

DRAINAGE REPORT

FOR

PRESBYTERIAN MANORS ADDITION
Sedgwick County, Kansas

FEBRUARY 2013



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Checklist



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:	Presbyterian Manor Addition		
Total Area of Project:	15.7	acres	
Development Type:	Senior Living	Other:	
Developer Name:	PMMA, Inc.	Contact:	Bruce Shogren
		Phone:	(316) 652-6245
Email:	bshogren@pmma.org		
Engineer Name:	MKEC Engineering	Contact:	Kara Anderson
		Phone:	(316) 684-9600
Email:	kanderson@mkec.com		

Directions:

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

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

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
1.0	General		
1.1	Digital copy of drainage plan, including preliminary Master Grading Plan, preliminary plat and proposed plat, in PDF format and one half size, bound, paper copy.	yes	
1.2	Professional Engineer's seal, signature and date on plan cover.	yes	
1.3	Site location map, using color ortho-imagery and showing the project boundaries, a north arrow and an accurate scale.	yes	
1.4	Narrative of the development type, existing conditions and proposed impacts on stormwater runoff, wetlands, riparian zones and floodplains/floodways.	yes	
1.5	Discussion of off-site conditions surrounding the proposed development.	yes	
1.6	Summary table of runoff calculations (pre/post development).	yes	
1.7	Narrative description of the type and function of the permanent structural stormwater management facilities.	yes	
2.0	Existing Conditions Information		
2.1	Existing Conditions Drainage Map		
2.1.1	On-site and off-site topography: NAVD 88 datum, one-foot contours with spot elevations.	yes	
2.1.2	On-site and off-site drainage features, including perennial and intermittent streams (with names labeled), conveyance systems such as open channels, ditches, swales and areas of overland flow. Flow direction must be indicated by arrows.	yes	
2.1.3	Storm sewer system components, including storm drains, inlets, catch basins, gutters, manholes, headwalls, pipes and culverts. Material and size must be noted for all pipes and culverts.	yes	
2.1.4	Location and boundaries of natural features such as wetlands, lakes, ponds with the normal water elevation noted, rock outcroppings, wooded areas and tree rows.	yes	
2.1.5	Location, dimensions and elevations of existing bridges and culvert crossings.	yes	
2.1.6	Location of existing utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.	yes	
2.1.7	Groundwater elevations, if applicable.	yes	
2.1.8	Delineation of predominant soil based on USDA soil surveys and/or on-site soil borings; indicate NRCS soil name and Hydrologic Soil Group for undisturbed surface soils.	yes	
2.1.9	Land use types per NRCS nomenclature.	yes	
2.1.10	Footprint of existing impervious areas (labeled, area given in acres).	yes	
2.1.11	Internal drainage subbasin boundaries used for hydrologic calculations (labeled with ID, total area in acres, impervious area in acres and curve number).	yes	
2.1.12	Time of concentration flow paths. Indicate and label each segment separately (i.e., overland flow, shallow concentrated, channel1, channel2, etc.). For each segment, provide the appropriate data to calculate Tc (e.g., length, slope, cover type, paved/unpaved, roughness parameters, geometric properties, etc.).	yes	
2.2	Existing Conditions Hydrology and Hydraulics Analysis		

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
2.2.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).	yes	
2.2.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).	yes	
2.2.3	Table of existing condition runoff curve numbers with supporting data and calculations.	yes	
2.2.4	Table of existing condition times of concentration with supporting data and calculations.	yes	
2.2.5	A summary table of rainfall data used in the hydrologic analysis, and a reference for the source of the data.	yes	
2.2.6	Cross-sections and other diagrams of existing open channels, bridge and culvert sections and other hydraulic features as required to illustrate the basis for hydraulic analysis.	N/A	n
2.2.7	Hydrologic and hydraulic analyses for runoff rates, volumes, velocities and elevations. Provide supporting data not specified above and identify assumptions. Include detailed calculations for the 2, 5, 10, 25 & 100-year, 24-hour storm events. Provide results in a tabular form. Provide digital copies of any computer files and models used.	yes	
3.0	postdevelopment Conditions Information		
3.1	postdevelopment Conditions Drainage Map		
3.1.1	Proposed project boundary.	yes	
3.1.2	on-site and off-site topography: NAVD 88 datum, one-foot contours with spot elevations.	yes	
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.	yes	
3.1.4	Location and description of off-site through-drainage conveyances which are confined to an easement, dedication and/or reserve.	yes	
3.1.5	Footprint of proposed impervious areas, including roads, parking lots, buildings and other structures.	yes	
3.1.6	Location of proposed utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.	yes	
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.	yes	
3.1.8	Land use cover per NRCS nomenclature.	yes	
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).	yes	
3.1.10	Proposed limits of land disturbing activity (i.e., grading limits).	yes	
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.).	yes	
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.	yes	
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.	yes	
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.	yes	
3.2.4	Location(s) of stormwater management facilities and any associated drainage easements.	yes	
3.2.5	Proposed energy dissipaters and other channel protection devices.	yes	
3.2.6	Location(s) and dimension(s) of proposed channel, bridge and culvert crossings.	yes	
3.2.7	Normal pool and 100-year pool elevations for ponds and lakes.	N/A	
3.2.8	Permanent concrete outfall control structure(s) for ponds.	N/A	
3.2.9	Emergency overflow spillways and top of berm elevations for ponds and other volume/peak discharge control facilities.	N/A	
3.2.10	Floodplains, ponds, and stormwater management facilities located in reserves.	N/A	
3.3	postdevelopment Conditions Hydrology & Hydraulics		
3.3.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).	yes	

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
3.3.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).	yes	
3.3.3	Table of postdevelopment condition runoff curve numbers with supporting data and calculations.	yes	
3.3.4	Table of postdevelopment condition times of concentration with supporting data and calculations.	yes	
3.3.5	Cross-sections and other diagrams of existing open channels, bridge and culvert sections and other hydraulic features as	N/A	
3.3.6	Hydrologic and hydraulic analyses for runoff rates, volumes, velocities and elevations. Provide supporting data not specified above and identify assumptions. Include detailed calculations for the 2, 5, 10, 25 & 100-year, 24-hour storm events. Provide results in a tabular form. Provide digital copies of any computer files and models used.	yes	
3.3.7	Downstream peak discharge assessment (10% Rule) results and supporting data and calculations. Provide digital copies of any computer files and models used.	yes	
3.3.8	Stage-storage-discharge or other outlet rating curves and inflow/outflow hydrographs for all ponds.	N/A	
3.3.9	Demonstrate that the pond contours on the master grading plan and the stage-storage-discharge data are consistent for all ponds.	N/A	
3.3.10	Demonstrate that all ponds have one foot of freeboard above the 100-year, 24-hour high water level.	N/A	
3.3.11	Demonstrate that runoff from the proposed project site is discharged in the same manner as prior to development, using level spreaders, energy dissipaters, other devices or grading as required, or identify an appropriate flowage easement.	yes	
3.4 Stormwater Quantity Control Sizing			
3.4.1	Hydraulic sizing calculations for all stormwater management controls.	yes	
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.	yes	
3.4.3	Typical details (including cross-sections where applicable) for outlet structures, embankments, spillways, grade control structures, conveyance channels, etc.	yes	
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.	yes	
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.).	yes	
3.5.3	Water quality volume (total and by facility), with supporting data and calculations.	yes	
3.5.4	% TSS removal value (total and by facility) with supporting data and calculation. Must be equal to or greater than 80%.	yes	
3.5.5	Channel protection volume with supporting data and calculations.	N/A	
3.5.6	Water quality volume and channel protection volume orifice size calculations.	yes	
3.5.7	Other calculations required for each stormwater management facility as specified in the Wichita/Sedgwick County Stormwater Manual.	yes	
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.	yes	
4.0 Floodplains			
4.1	Reference the source of flood profile, floodplain, floodway and stream discharge information.	yes	
4.2	Delineation of nearest base flood elevations.	yes	
4.3	Delineation of predevelopment regulatory floodplain/floodway limits using FEMA's current GIS database; limits to be per elevation and scaled location.	N/A	
4.4	Delineation of postdevelopment regulatory floodplain/floodway limits; limits to be per elevation and scaled location, with project limits shown.	N/A	
4.5	Floodway data table and discharges.	N/A	
4.6	Hydrologic and hydraulic study information for local floodplain analysis, unnumbered Zone A elevation determinations and floodplain map revisions or required permits.	N/A	
4.7	Regulatory floodway and four natural profile models (10, 50, 100 and 500-year) for existing and postdevelopment conditions.	N/A	
4.8	Floodplains and floodways located within a reserve, where necessary.	N/A	
4.9	Floodplain cut and fill calculations for volume sensitive basins.	N/A	

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

General Information

Location

The subject property is in the City of Wichita, Sedgwick County, Kansas. The address is 4700 West 13th Street North. The site is currently platted as Lot 1 of the Synod Addition and includes an adjacent unplatted tract. The development is bounded by West 13th Street to the south and Zoo Boulevard to the northeast. The site is bounded by I-235 Highway to the north. To the west, a detention pond on City of Wichita property and Westwood Village 3rd Addition bound the property. The site is in the southwest quarter of the southeast quarter of Section 11, Township 27 South, Range 1 West of the 6th P.M. The plat area is 15.7 acres as shown on the pre-plat, Appendix A. The site is shown on the USGS Map, Appendix B. The site is also shown on the aerial photograph, Appendix C.

Datum

The site is shown in NAVD 88 datum.

Soils

According to the USDA NRCS Soil Survey, Appendix D, the site contains the following soil groups:

- Canadian fine sandy loam, rarely flooded, HSG "B"
- Naron fine sandy loam, 0 to 1 percent slopes, HSG "B"

The HSG used to select curve numbers is HSG "B."

Flood Insurance Rate Map (FIRM)

The site is shown on the FEMA FIRM Panel 335, Sedgwick County Kansas and Incorporated Areas, Effective February 2, 2007, Appendix E. The site is in the City of Wichita, Community Number 200328. The entire site is in Zone X (shaded), areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. The nearest Zone A floodplain, areas of 100-year flooding, is approximately ½-mile northwest of the site.

Groundwater

According to the Kansas Geological Survey Water Wells Map (located at <http://www.kgs.ku.edu/Magellan/WaterWell/index.html> and referenced in January 2013,) the static water level of existing wells on site is 13-17 feet deep.

Existing Development

Description

The site is currently developed as a senior living community offering independent living, long-term care, skilled nursing, and short-term rehabilitation. The existing site is comprised of multiple buildings, covered and uncovered parking areas, driveways, and sidewalks. The site is shown on the existing conditions drainage map, Appendix F. The existing site has 7.7 acres of impervious area of the 15.69 acres of the site, Appendix G.

Drainage Characteristics

The southern portion of the existing site generally drains to the south. Onsite stormwater sewer connects to an existing stormwater sewer system along 13th Street. The 13th Street stormwater sewer system flows to the west and then to the north into an existing City owned detention pond

in the Westwood Village 3rd Addition. The detention pond is pumped into the Wichita Valley Center Floodway. The northern portion of the existing site generally drains to the west into the existing detention pond. If the stormwater sewer system in 13th Street fails, the runoff will flow overland and into the detention pond at an elevation of approximately 1317.5. The 100-year storm event is contained within the streets and parking lots. The escape route elevation is greater than the hydraulic grade lines of the pipe system in the 100-year design event.

The curve number for the existing conditions site is 88.8, Appendix G. The time of concentration for the site was calculated to be 18.4 minutes, Appendix I. The peak flow rates from the entire site were calculated using Hydraflow Hydrographs, Appendix J. The site was assumed to be one basin since it ultimately flows to the same detention facility. The peak project flow rates for the Existing site are shown in Table 1.

Approximately 220 acres drain into the existing detention pond, Appendix K. An analysis of the existing drainage area was done to determine the approximate flow rate into the pond. Flow rates are shown in Table 1.

Table 1. Runoff Calculations.

Location	Area (ac)	CN	T _c (min)	Design Storm Peak Flow Rate (cfs)						
				1-Yr	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Existing Site	15.4	88.8	18.4	29.1	39.8	55.2	66.0	79.9	92.1	105.9
Exist. to 13 th	40.7	-	-	101.1	134.9	158.4	171.7	198.5	221.9	241.1
Exist. to Pond	220	90.1	60	222.1	300.8	414.0	493.3	594.8	684.7	785.4

Stormwater Sewer

A basic model of the existing stormwater sewer system was done in Hydraflow Hydrographs, Appendix L. The drainage basins were approximated using LiDAR information. The pipe sizes and flow lines were obtained from GIS. The flow rates were calculated using the Rational Method with 5 minute minimum time of concentrations. A rational coefficient of 0.73 was assumed. The drainage area going to the downstream pipe system that flows into the pond is 40.7 acres. The flow rates at the pipe are shown in Table 1. The capacity of the pipe is 102.1 cfs.

The existing system in 13th Street North conveys approximately a 5-year design storm, but existing pipe sizes on site do not convey the 2-year design storm. Any runoff that exceeds the capacity of these pipes would flow overland via existing paved access to the south and into 13th Street where it would be picked up by other inlets in the system.

Utilities

Existing water, sanitary sewer, stormwater sewer, electric, phone, and cable utilities serve the site. The existing stormwater sewer is connected to an existing system along 13th Street North.

Lowest Opening

The elevations of existing buildings on site vary from 1318.1 to 1326.2.

Proposed Development

Description

The proposed site will re-develop for the same use. The northern portion of the site will not change with the proposed plan. The platted site will be 15.4 acres. A portion of the site has been dedicated to street right-of-way reducing the total site area. The site will continue to be used as a senior living community. Some of the existing structures will be demolished and replaced with new buildings. The proposed parking layout will change to accommodate the proposed buildings. The impervious area of the site will increase to 9.37 acres, Appendix M.

Drainage Characteristics

The southern portion of the site that is re-developing will continue to drain to the south into 13th Street North. The increase impervious area will increase by approximately 1.6 acres, the curve number for the site has increased from 88.8 to 90.7, Appendix N. Proposed grading for the site is shown on the Grading Plan, Appendix O.

Table 2. Runoff Calculations.

Location	Area (ac)	CN	T _c (min)	Design Storm Peak Flow Rate (cfs)						
				1-Yr	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Proposed Site	15.4	90.7	18.4	31.9	42.7	58.1	68.9	82.6	94.8	108.4
Prop. to 13 th	42.2	-	-	90.5	119.1	147.5	174.7	208.5	237.9	262.2
Prop. to Pond	220	90.2	60	223.1	301.8	415.1	494.3	595.8	685.7	786.3

Stormwater Sewer

The proposed onsite storm water sewer system is designed to handle a 5-year design storm, Appendix P. Drainage areas and pipe sizes are shown on the Drainage and Utility Plan, Appendix Q. The courtyards that are enclosed by buildings on all sides have redundant pipe systems with two 100-year pipes exiting the courtyard. The downstream pipes to these systems are not designed for the 100-year design event, but the system will be designed so that the runoff will flow out of a downstream inlet to provide relief during large storms. Escape routes will be provided for all stormwater sewer inlets. The proposed system will be larger than the existing system and will convey more runoff into the 13th Street stormwater sewer system. The 13th Street stormwater sewer system is sized to convey this flow for the 5-year design event. By increasing the size of the on-site stormwater sewer system, runoff that overland flows directly into 13th Street will be reduced since it is already in the underground system.

The drainage area in the Hydraflow Storm Sewers model has increased to the pipe that flows into the detention pond. The reason for this increase is that the drainage area to each courtyard was modeled to flow into two different systems to create redundancy since there are no escape routes. The flow to 13th Street has been decreased in the smaller design storms. The proposed storm water sewer system has a greater length which has increased the travel time through the pipe system. This has decreased the flow to the 13th Street stormwater sewer system in the 1, 2, and 5 year design storms.

Utilities

The existing water system and sanitary sewer system will be revised to match the proposed site layout. The new layouts are shown on the Drainage and Utility Plan, Appendix Q.

Detention and Downstream Peak Discharge Assessment

The site ultimately drains into an existing detention pond owned by the City. The site is located adjacent to the pond in the downstream portion of the basin. The drainage area to this pond is approximately 220 acres. The site is 6.5% of the total area of this drainage basin. The increase in impervious area from this site will increase the runoff to the pond by approximately 1 cfs in all design storms. This is less than a 1% increase in the flow rate to the pond and would be insignificant. The onsite storm water sewer is sized for the 5-year design event and larger events will pond around each inlet. There will be an undetermined volume of detention onsite in the sumps around the inlets for storm events larger than the 5-year design storm. In storms smaller than the 100-year design storm, the runoff will flow directly into the stormwater sewer and less runoff will flow directly into 13th Street North than it currently does under existing conditions.

Lowest Opening

The proposed buildings will be set with a finish floor of 1319.4. This is above the emergency escape route by approximately 2'. Existing buildings on the northern portion of the site have a finish floor elevation of 1318.81.

Water Quality

With the increase of impervious area of approximately 1.6 acres, the site will be required to meet water quality requirements. A proprietary system will be installed in order to meet the water quality requirements. The volume required will be approximately 0.28 acre-feet. Calculations were done in Microsoft Excel, Appendix R.

Channel Protection

The site is draining directly into a city stormwater sewer system which drains into a pumped detention pond. Channel protection will not be required for this redevelopment site.

Federal, State, and Local Permits

US Army Corps of Engineers

The site will not modify any jurisdictional streams or wetlands.

Kansas Department of Agriculture – Division of Water Resources

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

FEMA

The site will not modify any FEMA floodplains. No FEMA permits will be required.

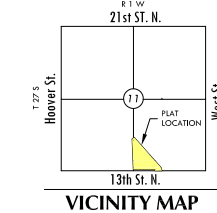
Summary

The site will re-develop for use as a senior living facility as it is currently. Several buildings on the site will be demolished and replaced with new buildings. The impervious area of the site will increase by approximately 1.6 acres with the new site layout. The site drains into a city owned detention pond. The increase in impervious area from this site increases the flow rates to the pond by less than 0.5% in all design storms, see Table 3. The stormwater sewer system is sized for the 5-year design event and will provide some detention on site in sumps during larger design events. The storm water sewer system is larger than the existing site system and during smaller design events overland flow into 13th Street North will be significantly reduced. Due to the increased pipe length of the proposed system, the travel time to the system in 13th Street has increased, thus flow to the 13th Street Stormwater has decreased in the smaller design storms.

