



POE & ASSOCIATES, INC.

5940 E. Central, Suite 200
Wichita, Kansas 67208

CONSULTING ENGINEERS

(316) 685-4114
FAX: (316) 685-4444

TRANSMITTAL

DATE 2/12/14	JOB NO.: 102080
TO: Mr. Scott Lindebak City of Wichita Stormwater Department City Hall 455 N Main Wichita, KS 67202	
RE: 21 st and Amidon Addition	

WE ARE SENDING YOU Attached Under separate cover via U.S. Mail the following items:

- Shop drawings Prints Plans Ownership List Tract Maps
 Copy of letter Change order Drainage Study

NO.	DATE	COPIES	DESCRIPTION
	2-12-14	1	Drainage Study

THESE ARE TRANSMITTED as checked below

- For approval Approved as submitted For your use Approved as noted
 As requested Approved Not Approved
 Other

Comments: For your review and approval

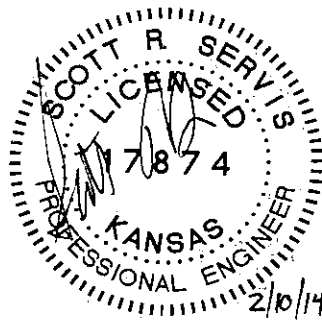
SIGNED: _____

Scott R. Servis, P.E.

POE & ASSOCIATES, INC.

21ST AND AMIDON ADDITION

DRAINAGE REPORT



POE & ASSOCIATES, INC.
CONSULTING ENGINEERS
5940 E. Central, Suite 200 • Wichita, KS 67208-4242
Phone 316/685-4114 • FAX 316/685-4444

FEBRUARY 2014



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: 21st and Amidon Addition	
Total Area of Project: 0.6 acres	
Development Type: Commercial	Other:
Developer Name:	Contact: Phone:
Email:	
Engineer Name: Poe and Associates, Inc.	Contact: Scott R. Servis, P.E. Phone: (316) 685-4114
Email: scott.servis@poeandassociates.com (5940 East Central, Suite #200, Wichita, KS 67208)	

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.

#	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 channel, channel, 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		
2.2.1	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
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).		
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.		

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
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 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.		
3.3.6	Downstream peak discharge assessment (10% Rule) results and supporting data and calculations. Provide digital copies of any computer files and models used.		
3.3.7	Stage-storage-discharge or other outlet rating curves and inflow/outflow hydrographs for all ponds.		
3.3.8	Demonstrate that the pond contours on the master grading plan and the stage-storage-discharge data are consistent for all ponds.		
3.3.9	Demonstrate that all ponds have one foot of freeboard above the 100-year, 24-hour high water level.		
3.3.10	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.		
3.3.11			
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.		
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)		

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
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			

1.0 General Information

1.1 Drainage Plan Files

See enclosed CD and paper copies of Drainage Plan (Exhibit 1-1), Preliminary Grading Plan (Exhibit 1-2), and One-Step Final Plat (Exhibit 1-3).

1.2 Professional Engineer's Seal

Final report includes sealed and signed cover sheet along with sealed and signed final drainage plan sheet.

1.3 Site Location Map

See Exhibit 1-4 for USGS Map and 1-5 for Aerial Photo of this area. The 21st and Amidon Addition is a 0.6-acre tract of land located in the Northeast Quarter of Section 7-T27S-R1E in the City of Wichita, Sedgwick County, Kansas. The area is currently unplatted. The site is bounded on the north by 21st Street, on the west by Amidon Avenue and on the east and south by Twin Lakes Addition.

1.4 Narrative of Development

The property is currently zoned to allow Limited Commercial use (refer to Exhibit 1-6 for Zoning information). It is anticipated that this site will be developed as a retail strip mall. The existing site is completely impervious and covered by either paved surfaces or existing buildings. An existing storm sewer system to carry runoff is not available in 21st Street or Amidon Avenue. Current plans for paving improvements to this intersection do not include proposed storm sewer to pick up site flows. Post-developed storm sewer flows will be routed to 21st Street and Amidon Avenue as surface flow. Said surface flow will be routed through a series of curb castings on the site before being slowly released to the adjoining street rights-of-way.

Presently, the site is occupied by an existing gas station. As shown in the Drainage Plan (Exhibit 1-1), the drainage consists of two primary areas. Run-off from the property traverses over land routes to the adjacent 21st Street and Amidon Avenue Rights-of-Way before discharging to the Arkansas River to the south and the Little Arkansas River to the east. Off-site runoff drains to existing curbs in Amidon Avenue and 21st Street and is routed around the site to the north and west. Off-site runoff to the south and east drains to existing curb and gutter and/or concrete flumes within adjoining parking lots and is routed to Amidon Avenue and 21st Street as surface flow. According to the NRCS Soil Survey, the predominant soil type within the property is Urban land-Canadian Complex series material. See Exhibit 1-8 for NRCS Soil Survey map and information showing existing soil types and descriptions.

The lies west and north of FEMA Floodways (refer to Exhibit 1-9 for FIRM Panel 355, Wichita, Sedgwick County, Kansas, February 2, 2007. No impact on storm water shall be

addressed in the summary of runoff calculations text. The site does not contain wetland or riparian areas, and thus the development has no impact in that regard.

1.5 Discussion of Off-Site Conditions

Limited commercial areas are located directly north, south, east and west of this site (See Exhibit 1-6). The original, modern land use for the site was a mixture of limited commercial and undeveloped uses.

Total developed on-site drainage area equals 0.50 acres. The site development would route off-site drainage around the site through a series of existing gutters Amidon Avenue and 21st Street North and gutters and flumes in commercial areas to the east and south. Land use within the drainage basin is commercial in character. The existing grades convey storm water away from the subject property. Storm water is presently conveyed off-site through the previously discussed storm water sewer systems and overland flow channels (See Exhibit 1-1).

1.6 Summary of Runoff Calculations

Onsite Area "A" Existing Conditions						Onsite Area "A" Proposed Conditions					
CN= 92.0		Tc(min)= 8.2		Area(Ac)= 0.28		CN= 92.0		Tc(min)= 1.7		Area(Ac)= 0.35	
1-Year	2-Year	5-Year	10-Year	25-Year	100-Year	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
0.88	1.16	1.53	1.8	2.17	2.71	1.31	1.71	2.25	2.65	3.17	3.96

Offsite Area "B" Existing Conditions						Onsite Area "B" Proposed Conditions					
CN= 92.0		Tc(min)= 7.6		Area(Ac)= 0.22		CN= 92.0		Tc(min)= 1.9		Area(Ac)= 0.05	
1-Year	2-Year	5-Year	10-Year	25-Year	100-Year	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
0.7	0.91	1.2	1.42	1.7	2.13	0.19	0.25	0.32	0.38	0.45	0.57

Onsite Area "C" Proposed Conditions					
CN= 92.0		Tc(min)= 1.4		Area(Ac)= 0.09	
1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
0.34	0.44	0.58	0.68	0.82	1.01

Using the SCS Method, calculations were made to determine the existing flows from this site. Both the existing and proposed site drainage consists of two areas as shown on the attached Drainage Plan, Exhibit 1-1. Off-site drainage is considered, and shall be routed around the north and west property line through a series of existing gutters and does not enter this study site. Each area is evaluated based on existing and proposed conditions.

Off-site time of concentration was not considered as offsite areas are contained by parking lot curbs or flumes and do not enter the site. On-site time of concentration was estimated for all separate drainage areas as shown in the summary table above. On-site detention is not required for this site, as the site is well under 1 acre in size. It is assumed that immediate downstream capacities are adequate to handle current flows leaving this site. Runoff will be routed to a series of curb castings and small diameter outlet pipes to meter the flow to 21st Street North and Amidon. The final design of on-site drainage systems shall comply with current City of Wichita design criteria.

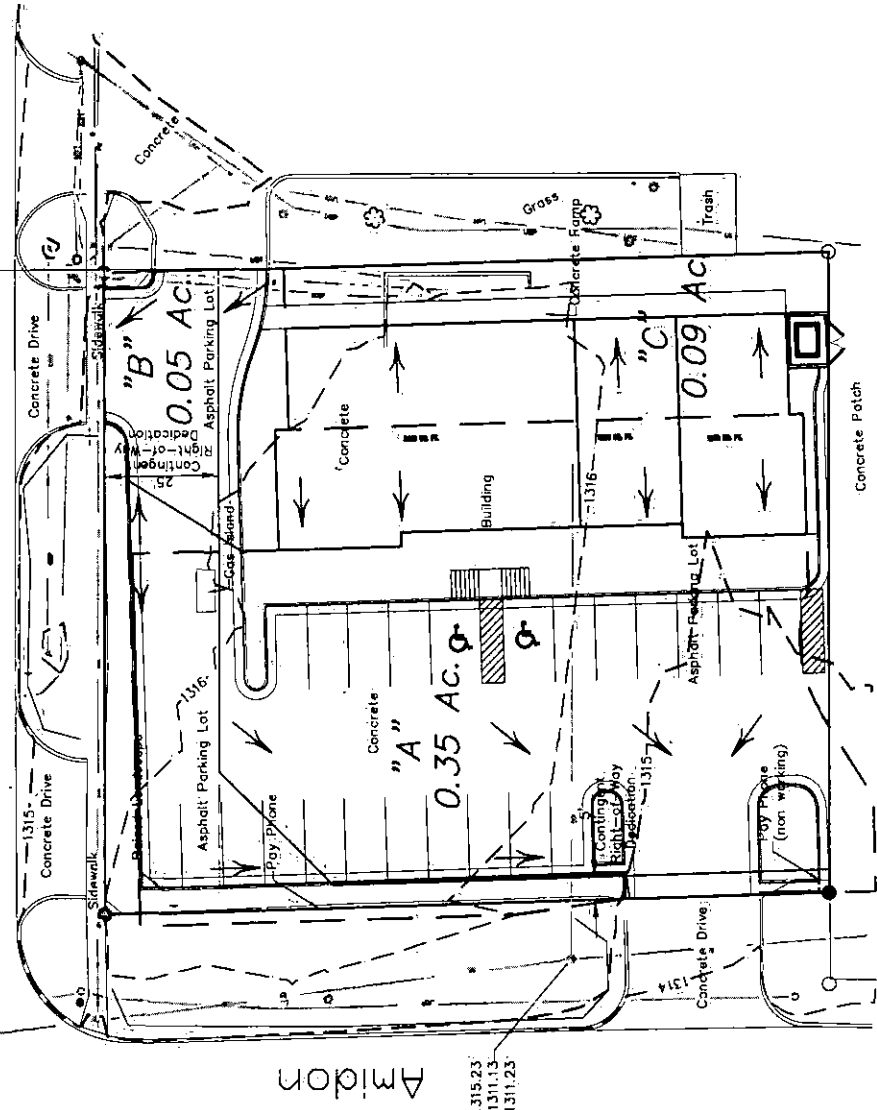
1.7 Narrative Description of Permanent Best Management Practices

The contractor shall provide stabilized construction entrance prior to any street paving. A buffer of 10 feet of undisturbed native vegetation shall be maintained around perimeter of site where possible. Earthwork stockpiles shall be maintained away from any ponds. Fuel storage and refueling of equipment shall not be allowed around any ponds, drainage channels, or other waterways. Sediment barriers will be placed at storm sewer inlets and rock rip-rap at outlets. Sediment barriers (type determined by owner or contractor) shall be used to prevent sediment from flowing off site. Disturbed earth shall be stabilized where construction activity ceases for at least 14 days with owner's choice of mulch, temporary seed (Rye grass) during the planting season or other suitable BMP device. BMP devices shall be in place until there is a good stand of grass. Disturbed portions of the site where construction activities permanently cease shall be stabilized with permanent seed no later than 14 days after the last construction activity in that area (during the planting season only). The permanent seed shall consist of fescue or grass chosen by the owner. BMP devices shall be used at back of curb/edge of pavement until vegetation is 75% established.

21ST AND AMIDON ADDITION

EXHIBIT 1-1

21st Street North



Top=1315.23
FL Out(N)=1311.13
FL In(S)=1311.23

21ST AND AMIDDON ADDITION

A TRACT IN THE NORTHEAST QUARTER OF SECTION 7, T27S, R1E
WICHITA, SEDGWICK COUNTY, KANSAS

PROPOSED DRAINAGE PLAN

2014

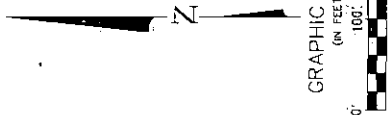
NOTES:

1. Cross-drainage agreements shall be required of the time of platting.
2. Site is under 1.0 acre in size. City of Wichita water quality downstream channel protection and detention requirements are therefore not applicable.
3. Detailed site grading and final drainage plans to be designed by a licensed professional engineer at the time of building permit.
4. Storm sewer easements will be provided at the time of building permit only as needed to allow drainage to discharge across adjacent lots.
5. Any revised drainage plan must be approved by storm water engineer prior to building permits being issued.

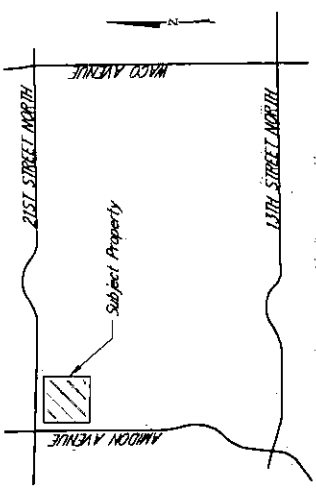
CALCULATION NOTES:

1. Determination of O₃ was made using the SCS method.
2. Curve Numbers weighted based on hydrologic soil groups.

Site	Area	Existing Conditions (24-Hour Storm)					Proposed Conditions (24-Hour Storm)				
		CN	1-Year	2-Year	5-Year	10-Year	10-Year	25-Year	100-Year	100-Year	
Area A	0.28	92.0	0.88	1.16	1.53	1.80	2.17	2.71	3.96		
Area B	0.22	92.0	0.70	0.91	1.20	1.42	1.70	2.13	3.17		
Area C	0.09	92.0	0.34	0.44	0.58	0.68	0.82	1.01	1.45		



- LEGEND:**
- 1 1/2" Pipe Found
 - ⊙ Missing BcC Found
 - ▲ Section Corner Found
 - 5/8" Bar w/Pvc Cap Set
 - ⊙ BENCHMARK
- BENCHMARK:**
City also at Amidon and 21st St. North
C.O.M. Benchmark SW cor. intersection
3' south of back of walk west and 7'
east of back of walk south 9.3' south of
walk light 2.0' east of face of walk.
Elevation 1315.76 NAVD88



PROPERTY OWNER: SUBMITTER

1991, LLC of Sedgewick County, in the State of Kansas

SURVEY NOTES:

Field Survey work completed on January 31, 2014.
Horizontal datum NAD 83 modified to ground
Vertical datum NAVD 88

ROE & ASSOCIATES, INC.
CONSULTING ENGINEERS
3940 E. Central, Suite 200 - Wichita, KS
978-694-1111
Phone 316-855-4114 - FAX 316-865-4444



LOCATION MAP
Not to Scale

21ST AND AMIDON ADDITION

EXHIBIT 1-2

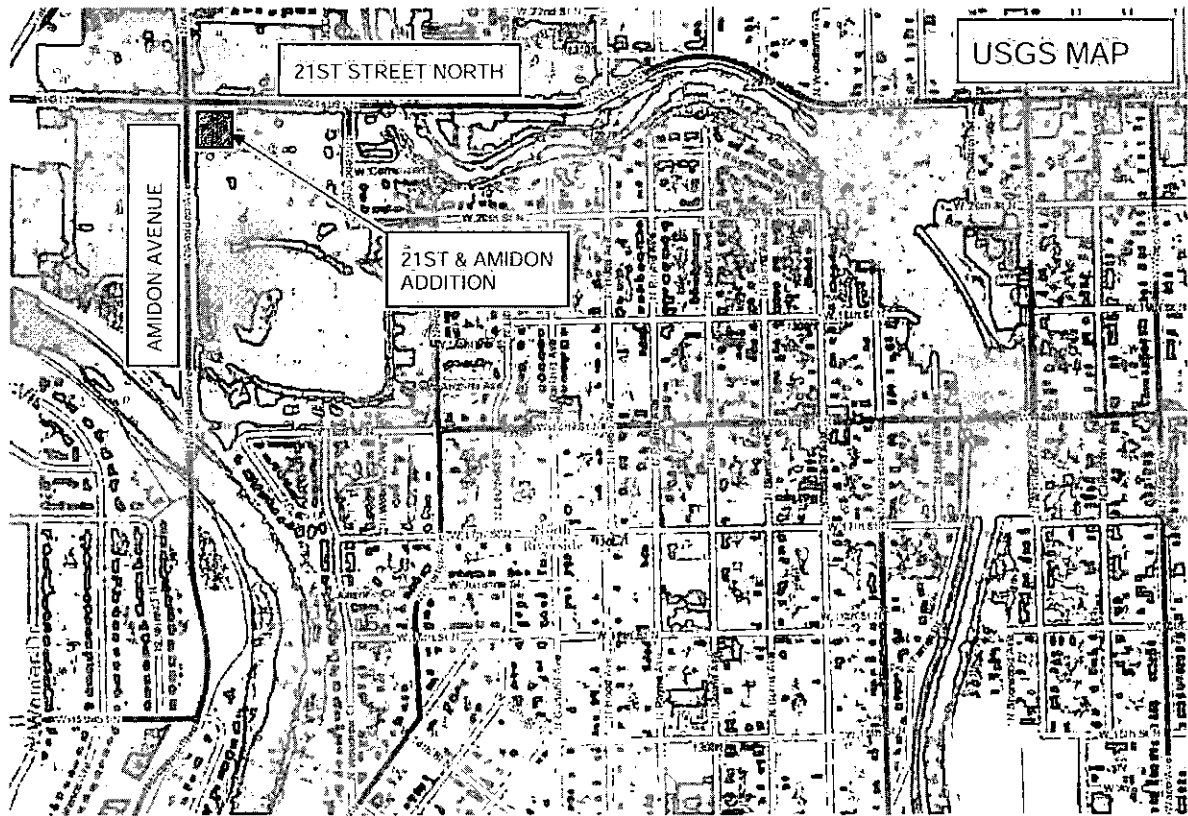
A site grading plan will be developed and submitted
for approval once site layout is better defined.

