

DRAINAGE CONCEPT

FOR

BEHNKE ADDITION
Sedgwick County, Kansas

MAY 2012





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: _____			
Total Area of Project: _____		acres	
Development Type: _____		Other: _____	
Developer Name: _____		Contact: _____	Phone: _____
Email: _____			
Engineer Name: _____		Contact: _____	Phone: _____
Email: _____			

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		
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.		
1.2	Professional Engineer's seal, signature and date on plan cover.		
1.3	Site location map, using color ortho-imagery and showing the project boundaries, a north arrow and an accurate scale.		
1.4	Narrative of the development type, existing conditions and proposed impacts on stormwater runoff, wetlands, riparian zones and floodplains/floodways.		
1.5	Discussion of off-site conditions surrounding the proposed development.		
1.6	Summary table of runoff calculations (pre/post development).		
1.7	Narrative description of the type and function of the permanent structural stormwater management facilities.		
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.		
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.		
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.		
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.		
2.1.5	Location, dimensions and elevations of existing bridges and culvert crossings.		
2.1.6	Location of existing utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.		
2.1.7	Groundwater elevations, if applicable.		
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.		
2.1.9	Land use types per NRCS nomenclature.		
2.1.10	Footprint of existing impervious areas (labeled, area given in acres).		
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).		
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.).		
2.2	Existing Conditions Hydrology and Hydraulics Analysis		

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
2.2.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).		
2.2.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).		
2.2.3	Table of existing condition runoff curve numbers with supporting data and calculations.		
2.2.4	Table of existing condition times of concentration with supporting data and calculations.		
2.2.5	A summary table of rainfall data used in the hydrologic analysis, and a reference for the source of the data.		
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.		
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.		
3.0 postdevelopment Conditions Information			
3.1 postdevelopment Conditions Drainage Map			
3.1.1	Proposed project boundary.		
3.1.2	on-site and off-site topography: NAVD 88 datum, one-foot contours with spot elevations.		
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.		
3.1.4	Location and description of off-site through-drainage conveyances which are confined to an easement, dedication and/or reserve.		
3.1.5	Footprint of proposed impervious areas, including roads, parking lots, buildings and other structures.		
3.1.6	Location of proposed utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.		
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.		
3.1.8	Land use cover per NRCS nomenclature.		
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).		
3.1.10	Proposed limits of land disturbing activity (i.e., grading limits).		
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.)		
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.		
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.		
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.		
3.2.4	Location(s) of stormwater management facilities and any associated drainage easements.		
3.2.5	Proposed energy dissipaters and other channel protection devices.		
3.2.6	Location(s) and dimension(s) of proposed channel, bridge and culvert crossings.		
3.2.7	Normal pool and 100-year pool elevations for ponds and lakes.		
3.2.8	Permanent concrete outfall control structure(s) for ponds.		
3.2.9	Emergency overflow spillways and top of berm elevations for ponds and other volume/peak discharge control facilities.		
3.2.10	Floodplains, ponds, and stormwater management facilities located in reserves.		
3.3 postdevelopment Conditions Hydrology & Hydraulics			
3.3.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).		

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
3.3.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).		
3.3.3	Table of postdevelopment condition runoff curve numbers with supporting data and calculations.		
3.3.4	Table of postdevelopment condition times of concentration with supporting data and calculations.		
3.3.5	Cross-sections and other diagrams of existing open channels, bridge and culvert sections and other hydraulic features as		
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.		
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.		
3.3.8	Stage-storage-discharge or other outlet rating curves and inflow/outflow hydrographs for all ponds.		
3.3.9	Demonstrate that the pond contours on the master grading plan and the stage-storage-discharge data are consistent for all ponds.		
3.3.10	Demonstrate that all ponds have one foot of freeboard above the 100-year, 24-hour high water level.		
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.		
3.4 Stormwater Quantity Control Sizing			
3.4.1	Hydraulic sizing calculations for all stormwater management controls.		
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.		
3.4.3	Typical details (including cross-sections where applicable) for outlet structures, embankments, spillways, grade control structures, conveyance channels, etc.		
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.		
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.).		
3.5.3	Water quality volume (total and by facility), with supporting data and calculations.		
3.5.4	% TSS removal value (total and by facility) with supporting data and calculation. Must be equal to or greater than 80%.		
3.5.5	Channel protection volume with supporting data and calculations.		
3.5.6	Water quality volume and channel protection volume orifice size calculations.		
3.5.7	Other calculations required for each stormwater management facility as specified in the Wichita/Sedgwick County Stormwater Manual.		
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.		
4.0 Floodplains			
4.1	Reference the source of flood profile, floodplain, floodway and stream discharge information.		
4.2	Delineation of nearest base flood elevations.		
4.3	Delineation of predevelopment regulatory floodplain/floodway limits using FEMA's current GIS database; limits to be per elevation and scaled location.		
4.4	Delineation of postdevelopment regulatory floodplain/floodway limits; limits to be per elevation and scaled location, with project limits shown.		
4.5	Floodway data table and discharges.		
4.6	Hydrologic and hydraulic study information for local floodplain analysis, unnumbered Zone A elevation determinations and floodplain map revisions or required permits.		
4.7	Regulatory floodway and four natural profile models (10, 50, 100 and 500-year) for existing and postdevelopment conditions.		
4.8	Floodplains and floodways located within a reserve, where necessary.		
4.9	Floodplain cut and fill calculations for volume sensitive basins.		

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

Tab 1. General

Location

The subject property is in the City of Wichita, Sedgwick County, Kansas. The proposed development is on Topeka Ave and 35th Street South. The site is the northwest quarter of Section 9, Township 28 South, Range 1 East of the 6th P.M. The site is bordered by East Robins Addition to the north, unplatted areas to the south and east, and the Union Pacific Railroad to the west. The plat area is 10.4 acres. The site is shown on the USGS Map, Appendix 1.1. The site is also shown on the aerial photograph, Appendix 1.2.

Discussion of Project

Existing

The site is currently unplatted grassland with several trails where vehicles have driven through the property. The west side of the property is several feet higher than the rest of the site and has an escarpment with an approximate 10:1 slope, over approximately 50 feet, that separates the west area from the east. The majority of the site is east of the escarpment and is extremely flat, but generally slopes from the southwest to the northeast. Runoff exits the site to the north into Go Lake. The City of Wichita has recently purchased the property.

Proposed

Development Type

The property will develop as 3 single family residential lots. Lot 1 is 1.03 acres, Lot 2 is 0.56 acres, and Lot 3 is 3.98 acres in size. The proposed plat also includes a 2.95 acre reserve that will be utilized to construct a dry retention pond; and 1.88 acres that have been dedicated for the construction of the Broadway Bridge, Topeka Circle, and 35th Street South. A copy of the preliminary plat is located in Appendix 1.3 and the final plat is included in Appendix 1.4.

The City purchased the land in order to accommodate the realignment of the Broadway Bridge over the Union Pacific Railroad, just west of the site. As mentioned the City will construct a retention pond within Reserve "A" of Behnke Addition. The retention pond has been sized to contain the entire 24-hr, 100-year runoff volume from the area between Topeka Street and Broadway north of 37th Street. The basin holds the runoff until the water is able to evaporate or percolate into the ground.

The City will be relocating an historic house onto Lot 1 and will provide minor grading on Lot 2 in conjunction with the Broadway Bridge project. A Preliminary Four Corner Lot Grading Plan is included in Appendix 1.5.

Impacts on Stormwater

A large retention basin will be constructed within Reserve "A". This basin will contain the entire runoff volume for a 24-hr, 100-year storm for the area draining to it. A portion of the site, consisting mostly of grassy backyard areas will continue to follow existing drainage patterns and drain towards Go Lake. A comparison of the pre and post-project from rates offsite is included below in Table 1.1.

Table 2.2. Discharge from Behnke Addition.

Location	Post-Project Runoff From Site (cfs)					
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Pre Project	6.1	10.7	14.1	18.8	23.1	28.1
Post-Project	5.1	7.9	10.0	12.7	15.2	18.0

Permanent Structural Stormwater Management Facilities

The retention basin will provide detention, water quality, and channel protection for the disturbed area from the south half of the Broadway Bridge project. The front half of lots 1 and 2 will also drain to the basin. The basin will hold onto the water until it either evaporates back into the atmosphere or percolates into the ground.

Offsite

The site is bounded by East Robins Addition/Go Lake to the north, unplatted areas to the south and east, and Broadway Street and the Union Pacific Railroad to the west.

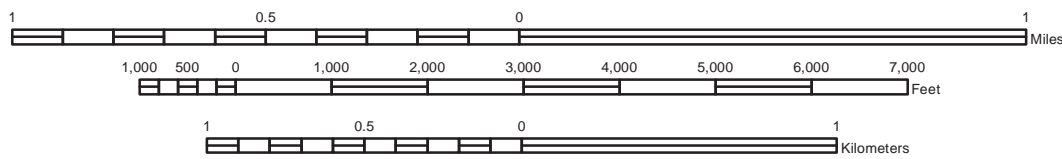
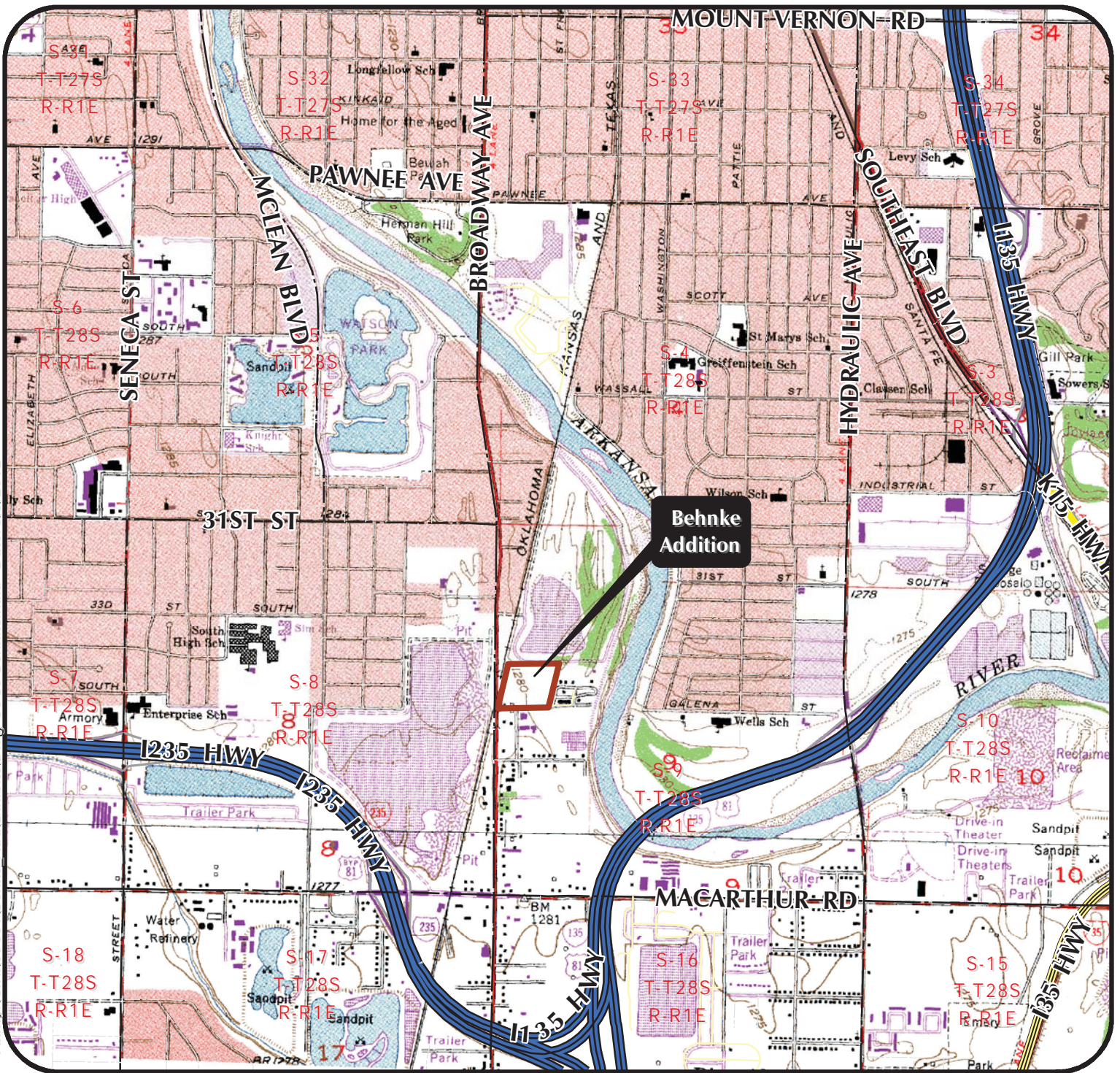
Summary

The site will develop from vacant land to three single family residential lots. A retention basin will be constructed near the northwest corner of the site that will provided detention, water quality, and channel protection for the Broadway Bridge at 34th Street South Project. The basin will provide 5.81 ac-feet of storage. The 24-hr 100-year runoff volume is approximately 5.57 acre-feet.

