DRAINAGE PLAN AND SUPPORTING CALCULATIONS

FOR

CAMPBELL'S GREENHOUSE ADDITION
SW ¼ OF SECTION 9, T28S, R1E
SEDGWICK COUNTY, KS

PREPARED FOR:
SAVOY COMPANY, P.A.
433 S. HYDRAULIC ST.
WICHITA, KS 67211

OCTOBER 9TH, 2014

PREPARED BY:

CERTIFIED ENGINEERING DESIGN, P.A.
1935 WEST MAPLE
WICHITA, KANSAS 67213-3311
(316)262-8808 PHONE
(316)262-1669 FAX

HARLAN DALE FOWLER
LICENSED
10891
10.9.14
KANSAS
PROFESSIONAL ENGINEER

City of Wichita/Sedgwick County
Subdivision Drainage Plan Checklist

Submit completed forms to:
City of Wichita Public Works & Utilities, 455 N. Main 8th Floor, Wichita KS 67202; or
Sedgwick County Stormwater Management, 1144 S. Seneca, Wichita KS 67213.

Project Name:	Campbell's Greenhouse Addition				
Total Area of Project:	6.5 acres				
Development Type:	Commercial	**Other:**			
Developer Name:	Gene M. Campbell	**Contact:**	Allyson Wetter	**Phone:**	(316) 524-5311
Email:					
Engineer Name:	Harlan Foraker	**Contact:**	Logan Mills	**Phone:**	(316) 262-8808
Email:	hforaker@cedpa.com, lmills@cedpa.com				

Directions:

(1) Fill-out this checklist completely and include it with the Drainage Plan submittal. This checklist should be included in the bound copy, behind the cover sheet for the submittal. Incomplete Drainage Plans and checklists will not be accepted.

*(2) Indicate whether a plan element is included or not included in the submittal by choosing "**Yes**" or "**No**" from the dropdown list in the **"Element Included?"** column. The question must be answered for every plan element for this checklist to be considered complete. An explanation must be provided for all **"No"** answers.*

Drainage Plan Checklist

#	Plan Element Description	Element Included?	Explanation/Notes
1.0	**General Information**		
1.1	Digital copy of drainage plan, including preliminary Master Grading Plan, preliminary plat and proposed plat, in PDF format and one half size, bound, paper copy.	Yes	
1.2	Professional Engineer's seal, signature and date on plan cover.	Yes	
1.3	Site location map, using color ortho-imagery and showing the project boundaries, a north arrow and an accurate scale.	Yes	
1.4	Narrative of the development type, existing conditions and proposed impacts on stormwater runoff, wetlands, riparian zones and floodplains/floodways.	Yes	
1.5	Discussion of off-site conditions surrounding the proposed development.	Yes	
1.6	Summary table of runoff calculations (pre/post development).	Yes	
1.7	Narrative description of the type and function of the permanent structural stormwater management facilities.	No	No structures required because there are no known improvements
2.0	**Existing Conditions Information**		
2.1	**Existing Conditions Drainage Map**		
2.1.1	On-site and off-site topography: NAVD 88 datum, one-foot contours with spot elevations	Yes	
2.1.2	On-site and off-site drainage features, including perennial and intermittent streams (with names labeled), conveyance systems such as open channels, ditches, swales and areas of overland flow. Flow direction must be indicated by arrows.	Yes	
2.1.3	Storm sewer system components, including storm drains, inlets, catch basins, gutters, manholes, headwalls, pipes and culverts. Material and size must be noted for all pipes and culverts.	Yes	
2.1.4	Location and boundaries of natural features such as wetlands, lakes, ponds with the normal water elevation noted, rock outcroppings, wooded areas and tree rows.	Yes	
2.1.5	Location, dimensions and elevations of existing bridges and culvert crossings.	Yes	
2.1.6	Location of existing utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.	Yes	
2.1.7	Groundwater elevations, if applicable.	Yes	
2.1.8	Delineation of predominant soil based on USDA soil surveys and/or on-site soil borings; indicate NRCS soil name and Hydrologic Soil Group for undisturbed surface soils.	Yes	
2.1.9	Land use types per NRCS nomenclature.	Yes	
2.1.10	Footprint of existing impervious areas (labeled, area given in acres).	Yes	
2.1.11	Internal drainage subbasin boundaries used for hydrologic calculations (labeled with ID, total area in acres, impervious area in acres and curve number).	Yes	
2.1.12	Time of concentration flow paths. Indicate and label each segment separately (i.e., overland flow, shallow concentrated, channel1, channel2, etc.). For each segment, provide the appropriate data to calculate Tc (e.g., length, slope, cover type, paved/unpaved, roughness parameters, geometric properties, etc.).	Yes	

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
2.2	**Existing Conditions Hydrology and Hydraulics Analysis**		
2.2.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).	Yes	
2.2.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).	Yes	
2.2.3	Table of existing condition runoff curve numbers with supporting data and calculations.	Yes	
2.2.4	Table of existing condition times of concentration with supporting data and calculations.	Yes	
2.2.5	A summary table of rainfall data used in the hydrologic analysis, and a reference for the source of the data.	Yes	
2.2.6	Cross-sections and other diagrams of existing open channels, bridge and culvert sections and other hydraulic features as required to illustrate the basis for hydraulic analysis.	No	N/A
2.2.7	Hydrologic and hydraulic analyses for runoff rates, volumes, velocities and elevations. Provide supporting data not specified above and identify assumptions. Include detailed calculations for the 2, 5, 10, 25 & 100-year, 24-hour storm events. Provide results in a tabular form. Provide digital copies of any computer files and models used.	Yes	
3.0	**postdevelopment Conditions Information**		
3.1	**postdevelopment Conditions Drainage Map**		
3.1.1	Proposed project boundary.	No	No proposed improvements are shown at this time. The property is just being platted.
3.1.2	on-site and off-site topography: NAVD 88 datum, one-foot contours with spot elevations.	No	
3.1.3	Existing on-site and off-site drainage features that are to remain after development, including perennial and intermittent streams (with names labeled), conveyance systems such as open channels, ditches, swales and areas of overland flow. Flow direction must be indicated by arrows.	No	
3.1.4	Location and description of off-site through-drainage conveyances which are confined to an easement, dedication and/or reserve.	No	
3.1.5	Footprint of proposed impervious areas, including roads, parking lots, buildings and other structures.	No	
3.1.6	Location of proposed utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.	No	
3.1.7	Delineation of predominant soils, based on anticipated soil textures and NRCS guidelines if different from predevelopment soil conditions; indicate NRCS soil name and Hydrologic Soil Group for surface soils.	No	
3.1.8	Land use cover per NRCS nomenclature.	No	
3.1.9	Internal drainage subbasin boundaries used for hydrologic calculations (labeled with ID, total area in acres, impervious area in acres and curve number).	No	
3.1.10	Proposed limits of land disturbing activity (i.e., grading limits).	No	
3.1.11	Time of concentration flow paths. Indicate and label each segment separately (i.e., overland flow, shallow concentrated, channel1, channel2, etc.). For each segment, provide the appropriate data to calculate Tc (e.g., length, slope, cover type, paved/unpaved, roughness parameters, geometric properties, etc.).	No	
3.2	**Proposed Conveyances Map**		
3.2.1	on-site and off-site drainage features, including perennial and intermittent streams (with names labeled), proposed conveyance systems (such as open channels, ditches, swales and areas of overland flow, including backyard drainage). Flow direction must be indicated by arrows.	No	No proposed improvements are shown at this time. The property is just being platted.
3.2.2	Storm sewer system components, including storm drains, inlets, catchbasins, gutters, manholes, headwalls, pipes and culverts. Material and size must be noted for all pipes and culverts.	No	
3.2.3	For any subbasin or drainage area > 40 acres, show that the stormwater flow is confined to an open channel with required side benches and freeboard, or conformance to applicable policy and design requirements if partially enclosed.	No	
3.2.4	Location(s) of stormwater management facilities and any associated drainage easements.	No	
3.2.5	Proposed energy dissipaters and other channel protection devices.	No	
3.2.6	Location(s) and dimension(s) of proposed channel, bridge and culvert crossings.	No	
3.2.7	Normal pool and 100-year pool elevations for ponds and lakes.	No	
3.2.8	Permanent concrete outfall control structure(s) for ponds.	No	
3.2.9	Emergency overflow spillways and top of berm elevations for ponds and other volume/peak discharge control facilities.	No	
3.2.10	Floodplains, ponds, and stormwater management facilities located in reserves.	No	
3.3	**postdevelopment Conditions Hydrology & Hydraulics**		

