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Drainage Computations and Permit Application

NORTH HANCOCK ROAD (PHASE 1)

LAKE COUNTY, FLORIDA

(50126-1)

42-069-1391 ANG-ERP

BOARD OF COUNTY COMMISSIONERS · LAKE COUNTY, FLORIDA · Since 1887

Prepared For:

Lake County Public Works Department

123 N. Sinclair Avenue

Tavares, Florida 32778

Prepared By:

VANASSE HANGEN BRUSTLIN, INC.

135 W. Central Boulevard, Suite 1150

Orlando, Florida 32801

February 26, 1999

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3-4-99

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3-4-99

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EXECUTIVE SUMMARY

North Hancock Road is a new urban roadway being constructed from State Road (SR) 50 to County Road (CR) 50. The overall length of the project is approximately 2.0 miles, and it will be constructed in two phases. However, at this time only Phase 1 is proposed which extends from SR 50 to station 117+00. In addition, turn lanes will be added at the SR 50/North Hancock Road intersection. The roadway will consist of a four lane urban typical section with provisions to accommodate a section of the South Lake Rails to Trails Project. As a result of the proposed roadway construction, no wetlands will be impacted and no portion of the roadway will encroach into the 100-year floodplain.

The new roadway will provide a closed storm sewer drainage system with a dry retention pond for the entire length of this phase of the project. The pond is an existing Florida Department of Transportation (FDOT) pond that will be expanded with this project.

Since the project will be permitted through the SJRWMD under 40C-42, treatment volume requirements will be met. It should be noted a Florida Department of Transportation (FDOT) Drainage Connection Permit will also be required.

This project meets the requirements set forth by the SJRWMD, Lake County, and the Army Corps of Engineers.

INTRODUCTION

This report provides calculations and documentation to support the drainage design and a Environmental Resource Application (ERP) of Phase 1 of the North Hancock Road project. The proposed roadway is all new construction which will include the following: four 12 foot lanes, a 22 foot raised median, two 4 foot bike lanes, and curb and gutter with a closed storm sewer system. The improvements for Phase 1 of the project will extend from the beginning of the project at SR 50, or station 100+00, to station 117+00 with an overall length of this phase of approximately 0.3 miles. It should be noted that Phase 2, which extends from 117+00 to 140+64, and Phase 3, which extends from 140+64 to CR 50, will be constructed in the future for an additional length of 1.6 miles. The design of Phases 2 and 3 will be completed at a later date.

This project meets the requirements set forth by the SJRWMD, Lake County, and the Army Corps of Engineers. The ERP application is included in Appendix A.

PROJECT LOCATION

The project is located within Sections 21, 22, 27, and 28 Range 26 East, Township 22 South in Lake County, Florida. Figure 1 is a location map that shows the limits of the project. The project area, for Phase 1, within right-of-way, is approximately 5.9 acres. The total project area of Phases 1, 2 and 3, within right-of-way, is approximately 29.2 acres.

SOILS INFORMATION

The soils within the project limits are identified in the "Soil Survey of Lake County Area, Florida" as Astatula sands. These soils are nearly level to strongly sloping, excessively drained soils. Figure 2 is a copy of a portion of the soil survey which shows the limits of the project. A summary of the soils information is included in Appendix B.

A subsurface exploration was performed by Nodarse & Associates for the project. The exploration included a series of 18 auger borings along the centerline of the proposed roadway alignment, ranging in depth from 5 to 25 feet; 9 machine auger borings; and two falling head permeability tests. A copy of the report is included in Appendix B.

FLOODPLAIN INFORMATION

Figure 3 is a copy of a portion of Panel 120421 325B and 375B of the Flood Insurance Rate Map for Lake County, Florida, dated April 1, 1982. As shown in Figure 3, the proposed roadway does not encroach into any areas designated as 100-year floodplain. Therefore, there will be no impacts to the 100-year floodplain.

EXISTING DRAINAGE PATTERNS

From station 100+00 to 117+00 stormwater runoff drains from west to east towards an existing lake, north of SR 50. Stormwater runoff from SR 50 is collected in roadside and median swales and are conveyed to one of several FDOT dry retention ponds. North of North Hancock Road the stormwater runoff drains to Pond A.

PROPOSED DRAINAGE PATTERNS AND DESIGN

Phase 1 is comprised of one basin. Runoff from this basin is collected via curb and gutter and conveyed to Pond A, which is an existing FDOT pond. Since the project will be permitted through the SJRWMD under 40C-42, the treatment volume requirements will be met. The treatment volume will be handled in the dry retention ponds with a 72 hour recovery period.

Basin A runs from SR 50 or station 100+00 to the entrance of the college or station 122+00, however the project will only be constructed to 117+00 at this time. The project drainage area of Basin A is approximately 5.4 acres, and the total area that drains to Pond A is approximately 102 acres. The required treatment volume is approximately 8.5 acre-ft. The stormwater runoff from Basin A is treated and attenuated in an existing FDOT dry retention pond located approximately 800 feet west of the intersection of SR 50 and North Hancock Road.

DESIGN CRITERIA

Regulations which govern the stormwater management design for the North Hancock Road project include: CH. 40C-42 F.A.C., administered by the SJRWMD; NPDES, an EPA regulation administered jointly by EPA and FDEP; National Flood Insurance Program, administered by FEMA, and Lake County.

Lake County Criteria

A. Pavement Hydraulics Design Criteria

1. Spread: Stormwater flooding shall not exceed one-half of the travel lane for the 10-year 24-hour storm (arterial roadways). In addition, inlets shall be placed at all low points. *9.06.05.(K)(4) and VI.A (6).*
2. Interception Rates *VI.A.(7)*
   - Maximum for a single throat curb inlet = 5.0 cfs
   - Maximum for a sag inlet = 9.0 cfs.
   - Maximum bypass flow = 1.0 cfs
   - Off-site flows from impervious more than 0.5 acres shall be intercepted prior to the right-of-way.
3. Low Point Inlets: Interception of 100 percent of design flow without exceeding spread criteria. On arterial roadways three inlets shall be placed at low points; one inlet shall be placed on each side of the low point at 0.2 feet higher than the low point. *VI.A.(9)*

B. Storm Sewer Design Criteria

1. Hydraulic Gradient: For arterial roadways the hydraulic gradient shall be 1.0 foot below the gutter or edge of pavement for a 10-year storm. *9.060.05 (K)(5) and VI.A (4).*
2. Runoff Methodology: Rational method. *VI A.(5)*
3. Pipe size: 18 inch minimum. *VI B .(3)*
4. Pipe Grade: *VI B .(4)*
   - Minimum slope shall be the grade that produces a velocity of 2.0 feet per second (fps) when flowing full.
   - Maximum slope shall be the grade that yields a velocity of 10 fps.
5. Pipe Lengths: *VI B .(5)*
   - 18 inch pipe: 300 feet maximum
   - 24 to 36 inches: 400 feet maximum
   - 42 inches and larger: 500 feet maximum
6. Design Tailwater: The stage in the receiving water for the storm sewer design frequency. *VI.B.(6)*

7. Hydraulic Grade Line Computations: Include the design tailwater, energy losses associated with entrance and exit losses, friction losses, and structure losses. *VI.B. (7)*
8. Allowable Materials: In accordance with the FDOT Standards and Specifications. *VI.B. (8)*

C. Stormwater Ponds

1. Geometric Criteria: *V.E*
   - Maintenance Berm Width: 20 feet (with fencing)
     10 feet (without fencing)
   - Maximum Side Slopes: 4:1
   - Minimum Bottom Width: 4 feet
   - Erosion Protection: Side slopes and berms shall be sodded, and the bottom shall be grassed and mulched.
   - Freeboard: A minimum of 1.0 feet above the design peak stage.
2. Pollution Abatement: Greater of 0.5 inches over the drainage area or the first inch of rainfall. *II.A. (1)*
3. Runoff Volume: Storage shall be provided equal to the difference between the post- and pre-development runoff volumes for the 25-year 96-hour storm event. *II.C. (1)*
4. Hydrograph Methodology: Santa Barbara Unit Hydrograph or other acceptable methods. *V.A. (1).*
5. Design Storm: 25-year 96-hour. *V.B*
6. Pond Recovery:
   - Pollution abatement volume in 72 hours. *V.D. (1)*
   - 80% of the storage volume, in excess of the pollution abatement volume, shall recover within 10 days after the design storm. The remaining 20% shall recover within an additional 4 days. *V.D. (4)*
7. Groundwater Clearance: The bottom of the pond shall be a minimum of 3.0 feet above the seasonal high water elevation. *V.D. (1)*

St. Johns River Water Management District

1. Storm Frequency: 10-year and 25-year
2. Storm duration: 24 hours (discharge) and 96-hours (volume of runoff)
3. Runoff Volume: The post-development runoff volume shall be less than or equal to the pre-development runoff volume.
4. Peak Discharge: The post-development peak discharge shall be less than or equal to the pre-development peak discharge.

5. Pollution Abatement: Greater of 1.0 inch over the basin area or 1.75 inches over the impervious area.
6. Pond Recovery:
   - Pollution abatement volume in 72 hours.

NPDES Criteria

➤ Effective sediment and erosion controls be employed for construction sites which have 5 or more acres of exposed soils.

FEMA Criteria

➤ Since a regulatory floodway has not been established for the floodplains along North Hancock Road, encroachment in the 100-year floodplain shall cause no more than a 1.0 foot rise in the 100-year water surface elevation.

ANALYSIS

Hydrologic Analysis

The Rational Method was used to compute peak discharges. Times of concentration and runoff volumes were computed utilizing the methodology described in TR-55. Drainage areas were computed from the roadway plans. Runoff coefficients were determined utilizing Table 5-5 from the FDOT Drainage Manual, Volume 2A. Rainfall intensities were estimated from Figure 5-8 of the FDOT Drainage Manual, Volume 1. Copies of these tables and figures are included in Appendix B. Advanced Interconnected Pond Routing was used to develop hydrographs and compute peak stages of the pond. Hydrologic computations are included in Appendix D.

Hydraulic Analysis

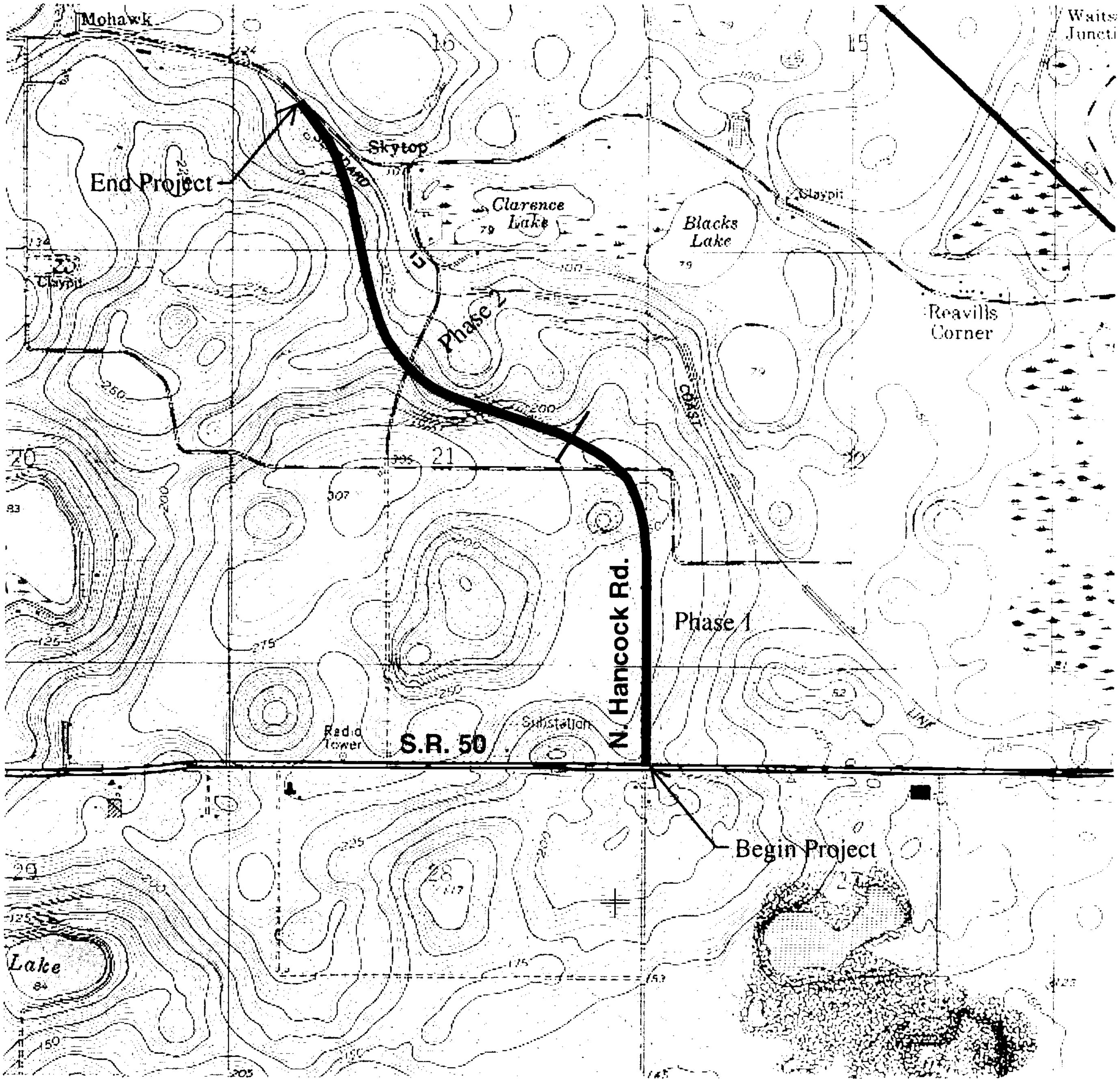
The hydraulic analysis of the storm sewer systems was performed utilizing the hydraulic program, Automated Storm Sewer Analysis and Design (ASAD), and the hydraulic analysis of the ditches was performed using Manning's Equation and the hydraulic program, FlowMaster. The hydraulic analyses are included in Appendix D.

Pond Recovery Analysis

The recovery analysis of the pond was performed utilizing the program, PONDS. The analysis was performed by Nodarse & Associates, Inc. and is included in Appendix B.

SUMMARY AND RESULTS

The storm sewer systems were designed so that the hydraulic grade line from the 10-year design storm is at least 1.0 foot below the gutter elevations of North Hancock Road. In addition, inlets were spaced so that the spread along the roadway is a maximum of one-half of the outside lane width. Pond A was expanded to accommodate the additional runoff and treatment volume from North Hancock Road. In addition, the treatment volume will recover within 24 hours and the 1000-year 10-day runoff volume will recover within 3.5 days.



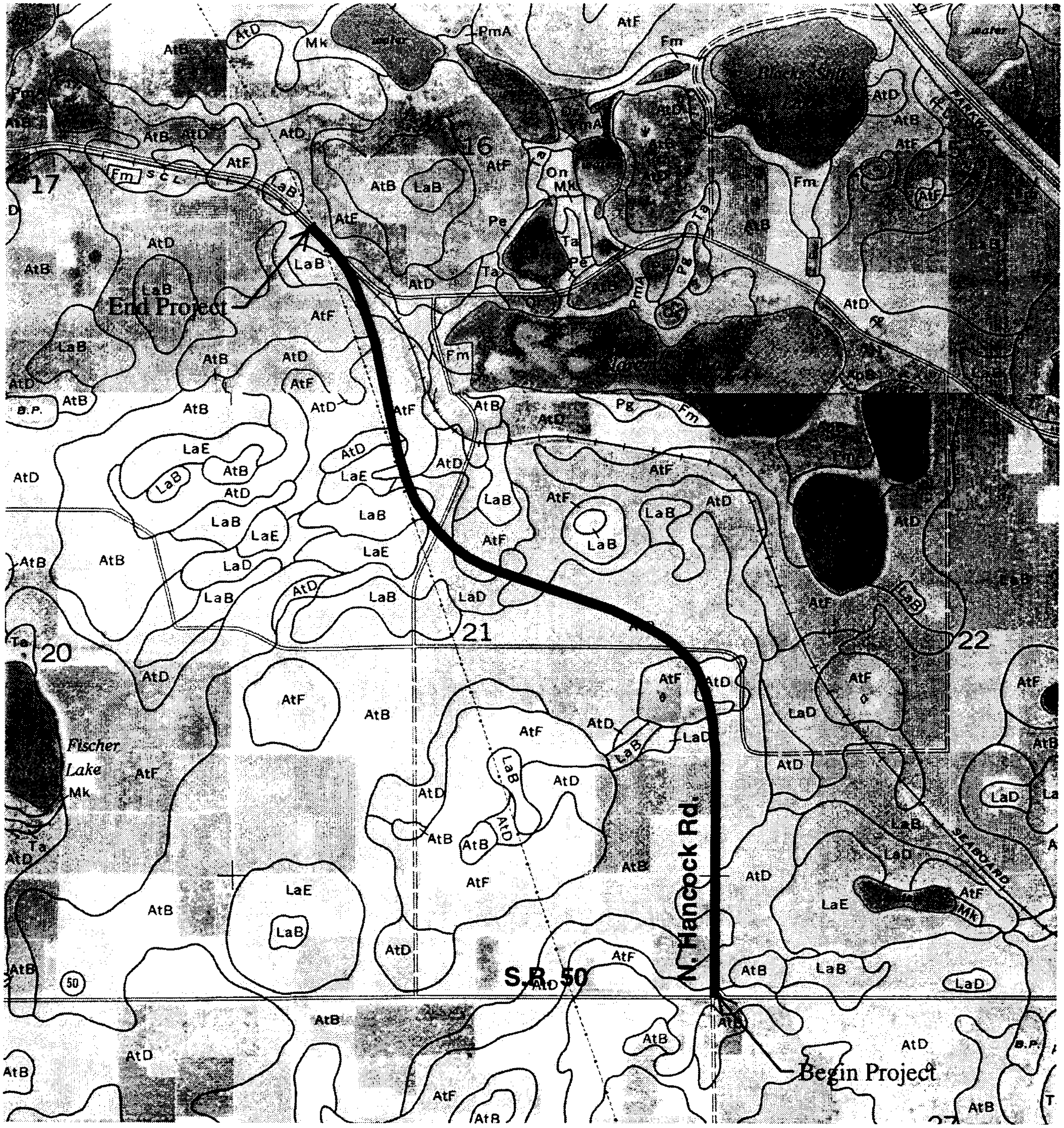
Source
USGS Quadrangle Map
Clermont East, Florida
Sections <u>16,21,22,27,28,</u> Township <u>22</u> South, Range <u>26</u> East
Scale: 1" = 2000'
1980

Vanasse Hangen Brustlin, Inc.

