City of Doral

Stormwater Vulnerability Assessment Final Report

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City of Doral Stormwater Vulnerability Assessment
Final Report

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1.0 INTRODUCTION

1.1 Background

The City of Doral (City) was incorporated in 2003, is located geographically in the western-central portion of Miami-Dade County and comprises a total area of approximately 14.9 square miles. The City is roughly bounded by NW 90th Street to the north, the Florida Turnpike to the west, State Road 836 (Dolphin Expressway) to the south, and State Road 826 (Palmetto Expressway) to the east. **Figure 1.1** depicts the City limits.

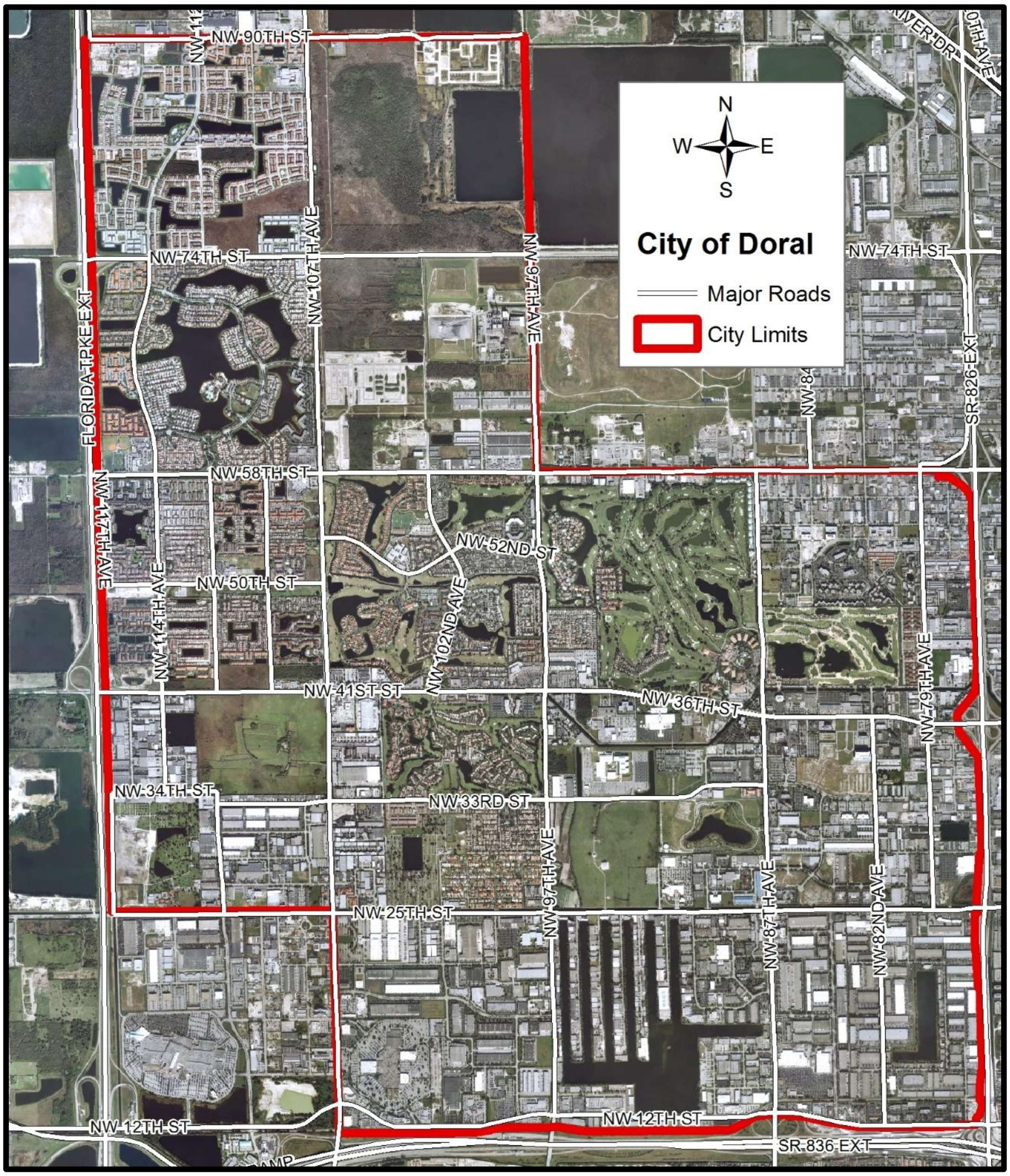


Figure 1.1 –City of Doral Limits

1.2 Purpose

A.D.A. Engineering, Inc. (ADA) was contracted by City of Doral (City) under the General Engineering/Architectural Services (RFQ 2017-21) agreement between the City and ADA to perform a stormwater vulnerability assessment. This vulnerability assessment focuses on evaluating the potential impacts to the City's primary stormwater management infrastructure due to the predicted groundwater rise within the City, based on the projected sea level rise (SLR) within Miami-Dade County.

1.3 Scope of Work

The Scope of Work is divided into the following three tasks.

Task 1 – Data Collection and Evaluation: This task includes collecting and evaluating data provided by the City, including GIS shapefiles for the stormwater infrastructure, the latest high-resolution aerials, and other pertinent GIS data/coverages of the City's stormwater management systems to support the development of the Doral Stormwater Vulnerability Assessment Report. This task also includes collecting and evaluating available data from other entities such as Miami-Dade County, the United States Geological Survey (USGS) and other entities with relevant available data.

Task 2 – Groundwater Rise Risk Assessment: This task uses the available data collected as part of Task 1 and projected groundwater rise within the City for the selected SLR planning horizon (2050) to perform vulnerability analyses for the following key stormwater management assets within the City:

- Exfiltration trenches,
- Drainage swales, and
- Excess stormwater runoff volume from City stormwater sub-basins.

The exfiltration trench analysis includes an exfiltration volume reduction estimation for each of the City's stormwater sub-basins based on the potential reduction of the exfiltration trenches' hydraulic head that will be observed with the projected groundwater rise. The drainage swale analysis evaluates the swales that currently meet or do not meet the one-foot clearance above average October water table elevation for allowable infiltration. Then, the swales are re-evaluated to determine the additional number of swales that will not meet the one-foot clearance requirement for the projected groundwater rise. The excess stormwater runoff of each sub-basin within the City will be estimated based on the soil storage reduction due to the projected groundwater rise. This assessment will summarize the additional stormwater runoff that the City's stormwater infrastructure will have to convey in the future.

Task 3 – Doral Stormwater Vulnerability Assessment Report: This task includes preparing a draft and final Stormwater Vulnerability Assessment Report summarizing the findings of Tasks 1 and 2.

2.0 DATA COLLECTION AND EVALUATION

Available data was collected from the City, Miami-Dade County and USGS. A catalog of all the available data collected is summarized in **Attachment A**. The following section describes the details of the key data collected and any data processing done to make it useable for the intended tasks.

2.1 City of Doral

2.1.1 Right of Way Maintenance Maps

The City provided three Right of Way Maintenance maps that indicate which streets have swales that the City maintains. Since the PDF maps provided were too coarse to directly determine swale locations, ADA digitized swale locations in GIS by using a combination of the PDF Right-of-Way maps and Google Maps Street View to estimate specific swale locations.

2.1.2 As-Built Data

The as-built data for completed stormwater improvement projects provided by the City are described in **Attachment A**. The as-builts were used for the exfiltration trench analysis portion of the vulnerability assessment. Average geometries, depths, and general exfiltration trench design criteria were extracted from the available data to establish exfiltration volume estimates.

2.1.3 Geotechnical Reports

In order to establish hydraulic conductivity values (k-values) for use in exfiltration trench calculations, percolation test results from projects throughout the City were provided. The drainage and geotechnical reports provided by the City are summarized in **Attachment A**.

2.1.4 GIS Data

Several stormwater-related GIS shapefiles were provided by the City and available from Miami-Dade County. The two key shapefiles used for this assessment study include:

1. A contour shapefile for the average October ground water elevation in feet relative to the National Geodetic Vertical Datum of 1929 (ft-NAVD29). **Figure 2.1** shows these average October water table contour lines. This shapefile is available from Miami-Dade County.
2. A polyline shapefile of the exfiltration trench data was provided by the City. The attribute table includes the diameter and length of the exfiltration trench, and in some cases the year of installation. However, the exfiltration trench database did not include the depth of trench, width of trench or hydraulic conductivity for soils in the vicinity of the trenches.

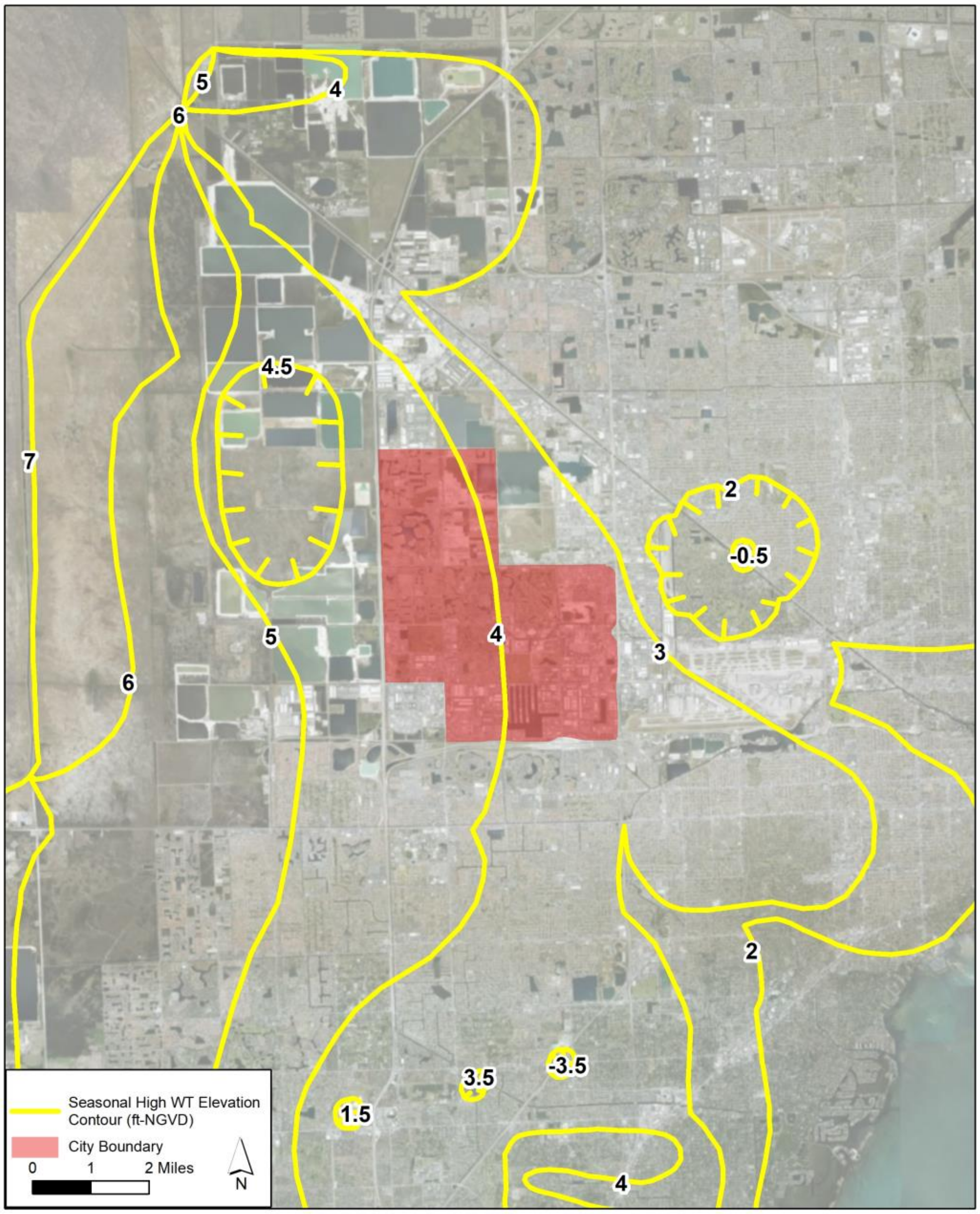


Figure 2.1 – Average October Elevation Contours (FT-NGVD29)

2.2 Data from Other Sources

2.2.1 United States Geological Survey (USGS)

The study performed by USGS in cooperation with the Miami-Dade Water and Sewer Department (*Hydrologic Conditions in Urban Miami-Dade County, Florida, and the Effect of Groundwater Pumpage and Increased Sea Level on Canal Leakage and Regional Groundwater Flow, Version 1.2 July 2016*) estimated groundwater rise conditions in the region. **Figure 2.2** shows the figure from the USGS report of the change in water-table elevations from one foot of sea level rise for projected sea level rise in 2045. The figure can be used to estimate the amount of groundwater rise in the City for future sea level conditions.

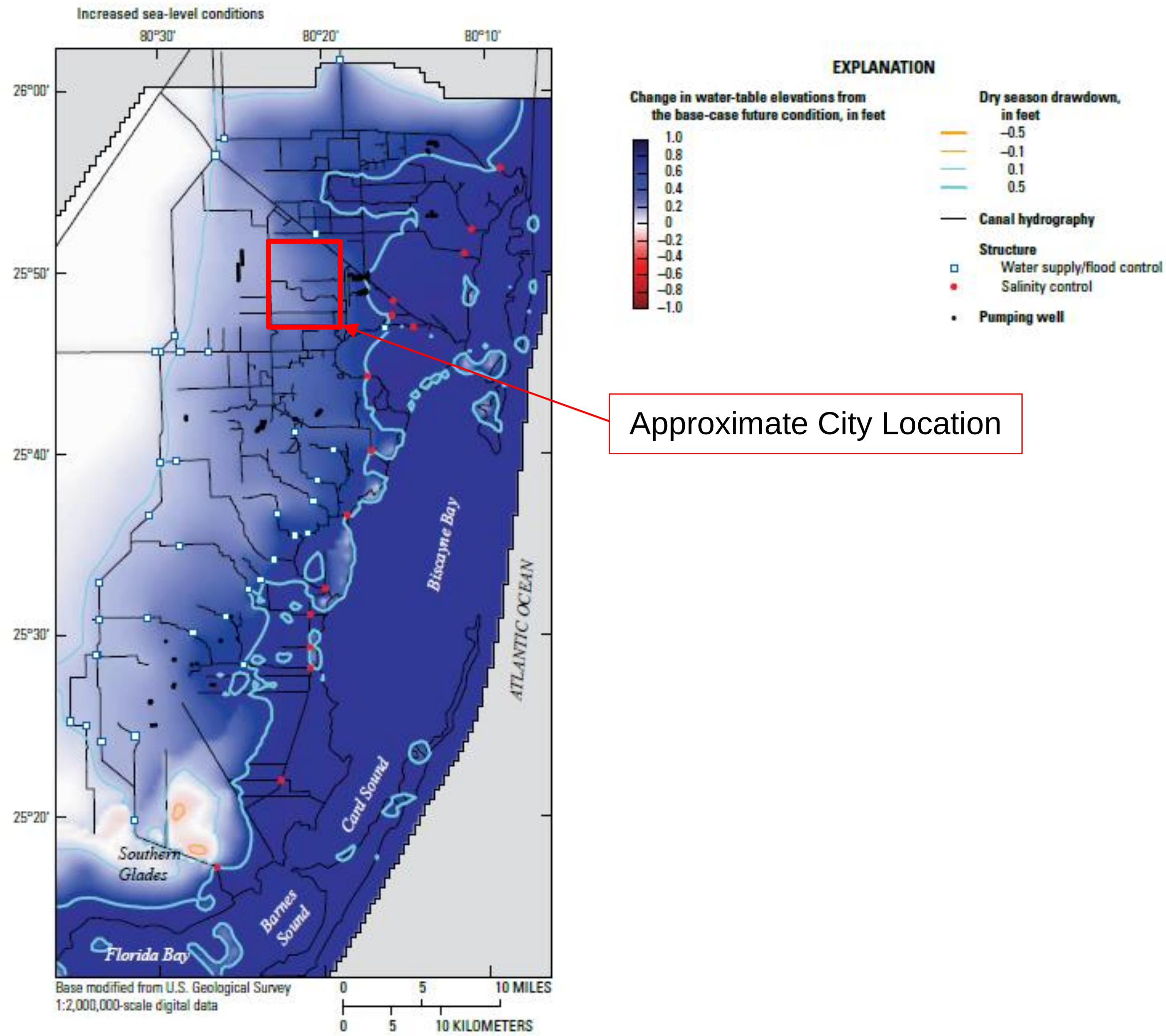


Figure 2.2 – Hydrologic Conditions and Effect of Pumpage and Sea Level on Canal Leakage and Groundwater Regional Flow

2.2.2 South Florida Water Management District (SFWMD)

The Environmental Resource Permit (ERP) Applicant's Handbook Volume II (2014) from the Regulation Division of SFWMD was downloaded from sfwmd.gov. It contains values for soil storage based on the depth to the water table as well as the minimum design bottom elevation for a swale based on depth to the water table.

2.2.3 Natural Resources Conservation Service (NRCS)

The publication *Urban Hydrology for Small Watersheds TR-55* by the United States Department of Agriculture (USDA) NRCS contains calculations for runoff based on precipitation and soil storage with the Soil Conservation Service (SCS) Curve Number (CN) method. The publication also contains average velocities for estimating travel time for shallow concentrated flow based on the watercourse slope.

2.2.4 Florida Department of Transportation (FDOT)

FDOT – District 6 Exfiltration Trench Reference Manual (ETRM) report contains equations and methods to calculate the exfiltration capacity of an exfiltration trench. Using these equations, the primary parameters used to calculate the exfiltration rate of an exfiltration trench are the hydraulic conductivity (k), the elevation of the design high water (DHW), the depth of the trench, and the control elevation.

Depending on the elevation of the DHW and the control elevation, different equations are used. In Miami-Dade County, the DHW is established based on the average October groundwater elevation. The following two scenarios from the FDOT District 6 ERTM are applicable to the subsequent tasks of assessing the City's exfiltration trench vulnerability:

- Scenario 2 pertains to exfiltration trench in which the DHW and control elevations are both above the aggregate media.
- Scenario 3 pertains to exfiltration trench in which the DHW is within the aggregate media* and the control elevation is above the aggregate media.
  **Aggregate media is the fill material for the trench that allows for water to readily exfiltrate.*

Attachment B describes the equations associated with each scenario in greater detail.

2.2.5 Southeast Florida Climate Change Regional Compact

The *Unified Sea Level Rise Project for Southeast Florida (2015)* contains three global curves adapted for regional application as shown in **Figure 2.3**. The USACE High Curve from this study was chosen for application to the subsequent tasks because the City agreed that the planning horizon for this vulnerability study is year 2050, and this curve is intended for use for the short-term until 2060.

