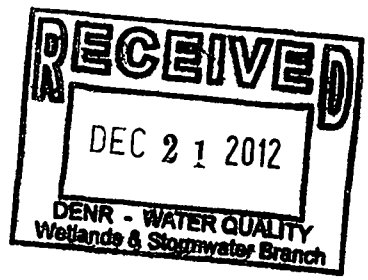
20121140

KE

KELLER ENVIRONMENTAL
ENVIRONMENTAL CONSULTANTS

December 21, 2012

To: NC Division of Water Quality
401 Oversight Unit
Attn: Staff
1617 Mail Service Center
Raleigh, NC 27699-1617



From: Jay Keller
Keller Environmental
7921 Haymarket Lane
Raleigh, NC 27613

Re: **SW Cary Parkway Daycare**
Major Variance Submittal
Cary, Wake County, North Carolina

On behalf of the applicant, Lyle Gardener, please find attached a complete application and supplemental information requesting a major Variance approval from the North Carolina Division of Water Quality (DWQ) for 0.349 acres of impact to the Neuse River Buffer area associated with the construction of proposed daycare facility. Please contact me at (919) 749-8259 or jay@kellerenvironmental.com if you have any questions or require any additional information.

PROJECT SUMMARY

Project Name	SW CARY PARKWAY DAYCARE
Project Type	DAYCARE FACILITY
Owner / Applicant	Lyle Gardener; LBJ Cary Associates, LLC
County	Wake
Nearest Town	Cary
Waterbody Name	UT to Williams Creek
Basin / Sub-basin	03020201
Index Number	27-43-2
Class	WS-III; NSW

IMPACT SUMMARY

Stream Impact (linear feet)	145
Neuse River Buffer Zone 1 Impacts (square feet)	8,047
Neuse River Buffer Zone 2 Impacts (square feet)	7,140

Sincerely,
KELLER ENVIRONMENTAL, LLC

Jay Keller
Principal

Attachments:
Major Variance Request Form
Stream Determination Letter (3-16-12)
Birchwood USGS Map
Birchwood NRCS Soil Map
Kilarney Pointe 2012 Vicinity Aerial
Kilarney Pointe 2012 Aerial
Real Estate Market Analysis
Engineering Plan Sheets (2)

North Carolina Department of Environment and Natural Resources
Division of Water Quality
Charles Wakild, P.E.
Director

Beverly Eaves Perdue
Governor
Dee Freeman
Secretary

Variance Request Form
(For Minor and Major Variances)

Protection and Maintenance of Riparian Areas Rules

NOTE: This form may be photocopied for use as an original.

Check the appropriate box below:

X Major Variance

☐ Minor Variance

Please identify which Riparian Area Protection Rule applies (Note-this must be one of North Carolina's four buffered river basins. The River Bain map is available at http://h2o.enr.state.nc.us/admin/maps/.)

☐ **Neuse River Basin: Nutrient Sensitive Waters Management Strategy Protection and Maintenance of Riparian Areas Rule (15A NCAC 02B.0233)**

☐ **Tar-Pamlico River Basin: Nutrient Sensitive Waters Management Strategy Protection and Maintenance of Riparian Areas Rule (15A NCAC 02B.0259)**

Part 1: General Information

(Please include attachments if the room provided is insufficient.)

1. Applicant's name (the corporation, individual, etc. who owns the property):
   LBJ Cary Associates LLC

2. Print owner/Signing official (person legally responsible for the property and its compliance)
   Name: Lyle Gardener
   Title: Manager
   Street address: 7706 Six Forks Road
   City, State, Zip: Raleigh, NC 27615
   Telephone: (919) 848-2042
   Fax: ( )

3. Contact person who can answer questions about the proposed project:
   Name: Jay Keller
   Telephone: (919) 749-8259
   Fax: (919) 803-0970
   Email: jay@kellerenvironmental.com

4. Project name (Subdivision, facility, or establishment name - consistent with project name on plans, specifications, letters, operation and maintenance agreements, etc.):
   Kilarney Ridge Loop

5. Project location:
   Street address: 0 SW Cary Parkway
   City, State, Zip: Cary, NC 27511
   County: Wake
   Latitude/longitude: 35.760384; -78.822005

6. Date property was purchased: 06/01/2004

7. Directions to site from nearest major intersection (Attach an 8 ½ x 11 copy of the USGS topographic map indicating the location of the site). Site is 0.1-mile southwest of intersection of Cary Parkway and Old Apex Road.

8. Stream to be impacted by the proposed activity:
   Stream name (for unnamed streams label as "UT" to the nearest named stream):
   UT to Williams Creek (27-43-2; C; WS-III; NSW; 03-04-02); USGS Cataloging Unit 03020201

9. Which of the following permits/approvals will be required or have been received already for this project?

Required:	Received:	Date received:	Permit Type:
yes	no		CAMA Major
no			CAMA Minor
yes	no		401 Certification/404 Permit
no			On-site Wastewater Permit
yes	yes		NPDES Permit (including stormwater)
no			Non-discharge Permit
no			Water Supply Watershed Variance
yes	no		Erosion/Sedimentation Control
			Others (specify)

Part 2: Proposed Activity

(Please include attachments if the room provided is insufficient.)

Description of proposed activity [Also, please attach a map of sufficient detail (such as a plat map or site plan in Adobe (pdf) format) to accurately delineate the boundaries of the land to be utilized in carrying out the activity, the location and dimension of any disturbance in the riparian buffers associated with the activity, and the extent of riparian buffers on the land. **Include the area of buffer impact in ft²**.: The proposed project is to construct a daycare facility and associated infrastructure including parking (see attached plans). To accomplish this, the site development proposes lot grading within Zones 1 & 2 of the protected riparian buffer so that the appropriate site grades can be achieved

in order to locate the proposed approximately 11,790 SF daycare structure, driveways and parking areas on the site. The site plan also depicts the necessary parking facility, which proposes one (1) parking stall per 200 SF, 52 parking stalls, as is required by the Town of Cary UDO. **Total area of buffer proposed to be permanently impacted is 15,187 square feet.** A detailed breakdown of the individual buffer impacts is depicted on the attached site plan as well as expounded upon below.

2. Fill in the table below to identify the square footage of impact to Zones 1 & 2 in the protected riparian buffers and the required mitigation (**Fill in the impacts portion of the table, even if mitigation is not required):**

Zone of Impact	Impact in Square Feet	Buffer Impact Number (Indicate on Plan Sheet)	Purpose for the Impact	Multiplier	Required Mitigation
Zone 1	8,047	1		3	24,141
Zone 2	7,140	2		1.5	10,710
Total	15,187				34,851

*Zone 1 extends out 30 feet perpendicular from the most landward limit of the top of bank or the rooted herbaceous vegetation; Zone 2 extends an additional 20 feet from the edge of Zone 1.

3. State reasons why this plan for the proposed activity cannot be practically accomplished, reduced or reconfigured to better minimize or eliminate disturbance to the riparian buffers:
Several potential buyers have reviewed this site and potential site plans for a daycare or funeral home were designed by the engineer- Hugh J. Gilleece. These plans were shown to Mrs. Amy Chapman & Mr. Ian McMillan during our June 7, 2012 office meeting. Unfortunately, the central location of the stream on the property restricted adequate building sizes and/or associated infrastructure. The site is also restricted by the multiple easements, buffers, roads, driveway and adjacent residential lot 1.

4. Description of any best management practices to be used to control impacts associated with the proposed activity (i.e., control of runoff from impervious surfaces to provide diffuse flow, re-planting vegetation or enhancement of existing vegetation, etc.):
Two stormwater wetlands were constructed for the entire Kilarney Pointe neighborhood in 2005. The eastern stormwater wetland is immediately adjacent to the proposed daycare site. This stormwater wetland was designed and constructed for eastern end of neighborhood plus the proposed daycare site. It is in excellent condition and was viewed by Mr. Ian McMillian & Eric Kulz along with Mrs. Lauren Witherspoon during the site meetings.

5. Please provide an explanation of the following:
(1) The practical difficulties or hardships that would result from the strict application of this Rule.
The current stream relocation with accompanying riparian buffers significantly restricts potential site layouts for this commercial site. The site has an excellent location which has drawn multiple interests from potential buyers for several years. A recent real estate market analysis (see attached) was conducted. These findings along with new interest from potential buyers has resulted in the revised layout incorporating the proposed removal of the intermittent stream channel and associated riparian buffer areas.

(2) How these difficulties or hardships result from conditions that are unique to the property involved. This site is located in an area of Cary that has been developed for several years. The mixed-use vicinity area is comprised of shopping centers, residential neighborhoods, mini-storage business, business park, schools, railroad and other commercial properties. The site geometry,

topography and jurisdictional areas along with the immediate roads, buffers, easements and other restrictions has placed a unique hardship for development conducive to this site and area.

The stream is in very good condition immediately below Kilarney Ridge Loop for approximately 200 linear feet. This section of stream is also adjacent to the eastern stormwater wetland and open space areas. However, the stream is culverted for approximately 1,700 linear feet when it leaves the Kilarney Pointe neighborhood until it resurfaces at Apex Community Park. Also, the stream is significantly incised on the proposed daycare site and displayed poor aquatic quality which is very likely due to volatility of stormwater flowing from the upstream Cary Parkway and business park.

(3) If economic hardship is the major consideration, then include a specific explanation of the economic hardships and the proportion of the hardship to the entire value of the project.
Several potential buyers have explored developing this site. Prospective site designs were conducted incorporating the previously mentioned factors. The restrictions resulted in a non-developable site to the potential buyers and their interests and monetary assets moved elsewhere.

Part 3: Stormwater

1. Provide a description of all best management practices (BMPs) that will be used to control nutrients and sedimentation impacts associated with the proposed activity. Please ensure to include all applicable operation & maintenance agreements and worksheets for the proposed BMPs. Also, include the BMPs on your plan sheets.
   Two constructed stormwater wetland areas were constructed for Kilarney Pointe in 2005 and are in excellent condition. The proposed daycare site will drain to the eastern stormwater wetland area.

2. Attach a description of how diffuse flow will be maintained through the protected riparian buffers. Please ensure to include all applicable operation & maintenance agreements and worksheets for the proposed diffuse flow measure(s). Also, include the diffuse flow measure(s) on your plan sheets.
   The remaining riparian buffer areas will be mostly comprised of the existing woodlands. The impervious surface areas adjacent to the riparian buffers will drain to the eastern stormwater wetland. The newly-constructed stormwater pipes on the site will attach to the existing stormwater pipes of Kilarney Ridge Loop.

3. What will be the annual nitrogen load contributed by this site after development in pounds per acre per year without structural BMPs (stormwater pond, wetland, infiltration basin, etc)? Attach a detailed plan for all proposed structural stormwater BMPs.

Drainage basin	*Size of drainage basin (ac)*	*Post-development nitrogen[6] loading rate without BMPs[4] (lbs/ac/yr)*	*BMP nitrogen[6] removal efficiency[5] (%)*	*Final nitrogen[6] loading rate (lbs/ac/yr)*	*Final nitrogen[6] loading from drainage basin (lbs)*
1	13.48	10.47	40	6.28	84.65
2					
3					
4					
5					
Totals		-----	-----	-----	

[4] *Attach calculations and references.*
[5] *Attach calculations and references.*
[6] *Include Phosphorus in the Tar-Pamlico Basin*

4. Attach all applicable supplement form(s) and Inspection and Maintenance (I&M) Form(s) to this completed application. The applicable supplemental form(s) and I&M form(s) for the proposed BMPs noted in your application can be downloaded from the following website:

   http://h2o.enr.state.nc.us/su/bmp_forms.htm

Part 4: Proposed Impacts and Mitigation

Provide a description of how mitigation will be achieved at your site pursuant to 15A NCAC 2B.0242 for the Neuse Basin and 15A NCAC 2B.060 for the Tar-Pamlico Basin.

If buffer restoration is the method you are requesting, be sure to include a detailed planting plan to include plant type, date of plantings, the date of the one-time fertilization in the protected riparian buffers and a plan sheet showing the proposed location of the plantings. A guide to buffer restoration can be downloaded at the following website: **http://www.nceep.net/news/reports/buffers.pdf**

If payment into a buffer restoration fund is how you plan to achieve your mitigation requirement, then include an acceptance letter from the mitigation bank you propose to use stating they have the mitigation credits available for the mitigation requested.
The applicant proposes to either purchase buffer mitigation credit through an appropriate, private mitigation bank (should one be available) or to make an in-lieu payment to the NC EEP for the proposed buffer impacts. The applicant wishes to determine if this major variance request will be issued prior to reserving credits at a private mitigation bank as they, typically, require a significant deposit up front prior to set the credits aside.

Part 5: Deed Restrictions

By your signature in Part 6 of this application, you certify that all structural stormwater BMPs required by this variance shall be located in recorded stormwater easements, that the easements will run with the land, that the easements cannot be changed or deleted without concurrence from the State, and that the easements will be recorded prior to the sale of any lot.

Part 6: Applicant's Certification

I, Lyle Gardener (print or type name of person listed in Part I, Item 2), certify that the information included on this permit application form is correct, that the project will be constructed in conformance with the approved plans and that the deed restrictions in accordance with Part 5 of this form will be recorded with all required permit conditions.

Signature: 
Date: 11/24/12
Title: managing member

Part 7: Plan Sheets

Be sure to include a copy of all of your completed application form, plan sheets and maps in Adobe (pdf) format on a CD or floppy disk.

Part 8: Checklist

A complete application submittal consists of the following components. Incomplete submittals will be returned to the applicant. The complete variance request submittal must be received 90 days prior to the EMC meeting at which you wish the request to be heard. Initial below to indicate that the necessary information has been provided.

Applicant's Initials	Item
	• Original and two copies of the Variance Request Form and the attachments listed below.
	• A vicinity map of the project (see Part 1, Item 5)
	• Narrative demonstration of the need for a variance (see Part 2)
	• A detailed narrative description of stormwater treatment/management (see Part 4)
	• Calculations supporting nitrogen (phosphorus in the Tar-Pamlico Basin) loading estimates (see Part 4)
	• Calculations and references supporting nitrogen (phosphorus in the Tar-Pamlico Basin) removal from proposed BMPs (see Part 4)
engineer	• Location and details for all proposed structural stormwater BMPs (see Part 4)
engineer	• Three copies of the applicable Supplement Form(s) and I&M Form(s) for each BMP and/or narrative for each innovative BMP (see Part 4)
	• Three copies of plans and specifications, including:
	◊ Development/Project name
	◊ Engineer and firm
	◊ Legend and north arrow
	◊ Scale (1" = 50' is preferred)
	◊ Revision number & date
	◊ Mean high water line (if applicable)
	◊ Dimensioned property/project boundary
	◊ Location map with named streets or NC State Road numbers
	◊ Original contours, proposed contours, spot elevations, finished floor elevations
	◊ Details of roads, parking, cul-de-sacs, sidewalks, and curb and gutter
	◊ Footprint of any proposed buildings or other structures
OWQ Confirmed	◊ Wetlands delineated, or a note on plans that none exist
	◊ Existing drainage (including off-site), drainage easements, pipe sizes, runoff calculations
	◊ Drainage basins delineated
	◊ Perennial and intermittent streams, ponds, lakes, rivers and estuaries
	◊ Location of forest vegetation along the streams, ponds, lakes, rivers and estuaries

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Water Quality
Charles Wakild, PE
Director

Beverly Eaves Perdue
Governor

Dee Freeman
Secretary

March 16, 2012

Jay Keller
Keller Environmental, LLC
7921 Haymarket Lane
Raleigh, NC 27615

NBRRO#12-033
Wake County

BASIN:

☒ Neuse (15A NCAC 2B .0233) ☐ Tar-Pamlico (15A NCAC 2B .0259)

☐ Ephemeral/Intermittent/Perennial Determination ☐ Isolated Wetland Determination

Project Name: Kilarney Ridge Loop Properties

Location/Directions: Northeast of west of Cary Parkway and north and south of Kilarney Loop Road

Subject Stream: UT to Williams

Date of Determination: 2/15/12

Feature	E/I/P*	Not Subject	Subject	Start@	Stop@	Soil Survey	USGS Topo	Stream Form Points
A			X	culvert		X		26

E/I/P = Ephemeral/Intermittent/Perennial

Explanation: The feature(s) listed above has or have been located on the Soil Survey of Wake County, North Carolina or the most recent copy of the USGS Topographic map at a 1:24,000 scale. Each feature that is checked "Not Subject" has been determined not to be a stream or is not present on the property. Features that are checked "Subject" have been located on the property and possess characteristics that qualify it to be a stream. There may be other streams located on your property that do not show up on the maps referenced above but, still may be considered jurisdictional according to the US Army Corps of Engineers and/or to the Division of Water Quality.

This on-site determination shall expire five (5) years from the date of this letter. Landowners or affected parties that dispute a determination made by the DWQ or Delegated Local Authority may request a determination by the Director. An appeal request must be made within sixty (60) days of date of this letter or from the date the affected party (including downstream and/or adjacent owners) is notified of this letter. A request for a determination by the

Director shall be referred to the Director in writing c/o Karen Higgins, DWQ WeBSCaPe Unit, 1650 Mail Service Center, Raleigh, NC 27699-1650.

If you dispute the Director's determination you may file a petition for an administrative hearing. You must file the petition with the Office of Administrative Hearings within sixty (60) days of the receipt of this notice of decision. A petition is considered filed when it is received in the Office of Administrative Hearings during normal office hours. The Office of Administrative Hearings accepts filings Monday through Friday between the hours of 8:00 am and 5:00 pm, except for official state holidays. To request a hearing, send the original and one (1) copy of the petition to the Office of Administrative Hearings, 6714 Mail Service Center, Raleigh, NC 27699-6714. The petition may also be faxed to the attention of the Office of Administrative Hearings at (919) 733-3478, provided the original and one (1) copy of the document is received by the Office of Administrative Hearings within five (5) days following the date of the fax transmission. A copy of the petition must also be served to the Department of Natural Resources, c/o Mary Penny Thompson, General Counsel, 1601 Mail Service Center, Raleigh, NC 27699-1601.

This determination is final and binding unless, as detailed above, you ask for a hearing or appeal within sixty (60) days.

The owner/future owners should notify the Division of Water Quality (including any other Local, State, and Federal Agencies) of this decision concerning any future correspondences regarding the subject property (stated above). This project may require a Section 404/401 Permit for the proposed activity. Any inquiries should be directed to the Division of Water Quality (Central Office) at (919)-733-1786, and the US Army Corp of Engineers (Raleigh Regulatory Field Office) at (919)-554-4884.

Respectfully,

Lauren Witherspoon
Environmental Senior Specialist

cc: WeBSCaPe – 1650 Mail Service Center
RRO/SWP File Copy

NC DWQ Stream Identification Form Version 4.11

Date: 2/15/12	Project/Site: Kilarney Park Loop	Latitude:
Evaluator: LCW	County: Wake	Longitude:
Total Points: Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 26	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other e.g. Quad Name: Cary

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1* Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	(1)	2	3
5. Active/relict floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	(2)	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = 0		Yes = 3	

* artificial ditches are not rated; see discussions in manual

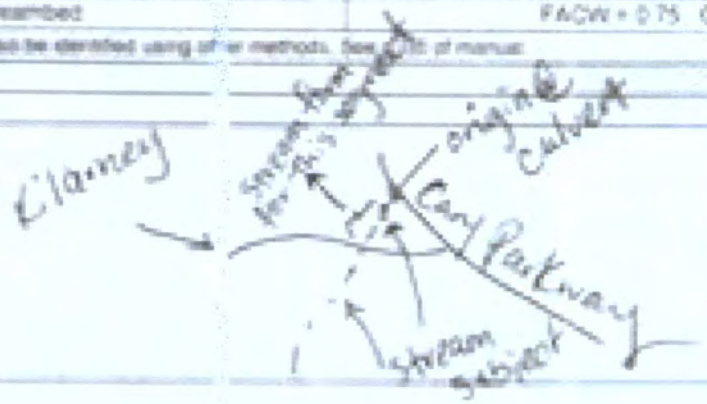
B. Hydrology (Subtotal = 9.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75 OBL = 1.5 Other = 0			

* perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

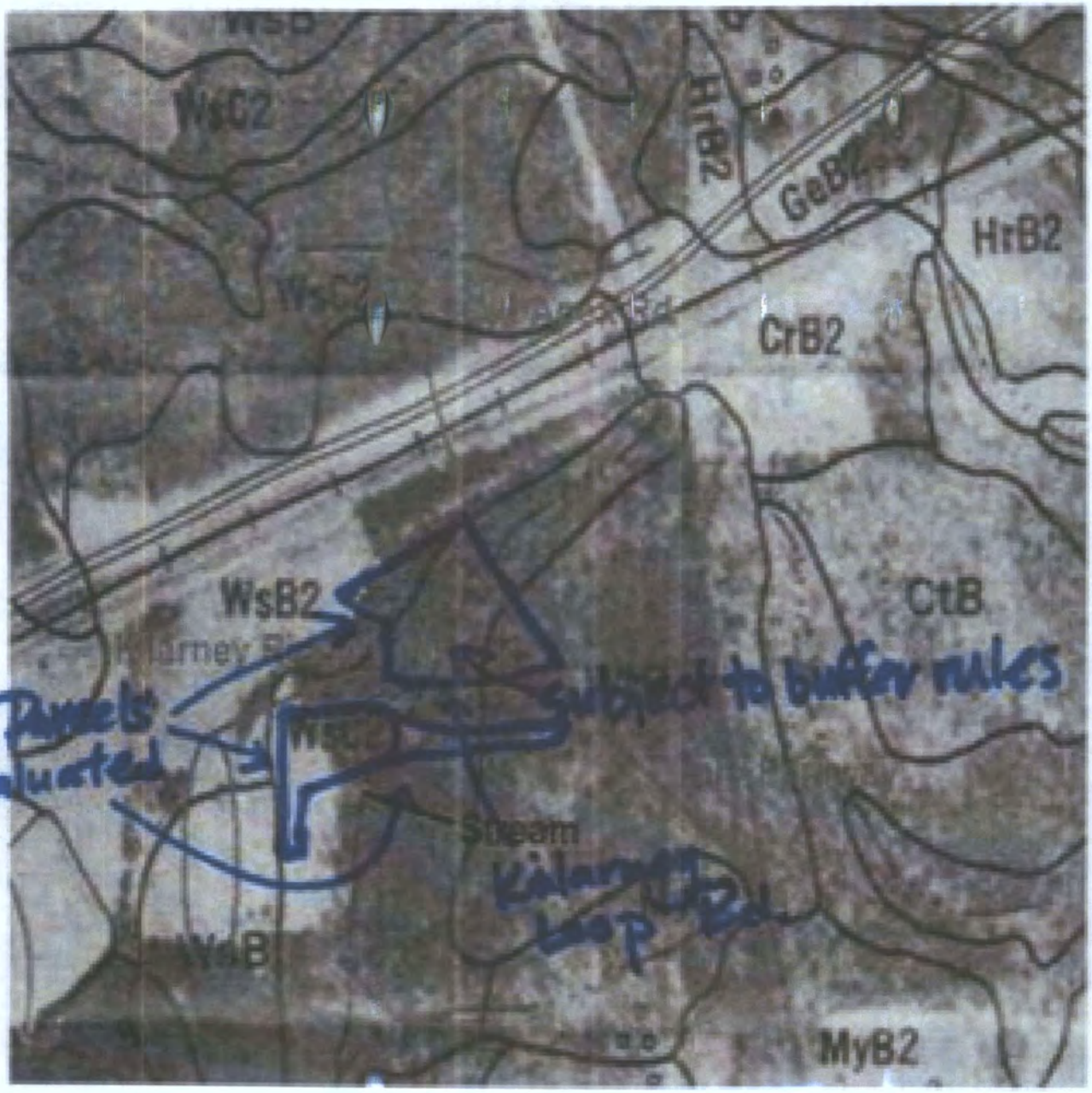
Sketch:



NBRRO 12-033

NBRRO 12-033

Killarney Ridge Loop Properties
Cary, NC
NRCS Wake County Soil Survey



Not to Scale

N
W
E
S

LCW
2/15/2012

Kilarney Ridge Loop 2010 Aerial

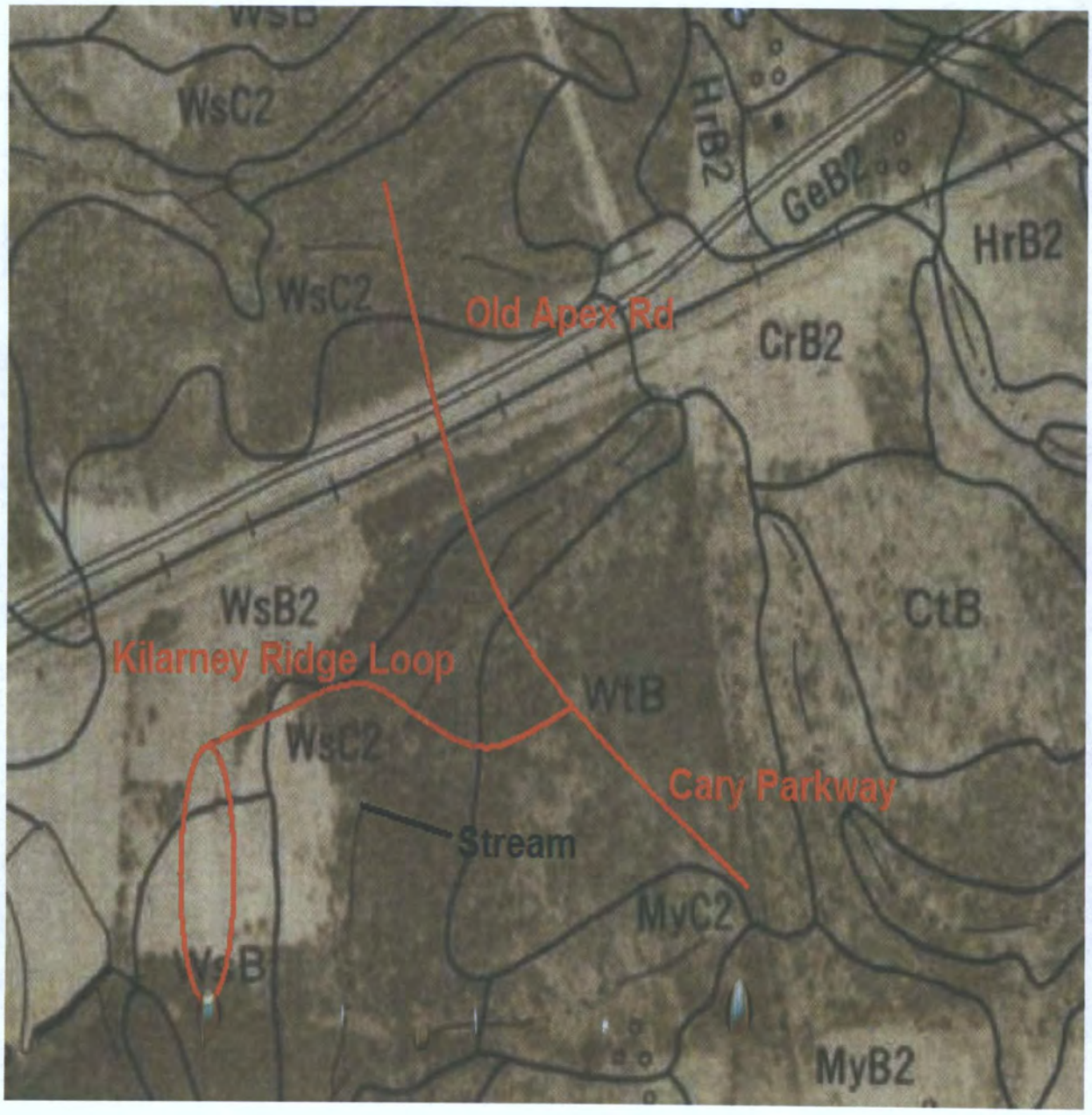
0 50 100 200 Feet

LCW
2/15/2012
NBRRO 12 033

WAKE COUNTY

 Source Data: USGS 450 ft Scale: 1 : 12,000 Detail: 13-6 Datum: WGS84

Kilarney Ridge Loop Properties
Cary, NC
NRCS Wake County Soil Survey



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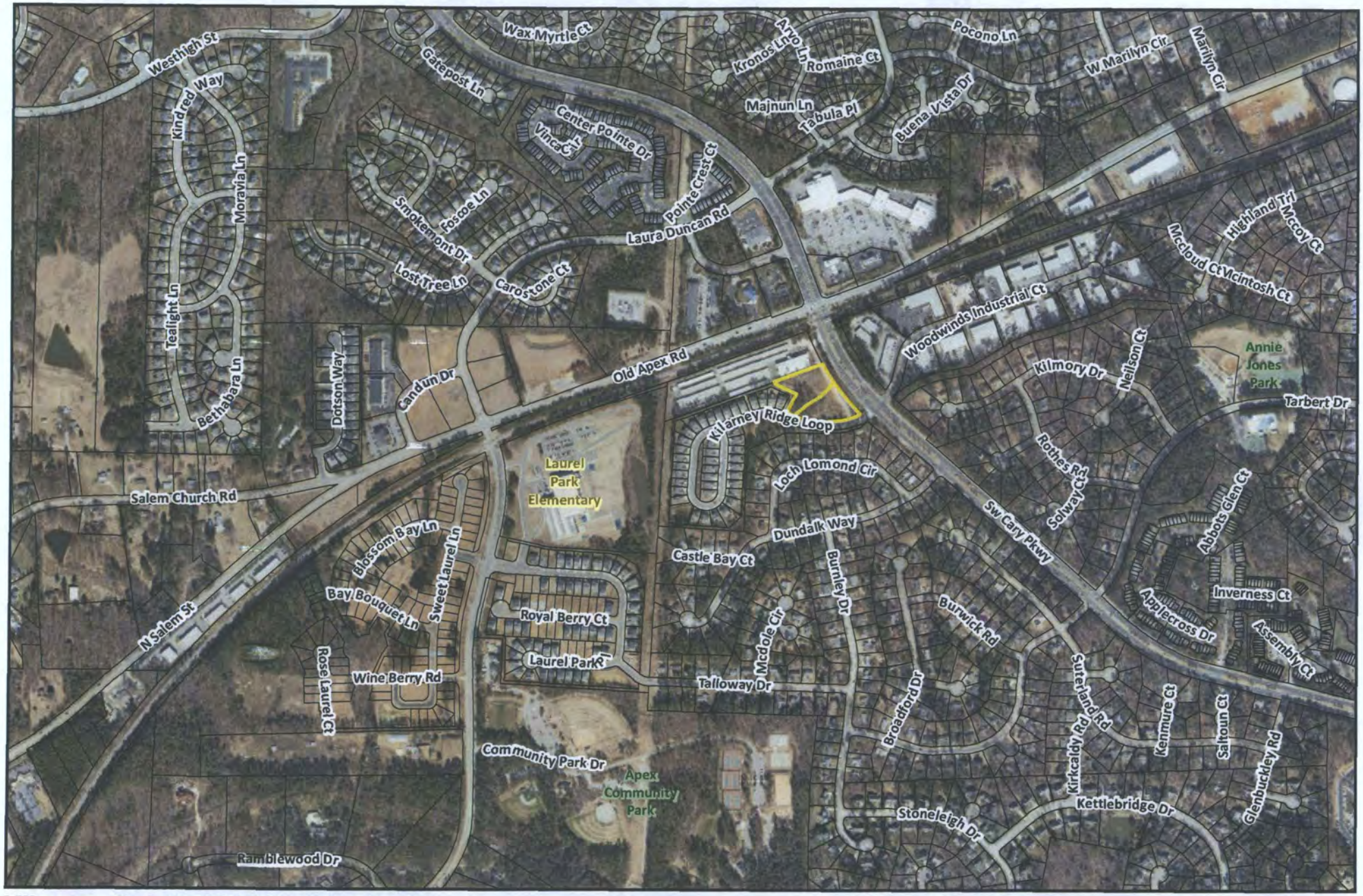


