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WHEN RECORDED, MAIL TO:  
Utah Department of Transportation  
Right of Way, Fourth Floor  
Box 148420  
Salt Lake City, UT 84114-8240

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04/05/2017 09:37 AM \$59.00  
Book - 10544 Pg - 7493-7517  
GARY W. OTT  
RECORDER, SALT LAKE COUNTY, UTAH  
BRAD REYNOLDS C/O UDOT  
RIGHT OF WAY FOURTH FLOOR  
BOX 148420  
SLC UT  
BY: SMA, DEPUTY - WI 25 P.

## UTAH DEPARTMENT OF TRANSPORTATION DRAINAGE AGREEMENT

Salt Lake County Tax ID No. 2805351028

This Drainage Agreement made and entered into this 21 day of December  
2016 between Utah Department of Transportation ("Department") and  
Brad Reynolds ("Permittee"), who owns the property described in Exhibit A.

### RECITALS

The Permittee (property owner) desires to construct a drainage system and a drainage connection within the Department Right of Way subject to the requirements and conditions described in the Permit.

Department's Policy 08A-06 requires the Permittee to sign the Drainage Agreement as part of the permitting process for a drainage connection.

The parties agree as follows:

(1) **COMPLIANCE:** Permittee must comply with the conditions in the permit and applicable state and federal statutes, regulations and rules. The Department may perform inspection of Permittee's drainage system to monitor compliance with the Permit and with state and federal statutes, regulations, and rules. Permittee grants the Department access to the Permittee's property for inspection or to perform any repairs to prevent damage to the Department's Right of Way. The Department's inspection does not relieve the Permittee of its responsibilities in meeting the Permit conditions. The Permittee is responsible for the Department's inspection costs. Permittee's responsibilities include:

- a) Permittee is responsible for repairing and restoring any portion of the Department Right of Way and drainage systems located therein that may be damaged as a result of making the drainage connection or as the result of any subsequent drainage originating from the Permittee's property.
- b) Permittee must not increase its drainage discharge into the Department's drainage system without the written permission of the Department.
- c) A bonded contractor must apply for the required permit to install drainage systems in the Department Right of Way prior to the commencement of any such work.
- d) The Permittee is responsible to obtain environmental clearances, permits, or other approvals from any other local, state or federal agency that may have regulatory jurisdiction or oversight.

(2) **MAINTENANCE:** Permittee's drainage system must at all times be maintained, repaired, constructed, and operated by and at the expense of the Permittee. The drainage system will be serviced without access from any interstate highway or ramp. The Department may notify the Permittee of any maintenance requirements if the Permittee fails to maintain the drainage system. The Department reserves the right, without relieving the Permittee of its obligations, to reconstruct or make repairs to the drainage system, as it may consider necessary, and the Permittee must reimburse the Department for its cost if the Permittee fails to comply with the Department's written notification and complete the required maintenance.

(3) **FUTURE IMPACTS:** The Department has the right to change its drainage system for any future transportation project. If the Department's drainage system is reconstructed or modified, the Department reserves the right to hold the Permittee responsible for the cost to reconnect to the Department's drainage system. The Department is not responsible for any costs the Permittee incurs due to the drainage system being reconstructed or modified.

(4) **LIABILITY:** Pursuant to R930-7-6(2)(b), the Permittee is required to guarantee satisfactory performance under this Permit. The Department may proceed against Permittee to recover all expenses incurred by the Department, its employees, or contractors in repairing the sections of roadway damaged by the Permittee or its drainage system, including the failure to restore the Right of Way to Department standards. The Permittee will be liable for all costs the Department incurs under this agreement.

The Permittee will indemnify, defend, and hold harmless the Department, its employees, and the State of Utah from responsibility for any damage or liability arising from Permittee's construction, maintenance, repair, or any other related operation of the drainage system pursuant to the Permit issued under this agreement.

The Permittee will not hold the Department liable for damages resulting from any back-up or flow into the Permittee's drainage system or property. The Permittee accepts all risks associated with the connection to the Department's drainage system. The Permittee is responsible for all liability resulting from the discharge of pollutants into the Department's drainage system from its property or drainage system.