Appendix 1.1

USGS Quadrangle Map

Path: J:\Civil\09081\Behnke_Add\Exhibits\Drng-USGS-Behnke.mxd - Date: 5/9/2012



Behnke Addition

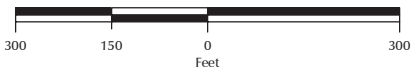
Project Name:
USGS Quadrangle
 Sheet Title:



JGD	May 2012
Drawn By:	Date:
KLA	09081
Design / Review:	Job No.:

Appendix 1.2
Aerial Photograph

Path: J:\Civil\09081\Behnke_Add\Exhibits\Drng-Aerial_Behnke.mxd - Date: 5/9/2012



Behnke Addition

Project Name:

2011 Aerial Photography

Sheet Title:



JGD

Drawn By:

KLA

Design / Review:

May 2012

Date:

09081

Job No.:

Appendix 1.3

Preliminary Plat

NOTES

- LOCATION: Located in south Wichita east of Broadway Avenue and a half of mile south of 31st St. S. in an area of mixed uses having single family residential, plant nursery, outdoor recreation (Go Lake), and outdoor storage.
- LOT TOTAL - 3
- ANNEXATION: City of Wichita
- EXISTING/PROPOSED USES: Existing - vacant land
Proposed - single family residential
- ZONING: Existing / Proposed - "GC" General Commercial
- PLAT AREA: Gross = 10.4 Acres
- SURVEY DATE: May 2010 (by MKEC)
- PUBLIC UTILITIES: Municipal water is available south side of 35th Street and municipal sanitary sewer is not available.
- ACCESS / ACCESS CONTROLS: None
- RESERVES: One
- FLOOD: According to FEMA FIRM Community Unit Panel 20173C0365E, effective date February 7th, 2007; this property lies within flood zone "X", "Areas determined to be outside the 0.2% annual chance floodplain."
- DRAINAGE: A drainage report shall accompany this plat and will be submitted to the Public Works Department.
- BUILDING SETBACKS: As per Zoning District

LEGAL DESCRIPTION

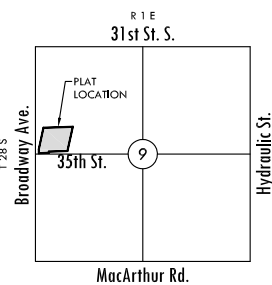
Beginning at a point 2006 feet South and 198.25 feet East of the Northwest corner of Section 9, Township 28 South, Range 1 East of the 6th P.M., and on the East line of the C.R.I. and P.R.R. Railway right of way; thence in an Easterly direction 728.25 feet; thence with an included angle of 75°48'30" in a Southwesterly direction 644.25 feet to the old hedge line or South line of Government Lot 9 as established by District Court Order #19897; thence West parallel to the above described North line 703.75 feet to a point on the East line of highway right of way; thence North along said highway right of way 92 feet to a point the East line of said railroad right of way; thence Northeasterly along the East line of the railroad right of way 549.55 feet more or less to the point of beginning; EXCEPT the South 30 feet thereof for road easement as described in Book of Miscellaneous No. 175, Page 187.

LEGEND

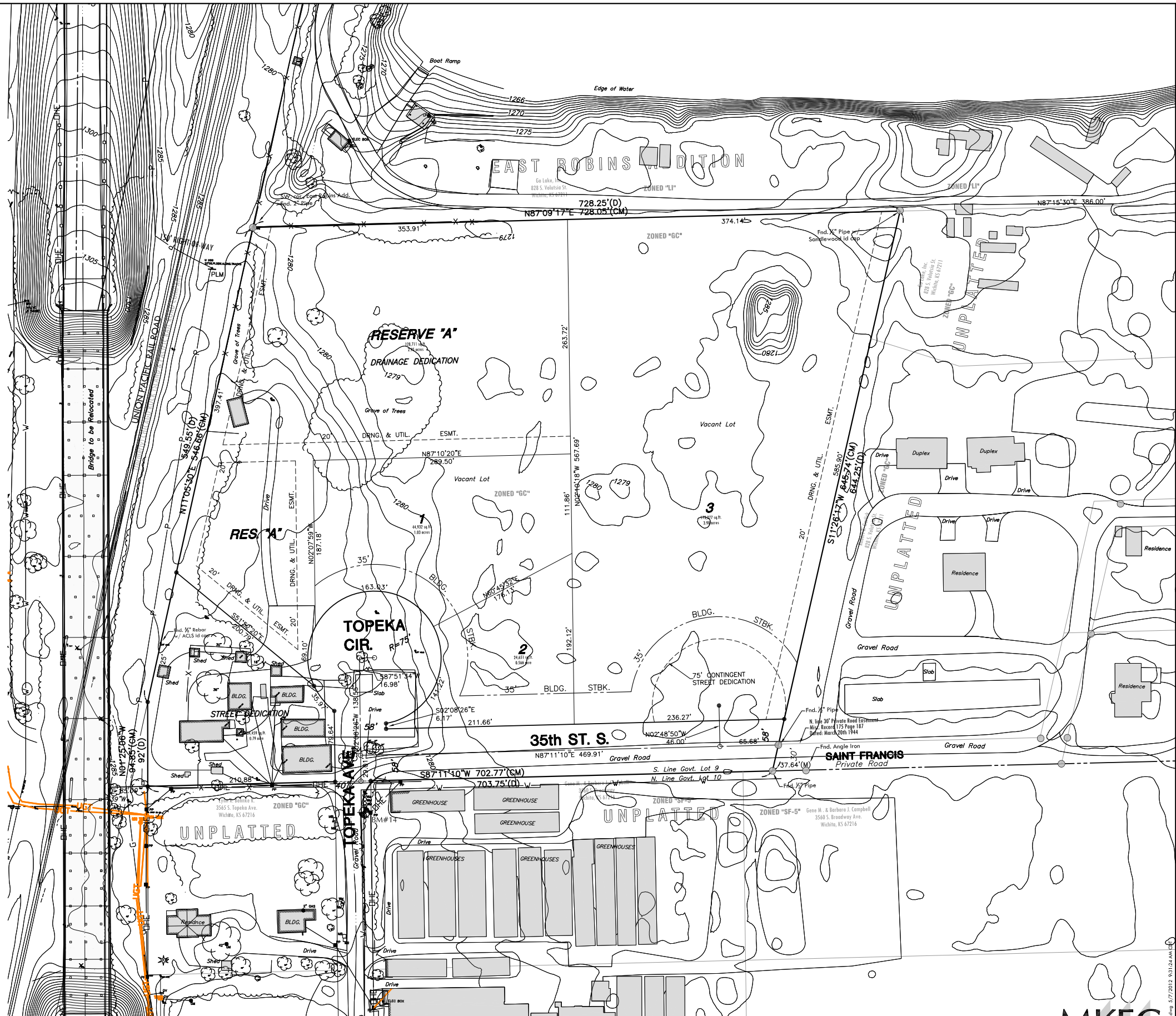
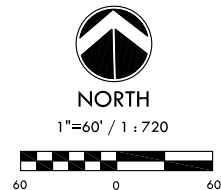
- | | |
|---|---|
| <ul style="list-style-type: none"> - EDGE OF TREES • CONIFEROUS TREE • DECIDUOUS TREE • SIGN • POWER POLE • ELECTRIC BOX • LIGHT POLE • FIRE HYDRANT • WATER VALVE • WATER METER • TELEPHONE MANHOLE • TELEPHONE RISER • GAS METER | <ul style="list-style-type: none"> • BENCHMARK • 3/8" REBAR/MKEC CLS 39 • PROPERTY CORNER FOUND • SECTION CORNER - EASEMENT - FENCE - STORM SEWER PIPE - WATER LINE - SANITARY SEWER LINE - GAS LINE - OVERHEAD ELECTRIC |
|---|---|

BENCH MARK

BM 14 - Northwest bolt of top flange fire hydrant on southeast corner 35th Street South and Topeka, 7.8' West of east right of way of Topeka and 34.9' South of south line Government Lot 10 in Section 9, Township 28 South, Range 1 East. Elev. = 1284.42 NAVD 88.



VICINITY MAP



PRELIMINARY PLAT

A portion of the NW 1/4, Sec. 9, T28S, R1E, 6th P.M.

BEHNKE ADDITION

DEVELOPER/OWNER: City Of Wichita,

455 N. Main 67202

Date submitted: May 7th, 2012
MAPC Hearing: June 7th, 2012

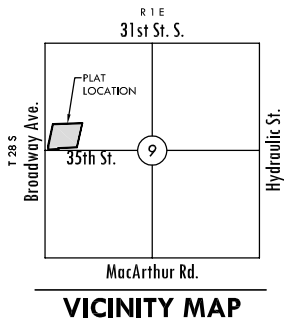
Subdivision Hearing: May 24th, 2012

MKEC
ENGINEERING
CONSULTANTS, INC.

411 N. WEBB ROAD
WICHITA, KS. 67206
316-684-9600

Appendix 1.4

Final Plat



CERTIFICATE OF SURVEY

I, Gregory J. Allison, a registered land surveyor in Kansas, do hereby certify that I have been in responsible charge of surveying and platting of "BEHNKE ADDITION," an addition to Wichita, Sedgwick County, Kansas, into Lots, a Block, and Streets, the same being accurately set forth in the accompanying plat and described herein:

Beginning at a point 2006 feet South and 198.25 feet East of the Northwest corner of Section 9, Township 28 South, Range 1 East of the 6th P.M., and on the East line of the C.R.I. and P.R.R. Railway right of way; thence in an Easterly direction 728.25 feet; thence with an included angle of 75°48'30" in a Southwesterly direction 644.25 feet to the old hedge line or South line of Government Lot 9 as established by District Court Order #19897; thence West parallel to the above described North line 703.75 feet to a point on the East line of highway right of way; thence North along said highway right of way 92 feet to a point on the East line of said railroad right of way; thence Northeasterly along the East line of the railroad right of way 349.55 feet more or less to the point of beginning; EXCEPT the South 30 feet thereof for road easement as described in Book of Miscellaneous No. 175, Page 187.

All streets, easements, setbacks, access controls, together with any and all other public dedications within the above described property are hereby vacated and replatted by virtue of K.S.A. 12-512(b).

I hereby certify that the details of this plat are correct to the best of my knowledge and belief this ___ day of _____, 2012.

Gregory J. Allison, PE, LS #1257
MKEC Engineering Consultants, Inc.
411 North Webb Road
Wichita, Kansas 67206

OWNER'S CERTIFICATES

Know all men by these presents that we the undersigned property owners of the land above set forth in the Registered Land Surveyor's Certificate, have caused the same to be surveyed and platted into Lots, a Block, and Streets, the same to be known as "BEHNKE ADDITION," an addition to Wichita, Sedgwick County, Kansas.

The streets are hereby dedicated to and for the use of the public.

Easements for the construction and maintenance of public utilities and drainage, as indicated hereon, are hereby granted to the public.

Reserves "A" is platted for drainage, landscaping, open space, and uses permitted by the Zoning that are not in conflict with the conveyance of stormwater, and utilities confined by easement(s) or rights-of-way. The Reserve shall be owned and maintained by the owner(s) of Lots 1, 2, and 3, Block 1, and/or their successors, assigns, and/or an Owner's Association.

A drainage plan has been developed for this plat. All drainage easements, rights-of-ways, or reserves shall remain at established grades or as modified with the approval of the applicable City or County Engineer, and unobstructed to allow for the conveyance of storm water.

CITY OF WICHITA
At the direction of City Council

_____, Mayor
Carl Brewer, Mayor

STATE OF KANSAS, SEDGWICK COUNTY} ss:

This instrument was acknowledged before me on ___ day of _____, 2012, by Carl Brewer, Mayor, City of Wichita.

