
Fort Myers Brewing Company

Hydraulics Report - REV00

September 22, 2022

Prepared By:



CONSULTING. ENGINEERING. CONSTRUCTION.

28100 Bonita Grande Dr. Suite 305
Bonita Springs, FL 34135
(239) 405-7777

Prepared For:
1227 Holdings, LLC

Engineer of Record:



Digitally signed by Jeremy H
Arnold
Date: 2022.09.22 11:39:25-04'00'

Jeremy H. Arnold, P.E.

Date:

FL Registration #66421
COA #8636

Jeremy H. Arnold State of Florida Professional Engineer, License No. 66421
This item has been digitally signed and sealed by Jeremy H. Arnold, P.E., on 09/22/2022.
Printed copies of this document are not considered signed and sealed and the signature
must be verified on any electronic copies.

Table of Contents

Project Description:	1
General Site Information	1
Existing Conditions	1
Post-Development Hydraulic Calculations	1
Design Methodology	1
Storm Event (<i>i</i>)	1
Time of Concentration	2
Overland Flow (<i>A</i>)	2
Weighted Coefficient (<i>C</i>)	2
Rational Method Equation (<i>Q</i>)	2
Hydraulic Sizing	2
Results & Conclusion	3

List of Appendices

Appendix A: Overland Flow Exhibit	4
Appendix B: Supplemental Calculation Data	6

Project Description:

Fort Myers Brewing Company is a Mixed-Use Planned Development (MPD) consisting of approximately 20.64± total acres. The proposed project is composed of 11.30± acres of commercial development with a stormwater management system and 0.71± acres of offsite Right-of-Way (ROW) improvements via a turn lane on Commerce Lakes Drive and sidewalk path on Daniels Pkwy (included in the stormwater management calculations as compensating water quality). The project boundary for the Stormwater Management calculations is approximately 11.30 acres that will consist of three (3) sub-basins. It will contain commercial development totaling 45,875± SF (with 13,491± SF future development) with required parking, a stormwater management lake and dry pre-treatment areas. The project is generally located within Sections 17 & 18, Township 45, Range 26 East, of unincorporated Lee County, Florida and within the Six Mile Cypress Watershed.

The project is bounded to the south by Daniels Pkwy, to the north by commercial development, to the west by undeveloped land and Commerce Lakes Drive, and to the east by undeveloped land.

This report is intended to be a supplement to the proposed onsite stormwater management system to demonstrate the hydraulics calculations for the sizing of the proposed 29x45 ERCP side drain pipe under the proposed sidewalk in the Daniels Pkwy ROW.

General Site Information

Existing Conditions

The project site is undeveloped, containing vegetation and approximately 13.03± acres of existing wetlands (see attached environmental report). There has been no development of any previously permitted stormwater management facilities within the project boundary.

The project outfalls through the existing wetland to the east and then across Daniels Pkwy to the existing stormwater management system. The project will ultimately flow through existing flow-ways and culverts to the Six Mile Cypress Watershed with the ultimate out fall as the Estero Bay.

Post-Development Hydraulic Calculations

Design Methodology

A culvert capacity analysis was utilized to determine the size of the side drain pipe. The total overland flow contributing to the existing Daniels Pkwy swale was quantified and the Rational Method Equation ($Q=CiA$) was used to determine the flow, Q .

Storm Event (i)

Rainfall information used to model the storm event is based on the FDOT Zone 8 IDF curve. A summary of the rainfall amount for the storm event can be seen in Table 1 below and the IDF Curve can be referenced in Appendix B.

Table 1: Storm Event

Storm Event	Rainfall Amount
FDOT- 10 Year	6.55 inches

Time of Concentration

The time of concentration used in this analysis was 15 minutes.

Overland Flow (A)

The contributing areas to the existing Daniels Pkwy swale are defined in Table 2 below. A map of the overland flow can be found in Appendix A.

