

**GAINESVILLE MUNICIPAL AIRPORT**  
**GAINESVILLE, TEXAS**

## **Airfield Drainage Study**

KSA Project No. 103755

May 2026

Prepared by:



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## 1. INTRODUCTION AND PROJECT DESCRIPTION

This report presents the results of a planning-level assessment of the stormwater drainage system at Gainesville Municipal Airport (GLE or the Airport) located in Gainesville, Texas. The purpose of this drainage study is to evaluate the capacity and performance of the existing airfield drainage infrastructure and provide recommendations for improvements where inadequacies or problems have been identified. The results of this report are not intended to be used for construction, permitting, or bidding purposes.

GLE is located within Cooke County, Texas approximately 2.5 miles west of IH-35 in Gainesville along Highway 82 as shown in **Exhibit 1 Location Map**. GLE is a public use airport owned and operated by the City of Gainesville.

The Airport is included on **FEMA Map Number 48097C0300C and 48097C0295C** (effective date 1/16/2008) as shown in **Exhibit 2 FEMA Flood Plain**. A small portion of a zone A 100-yr flood hazard layer clips the eastern boundary of the airport property. The area designated for airfield operations lies outside the 100-yr and 500-yr flood hazard zones.

## 2. ISSUES IDENTIFIED AND PROPOSED RECOMMENDATIONS

A site visit was held on April 7<sup>th</sup>, 2026 to discuss frequent drainage issues observed by airport staff. Gainesville Municipal Airport contains over 13,000 linear feet of drainage ditches, culverts and storm drain network. This drainage infrastructure conveys stormwater away from pavement, parking, and buildings and into the Airport's discharge waterways to the west, south and east.

Analysis of off-site flows and drainage patterns is outside the scope, so the recommendations made herein pertain only to on-site improvements. Proper design and maintenance of on-site localized drainage features is required for a functional Airport-wide drainage system.

Ditches, culverts, and inlets that are not adequately sized and maintained will inevitably become problematic for the Airport. Problems related to inadequately sized or failed infrastructure include, but are not limited to, flooding of hangars and pavement, accelerated deterioration of airfield pavement and other infrastructure from saturation of soils, and ponding water between storm events which encroaches on airfield pavements and attracts wildlife. During the site visit, it was observed that several areas do not properly drain runoff generated from their respective drainage areas. Several drainage ditches or infield runoff paths contain high points along their

respective flow paths that impede the flow of stormwater runoff and result in impounded water. This leads to ponding water and, in significant rain events, flooding of Airport infrastructure.

Several drainage deficiencies were identified west of the apron and main terminal building. A series of culverts of varying sizes are installed along Airport Drive to convey runoff southward from areas located west of the apron. However, survey data indicate that portions of the roadside ditch exhibit insufficient longitudinal slope to effectively convey flow. As a result, stormwater ponding has been observed along the east side of Airport Drive, as illustrated in **Exhibit 3**.

Several drainage issues were observed in the southern portion of the airport, characterized by persistent saturation and reduced outfall efficiency in low-lying areas. These conditions are likely driven by minimal channel/ infield area slopes, downstream restrictions at offsite discharge locations, and the cumulative impact of upstream runoff that bypasses its intended inlets.

Inadequate drainage infrastructure inevitably results in increased incidence of wildlife on the airfield as they are attracted to the flooded airfield environment. This compounds the issues that airports face when addressing on-site drainage. According to the FAA, wildlife strikes have increased from 1,850 in 1990, to record numbers well over 13,000 in the last five years. Statistics have led to the creation of Advisory Circulars that address the safety hazard and need to control fauna at airport facilities. The **Federal Aviation Administration's (FAA) Advisory Circular (AC) 150/5200-33C, Hazardous Wildlife Attractants on or near Airports**, identifies certain land uses that have shown to attract hazardous wildlife; water management facilities and wetlands are among the land uses with the highest potential to attract fauna. Additionally, the Airport Cooperative Research Program (ACRP) addresses the issue in Report 125, *Balancing Airport Stormwater and Bird Hazard Management*. It indicates that direct impervious runoff to pervious areas and vegetated swales are among the riskiest features, aside from detention basins.

The approach to correction of on-airfield drainage will be multifaceted as it must involve administration of remedial actions to multiple types of drainage infrastructure. It is recommended that all ditches or infield areas with impeded flow be regraded for establishment of positive drainage away from airfield facilities. Per guidance contained within **FAA AC 150/5320-5D, *Airfield Drainage Design***, it is recommended that all drainage ditches, culverts, and inlets be properly sized to convey the 5-year storm event flows with no encroachment of runoff on airfield pavements. Gradual side slopes should be used in open ditches to reduce the risk of erosion and enable maintenance between storm events. Concrete pilot channels can also be employed to maintain consistent ditch flowlines and mitigate future erosion concerns. Frequent maintenance is necessary to preserve positive stormwater flows by mowing vegetation in ditches and removing any sediment or debris from inlets and culverts. It is also recommended that additional investigation into the condition of all airfield culverts and storm drain network pipes be undertaken. Any compromised culverts or storm drainage pipes should be replaced, and all interior siltation should be eradicated. Additionally, all culverts and storm drain pipes that are determined to be undersized for conveyance of 5-year design storm event flows should be replaced with adequately sized drainage structures.

In conclusion, proper design and maintenance of drainage conveyance systems are critical to providing a functional drainage system at Gainesville Municipal Airport. The flow rates generated by each drainage area summarized in this report can be used as a basis for guiding the design of the proposed grading, culvert sizing, and stormwater drainage network recommendations.

The following sections of this report detail the means and methods employed during the hydrologic analysis of drainage infrastructure at GLE.

### 3. METHODOLOGY

Information used during the development of this document was obtained from various sources including a site visit performed by Tyler Campbell P.E, CFM with KSA, information supplied by the Airport, and a site survey of existing drainage infrastructure at the airport, augmented by LIDAR, performed by *Martinez Geospatial*. KSA conducted a site visit on April 7<sup>th</sup>, 2026, to evaluate the existing conditions.

The field data collection survey was completed in April 2026. Due to the size of the airport drainage system, the data collected was high level and provided above ground area storm drain features and ditch flowlines. Detailed survey will be required during the design phase of the recommended improvements.

The hydrologic analysis was prepared based on the **Natural Resource Conservation Service (NRCS)**, *Urban Hydrology for Small Watersheds* TR-55 dated June 1986 and the **FAA AC 150/5320-5D**, *Airport Drainage Design* dated 8/15/2013. KSA used the rational method to calculate the amount of stormwater runoff generated from the Airport property for 2-, 5-, 10-, and 100-year storm events. Hydrologic parameters were analyzed in Civil 3D and were used to evaluate existing hydrologic and hydraulic conditions at the airport and calculate stormwater runoff values. The rational method does not account for infiltration and assumes all rainfall is directly converted to runoff.

This document is intended to serve as a planning-level summary of the existing stormwater drainage conditions at Gainesville Municipal Airport. Existing drainage infrastructure has proven inadequate during recent heavy rainfall events at the Airport. During such events, stormwater accumulates on portions of the airfield. This report details the specific actions taken to analyze the existing hydrologic conditions contributing to runoff for airfield drainage systems.

## 4. EXISTING DRAINAGE CONDITIONS

### 4.1. Drainage Area Delineation

Existing subbasins were delineated using 1-foot contour mapping provided by Martinez Geospatial. In areas where topography did not clearly define drainage patterns, aerial imagery was utilized to supplement the analysis. Based on the combined evaluation of contour data and aerial imagery, stormwater runoff from the airport is conveyed to six primary outfall locations.

Runoff from the northwestern portion of the airport, generally bounded by the northern segment of the north–south (N–S) runway to the east and existing taxiways and connectors to the north, west, and south, is collected by an existing storm inlet system and ultimately discharges southwest toward Airport Drive. The area between the N–S runway and the apron taxiway drains into a storm drainage network that conveys runoff south and west toward drainage infrastructure near Highway 82.

Runoff from the central and southern portions of the airport, located between the N–S and northwest–southeast (NW–SE) runways, is conveyed south through a storm drainage system and discharges toward Highway 82. In the southeastern portion of the site, runoff is collected by an east–west oriented storm drainage network that conveys flows to a centralized discharge point, also directing runoff south toward Highway 82.

Runoff northeast of the northeast–southwest (NE–SW) runway is conveyed southeast through a storm drainage network and ultimately discharges to an existing tributary. A smaller area in the far northeastern portion of the airport drains to an inlet and discharges northeast to the same tributary system.

Overall, the airport functions as a topographic high point, with runoff generally draining west toward a tributary of Montague Creek and south and east toward tributaries of Dozier Creek. The delineated subbasins are presented in **Exhibit 4**.

#### 4.2. Time Of Concentration

The longest flow paths were determined for each drainage area and are comprised of sheet, shallow concentrated, and channel and/or pipe flows. The latest version of TR-55 “*WINTR-55 Small Watershed Hydrology*” was used to compute the time of concentration for each drainage area. The user guide states that sheet flow becomes concentrated flow beyond 100 feet, therefore sheet flow was limited to 100 feet. Manning’s Kinematic Equation (provided below) was used to calculate the *time of concentration* ( $T_t$ ) for sheet flow. Table 3-1 from TR-55 contains the *Manning’s sheet flow roughness coefficients* ( $n$ ) and can be found in **Appendix A Manning Roughness Coefficient – Sheet Flow**.

