

WAKE COUNTY, NC 440  
 LAURA M RIDDICK  
 REGISTER OF DEEDS  
 PRESENTED & RECORDED ON  
 05/02/2006 AT 14:17:47

BOOK:011938 PAGE:02357 - 02377

STATE OF NORTH CAROLINA :

COUNTY OF WAKE :

DECLARATION

Prepared by and return to: Alison R. Cayton, Manning, Fulton & Skinner, P. A., P. O. Box 20389, Raleigh, North Carolina 27619-0389

THIS DECLARATION ("Declaration"), made as of this the 2d day of May, 2006 by Hasentree Corp., a North Carolina corporation (herein the "Declarant");

WITNESSETH:

WHEREAS, Declarant is the owner of that tract of land more fully described on **Exhibit A** attached hereto; (herein the "Property"); and

WHEREAS, Declarant desires that the Property be developed and maintained for those purposes approved by Wake County, including but not limited to development as the open space and cluster unit development known as Hasentree Subdivision.

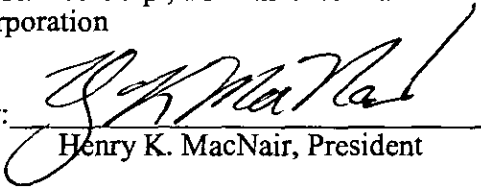
NOW THEREFORE, in consideration of the benefits to Declarant and to the Property, Declarant does hereby create and establish this Declaration on the following terms and conditions:

Declarant hereby declares that the Property shall be held, transferred, sold, conveyed, developed and occupied subject to the requirement that the Stormwater Management procedures for the Bio-retention Basins located on the Property shall be as noted on the Stormwater Operations and Maintenance Manual attached hereto as **Exhibit B** and made a part hereof; and Stormwater Management procedures for the Wet Retention Pond located on the Property shall be as noted on the Stormwater Operations and Maintenance Manual attached hereto as **Exhibit C**.

The requirement contained herein shall be binding upon Declarant's successors and assigns, and shall be perpetual and run with the land until released or amended by a release or amendment approved by Declarant, its successors and assigns, and Wake County.

IN WITNESS WHEREOF, the Declarant hereinbefore named has duly executed this Declaration on the day and year first above written.

Hasentree Corp., a North Carolina corporation

By: 

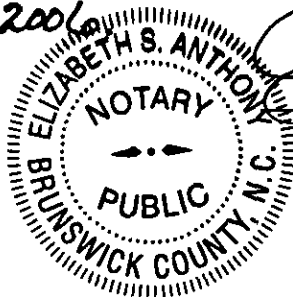
Henry K. MacNair, President

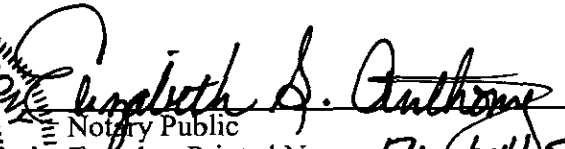
STATE OF NORTH CAROLINA :

COUNTY OF WAKE :

I, the undersigned Notary Public, certify that Henry K. MacNair personally came before me this day and acknowledged that he is President of **Hasentree Corp.**, a North Carolina corporation, and that he as President, being so authorized to do so, executed the foregoing on behalf of the corporation.

