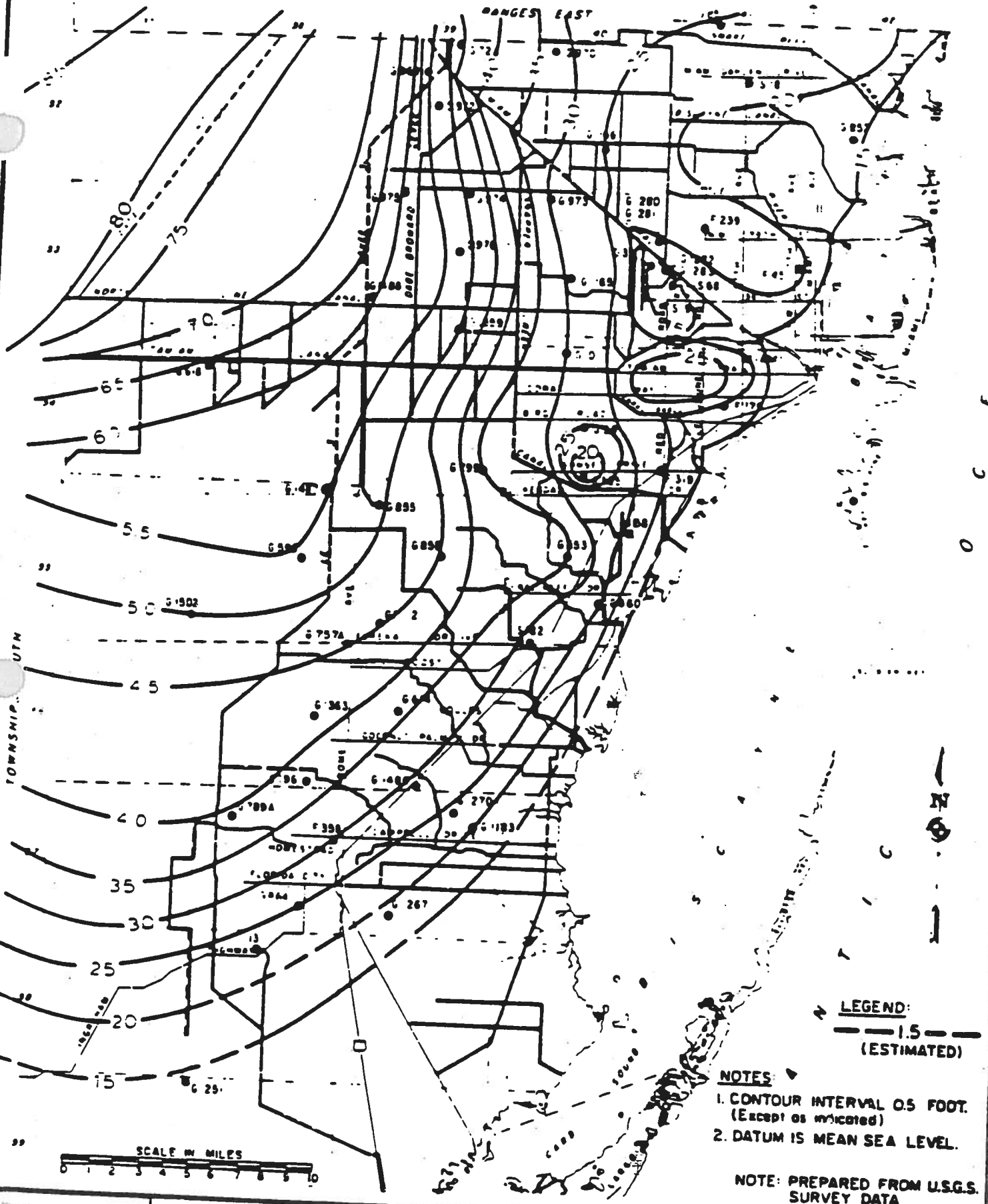
METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 4/[illegible]/72	REVISED 2/[illegible]/75 4/[illegible]/77	DESIGN STANDARDS AVERAGE OCTOBER GROUND WATER LEVEL 1960–75	W.C. 2.2 SHEET 1 OF 1



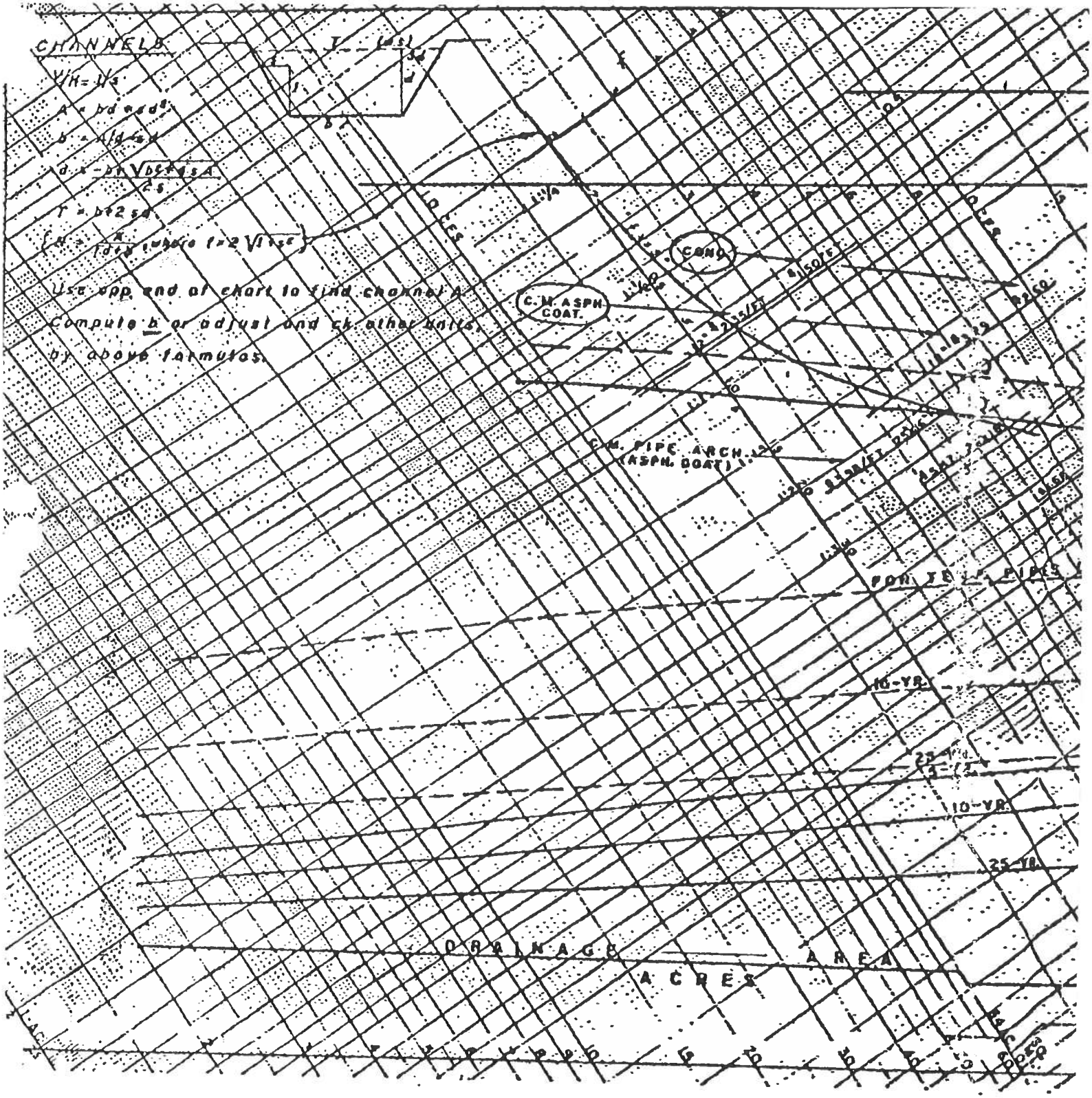
METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 4-5-72	REVISED 2/10/75 4/14/77 2/7/83	DESIGN STANDARDS AVERAGE YEARLY LOWEST GROUND-WATER LEVEL 1965-78	W.C. 2.3 SHEET 1 OF 1