Kilarney Pointe 2012 Vicinity Aerial

N

0 400 800 1,600 Feet

1 inch = 800 feet

Kilarney Pointe 2012 Aerial

N

0 50 100 200 Feet

1 inch = 100 feet

1 131/140/151 MacGregor Pines Rd

Listing # 34482
For Sale

131/140/151 MacGregor Pines Rd
131-151 MacGregor Pines Rd
Cary NC 27511
WakeCounty

Cross Street:Lake Pine Dr
Mkt Area 1200: Cary

List Price:	$477,660
Status:	**Available**
Asset Class:	Land

Property Information

Building Status:	Land
Tax ID #'s:	
0752369040	
0752356785	
0752462198	
Owner:	MACGREGOR CE
Structure On Site:	No
Owner/Build to Suit:	No

Listing Information

Days on Market:	689
Land $/SF:	$1.20
Land $/Acre:	$52,260

Land Information

Total Land SF:	398,138
Acres:	9.14
Land Use:	Office

Sustainablility/Green Building

LEED Cert:	No
Energy Star Cert:	No

Additional Information

Property/Building Comments

Three building lots ranging in size from 1.82 acres to 4.42 acres suitable for office, medial or retail use located just of Hwy. 64 in Cary in a densely populated area. Utilities are available.

Public Listing Comments

Three building lots ranging in size from 1.82 acres to 4.42 acres suitable for office, medial or retail use located just of Hwy. 64 in Cary in a densely populated area. Utilities are available. Land is for sale at $12.00/SF.

Asset Class Information - Land Details

2 111 High House Rd Land

Listing # 37950
For Sale

111 High House Rd Land
111 High House Rd
Cary NC 27511
WakeCounty

Mkt Area 1200: Cary

List Price:	$345,500
Status:	**Available**
Asset Class:	Land

Property Information

Building Status:	Land
Tax ID #'s: 0763098906	
Owner:	CPO LLC
Structure On Site:	No
Owner/Build to Suit:	No

Listing Information

Days on Market:	536
Land $/SF:	$7.93
Land $/Acre:	$345,500

Land Information

Total Land SF:	43,560
Acres:	1.00
Zoning:	GCCU
Land Use:	Office

Sustainablility/Green Building

LEED Cert:	No
Energy Star Cert:	No

Additional Information

Property/Building Comments
Convenient to downtown Cary and Research Triangle Park.

Public Listing Comments
111 & 114 High House Rd Land: Traffic Counts
> High House & Maynard: 15,000
> Old Apex Rd: 11,000NCDOT

Best Use
> Retail, Restaurant, Franchise, Auto Service, Medical, Dental

Utilities
> On-Site Electric & Sewer

Topography
> Flat, Graded & Fully Improved

Asset Class Information - Land Details

3 141 High House Rd Land

Listing # 37951
For Sale

141 High House Rd Land
141 High House Rd
Cary NC 27511
WakeCounty

Mkt Area 1200: Cary

List Price:	$460,000
Status:	**Available**
Asset Class:	Land

Property Information

Building Status:	Land
Tax ID #'s: 0753999998	
Owner:	CPO LLC
Structure On Site:	No
Owner/Build to Suit:	No

Listing Information

Days on Market:	536
Land $/SF:	$13.04
Land $/Acre:	$567,901

Land Information

Total Land SF:	35,284
Acres:	0.81
Zoning:	GCCU
Land Use:	Office

Sustainablility/Green Building

LEED Cert:	No
Energy Star Cert:	No

Additional Information

Property/Building Comments
Convenient to downtown Cary and Research Triangle Park.

Public Listing Comments
141 High House Rd Land: Traffic Counts
> High House & Maynard: 15,000
> Old Apex Rd: 11,000 NCDOT

Best Use
> Retail, Restaurant, Franchise, Auto Service, Medical, Dental

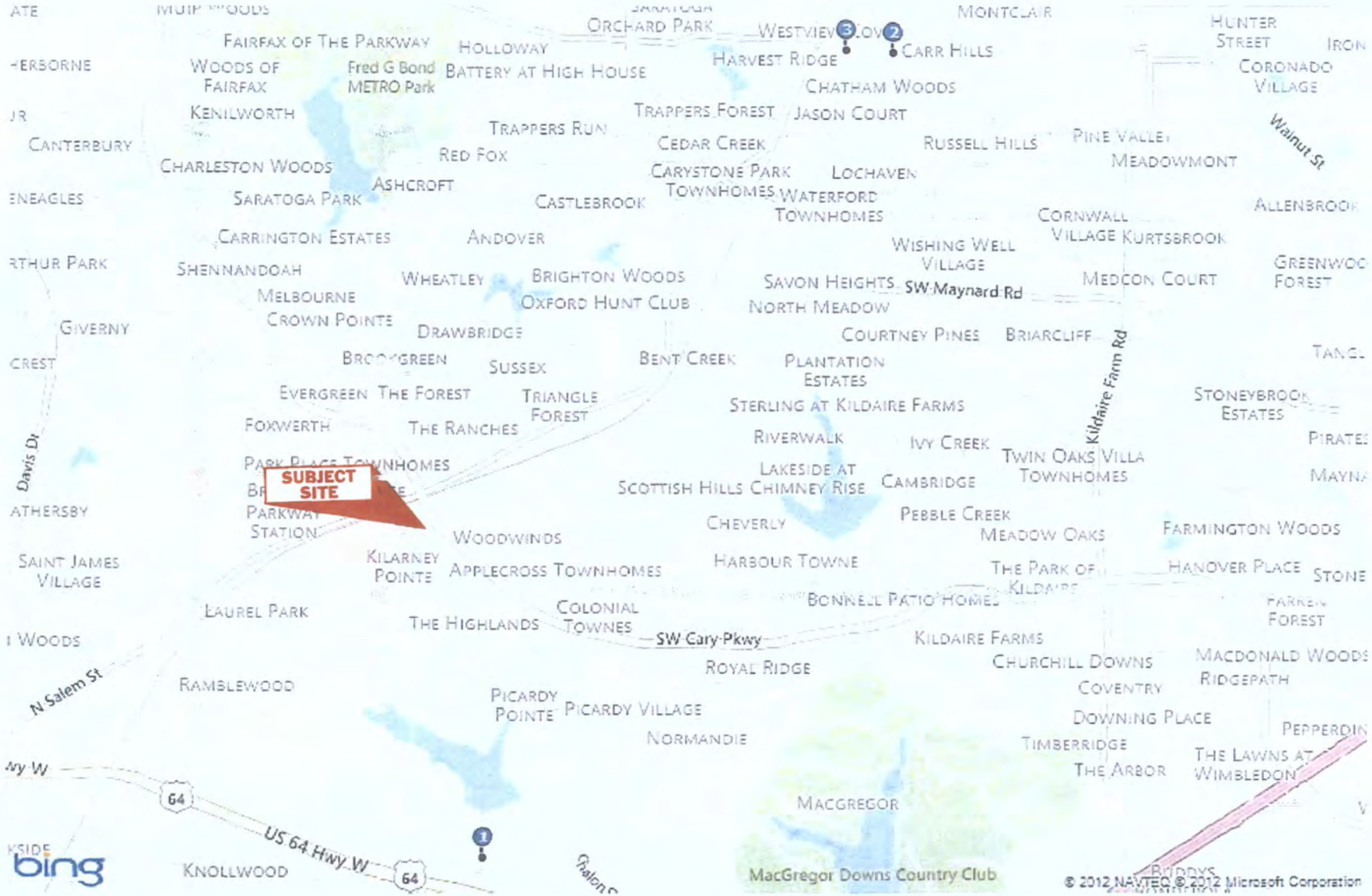
Utilities
> On-Site Electric & Sewer

Topography
> Flat, Graded & Fully Improved

Asset Class Information - Land Details

Property Map Report

Prepared By: Beverly Keith, CCIM



TRINITY PARTNERS

Summary Page

Prepared By: Beverly Keith, CCIM

131/140/151 MacGregor Pines Rd
131-151 MacGregor Pines Rd
Cary NC 27511
Wake County
TB Map:
Area: 1200 - Cary
Status: Available

Listing #: 34482
Condo: No

Cap Rate:	0.00	**List Price:**	$477,660
Floors:		**Rent Area:**	
Tax ID:	0752369040	**Total Utilities:**	
Land $/SF:	1	**Expenses:**	
Building SF:		**Land SF:**	398,138
$/SF:		**Acres**	9.14
Year Built:		**Property Type:**	
Year Remodeled:		Land	

111 High House Rd Land
111 High House Rd
Cary NC 27511
Wake County
TB Map:
Area: 1200 - Cary
Status: Available

Listing #: 37950
Condo: No

Cap Rate:	0.00	**List Price:**	$345,500
Floors:	0	**Rent Area:**	0
Tax ID:	0763098906	**Total Utilities:**	
Land $/SF:	8	**Expenses:**	
Building SF:	0	**Land SF:**	43,560
$/SF:		**Acres**	1.00
Year Built:	0	**Property Type:**	
Year Remodeled:		Land	

141 High House Rd Land
141 High House Rd
Cary NC 27511
Wake County
TB Map:
Area: 1200 - Cary
Status: Available

Listing #: 37951
Condo: No

Cap Rate:		**List Price:**	$460,000
Floors:	0	**Rent Area:**	0
Tax ID:	0753999998	**Total Utilities:**	
Land $/SF:	13	**Expenses:**	
Building SF:	0	**Land SF:**	35,284
$/SF:		**Acres**	0.81
Year Built:	0	**Property Type:**	
Year Remodeled:		Land	

20121140

NOTE:

1. THIS PLAN REFLECTS A GENERAL CONFIGURATION FOR A BUILDING SIZE OF 11,790.
2. PARKING REQUIREMENTS PER TOWN OF CARY SET AT 1 PARKING STALL PER 200 S.F. = 52 PARKING STALL
3. BOUNDARY IS BASED ON A THE PLAT DONE BY BNK. TOPO IS BASED ON FIELD SURVEY DONE ON 9-28-04.

Hugh J. Gilleece and Associates
875 Walnut Street
Suite 360
Cary, NC 27511
Phone: (919)469-1101
Fax: (919)460-7637

No.	DATE	REVISION	DWN/CHK
--	--/--/--	----	---/---

EXISTING CONDITIONS
FOR
SW CARY PARKWAY DAYCARE
SITUATED AT
SW CARY PARKWAY
CARY
WAKE COUNTY, NORTH CAROLINA

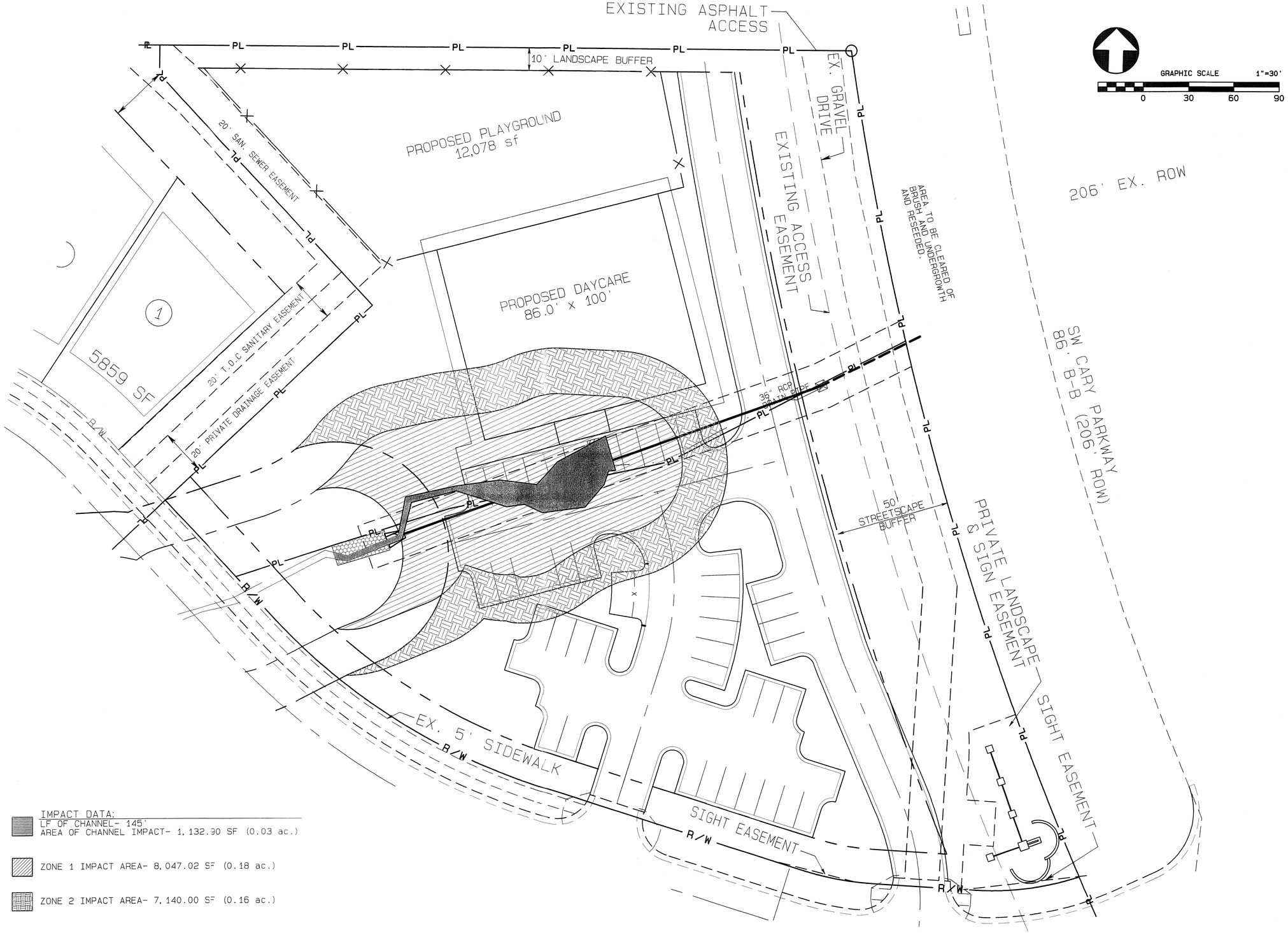
FILE: J:\HGA Backup\Data\Jobs\1700\Kilarney Pointe 50\dwg\Conceptual\Commercial Daycare Layout.pro

JOB # 5500.00

DSN/CHK BY:	---/---
DWN BY:	---
DATE:	--/--/--
HRZ SCALE:	1"= 20'
VRT SCALE:	NONE

SHEET NO.

EC



IMPACT DATA:
LF OF CHANNEL- 145'
AREA OF CHANNEL IMPACT- 1,132.30 SF (0.03 ac.)

ZONE 1 IMPACT AREA- 8,047.02 SF (0.18 ac.)

ZONE 2 IMPACT AREA- 7,140.00 SF (0.16 ac.)

Hugh J. Gilleece and Associates
875 Walnut Street
Suite 360
Cary, NC 27511
Phone: (919)469-1101
Fax: (919)460-7637

No.	DATE	REVISION	DWN/CHK
--	--/--/--	-----	---/---

PRELIMINARY SITE LAYOUT

FOR

SW CARY PARKWAY DAYCARE

SITUATED AT

SW CARY PARKWAY
CARY
WAKE COUNTY, NORTH CAROLINA

JOB #	5500.00
DSN/CHK BY:	---/---
DWN BY:	---
DATE:	--/--/--
HRZ SCALE:	1"= 20'
VRT SCALE:	NONE

SHEET NO.

1

FILE: J:\HJG Backup\Data\Jobs\5700's\Jarvis Pointe - SW\Dwg\Concept\Commercial\ Daycare Layout.dwg

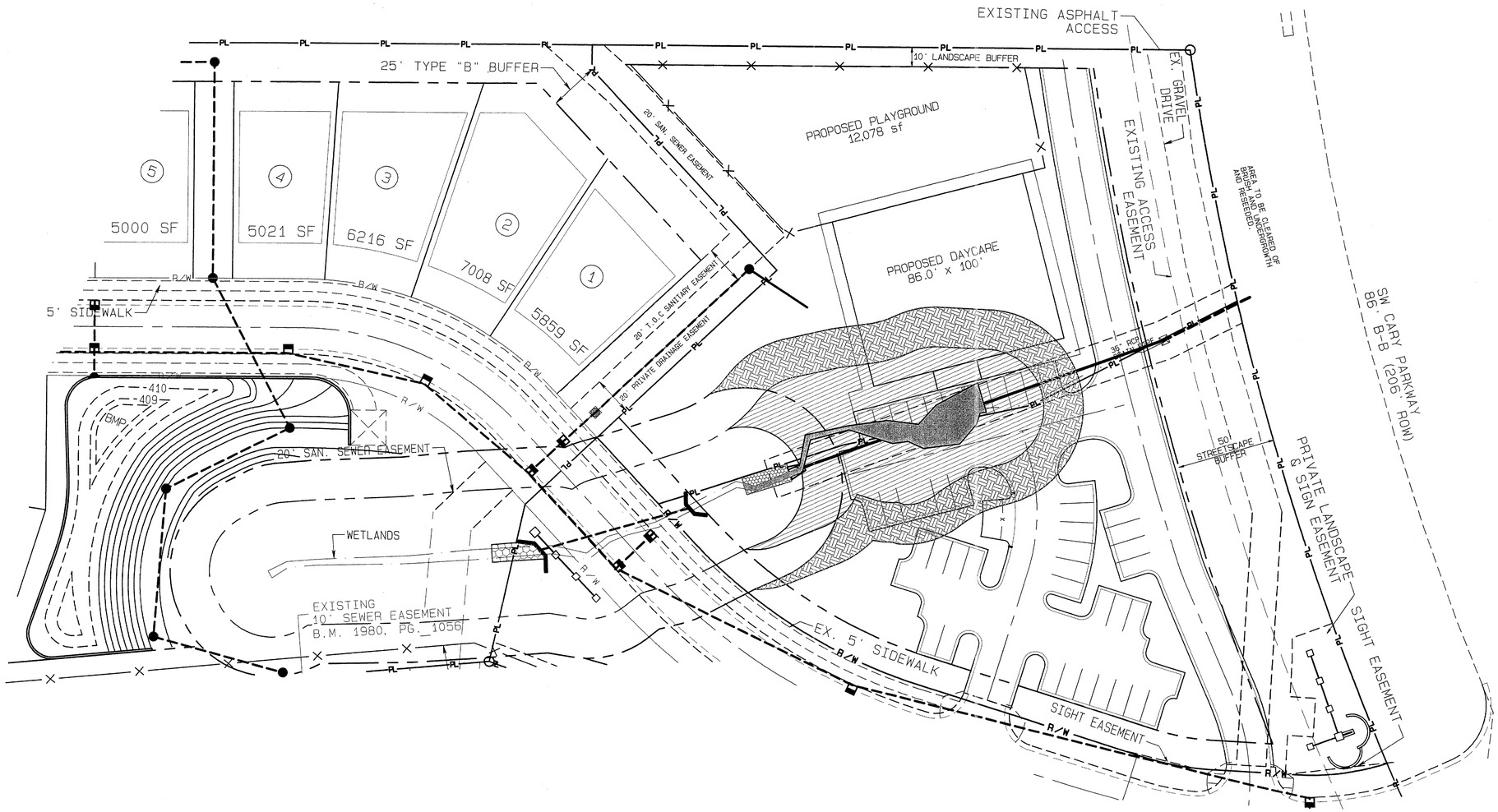
GRAPHIC SCALE 1"=30'

0 30 60 90

IMPACT DATA:
LF OF CHANNEL- 145'
AREA OF CHANNEL IMPACT- 1,132.90 SF (0.03 ac.)

ZONE 1 IMPACT AREA- 8,047.02 SF (0.18 ac.)

ZONE 2 IMPACT AREA- 7,140.00 SF (0.16 ac.)



Hugh J. Gilleece and Associates
875 Walnut Street
Suite 360
Cary, NC 27511
Phone: (919)469-1101
Fax: (919)460-7637

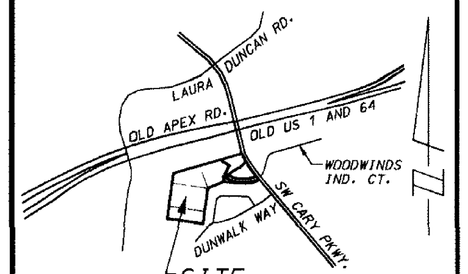
No.	DATE	REVISION	DWN/CHK
-	--/--/--	----	---/---

PRELIMINARY SITE LAYOUT
FOR
SW CARY PARKWAY DAYCARE
SITUATED AT
SW CARY PARKWAY
CARY
WAKE COUNTY, NORTH CAROLINA

JOB #	5500.00
DSN/CHK BY:	---/---
DWN BY:	---
DATE:	--/--/--
HRZ SCALE:	1"= 30'
VRT SCALE:	NONE

SHEET NO.
1

FILE: Y:\Jobs\7700\Killarney Pointe 50'dwg\Conceptual\Commercial Daycare Layout.pco



VICINITY MAP – NOT TO SCALE

LEGEND
ECM = EXISTING CONCRETE MARKER
EIP = EXISTING IRON PIPE
NIP = NEW IRON PIPE
PKN = PK NAIL
R / W = RIGHT OF WAY
B.O.M. = BOOK OF MAPS
D.B. = DEED BOOK
PP = POWER POLE
YI = YARD INLET
MH = MANHOLE
RCP = REINFORCED CONCRETE PIPE
CMP = CORRUGATED METAL PIPE
SS = SANITARY SEWER

3120 DENOTES ADDRESS

(20) DENOTES LOT NUMBERS

DATA

	DELTA/BEARING	RADIUS	LEN./DIST.	TANGENT	CHORD BEARING	CHORD DIST.
1	21°25'30"	125.00	46.74	23.65	S 61°52'44"W	46.47
2	13°58'07"	125.00	30.47	15.31	S 79°34'32"W	30.40
3	29°34'13"	275.00	141.93	72.58	N 78°39'18"W	140.36
4	9°42'25"	1457.28	246.89	123.74	S 39°02'15"E	246.59
5	N 20°29'15"W		12.71			
6	5°06'13"	1457.28	129.81	64.95	S 31°37'56"E	129.76
7	29°34'13"	325.00	167.73	85.78	S 78°39'18"E	165.88
8	13°58'07"	175.00	42.66	21.44	N 79°34'32"E	42.56
9	2°21'21"	1457.28	59.92	29.96	S 45°04'08"E	59.91
10	17°09'59"	1457.28	436.62	219.96	S 37°39'49"E	434.98
11	N 02°45'39" E	19.54				

STATE OF NORTH CAROLINA WAKE COUNTY

I, SCOTT WILSON, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION. DEED DESCRIPTION RECORDED IN BOOK 5[illegible], PAGE 122; I THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN BOOK [illegible], PAGE [illegible]; THAT THE RATIO OF PRECISION AS CALCULATED IS 1: 12,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED.

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER AND SEAL THIS 8TH DAY OF MARCH, A.D., 2005.

PROFESSIONAL LAND SURVEYOR – LICENSE # 2601

NORTH CAROLINA PROFESSIONAL SEAL L-2601 LAND SURVEYOR SCOTT WILSON

I, SCOTT WILSON, PROFESSIONAL LAND SURVEYOR NO. L-2601 CERTIFY TO ONE OR MORE OF THE FOLLOWING AS INDICATED.
A. THAT THIS PLAT IS OF A SURVEY THAT CREATES A SUBDIVISION OF LAND WITHIN THE AREA OF A COUNTY OR MUNICIPALITY THAT HAS AN ORDINANCE THAT REGULATES PARCELS OF LAND;
B. THAT THIS PLAT IS OF A SURVEY THAT IS LOCATED IN SUCH PORTION OF A COUNTY OR MUNICIPALITY THAT IS UNREGULATED AS TO AN ORDINANCE THAT REGULATES PARCELS OF LAND;
C. THAT THIS IS OF A SURVEY OF AN EXISTING PARCEL OR PARCELS OF LAND;
D. THAT THIS PLAT IS OF A SURVEY OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY OR OTHER EXCEPTION TO THE DEFINITION OF SUBDIVISION;
E. THAT THE INFORMATION AVAILABLE TO THIS SURVEYOR IS SUCH THAT I AM UNABLE TO MAKE A DETERMINATION TO THE BEST OF MY PROFESSIONAL ABILITY AS TO PROVISIONS CONTAINED IN (A) THROUGH (D) ABOVE.

SCOTT WILSON P.L.S. NO. 2601

STORMWATER MANAGEMENT CERTIFICATE

I CERTIFY THAT THE PLAT SHOWN HEREON COMPLIES WITH CHAPTER 4.4.6 WATERSHED PROTECTION OVERLAY DISTRICT OF THE TOWN OF CARY LAND DEVELOPMENT ORDINANCE AND IS APPROVED FOR RECORDING IN THE REGISTER OF DEEDS OFFICE. NOTICE: THIS PROPERTY IS LOCATED WITHIN A PUBLIC DRINKING WATER SUPPLY WATERSHED. DEVELOPMENT RESTRICTIONS MAY APPLY.

