



INTENTIONAL INNOVATION

## **DRAINAGE REPORT**

**PREPARED FOR:**

### **JOHNSON COUNTY JAIL EXPANSION**

**1091 Hospital Road  
Franklin, IN 46131**

**September 5, 2019**

## **PROJECT DESCRIPTION**

RQAW Corporation is submitting site development plans and drainage calculations for the proposed Johnson County Jail Expansion project to your office for drainage and stormwater approval.

The project is located on the existing Johnson County Jail site in Franklin, Indiana located on the south side of Hospital Road approximately 0.65 miles west of US 31. Refer to Appendix A for the site location and vicinity maps.

## **SOILS**

Per the USDA NRCS Web Soil Survey, there are multiple soil types on site. Some of the soil types include Brookston silty clay loam (Br), Crosby silt loam (CrA), Eel silt loam (Ee), Miami silt loam (MnB2), and Miami clay loam (MtC3). Refer to Appendix A for a soils map of the site.

## **FLOODPLAIN AND COMPENSATORY STORAGE**

A floodplain is located on site where the proposed development will occur and is outlined on the existing basin map. A Conditional Letter of Map Revision based on Fill (CLOMR-F) and a LOMR-F will be completed for this project to remove that area from the floodplain. Due to the fill in the floodplain area, compensatory storage will also be provided for the project. The base flood elevation (BFE) is 728.55 with a proposed fill volume up to that elevation of approximately 1,244 cubic yards. After re-grading the open ditch, it is proposed to provide a cut in the amount of 1,397 cubic yards. Refer to Appendix D for calculations and exhibits can be seen in Appendix D.

## **EXISTING CONDITIONS**

The existing site is approximately 33 acres in area and consists of multiple facilities that include the jail, juvenile detention center, emergency dispatch center, and a shooting range. The existing jail building is in the middle of the property with an asphalt parking lot north of the jail building with smaller parking areas located west of the jail. There is also an access drive on the east side of the jail that goes south towards the dispatch center and shooting range.

The site generally drains from north to south, with an existing storm sewer network that runs along the east side of the property and outlets an open ditch. A smaller storm sewer system drains the west side of the site which also outlets to an open ditch. In addition, there is a 5'x3' concrete box culvert that carries upstream water and outlets it into an open ditch on the west side of the site. The open ditch runs southeast across the site where it eventually outlets to Young's Creek which borders the south edge of the property.

The existing site can be split into three sub-basins, all of which, ultimately outlet to Young's Creek. One of the basins is unaffected by the development and was therefore not analyzed. The other two sub-basins drain the east and west sides of the site, before combining to a single discharge location at a tributary upstream of Young's Creek. To date, no stormwater storage has been provided on site. A breakdown of the basins can be seen in Table 1 and an existing basins map in Appendix B.

**Table 1:** Existing Drainage Basin Summary

| Basin            | Acres    | Discharge Location      | 10-yr Discharge | 100-yr Discharge |
|------------------|----------|-------------------------|-----------------|------------------|
| Existing Basin 1 | ±7.6 ac  | Young's Creek Tributary | 9.1 cfs         | 17.1 cfs         |
| Existing Basin 2 | ±5.3 ac  | Young's Creek Tributary | 12.3 cfs        | 20.8 cfs         |
| Combined Outlet  | ±12.9 ac | Young's Creek Tributary | 19.1 cfs        | 36.1 cfs         |

### PROPOSED CONDITIONS

The proposed project consists of the construction of a new ±29,000 square foot housing pod on the west side of the existing jail, with a reconfigured asphalt parking lot. A proposed ±4,300 square foot sallyport will also be constructed on the north side of the existing jail which will require minor parking lot reconfigurations. Existing drainage patterns and basins will remain the same in the proposed scenario. Refer to Appendix C for the proposed basins map.

In order to make room for the proposed housing pod on the west side of the existing jail building, the existing 5'x3' box culvert will be intercepted and rerouted along the west property line. The proposed box culvert will outlet south of the pod expansion in to a reconfigured open ditch that will continue to flow southeast.

Due to the fill in the open ditch and existing storm sewers having buried outlets, it was necessary to rebuild approximately 260 feet of existing sewer along the west property line in order to provide positive drainage.

The existing site was developed with no stormwater storage areas, with facilities being constructed in the ideal location for them. Therefore, it was not practical to meet the release requirements specified in the Franklin Subdivision Control ordinance. After consultation with the city engineer, it was determined that providing stormwater storage to meet existing release rates would be sufficient. In order to meet the existing release rates, an underground stormwater system will be located north of the proposed pod expansion and will outlet to the rerouted box culvert. More information on the underground stormwater system can be found in the stormwater detention section of this report. The addition of the detention system caused Existing Basin 1 to be split into two sub-basins; the section that drained to the detention system and the section that did not drain to the detention system. These are shown as Basin 1A and 1B on the proposed basins map.

### STORMWATER DETENTION

The underground storage system is proposed to handle the increase in runoff from the proposed jail expansion. The outlet will contain a check valve to prevent flow from the box culvert backing up into the detention system. The basis of design is a Stormtech Chamber system that provides approximately 7,946 cubic feet of storage. The system will outlet through a 12" pipe with a 10.5" orifice to control release rates. The proposed outlet release rates were required to meet existing outlet release rates to

Young's Creek tributary. A summary of the proposed basin release rates can be seen in Table 2.

**Table 2:** Proposed Drainage Basin Summary

| Basin                              | Acres    | Discharge Location      | 10-yr Allowable Release Rate | Proposed 10-yr Discharge | 100-yr Allowable Release Rate | Proposed 100-yr Discharge |
|------------------------------------|----------|-------------------------|------------------------------|--------------------------|-------------------------------|---------------------------|
| Proposed Basin 1A (With Detention) | ±2.5 ac  | 5'x3' Box Culvert       |                              | 3.0 cfs                  |                               | 4.6 cfs                   |
| Proposed Basin 1B                  | ±5.1 ac  | Young's Creek Tributary |                              | 5.8 cfs                  |                               | 11.1 cfs                  |
| Proposed Basin 2                   | ±5.3 ac  | Young's Creek Tributary |                              | 12.3 cfs                 |                               | 20.8 cfs                  |
| Combined Outlet                    | ±12.9 ac | Young's Creek Tributary | 19.1 cfs                     | 18.5 cfs                 | 36.1 cfs                      | 33.4 cfs                  |

#### STORM SEWER SUMMARY

Proposed storm sewers were sized using the peak flow from a 10-yr storm determined from the rational method and TR-55 time of concentration.

#### STORM WATER QUALITY

The underground stormwater chambers come equipped with an isolator row that is designed to provide settling and filtration of sediment as stormwater rises. More information, including third party testing results, on the isolator row can be seen in Appendix E.

#### SUMMARY

Design and calculations were performed according to the City of Franklin drainage requirements located in the Subdivision Control ordinance. Detention requirements that differed from the drainage requirements were verbally approved by the Franklin city engineer. RQAW is confident that no adverse impacts will occur from this development.



If you have any questions, feel free to contact me.



Dillon Reynolds, EI  
Staff Engineer  
[dreynolds@rqaw.com](mailto:dreynolds@rqaw.com)  
(317) 588-1777

## APPENDICES

### Appendix A – Site Maps

- Project Vicinity Map
- Project Location Map
- Soils Map
- Flood Insurance Rate Map (FIRM)

### Appendix B – Existing Conditions

- Existing Drainage Basin Map
- Existing Runoff Calculations (HydroCAD output)

### Appendix C – Proposed Conditions

- Proposed Drainage Basin Map
- Proposed Runoff and Detention Calculations (HydroCAD output)
- Proposed Storm Sewer Drainage Basin Map
- Composite C Value Calculations
- Inlet Capacity Calculations

### Appendix D – Compensatory Storage Calculations

- Proposed Fill Volume Calculations
- Proposed Cut Volume Calculations

### Appendix E – Water Quality Calculations

- Isolator Row Information
- Testing Results

# **APPENDIX A**

## SITE MAPS





Project Location

Google Earth

© 2018 Google

Vicinity Map

2 mi





Project Area

Hospital Rd

Vindale Blvd

Fleetwood Blvd

Google Earth

Site Location



600 ft



# Hydrologic Soil Group—Johnson County, Indiana

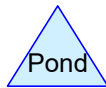
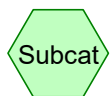
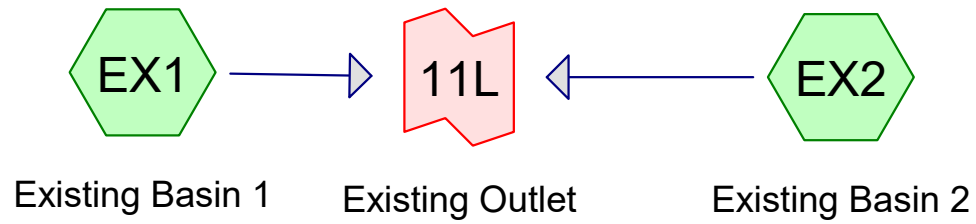


## Hydrologic Soil Group

| Map unit symbol                    | Map unit name                                               | Rating | Acres in AOI | Percent of AOI |
|------------------------------------|-------------------------------------------------------------|--------|--------------|----------------|
| Br                                 | Brookston silty clay loam, 0 to 2 percent slopes            | B/D    | 1.6          | 10.1%          |
| CrA                                | Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes | C/D    | 4.7          | 30.1%          |
| Ee                                 | Eel silt loam, 0 to 2 percent slopes, frequently flooded    | A/D    | 1.7          | 11.0%          |
| MnB2                               | Miami silt loam, 2 to 6 percent slopes, eroded              | C      | 5.5          | 35.3%          |
| MnC2                               | Miami silt loam, 6 to 12 percent slopes, eroded             | C      | 1.0          | 6.4%           |
| MtC3                               | Miami clay loam, 6 to 12 percent slopes, severely eroded    | C      | 1.1          | 7.1%           |
| <b>Totals for Area of Interest</b> |                                                             |        | <b>15.7</b>  | <b>100.0%</b>  |