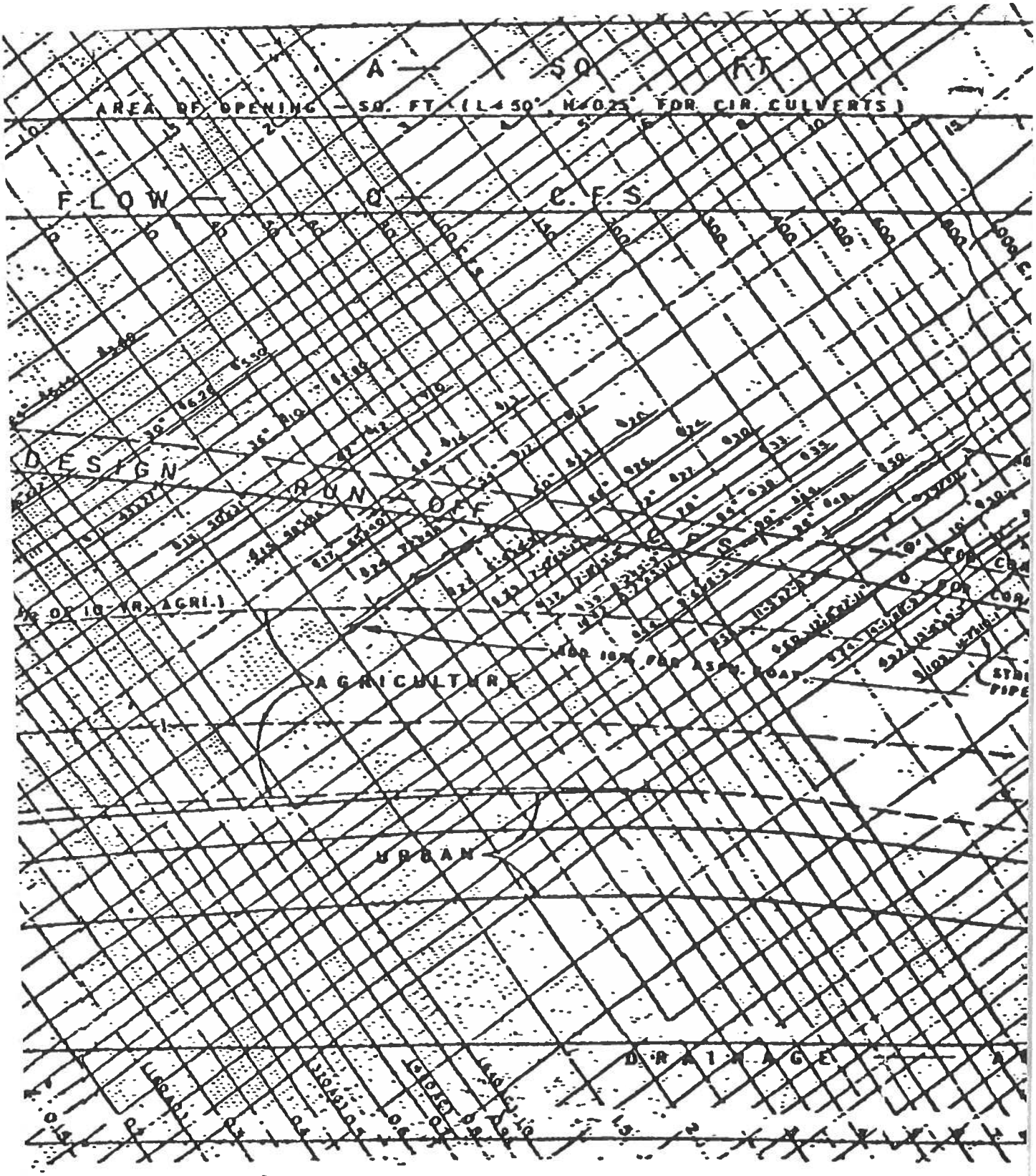


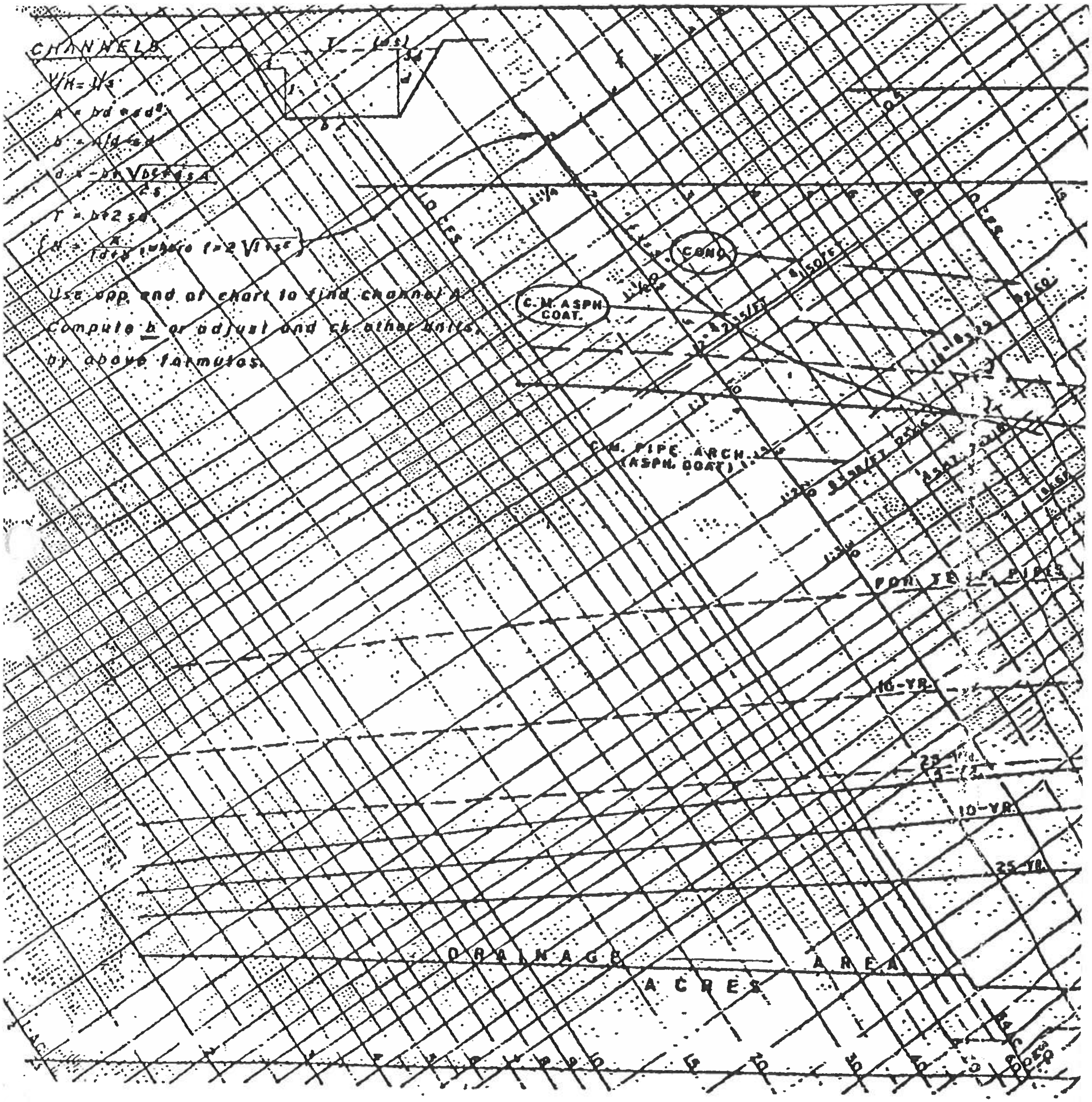
ROPOLITAN E COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 4/5/72	REVISED 2/13/75 4/14/77	DESIGN STANDARDS AVERAGE MAY GROUND WATER LEVEL 1960–75	W.C. 2.4 SHEET 1 OF 1

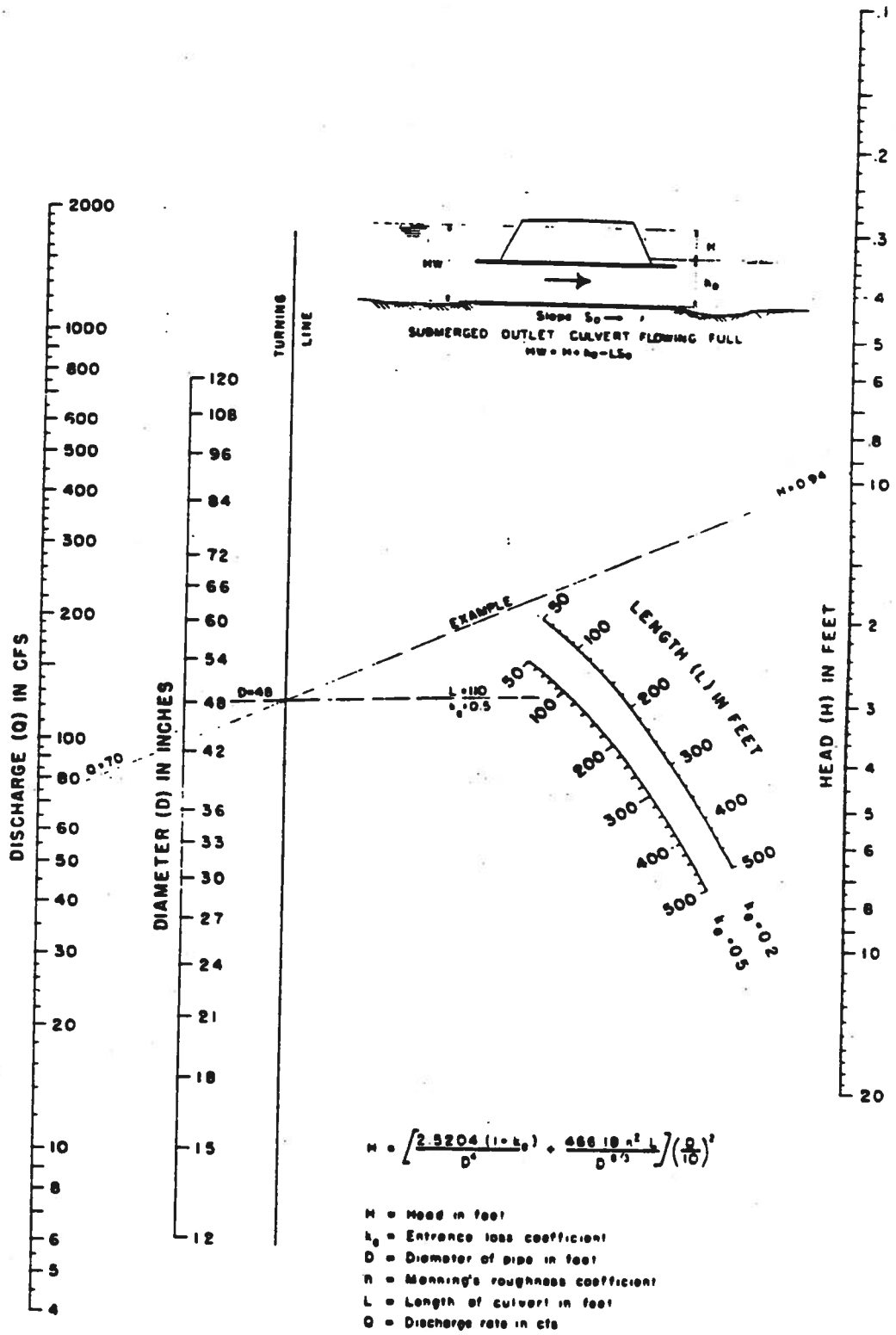


ROPOLITAN E COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 4/5/72	REVISED 2/19/75 4/14/77	DESIGN STANDARDS AVERAGE GROUND-WATER LEVEL 1960-75	W.C. 2.5 SHEET 1 OF 1


CHANNELS
V/H = 1/s
A = bd + sd²
b = A/d − sd
d = −b + √(b² + 4sA) / 2s
T = b + 2sd
Q = A/n (1.49 r^⅔ s^½ where r = 2√(1+s²) − s)
Use opp. end of chart to find channel A.
Compute b or adjust and ck other units by above formulas.
C.M. ASPH COAT.
C.M. PIPE ARCH (ASPH. COAT.)
PDH I.B. PIPES
10-YR.
25-YR.
DRAINAGE AREA
ACRES


A — SQ. FT.
AREA OF OPENING — SQ. FT. (L = 50', H = 0.25' FOR CIR. CULVERTS)
FLOW — C.F.S.
DESIGN RUNOFF
AGRICULTURE
URBAN
DRAINAGE


CHANNELS
Use opp. end of chart to find channel A.
Compute b or adjust and ck other units
by above formulas.
CONC.
C.M. ASPH. COAT.
C.M. PIPE ARCH
(ASPH. COAT)
FOR TEMP. PIPES
10-YR.
10-YR.
25-YR.
DRAINAGE AREA
ACRES