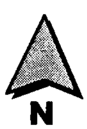
Drainage Area / Location Map

Figure 1

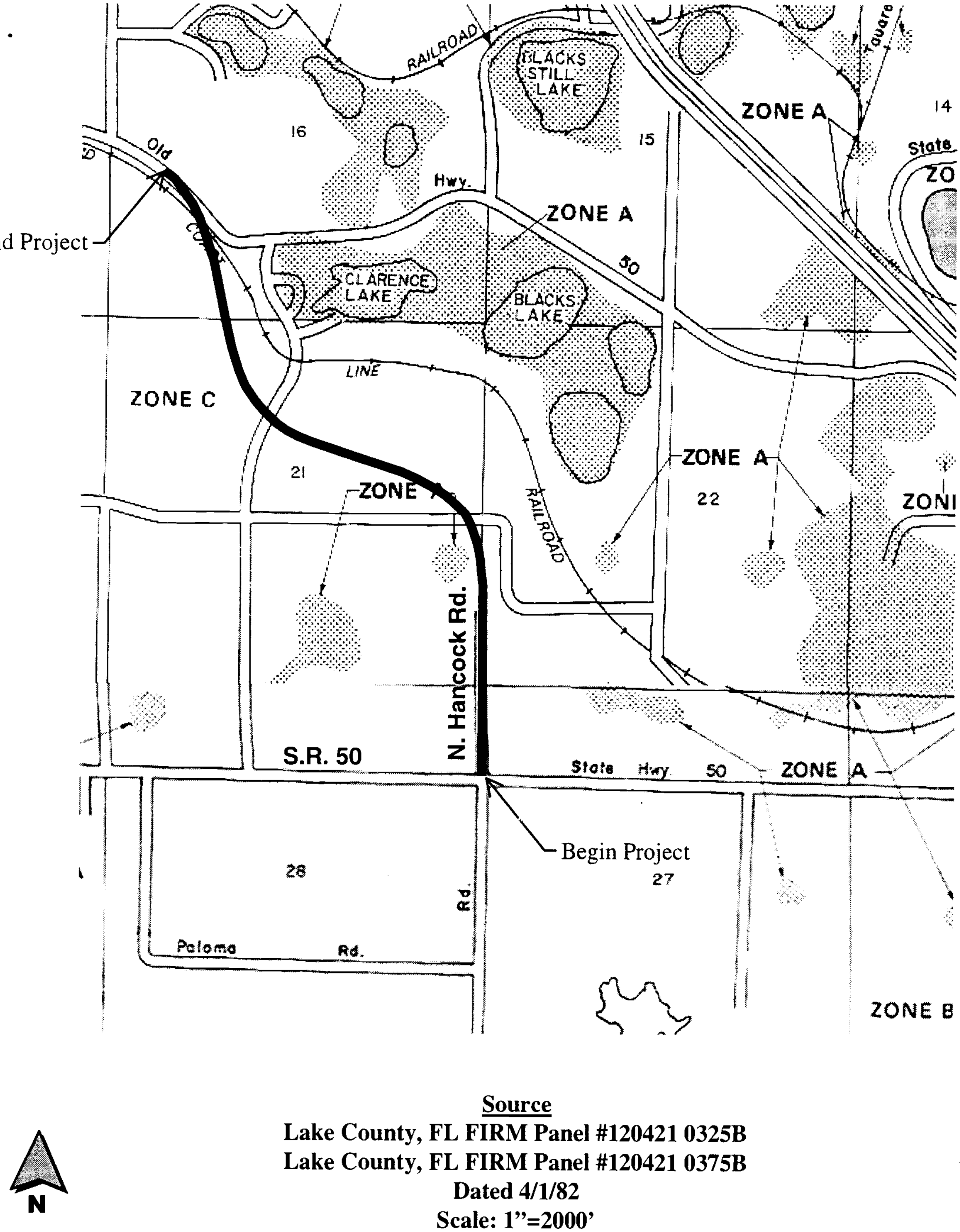
North Hancock Road



Source
Soils Survey of Lake County, FL
Sections 16,17,21,22,27,28, Township 22 South,
Range 26 East
Scale: 1:20000
1990



Soils Map Figure 2



Source
Lake County, FL FIRM Panel #120421 0325B
Lake County, FL FIRM Panel #120421 0375B
Dated 4/1/82
Scale: 1"=2000'

Flood Plain Map Figure 3

Table 1

Summary of Results
Basin A (Pond A)

Storm Event	Peak Stage (feet)	
	Existing	Proposed
25-Year 96 Hour 100-Year 240 Hour	179.61 184.05	178.77 183.98

Storm Event	Peak Inflow (ft^3/s)	
	Existing	Proposed
25-Year 96 Hour 100-Year 240 Hour	155.03 39.37	186.23 45.44

Section H

A. General site conditions

1. Recent aerial photo of project site. *Figure H.1 is an aerial photograph of the project site.*
2. Map(s) or applicable construction plan(s) showing:
   a. General location of project shown on USGS quad map(s), including points of discharge. *Figure 1 of the report is a general location map.*
   b. Project area boundary. *Figure 1 of the report shows the limits of the project.*
   c. Pre-development (existing) topography. *The existing profile of North Hancock Road is included in the attached plans.*
   d. Pre-development drainage patterns including points of discharge for existing site drainage and drainage basin boundaries. *A copy of the pre-development and offsite drainage map is included in Appendix D.*
   e. Off-site drainage area and flow patterns across project site. *A copy of the pre-development and offsite drainage map is included in Appendix D.*
   f. Location of existing drainage right-of-way easements on-site. *The rights of way for North Hancock Road are shown on the attached plans.*
   g. Location of private and public water supply wells on-site. *There are no private and public water supply wells on-site.*
   h. All wetlands on the site. *There are no wetlands within or adjacent to the project limits.*
3. SCS soils map and report and/or soil boring date for treatment facility locations. *Figure 2 of the report is a copy of the SCS soils map for the project area. Soils information is included in Appendix B.*
4. Water table data
   a. Date, location, and water table level of actual measurements (if collected) with estimated depth of antecedent rainfall during the previous one month period. *Water table elevations were collected and are included in the Soils Report in Appendix B. No groundwater was encountered in any of the soil borings.*
   b. Estimated normal dry and wet season water table elevation. *No groundwater was encountered in any of the soil borings. However, estimated wet season water table elevations are estimated to be deeper than 6 feet beneath the existing ground surface.*

B. Post-development Project Site Conditions

1. Describe or document the legal outfall for point discharges of treated stormwater to adjacent property. *Roadway stormwater runoff will be collected in a closed storm sewer system and conveyed to Pond A (modified existing dry stormwater retention pond along SR 50). Since the pond has no outfall below elevation 182.9, in general stormwater will infiltrate into the ground.*
2. Identify and describe all on-site and off-site stormwater management systems which discharge into or receive discharge from the proposed project.

Stormwater is conveyed to a modified existing stormwater retention pond along SR 50.

3. Provide the design tailwater elevation at all points of discharge. *Not applicable (discharge is through infiltration).*
4. **Include the following on construction drawings for the project site:**
   a. Project land use and land cover.
   b. Proposed construction, including erosion and sediment control plan for each phase. *Please see the attached construction plans. Please note this is a phased construction project.*
   c. Vegetative cover plan for all on-site and off-site earth surfaces disturbed by construction. *All disturbed surfaces will either be sodded or seeded and mulched. Please see the attached construction plans.*
   d. Legal reservations for access to the treatment system for maintenance and operation by future maintenance entities for subdivided projects. *Stormwater treatment will be provided in modified existing stormwater retention pond. The right-of-way of the pond is owned by the Florida Department of Transportation and the area of expansion will be deeded to the FDOT by Lake County.*
   e. Provide locations for the following on construction plans:
      (1) Drainage divide and area served by each hydraulically separate stormwater treatment system. *A drainage map for the project is included in the attached report.*
      (2) Septic tank or other proposed on-site wastewater treatment facility. *Not applicable.*
      (3) Wells and surface water withdrawals. *Not applicable.*
   f. Provide plans, elevations and/or profiles, and details for the following:
      (1) Roadway and parking pavements. *Please see the attached construction plans.*
      (2) Floor slabs, walkways and other paved surfaces. *All proposed sidewalks are shown on the attached construction plans.*
      (3) Earthwork grades for pervious landscaped areas. *Please see the attached construction plans.*
      (4) All stormwater treatment and drainage facilities. *Please see the attached construction plans.*
      (5) Show the following details for stormwater treatment systems construction plans.
         a) All treatment systems:
            (1) Show the elevations of normal wet season water table, design normal water elevation, and elevations for storage of the treatment volume. *Stormwater treatment will be provided in Pond A (modified existing retention pond along SR 50). According to the geotechnical report, included in Appendix A, the seasonal high water table is at least 6 feet below the existing ground surface. No groundwater was encountered in the soil borings.*
            (2) Details of oil and grease control mechanism, if required. *Not applicable.*

(3) Details of the outlet and overflow control structure. *Not applicable. In general discharge is through groundwater infiltration.*

(4) Details of treatment drawdown outlets. Show the design tailwater elevations on the outlet details. *Not applicable.*

(5) The minimum erosion and sediment control measures to be implemented during construction and all permanent control measures in post-development conditions. *Please see the attached construction plans.*

b) Retention/detention facilities:

(1) Plan contours and/or cross section details showing bottom contours and elevations, all design dimensions, side slopes, and top of bank elevations. *Please see the attached construction plans.*

(2) Grassing or planting of all treatment system earth surfaces. *Please see the attached construction plans.*

c) Exfiltration trench. *Not applicable.*

d) Underdrain and filter systems. *Not applicable.*

e) Wet detention systems. *Not applicable.*

f) Wetland stormwater management systems. *Not applicable.*

g) Karst Sensitive Areas. *Not applicable.*

6. **Design analysis/calculations**

a. Provide the rational method runoff coefficient, drainage area, and impervious area for each treatment system. *The runoff coefficient, drainage area, and impervious area calculations are included in Appendix D.*

b. Calculate treatment volume required for each separate system. *Treatment volume calculations are included in Appendix D.*

c. Provide stage-storage tabulations... *Included in Appendix D.*

d. Demonstrate 72-hour drawdown... *Included in Appendix D.*

e. Demonstrate that the function of the proposed treatment systems does not aversely affect the treatment performance of all other stormwater management systems which serve or are served by the proposed project. *Not applicable.*

f. Demonstrate no more than half the treatment volume is discharge within 48 to 60 hours... *Not applicable.*

g. Design analysis for sizing wet detention permanent pool volume. *Not applicable.*

h. Describe any additional management practices such as pretreatment, which will be used to enhance the water quality of the stormwater discharge. *Not applicable.*

i. Peak discharge and conveyance calculations for pre-development and post-development conditions as follows:

(1) Runoff characteristics, including area, runoff curve number or runoff coefficient, SCS hydrologic soil group, and time of concentration for

each drainage hydrologic unit. *Runoff coefficients and times of concentrations are included in Appendix D.*

(2) Design storms used including duration, frequency, and time distribution. *Included in Appendix D.*

(3) Runoff hydrographs for each drainage basin. *Included in Appendix D.*

(4) Stage-storage computations. *Included in Appendix D.*

(5) Stage-discharge computations. *Not applicable.*

(6) Flood routings through on-site conveyance and storage areas. *Included in Appendix D.*

(7) Water surface profiles and elevations in the primary surface water management system for the required design storm events. *Included in Appendix D.*

(8) Runoff peak rates and volumes discharges from the system for the design storm event. *Included in Appendix D.*

7. **Operation and maintenance** *North Hancock Road will be owned and operated by Lake County. The existing stormwater pond is owned and operated by the FDOT. The area of expansion will be deeded to the FDOT. Therefore, the FDOT will continue to operate and maintain the pond.*
8. **Alternative stormwater treatment** *Not applicable*
9. **Wekiva River Basin** *Not applicable*

[redacted]

Vanasse Hangen Brustlin, Inc.

Transportation
Land Development
Environmental Services

VHB

135 West Central Boulevard
Suite 1150
Orlando, Florida 32801-2436
407 839-4006
FAX 407 839-4008

Meeting Notes

Attendees:	Chou Fang, Ph.D., P.E., SJRWMD Paul Yeargain, P.E., VHB Joe Keezel, E.I., VHB	Date/Time:	Wednesday, December 9, 1998 @ 10:30 A.M.
		Project No.:	60633.00
Place:	SJRWMD	Re:	North Hancock Road
		Notes taken by:	PWY/JK

The following were discussed in the pre-application meeting for the N. Hancock Rd. stormwater permit:

- Since there will be no wetland or surface water impacts and the total area was less than 40 ac., a 40C-42 Stormwater Permit is required.
- Ruth Grady will be responsible for reviewing the permit.
- In regard to the outfall for segment 2, Dr. Fang asked if grading is proposed in the depression area. It is anticipated that no grading would be necessary. Dr. Fang suggested that we provide a boring location there to determine if there is an impermeable (clay) layer so as not to allow direct seepage into the aquifer.
- It must be shown that no additional flooding will occur (25yr-96-hr storm event) by using the depression as a stormwater management facility.
- Dr. Fang suggested that we research the FDOT pond on SR 50, which will be used as an outfall for segment 1. It may have been permitted through DEP. This information will need to be included in the application.
- The calculations for the additional volume that we are adding to the pond must be included.
- Recovery of treatment volume is 72 hours. Dr. Fang said he would get back with us on the policy for recovery when adding new volume to an existing pond.

We will submit the application for segments 1 & 2 and later submit a permit modification for segments 3 & 4. We will need to show consistency between projects and between the adjacent developments which accept stormwater from North Hancock Road.

cc: Fred Schneider, P.E., Lake County
Matthew Kalus, Lake County
J. Dwayne Darbonne, P.E., VHB
Correspondence File
Project File

SOIL LEGEND

The first capital letter is the initial one of the mapping unit name. The second capital letter, A, B, C, D, E, or F shows the class of slope. Symbols without a slope letter identify nearly level soils.

SYMBOL	NAME
AbB	Albany sand, 0 to 5 percent slopes
AbD	Albany sand, 5 to 12 percent slopes
Ac	Anclote fine sand
Am	Anclote and Myakka soils *
ApB	Apopka sand, 0 to 5 percent slopes
ApD	Apopka sand, 5 to 12 percent slopes
AsB	Astatula sand, 0 to 5 percent slopes
AtB	Astatula sand, dark surface, 0 to 5 percent slopes
AtD	Astatula sand, dark surface, 5 to 12 percent slopes
AtF	Astatula sand, dark surface, 12 to 40 percent slopes
Br	Brighton soils
Ca	Cassia sand
Em	Emeralda fine sand
Eu	Eureka loamy fine sand
Fd	Felda fine sand
Fe	Fellowship fine sandy loam, ponded
Fm	Fill land, loamy materials
Ib	Iberia sandy clay
Im	Iberia and Manatee soils
Is	Immokalee sand
LaB	Lake sand, 0 to 5 percent slopes
LaD	Lake sand, 5 to 12 percent slopes
LaE	Lake sand, 12 to 22 percent slopes
LuB	Lucy sand, 0 to 5 percent slopes
LuC	Lucy sand, 5 to 8 percent slopes
Ma	Manatee fine sand
Md	Montverde muck
Mk	Myakka sand
MpC	Myakka and Placid sands, 2 to 8 percent slopes *
Oc	Ocilla sand
Oe	Ocoee peat
Oh	Oklawaha muck
On	Ona fine sand
Or	Orlando fine sand
PaB	Paola sand, 0 to 5 percent slopes
PaD	Paola sand, 5 to 12 percent slopes
Pd	Pelham sand
Pe	Placid sand
Pg	Placid sand, slightly wet
PmA	Placid and Myakka sands, 0 to 2 percent slopes *
Pn	Pomello sand
Po	Pompano sand, acid
Sc	St. Lucie sand
Sw	Swamp *
Ta	Tavares sand
Te	Tavares sand, white subsurface variant
Va	Vaucluse sand
Wa	Wabasso sand
Wc	Wauchula sand

* The composition of these units is more variable than that of the other units in the county but has been controlled well enough to interpret for the expected use of the soils.

V

Highways and
Divided ..
Good moto
Poor moto
Trail .....

Highway mark
National In
U. S. ....
State or co

Railroads
Single trac
Multiple tr
Abandoned

Bridges and c
Road ....
Trail .....
Railroad .
Ferry ....
Ford .....
Grade ...
R. R. over
R. R. unde

Buildings ..
School ..
Church ..

Mine and qu
Gravel pit ..
Power line
Pipeline ....
Cemetery ..
Dams .....
Levee .....
Tanks .....
Well, oil or g
Forest fire or
Windmill ...
Located obje

TABLE 8.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soil for referring to other series that appear in the first column

Soil series and map symbols	Depth to seasonally high water table [1]	Flood hazard [2]	Depth from surface	Classification USDA	Classification Unified	Classification AASHO
	In.		*In.*			
Albany: AbB, AbD	15–40	None	0–52	Sand	SP, SP–SM	A–3, A–2–4
			52–85	Sandy clay loam	SC	A–2–6
*Anclote: Ac, Am. For Myakka part of Am, see Myakka series.	0–10	Every year for more than 6 months.	0–46	Fine sand	SP–SM	A–3, A–2–4
			46–82	Loamy fine sand	SM, SM–SC	A–2–4, A–4
Apopka: ApB, ApD	>84	None	0–55	Sand	SP, SP–SM	A–3, A–2–4
			55–84	Sandy clay loam	SC, SM	A–2–6, A–2–4, A–4
Astatula: AsB, AtB, AtD, AtF	>120	None	0–86	Sand	SP, SP–SM	A–3
Brighton: Br	0	Flooded most of year.	0–63	Peat	Pt	Organic
			63–75	Coarse sand	SP, SP–SM	A–3, A–2–4
Cassia: Ca	10–40	None	0–25	Sand	SP, SP–SM	A–3
			25–37	Sand	SM, SP–SM	A–2–4, A–3
			37–80	Sand	SP, SP–SM	A–3
Emeralda: Em	0	Every year for more than 6 months.	0–11	Fine sand	SP–SM, SM	A–2, A–3
			11–66	Sandy clay	CH, SC	A–6, A–7
Eureka: Eu	0–10	Every year for 1 to 2 months.	0–8	Loamy fine sand	SM	A–2–4
			8–90	Heavy sandy clay and clay.	CH	A–7
Felda: Fd	0–10	Every year for more than 6 months.	0–25	Fine sand	SP	A–3
			25–38	Fine sandy loam	SM–SC, SC	A–2–4, A–2–6
			38–56	Sandy clay loam	SC	A–4, A–6
			56–60	Clay	CH	A–7
Fellowship: Fe	0	Every year for more than 6 months.	0–6	Fine sandy loam	SM–SC, SM	A–4, A–2–4
			6–62	Sandy clay loam to clay.	CH	A–7–6
Fill land, loamy materials: Fm. No valid estimates can be made.						
*Iberia: Ib, Im. For Manatee part of Im, see Manatee series.	0	Every year for more than 6 months.	0–54	Sandy clay	CH	A–7–6
			54–60	Marl and sandy clay.	CH, SC	A–7–6, A–6
Immokalee: Is	0–10	Every year for a few days.	0–38	Sand	SP, SP–SM	A–3
			38–56	Sand	SP–SM, SM	A–2–4, A–3
			56–68	Sand	SP, SP–SM	A–3
Lake: LaB, LaD, LaE	>120	None	0–98	Sand	SP, SP–SM	A–3, A–2–4
Lucy: LuB, LuC	>120	None	0–32	Sand	SP, SP–SM	A–3, A–2–4
			32–75	Sandy clay loam	SC	A–2–6, A–7
Manatee: Ma	0	Every year for more than 6 months.	0–10	Fine sand	SP, SP–SM	A–3, A–2–4
			10–60	Loamy fine sand to fine sandy loam.	SM, SM–SC	A–2–4, A–4
Montverde: Md	0	Every year for more than 6 months.	0–11	Muck	Pt	Organic
			11–80	Peat	Pt	Organic

significant in engineering

uch mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions ..s table. Symbol > means greater than, < means less than]