STORM WATER MANAGEMENT ENGINEER — DATE 3/14/05

CERTIFICATE OF APPROVAL FOR RECORDING

I hereby certify that the subdivision plat shown hereon has been found to comply with the subdivision regulations of the Town of Cary with the exception of such variances, if any, and conditions of approval as are noted in the minutes of the Town Council and/or the Zoning Board of Adjustment and that has been approved for recording in the office of the county register of deeds.

Director of Planning — March 14, 2005 Date

CERTIFICATE OF APPROVAL AND ACCEPTANCE OF DEDICATIONS

I, Karen C. Gray, ~~Town Clerk~~/Deputy Town Clerk of Cary, N.C., do certify that the Town of Cary approved this plat or map and accepted the dedication of the streets, easements, rights-of-ways and public parks shown thereon, but assume no responsibility to open or maintain the same until in the opinion of the governing body of the Town of Cary it is in the public interest to do so.

~~Town Clerk~~ or Deputy Town Clerk — 3/15/05 Date

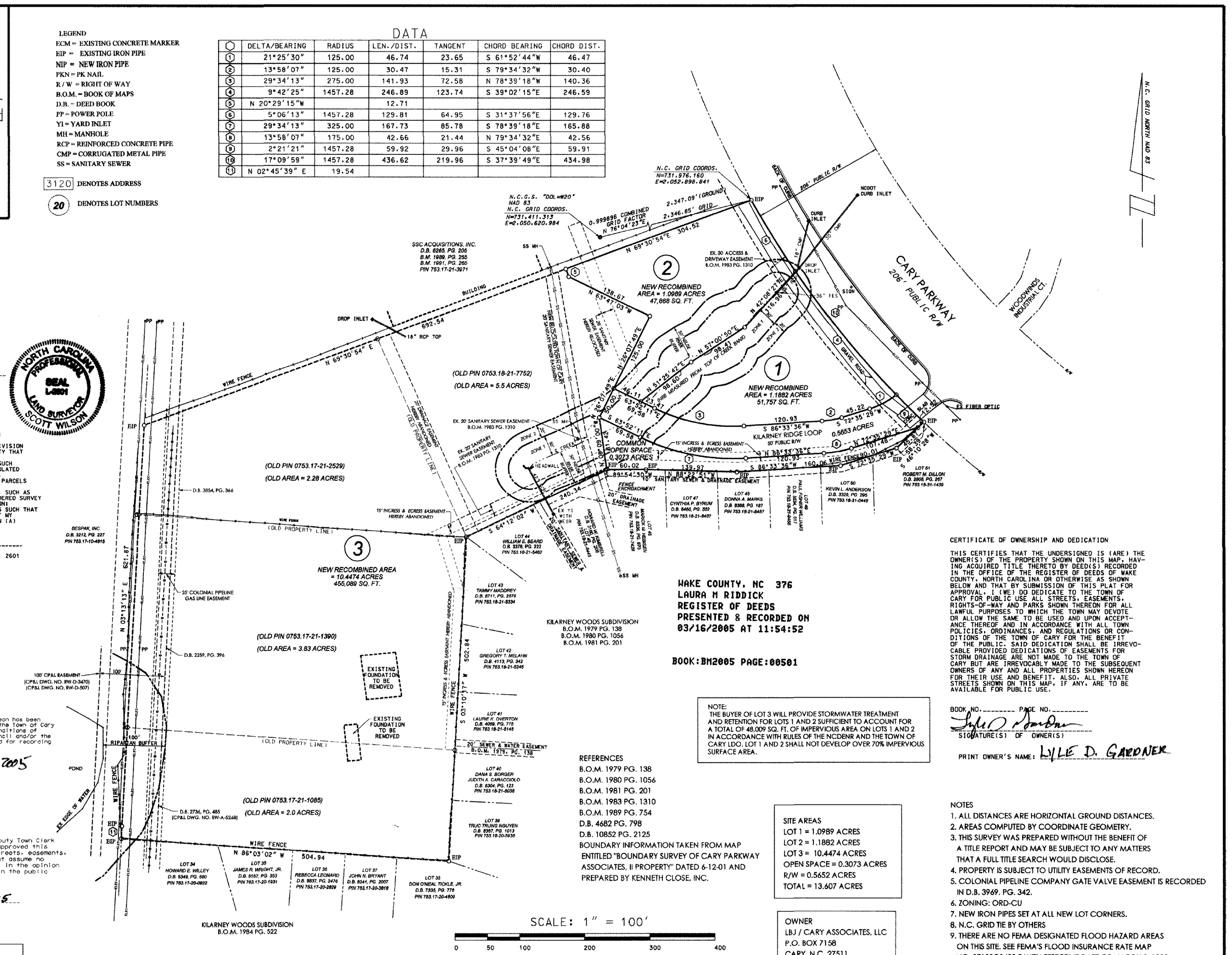
30 DAY RECORDING LIMIT

THIS PLAT NOT TO BE RECORDED AFTER 12 DAY OF April 2005
1 COPY TO BE RETAINED FOR THE CITY.
THIS PLAT IS ✓ IN ( ) OUT OF THE CITY LIMITS.
TOWN OF CARY HTE# SR-0170 COUNTY TRACKING # CA3142

REVIEW OFFICER CERTIFICATE
STATE OF NORTH CAROLINA COUNTY OF WAKE

I, J.W. Gleaton REVIEW OFFICER OF CARY, N.C. IN WAKE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

REVIEW OFFICER'S SIGNATURE — March 14, 2005 DATE



CERTIFICATE OF OWNERSHIP AND DEDICATION

THIS CERTIFIES THAT THE UNDERSIGNED IS (ARE) THE OWNER(S) OF THE PROPERTY SHOWN ON THIS MAP, HAVING ACQUIRED TITLE THERETO BY DEED(S) RECORDED IN THE OFFICE OF THE REGISTER OF DEEDS OF WAKE COUNTY, NORTH CAROLINA OR OTHERWISE AS SHOWN BELOW AND THAT BY SUBMISSION OF THIS PLAT FOR APPROVAL, I (WE) DO DEDICATE TO THE TOWN OF CARY FOR PUBLIC USE ALL STREETS, EASEMENTS, RIGHTS-OF-WAY AND PARKS SHOWN THEREON FOR ALL LAWFUL PURPOSES TO WHICH THE TOWN MAY DEVOTE OR ALLOW THE SAME TO BE USED AND UPON ACCEPTANCE THEREOF AND IN ACCORDANCE WITH ALL TOWN POLICIES, ORDINANCES, AND REGULATIONS OR CONDITIONS OF THE TOWN OF CARY FOR THE BENEFIT OF THE PUBLIC. SAID DEDICATION SHALL BE IRREVOCABLE PROVIDED DEDICATIONS OF EASEMENTS FOR STORM DRAINAGE ARE NOT MADE TO THE TOWN OF CARY BUT ARE IRREVOCABLY MADE TO THE SUBSEQUENT OWNERS OF ANY AND ALL PROPERTIES SHOWN HEREON FOR THEIR USE AND BENEFIT. ALSO, ALL PRIVATE STREETS SHOWN ON THIS MAP, IF ANY, ARE TO BE AVAILABLE FOR PUBLIC USE.

BOOK NO. _____ PAGE NO. _____

SIGNATURE(S) OF OWNER(S)

PRINT OWNER'S NAME: LYLE D. GARDNER

WAKE COUNTY, NC 376
LAURA M RIDDICK
REGISTER OF DEEDS
PRESENTED & RECORDED ON
03/16/2005 AT 11:54:52

BOOK:BM2005 PAGE:00501

NOTE:
THE BUYER OF LOT 3 WILL PROVIDE STORMWATER TREATMENT AND RETENTION FOR LOTS 1 AND 2 SUFFICIENT TO ACCOUNT FOR A TOTAL OF 48,009 SQ. FT. OF IMPERVIOUS AREA ON LOTS 1 AND 2 IN ACCORDANCE WITH RULES OF THE NCDENR AND THE TOWN OF CARY LDO. LOT 1 AND 2 SHALL NOT DEVELOP OVER 70% IMPERVIOUS SURFACE AREA.

REFERENCES
B.O.M. 1979 PG. 138
B.O.M. 1980 PG. 1056
B.O.M. 1981 PG. 201
B.O.M. 1983 PG. 1310
B.O.M. 1989 PG. 754
D.B. 4682 PG. 798
D.B. 10852 PG. 2125
BOUNDARY INFORMATION TAKEN FROM MAP ENTITLED "BOUNDARY SURVEY OF CARY PARKWAY ASSOCIATES, II PROPERTY" DATED 6-12-01 AND PREPARED BY KENNETH CLOSE, INC.

SITE AREAS
LOT 1 = 1.0989 ACRES
LOT 2 = 1.1882 ACRES
LOT 3 = 10.4474 ACRES
OPEN SPACE = 0.3073 ACRES
R/W = 0.5652 ACRES
TOTAL = 13.607 ACRES

OWNER
LBJ / CARY ASSOCIATES, LLC
P.O. BOX 7158
CARY, N.C. 27511

NOTES
1. ALL DISTANCES ARE HORIZONTAL GROUND DISTANCES.
2. AREAS COMPUTED BY COORDINATE GEOMETRY.
3. THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT AND MAY BE SUBJECT TO ANY MATTERS THAT A FULL TITLE SEARCH WOULD DISCLOSE.
4. PROPERTY IS SUBJECT TO UTILITY EASEMENTS OF RECORD.
5. COLONIAL PIPELINE COMPANY GATE VALVE EASEMENT IS RECORDED IN D.B. 3969, PG. 342.
6. ZONING: ORD-CU
7. NEW IRON PIPES SET AT ALL NEW LOT CORNERS.
8. N.C. GRID TIE BY OTHERS
9. THERE ARE NO FEMA DESIGNATED FLOOD HAZARD AREAS ON THIS SITE. SEE FEMA'S FLOOD INSURANCE RATE MAP NO. 37183C0482 E WITH EFFECTIVE DATE OF MARCH 3, 1992.

TOC # 04-SB-025

RECORDED IN BOOK OF MAPS 2005, PAGE 0501, WAKE COUNTY REGISTRY.

REV.	DATE	DESCRIPTION

BNK **BASS, NIXON & KENNEDY, INC.**
CONSULTING ENGINEERS
•6310 CHAPEL HILL ROAD, SUITE 250
RALEIGH, NORTH CAROLINA 27607
•10405E LIGON MILL ROAD
WAKE FOREST, NORTH CAROLINA 27587
•TELEPHONE: (919)851-4422 OR (800)354-1879
FAX: (919)851-8968 (Ral.), (919)570-1362 (WF)

SURVEYED BY	
DRAWN BY	PM
CHECKED BY	SW
DATE	02-24-05

RECOMBINATION AND R/W DEDICATION PLAT
FOR PROPERTY OF
LBJ / CARY ASSOCIATES, LLC
KILARNEY POINTE
CARY WAKE COUNTY N.C.

SHEET 1 OF 1

Job Number r:/2005jobs/05098 Kilarney Point/Survey/Plats/Recombination & RW.dgn

SW CARY PARKWAY DAYCARE
CARY, NC

DATES: February 8, 2013	**KELLER ENVIRONMENTAL PROJECT NUMBER: 1010**

SITE LOCATION: Southeast corner of project area near Kilarney Ridge Loop & Cary Parkway

PHOTOGRAPH NUMBER:
1

COMMENTS:

Northwest view of project area from Kilarney Ridge Loop & Cary Parkway intersection. Stream & Riparian Area on left side. "Public Storage" business on right background.

PHOTOGRAPH NUMBER:
2

DATE: February 8, 2013

COMMENTS:

West view of southern project area from Kilarney Ridge Loop & Cary Parkway intersection. Stream & Riparian Area on right side. Kilarney Pointe neighborhood in background.

SW CARY PARKWAY DAYCARE
CARY, NC

DATE: February 8, 2013	**KELLER ENVIRONMENTAL PROJECT NUMBER: 1010**

SITE LOCATION: Northern half of project area

PHOTOGRAPH NUMBER: 3

COMMENTS:

Southern view Cary Parkway & road/power line easement from "Public Storage."

PHOTOGRAPH NUMBER: 4

DATE: February 8, 2013

COMMENTS:

Eastern view of north project area from Northeast property corner of Lot 1. Proposed location of stormwater collection point of north project area to existing stormwater line/easement.

SW CARY PARKWAY DAYCARE
CARY, NC

DATES: February 8, 2013	**KELLER ENVIRONMENTAL PROJECT NUMBER: 1010**

SITE LOCATION: Lower Stream Riparian Area and Stormwater Wetland

PHOTOGRAPH NUMBER:
5

COMMENTS:

Northeastern view of stream riparian area & incised stream immediately upstream of Kilarney Ridge Loop culvert.

PHOTOGRAPH NUMBER:
6

DATE: February 8, 2013

COMMENTS:

North view of eastern stormwater wetland. Kilarney Pointe Lots 4-6 in background.

KELLER ENVIRONMENTAL
ENVIRONMENTAL CONSULTANTS
7921 Haymarket Lane, Raleigh, NC
(919) 749-8259
(919) 803-0970 Fax

LETTER OF TRANSMITTAL

DATE: February 12, 2013

TO: NC Division of Water Quality
401 Wetlands WQ Certification Unit
1650 Mail Service Center
Raleigh, North Carolina 27699-1650

ATTENTION: Karen Higgins

RE: SW Cary Parkway Daycare
DWQ Project: 2012-1140

WE ARE SENDING YOU THE FOLLOWING:

☐ Pre-construction Notification (PCN) ☒ Plans ☐ Maps ☐ Specifications
☒ Documents ☐ Other

THESE ARE TRANSMITTED AS CHECKED BELOW:

☒ For approval ☒ As requested ☒ For review & comment
☒ Please reply ☐ See below ☒ For your files

☐ Regular Mail ☐ Fed-Ex ☒ Delivered by KE ☐ Picked Up

COPIES	DATE	DESCRIPTION
2	2-11-12	Re-Submittal Letter
2	2-1-13	DWQ Request for More Information Letter
2	2-11-12	Forrest Creek Riparian Buffer Mitigation Bank Letter
2	7-11-05	Town of Cary Approval Letter
2		Alternate Site Plans (2)
2	6-6-05	EEP Nutrient Offset Receipt
2	6-14-05	Kilarney Pointe Memorandum
1	4-15-05	Kilarney Pointe Stormwater Wetlands Design Manual
2	3-16-05	Kilarney Pointe Plat
2		SW Cary Parkway Daycare Preliminary Site Layout

RECEIVED
FEB 12 2013
DENR - WATER QUALITY
Wetlands & Stormwater Branch

Remarks:

THANK YOU!

Rec'd By: _____ Signed _____

KELLER ENVIRONMENTAL
ENVIRONMENTAL CONSULTANTS

February 11, 2013

Karen Higgins
NC Division of Water Quality
401 Wetlands WQ Certification Unit
1650 Mail Service Center
Raleigh, North Carolina 27699-1650

Re: SW Cary Parkway Daycare
Keller Environmental Job No. 1010
DWQ Project 2012-1140
Cary, North Carolina

Dear Ms. Higgins:

Thank you for your help with the Major Variance for this proposed daycare facility in Cary, NC. We are submitting the additional information requested from written correspondence on February 1, 2013. We are requesting a Major Variance approval from the N.C. Division of Water Quality (DWQ) for 0.35 acres of impact to the Neuse River Buffer. We have addressed your included written comments in the following paragraphs.

1. **Please provide a full-size plan sheet showing the entire site with its storm drainage system, including every inlet, outlet and conveyance device. Please show how every proposed outlet will be discharged to an appropriately size and designed stormwater wetland as described in the Variance Request Form.**

   Please review the attached preliminary site layout. The northern half of the property will discharge to the existing drainage system on the east side of Lot 1. The parking area on the southern half will discharge to the existing Kilarney Ridge Loop drainage system.

2. **Please provide a copy of the stormwater management plan for the stormwater wetlands approved by the town of Cary, including plan details and calculations. Also, please provide documentation that the stormwater wetlands have adequate capacity to treat the stormwater from the proposed daycare center.**

   Please refer to the attached Kilarney Pointe Stormwater Wetlands Design Manual. The Town of Cary approval letter and NCEEP nutrient offset payment receipt is also attached.

3. **Please provide an explanation as to whether each of the following hardships are met:**

   A. **If the applicant complies with the provisions of this rule, he/she can secure no reasonable return from, nor make reasonable use of, his/her property. Merely providing that the variance would permit a greater profit from the property shall not be considered adequate justification for a variance. Moreover, the division or delegated local authority shall consider whether the variance is the minimum possible deviation from the terms of this Rule that shall make reasonable use of the property possible.**

   The ownership group has attempted multiple site designs for this project. Unfortunately, the prospective buyers have all rejected them. Attached are two of the site plans proposed.

   B. **The hardship results from application of this Rule to the property rather than from other factors such as deed restrictions or other hardship.**

   The riparian buffer areas extending from the stream consume a large portion of the property and their central location is very limiting. Removing the application of this Rule would greatly reduce the hardship endured by the ownership group for several years.

   C. **The hardship is due to the physical nature of the applicant's property, such as its size, shape, or topography, which is different from that of neighboring property.**

   This property has several physical natures that make it difficult to properly plan a marketable structure, parking and other affiliated structures. We have attached some of the attempted site designs but they have been rejected by potential buyers. They include the following:

   - Central location of the stream and its affiliated riparian buffers
   - Property configuration
   - Access Road and road easement on eastern side of property between Kilarney Ridge Loop (south) and mini-storage (north)
   - Topography
   - Existing sanitary and drainage easements

D. The applicant did not cause the hardship by knowingly or unknowingly violating this Rule.

The applicant did not cause the hardship by knowingly or unknowingly violating this Rule.

E. The applicant did not purchase the property after the effective date of this Rule, and then requesting an appeal.

The applicant has attempted several configurations to make this project work without impacting the property's natural resources. However, we are requesting your assistance with granting the variance despite the property being purchased in 2004.

F. The hardship is unique to the applicant's property, rather than the result of conditions that are widespread. If other properties are equally subject to the hardship created in the restriction, then granting a variance would be a special privilege denied to others, and would not promote equal justice.

As mentioned in Section C, this property has several existing physical natures that limit its marketability and designs.

4. Please provide documentation from an appropriate mitigation bank or the NCEEP indicating their willingness to accept your request to purchase 34,581 buffer credits. Mitigation provider selection must conform to the requirements of G.S. 143-214.20.

Please refer to the attached February 11, 2013 acceptance letter from environmental banc and exchange.

Thank you again for your and your staff's assistance with this project. This includes site meetings with Ian McMillan, Eric Kulz, and Lauren Witherspoon and an office meeting with Amy Chapman and Ian McMillan. If you should have questions or require additional clarification please feel free to contact me at (919) 749-8259 (cell) or email: jay@kellerenvironmental.com.

Sincerely,

Keller Environmental, LLC

Jay Keller
Principal

Cc: Lyle Gardner
Jay Gilleece
Bryan Benton

Attachment:

- July 28, 2011 DWQ Request for More Information letter

North Carolina Department of Environment and Natural Resources
Division of Water Quality

Pat McCrory
Governor

Charles Wakild, P. E.
Director

John E. Skvarla, III
Secretary

February 1, 2013

DWQ #: 2012-1140
Wake County

LBJ Cary Associates LLC
Attn: Lyle Gardener
7706 Six Forks Road
Raleigh, NC 27615

Subject: **REQUEST FOR ADDITIONAL INFORMATION**
SW Cary Parkway Daycare

Dear Mr. Gardener:

On December 21, 2012, the Division of Water Quality (Division) received your application requesting a Major Variance to the Neuse Riparian Buffer Rules for your project. The Division has determined that your application is incomplete and cannot be processed. **The application is on-hold until all of the following information is received**:

1. Please provide a full-size plan sheet showing the entire site with its storm drainage system, including every inlet, outlet and conveyance device. Please show how every proposed outlet will be discharged to an appropriately sized and designed stormwater wetland as described in the Variance Request Form.

2. Please provide a copy of the stormwater management plan for the two stormwater wetlands approved by the town of Cary, including plan details and calculations. Also, please provide documentation that the stormwater wetlands have adequate capacity to treat the stormwater from the proposed daycare center.

3. Please provide an explanation as to whether <u>each</u> of the following hardships (15A NCAC 02B .0233 (9)(a)(i) are met:

   A. If the applicant complies with the provisions of this Rule, he/she can secure no reasonable return from, nor make reasonable use of, his/her property. Merely proving that the variance would permit a greater profit from the property shall not be considered adequate justification for a variance. Moreover, the Division or delegated local authority shall consider whether the variance is the minimum possible deviation from the terms of this Rule that shall make reasonable use of the property possible.

   B. The hardship results from application of this Rule to the property rather than from other factors such as deed restrictions or other hardship.

Wetlands, Buffers, Stormwater, Compliance and Permitting Website, Email
1 Eq Mail Service Center, Raleigh, North Carolina 27699-1636
Location: 512 N. Salisbury St. Raleigh, North Carolina 27604
Phone: (919) 807-6300 FAX: (919) 807-6494 Customer Service: 1-877-623-6748
Internet: www.ncwaterquality.org

C. The hardship is due to the physical nature of the applicant's property, such as its size, shape, or topography, which is different from that of neighboring property.

D. The applicant did not cause the hardship by knowingly or unknowingly violating this Rule.

E. The applicant did not purchase the property after the effective date of this Rule, and then requesting an appeal.

F. The hardship is unique to the applicant's property, rather than the result of conditions that are widespread. If other properties are equally subject to the hardship created in the restriction, then granting a variance would be a special privilege denied to others, and would not promote equal justice;

4. Please provide documentation from an appropriate mitigation bank or the NCEEP indicating their willingness to accept your request to purchase 34,581 buffer credits. Mitigation provider selection must conform to the requirements of G.S. 143-214.20.

Pursuant to Title 15A NCAC 02B .0233, the applicant shall furnish all of the above requested information for the proper consideration of the application. If all of the requested information is not received in writing within 30 calendar days of receipt of this letter, the Division will be unable to approve the application and it will be returned. The return of this project will necessitate reapplication to the Division for approval.

Respond in writing within 30 calendar days of receipt of this letter by sending two copies of all of the above requested information to the Wetlands, Buffers, Stormwater – Compliance and Permitting (Webscape) Unit, 1650 Mail Service Center, Raleigh, NC 27699-1650.

Please be aware that you have no authorization under Section 401 of the Clean Water Act or the Neuse Riparian Buffer Rules for this activity and any work done within waters of the state may be a violation of North Carolina General Statutes and Administrative Code.

Contact Karen Higgins at karen.higgins@ncdenr.gov or 919-807-6360 if you have any questions or concerns, or contact Annette Lucas at annette.lucas@ncdenr.gov or 919-807-6381 if you have any questions related to stormwater (items # 1 & 2 above).

Sincerely,

Karen Higgins

Karen Higgins, Supervisor
Wetlands, Buffers, Stormwater – Compliance & Permitting Unit

cc: Jay Keller, Keller Environmental (via email)
File Copy

File name: 121140SWCaryParkwayDaycare(Wake)_NBR_MV_Hold.docx

Forrest Creek Riparian Buffer Mitigation Bank
Rudolph Riparian Buffer Bank
Statement of Availability February 11, 2013

NC Division of Water Quality
Ms. Katie Merritt
401 Oversight/Express Permitting Unit
1650 Mail Service Center
Raleigh, NC 27699-1650

U.S. Army Corps of Engineers
Mr. Monti Matthews
CESAW-RG-R
Raleigh Regulatory Field Office
3331 Heritage Trade Center, Suite 105
Wake Forest, NC 27587

Re Project: SW Parkway Daycare-DWQ Project # 2012-1140

This document confirms that the (Applicant) for the **SW Parkway Daycare** has expressed an interest to utilize **34,851 Square Feet of Riparian Buffer Mitigation Credits** from either of the EBX Neuse Riparian Buffer Umbrella Mitigation Bank/Rudolph Site, Forrest Creek Riparian Buffer Mitigation Bank, and/or the Upper Neuse Buffer Bank located in Neuse-Cedar Grove Site, all located in HUC 03020201. As the Bank Sponsor for all sites, EBX attests to the fact that mitigation is available for transfer upon permit issuance at this time.

Banker will notify applicant if the **34,851 Sq. Ft. of Buffer Mitigation** become considered "At Risk" of not being available prior to permit issuance. Credits are not considered secured until payment in full is received from the applicant resulting in the issuance of a Bill of Sale and Affidavit of Sale by the bank acknowledging that the applicant has **fully secured** credits from the bank and the Banker has accepted full responsibility for the mitigation obligation requiring the credits/units.

The Banker will issue the Affidavit of Sale within ten (10) days of receipt of the balance of the Purchase Price. Banker shall provide to Applicant with a copy of the Affidavit of Sale and a documented copy of the debit of credits from the Bank Official Credit Ledger(s) showing the permit number and the resource type secured by the applicant. A copy of the Affidavit of Sale, with an updated Official Credit Ledger will also be sent to regulatory agencies showing the proper documentation.

If any questions need to be answered, please contact me at 239-872-1678

Best Regards

Matthew R. Fisher
EBX-EM, LLC
909 Capability Drive Suite 3100, Raleigh, NC 27606

ENGINEERING DEPARTMENT

July 11, 2005

James W. Caldwell
John R McAdams Company, Inc.
2905 Meridian Parkway
Durham NC 27713

Subject: Kilarney Pointe - Revision
04-SB-025

Dear James W. Caldwell:

The Town of Cary has reviewed the revised plans for Kilarney Pointe 04-SB-025, and concurs that a payment to the North Carolina Ecosystem Enhancement Program is necessary to meet the nitrogen export requirement of the Neuse Stormwater Rules. A payment of $1013.69 is needed to offset nitrogen loading from the subject project that was revised. Cary's Stormwater Division has checked that your calculations have been computed based on the provisions of the Neuse Stormwater Rule and the methods agreed to by the Neuse Stormwater Team.

This letter will serve as an invoice for the payment due to the North Carolina Ecosystem Enhancement Program (NC DENR EEP). Attn: Carol Shaw, 1652 Mail Service Center, Raleigh, NC 27699-1652, phone number (919)715-0476.

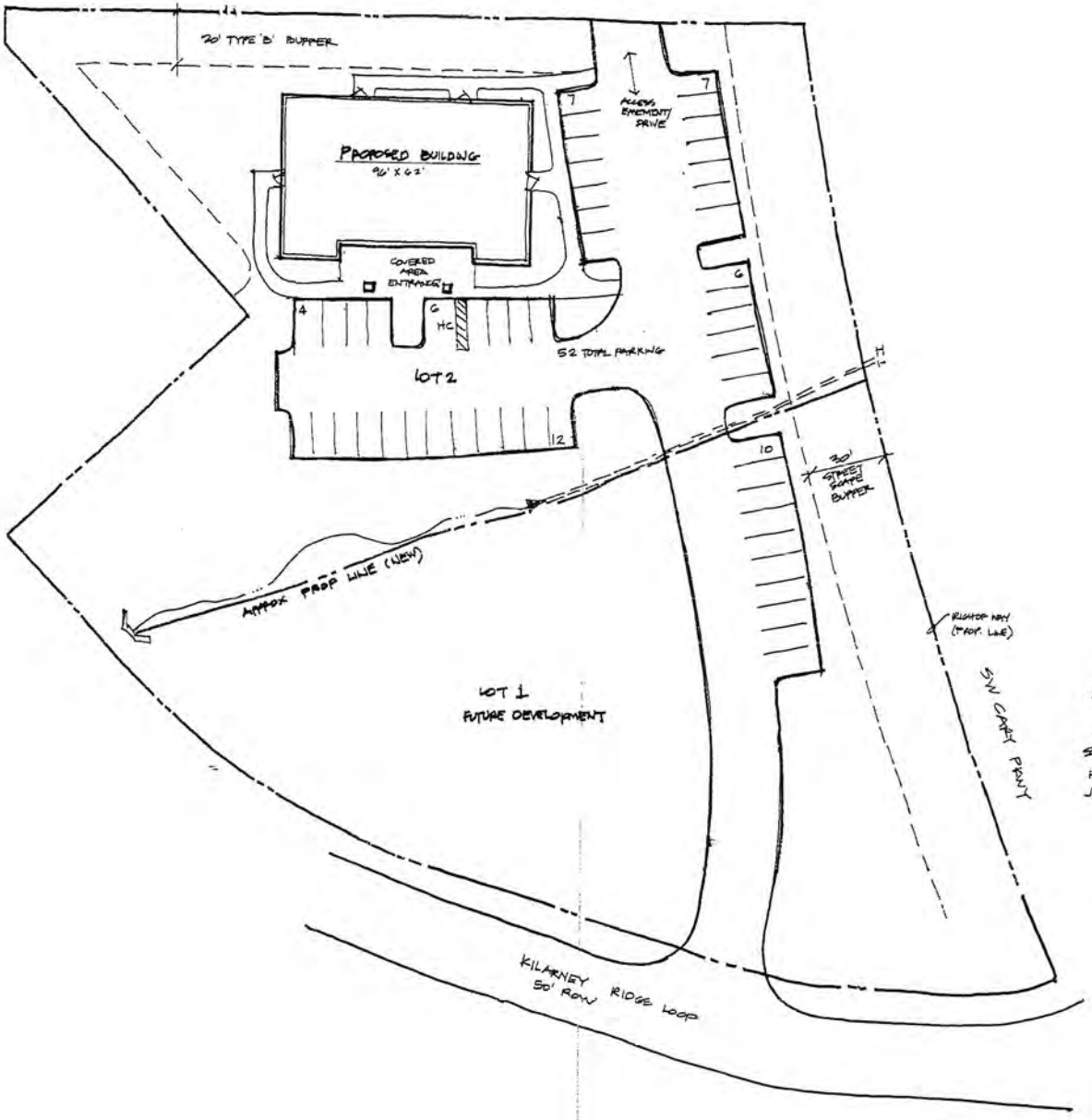
Please be aware that the above referenced plan will not receive final approval until the Town of Cary obtains receipt of payment from the NC DENR EEP.

