

DRAINAGE PLAN
FRONTGATE ADDITION
TO
WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY



12 FEBRUARY 2013



DRAINAGE PLAN FRONTGATE ADDITION

FINAL REPORT

**Prepared by Baughman Company, P.A.
12 February 2013**

**By Trevor R. Kurth, P.E., CFM
N. Brent Wooten, P.E., L.S.**



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PROJECT NARRATIVE

EXISTING CONDITIONS

The site is located along the south side of Central Avenue and to the west adjacent to Jackson Heights. This site is approximately 8.7 acres and was previously platted as Plaza Central Office Park 2nd Addition in 2000. A Drainage Plan currently is on file which shows no detention onsite and also portrays the onsite runoff to be conveyed to the east via SWS to the channel alongside Jackson Heights. The site slopes to the north and northeast and is currently vacant and tree covered. There is a 24" RCP stub and inlet which drains a large majority of this site at the north east corner.

There is no FEMA SFHA located on this property as of this report. The drainage patterns as defined above can be seen on the Aerial (Exhibit 2).

PROPOSED CONDITIONS

The property is being re-platted for single family homes in a residential subdivision which will feature narrow street ROWs and homes covering the majority of the platted lots (while meeting all local applicable building code requirements). There is a detention facility proposed on this site located at the northeast corner and will discharge via a new storm sewer which will be located under Jackson Heights. On-site storm sewer will be utilized to convey south offsite runoff as well as developed onsite runoff to the detention facility. The detention facility has been sized for standard detention requirements as well as water quality and downstream channel protection responsibilities. The majority of the site will flow directly to the detention area; although some areas will sheet flow offsite as they do currently, the pond has been over-sized to account for these losses.

For a half-scale copy of the Plat, see Exhibit 3.

OFFSITE CONDITIONS

The site currently drains to the north and east into a SWS which is conveyed to the existing channel section located in Reserve A, Plaza Central Office Addition along the east edge of Jackson Heights. There is offsite runoff from the south entering at two separate locations. They are both within 150' of each other and appear to be sheet flow of shallow concentrated flow. The offsite runoff appears to be minimal and is approximately 3.2 acres in total area. There is an offsite pond to the west / northwest which also drains to the city SWS system. The majority of the site flows to the north east corner and into the same SWS system, as mentioned above.

However, some of the site sheet flows directly to the east and over Jackson Heights asphalt roadway and directly into the channel section. The channel section is not located in a FEMA SFHA at this time, however, based on the Plaza Central Office Addition Drainage Plan a flooding peak elevation is expected at a 1344.86 (assuming NGVD29 datum). The nearest Zone AE BFE is approximately 1000' downstream and is shown as a 1344.0 elevation (NAVD88 datum).

The overall site location and hydrogeodatabase can be seen with the site location plotted as Exhibit 1.

EXISTING CONDITIONS RUNOFF CALCULATIONS

DRAINAGE METHODS & STANDARDS

The following methods and standards, although not a complete list, were used in calculating the existing conditions runoff values.

- **STORM SERIES**
 - 24-hour; 2-yr, 5-yr, 10-yr, 25-yr, 100-yr Storm Events Modeled
 - 2-yr Rainfall Depth = 3.5 in
 - 10-yr Rainfall Depth = 5.3 in
 - 100-yr Rainfall Depth = 7.9 in

- **FLOW DATA**
 - Areas per LIDAR data, USGS Quadrangle Sheet, Aerial Photos, and Site Visits
 - SCS Curve Number used for Existing Flows (CN = 84)
 - Time of Concentration: Lag Method (minimum 15 min)

SITE CHARACTERISTICS

The site is currently platted as general office as Plaza Central Office Park Addition. The site mainly sheet flows to the north and north east and drains ultimately to the channel along Jackson Heights. There is currently a Drainage Plan on file with the City of Wichita which shows no detention on site and all developed runoff flowing via SWS to the channel section. This site is not developed per this plan, and is currently vacant.

The existing site characteristics can be seen from the aerial exhibit (Exhibit 2).

EXISTING CONDITIONS HYDROLOGIC ANALYSIS

The site was analyzed for pre-development conditions using the SCS Curve Number method for the entire storm event series. A Curve Number of 84 was used based on undeveloped existing area in Soil Type D. A minimum Time of Concentration of 15 minutes was used.

DOWNSTREAM DRAINAGE CAPACITY

The existing site drains primarily to the north and northeast portions of the site. Currently there is a 24" stub with a drop inlet located at the NE corner which drains into the City SWS system in Central Avenue. The east portions of the site sheet flow across Jackson Heights, which is currently asphalt mat, and into the adjacent channel. A small portion at the northwest corner drains to the adjacent corner and into the SWS central in Central Avenue. There is also currently general sheet flow from the site which drains to the ROW and into the Central Avenue ROW.

POST-DEVELOPMENT HYDROLOGIC ANALYSIS

DRAINAGE METHODS & STANDARDS

The following methods and standards, although not a complete list, were used in developing the drainage and grading plans.

- **STORM SERIES**
 - 24-hour; 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, 100-yr Storm Events Modeled
 - 1.2" Water Quality Flow modeled as '3-yr event' in HydraFlow
 - Hydrograph Method utilized for Developed Flows
 - CN = 92 (Soil Type D – composite of impervious area and disturbed area)
 - Time of Concentration; Lag Method, minimum Tc = 15min

- **GRADING CONSTRAINTS TO BE OBSERVED AT SITE PLAN**
 - One foot freeboard between 100-yr WSE and adjacent lot corner
 - Match all existing perimeter grades

DEVELOPED CONDITIONS HYDROLOGIC ANALYSIS

The site is proposed to be re-platted into a residential subdivision with corresponding streets, utilities, drainage paths and structures, and amenities. There is currently one detention facility located on the proposed layout which consists of a wet pond surface at the northeast corner. The sites developed runoff will be conveyed to the pond primarily by onsite storm water sewer and conveyance in the street ROWs and rear yard easements. A CN of 92 was used based on a composite of disturbed areas and impervious areas in Soil Type D cover.

Please be aware, that the storm listed as the '3-yr event' in the Hydraflow model is actually the 1.2" rainfall water quality event. This is due to the constraints of the programs naming conventions. All the other storm events correspond to their respective years. The Channel Protection volume is generated using the 1-year event.

DETENTION FACILITIES

There is one detention pond proposed for this site. The pond will be located in the extreme north east corner of the site – near its natural low area – and will discharge via a proposed 30" RCP extended to the channel on the east side of Jackson Heights. The pond has been sized for water quality as well as quantity control purposes. The facility is detailed in depth below.

➤ **Proposed Pond**

The pond is located at the NE corner of the site. Runoff from the site will be primarily conveyed to the area via SWS. The pond will have a static WSE at a 1346.0. The pond will drain via a 2" orifice located at static, a riser/drop structure at elevation 1348.3, and a primary 30" RCP with an approximate flowline elevation at 1342.0. The orifice will slowly drain the 1-year storm event over 22 hours. We are aware that this is just short of the 24 hour City requirement. However, the adjacent channel is sized for a much larger storm event and

downstream is a series of ponds that were originally intended for this sites detention. We also caution the use of an orifice smaller than 2" due to clogging and maintenance and feel that the 22 hours is a suitable compromise from the original intent of no detention or channel protection. The corresponding 100-year WSE is expected to be 1349.4.

DISCHARGE POINTS SUMMARY

The site will incorporate a new SWS under Jackson Heights and will not utilize the 24" stub that is currently serving the property. The property will primarily discharge through this new conduit, and it will continue to discharge into the existing offsite channel. Some of the site will continue to sheet flow offsite as it does today.

However, the pond system has been sized to handle the total site area detention requirement to compensate for offsite flow.

The proposed orifice on the pond outfall will limit the flow volume as compared to the existing conditions. In short, the flow rates from 1 and 2 year storm events, which are the 'erosion causing storms' will be greatly reduced by the pond outfall and storage.

WATER QUALITY

Water quality will be obtained within the wet ponds static pool. The pond is oversized and will provide more than adequate volume to account for the water quality volume. The total water quality volume generated on the site in the 1.2 in storm event is approximately 26,625 cubic foot of storage needed. The proposed pond will contain approximately 47,916 cubic feet of volume under their static water surface. The WQ calculations can be found in the Appendix.

DOWNSTREAM CHANNEL PROTECTION

Downstream channel protection will be provided on the site in the proposed detention pond. The pond will provide approximately 22 hours of extended detention during the 1-year storm even. This is achieved via the 2" orifice and overflow structure. This will be done for not only the proposed site, but also the south offsite which drains through this basin.

POTENTIAL UPSTREAM/DOWNSTREAM IMPACTS

The site will provide detention for the entire range of storm events as well as provide downstream channel protection and meet water quality requirements. Although this site is draining some areas undetained into the Central and Jackson Heights streets ROWs, it is accepting the entire south offsite runoff into the detention pond. Since these areas ultimately discharge to the offsite channel, the net detention, channel protection, and water quality effects are the same.

Due to these issues being addressed, we do not anticipate any downstream impacts with this subdivision.

FLOODPLAIN SUBMITTAL

SOURCE OF FLOODPLAIN INFORMATION

The site lies within a FEMA Zone X - Unshaded. The location of the property, on FEMA FIRM Panel 379 of 700 for Sedgwick County, Kansas, effective February 2, 2007, is attached as Exhibit 6.

FEDERAL, STATE, & LOCAL PERMITTING

US ARMY CORPS OF ENGINEERS

There does not appear to be any jurisdictional waters of the US on this site.

KANSAS DEPT OF AGRICULTURE – DWR PERMITTING

There does not appear to be any DWR permitting needed on the proposed site at this time. The areas of discharge do not account for more than 240 acres.

FEMA

There is no mapped floodplain located upon the proposed site. Therefore, no FEMA permitting is expected at this time.

KANSAS DEPT OF TRANSPORTATION

There is no KDOT ROW adjacent or near this property which would require a permit at this time.

SEDGWICK COUNTY PERMITTING

There does not appear to be any Sedgwick County permitting needed at this time.