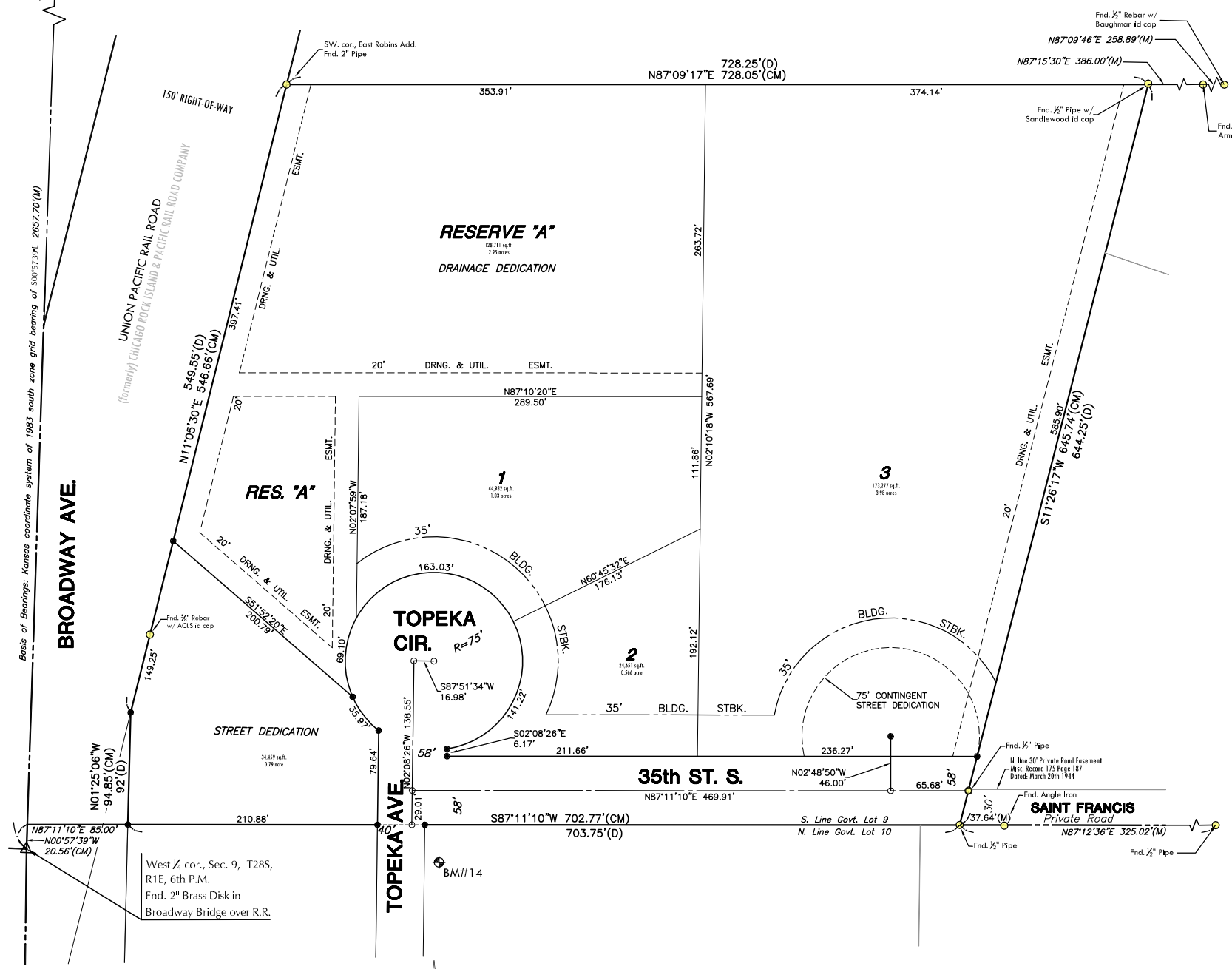
IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year last above written.

SEAL

_____, Notary Public
Notary Public:

My Term Expires: _____.

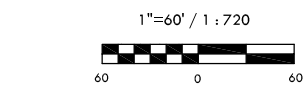
NW. cor., NW ¼, Sec. 9,
T28S, R1E, 6th P.M.
Fnd. PK Nail



LEGEND

Date of Survey: May, 2010

- △ = Section Corner Monument Found
- = Found survey monument see annotation for type
- = Set ½" rebar w/ MKEC CLS 39 id. cap
- (M) = Measured
- (CM) = Calculated from measured
- (D) = Described



Basis of Bearing: Kansas coordinate system of 1983 south zone grid bearing of S00°57'39"E along the W. line of NW ¼, Sec. 9, T28S, R1E, 6th P.M.

This plat is surveyed and platted on NAVD88-09 using Kansas state plane south zone coordinates, modified to the surface, having a combined adjustment scale factor of 1.000120014401728

FINAL PLAT
BEHNKE ADDITION
AN ADDITION TO WICHITA, SEDGWICK COUNTY, KANSAS

PLANNING COMMISSION CERTIFICATE

This plat of "BEHNKE ADDITION" has been submitted to and approved by the Wichita-Sedgwick County Metropolitan Area Planning Commission, Wichita, Kansas.

Dated this ___ day of _____, 2012

WICHITA-SEDGWICK COUNTY METROPOLITAN AREA PLANNING COMMISSION

_____, Chair
Debra Miller Stevens, Chair

Attest: _____, Secretary
John L. Schlegel, Secretary

Affix MAPC Seal

GOVERNING BODY CERTIFICATE

The dedications shown on this plat are hereby accepted and this plat is hereby approved by the governing body of the City of Wichita, Kansas.

Dated this ___ day of _____, 2012

At the direction of the City Council.

_____, Mayor
Carl Brewer, Mayor

Attest: _____, City Clerk
Karen Sublett, City Clerk

Affix City Seal

TRANSFER RECORD

STATE OF KANSAS, SEDGWICK COUNTY} ss:

Entered on transfer record this ___ day of _____, 2012

_____, County Clerk
Kelly B. Arnold, County Clerk

Affix County Clerk Seal

REGISTER OF DEEDS CERTIFICATE

STATE OF KANSAS, SEDGWICK COUNTY} ss:

This is to certify that this instrument was filed for record in the Register of Deeds office this ___ day of _____, 2012, at _____ o'clock _M; and is duly recorded.

_____, Register of Deeds
Bill Meek, Register of Deeds

Attest: _____, Deputy
Tonya E. Buckingham, Deputy

Affix Register of Deeds Seal

COUNTY SURVEYOR

STATE OF KANSAS, SEDGWICK COUNTY} ss:

Reviewed in accordance with K.S.A. 58-2005 on this ___ day of _____, 2012.

_____, Deputy County Surveyor
Tricia L. Robello, LS #1246
Deputy County Surveyor
Sedgwick County, Kansas



411 N. WEBB ROAD
WICHITA, KS. 67206
316-684-9600

Appendix 1.5

Four Corner Lot Grading Plan

PRELIMINARY
NOT FOR
CONSTRUCTION

BEHNKE ADDITION

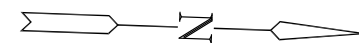
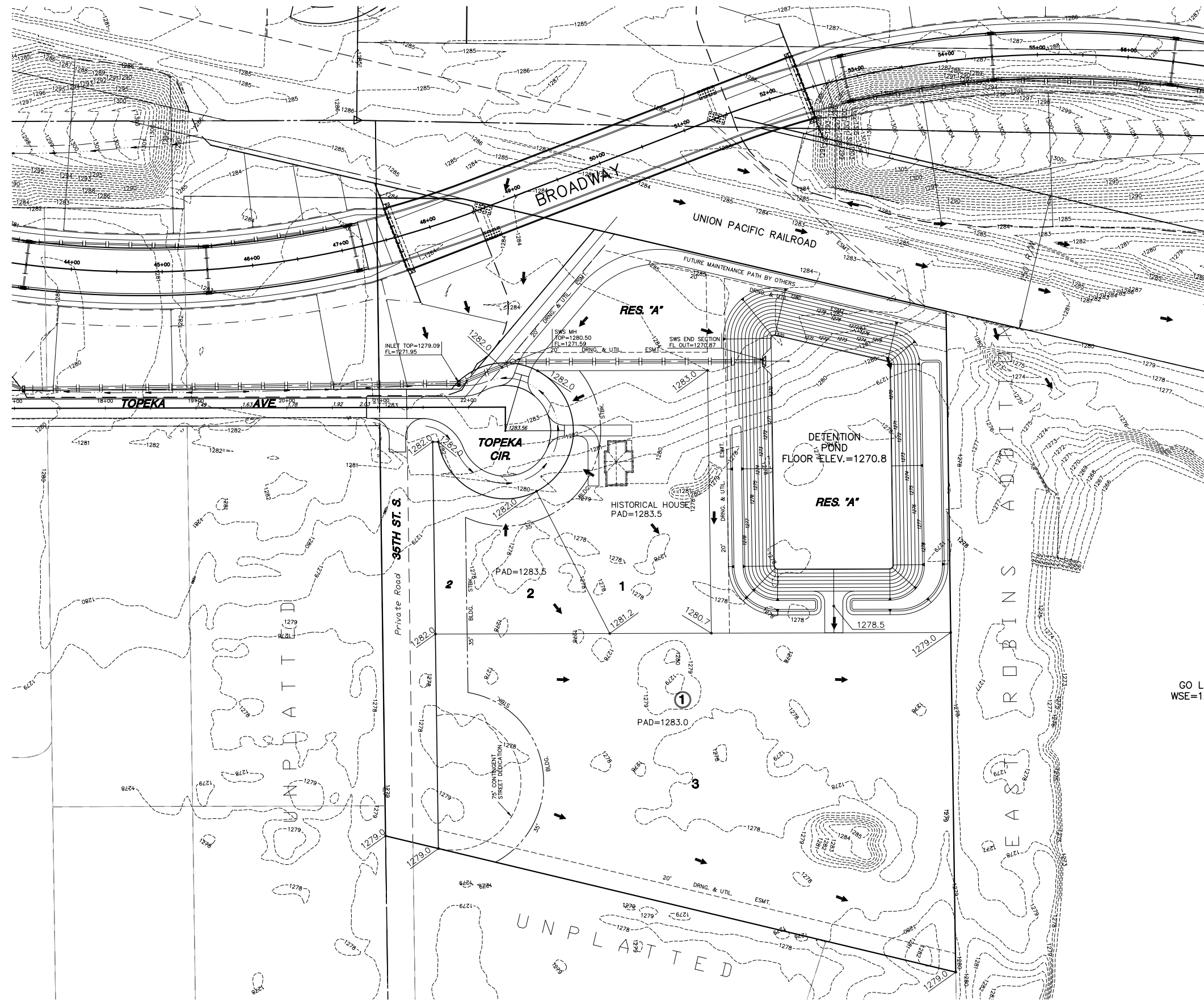
**4 CORNER
GRADING MAP**

SHEET TITLE
09081
PROJECT NUMBER

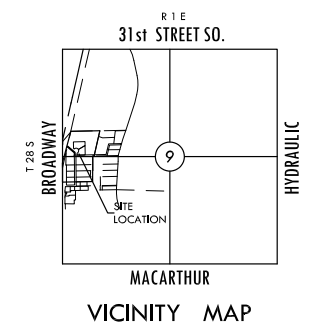
AJK / DM / JRA
DESIGNED / DRAWN / CHECKED

ISSUED
May 2012
REVISED

SHEET NO.
1 of 1



SCALE: 1"=60'
0 60 120



LEGEND

- - CONIFEROUS TREE
- - DECIDUOUS TREE
- - SIGN
- PP - POWER POLE
- ELEC BOX - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SC - SECTION CORNER
- BM - BENCHMARK
- - EASEMENT
- - BUILDING SETBACK
- - FENCE
- - STORM SEWER PIPE
- - WATER LINE
- - SANITARY SEWER LINE
- - GAS LINE
- - GAS PIPELINE
- - TELEPHONE LINE
- - UNDERGROUND ELEC.
- - OVERHEAD ELECTRIC
- - FIBER OPTIC CABLE
- - DRAINAGE SUB BASIN
- - DRAINAGE BASIN
- - FLOW ARROW
- A17 - AREA FOR SWS SIZING

GO LAKE
WSE=1266.0

Tab 2. Existing Conditions

Datum

The site is shown in NAVD 88 datum.

Drainage Patterns

The majority site is extremely flat with an escarpment separating higher ground in the western portion of the site from a lower region to the east. The eastern portion of the site ranges in elevation from 1278 to 1280. The site has several existing sump locations. However the site generally drains overland from south to north into the Go Lake. The existing conditions are shown on the Existing Conditions Drainage Map, Appendix 2.1.

Groundwater Elevations

Go Lake just north of the site is a ground water lake. LiDAR indicates that the water surface elevation of Go Lake is approximately 1266. This would indicate that the groundwater elevation is approximately 12 feet below the lowest elevation on the site.

Utilities

Water

An existing 6" waterline is located along the east side of Topeka Avenue and the south side of 35th Street South.

Sanitary Sewer

Sanitary Sewer is not readily available near the site. According to GIS information the nearest manholes are located approximately 1000' north and south of the site.

Stormwater

There are no stormwater sewer systems or ditches on the site.

Others

There are no other existing utilities on site.

Hydrologic Analysis

The site is currently vacant grass land draining from south to north. The site was modeled using the SCS method in Hydraflow Hydrographs, Appendix 2.2. The property was considered to be one basin with a pre-developed CN of 71.

Table 2.1. Rainfall Depths for 24-Hour Design Storms

Location	Design Storm Rainfall Depth (in)							
	1-Yr	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
Sedgwick County	2.8	3.5	4.5	5.2	6.1	6.9	7.8	9.4

The combination of long time of concentration and the low CN results in low runoff rates from the site. Table 2.2 below shows the pre-project runoff rates from the site.

Table 2.2. Discharge from Behnke Addition.

Location	Post-Project Runoff From Site (cfs)					
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Pre Project	6.1	10.7	14.1	18.8	23.1	28.1

Soil Type

- Naron fine sandy loam, 0 to 3 percent slopes, HSG “B”
- Canadian fine sandy loam, rarely flooded, HSG “B”
- Pratt-Tivoli loamy fine sands, 5 to 15 percent slopes, HSG “A”

The HSG used to select curve numbers is HSG “B.” The site is shown on the soil survey, Appendix 2.3.

Land Use, Impervious Area, and Curve Number

The site is currently undeveloped land with natural grass covering the site. A curve number of 71 was selected to represent the existing conditions for the site. Pre and post-project curve number calculations are included in Appendix 2.4.

Time of Concentration

The site is extremely sandy and flat, but generally drains from south to north. The lack of grade results in long time of concentration. The time of concentration was calculated using to be approximately 54 minutes assuming that the site is unpaved, Appendix 2.5.

