Final Drainage Report

Compark Village South, Filing No. 1
Parker, Colorado

P.N. CLCPKC3

Prepared for:
470 Compark, LLC
290 Fillmore St, Suite 1A
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Prepared By:

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Contact: Rick Moore, P.E.
303-708-0500

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016
Revised December 20, 2016

This final drainage report for the Compark South was prepared by me or under my direct supervision in accordance with the provisions of the *Town of Parker Storm Drainage and Environmental Criteria Manual.* I understand that the Town of Parker and its designated town authority do not and will not assume liability for drainage facilities designed by others.

Prepared by:

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State of Colorado No. 49038

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I. GENERAL LOCATION AND DESCRIPTION

A. Scope

This project is part of the Compark Village South development. The purpose of this report is to demonstrate the feasibility of the proposed storm drainage system planned to control the overall Green Acres Tributary drainage basins associated with the project. Drainage criteria are in accordance with the *Town of Parker Storm Drainage and Environmental Criteria Manual and Urban Drainage and Flood Control District*.

B. Location

Compark Village South lies within Section 6, Township 6 South, Range 66 West of the Sixth Principal Meridian, Town of Parker, Colorado. General project area boundaries include Highway E-470 to the north, Grand View Estates to the south, an undeveloped parcel to the west (Cordillera Corp property), and Compark 190, LLC property to the east (see vicinity map in Maps section at the end of this report). The project will include a new main access road, Belford Avenue, running east-west connecting South Peoria Street to South Chambers Road.

C. Description of Property

The Compark South Development Site consists of approximately 150 acres, and is mostly vacant with ground cover consisting of native grasses and shrubs. There are currently 2 residences on the south side of the property, which will be removed. Onsite soils consist mainly of Newlin gravelly sandy loams and Fondis clay loam. These dominant soils are classified as hydrologic group B and C soils, respectively. The site is approximately 77% Hydrologic Soil Group “B” and 23% HSG “C”. Refer to Appendix B of this report for excerpts of the SCS soil survey summary.

D. Floodplain Information

Compark Village South is located within two major drainage basins. Happy Canyon Creek is a major drainage basin that has a regulatory 100-year floodplain. Firm Map No’s 08035C0062G and 08035C0066G, Effective date:

March 16, 2016 reflect a Zone AE and Zone X floodplain across the eastern edge of the site. Green Acres Tributary is a sub-basin tributary to Happy Canyon Creek. Firm Map No. 08035C0062G, Effective date: March 16, 2016 reflects a Zone A non-detailed study floodplain over a portion of the Green Acres Tributary. Refer to Appendix C for FIRMETTE copies of the FIRM Map. A Floodplain Development Permit from the Town of Parker will be required for any construction within the documented floodplains on the property.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

Approximately 70 percent (+/- 105 ac) of this project lies within the Green Acres Tributary drainage basin. The remaining 30 percent (+/- 45 ac) of the site lies directly within the Happy Canyon Creek drainage basin, as studied as a part of the Happy Canyon Creek basin by the Urban Drainage and Flood Control District under the following studies:

- UDFCD – Outfall System Planning – Happy Canyon Creek Watershed within Douglas County, prepared by Kiowa Consultants, June 1993. Urban Drainage in conjunction with sponsor partners Town of Parker and Douglas County are planning on updating the Happy Canyon Creek OSP.

- Green Acres Tributary is a part of the Happy Canyon Creek watershed. The upstream area of the Green Acres Tributary contains several existing and proposed development projects that contain features for which drainage studies have been prepared. All current upstream drainage features are part of the Meridian Office Park, Filings 4 & 5 (reference 5) master drainage analysis.

- Happy Canyon Creek Major Drainageway Plan, prepared by Muller Engineering Company, March 2014.

- Amendment to Happy Canyon Creek Major Drainageway Plan, March 2014, prepared by Manhard Consulting, February 2016.

B. Basin Description

The overall drainage basin including the proposed site is divided into six sub-area basins, A, B, C, D, E, and F (See the Map Section at the end of this report). Basins A through E make up the Green Acres Tributary Basin and Basin F comprises the direct flow area tributary to Happy Canyon Creek. The drainage basin is divided into twelve sub-areas within the Happy Canyon Creek MDP. Sub-basins H100, H110, H115, H-120, H130, H140, H145, H150, H160, H170 and H180 drain to the Green Acres Tributary and sub-basin A370 drains directly to Happy Canyon Creek. Refer to the drainage maps included at the rear of this report for the spatial relationship of these drainage basins.

Basin A (H100, H110, H115, H120 & H130)

Basin A is comprised of approximately 370 acres of the Meridian Development area and directs surface drainage within Green Acres Tributary to a regional pond on the Meridian site, adjacent to Peoria Street.

Basin B (H140, H145, H150 & Portion of H160)

Basin B consists of approximately 310 acres of undeveloped land between Peoria Street and the site's western boundary. Green Acres Tributary (natural drainage channel) bisects this basin and intercepts surface runoff. It is assumed that any development within this 310-acre basin will provide corresponding water quality measures and detention storage for the major and minor storm events. Construction of a regional detention pond immediately upstream of the site is recommended in the UDFCD 2014 Major Drainageway Plan for Happy Canyon Creek (Airport 320 Pond).

Basin C (Portions of H170 & H180)

Basin C includes approximately 88 acres of existing Grand View Estates – a large rural residential lot development, which is tributary to Green Acres Tributary. These large lots have an approximate impervious value of 15%. Natural drainage swales exist onsite that historically drain across the Compark Village South site to Green Acres Tributary. The existing surface

runoff from Basin C will be intercepted by the proposed on-site storm drainage infrastructure and routed across Basin D to Green Acres Tributary.

Basin D (Portions of H160, H170 & H180)

Basin D includes approximately 100 acres of the site that drains directly into the Green Acres Tributary. Basin D comprises a majority of the proposed site development area. This basin will have an approximate improved site impervious value of 60%. Onsite flows will be combined with the discharge from Basins A, B, and C. A new regional pond is proposed on site for water quality and to attenuate stormwater peaks from basins C and D. This regional pond is referenced as the E-470 Pond in the UDFCD 2014 MDP.

Green Acres Tributary will intercept upstream flows from Basins A and B and will combine with future developed flows from Basins C and D. These combined flows will be routed through the proposed onsite regional detention pond and discharged through an existing drainage conveyance structure (12-ft by 10-ft RCBC) underneath C-470. Green Acres Tributary continues downstream through improved drainage channels and roadway crossing structures to converge with Happy Canyon Creek near Jordan Road within Arapahoe County. Note: The Arapahoe County portion of Green Acres Tributary is an unimproved channel segment.

A more detailed breakdown and analysis of these basins can be found on the Drainage Basin Map in Appendix H.

Basin E (Portion of H185)

Basin E is a small remnant basin within Green Acres Tributary basin that has been cutoff by the development of E-470 Tollway. Basin E is currently comprised of approximately 52 acres and includes a small portion of improved E-470 roadway and a larger portion of undeveloped property. E-470 construction provided a 48” diameter storm sewer system to collect and direct this basin area runoff under E-470. These basin flows merge back into Green Acres Tributary on the north side of E-470.

A small portion of the proposed site (+/- 10-acres) is impacted by existing topography and a natural drainage swale that directs offsite surface runoff

across the very northwest corner of the site to the existing E-470 storm sewer entrance structure which is a multi-grate type D inlet.

Basin F (Portions of A360 & A370)

Basin F includes the remaining 45 acres of the site that drains directly into Happy Canyon Creek. The runoff from the developed portion of this basin will be treated by a proposed local water quality/detention pond prior to discharging into Happy Canyon Creek. This basin will have a low density and an approximate composite impervious value of 34%.

III. DRAINAGE CHANNELS

A. Happy Canyon Creek

Happy Canyon Creek is a major basin that is tributary to Cherry Creek. The portion of Happy Canyon Creek thalweg that extends through the proposed site is a natural sandy bottom channel. The thalweg has an existing natural meander bend located near the southwest corner of the site. No apparent head cutting exists within this channel reach. The active channel is a dry stream bed that experiences active flows during wet seasonal conditions.

As discussed earlier, a Zone AE and Zone X floodplain exist along Happy Canyon Creek. It is anticipated that bank stabilization will be required along the outer edges of the existing meander bends. No major channel improvements are contemplated for Happy Canyon Creek, except the future construction of a roadway bridge crossing needed for Belford Avenue and possible installation of grade control structures. This bridge structure will likely span the existing floodplain. Floodplain mitigation is anticipated through the thalweg. Felsburg Holt & Ullevig (FHU) has been contracted to perform the proposed bridge design and floodplain mitigation. All proposed improvements to Happy Canyon Creek will be addressed in a separate drainage report.

UDFCD and the Town of Parker have sponsored an update to the existing Happy Canyon Creek Outfall Systems Plan (OSP) and the 2014 Happy Canyon Creek Major Drainageway Plan (MDP). Any recommendations to channel upgrades to this reach of Happy Canyon Creek need to meet the

recommendations of the OSP and 2014 MDP. Channel design and the Happy Canyon Creek bridge design must be reviewed and approved by UDFCD prior to the approval of associated drawings.

Note: All channel improvement design and construction shall meet the minimum requirements of the UDFCD maintenance eligibility program.

B. Green Acres Tributary

Green Acres Tributary is a sizeable drainage basin (approximately 920 ac as noted above) within the Happy Canyon Creek drainage basin. The portion of Green Acres Tributary thalweg that extends through the site begins at an existing 12-ft. x 10-ft. RCBC structure at E-470 and extends southwest upstream through the site to the southwest corner. This channel receives intermittent seasonal flows and is normally a dry stream bed. A small pocket of wetlands exists within the channel near the upper reach of the channel. The on-site wetland areas were determined to be isolated and non-jurisdictional. A current wetland determination prepared by Smith Environmental and Engineers has been certified by the US Army Corps of Engineers and is valid until March 2, 2017. See Appendix C for a copy of the Approved Jurisdictional Determination.

As discussed earlier, a Zone A non-detailed floodplain exists over a portion of the lower reach of the Green Acres Tributary channel near the E-470 box culvert. Channel improvements will be needed to stabilize the existing channel bed and allow for on-stream detention/water quality storage. Several roadway crossing structures will be required to provide access to future developed sites and to provide a channel crossing for Belford Avenue. As currently planned, the Green Acres Tributary will be realigned throughout the site. Significant channel drop occurs across the site. Some of this drop will be provided through the roadway crossing structures and the remaining drop will require stable drop structures strategically placed to minimize the difference in elevation between the proposed channel and the adjacent parcels to be developed.

Floodplain mitigation will be required to map the final floodplain through the site and mitigate the existing Zone A floodplain. A LOMR will be required to complete this floodplain mitigation.

IV. DRAINAGE DESIGN CRITERIA

A. Regulations

The regulations, guidelines, and drainage design criteria to be used are those contained within the *Town of Parker Storm Drainage Design and Environmental Criteria* and the *Urban Storm Drainage Criteria Manual*. The general drainage concept is to construct a regional pond to provide detention for that portion of Green Acres Tributary basin downstream of the western limits of the proposed site and Grand View Estates. In addition, detention/water quality ponds will be required for all areas not treated by the proposed regional detention pond. Hydrodynamic separator water quality structures will be installed to treat runoff from developed areas prior to the runoff entering the Green Acres Tributary upstream of the proposed full spectrum regional detention pond.

B. Hydrologic Criteria

The Colorado Unit Hydrograph Procedure (CUHP) will be used in the runoff calculations of the site's historic and developed flows. The initial storm will be based on a five-year storm frequency. The major storm discharge will be calculated for the 100-year storm frequency. The pond outfall storm sewer will be designed for the 100-year storm. The Town of Parker intensity-frequency-duration curves will be used to determine the flows for each of the basins (refer to Appendix A). The final required volumes of the sediment and detention ponds will be determined using the *Town of Parker Storm Drainage Design and Environmental Criteria*. Allowable release rates for the regional detention pond will be based on release rates contained in the Happy Canyon Creek Major Drainageway Plan, March 2014.

Future sizing of planned regional and sub-regional detention pond facilities shall follow the recommendations of UDFCD Outfall Systems Plan (OSP) and the 2014 Major Drainageway Plan for the Happy Canyon/Green Acres Tributary.

Based on the existing Grand View Estates Subdivision and the assumed imperviousness for the proposed site, preliminary sizing for the on-site

regional detention was completed. Through the CLOMR process, the proposed detention pond was upsized from that required to meet Town of Parker/2014 MDP requirements to one sized to attenuate the proposed runoff from future development utilizing the hydrologic model contained in the 1993 OSP.

The proposed on-site regional water quality/detention pond will include a 5' deep permanent pool. An upstream water feature pond will also include a 5' permanent pool. The upstream pond is labeled as a water feature since its volume is not included in the calculations to meet the Town of Parker/UDFCD water quality/detention requirements. The proposed ponds will be online with the Green Acres Tributary. The proposed detention pond will discharge via an outlet structure to the existing 12'x10' RCBC beneath Highway E-470. This is in accordance with predeveloped conditions

The proposed regional pond (HCC MDP Basin GA350) planned within Basin D will be required to contain a combined storage for water quality and detention volume for the major storm event. The proposed pond will meet the recommendations of the UDFCD OSP and Major Drainageway Plan updates.

Model	100 yr Inflow to Det Pond	100 yr Outflow from Det Pond
1993 OSP Hydrology	2014 cfs	1394 cfs
Amended 2014 MDP Hydrology	588 cfs	570 cfs

The water quality/detention pond(s) in Basin F will be required to contain the combined total storage for water quality and detention volume for the major storm event. Detention/Water Quality shall be designed to meet the minimum requirements of the UDFCD OSP and the Town of Parker requirements.

The Green Acres Tributary will be designed to carry the initial storm, 5 yr frequency, in the low flow channel and the major storm, 100 yr frequency, within its top of bank. A gravel maintenance path will follow the channel at an elevation at least 12" above the 100 yr water surface elevation. The channel will be seeded with riparian seed. Slopes of the channel were minimized to obtain a velocity less than 6 ft/s to discourage erosion of the channel. The USACOE HEC-RAS model was run to determine the 100 yr

water surface limits and the velocities within the channel and over the proposed grouted boulder drop structures. The channel will flow through a 28'x11' arch culvert under the proposed Belford Avenue. The channel will consist of a 10' wide x 2.5' deep concrete channel and 10' concrete maintenance trail through the culvert. The trail will slope at 2% toward the channel and will have a 6" curb to separate it from the drainage channel. The curb will contain curb cuts to allow runoff to enter the channel. From the results of the HEC-RAS model, the trail under Belford Avenue will be inundated during 5 yr frequency storms and greater. The GAT maintenance trail for the rest of the project is located at least 12" above the 100 yr storm elevation of the channel.

The proposed grouted boulder drop structures have been strategically placed at proposed road crossings, i.e. Belford Avenue and two future road crossings and the inflow points into the proposed ponds. Two HEC-RAS models were created. One for the current proposed condition including the Belford Avenue arch culvert and one for the future condition including two 20'x6' box culverts for future road crossings. The associated upstream grouted boulder drops and downstream boulder outfalls for the proposed and future road crossings will be installed with the Green Acres Tributary, Compark Village South Filing No. 1 project. The velocities across the proposed grouted boulder drop structures were analyzed to ensure that they will not exceed the erosive velocity for grout, i.e. 13 ft/s, as this will be the limiting material of the structures. The maximum velocity for the convex drops into the proposed ponds is 7 ft/s, but the average was 4.5 ft/s. This is well below the erosive velocity for grout.

C. Variance from Criteria

Because the proposed regional detention pond is a wet pond, UDFCD has indicated it is not eligible for full maintenance eligibility. They indicated it is eligible for maintenance of the proposed outlet structure, forebays and maintenance trail. They also indicated the proposed water feature pond is not eligible for maintenance.

The Town of Parker Storm Drainage and Environmental Criteria Manual, section 2.4.2.2 "requires all major drainage facilities located outside of street rights-of-way be eligible for UDFCD's maintenance program as a pre-

condition of approval". A variance from this requirement has been requested.

V. ENVIRONMENTAL PROTECTION CRITERIA

A. General

Site drainage improvements are intended to minimize the impact to the environment.

B. Construction BMP Plan

Construction BMPs shall be placed during the appropriate construction phases to minimize soil erosion and the movement of sediment offsite. Construction BMPs shall be placed in two phases (Phase A and Phase B). The intent of the Phase A BMPs are to fulfill water quality objectives during the overlot and roadway rough grading phase of the project. Once Phase A rough grading and earthmoving is completed, Phase B BMP placement will commence. Phase B includes fine grading, utility construction, and street construction. Construction Plans will contain all appropriate Stormwater Management Details. In addition, a Stormwater Management Plan will be prepared to meet the town of Parker, State of Colorado, and Environmental Protection Agency criteria.

VI. CONCLUSION

This final drainage report complies with all major standards of the Town of Parker and the Urban Drainage Flood Control District. This overall plan for the site's drainage design is effective and economical for controlling damage due to excess storm runoff and minimizing erosive discharges. This plan is intended to integrate into the future basin planning efforts by UDFCD, Douglas County and the Town of Parker when the Happy Canyon Creek Outfall System Planning study is updated.

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Revised May 27, 2016
Revised October 21, 2016
Revised December 20, 2016

VII.REFERENCES

1. *Soil Survey of Castle Rock Area*, US Department of Agriculture Soil Conservation Service, September 23, 2014.
2. *Town of Parker Storm Drainage and Environmental Criteria Manual*, last revised February 2014.
3. *Urban Storm Drainage Criteria Manual*, Volumes 1–3, Urban Drainage and Flood Control District, 2010, with current revisions.
4. *UDFCD – Outfall System Planning – Happy Canyon Creek Watershed within Douglas County*, prepared by Kiowa Consultants, June 1993.
5. *Meridian Office Park Filings 4 & 5 2nd. Amended Master Drainage Study,* prepared by Martin and Martin, November 2010.
6. UDFCD – Happy Canyon Creek Master Drainage Plan, Muller Engineering March 2014.
7. Amendment to Happy Canyon Creek Major Drainageway Plan, March 2014, prepared by Manhard Consulting, February 2016.

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APPENDIX A

USDA NRSC Soils Information Summary

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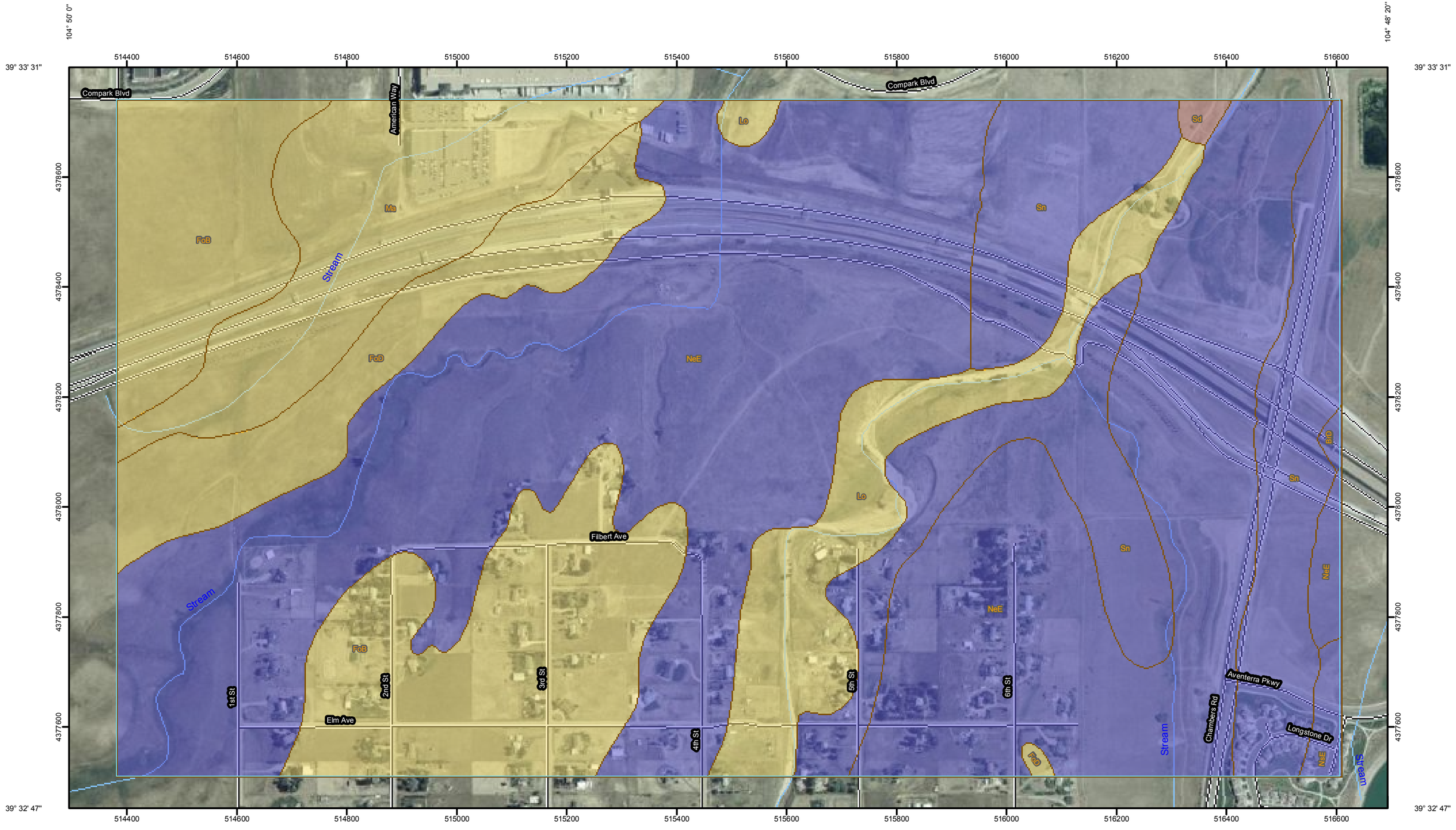

Map Scale: 1:6,630 if printed on B size (11" x 17") sheet.

N

Meters: 0, 100, 200, 400, 600

Feet: 0, 400, 800, 1,600, 2,400

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:6,630 if printed on B size (11" × 17") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 6, May 4, 2009

Date(s) aerial images were photographed: 7/30/2005; 7/29/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Castle Rock Area, Colorado (CO622)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
BrD	Bresser sandy loam, 3 to 9 percent slopes	B	0.8	0.1%
FoB	Fondis clay loam, 1 to 3 percent slopes	C	100.7	14.9%
FoD	Fondis clay loam, 3 to 9 percent slopes	C	38.8	5.7%
Lo	Loamy alluvial land	C	44.9	6.6%
Ma	Manzanola clay loam	C	55.6	8.2%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	334.2	49.4%
NsE	Newlin-Satanta complex, 5 to 20 percent slopes	B	3.2	0.5%
Sd	Sandy alluvial land	A	1.4	0.2%
Sn	Satanta loam	B	97.2	14.4%
Totals for Area of Interest			**676.8**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX B

FEMA FIRM Maps

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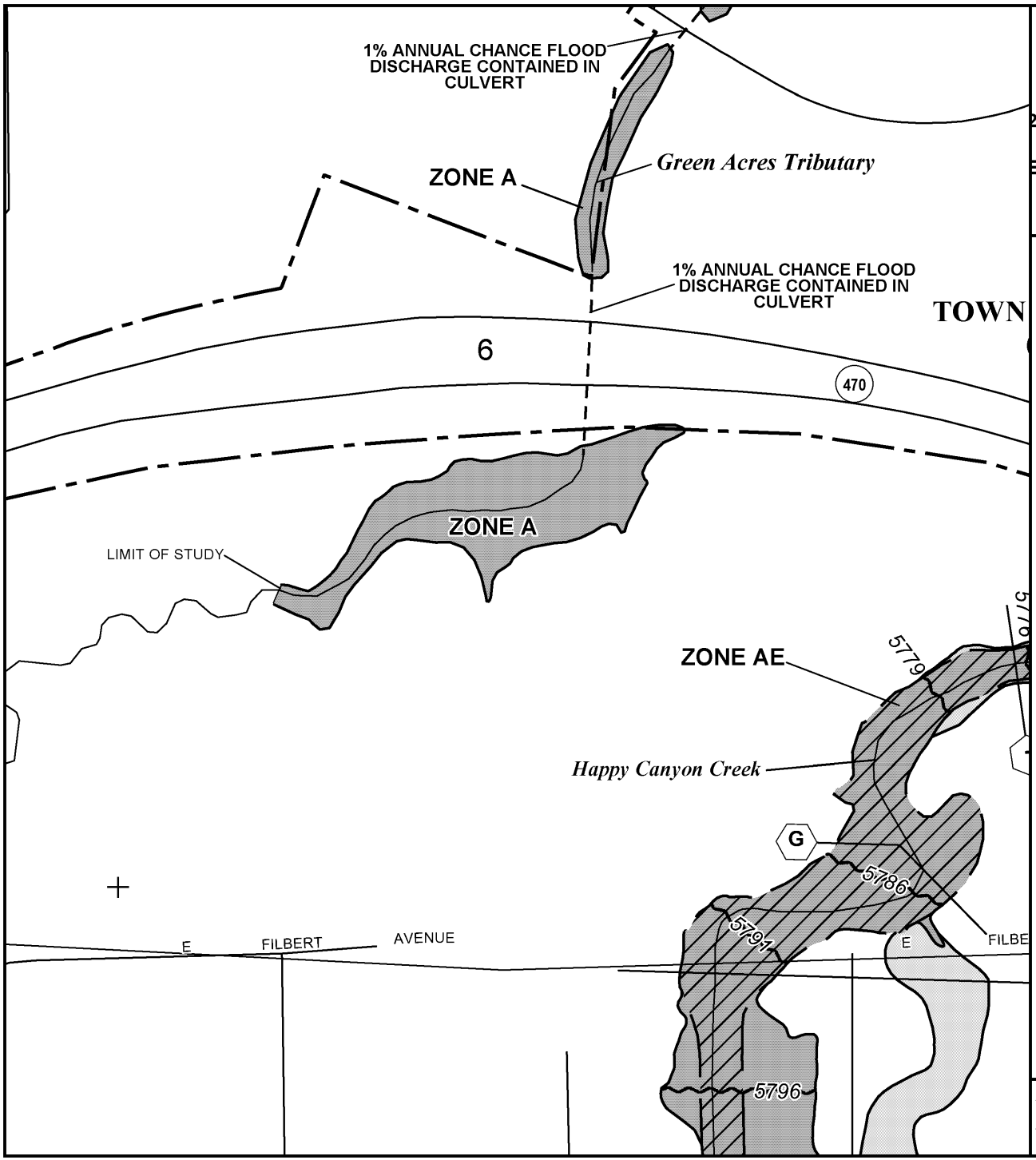

MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0062G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 62 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0062	G
LONE TREE, CITY OF	080319	0062	G
PARKER, TOWN OF	080310	0062	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0062G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

APPENDIX C

USACOE Approved Jurisdictional Determination

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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 SOUTH WADSWORTH BOULEVARD
LITTLETON, COLORADO 80128-6901

March 2, 2012

Mr. Peter Smith
Smith Environmental and Engineers
1490 W. 121st. Avenue, Suite 101
Westminster, CO 80234

RE: Compark Development Approved Jurisdictional Determination, Two Isolated Drainages (Green Acres Tributary)
Corps File No. 199780436

Dear Mr. Smith:

Reference is made to the above-mentioned project located at 39.554033; -104.824038, Douglas County, Colorado. These isolated drainages at this site were determined to be non-jurisdictional and are not regulated under Section 404 of the Clean Water Act.

This site has been reviewed in accordance with Section 404 of the Clean Water Act under which the U.S. Army Corps of Engineers regulates the discharge of dredged and fill material and certain excavation activities in waters of the United States. Waters of the U.S. includes ephemeral, intermittent and perennial streams, their surface connected wetlands and adjacent wetlands and certain lakes, ponds, drainage ditches and irrigation ditches that have a nexus to interstate commerce.

An approved jurisdictional determination (JD) has been completed for this project. The JD is attached to this letter. If you are not in agreement with the JD decision, you may request an administrative appeal under regulation 33 CFR 331, by using the attached Appeal Form and Administrative Appeal Process form. The request for appeal must be received within 60 days from the date of this letter. If you would like more information on the jurisdictional appeal process, contact this office. It is not necessary to submit a Request for Appeal if you do not object to the JD.

This JD is valid for a period of five years from the date of this letter, unless new information warrants revisions of the JDs before the expiration date, or unless the Corps has identified, after a possible public notice and comment, that specific geographic areas with rapidly changing environmental conditions merit re-verification on a more frequent basis.

The Omaha District, Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete our Customer Service Survey found on our website at http://per2.nwp.usace.army.mil/survey.html. If you do not have Internet access, you may call and request a paper copy of the survey that you can complete and return to us by mail or fax. (Completing the survey is a voluntary action)

If there are any questions call **Mr. Terry McKee** of my office at **303-979-4120** and reference **Corps File No. 199780436.**

Sincerely,

Timothy T. Carey
Chief, Denver Regulatory Office

tm

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant:	File Number: 199780436	Date:
Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
X	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:

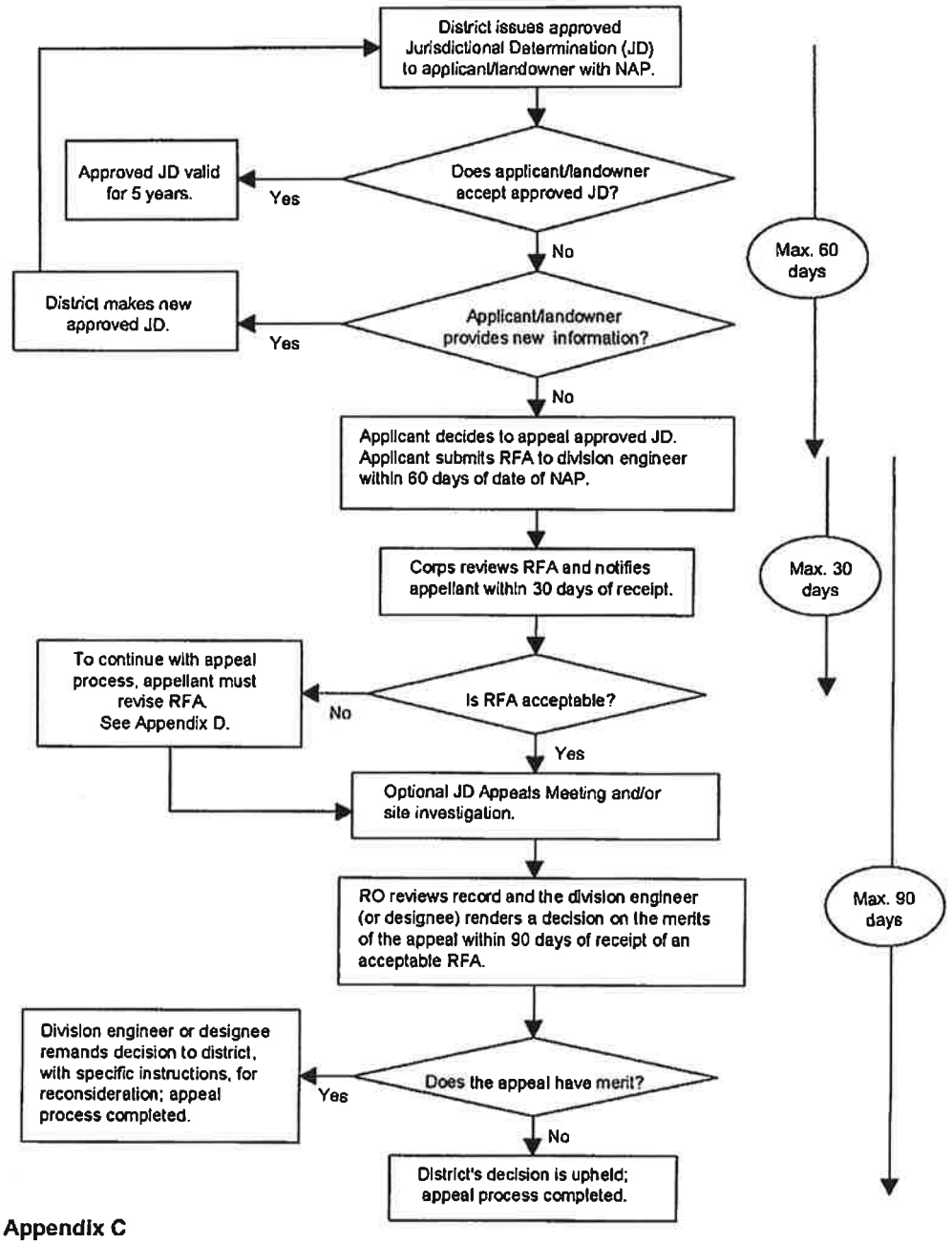
Timothy T. Carey
Chief, Denver Regulatory Office
9307 South Wadsworth Boulevard
Littleton, CO 80128
(303) 979-4120

If you only have questions regarding the appeal process you may also contact:

US Army Corps of Engineers, Northwestern Division
Attn: David Gesl, Appeal Review Officer
1125 NW Couch St.
Portland, OR 97209-4141
Telephone (503) 808-3825

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

Administrative Appeal Process for Approved Jurisdictional Determinations



Appendix C

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): March 1, 2012

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Denver Regulatory Office
Compark Development
199780436

C. PROJECT LOCATION AND BACKGROUND INFORMATION:
State: Co County/parish/borough: Douglas City: Parker
Center coordinates of site (lat/long in degree decimal format): Lat. 39.554033 N; Long. -104.824038 W
Name of nearest waterbody: Happy Canyon Creek
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: N/A
Name of watershed or Hydrologic Unit Code (HUC): 10190003
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: February 16, 2012
☒ Field Determination. Date(s): December 15, 2011

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are no** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
   ☐ TNWs, including territorial seas
   ☐ Wetlands adjacent to TNWs
   ☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
   ☐ Non-RPWs that flow directly or indirectly into TNWs
   ☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
   ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
   ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
   ☐ Impoundments of jurisdictional waters
   ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
   Non-wetland waters: linear feet: width (ft) and/or acres.
   Wetlands: acres.

   c. **Limits (boundaries) of jurisdiction** based on: **Pick List**
   Elevation of established OHWM (if known): .

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☒ **Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional. Explain:** This wetland is at the upper end of a drainage approximately 8,600 feet up-gradient from Happy Canyon Creek. The soil along the reach of this drainage is sandy and porus, which allows most normal flows to dissapate into the ground before reaching Happy Canyon Creek. Sporadic wetlands exist down-gradient, associated with culverts and grade control structures. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

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[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:
Watershed size: 1815 **square miles**
Drainage area: 2 **square miles**
Average annual rainfall: 14 inches
Average annual snowfall: 40 inches

(ii) Physical Characteristics:
(a) Relationship with TNW:
☐ Tributary flows directly into TNW.
☒ Tributary flows through 0 tributaries before entering TNW.

Project waters are 5-10 river miles from TNW.
Project waters are 2-5 river miles from RPW.
Project waters are 5-10 aerial (straight) miles from TNW.
Project waters are 2-5 aerial (straight) miles from RPW.
Project waters cross or serve as state boundaries. Explain:

Identify flow route to TNW[5]: There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porus, which allows most normal flows to dissapate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

Tributary stream order, if known:

(b) General Tributary Characteristics (check all that apply): This drainage/swale displays no OHWM physical characteristics
Tributary is: ☐ Natural
☐ Artificial (man-made). Explain:
☐ Manipulated (man-altered). Explain:

Tributary properties with respect to top of bank (estimate):
Average width: feet
Average depth: 1 feet
Average side slopes: 3:1 .

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[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.
[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

Primary tributary substrate composition (check all that apply):

- ☐ Silts
- ☒ Sands
- ☐ Concrete
- ☐ Cobbles
- ☐ Gravel
- ☐ Muck
- ☐ Bedrock
- ☐ Vegetation. Type/% cover:
- ☐ Other. Explain: .

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: stable.
Presence of run/riffle/pool complexes. Explain: .
Tributary geometry: **Meandering**
Tributary gradient (approximate average slope): 0.5 %

(c) Flow:

Tributary provides for: **Ephemeral flow**
Estimate average number of flow events in review area/year: Unknown
Describe flow regime: There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porus, which allows most normal flows to dissapate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

Other information on duration and volume: Flows from the project site would reach Happy Canyon Creek only during a 5 – 10 flow year event.

Surface flow is: **Overland sheetflow.**
Characteristics: The soil along the reach of this drainage is sandy and porus, which allows most normal flows to dissapate into the ground before reaching Happy Canyon Creek.

Subsurface flow: **Unknown.** Explain findings: .

- ☐ Dye (or other) test performed: .

Tributary has (check all that apply): This drainage/swale displays no OHWM physical characteristics

- ☐ Bed and banks
- ☐ OHWM[6] (check all indicators that apply):
  - ☐ clear, natural line impressed on the bank
  - ☐ changes in the character of soil
  - ☐ shelving
  - ☐ vegetation matted down, bent, or absent
  - ☐ leaf litter disturbed or washed away
  - ☐ sediment deposition
  - ☐ water staining
  - ☒ other (list): wetland only
  - ☐ the presence of litter and debris
  - ☐ destruction of terrestrial vegetation
  - ☐ the presence of wrack line
  - ☐ sediment sorting
  - ☐ scour
  - ☐ multiple observed or predicted flow events
  - ☐ abrupt change in plant community
- ☐ Discontinuous OHWM.[7] Explain:.

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

- ☐ High Tide Line indicated by:
  - ☐ oil or scum line along shore objects
  - ☐ fine shell or debris deposits (foreshore)
  - ☐ physical markings/characteristics
  - ☐ tidal gauges
  - ☐ other (list):
- ☐ Mean High Water Mark indicated by:
  - ☐ survey to available datum;
  - ☐ physical markings;
  - ☐ vegetation lines/changes in vegetation types.

(iii) Chemical Characteristics:

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain: There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porus, which allows most normal flows to dissapate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.
Identify specific pollutants, if known: .

(iv) Biological Characteristics. Channel supports (check all that apply):

- ☒ Riparian corridor. Characteristics (type, average width): upland grass and weeds
- ☐ Wetland fringe. Characteristics: .

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[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

☒ Habitat for:
☐ Federally Listed species. Explain findings: .
☐ Fish/spawn areas. Explain findings: .
☐ Other environmentally-sensitive species. Explain findings: .
☒ Aquatic/wildlife diversity. Explain findings: wetland habitat for wildlife adapted to life on the high plains. Corridor generally has upland vegetation throughout the upland swales, supporting natural high plains wildlife and birds.

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:
Properties:
Wetland size: 1.36 acres
Wetland type. Explain: PEM.
Wetland quality. Explain: Poor.
Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:
Flow is: **No Flow** . Explain: There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porus, which allows most normal flows to dissapate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek..

Surface flow is: **Overland sheetflow**
Characteristics: There is no continuous flow route to a TNW. As such, this drainage/swale is not considered a tributary. The soil along the reach of this drainage is sandy and porus, which allows most normal flows to dissapate into the ground before reaching Happy Canyon Creek. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

Subsurface flow: **Unknown**. Explain findings: .
☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW: This wetland is at the upper end of a drainage approximately 8,600 feet up-gradient from Happy Canyon Creek. The soil along the reach of this drainage is sandy and porus, which allows most normal flows to dissapate into the ground before reaching Happy Canyon Creek. Sporadic wetlands exist down-gradient, associated with culverts and grade control structures. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek. These wetlands are not adjacent to any tributary.
☐ Directly abutting
☐ Not directly abutting
☐ Discrete wetland hydrologic connection. Explain: .
☐ Ecological connection. Explain: .
☐ Separated by berm/barrier. Explain: .

(d) Proximity (Relationship) to TNW
Project wetlands are **5-10** river miles from TNW.
Project waters are **5-10** aerial (straight) miles from TNW.
Flow is from: **No Flow.**
Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:
Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: .
Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):
☒ Riparian buffer. Characteristics (type, average width): .
☐ Vegetation type/percent cover. Explain: .
☐ Habitat for:
☐ Federally Listed species. Explain findings: .
☐ Fish/spawn areas. Explain findings: .
☐ Other environmentally-sensitive species. Explain findings: .
☒ Aquatic/wildlife diversity. Explain findings: .

3. Characteristics of all wetlands adjacent to the tributary (if any)
All wetland(s) being considered in the cumulative analysis: 2

Approximately (1.36) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)
Wetland 1	1.10		
Wetland 2	0.26		

Summarize overall biological, chemical and physical functions being performed: The biological function provides habitat for micro and macro invertebrates including annelids, arthropods, arachnids and amphibians, which may be a food source for birds, rodents, small carnivorous mammals and reptiles. The vegetation may provide cover and a food source for rabbits and certain birds and other wildlife associated with the high plains. Chemical function is most likely insignificant given that flows from these wetlands would rarely, if ever, reach a downstream TNW.

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

Findings of absence of significant nexus.

Drainage (locally called Green Acres Tributary):

This wetland is at the upper end of a drainage approximately 8,600 feet up-gradient from Happy Canyon Creek. The soil along the reach of this drainage is sandy and porus, which allows most normal flows to dissapate into the ground before reaching Happy Canyon Creek. Sporadic wetlands exist down-gradient, associated with culverts and grade control structures at E-470, Compark Blvd, and South Chambers Road. No channel or tributary OHWM features exist down-gradient. 3,500 feet of upland swale, with no wetland inclusions, exists up-gradient of Happy Canyon Creek.

During a January 9, 2012 discussion with the Town of Parker's Engineering Manager, it was determined the flows from the project site would reach Happy Canyon Creek only during a 5 – 10 flow year event. He stated that he has driven over Jordon Road at the intersection of this drainage and Happy Canyon Creek for several years and has never seen water flowing from this drainage into Happy Canyon Creek.

Wetlands at the project site are approximately 8,600 feet up-gradient of Happy Canyon Creek. From this intersection, Happy Canyon Creek, and ephemeral non-RPW, flows for approximately 2,800 feet to its confluence with Cherry Creek, an RPW. From this confluence, Cherry Creek flows for approximately 5.45 miles to Cherry Creek Reservoir, a TNW.

The entire Cherry Creek drainage including East and West Cherry Creek is 400 square miles. The drainage comprises less than 0.001% of the total Cherry Creek watershed, which includes Cherry Creek Reservoir.

The composition of both the drainage basin and stream substrates is highly porous alluvial sand and gravel, and both rainfall and any accumulated flows quickly disappear into the ground. Only during less-frequent, high-precipitation storms would flows gather and negotiate through the broad upland swale to reach Happy Canyon Creek. Predominantly upland characteristics, along with the absence of normal aquatic resource characteristics at the lower end of the drainage help demonstrate that surficial flows to Happy Canyon Creek are rare. There are not even signs of high flows, such as drift deposits, reaching Happy Canyon Creek. Based on topography of the land and physical evidence it appears unlikely that water in this drainage flows to Happy Canyon Creek, the downstream tributary, on any routine basis.

The hydrologic nexus to the Cherry Creek Reservoir is so minimal as to be insubstantial. There is also no evidence of a significnat biological or ecological nexus, such as ESA habitat or aquatic life movement.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- ☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☒ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☒ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☒ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: See Section C
- ☐ Other: (explain, if not covered above):

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams):
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: Smith Environmental
- ☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☒ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24000, Parker
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
- ☐ National wetlands inventory map(s). Cite name: .
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☒ Photographs: ☐ Aerial (Name & Date):
  or ☒ Other (Name & Date): Project site
- ☐ Previous determination(s). File no. and date of response letter: .
- ☒ Applicable/supporting case law: Rapanos and Carabell cases.
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

Project area map

E Broncos Pkwy
S Potomac St
S Chambers Rd
S Jordan Rd
County Line Rd
3500' of upland
Happy Canyon Creek
Upland swale with wetland inclusions
435' of upland
Project Area
© 2012 Google

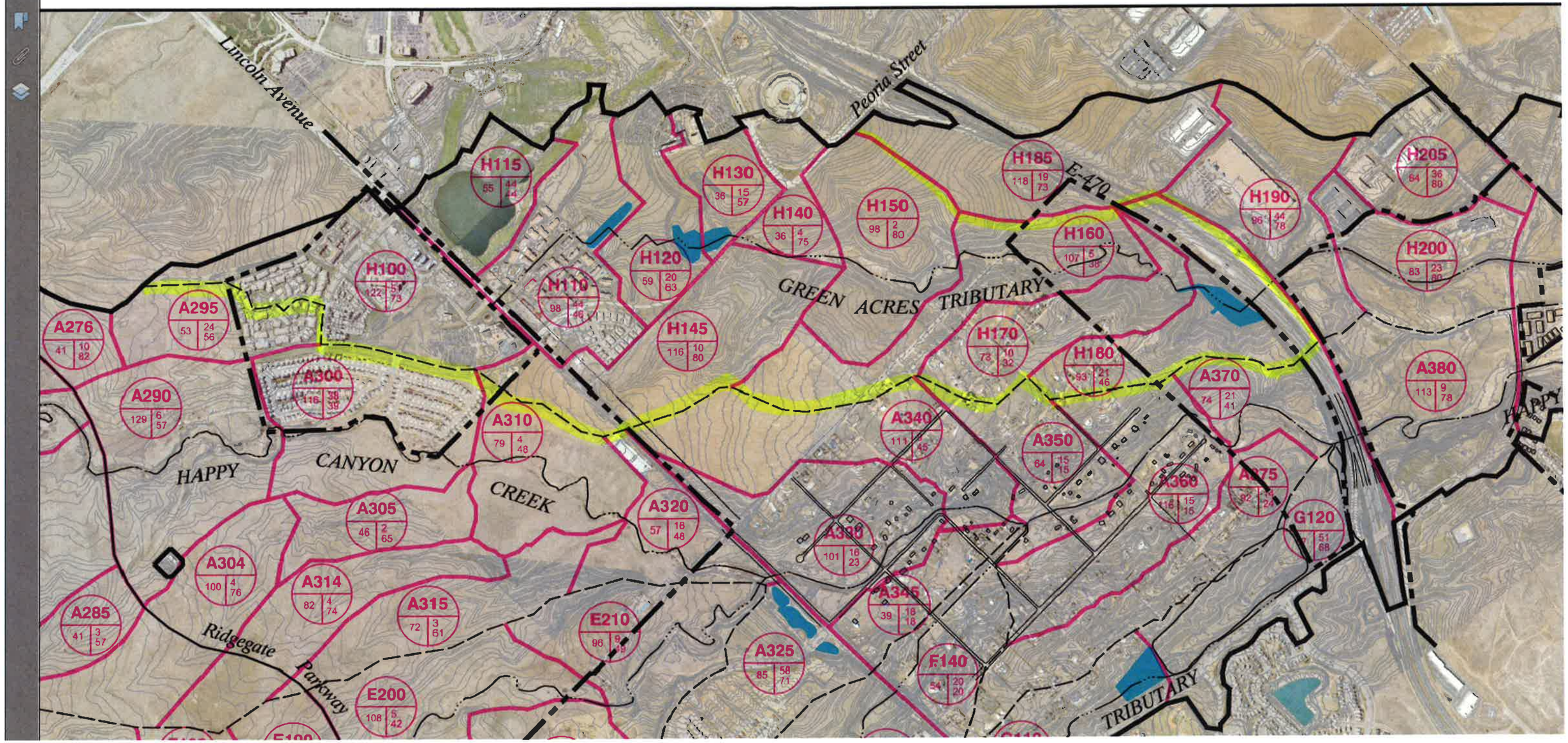
American Way
E-470 (Toll road)
E-470 (Toll road)
E-470 (Toll road)
Cherokee Trail
Cherokee Trail
Cherokee Trail
Cherokee Trail

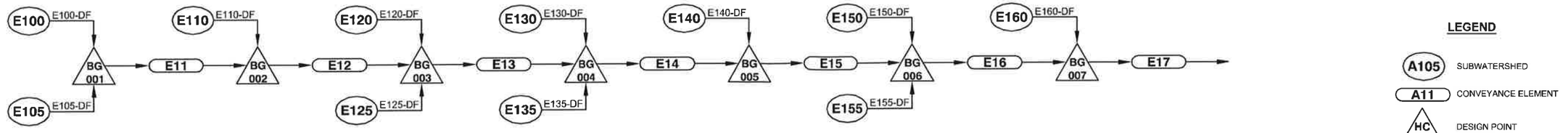
APPENDIX D

Excerpts from Happy Canyon Major Drainageways Plan

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016

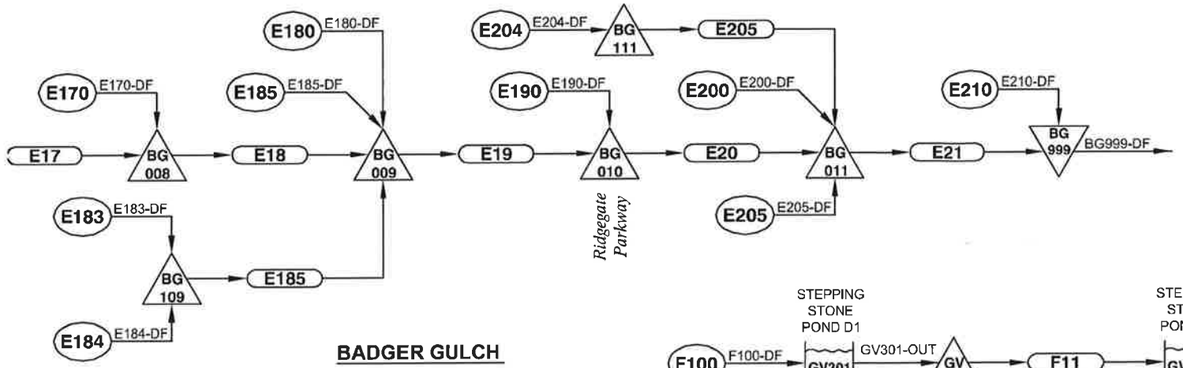
HappyCanyonMDP_ConceptualDesign_FINAL-03-14.pdf - Adobe Reader
File Edit View Window Help
Open 159 / 283 150% Tools Fill & Sign Commen



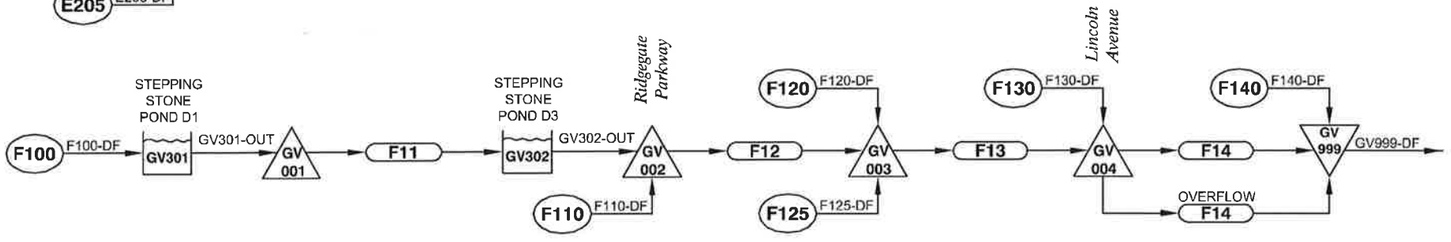


LEGEND

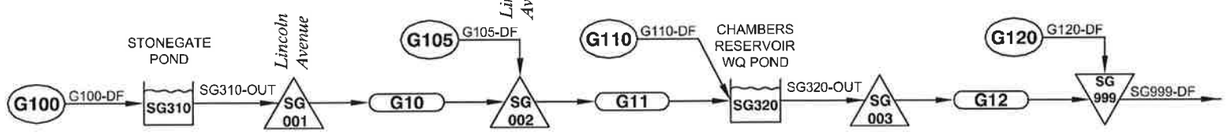
- A105 — SUBWATERSHED
- A11 — CONVEYANCE ELEMENT
- HC 003 — DESIGN POINT
- HC310 — DETENTION FACILITY
- BH 999 — OUTFALL



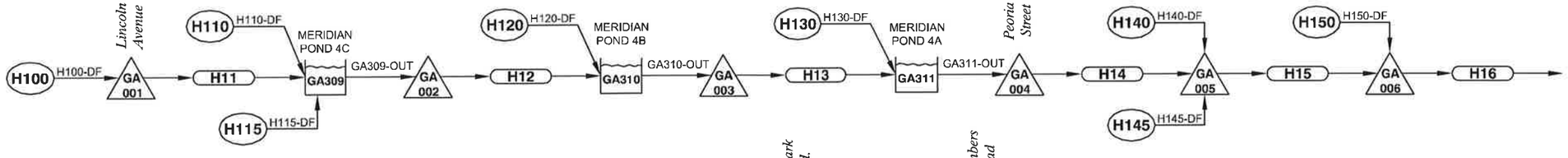
BADGER GULCH

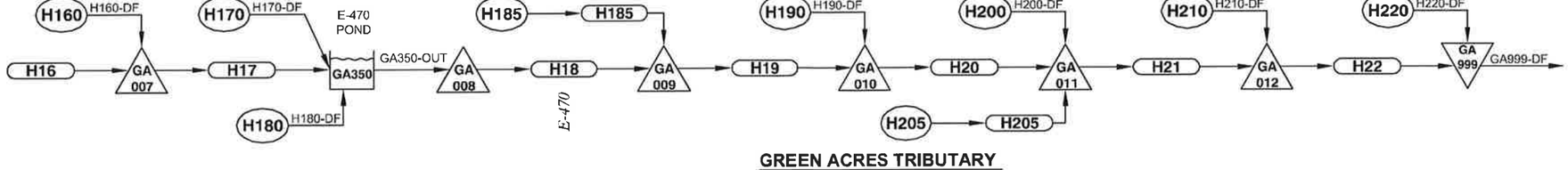


GRANDVIEW TRIBUTARY



STONEGATE TRIBUTARY





GREEN ACRES TRIBUTARY

No.	DATE	REVISIONS	APPR.

MULLER ENGINEERING CO., INC.
CONSULTING ENGINEERS
777 SOUTH WADSWORTH BLVD. # 100
LAKEWOOD, COLORADO 80226 (303) 988-4949
PROJECT NO. 12-010.01

DESIGN MDC
DRAWN JHK
CHECK JTW

HAPPY CANYON CREEK
MAJOR DRAINAGEWAY PLAN

SWMM SCHEMATIC
LOWER TRIBUTARIES

DATE JULY 2013
FIGURE NO. B-5

DATE: OCT 08, 2013 TIME: 2:25 PM
NAME: P:\12\010.01 Happy Canyon Creek MDP & PHASE I\DP\CAD\2013\Submit Submittals

Subwatershed ID	Area acres	Area sq mi	Dist to Centroid ft	Dist to Centroid mi	Length ft	Length mi	Length-Weighted Slope ft/ft	Weighted % Impervious Existing %	Weighted % Impervious Future %	Depression Storage Pervious watershed in	Depression Storage Impervious watershed in	Infiltration Initial Rate in/hr	Infiltration Decay Coeff. 1/second	Infiltration Final Rate in/hr	Corresponding Basin IDs - 1993 OSP
E204	42	0.06605	1067	0.202	2541	0.481	0.0294	2.0	71.6	0.5	0.1	3	0.0018	0.5	94
E205	100	0.15620	1948	0.369	4214	0.798	0.0320	35.2	52.8	0.5	0.1	3.15	0.0018	0.51	94
E210	96	0.14956	2674	0.507	5765	1.092	0.0159	9.2	49.3	0.5	0.1	3.825	0.0018	0.555	98
Grandview Tributary															
F100	93	0.14511	800	0.152	2700	0.511	0.0308	2.0	56.8	0.5	0.1	3	0.0018	0.5	100
F110	105	0.16378	880	0.167	2240	0.424	0.0234	6.5	52.5	0.5	0.1	3	0.0018	0.5	100,101,103
F120	124	0.19354	1990	0.377	3526	0.668	0.0282	38.3	55.6	0.5	0.1	3.075	0.0018	0.505	101,102,103
F125	70	0.10874	1339	0.254	3288	0.623	0.0252	2.0	50.0	0.5	0.1	3.675	0.0018	0.545	101,103,104
F130	107	0.16717	1518	0.287	3294	0.624	0.0217	4.7	51.4	0.5	0.1	3.675	0.0018	0.545	104
F140	54	0.08509	2009	0.380	4129	0.782	0.0215	19.6	19.6	0.5	0.1	4.05	0.0018	0.57	105
Stonegate Tributary															
G100	112	0.17554	3093	0.586	6705	1.270	0.0154	2.0	50.0	0.5	0.1	3.075	0.0018	0.505	107
G105	43	0.06657	1219	0.231	3081	0.584	0.0194	50.0	50.0	0.5	0.1	3.825	0.0018	0.555	107
G110	73	0.11451	1596	0.302	3413	0.646	0.0227	22.8	22.8	0.5	0.1	4.05	0.0018	0.57	108,111
G120	87	0.13633	2412	0.457	4933	0.934	0.0215	50.5	68.3	0.5	0.1	4.5	0.0018	0.6	111
Green Acres Tributary															
H100	122	0.19127	1349	0.255	5346	1.013	0.0122	51.2	72.6	0.5	0.1	3	0.0018	0.5	119,67,121
H110	98	0.15386	557	0.105	1981	0.375	0.0186	44.4	46.4	0.5	0.1	3	0.0018	0.5	120,124
H115	55	0.08578	691	0.131	1531	0.290	0.0131	44.4	44.4	0.5	0.1	3	0.0018	0.5	119,120
H120	59	0.09167	1533	0.290	2500	0.473	0.0165	19.5	63.0	0.5	0.1	3	0.0018	0.5	120,123
H130	36	0.05656	810	0.153	2112	0.400	0.0172	15.2	56.9	0.5	0.1	3	0.0018	0.5	123,124
H140	36	0.05631	1750	0.331	3054	0.578	0.0235	3.5	75.0	0.5	0.1	3.375	0.0018	0.525	123,124,125
H145	116	0.18173	2457	0.465	5742	1.088	0.0167	10.2	79.6	0.5	0.1	3.075	0.0018	0.505	68,124
H150	98	0.15282	637	0.121	2590	0.491	0.0323	2.0	80.0	0.5	0.1	3.6	0.0018	0.54	125
H160	107	0.16661	3461	0.655	6975	1.321	0.0172	5.2	37.7	0.5	0.1	3.675	0.0018	0.545	125,129
H170	73	0.11465	1902	0.360	4331	0.820	0.0214	10.0	32.3	0.5	0.1	3.75	0.0018	0.55	128
H180	93	0.14542	1094	0.207	3929	0.744	0.0191	21.1	45.7	0.5	0.1	3.75	0.0018	0.55	131
H185	118	0.18474	1850	0.350	5098	0.966	0.0219	19.0	73.3	0.5	0.1	3	0.0018	0.5	130,132
H190	96	0.15048	561	0.106	2865	0.543	0.0348	43.8	77.6	0.5	0.1	3.375	0.0018	0.525	132,133
H200	83	0.12951	1236	0.234	3650	0.691	0.0189	23.4	80.0	0.5	0.1	3.9	0.0018	0.56	132,133,114,134
H205	64	0.10061	820	0.155	1900	0.360	0.0349	35.8	80.0	0.5	0.1	3.75	0.0018	0.55	132,133,134
H210	120	0.18689	1520	0.288	3320	0.629	0.0222	4.9	78.6	0.5	0.1	3.8	0.00169	0.59	133,115,134,135
H220	50	0.07869	1530	0.290	2490	0.472	0.0269	4.4	64.0	0.5	0.1	3.55	0.00158	0.61	135,116

Storage Curve			Outlet Curve	
Elevation (ft)	Stage (ft)	Area (sq ft)	Stage (ft)	Discharge (cfs)
Chambers Reservoir WQ Pond (SWMM element SG320)				
5837.2	0	0	0.0	0
5838	0.8	334	0.8	0.4
5840	2.8	47285	2.8	2.2
5840.3	3.1	51599	3.1	2.5
5842	4.8	88359	4.8	3.7
5844	6.8	110216	6.8	64.7
5846	8.8	124039	8.8	75.1
5848	10.8	137906	10.8	2671
5849	11.8	145138	11.8	4890
Stonegate Pond (SWMM element SG310)				
5886.3	0	260	0.0	0.00
5887	1	4340	0.7	0.13
5888	2	9086	1.7	0.40
5889	3	24864	2.7	0.75
5890	4	52193	3.7	1.18
5891	5	77199	4.7	1.66
5892	5.7	94517	5.7	2.20
5893	6.7	105201	6.7	7.05
5894	7.7	112546	7.7	32.5
5895	8.7	120451	8.7	41.8
5896	9.7	127914	9.7	43.9
5897	10.7	135421	10.7	45.8
5898	11.7	147109	11.7	47.7
5899	12.7	160614	12.7	49.5
E-470 Pond (SWMM element GA350)				
5782	0	200	0	103
5784	2	21000	2	291
5786	4	58900	4	531
5788	6	115100	6	813
5790	8	192300	8	1134
5792	10	269600	10	1467

Storage Curve			Outlet Curve	
Elevation (ft)	Stage (ft)	Area (sq ft)	Stage (ft)	Discharge (cfs)
Meridian Pond 4A (SWMM element GA311)				
5888.5	0	11333	0.0	0.0
5889	0.5	15901	0.5	0.0
5890	1.5	34312	1.5	0.11
5891	2.5	52329	2.5	0.51
5892	3.5	64920	3.5	1.06
5893	4.5	70257	4.5	1.73
5894	5.5	75559	5.5	58.1
5895	6.5	79701	6.5	219
5896	7.5	83843	7.5	290
5897	8.5	87985	8.5	337
Meridian Pond 4B (SWMM element GA310)				
5891.5	0	0	0.0	0.0
5892	0.5	348	0.5	3.26
5893	1.5	5730	1.5	16.9
5894	2.5	24126	2.5	36.5
5895	3.5	53961	3.5	60.4
5896	4.5	92234	4.5	75.7
5897	5.5	126509	5.5	118
5898	6.5	146888	6.5	147
5899	7.5	153323	7.5	161
5900	8.5	159889	8.5	173
5901	9.5	166733	9.5	185
5902	10.5	173678	10.5	197
5903	11.5	180632	11.5	207
5904	12.5	187664	12.5	217
5905	13.5	194696	13.5	452
5906	14.5	201728	14.5	677
Meridian Pond 4C (SWMM element GA309)				
5917	0	10	0	0.00
5918	1	2120	1	9.22
5919	2	15960	2	26.1
5920	3	33760	3	55.3
5921	4	42906	4	94.6
5922	5	51523	5	160
5923	6	60321	6	258
5924	7	78033	7	268
5925	8	184401	8	278
5926	9	190000	9	437
5927	10	195600	10	711

Storage Curve			Outlet Curve	
Elevation (ft)	Stage (ft)	Area (sq ft)	Stage (ft)	Discharge (cfs)
Stepping Stone Pond D1 (SWMM element GV301)				
6007.5	0	10	0.0	0.0
6008	0.5	2672	0.5	1.3
6009	1.5	13483	1.5	13.20
6010	2.5	27296	2.5	30.90
6011	3.5	44579	3.5	52.20
6012	4.5	66756	4.5	71.20
6013	5.5	76808	5.5	86.4
6014	6.5	86899	6.5	99
6015	7.5	96990	7.5	151
6016	8.5	107081	8.5	484
Stepping Stone Pond D3 (SWMM element GV302)				
5973.5	0	76487	0.0	0.0
5974	0.5	114069	0.5	0.21
5975	1.5	122270	1.5	0.5
5976	2.5	131136	2.5	13.7
5977	3.5	138533	3.5	87.0
5978	4.5	147406	4.5	193.8
5979	5.5	157864	5.5	207
5980	6.5	167217	6.5	220
5981	7.5	176570	7.5	390
5982	8.5	185923	8.5	915
5983	9.5	195276	9.5	1677

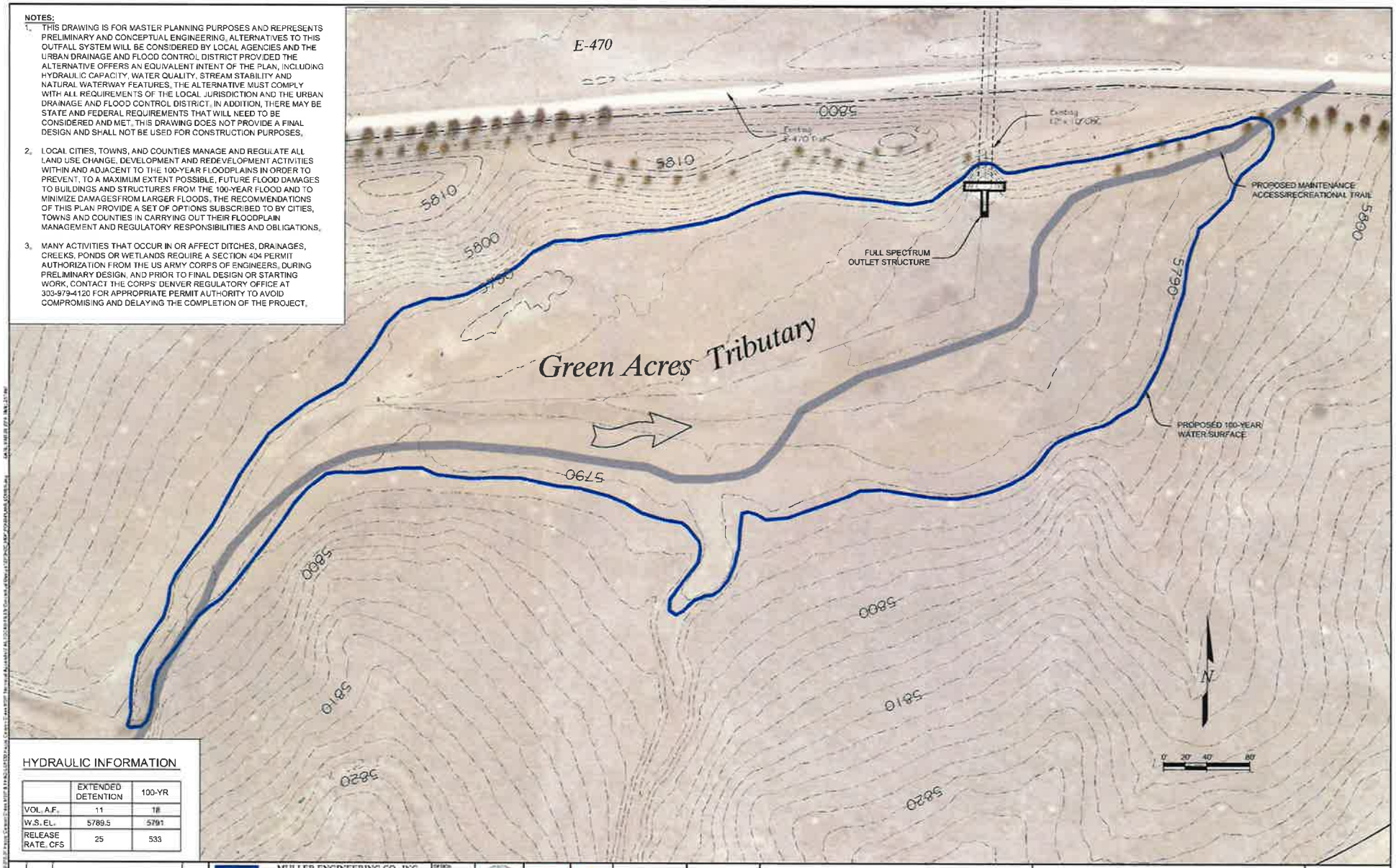
SWMM Node	Station (ft)	Channel Reach	Landmark	Design Storm	EXISTING DEVELOPMENT 500-YR (cfs)	100-YR (cfs)	50-YR (cfs)	25-YR (cfs)	10-YR (cfs)	5-YR (cfs)	2-YR (cfs)	FUTURE DEVELOPMENT 500-YR (cfs)	100-YR (cfs)	50-YR (cfs)	25-YR (cfs)	10-YR (cfs)	5-YR (cfs)	2-YR (cfs)
HC124				2-hr	75	52	38	28	13	7	0.8	154	119	101	85	59	50	31
HC123				2-hr	116	82	61	45	20	11	1.4	235	183	155	131	93	78	49
HC122				2-hr	54	38	29	21	9	5	0.5	99	76	63	52	35	28	16
HC119				2-hr	195	136	101	74	31	16	1.0	276	200	157	122	66	45	18
HC117				2-hr	294	205	155	114	49	25	1.5	328	231	177	133	62	36	6
HC116				2-hr	141	99	75	56	25	13	0.8	173	124	96	74	37	24	6
HC104				2-hr	417	304	244	193	115	82	36	417	304	244	193	115	82	36
HC103				2-hr	371	279	231	187	126	97	52	371	279	231	187	126	97	52
GREEN ACRES TRIBUTARY																		
GA999	70000		Confluence w/ Happy Canyon	2-hr	1249	882	667	507	253	165	69	1874	1446	1182	986	669	545	317
GA012	71400			2-hr	1193	844	640	488	257	169	70	1780	1377	1125	940	640	521	304
GA011	73700		Chambers Road	2-hr	1041	740	563	434	240	166	73	1543	1199	979	819	559	454	265
GA010	76300		Compark Boulevard	2-hr	819	580	431	332	191	158	64	1253	976	800	667	454	367	213
GA009	77200		E-470 (D/S)	2-hr	703	495	368	293	187	176	86	1106	861	710	589	396	320	200
GA008	77700		E-470 (U/S) / E-470 Pond Outflow	2-hr	594	420	332	269	171	141	70	891	688	567	470	319	249	144
GA350	77700		E-470 Pond Inflow	2-hr	600	422	332	270	171	115	47	961	725	586	479	319	250	144
GA007	79200			2-hr	481	355	287	240	159	110	46	680	522	430	357	287	229	118
GA006	82600		NW Corner of Grandview Estates (approx.)	2-hr	423	320	265	228	158	114	50	592	457	383	322	267	218	115
GA005	84600			2-hr	378	288	247	217	157	115	51	475	385	335	297	241	201	111
GA004	86000		Peoria Street / Meridian Pond 4A Outflow	2-hr	303	212	193	176	137	106	50	332	224	207	193	164	141	81
GA311	86000		Meridian Pond 4A Inflow	2-hr	326	213	194	178	139	111	65	383	226	208	194	166	143	87
GA003	86600		Meridian Pond 4B Outflow	2-hr	308	201	182	165	132	106	63	357	212	195	178	151	132	80
GA310	86600		Meridian Pond 4B Inflow	2-hr	580	420	324	303	203	155	79	617	477	366	335	256	204	112
GA002	87000		Mt Belford Avenue / Meridian Pond 4C Outflow	2-hr	519	361	276	264	182	141	74	559	394	301	271	212	169	92
GA309	87000		Meridian Pond 4C Inflow	2-hr	662	499	410	334	215	169	91	709	540	450	371	249	202	115
GA001	89600		Lincoln Avenue	2-hr	261	197	162	133	87	69	39	299	232	196	165	116	98	61
STONEGATE TRIBUTARY																		
SG999	90000		Confluence w/ Happy Canyon	2-hr	186	131	98	75	46	36	22	201	143	110	92	62	51	32
SG003	94500		Chambers Reservoir WQ Pond Outflow	2-hr	74	65	50	36	16	4	3	127	69	61	42	18	6	3
SG320	94500		Chambers Reservoir WQ Pond Inflow	2-hr	191	139	109	86	47	33	17	191	140	109	86	47	34	17
SG002	97500		Lincoln Avenue	2-hr	85	64	52	43	27	21	12	96	66	53	44	28	22	13
SG001	97300		Stonegate Pond Outflow	2-hr	35	21	9	4	2	1.0	0.2	45	41	35	26	11	5	2
SG310	97300		Stonegate Pond Inflow	2-hr	89	62	45	33	15	7	0.5	167	126	103	84	54	43	23
GRANDVIEW TRIBUTARY																		
GV999	110000		Confluence w/ Happy Canyon	2-hr	602	394	277	215	123	76	30	846	629	482	374	221	163	96
GV004	112900		Lincoln Avenue	2-hr	561	364	269	207	104	68	27	811	604	463	359	214	169	93
GV003	116500		Meridian Filing No. 7 / Sierra Ridge Boundary	2-hr	448	290	209	165	94	68	32	620	475	365	284	173	129	74
GV002	120100		Main Street / Stepping Stone Pond D3 Outflow	2-hr	194	133	90	58	9	0	0	219	198	169	136	85	60	13
GV302	120100		Stepping Stone Pond D3 Inflow	2-hr	286	210	165	127	61	35	5	431	337	287	241	166	136	80
GV001	121200		Stepping Stone Pond D1 Outflow	2-hr	97	78	64	51	25	14	1	200	119	94	84	65	57	36
GV301	121200		Stepping Stone Pond D1 Inflow	2-hr	182	128	98	73	33	18	1	327	249	208	172	119	96	55

NOTES:

1. THIS DRAWING IS FOR MASTER PLANNING PURPOSES AND REPRESENTS PRELIMINARY AND CONCEPTUAL ENGINEERING. ALTERNATIVES TO THIS OUTFALL SYSTEM WILL BE CONSIDERED BY LOCAL AGENCIES AND THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PROVIDED THE ALTERNATIVE OFFERS AN EQUIVALENT INTENT OF THE PLAN, INCLUDING HYDRAULIC CAPACITY, WATER QUALITY, STREAM STABILITY AND NATURAL WATERWAY FEATURES. THE ALTERNATIVE MUST COMPLY WITH ALL REQUIREMENTS OF THE LOCAL JURISDICTION AND THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT. IN ADDITION, THERE MAY BE STATE AND FEDERAL REQUIREMENTS THAT WILL NEED TO BE CONSIDERED AND MET. THIS DRAWING DOES NOT PROVIDE A FINAL DESIGN AND SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.

2. LOCAL CITIES, TOWNS, AND COUNTIES MANAGE AND REGULATE ALL LAND USE CHANGE, DEVELOPMENT AND REDEVELOPMENT ACTIVITIES WITHIN AND ADJACENT TO THE 100-YEAR FLOODPLAINS IN ORDER TO PREVENT, TO A MAXIMUM EXTENT POSSIBLE, FUTURE FLOOD DAMAGES TO BUILDINGS AND STRUCTURES FROM THE 100-YEAR FLOOD AND TO MINIMIZE DAMAGESFROM LARGER FLOODS. THE RECOMMENDATIONS OF THIS PLAN PROVIDE A SET OF OPTIONS SUBSCRIBED TO BY CITIES, TOWNS AND COUNTIES IN CARRYING OUT THEIR FLOODPLAIN MANAGEMENT AND REGULATORY RESPONSIBILITIES AND OBLIGATIONS.

3. MANY ACTIVITIES THAT OCCUR IN OR AFFECT DITCHES, DRAINAGES, CREEKS, PONDS OR WETLANDS REQUIRE A SECTION 404 PERMIT AUTHORIZATION FROM THE US ARMY CORPS OF ENGINEERS. DURING PRELIMINARY DESIGN, AND PRIOR TO FINAL DESIGN OR STARTING WORK, CONTACT THE CORPS' DENVER REGULATORY OFFICE AT 303-979-4120 FOR APPROPRIATE PERMIT AUTHORITY TO AVOID COMPROMISING AND DELAYING THE COMPLETION OF THE PROJECT.



HYDRAULIC INFORMATION

	EXTENDED DETENTION	100-YR
VOL. A.F.	11	18
W.S. EL.	5789.5	5791
RELEASE RATE, CFS	25	533

NO.	DATE	REVISIONS	APP'R

MULLER ENGINEERING CO., INC.
CONSULTING ENGINEERS
137 SOUTH WADSWORTH BLVD. A-100
LAKEWOOD, COLORADO
80226 (303) 940-4929

DESIGN: MDC
DRAWN: SAR
CHK'D: JTW

HAPPY CANYON CREEK
MAJOR DRAINAGEWAY PLAN

CONCEPTUAL DESIGN
E-470 POND PLAN

DATE: MARCH 2014
FIGURE NO.: G-4

APPENDIX E

Basin Hydrology & SWMM Update

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016

Basin Hydrology & SWMM Update

A copy of the CUHP and SWMM models associated with the latest Happy Canyon Creek Major Drainageway Plan was obtained from UDFCD. This model was run unedited as a calibration model. The results represented the values shown in the 2014 MDP, prepared by Muller Engineering Company, Inc.

The MDP model included a regional detention pond in the area of the existing natural low area just upstream of the existing 12'x10' RCBC that conveys the Green Acres Tributary under E-470. This model was edited to include the stage/storage pairs obtained from a current topographic survey of existing conditions in this area. Key nodes were compared with the original model. This data can be seen in the attached table.

The model was then revised to include the sizing proposed in the Manhard Consulting design of the regional detention pond. The differences between the inflows at the key nodes were not significant when compared with the original model utilized for the Happy Canyon Creek MDP.

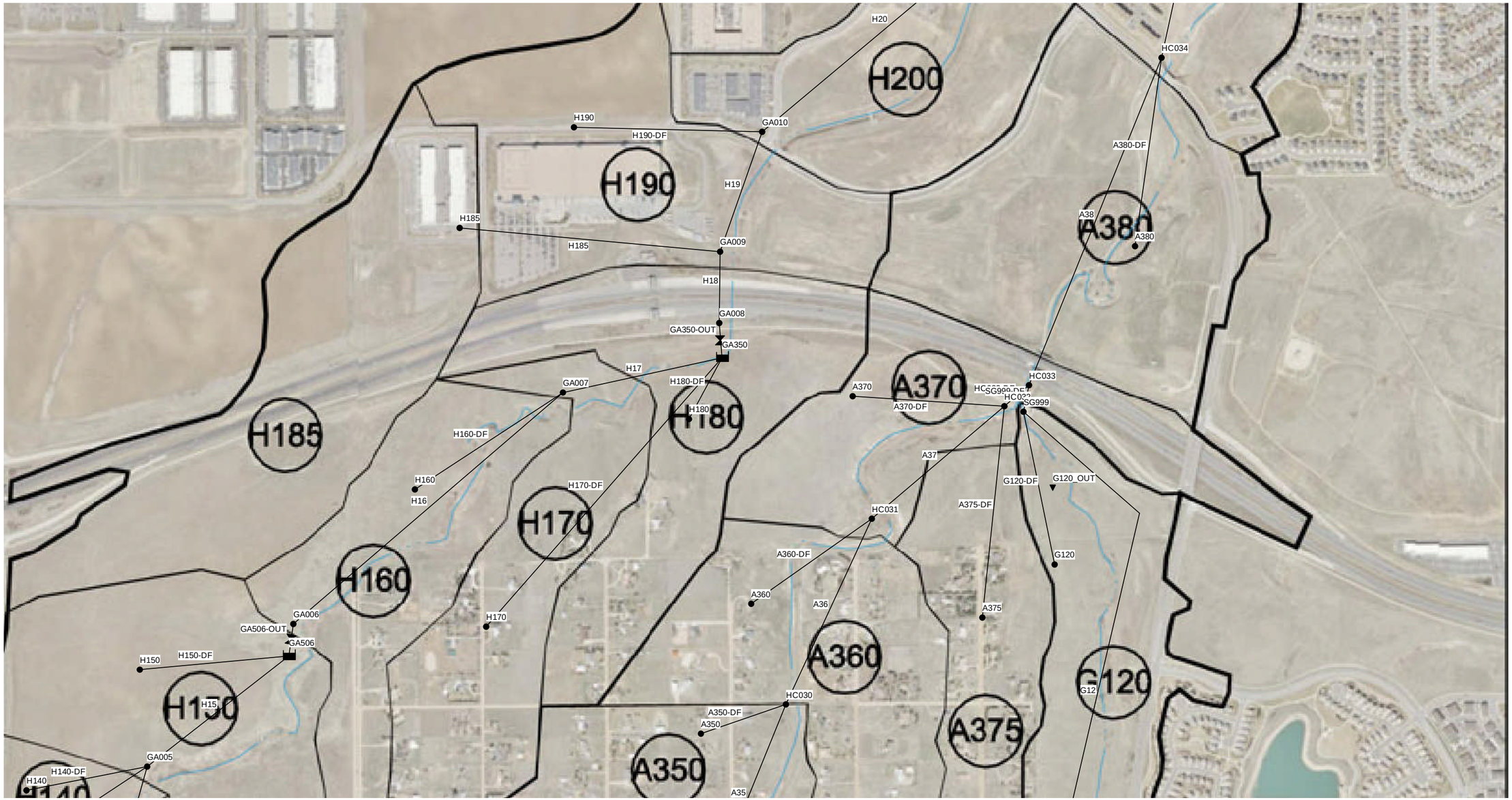
Given the details of the proposed development of Compark South, Manhard Consulting prepared a more detailed delineation of the sub-basin areas in this area. Some of the existing sub-basins included in the 2014 Happy Canyon MDP were also revised per more detailed information currently available. These revised drainage basins were input into the original MDP model as a calibration between the proposed Manhard model and the original MDP model. A comparison of the node inflows at key nodes within the model can be seen in the attached table.

As stated before, Manhard Consulting has re-delineated some of the drainage basins for Green Acres Tributary to better reflect the new development and more accurately evaluate the hydrology for the area. Basin H150 has been expanded to include portions of basin H160 and basin A340 from the 2014 MDP model. Basin H160 was reduced in size and split into two basins, creating a new basin (H161) to coincide with the residential development to the south of Belford Ave. H170 and 180 were split into two basins, creating two new basins (H171 and H181), also to coincide with the residential development to the south of Belford Ave. The northern portions of the original 2014 MDP basins H160, H170, and H180 were combined and now make up a new basin, H182, which includes the detention pond just south of E-470. An even further north portion of the original 2014 MDP basin H180, which includes a stretch of E-470, was combined with a small portion of the 2014 MDP basin A190 to form the new basin H183. Originally, most of this area was shown to be routed through the detention pond to the south of E-470, but based on as-built information obtained from E-470 Public Highway Authority we believe this area actually discharges, undetained, to Green Acres Tributary, just to the north of the box culvert that runs under E-470. Original MDP basins H185 and H190 were each split into two basins, creating two new basins (H186 and H191, respectively).

Once the drainage area basins were revised and the model seemed to represent the original MDP model, the proposed Manhard regional detention pond design criteria and the proposed design of the Green Acres Tributary channel were entered into the model while retaining the original routing of the MDP model. These results can be seen in the attached table. Another model was then run with a new routing network to more accurately show the designed flow paths given the new basin delineation and proposed infrastructure. This model also adds of a portion of Basin A340 (originally tributary to Happy Canyon Creek) to Basin H150. We believe this area will actually be tributary to the Green Acres Tributary. The main difference between the routing of the Manhard model and the MDP model is that basin H183 runoff is routed straight to Node GA010. In the MDP model a large portion of this drainage basin was shown draining to the E-470 pond. However, the portion north of E-470 will not drain south under E-470 to the pond. A final model was run to show the effects of a hypothetical regional detention pond before node GA010 to detain runoff from Basins H185, H186 and H190.

From the attached comparison of model results, it can be concluded that the proposed regional detention pond will meet the recommendations included in the 2014 Happy Canyon Major Drainageway Plan.

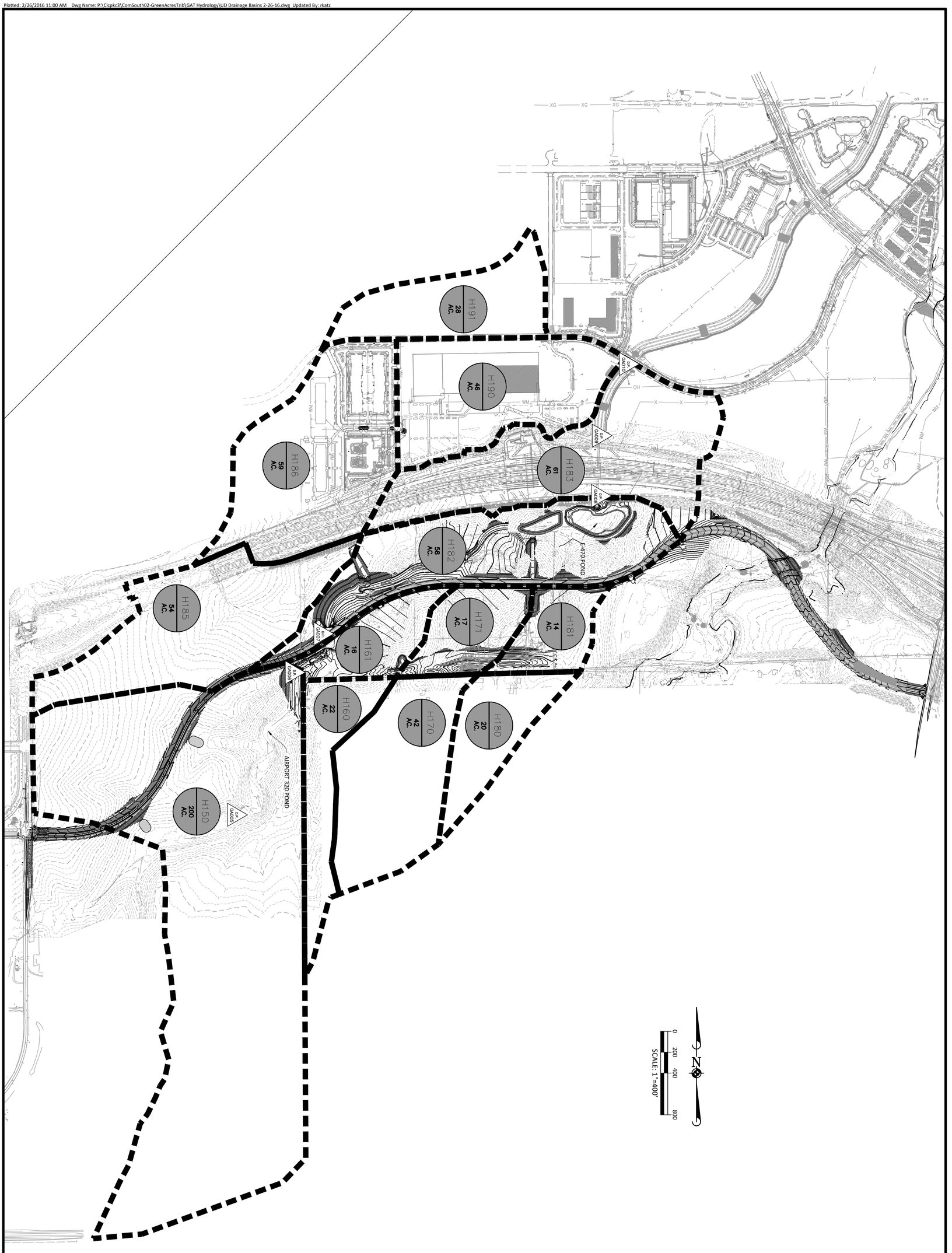
HAPPY CANYON CREEK MDP & FHAD



COMPARK VILLAGE SOUTH

01/01/2005 00:01:00

Plotted: 2/26/2016 11:00 AM Dwg Name: P:\Ckpkc3\ComSouth02-GreenAcresTrib\GAT Hydrology\UD Drainage Basins 2-26-16.dwg Updated By: rkatz



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SHEET 1 OF 1
CLCPKC3

PROJ. MGR.: JBB
PROJ. ENGR.: RAK
DRAWN BY:
DATE: 11-20-15

COLORADO REGISTERED PROFESSIONAL ENGINEER
JOSEPH B. WILLIAMS
30877

COMPARK SOUTH
TOWN OF PARKER, CO
SWMM Model Drainage Area Map

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Civil Engineers • Surveyors • Water Resource Engineers • Water & Wastewater Engineers
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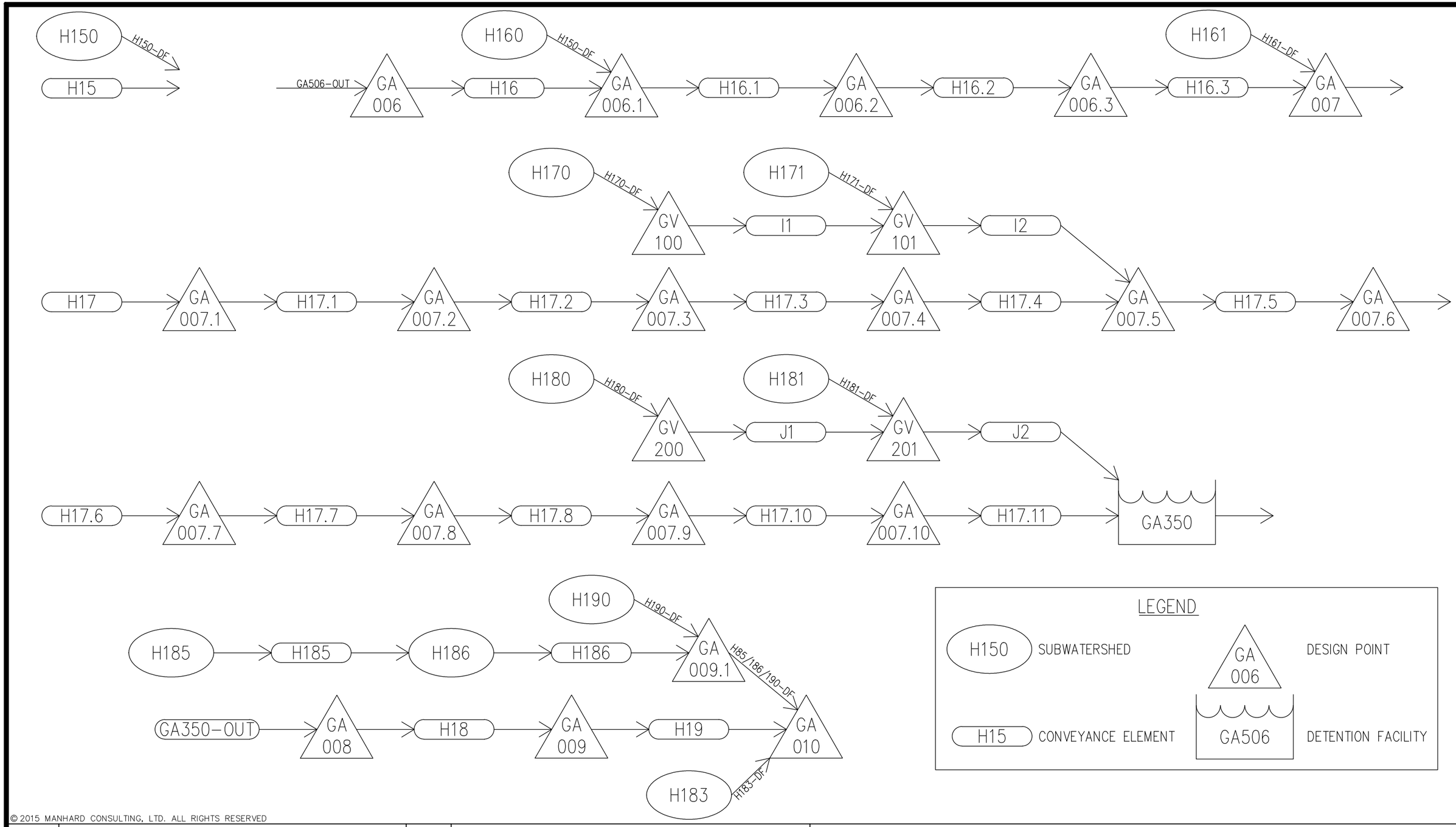
DATE	REVISIONS	DRAWN BY

E-470 Natural Ex. Det Basin
Stage - Discharge

Elevation (ft)	H (ft)	L (ft)	Q_w (cfs)	HW (ft)	TW (ft)	Q_{cul} (cfs)	Q_{rel} (cfs)	Area (sf)	Vol. (AF)
5782.5	0	26	0.0	5782.5	5772.0	0.0	0.0	0	0.00
5783	0.5	26	34.0	5783	5774.1	185.5	34.0	936	0.00
5784	1.5	26	143.3	5784	5774.3	280.0	143.3	9,967	0.11
5785	2.5	28.4	336.8	5785	5774.6	384.4	336.8	24,707	0.50
5786	3.5	30.7	603.1	5786	5775.0	500.0	500.0	41,715	1.25
5787	4.5	32.9	942.2	5787	5775.3	626.3	626.3	68,834	2.51
5788	5.5	35.2	1362.1	5788	5775.6	760.0	760.0	99,020	4.42
5789	6.5	37.4	1859.4	5789	5775.9	902.9	902.9	132,636	7.07
5790	7.5	39.7	2446.3	5790	5776.3	1051.7	1051.7	166,976	10.50
5791	8.5	41.9	3115.0	5791	5776.6	1210.0	1210.0	206,888	14.76
5792	9.5	41.9	3680.6	5792	5776.8	1376.7	1376.7	243,993	19.93
5793	10.5	41.9	-	5793	5777.0	1508.0	1508.0	284,008	25.98
5794	11.5			5794	5777.1	1620.0	1620.0	315,488	32.86
5795	12.5			5795	5777.2	1730.0	1730.0	348,125	40.48
5796	13.5			5796	5777.4	1840.0	1840.0	381,674	48.85

E-470 Proposed Regional FS Pond
Lower Pond Stage - Discharge

Elevation (ft)	WQ H (ft)	Q (cfs) WQ Plate	Q_w H (ft)	Q_w (cfs) 100' Weir @ 5788.5	Q_{BC} H (ft)	Q (cfs) 22.5'x4' RCBC @ 5782.5	Q_{EX} H (ft)	Q (cfs) 12'x10' EX RCBC @5779.78	Q_{rel} (cfs)	Area (sf)	Vol. (AF)	
5786	0.0	0.7			3.5		6.22		0.7	102,775.14	0.00	
5786.5	0.5	1.3			4.0		6.72		1.3	114,436.35	1.25	
5787	1.0	1.9			4.5		7.22		1.9	126,508.10	2.63	
5787.5	1.5	2.5			5.0		7.72		2.5	134,817.54	4.13	
5788	2.0	2.9			5.5		8.22		2.9	143,301.36	5.72	EURV
5788.5	2.5	3.2	0	0.0	6.0	715	8.72	866.2	3.2	150,562.37	7.41	V=7.7 ac-ft
5789	3.0	3.5	0.5	106.1	6.5	770	9.22	942.2	109.6	157,942.05	9.18	El 5788.5
5789.5	3.5	3.8	1	300.0	7.0	825	9.72	1019.4	303.8	167,505.63	11.05	
5790	4.0	4.1	1.5	551.1	7.5	880	10.22	1100.0	555.2	177,254.82	13.03	100 yr
5790.5	4.5	4.3	2	848.5	8.0	936	10.72	1180.7	852.8	185,058.87	15.11	V=13.1 ac-ft
5791	5.0	4.6	2.5	1185.9	8.5	993	11.22	1263.8	993.0	192,974.20	17.28	El 5790.0
5791.5	5.5	4.8	3	1558.9	9.0	1049	11.72	1350.0	1049.0	201,292.94	19.54	
5792	6.0	5.0	3.5	1964.4	9.5	1106	12.22	1414.1	1106.0	209,727.89	21.90	
5792.5	6.5	5.2	4	2400.0	10.0	1163	12.72	1468.1	1163.0	260,781.31	24.59	
5793	7.0	5.4	4.5	2863.8	10.5	1220	13.22	1526.3	1220.0	315,416.45	27.89	
5793.5	7.5	5.6	5	3354.1	11.0	1278	13.72	1595.7	1278.0	323,554.61	31.56	
5794	8.0	5.8	5.5	3869.6	11.5	1333	14.22	1666.2	1333.0	331,761.59	35.32	
5794.5	8.5	6.0	6	4409.1	12.0	1385	14.72	1733.8	1385.0	338,525.13	39.17	
5795	9.0	6.1	6.5	4971.5	12.5	1431	15.22	1800.0	1431.0	345,334.02	43.09	
5795.5	9.5	6.3	7	5556.1	13.0	1475	15.72	1861.0	1475.0	350,826.56	47.09	
5796	10.0	6.5	7.5	6161.9	13.5	1519	16.22	1921.43	1519.0	356,348.00	51.15	



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DATE	REVISIONS	DRAWN BY

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Civil Engineers • Surveyors • Water Resource Engineers • Water & Wastewater Engineers
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AMENDMENT TO "HAPPY CANYON CREEK MAJOR DRAINAGEWAY PLAN, MARCH 2014"

COMPARK SOUTH - PARKER, CO

SWMM SCHEMATIC LOWER TRIBUTARIES

DRAWN BY:	DATE:	SCALE:	CODE:
RAK	4/20/2016	N/A	CLCPKC3

	2014 MDP Basin Delineation		2015 MCL Basin Delineation		Historical Design Flows	
Node ID	UDFCD Original MDP Model, Future Development Includes Construction of Airport 320 Regional Det Pond		MCL Model with New MCL Designed E-470 Pond, Airport 320 Pond (by others), Channels, and Storm Sewer. Basins Rerouted to Accurately Show Flow Paths		LOMR By Others	Downstream Channel Design Plans By Others
	Q_{5yr} Inflow (cfs)	Q_{100yr} Inflow (cfs)	Q_{5yr} Inflow (cfs)	Q_{100yr} Inflow (cfs)		
GA007	240.5	460.1	254.9	485.0		
GA350 (E-470 Pond)	242.4	543.2	267.6	587.9		
GA008 (Pond Outflow)	196.3	533.2	256.2	570.0		
GA009	198.2	602.0	256.1	569.9	724.0	1500.0
GA010	197.8	620.1	395.3	872.6	1189.0	1720.0
HC036	997.0	6737.4	978.0	6736.4		
HC999	992.7	6721.8	974.1	6721.3		

APPENDIX F

Channel & Arch Culvert Hydraulic Design

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016
Revised December 20, 2016

Channel & Arch Culvert Hydraulic Design

The peak runoffs utilized for design of Green Acres Tributary and the E-470 regional detention pond were taken from the "Amendment to Happy Canyon Major Drainageway Plan", prepared by Manhard Consulting, dated February 2016. The peak runoffs utilized considered future development of the drainage basin and no improvements to the existing infrastructure, except for construction of the Airport 320 Pond as referenced in the MDP. The peak runoff during the minor 5 year design storm is 255 cfs to the GAT channel just downstream of the Belford Ave crossing and 268 cfs into the regional detention pond. The peak runoff during the major 100 year design storm is 485 cfs to the GAT channel just downstream of the Belford Ave crossing and 588 cfs to the regional detention pond.