There is a larger drainage area going to the 13th Street stormwater system in proposed conditions due to a reduced that was planned to protect the enclosed courtyards. The proposed project will include a proprietary water quality device sized for the redevelopment.

Table 3. Runoff Calculations.

Location	Area (ac)	CN	T _c (min)	Design Storm Peak Flow Rate (cfs)						
				1-Yr	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Exist. Site	15.4	88.8	18.4	29.1	39.8	55.2	66.0	79.9	92.1	105.9
Prop. Site	15.4	90.7	18.4	31.9	42.7	58.1	68.9	82.6	94.8	108.4
Site Change	-	-	-	9.8%	7.4%	5.3%	4.3%	3.5%	2.9%	2.4%
Exist. to 13 th	40.7	-	-	101.1	134.9	158.4	171.7	198.5	221.9	241.1
Prop. to 13 th	42.2	-	-	90.5	119.1	147.5	174.7	208.5	237.9	262.2
13 th Change	-	-	-	-10.5%	-11.7%	-6.9%	1.7%	5.0%	7.2%	8.8%
Exist to Pond	220	90.1	60	222.1	300.8	414.0	493.3	594.8	684.7	785.4
Prop. to Pond	220	90.2	60	223.1	301.8	415.1	494.3	595.8	685.7	786.3
Pond Change	-	-	-	0.5%	0.3%	0.3%	0.2%	0.2%	0.1%	0.1%



PRESBYTERIAN MANOR ADDITION

OWNERS / DEVELOPER: Presbyterian Manors, Inc., 6525 E. Mainsgate Wichita, KS 67208 Attn: Bruce H. Shogren (316) 685-1100

- ## LEGAL DESCRIPTION

A replat of Lot 1, Block 1, Synod Addition, an addition to Wichita, Sedgwick County, Kansas:
TOGETHER WITH:
A tract in the Southeast Quarter of Section 11, Township 27 South, Range 1 West of the 6th Principal Meridian, in Sedgwick County, Kansas described as follows: Beginning at a point at the intersection of the West line of the Missouri-Pacific Railroad Right of Way, and the South line of said Southeast Quarter, said point being 1370.3 feet West of the Southeast corner of said Section 11; thence West along the South line of said Section 11, a distance of 486.22 feet; thence North at right angles along a 54' feet to a point in the West line of the Missouri-Pacific Railroad Right of Way; thence in a Southeasterly direction along said West line of Way line to the POINT OF BEGINNING.

LEGEND

- L — LANDSCAPING
- R — RUSH
- E — EDGE OF TREES
- D — DECIDUOUS TREE
- N — SNOW
- G — GATE
- P — POST / ROLLAD
- B — BENCH
- F — FLAG POLE
- M — MANHOLE
- F — FOUNTAIN POLE
- P — POWER POLE WITH LIGHT
- P — SHORT RESIDENTIAL LIGHT POLE
- G — GROUND LIGHT
- E — ELECTRIC BOX
- A — AIR CONDITIONING UNIT
- E — ELECTRIC TRANSFORMER
- L — LIGHT POLE
- C — FIRE HYDRANT
- W — WATER VALVE
- W — WATER METER
- W — WATER SPROUT
- I — IRRIGATION CONTROL VALVE
- W — WATER METER VALVE
- R — ROOFING ASSEMBLY
- S — STORM WATER MANHOLE
- S — SANITARY SEWER MANHOLE
- C — CLEANOUT
- T — TELEPHONE LINE
- C — CABLE TV RISER
- F — FIBER OPTICS INDICATOR SIGN
- G — GAS METER
- G — GAS METER VALVE
- S — Set "M" BEAK / MKEC
- C — C/S
- C — PROPERTY CORNER FOLD
- C — SECTION CORNER FOLD
- F — FENCE
- M — MEASURED
- CM — CALCULATED FROM MEASURED
- D — DEEDED
- E — EASTMENT
- — — — — BUILDING SETBACK
- X — FENCE
- — — — — STORM SEWER PIPE
- — — — — WATER LINE
- — — — — SANITARY SEWER LINE
- — — — — GAS LINE
- — — — — TELEPHONE LINE
- — — — — UNDERGROUND CABLE TV LINE
- — — — — UNDERGROUND ELECTRIC LINE
- — — — — OVERHEAD TELEPHONE
- — — — — OVERHEAD ELECTRIC
- — — — — PIPELINE
- — — — — PIPELINE (NON-SERVED)
- — — — — 50' STREET DEDICATION
- — — — — BUILDING RETAINED
- — — — — BUILDING TO BE REDEVELOPED

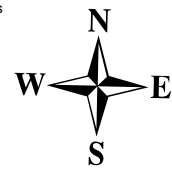
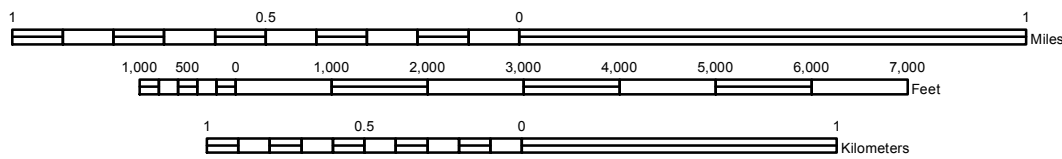
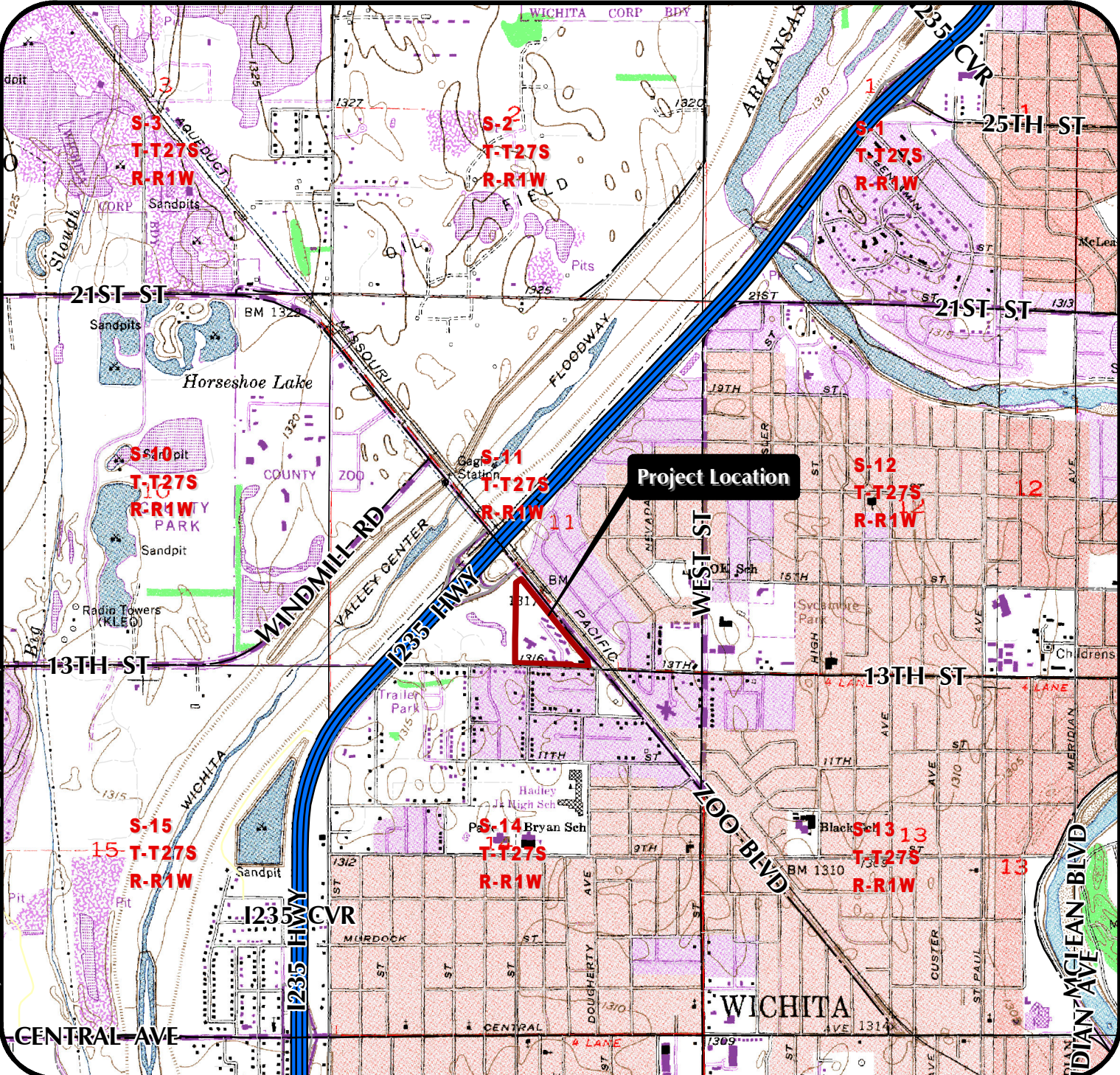
BENCH MARKS

PK Nail and Washer on South side of 13th Street North, in line with East edge of East drive into Presbyterian Manor, 34 feet South of back of North curb of 13th Street.

Appendix B

USGS Quadrangle Map

Path: J:\Projects\2012\1201010451_Greystone - Presbyterian Manors\5-Civil\GIS\Exhibits\Drng-USGS-Presbyterian Manors.mxd - Date: 8/2/2012



Presbyterian Manors

Project Name:

USGS Quadrangle

Sheet Title:



JGD

Drawn By:

July 2012

Date:

KLA

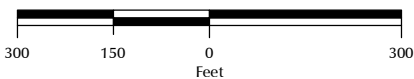
Design / Review:

1201010451

Job No.:

Appendix C

Aerial Photograph



Presbyterian Manors

Project Name:

2011 Aerial Photography - Wichita, Sedgwick County, KS

Sheet Title:

MKEC
ENGINEERING
CONSULTANTS, INC.

JGD

Drawn By:

July 2012

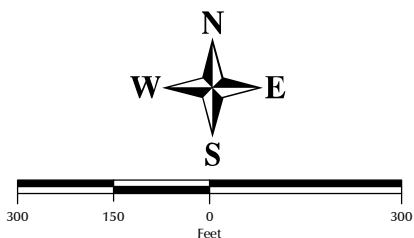
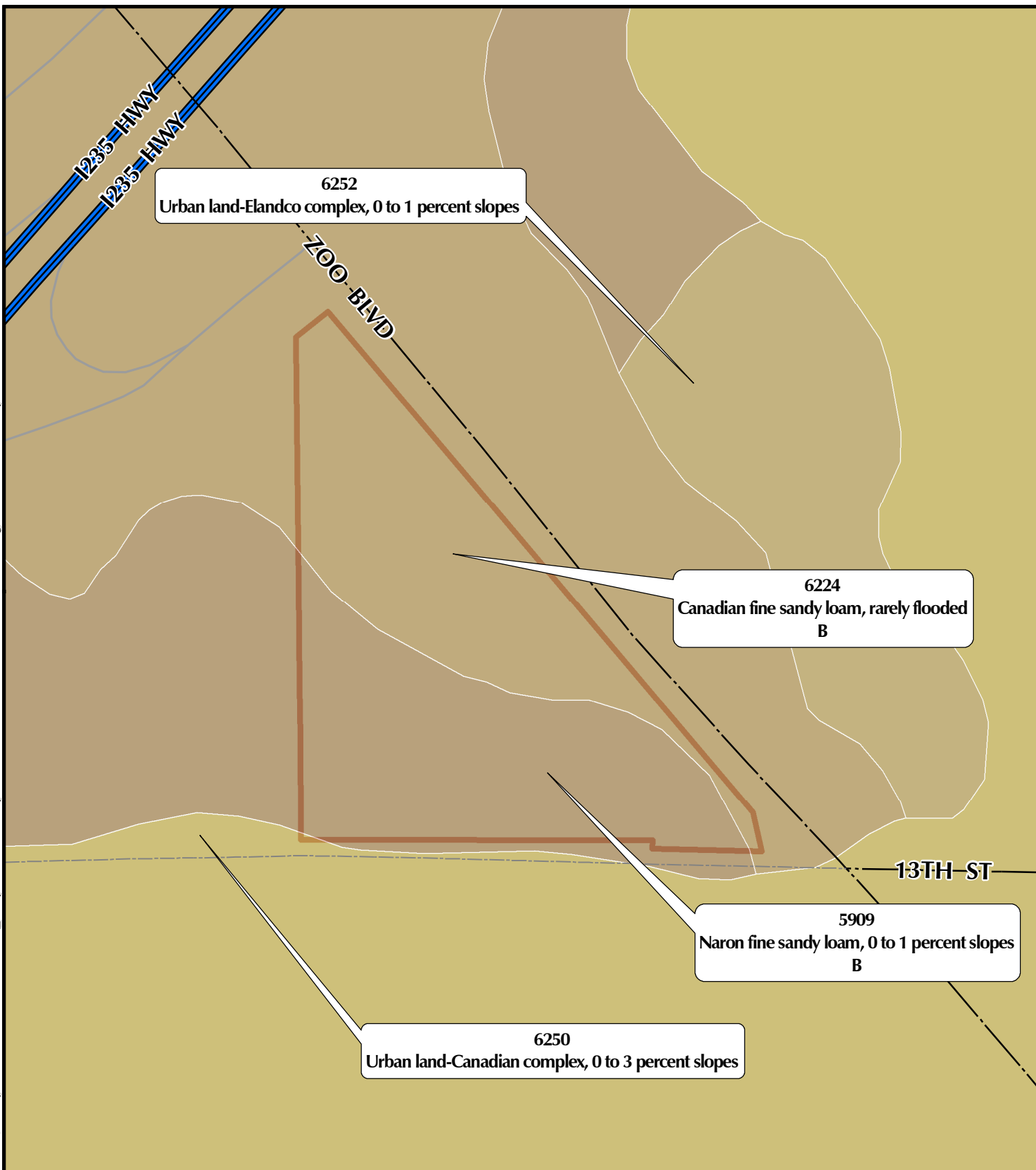
Date:

KLA

Design / Review:

1201010451

Job No.:



Presbyterian Manors

Project Name:

NRCS Soil Survey

Sheet Title:



JGD

Drawn By:

KLA

Design / Review:

July 2012

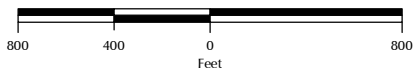
Date:

1201010451

Job No.:

Appendix E

FEMA Flood Insurance Rate Map (FIRM)

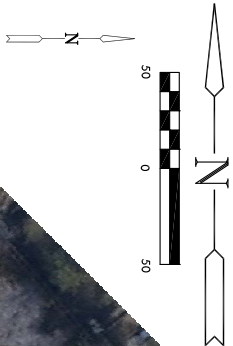
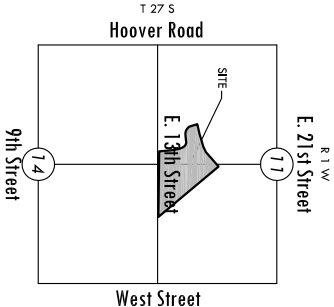


MKEC
ENGINEERING
CONSULTANTS, INC.

Job No.:

LEGEND

- 6IN - CONIFEROUS TREE
- 3IN - DECIDUOUS TREE
- SN - SIGN
- PP - POWER POLE
- ELEC BOX - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SECTION CORNER
- BM - BENCHMARK
- EASEMENT
- BUILDING SETBACK
- FENCE
- STORM SEWER PIPE
- WATER LINE
- SANITARY SEWER LINE
- GAS LINE
- GAS PIPELINE
- TELEPHONE LINE
- UNDERGROUND ELEC.
- OVERHEAD ELECTRIC
- FIBER OPTIC CABLE



VICINITY MAP



J:\PROJECTS\2012\1201010451_GREYSTONE - PRESBYTERIAN MANORS\5-CIVIL\CAD\DRAWING\DRAWING\12451_EXISTING_COND.DWG

SITE DRAINAGE & UTILITY PLAN

GREYSTONE - PRESBYTERIAN PRESBYTARIAN MANORS

EXISTING COND. PLAN

SHEET TITLE

02014

PROJECT NUMBER

KLA / DM / GJA
DESIGNED DRAWN CHECKED

ISSUED

February 2013

REVISED

SHEET NO.

1 of 1

PRELIMINARY
NOT FOR
CONSTRUCTION

MKEC
ENGINEERING
CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

Appendix G

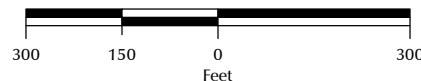
Existing Impervious Area Map



Presbyterian Manors

Exhibit D - Impervious Area Map

Zoo Blvd. & 13th St.



MKEC
ENGINEERING
CONSULTANTS, INC.

The information presented hereon is best available data gathered by MKEC from various outside sources. MKEC does not guarantee the positional accuracy the data shown.
In no event shall MKEC become liable to users of the data presented hereon, for any loss or damages, consequential or otherwise, including but not limited to time, money, or goodwill, arising from the use of the presented data.
In using the data presented hereon, the user further agrees to indemnify, defend, and hold harmless MKEC for any and all liability of any nature arising out of or resulting from the lack of accuracy or correctness of the data, or the use of the data.