Table 2: Overland Flow

Land Use	Area
Roadway	1.65 ac
Swale & Sidewalk	2.62 ac
Total	4.27 ac

Weighted Coefficient (C)

A coefficient of 0.9 was used for the roadway section and a coefficient of 0.4 was used for the swale and sidewalk section. The weighted coefficient value of the overland areas was calculated using the equation below.

$$\text{Weighted } C = \frac{(0.9 * 1.65ac) + (0.4 * 2.62ac)}{1.65ac + 2.62ac} = \frac{2.53ac}{4.27ac} = 0.59$$

Rational Method Equation (Q)

The flow, Q, was determined using the follow equation.

$$Q = CiA = 0.59 * \frac{6.55in}{hr} * 4.27ac = \mathbf{16.50\ cfs}$$

where:

Q = flow rate (cfs)

C= Rational Coefficient

i = Rainfall Intensity (in/hr)

A = Total Area (ac)

Hydraulic Sizing

In order to determine the minimum diameter of the proposed side drain pipe, the “*Minimum Diameter of Circular Pipe Under Full Flow Conditions*” equation from the NCEES PE Civil Handbook Version 1-1 was used. This can be found is Appendix B.

$$D = \left[\frac{C_0 * Q * n}{\sqrt{S}} \right]^{\frac{3}{8}} = \left[\frac{2.16 * 16.50\ cfs * 0.012}{\sqrt{0.01}} \right]^{\frac{3}{8}} = 1.72\ ft = \mathbf{20.64\ in}$$

where:

D = diameter of pipe (ft)

C₀= 2.16 for USCS units

Q = flow rate (cfs)

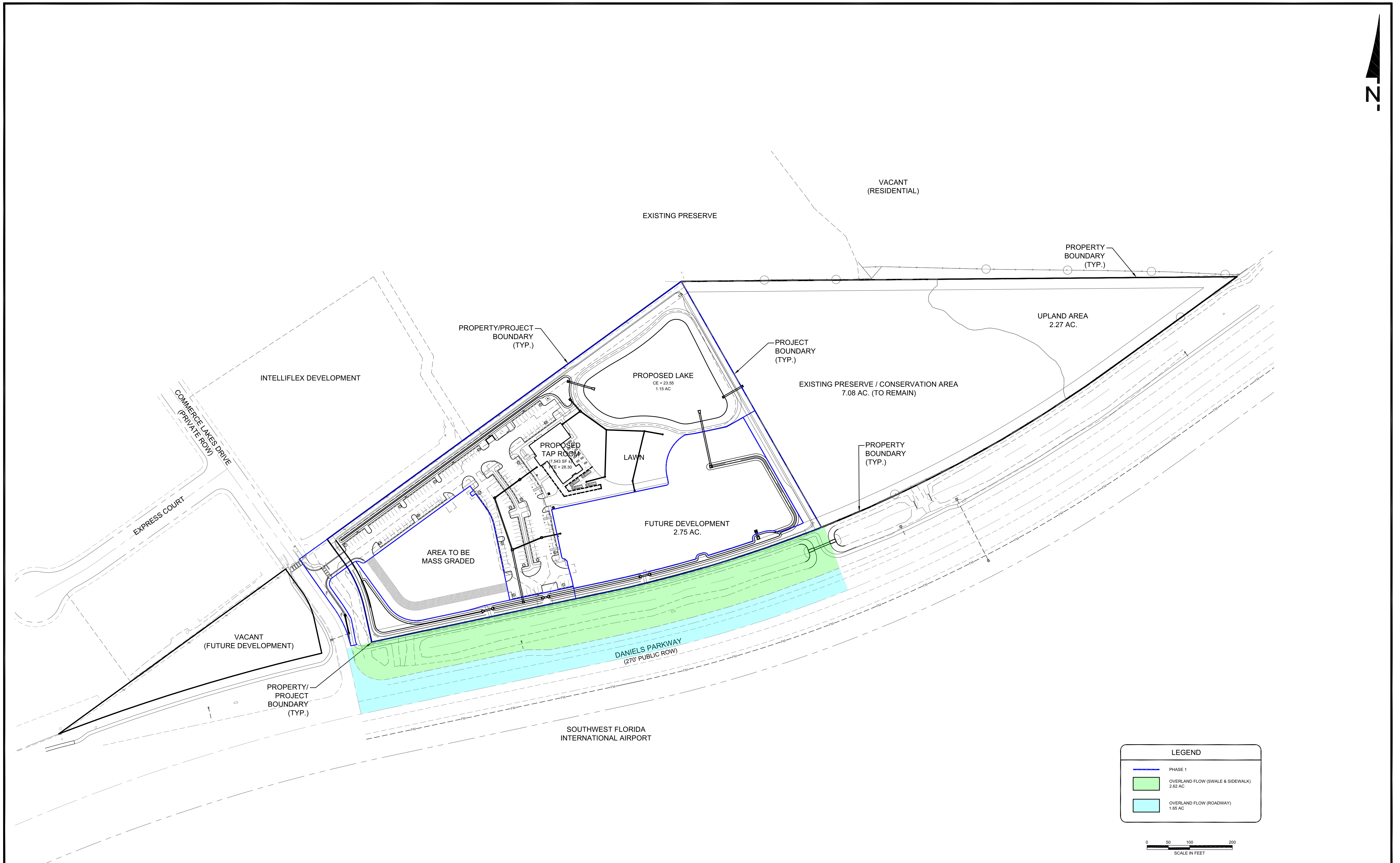
n = Manning’s roughness coefficient (0.012 for concrete)