These peak runoffs were utilized to design the proposed channel sections for Green Acres Tributary. The peak runoff for the 5 year storm was utilized for the low flow section of the proposed channel. UDFCD requires the low flow channel be designed to carry at least 2% of the 100 year flow. The peak runoff for the 5 year storm is greater than 2% of the peak 100 year runoff (588 cfs x 2%=11.76 cfs). Therefore the proposed low flow channel will meet the requirements of UDFCD and the Town of Parker.

The peak 100 year storm was utilized for design of the overall capacity of the channel. At least one foot of freeboard is provided between the 100 year flow elevation in the channel and the proposed elevations of the maintenance trail.

The channel will flow through a 28'x11' arch culvert under the proposed Belford Avenue. The channel will consist of a 10' wide x 2.5' deep concrete channel and 10' concrete maintenance trail through the culvert. The trail will slope at 2% toward the channel and will have a 6" curb to separate it from the drainage channel. The curb will contain curb cuts to allow runoff to enter the channel. From the results of the HEC-RAS model, the trail under Belford Avenue will be inundated during 5 yr frequency storms and greater.

See following calculations

GAT Channel 10' Bottom 10' Shelf - 5 yr Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Discharge	255.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	5.20
0+10	2.70
0+20	2.50
0+30	0.00
0+40	0.00
0+50	2.50
0+60	2.70
0+70	5.20

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5.20)	(0+20, 2.50)	0.035
(0+20, 2.50)	(0+60, 2.70)	0.045
(0+60, 2.70)	(0+70, 5.20)	0.035

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	3.24	ft
Elevation Range	0.00 to 5.20 ft	
Flow Area	85.91	ft²

GAT Channel 10' Bottom 10' Shelf - 5 yr Storm

Results

Wetted Perimeter		55.03	ft
Hydraulic Radius		1.56	ft
Top Width		54.28	ft
Normal Depth		3.24	ft
Critical Depth		2.06	ft
Critical Slope		0.02413	ft/ft
Velocity		2.97	ft/s
Velocity Head		0.14	ft
Specific Energy		3.37	ft
Froude Number		0.42	≤ 0.5 ✓
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.24	ft
Critical Depth	2.06	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.02413	ft/ft

GAT Channel 10' Bottom 10' Shelf - 100 yr Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Discharge	485.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	5.20
0+10	2.70
0+20	2.50
0+30	0.00
0+40	0.00
0+50	2.50
0+60	2.70
0+70	5.20

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5.20)	(0+20, 2.50)	0.035
(0+20, 2.50)	(0+60, 2.70)	0.045
(0+60, 2.70)	(0+70, 5.20)	0.035

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	4.02	ft
Elevation Range	0.00 to 5.20 ft	
Flow Area	130.70	ft²

GAT Channel 10' Bottom 10' Shelf - 100 yr Storm

Results

Wetted Perimeter		61.47	ft
Hydraulic Radius		2.13	ft
Top Width		60.52	ft
Normal Depth		4.02	ft
Critical Depth		2.98	ft
Critical Slope		0.02331	ft/ft
Velocity		3.71	ft/s
Velocity Head		0.21	ft
Specific Energy		4.23	ft
Froude Number		0.45	≤ 0.5 ✓
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.02	ft
Critical Depth	2.98	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.02331	ft/ft

GAT Section Through Belford Ave Arch Culvert - 5 yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00500	ft/ft
Discharge	255.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	11.00
0+00	2.56
0+03	2.50
0+03	0.00
0+13	0.00
0+13	2.50
0+16	2.80
0+26	3.00
0+29	3.06
0+29	11.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 11.00)	(0+03, 2.50)	0.013
(0+03, 2.50)	(0+26, 3.00)	0.013
(0+26, 3.00)	(0+29, 11.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	2.32	ft

GAT Section Through Belford Ave Arch Culvert - 5 yr

Results

Elevation Range	0.00 to 11.00 ft		
Flow Area		23.20	ft²
Wetted Perimeter		14.63	ft
Hydraulic Radius		1.59	ft
Top Width		10.01	ft
Normal Depth		2.32	ft
Critical Depth		3.19	ft
Critical Slope		0.00284	ft/ft
Velocity		10.99	ft/s
Velocity Head		1.88	ft
Specific Energy		4.20	ft
Froude Number		1.27	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.32	ft
Critical Depth	3.19	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00284	ft/ft

GAT Section Through Belford Arch Culvert - 100 yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00500	ft/ft
Discharge	485.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	11.00
0+00	2.56
0+03	2.50
0+03	0.00
0+13	0.00
0+13	2.50
0+16	2.80
0+26	3.00
0+29	3.06
0+29	11.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 11.00)	(0+03, 2.50)	0.013
(0+03, 2.50)	(0+26, 3.00)	0.013
(0+26, 3.00)	(0+29, 11.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	3.53	ft

GAT Section Through Belford Arch Culvert - 100 yr

Results

Elevation Range	0.00 to 11.00 ft		
Flow Area		48.60	ft²
Wetted Perimeter		35.42	ft
Hydraulic Radius		1.37	ft
Top Width		28.99	ft
Normal Depth		3.53	ft
Critical Depth		3.91	ft
Critical Slope		0.00260	ft/ft
Velocity		9.98	ft/s
Velocity Head		1.55	ft
Specific Energy		5.07	ft
Froude Number		1.36	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.53	ft
Critical Depth	3.91	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00260	ft/ft

MANHARD CONSULTING LTD.

Engineers
Surveyors
Planners

PROJECT Compark South
DATE 3/18/16
BY ASD
SHEET ____ OF ____

ROCK SIZING CALCS

DROP # 1

Total Drop 5'
CREST STA. 112 + 24.52
FROM HEC RAS
$V_c = 7.29$ ft/s

EG $S = 0.015657$ Actual $S = 0.17$
$S_G = 2.55$ $R_p = 4.0$

$$R_p = \frac{VS^{0.17}}{(S_G - 1)^{0.66}} = \frac{(7.29)(0.016)^{0.17}}{(2.55-1)^{0.66}} = \frac{3.61}{1.34} = 2.69$$

UDFCD TABLE 9-4: MIN BOULDER SIZE = B18

DROP # 1A

TOTAL DROP 4'
CREST STA. 110 + 74.83
FROM HEC RAS
$V_c = 7.71$ ft/s

EG $S = 0.061254$ Actual $S = 0.14$
$S_G = 2.55$ $R_p = 4.1$

$$R_p = \frac{(7.71)(0.061)^{0.17}}{(2.55-1)^{0.66}} = 3.59$$

UDFCD TABLE 9-4: MIN BOULDER SIZE = B18

MANHARD CONSULTING LTD.

Engineers
Surveyors
Planners

PROJECT COMPARK SOUTH
DATE 3/18/16
BY ASD
SHEET ____ OF ____

DROP #2

Total Drop 5.5'
CREST STA: 103+00
FROM HEC RAS
$V_c = 6.31$ ft/s

EG $S = 0.034392$
$S_G = 2.55$

Actual $S = 0.28$
$R_p = 3.8$

$$R_p = \frac{(6.31)(0.034)^{0.17}}{(2.55-1)^{0.66}} = 2.66$$

UDFCD TABLE 9-4: MIN BOULDER SIZE = B18

DROP #3

Total Drop 6'
CREST STA: 92+33.34
FROM HEC-RAS
$V_c = 5.58$ ft/s

EG $S = 0.029682$
$S_G = 2.55$

Actual $S = 0.30$
$R_p = 3.4$

$$R_p = \frac{(5.58)(0.030)^{0.17}}{(2.55-1)^{0.66}} = 2.3$$

UDFCD TABLE 9-4: MIN BOULDER SIZE = B18

MANHARD CONSULTING LTD.

Engineers
Surveyors
Planners

PROJECT Compark South
DATE 3/18/16
BY ASD
SHEET ____ OF ____

DROP #4

TOTAL DROP 9.5'
CREST STA. 86+50
FROM HEC-RAS
$V = 7.74$ ft/s

EG $S = 0.014865$
$S_G = 2.55$

Actual $S = 0.12$
$R_p = 4.0$

$$R_p = \frac{(7.74)(0.015)^{0.17}}{(2.55-1)^{0.66}} = 2.84$$

UDFCD TABLE 9-4 : MIN BOULDER SIZE = B18

DROP #5

TOTAL DROP 7'
CREST STA. 81+19.18
FROM HEC-RAS
$V = 6.06$ ft/s

EG $S = 0.073454$
$S_G = 2.55$

Actual $S = 0.091$
$R_p = 3.0$

$$R_p = \frac{(6.06)(0.073)^{0.17}}{(2.55-1)^{0.66}} = 2.91$$

UDFCD TABLE 9-4 : MIN BOULDER SIZE = B18

Table 9-4. Boulder sizes for various rock sizing parameters

Rock Sizing Parameter, R_p	Grouted Boulders [1]
	Boulder Classification [2]
Less than 4.50	B18
4.50 to 4.99	B18
5.00 to 5.59	B24
5.60 to 6.99	B36
7.00 to 8.00	B48

[1] Grouted to no less than $^1/_3$ the height (+1"/- 0"), no more than $^1/_2$ (+0"/- 1") of boulder height.
[2] See *Open Channels* chapter.

Grout
Grout all boulders to a depth of one-half their height through the approach, sloping face, and basin areas. Grout should extend near full depth of the rock at the upstream crest and around the perimeter of the structure where it is adjoining the earth in order to provide stability of the approach channel. See Figure 9-15 for grout placement and material specifications.

Edge Wall
A wall should be constructed that extends roughly 3 feet below the top surface of the structure around the entire perimeter of the GSB drop structure. See Figure 9-22 for an edge wall detail. An edge wall is especially necessary for structures designed to convey less than the 100-year flow but is also beneficial for structures that do span the 100-year flow. The transition between soil and the grouted boulders can become a problem if not properly addressed during design and construction. Ensure compaction around the perimeter of the structure and grade this area higher than the structure to promote sheet flow onto the structure. In addition to the edge wall, in most cases it is recommended that buried riprap be installed around the perimeter of the structure to reduce the potential for erosion.

Additional Design Guidance
Grouted boulders must cover the crest and cutoff and extend downstream through the stilling basin (when applicable), or through the embedded toe of the drop structure when a stilling basin is not included. Place boulders to create a stepped appearance, which helps to increase roughness. Requirements for the riprap and boulders are specified in the *Open Channels* chapter.

2.6.4 Construction Guidance

Grouted boulder drop structures require significant construction oversight. During placement of the rock and construction in general, disturb the subgrade as little as possible to reduce the potential for piping under the structure. Good subgrade preparation, careful rock placement, and removal of loose materials will reduce potential piping. Absolutely no granular bedding (or subgrade fill using granular materials)

8.1 Riprap Sizing

Procedures for sizing rock to be used in soil riprap, void-filled riprap, and riprap over bedding are the same.

8.1.1 Mild Slope Conditions

When subcritical flow conditions occur and/or slopes are mild (less than 2 percent), UDFCD recommends the following equation (Hughes, et al, 1983):

$$d_{50} \geq \left[\frac{VS^{0.17}}{4.5(G_s - 1)^{0.66}} \right]^2 \qquad \text{Equation 8-11}$$

Where:

V = mean channel velocity (ft/sec)

S = longitudinal channel slope (ft/ft)

d_{50} = mean rock size (ft)

Gs = specific gravity of stone (minimum = 2.50, typically 2.5 to 2.7), Note: In this equation (Gs -1) considers the buoyancy of the water, in that the specific gravity of water is subtracted from the specific gravity of the rock.

Note that Equation 8-11 is applicable for sizing riprap for channel lining with a longitudinal slope of no more than 2%. This equation is not intended for use in sizing riprap for steep slopes (typically in excess of 2 percent), rundowns, or protection downstream of culverts. Information on rundowns is provided in Section 7.0 of the *Hydraulic Structures* chapter of the USDCM, and protection downstream of culverts is discussed in the *Culverts and Bridges* chapter. For channel slopes greater than 2% use one of the methods presented in 8.1.2.

Rock size does not need to be increased for steeper channel side slopes, provided the side slopes are no steeper than 2.5H:1V (UDFCD 1982). Channel side slopes steeper than 2.5H:1V are not recommended because of stability, safety, and maintenance considerations. See Figure 8-34 for riprap placement specifications. At the upstream and downstream termination of a riprap lining, the thickness should be increased 50% for at least 3 feet to prevent undercutting.

8.1.2 Steep Slope Conditions

Steep slope rock sizing equations are used for applications where the slope is greater than 2 percent and/or flows are in the supercritical flow regime. The following rock sizing equations may be referred to for riprap design analysis on steep slopes:

- CSU Equation, *Development of Riprap Design Criteria by Riprap Testing in Flumes: Phase II* (prepared by S.R. Abt, et al, Colorado State University, 1988). This method was developed for steep slopes from 2 to 20 percent.

- USDA- Agricultural Research Service Equations, *Design of Rock Chutes* (by K.M. Robinson, et al, USDA- ARS, 1998 Transactions of ASAE) and *An Excel Program to Design Rock Chutes for Grade*

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VF RIP RAP SIZING DROP 1A → 1B

UDFCD EQN 8-11

$$d_{50} \geq \left[\frac{V S^{0.17}}{4.5 (G_s - 1)^{0.66}} \right]^2$$

$V_{100} = 5.2$ ft/s

$S = 0.027$

$G_s = 2.5$

$$d_{50} \geq \left[\frac{5.2 (0.027)^{0.17}}{4.5 (2.5-1)^{0.66}} \right]^2 \geq 0.23' = 2.75''$$

USE $d_{50} = 6''$ TYPE VL

SOIL FILLED RIP RAP UPSTREAM / DOWNSTREAM DROP 1A + 1B

STA 112+24 UPSTREAM 1A $V_{100} = 6.85$, $S = 0.5\%$ ←
STA 110+40 DOWNSTREAM 1B $V_{100} = 3.60$, $S = 0.55\%$

$$d_{50} \geq \left[\frac{6.85 (0.005)^{0.17}}{4.5 (2.5-1)^{0.66}} \right]^2 \geq 0.22' = 2.69''$$

USE $d_{50} = 6''$ TYPE VL

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SF RIP RAP UPSTREAM / DOWNSTREAM DROP 2

STA 103+00 UPSTREAM V_{100} = 5.53 ft/s, S = 0.2% ←
STA 102+16 DOWNSTREAM V_{100} = 4.69 ft/s, S = 0.4%

$$d_{50} \geq \left[\frac{5.53\,(0.002)^{0.17}}{4.5\,(2.5-1)^{0.66}}\right]^2 \geq 0.11' = 1.3''$$

USE 6" TYPE VL

SF RIP RAP UPSTREAM / DOWNSTREAM DROP 3

STA 92+50 UPSTREAM V_{100} = 7.11 ft/s, S = 0.4%
STA 91+36 DOWNSTREAM V_{100} = 3.93 ft/s, S = 0.3%

$$d_{50} \geq \left[\frac{7.11\,(0.004)^{0.17}}{4.5\,(2.5-1)^{0.66}}\right]^2 \geq 0.22' = 2.7''$$

USE d_{50} = 6" TYPE VL

SF RIPRAP UPSTREAM DROP 4

STA 86+50 V_{100} = 7.41 ft/s, S = 0.4%

$$d_{50} \geq \left[\frac{7.41\,(0.004)^{0.17}}{4.5\,(2.5-1)^{0.66}}\right]^2 \geq 0.24' = 2.9''$$

USE d_{50} = 6" TYPE VL

Plan: Plan 01 02-CL ALIGNMENT- 02-CL ALIGNMENT- RS: 10177.34 Culv Group: Culvert #1 Profile: 100 YR STORM

Q Culv Group (cfs)	588.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	9.82
Q Barrel (cfs)	588.00	Culv Vel DS (ft/s)	11.11
E.G. US. (ft)	5823.49	Culv Inv El Up (ft)	5818.25
W.S. US. (ft)	5823.33	Culv Inv El Dn (ft)	5818.00
E.G. DS (ft)	5821.93	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	5821.15	Culv Exit Loss (ft)	0.64
Delta EG (ft)	1.56	Culv Entr Loss (ft)	0.75
Delta WS (ft)	2.18	Q Weir (cfs)	
E.G. IC (ft)	5823.04	Weir Sta Lft (ft)	
E.G. OC (ft)	5823.49	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	5821.25	Weir Max Depth (ft)	
Culv WS Outlet (ft)	5820.65	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.45	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.99	Min El Weir Flow (ft)	5832.01

Plan: Plan 01 02-CL ALIGNMENT- 02-CL ALIGNMENT- RS: 9116.3 Culv Group: Culvert #1 Profile: 100 YR STORM

Q Culv Group (cfs)	588.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	9.82
Q Barrel (cfs)	588.00	Culv Vel DS (ft/s)	12.39
E.G. US. (ft)	5811.24	Culv Inv El Up (ft)	5806.00
W.S. US. (ft)	5811.11	Culv Inv El Dn (ft)	5805.50
E.G. DS (ft)	5808.89	Culv Frctn Ls (ft)	0.00
W.S. DS (ft)	5808.59	Culv Exit Loss (ft)	1.37
Delta EG (ft)	2.35	Culv Entr Loss (ft)	0.75
Delta WS (ft)	2.52	Q Weir (cfs)	
E.G. IC (ft)	5810.78	Weir Sta Lft (ft)	
E.G. OC (ft)	5811.24	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	5809.00	Weir Max Depth (ft)	
Culv WS Outlet (ft)	5807.87	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.98	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.99	Min El Weir Flow (ft)	5820.01

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Rock Sizing For Boulder Outfalls

Arch Culvert Belford Ave Sta. 107+69, Total Drop = 0'

$V = 9.98$ ft/s, $S = 0.2\%$

$$R_p = \frac{V S^{0.17}}{(S_s - 1)^{0.66}} = \frac{10(0.002)^{.17}}{(2.55-1)^{0.66}} = 2.6$$

UDFCD Table 9-4: Min Boulder Size B18

Future Box Culvert Sta 101+20, Total Drop 2'

$$R_p = \frac{V S^{0.17}}{(S_s - 1)^{0.66}}$$

From HEC-RAS
$V = 11.11$ ft/s
$S_s = 2.55$
$S = 0.2$ ft/ft

$$R_p = \frac{(11.11)(0.2)^{0.17}}{(2.55-1)^{0.66}} = 6.33$$

UDFCD Table 9-4: Min Boulder Size B36

Future Box Culvert Sta 90+61, Total Drop 2'

From HEC-RAS
$V = 12.39$ ft/s
$S_s = 2.55$
$S = 0.2$ ft/ft

$$R_p = \frac{V S^{0.17}}{(S_s - 1)^{0.66}}$$

$$R_p = \frac{(12.39)(0.2)^{0.17}}{(2.55-1)^{0.66}} = 7.06$$

UDFCD Table 9-4: Min Boulder Size B36

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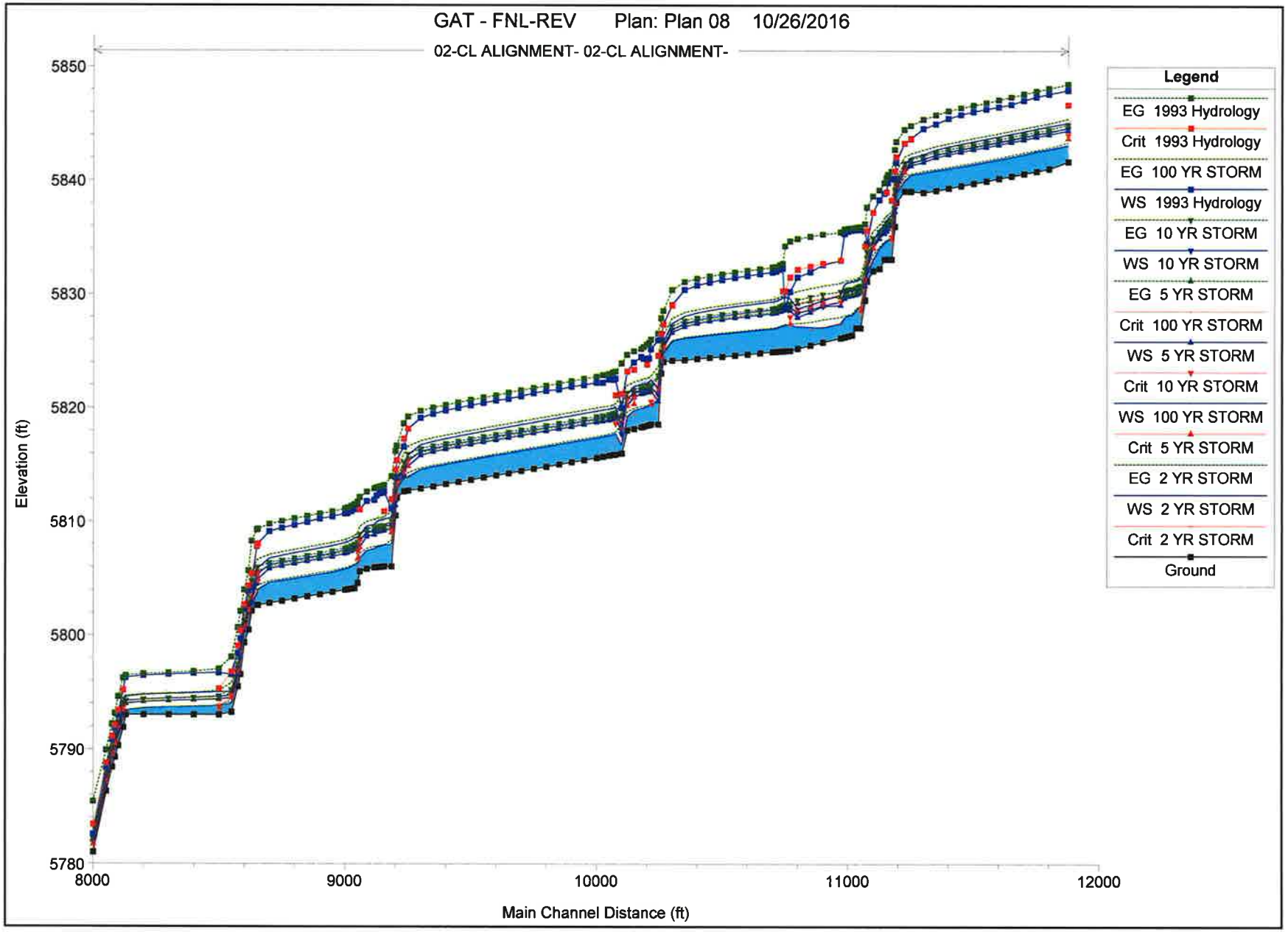
FROM VDFCD Chapter 8, Sec. 4.4

MINIMUM RADIUS OF CURVATURE = $2.3\ W_{bf}$

GAT BANK FULL WIDTH W_{bf} = 30'

MIN RADIUS = 2.3 (30') = 69'

MIN. DESIGN RADIUS = 100' OK


GAT - FNL-REV Plan: Plan 08 10/26/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Elevation (ft)
5850
5840
5830
5820
5810
5800
5790
5780
8000
9000
10000
11000
12000
Main Channel Distance (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
EG 100 YR STORM
WS 1993 Hydrology
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
WS 100 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
Ground

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT-

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	11876	2 YR STORM	88.00	5841.61	5843.05	5842.75	5843.28	0.008101	3.89	22.62	21.66	0.67	0.52
02-CL ALIGNMENT-	11876	5 YR STORM	255.00	5841.61	5844.35	5843.67	5844.63	0.007893	4.22	60.38	50.31	0.68	0.58
02-CL ALIGNMENT-	11876	10 YR STORM	324.00	5841.61	5844.58	5843.94	5844.89	0.007479	4.51	71.79	51.96	0.68	0.64
02-CL ALIGNMENT-	11876	100 YR STORM	485.00	5841.61	5845.03	5844.59	5845.43	0.006887	5.04	96.18	55.33	0.67	0.74
02-CL ALIGNMENT-	11800	2 YR STORM	88.00	5840.97	5842.70		5842.84	0.003925	3.01	29.21	23.81	0.48	0.30
02-CL ALIGNMENT-	11800	5 YR STORM	255.00	5840.97	5844.00		5844.18	0.004083	3.41	74.75	52.29	0.50	0.36
02-CL ALIGNMENT-	11800	10 YR STORM	324.00	5840.97	5844.24		5844.45	0.004099	3.71	87.30	53.94	0.51	0.41
02-CL ALIGNMENT-	11800	100 YR STORM	485.00	5840.97	5844.71		5844.99	0.004140	4.27	113.60	57.22	0.53	0.51
02-CL ALIGNMENT-	11750	2 YR STORM	88.00	5840.76	5842.51		5842.65	0.003702	2.95	29.83	24.02	0.47	0.28
02-CL ALIGNMENT-	11750	5 YR STORM	255.00	5840.76	5843.80		5843.98	0.003991	3.38	75.38	52.51	0.50	0.35
02-CL ALIGNMENT-	11750	10 YR STORM	324.00	5840.76	5844.04		5844.25	0.004035	3.69	87.92	54.28	0.51	0.40
02-CL ALIGNMENT-	11750	100 YR STORM	485.00	5840.76	5844.51		5844.79	0.004112	4.24	114.27	57.81	0.53	0.50
02-CL ALIGNMENT-	11700	2 YR STORM	88.00	5840.55	5842.25		5842.42	0.005435	3.37	26.12	22.73	0.55	0.38
02-CL ALIGNMENT-	11700	5 YR STORM	255.00	5840.55	5843.56		5843.76	0.004847	3.59	71.11	52.28	0.54	0.40
02-CL ALIGNMENT-	11700	10 YR STORM	324.00	5840.55	5843.79		5844.02	0.004784	3.88	83.54	54.05	0.55	0.45
02-CL ALIGNMENT-	11700	100 YR STORM	485.00	5840.55	5844.26		5844.56	0.004700	4.42	109.79	57.60	0.56	0.55
02-CL ALIGNMENT-	11650	2 YR STORM	88.00	5840.33	5842.02		5842.17	0.004248	3.10	28.39	23.53	0.50	0.31
02-CL ALIGNMENT-	11650	5 YR STORM	255.00	5840.33	5843.34		5843.52	0.004287	3.46	73.68	52.33	0.51	0.37
02-CL ALIGNMENT-	11650	10 YR STORM	324.00	5840.33	5843.57		5843.79	0.004293	3.76	86.20	54.12	0.53	0.42
02-CL ALIGNMENT-	11650	100 YR STORM	485.00	5840.33	5844.05		5844.33	0.004305	4.31	112.63	57.72	0.54	0.52
02-CL ALIGNMENT-	11600	2 YR STORM	88.00	5840.12	5841.81		5841.96	0.004252	3.10	28.39	23.55	0.50	0.31
02-CL ALIGNMENT-	11600	5 YR STORM	255.00	5840.12	5843.12		5843.31	0.004297	3.46	73.63	52.34	0.51	0.37
02-CL ALIGNMENT-	11600	10 YR STORM	324.00	5840.12	5843.36		5843.58	0.004301	3.76	86.16	54.14	0.53	0.42
02-CL ALIGNMENT-	11600	100 YR STORM	485.00	5840.12	5843.83		5844.12	0.004324	4.31	112.49	57.73	0.54	0.52
02-CL ALIGNMENT-	11550	2 YR STORM	88.00	5839.90	5841.60		5841.75	0.004164	3.08	28.60	23.60	0.49	0.31
02-CL ALIGNMENT-	11550	5 YR STORM	255.00	5839.90	5842.91		5843.10	0.004280	3.46	73.72	52.34	0.51	0.37
02-CL ALIGNMENT-	11550	10 YR STORM	324.00	5839.90	5843.14		5843.36	0.004292	3.76	86.22	54.15	0.52	0.42
02-CL ALIGNMENT-	11550	100 YR STORM	485.00	5839.90	5843.61		5843.90	0.004332	4.31	112.45	57.76	0.54	0.52
02-CL ALIGNMENT-	11500	2 YR STORM	88.00	5839.69	5841.40		5841.54	0.004121	3.06	28.72	23.66	0.49	0.31
02-CL ALIGNMENT-	11500	5 YR STORM	255.00	5839.69	5842.69		5842.88	0.004341	3.47	73.39	52.32	0.52	0.38
02-CL ALIGNMENT-	11500	10 YR STORM	324.00	5839.69	5842.93		5843.15	0.004354	3.77	85.84	54.13	0.53	0.43
02-CL ALIGNMENT-	11500	100 YR STORM	485.00	5839.69	5843.39		5843.68	0.004411	4.34	111.81	57.72	0.55	0.53
02-CL ALIGNMENT-	11450	2 YR STORM	88.00	5839.48	5841.19		5841.34	0.004048	3.05	28.89	23.71	0.49	0.30
02-CL ALIGNMENT-	11450	5 YR STORM	255.00	5839.48	5842.47		5842.66	0.004457	3.50	72.81	52.31	0.52	0.38
02-CL ALIGNMENT-	11450	10 YR STORM	324.00	5839.48	5842.70		5842.93	0.004467	3.80	85.21	54.17	0.53	0.43
02-CL ALIGNMENT-	11450	100 YR STORM	485.00	5839.48	5843.16		5843.46	0.004535	4.37	110.97	57.85	0.56	0.54
02-CL ALIGNMENT-	11400	2 YR STORM	88.00	5839.26	5841.01		5841.14	0.003771	2.97	29.64	23.96	0.47	0.29
02-CL ALIGNMENT-	11400	5 YR STORM	255.00	5839.26	5842.24		5842.43	0.004545	3.52	72.35	52.25	0.53	0.39
02-CL ALIGNMENT-	11400	10 YR STORM	324.00	5839.26	5842.47		5842.70	0.004560	3.83	84.63	54.10	0.54	0.44

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	11400	100 YR STORM	485.00	5839.26	5842.92		5843.23	0.004668	4.41	109.91	57.71	0.56	0.55
02-CL ALIGNMENT-	11350	2 YR STORM	88.00	5839.05	5840.83		5840.96	0.003498	2.89	30.45	24.23	0.45	0.27
02-CL ALIGNMENT-	11350	5 YR STORM	255.00	5839.05	5841.99		5842.20	0.004922	3.62	70.47	51.94	0.55	0.41
02-CL ALIGNMENT-	11350	10 YR STORM	324.00	5839.05	5842.22		5842.46	0.004896	3.92	82.65	53.78	0.56	0.46
02-CL ALIGNMENT-	11350	100 YR STORM	485.00	5839.05	5842.67		5842.98	0.005034	4.53	107.14	57.31	0.58	0.58
02-CL ALIGNMENT-	11300	2 YR STORM	88.00	5838.89	5840.66		5840.78	0.003472	2.87	30.61	24.42	0.45	0.27
02-CL ALIGNMENT-	11300	5 YR STORM	255.00	5838.89	5841.58		5841.88	0.008172	4.36	58.54	47.80	0.69	0.62
02-CL ALIGNMENT-	11300	10 YR STORM	324.00	5838.89	5841.82		5842.15	0.007930	4.60	70.50	51.77	0.69	0.66
02-CL ALIGNMENT-	11300	100 YR STORM	485.00	5838.89	5842.26		5842.67	0.007460	5.17	93.89	55.21	0.70	0.78
02-CL ALIGNMENT-	11250	2 YR STORM	88.00	5838.96	5840.44		5840.57	0.005385	2.89	30.43	33.78	0.54	0.30
02-CL ALIGNMENT-	11250	5 YR STORM	255.00	5838.96	5841.27		5841.51	0.005956	3.96	64.33	48.01	0.60	0.49
02-CL ALIGNMENT-	11250	10 YR STORM	324.00	5838.96	5841.51		5841.79	0.006014	4.25	76.28	51.57	0.62	0.55
02-CL ALIGNMENT-	11250	100 YR STORM	485.00	5838.96	5841.95		5842.32	0.006141	4.85	99.92	56.09	0.64	0.68
02-CL ALIGNMENT-	11224.52	2 YR STORM	88.00	5839.00	5839.95	5839.95	5840.31	0.020346	4.79	18.38	25.99	1.00	0.89
02-CL ALIGNMENT-	11224.52	5 YR STORM	255.00	5839.00	5840.69	5840.69	5841.24	0.017632	5.93	43.03	39.70	1.00	1.19
02-CL ALIGNMENT-	11224.52	10 YR STORM	324.00	5839.00	5840.91	5840.91	5841.51	0.017181	6.25	51.87	43.37	1.01	1.28
02-CL ALIGNMENT-	11224.52	100 YR STORM	485.00	5839.00	5841.31	5841.31	5842.04	0.016412	6.85	70.84	49.79	1.01	1.45
02-CL ALIGNMENT-	11191.87	2 YR STORM	88.00	5838.02	5838.80	5838.80	5839.07	0.087730	4.20	20.94	38.25	1.00	2.99
02-CL ALIGNMENT-	11191.87	5 YR STORM	255.00	5838.02	5839.15	5839.35	5839.94	0.148031	7.13	35.77	43.72	1.39	7.54
02-CL ALIGNMENT-	11191.87	10 YR STORM	324.00	5838.02	5839.29	5839.54	5840.23	0.148420	7.78	41.66	44.75	1.42	8.59
02-CL ALIGNMENT-	11191.87	100 YR STORM	485.00	5838.02	5839.57	5839.91	5840.79	0.144953	8.87	54.66	47.23	1.45	10.41
02-CL ALIGNMENT-	11186.38	2 YR STORM	88.00	5835.89	5836.65	5837.01	5837.95	0.589672	9.16	9.60	22.67	2.48	15.52
02-CL ALIGNMENT-	11186.38	5 YR STORM	255.00	5835.89	5837.25	5837.71	5838.81	0.260832	10.01	25.48	28.29	1.86	14.44
02-CL ALIGNMENT-	11186.38	10 YR STORM	324.00	5835.89	5837.44	5837.93	5839.15	0.226039	10.48	30.90	28.55	1.78	14.94
02-CL ALIGNMENT-	11186.38	100 YR STORM	485.00	5835.89	5837.86	5838.55	5839.84	0.177140	11.29	42.94	29.14	1.64	15.72
02-CL ALIGNMENT-	11173.48	2 YR STORM	88.00	5833.00	5834.83	5834.06	5834.90	0.006736	2.14	41.18	29.07	0.32	0.57
02-CL ALIGNMENT-	11173.48	5 YR STORM	255.00	5833.00	5835.94	5834.75	5836.11	0.009687	3.31	77.06	36.94	0.40	1.21
02-CL ALIGNMENT-	11173.48	10 YR STORM	324.00	5833.00	5836.27	5834.97	5836.47	0.010408	3.61	89.81	39.99	0.42	1.40
02-CL ALIGNMENT-	11173.48	100 YR STORM	485.00	5833.00	5836.92	5835.52	5837.19	0.011350	4.11	117.98	46.22	0.45	1.74
02-CL ALIGNMENT-	11158.82	2 YR STORM	88.00	5832.99	5834.70		5834.79	0.008488	2.37	37.12	27.00	0.36	0.71
02-CL ALIGNMENT-	11158.82	5 YR STORM	255.00	5832.99	5835.72		5835.94	0.013075	3.79	67.33	33.23	0.47	1.59
02-CL ALIGNMENT-	11158.82	10 YR STORM	324.00	5832.99	5836.02		5836.29	0.013947	4.17	77.67	34.73	0.49	1.87
02-CL ALIGNMENT-	11158.82	100 YR STORM	485.00	5832.99	5836.61		5836.98	0.015541	4.90	98.90	37.49	0.53	2.45
02-CL ALIGNMENT-	11153.7	2 YR STORM	88.00	5832.99	5834.60		5834.73	0.015829	2.92	30.12	25.71	0.48	1.13
02-CL ALIGNMENT-	11153.7	5 YR STORM	255.00	5832.99	5835.51		5835.84	0.021982	4.62	55.25	30.02	0.60	2.44
02-CL ALIGNMENT-	11153.7	10 YR STORM	324.00	5832.99	5835.78		5836.18	0.023881	5.10	63.58	31.65	0.63	2.89
02-CL ALIGNMENT-	11153.7	100 YR STORM	485.00	5832.99	5836.30		5836.86	0.027294	6.01	80.71	34.62	0.69	3.82
02-CL ALIGNMENT-	11145.22	2 YR STORM	88.00	5832.99	5834.46		5834.59	0.016627	2.93	30.08	26.84	0.49	1.15

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	11145.22	5 YR STORM	255.00	5832.99	5835.31		5835.64	0.024361	4.63	55.04	32.62	0.63	2.52
02-CL ALIGNMENT-	11145.22	10 YR STORM	324.00	5832.99	5835.57		5835.97	0.026301	5.08	63.81	34.90	0.66	2.94
02-CL ALIGNMENT-	11145.22	100 YR STORM	485.00	5832.99	5836.07		5836.61	0.029396	5.88	82.53	39.40	0.72	3.77
02-CL ALIGNMENT-	11125.26	2 YR STORM	88.00	5832.16	5833.94		5834.12	0.034412	3.37	26.15	32.50	0.66	1.70
02-CL ALIGNMENT-	11125.26	5 YR STORM	255.00	5832.16	5834.85		5835.13	0.025111	4.28	59.54	40.64	0.62	2.25
02-CL ALIGNMENT-	11125.26	10 YR STORM	324.00	5832.16	5835.11		5835.44	0.025044	4.61	70.30	42.88	0.63	2.51
02-CL ALIGNMENT-	11125.26	100 YR STORM	485.00	5832.16	5835.61		5836.03	0.025220	5.20	93.18	47.60	0.66	3.02
02-CL ALIGNMENT-	11100	2 YR STORM	88.00	5831.99	5832.96	5832.96	5833.43	0.020347	5.53	15.92	17.03	1.01	1.11
02-CL ALIGNMENT-	11100	5 YR STORM	255.00	5831.99	5833.96	5833.96	5834.57	0.017743	6.25	40.77	33.65	1.00	1.29
02-CL ALIGNMENT-	11100	10 YR STORM	324.00	5831.99	5834.19	5834.19	5834.88	0.017310	6.66	48.64	35.90	1.01	1.41
02-CL ALIGNMENT-	11100	100 YR STORM	485.00	5831.99	5834.65	5834.65	5835.49	0.016031	7.35	65.96	39.67	1.01	1.60
02-CL ALIGNMENT-	11074.83	2 YR STORM	88.00	5831.06	5831.69	5831.84	5832.23	0.215920	5.90	14.93	32.25	1.53	6.23
02-CL ALIGNMENT-	11074.83	5 YR STORM	255.00	5831.06	5832.05	5832.44	5833.37	0.282349	9.20	27.73	37.49	1.89	12.98
02-CL ALIGNMENT-	11074.83	10 YR STORM	324.00	5831.06	5832.19	5832.64	5833.70	0.260584	9.85	32.90	37.64	1.86	14.09
02-CL ALIGNMENT-	11074.83	100 YR STORM	485.00	5831.06	5832.49	5833.05	5834.36	0.223495	10.97	44.20	37.96	1.79	15.96
02-CL ALIGNMENT-	11068.15	2 YR STORM	88.00	5829.44	5830.19	5830.35	5830.77	0.219160	6.14	14.33	29.38	1.55	6.65
02-CL ALIGNMENT-	11068.15	5 YR STORM	255.00	5829.44	5830.70	5831.03	5831.79	0.185898	8.38	30.41	34.30	1.57	10.18
02-CL ALIGNMENT-	11068.15	10 YR STORM	324.00	5829.44	5830.84	5831.24	5832.15	0.192403	9.19	35.26	35.54	1.63	11.78
02-CL ALIGNMENT-	11068.15	100 YR STORM	485.00	5829.44	5831.11	5831.67	5832.90	0.207746	10.74	45.17	38.16	1.74	15.16
02-CL ALIGNMENT-	11050	2 YR STORM	88.00	5826.99	5828.84	5827.82	5828.88	0.003532	1.66	52.93	33.87	0.23	0.33
02-CL ALIGNMENT-	11050	5 YR STORM	255.00	5826.99	5830.17	5828.47	5830.25	0.004633	2.33	109.52	51.96	0.28	0.59
02-CL ALIGNMENT-	11050	10 YR STORM	324.00	5826.99	5830.60	5828.68	5830.70	0.004115	2.45	132.29	52.79	0.27	0.62
02-CL ALIGNMENT-	11050	100 YR STORM	485.00	5826.99	5831.31	5829.18	5831.43	0.004378	2.84	170.60	56.78	0.29	0.79
02-CL ALIGNMENT-	11040.64	2 YR STORM	88.00	5826.98	5828.74		5828.83	0.008069	2.40	36.64	24.61	0.35	0.71
02-CL ALIGNMENT-	11040.64	5 YR STORM	255.00	5826.98	5830.01		5830.18	0.011739	3.30	77.23	43.08	0.43	1.26
02-CL ALIGNMENT-	11040.64	10 YR STORM	324.00	5826.98	5830.46		5830.63	0.010310	3.30	98.08	49.73	0.41	1.22
02-CL ALIGNMENT-	11040.64	100 YR STORM	485.00	5826.98	5831.17		5831.37	0.009112	3.60	134.79	54.55	0.40	1.35
02-CL ALIGNMENT-	11032.17	2 YR STORM	88.00	5826.98	5828.49		5828.69	0.038402	3.61	24.38	29.19	0.70	1.94
02-CL ALIGNMENT-	11032.17	5 YR STORM	255.00	5826.98	5829.90		5830.07	0.013579	3.27	77.87	49.10	0.46	1.29
02-CL ALIGNMENT-	11032.17	10 YR STORM	324.00	5826.98	5830.39		5830.54	0.010723	3.09	104.83	60.43	0.41	1.12
02-CL ALIGNMENT-	11032.17	100 YR STORM	485.00	5826.98	5831.12		5831.28	0.008928	3.15	154.15	75.07	0.39	1.10
02-CL ALIGNMENT-	11015.57	2 YR STORM	88.00	5826.35	5828.10		5828.22	0.019616	2.79	31.54	33.80	0.51	1.11
02-CL ALIGNMENT-	11015.57	5 YR STORM	255.00	5826.35	5829.83		5829.92	0.004688	2.40	106.13	47.76	0.28	0.62
02-CL ALIGNMENT-	11015.57	10 YR STORM	324.00	5826.35	5830.32		5830.42	0.004075	2.50	129.78	49.41	0.27	0.64
02-CL ALIGNMENT-	11015.57	100 YR STORM	485.00	5826.35	5831.03		5831.16	0.004746	2.92	165.87	55.74	0.30	0.84
02-CL ALIGNMENT-	11000	2 YR STORM	88.00	5826.25	5828.07		5828.14	0.001742	2.22	39.58	27.36	0.33	0.15
02-CL ALIGNMENT-	11000	5 YR STORM	255.00	5826.25	5829.77		5829.89	0.001317	2.73	93.34	37.85	0.31	0.19
02-CL ALIGNMENT-	11000	10 YR STORM	324.00	5826.25	5830.25		5830.38	0.001642	2.83	114.43	52.38	0.34	0.22
02-CL ALIGNMENT-	11000	100 YR STORM	485.00	5826.25	5830.97		5831.12	0.001593	3.12	155.26	60.04	0.34	0.25

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear Chan (lb/sq ft)
02-CL ALIGNMENT-	10986.86	2 YR STORM	88.00	5826.17	5827.90		5828.08	0.017670	3.43	25.64	18.30	0.51	1.48
02-CL ALIGNMENT-	10986.86	5 YR STORM	255.00	5826.17	5829.60		5829.83	0.014568	3.88	65.73	33.79	0.49	1.69
02-CL ALIGNMENT-	10986.86	10 YR STORM	324.00	5826.17	5830.10		5830.32	0.013506	3.75	86.32	44.10	0.47	1.58
02-CL ALIGNMENT-	10986.86	100 YR STORM	485.00	5826.17	5830.81		5831.07	0.011756	4.09	118.63	47.50	0.46	1.74
02-CL ALIGNMENT-	10970.68	2 YR STORM	88.00	5826.09	5827.37	5827.37	5827.95	0.002651	6.12	14.37	12.43	1.00	0.18
02-CL ALIGNMENT-	10970.68	5 YR STORM	255.00	5826.09	5828.97		5829.73	0.001415	6.97	36.57	15.01	0.79	0.18
02-CL ALIGNMENT-	10970.68	10 YR STORM	324.00	5826.09	5829.26	5829.26	5830.17	0.002383	7.67	42.22	23.20	1.00	0.24
02-CL ALIGNMENT-	10970.68	100 YR STORM	485.00	5826.09	5829.90	5829.90	5830.92	0.002316	8.12	59.75	29.56	1.01	0.26
02-CL ALIGNMENT-	10900	2 YR STORM	88.00	5825.71	5826.99	5827.05	5827.72	0.003516	6.87	12.81	10.05	1.07	0.22
02-CL ALIGNMENT-	10900	5 YR STORM	255.00	5825.71	5828.89	5828.89	5829.56	0.002854	6.58	38.76	29.00	1.00	0.20
02-CL ALIGNMENT-	10900	10 YR STORM	324.00	5825.71	5828.94	5829.12	5829.95	0.004076	8.05	40.26	29.00	1.20	0.29
02-CL ALIGNMENT-	10900	100 YR STORM	485.00	5825.71	5829.38	5829.60	5830.68	0.003766	9.14	53.05	29.01	1.19	0.35
02-CL ALIGNMENT-	10850	2 YR STORM	88.00	5825.44	5827.06	5826.78	5827.51	0.001724	5.43	16.20	10.06	0.75	0.13
02-CL ALIGNMENT-	10850	5 YR STORM	255.00	5825.44	5828.37	5828.63	5829.36	0.004070	8.00	31.88	22.46	1.18	0.29
02-CL ALIGNMENT-	10850	10 YR STORM	324.00	5825.44	5828.61	5828.85	5829.72	0.004771	8.45	38.35	29.00	1.30	0.33
02-CL ALIGNMENT-	10850	100 YR STORM	485.00	5825.44	5829.01	5829.33	5830.47	0.004538	9.69	50.04	29.00	1.30	0.40
02-CL ALIGNMENT-	10800	2 YR STORM	88.00	5825.16	5827.08		5827.40	0.001025	4.56	19.28	10.08	0.58	0.09
02-CL ALIGNMENT-	10800	5 YR STORM	255.00	5825.16	5827.92	5828.34	5829.14	0.003883	8.86	28.77	15.62	1.15	0.34
02-CL ALIGNMENT-	10800	10 YR STORM	324.00	5825.16	5828.30	5828.58	5829.46	0.005166	8.66	37.41	29.00	1.34	0.35
02-CL ALIGNMENT-	10800	100 YR STORM	485.00	5825.16	5828.69	5829.06	5830.22	0.004915	9.94	48.81	29.00	1.35	0.42
02-CL ALIGNMENT-	10769.62	2 YR STORM	88.00	5824.97	5827.20		5827.33	0.000354	2.94	29.90	16.21	0.38	0.04
02-CL ALIGNMENT-	10769.62	5 YR STORM	255.00	5824.97	5828.53	5827.31	5828.78	0.000543	4.03	63.28	29.68	0.49	0.06
02-CL ALIGNMENT-	10769.62	10 YR STORM	324.00	5824.97	5828.86	5827.93	5829.16	0.000553	4.42	73.23	29.74	0.50	0.07
02-CL ALIGNMENT-	10769.62	100 YR STORM	485.00	5824.97	5829.59	5828.42	5829.99	0.000552	5.11	94.88	29.87	0.51	0.09
02-CL ALIGNMENT-	10750	2 YR STORM	89.00	5824.96	5827.23		5827.29	0.005582	2.05	43.34	28.85	0.30	0.51
02-CL ALIGNMENT-	10750	5 YR STORM	268.00	5824.96	5828.60		5828.71	0.007474	2.66	100.79	56.67	0.35	0.81
02-CL ALIGNMENT-	10750	10 YR STORM	355.00	5824.96	5828.95		5829.08	0.007699	2.91	122.09	61.15	0.36	0.94
02-CL ALIGNMENT-	10750	100 YR STORM	588.00	5824.96	5829.71		5829.90	0.007717	3.46	169.81	64.93	0.38	1.22
02-CL ALIGNMENT-	10740.38	2 YR STORM	89.00	5824.94	5827.16		5827.23	0.006553	2.19	40.65	27.74	0.32	0.59
02-CL ALIGNMENT-	10740.38	5 YR STORM	268.00	5824.94	5828.52		5828.64	0.007150	2.71	98.98	52.59	0.35	0.83
02-CL ALIGNMENT-	10740.38	10 YR STORM	355.00	5824.94	5828.87		5829.01	0.008285	3.02	117.70	59.45	0.38	1.01
02-CL ALIGNMENT-	10740.38	100 YR STORM	588.00	5824.94	5829.63		5829.82	0.008771	3.44	170.70	73.80	0.40	1.25
02-CL ALIGNMENT-	10729.76	2 YR STORM	89.00	5824.92	5827.08		5827.16	0.007045	2.25	39.50	27.26	0.33	0.63
02-CL ALIGNMENT-	10729.76	5 YR STORM	268.00	5824.92	5828.44		5828.56	0.007838	2.73	98.22	55.36	0.36	0.86
02-CL ALIGNMENT-	10729.76	10 YR STORM	355.00	5824.92	5828.78		5828.92	0.008290	3.02	117.38	59.12	0.38	1.01
02-CL ALIGNMENT-	10729.76	100 YR STORM	588.00	5824.92	5829.52		5829.72	0.009898	3.58	164.24	73.42	0.42	1.36
02-CL ALIGNMENT-	10715.1	2 YR STORM	89.00	5824.89	5826.95		5827.04	0.008760	2.43	36.56	26.48	0.37	0.74
02-CL ALIGNMENT-	10715.1	5 YR STORM	268.00	5824.89	5828.31		5828.44	0.008813	2.82	95.14	55.84	0.38	0.92

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	10715.1	10 YR STORM	355.00	5824.89	5828.64		5828.79	0.009047	3.12	113.87	58.50	0.39	1.08
02-CL ALIGNMENT-	10715.1	100 YR STORM	588.00	5824.89	5829.36		5829.57	0.009644	3.72	157.98	65.21	0.42	1.44
02-CL ALIGNMENT-	10700	2 YR STORM	89.00	5824.86	5826.90		5826.99	0.002101	2.41	36.93	26.29	0.36	0.18
02-CL ALIGNMENT-	10700	5 YR STORM	268.00	5824.86	5828.25		5828.38	0.002251	2.84	94.32	55.51	0.38	0.24
02-CL ALIGNMENT-	10700	10 YR STORM	355.00	5824.86	5828.58		5828.73	0.002313	3.15	112.83	58.12	0.40	0.28
02-CL ALIGNMENT-	10700	100 YR STORM	588.00	5824.86	5829.28		5829.50	0.002444	3.77	156.01	63.79	0.42	0.37
02-CL ALIGNMENT-	10650	2 YR STORM	89.00	5824.76	5826.79		5826.88	0.002135	2.42	36.71	26.22	0.36	0.18
02-CL ALIGNMENT-	10650	5 YR STORM	268.00	5824.76	5828.13		5828.26	0.002325	2.87	93.31	55.37	0.39	0.24
02-CL ALIGNMENT-	10650	10 YR STORM	355.00	5824.76	5828.45		5828.61	0.002392	3.18	111.57	57.95	0.40	0.28
02-CL ALIGNMENT-	10650	100 YR STORM	588.00	5824.76	5829.15		5829.38	0.002538	3.82	154.02	63.55	0.43	0.38
02-CL ALIGNMENT-	10600	2 YR STORM	89.00	5824.66	5826.68		5826.77	0.002174	2.44	36.47	26.14	0.36	0.19
02-CL ALIGNMENT-	10600	5 YR STORM	268.00	5824.66	5828.01		5828.14	0.002424	2.91	92.02	55.17	0.40	0.25
02-CL ALIGNMENT-	10600	10 YR STORM	355.00	5824.66	5828.33		5828.49	0.002497	3.23	109.96	57.72	0.41	0.29
02-CL ALIGNMENT-	10600	100 YR STORM	588.00	5824.66	5829.02		5829.25	0.002659	3.88	151.57	63.22	0.44	0.39
02-CL ALIGNMENT-	10550	2 YR STORM	89.00	5824.56	5826.57		5826.66	0.002225	2.46	36.15	26.03	0.37	0.19
02-CL ALIGNMENT-	10550	5 YR STORM	268.00	5824.56	5827.88		5828.02	0.002560	2.97	90.37	54.94	0.41	0.26
02-CL ALIGNMENT-	10550	10 YR STORM	355.00	5824.56	5828.19		5828.36	0.002642	3.29	107.90	57.43	0.42	0.31
02-CL ALIGNMENT-	10550	100 YR STORM	588.00	5824.56	5828.87		5829.11	0.002817	3.96	148.60	62.84	0.45	0.41
02-CL ALIGNMENT-	10500	2 YR STORM	89.00	5824.46	5826.45		5826.55	0.002293	2.49	35.76	25.91	0.37	0.19
02-CL ALIGNMENT-	10500	5 YR STORM	268.00	5824.46	5827.74		5827.88	0.002760	3.04	88.14	54.61	0.42	0.27
02-CL ALIGNMENT-	10500	10 YR STORM	355.00	5824.46	5828.04		5828.22	0.002850	3.38	105.18	57.05	0.44	0.32
02-CL ALIGNMENT-	10500	100 YR STORM	588.00	5824.46	5828.71		5828.96	0.003039	4.06	144.80	62.35	0.47	0.43
02-CL ALIGNMENT-	10450	2 YR STORM	89.00	5824.37	5826.33		5826.43	0.002445	2.55	34.96	25.70	0.38	0.20
02-CL ALIGNMENT-	10450	5 YR STORM	268.00	5824.37	5827.58		5827.73	0.003136	3.17	84.48	54.07	0.45	0.30
02-CL ALIGNMENT-	10450	10 YR STORM	355.00	5824.37	5827.88		5828.07	0.003226	3.52	100.92	56.45	0.46	0.35
02-CL ALIGNMENT-	10450	100 YR STORM	588.00	5824.37	5828.52		5828.80	0.003412	4.22	139.21	61.65	0.50	0.47
02-CL ALIGNMENT-	10400	2 YR STORM	89.00	5824.27	5826.20		5826.30	0.002607	2.61	34.16	25.45	0.40	0.21
02-CL ALIGNMENT-	10400	5 YR STORM	268.00	5824.27	5827.38		5827.56	0.003784	3.38	79.40	53.32	0.49	0.35
02-CL ALIGNMENT-	10400	10 YR STORM	355.00	5824.27	5827.67		5827.89	0.003848	3.73	95.15	55.63	0.50	0.41
02-CL ALIGNMENT-	10400	100 YR STORM	588.00	5824.27	5828.30		5828.61	0.004007	4.46	131.81	60.68	0.53	0.53
02-CL ALIGNMENT-	10350	2 YR STORM	89.00	5824.17	5826.05		5826.17	0.002869	2.70	32.99	25.06	0.41	0.23
02-CL ALIGNMENT-	10350	5 YR STORM	268.00	5824.17	5827.09		5827.32	0.005719	3.87	69.31	51.77	0.59	0.47
02-CL ALIGNMENT-	10350	10 YR STORM	355.00	5824.17	5827.38		5827.65	0.005472	4.19	84.64	54.09	0.59	0.53
02-CL ALIGNMENT-	10350	100 YR STORM	588.00	5824.17	5828.00		5828.37	0.005353	4.92	119.50	59.04	0.61	0.67
02-CL ALIGNMENT-	10300	2 YR STORM	89.00	5824.12	5825.80		5825.89	0.013268	2.48	35.91	34.95	0.43	0.85
02-CL ALIGNMENT-	10300	5 YR STORM	268.00	5824.12	5826.58		5826.83	0.021107	4.02	66.70	44.49	0.58	1.96
02-CL ALIGNMENT-	10300	10 YR STORM	355.00	5824.12	5826.83		5827.15	0.024004	4.53	78.32	47.99	0.63	2.42
02-CL ALIGNMENT-	10300	100 YR STORM	588.00	5824.12	5827.36		5827.83	0.030344	5.53	106.33	57.67	0.72	3.46

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	10265.7	2 YR STORM	89.00	5824.00	5824.68	5824.68	5824.91	0.098681	3.80	23.40	54.27	1.02	2.65
02-CL ALIGNMENT-	10265.7	5 YR STORM	268.00	5824.00	5825.16	5825.16	5825.55	0.079947	5.04	53.22	69.18	1.01	3.84
02-CL ALIGNMENT-	10265.7	10 YR STORM	355.00	5824.00	5825.32	5825.32	5825.79	0.075759	5.47	64.89	71.51	1.01	4.29
02-CL ALIGNMENT-	10265.7	100 YR STORM	588.00	5824.00	5825.71	5825.71	5826.32	0.068156	6.28	93.61	77.42	1.01	5.13
02-CL ALIGNMENT-	10256.85	2 YR STORM	89.00	5823.00	5823.42	5823.50	5823.79	0.169693	4.86	18.32	43.81	1.32	4.39
02-CL ALIGNMENT-	10256.85	5 YR STORM	268.00	5823.00	5823.89	5824.07	5824.63	0.130349	6.91	38.81	44.40	1.30	6.96
02-CL ALIGNMENT-	10256.85	10 YR STORM	355.00	5823.00	5824.11	5824.32	5824.92	0.117735	7.21	49.24	48.89	1.27	7.24
02-CL ALIGNMENT-	10256.85	100 YR STORM	588.00	5823.00	5824.57	5824.80	5825.53	0.111559	7.86	74.84	63.03	1.27	8.12
02-CL ALIGNMENT-	10244.44	2 YR STORM	89.00	5818.50	5820.42	5819.81	5820.68	0.022646	4.11	21.66	13.07	0.56	2.06
02-CL ALIGNMENT-	10244.44	5 YR STORM	268.00	5818.50	5820.51	5821.41	5822.63	0.173960	11.67	22.96	13.31	1.57	16.44
02-CL ALIGNMENT-	10244.44	10 YR STORM	355.00	5818.50	5821.15	5821.71	5822.82	0.239745	10.35	34.29	32.05	1.76	14.88
02-CL ALIGNMENT-	10244.44	100 YR STORM	588.00	5818.50	5821.66	5822.21	5823.57	0.215405	11.07	53.12	41.40	1.72	16.01
02-CL ALIGNMENT-	10216.64	2 YR STORM	89.00	5818.50	5820.22		5820.29	0.007186	2.10	42.45	33.38	0.33	0.56
02-CL ALIGNMENT-	10216.64	5 YR STORM	268.00	5818.50	5821.48	5820.20	5821.62	0.007150	3.07	87.44	37.72	0.35	1.00
02-CL ALIGNMENT-	10216.64	10 YR STORM	355.00	5818.50	5821.79	5820.48	5821.99	0.008521	3.57	99.33	38.57	0.39	1.31
02-CL ALIGNMENT-	10216.64	100 YR STORM	588.00	5818.50	5822.43	5821.10	5822.77	0.012105	4.69	125.26	41.82	0.48	2.15
02-CL ALIGNMENT-	10208.4	2 YR STORM	89.00	5818.44	5820.09		5820.21	0.014987	2.69	33.03	31.04	0.46	0.99
02-CL ALIGNMENT-	10208.4	5 YR STORM	268.00	5818.44	5821.35		5821.54	0.011041	3.53	76.03	37.47	0.44	1.37
02-CL ALIGNMENT-	10208.4	10 YR STORM	355.00	5818.44	5821.63		5821.89	0.013087	4.09	86.78	38.77	0.48	1.79
02-CL ALIGNMENT-	10208.4	100 YR STORM	588.00	5818.44	5822.19		5822.64	0.018827	5.38	109.20	42.29	0.59	2.95
02-CL ALIGNMENT-	10200	2 YR STORM	89.00	5818.39	5820.04		5820.15	0.003397	2.69	33.12	28.98	0.44	0.24
02-CL ALIGNMENT-	10200	5 YR STORM	268.00	5818.39	5821.30		5821.50	0.003038	3.56	75.31	39.40	0.45	0.36
02-CL ALIGNMENT-	10200	10 YR STORM	355.00	5818.39	5821.58		5821.84	0.003554	4.11	86.46	40.97	0.50	0.46
02-CL ALIGNMENT-	10200	100 YR STORM	588.00	5818.39	5822.12		5822.57	0.005053	5.36	109.70	45.33	0.61	0.75
02-CL ALIGNMENT-	10187.31	2 YR STORM	89.00	5818.31	5819.95		5820.10	0.004745	3.12	28.54	25.59	0.52	0.33
02-CL ALIGNMENT-	10187.31	5 YR STORM	268.00	5818.31	5821.23		5821.45	0.004349	3.77	71.08	44.81	0.53	0.42
02-CL ALIGNMENT-	10187.31	10 YR STORM	355.00	5818.31	5821.51		5821.79	0.004696	4.23	83.89	47.09	0.56	0.51
02-CL ALIGNMENT-	10187.31	100 YR STORM	588.00	5818.31	5822.06		5822.49	0.005740	5.29	111.11	51.78	0.64	0.76
02-CL ALIGNMENT-	10177.34	2 YR STORM	89.00	5818.25	5819.88		5820.05	0.005057	3.31	26.89	23.03	0.54	0.36
02-CL ALIGNMENT-	10177.34	5 YR STORM	268.00	5818.25	5821.16		5821.40	0.005852	3.90	68.80	51.70	0.60	0.48
02-CL ALIGNMENT-	10177.34	10 YR STORM	355.00	5818.25	5821.46		5821.73	0.005486	4.20	84.55	54.05	0.59	0.53
02-CL ALIGNMENT-	10177.34	100 YR STORM	588.00	5818.25	5822.03		5822.43	0.005749	5.04	116.57	58.53	0.63	0.70
02-CL ALIGNMENT-	10149	2 YR STORM	89.00	5818.12	5819.69	5819.30	5819.89	0.006263	3.56	25.00	22.55	0.60	0.43
02-CL ALIGNMENT-	10149	5 YR STORM	268.00	5818.12	5820.90	5820.26	5821.20	0.008369	4.38	61.25	50.60	0.70	0.62
02-CL ALIGNMENT-	10149	10 YR STORM	355.00	5818.12	5821.25	5820.82	5821.56	0.006565	4.45	79.74	53.45	0.64	0.60
02-CL ALIGNMENT-	10149	100 YR STORM	588.00	5818.12	5821.80	5821.31	5822.24	0.006839	5.34	110.08	57.83	0.68	0.80
02-CL ALIGNMENT-	10120.96	2 YR STORM	89.00	5817.99	5819.14	5819.14	5819.58	0.019302	5.32	16.73	19.26	1.01	1.03
02-CL ALIGNMENT-	10120.96	5 YR STORM	268.00	5817.99	5820.11	5820.11	5820.83	0.016246	6.83	39.22	27.12	1.00	1.44
02-CL ALIGNMENT-	10120.96	10 YR STORM	355.00	5817.99	5820.66	5820.66	5821.25	0.017121	6.19	57.38	48.21	1.00	1.26

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	10120.96	100 YR STORM	588.00	5817.99	5821.15	5821.15	5821.93	0.016174	7.10	82.81	54.17	1.01	1.52
02-CL ALIGNMENT-	10100	2 YR STORM	89.00	5815.95	5816.65	5817.17	5818.56	0.152204	11.08	8.03	14.52	2.63	5.20
02-CL ALIGNMENT-	10100	5 YR STORM	268.00	5815.95	5819.16	5818.14	5819.32	0.003383	3.25	82.56	54.06	0.46	0.32
02-CL ALIGNMENT-	10100	10 YR STORM	355.00	5815.95	5817.65	5818.69	5820.36	0.081146	13.22	26.86	23.12	2.16	5.79
02-CL ALIGNMENT-	10100	100 YR STORM	588.00	5815.95	5818.29	5819.16	5821.14	0.059938	13.55	43.40	28.62	1.94	5.57
02-CL ALIGNMENT-	10075.04	2 YR STORM	89.00	5815.85	5817.70	5817.04	5817.82	0.006790	2.84	31.38	24.75	0.44	0.53
02-CL ALIGNMENT-	10075.04	5 YR STORM	268.00	5815.85	5819.04		5819.20	0.006834	3.24	82.71	53.89	0.46	0.65
02-CL ALIGNMENT-	10075.04	10 YR STORM	355.00	5815.85	5819.34	5818.55	5819.54	0.006951	3.58	99.14	56.28	0.48	0.75
02-CL ALIGNMENT-	10075.04	100 YR STORM	588.00	5815.85	5820.00	5819.06	5820.28	0.007121	4.25	138.19	61.59	0.50	0.98
02-CL ALIGNMENT-	10064.92	2 YR STORM	89.00	5815.82	5817.58		5817.74	0.009515	3.20	27.84	23.64	0.52	0.69
02-CL ALIGNMENT-	10064.92	5 YR STORM	268.00	5815.82	5818.94		5819.13	0.008358	3.46	77.55	53.39	0.51	0.75
02-CL ALIGNMENT-	10064.92	10 YR STORM	355.00	5815.82	5819.24		5819.46	0.008265	3.79	93.75	55.76	0.51	0.86
02-CL ALIGNMENT-	10064.92	100 YR STORM	588.00	5815.82	5819.90		5820.20	0.008136	4.45	132.27	61.03	0.53	1.08
02-CL ALIGNMENT-	10050	2 YR STORM	89.00	5815.76	5817.50		5817.65	0.003870	3.01	29.61	23.95	0.48	0.29
02-CL ALIGNMENT-	10050	5 YR STORM	268.00	5815.76	5818.86		5819.04	0.003880	3.40	78.75	53.23	0.49	0.35
02-CL ALIGNMENT-	10050	10 YR STORM	355.00	5815.76	5819.16		5819.38	0.003871	3.74	94.96	55.61	0.50	0.41
02-CL ALIGNMENT-	10050	100 YR STORM	588.00	5815.76	5819.82		5820.12	0.003866	4.41	133.42	60.89	0.52	0.52
02-CL ALIGNMENT-	10025.15	2 YR STORM	89.00	5815.66	5817.41		5817.55	0.003932	3.02	29.50	24.04	0.48	0.30
02-CL ALIGNMENT-	10025.15	5 YR STORM	268.00	5815.66	5818.77		5818.95	0.003858	3.40	78.90	53.26	0.49	0.35
02-CL ALIGNMENT-	10025.15	10 YR STORM	355.00	5815.66	5819.06		5819.28	0.003852	3.73	95.12	55.63	0.50	0.41
02-CL ALIGNMENT-	10025.15	100 YR STORM	588.00	5815.66	5819.72		5820.03	0.003853	4.40	133.55	60.90	0.52	0.52
02-CL ALIGNMENT-	10000	2 YR STORM	89.00	5815.56	5817.31		5817.45	0.003823	2.99	29.73	23.97	0.47	0.29
02-CL ALIGNMENT-	10000	5 YR STORM	268.00	5815.56	5818.67		5818.85	0.003840	3.39	79.00	53.23	0.49	0.35
02-CL ALIGNMENT-	10000	10 YR STORM	355.00	5815.56	5818.97		5819.18	0.003841	3.73	95.18	55.61	0.50	0.40
02-CL ALIGNMENT-	10000	100 YR STORM	588.00	5815.56	5819.63		5819.93	0.003847	4.40	133.60	60.88	0.52	0.52
02-CL ALIGNMENT-	9950	2 YR STORM	89.00	5815.37	5817.12		5817.26	0.003834	3.00	29.71	23.99	0.47	0.29
02-CL ALIGNMENT-	9950	5 YR STORM	268.00	5815.37	5818.48		5818.66	0.003836	3.39	79.03	53.24	0.49	0.35
02-CL ALIGNMENT-	9950	10 YR STORM	355.00	5815.37	5818.78		5818.99	0.003838	3.73	95.22	55.62	0.50	0.40
02-CL ALIGNMENT-	9950	100 YR STORM	588.00	5815.37	5819.44		5819.74	0.003847	4.40	133.62	60.90	0.52	0.52
02-CL ALIGNMENT-	9900	2 YR STORM	89.00	5815.18	5816.93		5817.07	0.003860	3.00	29.62	23.94	0.48	0.29
02-CL ALIGNMENT-	9900	5 YR STORM	268.00	5815.18	5818.28		5818.46	0.003866	3.40	78.81	53.18	0.49	0.35
02-CL ALIGNMENT-	9900	10 YR STORM	355.00	5815.18	5818.58		5818.80	0.003862	3.74	94.97	55.53	0.50	0.41
02-CL ALIGNMENT-	9900	100 YR STORM	588.00	5815.18	5819.24		5819.54	0.003870	4.41	133.23	60.71	0.53	0.52
02-CL ALIGNMENT-	9850	2 YR STORM	89.00	5814.99	5816.73		5816.87	0.003885	3.01	29.56	23.94	0.48	0.29
02-CL ALIGNMENT-	9850	5 YR STORM	268.00	5814.99	5818.09		5818.27	0.003874	3.40	78.77	53.19	0.49	0.35
02-CL ALIGNMENT-	9850	10 YR STORM	355.00	5814.99	5818.39		5818.61	0.003870	3.74	94.93	55.56	0.50	0.41
02-CL ALIGNMENT-	9850	100 YR STORM	588.00	5814.99	5819.05		5819.35	0.003879	4.41	133.20	60.79	0.53	0.52
02-CL ALIGNMENT-	9800	2 YR STORM	89.00	5814.79	5816.54		5816.68	0.003818	2.99	29.75	24.00	0.47	0.29

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	9800	5 YR STORM	268.00	5814.79	5817.90		5818.08	0.003823	3.39	79.14	53.29	0.49	0.35
02-CL ALIGNMENT-	9800	10 YR STORM	355.00	5814.79	5818.20		5818.41	0.003826	3.72	95.34	55.68	0.50	0.40
02-CL ALIGNMENT-	9800	100 YR STORM	588.00	5814.79	5818.85		5819.16	0.003847	4.40	133.67	60.95	0.52	0.52
02-CL ALIGNMENT-	9750	2 YR STORM	89.00	5814.60	5816.35		5816.49	0.003835	3.00	29.70	23.98	0.47	0.29
02-CL ALIGNMENT-	9750	5 YR STORM	268.00	5814.60	5817.71		5817.89	0.003837	3.39	79.04	53.27	0.49	0.35
02-CL ALIGNMENT-	9750	10 YR STORM	355.00	5814.60	5818.00		5818.22	0.003845	3.73	95.18	55.66	0.50	0.40
02-CL ALIGNMENT-	9750	100 YR STORM	588.00	5814.60	5818.66		5818.96	0.003872	4.41	133.38	60.92	0.53	0.52
02-CL ALIGNMENT-	9700	2 YR STORM	89.00	5814.41	5816.16		5816.30	0.003865	3.00	29.62	23.96	0.48	0.29
02-CL ALIGNMENT-	9700	5 YR STORM	268.00	5814.41	5817.51		5817.69	0.003868	3.40	78.83	53.24	0.49	0.35
02-CL ALIGNMENT-	9700	10 YR STORM	355.00	5814.41	5817.81		5818.03	0.003875	3.74	94.94	55.62	0.50	0.41
02-CL ALIGNMENT-	9700	100 YR STORM	588.00	5814.41	5818.46		5818.77	0.003905	4.42	132.99	60.87	0.53	0.52
02-CL ALIGNMENT-	9650	2 YR STORM	89.00	5814.22	5815.96		5816.10	0.003916	3.02	29.48	23.91	0.48	0.30
02-CL ALIGNMENT-	9650	5 YR STORM	268.00	5814.22	5817.32		5817.50	0.003918	3.41	78.49	53.18	0.50	0.36
02-CL ALIGNMENT-	9650	10 YR STORM	355.00	5814.22	5817.61		5817.83	0.003921	3.75	94.55	55.54	0.51	0.41
02-CL ALIGNMENT-	9650	100 YR STORM	588.00	5814.22	5818.26		5818.57	0.003954	4.44	132.40	60.75	0.53	0.53
02-CL ALIGNMENT-	9600	2 YR STORM	89.00	5814.02	5815.77		5815.91	0.003848	3.00	29.67	23.97	0.48	0.29
02-CL ALIGNMENT-	9600	5 YR STORM	268.00	5814.02	5817.12		5817.30	0.003865	3.40	78.85	53.24	0.49	0.35
02-CL ALIGNMENT-	9600	10 YR STORM	355.00	5814.02	5817.42		5817.64	0.003878	3.74	94.90	55.60	0.50	0.41
02-CL ALIGNMENT-	9600	100 YR STORM	588.00	5814.02	5818.07		5818.37	0.003934	4.43	132.64	60.80	0.53	0.53
02-CL ALIGNMENT-	9550	2 YR STORM	89.00	5813.83	5815.57		5815.71	0.003886	3.01	29.56	23.94	0.48	0.29
02-CL ALIGNMENT-	9550	5 YR STORM	268.00	5813.83	5816.93		5817.11	0.003914	3.41	78.52	53.19	0.50	0.36
02-CL ALIGNMENT-	9550	10 YR STORM	355.00	5813.83	5817.22		5817.44	0.003928	3.76	94.50	55.55	0.51	0.41
02-CL ALIGNMENT-	9550	100 YR STORM	588.00	5813.83	5817.87		5818.17	0.004001	4.46	131.88	60.70	0.53	0.53
02-CL ALIGNMENT-	9500	2 YR STORM	89.00	5813.64	5815.38		5815.52	0.003955	3.03	29.38	23.88	0.48	0.30
02-CL ALIGNMENT-	9500	5 YR STORM	268.00	5813.64	5816.73		5816.91	0.004010	3.44	77.90	53.10	0.50	0.36
02-CL ALIGNMENT-	9500	10 YR STORM	355.00	5813.64	5817.02		5817.24	0.004014	3.78	93.82	55.45	0.51	0.42
02-CL ALIGNMENT-	9500	100 YR STORM	588.00	5813.64	5817.66		5817.97	0.004098	4.49	130.81	60.56	0.54	0.54
02-CL ALIGNMENT-	9450	2 YR STORM	89.00	5813.44	5815.18		5815.32	0.003916	3.02	29.48	23.91	0.48	0.30
02-CL ALIGNMENT-	9450	5 YR STORM	268.00	5813.44	5816.53		5816.71	0.004019	3.44	77.84	53.08	0.50	0.36
02-CL ALIGNMENT-	9450	10 YR STORM	355.00	5813.44	5816.82		5817.04	0.004028	3.79	93.70	55.42	0.51	0.42
02-CL ALIGNMENT-	9450	100 YR STORM	588.00	5813.44	5817.45		5817.76	0.004154	4.52	130.20	60.46	0.54	0.55
02-CL ALIGNMENT-	9400	2 YR STORM	89.00	5813.25	5814.98		5815.12	0.004021	3.05	29.20	23.82	0.49	0.30
02-CL ALIGNMENT-	9400	5 YR STORM	268.00	5813.25	5816.31		5816.50	0.004220	3.50	76.60	52.90	0.51	0.38
02-CL ALIGNMENT-	9400	10 YR STORM	355.00	5813.25	5816.60		5816.83	0.004201	3.84	92.41	55.24	0.52	0.43
02-CL ALIGNMENT-	9400	100 YR STORM	588.00	5813.25	5817.22		5817.55	0.004354	4.59	128.15	60.20	0.55	0.57
02-CL ALIGNMENT-	9350	2 YR STORM	89.00	5813.06	5814.77		5814.92	0.004232	3.10	28.67	23.64	0.50	0.31
02-CL ALIGNMENT-	9350	5 YR STORM	268.00	5813.06	5816.08		5816.28	0.004656	3.61	74.16	52.53	0.54	0.41
02-CL ALIGNMENT-	9350	10 YR STORM	355.00	5813.06	5816.37		5816.61	0.004528	3.94	90.13	54.91	0.54	0.46
02-CL ALIGNMENT-	9350	100 YR STORM	588.00	5813.06	5816.97		5817.32	0.004729	4.72	124.62	59.73	0.58	0.61

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	9300	2 YR STORM	89.00	5812.87	5814.53		5814.69	0.004724	3.23	27.56	23.26	0.52	0.34
02-CL ALIGNMENT-	9300	5 YR STORM	268.00	5812.87	5815.77		5816.01	0.005988	3.92	68.28	51.62	0.60	0.49
02-CL ALIGNMENT-	9300	10 YR STORM	355.00	5812.87	5816.10		5816.37	0.005290	4.15	85.60	54.25	0.58	0.51
02-CL ALIGNMENT-	9300	100 YR STORM	588.00	5812.87	5816.68		5817.06	0.005515	4.97	118.30	58.88	0.62	0.68
02-CL ALIGNMENT-	9250	2 YR STORM	89.00	5812.67	5813.85	5813.82	5814.26	0.017047	5.10	17.44	19.45	0.95	0.94
02-CL ALIGNMENT-	9250	5 YR STORM	268.00	5812.67	5814.81	5814.81	5815.50	0.016482	6.67	40.15	29.13	1.00	1.39
02-CL ALIGNMENT-	9250	10 YR STORM	355.00	5812.67	5815.25	5815.25	5815.90	0.016534	6.47	54.85	41.93	1.00	1.33
02-CL ALIGNMENT-	9250	100 YR STORM	588.00	5812.67	5815.80	5815.80	5816.58	0.015942	7.11	82.67	53.42	1.01	1.52
02-CL ALIGNMENT-	9233.34	2 YR STORM	89.00	5812.61	5813.79		5813.90	0.015850	2.58	34.48	36.06	0.47	0.94
02-CL ALIGNMENT-	9233.34	5 YR STORM	268.00	5812.61	5814.50	5814.04	5814.79	0.025595	4.31	62.19	43.11	0.63	2.28
02-CL ALIGNMENT-	9233.34	10 YR STORM	355.00	5812.61	5813.92	5814.31	5815.19	0.169590	9.05	39.24	36.97	1.55	11.15
02-CL ALIGNMENT-	9233.34	100 YR STORM	588.00	5812.61	5814.46	5814.87	5815.92	0.133116	9.72	60.52	42.67	1.44	11.68
02-CL ALIGNMENT-	9204.7	2 YR STORM	89.00	5812.06	5812.76	5812.76	5812.96	0.098549	3.62	24.61	61.48	1.01	2.46
02-CL ALIGNMENT-	9204.7	5 YR STORM	268.00	5812.06	5813.19	5813.19	5813.58	0.079923	5.02	53.42	69.61	1.01	3.81
02-CL ALIGNMENT-	9204.7	10 YR STORM	355.00	5812.06	5813.35	5813.36	5813.82	0.075244	5.48	64.82	70.67	1.01	4.28
02-CL ALIGNMENT-	9204.7	100 YR STORM	588.00	5812.06	5813.72	5813.73	5814.37	0.069318	6.44	91.24	73.01	1.02	5.36
02-CL ALIGNMENT-	9200	2 YR STORM	89.00	5810.50	5810.85	5811.14	5811.91	0.633722	8.27	10.77	30.93	2.47	13.54
02-CL ALIGNMENT-	9200	5 YR STORM	268.00	5810.50	5811.39	5811.83	5812.85	0.262386	9.69	27.65	31.75	1.83	13.79
02-CL ALIGNMENT-	9200	10 YR STORM	355.00	5810.50	5811.65	5812.23	5813.17	0.199835	9.91	35.82	32.24	1.66	13.31
02-CL ALIGNMENT-	9200	100 YR STORM	588.00	5810.50	5812.30	5812.79	5813.80	0.173828	9.84	59.73	49.27	1.58	12.73
02-CL ALIGNMENT-	9183.98	2 YR STORM	89.00	5806.00	5807.94	5807.50	5808.31	0.036575	4.88	18.25	11.13	0.67	3.01
02-CL ALIGNMENT-	9183.98	5 YR STORM	268.00	5806.00	5809.35	5808.98	5809.65	0.029971	4.38	61.18	42.75	0.65	2.43
02-CL ALIGNMENT-	9183.98	10 YR STORM	355.00	5806.00	5809.68	5809.20	5810.02	0.026798	4.71	75.37	43.11	0.63	2.64
02-CL ALIGNMENT-	9183.98	100 YR STORM	588.00	5806.00	5810.34	5809.72	5810.84	0.026147	5.64	104.28	44.22	0.65	3.44
02-CL ALIGNMENT-	9155.34	2 YR STORM	89.00	5806.00	5807.86		5807.91	0.004973	1.83	48.56	34.45	0.27	0.42
02-CL ALIGNMENT-	9155.34	5 YR STORM	268.00	5806.00	5809.16		5809.26	0.005865	2.53	105.81	52.61	0.31	0.71
02-CL ALIGNMENT-	9155.34	10 YR STORM	355.00	5806.00	5809.50		5809.63	0.006333	2.87	123.79	53.80	0.33	0.87
02-CL ALIGNMENT-	9155.34	100 YR STORM	588.00	5806.00	5810.16		5810.37	0.008102	3.68	159.76	56.94	0.39	1.35
02-CL ALIGNMENT-	9147.95	2 YR STORM	89.00	5805.99	5807.82		5807.88	0.003657	2.00	44.41	37.25	0.32	0.27
02-CL ALIGNMENT-	9147.95	5 YR STORM	268.00	5805.99	5809.13		5809.23	0.003136	2.62	102.23	50.88	0.33	0.39
02-CL ALIGNMENT-	9147.95	10 YR STORM	355.00	5805.99	5809.46		5809.60	0.003432	2.97	119.42	52.35	0.35	0.48
02-CL ALIGNMENT-	9147.95	100 YR STORM	588.00	5805.99	5810.10		5810.32	0.004497	3.83	153.69	56.06	0.41	0.75
02-CL ALIGNMENT-	9136.23	2 YR STORM	89.00	5805.96	5807.77		5807.85	0.002206	2.16	41.25	36.40	0.36	0.15
02-CL ALIGNMENT-	9136.23	5 YR STORM	268.00	5805.96	5809.09		5809.21	0.001700	2.74	97.73	49.31	0.34	0.21
02-CL ALIGNMENT-	9136.23	10 YR STORM	355.00	5805.96	5809.42		5809.57	0.001923	3.11	114.32	52.46	0.37	0.26
02-CL ALIGNMENT-	9136.23	100 YR STORM	588.00	5805.96	5810.04		5810.28	0.002566	3.93	149.44	59.67	0.44	0.40
02-CL ALIGNMENT-	9124.8	2 YR STORM	89.00	5805.93	5807.72		5807.82	0.002869	2.51	35.41	30.16	0.41	0.21
02-CL ALIGNMENT-	9124.8	5 YR STORM	268.00	5805.93	5809.02		5809.18	0.002490	3.18	84.34	45.37	0.41	0.29

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	9124.8	10 YR STORM	355.00	5805.93	5809.34		5809.54	0.002881	3.57	99.34	49.99	0.45	0.35
02-CL ALIGNMENT-	9124.8	100 YR STORM	588.00	5805.93	5809.93		5810.24	0.003831	4.47	131.57	58.65	0.53	0.53
02-CL ALIGNMENT-	9116.3	2 YR STORM	89.00	5805.91	5807.54		5807.77	0.007215	3.85	23.10	20.40	0.64	0.50
02-CL ALIGNMENT-	9116.3	5 YR STORM	268.00	5805.91	5808.81		5809.13	0.007456	4.54	59.00	41.99	0.68	0.64
02-CL ALIGNMENT-	9116.3	10 YR STORM	355.00	5805.91	5809.13		5809.48	0.007941	4.74	74.86	52.43	0.70	0.70
02-CL ALIGNMENT-	9116.3	100 YR STORM	588.00	5805.91	5809.69		5810.18	0.007649	5.61	104.78	55.27	0.72	0.89
02-CL ALIGNMENT-	9087	2 YR STORM	89.00	5805.79	5807.39		5807.57	0.005445	3.40	26.19	22.78	0.56	0.38
02-CL ALIGNMENT-	9087	5 YR STORM	268.00	5805.79	5808.65		5808.90	0.006703	4.08	65.76	51.14	0.63	0.53
02-CL ALIGNMENT-	9087	10 YR STORM	355.00	5805.79	5808.99		5809.27	0.005606	4.24	83.78	53.67	0.60	0.54
02-CL ALIGNMENT-	9087	100 YR STORM	588.00	5805.79	5809.55		5809.96	0.005876	5.10	115.28	57.84	0.64	0.72
02-CL ALIGNMENT-	9058.28	2 YR STORM	89.00	5805.56	5806.71	5806.71	5807.15	0.077755	5.34	16.66	19.15	1.01	4.16
02-CL ALIGNMENT-	9058.28	5 YR STORM	268.00	5805.56	5807.67	5807.67	5808.41	0.065955	6.89	38.90	26.86	1.01	5.85
02-CL ALIGNMENT-	9058.28	10 YR STORM	355.00	5805.56	5808.26	5808.26	5808.85	0.069653	6.16	57.59	49.27	1.01	5.02
02-CL ALIGNMENT-	9058.28	100 YR STORM	588.00	5805.56	5808.74	5808.74	5809.52	0.065204	7.09	82.88	54.62	1.02	6.10
02-CL ALIGNMENT-	9050	2 YR STORM	89.00	5804.54	5806.22	5805.70	5806.38	0.018290	3.19	27.89	23.38	0.52	1.34
02-CL ALIGNMENT-	9050	5 YR STORM	268.00	5804.54	5807.59	5806.66	5807.79	0.017995	3.55	75.42	53.42	0.53	1.57
02-CL ALIGNMENT-	9050	10 YR STORM	355.00	5804.54	5807.90	5807.24	5808.13	0.017121	3.83	92.74	56.57	0.53	1.73
02-CL ALIGNMENT-	9050	100 YR STORM	588.00	5804.54	5808.59	5807.73	5808.89	0.015886	4.39	133.97	62.86	0.53	2.08
02-CL ALIGNMENT-	9037.19	2 YR STORM	89.00	5804.10	5806.11		5806.20	0.008921	2.46	36.13	26.04	0.37	0.76
02-CL ALIGNMENT-	9037.19	5 YR STORM	268.00	5804.10	5807.48		5807.60	0.009207	2.86	93.64	55.44	0.39	0.96
02-CL ALIGNMENT-	9037.19	10 YR STORM	355.00	5804.10	5807.79		5807.95	0.009592	3.18	111.50	57.98	0.40	1.13
02-CL ALIGNMENT-	9037.19	100 YR STORM	588.00	5804.10	5808.48		5808.71	0.010303	3.84	153.30	63.51	0.44	1.53
02-CL ALIGNMENT-	9025.02	2 YR STORM	89.00	5804.05	5805.98		5806.08	0.010541	2.62	34.02	25.39	0.40	0.87
02-CL ALIGNMENT-	9025.02	5 YR STORM	268.00	5804.05	5807.34		5807.48	0.010794	3.02	88.84	54.76	0.42	1.08
02-CL ALIGNMENT-	9025.02	10 YR STORM	355.00	5804.05	5807.65		5807.82	0.011120	3.35	106.12	57.25	0.43	1.27
02-CL ALIGNMENT-	9025.02	100 YR STORM	588.00	5804.05	5808.32		5808.57	0.011779	4.01	146.46	62.66	0.46	1.69
02-CL ALIGNMENT-	9010.04	2 YR STORM	89.00	5803.99	5805.84		5805.96	0.006282	2.76	32.19	24.86	0.43	0.50
02-CL ALIGNMENT-	9010.04	5 YR STORM	268.00	5803.99	5807.20		5807.36	0.006367	3.17	84.61	54.07	0.45	0.61
02-CL ALIGNMENT-	9010.04	10 YR STORM	355.00	5803.99	5807.50		5807.70	0.006500	3.50	101.35	56.53	0.46	0.72
02-CL ALIGNMENT-	9010.04	100 YR STORM	588.00	5803.99	5808.17		5808.44	0.006791	4.19	140.47	61.89	0.49	0.95
02-CL ALIGNMENT-	9000	2 YR STORM	89.00	5803.95	5805.77		5805.90	0.006662	2.83	31.48	24.57	0.44	0.52
02-CL ALIGNMENT-	9000	5 YR STORM	268.00	5803.95	5807.13		5807.29	0.006776	3.23	82.91	53.86	0.46	0.64
02-CL ALIGNMENT-	9000	10 YR STORM	355.00	5803.95	5807.43		5807.63	0.006882	3.57	99.45	56.27	0.47	0.75
02-CL ALIGNMENT-	9000	100 YR STORM	588.00	5803.95	5808.09		5808.37	0.007120	4.25	138.19	61.55	0.50	0.98
02-CL ALIGNMENT-	8950	2 YR STORM	89.00	5803.76	5805.51		5805.65	0.003860	3.00	29.63	23.96	0.48	0.29
02-CL ALIGNMENT-	8950	5 YR STORM	268.00	5803.76	5806.86		5807.04	0.003927	3.42	78.44	53.18	0.50	0.36
02-CL ALIGNMENT-	8950	10 YR STORM	355.00	5803.76	5807.15		5807.37	0.003926	3.76	94.53	55.56	0.51	0.41
02-CL ALIGNMENT-	8950	100 YR STORM	588.00	5803.76	5807.80		5808.11	0.003984	4.45	132.09	60.75	0.53	0.53