Appendix 2.1

Existing Conditions Drainage Map

PRELIMINARY
NOT FOR
CONSTRUCTION

BEHNKE ADDITION

**EXIST. DRNG
CONDITIONS**

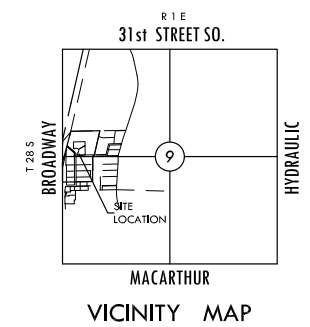
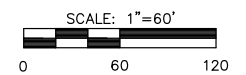
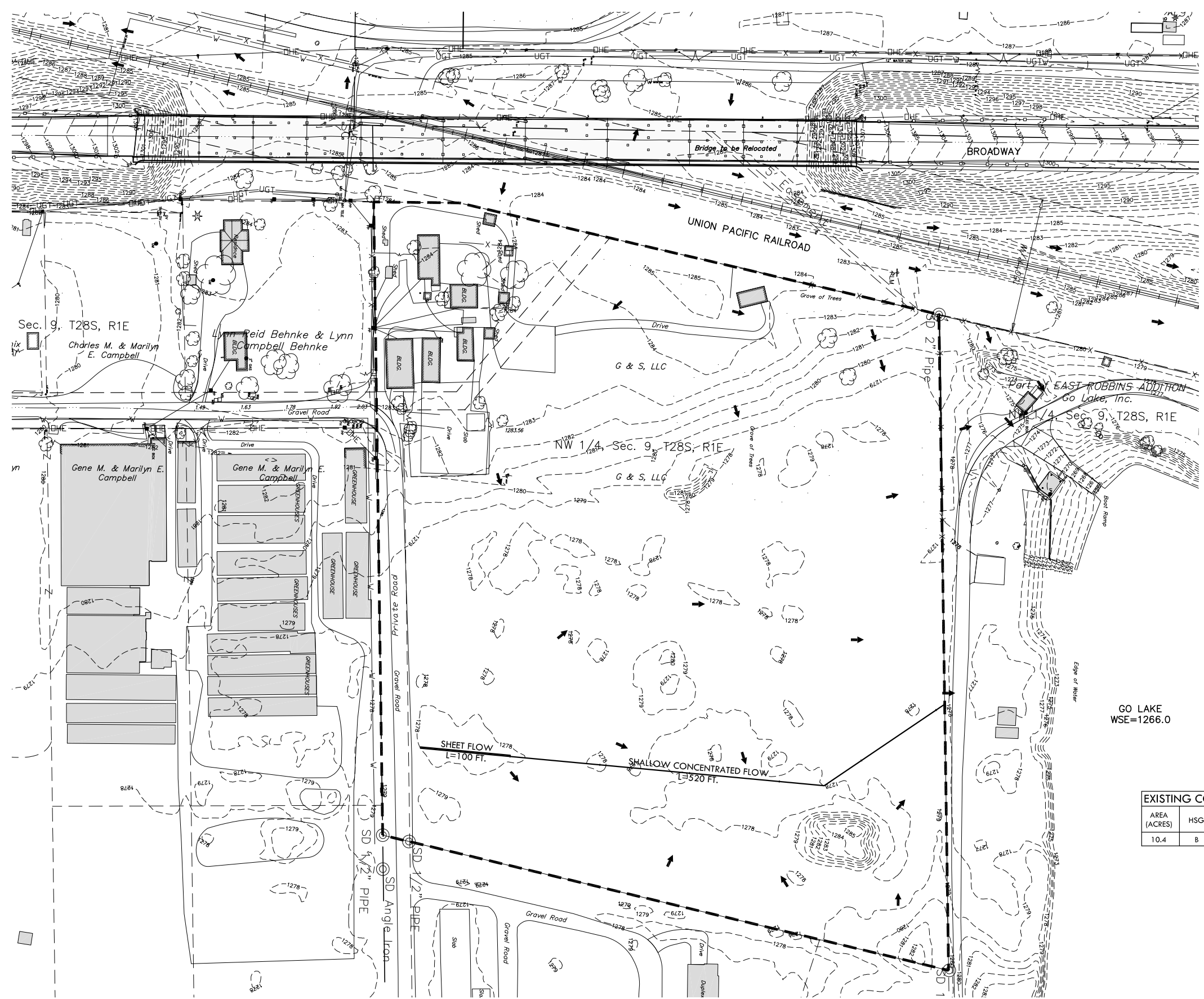
SHEET TITLE
09081
PROJECT NUMBER

AJK / DM / JRA
DESIGNED DRAWN CHECKED

ISSUED
May 2012

REVISED

SHEET NO.
1 of 1



LEGEND

- BT - CONIFEROUS TREE
- DT - DECIDUOUS TREE
- SN - SIGN
- PP - POWER POLE
- EB - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SC - SECTION CORNER
- BM - BENCHMARK
- E - EASEMENT
- BS - BUILDING SETBACK
- F - FENCE
- SSP - STORM SEWER PIPE
- WL - WATER LINE
- SSL - SANITARY SEWER LINE
- GL - GAS LINE
- GPL - GAS PIPELINE
- UTL - TELEPHONE LINE
- UUE - UNDERGROUND ELEC.
- OUE - OVERHEAD ELECTRIC
- FOC - FIBER OPTIC CABLE
- S/B - SITE/BOUNDARY
- DB - DRAINAGE BASIN
- FA - FLOW ARROW
- A17 - AREA FOR SWS SIZING

EXISTING CONDITIONS									
AREA (ACRES)	HSG	Tc (MIN.)	CN	Q 2 (CFS)	Q 5 (CFS)	Q 10 (CFS)	Q 25 (CFS)	Q 50 (CFS)	Q 100 (CFS)
10.4	B	53.8	71	6.1	10.7	14.1	18.8	23.1	28.1

Appendix 2.2

Hydraflow Hydrographs

Hydraflow Table of Contents

Watershed Model Schematic	1
Hydrograph Return Period Recap	2
2 - Year	
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5 - Year	
Summary Report	4
10 - Year	
Summary Report	5
25 - Year	
Summary Report	6
50 - Year	
Summary Report	7
100 - Year	
Summary Report	8

Hydraflow Table of Contents

100 - Year

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Hydrograph No. 2, SCS Runoff, East Basin Post to North	10

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066



Legend

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
1	SCS Runoff	Pre-proj to North
2	SCS Runoff	East Basin Post to North

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-----	3.386	6.127	0.040	10.68	14.14	18.81	23.12	28.09	Pre-proj to North
2	SCS Runoff	-----	3.242	5.073	0.210	7.903	9.976	12.71	15.17	17.98	East Basin Post to North

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	6.127	2	746	0.929	-----	-----	-----	Pre-proj to North
2	SCS Runoff	5.073	2	746	0.712	-----	-----	-----	East Basin Post to North
Behnke Model.gpw					Return Period: 2 Year			Friday, May 11, 2012	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	10.68	2	746	1.525	-----	-----	-----	Pre-proj to North
2	SCS Runoff	7.903	2	746	1.089	-----	-----	-----	East Basin Post to North
Behnke Model.gpw					Return Period: 5 Year			Friday, May 11, 2012	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	14.14	2	746	1.982	-----	-----	-----	Pre-proj to North
2	SCS Runoff	9.976	2	746	1.367	-----	-----	-----	East Basin Post to North
Behnke Model.gpw					Return Period: 10 Year			Friday, May 11, 2012	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	18.81	2	746	2.602	-----	-----	-----	Pre-proj to North
2	SCS Runoff	12.71	2	746	1.738	-----	-----	-----	East Basin Post to North
Behnke Model.gpw					Return Period: 25 Year			Friday, May 11, 2012	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	23.12	2	746	3.179	-----	-----	-----	Pre-proj to North
2	SCS Runoff	15.17	2	746	2.077	-----	-----	-----	East Basin Post to North
Behnke Model.gpw					Return Period: 50 Year			Friday, May 11, 2012	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	28.09	2	746	3.848	-----	-----	-----	Pre-proj to North
2	SCS Runoff	17.98	2	744	2.465	-----	-----	-----	East Basin Post to North
Behnke Model.gpw					Return Period: 100 Year			Friday, May 11, 2012	

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

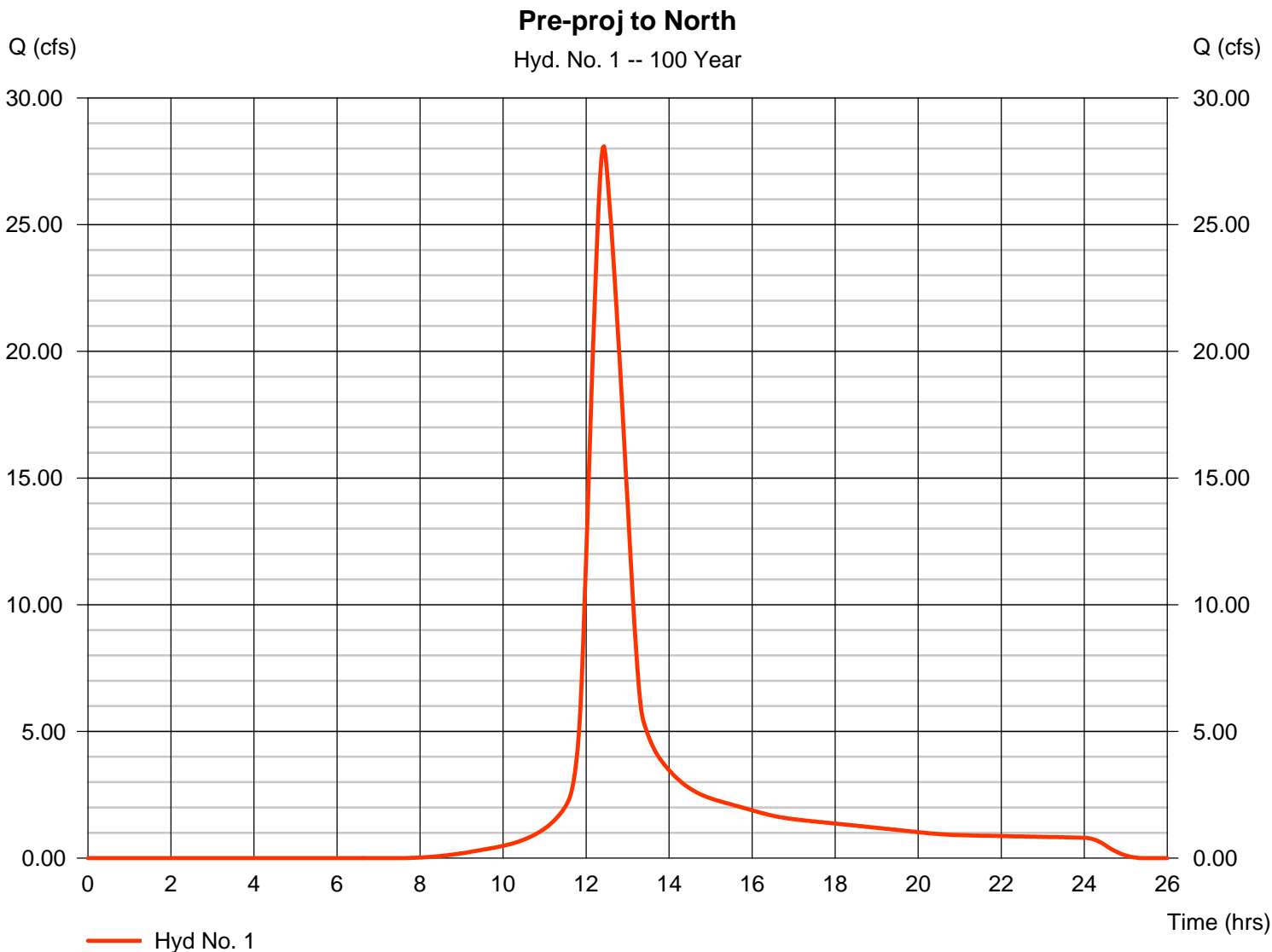
Friday, May 11, 2012

Hyd. No. 1

Pre-proj to North

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 2 min
 Drainage area = 10.400 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 28.09 cfs
 Time to peak = 12.43 hrs
 Hyd. volume = 3.848 acft
 Curve number = 71
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 53.80 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