EXHIBITS

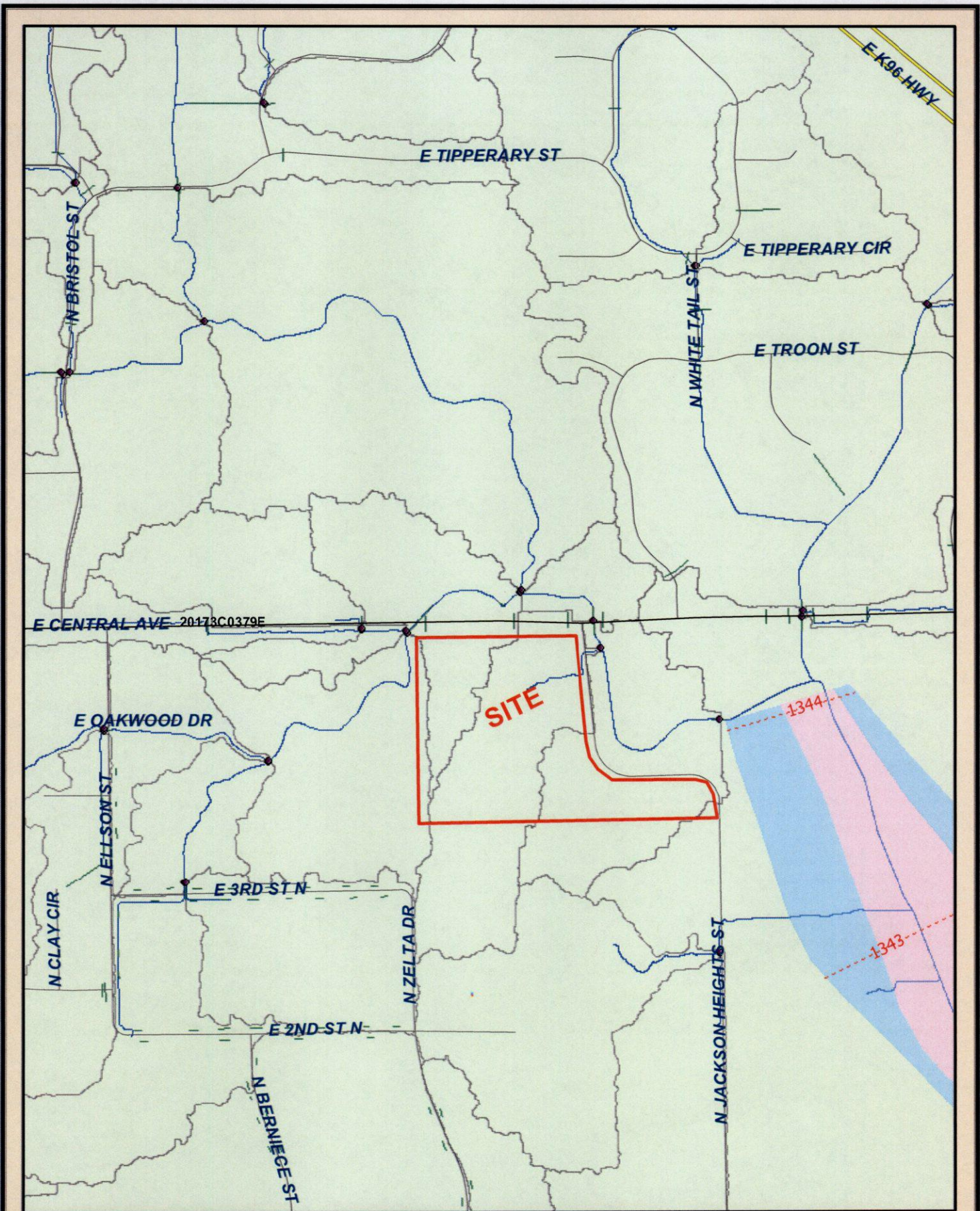
EXHIBIT 1: Site Location Map

EXHIBIT 2: Aerial Photo Exhibit with Lidar Topography

EXHIBIT 3: Plat – Half Scale

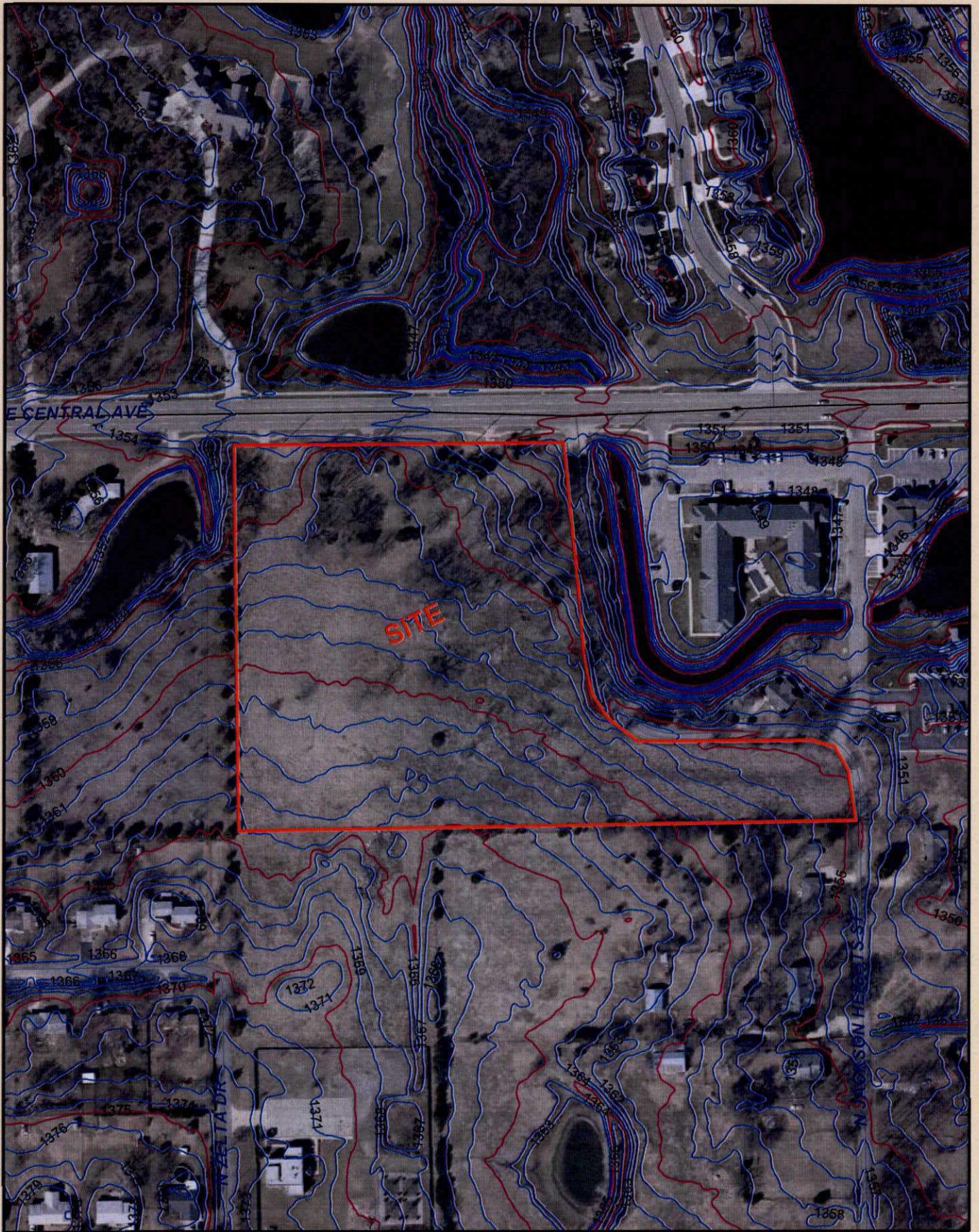
EXHIBIT 4: Drainage Plan – Half Scale

EXHIBIT 5: Floodplain Location (FIRM)

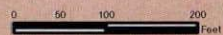


Site Location Map





Aerial & Lidar Exhibit



State of Kansas) SS We, Baughman Company, P.A., Surveyors in
Sedgwick County) aforasaid county and state do hereby certify that we have surveyed and plotted
"FRONTGATE ADDITION", Wichita, Sedgwick County, Kansas and that the
accompanying plot is a true and correct exhibit of the property surveyed,
described as and being a replat of all of Lots 1, 2, 3, and 4, Block 1, Plaza
Central Office Park 2nd Addition to Wichita, Sedgwick County, Kansas, TOGETHER
with that part of Jackson Heights as dedicated in said Plaza Central Office Park
2nd Addition and that part of Jackson Ave., (now Jackson Heights), as dedicated
in Gilder's Gardens, Sedgwick County, Kansas described as follows: Beginning at
the northeast corner of said Lot 3, thence easterly along the extension of the
north line of said Lot 3, (and along the north line of said Jackson Heights),
35.22 feet, more or less, to the centerline of said Jackson Heights, said
centerline being 35.00 feet normally distant easterly of the west line of said
Jackson Heights; thence southerly along the centerline of said Jackson Heights,
(and parallel with the west line of said Jackson Heights), 109.85 feet; thence
westerly perpendicular to the west line of said Jackson Heights, 35.00 feet to a
point on the west line of said Jackson Heights; thence northerly along the west
line of said Jackson Heights, 113.81 feet to the point of beginning.

All being situated in the Northwest Quarter and the Northeast
Quarter of Section 22, Township 27 South, Range 2 East
of the Sixth Principal Meridian, Sedgwick County, Kansas.
Existing public easements, access controls, building setbacks, and
dedications being vacated by virtue of K.S.A. 12-512b, as amended.
Baughman Company, P.A.

Michael G. Conrey, Surveyor

FRONTGATE ADDITION WICHITA, SEDGWICK COUNTY, KANSAS

Know all men by these presents that we,
the undersigned, have caused the land in the surveyors certificate to be
plotted into Lots, Blocks, Streets, and Reserves to be known as
"FRONTGATE ADDITION", Wichita, Sedgwick County, Kansas. The drainage
easement is hereby granted as indicated for drainage purposes. The wall
easements are hereby granted as indicated for the construction and
maintenance of private screening walls and utility main lines and service
lines shall be allowed to cross these easements. The drainage and utility
easements are hereby granted as indicated for drainage purposes and for
the construction and maintenance of all public utilities. The street,
drainage, and utility easements are hereby granted as indicated for street
purposes, for drainage purposes, and for the construction and
maintenance of all public utilities. Reserves "A", "F", and "G" are hereby
reserved for open space, landscaping, streets, entry monuments, drainage
purposes, and utilities. Reserve "B" is hereby reserved for open space,
landscaping, entry monuments, berms, streets as confined to easements,
utilities as confined to easements, fences, sidewalks, playgrounds, parking,
gazebos, a clubhouse and related appurtenances, and swimming pools and
related appurtenances. Reserve "C" is hereby reserved for open space,
landscaping, berms, lakes, gazebos, drainage purposes, utilities as confined
to easements, sidewalks, parking, entry monuments, walls as confined to
easement, and streets as confined to easements. There shall be no
building setback requirements in said Reserve "C" along Frontgate.
Reserve "D" is hereby reserved for open space, landscaping, drainage
purposes, and utilities. Reserve "E" is hereby reserved for open space,

landscaping, sidewalks, drainage purposes, berms, gazebos, utilities as
confined to easements, streets as confined to easements, entry
monuments, and sanitary sewer main lines and service lines. Reserves
"A", "B", "C", "D", "E", "F", and "G" shall be owned and maintained by
the homeowners association for the addition. Access controls shall be
as depicted on the face of the plat and are hereby granted to the City
of Wichita, Kansas. The permitted opening locations shall be as
determined by the City Engineer of the City of Wichita, Kansas. The
Minimum Building Pad Elevations for the lowest opening to the structures
on Lot 1, Block B shall be 1351.5 NAVD88.

Hutton Development, LLC,
a Kansas limited liability company

Trent Banister, Vice President

State of Kansas) SS The foregoing instrument acknowledged before
Sedgwick County) me, this _____ day of _____, 2013, by Trent Banister,
Vice President of Hutton Development, LLC, a Kansas limited liability
company, on behalf of the limited liability company.

Notary Public

My App'l. Exp. _____

We, the undersigned, holders of a mortgage on
the above described property, do hereby consent to this plat of
"FRONTGATE ADDITION", Wichita, Sedgwick County, Kansas.
Relianz Bank

State of Kansas) SS The foregoing instrument acknowledged be-
fore me, this _____ day of _____, 2013, by _____,
of Relianz Bank, on behalf of the bank.

Notary Public

My App'l. Exp. _____

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

Dated this _____ day of _____, 2013.
Wichita-Sedgwick County Metropolitan Area Planning Commission

David Dennis, Chair

John L. Schlegel, Secretary

This plat approved and all dedications
shown hereon accepted by the City Council of the City of Wichita,
Kansas, this _____ day of _____, 2013.

Carl Brewer, Mayor

Karen Sublett, City Clerk

Reviewed in accordance with K.S.A. 58-2005
on this _____ day of _____, 2013.

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

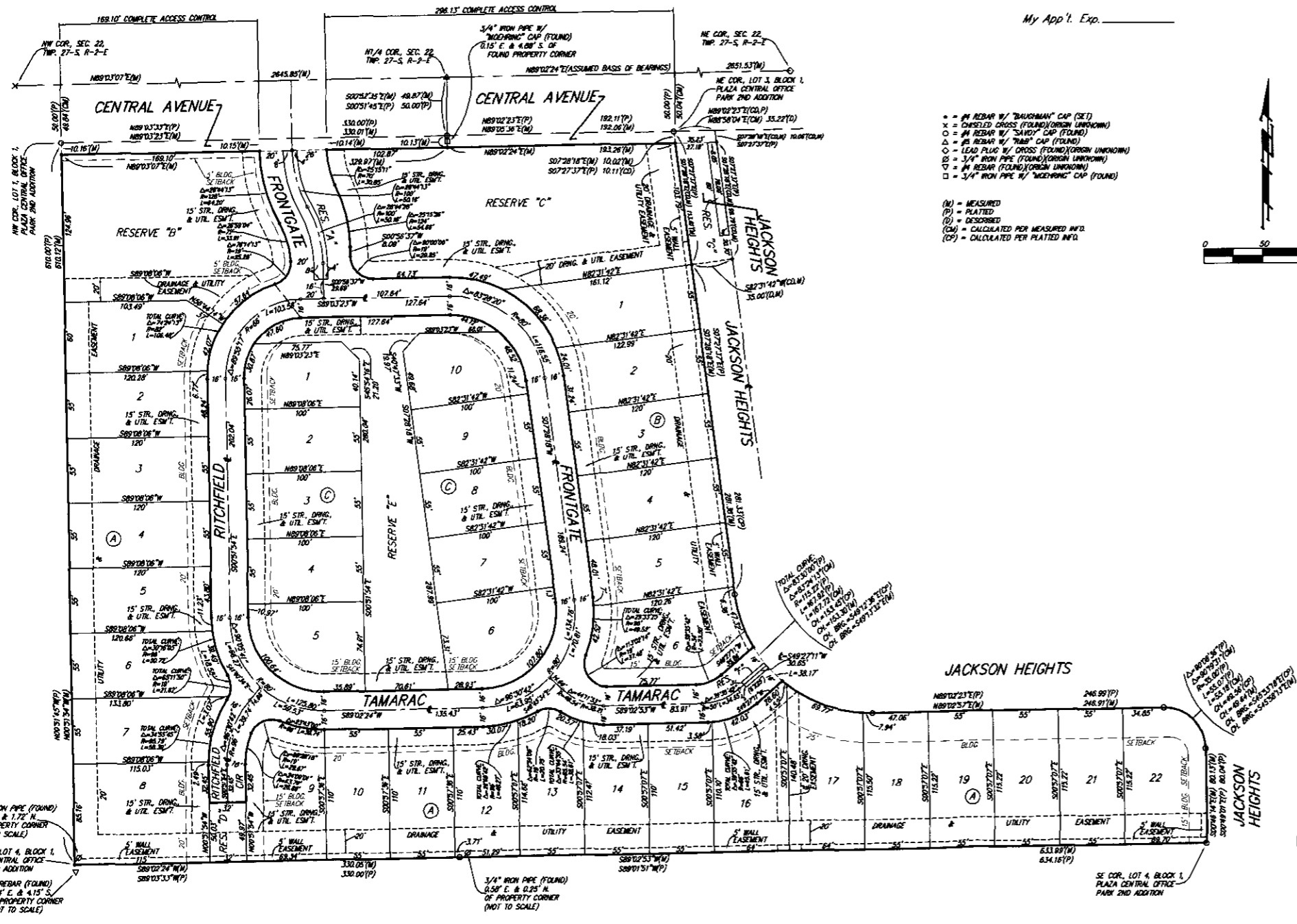
Entered on transfer record this _____ day
of _____, 2013.

