Date: March 26, 1992
ETM No. E91-126-2

TRAIL RIDGE LANDFILL - SIDESLOPE REVISONS

HYDRAULIC CALCULATIONS

TABLE OF CONTENTS

DETERMINATION OF REQUIRED HEADWATER DEPTH AT INTERCEPTOR BERM

ESTIMATION OF TIME OF CONCENTRATION (Refer to plans for flow path)

Distance (Ft)	Slope (%)	Method of Conveyance	Velocity (Ft/s)	Time (Min)
300	2.0	Overland (Fallow)	0.14	35.5*
380	2.0	Shallow Concentrated	2.3	2.8
240	1.3	Open Channel	2.0	2.0
			Time of Concentration	40.3 Min

* Calculated Using the Kinematic Wave Equation

INTENSITY (25 YR STORM)

$$I_{25} = \frac{145}{(Tc + 20)^{0.863}}$$

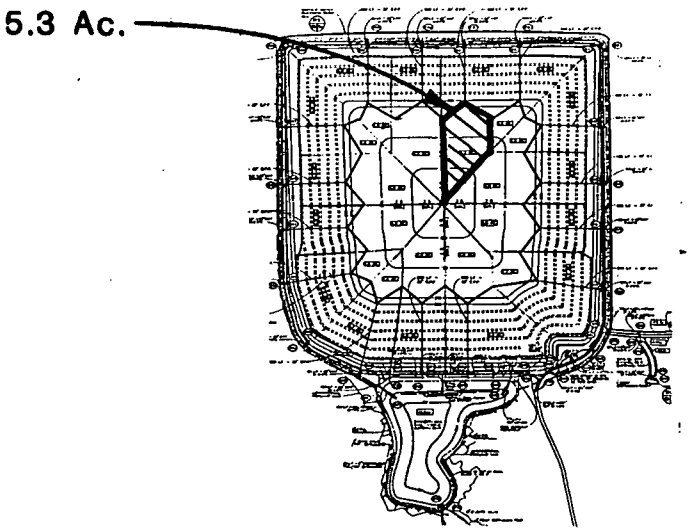
(Formula taken from a chart compiled by the U.S. Weather Bureau; Intensity, duration and frequency of rainfall for Jacksonville, Florida)

$$= \frac{145}{(40.3 + 20)^{0.863}}$$

$$= 4.2 \text{ in/hr}$$

AREA

The largest drainage area contributing runoff to the interceptor berm is shown below, and has an area of 5.3 acres.



DISCHARGE

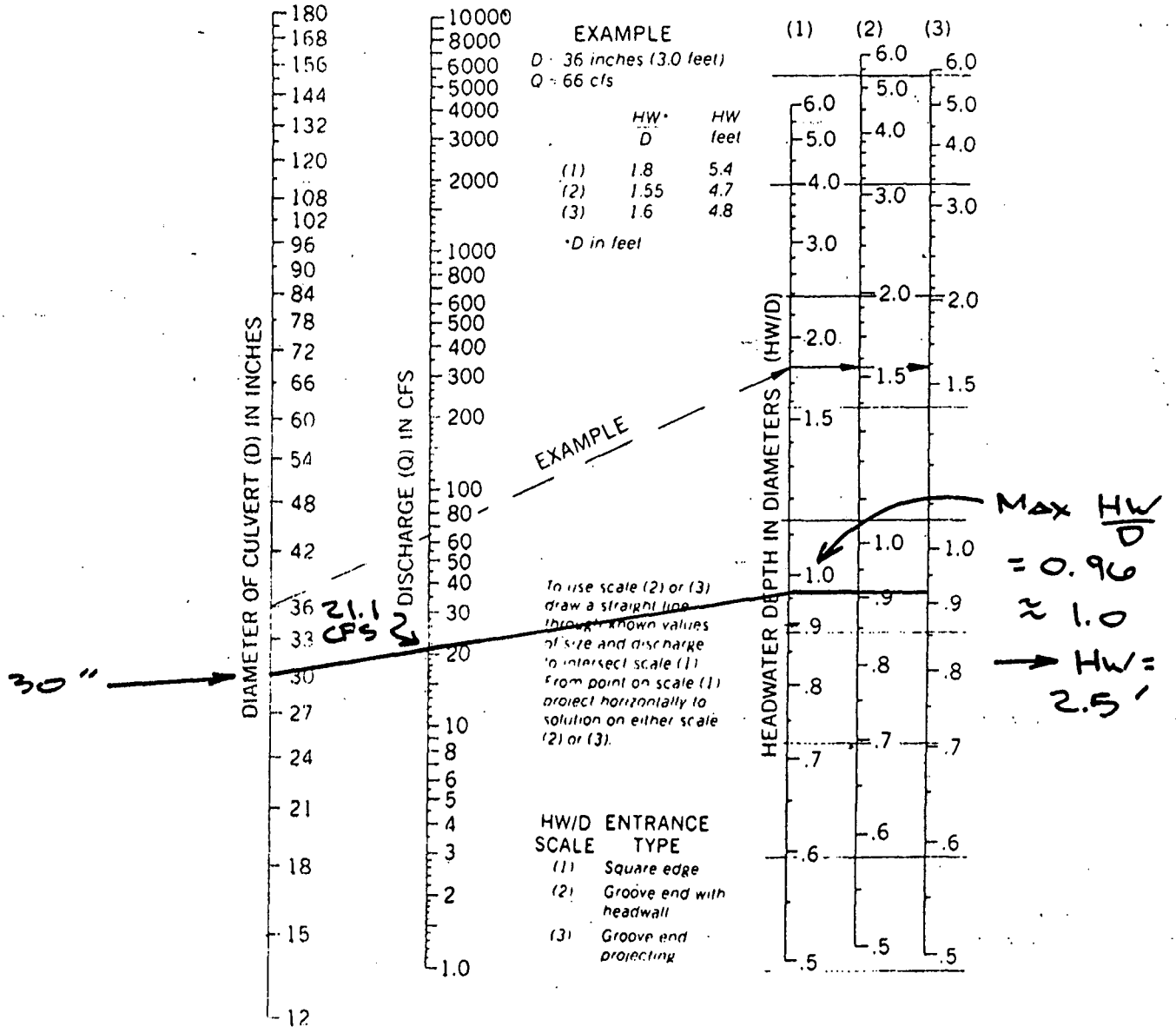
$$Q = CIA = 0.95\ (4.2)\ 5.3 = 21.1 \text{ cfs}$$