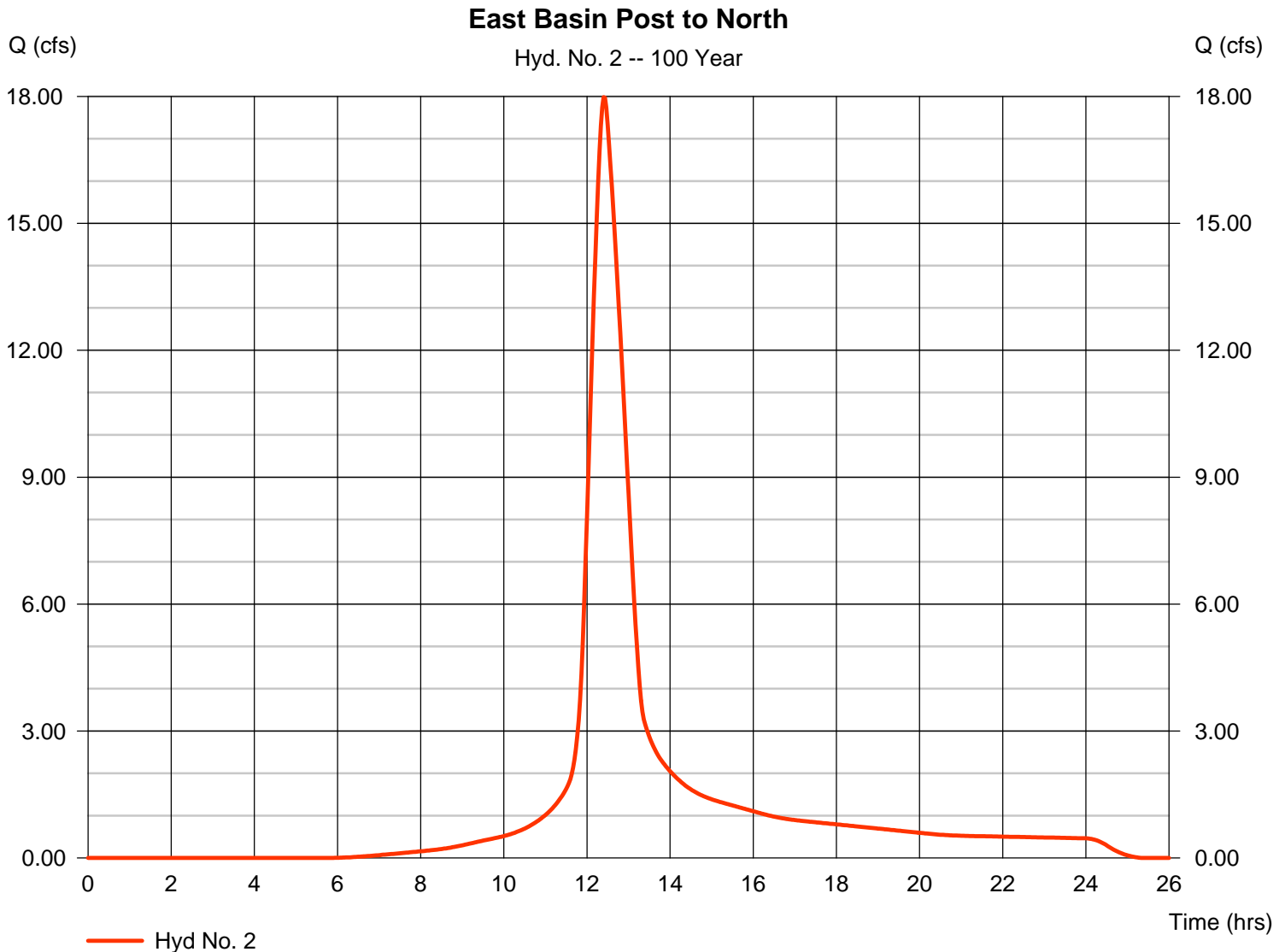
Friday, May 11, 2012

Hyd. No. 2

East Basin Post to North

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 2 min
 Drainage area = 5.613 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

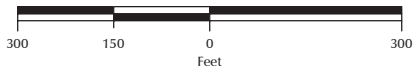
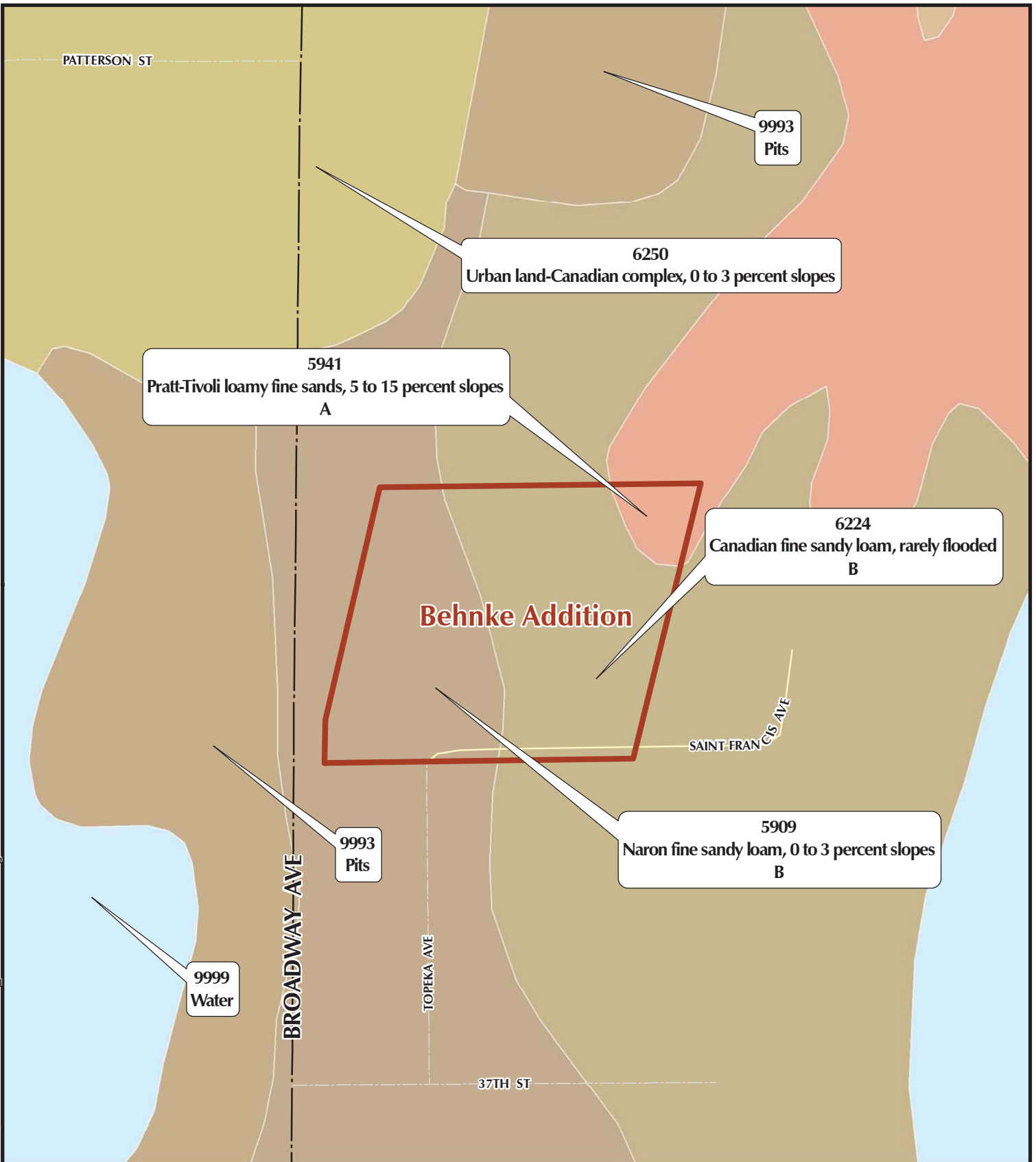
Peak discharge = 17.98 cfs
 Time to peak = 12.40 hrs
 Hyd. volume = 2.465 acft
 Curve number = 78.2
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 52.70 min
 Distribution = Type II
 Shape factor = 484



Appendix 2.3

Soil Survey

Path: J:\Civil\09081\Behnke_Add\Exhibits\Drng-NRCS-Soil-Behnke.mxd - Date: 5/10/2012



Behnke Addition

Project Name:

NRCS Soil Survey

Sheet Title:



JGD | **May 2012**

Drawn By: | Date:

KLA | **09081**

Design / Review: | Job No.:

Appendix 2.4

Curve Number Calculations

Behnke Addition

Land Use	Hydrologic Soil Group			
	A	B	C	D
Pre-Developed or Undisturbed Pervious	55	71	80	84
Developed or Disturbed Pervious	71	80	84	88
Impervious	98	98	98	98

HSG	B	
	Area	CN
Pre-project	10.4	71

Post Project	East Basin	
Undisturbed	2.42	71
Disturbed Pervious	2.55	80
Impervious	0.64	98
Total	5.61	78.2

Appendix 2.5

Time of Concentration Calculations

Project	Behnke Addition
Feature	Runoff from the site to the north
Analyst	Adam Koster
Version	
Notes	Retention basin in West watershed reduces the area draining offsite to the north from the site

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	Existing Behnke	2	20.0	33.7	0.0	0.0	0.0	0.0	53.8	620	1	0.16	0.19	32.3	0.538	10.4
2	Behnke East Basin	2	23.8	29.0	0.0	0.0	0.0	0.0	52.7	520	1	0.19	0.16	31.6	0.527	5.16
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

Subbasin Name	Existing Behnke
Drainage Area (ac)	10.4
Drainage Area (sq mi)	0.01625

Sheet Flow

selected->	Select (0 or 1)	1	0	0	0	0	Total
	Length (ft)	100	1	1	1	1	1 segments 100 feet length
	Top Elevation (ft)	1279	1	1	1	1	
	Bottom Elevation (ft)	1279	1	1	1	1	
	Cover	0.15, Short grass prairie	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
	Specify alternate "n"						
	Sheet Flow "n" (dim)	0.150	0.000	0.000	0.000	0.000	
	2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
	Drop (ft)	0	0	0	0	0	0 feet drop
	Slope (ft/ft)	0.0030	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	0.30	0.00	0.00	0.00	0.00	
	Velocity (fps)	0.08					
	Travel Time (hrs)	0.333					
	Travel Time (mins)	20.01					20.0 mins travel

Shallow Concentrated Flow

selected->	Select (0 or 1)	1	0	0	0	0	Total
	Length (ft)	520	1	1	1	1	1 segments 520 feet length
	Top Elevation (ft)	1278.7	1	1	1	1	
	Bottom Elevation (ft)	1278	1	1	1	1	
	Cover	7, Short grass pasture	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
	Specify alternate "K"						
	Surface Coeff (dim)	7.00	0.00	0.00	0.00	0.00	
	Drop (ft)	1	0	0	0	0	0.7 feet drop
	Slope (ft/ft)	0.0013	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	0.13	0.00	0.00	0.00	0.00	
	Velocity (fps)	0.26					
	Travel Time (mins)	33.74					33.7 mins travel

Open Channel Ditch Flow

	Select (0 or 1)	0	0	0	0	0	Total
	Length (ft)	100	1	1	1	1	0 segments 0 feet length
	Top Elevation (ft)	50	1	1	1	1	
	Bottom Elevation (ft)	47	1	1	1	1	
	Channel Lining	0.03, Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
	Bottom Width (ft)	25.00	0.00	1.00	1.00	1.00	
	Left Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
	Right Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
	Depth (ft)	3.00	1.00	1.00	1.00	1.00	
	Specify alternate "n"						
	Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
	Drop (ft)	3	0	0	0	0	0 feet drop
	Slope (ft/ft)	0.0300	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	3.00	0.00	0.00	0.00	0.00	
	Flow Area (sq ft)	102.00	1.00	2.00	2.00	2.00	
	Wet Perimeter (ft)	43.97	2.83	3.83	3.83	3.83	
	Hydraulic Radius (ft)	2.32	0.35	0.52	0.52	0.52	
	Velocity (fps)						
	Normal Flow (cfs)						
	Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

	Select (0 or 1)	0	0	0	0	0	Total
	Length (ft)	533	1	1	1	1	0 segments 0 feet length
	Top Elevation (ft)	1396	1	1	1	1	
	Bottom Elevation (ft)	1393	1	1	1	1	
	Pipe Material	0.017, Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
	Diameter (ins)	24.00	1.00	1.00	1.00	1.00	
	Flow Depth (ins)	24.00	1.00	1.00	1.00	1.00	
	Specify alternate "n"						
	Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
	Drop (ft)	3	0	0	0	0	0 feet drop
	Slope (ft/ft)	0.0056	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	0.56	0.00	0.00	0.00	0.00	
	Theta (radians)	6.283	6.283	6.283	6.283	6.283	
	Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
	Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
	Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
	Velocity (fps)						
	Normal Flow (cfs)						
	Travel Time (mins)						0.0 mins travel

Open Channel General Flow

	Select (0 or 1)	0	0	0	0	0	Total
	Length (ft)	150	1	1	1	1	0 segments 0 feet length
	Top Elevation (ft)	30	1	1	1	1	
	Bottom Elevation (ft)	26	1	1	1	1	
	Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
	Channel Lining	0.025, Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
	Specify alternate "n"						
	Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
	Drop (ft)	4	0	0	0	0	0 feet drop
	Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	2.67	0.00	0.00	0.00	0.00	
	Velocity (fps)						
	Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

	Select (0 or 1)	0	0	0	0	0	Total
	Length (ft)	500	1	1	1	1	0 segments 0 feet length
	Drop (ft)	10	1	1	1	1	0 feet drop
	Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
	Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
	Slope (%)	2.00	100.00	100.00	100.00	100.00	
	Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	2
Length (ft)	620
Drop (ft)	1
Slope (ft/ft)	0.0016

Subbasin Name	Behnke East Basin
Drainage Area (ac)	5.16
Drainage Area (sq mi)	0.0080625

Sheet Flow

selected->	Select (0 or 1)	1	0	0	0	0	Total
	Length (ft)	100	1	1	1	1	1 segments 100 feet length
	Top Elevation (ft)	1279	1	1	1	1	
	Bottom Elevation (ft)	1279	1	1	1	1	
	Cover	0.24, Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
	Specify alternate "n"						
	Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
	2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
	Drop (ft)	1	0	0	0	0	1 feet drop
	Slope (ft/ft)	0.0050	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	0.50	0.00	0.00	0.00	0.00	
	Velocity (fps)	0.07					
	Travel Time (hrs)	0.396					
	Travel Time (mins)	23.76					23.8 mins travel