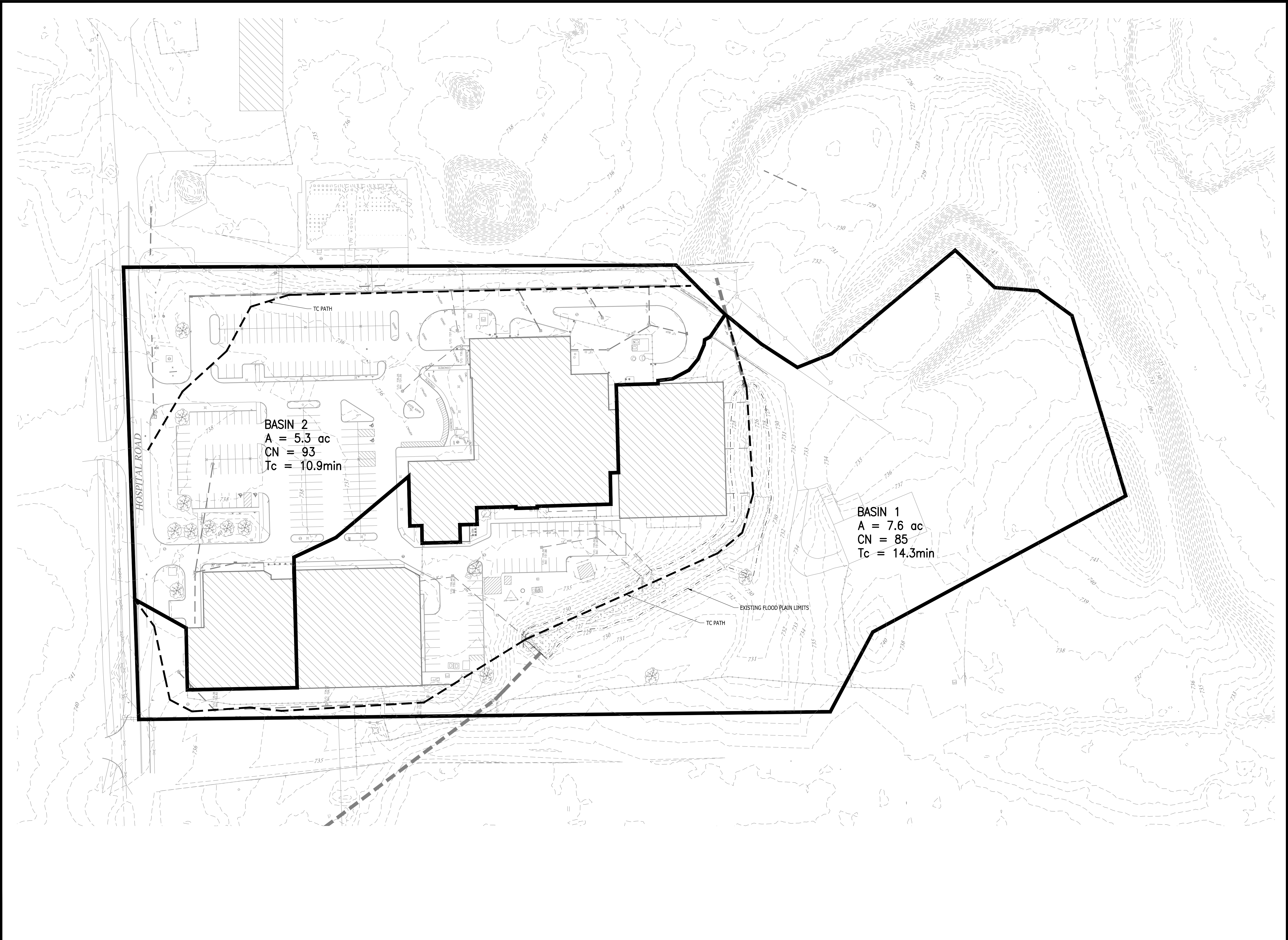
## **APPENDIX B**

### EXISTING CONDITIONS



**Routing Diagram for JCJ**  
Prepared by RQAW Corporation  
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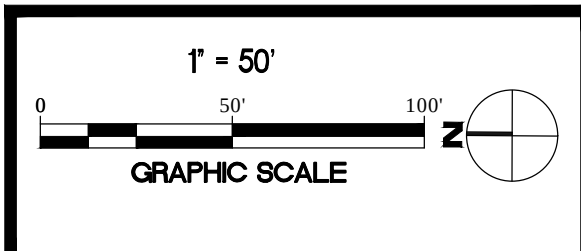




JOHNSON COUNTY JAIL  
FRANKLIN, INDIANA

| # | Revision | Date |
|---|----------|------|
|   |          |      |

|                  |
|------------------|
| Project Number:  |
| Designed By: DKR |
| Drawn By: DKR    |
| Checked By: ACC  |
| Date: 08/25/19   |



EXISTING DRAINAGE  
BASINS



JCJ

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### Summary for Subcatchment EX1: Existing Basin 1

Runoff = 8.11 cfs @ 1.55 hrs, Volume= 2.005 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs  
Indy Huff 1st Quartile 6.00 hrs 100yr,6hr Rainfall=4.78"

| Area (ac) | CN | Description              |
|-----------|----|--------------------------|
| * 4.200   | 74 | Grass/Lawn Area          |
| * 3.400   | 98 | Impervious Pavement/Roof |
| 7.600     | 85 | Weighted Average         |
| 4.200     |    | 55.26% Pervious Area     |
| 3.400     |    | 44.74% Impervious Area   |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description                                                           |
|----------|---------------|---------------|-------------------|----------------|-----------------------------------------------------------------------|
| 10.2     | 100           | 0.0200        | 0.16              |                | <b>Sheet Flow,</b><br>Grass: Short n= 0.150 P2= 2.93"                 |
| 0.5      | 80            | 0.0250        | 2.55              |                | <b>Shallow Concentrated Flow,</b><br>Unpaved Kv= 16.1 fps             |
| 2.3      | 482           |               | 3.50              |                | <b>Direct Entry, Flow through Pipe (Assumed 3.5 ft/s)</b>             |
| 1.3      | 582           | 0.0050        | 7.29              | 830.55         | <b>Channel Flow,</b><br>Area= 114.0 sf Perim= 38.0' r= 3.00' n= 0.030 |
| 14.3     | 1,244         | Total         |                   |                |                                                                       |

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**Events for Subcatchment EX1: Existing Basin 1**

| Event        | Rainfall<br>(inches) | Runoff<br>(cfs) | Volume<br>(acre-feet) | Depth<br>(inches) |
|--------------|----------------------|-----------------|-----------------------|-------------------|
| 2yr,015min   | 0.85                 | 3.29            | 0.069                 | 0.11              |
| 2yr,030min   | 1.13                 | 4.63            | 0.150                 | 0.24              |
| 2yr,05min    | 0.44                 | 0.14            | 0.003                 | 0.00              |
| 2yr,10min    | 0.69                 | 1.80            | 0.034                 | 0.05              |
| 2yr,12hr     | 2.45                 | 1.51            | 0.721                 | 1.14              |
| 2yr,1hr      | 1.39                 | 3.80            | 0.243                 | 0.38              |
| 2yr,24hr     | 2.93                 | 1.39            | 0.969                 | 1.53              |
| 2yr,2hr      | 1.62                 | 2.92            | 0.335                 | 0.53              |
| 2yr,3hr      | 1.72                 | 2.37            | 0.378                 | 0.60              |
| 2yr,6hr      | 2.06                 | 1.83            | 0.532                 | 0.84              |
| 10yr,010min  | 0.93                 | 4.59            | 0.090                 | 0.14              |
| 10yr,015min  | 1.14                 | 6.98            | 0.154                 | 0.24              |
| 10yr,030min  | 1.59                 | 9.11            | 0.323                 | 0.51              |
| 10yr,05min   | 0.60                 | 1.06            | 0.019                 | 0.03              |
| 10yr,12hr    | 3.54                 | 2.65            | 1.299                 | 2.05              |
| 10yr,1hr     | 2.02                 | 7.93            | 0.513                 | 0.81              |
| 10yr,24hr    | 4.10                 | 2.19            | 1.613                 | 2.55              |
| 10yr,2hr     | 2.38                 | 6.67            | 0.686                 | 1.08              |
| 10yr,3hr     | 2.53                 | 5.29            | 0.762                 | 1.20              |
| 10yr,6hr     | 3.04                 | 3.85            | 1.027                 | 1.62              |
| 100yr,010min | 1.25                 | 9.57            | 0.191                 | 0.30              |
| 100yr,015min | 1.56                 | 13.61           | 0.311                 | 0.49              |
| 100yr,030min | 2.25                 | 16.39           | 0.622                 | 0.98              |
| 100yr,05min  | 0.83                 | 3.50            | 0.064                 | 0.10              |
| 100yr,12hr   | 5.38                 | 4.73            | 2.357                 | 3.72              |
| 100yr,1hr    | 3.01                 | <b>17.05</b>    | 1.011                 | 1.60              |
| 100yr,24hr   | <b>5.93</b>          | 3.43            | <b>2.683</b>          | <b>4.24</b>       |
| 100yr,2hr    | 3.65                 | 14.36           | 1.360                 | 2.15              |
| 100yr,3hr    | 3.94                 | 11.46           | 1.523                 | 2.40              |
| 100yr,6hr    | 4.78                 | 8.11            | 2.005                 | 3.17              |



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### Summary for Subcatchment EX2: Existing Basin 2

Runoff = 7.74 cfs @ 1.36 hrs, Volume= 1.759 af, Depth= 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs  
Indy Huff 1st Quartile 6.00 hrs 100yr,6hr Rainfall=4.78"

| Area (ac) | CN | Description              |
|-----------|----|--------------------------|
| * 1.200   | 74 | Grass/Lawn Area          |
| * 4.100   | 98 | Impervious Pavement/Roof |
| 5.300     | 93 | Weighted Average         |
| 1.200     |    | 22.64% Pervious Area     |
| 4.100     |    | 77.36% Impervious Area   |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description                                              |
|----------|---------------|---------------|-------------------|----------------|----------------------------------------------------------|
| 6.8      | 70            | 0.0270        | 0.17              |                | <b>Sheet Flow,</b><br>Grass: Short n= 0.150 P2= 2.93"    |
| 1.5      | 100           | 0.0130        | 1.11              |                | <b>Sheet Flow,</b><br>Smooth surfaces n= 0.011 P2= 2.93" |
| 1.1      | 146           | 0.0130        | 2.31              |                | <b>Shallow Concentrated Flow,</b><br>Paved Kv= 20.3 fps  |
| 1.5      | 450           |               | 4.90              |                | <b>Direct Entry, Pipe Flow (Vel. = 4.9ft/s)</b>          |
| 10.9     | 766           | Total         |                   |                |                                                          |