(5) **CANCELLATION OF PERMIT:** Any failure on the part of Permittee to comply with the terms and conditions set forth in the Permit or this Agreement may result in cancellation of the Permit. Failure of the Permittee to pay any sum of money for costs incurred by the Department in association with inspection, reconstruction, repair, or maintenance of the drainage system may also result in cancellation of the Permit. Non-compliance with either the Permit or Agreement may result in the Department removing the drainage system and restoring the highway and Right of Way at the sole expense of the Permittee. The Department will notify the Permittee in writing prior to any cancellation, setting forth the violations, and will provide the Permittee a reasonable time to correct the violations to the satisfaction of the Department. The Department may order the Permittee to remove its drainage system if the violations are not corrected.

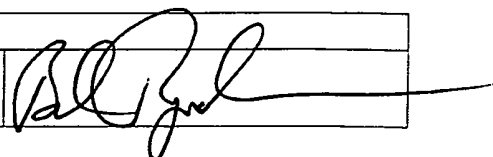
(6) **SUCCESSORS AND ASSIGNS:** All covenants, obligations and agreements will be binding upon the parties, their successors and assigns and run with the land as described in Exhibit A until the drainage connection is removed from the Department's Right of Way.

(7) **MISCELLANEOUS:**

- a) Each party agrees to undertake and perform all further acts that are reasonably necessary to carry out the intent and purpose of the Agreement at the request of the other party.
- b) This Agreement does not create any type of agency relationship, joint venture, or partnership between the Department and Permittee.
- c) The failure of either party to insist upon strict compliance of any of the terms and conditions, or failure or delay by either party to exercise any rights or remedies provided in this Agreement, or by law, will not release either party from any obligations arising under this Agreement.

- d) This Agreement shall be deemed to be made under and shall be governed by the laws of the State of Utah in all respects. Each person signing this Agreement warrants that the person has full legal capacity, power and authority to execute this Agreement for and on behalf of the respective party and to bind such party.
- e) If any portion of this Agreement is held to be invalid or unenforceable for any reason by a court of competent jurisdiction, such invalidity or unenforceability shall not affect any other provision, and this Agreement shall be construed as if such invalid or unenforceable provision had never been included.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement the day and year first above written.

CURRENT PROPERTY OWNER/PERMITTEE			
Name Printed:	Brad Reynolds	Signature:	

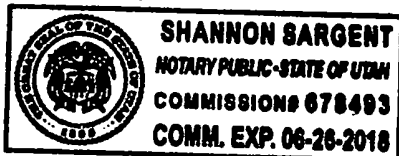
State of Utah )

County of Salt Lake )

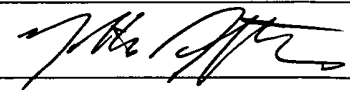
On this 21 day of December, in the year 2016,

Brad Reynolds personally appeared before me and duly acknowledged to me that he/she executed this agreement as the current property owner of said property or was authorized to sign the agreement on behalf of the property owner. Witness my hand and official seal.

(NOTARY SEAL)



  
Notary Public

UTAH DEPARTMENT OF TRANSPORTATION – Region Permits Officer			
Name Printed:	NATHAN STEPHENS	Signature:	

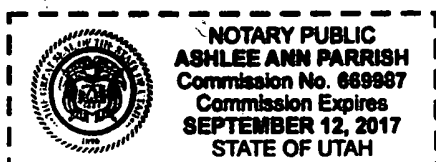
State of Utah)

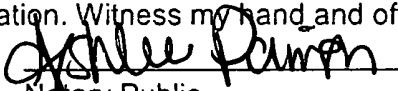
County of Salt Lake )

On this 4 day of April, in the year 2017,

Nathan Stephens personally appeared before me, who duly acknowledged to me that he/she executed this agreement pursuant to the authority delegated to him/her for the Utah Department of Transportation. Witness my hand and official seal.

(NOTARY SEAL)



  
Notary Public

**EXHIBIT A (Legal Description of Permittee's Property)**

PARCEL 28-05-351-020

Land located in Salt Lake County, State of Utah, more particularly described as follows:  
Beginning at a point  
which is North 0°07'00" East along the monument line 889.02 feet and South 89°12'10"  
East 529.14 feet from the Southwest Corner of Section 5, Township 3 South, Range 1  
East, Salt Lake Base and Meridian, and running thence North 0°07'00" East 298.31 feet;  
thence North 89°12'10" West 476.14 feet to the East right-of-way line of 700 East Street;  
thence North 0°07'00" East along said East right-of-way line 50 feet; thence South  
89°12'10" East 1267 feet; thence South 0°07'00 West 348.315 feet; thence North 89°  
12'10" West 790.86 feet to the point of beginning.