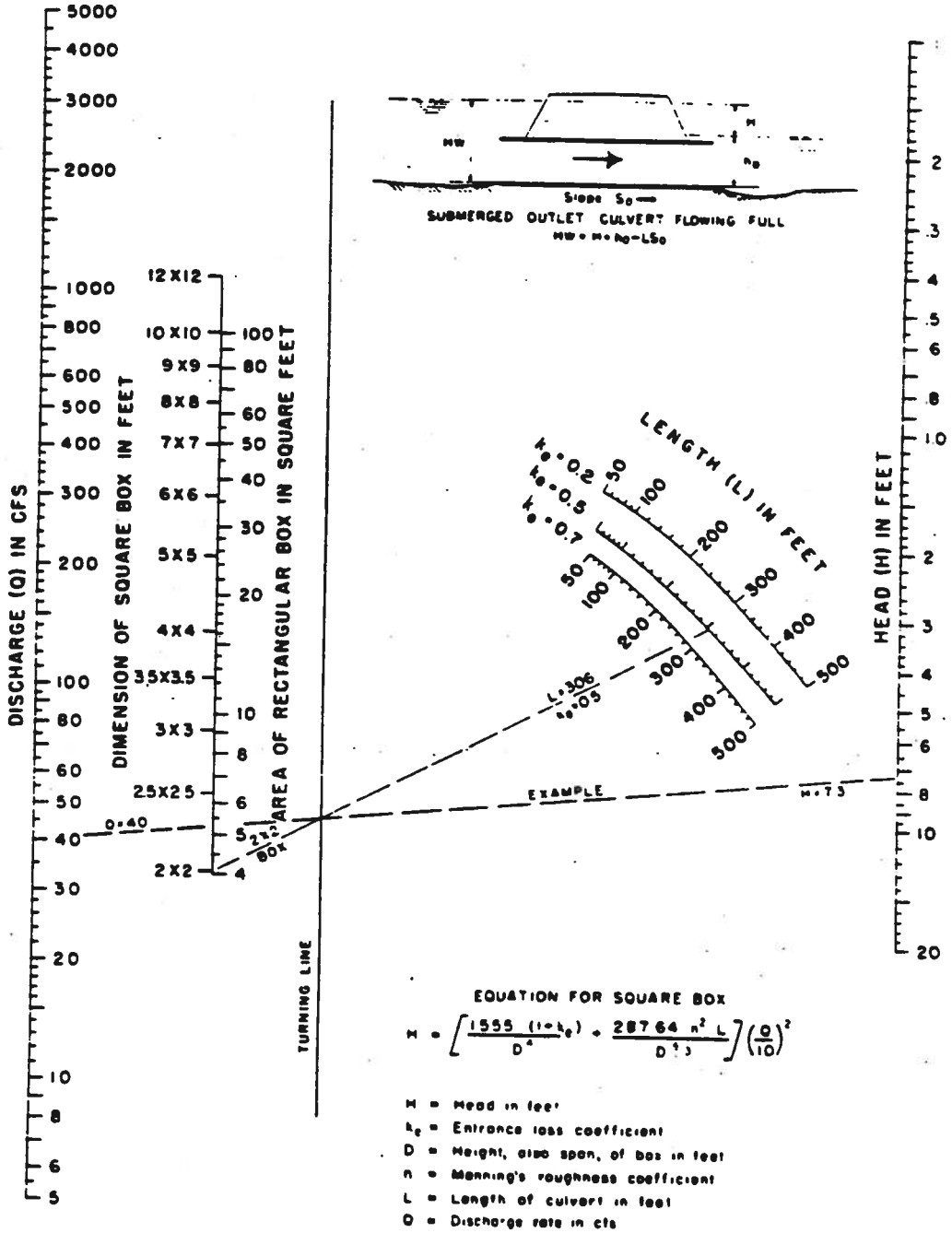


$$H = \left[\frac{2.5204\,(1+k_e)}{D^4} + \frac{466.18\,n^2\,L}{D^{5.3}}\right]\left(\frac{Q}{10}\right)^2$$

H = Head in feet
k_e = Entrance loss coefficient
D = Diameter of pipe in feet
n = Manning's roughness coefficient
L = Length of culvert in feet
Q = Discharge rate in cfs

BUREAU OF PUBLIC ROADS JAN. 1963
MODIFIED BY DADE CO. W.C. DIV. APRIL 1966

METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 9/26/68	REVISED	DESIGN STANDARDS HEAD FOR CONCRETE PIPE CULVERTS FLOWING FULL (n = 0.012)	WC 4.1 SHEET 1 OF 1



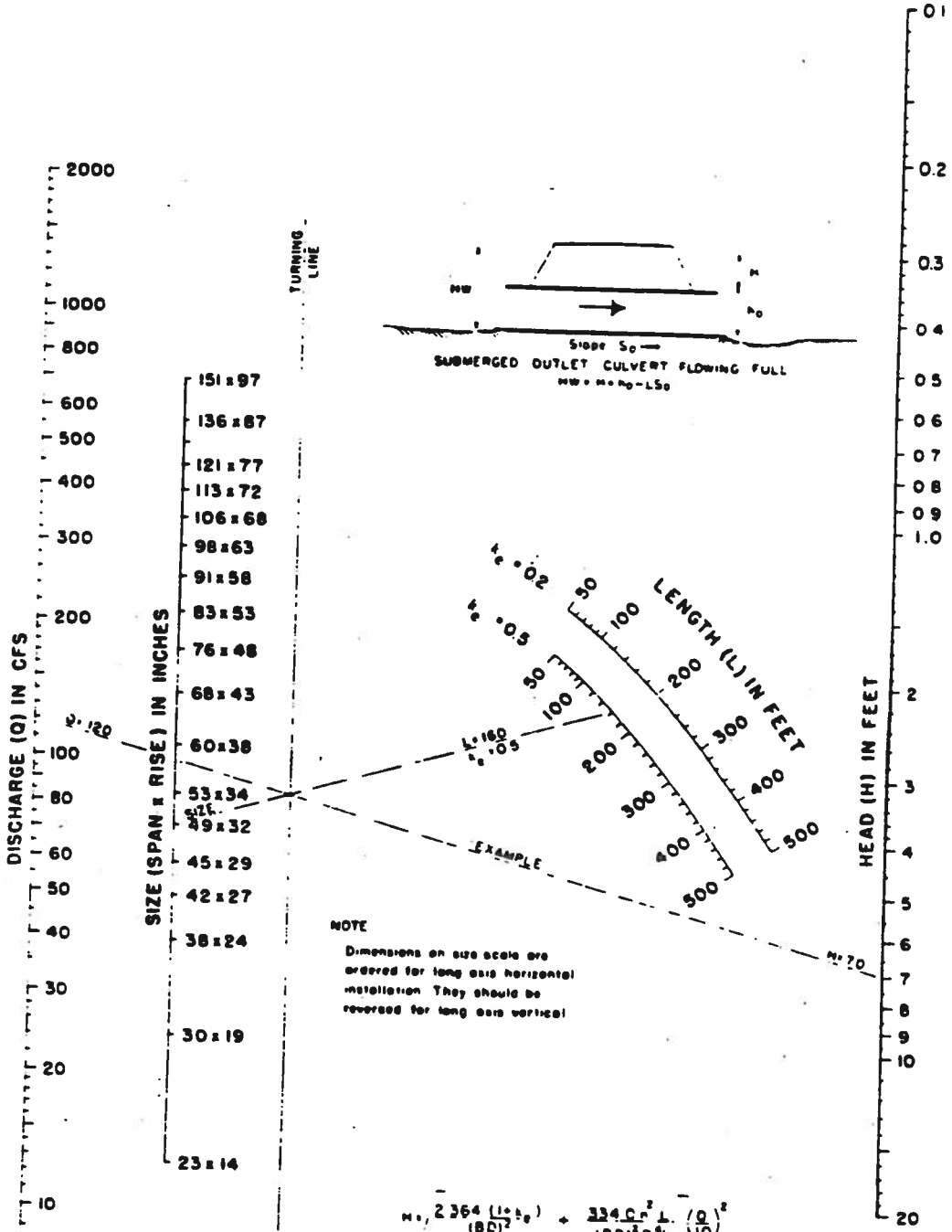
EQUATION FOR SQUARE BOX

$$H = \left[\frac{1555\,(1+k_e)}{D^4} + \frac{287.64\,n^2 L}{D^{5.3}}\right]\left(\frac{Q}{10}\right)^2$$

H = Head in feet
k_e = Entrance loss coefficient
D = Height, also span, of box in feet
n = Manning's roughness coefficient
L = Length of culvert in feet
Q = Discharge rate in cfs

BUREAU OF PUBLIC ROADS JAN. 1963
MODIFIED BY DADE CO W. C DIV APRIL 1966

METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 9/26/68	REVISED	DESIGN STANDARDS HEAD FOR CONCRETE BOX CULVERTS FLOWING FULL (n = 0.012)	WC 4.2 SHEET 1 OF 1

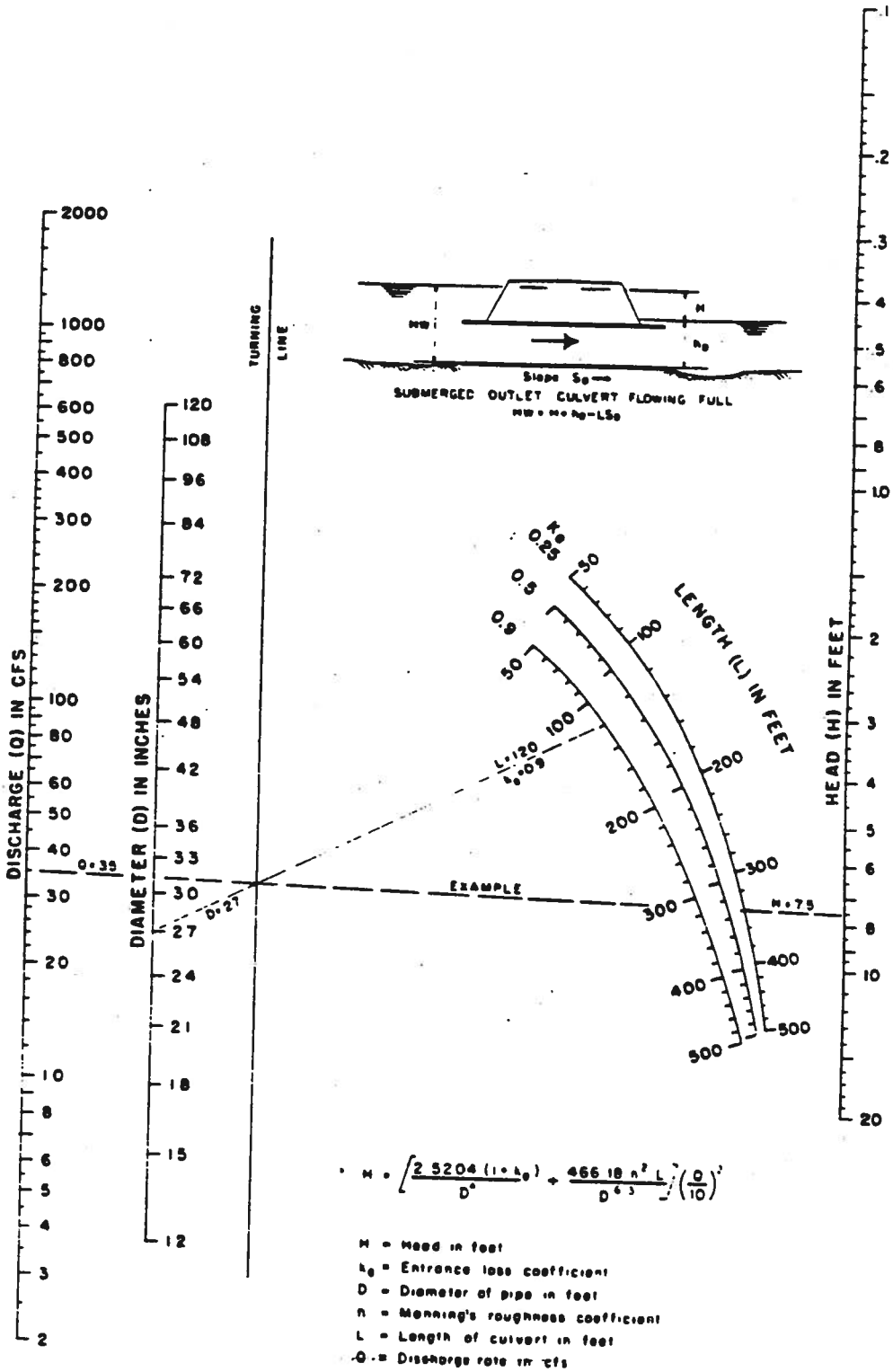


$$H = \frac{2.364\,(1+k_e)}{(BD)^2} + \frac{33.4\,n^2 L}{(BD)^2 D^{4/3}} \left(\frac{Q}{10}\right)^2$$

H = Head in feet
k_e = Entrance loss coefficient
B = Span in feet
D = Rise in feet
n = Manning's roughness coefficient
L = Length of culvert in feet
Q = Discharge rate in cfs