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**Events for Subcatchment EX2: Existing Basin 2**

| Event        | Rainfall<br>(inches) | Runoff<br>(cfs) | Volume<br>(acre-feet) | Depth<br>(inches) |
|--------------|----------------------|-----------------|-----------------------|-------------------|
| 2yr,015min   | 0.85                 | 7.20            | 0.149                 | 0.34              |
| 2yr,030min   | 1.13                 | 6.90            | 0.245                 | 0.55              |
| 2yr,05min    | 0.44                 | 2.45            | 0.036                 | 0.08              |
| 2yr,10min    | 0.69                 | 5.94            | 0.099                 | 0.23              |
| 2yr,12hr     | 2.45                 | 1.53            | 0.765                 | 1.73              |
| 2yr,1hr      | 1.39                 | 6.40            | 0.341                 | 0.77              |
| 2yr,24hr     | 2.93                 | 1.21            | 0.966                 | 2.19              |
| 2yr,2hr      | 1.62                 | 4.74            | 0.429                 | 0.97              |
| 2yr,3hr      | 1.72                 | 3.62            | 0.468                 | 1.06              |
| 2yr,6hr      | 2.06                 | 2.47            | 0.605                 | 1.37              |
| 10yr,010min  | 0.93                 | 10.26           | 0.175                 | 0.40              |
| 10yr,015min  | 1.14                 | 11.73           | 0.248                 | 0.56              |
| 10yr,030min  | 1.59                 | 12.28           | 0.417                 | 0.95              |
| 10yr,05min   | 0.60                 | 5.05            | 0.074                 | 0.17              |
| 10yr,12hr    | 3.54                 | 2.43            | 1.225                 | 2.77              |
| 10yr,1hr     | 2.02                 | 11.68           | 0.589                 | 1.33              |
| 10yr,24hr    | 4.10                 | 1.77            | 1.465                 | 3.32              |
| 10yr,2hr     | 2.38                 | 8.57            | 0.736                 | 1.67              |
| 10yr,3hr     | 2.53                 | 6.49            | 0.798                 | 1.81              |
| 10yr,6hr     | 3.04                 | 4.33            | 1.012                 | 2.29              |
| 100yr,010min | 1.25                 | 16.65           | 0.288                 | 0.65              |
| 100yr,015min | 1.56                 | 18.94           | 0.406                 | 0.92              |
| 100yr,030min | 2.25                 | <b>20.76</b>    | 0.683                 | 1.55              |
| 100yr,05min  | 0.83                 | 9.57            | 0.142                 | 0.32              |
| 100yr,12hr   | 5.38                 | 3.92            | 2.019                 | 4.57              |
| 100yr,1hr    | 3.01                 | 20.66           | 1.000                 | 2.26              |
| 100yr,24hr   | <b>5.93</b>          | 2.65            | <b>2.258</b>          | <b>5.11</b>       |
| 100yr,2hr    | 3.65                 | 15.39           | 1.272                 | 2.88              |
| 100yr,3hr    | 3.94                 | 11.80           | 1.396                 | 3.16              |
| 100yr,6hr    | 4.78                 | 7.74            | 1.759                 | 3.98              |

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**Events for Link 11L: Existing Outlet**

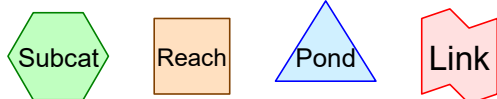
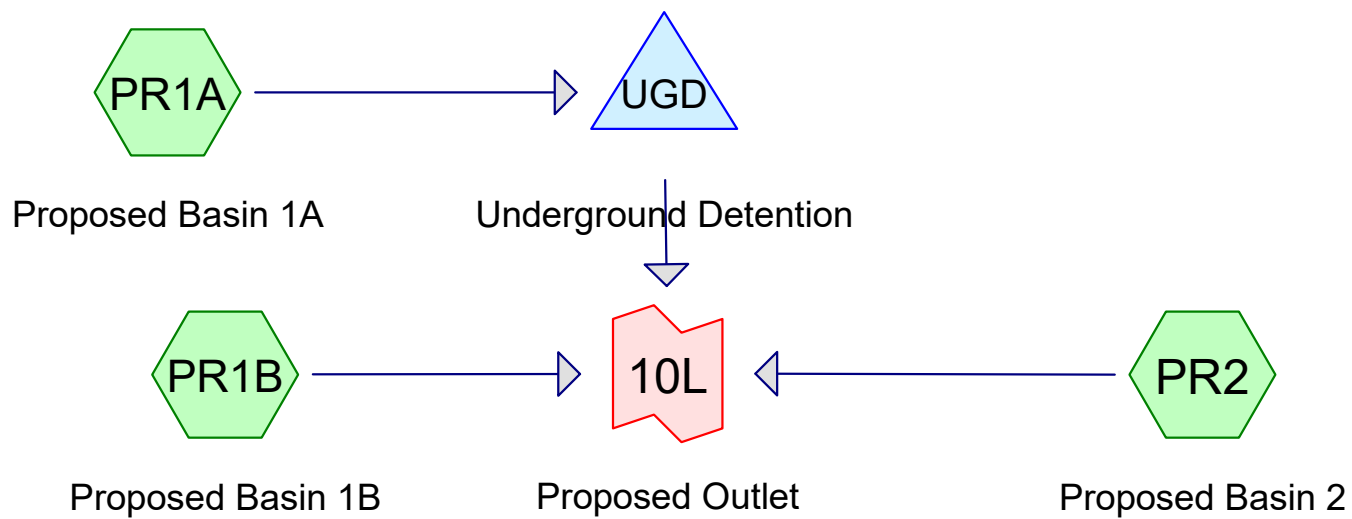
| Event        | Inflow<br>(cfs) | Primary<br>(cfs) | Elevation<br>(feet) |
|--------------|-----------------|------------------|---------------------|
| 2yr,015min   | 9.90            | 9.90             | <b>0.00</b>         |
| 2yr,030min   | 10.72           | 10.72            | 0.00                |
| 2yr,05min    | 2.56            | 2.56             | 0.00                |
| 2yr,10min    | 7.35            | 7.35             | 0.00                |
| 2yr,12hr     | 2.99            | 2.99             | 0.00                |
| 2yr,1hr      | 9.06            | 9.06             | 0.00                |
| 2yr,24hr     | 2.60            | 2.60             | 0.00                |
| 2yr,2hr      | 7.28            | 7.28             | 0.00                |
| 2yr,3hr      | 5.73            | 5.73             | 0.00                |
| 2yr,6hr      | 4.16            | 4.16             | 0.00                |
| 10yr,010min  | 14.14           | 14.14            | 0.00                |
| 10yr,015min  | 17.78           | 17.78            | 0.00                |
| 10yr,030min  | <b>19.07</b>    | 19.07            | 0.00                |
| 10yr,05min   | 5.90            | 5.90             | 0.00                |
| 10yr,12hr    | 5.02            | 5.02             | 0.00                |
| 10yr,1hr     | 18.58           | 18.58            | 0.00                |
| 10yr,24hr    | 3.94            | 3.94             | 0.00                |
| 10yr,2hr     | 14.65           | 14.65            | 0.00                |
| 10yr,3hr     | 11.39           | 11.39            | 0.00                |
| 10yr,6hr     | 8.00            | 8.00             | 0.00                |
| 100yr,010min | 25.07           | 25.07            | 0.00                |
| 100yr,015min | 31.04           | 31.04            | 0.00                |
| 100yr,030min | 33.88           | 33.88            | 0.00                |
| 100yr,05min  | 12.56           | 12.56            | 0.00                |
| 100yr,12hr   | 8.62            | 8.62             | 0.00                |
| 100yr,1hr    | <b>36.13</b>    | <b>36.13</b>     | 0.00                |
| 100yr,24hr   | 6.04            | 6.04             | 0.00                |
| 100yr,2hr    | 28.85           | 28.85            | 0.00                |
| 100yr,3hr    | 22.71           | 22.71            | 0.00                |
| 100yr,6hr    | 15.64           | 15.64            | 0.00                |

Total Flow to Discharge Point in Existing  
Conditions for peak 10-yr and 100-yr  
storm



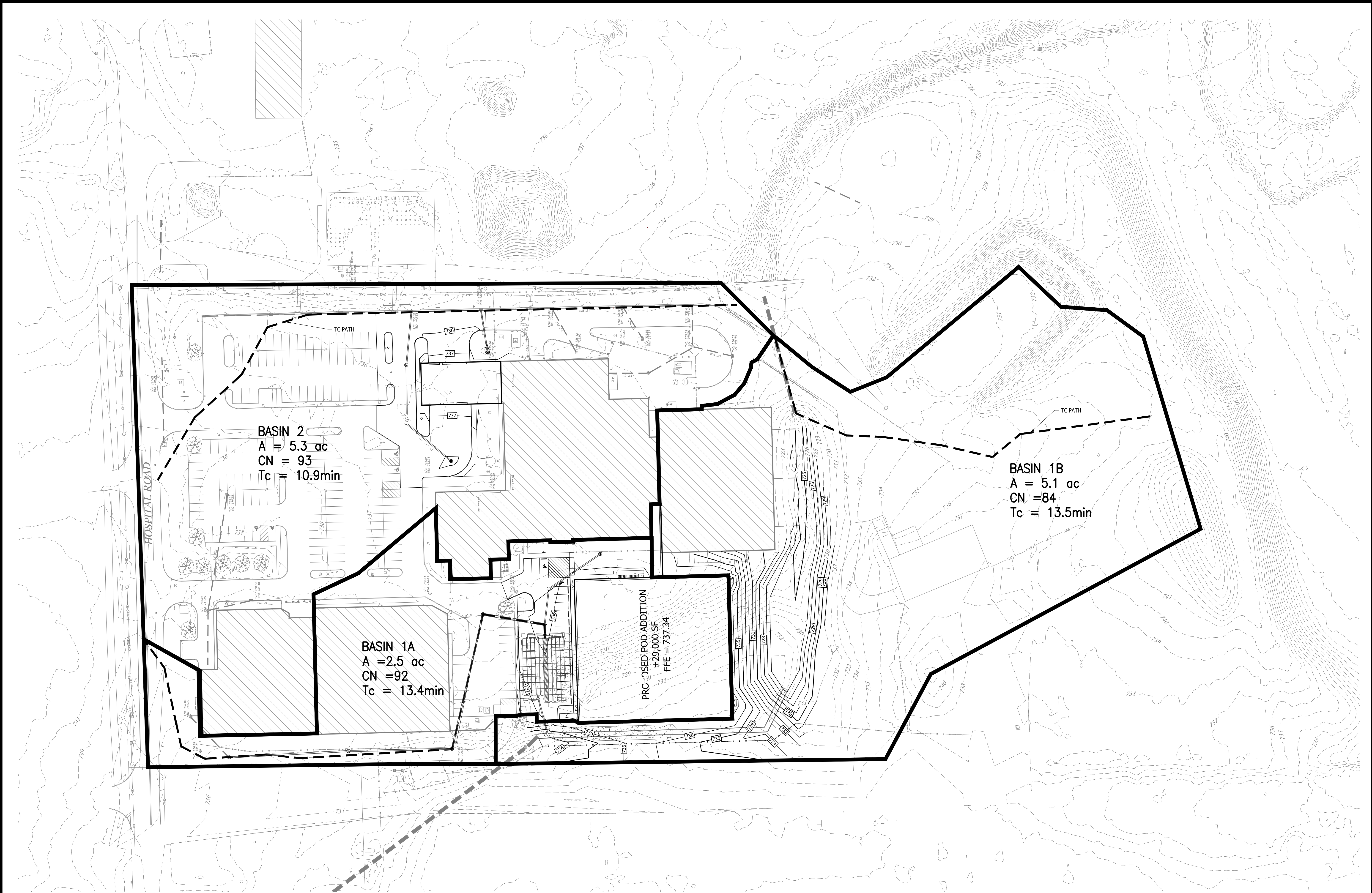
## **APPENDIX C**

### PROPOSED CONDITIONS



**Routing Diagram for JCJ**  
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BASIN 2  
A = 5.3 ac  
CN = 93  
Tc = 10.9min