Kelly B. Arnold, County Clerk

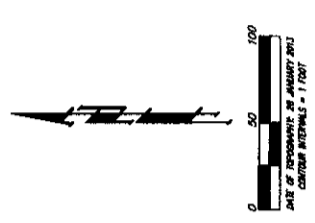
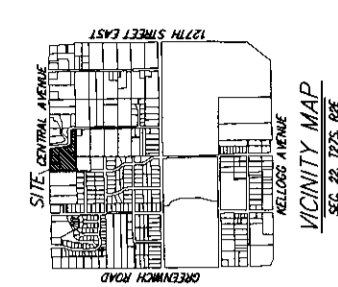
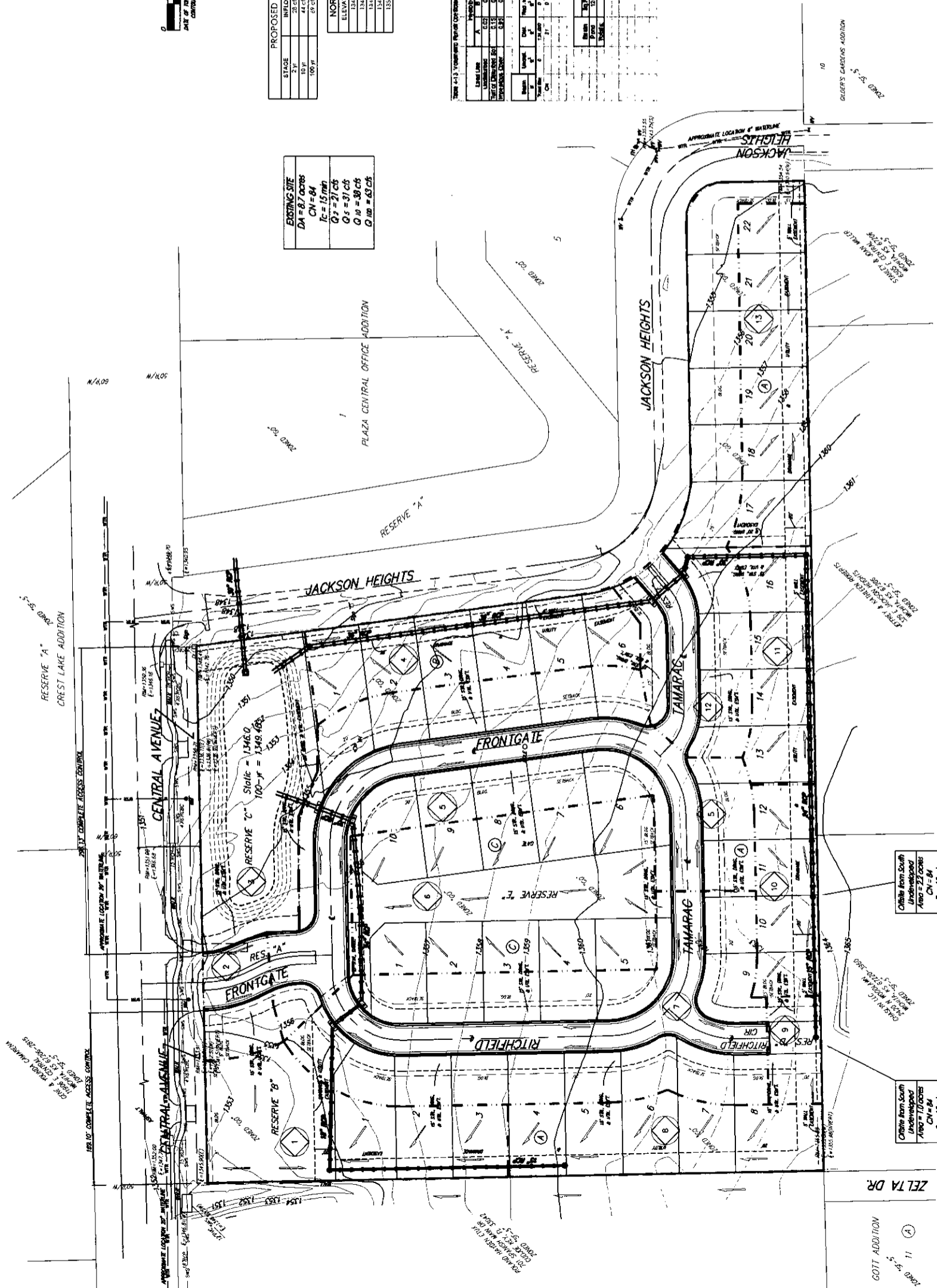
State of Kansas) SS This is to certify that this plat has been
Sedgwick County) filed for record in the office of the Register of Deeds, this _____ day
of _____, 2013 at _____ o'clock _____ M.; and is duly recorded.

Bill Meek, Register of Deeds

Tonya Buckingham, Deputy



DRAINAGE PLAN FRONTGATE ADDITION WICHITA, SEDGWICK COUNTY, KANSAS



PROPOSED FOND (Bottom = 1346.0)

STAGE	SECTION	CURVE LOW	ELEVATION
3.70	20.01	14.01	1346.3
10.77	44.01	38.01	1349.1
100.00	69.01	63.01	1349.4

NORTH WEST BASIN AREA (sq ft)

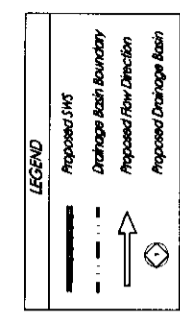
1346	12000
1347	14000
1348	16000
1349	18000
1350	21000

EXISTING SITE

DA = 6.7 acres
 CN = 84
 Tc = 15 min
 Q2 = 91 cfs
 Q5 = 91 cfs
 Q10 = 98 cfs
 Q20 = 83 cfs

TABLE 4-1.1. Proposed Stormwater Runoff Characteristics for Frontgate Addition

Area	Area (Ac)	Runoff Coefficient (C)	Time of Concentration (Tc) (min)	Peak Runoff (Qp) (cfs)	Peak Time (Tp) (min)
1	1.5	0.8	15	1.5	15
2	1.5	0.8	15	1.5	15
3	1.5	0.8	15	1.5	15
4	1.5	0.8	15	1.5	15
5	1.5	0.8	15	1.5	15
6	1.5	0.8	15	1.5	15
7	1.5	0.8	15	1.5	15
8	1.5	0.8	15	1.5	15
9	1.5	0.8	15	1.5	15
10	1.5	0.8	15	1.5	15
11	1.5	0.8	15	1.5	15
12	1.5	0.8	15	1.5	15
13	1.5	0.8	15	1.5	15
14	1.5	0.8	15	1.5	15
15	1.5	0.8	15	1.5	15
16	1.5	0.8	15	1.5	15
17	1.5	0.8	15	1.5	15
18	1.5	0.8	15	1.5	15
19	1.5	0.8	15	1.5	15
20	1.5	0.8	15	1.5	15
21	1.5	0.8	15	1.5	15
22	1.5	0.8	15	1.5	15
23	1.5	0.8	15	1.5	15
24	1.5	0.8	15	1.5	15
25	1.5	0.8	15	1.5	15
26	1.5	0.8	15	1.5	15
27	1.5	0.8	15	1.5	15
28	1.5	0.8	15	1.5	15
29	1.5	0.8	15	1.5	15
30	1.5	0.8	15	1.5	15
31	1.5	0.8	15	1.5	15
32	1.5	0.8	15	1.5	15
33	1.5	0.8	15	1.5	15
34	1.5	0.8	15	1.5	15
35	1.5	0.8	15	1.5	15
36	1.5	0.8	15	1.5	15
37	1.5	0.8	15	1.5	15
38	1.5	0.8	15	1.5	15
39	1.5	0.8	15	1.5	15
40	1.5	0.8	15	1.5	15
41	1.5	0.8	15	1.5	15
42	1.5	0.8	15	1.5	15
43	1.5	0.8	15	1.5	15
44	1.5	0.8	15	1.5	15
45	1.5	0.8	15	1.5	15
46	1.5	0.8	15	1.5	15
47	1.5	0.8	15	1.5	15
48	1.5	0.8	15	1.5	15
49	1.5	0.8	15	1.5	15
50	1.5	0.8	15	1.5	15
51	1.5	0.8	15	1.5	15
52	1.5	0.8	15	1.5	15
53	1.5	0.8	15	1.5	15
54	1.5	0.8	15	1.5	15
55	1.5	0.8	15	1.5	15
56	1.5	0.8	15	1.5	15
57	1.5	0.8	15	1.5	15
58	1.5	0.8	15	1.5	15
59	1.5	0.8	15	1.5	15
60	1.5	0.8	15	1.5	15
61	1.5	0.8	15	1.5	15
62	1.5	0.8	15	1.5	15
63	1.5	0.8	15	1.5	15
64	1.5	0.8	15	1.5	15
65	1.5	0.8	15	1.5	15
66	1.5	0.8	15	1.5	15
67	1.5	0.8	15	1.5	15
68	1.5	0.8	15	1.5	15
69	1.5	0.8	15	1.5	15
70	1.5	0.8	15	1.5	15
71	1.5	0.8	15	1.5	15
72	1.5	0.8	15	1.5	15
73	1.5	0.8	15	1.5	15
74	1.5	0.8	15	1.5	15
75	1.5	0.8	15	1.5	15
76	1.5	0.8	15	1.5	15
77	1.5	0.8	15	1.5	15
78	1.5	0.8	15	1.5	15
79	1.5	0.8	15	1.5	15
80	1.5	0.8	15	1.5	15
81	1.5	0.8	15	1.5	15
82	1.5	0.8	15	1.5	15
83	1.5	0.8	15	1.5	15
84	1.5	0.8	15	1.5	15
85	1.5	0.8	15	1.5	15
86	1.5	0.8	15	1.5	15
87	1.5	0.8	15	1.5	15
88	1.5	0.8	15	1.5	15
89	1.5	0.8	15	1.5	15
90	1.5	0.8	15	1.5	15
91	1.5	0.8	15	1.5	15
92	1.5	0.8	15	1.5	15
93	1.5	0.8	15	1.5	15
94	1.5	0.8	15	1.5	15
95	1.5	0.8	15	1.5	15
96	1.5	0.8	15	1.5	15
97	1.5	0.8	15	1.5	15
98	1.5	0.8	15	1.5	15
99	1.5	0.8	15	1.5	15
100	1.5	0.8	15	1.5	15



NOTES: There is no FEMA FEMA located on the property as of the date per FEMA Risk Panel 377 of 101 for Wichita, Sedgewick County, Kansas effective February 2, 2007.

The Internal Storm Water Sewer will drain the developed area into the proposed pond which will be constructed in accordance with the design and construction details for the pond and will be provided with SWS and street engineering plans submitted.

DRAINAGE PLAN FRONTGATE ADDITION

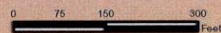
15 FEB 2011

Baughman Company, P.A.
 1155 WEST 10TH STREET
 WICHITA, KANSAS 67202
 (316) 261-1111

Prepared by: [Name] Checked by: [Name] Drawn by: [Name]



FEMA FIRM



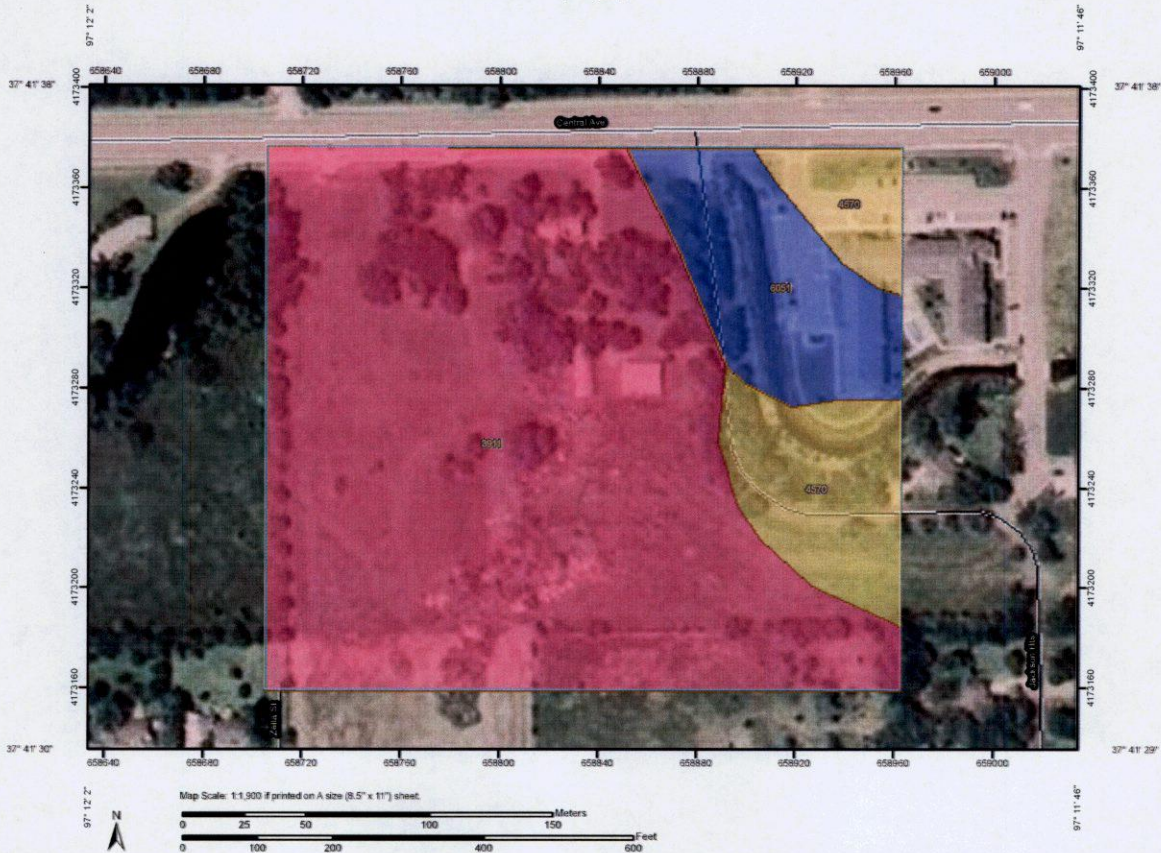
SUPPORTING CALCULATIONS

APPENDIX A: USGS Soils Survey

**APPENDIX B : HydraFlow Hydrographs
Site Flow and Pond Routing**

USGS Soils Survey

Hydrologic Soil Group—Sedgwick County, Kansas
(Frontgate)