BUREAU OF PUBLIC ROADS JAN 1963
MODIFIED BY DADE CO. W.C. DIV. APRIL 1966

METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 9/26/68	REVISED	DESIGN STANDARDS HEAD FOR OVAL CONCRETE PIPE CULVERTS LONG AXIS HORIZONTAL OR VERTICAL FLOWING FULL (n = 0.012)	WC 4.3 SHEET 1 OF 1

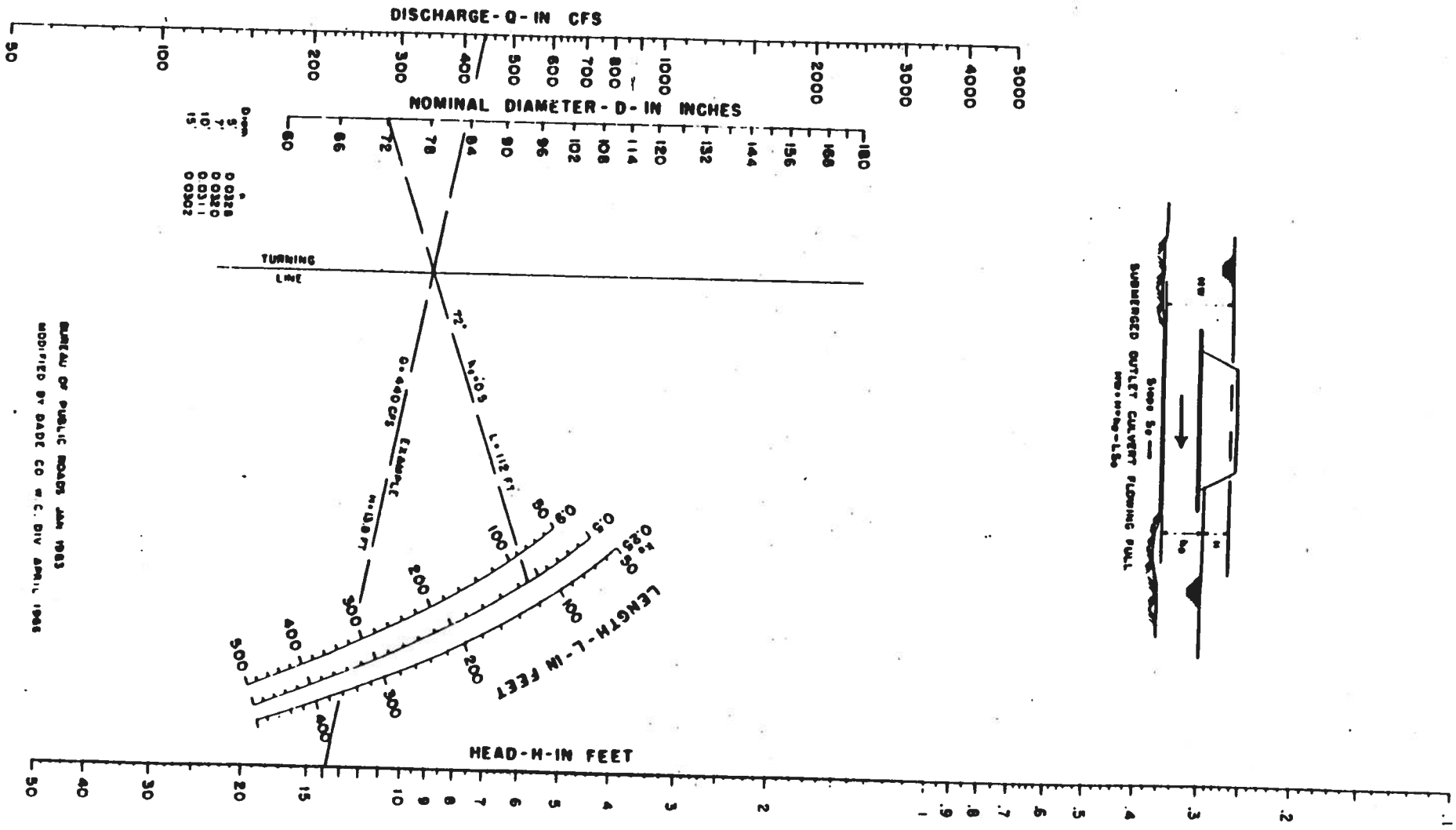


$$H = \left[\frac{2.5204\,(1+k_e)}{D^4} + \frac{466.18\,n^2 L}{D^{5.3}}\right]\left(\frac{Q}{10}\right)^2$$

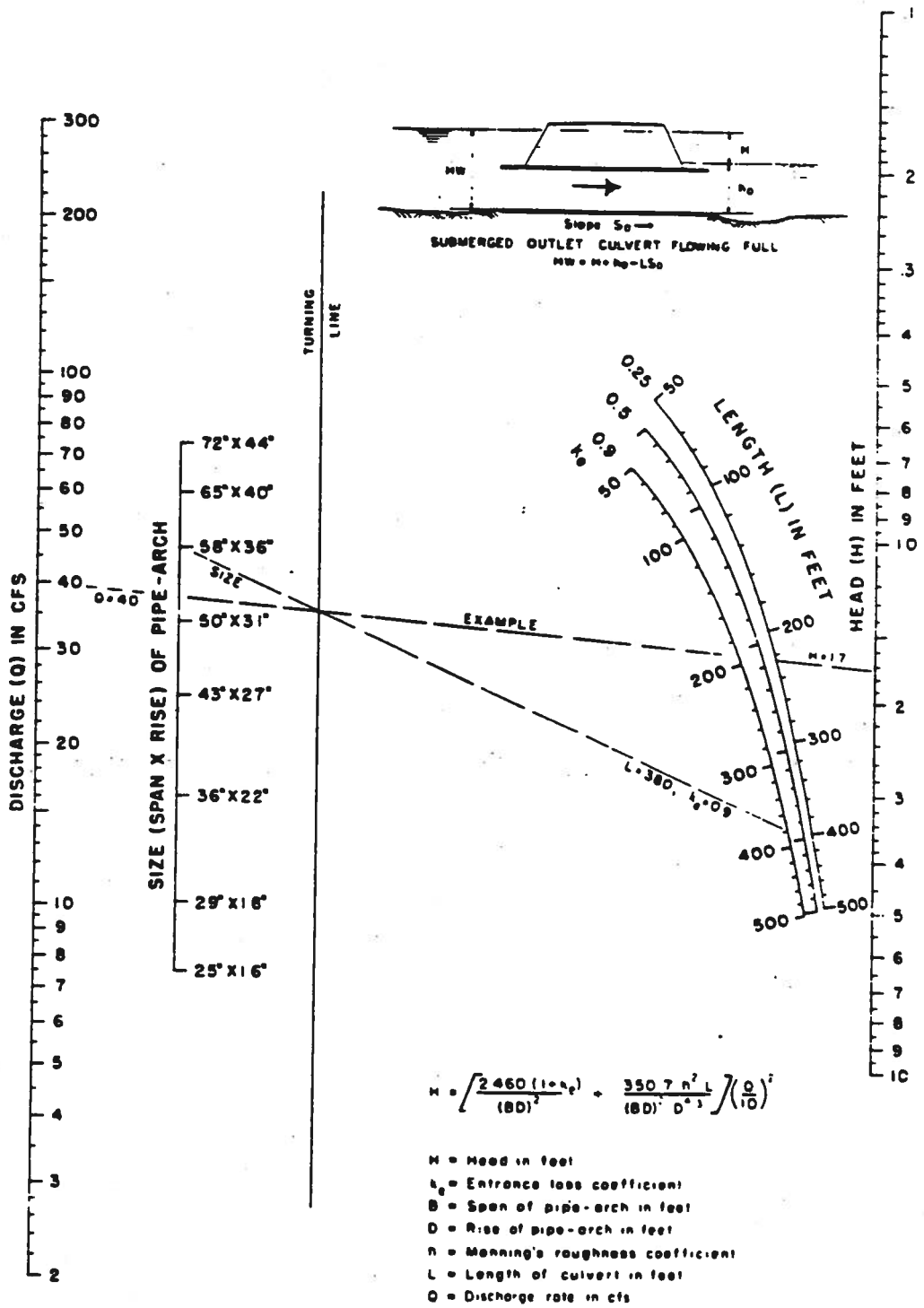
H = Head in feet
k_e = Entrance loss coefficient
D = Diameter of pipe in feet
n = Manning's roughness coefficient
L = Length of culvert in feet
Q = Discharge rate in cfs

BUREAU OF PUBLIC ROADS JAN 1963
MODIFIED BY DADE CO W.C. DIV APRIL 1966

METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 9/26/68	REVISED	DESIGN STANDARDS HEAD FOR STANDARD C.M. PIPE CULVERTS FLOWING FULL (n = 0.024)	WC 4.4 SHEET 1 OF 1



METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 9/26/68	REVISED --	DESIGN STANDARDS HEAD FOR STRUCTURAL PLATE C. M. PIPE CULVERTS FLOWING FULL	WC 4.5

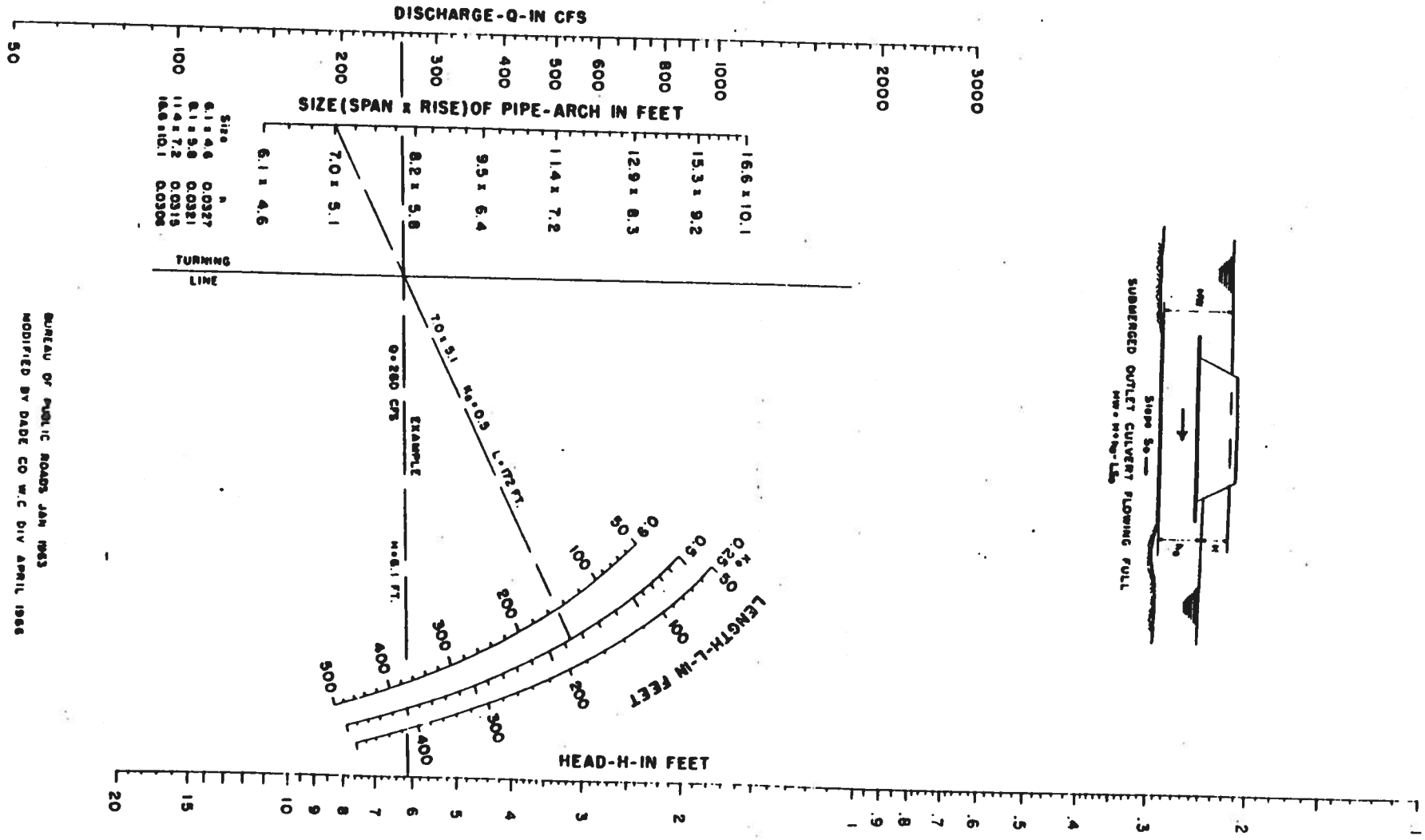


$$H = \left[\frac{2460(1+k_e)}{(BD)^2} + \frac{350.7\,n^2 L}{(BD)^{1.33} D^{0.33}}\right]\left(\frac{Q}{100}\right)^2$$