BASIN 1A  
A = 2.5 ac  
CN = 92  
Tc = 13.4min

PROPOSED POD ADDITION  
±29,000 SF  
FFE = 737.34

BASIN 1B  
A = 5.1 ac  
CN = 84  
Tc = 13.5min

JOHNSON COUNTY JAIL  
FRANKLIN, INDIANA

| # | Revision | Date |
|---|----------|------|
|   |          |      |
|   |          |      |
|   |          |      |

Project Number:

Designed By: DKR

Drawn By: DKR

Checked By: ACC

Date: 08/25/19

NOT FOR CONSTRUCTION

1" = 50'

0 50' 100'

GRAPHIC SCALE

PROPOSED DRAINAGE BASINS



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### Summary for Subcatchment PR1A: Proposed Basin 1A

Runoff = 3.51 cfs @ 1.41 hrs, Volume= 0.807 af, Depth= 3.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs  
Indy Huff 1st Quartile 6.00 hrs 100yr,6hr Rainfall=4.78"

| Area (ac) | CN | Description              |
|-----------|----|--------------------------|
| * 1.910   | 98 | Impervious Pavement/Roof |
| * 0.590   | 74 | Lawn Area                |
| 2.500     | 92 | Weighted Average         |
| 0.590     |    | 23.60% Pervious Area     |
| 1.910     |    | 76.40% Impervious Area   |

| Tc<br>(min) | Length<br>(feet) | Slope<br>(ft/ft) | Velocity<br>(ft/sec) | Capacity<br>(cfs) | Description                                           |
|-------------|------------------|------------------|----------------------|-------------------|-------------------------------------------------------|
| 10.2        | 100              | 0.0200           | 0.16                 |                   | <b>Sheet Flow,</b><br>Grass: Short n= 0.150 P2= 2.93" |
| 3.2         | 581              |                  | 3.00                 |                   | <b>Direct Entry, Pipe Flow (Assumed 3ft/s)</b>        |
| 13.4        | 681              | Total            |                      |                   |                                                       |

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**Events for Subcatchment PR1A: Proposed Basin 1A**

| Event        | Rainfall<br>(inches) | Runoff<br>(cfs) | Volume<br>(acre-feet) | Depth<br>(inches) |
|--------------|----------------------|-----------------|-----------------------|-------------------|
| 2yr,015min   | 0.85                 | 2.76            | 0.062                 | 0.30              |
| 2yr,030min   | 1.13                 | 2.76            | 0.104                 | 0.50              |
| 2yr,05min    | 0.44                 | 0.74            | 0.013                 | 0.06              |
| 2yr,10min    | 0.69                 | 2.09            | 0.040                 | 0.19              |
| 2yr,12hr     | 2.45                 | 0.69            | 0.343                 | 1.65              |
| 2yr,1hr      | 1.39                 | 2.53            | 0.148                 | 0.71              |
| 2yr,24hr     | 2.93                 | 0.56            | 0.436                 | 2.10              |
| 2yr,2hr      | 1.62                 | 1.97            | 0.188                 | 0.90              |
| 2yr,3hr      | 1.72                 | 1.53            | 0.206                 | 0.99              |
| 2yr,6hr      | 2.06                 | 1.07            | 0.269                 | 1.29              |
| 10yr,010min  | 0.93                 | 3.79            | 0.073                 | 0.35              |
| 10yr,015min  | 1.14                 | 4.66            | 0.106                 | 0.51              |
| 10yr,030min  | 1.59                 | 4.89            | 0.183                 | 0.88              |
| 10yr,05min   | 0.60                 | 1.64            | 0.029                 | 0.14              |
| 10yr,12hr    | 3.54                 | 1.11            | 0.557                 | 2.68              |
| 10yr,1hr     | 2.02                 | 4.76            | 0.261                 | 1.25              |
| 10yr,24hr    | 4.10                 | 0.82            | 0.670                 | 3.21              |
| 10yr,2hr     | 2.38                 | 3.66            | 0.330                 | 1.58              |
| 10yr,3hr     | 2.53                 | 2.82            | 0.359                 | 1.72              |
| 10yr,6hr     | 3.04                 | 1.92            | 0.458                 | 2.20              |
| 100yr,010min | 1.25                 | 6.36            | 0.124                 | 0.60              |
| 100yr,015min | 1.56                 | 7.70            | 0.177                 | 0.85              |
| 100yr,030min | 2.25                 | 8.37            | 0.305                 | 1.46              |
| 100yr,05min  | 0.83                 | 3.27            | 0.059                 | 0.28              |
| 100yr,12hr   | 5.38                 | 1.82            | 0.929                 | 4.46              |
| 100yr,1hr    | 3.01                 | <b>8.63</b>     | 0.452                 | 2.17              |
| 100yr,24hr   | <b>5.93</b>          | 1.23            | <b>1.042</b>          | <b>5.00</b>       |
| 100yr,2hr    | 3.65                 | 6.72            | 0.579                 | 2.78              |
| 100yr,3hr    | 3.94                 | 5.24            | 0.637                 | 3.06              |
| 100yr,6hr    | 4.78                 | 3.51            | 0.807                 | 3.87              |

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Indy Huff 1st Quartile 6.00 hrs 100yr,6hr Rainfall=4.78"

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### Summary for Pond UGD: Underground Detention

Inflow Area = 2.500 ac, 76.40% Impervious, Inflow Depth = 3.87" for 100yr,6hr event  
Inflow = 3.51 cfs @ 1.41 hrs, Volume= 0.807 af  
Outflow = 3.01 cfs @ 1.82 hrs, Volume= 0.807 af, Atten= 14%, Lag= 24.8 min  
Primary = 3.01 cfs @ 1.82 hrs, Volume= 0.807 af

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs  
Peak Elev= 730.17' @ 1.82 hrs Surf.Area= 0.082 ac Storage= 0.084 af

Plug-Flow detention time= 20.2 min calculated for 0.807 af (100% of inflow)  
Center-of-Mass det. time= 19.3 min ( 192.1 - 172.9 )

| Volume | Invert  | Avail.Storage | Storage Description                                                                                                                                                                                    |
|--------|---------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1A    | 728.65' | 0.075 af      | <b>77.50"W x 46.34"L x 3.50'H Field A</b><br>0.289 af Overall - 0.101 af Embedded = 0.187 af x 40.0% Voids                                                                                             |
| #2A    | 729.15' | 0.101 af      | <b>ADS_StormTech SC-740 +Cap</b> x 96 Inside #1<br>Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf<br>Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap<br>16 Rows of 6 Chambers |
|        |         | 0.176 af      | Total Available Storage                                                                                                                                                                                |

Storage Group A created with Chamber Wizard

| Device | Routing  | Invert  | Outlet Devices                                                                                                                                                                   |
|--------|----------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| #1     | Primary  | 728.65' | <b>12.0" Round Culvert</b><br>L= 44.0' RCP, groove end projecting, Ke= 0.200<br>Inlet / Outlet Invert= 728.65' / 728.51' S= 0.0032 '/' Cc= 0.900<br>n= 0.012, Flow Area= 0.79 sf |
| #2     | Device 1 | 728.65' | <b>10.5" Vert. Orifice/Grate</b> C= 0.600                                                                                                                                        |

**Primary OutFlow** Max=3.01 cfs @ 1.82 hrs HW=730.17' (Free Discharge)

↑ **1=Culvert** (Passes 3.01 cfs of 3.32 cfs potential flow)  
↑ **2=Orifice/Grate** (Orifice Controls 3.01 cfs @ 5.01 fps)



**JCJ***Indy Huff 1st Quartile 6.00 hrs 100yr,6hr Rainfall=4.78"*

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**Events for Pond UGD: Underground Detention**

| Event        | Inflow<br>(cfs) | Primary<br>(cfs) | Elevation<br>(feet) | Storage<br>(acre-feet) |
|--------------|-----------------|------------------|---------------------|------------------------|
| 2yr,015min   | 2.76            | 1.38             | 729.40              | 0.033                  |
| 2yr,030min   | 2.76            | 1.99             | 729.59              | 0.046                  |
| 2yr,05min    | 0.74            | 0.21             | 728.93              | 0.009                  |
| 2yr,10min    | 2.09            | 0.92             | 729.24              | 0.023                  |
| 2yr,12hr     | 0.69            | 0.69             | 729.16              | 0.017                  |
| 2yr,1hr      | 2.53            | 1.81             | 729.53              | 0.042                  |
| 2yr,24hr     | 0.56            | 0.56             | 729.10              | 0.015                  |
| 2yr,2hr      | 1.97            | 1.44             | 729.42              | 0.035                  |
| 2yr,3hr      | 1.53            | 1.24             | 729.35              | 0.030                  |
| 2yr,6hr      | 1.07            | 0.98             | 729.26              | 0.024                  |
| 10yr,010min  | 3.79            | 1.72             | 729.50              | 0.040                  |
| 10yr,015min  | 4.66            | 2.33             | 729.73              | 0.056                  |
| 10yr,030min  | 4.89            | 3.01             | 730.17              | 0.084                  |
| 10yr,05min   | 1.64            | 0.71             | 729.16              | 0.017                  |
| 10yr,12hr    | 1.11            | 1.10             | 729.31              | 0.027                  |
| 10yr,1hr     | 4.76            | 2.91             | 730.10              | 0.079                  |
| 10yr,24hr    | 0.82            | 0.82             | 729.21              | 0.020                  |
| 10yr,2hr     | 3.66            | 2.55             | 729.86              | 0.064                  |
| 10yr,3hr     | 2.82            | 2.27             | 729.70              | 0.054                  |
| 10yr,6hr     | 1.92            | 1.76             | 729.52              | 0.041                  |
| 100yr,010min | 6.36            | 2.66             | 729.93              | 0.069                  |
| 100yr,015min | 7.70            | 3.32             | 730.40              | 0.098                  |
| 100yr,030min | 8.37            | 4.44             | 731.44              | 0.152                  |
| 100yr,05min  | 3.27            | 1.39             | 729.40              | 0.033                  |
| 100yr,12hr   | 1.82            | 1.81             | 729.53              | 0.042                  |
| 100yr,1hr    | <b>8.63</b>     | <b>4.62</b>      | <b>731.63</b>       | <b>0.159</b>           |
| 100yr,24hr   | 1.23            | 1.23             | 729.35              | 0.030                  |
| 100yr,2hr    | 6.72            | 4.08             | 731.07              | 0.136                  |
| 100yr,3hr    | 5.24            | 3.69             | 730.71              | 0.116                  |
| 100yr,6hr    | 3.51            | 3.01             | 730.17              | 0.084                  |