DETERMINATION OF HEADWATER DEPTH

Due to the substantial slope of the pipe (33.3%), the calculated normal depth of flow is less than the calculated critical depth of flow, and an inlet control condition exists. Using a nomograph from the Concrete Pipe Design Manual (attached), the computed discharge of 21.1 CFS, and the design pipe size of 30 inches, a required headwater depth of 2.5 feet was determined. This headwater depth will allow for one-half foot of freeboard below the top of the interceptor berm.

FIGURE 33

HEADWATER DEPTH FOR CIRCULAR CONCRETE PIPE CULVERTS WITH INLET CONTROL



BUREAU OF PUBLIC ROADS JAN 1963

HEADWATER SCALES 2&3
REVISED MAY 1964

DETERMINATION OF REQUIRED HEADWATER DEPTH IN TERRACE SWALES

ESTIMATION OF TIME OF CONCENTRATION (Refer to plans for flow path)

Distance (Ft)	Slope (%)	Method of Conveyance	Velocity (Ft/s)	Time (Min)
65	33.3	Overland (Fallow)	0.45	2.4
700	1.0	Open Channel	2.6	4.5
			Time of Concentration	6.9 Min

* Calculated Using the Kinematic Wave Equation

INTENSITY (25 YR STORM)

$$I_{25} = \frac{145}{(Tc + 20)^{0.863}}$$

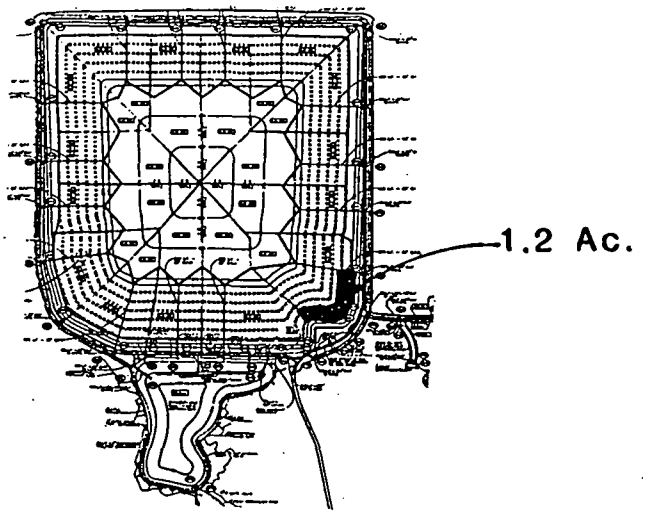
(Formula taken from a chart compiled by the U.S. Weather Bureau; Intensity, duration and frequency of rainfall for Jacksonville, Florida)

$$= \frac{145}{(6.9 + 20)^{0.863}}$$

$$= 8.5 \text{ in/hr}$$

AREA

The largest drainage area contributing runoff to a terrace swale is shown below, and has an area of 1.2 acres.