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

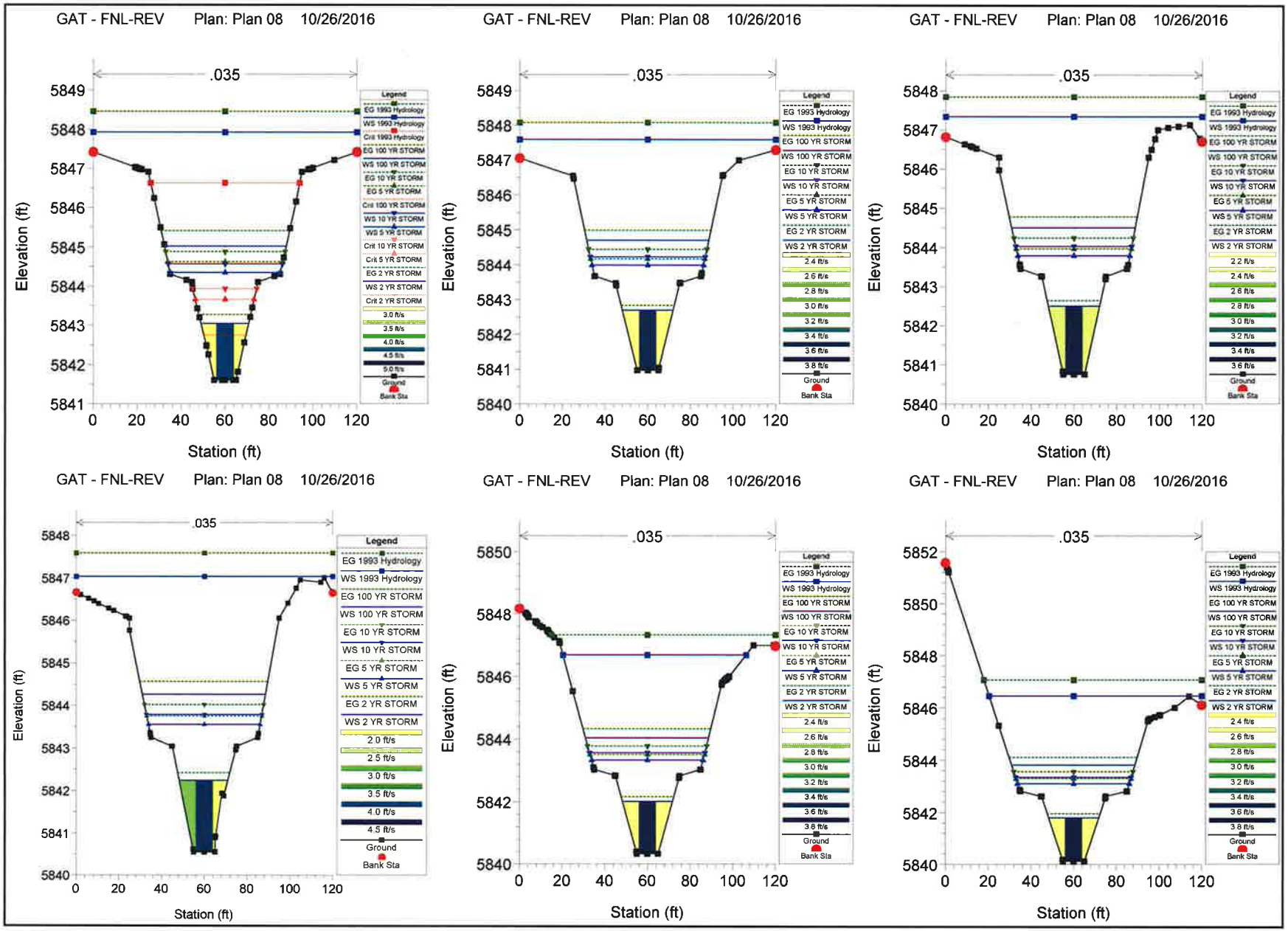
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	8900	2 YR STORM	89.00	5803.56	5805.32		5805.45	0.003765	2.98	29.90	24.05	0.47	0.29
02-CL ALIGNMENT-	8900	5 YR STORM	268.00	5803.56	5806.66		5806.84	0.003909	3.41	78.52	53.13	0.50	0.36
02-CL ALIGNMENT-	8900	10 YR STORM	355.00	5803.56	5806.96		5807.18	0.003912	3.75	94.59	55.51	0.51	0.41
02-CL ALIGNMENT-	8900	100 YR STORM	588.00	5803.56	5807.60		5807.91	0.004005	4.46	131.80	60.66	0.53	0.54
02-CL ALIGNMENT-	8850	2 YR STORM	89.00	5803.37	5805.13		5805.27	0.003740	2.97	29.97	24.07	0.47	0.29
02-CL ALIGNMENT-	8850	5 YR STORM	268.00	5803.37	5806.46		5806.64	0.003965	3.43	78.18	53.13	0.50	0.36
02-CL ALIGNMENT-	8850	10 YR STORM	355.00	5803.37	5806.76		5806.98	0.003958	3.77	94.25	55.50	0.51	0.41
02-CL ALIGNMENT-	8850	100 YR STORM	588.00	5803.37	5807.39		5807.70	0.004079	4.49	131.01	60.57	0.54	0.54
02-CL ALIGNMENT-	8800	2 YR STORM	89.00	5803.18	5804.94		5805.08	0.003700	2.96	30.09	24.11	0.47	0.28
02-CL ALIGNMENT-	8800	5 YR STORM	268.00	5803.18	5806.25		5806.44	0.004108	3.47	77.27	53.00	0.51	0.37
02-CL ALIGNMENT-	8800	10 YR STORM	355.00	5803.18	5806.55		5806.78	0.004066	3.80	93.41	55.38	0.52	0.42
02-CL ALIGNMENT-	8800	100 YR STORM	588.00	5803.18	5807.18		5807.50	0.004223	4.54	129.47	60.36	0.55	0.56
02-CL ALIGNMENT-	8750	2 YR STORM	89.00	5802.98	5804.77		5804.90	0.003509	2.90	30.67	24.30	0.46	0.27
02-CL ALIGNMENT-	8750	5 YR STORM	268.00	5802.98	5806.04		5806.23	0.004215	3.50	76.62	52.89	0.51	0.38
02-CL ALIGNMENT-	8750	10 YR STORM	355.00	5802.98	5806.35		5806.57	0.004120	3.82	93.00	55.32	0.52	0.43
02-CL ALIGNMENT-	8750	100 YR STORM	588.00	5802.98	5806.95		5807.28	0.004360	4.59	128.08	60.18	0.55	0.57
02-CL ALIGNMENT-	8700	2 YR STORM	89.00	5802.79	5804.60		5804.73	0.003348	2.85	31.19	24.48	0.45	0.26
02-CL ALIGNMENT-	8700	5 YR STORM	268.00	5802.79	5805.81		5806.01	0.004632	3.61	74.28	52.54	0.53	0.40
02-CL ALIGNMENT-	8700	10 YR STORM	355.00	5802.79	5806.12		5806.36	0.004366	3.89	91.22	55.06	0.53	0.45
02-CL ALIGNMENT-	8700	100 YR STORM	588.00	5802.79	5806.71		5807.05	0.004720	4.72	124.68	59.72	0.58	0.61
02-CL ALIGNMENT-	8654.07	2 YR STORM	89.00	5802.61	5803.96	5803.96	5804.39	0.020121	5.23	17.02	20.79	1.02	1.02
02-CL ALIGNMENT-	8654.07	5 YR STORM	268.00	5802.61	5804.88	5804.88	5805.59	0.016653	6.79	39.48	28.14	1.01	1.43
02-CL ALIGNMENT-	8654.07	10 YR STORM	355.00	5802.61	5805.39	5805.39	5805.97	0.017432	6.10	58.16	50.62	1.00	1.24
02-CL ALIGNMENT-	8654.07	100 YR STORM	588.00	5802.61	5805.86	5805.86	5806.64	0.016239	7.10	82.80	54.37	1.01	1.52
02-CL ALIGNMENT-	8650	2 YR STORM	89.00	5802.60	5803.57	5803.75	5804.25	0.035973	6.63	13.43	17.75	1.34	1.68
02-CL ALIGNMENT-	8650	5 YR STORM	268.00	5802.60	5804.52	5804.71	5805.49	0.024152	7.91	33.89	25.36	1.21	1.98
02-CL ALIGNMENT-	8650	10 YR STORM	355.00	5802.60	5805.15	5805.29	5805.89	0.016054	6.86	51.78	35.37	1.00	1.44
02-CL ALIGNMENT-	8650	100 YR STORM	588.00	5802.60	5805.71	5805.77	5806.57	0.018266	7.41	79.34	53.33	1.07	1.67
02-CL ALIGNMENT-	8629.07	2 YR STORM	89.00	5802.10	5802.62	5802.68	5802.90	0.112232	3.73	21.84	53.85	1.06	2.66
02-CL ALIGNMENT-	8629.07	5 YR STORM	268.00	5802.10	5802.75	5803.15	5804.14	0.420727	8.76	29.35	56.89	2.16	13.32
02-CL ALIGNMENT-	8629.07	10 YR STORM	355.00	5802.10	5802.81	5803.32	5804.78	0.548962	10.64	32.41	58.18	2.51	19.08
02-CL ALIGNMENT-	8629.07	100 YR STORM	588.00	5802.10	5803.09	5803.70	5805.38	0.427778	12.08	49.60	65.30	2.36	21.67
02-CL ALIGNMENT-	8617.08	2 YR STORM	89.00	5800.44	5801.41	5801.49	5801.79	0.148119	4.99	17.84	36.95	1.27	4.41
02-CL ALIGNMENT-	8617.08	5 YR STORM	268.00	5800.44	5802.13	5802.14	5802.53	0.082411	5.08	52.77	68.63	1.02	3.91
02-CL ALIGNMENT-	8617.08	10 YR STORM	355.00	5800.44	5802.29	5802.29	5802.77	0.077913	5.54	64.09	70.13	1.02	4.40
02-CL ALIGNMENT-	8617.08	100 YR STORM	588.00	5800.44	5802.59	5802.69	5803.32	0.085490	6.86	85.70	72.90	1.12	6.20
02-CL ALIGNMENT-	8600	2 YR STORM	89.00	5799.32	5800.09	5800.09	5800.32	0.100232	3.85	23.12	53.15	1.03	2.71
02-CL ALIGNMENT-	8600	5 YR STORM	268.00	5799.32	5800.52	5800.59	5801.01	0.099935	5.59	47.90	62.71	1.13	4.75
02-CL ALIGNMENT-	8600	10 YR STORM	355.00	5799.32	5800.67	5800.76	5801.26	0.100862	6.14	57.79	66.19	1.16	5.48

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	8600	100 YR STORM	588.00	5799.32	5801.07	5801.19	5801.79	0.093983	6.82	86.20	80.04	1.16	6.30
02-CL ALIGNMENT-	8585	2 YR STORM	89.00	5796.52	5797.74	5797.83	5798.10	0.237249	4.82	18.46	57.23	1.50	4.71
02-CL ALIGNMENT-	8585	5 YR STORM	268.00	5796.52	5798.07	5798.31	5798.86	0.212148	7.13	37.61	59.53	1.58	8.24
02-CL ALIGNMENT-	8585	10 YR STORM	355.00	5796.52	5798.21	5798.48	5799.14	0.202131	7.72	45.96	62.19	1.58	9.19
02-CL ALIGNMENT-	8585	100 YR STORM	588.00	5796.52	5798.50	5798.92	5799.77	0.195023	9.03	65.11	67.90	1.63	11.51
02-CL ALIGNMENT-	8574.99	2 YR STORM	89.00	5795.46	5796.21	5796.24	5796.45	0.116771	4.00	22.22	53.98	1.10	2.99
02-CL ALIGNMENT-	8574.99	5 YR STORM	268.00	5795.46	5796.57	5796.70	5797.17	0.129788	6.21	43.13	58.38	1.27	5.93
02-CL ALIGNMENT-	8574.99	10 YR STORM	355.00	5795.46	5796.70	5796.88	5797.46	0.132916	6.97	50.95	59.04	1.32	7.09
02-CL ALIGNMENT-	8574.99	100 YR STORM	588.00	5795.46	5797.02	5797.31	5798.12	0.133034	8.41	69.89	60.82	1.38	9.41
02-CL ALIGNMENT-	8549.51	2 YR STORM	89.00	5793.23	5794.03	5794.03	5794.25	0.096659	3.75	23.73	55.33	1.01	2.58
02-CL ALIGNMENT-	8549.51	5 YR STORM	268.00	5793.23	5794.50	5794.50	5794.93	0.076761	5.24	51.17	60.71	1.01	4.03
02-CL ALIGNMENT-	8549.51	10 YR STORM	355.00	5793.23	5794.68	5794.69	5795.19	0.074125	5.70	62.33	63.50	1.01	4.53
02-CL ALIGNMENT-	8549.51	100 YR STORM	588.00	5793.23	5795.01	5795.11	5795.77	0.083321	7.00	83.96	68.46	1.11	6.36
02-CL ALIGNMENT-	8500	2 YR STORM	89.00	5793.00	5793.78	5793.29	5793.80	0.001006	1.11	79.89	105.97	0.23	0.05
02-CL ALIGNMENT-	8500	5 YR STORM	268.00	5793.00	5794.36	5793.60	5794.41	0.001402	1.88	142.73	110.86	0.29	0.11
02-CL ALIGNMENT-	8500	10 YR STORM	355.00	5793.00	5794.57	5793.72	5794.64	0.001510	2.13	166.30	112.63	0.31	0.14
02-CL ALIGNMENT-	8500	100 YR STORM	588.00	5793.00	5795.00	5794.02	5795.11	0.001827	2.73	215.36	116.24	0.35	0.21
02-CL ALIGNMENT-	8400	2 YR STORM	89.00	5793.00	5793.71		5793.72	0.000574	0.80	111.35	159.64	0.17	0.02
02-CL ALIGNMENT-	8400	5 YR STORM	268.00	5793.00	5794.28		5794.31	0.000725	1.32	203.48	164.26	0.21	0.06
02-CL ALIGNMENT-	8400	10 YR STORM	355.00	5793.00	5794.49		5794.52	0.000763	1.49	238.23	165.97	0.22	0.07
02-CL ALIGNMENT-	8400	100 YR STORM	588.00	5793.00	5794.92		5794.97	0.000900	1.90	309.55	169.43	0.25	0.10
02-CL ALIGNMENT-	8300	2 YR STORM	89.00	5793.00	5793.66		5793.66	0.000550	0.74	119.69	185.31	0.16	0.02
02-CL ALIGNMENT-	8300	5 YR STORM	268.00	5793.00	5794.22		5794.24	0.000644	1.19	224.52	191.70	0.19	0.05
02-CL ALIGNMENT-	8300	10 YR STORM	355.00	5793.00	5794.42		5794.45	0.000671	1.34	264.97	196.18	0.20	0.06
02-CL ALIGNMENT-	8300	100 YR STORM	588.00	5793.00	5794.84		5794.89	0.000765	1.69	348.01	200.00	0.23	0.08
02-CL ALIGNMENT-	8200	2 YR STORM	89.00	5793.00	5793.58		5793.60	0.000870	0.86	103.64	182.41	0.20	0.03
02-CL ALIGNMENT-	8200	5 YR STORM	268.00	5793.00	5794.14		5794.16	0.000845	1.27	211.86	203.41	0.22	0.05
02-CL ALIGNMENT-	8200	10 YR STORM	355.00	5793.00	5794.35		5794.38	0.000810	1.40	254.43	204.04	0.22	0.06
02-CL ALIGNMENT-	8200	100 YR STORM	588.00	5793.00	5794.76		5794.80	0.000871	1.74	338.07	205.27	0.24	0.09
02-CL ALIGNMENT-	8130	2 YR STORM	89.00	5793.00	5793.39		5793.42	0.018846	1.52	58.71	156.45	0.44	0.44
02-CL ALIGNMENT-	8130	5 YR STORM	268.00	5793.00	5793.98		5794.03	0.007850	1.69	158.23	184.65	0.32	0.42
02-CL ALIGNMENT-	8130	10 YR STORM	355.00	5793.00	5794.20		5794.25	0.006488	1.78	199.34	186.76	0.30	0.43
02-CL ALIGNMENT-	8130	100 YR STORM	588.00	5793.00	5794.60		5794.67	0.006292	2.15	273.53	188.42	0.31	0.57
02-CL ALIGNMENT-	8119.18	2 YR STORM	89.00	5791.91	5792.77	5792.77	5793.05	0.067929	4.31	21.83	41.41	0.91	2.91
02-CL ALIGNMENT-	8119.18	5 YR STORM	268.00	5791.91	5793.38	5793.38	5793.81	0.059436	5.58	54.89	67.00	0.93	4.15
02-CL ALIGNMENT-	8119.18	10 YR STORM	355.00	5791.91	5793.58	5793.58	5794.05	0.057372	5.95	69.14	75.00	0.93	4.53
02-CL ALIGNMENT-	8119.18	100 YR STORM	588.00	5791.91	5794.03	5794.03	5794.48	0.063861	5.80	112.90	119.78	0.96	4.49
02-CL ALIGNMENT-	8100	2 YR STORM	89.00	5790.31	5791.12	5791.17	5791.43	0.106904	4.48	20.11	44.20	1.09	3.46

HEC-RAS Plan: Plan 08 River: 02-CL ALIGNMENT- Reach: 02-CL ALIGNMENT- (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)
02-CL ALIGNMENT-	8100	5 YR STORM	268.00	5790.31	5791.52	5791.71	5792.15	0.134594	6.62	44.86	78.98	1.31	6.58
02-CL ALIGNMENT-	8100	10 YR STORM	355.00	5790.31	5791.64	5791.86	5792.38	0.144845	7.23	54.63	84.90	1.38	7.66
02-CL ALIGNMENT-	8100	100 YR STORM	588.00	5790.31	5791.97	5792.19	5792.76	0.126759	7.61	84.70	99.70	1.33	7.99
02-CL ALIGNMENT-	8086.45	2 YR STORM	89.00	5789.28	5789.97	5790.03	5790.24	0.118897	4.28	21.74	57.96	1.13	3.32
02-CL ALIGNMENT-	8086.45	5 YR STORM	268.00	5789.28	5790.46	5790.48	5790.79	0.069029	4.85	61.28	96.37	0.95	3.50
02-CL ALIGNMENT-	8086.45	10 YR STORM	355.00	5789.28	5790.61	5790.62	5790.97	0.067198	5.11	76.58	104.61	0.95	3.75
02-CL ALIGNMENT-	8086.45	100 YR STORM	588.00	5789.28	5790.89	5790.94	5791.38	0.075161	5.98	107.06	119.70	1.03	4.89
02-CL ALIGNMENT-	8075	2 YR STORM	89.00	5788.41	5789.12	5789.12	5789.31	0.080087	3.63	25.99	69.37	0.93	2.35
02-CL ALIGNMENT-	8075	5 YR STORM	268.00	5788.41	5789.48	5789.55	5789.86	0.097517	5.21	56.58	100.83	1.10	4.24
02-CL ALIGNMENT-	8075	10 YR STORM	355.00	5788.41	5789.59	5789.67	5790.04	0.101285	5.65	68.87	109.01	1.14	4.84
02-CL ALIGNMENT-	8075	100 YR STORM	588.00	5788.41	5789.87	5789.95	5790.43	0.091678	6.31	100.88	119.56	1.13	5.56
02-CL ALIGNMENT-	8051.91	2 YR STORM	89.00	5786.32	5786.83	5786.84	5786.99	0.128370	3.27	27.22	96.52	1.09	2.26
02-CL ALIGNMENT-	8051.91	5 YR STORM	268.00	5786.32	5787.13	5787.17	5787.46	0.109634	4.67	57.40	105.96	1.12	3.71
02-CL ALIGNMENT-	8051.91	10 YR STORM	355.00	5786.32	5787.24	5787.29	5787.64	0.104426	5.09	69.74	109.01	1.12	4.17
02-CL ALIGNMENT-	8051.91	100 YR STORM	588.00	5786.32	5787.46	5787.57	5788.07	0.114151	6.28	93.68	114.34	1.22	5.83
02-CL ALIGNMENT-	8000	2 YR STORM	89.00	5781.00	5781.52	5781.32	5781.57	0.005003	1.90	46.94	93.45	0.47	0.16
02-CL ALIGNMENT-	8000	5 YR STORM	268.00	5781.00	5782.00	5781.65	5782.13	0.004999	2.89	92.89	98.40	0.52	0.29
02-CL ALIGNMENT-	8000	10 YR STORM	355.00	5781.00	5782.18	5781.78	5782.34	0.005000	3.20	110.79	100.24	0.54	0.34
02-CL ALIGNMENT-	8000	100 YR STORM	588.00	5781.00	5781.69	5782.09	5783.02	0.081560	9.25	63.57	95.29	2.00	3.39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Station (ft)
Legend
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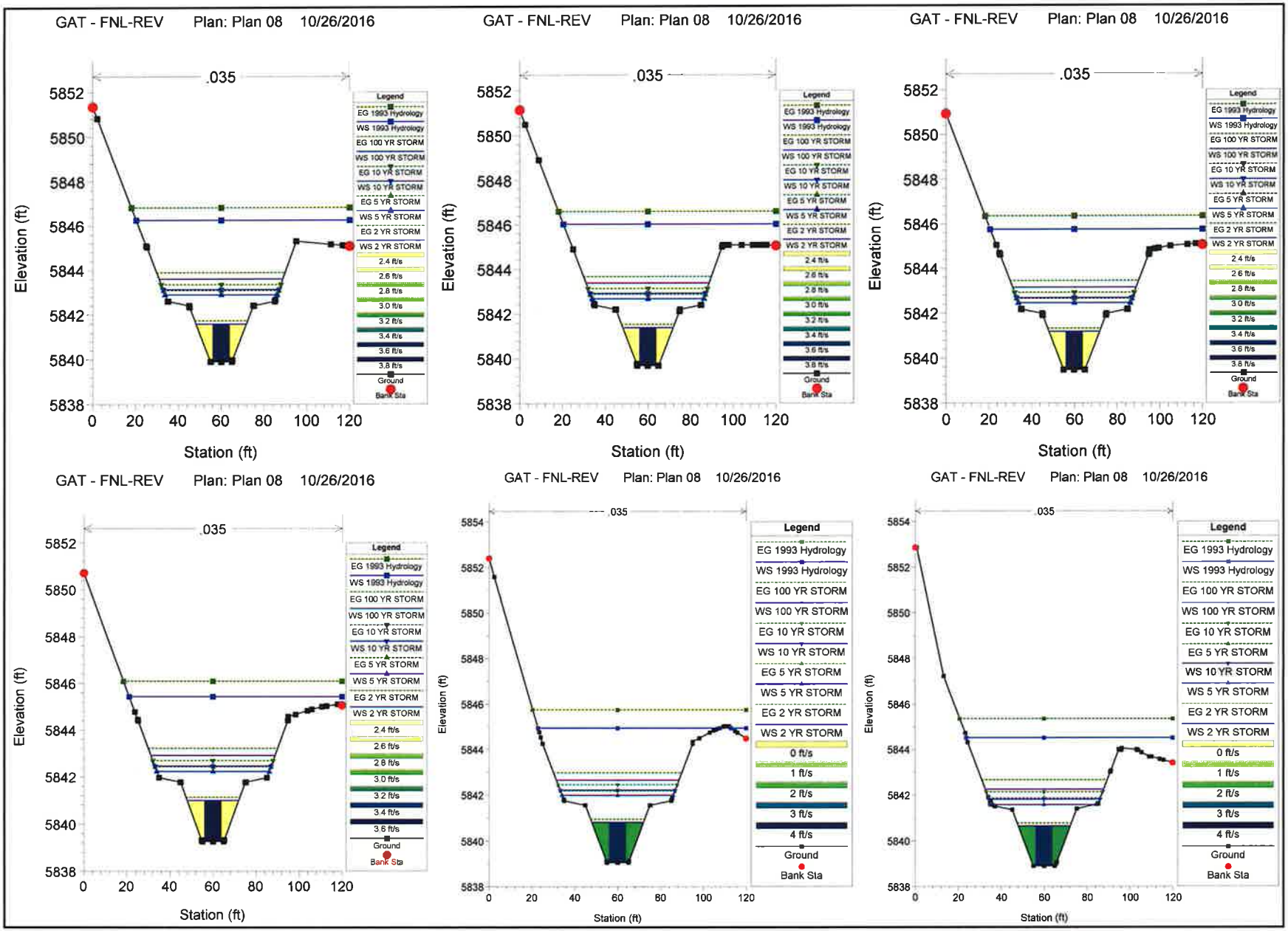
WS 1993 Hydrology
EG 100 YR STORM
WS 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Ground
Bank Sta


GAT - FNL-REV Plan: Plan 08 10/26/2016
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Elevation (ft)
Station (ft)
Legend
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WS 1993 Hydrology
EG 100 YR STORM
WS 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
3.4 ft/s
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Ground
Bank Sta
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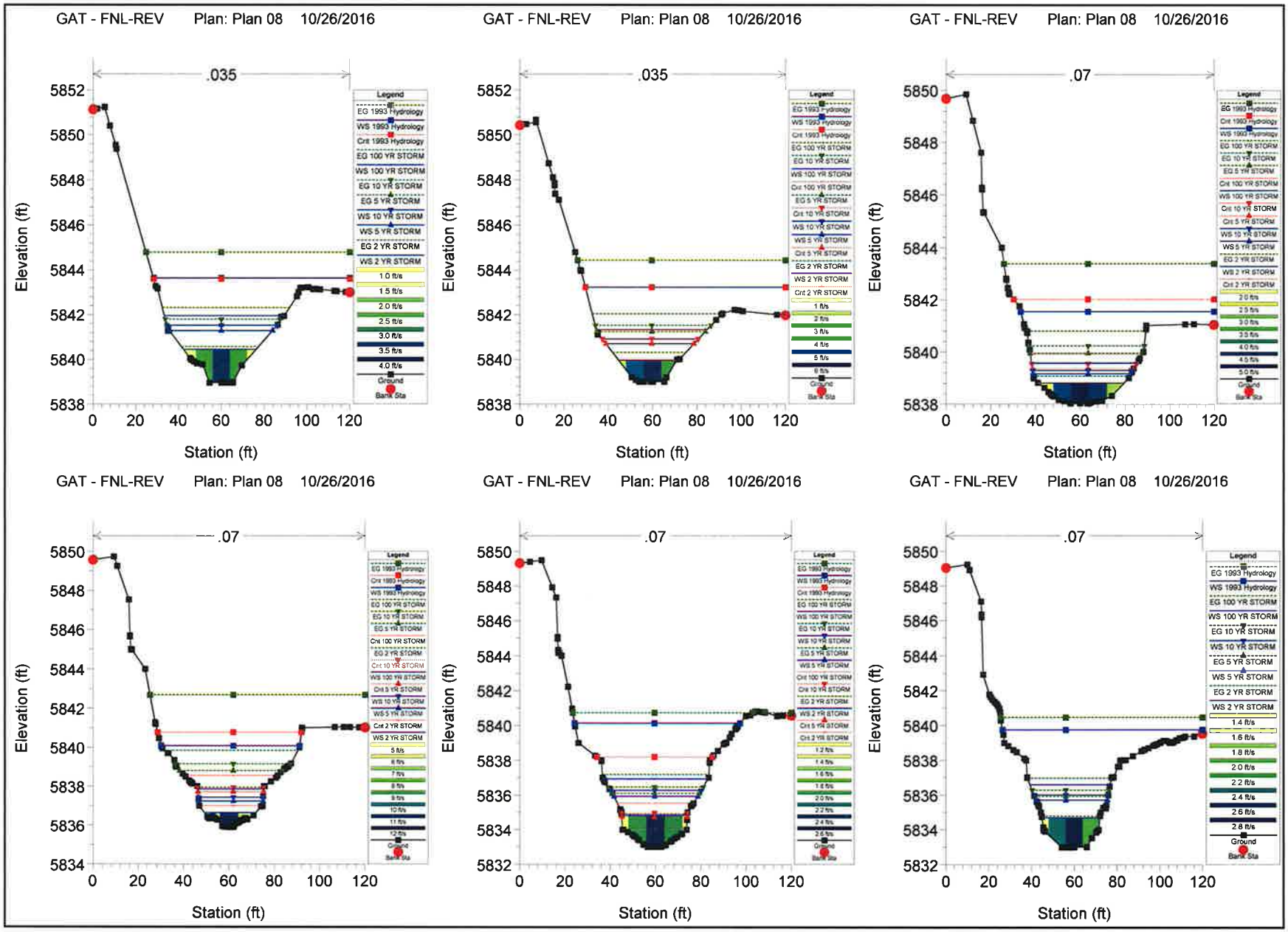
1 ft/s
2 ft/s
3 ft/s
4 ft/s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Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
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Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
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Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
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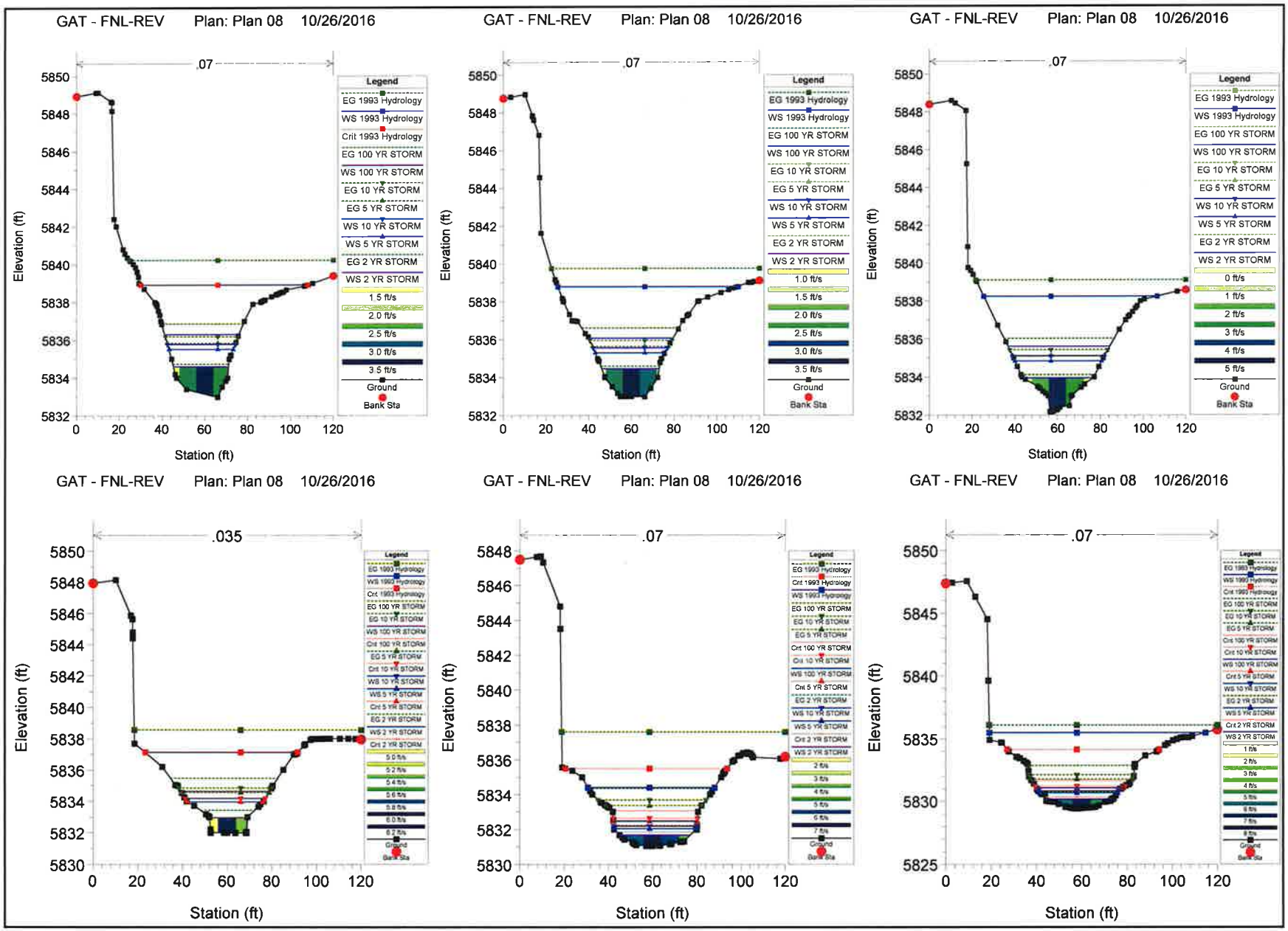
Elevation (ft)
Station (ft)


GAT - FNL-REV Plan: Plan 08 10/26/2016
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Legend
EG 1993 Hydrology
WS 1993 Hydrology
Crit 1993 Hydrology
EG 100 YR STORM
WS 100 YR STORM
EG 10 YR STORM
EG 5 YR STORM
WS 10 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Legend
EG 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
WS 100 YR STORM
EG 10 YR STORM
EG 5 YR STORM
WS 10 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
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1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
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Legend
EG 1993 Hydrology
WS 1993 Hydrology
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WS 100 YR STORM
EG 10 YR STORM
EG 5 YR STORM
WS 10 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
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1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
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Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Elevation (ft)
Station (ft)
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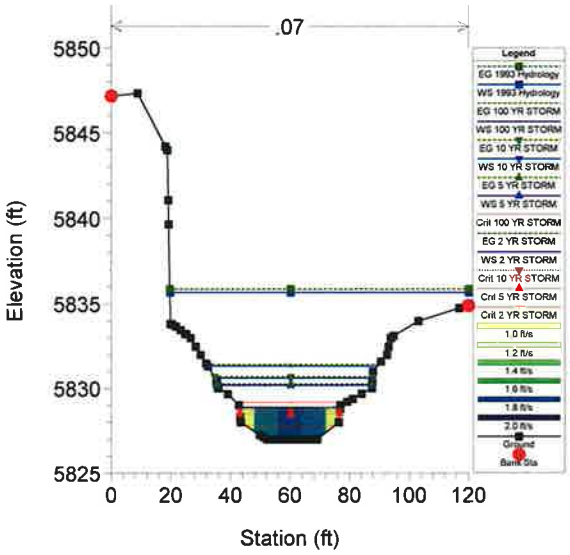
Elevation (ft)
Station (ft)

GAT - FNL-REV Plan: Plan 08 10/26/2016



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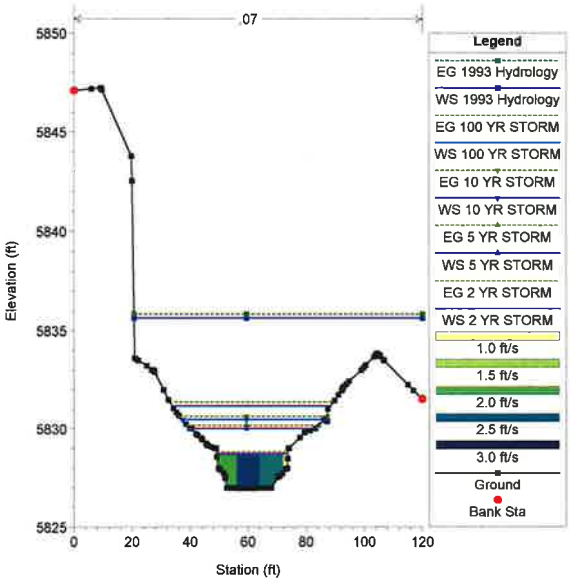

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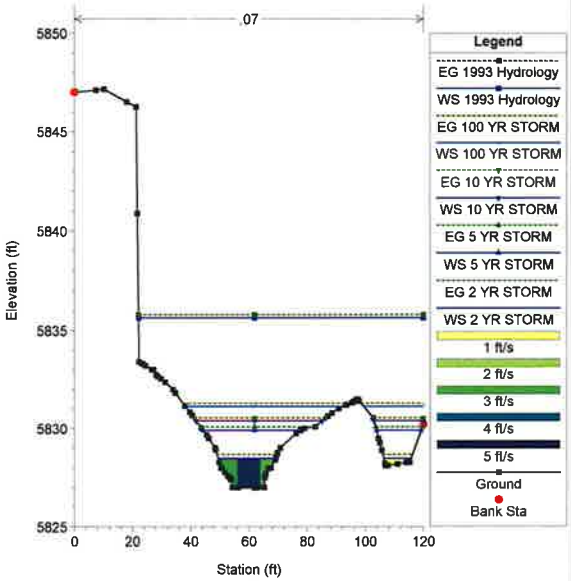

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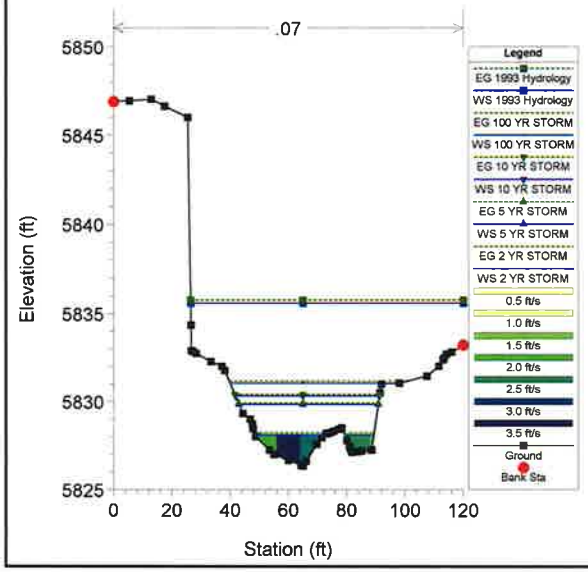

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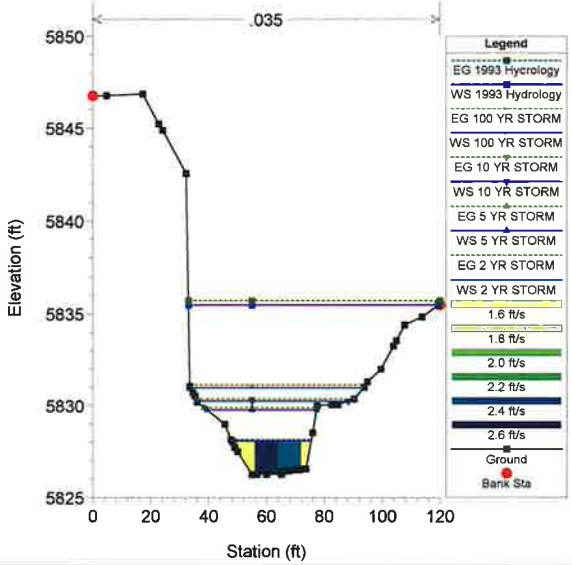

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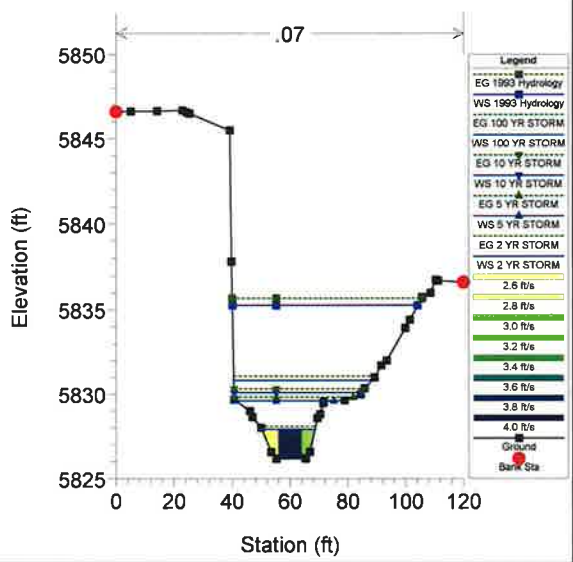

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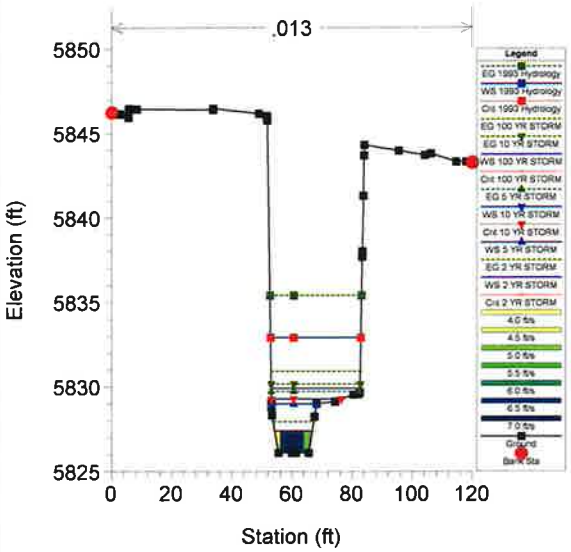

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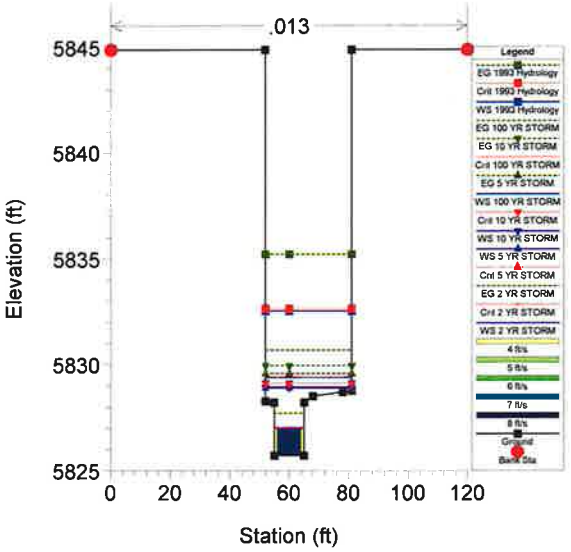

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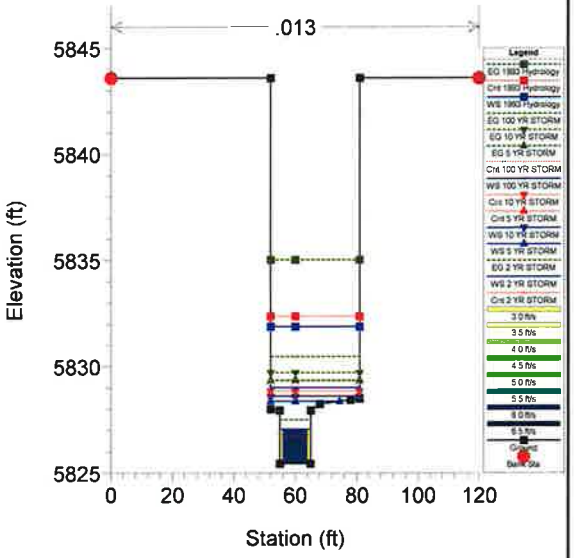

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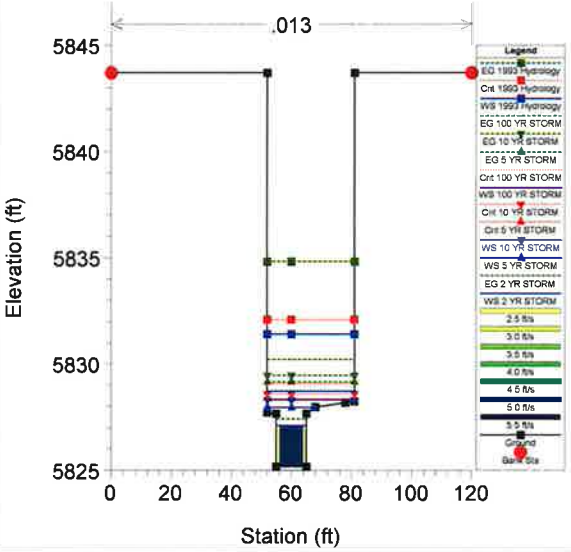

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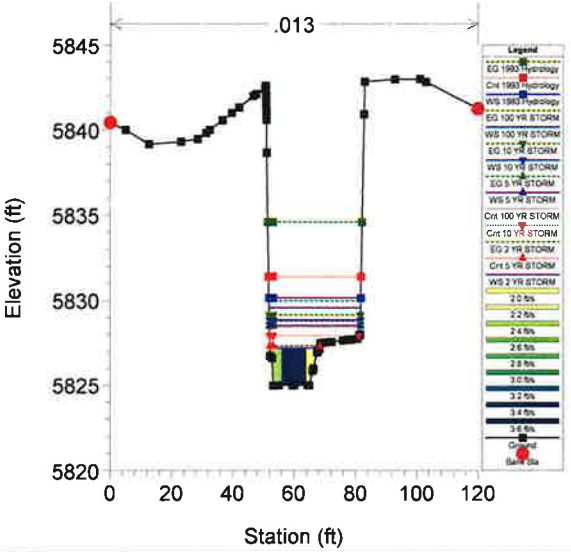

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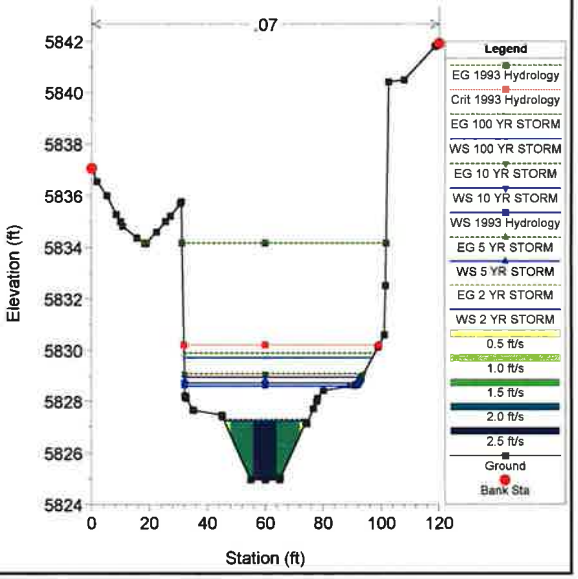

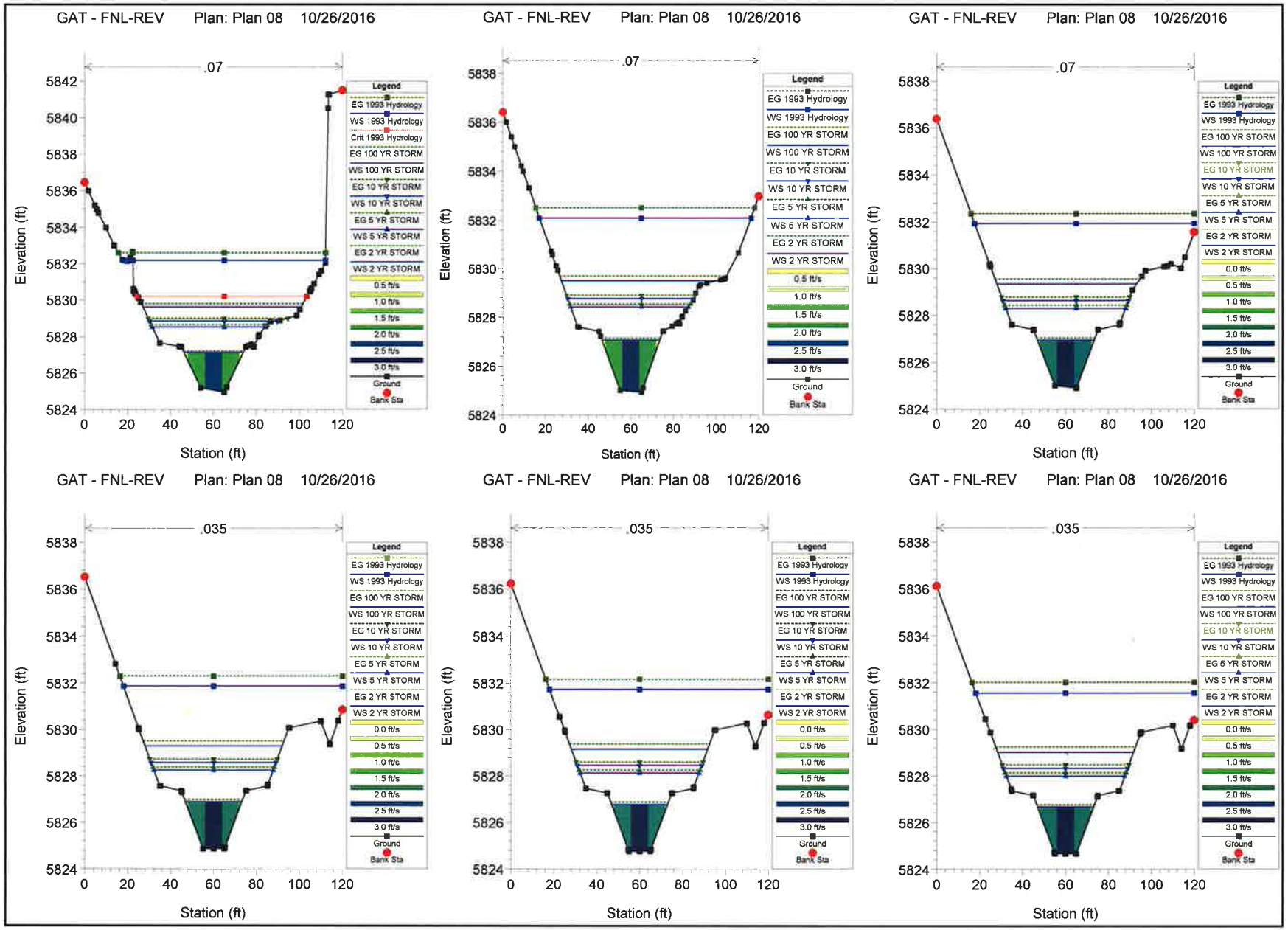
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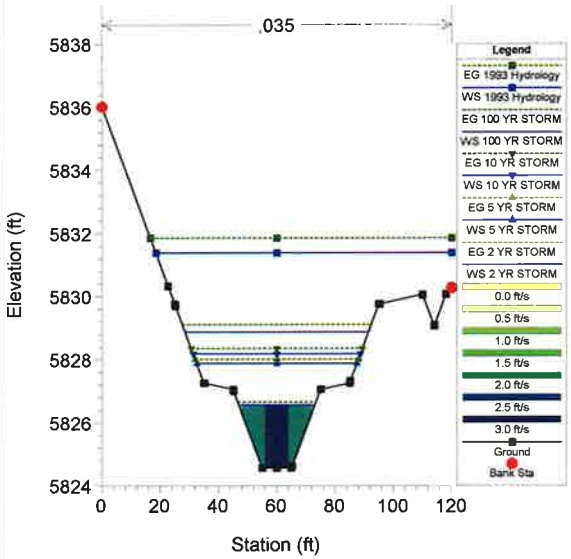

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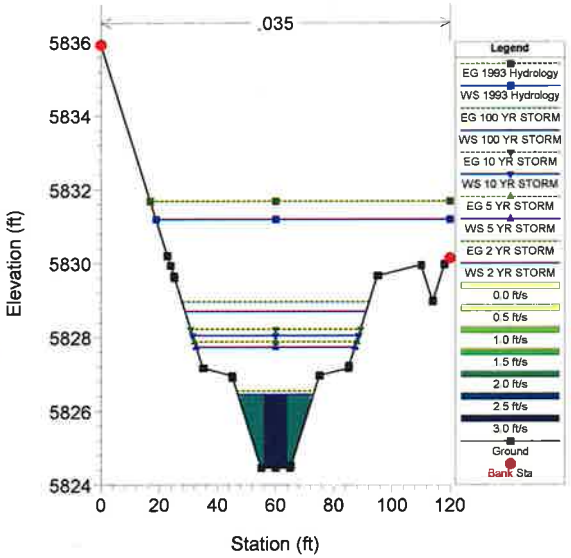

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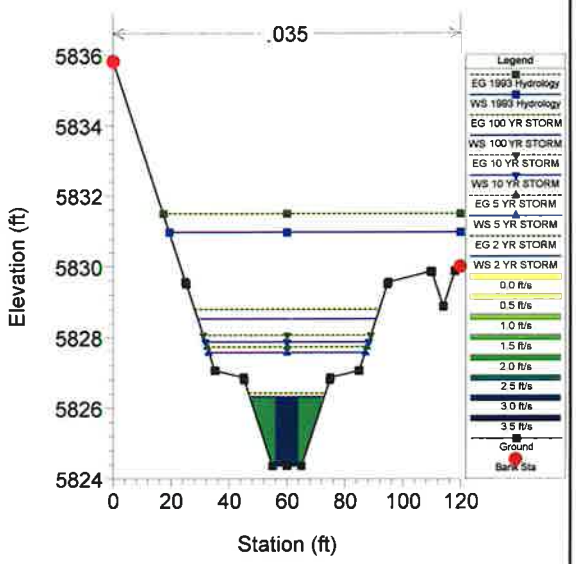

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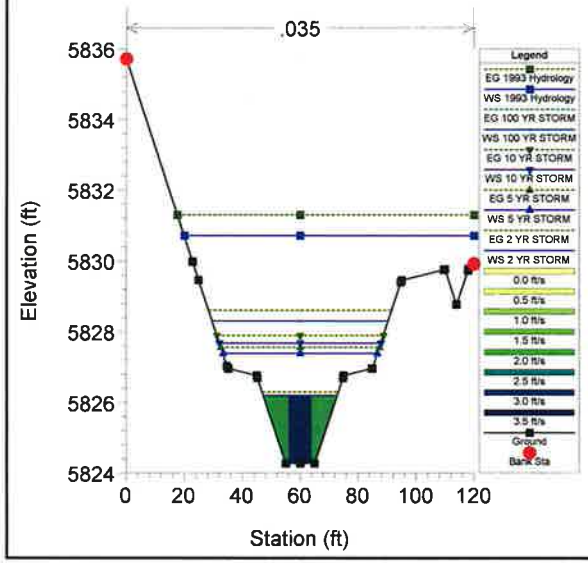

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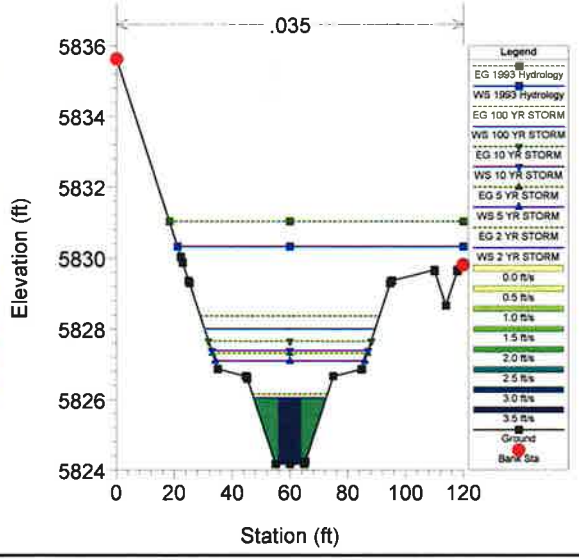

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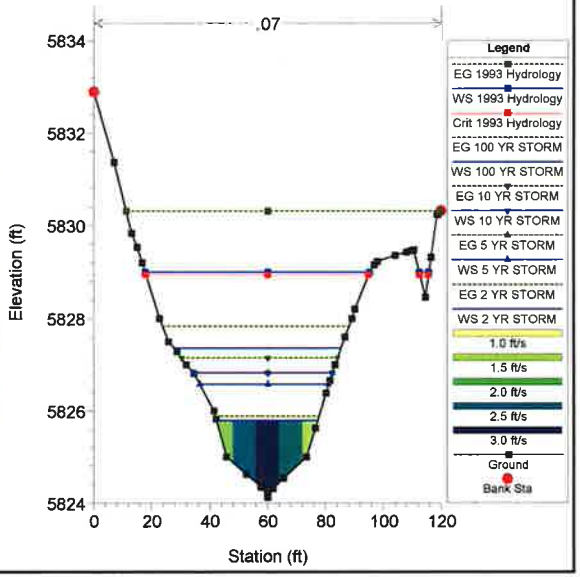

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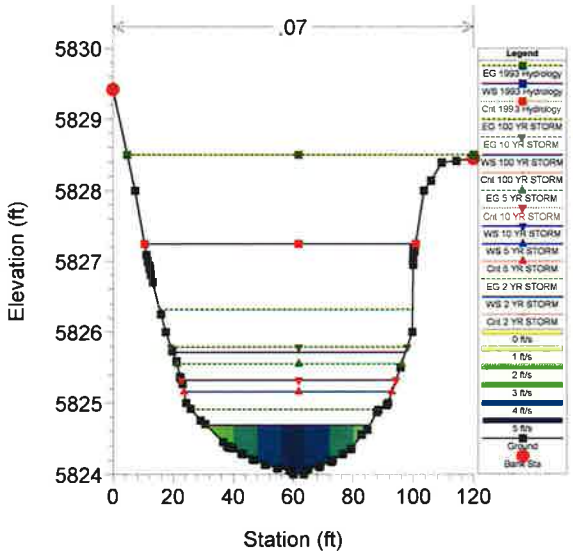

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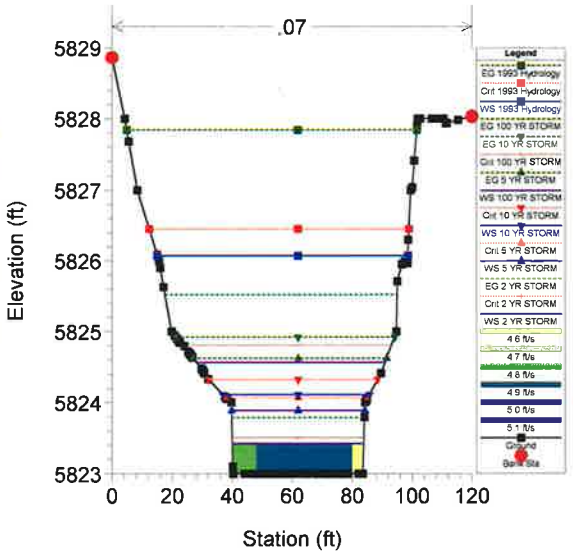

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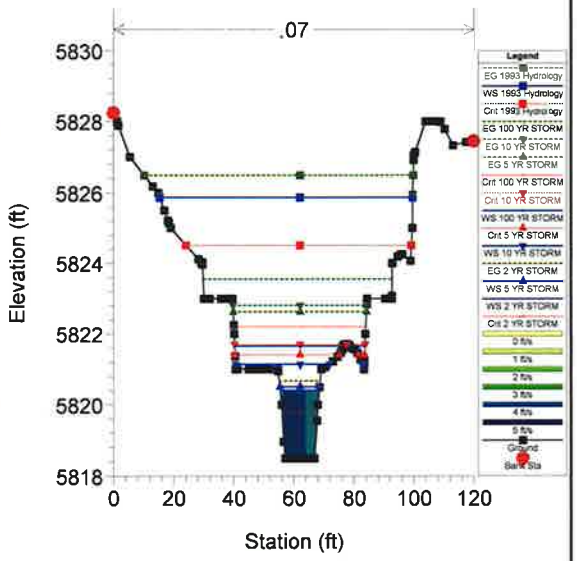

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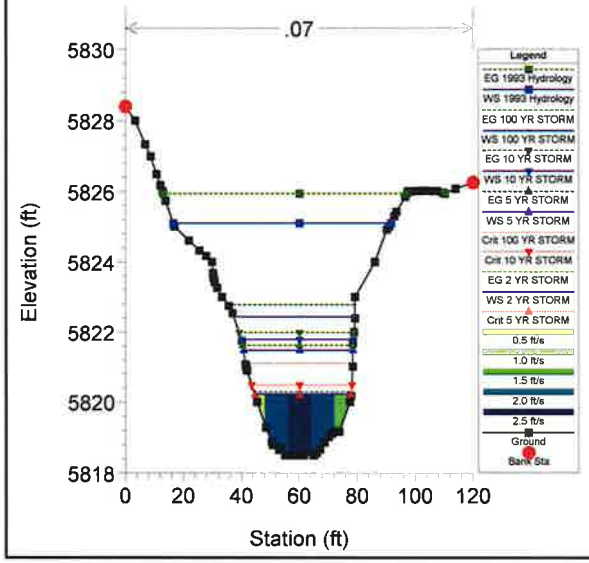

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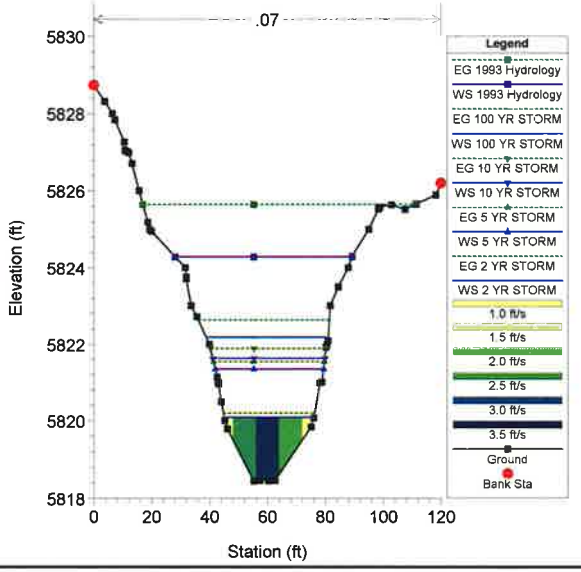

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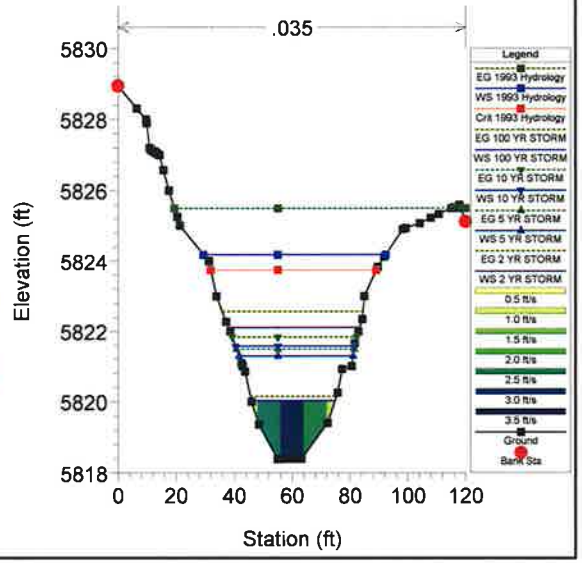

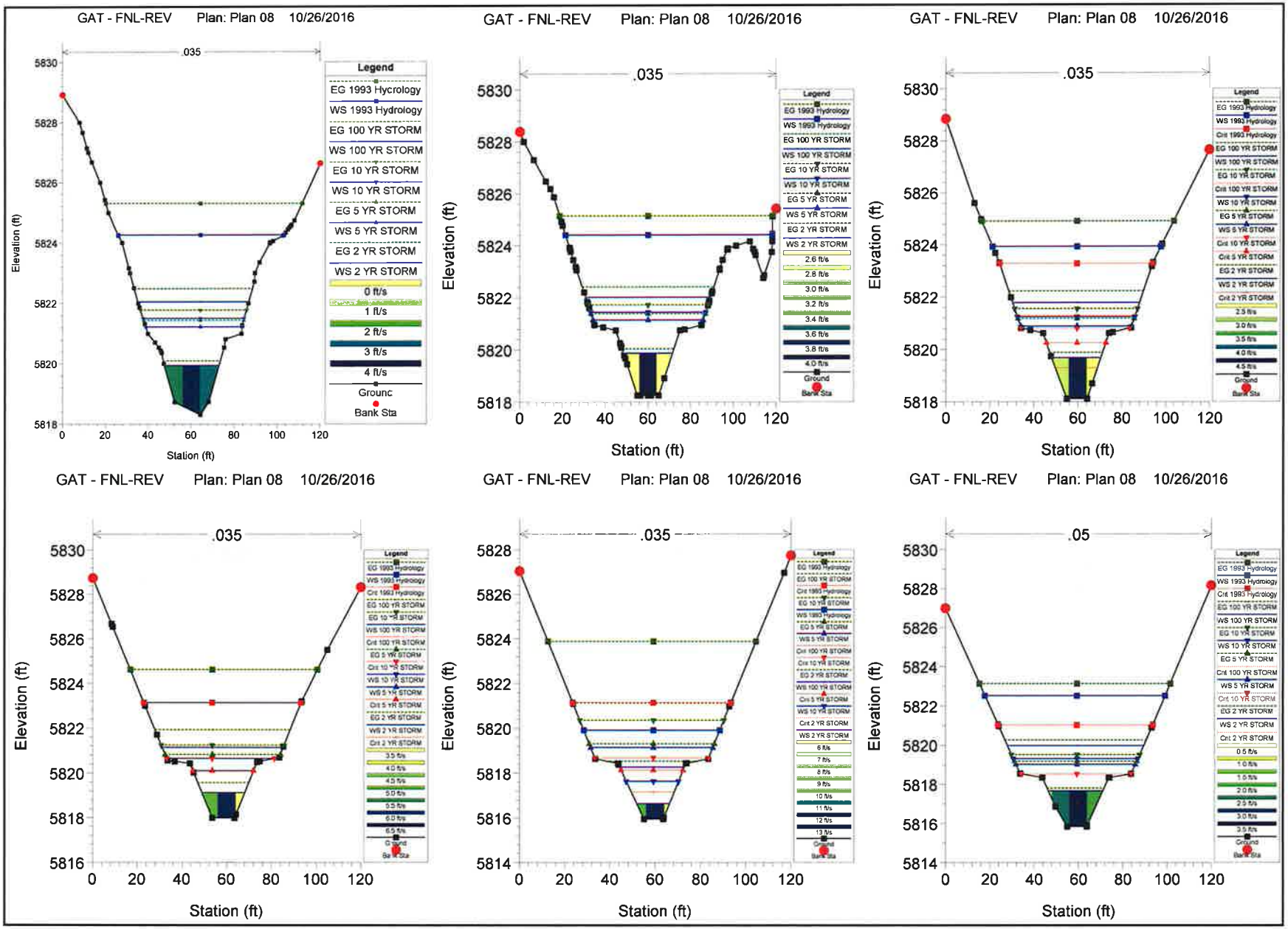
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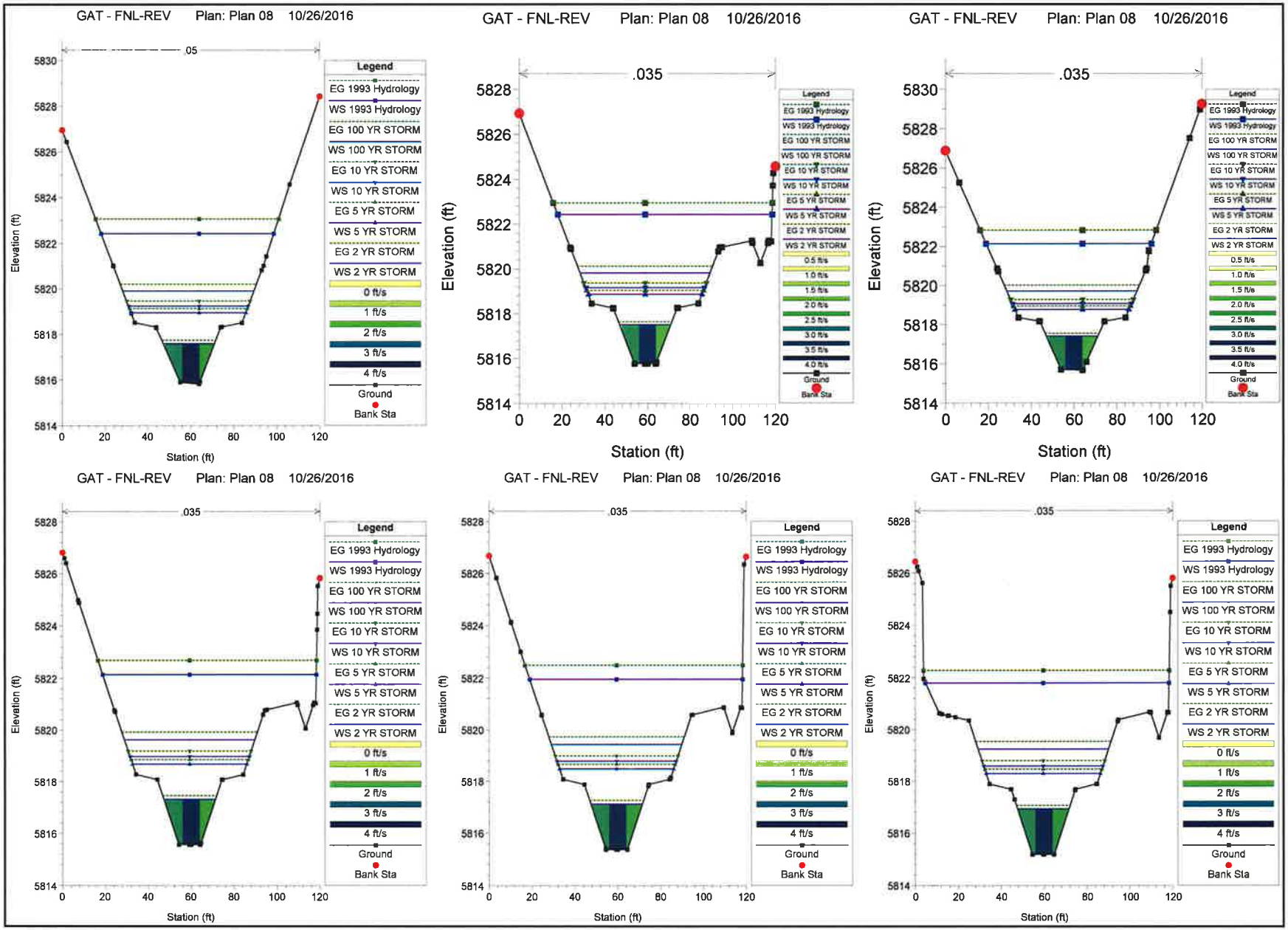
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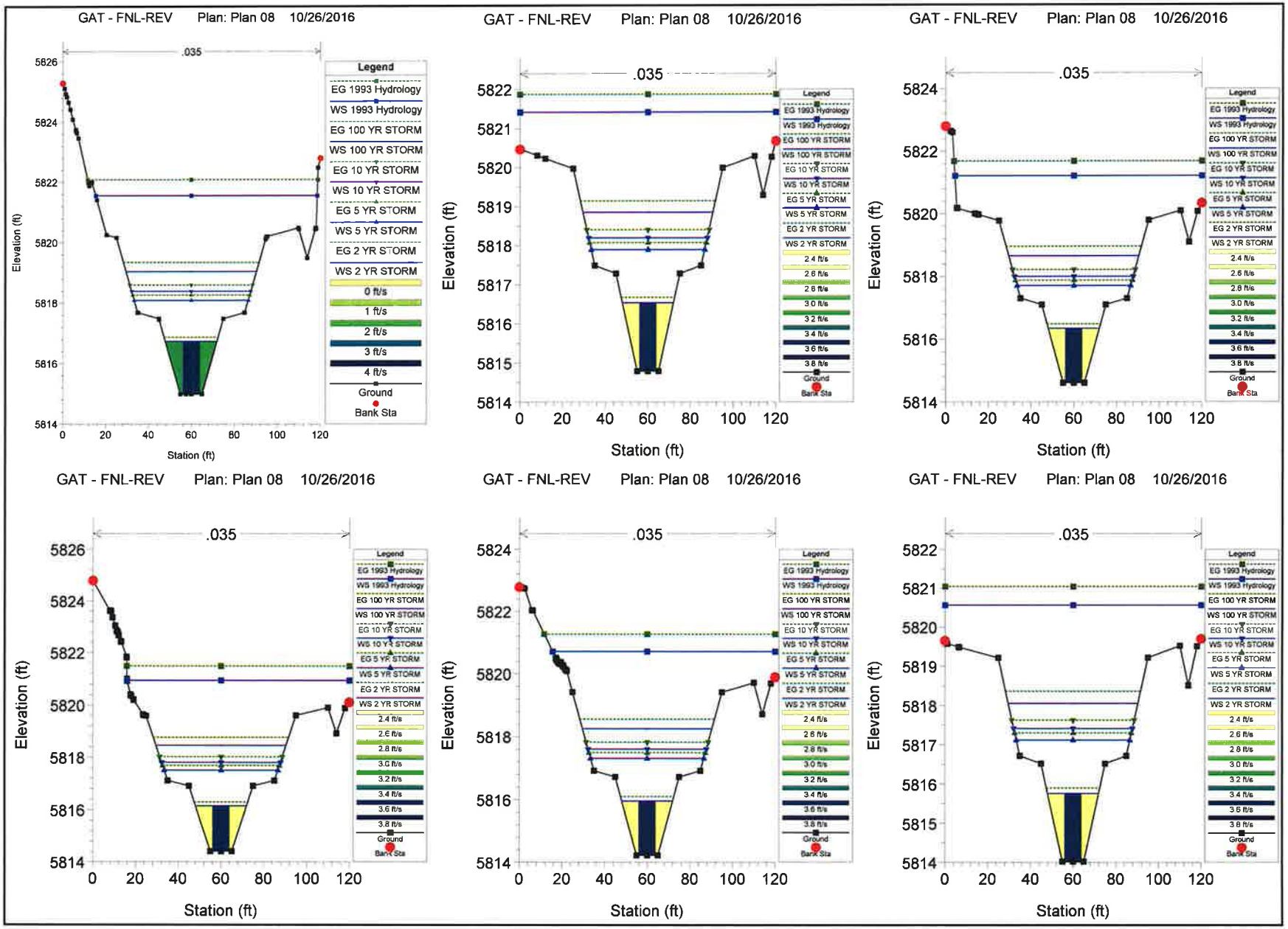
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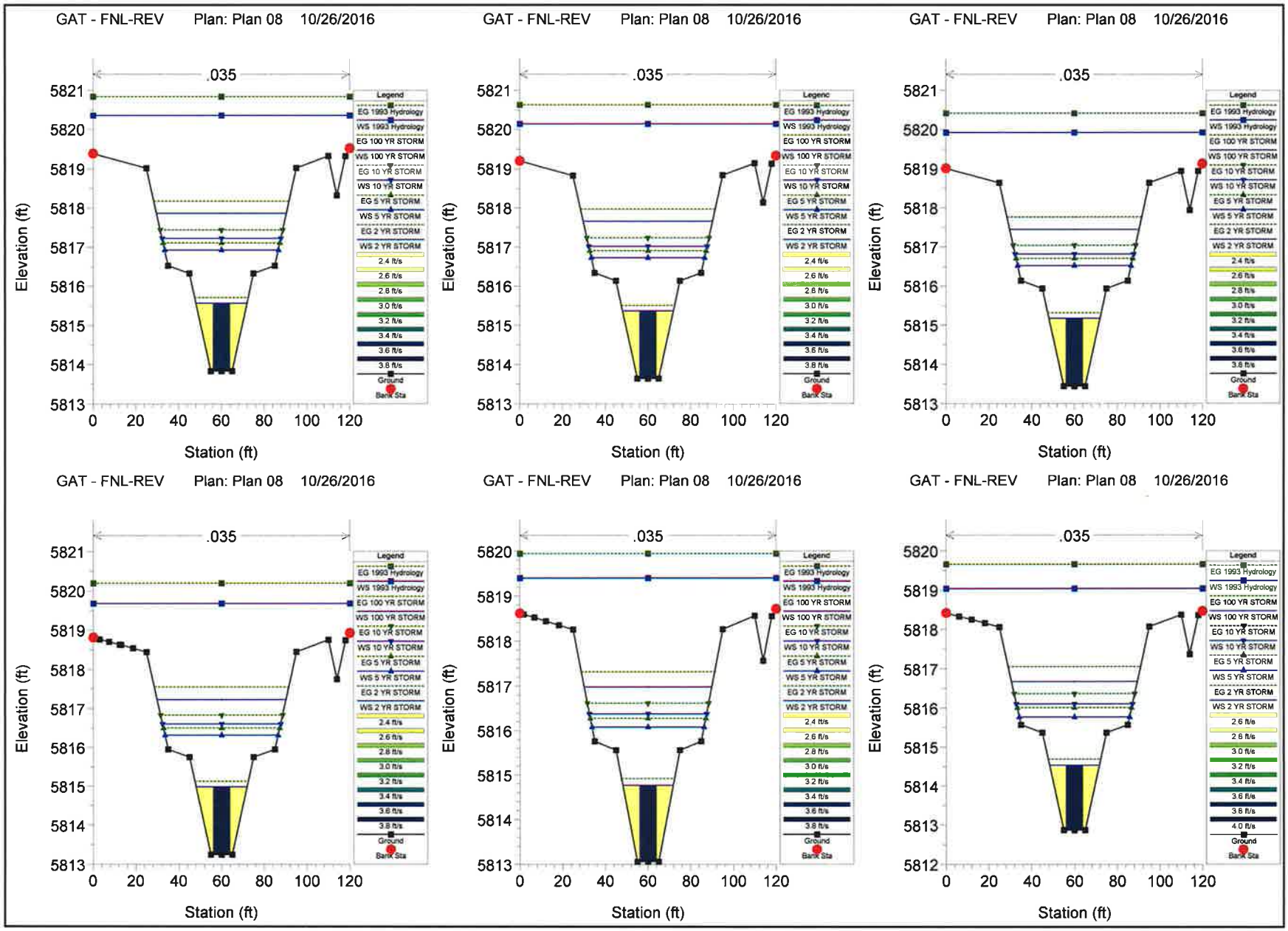
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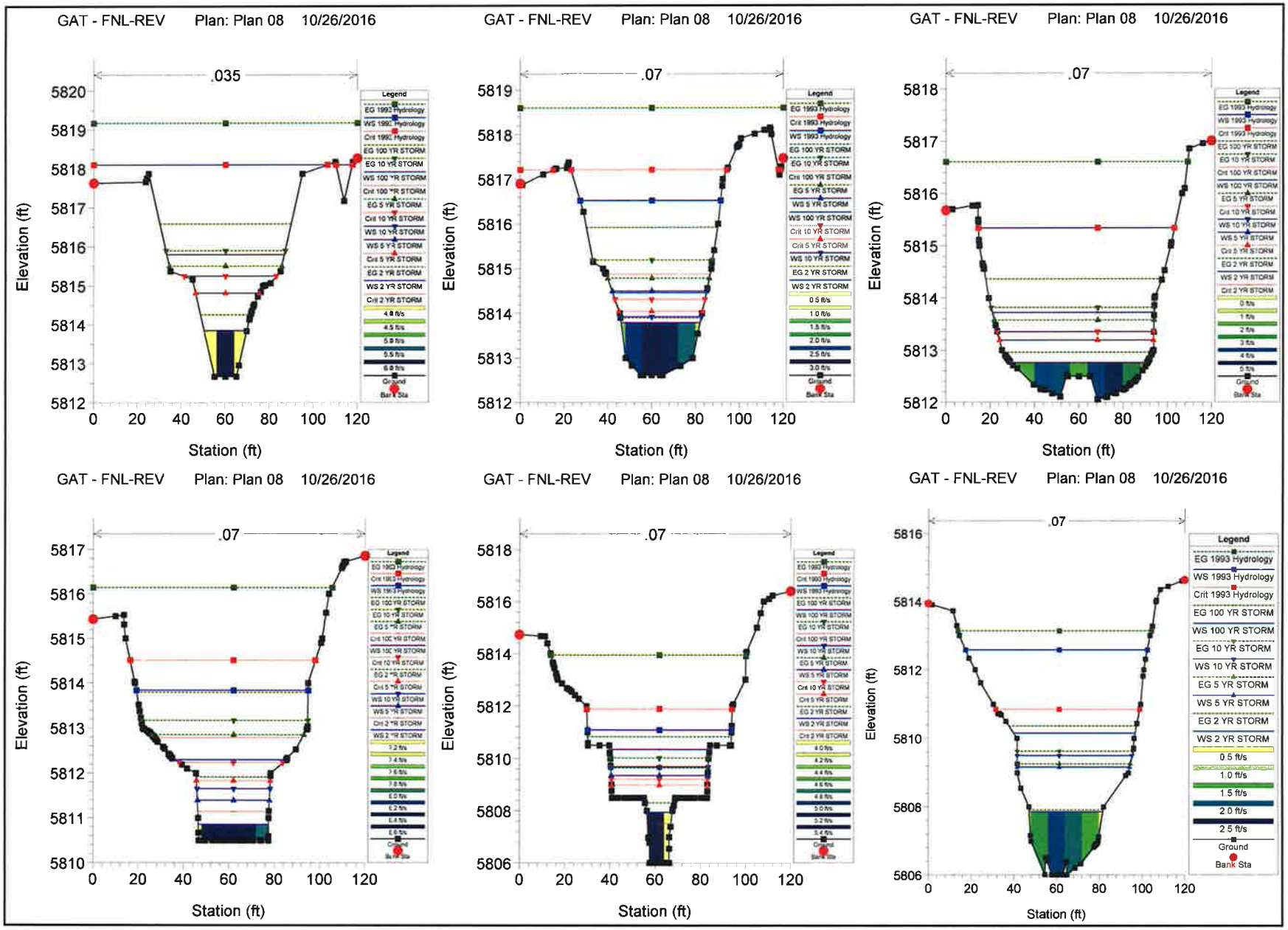
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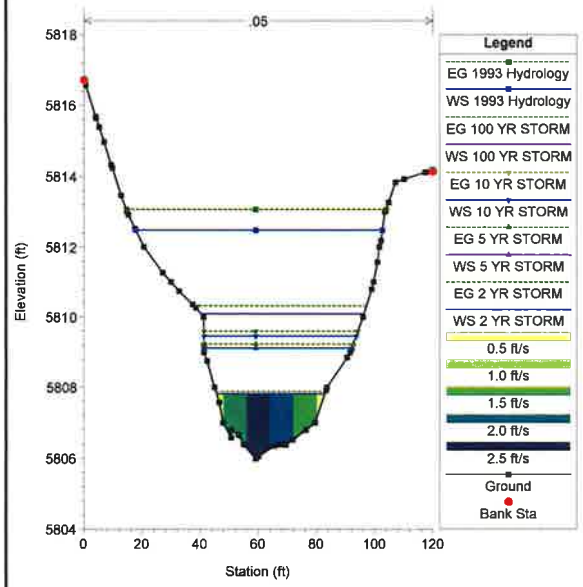

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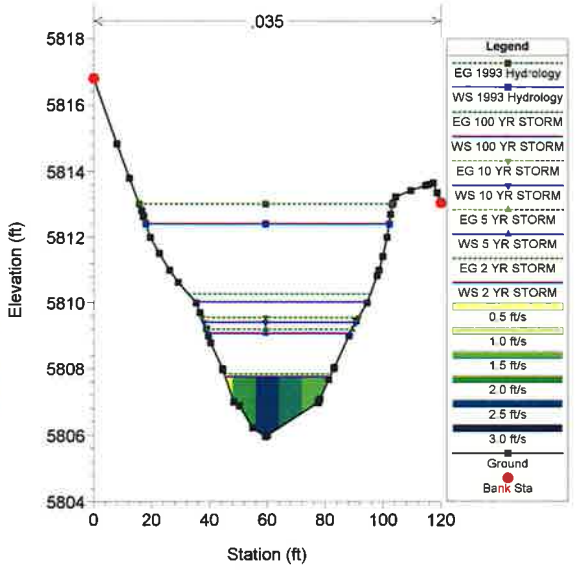

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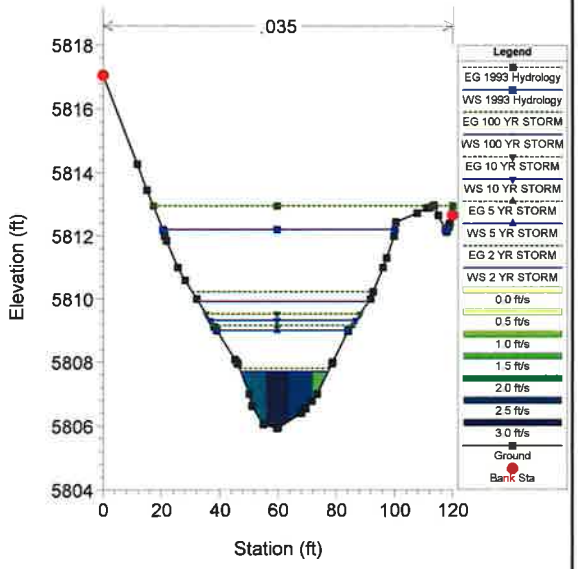

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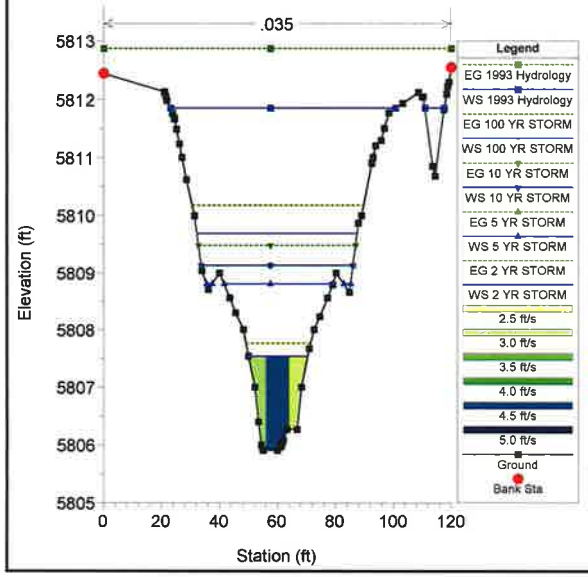

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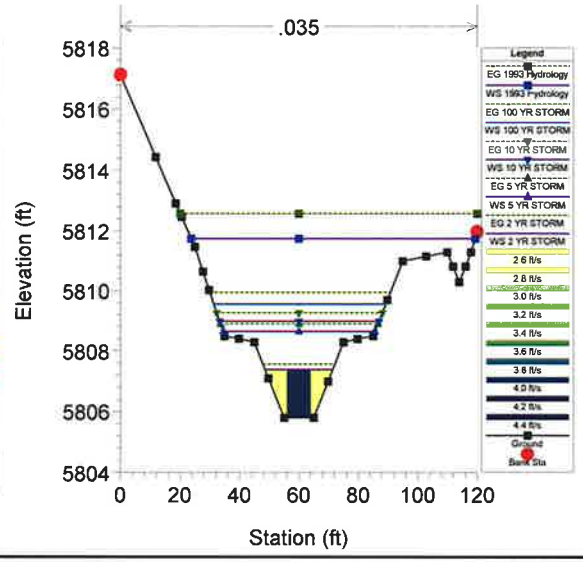

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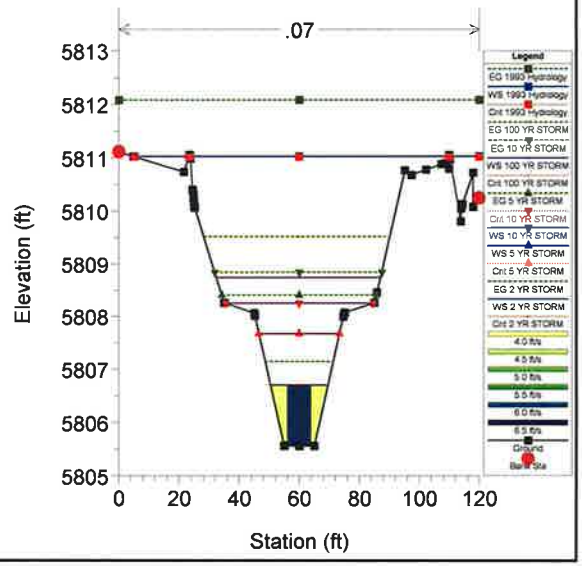