21ST AND AMIDON ADDITION

EXHIBIT 1-3

21ST AND AMIDON ADDITION

EXHIBIT 1-4

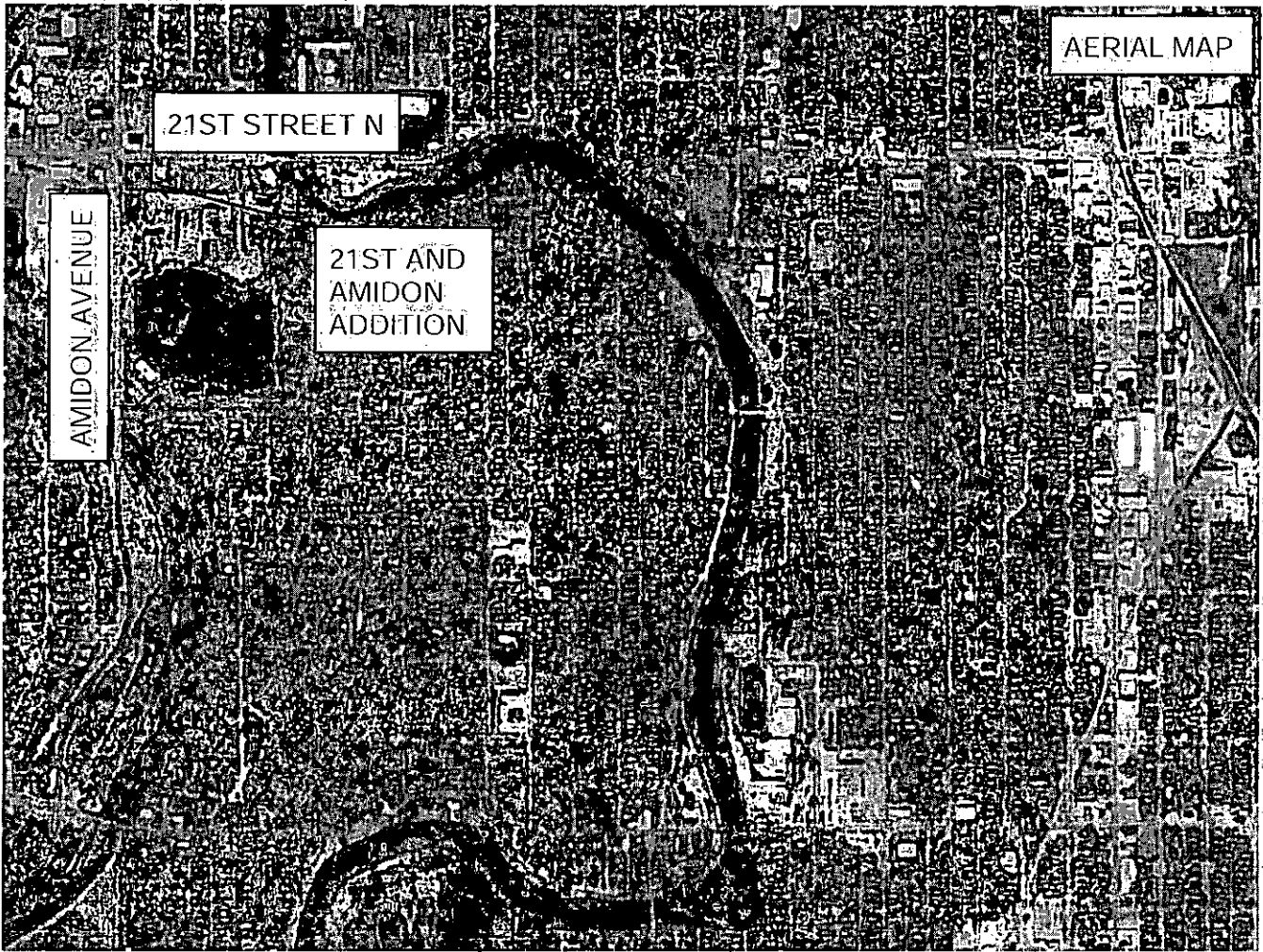


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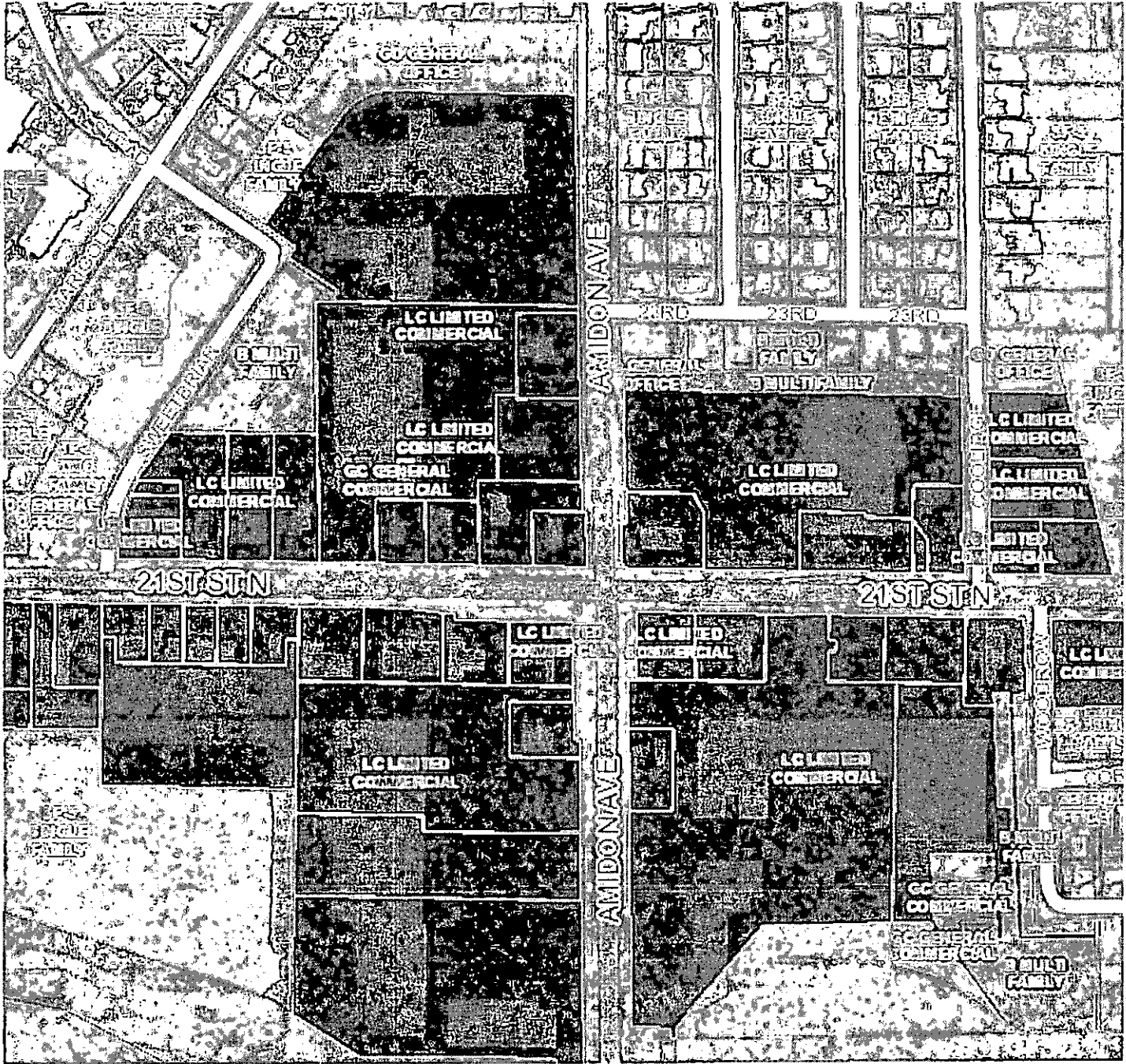
EXHIBIT 1-5



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Phone 316/685-4114 ■ FAX 316/685-4444

21ST AND AMIDON ADDITION

EXHIBIT 1-6



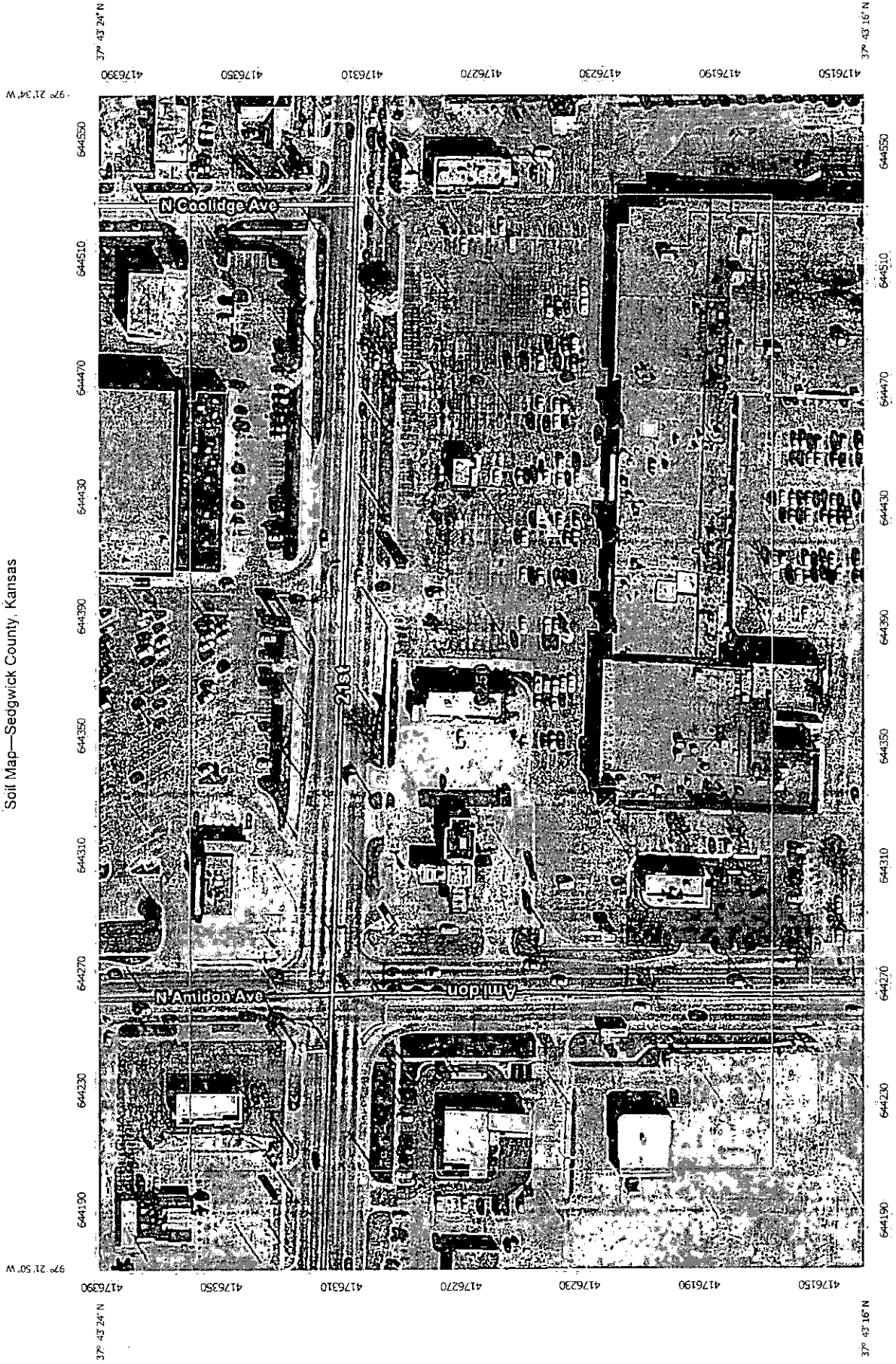
21ST AND AMIDON ADDITION

EXHIBIT 1-7

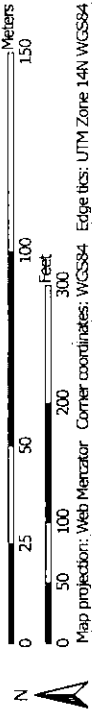
21ST AND AMIDON ADDITION

EXHIBIT 1-8

Soil Map—Sedgwick County, Kansas



Map Scale: 1:1,800 if printed on A landscape (11" x 8.5") sheet.



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

MAP LEGEND

- Area of Interest (AOI)
- Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points
- Special Point Features**
 - Blowout
 - Borrow Pit
 - Clay Spot
 - Closed Depression
 - Gravel Pit
 - Gravelly Spot
 - Landfill
 - Lava Flow
 - Marsh or swamp
 - Mine or Quarry
 - Miscellaneous Water
 - Perennial Water
 - Rock Outcrop
 - Saline Spot
 - Sandy Spot
 - Severely Eroded Spot
 - Sinkhole
 - Slide or Slip
 - Sodic Spot
- Water Features**
 - Streams and Canals
- Transportation**
 - Rails
 - Interstate Highways
 - US Routes
 - Major Roads
 - Local Roads
- Background**
 - Aerial Photography
- Special Line Features**
 - Spoil Area
 - Stony Spot
 - Very Stony Spot
 - Wet Spot
 - Other

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.

Map Unit Legend

Sedgwick County, Kansas (KS173)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6250	Urban land-Canadian complex, 0 to 3 percent slopes	15.8	100.0%
Totals for Area of Interest		15.8	100.0%

21ST AND AMIDON ADDITION

EXHIBIT 1-9

2.0 Existing Conditions Information

2.1 Existing Conditions Drainage Map

See Existing Conditions Drainage Map on Exhibit 2-1.

2.1.1 On-Site and Off-Site Topography

The existing topography is shown on Exhibit 2-1.

2.1.2 On-Site and Off-Site Drainage Features

Exhibit 2-1 shows any water features within the site.

2.1.3 Storm Sewer System Components

Flow within the site is carried by overland flow, of which a majority is sheet flow. Roadway curb and gutter along 21st Street North drain this street and a portion of the site to the Little Arkansas River. Roadway curb and gutter along Amidon Avenue drain this street and the balance of the site to the Arkansas River.

2.1.4 Location and Boundaries of Natural Features

The site does not contain wetlands or lakes.

2.1.5 Location, Dimensions, and Elevations of Existing Bridges and Culvert Crossings

There are no bridges or culvert crossings within the boundaries of this site. However, a series of curbs and gutters in 21st Street North and Amidon Avenue carry storm runoff from offsite properties to the The Arkansas River and the Arkansas River, which lie east and south of the site.

2.1.6 Location of Existing Utilities

Locates shall be called in prior to any excavation in this area. The site contains various utilities along all sides of the property. Fiber optic, overhead power, underground power, underground telephone and water mains run along the south side of 21st Street North just north of the north property line. Sewer and underground run along the east side of Amidon Avenue just west of the west property line.

2.1.7 Groundwater Elevations

This property is in a zone identified by the Kansas Geologic Survey as likely to have groundwater at some or all times within 18 feet of the ground surface elevation. Building with specially engineered foundations or with the lowest floor opening above groundwater is recommended, and owners seeking building permits on this property will be similarly advised. More detailed information on recorded groundwater elevations in the vicinity of this property is available in the City Engineers' office.

2.1.8 Delineation of Predominate Soils Based on USDA Soil Surveys

The predominant soil type is an Urban land-Canadian complex (6250) series material, which is found in 100% of the overall existing drainage areas. See Exhibit 1-6 for NRCS Soil Survey map and information showing existing soil types and descriptions. These soils are classified as Hydrologic Group B soils. The Hydrologic Groups are used to select curve numbers for the runoff calculations in both the existing and developed conditions.

2.1.9 Land Use Types per NRCS Nomenclature

The current land use type can be classified as commercial. Previous use of the land included similar uses.

2.1.10 Footprint of Existing Impervious Areas

Currently, the portion of the property to be developed is occupied by an existing gas station. The existing gas station and surrounding pavement section and fuel pumps will be demolished prior to commencement of construction.

2.1.11 Internal Drainage/Sub-Basin Boundaries

The total area of 21st and Amidon Addition encompasses 0.58 acres. The north basin denoted as Area "A" is approximately 0.28 acres and runs across the northern half of the property as shown on the existing plan. The south basin denoted as Area "B" is approximately 0.22 acres and runs across the southern half of the property.

2.1.12 Time of Concentration Flow Paths

The existing condition drainage plan shows the general flow paths for each drainage area in the basin. The site drainage is all collected in the proposed curb and gutter along the north and west property lines and will exit the site to the north and west through a series of proposed curb castings and associated outlet pipes. The flow to these areas is mostly sheet flow with minor concentrated flow at the lower ends of the basins.

2.2 Existing Conditions Hydrology and Hydraulics Analysis

2.2.1 Narrative of the Hydrologic Analysis Methodology

The runoff method used to determine storm water flows was the SCS method. Supporting data and calculation results are shown on Exhibit 2-2. The analysis was completed using the SCS method. The 1, 2, 5, 10, 25, & 100 year, 24-hour storm events were evaluated.

2.2.2 Summary Table of Drainage Sub-Basin Hydrologic Parameters

Drainage Basin	Area (Acres)	Curve Number	T _c (min)
Area "A"	0.28	92.0	82
Area "B"	0.22	92.0	7.6

2.2.3 Table of Existing Condition Runoff Curve Numbers

For the existing condition, the curve numbers were weighted based on area of their respective hydrologic soil groups over the site. The results are shown in the table below.

Area "A"		Hydrologic Group	Area		% of Area	CN Existing
Soil #	Soil Information		Square Feet	Acres		
6250	Urban land-Canadian complex, 0 to 3% slopes	B	12338.00	0.283	100.00%	92.0
TOTALS			12338.00	0.283	100.00%	92.0

Area "B"		Hydrologic Group	Area		% of Area	CN Existing
Soil #	Soil Information		Square Feet	Acres		
6250	Urban land-Canadian complex, 0 to 3% slopes	B	9496.00	0.218	100.00%	92.0
TOTALS			9496.00	0.218	100.00%	92.0

2.2.4 Table of Existing Condition Times of Concentration

Area	T _c (min)
Area "A"	8.2
Area "B"	7.6

Supporting data and calculations are found on the time of concentration worksheet attached as Exhibit 2-3.

2.2.5 Summary Table of Rainfall Data

Rainfall information shown in Exhibit 2-4.

2.2.6 Cross-Section Data of Existing Open Channels

There are no existing open channels adjacent to the site. Flow in adjoining streets is carried in concrete curb and gutter. While the intersection of 21st and Amidon is presently planned to be improved, curb and gutter sections in these roadways will remain virtually unchanged adjacent to the site.

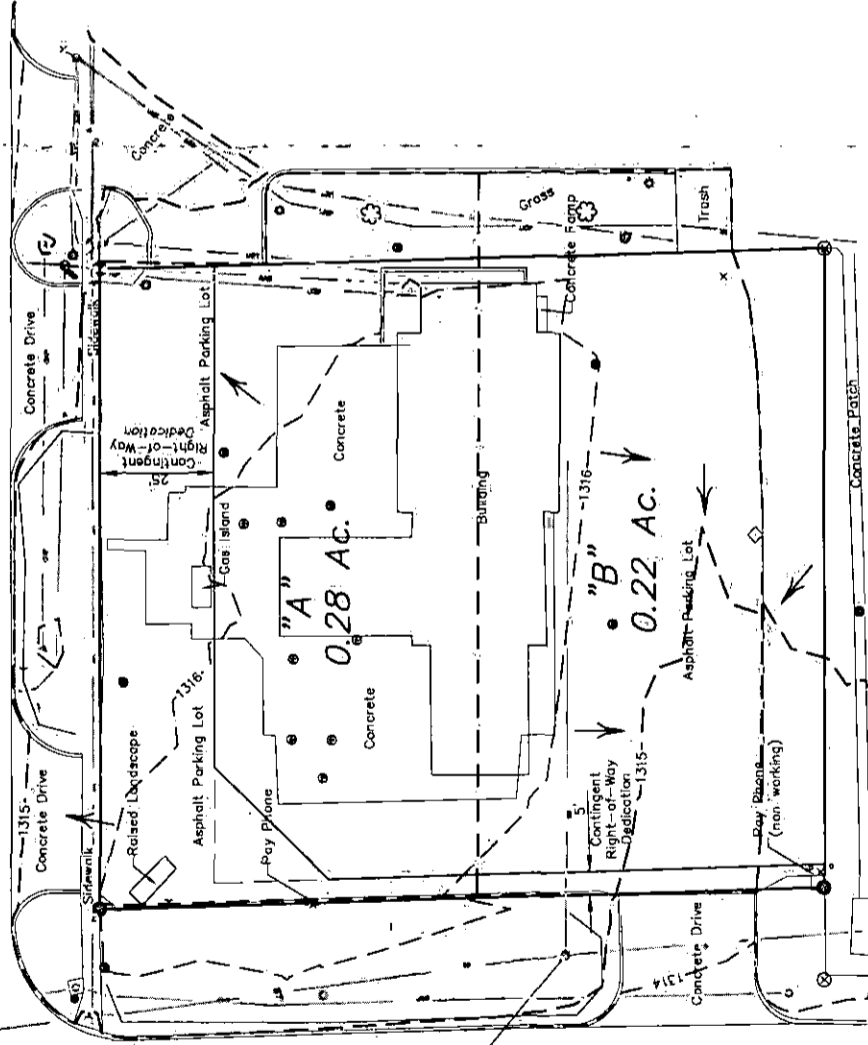
2.2.7 Existing Condition Hydrologic and Hydraulic Analyses

Existing condition analysis report attached as Exhibit 2-2.

21ST AND AMIDON ADDITION

EXHIBIT 2-1

21st Street North



Amidon

Top=1315.23
FL Out(N)=1311.13
FL In(S)=1311.23

NOTES:

1. Cross-drainage agreements shall be required at the time of paving.
2. Site is under 1.0 acre in size. City of Wichita water quality and detention requirements are therefore not applicable.
3. Detailed site grading and final drainage plans to be designed by a Licensed Professional Engineer at the time of building permit.
4. Storm sewer easements will be provided at the time of building permit only as needed to allow drainage to discharge across adjacent lots.
5. Any revised drainage plan must be approved by storm water engineer prior to building permits being issued.