Hydrologic Soil Group—Sedgwick County, Kansas
(Frontgate)

MAP LEGEND	MAP INFORMATION
<p>Area of Interest (AOI)</p> <ul style="list-style-type: none"> Area of Interest (AOI) <p>Soils</p> <ul style="list-style-type: none"> Soil Map Units <p>Soil Ratings</p> <ul style="list-style-type: none"> A A/D B B/D C C/D D Not rated or not available <p>Political Features</p> <ul style="list-style-type: none"> Cities <p>Water Features</p> <ul style="list-style-type: none"> Streams and Canals <p>Transportation</p> <ul style="list-style-type: none"> Rails Interstate Highways US Routes Major Roads Local Roads 	<p>Map Scale: 1:1,900 if printed on A size (8.5" x 11") sheet.</p> <p>The soil surveys that comprise your AOI were mapped at 1:24,000.</p> <p>Warning: Soil Map may not be valid at this scale.</p> <p>Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.</p> <p>Please rely on the bar scale on each map sheet for accurate map measurements.</p> <p>Source of Map: Natural Resources Conservation Service Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov Coordinate System: UTM Zone 14N NAD83</p> <p>This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.</p> <p>Soil Survey Area: Sedgwick County, Kansas Survey Area Data: Version 8, Sep 20, 2012</p> <p>Date(s) aerial images were photographed: 6/20/2006</p> <p>The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.</p>

Hydrologic Soil Group

Hydrologic Soil Group—Summary by Map Unit — Sedgwick County, Kansas (KS173)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3911	Rosell silt clay, 1 to 3 percent slopes	D	10.4	79.2%
4670	Clina silt clay, 3 to 7 percent slopes	C	1.8	13.0%
6051	Ellipton silt loam, frequently flooded	B	1.8	11.8%
Totals for Area of Interest			13.8	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

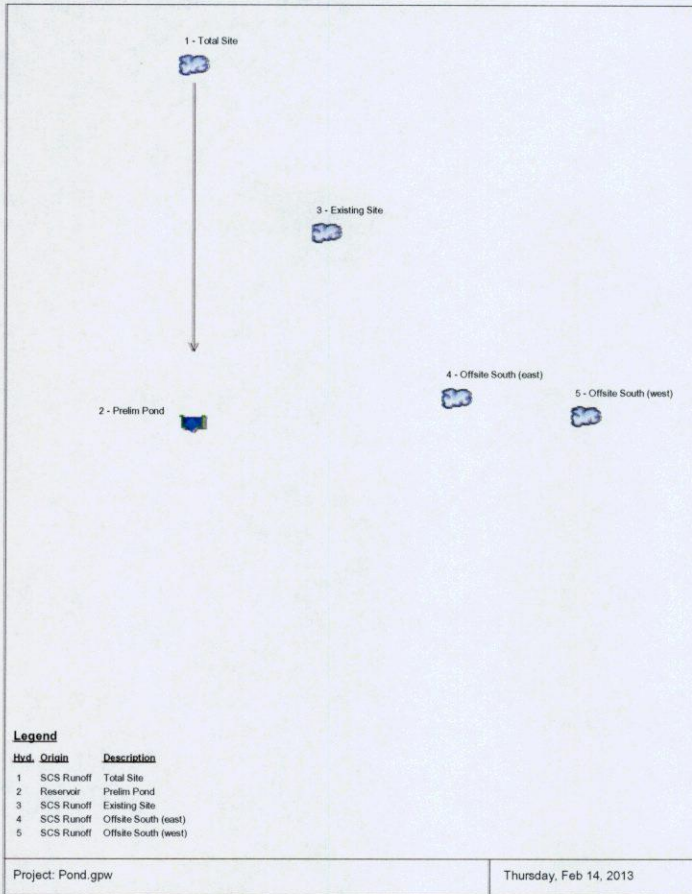
Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

HydraFlow Hydrographs
Site Flow & Pond Routing

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6



Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	21.27	28.05	6.072	37.70	44.41	52.99	60.57	69.07	Total Site
2	Reservoir	1	2.764	13.58	0.100	29.29	37.76	47.15	54.57	62.59	Prelim Pond
3	SCS Runoff	-----	14.83	21.27	2.308	30.78	37.54	46.28	54.02	62.74	Existing Site
4	SCS Runoff	-----	3.750	5.379	0.584	7.764	9.492	11.70	13.66	15.87	Offsite South (east)
5	SCS Runoff	-----	1.705	2.445	0.285	3.538	4.314	5.317	6.209	7.212	Offsite South (west)

Proj. file: Pond.gpw Thursday, Feb 14, 2013

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total slope used (cuft)	Hydrograph Description
1	SCS Runoff	21.27	2	722	60,746	-----	-----	-----	Total Site
2	Reservoir	2.764	2	750	55,794	1	1348.43	35,401	Prelim Pond
3	SCS Runoff	14.83	2	722	41,673	-----	-----	-----	Existing Site
4	SCS Runoff	3.750	2	722	10,538	-----	-----	-----	Offsite South (east)
5	SCS Runoff	1.705	2	722	4,700	-----	-----	-----	Offsite South (west)

Pond.gpw Return Period: 1 Year Thursday, Feb 14, 2013

Hydrograph Report

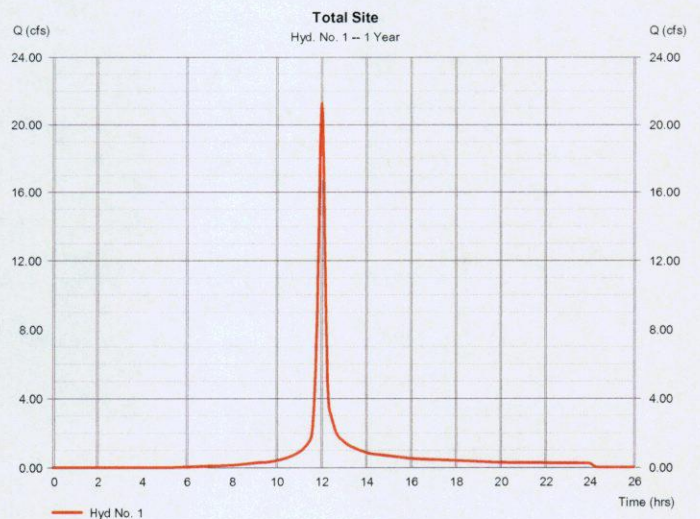
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Thursday, Feb 14, 2013

Hyd. No. 1

Total Site

Hydrograph type	= SCS Runoff	Peak discharge	= 21.27 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 60,746 cuft
Drainage area	= 8.700 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

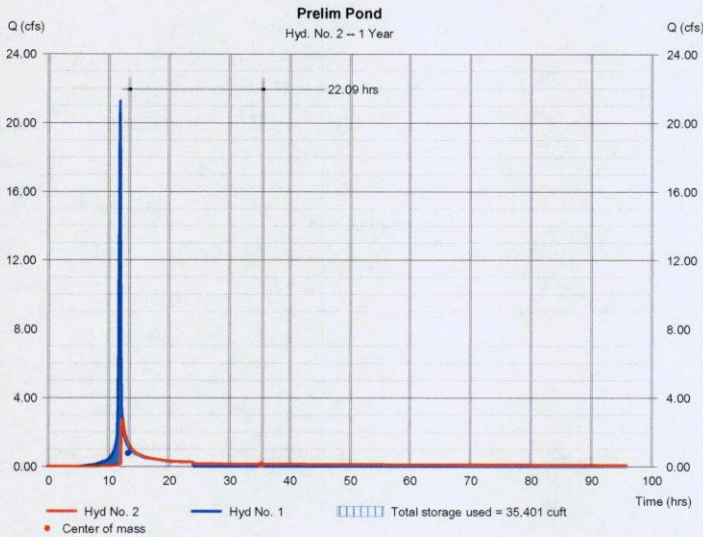
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Feb 14, 2013

Hyd. No. 2

Prelim Pond

Hydrograph type	= Reservoir	Peak discharge	= 2.764 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.50 hrs
Time interval	= 2 min	Hyd. volume	= 55,794 cuft
Inflow hyd. No.	= 1 - Total Site	Max. Elevation	= 1348.43 ft
Reservoir name	= <New Pond>	Max. Storage	= 35,401 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Feb 14, 2013

Pond No. 1 - <New Pond>

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 1346.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1346.00	12,000	0	0
1.00	1347.00	14,000	12,980	12,980
2.00	1348.00	16,000	14,987	27,973
3.00	1349.00	18,000	17,292	45,255
4.00	1348.00	21,800	20,177	65,432
5.00	1351.00	23,000	22,395	87,827

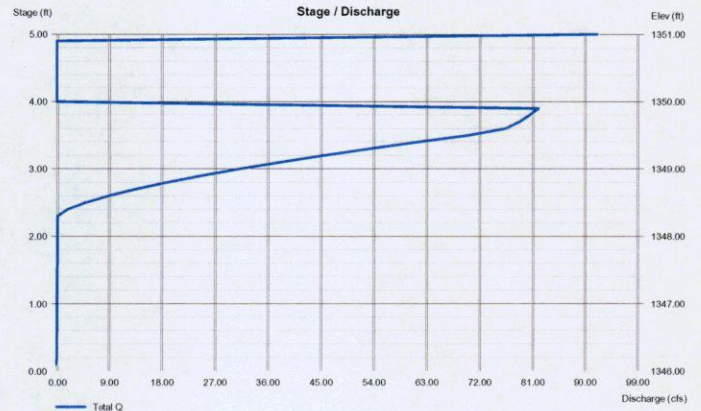
Culvert / Orifice Structures

	[A]	[B]	[C]	[Pr/Rsr]
Rise (in)	= 36.00	2.00	0.00	0.00
Span (in)	= 36.00	2.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1342.00	1346.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	0.00	0.00	0.00
Crest El. (ft)	= 1348.30	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil. (in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir weirs checked for orifice conditions (ic) and submergence (si).



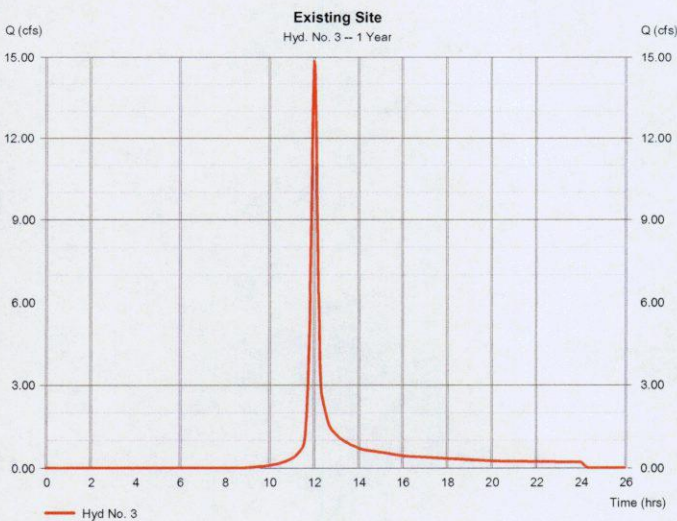
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Feb 14, 2013

Hyd. No. 3

Existing Site

Hydrograph type	= SCS Runoff	Peak discharge	= 14.83 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 41,673 cuft
Drainage area	= 8.700 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



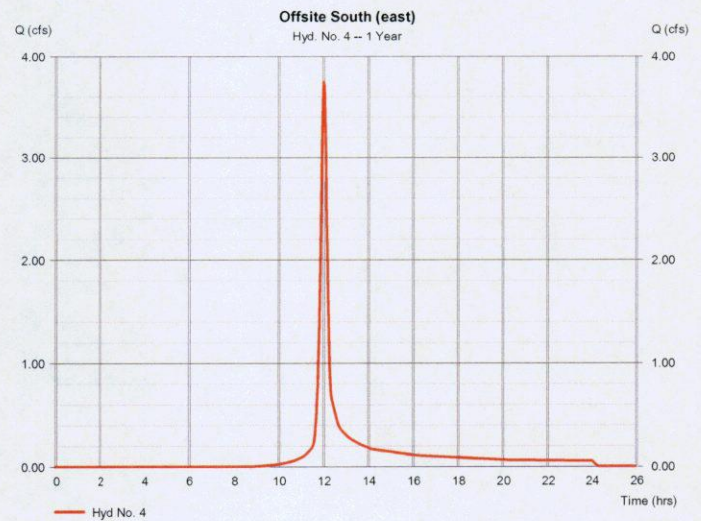
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Feb 14, 2013

Hyd. No. 4

Offsite South (east)

Hydrograph type	= SCS Runoff	Peak discharge	= 3.750 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 10,538 cuft
Drainage area	= 2.200 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

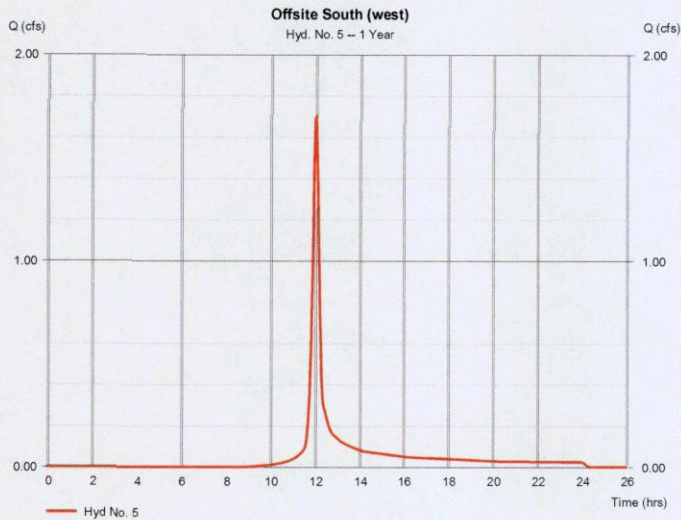


Hydrograph Report

Hyd. No. 5

Offsite South (west)

