Opinion of Potential Infrastructure Cost

For

Stormwater Runoff Volume Control

Prepared for

Beaufort County
Beaufort, SC

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J-22024

Thomas & Hutton Engineering Co.

Savannah, Georgia ◆ Brunswick, Georgia
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BACKGROUND AND INTRODUCTION

Beaufort County, along with other jurisdictions in the Beaufort and Jasper County area, has been working to protect its local resources including the unique system of salt water marshes, tidal creeks, and rivers. It has been theorized that the additional runoff volume created by developed sites has negatively impacted water quality. Specifically, the additional freshwater input (particularly in the form of large slugs) from the developed areas has affected salinity concentrations and other water quality conditions (particularly elevated levels of bacteria).

Beaufort County has recently amended its Zoning and Development Standards Ordinance (ZDSO) for Stormwater Management Standards to address stormwater runoff volume. This amendment represents a major shift in the way that the County regulates development (and redevelopment) with regards to stormwater management. The amendments to this section of the ZDSO include the stated purpose of "*…no development or redevelopment shall cause the post development stormwater rates, quality or volume to increase above pre development levels…".*

The County, along with other local, regional and state governmental entities, has long regulated stormwater management associated with development by limiting the post-development peak runoff rate to that of the pre-development peak runoff rate (for certain design storms) from a site. This generally meant that detention ponds were required to temporarily hold the stormwater runoff and slowly release it over time at a rate less than or equal to the pre-development peak runoff rate. However, the stormwater standards will require new developments (and redevelopments) to design, construct and operate additional stormwater management infrastructure to control the volume of runoff that leaves a site.

Thomas & Hutton Engineering Co. (T&H) has been working with Beaufort County on this and other stormwater issues for many years. Most recently T&H has completed two studies related to this subject including:

- *Okatie River Sub-watersheds Fecal Coliform Pollutant Load Study,* April 2009. This was a model study of potential fecal coliform pollutant loads from two developed sub-watersheds contributing to the Okatie River. The study accounted for sub-watershed area, varying land uses, rainfall patterns, stormwater best management practices (particularly stormwater lagoons), and other factors that may affect the fecal coliform loadings. The study defined seasonal patterns of potential fecal coliform loading and variability due to rainfall amounts.

- *Eagle's Point Watershed Stormwater Volume Study,* September 2009. This study estimated the hydrologic effect of a typical development on the flow of freshwater into the surrounding creeks and rivers. Two approached were taken to estimate freshwater (i.e. stormwater) flows. The first approach was an analysis of general hydrologic principles (based on National Resource Conservation Service methods) using typical design and analysis values applicable to Beaufort County. The second approach was a model study of the Eagle's Point pre- and post-development watershed using the InfoSWMM computer model for continuous simulations.

The purpose of this study is to estimate the potential costs associated with the implementation of the County's new stormwater management regulations – particularly to estimate the cost of infrastructure necessary to control stormwater runoff volumes to pre-development amounts – for residential development.

STUDY AREA DESCRIPTION

Building on our previous work, T&H has investigated the potential impacts of the County's proposed stormwater runoff volume control requirements on the estimated cost of residential development infrastructure for two scenarios:

- Scenario 1 – Residential Development with a golf (Eagle's Point development), and
- Scenario 2 – Residential Development only (hypothetical development).