##### Equation 1. Manning’s Kinematic Equation

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}S^{0.4}}$$

Where:

$T_t$  = travel time (hr)

$n$  = Manning’s roughness coefficient (Table 3 – 1)

$L$  = flow length (ft)

$P_2$  = 2-year, 24-hour rainfall (in)

$S$  = slope of hydraulic grade line (land slope, ft/ft)

Shallow concentrated flow was calculated using paved or unpaved conditions. The equations below present the equations used to calculate velocity for shallow concentrated flow.

##### Equation 2. Unpaved Concentrated Velocity

$$V = 16.1345(S^{0.5})$$

### Equation 3. Paved Concentrated Velocity

$$V = 20.3282(S^{0.5})$$

Where:

$V$  = average velocity (ft/s)

$S$  = slope of hydraulic grade line (watercourse slope, ft/ft)

Pipe and channel flow velocities were calculated using Manning's Equation. The velocities for shallow concentrated flow and pipe flow were converted to travel time, calculated by dividing the flow path length by the velocity. **Appendix B Manning Roughness Coefficient – Pipe Flow** contains Manning's roughness coefficients (n) for pipe flow.

### Equation 4. Manning's Equation

$$V = \frac{1.49}{n} R^{2/3} S^{1/2} ; R = \frac{A}{pw}$$

Where:

$V$  = average velocity (ft/s)

$R$  = hydraulic radius (ft)

$A$  = cross sectional flow area (ft<sup>2</sup>)

$pw$  = wetted perimeter (ft)

$S$  = slope of the hydraulic grade line (channel slope, ft/ft)

$n$  = Manning's roughness coefficient for open channel flow.

### Equation 5. Travel Time

$$T_t = \frac{L}{3600V}$$

Where:

$T_t$  travel time (hr)

$L$  = flow length (ft)

$V$  = average velocity (ft/s)

3600 = conversion factor from seconds to hours.

Slopes were calculated using the 1-foot contours mapped from Martinez Geospatial and surveyed data. The travel times for sheet, shallow concentrated, and pipe or channel flow were added to determine the time of concentration for each drainage basin. The time of concentration flow paths are shown on **Exhibit 3 Airfield Drainage Analysis**. **Appendix C Time of Concentration Calculations** contains the backup data for the Tc calculation of each flow path. It should be noted that some slopes inside the infield ditches/flow areas were extremely flat (<.01 ft/ft) resulting in high time of concentration values.

#### 4.3. Existing Runoff Coefficients

The rational method was used to calculate composite runoff coefficients based on land use and impervious cover. **Appendix D Composite Runoff Coefficient Calculations** contains the backup calculation data for composite runoff coefficients per each drainage basin.

### 5. RAINFALL DATA

Precipitation depths for each storm event were taken from NOAA Atlas 14 and used to analyze the 2-, 5-, 10-, and 100-year (50%, 20%, 10%, and 1% respectively) storm events. Below are the precipitation depths in inches used for each storm event.

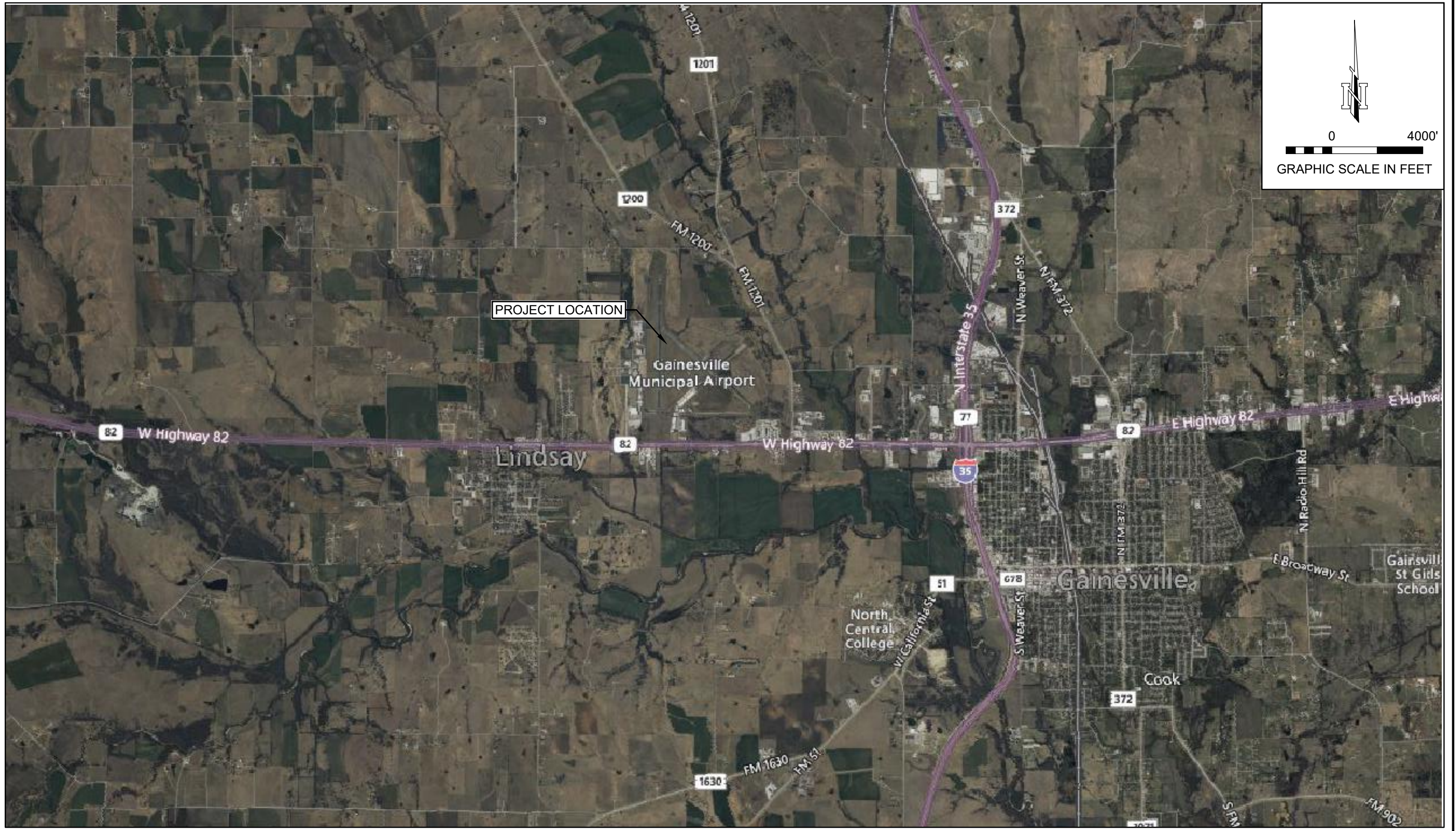
Rainfall depths (NOAA Atlas 14):

- 2-year, 24-hr: 3.93 in
- 5-year, 24-hr: 5.00 in
- 10-year, 24-hr: 5.93 in
- 100-year, 24-hr: 9.58 in

### 6. HYDROLOGIC RESULTS

The hydrologic parameters discussed above were utilized in the determination of discharge values in order to quantify existing hydrologic conditions. The calculated flow rates can serve as a guide when designing and constructing future stormwater improvements at the airport. **Appendix E Rational Method Hydrology Calculations** shows the peak flow generated by each drainage area for the previously described storm event frequencies. Moving forward, KSA will apply the same assumptions for travel time and impervious area mentioned above to develop a HEC-HMS model for the estimation of peak discharges within each storm basin, and compare the results to the computed rational method results. The model results will be used to evaluate the

capacity of the existing drainage system to convey stormwater runoff based on the contributing drainage areas.