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
3.3.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).	No	No proposed improvements are shown at this time. The property is just being platted.
3.3.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).	No	
3.3.3	Table of postdevelopment condition runoff curve numbers with supporting data and calculations.	No	
3.3.4	Table of postdevelopment condition times of concentration with supporting data and calculations.	No	
3.3.5	Cross-sections and other diagrams of existing open channels, bridge and culvert sections and other hydraulic features as	No	
3.3.6	Hydrologic and hydraulic analyses for runoff rates, volumes, velocities and elevations. Provide supporting data not specified above and identify assumptions. Include detailed calculations for the 2, 5, 10, 25 & 100-year, 24-hour storm events. Provide results in a tabular form. Provide digital copies of any computer files and models used.	No	
3.3.7	Downstream peak discharge assessment (10% Rule) results and supporting data and calculations. Provide digital copies of any computer files and models used.	No	
3.3.8	Stage-storage-discharge or other outlet rating curves and inflow/outflow hydrographs for all ponds.	No	
3.3.9	Demonstrate that the pond contours on the master grading plan and the stage-storage-discharge data are consistent for all ponds.	No	
3.3.10	Demonstrate that all ponds have one foot of freeboard above the 100-year, 24-hour high water level.	No	
3.3.11	Demonstrate that runoff from the proposed project site is discharged in the same manner as prior to development, using level spreaders, energy dissipaters, other devices or grading as required, or identify an appropriate flowage easement.	No	
3.4	**Stormwater Quantity Control Sizing**		
3.4.1	Hydraulic sizing calculations for all stormwater management controls.	No	No proposed improvements are shown at this time. The property is just being platted.
3.4.2	Table(s) listing all stormwater management controls. Present the types, sizes, elevations, flows, velocities and depths for each control, as applicable. Verify that velocities are self-cleaning and non-erosive.	No	
3.4.3	Typical details (including cross-sections where applicable) for outlet structures, embankments, spillways, grade control structures, conveyance channels, etc.	No	
3.5	**Stormwater Quality Management Facilities**		
3.5.1	Table(s) listing all stormwater management facilities. Present the description, % TSS removal value, water quality volume handled, contributing drainage area in acres and contributing impervious area in acres.	No	No proposed improvements are shown at this time. The property is just being platted.
3.5.2	Indicate the responsible party for maintenance, as shown in the plat text (i.e., Home Owners Association, Lot Owners Association, property owner, etc.).	No	
3.5.3	Water quality volume (total and by facility), with supporting data and calculations.	No	
3.5.4	% TSS removal value (total and by facility) with supporting data and calculation. Must be equal to or greater than 80%.	No	
3.5.5	Channel protection volume with supporting data and calculations.	No	
3.5.6	Water quality volume and channel protection volume orifice size calculations.	No	
3.5.7	Other calculations required for each stormwater management facility as specified in the Wichita/Sedgwick County Stormwater Manual.	No	
3.5.8	Typical details (including cross-sections where applicable) for outlet structures, embankments, internal grading, forebays and other siltation prefilters, filtration/infiltration media, vegetation, check dams, operational controls, etc.	No	
4.0	**Floodplains**		
4.1	Reference the source of flood profile, floodplain, floodway and stream discharge information.	Yes	
4.2	Delineation of nearest base flood elevations.	Yes	
4.3	Delineation of predevelopment regulatory floodplain/floodway limits using FEMA's current GIS database; limits to be per elevation and scaled location.	Yes	
4.4	Delineation of postdevelopment regulatory floodplain/floodway limits; limits to be per elevation and scaled location, with project limits shown.	No	
4.5	Floodway data table and discharges.	No	
4.6	Hydrologic and hydraulic study information for local floodplain analysis, unnumbered Zone A elevation determinations and floodplain map revisions or required permits.	No	
4.7	Regulatory floodway and four natural profile models (10, 50, 100 and 500-year) for existing and postdevelopment conditions.	No	
4.8	Floodplains and floodways located within a reserve, where necessary.	No	