PARCEL 28-05-351-028

Lot 7B, AMENDMENT OF LOT 7, 9400 SOUTH COMMERCIAL SUBDIVISION,  
according to the official plat thereof, as recorded in the office of the County Recorder,  
Salt Lake County, State of Utah.

**EXHIBIT B**

(include drainage plan showing state route, mile post and location of all drainage systems and drainage calculations)





# DRAINAGE REPORT

## VILLAGES AT SANDY

SANDY, UTAH

*PREPARED FOR:*  
BRAD REYNOLDS CONTRUCTION  
BRAD REYNOLDS  
P.O. BOX 17958  
SALT LAKE CITY, UT 84117  
(801) 281-2200



*PREPARED BY:*  
ENSIGN ENGINEERING  
RILEY FORD  
45 WEST 10000 SOUTH #500  
SANDY, UT 84070  
(801) 255-0529

DECEMBER 29, 2016

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## 1.0 PROJECT OVERVIEW

The proposed Villages at Sandy project is located in the Northwest Quarter of Section 5, Township 3 South, Range 1 East, Salt Lake Base and Meridian, Sandy, Utah. The property is bordered by existing residential communities to the north and east and commercial properties to the south and west. The development area project is approximately 14.13 acres. The project, at this time, will stub an 18-inch storm drain from the 700 East UDOT right-of-way to the proposed development.

The purpose of this report is to provide a preliminary drainage plan for future developments located within the project to adequately size all pipe stubs, and planning for downstream storm drain networks of the potential impacts from runoff generated by future developments.

## 2.0 DESIGN CRITERIA

The site drainage system has been designed to conform to the requirements of Sandy City. The following standards were implemented into the design of the proposed storm drainage system.

- 10-year storm event is used to size underground conveyance systems.
- Surface systems are planned to safely pass the 100-year storm event.
- 100-year storm event used to determine required capacity of project detention facilities.
- Release rate of 0.2 cfs per acre used for calculating detention volumes.

## 3.0 HYDROLOGIC MODELING

The Rational Method was used in Autodesk Storm and Sanitary Analysis 2017 computer software program to model the hydrology of the project site.

The project site is separated into drainage catchments, each with an outlet design point for runoff analysis. The combined flows are routed through the storm drain conveyance system until reaching the detention basins. Each of the respective catchments is assigned a runoff coefficient based on the anticipated ground cover and impervious area. The runoff coefficient establishes the relationship between rainfall depth and actual

runoff from a given catchment. The rational coefficients used for the site can be seen in Table 3-1.

TABLE 3-1 RATIONAL COEFFICIENTS

Description	Rational Coefficient
Open Space (lawns, parks, ect.)	0.15
Impervious Areas: roofs, roads, walks, ect	0.90

Precipitation data has been provided by Sandy City. The Intensity–Duration–Frequency (IDF) curve for a 10–year and 100–year storm event was entered into the hydrologic calculations. The time of concentration for each basin is calculated according to the TR-55 method. The time of concentration can be described as the travel time required for water at the most distant point of the watershed to reach the outlet so that the entire basin is contributing to the discharge. The TR-55 method combines the travel time of sheet flow, shallow concentrated flow, and channel/pipe flow to develop the time of concentration. Values for the time of concentration have been shown as 6 minutes for conservative results.

#### 4.0 EXISTING DRAINAGE CONDITIONS

The project area consists of 14.13 acres of mostly undeveloped land and some roadway improvements along the access road. There is roughly 12 feet of grade on the site, sloping from east to west. The site is covered by existing trees and vegetation.

The soils have been classified as hydrologic soil group B. For calculations, the soils will be classified as group B. According to NRCS the soil groups can be described 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.

## 5.0 PROPOSED DRAINAGE CONDITIONS

The proposed drainage system consists of catch basins, cleanout boxes, inlet boxes and storm drain pipes. Road grades have been designed to direct runoff into the proposed curb and gutter. Catch basins and combo boxes will collect the flow channeled by the curb and gutter and route them through the underground pipe network. The storm water will then be conveyed to the nearest detention ponds where the runoff will be detained and proposed to be released into the UDOT storm drain system in 700 East street.