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### Summary for Subcatchment PR1B: Proposed Basin 1B

Runoff = 5.23 cfs @ 1.55 hrs, Volume= 1.305 af, Depth= 3.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs  
Indy Huff 1st Quartile 6.00 hrs 100yr,6hr Rainfall=4.78"

| Area (ac) | CN | Description              |
|-----------|----|--------------------------|
| * 2.900   | 74 | Grass/Lawn Area          |
| * 2.200   | 98 | Impervious Pavement/Roof |
| 5.100     | 84 | Weighted Average         |
| 2.900     |    | 56.86% Pervious Area     |
| 2.200     |    | 43.14% Impervious Area   |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description                                               |
|----------|---------------|---------------|-------------------|----------------|-----------------------------------------------------------|
| 10.7     | 100           | 0.0180        | 0.16              |                | <b>Sheet Flow,</b><br>Grass: Short n= 0.150 P2= 2.93"     |
| 2.7      | 314           | 0.0150        | 1.97              |                | <b>Shallow Concentrated Flow,</b><br>Unpaved Kv= 16.1 fps |
| 0.1      | 45            | 0.2500        | 8.05              |                | <b>Shallow Concentrated Flow,</b><br>Unpaved Kv= 16.1 fps |
| 13.5     | 459           | Total         |                   |                |                                                           |

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**Events for Subcatchment PR1B: Proposed Basin 1B**

| Event        | Rainfall<br>(inches) | Runoff<br>(cfs) | Volume<br>(acre-feet) | Depth<br>(inches) |
|--------------|----------------------|-----------------|-----------------------|-------------------|
| 2yr,015min   | 0.85                 | 1.96            | 0.039                 | 0.09              |
| 2yr,030min   | 1.13                 | 2.88            | 0.090                 | 0.21              |
| 2yr,05min    | 0.44                 | 0.04            | 0.001                 | 0.00              |
| 2yr,10min    | 0.69                 | 1.02            | 0.018                 | 0.04              |
| 2yr,12hr     | 2.45                 | 0.97            | 0.458                 | 1.08              |
| 2yr,1hr      | 1.39                 | 2.39            | 0.149                 | 0.35              |
| 2yr,24hr     | 2.93                 | 0.90            | 0.620                 | 1.46              |
| 2yr,2hr      | 1.62                 | 1.77            | 0.208                 | 0.49              |
| 2yr,3hr      | 1.72                 | 1.45            | 0.235                 | 0.55              |
| 2yr,6hr      | 2.06                 | 1.13            | 0.334                 | 0.79              |
| 10yr,010min  | 0.93                 | 2.80            | 0.052                 | 0.12              |
| 10yr,015min  | 1.14                 | 4.34            | 0.092                 | 0.22              |
| 10yr,030min  | 1.59                 | 5.79            | 0.200                 | 0.47              |
| 10yr,05min   | 0.60                 | 0.56            | 0.010                 | 0.02              |
| 10yr,12hr    | 3.54                 | 1.71            | 0.838                 | 1.97              |
| 10yr,1hr     | 2.02                 | 4.96            | 0.322                 | 0.76              |
| 10yr,24hr    | 4.10                 | 1.43            | 1.045                 | 2.46              |
| 10yr,2hr     | 2.38                 | 4.20            | 0.435                 | 1.02              |
| 10yr,3hr     | 2.53                 | 3.33            | 0.484                 | 1.14              |
| 10yr,6hr     | 3.04                 | 2.44            | 0.658                 | 1.55              |
| 100yr,010min | 1.25                 | 6.03            | 0.116                 | 0.27              |
| 100yr,015min | 1.56                 | 8.68            | 0.192                 | 0.45              |
| 100yr,030min | 2.25                 | 10.56           | 0.393                 | 0.93              |
| 100yr,05min  | 0.83                 | 2.08            | 0.036                 | 0.09              |
| 100yr,12hr   | 5.38                 | 3.09            | 1.538                 | 3.62              |
| 100yr,1hr    | 3.01                 | <b>11.05</b>    | 0.648                 | 1.52              |
| 100yr,24hr   | <b>5.93</b>          | 2.27            | <b>1.756</b>          | <b>4.13</b>       |
| 100yr,2hr    | 3.65                 | 9.24            | 0.878                 | 2.07              |
| 100yr,3hr    | 3.94                 | 7.37            | 0.985                 | 2.32              |
| 100yr,6hr    | 4.78                 | 5.23            | 1.305                 | 3.07              |



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**Events for Subcatchment PR2: Proposed Basin 2**

| Event        | Rainfall<br>(inches) | Runoff<br>(cfs) | Volume<br>(acre-feet) | Depth<br>(inches) |
|--------------|----------------------|-----------------|-----------------------|-------------------|
| 2yr,015min   | 0.85                 | 7.20            | 0.149                 | 0.34              |
| 2yr,030min   | 1.13                 | 6.90            | 0.245                 | 0.55              |
| 2yr,05min    | 0.44                 | 2.45            | 0.036                 | 0.08              |
| 2yr,10min    | 0.69                 | 5.94            | 0.099                 | 0.23              |
| 2yr,12hr     | 2.45                 | 1.53            | 0.765                 | 1.73              |
| 2yr,1hr      | 1.39                 | 6.40            | 0.341                 | 0.77              |
| 2yr,24hr     | 2.93                 | 1.21            | 0.966                 | 2.19              |
| 2yr,2hr      | 1.62                 | 4.74            | 0.429                 | 0.97              |
| 2yr,3hr      | 1.72                 | 3.62            | 0.468                 | 1.06              |
| 2yr,6hr      | 2.06                 | 2.47            | 0.605                 | 1.37              |
| 10yr,010min  | 0.93                 | 10.26           | 0.175                 | 0.40              |
| 10yr,015min  | 1.14                 | 11.73           | 0.248                 | 0.56              |
| 10yr,030min  | 1.59                 | 12.28           | 0.417                 | 0.95              |
| 10yr,05min   | 0.60                 | 5.05            | 0.074                 | 0.17              |
| 10yr,12hr    | 3.54                 | 2.43            | 1.225                 | 2.77              |
| 10yr,1hr     | 2.02                 | 11.68           | 0.589                 | 1.33              |
| 10yr,24hr    | 4.10                 | 1.77            | 1.465                 | 3.32              |
| 10yr,2hr     | 2.38                 | 8.57            | 0.736                 | 1.67              |
| 10yr,3hr     | 2.53                 | 6.49            | 0.798                 | 1.81              |
| 10yr,6hr     | 3.04                 | 4.33            | 1.012                 | 2.29              |
| 100yr,010min | 1.25                 | 16.65           | 0.288                 | 0.65              |
| 100yr,015min | 1.56                 | 18.94           | 0.406                 | 0.92              |
| 100yr,030min | 2.25                 | <b>20.76</b>    | 0.683                 | 1.55              |
| 100yr,05min  | 0.83                 | 9.57            | 0.142                 | 0.32              |
| 100yr,12hr   | 5.38                 | 3.92            | 2.019                 | 4.57              |
| 100yr,1hr    | 3.01                 | 20.66           | 1.000                 | 2.26              |
| 100yr,24hr   | <b>5.93</b>          | 2.65            | <b>2.258</b>          | <b>5.11</b>       |
| 100yr,2hr    | 3.65                 | 15.39           | 1.272                 | 2.88              |
| 100yr,3hr    | 3.94                 | 11.80           | 1.396                 | 3.16              |
| 100yr,6hr    | 4.78                 | 7.74            | 1.759                 | 3.98              |

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### Summary for Subcatchment PR2: Proposed Basin 2

Runoff = 7.74 cfs @ 1.36 hrs, Volume= 1.759 af, Depth= 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs  
Indy Huff 1st Quartile 6.00 hrs 100yr,6hr Rainfall=4.78"

| Area (ac) | CN | Description              |
|-----------|----|--------------------------|
| * 1.200   | 74 | Grass/Lawn Area          |
| * 4.100   | 98 | Impervious Pavement/Roof |
| 5.300     | 93 | Weighted Average         |
| 1.200     |    | 22.64% Pervious Area     |
| 4.100     |    | 77.36% Impervious Area   |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description                                              |
|----------|---------------|---------------|-------------------|----------------|----------------------------------------------------------|
| 6.8      | 70            | 0.0270        | 0.17              |                | <b>Sheet Flow,</b><br>Grass: Short n= 0.150 P2= 2.93"    |
| 1.5      | 100           | 0.0130        | 1.11              |                | <b>Sheet Flow,</b><br>Smooth surfaces n= 0.011 P2= 2.93" |
| 1.1      | 146           | 0.0130        | 2.31              |                | <b>Shallow Concentrated Flow,</b><br>Paved Kv= 20.3 fps  |
| 1.5      | 450           |               | 4.90              |                | <b>Direct Entry, Pipe Flow (Vel. = 4.9ft/s)</b>          |
| 10.9     | 766           | Total         |                   |                |                                                          |