H = Head in feet
k_e = Entrance loss coefficient
B = Span of pipe-arch in feet
D = Rise of pipe-arch in feet
n = Manning's roughness coefficient
L = Length of culvert in feet
Q = Discharge rate in cfs

BUREAU OF PUBLIC ROADS JAN 1963
MODIFIED BY DADE CO W C DIV. APRIL 1966

METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 9/26/68	REVISED	DESIGN STANDARDS HEAD FOR STANDARD C.M. PIPE ARCH CULVERTS FLOWING FULL (n = 0.024)	WC 4.6 SHEET 1 OF 1



METROPOLITAN DADE COUNTY PUBLIC WORKS DEPARTMENT	APPROVED 9/26/68	REVISED	DESIGN STANDARDS HEAD FOR STRUCTURAL PLATE C. M. PIPE ARCH CULVERTS 18 IN. CORNER RADIUS FLOWING FULL	WC 4.7 SHEET 1 OF 1

SECTION D-5

COASTAL AND OTHER WATERFRONT CONSTRUCTION

A PORTION OF

PART 2 - PUBLIC WORKS MANUAL

SECTION D5 - COASTAL AND OTHER WATERFRONT CONSTRUCTION

D5.01 GENERAL INFORMATION

1. PURPOSE

It is the purpose of this section of the Public Works Manual to prescribe minimum standards for design and construction of coastal and other waterfront structures.

2. SCOPE

Requirements of this section apply to all coastal construction such as excavation, dredging, filling, and waterfront construction in, upon, or contiguous to tidal and baybottom lands in the unincorporated areas of Metropolitan Dade County and in, upon, or contiguous to those canals, lakes, bays, rivers, and all waterways under the direct control of Metropolitan Dade County whether or not in the unincorporated areas.

Said coastal construction includes, but is not limited to, excavation, dredging, filling, docks, piers, wharves, bridges, groins, jetties, moles, breakwaters, seawalls, revetments, causeways, artificial nourishment of beaches, quays, slips, moorings, marinas, ports, and related structures.

3. AUTHORITY

The Code of Metropolitan Dade County establishes the requirements and procedure for securing a permit to perform the various types of coastal construction.

4. OTHER REQUIREMENTS

In addition to the requirements set forth in this section, permits may be required from the U.S. Army Corps of Engineers, Trustees of the Internal Improvement Fund, Division of Beaches and Shores of the Florida Board of Conservation, Central and Southern Florida Flood Control District; and also the Dade County Building and Zoning Department, principally for private lands and private water areas not affected in any manner by establishment of the official bulkhead line or by State or Federal permits.

Construction in navigable waters requires a permit from the U.S. Army Corps of Engineers. Work that may affect the water-control system of the Central and Southern Florida Flood Control District will require a permit issued by that agency. Ultimate control of submerged or tidal lands rests with the Trustees of the Internal Improvement Fund.

TIIF permits cover tidal and baybottom dredging and filling and construction of open-trestle docks, piers, wharves, bridges, boat slips and houses, concessions, marinas and shipping facilities, and similar structures of permeable or open-type design--as contrasted with solid or highly impermeable structures likely to physically affect existing coastal conditions and the natural shoreline.

The Division of Beaches and Shores of the Florida Board of Conservation require permits covering solid or highly impermeable groins, jetties, moles, breakwaters, seawalls, revetments, causeways, and artificial beach nourishment or other deposition or removal of beach material--structures or activities which are likely to have a material physical effect on coastal conditions and the natural shoreline.

D5.02 DESIGN CRITERIA

1. GENERAL

All coastal structures shall be designed by an engineer registered in the State of Florida and all plans submitted to the Public Works Department for approval shall bear his signature and seal.

2. LOADS

Coastal structures are to be designed and constructed to resist the erosive and corrosive effects of the elements and where applicable to withstand the horizontal and vertical forces or loads listed below.

a. Earth (Soil)
b. Water
c. Waves
d. Wind
e. Currents
f. Weight of Structure
g. Weight of Decks, Platforms or other Attachments
h. Pedestrian Live Load (80 lbs. per square foot minimum).
i. Vehicular Loading (AASHTO-H-20 minimum where vehicular loads are anticipated).
j. Impact
k. Material and Equipment Stored
l. Anchors or Tiebacks
m. Boats, Barges, or other Vessels

3. ALLOWABLE STRESSES

Allowable stresses for structural design of steel, concrete, wood, and other materials shall be as specified in the South Florida Building Code.

D5.03 STRUCTURES—LOCATION, TYPE, GENERAL SPECIFICATIONS

Any type of construction not prohibited by the South Florida Building Code may be approved if it is adaptable to the site conditions and to the purpose of the structure.

If the proposed type or method of construction does not have an experience record sufficient to justify approval, the Public Works Department may require special tests or demonstrations to prove the acceptability of the project.

1. BULKHEADS AND SEAWALLS

a. Location

Bulkheads, revetments, and retaining walls shall normally be located to obtain uniformity of alignment and compatibility with the natural shoreline. They shall be placed on or upland of the mean high water line or such other line officially established for this or other set back purposes, and their location including revetments shall comply with local and state regulations for set back of structures along shorelines.

Bulkheads along canals or other waterways that are part of the official Dade County Water Control Plan shall be located to provide the required waterway section of the canal or waterway. They shall be continuous without abrupt change of direction and their location shall not be detrimental to adjacent property.

Bulkheads on lakes or similar water areas under the direct control of Dade County shall be on or landward of the water-fronting property line, or in the absence of such line shall be located on or landward of the ordinary high water line of the lake or water area; and if said lakes and water areas are privately owned, or if the proposed wall is located entirely on private property, then bulkhead and wall location requirements shall be as set forth in required permits from the County Building and Zoning Department. However, approval by the Building and Zoning Department pursuant to its applicable regulatory jurisdiction, shall not preclude or dispense with the necessity for all other permitting procedures required by other local and state regulations regarding such works.

Bulkheads proposed between two properties where bulkheads already exist shall be designed to connect such bulkheads. Bulkheads proposed adjacent to property not bulkheaded shall be designed to return along the side property line a distance sufficient to protect the back fill and prevent damage to adjacent property, but not less than 25 feet along the ocean and bay or 10 feet along canals, rivers, and other water areas. The return wall shall be protected from erosion by riprap or slope pavement.

b. Types of Walls

The use of vertical face bulkheads without a rock revetment will normally be prohibited, although exceptions may be allowed for projects such as canals, and for enclosed marinas, when it can be shown that equal or better conditions of environment or wave action can be attained with a vertical wall, and that such wall is necessary for the contemplated use, and is not within the Biscayne Bay Aquatic Preserve.

On the ocean front, seawalls along sand beaches subject to wave action, shall be an approved sloping high-energy absorbing type, or vertical walls with sloped energy-absorbing rock revetment on the face subject to wave action. The revetments slope shall be one vertical to two horizontal or flatter. Revetment composed of native limestone rock is considered desirable.

In bay areas bulkheads, seawalls, revetments, and retaining walls shall normally be sloped walls, or vertical walls with sloping rubble mound revetment on the water side. Such slopes shall be one vertical to two horizontal or flatter. Native limestone rock is considered desirable as revetment material.

Inside the Biscayne Bay Aquatic Preserve, bulkheads, seawalls, revetments, retaining walls and dikes shall meet all the foregoing requirements for bay areas, and in addition, provisions must be made in the wall, revetment, or dike for seepage and relatively free movement of groundwater from the upland side into the bay in order to maintain, insofar as feasible, natural shoreline conditions of groundwater flow.

Exceptions for bay areas and the Aquatic Preserve may be allowed in reference to the foregoing requirements, if permitted by existing laws, and whenever it can be shown that equal or better conditions of the bay environment can be attained by use of other type of walls, revetments, walls, or dikes, and that such other type structure is essential to the purpose for which it is to be built—for example, to retain the bank of coastal canals, or of enclosed marinas.

Whenever the beach in front of an existing vertical wall has eroded to such extent that water reaches the bottom of the wall at mean high tide, a sloping rock revetment conforming with the foregoing requirements shall be placed in front of the wall. Whenever any existing vertical wall located on the oceanfront or in bay areas is in need of major repairs, it shall not be repaired or replaced unless the foregoing requirements concerning a sloping face or revetment are first met. A proposed repair will be considered major when the total cost of repairs within the previous twelve (12) months, if any, plus the estimated cost of the proposed repair is more than fifty percent (50%) of the current cost of replacement.

c. General Specifications

All bulkheads shall have a concrete cap designed to withstand the various loads placed upon it. The cap shall be large enough to provide no less than four inches of concrete cover between the piles, panels or masonry and nearest exterior face of cap.

The elevation of the top of cap should be above the official flood criteria. (Such criteria provide for a minimum fill elevation, but not for storm wave heights.) Other cap elevations may be approved but only when land useage, proximity of buildings, and effect on adjacent property have been considered.

Safety curbs or guardrails shall be provided for bulkheads adjacent to roadways. Handrails shall be provided for bulkheads adjacent to walkways.

Cables or steel rods used in tiebacks must be protected by at least three inches of concrete encasement if the cable or rod is less than one inch in diameter. Tiebacks not encased in concrete are to be protected by coating and wrapping with bituminous or other corrosive-resistant material.

Anchors for tiebacks, whether piles or other types, shall bear on undisturbed or well compacted soil and shall be designed to provide adequate horizontal support.

Precast concrete panels of tee-pile and panel bulkheads shall have the foot of the panels placed in a manner that will prevent undermining of the backfill material.

Fill material placed on the water side of a bulkhead shall not be considered to offer any passive resistance when such fill is subject to erosion.

Gravity type bulkheads of stone and concrete combination will be permitted, provided they are constructed of no less that 40 percent cast in place concrete by cross sectional area and volume.

2. PIERS AND DOCKS

a. Location

Piers and docks at right angles to the shoreline, or nearly so, shall be located not closer to the side property line, or said line extended, than a distance equal to the length of the pier or dock itself, provided however, no such distance shall be less than 10 feet.