Percentage less than 3 inches passing sieve [3]—				Permeability	Available water capacity	Reaction	Shrink-swell potential [4]
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				In./hr.	*In./in. of soil*	*pH*	
100	95–100	90–100	3–12	6. 0–20. 0	<0. 05	4. 5–5. 5	Low.
100	95–100	85–99	15–35	0. 63–2. 0	0. 10–0. 15	4. 5–5. 5	Low to moderate.
100	100	70–100	5–12	6. 3–20. 0	0. 10–0. 15	6. 1–8. 4	Low.
100	100	70–100	25–40	6. 3–20. 0	0. 10–0. 15	6. 1–8. 4	Low.
100	100	80–95	3–12	6. 3–20. 0	<0. 05	4. 5–6. 0	Low.
95–100	90–100	60–90	20–40	0. 63–6. 3	0. 13–0. 17	4. 5–6. 0	Low to moderate.
100	100	90–99	2–7	>20. 0	0. 02–0. 05	4. 5–6. 0	Low.
----------	----------	----------	----------	6. 3–20. 0	0. 45–0. 50	<4. 5–5. 0	High.
100	90–95	25–50	2–12	6. 3–20. 0	<0. 05	<4. 5–5. 0	Low.
100	100	95–100	1–7	>20. 0	0. 02–0. 05	4. 5–6. 0	Low.
100	100	70–100	5–20	2. 0–6. 3	0. 10–0. 15	4. 5–6. 0	Low.
100	100	95–100	2–10	6. 3–20. 0	0. 02–0. 05	4. 5–6. 0	Low.
100	100	90–99	10–25	6. 3–20. 0	0. 10–0. 15	5. 1–6. 5	Low.
100	100	90–99	45–80	0. 06–0. 20	0. 15–0. 20	6. 1–8. 4	High.
100	100	90–99	13–25	6. 3–20. 0	0. 05–0. 10	4. 5–5. 5	Low.
100	100	90–99	51–80	<0. 06	0. 15–0. 20	4. 5–5. 5	High.
100	100	90–99	2–5	6. 3–20. 0	0. 02–0. 05	5. 1–6. 5	Low.
100	100	90–99	23–35	0. 63–2. 0	0. 10–0. 15	6. 6–7. 8	Moderate.
100	95–100	85–99	36–50	2. 0–6. 3	0. 10–0. 15	6. 6–7. 8	Moderate.
90–100	85–90	70–90	51–80	0. 06–0. 20	0. 10–0. 15	7. 4–8. 4	High.
100	100	90–100	25–40	0. 63–2. 0	0. 15–0. 20	4. 5–5. 5	Low.
100	95–100	90–100	51–80	<0. 06	0. 10–0. 15	4. 5–8. 4	High.
100	100	90–100	51–80	<0. 06	0. 10–0. 15	5. 6–8. 4	High.
100	100	80–100	36–70	<0. 06	0. 10–0. 15	7. 4–8. 4	High.
100	100	80–100	2–10	6. 3–20. 0	0. 02–0. 05	4. 5–5. 5	Low.
100	100	80–100	5–20	0. 63–2. 0	0. 10–0. 15	4. 5–5. 5	Low.
100	100	80–100	2–10	6. 3–20. 0	0. 02–0. 05	4. 5–5. 5	Low.
100	100	85–99	3–12	>20. 0	0. 03–0. 05	4. 5–5. 5	Low.
100	100	85–99	3–12	6. 3–20. 0	0. 05–0. 10	4. 5–6. 0	Low.
100	100	65–100	20–45	0. 63–2. 0	0. 10–0. 15	4. 5–6. 0	Low.
100	100	90–100	3–12	2. 0–6. 3	0. 10–0. 15	6. 1–7. 3	Low.
100	100	90–100	25–40	0. 63–2. 0	0. 15–0. 20	6. 1–7. 8	Moderate.
----------	----------	----------	----------	2. 0–6. 3	0. 20–0. 25	5. 6–8. 4	High.
----------	----------	----------	----------	6. 3–20. 0	0. 45–0. 50	5. 6–8. 4	High.

TABLE 8.—*Estimated soil properti*

Soil series and map symbols	Depth to seasonally high water table [1]	Flood hazard [2]	Depth from surface	Classification		
				USDA	Unified	AASHO
	In.		*In.*			
Wabasso: Wa	0–10	Every year for a few days.	0–18	Sand	SP, SP-SM	A-3
			18–28	Sand	SP-SM, SM	A-2-4, A-3
			28–68	Sandy clay loam	SC	A-4, A-6, A-2-4, A-2-6
Wauchula: Wc	0–10	Every year for a few days.	0–22	Sand	SP, SP-SM	A-3, A-2-4
			22–38	Sand	SP-SM	A-2-4, A-3
			38–80	Sandy loam to sandy clay loam.	SC	A-2-6, A-6

[1] Level expected at some period during the normal wet season.
[2] Water standing or flowing above the surface of the soil under natural conditions without artificial drainage.

TABLE 9.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that

Soil series and map symbols	Suitability as source for—		Soil features adversely affecting—
	Topsoil	Road fill	Sanitary land fill [1]
Albany: AbB, AbD	Poor: sand texture	Good: high water table	High water table
*Anclote: Ac, Am. For Myakka part of Am, refer to Myakka series.	Poor: sand texture	Poor: high water table	High water table
Apopka: ApB, ApD	Poor: sand texture	Good	None
Astatula: AsB, AtB	Poor: sand texture	Good	None
AtD	Poor: sand texture	Good	None
AtF	Poor: sand texture	Good	None
Brighton: Br	Poor: high water table	Very poor: traffic-supporting capacity; high water table.	High water table; flooding

See footnotes at end of table.

significant in engineering—Continued

Percentage less than 3 inches passing sieve [3]— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction	Shrink-swell potential [4]
				In./hr.	*In./in. of soil*	*pH*	
100	100	95–100	2–10	6. 3–20. 0	0. 02–0. 05	4. 5–5. 5	Low.
100	100	95–100	5–20	0. 63–2. 0	0. 10–0 15	5. 1–7. 3	Moderate.
100	100	95–100	20–40	0. 63–2. 0	0. 10–0. 15	5. 6–8. 4	Moderate.
100	100	90–100	2–12	6. 3–20. 0	0. 02–0. 05	4. 5–5. 5	Low.
100	100	90–100	5–12	0. 63–2. 0	0. 10–0. 15	4. 5–5. 5	Low.
100	95–100	85–100	20–40	0. 63–2. 0	0. 10–0. 15	4. 5–5. 5	Moderate.

[3] The estimated percentage coarse fraction greater than 3 inches is 0 in all soils but Felda fine sand. This soil has an estimated 5 percent coarse fraction greater than 3 inches at depths of 38 to 56 inches.
[4] The mucks and peats have a high potential subsidence rate.

interpretations

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions appear in the first column of this table]

Soil features adversely affecting—Continued: Excavated ponds	Drainage	Sprinkler irrigation	Subsurface irrigation	Ditches and canals
Rapid permeability; seasonal low water table; loose sands; unstable side slopes.	Loose erodible sands	Very low available water capacity in surface and subsurface layers.	Rapid permeability; depth to water table.	Loose erodible sands; unstable side slopes.
Loose sands; unstable side slopes.	Loose sand; some areas have no outlets.	Flooding	Flooding	Loose erodible sands; unstable side slopes.
Depth to water table	Well drained	Very low available water capacity.	Rapid permeability in upper layers; depth to water table.	Loose erodible sands; unstable side slopes.
Very rapid permeability; depth to water table.	Excessively drained	Very low available water capacity.	Very rapid permeability; depth to water table.	Loose erodible sands; unstable side slopes.
Very rapid permeability; depth to water table.	Excessively drained	Very low available water capacity; slope.	Very rapid permeability; depth to water table; slope.	Slope; loose erodible sands; unstable side slopes.
Very rapid permeability; depth to water table.	Excessively drained	Very low available water capacity.	Very rapid permeability; depth to water table.	Slope; loose erodible sands; unstable side slopes.
Flooding	Inadequate outlets; rapid oxidation.	High water table; flooding.	Flooding	High organic-matter content.

Nodarse
& Associates

**Report of Subsurface Exploration and Geotechnical Engineering Evaluation
North Hancock Road
Lake County, Florida**

Geotechnical, Environmental Geotechnics & Material Engineers

NODARSE & ASSOCIATES, INC.

Geotechnical, Environmental Geotechnics & Materials Engineering

January 31, 1999
Project No. W98-G-032

Mr. J. Dwayne Darbonne, P.E.
Vanasse Hangen Brustlin, Inc.
135 West Central Boulevard, Suite 1150
Orlando, Florida 32801-2436

RE: Report of Subsurface Exploration and Geotechnical Engineering Evaluation North Hancock Road Lake County, Florida

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Dear Mr. Darbonne:

Nodarse & Associates, Inc. (N&A) is pleased to submit the following report of subsurface exploration and geotechnical engineering evaluation for the above-referenced project. This exploration was performed in general accordance with the scope in our contract dated June 2, 1998 to provide geotechnical services for the engineering design of North Hancock Road. The purpose of this exploration was to obtain geotechnical engineering data to aid in design of the above-referenced site.

SITE AND PROJECT DESCRIPTION

We understand North Hancock Road is to be improved and extended from approximately State Road 50 to County Road 50. The project is two miles long and begins at Station 99+95.53 at the intersection of State Road 50 and extends north to Station 206+00 where it intersects County Road 50. The subject roadway is located within Sections 16, 21, 22, 27 and 28, Township 22 South, Range 26 East in Lake County, Florida. Three (3) stormwater retention ponds are to be utilized for the runoff from North Hancock Road. One (1) pond is an existing Florida Department of Transportation (FDOT) pond, one (1) is an existing depressional area and one (1) will be a new excavated pond. A vicinity map showing the project location is included as **Figure 1** in the **Appendix**. In addition, two (2) tunnels are to be constructed along the project to allow bike trails to cross safely.

For this project, the USDA Soil Conservation Service soil survey report for Lake County was reviewed. The soils on the project are shown below. Also included is the depth of the estimated seasonal high groundwater level for the site in its natural condition.

SCS Map Symbol	Conversion Symbol	Map Unit Name	Lake County Soil Survey Estimated Seasonal High Groundwater Level
AtB	13	Candler sand, 0 to 5 percent slopes	Greater Than 6.0'
AtD	15	Candler sand, 5 to 12 percent slopes	Greater Than 6.0'
AtF	17	Candler sand, 12 to 25 percent slopes	Greater Than 6.0'
LaB	28	Lake sand, 0 to 5 percent slopes	Greater Than 6.0'
LaD	30	Lake sand, 5 to 12 percent slopes	Greater Than 6.0'

SUBSURFACE EXPLORATION

Our field exploration consisted of performing a series of eighteen (18) auger borings along the centerline of the proposed roadway alignment ranging from in depth from 5 to 25 feet below the existing road surface. These depths were chosen based on the plan/profile sheets supplied by your firm. In addition, nine (9) machine auger borings (three [3] in each pond location) were performed to a depth of 25 feet. Four (4) 40 foot deep Standard Penetration Test (SPT) borings were also performed (one [1] at each end) in the proposed tunnel areas. The approximate locations for the tunnel and the pond borings are shown on **Figure 2** in the **Appendix**. The approximate stations and offset for the roadway borings are shown on **Figure 3** in the **Appendix**.

Standard Penetration Tests were performed continuously in the SPT borings to a depth of 10 feet and at 5 foot depth intervals thereafter. Each sample was removed from the sampler in the field and was examined and visually classified by an engineering technician. Representative portions of each sample were packaged and sealed for transportation to our laboratory for further examination and visual classification. Water levels, if encountered, were measured in the boreholes at the time of our field exploration to evaluate the depth to groundwater.

The machine auger borings were performed by hydraulically turning a 4 inch diameter continuous flight auger into the ground in 5 foot increments. Additional flights are added until the desired termination depth was achieved. The auger is then extracted without further rotation and representative soil samples are retrieved from the auger. Samples are visually classified in the field and are then packaged and returned to our soils laboratory for further classification and testing.

The hand auger boring procedure consisted of manually turning a 3 inch diameter, 6 inch long sampler into the soil until it is full. The sampler was then retrieved and the soils in the sampler were visually examined and classified. The procedure was repeated until the desired termination depth was achieved. Samples of representative strata were obtained for further visual examination and classification in our laboratory. The borings were then backfilled with soil cuttings.

GENERAL SUBSURFACE CONDITIONS

The soil and groundwater conditions encountered in the auger borings are shown on **Figures 3, 4 and 5** in the **Appendix**. Descriptions of the soils encountered in the borings are accompanied by the American Association of State Highway and Transportation Officials (AASHTO) symbol.

Generally, the borings encountered orangish-brown to brown fine sand to slightly silty fine sand (A-3) (Stratum 1) to their termination depths. Several of the borings also encountered an orangish-brown to orange fine sand (A-2-4) (Stratum 2) at various elevations. One exception was noted to this generalized boring profile. This exception was observed in the form of reddish-orange silty fine sand, trace clay (A-2-4) (Stratum 3). This material was found in existing roadway areas and is imported roadway/stabilizing material.

SPT "N" values, the distance required by 140 pound hammer required to drive a split spoon sampler 12 inches, observed in the tunnel borings indicate the soils are initially loose near the ground surface and become more dense with depth.

Groundwater was not encountered during our field exploration to depths of 40 feet beneath the existing ground surface. Where not encountered, groundwater should not be a concern for roadway design.

LABORATORY TESTING

Laboratory testing for this project included seven (7) single sieve grain size analyses. All tests results are shown next to the boring profiles on **Figures 3, 4 and 5** in the **Appendix**. The tests are performed in accordance with the appropriate American Society for Testing Materials (ASTM) procedures.

LABORATORY PERMEABILITY TESTING

Two (2) falling head permeability tests were performed on boring samples obtained from the proposed pond areas. The resulting vertical permeability rates were measured to be around 61 per day. Although a vertical permeability rate of 61 feet per day was recorded, we recommend limiting using vertical and horizontal permeability rates for design to 30 and 40 feet per day, respectively. Compaction effects of construction and mowing equipment, and siltation of the pond bottom, can reduce the effective permeability rate. Results for each location are shown next to the boring profiles on **Figure 5** in the **Appendix.**

CONCLUSIONS AND RECOMMENDATIONS

General: The following conclusions and recommendations are based on the project characteristics previously described, the data obtained in our field exploration and our experience with similar subsurface conditions and construction types. If subsurface conditions different from those disclosed by the borings are encountered during construction, we should be notified immediately so that we might review the following recommendations in light of such changes.

Roadway Construction: Based on the results of this exploration, the soil and groundwater conditions appear suitable for conventional construction according to the applicable Lake County requirements and the FDOT Roadway and Traffic Design Standards. Strata 1 and 2 encountered for this study can be treated as select (S) material and should generally be suitable for use as fill soils. The silty fine sand (A-2-4) material included in Stratum 2 may be sensitive to moisture content changes. Stratum 3 is part of several clay roads that cross the proposed roadway alignment. This material can be classified as select (S) but may be very difficult to handle if it becomes wet due to its clay content. However, if moisture content is carefully controlled and the material is thoroughly pulverized and mixed with subgrade soils, it can be used as a stabilizing material.

During our subsurface exploration, no near surface muck material was encountered. However, if muck is encountered within the roadway embankment area during construction, it should be removed in accordance with Index 500 of the FDOT Roadway and Traffic Design Standards.

The Lake County soil survey estimates seasonal high groundwater depth for the site in its natural state to be deeper than 6 feet beneath the existing ground surface. Therefore, based on our field exploration and the soil survey, groundwater does not appear to be a concern in roadway design. Pavement construction should be according to any Lake County requirements.

For pavement design, an estimated Limerock Bearing Ratio (LBR) value of 15 may be used for soils encountered at the site.

Tunnel Design: Tunnels are planned at two locations for trail access. SPT "N" values in the upper 10 feet in the proposed tunnel areas indicate the soils are generally loose in relative density. We assume these tunnels will be constructed using conventional cut and cover techniques.

In order to densify the native sandy soils and/or fill material at the tunnel base elevation and to provide more uniform bearing support, the following soil improvement steps are recommended.

1. Prior to excavation of the tunnel areas, the site should be cleared of existing vegetation, topsoil and any other unsuitable materials. Excavations for the project should be made in accordance with recommendations outlined by the Occupational Safety and Health Administration (OSHA) "Construction Standard for Excavations" (29 CFR Part 1926.650 - .652, Subpart P, effective March 5, 1990). Our interpretation of this document based on prevailing subsoil conditions indicates that a maximum slope of 1.5 horizontal to 1 vertical (1.5H:1V) is permissible for excavations up to 20 feet in depth assuming there are no space constraints.

2. After the tunnel sites have been excavated to base elevation, the site should be proofrolled using a large vibratory roller (minimum 10 ton static weight). Extreme caution should be exercised when operating vibratory equipment near existing structures. Proofrolling of the tunnel areas should consist of at least ten (10) overlapping passes in each of the two perpendicular directions and should be observed by a geotechnical engineer. The purposes of the proofrolling will be to detect any areas where unsuitable soils are present as well as to densify the near-surface loose soils for support of the tunnels. Materials which yield excessively during the proofrolling should be undercut and replaced with well-compacted structural fill. The geotechnical engineer, based on observations at the site, can recommend the nature and extent of any remedial work. Based on our exploration, no major remedial work is anticipated at this site. Proofrolling of the tunnel structure areas should continue for the required number of passes and until the soil at a depth of 24 inches below the compaction surface has attained a minimum of 95 percent of the soil's modified Proctor maximum dry density as determined by ASTM Specification D-1557. The tunnel structures can then be constructed or placed on these densified soils. The tunnel structure can be designed using an allowable bearing pressure of 2,500 psf.

3. Suitable excavated fill soils can be replaced as backfill in uniform lifts not to exceed 8 inches loose and compacted a minimum to 95 percent of its modified Proctor density with light hand guided equipment (i.e., jumping jack) and should be carefully compacted to avoid damage to the tunnel walls. Fill placed adjacent to walls should not exceed a density of 98 percent of modified Proctor density. Suitable materials are sands or slightly silty sand with less than 10 percent fines passing the U.S. Standard No. 200 sieve, unless otherwise approved by the geotechnical engineer.

4. Once backfill of the tunnels is complete and construction of North Hancock Road is underway, we recommend the base be placed directly on top of the tunnel. Compaction of the base over the tunnel should be static and not vibratory.

Tunnel and retaining walls will be subjected to lateral at-rest earth pressure conditions due to the backfill material. To calculate loads associated with this backfill material, we recommend the following design parameters:

Material:	Sand
Friction Angle (ϕ):	30°
Active Earth Pressure Coefficient:	0.33
Passive Earth Pressure Coefficient:	3.0
At-Rest Earth Pressure Coefficient:	0.5
Moist Unit Weight (Υ_m):	115 pcf
Saturated Unit Weight (Υ_{sat}):	120 pcf
Footing Base Coefficient of Friction:	0.4

If adequate drainage is provided for tunnel walls, the moist unit weight (Υ_m) may be used in calculations. If portions of the tunnel walls are below the groundwater table or where hydrostatic pressures can build up should be analyzed using effective unit weights (Υ_{sat} - Υ_{water}); however, hydrostatic pressures must then be added to the load on the wall. It appears due to the soil and groundwater conditions, a moist unit of 115 pcf should be used.