Hydrograph type	= SCS Runoff	Peak discharge	= 1,705 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 4,790 cuft
Drainage area	= 1,000 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	28.05	2	722	81,189	-----	-----	-----	Total Site
2	Reservoir	13.58	2	732	76,222	1	1348.70	40,048	Prelim Pond
3	SCS Runoff	21.27	2	722	59,027	-----	-----	-----	Existing Site
4	SCS Runoff	5.379	2	722	15,078	-----	-----	-----	Offsite South (east)
5	SCS Runoff	2.445	2	722	6,854	-----	-----	-----	Offsite South (west)

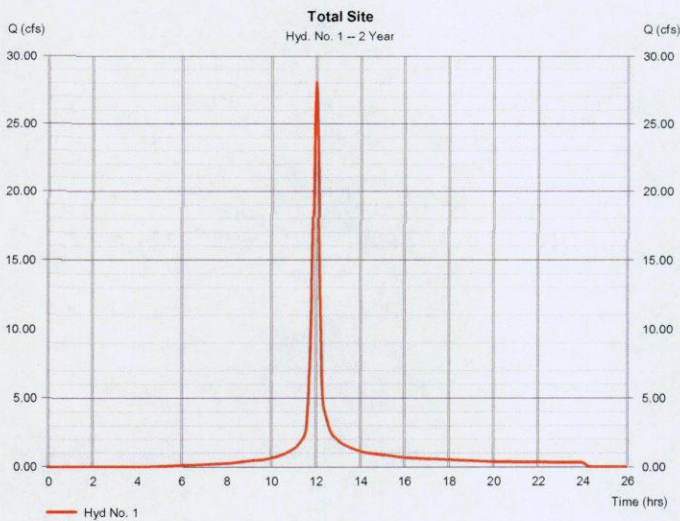
Pond.gpw Return Period: 2 Year Thursday, Feb 14, 2013

Hydrograph Report

Hyd. No. 1

Total Site

Hydrograph type	= SCS Runoff	Peak discharge	= 28.05 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 81,189 cuft
Drainage area	= 8,700 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



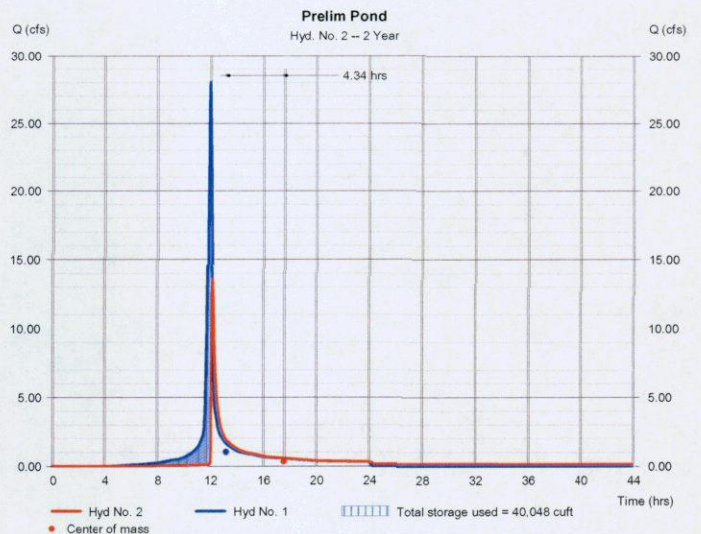
Hydrograph Report

Hyd. No. 2

Prelim Pond

Hydrograph type	= Reservoir	Peak discharge	= 13.58 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 76,222 cuft
Inflow hyd. No.	= 1 - Total Site	Max. Elevation	= 1348.70 ft
Reservoir name	= <New Pond>	Max. Storage	= 40,048 cuft

Storage Indication method used.

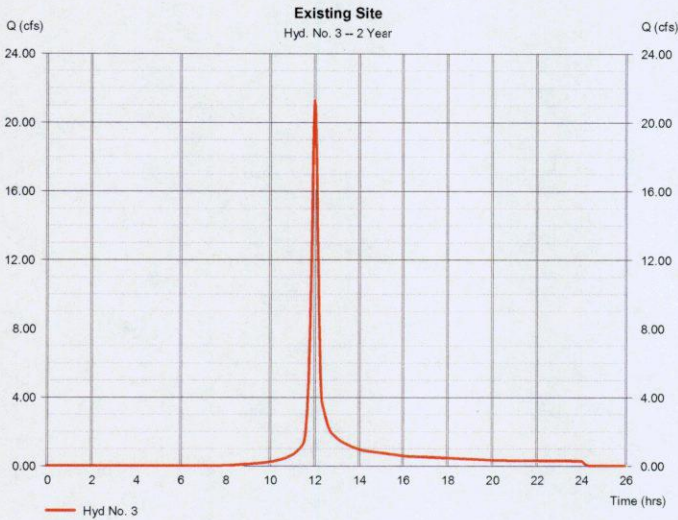


Hydrograph Report

Hyd. No. 3

Existing Site

Hydrograph type	= SCS Runoff	Peak discharge	= 21.27 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 59,627 cuft
Drainage area	= 8.700 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

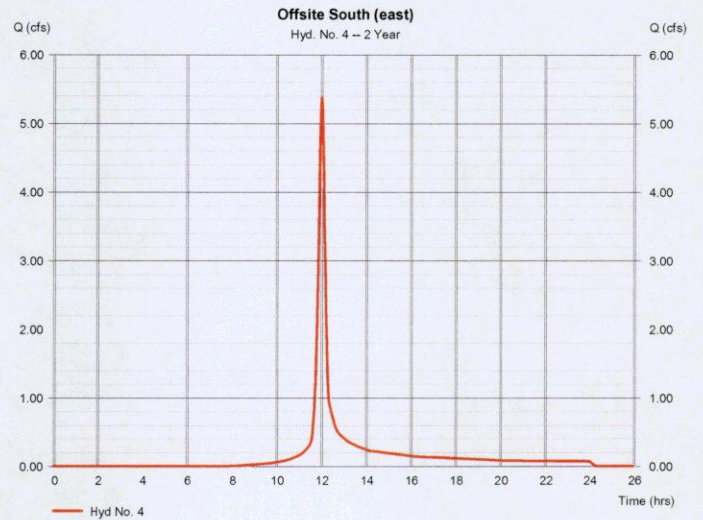


Hydrograph Report

Hyd. No. 4

Offsite South (east)

Hydrograph type	= SCS Runoff	Peak discharge	= 5.379 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 15,078 cuft
Drainage area	= 2.200 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

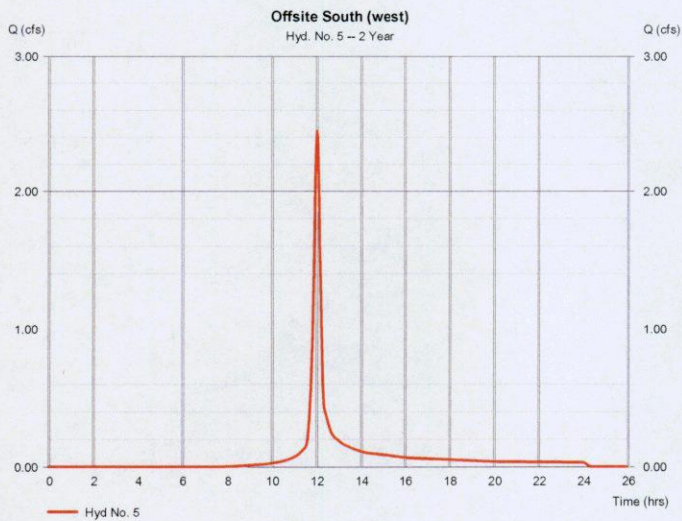


Hydrograph Report

Hyd. No. 5

Offsite South (west)

Hydrograph type	= SCS Runoff	Peak discharge	= 2.445 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 6,854 cuft
Drainage area	= 1.000 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total storage used (cuft)	Hydrograph Description
1	SCS Runoff	6.072	2	722	17,102	-----	-----	-----	Total Site
2	Reservoir	0.100	2	1270	16,389	1	1346.99	12,887	Prelim Pond
3	SCS Runoff	2.308	2	724	7,583	-----	-----	-----	Existing Site
4	SCS Runoff	0.584	2	724	1,916	-----	-----	-----	Offsite South (east)
5	SCS Runoff	0.265	2	724	872	-----	-----	-----	Offsite South (west)

Pond.gpw Return Period: 3 Year Thursday, Feb 14, 2013

Hydrograph Report

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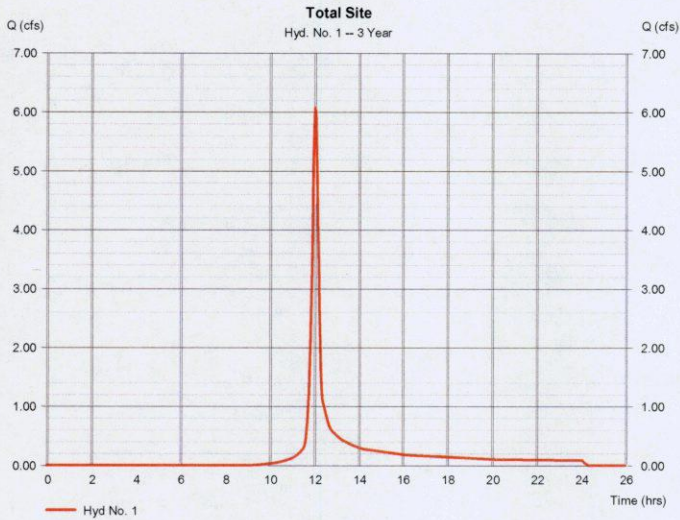
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 1

Total Site

Hydrograph type	= SCS Runoff	Peak discharge	= 6.072 cfs
Storm frequency	= 3 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 17,102 cuft
Drainage area	= 8.700 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 1.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

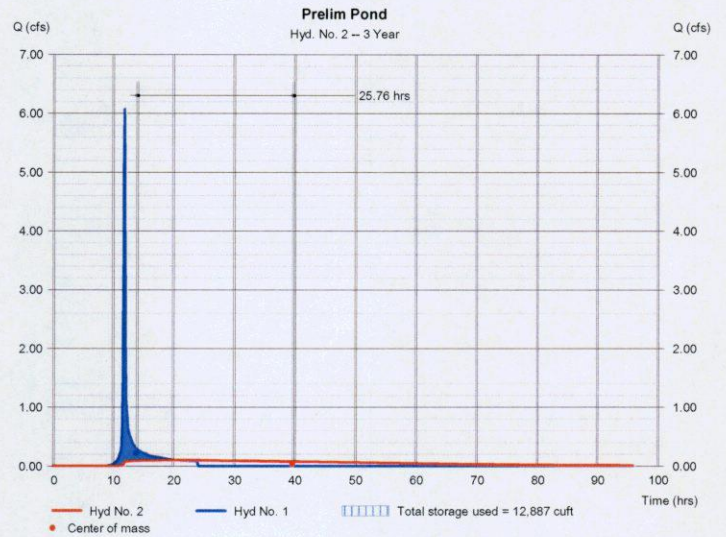
Thursday, Feb 14, 2013

Hyd. No. 2

Prelim Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.100 cfs
Storm frequency	= 3 yrs	Time to peak	= 21.17 hrs
Time interval	= 2 min	Hyd. volume	= 16,389 cuft
Inflow hyd. No.	= 1 - Total Site	Max. Elevation	= 1346.99 ft
Reservoir name	= <New Pond>	Max. Storage	= 12,887 cuft

Storage indication method used.



Hydrograph Report

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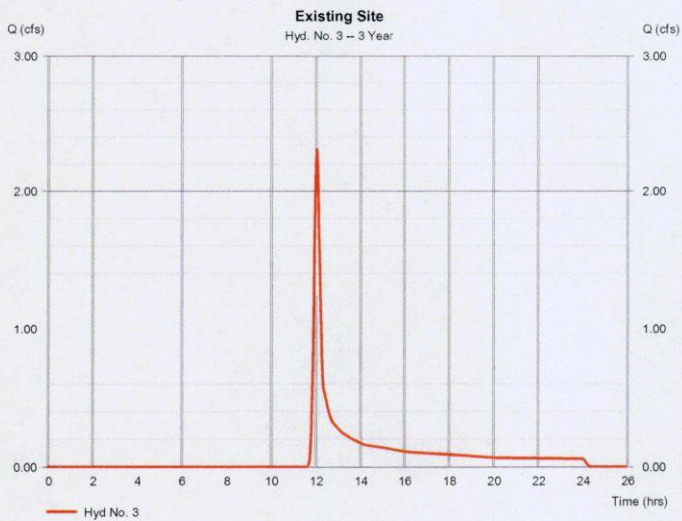
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 3

Existing Site

Hydrograph type	= SCS Runoff	Peak discharge	= 2.308 cfs
Storm frequency	= 3 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 7,583 cuft
Drainage area	= 8.700 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 1.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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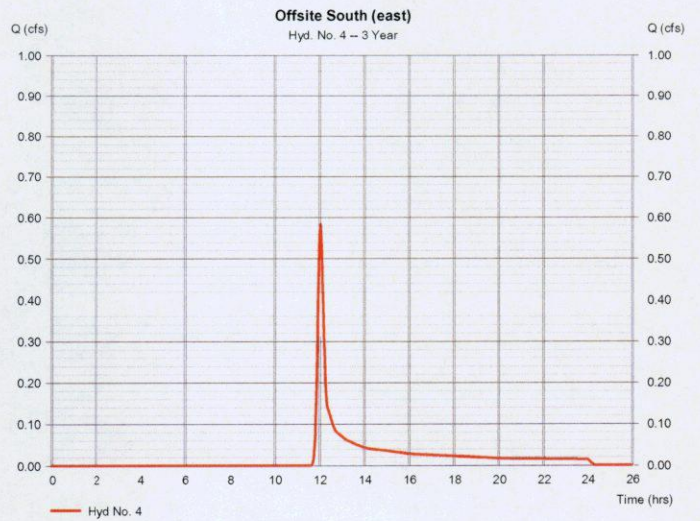
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 4