Scenario 1 – Residential Development with Golf

The analysis of Scenario 1 builds upon studies conducted by T&H and documented in *Eagle's Point Watershed Stormwater Volume Study,* September 2009. The Eagle's Point development is located in southern Beaufort County off US Highway 278 near the intersection with SC Highway 170. Runoff from this development ultimately flows to Okatie and Colleton Rivers. Figures 1 and 2 illustrate the pre- and post-development conditions for Scenario 1 (Eagle' Point). The information below summarizes pertinent information for the Scenario 1 study area:

- Total Area: 361.9 acres
- Developed Area (including golf course): 265 acres
- Residential Lots: 240
- Developed area pre-development CN: 78.1
- Developed area post-development CN: 85.5 (approximately 17.8% impervious)
- Approximate average lot size: 0.25 acres
- Golf Course Irrigated Area: 80 acres
- Soils Conditions: 92% HSG D, balance of soils are HSG B and C

Scenario 2 – Residential Development Only

Scenario 2 is a hypothetical residential development (that would be typical for Beaufort County) and would be a "stand alone" residential development (not associated with a golf course). To assess this scenario several assumptions were made base on knowledge of Beaufort County and past experience in the design of residential development. The analysis of this scenario is based on the following assumptions:

- Total Area: 100 acres
- Developed Area: 100 acres
- Residential Lots: 300
- Developed area pre-development CN: 78.1
- Developed area post-development CN: 87.0
- Approximate average lot size: 0.25 acres
- Available irrigation area per lot: 6,000 sf
- Soils Conditions: 92% HSG D, balance of soils are HSG B and C
- Stormwater Ponds/Lagoon surface area: 15 acres

STORMWATER RUNOFF VOLUME CONTROL APPROACH

T&H's proposed approach to the control of stormwater runoff volume utilizes infrastructure that is typical (and required by other stormwater management regulations) for residential developments in Beaufort County and expands the infrastructure as necessary to meet the intent of the new regulation.

To control post-development runoff volume to pre-development levels, the proposed approach would be to "harvest" stormwater runoff volumes from stormwater ponds/lagoons and divert the volume to a dedicated pond to for reuse as irrigation. In the case of the residential development with golf (Scenario 1), the golf course would be used for irrigation of the diverted stormwater. In the case of the "stand-alone" residential development (Scenario 2), the diverted stormwater would be used for residential yard irrigation. The infrastructure required for these scenarios is discussed in later sections.

This approach would require that the design and construction of typical stormwater ponds/lagoons be modified such that a volume is available to capture stormwater runoff in the short term, where it could them be pumped to a dedicated reuse/irrigation pond for irrigation of the golf course or residential lots. The benefit to this approach is that it re-uses some necessary infrastructure (stormwater ponds/lagoons) to capture the runoff and hold it until it can be pumped to the reuse/irrigation pond. In addition, it reduces the need (and costs) for well water or other sources of irrigation water for the golf course or residential irrigation systems. A potential drawback is that due to the large slugs of stormwater runoff that needs to be temporarily stored in the stormwater ponds/lagoons, the ponds/lagoons will have a variable normal water level (NWL). This can create a maintenance/aesthetic issue, but may be addressed with design and construction considerations.

STORMWATER RUNOFF VOLUME

The amendment to the Beaufort County Zoning and Development Standards Ordinance for Stormwater Management Standards does not address the specific standards by which the regulations will be applied. Beaufort County will update its *Manual for Stormwater BMPs* to address the specific standards by which stormwater runoff volume will be controled. However, it is T&H's understanding that it is the intent of Beaufort County to require the re-establishment of pre-development runoff volumes from developed areas (post-development) based on an analysis using typical and widely used concepts that predict runoff volumes based on land use and soils conditions. Further, it is our understanding that the BMP manual will require that the design of the infrastructure accomplish this volume control based on an annual average basis and will be limited to runoff from rainfall events up to 1.95-inches (which has been identified as 95th percentile daily rainfall total).

Given this, T&H conducted an analysis for each scenario to assess the feasibility and effectiveness of our proposed stormwater volume control approach. The analyses of each scenario consisted of two long-term spreadsheet calculations (60-years of daily values) that 1) assessed daily pre- and post-development runoff volumes (and thus the volume difference that must be controlled) and 2) assessed the function and interaction of the stormwater ponds/lagoons, diversion pumping, reuse/irrigation pond, irrigation pumping, an irrigation demand. This section documents the long-term analysis of pre- and post-development runoff volumes. The following section documents the long-term analysis of the stormwater runoff volume capture and irrigation use.