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
4.9	Floodplain cut and fill calculations for volume sensitive basins.	No	
4.10	Demonstrate that floodway elevations and velocities do not increase due to construction in the floodway ("No Rise Certification").	No	
5.0	**Federal, State and Local Permits**		
5.1	US Army Corps of Engineers regulatory program permits (Section 404 permit)	No	
5.2	Kansas Department of Agriculture - Division of Water Resources Permits (Stream Obstruction, Channel Change, Floodplain Fill, Levee, Water Appropriations, Dam Safety permit, etc.).	No	
5.3	FEMA letters of map change/revision - LOMA, LOMR, LOMR-f, CLOMR, etc.; shall be included and approved when project modifies the limits of the floodplain/floodway.	No	
6.0	**Half Scale Preliminary Master Grading Plan**		
6.1	One set of plans and associated PDF of plans.	No	No proposed improvements are shown at this time. The property is just being platted.
6.2	Professional Engineer's seal, signature and date.	No	
6.3	Title block including subdivision name and phase and dated revision documentation.	No	
6.4	Future phases shown but cross-hatched as information only.	No	
6.5	Scale, not greater than 1-inch = 60 feet.	No	
6.6	North arrow.	No	
6.7	Index or legend key.	No	
6.8	Benchmarks (minimum of 2) used for site control (NAVD 88 vertical datum).	No	
6.9	Existing contours of entire site with contour interval of one foot.	No	
6.10	Proposed contours for channels, ponds, and other permanent stormwater management facilities, with contour interval of one foot.	No	
6.11	Spot elevations shown to the nearest tenth of a foot for critical locations, including lot and property boundaries.	No	
6.12	Proposed lot and street layout.	No	
6.13	Locations of underground storm drains.	No	
6.14	Overflow locations for storms exceeding storm drain capacity, with elevations.	No	
6.15	Top elevations of storm drains at all inlets, manholes, and flow line elevations for all outfalls.	No	
6.16	Locations of open ditches and lakes.	No	
6.17	Flow direction arrows.	No	
6.18	Proposed flow line elevations of all open ditches at maximum 100 foot intervals, and 100-year flood elevations thereon.	No	
6.19	Ponds: Location, bottom elevation, normal pool elevation, 100-year flood elevation, emergency overflow elevation.	No	
6.20	Proposed top-of-curb elevations at points where drainage will be required to flow over the curb.	No	
6.21	Platted minimum building opening elevation for each lot, in table form for all lots (excluding basement floor elevations).	No	
6.22	Standard foundation and elevation detail for slab on grade, full basement, view-out, partial view-out and/or walk-out construction.	No	
6.23	Top of foundation elevation for each lot.	No	
6.24	Notation for builders for each lot as to the type of structure that may be constructed and the view-out, walk-out or pad elevation, as applicable.	No	
6.25	Indicate that all lots are above the 100-year flood elevation.	No	
6.26	Indicate that grading around structures conforms to perimeter drainage requirements.	No	
6.27	Indicate that backyard drainage grading conforms to backyard drainage requirements.	No	
6.28	Adjacent subdivision lot lines, with lot labels and subdivision names.	No	
6.29	Boundaries and labels for all easements, rights-of-way and reserves.	No	
6.30	Statement on proposed final plat: "*A drainage plan has been developed for the subdivision and all drainage easements, rights-of-way, or reserves shall remain at the established grades and remain unobstructed to allow for the conveyance of stormwater.*".	No	
End of Checklist			

CERTIFIED ENGINEERING DESIGN, P.A
1935 West Maple
Wichita, KS 67213-3311
(316)262-8808 Office
(316)262-1669 Fax

LETTER OF TRANSMITTAL

DATE: October 9th, 2014

TO: Mr. Scott Lindebak, P.E.
Storm Water Engineer
City of Wichita
8th Floor
455 N. Main
Wichita, KS 67202

RE: Drainage Plan
Campbell's Greenhouse Addition
Wichita, KS

FROM: Harlan D. Foraker, P.E.

cc: Mark Savoy, Savoy Company, P.A.

I. TAB 1 – PROJECT NARRATIVE:

Discussion of Development

The goal of this report is to analyze the existing drainage patterns and design the proposed drainage system to serve the Campbell's Greenhouse Addition site in Wichita, KS. This site is located approximately 500 ft north of the intersection of E. 37th St. and Topeka St. and located on the east side of the road. The west side of the site is developed with several greenhouses and the east side of the site is undeveloped with native grass cover.

The SCS soil types present on the site are the Saltcreek and Naron Fine Sandy Loams (SCS Type C Soil) and Canadian Fine Sandy Loam (SCS Type B Soil). There are no plans now or in the future to further develop this property. However, at the time of any future development, a site specific drainage plan shall be submitted to the city engineer prior to development. The plan shall comply with Chapter 16.32 of the City Code, which includes storm water detention and water quality treatment. The total area of the property is approximately 6.45 acres. An aerial photograph of the proposed plat site is located in the Appendix.

Offsite Conditions

It appears that there is a small amount of offsite drainage entering the site from the surrounding properties to the north. At the time of future development, it is critical to

not obstruct this offsite drainage from flowing through or into Campbell's Greenhouse Addition property.

Description of Best Management Practices

The proposed plat site is only being platted. Therefore there are no best management practices incorporated into the site design at this time.

Summary of Runoff Calculations

The only calculations computed for the plat are existing peak runoff calculations. There are no proposed improvements to the property, and therefore no developed peak runoff calculations to compare. Table 1 shows existing peak runoff calculations.

Existing Peak Runoff							
Description	Percent Impervious (%)	SCS Soil Type (%)	C	Tc	I (in./hr)	Area (acres)	Q (cfs)
Existing Basin A (2 yr.)	40	B (60)	0.47	27	2.40	6.45	7.28
Existing Basin A 5 yr.)			0.48	27	3.02	6.45	9.35
Existing Basin A (10 yr.)			0.52	27	3.50	6.45	11.74
Existing Basin A (25 yr.)			0.53	27	4.12	6.45	14.08
Existing Basin A (100 yr.)			0.60	27	5.06	6.45	19.58

Table 1 – Existing Peak Runoff Calculations

II. TAB 2 – EXISTING CONDITIONS INFORMATION

Runoff Method

The rational method was used to compute the peak discharges for existing conditions. Rational 'C' factors were assigned to the existing site from the City of Wichita Storm Water Manual. Rainfall intensity tables from the same manual were utilized to determine the rainfall intensity for the 2, 5, 10, 25, and 100 year design storms. The Soil Conservation Service TR-55 manual was used to compute the time of concentration for the drainage areas. A design assumption was made as follows: that the minimum time of concentration is 15 minutes. Time of concentration calculations can be seen in the Appendix for each sub-basin.

Soil Types were determined from the Natural Resource Conservation Soil Survey website. The SCS soil types present on the site are the Saltcreek and Naron Fine Sandy Loams (SCS Type C Soil) and Canadian Fine Sandy Loam (SCS Type B Soil).

Existing Conditions

The entire existing 6.45 acre site is outlined as existing basin A. Basin A sheet flows to the east and south where runoff exits the site and flows into multiple existing pond/depression areas south of the plat site. A summary of the existing drainage calculations can be seen in Table 2. The existing drainage basins can be seen on the Drainage Plan Map located in the Appendix.