For simplicity, the site has been broken into three separate basins, Basin–1 consists of 0.24 acres on the site access road. Basin–2 consists of 1.31 acres of a future high density development site, and Basin–3 also consists of 12.58 acres of a future high density site.

The total allowable release rate from the site into the 700 East UDOT storm drain would be 2.82 cfs ( $14.13 \text{ acres} \times 0.2 \text{ cfs/acre}$ ), therefore each future development will be required to detain the 100–year storm runoff generated from their site.

### BASIN–1

Basin–1 consists of 0.24 acres. It is anticipated that due to the lower elevation of Basin–1, that this basin will be directly discharged into the existing storm drain network located in

700 East, therefore the remaining site will be required to have an excess amount of storage to compensate for this direct discharge.

Basin-1 consists of mostly hardscape and was given a runoff coefficient of 0.76, using this in the drainage model, it was determined that this basin will have a peak runoff of 1.18 cfs. This basin is located nearest to the UDOT connection point and much of the peak flow will begin to pass through the system before the peak flow from the upstream basins hits the UDOT storm drainage system.

#### **BASIN-2**

Basin-2 consists of 1.31 acres. This area is anticipated to be a high density residential development. It has been assigned a runoff coefficient value of 0.70.

Using this information in the drainage model, it was determined that this site will have to detain an approximate volume of 2,002 ft<sup>3</sup> and will be allowed a total release rate of 0.26 cfs. This peak flow will continue downstream and join the flow from Basin-1.

#### **BASIN-3**

Basin-3 consists of 12.58 acres. This area is also anticipated to be a high density residential development. This area has also been assigned a runoff coefficient value of 0.70 due to the anticipated hardscape coverage.

Using this information in the drainage model, it was determined that this site will have to detain an approximate volume of 19,469 ft<sup>3</sup> and will be allowed a total release rate of 2.12 cfs. This peak flow will flow downstream and merge with the flows from Basin-1 and Basin-2. The model results shown in Appendix A, in the Node Summary section, show that the peak flow into Out-01 meets the 2.82 cfs maximum release rate from the site.

**TABLE 5-1 DETENTION RELEASE RATES**

<b>DESCRIPTION</b>	<b>STORAGE REQUIRED (CUFT)</b>	<b>PEAK FLOW (CFS)</b>
BASIN-1	NONE	1.18
BASIN-2	2,002	0.26
BASIN-3	19,469	2.12
<b>TOTAL</b>	<b>21,471</b>	<b>2.82</b>

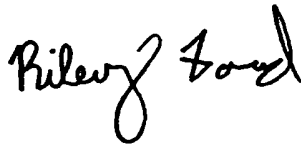
## PIPE CAPACITY

An 18" pipe has been designed to run at a slope of 0.35% from the 700 East UDOT storm drain system and into the proposed development. A pipe of this size, running at this slope, has a design flow capacity of 6.21 cfs and should adequately convey the peak runoff flow of 2.82 cfs from the proposed future developments.

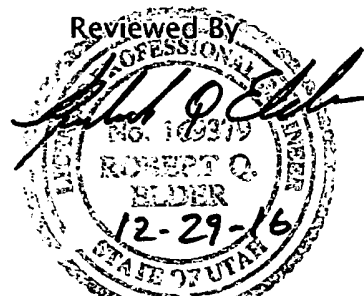
## 6.0 CONCLUSIONS

The preliminary drainage system as outlined is sized to detain the 100-year storm event runoff, and to release it at no greater than 0.20 cfs per acre. Resulting in a total peak flow of 2.82 cfs running into the existing UDOT storm drain system located in 700 East during the 100-year storm event. The 18-inch proposed pipe will adequately convey the peak runoff from the site, into the existing storm drain network.