For uniform surcharge loads on top of the tunnel (such as soil or traffic loading), the additional pressure on the wall may be calculated using 0.5 times the surcharge pressure.

Stormwater Management Design Considerations: The borings performed in the Stormwater Ponds No. 2 and 3 encountered Stratum 1 (A-3) to the boring termination depth of 25 feet. Borings in Stormwater Pond No. 1 generally found Stratum 1 (A-3) soils over Stratum 2 (A-2-4) soils to their termination depth of 25 feet. Groundwater was not encountered at the termination depth of 25 feet beneath the existing ground surface. Two (2) falling head vertical permeability tests were performed on samples obtained at a depth of 5 beneath the existing ground surface in Borings AB-1 and AB-4. The tests resulted in a vertical permeability rate of about 61 feet per day. We recommend that maximum rate of 30 feet per day for vertical permeability and 40 feet per day for horizontal permeability be used for design.

A stormwater recovery analysis was performed for the FDOT pond (No. 1) along State Road 50. We understand the pond must recover a water quality volume of 8.47 acre-feet in 72 hours and a runoff volume of 16.3 acre-feet in thirty (30) days. Because two of the borings in his pond (AB-1 and AB-2) encountered slightly silty to silty fine sand (A-2-4) the permeability rate modelled was reduced. The stormwater recovery analysis was modelled on the computer program PONDS, Version 2.26 using the simplified method. Analyses showed the water quality volume being recovered in about one (1) day with the total runoff volume recovreed in about 3.4 days. **Calculations** are included in the **Appendix**.

NODARSE & ASSOCIATES, INC.

CLOSURE

N&A appreciates the opportunity to be of service to you on this project. If you should have any questions concerning the contents of this report, or if we may be of further assistance, please do not hesitate to contact us.

Sincerely,

NODARSE & ASSOCIATES, INC.

2-5-99

Michael J. Horst, P.E.
Project Engineer
FL Registration No. 52668

2/5/99

Jay W. Casper, P.E.
Manager, Geotechnical Services
FL Registration No. 36330

W98-032.REP:MJH1-99/sc

Recovery Analysis

NODARSE
& ASSOCIATES, INC.

Geotechnical, Environmental Geotechnics & Materials Engineering

February 8, 1999
Project No. W98-G-032

RECD
FEB 09 1999
VHB FLORIDA

Mr. J. Dwayne Darbonne, P.E.
Vanasse Hangen Brustlin, Inc.
135 West Central Boulevard, Suite 1150
Orlando, Florida 32801

RE: Stormwater Recovery Analysis
Florida Department of Transportation Pond
North Hancock Road Improvements
Lake County, Florida

Dear Mr. Darbonne:

At the request of Mr. Paul Yeargain of your firm, Nodarse & Associates, Inc. (N&A) has performed a stormwater recovery analysis on the Florida Department of Transportation (FDOT) pond on State Road 50 for the North Hancock Road Project. We understand the requirements for the pond are as follows:

- Water quality volume of 8.47 acre feet in 72 hours.
- Stormwater runoff volume of 16.3 acre feet in thirty (30) days. The first half of the volume recovering in seven (7) days.

Borings in the stormwater pond generally found Stratum 1 soils (A-3) over Stratum 2 soils (A-2-4) to their boring termination depth of 25 feet below the existing pond bottom. The boring locations and profiles are attached. Groundwater was not observed to the termination depth of 25 feet. A falling head vertical permeability test was performed on a sample obtained from Boring AB-1 at a depth of 5 feet below the existing pond bottom. Laboratory test results found the vertical permeability rate to be approximately 61 feet per day. Since the vertical permeability test was performed with Stratum 1 soils, the effective permeability rate of the soils was reduced to approximately 10 feet per day to account for the increased amount of fines in Stratum 2 and possible siltation of the pond bottom. Stormwater recovery analysis was modeled using the computer program PONDS, Version 2.26 using the simplified method. Analyses show the water quality volume being recovered in approximately one (1) day with the total runoff volume recovered in 3.4 days. The calculations are attached.

Vanasse Hangen Brustlin, Inc.
Project No. W98-G-032
Page 2

NODARSE & ASSOCIATES, INC.

Should you have any questions, or if we can be of any further service to you, please do not hesitate to contact us.

Sincerely,

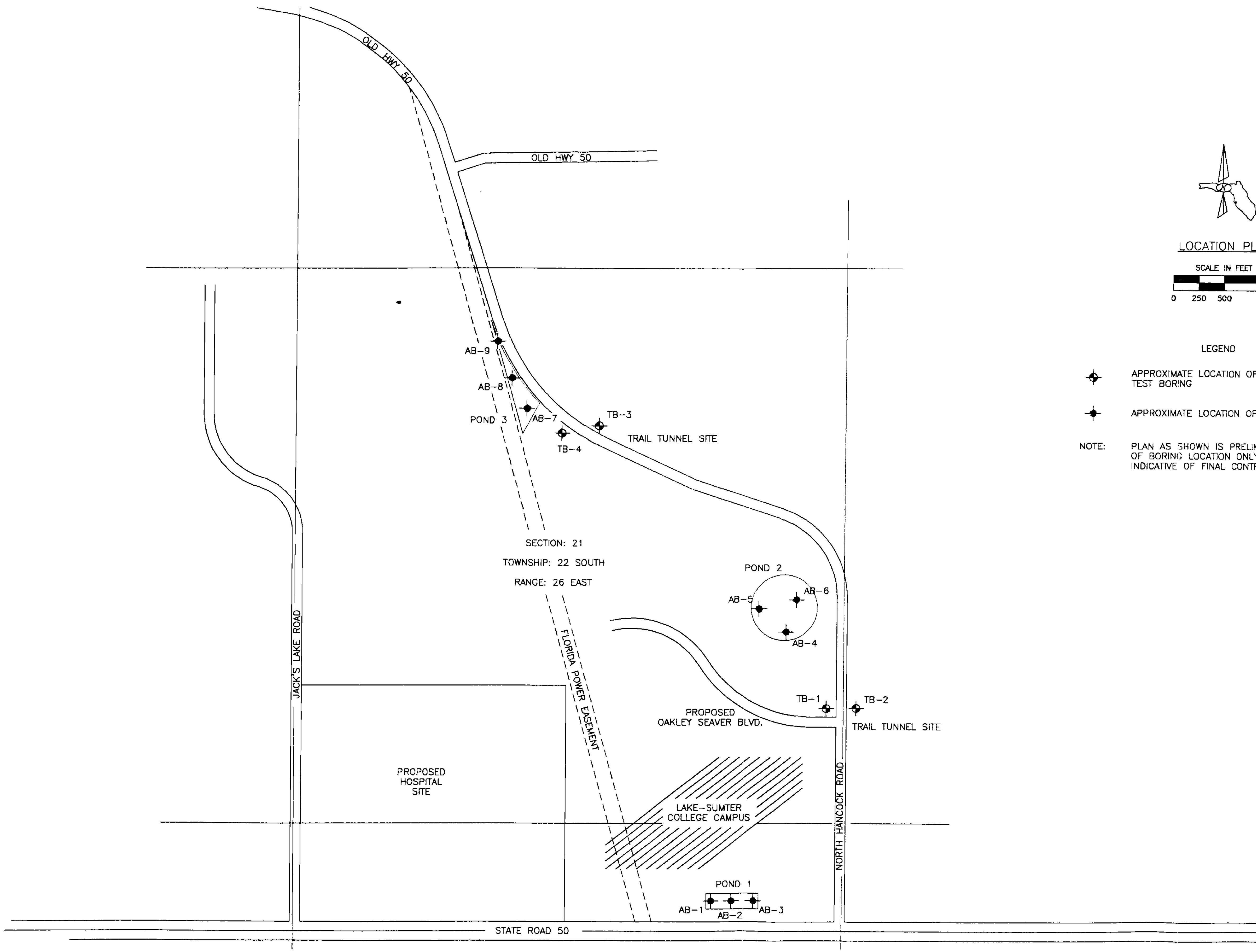
Michael J. Horst, P.E. 2/5/99
Project Engineer
FL Registration No. 52668

Jay W. Casper, P.E. 2/5/99
Manager, Geotechnical Services
FL Registration No. 36330

W98-032.LET:MJH2-99/sc

Attachment: Calculations

FED. ROAD DIV. NO.	STATE	PROJECT NO.	FISCAL YEAR	SHEET NO.
	FLA.			



LEGEND

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

APPROXIMATE LOCATION OF AUGER BORING

NOTE: PLAN AS SHOWN IS PRELIMINARY FOR REPRESENTATION OF BORING LOCATION ONLY AND MAY NOT BE INDICATIVE OF FINAL CONTRACT PLANS.

APPROVED BY: ____________________

JAY W. CASPER

P.E. NO.: 36330 DATE:

POND AND TUNNEL BORING LOCATION PLAN

REVISIONS								
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE
DESIGNED BY	N/A	N/A	DRAWN BY	SW	1-30-99
CHECKED BY	N/A	N/A	CHECKED BY	MJH	1-30-99

SUPERVISED BY: JAY W. CASPER, P.E.

Nodarse & Associates, Inc.
Geotechnical, Environmental & Materials Engineers

APPROVED BY:

DATE:

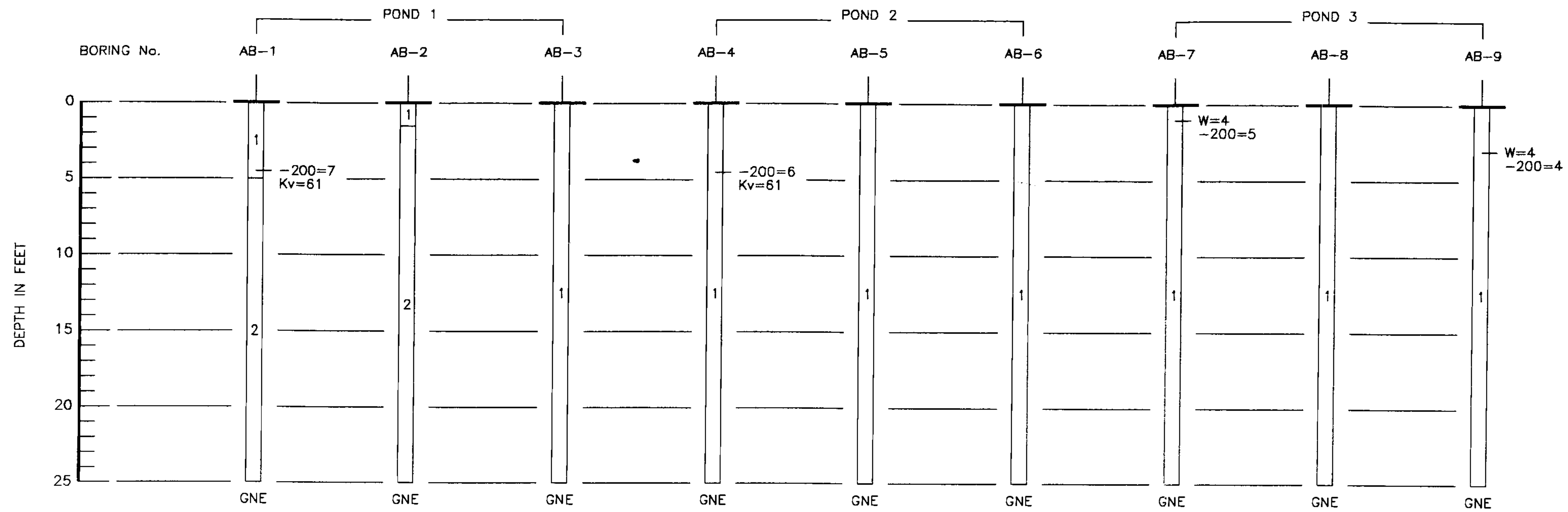
GEOTECHNICAL ENGINEERING EVALUATION

NORTH HANCOCK ROAD

LAKE COUNTY, FLORIDA

NODARSE and ASSOC. No. W98G-032 FIGURE: 2

FED. ROAD DIV. NO.	STATE	PROJECT NO.	FISCAL YEAR	SHEET NO.
	FLA.			



LEGEND

1	ORANGE-BROWN TO BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND (A-3)
2	ORANGE-BROWN TO ORANGE SLIGHTLY SILTY TO SILTY FINE SAND (A-2-4)
3	RED-ORANGE SILTY FINE SAND, TRACE CLAY (A-2-4)
(A-3)	A.A.S.H.T.O. SOIL CLASSIFICATION GROUP SYMBOL AS DETERMINED BY VISUAL EXAMINATION
GNE	GROUNDWATER NOT ENCOUNTERED TO DEPTH OF BORING
W	NATURAL MOISTURE CONTENT (%)
-200	FINES PASSING No. 200 SIEVE (%)
Kv	COEFFICIENT OF VERTICAL PERMEABILITY (ft./day)

APPROVED BY: ____________________

JAY W. CASPER

P.E. NO.: 36330 DATE:

POND BORINGS

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAME	DATE		NAME	DATE
DESIGNED BY	N/A	N/A	DRAWN BY	SW	1-25-99
CHECKED BY	N/A	N/A	CHECKED BY	MJH	1-25-99

SUPERVISED BY: JAY W. CASPER, P.E.

Nodarse & Associates, Inc. Geotechnical, Environmental & Materials Engineers

APPROVED BY:

DATE:

GEOTECHNICAL ENGINEERING EVALUATION

NORTH HANCOCK ROAD

LAKE COUNTY, FLORIDA

NODARSE and ASSOC. No. W98G-032 FIGURE: 5

PONDS - Version 2.26

Written By Devo Seereeram, Ph.D., P.E.
And Robert D. Casper

Retention Pond Recovery Analysis

I. Job Information

Job Name: North Hancock Road Water Quality
Engineer: MJH
Date: 2/4/99

II. Input Data

Equivalent Pond Length, [L] (ft):	550.00
Equivalent Pond Width, [W] (ft):	315.00
Pond Bottom Elevation, [PB] (ft above datum):	173.00
Porosity Of Material Within Pond, [p] (%):	100.00
Base Of Aquifer Elevation, [B] (ft above datum):	148.00
Water Table Elevation, [WT] (ft above datum):	148.10
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day)	10.00
Fillable Porosity of Aquifer, [n] (%):	25.00
Runoff Volume, [V] (cubic feet)	368954.00
Percent Recovery Of Runoff Volume, [PV] (%)	100.00

III. Results

UNSATURATED FLOW

Not Considered.

SATURATED FLOW

Recovery Time From Saturated Flow, [T2] (days):	1.0280
Recovered Volume From Saturated Flow, [V2] (ft^3):	368954.00
Maximum Radius Of Influence, [R] (ft):	63.62
Maximum Driving Head, [Hmax] (ft):	27.030
Minimum Driving Head, [Hmin] (ft):	24.900

TOTAL

Total Recovery Time, [T] (days):	1.0280
Total Recovered Volume, [V] (ft^3):	368954.00

PONDS - Version 2.26

Written By Devo Seereeram, Ph.D., P.E.
And Robert D. Casper

Retention Pond Recovery Analysis

I. Job Information

Job Name: North Hancock Road – Total Volume
Engineer: MJH
Date: 2/4/99

II. Input Data

Equivalent Pond Length, [L] (ft):	550.00
Equivalent Pond Width, [W] (ft):	315.00
Pond Bottom Elevation, [PB] (ft above datum):	173.00
Porosity Of Material Within Pond, [p] (%):	100.00
Base Of Aquifer Elevation, [B] (ft above datum):	148.00
Water Table Elevation, [WT] (ft above datum):	148.10
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day)	10.00
Fillable Porosity of Aquifer, [n] (%):	25.00
Runoff Volume, [V] (cubic feet)	710028.00
Percent Recovery Of Runoff Volume, [PV] (%)	100.00

III. Results

UNSATURATED FLOW

Not Considered.

SATURATED FLOW

Recovery Time From Saturated Flow, [T2] (days):	3.4088
Recovered Volume From Saturated Flow, [V2] (ft^3):	710028.00
Maximum Radius Of Influence, [R] (ft):	115.67
Maximum Driving Head, [Hmax] (ft):	28.998
Minimum Driving Head, [Hmin] (ft):	24.900

TOTAL

Total Recovery Time, [T] (days):	3.4088
Total Recovered Volume, [V] (ft^3):	710028.00

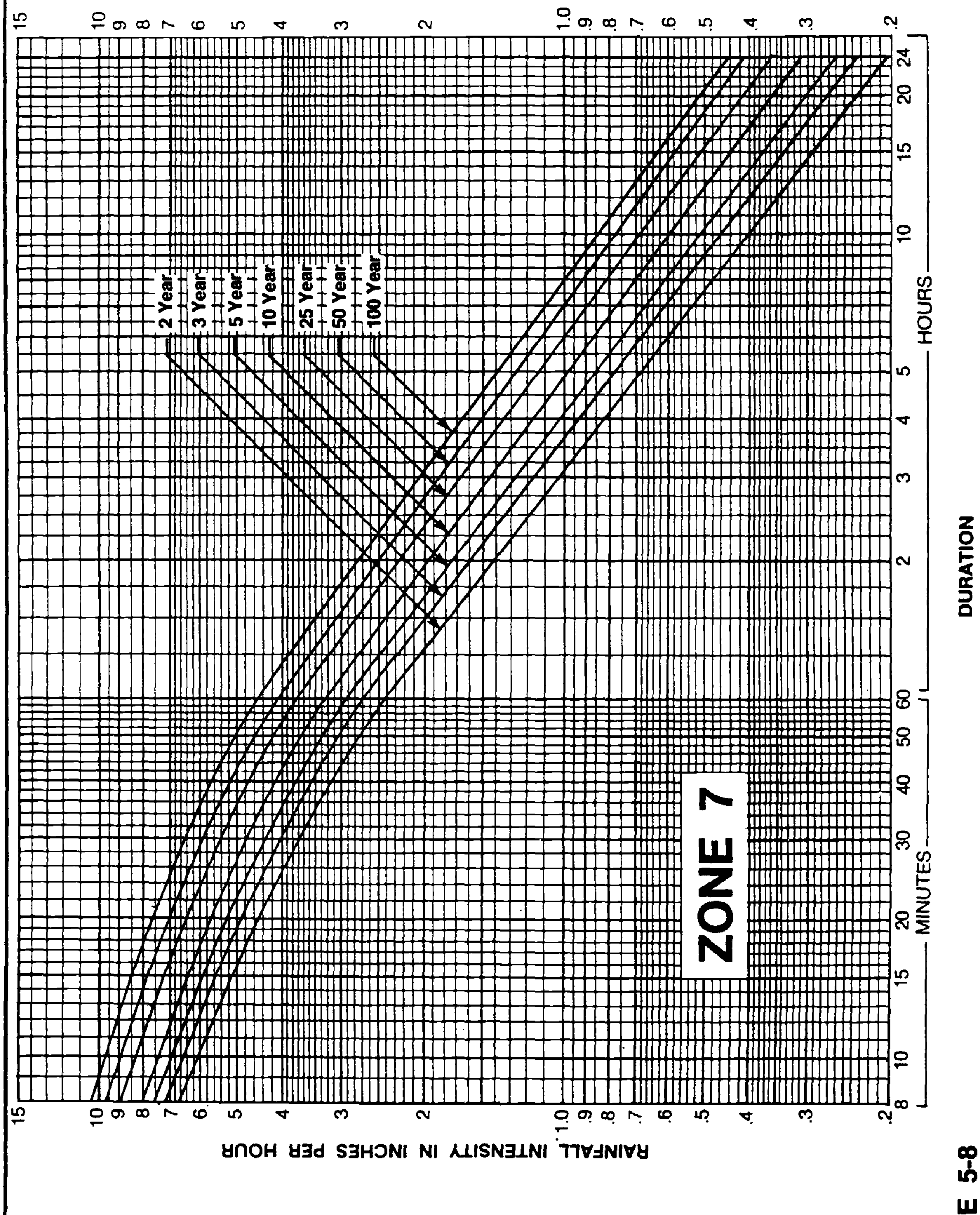


FIGURE 5-8
Rainfall Intensity-Duration-Frequency Curves for Zone 7

Table 5-5
RUNOFF COEFFICIENTS[a] FOR A DESIGN STORM RETURN
PERIOD OF 10 YEARS OR LESS

Slope	Land Use	Sandy Soils Min.	Sandy Soils Max.	Clay Soils Min.	Clay Soils Max.
Flat (0-2%)	Woodlands	0.10	0.15	0.15	0.20
	Pasture, grass, and farmland[b]	0.15	0.20	0.20	0.25
	Rooftops and pavement	0.95	0.95	0.95	0.95
	Pervious pavements[c]	0.75	0.95	0.90	0.95
	SFR: ½-acre lots and larger	0.30	0.35	0.35	0.45
	Smaller lots	0.35	0.45	0.40	0.50
	Duplexes	0.35	0.45	0.40	0.50
	MFR: Apartments, townhouses, and condominiums	0.45	0.60	0.50	0.70
	Commercial and Industrial	0.50	0.95	0.50	0.95
Rolling (2-7%)	Woodlands	0.15	0.20	0.20	0.25
	Pasture, grass, and farmland[b]	0.20	0.25	0.25	0.30
	Rooftops and pavement	0.95	0.95	0.95	0.95
	Pervious pavements[c]	0.80	0.95	0.90	0.95
	SFR: ½-acre lots and larger	0.35	0.50	0.40	0.55
	Smaller lots	0.40	0.55	0.45	0.60
	Duplexes	0.40	0.55	0.45	0.60
	MFR: Apartments, townhouses, and condominiums	0.50	0.70	0.60	0.80
	Commercial and Industrial	0.50	0.95	0.60	0.95
Steep (7%+)	Woodlands	0.20	0.25	0.25	0.30
	Pasture, grass, and farmland[b]	0.25	0.35	0.30	0.40
	Rooftops and pavement	0.95	0.95	0.95	0.95
	Pervious pavements[c]	0.85	0.95	0.90	0.95
	SFR: ½-acre lots and larger	0.40	0.55	0.50	0.65
	Smaller lots	0.45	0.60	0.55	0.70
	Duplexes	0.45	0.60	0.55	0.70
	MFR: Apartments, townhouses, and condominiums	0.60	0.75	0.65	0.85
	Commercial and Industrial	0.60	0.95	0.65	0.95

