

## APPENDIX B: MODEL INPUT METHODS AND ASSUMPTIONS

### **SET Tool – Downtown Catchment – Existing Land Use**

#### Site Data

Area: 254 acres

Slope: 2% - 6%

Soil Hydrologic Groups: 0.7% Group C, 99.3% Group D

Pollutant Target: Urban Non-Residential

#### *Assumptions*

1. Catchment area was based on the City's 2007 Duke Diet & Fitness Center Report<sup>1</sup> and was rounded down from 254.4 acres to 254 acres.
2. Slope was assumed to be moderate which was the 2% - 6% category
3. Hydrologic Groups were calculated based on soil layers dataset and information from USDA's soil data mart
4. Catchment was assumed to be mostly Urban Non-residential

#### Land Use

#### *Assumptions*

1. "Residential & light Industrial" contained impervious areas under the categories "Residential" and "industrial" based on the City's land use layer from the 2007 DDFC report.
2. "Commercial & Heavy Industrial" contained impervious areas under the category "Commercial" based on the City's land use layer from the 2007 DDFC report.
3. "Forest" was used as at least a cluster of trees, not individual trees along roadsides. It was calculated based on estimates from 2006 aerial imagery.
4. "Lawn" was calculated by subtracting forest, and all impervious area in the catchment from the total catchment area.
5. "Rooftops" were calculated from the City's impervious cover layer under the code "building".

6. "Driveways/Parking Lots" were calculated from the City's impervious cover layer under the code "paved"
7. "Other Impervious" was calculated from the City's impervious cover layer under the code "other"
8. "Road" was calculated based on roads that were part of the City's secondary roads layer. This layer was a polyline, areas of the roads were determined by creating polygons based on 2006 aerial imagery.
9. "Sidewalk" was calculated based on the City's sidewalk layer. This layer was a polyline, areas of the sidewalks were determined by creating polygons based on 2006 aerial imagery.
10. "All Other BMPs" included a sand filter at Durham Center for Senior Life and a two other sand filters and a bioretention area at Cobb Warehouse in West Village. The areas of these BMPs were calculated based on Stormwater Facility Agreement<sup>2</sup> documents found through Durham County Register of Deeds.

### Drainage Areas

#### *Assumptions*

1. The drainage areas of the existing BMPs were calculated based on topography and stormwater drain GIS layers.

### BMPs

#### *Assumptions*

1. The time of concentration was 39 minutes, based on the City's 2007 DDFC report.

### **Downtown Catchment – Wet Pond**

All assumptions are the same as in the existing land use scenario with the following exceptions:

#### Site Data

Area: 255.075 acres

#### *Assumptions*

1. The area of the catchment was expanded to include the area of the wet pond at the DDFC site.

## Land Use

### *Assumptions*

1. The area and depth of the wet pond BMP were calculated based on NC DWQ guidelines<sup>3</sup>. The size of the BMP is an estimate, but has been validated as a good estimate by an engineer who had done some work on the project.

### **Downtown Catchment – Wet Pond, Green Roofs**

All assumptions are the same as in the wet pond scenario with the following exceptions:

#### Land Use/BMPs

### *Assumptions*

1. The area of the green roofs included all commercial and industrial properties with rooftops greater than 1000 ft<sup>2</sup>. This is a fairly arbitrary measure; slope of the roofs should also be taken into account when deciding suitability for this type of BMP. Additionally, smaller rooftops may also be suitable for this type of BMP, depending on cost and percentage volume reduction that could be achieved.
2. I used the SET estimate for storage volume of the green roofs.

### **Downtown Catchment – Wetland, Green Roofs**

All assumptions are the same as in the wet pond, green roofs scenario with the following exceptions:

#### Land Use/BMPs

1. The stormwater wetland was the same surface area as the wet pond, but I assumed that it was only 3 feet deep
2. I used the SET estimate for storage volume for the wetland

### **SET Tool – Trinity Catchment – Existing Land Use**

All assumptions are the same as in the Downtown Catchment- Existing Land Use with the following exceptions:

#### Site Data

Area: 219.8 acres

Soils: 4% Group C, 96% Group D

### *Assumptions*

1. Area of the catchment was calculated based on topography, stormwater drain and pipe network, and New Hope Creek, Ellerbe Creek Watershed divide (USGS Huc data). Methodology was consistent with 2007 DDFC report.
2. Soil Hydrologic Groups were calculated based on soil layers dataset and information from USDA's soil data mart