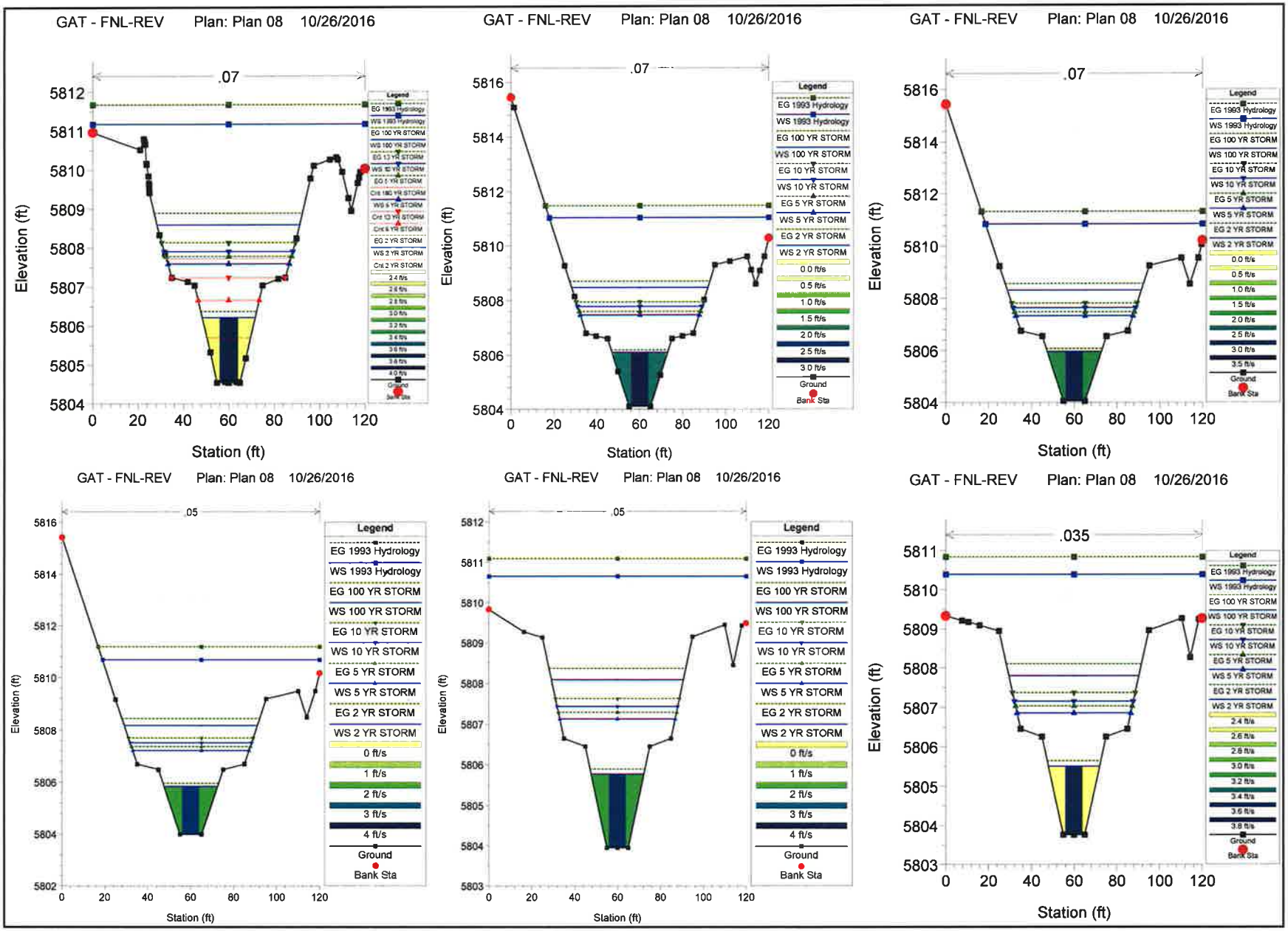
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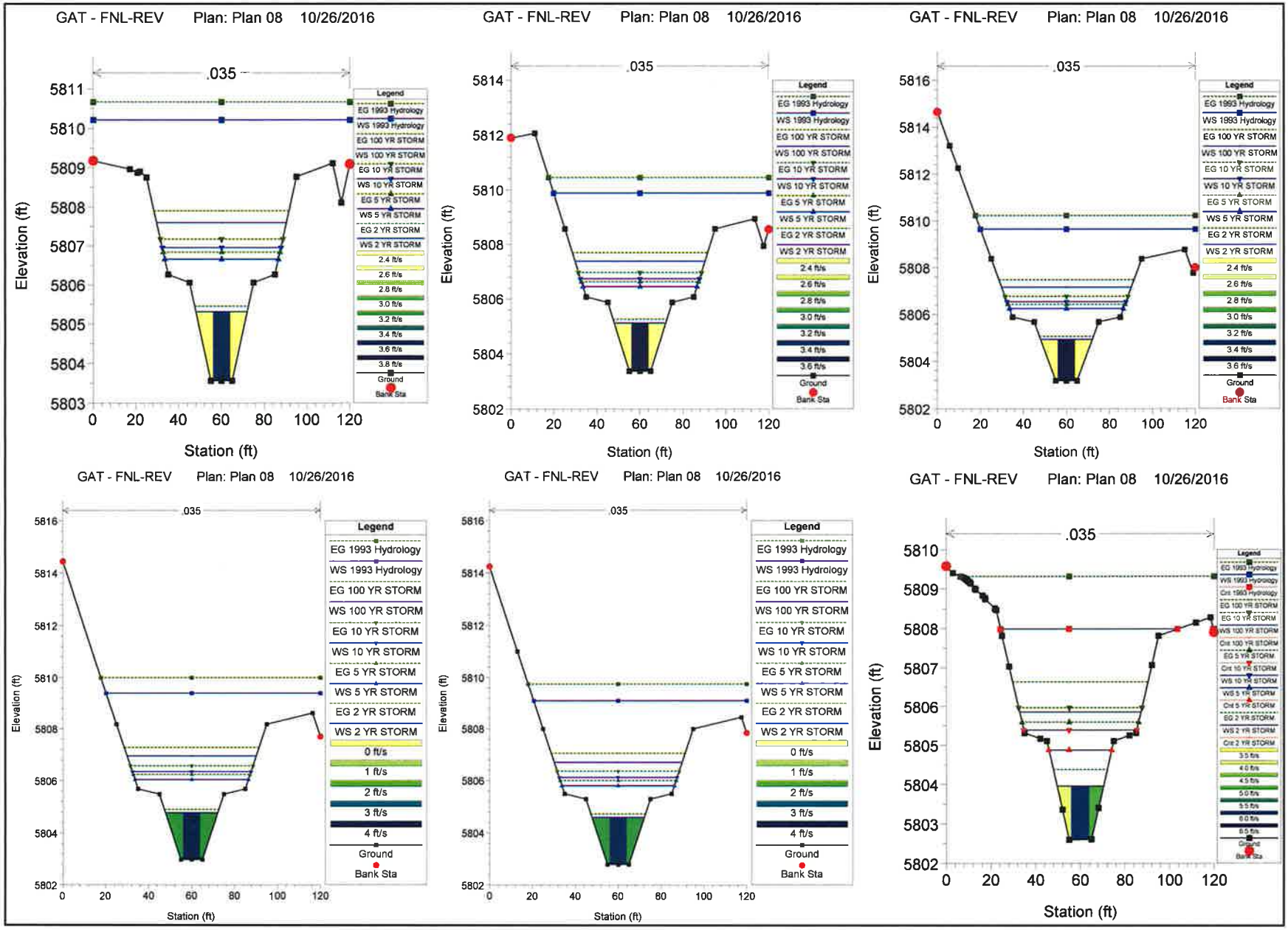
EG 2 YR STORM
WS 2 YR STORM
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
GAT - FNL-REV Plan: Plan 08 10/26/2016
.05
Elevation (ft)
Station (ft)
Legend
EG 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
WS 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta
GAT - FNL-REV Plan: Plan 08 10/26/2016
.05
Elevation (ft)
Station (ft)
Legend
EG 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
WS 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta
GAT - FNL-REV Plan: Plan 08 10/26/2016
.035
Elevation (ft)
Station (ft)
Legend
EG 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
WS 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
3.4 ft/s
3.6 ft/s
3.8 ft/s
Ground
Bank Sta


GAT - FNL-REV Plan: Plan 08 10/26/2016
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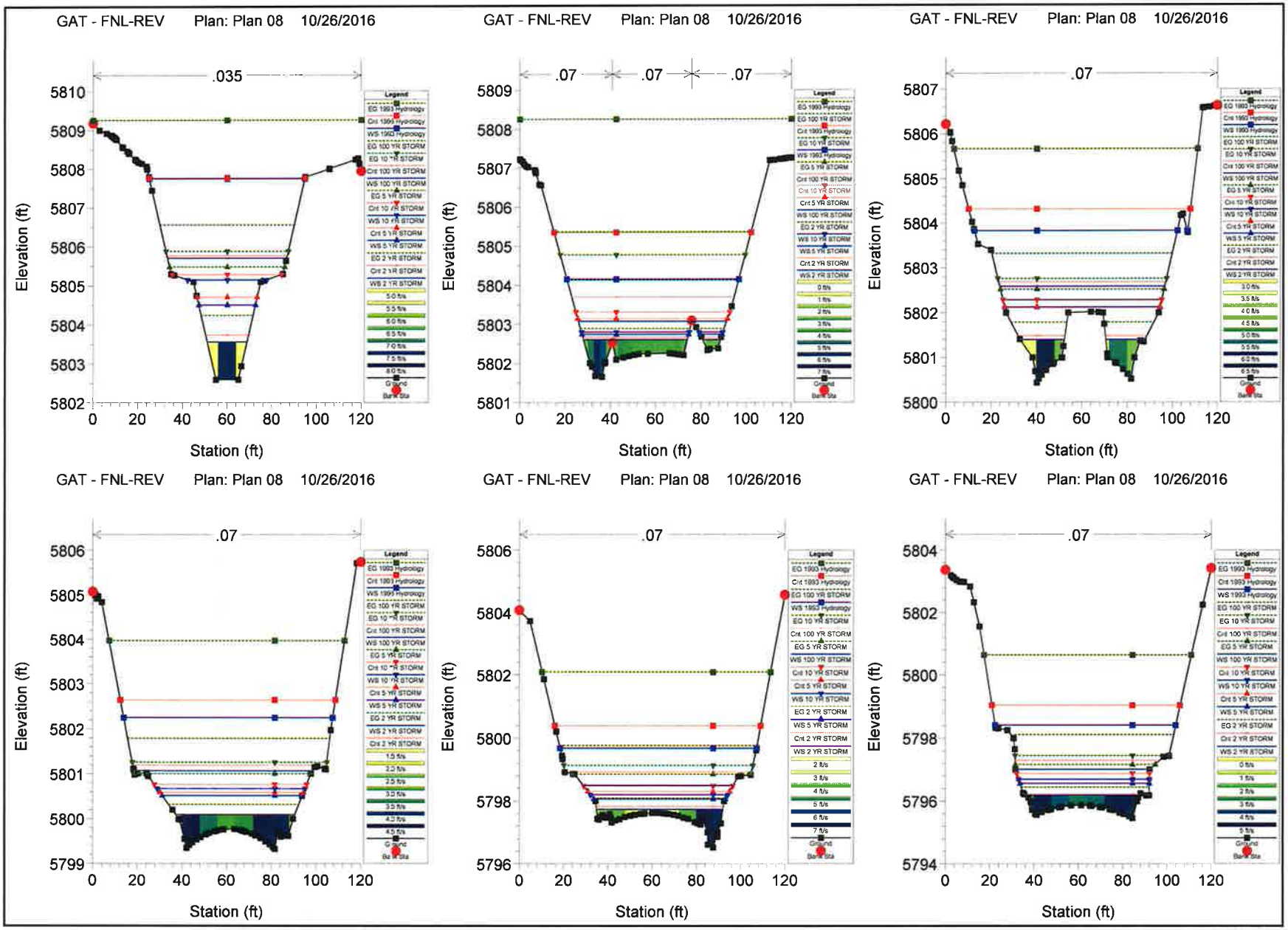
Elevation (ft)
Station (ft)
Legend
EG 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
WS 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Ground
Bank Sta


GAT - FNL-REV Plan: Plan 08 10/26/2016
.035
Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
.07
.07
Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Elevation (ft)
Station (ft)
GAT - FNL-REV Plan: Plan 08 10/26/2016
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Elevation (ft)
Station (ft)
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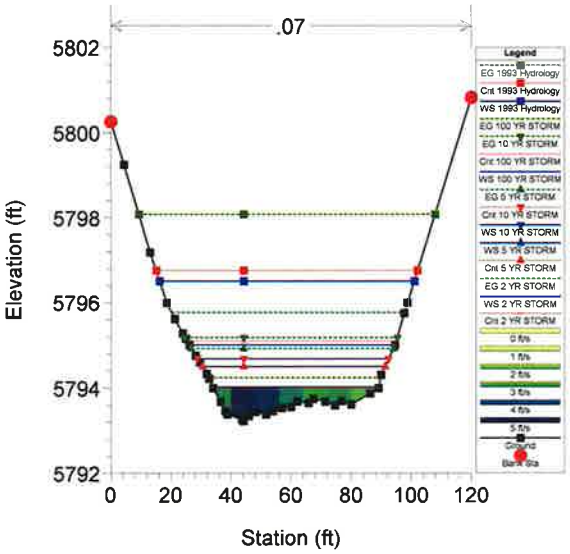
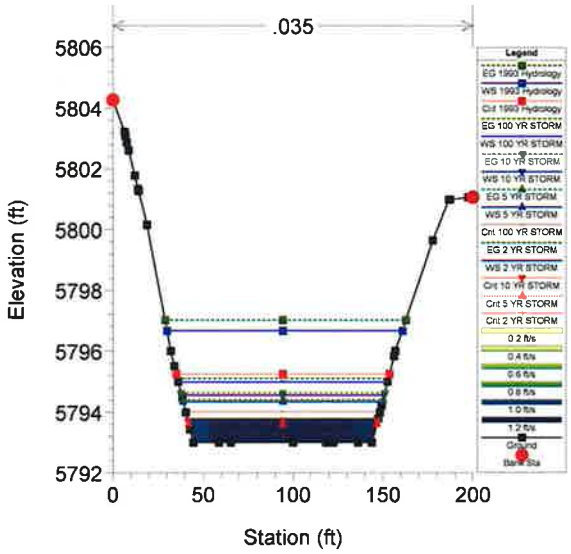
Elevation (ft)
Station (ft)

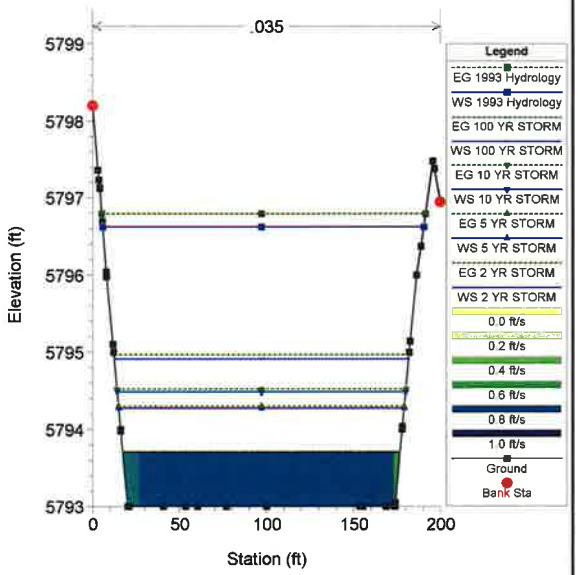
GAT - FNL-REV Plan: Plan 08 10/26/2016



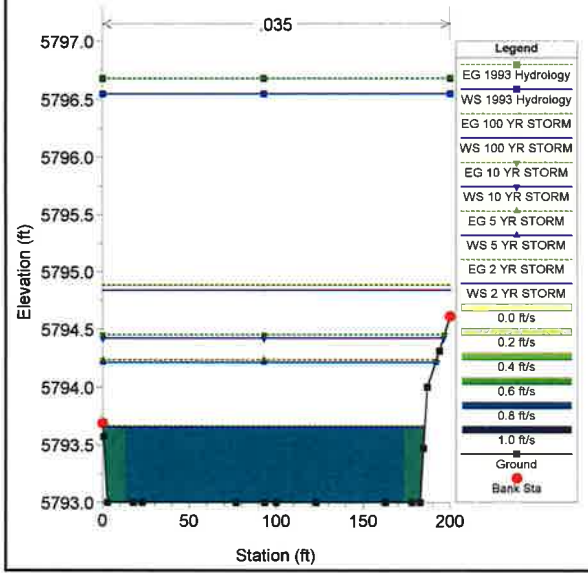
GAT - FNL-REV Plan: Plan 08 10/26/2016



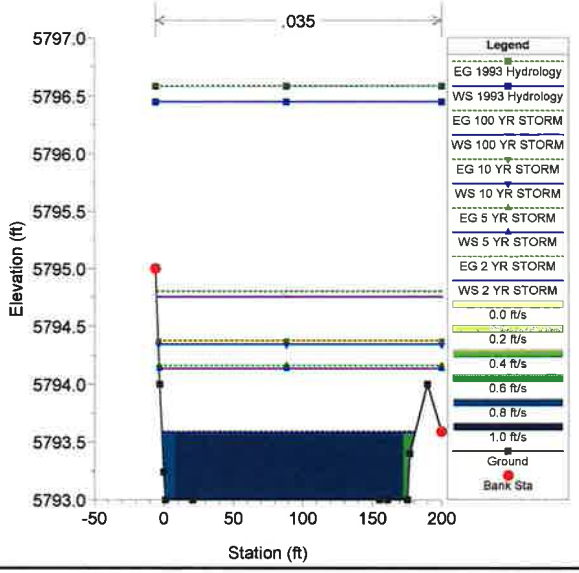
GAT - FNL-REV Plan: Plan 08 10/26/2016



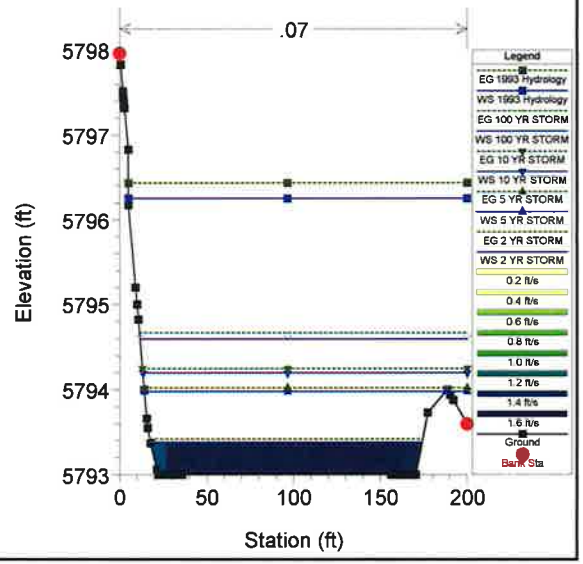
GAT - FNL-REV Plan: Plan 08 10/26/2016

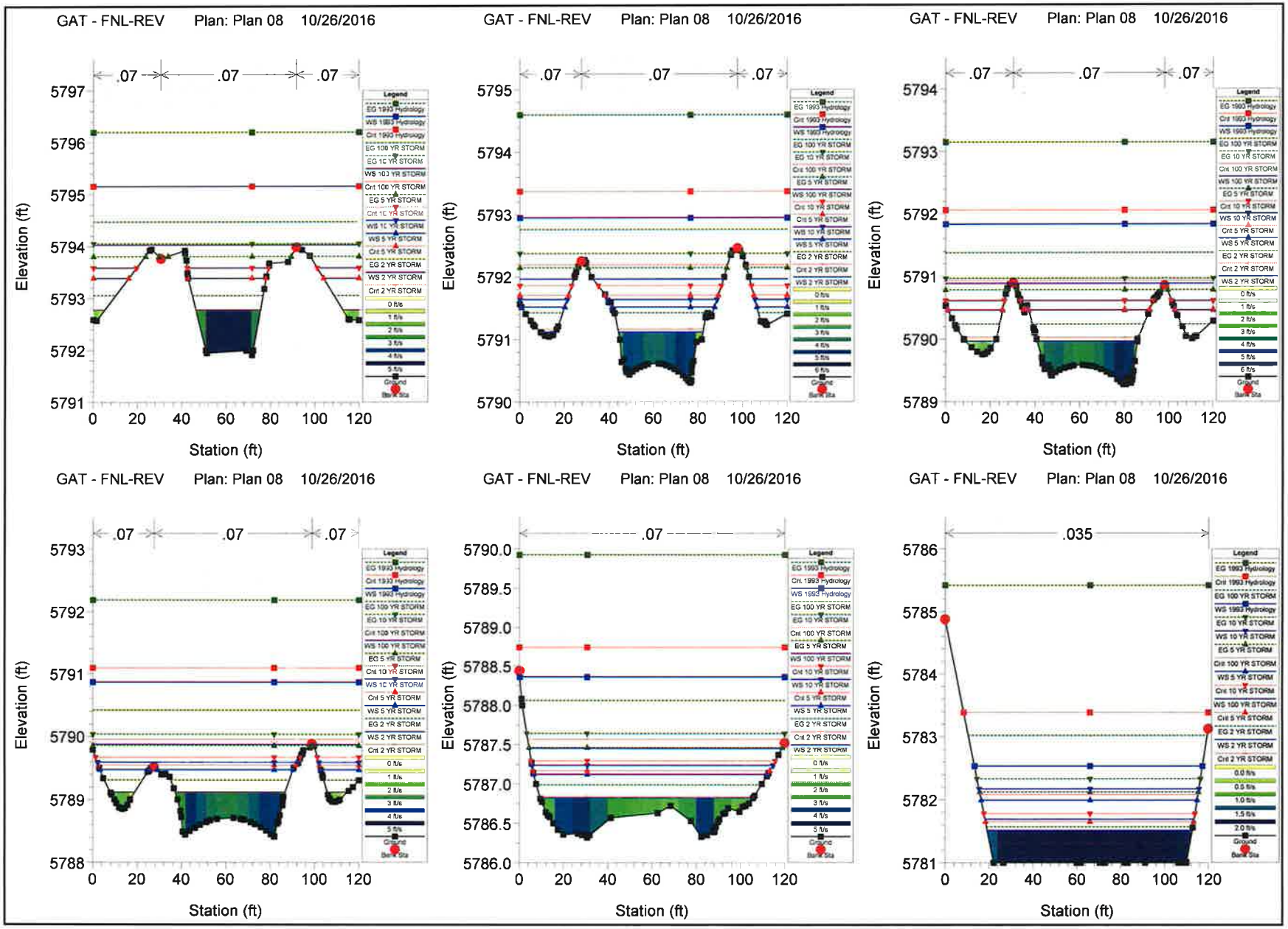


GAT - FNL-REV Plan: Plan 08 10/26/2016



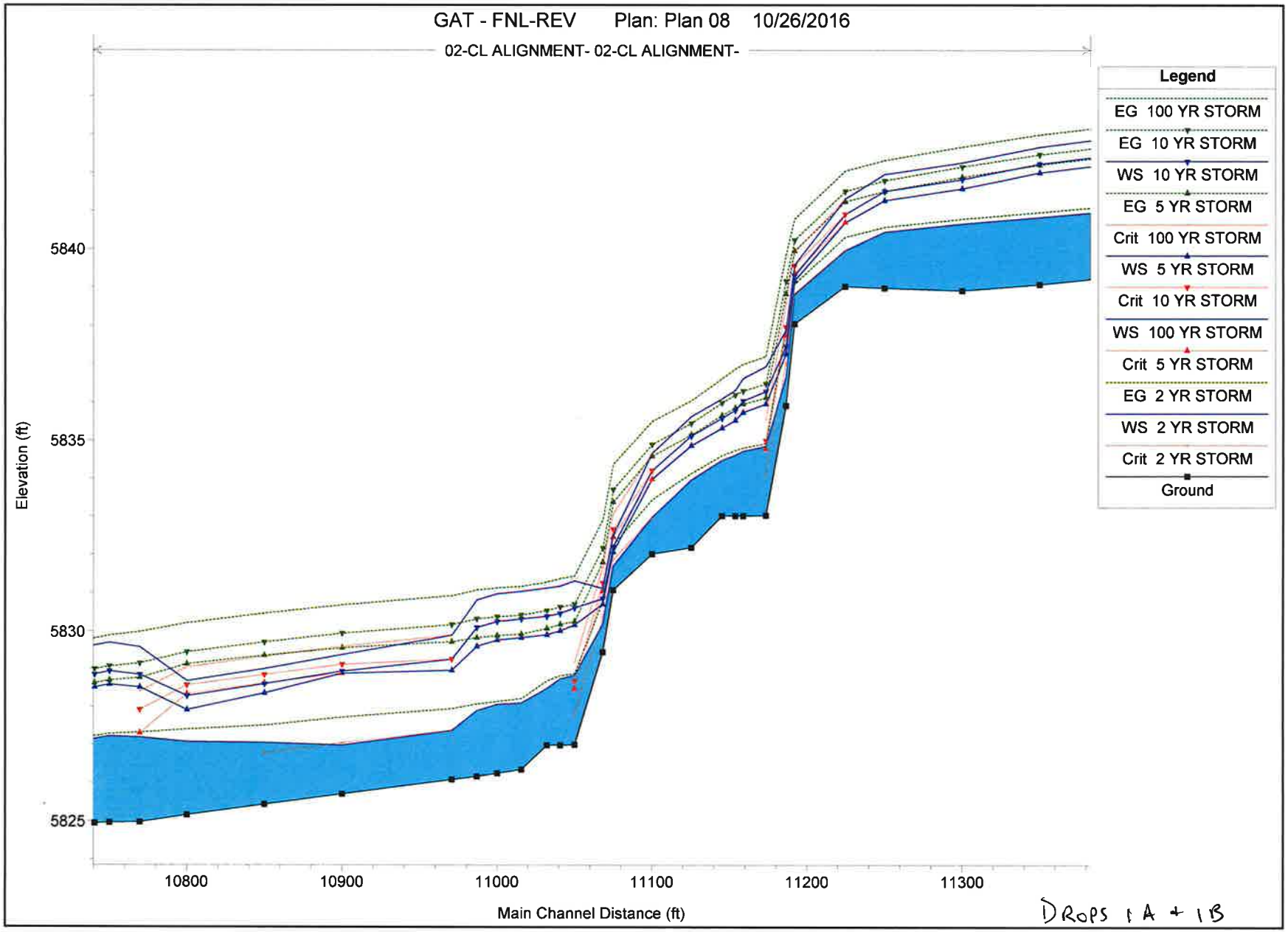
GAT - FNL-REV Plan: Plan 08 10/26/2016

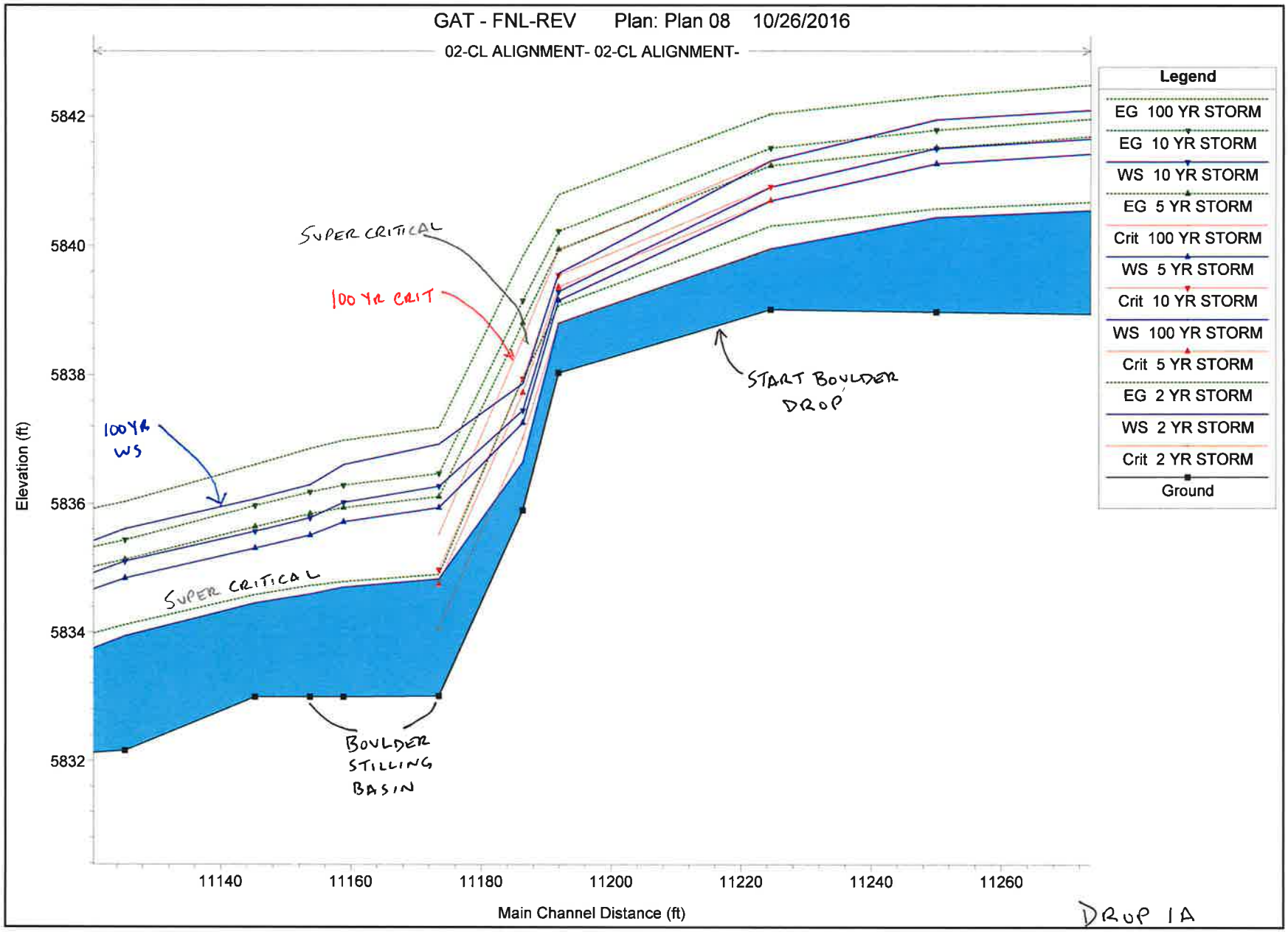


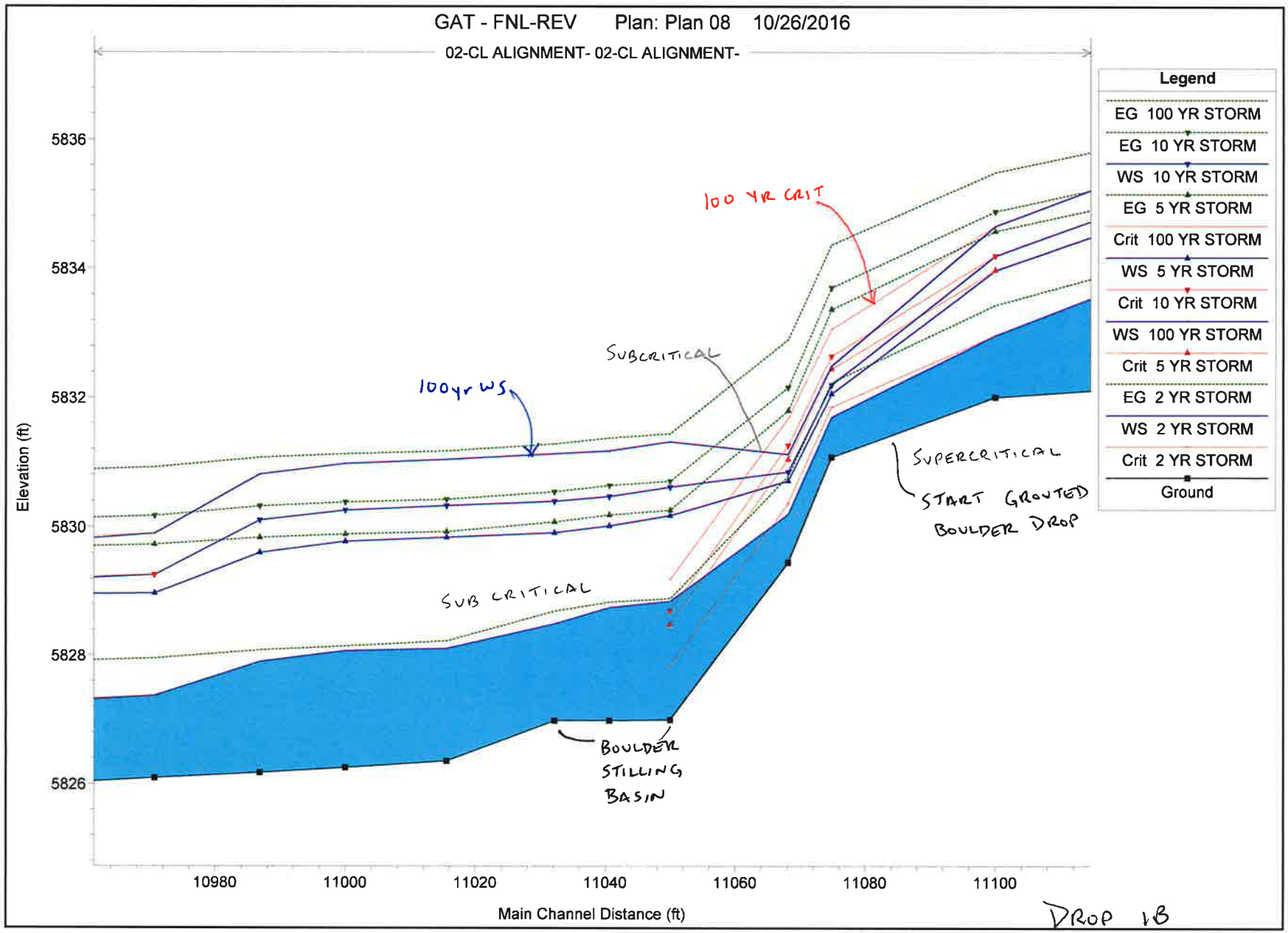

GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
.07
.07
Elevation (ft)
Station (ft)
5797
5796
5795
5794
5793
5792
5791
0 20 40 60 80 100 120
Legend
EG 1993 Hydrology
WS 1993 Hydrology
Crit 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
WS 100 YR STORM
Crit 100 YR STORM
EG 5 YR STORM
Crit 10 YR STORM
WS 5 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
.07
.07
Elevation (ft)
Station (ft)
5795
5794
5793
5792
5791
5790
0 20 40 60 80 100 120
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
.07
.07
Elevation (ft)
Station (ft)
5794
5793
5792
5791
5790
5789
0 20 40 60 80 100 120
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
.07
.07
Elevation (ft)
Station (ft)
5793
5792
5791
5790
5789
5788
0 20 40 60 80 100 120
GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Elevation (ft)
Station (ft)
5790.0
5789.5
5789.0
5788.5
5788.0
5787.5
5787.0
5786.5
5786.0
0 20 40 60 80 100 120
GAT - FNL-REV Plan: Plan 08 10/26/2016
.035
Elevation (ft)
Station (ft)
5786
5785
5784
5783
5782
5781
0 20 40 60 80 100 120

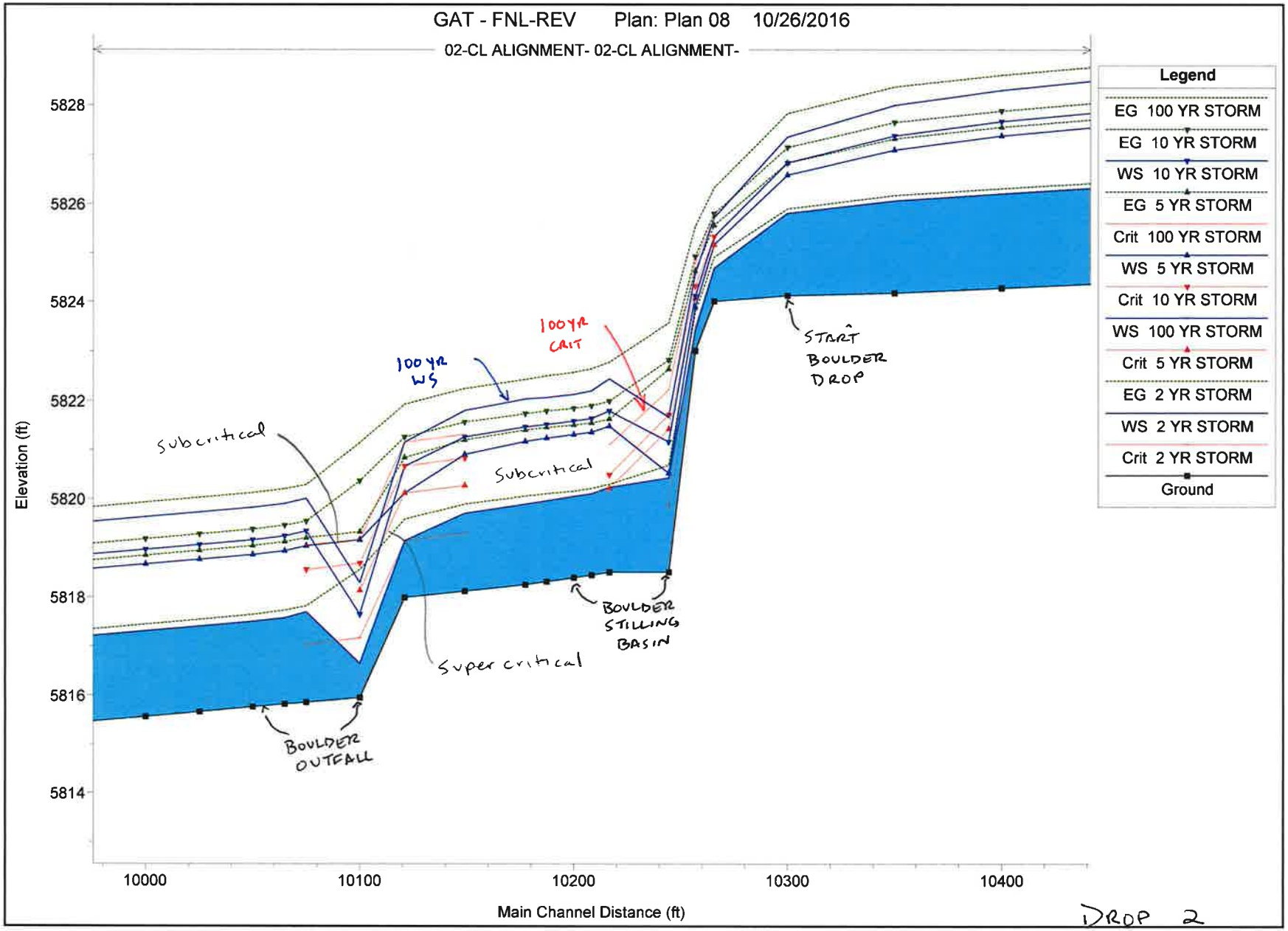
Grouted Boulder Drop Structure/Channel Analysis

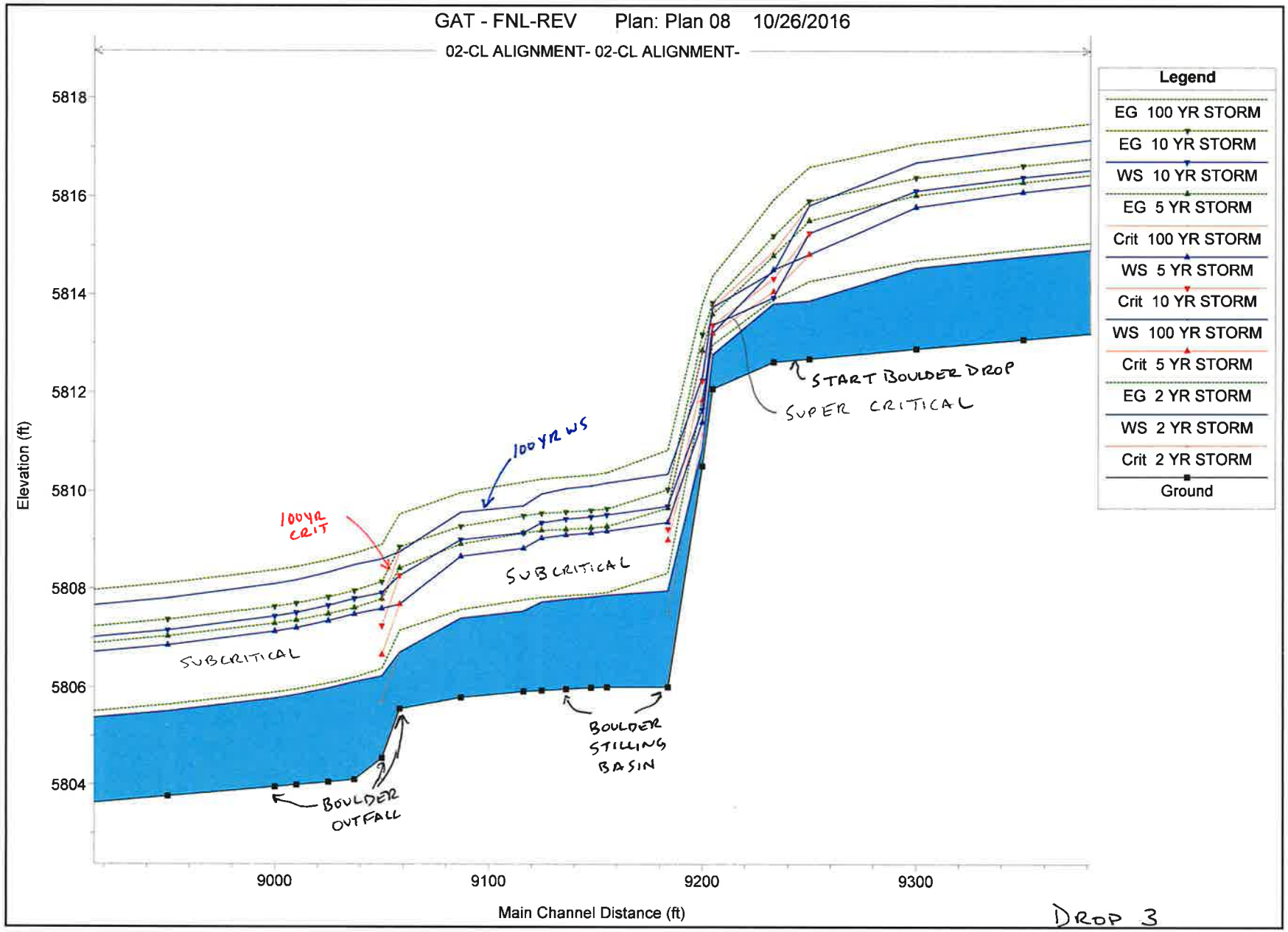
Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016

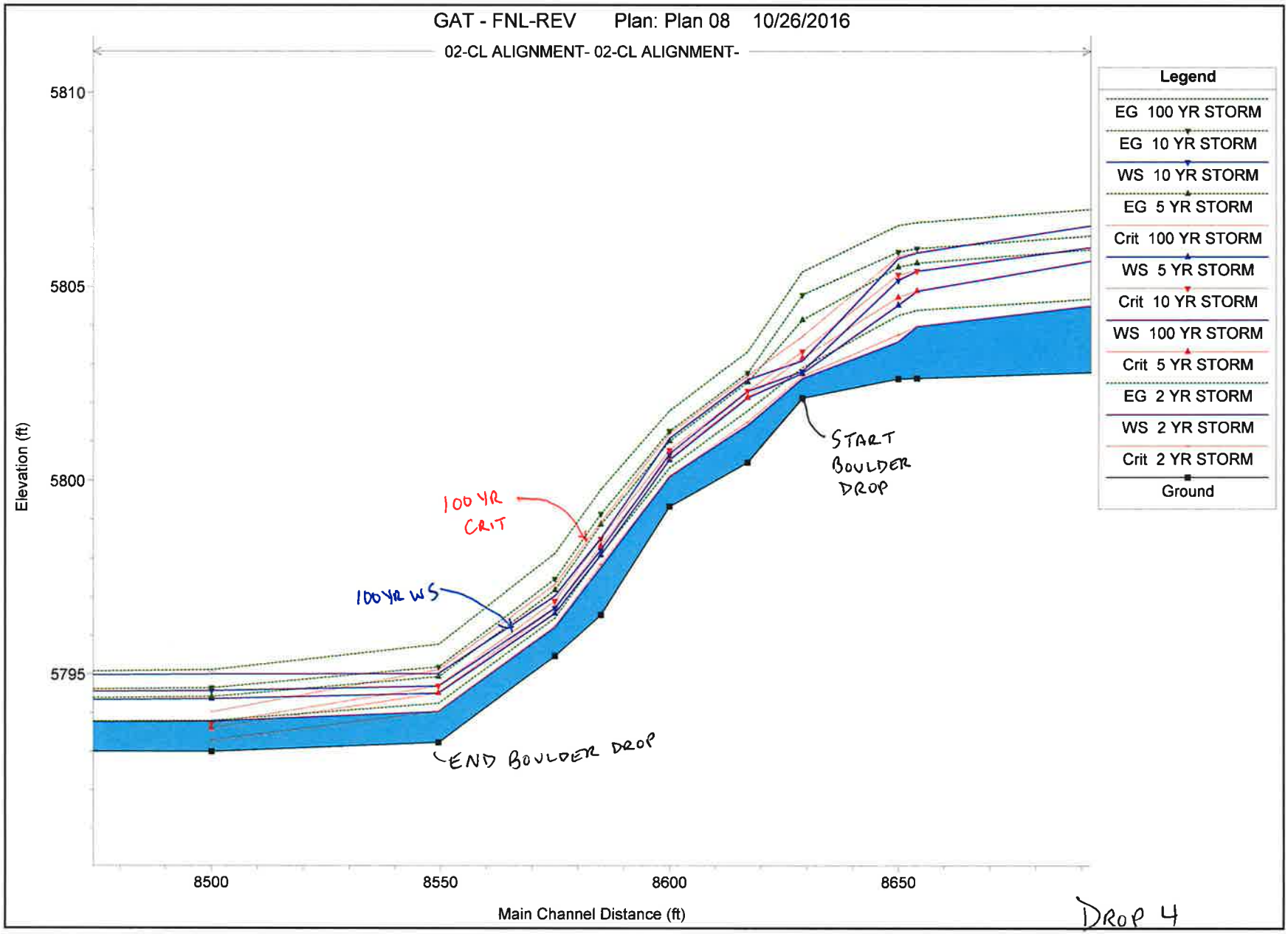

GAT - FNL-REV Plan: Plan 08 10/26/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Legend
EG 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
WS 100 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
Ground
Elevation (ft)
5840
5835
5830
5825
10800
10900
11000
11100
11200
11300
Main Channel Distance (ft)
DROPS 1A + 1B

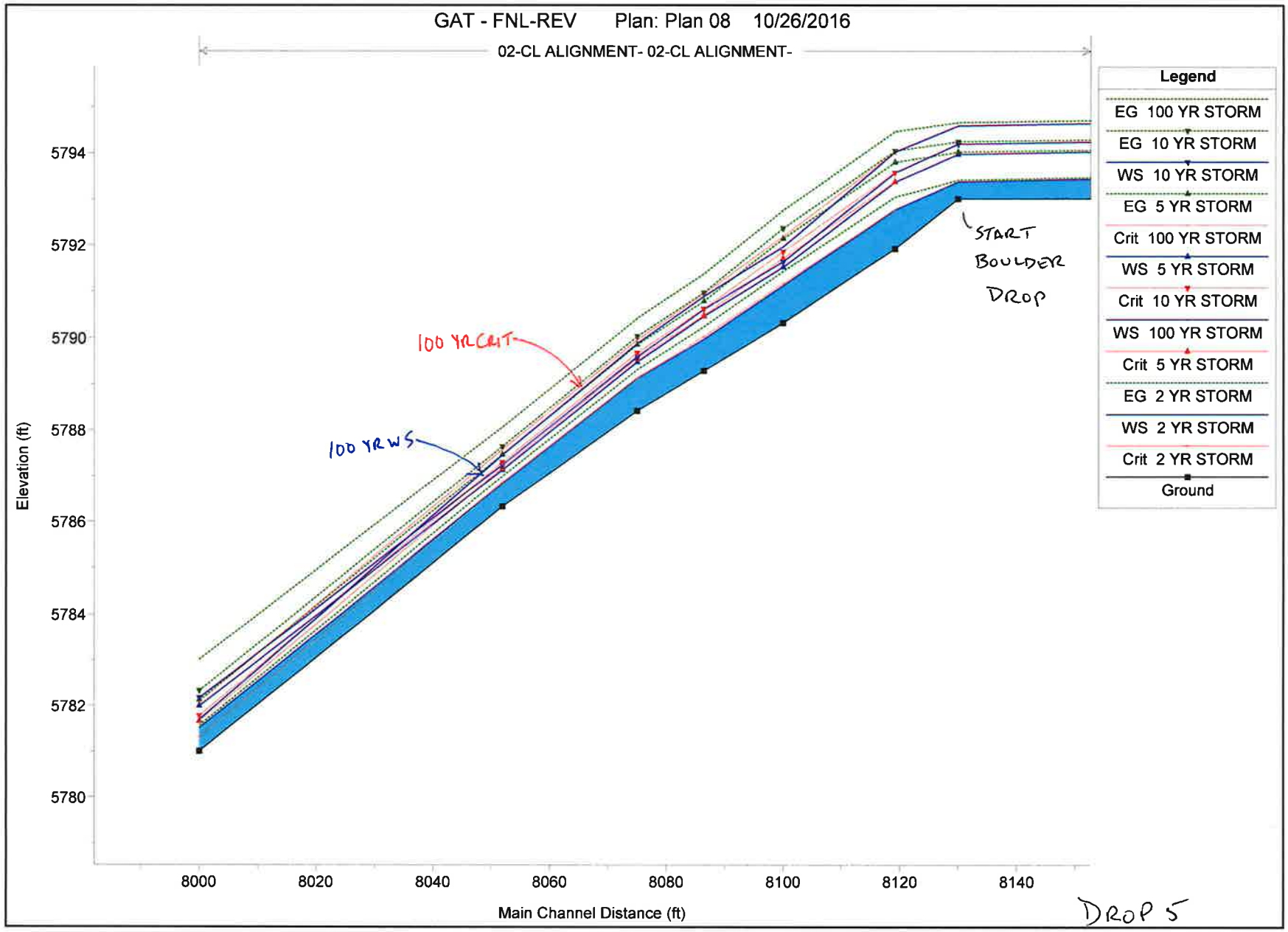

GAT - FNL-REV Plan: Plan 08 10/26/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Legend
EG 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
WS 100 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
Ground
SUPER CRITICAL
100 YR CRIT
100 YR WS
START BOULDER DROP
SUPER CRITICAL
BOULDER STILLING BASIN
Elevation (ft)
5842
5840
5838
5836
5834
5832
11140
11160
11180
11200
11220
11240
11260
Main Channel Distance (ft)
DROP 1A


GAT - FNL-REV Plan: Plan 08 10/26/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Legend
EG 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
WS 100 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
Ground
Elevation (ft)
5836
5834
5832
5830
5828
5826
10980
11000
11020
11040
11060
11080
11100
Main Channel Distance (ft)
100 YR CRIT
SUBCRITICAL
100yr WS
SUPERCRITICAL
START GROUTED BOULDER DROP
SUB CRITICAL
BOULDER STILLING BASIN
DROP 1B


GAT - FNL-REV Plan: Plan 08 10/26/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Legend
EG 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
WS 100 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
Ground
Elevation (ft)
5828
5826
5824
5822
5820
5818
5816
5814
10000
10100
10200
10300
10400
Main Channel Distance (ft)
100 YR WS
100 YR CRIT
Subcritical
Subcritical
Super critical
START BOULDER DROP
BOULDER STILLING BASIN
BOULDER OUTFALL
DROP 2


GAT - FNL-REV Plan: Plan 08 10/26/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Elevation (ft)
5818
5816
5814
5812
5810
5808
5806
5804
9000
9100
9200
9300
Main Channel Distance (ft)
Legend
EG 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
WS 100 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
Ground
100YR WS
100YR CRIT
SUBCRITICAL
SUBCRITICAL
START BOULDER DROP
SUPER CRITICAL
BOULDER OUTFALL
BOULDER STILLING BASIN
DROP 3


GAT - FNL-REV Plan: Plan 08 10/26/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Legend
EG 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
WS 100 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
Ground
Elevation (ft)
5810
5805
5800
5795
8500
8550
8600
8650
Main Channel Distance (ft)
100 YR CRIT
100 YR WS
START BOULDER DROP
END BOULDER DROP
DROP 4


GAT - FNL-REV Plan: Plan 08 10/26/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Legend
EG 100 YR STORM
EG 10 YR STORM
WS 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
WS 100 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
Ground
START BOULDER DROP
100 YR CRIT
100 YR WS
Elevation (ft)
5794
5792
5790
5788
5786
5784
5782
5780
8000
8020
8040
8060
8080
8100
8120
8140
Main Channel Distance (ft)
DROP 5

Future Box Culvert Road Crossing Channel Analysis

Initially Submitted November 20, 2015
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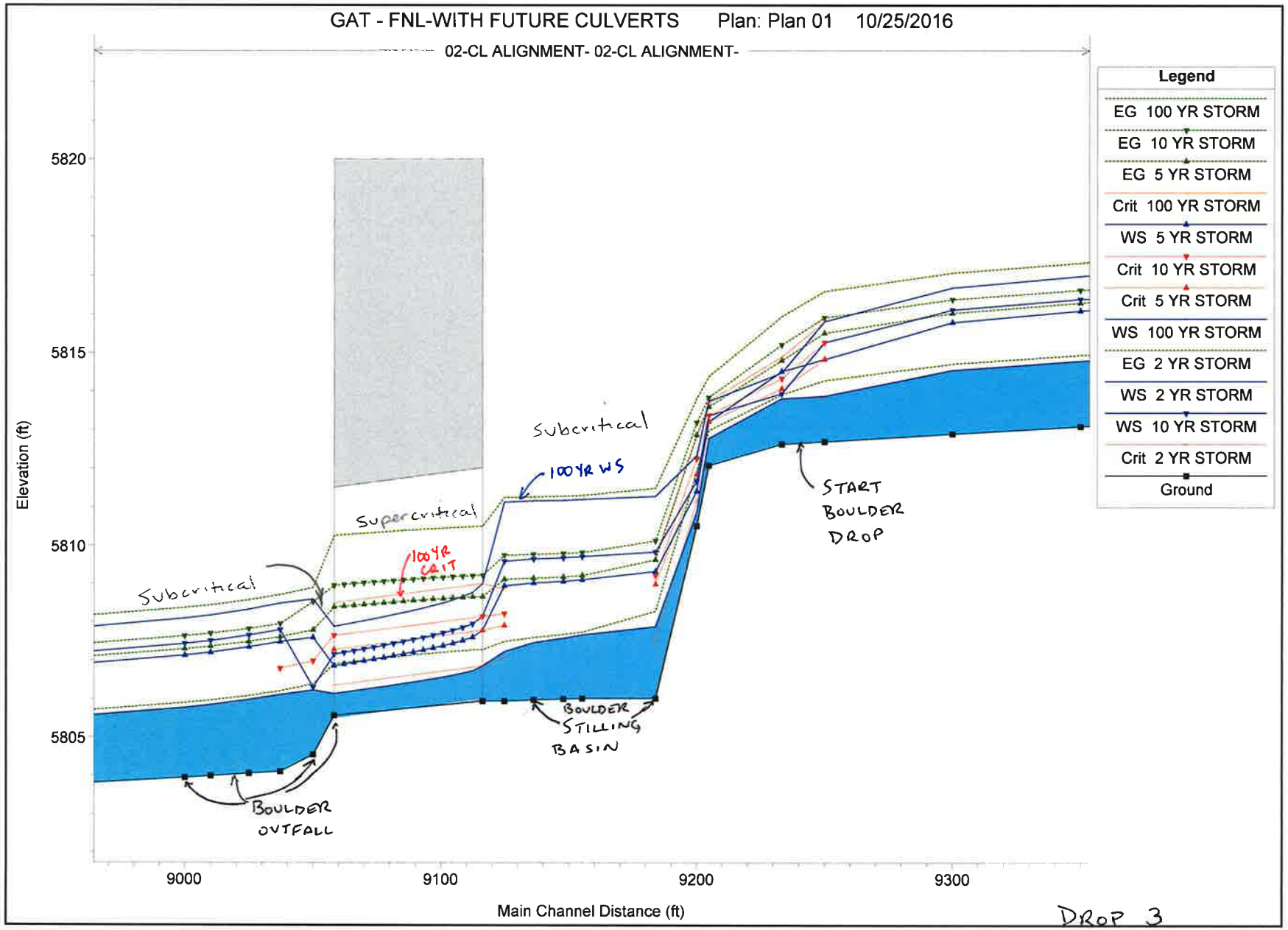
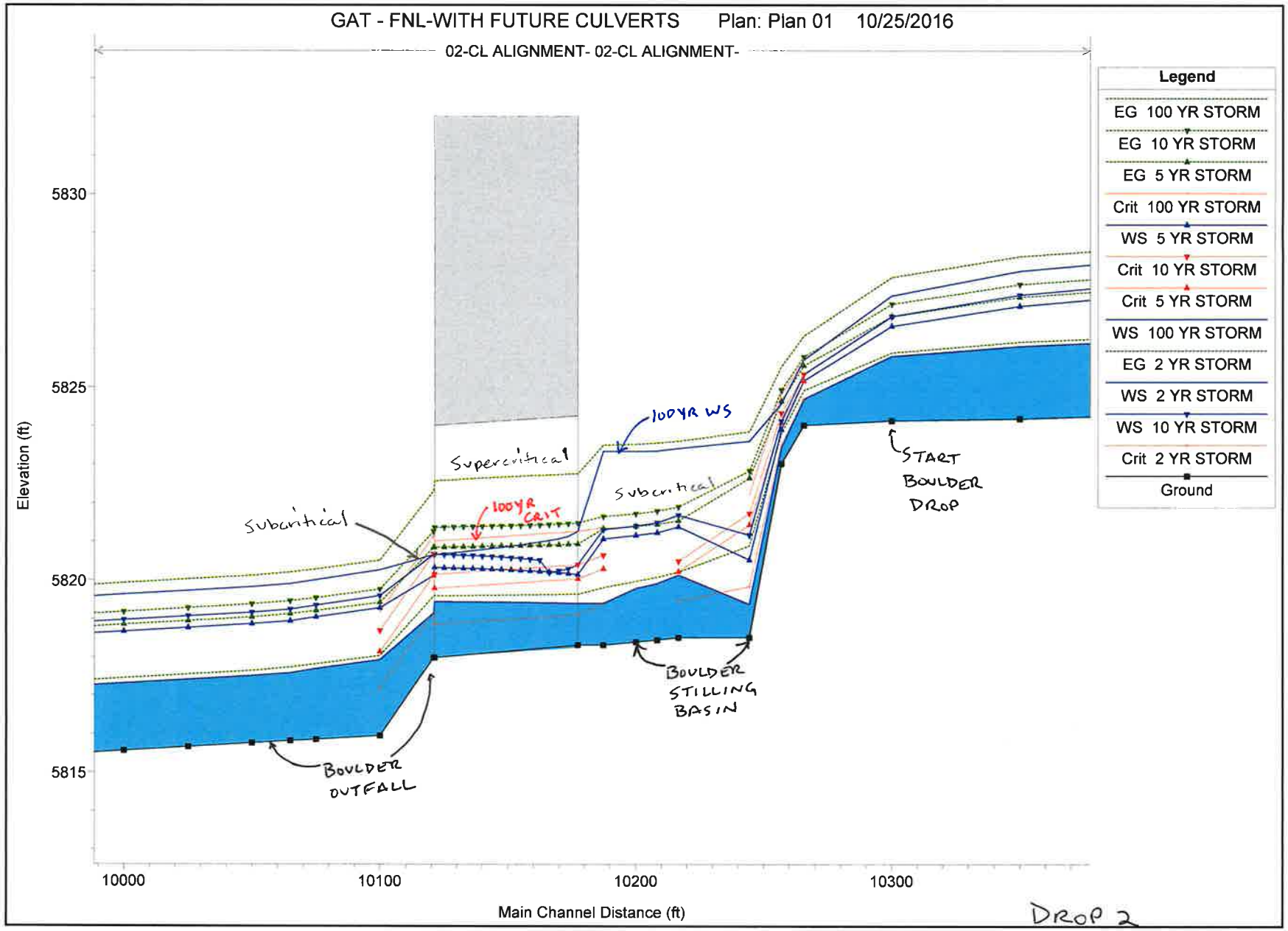

GAT - FNL-WITH FUTURE CULVERTS Plan: Plan 01 10/25/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Legend
EG 100 YR STORM
EG 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
Crit 5 YR STORM
WS 100 YR STORM
EG 2 YR STORM
WS 2 YR STORM
WS 10 YR STORM
Crit 2 YR STORM
Ground
Elevation (ft)
5820
5815
5810
5805
9000
9100
9200
9300
Main Channel Distance (ft)
Subcritical
Supercritical
Subcritical
100YR WS
100YR CRIT
START BOULDER DROP
BOULDER STILLING BASIN
BOULDER OUTFALL
DROP 3


GAT - FNL-WITH FUTURE CULVERTS Plan: Plan 01 10/25/2016
02-CL ALIGNMENT- 02-CL ALIGNMENT-
Legend
EG 100 YR STORM
EG 10 YR STORM
EG 5 YR STORM
Crit 100 YR STORM
WS 5 YR STORM
Crit 10 YR STORM
Crit 5 YR STORM
WS 100 YR STORM
EG 2 YR STORM
WS 2 YR STORM
WS 10 YR STORM
Crit 2 YR STORM
Ground
Elevation (ft)
5830
5825
5820
5815
10000
10100
10200
10300
Main Channel Distance (ft)
100YR WS
Supercritical
Subcritical
100YR CRIT
Subcritical
START BOULDER DROP
BOULDER STILLING BASIN
BOULDER OUTFALL
DROP 2

Pond Grouted Boulder Drop Structures' Velocity Analysis

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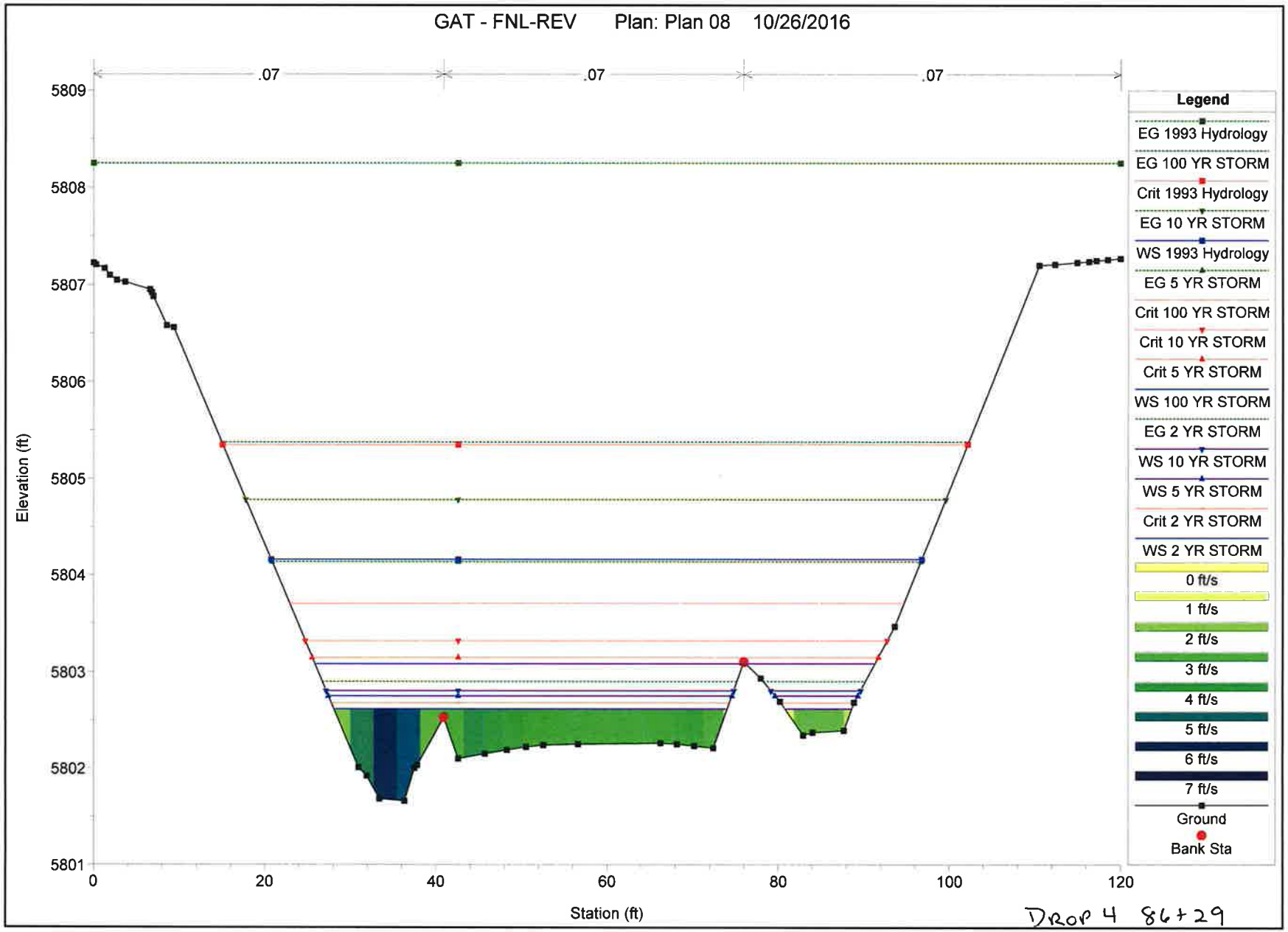
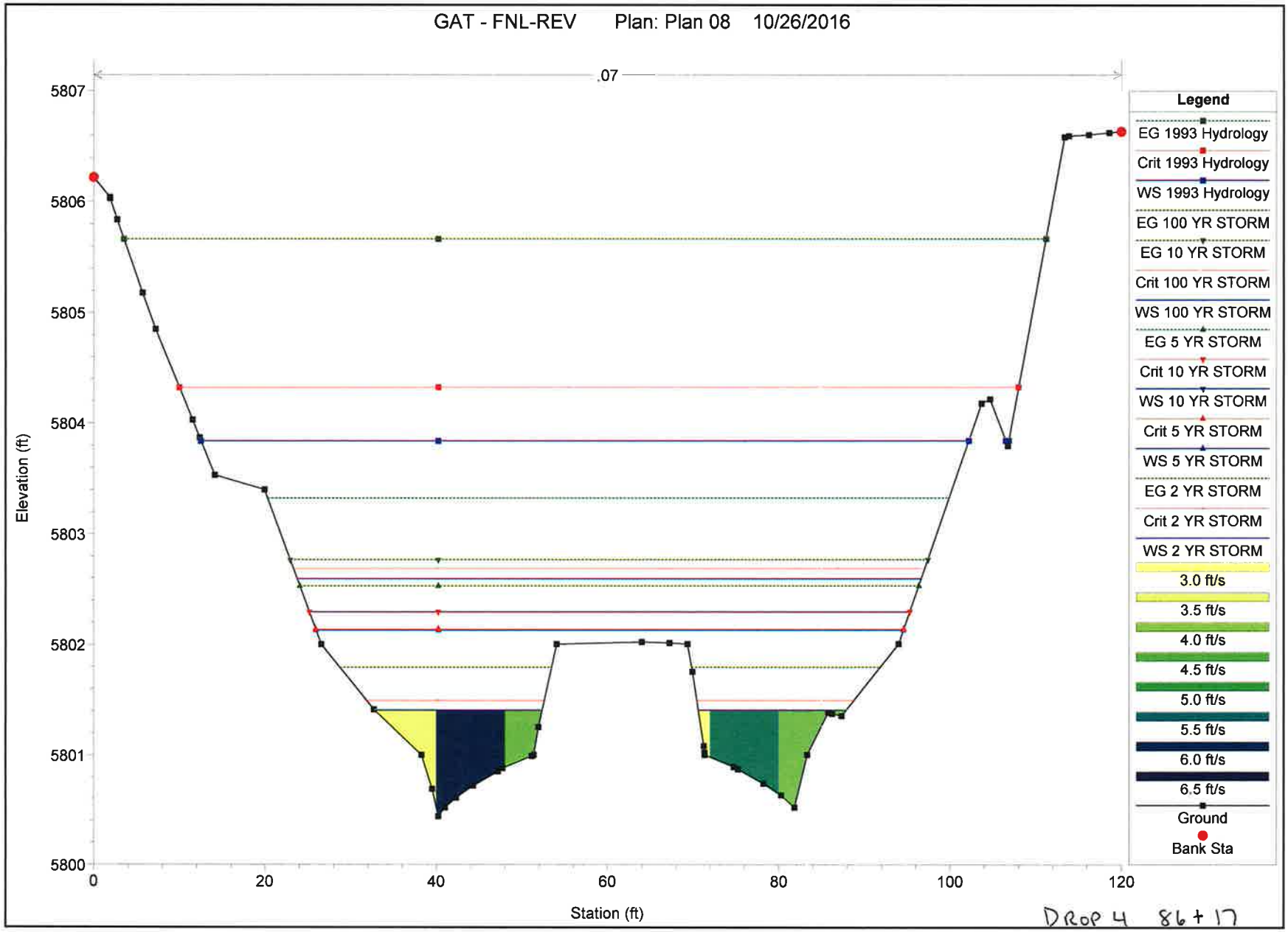
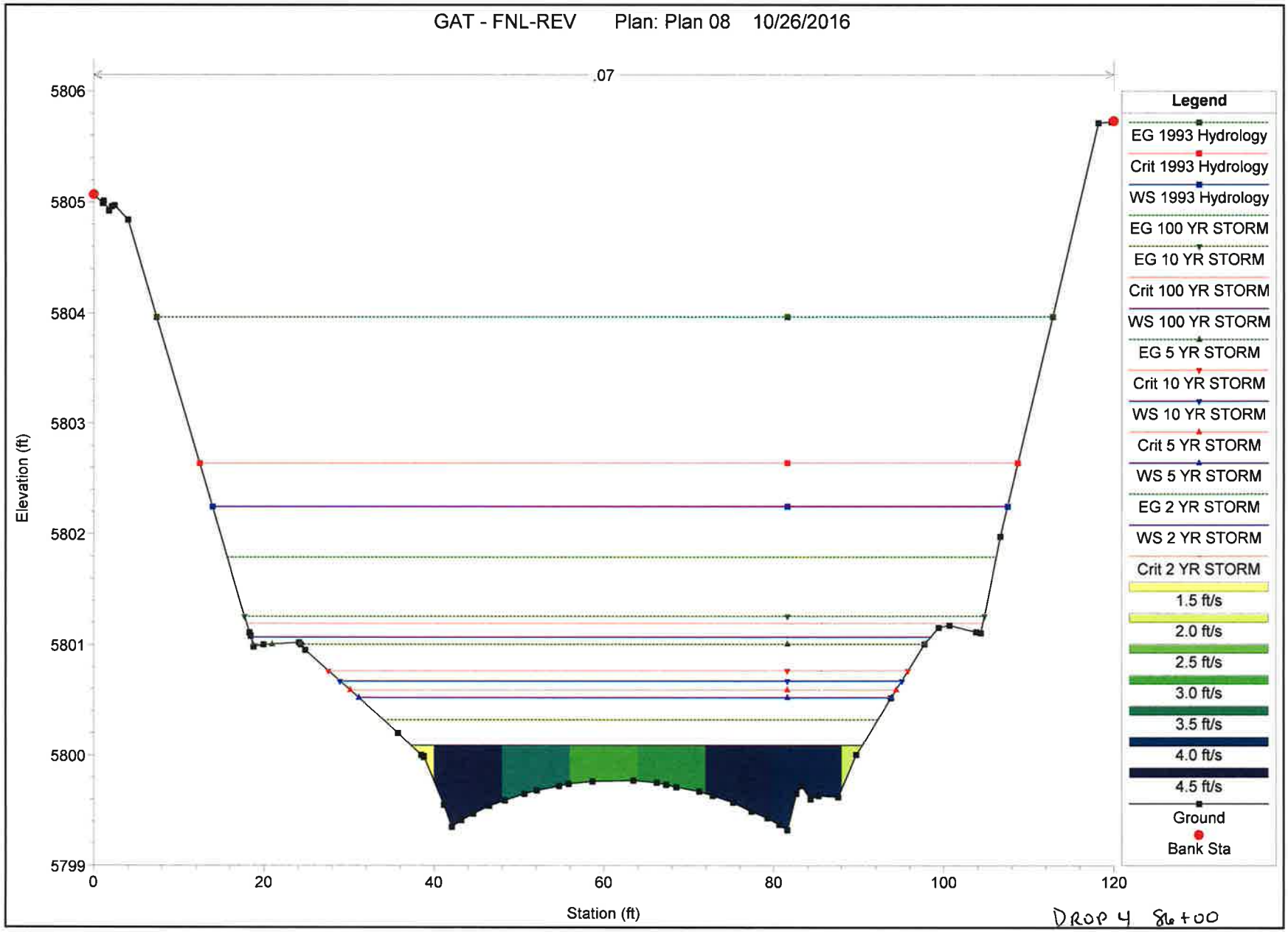
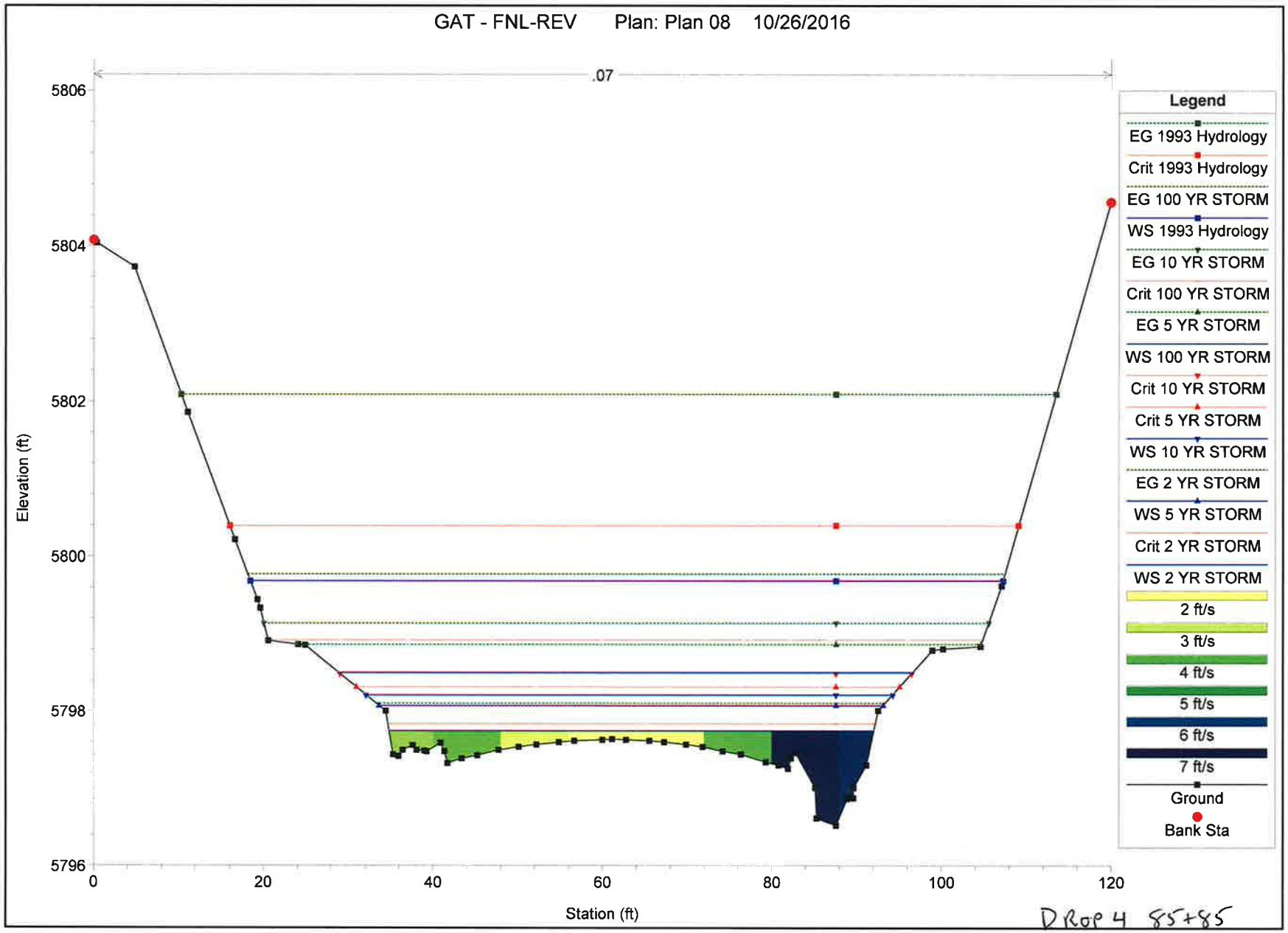
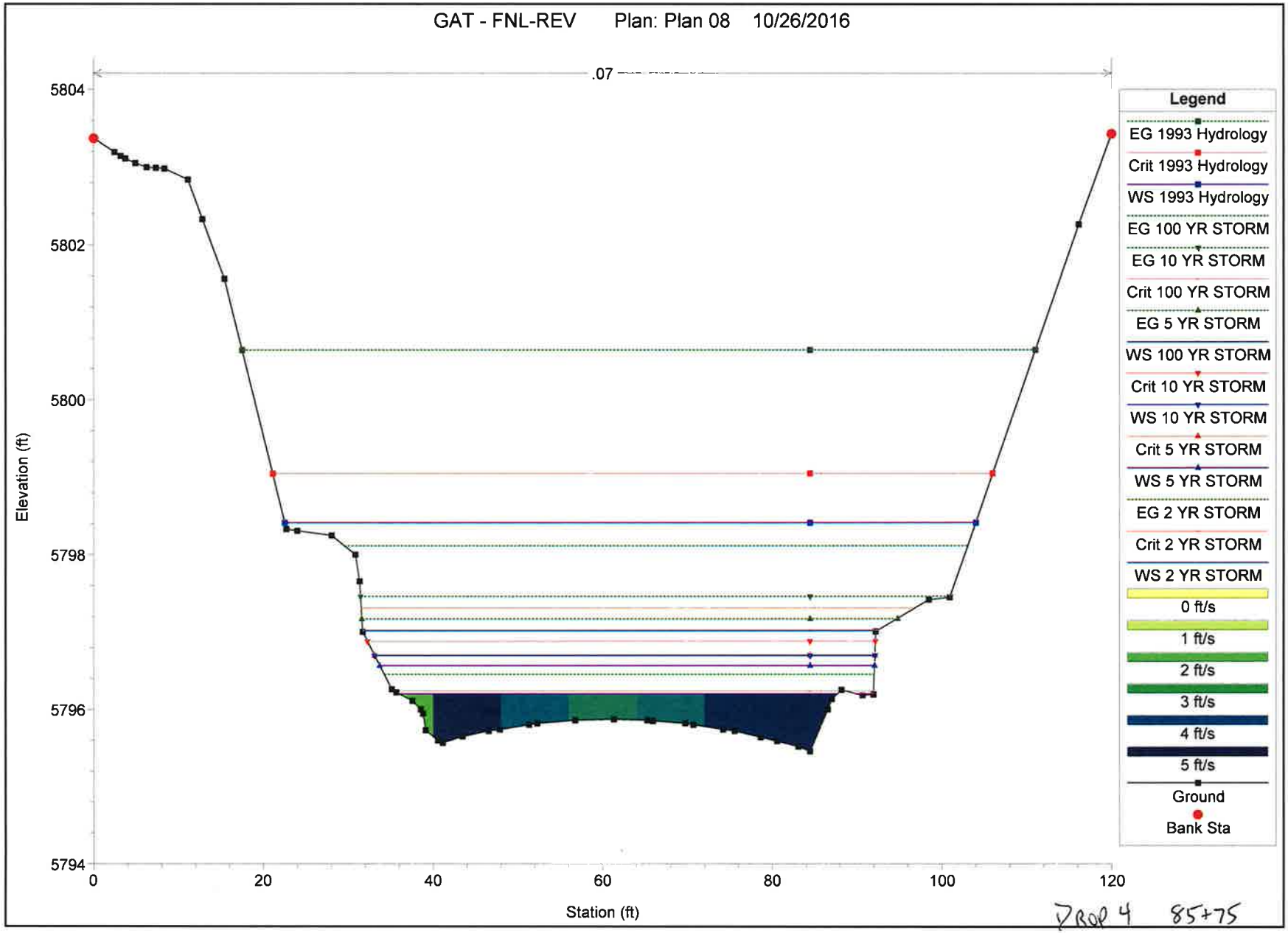

GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
.07
.07
Elevation (ft)
5809
5808
5807
5806
5805
5804
5803
5802
5801
0
20
40
60
80
100
120
Station (ft)
Legend
EG 1993 Hydrology
EG 100 YR STORM
Crit 1993 Hydrology
EG 10 YR STORM
WS 1993 Hydrology
EG 5 YR STORM
Crit 100 YR STORM
Crit 10 YR STORM
Crit 5 YR STORM
WS 100 YR STORM
EG 2 YR STORM
WS 10 YR STORM
WS 5 YR STORM
Crit 2 YR STORM
WS 2 YR STORM
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta
DROP 4 86+29


GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Elevation (ft)
5807
5806
5805
5804
5803
5802
5801
5800
0
20
40
60
80
100
120
Station (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
Crit 100 YR STORM
WS 100 YR STORM
EG 5 YR STORM
Crit 10 YR STORM
WS 10 YR STORM
Crit 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
Crit 2 YR STORM
WS 2 YR STORM
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
5.5 ft/s
6.0 ft/s
6.5 ft/s
Ground
Bank Sta
DROP 4 86+17


GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Elevation (ft)
5806
5805
5804
5803
5802
5801
5800
5799
0
20
40
60
80
100
120
Station (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
Crit 100 YR STORM
WS 100 YR STORM
EG 5 YR STORM
Crit 10 YR STORM
WS 10 YR STORM
Crit 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
Ground
Bank Sta
DROP 4 Sta 100


GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
Elevation (ft)
5806
5804
5802
5800
5798
5796
0
20
40
60
80
100
120
Station (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
EG 100 YR STORM
WS 1993 Hydrology
EG 10 YR STORM
Crit 100 YR STORM
EG 5 YR STORM
WS 100 YR STORM
Crit 10 YR STORM
Crit 5 YR STORM
WS 10 YR STORM
EG 2 YR STORM
WS 5 YR STORM
Crit 2 YR STORM
WS 2 YR STORM
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta
DROP 4 85+85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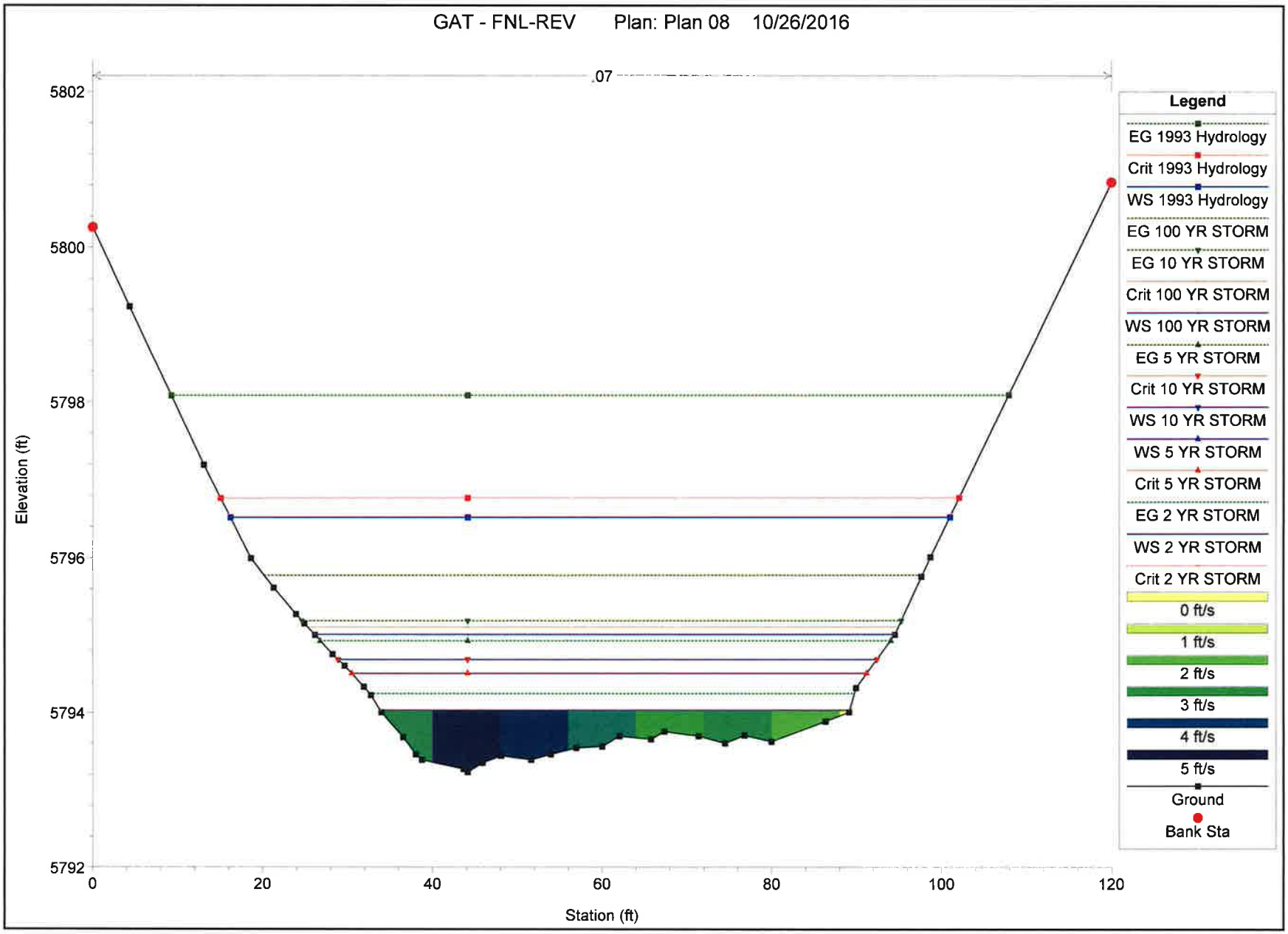
.07
Elevation (ft)
5804
5802
5800
5798
5796
5794
0
20
40
60
80
100
120
Station (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
Crit 100 YR STORM
EG 5 YR STORM
WS 100 YR STORM
Crit 10 YR STORM
WS 10 YR STORM
Crit 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
Crit 2 YR STORM
WS 2 YR STORM
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
DROP 4 85+75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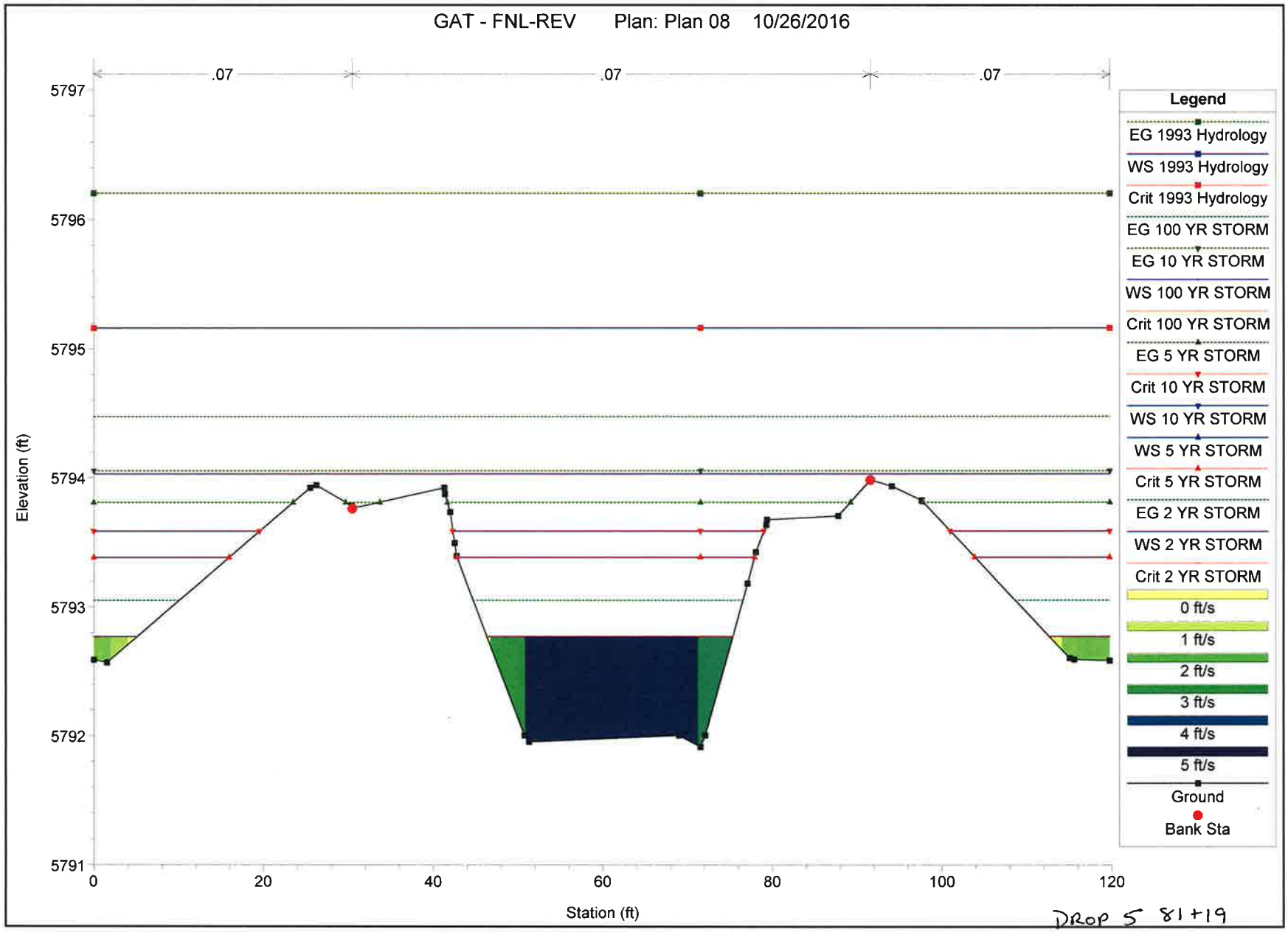
5798
5796
5794
5792
0
20
40
60
80
100
120
Station (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
Crit 100 YR STORM
WS 100 YR STORM
EG 5 YR STORM
Crit 10 YR STORM
WS 10 YR STORM
WS 5 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta

DROP 4 85749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Station (ft)
Legend
EG 1993 Hydrology
WS 1993 Hydrology
Crit 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
WS 100 YR STORM
Crit 100 YR STORM
EG 5 YR STORM
Crit 10 YR STORM
WS 10 YR STORM
WS 5 YR STORM
Crit 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
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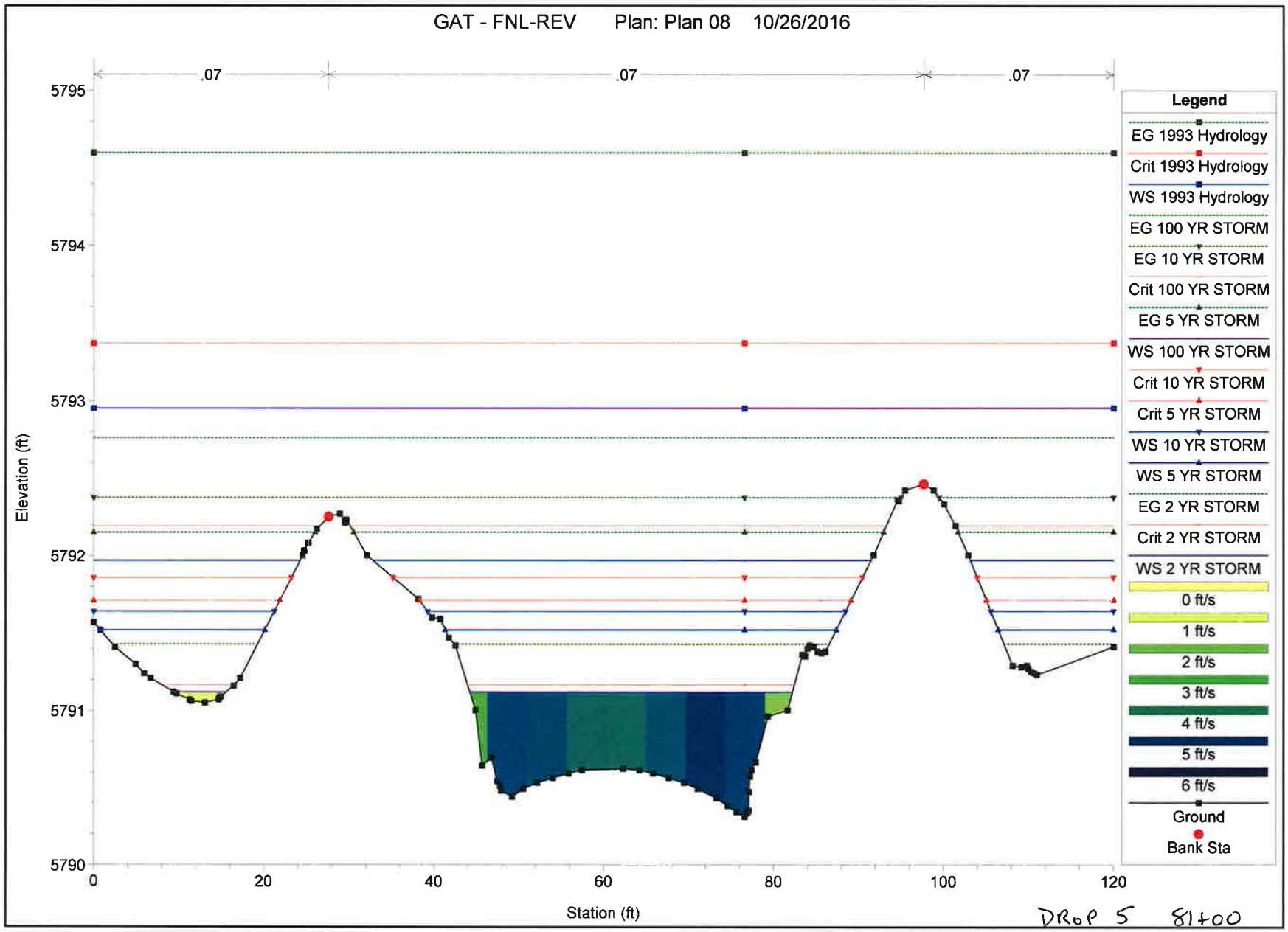
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
DROP 5 81+19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Elevation (ft)
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Station (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
Crit 100 YR STORM
EG 5 YR STORM
WS 100 YR STORM
Crit 10 YR STORM
Crit 5 YR STORM
WS 10 YR STORM
WS 5 YR STORM
EG 2 YR STORM
Crit 2 YR STORM
WS 2 YR STORM
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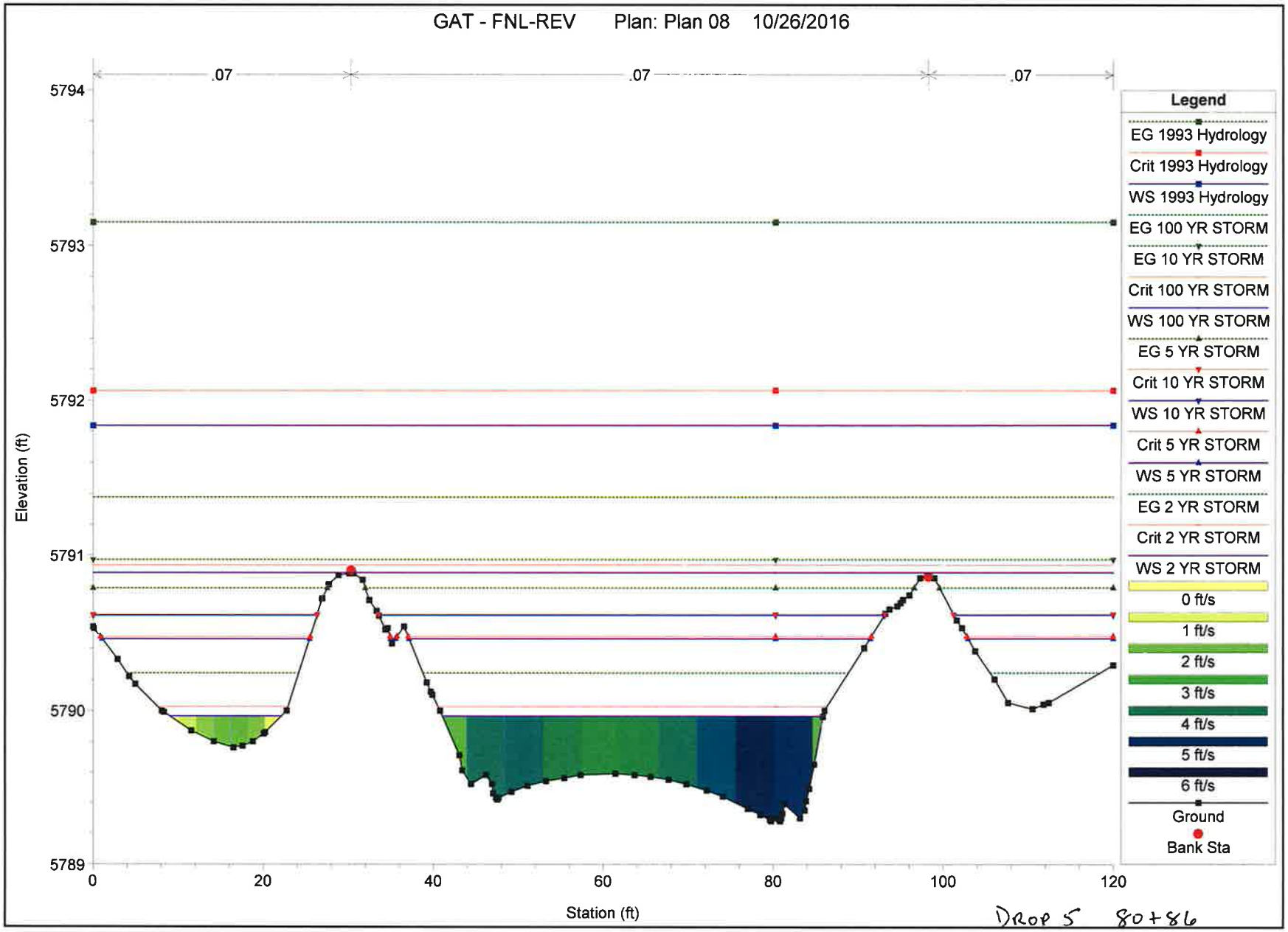
5 ft/s
6 ft/s
Ground
Bank Sta
DROP 5 81+00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100
120
Station (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
Crit 100 YR STORM
WS 100 YR STORM
EG 5 YR STORM
Crit 10 YR STORM
WS 10 YR STORM
Crit 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
Crit 2 YR STORM
WS 2 YR STORM
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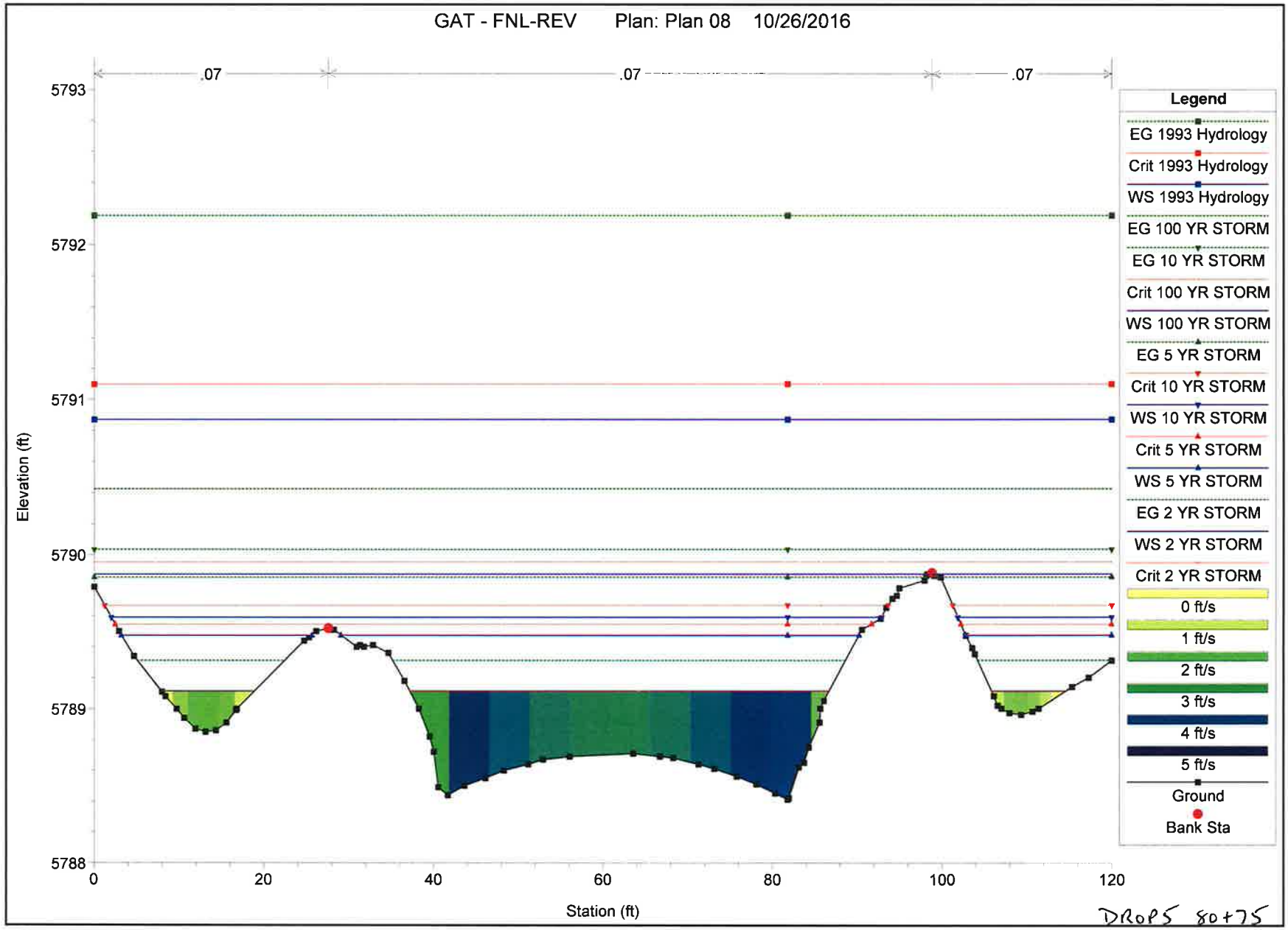
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta
Drop 5 80+86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.07
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Elevation (ft)
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20
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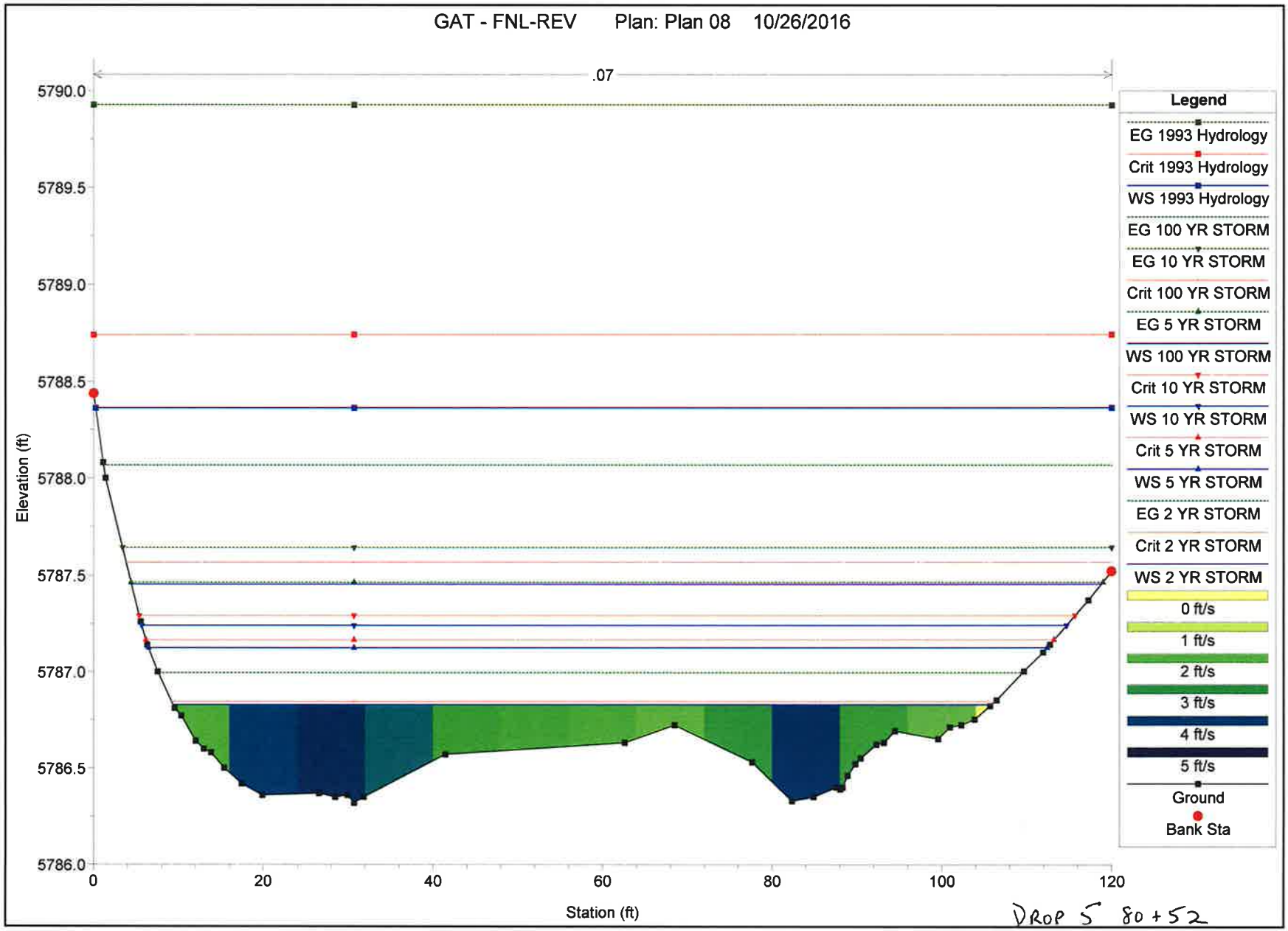
80
100
120
Station (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
Crit 100 YR STORM
WS 100 YR STORM
EG 5 YR STORM
Crit 10 YR STORM
WS 10 YR STORM
Crit 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
WS 2 YR STORM
Crit 2 YR STORM
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
DROPS 80+75


GAT - FNL-REV Plan: Plan 08 10/26/2016
.07
5790.0
5789.5
5789.0
5788.5
5788.0
5787.5
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5786.5
5786.0
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
EG 1993 Hydrology
Crit 1993 Hydrology
WS 1993 Hydrology
EG 100 YR STORM
EG 10 YR STORM
Crit 100 YR STORM
EG 5 YR STORM
WS 100 YR STORM
Crit 10 YR STORM
WS 10 YR STORM
Crit 5 YR STORM
WS 5 YR STORM
EG 2 YR STORM
Crit 2 YR STORM
WS 2 YR STORM
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
DROP 5' 80+52

APPENDIX G

Regional Detention/Water Quality Pond Design

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: Compark South

Basin ID: H160, H170, H180, H161, H171, H181 & H182

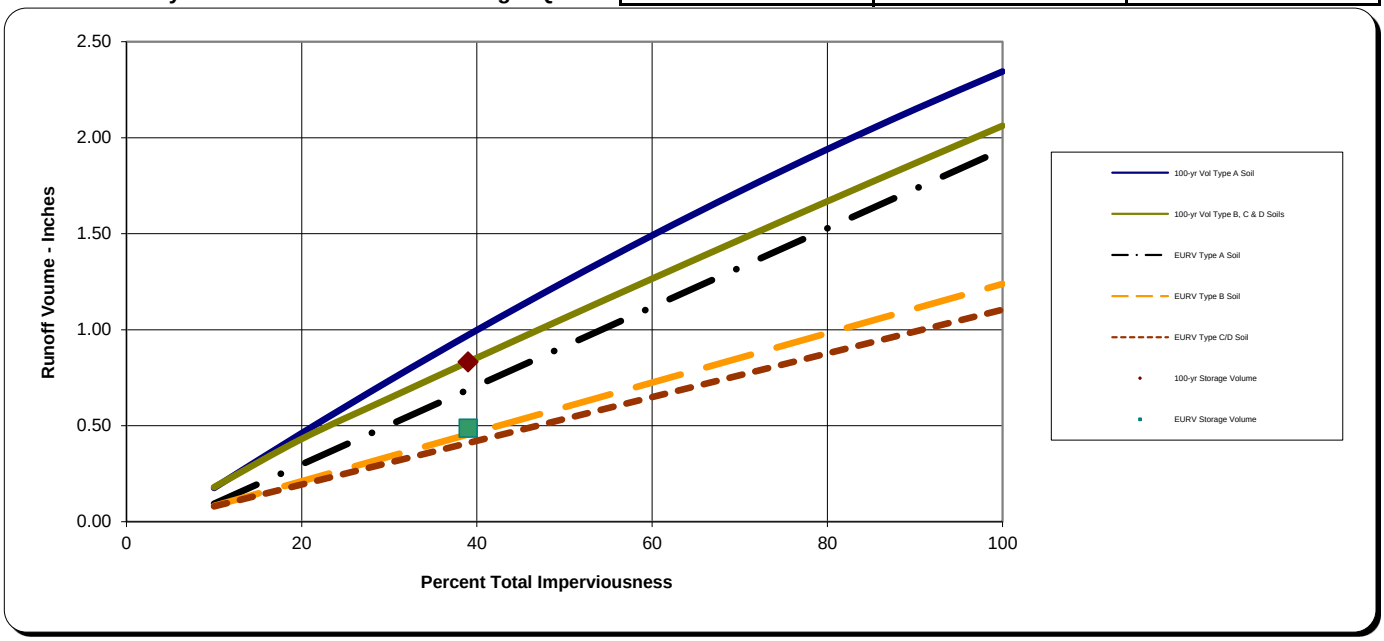
* User input data shown in blue.

Area of Watershed (acres)	189.00	
Subwatershed Imperviousness	39.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	39.0%	

Hydrologic Soil Type	**Percentage of Area**	**Area (acres)**
Type A	0.0%	0.0
Type B	75.0%	141.8
Type C or D	25.0%	47.3

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		**Decay Coefficient--α**
Initial--f_i	**Final--fo**	
4.125	0.6	0.0018

	Detention Volumes [2,5]		
	(watershed inches)	**(acre-feet)**	**Maximum Allowable Release Rate, cfs[3]**
Excess Urban Runoff Volume[4]	0.49	7.69	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.83	13.11	167.74



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

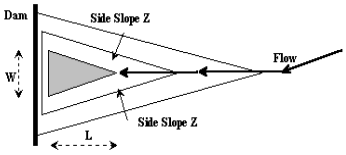
4) EURV approximates the difference between developed and pre-developed runoff volume.

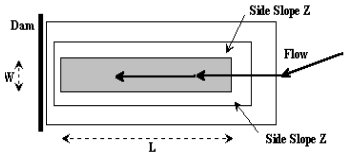
5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

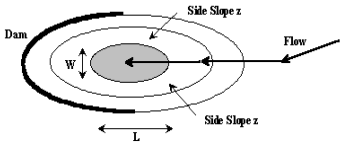
STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____

Basin ID: _____







Design Information (Input):

Width of Basin Bottom, W =		ft
Length of Basin Bottom, L =		ft
Dam Side-slope (H:V), Z_d =		ft/ft

Check Basin Shape

Right Triangle		OR…
Isosceles Triangle		OR…
Rectangle		OR…
Circle / Ellipse		OR…
Irregular		(Use Overide values in cells G32:G52)

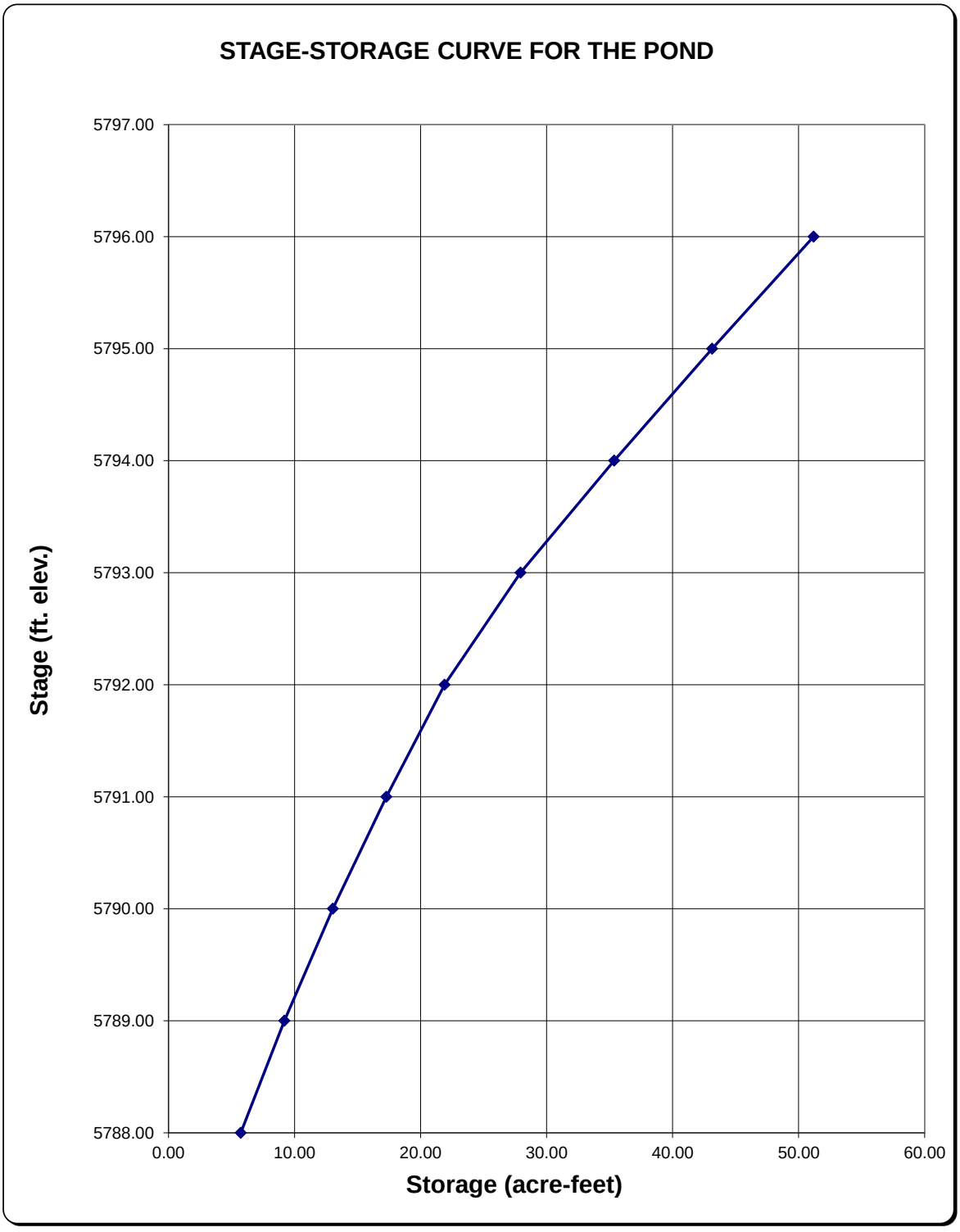
Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	7.69	13.11	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	5786.00					102,775.14		2.359	0.000	
	5787.00		0.00	0.00		126,508.10	114,642	2.904	2.632	
	5788.00		0.00	0.00		143,301.36	249,546	3.290	5.729	
	5789.00		0.00	0.00		157,942.05	400,168	3.626	9.187	EURV 7.69 Ac-ft
	5790.00		0.00	0.00		177,254.82	567,766	4.069	13.034	5788.5
	5791.00		0.00	0.00		192,974.20	752,881	4.430	17.284	100 yr 13.11 Ac-ft
	5792.00		0.00	0.00		209,727.89	954,232	4.815	21.906	5790.0
	5793.00		0.00	0.00		315,416.45	1,216,804	7.241	27.934	
	5794.00		0.00	0.00		331,761.59	1,540,393	7.616	35.363	
	5795.00		0.00	0.00		345,334.02	1,878,941	7.928	43.135	
	5796.00		0.00	0.00		356,347.91	2,229,782	8.181	51.189	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project:
Basin ID:



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: Compark South

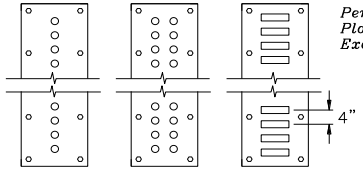
Basin ID: Regional Detention Pond

WQCV Design Volume (Input):

Catchment Imperviousness, I_a =	39.0 percent		
Catchment Area, A =	189.00 acres	Diameter of holes, D =	inches
Depth at WQCV outlet above lowest perforation, H =	2 feet	Number of holes per row, N =	
Vertical distance between rows, h =	6.00 inches	**OR**	
Number of rows, NL =	4.00		
Orifice discharge coefficient, C_o =	0.65	Height of slot, H =	2.00 inches
Slope of Basin Trickle Channel, S =	0.010 ft / ft	Width of slot, W =	7.05 inches
Time to Drain the Pond =	56 hours		

Watershed Design Information (Input):

Percent Soil Type A =	0 %
Percent Soil Type B =	75 %
Percent Soil Type C/D =	25 %



Perforated Plate Examples

Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	0.488 watershed inches
	N/A
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	**7.686 acre-feet**
Outlet area per row, Ao =	14.10 square inches
Total opening area at each row based on user-input above, Ao =	14.10 square inches
Total opening area at each row based on user-input above, Ao =	0.098 square feet

3

	Central Elevations of Rows of Holes in feet																							Σ Flow
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	
	5785.26	5785.76	5786.26	5786.76																					
	Collection Capacity for Each Row of Holes in cfs																								
5786.00	0.4392	0.2501	0.0000	0.0000																					0.69
5786.50	0.5686	0.4392	0.2501	0.0000																					1.26
5787.00	0.6735	0.5686	0.4392	0.2501																					1.93
5787.50	0.7642	0.6735	0.5686	0.4392																					2.45
5788.00	0.8452	0.7642	0.6735	0.5686																					2.85
5788.50	0.9191	0.8452	0.7642	0.6735																					3.20
5789.00	0.9874	0.9191	0.8452	0.7642																					3.52
5789.50	1.0514	0.9874	0.9191	0.8452																					3.80
5790.00	1.1116	1.0514	0.9874	0.9191																					4.07
5790.50	1.1688	1.1116	1.0514	0.9874																					4.32
5791.00	1.2233	1.1688	1.1116	1.0514																					4.56
5791.50	1.2755	1.2233	1.1688	1.1116																					4.78
5792.00	1.3256	1.2755	1.2233	1.1688																					4.99
5792.50	1.3739	1.3256	1.2755	1.2233																					5.20
5793.00	1.4205	1.3739	1.3256	1.2755																					5.40
5793.50	1.4657	1.4205	1.3739	1.3256																					5.59
5794.00	1.5095	1.4657	1.4205	1.3739																					5.77
5794.50	1.5521	1.5095	1.4657	1.4205																					5.95
5795.00	1.5935	1.5521	1.5095	1.4657																					6.12
5795.50	1.6339	1.5935	1.5521	1.5095																					6.29
5796.00	1.6733	1.6339	1.5935	1.5521																					6.45
5796.50	1.7118	1.6733	1.6339	1.5935																					6.61
	#N/A	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A	#N/A																					#N/A
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	#N/A	#N/A	#N/A	#N/A																					#N/A
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	#N/A	#N/A	#N/A	#N/A																					#N/A
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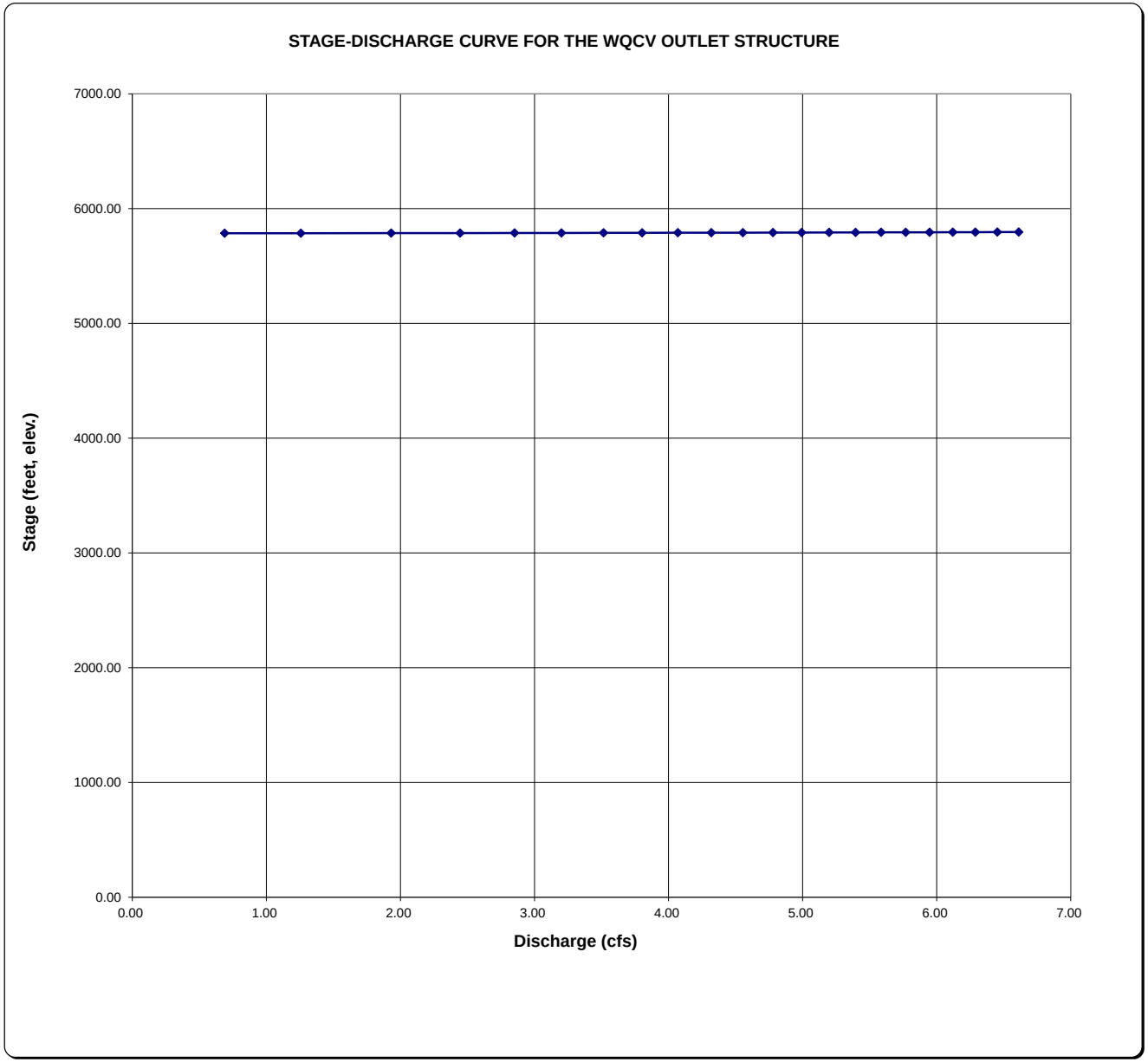
	#N/A	#N/A	#N/A	#N/A																					#N/A
	#N/A	#N/A	#N/A	#N/A																					#N/A
	Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24	

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: **Compark South**

Basin ID: **Regional Detention Pond**



E-470 Proposed Regional FS Pond
Lower Pond Stage - Discharge

Elevation (ft)	WQ H (ft)	Q (cfs) WQ Plate	Q_w H (ft)	Q_w (cfs) 100' Weir @ 5788.5	Q_{BC} H (ft)	Q (cfs) 22.5'x4' RCBC @ 5782.5	Q_{EX} H (ft)	Q (cfs) 12'x10' EX RCBC @5779.78	Q_{rel} (cfs)	Area (sf)	Vol. (AF)	
5786	0.0	0.7			3.5		6.22		0.7	102,775.14	0.00	
5786.5	0.5	1.3			4.0		6.72		1.3	114,436.35	1.25	
5787	1.0	1.9			4.5		7.22		1.9	126,508.10	2.63	
5787.5	1.5	2.5			5.0		7.72		2.5	134,817.54	4.13	
5788	2.0	2.9			5.5		8.22		2.9	143,301.36	5.72	EURV
5788.5	2.5	3.2	0	0.0	6.0	715	8.72	866.2	3.2	150,562.37	7.41	V=7.7 ac-ft
5789	3.0	3.5	0.5	106.1	6.5	770	9.22	942.2	109.6	157,942.05	9.18	El 5788.5
5789.5	3.5	3.8	1	300.0	7.0	825	9.72	1019.4	303.8	167,505.63	11.05	
5790	4.0	4.1	1.5	551.1	7.5	880	10.22	1100.0	555.2	177,254.82	13.03	100 yr
5790.5	4.5	4.3	2	848.5	8.0	936	10.72	1180.7	852.8	185,058.87	15.11	V=13.1 ac-ft
5791	5.0	4.6	2.5	1185.9	8.5	993	11.22	1263.8	993.0	192,974.20	17.28	El 5790.0
5791.5	5.5	4.8	3	1558.9	9.0	1049	11.72	1350.0	1049.0	201,292.94	19.54	
5792	6.0	5.0	3.5	1964.4	9.5	1106	12.22	1414.1	1106.0	209,727.89	21.90	
5792.5	6.5	5.2	4	2400.0	10.0	1163	12.72	1468.1	1163.0	260,781.31	24.59	
5793	7.0	5.4	4.5	2863.8	10.5	1220	13.22	1526.3	1220.0	315,416.45	27.89	
5793.5	7.5	5.6	5	3354.1	11.0	1278	13.72	1595.7	1278.0	323,554.61	31.56	
5794	8.0	5.8	5.5	3869.6	11.5	1333	14.22	1666.2	1333.0	331,761.59	35.32	
5794.5	8.5	6.0	6	4409.1	12.0	1385	14.72	1733.8	1385.0	338,525.13	39.17	
5795	9.0	6.1	6.5	4971.5	12.5	1431	15.22	1800.0	1431.0	345,334.02	43.09	
5795.5	9.5	6.3	7	5556.1	13.0	1475	15.72	1861.0	1475.0	350,826.56	47.09	
5796	10.0	6.5	7.5	6161.9	13.5	1519	16.22	1921.43	1519.0	356,348.00	51.15	

APPENDIX H

State Engineer's Office Exemption

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016

From: Schoolmeesters - DNR, Ryan
To: Amie S. Drucker
Cc: John Hunyadi - DNR; Jeremy Franz - DNR
Subject: Jurisdictional Determination for Compark Village Detention Dam
Date: Monday, March 21, 2016 11:39:14 AM

Hi Amie,
Thank you for taking the pro-active step and contacting our office for a determination on the regulatory status of the proposed Compark Village Detention Pond dam pursuant to the State Engineer's regulation of water impoundment structures under CRS 37-87-105. We understand that the proposed lake will be owned and operated by 470 Compark, LLC.
According to your letter dated March 14, 2016, the facility is situated within the SW quarter of Section 6, Township 6 South, Range 66 West of the 6th P.M. in Parker, Colorado. It lies within Water Division 1, Water District 8. The information provided in your letter indicates that the existing structure will have a jurisdictional height of 9 feet and impounds a reservoir of 22.2 acre-feet that covers 3.4 surface acres.
Based on a review of the information provided in the aforementioned letter, we conclude that the Compark Village Detention Dam classifies as a Non-Jurisdictional size structure with a Low Hazard Class. As a Low Hazard, Non-jurisdictional size structure, our office is not required to review and approve the plans and specifications for improvements to the structure. The dam has been assigned DAMID: 080454. Please reference this damid in any future correspondence.
We sincerely appreciate that you contacted this office for a ruling on the regulatory status of this structure. Feel free to contact me at (303) 866-3581 x8284 if you have any questions or comments regarding the information presented herein or any other dam safety related topics.
Regards,
Ryan
--
Ryan Schoolmeesters, PE
Dam Safety Engineer
Dam Safety Branch
P 303.866.3581 x8284 / C 303.842.1424
1313 Sherman Street, Room 818, Denver, CO 80203
Ryan.Schoolmeesters@state.co.us / www.water.state.co.us

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Compark Village South Regional Detention Pond**

Facility Location & Jurisdiction: **39 33' 19"N, 104 49' 12"W, Town of Parker, CO**

User Input: Watershed Characteristics

Watershed Slope =	0.035	ft/ft
Watershed Length =	5300	ft
Watershed Area =	189.00	acres
Watershed Imperviousness =	39.0%	percent
Percentage Hydrologic Soil Group A =		percent
Percentage Hydrologic Soil Group B =	75.0%	percent
Percentage Hydrologic Soil Groups C/D =	25.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

Parker - Parker Town Court

WQCV Treatment Method = Extended Detention

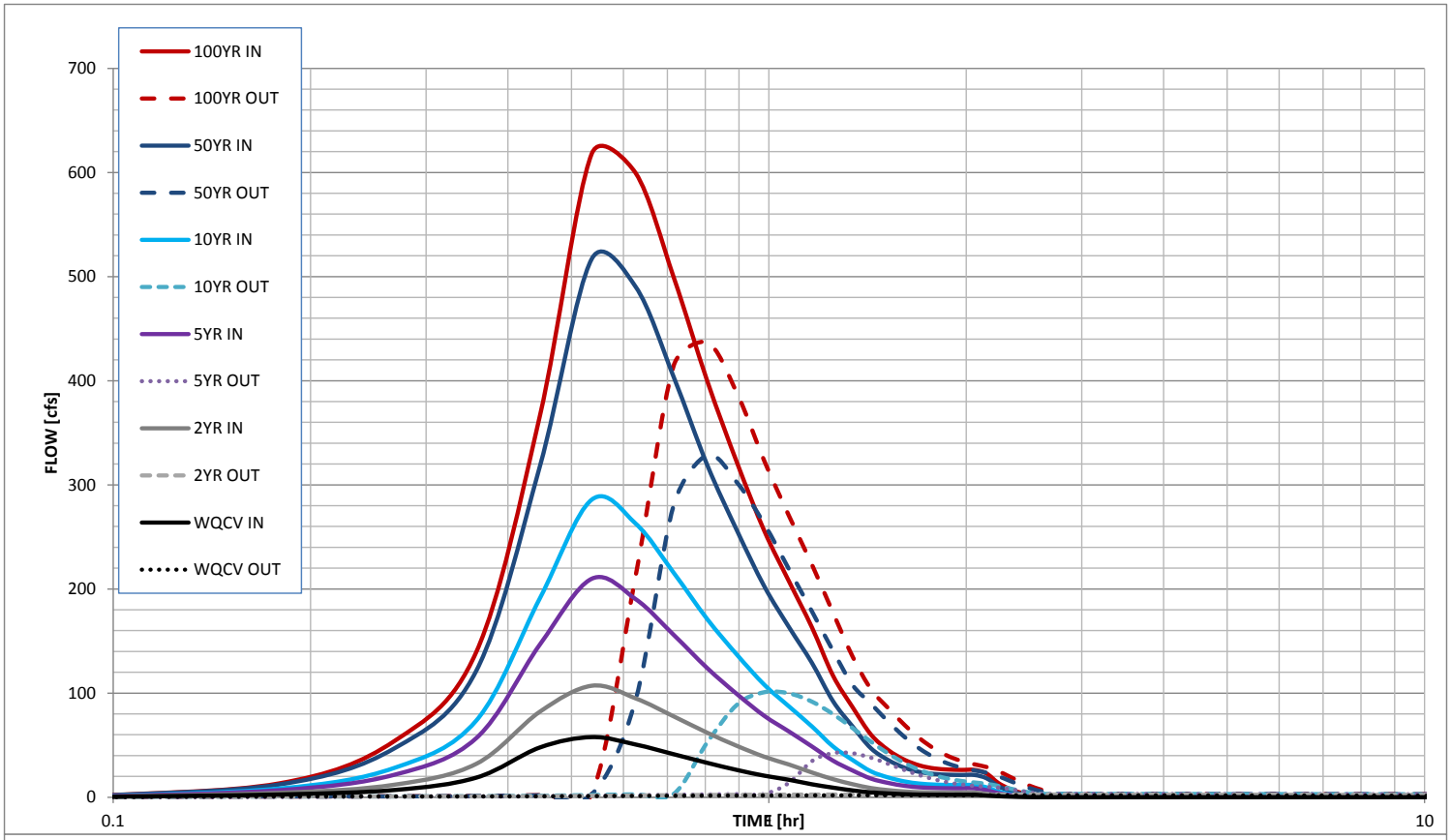
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	102,775	0.00	0.70
0.50	114,436	0.50	1.30
1.00	126,508	1.00	1.90
1.50	134,817	1.50	2.45
2.00	143,301	2.00	2.85
2.50	150,562	2.50	3.20
3.00	157,942	3.00	109.60
3.50	167,506	3.50	303.80
4.00	177,255	4.00	555.20
4.50	185,059	4.50	852.80
5.00	192,974	5.00	993.00
5.50	201,293	5.50	1049.00
6.00	209,728	6.00	1106.00
6.50	260,781	6.50	1163.00
7.00	315,416	7.00	1220.00
7.50	323,555	7.50	1278.00
8.00	331,762	8.00	1333.00
8.50	338,525	8.50	1385.00
9.00	345,334	9.00	1431.00
9.50	350,827	9.50	1475.00
10.00	356,348	10.00	1519.00

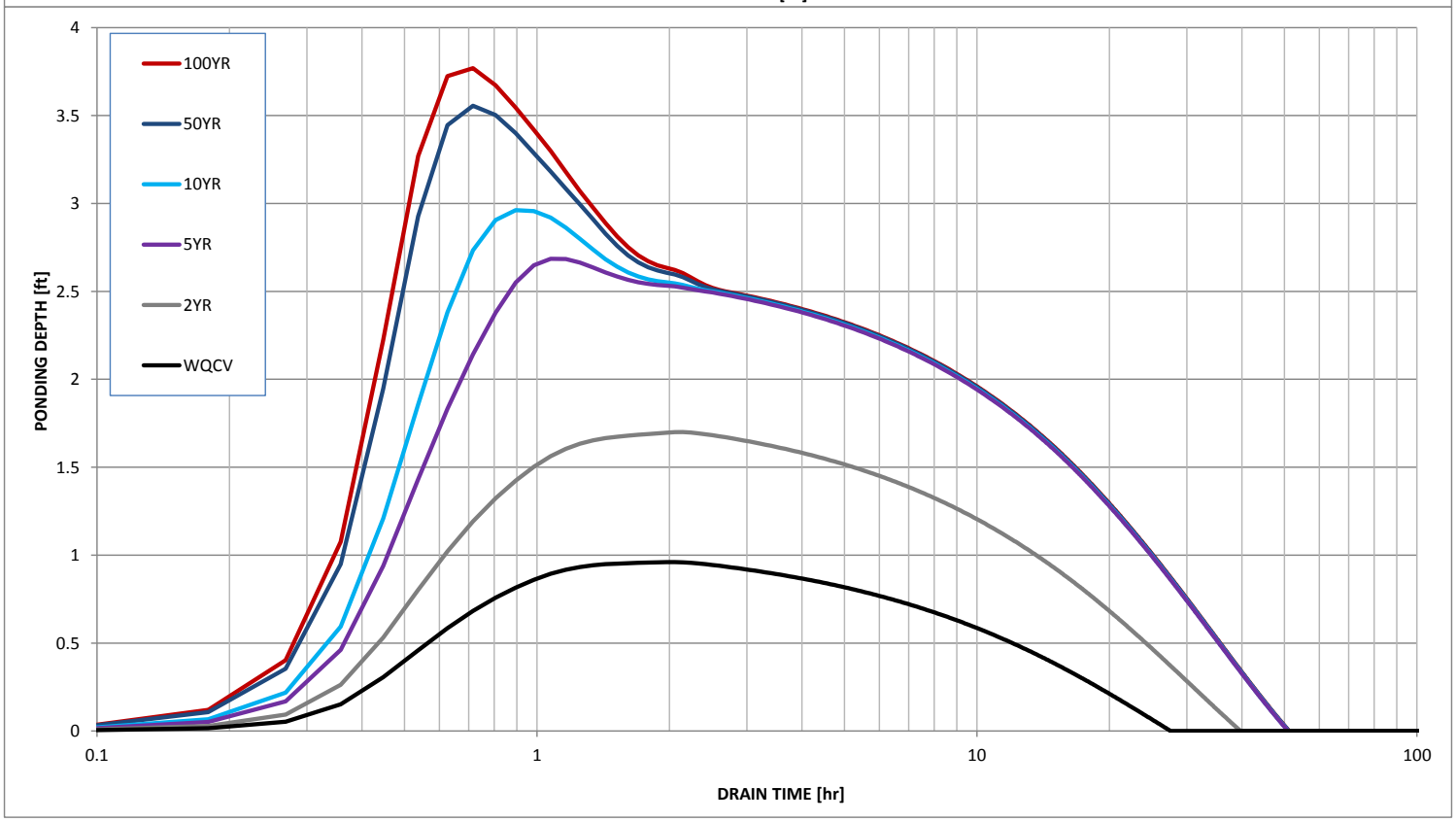
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	0.96	1.40	1.65	2.30	2.61	in
Calculated Runoff Volume =	2.791	5.148	10.081	13.762	25.157	30.847	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	2.790	5.142	10.076	13.759	25.153	30.840	acre-ft
Time to Drain 97% of Inflow Volume =	26.2	37.2	**46.3**	44.8	40.8	38.9	hours
Time to Drain 99% of Inflow Volume =	27.1	38.9	49.3	48.8	47.2	**46.4**	hours
Maximum Ponding Depth =	0.96	1.70	2.69	2.96	3.56	3.77	ft
Maximum Ponded Area =	2.88	3.17	3.52	3.61	3.86	**3.96**	acres
Maximum Volume Stored =	2.501	4.748	8.034	9.038	11.237	12.072	acre-ft

Stormwater Detention and Infiltration Design Data Sheet

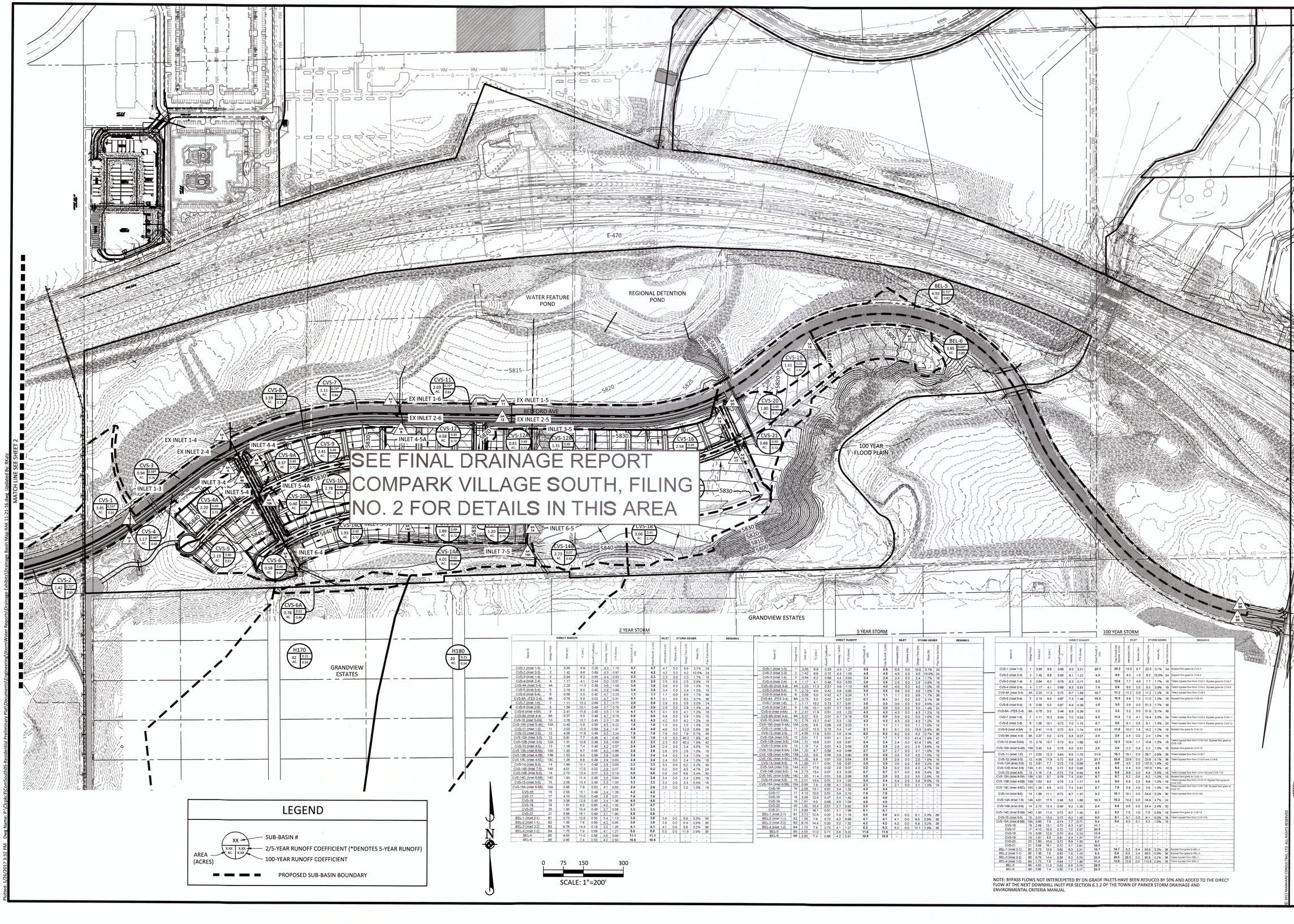




APPENDIX I

Storm Sewer Design

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016
Revised December 20, 2016



2 YEAR STORM

Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient	Intensity, I (in/hr)	Q=CIA (ft³/s)	Total Runoff, Q (ft³/s)	INLET Interceptor, Q (ft³/s)	INLET Bypass (ft³/s)	STORM SEWER Design Flow (ft³/s)	STORM SEWER Slope (%)	STORM SEWER Pipe Size (inches)	REMARKS
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.28	4.3	1.10	4.7	4.7	0.0	6.9	3.1%	24	
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.69	4.3	0.97	4.2	4.2	0.0	4.2	10.0%	24	
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.55	4.4	0.52	2.3	2.3	0.0	2.3	1.7%	18	
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.45	5.0	0.51	2.5	2.5	0.0	2.5	0.9%	18	
CVS-4A (Inlet 3-4)	4A	2.20	11.3	0.49	3.6	1.08	3.9	3.9	0.0	3.9	1.0%	18	
CVS-5 (Inlet 5-4)	5	2.19	9.0	0.40	3.9	0.86	3.4	3.4	0.0	3.4	0.9%	18	
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.40	4.7	0.23	1.1	1.1	0.0	9.6	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	0.1	0.1	0.0	8.5	3.1%	36	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.69	3.7	0.77	2.9	2.9	0.0	5.8	3.0%	24	
CVS-8 (Inlet 2-6)	8	1.59	12.1	0.49	3.7	0.78	2.9	2.9	0.0	2.9	1.4%	24	
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.49	3.5	1.18	4.1	4.1	0.0	4.1	1.2%	18	
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.49	4.7	0.18	0.9	0.9	0.0	0.9	1.0%	18	
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.45	3.3	1.26	4.2	4.2	0.0	4.2	1.2%	18	
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.56	4.5	0.22	1.0	1.0	0.0	1.0	1.0%	18	
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.69	3.4	1.41	4.9	4.9	0.0	6.6	2.0%	30	
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.49	3.5	2.24	7.9	7.9	0.0	7.9	0.7%	36	
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.49	4.1	0.40	1.6	1.6	0.0	40.0	1.9%	42	
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.49	3.6	0.64	2.3	2.3	0.0	40.0	1.9%	42	
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.49	4.2	0.57	2.4	2.4	0.0	2.4	3.6%	18	
CVS-13A (Inlet 6-5A)	13A	1.20	8.7	0.55	4.0	0.66	2.6	2.6	0.0	2.6	1.0%	18	
CVS-13B (Inlet 4-5B)	13B	1.53	9.0	0.59	3.9	0.96	3.4	3.4	0.0	3.4	1.0%	18	
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.49	3.9	0.62	2.4	2.4	0.0	2.4	1.0%	18	
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.49	3.6	0.93	3.3	3.3	0.0	8.2	3.2%	30	
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.02	2.9	0.07	0.2	0.2	0.0	4.3	4.7%	24	
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.07	3.3	0.19	0.6	0.6	0.0	8.6	3.4%	30	
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.49	3.5	0.84	3.4	3.4	0.0	3.4	2.8%	18	
CVS-15 (Inlet 5-5)	15	2.05	13.4	0.49	3.3	1.00	3.3	3.3	0.0	3.3	5.0%	18	
CVS-15A (Inlet 6-5B)	15A	0.95	7.9	0.53	4.1	0.50	2.0	2.0	0.0	2.0	1.0%	18	
CVS-16	16	2.58	13.1	0.49	3.3	1.26	4.2	4.2	-	-	-	-	
CVS-17	17	4.10	10.0	0.49	3.8	2.01	7.6	7.6	-	-	-	-	
CVS-18	18	3.06	12.8	0.45	3.4	1.36	4.6	4.6	-	-	-	-	
CVS-19	19	1.61	6.0	0.65	4.5	1.05	4.7	4.7	-	-	-	-	
CVS-20	20	1.80	10.4	0.49	3.7	0.98	3.3	3.3	-	-	-	-	
CVS-21	21	3.88	16.1	0.49	3.1	1.90	5.8	5.8	-	-	-	-	
BEL-1 (Inlet 2-1)	B1	3.73	12.8	0.30	3.4	1.13	3.8	3.8	0.0	5.9	3.3%	36	
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.69	4.2	0.95	3.9	3.9	0.0	8.4	0.9%	36	
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.19	3.2	1.26	4.1	4.1	0.0	6.6	3.2%	36	
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.84	4.1	1.21	5.0	5.0	0.0	11.6	2.9%	36	
BEL-5	B5	4.55	11.0	0.68	3.6	3.08	11.1	11.1	-	-	-	-	
BEL-6	B6	3.95	7.4	0.63	4.2	2.50	10.6	10.6	-	-	-	-	

5 YEAR STORM

Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient	Intensity, I (in/hr)	Q=CIA (ft³/s)	Total Runoff, Q (ft³/s)	INLET Interceptor (ft³/s)	INLET Bypass (ft³/s)	STORM SEWER Design Flow (ft³/s)	STORM SEWER Slope (%)	STORM SEWER Pipe Size (inches)	REMARKS
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.33	4.3	1.27	5.5	5.5	0.0	10.0	3.1%	24	
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.72	4.3	1.09	4.5	4.5	0.0	4.5	10.0%	24	
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.58	4.4	0.54	2.4	2.4	0.0	2.4	1.7%	18	
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.46	5.0	0.53	2.6	2.6	0.0	2.6	0.9%	18	
CVS-4A (Inlet 3-4)	4A	2.20	11.3	0.51	3.6	1.13	4.0	4.0	0.0	4.0	1.0%	18	
CVS-5 (Inlet 5-4)	5	2.19	9.0	0.42	3.9	0.90	3.6	3.6	0.0	3.6	0.9%	18	
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.42	4.7	0.24	1.1	1.1	0.0	9.6	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	0.1	0.1	0.0	8.5	3.1%	36	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.73	3.7	0.81	3.0	3.0	0.0	6.0	3.0%	24	
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.51	3.7	0.81	3.0	3.0	0.0	3.0	1.4%	24	
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.51	3.5	1.23	4.3	4.3	0.0	4.3	1.2%	18	
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.51	4.7	0.19	0.9	0.9	0.0	0.9	1.0%	18	
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.47	3.3	1.32	4.3	4.3	0.0	4.3	1.2%	18	
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.59	4.5	0.23	1.1	1.1	0.0	1.1	1.0%	18	
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.73	3.4	1.47	5.1	5.1	0.0	13.3	0.9%	36	
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.51	3.5	2.34	8.2	8.2	0.0	8.2	0.7%	36	
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.51	4.1	0.42	1.7	1.7	0.0	41.4	1.9%	42	
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.51	3.6	0.67	2.4	2.4	0.0	41.4	1.9%	42	
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.51	4.2	0.59	2.5	2.5	0.0	2.5	3.6%	18	
CVS-13A (Inlet 6-5A)	13A	1.20	8.7	0.58	4.0	0.69	2.7	2.7	0.0	2.7	1.0%	18	
CVS-13B (Inlet 4-5B)	13B	1.53	9.0	0.62	3.9	0.99	3.5	3.5	0.0	3.5	1.0%	18	
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.51	3.9	0.64	2.5	2.5	0.0	2.5	1.0%	18	
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.51	3.6	0.97	3.5	3.5	0.0	8.5	3.2%	30	
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.02	2.9	0.07	0.2	0.2	0.0	4.3	4.7%	24	
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.07	3.3	0.20	0.7	0.7	0.0	8.8	3.4%	30	
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.51	3.5	0.88	3.5	3.5	0.0	3.5	2.8%	18	
CVS-15 (Inlet 5-5)	15	2.01	13.4	0.51	3.3	1.03	3.4	3.4	0.0	3.4	5.0%	18	
CVS-15A (Inlet 6-5B)	15A	0.95	7.9	0.55	4.1	0.52	2.1	2.1	0.0	2.1	1.0%	18	
CVS-16	16	2.58	13.1	0.51	3.4	1.32	4.4	4.4	-	-	-	-	
CVS-17	17	4.10	10.0	0.51	3.8	2.10	7.9	7.9	-	-	-	-	
CVS-18	18	3.06	12.8	0.47	3.4	1.42	4.8	4.8	-	-	-	-	
CVS-19	19	1.61	6.0	0.68	4.5	1.09	4.9	4.9	-	-	-	-	
CVS-20	20	1.80	10.4	0.51	3.7	0.962	3.4	3.4	-	-	-	-	
CVS-21	21	3.88	16.1	0.51	3.1	1.96	6.1	6.1	-	-	-	-	
BEL-1 (Inlet 2-1)	B1	3.73	12.8	0.32	3.4	1.18	4.0	4.0	0.0	6.1	3.3%	36	
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.72	4.2	0.99	4.1	4.1	0.0	8.8	0.9%	36	
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.20	3.2	1.32	4.2	4.2	0.0	6.9	3.2%	36	
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.84	4.1	1.21	5.2	5.2	0.0	12.1	2.9%	36	
BEL-5	B5	4.55	11.0	0.71	3.6	3.22	11.6	11.6	-	-	-	-	
BEL-6	B6	3.95	7.4	0.66	4.2	2.61	10.9	10.9	-	-	-	-	

100 YEAR STORM

Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient	Intensity, I (in/hr)	Q=CIA (ft³/s)	Total Runoff, Q (ft³/s)	INLET Interceptor (ft³/s)	INLET Bypass (ft³/s)	STORM SEWER Design Flow (ft³/s)	STORM SEWER Slope (%)	STORM SEWER Pipe Size (inches)	REMARKS
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.65	8.0	2.01	20.2	20.2	13.5	6.7	22.5	3.1%	24	Bypass flow goes to CVS-3
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.85	8.1	1.21	9.9	9.9	1.0	8.9	10.0%	24	Bypass flow goes to CVS-4
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.76	8.3	0.71	8.9	12.6	7.7	4.9	7.7	1.7%	18	Takes bypass flow from CVS-1. Bypass goes to CVS-7
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.69	9.3	0.81	7.5	8.5	5.0	3.5	8.0	0.9%	18	Takes bypass flow from CVS-2. Bypass goes to CVS-8
CVS-4A (Inlet 3-4)	4A	2.20	11.3	0.72	6.7	1.59	10.7	11.2	0.0	11.2	1.0%	18	Takes bypass flow from CVS-5
CVS-5 (Inlet 5-4)	5	2.19	9.0	0.67	7.3	1.48	10.0	10.8	1.0	11.0	1.0%	18	Bypass flow goes to CVS-4A
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.67	8.8	0.39	3.5	3.5	0.0	51.3	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.46	8.8	0.36	3.2	3.2	0.0	51.0	3.1%	36	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.84	7.0	0.93	6.5	11.4	7.3	4.1	15.4	3.0%	24	Takes bypass flow from CVS-3. Bypass goes to CVS-11
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.72	7.0	1.15	8.1	8.6	5.1	3.5	8.1	1.4%	24	Takes bypass flow from CVS-4. Bypass goes to CVS-12
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.72	6.5	1.74	11.4	11.8	10.2	1.4	10.2	1.2%	18	Bypass flow goes to CVS-12.
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.72	8.8	0.27	2.4	2.4	0.0	2.4	1.0%	18	
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.70	6.2	1.96	12.1	12.3	10.6	1.7	10.6	1.2%	18	Takes bypass flow from CVS-13A. Bypass flow goes to CVS-15B.
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.76	8.5	0.31	2.6	2.6	2.2	0.4	2.2	1.0%	18	Bypass flow goes to CVS-10
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.84	6.9	1.70	11.9	11.9	0.0	38.7	0.8%	36	Takes bypass flow from CVS-7
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.72	6.8	3.31	21.7	23.8	23.8	0.0	23.8	0.7%	36	Takes bypass flow from CVS-9 and CVS-9.
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.72	7.8	0.59	4.6	4.6	4.5	0.0	137.0	1.9%	42	
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.72	6.8	0.64	6.6	9.4	9.4	0.0	137.0	1.9%	42	
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.72	7.9	0.64	6.6	8.9	8.9	0.0	8.9	3.6%	18	Takes bypass flow from CVS-13A and CVS 13C
CVS-13A (Inlet 6-5A)	13A	1.20	8.7	0.76	7.4	0.69	6.7	8.7	6.2	0.5	6.7	1.0%	18	Bypass flow goes to CVS-13
CVS-13B (Inlet 4-5B)	13B	1.53	9.0	0.76	7.4	0.84	6.9	8.4	3.4	2.5	6.9	1.0%	18	Takes bypass flow from CVS-13B. Bypass has goes to CVS-13
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.72	7.4	0.91	6.7	7.9	3.9	4.0	3.9	1.0%	18	
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.72	6.7	1.37	9.2	10.1	0.0	54.4	3.2%	30	Takes bypass from CVS-14C
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.46	5.5	1.66	10.3	10.2	0.0	34.8	4.7%	24	
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.49	6.2	1.35	8.4	9.5	9.5	0.0	54.4	3.4%	30	
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.72	6.7	1.40	9.3	9.3	7.5	1.8	7.5	2.8%	18	Bypass flow goes to CVS-14
CVS-15 (Inlet 5-5)	15	2.05	13.4	0.72	6.2	1.45	9.0	9.1	9.1	0.0	9.1	5.0%	18	Bypass flow from CVS-15A
CVS-15A (Inlet 6-5B)	15A	0.95	7.9	0.74	7.7	0.71	5.4	5.4	5.3	0.1	5.3	1.0%	18	
CVS-16	16	2.58	13.1	0.72	6.3	1.67	11.7	-	-	-	-	-	-	
CVS-17	17	4.10	10.0	0.72	7.0	2.87	20.9	-	-	-	-	-	-	
CVS-18	18	3.06	12.8	0.70	6.4	2.14	13.6	-	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.81	8.4	1.31	11.0	-	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.72	6.8	1.90	9.0	-	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.72	5.7	2.81	18.9	-	-	-	-	-	-	
BEL-1 (Inlet 2-1)	B1	3.73	12.8	0.62	6.3	2.31	14.7	5.3	5.4	63.6	3.3%	36	Bypass flow goes to BEL-1
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.83	7.8	1.15	8.9	8.9	6.5	2.4	69.5	0.9%	36	Bypass flow goes to BEL-4
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.56	6.0	3.76	22.6	29.6	29.0	0.0	95.6	3.2%	36	Takes bypass from BEL-1
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.84	7.7	1.46	11.2	13.6	0.0	110.8	2.9%	36	Takes bypass from BEL-2
BEL-5	B5	4.55	11.0	0.83	6.6	3.76	26.9	-	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.80	7.9	3.17	24.9	-	-	-	-	-	-	

NOTE: BYPASS FLOWS NOT INTERCEPTED BY ON GRADE INLETS HAVE BEEN REDUCED BY 50% AND ADDED TO THE DIRECT FLOW AT THE NEXT DOWNHILL INLET PER SECTION 6.3.2 OF THE TOWN OF PARKER STORM DRAINAGE AND ENVIRONMENTAL CRITERIA MANUAL

LEGEND

- XX — SUB-BASIN #
- AREA (ACRES) — X.XX AC | X.XX | X.XX — 2/5-YEAR RUNOFF COEFFICIENT (*DENOTES 5-YEAR RUNOFF) / 100-YEAR RUNOFF COEFFICIENT
- PROPOSED SUB-BASIN BOUNDARY

N

0 75 150 300

SCALE: 1"=200'

DRAWN BY:	RAK
REVISIONS:	REVISED PER TOWN COMMENTS
DATE:	11/21/2016
	A

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COMPARK SOUTH
TOWN OF PARKER, CO
PROPOSED DRAINAGE AREA MAP

COLORADO REGISTERED PROFESSIONAL ENGINEER — RICHARD L. BOWER — 30877 — 1-26-17

PROJ. MGR.:	RLB
PROJ. ASSOC.:	ASD
DRAWN BY:	RAK
DATE:	6-30-16

SHEET 1 OF 3

CLCPKC3

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Plotted: 1/26/2017 3:32 PM Dwg Name: P:\Capital\Comfort\05-Residential Preliminary Plat\Documents\Engineering\Storm\Water Reports\Drainage Exhibits\Drainage Basin Map RAK 11-21-16.dwg Updated By: RKatz

LEGEND

AREA (ACRES) — XX — SUB-BASIN #

X.XX AC. — X.XX — 2/5-YEAR RUNOFF COEFFICIENT (*DENOTES 5-YEAR RUNOFF)

X.XX — 100-YEAR RUNOFF COEFFICIENT

PROPOSED SUB-BASIN BOUNDARY

2 YEAR STORM

Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr.)	CA (Acres)	Direct Runoff, Q (cfs)	Total Runoff, Q (cfs)	INLET Intercepted (cfs)	INLET Bypass (cfs)	STORM SEWER Design Flow (cfs)	STORM SEWER Slope (%)	STORM SEWER Pipe Size (inches)	REMARKS
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.28	4.3	1.10	4.7	4.7	0.0	8.9	3.1%	24		
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.69	4.3	0.97	4.2	4.2	0.0	4.2	10.0%	24		
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.55	4.4	0.52	2.3	2.3	0.0	2.3	1.7%	18		
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.44	5.0	0.51	2.5	2.5	0.0	2.5	0.9%	18		
CVS-4A (Inlet 3-4)	4A	2.20	11.3	0.49	3.6	1.08	3.9	3.9	0.0	4.0	1.0%	18		
CVS-5 (Inlet 5-4)	5	2.19	9.0	0.40	3.9	0.88	3.4	3.4	0.0	3.4	1.0%	18		
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.40	4.7	0.23	1.1	1.1	0.0	0.6	1.7%	36		
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	0.1	0.1	0.0	0.5	3.1%	36		
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.69	3.7	0.77	2.9	2.9	0.0	5.8	3.0%	24		
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.40	3.7	0.78	2.9	2.9	0.0	2.9	1.4%	24		
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.49	3.5	1.18	4.1	4.1	0.0	4.1	1.2%	18		
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.40	4.7	0.18	0.9	0.9	0.0	0.9	1.0%	18		
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.45	3.3	1.26	4.2	4.2	0.0	4.2	1.2%	18		
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.56	4.5	0.22	1.0	1.0	0.0	1.0	1.0%	18		
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.69	3.4	1.41	4.9	4.9	0.0	12.8	0.8%	36		
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.49	3.5	2.24	7.8	7.9	0.0	7.9	0.7%	36		
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.49	4.1	0.40	1.6	1.6	0.0	40.0	1.9%	42		
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.49	3.6	0.64	2.3	2.3	0.0	40.0	1.9%	42		
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.49	4.2	0.67	2.4	2.4	0.0	2.4	3.6%	18		
CVS 13A (Inlet 6-5A)	13A	1.20	8.7	0.55	4.0	0.66	2.6	2.6	0.0	2.6	1.0%	18		
CVS 13B (Inlet 4-6B)	13B	1.53	9.0	0.56	3.9	0.66	3.4	3.4	0.0	3.4	1.0%	18		
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.49	3.9	0.62	2.4	2.4	0.0	2.4	1.0%	18		
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.49	3.6	0.93	3.3	3.3	0.0	6.2	3.2%	30		
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.02	2.9	0.07	0.2	0.2	0.0	4.3	4.7%	24		
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.07	3.3	0.09	0.6	0.6	0.0	8.6	3.4%	30		
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.51	3.6	0.99	3.5	3.5	0.0	3.5	2.8%	18		
CVS-15 (Inlet 5-5)	15	2.05	13.4	0.49	3.3	1.00	3.3	3.3	0.0	3.3	5.0%	18		
CVS-15A (Inlet 6-5B)	15A	0.66	7.9	0.53	4.1	0.50	2.0	2.0	0.0	2.0	1.0%	18		
CVS-16	16	2.58	13.1	0.49	3.4	1.26	4.2	4.2	-	-	-	-	-	
CVS-17	17	4.10	10.0	0.49	3.8	2.01	7.6	7.6	-	-	-	-	-	
CVS-18	18	3.06	12.8	0.45	3.4	1.36	4.6	4.6	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.65	4.5	1.05	4.7	4.7	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.49	3.7	0.88	3.3	3.3	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.49	3.1	1.90	5.8	5.8	-	-	-	-	-	
BEL-1 (Inlet 2-1)	B1	3.73	12.6	0.30	3.4	1.13	3.8	3.8	0.0	5.9	3.3%	36		
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.69	4.2	0.95	3.9	3.9	0.0	8.4	0.9%	36		
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.19	3.2	1.26	4.1	4.1	0.0	6.6	3.2%	36		
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.69	4.1	1.21	5.0	5.0	0.0	11.6	2.9%	36		
BEL-5	B5	4.55	11.0	0.69	3.6	3.08	11.1	11.1	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.63	4.2	2.50	10.5	10.5	-	-	-	-	-	

5 YEAR STORM

Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr.)	CA (Acres)	Direct Runoff, Q (cfs)	Total Runoff, Q (cfs)	INLET Intercepted (cfs)	INLET Bypass (cfs)	STORM SEWER Design Flow (cfs)	STORM SEWER Slope (%)	STORM SEWER Pipe Size (inches)	REMARKS
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.33	4.3	1.27	5.5	5.5	0.0	10.0	3.1%	24		
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.72	4.3	1.03	4.5	4.5	0.0	4.5	10.0%	24		
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.58	4.4	0.54	2.4	2.4	0.0	2.4	1.7%	18		
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.46	5.0	0.53	2.6	2.6	0.0	2.6	0.9%	18		
CVS-4A (Inlet 3-4)	4A	2.20	11.3	0.51	3.6	1.13	4.0	4.0	0.0	4.0	1.0%	18		
CVS-5 (Inlet 5-4)	5	2.19	9.0	0.42	3.9	0.92	3.6	3.6	0.0	3.6	1.0%	18		
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.42	4.7	0.24	1.1	1.1	0.0	0.6	1.7%	36		
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	0.1	0.1	0.0	8.5	3.1%	36		
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.73	3.7	0.81	3.0	3.0	0.0	6.0	3.0%	24		
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.42	3.7	0.81	3.0	3.0	0.0	3.0	1.4%	24		
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.51	3.5	1.23	4.3	4.3	0.0	4.3	1.2%	18		
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.51	4.7	0.19	0.9	0.9	0.0	0.9	1.0%	18		
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.47	3.3	1.32	4.3	4.3	0.0	4.3	1.2%	18		
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.59	4.5	0.23	1.1	1.1	0.0	1.1	1.0%	18		
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.73	3.4	1.47	5.1	5.1	0.0	13.3	0.8%	36		
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.51	3.5	2.34	8.2	8.2	0.0	8.2	0.7%	36		
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.51	4.1	0.41	1.7	1.7	0.0	41.4	1.9%	42		
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.51	3.6	0.67	2.4	2.4	0.0	41.4	1.9%	42		
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.51	4.2	0.59	2.5	2.5	0.0	2.5	3.6%	18		
CVS 13A (Inlet 6-5A)	13A	1.20	8.7	0.58	4.0	0.69	2.7	2.7	0.0	2.7	1.0%	18		
CVS 13B (Inlet 4-6B)	13B	1.53	9.0	0.59	3.9	0.90	3.5	3.5	0.0	3.5	1.0%	18		
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.51	3.9	0.64	2.5	2.5	0.0	2.5	1.0%	18		
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.51	3.6	0.97	3.5	3.5	0.0	8.5	3.2%	30		
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.02	2.9	0.07	0.2	0.2	0.0	4.3	4.7%	24		
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.07	3.3	0.09	0.7	0.7	0.0	8.8	3.4%	30		
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.51	3.6	0.99	3.5	3.5	0.0	3.5	2.8%	18		
CVS-15 (Inlet 5-5)	15	2.05	13.4	0.49	3.3	1.00	3.4	3.4	0.0	3.4	5.0%	18		
CVS-15A (Inlet 6-5B)	15A	0.66	7.9	0.55	4.1	0.52	2.1	2.1	0.0	2.1	1.0%	18		
CVS-16	16	2.58	13.1	0.51	3.4	1.32	4.4	-	-	-	-	-		
CVS-17	17	4.10	10.0	0.51	3.8	2.10	7.9	-	-	-	-	-		
CVS-18	18	3.06	12.8	0.47	3.4	1.42	4.8	-	-	-	-	-		
CVS-19	19	1.61	6.0	0.68	4.5	1.09	4.9	-	-	-	-	-		
CVS-20	20	1.80	10.4	0.51	3.7	0.92	3.4	-	-	-	-	-		
CVS-21	21	3.88	16.1	0.51	3.1	1.98	6.1	-	-	-	-	-		
BEL-1 (Inlet 2-1)	B1	3.73	12.6	0.32	3.4	1.18	4.0	4.0	0.0	6.1	3.3%	36		
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.72	4.2	0.99	4.1	4.1	0.0	8.8	0.9%	36		
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.20	3.2	1.32	4.2	4.2	0.0	6.9	3.2%	36		
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.73	4.1	1.27	5.2	5.2	0.0	12.1	2.9%	36		
BEL-5	B5	4.55	11.0	0.71	3.6	3.22	11.6	11.6	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.66	4.2	2.61	10.9	10.9	-	-	-	-	-	

100 YEAR STORM

Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr.)	CA (Acres)	Direct Runoff, Q (cfs)	Total Runoff with Bypass Flows (cfs)	INLET Intercepted (cfs)	INLET Bypass (cfs)	STORM SEWER Design Flow (cfs)	STORM SEWER Slope (%)	STORM SEWER Pipe Size (inches)	REMARKS
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.65	8.0	2.51	20.2	20.2	13.5	6.7	22.5	3.1%	24	Bypass flow goes to CVS-3.
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.85	8.1	1.21	9.9	9.9	9.0	1.0	9.0	10.0%	24	Bypass flow goes to CVS-4.
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.76	8.3	0.71	5.9	12.6	7.7	4.9	7.7	1.7%	18	Takes bypass flow from CVS-1. Bypass goes to CVS-7.
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.69	9.3	0.81	7.5	8.6	8.0	0.5	8.0	0.9%	18	Takes bypass flow from CVS-2. Bypass goes to CVS-8.
CVS-4A (Inlet 3-4)	4A	2.20	11.3	0.72	6.7	1.59	10.7	11.2	11.2	0.0	11.2	1.0%	18	Takes bypass flow from CVS-5.
CVS-5 (Inlet 5-4)	5	2.19	9.0	0.67	7.3	1.48	10.8	10.8	9.8	1.0	11.0	1.0%	18	Bypass flow goes to CVS-4A.
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.67	8.8	0.39	3.5	3.5	3.5	0.0	51.3	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.46	8.8	0.36	3.2	3.2	0.0	51.0	3.1%	36		
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.84	7.0	0.93	6.5	11.4	7.3	4.1	15.4	3.0%	24	Takes bypass flow from CVS-3. Bypass goes to CVS-11.
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.72	7.0	1.15	8.1	8.6	8.1	0.5	8.1	1.4%	24	Takes bypass flow from CVS-4. Bypass goes to CVS-12.
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.72	6.5	1.74	11.4	11.6	10.2	1.4	10.2	1.2%	18	Bypass flow goes to CVS-12.
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.72	8.8	0.27	2.4	2.4	2.4	0.0	2.4	1.0%	18	
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.70	6.2	1.96	12.1	12.3	10.6	1.7	10.6	1.2%	18	Takes bypass flow from CVS-13A. Bypass flow goes to CVS-13B.
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.76	8.5	0.31	2.6	2.6	2.2	0.4	2.2	1.0%	18	Bypass flow goes to CVS-10
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.84	6.5	1.70	11.0	15.1	15.1	0.0	38.7	0.8%	36	Takes bypass flow from CVS-7
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.72	6.6	3.31	21.7	23.6	0.0	23.6	0.7%	36		Takes bypass flow from CVS-8 and CVS-9.
CVS-12A (Inlet 3-5)	12A	1.31	10.8	0.72	6.8	0.95	6.5	9.4	9.4	0.0	137.0	1.9%	42	
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.72	7.5	0.84	6.3	8.9	0.0	8.9	3.6%	18		Takes bypass flow from CVS-13A and CVS 13C.
CVS 13A (Inlet 6-5A)	13A	1.20	8.7	0.76	7.4	0.91	6.7	6.7	0.2	0.5	6.2	1.0%	18	Bypass flow goes to CVS-13
CVS 13B (Inlet 4-6B)	13B	1.53	9.0	0.76	7.3	1.17	8.6	9.4	8.9	2.5	8.9	1.0%	18	Takes bypass flow from CVS-13. Bypass flow goes to CVS-13C
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.72	7.4	0.91	6.7	7.9	3.9	4.0	3.9	1.0%	18	Takes bypass flow from CVS 13B. Bypass flow goes to CVS-13.
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.72	6.7	1.37	9.2	10.1	10.1	0.0	54.4	3.2%	30	Takes bypass from CVS-14C
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.46	5.5	1.86	10.2	10.2	10.2	0.0	34.8	4.7%	24	
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.49	6.2	1.35	8.4	9.5	9.5	0.0	54.4	3.4%	30	
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.72	6.7	1.40	9.3	9.3	7.5	1.8	7.5	2.8%	18	Bypass flow goes to CVS-14
CVS-15 (Inlet 5-5)	15	2.01	13.4	0.72	6.2	1.45	9.0	9.1	9.1	0.0	9.1	5.0%	18	Takes bypass flow from CVS-15A
CVS-15A (Inlet 6-5B)	15A	0.66	7.9	0.74	7.7	0.71	5.4	5.4	5.3	0.1	5.3	1.0%	18	
CVS-16	16	2.58	13.1	0.72	6.3	1.87	11.7	-	-	-	-	-		
CVS-17	17	4.10	10.0	0.72	7.0	2.87	20.9	-	-	-	-	-		
CVS-18	18	3.06	12.8	0.70	6.4	2.14	13.8	-	-	-	-	-		
CVS-19	19	1.61	6.0	0.81	8.4	1.31	11.0	-	-	-	-	-		
CVS-20	20	1.80	10.4	0.72	6.9	1.30	9.0	-	-	-	-	-		
CVS-21	21	3.88	16.1	0.72	5.7	2.81	16.0	-	-	-	-	-		
BEL-1 (Inlet 2-1)	B1	3.73	12.6	0.62	6.3	2.31	14.7	14.7	8.3	6.4	63.6	3.3%	36	Bypass flow goes to BEL-3.
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.83	7.8	1.15	8.9	8.9	6.5	2.4	69.5	0.9%	36	Takes bypass flow from BEL-4.
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.56	6.0	3.76	22.6	29.0	28.0	0.0	95.6	3.2%	36	Takes bypass from BEL-1.
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.84	7.7	1.46	11.2	13.6	13.6	0.0	110.8	2.9%	36	Takes bypass from BEL-2.
BEL-5	B5	4.55	11.0	0.83	6.8	3.76	25.5	-	-	-	-	-		
BEL-6	B6	3.95	7.4	0.80	7.9	3.17	24.9	-	-	-	-	-		

NOTE: BYPASS FLOWS NOT INTERCEPTED BY ON GRADE INLETS HAVE BEEN REDUCED BY 50% AND ADDED TO THE DIRECT FLOW AT THE NEXT DOWNHILL INLET PER SECTION 6.3.2 OF THE TOWN OF PARKER STORM DRAINAGE AND ENVIRONMENTAL CRITERIA MANUAL

N

0 75 150 300

SCALE: 1"=200'

DATE	REVISIONS	DRAWN BY
11/21/2016	REVISED PER TOWN COMMENTS	RAK

Manhard CONSULTING LTD

8008 E. Arapahoe Court, Suite 110, Centennial, CO 80112 ph:303.708.0500 fx:303.708.0400 manhard.com

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COMPARK SOUTH

TOWN OF PARKER, CO

PROPOSED DRAINAGE AREA MAP

COLORADO REGISTERED BRADY R. WOLFE 30877 1-26-17 PROFESSIONAL ENGINEER

PROJ. MGR.: RLB

PROJ. ASSOC.: ASD

DRAWN BY: RAK

DATE: 6-30-16

SHEET 2 OF 3

CLCPKC3

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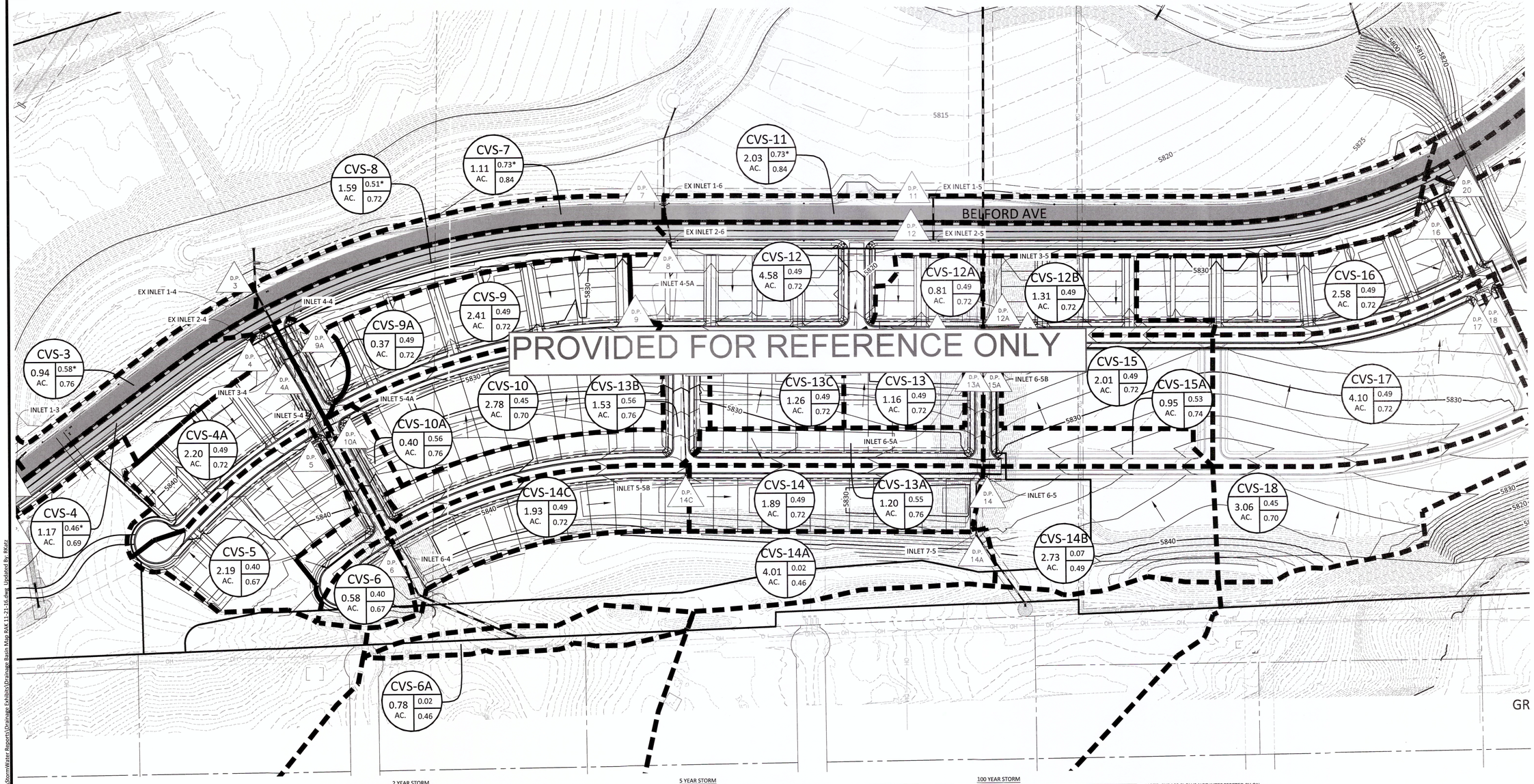
Plotted: 1/26/2017 3:28 PM Dwg Name: P:\Clepkc3\Com\South\05-Residential Preliminary Plat\Documents\Engineering\StormWater Reports\Drainage Exhibits\Drainage Basin Map RAK 11-21-16.dwg Updated By: RKatz



Plotted: 1/26/2017 3:26 PM By: RKatz Dwg Name: P:\Compark\3 ComSouth\05 Residential Preliminary\Plat\Documents\Engineering\StormWater Reports\Drainage Exhibits\Drainage Basin Map RAK 11-21-16.dwg Updated By: RKatz

2 YEAR STORM

Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	CfA (Acres)	Direct Runoff, Q (cfs)	Inlet Runoff, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (inlet 1-3)	1	3.85	6.9	0.28	4.3	1.10	**4.7**	**4.7**	4.7	0.0	8.9	3.1%	24	
CVS-2 (inlet 2-3)	2	1.42	6.6	0.69	4.3	0.97	**4.2**	**4.2**	4.2	0.0	4.2	10.0%	24	
CVS-3 (inlet 1-4)	3	0.94	6.2	0.55	4.4	0.52	**2.3**	**2.3**	2.3	0.0	2.3	1.7%	18	
CVS-4 (inlet 2-4)	4	1.17	4.1	0.44	5.0	0.51	**2.5**	**2.5**	2.5	0.0	2.5	0.9%	18	
CVS-4A (inlet 3-4)	4A	2.20	11.3	0.49	3.6	1.08	**3.9**	**3.9**	3.9	0.0	3.9	1.0%	18	
CVS-5 (inlet 5-4)	5	2.19	9.0	0.40	3.9	0.88	**3.4**	**3.4**	3.4	0.0	3.4	1.0%	18	
CVS-6 (inlet 6-4)	6	0.58	5.0	0.40	4.7	0.23	**1.1**	**1.1**	1.1	0.0	9.8	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	**0.1**	**0.1**	0.1	0.0	8.5	3.1%	36	
CVS-7 (inlet 1-6)	7	1.11	10.2	0.69	3.7	0.77	**2.9**	**2.9**	2.9	0.0	5.8	3.0%	24	
CVS-8 (inlet 2-6)	8	1.59	10.1	0.49	3.7	0.78	**2.9**	**2.9**	2.9	0.0	2.9	1.4%	24	
CVS-9 (inlet 4-5A)	9	2.41	11.9	0.49	3.5	1.18	**4.1**	**4.1**	4.1	0.0	4.1	1.2%	18	
CVS-9A (inlet 4-4)	9A	0.37	5.0	0.49	4.7	0.18	**0.9**	**0.9**	0.9	0.0	0.9	1.0%	18	
CVS-10 (inlet 5-5A)	10	2.78	13.7	0.45	3.3	1.26	**4.2**	**4.2**	4.2	0.0	4.2	1.2%	18	
CVS-10A (inlet 5-4A)	10A	0.40	5.8	0.56	4.5	0.22	**1.0**	**1.0**	1.0	0.0	1.0	1.0%	18	
CVS-11 (inlet 1-5)	11	2.03	12.3	0.73	3.4	1.47	**5.1**	**4.9**	4.9	0.0	12.8	0.8%	36	
CVS-12 (inlet 2-5)	12	4.58	11.9	0.49	3.5	2.24	**7.9**	**7.9**	7.9	0.0	7.9	0.7%	36	
CVS-12A (inlet 3-5)	12	0.81	7.7	0.49	4.1	0.40	**1.6**	**1.6**	1.6	0.0	40.0	1.9%	42	
CVS-12B (inlet 3-5)	12A	1.31	10.8	0.49	3.6	0.64	**2.3**	**2.3**	2.3	0.0	40.0	1.9%	42	
CVS-13 (inlet 6-5)	13	1.16	7.4	0.49	4.2	0.57	**2.4**	**2.4**	2.4	0.0	2.4	3.6%	18	
CVS-13A (inlet 6-5A)	13A	1.20	9.7	0.55	4.0	0.66	**2.6**	**2.6**	2.6	0.0	2.6	1.0%	18	
CVS-13B (inlet 4-5B)	13B	1.53	9.0	0.56	3.9	0.86	**3.4**	**3.4**	3.4	0.0	3.4	1.0%	18	
CVS 13C (inlet 4-5C)	13C	1.26	8.8	0.49	3.9	0.62	**2.4**	**2.4**	2.4	0.0	2.4	1.0%	18	
CVS-14 (inlet 6-5)	14	1.89	11.1	0.49	3.6	0.93	**3.3**	**3.3**	3.3	0.0	8.2	3.2%	30	
CVS-14A (inlet 7-5)	14A	4.01	17.5	0.02	2.8	0.07	**0.2**	**0.2**	0.2	0.0	4.3	4.7%	24	
CVS-14B (inlet 6-5)	14	2.73	13.4	0.07	3.3	0.19	**0.6**	**0.6**	0.6	0.0	8.6	3.4%	30	
CVS-14C (inlet 5-5B)	14C	1.93	11.4	0.49	3.6	0.94	**3.4**	**3.4**	3.4	0.0	3.4	2.8%	18	
CVS-15 (inlet 5-5)	15	2.05	13.4	0.49	3.3	1.00	**3.3**	**3.3**	3.3	0.0	3.3	5.0%	18	
CVS-15A (inlet 6-5B)	15A	0.95	7.9	0.53	4.1	0.50	**2.0**	**2.0**	2.0	0.0	2.0	1.0%	18	
CVS-16	16	2.58	13.1	0.49	3.4	1.26	**4.2**	**4.2**	-	-	-	-	-	
CVS-17	17	4.10	10.0	0.49	3.8	2.01	**7.6**	**7.6**	-	-	-	-	-	
CVS-18	18	3.06	12.8	0.45	3.4	1.35	**4.6**	**4.6**	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.65	4.5	1.05	**4.7**	**4.7**	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.49	3.7	0.88	**3.3**	**3.3**	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.49	3.1	1.90	**5.8**	**5.8**	-	-	-	-	-	
BEL-1 (inlet 2-1)	B1	3.73	12.8	0.30	3.4	1.13	**3.8**	**3.8**	3.8	0.0	5.9	3.3%	36	
BEL-2 (inlet 1-1)	B2	1.38	7.6	0.69	4.2	0.96	**3.9**	**3.9**	3.9	0.0	8.4	0.9%	36	
BEL-3 (inlet 2-2)	B3	6.76	14.4	0.19	3.2	1.28	**4.1**	**4.1**	4.1	0.0	6.6	3.2%	36	
BEL-4 (inlet 1-2)	B4	1.75	7.9	0.69	4.1	1.21	**5.0**	**5.0**	5.0	0.0	11.6	2.9%	36	
BEL-5	B5	4.55	11.0	0.68	3.6	3.08	**11.1**	**11.1**	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.63	4.2	2.50	**10.5**	**10.5**	-	-	-	-	-	

5 YEAR STORM

Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	CfA (Acres)	Direct Runoff, Q (cfs)	Inlet Runoff, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (inlet 1-3)	1	3.85	6.9	0.33	4.3	1.27	**5.5**	**5.5**	5.5	0.0	10.0	3.1%	24	
CVS-2 (inlet 2-3)	2	1.42	6.6	0.72	4.3	1.03	**4.5**	**4.5**	4.5	0.0	4.5	10.0%	24	
CVS-3 (inlet 1-4)	3	0.94	6.2	0.58	4.4	0.54	**2.4**	**2.4**	2.4	0.0	2.4	1.7%	18	
CVS-4 (inlet 2-4)	4	1.17	4.1	0.46	5.0	0.53	**2.6**	**2.6**	2.6	0.0	2.6	0.9%	18	
CVS-4A (inlet 3-4)	4A	2.20	11.3	0.51	3.6	1.13	**4.0**	**4.0**	4.0	0.0	4.0	1.0%	18	
CVS-5 (inlet 5-4)	5	2.19	9.0	0.42	3.9	0.92	**3.6**	**3.6**	3.6	0.0	3.6	1.0%	18	
CVS-6 (inlet 6-4)	6	0.58	5.0	0.42	4.7	0.24	**1.1**	**1.1**	1.1	0.0	0.6	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	**0.1**	**0.1**	0.1	0.0	8.5	3.1%	36	
CVS-7 (inlet 1-6)	7	1.11	10.2	0.73	3.7	0.81	**3.0**	**3.0**	3.0	0.0	6.0	3.0%	24	
CVS-8 (inlet 2-6)	8	1.59	10.1	0.51	3.7	0.81	**3.0**	**3.0**	3.0	0.0	3.0	1.4%	24	
CVS-9 (inlet 4-5A)	9	2.41	11.9	0.51	3.5	1.23	**4.3**	**4.3**	4.3	0.0	4.3	1.2%	18	
CVS-9A (inlet 4-4)	9A	0.37	5.0	0.51	4.7	0.19	**0.9**	**0.9**	0.9	0.0	0.9	1.0%	18	
CVS-10 (inlet 5-5A)	10	2.78	13.7	0.47	3.3	1.32	**4.3**	**4.3**	4.3	0.0	4.3	1.2%	18	
CVS-10A (inlet 5-4A)	10A	0.40	5.8	0.59	4.5	0.23	**1.1**	**1.1**	1.1	0.0	1.1	1.0%	18	
CVS-11 (inlet 1-5)	11	2.03	12.3	0.73	3.4	1.47	**5.1**	**5.1**	5.1	0.0	13.3	0.8%	36	
CVS-12 (inlet 2-5)	12	4.58	11.9	0.51	3.5	2.34	**8.2**	**8.2**	8.2	0.0	8.2	0.7%	36	
CVS-12A (inlet 3-5)	12	0.81	7.7	0.51	4.1	0.41	**1.7**	**1.7**	1.7	0.0	41.4	1.9%	42	
CVS-12B (inlet 3-5)	12A	1.31	10.8	0.51	3.6	0.67	**2.4**	**2.4**	2.4	0.0	41.4	1.9%	42	
CVS-13 (inlet 6-5)	13	1.16	7.4	0.51	4.2	0.59	**2.5**	**2.5**	2.5	0.0	2.5	3.6%	18	
CVS-13A (inlet 6-5A)	13A	1.20	9.7	0.58	4.0	0.69	**2.7**	**2.7**	2.7	0.0	2.7	1.0%	18	
CVS-13B (inlet 4-5B)	13B	1.53	9.0	0.59	3.9	0.90	**3.5**	**3.5**	3.5	0.0	3.5	1.0%	18	
CVS 13C (inlet 4-5C)	13C	1.26	8.8	0.51	3.9	0.64	**2.5**	**2.5**	2.5	0.0	2.5	1.0%	18	
CVS-14 (inlet 6-5)	14	1.89	11.1	0.51	3.6	0.97	**3.5**	**3.5**	3.5	0.0	8.5	3.2%	30	
CVS-14A (inlet 7-5)	14A	4.01	17.5	0.02	2.9	0.07	**0.2**	**0.2**	0.2	0.0	4.4	4.7%	24	
CVS-14B (inlet 6-5)	14	2.73	13.4	0.07	3.3	0.20	**0.7**	**0.7**	0.7	0.0	8.8	3.4%	30	
CVS-14C (inlet 5-5B)	14C	1.93	11.4	0.51	3.6	0.99	**3.5**	**3.5**	3.5	0.0	3.5	2.8%	18	
CVS-15 (inlet 5-5)	15	2.01	13.4	0.51	3.3	1.03	**3.4**	**3.4**	3.4	0.0	3.4	5.0%	18	
CVS-15A (inlet 6-5B)	15A	0.95	7.9	0.56	4.1	0.52	**2.1**	**2.1**	2.1	0.0	2.1	1.0%	18	
CVS-16	16	2.58	13.1	0.51	3.4	1.32	**4.4**	**4.4**	-	-	-	-	-	
CVS-17	17	4.10	10.0	0.51	3.8	2.10	**7.9**	**7.9**	-	-	-	-	-	
CVS-18	18	3.06	12.8	0.47	3.4	1.42	**4.8**	**4.8**	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.68	4.5	1.09	**4.9**	**4.9**	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.51	3.7	0.92	**3.4**	**3.4**	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.51	3.1	1.98	**6.1**	**6.1**	-	-	-	-	-	
BEL-1 (inlet 2-1)	B1	3.73	12.8	0.32	3.4	1.18	**4.0**	**4.0**	4.0	0.0	6.1	3.3%	36	
BEL-2 (inlet 1-1)	B2	1.38	7.6	0.72	4.2	0.99	**4.1**	**4.1**	4.1	0.0	8.8	0.9%	36	
BEL-3 (inlet 2-2)	B3	6.76	14.4	0.20	3.2	1.32	**4.2**	**4.2**	4.2	0.0	6.8	3.2%	36	
BEL-4 (inlet 1-2)	B4	1.75	7.9	0.73	4.1	1.27	**5.2**	**5.2**	5.2	0.0	12.1	2.9%	36	
BEL-5	B5	4.55	11.0	0.71	3.6	3.22	**11.6**	**11.6**	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.66	4.2	2.61	**10.9**	**10.9**	-	-	-	-	-	

100 YEAR STORM

Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	CfA (Acres)	Direct Runoff, Q (cfs)	Unintercepted Bypass, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	REMARKS
CVS-1 (inlet 1-3)	1	3.85	6.9	0.65	8.0	2.51	**20.2**	**20.2**	13.5	6.7	22.5	3.1%	24	Bypass flow goes to CVS-3.
CVS-2 (inlet 2-3)	2	1.42	6.6	0.85	8.1	1.21	**9.9**	**9.9**	9.0	1.0	9.0	10.0%	24	Bypass flow goes to CVS-4.
CVS-3 (inlet 1-4)	3	0.94	6.2	0.78	8.3	0.78	**6.5**	**12.4**	7.7	4.8	7.7	1.7%	18	Takes bypass flow from CVS-1. Bypass goes to CVS-7.
CVS-4 (inlet 2-4)	4	1.17	4.1	0.89	9.3	0.81	**7.5**	**8.5**	8.0	0.5	8.0	0.9%	18	Takes bypass flow from CVS-2. Bypass goes to CVS-8.
CVS-4A (inlet 3-4)	4A	2.20	11.3	0.72	6.7	1.59	**10.7**	**11.2**	11.2	0.0	11.2	1.0%	18	Takes bypass flow from CVS-8.
CVS-5 (inlet 5-4)	5	2.19	9.0	0.67	7.3	1.48	**10.8**	**10.8**	9.8	1.0	11.0	1.0%	18	Bypass flow goes to CVS-4A.
CVS-6 (inlet 6-4)	6	0.58	5.0	0.67	8.8	0.38	**3.2**	**3.5**	0.0	51.3	1.7%	36		
CVS-6A (FES 2-4)	6A	0.78	5.0	0.46	8.8	0.36	**3.2**	**3.2**	0.0	51.0	3.1%	36		
CVS-7 (inlet 1-6)	7	1.11	10.2	0.84	7.0	0.93	**6.5**	**11.4**	7.3	4.1	15.4	3.0%	24	Takes bypass flow from CVS-3. Bypass goes to CVS-11.
CVS-8 (inlet 2-6)	8	1.59	10.1	0.72	7.0	1.15	**8.1**	**8.6**	8.1	0.5	8.1	1.4%	24	Takes bypass flow from CVS-4. Bypass goes to CVS-12.
CVS-9 (inlet 4-5A)	9	2.41	11.9	0.72	6.5	1.74	**11.4**	**11.6**	10.2	1.4	10.2	1.2%	18	Bypass flow goes to CVS-12.
CVS-9A (inlet 4-4)	9A	0.37	5.0	0.72	8.8	0.27	**2.4**	**2.4**	0.0	2.4	0.0	1.0%	18	
CVS-10 (inlet 5-5A)	10	2.78	13.7	0.70	6.2	1.96	**12.1**	**12.3**	10.6	1.7	10.6	1.2%	18	Takes bypass flow from CVS-10A. Bypass flow goes to CVS-15B.
CVS-10A (inlet 5-4A)	10A	0.40	5.8	0.76	8.5	0.31	**2.6**	**2.6**	2.2	0.4	2.2	1.0%	18	Bypass flow goes to CVS-10
CVS-11 (inlet 1-5)	11	2.03	12.3	0.84	6.5	1.70	**11.0**	**15.1**	15.1	0.0	38.7	0.8%	36	
CVS-12 (inlet 2-5)	12	4.58	11.9	0.72	6.6	3.31	**21.7**	**23.6**	0.0	23.6	0.7%	36		Takes bypass flow from CVS-8 and CVS-9.
CVS-12A (inlet 3-5)	12	0.81	7.7	0.72	7.8	0.59	**4.6**	**4.5**	0.0	137.0	1.9%	42		
CVS-12B (inlet 3-5)	12A	1.31	10.8	0.72	6.8	0.90	**6.6**	**9.4**	9.4	0.0	137.0	1.9%	42	
CVS-13 (inlet 6-5)	13	1.16	7.4	0.72	7.9	0.84	**6.6**	**8.9**	0.0	8.8	3.6%	18		Takes bypass flow from CVS-13A and CVS 13C
CVS-13A (inlet 6-5A)	13A	1.20	9.7	0.77	7.4	0.91	**6.7**	**6.7**	6.2	0.5	6.2	1.0%	18	Takes bypass flow from CVS-13.
CVS-13B (inlet 4-5B)	13B	1.53	9.0	0.76	7.3	1.17	**8.5**	**9.4**	6.9	2.5	6.9	1.0%	18	Takes bypass flow from CVS-10. Bypass flow goes to CVS-13.
CVS 13C (inlet 4-5C)	13C	1.26	8.8	0.72	7.4	0.91	**6.7**	**7.9**	3.9	4.0	3.9	1.0%	18	Takes bypass flow from CVS 13B. Bypass flow goes to CVS-13.
CVS-14 (inlet 6-5)	14	1.89	11.1	0.72	6.7	1.37	**9.2**	**10.1**	10.1	0.0	54.4	3.2%	30	Takes bypass flow from CVS-14C
CVS-14A (inlet 7-5)	14A	4.01	17.5	0.48	5.5	1.86	**10.2**	**10.2**	0.0	34.8	4.7%	24		
CVS-14B (inlet 6-5)	14	2.73	13.4	0.49	6.2	1.35	**8.4**	**9.5**	9.5	0.0	54.4	3.4%	30	
CVS-14C (inlet 5-5B)	14C	1.93	11.4	0.72	6.7	1.40	**9.3**	**9.3**	7.5	1.8	7.5	2.8%	18	Takes bypass flow from CVS-14A
CVS-15 (inlet 5-5)	15	2.01	13.4	0.72	6.2	1.45	**9.0**	**9.1**	9.1	0.0	9.1	5.0%	18	Takes bypass flow from CVS-15A
CVS-15A (inlet 6-5B)	15A	0.95	7.9	0.77	7.9	0.74	**5.9**	**5.4**	5.3	0.1	5.3	1.0%	18	
CVS-16	16	2.58	13.1	0.72	6.3	1.67	**10.5**	-	-	-	-	-	-	
CVS-17	17	4.10	10.0	0.72	7.0	2.87	**20.3**	-	-	-	-	-	-	
CVS-18	18	3.06	12.8	0.70	6.4	2.14	**13.8**	-	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.81	8.4	1.35	**11.0**	-	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.72	6.9	1.30	**9.0**	-	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.72	5.7	2.81	**16.0**	-	-	-	-	-	-	
BEL-1 (inlet 2-1)	B1	3.73	12.8	0.62	6.3	2.31	**14.7**	**14.7**	8.3	6.4	63.6	3.3%	36	Bypass flow goes to BEL-3.
BEL-2 (inlet 1-1)	B2	1.38	7.6	0.83	7.9	1.10	**8.9**	**8.9**	6.5	2.4	68.5	0.9%	36	Bypass flow goes to BEL-4.
BEL-3 (inlet 2-2)	B3	6.76	14.4	0.56	6.0	3.76	**22.6**	**29.0**	0.0	95.6	3.2%	36		Takes bypass from BEL-1.
BEL-4 (inlet 1-2)	B4	1.75	7.9	0.84	7.7	1.46	**11.2**	**13.6**	0.0	110.6	2.9%	36		Takes bypass from BEL-2.
BEL-5	B5	4.55	11.0	0.83	6.8	3.76	**25.5**	-	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.80	7.9	3.17	**24.9**	-	-	-	-	-	-	

NOTE: BYPASS FLOWS NOT INTERCEPETED BY ON GRADE INLETS HAVE BEEN REDUCED BY 50% AND ADDED TO THE DIRECT FLOW AT THE NEXT DOWNHILL INLET PER SECTION 6.3.2 OF THE TOWN OF PARKER STORM DRAINAGE AND ENVIRONMENTAL CRITERIA MANUAL

LEGEND

- XX — SUB-BASIN #
- AREA (ACRES): X.XX AC. | X.XX X.XX
- 2/5-YEAR RUNOFF COEFFICIENT (*DENOTES 5-YEAR RUNOFF)
- 100-YEAR RUNOFF COEFFICIENT
- PROPOSED SUB-BASIN BOUNDARY

DATE	REVISIONS	DRAWN BY
A 11/21/2016	REVISED PER TOWN COMMENTS	RAK

Manhard CONSULTING LTD
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COMPARK SOUTH
TOWN OF PARKER, CO

PROPOSED DRAINAGE AREA MAP - FILING NO. 2

COLORADO REGISTERED
RANDY K. MOORE
30877
PROFESSIONAL ENGINEER
1-26-17

PROJ. MGR.: RLB
PROJ. ASSOC.: ASD
DRAWN BY: RAK
DATE: 6-30-16

SHEET 3 OF 3
CLCPKC3

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Compark South

TOWN OF PARKER, COLORADO
PROPOSED IMPERVIOUSNESS CALCULATIONS
6/9/2016

CVS-1

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.18	1.18
Landscape	2%	2.67	0.05
	Total Area:	3.85	

Percentage Imperviousness: **32.0%**
C_2 (Table 6-4, Type C Soil): **0.28**
C_5 (Table 6-4, Type C Soil): **0.33**
C_{100} (Table 6-4, Type C Soil): **0.65**

CVS-2

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.09	1.09
Landscape	2%	0.33	0.01
	Total Area:	1.42	

Percentage Imperviousness: **77.0%**
C_2 (Table 6-4, Type C Soil): **0.69**
C_5 (Table 6-4, Type C Soil): **0.72**
C_{100} (Table 6-4, Type C Soil): **0.85**

CVS-3

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.57	0.57
Landscape	2%	0.37	0.01
	Total Area:	0.94	

Percentage Imperviousness: **62.0%**
C_2 (Table 6-4, Type B Soil): **0.55**
C_5 (Table 6-4, Type B Soil): **0.58**
C_{100} (Table 6-4, Type B Soil): **0.76**

CVS-4

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.56	0.56
Landscape	2%	0.61	0.01
	Total Area:	1.17	

Percentage Imperviousness: **49.0%**
C_2 (Table 6-4, Type B Soil): **0.44**
C_5 (Table 6-4, Type B Soil): **0.46**
C_{100} (Table 6-4, Type B Soil): **0.69**

*Note: Impervous percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Critera Manual.