Witness my hand and Notarial Stamp/Seal this 24th day of April, 2006



  
Notary Public

Typed or Printed Name: Elizabeth S. Anthony  
My Commission Expires: 2/14/2007

**EXHIBIT A**  
**LEGAL DESCRIPTION OF THE PROPERTY**

**TRACT 1:**

BEGINNING at a point located in the eastern line of that property owned by Three Blind Mice, said point being located North 46° 35' 10" East 2555.91 feet from N.C.G.S. Monument "Guide" having a Y Coordinate of 811,395.73 and an X Coordinate of 2,117,677.25 (NAD 83), runs thence from the place of beginning with the eastern line of the Three Blind Mice property North 03° 31' 16" East 1,453.79 feet to an existing iron pipe; runs thence North 41° 17' 31" West 918.35 feet to an existing iron pipe; runs thence South 88° 19' 55" West 2,165.32 feet to an existing iron pipe; runs thence North 02° 22' 17" East 1,427.51 feet to an existing iron pipe; runs thence North 86° 00' 29" East 1,481.31 feet to an existing iron pipe; runs thence North 28° 38' 31" West 2,053.60 feet to an existing iron pipe; runs thence South 81° 26' 00" East 40.00 feet to a new iron pipe; runs thence North 87° 34' 31" East 1,727.46 feet to an existing iron pipe; runs thence North 17° 02' 22" West 1,690.08 feet to an existing iron pipe; runs thence North 76° 54' 08" East 1,102.91 feet to an existing iron pipe; runs thence North 78° 17' 19" East 1,598.67 feet to an existing iron pipe; runs thence South 00° 38' 03" West 1,774.47 feet to an existing iron pipe; runs thence North 76° 10' 01" East 163.87 feet to an existing iron pipe; runs thence North 80° 59' 30" East 206.09 feet to an existing iron pipe; runs thence South 00° 50' 08" West 167.35 feet to an existing iron pipe; runs thence North 88° 35' 27" East 402.82 feet to an existing iron pipe; runs thence North 89° 27' 59" East 763.30 feet to an existing iron pipe; runs thence South 00° 18' 31" West 1,337.27 feet to a stone; runs thence North 89° 23' 25" West 1,141.45 feet to an existing iron pipe; runs thence South 00° 35' 37" East 682.64 feet to an existing iron pipe; runs thence South 01° 33' 18" East 1,089.14 feet to an existing iron pipe; runs thence South 89° 56' 11" East 613.12 feet to an existing iron pipe; runs thence South 10° 14' 22" East 474.00 feet to an existing iron pipe; runs thence South 26° 27' 41" West 1,067.19 feet to a monument; runs thence North 79° 29' 59" West 151.51 feet to an existing iron pipe; runs thence South 04° 46' 38" East 251.93 feet to an existing iron pipe; runs thence South 03° 41' 35" West 197.69 feet to an existing iron pipe; runs thence South 07° 26' 28" West 156.05 feet to an existing iron pipe; runs thence South 12° 14' 53" West 214.88 feet to an existing iron pipe; runs thence South 15° 11' 44" West 204.87 feet to an existing iron pipe; runs thence South 17° 27' 15" West 145.03 feet to an existing iron pipe; runs thence South 14° 19' 45" West 292.48 feet to a monument; runs thence North 11° 00' 31" West 1,971.85 feet to a monument; runs thence South 31° 27' 46" West 1,608.16 feet to an existing iron pipe; runs thence South 28° 39' 19" East 665.57 feet to an existing iron pipe; runs thence South 07° 25' 26" East 520.25 feet to an existing iron pipe; runs thence North 75° 11' 21" West 217.65

feet to an existing iron pipe; runs thence North 67° 57' 33" West 310.65 feet to an existing iron pipe; runs thence North 62° 22' 36" West 194.13 feet to an existing iron pipe; runs thence North 54° 08' 42" West 470.41 feet to an existing iron pipe; runs thence North 52° 20' 31" West 177.19 feet to an existing iron pipe, said pipe being the point and place of BEGINNING and containing 576.377 acres as shown on that survey entitled Survey for Three Blind Mice, a North Carolina General Partnership of the Hasentree Company Tract dated August 25, 2000 by Ellingburg Land Survey, Co., P.A.

TOGETHER WITH AND INCLUDING that certain easement known as the "Keith Easement" containing 1.34 acres described in that deed of easement recorded in Book 3384, page 221, Wake County Registry which description is incorporated herein by reference.

SAVE AND EXCEPT THAT 6.012 acre tract conveyed out and further described in Book 9332, page 1217 and shown in Book of Maps 2002, page 418. Wake County Registry.

## **TRACT 2**

COMMENCING at a point having NCGS grid coordinates of Y=812,233.88 and X = 2,117,679.56 (NAD 83). Runs thence North 53° 32' 08" East 349.59 feet to a point; runs thence North 60° 19' 59" West 11.21 feet to a point; runs thence North 55° 52' 13" East 800.78 feet to an existing iron pipe; runs thence North 88° 22' 01" West 519.51 feet to a point; runs thence North 88° 07' 57" West 552.46 feet to a point, said point being the point and place of BEGINNING; runs thence North 11° 31' 47" East 443.11 feet to an axle; thence with the Northern line of Marvin Anderson Ray North 63° 59' 36" East 1089.38 feet to a point in the center line of Keith Road – State Road 1921 (60' right-of-way); runs thence with the center line of Keith Road the following courses and distances: South 77° 59' 40" East 103.75 feet to a point; South 69° 01' 35" East 158.50 feet to a point; South 61° 19' 19" East 167.50 feet to a point; South 54° 07' 02" East 144.52 feet to a point; South 44° 17' 18" East 161.07 feet to a point; South 40° 50' 56" East 312.30 feet to a point; and South 44° 55' 17" East 132.58 feet to a point; runs thence away from the center line of Keith Road and with the Western line of that property now or formerly owned by Hasentree Company North 03° 31' 16" East 1453.79 feet to a point and North 41° 17' 31" West 918.35 feet to a point; runs thence continuing with the boundary line of that property now or formerly owned by Hasentree Company South 88° 19' 55" West 2,083.01 feet to a point; runs thence North 47° 46' 34" West 104.87 feet to a point; runs thence South 03° 37' 31" West 73.02 feet to a point; runs thence South 03° 37' 31" West 46.73 feet to a point; runs thence South 03° 36' 57" West 36.34 feet to a point; runs thence with the Eastern line of that property now or formerly owned by Coleman B. Davis South 00° 24' 26" West 491.05 feet to a point; thence with the Eastern line of that property now or formerly owned by