Sincerely,

Thomas L. Horstman
Erosion Control Supervisor

Cc: NC DENR EEP

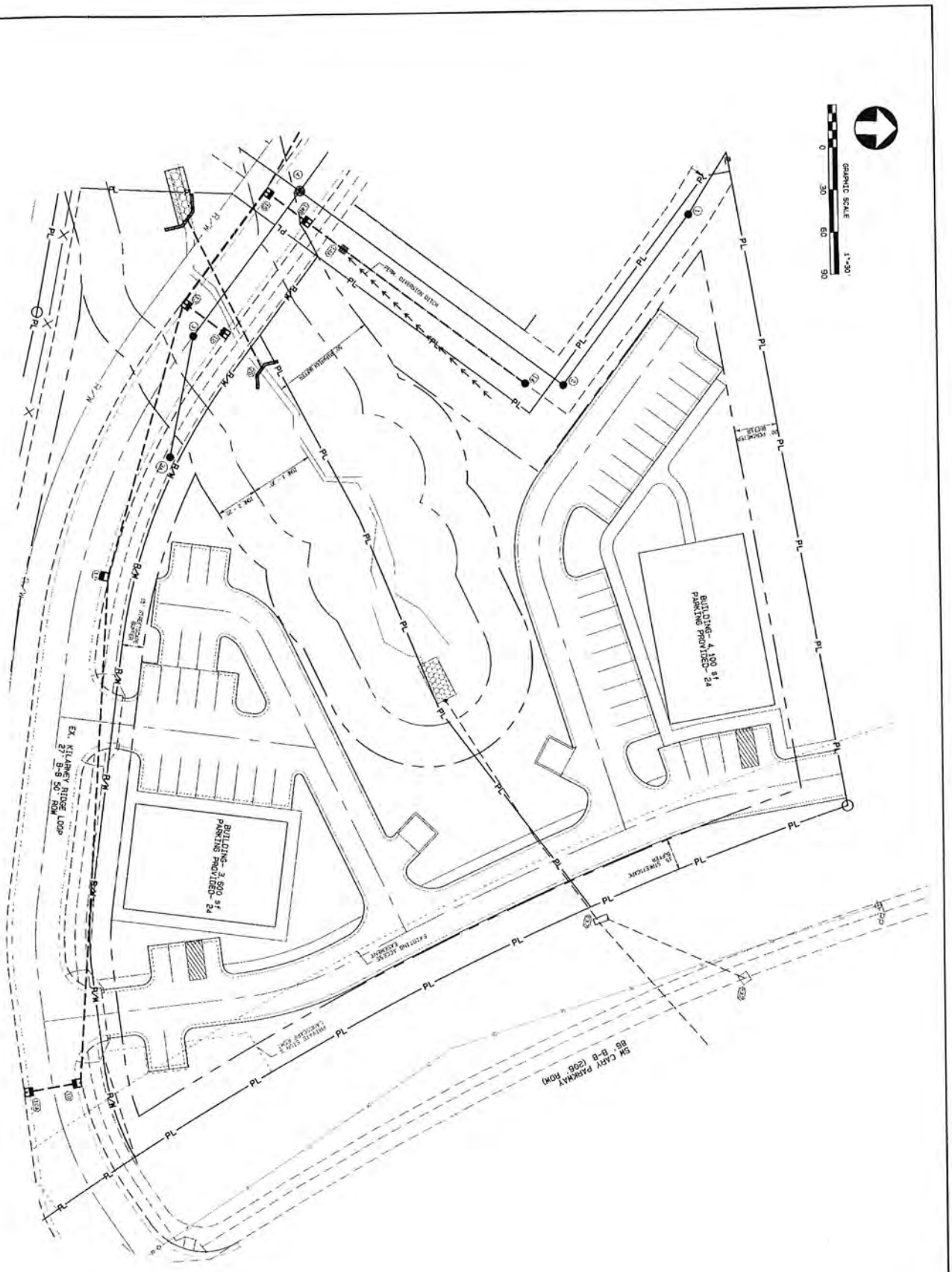
TOWN *of* CARY
318 North Academy Street •Cary, NC 27513•PO Box 8005•Cary, NC 27512-8005
tel 919-469-4030 • fax 919-460-4935• www.townofcary.org



COMMERCIAL LOTS
FOR
KILARNEY POINTE
CARY, NC

NORTH
SCALE 1" = 20'

HUGH J. GILLESPIE & ASSOCIATES; CARY NC
JERRY TURNER & ASSOCIATES; RALEIGH NC



SITE LAYOUT

FOR

KILARNEY POINTE

SITUATED AT

CARY PARKWAY, CARY

WAKE COUNTY, NORTH CAROLINA

JOB # 8000.00

SHEET NO. 1

No.	DATE	REVISION	INITIALS

Hugh J. Gilleece and Associates
Business License # C-486
875 Walnut Street
Suite 360
Cary, NC 27511
Phone (919)469-1101
Fax (919)460-7637

Ecosystem Enhancement PROGRAM

RECEIPT

June 6, 2005

Moore & Alphin, PLLC
3716 National Drive, Suite 100
Raleigh, NC 27612

Subject: Kilarney Pointe, 04-SB-025
Town of Cary

The North Carolina Ecosystem Enhancement Program has received a check in the amount of $10,890.00, check number 87621, as payment for nutrient offset for the above referenced project. The Town of Cary has verified the amount of this payment. Nutrient offset payments made as part of fulfilling the requirements of the Neuse River Nutrient Sensitive Waters Management Strategy shall be paid to NC EEP at a rate specified in 15A NCAC 02B.0240.

You must also comply with any other state, federal or local government permits or authorization associated with this activity. If you have any questions or need additional information, please contact Carol Shaw at 919-733-5205.

Please note that a payment to the Ecosystem Enhancement Program is **not** reimbursable unless a request for reimbursement is received within 12 months of the date of this receipt. Any such requests must be accompanied by letters from the permitting agency stating that the permit and/or authorization have been rescinded.

Sincerely,

James B. Stanfill for

William D. Gilmore, PE
Director

cc: Thomas L. Horstman, Town of Cary
File

Since 1979
THE JOHN R. McADAMS COMPANY, INC.

MEMORANDUM

June 14, 2005

To: Mr. Chuck Welsh

From: James W. Caldwell, PE JWC 6/14/05

RE: Kilarney Pointe
Cary, North Carolina
AGL-05000

The stormwater management calculations and design for the subject site were reanalyzed to include 48,000 square feet of impervious area for the commercial portion of the site. The roads and sidewalks for the commercial area were added to this amount for detention and nitrogen export analysis.

As a result of revised analysis, the riser elevation for Stormwater Wetland #1 was raised 0.10' vertical feet to a crest elevation of 418.80 (see Sheet SW-6A). Also, the Nitrogen Offset Fee to the Ecosystem Enhancement Fund was revised to $11,923.39. This represents an increase of $1013.69 from the previously calculated amount (see design report dated April 15, 2005).

A revised design report and design drawings for the stormwater management facilities is being submitted to The Town of Cary for review and approval.

Research Triangle Park, NC
Post Office Box 14005
Research Triangle Park,
North Carolina 27709
2905 Meridian Parkway
Durham, North Carolina 27713
800-733-5646
919-361-5000
919-361-2269 Fax

Charlotte, NC
5311 Seventy-Seven Center Drive,
Suite 66
Charlotte, North Carolina 28217
800-733-5646
704-527-0800
704-527-2003 Fax

www.johnrmcadams.com

NITROGEN EXPORT CALCULATIONS

KILARNEY POINTE
AGL-05000

KILARNEY POINTE
AGL-05000

NITROGEN EXPORT CALCULATIONS

(Apportioning Method- Residential and Commercial)

JW Caldwell, PE
6/14/2005

I. SITE INFORMATION

Area ID	Total Area [acres]	Pre-Dev. [ac]		Post-Dev Res. [ac]		Post-Dev Com. [ac]	
		Imp.	Open	Imp.	Open	Imp.	Open
Site	13 75	0 11	13 64	4 23	7 68	1 32	0 52
Totals =	13 75	0 11	13 64	4 23	7 68	1 32	0 52

II. APPORTIONING CALCULATIONS

Total impervious surface =	5 55	acres
=	241758	sq ft
Existing impervious surface =	0 11	acres
=	4792	sq ft
Existing impervious surface as a percent of total =	1 98%	
Additional impervious area =	5 44	acres
=	236966	sq ft
Proposed open space (total) =	8.20	acres
=	357192	sq ft
Therefore,		
Open associated with new impervious =	8 04	acres
=	350113	sq ft
Open associated with existing impervious =	0 16	acres
	7079	sq ft

Area to consider for TN-export calculations = 13.48 acres

KILARNEY POINTE
AGL-05000

NITROGEN EXPORT CALCULATIONS

(Apportioning Method- Residential and Commercial)

JW Caldwell, PE
6/14/2005

I. SITE INFORMATION

Area ID	Total Area [acres]	Pre-Dev. [ac]		Post-Dev Res. [ac]		Post-Dev Com. [ac]	
		Imp.	Open	Imp.	Open	Imp.	Open
Site	13.75	0.11	13.64	4.23	7.68	1.32	0.52
Totals =	13.75	0.11	13.64	4.23	7.68	1.32	0.52

II. APPORTIONING CALCULATIONS

Total impervious surface =	5.55	acres
=	241758	sq.ft.
Existing impervious surface =	0.11	acres
=	4792	sq.ft.
Existing impervious surface as a percent of total =	1.98%	
Additional impervious area =	5.44	acres
=	236966	sq.ft.
Proposed open space (total) =	8.20	acres
=	357192	sq.ft.
Therefore,		
Open associated with new impervious =	8.04	acres
=	350113	sq.ft.
Open associated with existing impervious =	0.16	acres
	7079	sq.ft.

Area to consider for TN-export calculations = 13.48 **acres**

NITROGEN EXPO. . CALCULATIONS
(Apportioned Area- Commercial)

METHOD 2:

Quantifying TN Export from Residential / Industrial / Commercial Developments when Footprints of all Impervious Surfaces are shown.

STEP 1: *Determine the area for each type of land use and enter in Column (2).*
STEP 2: *Total the areas for each type of land use and enter at the bottom of Column (2).*
STEP 3: *Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).*
STEP 4: *Total the TN exports for each type of land use and enter at the bottom of Column (4).*
STEP 5: *Determine the export coefficient for the site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).*

(1) Type of Land Cover	(2) Area [acres]	(3) TN export coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
Permanently protected undisturbed open space *(forest, unmown meadow)*	0	0.6	0
Permanently protected managed open space *(grass, landscaping, etc.)*	0.52	1.2	0.6
Impervious surfaces *(roads, parking lots, driveways, roofs, paved storage areas, etc.)*	1.32	21.2	28.0
TOTAL	1.84	---	28.61

Total TN Export = 15.5 lbs/ac/yr

Maximum TN loading allowed = 18.40 lbs/yr (based on 10.00 lbs/ac/yr)

Therefore, on-site nitrogen removal required = 10.21 lbs/yr (total post-dev't TN loading minus maximum allowed for apportioned area)

REFERENCE:

"City of Raleigh, Stormwater Management Design Manual" January 2002

KILARNEY POINTE
AGL-05000

NITROGEN OFFSET FEE CALCULATIONS

JW Caldwell, PE
6/14/2005

II. ESTIMATED OFFSET PAYMENT

Apportioned area =		13.48	acres
Max. allowable export w/o offset payment =		3.6	lbs/ac/yr
=		48.52	lbs/yr
TN-Export after SF treatment =		84.65	lbs/yr
		6.28	lbs/ac/yr
Required TN-export offset amount =		36.13	lbs/yr
Offset Fee =	$	330.00	per lb. of TN

Estimated Offset fee = $ 11,923.39

NITROGEN EXPO.. CALCULATIONS
(To Wetlands)

JW Ca..well, PE
6/14/2005

METHOD 2:
Quantifying TN Export from Residential / Industrial / Commercial Developments when Footprints of all Impervious Surfaces are shown.

STEP 1: *Determine the area for each type of land use and enter in Column (2).*
STEP 2: *Total the areas for each type of land use and enter at the bottom of Column (2)*
STEP 3: *Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).*
STEP 4: *Total the TN exports for each type of land use and enter at the bottom of Column (4).*
STEP 5: *Determine the export coefficient for the site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).*

(1) Type of Land Cover	(2) Area [acres]	(3) TN export coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
Permanently protected undisturbed open space *(forest, unmown meadow)*	0	0.6	0
Permanently protected managed open space *(grass, landscaping, etc.)*	3.94	1.2	4.73
Impervious surfaces *(roads, parking lots, driveways, roofs, paved storage areas, etc.)*	4.83	21.2	102.40
TOTAL	8.77	---	107.12

Total TN Export =	12.21	lbs/ac/yr
Assume BMP Removal Efficiency =	40%	
TN-Export After BMP =	64.27	lbs/yr
Therefore, provided reduction =	42.85	lbs/yr

REFERENCE:
"City of Raleigh, Stormwater Management Design Manual" January 2002.

Since 1979
THE JOHN R. McADAMS COMPANY, INC.

KILARNEY POINTE

CARY, NORTH CAROLINA

STORMWATER WETLANDS DESIGN

REVISED STORM DRAIN SYSTEM DESIGN

(SYSTEM 10A-10-11-12-13-14-14A-14B-15-16-17-18-19-20-21-22 ONLY)

AGL-05000

4/15/05

Revised 6/14/05 JWC

James W. Caldwell, PE
Project Engineer – Stormwater Management Group

Research Triangle Park, NC
Post Office Box 14005
Research Triangle Park,
North Carolina 27709
2905 Meridian Parkway
Durham, North Carolina 27713
800-733-5646
919-361-5000
919-361-2269 Fax

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5311 Seventy-Seven Center Drive,
S 56
dte, North Carolina 28217
800-733-5646
704-527-0800
704-527-2003 Fax

www.johnrmcadams.com

KILARNEY POINTE

Revised Stormwater Wetland Design
Revised Nitrogen Calculations
Revised Storm Drainage System

Project Description and Summary

Located on the southwest corner of the intersection between Old Apex Road and Cary Parkway in Cary, North Carolina is the proposed residential and commercial development known as Kilarney Pointe. Proposed for development on this 13.6-acre site is of the construction of single-family homes, future commercial development, and any necessary utility improvements. The site as it exists (pre-development) is mostly wooded and open space. In the post-development condition, the site will be approximately 40% impervious.

The stormwater design for the project was performed by Hugh J. Gilleece and Associates, P.A. This design was approved by The Town of Cary. The John R. McAdams Company, Inc. has been hired to perform "value engineering" for the stormwater portion of the project. This report addresses aspects of redesign of the two stormwater management facilities, revised nitrogen export calculations, and revisions to portion of the storm drain system that tie directly into the stormwater management facilities. All calculations, drawings, and assumptions for this report were made from drawings provided by Hugh J. Gilleece and Associates, P.A. dated March 2, 2005. The John R. McAdams Company assumes no liability for any portion of the project designed by Hugh J. Gilleece and Associates, LLC.

The proposed site is located within the Neuse River basin, and, therefore, is subject to the Neuse Performance Standards to control nitrogen from new development. Also, per the Town of Cary Standards, post-development peak flow rates can be no greater than pre-development levels, in the 1-year storm. If there is an increase between pre- and post-development flowrates, then stormwater detention is required for these storm events. The proposed development will cause an increase in the peak flowrates in the 1-year storm event. Also, due to existing problems with the storm drain system in the neighborhood downstream of the proposed development, detention for the 25-year year event is required as well. Conclusively, stormwater detention is required to reduce the post-development peak flowrates in the 1-, and 25-year storm events back to pre-development levels. In order to meet the detention requirements, two stormwater wetlands are proposed to provide the necessary detention. The previous design of the site included two wet detention ponds. These wet detention ponds have been changed to constructed wetlands to provide additional detention storage and a greater nitrogen removal rate.

Also included in the Wake County Neuse Performance Standards is the control of nitrogen export to a maximum of 3.6 lbs/ac/yr. However, nitrogen loads that exceed this standard may be offset by payment of a fee to the Wetlands Restoration Fund provided that no new non-residential development can exceed 10.0 lbs/ac/yr and no new residential limit can exceed 6.0 lbs/ac/yr. In order for the proposed site to meet the limitations, two stormwater wetlands will be provided to remove the appropriate amount of nitrogen to reach the maximum levels. The two portions of the project (residential and commercial) have been analyzed together. The calculations contained within this booklet detail the total nitrogen export for the proposed site.

Please refer to the watershed maps included in this report for identification of the portions of the proposed development that were included in this stormwater impact analysis.

Calculation Methodology

- Using the Wake County Soil Survey, the proposed site contains a combination of HSG C, and HSG D soils. Therefore, composite SCS Curve Numbers were then calculated based on the relative percentage of these soils groups. These composite curve numbers were then used in peak flow calculations. The soil survey map from which the soils were determined for this analysis has been included in this report.

- On-site topography is from a field survey provided by Hugh J. Gilleece and Associates, LLC.

- HEC-HMS Version 2.2.2, by the U.S. Army Corps of Engineers, was used to generate pre-development peak flow rates in the 1-, 25-year storm events and post-development peak flow rates in the 1-, 10-, 25- and 100-year storm events.

- A composite SCS curve number was calculated the proposed site for both the pre- and post-development conditions. Pre-development land cover conditions were determined using survey and GIS information. The area of each cover condition was measured in AutoCAD for use in the calculation of the composite curve numbers. The post-development land cover conditions were taken from the proposed development plan.

- Rainfall data for the Raleigh-Durham region is from USWB Technical Paper No. 40 and NOAA Hydro-35. This data was used to generate a depth-duration-frequency table describing rainfall depth versus time for varying return periods in the RDU region. Rainfall depths from this table were then input into HEC-HMS for hydrologic calculations.

- For the 1-year storm rainfall data, the SCS Type II storm distribution with a precipitation depth of 3.00 inches in a 24-hour period was used.

- The pre- and post-development times of concentration for the proposed site were calculated using the SCS Segmental Approach (TR-55, 1986). Each T_C path was divided into segments consisting of overland flow, shallow concentrated flow, and channel flow. The overall time of concentration is the sum of the individual segment times.

- Nitrogen export calculations were completed using the City of Raleigh Apportioning Method. This method is described in the City of Raleigh Stormwater Management Design Manual (3/20/2002). Two stormwater wetlands are proposed for nitrogen reduction. The nitrogen calculations that detail how the export loading rates were calculated have been included in this report.

- The stormwater wetland design calculations were performed in accordance with the N.C. Stormwater Best Management Practices manual (NCDENR April 1999).

- Wetland #1 ties into a storm drain system that handles off-site area from the north (bypass-area). This system ties into an existing system located in the subdivision to the south of the proposed development. An analysis of this system was performed by Hugh J. Gilleece and Associates, LLC. A tailwater elevation from this analysis of 411.20 was used as a constant tailwater elevation for analysis of Wetland #1.

- Sub-basin 3 leaves the site undetained in the post-development consition. Due to regrading and the storm drain system, less area goes to SB3 in the post-development condition. The increase in peak flow rates in the 1-year storm is less than 10%, as required.

- An impervious area of 48,000 square feet for the commercial lots was assumed for the revised analysis (within the right-of-way lines). The additional impervious area for the sidewalks and roads was added for analysis of the commercial area.

Discussion of Results

The redesign of the stormwater management facilities provided detention for the three subbasins within the site for both the 1-year and 25-year storm events. The constructed wetlands also pass the 100-year storm with adequate freeboard. All calculations associated with pre- and post-development are shown in this report. Please refer to the next few sections in this report for any detailed calculations.

Revised Storm Drain System Design

The previously designed and approved storm drain system for the proposed development included oversized pipes in the portion of the system that ties directly into stormwater facility #1 (10-10A-11-12-13-14-14A-14B-15-16-17-18-19-20-21-22 only- other legs of the storm drain system were not reanalyzed or redesigned). The pipes were previously oversized intentionally to provide extra storage capacity for detention in the system. The storm drain system and stormwater facility #1 (previously a wet detention pond) were designed to work in conjunction to provide adequate detention. Stormwater management facility #1 has been redesigned to provide detention in the 1-year and 25-year events independent of the storm drain system that ties directly into it. Therefore, the storm drain system has been redesigned to convey the 10-year storm without providing additional detention storage. Hydrologic aspects of the design were taken directly for the original design performed by Hugh J. Gilleece and Associates, LLC (drainage areas and Rational Method "c" values). The locations of the inlets and the rim elevations of the inlets did not change. Therefore, all aspects of the hydrologic design were taken directly from the original design report.

The revised storm drain system for section 10-10A-11-12-13-14-14A-14B-15-16-17-18-19-20-21-22 was modeled in StormCAD. Inlet inverts were changed and various pipe sizes were reduced in this redesign. The maximum water surface elevation in the 10-year storm event in stormwater wetland #1 was used as the tailwater elevation for the system. The outlet invert for the redesigned system was set at the same elevation as the normal pool elevation for stormwater wetland #1 to avoid standing water in any portion of the storm drain system. Due to the tailwater elevation on the system, portions of the system are to be constructed of O-Ring Reinforced Concrete Pipe.

Please refer to appropriate portions of this report for detailed calculations.

Calculation Methodology

- Drainage areas and Rational Method "c" values to each inlet were taken from the original design performed by Hugh J. Gilleece and Associates, LLC. No inlet locations or inlet rim elevations changed from the original design. The John R.

McAdams Company, Inc. assumes no liability for the hydrologic aspects fo the storm drain system design. This analysis and redesign was performed only for hydraulic aspects of the system. No gutter spread calculations were performed by the John R. McAdams Company, Inc. due to no inlet locations changing.

- StormCAD Version 4.1.1 by Haestad Methods was used to analyze the new system.
- A time of concentration of 5 minutes was assumed for each inlet.

SUMMARY OF RESULTS

KILARNEY POINTE
AGL-05000

Summary of Results

Detention Analysis

	SB1	SB2	SB3*
Pre-Dev 1-Yr Q [cfs] =	72.49	6.08	3.69
Post-Dev 1-Yr Q [cfs]=	72.47	5.79	3.88
Change [cfs]=	-0.02	-0.29	0.19

	SB1	SB2	SB3
Pre-Dev 25-Yr Q [cfs] =	166.78	18.08	10.74
Post-Dev 25-Yr Q [cfs]=	156.29	12.63	9.50
Change [cfs]=	-10.49	-5.45	-1.25

*Note: SB3 leaves the site undetained. The 1-yr increase is less than 10%.

Wetland 1

Top of Berm Elev. [ft]=	418.00
100-yr WSE [ft]=	417.39
100-yr Freeboard [ft]=	0.61

Wetland 2

Top of Berm Elev. [ft]=	418.25
100-yr WSE [ft]=	417.66
100-yr Freeboard [ft]=	0.59

Nitrogen Control Plan
Commercial / Industrial / Residential Sites with Known Impervious Area

Project Title: Kilarney Pointe

Note: Information taken from original design report by Hugh J. Gilleece and Associates, LLC.

Part I. Riparian Buffers
Area includes riparian buffers? [ ] No [X] Yes [ ]Exempt
If yes, [X] 50 foot [ ] 100 foot
River Basin? [X] Neuse [ ] Cape Fear
Basis for exemption _____
Show buffers on site plan.

Part II. Nitrogen Calculations (Method 2, Appendix C):

a. Site Information

Total area of property incl. R/W	13.75
Denuded Area	9.81
Impervious Area incl. R/W	5.55
Managed open space	8.20
Protected open space	0

b. Pre-development loading:

Type of Land Cover	Area (acres)	TN export coeff. (lbs/ac/yr)	TN export from use (lbs/yr)
Permanently protected undisturbed open space (forest, unmown meadow)	13.64	0.60	8.18
Permanently protected managed open space (grass, landscaping, etc.)	0	1.20	0
Impervious Area	0.11	21.20	2.33
TOTAL	13.75		10.52

Nitrogen Loading Rate (lbs/ac/yr) = 0.77

c. Post-development loading:

Type of Land Cover	Area (acres)	TN export coeff. (lbs/ac/yr)	TN export from use (lbs/yr)
Permanently protected undisturbed open space (forest, unmown meadow)	0	0.60	0
Permanently protected managed open space (grass, landscaping, etc.)	8.20	1.20	9.84
Impervious Area	5.55	21.20	117.66
TOTAL	13.75		127.50

Note: see design report for apportioning method

Nitrogen Loading Rate (lbs/ac/yr) = 9.27

Proposed BMP(s) 2 Const. Wetlands
Nitrogen Load after BMPs = 6.28 lbs/ac/yr
Nitrogen Load Offset by Payments = 2.63 lbs/ac/yr
Net change in on-site N Load = 4.85 lbs/ac/yr

Part III. Control of Peak Stormwater Flow (for 1 year, design storm)

Note: see summary of results in design rpt.

Calculated Pre-development Peak Flow 1-Yr: SB1 - 72.49, SB2 - 6.08, SB3 - 3.69
25-Yr: SB1 - 166.78, SB2 - 18.08, SB3 - 10.74
Flow Control Method 2 Constructed Wetlands
Calculated Post-development Peak Flow 1-Yr: SB1 - 72.47, SB2 - 5.79, SB3 - 3.88
25-Yr: SB1 - 156.29, SB2 - 12.63, SB3 - 9.50

I, the undersigned, certify to the best of my knowledge that the above information is correct (affix seal).

Supply notes & details showing control of Nitrogen and peak stormwater runoff.