PROJECT LOCATION

Gainesville  
Municipal Airport

Lindsay

North  
Central  
College

Gainesville

Cook

Gainesville  
St Girls  
School

**KSA**

a **PARSONS** company  
10801 North Mopac Expressway Building 3-Suite 200  
Austin, TX 78759  
T. 512.342.6868  
www.ksaeng.com

GAINESVILLE MUNICIPAL AIRPORT  
COOKE COUNTY, TEXAS

EXHIBIT 1  
LOCATION MAP

**NOTES TO USERS**

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **flowways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only to landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **flowways** were computed at cross sections and interpolated between cross sections. The flowways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 14. The horizontal datum was NAD83. GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NCS Information Services  
NOAA NNGS12  
National Geodetic Survey  
SSAC-3 #0202  
1315 East-West Highway  
Silver Spring, MD 20910-3282

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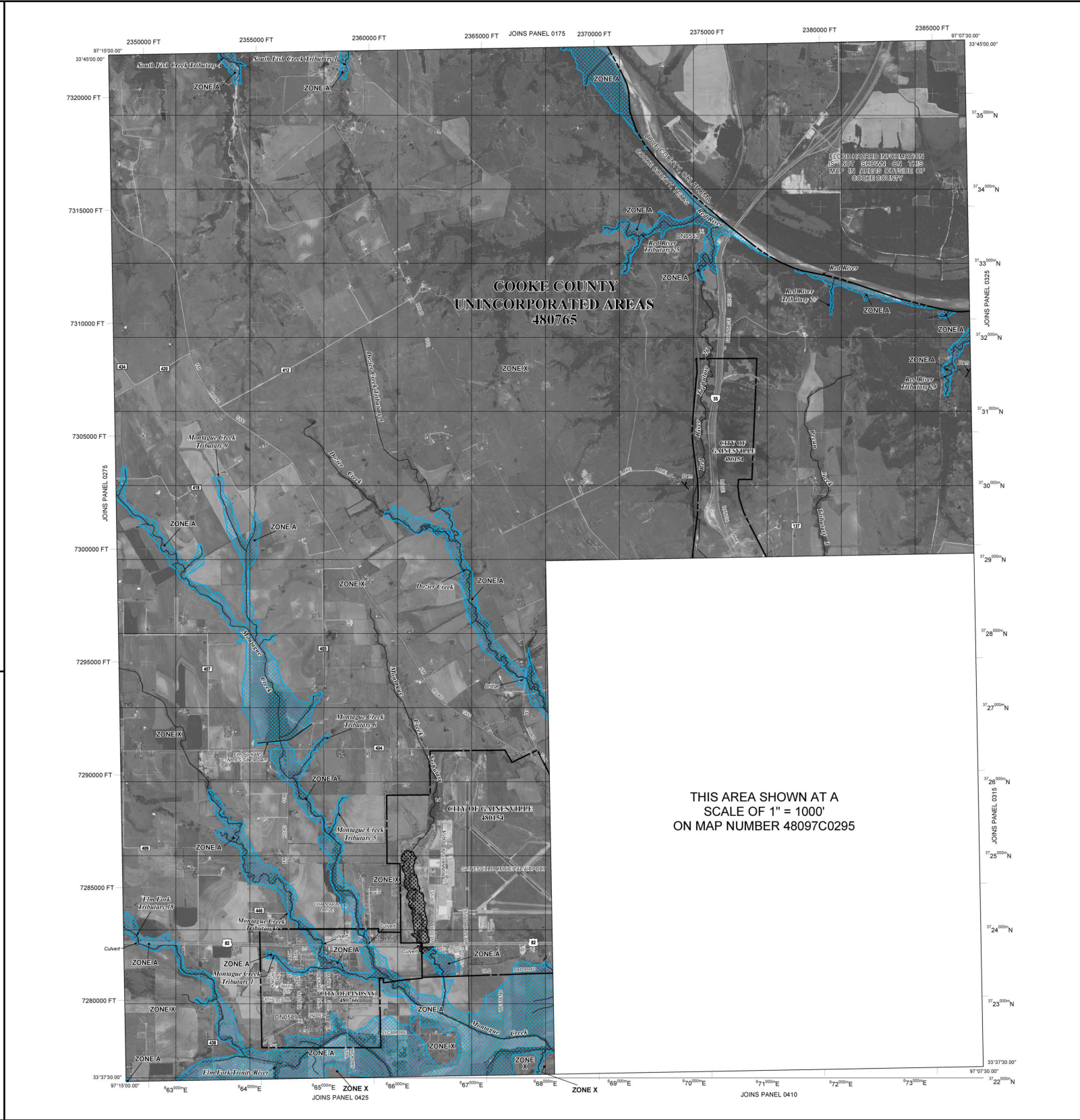
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Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/>.



**LEGEND**

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevations determined.

**ZONE AE** Base Flood Elevations determined.

**ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

**ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

**ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

**ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

**ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

**ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOWWAYS ARE IN ZONE AE**

The flowway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D** Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

Base Flood Elevation line and value; elevation in feet\*

Base Flood Elevation value where uniform within zone; elevation in feet\*

\* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

Cross section line

Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

1000-meter Universal Transverse Mercator grid values, zone 14

5000-foot grid ticks: Texas

System, north central zone (FIPSZONE 4302), Lambert Conformal Conic

Bench mark (see explanation in Notes to Users section of this FIRM panel)

DX5510

M1.5

MAP REPOSITORIES

Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

January 16, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-8620.

**MAP SCALE 1" = 2000'**

0 1000 2000 4000 FEET

0 800 1600 METERS

**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0300C**

**FIRM**

**FLOOD INSURANCE RATE MAP**

**COOKE COUNTY, TEXAS**

**AND INCORPORATED AREAS**

**PANEL 300 OF 600**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

| COMMUNITY          | NUMBER | PANEL | SUFFIX |
|--------------------|--------|-------|--------|
| COOKE COUNTY       | 480765 | 0300  | C      |
| GAINEVILLE CITY OF | 480764 | 0300  | C      |
| LINDSEY CITY OF    | 480766 | 0300  | C      |

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

**MAP NUMBER 4807C0300C**

**EFFECTIVE DATE JANUARY 16, 2008**

Federal Emergency Management Agency



10801 North Mopac Expressway Building 3-Suite 200  
Austin, TX 78759  
T. 512.342.6868  
[www.ksaeng.com](http://www.ksaeng.com)

**GAINESVILLE MUNICIPAL AIRPORT**  
**COOKE COUNTY, TEXAS**

**EXHIBIT 2**  
**FEMA FLOOD PLAIN**  
**(1 OF 2)**

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- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; No Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); No Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**  
The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

### OTHER FLOOD AREAS

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

### OTHER AREAS

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.  
**ZONE D** Areas in which flood hazards are undetermined, but possible.

### COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

### OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet\*
- Base Flood Elevation value where uniform within zone; elevation in feet\*

\* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

— Cross section line

— Transsect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

1000-meter Universal Transverse Mercator grid values, zone 14

5000-foot grid ticks: Texas State Plane coordinate system, north central zone (FIPS/NOE 4302), Lambert Conformal Conic

Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5  
River Mile

MAP REPOSITORIES  
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

January 16, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-8620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

PANEL 0295C

FIRM

FLOOD INSURANCE RATE MAP

COOKE COUNTY,

TEXAS

AND INCORPORATED AREAS

PANEL 295 OF 600

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY NUMBER PANEL SUFFIX

COOKE COUNTY 480765 0295 C

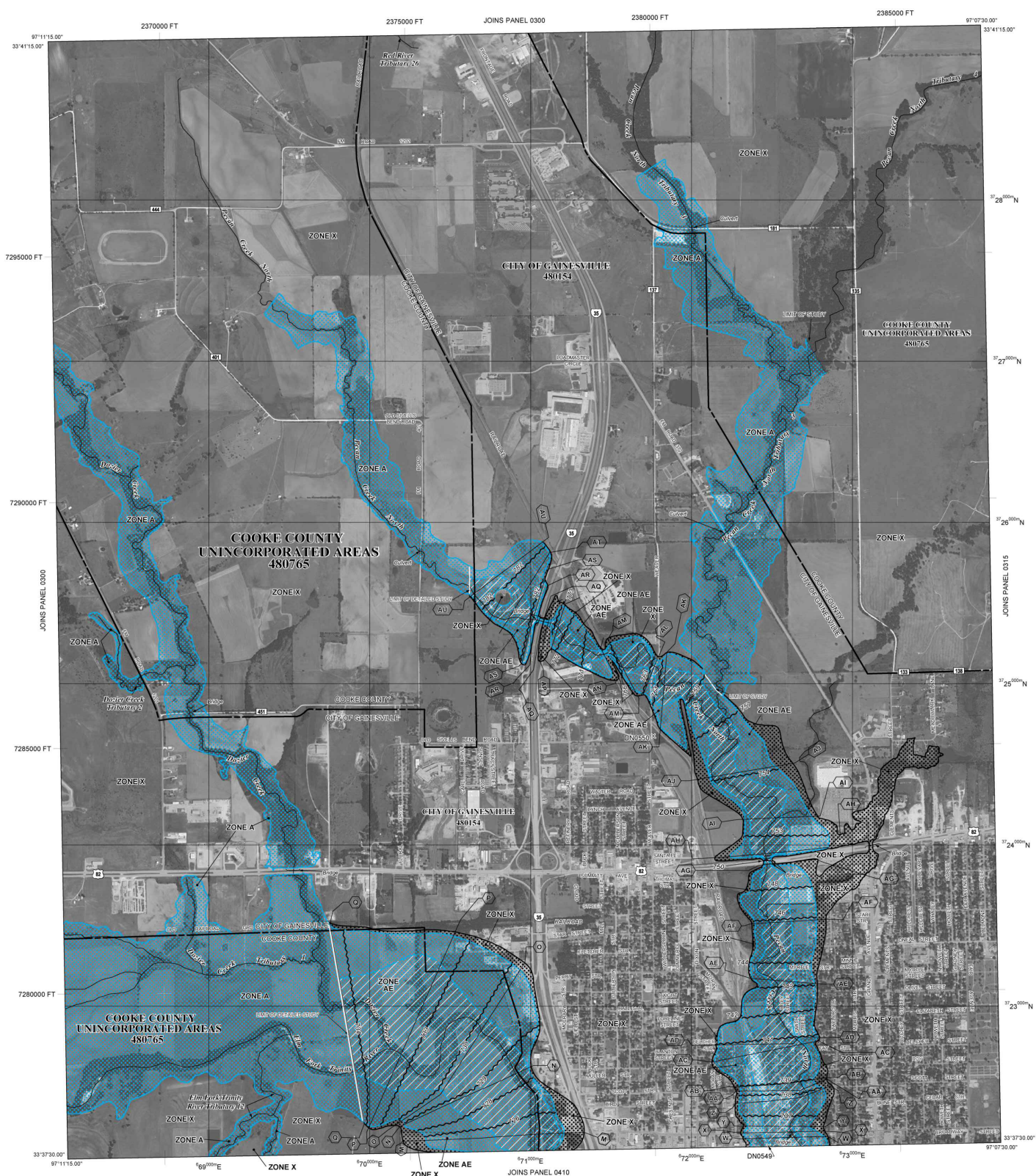
GAINESVILLE CITY OF 480154 0295 C

Notice to User: The Map Number shown below should be used when ordering map copies. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER 4807C0295C