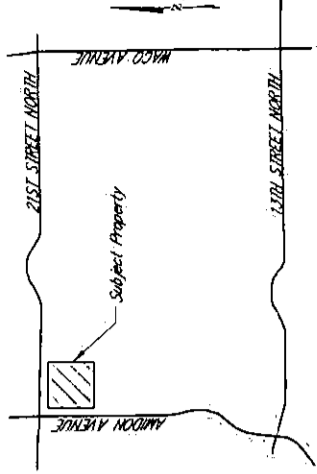
CALCULATION NOTES:

1. Determination of C.I. was made using the SCS method.
2. Curve Numbers weighted based on hydrologic soil groups.

Site	Area	Existing Conditions (24-Hour Storm)				
		1-Year	2-Year	5-Year	10-Year	100-Year
Area A	0.28	0.88	1.16	1.53	1.80	2.17
Area B	0.22	0.70	0.91	1.20	1.42	1.70
						2.13

- LEGEND:**
- 1.1/2" Pipe Found
 - ⊙ Manhole BAC Found
 - ▲ Section Corner Found
 - 5/8" Bar w/Poe Cap Set
 - ⊙ BENCHMARK

BENCHMARK:
City also at Amidon and 21st St. North
C.O.M. Benchmark SW cor. intersection
J' south of back of walk west and 7'
east of back of walk south. 9.3' south of
walk light. 2.0' east of face of walk.
Elevation 1315.76 MHD88



PROPERTY OWNER / SUBMITTER:
1981, LLC of Sedgewick County, in the State of Kansas

SURVEY NOTES:
Field Survey work completed on January 31, 2014.
Horizontal datum NAD 83 modified to ground.
Vertical datum MHD 88

21ST AND AMIDON ADDITION

A TRACT IN THE NORTHEAST QUARTER OF SECTION 7, T27S, R1E
WICHITA, SEDGWICK COUNTY, KANSAS

EXISTING CONDITIONS DRAINAGE PLAN

2014

POE & ASSOCIATES, INC.
CONSULTING ENGINEERS
5940 E. Central, Suite 200 - Wichita, KS
67208-0270
Phone: 316.685-4115 FAX: 316.685-4444

21ST AND AMIDON ADDITION

EXHIBIT 2-2

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New.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10



Legend

Hyd. Origin	Description
1	SCS Runoff Prop. Area A
2	SCS Runoff Prop. Area B
3	SCS Runoff Prop. Area C

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc: v10

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	-----	1.308	1.712	-----	2.247	2.645	3.173	3.567	3.960	Prop. Area A
2	SCS Runoff	-----	0.187	0.245	-----	0.321	0.378	0.453	0.510	0.566	Prop. Area B
3	SCS Runoff	-----	0.336	0.440	-----	0.578	0.680	0.816	0.917	1.018	Prop. Area C

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc., v10.

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.308	1	715	2,439	-----	-----	-----	Prop. Area A
2	SCS Runoff	0.187	1	715	348	-----	-----	-----	Prop. Area B
3	SCS Runoff	0.336	1	715	627	-----	-----	-----	Prop. Area C
New.gpw					Return Period: 1 Year		Tuesday, 02 / 11 / 2014		

Hydrograph Report

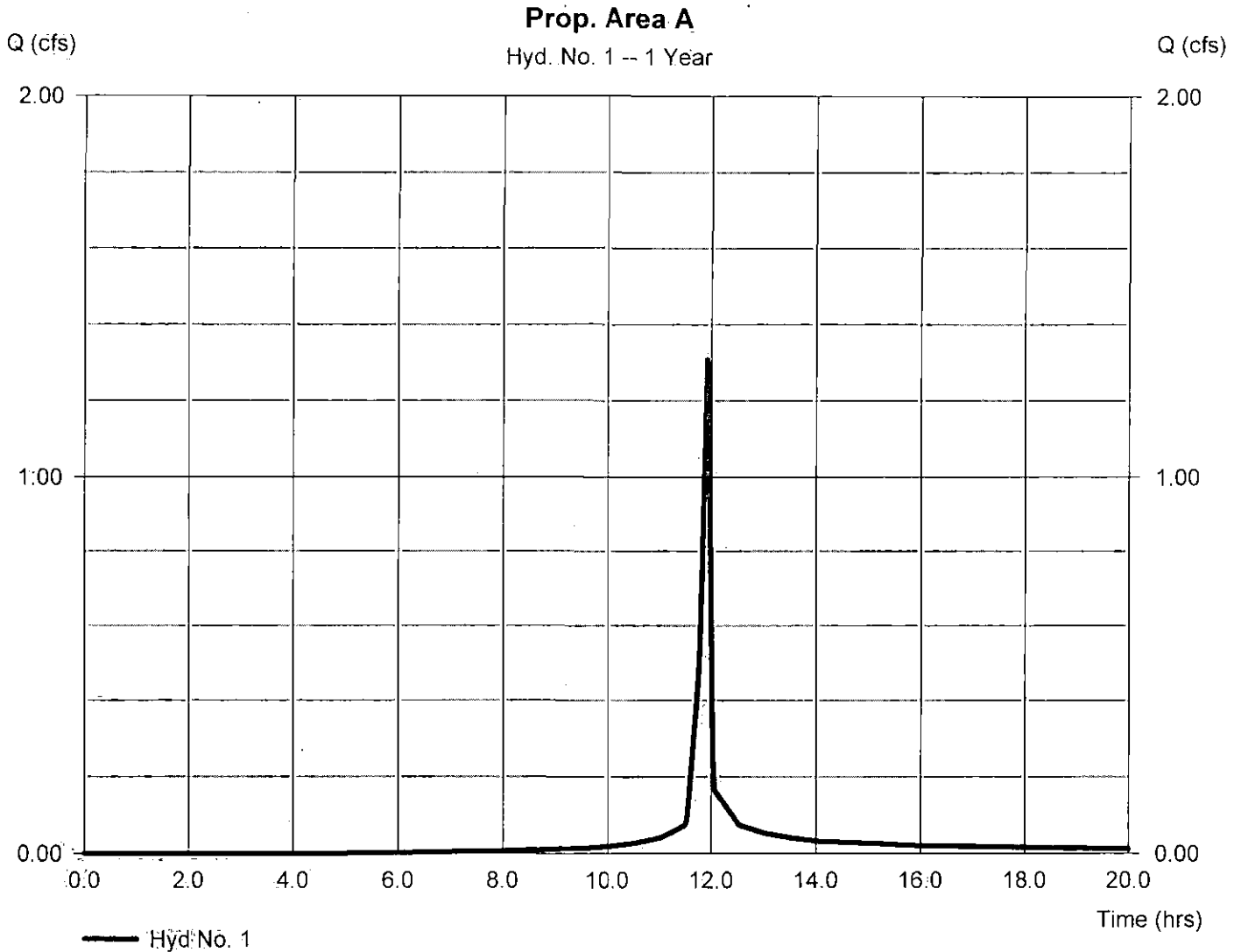
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 1

Prop. Area A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.308 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 2,439 cuft
Drainage area	= 0.350 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.70 min
Total precip.	= 2.88 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

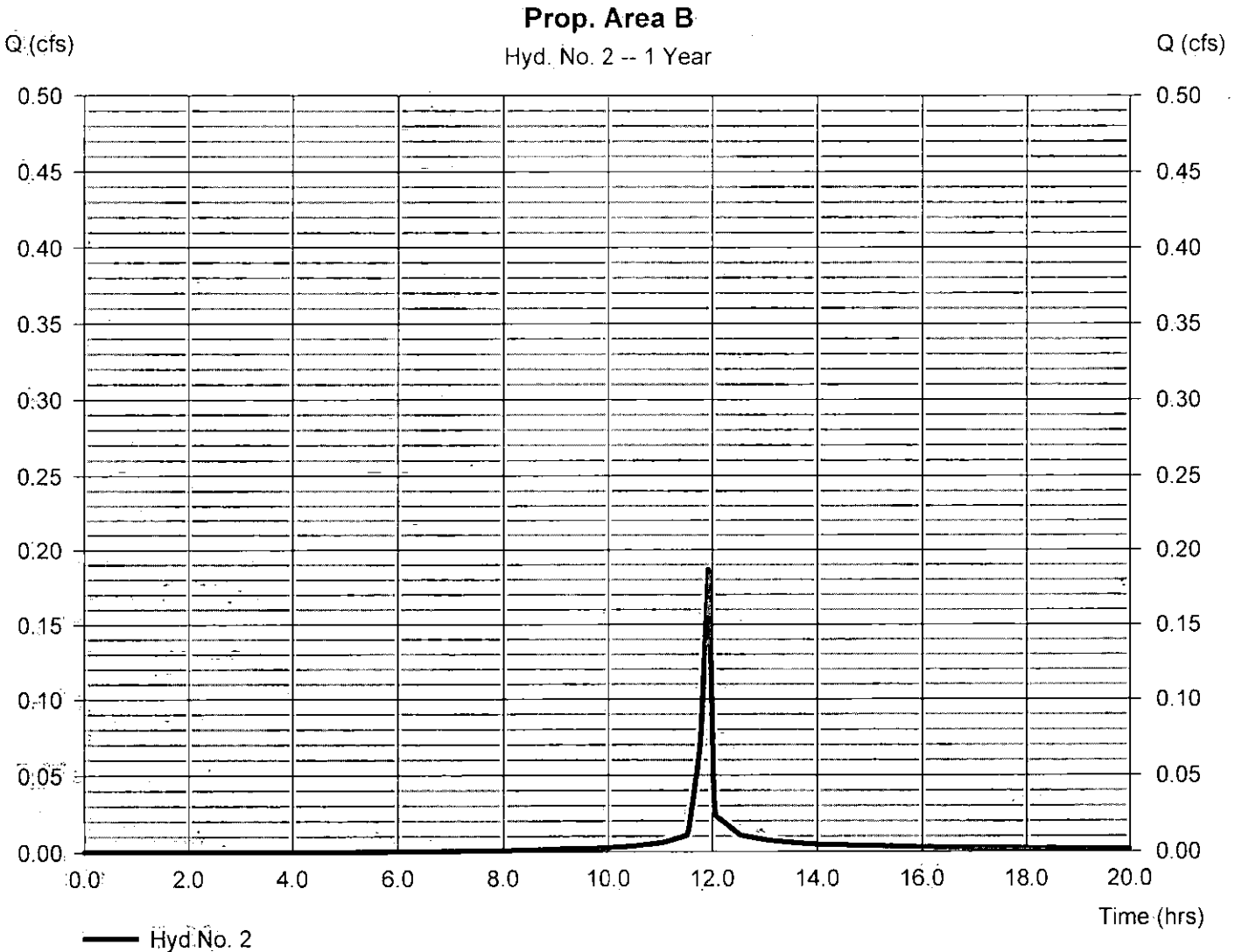
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02/11/2014

Hyd. No. 2

Prop. Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.187 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 348 cuft
Drainage area	= 0.050 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.90 min
Total precip.	= 2.88 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

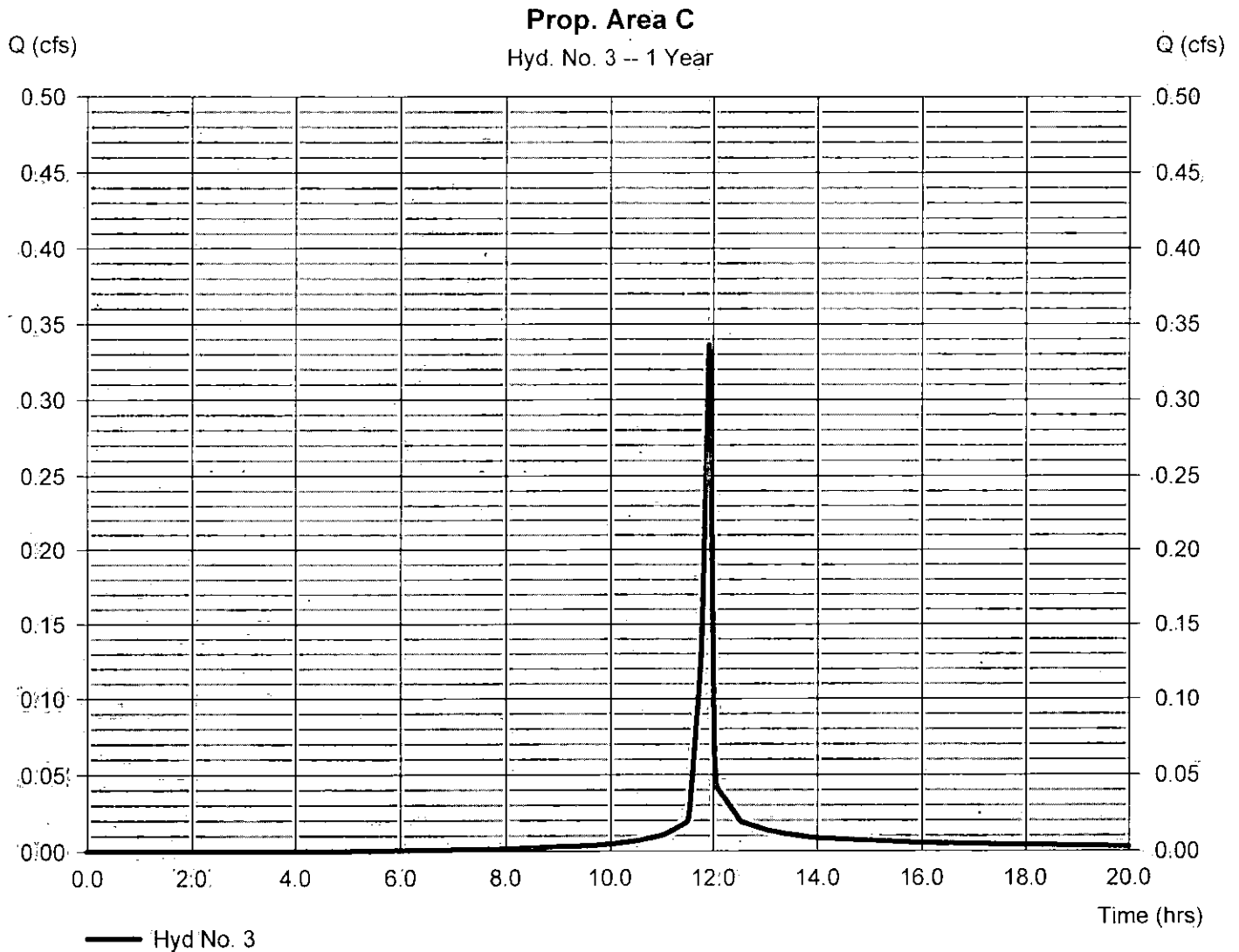
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 3

Prop. Area C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.336 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 627 cuft
Drainage area	= 0.090 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.60 min
Total precip.	= 2.88 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow.Hydrographs.Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.712	1	715	3,255	-----	-----	-----	Prop. Area A
2	SCS Runoff	0.245	1	715	465	-----	-----	-----	Prop. Area B
3	SCS Runoff	0.440	1	715	837	-----	-----	-----	Prop. Area C
New:gpw					Return Period: 2 Year			Tuesday, 02 / 11 / 2014	

Hydrograph Report

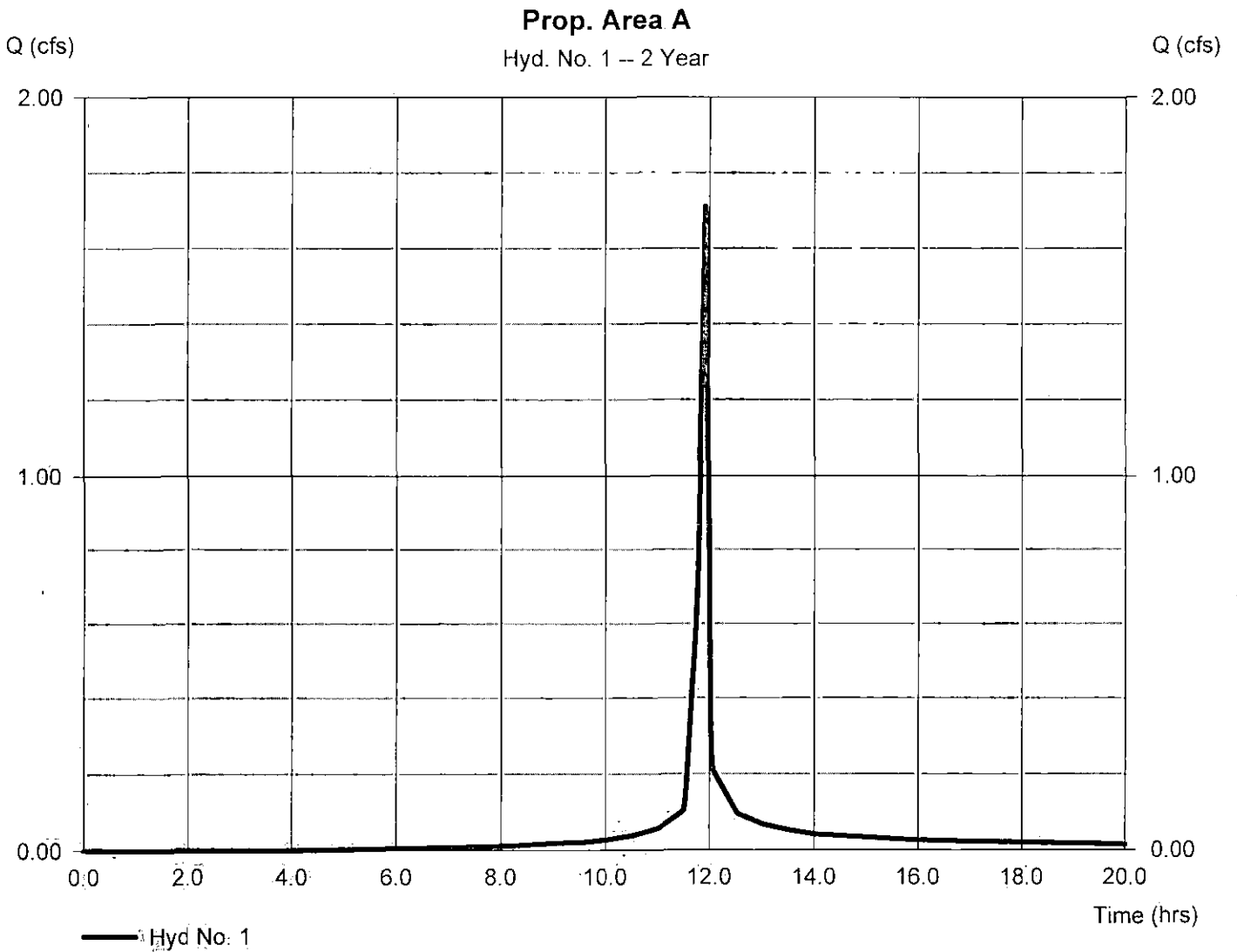
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 1

Prop. Area A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.712 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 3,255 cuft
Drainage area	= 0.350 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.70 min
Total precip.	= 3.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

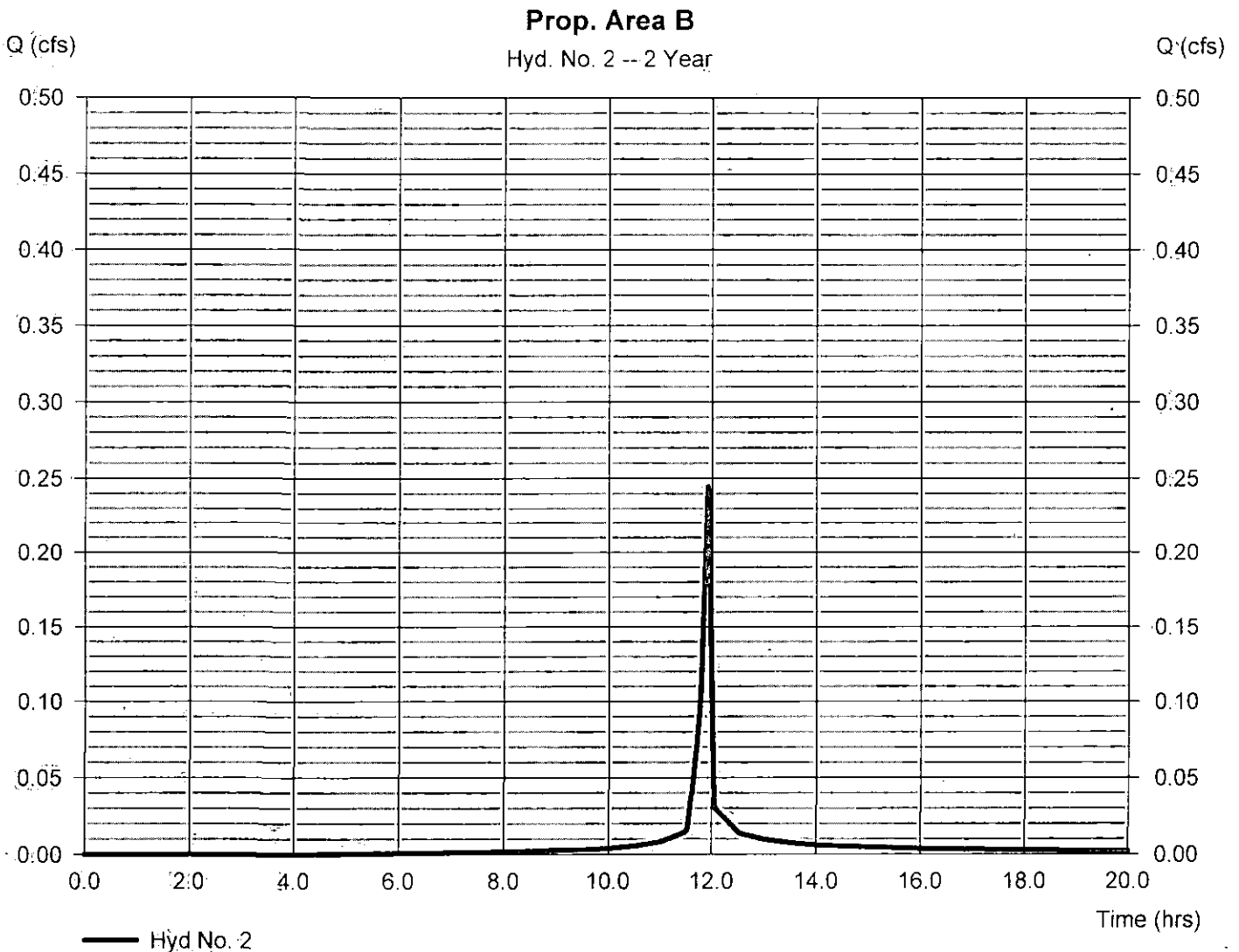
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 2