RAINFALL DATA

KILARNEY POINTE
AGL-05000

JW Caldwell, PE
4/13/2005

I. INPUT DATA

Location: Raleigh, North Carolina

	2-Year	100-Year	Source
5 minute	0.48	0.81	NOAA Hydro-35
15 minute	1.01	1.81	NOAA Hydro-35
60 minute	1.70	3.50	NOAA Hydro-35
24 hour	3.60	8.00	USWB TP-40

II. DEPTH-DURATION-FREQUENCY TABLE

Duration	Return Period					
	2-Year [inches]	5-Year [inches]	10-Year [inches]	25-Year [inches]	50-Year [inches]	100-Year [inches]
5 minutes	0.48	0.55	0.60	0.68	0.75	0.81
10 minutes	0.79	0.92	1.02	1.17	1.28	1.40
15 minutes	1.01	1.18	1.31	1.51	1.66	1.81
30 minutes	1.35	1.64	1.85	2.16	2.40	2.64
60 minutes	1.70	2.12	2.41	2.84	3.17	3.50
2 hours	1.91	2.40	2.74	3.23	3.61	4.00
3 hours	2.12	2.68	3.07	3.62	4.06	4.49
6 hours	2.65	3.38	3.90	4.62	5.19	5.75
12 hours	3.13	4.02	4.64	5.52	6.20	6.88
24 hours	3.60	4.65	5.38	6.41	7.21	8.00

III. INTENSITY-DURATION FREQUENCY DATA

Duration	Return Period					
	2-Year [in/hr]	5-Year [in/hr]	10-Year [in/hr]	25-Year [in/hr]	50-Year [in/hr]	100-Year [in/hr]
5 minutes	5.76	6.58	7.22	8.19	8.96	9.72
10 minutes	4.76	5.54	6.13	7.01	7.71	8.40
15 minutes	4.04	4.74	5.25	6.03	6.64	7.24
30 minutes	2.70	3.28	3.71	4.32	4.80	5.28
60 minutes	1.70	2.12	2.41	2.84	3.17	3.50
2 hours	0.95	1.20	1.37	1.62	1.81	2.00
3 hours	0.71	0.89	1.02	1.21	1.35	1.50
6 hours	0.44	0.56	0.65	0.77	0.86	0.96
12 hours	0.26	0.33	0.39	0.46	0.52	0.57
24 hours	0.15	0.19	0.22	0.27	0.30	0.33

IV. RESULTS

Return Period	g	h
2	132	18
5	169	21
10	195	22
25	232	23
50	261	24
100	290	25

CALCULATIONS:

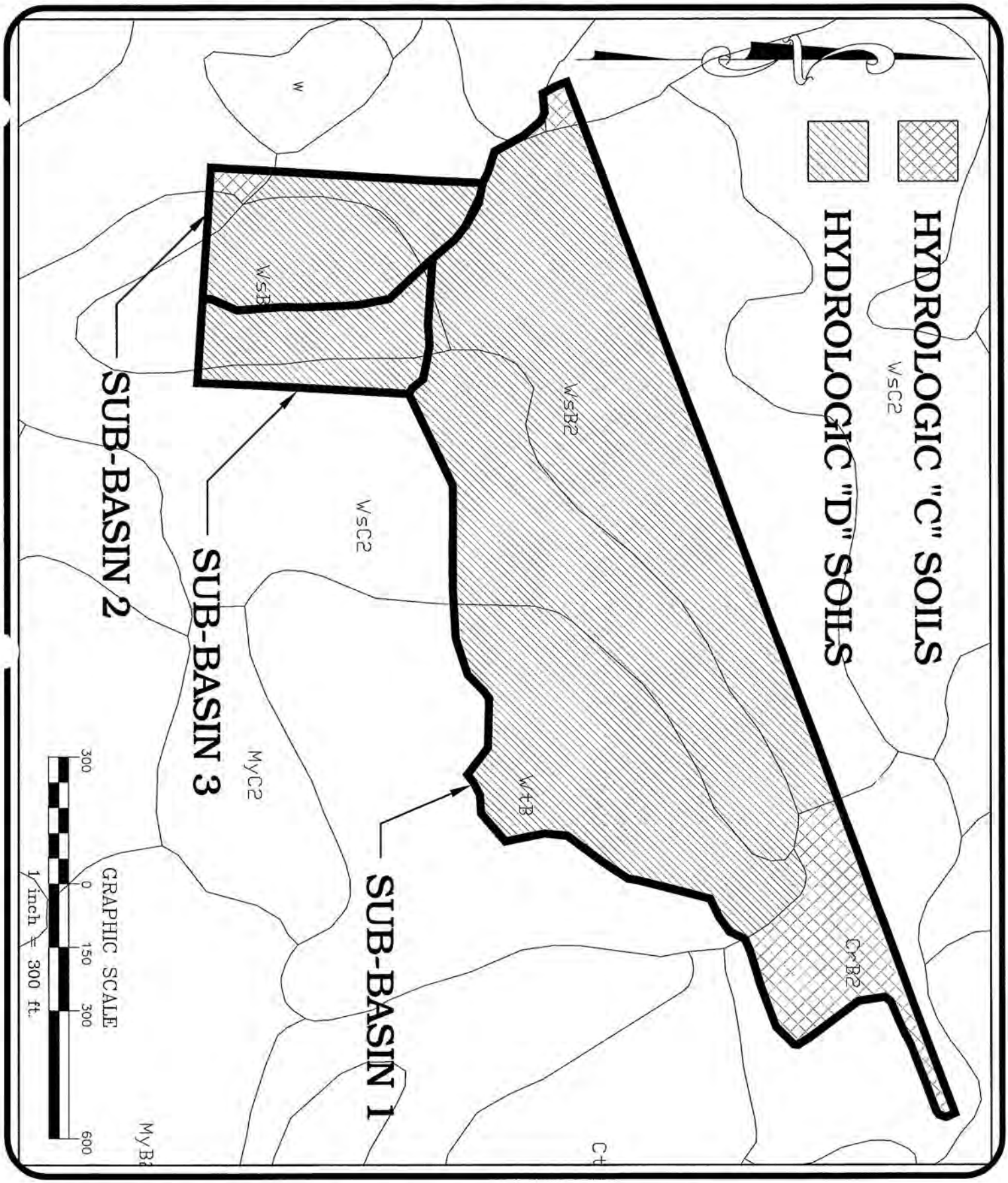
Duration	1/I 2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
5	0.17	0.15	0.14	0.12	0.11	0.10
10	0.21	0.18	0.16	0.14	0.13	0.12
15	0.25	0.21	0.19	0.17	0.15	0.14
30	0.37	0.30	0.27	0.23	0.21	0.19
60	0.59	0.47	0.41	0.35	0.32	0.29
120	1.05	0.83	0.73	0.62	0.55	0.50
180	1.42	1.12	0.98	0.83	0.74	0.67
360	2.26	1.77	1.54	1.30	1.16	1.04
720	3.84	2.99	2.59	2.18	1.94	1.75
1440	6.67	5.16	4.46	3.75	3.33	3.00

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Slope:	0.00760	0.00592	0.00513	0.00430	0.00383	0.00344
Y-Intercept:	0.13587	0.12225	0.11255	0.10001	0.09181	0.08486
g:	132	169	195	232	261	290
h:	18	21	22	23	24	25

WATERSHED SOILS DATA

KILARNEY POINTE
AGL-05000

X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\AGL05000_SOILS MAP.dwg, 4/5/2005 8:53:15 AM, caldwell, 1:1



PROJECT NO.	AGL-05000
FILENAME:	SOILS MAP.DWG
SCALE:	1"=300'
DATE:	4-5-05

McADAMS

KILARNEY POINTE
CARY, NORTH CAROLINA
WATERSHED SOILS MAP

THE JOHN R. McADAMS COMPANY, INC.
ENGINEERS/PLANNERS/SURVEYORS
RESEARCH TRIANGLE PARK, NC
P.O. BOX 14005 ZIP 27709-4005
(919) 361-5000

WATERSHED SOIL INFORMATION

==> On- & Off-site soils

Symbol	Name	Soil Classification
CrB2	Creedmoor sandy loam	C
CrC2	Creedmoor sandy loam	C
CrE	Creedmoor sandy loam	C
WsB2	White Store sandy loam	D
WsC2	White Store sandy loam	D
WtB	White Store silt loam	D

References:

1. SOIL SURVEY: WAKE COUNTY, NORTH CAROLINA. UNITED STATES DEPARTMENT OF AGRICULTURE: SOIL CONSERVATION SERVICE (IN COOPERATION WITH NORTH CAROLINA AGRICULTURE EXPERIMENT STATION).

2. SCS TR-55. UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL CONSERVATION SERVICE. 1986.

Conclusions:

The site consists of hydrologic soil groups 'C', and 'D' within the studied watersheds. Therefore, SCS Curve numbers will be chosen as follows:

Total Area of 'C' Soils [ac] :	3.33
Total Area of 'D' Soils [ac] :	31.39
Total Watershed Area [ac]:	34.72

% HSG 'C' =	10%
% HSG 'D' =	90%

Cover	HSG C	HSG D
Open	74	80
Wooded	70	77
Impervious	98	98
Commercial and Business	94	95

==> SCS CN Values used in Hydrologic Calculations

Cover	SCS CN Value
Open	79.4
Wooded	76.3
Impervious	98.0
Commercial and Business	94.9

PRE-DEVELOPMENT WATERSHED DATA

KILARNEY POINTE
AGL-05000


Segment 1
Segment 2
Segment 3a
Segment 3b
SB1 Tc Path
SUB-BASIN 1 C
SUB-BASIN 1 ON-SITE
Segment 1
SB3 Tc Path
Segment 2
SB 2 Tc Path
SUB-BASIN 3
OLD APEX ROAD
INDEXED TO MAP 0753.17

PRE-DEVELOPMENT WATERSHED DATA

TABLE 1: PRE-DEVELOPMENT COVER CONDITIONS

Sub-basin ID	Area [acres]			On-site Cover Conditions [acres]				Off-site Cover Conditions [acres]			
	Total	On-site	Off-site	Impervious	Wooded	Water	Open	Impervious	Wooded	Commercial	Open
1	28.12	7.04	21.08	0.00	7.04	0.00	0.00	0.00	4.50	16.58	0.00
2	3.97	3.97	0.00	0.00	1.95	0.00	2.02	0.00	0.00	0.00	0.00
3	2.54	2.54	0.00	0.11	1.16	0.00	1.27	0.00	0.00	0.00	0.00
Totals =	34.63	13.55	21.08	0.11	10.15	0.00	3.29	0.00	4.50	16.58	0.00

TABLE 2: PRE-DEVELOPMENT HEC-HMS INPUT

Sub-basin ID	Drainage Area		SCS CN	Tc [minutes]	Lag Time [minutes]
	[acres]	[sq.mi.]			
1	28.12	0.0439	87.3	10.0	6.0
2	3.97	0.0062	77.9	12.5	7.5
3	2.54	0.0040	78.8	16.7	10.0

HYDROLOGIC CALCULATIONS

Pre-Development: Sub-basin # 1

JW Caldwell, PE
4/7/2005

I. SCS CURVE NUMBERS

Cover Condition	SCS CN	Comments
Impervious	98.0	Assume 10% C, 90% D
Open	79.4	Assume 10% C, 90% D
Wooded	76.3	Assume 10% C, 90% D
Commercial	94.9	Assume 10% C, 90% D

II. PRE-DEVELOPMENT

A. Watershed Breakdown

Contributing Area	SCS CN	Area [acres]	Comments
Off-site Open	79.40	0.00	Assume good condition
Off-site Impervious	98.00	0.00	-
Off-site Wooded	76.30	4.50	Assume good condition
Off-Site Commercial	94.90	16.58	
On-site Open	79.40	0.00	Assume good condition
On-site Impervious	98.00	0.00	-
On-site Wooded	76.30	7.04	Assume good condition

Total area = 28.12 acres
0.0439 sq.mi.
Composite SCS CN = 87

% Impervious = N/A

B. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	50	ft
Height =	5.5	ft
Slope =	0.1100	ft/ft
Manning's n =	0.40	Woods
P (2-year/24-hour) =	3.61	inches (Wake County, NC)
Segment Time =	*5.87*	***minutes***

Segment 2: Concentrated Flow

Length =	195.35	ft
Height =	2.75	ft
Slope =	0.0141	ft/ft
Paved ? =	No	
Velocity =	1.91	ft/sec
Segment Time =	*1.70*	***minutes***

Segment 3a: Channel Flow

Length =	534	ft
Height =	11	ft
Slope =	0.0206	ft/ft
Manning's n =	0.013	RCP
Flow Area =	3.14	sf (24" RCP Assumed)
Wetted Perimeter =	6.28	ft (24" RCP Assumed)
Channel Velocity =	10.36	ft/sec
Segment Time =	*0.86*	***minutes***

Segment 3b: Channel Flow

Length =	418	ft
Height =	5	ft
Slope =	0.0120	ft/ft
Manning's n =	0.045	Natural stream
Flow Area =	16	sf (4' x 4' ft channel)
Wetted Perimeter =	12	ft (4' x 4' ft channel)
Channel Velocity =	4.39	ft/sec
Segment Time =	*1.59*	***minutes***

Time of Concentration =	10.0	minutes
SCS Lag Time =	6.0	minutes (SCS Lag = 0.6* Tc)
Time Increment =	1.74	minutes (= 0.29*SCS Lag)

HYDROLOGIC CALCULATIONS

Pre-Development: Sub-basin #2

I. SCS CURVE NUMBERS

Cover Condition	SCS CN	Comments
Impervious	98.0	Assume 10% C, 90% D Soils
Open	79.4	Assume 10% C, 90% D Soils
Wooded	76.3	Assume 10% C, 90% D Soils
Commercial	94.9	Assume 10% C, 90% D Soils

II. PRE-DEVELOPMENT

A. Watershed Breakdown

Contributing Area	SCS CN	Area [acres]	Comments
Off-site Open	79.40	0.00	Assume good condition
Off-site Impervious	98.00	0.00	-
Off-site Wooded	76.30	0.00	Assume good condition
Off-Site Commercial	94.90	0.00	
On-site Open	79.40	2.02	Assume good condition
On-site Impervious	98.00	0.00	-
On-site Wooded	76.30	1.95	Assume good condition

Total area = 3.97 acres
0.0062 sq.mi.
Composite SCS CN = 78

% Impervious = N/A

B. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow			***Segment 2: Concentrated Flow***		
Length =	50	ft	Length =	466	ft
Height =	0.5	ft	Height =	20.5	ft
Slope =	0.0100	ft/ft	Slope =	0.0440	ft/ft
Manning's n =	0.24	Grass	Paved ? =	No	
P (2-year/24-hour) =	3.61	inches (Wake County, NC)	Velocity =	3.38	ft/sec
Segment Time =	*10.18*	***minutes***	***Segment Time =***	*2.30*	***minutes***

Time of Concentration =	12.5	minutes
SCS Lag Time =	7.5	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.17	minutes (= 0.29*SCS Lag)

HYDROLOGIC CALCULATIONS

Pre-Development: Sub-basin # 3

I. SCS CURVE NUMBERS

Cover Condition	SCS CN	Comments
Impervious	98.0	Assume 10% C, 90% D Soils
Open	79.4	Assume 10% C, 90% D Soils
Wooded	76.3	Assume 10% C, 90% D Soils
Commercial	94.9	Assume 10% C, 90% D Soils

II. PRE-DEVELOPMENT

A. Watershed Breakdown

Contributing Area	SCS CN	Area [acres]	Comments
Off-site Open	79.40	0.00	Assume good condition
Off-site Impervious	98.00	0.00	-
Off-site Wooded	76.30	0.00	Assume good condition
Off-Site Commercial	94.90	0.00	
On-site Open	79.40	1.27	Assume good condition
On-site Impervious	98.00	0.11	-
On-site Wooded	76.30	1.16	Assume good condition

Total area = 2.54 acres
0.0040 sq.mi.
Composite SCS CN = 79

% Impervious = N/A

B. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length = 50 ft
Height = 0.5 ft
Slope = 0.0100 ft/ft
Manning's n = 0.40 Woods
P (2-year/24-hour) = 3.61 inches (Wake County, NC)

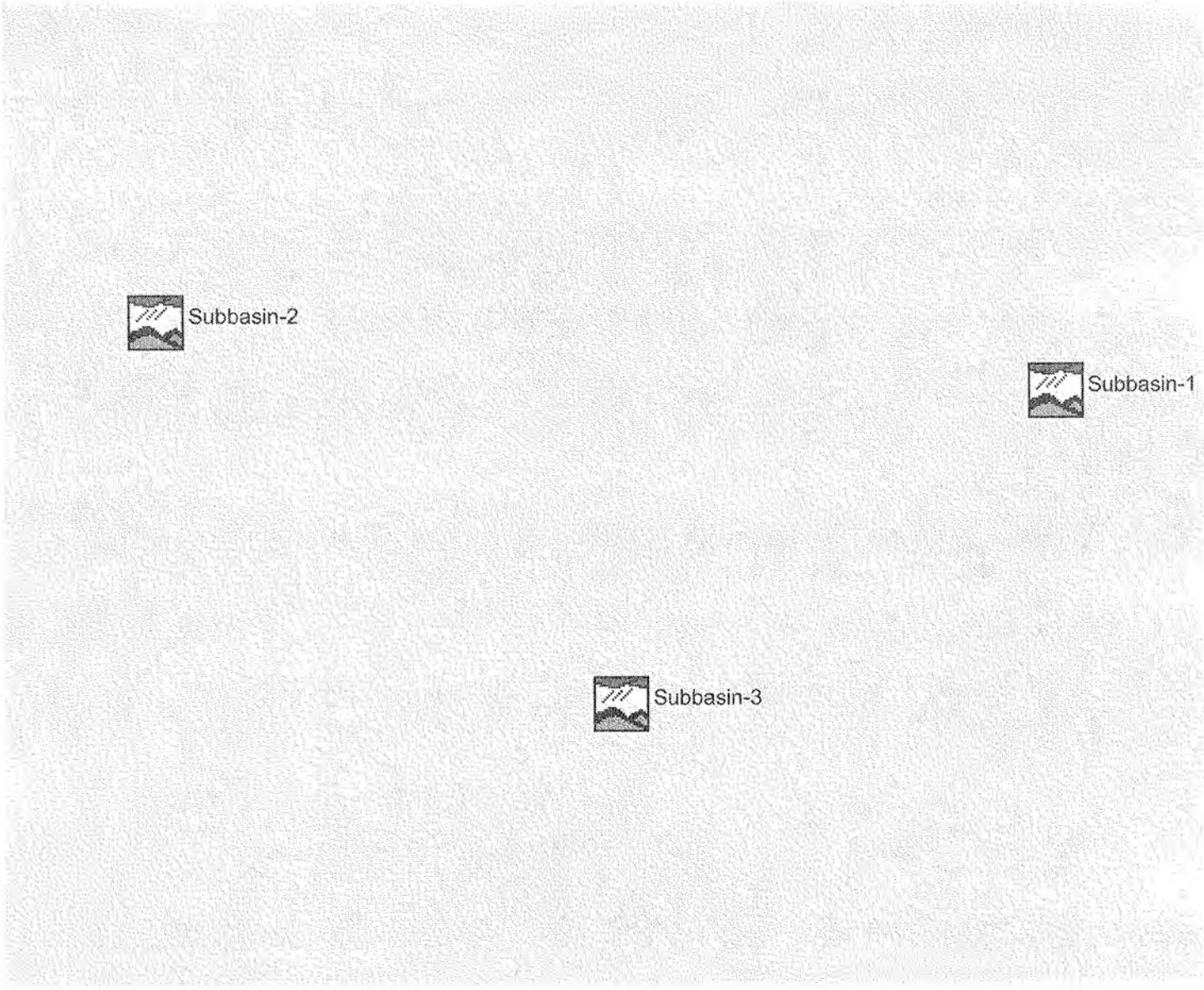
Segment Time = *15.32* ***minutes***

Segment 2: Concentrated Flow

Length = 283 ft
Height = 12 ft
Slope = 0.0424 ft/ft
Paved ? = No
Velocity = 3.32 ft/sec

Segment Time = *1.42* ***minutes***

Time of Concentration =	16.7	minutes
SCS Lag Time =	10.0	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.91	minutes (= 0.29*SCS Lag)


Subbasin-2
Subbasin-1
Subbasin-3

HMS * Summary of Results

Project : AGL-05000 Run Name : PRE 1

Start of Run : 04Apr05 0100 Basin Model : PRE-DEVELOPMENT
End of Run : 05Apr05 0100 Met. Model : 1 YR, 24 HR
Execution Time : 07Apr05 1506 Control Specs : 24 HR, dT 1 MIN

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Volume (ac ft)	Drainage Area (sq mi)
Subbasin-1	72.489	04 Apr 05 1259	4.1178	0.044
Subbasin-2	6.0775	04 Apr 05 1302	0.37006	0.006
Subbasin-3	3.6933	04 Apr 05 1304	0.24985	0.004

HMS * Summary of Results

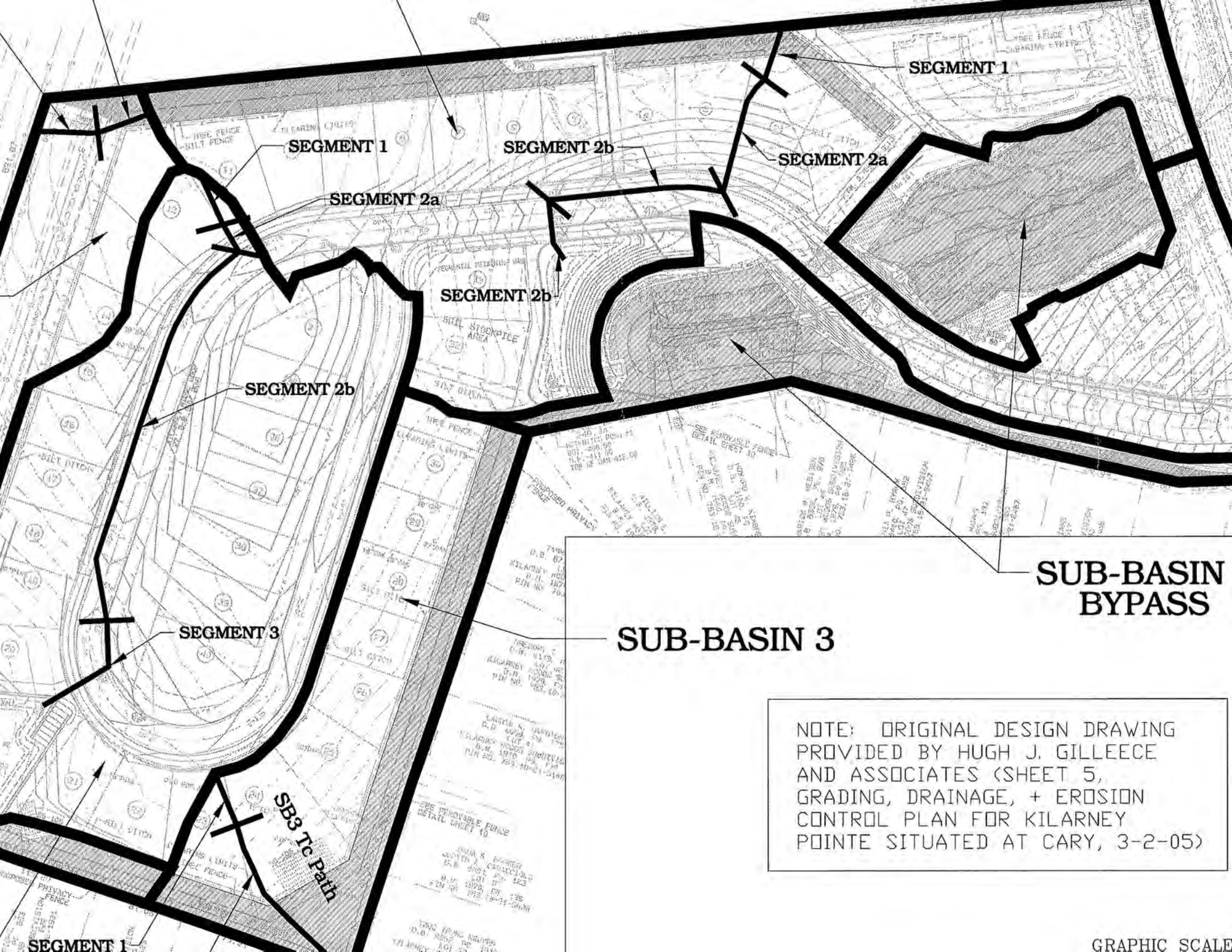
Project : AGL-05000 Run Name : PRE 25

Start of Run : 04Apr05 0100 Basin Model : PRE-DEVELOPMENT
End of Run : 05Apr05 0100 Met. Model : 25 YR, 24 HR
Execution Time : 07Apr05 1506 Control Specs : 24 HR, dT 1 MIN

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Volume (ac ft)	Drainage Area (sq mi)
Subbasin-1	166.78	04 Apr 05 1307	11.557	0.044
Subbasin-2	18.079	04 Apr 05 1309	1.2975	0.006
Subbasin-3	10.744	04 Apr 05 1312	0.85655	0.004

POST-DEVELOPMENT WATERSHED DATA

KILARNEY POINTE
AGL-05000


SEGMENT 1
SEGMENT 2b
SEGMENT 2a
SEGMENT 1
SEGMENT 2a
SEGMENT 2b
SEGMENT 2b
SEGMENT 3
SB3 Tc Path
SEGMENT 1
SUB-BASIN BYPASS
SUB-BASIN 3
NOTE: ORIGINAL DESIGN DRAWING PROVIDED BY HUGH J. GILLEECE AND ASSOCIATES (SHEET 5, GRADING, DRAINAGE, + EROSION CONTROL PLAN FOR KILARNEY POINTE SITUATED AT CARY, 3-2-05)
GRAPHIC SCALE

HYDROLOGIC CALCULATIONS

Impervious Areas

IMPERVIOUS AREA PER LOT [sf] =	3125

SUBBASIN 1 ON-SITE

NUMBER OF LOTS =	13.5
TOTAL LOT IMPERVIOUS AREA [ac] =	0.97
SIDEWALK AND ROAD IMPERVIOUS [ac] =	1.94
TOTAL IMPERVIOUS AREA [ac] =	**2.91**

SUBBASIN 2 ON-SITE TO POND

NUMBER OF LOTS =	16.5
TOTAL LOT IMPERVIOUS AREA [ac] =	1.18
SIDEWALK AND ROAD IMPERVIOUS [ac] =	0.74
TOTAL IMPERVIOUS AREA [ac] =	**1.92**

SUBBASIN 2 ON-SITE BYPASS

NUMBER OF LOTS =	2.0
TOTAL LOT IMPERVIOUS AREA [ac] =	0.14
SIDEWALK AND ROAD IMPERVIOUS [ac] =	0.00
TOTAL IMPERVIOUS AREA [ac] =	**0.14**

SUBBASIN 3 ON-SITE

NUMBER OF LOTS =	8.0
TOTAL LOT IMPERVIOUS AREA [ac] =	0.57
SIDEWALK AND ROAD IMPERVIOUS [ac] =	0.00
TOTAL IMPERVIOUS AREA [ac] =	**0.57**

TOTAL NUMBER OF LOTS =	40.0

TOTAL IMPERVIOUS AREA [ac] =	5.5

POST-DEVELOPMENT WATERSHED DATA

TABLE 1: POST-DEVELOPMENT COVER CONDITIONS

Sub-basin ID	Area [acres]			On-site Cover Conditions [acres]				Off-site Cover Conditions [acres]			
	Total	On-site	Off-site	Impervious	Wooded	Water	Open	Impervious	Wooded	Commercial	Open
1 To Pond	5.04	5.04	0.00	2.91	0.47	0.00	1.66	0.00	0.00	0.00	0.00
1 Bypass	22.93	1.84	21.08	0.00	1.24	0.00	0.60	0.00	4.50	16.58	0.00
2 To Pond	3.73	3.73	0.00	1.92	0.00	0.00	1.81	0.00	0.00	0.00	0.00
2 Bypass	1.54	1.54	0.00	0.14	0.19	0.00	1.21	0.00	0.00	0.00	0.00
3	1.60	1.60	0.00	0.57	0.54	0.00	0.49	0.00	0.00	0.00	0.00
Totals =	34.84	13.75	21.08	5.55	2.44	0.00	5.76	0.00	4.50	16.58	0.00

TABLE 2: POST-DEVELOPMENT HEC-HMS INPUT

Sub-basin ID	Drainage Area		SCS CN	Tc [minutes]	Lag Time [minutes]
	[acres]	[sq.mi.]			
1 To Pond	5.04	0.0079	89.8	9.4	5.7
1 Bypass	22.92	0.0358	89.8	10.0	6.0
2 To Pond	3.73	0.0058	89.0	12.6	7.6
2 Pypass	1.54	0.0024	80.8	11.9	7.1
3	1.60	0.0025	85.0	8.5	5.1

HYDROLOGIC CALCULATIONS

Post-Development: Sub-basin # 1 To Pond

I. SCS CURVE NUMBERS

Cover Condition	SCS CN	Comments
Impervious	98.0	Assume 10% C, 90% D
Open	79.4	Assume 10% C, 90% D
Wooded	76.3	Assume 10% C, 90% D
Commercial	94.9	Assume 10% C, 90% D

II. POST-DEVELOPMENT

A. Watershed Breakdown

Contributing Area	SCS CN	Area [acres]	Comments
Off-site Open	79.40	0.00	Assume good condition
Off-site Impervious	98.00	0.00	-
Off-site Wooded	76.30	0.00	Assume good condition
Off-Site Commercial	94.90	0.00	
On-site Open	79.40	1.66	Assume good condition
On-site Impervious	98.00	2.91	-
On-site Wooded	76.30	0.47	Assume good condition

Total area = 5.04 acres
0.0079 sq.mi.
Composite SCS CN = 90

% Impervious = N/A

B. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	50	ft
Height =	2.5	ft
Slope =	0.0500	ft/ft
Manning's n =	0.40	Woods
P (2-year/24-hour) =	3.61	inches (Wake County, NC)
Segment Time =	*8.05*	***minutes***

Segment 2A: Concentrated Flow

Length =	109	ft
Height =	8.5	ft
Slope =	0.0780	ft/ft
Paved ? =	No	
Velocity =	4.51	ft/sec
Segment Time =	*0.40*	***minutes***