Curve Number Calculations
Existing Presbyterian Manors

Estimate Imperviousness per Land Use

HSG A			HSG B			HSG C			HSG D		
Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)
Commercial and Business	85%		Commercial and Business	85%		Commercial and Business	85%		Commercial and Business	85%	
Industrial	72%		Industrial	72%		Industrial	72%		Industrial	72%	
Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%	
Residential 1/4 acre	38%		Residential 1/4 acre	38%		Residential 1/4 acre	38%		Residential 1/4 acre	38%	
Residential 1/3 acre	30%		Residential 1/3 acre	30%		Residential 1/3 acre	30%		Residential 1/3 acre	30%	
Residential 1/2 acre	25%		Residential 1/2 acre	25%		Residential 1/2 acre	25%		Residential 1/2 acre	25%	
Residential 1 acre	20%		Residential 1 acre	20%		Residential 1 acre	20%		Residential 1 acre	20%	
Residential 2 acres	12%		Residential 2 acres	12%		Residential 2 acres	12%		Residential 2 acres	12%	
Impervious Area (acres)		0	Impervious Area (acres)		0	Impervious Area (acres)		0	Impervious Area (acres)		0

Composite Curve Number (CN)

HSG A			HSG B			HSG C			HSG D		
Land Use	CN	Area (ac)	Land Use	CN	Area (ac)	Land Use	CN	Area (ac)	Land Use	CN	Area (ac)
Pre-Developed or Undisturbed Pervious	55		Pre-Developed or Undisturbed Pervious	71		Pre-Developed or Undisturbed Pervious	80		Pre-Developed or Undisturbed Pervious	84	
Developed or Disturbed Pervious	71		Developed or Disturbed Pervious	80	7.99	Developed or Disturbed Pervious	84		Developed or Disturbed Pervious	88	
Impervious	98	0	Impervious	98	7.7	Impervious	98	0	Impervious	98	0
Composite Curve Number HSG A (CN)	0.0	0	Composite Curve Number HSG B (CN)	88.8	15.69	Composite Curve Number HSG C (CN)	0.0	0	Composite Curve Number HSG D (CN)	0.0	0

Total Weighted Composite Curve Number (CN)	88.8
Total Area (A) (acres)	15.69

Curve Number Calculations
Existing Presbyterian Manors - To Detention Pond

Estimate Imperviousness per Land Use

HSG A			HSG B			HSG C			HSG D		
Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)
Commercial and Business	85%		Commercial and Business	85%	80	Commercial and Business	85%		Commercial and Business	85%	
Industrial	72%		Industrial	72%		Industrial	72%		Industrial	72%	
Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%	
Residential 1/4 acre	38%		Residential 1/4 acre	38%	124.6	Residential 1/4 acre	38%		Residential 1/4 acre	38%	
Residential 1/3 acre	30%		Residential 1/3 acre	30%		Residential 1/3 acre	30%		Residential 1/3 acre	30%	
Residential 1/2 acre	25%		Residential 1/2 acre	25%		Residential 1/2 acre	25%		Residential 1/2 acre	25%	
Residential 1 acre	20%		Residential 1 acre	20%		Residential 1 acre	20%		Residential 1 acre	20%	
Residential 2 acres	12%		Residential 2 acres	12%		Residential 2 acres	12%		Residential 2 acres	12%	
Impervious Area (acres)		0	Impervious Area (acres)		115.35	Impervious Area (acres)		0	Impervious Area (acres)		0

Composite Curve Number (CN)

HSG A			HSG B			HSG C			HSG D		
Land Use	CN	Area (ac)	Land Use	CN	Area (ac)	Land Use	CN	Area (ac)	Land Use	CN	Area (ac)
Pre-Developed or Undisturbed Pervious	55		Pre-Developed or Undisturbed Pervious	71		Pre-Developed or Undisturbed Pervious	80		Pre-Developed or Undisturbed Pervious	84	
Developed or Disturbed Pervious	71		Developed or Disturbed Pervious	80	96.95	Developed or Disturbed Pervious	84		Developed or Disturbed Pervious	88	
Impervious	98	0	Impervious	98	123.05	Impervious	98	0	Impervious	98	0
Composite Curve Number HSG A (CN)	0.0	0	Composite Curve Number HSG B (CN)	90.1	220	Composite Curve Number HSG C (CN)	0.0	0	Composite Curve Number HSG D (CN)	0.0	0

Total Weighted Composite Curve Number (CN)	90.1
Total Area (A) (acres)	220

Project	Presbyterian Manors
Feature	15.7
Analyst	Kara Anderson
Version	
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	Presbyterian Manors	3	12.4	2.0	0.0	4.1	0.0	0.0	18.4	1650	16	0.97	1.49	11.1	0.184	15.7
2	To Pond	3	2.0	1.9	0.0	57.9	0.0	0.0	61.9	5600	5	0.09	1.51	37.1	0.619	220

Subbasin Name	Presbyterian Manors
Drainage Area (ac)	15.7
Drainage Area (sq mi)	Kara Anderson

Sheet Flow						Total
selected>>	Select (0 or 1)	1				1 segments
	Length (ft)	100				100 feet length
	Top Elevation (ft)	1319.0				
	Bottom Elevation (ft)	1318.0				
	Cover	0.15, Short grass prairie				
	Specify alternate "n"					
	Sheet Flow "n" (dim)	0.150				
	2-yr, 24-hr Rainfall (ins)	3.50				
	Drop (ft)	1				1 feet drop
	Slope (ft/ft)	0.0100				
	Slope (%)	1.00				
	Velocity (fps)	0.13				
	Travel Time (hrs)	0.206				
	Travel Time (mins)	12.36				12.4 mins travel

Shallow Concentrated Flow						Total
selected>>	Select (0 or 1)	1				1 segments
	Length (ft)	180				180 feet length
	Top Elevation (ft)	1318				
	Bottom Elevation (ft)	1317				
	Cover	20.3, Paved				
	Specify alternate "K"					
	Surface Coeff (dim)	20.30				
	Drop (ft)	1				1 feet drop
	Slope (ft/ft)	0.0056				
	Slope (%)	0.56				
	Velocity (fps)	1.51				
	Travel Time (mins)	1.98				2.0 mins travel

Open Channel Ditch Flow						Total
	Select (0 or 1)					0 segments
	Length (ft)					0 feet length
	Top Elevation (ft)					
	Bottom Elevation (ft)					
	Channel Lining					
	Bottom Width (ft)					
	Left Side Slope (H:V)					
	Right Side Slope (H:V)					
	Depth (ft)					
	Specify alternate "n"					
	Manning "n" (dim)					
	Drop (ft)					0 feet drop
	Slope (ft/ft)					
	Slope (%)					
	Flow Area (sq ft)					
	Wet Perimeter (ft)					
	Hydraulic Radius (ft)					
	Velocity (fps)					
	Normal Flow (cfs)					
selected>>	Travel Time (mins)					0.0 mins travel

Open Channel Pipe Flow						Total
	Select (0 or 1)	1				1 segments
	Length (ft)	1370				### feet length
	Top Elevation (ft)	1317				
	Bottom Elevation (ft)	1303				
	Pipe Material	0.017, Rough concrete				
	Diameter (ins)	24.00				
	Flow Depth (ins)	24.00				
	Specify alternate "n"					
	Manning "n" (dim)	0.017				
	Drop (ft)	14				14 feet drop
	Slope (ft/ft)	0.0102				
	Slope (%)	1.02				
	Theta (radians)	6.283				
	Flow Area (sq ft)	3.14				
	Wet Perimeter (ft)	6.28				
	Hydraulic Radius (ft)	0.50				
	Velocity (fps)	5.58				
	Normal Flow (cfs)	17.5				
	Travel Time (mins)	4.09				4.1 mins travel

Open Channel General Flow						Total
	Select (0 or 1)					0 segments
	Length (ft)					0 feet length
	Top Elevation (ft)					
	Bottom Elevation (ft)					
	Hydraulic Radius (ft)					
	Channel Lining					
	Specify alternate "n"					
	Manning "n" (dim)					
	Drop (ft)					0 feet drop
	Slope (ft/ft)					
	Slope (%)					
	Velocity (fps)					
	Travel Time (mins)					0.0 mins travel

Other (Computed Separately)						Total
	Select (0 or 1)					0 segments
	Length (ft)					0 feet length
	Drop (ft)					0 feet drop
	Velocity (fps)					
	Slope (ft/ft)					
	Slope (%)					
	Travel Time (mins)					0.0 mins travel

Total for Subbasin	
Segments	3
Length (ft)	1650
Drop (ft)	16
Slope (ft/ft)	0.0097

Subbasin Name	To Pond
Drainage Area (ac)	220
Drainage Area (sq mi)	Kara Anderson

Sheet Flow						Total
selected>>	Select (0 or 1)	1				1 segments
	Length (ft)	100				100 feet length
	Top Elevation (ft)	1351				
	Bottom Elevation (ft)	1351				
	Cover	0.011, Concrete, asphalt, etc.				
	Specify alternate "n"					
	Sheet Flow "n" (dim)	0.011				
	2-yr, 24-hr Rainfall (ins)	3.50				
	Drop (ft)	1				1 feet drop
	Slope (ft/ft)	0.0050				
	Slope (%)	0.50				
	Velocity (fps)	0.83				
	Travel Time (hrs)	0.034				
	Travel Time (mins)	2.02				2.0 mins travel

Shallow Concentrated Flow						Total
selected>>	Select (0 or 1)	1				1 segments
	Length (ft)	200				200 feet length
	Top Elevation (ft)	1350.5				
	Bottom Elevation (ft)	1349				
	Cover	20.3, Paved				
	Specify alternate "K"					
	Surface Coeff (dim)	20.30				
	Drop (ft)	2				1.5 feet drop
	Slope (ft/ft)	0.0075				
	Slope (%)	0.75				
	Velocity (fps)	1.76				
	Travel Time (mins)	1.90				1.9 mins travel

Open Channel Ditch Flow						Total
	Select (0 or 1)					0 segments
	Length (ft)					0 feet length
	Top Elevation (ft)					
	Bottom Elevation (ft)					
	Channel Lining					
	Bottom Width (ft)					
	Left Side Slope (H:V)					
	Right Side Slope (H:V)					
	Depth (ft)					
	Specify alternate "n"					
	Manning "n" (dim)					
	Drop (ft)					0 feet drop
	Slope (ft/ft)					
	Slope (%)					
	Flow Area (sq ft)					
	Wet Perimeter (ft)					
	Hydraulic Radius (ft)					
	Velocity (fps)					
	Normal Flow (cfs)					
selected>>	Travel Time (mins)					0.0 mins travel

Open Channel Pipe Flow						Total
	Select (0 or 1)	1				1 segments
	Length (ft)	5300				5300 feet length
	Top Elevation (ft)	1320				
	Bottom Elevation (ft)	1317				
	Pipe Material	0.017, Rough concrete				
	Diameter (ins)	30.00				
	Flow Depth (ins)	30.00				
	Specify alternate "n"					
	Manning "n" (dim)	0.017				
	Drop (ft)	3				3 feet drop
	Slope (ft/ft)	0.0006				
	Slope (%)	0.06				
	Theta (radians)	6.283				
	Flow Area (sq ft)	4.91				
	Wet Perimeter (ft)	7.85				
	Hydraulic Radius (ft)	0.63				
	Velocity (fps)	1.52				
	Normal Flow (cfs)	7.5				
	Travel Time (mins)	57.95				57.9 mins travel

Open Channel General Flow						Total
	Select (0 or 1)					0 segments
	Length (ft)					0 feet length
	Top Elevation (ft)					
	Bottom Elevation (ft)					
	Hydraulic Radius (ft)					
	Channel Lining					
	Specify alternate "n"					
	Manning "n" (dim)					
	Drop (ft)					0 feet drop
	Slope (ft/ft)					
	Slope (%)					
	Velocity (fps)					
	Travel Time (mins)					0.0 mins travel

Other (Computed Separately)						Total
	Select (0 or 1)					0 segments
	Length (ft)					0 feet length
	Drop (ft)					0 feet drop
	Velocity (fps)					
	Slope (ft/ft)					
	Slope (%)					
	Travel Time (mins)					0.0 mins travel

Total for Subbasin	
Segments	3
Length (ft)	5600
Drop (ft)	5
Slope (ft/ft)	0.0009

Watershed Model Schematic

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

1



2



3



4



Legend

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
1	SCS Runoff	Existing
2	SCS Runoff	Proposed
3	SCS Runoff	Existing
4	SCS Runoff	Proposed

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	29.07	6	720	2.050	-----	-----	-----	Existing
2	SCS Runoff	31.91	6	720	2.258	-----	-----	-----	Proposed
3	SCS Runoff	222.11	6	750	33.176	-----	-----	-----	Existing
4	SCS Runoff	223.09	6	750	33.329	-----	-----	-----	Proposed
Presbyterian Manors.gpw					Return Period: 1 Year			Thursday, Feb 14, 2013	

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	39.78	6	720	2.814	-----	-----	-----	Existing
2	SCS Runoff	42.71	6	720	3.046	-----	-----	-----	Proposed
3	SCS Runoff	300.77	6	744	45.048	-----	-----	-----	Existing
4	SCS Runoff	301.83	6	744	45.217	-----	-----	-----	Proposed
Presbyterian Manors.gpw					Return Period: 2 Year			Thursday, Feb 14, 2013	

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	55.21	6	720	3.941	-----	-----	-----	Existing
2	SCS Runoff	58.13	6	720	4.196	-----	-----	-----	Proposed
3	SCS Runoff	414.04	6	744	62.442	-----	-----	-----	Existing
4	SCS Runoff	415.11	6	744	62.628	-----	-----	-----	Proposed
Presbyterian Manors.gpw					Return Period: 5 Year			Thursday, Feb 14, 2013	

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	66.01	6	720	4.744	-----	-----	-----	Existing
2	SCS Runoff	68.88	6	720	5.012	-----	-----	-----	Proposed
3	SCS Runoff	493.26	6	744	74.801	-----	-----	-----	Existing
4	SCS Runoff	494.32	6	744	74.996	-----	-----	-----	Proposed
Presbyterian Manors.gpw					Return Period: 10 Year			Thursday, Feb 14, 2013	

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	79.86	6	720	5.787	-----	-----	-----	Existing
2	SCS Runoff	82.63	6	720	6.068	-----	-----	-----	Proposed
3	SCS Runoff	594.78	6	744	90.832	-----	-----	-----	Existing
4	SCS Runoff	595.81	6	744	91.036	-----	-----	-----	Proposed
Presbyterian Manors.gpw					Return Period: 25 Year			Thursday, Feb 14, 2013	

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	92.12	6	720	6.723	-----	-----	-----	Existing
2	SCS Runoff	94.79	6	720	7.013	-----	-----	-----	Proposed
3	SCS Runoff	684.65	6	744	105.172	-----	-----	-----	Existing
4	SCS Runoff	685.65	6	744	105.383	-----	-----	-----	Proposed
Presbyterian Manors.gpw					Return Period: 50 Year			Thursday, Feb 14, 2013	

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	105.85	6	720	7.781	-----	-----	-----	Existing
2	SCS Runoff	108.41	6	720	8.079	-----	-----	-----	Proposed
3	SCS Runoff	785.35	6	744	121.377	-----	-----	-----	Existing
4	SCS Runoff	786.31	6	744	121.594	-----	-----	-----	Proposed
Presbyterian Manors.gpw					Return Period: 100 Year			Thursday, Feb 14, 2013	

Hydrograph Report

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

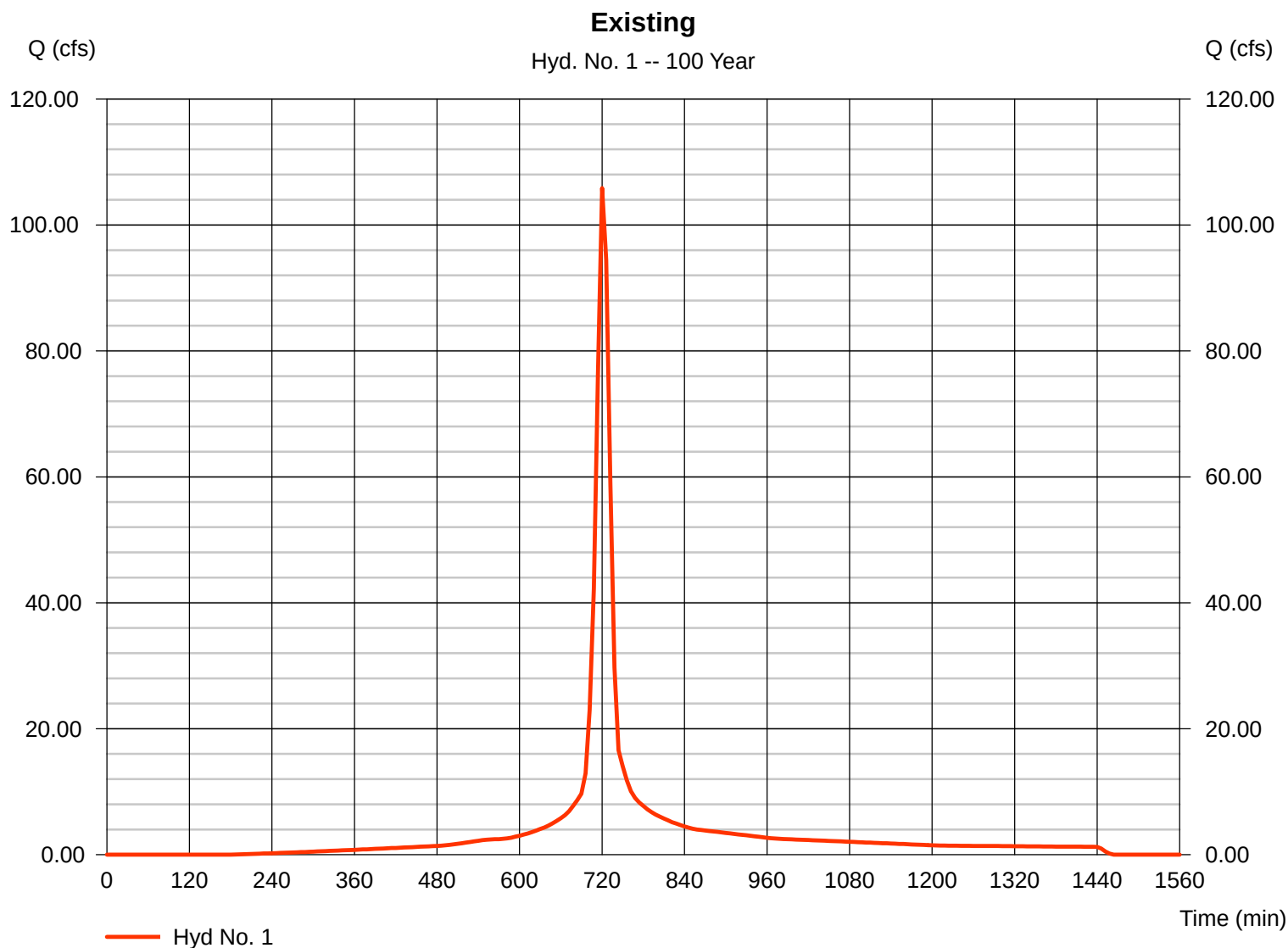
Thursday, Feb 14, 2013

Hyd. No. 1

Existing

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 6 min
 Drainage area = 15.400 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 105.85 cfs
 Time to peak = 720 min
 Hyd. volume = 7.781 acft
 Curve number = 88.8
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 18.40 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