Offsite South (east)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.584 cfs
Storm frequency	= 3 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,918 cuft
Drainage area	= 2.200 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 1.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

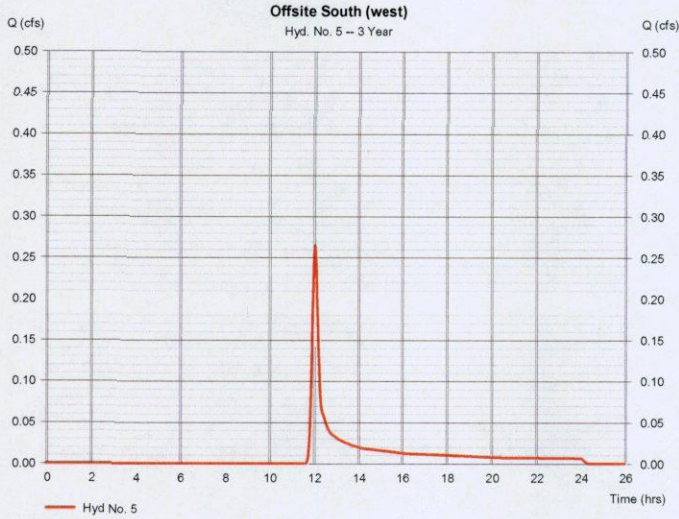
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Thursday, Feb 14, 2013

Hyd. No. 5

Offsite South (west)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.265 cfs
Storm frequency	= 3 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 872 cuft
Drainage area	= 1.000 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 1.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time Interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total storage used (cuft)	Hydrograph Description
1	SCS Runoff	37.70	2	722	110,913	-----	-----	-----	Total Site
2	Reservoir	29.29	2	728	105,930	1	1348.97	44,695	Prelim Pond
3	SCS Runoff	30.78	2	722	86,727	-----	-----	-----	Existing Site
4	SCS Runoff	7.784	2	722	21,931	-----	-----	-----	Offsite South (east)
5	SCS Runoff	3.538	2	722	9,909	-----	-----	-----	Offsite South (west)

Pond.gpw Return Period: 5 Year Thursday, Feb 14, 2013

Hydrograph Report

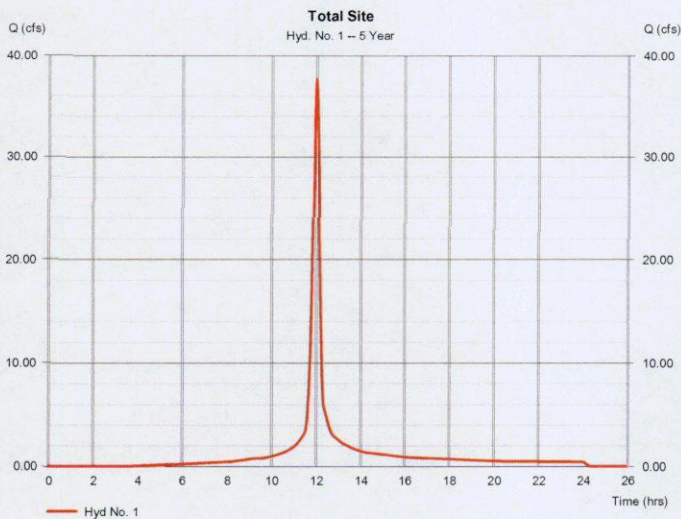
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Thursday, Feb 14, 2013

Hyd. No. 1

Total Site

Hydrograph type	= SCS Runoff	Peak discharge	= 37.70 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 110,913 cuft
Drainage area	= 8.700 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

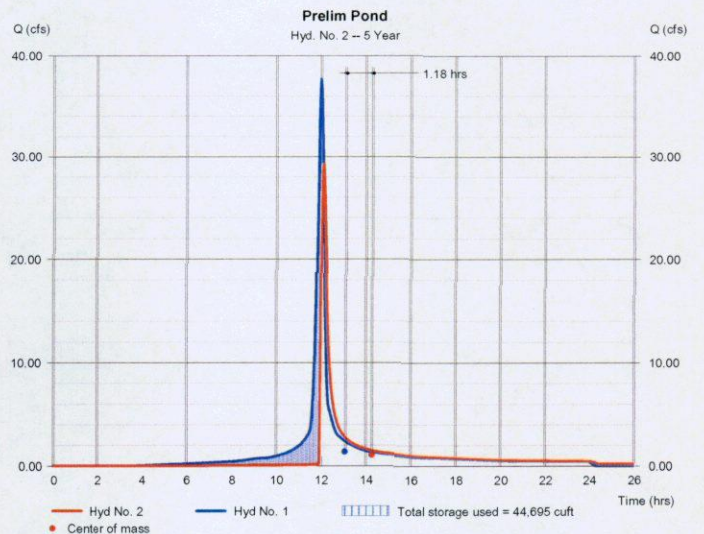
Thursday, Feb 14, 2013

Hyd. No. 2

Prelim Pond

Hydrograph type	= Reservoir	Peak discharge	= 29.29 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 105,930 cuft
Inflow hyd. No.	= 1 - Total Site	Max. Elevation	= 1348.97 ft
Reservoir name	= <New Pond>	Max. Storage	= 44,695 cuft

Storage Indication method used.



Hydrograph Report

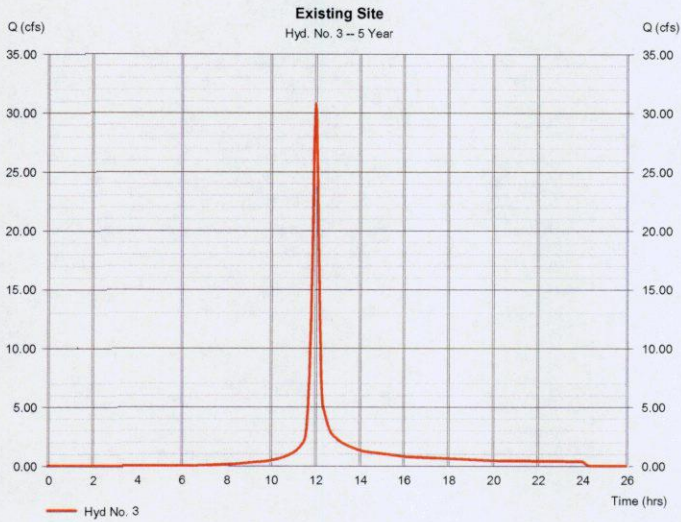
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 3

Existing Site

Hydrograph type	= SCS Runoff	Peak discharge	= 30.78 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 86,727 cuft
Drainage area	= 8.700 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

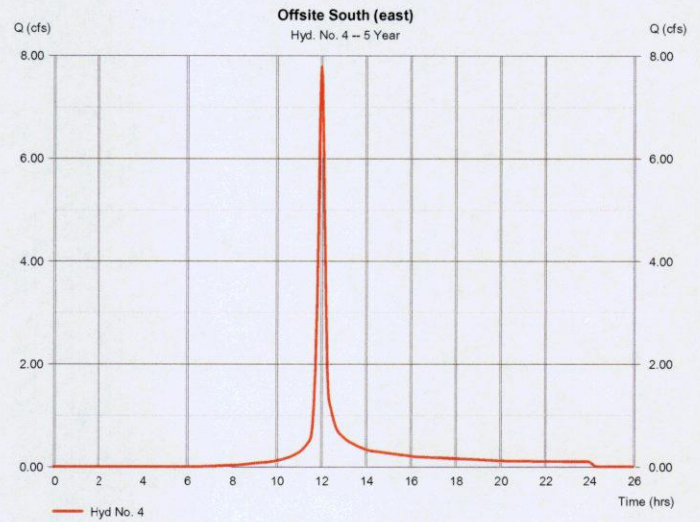
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 4

Offsite South (east)

Hydrograph type	= SCS Runoff	Peak discharge	= 7.784 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 21,931 cuft
Drainage area	= 2.200 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

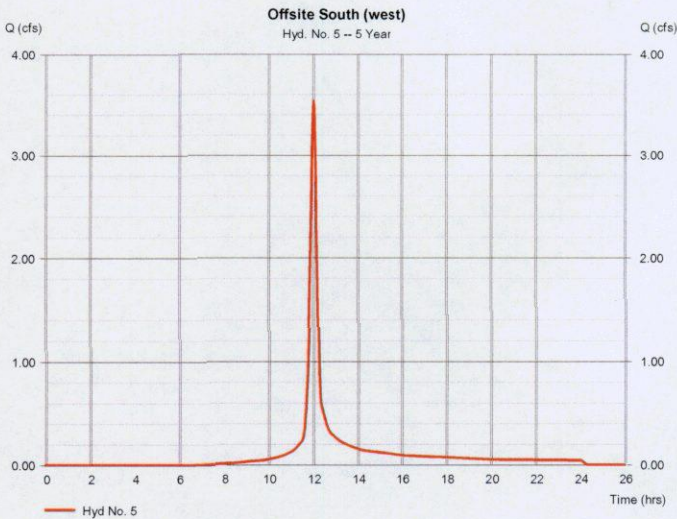
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 5

Offsite South (west)

Hydrograph type	= SCS Runoff	Peak discharge	= 3.538 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 9,969 cuft
Drainage area	= 1.000 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	44.41	2	722	131,035	-----	-----	-----	Total Site
2	Reservoir	37.76	2	726	126,943	1	1349.10	47,116	Prolim Pond
3	SCS Runoff	37.54	2	722	106,350	-----	-----	-----	Existing Site
4	SCS Runoff	9.462	2	722	26,803	-----	-----	-----	Offsite South (east)
5	SCS Runoff	4.314	2	722	12,224	-----	-----	-----	Offsite South (west)

Pond gpw Return Period: 10 Year Thursday, Feb 14, 2013

Hydrograph Report

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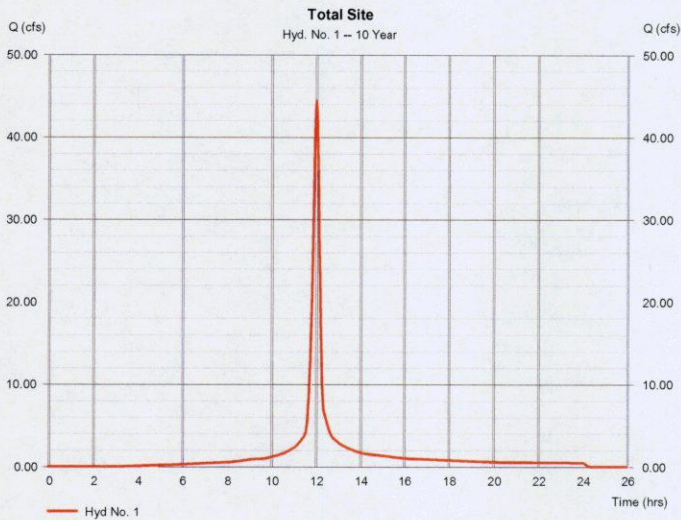
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 1

Total Site

Hydrograph type	= SCS Runoff	Peak discharge	= 44.41 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 131,935 cuft
Drainage area	= 8.700 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

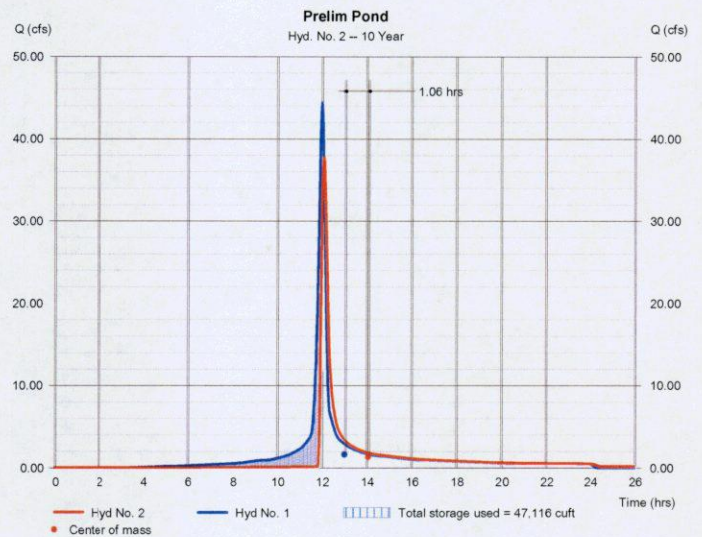
Thursday, Feb 14, 2013

Hyd. No. 2

Prelim Pond

Hydrograph type	= Reservoir	Peak discharge	= 37.76 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 126,943 cuft
Inflow hyd. No.	= 1 - Total Site	Max. Elevation	= 1349.10 ft
Reservoir name	= <New Pond>	Max. Storage	= 47,116 cuft

Storage indication method used.