Existing Peak Runoff							
Description	Percent Impervious (%)	SCS Soil Type (%)	C	Tc	I (in./hr)	Area (acres)	Q (cfs)
Existing Basin A (2 yr.)	40	B (60)	0.47	27	2.40	6.45	7.28
Existing Basin A 5 yr.)			0.48	27	3.02	6.45	9.35
Existing Basin A (10 yr.)			0.52	27	3.50	6.45	11.74
Existing Basin A (25 yr.)			0.53	27	4.12	6.45	14.08
Existing Basin A (100 yr.)			0.60	27	5.06	6.45	19.58

Table 2 – Existing Peak Runoff Calculations

Ground Water Elevations

According to the Kansas Geological Survey's Kansas Water Well Database, the static water surface depth of the ground water in this area is around 10-15 ft below the existing ground. A copy of the static water depth map for this area is located in the Appendix.

III. TAB 3 – DEVELOPED CONDITIONS INFORMATION

Developed Conditions

There are no plans now or in the future to develop this property, and no developed peak runoff calculations were computed. However, should circumstances change and future development be desired, a site specific drainage plan shall be submitted to the city engineer prior to development. The plan shall comply with Chapter 16.32 of the City Code, which includes storm water detention and water quality treatment. The reserve areas for any future detention pond(s) shall be recorded by separate instrument. Any future improvements shall not obstruct any offsite drainage that currently drains into/through the site.

Storm Water Quantity

There are currently no proposed improvements. Therefore no detention is required or shown.

Downstream Assessment Analysis

There are currently no proposed improvements. Therefore a downstream assessment analysis is not required.

Storm Water Quality

There are currently no proposed improvements. Therefore storm water quality is not required.

Channel Protection

There are currently no proposed improvements. Therefore channel protection is not required.

IV. TAB 4 – FLOODPLAIN SUBMITTAL

FEMA Floodplain Boundary

The property is located in Zone X on the FEMA flood map (FIRM #2017C0365E). The base flood elevation for this property is 1279.6 (NAVD 88). Minimum pad elevations are set at a minimum 2' above the Base Flood Elevation. A copy of the FEMA floodplain map is attached for review in the Appendix.