EFFECTIVE DATE JANUARY 16, 2008

Federal Emergency Management Agency

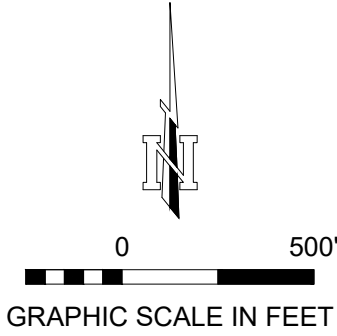


**KSA**  
KSA ENGINEERING

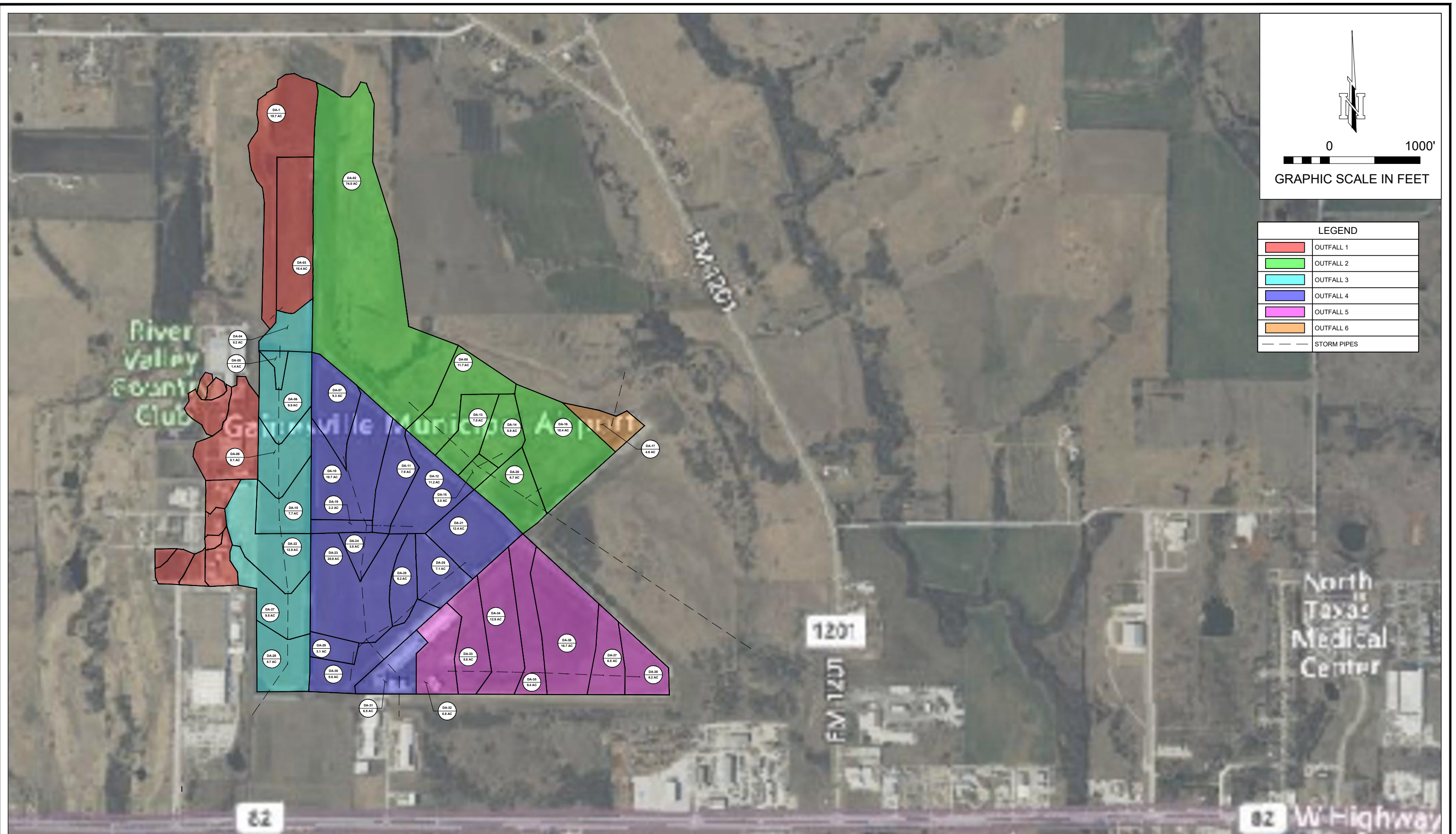
10801 North Mopac Expressway Building 3-Suite 200  
Austin, TX 78759  
T. 512.342.6868  
[www.ksaeng.com](http://www.ksaeng.com)

GAINESVILLE MUNICIPAL AIRPORT  
COOKE COUNTY, TEXAS

EXHIBIT 2  
FEMA FLOOD PLAIN  
(2 OF 2)



| DRAINAGE ISSUES |            |            |                               |
|-----------------|------------|------------|-------------------------------|
| POINT NO.       | NORTHING   | EASTING    | ISSUE                         |
| 1               | 7286255.27 | 2363078.77 | PONDING                       |
| 2               | 7285714.95 | 2363444.72 | EXCESSIVE STANDING WATER      |
| 3               | 7285642.09 | 2363028.85 | PONDING                       |
| 4               | 7283920.89 | 2364029.94 | PONDING                       |
| 5               | 7284695.64 | 2365778.81 | PONDING                       |
| 6               | 7283871.53 | 2365511.75 | PONDING                       |
| 7               | 7283838.79 | 2364828.20 | STANDING WATER                |
| 8               | 7283728.24 | 2365042.62 | PONDING                       |
| 9               | 7283724.61 | 2365238.81 | PONDING                       |
| 10              | 7284158.13 | 2364984.87 | WATER BACKUP                  |
| 11              | 7284364.27 | 2363590.76 | STANDING WATER                |
| 12              | 7286214.27 | 2363444.72 | WATER DRAINING INTO STRUCTURE |
| 13              | 7285469.26 | 2363028.85 | TOPPED CULVERT                |



**KSA**

a STANTEC-DANFORD company  
 10801 North Mopac Expressway Building 3-Suite 200  
 Austin, TX 78759  
 T. 512.342.6868  
 www.ksaeng.com

# GAINESVILLE MUNICIPAL AIRPORT COOKE COUNTY, TEXAS

# EXHIBIT 4 DRAINAGE AREA MAP

## Appendix A Manning's Roughness Coefficients for Sheet Flow

**Table 3-1** Roughness coefficients (Manning's  $n$ ) for sheet flow

| Surface description                                             | $n$ <sup>1/</sup> |
|-----------------------------------------------------------------|-------------------|
| Smooth surfaces (concrete, asphalt, gravel, or bare soil) ..... | 0.011             |
| Fallow (no residue) .....                                       | 0.05              |
| Cultivated soils:                                               |                   |
| Residue cover $\leq 20\%$ .....                                 | 0.06              |
| Residue cover $> 20\%$ .....                                    | 0.17              |
| Grass:                                                          |                   |
| Short grass prairie .....                                       | 0.15              |
| Dense grasses <sup>2/</sup> .....                               | 0.24              |
| Bermudagrass .....                                              | 0.41              |
| Range (natural) .....                                           | 0.13              |
| Woods: <sup>3/</sup>                                            |                   |
| Light underbrush .....                                          | 0.40              |
| Dense underbrush .....                                          | 0.80              |

<sup>1</sup> The  $n$  values are a composite of information compiled by Engman (1986).