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

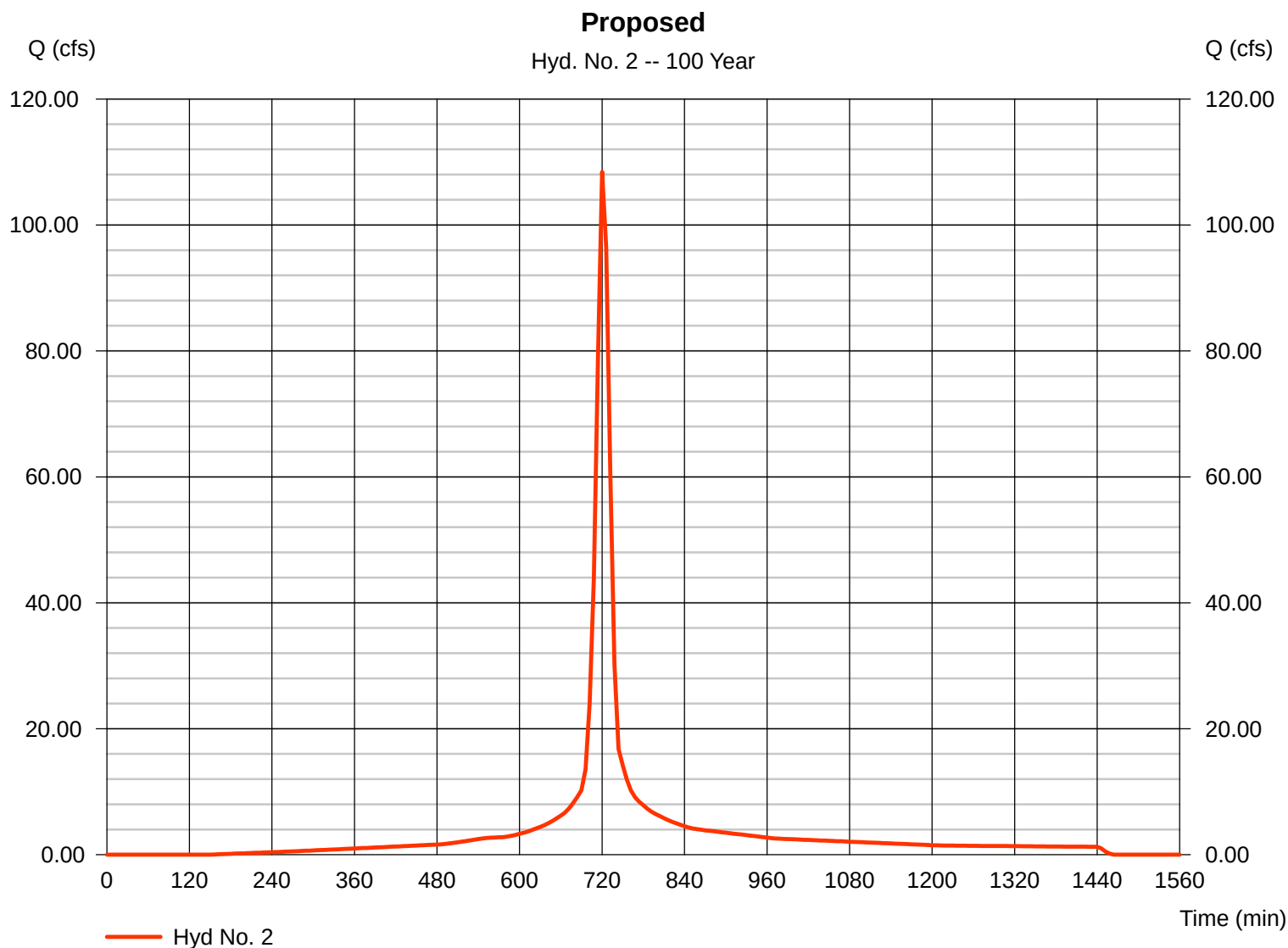
Thursday, Feb 14, 2013

Hyd. No. 2

Proposed

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 6 min
 Drainage area = 15.400 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 108.41 cfs
 Time to peak = 720 min
 Hyd. volume = 8.079 acft
 Curve number = 90.9
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 18.40 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

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

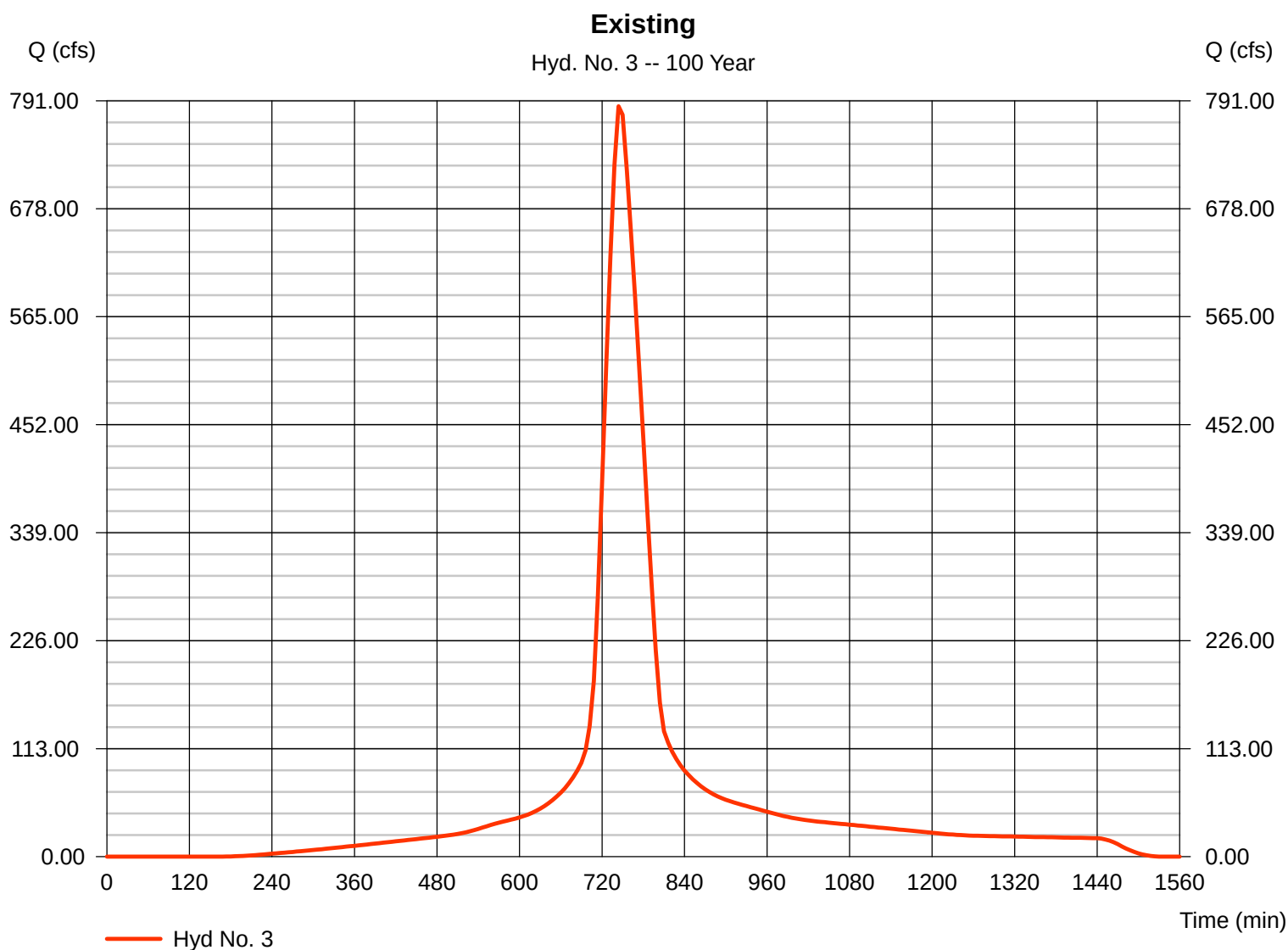
Thursday, Feb 14, 2013

Hyd. No. 3

Existing

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 6 min
 Drainage area = 220.000 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 785.35 cfs
 Time to peak = 744 min
 Hyd. volume = 121.377 acft
 Curve number = 90.1
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 60.00 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

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

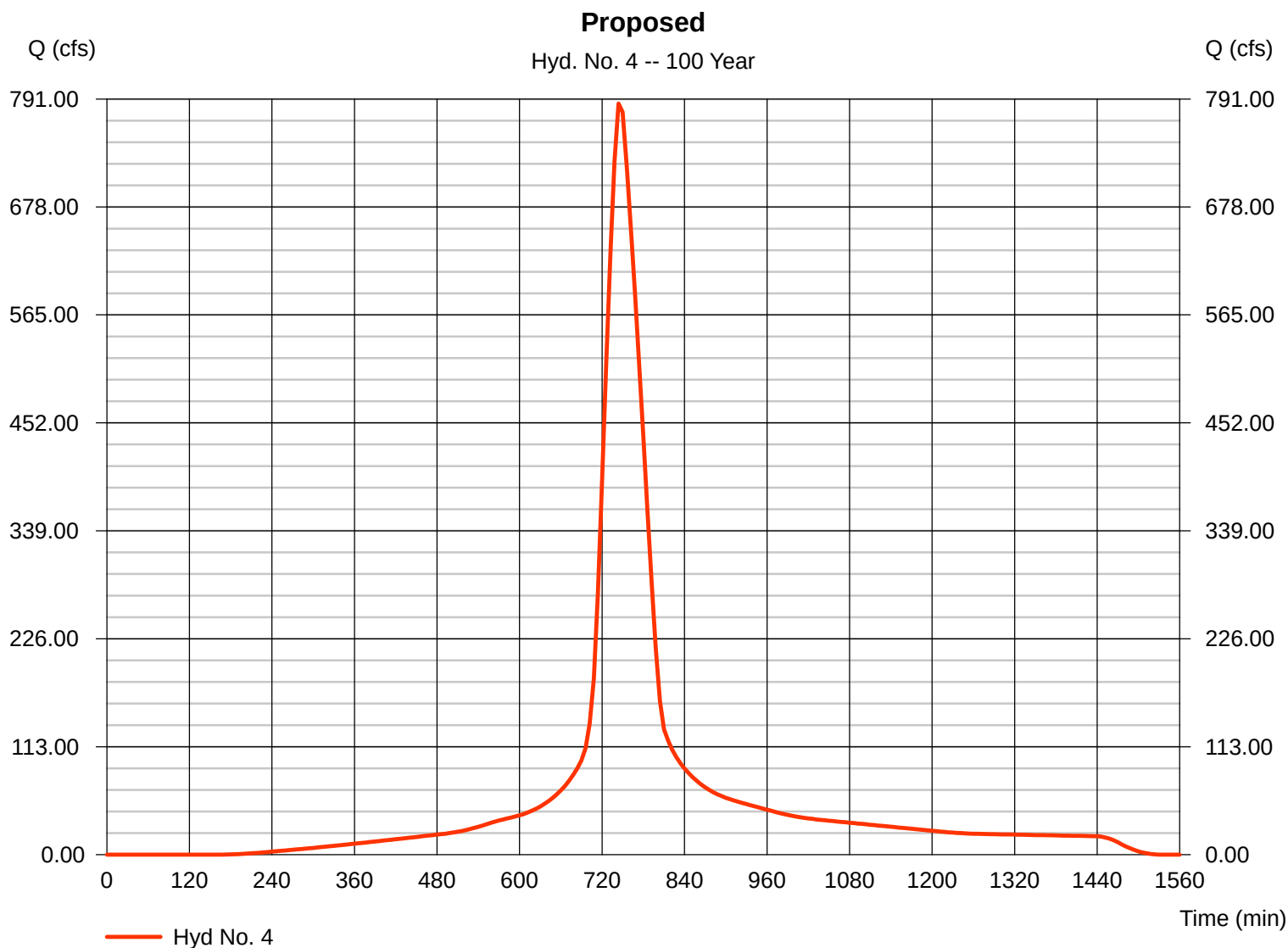
Thursday, Feb 14, 2013

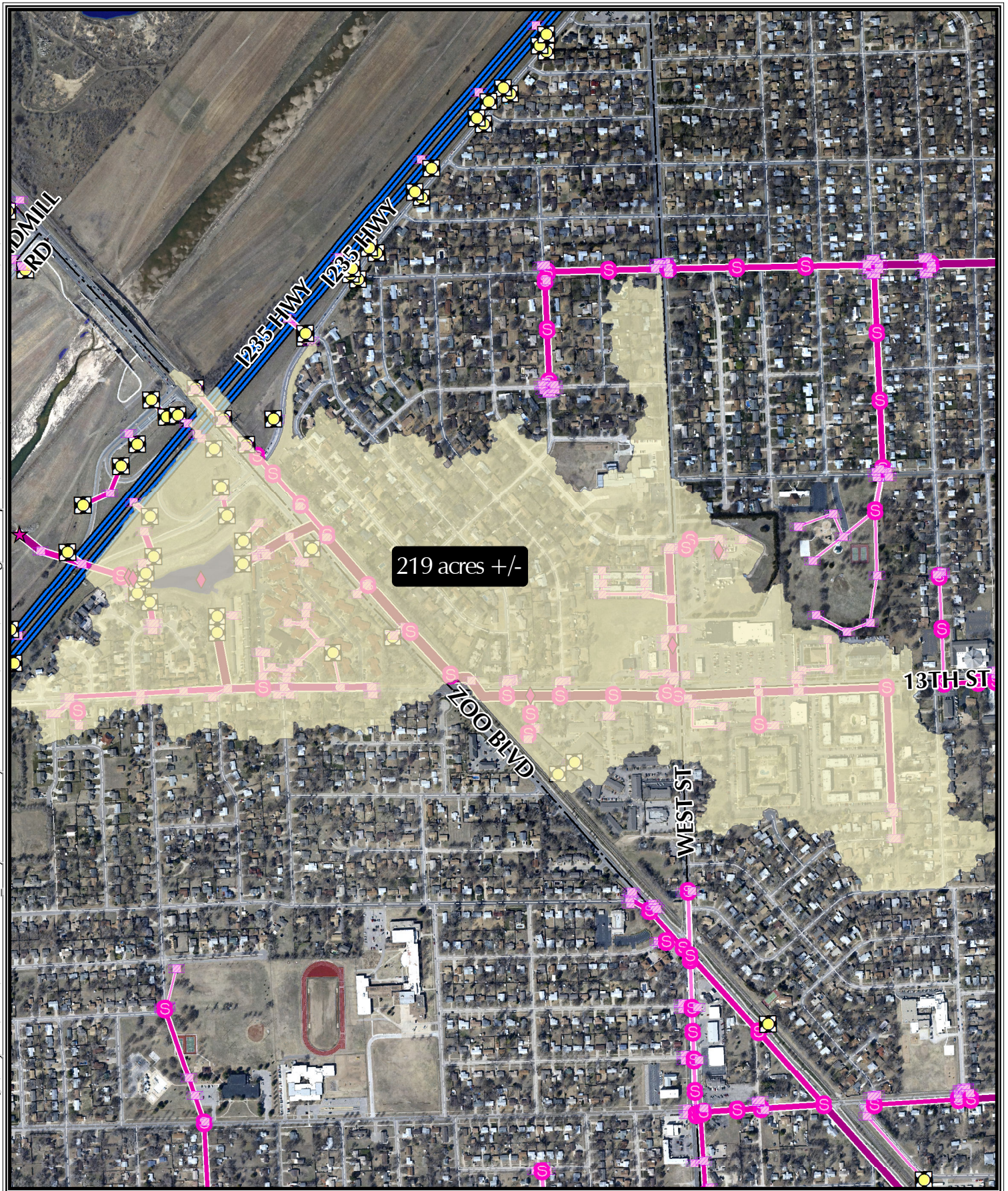
Hyd. No. 4

Proposed

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 6 min
 Drainage area = 220.000 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

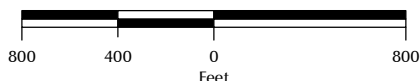
Peak discharge = 786.31 cfs
 Time to peak = 744 min
 Hyd. volume = 121.594 acft
 Curve number = 90.2
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 60.00 min
 Distribution = Type II
 Shape factor = 484