Prop. Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.245 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 465 cuft
Drainage area	= 0.050 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.90 min
Total precip.	= 3.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



— Hyd No. 2

Hydrograph Report

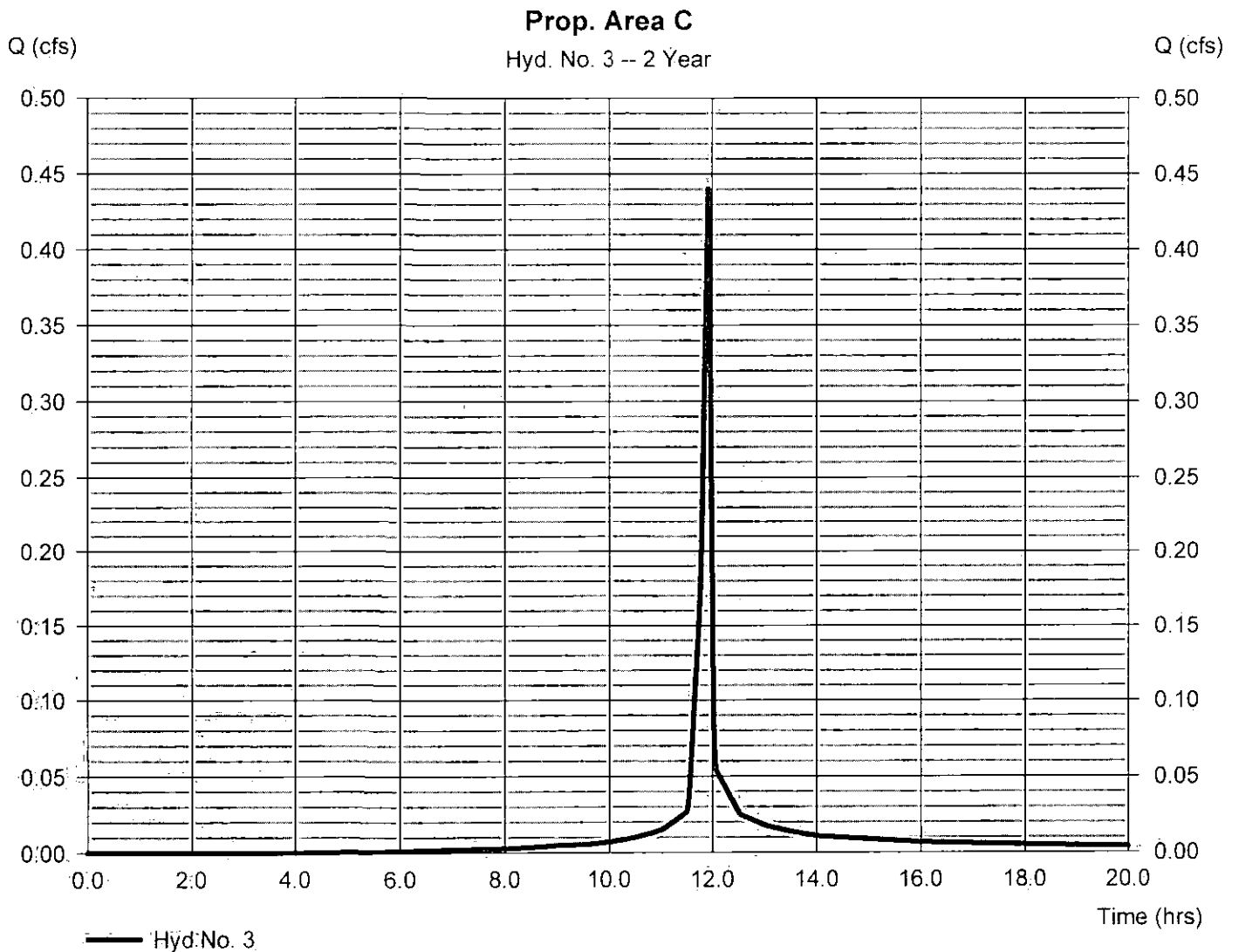
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10.

Tuesday, 02 / 11 / 2014

Hyd. No. 3

Prop. Area C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.440 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 837 cuft
Drainage area	= 0.090 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.60 min
Total precip.	= 3.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.247	1	715	4,360	-----	-----	-----	Prop. Area A
2	SCS Runoff	0.321	1	715	623	-----	-----	-----	Prop. Area B
3	SCS Runoff	0.578	1	715	1,121	-----	-----	-----	Prop. Area C
New.gpw					Return Period: 5 Year			Tuesday, 02 / 11 / 2014	

Hydrograph Report

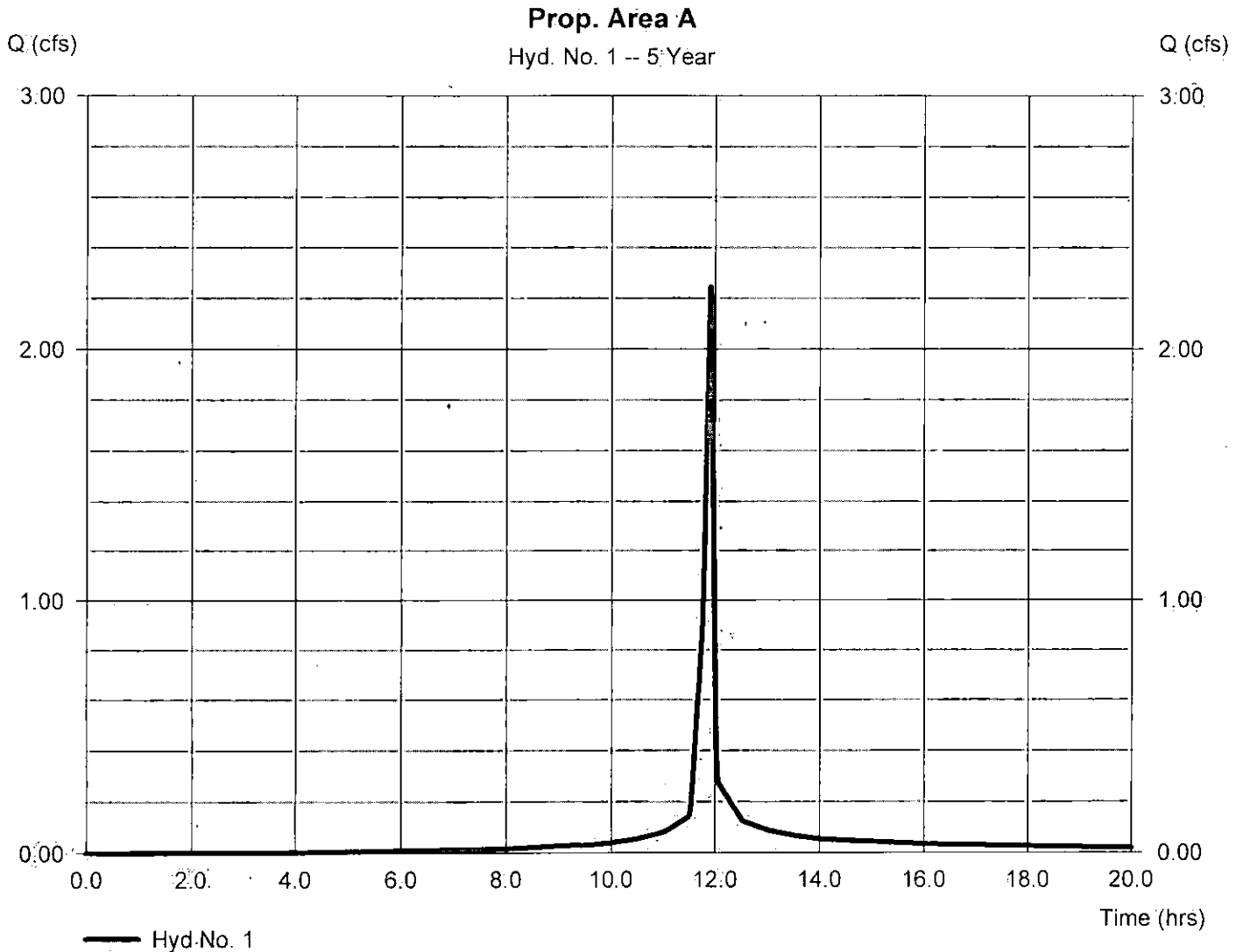
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02/11/2014

Hyd. No. 1

Prop. Area A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.247 cfs
Storm frequency	= 5 yrs.	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 4,360 cuft
Drainage area	= 0.350 ac.	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.70 min
Total precip.	= 4.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

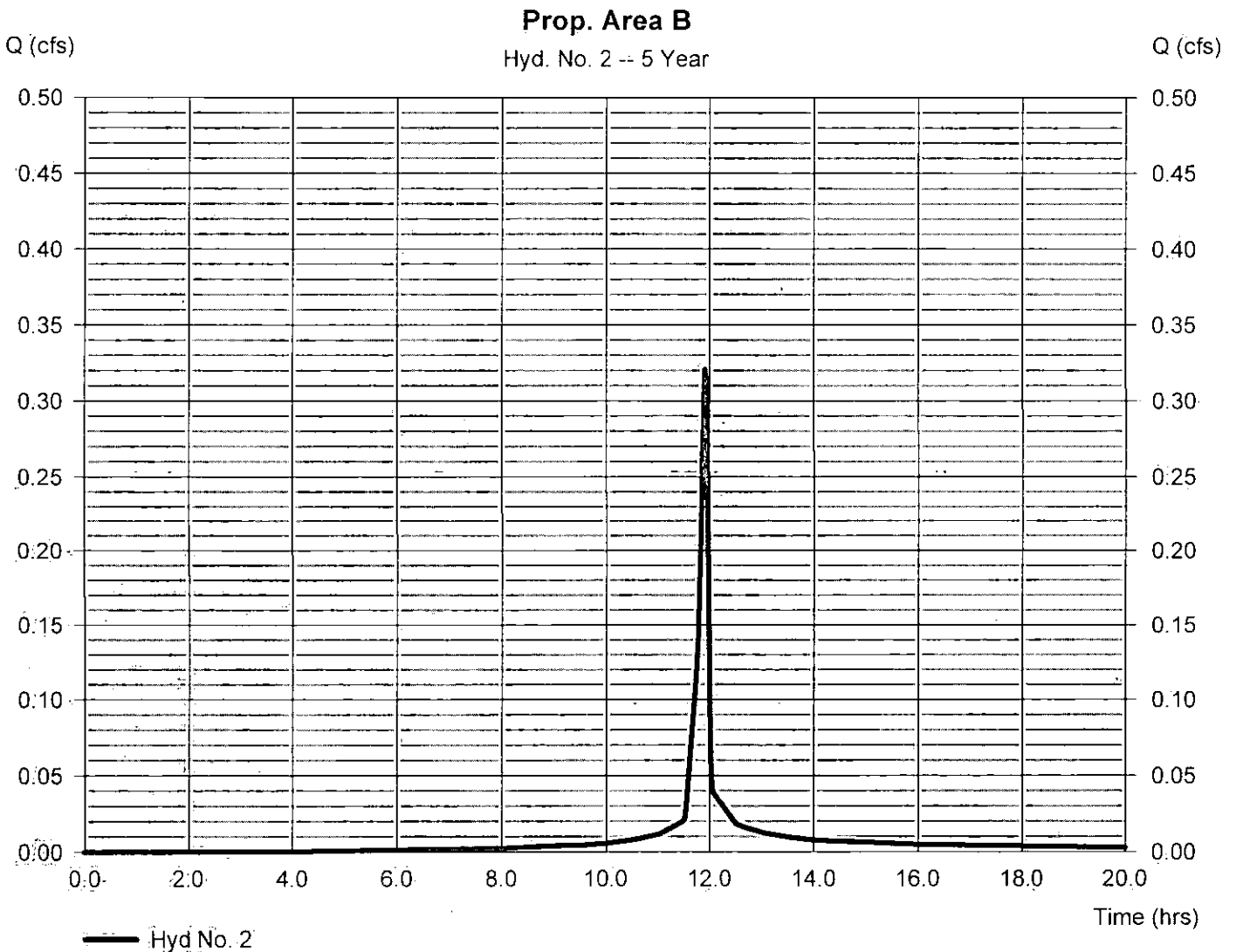
Hydraflow, Hydrographs Extension, for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10.

Tuesday, 02/11/2014

Hyd. No. 2

Prop. Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.321 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 623 cuft.
Drainage area	= 0.050 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.90 min
Total precip.	= 4.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

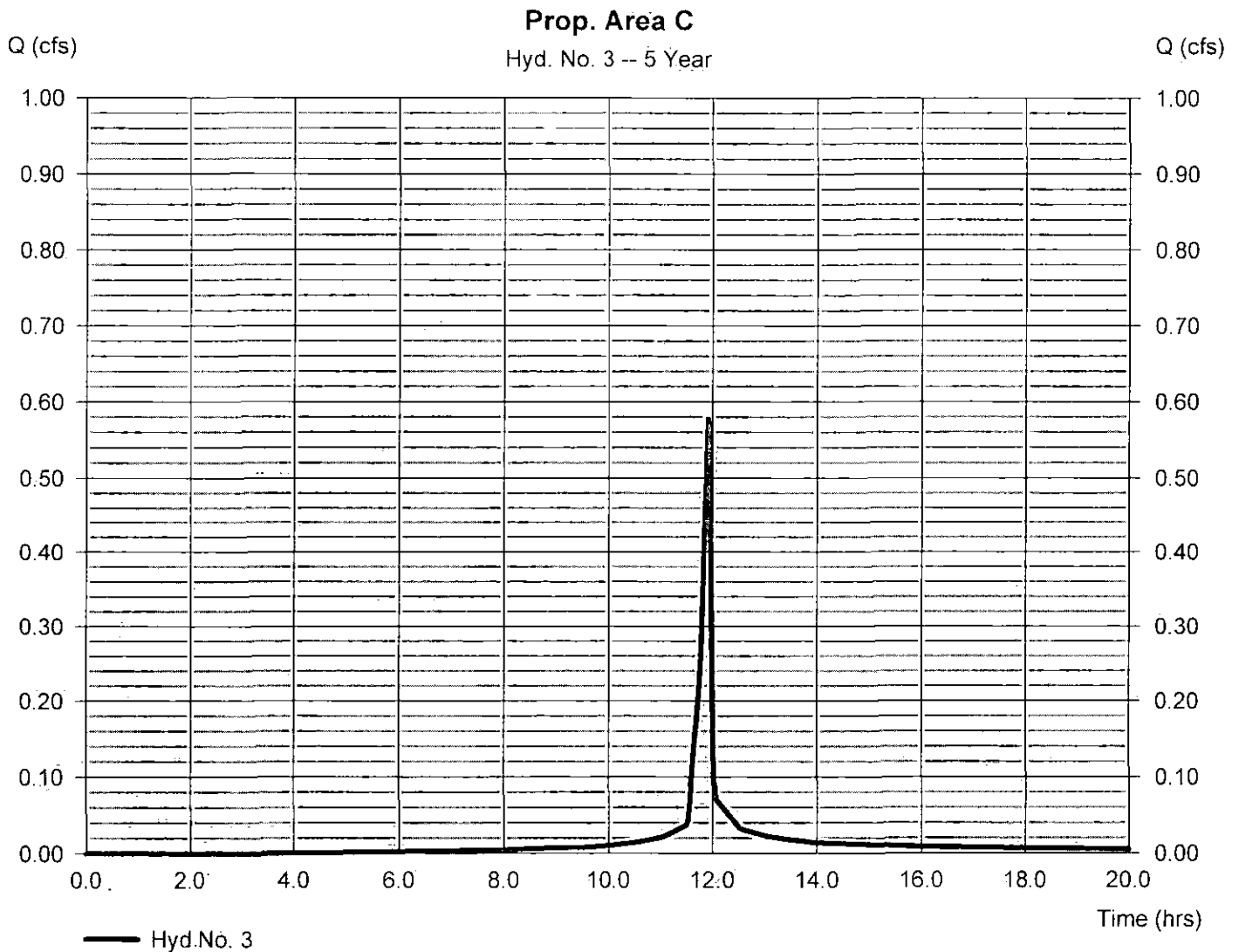
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 3

Prop. Area C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.578 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 1,121 cuft
Drainage area	= 0.090 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.60 min
Total precip.	= 4.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc., v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.645	1	715	5,197	-----	-----	-----	Prop. Area A.
2	SCS Runoff	0.378	1	715	742	-----	-----	-----	Prop. Area B
3	SCS Runoff	0.680	1	715	1,336	-----	-----	-----	Prop. Area C

Hydrograph Report

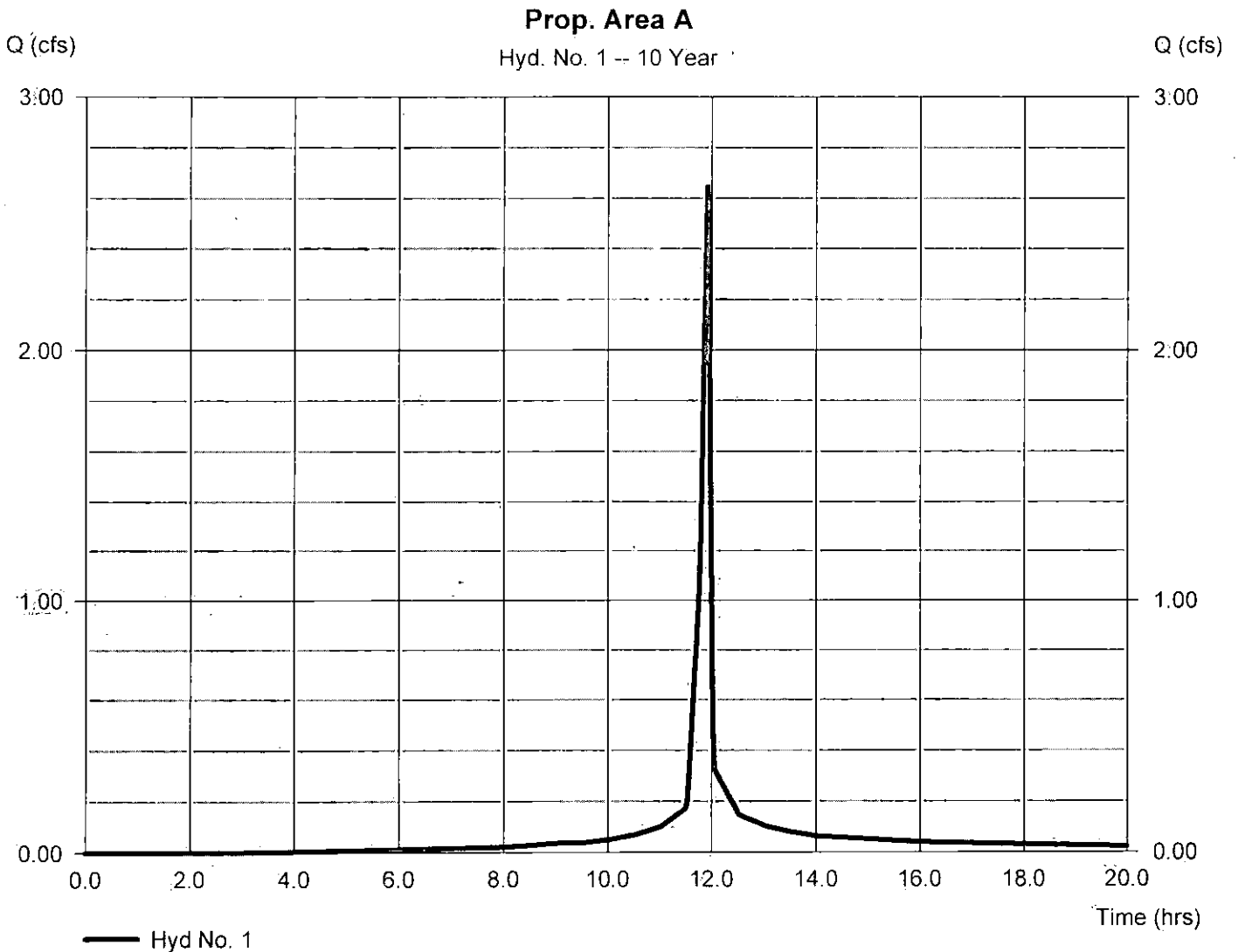
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10.