<sup>2</sup> Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

<sup>3</sup> When selecting  $n$ , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

*Appendix B*  
**Manning Roughness Coefficient**

| <b>Channel Material</b>                  | <b>Manning Roughness Coefficient, n</b> |
|------------------------------------------|-----------------------------------------|
| Plastic (PVC and ABS)                    | 0.009                                   |
| HDPE                                     | 0.012                                   |
| Concrete                                 | 0.013                                   |
| Brick                                    | 0.016                                   |
| Rubble Masonry                           | 0.017                                   |
| Corrugated Metal Pipe                    | 0.024                                   |
| Natural Channels (good condition)        | 0.025                                   |
| Riprap                                   | 0.035                                   |
| Natural Channels (with stones and weeds) | 0.035                                   |
| Natural Channels (poor condition)        | 0.060                                   |

Appendix C  
Time of Concentration Calculations  
SCS Hydrologic Method

| Basin Information |                           |           |                     | Sheet Flow Component |             |               |             |                   |                   | Shallow Concentrated Flow Component |             |               |                   | Pipe Flow Component |             |               |               |             |                   | Channel Flow Component |             |               |         |            |           | Σ Time      |                   |                   |                                   |                                  |                                   |       |
|-------------------|---------------------------|-----------|---------------------|----------------------|-------------|---------------|-------------|-------------------|-------------------|-------------------------------------|-------------|---------------|-------------------|---------------------|-------------|---------------|---------------|-------------|-------------------|------------------------|-------------|---------------|---------|------------|-----------|-------------|-------------------|-------------------|-----------------------------------|----------------------------------|-----------------------------------|-------|
| Basin ID          | Land Use                  | Area (ac) | P <sub>2</sub> (in) | Surface              | Length (ft) | Slope (ft/ft) | Manning's n | Velocity (ft/sec) | Travel Time (min) | Surface                             | Length (ft) | Slope (ft/ft) | Velocity (ft/sec) | Travel Time (min)   | Length (ft) | Slope (ft/ft) | Diameter (in) | Manning's n | Velocity (ft/sec) | Travel Time (min)      | Length (ft) | Slope (ft/ft) | BW (ft) | Depth (ft) | SS (ft/s) | Manning's n | Velocity (ft/sec) | Travel Time (min) | Minimum T <sub>c</sub> (Optional) | Travel Time T <sub>c</sub> (min) | SCS Lag Time T <sub>L</sub> (min) |       |
| DA-01             | Commercial and Industrial | 19.70     | 3.93                | Dense grasses        | 100         | 0.0164        | 0.24        | 0.12              | 13.94             | Unpaved                             | 826         | 0.0223        | 2.41              | 5.73                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 2150        | 0.0093        | 0       | 3          | 18        | 0.03        | 6.19              | 5.79              | 25.00                             | 25.44                            | 15.27                             |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-02             | Commercial and Industrial | 74.00     | 3.93                | Dense grasses        | 100         | 0.0201        | 0.24        | 0.13              | 12.85             | Unpaved                             | 3945.5      | 0.0103        | 1.64              | 40.18               | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 6          | 0         | 0           | 0                 | 0.00              | 0.00                              | 25.00                            | 53.03                             | 31.82 |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-03             | Commercial and Industrial | 15.40     | 3.93                | Smooth surfaces      | 78          | 0.0024        | 0.011       | 0.62              | 2.08              | Unpaved                             | 243         | 0.0079        | 1.43              | 2.83                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 1469        | 0.0109        | 117     | 2          | 50        | 0.03        | 6.38              | 3.84              | 10.00                             | 8.75                             | 5.25                              |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-04             | Commercial and Industrial | 5.20      | 3.93                | Smooth surfaces      | 100         | 0.0113        | 0.011       | 1.21              | 1.37              | Unpaved                             | 174         | 0.0128        | 2.30              | 1.25                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              | 10.00                             | 8.09                             | 4.85                              |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Unpaved                             | 422.16      | 0.0064        | 1.29              | 5.45                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-05             | Commercial and Industrial | 1.40      | 3.93                | Smooth surfaces      | 60          | 0.009         | 0.011       | 1.00              | 1.00              | Unpaved                             | 256         | 0.0089        | 1.52              | 2.80                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 204         | 0.0065        | 101.5   | 1.5        | 161       | 0.03        | 3.68              | 0.92              | 10.00                             | 4.73                             | 2.84                              |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-06             | Commercial and Industrial | 9.90      | 3.93                | Smooth surfaces      | 100         | 0.0138        | 0.011       | 1.31              | 1.27              | Unpaved                             | 35          | 0.0151        | 2.50              | 0.23                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 432         | 0.0104        | 0       | 1.33       | 150       | 0.03        | 3.87              | 1.86              | 10.00                             | 8.74                             | 5.24                              |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Unpaved                             | 552         | 0.0113        | 1.71              | 5.37                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-07             | Commercial and Industrial | 9.30      | 3.93                | Smooth surfaces      | 100         | 0.0063        | 0.011       | 0.96              | 1.74              | Unpaved                             | 68          | 0.0054        | 1.50              | 0.76                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              | 13.07                             | 13.07                            | 7.84                              |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Unpaved                             | 1066        | 0.0108        | 1.68              | 10.58               | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-08             | Commercial and Industrial | 11.70     | 3.93                | Dense grasses        | 100         | 0.0063        | 0.24        | 0.08              | 20.44             | Unpaved                             | 1063        | 0.0057        | 1.22              | 14.55               | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0                 | 0.00              | 0.00                              | 25.00                            | 34.99                             | 20.99 |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-09             | Commercial and Industrial | 8.10      | 3.93                | Smooth surfaces      | 100         | 0.0126        | 0.011       | 1.27              | 1.32              | Unpaved                             | 46          | 0.0111        | 2.14              | 0.36                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 433         | 0.0138        | 0       | 1.35       | 196       | 0.03        | 4.49              | 1.61              | 10.00                             | 8.29                             | 4.97                              |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Unpaved                             | 518         | 0.0114        | 1.72              | 5.01                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-10             | Commercial and Industrial | 18.70     | 3.93                | Smooth surfaces      | 100         | 0.0079        | 0.011       | 1.05              | 1.59              | Unpaved                             | 65          | 0.01          | 2.03              | 0.53                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              | 14.15                             | 14.15                            | 8.49                              |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Unpaved                             | 1277        | 0.012         | 1.77              | 12.03               | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-11             | Commercial and Industrial | 7.90      | 3.93                | Smooth surfaces      | 100         | 0.0085        | 0.011       | 1.08              | 1.54              | Unpaved                             | 48          | 0.0027        | 1.06              | 0.76                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              | 12.14                             | 12.14                            | 7.29                              |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Unpaved                             | 1083        | 0.0129        | 1.83              | 9.85                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-12             | Commercial and Industrial | 11.20     | 3.93                | Smooth surfaces      | 100         | 0.0081        | 0.011       | 1.06              | 1.57              | Unpaved                             | 122         | 0.0082        | 2.54              | 1.10                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              | 10.00                             | 9.75                             | 5.85                              |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Unpaved                             | 912         | 0.0112        | 2.15              | 7.08                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-13             | Commercial and Industrial | 7.00      | 3.93                | Dense grasses        | 100         | 0.0029        | 0.24        | 0.06              | 27.88             | Unpaved                             | 715         | 0.0108        | 1.68              | 7.10                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              | 25.00                             | 34.97                            | 20.98                             |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Unpaved                             | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-14             | Commercial and Industrial | 5.90      | 3.93                | Dense grasses        | 100         | 0.0117        | 0.24        | 0.10              | 15.96             | Unpaved                             | 581         | 0.0122        | 1.78              | 5.43                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              | 21.39                             | 21.39                            | 12.83                             |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Unpaved                             | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
|                   |                           |           |                     |                      |             |               |             |                   |                   | Paved                               | 0           | 0             | 0.00              | 0.00                | 0           | 0             | 0             | 0           | 0.00              | 0.00                   | 0           | 0             | 0       | 0          | 0         | 0           | 0.00              | 0.00              |                                   |                                  |                                   |       |
| DA-15             | Commercial and Industrial | 2.00      |                     |                      |             |               |             |                   |                   |                                     |             |               |                   |                     |             |               |               |             |                   |                        |             |               |         |            |           |             |                   |                   |                                   |                                  |                                   |       |