Presbyterian Manors

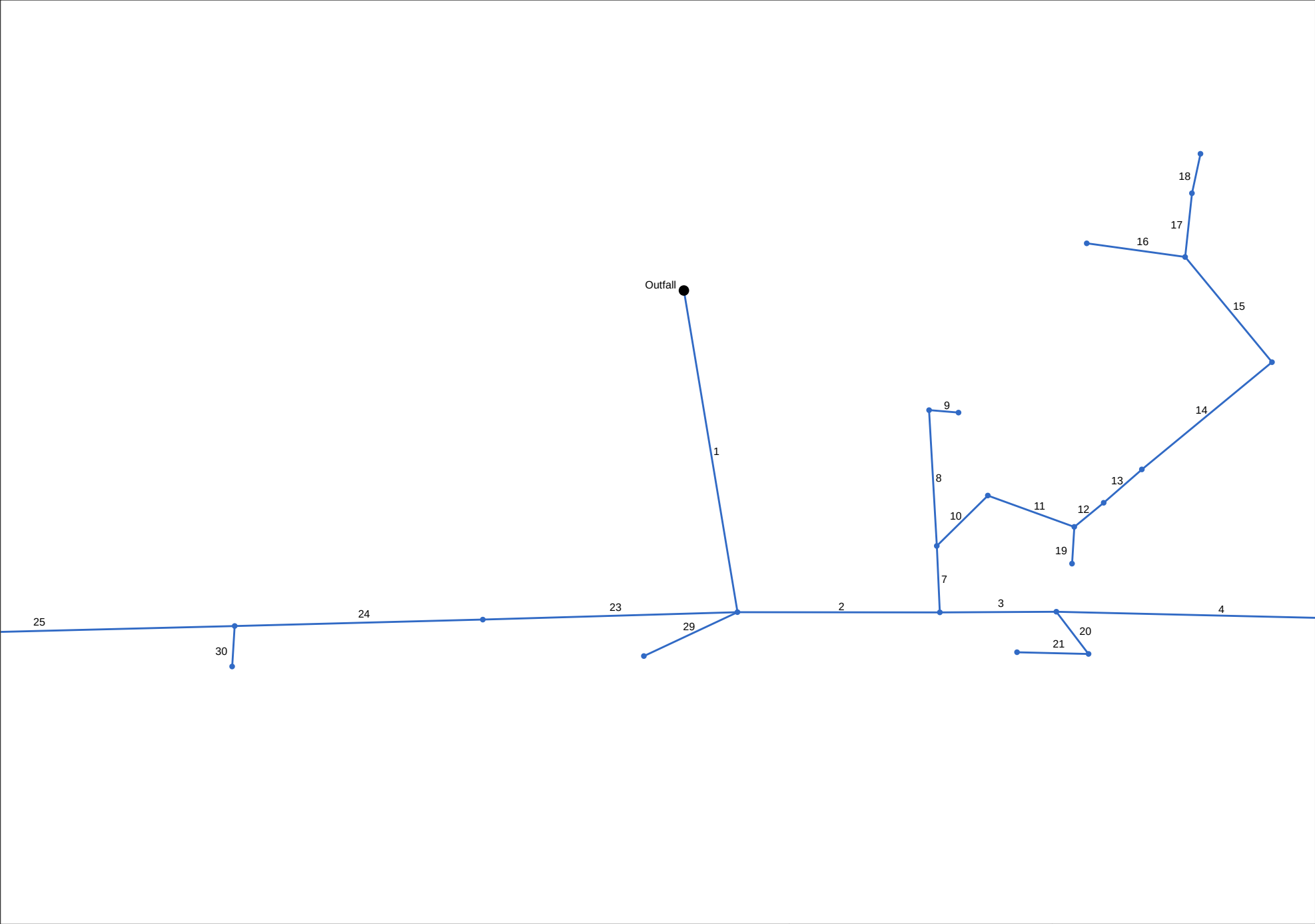
Drainage Basin

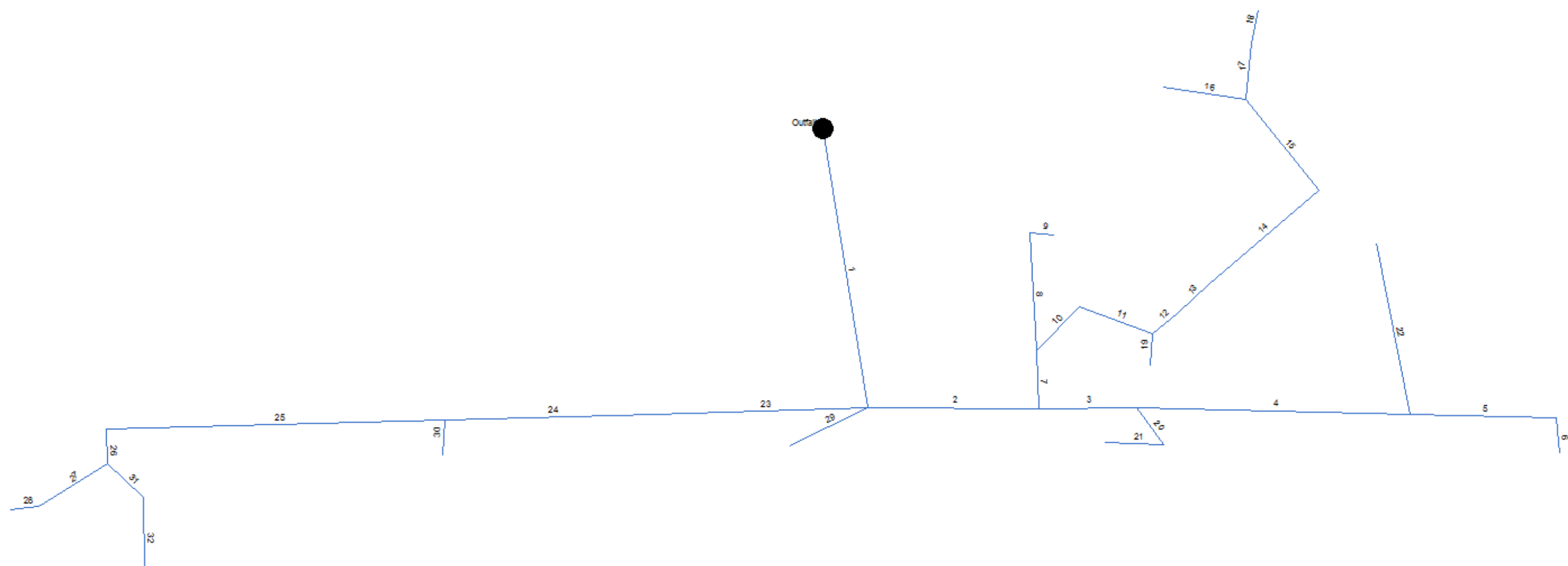


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Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan





Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	356.238	80.552	Genr	0.00	0.80	0.73	5.0	1302.08	0.27	1303.04	54	Cir	0.013	0.00	1316.37	
2	1	221.138	-80.486	Genr	0.00	0.20	0.73	5.0	1303.27	0.25	1303.82	48	Cir	0.013	0.00	1315.00	
3	2	127.319	-0.426	Genr	0.00	0.50	0.73	5.0	1304.03	0.38	1304.51	48	Cir	0.013	0.00	1314.56	
4	3	353.880	1.710	Genr	0.00	0.50	0.73	5.0	1304.72	0.62	1306.90	42	Cir	0.013	0.00	1315.36	
5	4	190.827	0.000	Genr	0.00	13.00	0.73	5.0	1307.12	0.43	1307.94	36	Cir	0.013	0.00	1314.43	
6	5	44.922	83.320	Genr	0.00	4.10	0.73	5.0	1308.47	1.60	1309.19	24	Cir	0.013	0.00	1314.64	
7	2	72.761	-92.710	Genr	0.00	0.40	0.73	5.0	1306.05	0.29	1306.26	18	Cir	0.013	0.00	1315.27	
8	7	148.603	-0.612	Genr	0.00	0.40	0.73	5.0	1306.57	1.99	1309.53	18	Cir	0.013	0.00	1315.88	
9	8	32.346	98.156	Genr	0.00	0.40	0.73	5.0	1310.83	0.80	1311.09	12	Cir	0.013	0.00	1315.80	
10	7	78.441	48.088	Genr	0.00	0.20	0.73	5.0	1309.16	1.20	1310.10	15	Cir	0.013	0.00	1316.29	
11	10	100.413	64.558	Genr	0.00	0.10	0.73	5.0	1310.07	0.23	1310.30	15	Cir	0.013	0.00	1315.78	
12	11	41.589	-59.488	Genr	0.00	0.10	0.73	5.0	1310.34	0.41	1310.51	15	Cir	0.013	0.00	1315.18	
13	12	55.354	-1.535	Genr	0.00	0.60	0.73	5.0	1310.51	0.40	1310.73	15	Cir	0.013	0.00	1315.45	
14	13	184.282	1.519	Genr	0.00	1.40	0.73	5.0	1310.73	0.62	1311.87	15	Cir	0.013	0.00	1315.13	
15	14	149.050	-90.056	Genr	0.00	0.30	0.73	5.0	1311.86	0.36	1312.39	15	Cir	0.013	0.00	1317.13	
16	15	108.491	-42.474	Genr	0.00	2.50	0.73	5.0	1312.42	0.79	1313.28	15	Cir	0.013	0.00	1317.00	
17	15	70.048	45.725	Genr	0.00	0.20	0.73	5.0	1312.45	0.49	1312.79	12	Cir	0.013	0.00	1316.19	
18	17	44.029	5.991	Genr	0.00	0.70	0.73	5.0	1312.79	0.66	1313.08	12	Cir	0.013	0.00	1317.32	
19	11	40.171	73.315	Genr	0.00	0.10	0.73	5.0	1312.24	1.32	1312.77	15	Cir	0.013	0.00	1315.19	
20	3	57.981	53.121	Genr	0.00	0.60	0.73	5.0	1308.99	0.85	1309.48	18	Cir	0.013	0.00	1314.27	
21	20	78.189	128.632	Genr	0.00	2.50	0.73	5.0	1309.88	0.96	1310.63	15	Cir	0.013	0.00	1314.44	
22	4	219.926	-102.667	Genr	0.00	1.00	0.73	5.0	1313.58	0.70	1315.11	12	Cir	0.013	0.00	1315.11	
23	1	278.398	97.790	Genr	0.00	0.70	0.73	5.0	1306.17	0.52	1307.61	30	Cir	0.013	0.00	1318.41	
Project File: Existing SWS System on 13th.stm												Number of lines: 32				Date: 02-14-2013	

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
24	23	271.156	0.181	Genr	0.00	2.00	0.73	5.0	1307.70	0.88	1310.08	24	Cir	0.013	0.00	1320.17	
25	24	438.824	0.042	Genr	0.00	2.20	0.73	5.0	1310.33	0.91	1314.32	24	Cir	0.013	0.00	1319.11	
26	25	44.296	-90.173	Genr	0.00	0.20	0.73	5.0	1315.15	0.50	1315.37	18	Cir	0.013	0.00	1319.02	
27	26	104.280	60.666	Genr	0.00	0.20	0.73	5.0	1315.90	0.28	1316.19	18	Cir	0.013	0.00	1319.31	
28	27	38.176	26.314	Genr	0.00	0.60	0.73	5.0	1315.86	0.89	1316.20	18	Cir	0.013	0.00	1319.26	
29	1	112.980	74.309	Genr	0.00	2.00	0.73	5.0	1311.17	1.50	1312.87	15	Cir	0.013	0.00	1316.69	
30	24	44.443	-85.029	Genr	0.00	1.00	0.73	5.0	1316.18	2.50	1317.29	15	Cir	0.013	0.00	1320.50	
31	26	62.626	-45.843	Genr	0.00	0.30	0.73	5.0	1315.74	0.10	1315.80	18	Cir	0.013	0.00	1318.60	
32	31	89.964	46.160	Genr	0.00	0.90	0.73	5.0	1315.74	0.42	1316.12	18	Cir	0.013	0.00	1318.48	
Project File: Existing SWS System on 13th.stm												Number of lines: 32				Date: 02-14-2013	

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
1		158.4	54	Cir	356.238	1302.08	1303.04	0.270	1306.37*	1308.58*	0.00	1308.58	End	Generic
2		116.0	48	Cir	221.138	1303.27	1303.82	0.249	1308.80*	1310.24*	0.00	1310.24	1	Generic
3		86.41	48	Cir	127.319	1304.03	1304.51	0.377	1310.83*	1311.29*	0.00	1311.29	2	Generic
4		72.39	42	Cir	353.880	1304.72	1306.90	0.616	1311.29*	1313.13*	0.00	1313.13	3	Generic
5		66.56	36	Cir	190.827	1307.12	1307.94	0.430	1313.13*	1315.03*	0.00	1315.03	4	Generic
6		15.96	24	Cir	44.922	1308.47	1309.19	1.603	1316.00*	1316.23*	0.00	1316.23	5	Generic
7		28.80	18	Cir	72.761	1306.05	1306.26	0.289	1310.24*	1315.72*	0.00	1315.72	2	Generic
8		3.11	18	Cir	148.603	1306.57	1309.53	1.992	1319.80*	1319.93*	0.00	1319.93	7	Generic
9		1.56	12	Cir	32.346	1310.83	1311.09	0.804	1319.93*	1319.99*	0.00	1319.99	8	Generic
10		24.13	15	Cir	78.441	1309.16	1310.10	1.198	1315.72*	1326.68*	0.00	1326.68	7	Generic
11		23.35	15	Cir	100.413	1310.07	1310.30	0.229	1327.06*	1340.20*	0.00	1340.20	10	Generic
12		22.57	15	Cir	41.589	1310.34	1310.51	0.409	1340.56*	1345.65*	0.00	1345.65	11	Generic
13		22.19	15	Cir	55.354	1310.51	1310.73	0.397	1345.83*	1352.36*	0.00	1352.36	12	Generic
14		19.85	15	Cir	184.282	1310.73	1311.87	0.619	1353.37*	1370.79*	0.00	1370.79	13	Generic
15		14.40	15	Cir	149.050	1311.86	1312.39	0.356	1372.72*	1380.14*	0.00	1380.14	14	Generic
16		9.73	15	Cir	108.491	1312.42	1313.28	0.793	1381.30*	1383.76*	0.00	1383.76	15	Generic
17		3.50	12	Cir	70.048	1312.45	1312.79	0.486	1381.97*	1382.64*	0.00	1382.64	15	Generic
18		2.72	12	Cir	44.029	1312.79	1313.08	0.658	1382.77*	1383.02*	0.00	1383.02	17	Generic
19		0.39	15	Cir	40.171	1312.24	1312.77	1.319	1345.82*	1345.83*	0.00	1345.83	11	Generic
20		12.07	18	Cir	57.981	1308.99	1309.48	0.845	1311.30*	1312.07*	0.00	1312.07	3	Generic
21		9.73	15	Cir	78.189	1309.88	1310.63	0.959	1312.07*	1313.84*	0.00	1313.84	20	Generic
22		3.89	12	Cir	219.926	1313.58	1315.11	0.696	1314.58*	1317.21*	0.00	1317.21	4	Generic
23		31.53	30	Cir	278.398	1306.17	1307.61	0.517	1309.48*	1311.13*	0.00	1311.13	1	Generic
24		28.80	24	Cir	271.156	1307.70	1310.08	0.878	1311.13*	1315.53*	0.00	1315.53	23	Generic

Project File: Existing SWS System on 13th.stm

Number of lines: 32

Run Date: 02-14-2013

NOTES: Return period = 5 Yrs. ; *Surcharged (HGL above crown).

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
25		17.13	24	Cir	438.824	1310.33	1314.32	0.909	1316.37*	1318.89*	0.00	1318.89	24	Generic
26		8.56	18	Cir	44.296	1315.15	1315.37	0.497	1318.99*	1319.28*	0.00	1319.28	25	Generic
27		3.11	18	Cir	104.280	1315.90	1316.19	0.278	1319.60*	1319.69*	0.00	1319.69	26	Generic
28		2.34	18	Cir	38.176	1315.86	1316.20	0.891	1319.71*	1319.73*	0.00	1319.73	27	Generic
29		7.78	15	Cir	112.980	1311.17	1312.87	1.505	1312.18	1313.98	0.00	1313.98	1	Generic
30		3.89	15	Cir	44.443	1316.18	1317.29	2.498	1316.72	1318.08	n/a	1318.08	24	Generic
31		4.67	18	Cir	62.626	1315.74	1315.80	0.096	1319.54*	1319.66*	0.00	1319.66	26	Generic
32		3.50	18	Cir	89.964	1315.74	1316.12	0.422	1319.71*	1319.81*	0.00	1319.81	31	Generic
Project File: Existing SWS System on 13th.stm									Number of lines: 32			Run Date: 02-14-2013		
NOTES: Return period = 5 Yrs. ; *Surcharged (HGL above crown).														

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (l)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	356.238	0.80	40.70	0.73	0.58	29.71	5.0	9.2	5.3	158.4	102.1	10.05	54	0.27	1302.08	1303.04	1306.37	1308.58	0.00	1316.37	
2	1	221.138	0.20	29.80	0.73	0.15	21.75	5.0	7.3	5.3	116.0	71.63	9.23	48	0.25	1303.27	1303.82	1308.80	1310.24	1316.37	1315.00	
3	2	127.319	0.50	22.20	0.73	0.37	16.21	5.0	6.5	5.3	86.41	88.20	6.88	48	0.38	1304.03	1304.51	1310.83	1311.29	1315.00	1314.56	
4	3	353.880	0.50	18.60	0.73	0.37	13.58	5.0	5.7	5.3	72.39	78.97	7.53	42	0.62	1304.72	1306.90	1311.29	1313.13	1314.56	1315.36	
5	4	190.827	13.00	17.10	0.73	9.49	12.48	5.0	5.1	5.3	66.56	43.72	9.42	36	0.43	1307.12	1307.94	1313.13	1315.03	1315.36	1314.43	
6	5	44.922	4.10	4.10	0.73	2.99	2.99	5.0	5.0	5.3	15.96	28.63	5.08	24	1.60	1308.47	1309.19	1316.00	1316.23	1314.43	1314.64	
7	2	72.761	0.40	7.40	0.73	0.29	5.40	5.0	7.3	5.3	28.80	5.64	16.30	18	0.29	1306.05	1306.26	1310.24	1315.72	1315.00	1315.27	
8	7	148.603	0.40	0.80	0.73	0.29	0.58	5.0	5.3	5.3	3.11	14.82	1.76	18	1.99	1306.57	1309.53	1319.80	1319.93	1315.27	1315.88	
9	8	32.346	0.40	0.40	0.73	0.29	0.29	5.0	5.0	5.3	1.56	3.19	1.98	12	0.80	1310.83	1311.09	1319.93	1319.99	1315.88	1315.80	
10	7	78.441	0.20	6.20	0.73	0.15	4.53	5.0	7.2	5.3	24.13	7.07	19.67	15	1.20	1309.16	1310.10	1315.72	1326.68	1315.27	1316.29	
11	10	100.413	0.10	6.00	0.73	0.07	4.38	5.0	7.1	5.3	23.35	3.09	19.03	15	0.23	1310.07	1310.30	1327.06	1340.20	1316.29	1315.78	
12	11	41.589	0.10	5.80	0.73	0.07	4.23	5.0	5.9	5.3	22.57	4.13	18.40	15	0.41	1310.34	1310.51	1340.56	1345.65	1315.78	1315.18	
13	12	55.354	0.60	5.70	0.73	0.44	4.16	5.0	5.9	5.3	22.19	4.07	18.08	15	0.40	1310.51	1310.73	1345.83	1352.36	1315.18	1315.45	
14	13	184.282	1.40	5.10	0.73	1.02	3.72	5.0	5.7	5.3	19.85	5.08	16.18	15	0.62	1310.73	1311.87	1353.37	1370.79	1315.45	1315.13	
15	14	149.050	0.30	3.70	0.73	0.22	2.70	5.0	5.5	5.3	14.40	3.85	11.74	15	0.36	1311.86	1312.39	1372.72	1380.14	1315.13	1317.13	
16	15	108.491	2.50	2.50	0.73	1.83	1.83	5.0	5.0	5.3	9.73	5.75	7.93	15	0.79	1312.42	1313.28	1381.30	1383.76	1317.13	1317.00	
17	15	70.048	0.20	0.90	0.73	0.15	0.66	5.0	5.2	5.3	3.50	2.48	4.46	12	0.49	1312.45	1312.79	1381.97	1382.64	1317.13	1316.19	
18	17	44.029	0.70	0.70	0.73	0.51	0.51	5.0	5.0	5.3	2.72	2.89	3.47	12	0.66	1312.79	1313.08	1382.77	1383.02	1316.19	1317.32	
19	11	40.171	0.10	0.10	0.73	0.07	0.07	5.0	5.0	5.3	0.39	7.42	0.32	15	1.32	1312.24	1312.77	1345.82	1345.83	1315.78	1315.19	
20	3	57.981	0.60	3.10	0.73	0.44	2.26	5.0	5.2	5.3	12.07	9.65	6.83	18	0.85	1308.99	1309.48	1311.30	1312.07	1314.56	1314.27	
21	20	78.189	2.50	2.50	0.73	1.83	1.83	5.0	5.0	5.3	9.73	6.32	7.93	15	0.96	1309.88	1310.63	1312.07	1313.84	1314.27	1314.44	
22	4	219.926	1.00	1.00	0.73	0.73	0.73	5.0	5.0	5.3	3.89	2.97	4.96	12	0.70	1313.58	1315.11	1314.58	1317.21	1315.36	1315.11	
23	1	278.398	0.70	8.10	0.73	0.51	5.91	5.0	8.5	5.3	31.53	29.49	6.42	30	0.52	1306.17	1307.61	1309.48	1311.13	1316.37	1318.41	
Project File: Existing SWS System on 13th.stm																Number of lines: 32				Run Date: 02-14-2013		
NOTES: Intensity = 52.62 / (Inlet time + 11.20) ^ 0.75; Return period = 5 Yrs. ; c = cir e = ellip b = box																						