Shallow Concentrated Flow

selected->	Select (0 or 1)	1	0	0	0	0	Total
	Length (ft)	420	1	1	1	1	1 segments 420 feet length
	Top Elevation (ft)	1278.5	1	1	1	1	
	Bottom Elevation (ft)	1278	1	1	1	1	
	Cover	7, Short grass pasture	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
	Specify alternate "K"						
	Surface Coeff (dim)	7.00	0.00	0.00	0.00	0.00	
	Drop (ft)	1	0	0	0	0	0.5 feet drop
	Slope (ft/ft)	0.0012	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	0.12	0.00	0.00	0.00	0.00	
	Velocity (fps)	0.24					
	Travel Time (mins)	28.98					29.0 mins travel

Open Channel Ditch Flow

	Select (0 or 1)	0	0	0	0	0	Total
	Length (ft)	100	1	1	1	1	0 segments 0 feet length
	Top Elevation (ft)	50	1	1	1	1	
	Bottom Elevation (ft)	47	1	1	1	1	
	Channel Lining	0.03, Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
	Bottom Width (ft)	25.00	0.00	1.00	1.00	1.00	
	Left Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
	Right Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
	Depth (ft)	3.00	1.00	1.00	1.00	1.00	
	Specify alternate "n"						
	Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
	Drop (ft)	3	0	0	0	0	0 feet drop
	Slope (ft/ft)	0.0300	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	3.00	0.00	0.00	0.00	0.00	
	Flow Area (sq ft)	102.00	1.00	2.00	2.00	2.00	
	Wet Perimeter (ft)	43.97	2.83	3.83	3.83	3.83	
	Hydraulic Radius (ft)	2.32	0.35	0.52	0.52	0.52	
	Velocity (fps)						
	Normal Flow (cfs)						
	Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

	Select (0 or 1)	0	0	0	0	0	Total
	Length (ft)	100	1	1	1	1	0 segments 0 feet length
	Top Elevation (ft)	20	1	1	1	1	
	Bottom Elevation (ft)	18	1	1	1	1	
	Pipe Material	0.017, Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
	Diameter (ins)	24.00	1.00	1.00	1.00	1.00	
	Flow Depth (ins)	24.00	1.00	1.00	1.00	1.00	
	Specify alternate "n"						
	Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
	Drop (ft)	2	0	0	0	0	0 feet drop
	Slope (ft/ft)	0.0200	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	2.00	0.00	0.00	0.00	0.00	
	Theta (radians)	6.283	6.283	6.283	6.283	6.283	
	Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
	Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
	Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
	Velocity (fps)						
	Normal Flow (cfs)						
	Travel Time (mins)						0.0 mins travel

Open Channel General Flow

	Select (0 or 1)	0	0	0	0	0	Total
	Length (ft)	150	1	1	1	1	0 segments 0 feet length
	Top Elevation (ft)	30	1	1	1	1	
	Bottom Elevation (ft)	26	1	1	1	1	
	Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
	Channel Lining	0.025, Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
	Specify alternate "n"						
	Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
	Drop (ft)	4	0	0	0	0	0 feet drop
	Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	2.67	0.00	0.00	0.00	0.00	
	Velocity (fps)						
	Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

	Select (0 or 1)	0	0	0	0	0	Total
	Length (ft)	500	1	1	1	1	0 segments 0 feet length
	Drop (ft)	10	1	1	1	1	0 feet drop
	Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
	Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
	Slope (%)	2.00	100.00	100.00	100.00	100.00	
	Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	2
Length (ft)	520
Drop (ft)	1
Slope (ft/ft)	0.0019

Tab 3. Proposed Conditions

Datum

The site is shown in NAVD 88 datum.

Drainage Patterns

Runoff from the front half of lots 1 and 2 as well as the street dedication located at the southwest corner of the site and Reserve "A" will be routed into a proposed dry retention pond. The pond will have a volume that is able to capture and store the 24-hr, 100-year runoff volume from the south half of the Broadway Bridge at 34th Street south project and a portion of Behnke Addition. The Drainage Map from the Broadway Bridge plans is included in Appendix 3.1. Runoff volume calculations for the area draining to the proposed retention pond are located in Appendix 3.2. Portions of Behnke Addition that are not able to drain to the proposed retention pond will continue to follow existing drainage patterns to the north into Go Lake. The proposed conditions are shown on the Drainage and Utility Plan is included in Appendix 3.3.

Groundwater Elevations

Go Lake just north of the site is a ground water lake. LiDAR indicates that the water surface elevation of Go Lake is approximately 1266. This would indicate that the groundwater elevation is 12 feet below the lowest elevation on the site.

Utilities

Water

A proposed waterline will be extended around Topeka Circle to serve lots 1 and 2. A water line will also be extended across 35th Street South to serve lot 3. Fire hydrants will be placed at the end of each of the proposed water lines. Proposed utilities are shown on the Drainage and Utility Plan, Appendix 3.3.

Sanitary Sewer

Sanitary Sewer is not readily available near the site. The lots will either need to implement individual septic systems or a lift station will need to be constructed to pump sewage to the nearest manhole to the north.

Stormwater

Proposed stormwater sewer will be extended onsite from Topeka Street. The SWS will route runoff from the south half of the Broadway Bridge at 34th Street South project into the proposed retention basin within Reserve "A".

Hydrologic Analysis

Runoff from the front half of Lots 1 and 2 as well as the street dedication located at the southwest corner of the site and Reserve "A" will be routed into a proposed dry retention pond. The pond is designed to contain the 24-hr, 100-year storm volume from the south half of the Broadway Bridge at 34th Street project as well as a portion of the Behnke Addition. The over detention of the retention pond will allow the remainder of the lots to drain offsite to the north undetained without increasing the flowrate exiting the site. By capturing the 24-hr, 100-year storm event, the retention pond provides an increased amount of water quality and channel protection detention than required.

Table 2.1. Rainfall Depths for 24-Hour Design Storms

Location	Design Storm Rainfall Depth (in)							
	1-Yr	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
Sedgwick County	2.8	3.5	4.5	5.2	6.1	6.9	7.8	9.4

Soil Type

- Naron fine sandy loam, 0 to 3 percent slopes, HSG “B”
- Canadian fine sandy loam, rarely flooded, HSG “B”
- Pratt-Tivoli loamy fine sands, 5 to 15 percent slopes, HSG “A”

The HSG used to select curve numbers is HSG “B.” The site is shown on the soil survey, Appendix 2.3.

Land Use, Impervious Area, and Curve Number

The property will develop as 3 single family residential lots of various sizes. Lot 1 is 1.03 acres, Lot 2 is 0.56 acres, and Lot 3 is 3.98 acres in size. The proposed plat also includes a 2.95 acre reserve that will be utilized to construct a retention pond; and 1.88 acres that have been dedicated for the construction of the Broadway Bridge, Topeka Circle, and 35th Street South. The curve number was calculated to be 78.2, Appendix 2.4.

Time of Concentration

The time of concentration was calculated to be approximately 53 minutes for the remaining area that will continue to drain to the north. The time of concentration was calculated using the method shown in Volume 2, Section 4.4, of the Wichita/Sedgwick County Stormwater Manual.

Basin Summary

The site was modeled as 1-10.4 acre basin under pre-project conditions and two basins under post-project conditions. Runoff from the West basin will be routed into the proposed retention pond located within Reserve “A”. This runoff will be held until it either evaporates or percolates into the ground. The runoff will not leave the site.

Much of the East Basin will remain extremely flat. The East Basin will continue to drain offsite to the north. The overall area draining offsite to the north has been reduced by 4.8 acres to approximately 5.6 acres by routing the West Basin into the retention area. The East Basin will consist of Lot 3 and the backyards of Lots 1 and 2. The area will be largely pervious; approximately 2.4 acres of Lot 3 will remain undisturbed.

Table 3.1 Discharge offsite from Behnke Addition

Location	Post-Project Runoff From Site (cfs)					
	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
West Basin	0.0	0.0	0.0	0.0	0.0	0.0
East Basin	5.1	7.9	10.0	12.7	15.2	18.0

Drainage Feature Summary

The proposed retention pond located within Reserve “A” is designed to hold the entire volume of the 24-hr, 100-year storm from the south half of the Broadway Bridge at 34th Street project. This

includes the area between Topeka Avenue and Broadway to the south of 35th Street North and a portion of Behnke Addition.

Downstream Peak Discharge Assessment (10% Rule)

The site has not been assessed for the (10% Rule).

Stormwater Quality Management

The water quality volume required for the Behnke Addition was calculated to be 0.19 acre-feet, Appendix 3.4. This volume is provided for in the proposed retention pond.

Channel Protection Volume

The channel protection volume is also provided by the retention pond in Reserve "A". The pond will not release water during the 24-hr, 100-year Storm. Therefore it is providing more storage than required for the 2.8" Channel Protection Design Storm.

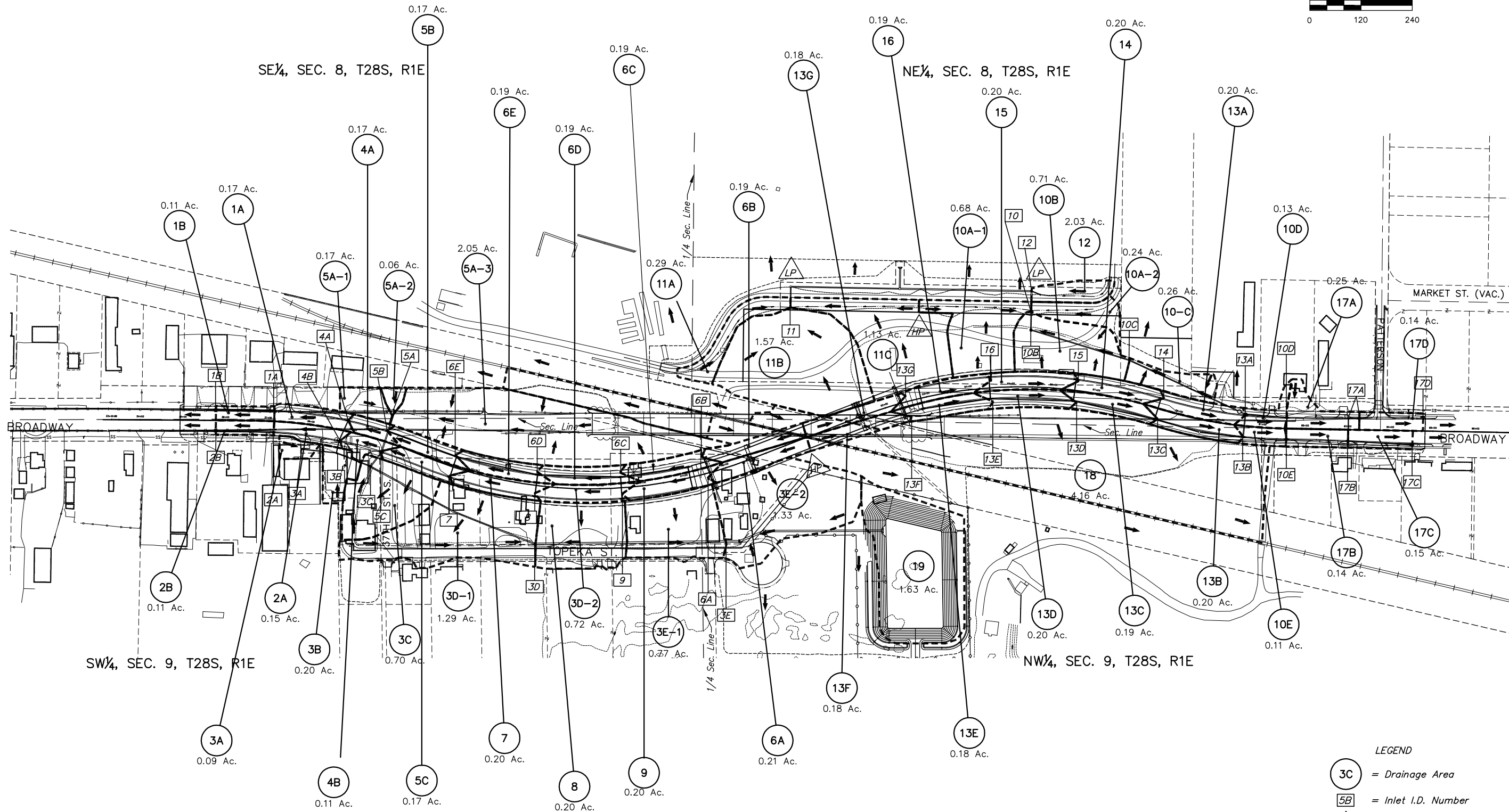
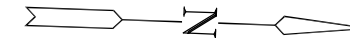
Appendix 3.1

Broadway Bridge Drainage Map

STATE	PROJECT NO.	YEAR	SHEET NO.	TOTAL SHEETS
KANSAS	87 N-0519-01	2012	51	93

MKEC
ENGINEERING
CONSULTANTS, INC.