To estimate stormwater runoff volumes, a calculation based on historic daily rainfall in the Beaufort County area and using Soil Conservation Service (SCS), now National Resources Conservation Service (NRCS), methods described in TR-55 was conducted. Daily rainfall data was obtained from NOAA's National Climactic Data Center. Daily rainfall data for the complete period of record as recorded at the Savannah International Airport was obtained (period of record of approximately 60 years).

A runoff volume for each day was calculated based on SCS methods outlined in Technical Release 55 (TR-55, June 1986). The equations used in the analysis include:

$$I_a = 0.2S$$

and

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

and

$$S = \frac{1000}{CN} - 10$$

Where:

Q = runoff (in)
P = rainfall (in)
Ia = initial abstraction (in)
S = potential maximum retention after runoff begins (in)
CN = curve number

The SCS method of calculating runoff assumes that runoff does not occur until initial abstraction is exceeded. Thus for this analysis (as with all designs and calculation), runoff for a particular CN is assumes as zero, unless the total runoff exceeds the initial abstraction for that particular CN.

The runoff curve number (CN) represents runoff potential – higher curve numbers produce more runoff, lower curve numbers produce less runoff. Major factors in estimating CNs are the hydrologic soil group (HSG), cover type (i.e. land use), treatment, hydrologic condition, and antecedent moisture condition (AMC). Curve numbers (as outlined previously) were calculated for Scenario 1 (Eagles Point) based on actual land use and soils conditions. For Scenario 2, typical Beaufort County values were utilized.

Antecedent moisture condition (AMC) heavily affect runoff volume. AMC is generally described as dry (AMC I), normal (AMC II), or wet (AMC III). Most CN's listed in available literature (including TR-55) are for normal, or AMC II, conditions. The National Engineering Handbook (1971) suggests the following for estimating AMC conditions.

TABLE 1
NEH AMC Conditions

AMC	5-day Rainfall (in)	
	Dormant Season	Growing Season
I	<0.51	<1.42
II	0.51 to 1.10	1.42 to 2.09
III	>1.10	>2.09

Per the chart above, the NEH further suggests that CNs for normal conditions (AMC II) be adjusted to account for non-normal AMC conditions (wet or dry) per Table 3. An assessment of actual rainfall and curve numbers conditions anticipated to be encountered for Beaufort County was conducted. The assessment indicated that the AMC conditions suggested by the NEH may over estimate the 5-day rainfall amount. Using the NEH values, "dry" conditions for storm events over the period of record are estimated more that 78% of the time. For this reason, the values were adjusted down to provide a more reasonable spread of "dry", "normal" and "wet" conditions. The following table lists the adjusted values used in this analysis. These values (approximately 35% of the NEH values) represent "dry" conditions for 55% of the rainfall events and "normal" or "wet" conditions for 45% of the rainfall events. For Beaufort County, the growing season was assumed to be March through October and the dormant season to be November through February.

TABLE 2
Adjusted AMC Conditions

AMC	5-day Rainfall (in)	
	Dormant Season	Growing Season
I	<.18	<0.50
II	0.18 to 0.39	0.50 to 0.73
III	>0.39	>0.73

For each scenario, the difference in daily pre- and post-development runoff volumes was estimated for each day of the 60-year period of record as follows (approximately 22,000 daily calculations are conducted):

1. Determine daily rainfall (from NOAA record for the Savannah International Airport)
2. Determine the season (growing / dormant)
3. Determine the previous 5-day rainfall amount
4. Determine AMC condition based on 5-day rainfall amount

For each condition (pre- and post-development) calculate the following:

5. Adjust CN based on AMC condition
6. Calculate S (potential maximum retention after runoff begins)
7. Calculate Ia (initial abstraction)
8. Calculate runoff

Using pre- and post-development conditions:

9. Calculate the difference in runoff

The difference in pre- and post-development runoff represents the target amount of runoff to be captured and reused on site in the post-development condition. A typical rainfall-runoff pattern for a one year period is illustrated in Figure 3. This represents a fraction of the calculations conducted to estimate rainfall and runoff values. From these values an annual average amount of rainfall, pre-development, and post-development runoff volume may be estimated. Tables 4 and 5 summarize the rainfall-runoff relationship for the two scenarios on average monthly and average annual basis.