Storm Sewer Tabulation

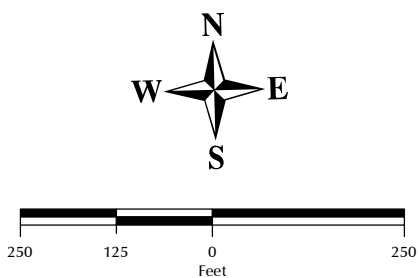
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (l)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
24	23	271.156	2.00	7.40	0.73	1.46	5.40	5.0	8.0	5.3	28.80	21.19	9.17	24	0.88	1307.70	1310.08	1311.13	1315.53	1318.41	1320.17	
25	24	438.824	2.20	4.40	0.73	1.61	3.21	5.0	6.6	5.3	17.13	21.57	5.45	24	0.91	1310.33	1314.32	1316.37	1318.89	1320.17	1319.11	
26	25	44.296	0.20	2.20	0.73	0.15	1.61	5.0	6.5	5.3	8.56	7.40	4.85	18	0.50	1315.15	1315.37	1318.99	1319.28	1319.11	1319.02	
27	26	104.280	0.20	0.80	0.73	0.15	0.58	5.0	5.5	5.3	3.11	5.54	1.76	18	0.28	1315.90	1316.19	1319.60	1319.69	1319.02	1319.31	
28	27	38.176	0.60	0.60	0.73	0.44	0.44	5.0	5.0	5.3	2.34	9.91	1.32	18	0.89	1315.86	1316.20	1319.71	1319.73	1319.31	1319.26	
29	1	112.980	2.00	2.00	0.73	1.46	1.46	5.0	5.0	5.3	7.78	7.92	7.07	15	1.50	1311.17	1312.87	1312.18	1313.98	1316.37	1316.69	
30	24	44.443	1.00	1.00	0.73	0.73	0.73	5.0	5.0	5.3	3.89	10.21	6.26	15	2.50	1316.18	1317.29	1316.72	1318.08	1320.17	1320.50	
31	26	62.626	0.30	1.20	0.73	0.22	0.88	5.0	5.8	5.3	4.67	3.25	2.64	18	0.10	1315.74	1315.80	1319.54	1319.66	1319.02	1318.60	
32	31	89.964	0.90	0.90	0.73	0.66	0.66	5.0	5.0	5.3	3.50	6.82	1.98	18	0.42	1315.74	1316.12	1319.71	1319.81	1318.60	1318.48	
Project File: Existing SWS System on 13th.stm																Number of lines: 32				Run Date: 02-14-2013		
NOTES: Intensity = 52.62 / (Inlet time + 11.20) ^ 0.75; Return period = 5 Yrs. ; c = cir e = ellip b = box																						

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow								Total Travel Time (min)
			n-Value	Flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	Flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	Flow Length (ft)	Travel Time (min)		
1		User																		5.00	
2		User																		5.00	
3		User																		5.00	
4		User																		5.00	
5		User																		5.00	
6		User																		5.00	
7		User																		5.00	
8		User																		5.00	
9		User																		5.00	
10		User																		5.00	
11		User																		5.00	
12		User																		5.00	
13		User																		5.00	
14		User																		5.00	
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22		User																		5.00	
23		User																		5.00	
24		User																		5.00	
Project File: Existing SWS System on 13th.stm					Min. Tc used for intensity calculations = 10 min							Number of lines: 32				Date: 02-14-2013					

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow								Total Travel Time (min)
			n-Value	Flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	Flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	Flow Length (ft)	Travel Time (min)		
25		User																		5.00	
26		User																		5.00	
27		User																		5.00	
28		User																		5.00	
29		User																		5.00	
30		User																		5.00	
31		User																		5.00	
32		User																		5.00	
Project File: Existing SWS System on 13th.stm					Min. Tc used for intensity calculations = 10 min					Number of lines: 32					Date: 02-14-2013						



Presbyterian Manors

Project Name:

Proposed Site - Impervious Area

Sheet Title:

MKEC
ENGINEERING
CONSULTANTS, INC.

JGD

Drawn By:

January 2013

Date:

BLB

Design / Review:

1201010451

Job No.:

Curve Number Calculations
Existing Presbyterian Manors

Estimate Imperviousness per Land Use

HSG A			HSG B			HSG C			HSG D		
Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)
Commercial and Business	85%		Commercial and Business	85%		Commercial and Business	85%		Commercial and Business	85%	
Industrial	72%		Industrial	72%		Industrial	72%		Industrial	72%	
Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%	
Residential 1/4 acre	38%		Residential 1/4 acre	38%		Residential 1/4 acre	38%		Residential 1/4 acre	38%	
Residential 1/3 acre	30%		Residential 1/3 acre	30%		Residential 1/3 acre	30%		Residential 1/3 acre	30%	
Residential 1/2 acre	25%		Residential 1/2 acre	25%		Residential 1/2 acre	25%		Residential 1/2 acre	25%	
Residential 1 acre	20%		Residential 1 acre	20%		Residential 1 acre	20%		Residential 1 acre	20%	
Residential 2 acres	12%		Residential 2 acres	12%		Residential 2 acres	12%		Residential 2 acres	12%	
Impervious Area (acres)		0	Impervious Area (acres)		0	Impervious Area (acres)		0	Impervious Area (acres)		0

Composite Curve Number (CN)

HSG A			HSG B			HSG C			HSG D		
Land Use	CN	Area (ac)	Land Use	CN	Area (ac)	Land Use	CN	Area (ac)	Land Use	CN	Area (ac)
Pre-Developed or Undisturbed Pervious	55		Pre-Developed or Undisturbed Pervious	71		Pre-Developed or Undisturbed Pervious	80		Pre-Developed or Undisturbed Pervious	84	
Developed or Disturbed Pervious	71		Developed or Disturbed Pervious	80	7.99	Developed or Disturbed Pervious	84		Developed or Disturbed Pervious	88	
Impervious	98	0	Impervious	98	7.7	Impervious	98	0	Impervious	98	0
Composite Curve Number HSG A (CN)	0.0	0	Composite Curve Number HSG B (CN)	88.8	15.69	Composite Curve Number HSG C (CN)	0.0	0	Composite Curve Number HSG D (CN)	0.0	0

Total Weighted Composite Curve Number (CN)	88.8
Total Area (A) (acres)	15.69

Curve Number Calculations
Existing Presbyterian Manors - To Detention Pond

Estimate Imperviousness per Land Use											
HSG A			HSG B			HSG C			HSG D		
Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)	Land Use	Average % Impervious	Area (ac)
Commercial and Business	85%		Commercial and Business	85%	80	Commercial and Business	85%		Commercial and Business	85%	
Industrial	72%		Industrial	72%		Industrial	72%		Industrial	72%	
Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%		Residential 1/8 acre or less (townhouse)	65%	
Residential 1/4 acre	38%		Residential 1/4 acre	38%	124.6	Residential 1/4 acre	38%		Residential 1/4 acre	38%	
Residential 1/3 acre	30%		Residential 1/3 acre	30%		Residential 1/3 acre	30%		Residential 1/3 acre	30%	
Residential 1/2 acre	25%		Residential 1/2 acre	25%		Residential 1/2 acre	25%		Residential 1/2 acre	25%	
Residential 1 acre	20%		Residential 1 acre	20%		Residential 1 acre	20%		Residential 1 acre	20%	
Residential 2 acres	12%		Residential 2 acres	12%		Residential 2 acres	12%		Residential 2 acres	12%	
Impervious Area (acres)		0	Impervious Area (acres)		115.35	Impervious Area (acres)		0	Impervious Area (acres)		0

Composite Curve Number (CN)											
HSG A			HSG B			HSG C			HSG D		
Land Use	CN	Area (ac)	Land Use	CN	Area (ac)	Land Use	CN	Area (ac)	Land Use	CN	Area (ac)
Pre-Developed or Undisturbed Pervious	55		Pre-Developed or Undisturbed Pervious	71		Pre-Developed or Undisturbed Pervious	80		Pre-Developed or Undisturbed Pervious	84	
Developed or Disturbed Pervious	71		Developed or Disturbed Pervious	80	96.95	Developed or Disturbed Pervious	84		Developed or Disturbed Pervious	88	
Impervious	98	0	Impervious	98	123.05	Impervious	98	0	Impervious	98	0
Composite Curve Number HSG A (CN)	0.0	0	Composite Curve Number HSG B (CN)	90.1	220	Composite Curve Number HSG C (CN)	0.0	0	Composite Curve Number HSG D (CN)	0.0	0

Total Weighted Composite Curve Number (CN)	90.1
Total Area (A) (acres)	220



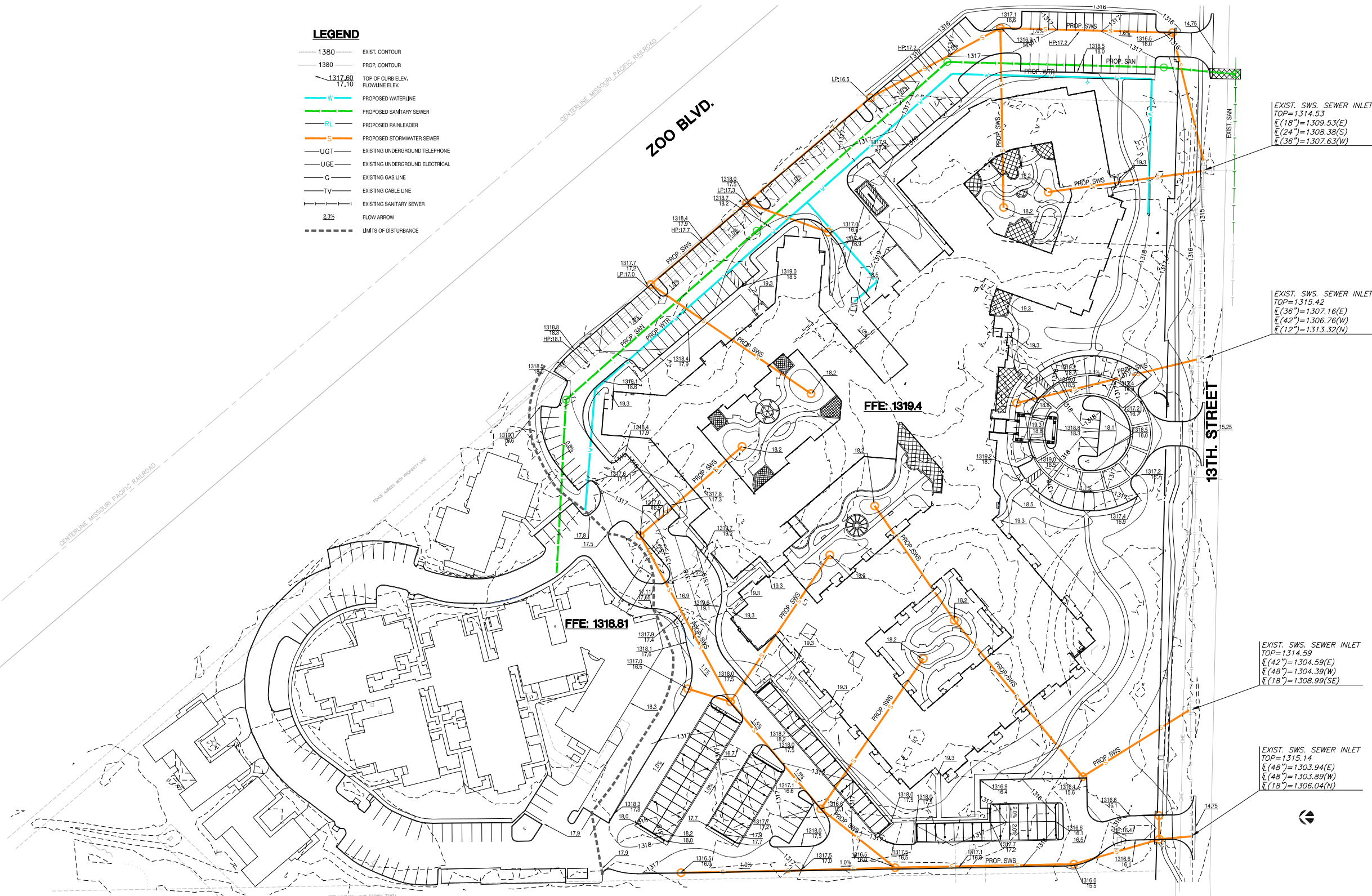
1414 WILSHIRE AVE.
WICHITA, KS 67202
TEL: 316.261.1111 FAX: 316.261.1111
WWW.BKSARCHITECTURE.COM

REVISIONS

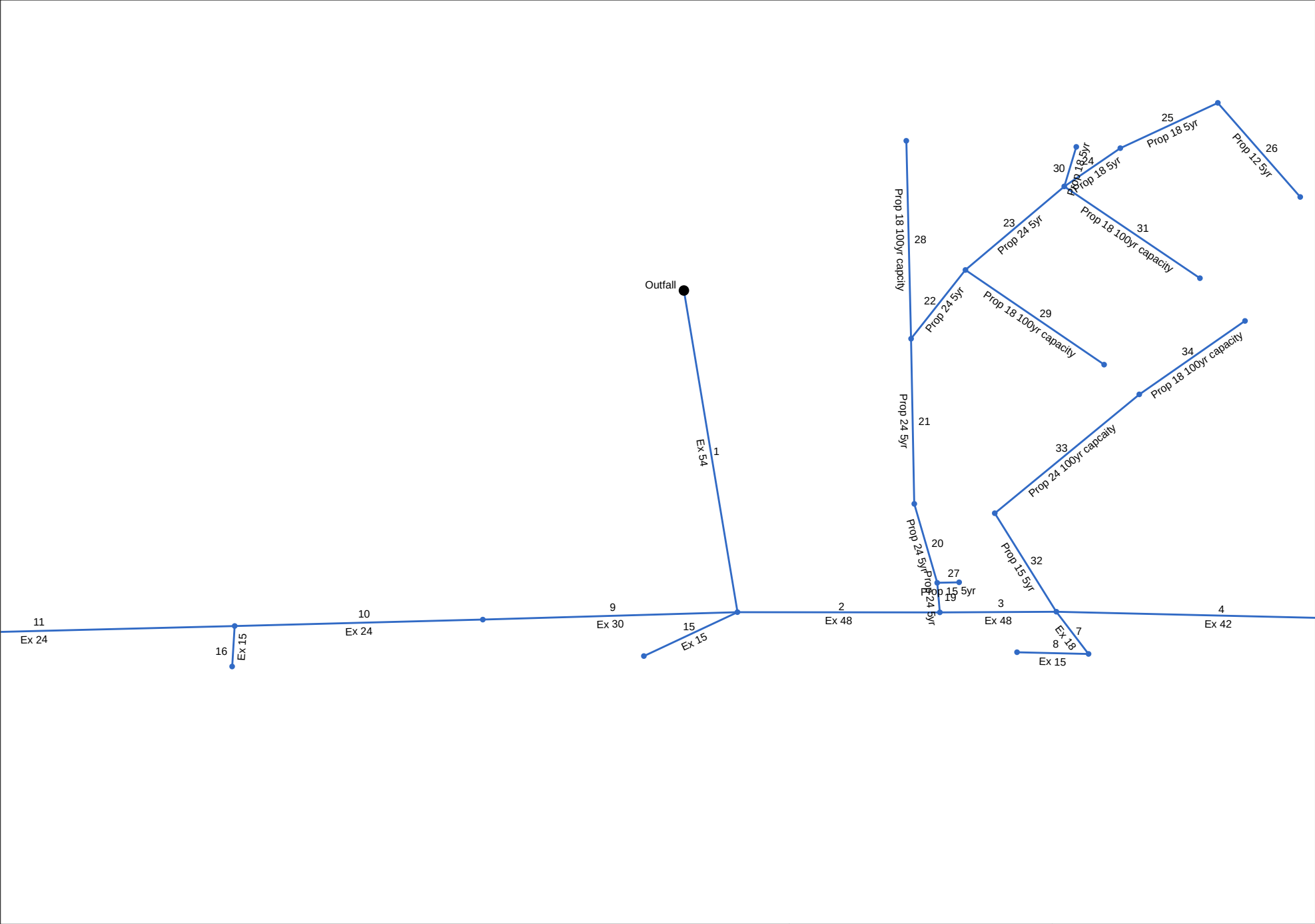
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BKS
DATE
9 OCT. 2012
PROJECT
111601
SHEET NO.