Tuesday, 02 / 11 / 2014

Hyd. No. 1

Prop. Area A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.645 cfs
Storm frequency	= 10 yrs.	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 5,197 cuft
Drainage area	= 0.350 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.70 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

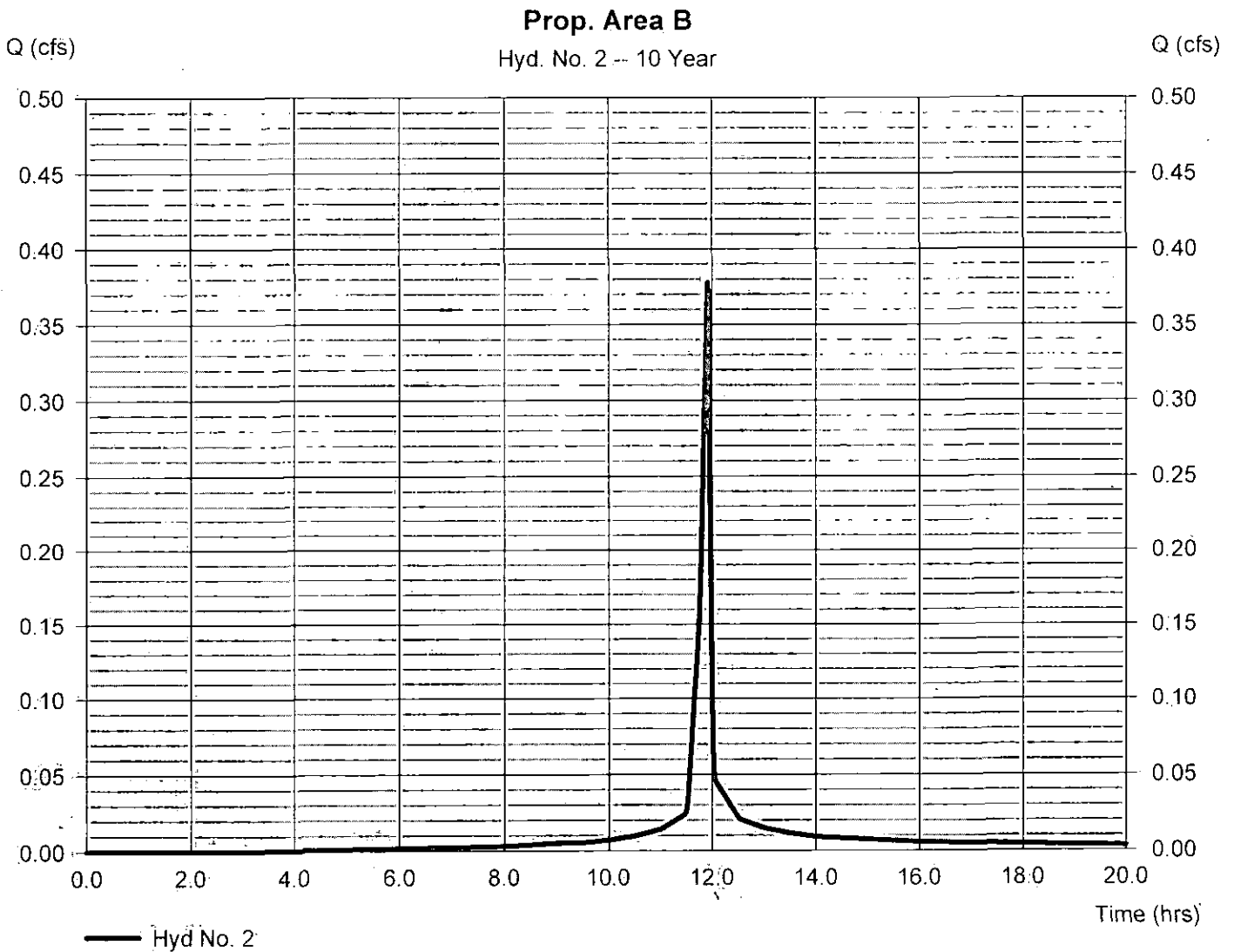
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 2

Prop. Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.378 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 742 cuft
Drainage area	= 0.050 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.90 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

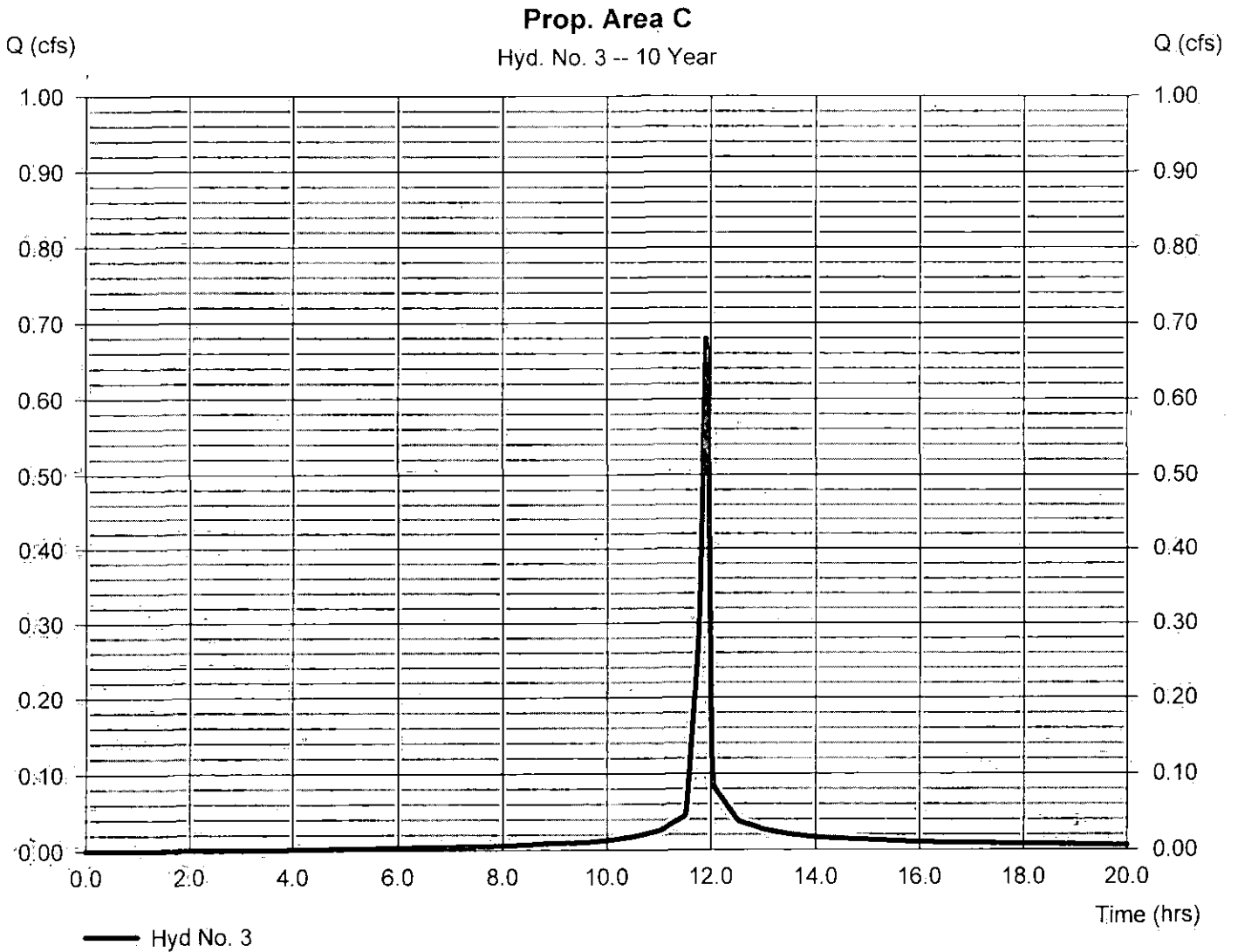
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 3

Prop. Area C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.680 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 1,336 cuft
Drainage area	= 0.090 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.60 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.173	1	715	6,319	-----	-----	-----	Prop. Area A
2	SCS Runoff	0.453	1	715	903	-----	-----	-----	Prop. Area B
3	SCS Runoff	0.816	1	715	1,625	-----	-----	-----	Prop. Area C
New.gpw					Return Period: 25 Year		Tuesday, 02 / 11 / 2014		

Hydrograph Report

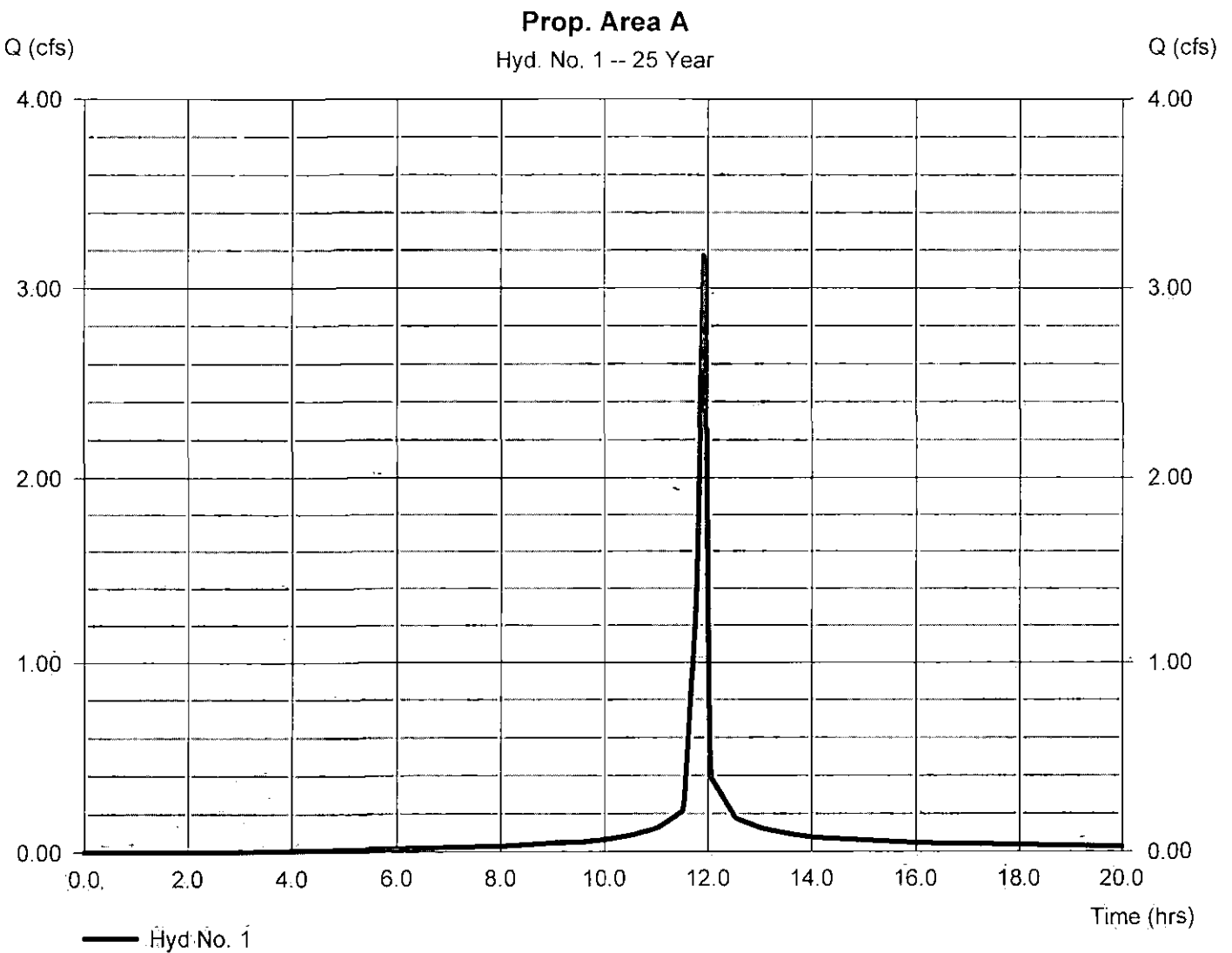
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013, by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 1

Prop. Area A

Hydrograph type	= SCS Runoff	Peak discharge	= 3.173 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 6,319 cuft
Drainage area	= 0.350 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.70 min
Total precip.	= 6.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

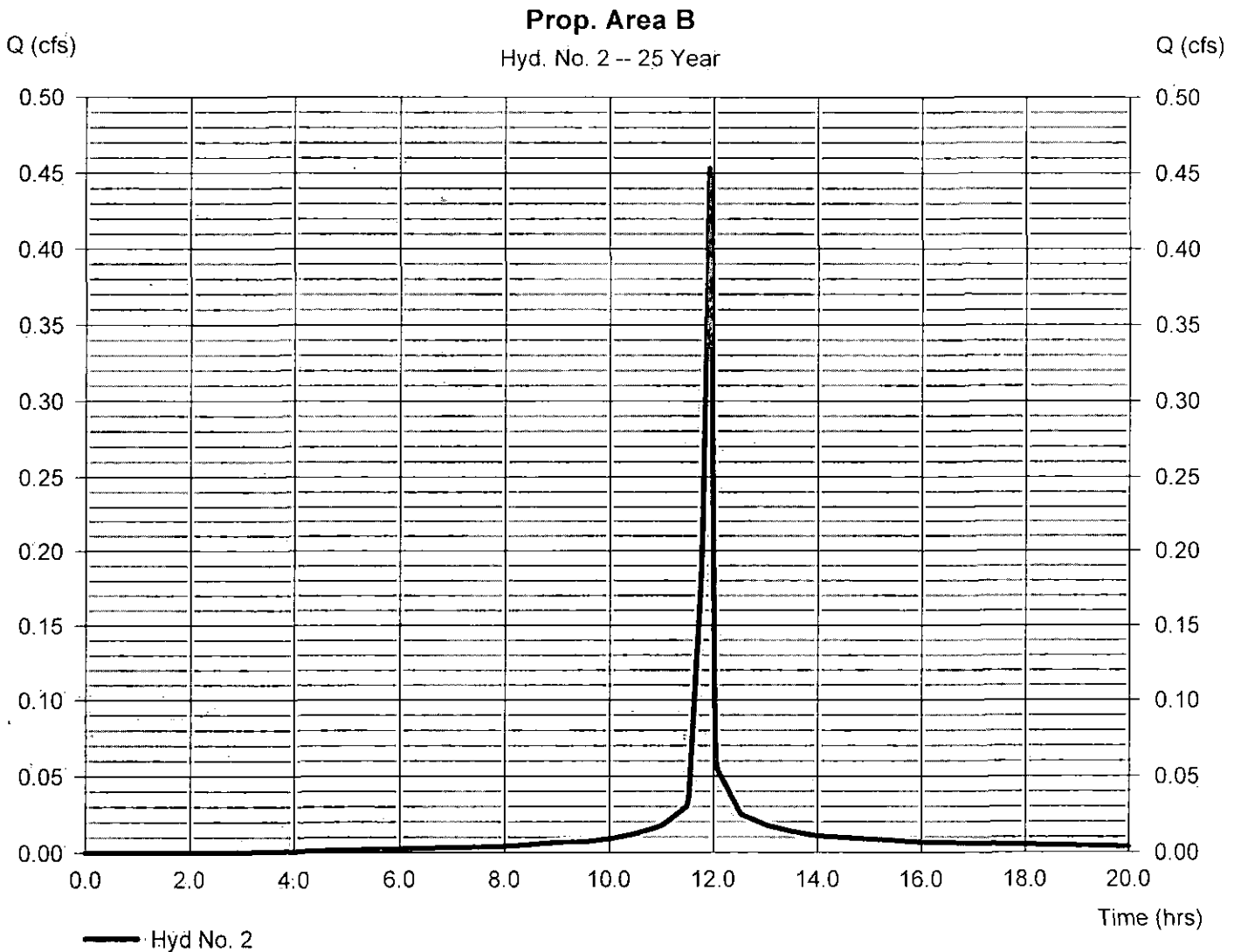
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 2

Prop. Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.453 cfs
Storm frequency	= 25 yrs..	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 903 cuft
Drainage area	= 0.050 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc.method	= User	Time of conc. (Tc)	= 1.90 min
Total precip.	= 6.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

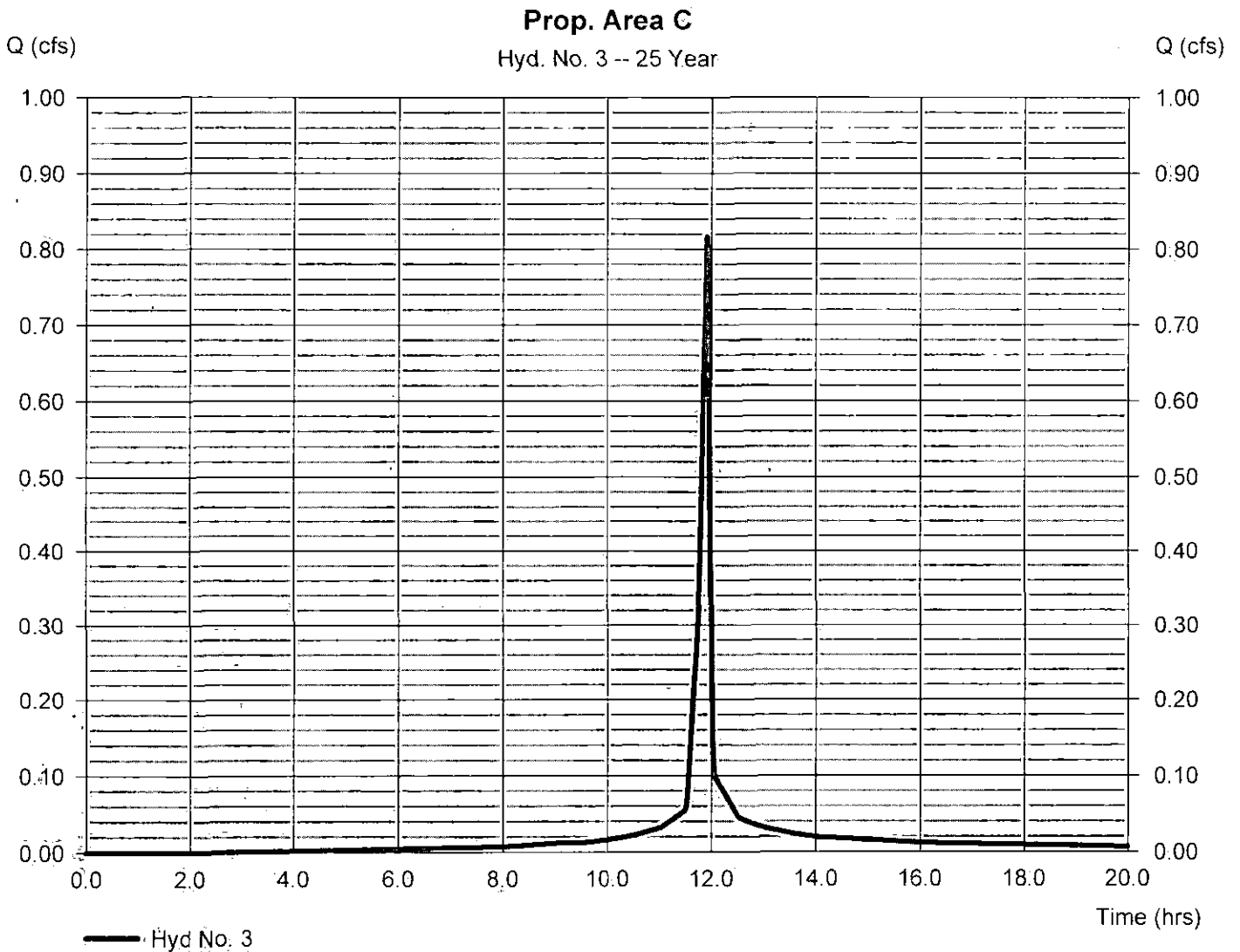
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 3

Prop. Area C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.816 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 1,625 cuft
Drainage area	= 0.090 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.60 min
Total precip.	= 6.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	3.567	1	715	7,165	-----	-----	-----	Prop. Area A	
2	SCS Runoff	0.510	1	715	1,024	-----	-----	-----	Prop. Area B	
3	SCS Runoff	0.917	1	715	1,842	-----	-----	-----	Prop. Area C	
New.gpw					Return Period: 50 Year		Tuesday, 02 / 11 / 2014			