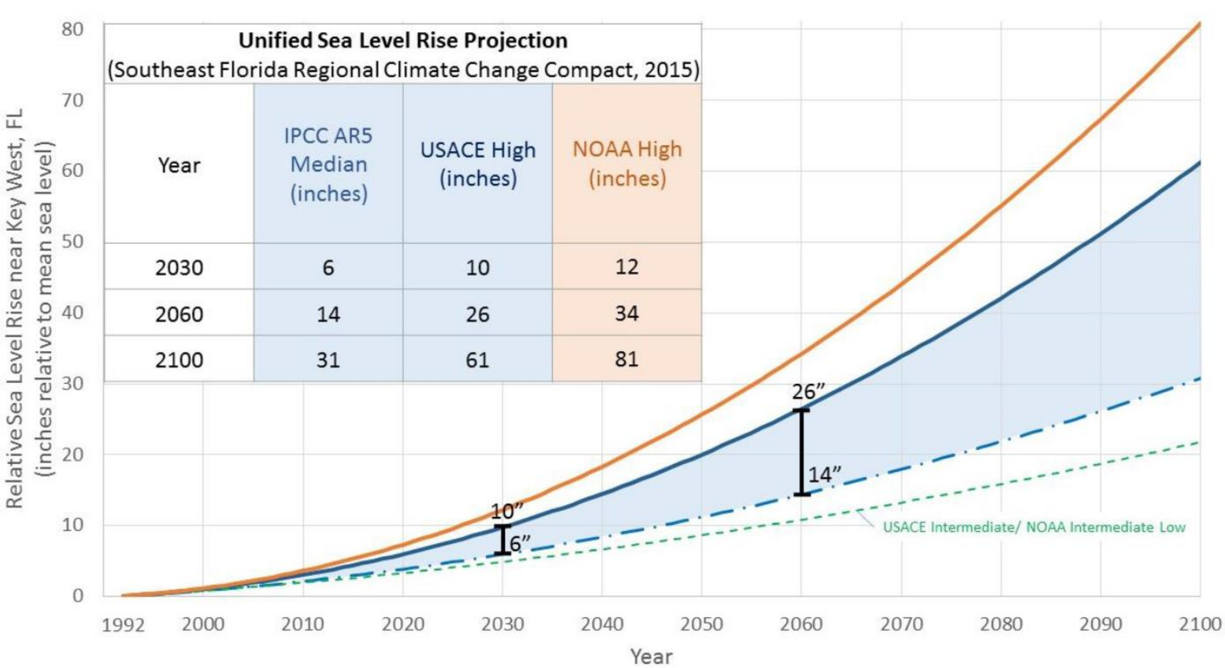


Figure 2.3 – Unified Sea Level Rise Projections for Southeast Florida (2015)

3.0 GROUNDWATER RISE RISK ANALYSIS

The following groundwater rise vulnerability analyses use sub-basin averages for several hydrologic and hydraulic parameters. The sub-basins referenced in these analyses are those delineated in the City of Doral Stormwater Master Plan (2014). **Figure 3.1** displays the locations and names of the City's sub-basins.

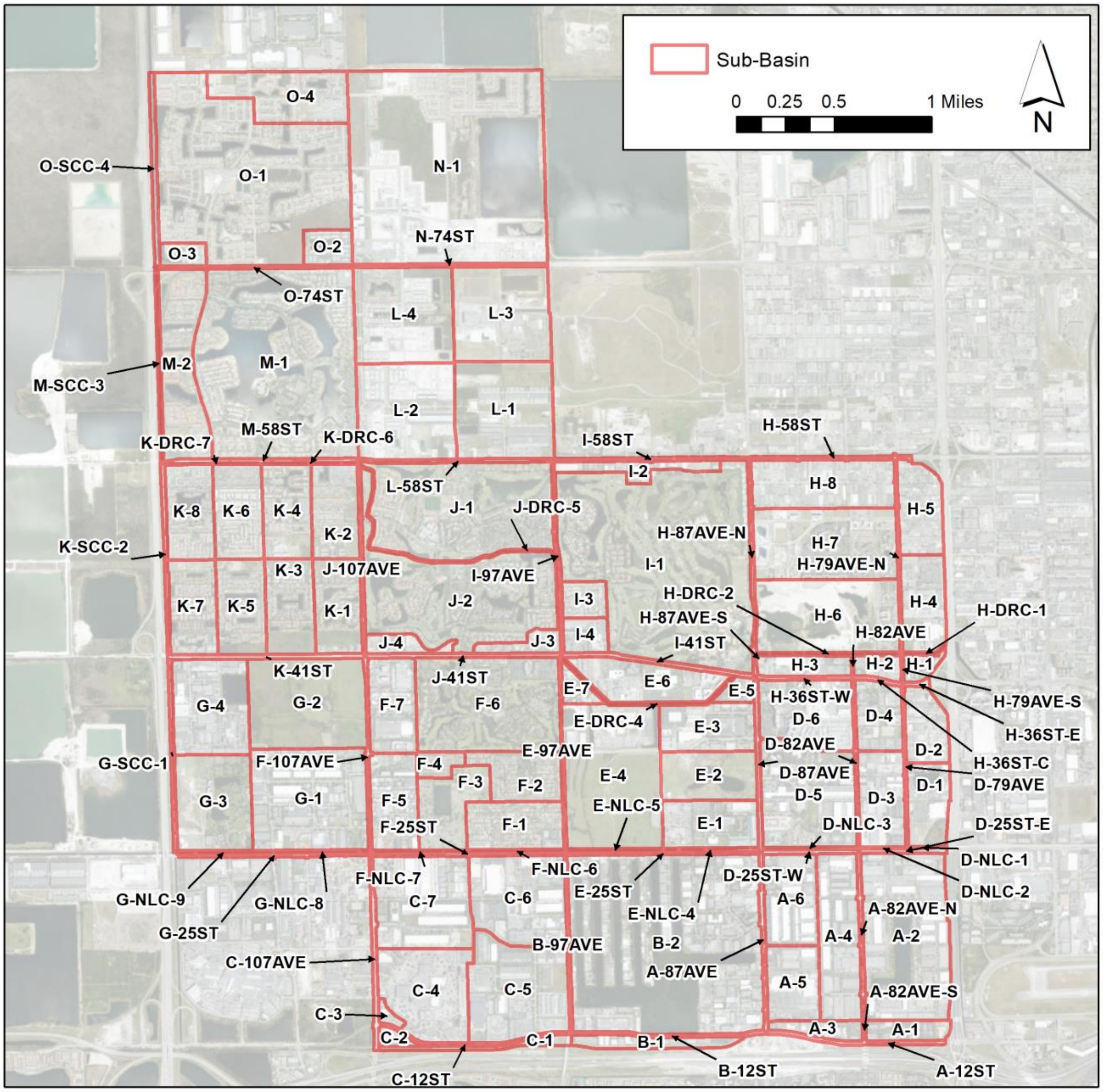


Figure 3.1 – City of Doral Sub-basins Map

The following sections detail the vulnerability assessment that was performed for the following key City stormwater management assets, based on the projected groundwater rise for a 2050 sea level rise planning horizon: exfiltration trenches, drainage swales, and excess stormwater runoff volume from City stormwater sub-basins

3.1 Groundwater Rise Analysis

Most stormwater infrastructure performance depends on the depth to the water table. The following sub-sections describe a groundwater rise analysis performed in order to develop a spatial coverage of depths to the water table for both current and year 2050 conditions.

3.1.1 Present Average October Elevations

Using the contours described in **Section 2.1.4**, ADA developed a continuous raster coverage of the currently accepted average October water table elevation. The ArcGIS "Topo to Raster" function was used to develop the coverage, and the coverage was converted from the ft-NGVD29 vertical datum to the North America Vertical Datum of 1988 (NAVD88) vertical datum by subtracting 1.5 feet across the entire raster coverage. **Figure 3.2** shows the average October elevation contour lines (yellow) that were provided by Miami-Dade County as well as the continuous raster coverage of the average October elevation that was developed by ADA.

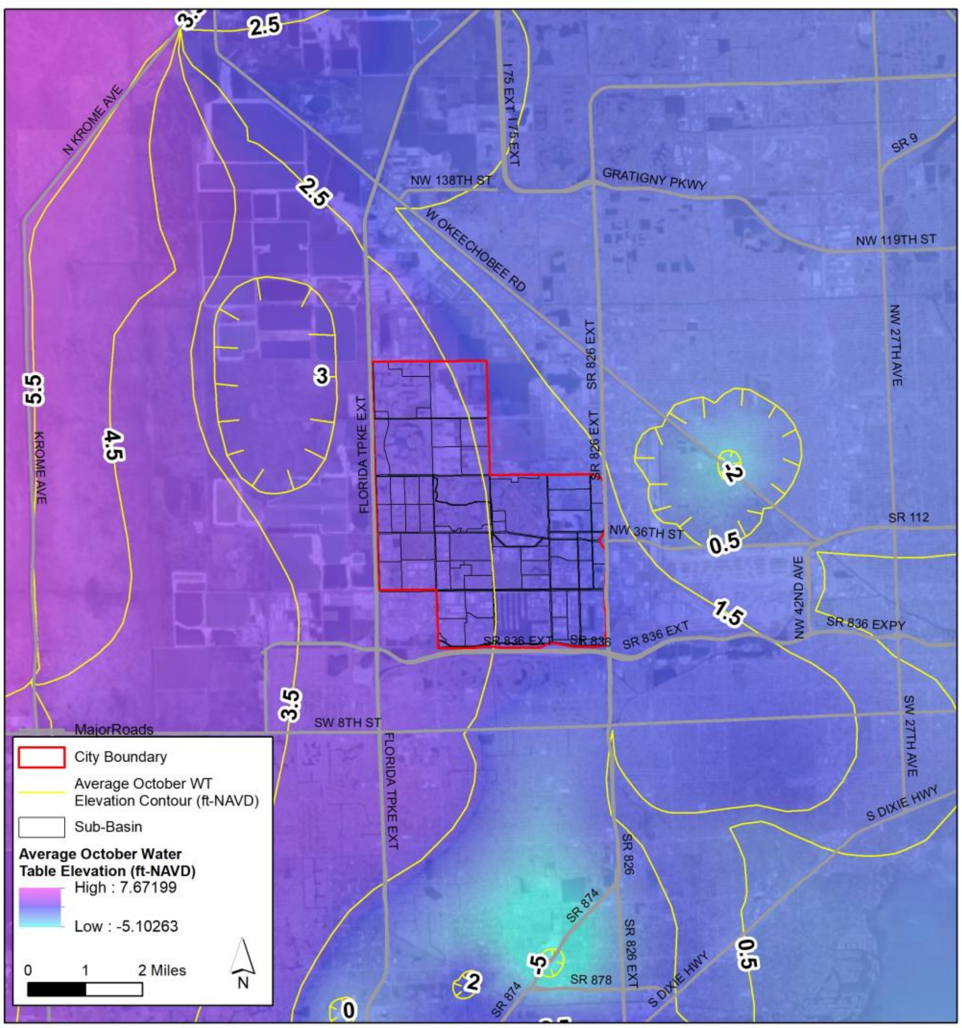


Figure 3.2 – Current Average October Elevation (ft-NAVD88)

Using the raster coverage of the average October Elevation, an average value for each sub-basin was calculated. These values are listed for each sub-basin in **Attachment E**.

3.1.2 Sea Level Rise Estimation from Present to 2050

Using the figure from **Section 2.2.5** that describes the Unified Sea Level Rise Projections for Southeast Florida, it is estimated that approximately 14 inches (1.17 feet) of sea level rise will occur between 2020 and 2050. **Figure 2.3** shows the graph from which this value was estimated. The *Unified Sea Level Rise Projections for Southeast Florida (2015)* report contains three global curves adapted for regional application. The USACE High Curve from the study was chosen for application to the tasks of this vulnerability study because the City of Doral agreed that the planning horizon for this vulnerability study is year 2050, and this curve is intended for use for the short-term until 2060.

3.1.3 2050 Projected Average October Elevations

Using the figure from the USGS report described in **Section 2.2.1**, contours were drawn using ArcGIS to represent the amount of groundwater rise anticipated by the USGS report for one foot of sea level rise. **Figure 3.3** shows the contours of groundwater rise estimated for one foot of sea level rise which based on the USACE high curve in **Figure 2.3** will happen around 2045.

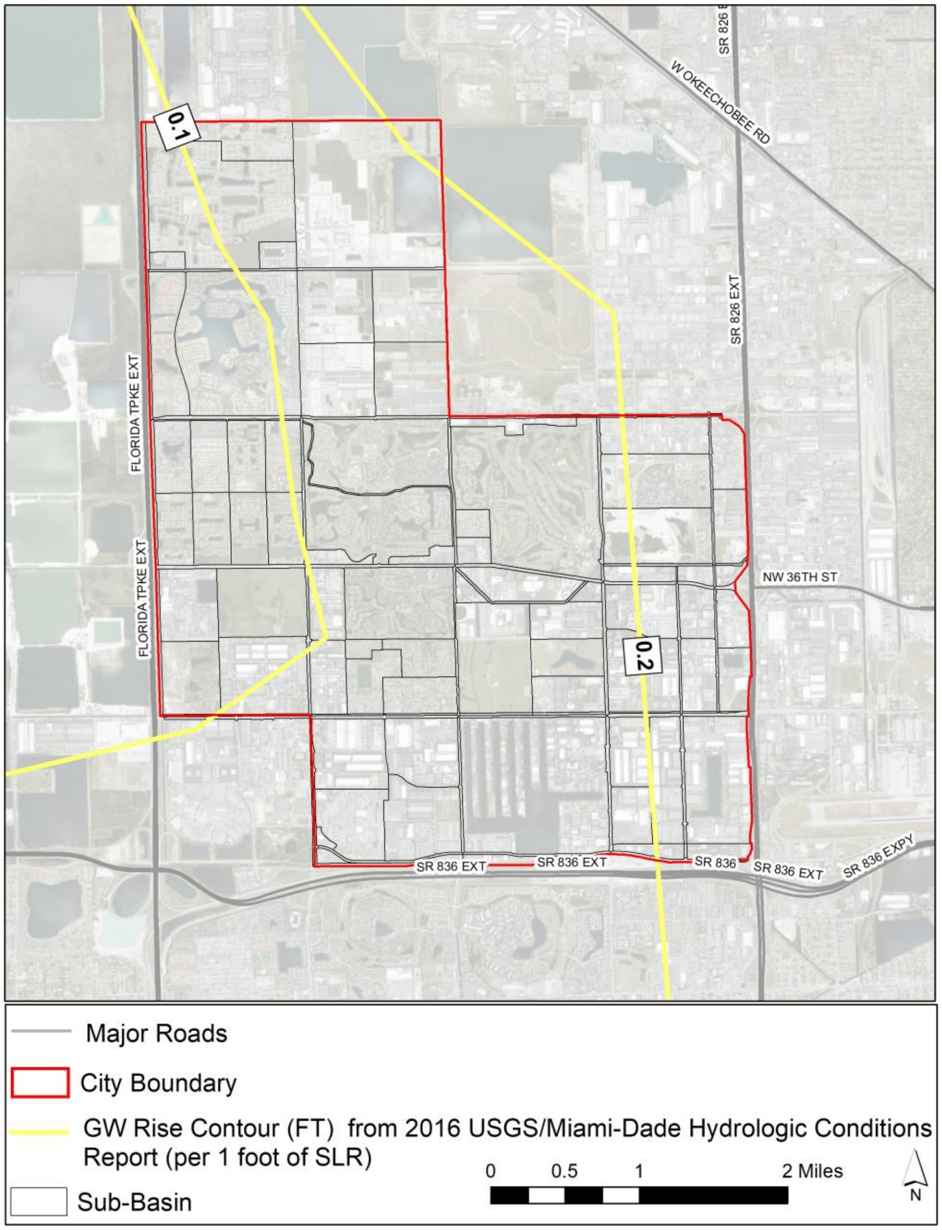


Figure 3.3 – October Average Groundwater Rise Contours with One Foot of Sea Level Rise

In order to estimate groundwater rise for 1.17 feet of sea level rise described in **Section 3.1.2**, 0.17 feet were added to the contours described on **Figure 3.3**, and polygons were drawn to delineate a continuous spatial coverage for groundwater rise within the City. The contours in **Figure 3.3** describe the outcome of one foot of sea level rise, whereas the estimated value of sea level rise for year 2050 is 1.17 feet. In order to account for the difference, 0.17 feet were added to the ground water rise contours. **Figure 3.4** shows the spatial coverage of estimated groundwater rise for 1.17 feet of sea level rise. **Attachment E** lists the estimated groundwater rise values for each sub-basin based on the spatial coverage.

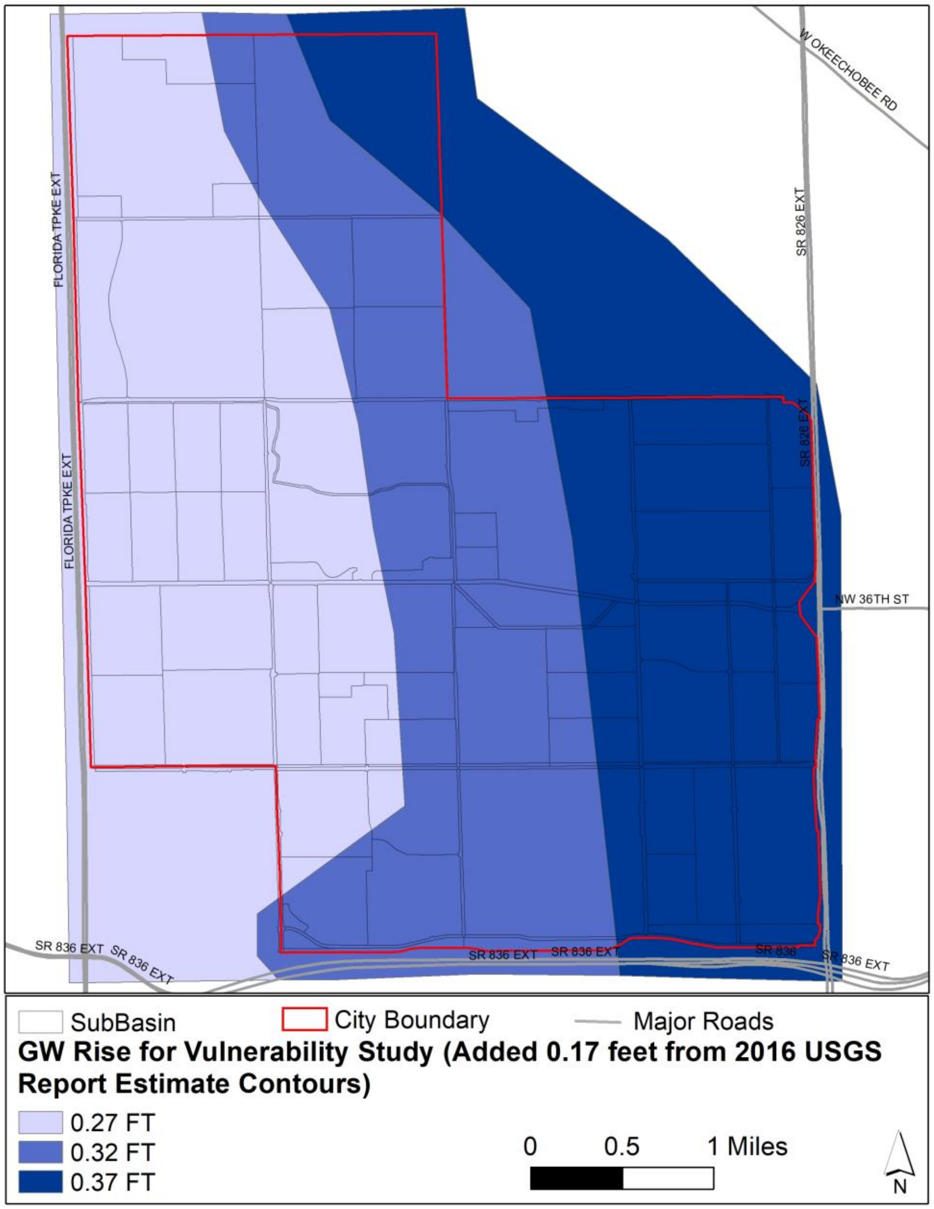


Figure 3.4 – 2050 Groundwater Rise Estimate for City

By adding the groundwater rise values for each sub-basin to the existing conditions average October elevation for each sub-basin, a value for the estimated 2050 average October elevation was obtained for each sub-basin. The sub-basins are outlined in **Figure 3.4**. **Attachment E** lists the estimated average October elevations for 2050 for each sub-basin.

3.2 Exfiltration Trenches

Exfiltration trenches are designed to exfiltrate excess stormwater runoff from rainfall events to meet the required roadway flood protection level of service. For City of Doral roads, the flood protection level of service is established based on a 5-year, 24-hour design rainfall event for secondary roads and a 10-year 24-hour design rainfall event for primary roads. Any reduction in extraction volume capacity will impact the City's roadway flood protection level of service. If groundwater rises due to SLR or other conditions, the exfiltration trench capacity will be reduced because the exfiltration hydraulic head will be reduced. The exfiltration volume reduction for the projected groundwater rise for a 2050 SLR planning horizon was estimated for each of the City's stormwater sub-basins.

Exfiltration calculation parameters were averaged on a by-sub-basin basis. After examining as-builts from recent exfiltration trench projects within the City, it was assumed that the bottoms of the exfiltration trenches are generally 15 ft below the ground surface, and the tops of the exfiltration trenches are approximately 2 ft below the ground surface. Percolation tests from recent exfiltration trench construction projects were examined for their hydraulic conductivity (k) values. These k-values were entered as a spatial dataset in ArcGIS to later create a continuous raster coverage of k-values for the City based on this available information. **Figure 3.5** shows the k-value points as well as the continuous raster coverage developed by ADA.