S = slope (ft/ft) (0.01 was used to represent a 1% slope of the pipe)

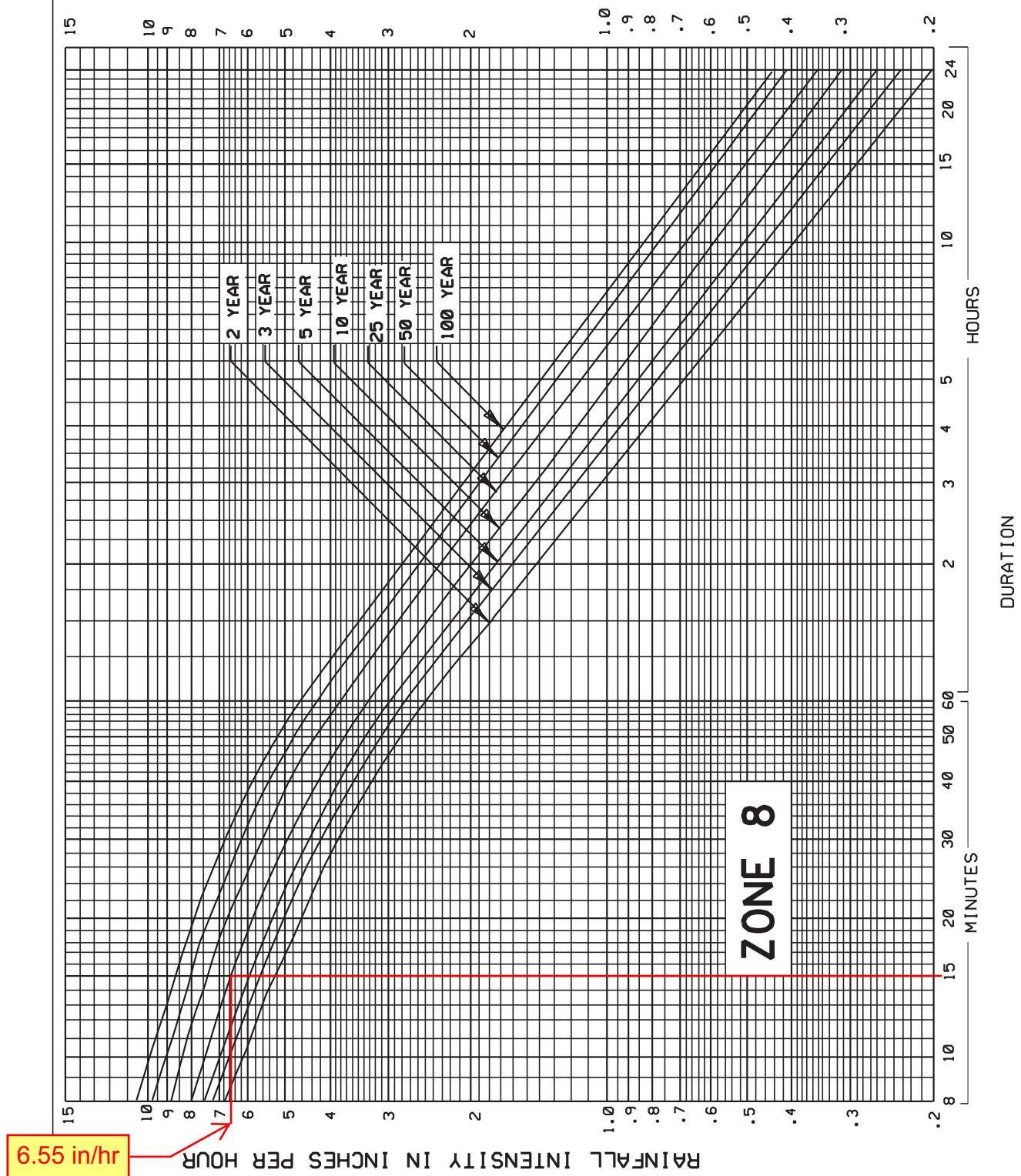
Results & Conclusion

The minimum diameter of the proposed side drain pipe was found to be 20.64 inches (pipe equivalency of 24 inch RCP/19x30 inch ERCP) to effectively handle the overland flow being routed through the existing Daniels Pkwy swale. There is an existing 19x30 inch ERCP (24 inch RCP) cross drain pipe that is located downstream East of the project in the existing Daniels Pkwy swale along with several other 14x23 inch ERCP (18 inch RCP) cross drain pipes. Based on this information and the calculations derived above, the proposed 29x45 ERCP (36 inch RCP equivalency) side drain pipe is more than adequate enough to maintain positive drainage in the post development conditions as it does today in the existing conditions.