V. TAB 5 – FEDERAL, STATE, AND LOCAL PERMITS

A. US Army Corps of Engineers
Not Applicable

B. Kansas Department of Agriculture
Not Applicable

C. Federal Emergency Management Agency (FEMA)
Not Applicable

D. Kansas Department of Transportation
Not Applicable

E. Sedgwick County Right-of-way Permit
Right-of-way Permit - Not Applicable
Storm Water Permit - Required

F. Kansas Department of Health and Environment
NOI - Required

APPENDIX

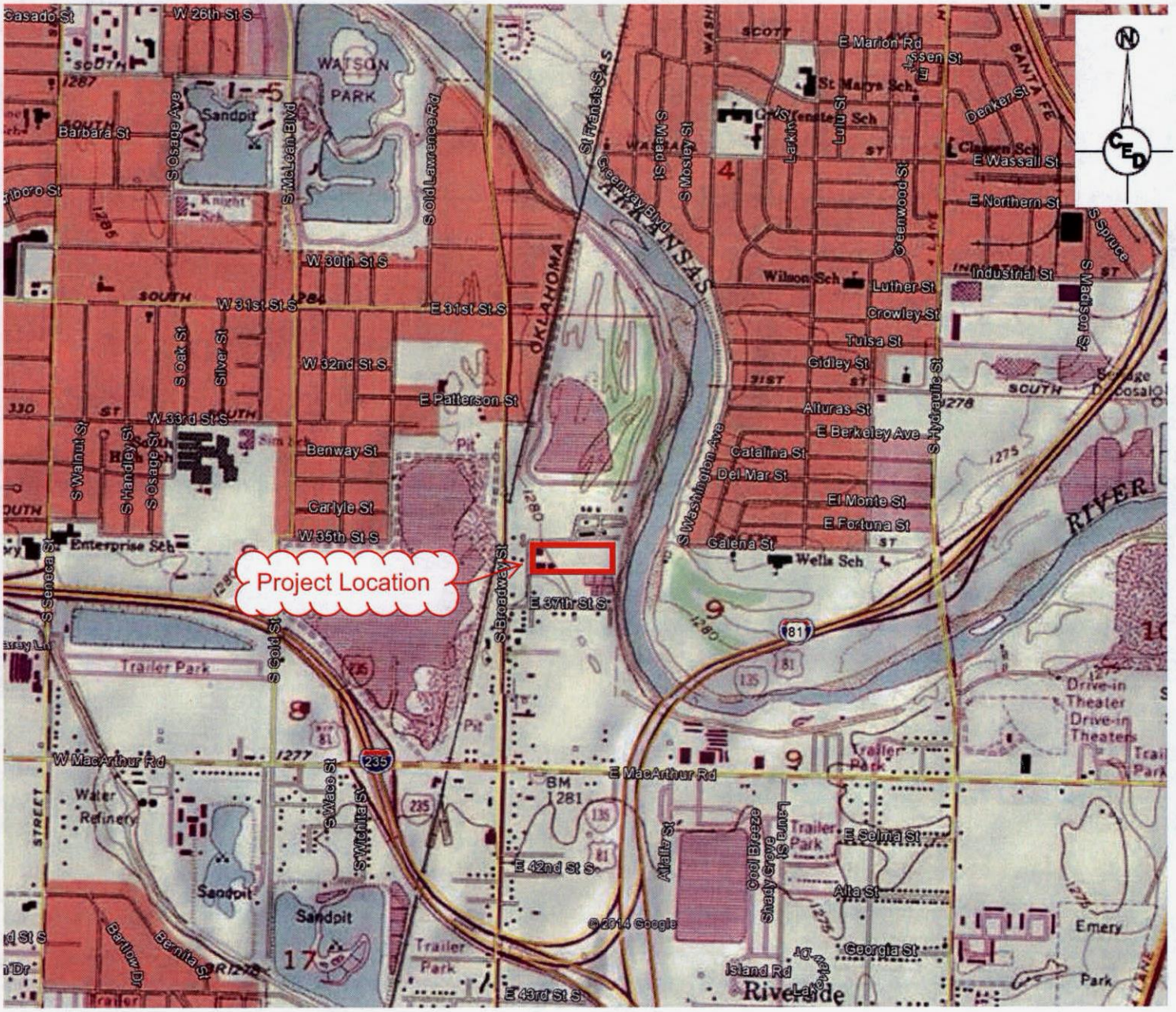
GENERAL MAPS

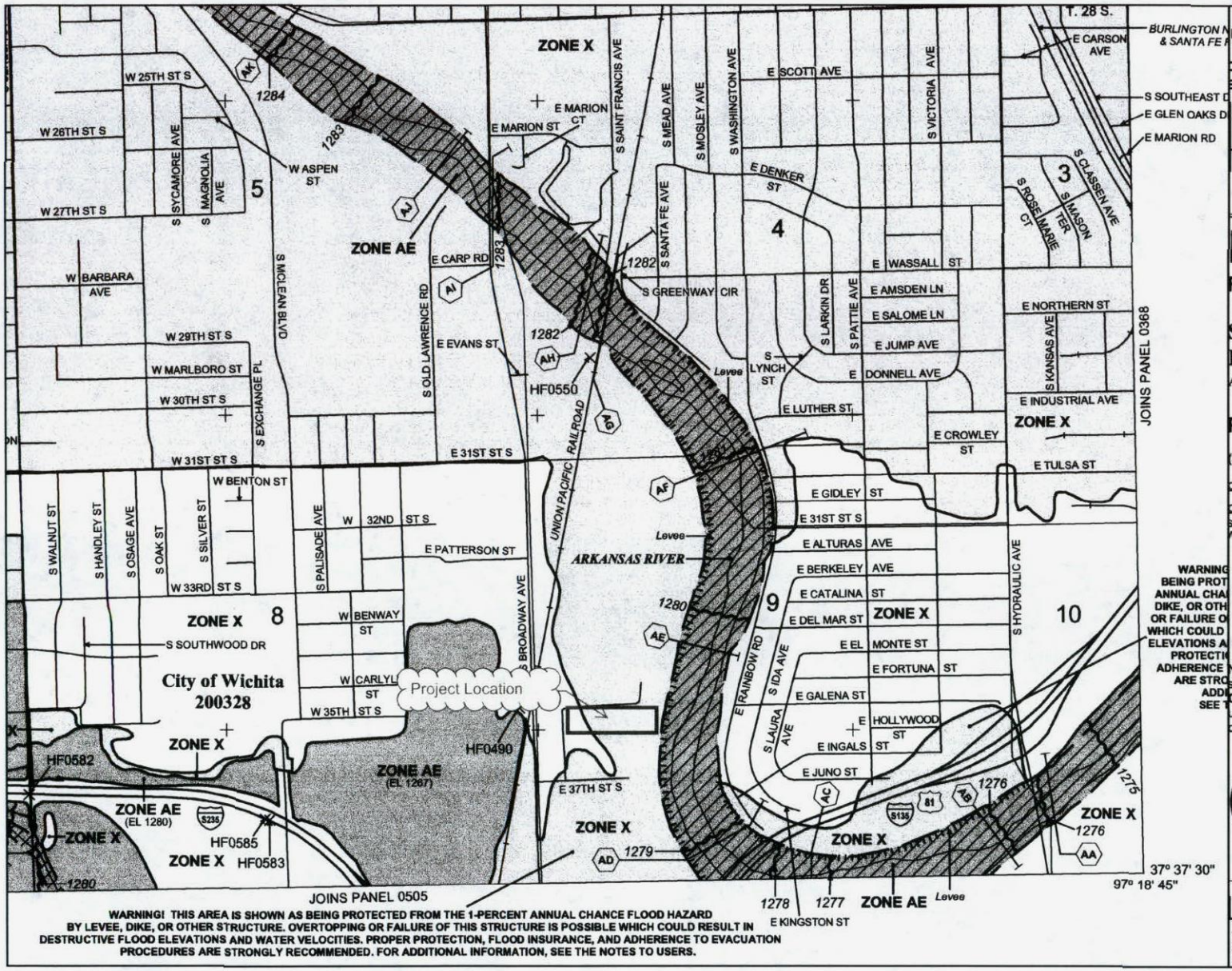
Aerial Photo

Campbell's Greenhouse Addition
SW ¼ of S9, T28S, R1E
Sedgwick County, Kansas
CED Job # 20142194

Quad Map

Campbell's Greenhouse Addition
SW ¼ of S9, T28S, R1E
Sedgwick County, Kansas
CED Job # 20142194





WARNING! THIS AREA IS SHOWN AS BEING PROTECTED FROM THE 1-PERCENT ANNUAL CHANCE FLOOD HAZARD BY LEVEE, DIKE, OR OTHER STRUCTURE. OVERTOPPING OR FAILURE OF THIS STRUCTURE IS POSSIBLE WHICH COULD RESULT IN DESTRUCTIVE FLOOD ELEVATIONS AND WATER VELOCITIES. PROPER PROTECTION, FLOOD INSURANCE, AND ADHERENCE TO EVACUATION PROCEDURES ARE STRONGLY RECOMMENDED. FOR ADDITIONAL INFORMATION, SEE THE NOTES TO USERS.

MAP SCALE 1" = 1000'

1000 2000 FEET

0 300 600 METERS

PANEL 0365E

FIRM

FLOOD INSURANCE RATE MAP

SEDGWICK COUNTY, KANSAS AND INCORPORATED AREAS

PANEL 365 OF 700

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SEDGWICK COUNTY	200321	0365	E
WICHITA, CITY OF	200328	0365	E

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
20173C0365E

EFFECTIVE DATE
FEBRUARY 2, 2007

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Static Water Depth (ft)

Hydrologic Soil Group—Sedgwick County, Kansas

Map Scale: 1:1,740 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Sedgwick County, Kansas
Survey Area Data: Version 9, Dec 10, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 18, 2010—Sep 27, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Sedgwick County, Kansas (KS173)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
5943	Saltcreek and Naron fine sandy loams, 0 to 1 percent slopes	C	1.2	18.2%
6224	Canadian fine sandy loam, rarely flooded	B	5.6	81.8%
Totals for Area of Interest			**6.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