411 N. WEBB ROAD
WICHITA, KS. 67206
316-684-9600



BROADWAY BRIDGE AT 34TH STREET SOUTH

DRAINAGE MAP

SHEET TITLE
472-84830
PROJECT NUMBER

DESIGN BY: JRA
DRAWN BY: WNU
CHECKED BY: JRA

ISSUED: 03-21-2012
REVISED:

SHEET NO.
51 of 93

- LEGEND**
- 3C = Drainage Area
 - SB = Inlet I.D. Number
 - △ LP = High Point/Low Point
 - = Drainage Basin Boundary
 - = Storm Sewer Pipe
 - = Storm Sewer Inlet
 - = Direction of Flow

PLOTED: Friday, May 11, 2012 @ 03:37PM

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Appendix 3.2

Runoff Volume Calculations for Area Routed to Dry Pond

From

Est. Rational "C" : Pavement = 0.90
 Residential = 0.70
 Precip = 5

Wshed	Condition	Area	C value	AxC		
3A	R	0.09	0.7	0.063	0.09	
3B	R	0.2	0.7	0.14	0.2	
3C	R	0.7	0.7	0.49	0.7	
3D-1	R	1.29	0.7	0.903	1.29	
3D-2	P	0.72	0.9	0.648	0.72	
3E-1	R	0.77	0.7	0.539	0.77	
3E-2	R	1.33	0.7	0.931	1.33	
4A	P	0.17	0.9	0.153	0.17	
4B	P	0.11	0.9	0.099	0.11	
5A-1	R	0.17	0.7	0.119	0.17	
5A-2	R	0.06	0.7	0.042	0.06	
5A-3	R	2.05	0.7	1.435	2.05	
5B	P	0.17	0.9	0.153	0.17	
5C	P	0.17	0.9	0.153	0.17	
6A	P	0.21	0.9	0.189	0.21	
6B	P	0.19	0.9	0.171	0.19	
6C	P	0.19	0.9	0.171	0.19	
6D	P	0.19	0.9	0.171	0.19	
6E	P	0.19	0.9	0.171	0.19	
7	P	0.2	0.9	0.18	0.2	
8	R	0.2	0.7	0.14	0.2	
9	P	0.2	0.9	0.18	0.2	
19	w	1.63	1	1.63	1.63	
$\Sigma =$		11.2	$\Sigma =$	8.871	6.86	4.34
				Composite	0.6125	0.3875
				0.792054		

1

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * C$; $d_{100} =$ 3.5
 $V =$ 2.587375

Calculate WQV using the 100-year P

Manual Eq. 4-25

WQV = 2.34675

Assuming 15min T_c , $I_{100} =$ 7.37

100-year Peak Q = 65.37927

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * .95$; $d_{500} =$ 11
 $V =$ 9.753333

Behnke Addition Pond

	depth	Area	Volume	Cum Vol
1271	0	29089.81	0	0
1274	3	38098.49	2.306683	2.306683
1277	6	47918.75	2.955571	5.262253

depth		area		Volume
3.32		39107.41		2.59033

From

Est. Rational "C" : Pavement = 0.90
 Residential = 0.70
 Precip = 5

Wshed	Condition	Area	C value	AxC		
3A	R	0.09	0.7	0.063	0.09	
3B	R	0.2	0.7	0.14	0.2	
3C	R	0.7	0.7	0.49	0.7	
3D-1	R	1.29	0.7	0.903	1.29	
3D-2	P	0.72	0.9	0.648	0.72	
3E-1	R	0.77	0.7	0.539	0.77	
3E-2	R	1.33	0.7	0.931	1.33	
4A	P	0.17	0.9	0.153	0.17	
4B	P	0.11	0.9	0.099	0.11	
5A-1	R	0.17	0.7	0.119	0.17	
5A-2	R	0.06	0.7	0.042	0.06	
5A-3	R	2.05	0.7	1.435	2.05	
5B	P	0.17	0.9	0.153	0.17	
5C	P	0.17	0.9	0.153	0.17	
6A	P	0.21	0.9	0.189	0.21	
6B	P	0.19	0.9	0.171	0.19	
6C	P	0.19	0.9	0.171	0.19	
6D	P	0.19	0.9	0.171	0.19	
6E	P	0.19	0.9	0.171	0.19	
7	P	0.2	0.9	0.18	0.2	
8	R	0.2	0.7	0.14	0.2	
9	P	0.2	0.9	0.18	0.2	
19	w	1.63	1	1.63	1.63	
$\Sigma =$		11.2	$\Sigma =$	8.871	6.86	4.34
				Composite	0.6125	0.3875
				0.792054		

1

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * C$; $d_{100} =$ 4.5
 $V =$ 3.326625

Calculate WQV using the 100-year P

Manual Eq. 4-25

WQV = 2.34675

Assuming 15min T_c , $I_{100} =$ 7.37

100-year Peak Q = 65.37927

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * .95$; $d_{500} =$ 11
 $V =$ 9.753333

Behnke Addition Pond

	depth	Area	Volume	Cum Vol
1271	0	29089.81	0	0
1274	3	38098.49	2.306683	2.306683
1277	6	47918.75	2.955571	5.262253

depth		area		Volume
4.12		41669.854		3.333162

From

Est. Rational "C" : Pavement = 0.90
 Residential = 0.70
 Precip = 5

Wshed	Condition	Area	C value	AxC		
3A	R	0.09	0.7	0.063	0.09	
3B	R	0.2	0.7	0.14	0.2	
3C	R	0.7	0.7	0.49	0.7	
3D-1	R	1.29	0.7	0.903	1.29	
3D-2	P	0.72	0.9	0.648	0.72	
3E-1	R	0.77	0.7	0.539	0.77	
3E-2	R	1.33	0.7	0.931	1.33	
4A	P	0.17	0.9	0.153	0.17	
4B	P	0.11	0.9	0.099	0.11	
5A-1	R	0.17	0.7	0.119	0.17	
5A-2	R	0.06	0.7	0.042	0.06	
5A-3	R	2.05	0.7	1.435	2.05	
5B	P	0.17	0.9	0.153	0.17	
5C	P	0.17	0.9	0.153	0.17	
6A	P	0.21	0.9	0.189	0.21	
6B	P	0.19	0.9	0.171	0.19	
6C	P	0.19	0.9	0.171	0.19	
6D	P	0.19	0.9	0.171	0.19	
6E	P	0.19	0.9	0.171	0.19	
7	P	0.2	0.9	0.18	0.2	
8	R	0.2	0.7	0.14	0.2	
9	P	0.2	0.9	0.18	0.2	
19	w	1.63	1	1.63	1.63	
$\Sigma =$		11.2	$\Sigma =$	8.871	6.86	4.34
				Composite	0.6125	0.3875
				0.792054		

1

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * C;$ $d_{100} =$ 5.2
 $V =$ 3.8441

Calculate WQV using the 100-year P

Manual Eq. 4-25

WQV = 2.34675

Assuming 15min Tc, $I_{100} =$ 7.37

100-year Peak Q = 65.37927

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * .95;$ $d_{500} =$ 11
 $V =$ 9.753333

Behnke Addition Pond

	depth	Area	Volume	Cum Vol
1271	0	29089.81	0	0
1274	3	38098.49	2.306683	2.306683
1277	6	47918.75	2.955571	5.262253

depth		area		Volume
4.64		43366.391		3.840714

From

Est. Rational "C" : Pavement = 0.90
 Residential = 0.70
 Precip = 5

Wshed	Condition	Area	C value	AxC		
3A	R	0.09	0.7	0.063	0.09	
3B	R	0.2	0.7	0.14	0.2	
3C	R	0.7	0.7	0.49	0.7	
3D-1	R	1.29	0.7	0.903	1.29	
3D-2	P	0.72	0.9	0.648	0.72	
3E-1	R	0.77	0.7	0.539	0.77	
3E-2	R	1.33	0.7	0.931	1.33	
4A	P	0.17	0.9	0.153	0.17	
4B	P	0.11	0.9	0.099	0.11	
5A-1	R	0.17	0.7	0.119	0.17	
5A-2	R	0.06	0.7	0.042	0.06	
5A-3	R	2.05	0.7	1.435	2.05	
5B	P	0.17	0.9	0.153	0.17	
5C	P	0.17	0.9	0.153	0.17	
6A	P	0.21	0.9	0.189	0.21	
6B	P	0.19	0.9	0.171	0.19	
6C	P	0.19	0.9	0.171	0.19	
6D	P	0.19	0.9	0.171	0.19	
6E	P	0.19	0.9	0.171	0.19	
7	P	0.2	0.9	0.18	0.2	
8	R	0.2	0.7	0.14	0.2	
9	P	0.2	0.9	0.18	0.2	
19	w	1.63	1	1.63	1.63	
$\Sigma =$		11.2	$\Sigma =$	8.871	6.86	4.34
				Composite	0.6125	0.3875
				0.792054		

1

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * C;$ $d_{100} =$ 6.1
 $V =$ 4.509425

Calculate WQV using the 100-year P

Manual Eq. 4-25

WQV = 2.34675

Assuming 15min Tc, $I_{100} =$ 7.37

100-year Peak Q = 65.37927

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * .95;$ $d_{500} =$ 11
 $V =$ 9.753333

Behnke Addition Pond

	depth	Area	Volume	Cum Vol
1271	0	29089.81	0	0
1274	3	38098.49	2.306683	2.306683
1277	6	47918.75	2.955571	5.262253

depth		area		Volume
5.3		45554.802		4.51295

From

Est. Rational "C" : Pavement = 0.90
 Residential = 0.70
 Precip = 5

Wshed	Condition	Area	C value	AxC		
3A	R	0.09	0.7	0.063	0.09	
3B	R	0.2	0.7	0.14	0.2	
3C	R	0.7	0.7	0.49	0.7	
3D-1	R	1.29	0.7	0.903	1.29	
3D-2	P	0.72	0.9	0.648	0.72	
3E-1	R	0.77	0.7	0.539	0.77	
3E-2	R	1.33	0.7	0.931	1.33	
4A	P	0.17	0.9	0.153	0.17	
4B	P	0.11	0.9	0.099	0.11	
5A-1	R	0.17	0.7	0.119	0.17	
5A-2	R	0.06	0.7	0.042	0.06	
5A-3	R	2.05	0.7	1.435	2.05	
5B	P	0.17	0.9	0.153	0.17	
5C	P	0.17	0.9	0.153	0.17	
6A	P	0.21	0.9	0.189	0.21	
6B	P	0.19	0.9	0.171	0.19	
6C	P	0.19	0.9	0.171	0.19	
6D	P	0.19	0.9	0.171	0.19	
6E	P	0.19	0.9	0.171	0.19	
7	P	0.2	0.9	0.18	0.2	
8	R	0.2	0.7	0.14	0.2	
9	P	0.2	0.9	0.18	0.2	
19	w	1.63	1	1.63	1.63	
$\Sigma =$		11.2	$\Sigma =$	8.871	6.86	4.34
				Composite	0.6125	0.3875
					0.792054	

1

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * C$; $d_{100} =$ 6.9
 $V =$ 5.100825

Calculate WQV using the 100-year P

Manual Eq. 4-25

WQV = 2.34675

Assuming 15min T_c , $I_{100} =$ 7.37

100-year Peak Q = 65.37927

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * .95$; $d_{500} =$ 11
 $V =$ 9.753333

Behnke Addition Pond

	depth	Area	Volume	Cum Vol
1271	0	29089.81	0	0
1274	3	38098.49	2.306683	2.306683
1277	6	47918.75	2.955571	5.262253

depth		area		Volume
5.85		47408.484		5.097105

From

Est. Rational "C" : Pavement = 0.90
 Residential = 0.70
 Precip = 5

Wshed	Condition	Area	C value	AxC		
3A	R	0.09	0.7	0.063	0.09	
3B	R	0.2	0.7	0.14	0.2	
3C	R	0.7	0.7	0.49	0.7	
3D-1	R	1.29	0.7	0.903	1.29	
3D-2	P	0.72	0.9	0.648	0.72	
3E-1	R	0.77	0.7	0.539	0.77	
3E-2	R	1.33	0.7	0.931	1.33	
4A	P	0.17	0.9	0.153	0.17	
4B	P	0.11	0.9	0.099	0.11	
5A-1	R	0.17	0.7	0.119	0.17	
5A-2	R	0.06	0.7	0.042	0.06	
5A-3	R	2.05	0.7	1.435	2.05	
5B	P	0.17	0.9	0.153	0.17	
5C	P	0.17	0.9	0.153	0.17	
6A	P	0.21	0.9	0.189	0.21	
6B	P	0.19	0.9	0.171	0.19	
6C	P	0.19	0.9	0.171	0.19	
6D	P	0.19	0.9	0.171	0.19	
6E	P	0.19	0.9	0.171	0.19	
7	P	0.2	0.9	0.18	0.2	
8	R	0.2	0.7	0.14	0.2	
9	P	0.2	0.9	0.18	0.2	
19	w	1.63	1	1.63	1.63	
$\Sigma =$		11.2	$\Sigma =$	8.871	6.86	4.34
				Composite	0.6125	0.3875
					0.792054	

1

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * C;$ $d_{100} =$ 7.8
 $V =$ 5.76615

Calculate WQV using the 100-year P

Manual Eq. 4-25

WQV = 2.34675

Assuming 15min $T_c,$ $I_{100} =$ 7.37

100-year Peak Q = 65.37927

Estimate Total Runoff Volume

$V = d/12 * \text{Area} * .95;$ $d_{500} =$ 11
 $V =$ 9.753333

Behnke Addition Pond

	depth	Area	Volume	Cum Vol
1271	0	29089.81	0	0
1274	3	38098.49	2.306683	2.306683
1277	6	47918.75	2.955571	5.262253

depth		area		Volume
6.46		49496.29		5.77046

Appendix 3.3

Drainage and Utility Plan

PRELIMINARY
NOT FOR
CONSTRUCTION

BEHNKE ADDITION

DRAINAGE & UTILITY PLAN

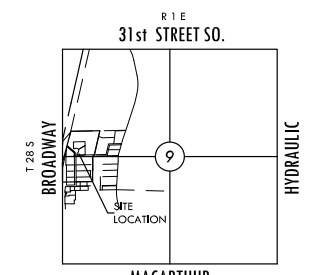
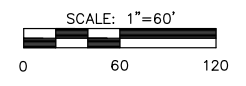
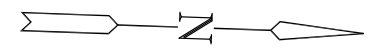
SHEET TITLE
09081
PROJECT NUMBER

AJK / DM / JRA
DESIGNED DRAWN CHECKED

ISSUED
May 2012

REVISED

SHEET NO.
1 of 1



MACARTHUR
VICINITY MAP

LEGEND

- ✖ - CONIFEROUS TREE
- - DECIDUOUS TREE
- SN - SIGN
- PP - POWER POLE
- ELEC BOX - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SC - SECTION CORNER
- BM - BENCHMARK
- - - - - EASEMENT
- - - - - BUILDING SETBACK
- x - x - FENCE
- - - - - STORM SEWER PIPE
- - - - - WATER LINE
- - - - - SANITARY SEWER LINE
- - - - - GAS LINE
- - - - - GAS PIPELINE
- - - - - TELEPHONE LINE
- - - - - UNDERGROUND ELEC.
- - - - - OVERHEAD ELECTRIC
- - - - - FIBER OPTIC CABLE
- - - - - DRAINAGE SUB BASIN
- - - - - DRAINAGE BASIN
- - FLOW ARROW
- A17 - AREA FOR SWS SIZING
- WTR - PROPOSED WTR.