Ester B. Davis South 00° 46' 57" East 519.58 feet to a point and thence with the Eastern line of that property now or formerly owned by William B. Ray South 04° 15' 56" West 1196.87 feet to a point; runs thence away from the Ray property and with the Northern property line of property also owned by Three Blind Mice South 88° 58' 23" East 780.41 feet to a point said point being the point and place of BEGINNING and containing 113.979 acres as shown that survey entitled "Three Blind Mice, a North Carolina General Partnership" dated April 18, 2000 by Ellingburg Land Survey Company, PA, being the same property described in that Deed recorded in Book 3475, page 182 Wake County Registry.

### TRACT 3

BEGINNING at a point said point having North Carolina grid coordinates of Y=812,233.88 and X=2,117,679.56 (NAD 83); runs thence with the Northern right-of-way of North Carolina Highway 98 (a variable right-of-way) the following calls: North 82° 09' 02" West 420.21 feet to a point; North 72° 39' 33" West 507.75 feet to a point; South 82° 39' 58" West 310.81 feet to a point; North 82° 02' 16" West 909.44 feet to a pole; North 83° 05' 53" West 259.13 feet to a point; thence along a curve to the left with a chord bearing and distance of South 86° 52' 16" East 150.52 feet and a radius of 2524.39 feet to a point; runs thence away from the right-of-way line of North Carolina Highway 98 North 01° 36' 13" West 109.49 feet to a point; North 01° 38' 30" West 69.54 feet to a point; North 01° 30' 37" West 28.23 feet to a point; runs thence South 88° 19' 29" East 48.66 feet to a point; South 88° 20' 15" East 124.75 feet to a point; runs thence South 88° 20' 23" East 1438.91 feet to a point; runs thence North 04° 15' 56" East 213.60 feet to a point; runs thence South 88° 58' 23" East 780.41 feet to a point; runs thence South 88° 07' 57" East 552.46 feet to a point; runs thence South 88° 22' 01" East 519.51 feet to an existing iron pipe; runs thence with the Western line of that property now or formerly owned by Leon G. and Ina Bell Keith South 55° 52' 13" West 800.78 feet and continuing with said Keith property the following two calls: South 60° 19' 59" East 11.21 feet to a point and South 53° 32' 08" West 349.59 feet to a point said point being the point and place of BEGINNING and containing 30.245 acres as shown on that survey entitled "Three Blind Mice, a North Carolina General Partnership" dated April 18, 2000 by Ellingburg Land Survey Company, PA., and being the same property described in that Deed recorded in Book 3908, page 261 Wake County Registry.

### TRACT 4:

BEGINNING at a new iron pipe having NC Grid Coordinates of Y=819,924.08 and X=2,121,305.09 (NAD '83) runs thence South 36° 40' 46" East 728.20 feet to a new iron pipe; runs thence North 63° 02' 43" East 50.71 feet to a new iron pipe; runs thence South 36° 40' 40" East 454.86 feet to an existing iron pipe; runs thence South 01° 56' 15" East 39.11 feet to an existing iron pipe; runs thence South 88° 35' 27" West 402.82 feet to an existing iron pipe; runs thence North 00° 50' 08" East 167.35 feet to an existing iron pipe; runs thence South 80° 59'

30" West 206.09 feet to an existing iron pipe; runs thence South 76° 10' 01" West 163.87 feet to an existing iron pipe; runs thence North 00° 38' 03" East 878.99 feet to a new iron pipe, said pipe being the point and place of Beginning and containing 7.630 acres as shown on that map entitled "Recombination Survey of the Waterford. LLC and W.G. Parker Tracts dated December 18, 2001 and recorded in Book of Maps 2002, page 418, Wake County Registry.

SAVE AND EXCEPT FROM TRACTS 1 – 4 above the following:

COMMENCING at a point located North 12° 49' 51" West 1,020.38 feet from NC Grid Monument 'Guide', said point having NC GRID Coordinates of North 811,935.7260, East 2,117,677.2500 thence leaving said point in an easterly direction North 72° 09' 28" East 262.03 feet to a point, said point being the point and place of BEGINNING, runs thence along a curve to the right with a radius of 100.00 feet, length of 381.36 feet, a tangent of 286.33 feet and delta of 218° 20' 13"; runs thence North 45° 00' 18" West 21.07 feet to a point; runs thence along a curve to the right with a radius of 100.00 feet, a length of 588.03 feet, a tangent of 20.42 feet and a delta of 336° 55' 02" to a point; runs thence South 45° 00' 18" West to a point; runs thence along a curve to the left with a radius of 100.00 feet, a length of 183.01 feet, a tangent of 129.98 feet and a delta of 104° 51' 20" to a point, said point being the point and place of BEGINNING containing 1.458 acres more or less.