Hydrograph Report

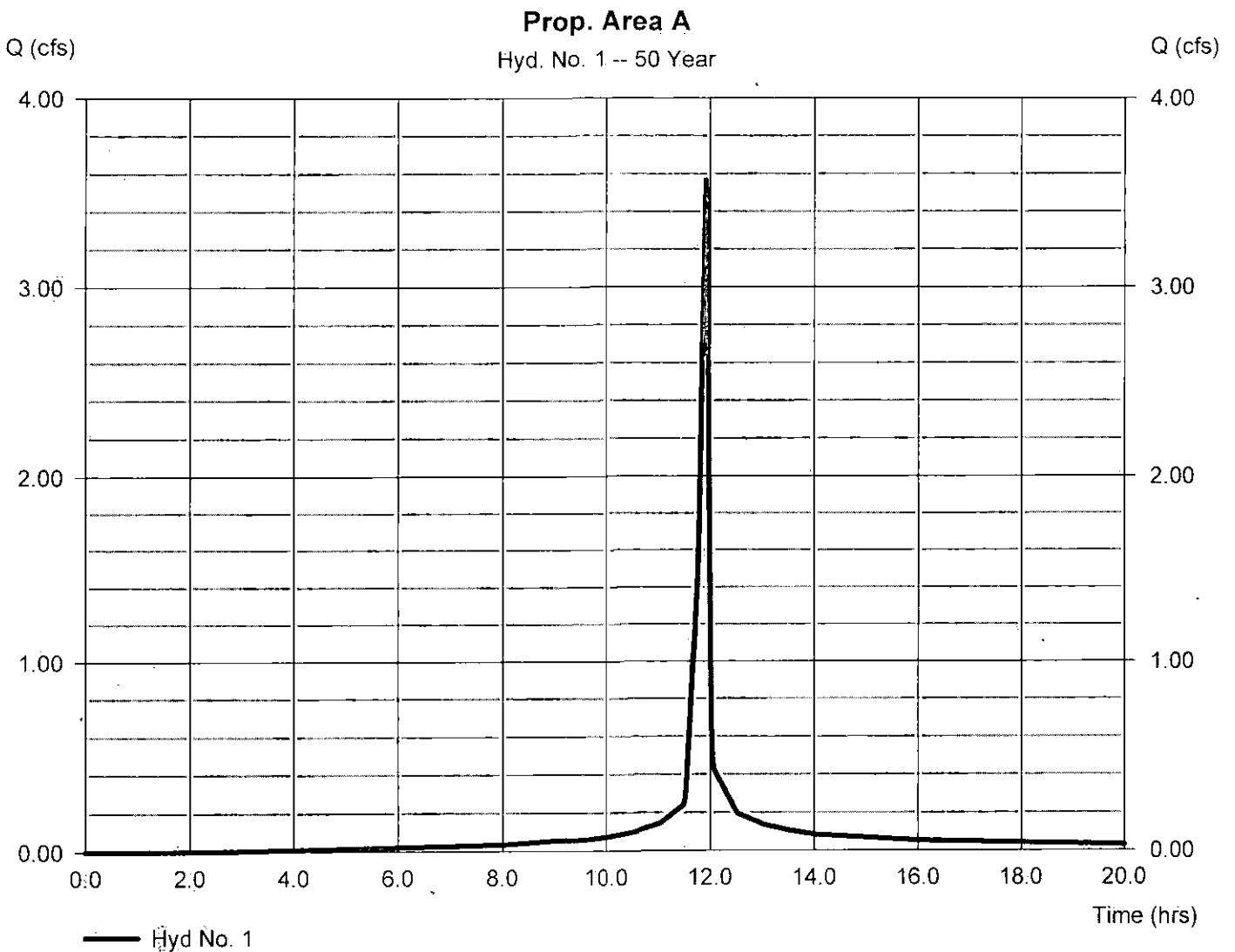
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02/11/2014

Hyd. No. 1

Prop. Area A

Hydrograph type	= SCS Runoff	Peak discharge	= 3.567 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.92 hrs.
Time interval	= 1 min.	Hyd. volume	= 7,165 cuft
Drainage area	= 0.350 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.70 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

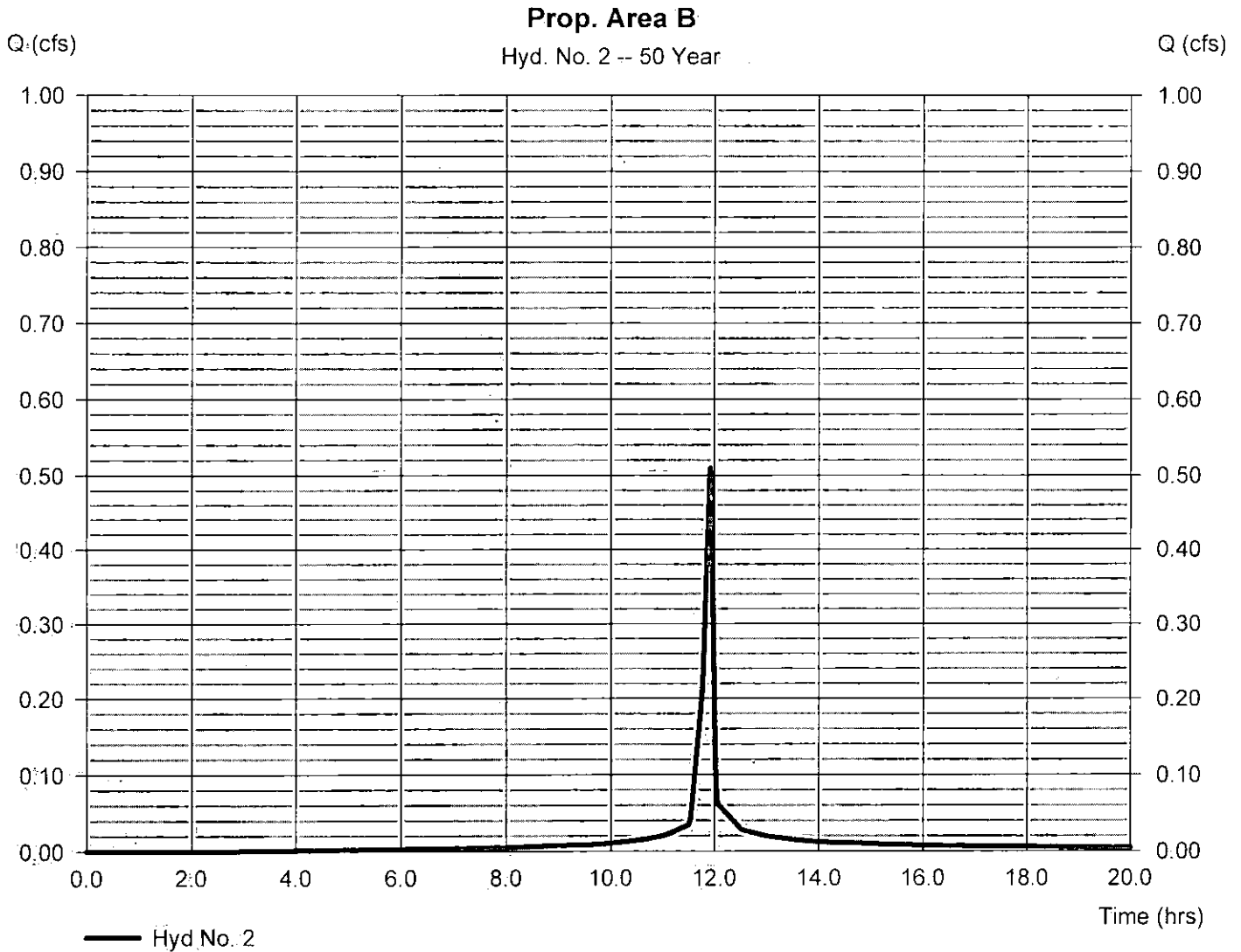
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02/11/2014

Hyd. No. 2

Prop. Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.510 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 1,024 cuft
Drainage area	= 0.050 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.90 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

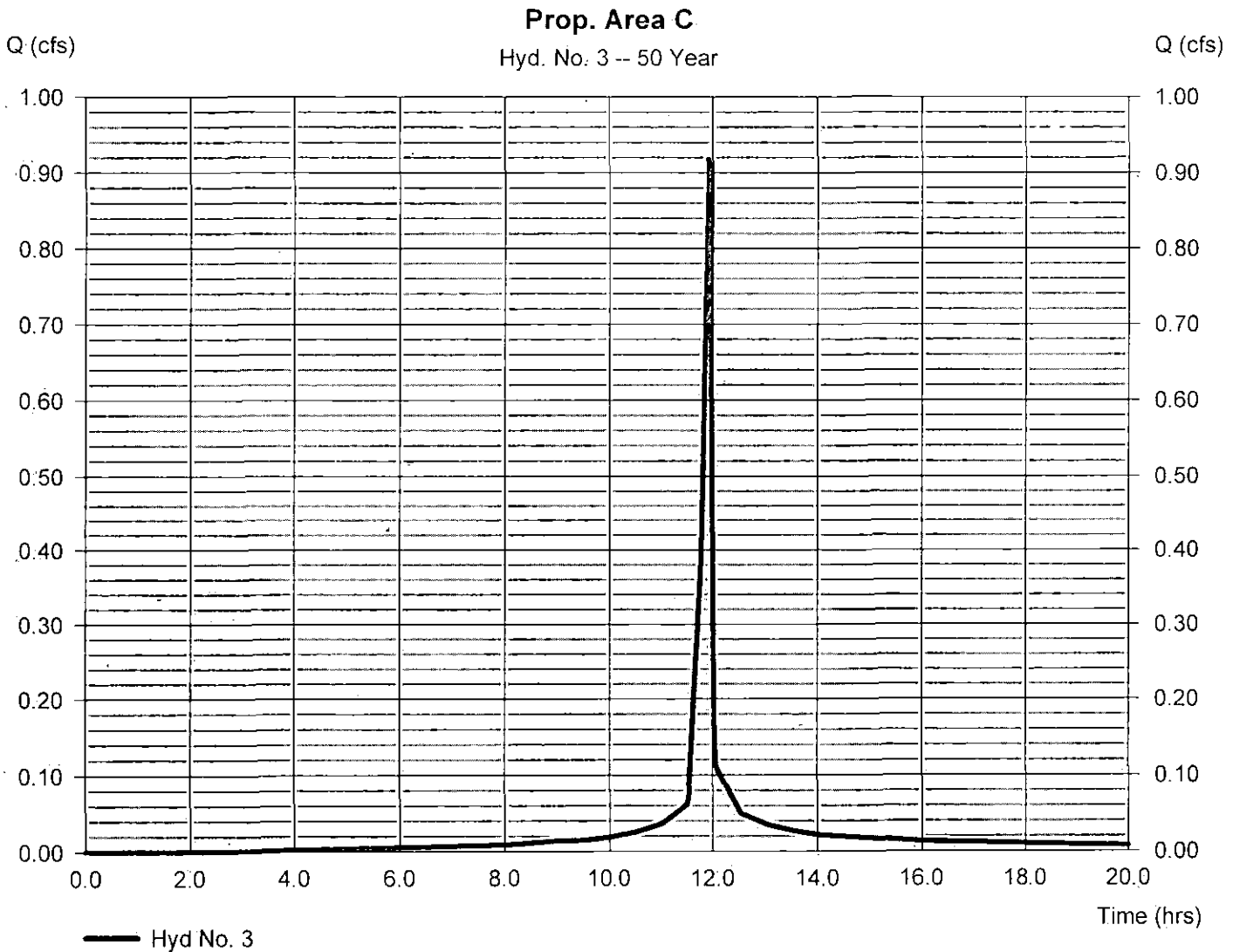
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 3

Prop. Area C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.917 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min.	Hyd. volume	= 1,842 cuft
Drainage area	= 0.090 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.60 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.960	1	715	8,012	----	----	----	Prop. Area A
2	SCS Runoff	0.566	1	715	1,145	----	----	----	Prop. Area B
3	SCS Runoff	1.018	1	715	2,060	----	----	----	Prop. Area C
New.gpw					Return Period: 100 Year		Tuesday, 02 / 11 / 2014		

Hydrograph Report

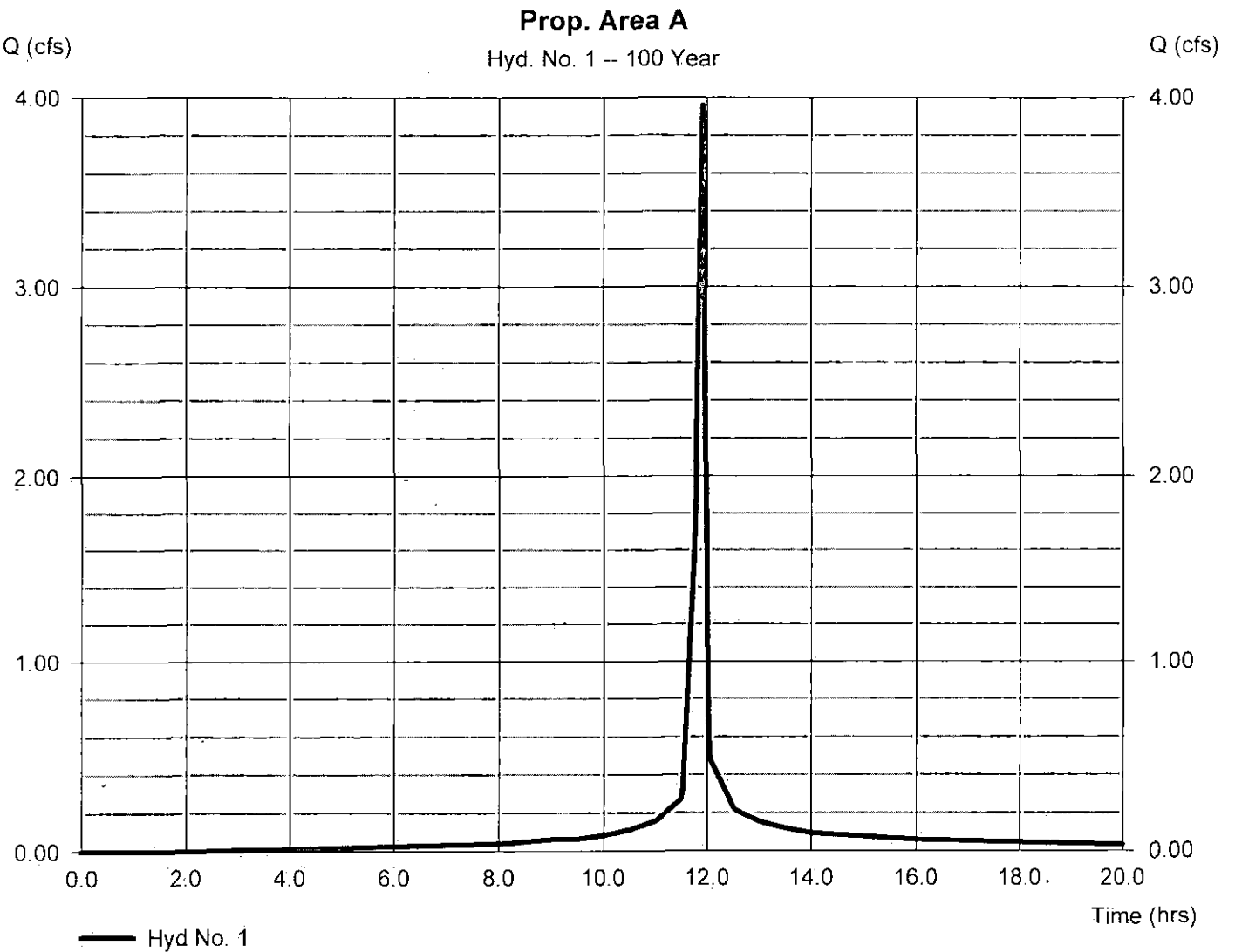
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 1

Prop. Area A

Hydrograph type	= SCS Runoff	Peak discharge	= 3.960 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 8,012 cuft
Drainage area	= 0.350 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.70 min
Total precip.	= 7.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

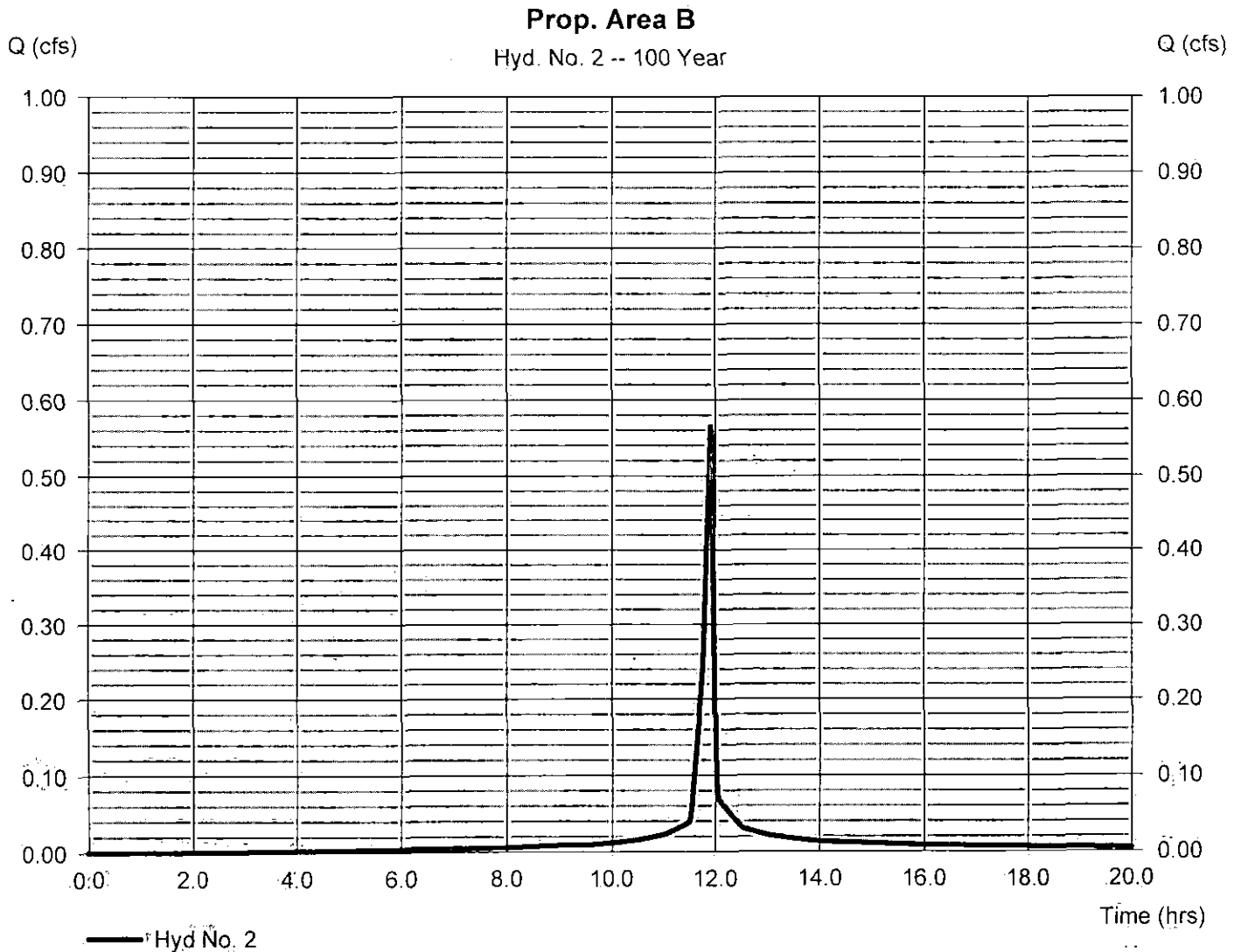
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 02 / 11 / 2014

Hyd. No. 2

Prop. Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.566 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 1,145 cuft
Drainage area	= 0.050 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.90 min
Total precip.	= 7.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