[a] Weighted coefficient based on percentage of impervious surfaces and green areas must be selected for each site.

[b] Coefficients assume good ground cover and conservation treatment.

[c] Depends on depth and degree of permeability of underlying strata.

Note: SFR = Single Family Residential
MFR = Multi-Family Residential

Table 5-8
SCS RUNOFF CURVE NUMBERS FOR SELECTED AGRICULTURAL, SUBURBAN, AND URBAN LAND USE

Land Use Description		Hydrologic Soil Group A	B	C	D
Cultivated Land[a]:					
Without conservation treatment		72	81	88	91
With conservation treatment		62	71	78	81
Pasture or range land:					
Poor condition		68	79	86	89
Good condition		39	61	74	80
Meadow: good condition		30	58	71	78
Wood or Forest Land:					
Thin stand, poor cover, no mulch		45	66	77	83
Good cover[b]		25	55	70	77
Open Spaces, Lawns, Parks, Golf Courses, Cemeteries:					
Good condition: grass cover on 75% or more of the area		39	61	74	80
Fair condition: grass cover on 50% to 75% of the area		49	69	79	84
Poor condition: grass cover on 50% or less of the area		68	79	86	89
Commercial and Business Areas (85% impervious)		89	92	94	95
Industrial Districts (72% impervious)		81	88	91	93
Residential[c]:					
Average lot size	Average % Impervious[d]				
1/8 acre or less	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
Paved Parking Lots, Roofs, Driveways[e]:		98	98	98	98
Streets and Roads:					
Paved with curbs and storm sewers[e]		98	98	98	98
Gravel		76	85	89	91
Dirt		72	82	87	89
Paved with open ditches		83	89	92	93
Newly graded area (no vegetation established)[f]		77	86	91	94

[a]For a more detailed description of agricultural land use curve numbers, refer to Table 5-9.

[b]Good cover is protected from grazing and litter and brush cover soil.

[c]Curve numbers are computed assuming the runoff from the house and driveway is directed toward the street with a minimum of roof water directed to lawns where additional infiltration could occur.

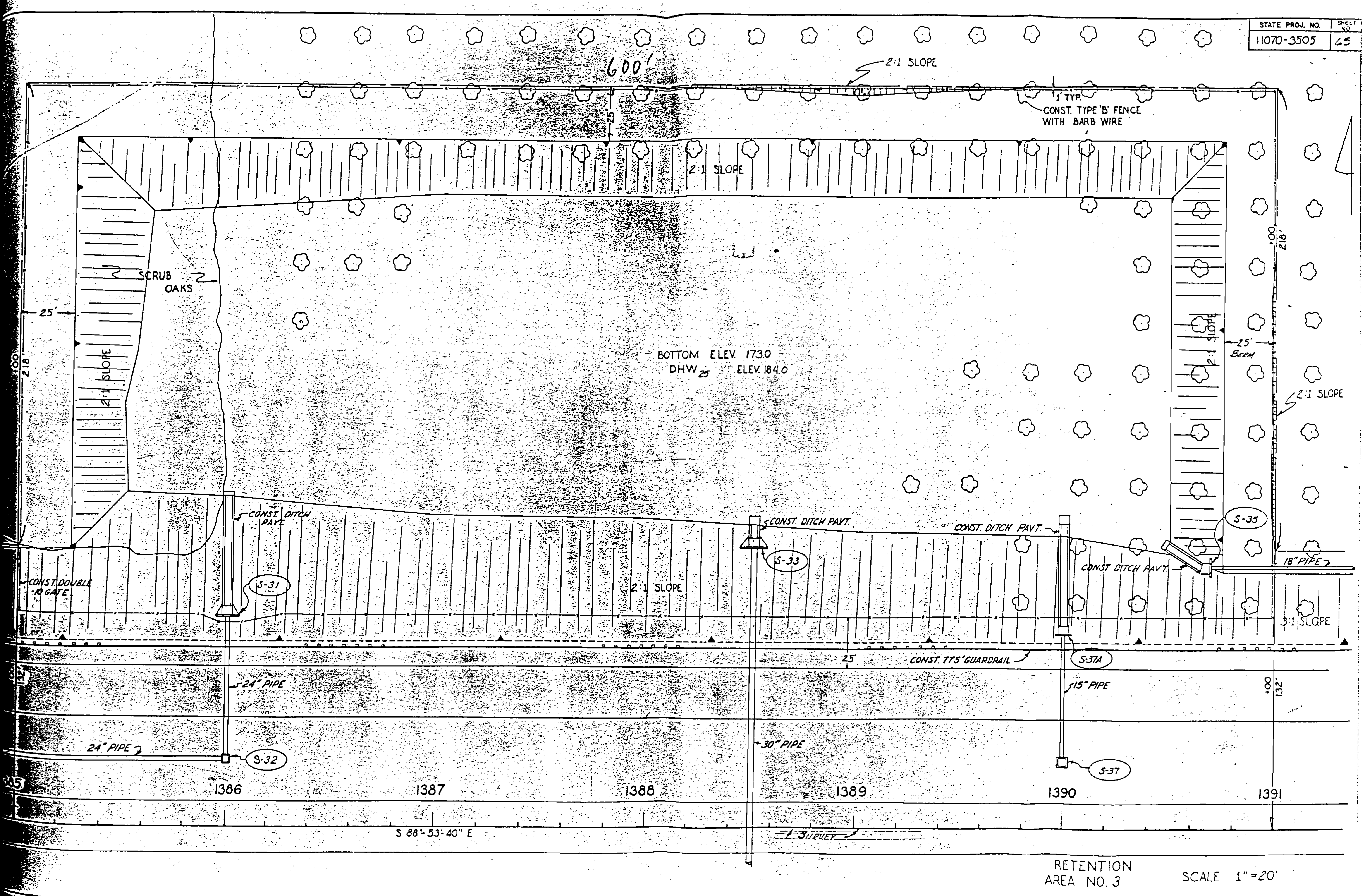
[d]The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

[e]In some warmer climates of the country, a curve number of 96 may be used.

[f]Use for temporary conditions during grading and construction.

Note: These values are for Antecedent Moisture Condition II, and $I_a = 0.2S$.

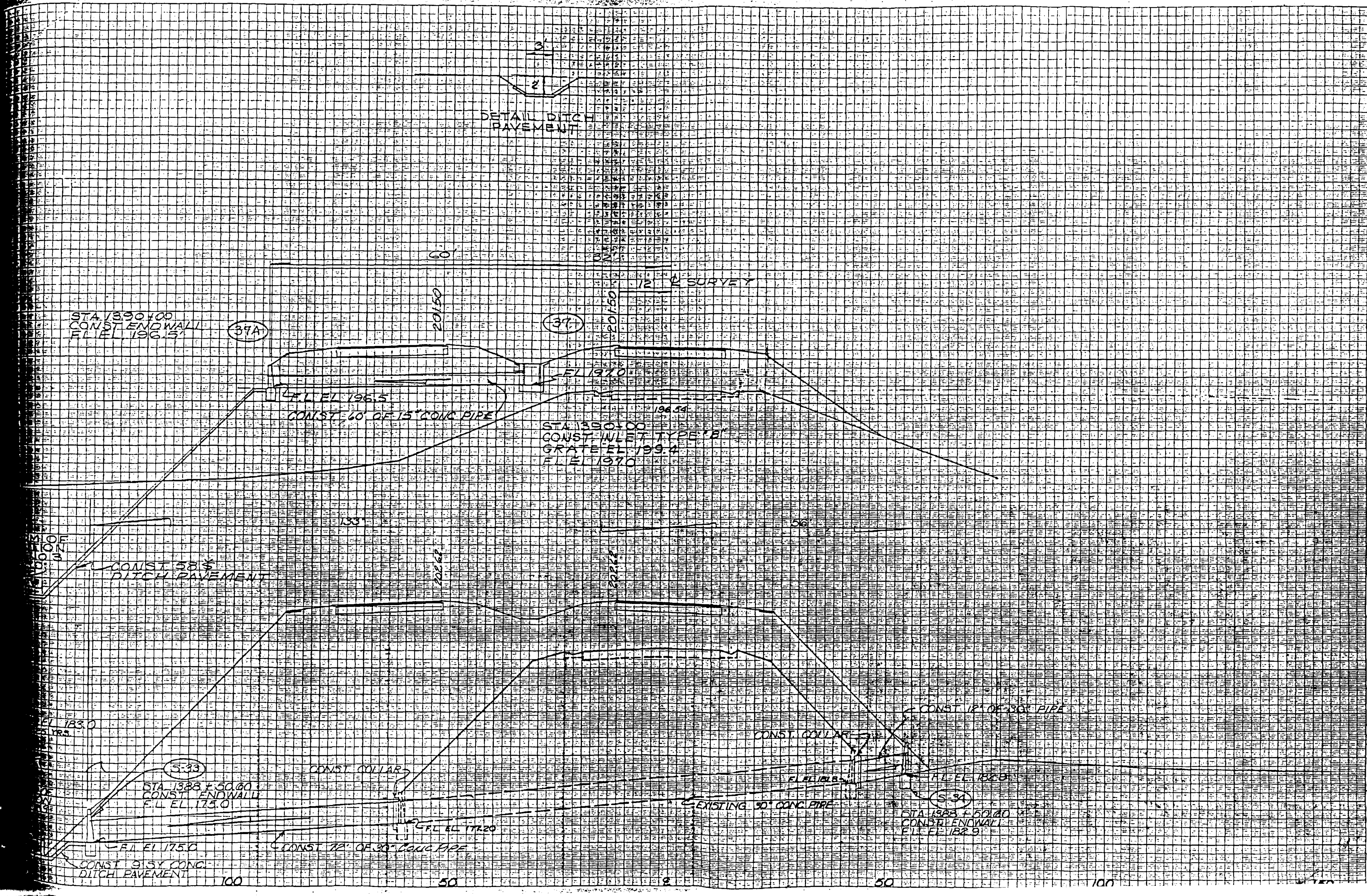
Reference: USDA, SCS, TR-55 (1984).


STATE PROJ. NO.
SHEET NO.
11070-3505
65
600'
2:1 SLOPE
1' TYP.
CONST. TYPE 'B' FENCE
WITH BARB WIRE
25
2:1 SLOPE
SCRUB
OAKS
25'
218
2:1 SLOPE
BOTTOM ELEV. 173.0
DHW25 ELEV. 184.0
218'
25'
BERM
2:1 SLOPE
CONST. DITCH PAVT.
CONST. DITCH PAVT.
CONST. DITCH PAVT.
CONST. DITCH PAVT.
S-35
18" PIPE
S-33
S-31
CONST. DOUBLE GATE
2:1 SLOPE
3:1 SLOPE
25'
CONST. 775' GUARDRAIL
S-37A
24" PIPE
15" PIPE
132'
24" PIPE
S-32
30" PIPE
S-37
1386
1387
1388
1389
1390
1391
S 88°-53'-40" E
SURVEY
RETENTION
AREA NO. 3
SCALE 1" = 20'

CROSS SECTIONS

Scale 1 inch = 5 feet

Fed. Road Div. No.	State	County	Route	Proj. No.	Sheet No.
3	Fla.	LAKE	50	11070-3503	43

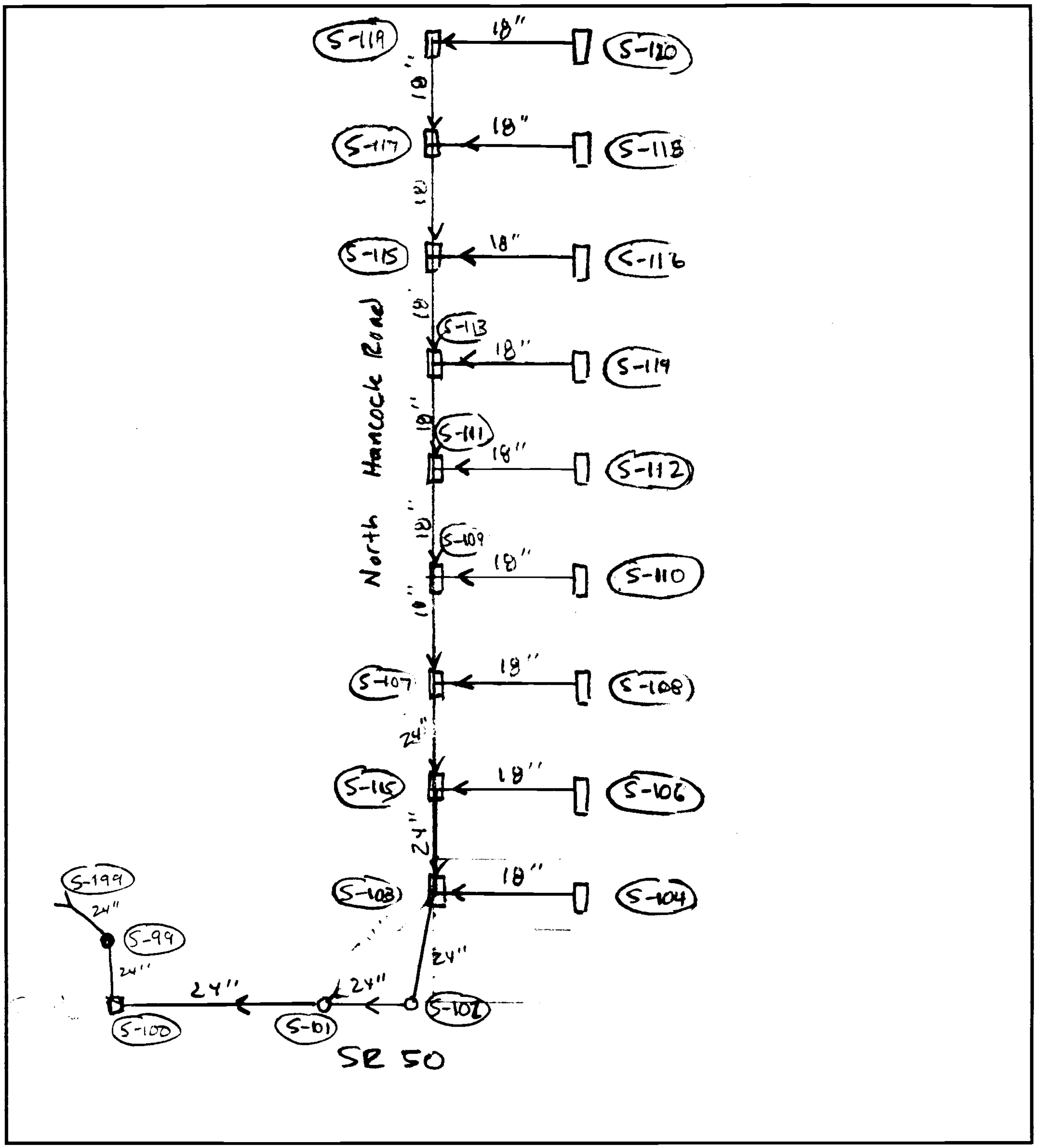


APPENDIX D TABLE OF CONTENTS

Storm Sewer Analysis

VHB Computations

Project N. Hancock Rd Project # 60633
Location Lake Co Sheet 1 of 1
Calculated by PWY Date 12/15/98
Checked by JK Date 2/11/99
Title Storm Sewer Nodal Basin A



2/18/99

STORM SEWER HYDRAULICS

System: **basina**

PROJECT			
Number:	60633	Organization:	Vanasse Hangen Brustlin, Inc.
Description:	N. HANCOCK	Designed by:	JOK
County:	LAKE COUNTY	Checked by:	PWY

CONDITIONS

		Storm Event		Runoff Coefficients		
		Zone	Freq	Area 1	Area 2	Area 3
Outfall Tailwater Elevation:	0.00					
Exit Loss at Outfall:	0.00					
Storm Sewer Control Elevatio	175.00	7	10	0.95	0.20	0.10