CVS-4A

Percentage Imperviousness*:	**55.0%**
C_2 (Table 6-4, Type B Soil):	**0.49**
C_5 (Table 6-4, Type B Soil):	**0.51**
C_{100} (Table 6-4, Type B Soil):	**0.72**

CVS-5

Percentage Imperviousness*:	**45.0%**
C_2 (Table 6-4, Type B Soil):	**0.40**
C_5 (Table 6-4, Type B Soil):	**0.42**
C_{100} (Table 6-4, Type B Soil):	**0.67**

CVS-6

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.28	0.28
Landscape	2%	0.37	0.01
	Total Area:	0.65	

Percentage Imperviousness:	**45.0%**
C_2 (Table 6-4, Type B Soil):	**0.40**
C_5 (Table 6-4, Type B Soil):	**0.42**
C_{100} (Table 6-4, Type B Soil):	**0.67**

CVS-6A

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.00	0.00
Landscape	2%	0.78	0.02
	Total Area:	0.78	

Percentage Imperviousness:	**2.0%**
C_2 (Table 6-4, Type B Soil):	**0.02**
C_5 (Table 6-4, Type B Soil):	**0.02**
C_{100} (Table 6-4, Type B Soil):	**0.46**

CVS-7

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.86	0.86
Landscape	2%	0.25	0.01
	Total Area:	1.11	

Percentage Imperviousness:	**78.0%**
C_2 (Table 6-4, Type B Soil):	**0.69**
C_5 (Table 6-4, Type B Soil):	**0.73**
C_{100} (Table 6-4, Type B Soil):	**0.84**

*Note: Impervous percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Critera Manual.

CVS-8

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.86	0.86
Landscape	2%	0.73	0.01
	Total Area:	1.59	

Percentage Imperviousness: **55.0%**
C_2 (Table 6-4, Type B Soil): **0.49**
C_5 (Table 6-4, Type B Soil): **0.51**
C_{100} (Table 6-4, Type B Soil): **0.72**

CVS-9

Percentage Imperviousness*: **55.0%**
C_2 (Table 6-4, Type B Soil): **0.49**
C_5 (Table 6-4, Type B Soil): **0.51**
C_{100} (Table 6-4, Type B Soil): **0.72**

CVS-9A

Percentage Imperviousness*: **55.0%**
C_2 (Table 6-4, Type B Soil): **0.49**
C_5 (Table 6-4, Type B Soil): **0.51**
C_{100} (Table 6-4, Type B Soil): **0.72**

CVS-10

Percentage Imperviousness*: **51.0%**
C_2 (Table 6-4, Type B Soil): **0.45**
C_5 (Table 6-4, Type B Soil): **0.47**
C_{100} (Table 6-4, Type B Soil): **0.70**

CVS-10A

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.25	0.25
Landscape	2%	0.15	0.00
	Total Area:	0.40	

Percentage Imperviousness: **63.0%**
C_2 (Table 6-4, Type B Soil): **0.56**
C_5 (Table 6-4, Type B Soil): **0.59**
C_{100} (Table 6-4, Type B Soil): **0.76**

CVS-11

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	2.08	2.08
Landscape	2%	1.39	0.03
	Total Area:	3.47	

Percentage Imperviousness: **78.0%**
C_2 (Table 6-4, Type B Soil): **0.69**
C_5 (Table 6-4, Type B Soil): **0.73**
C_{100} (Table 6-4, Type B Soil): **0.84**

*Note: Impervous percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Critera Manual.

CVS-12

Percentage Imperviousness*:	**55.0%**
C_2 (Table 6-4, Type B Soil):	**0.49**
C_5 (Table 6-4, Type B Soil):	**0.51**
C_{100} (Table 6-4, Type B Soil):	**0.72**

CVS-12A

Percentage Imperviousness*:	**55.0%**
C_2 (Table 6-4, Type B Soil):	**0.49**
C_5 (Table 6-4, Type B Soil):	**0.51**
C_{100} (Table 6-4, Type B Soil):	**0.72**

CVS-12B

Percentage Imperviousness*:	**55.0%**
C_2 (Table 6-4, Type B Soil):	**0.49**
C_5 (Table 6-4, Type B Soil):	**0.51**
C_{100} (Table 6-4, Type B Soil):	**0.72**

CVS-13

Percentage Imperviousness*:	**55.0%**
C_2 (Table 6-4, Type B Soil):	**0.49**
C_5 (Table 6-4, Type B Soil):	**0.51**
C_{100} (Table 6-4, Type B Soil):	**0.72**

CVS-13A

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.76	0.76
Landscape	2%	0.48	0.01
	Total Area:	1.24	

Percentage Imperviousness:	**62.0%**
C_2 (Table 6-4, Type B Soil):	**0.55**
C_5 (Table 6-4, Type B Soil):	**0.58**
C_{100} (Table 6-4, Type B Soil):	**0.76**

CVS-13B

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.79	0.79
Landscape	2%	0.48	0.01
	Total Area:	1.27	

Percentage Imperviousness:	**63.0%**
C_2 (Table 6-4, Type B Soil):	**0.56**
C_5 (Table 6-4, Type B Soil):	**0.59**
C_{100} (Table 6-4, Type B Soil):	**0.76**

*Note: Impervous percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Critera Manual.

CVS-13C

Percentage Imperviousness*:	**55.0%**
C_2 (Table 6-4, Type B Soil):	**0.49**
C_5 (Table 6-4, Type B Soil):	**0.51**
C_{100} (Table 6-4, Type B Soil):	**0.72**

CVS-14

Percentage Imperviousness:	**55.0%**
C_2 (Table 6-4, Type B Soil):	**0.49**
C_5 (Table 6-4, Type B Soil):	**0.51**
C_{100} (Table 6-4, Type B Soil):	**0.72**

CVS-14A

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.00	0.00
Landscape	2%	4.12	0.08
	Total Area:	4.12	

Percentage Imperviousness:	**2.0%**
C_2 (Table 6-4, Type B Soil):	**0.02**
C_5 (Table 6-4, Type B Soil):	**0.02**
C_{100} (Table 6-4, Type B Soil):	**0.46**

CVS-14B

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.18	0.18
Landscape	2%	2.55	0.05
	Total Area:	2.73	

Percentage Imperviousness:	**8.0%**
C_2 (Table 6-4, Type B Soil):	**0.07**
C_5 (Table 6-4, Type B Soil):	**0.07**
C_{100} (Table 6-4, Type B Soil):	**0.49**

CVS-14C

Percentage Imperviousness:	**55.0%**
C_2 (Table 6-4, Type B Soil):	**0.49**
C_5 (Table 6-4, Type B Soil):	**0.51**
C_{100} (Table 6-4, Type B Soil):	**0.72**

CVS-15

Percentage Imperviousness*:	**55.0%**
C_2 (Table 6-4, Type B Soil):	**0.49**
C_5 (Table 6-4, Type B Soil):	**0.51**
C_{100} (Table 6-4, Type B Soil):	**0.72**

*Note: Impervous percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Critera Manual.

CVS-15A

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.55	0.55
Landscape	2%	0.40	0.01
	Total Area:	0.95	

Percentage Imperviousness: **59.0%**
C_2 (Table 6-4, Type B Soil): **0.53**
C_5 (Table 6-4, Type B Soil): **0.55**
C_{100} (Table 6-4, Type B Soil): **0.74**

CVS-16

Percentage Imperviousness*: **55.0%**
C_2 (Table 6-4, Type B Soil): **0.49**
C_5 (Table 6-4, Type B Soil): **0.51**
C_{100} (Table 6-4, Type B Soil): **0.72**

CVS-17

Percentage Imperviousness*: **55.0%**
C_2 (Table 6-4, Type B Soil): **0.49**
C_5 (Table 6-4, Type B Soil): **0.51**
C_{100} (Table 6-4, Type B Soil): **0.72**

CVS-18

Percentage Imperviousness*: **50.0%**
C_2 (Table 6-4, Type B Soil): **0.45**
C_5 (Table 6-4, Type B Soil): **0.47**
C_{100} (Table 6-4, Type B Soil): **0.70**

CVS-19

Percentage Imperviousness*: **73.0%**
C_2 (Table 6-4, Type B Soil): **0.65**
C_5 (Table 6-4, Type B Soil): **0.68**
C_{100} (Table 6-4, Type B Soil): **0.81**

CVS-20

Percentage Imperviousness*: **55.0%**
C_2 (Table 6-4, Type B Soil): **0.49**
C_5 (Table 6-4, Type B Soil): **0.51**
C_{100} (Table 6-4, Type B Soil): **0.72**

CVS-21

Percentage Imperviousness*: **55.0%**
C_2 (Table 6-4, Type B Soil): **0.49**
C_5 (Table 6-4, Type B Soil): **0.51**
C_{100} (Table 6-4, Type B Soil): **0.72**

*Note: Impervous percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Critera Manual.

BEL-1

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.23	1.23
Landscape	2%	2.50	0.05
	Total Area:	3.73	

Percentage Imperviousness: **34.0%**
C_2 (Table 6-4, Type B Soil): **0.30**
C_5 (Table 6-4, Type B Soil): **0.32**
C_{100} (Table 6-4, Type B Soil): **0.62**

BEL-2

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	0.68	0.68
Landscape	2%	0.70	0.01
	Total Area:	1.38	

Percentage Imperviousness: **77.0%**
C_2 (Table 6-4, Type B Soil): **0.69**
C_5 (Table 6-4, Type B Soil): **0.72**
C_{100} (Table 6-4, Type B Soil): **0.83**

BEL-3

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.34	1.34
Landscape	2%	5.42	0.11
	Total Area:	6.76	

Percentage Imperviousness: **21.0%**
C_2 (Table 6-4, Type B Soil): **0.19**
C_5 (Table 6-4, Type B Soil): **0.20**
C_{100} (Table 6-4, Type B Soil): **0.56**

BEL-4

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	1.36	1.36
Landscape	2%	0.39	0.01
	Total Area:	1.75	

Percentage Imperviousness: **78.0%**
C_2 (Table 6-4, Type B Soil): **0.69**
C_5 (Table 6-4, Type B Soil): **0.73**
C_{100} (Table 6-4, Type B Soil): **0.84**

*Note: Impervous percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Critera Manual.

BEL-5

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	3.43	3.43
Landscape	2%	1.12	0.02
	Total Area:	4.55	

Percentage Imperviousness: **76.0%**
C_2 (Table 6-4, Type B Soil): **0.68**
C_5 (Table 6-4, Type B Soil): **0.71**
C_{100} (Table 6-4, Type B Soil): **0.83**

BEL-6

Land Use	Imperviousness (UDFCD Table 6-3)	Total Area (Acres)	Impervious Area (Acres)
Pavement/Hardscape	100%	2.77	2.77
Landscape	2%	1.18	0.02
	Total Area:	3.95	

Percentage Imperviousness: **71.0%**
C_2 (Table 6-4, Type B Soil): **0.63**
C_5 (Table 6-4, Type B Soil): **0.66**
C_{100} (Table 6-4, Type B Soil): **0.80**

*Note: Impervous percentages were determined using Figures 3-3, 3-4, 3-5 from Volume 3 of the Urban Storm Drainage Critera Manual.

PROPOSED DRAINAGE BASINS
STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

PROJECT: **COMPARK VILLAGE SOUTH, FILINGS 1 & 2** CLCPKC3

CALCULATED BY: RAK DATE: November 18, 2016 Manning's n-value =0.013 2-YEAR
REVISED BY: DATE:

DIRECT RUNOFF									INLET	STORM SEWER				REMARKS
Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	C*A (Acres)	Direct Runoff, Q (cfs)	Total Runoff, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.28	4.3	1.10	**4.7**	**4.7**	4.7	0.0	8.9	3.1%	24	
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.69	4.3	0.97	**4.2**	**4.2**	4.2	0.0	4.2	10.0%	24	
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.55	4.4	0.52	**2.3**	**2.3**	2.3	0.0	2.3	1.7%	18	
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.44	5.0	0.51	**2.5**	**2.5**	2.5	0.0	2.5	0.9%	18	
CVS-4A (Inlet 3-4)	4A	1.76	11.3	0.49	3.6	0.86	**3.1**	**3.1**	3.1	0.0	2.9	1.0%	18	
CVS-5 (Inlet 5-4)	5	2.63	9.0	0.40	3.9	1.05	**4.1**	**4.1**	4.1	0.0	4.1	1.0%	18	
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.40	4.7	0.23	**1.1**	**1.1**	1.1	0.0	9.6	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	**0.1**	**0.1**	0.1	0.0	8.5	3.1%	36	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.69	3.7	0.77	**2.9**	**2.9**	2.9	0.0	5.8	3.0%	24	
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.49	3.7	0.78	**2.9**	**2.9**	2.9	0.0	2.9	1.4%	24	
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.49	3.5	1.18	**4.1**	**4.1**	4.1	0.0	4.1	1.2%	18	
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.49	4.7	0.18	**0.9**	**0.9**	0.9	0.0	0.9	1.0%	18	
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.45	3.3	1.26	**4.2**	**4.2**	4.2	0.0	4.2	1.2%	18	
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.56	4.5	0.22	**1.0**	**1.0**	1.0	0.0	1.0	1.0%	18	
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.69	3.4	1.41	**4.9**	**4.9**	4.9	0.0	12.8	0.8%	36	
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.49	3.5	2.24	**7.9**	**7.9**	7.9	0.0	7.9	0.7%	36	
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.49	4.1	0.40	**1.6**	**1.6**	1.6	0.0	40.0	1.9%	42	
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.49	3.6	0.64	**2.3**	**2.3**	2.3	0.0	40.0	1.9%	42	
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.49	4.2	0.57	**2.4**	**2.4**	2.4	0.0	2.4	3.6%	18	
CVS 13A (Inlet 6-5A)	13A	1.20	8.7	0.55	4.0	0.66	**2.6**	**2.6**	2.6	0.0	2.6	1.0%	18	
CVS 13B (Inlet 4-5B)	13B	1.53	9.0	0.56	3.9	0.86	**3.4**	**3.4**	3.4	0.0	3.4	1.0%	18	
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.49	3.9	0.62	**2.4**	**2.4**	2.4	0.0	2.4	1.0%	18	
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.49	3.6	0.93	**3.3**	**3.3**	3.3	0.0	8.2	3.2%	30	
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.02	2.9	0.07	**0.2**	**0.2**	0.2	0.0	4.3	4.7%	24	
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.07	3.3	0.19	**0.6**	**0.6**	0.6	0.0	8.6	3.4%	30	
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.49	3.6	0.94	**3.4**	**3.4**	3.4	0.0	3.4	2.8%	18	
CVS-15 (Inlet 5-5)	15	2.05	13.4	0.49	3.3	1.00	**3.3**	**3.3**	3.3	0.0	3.3	5.0%	18	
CVS-15A (Inlet 6-5B)	15A	0.95	7.9	0.53	4.1	0.50	**2.0**	**2.0**	2.0	0.0	2.0	1.0%	18	
CVS-16	16	2.58	13.1	0.49	3.4	1.26	**4.2**	**4.2**	-	-	-	-	-	
CVS-17	17	4.10	10.0	0.49	3.8	2.01	**7.6**	**7.6**	-	-	-	-	-	
CVS-18	18	3.06	12.8	0.45	3.4	1.36	**4.6**	**4.6**	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.65	4.5	1.05	**4.7**	**4.7**	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.49	3.7	0.88	**3.3**	**3.3**	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.49	3.1	1.90	**5.8**	**5.8**	-	-	-	-	-	
BEL-1 (Inlet 2-1)	B1	3.73	12.8	0.30	3.4	1.13	**3.8**	**3.8**	3.8	0.0	5.9	3.3%	36	
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.69	4.2	0.95	**3.9**	**3.9**	3.9	0.0	8.4	0.9%	36	
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.19	3.2	1.26	**4.1**	**4.1**	4.1	0.0	6.6	3.2%	36	
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.69	4.1	1.21	**5.0**	**5.0**	5.0	0.0	11.6	2.9%	36	
BEL-5	B5	4.55	11.0	0.68	3.6	3.08	**11.1**	**11.1**	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.63	4.2	2.50	**10.5**	**10.5**	-	-	-	-	-	

PROPOSED DRAINAGE BASINS
STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

PROJECT: **COMPARK VILLAGE SOUTH, FILINGS 1 & 2** CLCPKC3

CALCULATED BY: RAK DATE: November 18, 2016 Manning's n-value =0.013 5-YEAR
REVISED BY: DATE:

		DIRECT RUNOFF							INLET		STORM SEWER			REMARKS
Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	C*A (Acres)	Direct Runoff, Q (cfs)	Total Runoff, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.33	4.3	1.27	**5.5**	**5.5**	5.5	0.0	10.0	3.1%	24	
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.72	4.3	1.03	**4.5**	**4.5**	4.5	0.0	4.5	10.0%	24	
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.58	4.4	0.54	**2.4**	**2.4**	2.4	0.0	2.4	1.7%	18	
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.46	5.0	0.53	**2.6**	**2.6**	2.6	0.0	2.6	0.9%	18	
CVS-4A (Inlet 3-4)	4A	1.76	11.3	0.51	3.6	0.90	**3.2**	**3.2**	3.2	0.0	3.1	1.0%	18	
CVS-5 (Inlet 5-4)	5	2.63	9.0	0.42	3.9	1.10	**4.3**	**4.3**	4.3	0.0	4.3	1.0%	18	
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.42	4.7	0.24	**1.1**	**1.1**	1.1	0.0	9.6	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.02	4.7	0.01	**0.1**	**0.1**	0.1	0.0	8.5	3.1%	36	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.73	3.7	0.81	**3.0**	**3.0**	3.0	0.0	6.0	3.0%	24	
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.51	3.7	0.81	**3.0**	**3.0**	3.0	0.0	3.0	1.4%	24	
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.51	3.5	1.23	**4.3**	**4.3**	4.3	0.0	4.3	1.2%	18	
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.51	4.7	0.19	**0.9**	**0.9**	0.9	0.0	0.9	1.0%	18	
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.47	3.3	1.32	**4.3**	**4.3**	4.3	0.0	4.3	1.2%	18	
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.59	4.5	0.23	**1.1**	**1.1**	1.1	0.0	1.1	1.0%	18	
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.73	3.4	1.47	**5.1**	**5.1**	5.1	0.0	13.3	0.8%	36	
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.51	3.5	2.34	**8.2**	**8.2**	8.2	0.0	8.2	0.7%	36	
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.51	4.1	0.41	**1.7**	**1.7**	1.7	0.0	41.4	1.9%	42	
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.51	3.6	0.67	**2.4**	**2.4**	2.4	0.0	41.4	1.9%	42	
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.51	4.2	0.59	**2.5**	**2.5**	2.5	0.0	2.5	3.6%	18	
CVS 13A (Inlet 6-5A)	13A	1.20	8.7	0.58	4.0	0.69	**2.7**	**2.7**	2.7	0.0	2.7	1.0%	18	
CVS 13B (Inlet 4-5B)	13B	1.53	9.0	0.59	3.9	0.90	**3.5**	**3.5**	3.5	0.0	3.5	1.0%	18	
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.51	3.9	0.64	**2.5**	**2.5**	2.5	0.0	2.5	1.0%	18	
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.51	3.6	0.97	**3.5**	**3.5**	3.5	0.0	8.5	3.2%	30	
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.02	2.9	0.07	**0.2**	**0.2**	0.2	0.0	4.3	4.7%	24	
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.07	3.3	0.20	**0.7**	**0.7**	0.7	0.0	8.8	3.4%	30	
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.51	3.6	0.99	**3.5**	**3.5**	3.5	0.0	3.5	2.8%	18	
CVS-15 (Inlet 5-5)	15	2.01	13.4	0.51	3.3	1.03	**3.4**	**3.4**	3.4	0.0	3.4	5.0%	18	
CVS-15A (Inlet 6-5B)	15A	0.95	7.9	0.55	4.1	0.52	**2.1**	**2.1**	2.1	0.0	2.1	1.0%	18	
CVS-16	16	2.58	13.1	0.51	3.4	1.32	**4.4**	**4.4**	-	-	-	-	-	
CVS-17	17	4.10	10.0	0.51	3.8	2.10	**7.9**	**7.9**	-	-	-	-	-	
CVS-18	18	3.06	12.8	0.47	3.4	1.42	**4.8**	**4.8**	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.68	4.5	1.09	**4.9**	**4.9**	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.51	3.7	0.92	**3.4**	**3.4**	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.51	3.1	1.98	**6.1**	**6.1**	-	-	-	-	-	
BEL-1 (Inlet 2-1)	B1	3.73	12.8	0.32	3.4	1.18	**4.0**	**4.0**	4.0	0.0	6.1	3.3%	36	
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.72	4.2	0.99	**4.1**	**4.1**	4.1	0.0	8.8	0.9%	36	
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.20	3.2	1.32	**4.2**	**4.2**	4.2	0.0	6.9	3.2%	36	
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.73	4.1	1.27	**5.2**	**5.2**	5.2	0.0	12.1	2.9%	36	
BEL-5	B5	4.55	11.0	0.71	3.6	3.22	**11.6**	**11.6**	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.66	4.2	2.61	**10.9**	**10.9**	-	-	-	-	-	

PROPOSED DRAINAGE BASINS
STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

PROJECT: **COMPARK VILLAGE SOUTH, FILINGS 1 & 2** CLCPKC3

CALCULATED BY: RAK DATE: November 18, 2016 Manning's n-value =0.013 100-YEAR

REVISED BY: DATE:

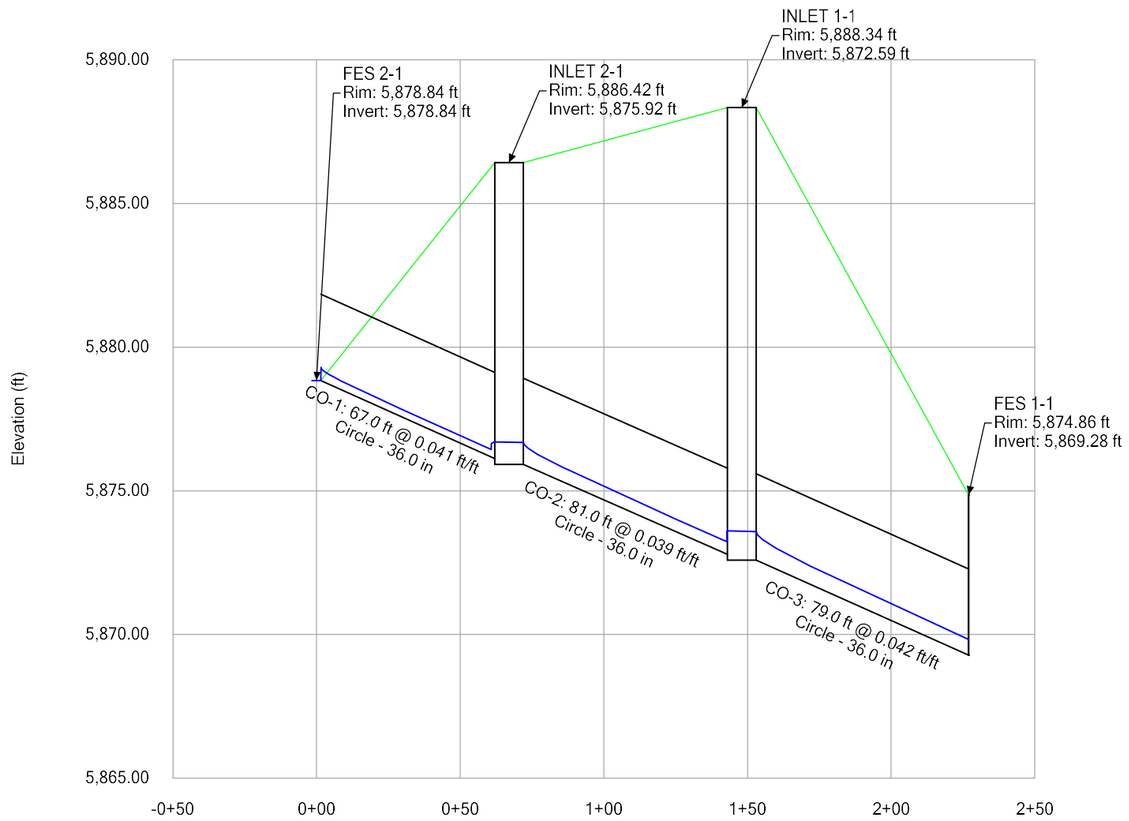
		DIRECT RUNOFF							INLET		STORM SEWER			REMARKS
Basin ID	Design Point	Area (ac)	Tc (min.)	Runoff Coefficient, C	Intensity, I (in/hr)	C*A (Acres)	Direct Runoff, Q (cfs)	Total Runoff with Bypass, Q (cfs)	Intercepted (cfs)	Bypass (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	
CVS-1 (Inlet 1-3)	1	3.85	6.9	0.65	8.0	2.51	**20.2**	**20.2**	13.5	6.7	22.5	3.1%	24	Bypass flow goes to CVS-3.
CVS-2 (Inlet 2-3)	2	1.42	6.6	0.85	8.1	1.21	**9.9**	**9.9**	9.0	1.0	9.0	10.0%	24	Bypass flow goes to CVS-4.
CVS-3 (Inlet 1-4)	3	0.94	6.2	0.76	8.3	0.71	**5.9**	**12.6**	7.7	4.9	7.7	1.7%	18	Takes bypass flow from CVS-1. Bypass goes to CVS-7.
CVS-4 (Inlet 2-4)	4	1.17	4.1	0.69	9.3	0.81	**7.5**	**8.5**	8.0	0.5	8.0	0.9%	18	Takes bypass flow from CVS-2. Bypass goes to CVS-8.
CVS-4A (Inlet 3-4)	4A	1.76	11.3	0.72	6.7	1.27	**8.5**	**9.5**	9.5	0.0	9.6	1.0%	18	Takes bypass flow from CVS-5.
CVS-5 (Inlet 5-4)	5	2.63	9.0	0.67	7.3	1.77	**13.0**	**13.0**	11.0	2.0	11.0	1.0%	18	Bypass flow goes to CVS-4A.
CVS-6 (Inlet 6-4)	6	0.58	5.0	0.67	8.8	0.39	**3.5**	**3.5**	3.5	0.0	51.3	1.7%	36	
CVS-6A (FES 2-4)	6A	0.78	5.0	0.46	8.8	0.36	**3.2**	**3.2**	3.2	0.0	51.0	3.1%	36	
CVS-7 (Inlet 1-6)	7	1.11	10.2	0.84	7.0	0.93	**6.5**	**11.4**	7.3	4.1	15.4	3.0%	24	Takes bypass flow from CVS-3. Bypass goes to CVS-11.
CVS-8 (Inlet 2-6)	8	1.59	10.1	0.72	7.0	1.15	**8.1**	**8.6**	8.1	0.5	8.1	1.4%	24	Takes bypass flow from CVS-4. Bypass goes to CVS-12.
CVS-9 (Inlet 4-5A)	9	2.41	11.9	0.72	6.5	1.74	**11.4**	**11.6**	10.2	1.4	10.2	1.2%	18	Bypass flow goes to CVS-12.
CVS-9A (Inlet 4-4)	9A	0.37	5.0	0.72	8.8	0.27	**2.4**	**2.4**	2.4	0.0	2.4	1.0%	18	
CVS-10 (Inlet 5-5A)	10	2.78	13.7	0.70	6.2	1.96	**12.1**	**12.3**	10.6	1.7	10.6	1.2%	18	Takes bypass flow from CVS-10A. Bypass flow goes to CVS-13B.
CVS-10A (Inlet 5-4A)	10A	0.40	5.8	0.76	8.5	0.31	**2.6**	**2.6**	2.2	0.4	2.2	1.0%	18	Bypass flow goes to CVS-10
CVS-11 (Inlet 1-5)	11	2.03	12.3	0.84	6.5	1.70	**11.0**	**15.1**	15.1	0.0	38.7	0.8%	36	Takes bypass flow from CVS-7.
CVS-12 (Inlet 2-5)	12	4.58	11.9	0.72	6.6	3.31	**21.7**	**23.6**	23.6	0.0	23.6	0.7%	36	Takes bypass flow from CVS-8 and CVS-9.
CVS-12A (Inlet 3-5)	12	0.81	7.7	0.72	7.8	0.59	**4.5**	**4.5**	4.5	0.0	137.0	1.9%	42	
CVS-12B (Inlet 3-5)	12A	1.31	10.8	0.72	6.8	0.95	**6.5**	**9.4**	9.4	0.0	137.0	1.9%	42	
CVS-13 (Inlet 4-5)	13	1.16	7.4	0.72	7.9	0.84	**6.6**	**8.9**	8.9	0.0	8.9	3.6%	18	Takes bypass flow from CVS-13A and CVS 13C.
CVS 13A (Inlet 6-5A)	13A	1.20	8.7	0.76	7.4	0.91	**6.7**	**6.7**	6.2	0.5	6.2	1.0%	18	Bypass flow goes to CVS-13
CVS 13B (Inlet 4-5B)	13B	1.53	9.0	0.76	7.3	1.17	**8.5**	**9.4**	6.9	2.5	6.9	1.0%	18	Takes bypass flow from CVS-10. Bypass flow goes to CVS-13C.
CVS 13C (Inlet 4-5C)	13C	1.26	8.8	0.72	7.4	0.91	**6.7**	**7.9**	3.9	4.0	3.9	1.0%	18	Takes bypass flow from CVS 13B. Bypass flwo goes to CVS-13
CVS-14 (Inlet 6-5)	14	1.89	11.1	0.72	6.7	1.37	**9.2**	**10.1**	10.1	0.0	54.4	3.2%	30	Takes bypass from CVS-14C
CVS-14A (Inlet 7-5)	14A	4.01	17.5	0.46	5.5	1.86	**10.2**	**10.2**	10.2	0.0	34.8	4.7%	24	
CVS-14B (Inlet 6-5)	14	2.73	13.4	0.49	6.2	1.35	**8.4**	**9.5**	9.5	0.0	54.4	3.4%	30	
CVS-14C (Inlet 5-5B)	14C	1.93	11.4	0.72	6.7	1.40	**9.3**	**9.3**	7.5	1.8	7.5	2.8%	18	Bypass flow goes to CVS-14
CVS-15 (Inlet 5-5)	15	2.01	13.4	0.72	6.2	1.45	**9.0**	**9.1**	9.1	0.0	9.1	5.0%	18	Takes bypass flow from CVS-15A
CVS-15A (Inlet 6-5B)	15A	0.95	7.9	0.74	7.7	0.71	**5.4**	**5.4**	5.3	0.1	5.3	1.0%	18	
CVS-16	16	2.58	13.1	0.72	6.3	1.87	**11.7**	**-**	-	-	-	-	-	
CVS-17	17	4.10	10.0	0.72	7.0	2.97	**20.9**	**-**	-	-	-	-	-	
CVS-18	18	3.06	12.8	0.70	6.4	2.14	**13.6**	**-**	-	-	-	-	-	
CVS-19	19	1.61	6.0	0.81	8.4	1.31	**11.0**	**-**	-	-	-	-	-	
CVS-20	20	1.80	10.4	0.72	6.9	1.30	**9.0**	**-**	-	-	-	-	-	
CVS-21	21	3.88	16.1	0.72	5.7	2.81	**16.0**	**-**	-	-	-	-	-	
BEL-1 (Inlet 2-1)	B1	3.73	12.8	0.62	6.3	2.31	**14.7**	**14.7**	8.3	6.4	63.6	3.3%	36	Bypass flow goes to BEL-3.
BEL-2 (Inlet 1-1)	B2	1.38	7.6	0.83	7.8	1.15	**8.9**	**8.9**	6.5	2.4	69.5	0.9%	36	Bypass flow goes to BEL-4.
BEL-3 (Inlet 2-2)	B3	6.76	14.4	0.56	6.0	3.76	**22.6**	**29.0**	29.0	0.0	95.6	3.2%	36	Takes bypass from BEL-1.
BEL-4 (Inlet 1-2)	B4	1.75	7.9	0.84	7.7	1.46	**11.2**	**13.6**	13.6	0.0	110.8	2.9%	36	Takes bypass from BEL-2.
BEL-5	B5	4.55	11.0	0.83	6.8	3.76	**25.5**	**-**	-	-	-	-	-	
BEL-6	B6	3.95	7.4	0.80	7.9	3.17	**24.9**	**-**	-	-	-	-	-	

FlexTable: Conduit Table

Start Node	Stop Node	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	System Fixed Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)
STMH 6-4	INLET 6-4	120.0	0.020	36.0	8.50	8.25	5,835.83	5,833.14	5,836.16	5,834.20
INLET 6-4	STMH 5-4	278.0	0.017	36.0	9.60	8.03	5,833.31	5,828.39	5,833.67	5,829.39
FES 2-5	INLET 8-5	7.7	0.070	24.0	4.10	10.91	5,835.25	5,834.45	5,835.51	5,835.38
INLET 5-4	STMH 5-4	52.0	0.010	18.0	3.40	5.28	5,830.05	5,829.42	5,830.32	5,829.85
INLET 3-4	STMH 4-4	20.0	0.010	18.0	3.90	5.40	5,826.18	5,825.89	5,826.47	5,826.31
INLET 1-4	STMH 2-4	65.0	0.017	18.0	2.30	5.79	5,823.61	5,822.33	5,823.83	5,822.85
INLET 4-4	STMH 4-4	20.0	0.010	18.0	0.90	3.57	5,825.77	5,825.53	5,825.90	5,825.73
INLET 2-6	INLET 1-6	80.0	0.014	24.0	2.90	5.56	5,813.62	5,812.63	5,813.84	5,812.76
INLET 2-5	INLET 1-5	90.0	0.007	36.0	7.90	5.50	5,808.98	5,808.73	5,809.30	5,808.86
INLET 1-5	STMH 1-5	103.0	0.008	36.0	12.80	6.59	5,808.60	5,808.70	5,808.89	5,808.78
STMH 1-5	FES 1-5	446.0	0.029	42.0	53.81	15.71	5,808.11	5,794.35	5,809.11	5,798.18
INLET 2-3	INLET 1-3	94.0	0.101	24.0	4.20	12.50	5,841.28	5,831.37	5,841.54	5,833.80
FES 2-4	STMH 6-4	221.0	0.031	36.0	8.50	9.68	5,842.92	5,835.66	5,843.25	5,837.11
STMH 5-4	STMH 4-4	163.0	0.027	36.0	14.00	10.69	5,828.60	5,823.68	5,829.05	5,825.46
INLET 4-5	STMH 2-5A	19.0	0.036	18.0	2.40	7.64	5,813.55	5,813.63	5,813.76	5,813.66
INLET 5-5	STMH 2-5	49.0	0.050	18.0	3.30	9.35	5,814.59	5,813.40	5,814.86	5,813.45
STMH 4-4	STMH 3-4	79.0	0.008	36.0	18.80	7.34	5,823.55	5,822.99	5,824.08	5,823.49
STMH 3-4	STMH 2-4	76.0	0.011	36.0	21.30	8.59	5,822.94	5,822.16	5,823.52	5,822.71
INLET 2-4	STMH 3-4	56.0	0.009	18.0	2.50	4.71	5,822.96	5,822.97	5,823.04	5,823.00
INLET 1-6	STMH 1-6	133.0	0.010	24.0	5.80	6.09	5,812.57	5,811.04	5,812.89	5,811.61
STMH 1-6	FES1-6	50.0	0.005	24.0	5.80	4.68	5,811.10	5,810.83	5,811.42	5,811.17
INLET 8-5	INLET 7-5	173.0	0.035	24.0	4.10	8.52	5,834.22	5,827.91	5,834.48	5,829.04
INLET 4-5A	STMH 2-5E	20.0	0.012	18.0	4.10	5.96	5,821.92	5,821.91	5,822.22	5,822.07
INLET 5-5A	STMH 2-5E	20.0	0.012	18.0	4.20	6.00	5,821.93	5,821.91	5,822.24	5,822.08
STMH 2-5	INLET 3-5	16.0	0.024	42.0	36.10	13.13	5,813.23	5,812.92	5,813.98	5,813.60
INLET 3-5	STMH 1-5	266.0	0.018	42.0	40.00	12.31	5,812.86	5,808.20	5,813.66	5,808.82
INLET 7-5	STMH 4-5	104.6	0.047	24.0	4.30	9.57	5,827.87	5,823.07	5,828.14	5,823.28
STMH 4-5	INLET 6-5	23.0	0.036	24.0	4.30	8.75	5,823.00	5,822.20	5,823.27	5,822.44
STMH 2-5A	STMH 2-5	50.0	0.014	36.0	20.00	9.32	5,813.60	5,813.41	5,814.16	5,813.67
STMH 2-5B	STMH 2-5A	241.0	0.014	30.0	17.60	9.06	5,816.93	5,813.65	5,817.51	5,814.18
STMH 2-4	STMH 1-4	60.0	0.026	36.0	23.60	12.21	5,821.98	5,819.88	5,822.60	5,821.76
STMH 1-4	FES 1-4	33.0	0.026	36.0	23.60	12.15	5,820.42	5,820.00	5,821.04	5,820.35
INLET 1-3	STMH 1-3	18.4	0.031	24.0	8.90	10.21	5,831.00	5,830.87	5,831.43	5,831.06
STMH 1-3	O-1	12.0	0.031	24.0	8.90	10.19	5,830.85	5,830.90	5,831.05	5,831.03
INLET 5-4A	STMH 5-4	43.0	0.010	18.0	1.00	3.75	5,829.63	5,829.14	5,829.77	5,829.36
STMH 2-5E	STMH 2-5D	44.0	0.015	24.0	8.30	7.79	5,821.83	5,821.42	5,822.23	5,821.65
STMH 2-5D	STMH 2-5C	45.0	0.014	24.0	11.80	8.25	5,821.35	5,820.86	5,821.88	5,821.27
STMH 2-5C	STMH 2-5B	289.0	0.014	30.0	15.20	8.69	5,820.81	5,816.97	5,821.33	5,817.38
INLET 4-5B	STMH 2-5C	18.0	0.010	18.0	3.40	5.30	5,820.85	5,820.85	5,820.94	5,820.92
INLET 5-5B	STMH 2-5D	293.0	0.028	18.0	3.50	7.71	5,829.01	5,821.43	5,829.29	5,821.51
INLET 4-5C	STMH 2-5B	18.0	0.010	18.0	2.40	4.82	5,816.96	5,816.96	5,817.00	5,816.99
INLET 6-5	STMH 3-5A	247.0	0.034	30.0	8.20	10.12	5,822.09	5,813.92	5,822.45	5,814.09
STMH 3-5A	STMH 2-5	48.0	0.027	30.0	12.80	10.58	5,813.87	5,813.31	5,814.34	5,813.46
INLET 6-5A	STMH 3-5A	19.0	0.010	18.0	2.60	4.93	5,813.90	5,813.91	5,813.97	5,813.95
INLET 6-5B	STMH 3-5A	19.0	0.010	18.0	2.00	4.58	5,813.90	5,813.90	5,813.93	5,813.93

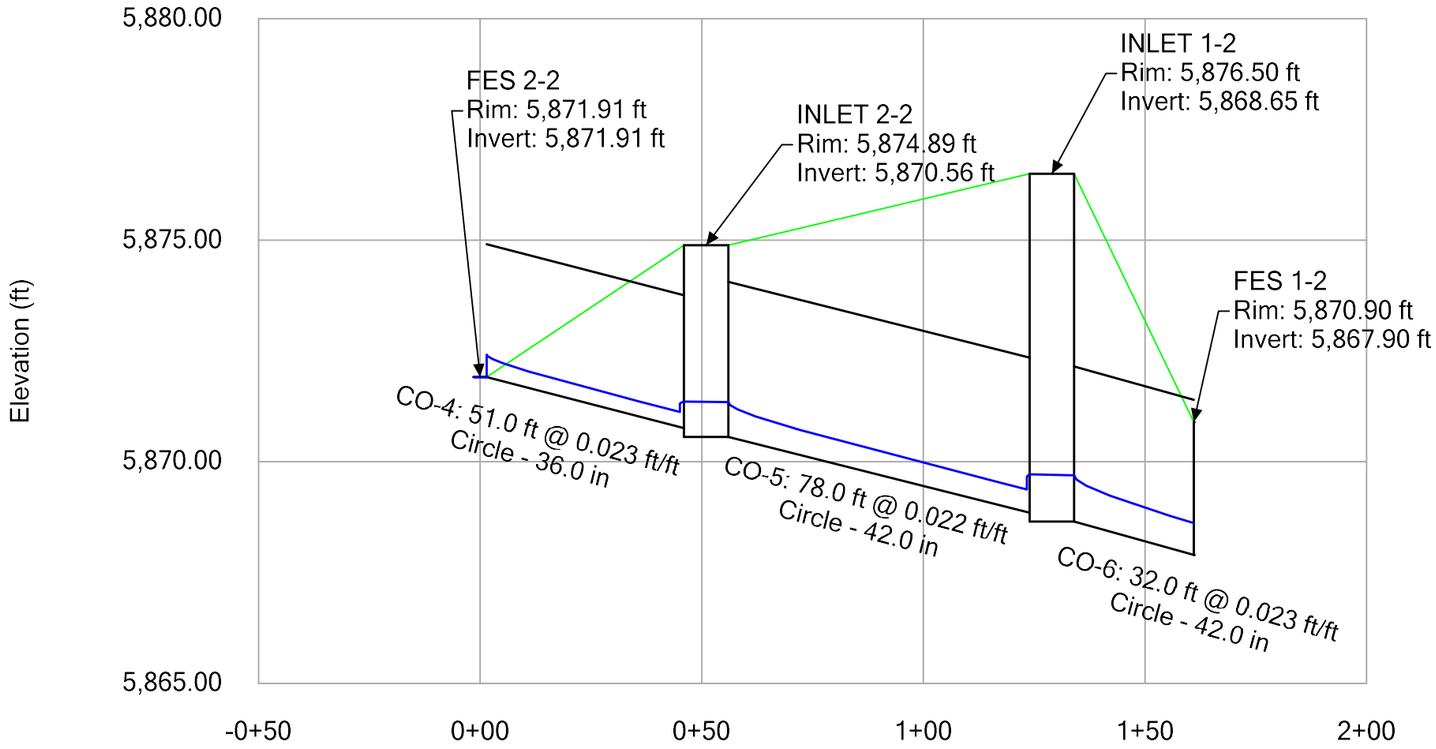
Profile Report

Engineering Profile - Profile - Storm Line 1 (Belford Ave StormCAD [2 year].stsw)



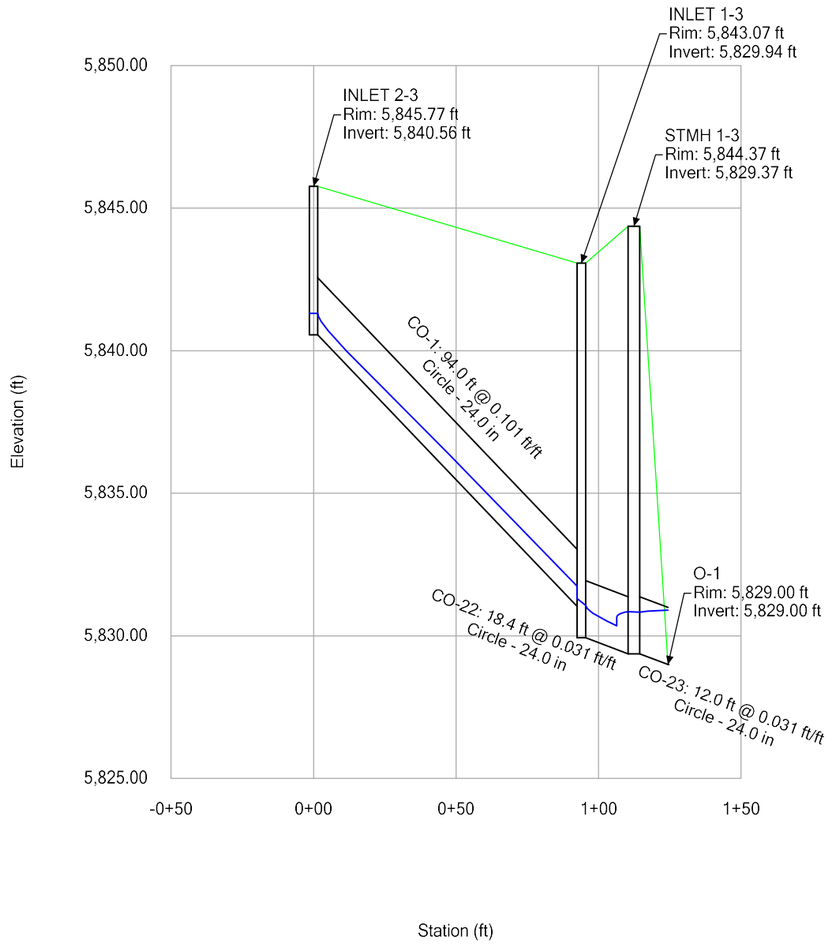
Profile Report

Engineering Profile - Profile - Storm Line 2 (Belford Ave StormCAD [2 year].stsw)

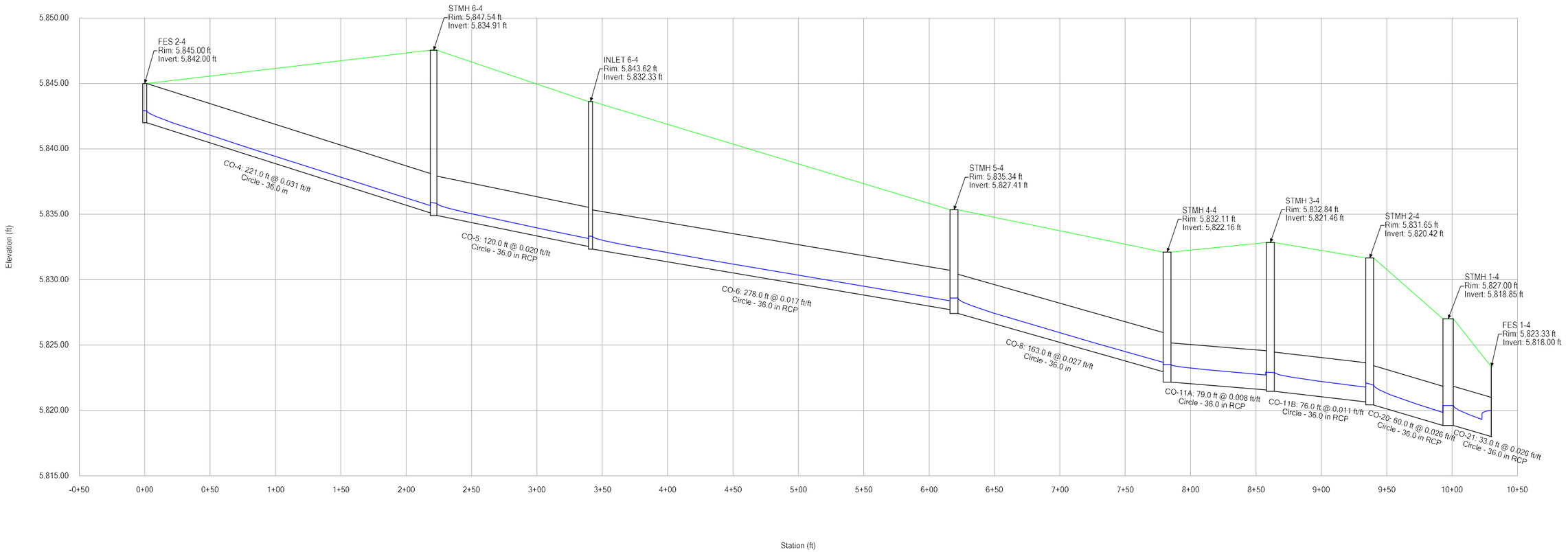


Profile Report

Engineering Profile - Profile - Storm Line 3 (Compark Village South StormCAD [2 year].stsw)

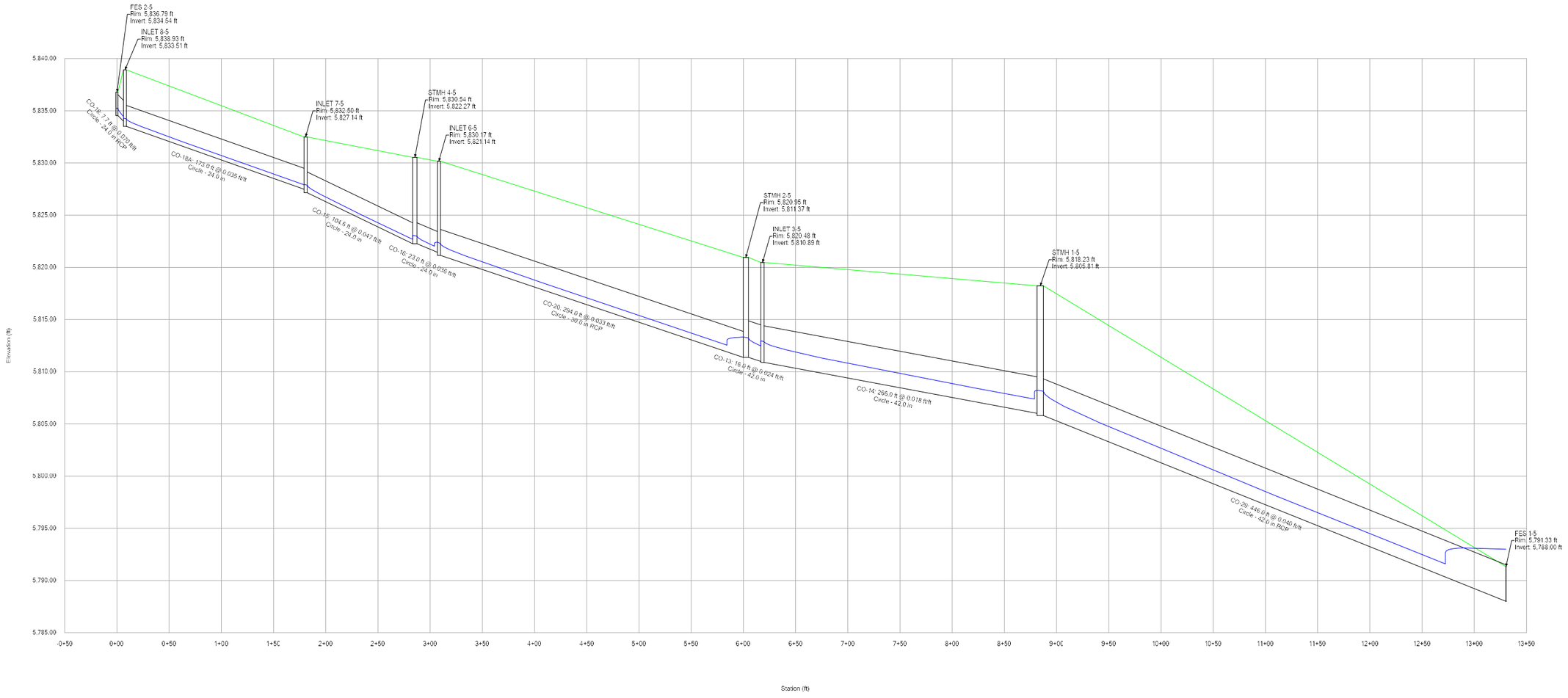


Profile Report
Engineering Profile - Profile - Storm Line 4 (Compark Village South StormCAD [2 year].stsw)



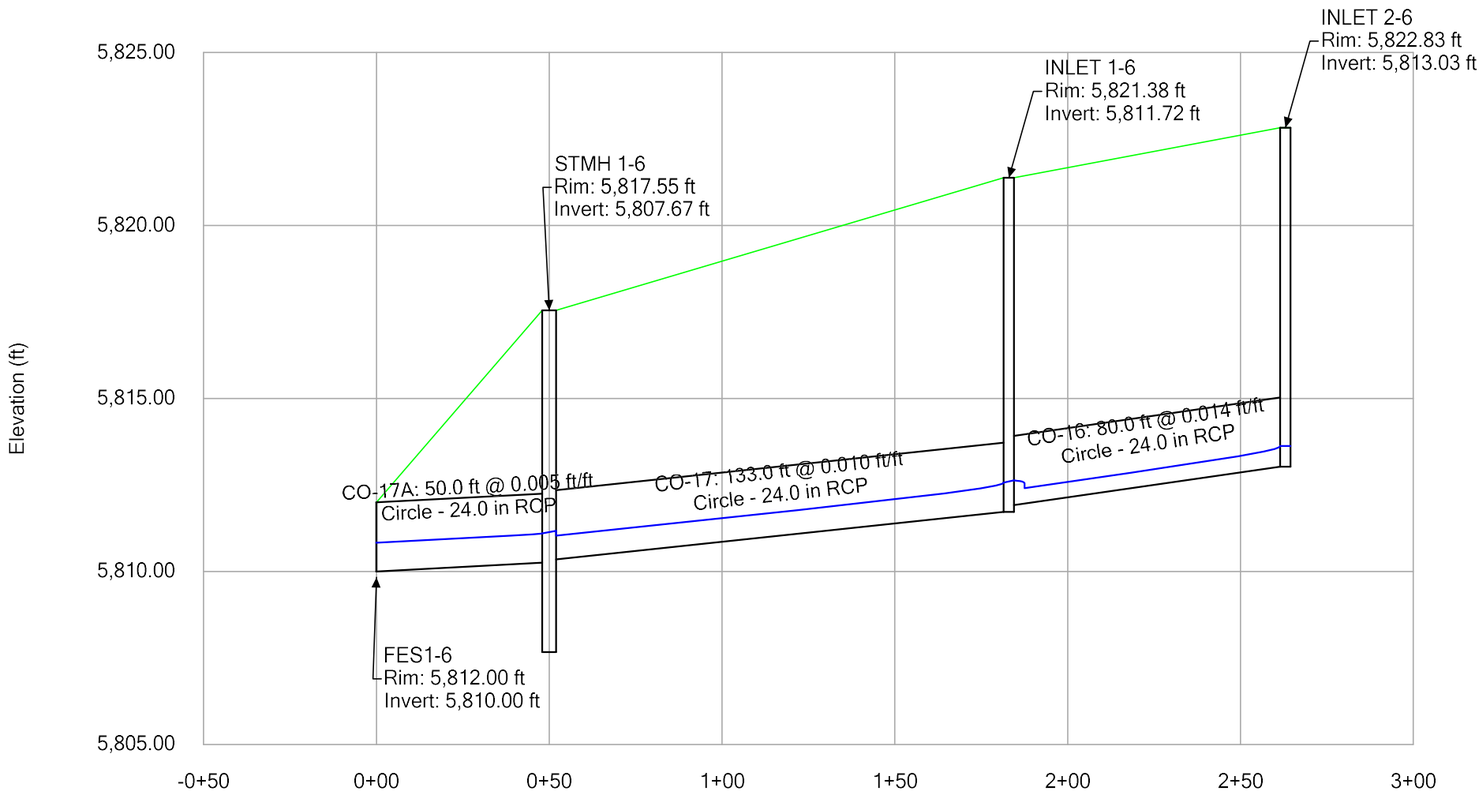
Profile Report

Engineering Profile - Profile - Storm Line 5 (Compark Village South StormCAD [2 year].stsw)



Profile Report

Engineering Profile - Profile - Storm Line 6 (Compark Village South StormCAD [2 year].stsw)

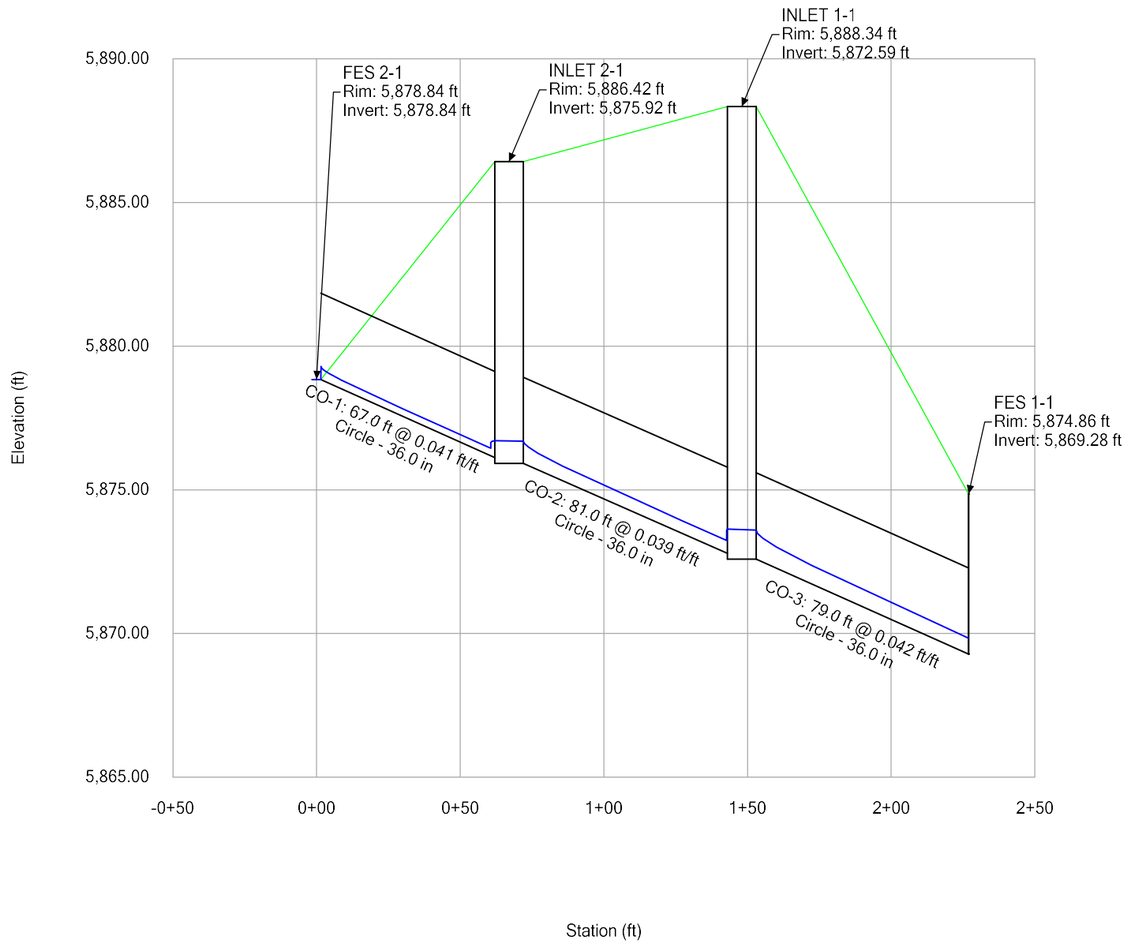


FlexTable: Conduit Table

Start Node	Stop Node	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	System Fixed Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)
STMH 6-4	INLET 6-4	120.0	0.020	36.0	8.50	8.25	5,835.83	5,833.14	5,836.16	5,834.20
INLET 6-4	STMH 5-4	278.0	0.017	36.0	9.60	8.03	5,833.31	5,828.39	5,833.67	5,829.39
FES 2-5	INLET 8-5	7.7	0.070	24.0	4.10	10.91	5,835.25	5,834.45	5,835.51	5,835.38
INLET 5-4	STMH 5-4	52.0	0.010	18.0	3.60	5.37	5,830.07	5,829.44	5,830.35	5,829.88
INLET 3-4	STMH 4-4	20.0	0.010	18.0	4.00	5.44	5,826.19	5,825.89	5,826.49	5,826.33
INLET 1-4	STMH 2-4	65.0	0.017	18.0	2.40	5.86	5,823.63	5,822.34	5,823.84	5,822.88
INLET 4-4	STMH 4-4	20.0	0.010	18.0	0.90	3.57	5,825.77	5,825.53	5,825.90	5,825.73
INLET 2-6	INLET 1-6	80.0	0.014	24.0	3.00	5.61	5,813.63	5,812.65	5,813.85	5,812.78
INLET 2-5	INLET 1-5	90.0	0.007	36.0	8.20	5.56	5,809.00	5,808.81	5,809.32	5,808.93
INLET 1-5	STMH 1-5	103.0	0.008	36.0	13.30	6.66	5,808.68	5,808.76	5,808.95	5,808.85
STMH 1-5	FES 1-5	446.0	0.029	42.0	55.71	15.85	5,808.15	5,794.38	5,809.18	5,798.28
INLET 2-3	INLET 1-3	94.0	0.101	24.0	4.50	12.77	5,841.31	5,831.38	5,841.58	5,833.91
FES 2-4	STMH 6-4	221.0	0.031	36.0	8.50	9.68	5,842.92	5,835.66	5,843.25	5,837.11
STMH 5-4	STMH 4-4	163.0	0.027	36.0	14.30	10.75	5,828.61	5,823.69	5,829.07	5,825.49
INLET 4-5	STMH 2-5A	19.0	0.036	18.0	2.50	7.73	5,813.56	5,813.65	5,813.78	5,813.69
INLET 5-5	STMH 2-5	49.0	0.050	18.0	3.40	9.43	5,814.60	5,813.44	5,814.87	5,813.50
STMH 4-4	STMH 3-4	79.0	0.008	36.0	19.20	7.38	5,823.56	5,823.01	5,824.11	5,823.51
STMH 3-4	STMH 2-4	76.0	0.011	36.0	21.80	8.64	5,822.96	5,822.19	5,823.55	5,822.74
INLET 2-4	STMH 3-4	56.0	0.009	18.0	2.60	4.76	5,822.98	5,822.99	5,823.07	5,823.02
INLET 1-6	STMH 1-6	133.0	0.010	24.0	6.00	6.15	5,812.59	5,811.05	5,812.92	5,811.64
STMH 1-6	FES1-6	50.0	0.005	24.0	6.00	4.73	5,811.12	5,810.85	5,811.45	5,811.20
INLET 8-5	INLET 7-5	173.0	0.035	24.0	4.10	8.52	5,834.22	5,827.91	5,834.48	5,829.04
INLET 4-5A	STMH 2-5E	20.0	0.012	18.0	4.30	6.04	5,821.94	5,821.93	5,822.25	5,822.10
INLET 5-5A	STMH 2-5E	20.0	0.012	18.0	4.30	6.04	5,821.94	5,821.93	5,822.25	5,822.10
STMH 2-5	INLET 3-5	16.0	0.024	42.0	37.30	13.25	5,813.27	5,812.96	5,814.03	5,813.65
INLET 3-5	STMH 1-5	266.0	0.018	42.0	41.40	12.42	5,812.89	5,808.25	5,813.71	5,808.88
INLET 7-5	STMH 4-5	104.6	0.047	24.0	4.30	9.57	5,827.87	5,823.07	5,828.14	5,823.28
STMH 4-5	INLET 6-5	23.0	0.036	24.0	4.30	8.75	5,823.00	5,822.22	5,823.27	5,822.44
STMH 2-5A	STMH 2-5	50.0	0.014	36.0	20.60	9.39	5,813.63	5,813.44	5,814.20	5,813.71
STMH 2-5B	STMH 2-5A	241.0	0.014	30.0	18.10	9.13	5,816.95	5,813.67	5,817.54	5,814.21
STMH 2-4	STMH 1-4	60.0	0.026	36.0	24.20	12.30	5,822.00	5,819.89	5,822.63	5,821.80
STMH 1-4	FES 1-4	33.0	0.026	36.0	24.20	12.24	5,820.44	5,820.00	5,821.07	5,820.36
INLET 1-3	STMH 1-3	18.4	0.031	24.0	10.00	10.55	5,831.07	5,830.85	5,831.53	5,831.10
STMH 1-3	O-1	12.0	0.031	24.0	10.00	10.53	5,830.83	5,830.90	5,831.09	5,831.06
INLET 5-4A	STMH 5-4	43.0	0.010	18.0	1.10	3.85	5,829.65	5,829.16	5,829.79	5,829.39
STMH 2-5E	STMH 2-5D	44.0	0.015	24.0	8.60	7.86	5,821.85	5,821.44	5,822.26	5,821.68
STMH 2-5D	STMH 2-5C	45.0	0.014	24.0	12.10	8.31	5,821.37	5,820.88	5,821.90	5,821.30
STMH 2-5C	STMH 2-5B	289.0	0.014	30.0	15.60	8.75	5,820.82	5,816.99	5,821.36	5,817.40
INLET 4-5B	STMH 2-5C	18.0	0.010	18.0	3.50	5.35	5,820.87	5,820.87	5,820.96	5,820.94
INLET 5-5B	STMH 2-5D	293.0	0.028	18.0	3.50	7.71	5,829.01	5,821.44	5,829.29	5,821.52
INLET 4-5C	STMH 2-5B	18.0	0.010	18.0	2.50	4.88	5,816.99	5,816.98	5,817.03	5,817.02
INLET 6-5	STMH 3-5A	247.0	0.034	30.0	8.50	10.23	5,822.11	5,813.94	5,822.47	5,814.12
STMH 3-5A	STMH 2-5	48.0	0.027	30.0	13.30	10.69	5,813.90	5,813.34	5,814.38	5,813.50
INLET 6-5A	STMH 3-5A	19.0	0.010	18.0	2.70	4.98	5,813.93	5,813.93	5,813.99	5,813.98
INLET 6-5B	STMH 3-5A	19.0	0.010	18.0	2.10	4.64	5,813.92	5,813.93	5,813.96	5,813.95

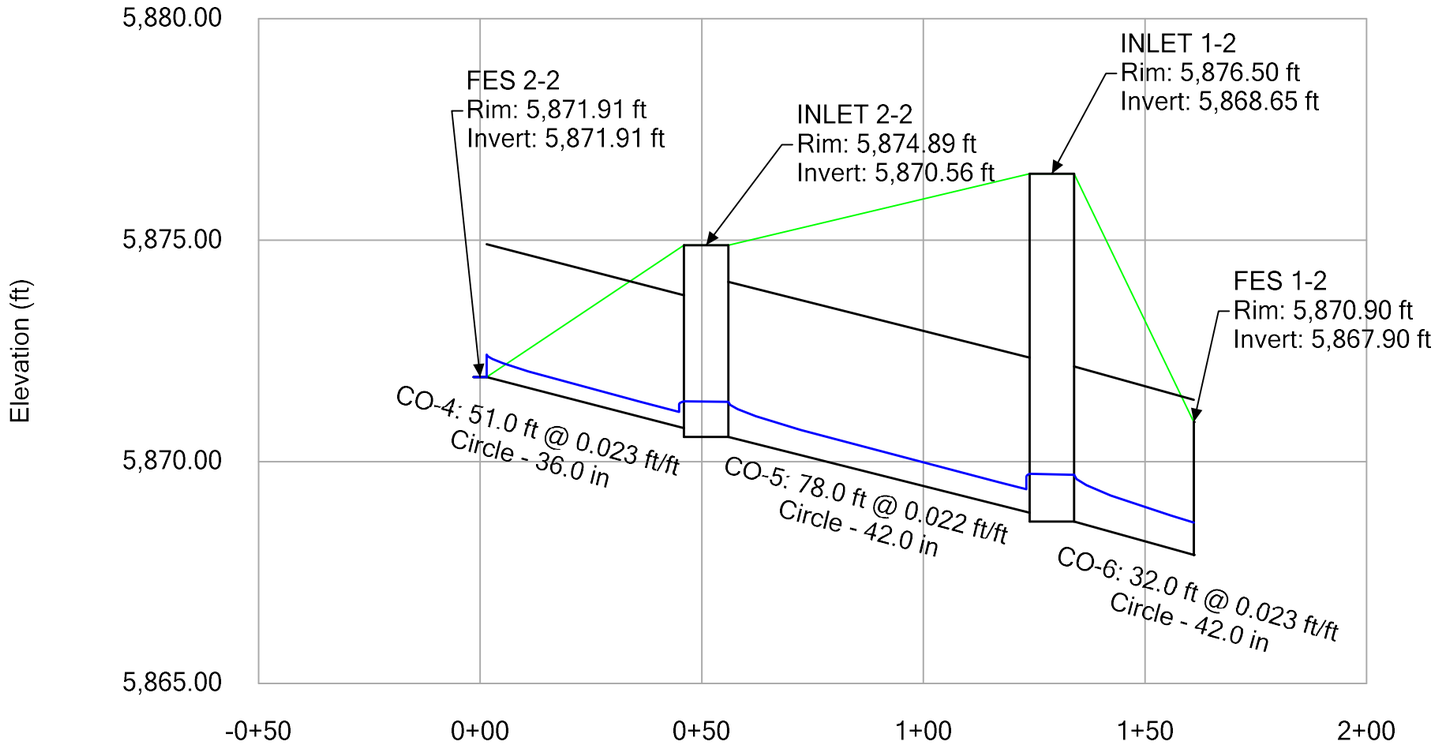
Profile Report

Engineering Profile - Profile - Storm Line 1 (Belford Ave StormCAD [5 year].stsw)

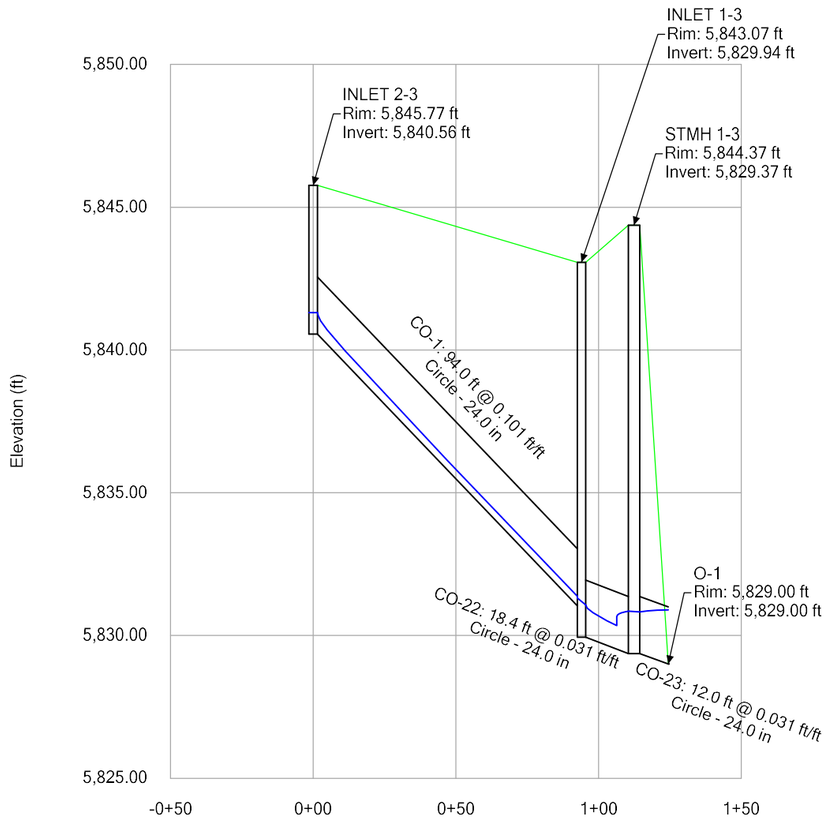


Profile Report

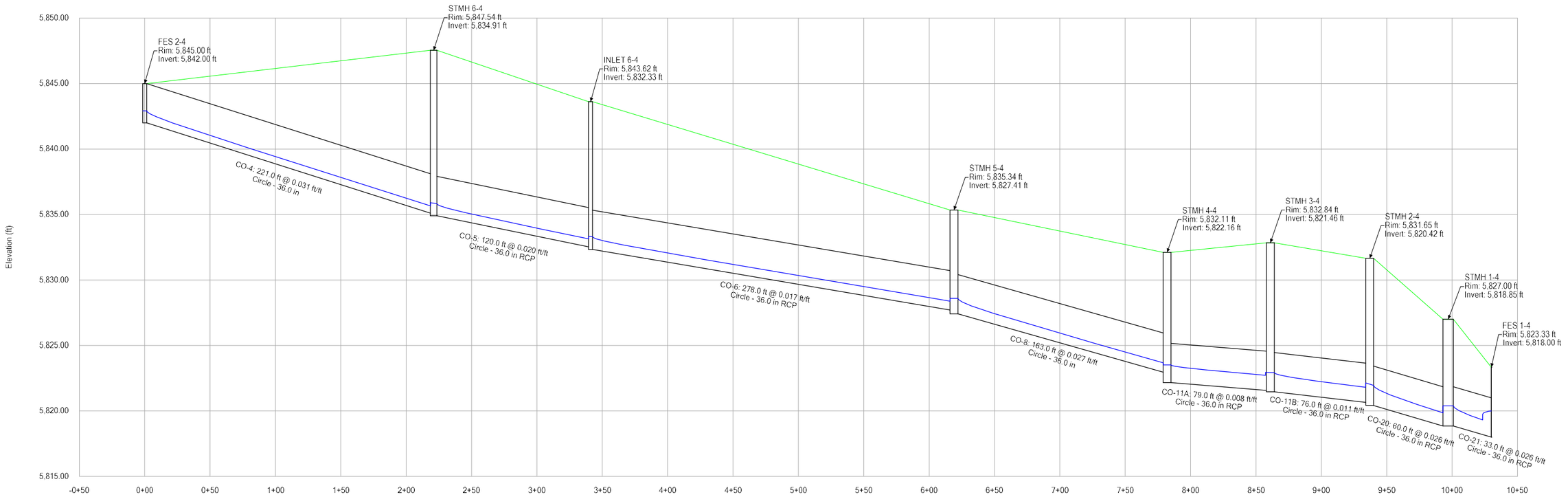
Engineering Profile - Profile - Storm Line 2 (Belford Ave StormCAD [5 year].stsw)



Profile Report
Engineering Profile - Profile - Storm Line 3 (Compark Village South StormCAD [5 year].stsw)

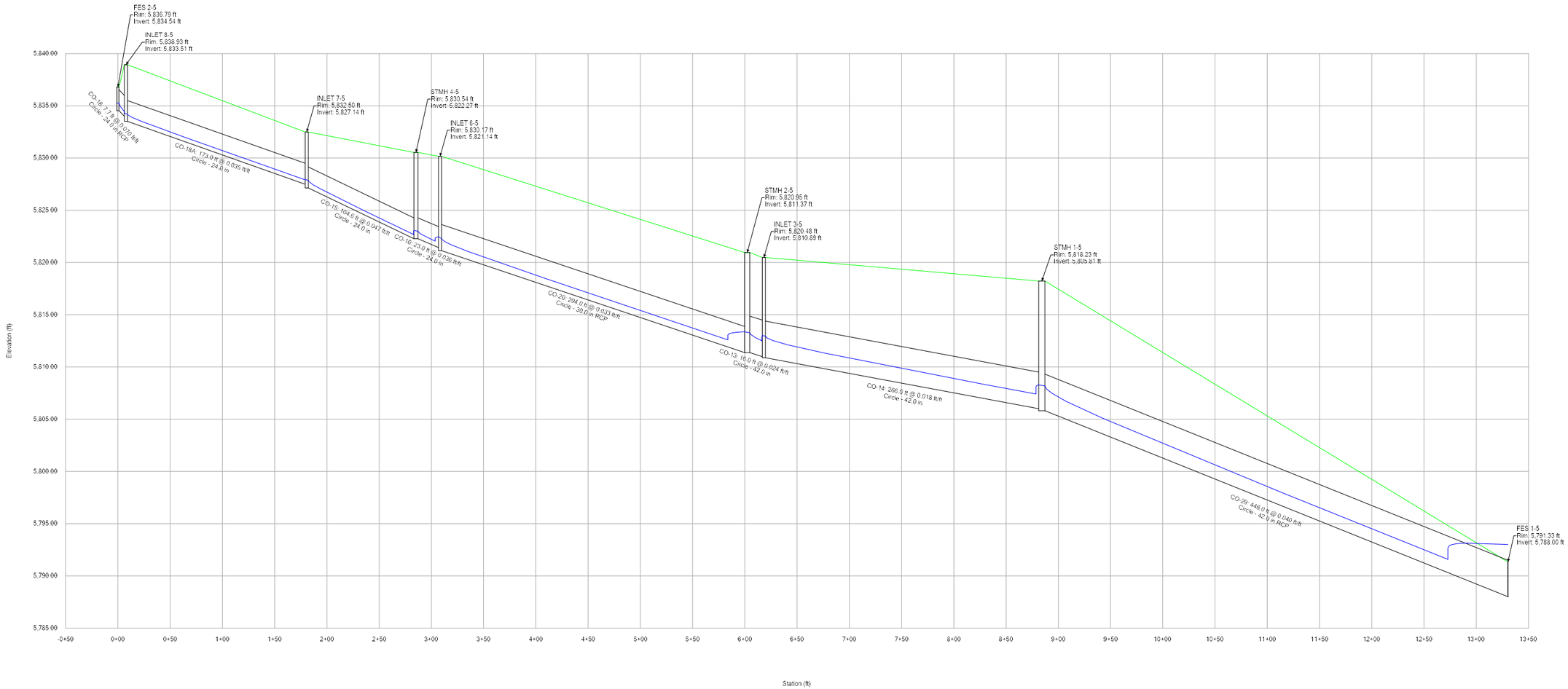


Profile Report
Engineering Profile - Profile - Storm Line 4 (Compark Village South StormCAD [5 year].stsw)



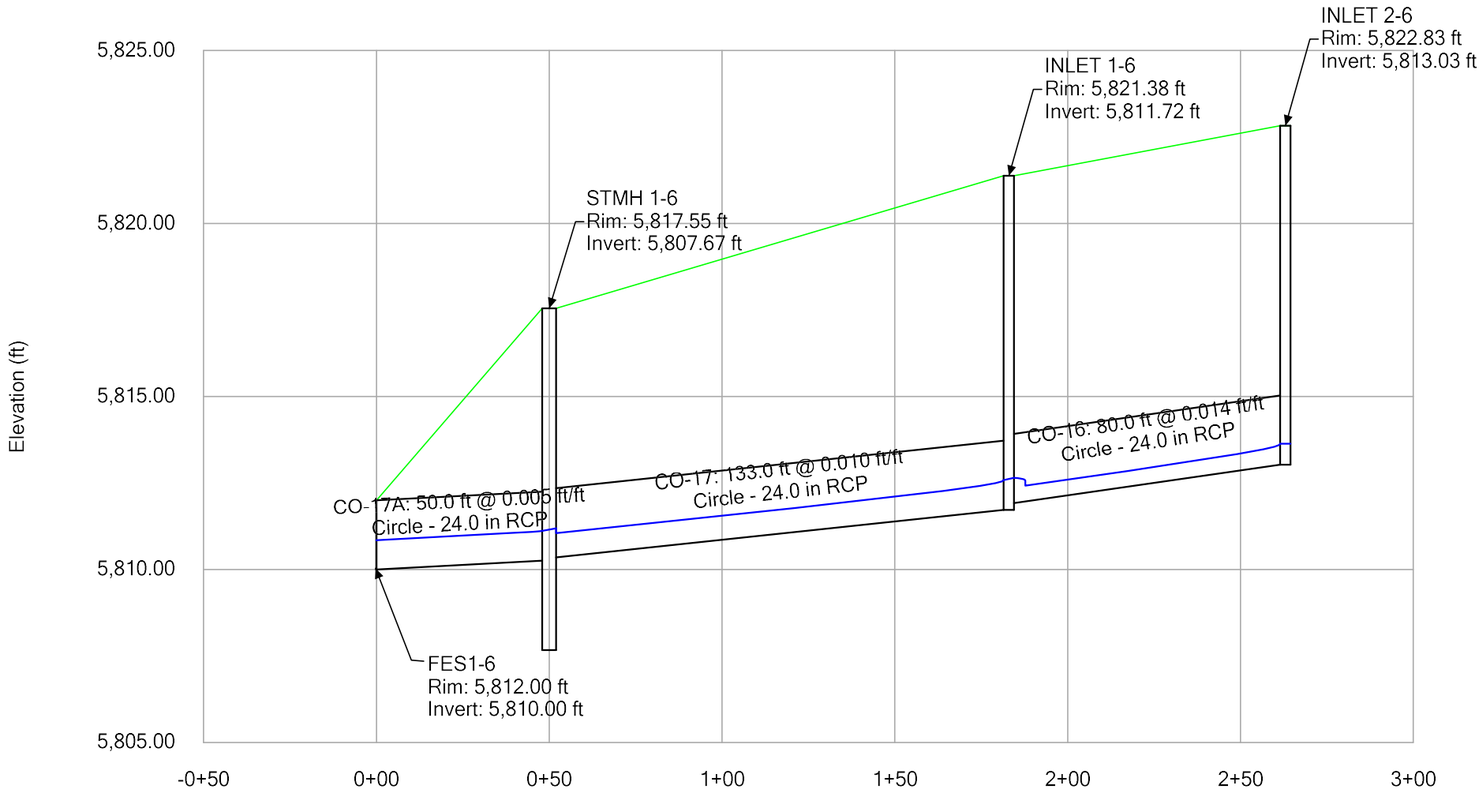
Profile Report

Engineering Profile - Profile - Storm Line 5 (Compark Village South StormCAD [5 year].stsw)