TABLE 3
Antecedent Moisture Condition CN Adjustment

CN (AMC II) "Normal"	Adjusted CN		CN (AMC II) "Normal"	Adjusted CN	
	CN (AMC I) "Dry"	CN (AMC III) "Wet"		CN (AMC I) "Dry"	CN (AMC III) "Wet"
0	0	0	63	43	80
5	2	13	64	44	81
10	4	22	65	45	82
15	6	30	66	46	82
20	9	37	67	47	83
25	12	43	68	48	84
30	15	50	69	50	84
31	16	51	70	51	85
32	16	52	71	52	86
33	17	53	72	53	86
34	18	54	73	54	87
35	18	55	74	55	88
36	19	56	75	57	88
37	20	57	76	58	89
38	21	58	77	59	89
39	21	59	78	60	90
40	22	60	79	62	91
41	23	61	80	63	91
42	24	62	81	64	92
43	25	63	82	66	92
44	25	64	83	67	93
45	26	65	84	68	93
46	27	66	85	70	94
47	28	67	86	72	94
48	29	68	87	73	95
49	30	69	88	75	95
50	31	70	89	76	96
51	31	70	90	78	96
52	32	71	91	80	97
53	33	72	92	81	97
54	34	73	93	83	98
55	35	74	94	85	98
56	36	75	95	87	98
57	37	75	96	89	99
58	38	76	97	91	99
59	39	77	98	94	99
60	40	78	99	97	100
61	41	78	100	100	100
62	42	79			

TABLE 4
Residential with Golf Runoff Comparison

Month	Rainfall	Runoff (in.)		
		Pre	Post	Diff
1	3.23	0.87	1.29	0.42
2	2.79	0.73	1.14	0.41
3	3.67	1.06	1.51	0.44
4	3.03	1.04	1.40	0.36
5	3.56	1.17	1.61	0.44
6	5.65	2.03	2.77	0.74
7	6.50	2.22	3.08	0.85
8	6.60	2.42	3.26	0.84
9	5.22	2.04	2.67	0.63
10	2.89	1.12	1.43	0.31
11	2.08	0.56	0.82	0.27
12	2.77	0.73	1.08	0.35
TOTAL	47.99	15.99	22.05	6.06
% of Rain		33%	46%	13%

TABLE 5
Residential Runoff Comparison

Month	Rainfall	Runoff (in.)		
		Pre	Post	Diff
1	3.23	0.87	1.53	0.65
2	2.79	0.73	1.35	0.62
3	3.67	1.06	1.75	0.69
4	3.03	1.04	1.60	0.56
5	3.56	1.18	1.84	0.67
6	5.66	2.04	3.15	1.10
7	6.50	2.22	3.54	1.31
8	6.60	2.42	3.71	1.29
9	5.22	2.04	3.01	0.97
10	2.89	1.12	1.60	0.48
11	2.08	0.56	0.97	0.41
12	2.77	0.73	1.28	0.55
TOTAL	47.99	15.99	25.31	9.30
% of Rain		33%	53%	19%

STORMWATER DIVERSION AND REUSE

To assess the feasibility, function and interaction of the stormwater ponds/lagoons, diversion pumping, reuse/irrigation pond, irrigation pumping, and irrigation demand; a long-term analysis similar to the pre- and post-development runoff analysis was conducted. This analysis is a "water budget" analysis of various water volumes associated with the capture and reuse of stormwater runoff.