DISCHARGE

$Q = CIA = 0.95\ (8.5)\ 1.2 = 9.7$ cfs

DETERMINATION OF HEADWATER DEPTH

An inlet control condition will exist for the given criteria. Using a nomograph from the Concrete Pipe Design Manual (attached), the computed discharge of 9.7 CFS, and the design pipe size of 18 inches, a required headwater depth of 2.1 feet was determined. this headwater depth will allow for 0.4 feet of freeboard below the top of the terrace swale.

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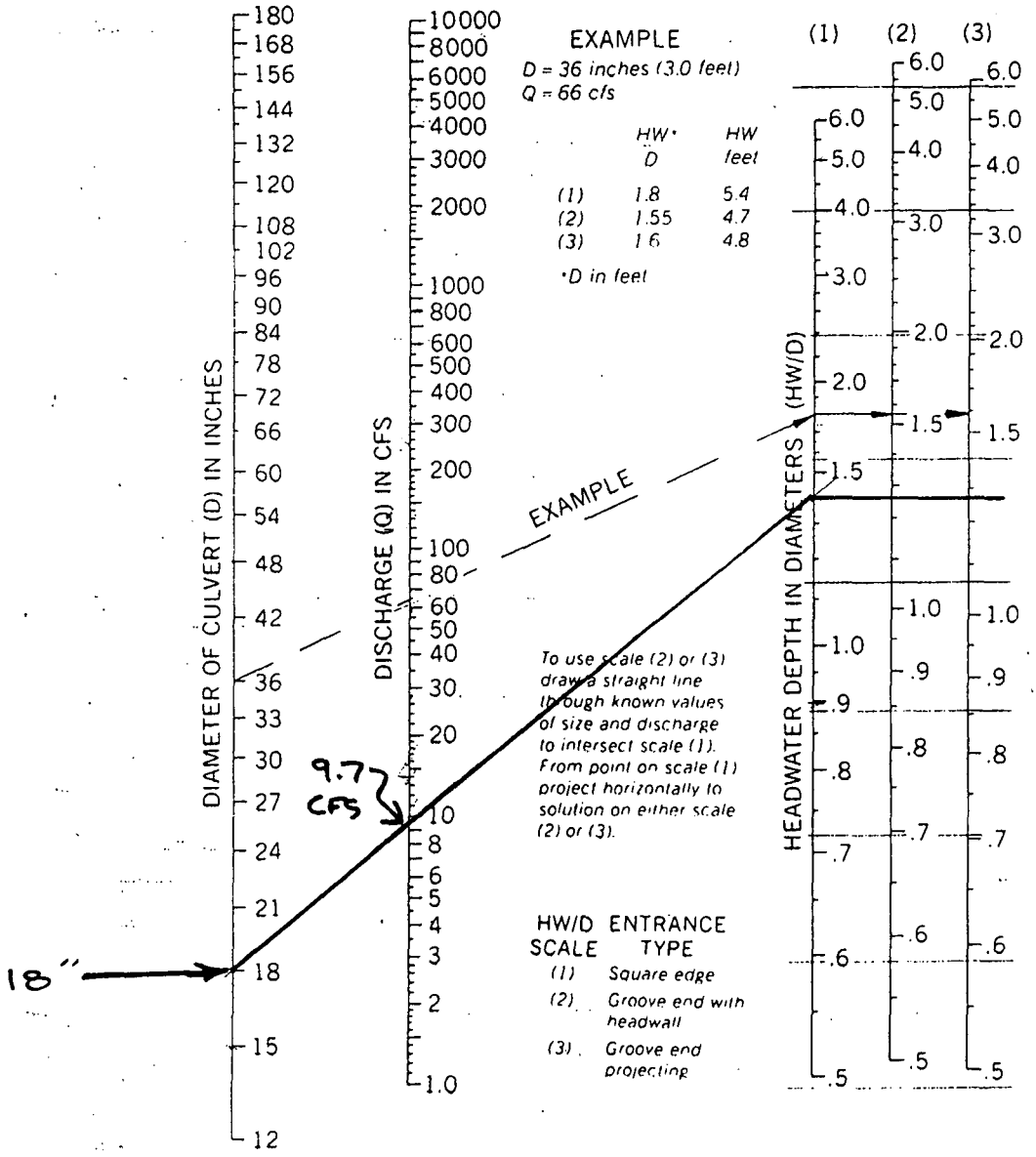
FIGURE 33