Segment 2B: Concentrated Flow

Length =	158	ft
Height =	3	ft
Slope =	0.0190	ft/ft
Paved ? =	Yes	
Velocity =	2.80	ft/sec
Segment Time =	*0.94*	***minutes***

Segment 3: Channel Flow

Length =	40	ft
Height =	7	ft
Slope =	0.1750	ft/ft
Manning's n =	0.013	RCP
Flow Area =	1.23	ft (15" RCP)
Wetted Perimeter =	3.93	ft (15" RCP)
Channel Velocity =	22.10	ft/sec
Segment Time =	*0.03*	***minutes***

Time of Concentration =	9.4	minutes
SCS Lag Time =	5.7	minutes (SCS Lag = 0.6* Tc)
Time Increment =	1.64	minutes (= 0.29*SCS Lag)

HYDROLOGIC CALCULATIONS

Post-Development: Sub-basin #1 Bypass

I. SCS CURVE NUMBERS

Cover Condition	SCS CN	Comments
Impervious	98.0	Assume 10% C, 90% D
Open	79.4	Assume 10% C, 90% D
Wooded	76.3	Assume 10% C, 90% D
Commercial	94.9	Assume 10% C, 90% D

II. POST-DEVELOPMENT

A. Watershed Breakdown

Contributing Area	SCS CN	Area [acres]	Comments
Off-site Open	79.40	0.00	Assume good condition
Off-site Impervious	98.00	0.00	-
Off-site Wooded	76.30	4.50	Assume good condition
Off-Site Commercial	94.90	16.58	
On-site Open	79.40	0.60	Assume good condition
On-site Impervious	98.00	0.00	-
On-site Wooded	76.30	1.24	Assume good condition

Total area = 22.92 acres
0.0358 sq.mi.
Composite SCS CN = 90

% Impervious = N/A

B. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	50	ft
Height =	5.5	ft
Slope =	0.1100	ft/ft
Manning's n =	0.40	Woods
P (2-year/24-hour) =	3.61	inches (Wake County, NC)
Segment Time =	***5.87***	***minutes***

Segment 2: Concentrated Flow

Length =	195.35	ft
Height =	2.75	ft
Slope =	0.0141	ft/ft
Paved ? =	No	
Velocity =	1.91	ft/sec
Segment Time =	***1.70***	***minutes***

Segment 3a: Channel Flow

Length =	534	ft
Height =	11	ft
Slope =	0.0206	ft/ft
Manning's n =	0.013	RCP
Flow Area =	3.14	sf (24" RCP Assumed)
Wetted Perimeter =	6.28	ft (24" RCP Assumed)
Channel Velocity =	10.36	ft/sec
Segment Time =	***0.86***	***minutes***

Segment 3b: Channel Flow

Length =	418	ft
Height =	5	ft
Slope =	0.0120	ft/ft
Manning's n =	0.045	Natural stream
Flow Area =	16	sf (4' x 4' ft channel)
Wetted Perimeter =	12	ft (4' x 4' ft channel)
Channel Velocity =	4.39	ft/sec
Segment Time =	***1.59***	***minutes***

Time of Concentration =	10.0	minutes
SCS Lag Time =	6.0	minutes (SCS Lag = 0.6* Tc)
Time Increment =	1.74	minutes (= 0.29*SCS Lag)

HYDROLOGIC CALCULATIONS

Post-Development: Sub-basin #2 To Pond

I. SCS CURVE NUMBERS

Cover Condition	SCS CN	Comments
Impervious	98.0	Assume 10% C, 90% D Soils
Open	79.4	Assume 10% C, 90% D Soils
Wooded	76.3	Assume 10% C, 90% D Soils
Commercial	94.9	Assume 10% C, 90% D Soils

II. POST-DEVELOPMENT

A. Watershed Breakdown

Contributing Area	SCS CN	Area [acres]	Comments
Off-site Open	79.40	0.00	Assume good condition
Off-site Impervious	98.00	0.00	-
Off-site Wooded	76.30	0.00	Assume good condition
Off-Site Commercial	94.90	0.00	
On-site Open	79.40	1.81	Assume good condition
On-site Impervious	98.00	1.92	-
On-site Wooded	76.30	0.00	Assume good condition

Total area = 3.73 acres
0.0058 sq.mi.
Composite SCS CN = 89

% Impervious = N/A

B. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	50	ft
Height =	0.5	ft
Slope =	0.0100	ft/ft
Manning's n =	0.24	Grass
P (2-year/24-hour) =	3.61	inches (Wake County, NC)
Segment Time =	***10.18***	***minutes***

Segment 2A: Concentrated Flow

Length =	28	ft
Height =	0.5	ft
Slope =	0.0179	ft/ft
Paved ? =	No	
Velocity =	2.16	ft/sec
Segment Time =	***0.22***	***minutes***

Segment 2B: Concentrated Flow

Length =	365	ft
Height =	7.5	ft
Slope =	0.0205	ft/ft
Paved ? =	Yes	
Velocity =	2.91	ft/sec
Segment Time =	***2.09***	***minutes***

Segment 3: Channel Flow

Length =	110	ft
Height =	8.5	ft
Slope =	0.0773	ft/ft
Manning's n =	0.013	RCP
Flow Area =	1.23	ft (15" RCP)
Wetted Perimeter =	3.93	ft (15" RCP)
Channel Velocity =	14.69	ft/sec
Segment Time =	***0.12***	***minutes***

Time of Concentration =	12.6	minutes
SCS Lag Time =	7.6	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.19	minutes (= 0.29*SCS Lag)

HYDROLOGIC CALCULATIONS

Post-Development: Sub-basin #2 Bypass

I. SCS CURVE NUMBERS

Cover Condition	SCS CN	Comments
Impervious	98.0	Assume 10% C, 90% D Soils
Open	79.4	Assume 10% C, 90% D Soils
Wooded	76.3	Assume 10% C, 90% D Soils
Commercial	94.9	Assume 10% C, 90% D Soils

II. POST-DEVELOPMENT

A. Watershed Breakdown

Contributing Area	SCS CN	Area [acres]	Comments
Off-site Open	79.40	0.00	Assume good condition
Off-site Impervious	98.00	0.00	-
Off-site Wooded	76.30	0.00	Assume good condition
Off-Site Commercial	94.90	0.00	
On-site Open	79.40	1.21	Assume good condition
On-site Impervious	98.00	0.14	-
On-site Wooded	76.30	0.19	Assume good condition

Total area = 1.54 acres
0.0024 sq.mi.

Composite SCS CN = 81

% Impervious = N/A

B. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length = 50 ft
Height = 1 ft
Slope = 0.0200 ft/ft
Manning's n = 0.40 Woods
P (2-year/24-hour) = 3.61 inches (Wake County, NC)

Segment Time = *11.61* ***minutes***

Segment 2: Concentrated Flow

Length = 55 ft
Height = 2.5 ft
Slope = 0.0455 ft/ft
Paved ? = No
Velocity = 3.44 ft/sec

Segment Time = *0.27* ***minutes***

Time of Concentration =	11.9	minutes
SCS Lag Time =	7.1	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.07	minutes (= 0.29*SCS Lag)

I. SCS CURVE NUMBERS

Cover Condition	SCS CN	Comments
Impervious	98.0	Assume 10% C, 90% D Soils
Open	79.4	Assume 10% C, 90% D Soils
Wooded	76.3	Assume 10% C, 90% D Soils
Commercial	94.9	Assume 10% C, 90% D Soils

II. POST-DEVELOPMENT

A. Watershed Breakdown

Contributing Area	SCS CN	Area [acres]	Comments
Off-site Open	79.40	0.00	Assume good condition
Off-site Impervious	98.00	0.00	-
Off-site Wooded	76.30	0.00	Assume good condition
Off-Site Commercial	94.90	0.00	
On-site Open	79.40	0.49	Assume good condition
On-site Impervious	98.00	0.57	-
On-site Wooded	76.30	0.54	Assume good condition

Total area = 1.60 acres
0.0025 sq.mi.
Composite SCS CN = 85

% Impervious = N/A

B. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length = 50 ft
Height = 1 ft
Slope = 0.0200 ft/ft
Manning's n = 0.24 Grass
P (2-year/24-hour) = 3.61 inches (Wake County, NC)

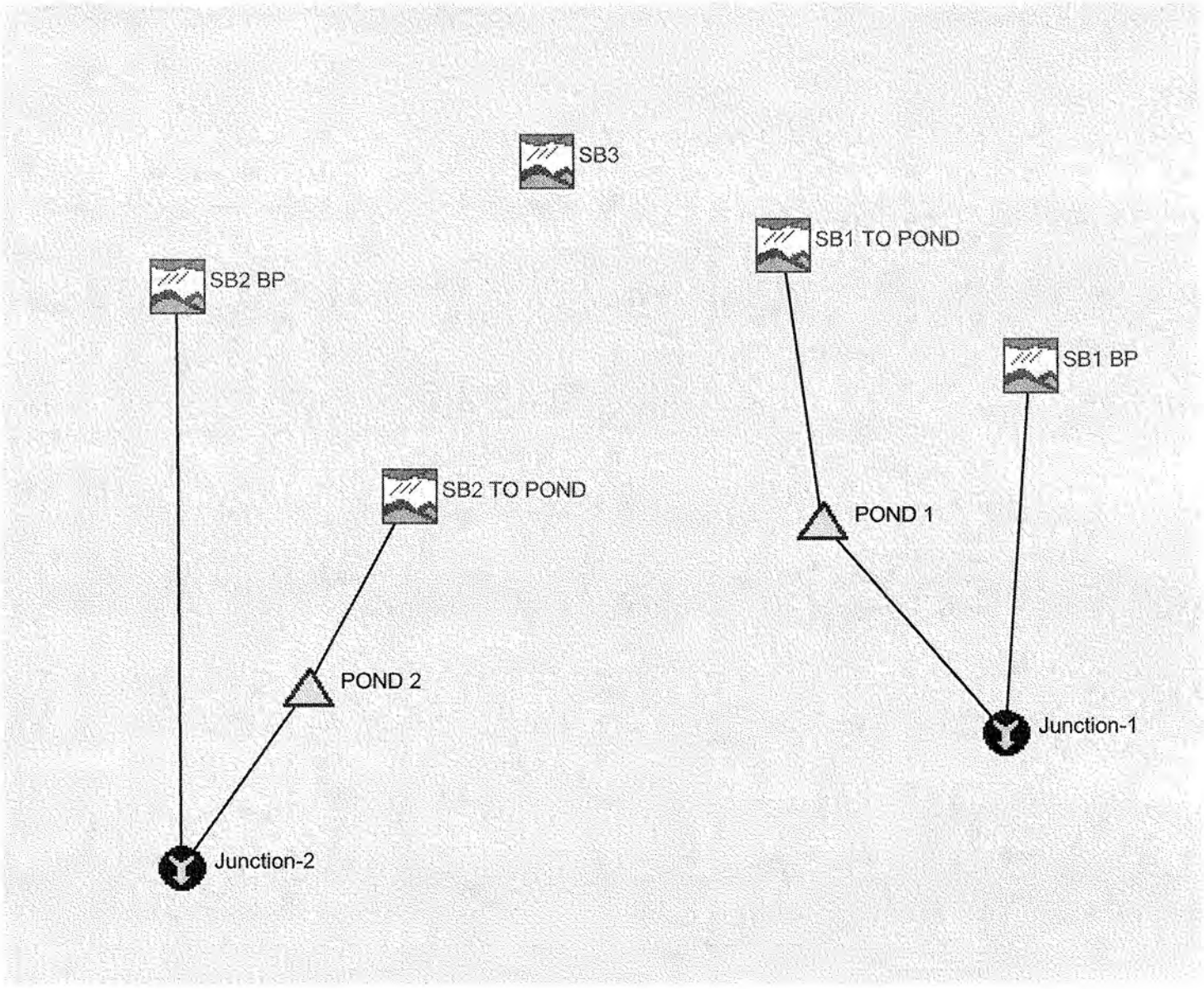
Segment Time = *7.72* ***minutes***

Segment 2: Concentrated Flow

Length = 172 ft
Height = 10 ft
Slope = 0.0581 ft/ft
Paved ? = No
Velocity = 3.89 ft/sec

Segment Time = *0.74* ***minutes***

Time of Concentration =	8.5	minutes
SCS Lag Time =	5.1	minutes (SCS Lag = 0.6* Tc)
Time Increment =	1.47	minutes (= 0.29*SCS Lag)


SB3
SB1 TO POND
SB2 BP
SB1 BP
SB2 TO POND
POND 1
POND 2
Junction-1
Junction-2

HMS * Summary of Results

Project : AGL-05000 Run Name : POST REV

Start of Run	: 04Apr05 0100	Basin Model	: POST-DEV REVISED
End of Run	: 05Apr05 0100	Met. Model	: 1 YR, 24 HR
Execution Time	: 14Jun05 1007	Control Specs	: 24 HR, dT 1 MIN

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Volume (ac ft)	Drainage Area (sq mi)
SB1 TO POND	14.607	04 Apr 05 1259	0.82719	0.008
POND 1	11.109	04 Apr 05 1304	0.58104	0.008
SB1 BP	65.334	04 Apr 05 1259	3.7482	0.036
Junction-1	72.471	04 Apr 05 1301	4.3292	0.044
SB2 TO POND	9.6264	04 Apr 05 1301	0.58615	0.006
POND 2	3.5574	04 Apr 05 1312	0.45949	0.006
SB2 BP	2.8061	04 Apr 05 1301	0.16598	0.002
Junction-2	5.7920	04 Apr 05 1303	0.62547	0.008
SB3	3.8833	04 Apr 05 1259	0.21135	0.003

HMS * Summary of Results

Project : AGL-05000 Run Name : POST 25 REV

Start of Run	: 04Apr05 0100	Basin Model	: POST-DEV REVISED
End of Run	: 05Apr05 0100	Met. Model	: 25 YR, 24 HR
Execution Time	: 14Jun05 1016	Control Specs	: 24 HR, dT 1 MIN

Hydrologic Element	Discharge Peak (cfs)	Time of Peak	Volume (ac ft)	Drainage Area (sq mi)
SB1 TO POND	31.678	04 Apr 05 1307	2.1976	0.008
POND 1	15.825	04 Apr 05 1317	1.9501	0.008
SB1 BP	141.48	04 Apr 05 1307	9.9578	0.036
Junction-1	156.29	04 Apr 05 1307	11.908	0.044
SB2 TO POND	21.110	04 Apr 05 1309	1.5849	0.006
POND 2	6.2414	04 Apr 05 1329	1.4460	0.006
SB2 BP	7.6225	04 Apr 05 1309	0.54134	0.002
Junction-2	12.632	04 Apr 05 1310	1.9874	0.008
SB3	9.4975	04 Apr 05 1306	0.62452	0.003

HMS * Summary of Results for POND 1

Project : AGL-05000 Run Name : POST 100 REV

Start of Run	: 04Apr05 0100	Basin Model	: POST-DEV REVISED
End of Run	: 05Apr05 0100	Met. Model	: 100 YR, 24 HR
Execution Time	: 14Jun05 1016	Control Specs	: 24 HR, dT 1 MIN

Computed Results

Peak Inflow	: 38.890 (cfs)	Date/Time of Peak Inflow	: 04 Apr 05 1307
Peak Outflow	: 16.941 (cfs)	Date/Time of Peak Outflow	: 04 Apr 05 1319
Total Inflow	: 6.77 (in)	Peak Storage	: 0.71406(ac-ft)
Total Outflow	: 6.18 (in)	Peak Elevation	: 417.39(ft)

HMS * Summary of Results for POND 2

Project : AGL-05000 Run Name : POST 100 REV

Start of Run	: 04Apr05 0100	Basin Model	: POST-DEV REVISED
End of Run	: 05Apr05 0100	Met. Model	: 100 YR, 24 HR
Execution Time	: 14Jun05 1016	Control Specs	: 24 HR, dT 1 MIN

Computed Results

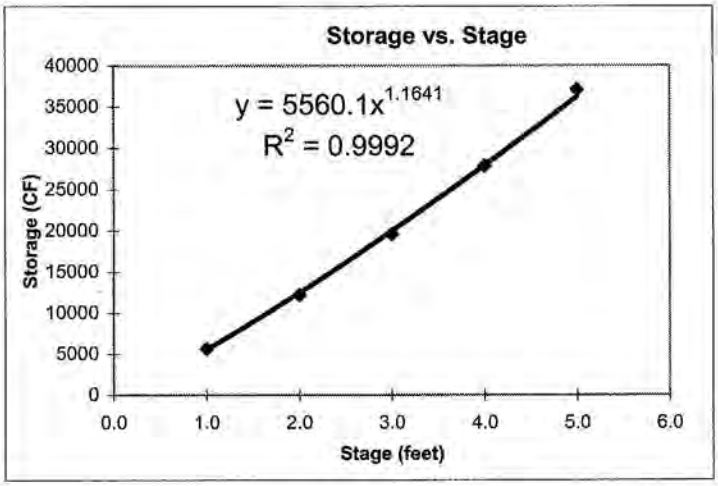
Peak Inflow	: 26.068 (cfs)	Date/Time of Peak Inflow	: 04 Apr 05 1309
Peak Outflow	: 7.0857 (cfs)	Date/Time of Peak Outflow	: 04 Apr 05 1331
Total Inflow	: 6.67 (in)	Peak Storage	: 0.75884(ac-ft)
Total Outflow	: 6.20 (in)	Peak Elevation	: 417.66(ft)

WETLAND #1 DESIGN DATA

STAGE-STORAGE FUNCTION

Above Normal Pool #1

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
413.0	0.0	5238				
414.0	1.0	6092	5665	5665	5665	1.02
415.0	2.0	6961	6527	6527	12192	1.96
416.0	3.0	7842	7402	7402	19593	2.95
417.0	4.0	8736	8289	8289	27882	4.00
418.0	5.0	9643	9190	9190	37072	5.10



K_S =	5560.1
b =	1.1641

STAGE-STORAGE FUNCTION

#1

==> Stage - Storage Function

Ks = 5560.1
b = 1.1641
Zo = 413

Elevation	Storage	
[feet]	[cf]	[acre-feet]
413	0	0.0000
413.25	1107	0.0254
413.5	2481	0.0570
413.75	3978	0.0913
414	5560	0.1276
414.25	7209	0.1655
414.5	8914	0.2046
414.75	10666	0.2449
415	12460	0.2860
415.25	14291	0.3281
415.5	16156	0.3709
415.75	18051	0.4144
416	19976	0.4586
416.25	21926	0.5034
416.5	23902	0.5487
416.75	25901	0.5946
417	27922	0.6410
417.25	29963	0.6879
417.5	32025	0.7352
417.75	34105	0.7829
418	36204	0.8311

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Rain Dir: X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\

==========
JOB TITLE
==========

Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 413.00 ft
Increment = .25 ft
Max. Elev.= 418.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Inlet Box	RI	--->	BA	414.800	418.000
Orifice-Circular	OR	--->	BA	413.000	418.000
Culvert-Circular	BA	--->	TW	409.000	418.000

TW SETUP, DS Channel

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

OUTLET STRUCTURE INPUT DATA

Structure ID = RI
Structure Type = Inlet Box

# of Openings	=	1
Invert Elev.	=	414.80 ft
Orifice Area	=	16.0000 sq.ft
Orifice Coeff.	=	.600
Weir Length	=	16.00 ft
Weir Coeff.	=	3.100
K, Submerged	=	.000
K, Reverse	=	1.000
Kb,Barrel	=	.000000 (per ft of full flow)
Barrel Length	=	.00 ft
Mannings n	=	.0000

Structure ID = OR
Structure Type = Orifice-Circular

# of Openings	=	1
Invert Elev.	=	413.00 ft
Diameter	=	.0830 ft
Orifice Coeff.	=	.600

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

OUTLET STRUCTURE INPUT DATA

Structure ID	=	BA	
Structure Type	=	Culvert-Circular	
No. Barrels	=	1	
Barrel Diameter	=	1.2500	ft
Upstream Invert	=	409.00	ft
Dnstream Invert	=	407.54	ft
Horiz. Length	=	25.00	ft
Barrel Length	=	25.04	ft
Barrel Slope	=	.05840	ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130	
Ke	=	.5000	(forward entrance loss)
Kb	=	.023225	(per ft of full flow)
Kr	=	.5000	(reverse entrance loss)
HW Convergence	=	.001	+/- ft

INLET CONTROL DATA...

Equation form	=	1	
Inlet Control K	=	.0098	
Inlet Control M	=	2.0000	
Inlet Control c	=	.03980	
Inlet Control Y	=	.6700	
T1 ratio (HW/D)	=	1.131	
T2 ratio (HW/D)	=	1.278	
Slope Factor	=	-.500	

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...

At T1 Elev =	410.41 ft	--->	Flow =	4.80	cfs
At T2 Elev =	410.60 ft	--->	Flow =	5.49	cfs

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Title... Project Date: 3/15/2005
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Project Title: Kilarney Point
Project Comments:

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = RI (Inlet Box)

Upstream ID = (Pond Water Surface)
DNstream ID = BA (Culvert-Circular)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
413.00	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
413.25	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
413.50	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
413.75	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
414.00	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
414.25	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
414.50	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
414.75	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
414.80	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
415.00	4.44	415.00	Free	411.63	.000	.000	411.20	.000
		Weir: H =.20						
415.25	13.73	415.25	415.25	415.25	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
415.50	14.15	415.50	415.50	415.50	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
415.75	14.55	415.75	415.75	415.75	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
416.00	14.95	416.00	416.00	416.00	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
416.25	15.33	416.25	416.25	416.25	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
416.50	15.71	416.50	416.50	416.50	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = RI (Inlet Box)

Upstream ID = (Pond Water Surface)
DNstream ID = BA (Culvert-Circular)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
416.75	16.07	416.75	416.75	416.75	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
417.00	16.43	417.00	417.00	417.00	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
417.25	16.78	417.25	417.25	417.25	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
417.50	17.07	417.50	417.50	417.50	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
417.75	17.34	417.75	417.75	417.75	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
418.00	17.61	418.00	418.00	418.00	.000	.000	411.20	.000
		DS HGL+Loss > crest: Flow set to Downstream outlet.						

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Project Title: Kilarney Point
Project Comments:

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = OR (Orifice-Circular)

Upstream ID = (Pond Water Surface)
DNstream ID = BA (Culvert-Circular)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
413.00	.00	...	...	...	...	...	411.20	.000
		WS below an invert; no flow.						
413.25	.01	413.25	Free	411.20	.000	.000	411.20	.000
		H =.21						
413.50	.02	413.50	Free	411.20	.000	.000	411.20	.000
		H =.46						
413.75	.02	413.75	Free	411.20	.000	.000	411.20	.000
		H =.71						
414.00	.03	414.00	Free	411.20	.000	.000	411.20	.000
		H =.96						
414.25	.03	414.25	Free	411.20	.000	.000	411.20	.000
		H =1.21						
414.50	.03	414.50	Free	411.20	.000	.000	411.20	.000
		H =1.46						
414.75	.03	414.75	Free	411.20	.000	.000	411.20	.000
		H =1.71						
414.80	.03	414.80	Free	411.20	.000	.000	411.20	.000
		H =1.76						
415.00	.04	415.00	Free	411.63	.000	.000	411.20	.000
		H =1.96						
415.25	.00	415.25	415.25	415.25	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
415.50	.00	415.50	415.50	415.50	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
415.75	.00	415.75	415.75	415.75	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
416.00	.00	416.00	416.00	416.00	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
416.25	.00	416.25	416.25	416.25	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
416.50	.00	416.50	416.50	416.50	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
416.75	.00	416.75	416.75	416.75	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
417.00	.00	417.00	417.00	417.00	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
417.25	.00	417.25	417.25	417.25	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
417.50	.00	417.50	417.50	417.50	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
417.75	.00	417.75	417.75	417.75	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				
418.00	.00	418.00	418.00	418.00	.000	.000	411.20	.000
				Full riser flow. Q=0 this opening.				

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = BA (Culvert-Circular)

Mannings open channel maximum capacity: 16.79 cfs
UPstream ID's= RI, OR
DNstream ID = TW (Pond Outfall)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
413.00	.00	411.20	411.20	411.20	.000	.000	411.20	.000
413.25	.01	411.20	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=.000ft HL=.000ft						
413.50	.02	411.20	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=.000ft HL=.000ft						
413.75	.02	411.20	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=.000ft HL=.000ft						
414.00	.03	411.20	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=.000ft HL=.000ft						
414.25	.03	411.20	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=.000ft HL=.000ft						
414.50	.03	411.20	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=.000ft HL=.000ft						
414.75	.03	411.20	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=.000ft HL=.000ft						
414.80	.03	411.20	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=.000ft HL=.000ft						
415.00	4.47	411.63	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=.206ft HL=.430ft						
415.25	13.73	415.25	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=1.946ft HL=4.050ft						
415.50	14.15	415.50	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=2.066ft HL=4.301ft						
415.75	14.55	415.75	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=2.186ft HL=4.550ft						
416.00	14.95	416.00	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=2.306ft HL=4.800ft						
416.25	15.33	416.25	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=2.426ft HL=5.050ft						
416.50	15.71	416.50	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=2.546ft HL=5.299ft						

File.... X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\AGL05000_REV.PPW
Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = BA (Culvert-Circular)

Mannings open channel maximum capacity: 16.79 cfs
UPstream ID's= RI, OR
DNstream ID = TW (Pond Outfall)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
416.75	16.07	416.75	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=2.666ft HL=5.549ft						
417.00	16.43	417.00	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=2.786ft HL=5.800ft						
417.25	16.78	417.25	411.20	411.20	.000	.000	411.20	.000
		FULL FLOW...Lfull=25.04ft Vh=2.907ft HL=6.051ft						
417.50	17.07	417.50	411.20	411.20	.000	.000	411.20	.000
		INLET CONTROL... Submerged: HW =8.50						
417.75	17.34	417.75	411.20	411.20	.000	.000	411.20	.000
		INLET CONTROL... Submerged: HW =8.75						
418.00	17.61	418.00	411.20	411.20	.000	.000	411.20	.000
		INLET CONTROL... Submerged: HW =9.00						

File.... X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\AGL05000_REV.PPW
Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

***** COMPOSITE OUTFLOW SUMMARY ****

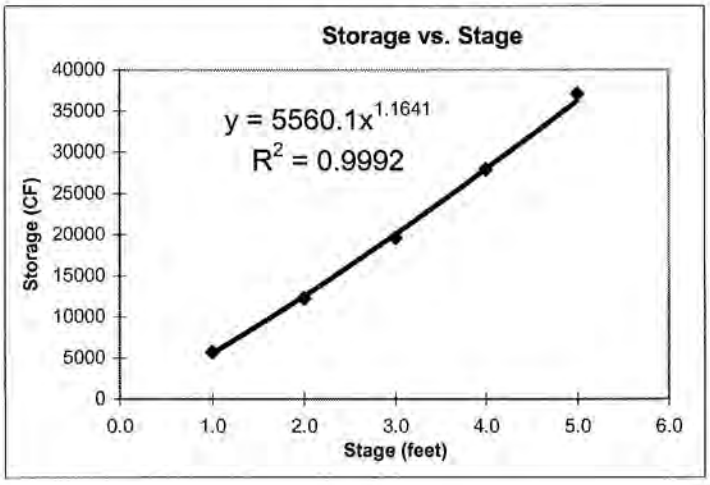
CUMULATIVE HGL CONVERGENCE ERROR .000 (+/- ft)

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
413.00	.00	411.20	.000	(no Q: RI,OR,BA)
413.25	.01	411.20	.000	OR,BA (no Q: RI)
413.50	.02	411.20	.000	OR,BA (no Q: RI)
413.75	.02	411.20	.000	OR,BA (no Q: RI)
414.00	.03	411.20	.000	OR,BA (no Q: RI)
414.25	.03	411.20	.000	OR,BA (no Q: RI)
414.50	.03	411.20	.000	OR,BA (no Q: RI)
414.75	.03	411.20	.000	OR,BA (no Q: RI)
414.80	.03	411.20	.000	OR,BA (no Q: RI)
415.00	4.47	411.20	.000	RI,OR,BA
415.25	13.73	411.20	.000	RI,BA (no Q: OR)
415.50	14.15	411.20	.000	RI,BA (no Q: OR)
415.75	14.55	411.20	.000	RI,BA (no Q: OR)
416.00	14.95	411.20	.000	RI,BA (no Q: OR)
416.25	15.33	411.20	.000	RI,BA (no Q: OR)
416.50	15.71	411.20	.000	RI,BA (no Q: OR)
416.75	16.07	411.20	.000	RI,BA (no Q: OR)
417.00	16.43	411.20	.000	RI,BA (no Q: OR)
417.25	16.78	411.20	.000	RI,BA (no Q: OR)
417.50	17.07	411.20	.000	RI,BA (no Q: OR)
417.75	17.34	411.20	.000	RI,BA (no Q: OR)
418.00	17.61	411.20	.000	RI,BA (no Q: OR)

Water Quality Pond Design Sheet

Project Name: Kilarney Pointe
Designer: JW Caldwell, PE
Job Number: AGL-05000
Date: 6/14/2005

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
413.0	0.0	5238				
414.0	1.0	6092	5665	5665	5665	1.02
415.0	2.0	6961	6527	6527	12192	1.96
416.0	3.0	7842	7402	7402	19593	2.95
417.0	4.0	8736	8289	8289	27882	4.00
418.0	5.0	9643	9190	9190	37072	5.10



K_S =	**5560.1**
b =	**1.1641**

Calculation of Runoff Volume required for storage

The runoff to the pond for the 1" storm detention requirement is calculated using the SCS curve number method. Impervious areas that directly enter the pond are counted as Directly Connected Impervious Areas (DCIAs). No infiltration calculation will be provided for these areas. Areas not directly connected will be accounted for in a composite curve number.