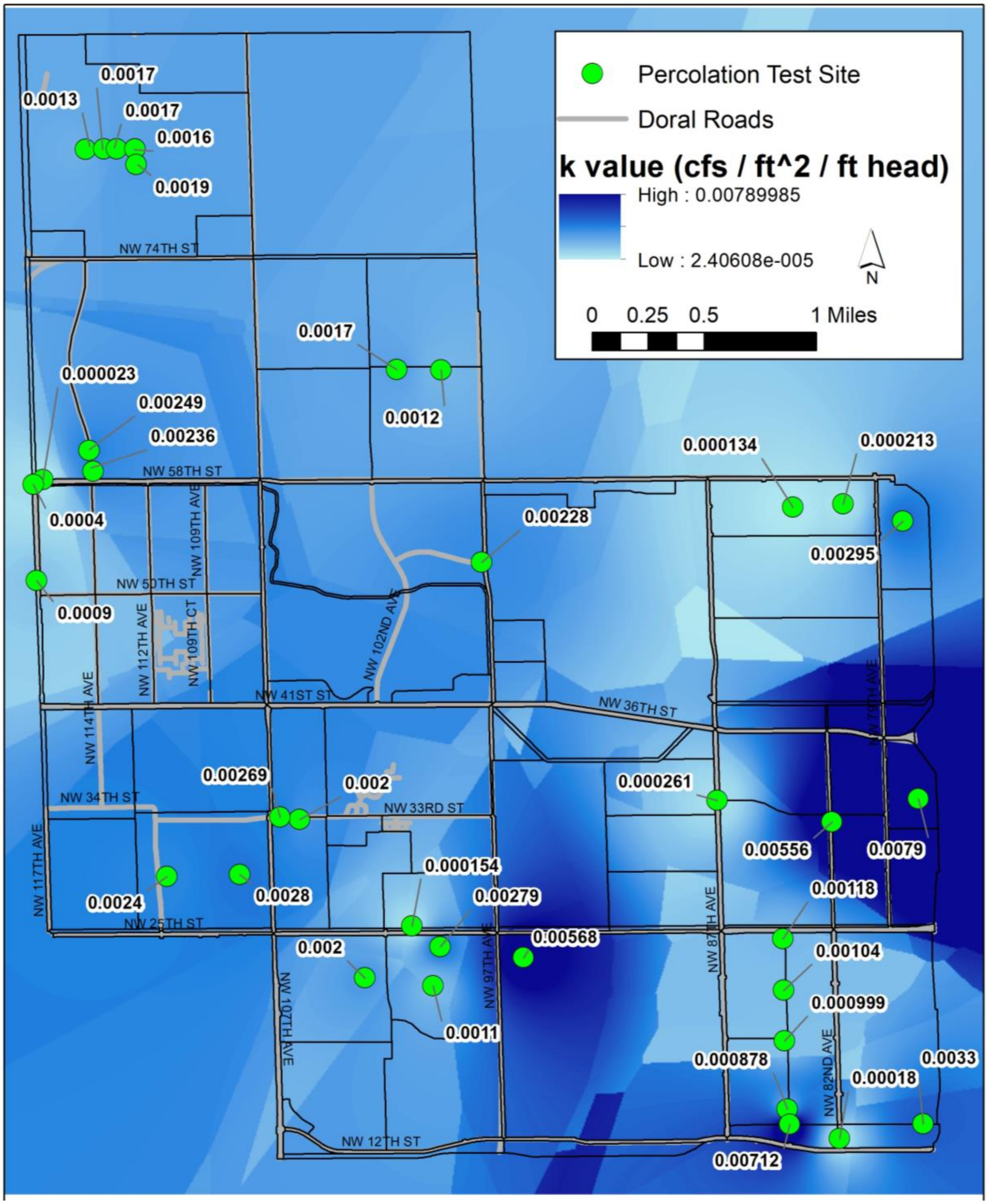


Figure 3.5 – Percolation Test Values

Attachment C contains the detailed calculations for determining the exfiltration reduction with projected groundwater rise. Equations for exfiltration rates are from the FDOT – District 6 ETRM previously described in **Section 2.2.4**. Average exfiltration rates for each sub-basin for current and future predicted design high water (DHW) conditions were first calculated using the average ground elevation in the sub-basin, the average DHW elevation in the sub-basin, the average k-value in the sub-basin, and the estimated geometry of the trench. After the average exfiltration rates for pre- and post- groundwater rise conditions for each sub-basin were calculated, a percent decrease in exfiltration rate capacity was calculated.

Overall, approximately 8.2% of exfiltration trench volume within the City is lost with the projected groundwater rise. **Attachment C** describes the percentage of exfiltration rate that is lost per sub-basin with the predicted groundwater rise for a 2050 planning horizon.

3.3 Drainage Swales

According to the SFWMD ERP Applicant's Handbook Volume II, dry retention/detention swales are designed to have a bottom elevation at least 1 foot above the DHW or average October elevation to meet the required water quality retention requirements. This allows for adequate unsaturated zone to infiltrate excess stormwater runoff and meet the required dry retention water quality treatment. If groundwater rises due to SLR or other conditions, and the bottom of the swales are less than 1 foot above the DHW, then the swales will not meet the dry retention requirements and will not be considered to meet the water quality requirements.

Therefore, using the SFWMD swale design criteria, the digitized swale coverage, the LiDAR DEM, the current average October elevations, and the groundwater rise coverage, the swale vulnerability to groundwater rise was estimated City-wide.

ArcGIS functions were used to associate a ground elevation, a current groundwater elevation, and a predicted 2050 groundwater elevation with each 10-ft segment of swale within the City. **Table 3.1** and **Table 3.2** describe the amount of swale that is predicted to be at least 1 foot above the average October water table with current groundwater conditions as well as with predicted 2050 groundwater conditions, respectively. **Attachment D** shows maps of the citywide coverage of swales and the distance to the groundwater for both current and predicted 2050 conditions. The total amount of swale that does not meet the swale design criteria of 1 ft above the average October water elevation for estimated 2050 groundwater rise conditions is approximately 0.5 miles (6% of total City's swale length) and is also illustrated in **Attachment D**.

Table 3.1 – Swale Performance Summary for Current Groundwater Conditions

Swale Description	Percentage of City's Total Swale Length	Length (mi)
Swale is at least 1 foot above the average October water table elevation	97%	8.7
Swale is less than 1 foot above the average October water table elevation	3%	0.2

Table 3.2 – Swale Performance Summary for Estimated 2050 Groundwater Conditions

Swale Description	Percentage of City's Total Swale Length	Length (mi)
Swale is at least 1 foot above the average October water table elevation	94%	8.4
Swale is less than 1 foot above the average October water table elevation	6%	0.5

3.4 Excess Stormwater Runoff Volume

Excess stormwater runoff for a given rainfall event is based on the amount of impervious area and available soil storage within the pervious areas. The City's stormwater management systems are designed to accommodate the excess stormwater runoff to meet the applicable flood protection level of service of the City's infrastructure. The soil storage within the pervious areas throughout the City could be reduced if the groundwater rises due to SLR or other conditions. If this occurs, the City's stormwater management systems will need to handle additional stormwater runoff, which would impact the flood protection level of service of the City's infrastructure.

Excess stormwater runoff volume was calculated for each sub-basin using the NRCS TR-55 Soil Conservation Service (SCS) runoff Curve Number (CN) Method for calculating runoff. This allows the use of soil storage and precipitation to calculate runoff volumes.

3.4.1 Precipitation Values

Design storm precipitation values are those used in the *City of Doral Stormwater Master Plan* (2014). The two design storms analyzed for runoff increase in this vulnerability assessment are the 5-year, 24-hour event and the 100-year, 72-hour event. **Table 3.3** describes the precipitation depths for the two design storms.

Table 3.3 – Design Storm Precipitation Depths

Design Storm	Precipitation Depth (in)
5-year, 24-hour	6.5
100-year, 72-hour	12.7

3.4.2 Soil Storage Parameters

In order to compare soil storage for present and future (2050) conditions several parameters from the provided data were developed.

First, the average October elevations for both present and future conditions were established for each sub-basin. For 2050 conditions, the average October elevation was established by adding the present average October elevation to a groundwater rise depth based on the USGS estimates outlined in **Section 3.1.3**. Next, a percent impervious value was assigned to each sub-basin based on the land use distribution within the sub-basin. This is because pervious area soil storage is variable and based on depth to water table whereas impervious area soil storage is constant and negligible. Finally, a pervious area curve number as well as an impervious area curve number were established for each sub-basin and the composite sub-basin curve number was calculated.

These parameters are described in greater detail in the following sections.

3.4.2.1 Percent Impervious Area

Percent impervious area was calculated using the Percentage Land Use Distribution from the 2014 *City of Doral Stormwater Master Plan.* **Attachment E** describes the percentage land use distribution for each sub-basin. Each land use has an associated percentage of impervious area as described by **Table 3.4** from the Miami-Dade County Zoning Standards.

Table 3.4 – Impervious Area Percentage Based on Land Use

Land Use Abbreviation	Description	Total Impervious Area(%)
ACCF	Row and Field Cropland.	0.01
ACCL	Horse Training and Stables.	0.01
ACCLS	Pasture (Grazing, Animal Farming, Dairy Farms and Animal Feed Lots), excluding Horse and Poultry.	0.01
AMNU	Plant Nurseries (Includes Sod Farms and Ornamental Nurseries).	0.01
TRNS	Airports (other than Military and Small Grass Airports).	82.6
UCCE	Sports Stadiums, Arenas, and Tracks.	78.42
UCHM	TRANSIENT-RESIDENTIAL (HOTEL-MOTEL)	61.53
UCPL	Ocean Ship Terminals and Port Facilities, Bay and River Based.	79.73
UCSC	Shopping Centers (Regional and Community).	82.6
UCSS	Office Building.	75.5
UIJK	Junk Yard.	74.71
UILT	Other Industrial Intensive, non-noxious.	74.55
UIIN	Industrial intensive, Commercial Condominium type of use	82.6
UOGC	Municipal Operated Parks	3
UOUN	Beaches.	0.01
URMF	Townhouses.	70.5
URMH	Mobile Home Parks and Permanent Mobile Homes.	74.93
URSL	Single-Family, Low-Density (Under 2 DU/Gross Acre).	64.62
URSM	Single-Family, Med.-Density (2-5 DU/Gross Acre).	69.63
USGF	Public Schools, Including Playgrounds (K-12, Vocational Ed., Day Care and Child Nurseries).	56.1
USMD	Hospitals, Nursing Homes and Adult Congregate Living Quarters.	59.72
USRL	Houses of Worship and Religious.	64.62
UTAP	Small Grass Airports (Includes Crop Dusting Activities).	27
UTEP	Extraction, Excavation, Quarrying, Rock-Mining, excluding the resulting water body (see 917).	27
W	Fish Farms (Includes Tropical Fish Aquariums, Fish and Alligator Farms).	100

In order to calculate the sub-basin's total impervious area, each sub-basin's land use percentage was multiplied by its associated percent impervious. This product was summed to calculate each sub-basin's total impervious area percentage. **Equation 3-1** describes the percentage impervious calculation for each sub-basin.

$$\%imp = \%LU_1 * \%imp_{LU1} + \%LU_2 * \%imp_{LU2} + \cdots + \%LU_n * \%imp_{LUn}$$ **Equation 3-1**

%imp	=	percent impervious area for a given sub-basin
$\%LU_n$	=	percentage of the sub-basin's area comprised of a given land use
$\%imp_{LUn}$	=	percent impervious area associated with the given land use

The impervious area percentage associated with each sub-basin is listed in **Attachment E**.

3.4.3 Soil Storage Calculation

The SFWMD ERP Information Manual (2014) describes the Curve Number (CN) for compressed coastal soils based on the depth to the water table; in this case the average October elevation (**Table 3.5**). These values are used for pervious area soil storage calculation.

Table 3.5 – Curve Number Based on Depth to Water Table for Compressed Coastal Soil

Depth to Water Table	Compressed Coastal Soil CN
1	96
2	84
3	67
4	55

It is assumed that the curve number for all impervious areas is 98, and therefore has minimal soil storage.

With the parameters developed in the preceding sections, both the present and the estimated 2050 CN were calculated for each sub-basin based on the sub-basin's average depth to the water table and the sub-basin's percentage of impervious area.

With the Soil Conservation Service (SCS) curve number method, soil storage is calculated using the curve number for a sub-basin (**Equation 3-2**). The data in **Section 3.4.2** is used to develop the S parameter for each sub-basin.

$$S = \frac{1000}{CN} - 10$$ **Equation 3-2**

Where:

S	=	soil storage (in)
CN	=	curve number

Attachment E contains the CN and the Soil Storage value for each sub-basin for both present and estimated 2050 groundwater levels

3.4.4 Runoff Volume Calculation

As stated before, runoff volume can be calculated with the SCS Curve Number Method which uses rainfall depth and a soil storage value as the equation parameters.

Equation 3-3 describes the runoff calculation using precipitation and soil storage parameters.

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \quad \textbf{Equation 3-3}$$

Where:

Q = runoff (in)
P = rainfall (in)
S = soil storage (in)

Since soil storage is an influencer of runoff, groundwater rise can decrease the soil storage capacity, and thus increase runoff volume. **Attachment F** contains the runoff volume calculation for both the 5-year, 24-hour storm and the 100-year, 72-hour storm for each sub-basin.

3.4.5 Runoff Volume Increase

The projected increase in stormwater runoff by sub-basin will range from 0% to 15%, with a City overall average of 3% increase for the 5-year 24-hour design storm and 1.7% increase for the 100-year, 72-hour design storm. **Figure 3.6** and **Figure 3.7** provide a visual representation of the change in runoff for the 5-year, 24-hour storm and the 100-year, 72-hour storm. **Figure 3.8** and **Figure 3.9** show the percent increase in runoff volume between the design storms for current groundwater conditions and the design storms for predicted 2050 groundwater conditions.

Increased runoff is more apparent in the sub-basins that have lower percentages of impervious area. Since impervious areas already experience maximum runoff, the sub-basins that are already comprised of mostly impervious area experience little-to-no impact from groundwater rise.