FROM Station Type	Brls	TO Offset Len	Drainage Areas Inc.	Sub-Total	Sub-Total CA	Tc (min)	Travel Time (min)	Inten. (in/hr)	Total CA (ac)	Flow (cfs) (Qb)	Sum(Qb) CIA TOTAL	Inlet Elevations Inlet Clear.	HGL Jnc Loss	Pipe Elevations HGL Crown Line Flow Line		Fall (ft)	Pipe Height Width (in)	HGL (%) FL (%)	Flow Type	Velocity (fps)	Capacity (cfs)	Mann'g 'N'
S-100		**S-99**	0.50	4.72	4.48					0.00	0.00	198.10	189.34	189.34	184.24	5.100	24	3.028	Partial			
100+40.82		-667.39	0.75	2.65	0.53	21.80	0.19	5.50	5.51		30.32			190.10	185.00				sub	14.77	42.65	0.0120
DBI-E	1	168.42	5.00	5.00	0.50						**30.32**	8.76	0.00	188.10	183.00	5.100	24	3.028				
S-101		**S-100**	0.00	4.22	4.01					0.00	0.00	204.00	199.67	199.67	195.60	4.070	24	1.390	Full			
100+20.5		-375.35	0.00	1.90	0.38	13.95	0.53	6.59	4.39		28.90			198.70	195.60					9.20	25.22	0.0120
MHP-7T	1	292.75	0.00	0.00	0.00						**28.90**	4.33	0.00	196.70	193.60	3.100	24	1.059				
S-102		**S-101**	0.00	4.22	4.01					0.00	0.00	206.08	204.43	204.43	199.67	4.760	24	1.436	Full			
100+23.58		-43.89	0.00	1.90	0.38	13.36	0.59	6.69	4.39		29.37			201.30	198.70					9.35	21.71	0.0120
MHP-7T	1	331.47	0.00	0.00	0.00						**29.37**	1.65	0.00	199.30	196.70	2.600	24	0.784				
S-103		**S-102**	0.26	4.22	4.01					0.00	0.00	207.03	205.32	205.32	204.43	0.892	24	1.445	Full			
100+85		-37.25	0.23	1.90	0.38	13.25	0.11	6.71	4.39		29.46			201.50	201.30					9.38	13.94	0.0120
P-5	1	61.78	0.00	0.00	0.00						**29.46**	1.71	0.00	199.50	199.30	0.200	24	0.324				
S-104		**S-103**	0.24	0.24	0.23					0.00	0.00	206.93	205.34	205.34	205.32	0.022	18	0.027	Full			
100+85.0		42.25	0.14	0.14	0.03	10.00	0.66	7.41	0.25		1.87			204.20	204.00					1.06	5.71	0.0120
P-5	1	79.50	0.00	0.00	0.00						**1.87**	1.58	0.00	202.70	202.50	0.200	18	0.252				
S-105		**S-103**	0.26	3.72	3.53					0.00	0.00	214.22	208.87	208.87	205.32	3.544	24	1.337	Partial			
103+50		-37.25	0.12	1.53	0.31	12.89	0.36	6.78	3.84		26.01			209.60	204.00				sub	12.40	35.63	0.0120
P-5	1	265.00	0.00	0.00	0.00						**26.01**	5.36	0.00	207.60	202.00	5.600	24	2.113				
S-106		**S-105**	0.29	0.29	0.27					0.00	0.00	214.12	210.54	210.54	210.34	0.200	18	0.252	Partial			
103+50		42.25	0.11	0.11	0.02	10.00	0.44	7.41	0.29		2.18			211.40	211.20				critical	3.01	5.71	0.0120
P-5	1	79.50	0.00	0.00	0.00						**2.18**	3.58	0.00	209.90	209.70	0.200	18	0.252				
S-107		**S-105**	0.29	3.17	3.01					0.00	0.00	222.74	216.05	216.05	209.60	6.454	24	2.433	Partial			
106+15		-49.25	0.16	1.30	0.26	12.56	0.33	6.84	3.27		22.40			217.00	209.60				sub	13.35	40.93	0.0120
P-5	1	265.27	0.00	0.00	0.00						**22.40**	6.68	0.00	215.00	207.60	7.400	24	2.790				
S-108		**S-107**	0.18	0.18	0.17					0.00	0.00	222.88	219.23	219.23	219.03	0.200	18	0.219	Partial			
106+15		42.25	0.12	0.12	0.02	10.00	0.59	7.41	0.20		1.44			220.20	220.00				critical	2.57	5.32	0.0120
P-5	1	91.50	0.00	0.00	0.00						**1.44**	3.64	0.00	218.70	218.50	0.200	18	0.219				
S-109		**S-107**	0.22	2.70	2.57					0.00	0.00	230.62	227.48	227.48	219.58	7.900	18	3.709	Partial			
108+28		-49.25	0.19	1.01	0.20	12.31	0.25	6.89	2.77		19.10			227.90	220.00				sub	14.01	21.92	0.0120
P-5	1	213.00	0.00	0.00	0.00						**19.10**	3.14	0.00	226.40	218.50	7.900	18	3.709				
S-110		**S-109**	0.24	0.24	0.23					0.00	0.00	230.76	227.93	227.93	227.90	0.025	18	0.027	Full			
108+28		42.25	0.14	0.14	0.03	10.00	0.76	7.41	0.25		1.89			228.10	227.90					1.07	5.32	0.0120
P-5	1	91.50	0.00	0.00	0.00						**1.89**	2.84	0.00	226.60	226.40	0.200	18	0.219				
S-111		**S-109**	0.19	2.24	2.13					0.00	0.00	240.27	236.72	236.72	227.90	8.820	18	3.718	Partial			
110+65		-38.82	0.19	0.68	0.14	12.02	0.29	6.95	2.27		15.76			237.30	227.90				sub	13.87	22.65	0.0120
P-5	1	237.23	0.00	0.00	0.00						**15.76**	3.55	0.00	235.80	226.40	9.400	18	3.962				

Units: ENGLISH

STORM SEWER HYDRAULICS

System: **basina**

PROJECT			
Number:	60633	Organization:	Vanasse Hangen Brustlin, Inc.
Description:	N. HANCOCK	Designed by:	JOK
County:	LAKE COUNTY	Checked by:	PWY

CONDITIONS		Storm Event		Runoff Coefficients		
		Zone	Freq	Area 1	Area 2	Area 3
Outfall Tailwater Elevation:	0.00	7	10	0.95	0.20	0.10
Exit Loss at Outfall:	0.00					
Storm Sewer Control Elevatio	175.00					

FROM Station Type	Brls	TO Offset Len	Drainage Areas Inc.	Drainage Areas Sub-Total	Drainage Areas Sub-Total CA	Tc (min)	Travel Time (min)	Inten. (in/hr)	Total CA (ac)	Flow (cfs) (Qb)	Flow (cfs) Sum(Qb) CIA TOTAL	Inlet Elevations Inlet / Clear.	Inlet Elevations HGL / Jnc Loss	Pipe Elevations HGL / Crown Line / Flow Line		Fall (ft)	Pipe Height Width (in)	HGL (%) FL (%)	Flow Type	Velocity (fps)	Capacity (cfs)	Mann'g 'N'
S-112		**S-111**	0.25	0.25	0.24					0.00	0.00	240.22	237.32	237.32	237.30	0.023	18	0.029	Full			
110+65		41.20	0.12	0.12	0.02	10.00	0.67	7.41	0.26		1.95			237.50	237.30					1.10	5.69	0.0120
P-5	1	80.02	0.00	0.00	0.00						**1.95**	2.90	0.00	236.00	235.80	0.200	18	0.250				
S-113		**S-111**	0.36	1.80	1.71					0.00	0.00	249.44	245.79	245.79	237.30	8.492	18	3.698	Partial			
112+95		-40.25	0.07	0.37	0.07	11.73	0.29	7.01	1.79		12.53			246.50	237.30				sub	13.23	22.78	0.0120
P-5	1	229.67	0.00	0.00	0.00						**12.53**	3.65	0.00	245.00	235.80	9.200	18	4.006				
S-114		**S-113**	0.22	0.22	0.21					0.00	0.00	249.44	246.52	246.52	246.50	0.018	18	0.022	Full			
112+95		40.25	0.08	0.08	0.02	10.00	0.67	7.41	0.23		1.69			246.70	246.50					0.96	5.67	0.0120
P-5	1	80.50	0.00	0.00	0.00						**1.69**	2.92	0.00	245.20	245.00	0.200	18	0.248				
S-115		**S-113**	0.27	1.22	1.16					0.00	0.00	257.29	253.75	253.75	246.50	7.250	18	3.291	Partial			
115+15		-52.25	0.03	0.22	0.04	11.42	0.32	7.08	1.20		8.52			254.60	246.50				sub	11.59	21.82	0.0120
P-5	1	220.33	0.00	0.00	0.00						**8.52**	3.54	0.00	253.10	245.00	8.100	18	3.676				
S-116		**S-115**	0.16	0.16	0.16					0.00	0.00	257.53	254.61	254.61	254.60	0.011	18	0.012	Full			
115+15		40.25	0.06	0.06	0.01	10.00	0.77	7.41	0.17		1.25			254.80	254.60					0.71	5.29	0.0120
P-5	1	92.50	0.00	0.00	0.00						**1.25**	2.92	0.00	253.30	253.10	0.200	18	0.216				
S-117		**S-115**	0.23	0.78	0.74					0.00	0.00	262.47	258.86	258.86	254.60	4.262	18	2.131	Partial			
117+15		-52.25	0.04	0.13	0.03	11.05	0.37	7.16	0.77		5.50			259.80	254.60				sub	9.09	18.35	0.0120
P-5	1	200.00	0.00	0.00	0.00						**5.50**	3.61	0.00	258.30	253.10	5.200	18	2.600				
S-118		**S-117**	0.20	0.20	0.19					0.00	0.00	262.71	259.82	259.82	259.80	0.015	18	0.017	Full			
117+15		40.25	0.03	0.03	0.01	10.00	0.77	7.41	0.20		1.47			260.00	259.80					0.83	5.29	0.0120
P-5	1	92.50	0.00	0.00	0.00						**1.47**	2.90	0.00	258.50	258.30	0.200	18	0.216				
S-119		**S-117**	0.15	0.35	0.34					0.00	0.00	265.75	261.83	261.83	259.80	2.029	18	1.013	Partial			
119+15		-40.25	0.04	0.06	0.01	10.50	0.55	7.29	0.35		2.54			262.90	259.80				sub	6.07	14.15	0.0120
P-5	1	200.36	0.00	0.00	0.00						**2.54**	3.92	0.00	261.40	258.30	3.100	18	1.547				
S-120		**S-119**	0.20	0.20	0.19					0.00	0.00	265.75	262.12	262.12	261.92	0.200	18	0.248	Partial			
119+15		40.25	0.02	0.02	0.00	10.00	0.50	7.41	0.19		1.44			263.10	262.90				critical	2.68	5.67	0.0120
P-5	1	80.50	0.00	0.00	0.00						**1.44**	3.64	0.00	261.60	261.40	0.200	18	0.248				
S-99		**S-199**	0.00	4.72	4.48					0.00	0.00	186.00	175.51	175.51	175.00	0.505	24	1.519	Full			
100+42.94		-835.80	0.00	2.65	0.53	21.99	0.00	5.48	5.51		30.20			175.50	175.00					9.61	30.04	0.0120
MHP-7T	1	33.28	0.00	5.00	0.50						**30.20**	10.49	0.00	173.50	173.00	0.500	24	1.502				

Units: ENGLISH

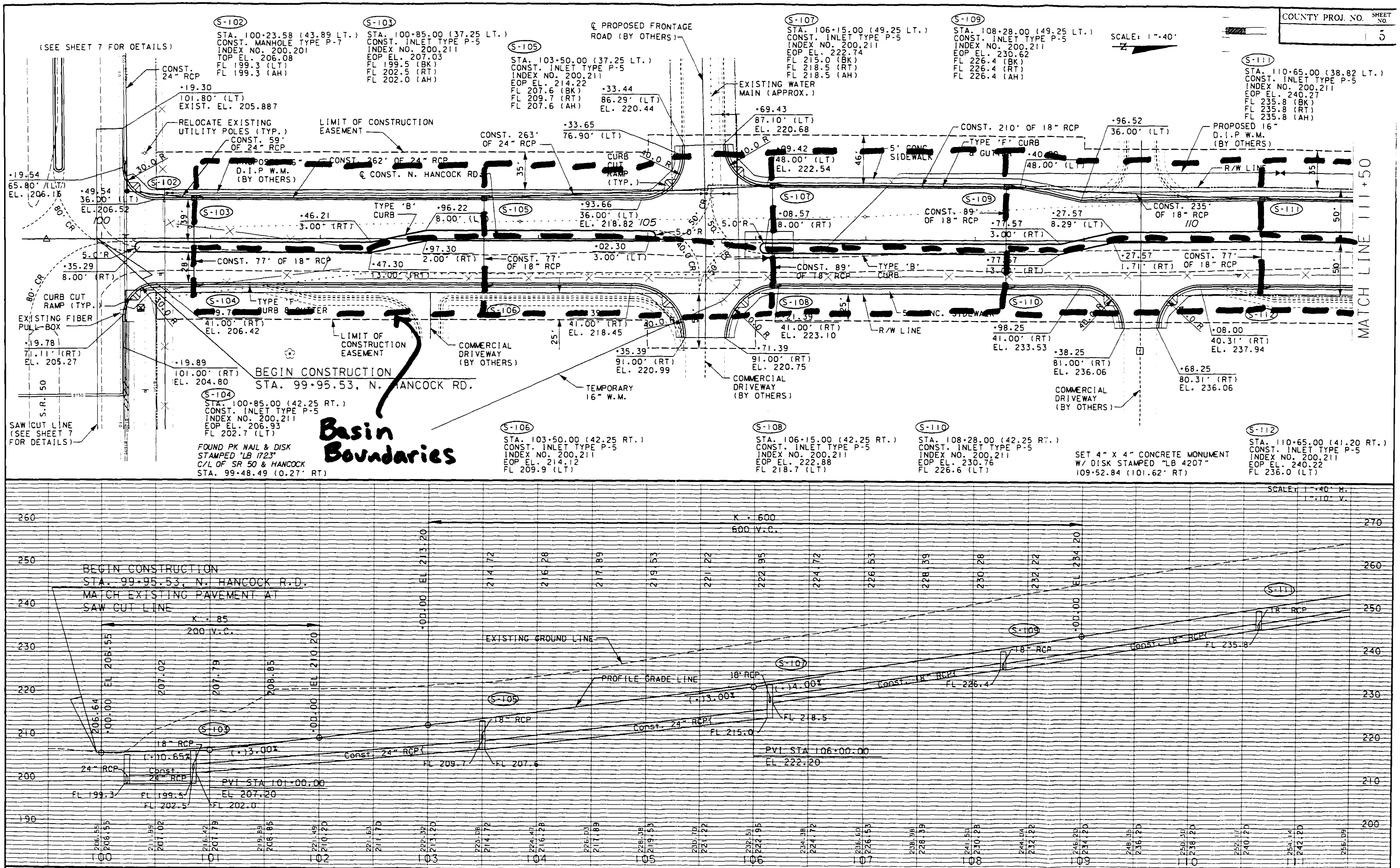
Spread Analysis

Project: North Hancock Rd
Location: Basin A
Computed by: PWY
Date: 2/11/99

Checked by: JOK
Date: 2/12/99

Inlet	Location	Area (acres)			I (inhr)	C	Longitudinal Slope (ft/ft)	Q (ft^3/s) Gutter	Q (ft^3/s) Intercepted	Q (ft^3/s) Bypass	Spread (ft)	Notes
		Total	Impervious	Grass								
S-103	100+85	0.49	0.26	0.23	7.4	0.57	0.017	2.35	2.20	0.15	8.2	
S-104	100+85	0.38	0.24	0.14	7.4	0.64	0.017	2.00	1.95	0.05	7.6	
S-105	103+50	0.38	0.26	0.12	7.4	0.68	0.03	2.18	1.90	0.28	6.9	Q_b to S-103
S-106	103+50	0.40	0.29	0.11	7.4	0.71	0.03	2.09	1.90	0.19	6.8	Q_b to S-104
S-107	106+15	0.45	0.29	0.16	7.4	0.65	0.03	2.17	1.90	0.27	6.9	Q_b to S-105
S-108	106+15	0.30	0.18	0.12	7.4	0.62	0.03	1.38	1.38	0.00	5.5	
S-109	108+28	0.41	0.22	0.19	7.4	0.58	0.04	1.75	1.75	0.00	5.8	
S-110	108+28	0.38	0.24	0.14	7.4	0.64	0.04	1.81	1.80	0.01	5.9	
S-111	110+65	0.38	0.19	0.19	7.4	0.55	0.04	1.55	1.55	0.00	5.4	
S-112	110+65	0.37	0.25	0.12	7.4	0.67	0.04	1.84	1.84	0.00	5.9	
S-113	112+95	0.31	0.24	0.07	7.4	0.74	0.04	1.70	1.70	0.00	5.7	
S-114	112+95	0.30	0.22	0.08	7.4	0.71	0.04	1.58	1.58	0.00	5.5	
S-115	115+15	0.30	0.27	0.03	7.4	0.83	0.030	1.84	1.84	0.00	6.4	
S-116	115+15	0.22	0.16	0.06	7.4	0.71	0.030	1.15	1.15	0.00	5.0	
S-117	117+15	0.27	0.23	0.04	7.4	0.80	0.020	1.59	1.59	0.00	6.6	
S-118	117+15	0.23	0.20	0.03	7.4	0.81	0.020	1.38	1.38	0.00	6.1	
S-119	119+15	0.19	0.15	0.04	7.4	0.75	0.009	1.06	1.06	0.00	6.6	
S-120	119+15	0.22	0.20	0.02	7.4	0.84	0.009	1.36	1.36	0.00	7.4	