Appendix A: Overland Flow Exhibit



Appendix B: Supplemental Calculation Data

Drainage Manual
IDF Curves

Chapter 6: Water Resources and Environmental

R_H = hydraulic radius (ft)

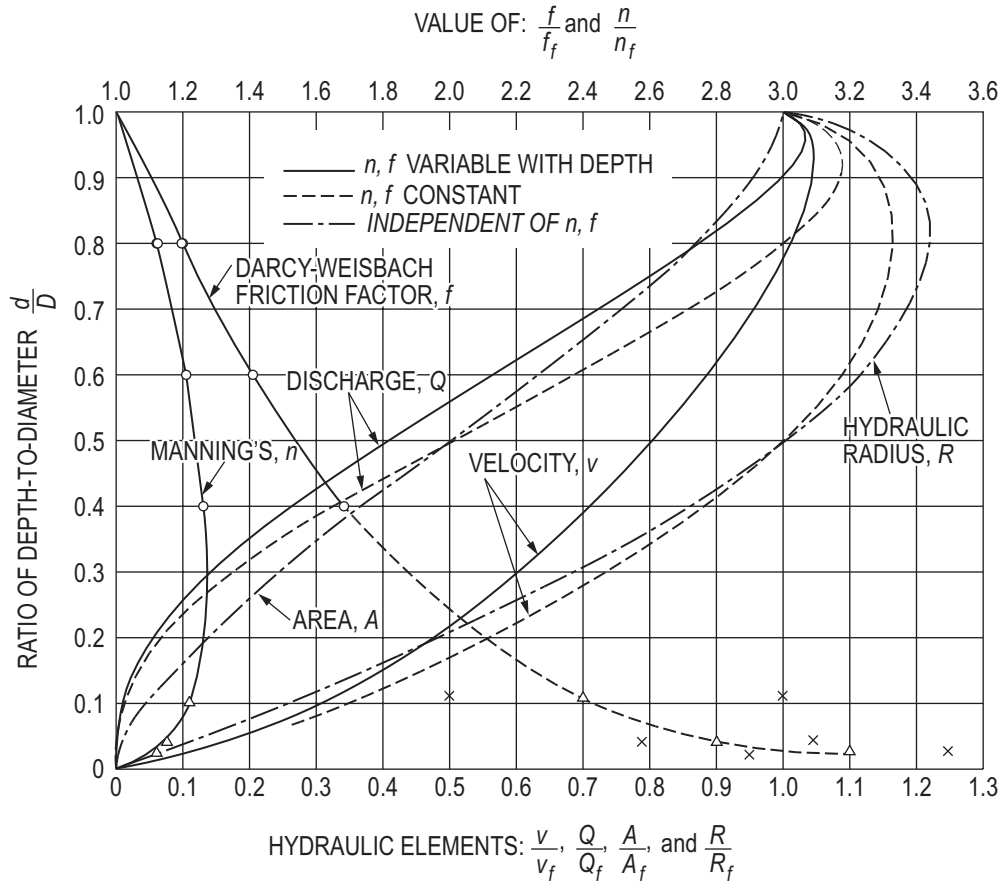
S = slope of hydraulic surface (ft/ft)

$$C = \frac{1}{n} R_H^{1/6}$$

where n = Manning's roughness coefficient

6.4.5.3 Flow in Circular Pipe

Hydraulic Elements Graph for Circular Pipe (Partial Flow Diagram)



Source: American Society of Civil Engineers. *Design and Construction of Sanitary and Storm Sewers*. Reston, VA: ASCE, 1970, pg. 87, fig. 24.

Minimum Diameter of Circular Pipe Under Full Flow Conditions

$$D = \left[\frac{C_0 Q n}{\sqrt{S}} \right]^{3/8}$$

where

Depth y is constant.

D = diameter of pipe (ft)

C_0 = 2.16 for USCS units

Q = flow (ft³/sec)

n = Manning's roughness coefficient

S = slope (ft/ft)