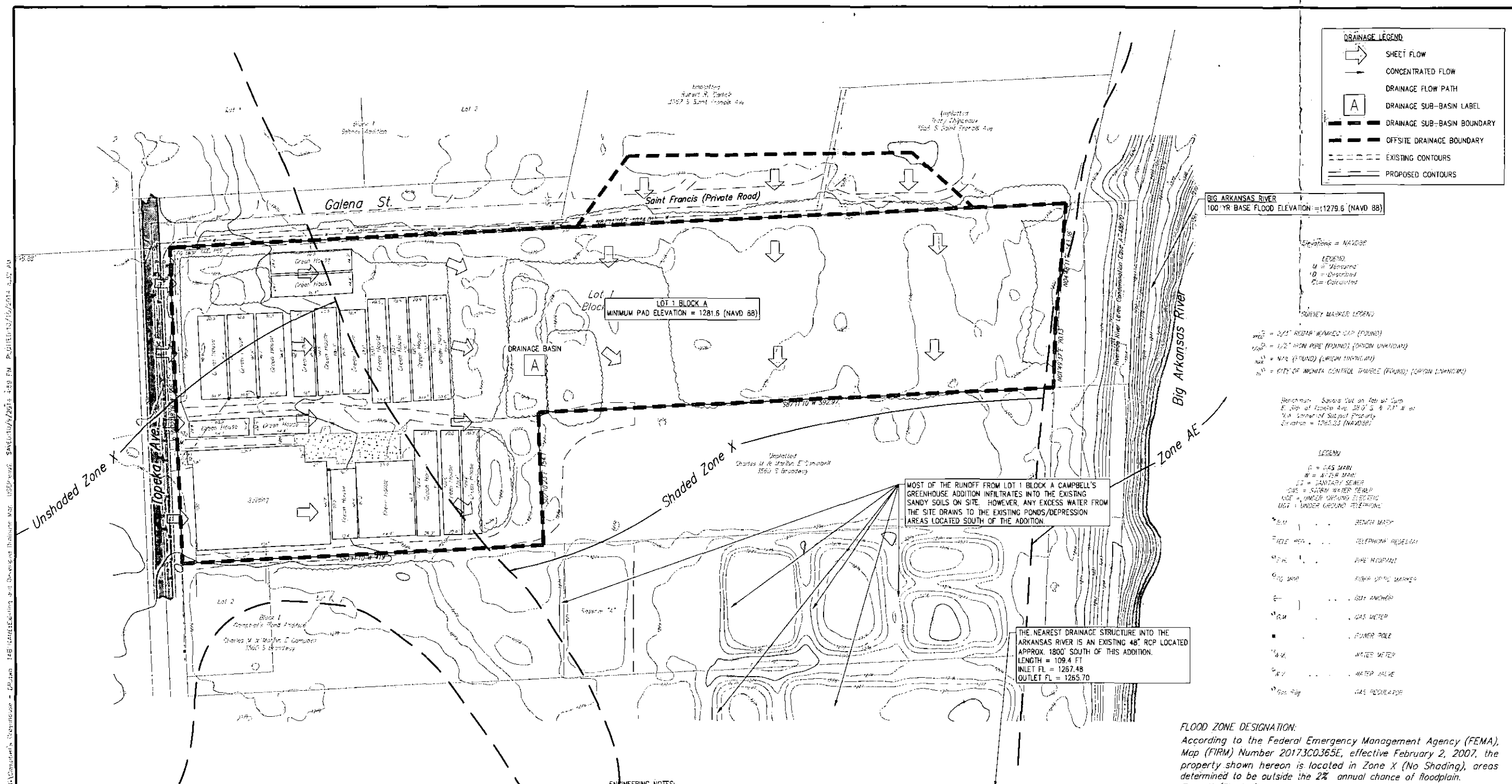
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

DRAINAGE PLAN MAP



DRAINAGE LEGEND

- SHEET FLOW
- CONCENTRATED FLOW
- DRAINAGE FLOW PATH
- A — DRAINAGE SUB-BASIN LABEL
- DRAINAGE SUB-BASIN BOUNDARY
- OFFSITE DRAINAGE BOUNDARY
- EXISTING CONTOURS
- PROPOSED CONTOURS

Elevations = NAVD88

LEGEND
M = Measured
D = Described
C = Calculated

SURVEY MARKER LEGEND

- = 3/4" REBAR W/MRED CAP (FOUND)
- = 1/2" IRON PIPE (FOUND) (ORIGIN UNKNOWN)
- = NAIL (FOUND) (ORIGIN UNKNOWN)
- = CITY OF WICHITA CONTROL TRIBLE (FOUND) (ORIGIN UNKNOWN)

Benchmark: Square Cut on Top of Curb E. Side of Topeka Ave. 38.0' S. & 7.1' W. of Nw Corner of Subject Property
Elevation = 1265.33 (NAVD88)

LEGEND

- G = GAS MAIN
- W = WATER MAIN
- SS = SANITARY SEWER
- SWS = STORM WATER SEWER
- UGE = UNDER GROUND ELECTRIC
- UGT = UNDER GROUND TELEPHONE
- BENCH MARK
- TELEPHONE PEDESTAL
- FIRE HYDRANT
- FIBER OPTIC MARKER
- GUY ANCHOR
- GAS METER
- POWER POLE
- WATER METER
- WATER VALVE
- GAS REGULATOR

FLOOD ZONE DESIGNATION:
According to the Federal Emergency Management Agency (FEMA), Map (FIRM) Number 20173C0365E, effective February 2, 2007, the property shown hereon is located in Zone X (No Shading), areas determined to be outside the 2% annual chance of floodplain. Zone X (Shaded), Subject to the 2% annual chance of floodplain. and Zone AE, Base Flood Elevation = Approximately 1279.6 (NAVD88)

ENGINEERING NOTES:

1. The rational method was used to compute the peak discharges for existing conditions. Rational 'C' factors were assigned to the existing site from the City of Wichita Storm Water Manual. A design assumption was made as follows: that the min. time of concentration is 15 minutes.
2. Soil Types were determined from the Natural Resource Conservation Soil Survey website.
3. The property is located in Zone X on the FEMA flood map. (FIRM #20173C0365E)
4. The Kansas Water Wells database has recorded groundwater depths in the area of this property at approximately 10–15 ft.
5. There are no plans now or in the future to develop this property. However, at the time of any future development, a site specific drainage plan shall be submitted to the city engineer prior to development. The plan shall comply with Chapter 16.32 of the City Code, which includes storm water detention and water quality treatment. The reserve areas for any future detention pond(s) shall be recorded by separate instrument. Any future improvements shall not obstruct any offsite drainage that currently drains into/through the site.

Existing Peak Runoff							
Description	Percent Impervious (%)	SCS Soil Type (%)	C	Tc	I (in./hr)	Area (acres)	Q (cfs)
Existing Basin A (2 yr.)	40	B (60)	0.47	27	2.40	6.45	7.28
Existing Basin A 5 yr.)			0.48	27	3.02	6.45	9.35
Existing Basin A (10 yr.)			0.52	27	3.50	6.45	11.74
Existing Basin A (25 yr.)			0.53	27	4.12	6.45	14.08
Existing Basin A (100 yr.)			0.60	27	5.06	6.45	19.58

REV.	DESCRIPTION	DATE

GRAPHIC SCALE
60' 0 60'
(IN FEET)
1"=60'

CAMPBELL'S GREENHOUSE ADDITION

SW ¼ OF SECTION 9, T28S, R1E
SEDGWICK COUNTY, KS

CERTIFIED ENGINEERING DESIGN, P.A.
CIVIL ENGINEERING SERVICES

1935 WEST MAPLE STREET
WICHITA, KANSAS 67213
PH.(316)262-8808 FAX.(316)262-1669

HARLAN DALE FORAKER
LICENSED
10891
10.9.14
KANSAS
PROFESSIONAL ENGINEER

PROJECT NO.: 20142194
ISSUE DATE: 10/09/14
CONTACT: L. MILLS / H. FORAKER
CHECKED BY:

DRAINAGE PLAN

TIME OF CONCENTRATION CALCULATIONS

Project	Campbell's Greenhouse Add.
Feature	TC Calcs
Analyst	Logan Mills
Version	10/9/2014
Notes	notes

Sheet	Subbasin	Number of Segments	Sheet Flow (mins)	Shallow Concentrated Flow (mins)	Open Channel Ditch Flow (mins)	Open Channel Pipe Flow (mins)	Open Channel General Flow (mins)	Other (mins)	Total Tc (mins)	Length (feet)	Drop (feet)	Avg. Slope (%)	Avg. Vel. (fps)	Lag (mins)	Lag (hours)	Area (acres)
1	A	2	18.7	7.8	0.0	0.0	0.0	0.0	26.5	421	4	0.95	0.26	15.9	0.265	500
2	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
3	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
4	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
5	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
6	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
7	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
8	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
9	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
10	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
11	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
12	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
13	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
14	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	0.00	0.82	16.4	0.273	500
15	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
16	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
17	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
18	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
19	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
20	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
21	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
22	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
23	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
24	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
25	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
26	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500

MISCELLANEOUS DRAINAGE INFORMATION

Intensity values are based on regression analysis of data obtained from NOAA Atlas 14, Volume 8); Return Periods 1-yr through 10-yr based on Point Precipitation Frequency Estimates (Partial Duration Series); Return Periods 25-yr through 1000-yr based on Point Precipitation Frequency Estimates (Annual Maximum Series). Data values used in the regression analysis were obtained from the NOAA Precipitation Frequency Data Server for Wichita-Mid Continent weather station location.

Table 1 City of Wichita and Sedgwick County, KS Rainfall Intensity Table (Duration 5 min – 120 min)

DURATION in hours	DURATION in	Return Period									
		1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr	500-yr	1000-yr
0.0833	5	5.07	5.43	6.79	7.82	9.14	10.16	11.17	12.16	13.45	14.44
0.1000	6	4.75	5.08	6.35	7.30	8.53	9.46	10.38	11.28	12.45	13.32
0.1167	7	4.47	4.78	5.97	6.87	8.02	8.88	9.73	10.56	11.64	12.44
0.1333	8	4.22	4.52	5.65	6.49	7.58	8.39	9.18	9.96	10.97	11.71
0.1500	9	4.01	4.29	5.36	6.16	7.19	7.96	8.71	9.44	10.40	11.10
0.1667	10	3.82	4.09	5.11	5.87	6.86	7.59	8.30	9.00	9.91	10.57
0.1833	11	3.65	3.90	4.88	5.62	6.56	7.26	7.94	8.61	9.48	10.12
0.2000	12	3.50	3.74	4.68	5.38	6.29	6.96	7.62	8.26	9.10	9.72
0.2167	13	3.36	3.59	4.50	5.18	6.05	6.70	7.33	7.95	8.76	9.36
0.2333	14	3.23	3.46	4.33	4.99	5.83	6.46	7.07	7.67	8.46	9.04
0.2500	15	3.12	3.34	4.18	4.81	5.63	6.24	6.83	7.42	8.19	8.75
0.2667	16	3.01	3.22	4.04	4.66	5.45	6.04	6.62	7.19	7.94	8.49
0.2833	17	2.92	3.12	3.92	4.51	5.28	5.86	6.42	6.98	7.71	8.25
0.3000	18	2.83	3.02	3.80	4.37	5.13	5.69	6.24	6.78	7.50	8.03
0.3167	19	2.74	2.93	3.69	4.25	4.99	5.53	6.07	6.60	7.31	7.83
0.3333	20	2.67	2.85	3.58	4.13	4.85	5.38	5.91	6.43	7.13	7.64
0.3500	21	2.59	2.77	3.49	4.02	4.73	5.25	5.76	6.28	6.96	7.46
0.3667	22	2.52	2.70	3.40	3.92	4.61	5.12	5.63	6.13	6.80	7.30
0.3833	23	2.46	2.63	3.32	3.83	4.50	5.00	5.50	6.00	6.65	7.14
0.4000	24	2.40	2.57	3.24	3.74	4.40	4.89	5.38	5.87	6.52	7.00
0.4167	25	2.34	2.51	3.16	3.65	4.30	4.78	5.27	5.75	6.39	6.87
0.4333	26	2.29	2.45	3.09	3.57	4.21	4.68	5.16	5.63	6.26	6.74
0.4500	27	2.24	2.40	3.02	3.50	4.12	4.59	5.06	5.53	6.15	6.62
0.4667	28	2.19	2.34	2.96	3.42	4.04	4.50	4.96	5.42	6.04	6.50
0.4833	29	2.15	2.30	2.90	3.35	3.96	4.42	4.87	5.33	5.94	6.39
0.5000	30	2.10	2.25	2.84	3.29	3.89	4.33	4.78	5.24	5.84	6.29
0.5167	31	2.06	2.20	2.79	3.23	3.82	4.26	4.70	5.15	5.74	6.19
0.5333	32	2.02	2.16	2.74	3.17	3.75	4.18	4.62	5.06	5.65	6.10
0.5500	33	1.98	2.12	2.69	3.11	3.68	4.11	4.55	4.98	5.57	6.01
0.5667	34	1.95	2.08	2.64	3.06	3.62	4.05	4.48	4.91	5.48	5.92
0.5833	35	1.91	2.05	2.59	3.01	3.56	3.98	4.41	4.83	5.40	5.84
0.6000	36	1.88	2.01	2.55	2.96	3.50	3.92	4.34	4.76	5.33	5.76
0.6167	37	1.85	1.98	2.51	2.91	3.45	3.86	4.28	4.70	5.26	5.69
0.6333	38	1.82	1.94	2.47	2.86	3.40	3.80	4.22	4.63	5.19	5.61
0.6500	39	1.79	1.91	2.43	2.82	3.35	3.75	4.16	4.57	5.12	5.54
0.6667	40	1.76	1.88	2.39	2.78	3.30	3.70	4.10	4.51	5.06	5.48
0.6833	41	1.73	1.85	2.36	2.74	3.25	3.65	4.05	4.45	4.99	5.41
0.7000	42	1.71	1.83	2.32	2.70	3.21	3.60	3.99	4.39	4.93	5.35
0.7167	43	1.68	1.80	2.29	2.66	3.16	3.55	3.94	4.34	4.88	5.29
0.7333	44	1.66	1.77	2.26	2.62	3.12	3.51	3.89	4.29	4.82	5.23
0.7500	45	1.63	1.75	2.22	2.59	3.08	3.46	3.85	4.24	4.76	5.17
0.7667	46	1.61	1.72	2.19	2.55	3.04	3.42	3.80	4.19	4.71	5.12
0.7833	47	1.59	1.70	2.17	2.52	3.00	3.38	3.76	4.14	4.66	5.07
0.8000	48	1.57	1.68	2.14	2.49	2.97	3.34	3.71	4.10	4.61	5.01
0.8167	49	1.55	1.66	2.11	2.46	2.93	3.30	3.67	4.05	4.56	4.96
0.8333	50	1.53	1.63	2.08	2.43	2.90	3.26	3.63	4.01	4.52	4.92
0.8500	51	1.51	1.61	2.06	2.40	2.86	3.22	3.59	3.97	4.47	4.87
0.8667	52	1.49	1.59	2.03	2.37	2.83	3.19	3.56	3.93	4.43	4.82
0.8833	53	1.47	1.57	2.01	2.34	2.80	3.16	3.52	3.89	4.39	4.78
0.9000	54	1.45	1.56	1.99	2.32	2.77	3.12	3.48	3.85	4.35	4.74
0.9167	55	1.43	1.54	1.96	2.29	2.74	3.09	3.45	3.81	4.31	4.69
0.9333	56	1.42	1.52	1.94	2.27	2.71	3.06	3.41	3.78	4.27	4.65
0.9500	57	1.40	1.50	1.92	2.24	2.68	3.03	3.38	3.74	4.23	4.61
0.9667	58	1.39	1.49	1.90	2.22	2.65	3.00	3.35	3.71	4.19	4.57
0.9833	59	1.37	1.47	1.88	2.19	2.63	2.97	3.32	3.67	4.16	4.54