Ensign Engineering



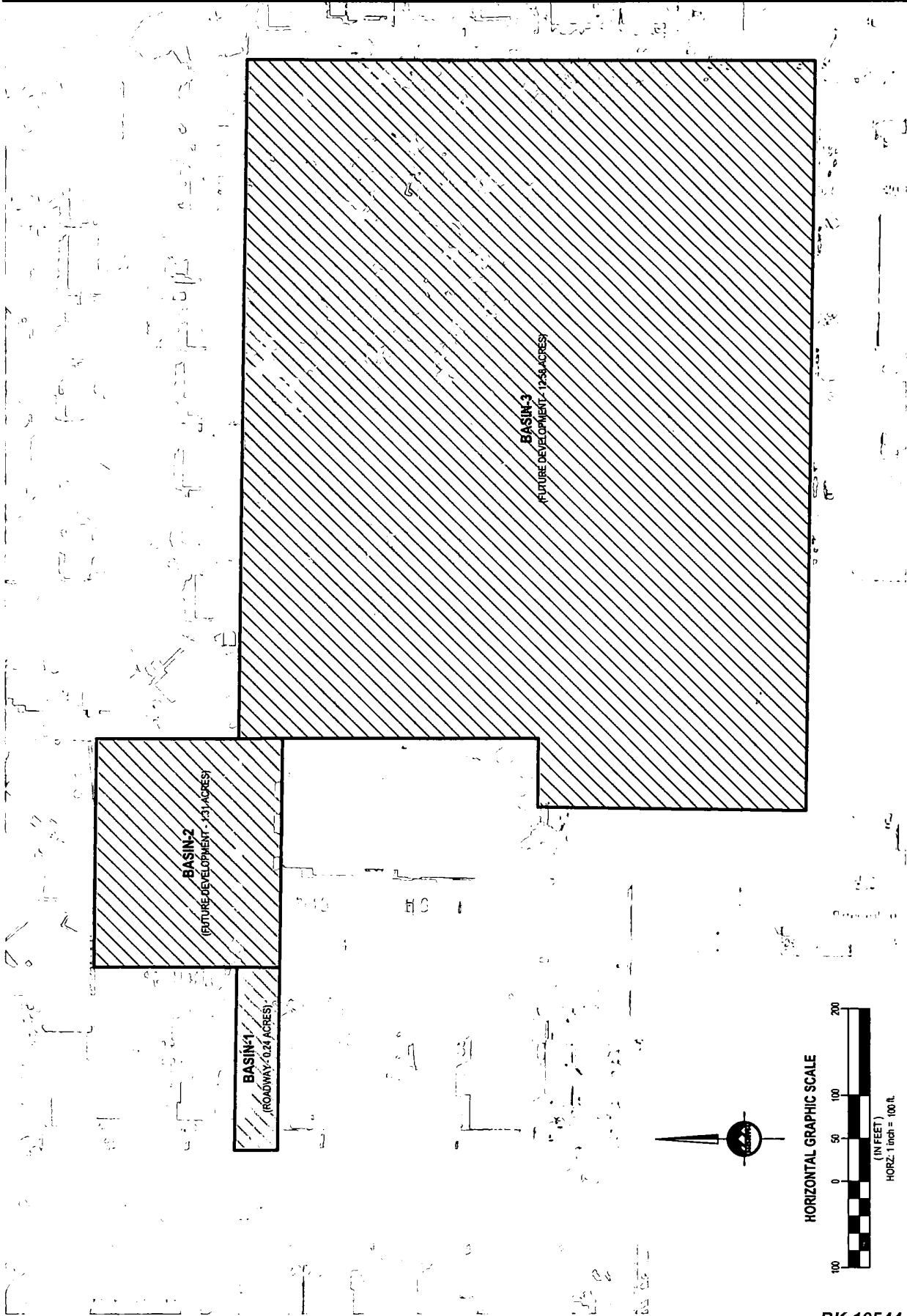
Riley Ford, E.I.T.  
Design Engineer



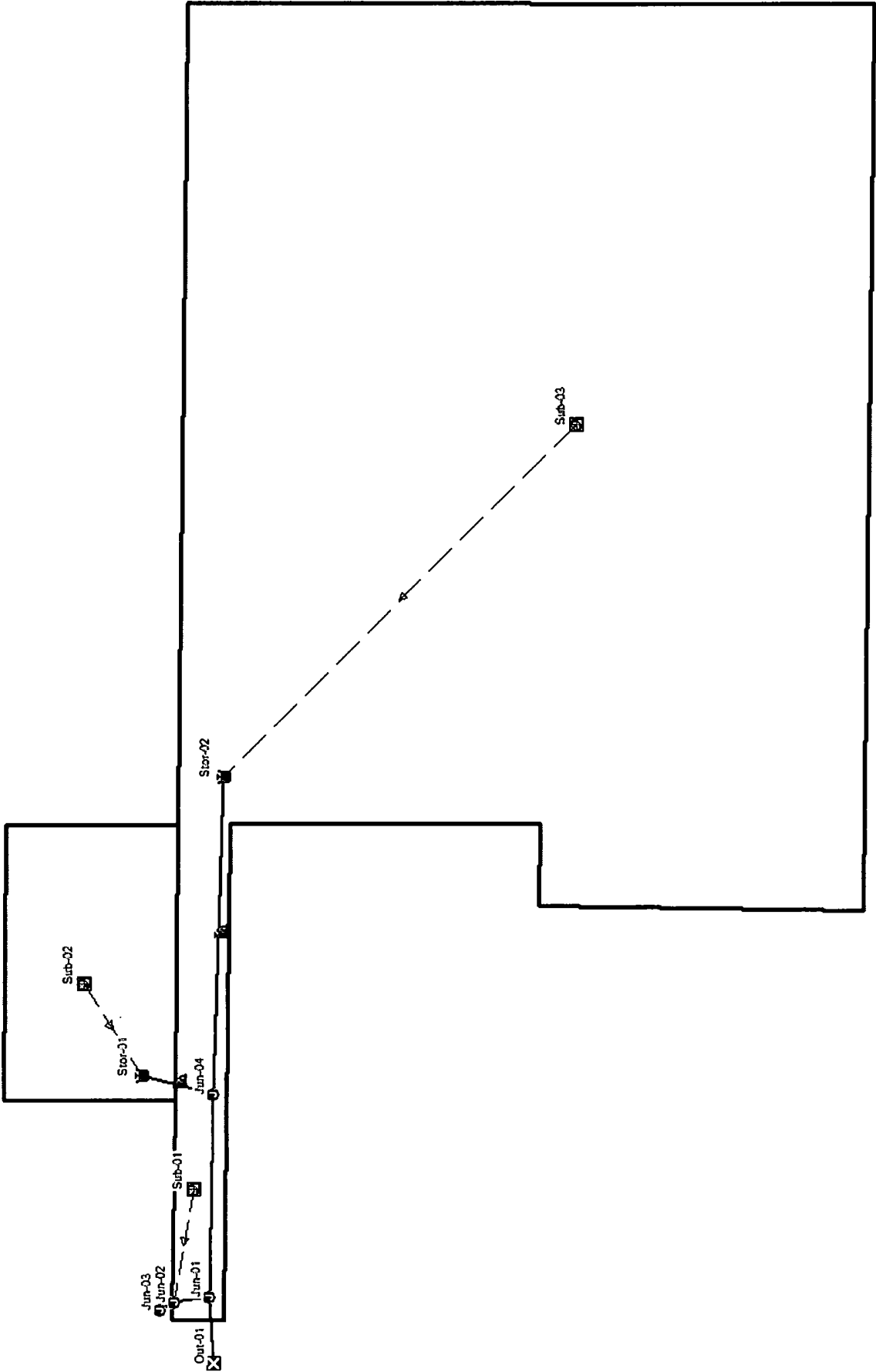
Robert Q. Elder, P.E.  
Principal

## 7.0 APPENDIX A – MODEL RESULTS



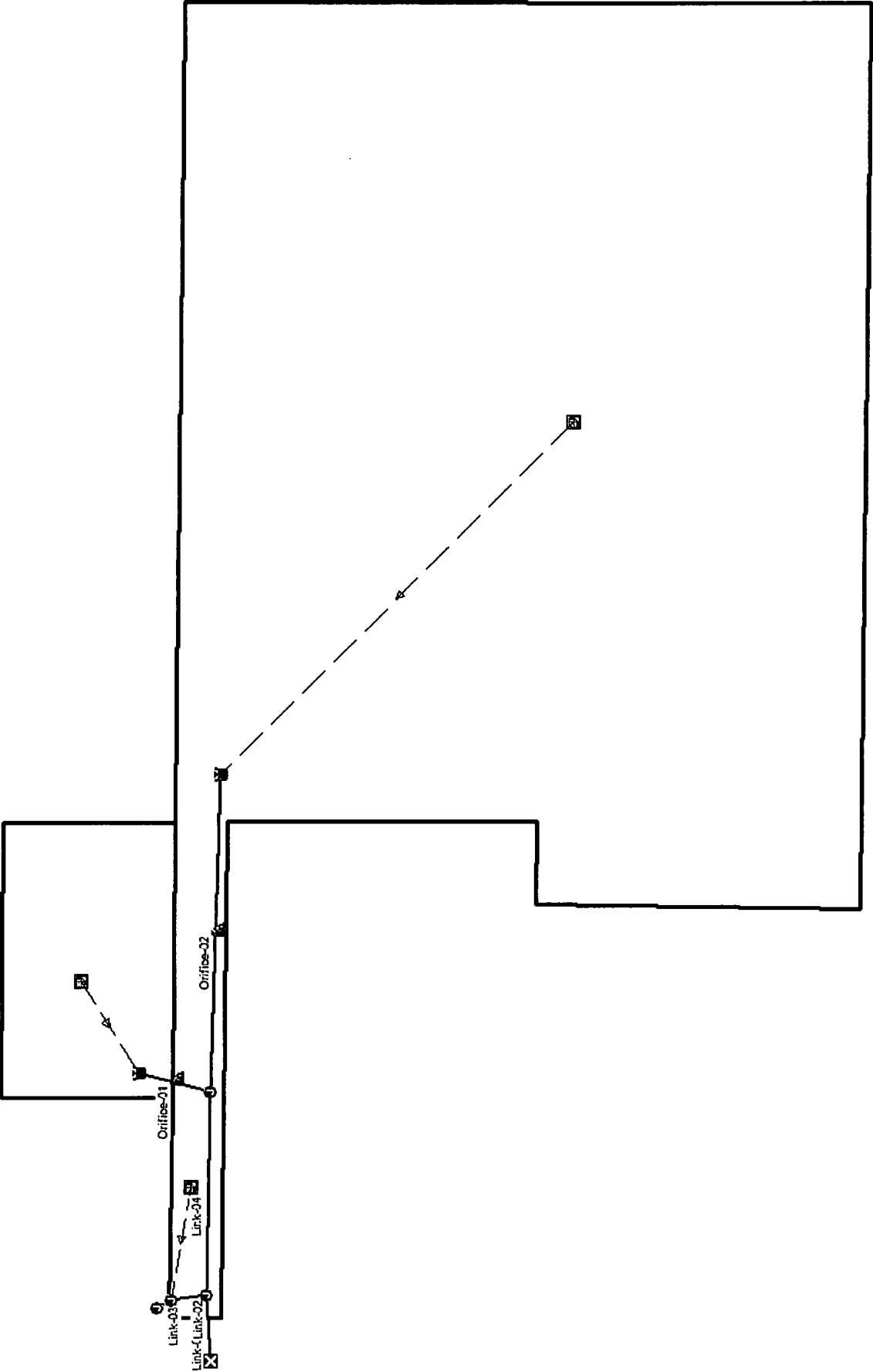


Sub-basin and Junction Layout – 100 Year Storm Event



SCHEMATIC NODE AND BASIN LAYOUT  
AUTODESK® STORM AND SANITARY ANALYSIS 2017

Link Layout – 100 Year Storm Event



SCHEMATIC LINK LAYOUT  
AUTODESK® STORM AND SANITARY ANALYSIS 2017

## Project Description

File Name ..... DRAINAGE MODEL.SPF

## Project Options

Flow Units ..... CFS  
Elevation Type ..... Elevation  
Hydrology Method ..... Rational  
Time of Concentration (TOC) Method ..... User-Defined  
Link Routing Method ..... Hydrodynamic  
Enable Overflow Ponding at Nodes ..... YES  
Skip Steady State Analysis Time Periods ..... NO

## Analysis Options

Start Analysis On ..... Nov 16, 2016 00:00:00  
End Analysis On ..... Nov 17, 2016 00:00:00  
Start Reporting On ..... Nov 16, 2016 00:00:00  
Antecedent Dry Days ..... 0 days  
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss  
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss  
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss  
Routing Time Step ..... 30 seconds

## Rainfall Details

Return Period..... 100 year(s)

## Subbasin Summary

Subbasin ID	Area	Weighted Runoff Coefficient	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
	(ac)		(in)	(in)	(ft <sup>3</sup> )	(cfs)	(days hh:mm:ss)
Sub-01	0.24	0.7600	0.64	0.49	429.57	1.18	0 00:06:00
Sub-02	1.31	0.7000	0.64	0.45	2138.25	5.89	0 00:06:00
Sub-03	12.58	0.7000	0.64	0.45	20546.16	56.62	0 00:06:00