GRADING PLAN 2

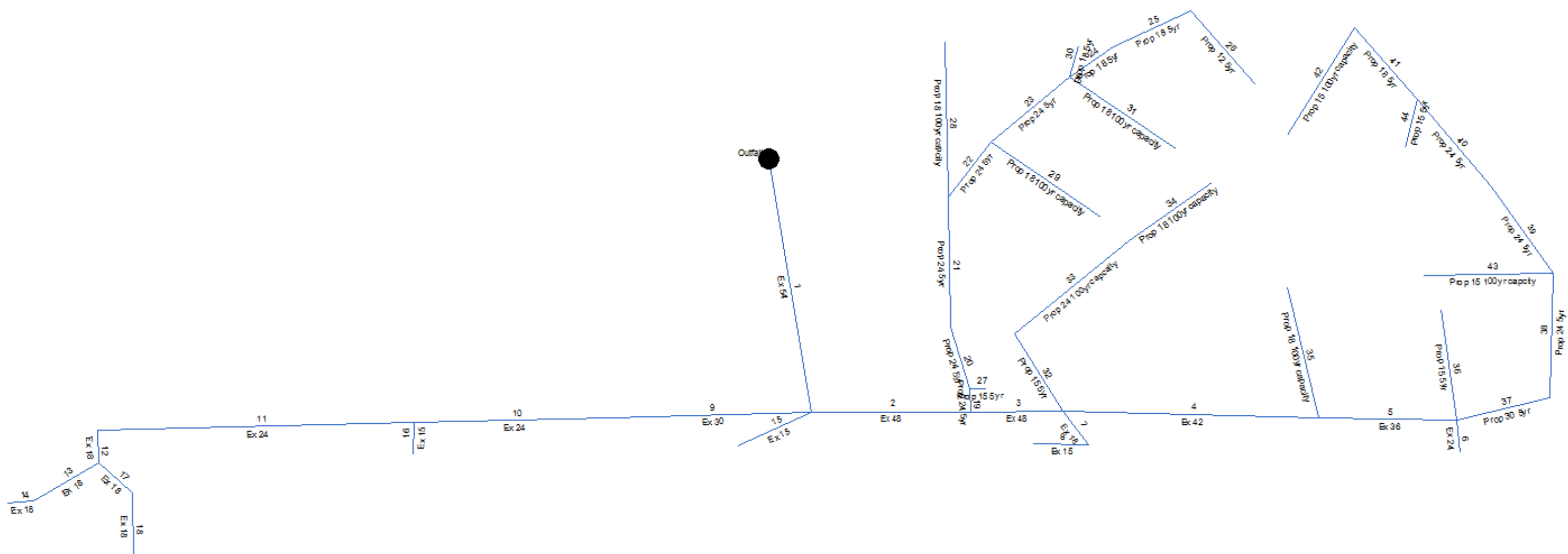
NOT TO SCALE
ALL DIMENSIONS ARE IN FEET
UNLESS OTHERWISE NOTED
BY USER, BKS
DATE: 9 OCT. 2012
PROJECT: 111601
SHEET NO.: 2



Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan



Project File: Proposed SWS System.stm	Number of lines: 44	Date: 02-14-2013
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Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	356.238	80.552	Genr	0.00	0.80	0.73	5.0	1302.08	0.27	1303.04	54	Cir	0.013	0.00	1316.37	Ex 54
2	1	221.138	-80.486	Genr	0.00	0.20	0.73	5.0	1303.27	0.25	1303.82	48	Cir	0.013	0.00	1315.00	Ex 48
3	2	127.319	-0.426	Genr	0.00	0.50	0.73	5.0	1304.03	0.38	1304.51	48	Cir	0.013	0.00	1314.56	Ex 48
4	3	353.880	1.710	Genr	0.00	1.30	0.73	5.0	1304.72	0.62	1306.90	42	Cir	0.013	0.00	1315.36	Ex 42
5	4	190.827	0.000	Genr	0.00	9.30	0.73	5.0	1307.12	0.43	1307.94	36	Cir	0.013	0.00	1314.43	Ex 36
6	5	44.922	83.320	Genr	0.00	4.10	0.73	5.0	1308.47	1.60	1309.19	24	Cir	0.013	0.00	1314.64	Ex 24
7	3	57.981	53.121	Genr	0.00	0.60	0.73	5.0	1308.99	0.85	1309.48	18	Cir	0.013	0.00	1314.27	Ex 18
8	7	78.189	128.632	Genr	0.00	2.50	0.73	5.0	1309.88	0.96	1310.63	15	Cir	0.013	0.00	1314.44	Ex 15
9	1	278.398	97.790	Genr	0.00	0.70	0.73	5.0	1306.17	0.52	1307.61	30	Cir	0.013	0.00	1318.41	Ex 30
10	9	271.156	0.181	Genr	0.00	2.00	0.73	5.0	1307.70	0.88	1310.08	24	Cir	0.013	0.00	1320.17	Ex 24
11	10	438.824	0.042	Genr	0.00	2.20	0.73	5.0	1310.33	0.91	1314.32	24	Cir	0.013	0.00	1319.11	Ex 24
12	11	44.296	-90.173	Genr	0.00	0.20	0.73	5.0	1315.15	0.50	1315.37	18	Cir	0.013	0.00	1319.02	Ex 18
13	12	104.280	60.666	Genr	0.00	0.20	0.73	5.0	1315.90	0.28	1316.19	18	Cir	0.013	0.00	1319.31	Ex 18
14	13	38.176	26.314	Genr	0.00	0.60	0.73	5.0	1315.86	0.89	1316.20	18	Cir	0.013	0.00	1319.26	Ex 18
15	1	112.980	74.309	Genr	0.00	2.00	0.73	5.0	1311.17	1.50	1312.87	15	Cir	0.013	0.00	1316.69	Ex 15
16	10	44.443	-85.029	Genr	0.00	1.00	0.73	5.0	1316.18	2.50	1317.29	15	Cir	0.013	0.00	1320.50	Ex 15
17	12	62.626	-45.843	Genr	0.00	0.30	0.73	5.0	1315.74	0.10	1315.80	18	Cir	0.013	0.00	1318.60	Ex 18
18	17	89.964	46.160	Genr	0.00	0.90	0.73	5.0	1315.74	0.42	1316.12	18	Cir	0.013	0.00	1318.48	Ex 18
19	2	32.545	-95.099	Curb	0.00	0.10	0.73	5.0	1303.92	0.31	1304.02	24	Cir	0.013	0.00	1315.50	Prop 24 5yr
20	19	89.811	-11.189	Curb	0.00	0.50	0.73	5.0	1304.12	0.30	1304.39	24	Cir	0.013	0.00	1315.60	Prop 24 5yr
21	20	180.458	15.078	Grate	0.00	0.40	0.73	5.0	1304.49	0.30	1305.03	24	Cir	0.013	0.00	1316.00	Prop 24 5yr
22	21	95.697	39.493	Curb	0.00	0.40	0.73	5.0	1305.13	0.30	1305.42	24	Cir	0.013	0.00	1316.10	Prop 24 5yr
23	22	141.459	11.455	Curb	0.00	0.40	0.73	5.0	1305.52	0.30	1305.94	24	Cir	0.013	0.00	1316.80	Prop 24 5yr
Project File: Proposed SWS System.stm												Number of lines: 44				Date: 02-14-2013	

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
24	23	74.098	5.936	MH	0.00	0.00	0.73	5.0	1306.04	0.30	1306.26	18	Cir	0.013	0.00	1316.50	Prop 18 5yr
25	24	117.603	9.373	Curb	0.00	1.10	0.73	5.0	1306.36	0.30	1306.71	18	Cir	0.013	0.00	1316.50	Prop 18 5yr
26	25	136.645	73.731	Grate	0.00	0.50	0.73	5.0	1306.81	0.30	1307.22	12	Cir	0.013	0.00	1317.80	Prop 12 5yr
27	19	24.021	93.889	Curb	0.00	0.10	0.73	5.0	1304.12	0.29	1304.19	15	Cir	0.013	0.00	1315.50	Prop 15 5yr
28	21	216.251	-0.213	Grate	0.00	0.60	0.73	5.0	1305.13	0.30	1305.78	15	Cir	0.013	0.00	1316.00	Prop 18 100yr capc
29	22	183.647	85.967	Grate	0.00	0.60	0.73	5.0	1305.52	0.30	1306.07	15	Cir	0.013	0.00	1317.80	Prop 18 100yr capa
30	23	45.119	-32.852	Grate	0.00	1.20	0.73	5.0	1306.04	0.31	1306.18	18	Cir	0.013	0.00	1316.50	Prop 18 5yr
31	23	179.031	74.257	Grate	0.00	0.70	0.73	5.0	1306.04	0.30	1306.58	15	Cir	0.013	0.00	1317.80	Prop 18 100yr capa
32	3	126.896	-121.682	Curb	0.00	0.50	0.73	5.0	1304.61	0.30	1304.99	15	Cir	0.013	0.00	1315.60	Prop 15 5yr
33	32	204.366	82.626	Grate	0.00	0.60	0.73	5.0	1305.09	0.30	1305.70	15	Cir	0.013	0.00	1317.80	Prop 24 100yr capc
34	33	140.630	4.595	Grate	0.00	0.70	0.73	5.0	1305.80	0.30	1306.22	15	Cir	0.013	0.00	1317.80	Prop 18 100yr capa
35	4	186.790	-104.922	Grate	0.00	0.60	0.73	5.0	1307.00	0.30	1307.56	15	Cir	0.013	0.00	1319.00	Prop 18 100yr capa
36	5	156.469	-99.150	Grate	0.00	0.40	0.73	5.0	1308.14	0.30	1308.61	15	Cir	0.013	0.00	1317.80	Prop 15 5yr
37	5	133.046	-14.982	Curb	0.00	0.30	0.73	5.0	1308.14	0.30	1308.54	30	Cir	0.013	0.00	1316.00	Prop 30 5yr
38	37	173.908	-74.804	Curb	0.00	0.40	0.73	5.0	1308.64	0.30	1309.16	24	Cir	0.013	0.00	1316.40	Prop 24 5yr
39	38	146.556	-37.288	Grate	0.00	0.30	0.73	5.0	1309.26	0.30	1309.70	24	Cir	0.013	0.00	1316.50	Prop 24 5yr
40	39	159.378	-4.723	Curb	0.00	0.20	0.73	5.0	1309.80	0.30	1310.28	24	Cir	0.013	0.00	1317.30	Prop 24 5yr
41	40	132.571	0.000	Curb	0.00	0.50	0.73	5.0	1310.38	0.30	1310.78	18	Cir	0.013	0.00	1317.00	Prop 18 5yr
42	41	177.092	-107.444	Grate	0.00	0.50	0.73	5.0	1310.88	0.30	1311.41	15	Cir	0.013	0.00	1317.80	Prop 15 100yr capa
43	38	181.108	-92.632	Grate	0.00	0.40	0.73	5.0	1309.26	0.30	1309.80	12	Cir	0.013	0.00	1317.80	Prop 15 100yr capc
44	40	68.551	-125.028	Grate	0.00	0.80	0.73	5.0	1310.38	0.31	1310.59	15	Cir	0.013	0.00	1317.80	Prop 15 5yr
Project File: Proposed SWS System.stm												Number of lines: 44				Date: 02-14-2013	

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
1	Ex 54	147.6	54	Cir	356.238	1302.08	1303.04	0.270	1306.37*	1308.29*	0.00	1308.29	End	Generic
2	Ex 48	111.0	48	Cir	221.138	1303.27	1303.82	0.249	1308.42*	1309.74*	0.00	1309.74	1	Generic
3	Ex 48	87.70	48	Cir	127.319	1304.03	1304.51	0.377	1310.19*	1310.67*	0.00	1310.67	2	Generic
4	Ex 42	70.14	42	Cir	353.880	1304.72	1306.90	0.616	1310.67*	1312.39*	0.00	1312.39	3	Generic
5	Ex 36	63.87	36	Cir	190.827	1307.12	1307.94	0.430	1312.39*	1314.14*	0.00	1314.14	4	Generic
6	Ex 24	15.96	24	Cir	44.922	1308.47	1309.19	1.603	1315.01*	1315.23*	0.00	1315.23	5	Generic
7	Ex 18	12.07	18	Cir	57.981	1308.99	1309.48	0.845	1310.70*	1311.47*	0.00	1311.47	3	Generic
8	Ex 15	9.73	15	Cir	78.189	1309.88	1310.63	0.959	1311.47*	1313.24*	0.00	1313.24	7	Generic
9	Ex 30	31.53	30	Cir	278.398	1306.17	1307.61	0.517	1308.99*	1310.63*	0.00	1310.63	1	Generic
10	Ex 24	28.80	24	Cir	271.156	1307.70	1310.08	0.878	1310.63*	1315.03*	0.00	1315.03	9	Generic
11	Ex 24	17.13	24	Cir	438.824	1310.33	1314.32	0.909	1315.88*	1318.39*	0.00	1318.39	10	Generic
12	Ex 18	8.56	18	Cir	44.296	1315.15	1315.37	0.497	1318.49*	1318.79*	0.00	1318.79	11	Generic
13	Ex 18	3.11	18	Cir	104.280	1315.90	1316.19	0.278	1319.10*	1319.19*	0.00	1319.19	12	Generic
14	Ex 18	2.34	18	Cir	38.176	1315.86	1316.20	0.891	1319.22*	1319.23*	0.00	1319.23	13	Generic
15	Ex 15	7.78	15	Cir	112.980	1311.17	1312.87	1.505	1312.18	1313.98	0.00	1313.98	1	Generic
16	Ex 15	3.89	15	Cir	44.443	1316.18	1317.29	2.498	1316.72	1318.08	n/a	1318.08	10	Generic
17	Ex 18	4.67	18	Cir	62.626	1315.74	1315.80	0.096	1319.04*	1319.17*	0.00	1319.17	12	Generic
18	Ex 18	3.50	18	Cir	89.964	1315.74	1316.12	0.422	1319.21*	1319.31*	0.00	1319.31	17	Generic
19	Prop 24 5yr	25.69	24	Cir	32.545	1303.92	1304.02	0.307	1309.91*	1310.33*	0.00	1310.33	2	Curb-Horiz
20	Prop 24 5yr	24.91	24	Cir	89.811	1304.12	1304.39	0.301	1310.39*	1311.48*	0.00	1311.48	19	Curb-Horiz
21	Prop 24 5yr	22.96	24	Cir	180.458	1304.49	1305.03	0.299	1311.63*	1313.49*	0.00	1313.49	20	Grate
22	Prop 24 5yr	19.07	24	Cir	95.697	1305.13	1305.42	0.303	1313.75*	1314.43*	0.00	1314.43	21	Curb-Horiz
23	Prop 24 5yr	15.18	24	Cir	141.459	1305.52	1305.94	0.297	1314.64*	1315.28*	0.00	1315.28	22	Curb-Horiz
24	Prop 18 5yr	6.23	18	Cir	74.098	1306.04	1306.26	0.297	1315.44*	1315.71*	0.00	1315.71	23	Manhole

Project File: Proposed SWS System.stm

Number of lines: 44

Run Date: 02-14-2013

NOTES: Return period = 5 Yrs. ; *Surcharged (HGL above crown).

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total
			n-Value	Flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	Flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	Flow Length (ft)	Travel Time (min)	Travel Time (min)
1	Ex 54	User																		5.00
2	Ex 48	User																		5.00
3	Ex 48	User																		5.00
4	Ex 42	User																		5.00
5	Ex 36	User																		5.00
6	Ex 24	User																		5.00
7	Ex 18	User																		5.00
8	Ex 15	User																		5.00
9	Ex 30	User																		5.00
10	Ex 24	User																		5.00
11	Ex 24	User																		5.00
12	Ex 18	User																		5.00
13	Ex 18	User																		5.00
14	Ex 18	User																		5.00
15	Ex 15	User																		5.00
16	Ex 15	User																		5.00
17	Ex 18	User																		5.00
18	Ex 18	User																		5.00
19	Prop 24 5yr	User																		5.00
20	Prop 24 5yr	User																		5.00
21	Prop 24 5yr	User																		5.00
22	Prop 24 5yr	User																		5.00
23	Prop 24 5yr	User																		5.00
24	Prop 18 5yr	User																		5.00
Project File: Proposed SWS System.stm					Min. Tc used for intensity calculations = 10 min						Number of lines: 44					Date: 02-14-2013				

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow								Total Travel Time (min)
			n-Value	Flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	Flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	Flow Length (ft)	Travel Time (min)		
25	Prop 18 5yr	User																		5.00	
26	Prop 12 5yr	User																		5.00	
27	Prop 15 5yr	User																		5.00	
28	Prop 18 100yr cap	User																		5.00	
29	Prop 18 100yr cap	User																		5.00	
30	Prop 18 5yr	User																		5.00	
31	Prop 18 100yr cap	User																		5.00	
32	Prop 15 5yr	User																		5.00	
33	Prop 24 100yr cap	User																		5.00	
34	Prop 18 100yr cap	User																		5.00	
35	Prop 18 100yr cap	User																		5.00	
36	Prop 15 5yr	User																		5.00	
37	Prop 30 5yr	User																		5.00	
38	Prop 24 5yr	User																		5.00	
39	Prop 24 5yr	User																		5.00	
40	Prop 24 5yr	User																		5.00	
41	Prop 18 5yr	User																		5.00	
42	Prop 15 100yr cap	User																		5.00	
43	Prop 15 100yr cap	User																		5.00	
44	Prop 15 5yr	User																		5.00	
Project File: Proposed SWS System.stm					Min. Tc used for intensity calculations = 10 min							Number of lines: 44				Date: 02-14-2013					

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
25	Prop 18 5yr	6.23	18	Cir	117.603	1306.36	1306.71	0.298	1315.71*	1316.12*	0.00	1316.12	24	Curb-Horiz
26	Prop 12 5yr	1.95	12	Cir	136.645	1306.81	1307.22	0.300	1316.22*	1316.63*	0.00	1316.63	25	Grate
27	Prop 15 5yr	0.39	15	Cir	24.021	1304.12	1304.19	0.291	1311.37*	1311.37*	0.00	1311.37	19	Curb-Horiz
28	Prop 18 100yr capacity	2.34	15	Cir	216.251	1305.13	1305.78	0.301	1314.26*	1314.55*	0.00	1314.55	21	Grate
29	Prop 18 100yr capacity	2.34	15	Cir	183.647	1305.52	1306.07	0.299	1314.94*	1315.18*	0.00	1315.18	22	Grate
30	Prop 18 5yr	4.67	18	Cir	45.119	1306.04	1306.18	0.310	1315.53*	1315.62*	0.00	1315.62	23	Grate
31	Prop 18 100yr capacity	2.72	15	Cir	179.031	1306.04	1306.58	0.302	1315.56*	1315.88*	0.00	1315.88	23	Grate
32	Prop 15 5yr	7.01	15	Cir	126.896	1304.61	1304.99	0.299	1310.92*	1312.41*	0.00	1312.41	3	Curb-Horiz
33	Prop 24 100yr capcaity	5.06	15	Cir	204.366	1305.09	1305.70	0.298	1312.65*	1313.91*	0.00	1313.91	32	Grate
34	Prop 18 100yr capacity	2.72	15	Cir	140.630	1305.80	1306.22	0.299	1314.10*	1314.35*	0.00	1314.35	33	Grate
35	Prop 18 100yr capacity	2.34	15	Cir	186.790	1307.00	1307.56	0.300	1313.16*	1313.40*	0.00	1313.40	4	Grate
36	Prop 15 5yr	1.56	15	Cir	156.469	1308.14	1308.61	0.300	1315.38*	1315.48*	0.00	1315.48	5	Grate
37	Prop 30 5yr	12.98	30	Cir	133.046	1308.14	1308.54	0.301	1315.30*	1315.43*	0.00	1315.43	5	Curb-Horiz
38	Prop 24 5yr	12.07	24	Cir	173.908	1308.64	1309.16	0.299	1315.43*	1315.93*	0.00	1315.93	37	Curb-Horiz
39	Prop 24 5yr	8.95	24	Cir	146.556	1309.26	1309.70	0.300	1316.03*	1316.26*	0.00	1316.26	38	Grate
40	Prop 24 5yr	7.78	24	Cir	159.378	1309.80	1310.28	0.301	1316.29*	1316.48*	0.00	1316.48	39	Curb-Horiz
41	Prop 18 5yr	3.89	18	Cir	132.571	1310.38	1310.78	0.302	1316.50*	1316.68*	0.00	1316.68	40	Curb-Horiz
42	Prop 15 100yr capacity	1.95	15	Cir	177.092	1310.88	1311.41	0.299	1316.72*	1316.88*	0.00	1316.88	41	Grate
43	Prop 15 100yr capacity	1.56	12	Cir	181.108	1309.26	1309.80	0.298	1316.10*	1316.44*	0.00	1316.44	38	Grate
44	Prop 15 5yr	3.11	15	Cir	68.551	1310.38	1310.59	0.306	1316.48*	1316.64*	0.00	1316.64	40	Grate
Project File: Proposed SWS System.stm									Number of lines: 44			Run Date: 02-14-2013		
NOTES: Return period = 5 Yrs. ; *Surcharged (HGL above crown).														