POND ELEVATION

2 YEAR=	1274.32
5 YEAR=	1275.12
10 YEAR=	1275.64
25 YEAR=	1276.30
50 YEAR=	1276.85
100 YEAR=	1277.46

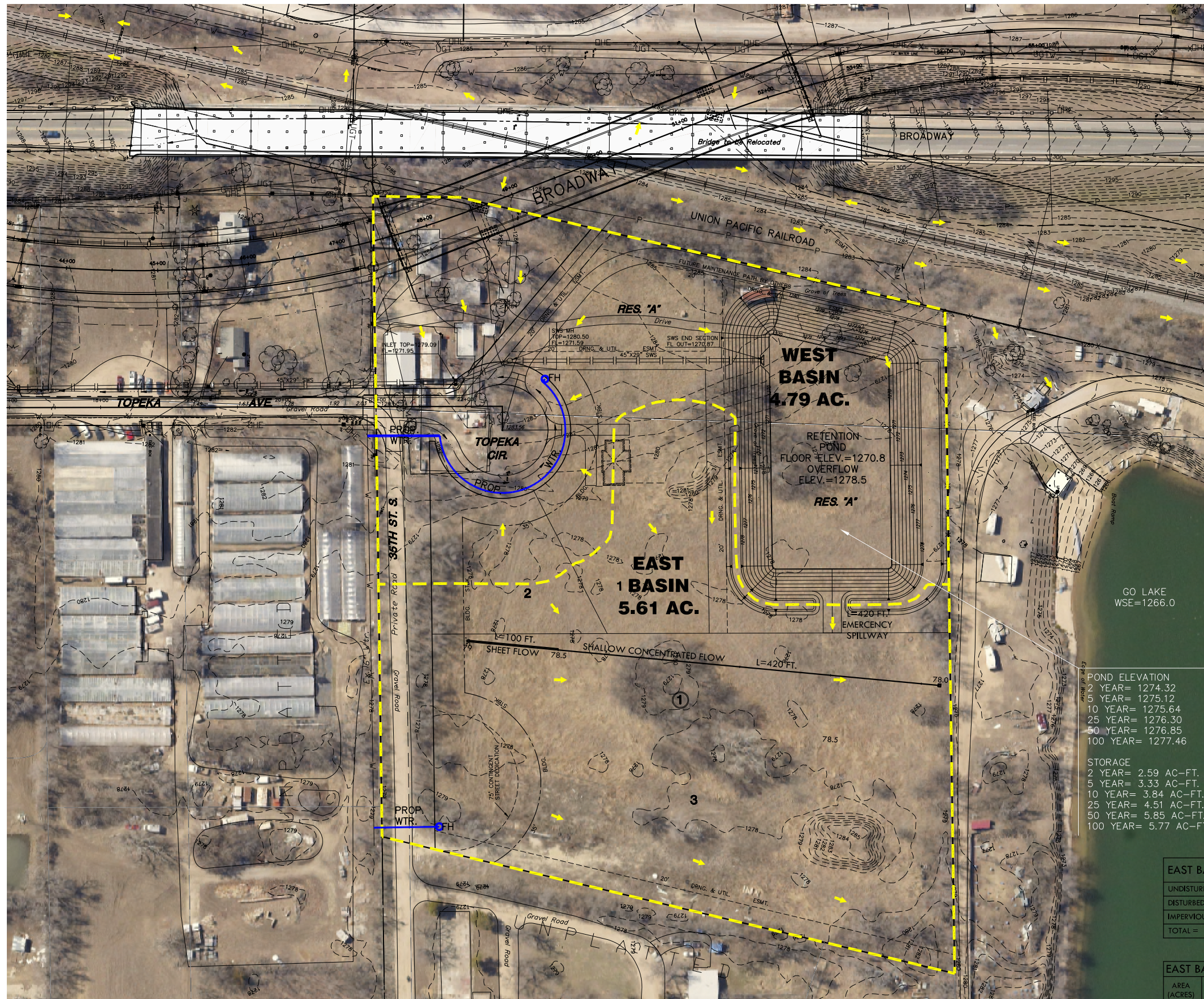
STORAGE

2 YEAR=	2.59 AC-FT.
5 YEAR=	3.33 AC-FT.
10 YEAR=	3.84 AC-FT.
25 YEAR=	4.51 AC-FT.
50 YEAR=	5.85 AC-FT.
100 YEAR=	5.77 AC-FT.

NOTE:
NEAREST SANITARY SEWER
MANHOLE IS LOCATED OVER
1000' FROM SITE. EACH LOT
WILL DISPOSE OF THEIR SEWER
THROUGH AN INDEPENDENT
LATERAL FIELD.

EAST BASIN		
AREA (ACRES)	AREA (ACRES)	CN
UNDISTURBED PERVIOUS =	2.42	71
DISTURBED PERVIOUS =	2.55	80
IMPERVIOUS =	0.64	98
TOTAL =	5.61	78.2

EAST BASIN									
AREA (ACRES)	HGS	Tc (MIN.)	CN	Q ₂ (CFS)	Q ₅ (CFS)	Q ₁₀ (CFS)	Q ₂₅ (CFS)	Q ₅₀ (CFS)	Q ₁₀₀ (CFS)
5.61	B	52.7	78.2	5.1	7.9	10.0	12.7	15.2	18.0



Appendix 3.4

Water Quality Calculations

Behnke Addition

Area impervious	0.37	ac
Area disturbed pervious	7.61	ac
Area undisturbed	2.42	ac
Total Area	10.4	ac
HSG	B	
$R_v =$	0.19	
$WQ_v =$	0.19	ac - ft
$Q_{wv} =$	0.22	in

HSG = Hydrologic Soil Group
 $WQ_v =$ water quality protection volume (acre-feet)
 $P =$ rainfall depth (in)
 $R_v =$ volumetric runoff coefficient
 $Q_{wv} =$ water quality protection volume (inches)

Behnke Addition

P =	2.80 in
R _v =	0.19
A =	10.40 ac
FP =	1.00
Q _{wv} =	0.52 in
CN =	78.50
S =	2.74
I _a =	0.55 in
I _a /P =	0.20
q _u =	350 cfs/mi ² /in
Q _{wq} =	2.98 cfs
Q =	1.02 in
Q _p =	5.78 cfs
q _o /q _i =	0.05
V _s /V _r =	0.61
V _s = CP _v =	0.54 ac-ft

P = Rainfall Depth (in)
 R_v = volumetric runoff coefficient
 A = Area (acres)
 FP = Pond and Swamp Adjustment Factors
 Q_{wv} = water quality protection volume (inches)
 CN = Curve Number
 S = pg 4-4
 I_a = pg 4-4
 q_u = Unit peak discharge
 Q_{wq} = water quality peak flow (cfs)
 Q = Excess Rainfall Depth (in)
 Q_p = Peak Discharge (cfs)
 q_o/q_i = Ratio of Outflow to Inflow
 V_s/V_r = Ration of Storage Volume to Runoff Volume

Tab 4. Floodplains

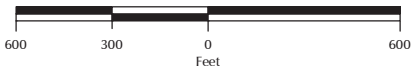
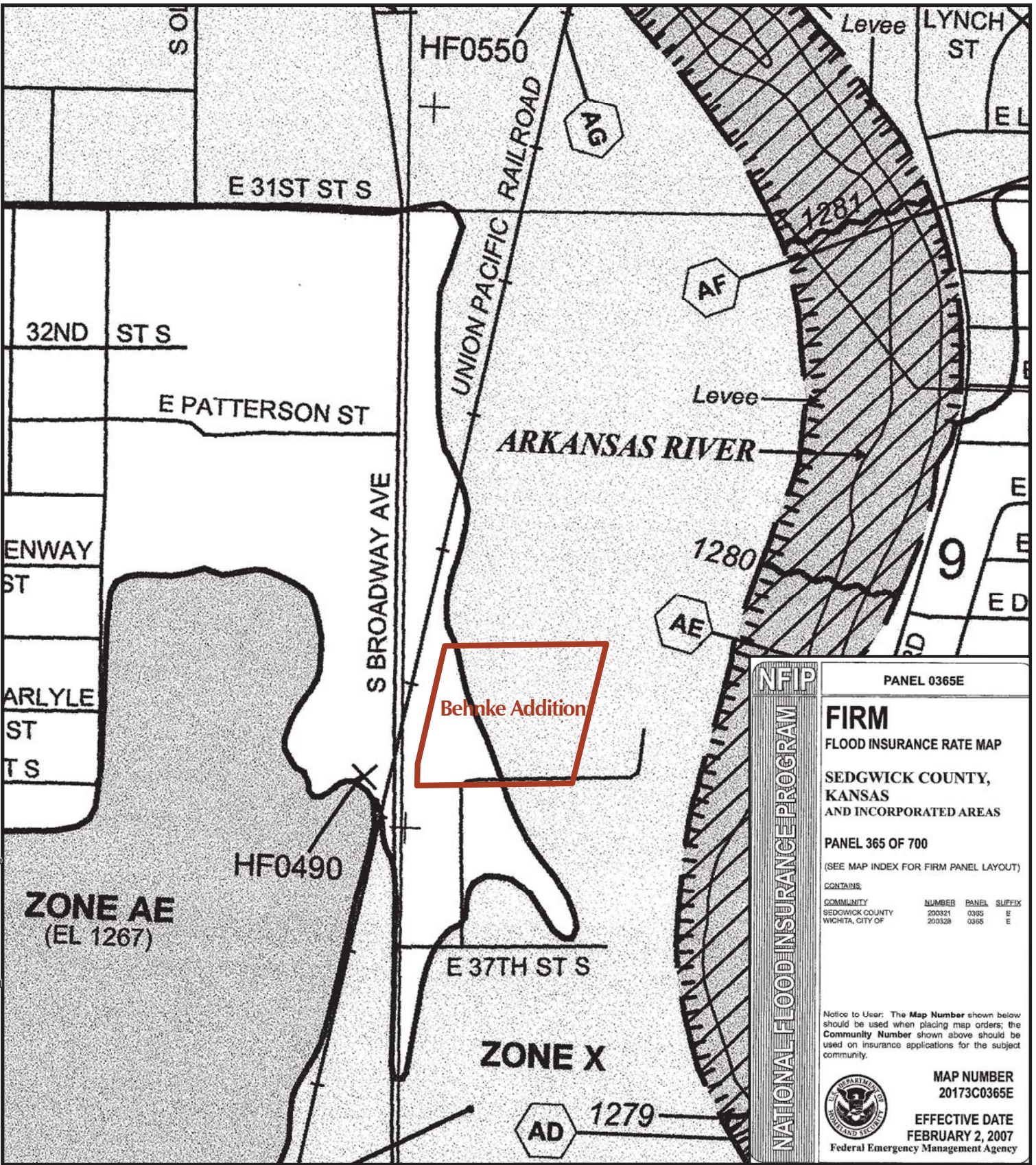
FEMA FIRM

Much of the site is in Zone X shaded, 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 according to FIRM panel 20173C0365E effective February 2, 2007, Appendix 4.1. The nearest 100-year floodplain is approximately 500 feet east of the site.

Appendix 4.1

Flood Insurance Rate Map (FIRM)

Path: J:\Civil\09081\Behnke_Add\Exhibits\Drng-FEMA-FIRM-Behnke.mxd - Date: 5/9/2012



Behnke Addition

Project Name:

FEMA FIRM

Sheet Title:



JGD | May 2012

Drawn By: | Date:

KLA | 09081

Design / Review: | Job No.:

Tab 5. Federal, State, and Local Permits

US Army Corps of Engineers

The site will not modify any jurisdictional streams or wetlands.

Kansas Department of Agriculture – Division of Water Resources

There are no proposed changes to a stream, floodplain, or pond with a drainage area of more than 160 acres.

FEMA

The site will not modify any FEMA floodplains.