PIERS AND DOCKS (Continued)

Where the zoning is residential or where the area is subdivided into tracts smaller than one acre each, piers and docks are to be located within the middle one-half of the water frontage.

b. Types

Structures such as piers which are to project beyond the bulkhead line, if allowed, shall be of an open type construction.

Wharves, piers, or docks of solid fill construction will be approved only where such construction will not extend seaward of the approved bulkhead line.

c. General Specifications

In areas where the zoning is residential or in areas where no tract is larger than one acre, piers and docks shall be no more than 30 feet wide. In no case shall piers or docks obstruct navigation or interfere with drainage facilities. The projection of a pier or dock into a restricted waterway such as a canal, river, creek or basin shall be no greater than 10 feet or 20% of the waterway width, whichever is smaller. Public Works Department's approval may be given for piers projecting more than 10 feet into open water areas such as bays and sounds provided the projecting pier does not obstruct navigation or encroach upon the rights of adjacent property owners.

3. GROINS

a. Location

Groins are to be located so that the entire system of groins will provide the maximum benefit without adverse effects. Groins shall be anchored sufficiently landward to prevent flanking.

b. Types

Groins shall be either very low impermeable nonadjustable or impermeable adjustable, designed and maintained in adjustable condition for their entire life. The use of permeable groins shall be limited to special conditions.

GROINS (Continued)

c. General Specifications

Groins may be used to stablize the beach if adjoining beaches are not adversely affected.

Groins should be impermeable, and adjustable to meet variations in natural conditions, and to produce the desired elevation of the beach.

Adjustable groins shall be maintained at elevations in accord with actual beach needs and development of desirable change of the beach profile, and so as to avoid damage to adjacent beaches. In no case shall the top of such groins be set higher than 2 feet above the beach profile. Impermeable, non-adjustable groins shall not extend seaward beyond the mean low water line, and their top elevation shall not be higher than 6 inches above the beach profile.

Groins must be constructed or adjusted low enough to provide pedestrian access between mean high and mean low water, or they must be provided with an adequate stairway for pedestrian access across them.

Consideration of the degree of beach protection to be provided by proposed groins, and the acceptability of such installations, will be based primarily on the following factors:

Direction and Volume of Littoral Drift
Wave Force and Direction
Wind Force and Direction
Land Useage
Type of Bulkhead
Type of Groin
Spacing and Length of Groins

A complete coastal engineering study may be required before approval is given to the number, type, and location of groins.

4. BEACH NOURISHMENT

Artificial nourishment of sand beaches, or creation of new beach areas are treated as construction projects in the issuance of permits by the County and by the Division of Beaches and Shores of the Florida Board of Conservation. Typical profiles for such projects consist of a 50-foot level berm at elevation 6 ft. MSL; a 1 on 20 slope from there to MLW; and a 1 on 30 slope seaward to existing bottom.

Special agreement between the upland owner proposing such a project and the County (also between the owner and the State) may be required in order to adequately protect and permanently safeguard any public rights existing at the proposed site.

5. JETTIES AND BREAKWATERS

Jetties and breakwaters shall be designed in accordance with the latest issue of the U.S. Army Corps of Engineers' Technical Report No. 4 entitled "Shore Protection, Planning and Design".

6. MOORING PILES AND BUOYS

All mooring piles and buoys shall be placed within the limits of the owner's water frontage, and shall be located in a manner not to interfere with navigation. Outer mooring piles and buoys shall not constrict a navigable waterway except as permitted by the appropriate agency having jurisdiction over the waterway.

7. BOAT SLIPS AND BOATHOUSES

Boat slips and boathouses to be located on private property require approval and permit from the Building and Zoning Department. Bulkheads proposed to be constructed for retaining the banks of the boat slip shall meet the requirements of this section of the manual. The location of boat slips shall conform to the same requirements as for piers and docks.

Boat slip and bank-line excavations proposed downstream of salt dams and inland of the County salt barrier line require approval of the County Commission (after proper certification by the Public Works Department).

Boathouses may be constructed over boat slips or as a separate structure subject to the following conditions:

a. The boathouse may not be used as a dwelling, guest house or servant's quarters unless specially constructed as such to the requirements of the Building and Zoning Department.

b. The boathouse does not extend into a water area a distance greater than that permitted for a dock or pier.

c. The overall size of the boathouse does not exceed 25 feet in width, 45 feet in length, or 18 feet in height, except commercial marinas and drydocks may be permitted larger boathouses constructed in compliance with applicable zoning and building regulations.

8. BRIDGES AND CULVERTS

The design of bridges and culverts shall be in accord with Section D6 of this manual.

D5.04 MATERIALS

1. PILES

a. Wood Piles

Wood piles may be used in bulkheads only to support or anchor tiebacks and only when cut off or capped in concrete one foot below mean low water. Wood piles are not to be used in groins.

Wood piles are to comply with Article 2404.3 of the South Florida Building Code.

b. Steel Piles

Piles of rolled structural steel shapes shall comply with Article 2404.7 of the South Florida Building Code.

Steel sheet piles shall meet the requirements of ASTM Designation A328 and shall be at least 3/8-inch thick.

Steel pipe, if used as piling, shall be filled with concrete and shall meet the requirements of AASHTO Specifications M94 and shall be at least 3/16-inch thick.

c. Concrete Piles

Concrete piles, whether cast in place, precast or prestressed, shall meet the requirements of Articles 2404.4, 2404.5, and 2404.6 of the South Florida Building Code.

d. Pile Foundations

When piles are used as foundations for coastal structures, they shall meet the requirements of Articles 2404.1 and 2404.2 of the South Florida Building Code.

2. CONCRETE

Concrete used in coastal structures shall be designed, mixed, transported and placed to meet the requirements of Chapter 25 of the South Florida Building Code.

Concrete to be placed under water shall have a slump between four and eight inches, a minimum cement content of 7.0 bags per cubic yard and a maximum net water cement ratio of 6.0 gallons per bag.

To prevent segregation--concrete to be placed under water shall be placed carefully in a compact mass in its final position by means of a tremie or other approved method.

Concrete shall not be placed in running water.

Concrete seals shall be placed in one continuous operation.

The tremie used for placing concrete shall consist of a tube at least 10 inches in diameter, constructed in sections and shall have flanged couplings fitted with gaskets.

3. STEEL

a. Reinforcing Steel

Reinforcing steel shall meet the requirements of Article 2504.3 of the South Florida Building Code. The use of special large size bars meeting ASTM Designation A431 and A432 is permitted.

b. Steel Wire Fabric

Steel wire fabric shall meet the requirements of ASTM Designation A185.

c. Structural Steel

Structural steel shall meet the requirements of ASTM Designation A7.

d. Nuts and Bolts

Nuts and bolts shall meet the requirements of ASTM Designation A307.

e. Steel Tieback Rods

Steel tieback rods may be either reinforcing steel or stress relieved strands or stress relieved wire, meeting the requirements of ASTM Designation A416 and A421.

f. Steel Fasteners for Wood

Steel fasteners for wood shall meet the requirements of the applicable portions of Chapter 29 of the South Florida Building Code.

4. WOOD

Timbers and wood structural members shall meet the requirements of AASHTO Specifications M168.

5. STONE

Stone used for revetments for bulkheads, or the construction of groins, jetties or breakwaters shall be dense, hard, and durable.

The size, range of sizes, and gradation shall be selected to meet the requirements of the individual situation and site.

6. FILL MATERIAL

Material for fills shall comply with Section C3 of this manual.

D5.05 INFORMATION REQUIRED ON AND FOR THE PREPARATION OF CONSTRUCTION PLANS

Construction plans must be prepared by an engineer registered in Florida. They shall be on sheet size 22"x36", arranged and numbered as a set and contain all (or applicable portions) of the following:

(1) Plan, elevation, and sections showing the complete structure.

(2) Details of structural components including precast members, structural connections, steel reinforcement, and expansion joints.

(3) Complete description of all materials to be used.

(4) Design loading and minimum penetration of piles.

(5) Location control.

(a) Horizontal control referred to a section line, road, or permanent landmark, and including property lines and the Official Bulkhead Line.

(b) Vertical control referred to U.S. Coast and Geodetic Survey Datum (MSL) including elevations landward, soundings in water areas, and the mean high water line.

(6) Graphical representation of test borings or soil profile parallel to and within five feet of proposed structures.

D5.06 PRELIMINARY APPROVAL OF CONSTRUCTION PLANS

The design engineer, when requesting preliminary approval of construction plans, shall submit:

1. Three (3) complete sets of construction plans and specifications.

2. Test boring data as may be required to determine the adequacy of the structure's foundation.

3. Design calculations if requested by the Public Works Department.

If the Public Works Department finds that the design and construction plans are in accord with this section, two sets of the plans will be returned stamped "APPROVED." Such approval does not constitute a construction permit.

D5.07 CONSTRUCTION PERMIT

A permit for construction may be issued to a certified contractor provided:

1. Four (4) sets of construction plans, identical to the approved plans, are presented.
2. Satisfactory evidence is presented that all other applicable approvals and permits have been obtained.
3. The required permit fee is paid.
4. A performance bond has been provided, in an amount determined by the Director of the County Public Works Department but not to exceed 100% of the estimated cost of the structure.
5. It is certified that a registered civil engineer has been retained to provide engineering supervision throughout the construction period.

D5.08 INFORMATION REQUIRED DURING CONSTRUCTION

The design engineer may be required to furnish the Public Works Department any portion of the following information during construction:

1. A complete pile driving log.
2. A report on the manufacture of all precast members including the stressing operation of prestressed members.
3. Test reports from a certified laboratory on all concrete used, including precast members.
4. Mill certificates for structural and reinforcing metals used.

D5.09 INFORMATION REQUIRED BEFORE FINAL ACCEPTANCE

When the structure is complete, and prior to final acceptance, the design engineer shall furnish the County (and other public agencies which may have issued permits) a complete set of As-Built drawings, together with his certification that the structure has been built in accord with the approved plans and specifications as finally revised.

D5.10 MAINTENANCE

These minimum requirements are not to be construed as an implication that Dade County proposes to maintain these structures when completed. A coastal structure shall be maintained at all times by the owner including any portion thereof that may extend into public property. All structures that are available for public use shall be maintained by the owner in a safe condition. Maintenance of groins will include periodic adjustments of the height to compensate for changes in the beach profile.

SECTION D-6

BRIDGES AND CULVERTS

A PORTION OF

PART 2 - PUBLIC WORKS MANUAL

SECTION D6 - BRIDGES AND CULVERTS

D6.01 - GENERAL

All road, pedestrian and utility crossings of waterways shall be designed in accordance with the information contained in this Section. The design of overpasses shall follow the same requirements as bridges, horizontal and vertical clearances being determined by the Public Works Department.

In all instances the Public Works Department will determine or approve the choice between a bridge or culvert, and the waterway capacity and clearance. In no case should a DESIGN ENGINEER proceed on the design of a bridge or culvert without such preliminary approval.

Preliminary approval may be obtained by an owner, a land developer or a DESIGN ENGINEER. However, for the purpose of this section it will be assumed that the DESIGN ENGINEER will be responsible for obtaining department approval.

The requirements of this section are to be considered as minimum. The DESIGN ENGINEER may, at his discretion and upon approval of the Public Works Department, design a waterway structure exceeding these minimum requirements.