Composite "C<sub>2</sub>" Calculation

|          | 0.74             | 0.25            | 1               | 0.5             |            |      |
|----------|------------------|-----------------|-----------------|-----------------|------------|------|
| Area No. | Paving<br>(0.74) | Grass<br>(0.25) | Building<br>(1) | Gravel<br>(0.5) | Total (SF) | "C"  |
| DA-01    | 65732.73         | 792402.70       |                 |                 | 858135.433 | 0.29 |
| DA-02    | 223517.10        | 2999935.79      |                 |                 | 3223452.89 | 0.28 |
| DA-03    | 117251.63        | 553575.06       |                 |                 | 670826.683 | 0.34 |
| DA-04    | 71353.76         | 155159.14       |                 |                 | 226512.906 | 0.40 |
| DA-05    | 7932.84          | 53051.40        |                 |                 | 60984.2439 | 0.31 |
| DA-06    | 56849.85         | 374395.88       |                 |                 | 431245.725 | 0.31 |
| DA-07    | 101806.99        | 303302.63       |                 |                 | 405109.62  | 0.37 |
| DA-08    | 29355.56         | 480298.48       |                 |                 | 509654.039 | 0.28 |
| DA-09    | 53904.57         | 298932.84       |                 |                 | 352837.411 | 0.32 |
| DA-10    | 115843.52        | 698731.73       |                 |                 | 814575.258 | 0.32 |
| DA-11    | 18105.93         | 326019.44       |                 |                 | 344125.377 | 0.28 |
| DA-12    | 102969.45        | 384904.51       |                 |                 | 487873.951 | 0.35 |
| DA-13    | 21812.31         | 283108.91       |                 |                 | 304921.22  | 0.29 |
| DA-14    | 3293.49          | 253711.53       |                 |                 | 257005.028 | 0.26 |
| DA-15    | 22162.11         | 64958.24        |                 |                 | 87120.3485 | 0.37 |
| DA-16    | 16048.92         | 785458.29       |                 |                 | 801507.206 | 0.26 |
| DA-17    | 35895.16         | 164481.64       |                 |                 | 200376.802 | 0.34 |
| DA-18    | 95870.71         | 239542.63       |                 |                 | 335413.342 | 0.39 |
| DA-19    | 22730.95         | 73101.44        |                 |                 | 95832.3833 | 0.37 |
| DA-20    | 57400.88         | 321572.63       |                 |                 | 378973.516 | 0.32 |
| DA-21    | 127423.38        | 412722.78       |                 |                 | 540146.161 | 0.37 |
| DA-22    | 266803.06        | 295123.19       |                 |                 | 561926.248 | 0.48 |
| DA-23    | 95125.11         | 815282.54       |                 |                 | 910407.642 | 0.30 |
| DA-24    | 20026.17         | 132434.44       |                 |                 | 152460.61  | 0.31 |
| DA-25    | 2742.84          | 223770.07       |                 |                 | 226512.906 | 0.26 |
| DA-26    | 46147.29         | 263129.94       |                 |                 | 309277.237 | 0.32 |
| DA-27    | 102546.62        | 311275.03       |                 |                 | 413821.655 | 0.37 |
| DA-28    | 99784.25         | 279189.27       |                 |                 | 378973.516 | 0.38 |
| DA-29    | 20254.05         | 114782.49       |                 |                 | 135036.54  | 0.32 |
| DA-30    | 112657.01        | 305520.66       |                 |                 | 418177.673 | 0.38 |
| DA-31    | 208930.09        | 74211.04        |                 |                 | 283141.133 | 0.61 |
| DA-32    | 128324.63        | 255004.90       |                 |                 | 383329.533 | 0.41 |
| DA-33    | 22187.22         | 361142.31       |                 |                 | 383329.533 | 0.28 |
| DA-34    | 23388.06         | 538538.18       |                 |                 | 561926.248 | 0.27 |
| DA-35    | 35439.61         | 374026.03       |                 |                 | 409465.638 | 0.29 |
| DA-36    | 77076.06         | 737499.20       |                 |                 | 814575.258 | 0.30 |
| DA-37    | 21595.30         | 261545.83       |                 |                 | 283141.133 | 0.29 |
| DA-38    | 30822.52         | 239250.56       |                 |                 | 270073.08  | 0.31 |

Composite "C<sub>5</sub>" Calculation

|          | 0.79             | 0.28            | 1               | 0.5             |            |      |
|----------|------------------|-----------------|-----------------|-----------------|------------|------|
| Area No. | Paving<br>(0.79) | Grass<br>(0.28) | Building<br>(1) | Gravel<br>(0.5) | Total (SF) | "C"  |
| DA-01    | 65732.73         | 792402.70       |                 |                 | 858135.433 | 0.32 |
| DA-02    | 223517.10        | 2999935.79      |                 |                 | 3223452.89 | 0.32 |
| DA-03    | 117251.63        | 553575.06       |                 |                 | 670826.683 | 0.37 |
| DA-04    | 71353.76         | 155159.14       |                 |                 | 226512.906 | 0.44 |
| DA-05    | 7932.84          | 53051.40        |                 |                 | 60984.2439 | 0.35 |
| DA-06    | 56849.85         | 374395.88       |                 |                 | 431245.725 | 0.35 |
| DA-07    | 101806.99        | 303302.63       |                 |                 | 405109.62  | 0.41 |
| DA-08    | 29355.56         | 480298.48       |                 |                 | 509654.039 | 0.31 |
| DA-09    | 53904.57         | 298932.84       |                 |                 | 352837.411 | 0.36 |
| DA-10    | 115843.52        | 698731.73       |                 |                 | 814575.258 | 0.35 |
| DA-11    | 18105.93         | 326019.44       |                 |                 | 344125.377 | 0.31 |
| DA-12    | 102969.45        | 384904.51       |                 |                 | 487873.951 | 0.39 |
| DA-13    | 21812.31         | 283108.91       |                 |                 | 304921.22  | 0.32 |
| DA-14    | 3293.49          | 253711.53       |                 |                 | 257005.028 | 0.29 |
| DA-15    | 22162.11         | 64958.24        |                 |                 | 87120.3485 | 0.41 |
| DA-16    | 16048.92         | 785458.29       |                 |                 | 801507.206 | 0.29 |
| DA-17    | 35895.16         | 164481.64       |                 |                 | 200376.802 | 0.37 |
| DA-18    | 95870.71         | 239542.63       |                 |                 | 335413.342 | 0.43 |
| DA-19    | 22730.95         | 73101.44        |                 |                 | 95832.3833 | 0.40 |
| DA-20    | 57400.88         | 321572.63       |                 |                 | 378973.516 | 0.36 |
| DA-21    | 127423.38        | 412722.78       |                 |                 | 540146.161 | 0.40 |
| DA-22    | 266803.06        | 295123.19       |                 |                 | 561926.248 | 0.52 |
| DA-23    | 95125.11         | 815282.54       |                 |                 | 910407.642 | 0.33 |
| DA-24    | 20026.17         | 132434.44       |                 |                 | 152460.61  | 0.35 |
| DA-25    | 2742.84          | 223770.07       |                 |                 | 226512.906 | 0.29 |
| DA-26    | 46147.29         | 263129.94       |                 |                 | 309277.237 | 0.36 |
| DA-27    | 102546.62        | 311275.03       |                 |                 | 413821.655 | 0.41 |
| DA-28    | 99784.25         | 279189.27       |                 |                 | 378973.516 | 0.41 |
| DA-29    | 20254.05         | 114782.49       |                 |                 | 135036.54  | 0.36 |
| DA-30    | 112657.01        | 305520.66       |                 |                 | 418177.673 | 0.42 |
| DA-31    | 208930.09        | 74211.04        |                 |                 | 283141.133 | 0.66 |
| DA-32    | 128324.63        | 255004.90       |                 |                 | 383329.533 | 0.45 |
| DA-33    | 22187.22         | 361142.31       |                 |                 | 383329.533 | 0.31 |
| DA-34    | 23388.06         | 538538.18       |                 |                 | 561926.248 | 0.30 |
| DA-35    | 35439.61         | 374026.03       |                 |                 | 409465.638 | 0.32 |
| DA-36    | 77076.06         | 737499.20       |                 |                 | 814575.258 | 0.33 |
| DA-37    | 21595.30         | 261545.83       |                 |                 | 283141.133 | 0.32 |
| DA-38    | 30822.52         | 239250.56       |                 |                 | 270073.08  | 0.34 |