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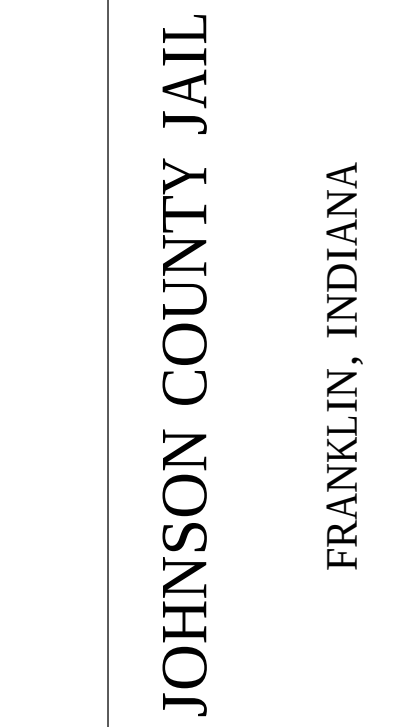
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**Events for Link 10L: Proposed Outlet**

| Event        | Inflow<br>(cfs) | Primary<br>(cfs) | Elevation<br>(feet) |
|--------------|-----------------|------------------|---------------------|
| 2yr,015min   | 9.65            | 9.65             | <b>0.00</b>         |
| 2yr,030min   | 10.73           | 10.73            | 0.00                |
| 2yr,05min    | 2.51            | 2.51             | 0.00                |
| 2yr,10min    | 7.13            | 7.13             | 0.00                |
| 2yr,12hr     | 3.14            | 3.14             | 0.00                |
| 2yr,1hr      | 8.89            | 8.89             | 0.00                |
| 2yr,24hr     | 2.67            | 2.67             | 0.00                |
| 2yr,2hr      | 7.33            | 7.33             | 0.00                |
| 2yr,3hr      | 5.91            | 5.91             | 0.00                |
| 2yr,6hr      | 4.41            | 4.41             | 0.00                |
| 10yr,010min  | 13.58           | 13.58            | 0.00                |
| 10yr,015min  | 16.97           | 16.97            | 0.00                |
| 10yr,030min  | <b>18.48</b>    | 18.48            | 0.00                |
| 10yr,05min   | 5.68            | 5.68             | 0.00                |
| 10yr,12hr    | 5.19            | 5.19             | 0.00                |
| 10yr,1hr     | 17.80           | 17.80            | 0.00                |
| 10yr,24hr    | 4.01            | 4.01             | 0.00                |
| 10yr,2hr     | 14.40           | 14.40            | 0.00                |
| 10yr,3hr     | 11.47           | 11.47            | 0.00                |
| 10yr,6hr     | 8.27            | 8.27             | 0.00                |
| 100yr,010min | 23.65           | 23.65            | 0.00                |
| 100yr,015min | 29.02           | 29.02            | 0.00                |
| 100yr,030min | 31.96           | 31.96            | 0.00                |
| 100yr,05min  | 12.03           | 12.03            | 0.00                |
| 100yr,12hr   | 8.80            | 8.80             | 0.00                |
| 100yr,1hr    | <b>33.39</b>    | <b>33.39</b>     | 0.00                |
| 100yr,24hr   | 6.11            | 6.11             | 0.00                |
| 100yr,2hr    | 27.08           | 27.08            | 0.00                |
| 100yr,3hr    | 21.76           | 21.76            | 0.00                |
| 100yr,6hr    | 15.55           | 15.55            | 0.00                |

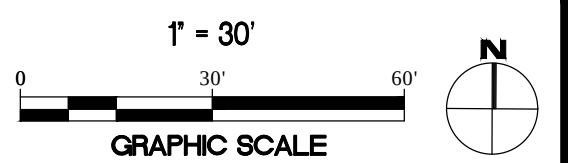
Total Proposed Flows to Discharge Point  
for 10-yr and 100-yr Storm



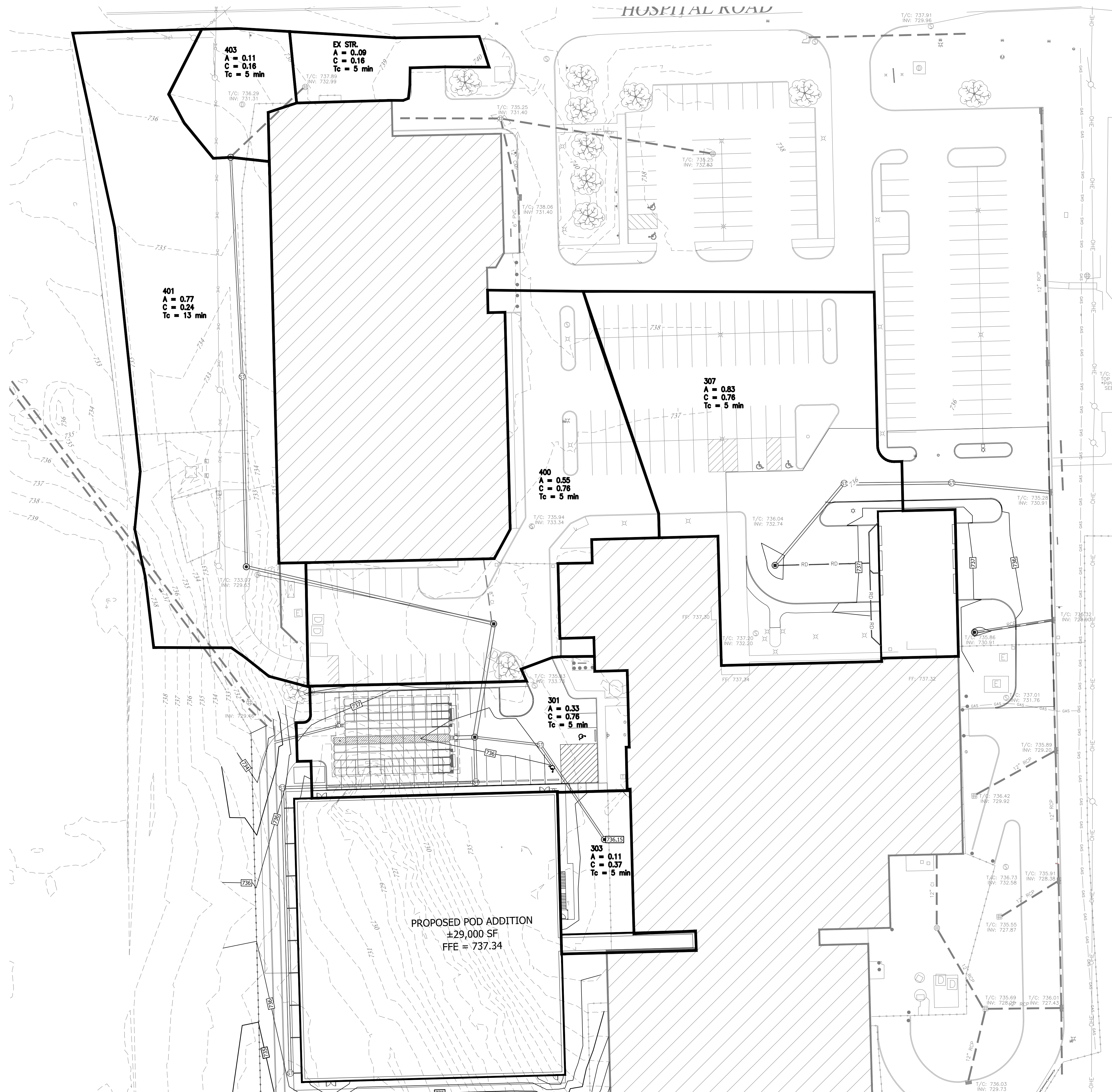
| # | Revision | Date |
|---|----------|------|
|   |          |      |

|                  |
|------------------|
| Project Number:  |
| Designed By: DKR |
| Drawn By: DKR    |
| Checked By: ACC  |
| Date: 08/25/19   |

NOT FOR CONSTRUCTION



## PROPOSED STORM SEWER BASINS







## COMPOSITE C CALCULATIONS -PROPOSED BASINS-

PROJECT: Johnson Co Jail  
JOB #: 19-700-104-1

DATE: 08/26/19  
COMPUTED BY: dkr

| Rational Method Runoff Coefficients |      |
|-------------------------------------|------|
| Roof                                | 0.85 |
| Concrete                            | 0.85 |
| Asphalt                             | 0.82 |
| Lawn                                | 0.16 |

### 301

| Roof               | Concrete           | Asphalt            | Lawn               | Total              | Total   | Composite |
|--------------------|--------------------|--------------------|--------------------|--------------------|---------|-----------|
| (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (acres) | C         |
| 950                | 480                | 0                  | 3,362              | 4,792              | 0.110   | 0.37      |

### 303

| Roof               | Concrete           | Asphalt            | Lawn               | Total              | Total   | Composite |
|--------------------|--------------------|--------------------|--------------------|--------------------|---------|-----------|
| (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (acres) | C         |
| 0                  | 1,600              | 11,430             | 1,345              | 14,375             | 0.330   | 0.76      |

### 307

| Roof               | Concrete           | Asphalt            | Lawn               | Total              | Total   | Composite |
|--------------------|--------------------|--------------------|--------------------|--------------------|---------|-----------|
| (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (acres) | C         |
| 4,300              | 2,200              | 26,245             | 3,410              | 36,155             | 0.830   | 0.76      |

### 307

| Roof               | Concrete           | Asphalt            | Lawn               | Total              | Total   | Composite |
|--------------------|--------------------|--------------------|--------------------|--------------------|---------|-----------|
| (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (acres) | C         |
| 4,300              | 2,200              | 26,245             | 3,410              | 36,155             | 0.830   | 0.76      |

### 400

| Roof               | Concrete           | Asphalt            | Lawn               | Total              | Total   | Composite |
|--------------------|--------------------|--------------------|--------------------|--------------------|---------|-----------|
| (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (acres) | C         |
| 0                  | 1,750              | 20,008             | 2,200              | 23,958             | 0.550   | 0.76      |

### 401

| Roof               | Concrete           | Asphalt            | Lawn               | Total              | Total   | Composite |
|--------------------|--------------------|--------------------|--------------------|--------------------|---------|-----------|
| (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (acres) | C         |
| 0                  | 4,000              | 0                  | 29,541             | 33,541             | 0.770   | 0.24      |

### 403

| Roof               | Concrete           | Asphalt            | Lawn               | Total              | Total   | Composite |
|--------------------|--------------------|--------------------|--------------------|--------------------|---------|-----------|
| (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (acres) | C         |
| 0                  | 0                  | 0                  | 4,792              | 4,792              | 0.110   | 0.16      |



## COMPOSITE C CALCULATIONS -PROPOSED BASINS-

PROJECT: Johnson Co Jail  
JOB #: 19-700-104-1

DATE: 08/26/19  
COMPUTED BY: dkr

| Rational Method Runoff Coefficients |      |
|-------------------------------------|------|
| Roof                                | 0.85 |
| Concrete                            | 0.85 |
| Asphalt                             | 0.82 |
| Lawn                                | 0.16 |

### EX-STR

| Roof               | Concrete           | Asphalt            | Lawn               | Total              | Total   | Composite |
|--------------------|--------------------|--------------------|--------------------|--------------------|---------|-----------|
| (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (ft <sup>2</sup> ) | (acres) | C         |
| 0                  | 0                  | 0                  | 3,920              | 3,920              | 0.090   | 0.16      |