TOGETHER WITH AND INCLUDING an access easement for ingress, egress and regress to the above referenced property and described as follows:

BEGINNING at a point located North 12° 49' 51" West 1,020.38 feet from NC Grid Monument 'Guide', said point having NC GRID Coordinates of North 811,935.7260, East 2,117,677.2500 thence leaving said point in an easterly direction North 72° 09' 28" East 262.03 feet to a point; runs thence along a curve to the right with a radius of 100 feet, a length of 23.64 feet, a tangent of 11.88 feet and a delta of 13° 52' 50" to a point; runs thence South 72° 09' 28" East 269.11 feet to a point in the eastern line of Future Road, runs thence with the eastern line of Future Road along a curve to the right with a radius of 705.00 feet, a length of 20.72 feet, a tangent of 10.36 feet and a delta of 01° 41' 03" to a point, said point being the point and place of BEGINNING containing 0.1217 acres more or less.

## EXHIBIT B

**STORMWATER OPERATIONS AND MAINTENANCE MANUAL**

Project:

**HASENTREE – GOLF COMMUNITY  
STORMWATER MANAGEMENT  
BIO-RETENTION BASINS**

Wake County, NC

Developer:  
Hasentree Corporation

Prepared By: CE Group, Inc.

Date Constructed: August 2005 – April 2006

Location: Hasentree Golf Community

Contractor: (List below)

|                   |                     |
|-------------------|---------------------|
| Impoundment & Dam | Medalist Golf       |
| Spillway          | ABE Utilities, Inc. |

Material Supplies: (List below)

|                   |                                 |
|-------------------|---------------------------------|
| Riser Structure   | Pre-cast Concrete Box Riser     |
| DIP, Bottom Drain | 4" DIP                          |
| Drain Gate Valve  | Gate Valve                      |
| Outlet Pipe       | Reinforced Concrete O-Ring Pipe |
| Rim               | Steel Drainage Grate            |

This manual establishes the procedures for maintenance and operation of the Bio-retention area as shown on the approved construction plans.

### **MAINTENANCE OF BIO-RETENTION AREA**

**Vegetation** – The drainage areas have a ground cover of fescue, which is properly maintained will prevent erosion of the embankment and provide an easy surface for inspection. The grass will be most difficult to obtain in the area subject to water level fluctuation. Grass should be fertilized every October and April.

**Re-Seeding** – Periodic re-seeding may be required to establish grass on areas where seed did not take or has been destroyed. Before seeding, fertilizer (12-12-12) should be applied at a minimum rate of 12-15 pounds per 1,000 S.F. The seed should be evenly sown at a rate of three pounds per 1,000 S.F. The seed should be covered with soil to the depth of approximately ¼". Immediately following the planting, the area should be mulched with straw.

**Trees and Shrubs** - Trees, shrubs, and other landscape vegetation should be permitted only as shown on the approved landscape plan. The vegetation should be kept healthy and vibrant. If a tree or shrub dies it should be removed and replaced with another tree or shrub from the same species.

**Mowing** – Grass mowing, brush cutting and removal of weed vegetation will be necessary for the proper maintenance of the areas. All area slopes and vegetation should be mowed when the grass exceeds 8" inches in height. Acceptable methods include the use of weed whips or power brush cutters and mowers.

**Erosion** – Erosion occurs when the water concentrates causing failure of the vegetation or when vegetation dies and sets up the environment for rill erosion and eventually gullies from the stormwater runoff. The areas should be inspected. Proper care of the vegetative areas that develop erosion is required to prevent more serious damage to the site. Rills and gullies should be filled with suitable soil compacted and then seeded. Methods described earlier on vegetation should be used to properly establish the grass surface. Where eroded areas are detected, the cause of the erosion should be addressed to prevent a continued maintenance problem. Frequently, problems result from the concentration of runoff to one point of the bio-retention area instead of a uniform distribution of runoff. This can be corrected by reshaping, to more evenly distribute runoff to areas not experiencing erosion problems.

**Rodent Control** – Generally in this urban environment, rodents are not a problem. Rodents such as groundhogs, muskrats, and moles are attracted to moist, wet areas and can be quite dangerous to structural integrity and proper performance of the earthwork and drainage. Groundhogs and muskrats thrive on burrowing into the manmade earthwork, which become pathways for seepage. In the event that burrows are detected within the bio-retention area, the rodents should be dealt with by removal.

**Trash and Debris** – Trash acts as a barrier to stormwater infiltration and attracts unwanted pests. The bio-retention area should be kept clear of debris such as loose bottles, cans, food containers and other forms of rubbish. The area should be cleared of debris as needed, but no less than twice a year.