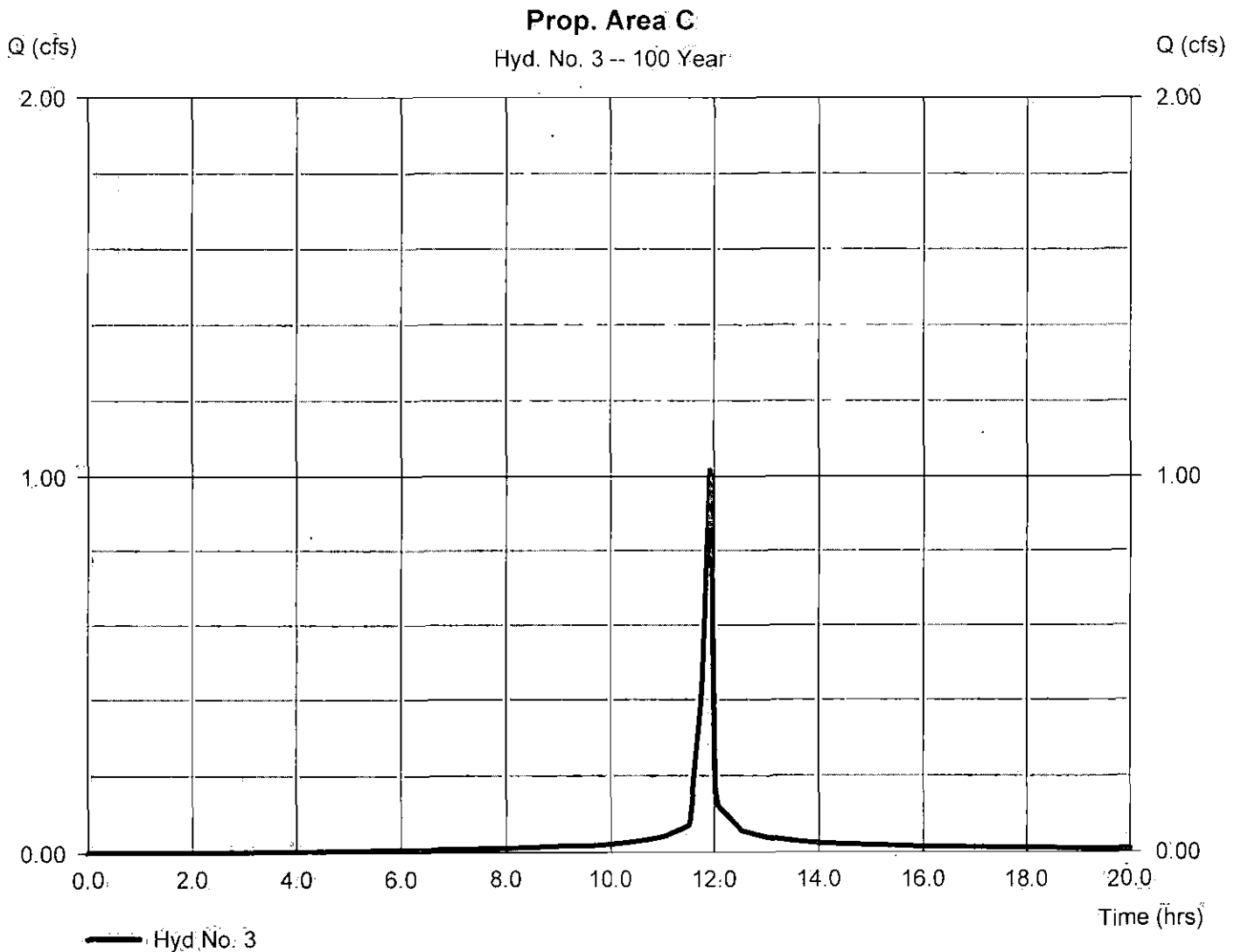


Hydrograph Report

Hyd. No. 3

Prop: Area C

Hydrograph type	= SCS Runoff	Peak discharge	= 1.018 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 2,060 cuft
Drainage area	= 0.090 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 1.60 min
Total precip.	= 7.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



21ST AND AMIDON ADDITION

EXHIBIT 2-3

Project
Feature
Analyst
Version
Notes

21st and Amidon Addition
EXISTING DRAINAGE
Scott R. Servis P.E.
20110418
.....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	Existing Area "A"	1	0.0	8.2	0.0	0.0	0.0	0.0	8.2	530	2	0.28	1.08	4.9	0.082	0.28
2	Existing Area "B"	3	5.7	1.4	0.5	0.0	0.0	0.0	7.6	636	11	1.67	1.39	4.6	0.076	0.22
3	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.00	0.00	0.0	0.000	0
4	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.00	0.00	0.0	0.000	0
5	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.00	0.00	0.0	0.000	0
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	3.48	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 Area "B"
Drainage Area (ac)	0.22
Drainage Area (sq mi)	0.00034375

Sheet Flow						Total
Select (0 or 1)	1	10	0	0	0	1 segments
Length (ft)	126	1	1	1	1	26 feet length
Top Elevation (ft)	1315	1	1	1	1	
Bottom Elevation (ft)	1315	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)	0	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0119	0.0000	0.0000	0.0000	0.0000	
Slope (%)	1.19	0.00	0.00	0.00	0.00	
Velocity (fps)	0.08					
Travel Time (hrs)	0.095					
Travel Time (mins)	5.71					5.7 mins travel

Shallow Concentrated Flow						Total
Select (0 or 1)	1	10	0	0	0	1 segments
Length (ft)	155	1	1	1	1	155 feet length
Top Elevation (ft)	1315.16	1	1	1	1	
Bottom Elevation (ft)	1314	1	1	1	1	
Cover	20.3 Paved	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	20.30	0.00	0.00	0.00	0.00	
Drop (ft)	1	0	0	0	0	1.3 feet drop
Slope (ft/ft)	0.0083	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.83	0.00	0.00	0.00	0.00	
Velocity (fps)	1.85					
Travel Time (mins)	1.39					1.4 mins travel

Open Channel Ditch Flow						Total
Select (0 or 1)	1	10	0	0	0	1 segments
Length (ft)	455	1145	1	1	1	455 feet length
Top Elevation (ft)	1365	164.23	1	1	1	
Bottom Elevation (ft)	1356	162.8	1	1	1	
Channel Lining	0.03 Grassed	0.05 Rough Natural Stream	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	6.00	8.00	1.00	1.00	1.00	
Left Side Slope (H:V)	4.00	3.00	1.00	1.00	1.00	
Right Side Slope (H:V)	3.00	3.00	1.00	1.00	1.00	
Depth (ft)	6.00	8.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.050	0.000	0.000	0.000	
Drop (ft)	9	0	0	0	0	9 feet drop
Slope (ft/ft)	0.0198	0.0012	0.0000	0.0000	0.0000	
Slope (%)	1.98	0.12	0.00	0.00	0.00	
Flow Area (sq ft)	162.00	256.00	2.00	2.00	2.00	
Wet Perimeter (ft)	49.71	58.60	3.83	3.83	3.83	
Hydraulic Radius (ft)	3.28	4.37	0.52	0.52	0.52	
Velocity (fps)	15.35					
Normal Flow (cfs)	2487.3					
Travel Time (mins)	0.49					0.5 mins travel

Open Channel Pipe Flow						Total
Select (0 or 1)	10	10	0	0	0	0 segments
Length (ft)	131	1400	1352	215	182	0 feet length
Top Elevation (ft)	167.9	167.02	66.48	65.96	65.23	
Bottom Elevation (ft)	167.02	66.48	66.2	65.7	64.23	
Pipe Material	0.017 Rough concrete	0.017 Rough concrete	0.017 Rough concrete	0.017 Rough concrete	0.024 Corrugated Metal	
Diameter (ins)	18.00	24.00	30.00	36.00	48.00	
Flow Depth (ins)	18.00	24.00	30.00	36.00	48.00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.017	0.017	0.017	0.024	
Drop (ft)	1	0	0	0	1	0 feet drop
Slope (ft/ft)	0.0067	0.0013	0.0008	0.0012	0.0058	
Slope (%)	0.67	0.13	0.08	0.12	0.55	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	1.77	3.14	4.91	7.07	12.57	
Wet Perimeter (ft)	4.71	6.28	7.85	9.42	12.57	
Hydraulic Radius (ft)	0.38	0.50	0.63	0.75	1.00	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	12.30	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)						Total
Select (0 or 1)	10	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	12.00	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	3
Length (ft)	636
Drop (ft)	11
Slope (ft/ft)	0.0167

21ST AND AMIDON ADDITION

EXHIBIT 2-4

1988 Drainage Criteria Manual
City of Wichita, Kansas
Rainfall Intensity Table for Sedgwick County, KS

The following tabulation contains rainfall intensity in inches per hour as derived from ESSA Weather Bureau Technical Paper 40 Modified to NWS Hydro-35, 1977 During First Hour.

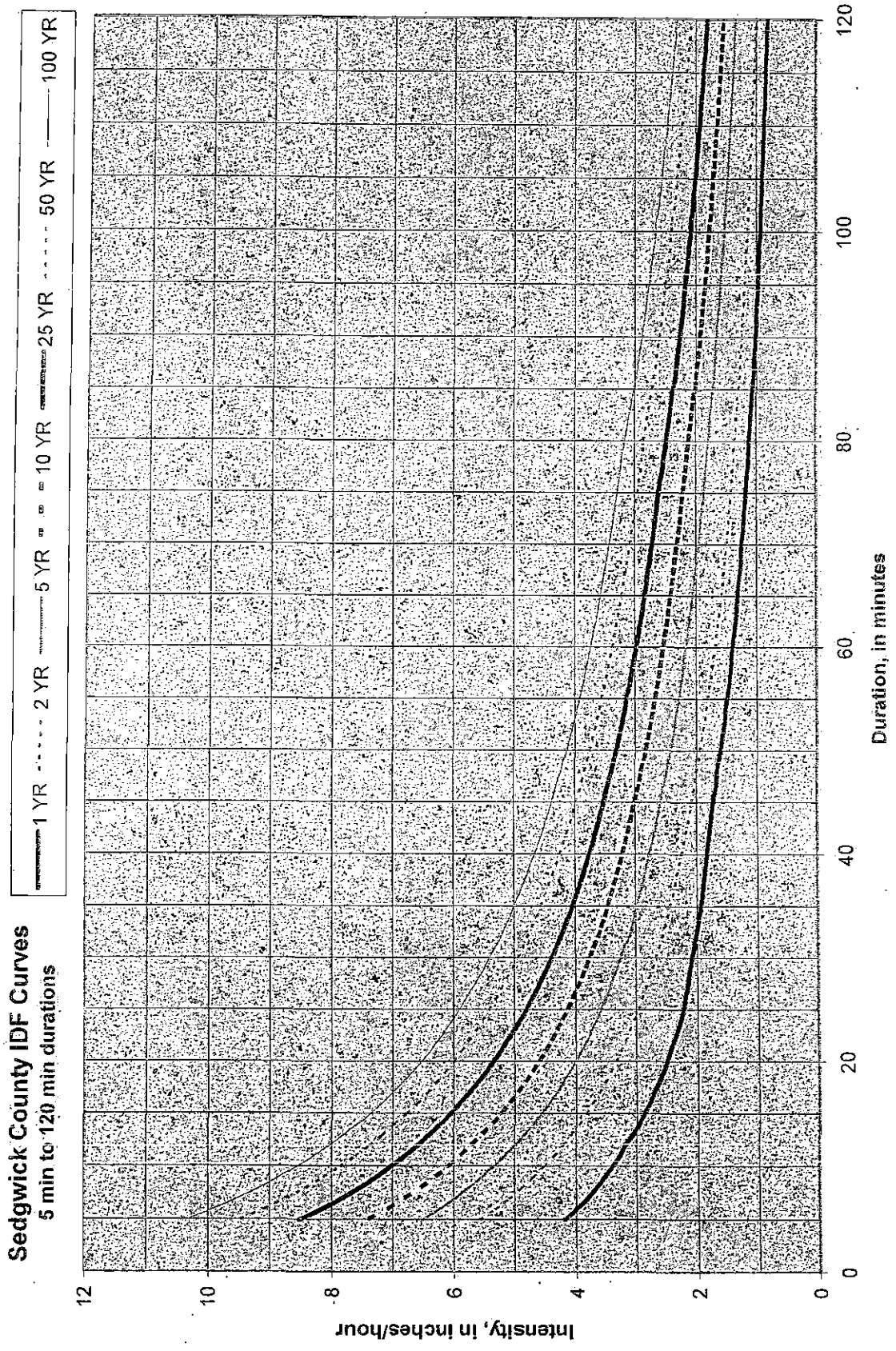
Table 1 Rainfall Intensity Table (Duration 15 min - 120 min)

DURATION in hours	DURATION in minutes	RETURN PERIOD						
		1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0.0833	5	4.18	5.57	6.53	7.41	8.52	9.48	10.32
0.1000	6	3.99	5.32	6.25	7.09	8.16	9.09	9.89
0.1167	7	3.81	5.09	5.99	6.81	7.84	8.74	9.50
0.1333	8	3.66	4.89	5.75	6.55	7.55	8.42	9.15
0.1500	9	3.52	4.70	5.54	6.31	7.28	8.13	8.83
0.1667	10	3.39	4.52	5.34	6.09	7.04	7.86	8.54
0.1833	11	3.27	4.36	5.16	5.89	6.81	7.61	8.27
0.2000	12	3.18	4.21	4.99	5.71	6.60	7.38	8.02
0.2167	13	3.05	4.08	4.84	5.53	6.41	7.17	7.79
0.2333	14	2.96	3.95	4.69	5.37	6.23	6.97	7.57
0.2500	15	2.87	3.83	4.56	5.22	6.06	6.78	7.37
0.2667	16	2.78	3.72	4.43	5.08	5.90	6.60	7.18
0.2833	17	2.71	3.61	4.31	4.95	5.75	6.44	7.00
0.3000	18	2.63	3.51	4.20	4.83	5.61	6.29	6.84
0.3167	19	2.56	3.42	4.10	4.71	5.47	6.14	6.68
0.3333	20	2.50	3.33	4.00	4.60	5.35	6.00	6.53
0.3500	21	2.44	3.25	3.90	4.50	5.23	5.87	6.39
0.3667	22	2.38	3.17	3.81	4.40	5.12	5.75	6.26
0.3833	23	2.32	3.10	3.73	4.31	5.01	5.63	6.13
0.4000	24	2.27	3.03	3.65	4.22	4.91	5.52	6.01
0.4167	25	2.22	2.96	3.57	4.13	4.81	5.41	5.90
0.4333	26	2.20	2.90	3.50	4.05	4.72	5.31	5.79
0.4500	27	2.16	2.84	3.43	3.98	4.63	5.21	5.69
0.4667	28	2.14	2.78	3.37	3.90	4.55	5.12	5.59
0.4833	29	2.11	2.72	3.30	3.83	4.47	5.03	5.49
0.5000	30	2.08	2.67	3.24	3.76	4.39	4.94	5.40
0.5167	31	2.05	2.62	3.19	3.70	4.32	4.86	5.32
0.5333	32	2.02	2.57	3.10	3.63	4.25	4.79	5.22
0.5500	33	1.99	2.52	3.05	3.57	4.18	4.71	5.14
0.5667	34	1.96	2.48	3.01	3.51	4.11	4.63	5.07
0.5833	35	1.93	2.44	2.98	3.46	4.05	4.56	5.00
0.6000	36	1.91	2.39	2.93	3.41	3.99	4.50	4.93
0.6167	37	1.89	2.35	2.88	3.36	3.93	4.43	4.86
0.6333	38	1.87	2.32	2.84	3.31	3.87	4.37	4.79
0.6500	39	1.85	2.28	2.80	3.26	3.82	4.31	4.73
0.6667	40	1.83	2.24	2.76	3.22	3.76	4.25	4.66
0.6833	41	1.81	2.21	2.72	3.17	3.71	4.19	4.60
0.7000	42	1.79	2.18	2.68	3.13	3.66	4.13	4.54
0.7167	43	1.77	2.14	2.64	3.09	3.61	4.08	4.49
0.7333	44	1.75	2.11	2.61	3.05	3.57	4.03	4.43

Appendix B

DURATION in hours	DURATION in minutes	RETURN PERIOD						
		1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0.7500	45	1.73	2.08	2.57	3.01	3.52	3.98	4.38
0.7667	46	1.70	2.05	2.54	2.97	3.48	3.93	4.33
0.7833	47	1.67	2.02	2.50	2.93	3.44	3.88	4.28
0.8000	48	1.66	2.00	2.47	2.90	3.39	3.84	4.23
0.8167	49	1.64	1.97	2.44	2.86	3.35	3.79	4.18
0.8333	50	1.61	1.95	2.41	2.83	3.32	3.75	4.13
0.8500	51	1.59	1.92	2.38	2.79	3.28	3.71	4.09
0.8667	52	1.56	1.89	2.35	2.76	3.24	3.67	4.05
0.8833	53	1.54	1.86	2.33	2.73	3.20	3.63	4.00
0.9000	54	1.52	1.84	2.30	2.70	3.17	3.59	3.96
0.9167	55	1.50	1.81	2.27	2.67	3.14	3.55	3.92
0.9333	56	1.47	1.79	2.25	2.64	3.10	3.51	3.88
0.9500	57	1.45	1.76	2.22	2.61	3.07	3.48	3.84
0.9667	58	1.43	1.74	2.20	2.59	3.04	3.44	3.81
0.9833	59	1.42	1.72	2.18	2.56	3.01	3.41	3.77
1.0000	60	1.40	1.69	2.15	2.53	2.98	3.37	3.73
1.0167	61	1.38	1.67	2.13	2.51	2.95	3.34	3.70
1.0333	62	1.36	1.65	2.11	2.48	2.92	3.31	3.67
1.0500	63	1.34	1.63	2.09	2.46	2.89	3.28	3.63
1.0667	64	1.33	1.61	2.07	2.44	2.86	3.25	3.60
1.0833	65	1.31	1.59	2.05	2.41	2.84	3.22	3.57
1.1000	66	1.30	1.57	2.03	2.39	2.81	3.19	3.54
1.1167	67	1.28	1.56	2.01	2.37	2.79	3.16	3.51
1.1333	68	1.26	1.54	1.99	2.35	2.76	3.13	3.48
1.1500	69	1.25	1.52	1.97	2.33	2.74	3.10	3.45
1.1667	70	1.24	1.50	1.95	2.31	2.71	3.08	3.42
1.1833	71	1.22	1.49	1.93	2.28	2.69	3.05	3.39
1.2000	72	1.21	1.47	1.92	2.26	2.67	3.02	3.36
1.2167	73	1.20	1.46	1.90	2.25	2.64	3.00	3.34
1.2333	74	1.18	1.44	1.88	2.23	2.63	2.98	3.31
1.2500	75	1.17	1.43	1.86	2.21	2.61	2.95	3.29
1.2667	76	1.16	1.41	1.85	2.19	2.58	2.93	3.26
1.2833	77	1.15	1.40	1.83	2.17	2.55	2.90	3.24
1.3000	78	1.13	1.38	1.82	2.15	2.53	2.88	3.22
1.3167	79	1.12	1.37	1.80	2.14	2.50	2.86	3.19
1.3333	80	1.11	1.36	1.79	2.12	2.48	2.84	3.16
1.3500	81	1.10	1.34	1.77	2.10	2.46	2.82	3.13
1.3667	82	1.09	1.33	1.76	2.08	2.43	2.79	3.10
1.3833	83	1.08	1.32	1.74	2.06	2.41	2.76	3.07
1.4000	84	1.07	1.31	1.73	2.04	2.39	2.74	3.04
1.4167	85	1.07	1.30	1.72	2.02	2.37	2.71	3.01
1.4333	86	1.05	1.28	1.70	2.00	2.34	2.69	2.99
1.4500	87	1.04	1.27	1.69	1.99	2.32	2.66	2.96
1.4667	88	1.03	1.26	1.68	1.97	2.30	2.64	2.93
1.4833	89	1.02	1.25	1.68	1.95	2.28	2.62	2.91
1.5000	90	1.01	1.24	1.66	1.93	2.26	2.59	2.88
1.5167	91	1.00	1.23	1.65	1.92	2.24	2.57	2.86
1.5333	92	1.00	1.22	1.63	1.90	2.22	2.55	2.83
1.5500	93	0.99	1.21	1.62	1.89	2.20	2.53	2.81
1.5667	94	0.98	1.20	1.61	1.87	2.19	2.51	2.79
1.5833	95	0.97	1.19	1.59	1.85	2.17	2.49	2.76

DURATION in hours	DURATION in minutes	RETURN PERIOD						
		1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
1.6000	96	0.96	1.18	1.58	1.84	2.15	2.46	2.74
1.6167	97	0.96	1.17	1.57	1.82	2.13	2.44	2.72
1.6333	98	0.95	1.16	1.56	1.81	2.12	2.42	2.70
1.6500	99	0.94	1.15	1.54	1.80	2.10	2.41	2.67
1.6667	100	0.93	1.14	1.53	1.78	2.08	2.39	2.65
1.6833	101	0.93	1.13	1.52	1.77	2.08	2.39	2.65
1.7000	102	0.92	1.13	1.51	1.75	2.05	2.35	2.61
1.7167	103	0.91	1.12	1.50	1.74	2.04	2.33	2.59
1.7333	104	0.90	1.11	1.49	1.73	2.02	2.31	2.57
1.7500	105	0.90	1.10	1.47	1.72	2.01	2.30	2.55
1.7667	106	0.89	1.09	1.46	1.70	1.99	2.28	2.54
1.7833	107	0.88	1.09	1.45	1.69	1.98	2.26	2.52
1.8000	108	0.88	1.08	1.44	1.68	1.96	2.25	2.50
1.8167	109	0.87	1.07	1.43	1.67	1.95	2.23	2.48
1.8333	110	0.87	1.06	1.42	1.65	1.93	2.21	2.46
1.8500	111	0.86	1.06	1.41	1.64	1.92	2.20	2.45
1.8667	112	0.85	1.05	1.40	1.63	1.91	2.18	2.43
1.8833	113	0.85	1.04	1.39	1.62	1.89	2.17	2.41
1.9000	114	0.84	1.03	1.38	1.61	1.88	2.15	2.40
1.9167	115	0.84	1.03	1.37	1.60	1.87	2.14	2.38
1.9333	116	0.83	1.02	1.36	1.59	1.86	2.12	2.36
1.9500	117	0.82	1.01	1.36	1.58	1.84	2.11	2.35
1.9667	118	0.82	1.01	1.35	1.57	1.83	2.09	2.33
1.9833	119	0.81	1.00	1.34	1.56	1.82	2.08	2.32
2.0000	120	0.81	0.99	1.33	1.55	1.81	2.07	2.30



21ST AND AMIDON ADDITION

EXHIBIT 2-5

3.0 Post-Development Conditions Information

3.1 Post-Development Conditions Drainage Map

3.1.1 Proposed Project Boundary

The one-step final plat showing property boundaries is included as Exhibit 1-3.