For each scenario, a daily water budget calculation was conducted. Once again, the calculation utilizes the 60-year period of record for rainfall (approximately 22,000 daily calculations are conducted). The following is a summary of the daily water budget calculation for each scenario:

1. Determine daily post-development runoff volume (from the previously described runoff analysis, in most cases this will be zero due to no rainfall)
2. Calculate available capture volume in stormwater ponds/lagoons (this volume was optimized as part of this analysis and represents a capture volume below the lowest outfall in the stormwater ponds/lagoons and is dependent on previous runoff and diversion pumping)
3. Calculate volume of runoff captured and volume of runoff released from stormwater ponds/lagoons
4. Calculate volume of captured runoff diverted to reuses/irrigation pond (based on a the capacity of a typical pump, assumed to be 100 gpm in this analysis)
5. Calculate available volume in reuse/irrigation pond (this volume was also optimized as part of this analysis and is dependent on previous diversion and irrigation pumping)
6. Calculate volume of reuse/irrigation pond (based on preceding stormwater volume diverted, irrigation volume, make-up water volume, and overflow volume)
7. Calculate irrigation volume (based on ASCE approach)
    a. Determine daily evaporation (see Table 6)
    b. Calculate daily irrigation demand as a function of evapotranspiration (Kc (coefficient) times daily evaporation)
    c. Calculate effect of daily rainfall on meeting daily irrigation demand (assumes that 25% of daily rainfall is effective in meeting the daily irrigation demand)
    d. Calculate required irrigation volume (required irrigation accounts for the inefficiency of irrigation (80% of irrigation is effective in meeting the irrigation demand) and the daily rainfall, it is assumed that a pumping system would be available to pump the irrigation volume required)
8. Calculate make-up water volume needed to meet irrigation volume (in both scenarios, the irrigation demand was more than the volume of stormwater diverted, i.e. more than the difference in pre- and post-development runoff volumes).
9. Calculate irrigation/reuse pond overflow (in some isolated instances, the irrigation/reuse pond was overwhelmed and an overflow was calculate, this happened infrequently and lost less than 0.2% on average of the stormwater diversion volume)

TABLE 6
Evaporation Rates

Month	Monthly Evaporation (in/month)	Daily Evaporation (in/day)
1	2.47	0.08
2	3.22	0.12
3	5.01	0.16
4	6.77	0.23
5	7.63	0.25
6	7.67	0.26
7	7.93	0.26
8	6.98	0.23
9	5.48	0.18
10	4.79	0.15
11	3.26	0.11
12	2.53	0.08

As a check of the irrigation assumptions listed above, calculated and measured (reported by Eagles Point Golf Course as part of their SCDHEC consumptive use permit for their irrigation well) irrigation volumes were compared for a three year period. Figure 4 illustrates the comparison. From this, it appears that the assumptions fairly accurately replicate the volume and timing of irrigation needs.

INFRASTRUCTURE COSTS

Scenario 1 – Residential with Golf

For this scenario, the stormwater runoff volume control concept involves the following additional costs (in addition to normal development fees):

- Cost to construct stormwater ponds with an additional "stormwater reuse volume" – this volume would be below the lowest control elevation of the ponds and thus the NWL of the ponds would be subject to fluctuation. This would require additional excavation volume and additional protection/landscaping at the edge of the lagoons/ponds.

- Cost to construct a diversion pump station from the stormwater ponds to the dedicated stormwater reuse/irrigation pond. It is assumed that only one pump station would be required, due to all lakes being interconnected (with no internal control structures). This may not be the case for ally developments.

- Cost to construct diversion force main.

- Cost to construct a dedicated stormwater reuse/irrigation storage pond – pond would most likely be lined and fluctuate significantly. Since the golf course would have required an irrigation pump and irrigation system, that cost is not considered as an additional cost in this analysis. A real estate cost may be associated with this component, since the pond would occupy area that could have normally been developed.