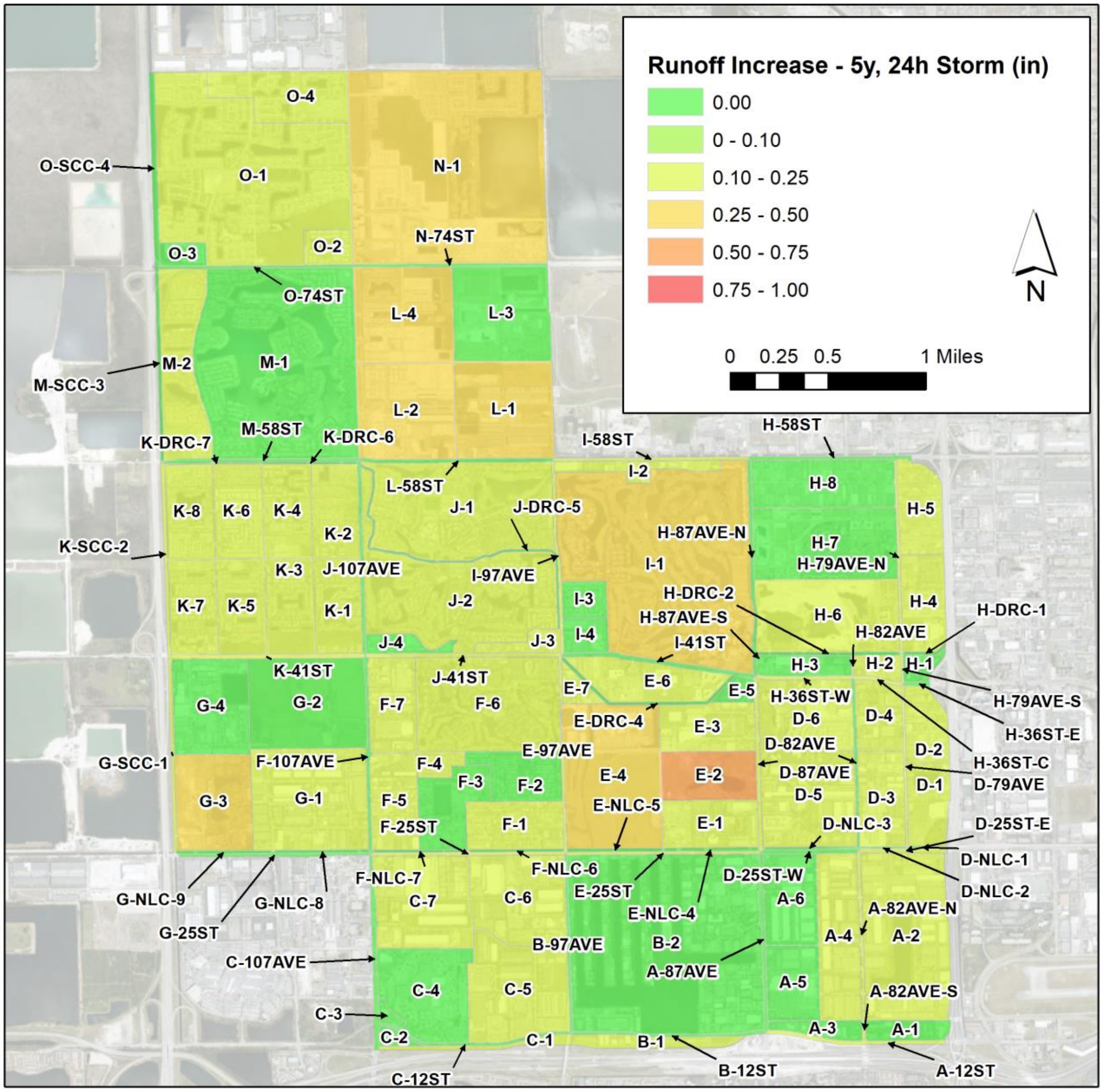


Figure 3.6 – Runoff Increase by Sub-Basin for the 5-year, 24-hour Storm

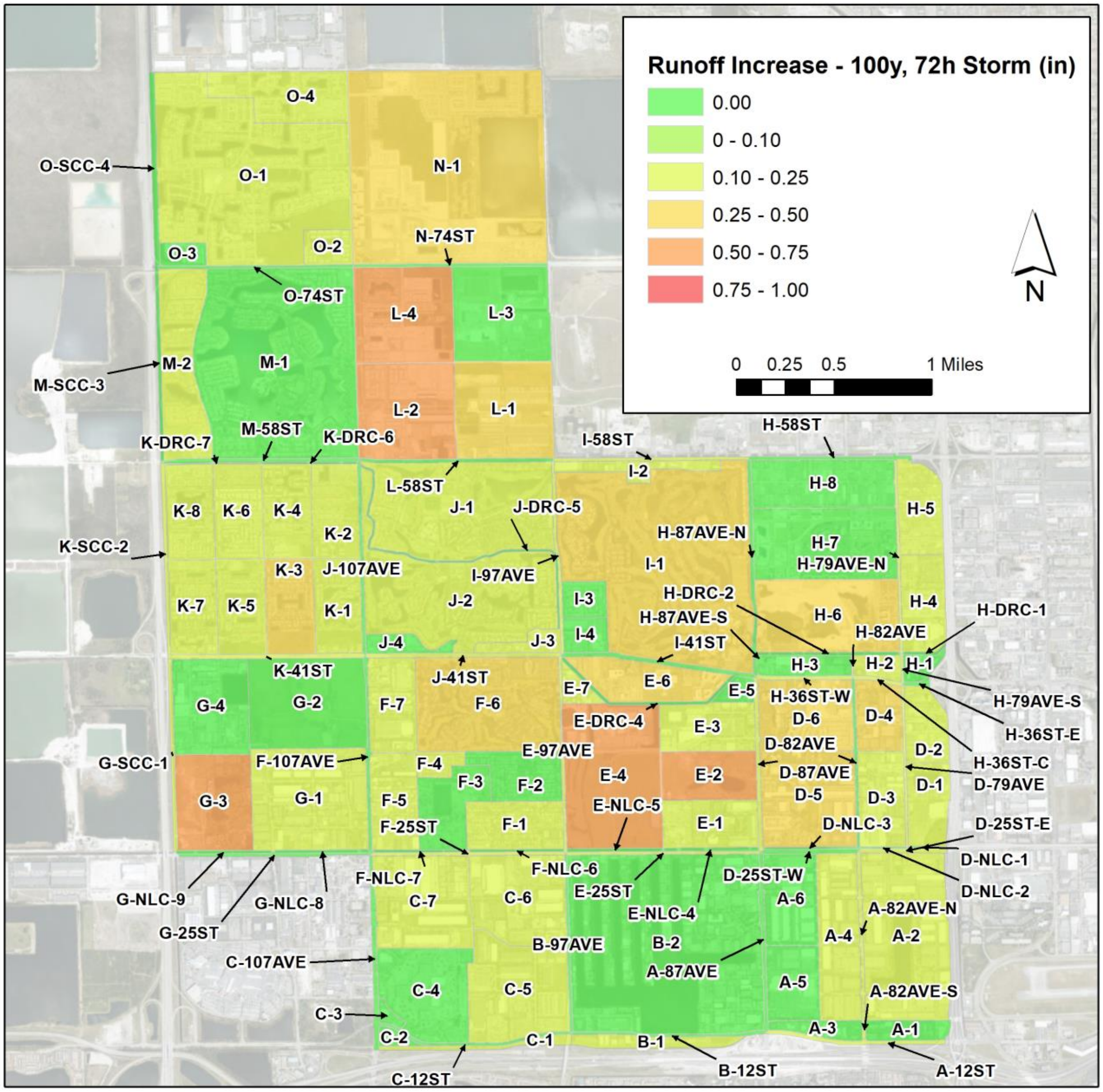


Figure 3.7 – Runoff Increase by Sub-Basin for the 100-year, 72-hour Storm

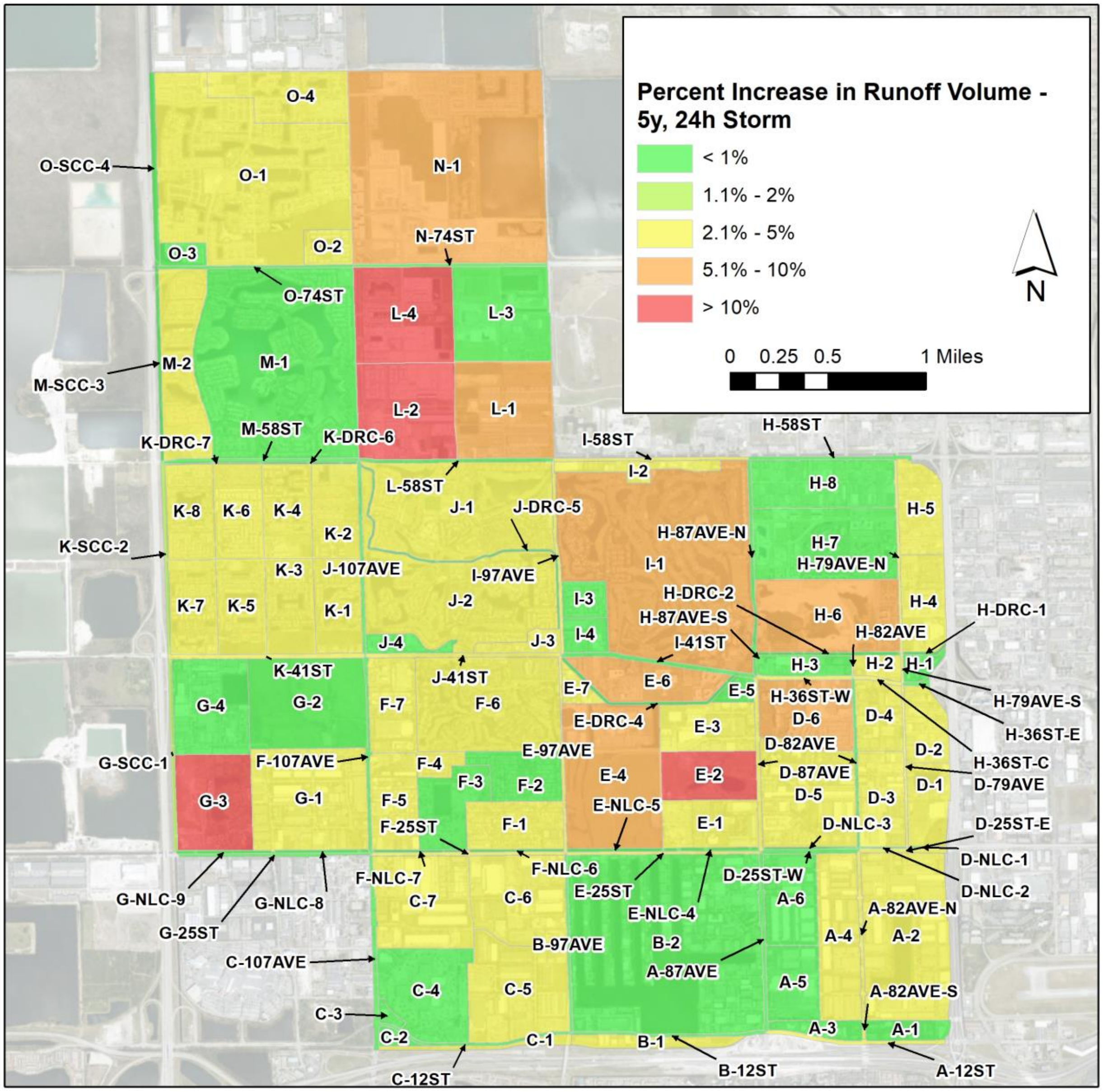


Figure 3.8 – Percent Increase in Runoff Volume between Current Groundwater Conditions and Future Groundwater Conditions for the 5-year, 24-hour Storm

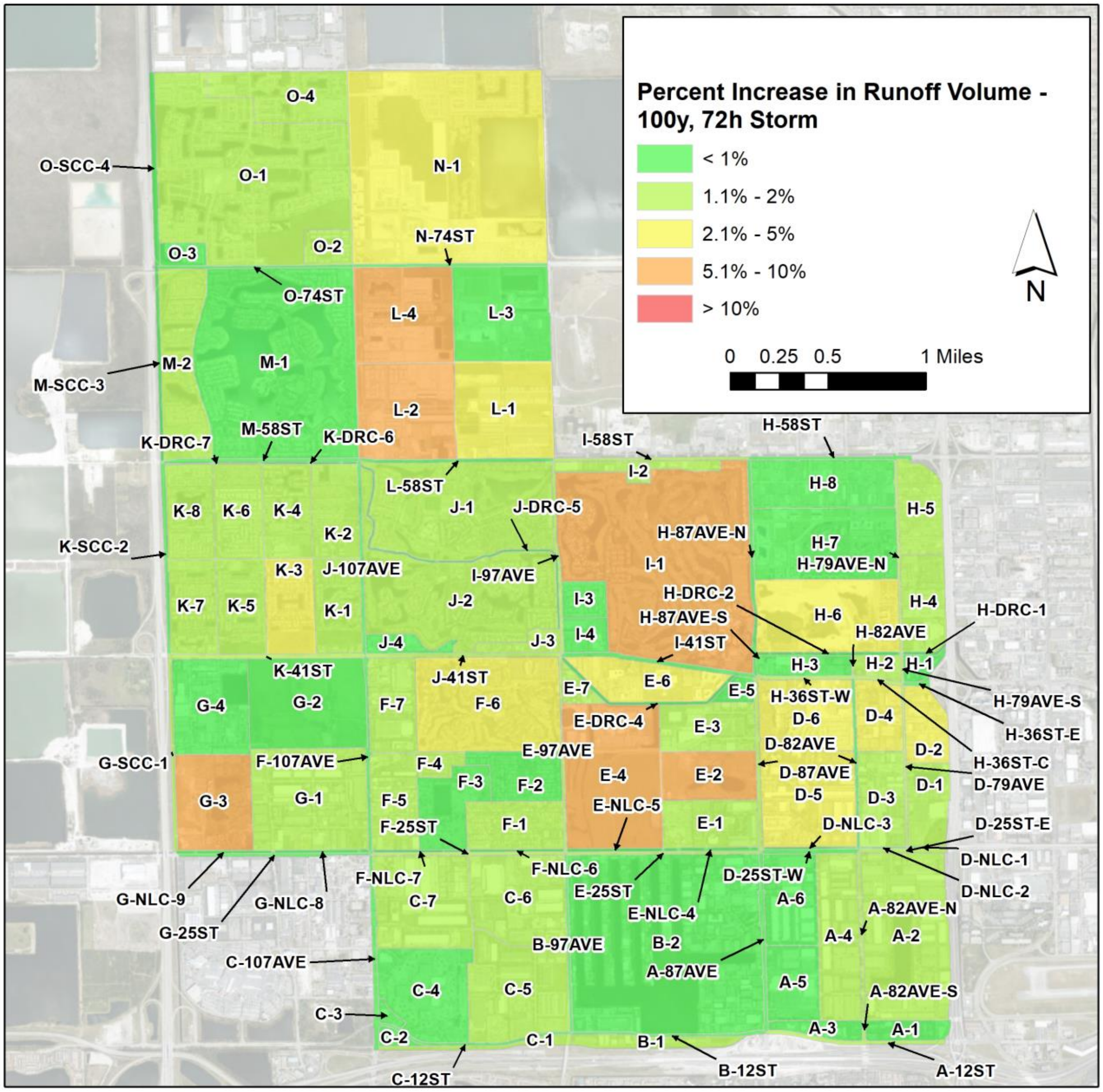


Figure 3.9 - Percent Increase in Runoff Volume between Current Groundwater Conditions and Future Groundwater Conditions for the 100-year, 72-hour Storm

4.0 CONCLUSIONS & RECOMMENDATIONS

4.1 Conclusions

The vulnerability assessment focused on evaluating the potential impacts to the City's primary stormwater management infrastructure due to the predicted groundwater rise within the City, based on the 2050 projected sea level rise (SLR) within Miami-Dade County. According to the Unified Sea Level Rise Projections for Southeast Florida, it is estimated that approximately 14 inches (1.17 feet) of sea level rise will occur between 2020 and 2050 based on the USACE High Curve. Figures from the 2016 USGS report described in **Section 2.2.1** define groundwater rise in the region with regard to 1 foot of sea level rise. Therefore, 0.17 feet was added across this entire coverage to define the groundwater rise within the City for predicted 2050 sea level rise conditions. From these projections, approximately 0.37 feet of groundwater rise is predicted on the eastern portion of the City and 0.27 feet on the western portion of the city in the year 2050.

Based on the analyses outlined in **Section 3.2 – Exfiltration Trenches**, the predominant range in exfiltration volume reduction within each sub-basin is from 0% to 10%, with an overall City average reduction of 8.2%. There are some sub-basins that will have higher exfiltration volume reduction ranging from 12% to 41%. However, these exfiltration volume reductions only occur in four sub-basins, which are the sub-basins with the smallest distance between the ground surface and the average October groundwater elevation (G-2, K-SCC-2, D-2, N-1). From this estimated amount of projected exfiltration volume reduction in 2050, it appears that predicted 2050 groundwater rise should not have a significant immediate impact to the roadway flood protection level of service in the future. However, as part of the upcoming Stormwater Master Plan update, an assessment should be performed to determine the quantity and location of additional exfiltration trench that will be needed throughout the City to mitigate the loss of the projected exfiltration volume reduction.

There are several swales along NW 117th Avenue, NW 107th Avenue, NW 111th Ct, NW 58th St, and the NW 36th Street ramps to the Palmetto Expressway that appear to have low elevations, and whose inverts may become less than 1 foot above the average October groundwater elevation with predicted 2050 groundwater rise. These impacted swales comprise 3% of the total swale length within the City. Note that current groundwater conditions show that 3% of swales do not currently meet the design criteria, thus after the projected groundwater rise, a total of 6% of the City's total swale length will not meet the criteria. This amount of impact to swales in the future is minimal and should not have a significant impact in roadway flooding or stormwater quality degradation. Future roadway project improvements in these areas should consider raising the road and swale elevation to maintain a minimum 1-foot swale invert clearance from the future projected seasonal high groundwater elevations.

Based on the analysis outlined in **Section 3.4 – Excess Stormwater Runoff Volume**, the projected increase in stormwater runoff by sub-basin will range from 0% to 15%, with a City overall average of 3% increase for the 5-year, 24-hour design storm and 1.7% increase for the 100-year, 72-hour design storm. Increased runoff is more apparent in the sub-basins that have lower percentages of impervious area. Since impervious areas already experience maximum runoff, the sub-basins that are already comprised of mostly impervious area experience little-to-no impact from groundwater rise. The sub-basins with the greatest amounts of runoff increase (E-2, G-3, L-2, L-4) have land use classifications primarily of golf courses or vacant land. Many roadway sub-basins and other commercial or 100% impervious sub-basins have zero increase in runoff with predicted groundwater rise. The amount of projected additional excess stormwater runoff in 2050 should not have a major impact to the drainage infrastructure within the City. However, as part of the upcoming Stormwater Master Plan update, a hydrologic/hydraulic assessment should be performed using an ICPR4 model (converted from the XP-SWMM model developed as part the 2014 Stormwater Master Plan update) to determine the actual impact to the City's stormwater management infrastructure. It should be noted that increased rainfall due to climate change was not considered during this study, and that only the impact of groundwater rise was analyzed.

4.2 Recommendations

The analyses performed in this report are general in nature to establish an estimate of the predicted impacts to the City's stormwater management infrastructure based on the project 2050 groundwater rise within the City of Doral. From these analyses, the predicted groundwater rise should not have a catastrophic impact to the stormwater management systems within the City. However, these impacts should be mitigated as part of future stormwater improvement projects to maintain, at a minimum, the current flood protection level of service. As part of the upcoming 2019 Stormwater Master Plan update, these projected impacts should be evaluated with the hydrologic/hydraulic model developed as part of the 2014 Stormwater Master Plan update to determine the amount of additional stormwater infrastructure needed and cost to fully mitigate the projected loss in flood protection level of service.

Sea level and groundwater rise predictions are approximate and will change over time. The Climate Change Compact revises these predictions approximately every four years. The City should continue monitoring the changes in projected sea level and groundwater rise to ensure the future projected increase does not accelerate from the current predictions. If predictions increase drastically, the City should update the projections and analyses performed in this report and incorporate the new predictions in future Stormwater Master Plan updates.

ATTACHMENT A

DATA ACQUISITION LOG

Title	Date	Data Type	Collected-By	Source	Author	Comments
DEM for C4 and C6 basins		TIFF	ADA Engineering	Miami Dade County Department of Regulatory and Economic Resources	Miami Dade County Department of Regulatory and Economic Resources	C4-C6_dem_10ft.tif
October Wet Season Water Table Elevation		SHP	ADA Engineering	Miami Dade County Public Works Department	Miami Dade County Public Works Department	oct_9099_sp83ft.shp
Hydrologic Conditions in Urban Miami-Dade County, Florida, and the Effect of Groundwater Pumpage and Increased Sea Level on Canal Leakage and Regional Groundwater Flow	7/1/2016	PDF	ADA Engineering	USGS	USGS and Miami-Dade Water and Sewer Department	
Unified Sea Level Rise Projection - Southeast Florida	10/1/2015	PDF	ADA Engineering	Sea Level Rise Work Group	Sea Level Rise Work Group	
City of Doral Stormwater Master Plan Final Report	2/1/2014	PDF	ADA Engineering	ADA Engineering	ADA Engineering	
Geotechnical Report - Drainage Improvement Project - NW 25 Terr, from NW 99th Ave to NW 100th Ave	7/24/2012	PDF	ADA Engineering	ADA Engineering	Dunkelberger Engineering & Testing, inc.	
Geotechnical Report - Drainage Improvement Project - NW 82nd Ave and NW 12th Street	9/24/2012	PDF	ADA Engineering	ADA Engineering	Dunkelberger Engineering & Testing, inc.	
NW 87th and NW 33rd Intersection Improvements - Preliminary Plans and Calculation Spreadsheets	2/22/2012	PDF, Excel Spreadsheet	ADA Engineering	ADA Engineering	ADA Engineering	
Bid Set Plans for Proposed Stormwater Improvements NW 84th Avenue and Exfiltration Trench Solver Spreadsheets for Project	7/3/2019	PDF, Excel Spreadsheets	ADA Engineering	ADA Engineering	ADA Engineering	
As-Built Plans for Proposed Stormwater Improvements Years 2 and 3, and Exfiltration Trench Solver Spreadsheets for Project	1/11/2017	PDF, Excel Spreadsheets	ADA Engineering	ADA Engineering	ADA Engineering	

Title	Date	Data Type	Collected-By	Source	Author	Comments
City of Doral Public Works Department Right-of-Way Maintenance	6/12/2019	PDF	City of Doral	City of Doral Public Works Department	City of Doral Public Works Department	
Shapefile of French Drain	6/12/2019	SHP	City of Doral	City of Doral	City of Doral	French_Drain.shp
Aerial Imagery of City of Doral	6/12/2019	TIFF	City of Doral	City of Doral	City of Doral	
As-Built - NW 117 Ave As-Built Plans	9/18/2014	PDF	City of Doral	City of Doral	Williams Paving Co, Inc.	
As-Built - Drawings Doral NW 109th Ave	10/5/2016	PDF	City of Doral	City of Doral	MPG Technical Group Corp.	
As-Built - NW 12 St from NW 87 Ave to NW 97 Ave - Proj No 662214	4/1/1994	PDF	City of Doral	City of Doral	Dade County Public Works Department	
As-Built - NW 97 Ave. between 70 - 74 St. (2015-16)	1/4/2016	PDF	City of Doral	City of Doral	Pegasus Land Surveyors	
As-Built - NW 102nd Ave & NW 53 St	5/16/2008	PDF	City of Doral	City of Doral	Metro Express, Inc.	
As-Built - Sub Basin D-3	2/2/2018	PDF	City of Doral	City of Doral	Vizcaya Surveying and Mapping, Inc.	
As-Built - NW 29 St., 31 St. between 87-79 Ave. (2018)	2/2/2018	PDF	City of Doral	City of Doral	Vizcaya Surveying and Mapping, Inc.	
As-Built - NW 33RD ST & NW 107TH AVE	5/13/2008	PDF	City of Doral	City of Doral	Metro Express, Inc.	
As-Built - NW 74th St. between NW 107 Ave. & NW 114 Ave	12/20/2011	PDF	City of Doral	City of Doral	Gannet Fleming	
As-Built - NW 82 St. (Legacy Park)(7-2017)	3/2/2016	PDF	City of Doral	City of Doral	Kimley Horn	
As-Built - City of Doral Basin H-8 Drainage	9/1/2017	PDF	City of Doral	City of Doral	MPG Technical Group Corp.	
City of Doral Remedial Drainage - NW 58th St and NW 117th Ave	5/17/2011	PDF	City of Doral	City of Doral	Corzo Castella Carballo Thompson Salman	
Drainage Report for NW 66th Street Roadway Improvements From NW 102nd Avenue to NW 97th Avenue	3/2/2016	PDF	City of Doral	City of Doral	Kimley Horn	
Drainage Report for Basin H-8 Priority 1 and 2 Drainage Improvements Design Stormwater Improvements 5-Year Capital Improvement Plan	6/1/2016	PDF	City of Doral	City of Doral	King	
Drainage Report for NW 117th Avenue Improvements From NW 50th St to NW 58th St.	12/17/2012	PDF	City of Doral	City of Doral	Kimley Horn	
Drainage Memorandum for Drainage Improvements at NW 84th Ave and NW 29th St	1/1/2014	PDF	City of Doral	City of Doral	Hardesty & Hanover	
Signed and Sealed Plans for NW 107th Ave from NW 58th ST to NW 66th St.	8/18/2015	PDF	City of Doral	City of Doral	Miami Dade County	
Drainage Report for NW 114th Avenue Drainage Improvements from NW 58th Street to NW 60th Street	4/10/2018	PDF	City of Doral	City of Doral	Kimley Horn	
Drainage Report for Doral Legacy Park & NW 82nd Street Widening	2/1/2016	PDF	City of Doral	City of Doral	Kimley Horn	