D6.02 - PRELIMINARY APPROVAL OF PLANS

1. SUBMITTING PROPOSAL

It shall be the responsibility of the DESIGN ENGINEER to notify the Public Works Department, by letter, of a proposed plan to construct a waterway structure. The letter should be addressed to the Dade County Public Works Department, Highway Division and shall contain the following information:

a. A location sketch showing existing and proposed right of way in sufficient detail to adequately relate the structure to existing topography.

b. Proposed use of the structure (vehicular traffic, foot traffic, utility crossing, etc.)

c. The name of the person or persons that the Public Works Department may contact if additional information is required. For example: Name of the owner or developer, his address and telephone number; name of the DESIGN ENGINEER, his address and telephone number.

d. A brief description of the proposed structure, the approximate span length and the existing and proposed channel section where applicable.

e. Any other information or details which may be peculiar to the specific situation, in order that the review may be complete.

2. LETTER OF APPROVAL

Upon receipt of this letter, the Public Works Department will review the information contained therein and will notify the DESIGN ENGINEER, by letter, of the requirements for the particular structure. The notification will include:

a. Statement as to whether the structure shall be a bridge or culvert.

b. Design water elevation, vertical and horizontal clearances.

c. Waterway section including side slopes and minimum berm widths.

d. Other permit requirements.

If the letter from Public Works Department states no objections to the structure, then the letter of reply may be considered by the DESIGN ENGINEER as preliminary approval, and he may proceed with his design in accordance with the information contained in this section. Final approval of the construction plans by the Public Works Department is required prior to the issuance of a permit for construction. No work shall proceed on the structure without a permit.

D6.03 - STRUCTURAL DESIGN CRITERIA

The criteria for the design of waterway crossings shall be as follows:

1. VEHICULAR BRIDGE AND CULVERT CROSSING

The structural design of all members of vehicular bridges and culverts shall be in accordance with the requirements of the current edition of Standard Specifications for Highway Bridges adopted by the American Association of State Highway Transportation Officials referred to hereafter as AASHTO. Items not covered by AASHTO may be designed by a recognized rational method.

2. PEDESTRIAN CROSSING

The design of the members of a pedestrian bridge shall be as required by the AASHTO.

3. UTILITY CROSSING

The design of the members of a utility crossing shall be as required by the South Florida Building Code for the particular member. All utility crossings shall be provided with adequate barricades or guards that will discourage or prohibit their use by pedestrians.

D6.04 - DESIGN LOADING

The loading for the design of waterway crossings shall be as follows:

1. VEHICULAR BRIDGE AND CULVERT CROSSING

The loading of a vehicular bridge shall be one of the following as designated by the AASHTO.

a. Public Roads---------- HS-20-44

b. Private Roads with Controlled Access--- H15-44 or H10-44*

c. Wind Load---------- AASHTO adjusted to 120 mph to meet South Florida Building Code Requirements

2. PEDESTRIAN CROSSING

a. Live Load---------- 85 lbs. per square ft.

b. Dead Load---------- as designed.

c. Wind Load---------- South Florida Building Code Requirements (Article 2306)

3. UTILITY CROSSING

a. Live Load---------- at the option of the DESIGN ENGINEERS. Refer to Article D6.03-3 of this section

b. Dead Load---------- as designed.

c. Wind Load---------- South Florida Building Code Requirements. (Article 2306)

* A heavier loading may be required under special conditions. Preliminary approval will ascertain which loading applies.

D6.05 - SIZE AND DIMENSIONS OF WATERWAY STRUCTURES

The dimensions of all waterway structures shall be no less than the following:

1. WIDTH

Section D6 - Bridges and Culverts

a. Vehicular Bridges

(1) Roadway (curb to curb)

The roadway over a bridge shall conform to Standard Details BC-2.1 through BC-2.5.

(2) Sidewalk*----------5'-0" clear width face of curb to handrail.

b. Pedestrian Crossing

A minimum clear width between handrails of 5'-0" is required.

c. Utility Crossing

A utility crossing shall be designed wide enough to conform to the facility it is supporting.

d. Culverts

The roadway over a culvert shall be designed to conform with Standard Detail BC-1.2 of the Public Works Manual.

Culvert crossings designed in accordance with Standard Detail BC-1.2 shall conform to the roadway requirements of vehicular bridges over the entire cross section including roadway width, curb height, sidewalk, handrail and drainage.

Concrete headwalls shall conform with Standard Details BC-3.1, 3.2, or 3.3, and riprap headwalls shall conform with Standard Details BC-3.4 and 3.5, provided, however, that headwalls may not be required where culvert extends beyond the intersection of invert with extended slope line of stable embankment.

For sizes in excess of the ones shown in the Standard Details, submittal of structural computations is required.

Sidewalk will be required for Standard Detail BC-1.2 only where sidewalk is required in the surrounding area by Code of Metropolitan Dade County. Chapter 28 - 15 (b) 3. Refer to Article D6.08-2 for sidewalk requirements.

2. LENGTH

a. Bridges or Utility Crossings

The length of the structure shall be a function of the waterway to be crossed. In no case shall the clear length between abutments be less than the sum of the following measured along the centerline of roadway or structure:

* Refer to Article D6.08-2 for sidewalk requirement.

(1) Waterway bottom width.

(2) Horizontal projection of approved bank slopes.

(3) Berms - Width as required by preliminary approval.

(4) Plus additional width as may be required for future widening of channel.

Once the over-all length of the structure has been established, the selection of span length and number of spans shall be made. The fewest number of spans that will suit the over-all length is desirable. A bridge of an odd number of spans (1, 3, 5, etc.) is preferred over a bridge of an even number of spans (2, 4, 6, etc.) because it permits an open center section in the channel.

b. Culverts

The culvert section should be selected to suit the special conditions of the proposed location such as; canal capacity, pipe cover, design water elevation, drainage area, etc. For waterway design refer to Section D4 Water Control.

3. HEIGHT - ELEVATION

a. Bridges and Utility Crossings

The Public Works Department will establish the design water elevation of the waterway to be crossed and the minimum clear vertical distance between the design water elevation and the lowest point of the superstructure.

b. Culverts

The elevation of a culvert shall be based on the crown of a pipe culvert of the inside top of a box culvert. The Public Works Department will establish the design water elevation and the elevation of the crown of the pipe or top of the box. The cover over a culvert shall be as required by the design loading on the particular type of culvert to be used, but normally not less than two (2) feet, at the lowest roadway section elevation.

D6.06 - GEOMETRIC DESIGN

1. LOCATION AND ALIGNMENT

It is desirable that all crossings be at right angles to a waterway. All bridges shall be designed with abutments and intermediate bents parallel with the waterway flow. All culverts shall be located parallel with the waterway flow.

2. HORIZONTAL CURVES

If a vehicular bridge or culvert is to be located on a horizontal curve, it shall be designed as a portion of the roadway, and the same roadway super-elevation and widening shall be provided for, as is shown in the Road Section of this manual.

3. APPROACH GRADES AND VERTICAL CURVES

If the design elevation of bridge or culvert structure differs from the connecting roadway elevation, the connection shall be made with approach grades not to exceed 5% and with vertical curves designed in accordance with the requirements of the Road Section of this manual.

It is desirable for bridges to be level from abutment to abutment with all the vertical transition in the approaches. However, for long bridges or culverts, the DESIGN ENGINEER may include the structure itself in part of the vertical curve, provided the minimum sight distance requirement of the Road Section is met.

D6.07 - MATERIALS AND TESTS

1. BRIDGE STRUCTURES

All permanent bridge structures proposed to be accepted and maintained by Dade County after the termination of the bond obligation shall be designed and constructed of reinforced concrete, prestressed concrete or approved structural metal. This shall include both substructure and superstructure. An exception may be made for footbridge piling in which case timber may be used, provided it meets the requirements of the South Florida Building Code Article 2404.3. The material for bridge handrails shall be as specified in Article D6.08-3.

2. CULVERTS

All culverts proposed to be accepted and maintained by Dade County after the termination of the bond obligation shall meet the following requirements:

a. Corrugated steel pipe and pipe arches manufactured to the requirements of AASHTO Designation M-36 or M-167, bituminous coated in accordance with AASHTO M-190, and carefully backfilled to produce the design load bearing capacity.

b. Corrugated aluminum pipe and pipe arches manufactured to the requirements of AASHTO Designation M-196, M-197, M-211, or M-219 whichever is applicable, carefully backfilled to produce the design load bearing capacity. In areas to be imbedded in or to be in contact with concrete the metal shall be coated with an approved corrosion preventive such as bituminous paint or clear alkali-resistant lacquer.

c. Reinforced concrete culvert pipe manufactured to the requirements of AASHTO Designation M-170.

d. Reinforced concrete boxes in accordance with the criteria herein established for bridges.

3. CONCRETE

All structural concrete shall conform to Article 345 of the current Florida D.O.T. Standard Specifications for Road and Bridge Construction. Structural concrete, other than prestressed, shall attain a compressive cylinder strength of not less than 3000 psi at 28 days in fresh water areas. In salt water areas the compressive strength of the concrete shall be not less than 4000 psi at 28 days and Type II or I-P Portland Cement shall be used. Concrete used in the manufacture of precast prestressed members shall attain a compressive cylinder strength of not less than 4000 psi before the tensioning load is transferred to the concrete and 5000 psi after 28 days.

All ready-mixed concrete shall be manufactured in accordance with ASTM Designation C-94. Job-mixed concrete will be permitted providing the mix is approved prior to construction and tested in a manner which will guarantee a quality equal to that of the ready-mixed concrete.

4. PRECAST CONCRETE PILE BUILD-UPS

Extensions or build-ups of piling shall be designed to develop the same structural strength as the original pile.

5. BACKFILL AT BRIDGE APPROACHES

All bridge approach embankments shall be compacted to a density of no less than 100% of the maximum dry density as determined by AASHTO Designation T-180 for an approved backfill material.

6. MATERIAL TESTS

All materials used in a bridge or culvert structure may be subjected to tests in accordance with current code and specification requirements.

7. UNUSUAL DESIGNS

The Public Works Department may require load tests of structural members of an unusual design.

D6.08 - GENERAL REQUIREMENTS

1. CURBS

All vehicular bridges shall be provided with curbs having a vertical height as determined by AASHTO, but not less than six (6) inches above the roadway surfacing material.

2. SIDEWALKS

Sidewalks are required on both sides of all bridges to a width prescribed by Article D6.05-1-a-(2) of this section. The Public Works Department may waive the sidewalk requirement on one side of a two (2) lane bridge that is part of a four (4) lane divided structure or on one side of a private bridge, provided the location conditions justify. Sidewalks on culverts shall be in accordance with Article D6.05-1-d.

Sidewalks shall be extended from the bridge structure to the canal right of way line, with vertical transition to avoid steps, and with a horizontal transition connecting to the proper location within the road right of way. The vertical and horizontal transition shall conform to Standard Detail R 13.2.

3. RAILINGS

Railings are required on all vehicular and pedestrian bridge crossings and on all culverts with sidewalks and shall be designed as follows:

a. Design Loading

(1) Vehicular Bridges

The loading used in the design of railings for vehicular bridges shall be in accordance with the article of AASHTO Standard Specifications for Highway Bridges entitled "Sidewalk, Curb, and Railing Loading."