The design of the system describe above was developed from an analysis of over 60 years of historic daily rainfall as input and estimating golf course irrigation needs, pre- and post-development runoff, pond/lagoon volume/stage, stormwater pond/lagoon discharge, irrigation make-up water (from alternative source, i.e. well), stormwater diverted, reuse/irrigation pond volume, etc. Irrigation needs are based on the evapotraspiration of typical turf grass and keeping the root zone supplied with moisture. Thus, if controlled correctly – no runoff or shallow ground water flow would be created by irrigation.

Typical residential infrastructure costs are approximately $20,000/lot. This includes all necessary infrastructure including roads, stormwater management, water and sewer. This cost does not include real estate costs. Based on this, the cost of the residential infrastructure cost for this scenario was approximately $4.8-million. Table 7 is an estimate of the additional costs (based on this scenario) that would be required to meet the County's stormwater volume requirements.

TABLE 7
Scenario 1 – Additional Infrastructure Costs

Item	Potential Costs	
	Low	High
Stormwater Pond Considerations	$ 250,000	$ 500,000
Diversion Pump Station	$ 50,000	$ 100,000
Diversion Force Main	$ 10,000	$ 25,000
Reuse/Irrigation Pond	$ 500,000	$ 1,000,000
TOTAL	$ 810,000	$ 1,625,000

From this analysis, the impact of the County's proposed ordinance would raise the cost of residential infrastructure by 17% to 33%.

Scenario 2 - Residential

The design and operation of the stormwater runoff volume control concept would be similar to that described for Scenario 1, however, a dedicated irrigation distribution system (i.e. purple pipe) would have to be constructed and each home would have an in-ground irrigation system.

Thus the additional infrastructure costs associated with this scenario would be:

- Cost to construct stormwater ponds with an additional "stormwater reuse volume" – this volume would be below the lowest control elevation of the ponds and thus the NWL of the ponds would be subject to fluctuation. This would require additional excavation volume and additional protection/landscaping at the edge of the lagoons/ponds.

- Cost to construct a diversion pump station from the stormwater ponds to the dedicated stormwater reuse/irrigation pond.

- Cost to construct diversion force main.

- Cost to construct a dedicated stormwater reuse/irrigation storage pond – pond would most likely be lined and fluctuate significantly. A real estate cost may be associated with this component, since the pond would occupy area that could have been developed.

- Cost to construct an irrigation pump station, this pump station would pressurize the irrigation distribution system though out the neighborhood. This would generally consist of a typical "purple pipe" system of PVC force mains

- Cost to construct irrigation systems for each homes. This cost could be assigned to the cost of the home and passed on to the homeowner. But this may lead to less than 100% participation. Also, each irrigation system would need to be design to draw from the stormwater reuse/irrigation pond when possible, but if additional irrigation is needed the system could be supplemented by the potable water system or with a well supplementing the irrigation/reuse pond.

The design of the system described above was developed from an analysis of over 60 years of historic daily rainfall as input and estimating residential irrigated area needs, pre- and post-development runoff, pond/lagoon volume/stage, stormwater pond/lagoon discharge, irrigation make-up water (from alternative source, i.e. well), stormwater diverted, reuse/irrigation pond volume, etc. Irrigation needs are based on the evapotraspiration of typical turf grass and keeping the root zone supplied with moisture. Thus, if controlled correctly – no runoff or shallow ground water flow would be created by irrigation.

Typical residential infrastructure costs are approximately $20,000/lot. This includes all necessary infrastructure including roads, stormwater management, water and sewer. This cost does not include real estate costs. Based on this, the cost of the residential infrastructure for the example presented here is approximately $6.0-million. Table 4 is an estimate of the additional costs (based on this scenario) that would be required to meet the County's stormwater volume requirements.