# Storm Sewer Capacity

Johnson Co Jail  
19-700-104-1  
8/29/19

Storm: 10 yr  
By: dkr

minimum velocity = 2.5 n= 0.012

| Path    |        | Length | Slope | Diam. | c    | A       | c*A  | Tc <sub>inlet</sub> | I <sub>inlet</sub> | I <sub>design</sub> (use > T) | Q-seg | Q-tot | Qf   | Q/Qf | Vf     | Time of Travel |
|---------|--------|--------|-------|-------|------|---------|------|---------------------|--------------------|-------------------------------|-------|-------|------|------|--------|----------------|
| FROM    | TO     | (ft)   | (%)   | (in)  |      | (acres) |      | (min)               | (in/hr)            | (in/hr)                       | (cfs) | (cfs) | cfs  |      | (ft/s) | (min)          |
| 303     | 302    | 71.00  | 0.32  | 12    | 0.37 | 0.11    | 0.04 | 5.00                | 7.21               | 7.21                          | 0.29  | 0.29  | 2.19 | 0.13 | 2.79   | 5.42           |
| 302     | 301    | 41.00  | 0.32  | 12    | 0.00 | 0.00    | 0.00 | 0.00                | 0.00               | 7.06                          | 0.00  | 0.29  | 2.19 | 0.13 | 2.79   | 5.67           |
| EX. STR | 403    | 63.00  | 1.50  | 12    | 0.16 | 0.09    | 0.01 | 5.00                | 7.21               | 7.21                          | 0.10  | 0.10  | 4.74 | 0.02 | 6.04   | 5.17           |
| 403     | 402    | 136.00 | 2.10  | 12    | 0.16 | 0.11    | 0.02 | 5.00                | 7.21               | 7.15                          | 0.13  | 0.23  | 5.61 | 0.04 | 7.14   | 5.32           |
| 402     | 401    | 118.00 | 0.20  | 15    | 0.00 | 0.00    | 0.00 | 0.00                | 0.00               | 7.10                          | 0.00  | 0.23  | 3.14 | 0.07 | 2.56   | 6.09           |
| 401     | 400    | 157.00 | 0.13  | 15    | 0.24 | 0.77    | 0.18 | 13.00               | 4.97               | 4.97                          | 0.92  | 1.08  | 2.53 | 0.43 | 2.06   | 14.27          |
| 400     | 301    | 71.00  | 0.07  | 24    | 0.76 | 0.55    | 0.42 | 5.00                | 7.21               | 4.72                          | 3.01  | 3.00  | 6.50 | 0.46 | 2.07   | 14.84          |
| 301     | UGD    | 12.00  | 0.10  | 24    | 0.76 | 0.33    | 0.25 | 5.00                | 7.21               | 4.60                          | 1.81  | 4.07  | 7.77 | 0.52 | 2.47   | 14.92          |
| 307     | 306    | 65.00  | 0.57  | 15    | 0.76 | 0.83    | 0.63 | 5.00                | 7.21               | 7.21                          | 4.55  | 4.55  | 5.29 | 0.86 | 4.32   | 5.25           |
| 306     | 305    | 65.00  | 0.57  | 15    | 0.00 | 0.00    | 0.00 | 0.00                | 0.00               | 7.13                          | 0.00  | 4.50  | 5.29 | 0.85 | 4.32   | 5.50           |
| 305     | EX STR | 60.00  | 0.57  | 15    | 0.00 | 0.00    | 0.00 | 0.00                | 0.00               | 7.05                          | 0.00  | 4.45  | 5.29 | 0.84 | 4.32   | 5.73           |



|                      |   |                      |   |                                    |
|----------------------|---|----------------------|---|------------------------------------|
| A = Square Foot Open | = | 5.28 ft <sup>2</sup> | = | 2.64 ft <sup>2</sup> (50% clogged) |
| P = Weir Perimeter   | = | 12.10 ft             | = | 6.05 ft (50% clogged)              |

|                      |   |                      |   |                                    |
|----------------------|---|----------------------|---|------------------------------------|
| A = Square Foot Open | = | 0.85 ft <sup>2</sup> | = | 0.43 ft <sup>2</sup> (50% clogged) |
| P = Weir Perimeter   | = | 1.34 ft              | = | 0.67 ft (50% clogged)              |

|                      |   |                      |   |                                    |
|----------------------|---|----------------------|---|------------------------------------|
| A = Square Foot Open | = | 1.88 ft <sup>2</sup> | = | 0.94 ft <sup>2</sup> (50% clogged) |
| P = Weir Perimeter   | = | 2.14 ft              | = | 1.07 ft (50% clogged)              |

COMPUTED BY: DKR

Weir Condition ( $d < 0.3''$ )

Orifice Condition ( $d > 0.4'$ )

Reference: HERPICC Stormwater Drainage Manual-Revised July 1994 (Equations 5.3.2 & 5.3.3)  
(control depth is based on  $d(\text{weir})$  if  $d(\text{weir}) < 0.4$ , if  $d(\text{weir}) > 0.4$  then  $d(\text{orifice})$ )

[illegible]



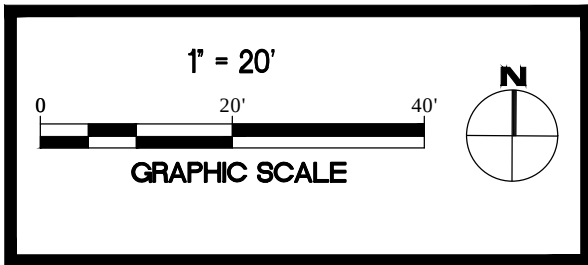
## **APPENDIX D**

### COMPENSATORY STORAGE

| # | Revision | Date |
|---|----------|------|
|   |          |      |

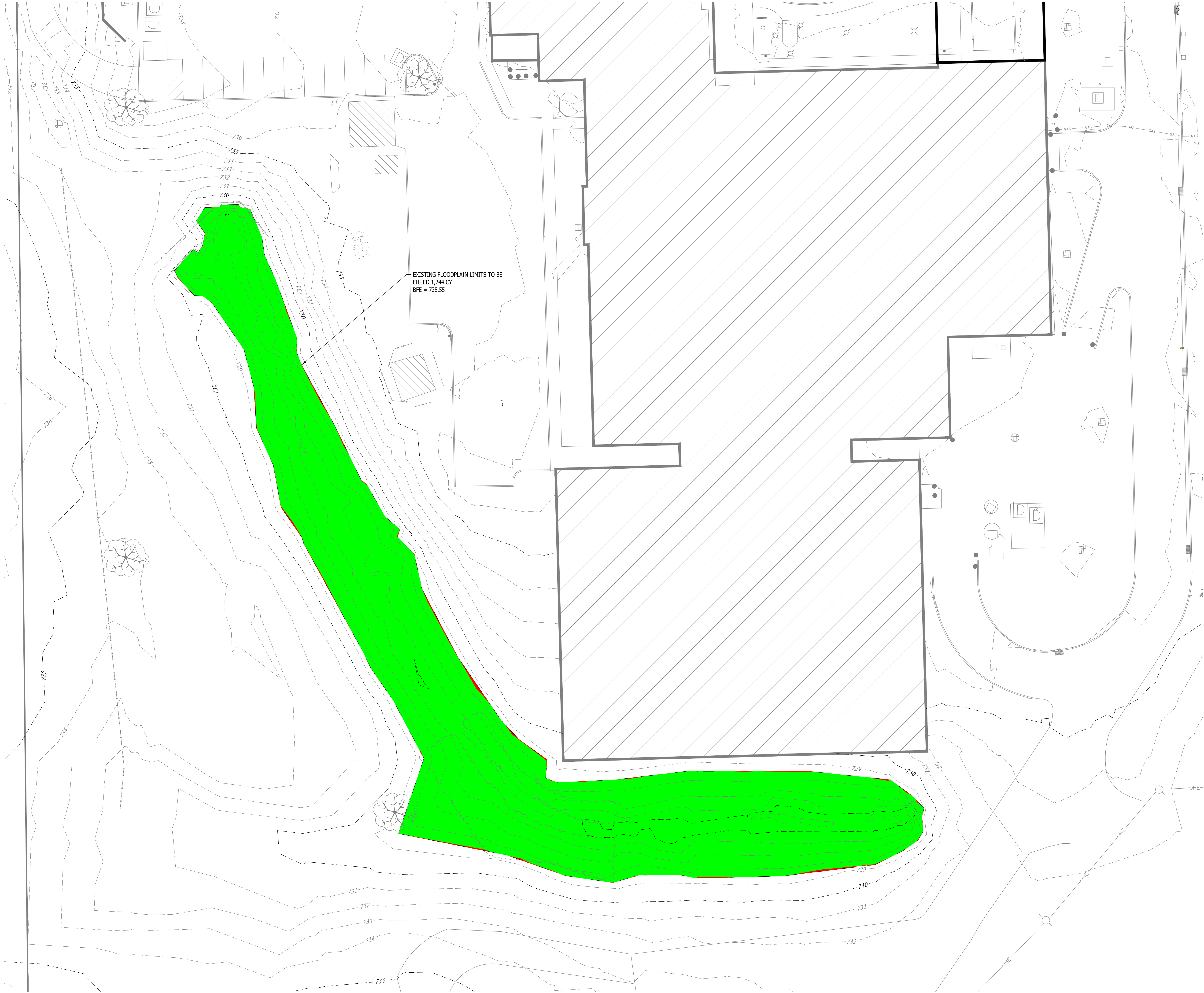
|                              |
|------------------------------|
| Project Number: 19-700-104-1 |
| Designed By: DKR             |
| Drawn By: DKR                |
| Checked By: ACC              |
| Date: 08/25/19               |

NOT FOR CONSTRUCTION



COMPENSATORY  
STORAGE

FILL AREA



# Cut/Fill Report

**Generated:** 2019-08-25 15:21:46  
**By user:** dreynolds  
 P:\19-700-104-1 Johnson County Justice Center\02  
 Design\Civil\Design\Stormwater\Compensatory Storage\P:\19-700-104-1  
**Drawing:** Johnson County Justice Center\02  
 Design\Civil\Design\Stormwater\Compensatory Storage\Comp Storage  
 Calc.dwg

| Volume Summary |      |            |             |                   |               |                |               |
|----------------|------|------------|-------------|-------------------|---------------|----------------|---------------|
| Name           | Type | Cut Factor | Fill Factor | 2d Area (Sq. Ft.) | Cut (Cu. Yd.) | Fill (Cu. Yd.) | Net (Cu. Yd.) |
| BFE-EX         | full | 1.000      | 1.000       | 18741.46          | 0.22          | 1243.97        | 1243.75<Fill> |

| Totals |                   |               |                |               |
|--------|-------------------|---------------|----------------|---------------|
|        | 2d Area (Sq. Ft.) | Cut (Cu. Yd.) | Fill (Cu. Yd.) | Net (Cu. Yd.) |
| Total  | 18741.46          | 0.22          | 1243.97        | 1243.75<Fill> |