(2) Pedestrian Bridges

Each rail of the railings for pedestrian bridges must be so designed that it will withstand a load of 50 pounds per lineal foot simultaneously applied horizontally and vertically. Railing posts shall be designed to withstand a load of 50 pounds per lineal foot applied to the top rail in the direction producing the maximum moment.

b. Height

The railings shall extend no less than 3'-0" above the sidewalk, (A preferred height is 3'-6".)

c. Intermediate Rails

The railings shall be provided with intermediate rails so that the clear vertical openings shall not exceed twelve (12) inches.

d. Special Protection (In addition to railings)

For certain locations the Public Works Department may require additional protection for safety of pedestrians.

e. Material

All railings on vehicular bridges shall be constructed of reinforced concrete. Under certain conditions a concrete railing may be required for culverts and sidewalks.

4. APPROACH SLABS

All vehicular bridges and reinforced concrete box culverts having a surface elevation equal to the roadway elevation shall be provided with reinforced concrete approach slabs equal to the bridge or culvert roadway width and extending a minimum of 20 feet from the abutment as measured parallel with the centerline of the roadway.

5. DRAINAGE

a. On Bridges

The bridge roadway shall slope 3/16 inches per foot from crown to curb. All two (2) lane bridges shall have a drainage structure equivalent to a four (4) inch pipe located no greater than twenty (20) feet center to center each side. These drains shall be located to prevent the discharge of water against any portion of the structure.

b. On Approaches and Embankments

Drainage facilities shall be provided for the bridge approaches that are adequate to prevent erosion of the embankment.

6. GUARDRAIL

Guardrail shall be provided at all vehicular bridges or culverts and shall be constructed and located in accordance with the R-20 series Standard Details of the Public Works Manual.

7. CONCRETE REINFORCEMENT COVER

The minimum clear cover for reinforcement shall be as follows:

a. Salt Water Areas*

(1) Cast-in-place members exposed to seawater erosion--------4"

(2) All other cast-in-place members (except slabs)----------3"

*For the purpose of this section, a salt water area shall consist of any area where the surface water salt content exceeds 1000 ppm.

(3) Precast Members----------2"

(4) Piles----------3"

(5) Deck Slabs----------2" Top
2" Bottom

b. Fresh Water Areas

(1) Cast-in-place members (except slabs)
(concrete placed against forms) 2"
(concrete placed against soil) 3"

(2) Precast Members----------2"

(3) Deck Slabs----------2" Top
1½" Bottom

Metal Chairs, or other devices designed for supporting, or maintaining required cover of reinforcing steel shall not be permitted. Only masonry units shall be used.

8. PENERATION AND COVER FOR PILES

a. Penetration into Soil

(1) Free Standing Piles (Intermediate Bents)

All free standing piles shall have a minimum penetration of one-third of their length but not less than ten (10) feet in firm material provided, however, that penetration is sufficient to develop the required capacity of the pile.

(2) Fully Supported Piles (Abutments)

Where stable bankslopes are provided, the minimum tip elevation of the piles shall be equal to the elevation of the channel bottom. Where vertical bank slopes are proposed or where an unstable bank slope may occur, the minimum tip elevation of the piles shall be ten (10) feet below the channel bottom.

b. Penetration into Pile Cap

The desired penetration of a pile into the cap is twelve (12) inches. However, in no case shall the pile penetrate the cap by less than nine (9) inches.

c. Concrete Cover

The minimum cover between the exterior face of piling and the nearest exterior face of pile cap shall be four (4) inches.

9. BRIDGE ABUTMENTS

The abutments of vehicular bridges shall be constructed upon pile foundations. An exception to the pile foundation requirement will not be made unless the DESIGN ENGINEER can show sufficient proof of the adequacy of another type of foundation design.

10. CONCRETE CURING AND FINISH

Curing of all concrete shall be according to current Florida D.O.T. Standard Specifications. All concrete shall be finished in a uniform color and in a workmanlike manner as follows:

a. Concrete Deck Slabs

Concrete deck slabs shall receive a broom finish perpendicular to centerline of roadway.

b. Approach Slabs

Approach slabs shall receive a broom finish perpendicular to centerline of roadway.

c. Concrete Sidewalk

Concrete sidewalk shall receive a broom finish perpendicular to centerline of sidewalk.

d. Precast Members

All precast members shall be finished as prescribed by Art. 400-18 of current Florida D.O.T. Standard Specifications.

e. All Other Exposed Surfaces

All exposed surfaces other than those described above, which appear in plan or elevation views of the structure, shall receive a Class I finish in accordance with Art. 400-15 of current Florida D.O.T. Standard Specifications.

11. CONCRETE RETAINING SLABS

The retaining walls and slabs shall be designed to resist all forces to which they are subjected, including all live loads required by current AASHTO Standard Specifications and Section D5 - Coastal and Other Waterfront Construction of the Public Works Manual.

12. JOINTS IN BRIDGE DECKS

For all joints in bridge decks between and at the ends of spans, preformed elastomeric compression seals shall be used.

13. TEST BORINGS FOR BRIDGES*

a. Vehicular Bridges

A minimum of two (2) test borings shall be required for each bridge location. These borings shall be made as close as possible to the location of two of the pile bents of the proposed structure. The borings shall be made by a testing laboratory certified by the Building Department and two (2) copies of the results shall be attached to the plans submitted to the Public Works Department for approval. This information shall appear also on the plans as stated in Article D6.10-11. In addition to the two (2) test borings, the Public Works Department may require other test borings in order that complete sub-surface condition can be determined.

b. Pedestrian Bridges

The procedure for pedestrian bridges shall be the same as required above for vehicular bridges except that a minimum of one test boring is required for each bridge location.

*Test borings shall be performed in accordance with ASTM D-1586 specification.

14. ELEVATION HUBS

Two (2) elevation hubs shall be installed on all vehicular and pedestrian bridges at locations on the bridge approved by the Public Works Department. The Public Works Department will furnish the hubs and determine their elevations.

15. OTHER REQUIREMENTS

It may be necessary for a particular project for the Public Works Department to make requirements other than those appearing in this section. These requirements shall supplement the information contained herein, unless otherwise stated.

D6.09 - INTENDED USE OF BRIDGE

The use of vehicular or pedestrian bridge shall be limited to vehicles and/or pedestrians. This precludes the use of these facilities for supporting, or in any manner being connected to utilities such as gas mains, water mains, sanitary sewer force mains, telephone cables, power cables, etc., except by permission in writing from the Public Works Department, as outlined in ART. D6.15, "Policy on Utility Attachment to County Bridges."

D6.10 - INFORMATION REQUIRED ON AND FOR THE PREPARATION OF CONSTRUCTION PLANS

All construction plans submitted to the Public Works Department for approval shall be prepared by, and bear the seal of, an Engineer registered in the State of Florida to practice Civil Engineering. They shall be prepared on sheet size 22" x 36" and contain all (or applicable portions) of the following:

1. Plan, elevation, and proposed water section for the structure.
2. Plan, elevation, and section of abutments, bents, piers and pile caps.
3. Plan, longitudinal section and details of approach slabs.
4. Detail showing the restraint to lateral and transverse translation of members.
5. Details showing the provisions for seating of members, and where necessary, details showing provisions for end rotation of members.
6. Adequate details of all structural components.
7. Adequate details of expansion joints and materials.
8. Complete description of all materials to be used.
9. Complete details of design loading of all piles.
10. Location Control.
    a. Horizontal control by referencing the structure to a section line, a road, or some obvious and permanent landmark.
    b. Vertical control that will clearly relate the structure to the entire channel. Elevations to be shown include elevation of the lowest point of the superstructure, the channel bottom, and elevation of the water and ground surface to mean sea level, United States Coast and Geodetic Survey datum.
11. A graphic representation of the test borings.

D6.11 - FINAL APPROVAL OF CONSTRUCTION PLANS

The DESIGN ENGINEER shall prepare the construction plans in accordance with the requirements of this Section. The Public Works Department will not proceed to check any plans submitted for approval unless they have been prepared in accordance with the instruction in this section.

The DESIGN ENGINEER, when requesting approval of the construction plans, shall submit the following:

1. Four (4) complete sets of blue or black-line construction plans and specifications.

2. Boring log data as required by Article No. D6.08-12.

3. Design calculations if requested by the Public Works Department.

If the Public Works Department determines that the proposed structure has been designed, and the construction plans prepared, in accordance with this section, one set of construction plans, will be returned stamped "APPROVED". This approval will enable the DESIGN ENGINEER or the contractor to obtain a permit for the construction of the structure. It should be noted that final approval of construction plans does not represent a permit for construction.

D6.12 - CONSTRUCTION PERMIT

A permit for construction will be issued provided:

1. Five sets of construction plans, identical to the approved plans, are presented.

2. Satisfactory evidence is presented that all other applicable approvals and permits have been obtained.

3. The required permit fee is paid.

AND for all structures that will be maintained by Dade County:

4. A performance bond has been provided, either under a subdivision agreement or a special agreement with Dade County, in the amount of 110% of the estimated cost of the structure.

5. Certification is presented to the effect that a registered civil engineer has been retained to provide engineering supervision throughout the construction period.

D6.13 - INFORMATION REQUIRED DURING CONSTRUCTION

The DESIGN ENGINEER shall furnish the Public Works Department the following minimum information during construction of the approved structure:

1. A complete pile driving log.

2. A report including shop drawings on the manufacture of all precast members including the stressing operation of pre-stressed members.

3. Test reports from a certified laboratory on all concrete used including that becoming part of precast members.

4. Mill certificates for structural and reinforcing metal used.

D6.14 - INFORMATION REQUIRED BEFORE FINAL ACCEPTANCE BY DADE COUNTY

The DESIGN ENGINEER shall furnish the Public Works Department the following minimum information when the structure is complete and prior to final acceptance by Dade County.

1. A letter from the DESIGN ENGINEER certifying that the structure has been built in accordance with the approved plans and specifications.

2. One complete set of "AS-BUILT" drawings.

METROPOLITAN DADE COUNTY

POLICY ON UTILITY ATTACHMENT TO COUNTY BRIDGES

1. GENERAL

Utility companies frequently find occasion to request permission to attach conduits to bridges crossing various waterways within the County. Since such attachment may in many instances interfere with traffic flow, road and bridge maintenance, or be otherwise objectional, a uniform policy of regulation is hereby established to be applicable to all installations on road and canal rights-of-way within the unincorporated area of Dade County and also to those rights-of-way maintained by Dade County but which lie within municipal boundaries.

In general Dade County does not encourage or issue permits for construction of utilities and related facilities which include details for attachment of utility conduits to existing bridges.

Facts and circumstances which render it undesirable to attach the subject conduits to existing bridges include:

(1) Repair, widening and replacement of existing bridges are complicated and delayed by such attachments, usually resulting in ultimate relocation of utilities to separate structures at additional cost.

(2) Multiple utility attachments become unsightly and complex and interfere with bridge maintenance.

(3) Traffic delays during maintenance and installation of utilities from the bridge deck.

(4) Increased engineering costs to Dade County necessitated by review of structural adequacy of existing bridge components.

2. EXCEPTIONS

Exceptions to the general policy may be made upon approval of the Director of Public Works where:

(1) Unusual conditions make it unreasonable to deny the utility owner convenient access for inspection and maintenance of its facility, such as on long viaducts or causeways.

(2) The bridge completely occupies the right of way and additional adjacent property is not available due to occupation.

(3) Arrangements are made prior to design of a bridge and provisions are included for utilities. Additional costs involved shall be borne by the utility company.

3. CONSTRUCTION PERMITS

All construction plans submitted for permit will be subject to the general provisions outlined in "Section D6 - Bridges and Culverts" of the Public Works Manual.