TABLE 8
Scenario 2 – Additional Infrastructure Costs

Item	Potential Costs	
	Low	High
Stormwater Pond Considerations	$ 50,000	$ 100,000
Diversion Pump Station	$ 50,000	$ 100,000
Diversion Forcemain	$ 10,000	$ 25,000
Reuse/Irrigation Pond	$ 350,000	$ 800,000
Reuse/Irrigation Pump Station	$ 50,000	$ 100,000
Reuse/Irrigation Distribution System	$ 100,000	$ 200,000
Sprinkler Systems	$ -	$ 750,000
TOTAL	$ 610,000	$ 2,075,000

From this analysis, the impact of the County's proposed ordinance would raise the cost of residential infrastructure by 10% to 35%. The cost of installing individual in-ground sprinkler systems is reflected in the high cost (would be borne by the developer), where as it is not reflected in the low cost (would be a cost passed to the home purchaser).

Figure 1

Eagle's Point

Pre-Development

Beaufort County, South Carolina

1994 Aerial Photography

Job Number: 22024	Produced: 11/06/09	Produced By: JMN
Scale: 1 inch = 1,000 feet	Modified:	Modified By:
Projection: South Carolina State Plane	Horizontal Datum: NAD 83	Vertical Datum:

File: N:\22024\GIS\MXD\EaglePoint_PreDev_Aerial94.mxd

Thomas & Hutton Engineering Co. compiled the map information from the following sources:

DATA	SOURCE	DATE
Aerial Photography	SC DNR - National Aerial Photography Program	1994
Parcel Boundaries	Beaufort County	2009

DISCLAIMER:
Where Thomas & Hutton Engineering Co. is cited as the data source, the firm has created or verified the data. For all other sources cited, Thomas & Hutton used the data "as is," has made no independent investigation of the data, and makes no representation as to the accuracy or completeness of the data. Please see each source for available documentation of its respective data sets.

Charleston Office
935 Houston Northcutt Blvd.
Mount Pleasant, SC 29464
(843) 894-0200

Figure

2

Job Number: 22024	Produced: 11/06/09	Produced By: JMN
Scale: 1 inch = 1,000 feet	Modified:	Modified By:
Projection: South Carolina State Plane	Horizontal Datum: NAD 83	Vertical Datum:

File: N:\22024\GIS\MXD\EaglePoint_PostDev_Aerial06.mxd

Thomas & Hutton Engineering Co. compiled the map information from the following sources:

DATA	SOURCE	DATE
Aerial Photography	SC DNR - National Aerial Photography Program	2006
Parcel Boundary Lines	Beaufort County	2009