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (l)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	356.238	0.80	42.20	0.73	0.58	30.81	5.0	13.2	4.8	147.6	102.1	9.36	54	0.27	1302.08	1303.04	1306.37	1308.29	0.00	1316.37	Ex 54
2	1	221.138	0.20	31.30	0.73	0.15	22.85	5.0	12.8	4.9	111.0	71.63	8.83	48	0.25	1303.27	1303.82	1308.42	1309.74	1316.37	1315.00	Ex 48
3	2	127.319	0.50	24.50	0.73	0.37	17.89	5.0	12.5	4.9	87.70	88.20	6.98	48	0.38	1304.03	1304.51	1310.19	1310.67	1315.00	1314.56	Ex 48
4	3	353.880	1.30	19.10	0.73	0.95	13.94	5.0	11.7	5.0	70.14	78.97	7.29	42	0.62	1304.72	1306.90	1310.67	1312.39	1314.56	1315.36	Ex 42
5	4	190.827	9.30	17.20	0.73	6.79	12.56	5.0	11.4	5.1	63.87	43.72	9.04	36	0.43	1307.12	1307.94	1312.39	1314.14	1315.36	1314.43	Ex 36
6	5	44.922	4.10	4.10	0.73	2.99	2.99	5.0	5.0	5.3	15.96	28.63	5.08	24	1.60	1308.47	1309.19	1315.01	1315.23	1314.43	1314.64	Ex 24
7	3	57.981	0.60	3.10	0.73	0.44	2.26	5.0	5.2	5.3	12.07	9.65	6.83	18	0.85	1308.99	1309.48	1310.70	1311.47	1314.56	1314.27	Ex 18
8	7	78.189	2.50	2.50	0.73	1.83	1.83	5.0	5.0	5.3	9.73	6.32	7.93	15	0.96	1309.88	1310.63	1311.47	1313.24	1314.27	1314.44	Ex 15
9	1	278.398	0.70	8.10	0.73	0.51	5.91	5.0	8.5	5.3	31.53	29.49	6.42	30	0.52	1306.17	1307.61	1308.99	1310.63	1316.37	1318.41	Ex 30
10	9	271.156	2.00	7.40	0.73	1.46	5.40	5.0	8.0	5.3	28.80	21.19	9.17	24	0.88	1307.70	1310.08	1310.63	1315.03	1318.41	1320.17	Ex 24
11	10	438.824	2.20	4.40	0.73	1.61	3.21	5.0	6.6	5.3	17.13	21.57	5.45	24	0.91	1310.33	1314.32	1315.88	1318.39	1320.17	1319.11	Ex 24
12	11	44.296	0.20	2.20	0.73	0.15	1.61	5.0	6.5	5.3	8.56	7.40	4.85	18	0.50	1315.15	1315.37	1318.49	1318.79	1319.11	1319.02	Ex 18
13	12	104.280	0.20	0.80	0.73	0.15	0.58	5.0	5.5	5.3	3.11	5.54	1.76	18	0.28	1315.90	1316.19	1319.10	1319.19	1319.02	1319.31	Ex 18
14	13	38.176	0.60	0.60	0.73	0.44	0.44	5.0	5.0	5.3	2.34	9.91	1.32	18	0.89	1315.86	1316.20	1319.22	1319.23	1319.31	1319.26	Ex 18
15	1	112.980	2.00	2.00	0.73	1.46	1.46	5.0	5.0	5.3	7.78	7.92	7.07	15	1.50	1311.17	1312.87	1312.18	1313.98	1316.37	1316.69	Ex 15
16	10	44.443	1.00	1.00	0.73	0.73	0.73	5.0	5.0	5.3	3.89	10.21	6.26	15	2.50	1316.18	1317.29	1316.72	1318.08	1320.17	1320.50	Ex 15
17	12	62.626	0.30	1.20	0.73	0.22	0.88	5.0	5.8	5.3	4.67	3.25	2.64	18	0.10	1315.74	1315.80	1319.04	1319.17	1319.02	1318.60	Ex 18
18	17	89.964	0.90	0.90	0.73	0.66	0.66	5.0	5.0	5.3	3.50	6.82	1.98	18	0.42	1315.74	1316.12	1319.21	1319.31	1318.60	1318.48	Ex 18
19	2	32.545	0.10	6.60	0.73	0.07	4.82	5.0	8.2	5.3	25.69	12.54	8.18	24	0.31	1303.92	1304.02	1309.91	1310.33	1315.00	1315.50	Prop 24 5yr
20	19	89.811	0.50	6.40	0.73	0.37	4.67	5.0	8.0	5.3	24.91	12.40	7.93	24	0.30	1304.12	1304.39	1310.39	1311.48	1315.50	1315.60	Prop 24 5yr
21	20	180.458	0.40	5.90	0.73	0.29	4.31	5.0	7.6	5.3	22.96	12.37	7.31	24	0.30	1304.49	1305.03	1311.63	1313.49	1315.60	1316.00	Prop 24 5yr
22	21	95.697	0.40	4.90	0.73	0.29	3.58	5.0	7.3	5.3	19.07	12.45	6.07	24	0.30	1305.13	1305.42	1313.75	1314.43	1316.00	1316.10	Prop 24 5yr
23	22	141.459	0.40	3.90	0.73	0.29	2.85	5.0	6.8	5.3	15.18	12.32	4.83	24	0.30	1305.52	1305.94	1314.64	1315.28	1316.10	1316.80	Prop 24 5yr

Project File: Proposed SWS System.stm

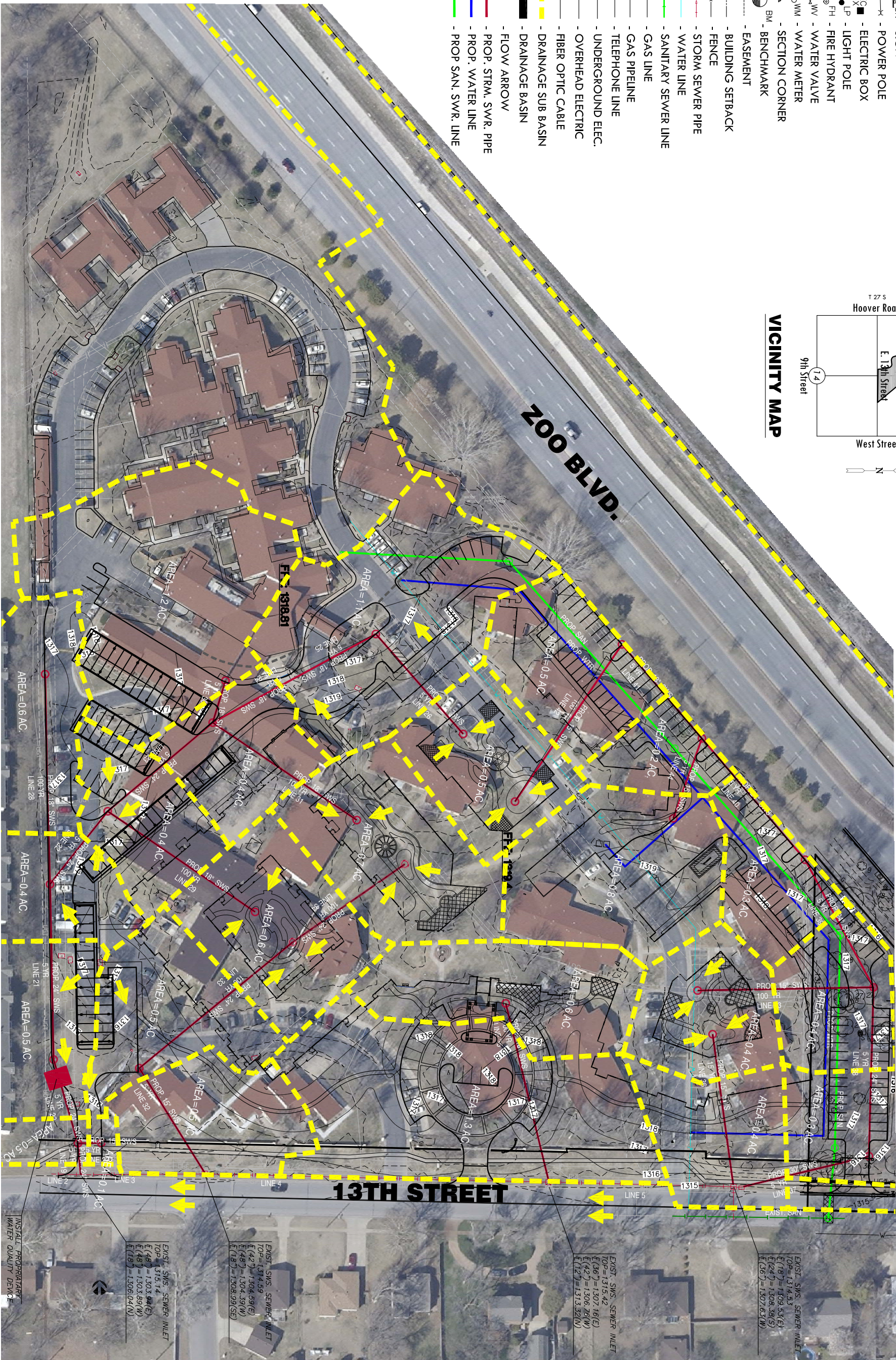
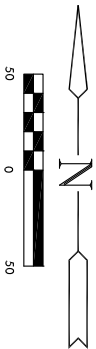
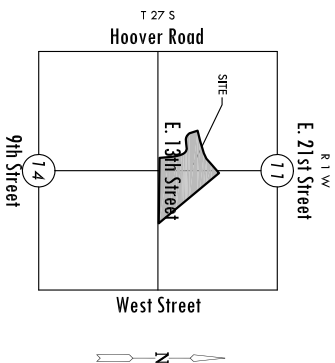
Number of lines: 44

Run Date: 02-14-2013

NOTES: Intensity = 52.62 / (Inlet time + 11.20) ^ 0.75; Return period = 5 Yrs. ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (l)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
24	23	74.098	0.00	1.60	0.73	0.00	1.17	5.0	6.5	5.3	6.23	5.72	3.52	18	0.30	1306.04	1306.26	1315.44	1315.71	1316.80	1316.50	Prop 18 5yr
25	24	117.603	1.10	1.60	0.73	0.80	1.17	5.0	5.9	5.3	6.23	5.73	3.52	18	0.30	1306.36	1306.71	1315.71	1316.12	1316.50	1316.50	Prop 18 5yr
26	25	136.645	0.50	0.50	0.73	0.37	0.37	5.0	5.0	5.3	1.95	1.95	2.48	12	0.30	1306.81	1307.22	1316.22	1316.63	1316.50	1317.80	Prop 12 5yr
27	19	24.021	0.10	0.10	0.73	0.07	0.07	5.0	5.0	5.3	0.39	3.48	0.32	15	0.29	1304.12	1304.19	1311.37	1311.37	1315.50	1315.50	Prop 15 5yr
28	21	216.251	0.60	0.60	0.73	0.44	0.44	5.0	5.0	5.3	2.34	3.54	1.90	15	0.30	1305.13	1305.78	1314.26	1314.55	1316.00	1316.00	Prop 18 100yr cap
29	22	183.647	0.60	0.60	0.73	0.44	0.44	5.0	5.0	5.3	2.34	3.53	1.90	15	0.30	1305.52	1306.07	1314.94	1315.18	1316.10	1317.80	Prop 18 100yr cap
30	23	45.119	1.20	1.20	0.73	0.88	0.88	5.0	5.0	5.3	4.67	5.85	2.64	18	0.31	1306.04	1306.18	1315.53	1315.62	1316.80	1316.50	Prop 18 5yr
31	23	179.031	0.70	0.70	0.73	0.51	0.51	5.0	5.0	5.3	2.72	3.55	2.22	15	0.30	1306.04	1306.58	1315.56	1315.88	1316.80	1317.80	Prop 18 100yr cap
32	3	126.896	0.50	1.80	0.73	0.37	1.31	5.0	6.9	5.3	7.01	3.53	5.71	15	0.30	1304.61	1304.99	1310.92	1312.41	1314.56	1315.60	Prop 15 5yr
33	32	204.366	0.60	1.30	0.73	0.44	0.95	5.0	6.1	5.3	5.06	3.53	4.12	15	0.30	1305.09	1305.70	1312.65	1313.91	1315.60	1317.80	Prop 24 100yr cap
34	33	140.630	0.70	0.70	0.73	0.51	0.51	5.0	5.0	5.3	2.72	3.53	2.22	15	0.30	1305.80	1306.22	1314.10	1314.35	1317.80	1317.80	Prop 18 100yr cap
35	4	186.790	0.60	0.60	0.73	0.44	0.44	5.0	5.0	5.3	2.34	3.54	1.90	15	0.30	1307.00	1307.56	1313.16	1313.40	1315.36	1319.00	Prop 18 100yr cap
36	5	156.469	0.40	0.40	0.73	0.29	0.29	5.0	5.0	5.3	1.56	3.54	1.27	15	0.30	1308.14	1308.61	1315.38	1315.48	1314.43	1317.80	Prop 15 5yr
37	5	133.046	0.30	3.40	0.73	0.22	2.48	5.0	10.5	5.2	12.98	22.49	2.65	30	0.30	1308.14	1308.54	1315.30	1315.43	1314.43	1316.00	Prop 30 5yr
38	37	173.908	0.40	3.10	0.73	0.29	2.26	5.0	9.8	5.3	12.07	12.37	3.84	24	0.30	1308.64	1309.16	1315.43	1315.93	1316.00	1316.40	Prop 24 5yr
39	38	146.556	0.30	2.30	0.73	0.22	1.68	5.0	8.9	5.3	8.95	12.39	2.85	24	0.30	1309.26	1309.70	1316.03	1316.26	1316.40	1316.50	Prop 24 5yr
40	39	159.378	0.20	2.00	0.73	0.15	1.46	5.0	7.9	5.3	7.78	12.41	2.48	24	0.30	1309.80	1310.28	1316.29	1316.48	1316.50	1317.30	Prop 24 5yr
41	40	132.571	0.50	1.00	0.73	0.37	0.73	5.0	6.9	5.3	3.89	5.77	2.20	18	0.30	1310.38	1310.78	1316.50	1316.68	1317.30	1317.00	Prop 18 5yr
42	41	177.092	0.50	0.50	0.73	0.37	0.37	5.0	5.0	5.3	1.95	3.53	1.59	15	0.30	1310.88	1311.41	1316.72	1316.88	1317.00	1317.80	Prop 15 100yr cap
43	38	181.108	0.40	0.40	0.73	0.29	0.29	5.0	5.0	5.3	1.56	1.94	1.98	12	0.30	1309.26	1309.80	1316.10	1316.44	1316.40	1317.80	Prop 15 100yr cap
44	40	68.551	0.80	0.80	0.73	0.58	0.58	5.0	5.0	5.3	3.11	3.57	2.54	15	0.31	1310.38	1310.59	1316.48	1316.64	1317.30	1317.80	Prop 15 5yr
Project File: Proposed SWS System.stm																Number of lines: 44				Run Date: 02-14-2013		
NOTES: Intensity = 52.62 / (Inlet time + 11.20) ^ 0.75; Return period = 5 Yrs. ; c = cir e = ellip b = box																						



Water Quality Volume Calculations Presbyterian Manors

Volumetric Runoff Coefficients by Land Use and Hydraulic Soil Group

	Hydrologic Soil Group								Total Area (ac)
	A		B		C		D		
Land Use	Area (ac)	R _v	Area (ac)	R _v	Area (ac)	R _v	Area (ac)	R _v	
Undisturbed		0.02		0.03		0.04		0.05	0
Disturbed Pervious		0.15	7.23	0.20		0.22		0.25	7.23
Impervious Cover		0.95	8.46	0.95		0.95		0.95	8.46
Total Area (ac)	0.00		15.69		0.00		0		15.69
Volumetric Runoff Coefficient (R _v)	0.00		0.60		0.00		0.00		0.60

Rainfall Depth (P) (in)	1.2
Water Quality Protection Volume (WQ _v) (ac-ft)	0.95
Water Quality Protection Volume (Q _{WV}) (in)	0.73
Redevelopment	Yes
Redevelopment Water Quality Protection Volume (WQ _v) (ac-ft)	0.28