Hydrograph Report

31

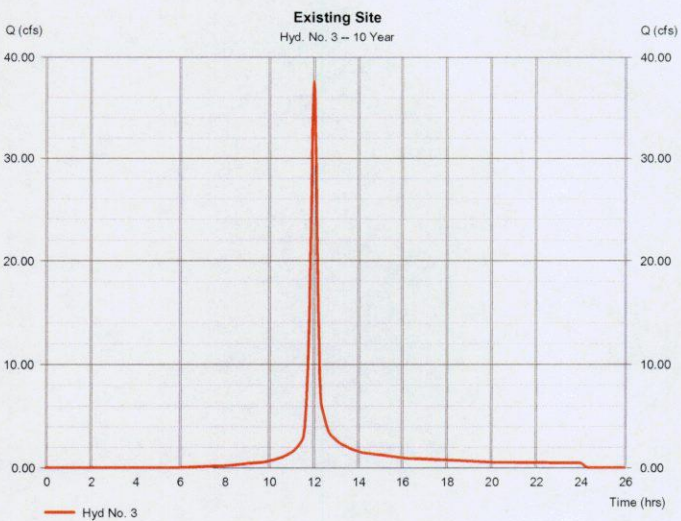
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 3

Existing Site

Hydrograph type	= SCS Runoff	Peak discharge	= 37.54 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 106,350 cuft
Drainage area	= 8.700 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

32

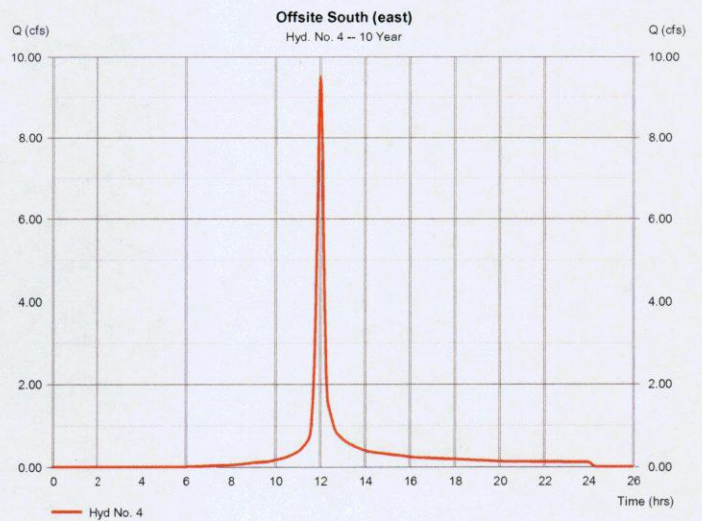
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 4

Offsite South (east)

Hydrograph type	= SCS Runoff	Peak discharge	= 9.492 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 26,893 cuft
Drainage area	= 2.200 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

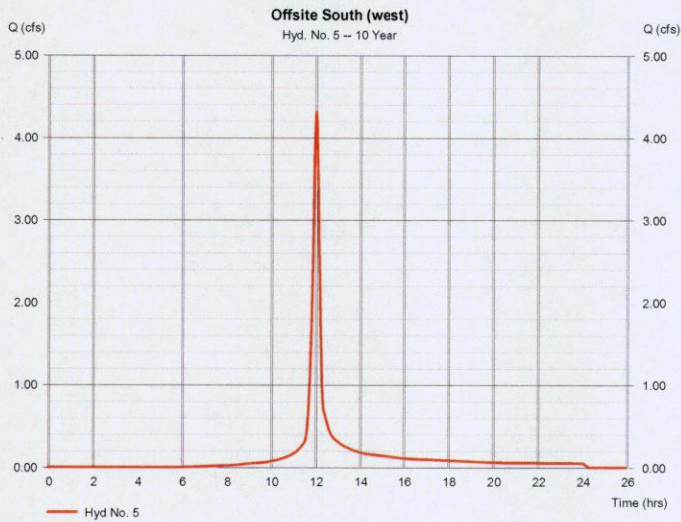


Hydrograph Report

Hyd. No. 5

Offsite South (west)

Hydrograph type	= SCS Runoff	Peak discharge	= 4.314 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 12,224 cuft
Drainage area	= 1,000 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	52.99	2	722	159,124	-----	-----	-----	Total Site
2	Reservoir	47.15	2	720	154,123	1	1349.22	49,675	Prelim Pond
3	SCS Runoff	46.26	2	722	132,101	-----	-----	-----	Existing Site
4	SCS Runoff	11.70	2	722	33,405	-----	-----	-----	Offsite South (east)
5	SCS Runoff	5.317	2	722	15,184	-----	-----	-----	Offsite South (west)

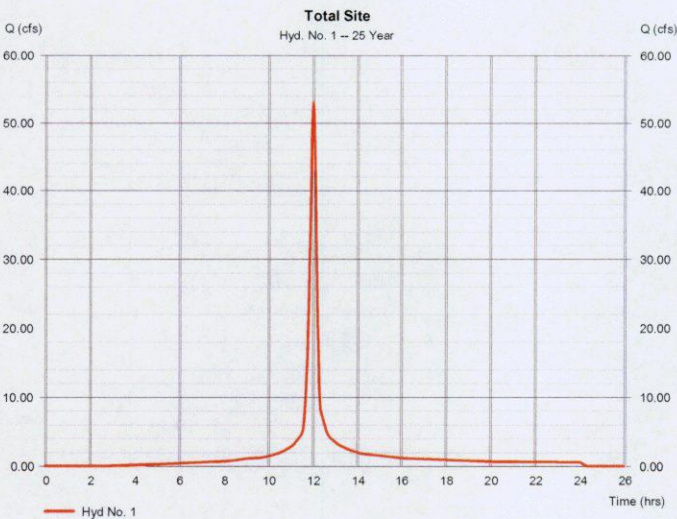
Pond.gpw Return Period: 25 Year Thursday, Feb 14, 2013

Hydrograph Report

Hyd. No. 1

Total Site

Hydrograph type	= SCS Runoff	Peak discharge	= 52.99 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 159,124 cuft
Drainage area	= 8,700 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



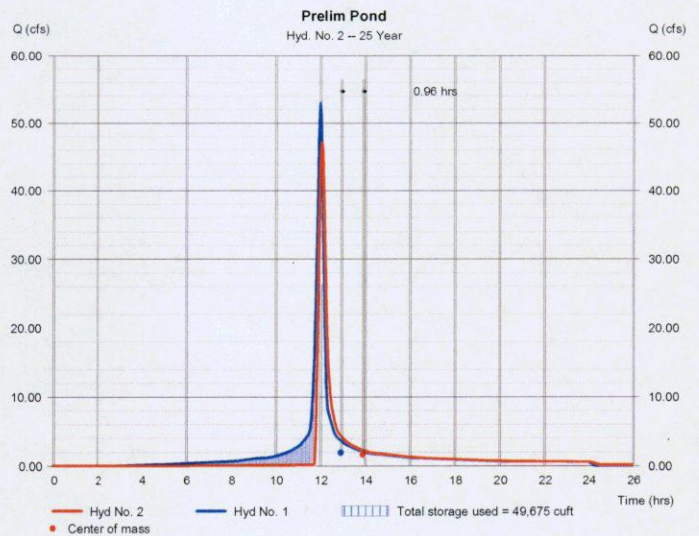
Hydrograph Report

Hyd. No. 2

Prelim Pond

Hydrograph type	= Reservoir	Peak discharge	= 47.15 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 154,123 cuft
Inflow hyd. No.	= 1 - Total Site	Max. Elevation	= 1349.22 ft
Reservoir name	= <New Pond>	Max. Storage	= 49,675 cuft

Storage Indication method used.



Hydrograph Report

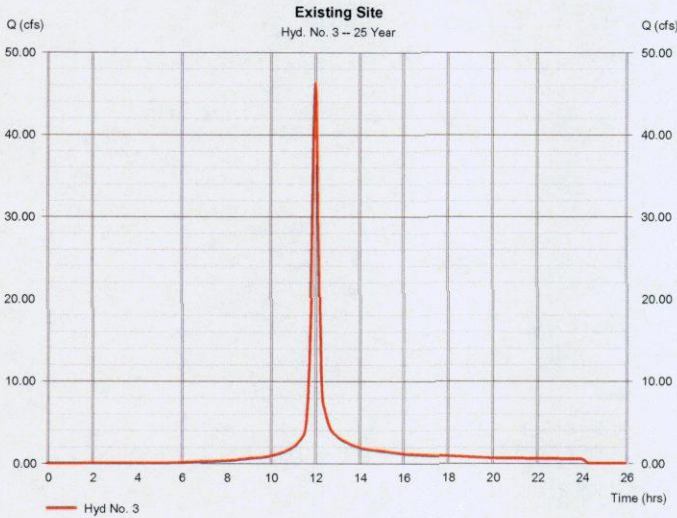
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 3

Existing Site

Hydrograph type	= SCS Runoff	Peak discharge	= 46.26 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 132,101 cuft
Drainage area	= 8.700 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

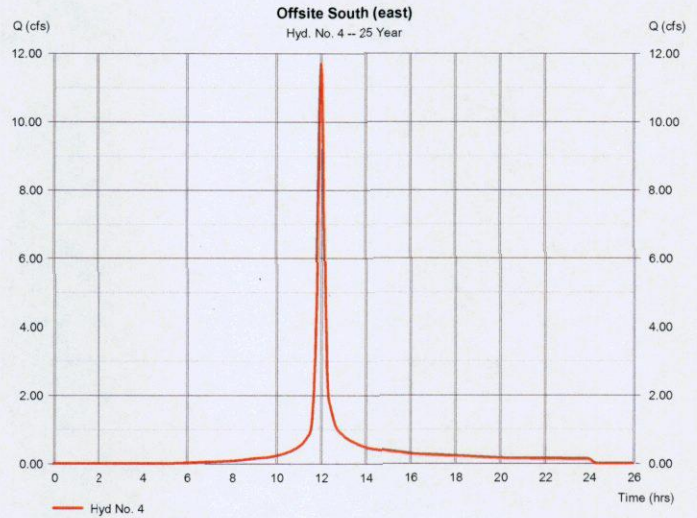
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 4

Offsite South (east)

Hydrograph type	= SCS Runoff	Peak discharge	= 11.70 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 33,405 cuft
Drainage area	= 2.200 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

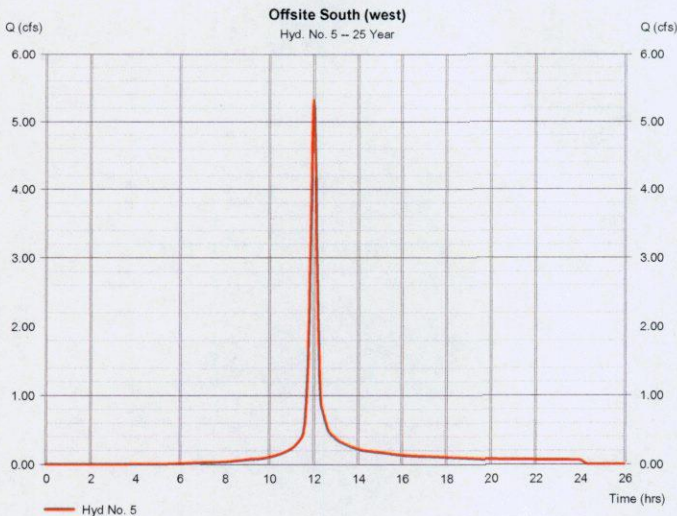
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 5

Offsite South (west)

Hydrograph type	= SCS Runoff	Peak discharge	= 5.317 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 15,184 cuft
Drainage area	= 1.000 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	60.57	2	722	183,396	-----	-----	-----	Total Site
2	Reservoir	54.57	2	726	178,388	1	1349.32	51,583	Prelim Pond
3	SCS Runoff	54.02	2	722	155,342	-----	-----	-----	Existing Site
4	SCS Runoff	13.66	2	722	39,282	-----	-----	-----	Offsite South (east)
5	SCS Runoff	6.209	2	722	17,855	-----	-----	-----	Offsite South (west)

Pond.gpw Return Period: 50 Year Thursday, Feb 14, 2013

Hydrograph Report

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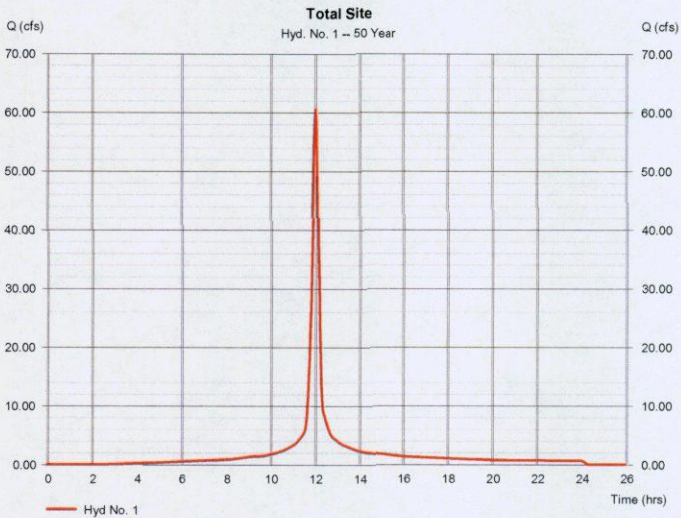
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 1

Total Site

Hydrograph type	= SCS Runoff	Peak discharge	= 60.57 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 183,396 cuft
Drainage area	= 8,700 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

42

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

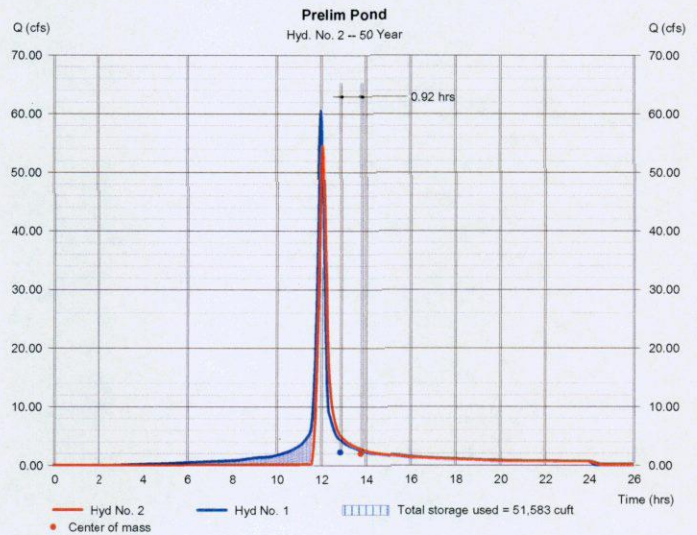
Thursday, Feb 14, 2013

Hyd. No. 2

Prelim Pond

Hydrograph type	= Reservoir	Peak discharge	= 54.57 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 178,388 cuft
Inflow hyd. No.	= 1 - Total Site	Max. Elevation	= 1349.32 ft
Reservoir name	= <New Pond>	Max. Storage	= 51,583 cuft

Storage Indication method used.