## **MAINTENANCE OF SPILLWAYS AND CONTROL STRUCTURES**

Inspection of Conduits - Conduits should be inspected thoroughly once a year. Conduits should be visually inspected at joints. Pipes should be inspected for proper alignment (sagging), elongation and displacement at joints, cracks, leaks, surface wear, loss of protective coating, corrosion and blocking. Problems with conduits most often occur at joints and special attention should be given to them during the inspection. Joints should be checked for gaps caused by elongation or settlement and loss of joint filler material. Open joints can permit erosion of the earthwork and possibly the piping of soil material through the joints. A depression in the soil surface over the pipe may be signs that soil is being removed from around the pipe.

## **OPERATION**

Drain Pipes – Drainpipes should always be operable so that the water can be drawn down in the event of severe rain or for repairs or maintenance.

Record Keeping – Operation of bio-retention area should include recording of the following:

Annual Inspections Reports – A collection of written inspection reports should be kept on record. Inspection should be conducted annually.

Observations – All observations should be recorded. Where periodic inspections are performed following significant rainfall, these inspections should be logged into the Periodic Inspection Log and kept as a part of this manual.

Maintenance – Written records of maintenance and or repairs should be recorded on the Periodic Inspection Log and kept as a part of this manual.

Other Operational Procedures – The owner should maintain a complete and up-to-date set of plans (as-built drawings) and all changes made to the bio-retention area over time should be recorded on the as-builts.

Sedimentation and Dredging – Sedimentation from on-site and off-site soils will eventually result in the clogging of drainage conduits and will have to be removed. The frequency of sediment removal can be reduced by ensuring that the site areas around the building be stabilized with a vegetative ground cover such that it restrains erosion. This would include a periodic application of fertilizer and/or other treatment necessary to promote a stable ground cover and minimize sedimentation to the pond. The removed material should be hauled off-site to a suitable landfill site or mounded somewhere on site and stabilized with ground cover sufficient to restrain erosion.

## **MAINTENANCE SCHEDULE**

| DESCRIPTION                              | METHOD  | FREQUENCY | TIME OF YEAR |
|------------------------------------------|---------|-----------|--------------|
| 1) Inspect and repair erosion            | Visual  | Monthly   | All year     |
| 2) Re-mulch or re-seed<br>any void areas | By Hand | As needed | As needed    |

|                                                                             |                           |                                  |                           |
|-----------------------------------------------------------------------------|---------------------------|----------------------------------|---------------------------|
| 3) Remove previous mulch Layer before applying new Layer (optional)         | By Hand                   | Once 2-3 Years                   | Spring                    |
| 4) Any additional mulch added                                               | By Hand                   | Once a year                      | Spring                    |
| 5) Removal and replacement Of dead and diseased Considered beyond treatment | See planting plan         | Twice a year                     | As directed by landscaper |
| 6) Treat all diseased trees and Shrubs                                      | Mechanical or N/A by hand |                                  | Varies,                   |
| 7) Inspect outlet structure for Blockage                                    | Visual                    | after rain events and/or monthly | All year                  |

## EXHIBIT C

**STORMWATER OPERATIONS AND MAINTENANCE MANUAL**

Project:

**HASENTREE – GOLF COMMUNITY  
STORMWATER MANAGEMENT  
WET RETENTION POND**

Wake County, NC

Developer:

Hasentree Corporation

Prepared By: CE Group, Inc.

Date Constructed: August 2005 – April 2006

Location: Hasentree Golf Community

Contractor: (List below)

|                   |                     |
|-------------------|---------------------|
| Impoundment & Dam | Medalist Golf       |
| Spillway          | ABE Utilities, Inc. |

Material Supplies: (List below)

|                   |                                 |
|-------------------|---------------------------------|
| Riser Structure   | Pre-cast Concrete Box Riser     |
| DIP, Bottom Drain | 4" DIP                          |
| Drain Gate Valve  | Gate Valve                      |
| Outlet Pipe       | Reinforced Concrete O-Ring Pipe |
| Trash Rack        | Fabricated Steel Trash Rack     |

## OPERATIONS & MAINTENANCE MANUAL

### Wet Retention Pond

This manual established procedures for maintenance and operation of the referenced wet detention stormwater control measure:

#### I. Background

The Hasentree Golf Community development is located within the Neuse River drainage basin. The stormwater management strategy approved by Wake requires that there be a minimal net increase between the pre-developed and post-developed peak flow condition for the 1-year 24-hour storm event. Refer to the approved Stormwater Management Analysis for Hasentree Golf Community dated September 2005 and updated in January 2006.