Profile Report

Engineering Profile - Profile - Storm Line 6 (Compark Village South StormCAD [5 year].stsw)

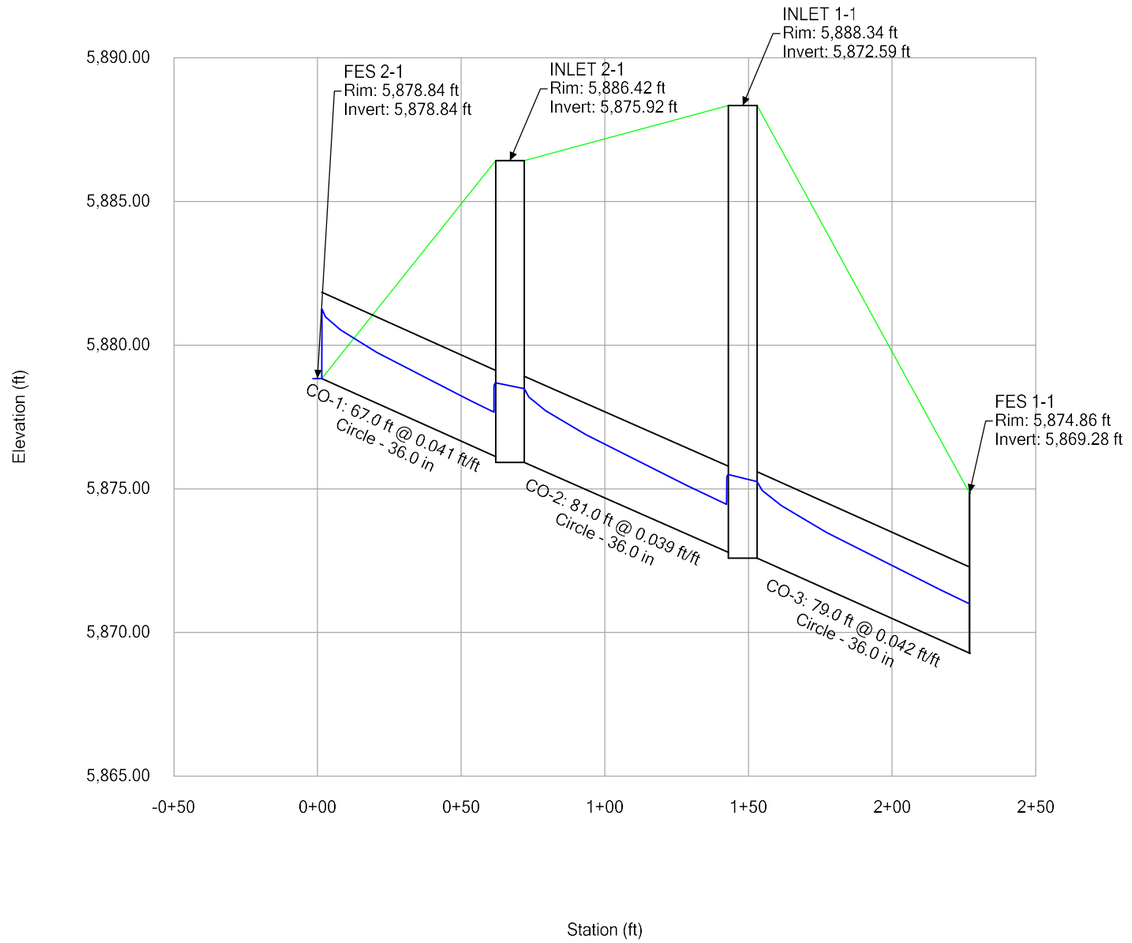


FlexTable: Conduit Table

Start Node	Stop Node	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	System Fixed Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)
STMH 6-4	INLET 6-4	120.0	0.020	36.0	47.81	13.34	5,837.16	5,834.11	5,838.26	5,836.61
INLET 6-4	STMH 5-4	278.0	0.017	36.0	51.31	12.70	5,834.66	5,829.38	5,835.84	5,831.88
FES 2-5	INLET 8-5	7.7	0.070	24.0	24.64	18.14	5,836.29	5,835.76	5,837.40	5,836.86
INLET 5-4	STMH 5-4	52.0	0.010	18.0	9.80	6.72	5,830.55	5,829.98	5,831.19	5,830.69
INLET 3-4	STMH 4-4	20.0	0.010	18.0	11.20	6.34	5,827.28	5,827.06	5,827.91	5,827.68
INLET 1-4	STMH 2-4	65.0	0.017	18.0	7.70	4.36	5,825.49	5,825.14	5,825.78	5,825.44
INLET 4-4	STMH 4-4	20.0	0.010	18.0	2.40	1.36	5,827.07	5,827.06	5,827.10	5,827.09
INLET 2-6	INLET 1-6	80.0	0.014	24.0	8.10	7.44	5,814.04	5,813.30	5,814.44	5,813.49
INLET 2-5	INLET 1-5	90.0	0.007	36.0	23.50	3.32	5,813.28	5,813.17	5,813.45	5,813.34
INLET 1-5	STMH 1-5	103.0	0.008	36.0	38.60	5.46	5,812.66	5,812.31	5,813.12	5,812.77
STMH 1-5	FES 1-5	446.0	0.029	42.0	156.03	20.10	5,809.21	5,795.64	5,813.36	5,801.90
INLET 2-3	INLET 1-3	94.0	0.101	24.0	9.00	15.64	5,841.63	5,832.27	5,842.06	5,832.58
FES 2-4	STMH 6-4	221.0	0.031	36.0	47.81	15.79	5,844.25	5,837.57	5,845.35	5,838.49
STMH 5-4	STMH 4-4	163.0	0.027	36.0	63.33	16.13	5,829.97	5,827.06	5,831.48	5,828.30
INLET 4-5	STMH 2-5A	19.0	0.036	18.0	8.90	5.04	5,816.29	5,816.15	5,816.68	5,816.55
INLET 5-5	STMH 2-5	49.0	0.050	18.0	9.10	5.15	5,816.41	5,816.04	5,816.82	5,816.46
STMH 4-4	STMH 3-4	79.0	0.008	36.0	76.93	10.88	5,827.06	5,826.01	5,828.90	5,827.85
STMH 3-4	STMH 2-4	76.0	0.011	36.0	84.93	12.02	5,825.66	5,824.43	5,827.90	5,826.67
INLET 2-4	STMH 3-4	56.0	0.009	18.0	8.00	4.53	5,826.14	5,825.81	5,826.46	5,826.13
INLET 1-6	STMH 1-6	133.0	0.010	24.0	15.40	7.83	5,813.13	5,811.97	5,813.79	5,812.46
STMH 1-6	FES1-6	50.0	0.005	24.0	15.40	5.80	5,811.80	5,811.42	5,812.34	5,812.07
INLET 8-5	INLET 7-5	173.0	0.035	24.0	24.64	13.95	5,835.26	5,829.98	5,836.37	5,830.94
INLET 4-5A	STMH 2-5E	20.0	0.012	18.0	10.20	5.77	5,823.36	5,823.17	5,823.87	5,823.69
INLET 5-5A	STMH 2-5E	20.0	0.012	18.0	10.62	6.01	5,823.38	5,823.18	5,823.94	5,823.74
STMH 2-5	INLET 3-5	16.0	0.024	42.0	123.06	12.79	5,815.19	5,814.95	5,817.73	5,817.49
INLET 3-5	STMH 1-5	266.0	0.018	42.0	136.96	14.24	5,814.59	5,809.66	5,817.74	5,812.81
INLET 7-5	STMH 4-5	104.6	0.047	24.0	34.84	16.88	5,829.06	5,826.17	5,831.02	5,828.08
STMH 4-5	INLET 6-5	23.0	0.036	24.0	34.84	11.09	5,825.05	5,824.51	5,826.97	5,826.42
STMH 2-5A	STMH 2-5	50.0	0.014	36.0	48.02	6.79	5,816.06	5,815.80	5,816.78	5,816.52
STMH 2-5B	STMH 2-5A	241.0	0.014	30.0	39.12	7.97	5,818.36	5,816.17	5,819.35	5,817.16
STMH 2-4	STMH 1-4	60.0	0.026	36.0	92.63	17.14	5,823.28	5,821.23	5,826.04	5,824.92
STMH 1-4	FES 1-4	33.0	0.026	36.0	92.63	17.04	5,821.71	5,820.49	5,824.47	5,823.88
INLET 1-3	STMH 1-3	18.4	0.031	24.0	22.50	13.06	5,831.63	5,831.16	5,832.61	5,832.05
STMH 1-3	O-1	12.0	0.031	24.0	22.50	13.04	5,831.06	5,830.90	5,832.04	5,831.73
INLET 5-4A	STMH 5-4	43.0	0.010	18.0	2.22	4.71	5,829.92	5,829.97	5,830.06	5,830.01
STMH 2-5E	STMH 2-5D	44.0	0.015	24.0	20.82	6.63	5,822.95	5,822.58	5,823.63	5,823.26
STMH 2-5D	STMH 2-5C	45.0	0.014	24.0	28.32	9.01	5,822.34	5,821.64	5,823.60	5,822.90
STMH 2-5C	STMH 2-5B	289.0	0.014	30.0	35.22	10.71	5,821.51	5,818.47	5,822.58	5,819.27
INLET 4-5B	STMH 2-5C	18.0	0.010	18.0	6.90	3.90	5,821.69	5,821.62	5,821.93	5,821.85
INLET 5-5B	STMH 2-5D	293.0	0.028	18.0	7.50	9.49	5,829.36	5,822.56	5,829.85	5,822.84
INLET 4-5C	STMH 2-5B	18.0	0.010	18.0	3.90	2.21	5,818.45	5,818.42	5,818.52	5,818.50
INLET 6-5	STMH 3-5A	247.0	0.034	30.0	54.44	16.83	5,823.49	5,817.26	5,825.50	5,819.17
STMH 3-5A	STMH 2-5	48.0	0.027	30.0	65.94	13.43	5,816.77	5,815.53	5,819.58	5,818.34
INLET 6-5A	STMH 3-5A	19.0	0.010	18.0	6.20	3.51	5,817.05	5,816.98	5,817.24	5,817.17
INLET 6-5B	STMH 3-5A	19.0	0.010	18.0	5.30	3.00	5,817.01	5,816.96	5,817.15	5,817.10

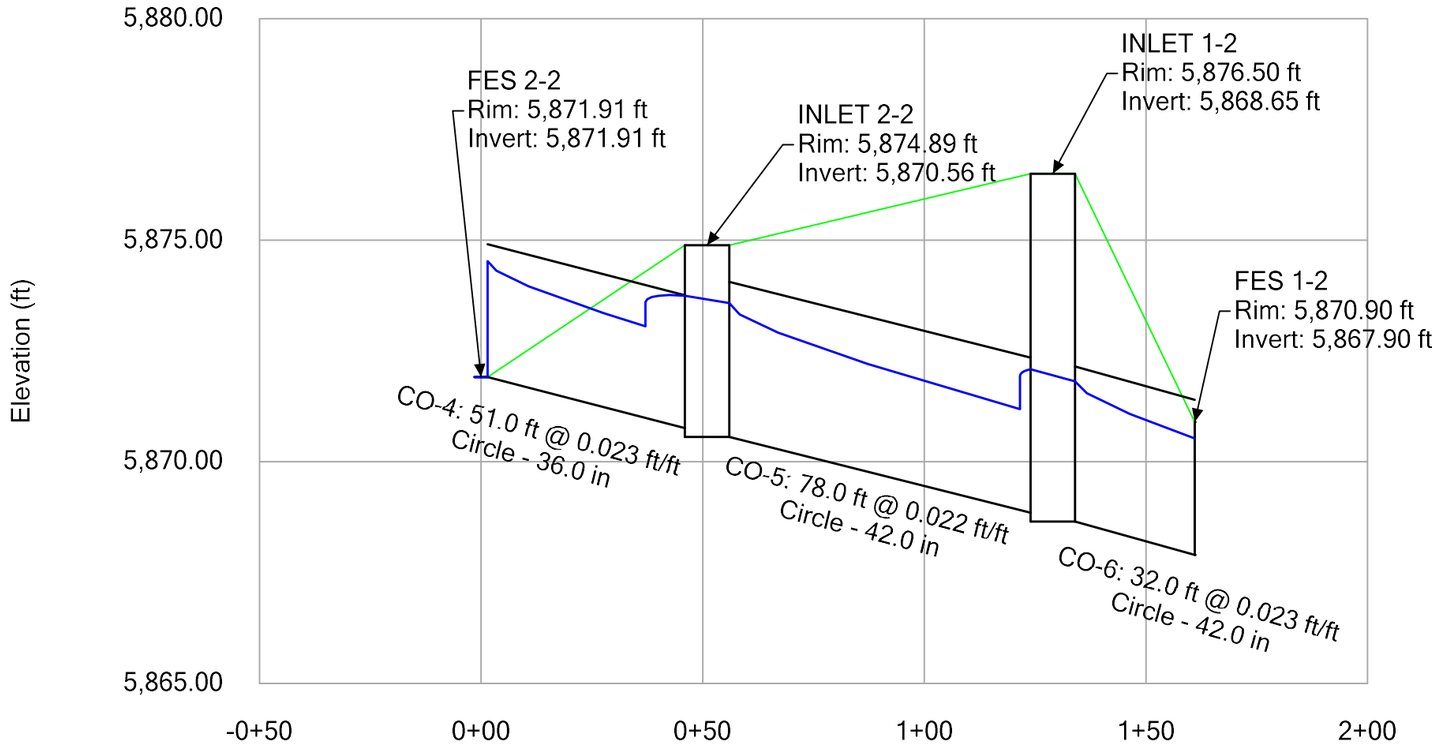
Profile Report

Engineering Profile - Profile - Storm Line 1 (Belford Ave StormCAD [100 year].stsw)



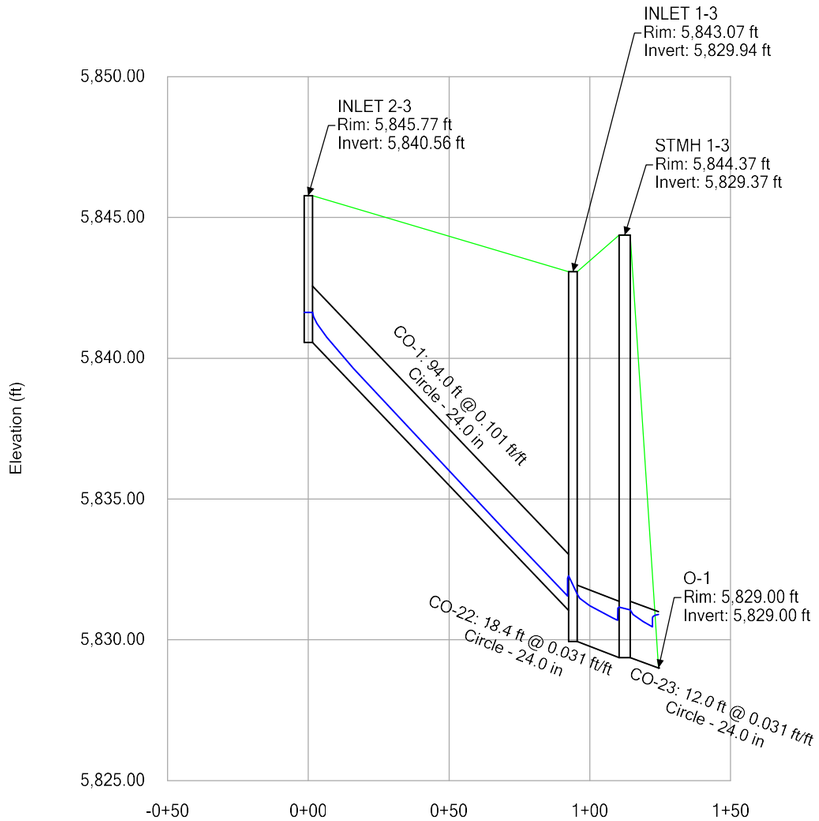
Profile Report

Engineering Profile - Profile - Storm Line 2 (Belford Ave StormCAD [100 year].stsw)

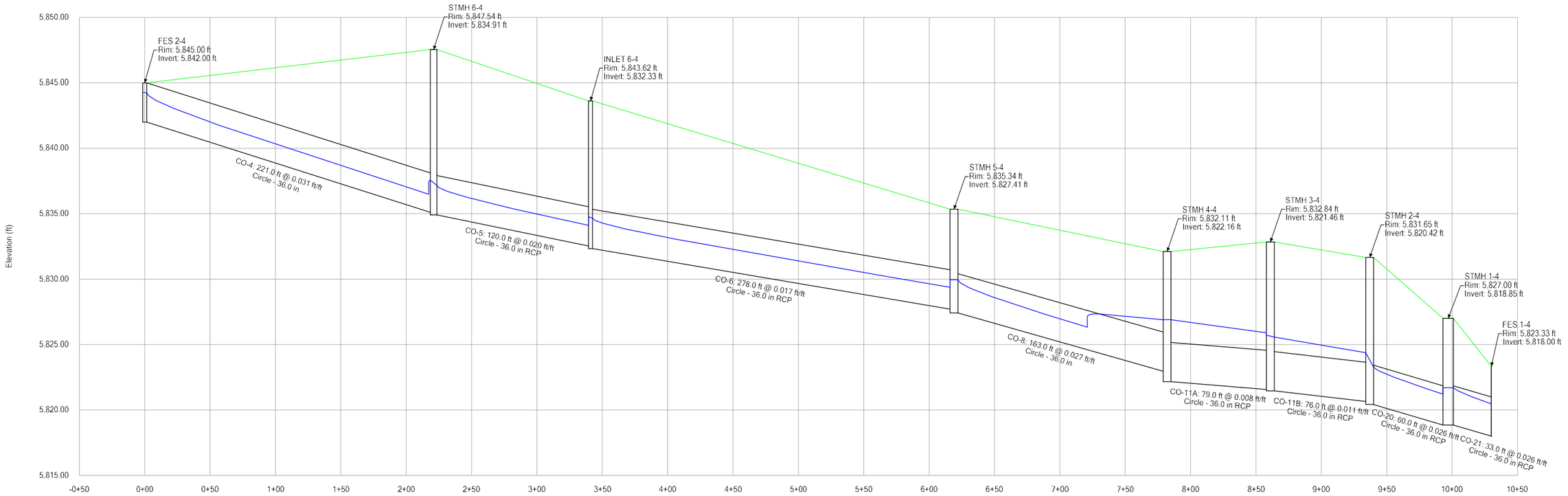


Profile Report

Engineering Profile - Profile - Storm Line 3 (Compark Village South StormCAD [100 year].stsw)

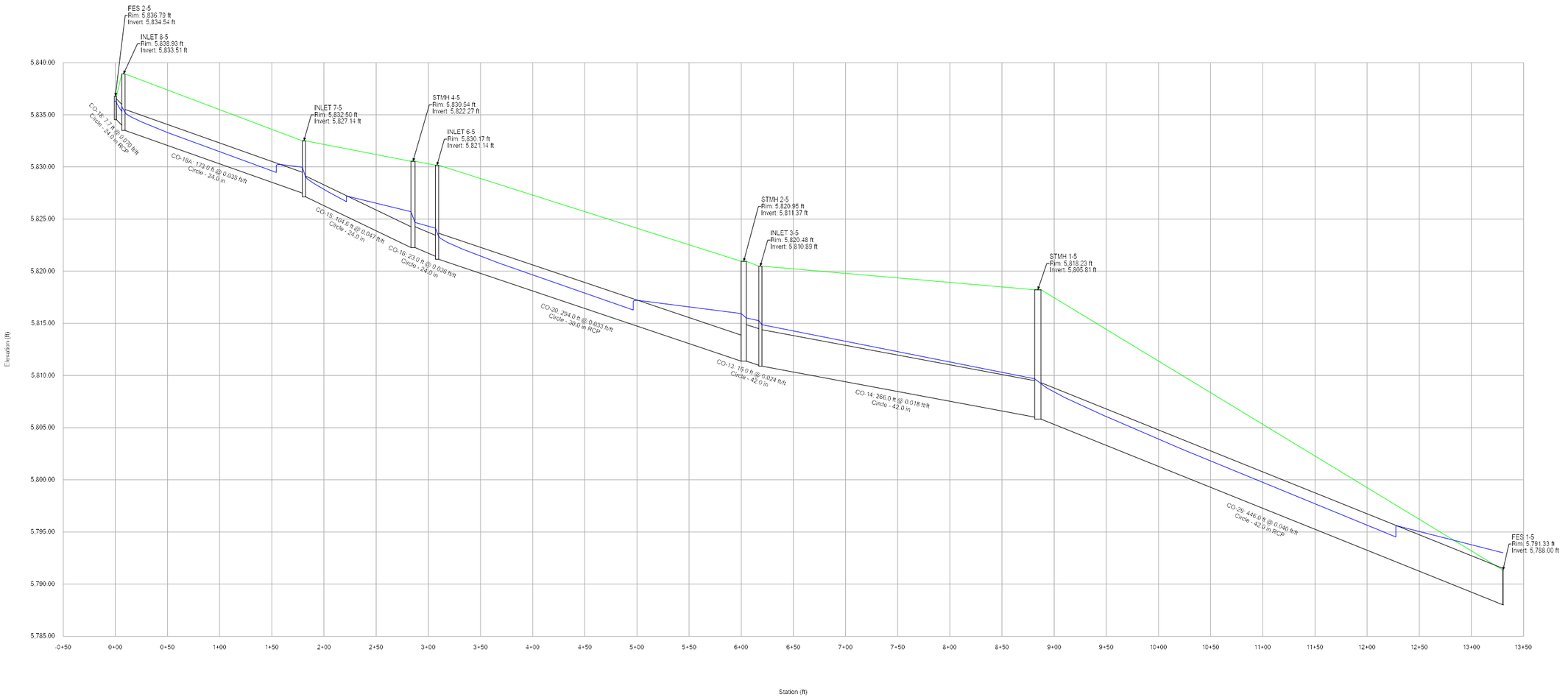


Profile Report
Engineering Profile - Profile - Storm Line 4 (Compark Village South StormCAD [100 year].stsw)



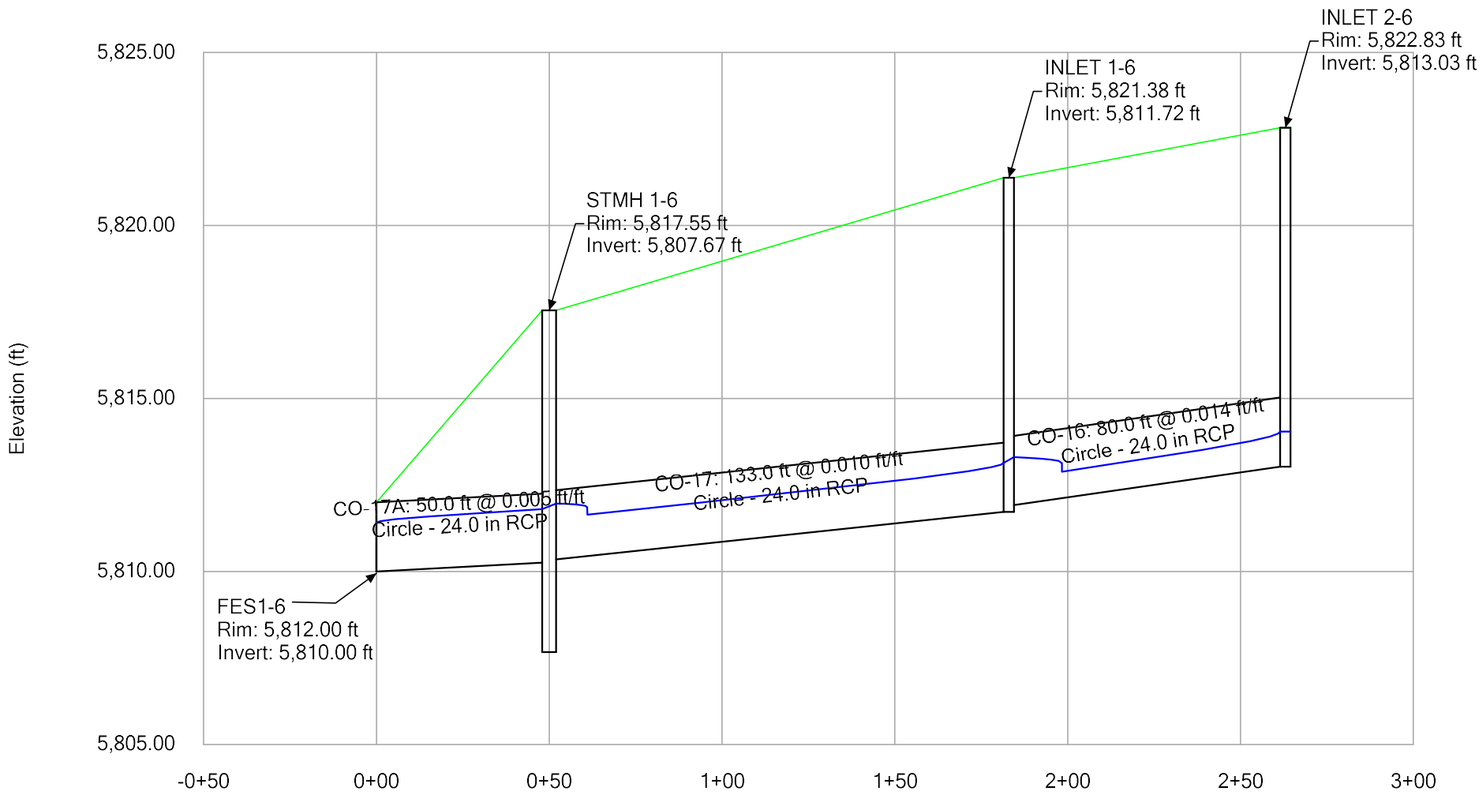
Profile Report

Engineering Profile - Profile - Storm Line 5 (Compark Village South StormCAD [100 year].stsw)



Profile Report

Engineering Profile - Profile - Storm Line 6 (Compark Village South StormCAD [100 year].stsw)



MANHARD CONSULTING LTD.

Engineers
Surveyors
Planners

PROJECT Comark Village South
DATE 6/15/16
BY ASD
SHEET 1 OF 1

ASSUME 95% IMPERVIOUS FOR FUTURE COMMERCIAL DEV.

$T_c = 5$ min
$C_{100} = 0.87$

DRAINAGE SYSTEM 8

DA = 6.4 ac Q_{100} = 46 cfs Tw Det Pond = 5790

INV @ INFLOW = 5789.0

FOR 36" RCP, @ Q = 46 cfs Hw = 5793.0 H = 4'

NOW Q_{100} = 21 cfs Hw = 5791.5, H = 2.5'

DRAINAGE SYSTEM 9

DA = 3.2 ac Q_{100} = 23 cfs
+ 9.8 cfs Filing 2 East

33 cfs Tw Det Pond = 5790

INV @ INFLOW = 5790.5

FOR 30" RCP @ Q = 33 cfs Hw = 5794.0, H = 3.5'

NOW Q_{100} = 10.3 cfs + 10 cfs = 20.3 cfs
Filing 2

Hw = 5793.0, H = 2.5'

Culvert Calculator Report
CVS Drainage System 8 FUTURE

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	5,800.00	ft	Headwater Depth/Height	1.26	
Computed Headwater Elev	5,792.79	ft	Discharge	46.00	cfs
Inlet Control HW Elev.	5,792.63	ft	Tailwater Elevation	5,790.00	ft
Outlet Control HW Elev.	5,792.79	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	5,789.00	ft	Downstream Invert	5,781.00	ft
Length	162.00	ft	Constructed Slope	0.049383	ft/ft

Hydraulic Profile					
Profile	CompositePressureProfileS1S2		Depth, Downstream	9.00	ft
Slope Type	N/A		Normal Depth	1.15	ft
Flow Regime	N/A		Critical Depth	2.21	ft
Velocity Downstream	6.51	ft/s	Critical Slope	0.005971	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	5,792.79	ft	Upstream Velocity Head	1.06	ft
Ke	0.50		Entrance Loss	0.53	ft

Inlet Control Properties					
Inlet Control HW Elev.	5,792.63	ft	Flow Control	Transition	
Inlet Type	Square edge w/headwall		Area Full	7.1	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Calculator Report
CVS Drainage System 8 CURRENT

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	5,800.00	ft	Headwater Depth/Height	0.78	
Computed Headwater Elev	5,791.34	ft	Discharge	21.00	cfs
Inlet Control HW Elev.	5,791.06	ft	Tailwater Elevation	5,790.00	ft
Outlet Control HW Elev.	5,791.34	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	5,789.00	ft	Downstream Invert	5,781.00	ft
Length	162.00	ft	Constructed Slope	0.049383	ft/ft

Hydraulic Profile					
Profile	CompositePressureProfileS1S2		Depth, Downstream	9.00	ft
Slope Type	N/A		Normal Depth	0.76	ft
Flow Regime	N/A		Critical Depth	1.47	ft
Velocity Downstream	2.97	ft/s	Critical Slope	0.004227	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	5,791.34	ft	Upstream Velocity Head	0.58	ft
Ke	0.50		Entrance Loss	0.29	ft

Inlet Control Properties					
Inlet Control HW Elev.	5,791.06	ft	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	7.1	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Calculator Report
CVS Drainage System 9 FUTURE

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	5,800.00	ft	Headwater Depth/Height	1.38	
Computed Headwater Elev	5,793.95	ft	Discharge	33.00	cfs
Inlet Control HW Elev.	5,793.89	ft	Tailwater Elevation	5,790.00	ft
Outlet Control HW Elev.	5,793.95	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	5,790.50	ft	Downstream Invert	5,781.00	ft
Length	144.00	ft	Constructed Slope	0.065972	ft/ft

Hydraulic Profile					
Profile	CompositePressureProfileS1S2		Depth, Downstream	9.00	ft
Slope Type	N/A		Normal Depth	0.96	ft
Flow Regime	N/A		Critical Depth	1.96	ft
Velocity Downstream	6.72	ft/s	Critical Slope	0.007095	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.50	ft
Section Size	30 inch		Rise	2.50	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	5,793.95	ft	Upstream Velocity Head	1.00	ft
Ke	0.50		Entrance Loss	0.50	ft

Inlet Control Properties					
Inlet Control HW Elev.	5,793.89	ft	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	4.9	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Calculator Report
CVS Drainage System 9 CURRENT

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	5,800.00	ft	Headwater Depth/Height	1.00	
Computed Headwater Elev	5,793.00	ft	Discharge	20.30	cfs
Inlet Control HW Elev.	5,792.76	ft	Tailwater Elevation	5,790.00	ft
Outlet Control HW Elev.	5,793.00	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	5,790.50	ft	Downstream Invert	5,781.00	ft
Length	144.00	ft	Constructed Slope	0.065972	ft/ft

Hydraulic Profile					
Profile	CompositePressureProfileS1S2		Depth, Downstream	9.00	ft
Slope Type	N/A		Normal Depth	0.74	ft
Flow Regime	N/A		Critical Depth	1.53	ft
Velocity Downstream	4.14	ft/s	Critical Slope	0.005109	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.50	ft
Section Size	30 inch		Rise	2.50	ft
Number Sections	1				

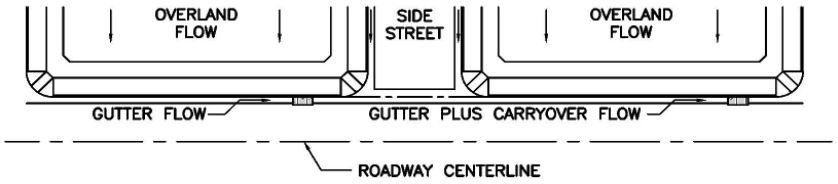
Outlet Control Properties					
Outlet Control HW Elev.	5,793.00	ft	Upstream Velocity Head	0.65	ft
Ke	0.50		Entrance Loss	0.32	ft

Inlet Control Properties					
Inlet Control HW Elev.	5,792.76	ft	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	4.9	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 1-1



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	4.1	8.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

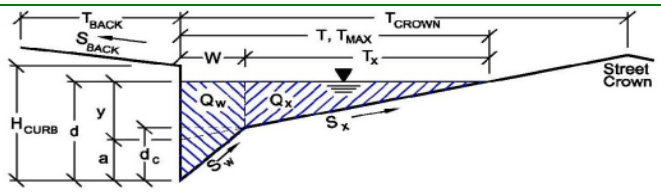
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**4.1**	**8.9**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 1-1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.019	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**23.4**	**207.0**	**cfs**

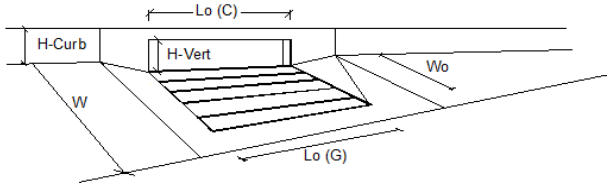
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 1-1



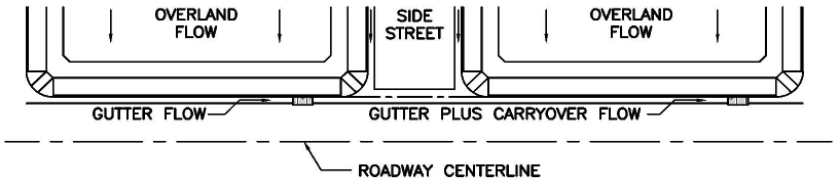
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.98**	**6.47**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**2.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**97**	**73**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 1-2



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	5.2	11.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

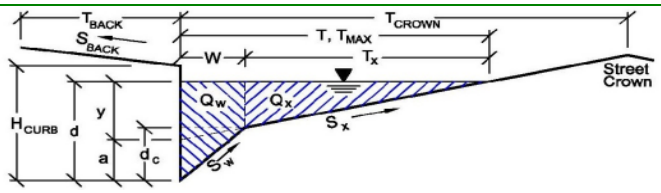
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**2.4**	**cfs**
Total Design Peak Flow, Q =	**5.2**	**13.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 1-2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

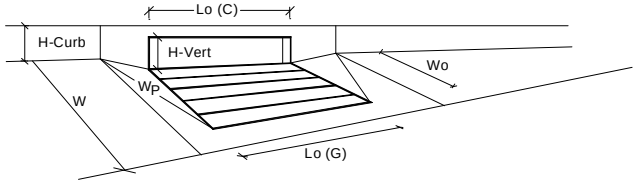
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 1-2

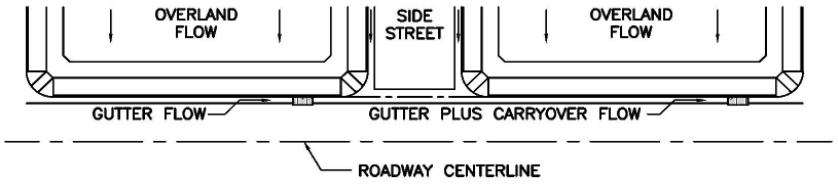


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	10.4	inches
				☐ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.5**	**23.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.2	13.6	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 1-3



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	5.5	20.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

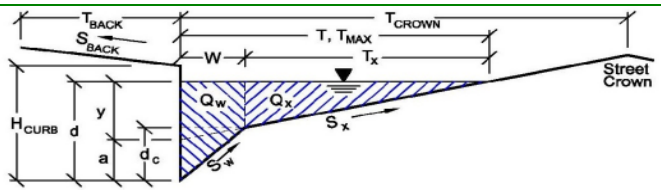
	Minor Storm	Major Storm	
Design Storm Return Period, T_t =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	5.5	20.2	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 1-3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.019	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**23.4**	**207.0**	**cfs**

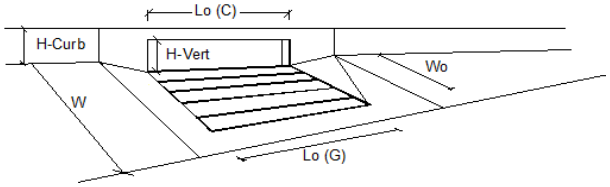
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 1-3



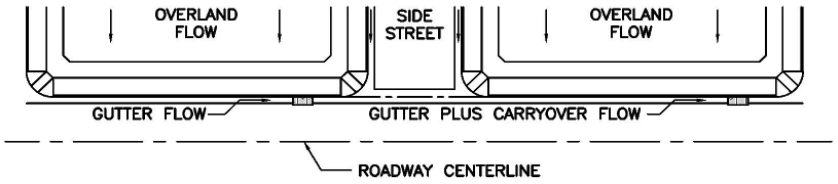
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.50**	**13.47**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**6.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**67**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 1-4



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	2.4	5.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

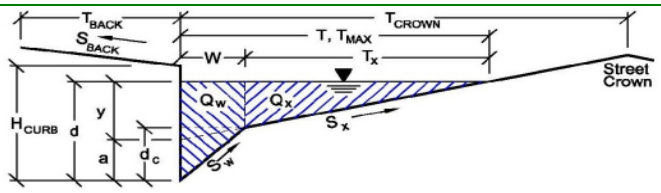
	Minor Storm	Major Storm	
Design Storm Return Period, T_t =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	6.7	cfs
Total Design Peak Flow, Q =	2.4	12.6	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 1-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.019	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**23.4**	**207.0**	**cfs**

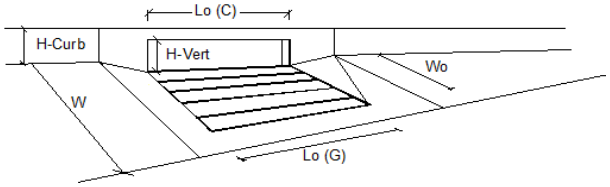
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 1-4



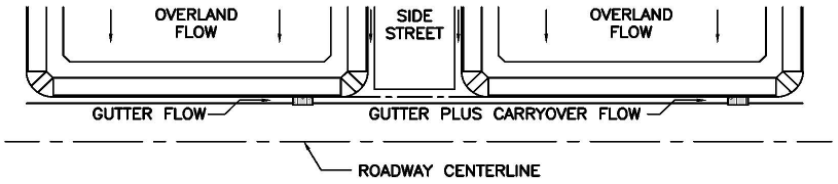
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.40**	**7.70**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**4.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**61**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 1-5



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	5.1	11.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

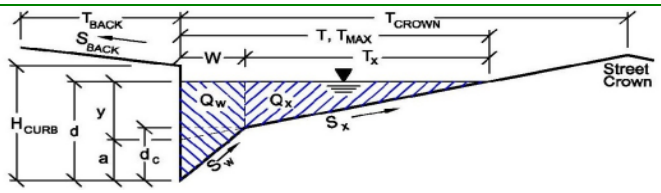
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**4.1**	**cfs**
Total Design Peak Flow, Q =	**5.1**	**15.1**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 1-5



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

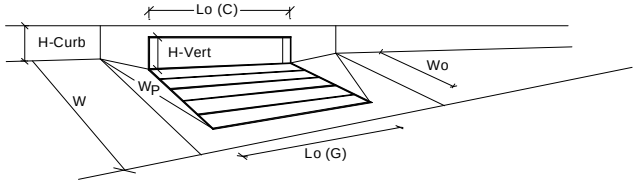
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 1-5

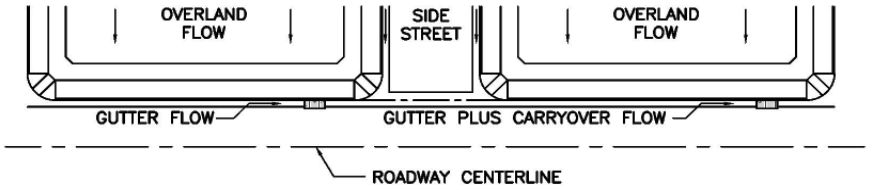


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	10.4	inches
				☐ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.5**	**23.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.1	15.1	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 1-6



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.0	6.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

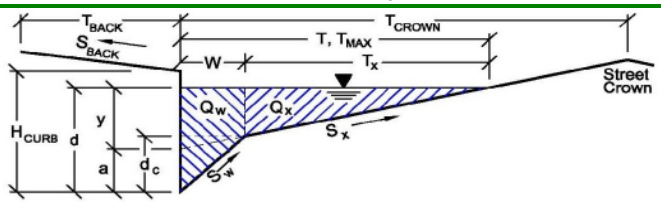
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	4.9	cfs
Total Design Peak Flow, Q =	3.0	11.4	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 1-6



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	**16.8**	**171.1**	**cfs**

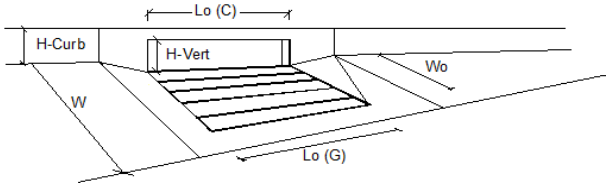
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 1-6



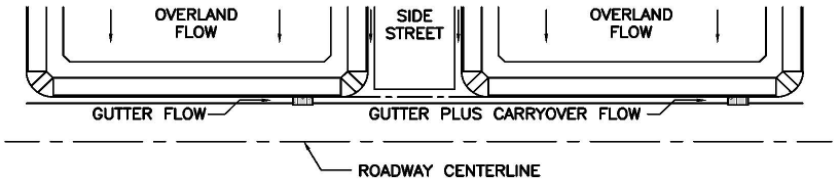
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.00**	**7.28**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**4.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**64**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 2-1



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	4.0	14.7	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

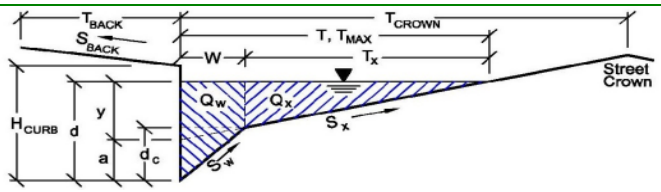
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	4.0	14.7	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 2-1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.019	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**23.4**	**207.0**	**cfs**

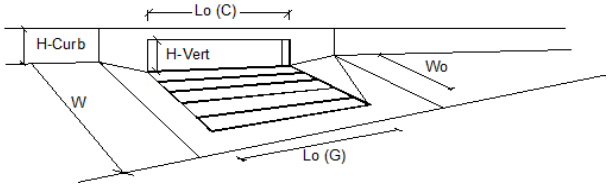
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 2-1



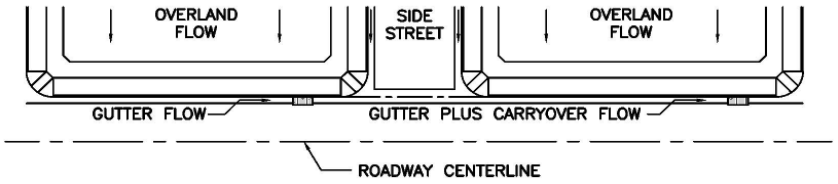
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.90**	**8.29**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**6.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**56**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 2-2



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	4.2	22.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

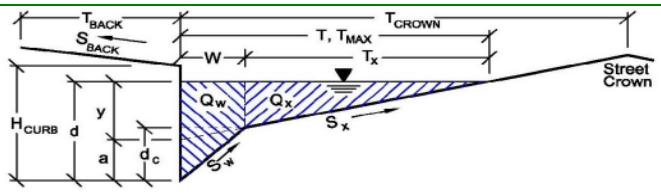
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.1**	**6.4**	**cfs**
Total Design Peak Flow, Q =	**4.3**	**29.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 2-2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

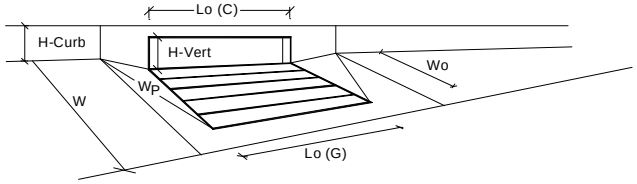
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 2-2

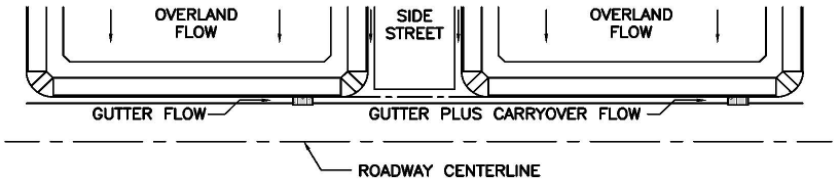


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	10.4	inches
				☐ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**13.5**	**36.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.3	29.0	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 2-3



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	4.5	9.9	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

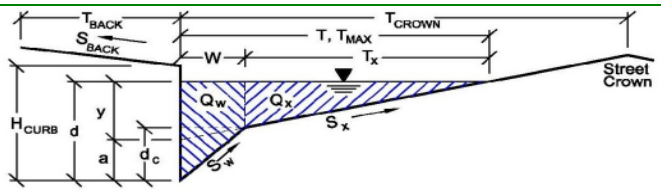
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	4.5	9.9	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 2-3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**20.8**	**225.6**	**cfs**

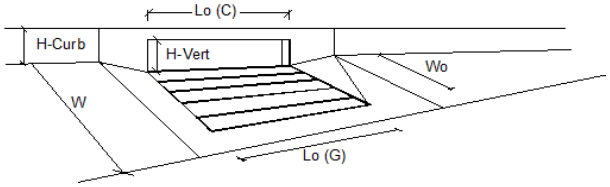
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 2-3



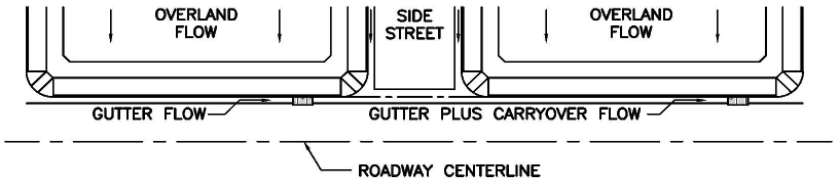
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.50**	**8.95**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**90**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 2-4



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	2.6	7.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

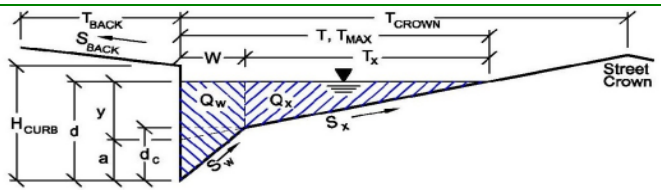
	Minor Storm	Major Storm	
Design Storm Return Period, T_t =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	1.0	cfs
Total Design Peak Flow, Q =	2.6	8.5	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 2-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**20.8**	**204.4**	**cfs**

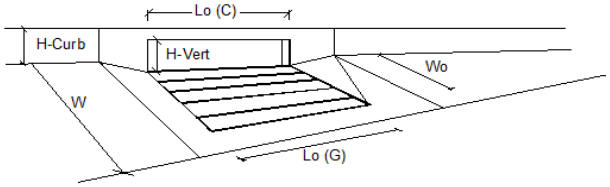
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 2-4



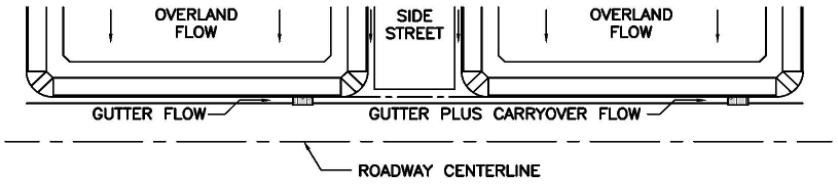
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.60**	**8.05**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**95**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 2-5



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	7.7	21.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

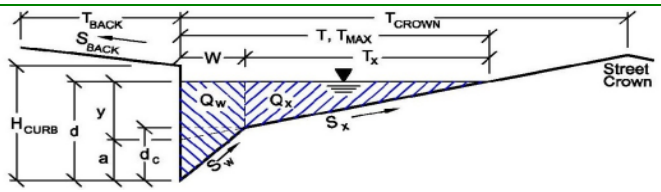
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**2.3**	**cfs**
Total Design Peak Flow, Q =	**7.7**	**23.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 2-5



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	10.2	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

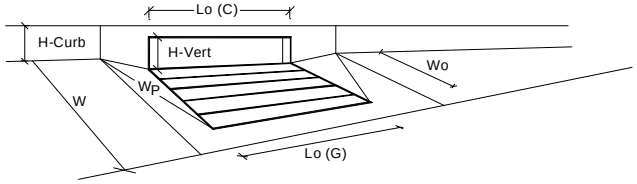
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 2-5

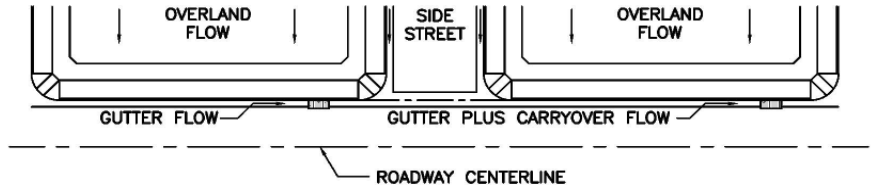


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.7**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.7	23.6	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 2-6



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	3.0	8.1	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR…

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

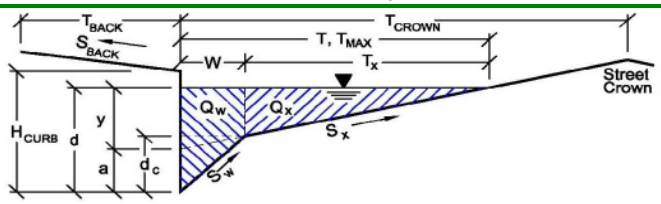
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.5	cfs
Total Design Peak Flow, Q =	3.0	8.6	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 2-6



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	37.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	37.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.0**	**118.0**	**cfs**

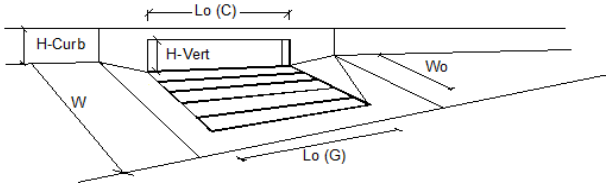
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 2-6



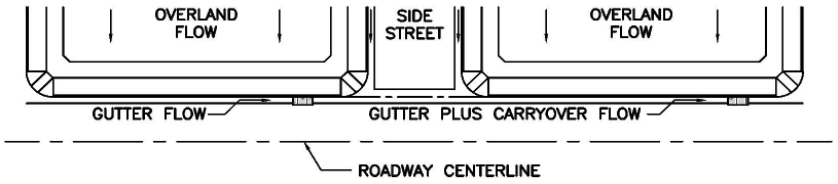
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.00**	**8.06**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**94**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 3-4



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	2.9	8.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

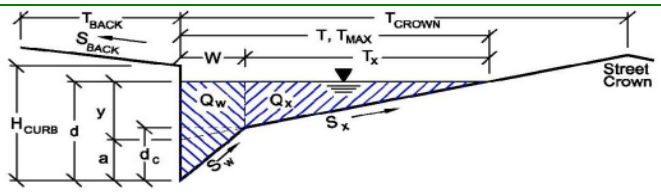
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**2.4**	**cfs**
Total Design Peak Flow, Q =	**2.9**	**11.0**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 3-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

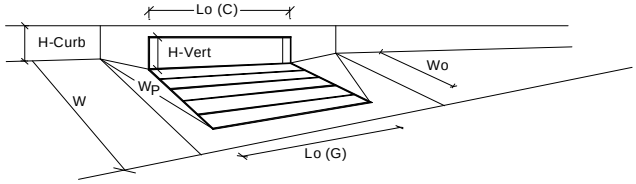
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 3-4

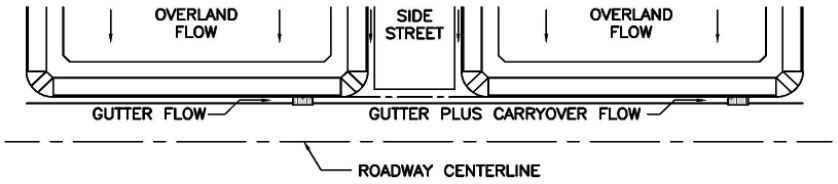


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.7**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.9	11.0	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 3-5



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	4.9	13.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

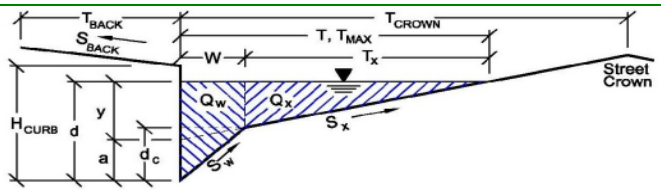
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	4.9	13.6	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 3-5



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

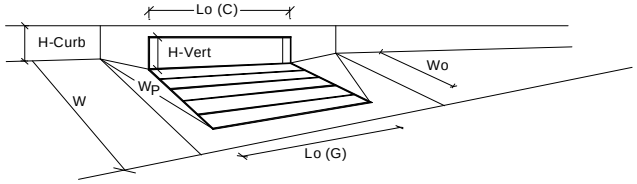
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 3-5

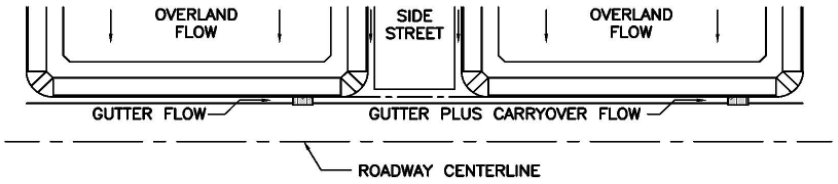


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.7**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.9	13.6	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 4-4



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	0.9	2.4	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

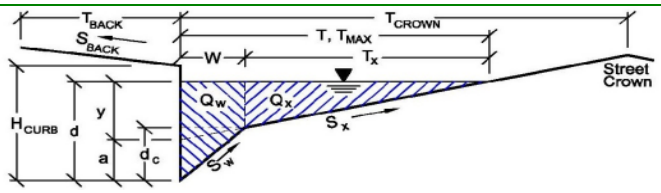
	Minor Storm	Major Storm	
Design Storm Return Period, T_t =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	0.9	2.4	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 4-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

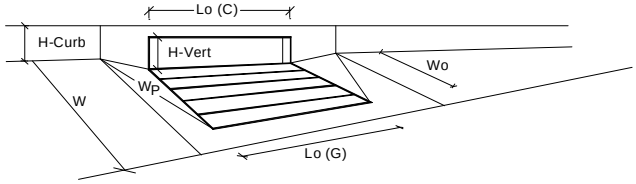
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 4-4

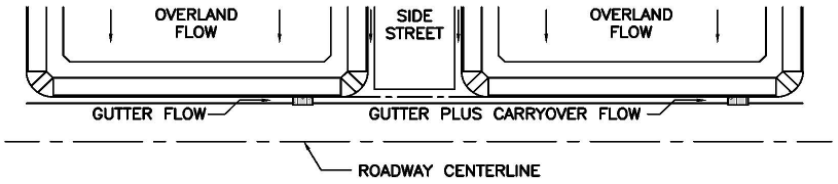


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	3.4	5.6	inches
				☐ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.1**	**4.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	0.9	2.4	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 4-5



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	9.6	26.6	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

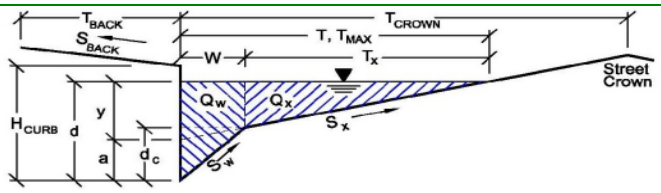
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	10.6	cfs
Total Design Peak Flow, Q =	9.6	37.2	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 4-5



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

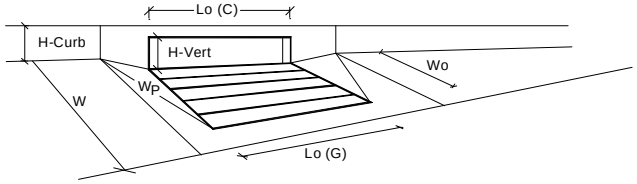
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 4-5

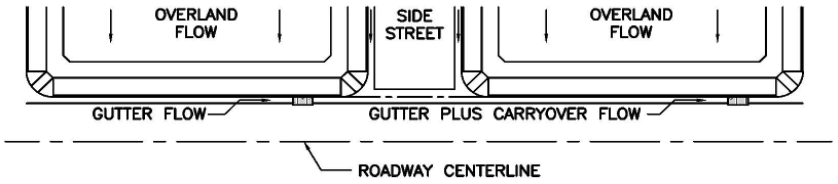


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**11.2**	**39.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	9.6	37.2	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 5-4



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	4.1	13.0	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

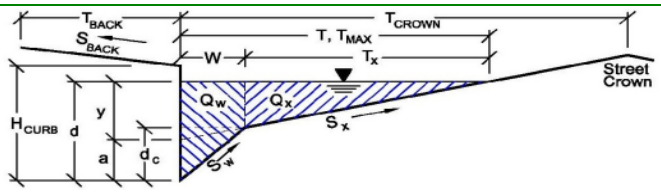
	Minor Storm	Major Storm	
Design Storm Return Period, T_t =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	4.1	13.0	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 5-4



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**16.4**	**137.5**	**cfs**

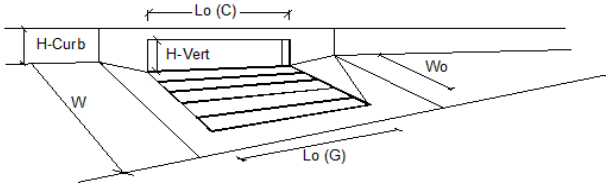
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 5-4



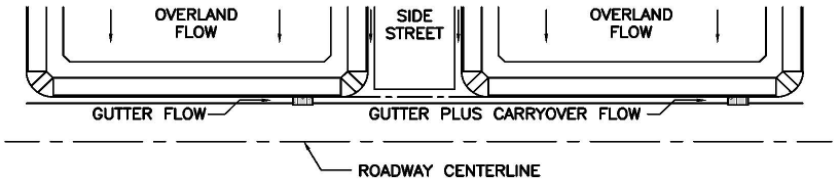
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.10**	**10.59**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**81**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 5-5



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	5.5	15.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

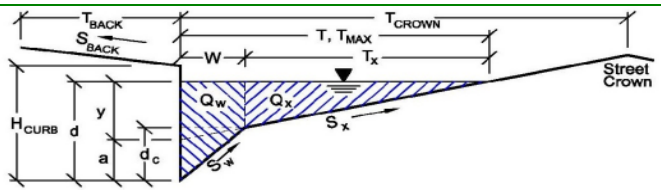
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**6.4**	**cfs**
Total Design Peak Flow, Q =	**5.5**	**21.6**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 5-5



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

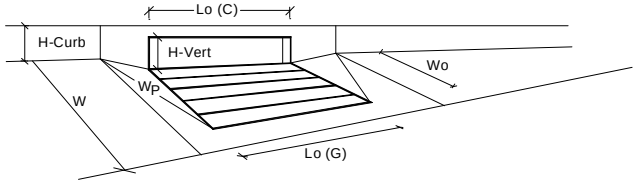
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 5-5

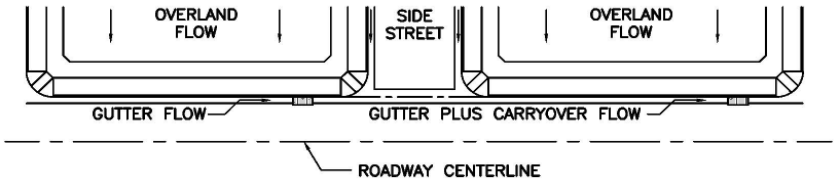


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.7**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.5	21.6	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 6-4



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	1.1	3.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

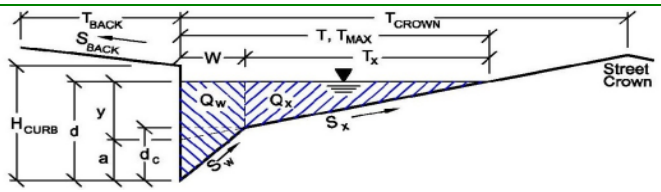
	Minor Storm	Major Storm	
Design Storm Return Period, T_t =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	**0.0**	**0.0**	**cfs**
Total Design Peak Flow, Q =	**1.1**	**3.5**	**cfs**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 6-4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.006	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**10.4**	**86.9**	**cfs**

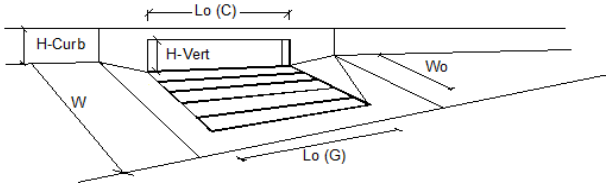
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: COMPARK SOUTH

Inlet ID: INLET 6-4



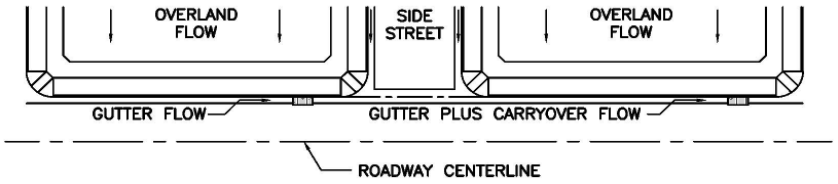
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.10**	**3.47**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**99**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 6-5



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	7.6	23.5	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

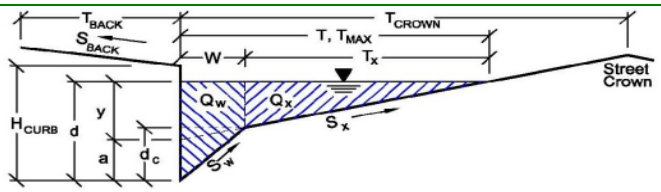
	Minor Storm	Major Storm	
Design Storm Return Period, T_t =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	7.6	23.5	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COMPARK SOUTH

Inlet ID: INLET 6-5



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

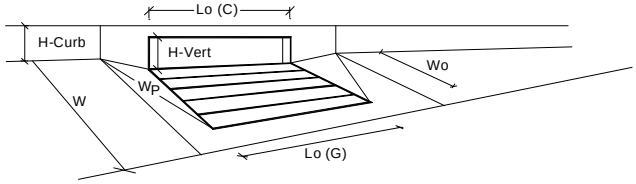
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = COMPARK SOUTH

Inlet ID = INLET 6-5

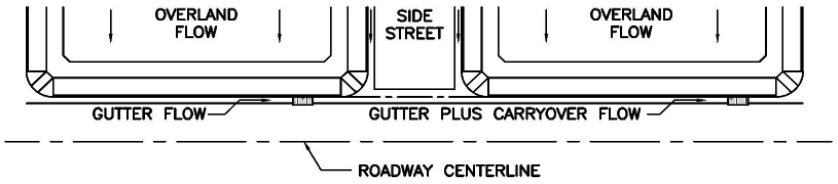


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	5.6	inches
				☐ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**11.1**	**11.1**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	7.6	23.5	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 7-4



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	0.1	3.2	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

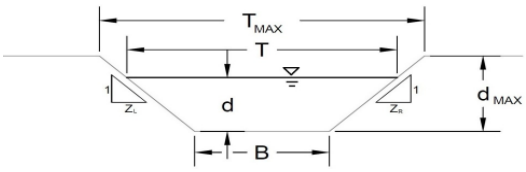
Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	0.1	3.2	cfs

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

COMPARK SOUTH

INLET 7-4



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

	NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	B	
	Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
	Channel Invert Slope	S_O =	0.0100	ft/ft
	Bottom Width	B =	5.00	ft
Warning 01	Left Side Slope	Z1 =	0.02	ft/ft
Warning 01	Right Side Slope	Z2 =	0.02	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One:
- ○ Sandy
- ◉ Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	12.00	12.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	1.50	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	1.88	4.99	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.00	1.50	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.10	3.20	cfs
Water Depth	d =	0.15	1.32	feet

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

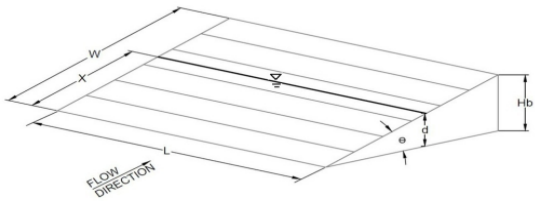
COMPARK SOUTH

INLET 7-4

Inlet Design Information (Input)

Type of Inlet — Inlet Type = CDOT Type C

Angle of Inclined Grade (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grade	W =	3.00	feet
Length of Grade	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grade	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	



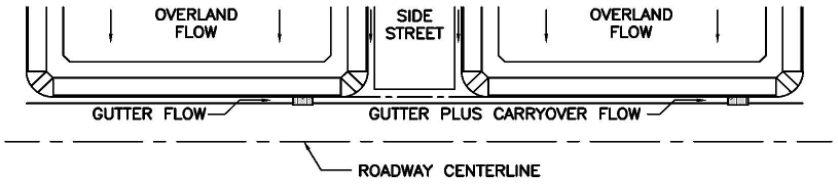
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.15	1.32	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.12**	**18.59**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (> Q PEAK)	**Bypassed Flow, Q_b =**	**0.00**	**0.00**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

Warning 01: Sideslope steepness exceeds USDCM Volume I recommendation.
Warning 02: Depth (d) exceeds USDCM Volume I recommendation.

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: COMPARK SOUTH
Inlet ID: INLET 7-5



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
*Q_{Known} =	0.2	9.8	cfs

<--- FILL IN THIS SECTION OR...

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <---

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- Site is Urban
- Site is Non-Urban

Flows Developed For:
- Street Inlets
- Area Inlets in a Median

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Channel Flow =		

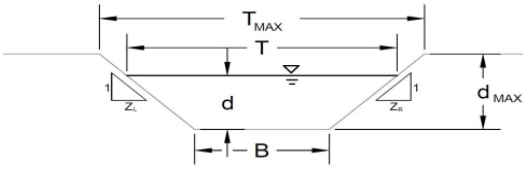
Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	0.2	9.8	cfs

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

COMPARK SOUTH

INLET 7-5



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

	NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E =	C	
	Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
	Channel Invert Slope	S_O =	0.0100	ft/ft
	Bottom Width	B =	2.00	ft
Warning 01	Left Side Slope	Z1 =	0.20	ft/ft
Warning 01	Right Side Slope	Z2 =	0.20	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One:
- ○ Sandy
- ◉ Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	12.00	12.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	2.10	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	1.02	10.51	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.00	2.10	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.20	9.80	cfs
Water Depth	d =	0.54	2.04	feet

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

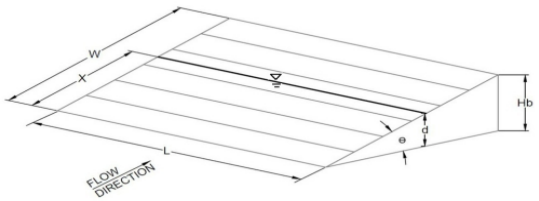
AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

COMPARK SOUTH

INLET 7-5

Inlet Design Information (Input)

Type of Inlet — Inlet Type = CDOT Type C



Angle of Inclined Grade (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grade	W =	3.00	feet
Length of Grade	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grade	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.54	2.04	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**7.23**	**23.09**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (> Q PEAK)	**Bypassed Flow, Q_b =**	**0.00**	**0.00**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

Warning 01: Sideslope steepness exceeds USDCM Volume I recommendation.
Warning 02: Depth (d) exceeds USDCM Volume I recommendation.

APPENDIX J

Miscellaneous Drainage Improvement Design

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016

Belford Avenue Water Quality Basin Design

Two full spectrum water quality/detention basins were designed to treat the runoff from the portions of Belford Avenue that will not be directed to the proposed regional detention/water quality pond proposed adjacent to E-470. The ponds are located at low points of the proposed Belford Avenue that correspond to existing low areas. The ponds were designed to treat the runoff from the entire drainage area intercepted by the ponds including the undeveloped land which historically drains to these low areas.

Sizing calculations are attached.

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: Compark South

Basin ID: Belford Ave Water Quality Pond - West

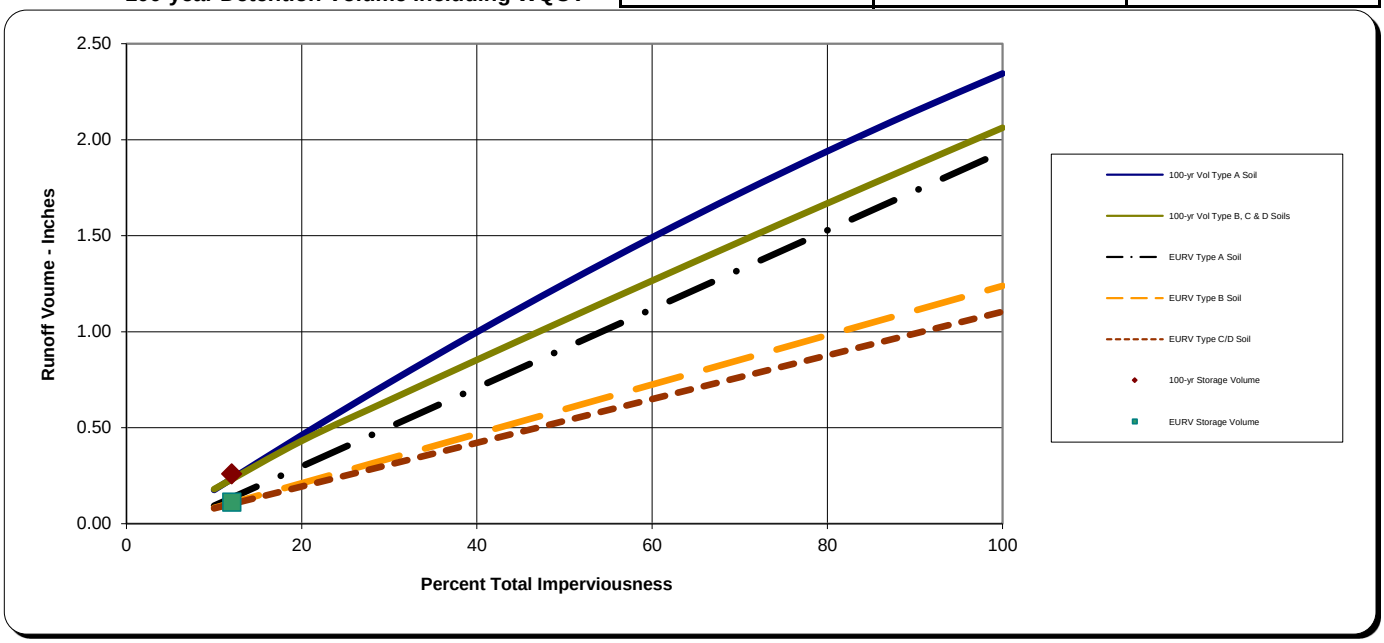
* User input data shown in blue.

Area of Watershed (acres)	17.50	
Subwatershed Imperviousness	12.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	12.0%	

Hydrologic Soil Type	**Percentage of Area**	**Area (acres)**
Type A		0.0
Type B		0.0
Type C or D	100.0%	17.5

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		**Decay Coefficient--α**
Initial--f_i	**Final--fo**	
3	0.5	0.0018

	Detention Volumes [2,5]		
	(watershed inches)	**(acre-feet)**	**Maximum Allowable Release Rate, cfs[3]**
Excess Urban Runoff Volume[4]	0.11	0.16	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.26	0.38	17.50



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

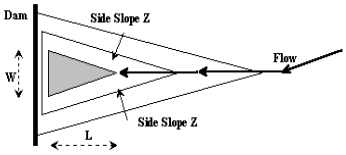
4) EURV approximates the difference between developed and pre-developed runoff volume.

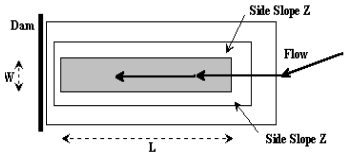
5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

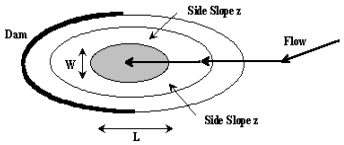
STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: Compark South

Basin ID: Belford Ave Water Quality Pond - West







Design Information (Input):

Width of Basin Bottom, W =		ft
Length of Basin Bottom, L =		ft
Dam Side-slope (H:V), Z_d =		ft/ft

Check Basin Shape

Right Triangle		OR…
Isosceles Triangle		OR…
Rectangle		OR…
Circle / Ellipse		OR…
Irregular		(Use Overide values in cells G32:G52)

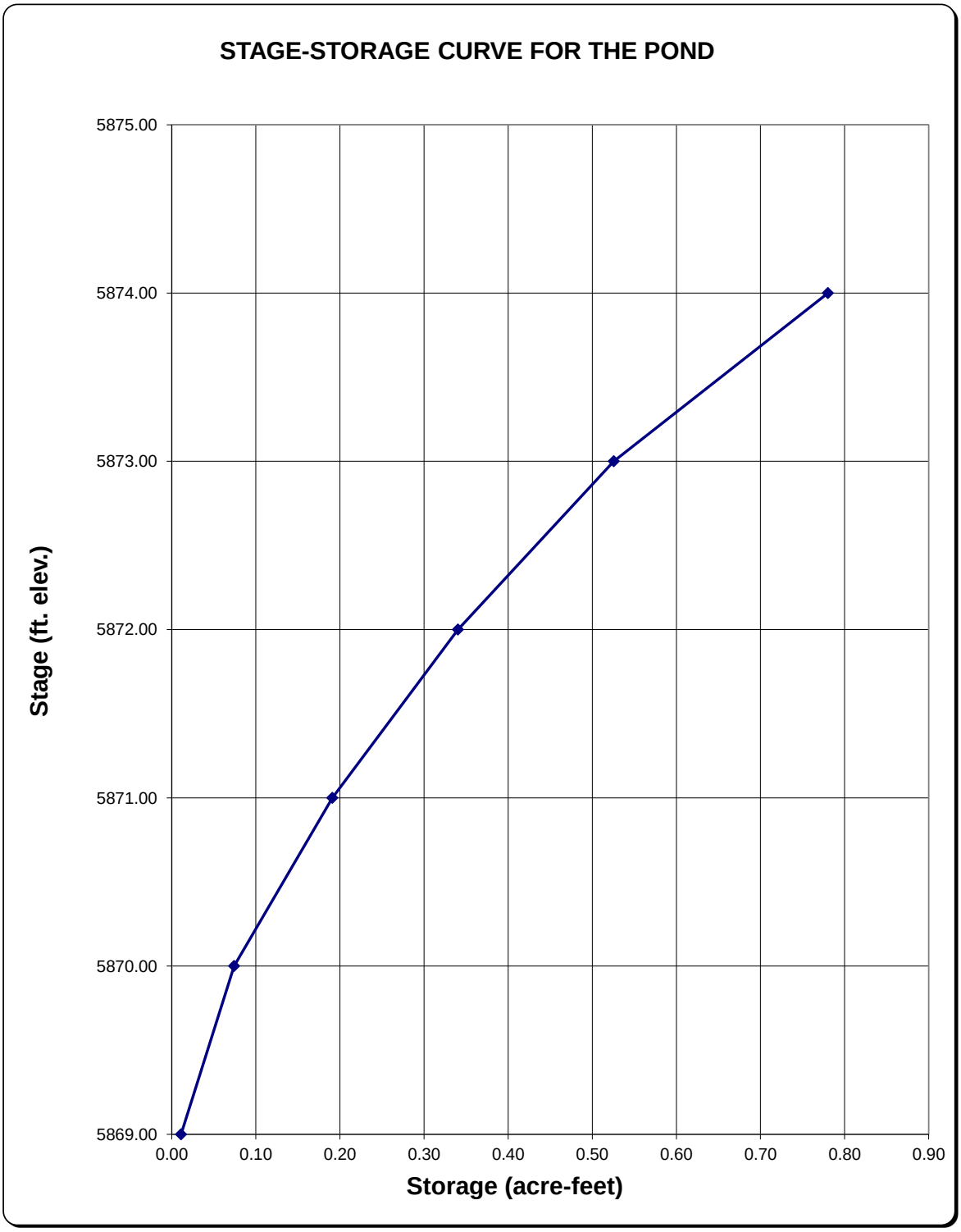
Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	0.16	0.38	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	5867.65					0		0.000	0.000	
	5868.17		0.00	0.00		0	0	0.000	0.000	
	5869.00		0.00	0.00		1,150	477	0.026	0.011	
EURV - 5870.69	5870.00		0.00	0.00		4,356	3,230	0.100	0.074	
	5871.00		0.00	0.00		5,816	8,316	0.134	0.191	
	5872.00		0.00	0.00		7,203	14,826	0.165	0.340	
	5873.00		0.00	0.00		8,945	22,900	0.205	0.526	
	5874.00		0.00	0.00		13,234	33,989	0.304	0.780	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project:
Basin ID:



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: Compark South

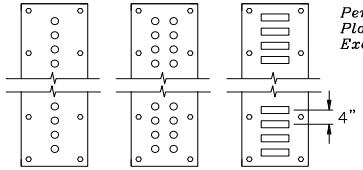
Basin ID: Belford Ave Water Quality Pond - West

WQCV Design Volume (Input):

Catchment Imperviousness, I_a =	12.0	percent		
Catchment Area, A =	17.50	acres	Diameter of holes, D =	0.563 inches
Depth at WQCV outlet above lowest perforation, H =	2	feet	Number of holes per row, N =	1
Vertical distance between rows, h =	4.00	inches	**OR**	
Number of rows, NL =	6.00			
Orifice discharge coefficient, C_o =	0.60		Height of slot, H =	inches
Slope of Basin Trickle Channel, S =	0.005	ft / ft	Width of slot, W =	inches
Time to Drain the Pond =	72	hours		

Watershed Design Information (Input):

Percent Soil Type A =		%
Percent Soil Type B =		%
Percent Soil Type C/D =	100	%



Perforated Plate Examples

Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	0.113	watershed inches
	N/A	
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	**0.165**	**acre-feet**
Outlet area per row, Ao =	0.27	square inches
Total opening area at each row based on user-input above, Ao =	0.25	square inches
Total opening area at each row based on user-input above, Ao =	0.002	square feet

3

	Central Elevations of Rows of Holes in feet																							Σ Flow
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	
	5868.02	5868.35	5868.69	5869.02	5869.35	5869.69																			
	Collection Capacity for Each Row of Holes in cfs																								
5868.02	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000																			**0.00**
5868.35	0.0048	0.0000	0.0000	0.0000	0.0000	0.0000																			**0.00**
5868.68	0.0068	0.0048	0.0000	0.0000	0.0000	0.0000																			**0.01**
5869.01	0.0083	0.0068	0.0047	0.0000	0.0000	0.0000																			**0.02**
5869.34	0.0096	0.0083	0.0067	0.0047	0.0000	0.0000																			**0.03**
5869.67	0.0107	0.0096	0.0082	0.0067	0.0047	0.0000																			**0.04**
5870.00	0.0117	0.0107	0.0095	0.0082	0.0067	0.0046																			**0.05**
5870.33	0.0127	0.0117	0.0107	0.0095	0.0082	0.0067																			**0.06**
5870.66	0.0135	0.0127	0.0117	0.0107	0.0095	0.0082																			**0.07**
5870.99	0.0143	0.0135	0.0126	0.0117	0.0107	0.0095																			**0.07**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
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	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
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	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
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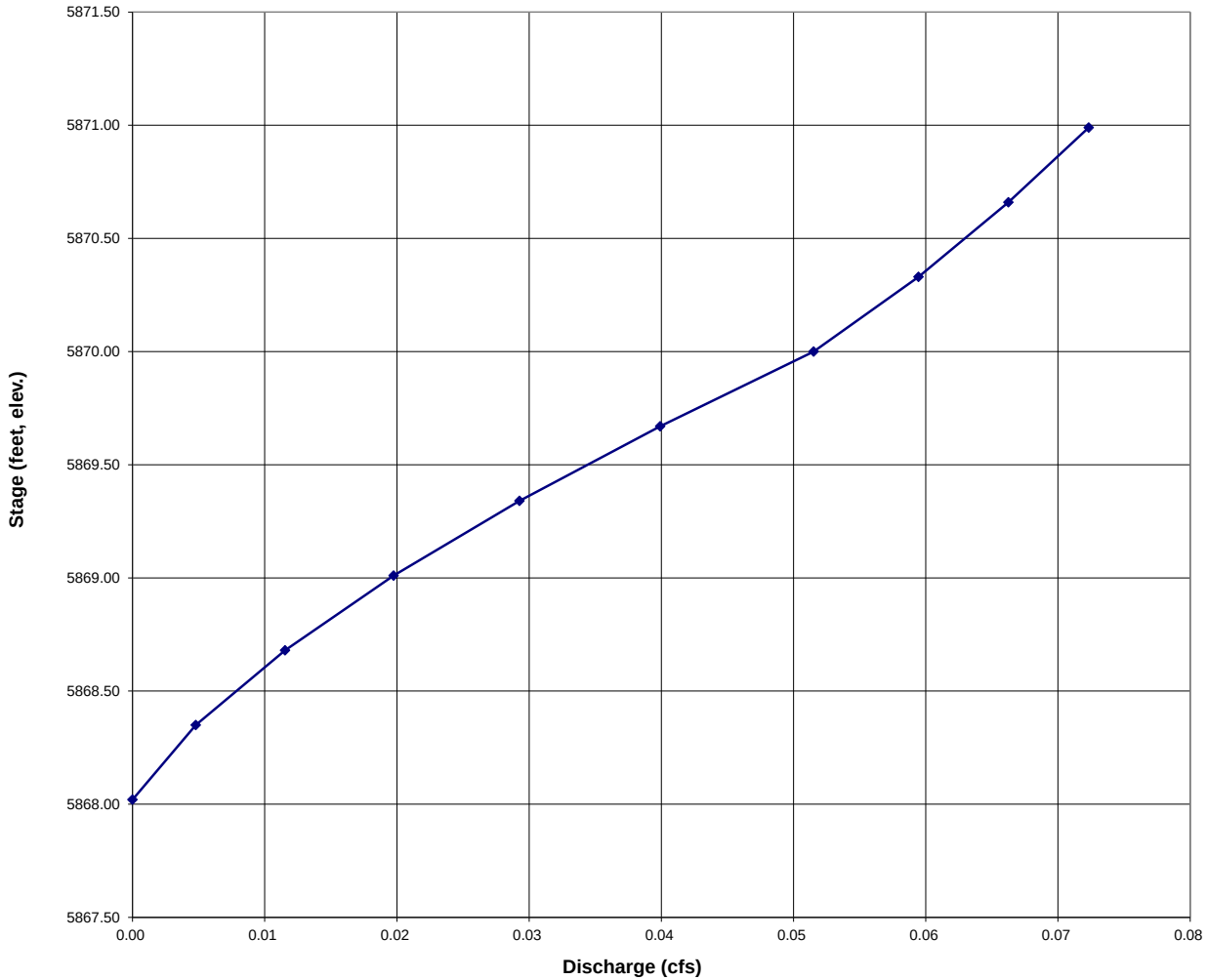
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24	

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: Compark South

Basin ID: Belford Ave Water Quality Pond - West



PROJECT: **Compark South**
CODE: CLCPKC3
DESIGN BY: Rick Katz
DATE: 3/8/2016
REV. :

GAT-1 FOREBAY VOLUME

Detention Pond Forebay

FOREBAY OUTLET ELEVATION = 6372.82

WQCV (in)	V (ACRE-FT)	V (FT^3)	Forebay at 2% (FT^3)	Forebay Area at 1.5'$_{DEPTH}$
0.078	0.114	4,957.27	99.15	66.10

WQCV Designed from Urban Drainage Criteria Manual Volume 3 (Pgs 3-5 through 3-9)

WQCV=a(0.91i^3-1.19i^2+0.78i)

a=1.0 40-hr drain time

V=(WQCV/12)A

http://www.udfcd.org/downloads/pdf/critmanual/Volume%203%20PDFs/Chapter%203%20Calculating%20the%20WQCV%20and%20Volume%20Reduction.pdf

Forbay Sizing Designed from Urban Drainage Criteria Manual Volume 3 (Pg EDB-12 table EDB-4)

http://www.udfcd.org/downloads/pdf/critmanual/Volume%203%20PDFs/Chapter%204%20Treatment%20BMPs.pdf

Ground Coverage

Weighted I (%):	**12.00%**
Total Acerage:	**17.50**

PROJECT: **Compark South**
CODE: CLCPKC3
DESIGN BY: Rick Katz
DATE: 3/8/2016
REV. :

GAT-1 INITIAL SURCHARGE AREA VOLUME

Detention Pond Forebay
INITIAL SURCHARGE AREA OUTLET ELEVATION =

WQCV (in)	V (ACRE-FT)	V (FT^3)	Intial Surcharge at 0.3% (FT^3)	Initial Surcharge Area at 0.5'$_{DEPTH}$ (FT^2)
0.078	0.114	4,957.27	14.87	29.74
				6x5

WQCV Designed from Urban Drainage Criteria Manual Volume 3 (Pgs 3-5 through 3-9)
WQCV=a(0.91i^3-1.19i^2+0.78i)
a=1.0 40-hr drain time
V=(WQCV/12)A
http://www.udfcd.org/downloads/pdf/critmanual/Volume%203%20PDFs/Chapter%203%20Calculating%20the%20WQCV%20and%20Volume%20Reduction.pdf

Forbay Sizing Designed from Urban Drainage Criteria Manual Volume 3 (Pg EDB-12 table EDB-4)
http://www.udfcd.org/downloads/pdf/critmanual/Volume%203%20PDFs/Chapter%204%20Treatment%20BMPs.pdf

Ground Coverage

Weighted I (%):	**12.00%**
Total Acerage:	**17.50**

West Forebay Outlet Weir

Project Description

Solve For	Crest Length

Input Data

Discharge		1.39	ft³/s
Headwater Elevation		1.50	ft
Crest Elevation		0.00	ft
Tailwater Elevation		0.00	ft
Weir Coefficient		0.00	US
Number Of Contractions	0		

Results

Crest Length	0.23	ft
Headwater Height Above Crest	1.50	ft
Tailwater Height Above Crest	0.00	ft
Flow Area	0.34	ft²
Velocity	4.08	ft/s
Wetted Perimeter	3.23	ft
Top Width	0.23	ft

GAT -1 Overflow Weir

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.00500	ft/ft
Normal Depth	2.31	ft
Left Side Slope	0.25	ft/ft (H:V)
Right Side Slope	0.25	ft/ft (H:V)
Bottom Width	25.00	ft

Results

Discharge	142.11	ft^3/s
Flow Area	59.08	ft^2
Wetted Perimeter	29.76	ft
Hydraulic Radius	1.99	ft
Top Width	26.16	ft
Critical Depth	1.00	ft
Critical Slope	0.07538	ft/ft
Velocity	2.41	ft/s
Velocity Head	0.09	ft
Specific Energy	2.40	ft
Froude Number	0.28	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.31	ft
Critical Depth	1.00	ft
Channel Slope	0.00500	ft/ft

GAT -1 Overflow Weir

GVF Output Data

Critical Slope	0.07538	ft/ft

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: Compark South

Basin ID: Belford Ave Water Quality Pond - East

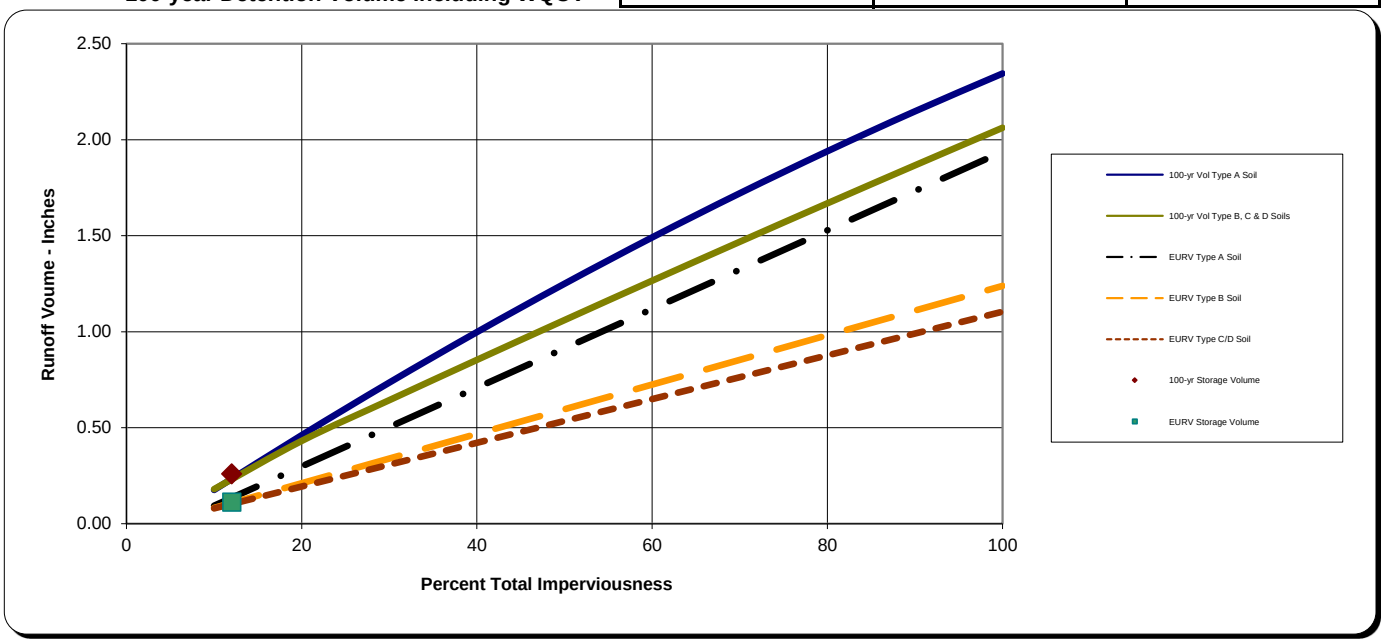
* User input data shown in blue.