### Land Use/BMPs

#### *Assumptions*

1. "Residential & Light Industrial" was based on Durham's zoning codes: "residential high, medium & low density", "downtown design support 2", "office institutional" and "institutional"
2. "Commercial & Heavy Industrial" was based on Durham's zoning codes: "downtown design core" and "downtown support 1"
3. "other BMPs" included a sand filter and a bioretention area at West Village – Liggett Warehouse. BMP areas were calculated based on Stormwater Facility Agreement documents found through Durham County Register of Deeds.
4. Time of concentration was estimated based on trends observed during stormwater monitoring. It was set at 60 minutes.

### **Trinity Catchment – Wet Pond**

All assumptions are the same as in the downtown catchment wet pond scenario with the following exceptions:

#### Site Data

#### *Assumptions*

1. Area was set at 222.2 acres to account for the addition of the BMP at the DDFC site

All assumptions for the "wet pond, green roofs" and "wetland, green roofs" scenarios are the same as in the Downtown Catchment.

## Jordan Lake Tool – Downtown Catchment – Existing Land Use

### Watershed Characteristics

Site Area: 254.4 acres

Geologic Region: Triassic Basin

Soil Hydrologic Group: D

Precipitation Location: Carrboro

Time of Concentration: 30 minutes

### *Assumptions*

1. Site area was calculated based on the 2007 DDFC report.
2. Geologic region was set based on a map of North Carolina provided in the model
3. The majority of the site was group D, so I selected that category
4. Durham was not an option for precipitation location so I chose nearby Carrboro
5. The closest category to the actual time of concentration (39 minutes) was 30 minutes.

### Non- Residential Land Use

6. "Commercial" contained impervious areas under the category "Commercial" based on the City's land use layer from the 2007 DDFC report.
7. "Industrial" contained impervious areas under the category "Industrial" based on the City's land use layer from the 2007 DDFC report.
8. "Roof" contained impervious areas coded as "building" in the City's impervious cover layer.
9. "Parking Lot" contained impervious areas coded as "paved" and "other" in the City's impervious cover layer.
10. "High Density Roads" included the areas calculated for Chapel Hill Street, Main Street, Mangum Street and Morgan Street within the commercial land use zone. These roads were considered high density based on my knowledge of traffic patterns in Durham. All roads were calculated based on roads that were part of the City's secondary roads layer. This layer was a polyline, areas of the roads were determined by creating polygons based on 2006 aerial imagery.
11. "Low Density Roads" included all other roads in the commercial district + 76% of the roads in the industrial/residential zone. 76% of this area was estimated to be industrial.

12. "Sidewalk" included all sidewalks in the commercial zone + 76% of the sidewalks in the industrial residential zone. 76% of this area was estimated to be industrial. Sidewalks were calculated based on sidewalks that were part of the City's sidewalk layer. This layer was a polyline, areas of the sidewalks were determined by creating polygons based on 2006 aerial imagery.
13. "Forest" was used as at least a cluster of trees, not individual trees along roadsides. It was calculated based on estimates from 2006 aerial imagery. Forest for non-residential land use was estimated to be 66% of the forest cover layer.
14. "Managed Pervious" was calculated by subtracting forest, and all impervious area in the catchment from the total catchment area. It was estimated to be 66% of the total managed pervious layer.
15. "Land Taken Up by BMPs" included existing BMPs in the watershed

#### Residential Land Use

16. "Residential" contained impervious areas under the category "Residential" based on the City's land use layer from the 2007 DDFC report.
17. "Lawn" was calculated by subtracting forest, and all impervious area in the catchment from the total catchment area. It was estimated to be 33% of the total managed pervious layer.
18. "Forest" was used as at least a cluster of trees, not individual trees along roadsides. It was calculated based on estimates from 2006 aerial imagery. Forest for residential land use was estimated to be 33% of the forest cover layer.
19. "Roadway" was 24% of the roads in the industrial/residential zone.
20. "Sidewalk/Patio" was 24% of the sidewalks in the industrial/residential zone.
21. "Driveway" was 50% of the "paved + other" impervious cover for residential land use.
22. "Parking Lot" was 50% of the "paved + other" impervious cover for residential land use.
23. "Roof" was the area coded as "building" in the City's impervious cover for residential land use.
24. Categories like "Forest", "Managed Pervious/Lawn", "Roads" and "Sidewalks" were estimated as percentages because these layers were calculated for combined industrial and residential land uses. Every category except for Managed Pervious/Lawn had the same nutrient loads for non-residential and residential land use categories. My assumption was that non-residential pervious area was "managed pervious" and that residential pervious area was "lawn".