\* Value adjusted by cut or fill factor other than 1.0

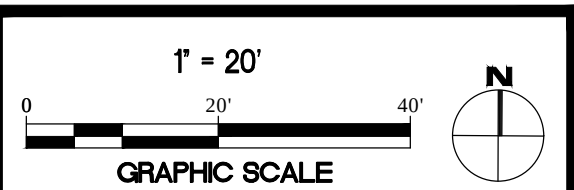


FILL AREA

CUT AREA



| #                            | Revision | Date |
|------------------------------|----------|------|
|                              |          |      |
| Project Number: 19-700-104-1 |          |      |
| Designed By: DKR             |          |      |
| Drawn By: DKR                |          |      |
| Checked By: ACC              |          |      |
| Date: 08/25/19               |          |      |





# Cut/Fill Report

**Generated:** 2019-08-25 15:24:41

**By user:** dreynolds

P:\19-700-104-1 Johnson County Justice Center\02

Design\Civil\Design\Stormwater\Compensatory Storage\P:\19-700-104-1

**Drawing:** Johnson County Justice Center\02

Design\Civil\Design\Stormwater\Compensatory Storage\Comp Storage

Calc.dwg

| Volume Summary |         |            |             |                   |               |                |               |
|----------------|---------|------------|-------------|-------------------|---------------|----------------|---------------|
| Name           | Type    | Cut Factor | Fill Factor | 2d Area (Sq. Ft.) | Cut (Cu. Yd.) | Fill (Cu. Yd.) | Net (Cu. Yd.) |
| PG-EX.1        | bounded | 1.000      | 1.000       | 17289.73          | 1454.28       | 56.78          | 1397.50<Cut>  |

| Totals |                      |                  |                   |                  |
|--------|----------------------|------------------|-------------------|------------------|
|        | 2d Area<br>(Sq. Ft.) | Cut<br>(Cu. Yd.) | Fill<br>(Cu. Yd.) | Net<br>(Cu. Yd.) |
| Total  | 17289.73             | 1454.28          | 56.78             | 1397.50<Cut>     |

\* Value adjusted by cut or fill factor other than 1.0

## **APPENDIX E**

### STORMWATER QUALITY



# *Isolator<sup>®</sup> Row O&M Manual*





## THE ISOLATOR<sup>®</sup> ROW

### INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

### THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

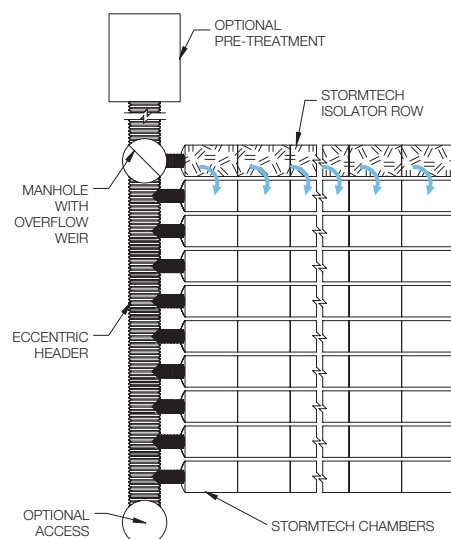
*Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.*



Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.



StormTech Isolator Row with Overflow Spillway (not to scale)







## ISOLATOR ROW INSPECTION/MAINTENANCE

### INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

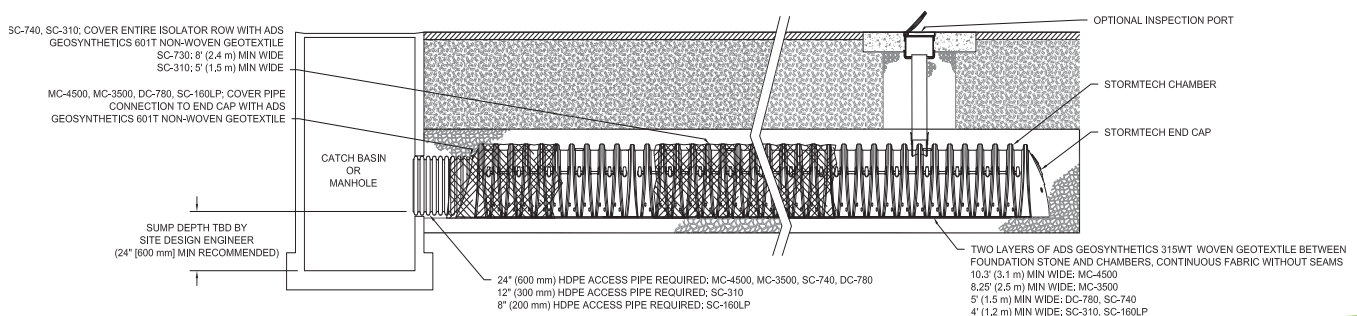
### MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45° are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

### StormTech Isolator Row (not to scale)

*Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.*



# ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

## STEP 1

Inspect Isolator Row for sediment.

- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
  - i. Remove cover from manhole at upstream end of Isolator Row
  - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

## STEP 2

Clean out Isolator Row using the JetVac process.

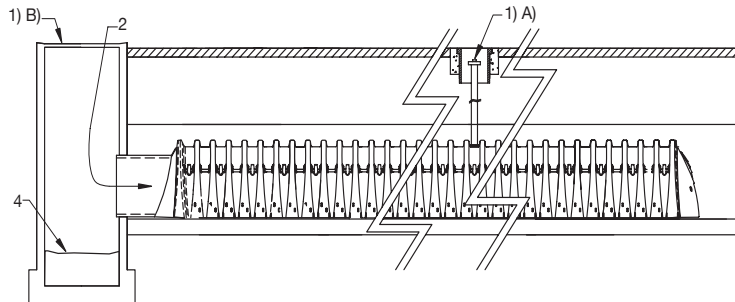
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

## STEP 3

Replace all caps, lids and covers, record observations and actions.

## STEP 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



## SAMPLE MAINTENANCE LOG

| Date    | Stadia Rod Readings                  |                                       | Sediment Depth<br>(1)-(2) | Observations/Actions                                                       | Inspector |
|---------|--------------------------------------|---------------------------------------|---------------------------|----------------------------------------------------------------------------|-----------|
|         | Fixed point to chamber<br>bottom (1) | Fixed point to top of<br>sediment (2) |                           |                                                                            |           |
| 3/15/11 | 6.3 ft                               | none                                  |                           | New installation. Fixed point is CI frame at grade                         | DJM       |
| 9/24/11 |                                      | 6.2                                   | 0.1 ft                    | Some grit felt                                                             | SM        |
| 6/20/13 |                                      | 5.8                                   | 0.5 ft                    | Mucky feel, debris visible in manhole and in Isolator Row, maintenance due | NV        |
| 7/7/13  | 6.3 ft                               |                                       | 0                         | System jetted and vacuumed                                                 | DJM       |

## Isolator Row Testing Summary

Thank you for your interest in the StormTech Isolator Row testing done to date. Below is a summary of the testing that has been completed on the StormTech Isolator Row. The most current testing done by the University of New Hampshire provides the data for 80% removal of TSS. The UNH testing was completed in the field as opposed to a lab test. Any of the referenced reports are available upon request.

- February 23, 2005 - Tennessee Tech University summarized laboratory testing on the Isolator Row in accordance with Maine DEP testing protocol. Tests demonstrated the following:
  - o 95% TSS overall removal at 8.1 gpm/sqft for US Silica OK-110 (110 micron).
  - o 80% captured on fabric.
- October 20, 2006 - Tennessee Tech University summarized laboratory testing on the Isolator Row in accordance with New Jersey Center for Advanced Technologies (NJCAT) testing protocol. Tests demonstrated the following:
  - o 60% TSS Removal at 3.2 gpm/sqft for Sil-Co-Sil 106 with accumulated fines ( $D_{50} = 10$  microns)
  - o 66% TSS Removal at 3.2 gpm/sqft for Sil-Co-Sil 106 ( $D_{50} = 22$  microns)
  - o 71% TSS Removal at 3.2 gpm/sqft for Sil-Co-Sil 250 ( $D_{50} = 45$  microns)
  - o 88% TSS Removal at 1.7 gpm/sqft for Sil-Co-Sil 250 ( $D_{50} = 45$  microns)
- August, 2007 – NJCAT summarized its third party evaluation of the Tennessee Tech test results and produced the “NJCAT Technology Verification Report StormTech Isolator Row”. Their verification is summarized as follows:
  - o **Claim 1:** A StormTech<sup>®</sup> SC-740 Isolator<sup>™</sup> Row, sized at a treatment rate of no more than 2.5 gpm/ft<sup>2</sup> of bottom area, using two layers of woven geotextile fabric under the base of the system and one layer of non-woven fabric wrapped over the top of the system and a mean event influent concentration of 270 mg/L (range of 139 – 361 mg/L) has been shown to have a TSS removal efficiency (measured as SSC) of at least 60% for SIL-CO-SIL 106, a manufactured silica product with an average particle size of 22 microns, in laboratory studies using simulated stormwater.
  - o **Claim 2:** A StormTech<sup>®</sup> SC-740 Isolator<sup>™</sup> Row, sized at a treatment rate of no more than 2.5 gpm/ft<sup>2</sup> of bottom area, using two layers of woven geotextile fabric under the base of the system and one layer of non-woven fabric wrapped over the top of the system and a mean event influent concentration of 318 mg/L (range of 129 – 441 mg/L) has been shown to have a TSS removal efficiency (measured as SSC) of 84% for SIL-CO-SIL

250, a manufactured silica product with an average particle size of 45 microns, in laboratory studies using simulated stormwater.

- o **Claim 3:** A StormTech® SC-740 Isolator™ Row, sized at a treatment rate of no more than 6.5 gpm/ft<sup>2</sup> of bottom area, using a single layer of woven geotextile fabric under the base of the system and one layer of non-woven fabric wrapped over the top of the system and a mean event influent concentration of 371 mg/L (range of 116 – 614 mg/L) has been shown to have a TSS removal efficiency (measured as SSC) of greater than 95% for OK-110, a manufactured silica product with an average particle size of 110 microns, in laboratory studies using simulated stormwater.
- June 2008 – The University of New Hampshire Stormwater Center releases the Final Report on Field Verification Testing of the StormTech Isolator Row Treatment Unit. Testing consisted of determining the water quality performance for multiple stormwater pollutants. As of the June report, data was recorded for 17 storm events.
  - o TSS median removal efficiency – 80%
  - o Petroleum Hydrocarbons median removal efficiency – 90%
  - o Zinc median removal efficiency – 53%
  - o Phosphorus median removal efficiency – 49%

References:

1. February 23, 2005 Tenn Tech report
2. October 20, 2006 Tenn Tech report
3. August 2007 NJCAT Verification
4. June 2008 UNH report