A majority of the drainage from the impervious surfaces (including building roofs, roadways, sidewalks, etc.) and overland golf course flow has been routed via sub-surface surface flow, channel flow, and storm drainage systems to the proposed pond locations. The proposed detention facilities outlet to existing natural drainage outfalls.

#### II. Maintenance of Embankments

##### A. Vegetation

The embankment has a ground cover of fescue, which if properly maintained will prevent erosion of the embankment and provide an easy surface for inspection. The grass will be most difficult to obtain in the area subject to water level fluctuation below the top of the riser. Grass should be fertilized every October and April.

- ◆ Re-Seeding – periodically re-seeding may be required to establish grass on areas where seed did not take or has been destroyed. Before seeding, fertilizer (12-12-12) should be applied at a minimum rate of 12 to 15 pounds per 1,000 SF. The seed should be evenly sewn at a rate of three pounds per 1,000 SF. The seed should be covered with soil to the depth of approximately ¼". Immediately following the planting, the area should be mulched with straw.
- ◆ Trees & Shrubs – trees, shrubs, and other landscape vegetation should be permitted only as shown on the approved planting plan.
- ◆ Mowing – grass mowing, brush cutting and removal of weed vegetation will be necessary for the proper maintenance of the embankment. All embankment slopes and vegetation of spillways should be mowed when the grass exceeds 8" in height. Acceptable methods include the use of

weed whips or power brush cutters and mowers.

## B. Erosion

Erosion occurs when the water concentrates causing failure of the vegetation or when vegetation dies and sets up the environment for rill erosion and eventually gullies from the stormwater runoff. The dam should be inspected for these areas. Proper care of vegetative areas that develop erosion is required to prevent more serious damage to the embankment. Rills and gullies should be filled with suitable soil compacted and then seeded. Methods described in Section II-A, on vegetation, should be used to properly establish the grass surface. Where eroded areas are detected, the cause of the erosion should be addressed to prevent a continued maintenance problem. Frequently problems result from the concentration of runoff to one point of the embankment crest instead of a uniform distribution of runoff. This can be corrected by reshaping the crest to more evenly distribute the runoff to areas, which are not experiencing erosion problems. The top of the dam should not be allowed to be used for pedestrian or bicycle traffic unless designed with hard surface path.

- ◆ Abutment Areas -- the abutment is the line formed where the embankment fill comes into contact with the existing slope. Runoff from rainfall concentrates in these gutter areas and can reach erosive velocities because of the steep slopes. If a normal stand of grass cannot be maintained on the abutments, additional measures may be needed such as jute matting to provide for the establishment of a good ground cover.
- ◆ Upstream Embankment Slope – Erosion problems can develop on the upstream face of the dam due to the fluctuation of water level in the pond. This is a result of a combination of wave actions and ground saturation, which occurs from the elevated water levels. The erosion generally occurs as the water level falls and the saturated ground becomes subjected to the wave action. If erosion becomes a problem, it may necessitate the installation of a stone armoring along the zone subject to fluctuating water level. This would consist of 18" of NCDOT Class B stone for erosion control underlain with Mirifi 140 geotextile fabric. It should be centered at the point of the erosion problem and covering an area 2' above and below the approximate center of the eroded area.

## C. Seepage

- ◆ Detection – Seepage may vary in appearance from a soft wet area to a flowing spring. It may show up first as only an area where the vegetation is more lush and darker green. Cattails, reeds, mosses and other marsh vegetation often become established in a seepage area. The downstream abutment areas where the embankment fill and natural ground interface are very common locations for seepage. Also the contact between the embankment and the spillway conduit is a very common location, which is generally attributed to poor compaction around the conduit. Due to the way in which conduits are put in, this is generally most evident on the

underside of the conduit. Slides may result from excessively saturated embankment slopes. The natural foundation area immediately downstream of the dam abutment should also be inspected to ensure that "piping" is not occurring underneath the embankment. "Piping" may appear as a "boil" evident as spring carries soil. The soil usually deposits around the boil area and is evident by the sedimentary deposits accompanying it. Seepage can also occur into the spillway conduit through cracks in the pipe or improperly sealed joints. These can be seen by observing the conduit when the water level is high. The movement of the water itself is not dangerous, but if soil particles are being carried with it, then it can create a shortcut for the piping of soil. This might show up on the upstream face of the embankment roughly along the line of the conduit itself.

#### D. Cracks, Slides, Sloughing, and Settlement

- ◆ Cracks – the entire embankment should be inspected for cracks. Short, isolated cracks are usually not significant, but larger cracks (wider than  $\frac{1}{4}$ "), well-defined cracks indicate a serious problem. There are two types of cracks: transverse and longitudinal.

Transverse cracks appear crossing the embankment and indicated difference of settlement within the embankment. These cracks provide avenues for seepage and piping could develop.