Hydrograph Report

43

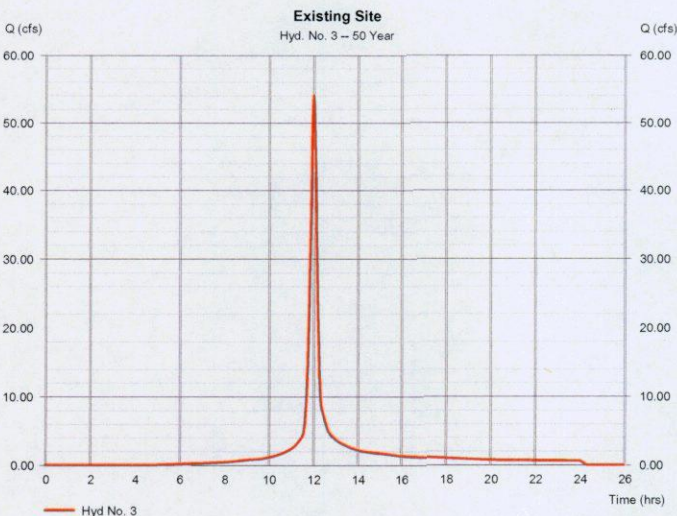
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 3

Existing Site

Hydrograph type	= SCS Runoff	Peak discharge	= 54.02 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 155,342 cuft
Drainage area	= 8,700 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

44

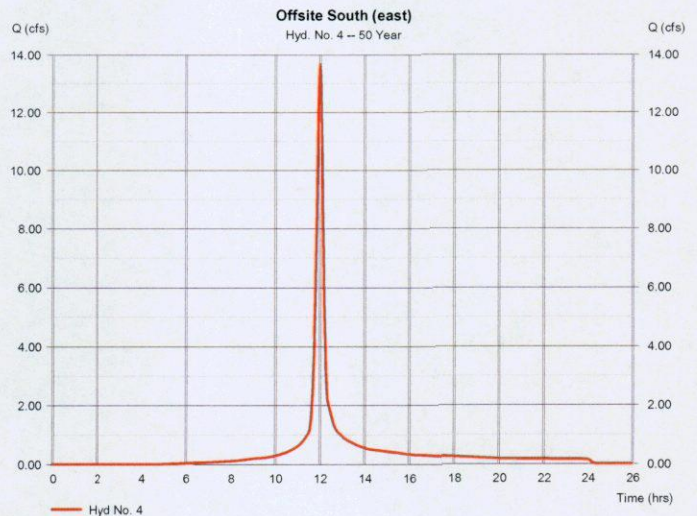
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Thursday, Feb 14, 2013

Hyd. No. 4

Offsite South (east)

Hydrograph type	= SCS Runoff	Peak discharge	= 13.66 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 39,282 cuft
Drainage area	= 2,200 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

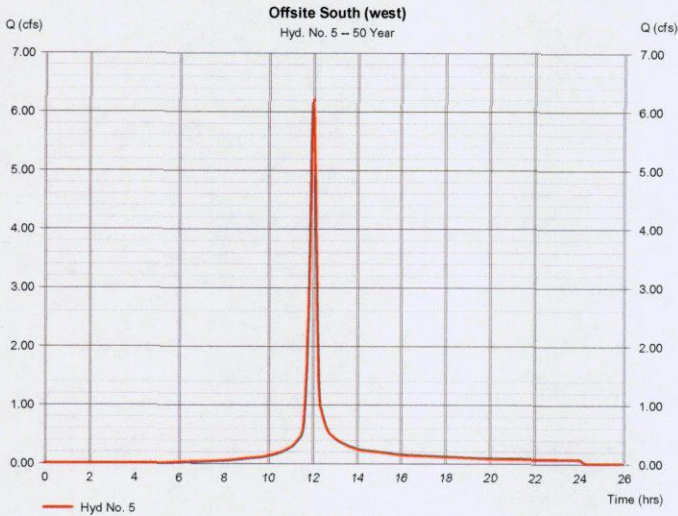


Hydrograph Report

Hyd. No. 5

Offsite South (west)

Hydrograph type	= SCS Runoff	Peak discharge	= 6,209 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 17,855 cuft
Drainage area	= 1,000 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	69.07	2	722	210,784	-----	-----	-----	Total Site
2	Reservoir	62.59	2	726	205,767	1	1349.42	53,554	Prelim Pond
3	SCS Runoff	62.74	2	722	181,775	-----	-----	-----	Existing Site
4	SCS Runoff	15.87	2	722	45,906	-----	-----	-----	Offsite South (east)
5	SCS Runoff	7.212	2	722	20,864	-----	-----	-----	Offsite South (west)

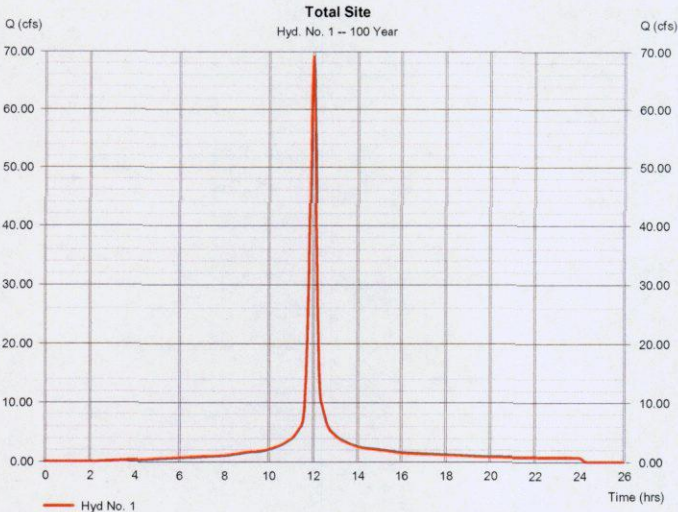
Pond.gpw Return Period: 100 Year Thursday, Feb 14, 2013

Hydrograph Report

Hyd. No. 1

Total Site

Hydrograph type	= SCS Runoff	Peak discharge	= 69.07 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 210,784 cuft
Drainage area	= 8,700 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 7.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



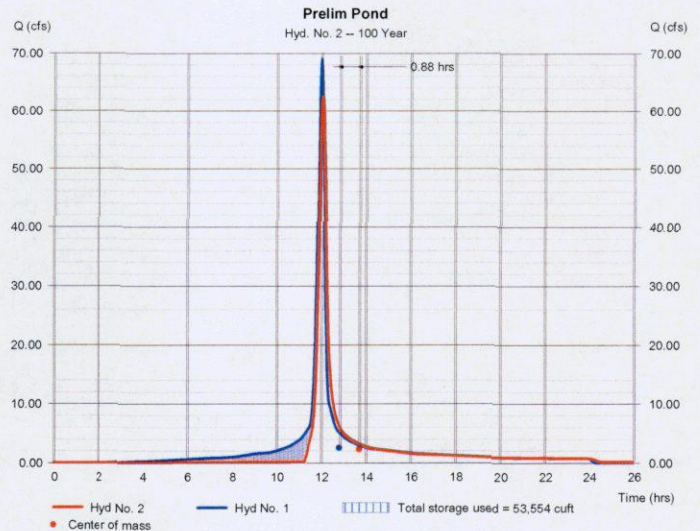
Hydrograph Report

Hyd. No. 2

Prelim Pond

Hydrograph type	= Reservoir	Peak discharge	= 62.59 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 205,767 cuft
Inflow hyd. No.	= 1 - Total Site	Max. Elevation	= 1349.42 ft
Reservoir name	= <New Pond>	Max. Storage	= 53,554 cuft

Storage Indication method used.

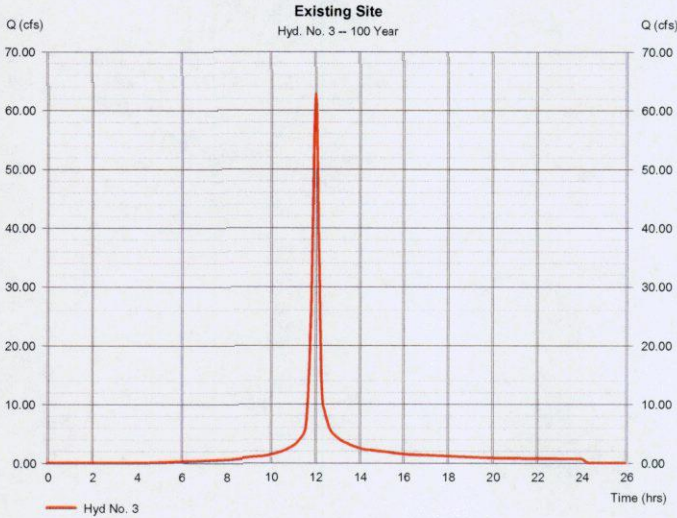


Hydrograph Report

Hyd. No. 3

Existing Site

Hydrograph type	= SCS Runoff	Peak discharge	= 62.74 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 181,775 cuft
Drainage area	= 8,700 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 7.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

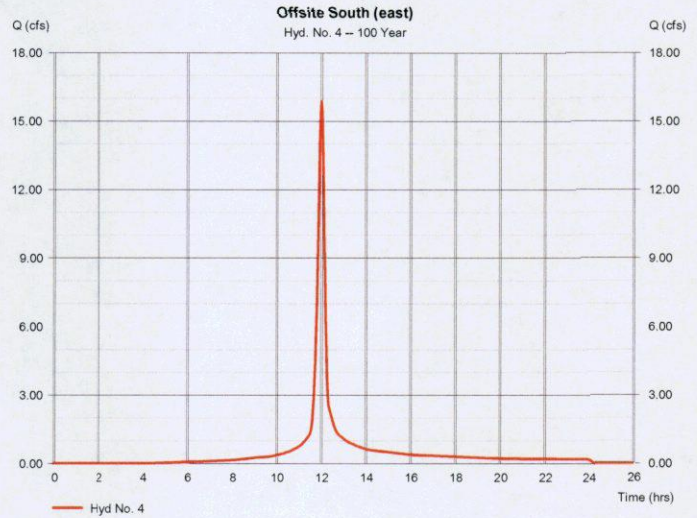


Hydrograph Report

Hyd. No. 4

Offsite South (east)

Hydrograph type	= SCS Runoff	Peak discharge	= 15.87 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 45,966 cuft
Drainage area	= 2,200 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 7.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

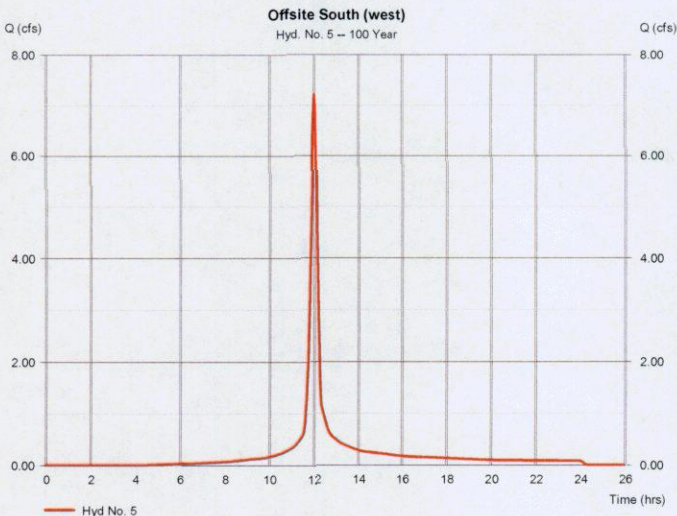


Hydrograph Report

Hyd. No. 5

Offsite South (west)

Hydrograph type	= SCS Runoff	Peak discharge	= 7.212 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 20,894 cuft
Drainage area	= 1,000 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 7.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	27.8967	9.8000	0.7047	-----
2	76.3137	14.3000	0.8844	-----
3	1.2000	0.1000	0.0000	-----
5	52.6224	11.2000	0.7497	-----
10	55.1841	11.1000	0.7229	-----
25	60.7012	11.1000	0.7068	-----
50	66.9222	11.3000	0.7004	-----
100	62.2794	10.1000	0.6624	-----

File name: wch_IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.18	3.40	2.90	2.55	2.29	2.06	1.91	1.78	1.66	1.56	1.48	1.40
2	5.57	4.54	3.85	3.35	2.97	2.67	2.43	2.23	2.06	1.92	1.80	1.69
3	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
5	6.52	5.33	4.55	3.99	3.57	3.24	2.97	2.75	2.57	2.41	2.27	2.15
10	7.40	6.09	5.22	4.60	4.13	3.76	3.46	3.21	3.00	2.82	2.67	2.53
25	8.51	7.03	6.05	5.35	4.81	4.39	4.05	3.76	3.52	3.32	3.14	2.98
50	9.47	7.86	6.78	6.00	5.41	4.94	4.56	4.24	3.98	3.75	3.55	3.37
100	10.31	8.53	7.37	6.53	5.90	5.40	5.00	4.66	4.37	4.13	3.92	3.73

Tc = time in minutes. Values may exceed 60.

Precip. file name: wch_24hr.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.80	3.50	1.20	4.50	5.20	6.10	6.90	7.80
SCS 6-Hr	0.00	1.80	0.00	0.00	2.80	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10