ATTACHMENT B

EXFILTRATION TRENCH EQUATIONS

Exfiltration Trench Exfiltration Rate Reduction Equations

$$Total\ Rate\ of\ Exfiltration = L * \mathrm{E}$$

L	=	Length of Exfiltration Trench, ft (Determined from GIS Polyline Shapefile)
E	=	Exfiltration rate, cfs/linear ft of trench

When the Design High Water (DHW) elevation is within the aggregate media and the control elevation is above the exfiltration trench aggregate, the following equation is used. This is described as Scenario 3 in the FDOT District 6 ERTM.

$$\mathrm{E} = 2K(d_u\left(d_p - \frac{d_u}{2}\right) + d_s d_p)$$

Equation 2.4-11 from the *FDOT – District 6 ERTM*

K	=	Hydraulic conductivity, cfs/ft^2 x ft of head
d_p	=	Hydraulic head on exfiltration trench, ft
d_u	=	depth of unsaturated aggregate media, ft
d_s	=	depth of saturated aggregate media, ft

When the DHW elevation and the control elevation are above the exfiltration trench aggregate media, the following equation is used. This is described as Scenario 2 in the FDOT District 6 ERTM.

$$\mathrm{E} = 2Kd_p d$$

Equation 2.4-8 from the *FDOT – District 6 ERTM*

d = depth of aggregate media, ft

ATTACHMENT C

EXFILTRATION TRENCH RATE CALCULATIONS

Assumed Trench Geometry	
Depth to bottom of trench, ft	15
Depth to top of trench, ft	2

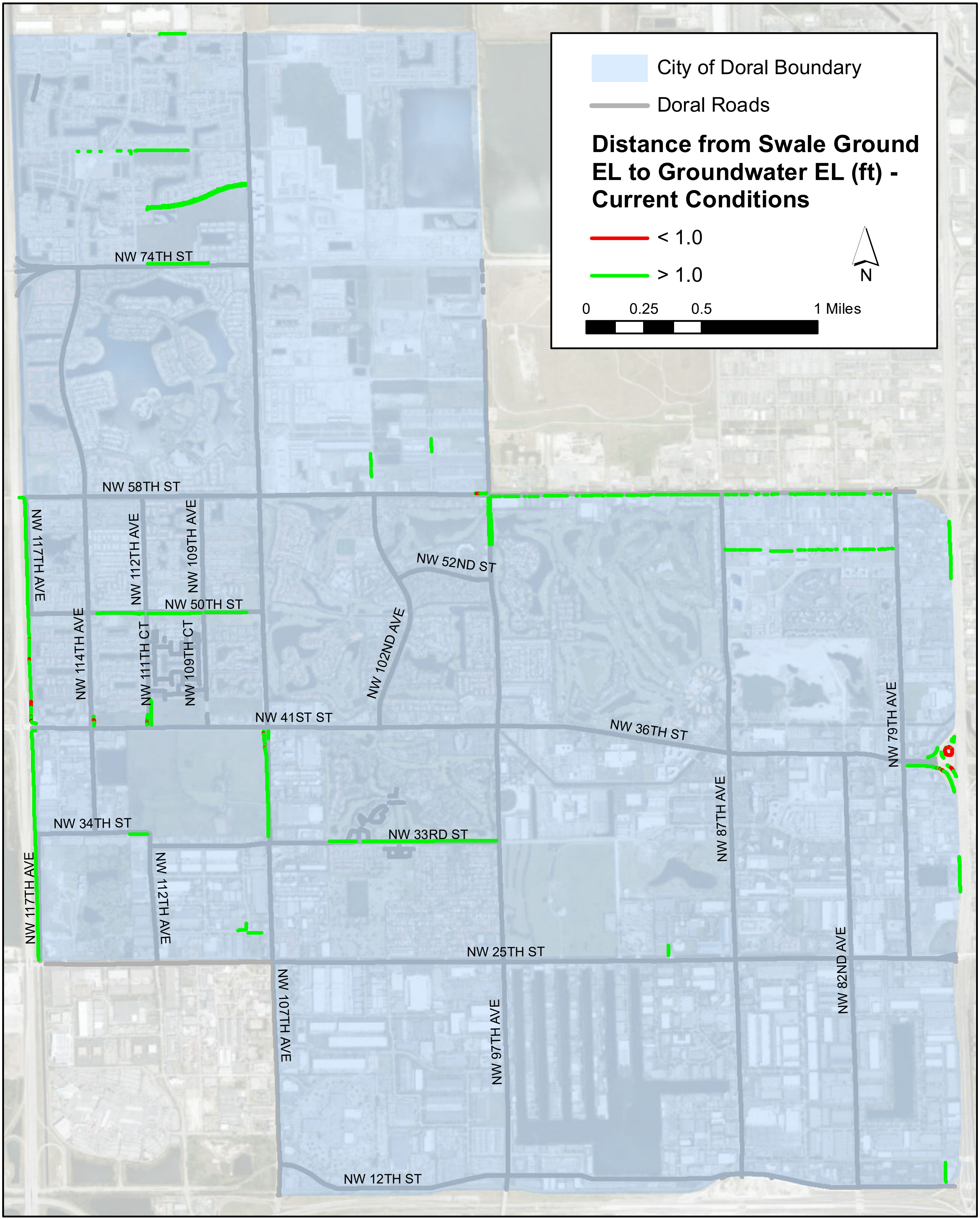
Subbasin	Percent Decrease in Exfiltration Rate	Estimated Total Basin Exfiltration Rate (current)	Estimated Total Basin Exfiltration Rate (2050)	L	E_t (current)	E_t (2050)	K	Average Ground EL	DHW (Current)	DHW (2050)	d_u (current)	d_u (2050)	d_s (current)	d_s (2050)	d_p (current)	d_p (2050)	Bottom of Trench EL	Top of Trench EL	Exfiltration Scenario (current)	Exfiltration Scenario (2050)
		CFS	*CFS*	*LF*	*CFS/LF*	*CFS/LF*	*CFS/FT^2/FT HEAD*	*FT-NAVD*	*FT-NAVD*	*FT-NAVD*	*FT*	*FT*	*FT*	*FT*	*FT*	*FT*	*FT-NAVD*	*FT-NAVD*		
A-1	6.5%	26.5	24.8	101	0.2628	0.2458	2.22E-03	7.0	2.1	2.5	2.9	2.5	10.1	10.5	4.9	4.5	-8.0	5.0	3	3
A-12ST	0.0%	0.0	0.0	0	0.2278	0.2096	2.95E-03	6.3	2.2	2.5	2.1	1.7	10.9	11.3	4.1	3.7	-8.7	4.3	3	3
A-2	8.4%	380.8	349.0	1727	0.2205	0.2021	1.79E-03	6.1	2.1	2.5	2.0	1.6	11.0	11.4	4.0	3.6	-8.9	4.1	3	3
A-3	6.9%	55.8	51.9	222	0.2513	0.2339	3.65E-03	6.8	2.2	2.6	2.6	2.2	10.4	10.8	4.6	4.2	-8.2	4.8	3	3
A-4	8.0%	232.1	213.5	1020	0.2276	0.2093	1.57E-03	6.3	2.2	2.6	2.1	1.7	10.9	11.3	4.1	3.7	-8.7	4.3	3	3
A-5	7.2%	84.3	78.3	345	0.2445	0.2268	2.27E-03	6.7	2.2	2.6	2.5	2.1	10.5	10.9	4.5	4.1	-8.3	4.7	3	3
A-6	7.2%	322.0	298.7	1321	0.2438	0.2261	1.07E-03	6.7	2.3	2.6	2.4	2.1	10.6	10.9	4.4	4.1	-8.3	4.7	3	3
A-82AVE-N	9.3%	813.2	737.7	3978	0.2044	0.1854	1.23E-03	5.8	2.2	2.6	1.6	1.3	11.4	11.7	3.6	3.3	-9.2	3.8	3	3
A-82AVE-S	8.4%	147.1	134.7	671	0.2192	0.2007	3.67E-04	6.1	2.2	2.5	1.9	1.6	11.1	11.4	3.9	3.6	-8.9	4.1	3	3
A-87AVE	0.0%	0.0	0.0	0	0.2098	0.1910	1.73E-03	6.0	2.3	2.6	1.7	1.4	11.3	11.6	3.7	3.4	-9.0	4.0	3	3
B-1	0.0%	0.0	0.0	0	0.2059	0.1895	3.46E-03	6.0	2.4	2.7	1.7	1.3	11.3	11.7	3.7	3.3	-9.0	4.0	3	3
B-12ST	0.0%	0.0	0.0	0	0.2041	0.1870	3.45E-03	6.0	2.4	2.7	1.6	1.3	11.4	11.7	3.6	3.3	-9.0	4.0	3	3
B-2	7.7%	1079.8	996.3	5031	0.2146	0.1980	3.24E-03	6.2	2.4	2.7	1.8	1.5	11.2	11.5	3.8	3.5	-8.8	4.2	3	3
B-97AVE	0.0%	0.0	0.0	0	0.2312	0.2156	3.63E-03	6.7	2.5	2.8	2.2	1.9	10.8	11.1	4.2	3.9	-8.3	4.7	3	3
C-1	0.0%	0.0	0.0	0	0.1758	0.1586	2.26E-03	5.7	2.6	3.0	1.1	0.8	11.9	12.2	3.1	2.8	-9.3	3.7	3	3
C-107AVE	0.0%	0.0	0.0	0	0.2511	0.2378	1.79E-03	7.5	2.9	3.2	2.6	2.3	10.4	10.7	4.6	4.3	-7.5	5.5	3	3
C-12ST	0.0%	0.0	0.0	0	0.2366	0.2211	2.07E-03	7.0	2.7	3.0	2.3	2.0	10.7	11.0	4.3	4.0	-8.0	5.0	3	3
C-2	0.0%	0.0	0.0	0	0.2482	0.2331	1.90E-03	7.4	2.8	3.2	2.5	2.2	10.5	10.8	4.5	4.2	-7.6	5.4	3	3
C-3	0.0%	0.0	0.0	0	0.2529	0.2379	1.63E-03	7.5	2.9	3.2	2.6	2.3	10.4	10.7	4.6	4.3	-7.5	5.5	3	3
C-4	6.0%	12.3	11.5	50	0.2457	0.2309	1.74E-03	7.3	2.8	3.1	2.5	2.2	10.5	10.8	4.5	4.2	-7.7	5.3	3	3
C-5	8.1%	227.2	208.8	1120	0.2029	0.1865	2.14E-03	6.2	2.6	2.9	1.6	1.3	11.4	11.7	3.6	3.3	-8.8	4.2	3	3
C-6	7.3%	200.8	186.1	945	0.2125	0.1969	2.11E-03	6.4	2.6	2.9	1.8	1.5	11.2	11.5	3.8	3.5	-8.6	4.4	3	3
C-7	6.8%	647.0	602.8	3166	0.2044	0.1904	1.74E-03	6.4	2.8	3.0	1.6	1.4	11.4	11.6	3.6	3.4	-8.6	4.4	3	3
D-1	12.3%	68.5	60.1	416	0.1648	0.1445	6.14E-03	5.0	2.1	2.5	0.9	0.5	12.1	12.5	2.9	2.5	-10.0	3.0	3	3
D-2	16.3%	21.2	17.7	163	0.1300	0.1088	7.49E-03	4.3	2.0	2.4	0.3	0.0	12.7	13.0	2.3	1.9	-10.7	2.3	3	2
D-25ST-E	0.0%	0.0	0.0	0	0.2173	0.1987	3.29E-03	6.0	2.1	2.5	1.9	1.5	11.1	11.5	3.9	3.5	-9.0	4.0	3	3
D-25ST-W	0.0%	0.0	0.0	0	0.2064	0.1874	1.26E-03	5.9	2.2	2.6	1.7	1.3	11.3	11.7	3.7	3.3	-9.1	3.9	3	3
D-3	9.6%	427.7	386.5	2150	0.1989	0.1797	4.85E-03	5.7	2.1	2.5	1.5	1.2	11.5	11.8	3.5	3.2	-9.3	3.7	3	3
D-4	8.9%	70.6	64.3	334	0.2113	0.1925	5.98E-03	5.9	2.1	2.5	1.8	1.4	11.2	11.6	3.8	3.4	-9.1	3.9	3	3
D-5	8.4%	829.1	759.3	3776	0.2196	0.2011	2.34E-03	6.2	2.2	2.6	1.9	1.6	11.1	11.4	3.9	3.6	-8.8	4.2	3	3
D-6	8.2%	15.7	14.4	70	0.2239	0.2056	3.08E-03	6.2	2.2	2.6	2.0	1.7	11.0	11.3	4.0	3.7	-8.8	4.2	3	3
D-79AVE	12.2%	700.4	615.1	4220	0.1660	0.1458	6.18E-03	5.0	2.1	2.5	0.9	0.5	12.1	12.5	2.9	2.5	-10.0	3.0	3	3
D-82AVE	9.4%	346.2	313.6	1713	0.2021	0.1830	4.70E-03	5.8	2.2	2.5	1.6	1.2	11.4	11.8	3.6	3.2	-9.2	3.8	3	3
D-87AVE	9.4%	58.1	52.7	286	0.2032	0.1841	8.33E-04	5.9	2.3	2.7	1.6	1.2	11.4	11.8	3.6	3.2	-9.1	3.9	3	3
D-NLC-1	0.0%	0.0	0.0	0	0.2538	0.2365	4.59E-03	6.8	2.1	2.5	2.7	2.3	10.3	10.7	4.7	4.3	-8.2	4.8	3	3
D-NLC-2	0.0%	0.0	0.0	0	0.1974	0.1782	2.22E-03	5.6	2.1	2.5	1.5	1.1	11.5	11.9	3.5	3.1	-9.4	3.6	3	3
D-NLC-3	0.0%	0.0	0.0	0	0.1313	0.1101	1.28E-03	4.5	2.2	2.6	0.3	0.0	12.7	13.0	2.3	1.9	-10.5	2.5	3	2
E-1	7.8%	318.7	293.8	1445	0.2205	0.2034	1.69E-03	6.3	2.4	2.7	2.0	1.6	11.0	11.4	4.0	3.6	-8.7	4.3	3	3
E-2	11.4%	138.1	122.4	830	0.1663	0.1474	1.27E-03	5.3	2.4	2.7	0.9	0.6	12.1	12.4	2.9	2.6	-9.7	3.3	3	3
E-25ST	0.0%	0.0	0.0	0	0.2191	0.2025	3.35E-03	6.3	2.4	2.7	1.9	1.6	11.1	11.4	3.9	3.6	-8.7	4.3	3	3
E-3	7.6%	241.4	223.1	1065	0.2267	0.2095	1.04E-03	6.4	2.3	2.7	2.1	1.7	10.9	11.3	4.1	3.7	-8.6	4.4	3	3
E-4	12.3%	289.7	254.0	1988	0.1457	0.1278	3.32E-03	5.0	2.5	2.8	0.5	0.2	12.5	12.8	2.5	2.2	-10.0	3.0	3	3
E-5	0.0%	0.0	0.0	0	0.2919	0.2760	9.52E-04	7.8	2.3	2.7	3.5	3.2	9.5	9.8	5.5	5.2	-7.2	5.8	3	3
E-6	0.0%	0.0	0.0	0	0.2250	0.2088	1.79E-03	6.5	2.4	2.7	2.1	1.7	10.9	11.3	4.1	3.7	-8.5	4.5	3	3
E-7	0.0%	0.0	0.0	0	0.2132	0.1970	1.81E-03	6.3	2.5	2.8	1.8	1.5	11.2	11.5	3.8	3.5	-8.7	4.3	3	3
E-97AVE	0.0%	0.0	0.0	0	0.1971	0.1805	2.70E-03	6.0	2.5	2.8	1.5	1.2	11.5	11.8	3.5	3.2	-9.0	4.0	3	3
E-DRC-4	0.0%	0.0	0.0	0	0.1371	0.1184	1.66E-03	4.8	2.4	2.7	0.4	0.0	12.6	13.0	2.4	2.0	-10.2	2.8	3	3
E-NLC-4	0.0%	0.0	0.0	0	0.1731	0.1545	2.00E-03	5.4	2.4	2.7	1.0	0.7	12.0	12.3	3.0	2.7	-9.6	3.4	3	3
E-NLC-5	13.6%	10.7	9.3	80	0.1343	0.1161	4.82E-03	4.8	2.5	2.8	0.3	0.0	12.7	13.0	2.3	2.0	-10.2	2.8	3	3
F-1	7.2%	1364.8	1265.9	6500	0.2100	0.1948	1.58E-03	6.3	2.6	2.9	1.8	1.5	11.2	11.5	3.8	3.5	-8.7	4.3	3	3
F-107AVE	6.9%	6.0	5.6	30	0.2012	0.1873	2.55E-03	6.4	2.8	3.1	1.6	1.3	11.4	11.7	3.6	3.3	-8.6	4.4	3	3
F-2	6.3%	47.4	44.5	200	0.2371	0.2223	1.94E-03	6.9	2.6	2.9	2.3	2.0	10.7	11.0	4.3	4.0	-8.1	4.9	3	3