D-4



DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

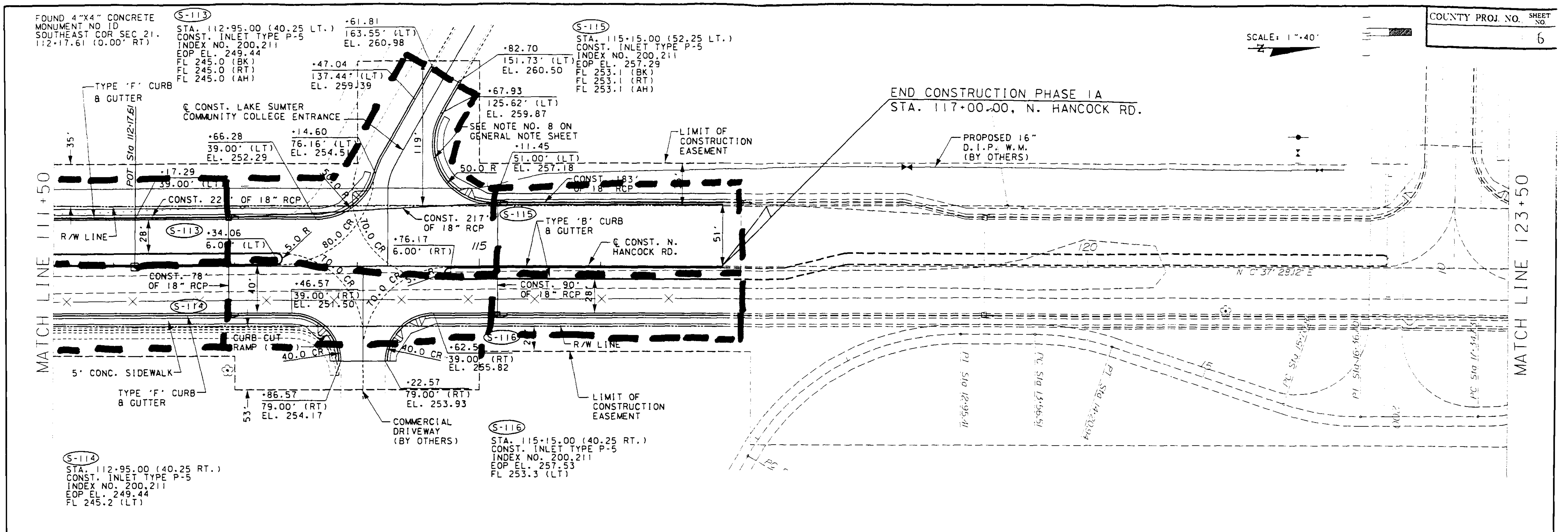
REVISIONS

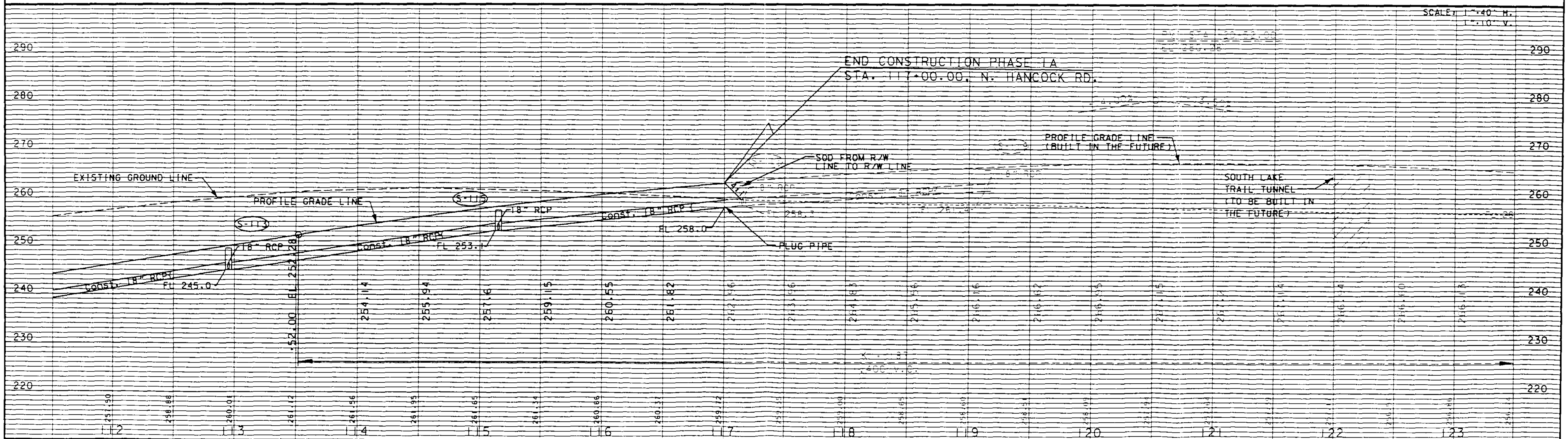
VHB VANASSE HANGEN BRUSTLIN, INC.
TRANSPORTATION, LAND DEVELOPMENT, ENVIRONMENTAL SERVICES
135 W. CENTRAL BLVD., SUITE 150
ORLANDO, FL 32801 (407)839-4006

LAKE COUNTY PUBLIC WORKS
ENGINEERING DIVISION
123 N. SINCLAIR AVE.
TAVARES, FLORIDA 32778

PLAN / PROFILE
N. HANCOCK ROAD
STA 99+95.53 TO STA 111+50

COUNTY PROJ. NO. | SHEET NO. 5





DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

REVISIONS

VHB VANASSE HANGEN BRUSTLIN, INC.
TRANSPORTATION, LAND DEVELOPMENT, ENVIRONMENTAL SERVICES
135 W. CENTRAL BLVD., SUITE 50
ORLANDO, FL 32801 (407) 839-4006

LAKE COUNTY PUBLIC WORKS
ENGINEERING DIVISION
123 N. SINCLAIR AVE.
TAVARES, FLORIDA 32778

PLAN / PROFILE
N. HANCOCK ROAD
STA 111+50 TO STA 117+00

COUNTY PROJ. NO. | SHEET NO. 6

Hydrologic Computations

Runoff Curve Number

Project:	North Hancock Road	**Computed by:**	PWY
Location:	Pond A (FDOT Ret. Area 3)	**Date:**	12/28/98
Basin:	A	**Checked:**	JK
Condition:	Pre-development	**Date:**	2/11/99

Soil Name and Hydrologic Group	Cover Description	CN			Area (acres)	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
Astatula (A)	Open Space (good condition)	39			6.12	238.7
Astatula (A)	Orange Grove (fair condition)	32			84.90	2716.8
Impervious	Roadway Pavement	98			4.63	453.7
				Totals =	95.65	3409.2

CN (Weighted) = (total product)/(total area) = 35.64 **Use CN = 36**

Directly Connected Impervious Area (%)= 4.8

CN (NDCIA) = 32.47 **Use CN = 32**

Vanasse Hangen Brustlin, Inc.
Reference: SCS TR-55

p:\projects\60633\ssheets\drainage\CurveNumber.xls

VHB Computations

Project N. Hancock Rd. Project # 60633
Location Lake Co Sheet 1 of
Calculated by PWY Date 12/11/98
Checked by JK Date 2/12/99
Title FDOT (Existing) Pond

1. Area draining to Pond:
   North Side = 62 Acres
   South Side = 33.6 Acres
   Total = 95.6 Acres

2 Cover Type:

Roadway Area:

Begin Station: 1362+50
End Station: 1398+50
Length = 3600 feet

Width = 56 feet (Pavement)

Area = $(3600)(56)\,ft^2 \left(\frac{1\,ac}{43560\,ft^2}\right) = \boxed{4.63\,ac}$

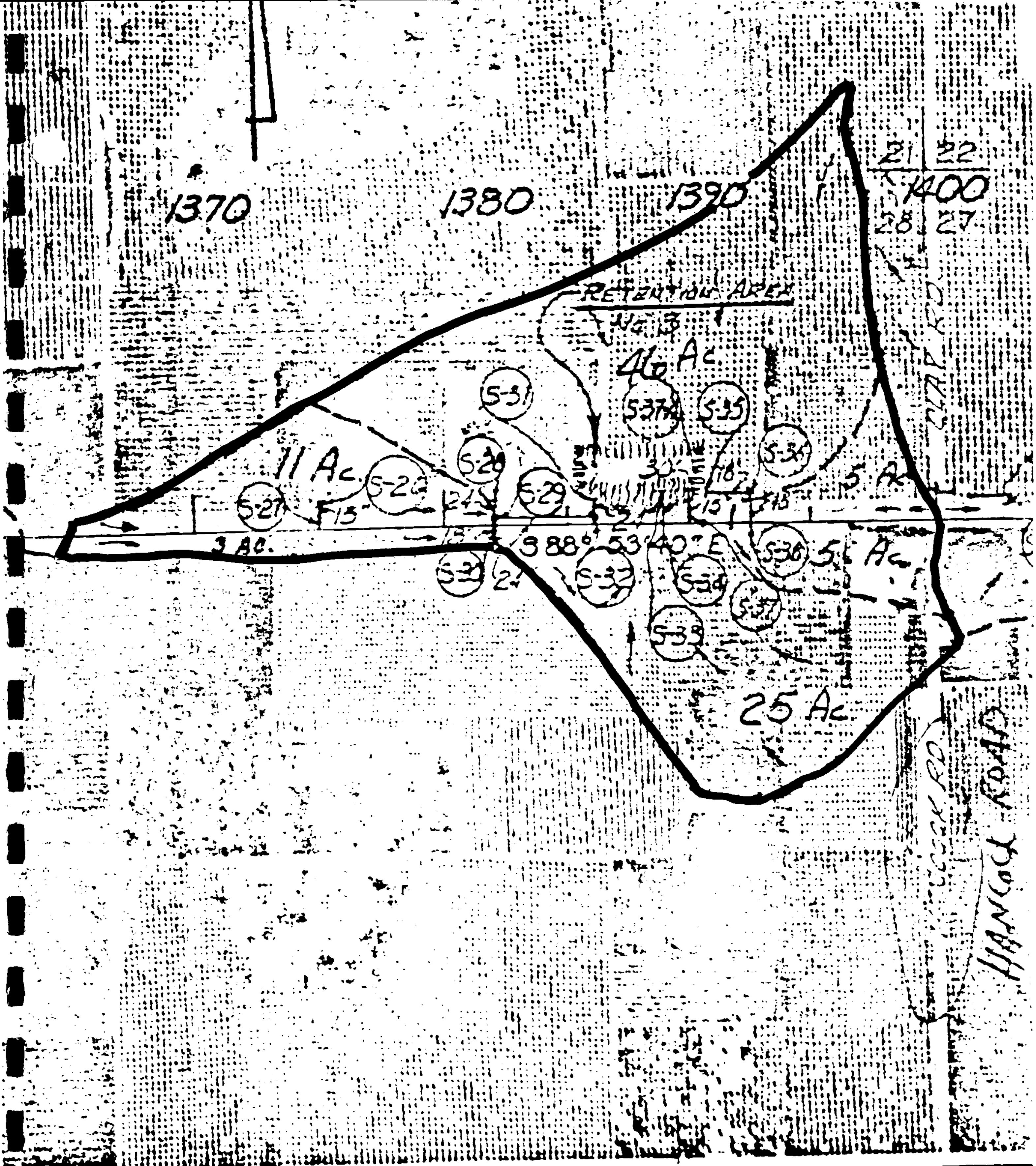
Grass Area:

Begin Station: 1362+50
End Station: 1398+50
Length: 3600 ft

Width: 74 feet (Grass)

Area = $(3600)(74)\,ft^2 \left(\frac{1\,ac}{43560\,ft^2}\right) = \boxed{6.12\,ac}$

Grove / Trees: $95.6\,ac - (4.63 + 6.12)\,ac = \boxed{84.9\,ac}$



F.P. 1081 (1:070-1505) SR 50 - SR 25 TO

Source: SR 50 Roadway Plans

Date: June 19, 1973

Runoff Curve Number

Project:	North Hancock Road	**Computed by:**	PWY
Location:	Pond A (FDOT Ret. Area 3)	**Date:**	12/28/98
Basin:	A	**Checked:**	GL
Condition:	Post-development	**Date:**	3/11/99

Soil Name and Hydrologic Group	Cover Description	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area (acres)	Product of CN x Area
Astatula (A)	Open Space (good condition)	39			5.79	225.8
Astatula (A)	Orange Grove (fair condition)	32			84.90	2716.8
Impervious	Roadway Pavement (SR 50)	98			4.96	486.1
Impervious	Roadway Pavement (N Hancock)	98			4.10	401.8
Astatula (A)	Grass (N Hancock)	39			1.83	71.4
				Totals =	101.58	3901.9

CN (Weighted) = (total product)/(total area) = 38.41 **Use CN =** **38**

Directly Connected Impervious Area (%)= 8.9

CN (NDCIA) = 32.58 **Use CN =** **33**

Vanasse Hangen Brustlin, Inc.
Reference: SCS TR-55

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Time of Concentration (TR-55)

Project: N. Hancock Rd.
Location: Basin A (Pond A)
Condition: Pre-development

Computed by: PWY
Date: 12/15/98
Checked by: JK
Date: 2/12/99

Sheet Flow

	Segment ID		
	1		
1. Surface Description (Table 3-1)	Grass/Trees		
2. Manning's roughness coeff., n (Table 3-1)	0.24		
3. Flow Length, L (total <= 300 ft) (feet)	300		
4. 2-year 24-hour rainfall, P_2 (inches)	4.7		
5. Land slope, s (ft/ft)	0.0583		**Sub-total**
6. Tt =(0.007 * (nL)^0.8)/((P_2^0.5)*(s^0.4)) (hr)	0.31		0.31

Shallow Concentrated Flow

	Segment ID		
	2		
7. Surface description (paved or unpaved)	unpaved		
8. Flow length, L (feet)	500		
9. Watercourse slope, s (ft/ft)	0.120		
10. Average velocity, V (figure 3-1) (ft/s)	5.59		**Sub-total**
11. Tt = (L/(3600*V) (hr)	0.02	0.00	0.02

Channel Flow

	Segment ID		
12. Cross section flow area, a (ft^2)			
13. Wetted perimeter, Pw (ft)			
14. Hydraulic radius, r = a/Pw (ft)			
15. Channel slope, s (ft/ft)			
16. Manning/s roughness coeff., n			
17. $V = (1.49*(r^{2/3})*(s^{1/2}))/n$ (ft/s)	0.00		
18. Flow length, L (ft)	0		**Sub-total**
19. Tt = (L/3600*V) (hr)	0.000		0.000

Total

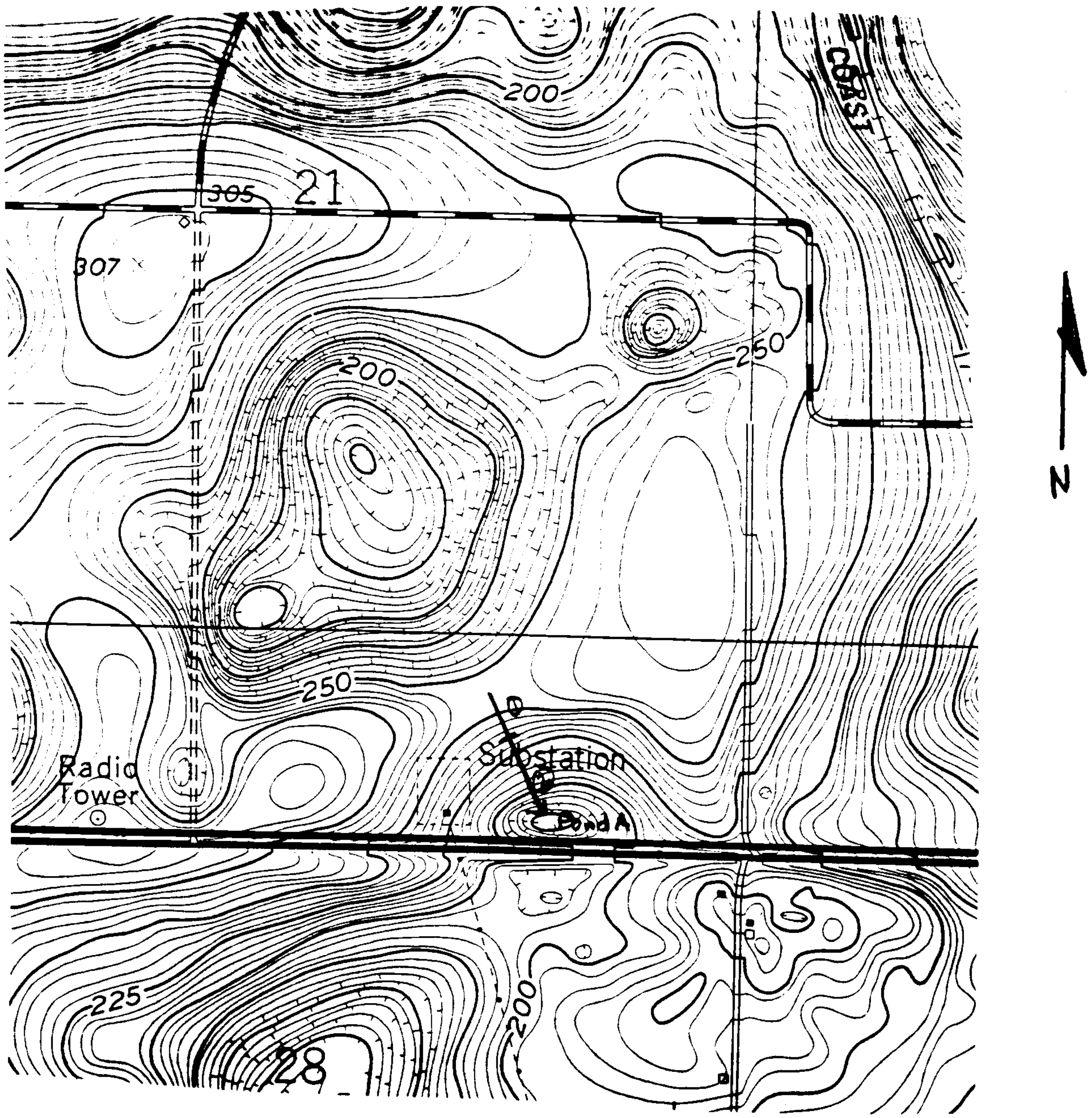
	Total
20. Total Tc (hr)	0.33
21. Total Tc (min)	20.0

Notes:

Vanasse Hangen Brustlin, Inc.
Reference: SCS TR-55

VHB **Computations**

Project N. Hancock Rd. Project # 60673
Location Lake Co. Sheet 2 of 2
Calculated by PWY Date 12/15/98
Checked by JK Date 2/12/99
Title Tc Flowpath



1" = 1000'

VHB **Computations**

Project N. Hancock Rd Project # 60633
Location Lake Co Sheet 1 of 1
Calculated by PWY Date 12/15/98
Checked by JK Date 2/12/99
Title Treatment Volume Basin A

Task: Compute treatment volume for Basin A.