#### BMPs

### *Assumptions*

1. Existing BMPs were based on the City's BMP dataset. Area of each BMP was assumed to be the same as it was in the Stormwater Facility Agreement documents found through Durham County Register of Deeds.
2. Drainage area for each BMP was calculated based on topography and stormwater drain GIS layers.

### **Downtown Catchment – Wet Pond**

All assumptions are the same for the existing land use scenario with the following exceptions:

1. Total area was changed to 255.08 acres to account for the Wet Pond BMP at the DDFC site.
2. The area and depth of the wet pond BMP were calculated based on NC DWQ guidelines. The size of the BMP is an estimate, but has been validated as a good estimate by an engineer who had done some work on the project.

### **Downtown Catchment – Wet Pond, Green Roofs**

All assumptions are the same for the Wet Pond scenario with the following exceptions:

1. The area of the green roofs included all commercial and industrial properties with rooftops greater than 1000 ft<sup>2</sup>. This is a fairly arbitrary measure; slope of the roofs should also be taken into account when deciding suitability for this type of BMP. Additionally, smaller rooftops may also be suitable for this type of BMP, depending on cost and percentage volume reduction that could be achieved.

### **Downtown Catchment – Wetland, Green Roofs**

All assumptions are the same for the Wet Pond, Green Roofs scenario with the following exceptions:

1. The stormwater wetland was the same surface area as the wet pond, but I assumed that it was only 3 feet deep.

## **Jordan Lake Tool – Trinity Catchment – Existing Land Use**

All assumptions are the same as the Downtown Catchment Existing Land Use scenario with the following exceptions:

### Watershed Characteristics

Area: 219.8 acres

Time of Concentration: 60 minutes

### *Assumptions*

1. Catchment area was calculated based on topography, stormwater drain and pipe network, and New Hope Creek, Ellerbe Creek Watershed divide (USGS Huc data). Methodology was consistent with 2007 DDFC report.
2. Time of Concentration was estimated based on trends observed during stormwater monitoring.

### Land Use

1. "Commercial" was based on Durham's zoning codes: "downtown design core" and "downtown support 1"
2. "Industrial" was based on Durham's zoning codes: "downtown design support 2", "office institutional" and "institutional"
3. "Residential" was based on Durham's zoning codes: "residential high, medium and low density"
4. Separate layers were created for previously shared categories "Roads", "Sidewalks" and "Forest".
5. Pervious area in non-residential land use was assumed to be "Managed Pervious". Pervious area in residential land use was assumed to be "Lawn"
6. "High Density Roads" included Main Street, Morgan Street, Gregson Street and Duke Street within the commercial land use zone. This was based on my knowledge of Durham's traffic patterns.
7. Some roads bordering industrial and residential areas were given an industrial classification. These roads are: Buchannan Blvd, Gregson and Duke Streets. Other roads were given a residential classification. These roads are: Watts Street and Trinity Avenue. Again, this was based on my knowledge of Durham's traffic patterns.



## **Trinity Catchment – Wet Pond**

All assumptions are the same as the Existing Land Use scenario with the following exceptions:

1. Site area was expanded to 222.21 acres to account for the addition of the Wet Pond at the DDFC site.

All assumptions for the “wet pond, green roofs” and “wetland, green roofs” scenarios are the same as in the Downtown Catchment.

## Sources

1. Preliminary Analysis Report for the Duke Diet & Fitness Center Stormwater Culvert. City of Durham Public Works Department. March 27, 2007.
2. State of North Carolina Stormwater Facility Agreement. City of Durham Public Works Department. June 15, 2007.
3. NC DENR Stormwater BMP Manual. Chapter 10: Wet Detention Basin. Revised: June 16, 2009.