Subbasin	Percent Decrease in Exfiltration Rate	Estimated Total Basin Exfiltration Rate (current)	Estimated Total Basin Exfiltration Rate (2050)	L	E_t (current)	E_t (2050)	K	Average Ground EL	DHW (Current)	DHW (2050)	d_u (current)	d_u (2050)	d_s (current)	d_s (2050)	d_p (current)	d_p (2050)	Bottom of Trench EL	Top of Trench EL	Exfiltration Scenario (current)	Exfiltration Scenario (2050)
		CFS	*CFS*	*LF*	*CFS/LF*	*CFS/LF*	*CFS/FT^2/FT HEAD*	*FT-NAVD*	*FT-NAVD*	*FT-NAVD*	*FT*	*FT*	*FT*	*FT*	*FT*	*FT*	*FT-NAVD*	*FT-NAVD*		
F-25ST	0.0%	0.0	0.0	0	0.2002	0.1854	1.76E-03	6.2	2.7	2.9	1.6	1.3	11.4	11.7	3.6	3.3	-8.8	4.2	3	3
F-3	0.0%	0.0	0.0	0	0.2421	0.2292	1.43E-03	7.1	2.7	3.0	2.4	2.1	10.6	10.9	4.4	4.1	-7.9	5.1	3	3
F-4	6.6%	171.4	160.1	824	0.2080	0.1943	2.04E-03	6.4	2.7	3.0	1.7	1.4	11.3	11.6	3.7	3.4	-8.6	4.4	3	3
F-5	6.3%	178.7	167.5	830	0.2154	0.2018	2.37E-03	6.7	2.8	3.1	1.9	1.6	11.1	11.4	3.9	3.6	-8.3	4.7	3	3
F-6	0.0%	0.0	0.0	0	0.1772	0.1615	2.01E-03	5.7	2.6	2.9	1.1	0.8	11.9	12.2	3.1	2.8	-9.3	3.7	3	3
F-7	6.9%	310.5	289.1	1545	0.2010	0.1871	2.38E-03	6.3	2.8	3.0	1.6	1.3	11.4	11.7	3.6	3.3	-8.7	4.3	3	3
F-NLC-6	0.0%	0.0	0.0	0	0.1262	0.1089	1.92E-03	4.8	2.6	2.9	0.2	0.0	12.8	13.0	2.2	1.9	-10.2	2.8	3	2
F-NLC-7	0.0%	0.0	0.0	0	0.1409	0.1257	1.79E-03	5.3	2.8	3.1	0.4	0.2	12.6	12.8	2.4	2.2	-9.7	3.3	3	3
G-1	6.6%	497.1	464.1	2400	0.2071	0.1934	2.59E-03	6.6	3.0	3.2	1.7	1.4	11.3	11.6	3.7	3.4	-8.4	4.6	3	3
G-2	41.4%	1.9	1.1	50	0.0377	0.0221	2.51E-03	3.6	2.9	3.2	0.0	0.0	13.0	13.0	0.7	0.4	-11.4	1.6	2	2
G-25ST	0.0%	0.0	0.0	0	0.1851	0.1708	2.56E-03	6.3	3.1	3.3	1.3	1.0	11.7	12.0	3.3	3.0	-8.7	4.3	3	3
G-3	0.0%	0.0	0.0	0	0.2093	0.1956	2.51E-03	6.8	3.1	3.4	1.7	1.5	11.3	11.5	3.7	3.5	-8.2	4.8	3	3
G-4	6.1%	397.4	373.1	1813	0.2192	0.2058	2.20E-03	7.0	3.0	3.3	1.9	1.7	11.1	11.3	3.9	3.7	-8.0	5.0	3	3
G-NLC-8	0.0%	0.0	0.0	0	0.0514	0.0358	2.62E-03	3.8	3.0	3.2	0.0	0.0	13.0	13.0	0.9	0.6	-11.2	1.8	2	2
G-NLC-9	0.0%	0.0	0.0	0	0.0251	0.0094	2.52E-03	3.5	3.1	3.4	0.0	0.0	13.0	13.0	0.4	0.2	-11.5	1.5	2	2
G-SCC-1	0.0%	0.0	0.0	0	0.1348	0.1194	2.21E-03	5.5	3.1	3.4	0.3	0.1	12.7	12.9	2.3	2.1	-9.5	3.5	3	3
H-1	0.0%	0.0	0.0	0	0.2540	0.2367	6.60E-03	6.6	2.0	2.3	2.7	2.3	10.3	10.7	4.7	4.3	-8.4	4.6	3	3
H-2	0.0%	0.0	0.0	0	0.1995	0.1803	5.66E-03	5.6	2.1	2.4	1.5	1.2	11.5	11.8	3.5	3.2	-9.4	3.6	3	3
H-3	0.0%	0.0	0.0	0	0.2448	0.2271	3.35E-03	6.7	2.2	2.6	2.5	2.1	10.5	10.9	4.5	4.1	-8.3	4.7	3	3
H-36ST-C	0.0%	0.0	0.0	0	0.1927	0.1733	5.74E-03	5.5	2.1	2.5	1.4	1.0	11.6	12.0	3.4	3.0	-9.5	3.5	3	3
H-36ST-E	0.0%	0.0	0.0	0	0.2451	0.2275	6.78E-03	6.5	2.0	2.4	2.5	2.1	10.5	10.9	4.5	4.1	-8.5	4.5	3	3
H-36ST-W	0.0%	0.0	0.0	0	0.1914	0.1720	3.22E-03	5.6	2.2	2.6	1.4	1.0	11.6	12.0	3.4	3.0	-9.4	3.6	3	3
H-4	8.7%	9.7	8.8	45	0.2145	0.1958	3.63E-03	5.7	1.9	2.3	1.8	1.5	11.2	11.5	3.8	3.5	-9.3	3.7	3	3
H-5	9.2%	1019.6	926.3	4934	0.2067	0.1877	2.34E-03	5.5	1.8	2.2	1.7	1.3	11.3	11.7	3.7	3.3	-9.5	3.5	3	3
H-58ST	0.0%	0.0	0.0	0	0.2484	0.2309	5.88E-04	6.5	1.9	2.3	2.5	2.2	10.5	10.8	4.5	4.2	-8.5	4.5	3	3
H-6	8.5%	63.5	58.1	290	0.2189	0.2004	2.14E-03	6.1	2.1	2.5	1.9	1.6	11.1	11.4	3.9	3.6	-8.9	4.1	3	3
H-7	7.0%	2558.7	2380.1	10238	0.2499	0.2325	7.74E-04	6.6	2.1	2.4	2.6	2.2	10.4	10.8	4.6	4.2	-8.4	4.6	3	3
H-79AVE-N	10.1%	873.7	785.1	4563	0.1915	0.1721	2.55E-03	5.3	1.9	2.3	1.4	1.0	11.6	12.0	3.4	3.0	-9.7	3.3	3	3
H-79AVE-S	9.2%	103.6	94.0	503	0.2059	0.1869	6.31E-03	5.7	2.0	2.4	1.7	1.3	11.3	11.7	3.7	3.3	-9.3	3.7	3	3
H-8	7.4%	2045.9	1893.7	8544	0.2395	0.2216	3.98E-04	6.3	2.0	2.4	2.4	2.0	10.6	11.0	4.4	4.0	-8.7	4.3	3	3
H-82AVE	7.9%	68.8	63.3	300	0.2293	0.2111	4.96E-03	6.3	2.1	2.5	2.1	1.8	10.9	11.2	4.1	3.8	-8.7	4.3	3	3
H-87AVE-N	0.0%	0.0	0.0	0	0.2818	0.2655	6.21E-04	7.5	2.2	2.6	3.3	2.9	9.7	10.1	5.3	4.9	-7.5	5.5	3	3
H-87AVE-S	0.0%	0.0	0.0	0	0.2520	0.2346	1.71E-03	6.9	2.3	2.6	2.6	2.3	10.4	10.7	4.6	4.3	-8.1	4.9	3	3
H-DRC-1	0.0%	0.0	0.0	0	0.1387	0.1177	6.43E-03	4.4	2.0	2.3	0.4	0.0	12.6	13.0	2.4	2.0	-10.6	2.4	3	3
H-DRC-2	0.0%	0.0	0.0	0	0.1134	0.0920	4.19E-03	4.1	2.1	2.5	0.0	0.0	13.0	13.0	2.0	1.6	-10.9	2.1	2	2
I-1	0.0%	0.0	0.0	0	0.2194	0.2023	1.37E-03	6.3	2.3	2.7	1.9	1.6	11.1	11.4	3.9	3.6	-8.7	4.3	3	3
I-2	7.2%	13.8	12.8	60	0.2292	0.2127	1.55E-03	6.5	2.3	2.7	2.1	1.8	10.9	11.2	4.1	3.8	-8.5	4.5	3	3
I-3	0.0%	0.0	0.0	0	0.2569	0.2421	2.02E-03	7.2	2.5	2.8	2.7	2.4	10.3	10.6	4.7	4.4	-7.8	5.2	3	3
I-4	0.0%	0.0	0.0	0	0.2387	0.2233	1.86E-03	6.8	2.5	2.8	2.3	2.0	10.7	11.0	4.3	4.0	-8.2	4.8	3	3
I-41ST	0.0%	0.0	0.0	0	0.2490	0.2332	1.69E-03	7.0	2.4	2.7	2.6	2.2	10.4	10.8	4.6	4.2	-8.0	5.0	3	3
I-58ST	0.0%	0.0	0.0	0	0.2257	0.2089	1.33E-03	6.4	2.3	2.6	2.1	1.7	10.9	11.3	4.1	3.7	-8.6	4.4	3	3
I-97AVE	0.0%	0.0	0.0	0	0.2137	0.1976	2.19E-03	6.3	2.5	2.8	1.8	1.5	11.2	11.5	3.8	3.5	-8.7	4.3	3	3
J-1	6.3%	673.6	631.1	2947	0.2286	0.2142	1.98E-03	6.7	2.6	2.9	2.1	1.8	10.9	11.2	4.1	3.8	-8.3	4.7	3	3
J-107AVE	7.2%	4.9	4.5	25	0.1944	0.1804	2.35E-03	6.2	2.8	3.0	1.4	1.2	11.6	11.8	3.4	3.2	-8.8	4.2	3	3
J-2	6.6%	200.8	187.5	920	0.2183	0.2038	2.30E-03	6.5	2.6	2.9	1.9	1.6	11.1	11.4	3.9	3.6	-8.5	4.5	3	3
J-3	0.0%	0.0	0.0	0	0.2200	0.2043	2.29E-03	6.5	2.5	2.9	2.0	1.6	11.0	11.4	4.0	3.6	-8.5	4.5	3	3
J-4	0.0%	0.0	0.0	0	0.2479	0.2352	2.40E-03	7.3	2.7	3.0	2.5	2.3	10.5	10.7	4.5	4.3	-7.7	5.3	3	3
J-41ST	0.0%	0.0	0.0	0	0.2118	0.1969	2.33E-03	6.4	2.6	2.9	1.8	1.5	11.2	11.5	3.8	3.5	-8.6	4.4	3	3
J-DRC-5	0.0%	0.0	0.0	0	0.1439	0.1274	2.24E-03	5.1	2.6	2.9	0.5	0.2	12.5	12.8	2.5	2.2	-9.9	3.1	3	3
K-1	8.2%	50.1	46.0	285	0.1758	0.1613	2.16E-03	5.9	2.8	3.1	1.1	0.8	11.9	12.2	3.1	2.8	-9.1	3.9	3	3
K-2	7.2%	114.8	106.5	590	0.1945	0.1805	1.97E-03	6.2	2.8	3.0	1.4	1.2	11.6	11.8	3.4	3.2	-8.8	4.2	3	3
K-3	9.0%	212.5	193.5	1295	0.1641	0.1494	1.82E-03	5.7	2.9	3.1	0.9	0.6	12.1	12.4	2.9	2.6	-9.3	3.7	3	3
K-4	7.3%	146.9	136.2	760	0.1933	0.1792	1.93E-03	6.2	2.8	3.1	1.4	1.2	11.6	11.8	3.4	3.2	-8.8	4.2	3	3
K-41ST	0.0%	0.0	0.0	0	0.2223	0.2090	1.98E-03	6.9	2.9	3.2	2.0	1.7	11.0	11.3	4.0	3.7	-8.1	4.9	3	3
K-5	7.9%	87.8	80.8	485	0.1810	0.1667	1.26E-03	6.1	2.9	3.2	1.2	0.9	11.8	12.1	3.2	2.9	-8.9	4.1	3	3
K-6	6.0%	219.7	206.6	985	0.2231	0.2097	1.67E-03	6.9	2.9	3.1	2.0	1.7	11.0	11.3	4.0	3.7	-8.1	4.9	3	3
K-7	0.0%	0.0	0.0	0	0.1924	0.1783	7.91E-04	6.4	3.0	3.3	1.4	1.1	11.6	11.9	3.4	3.1	-8.6	4.4	3	3

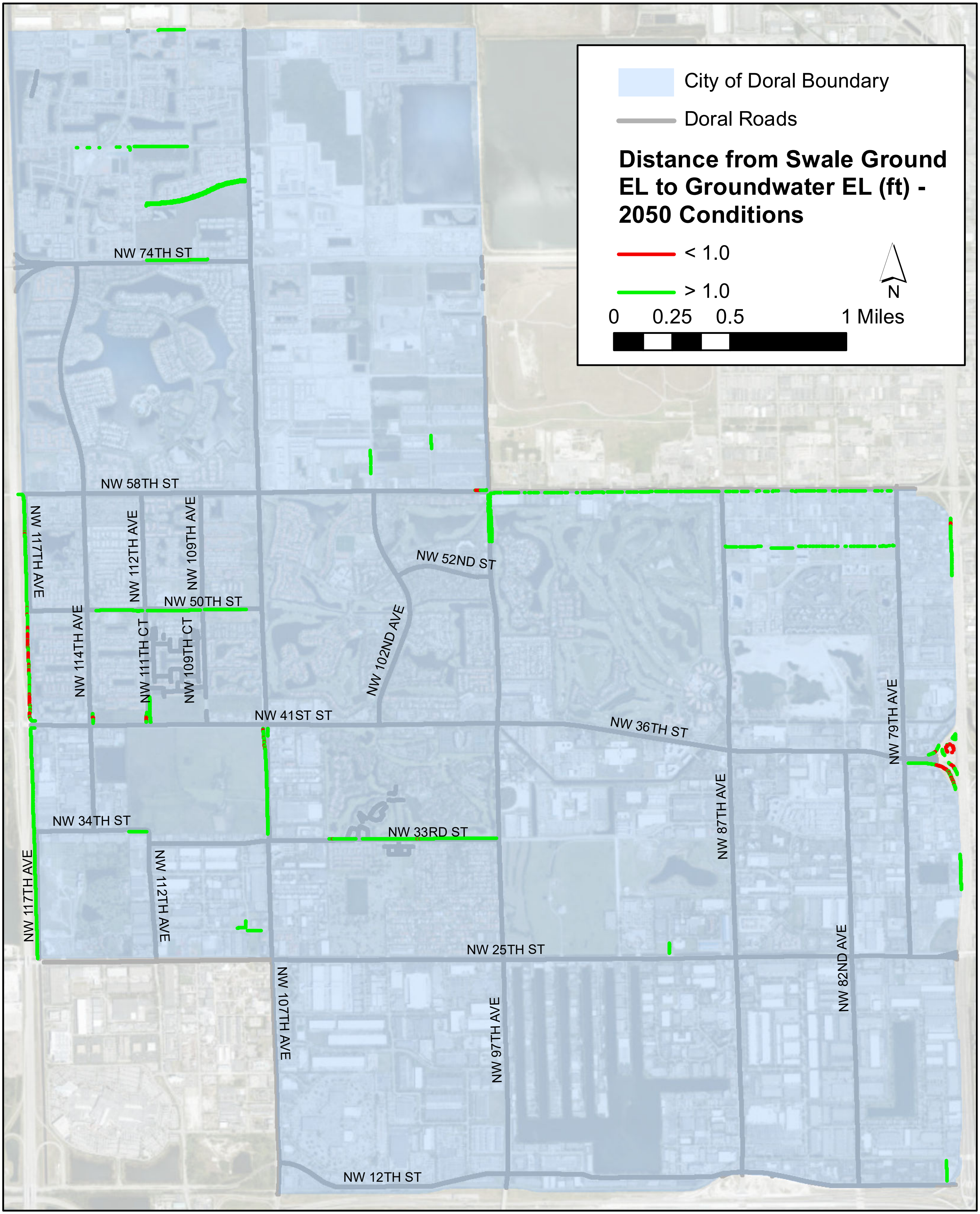
Subbasin	Percent Decrease in Exfiltration Rate	Estimated Total Basin Exfiltration Rate (current)	Estimated Total Basin Exfiltration Rate (2050)	L	E_t (current)	E_t (2050)	K	Average Ground EL	DHW (Current)	DHW (2050)	d_u (current)	d_u (2050)	d_s (current)	d_s (2050)	d_p (current)	d_p (2050)	Bottom of Trench EL	Top of Trench EL	Exfiltration Scenario (current)	Exfiltration Scenario (2050)
		CFS	*CFS*	*LF*	*CFS/LF*	*CFS/LF*	*CFS/FT^2/FT HEAD*	*FT-NAVD*	*FT-NAVD*	*FT-NAVD*	*FT*	*FT*	*FT*	*FT*	*FT*	*FT*	*FT-NAVD*	*FT-NAVD*		
K-8	6.1%	79.9	75.0	365	0.2189	0.2055	8.16E-04	6.8	2.9	3.2	1.9	1.7	11.1	11.3	3.9	3.7	-8.2	4.8	3	3
K-DRC-6	0.0%	0.0	0.0	0	0.1012	0.0856	2.01E-03	4.6	2.8	3.1	0.0	0.0	13.0	13.0	1.8	1.5	-10.4	2.6	2	2
K-DRC-7	0.0%	0.0	0.0	0	0.1690	0.1544	1.84E-03	5.9	2.9	3.2	1.0	0.7	12.0	12.3	3.0	2.7	-9.1	3.9	3	3
K-SCC-2	16.5%	87.1	72.7	922	0.0945	0.0788	6.67E-04	4.6	3.0	3.2	0.0	0.0	13.0	13.0	1.6	1.4	-10.4	2.6	2	2
L-1	9.6%	209.0	188.9	1175	0.1779	0.1608	1.54E-03	5.6	2.5	2.8	1.1	0.8	11.9	12.2	3.1	2.8	-9.4	3.6	3	3
L-2	8.6%	550.9	503.8	3162	0.1742	0.1593	1.70E-03	5.7	2.6	2.9	1.1	0.8	11.9	12.2	3.1	2.8	-9.3	3.7	3	3
L-3	1.6%	157.0	154.5	135	1.1632	1.1447	1.47E-03	29.1	2.5	2.8	13.0	13.0	0.0	0.0	26.6	26.3	14.1	27.1	3	3
L-4	11.5%	291.6	258.1	2003	0.1456	0.1288	1.61E-03	5.1	2.6	2.9	0.5	0.2	12.5	12.8	2.5	2.2	-9.9	3.1	3	3
L-58ST	0.0%	0.0	0.0	0	0.2040	0.1888	1.79E-03	6.2	2.6	2.9	1.6	1.3	11.4	11.7	3.6	3.3	-8.8	4.2	3	3
M-1	5.3%	228.7	216.7	937	0.2441	0.2313	2.00E-03	7.2	2.8	3.0	2.5	2.2	10.5	10.8	4.5	4.2	-7.8	5.2	3	3
M-2	5.5%	244.8	231.2	1040	0.2353	0.2223	1.62E-03	7.1	2.9	3.1	2.3	2.0	10.7	11.0	4.3	4.0	-7.9	5.1	3	3
M-58ST	7.8%	4.6	4.2	25	0.1825	0.1682	1.79E-03	6.0	2.8	3.1	1.2	0.9	11.8	12.1	3.2	2.9	-9.0	4.0	3	3
M-SCC-3	0.0%	0.0	0.0	0	0.0996	0.0840	1.09E-03	4.6	2.9	3.1	0.0	0.0	13.0	13.0	1.7	1.5	-10.4	2.6	2	2
N-1	16.3%	842.2	704.8	6921	0.1217	0.1018	1.64E-03	4.6	2.5	2.8	0.1	0.0	12.9	13.0	2.1	1.8	-10.4	2.6	3	2
N-74ST	0.0%	0.0	0.0	0	0.2679	0.2536	1.56E-03	7.5	2.5	2.9	3.0	2.7	10.0	10.3	5.0	4.7	-7.5	5.5	3	3
O-1	7.6%	1381.5	1276.1	7300	0.1892	0.1748	1.65E-03	6.1	2.8	3.0	1.3	1.1	11.7	11.9	3.3	3.1	-8.9	4.1	3	3
O-2	0.0%	0.0	0.0	0	0.2102	0.1965	1.75E-03	6.4	2.7	3.0	1.8	1.5	11.2	11.5	3.8	3.5	-8.6	4.4	3	3
O-3	0.0%	0.0	0.0	0	0.2123	0.1986	1.58E-03	6.6	2.8	3.1	1.8	1.5	11.2	11.5	3.8	3.5	-8.4	4.6	3	3
O-4	6.6%	846.0	789.9	3876	0.2183	0.2038	1.69E-03	6.6	2.7	3.0	1.9	1.6	11.1	11.4	3.9	3.6	-8.4	4.6	3	3
O-74ST	0.0%	0.0	0.0	0	0.2276	0.2143	1.71E-03	6.9	2.8	3.0	2.1	1.8	10.9	11.2	4.1	3.8	-8.1	4.9	3	3
O-SCC-4	0.0%	0.0	0.0	0	0.1654	0.1507	1.53E-03	5.8	2.9	3.2	0.9	0.6	12.1	12.4	2.9	2.6	-9.2	3.8	3	3
Total Exfiltration Rate Decrease	8.2%	24132.3	22142.2																	