## Node Summary

Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Peak Inflow	Max HGL Elevation Attained
		(ft)	(ft)	(cfs)	(ft)
Jun-01	Junction	4517.86	4522.41	2.87	4518.71
Jun-02	Junction	4517.99	4522.25	1.18	4518.71
Jun-03	Junction	4518.08	4521.83	0.06	4518.71
Jun-04	Junction	4520.94	4526.40	2.38	4521.42
Out-01	Outfall	4517.74		2.82	4518.45
Stor-01	Storage Node	4522.00	4524.00	5.88	4523.61
Stor-02	Storage Node	4528.00	4531.00	56.54	4529.96

## Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1 Link-01	Pipe	Jun-01	Out-01	34.21	4517.86	4517.74	0.3500	18.000	0.0130	2.82	6.22	0.45	3.04	0.78	0.52	0.00 Calculated
2 Link-02	Pipe	Jun-02	Jun-01	25.52	4517.99	4517.86	0.5000	18.000	0.0130	1.06	7.44	0.14	2.21	0.79	0.52	0.00 Calculated
3 Link-03	Pipe	Jun-03	Jun-02	17.58	4518.08	4517.99	0.5000	18.000	0.0130	0.06	7.43	0.01	0.65	0.68	0.45	0.00 Calculated
4 Link-04	Pipe	Jun-04	Jun-01	307.86	4520.94	4517.86	1.0000	18.000	0.0130	2.37	10.51	0.23	3.39	0.66	0.44	0.00 Calculated
5 Orifice-01	Orifice	Stor-01	Jun-04		4522.00	4520.94		2.800		0.26						
6 Orifice-02	Orifice	Stor-02	Jun-04		4528.00	4520.94		7.850		2.12						

## Storage Nodes

### Storage Node : Stor-01

#### Input Data

Invert Elevation (ft) ..... 4522.00  
 Max (Rim) Elevation (ft) ..... 4524.00  
 Max (Rim) Offset (ft) ..... 2.00  
 Initial Water Elevation (ft) ..... 4522.00  
 Initial Water Depth (ft) ..... 0.00  
 Ponded Area (ft²) ..... 0.00  
 Evaporation Loss ..... 0.00

#### Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
Orifice-01	Side	CIRCULAR	2.80			4496.25	0.61

#### Output Summary Results

Peak Inflow (cfs) ..... 5.88  
 Peak Lateral Inflow (cfs) ..... 5.88  
 Peak Outflow (cfs) ..... 0.26  
 Peak Exfiltration Flow Rate (cfm) ..... 0.00  
 Max HGL Elevation Attained (ft) ..... 4523.61  
 Max HGL Depth Attained (ft) ..... 1.61  
 Average HGL Elevation Attained (ft) ..... 4522.13  
 Average HGL Depth Attained (ft) ..... 0.13  
 Time of Max HGL Occurrence (days hh:mm) ..... 0 00:11  
 Total Exfiltration Volume (1000-ft³) ..... 0.000  
 Total Flooded Volume (ac-in) ..... 0  
 Total Time Flooded (min) ..... 0  
 Total Retention Time (sec) ..... 0.00



## Storage Node : Stor-02

### Input Data

Invert Elevation (ft) ..... 4528.00  
 Max (Rim) Elevation (ft) ..... 4531.00  
 Max (Rim) Offset (ft) ..... 3.00  
 Initial Water Elevation (ft) ..... 4528.00  
 Initial Water Depth (ft) ..... 0.00  
 Ponded Area (ft²) ..... 0.00  
 Evaporation Loss ..... 0.00

### Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
Orifice-02	Side	CIRCULAR	7.85			4497.00	0.61

### Output Summary Results

Peak Inflow (cfs) ..... 56.54  
 Peak Lateral Inflow (cfs) ..... 56.54  
 Peak Outflow (cfs) ..... 2.12  
 Peak Exfiltration Flow Rate (cfm) ..... 0.00  
 Max HGL Elevation Attained (ft) ..... 4529.96  
 Max HGL Depth Attained (ft) ..... 1.96  
 Average HGL Elevation Attained (ft) ..... 4528.21  
 Average HGL Depth Attained (ft) ..... 0.21  
 Time of Max HGL Occurrence (days hh:mm) ..... 0 00:11  
 Total Exfiltration Volume (1000-ft³) ..... 0.000  
 Total Flooded Volume (ac-in) ..... 0  
 Total Time Flooded (min) ..... 0  
 Total Retention Time (sec) ..... 0.00