Composite "C<sub>10</sub>" Calculation

|          | 0.82             | 0.3         | 1               | 0.5             |            |      |
|----------|------------------|-------------|-----------------|-----------------|------------|------|
| Area No. | Paving<br>(0.82) | Grass (0.3) | Building<br>(1) | Gravel<br>(0.5) | Total (SF) | "C"  |
| DA-01    | 65732.73         | 792402.70   |                 |                 | 858135.433 | 0.34 |
| DA-02    | 223517.10        | 2999935.79  |                 |                 | 3223452.89 | 0.34 |
| DA-03    | 117251.63        | 553575.06   |                 |                 | 670826.683 | 0.39 |
| DA-04    | 71353.76         | 155159.14   |                 |                 | 226512.906 | 0.46 |
| DA-05    | 7932.84          | 53051.40    |                 |                 | 60984.2439 | 0.37 |
| DA-06    | 56849.85         | 374395.88   |                 |                 | 431245.725 | 0.37 |
| DA-07    | 101806.99        | 303302.63   |                 |                 | 405109.62  | 0.43 |
| DA-08    | 29355.56         | 480298.48   |                 |                 | 509654.039 | 0.33 |
| DA-09    | 53904.57         | 298932.84   |                 |                 | 352837.411 | 0.38 |
| DA-10    | 115843.52        | 698731.73   |                 |                 | 814575.258 | 0.37 |
| DA-11    | 18105.93         | 326019.44   |                 |                 | 344125.377 | 0.33 |
| DA-12    | 102969.45        | 384904.51   |                 |                 | 487873.951 | 0.41 |
| DA-13    | 21812.31         | 283108.91   |                 |                 | 304921.22  | 0.34 |
| DA-14    | 3293.49          | 253711.53   |                 |                 | 257005.028 | 0.31 |
| DA-15    | 22162.11         | 64958.24    |                 |                 | 87120.3485 | 0.43 |
| DA-16    | 16048.92         | 785458.29   |                 |                 | 801507.206 | 0.31 |
| DA-17    | 35895.16         | 164481.64   |                 |                 | 200376.802 | 0.39 |
| DA-18    | 95870.71         | 239542.63   |                 |                 | 335413.342 | 0.45 |
| DA-19    | 22730.95         | 73101.44    |                 |                 | 95832.3833 | 0.42 |
| DA-20    | 57400.88         | 321572.63   |                 |                 | 378973.516 | 0.38 |
| DA-21    | 127423.38        | 412722.78   |                 |                 | 540146.161 | 0.42 |
| DA-22    | 266803.06        | 295123.19   |                 |                 | 561926.248 | 0.55 |
| DA-23    | 95125.11         | 815282.54   |                 |                 | 910407.642 | 0.35 |
| DA-24    | 20026.17         | 132434.44   |                 |                 | 152460.61  | 0.37 |
| DA-25    | 2742.84          | 223770.07   |                 |                 | 226512.906 | 0.31 |
| DA-26    | 46147.29         | 263129.94   |                 |                 | 309277.237 | 0.38 |
| DA-27    | 102546.62        | 311275.03   |                 |                 | 413821.655 | 0.43 |
| DA-28    | 99784.25         | 279189.27   |                 |                 | 378973.516 | 0.44 |
| DA-29    | 20254.05         | 114782.49   |                 |                 | 135036.54  | 0.38 |
| DA-30    | 112657.01        | 305520.66   |                 |                 | 418177.673 | 0.44 |
| DA-31    | 208930.09        | 74211.04    |                 |                 | 283141.133 | 0.68 |
| DA-32    | 128324.63        | 255004.90   |                 |                 | 383329.533 | 0.47 |
| DA-33    | 22187.22         | 361142.31   |                 |                 | 383329.533 | 0.33 |
| DA-34    | 23388.06         | 538538.18   |                 |                 | 561926.248 | 0.32 |
| DA-35    | 35439.61         | 374026.03   |                 |                 | 409465.638 | 0.35 |
| DA-36    | 77076.06         | 737499.20   |                 |                 | 814575.258 | 0.35 |
| DA-37    | 21595.30         | 261545.83   |                 |                 | 283141.133 | 0.34 |
| DA-38    | 30822.52         | 239250.56   |                 |                 | 270073.08  | 0.36 |

## Appendix D

Composite "C<sub>100</sub>" Calculation

|          | 0.96             | 0.41            | 1               | 0.5             |            |      |
|----------|------------------|-----------------|-----------------|-----------------|------------|------|
| Area No. | Paving<br>(0.96) | Grass<br>(0.41) | Building<br>(1) | Gravel<br>(0.5) | Total (SF) | "C"  |
| DA-01    | 65732.73         | 792402.70       |                 |                 | 858135.433 | 0.45 |
| DA-02    | 223517.10        | 2999935.79      |                 |                 | 3223452.89 | 0.45 |
| DA-03    | 117251.63        | 553575.06       |                 |                 | 670826.683 | 0.51 |
| DA-04    | 71353.76         | 155159.14       |                 |                 | 226512.906 | 0.58 |
| DA-05    | 7932.84          | 53051.40        |                 |                 | 60984.2439 | 0.48 |
| DA-06    | 56849.85         | 374395.88       |                 |                 | 431245.725 | 0.48 |
| DA-07    | 101806.99        | 303302.63       |                 |                 | 405109.62  | 0.55 |
| DA-08    | 29355.56         | 480298.48       |                 |                 | 509654.039 | 0.44 |
| DA-09    | 53904.57         | 298932.84       |                 |                 | 352837.411 | 0.49 |
| DA-10    | 115843.52        | 698731.73       |                 |                 | 814575.258 | 0.49 |
| DA-11    | 18105.93         | 326019.44       |                 |                 | 344125.377 | 0.44 |
| DA-12    | 102969.45        | 384904.51       |                 |                 | 487873.951 | 0.53 |
| DA-13    | 21812.31         | 283108.91       |                 |                 | 304921.22  | 0.45 |
| DA-14    | 3293.49          | 253711.53       |                 |                 | 257005.028 | 0.42 |
| DA-15    | 22162.11         | 64958.24        |                 |                 | 87120.3485 | 0.55 |
| DA-16    | 16048.92         | 785458.29       |                 |                 | 801507.206 | 0.42 |
| DA-17    | 35895.16         | 164481.64       |                 |                 | 200376.802 | 0.51 |
| DA-18    | 95870.71         | 239542.63       |                 |                 | 335413.342 | 0.57 |
| DA-19    | 22730.95         | 73101.44        |                 |                 | 95832.3833 | 0.54 |
| DA-20    | 57400.88         | 321572.63       |                 |                 | 378973.516 | 0.49 |
| DA-21    | 127423.38        | 412722.78       |                 |                 | 540146.161 | 0.54 |
| DA-22    | 266803.06        | 295123.19       |                 |                 | 561926.248 | 0.67 |
| DA-23    | 95125.11         | 815282.54       |                 |                 | 910407.642 | 0.47 |
| DA-24    | 20026.17         | 132434.44       |                 |                 | 152460.61  | 0.48 |
| DA-25    | 2742.84          | 223770.07       |                 |                 | 226512.906 | 0.42 |
| DA-26    | 46147.29         | 263129.94       |                 |                 | 309277.237 | 0.49 |
| DA-27    | 102546.62        | 311275.03       |                 |                 | 413821.655 | 0.55 |
| DA-28    | 99784.25         | 279189.27       |                 |                 | 378973.516 | 0.55 |
| DA-29    | 20254.05         | 114782.49       |                 |                 | 135036.54  | 0.49 |
| DA-30    | 112657.01        | 305520.66       |                 |                 | 418177.673 | 0.56 |
| DA-31    | 208930.09        | 74211.04        |                 |                 | 283141.133 | 0.82 |
| DA-32    | 128324.63        | 255004.90       |                 |                 | 383329.533 | 0.59 |
| DA-33    | 22187.22         | 361142.31       |                 |                 | 383329.533 | 0.44 |
| DA-34    | 23388.06         | 538538.18       |                 |                 | 561926.248 | 0.43 |
| DA-35    | 35439.61         | 374026.03       |                 |                 | 409465.638 | 0.46 |
| DA-36    | 77076.06         | 737499.20       |                 |                 | 814575.258 | 0.46 |
| DA-37    | 21595.30         | 261545.83       |                 |                 | 283141.133 | 0.45 |
| DA-38    | 30822.52         | 239250.56       |                 |                 | 270073.08  | 0.47 |