From SCS Soils Survey map, predominant hydrologic soil type = C

Using basic SCS runoff methodology, with no adjustments made to initial abstractions (0.2*S and 0.8*S).

Impervious Area, directly connected (DCIA) =	2.91	acres
@ CN =	98	
Other areas draining to pond (not DCIA) =	2.13	acres
@ CN =	79.4	

Runoff from DCIAs ==>

Precipitation amount =	1.0	inches	
S =	0.204	inches	(calculated)
Q* =	0.791	inches	(calculated)
Runoff volume =	**8355**	CF	

Runoff from non-connected areas ==>

Precipitation amount =	1.0	inches	
S =	2.594	inches	(calculated)
Q* =	0.075	inches	(calculated)
Runoff volume =	**582**	CF	

Therefore, total runoff from precipitation in question =	**8936**	CF

This amount of runoff must be stored in the pond above normal pool elevation, and be released in a period of two (2) to five (5) days, by an inverted PVC siphon, the invert end of which is set at permanent pool elevation.

Calculation of depth required for runoff storage pool (above normal pool)

Normal pool depth (above invert) =	0.00	feet
Storage provided at permanent pool depth =	0	CF (calculated)
Total storage required for normal + storage pool =	8936	CF
Stage (above invert) associated with this storage =	1.50	feet

Therefore, depth required above normal pool for storm storage =	1.50	feet
	18.04	inches

Principal spillway set at stage =	1.80	feet
and EL =	414.80	feet

At principal spillway crest, storm pool storage provided =	11022	CF

Kilarney Point

I. SURFACE AREA CHECK

Impervious Area =	2.91	acres
Drainage Area =	5.04	acres
% Impervious =	57.7%	

Average Depth = Z / b

z =	#REF!	feet
b =	#REF!	
Average Depth =	3.00	ft.

==> From the NCDENR Stormwater BMP Handbook (4/99), the required SA/DA ratio for 85% TSS Removal in the Piedmont is as follows:

		3.0	3.00	4.0
Lower Boundary =>	50.0	2.06		1.70
Site % impervious =>	57.7	2.32	***2.32***	1.96
Upper Boundary =>	60.0	2.40		2.03

Area Required =	5100	sq.ft.
Area Provided =	5238	**sq.ft. @ 414 OK**

SIPHON DESIGN SHEET

D siphon =	1 inches
No. siphons =	1
Ks =	5560.1
b =	1.1641
Cd siphon =	0.60
Siphon Invert =	413.00 feet
Volume @ Normal Pool =	0 CF
Basin Invert =	413.00 feet

WSEL (feet)	Vol. Stored (cf)	Siphon Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
414.410	8294	0.031			
414.281	7416	0.029	0.030	878	29345
414.152	6552	0.028	0.028	864	30411
414.022	5704	0.026	0.027	848	31650
413.893	4874	0.024	0.025	831	33118
413.764	4063	0.022	0.023	811	34901
413.635	3274	0.020	0.021	789	37142
413.505	2512	0.018	0.019	763	40093
413.376	1781	0.015	0.017	731	44280
413.247	1091	0.012	0.014	690	51051
413.118	460	0.007	0.010	631	66058

Drawdown Time =	4.61 days

By comparison, if calculated by the average head over the orifice (assuming average head is half the total depth), the result would be:

Average driving head on orifice =	0.729 feet
Orifice composite loss coefficient =	0.600
X-Sectional area of 1 - 1" inverted siphon =	0.005 ft^2

Q = 0.0224 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	4.28 days

Conclusion : Use 1 - 1" Diameter Siphon to drawdown the accumulated volume from the 1.0 " storm runoff, with a required time of about 4.5 days.

JW Caldwell, PE
6/14/2005

Riser/Barrel Anti-Flotation Calculation Sheet

Input Data ==>

Inside wall dimension of riser (1) =	4.0	feet
Inside wall dimension of riser (2) =	4.0	feet
Min. wall thickness of riser =	6.0	inches
Inside height of Riser* =	5.80	feet
Min. wall thickness of top =	0.0	inches
Concrete unit weight =	142.0	PCF
OD of barrel exiting riser =	1.3	inches
Total weir open area =	0.0	SF
Size of drain pipe (if present) =	1.0	inches

Note: NC Products lists unit wt. of riser concrete at 142 PCF.

*Note- from riser floor to inside of top

Concrete Present ==>

Total amount of concrete:

Riser Walls =	52.20	CF
Riser Top =	0.00	CF

Adjust for openings:

Opening for barrel =	0.00	CF
Opening for drain pipe =	0.00	CF
Opening for weirs =	0.00	CF

Total Concrete present, adjusted for openings = ***52.193 CF***
Weight of concrete present = ***7411 lbs***

Amount of water displaced ==>

Displacement by concrete =	52.193	CF
Displacement by open air in riser =	92.800	CF

Total water displaced by riser/barrel structure = ***144.993 CF***
Weight of water displaced = ***9048 lbs***

Calculate amount of concrete to be added to riser ==>

Safety factor to use = 1.15 (recommend 1.15 or higher)

Must add = 2993 lbs concrete for buoyancy

Concrete unit weight for use =	142	PCF (note above observation for NCP concrete)
Buoyant weight of this concrete =	79.60	PCF
Buoyant, with safety factor applied =	69.22	PCF

Therefore, must add = 43.245 CF of concrete

Calculate size of base for riser assembly ==>

Outside Dimension (1) =	6.000	feet	
Outside Dimension (2) =	6.000	feet	
Thickness =	24.0	inches	
Concrete Present =	72.000	CF	OK

Check validity of base as designed ==>

Total Water Displaced =	216.993	CF	
Total Concrete Present =	124.193	CF	
Total Water Displaced =	13540	lbs	
Total Concrete Present =	17635	lbs	
Actual safety factor =	*1.30*		OK

Results of design ==>

Outside Base Dimensions (rectangular) =	**6.00**	**feet**	**x**	**6.00**	**feet**
Base Thickness =	**24.00**	**inches**			
CY of concrete total in base =	**2.67**	**CY**			
Concrete unit weight in added base >=	**142**	**PCF**			

JW Caldwell, PE
4/13/2005

Anti-Seep Collar Design Sheet

This sheet will, given the barrel length of interest and minimum seep collar projection from the barrel, determine the number of anti-seep collars to place along the barrel section, and the expected spacing of the collars.

Design Requirements ==>

Anti-seep collars shall increase the flow path along the barrel by 15%.

Anti-seep collars shall be spaced a maximum of 14X the minimum collar projection or 25 feet, whichever is less.

Anti-Seep Collar Design ==>

Pond ID	Flow Length along barrel through embankment (feet)	Min. Projection (feet)	Calc'd # of collars required	Max. Spacing (feet)	# of collars to use	Use Spacing (feet)	Spacing OK?
Wetland 1	32.0	2.50	0.96	17	*1.00*	*16*	*YES*

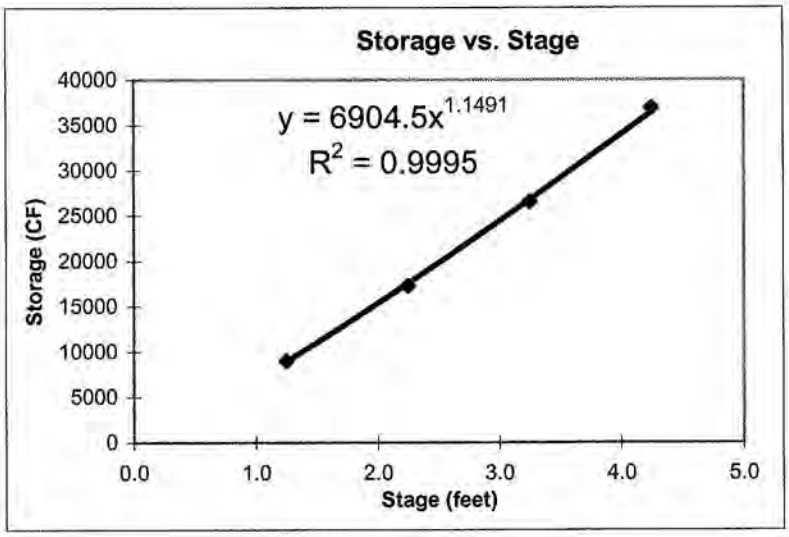
***Note**: If spacing to use is greater than the maximum spacing, add collars until the spacing to use is equal to or less than the maximum spacing allowable for the collar design. Anti-seep collars shall be used under the structural fill portions of all berms/dams unless an approved drainage diaphragm is present at the downstream end of the barrel.*

WETLAND #2 DESIGN DATA

STAGE-STORAGE FUNCTION

Above Normal Pool #2

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
413.8	0.0	6644				
415.0	1.3	7769	7207	9008	9008	1.26
416.0	2.3	8751	8260	8260	17268	2.22
417.0	3.3	9798	9275	9275	26543	3.23
418.0	4.3	10906	10352	10352	36895	4.30



K_S =	**6904.5**
b =	**1.1491**

STAGE-STORAGE FUNCTION
#2

==> Stage - Storage Function

Ks = 6904.5
b = 1.1491
Zo = 413.75

Elevation	Storage	
[feet]	[cf]	[acre-feet]
413.75	0	0.0000
414	1404	0.0322
414.25	3113	0.0715
414.5	4961	0.1139
414.75	6905	0.1585
415	8923	0.2048
415.25	11002	0.2526
415.5	13134	0.3015
415.75	15312	0.3515
416	17532	0.4025
416.25	19788	0.4543
416.5	22078	0.5069
416.75	24400	0.5602
417	26751	0.6141
417.25	29129	0.6687
417.5	31532	0.7239
417.75	33959	0.7796
418	36409	0.8358

Job File: X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\AGL05000.PPW
Rain Dir: X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\

==========
JOB TITLE
==========

Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

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********** OUTLET STRUCTURES **********

File.... X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\AGL05000.PPW
Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 413.75 ft
Increment = .25 ft
Max. Elev.= 418.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Inlet Box	RI	--->	BA	414.700	418.000
Culvert-Circular	BA	--->	TW	413.750	418.000

TW SETUP, DS Channel

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

OUTLET STRUCTURE INPUT DATA

Structure ID	= RI	
Structure Type	= Inlet Box	
# of Openings	= 1	
Invert Elev.	= 414.70	ft
Orifice Area	= 16.0000	sq.ft
Orifice Coeff.	= .600	
Weir Length	= 12.00	ft
Weir Coeff.	= 3.100	
K, Submerged	= .000	
K, Reverse	= 1.000	
Kb,Barrel	= .000000	(per ft of full flow)
Barrel Length	= .00	ft
Mannings n	= .0000	

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

OUTLET STRUCTURE INPUT DATA

Structure ID	= BA	
Structure Type	= Culvert-Circular	
No. Barrels	= 1	
Barrel Diameter	= 1.0000	ft
Upstream Invert	= 413.75	ft
Dnstream Invert	= 413.50	ft
Horiz. Length	= 50.00	ft
Barrel Length	= 50.00	ft
Barrel Slope	= .00500	ft/ft

OUTLET CONTROL DATA...

Mannings n	= .0130	
Ke	= .5000	(forward entrance loss)
Kb	= .031274	(per ft of full flow)
Kr	= .5000	(reverse entrance loss)
HW Convergence	= .001	+/- ft

INLET CONTROL DATA...

Equation form	= 1	
Inlet Control K	= .0098	
Inlet Control M	= 2.0000	
Inlet Control c	= .03980	
Inlet Control Y	= .6700	
T1 ratio (HW/D)	= 1.157	
T2 ratio (HW/D)	= 1.304	
Slope Factor	= -.500	
Calc inlet only	= Yes	

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 414.91 ft ---> Flow = 2.75 cfs
At T2 Elev = 415.05 ft ---> Flow = 3.14 cfs

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

OUTLET STRUCTURE INPUT DATA

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 30
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .10 cfs
Max. Q tolerance = .10 cfs

File.... X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\AGL05000.PPW
Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = RI (Inlet Box)

Upstream ID = (Pond Water Surface)
DNstream ID = BA (Culvert-Circular)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
413.75	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
414.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
414.25	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
414.50	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
414.70	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
414.75	.42	414.75	Free	414.11	.000	.000	Free Outfall	
		Weir: H =.05						
415.00	3.00	415.00	415.00	415.00	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
415.25	3.59	415.25	415.25	415.25	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
415.50	4.09	415.50	415.50	415.50	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
415.75	4.54	415.75	415.75	415.75	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
416.00	4.95	416.00	416.00	416.00	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
416.25	5.33	416.25	416.25	416.25	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
416.50	5.68	416.50	416.50	416.50	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
416.75	6.01	416.75	416.75	416.75	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
417.00	6.33	417.00	417.00	417.00	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
417.25	6.63	417.25	417.25	417.25	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = RI (Inlet Box)

Upstream ID = (Pond Water Surface)
DNstream ID = BA (Culvert-Circular)

Pond WS Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
417.50	6.91	417.50	417.50	417.50	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
417.75	7.19	417.75	417.75	417.75	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						
418.00	7.45	418.00	418.00	418.00	.000	.000	Free Outfall	
		DS HGL+Loss > crest: Flow set to Downstream outlet.						

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Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = BA (Culvert-Circular)

Mannings open channel maximum capacity: 2.71 cfs
UPstream ID = RI (Inlet Box)
DNstream ID = TW (Pond Outfall)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
413.75	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
414.00	.00	413.75	Free	Free	.000	.000	Free Outfall	
414.25	.00	413.75	Free	Free	.000	.000	Free Outfall	
414.50	.00	413.75	Free	Free	.000	.000	Free Outfall	
414.70	.00	413.75	Free	Free	.000	.000	Free Outfall	
414.75	.42	414.11	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Equ.1: HW =.36	dc=.267	Ac=.1688		
415.00	3.00	415.00	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Transition: HW =1.25				
415.25	3.59	415.25	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged: HW =1.50				
415.50	4.09	415.50	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged: HW =1.75				
415.75	4.54	415.75	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged: HW =2.00				
416.00	4.95	416.00	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged: HW =2.25				
416.25	5.33	416.25	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged: HW =2.50				
416.50	5.68	416.50	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged: HW =2.75				
416.75	6.01	416.75	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged: HW =3.00				
417.00	6.33	417.00	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged: HW =3.25				
417.25	6.63	417.25	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged: HW =3.50				

File.... X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\AGL05000.PPW
Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = BA (Culvert-Circular)

Mannings open channel maximum capacity: 2.71 cfs
UPstream ID = RI (Inlet Box)
DNstream ID = TW (Pond Outfall)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
417.50	6.91	417.50	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged:	HW =3.75			
417.75	7.19	417.75	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged:	HW =4.00			
418.00	7.45	418.00	Free	Free	.000	.000	Free Outfall	
		INLET CONTROL...		Submerged:	HW =4.25			

File.... X:\Projects\AGL\AGL-05000\Storm\Kilarney Point_CALDWELL\AGL05000.PPW
Title... Project Date: 3/15/2005
Project Engineer: James W. Caldwell
Project Title: Kilarney Point
Project Comments:

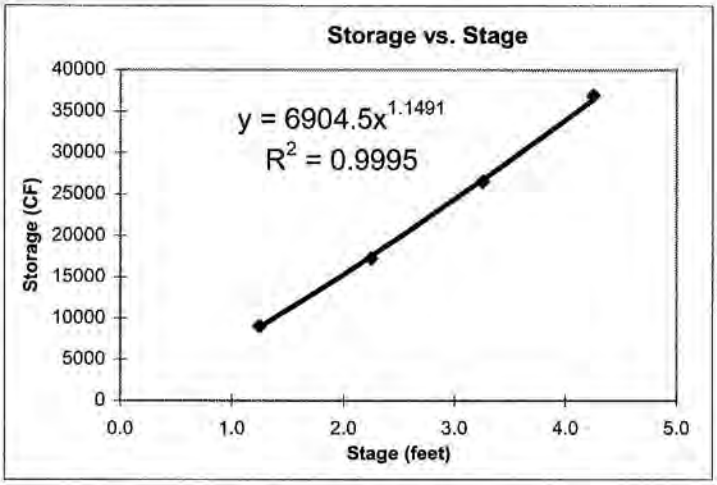
***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
413.75	.00	Free Outfall		(no Q: RI,BA)
414.00	.00	Free Outfall		(no Q: RI,BA)
414.25	.00	Free Outfall		(no Q: RI,BA)
414.50	.00	Free Outfall		(no Q: RI,BA)
414.70	.00	Free Outfall		(no Q: RI,BA)
414.75	.42	Free Outfall		RI,BA
415.00	3.00	Free Outfall		RI,BA
415.25	3.59	Free Outfall		RI,BA
415.50	4.09	Free Outfall		RI,BA
415.75	4.54	Free Outfall		RI,BA
416.00	4.95	Free Outfall		RI,BA
416.25	5.33	Free Outfall		RI,BA
416.50	5.68	Free Outfall		RI,BA
416.75	6.01	Free Outfall		RI,BA
417.00	6.33	Free Outfall		RI,BA
417.25	6.63	Free Outfall		RI,BA
417.50	6.91	Free Outfall		RI,BA
417.75	7.19	Free Outfall		RI,BA
418.00	7.45	Free Outfall		RI,BA

Water Quality Pond Design Sheet

Project Name: Kilarney Pointe
Designer: JW Caldwell, PE
Job Number: AGL-05000
Date: 4/13/2005

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
413.8	0.0	6644				
415.0	1.3	7769	7207	9008	9008	1.26
416.0	2.3	8751	8260	8260	17268	2.22
417.0	3.3	9798	9275	9275	26543	3.23
418.0	4.3	10906	10352	10352	36895	4.30



K_S =	**6904.5**
b =	**1.1491**

Calculation of Runoff Volume required for storage

The runoff to the pond for the 1" storm detention requirement is calculated using the SCS curve number method. Impervious areas that directly enter the pond are counted as Directly Connected Impervious Areas (DCIAs). No infiltration calculation will be provided for these areas. Areas not directly connected will be accounted for in a composite curve number.

From SCS Soils Survey map, predominant hydrologic soil type = C

Using basic SCS runoff methodology, with no adjustments made to initial abstractions (0.2*S and 0.8*S).

Impervious Area, directly connected (DCIA) = 1.92 acres
@ CN = 98

Other areas draining to pond (not DCIA) =	1.81	acres
@ CN =	79.4	

Runoff from DCIAs ==>

Precipitation amount =	1.0 inches	
S =	0.204 inches	(calculated)
Q* =	0.791 inches	(calculated)
Runoff volume =	**5512** CF	

Runoff from non-connected areas ==>

Precipitation amount =	1.0 inches	
S =	2.594 inches	(calculated)
Q* =	0.075 inches	(calculated)
Runoff volume =	**494** CF	

Therefore, total runoff from precipitation in question =	**6007** CF

This amount of runoff must be stored in the pond above normal pool elevation, and be released in a period of two (2) to five (5) days, by an inverted PVC siphon, the invert end of which is set at permanent pool elevation.

Calculation of depth required for runoff storage pool (above normal pool)

Normal pool depth (above invert) =	0.00	feet
Storage provided at permanent pool depth =	0	CF (calculated)
Total storage required for normal + storage pool =	6007	CF
Stage (above invert) associated with this storage =	0.89	feet

Therefore, depth required above normal pool for storm storage =	0.89	feet
	10.63	inches

Principal spillway set at stage =	0.95	feet
and EL =	414.70	feet

At principal spillway crest, storm pool storage provided =	6509 CF

Kilarney Point

I. SURFACE AREA CHECK

Impervious Area =	1.92	acres
Drainage Area =	3.73	acres
% Impervious =	51.5%	

Average Depth = Z / b

z =	#REF!	feet
b =	#REF!	
Average Depth =	3.00	ft.

==> From the NCDENR Stormwater BMP Handbook (4/99), the required SA/DA ratio for 85% TSS Removal in the Piedmont is as follows:

		3.0	3.00	4.0
Lower Boundary =>	50.0	2.06		1.70
Site % impervious =>	51.5	2.11	***2.11***	1.75
Upper Boundary =>	60.0	2.40		2.03

Area Required = 3429 sq.ft.

Area Provided = 6643 **sq.ft. @ 416 OK**

SIPHON DESIGN SHEET

D siphon =	1 inches
No. siphons =	1
Ks =	6904.5
b =	1.1491
Cd siphon =	0.60
Siphon Invert =	413.75 feet
Volume @ Normal Pool =	0 CF
Basin Invert =	413.75 feet

WSEL (feet)	Vol. Stored (cf)	Siphon Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
414.640	6039	0.024			
414.563	5443	0.023	0.024	596	25284
414.486	4855	0.022	0.022	588	26208
414.409	4276	0.021	0.021	579	27277
414.332	3707	0.019	0.020	569	28535
414.255	3149	0.018	0.019	558	30052
414.178	2604	0.016	0.017	545	31934
414.101	2073	0.015	0.015	531	34371
414.024	1560	0.013	0.014	513	37728
413.947	1068	0.010	0.011	492	42849
413.870	604	0.007	0.009	464	52471

Drawdown Time =	3.90 days

By comparison, if calculated by the average head over the orifice (assuming average head is half the total depth), the result would be:

Average driving head on orifice =	0.424 feet
Orifice composite loss coefficient =	0.600
X-Sectional area of 1 - 1" inverted siphon =	0.005 ft^2

Q = 0.0171 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	4.09 days

Conclusion : Use 1 - 1" Diameter Siphon to drawdown the accumulated volume from the 1.0 " storm runoff, with a required time of about 4 days.

JW Caldwell, PE
4/13/2005

Riser/Barrel Anti-Flotation Calculation Sheet

Input Data ==>

Inside wall dimension of riser (1) =	4.0	feet
Inside wall dimension of riser (2) =	4.0	feet
Min. wall thickness of riser =	6.0	inches
Inside height of Riser* =	0.95	feet
Min. wall thickness of top =	0.0	inches
Concrete unit weight =	142.0	PCF
OD of barrel exiting riser =	15.0	inches
Total weir open area =	0.0	SF
Size of drain pipe (if present) =	0.5	inches

Note: NC Products lists unit wt. of riser concrete at 142 PCF.

*Note- from riser floor to inside of top

Concrete Present ==>

Total amount of concrete:

Riser Walls =	8.55	CF
Riser Top =	0.00	CF

Adjust for openings:

Opening for barrel =	0.61	CF
Opening for drain pipe =	0.00	CF
Opening for weirs =	0.00	CF

Total Concrete present, adjusted for openings =	***7.936***	***CF***
Weight of concrete present =	***1127***	***lbs***

Amount of water displaced ==>

Displacement by concrete =	7.936	CF
Displacement by open air in riser =	15.200	CF

Total water displaced by riser/barrel structure =	***23.136***	***CF***
Weight of water displaced =	***1444***	***lbs***

Calculate amount of concrete to be added to riser ==>

Safety factor to use = 1.15 (recommend 1.15 or higher)

Must add = 533 lbs concrete for buoyancy

Concrete unit weight for use =	142	PCF (note above observation for NCP concrete)
Buoyant weight of this concrete =	79.60	PCF
Buoyant, with safety factor applied =	69.22	PCF

Therefore, must add = 7.705 CF of concrete

Calculate size of base for riser assembly ==>

Outside Dimension (1) =	6.000	feet	
Outside Dimension (2) =	6.000	feet	
Thickness =	12.0	inches	
Concrete Present =	36.000	CF	OK

Check validity of base as designed ==>

Total Water Displaced =	59.136	CF	
Total Concrete Present =	43.936	CF	
Total Water Displaced =	3690	lbs	
Total Concrete Present =	6239	lbs	
Actual safety factor =	*1.69*		OK

Results of design ==>

Outside Base Dimensions (rectangular) =	**6.00**	**feet**	**x**	**6.00**	**feet**
Base Thickness =	**12.00**	**inches**			
CY of concrete total in base =	**1.33**	**CY**			
Concrete unit weight in added base >=	**142**	**PCF**			

JW Caldwell, PE

Anti-Seep Collar Design Sheet

This sheet will, given the barrel length of interest and minimum seep collar projection from the barrel, determine the number of anti-seep collars to place along the barrel section, and the expected spacing of the collars.

Design Requirements ==>

Anti-seep collars shall increase the flow path along the barrel by 15%.

Anti-seep collars shall be spaced a maximum of 14X the minimum collar projection or 25 feet, whichever is less.

Anti-Seep Collar Design ==>

Pond ID	Flow Length along barrel through embankment (feet)	Min. Projection (feet)	Calc'd # of collars required	Max. Spacing (feet)	# of collars to use	Use Spacing (feet)	Spacing OK?
Wetland 2	50.0	2.00	1.88	17	*2.00*	***16.6667***	*YES*

***Note**: If spacing to use is greater than the maximum spacing, add collars until the spacing to use is equal to or less than the maximum spacing allowable for the collar design. Anti-seep collars shall be used under the structural fill portions of all berms/dams unless an approved drainage diaphragm is present at the downstream end of the barrel.*

NRCD Land Quality Section
NYDOT Dissipator Design Results

Pipe diameter (ft)	1.25
Outlet velocity (fps)	5.55
Apron length (ft)	**5.00**

AVG DIAM (inches)	STONE CLASS	THICKNESS (inches)
» 3	A	9 «
6	**B**	**22**
13	B or 1	22
23	2	27

-- Dissipator , Pipe or Quit (D P or Q) --

KILARNEY POINTE
AGL-05000

HMS * Summary of Results for POND 2

Project : AGL-05000 Run Name : POST 10

Start of Run	: 04Apr05 0100	Basin Model	: POST-DEVELOPMENT
End of Run	: 05Apr05 0100	Met. Model	: 10YR, 24HR
Execution Time	: 13Apr05 1603	Control Specs	: 24 HR, dT 1 MIN

Computed Results

Peak Inflow	: 17.816 (cfs)	Date/Time of Peak Inflow	: 04 Apr 05 1309
Peak Outflow	: 5.6309 (cfs)	Date/Time of Peak Outflow	: 04 Apr 05 1327
Total Inflow	: 4.13 (in)	Peak Storage	: 0.49952(ac-ft)
Total Outflow	: 3.69 (in)	Peak Elevation	: 416.46(ft)

NITROGEN EXPORT CALCULATIONS

KILARNEY POINTE
AGL-05000

NITROGEN EXPORT CALCULATIONS

(Apportioning Method- Residential and Commercial)

I. SITE INFORMATION

Area ID	Total Area [acres]	Pre-Dev. [ac]		Post-Dev Res. [ac]		Post-Dev Com. [ac]	
		Imp.	Open	Imp.	Open	Imp.	Open
Site	13.75	0.11	13.64	4.23	7.68	1.32	0.52
Totals =	13.75	0.11	13.64	4.23	7.68	1.32	0.52

II. APPORTIONING CALCULATIONS

Total impervious surface =	5.55	acres
=	241758	sq.ft.
Existing impervious surface =	0.11	acres
=	4792	sq.ft.
Existing impervious surface as a percent of total =	1.98%	
Additional impervious area =	5.44	acres
=	236966	sq.ft.
Proposed open space (total) =	8.20	acres
=	357192	sq.ft.
Therefore,		
Open associated with new impervious =	8.04	acres
=	350113	sq.ft.
Open associated with existing impervious =	0.16	acres
	7079	sq.ft.

Area to consider for TN-export calculations = **13.48** **acres**

NITROGEN EXPORT CALCULATIONS

(Apportioned Area- Residential)

JW Caldwell, PE
6/14/2005

METHOD 2:

Quantifying TN Export from Residential / Industrial / Commercial Developments when Footprints of all Impervious Surfaces are shown.