Longitudinal cracks run parallel to the embankment and may signal the early stages of a slide. In recently built structures, these cracks may be indicative of poor compaction or poor foundation preparation resulting in consolidation after construction.

- ◆ Slides – Slides and slumps are serious threats to the safety of an embankment. Slides can be detected easily unless obscured by vegetation. Arch shaped cracks are indications that slides are slipping or beginning to slip. These cracks soon develop into large scarps in the slope at the top of the slide.
- ◆ Settlement – settlement occurs both during construction and after the embankment has been completed and places in service. To a certain degree this is normal and should be experienced. It is usually the most pronounced at the location of maximum foundation depth or embankment height. Excessive settlement will reduce the free board (difference in elevation between the water surface and the top of the dam). Any area of excessive settlement should be restored to original elevation and condition to reduce the risk of overtopping. A relatively large amount of settlement (more than 6") within a small area could indicate serious problems in the foundation or perhaps the lower part of the embankment. Settlement accompanied by cracking often precedes failure.
- ◆ What to do if seepage, cracks, slides or settlement are detected: If any of the above items are detected there may be signs of significant problems, which could lead, to the failure of the structure. A geotechnical or civil engineer should be consulted regarding the origin of these problems and

for the assessment of the appropriate solutions for correcting them. If the professional is not immediately able to inspect the dam, then the bottom drain should be opened and the water level lowered to remove the risk of failure until a professional can observe these problems.

#### E. Rodent Control

Generally in this urban environment, rodents are not a problem. Rodents such as ground hogs, muskrats, and beavers are attracted to dams and reservoirs and can be quite dangerous to structural integrity and proper performance of the embankment and spillway. Groundhog and muskrats thrive on burrowing in the manmade earth embankments, which become pathways for seepage. In the event that burrows are detected within the dam, then the rodents should be dealt with by removal.

### III. MAINTENANCE OF SPILLWAYS & CONTROL STRUCTURES

#### A. Inspection of Spillway Conduits

Conduits should be inspected thoroughly once a year. Conduits should be visually inspected by actually entering the conduit a sufficient distance between the riser structure and the outlet to check all the joints. Because the outlet works tie into the street storm sewer system, catch basins and pipes. Conduit should be inspected for proper alignment (sagging), elongation and displacement at joints, cracks, leaks, surface water, surface wear, loss of protective coating, corrosion and blocking. Problems with conduits most often occur at joints and special attention should be given to them during inspection. Joints should be checked for gaps caused by elongation or settlement and loss of joint filler material. Open joints can permit erosion of the embankment material and possibly the piping of soil material through the joints. Catch basin should be checked for signs that water is seeping along the exterior surface of the pipe where it enters the catch basin. A depression in the soil surface over the pipe may be signs that soil is being removed from around the pipe.

- ◆ What to do if problems are detected with the spillway: Retain the assistance of a civil engineer or geotechnical engineer qualified in the design of embankments to perform an inspection of the dam. If in doubt, lower the water surface elevation of the pond until such time as a qualified professional can perform an inspection.

#### B. Trashracks on Pipe Spillways

The spillway riser for this dam is the only spillway structure. The intake structure has been fitted with a trashrack to prevent debris from entering the spillway structure. Most of the runoff entering the pond comes in through grated inlets, which have essentially provided filtration of the runoff and should limit the size of the debris that enters the basin to floating debris, which will most likely pass through the trashrack. The opening between the trashrack and riser is smaller than the opening of the outlet pipe. The intent is

that any debris, which passes through the trashrack, will be easily passed by the pipe outlet.

Maintenance should include periodically checking the rack for rusted or broken sections and repairing as needed. The trashrack should be checked frequently during and after storm events to ensure that it is properly functioning and to remove accumulated debris.

#### IV. OPERATION

##### A. Lake Drains

Lake drains should always be operable so that the pool level can be drawn down in case of an emergency or for repairs or maintenance. Lake drain valves or gates that have not been operated for a long time present a special problem. Generally, when draining the pond, it should be drained slowly. Open the drain until a good flow of water is present but not a torrent, so that the water level can be drained over a period of 48 hours or more. Rapidly lowering the water level in the pond can cause permanent damage to the embankment and must be avoided. The gate valve controlling the lake drain should be operated from fully closed to fully opened position at least twice a year.

##### B. Record Keeping

Operation of a dam should include recording of the following:

- ◆ Annual Inspection Reports – a collection of written inspection report should be kept on record in Section V of this manual. Inspection should be conducted annually. Copies should be provided to the owner or homeowner's association.
- ◆ Observations – all observations should be recorded. Where periodic inspections are performed following significant rainfall events, these inspections should be logged into the Periodic Inspection, Operation & Maintenance Form in Section V of this manual.
- ◆ Maintenance – written records of maintenance and/or repairs should be recorded on the Periodic Inspection, Operation & Maintenance Form in Section V of this manual.
- ◆ Other Operation Procedures – the owner should maintain a complete and up-to-date set of plans (as-built drawings) and all changes made to the dam over time should be recorded on the as-builts.