HEADWATER DEPTH FOR CIRCULAR CONCRETE PIPE CULVERTS WITH INLET CONTROL



Max HW/D = 1.4
→ HW = 2.1'

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER SCALES 2&3
REVISED MAY 1964

DETERMINATION OF DEPTH OF FLOW IN TERRACE SWALES

ESTIMATION OF TIME OF CONCENTRATION (Refer to plans for flow path)

Distance (Ft)	Slope (%)	Method of Conveyance	Velocity (Ft/s)	Time (Min)
65	33.3	Overland (Fallow)	0.45	2.4
			Time of Concentration	2.4 Min

* Calculated Using the Kinematic Wave Equation

INTENSITY (25 YR STORM)

$$I_{25} = \frac{145}{(Tc + 20)^{0.863}}$$

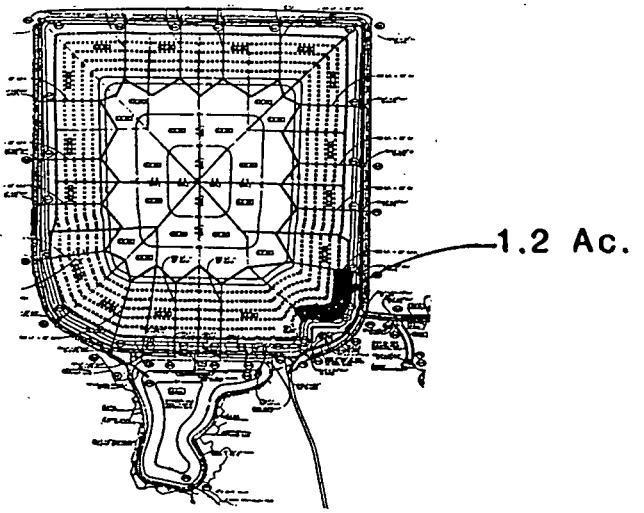
(Formula taken from a chart compiled by the U.S. Weather Bureau; Intensity, duration and frequency of rainfall for Jacksonville, Florida)

$$= \frac{145}{(2.4 + 20)^{0.863}}$$

$$= 9.9 \text{ in/hr}$$

AREA

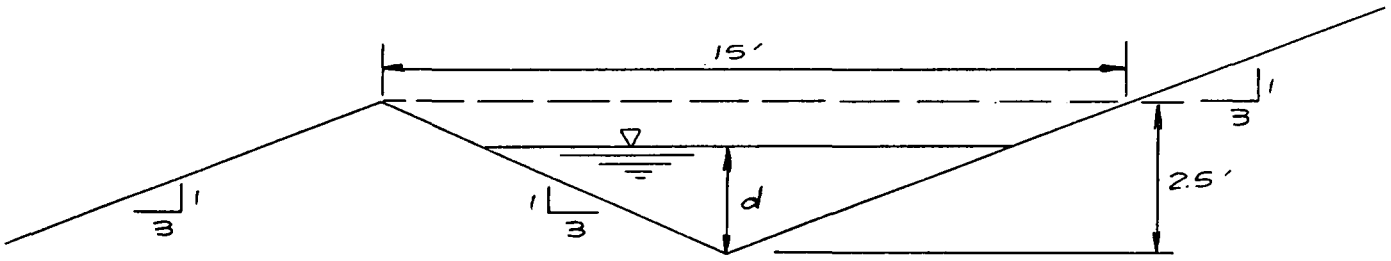
The largest drainage area contributing runoff to a terrace swale is shown below, and has an area of 1.2 acres.



DISCHARGE

$$Q = CIA = 0.95\ (9.9)\ 1.2 = 11.3 \text{ cfs}$$

CALCULATION OF DEPTH OF FLOW IN TERRACE SWALE (continued)



- Flow Area = $3d^2$
- Wetted Perimeter = $2d\ (10)^{1/2}$
- Hydraulic Radius = $\frac{3d^2}{2d(10)^{1/2}}$
- Manning's "n" for an earth channel = 0.04 (Average Condition)
- Slope: 0.01
- Q (from previous page) = 11.3 cfs
- Solving Mannings equation in the following form:

$$11.3 = \frac{1.486}{0.04}\left[\frac{3d^2}{2d(10)^{1/2}}\right]^{2/3}(0.01)^{1/2}(3d^2)$$

Yields d = 1.21 feet and
v = 2.6 ft/s

- The terrace swales have a depth of 2.5 feet, therefore 1.3 feet of freeboard will be available.