STEP 1: *Determine the area for each type of land use and enter in Column (2).*
STEP 2: *Total the areas for each type of land use and enter at the bottom of Column (2).*
STEP 3: *Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).*
STEP 4: *Total the TN exports for each type of land use and enter at the bottom of Column (4).*
STEP 5: *Determine the export coefficient for the site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).*

(1) Type of Land Cover	(2) Area [acres]	(3) TN export coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
Permanently protected undisturbed open space *(forest, unmown meadow)*	0	0.6	0
Permanently protected managed open space *(grass, landscaping, etc.)*	7.68	1.2	9.2
Impervious surfaces *(roads, parking lots, driveways, roofs, paved storage areas, etc.)*	4.23	21.2	89.7
TOTAL	11.91	---	98.89

Total TN Export =	8.3	lbs/ac/yr
Maximum TN loading allowed =	71.46	lbs/yr (based on 6.0 lbs/ac/yr)
Therefore, on-site nitrogen removal required =	27.43	lbs/yr (total post-dev't TN loading minus maximum allowed for apportioned area)

REFERENCE:

"City of Raleigh, Stormwater Management Design Manual" January 2002.

NITROGEN EXPORT CALCULATIONS
(Apportioned Area- Commercial)

METHOD 2:
Quantifying TN Export from Residential / Industrial / Commercial Developments when Footprints of all Impervious Surfaces are shown.

STEP 1: *Determine the area for each type of land use and enter in Column (2).*
STEP 2: *Total the areas for each type of land use and enter at the bottom of Column (2).*
STEP 3: *Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).*
STEP 4: *Total the TN exports for each type of land use and enter at the bottom of Column (4).*
STEP 5: *Determine the export coefficient for the site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).*

(1) Type of Land Cover	(2) Area [acres]	(3) TN export coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
Permanently protected undisturbed open space *(forest, unmown meadow)*	0	0.6	0
Permanently protected managed open space *(grass, landscaping, etc.)*	0.52	1.2	0.6
Impervious surfaces *(roads, parking lots, driveways, roofs, paved storage areas, etc.)*	1.32	21.2	28.0
TOTAL	1.84	---	28.61

Total TN Export =	15.5	lbs/ac/yr
Maximum TN loading allowed =	18.40	lbs/yr (based on 10.00 lbs/ac/yr)
Therefore, on-site nitrogen removal required =	10.21	lbs/yr (total post-dev't TN loading minus maximum allowed for apportioned area)

REFERENCE:
"City of Raleigh, Stormwater Management Design Manual" January 2002.

NITROGEN OFFSET FEE CALCULATIONS

II. ESTIMATED OFFSET PAYMENT

Apportioned area =		13.48	acres
Max. allowable export w/o offset payment =		3.6	lbs/ac/yr
=		48.52	lbs/yr
TN-Export after SF treatment =		84.65	lbs/yr
		6.28	lbs/ac/yr
Required TN-export offset amount =		36.13	lbs/yr
Offset Fee =	$	330.00	per lb. of TN

Estimated Offset fee = $ 11,923.39

NITROGEN EXPORT CALCULATIONS
(To Wetlands)

METHOD 2:
Quantifying TN Export from Residential / Industrial / Commercial Developments when Footprints of all Impervious Surfaces are shown.

STEP 1: *Determine the area for each type of land use and enter in Column (2).*
STEP 2: *Total the areas for each type of land use and enter at the bottom of Column (2).*
STEP 3: *Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).*
STEP 4: *Total the TN exports for each type of land use and enter at the bottom of Column (4).*
STEP 5: *Determine the export coefficient for the site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).*

(1) Type of Land Cover	(2) Area [acres]	(3) TN export coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
Permanently protected undisturbed open space *(forest, unmown meadow)*	0	0.6	0
Permanently protected managed open space *(grass, landscaping, etc.)*	3.94	1.2	4.73
Impervious surfaces *(roads, parking lots, driveways, roofs, paved storage areas, etc.)*	4.83	21.2	102.40
TOTAL	8.77	---	107.12

Total TN Export =	12.21	lbs/ac/yr
Assume BMP Removal Efficiency =	40%	
TN-Export After BMP =	64.27	lbs/yr
Therefore, provided reduction =	42.85	lbs/yr

REFERENCE:

"City of Raleigh, Stormwater Management Design Manual" January 2002.

REVISED STORM DRAIN SYSTEM CALCULATIONS

KILARNEY POINTE
AGL-05000

KILARNEY POINTE
AGL-05000

DRAINAGE SCHEDULE - RATIONAL METHOD

J.W. CALDWELL, PE
4/14/2005

INTENSITIES:

2-Year = 5.76 in./hr.
10-Year = 7.22 in./hr.
25-Year = 8.19 in./hr.

FROM	TO	D.A. (ac)	TOTAL D.A. (ac)	C (THIS AREA)	COMPOSITE C	UPSTREAM INVERT (ft)	DOWNSTREAM INVERT (ft)	RIM ELEV.	LENGTH (ft)	SLOPE (ft/ft)	PIPE MATERIAL	DIAMETER (in)
10A	10	0.46	0.46	0.686	0.686	433.85	433.72	437.35	26	0.005	RCP	15
10	11	0.50	0.96	0.834	0.763	433.62	418.59	437.35	239	0.063	RCP	15
11	13	0.40	1.36	0.837	0.785	418.49	415.39	422.09	135	0.023	O-RING RCP	15
12	13	0.15	0.15	0.711	0.711	415.39	415.26	418.89	26	0.005	O-RING RCP	15
13	15	0.31	1.82	0.654	0.757	415.00	414.68	418.89	65	0.005	O-RING RCP	24
14	14A	0.71	0.71	0.850	0.850	418.70	414.50	422.20	107	0.039	O-RING RCP	15
14A	14B	0.38	1.09	0.478	0.720	414.50	414.40	418.00*	20	0.005	O-RING RCP	15
14B	15	1.13	2.22	0.589	0.653	414.40	414.27	419.32	26	0.005	O-RING RCP	24
15	16	0.04	4.08	0.715	0.700	414.27	413.92	419.32	70	0.005	O-RING RCP	30
16	17	0.04	4.12	0.657	0.700	413.92	413.56	419.88	71	0.005	O-RING RCP	30
17	21	0.06	4.18	0.654	0.699	413.56	413.06	420.47	99	0.005	O-RING RCP	30
18	21	0.57	0.57	0.789	0.789	418.85	418.59	422.35	26	0.010	RCP	15
19	20	0.04	0.04	0.627	0.627	427.32	425.45	430.82	51	0.037	RCP	15
20	21		0.04		0.627	425.35	413.16	428.95**	144	0.085	O-RING RCP	15
21	22	0.09	4.88	0.707	0.709	413.06	413.00	422.35	13	0.005	O-RING RCP	30

*Yard Inlet
**Junction Box

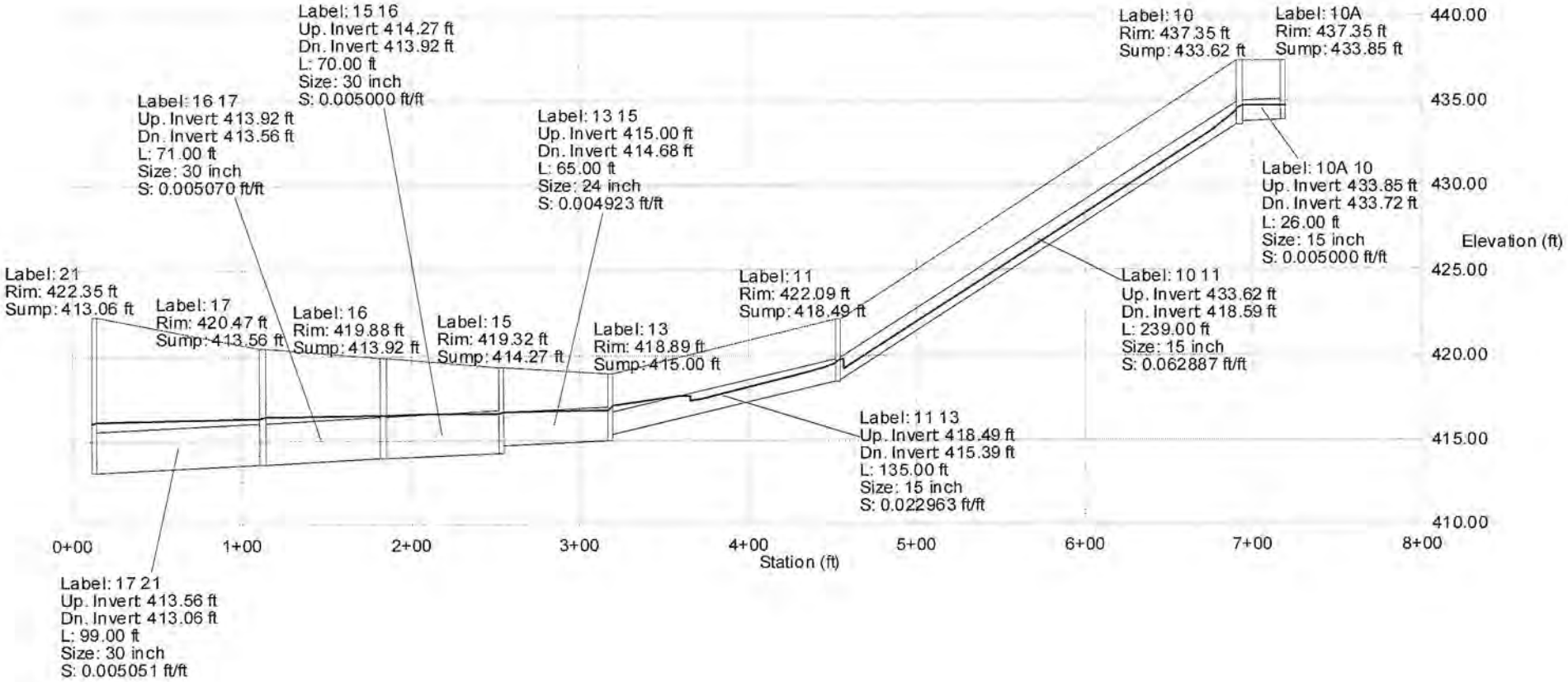
KILARNEY POINTE
AGL-05000

STORM CAD OUTPUT

J.W. CALDWELL
4/14/2005

Label	Upstream Node	Downstream Node	Length (ft)	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	Upstream Inlet Rational Flow (cfs)	Section Size	Full Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Total System Flow (cfs)
10A 10	10A	10	26	0.46	0.69	0.32	0.32	2.3	15 inch	4.57	2.43	433.85	433.72	0.0050	2.3
14 14A	14	14A	107	0.71	0.85	0.6	0.6	4.39	15 inch	12.8	4.26	418.7	414.5	0.0393	4.39
10 11	10	11	239	0.5	0.83	0.42	0.73	3.03	15 inch	16.2	4.89	433.62	418.59	0.0629	5.31
14A 14B	14A	14B	20	0.38	0.48	0.18	0.79	1.32	15 inch	4.57	4.6	414.5	414.4	0.0050	5.65
12 13	12	13	26	0.15	0.71	0.11	0.11	0.78	15 inch	4.57	0.63	415.39	415.26	0.0050	0.78
11 13	11	13	135	0.4	0.84	0.33	1.07	2.44	15 inch	9.79	6.4	418.49	415.39	0.0230	7.56
14B 15	14B	15	26	0.13	0.59	0.08	0.86	0.56	24 inch	16	1.97	414.4	414.27	0.0050	6.19
13 15	13	15	65	0.31	0.65	0.2	1.38	1.48	24 inch	15.87	3.18	415	414.68	0.0049	9.65
15 16	15	16	70	0.04	0.72	0.03	2.27	0.21	30 inch	29	3.25	414.27	413.92	0.0050	15.74
19 20	19	20 J	51	0.04	0.63	0.03	0.03	0.18	15 inch	12.37	2.77	427.32	425.45	0.0367	0.18
16 17	16	17	71	0.04	0.66	0.03	2.29	0.19	30 inch	29.21	3.21	413.92	413.56	0.0051	15.76
20 21	20 J	21	144	N/A	N/A	N/A	0.03	N/A	15 inch	18.79	1.03	425.35	413.16	0.0847	0.18
18 21	18	21	26	0.57	0.79	0.45	0.45	3.27	15 inch	6.46	4.82	418.85	418.59	0.0100	3.27
17 21	17	21	99	0.06	0.65	0.04	2.33	0.29	30 inch	29.15	3.23	413.56	413.06	0.0051	15.86
21 22	21	22 O	13	0.09	0.71	0.06	2.87	0.46	30 inch	27.86	3.92	413.06	413	0.0046	19.23

Profile
Scenario: Base



Profile
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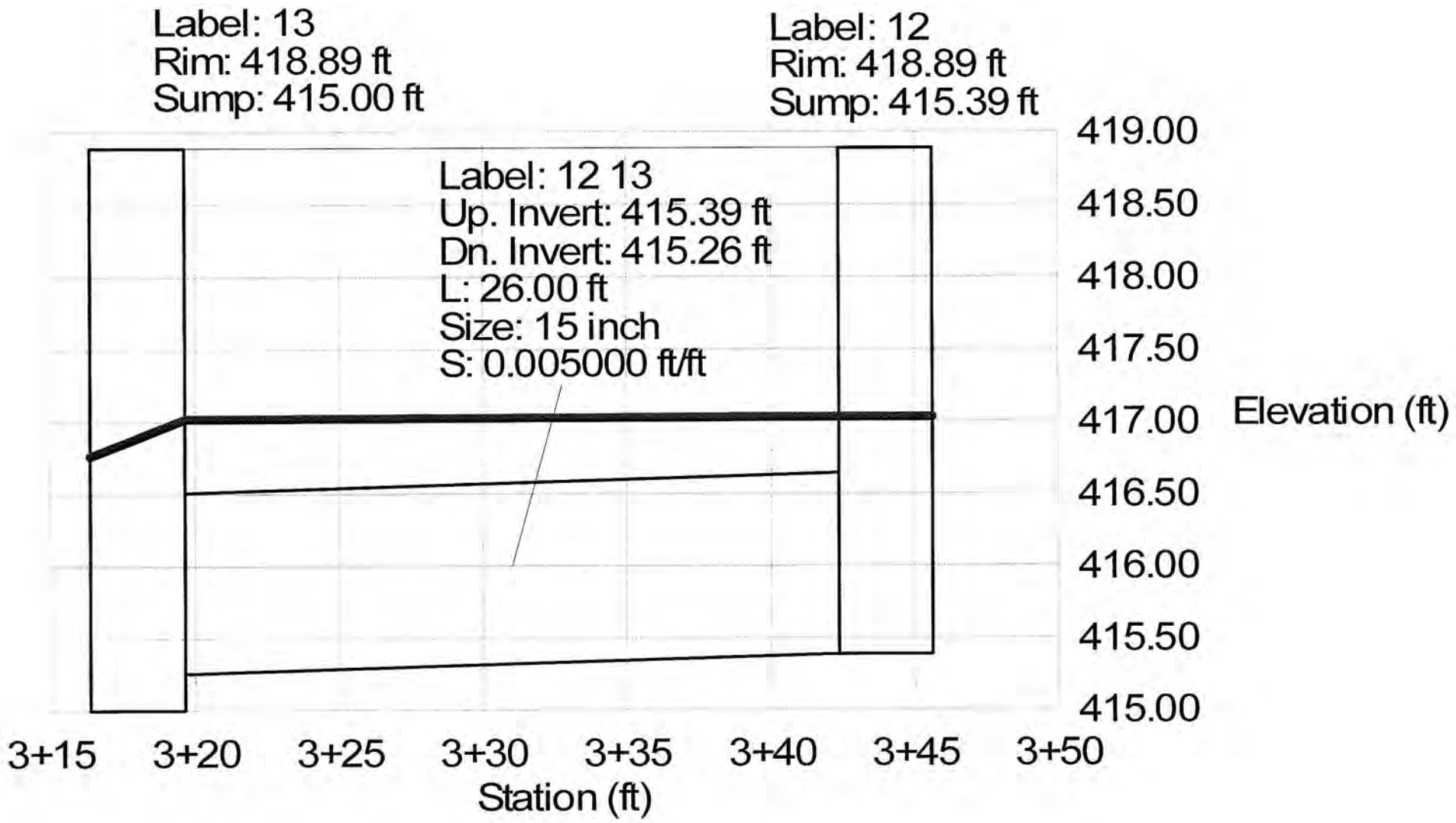

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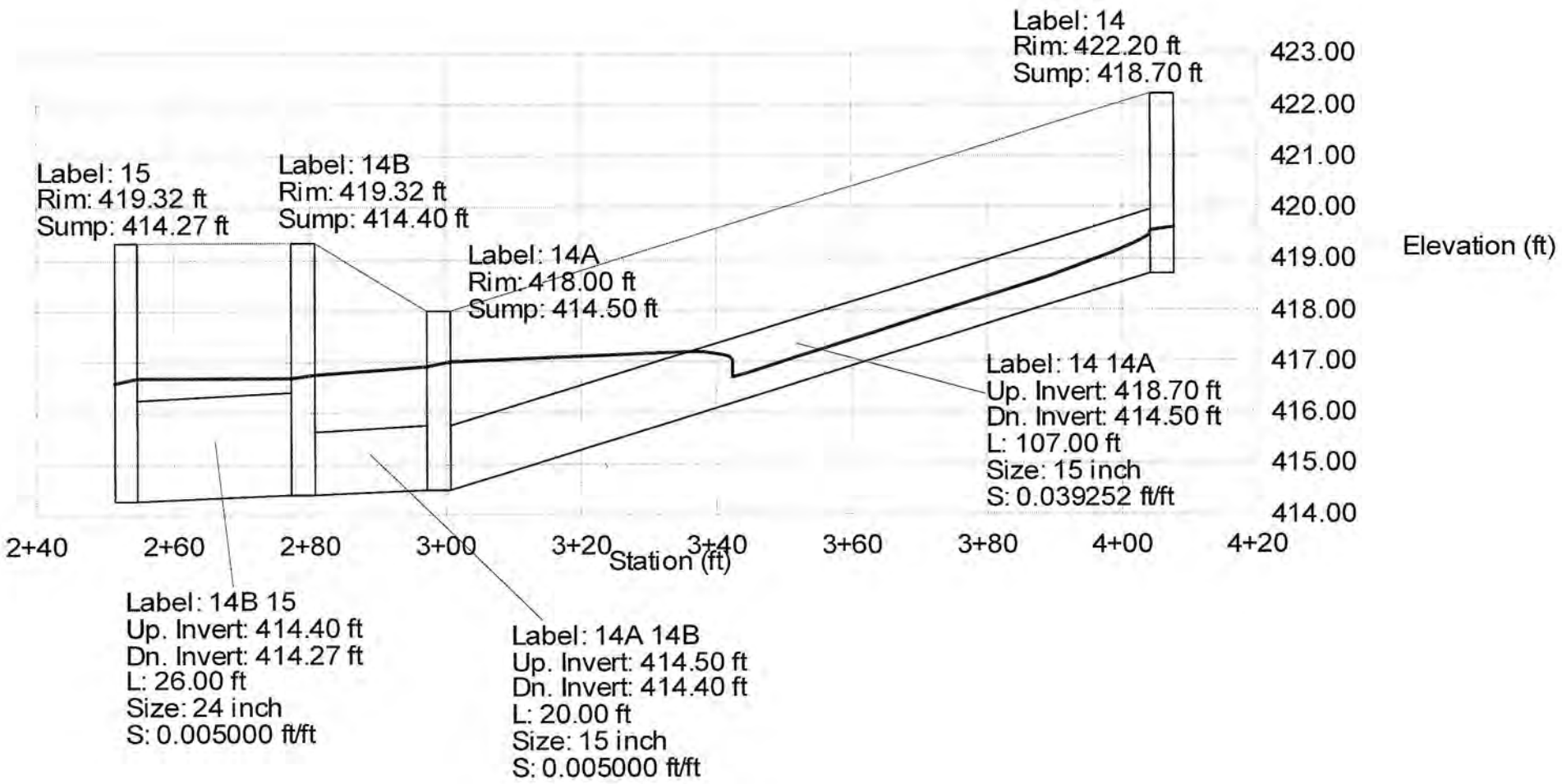
Profile
Scenario: Base



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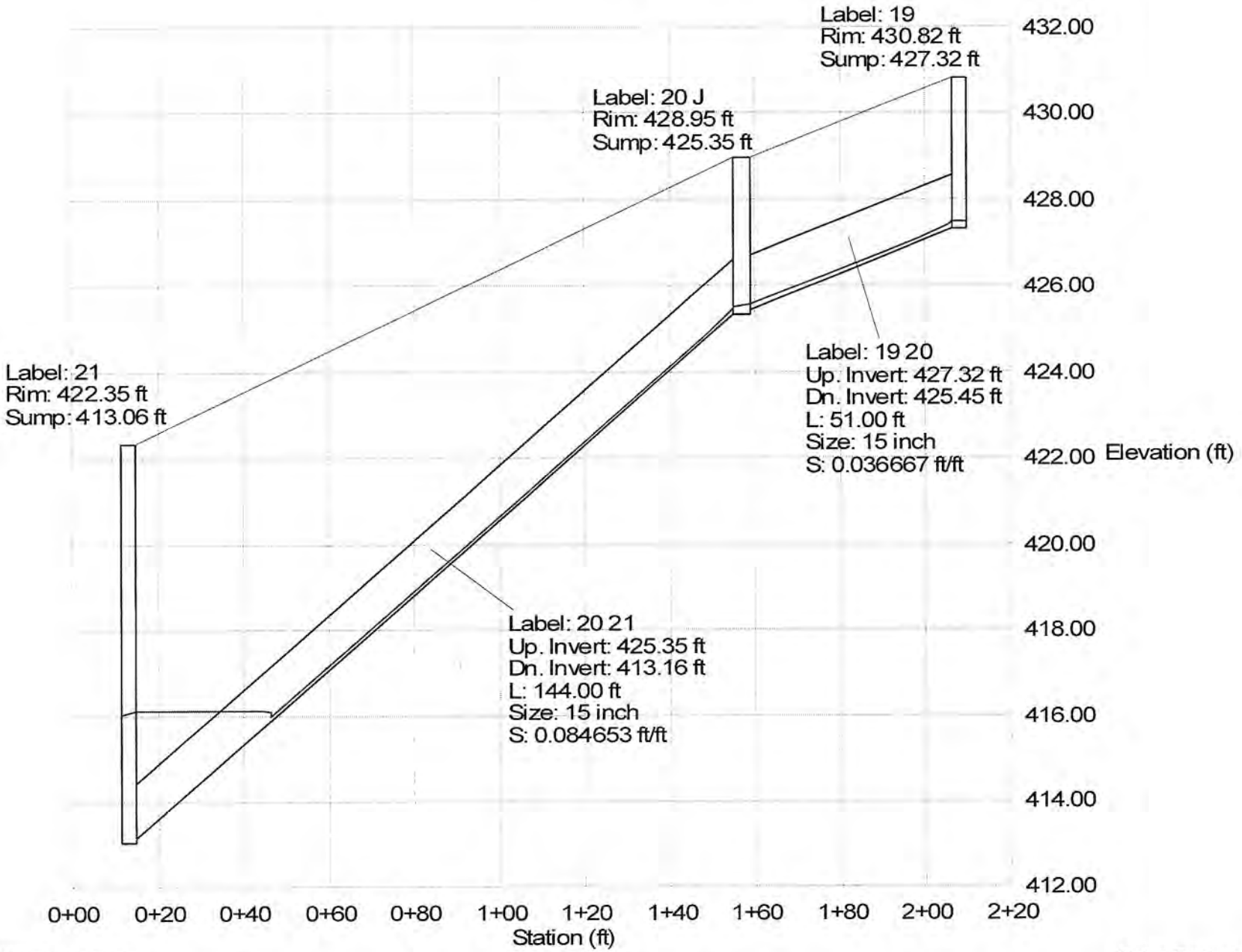

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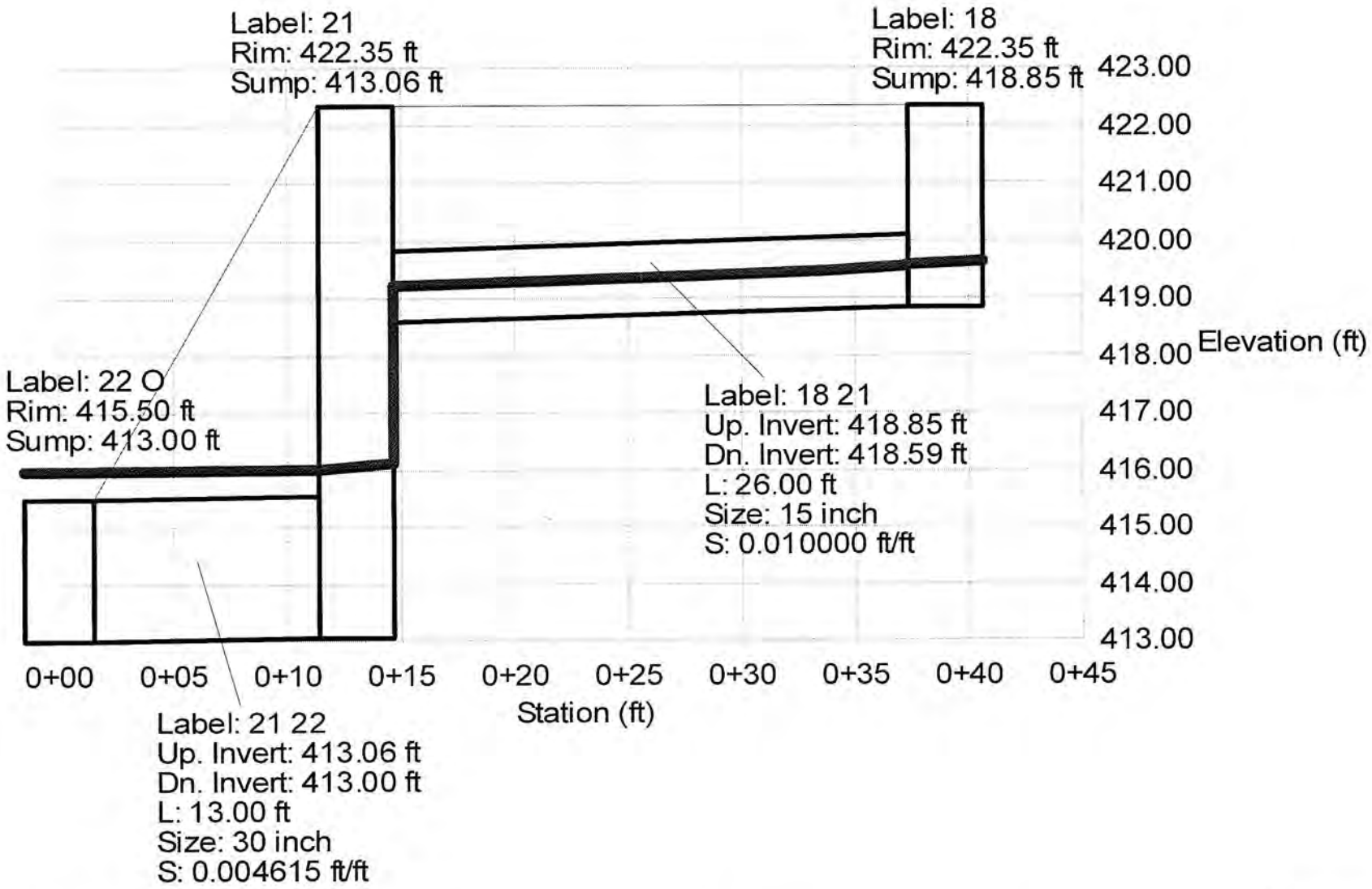
Profile
Scenario: Base



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HMS * Summary of Results for POND 1

Project : AGL-05000 Run Name : POST 10

Start of Run : 04Apr05 0100 Basin Model : POST-DEVELOPMENT
End of Run : 05Apr05 0100 Met. Model : 10YR, 24HR
Execution Time : 13Apr05 1438 Control Specs : 24 HR, dT 1 MIN

Computed Results

Peak Inflow : 26.471 (cfs) Date/Time of Peak Inflow : 04 Apr 05 1307
Peak Outflow : 14.951 (cfs) Date/Time of Peak Outflow : 04 Apr 05 1315
Total Inflow : 4.12 (in) Peak Storage : 0.45871(ac-ft)
Total Outflow : 3.59 (in) Peak Elevation : 416.00(ft)

Max WSE in Wetland #1
Tailwater for SD System