##### C. Sedimentation & Dredging

Sedimentation from establishing areas tributary to the pond will eventually result in the reduction of the retention pool and eventually will have to be removed. The frequency of this sediment removal can be reduced by ensuring that the site areas around the building be stabilized with a vegetative ground cover such that it restrains erosion. This would include a periodic

application of fertilizer and other treatments necessary to promote a stable groundcover and minimize sedimentation to the pond. For aesthetic purposes it may be desirable to maintain it prior to this point. Generally, the dredging process begins with the removal of as much water as possible from the deposited silt and so the material can be excavated with conventional equipment for trucking offsite. The removed material should be hauled offsite to a suitable landfill site or mounded somewhere on site and stabilized with a groundcover sufficient to restrain erosion.

#### D. Major Repair

Whenever the above stated maintenance and inspection reports show that any repairs requiring greater than one-third or more of the original construction cost would be considered a major repair. Examples of major repair items could include dam seepage, cracks, slides, riser structure cracks, etc. that require replacement or major repair of such items.

### V. INSPECTION, OPERATION & MAINTENANCE CHECKLISTS

**POND INSPECTION CHECKLIST**

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Wet Detention Pond

**SPILLWAYS – DRAINS – OUTLETS**

| Check/Circle<br>Condition Noted         | Observations | Action<br>Repair – | Action<br>Monitor – | Action<br>Investigative – |
|-----------------------------------------|--------------|--------------------|---------------------|---------------------------|
| <b>Principal<br/>Spillway</b>           | <b>Type:</b> |                    |                     |                           |
| Trashracks/Debris                       |              |                    |                     |                           |
| Cracks/Deterioration                    |              |                    |                     |                           |
| Joint Deterioration                     |              |                    |                     |                           |
| Improper Alignment                      |              |                    |                     |                           |
| Cracks/Deterioration                    |              |                    |                     |                           |
| Joint Deterioration                     |              |                    |                     |                           |
| Seepage/Piping                          |              |                    |                     |                           |
| Undercutting                            |              |                    |                     |                           |
| Erosion                                 |              |                    |                     |                           |
| Debris                                  |              |                    |                     |                           |
| <b>Lake<br/>Drain/Other<br/>Outlets</b> | <b>Type:</b> |                    |                     |                           |
| Gates/Valves                            |              |                    |                     |                           |
| Operability                             |              |                    |                     |                           |
|                                         |              |                    |                     |                           |

**General Comments, Sketches & Field Measurements**

**POND INSPECTION CHECKLIST**

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Wet Detention Pond

**EMBANKMENT -- POOL**

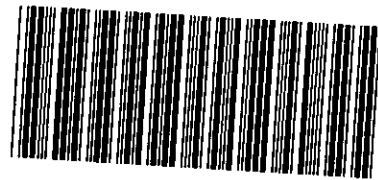
| Check/Circle Condition Noted | Observations | Action Repair – | Action Monitor – | Action Investigative – |
|------------------------------|--------------|-----------------|------------------|------------------------|
| <b>U/S Slope</b>             | <b>Type:</b> |                 |                  |                        |
| Vegetation/Riprap            |              |                 |                  |                        |
| Beaching/slides/cracks       |              |                 |                  |                        |
| Undermining/erosion          |              |                 |                  |                        |
| Rodent burrows               |              |                 |                  |                        |
| <b>Crest</b>                 | <b>Type:</b> |                 |                  |                        |
| Ruts/erosion                 |              |                 |                  |                        |
| Cracks/settlement            |              |                 |                  |                        |
| Poor alignment               |              |                 |                  |                        |
| <b>D/S Slope</b>             | <b>Type:</b> |                 |                  |                        |
| Vegetation/erosion           |              |                 |                  |                        |
| Rodent burrows               |              |                 |                  |                        |
| Sloughs/slides/cracks        |              |                 |                  |                        |
| Seepage/wetness              |              |                 |                  |                        |
| <b>Pool</b>                  | <b>Type:</b> |                 |                  |                        |
| Erosion/ground cover         |              |                 |                  |                        |
| Sedimentation                |              |                 |                  |                        |
| Water quality                |              |                 |                  |                        |
| <b>Abutment</b>              | <b>Type:</b> |                 |                  |                        |
| Vegetation/erosion           |              |                 |                  |                        |
| Slough/slides/cracks         |              |                 |                  |                        |
| Seepage/wetness              |              |                 |                  |                        |

**General Comments, Sketches & Field Measurements**

## PERIODIC INSPECTION, OPERATION & MAINTENANCE RECORDS

### Wet Detention Pond

[illegible]



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Laura M. Riddick  
Register of Deeds**

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