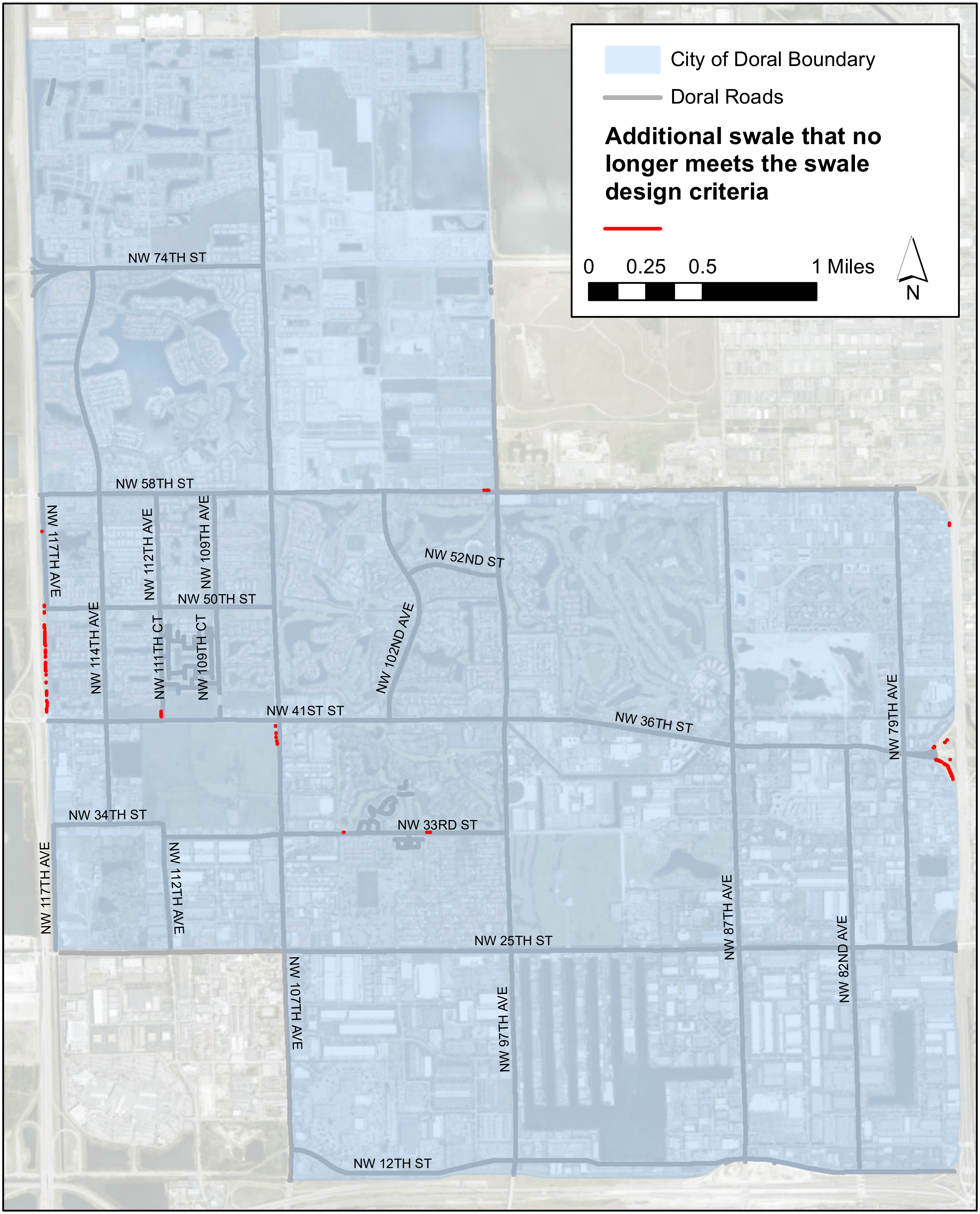
ATTACHMENT D

MAPS OF SWALE DISTANCE TO GROUNDWATER FOR CITY



City of Doral Boundary
Doral Roads
Distance from Swale Ground EL to Groundwater EL (ft) - Current Conditions
< 1.0
> 1.0
N
0
0.25
0.5
1 Miles
NW 74TH ST
NW 58TH ST
NW 117TH AVE
NW 112TH AVE
NW 109TH AVE
NW 52ND ST
NW 50TH ST
NW 114TH AVE
NW 111TH CT
NW 109TH CT
NW 102ND AVE
NW 41ST ST
NW 36TH ST
NW 79TH AVE
NW 87TH AVE
NW 34TH ST
NW 33RD ST
NW 117TH AVE
NW 112TH AVE
NW 25TH ST
NW 82ND AVE
NW 107TH AVE
NW 97TH AVE
NW 12TH ST


City of Doral Boundary
Doral Roads
Distance from Swale Ground EL to Groundwater EL (ft) - 2050 Conditions
< 1.0
> 1.0
N
0 0.25 0.5 1 Miles
NW 74TH ST
NW 58TH ST
NW 117TH AVE
NW 112TH AVE
NW 109TH AVE
NW 52ND ST
NW 50TH ST
NW 114TH AVE
NW 111TH CT
NW 109TH CT
NW 102ND AVE
NW 41ST ST
NW 36TH ST
NW 79TH AVE
NW 34TH ST
NW 33RD ST
NW 87TH AVE
NW 117TH AVE
NW 112TH AVE
NW 25TH ST
NW 107TH AVE
NW 97TH AVE
NW 82ND AVE
NW 12TH ST


City of Doral Boundary
Doral Roads
Additional swale that no longer meets the swale design criteria
0
0.25
0.5
1 Miles
N
NW 74TH ST
NW 58TH ST
NW 117TH AVE
NW 112TH AVE
NW 109TH AVE
NW 52ND ST
NW 50TH ST
NW 114TH AVE
NW 111TH CT
NW 109TH CT
NW 102ND AVE
NW 41ST ST
NW 36TH ST
NW 79TH AVE
NW 34TH ST
NW 33RD ST
NW 117TH AVE
NW 112TH AVE
NW 25TH ST
NW 87TH AVE
NW 82ND AVE
NW 107TH AVE
NW 97TH AVE
NW 12TH ST

ATTACHMENT E

SOIL STORAGE CALCULATIONS

Basin Name	Avg WSWT (FT-NAVD)		Avg Ground EL (FT-NAVD)	Depth to WT (FT)		% Impervious	% Pervious	Pervious Area CN		Impervious Area CN	Weighted CN		Soil Storage (in)	
	2020	2050		2020	2050			2020	2050		2020	2050	2020	2050
A-1	2.1	2.5	7.0	4.9	4.5	82%	18%	55	55	98	91	91	0.99	0.99
A-12ST	2.2	2.5	6.3	4.1	3.7	83%	17%	55	58	98	91	92	0.99	0.87
A-2	2.1	2.5	6.1	4.0	3.6	76%	24%	56	60	98	88	89	1.36	1.24
A-3	2.2	2.6	6.8	4.6	4.2	78%	22%	55	55	98	89	89	1.24	1.24
A-4	2.2	2.6	6.3	4.1	3.7	74%	26%	55	58	98	87	88	1.49	1.36
A-5	2.2	2.6	6.7	4.5	4.1	77%	23%	55	55	98	88	88	1.36	1.36
A-6	2.3	2.6	6.7	4.4	4.1	76%	24%	55	55	98	88	88	1.36	1.36
A-82AVE-N	2.2	2.6	5.8	3.6	3.3	83%	17%	59	64	98	92	93	0.87	0.75
A-82AVE-S	2.2	2.5	6.1	3.9	3.6	83%	17%	56	60	98	91	92	0.99	0.87
A-87AVE	2.3	2.6	6.0	3.7	3.4	83%	17%	58	63	98	92	92	0.87	0.87
B-1	2.4	2.7	6.0	3.7	3.3	75%	25%	59	63	98	89	90	1.24	1.11
B-12ST	2.4	2.7	6.0	3.6	3.3	82%	18%	59	63	98	92	92	0.87	0.87
B-2	2.4	2.7	6.2	3.8	3.5	84%	16%	57	60	98	92	92	0.87	0.87
B-97AVE	2.5	2.8	6.7	4.2	3.9	83%	17%	55	57	98	91	91	0.99	0.99
C-1	2.6	3.0	5.7	3.1	2.8	73%	27%	67	71	98	90	91	1.11	0.99
C-107AVE	2.9	3.2	7.5	4.6	4.3	83%	17%	55	55	98	91	91	0.99	0.99
C-12ST	2.7	3.0	7.0	4.3	4.0	83%	17%	55	56	98	91	91	0.99	0.99
C-2	2.8	3.2	7.4	4.5	4.2	83%	17%	55	55	98	91	91	0.99	0.99
C-3	2.9	3.2	7.5	4.6	4.3	83%	17%	55	55	98	91	91	0.99	0.99
C-4	2.8	3.1	7.3	4.5	4.2	80%	20%	55	55	98	90	90	1.11	1.11
C-5	2.6	2.9	6.2	3.6	3.3	78%	22%	59	64	98	90	91	1.11	0.99
C-6	2.6	2.9	6.4	3.8	3.5	72%	28%	57	62	98	87	88	1.49	1.36
C-7	2.8	3.0	6.4	3.6	3.4	73%	27%	59	63	98	88	89	1.36	1.24
D-1	2.1	2.5	5.0	2.9	2.5	65%	35%	70	75	98	89	90	1.24	1.11
D-2	2.0	2.4	4.3	2.3	1.9	76%	24%	80	86	98	94	96	0.64	0.42
D-25ST-E	2.1	2.5	6.0	3.9	3.5	83%	17%	57	60	98	91	92	0.99	0.87
D-25ST-W	2.2	2.6	5.9	3.7	3.3	83%	17%	59	63	98	92	92	0.87	0.87
D-3	2.1	2.5	5.7	3.5	3.2	74%	26%	60	65	98	89	90	1.24	1.11
D-4	2.1	2.5	5.9	3.8	3.4	70%	30%	58	62	98	86	88	1.63	1.36
D-5	2.2	2.6	6.2	3.9	3.6	58%	42%	56	60	98	81	83	2.35	2.05
D-6	2.2	2.6	6.2	4.0	3.7	46%	54%	55	59	98	75	77	3.33	2.99
D-79AVE	2.1	2.5	5.0	2.9	2.5	83%	17%	68	75	98	93	94	0.75	0.64
D-82AVE	2.2	2.5	5.8	3.6	3.2	82%	18%	60	64	98	92	92	0.87	0.87
D-87AVE	2.3	2.7	5.9	3.6	3.2	83%	17%	59	64	98	92	93	0.87	0.75
D-NLC-1	2.1	2.5	6.8	4.7	4.3	98%	2%	55	55	98	98	98	0.20	0.20
D-NLC-2	2.1	2.5	5.6	3.5	3.1	100%	0%	60	65	98	98	98	0.20	0.20
D-NLC-3	2.2	2.6	4.5	2.3	1.9	100%	0%	80	85	98	98	98	0.20	0.20
E-1	2.4	2.7	6.3	4.0	3.6	66%	34%	56	59	98	84	85	1.90	1.76
E-2	2.4	2.7	5.3	2.9	2.6	36%	64%	68	75	98	79	84	2.66	1.90
E-25ST	2.4	2.7	6.3	3.9	3.6	83%	17%	56	59	98	91	92	0.99	0.87
E-3	2.3	2.7	6.4	4.1	3.7	76%	24%	55	58	98	88	89	1.36	1.24
E-4	2.5	2.8	5.0	2.5	2.2	22%	78%	75	80	98	81	85	2.35	1.76
E-5	2.3	2.7	7.8	5.5	5.2	83%	17%	55	55	98	91	91	0.99	0.99
E-6	2.4	2.7	6.5	4.1	3.7	51%	49%	55	58	98	77	79	2.99	2.66
E-7	2.5	2.8	6.3	3.8	3.5	67%	33%	57	62	98	85	86	1.76	1.63
E-97AVE	2.5	2.8	6.0	3.5	3.2	82%	18%	62	65	98	92	93	0.87	0.75
E-DRC-4	2.4	2.7	4.8	2.4	2.0	99%	1%	78	84	98	98	98	0.20	0.20
E-NLC-4	2.4	2.7	5.4	3.0	2.7	98%	2%	67	73	98	98	98	0.20	0.20
E-NLC-5	2.5	2.8	4.8	2.3	2.0	100%	0%	78	84	98	98	98	0.20	0.20
F-1	2.6	2.9	6.3	3.8	3.5	73%	27%	58	62	98	88	89	1.36	1.24
F-107AVE	2.8	3.1	6.4	3.6	3.3	82%	18%	60	63	98	92	92	0.87	0.87
F-2	2.6	2.9	6.9	4.3	4.0	73%	27%	55	56	98	87	87	1.49	1.49
F-25ST	2.7	2.9	6.2	3.6	3.3	83%	17%	60	64	98	92	93	0.87	0.75
F-3	2.7	3.0	7.1	4.4	4.1	16%	84%	55	55	98	62	62	6.13	6.13
F-4	2.7	3.0	6.4	3.7	3.4	68%	32%	58	62	98	86	87	1.63	1.49
F-5	2.8	3.1	6.7	3.9	3.6	77%	23%	57	60	98	89	90	1.24	1.11
F-6	2.6	2.9	5.7	3.1	2.8	52%	48%	65	70	98	83	85	2.05	1.76
F-7	2.8	3.0	6.3	3.6	3.3	76%	24%	60	63	98	89	90	1.24	1.11
F-NLC-6	2.6	2.9	4.8	2.2	1.9	99%	1%	82	86	98	98	98	0.20	0.20
F-NLC-7	2.8	3.1	5.3	2.4	2.2	100%	0%	76	82	98	98	98	0.20	0.20
G-1	3.0	3.2	6.6	3.7	3.4	73%	27%	59	62	98	88	89	1.36	1.24
G-2	2.9	3.2	3.6	0.7	0.4	1%	99%	98	98	98	98	98	0.20	0.20
G-25ST	3.1	3.3	6.3	3.3	3.0	83%	17%	64	68	98	93	93	0.75	0.75
G-3	3.1	3.4	6.8	3.7	3.5	14%	86%	58	62	98	64	68	5.63	4.71
G-4	3.0	3.3	7.0	3.9	3.7	79%	21%	56	59	98	90	90	1.11	1.11
G-NLC-8	3.0	3.2	3.8	0.9	0.6	43%	57%	98	98	98	98	98	0.20	0.20
G-NLC-9	3.1	3.4	3.5	0.4	0.2	86%	14%	98	98	98	98	98	0.20	0.20
G-SCC-1	3.1	3.4	5.5	2.3	2.1	87%	13%	78	84	98	96	97	0.42	0.31
H-1	2.0	2.3	6.6	4.7	4.3	69%	31%	55	55	98	85	85	1.76	1.76
H-2	2.1	2.4	5.6	3.5	3.2	75%	25%	60	65	98	89	90	1.24	1.11
H-3	2.2	2.6	6.7	4.5	4.1	83%	17%	55	55	98	91	91	0.99	0.99
H-36ST-C	2.1	2.5	5.5	3.4	3.0	83%	17%	62	67	98	92	93	0.87	0.75
H-36ST-E	2.0	2.4	6.5	4.5	4.1	83%	17%	55	55	98	91	91	0.99	0.99
H-36ST-W	2.2	2.6	5.6	3.4	3.0	83%	17%	63	67	98	92	93	0.87	0.75
H-4	1.9	2.3	5.7	3.8	3.5	71%	29%	57	62	98	87	88	1.49	1.36
H-5	1.8	2.2	5.5	3.7	3.3	74%	26%	59	63	98	88	89	1.36	1.24
H-58ST	1.9	2.3	6.5	4.5	4.2	82%	18%	55	55	98	91	91	0.99	0.99
H-6	2.1	2.5	6.1	3.9	3.6	34%	66%	56	60	98	71	73	4.08	3.70
H-7	2.1	2.4	6.6	4.6	4.2	60%	40%	55	55	98	81	81	2.35	2.35
H-79AVE-N	1.9	2.3	5.3	3.4	3.0	83%	17%	63	67	98	92	93	0.87	0.75
H-79AVE-S	2.0	2.4	5.7	3.7	3.3	83%	17%	59	64	98	92	93	0.87	0.75
H-8	2.0	2.4	6.3	4.4	4.0	72%	28%	55	56	98	87	87	1.49	1.49
H-82AVE	2.1	2.5	6.3	4.1	3.8	83%	17%	55	58	98	91	92	0.99	0.87

Basin Name	Avg WSWT (FT-NAVD)		Avg Ground EL (FT-NAVD)	Depth to WT (FT)		% Impervious	% Pervious	Pervious Area CN		Impervious Area CN	Weighted CN		Soil Storage (in)	
	2020	2050		2020	2050			2020	2050		2020	2050	2020	2050
H-87AVE-N	2.2	2.6	7.5	5.3	4.9	83%	17%	55	55	98	91	91	0.99	0.99
H-87AVE-S	2.3	2.6	6.9	4.6	4.3	83%	17%	55	55	98	91	91	0.99	0.99
H-DRC-1	2.0	2.3	4.4	2.4	2.0	100%	0%	76	84	98	98	98	0.20	0.20
H-DRC-2	2.1	2.5	4.1	2.0	1.6	100%	0%	85	90	98	98	98	0.20	0.20
I-1	2.3	2.7	6.3	3.9	3.6	33%	67%	56	60	98	70	73	4.29	3.70
I-2	2.3	2.7	6.5	4.1	3.8	60%	40%	55	57	98	81	82	2.35	2.20
I-3	2.5	2.8	7.2	4.7	4.4	73%	27%	55	55	98	87	87	1.49	1.49
I-4	2.5	2.8	6.8	4.3	4.0	53%	47%	55	55	98	78	78	2.82	2.82
I-41ST	2.4	2.7	7.0	4.6	4.2	83%	17%	55	55	98	91	91	0.99	0.99
I-58ST	2.3	2.6	6.4	4.1	3.7	83%	17%	55	58	98	91	92	0.99	0.87
I-97AVE	2.5	2.8	6.3	3.8	3.5	83%	17%	57	60	98	91	92	0.99	0.87
J-1	2.6	2.9	6.7	4.1	3.8	60%	40%	55	57	98	81	82	2.35	2.20
J-107AVE	2.8	3.0	6.2	3.4	3.2	82%	18%	62	65	98	92	92	0.87	0.87
J-2	2.6	2.9	6.5	3.9	3.6	56%	44%	56	59	98	80	81	2.50	2.35
J-3	2.5	2.9	6.5	4.0	3.6	83%	17%	56	59	98	91	92	0.99	0.87
J-4	2.7	3.0	7.3	4.5	4.3	82%	18%	55	55	98	91	91	0.99	0.99
J-41ST	2.6	2.9	6.4	3.8	3.5	82%	18%	58	62	98	91	92	0.99	0.87
J-DRC-5	2.6	2.9	5.1	2.5	2.2	100%	0%	75	80	98	98	98	0.20	0.20
K-1	2.8	3.1	5.9	3.1	2.8	62%	38%	67	70	98	87	88	1.49	1.36
K-2	2.8	3.0	6.2	3.4	3.2	67%	33%	62	65	98	87	88	1.49	1.36
K-3	2.9	3.1	5.7	2.9	2.6	57%	43%	70	75	98	87	89	1.49	1.24
K-4	2.8	3.1	6.2	3.4	3.2	74%	26%	62	65	98	89	90	1.24	1.11
K-41ST	2.9	3.2	6.9	4.0	3.7	83%	17%	55	58	98	91	92	0.99	0.87
K-5	2.9	3.2	6.1	3.2	2.9	66%	34%	65	68	98	87	88	1.49	1.36
K-6	2.9	3.1	6.9	4.0	3.7	74%	26%	55	58	98	87	88	1.49	1.36
K-7	3.0	3.3	6.4	3.4	3.1	70%	30%	62	65	98	88	89	1.36	1.24
K-8	2.9	3.2	6.8	3.9	3.7	77%	23%	56	59	98	89	90	1.24	1.11
K-DRC-6	2.8	3.1	4.6	1.8	1.5	93%	7%	87	91	98	98	98	0.20	0.20
K-DRC-7	2.9	3.2	5.9	3.0	2.7	89%	11%	68	73	98	95	96	0.53	0.42
K-SCC-2	3.0	3.2	4.6	1.6	1.4	88%	12%	88	92	98	97	98	0.31	0.20
L-1	2.5	2.8	5.6	3.1	2.8	34%	66%	65	70	98	77	80	2.99	2.50
L-2	2.6	2.9	5.7	3.1	2.8	11%	89%	67	71	98	71	75	4.08	3.33
L-3	2.5	2.8	29.1	26.6	26.3	76%	24%	55	55	98	88	88	1.36	1.36
L-4	2.6	2.9	5.1	2.5	2.2	15%	85%	75	80	98	79	83	2.66	2.05
L-58ST	2.6	2.9	6.2	3.6	3.3	82%	18%	59	63	98	92	92	0.87	0.87
M-1	2.8	3.0	7.2	4.5	4.2	81%	19%	55	55	98	90	90	1.11	1.11
M-2	2.9	3.1	7.1	4.3	4.0	67%	33%	55	56	98	84	85	1.90	1.76
M-58ST	2.8	3.1	6.0	3.2	2.9	86%	14%	64	68	98	94	94	0.64	0.64
M-SCC-3	2.9	3.1	4.6	1.7	1.5	99%	1%	87	91	98	98	98	0.20	0.20
N-1	2.5	2.8	4.6	2.1	1.8	26%	74%	82	87	98	87	90	1.49	1.11
N-74ST	2.5	2.9	7.5	5.0	4.7	27%	73%	55	55	98	67	67	4.93	4.93
O-1	2.8	3.0	6.1	3.3	3.1	64%	36%	63	67	98	86	87	1.63	1.49
O-2	2.7	3.0	6.4	3.8	3.5	81%	19%	58	62	98	91	92	0.99	0.87
O-3	2.8	3.1	6.6	3.8	3.5	81%	19%	58	60	98	91	91	0.99	0.99
O-4	2.7	3.0	6.6	3.9	3.6	65%	35%	56	59	98	84	85	1.90	1.76
O-74ST	2.8	3.0	6.9	4.1	3.8	83%	17%	55	57	98	91	91	0.99	0.99
O-SCC-4	2.9	3.2	5.8	2.9	2.6	91%	9%	70	73	98	96	96	0.42	0.42