3.1.2 On-Site and Off-Site Topography

Topography in the area is shown on the drainage plan, Exhibit 1-1.

3.1.3 Existing On-Site and Off-Site Drainage Features Remaining

Storm water runoff will be slowly released to 21st Street North and Amidon Avenue through a series of curb castings and small outlet pipes. The storm sewer and curb and gutter systems in 21st Street North and Amidon Avenue will for the most part remain unchanged, although a CIP project has been designed to improve this intersection. The curb and gutter in 21st Street North and Amidon Avenue will continue to route flow around the site to the west and north.

3.1.4 Location and Description of Off-Site Through-Drainage Conveyances

All offsite flows will continue to be routed around the site to the west, north, east and south by curb and gutter and flumes in 21st Street North, Amidon Avenue and the adjoining commercial properties. Required drainage improvements within these road right-of-ways due to this development is anticipated to be minimal.

3.1.5 Footprint of Proposed Impervious Areas

The total impervious area for the area to be developed, estimated based on actual land use, is estimated at 90% of the drainage areas. Therefore, the total impervious area on the entire site to be developed could be up to 0.45 acres. The total impervious area for the existing developed area within the platted boundary, estimated based on actual land use, is estimated at 98% of the drainage area. Therefore, the total impervious area on the existing portion of the site already developed is estimated to be 0.49 acres.

3.1.6 Location of Proposed Utilities

Proposed utilities shall be laid out as part of future construction plans to be submitted to the City for review. This shall include the extension of water mains to serve the proposed development and run in public utility easements. The plat (Exhibit 1-3) shows proposed easements, which will be the location for any future utilities. Additional utility easements likely will be dedicated by separate instrument as final site configuration is determined.

3.1.7 Delineation of Predominant Soils

The predominant soil type is discussed in section 2.1.8. See Exhibit 1-6 for NRCS Soil Survey map and information showing existing soil types and descriptions.

3.1.8 Land Use Cover per NRCS Nomenclature

All landscaped areas within the site currently have fair grass cover. The balance of the site is either paved or covered with existing buildings.

3.1.9 Internal Drainage/Sub-Basin Boundaries

The proposed drainage plan (Exhibit 1-1) delineates the proposed internal sub-basins and Exhibit 3-1 shows a table of the areas.

3.1.10 Proposed Limits of Land Disturbing Activity

Clearing and grading shall be done only as needed for development and will be established upon any submittal for site improvements.

3.1.11 Time of Concentration Flow Paths

The proposed drainage plan in Exhibit 1-1 shows the general flow paths for each drainage area in the two main basins. The sub-basin site drainage will be collected in proposed curb castings and drain into the existing streets through a series of small outlet pipes. The flow to these areas is mostly sheet flow with minor concentrated flow at the lower ends of the basins. Offsite drainage flows around the site to the west, north, east and south in curb and gutter and flumes in 21st Street North, Amidon Avenue and the adjoining commercial properties. These roadways and the site ultimately discharge to the Arkansas River to the south of the site and the Little Arkansas River to the east of the site.

3.2 Proposed Conveyances Map

3.2.1 On-Site and Off-Site Drainage Features Proposed

Existing conveyance systems are shown on Exhibit 1-1.

3.2.2 Storm Sewer System Components

Proposed changes to existing systems are discussed in Section 3.1.11 and further lot development would include adding curb castings and associated outlet pipes at sump areas as needed in proposed parking areas or common access drives discharging to the 21st Street North and Amidon Avenue Rights-of-Way. Any additional storm sewer designs shall comply with the latest City of Wichita design criteria to convey any added site runoff.

3.2.3 Stormwater Flow for Sub-Basin or Drainage Area > 40 Acres

Proposed drainage areas and sub-basin do not exceed 40 acres.

3.2.4 Location of Stormwater Management Facilities

A series of curb castings and small outlet pipes along the north and west property lines will be designed to catch runoff and slowly release it to the adjoining streets.

3.2.5 Proposed Energy Dissipaters and Other Channel Protection Devices

The outlets for the proposed curb castings will be piped to existing curb and gutter in 21st Street North and Amidon Avenue to reduce erosion.

3.2.6 Locations and Dimensions of Proposed Channel, Bridge, and Culvert Crossings

No channel, bridge or culvert crossings are proposed within the site.

3.2.7 Normal Pool and 100-Year Pool Elevations for Ponds and Lakes

The site is under one acre in size and thus a proposed detention cell is not required or planned.

3.2.8 Permanent Concrete Outfall Control Structures for Ponds

The site is under one acre in size and thus a proposed detention cell is not required or planned.

3.2.9 Emergency Overflow Spillways and Top of Berm Elevations for Ponds

The site is under one acre in size and thus a proposed detention cell is not required or planned. All runoff from the site will be routed to 21st Street North and Amidon Avenue through a series of curb castings and small outlet pipes designed to slowly release runoff to the adjoining street rights-of-way.

3.2.10 Floodplains, Ponds, and Stormwater Management Facilities Located in Reserves

This site is not within the limits of a delineated FEMA Floodplain. Changes to this Drainage Plan must be approved by the appropriate governing body prior to issuing any building permit to ensure that drainage requirements are met.

3.3 Post-Development Conditions Hydrology and Hydraulics

3.3.1 Narrative of the Hydrologic Analysis Methodology

The analysis was completed using the SCS Hydrograph method. The 1, 2, 5, 10, 25, & 100 year, 24-hour storm events were evaluated. The analysis information appears in Exhibit 3-2.

3.3.2 Summary Table of Drainage Sub-Basin Hydrologic Parameters

Drainage Basin	Area (Acres)	Curve Number	T _c (min)
Area "A"	0.35	92.0	1.7
Area "B"	0.05	92.0	1.9
Area "C"	0.09	92.0	1.4

3.3.3 Table of Post-Development Condition Runoff Curve Numbers

For the post-development condition, the curve numbers were weighted based on area of their respective hydrologic soil groups over the site and include adjustment for impervious areas. The results are shown in the table below.

Area "A"		Hydrologic Group	Area		% of Area	CN
Soil #	Soil Information		Square Feet	Acres	%	Existing
6250	Urban land-Canadian complex, 0 to 3% slopes	B	15106.00	0.347	100.00%	92.0
		TOTALS	15106.00	0.347	100.00%	92.0

Area "B"		Hydrologic Group	Area		% of Area	CN
Soil #	Soil Information		Square Feet	Acres	%	Existing
6250	Urban land-Canadian complex, 0 to 3% slopes	B	2178.00	0.050	100.00%	92.0
		TOTALS	2178.00	0.050	100.00%	92.0

Area "B"		Hydrologic Group	Area		% of Area	CN
Soil #	Soil Information		Square Feet	Acres	%	Existing
6250	Urban land-Canadian complex, 0 to 3% slopes	B	3920.00	0.090	100.00%	92.0
		TOTALS	3920.00	0.090	100.00%	92.0

3.3.4 Table of Post-Development Condition Times of Concentration

Area	T _c (min)
Area "A"	1.7
Area "B"	1.9
Area "B"	1.4

Supporting data and calculations are found on the time of concentration worksheet attached as Exhibit 3-3.

3.3.5 Cross-Sections and Other Diagrams of Hydraulic Features

All proposed channels/ditches shall have maximum side slopes of 4:1.

3.3.6 Hydrologic and Hydraulic Analyses

Post-development condition analysis report attached as Exhibit 3-2.

3.3.7 Downstream Peak Discharge Assessment (10% Rule)

This site is under one acre in size and thus a downstream peak discharge assessment has not been completed.

3.3.8 Stage-Storage-Discharge Curves

Stage-Storage-Discharge Curves were not generated for this site, as total site area is well under 1 acre in size and detention is therefore not required.

3.3.9 Pond Contours on the Master Grading Plan

This site is under one acre in size and thus on-site detention is not required.

3.3.10 One Foot of Freeboard Above the 100-Year, 24-Hour High Water Level

This site is under one acre in size and thus on-site detention is not required.

3.3.11 Runoff Discharge Comparison

This site is under one acre in size and thus on-site detention is not required.

3.4 Stormwater Quantity Control Sizing

3.4.1 Hydraulic Sizing Calculations

Storm water controls will include appropriate inlet and pipe networks at locations to be finalized as part of the construction plans. No proposed layouts of storm sewer networks have been included as part of this drainage study, as final site configuration of this property has yet to be determined. Pipe networks to convey the five-year storm at a minimum will be designed. Sump locations in specific drainage areas will have flows routed overland to other low points and carried through the remainder of the system.

3.4.2 Table of Stormwater Quantity Management Controls

A summary table of the proposed storm sewer networks has not been included in this report as final site configurations are not known at this time. A supplementary drainage study will be submitted including these calculations once lot configuration is better defined.

3.4.3 Typical Details

All structures shall conform to City of Wichita standards.

3.5 Stormwater Quality Management Facilities

3.5.1 Table of Stormwater Quality Management Facilities

Facilities are listed in Exhibit 3-5.

3.5.2 Maintenance Responsibility of Stormwater Management Facilities

The maintenance of storm water management facilities shall be the responsibility of the owner and shall be transferred to new owner upon the sale of any part thereof.

3.5.3 Water Quality Volume

Water quality treatment for site runoff is not required, as this site is under one acre in size.

3.5.4 % TSS Removal Value

Water quality treatment for site runoff is not required, as this site is under one acre in size.

3.5.5 Channel Protection Volume

Channel protection volume for site runoff is not required, as this site is under one acre in size.

3.5.6 Water Quality Volume and Channel Protection Volume Orifice Sizing

Water quality treatment for site runoff is not required, as this site is under one acre in size.

3.5.7 Additional Calculations

No additional calculations at this time.

3.5.8 Typical Details

All structures shall conform to City of Wichita standards.

21ST AND AMIDON ADDITION

EXHIBIT 3-1

21ST AND AMIDON ADDITION SUB-BASIN AREAS

EXISTING

PROPOSED

Parcel Name	Square Feet	Acres	Parcel Name	Square Feet	Acres
Area "A"	12,196.80	0.28	Area "A"	15,246.00	0.35
Area "B"	9,583.20	0.22	Area "B"	2,178.00	0.05
Area "A"		0.28	Area "C"	3,920.40	0.09
Area "B"		0.22	Area "A"		0.35
			Area "B"		0.05
			Area "C"		0.09
Total		0.50	Total		0.49

21ST AND AMIDON ADDITION

EXHIBIT 3-2

On site detention is not required as this site is well under 1 acre in size. However, the site will be designed in such a manner as to slowly release runoff into the adjoining arterial streets via curb castings and outlet pipes or curb cuts.

21ST AND AMIDON ADDITION

EXHIBIT 3-3

Project
Feature
Analyst
Version:
Notes

2.1strand Amidon/Addition
PROPOSED DRAINAGE
Scott R. Semis, P.E.
20110418
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	Proposed Area "A"	1	0.0	1.7	0.0	0.0	0.0	0.0	1.7	183	1	0.78	1.79	1.0	0.017	0.35
2	Proposed Area "B"	2	1.7	0.2	0.0	0.0	0.0	0.0	1.9	52	1	2.23	0.46	1.1	0.019	0.05
3	Proposed Area "C"	2	1.4	0.0	0.0	0.0	0.0	0.0	1.4	37	2	5.41	0.45	0.8	0.014	0.09
4	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.00	0.00	0.0	0.000	0
5	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.00	0.00	0.0	0.000	0
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	3.48	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	Proposed Area "B"
Drainage Area (ac)	0.05
Drainage Area (sq mi)	0.000078125

Sheet Flow

selected>> Select (0 or 1)	1	0	0	0	0	0	0	0	1 segments
Length (ft)	8	1	1	1	1	1	1	1	8 feet length
Top Elevation (ft)	1317	1	1	1	1	1	1	1	
Bottom Elevation (ft)	1317	1	1	1	1	1	1	1	
Cover	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	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	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	0	0	0	0	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Velocity (fps)	0.08								
Travel Time (hrs)	0.028								
Travel Time (mins)	1.65								1.7 mins travel

Shallow Concentrated Flow

selected>> Select (0 or 1)	1	0	0	0	0	0	0	0	1 segments
Length (ft)	44	1	1	1	1	1	1	1	44 feet length
Top Elevation (ft)	1316.18	1	1	1	1	1	1	1	
Bottom Elevation (ft)	1315	1	1	1	1	1	1	1	
Cover	20.3 Paved	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"									
Surface Coeff (dim)	20.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Drop (ft)	1	0	0	0	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0218	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Velocity (fps)	3.00								
Travel Time (mins)	0.24								0.2 mins travel

Open Channel Ditch Flow

Select (0 or 1)	0	0	0	0	0	0	0	0	0 segments
Length (ft)	455	11145	1	1	1	1	1	1	0 feet length
Top Elevation (ft)	1365	64.23	1	1	1	1	1	1	
Bottom Elevation (ft)	1356	52.8	1	1	1	1	1	1	
Channel Lining	0.03 Grassed	0.05 Rough Natural Stream	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	6.00	8.00	1.00	1.00	1.00	1.00	1.00	1.00	
Left Side Slope (H:V)	4.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	
Right Side Slope (H:V)	3.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	
Depth (ft)	6.00	8.00	1.00	1.00	1.00	1.00	1.00	1.00	
Specify alternate "n"									
Manning "n" (dim)	0.030	0.050	0.000	0.000	0.000	0.000	0.000	0.000	
Drop (ft)	9	1	0	0	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0198	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Slope (%)	1.98	0.12	0.00	0.00	0.00	0.00	0.00	0.00	
Flow Area (sq ft)	162.00	256.00	2.00	2.00	2.00	2.00	2.00	2.00	
Wet Perimeter (ft)	49.71	56.60	3.83	3.83	3.83	3.83	3.83	3.83	
Hydraulic Radius (ft)	3.26	4.37	0.52	0.52	0.52	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	0	0	0	0 segments
Length (ft)	131	400	352	215	182	182	182	182	0 feet length
Top Elevation (ft)	67.9	167.02	66.48	65.96	65.23	65.23	65.23	65.23	
Bottom Elevation (ft)	67.02	66.48	66.2	65.7	64.23	64.23	64.23	64.23	
Pipe Material	0.017 Rough concrete	0.017 Rough concrete	0.017 Rough concrete	0.017 Rough concrete	0.024 Corrugated Metal	0.024 Corrugated Metal	0.024 Corrugated Metal	0.024 Corrugated Metal	
Diameter (ins)	18.00	24.00	30.00	36.00	48.00	48.00	48.00	48.00	
Flow Depth (ins)	18.00	24.00	30.00	36.00	48.00	48.00	48.00	48.00	
Specify alternate "n"									
Manning "n" (dim)	0.017	0.017	0.017	0.017	0.024	0.024	0.024	0.024	
Drop (ft)	1	1	0	0	1	1	1	1	0 feet drop
Slope (ft/ft)	0.0067	0.0013	0.0008	0.0012	0.0055	0.0055	0.0055	0.0055	
Slope (%)	0.67	0.13	0.08	0.12	0.55	0.55	0.55	0.55	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	1.77	3.14	4.91	7.07	12.57	12.57	12.57	12.57	
Wet Perimeter (ft)	4.71	6.28	7.85	9.42	12.57	12.57	12.57	12.57	
Hydraulic Radius (ft)	0.38	0.50	0.63	0.75	1.00	1.00	1.00	1.00	
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	0	0	0	0 segments
Length (ft)	150	1	1	1	1	1	1	1	0 feet length
Top Elevation (ft)	330	1	1	1	1	1	1	1	
Bottom Elevation (ft)	326	1	1	1	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	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	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	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	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	0	0	0	0 segments
Length (ft)	500	1	1	1	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Travel Time (mins)									0.0 mins travel

Total for Subbasin

Segments	2
Length (ft)	52
Drop (ft)	1
Slope (ft/ft)	0.0223

Subbasin Name	Proposed Area	CW
Drainage Area (ac)	0.09	
Drainage Area (sq mi)	0.000140625	

Sheet Flow						Total
Select (0 or 1)	1	1	0	10	0	2 segments
Length (ft)	127	10	1	1	1	37 feet length
Top Elevation (ft)	1317	1316	1	1	1	
Bottom Elevation (ft)	1316	1315	1	1	1	
Cover	0.011 Concrete asphalt etc	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.011	0.240	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	1	0	0	0	2 feet drop
Slope (ft/ft)	0.0222	0.1400	0.0000	0.0000	0.0000	
Slope (%)	2.22	14.00	0.00	0.00	0.00	
Velocity (fps)	1.15	0.17				
Travel Time (hrs)	0.006	0.017				
Travel Time (mins)	0.39	0.99				1.4 mins travel

Shallow Concentrated Flow						Total
Select (0 or 1)	0	0	0	10	0	0 segments
Length (ft)	200	1	1	1	1	0 feet length
Top Elevation (ft)	130	1	1	1	1	
Bottom Elevation (ft)	122	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)	8	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0400	0.0000	0.0000	0.0000	0.0000	
Slope (%)	4.00	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Open Channel Ditch Flow						Total
Select (0 or 1)	0	0	0	10	0	0 segments
Length (ft)	880	1	1	1	1	0 feet length
Top Elevation (ft)	1270	1	1	1	1	
Bottom Elevation (ft)	1260	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)	4.00	1.00	1.00	1.00	1.00	
Right Side Slope (H:V)	4.00	1.00	1.00	1.00	1.00	
Depth (ft)	15.00	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)	10	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0114	0.0000	0.0000	0.0000	0.0000	
Slope (%)	1.14	0.00	0.00	0.00	0.00	
Flow Area (sq ft)	225.00	1.00	2.00	2.00	2.00	
Wet Perimeter (ft)	66.23	2.83	3.83	3.83	3.83	
Hydraulic Radius (ft)	3.40	0.35	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow						Total
Select (0 or 1)	0	0	0	10	0	0 segments
Length (ft)	100	1	1	1	1	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						Total
Select (0 or 1)	0	0	0	10	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	130	1	1	1	1	
Bottom Elevation (ft)	126	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)						Total
Select (0 or 1)	0	0	0	10	0	0 segments
Length (ft)	1500	1	1	1	1	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)	37
Drop (ft)	2
Slope (ft/ft)	0.0541

21ST AND AMIDON ADDITION

EXHIBIT 3-4

This section has intentionally been omitted as the site will be drained through a series of curb castings and small outlet pipes. Public storm sewer is not available in either 21st Street North or Amidon Avenue.

21ST AND AMIDON ADDITION

EXHIBIT 3-5

TSS Removals are not required for this site, as the total site area is less than .1 acre in size.

21ST AND AMIDON ADDITION

EXHIBIT 3-6

4.0 Floodplains

4.1 Source of Flood Profile

Current FEMA mapping attached as Exhibit 1-9.

4.2 Nearest Base Flood Elevations

Existing base flood elevations are not applicable as this site is Levee Protected.

4.3 Delineation of Pre-Development Regulatory Floodplain/Floodway Limits

Current FEMA mapping attached as Exhibit 1.9.

4.4 Delineation of Post-Development Regulatory Floodplain/Floodway Limits

Site development will not affect current FEMA mapping.

4.5 Floodplain Data Table and Discharges

This site is outside the mapped FEMA Floodplain and is Levee Protected.

4.6 Hydrologic and Hydraulic Study Information

This site is outside the mapped FEMA Floodplain and is Levee Protected.

4.7 Provide regulatory floodway and four natural profile models (10, 50, 100, & 500-yr) for existing and future watershed conditions

This site is outside the mapped FEMA Floodplain and is Levee Protected.

4.8 Floodplains and Floodways Located within a Reserve

Not applicable to this development.

21ST AND AMIDON ADDITION

EXHIBIT 4-1

5.0 Federal, State, and Local Permits

5.1 US Army Corps of Engineers Regulatory Program Permits

Not applicable to this development.

5.2 Kansas Department of Agriculture Division of Water Resources Permits

Not applicable to this development.

5.3 Federal Emergency Management Agency (FEMA) Letter of Map Changes

Not applicable to this development.

6.0 Preliminary Master Grading Plan

See Exhibit 1-2 for Preliminary Grading Plan.