Table C-1 Rational C Values

Land Use or Surface Characteristics	Percent Impervious	Frequency 2	5	10	100
Business					
Downtown Areas	95	0.84	0.85	0.87	0.91
Neighborhood Areas	70	0.68	0.69	0.73	0.80
Residential Single Family (Soil Group D)					
1/8 Acre	50	0.57	0.61	0.66	0.79
1/4 Acre	38	0.50	0.54	0.62	0.76
1/3 Acre	30	0.46	0.50	0.59	0.73
1/2 Acre	25	0.42	0.48	0.56	0.72
3/4 Acre	22	0.42	0.46	0.55	0.71
1 Acre	20	0.41	0.45	0.54	0.71
Residentia Multi-Family (Soil Group D)					
Multi-Unit (detached)	60	0.62	0.66	0.72	0.82
Multi-Unit (attached)	65	0.64	0.68	0.73	0.83
Apartments	75	0.70	0.73	0.79	0.86
Residential Single Family (Soil Group C)					
1/8 Acre	50	0.55	0.58	0.64	0.73
1/4 Acre	38	0.48	0.51	0.57	0.68
1/3 Acre	30	0.43	0.46	0.53	0.65
1/2 Acre	25	0.40	0.43	0.50	0.63
3/4 Acre	22	0.39	0.42	0.49	0.62
1 Acre	20	0.37	0.40	0.48	0.61
Residential Multi-Family (Soil Group C)					
Multi-Unit (detached)	60	0.60	0.63	0.69	0.77
Multi-Unit (attached)	65	0.63	0.66	0.71	0.79
Apartments	75	0.68	0.72	0.77	0.83
Residential Single Family (Soil Group B)					
1/8 Acre	50	0.52	0.54	0.59	0.67
1/4 Acre	38	0.44	0.46	0.52	0.61
1/3 Acre	30	0.39	0.41	0.47	0.57
1/2 Acre	25	0.36	0.38	0.44	0.54
3/4 Acre	22	0.34	0.36	0.42	0.52
1 Acre	20	0.33	0.35	0.40	0.51
Residential Multi-Family (Soil Group B)					
Multi-Unit (detached)	60	0.58	0.60	0.65	0.72
Multi-Unit (attached)	65	0.61	0.64	0.68	0.75
Apartments	75	0.67	0.70	0.74	0.80
Single Family (Soil Group A)					
1/8 Acre	50	0.47	0.50	0.54	0.60
1/4 Acre	38	0.39	0.41	0.45	0.52
1/3 Acre	30	0.33	0.35	0.39	0.47
1/2 Acre	25	0.30	0.31	0.35	0.44

Land Use or Surface Characteristics	Percent Impervious	Frequency 2	5	10	100
3/4 Acre	22	0.28	0.29	0.33	0.42
1 Acre	20	0.26	0.28	0.32	0.40
Multi-Family (Soil Group A)					
Multi-Unit (detached)	60	0.55	0.57	0.61	0.67
Multi-Unit (attached)	65	0.58	0.60	0.64	0.70
Apartments	75	0.65	0.68	0.72	0.77
Industrial					
Light Areas	70	0.68	0.69	0.73	0.80
Heavy Areas	80	0.74	0.76	0.79	0.84
Playgrounds	15	0.33	0.35	0.42	0.55
Schools	40	0.49	0.51	0.56	0.66
Railroad Yard Areas	30	0.43	0.45	0.50	0.62
Undeveloped Urban Areas					
Offsite Flow Analysis (when land use not defined)	45	0.52	0.54	0.59	0.68
Streets					
Paved	99	0.87	0.88	0.90	0.93
Gravel	00	0.24	0.26	0.33	0.48
Drive, Parking Lots and Walks:	96	0.87	0.87	0.88	0.89
Roofs	90	0.80	0.85	0.90	0.93
Urban Lawn Areas (Soil Group A)					
Slope less than 1%	00	0.08	0.09	0.13	0.23
Slope 1% to 4%	00	0.12	0.13	0.17	0.27
Slope more than 4%	00	0.16	0.17	0.21	0.31
Urban Lawn Areas (Soil Group B)					
Slope less than 1%	00	0.16	0.18	0.24	0.37
Slope 1% to 4%	00	0.20	0.22	0.28	0.41
Slope more than 4%	00	0.24	0.26	0.32	0.45
Urban Lawn Areas (Soil Group C)					
Slope less than 1%	00	0.24	0.27	0.35	0.51
Slope 1% to 4%	00	0.26	0.29	0.37	0.53
Slope more than 4%	00	0.28	0.31	0.39	0.55
Urban Lawn Areas (Soil Group D)					
Slope less than 1%	00	0.28	0.33	0.43	0.63
Slope 1% to 4%	00	0.30	0.35	0.45	0.65
Slope more than 4%	00	0.32	0.37	0.47	0.67