ATTACHMENT F

RUNOFF DIFFERENCE CALCULATIONS

Sub-Basin Name	5y, 24h Rainfall (in)	100y, 72h Rainfall (in)	Soil Storage (S)		5y, 24h Runoff (in)		100y, 72h Runoff (in)		5y, 24h Runoff Difference (in)	100y, 24h Runoff Difference (in)	Sub-Basin Area (Ac)	5y, 24h Runoff (Ac-ft)		100y, 72h Runoff (Ac-ft)		Percent Increase in Volume 5y, 24h	Percent Increase in Volume 100y, 72h
			2020	*2050*	*2020*	*2050*	*2020*	*2050*				*2020*	*2050*	*2020*	*2050*		
A-1	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	28.69	13	13	28	28	0.0%	0.0%
A-12ST	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	12.07	5	6	12	12	2.1%	1.1%
A-2	6.5	12.7	1.36	1.24	5.11	5.22	11.20	11.33	0.11	0.13	238.41	101	104	222	225	2.2%	1.2%
A-3	6.5	12.7	1.24	1.24	5.22	5.22	11.33	11.33	0.00	0.00	24.02	10	10	23	23	0.0%	0.0%
A-4	6.5	12.7	1.49	1.36	5.00	5.11	11.07	11.20	0.11	0.13	115.19	48	49	106	107	2.2%	1.2%
A-5	6.5	12.7	1.36	1.36	5.11	5.11	11.20	11.20	0.00	0.00	66.53	28	28	62	62	0.0%	0.0%
A-6	6.5	12.7	1.36	1.36	5.11	5.11	11.20	11.20	0.00	0.00	81.74	35	35	76	76	0.0%	0.0%
A-82AVE-N	6.5	12.7	0.87	0.75	5.56	5.68	11.71	11.84	0.11	0.13	11.29	5	5	11	11	2.1%	1.1%
A-82AVE-S	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	1.17	1	1	1	1	2.1%	1.1%
A-87AVE	6.5	12.7	0.87	0.87	5.56	5.56	11.71	11.71	0.00	0.00	12.54	6	6	12	12	0.0%	0.0%
B-1	6.5	12.7	1.24	1.11	5.22	5.33	11.33	11.46	0.11	0.13	32.88	14	15	31	31	2.2%	1.1%
B-12ST	6.5	12.7	0.87	0.87	5.56	5.56	11.71	11.71	0.00	0.00	10.03	5	5	10	10	0.0%	0.0%
B-2	6.5	12.7	0.87	0.87	5.56	5.56	11.71	11.71	0.00	0.00	574.10	266	266	560	560	0.0%	0.0%
B-97AVE	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	9.04	4	4	9	9	0.0%	0.0%
C-1	6.5	12.7	1.11	0.99	5.33	5.45	11.46	11.59	0.11	0.13	16.61	7	8	16	16	2.1%	1.1%
C-107AVE	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	15.00	7	7	14	14	0.0%	0.0%
C-12ST	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	10.03	5	5	10	10	0.0%	0.0%
C-2	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	9.16	4	4	9	9	0.0%	0.0%
C-3	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	6.44	3	3	6	6	0.0%	0.0%
C-4	6.5	12.7	1.11	1.11	5.33	5.33	11.46	11.46	0.00	0.00	128.06	57	57	122	122	0.0%	0.0%
C-5	6.5	12.7	1.11	0.99	5.33	5.45	11.46	11.59	0.11	0.13	159.98	71	73	153	154	2.1%	1.1%
C-6	6.5	12.7	1.49	1.36	5.00	5.11	11.07	11.20	0.11	0.13	138.00	57	59	127	129	2.2%	1.2%
C-7	6.5	12.7	1.36	1.24	5.11	5.22	11.20	11.33	0.11	0.13	149.19	64	65	139	141	2.2%	1.2%
D-1	6.5	12.7	1.24	1.11	5.22	5.33	11.33	11.46	0.11	0.13	57.66	25	26	54	55	2.2%	1.1%
D-2	6.5	12.7	0.64	0.42	5.79	6.03	11.96	12.21	0.23	0.25	50.85	25	26	51	52	4.0%	2.1%
D-25ST-E	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	7.14	3	3	7	7	2.1%	1.1%
D-25ST-W	6.5	12.7	0.87	0.87	5.56	5.56	11.71	11.71	0.00	0.00	7.31	3	3	7	7	0.0%	0.0%
D-3	6.5	12.7	1.24	1.11	5.22	5.33	11.33	11.46	0.11	0.13	74.23	32	33	70	71	2.2%	1.1%
D-4	6.5	12.7	1.63	1.36	4.89	5.11	10.94	11.20	0.22	0.26	53.68	22	23	49	50	4.6%	2.4%
D-5	6.5	12.7	2.35	2.05	4.34	4.56	10.26	10.53	0.22	0.27	161.97	59	62	139	142	5.0%	2.7%
D-6	6.5	12.7	3.33	2.99	3.71	3.92	9.42	9.71	0.21	0.28	102.72	32	34	81	83	5.6%	3.0%
D-79AVE	6.5	12.7	0.75	0.64	5.68	5.79	11.84	11.96	0.12	0.13	7.17	3	3	7	7	2.0%	1.1%
D-82AVE	6.5	12.7	0.87	0.87	5.56	5.56	11.71	11.71	0.00	0.00	8.46	4	4	8	8	0.0%	0.0%
D-87AVE	6.5	12.7	0.87	0.75	5.56	5.68	11.71	11.84	0.11	0.13	12.27	6	6	12	12	2.1%	1.1%
D-NLC-1	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	0.79	0	0	1	1	0.0%	0.0%
D-NLC-2	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	1.54	1	1	2	2	0.0%	0.0%
D-NLC-3	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	3.31	2	2	3	3	0.0%	0.0%
E-1	6.5	12.7	1.90	1.76	4.67	4.78	10.67	10.80	0.11	0.13	76.37	30	30	68	69	2.3%	1.3%
E-2	6.5	12.7	2.66	1.90	4.13	4.67	9.99	10.67	0.54	0.68	78.61	27	31	65	70	13.0%	6.8%
E-25ST	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	9.50	4	4	9	9	2.1%	1.1%
E-3	6.5	12.7	1.36	1.24	5.11	5.22	11.20	11.33	0.11	0.13	76.69	33	33	72	72	2.2%	1.2%
E-4	6.5	12.7	2.35	1.76	4.34	4.78	10.26	10.80	0.43	0.54	234.28	85	93	200	211	10.0%	5.3%
E-5	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	13.46	6	6	13	13	0.0%	0.0%
E-6	6.5	12.7	2.99	2.66	3.92	4.13	9.71	9.99	0.21	0.28	85.54	28	29	69	71	5.4%	2.9%
E-7	6.5	12.7	1.76	1.63	4.78	4.89	10.80	10.94	0.11	0.13	16.00	6	7	14	15	2.3%	1.2%
E-97AVE	6.5	12.7	0.87	0.75	5.56	5.68	11.71	11.84	0.11	0.13	8.89	4	4	9	9	2.1%	1.1%
E-DRC-4	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	10.65	6	6	11	11	0.0%	0.0%
E-NLC-4	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	5.54	3	3	6	6	0.0%	0.0%
E-NLC-5	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	5.62	3	3	6	6	0.0%	0.0%
F-1	6.5	12.7	1.36	1.24	5.11	5.22	11.20	11.33	0.11	0.13	78.08	33	34	73	74	2.2%	1.2%
F-107AVE	6.5	12.7	0.87	0.87	5.56	5.56	11.71	11.71	0.00	0.00	11.02	5	5	11	11	0.0%	0.0%
F-2	6.5	12.7	1.49	1.49	5.00	5.00	11.07	11.07	0.00	0.00	65.70	27	27	61	61	0.0%	0.0%
F-25ST	6.5	12.7	0.87	0.75	5.56	5.68	11.71	11.84	0.11	0.13	11.61	5	5	11	11	2.1%	1.1%

Sub-Basin Name	5y, 24h Rainfall (in)	100y, 72h Rainfall (in)	Soil Storage (S)		5y, 24h Runoff (in)		100y, 72h Runoff (in)		5y, 24h Runoff Difference (in)	100y, 24h Runoff Difference (in)	Sub-Basin Area (Ac)	5y, 24h Runoff (Ac-ft)		100y, 72h Runoff (Ac-ft)		Percent Increase in Volume 5y, 24h	Percent Increase in Volume 100y, 72h
			2020	*2050*	*2020*	*2050*	*2020*	*2050*				*2020*	*2050*	*2020*	*2050*		
F-3	6.5	12.7	6.13	6.13	2.44	2.44	7.48	7.48	0.00	0.00	76.11	15	15	47	47	0.0%	0.0%
F-4	6.5	12.7	1.63	1.49	4.89	5.00	10.94	11.07	0.11	0.13	18.46	8	8	17	17	2.3%	1.2%
F-5	6.5	12.7	1.24	1.11	5.22	5.33	11.33	11.46	0.11	0.13	76.91	33	34	73	73	2.2%	1.1%
F-6	6.5	12.7	2.05	1.76	4.56	4.78	10.53	10.80	0.22	0.27	226.96	86	90	199	204	4.8%	2.5%
F-7	6.5	12.7	1.24	1.11	5.22	5.33	11.33	11.46	0.11	0.13	75.64	33	34	71	72	2.2%	1.1%
F-NLC-6	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	4.12	2	2	4	4	0.0%	0.0%
F-NLC-7	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	3.99	2	2	4	4	0.0%	0.0%
G-1	6.5	12.7	1.36	1.24	5.11	5.22	11.20	11.33	0.11	0.13	196.76	84	86	184	186	2.2%	1.2%
G-2	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	177.68	93	93	184	184	0.0%	0.0%
G-25ST	6.5	12.7	0.75	0.75	5.68	5.68	11.84	11.84	0.00	0.00	10.66	5	5	11	11	0.0%	0.0%
G-3	6.5	12.7	5.63	4.71	2.63	3.01	7.79	8.40	0.38	0.61	122.19	27	31	79	86	14.6%	7.8%
G-4	6.5	12.7	1.11	1.11	5.33	5.33	11.46	11.46	0.00	0.00	121.64	54	54	116	116	0.0%	0.0%
G-NLC-8	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	4.99	3	3	5	5	0.0%	0.0%
G-NLC-9	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	5.07	3	3	5	5	0.0%	0.0%
G-SCC-1	6.5	12.7	0.42	0.31	6.03	6.14	12.21	12.34	0.12	0.12	12.28	6	6	13	13	2.0%	1.0%
H-1	6.5	12.7	1.76	1.76	4.78	4.78	10.80	10.80	0.00	0.00	14.47	6	6	13	13	0.0%	0.0%
H-2	6.5	12.7	1.24	1.11	5.22	5.33	11.33	11.46	0.11	0.13	17.82	8	8	17	17	2.2%	1.1%
H-3	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	32.57	15	15	31	31	0.0%	0.0%
H-36ST-C	6.5	12.7	0.87	0.75	5.56	5.68	11.71	11.84	0.11	0.13	3.36	2	2	3	3	2.1%	1.1%
H-36ST-E	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	2.51	1	1	2	2	0.0%	0.0%
H-36ST-W	6.5	12.7	0.87	0.75	5.56	5.68	11.71	11.84	0.11	0.13	6.12	3	3	6	6	2.1%	1.1%
H-4	6.5	12.7	1.49	1.36	5.00	5.11	11.07	11.20	0.11	0.13	71.24	30	30	66	66	2.2%	1.2%
H-5	6.5	12.7	1.36	1.24	5.11	5.22	11.20	11.33	0.11	0.13	65.87	28	29	61	62	2.2%	1.2%
H-58ST	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	9.36	4	4	9	9	0.0%	0.0%
H-6	6.5	12.7	4.08	3.70	3.31	3.51	8.84	9.14	0.20	0.29	175.02	48	51	129	133	6.1%	3.3%
H-7	6.5	12.7	2.35	2.35	4.34	4.34	10.26	10.26	0.00	0.00	172.13	62	62	147	147	0.0%	0.0%
H-79AVE-N	6.5	12.7	0.87	0.75	5.56	5.68	11.71	11.84	0.11	0.13	8.59	4	4	8	8	2.1%	1.1%
H-79AVE-S	6.5	12.7	0.87	0.75	5.56	5.68	11.71	11.84	0.11	0.13	1.30	1	1	1	1	2.1%	1.1%
H-8	6.5	12.7	1.49	1.49	5.00	5.00	11.07	11.07	0.00	0.00	116.44	48	48	107	107	0.0%	0.0%
H-82AVE	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	0.67	0	0	1	1	2.1%	1.1%
H-87AVE-N	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	11.80	5	5	11	11	0.0%	0.0%
H-87AVE-S	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	1.29	1	1	1	1	0.0%	0.0%
H-DRC-1	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	2.35	1	1	2	2	0.0%	0.0%
H-DRC-2	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	8.01	4	4	8	8	0.0%	0.0%
I-1	6.5	12.7	4.29	3.70	3.21	3.51	8.70	9.14	0.30	0.44	555.18	148	162	402	423	9.4%	5.1%
I-2	6.5	12.7	2.35	2.20	4.34	4.45	10.26	10.40	0.11	0.14	33.48	12	12	29	29	2.5%	1.3%
I-3	6.5	12.7	1.49	1.49	5.00	5.00	11.07	11.07	0.00	0.00	27.10	11	11	25	25	0.0%	0.0%
I-4	6.5	12.7	2.82	2.82	4.02	4.02	9.85	9.85	0.00	0.00	26.21	9	9	22	22	0.0%	0.0%
I-41ST	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	14.07	6	6	14	14	0.0%	0.0%
I-58ST	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	10.87	5	5	10	11	2.1%	1.1%
I-97AVE	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	10.31	5	5	10	10	2.1%	1.1%
J-1	6.5	12.7	2.35	2.20	4.34	4.45	10.26	10.40	0.11	0.14	279.28	101	104	239	242	2.5%	1.3%
J-107AVE	6.5	12.7	0.87	0.87	5.56	5.56	11.71	11.71	0.00	0.00	10.60	5	5	10	10	0.0%	0.0%
J-2	6.5	12.7	2.50	2.35	4.24	4.34	10.13	10.26	0.11	0.14	283.11	100	102	239	242	2.5%	1.4%
J-3	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	22.34	10	10	22	22	2.1%	1.1%
J-4	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	21.52	10	10	21	21	0.0%	0.0%
J-41ST	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	14.04	6	7	14	14	2.1%	1.1%
J-DRC-5	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	12.62	7	7	13	13	0.0%	0.0%
K-1	6.5	12.7	1.49	1.36	5.00	5.11	11.07	11.20	0.11	0.13	74.95	31	32	69	70	2.2%	1.2%
K-2	6.5	12.7	1.49	1.36	5.00	5.11	11.07	11.20	0.11	0.13	74.75	31	32	69	70	2.2%	1.2%
K-3	6.5	12.7	1.49	1.24	5.00	5.22	11.07	11.33	0.22	0.26	77.79	32	34	72	73	4.5%	2.4%
K-4	6.5	12.7	1.24	1.11	5.22	5.33	11.33	11.46	0.11	0.13	77.88	34	35	74	74	2.2%	1.1%
K-41ST	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	15.46	7	7	15	15	2.1%	1.1%

Sub-Basin Name	5y, 24h Rainfall (in)	100y, 72h Rainfall (in)	Soil Storage (S)		5y, 24h Runoff (in)		100y, 72h Runoff (in)		5y, 24h Runoff Difference (in)	100y, 24h Runoff Difference (in)	Sub-Basin Area (Ac)	5y, 24h Runoff (Ac-ft)		100y, 72h Runoff (Ac-ft)		Percent Increase in Volume 5y, 24h	Percent Increase in Volume 100y, 72h
			2020	*2050*	*2020*	*2050*	*2020*	*2050*				*2020*	*2050*	*2020*	*2050*		
K-5	6.5	12.7	1.49	1.36	5.00	5.11	11.07	11.20	0.11	0.13	78.28	33	33	72	73	2.2%	1.2%
K-6	6.5	12.7	1.49	1.36	5.00	5.11	11.07	11.20	0.11	0.13	77.80	32	33	72	73	2.2%	1.2%
K-7	6.5	12.7	1.36	1.24	5.11	5.22	11.20	11.33	0.11	0.13	75.42	32	33	70	71	2.2%	1.2%
K-8	6.5	12.7	1.24	1.11	5.22	5.33	11.33	11.46	0.11	0.13	76.12	33	34	72	73	2.2%	1.1%
K-DRC-6	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	2.71	1	1	3	3	0.0%	0.0%
K-DRC-7	6.5	12.7	0.53	0.42	5.91	6.03	12.09	12.21	0.12	0.12	2.32	1	1	2	2	2.0%	1.0%
K-SCC-2	6.5	12.7	0.31	0.20	6.14	6.26	12.34	12.46	0.12	0.12	12.67	6	7	13	13	1.9%	1.0%
L-1	6.5	12.7	2.99	2.50	3.92	4.24	9.71	10.13	0.32	0.42	160.06	52	56	129	135	8.1%	4.3%
L-2	6.5	12.7	4.08	3.33	3.31	3.71	8.84	9.42	0.41	0.58	158.38	44	49	117	124	12.3%	6.6%
L-3	6.5	12.7	1.36	1.36	5.11	5.11	11.20	11.20	0.00	0.00	154.07	66	66	144	144	0.0%	0.0%
L-4	6.5	12.7	2.66	2.05	4.13	4.56	9.99	10.53	0.43	0.55	158.86	55	60	132	139	10.4%	5.5%
L-58ST	6.5	12.7	0.87	0.87	5.56	5.56	11.71	11.71	0.00	0.00	11.42	5	5	11	11	0.0%	0.0%
M-1	6.5	12.7	1.11	1.11	5.33	5.33	11.46	11.46	0.00	0.00	491.70	219	219	469	469	0.0%	0.0%
M-2	6.5	12.7	1.90	1.76	4.67	4.78	10.67	10.80	0.11	0.13	132.01	51	53	117	119	2.3%	1.3%
M-58ST	6.5	12.7	0.64	0.64	5.79	5.79	11.96	11.96	0.00	0.00	13.21	6	6	13	13	0.0%	0.0%
M-SCC-3	6.5	12.7	0.20	0.20	6.26	6.26	12.46	12.46	0.00	0.00	11.13	6	6	12	12	0.0%	0.0%
N-1	6.5	12.7	1.49	1.11	5.00	5.33	11.07	11.46	0.34	0.39	632.13	263	281	583	604	6.7%	3.5%
N-74ST	6.5	12.7	4.93	4.93	2.91	2.91	8.25	8.25	0.00	0.00	10.30	3	3	7	7	0.0%	0.0%
O-1	6.5	12.7	1.63	1.49	4.89	5.00	10.94	11.07	0.11	0.13	479.97	195	200	437	443	2.3%	1.2%
O-2	6.5	12.7	0.99	0.87	5.45	5.56	11.59	11.71	0.11	0.13	28.73	13	13	28	28	2.1%	1.1%
O-3	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	17.80	8	8	17	17	0.0%	0.0%
O-4	6.5	12.7	1.90	1.76	4.67	4.78	10.67	10.80	0.11	0.13	101.90	40	41	91	92	2.3%	1.3%
O-74ST	6.5	12.7	0.99	0.99	5.45	5.45	11.59	11.59	0.00	0.00	9.60	4	4	9	9	0.0%	0.0%
O-SCC-4	6.5	12.7	0.42	0.42	6.03	6.03	12.21	12.21	0.00	0.00	18.11	9	9	18	18	0.0%	0.0%