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Eagle's Point

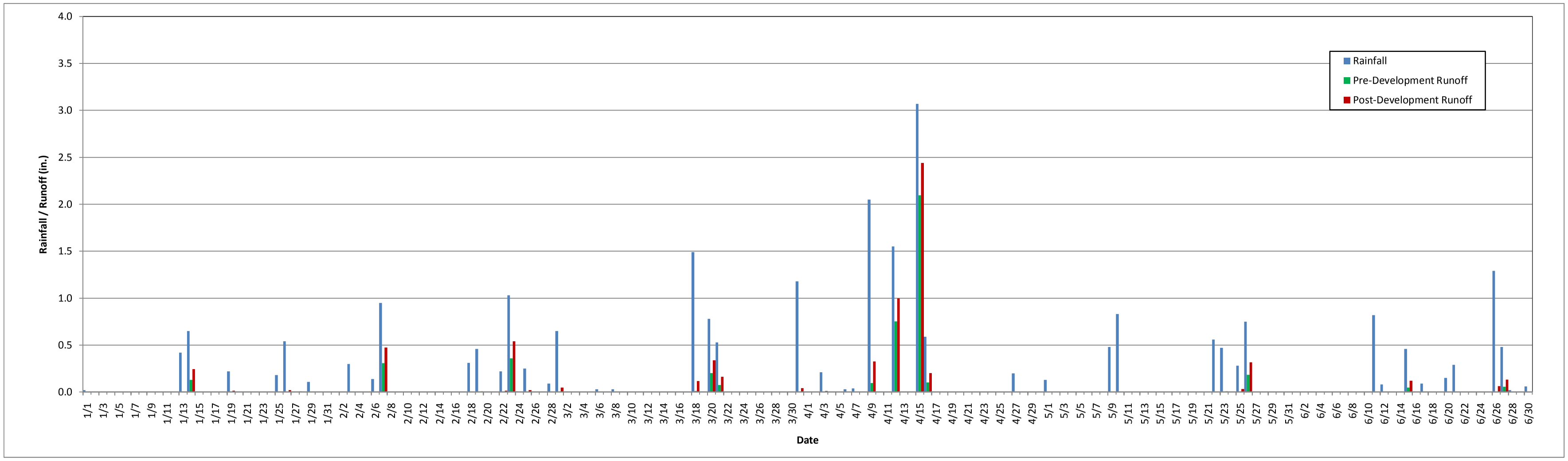
Post-Development

Beaufort County, South Carolina

2006 Aerial Photography

Charleston Office
935 Houston Northcutt Blvd.
Mount Pleasant, SC 29464
(843) 894-0200

Figure 3
Typical Rainfall / Runoff Values



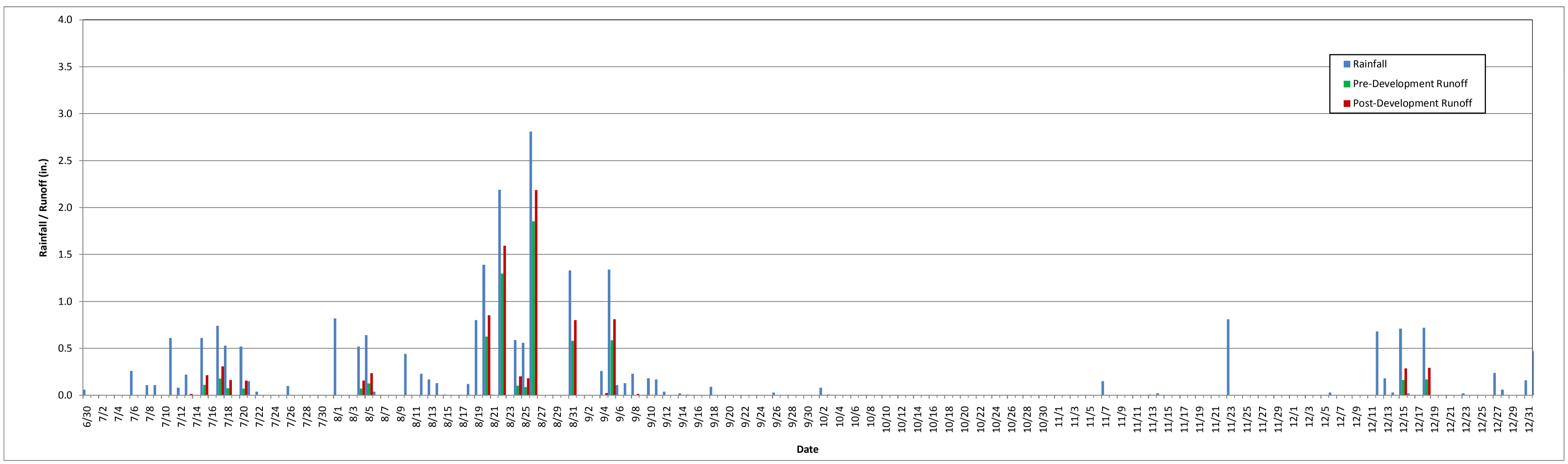


Figure 4
Eagles Pointe Golf Couse - Irrigation Volume