Requirement: Greater of 1.0 inch over basin area
or
1.75 inches over impervious area

Total Area = 101.03 acres
Impervious Area = 9.21 acres

$TV_1 = (101.03ac)(1in)\left(\frac{1ft}{12in}\right) = 8.42ac\text{-}ft$

$TV_2 = (9.21ac)(1.75in)\left(\frac{1ft}{12in}\right) = 1.34ac\text{-}ft$

∴ Required TV = 8.42 ac-ft

Note: The North Hancock Road Contribution is:
Impervious Area: 4.25ac
Grass Area: 1.13ac

Stage -Storage Analysis

Project: North Hancock Road
Pond: A
Computed by: PWY
Date: 12/15/98

Existing Conditions		
Stage (ft)	**Area (acres)**	**Incremental Volume (ac-ft)**
173	1.77	0.00
186	2.99	30.94
Total		**30.94**

Proposed Conditions		
Stage (ft)	**Area (acres)**	**Incremental Volume (ac-ft)**
171	2.03	0.00
173	2.16	4.19
186	3.44	36.4
Total		**40.59**

Volume required for attentuation (ac-ft): 9.55
(100-year 240-hour)

Volume provided (ac-ft): 9.65

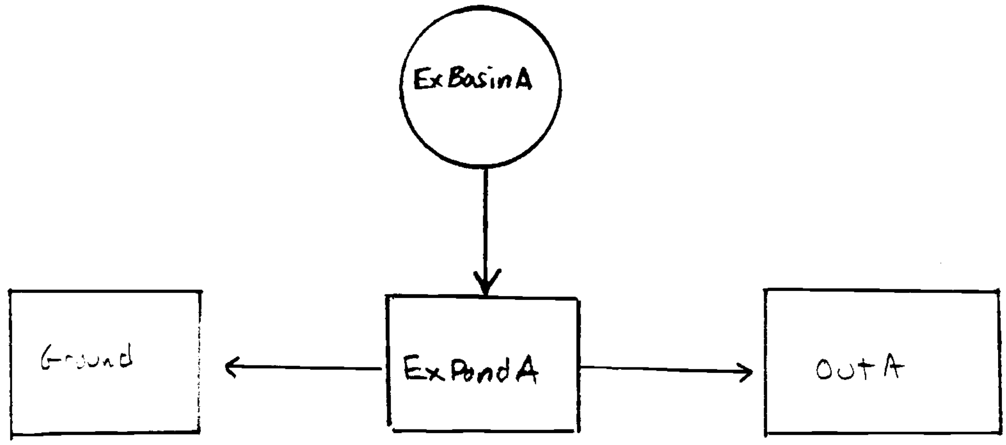
p:\projects\60633\ssheets\drainage\pondstorage.xls

AdICPR Input

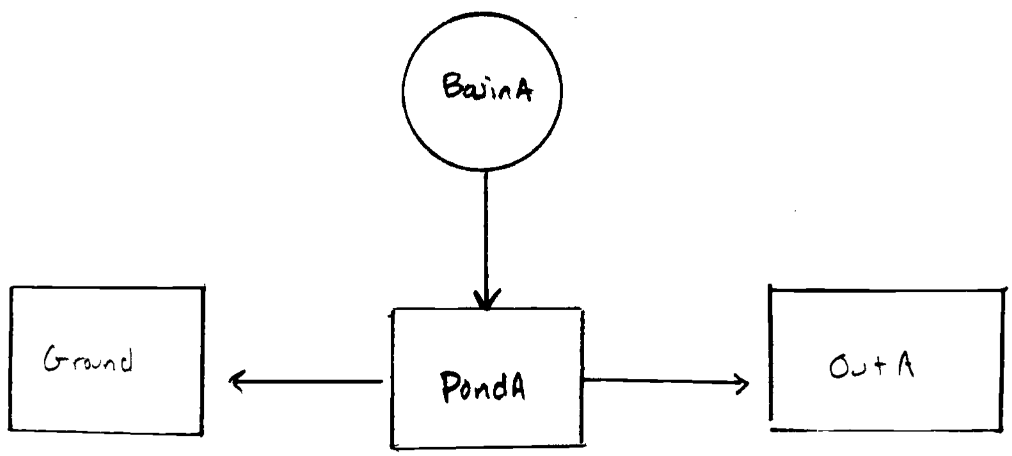
VHB **Computations**

Project N. Hancock Rd. Project # 60633
Location Lake Co Sheet 1 of 1
Calculated by PWY Date 12/15/98
Checked by ______ Date ______
Title Nodal Diagram Basin A

Existing



Proposed



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Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.11) [1]
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North Hancock Road (Basin A)



********** Input Report ********************************************************
--------Class: Node--------------------------------------------------------------
   Name: EXPONDA    Base Flow(cfs): 0          Init Stage(ft): 173
  Group: BASE           Length(ft): 0          Warn Stage(ft): 184
Comment: pre-development

Stage(ft)     Area(ac)
173           1.77
186           2.99
--------Class: Node--------------------------------------------------------------
   Name: GROUND     Base Flow(cfs): 0          Init Stage(ft): 160
  Group: BASE           Length(ft): 0          Warn Stage(ft): 0
Comment:

Time(hrs)     Stage(ft)
0             160
250           160
--------Class: Node--------------------------------------------------------------
   Name: OUTA       Base Flow(cfs): 0          Init Stage(ft): 170
  Group: BASE           Length(ft): 0          Warn Stage(ft): 0
Comment:

Time(hrs)     Stage(ft)
0             170
250           170
--------Class: Node--------------------------------------------------------------
   Name: PONDA      Base Flow(cfs): 0          Init Stage(ft): 171
  Group: BASE           Length(ft): 0          Warn Stage(ft): 184
Comment:

Stage(ft)     Area(ac)
171           1.78
173           2.07
186           3.33
--------Class: Operating Table---------------------------------------------------
   Name: GRNDIN2       Type: Rating Curve
Comment: Proposed Condition

   U/S Stage(ft)      Discharge(cfs)
   171                2.41
   186                2.41

--------Class: Operating Table---------------------------------------------------
   Name: GROUNDIN      Type: Rating Curve
Comment:

   U/S Stage(ft)      Discharge(cfs)
   173                2.41
   186                2.41
```

```
Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.11) [2]
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North Hancock Road (Basin A)


********** Input Report ********************************************************
--------Class: Basin-----------------------------------------------------------
Basin: BASINA      Node: PONDA      Status: On Site      Type: SCS Unit Hydr
Group: BASE
    Unit Hydrograph: UH484                      Peak Factor: 484
      Rainfall File: SJRWMD96          Storm Duration(hrs): 0
Rainfall Amount(in): 0
           Area(ac): 101.58      Concentration Time(min): 20
            Curve #: 38                     Lag Time(hrs): 0
            DCIA(%): 0

          Six Lane SR 50

--------Class: Basin-----------------------------------------------------------
Basin: EXBASINA    Node: EXPONDA    Status: On Site      Type: SCS Unit Hydr
Group: BASE
    Unit Hydrograph: UH484                      Peak Factor: 484
      Rainfall File: SJRWMD96          Storm Duration(hrs): 0
Rainfall Amount(in): 0
           Area(ac): 96.65       Concentration Time(min): 20
            Curve #: 36                     Lag Time(hrs): 0
            DCIA(%): 0

          pre-development

--------Class: Pipe------------------------------------------------------------

           Name: PIPE          From Node: PONDA      Length(ft): 186
          Group: BASE            To Node: OUTA            Count: 1

                 UPSTREAM      DOWNSTREAM              Equation: Average K
       Geometry: Circular      Circular                    Flow: Both
       Span(in): 30            30            Entrance Loss Coef: 0.5
       Rise(in): 30            30                Exit Loss Coef: 0.5
     Invert(ft): 175           182.9             Bend Loss Coef: 0
     Manning's N: 0.012        0.012         Outlet Cntrl Spec: Use dc or tw
    Top Clip(in): 0            0              Inlet Cntrl Spec: Use dc
 Bottom Clip(in): 0            0             Stabilizer Option: None


     Upstream FHWA Inlet Edge Description:
     Circular Concrete: Square edge w/ headwall              1     1

     Downstream FHWA Inlet Edge Description:
     Circular Concrete: Square edge w/ headwall              1     1
```

Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.11) [3]

North Hancock Road (Basin A)

```
********** Input Report ********************************************************
--------Class: Pipe-------------------------------------------------------------

          Name: PIPE-EX      From Node: EXPONDA   Length(ft): 186
         Group: BASE           To Node: OUTA           Count: 1

                UPSTREAM     DOWNSTREAM           Equation: Average K
      Geometry: Circular     Circular                 Flow: Both
      Span(in): 30           30           Entrance Loss Coef: 0.5
      Rise(in): 30           30               Exit Loss Coef: 0.5
    Invert(ft): 175          182.9            Bend Loss Coef: 0
   Manning's N: 0.012        0.012         Outlet Cntrl Spec: Use dc or tw
  Top Clip(in): 0            0              Inlet Cntrl Spec: Use dc
Bottom Clip(in): 0           0             Stabilizer Option: None


     Upstream FHWA Inlet Edge Description:
     Circular Concrete: Square edge w/ headwall                    1     1

     Downstream FHWA Inlet Edge Description:
     Circular Concrete: Square edge w/ headwall                    1     1

--------Class: Rating Curve-----------------------------------------------------
   Name: GRNDIN      Count: 1          From Node: PONDA
  Group: BASE         Flow: Positive     To Node: GROUND

          NAME       ELEV ON(ft) ELEV OFF(ft)
     #1: GRNDIN2     171         170.9
     #2:             0           0
     #3:             0           0
     #4:             0           0

post-development

--------Class: Rating Curve-----------------------------------------------------
   Name: GRNDINEX    Count: 1          From Node: EXPONDA
  Group: BASE         Flow: Positive     To Node: GROUND

          NAME       ELEV ON(ft) ELEV OFF(ft)
     #1: GROUNDIN    173         172.9
     #2:             0           0
     #3:             0           0
     #4:             0           0

Pre-development
```

AdICPR Output

Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.11) [1]

North Hancock Road
25-year 96-hour
PWY 3-1-99

********** Basin Summary - 2596TEST **

***

Basin Name:	EXBASINA	BASINA
Group Name:	BASE	BASE
Node Name:	EXPONDA	PONDA
Hydrograph Type:	UH	UH
Unit Hydrograph:	UH484	UH484
Peaking Factor:	484.00	484.00
Spec Time Inc (min):	2.67	2.67
Comp Time Inc (min):	2.67	2.67
Rainfall File:	SJRWMD96	SJRWMD96
Rainfall Amount (in):	11.80	11.80
Storm Duration (hr):	96.00	96.00
Status:	ONSITE	ONSITE
Time of Conc. (min):	20.00	20.00
Lag Time (hr):	0.00	0.00
Area (acres):	96.65	101.58
Vol of Unit Hyd (in):	1.00	1.00
Curve Number:	36.00	38.00
DCIA (%):	0.00	0.00
Time Max (hrs):	60.09	60.09
Flow Max (cfs):	155.03	186.23
Runoff Volume (in):	2.61	2.93
Runoff Volume (cf):	915160	1079810

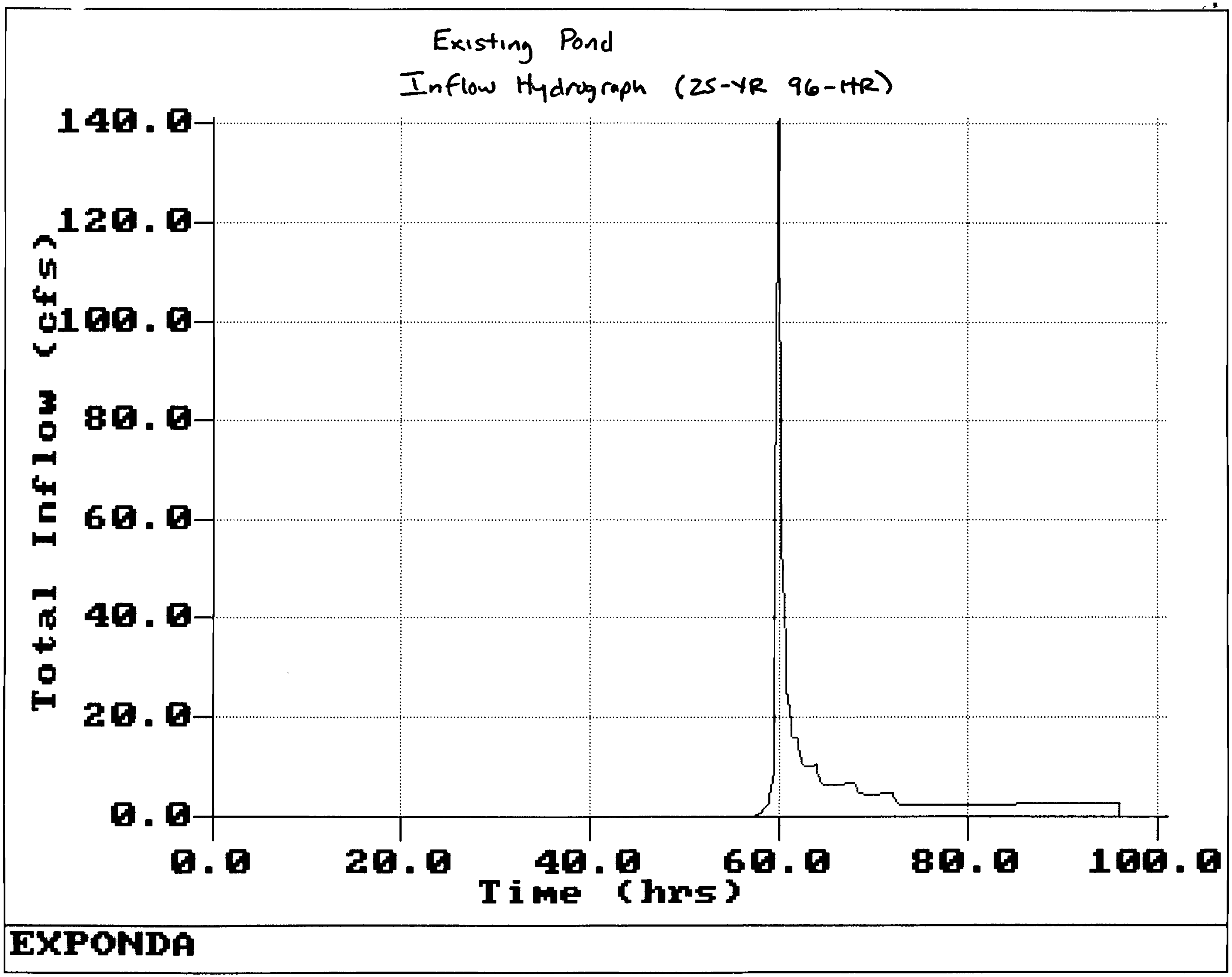
Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.11) [1]

North Hancock Road
25-year 96-hour
PWY 2-18-99

********** Node Maximum Conditions - 2596TEST **********

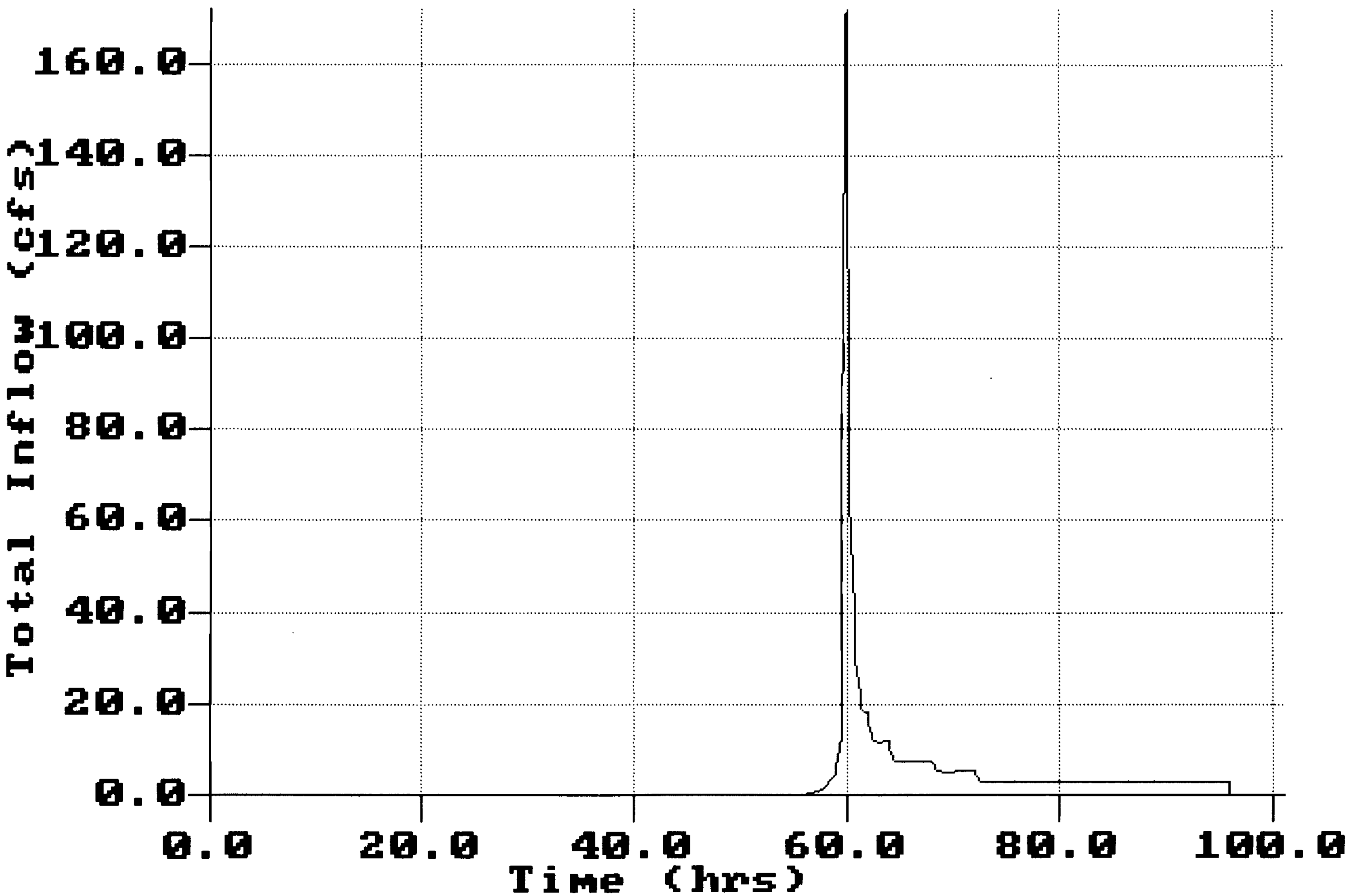
^(Time units - hours)

Node Name	Group Name	Max Time Conditions	Max Stage (ft)	Warning Stage (ft)	Max Delta Stage (ft)	Max Surface Area (sf)	Max Time Inflow	Max Inflow (cfs)	Max Time Outflow	Max Outflow (cfs)
EXPONDA	BASE	96.00	179.61	184.00	0.0433	104140.69	60.00	140.78	0.00	2.41
GROUND	BASE	0.00	160.00	0.00	0.0000	0.00	0.00	4.82	0.00	0.00
OUTA	BASE	0.00	170.00	0.00	0.0000	23.25	0.00	0.00	0.00	0.00
PONDA	BASE	96.00	178.77	184.00	0.0499	114524.61	60.00	171.58	0.00	2.41



Existing Pond
Inflow Hydrograph (25-YR 96-HR)
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Total Inflow (cfs)
0.0
20.0
40.0
60.0
80.0
100.0
Time (hrs)
EXPONDA

Proposed Pond (Expansion)
Inflow Hydrograph (25YR - 96-HR)



PONDA

Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.11) [1]

NORTH HANCOCK ROAD (LAKE COUNTY)
CRITICAL STORM 100 YEAR 240 HOUR
PWY 02/23/99

********** Basin Summary - 100Y240H **

***

Basin Name:	EXBASINA	BASINA
Group Name:	BASE	BASE
Node Name:	EXPONDA	PONDA
Hydrograph Type:	UH	UH
Unit Hydrograph:	UH484	UH484
Peaking Factor:	484.00	484.00
Spec Time Inc (min):	2.67	2.67
Comp Time Inc (min):	2.67	2.67
Rainfall File:	FDOT-240	FDOT-240
Rainfall Amount (in):	18.70	18.70
Storm Duration (hr):	240.00	240.00
Status:	ONSITE	ONSITE
Time of Conc. (min):	20.00	20.00
Lag Time (hr):	0.00	0.00
Area (acres):	96.65	101.58
Vol of Unit Hyd (in):	1.00	1.00
Curve Number:	36.00	40.00
DCIA (%):	0.00	0.00
Time Max (hrs):	184.00	184.00
Flow Max (cfs):	39.37	45.44
Runoff Volume (in):	6.96	8.02
Runoff Volume (cf):	2440581	2956285

Advanced Interconnected Channel & Pond Routing (ICPR Ver 2.11) [1]

NORTH HANCOCK ROAD (LAKE COUNTY)
CRITICAL STORM 100 YEAR 240 HOUR
PWY 02/23/99

********** Node Maximum Conditions - 100Y240H **

^(Time units - hours)

Node Name	Group Name	Max Time Conditions	Max Stage (ft)	Warning Stage (ft)	Max Delta Stage (ft)	Max Surface Area (sf)	Max Time Inflow	Max Inflow (cfs)	Max Time Outflow	Max Outflow (cfs)
EXPONDA	BASE	192.12	184.05	185.00	0.0191	122318.48	184.00	39.34	192.12	7.07
GROUND	BASE	0.00	160.00	160.00	0.0000	0.00	0.00	4.82	0.00	0.00
OUTA	BASE	0.00	170.00	170.00	0.0000	23.25	192.22	8.83	0.00	0.00
PONDA	BASE	192.35	183.98	185.00	0.0215	136570.31	184.00	45.40	192.35	6.59