# Appendix E

| Area No. | Acres | Runoff<br>Coeff. | CA    | T <sub>c</sub><br>(min.) | C <sub>2</sub> | I <sub>2</sub> (in./hr.) | Q <sub>2</sub><br>(c.f.s.) | C <sub>5</sub> | I <sub>5</sub><br>(in./hr.) | Q <sub>5</sub><br>(c.f.s.) | C <sub>10</sub> | I <sub>10</sub><br>(in./hr.) | Q <sub>10</sub><br>(c.f.s.) | C <sub>100</sub> | I <sub>100</sub><br>(in./hr.) | Q <sub>100</sub><br>(c.f.s.) |
|----------|-------|------------------|-------|--------------------------|----------------|--------------------------|----------------------------|----------------|-----------------------------|----------------------------|-----------------|------------------------------|-----------------------------|------------------|-------------------------------|------------------------------|
| DA-01    | 19.70 | 0.29             | 5.66  | 25.4                     | 0.29           | 3.02                     | 17.10                      | 0.32           | 3.70                        | 23.26                      | 0.34            | 4.26                         | 28.54                       | 0.45             | 6.27                          | 55.83                        |
| DA-02    | 74.00 | 0.28             | 21.01 | 53.0                     | 0.28           | 1.96                     | 41.27                      | 0.32           | 2.38                        | 55.66                      | 0.34            | 2.74                         | 68.25                       | 0.45             | 4.09                          | 135.70                       |
| DA-03    | 15.40 | 0.34             | 5.17  | 8.8                      | 0.34           | 4.88                     | 25.22                      | 0.37           | 5.93                        | 33.70                      | 0.39            | 6.83                         | 41.13                       | 0.51             | 10.25                         | 79.91                        |
| DA-04    | 5.20  | 0.40             | 2.10  | 8.1                      | 0.40           | 5.03                     | 10.58                      | 0.44           | 6.11                        | 14.00                      | 0.46            | 7.05                         | 16.99                       | 0.58             | 10.56                         | 32.03                        |
| DA-05    | 1.40  | 0.31             | 0.44  | 4.7                      | 0.31           | 4.97                     | 2.18                       | 0.35           | 5.75                        | 2.79                       | 0.37            | 6.97                         | 3.59                        | 0.48             | 8.04                          | 5.42                         |
| DA-06    | 9.90  | 0.31             | 3.11  | 8.7                      | 0.31           | 4.88                     | 15.21                      | 0.35           | 5.93                        | 20.39                      | 0.37            | 6.84                         | 24.94                       | 0.48             | 10.26                         | 49.00                        |
| DA-07    | 9.30  | 0.37             | 3.47  | 13.1                     | 0.37           | 4.12                     | 14.29                      | 0.41           | 5.05                        | 19.15                      | 0.43            | 5.82                         | 23.32                       | 0.55             | 8.63                          | 44.01                        |
| DA-08    | 11.70 | 0.28             | 3.26  | 35.0                     | 0.28           | 2.52                     | 8.19                       | 0.31           | 3.07                        | 11.11                      | 0.33            | 3.53                         | 13.64                       | 0.44             | 5.21                          | 26.93                        |
| DA-09    | 8.10  | 0.32             | 2.63  | 8.3                      | 0.32           | 4.99                     | 13.12                      | 0.36           | 6.06                        | 17.56                      | 0.38            | 6.98                         | 21.45                       | 0.49             | 10.47                         | 41.88                        |
| DA-10    | 18.70 | 0.32             | 5.98  | 14.2                     | 0.32           | 3.95                     | 23.62                      | 0.35           | 4.86                        | 32.02                      | 0.37            | 5.61                         | 39.22                       | 0.49             | 8.27                          | 75.48                        |
| DA-11    | 7.90  | 0.28             | 2.18  | 12.1                     | 0.28           | 4.26                     | 9.28                       | 0.31           | 5.21                        | 12.62                      | 0.33            | 6.01                         | 15.53                       | 0.44             | 8.95                          | 31.02                        |
| DA-12    | 11.20 | 0.35             | 3.96  | 9.8                      | 0.35           | 4.65                     | 18.40                      | 0.39           | 5.65                        | 24.53                      | 0.41            | 6.51                         | 29.88                       | 0.53             | 9.79                          | 57.66                        |
| DA-13    | 7.00  | 0.29             | 2.00  | 35.0                     | 0.29           | 2.52                     | 5.02                       | 0.32           | 3.07                        | 6.80                       | 0.34            | 3.53                         | 8.34                        | 0.45             | 5.21                          | 16.39                        |
| DA-14    | 5.90  | 0.26             | 1.51  | 21.4                     | 0.26           | 3.33                     | 5.04                       | 0.29           | 4.09                        | 6.92                       | 0.31            | 4.72                         | 8.54                        | 0.42             | 6.93                          | 17.06                        |
| DA-15    | 2.00  | 0.37             | 0.75  | 4.3                      | 0.37           | 4.97                     | 3.72                       | 0.41           | 5.75                        | 4.71                       | 0.43            | 6.97                         | 6.03                        | 0.55             | 8.04                          | 8.84                         |
| DA-16    | 18.40 | 0.26             | 4.78  | 26.6                     | 0.26           | 2.93                     | 14.02                      | 0.29           | 3.59                        | 19.18                      | 0.31            | 4.14                         | 23.63                       | 0.42             | 6.08                          | 47.13                        |
| DA-17    | 4.60  | 0.34             | 1.55  | 22.5                     | 0.34           | 3.25                     | 5.04                       | 0.37           | 3.99                        | 6.81                       | 0.39            | 4.60                         | 8.31                        | 0.51             | 6.75                          | 15.79                        |
| DA-18    | 7.70  | 0.39             | 3.00  | 7.5                      | 0.39           | 5.17                     | 15.51                      | 0.43           | 6.27                        | 20.55                      | 0.45            | 7.23                         | 24.97                       | 0.57             | 10.83                         | 47.28                        |
| DA-19    | 2.20  | 0.37             | 0.81  | 9.2                      | 0.37           | 4.77                     | 3.84                       | 0.40           | 5.79                        | 5.11                       | 0.42            | 6.67                         | 6.22                        | 0.54             | 10.02                         | 11.92                        |
| DA-20    | 8.70  | 0.32             | 2.82  | 5.6                      | 0.32           | 5.62                     | 15.85                      | 0.36           | 6.81                        | 21.17                      | 0.38            | 7.86                         | 25.89                       | 0.49             | 11.73                         | 50.36                        |
| DA-21    | 12.40 | 0.37             | 4.53  | 6.6                      | 0.37           | 5.38                     | 24.38                      | 0.40           | 6.53                        | 32.39                      | 0.42            | 7.52                         | 39.44                       | 0.54             | 11.25                         | 75.32                        |
| DA-22    | 12.90 | 0.48             | 6.23  | 11.8                     | 0.48           | 4.31                     | 26.81                      | 0.52           | 5.26                        | 35.43                      | 0.55            | 6.07                         | 42.79                       | 0.67             | 9.05                          | 78.34                        |
| DA-23    | 20.90 | 0.30             | 6.30  | 14.2                     | 0.30           | 3.95                     | 24.87                      | 0.33           | 4.86                        | 33.84                      | 0.35            | 5.61                         | 41.53                       | 0.47             | 8.27                          | 80.77                        |
| DA-24    | 3.50  | 0.31             | 1.10  | 5.6                      | 0.31           | 5.61                     | 6.17                       | 0.35           | 6.80                        | 8.26                       | 0.37            | 7.84                         | 10.11                       | 0.48             | 11.71                         | 19.77                        |
| DA-25    | 5.20  | 0.26             | 1.33  | 9.9                      | 0.26           | 4.61                     | 6.14                       | 0.29           | 5.61                        | 8.35                       | 0.31            | 6.46                         | 10.29                       | 0.42             | 9.72                          | 21.05                        |
| DA-26    | 7.10  | 0.32             | 2.29  | 5.9                      | 0.32           | 5.53                     | 12.69                      | 0.36           | 6.71                        | 16.96                      | 0.38            | 7.74                         | 20.74                       | 0.49             | 11.56                         | 40.39                        |
| DA-27    | 9.50  | 0.37             | 3.53  | 9.6                      | 0.37           | 4.69                     | 16.54                      | 0.41           | 5.70                        | 21.99                      | 0.43            | 6.57                         | 26.75                       | 0.55             | 9.87                          | 51.20                        |
| DA-28    | 8.70  | 0.38             | 3.30  | 5.7                      | 0.38           | 5.60                     | 18.46                      | 0.41           | 6.79                        | 24.47                      | 0.44            | 7.83                         | 29.77                       | 0.55             | 11.70                         | 56.46                        |
| DA-29    | 3.10  | 0.32             | 1.00  | 8.0                      | 0.32           | 5.06                     | 5.07                       | 0.36           | 6.14                        | 6.78                       | 0.38            | 7.08                         | 8.29                        | 0.49             | 10.61                         | 16.19                        |
| DA-30    | 9.60  | 0.38             | 3.67  | 19.8                     | 0.38           | 3.45                     | 12.65                      | 0.42           | 4.24                        | 17.00                      | 0.44            | 4.89                         | 20.68                       | 0.56             | 7.19                          | 38.51                        |
| DA-31    | 6.50  | 0.61             | 3.98  | 10.9                     | 0.61           | 4.46                     | 17.73                      | 0.66           | 5.43                        | 23.17                      | 0.68            | 6.26                         | 27.83                       | 0.82             | 9.38                          | 49.76                        |
| DA-32    | 8.80  | 0.41             | 3.64  | 9.1                      | 0.41           | 4.79                     | 17.45                      | 0.45           | 5.82                        | 23.08                      | 0.47            | 6.71                         | 27.98                       | 0.59             | 10.07                         | 52.65                        |
| DA-33    | 8.80  | 0.28             | 2.45  | 10.1                     | 0.28           | 4.57                     | 11.20                      | 0.31           | 5.56                        | 15.15                      | 0.33            | 6.41                         | 18.61                       | 0.44             | 9.63                          | 37.45                        |
| DA-34    | 12.90 | 0.27             | 3.49  | 12.9                     | 0.27           | 4.15                     | 14.47                      | 0.30           | 5.08                        | 19.75                      | 0.32            | 5.86                         | 24.33                       | 0.43             | 8.70                          | 48.60                        |
| DA-35    | 9.40  | 0.29             | 2.75  | 13.9                     | 0.29           | 4.00                     | 10.98                      | 0.32           | 4.91                        | 14.96                      | 0.35            | 5.67                         | 18.37                       | 0.46             | 8.37                          | 35.98                        |
| DA-36    | 18.70 | 0.30             | 5.54  | 14.7                     | 0.30           | 3.86                     | 21.42                      | 0.33           | 4.76                        | 29.22                      | 0.35            | 5.50                         | 35.90                       | 0.46             | 8.08                          | 69.80                        |
| DA-37    | 6.50  | 0.29             | 1.87  | 8.0                      | 0.29           | 5.06                     | 9.46                       | 0.32           | 6.15                        | 12.74                      | 0.34            | 7.09                         | 15.65                       | 0.45             | 10.62                         | 31.20                        |
| DA-38    | 6.20  | 0.31             | 1.90  | 6.4                      | 0.31           | 5.43                     | 10.30                      | 0.34           | 6.59                        | 13.82                      | 0.36            | 7.60                         | 16.93                       | 0.47             | 11.36                         | 33.30                        |