Area of Watershed (acres)	24.00	
Subwatershed Imperviousness	12.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	12.0%	

Hydrologic Soil Type	**Percentage of Area**	**Area (acres)**
Type A		0.0
Type B		0.0
Type C or D	100.0%	24.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		**Decay Coefficient--α**
Initial--f_i	**Final--fo**	
3	0.5	0.0018

	Detention Volumes [2,5]		
	(watershed inches)	**(acre-feet)**	**Maximum Allowable Release Rate, cfs[3]**
Excess Urban Runoff Volume[4]	0.11	0.23	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.26	0.52	24.00



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

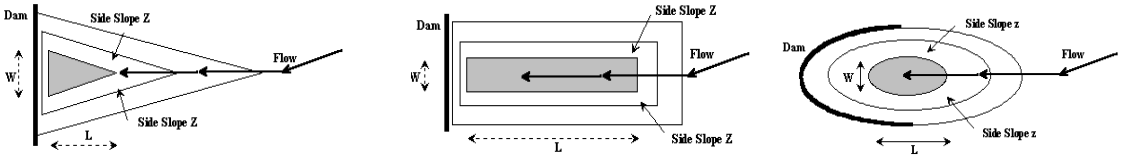
4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: Compark South

Basin ID: Belford Ave Water Quality Pond - East



Design Information (Input):

Width of Basin Bottom, W =		ft
Length of Basin Bottom, L =		ft
Dam Side-slope (H:V), Z_d =		ft/ft

Check Basin Shape

Right Triangle		OR…
Isosceles Triangle		OR…
Rectangle		OR…
Circle / Ellipse		OR…
Irregular		(Use Overide values in cells G32:G52)

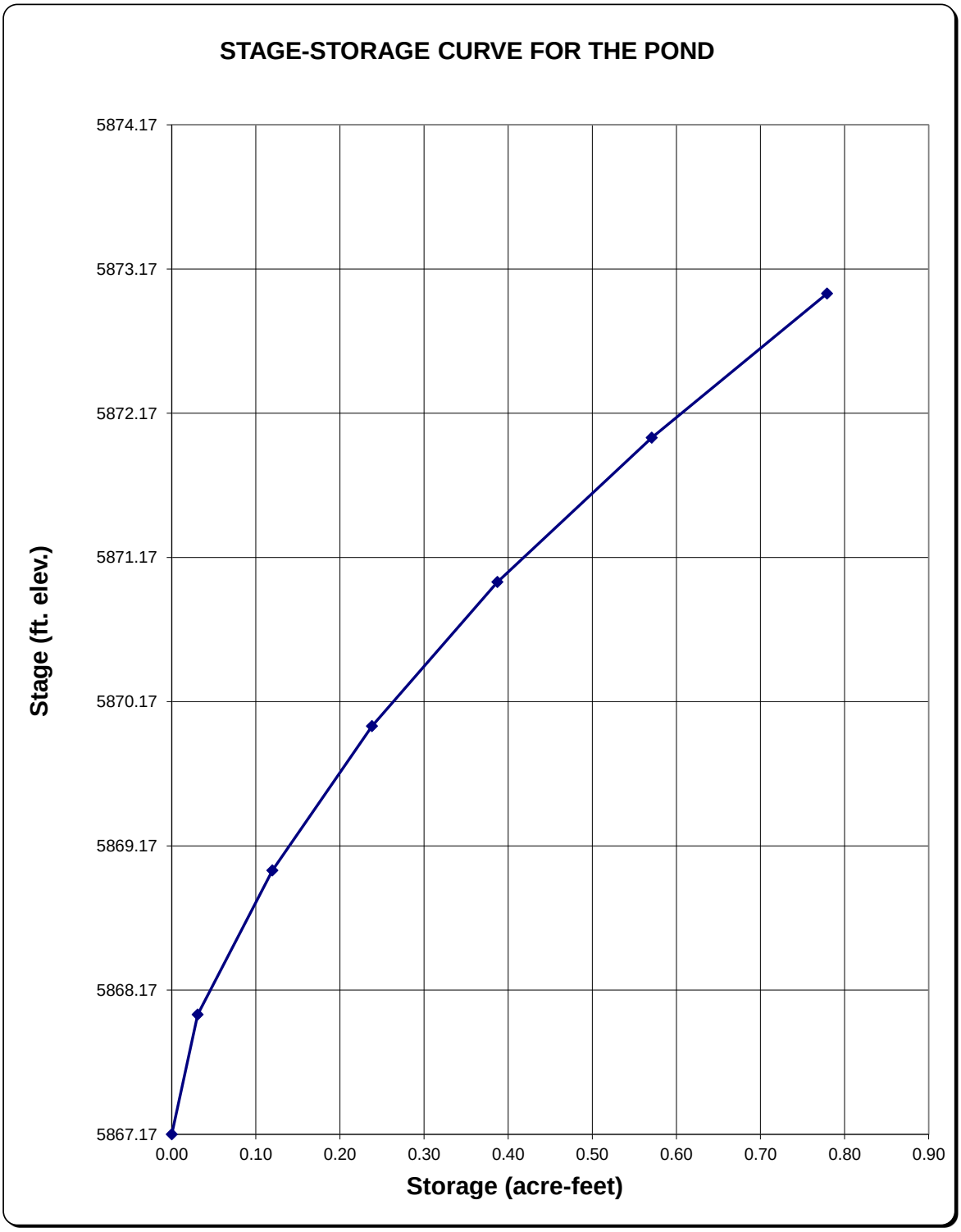
Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	0.23	0.52	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	5867.17					0		0.000	0.000	
	5868.00		0.00	0.00		3,237	1,343	0.074	0.031	
	5869.00		0.00	0.00		4,510	5,217	0.104	0.120	
EURV - 5870.00	5870.00		0.00	0.00		5,790	10,367	0.133	0.238	
	5871.00		0.00	0.00		7,214	16,869	0.166	0.387	
	5872.00		0.00	0.00		8,767	24,859	0.201	0.571	
	5873.00		0.00	0.00		9,395	33,940	0.216	0.779	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project:
Basin ID:



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: Compark South

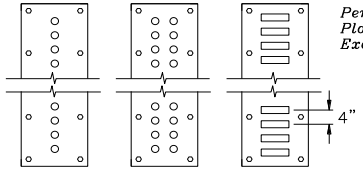
Basin ID: Belford Ave Water Quality Pond - East

WQCV Design Volume (Input):

Catchment Imperviousness, I_a =	24.0	percent		
Catchment Area, A =	12.00	acres	Diameter of holes, D =	0.781 inches
Depth at WQCV outlet above lowest perforation, H =	1	feet	Number of holes per row, N =	1
Vertical distance between rows, h =	4.00	inches	**OR**	
Number of rows, NL =	3.00			
Orifice discharge coefficient, C_o =	0.60		Height of slot, H =	inches
Slope of Basin Trickle Channel, S =	0.005	ft / ft	Width of slot, W =	inches
Time to Drain the Pond =	72	hours		

Watershed Design Information (Input):

Percent Soil Type A =		%
Percent Soil Type B =		%
Percent Soil Type C/D =	100	%



Perforated Plate Examples

Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	0.113	watershed inches
	N/A	
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	**0.226**	**acre-feet**
Outlet area per row, Ao =	0.48	square inches
Total opening area at each row based on user-input above, Ao =	0.48	square inches
Total opening area at each row based on user-input above, Ao =	0.003	square feet

3

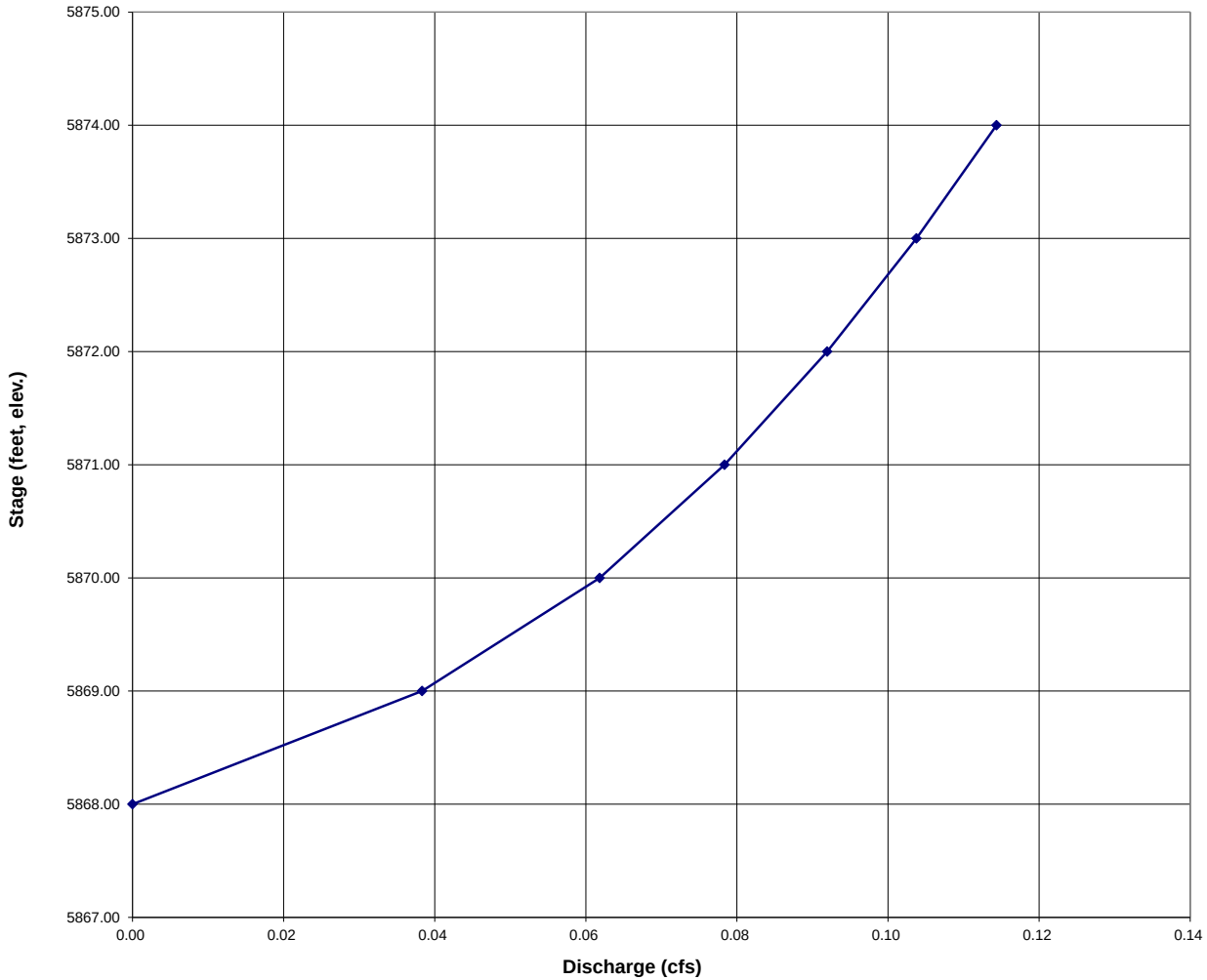
	Central Elevations of Rows of Holes in feet																								Σ Flow
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	
	5868.00	5868.33	5868.67																						
	Collection Capacity for Each Row of Holes in cfs																								
5868.00	0.0000	0.0000	0.0000																						0.00
5869.00	0.0160	0.0131	0.0092																						0.04
5870.00	0.0227	0.0207	0.0185																						0.06
5871.00	0.0277	0.0262	0.0245																						0.08
5872.00	0.0320	0.0307	0.0292																						0.09
5873.00	0.0358	0.0346	0.0333																						0.10
5874.00	0.0392	0.0381	0.0370																						0.11
	#N/A	#N/A	#N/A																						#N/A

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: Compark South

Basin ID: Belford Ave Water Quality Pond - East



PROJECT: **Compark South**
CODE: CLCPKC3
DESIGN BY: Rick Katz
DATE: 3/8/2016
REV. :

GAT-2 FOREBAY VOLUME

Detention Pond Forebay

FOREBAY OUTLET ELEVATION = 6372.82

WQCV (in)	V (ACRE-FT)	V (FT^3)	Forebay at 2% (FT^3)	Forebay Area at 1.5'$_{DEPTH}$
0.078	0.156	6,798.54	135.97	90.65

WQCV Designed from Urban Drainage Criteria Manual Volume 3 (Pgs 3-5 through 3-9)

WQCV=a(0.91i^3-1.19i^2+0.78i)

a=1.0 40-hr drain time

V=(WQCV/12)A

http://www.udfcd.org/downloads/pdf/critmanual/Volume%203%20PDFs/Chapter%203%20Calculating%20the%20WQCV%20and%20Volume%20Reduction.pdf

Forbay Sizing Designed from Urban Drainage Criteria Manual Volume 3 (Pg EDB-12 table EDB-4)

http://www.udfcd.org/downloads/pdf/critmanual/Volume%203%20PDFs/Chapter%204%20Treatment%20BMPs.pdf

Ground Coverage

Weighted I (%):	**12.00%**
Total Acerage:	**24.00**

PROJECT: **Compark South**
CODE: CLCPKC3
DESIGN BY: Rick Katz
DATE: 3/8/2016
REV. :

GAT-2 INITIAL SURCHARGE AREA VOLUME

Detention Pond Forebay

INITIAL SURCHARGE AREA OUTLET ELEVATION =

WQCV (in)	V (ACRE-FT)	V (FT^3)	Forebay at 0.3% (FT^3)	Forebay Area at 0.5'$_{DEPTH}$ (FT^2)
0.078	0.156	6,798.54	20.40	40.79

WQCV Designed from Urban Drainage Criteria Manual Volume 3 (Pgs 3-5 through 3-9)

WQCV=a(0.91i^3-1.19i^2+0.78i)

a=1.0 40-hr drain time

V=(WQCV/12)A

http://www.udfcd.org/downloads/pdf/critmanual/Volume%203%20PDFs/Chapter%203%20Calculating%20the%20WQCV%20and%20Volume%20Reduction.pdf

Forbay Sizing Designed from Urban Drainage Criteria Manual Volume 3 (Pg EDB-12 table EDB-4)

http://www.udfcd.org/downloads/pdf/critmanual/Volume%203%20PDFs/Chapter%204%20Treatment%20BMPs.pdf

Ground Coverage

Weighted I (%):	**12.00%**
Total Acerage:	**24.00**

East Forebay Outlet Weir

Project Description

Solve For	Crest Length

Input Data

Discharge		2.17	ft³/s
Headwater Elevation		1.50	ft
Crest Elevation		0.00	ft
Tailwater Elevation		0.00	ft
Weir Coefficient		3.33	US
Number Of Contractions	0		

Results

Crest Length	0.35	ft
Headwater Height Above Crest	1.50	ft
Tailwater Height Above Crest	0.00	ft
Flow Area	0.53	ft²
Velocity	4.08	ft/s
Wetted Perimeter	3.35	ft
Top Width	0.35	ft

GAT-2 Overflow Weir

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.00500	ft/ft
Normal Depth	2.00	ft
Left Side Slope	0.25	ft/ft (H:V)
Right Side Slope	0.25	ft/ft (H:V)
Bottom Width	35.00	ft

Results

Discharge	160.86	ft^3/s
Flow Area	71.00	ft^2
Wetted Perimeter	39.12	ft
Hydraulic Radius	1.81	ft
Top Width	36.00	ft
Critical Depth	0.87	ft
Critical Slope	0.07663	ft/ft
Velocity	2.27	ft/s
Velocity Head	0.08	ft
Specific Energy	2.08	ft
Froude Number	0.28	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.00	ft
Critical Depth	0.87	ft
Channel Slope	0.00500	ft/ft

GAT-2 Overflow Weir

GVF Output Data

Critical Slope	0.07663	ft/ft

PROPOSED FIRST STREET ROADSIDE SWALE SIZING CALCULATIONS (West Side of Road)

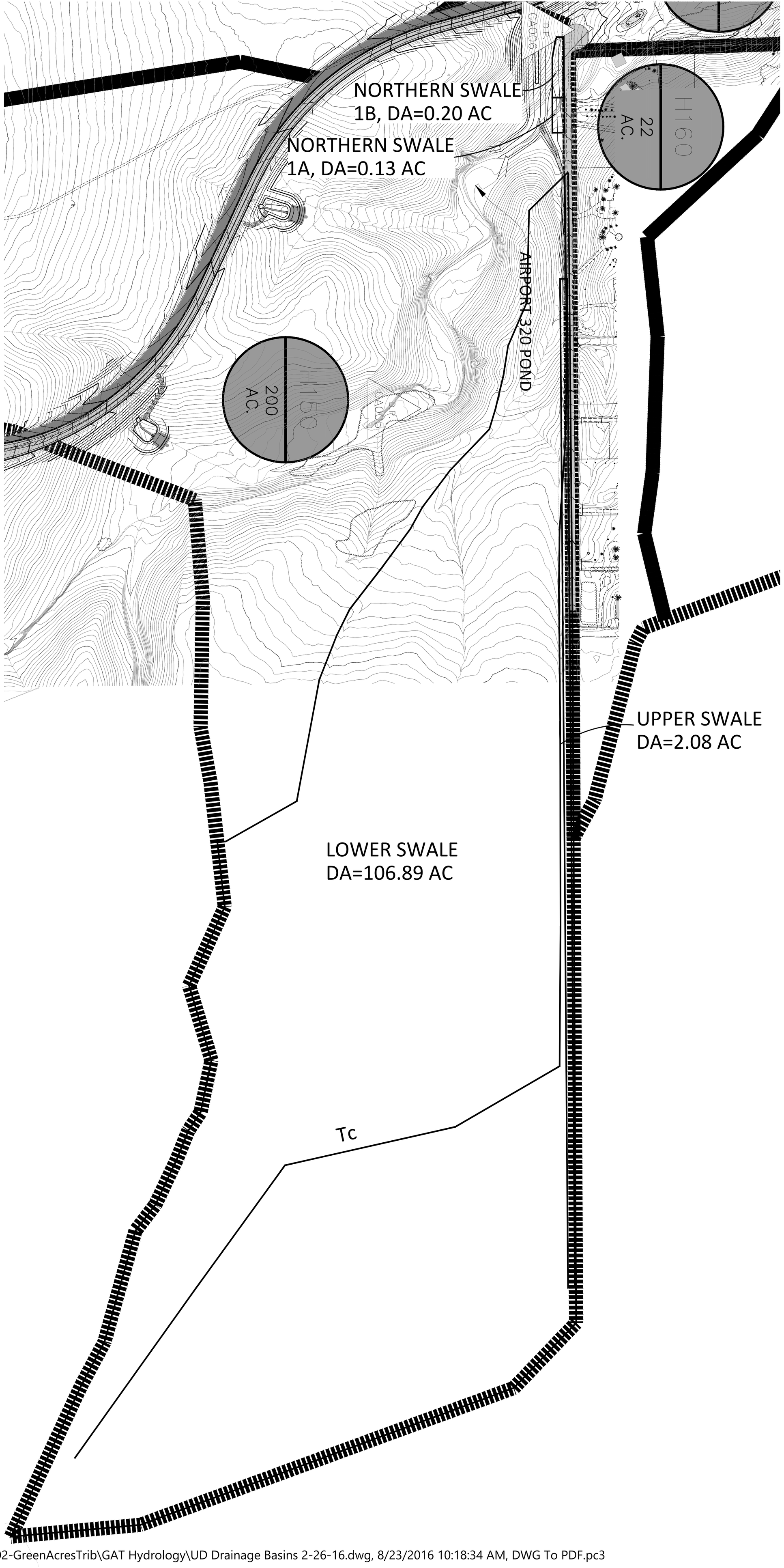
1. There are three parts to the roadside swale. The upper reach (southernmost section Sta 10+79.6-22+34)) is smaller and collecting mostly the road runoff. The lower reach (Sta 22+34-26+50) is the larger section to the north and collects a much larger drainage area. The northern most portion of the swale (Sta 27+50-29+27.5 and Sta 29+27.5-31+44.6) is the smallest drainage area and only includes the grassed area between the proposed berm adjacent to Green Acres Tributary and the edge of pavement of First Street.
2. The roadside swales were designed in accordance with Section 7.8, Rural Roadside Ditches of the Douglas County Storm Drainage Design and Technical Criteria Manual (DCSDDTCM).
    a. Minor storm within the channel
    b. Major storm at 6" depth at roadway crown
3. Drainage Areas are shown in attached sketch.
4. Runoff Calculations
    a. Drainage Area
        i. Upper = 2.08 Acres
        ii. Lower = 106.89 Acres
        iii. Northern 1A = 0.13 Acre
        iv. Northern 1B= 0.20 Acre
    b. Type B soil
    c. Tc
        i. Upper = 29 minutes
        ii. Lower = 40 minutes
        iii. Northern 1A & 1B = 10 minutes
    d. Rainfall Intensity (Zone 1) (Figure 6-2 from DCSDDTCM)
        i. Upper
            1. I100 = 4.1 in/hr
            2. I5 = 2.25 in/hr
        ii. Lower
            1. I100 = 3.5 in/hr
            2. I5 = 1.8 in/hr
        iii. Northern (1A & 1B)
            1. I100 = 7.0 in/hr
            2. I5 = 3.85 in/hr
    e. Undeveloped Coverage (Historical)
        i. Upper (50% Impervious)
            1. C100 = 0.70
            2. C5 = 0.53
        ii. Lower (2% Impervious) HSG B Soil — HSG A Soil
            1. C100 = 0.46 — C100 = 0.17
            2. C5 = 0.02 — C5 = 0.02
        iii. Northern (1A & 1B) (2% Impervious)
            1. C100=0.46
            2. C5 = 0.02

f. Developed Coverage
    i. Upper
        1. C100 = 0.70
        2. C5 = 0.53
    ii. Lower
        1. C100 = 0.51
        2. C5 = 0.3
    iii. Northern (1A & 1B)
        1. C100 = 0.46
        2. C5 = 0.02
g. Historic Runoff (Rational)
    i. Upper
        1. Q100 = 6.02 cfs
        2. Q5 = 2.5 cfs
    ii. Lower (HSG B Soil)
        1. Q100 = 172.09 cfs
        2. Q5 = 3.85 cfs

HSG A Soil
Q100 = 63.6 cfs
Q5 = 3.85 cfs

    iii. Northern 1A
        1. Q100 = 0.42 cfs
        2. Q5 = 0.01 cfs
    iv. Northern 1B
        1. Q100 = 0.64 cfs
        2. Q5 = 0.02 cfs
h. Developed Runoff (Rational)
    i. Upper
        1. Q100 = 6.02 cfs
        2. Q5 = 2.5 cfs
    ii. Lower
        1. Q100 = 190 cfs
        2. Q5 = 57.72 cfs
    iii. Northern 1A
        1. Q100 = 0.42 cfs
        2. Q5 = 0.01 cfs
    iv. Northern 1B
        1. Q100 = 0.64 cfs
        2. Q5 = 0.02 cfs

5. Channel Design
    a. The Flowmaster model was utilized to determine the velocity in the proposed swales (see attached)
    b. Channel Lining
        i. Upper = Grass Lined
        ii. Lower = Type M Rip Rap (d50 = 1')
        iii. Northern 1A & 1B = Grass Lined


NORTHERN SWALE
1B, DA=0.20 AC
NORTHERN SWALE
1A, DA=0.13 AC
H160
22
AC.
AIRPORT 320 POND
D.P.
GA006
H160
200
AC.
D.P.
GA005
UPPER SWALE
DA=2.08 AC
LOWER SWALE
DA=106.89 AC
Tc

First Street - Upper Channel Full Channel Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.02400	ft/ft
Normal Depth	0.63	ft

Section Definitions

Station (ft)	Elevation (ft)
0+23	5878.38
0+32	5875.84
0+34	5875.21
0+36	5875.21
0+38	5875.84
0+50	5876.08
0+50	5876.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+23, 5878.38)	(0+32, 5875.84)	0.030
(0+32, 5875.84)	(0+36, 5875.21)	0.040
(0+36, 5875.21)	(0+38, 5875.84)	0.040
(0+38, 5875.84)	(0+50, 5876.08)	0.011
(0+50, 5876.08)	(0+50, 5876.58)	0.011

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	7.59	ft³/s
Elevation Range	5875.21 to 5878.38 ft	

$Q_{5yr} = 2.5$ cfs

First Street - Upper Channel Full Channel Capacity

Results

Flow Area		2.52	ft²
Wetted Perimeter		6.66	ft
Hydraulic Radius		0.38	ft
Top Width		6.50	ft
Normal Depth		0.63	ft
Critical Depth		0.58	ft
Critical Slope		0.03373	ft/ft
Velocity		3.01	ft/s
Velocity Head		0.14	ft
Specific Energy		0.77	ft
Froude Number		0.85	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.63	ft
Critical Depth	0.58	ft
Channel Slope	0.02400	ft/ft
Critical Slope	0.03373	ft/ft

First Street - Upper Channel 100 yr Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02400	ft/ft
Discharge	6.02	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+23	5878.38
0+32	5875.84
0+34	5875.21
0+36	5875.21
0+38	5875.84
0+50	5876.08
0+50	5876.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+23, 5878.38)	(0+32, 5875.84)	0.030
(0+32, 5875.84)	(0+36, 5875.21)	0.040
(0+36, 5875.21)	(0+38, 5875.84)	0.040
(0+38, 5875.84)	(0+50, 5876.08)	0.011
(0+50, 5876.08)	(0+50, 5876.58)	0.011

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.57	ft
Elevation Range	5875.21 to 5878.38 ft	

Swale depth 0.63'

First Street - Upper Channel 100 yr Storm

Results

Flow Area		2.12	ft²
Wetted Perimeter		6.14	ft
Hydraulic Radius		0.35	ft
Top Width		6.00	ft
Normal Depth		0.57	ft
Critical Depth		0.52	ft
Critical Slope		0.03481	ft/ft
Velocity		2.84	ft/s
Velocity Head		0.12	ft
Specific Energy		0.69	ft
Froude Number		0.84	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.57	ft
Critical Depth	0.52	ft
Channel Slope	0.02400	ft/ft
Critical Slope	0.03481	ft/ft

First Street - Lower Channel Full Channel Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.02400	ft/ft
Normal Depth	1.75	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	5854.00
0+08	5852.00
0+13	5850.25
0+15	5850.25
0+22	5852.00
0+34	5852.24
0+34	5852.74

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5854.00)	(0+08, 5852.00)	0.030
(0+08, 5852.00)	(0+15, 5850.25)	0.040
(0+15, 5850.25)	(0+22, 5852.00)	0.040
(0+22, 5852.00)	(0+34, 5852.24)	0.011
(0+34, 5852.24)	(0+34, 5852.74)	0.011

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	78.66 ft³/s	$Q_{5yr} = 57.72$ cfs
Elevation Range	5850.25 to 5854.00 ft	

First Street - Lower Channel Full Channel Capacity

Results

Flow Area		14.00	ft²
Wetted Perimeter		14.51	ft
Hydraulic Radius		0.96	ft
Top Width		14.00	ft
Normal Depth		1.75	ft
Critical Depth		1.74	ft
Critical Slope		0.02449	ft/ft
Velocity		5.62	ft/s
Velocity Head		0.49	ft
Specific Energy		2.24	ft
Froude Number		0.99	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.75	ft
Critical Depth	1.74	ft
Channel Slope	0.02400	ft/ft
Critical Slope	0.02449	ft/ft

First Street - Lower Channel 100 yr Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02400	ft/ft
Discharge	190.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	5854.00
0+08	5852.00
0+13	5850.25
0+15	5850.25
0+22	5852.00
0+34	5852.24
0+34	5852.74

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 5854.00)	(0+08, 5852.00)	0.030
(0+08, 5852.00)	(0+15, 5850.25)	0.040
(0+15, 5850.25)	(0+22, 5852.00)	0.040
(0+22, 5852.00)	(0+34, 5852.24)	0.011
(0+34, 5852.24)	(0+34, 5852.74)	0.011

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	2.27 ft	Swale depth 1.75', crown 0.25'
Elevation Range	5850.25 to 5854.00 ft	26" @ crown 0.1C.

First Street - Lower Channel 100 yr Storm

Results

Flow Area		26.52	ft²
Wetted Perimeter		28.93	ft
Hydraulic Radius		0.92	ft
Top Width		28.12	ft
Normal Depth		2.27	ft
Critical Depth		2.45	ft
Critical Slope		0.01357	ft/ft
Velocity		7.16	ft/s
Velocity Head		0.80	ft
Specific Energy		3.06	ft
Froude Number		1.30	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.27	ft
Critical Depth	2.45	ft
Channel Slope	0.02400	ft/ft
Critical Slope	0.01357	ft/ft

Northern First Street Swale Calcs

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01360	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	0.64	ft³/s

Results

Normal Depth	0.31	ft
Flow Area	0.39	ft²
Wetted Perimeter	2.57	ft
Hydraulic Radius	0.15	ft
Top Width	2.50	ft
Critical Depth	0.28	ft
Critical Slope	0.02644	ft/ft
Velocity	1.64	ft/s
Velocity Head	0.04	ft
Specific Energy	0.35	ft
Froude Number	0.73	
Flow Type	Subcritical	

GVF Input Data

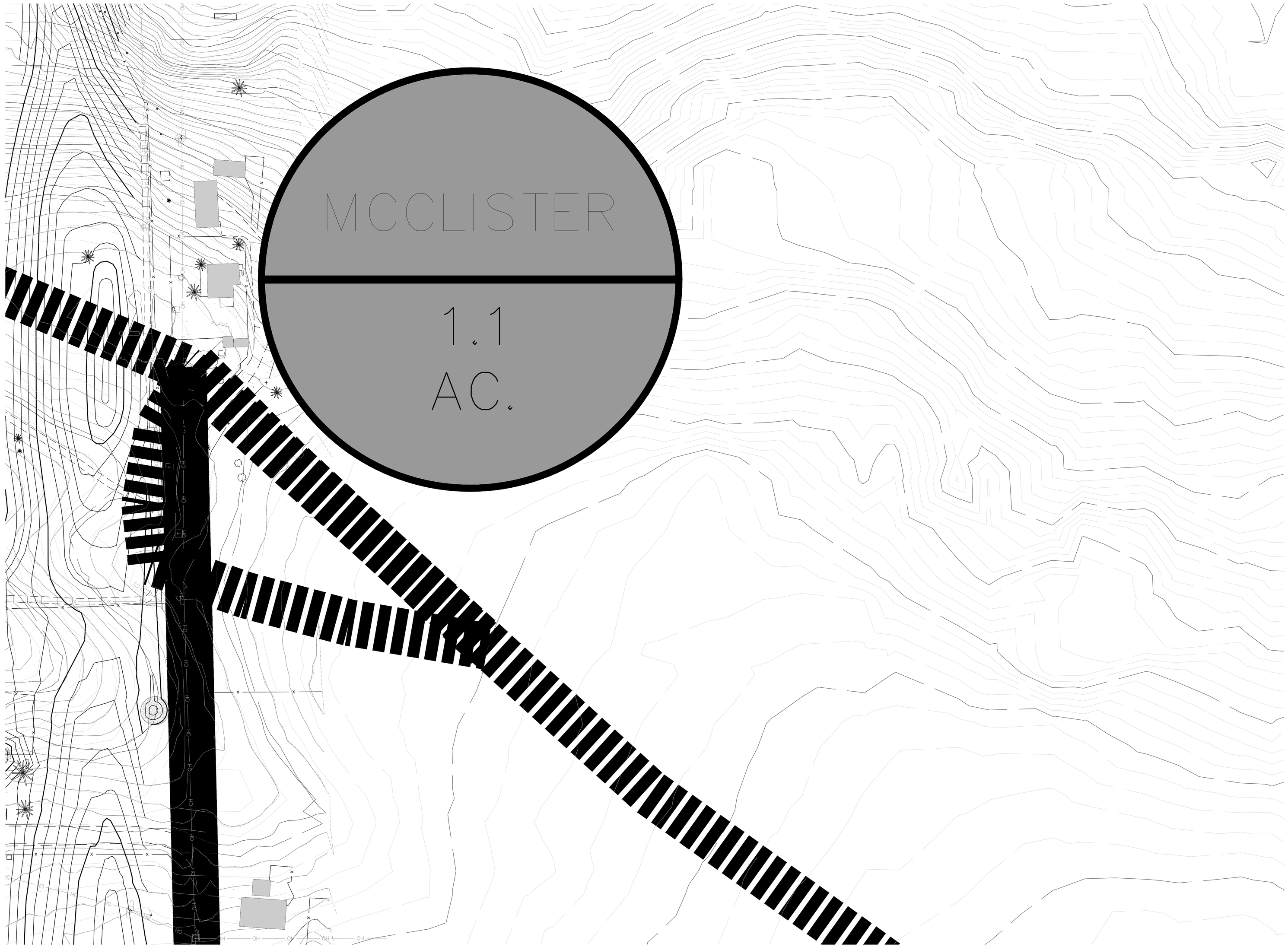
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.31	ft
Critical Depth	0.28	ft
Channel Slope	0.01360	ft/ft
Critical Slope	0.02644	ft/ft

McLISTER SWALE

The McLister property is located at the northwest corner of Drainage Basin H180. In order to keep storm water from flowing offsite, a swale has been designed to convey water from the McLister property into the proposed storm sewer system. Water is directed to a flared end structure, at which point it enters a storm line that serves Compark Village South, Filing No. 2 and Belford Ave. This storm water eventually outfalls into the E-470 Regional Pond.


MCCLISTER
1.1
AC.

COMPARK VILLAGE SOUTH TEMPORARY SWALES

There are two temporary swales that will be constructed as part of Drainage System 4 and Drainage System 5. These swales will convey the runoff from the culverts under the proposed berm along the southern property line to the proposed culverts under Belford Avenue. These swales will be replaced by an underground storm sewer system when the Compark Village South, Filing No. 2 project is developed.

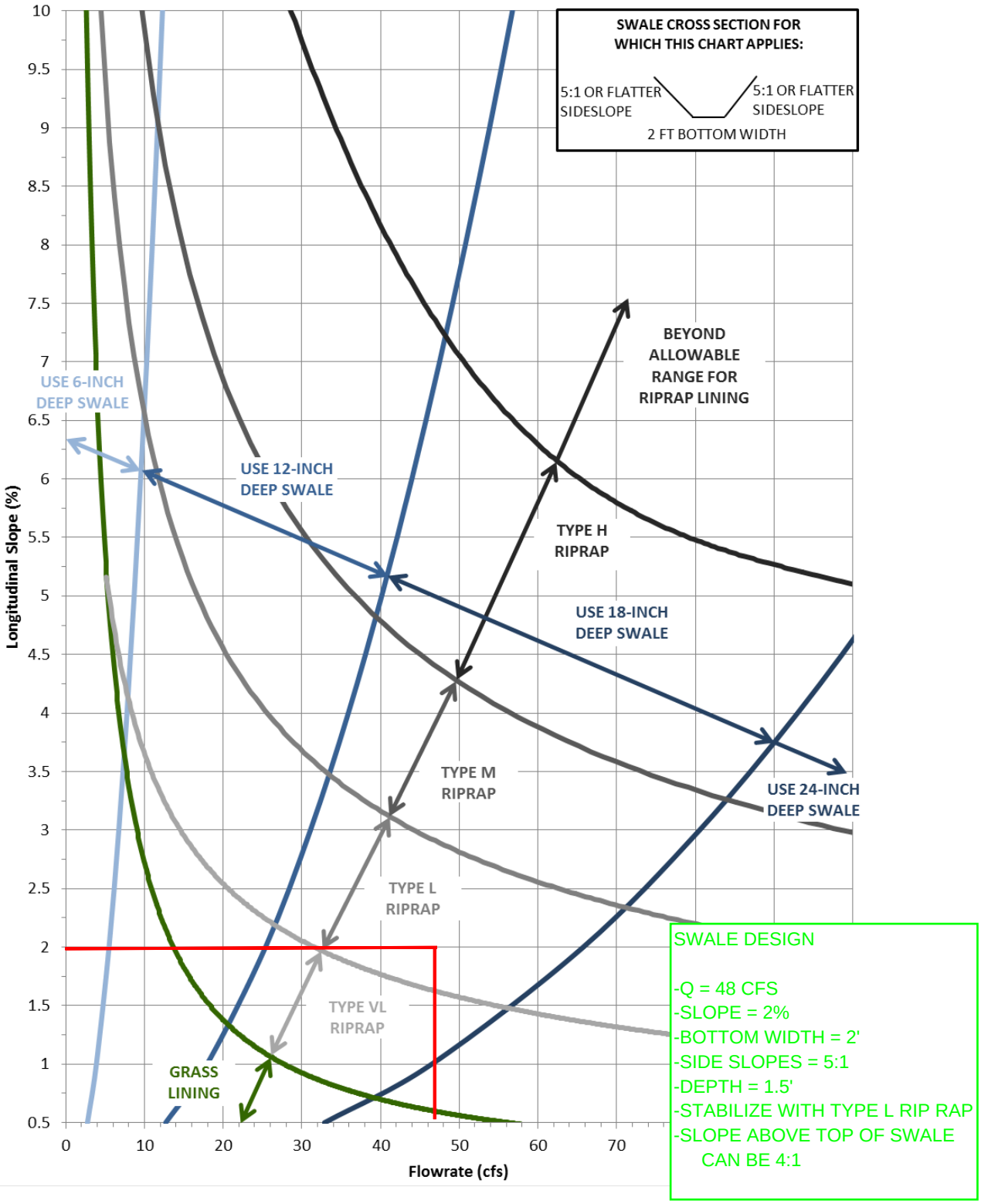


Figure 8-22. Swale stability chart; 2- to 4-foot bottom width and side slopes between 5:1 and 10:1
(Note: Riprap classifications refer to gradation for riprap used in soil riprap or void-filled riprap. See Figure 8-34 for gradations.) (Source: Muller Engineering Company)

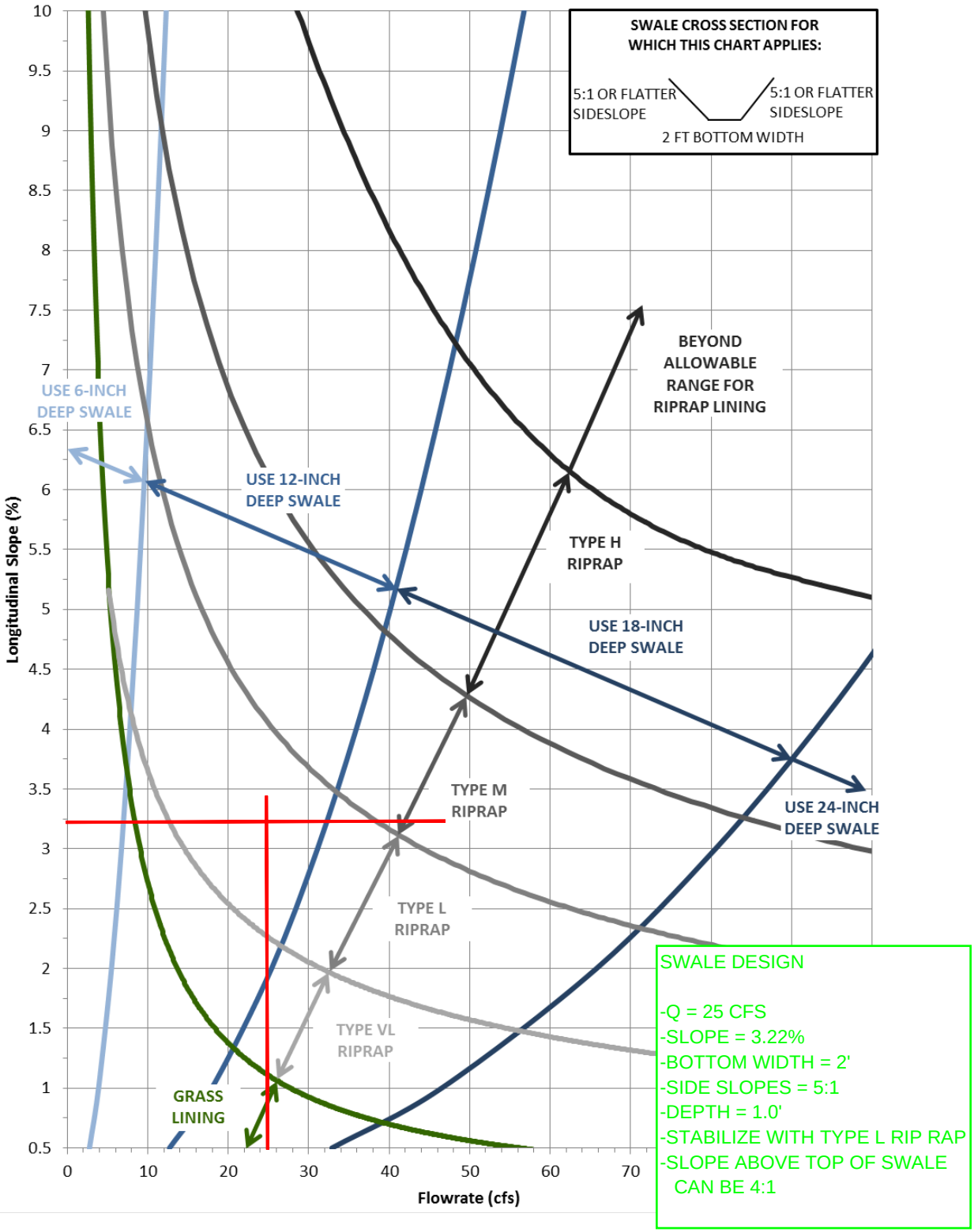


Figure 8-22. Swale stability chart; 2- to 4-foot bottom width and side slopes between 5:1 and 10:1
(Note: Riprap classifications refer to gradation for riprap used in soil riprap or void-filled riprap. See Figure 8-34 for gradations.) (Source: Muller Engineering Company)

BOTTOM OF BERM SWALE (NORTH SIDE)

A proposed swale will be constructed along the north side of the berm along the southern property line. This grassed swale will direct runoff eastward to a proposed flared end structure, at which point it enters a storm line that serves Compark Village South, Filing No. 2 and Belford Ave. This storm water eventually outfalls into the E-470 Regional Pond.

SWALE AT BASE OF BERM ALONG SOUTH PL

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Normal Depth	1.00	ft
Left Side Slope	0.20	ft/ft (H:V)
Right Side Slope	0.20	ft/ft (H:V)
Bottom Width	2.00	ft

Results

Discharge	7.27	ft^3/s
Flow Area	2.20	ft^2
Wetted Perimeter	4.04	ft
Hydraulic Radius	0.54	ft
Top Width	2.40	ft
Critical Depth	0.72	ft
Critical Slope	0.02605	ft/ft
Velocity	3.30	ft/s
Velocity Head	0.17	ft
Specific Energy	1.17	ft
Froude Number	0.61	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.00	ft
Critical Depth	0.72	ft
Channel Slope	0.01000	ft/ft

SWALE AT BASE OF BERM ALONG SOUTH PL

GVF Output Data

Critical Slope	0.02605	ft/ft

TEMPORARY SWALE EAST OF STREET E

A temporary proposed swale will be constructed along the east side of Street E. This grassed swale will direct runoff from the Compark Village South, Filing No. 2 rough grading northward to a proposed flared end structure, at which point it enters a storm line that directly discharges to the E-470 Regional Detention/Water Quality Pond. During future development of Belford Avenue, this swale will be replaced with an underground storm sewer system.

Temp Swale East of Street E - Top

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01000	ft/ft
Left Side Slope	0.20	ft/ft (H:V)
Right Side Slope	0.20	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	9.80	ft^3/s

Results

Normal Depth	0.79	ft
Flow Area	3.29	ft^2
Wetted Perimeter	5.62	ft
Hydraulic Radius	0.59	ft
Top Width	4.32	ft
Critical Depth	0.57	ft
Critical Slope	0.02837	ft/ft
Velocity	2.98	ft/s
Velocity Head	0.14	ft
Specific Energy	0.93	ft
Froude Number	0.60	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.79	ft
Critical Depth	0.57	ft
Channel Slope	0.01000	ft/ft

Temp Swale East of Street E - Top

GVF Output Data

Critical Slope	0.02837	ft/ft

Temp Swale East of Street E - Bottom

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.050	
Channel Slope	0.10000	ft/ft
Left Side Slope	0.20	ft/ft (H:V)
Right Side Slope	0.20	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	9.80	ft³/s

Results

Normal Depth	0.48	ft
Flow Area	1.95	ft²
Wetted Perimeter	4.97	ft
Hydraulic Radius	0.39	ft
Top Width	4.19	ft
Critical Depth	0.57	ft
Critical Slope	0.05791	ft/ft
Velocity	5.03	ft/s
Velocity Head	0.39	ft
Specific Energy	0.87	ft
Froude Number	1.30	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.48	ft
Critical Depth	0.57	ft
Channel Slope	0.10000	ft/ft

Temp Swale East of Street E - Bottom

GVF Output Data

Critical Slope	0.05791	ft/ft

APPENDIX K

Detention Pond Water Rights/Accounting Requirements

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016

BBA water consultants

BISHOP-BROGDEN ASSOCIATES, INC.

Christopher J. Sanchez
Jeffrey A. Clark
Daniel O. Niemela
Jonathan D. George
Michael A. Sayler
Charles E. Stanzione

May 18, 2016

Mr. Rick Moore
Senior Project Manager
Manhard Consulting
By email only: rmoore@manhard.com

RE: Green Acres Tributary Pond – Water Supply Plan and Compliance

Dear Rick:

The purpose of this letter is to describe the water supply plan and regulatory framework for the planned Green Acres tributary pond (the Pond). The Pond is a detention facility with a planned permanent pool of water and a recirculating pump system intended to create a flowing stream entering the pond. The Pond is located on an intermittent drainage tributary to Happy Canyon Creek, which is a tributary to Cherry Creek.

Water Supply Source

A water supply source for the pond is needed to maintain the water level in the pond and to replace evaporative losses. The planned water supply source is a potable water tap from a municipal provider. At a later date, the developer may opt to construct a water supply well and utilize a ground water source as the water supply instead of the potable tap.

Regulatory Framework

Given the planned recirculating pump operations in the Pond, the proposed pond does not fall under the allowable exemptions for detention facilities. According to South Platte Basin Reservoir Accounting Guidelines, the proposed detention pond / water feature is considered an on-stream reservoir and will need to follow specific accounting procedures to ensure that water is not stored out of priority and that senior water rights are not injured. Detailed accounting procedures will be required and will generally entail quantification of inflows, outflows, evaporative losses, daily stage readings, and storage that is owed to the river. We contacted the State Engineer's Office and learned that with the use of detailed accounting, it should be feasible to operate the pond without a water rights augmentation plan. However, the administrative classification of the pond will be

subject to the determination of the Division Engineer's Office, and it is possible that they may determine that an augmentation plan is needed. If that occurs, then the developer will pursue an augmentation plan, as needed. It is our opinion that an augmentation plan should not be needed for the pond as long as the Pond is operated in accordance with the South Platte Basin Reservoir Accounting Guidelines. Operation under the Reservoir Accounting Guidelines is adequate to ensure that other water rights will not be injured.

If you have questions or comments, please do not hesitate to call.

Very truly yours,

BISHOP-BROGDEN ASSOCIATES, INC.

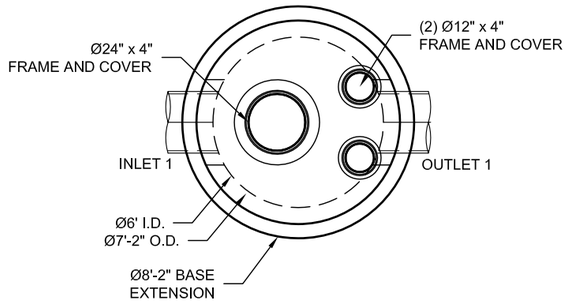
Christopher J. Sanchez, P.G.
Principal

CJS/jeb
cc: Mike Vickers - mvickers@mpvcompark.com
9822.00

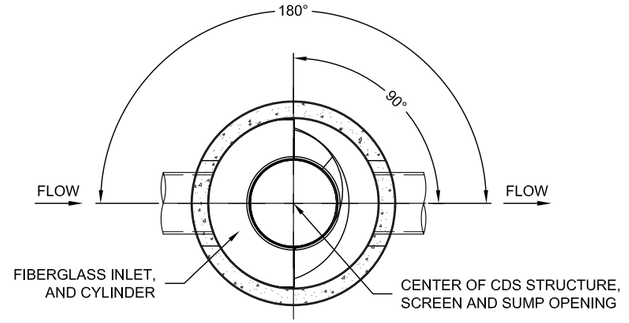
APPENDIX L

Water Quality Structures' Design

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016

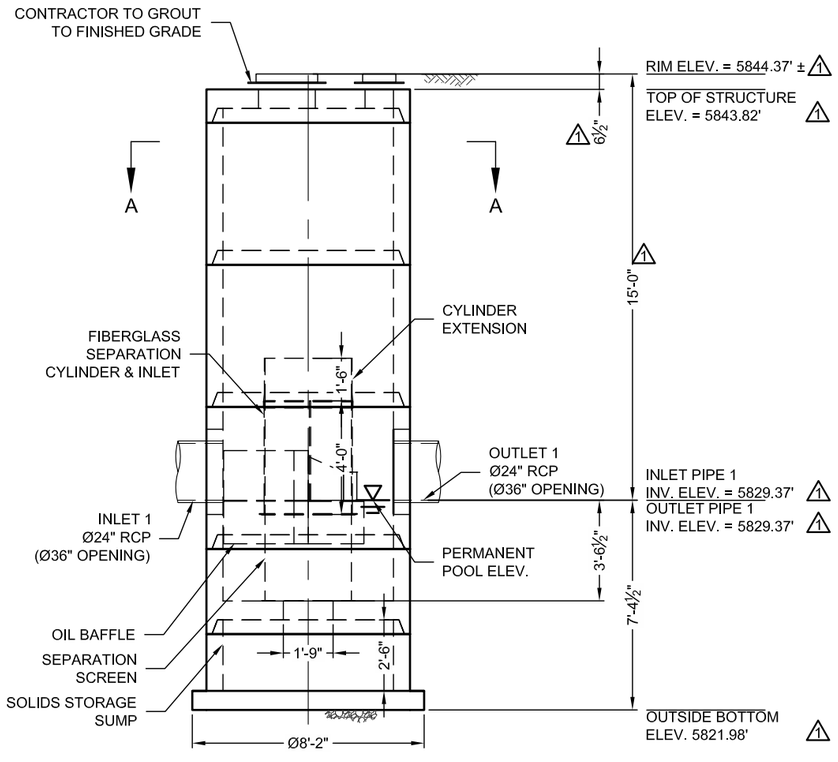


PLAN VIEW



SECTION A-A

● INTERNAL COMPONENTS TO BE INSTALLED BY CONTECH ON SITE



ELEVATION VIEW

MATERIAL LIST (PROVIDED BY CONTECH)

COUNT	DESCRIPTION	INSTALLED BY
1	FIBERGLASS INLET AND CYLINDER	CONTECH
1	2400 micron, 3' O.D. x 3.04' SEP. SCREEN	CONTECH
1	CYLINDER EXTENSION	CONTRACTOR
1	SEALANT FOR JOINTS (BY PRECASTER)	CONTRACTOR
1	Ø24" x 4" FRAME & COVER, EJ#41600389, OR EQUIV.	CONTRACTOR
2	Ø12" x 4" FRAME & COVER, EJ#41610201, OR EQUIV.	CONTRACTOR

SITE DESIGN DATA

WATER QUALITY FLOW RATE	0 CFS
PEAK FLOW RATE	29.2 CFS
RETURN PERIOD OF PEAK FLOW	100 YRS

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO HS-20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
6. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

1 STRUCTURE WEIGHT
APPROXIMATE HEAVIEST PICK = 10000 LBS.
STRUCTURE IS DELIVERED IN 6 PIECES

MAX FOOTPRINT = Ø8'-2"

CONTECH
CONTRACT
DRAWING

LPICO
LAYOUT 1A
3030-6-FGIS
1026 / FI72886

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MARK	DATE	REVISION DESCRIPTION	BY
1	7/28/16	IN/OUTLET & RIM ELEVATIONS	KJW

CDS3030-6-C - 542946-10
COMPARK SOUTH
PARKER, CO
for SYSTEM: STMH 1-3

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
2201 W. Royal Lane, Suite 280, Irving, TX 75063
972-580-2000 972-580-2039 FAX

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 7,789,948;7,704,7,297,7,625,7,351,285;7,425,783; 8,557,104;8,802,001;8,673,153;8,124,059;8,470,173;8,475,674; 8,512,560;8,431,001;8,057,675;8,974,674.

DATE:	SCALE:
07/15/16	3/16" = 1'-0"
DESIGNED: JHR	DRAWN: KJW
CHECKED: XXX	APPROVED: ----
PROJECT No.: 542946	SEQUENCE No.: 10
SHEET: 1 OF 1	

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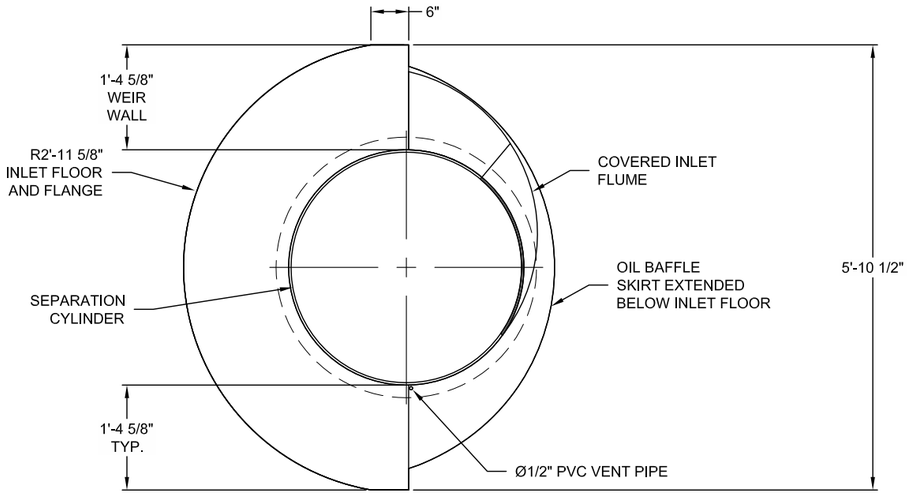
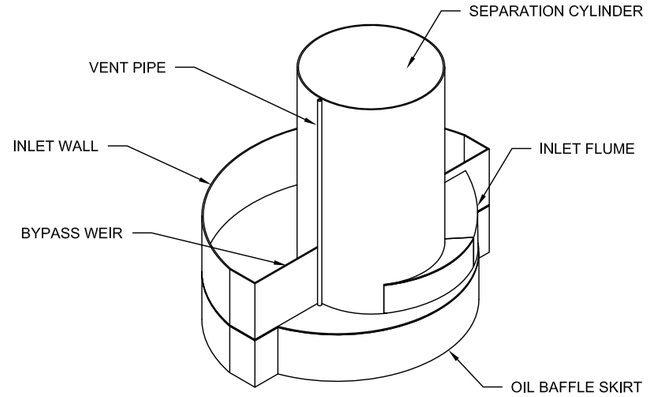
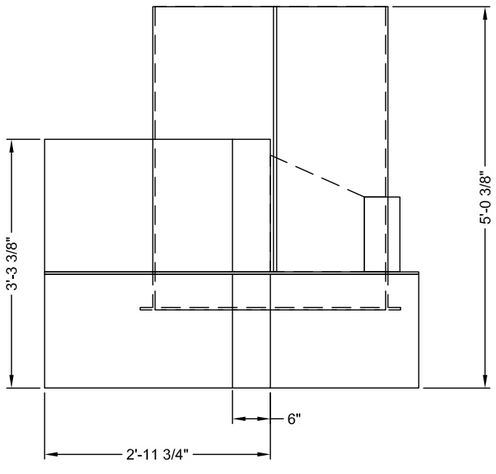


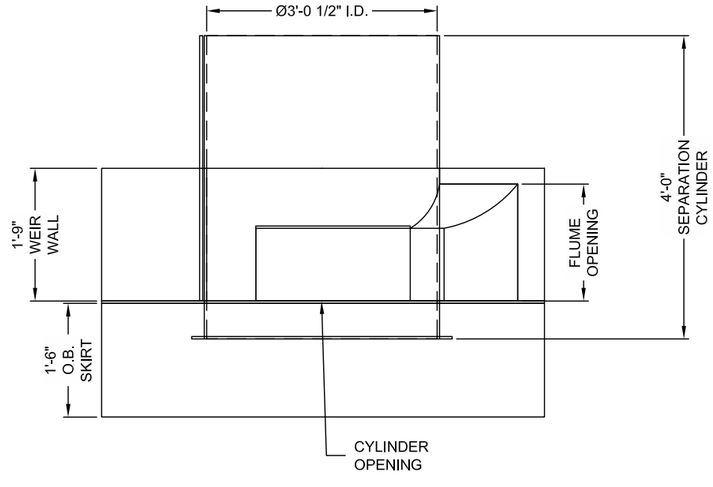
PLAN VIEW



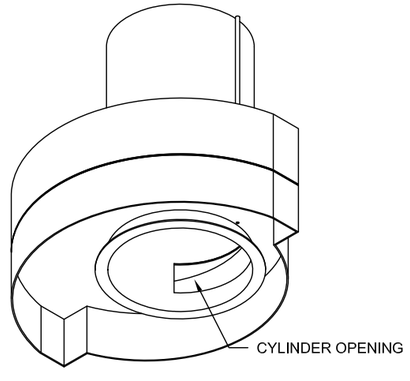
ASSEMBLY TOP VIEW
N.T.S.



ELEVATION VIEW



SIDE VIEW



ASSEMBLY BOTTOM VIEW
N.T.S.

CONTECH
FABRICATION
DRAWING

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MARK	DATE	REVISION DESCRIPTION	BY

CDS3030-6-C - 542946-10
COMPARK SOUTH
PARKER, CO
for SYSTEM: STMH 1-3

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DATE:	SCALE:
07/15/16	1/2" = 1'-0"
DESIGNED: JHR	DRAWN: KJW
CHECKED: XXX	APPROVED: ----
PROJECT No.: 542946	SEQUENCE No.: 10
SHEET: 1 OF 1	

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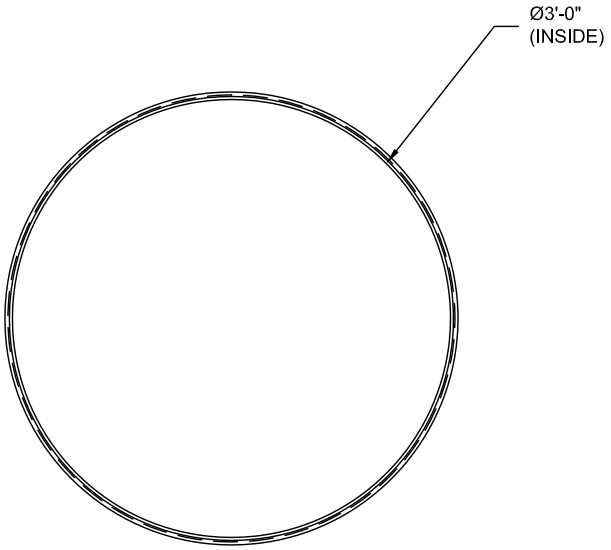
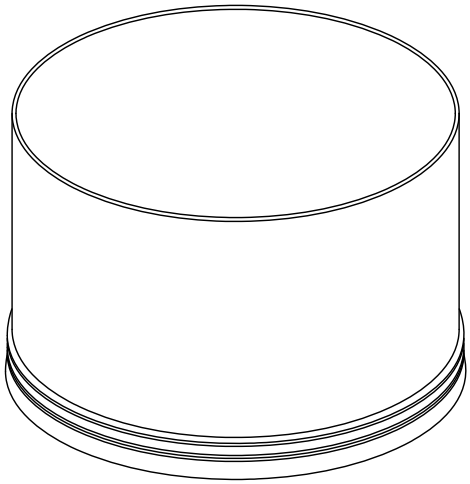
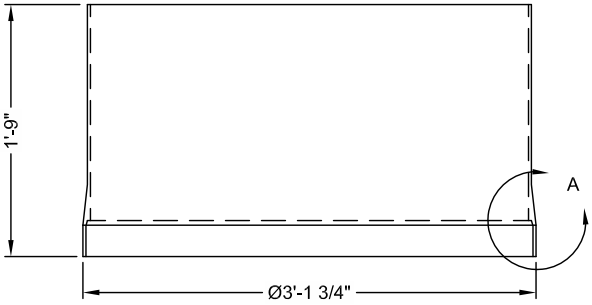


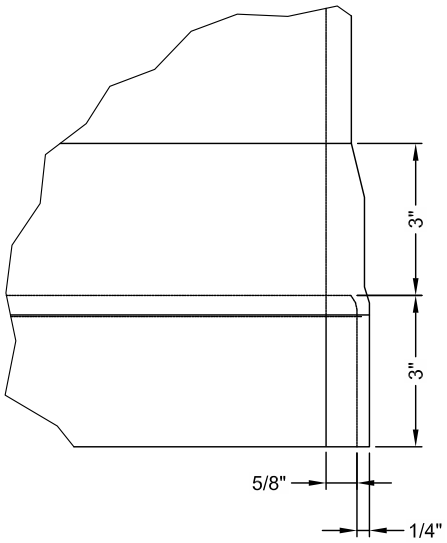
PLAN VIEW



ISOMETRIC VIEW



ELEVATION VIEW



DETAIL A
SCALE 3/16

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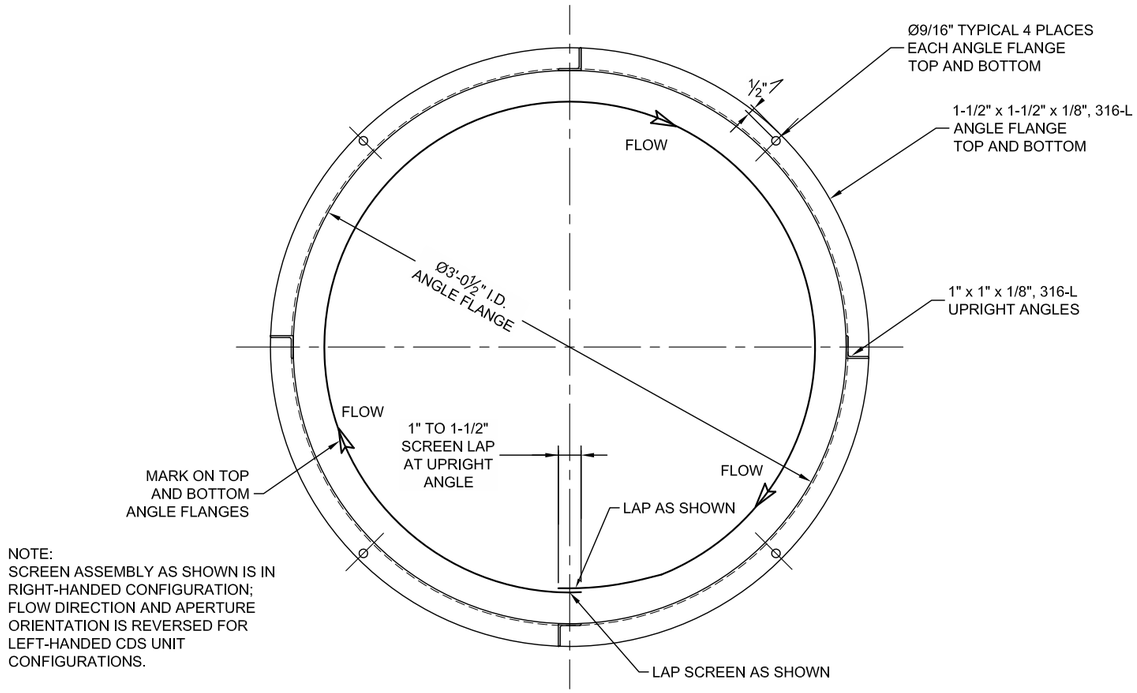
CDS3030-6-C - 542946-10, CYLINDER EXTENSION DETAILS
COMPARK SOUTH
PARKER, CO
for SYSTEM: WQ UNIT #1

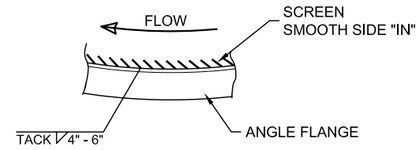
DATE:07/15/16	SCALE: 3/4" = 1'-0"	PROJECT No.: 542946	SEQ. No.: 10	DRAWN: KJW	CHECKED: XXX

I:\MERLIN\PROJECTVACTIVE\542900\542946\542946-10-CDS\DRAWINGS\PRE-542946-10-CDS3030-6 CONFAB.DWG 7/15/2016 10:19 AM

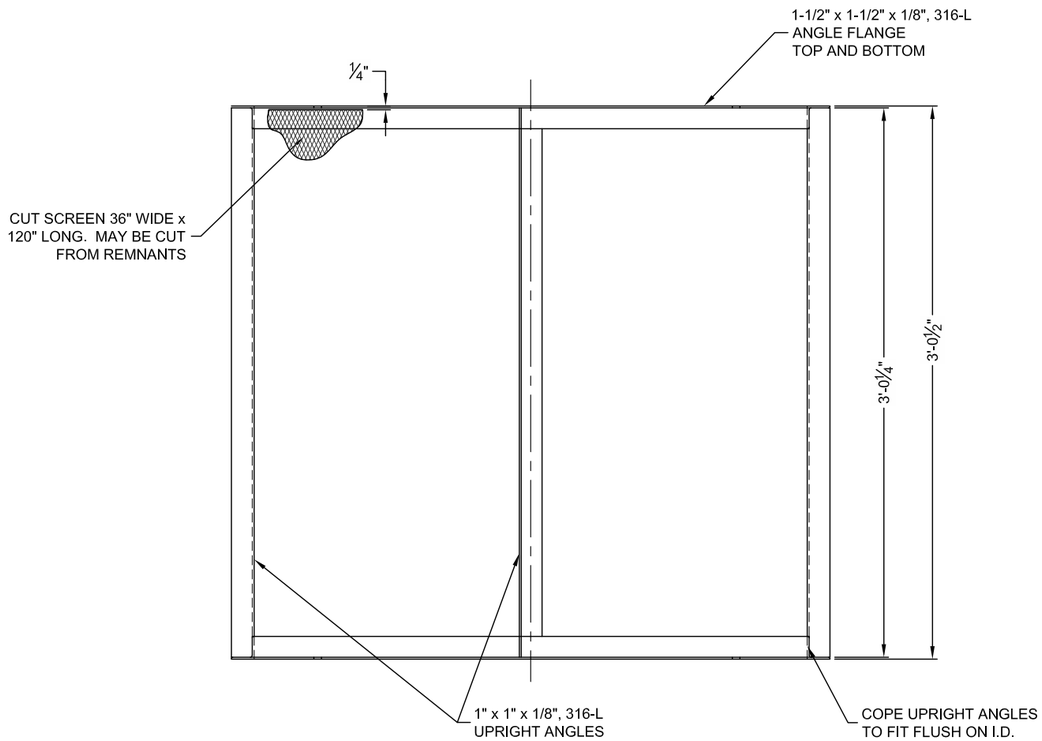


NOTE:
SCREEN ASSEMBLY AS SHOWN IS IN RIGHT-HANDED CONFIGURATION; FLOW DIRECTION AND APERTURE ORIENTATION IS REVERSED FOR LEFT-HANDED CDS UNIT CONFIGURATIONS.

PLAN VIEW



SCREEN DETAIL
TOP VIEW



ELEVATION VIEW

GENERAL NOTES:

1. ALL MATERIAL IS 316-L STAINLESS
2. SCREEN SHALL BE STAINLESS STEEL EXPANDED METAL CONFORMING TO ASTM 1267-01.
3. SCREEN APERTURE SIZE SHALL BE EITHER 4700 MICRON OR 2400 MICRON PER PROJECT ORDER.
4. TOP AND BOTTOM FLANGES MUST BE ROUND, FLAT, PARALLEL AND PLUM.
5. UPRIGHT ANGLES MUST BE PLUM AND SQUARE
6. STRAIGHTEN TOP AND BOTTOM FLANGES PRIOR TO ASSEMBLY OF FRAME.
7. FLATTEN ENDS OF SCREEN TO TOP AND BOTTOM ANGLE FLANGES PRIOR TO WELDING.
8. SCREEN IS TACK WELDED TO FRAME @ 4" CENTERS WITH SMOOTH SIDE ON INSIDE.
9. WIPE ANGLE FLANGES CLEAN AND PAINT:
   - CLOCKWISE END "GREEN" (RIGHT HAND FLOW).
   - COUNTER-CLOCKWISE END "RED" (LEFT HANDED FLOW).
10. FLANGE PAINTED GREEN ON TOP FOR RIGHT-HANDED CONFIGURATION.
11. FLANGE PAINTED RED ON TOP FOR LEFT-HANDED CONFIGURATION.
12. FABRICATOR TO SUPPLY THE FOLLOWING STAINLESS STEEL HARDWARE. SIZE AND QUANTITY OF ANCHORS AS INDICATED ON PROJECT ORDER.
    - FOR EACH 3/8" ANCHOR REQUIRED:
      (1) 3/8" X 2-3/4" ANCHOR
      (1) 3/8" NUT
      (1) 3/8" LOCKWASHER
      (1) 3/8" FLAT WASHER
    - FOR EACH 1/2" BOLT REQUIRED:
      (1) 1/2" X 1-1/2" BOLT
      (1) 1/2" NUT
      (1) 1/2" LOCKWASHER
      (2) 1/2" FLAT WASHERS

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MARK	DATE	REVISION DESCRIPTION	BY

CDS3030
SCREEN ASSEMBLY DETAILS

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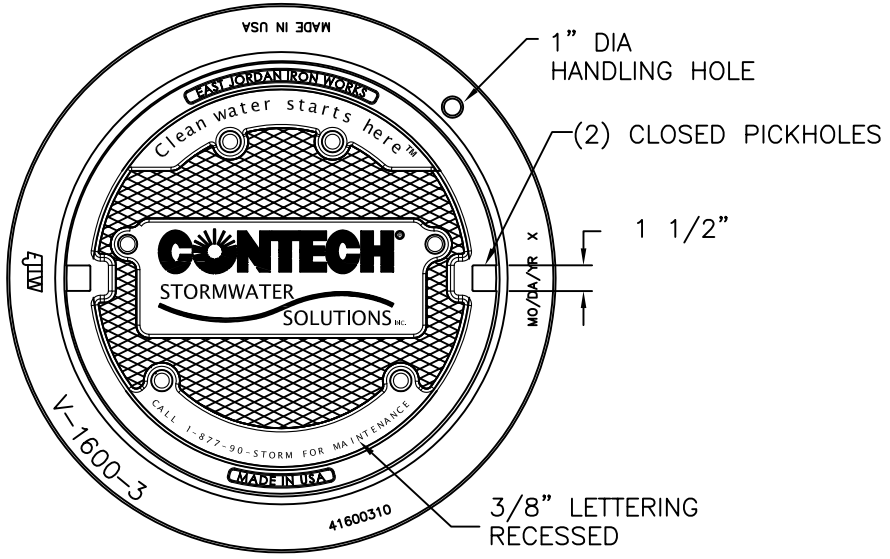
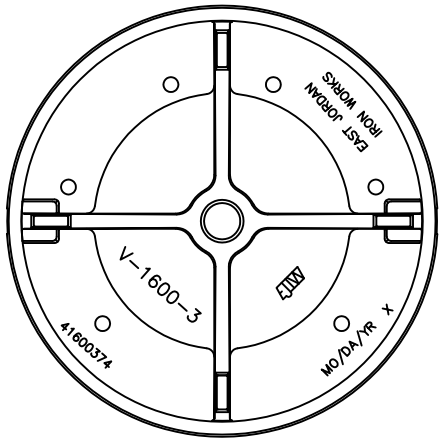
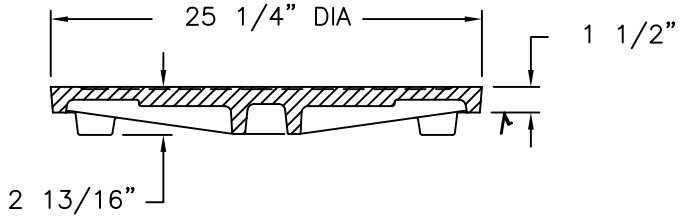
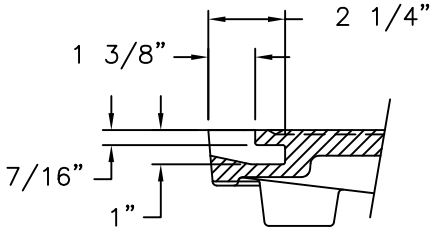




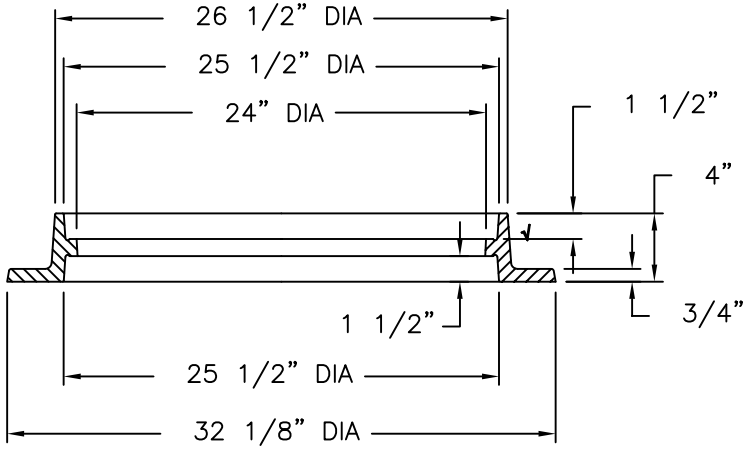
COVER BACK



COVER SECTION



PICKHOLE DETAIL



RING SECTION

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EJIW EAST JORDAN IRON WORKS EST.1883

800-626-4653
www.ejiw.com
MADE IN USA

PRODUCT NUMBER
41600389

CATALOG NUMBER
V1600-3

REVERSIBLE RING & COVER ASSEMBLY

LOAD RATING
HEAVY DUTY HS-20

COATING
UNDIPPED

ESTIMATED WEIGHT
COVER: 135 LBS
RING: 120 LBS
UNIT: 255 LBS

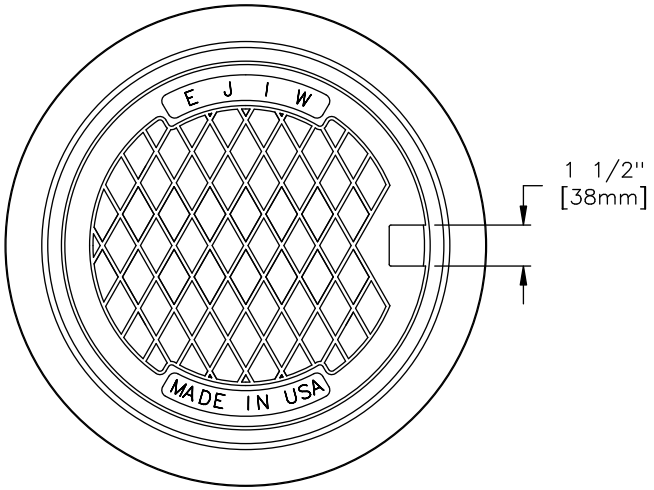
MATERIAL SPECIFICATION
RING – GRAY IRON ASTM A48 CL35B
COVER – GRAY IRON ASTM A48 CL35B

OPEN AREA
N/A

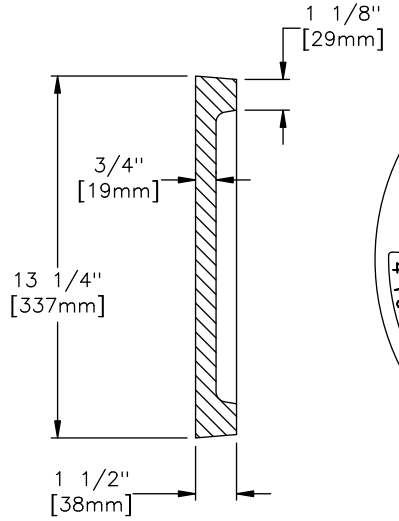
√DESIGNATES MACHINE SURFACE

DRAWN	DATE
DEW	05/02/08
LAST REVISED	DATE

REFERENCE INFORMATION
41600310
41600374



RING BOTTOM FLANGE



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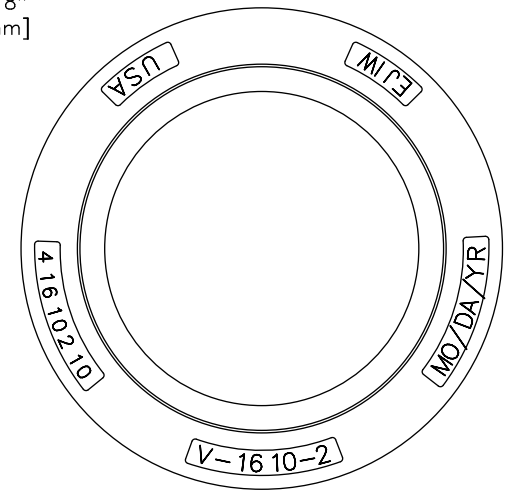
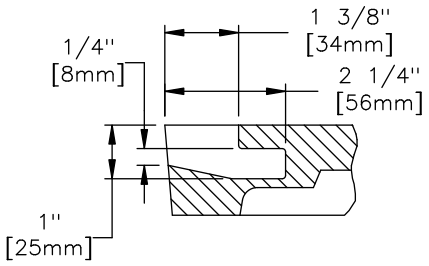
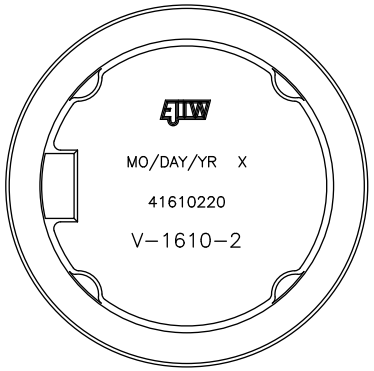


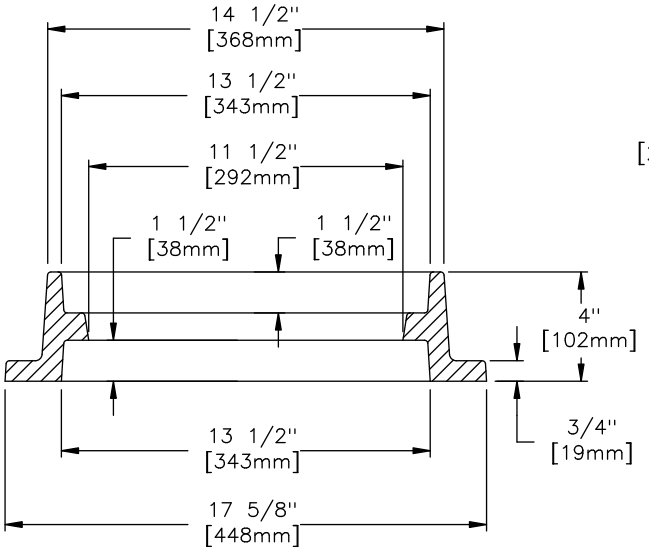
RING TOP FLANGE



PICKHOLE DETAIL



COVER BACK



RING SECTION

NOTE:
RING IS REVERSIBLE AND CAN BE INSTALLED AS A TOP FLANGE UNIT

EAST JORDAN IRON WORKS, INC.
P.O. BOX 439
EAST JORDAN, MI. 49727
1-800-874-4100
FAX 231-536-4458

DRAWN	DATE
DAL	06/12/03
APPROVED	DATE

ASSEMBLY

PRODUCT NO.

41610201

CATALOG NO.

V-1610-2

REF. SALES DRAWING
41610210
41610220

EST. WT.
COVER: 36 LBS 16kg
RING: 45 LBS 20kg
TOTAL: 81 LBS 37kg

OPEN AREA
N/A

MAT'L SPEC.
COVER – GRAY IRON
ASTM A48 CL35B
RING – GRAY IRON
ASTM A48 CL35B

LOAD RATING

HEAVY DUTY

INLINE HYDRAULIC CALCULATIONS

COMPARK SOUTH
PARKER, CO
542946-10

DESIGN PARAMETERS

CDS Model No. =	CDS3030	
Design Treatment Flow =	**3.0**	cfs
Peak Design Flow =	29.20	cfs
Peak Design Return Interval =	100	year
Rim Elevation @ US Structure	5843.08	ft

DETAILED CALCULATIONS

TREATMENT FLOW

Tailwater Condition at Outfall, EL_0

EL_0 = 5,830.16 ft (invert plus depth of flow at D/S outlet)

Exit Loss from DownStream Pipe, h_1

$h_1 = k * [V^2 / (2*g)]$

where,

k = 1.00

$V = Q / A_F$

= 7.48 fps

h_1 = 0.87 ft

$EGL_1 = EL_0 + h_1$

= 5831.03 ft

Head Loss Through Downstream Pipe, h_2

Friction Losses, h_2

$h_2 = S_{EGL} * L$

where,

L = 12 ft

$S_{EGL} = [(Q * n) / (1.49 * A_F * R^{2/3})]^2$

where,

Pipe Characteristics

Dia. =	24	in
S_{PIPE} =	0.0310	ft/ft
n =	0.013	

Flow Characteristics

d_F =	0.37	ft
A_F =	0.40	sf
P_W =	1.78	ft
R =	0.23	ft

Head Loss Through Downstream Pipe, h_2 (cont.'d)

S_{EGL} = 0.03112 ft / ft

h_2 = 0.3734 ft

EGL_2' = $EGL_1 + h_2$
= 5831.40 ft

Check Entrance Condition for Critical Depth Control

$EL_{CDS\ Inv.}$ = 5830.16 ft

d_c = 0.61 ft

EGL_C = $EL_{CDS\ Inv.} + d_c + V_{dc}^2 / (2*g)$
= 5830.98 ft

Identify Controling EGL

Flow enters pipe at critical depth, EGLc controls.
EGL_2 = 5830.98 ft

Re-entry Loss into DownStream Pipe, h_3

$h_3 = k * [V^2 / (2*g)]$

where,

k = 0.20
V = Q / A
= 3.69 fps (area based on critical depth)

h_3 = 0.04 ft

EGL_3' = $EGL_2 + h_3$
= 5831.03 ft

Oil Baffle Loss, h_4

$h_4 = k * [V^2 / (2*g)]$

where,

k = 1.00
A_{Baffle} = **6.49** sf
V = Q / Abaffle
= 0.46 fps

h_4 = 0.0033 ft

EGL_4 = $EGL_3 + h_4$
= 5831.03 ft

Check Standard Weir Elevation

HL_{CDS} = 0.67 ft

EL_W' = $EGL_4 + HL_{CDS}$
= 5831.70 ft

H_W' = $EL_W' - EL_{CDS\ INV.}$
= 1.54 ft, or 18.46 in

Std. Weir Height = 21 in
Status **OK**

Use H_W = **21** in, or 1.75 ft

EL_W = $EL_{CDS\ INV.} + H_W$
= 5831.91 ft

PEAK CONVEYANCE FLOW

Tailwater Condition at Outfall, EL_0

EL_0 = **5,830.90** ft (tailwater condition per engineer, 100-yr)

Exit Loss from DownStream Pipe, h_1

$h_1 = k * [V^2 / (2*g)]$

where,

k = 1.00

$V = Q / A_F$

= 13.89 fps

h_1 = 2.99 ft

$EGL_1 = EL_0 + h_1$

= 5833.89 ft

Head Loss Through Downstream Pipe, h_2

Friction Losses, h_2

$h_2 = S_{EGL} * L$

where,

L = 12 ft

$S_{EGL} = [(Q * n) / (1.49 * A_F * R^{2/3})]^2$

where,

Pipe Characteristics

Dia. = 24 in

S_{PIPE} = 0.0310 ft/ft

n = 0.013

Flow Characteristics

d_n = 1.27 ft

A_F = 2.10 sf

P_W = 3.69 ft

R = 0.57 ft

S_{EGL} = 0.0310 ft / ft

h_2 = 0.37 ft

$EGL_2' = EGL_1 + h_2$

= 5834.27 ft

Check Entrance Condition for Critical Depth Control

$EL_{CDS\ Inv.}$ = 5830.16 ft

d_c = 1.91 ft

$EGL_C = EL_{CDS\ Inv.} + d_c + V_{dc}^2 / (2*g)$

= 5833.46 ft

Identify Controling EGL

Flow enters pipe at critical depth, EGLc controls.

EGL_2 = 5833.46 ft

Re-entry Loss into DownStream Pipe, h_3

$h_3 = k * [V^2 / (2*g)]$

where,

$k =$ 0.20

$V = Q / A_F$

$=$ 9.46 fps (area based on critical depth)

$h_3 =$ 0.28 ft

$EGL_3 = EGL_2 + h_3$

$=$ 5833.73 ft

Oil Baffle Loss, h_4

$h_4 = k * [V^2 / (2*g)]$

where,

$k =$ 0.00 (Skirted-baffle model)

$A_{Baffle} =$ 6.49 sf

$V = Q / A_{Baffle}$

$=$ 4.50 fps

$h_4 =$ 0.00 ft

$EGL_4 = EGL_3 + h_4$

$=$ 5833.73 ft

$HGL_4 = EGL_4 - [V_P^2 / (2*g)]$

$=$ 5832.35 ft

Head over Diversion Weir, h_5

Elevation of Weir

$EL_{Weir} =$ 5831.91 ft (established above)

Headloss for Free Discharge Condition

$h_{5a} = [Q / (C * L)]^{2/3}$

where,

$C =$ 3.1

$L =$ 3.00 ft

$h_{5a} =$ 2.14 ft

$EGL_{5a} = EL_{Weir} + h_{5a}$

$=$ 5834.05 ft

Headloss for Submerged Condition

$d_{Sub} =$ 0.44 ft (depth of submergence)

$h_{5b} =$ 1.76 ft (separate submerged weir calc.)

$EGL_{5b} = EGL_4 + h_{5b}$

$=$ 5835.50 ft

Identify EGL U/S of Weir

The discharge condition is Submerged, therefore

$EGL_5 =$ 5835.50 ft

Expansion Loss from U/S Pipe, h_6

$h_6 = k * [V^2 / (2*g)]$

where,

$k =$ 0.30

$V = Q / A_F$

$=$ 9.30 fps

$h_6 =$ 0.40 ft

$EGL_6 = EGL_5 + h_6$

$=$ 5835.90 ft

Head Loss Through Upstream Pipe, h_7

Friction Losses, h_7

$h_7 = S_{EGL} * L$

where,

$L =$ 18 ft

$S_{EGL} = [(Q * n) / (1.49 * A_F * R^{2/3})]^2$

where,

Pipe Characteristics

Dia. = 24 in

$S_{PIPE} =$ 0.0310 ft/ft

$n =$ 0.013

Flow Characteristics

$d_n =$ 2.00 ft

$A_F =$ 3.14 sf

$P_W =$ 6.28 ft

$R =$ 0.50 ft

$S_{EGL} =$ 0.0166 ft / ft

$h_7 =$ 0.30 ft

$EGL_7' = EGL_6 + h_7$

$=$ 5836.20 ft

Check Entrance Condition for Critical Depth Control

$EL_{U/S\ Inv.} =$ 5830.72 ft

$d_c =$ 1.91 ft

$EGL_C = EL_{CDS\ Inv.} + d_c + V_{dc}^2 / (2*g)$

$=$ 5834.01 ft

Identify Controling EGL

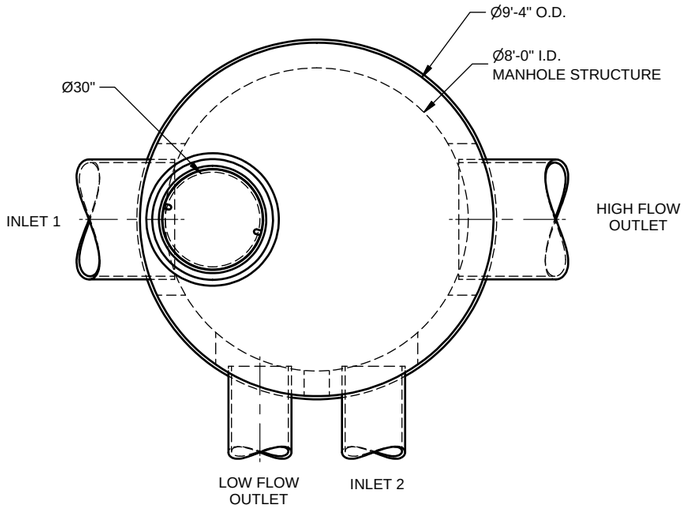
Friction based EGL controls.

$EGL_7 =$ 5836.20 ft

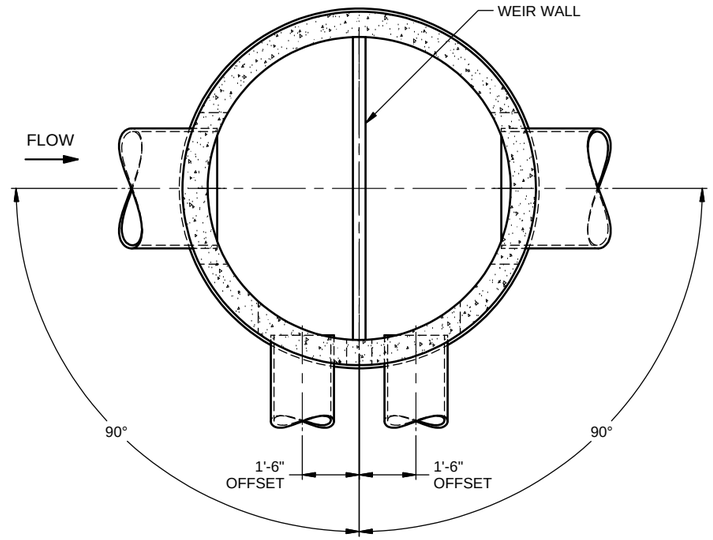
$HGL_7 = EGL_7 - [V^2 / (2*g)]$

$=$ 5834.85 ft

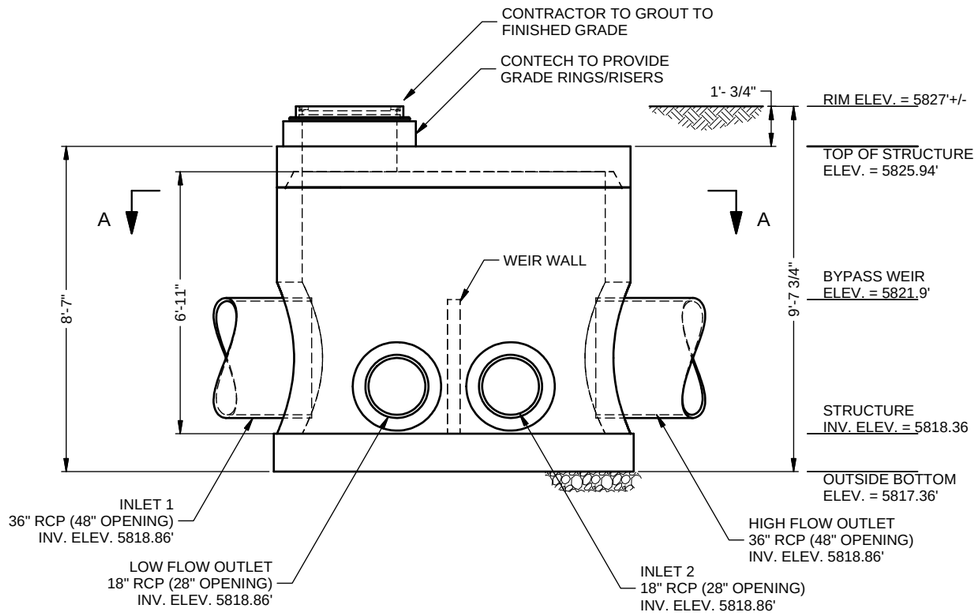
Freeboard = 8.23 ft (at first upstream structure)



PLAN VIEW



SECTION A-A



ELEVATION VIEW

MATERIAL LIST - PROVIDED BY CONTECH

COUNT	DESCRIPTION	INSTALLED BY
1	JOINT SEALANT (BY PRECASTER)	CONTRACTOR
1 PLACE	GRADE RINGS/RISERS	CONTRACTOR
1	Ø30" x 4" EJ #41600484, OR EQUIVALENT	CONTRACTOR

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.ContechES.com.
3. BYPASS STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO HS-20 ASSUMING EARTH COVER OF 0' - 5', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE CONTECH LOGO.
5. BYPASS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S).
E. CONTRACTOR TO INSTALL GRADE RINGS/RISERS OR BLOCK REQUIRED BETWEEN THE TOP OF THE STRUCTURE AND THE BASE OF THE MANHOLE FRAMES.

STRUCTURE WEIGHT
APPROXIMATE HEAVIEST PICK = 27000 LBS.
OF 2 PIECES

MAX FOOTPRINT = 9.5'

CONTECH
CONTRACT
DRAWING

LPICO
LAYOUT 1C

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If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

NO.	DATE	REVISION DESCRIPTION	BY

DIVERSION BYPASS BPMH96 - 542946-40 COMPARK SOUTH PARKER, CO

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Drive, Suite 400, West Chester, OH
800-338-1122 513-645-7000 513-645-7846 FAX

DATE: 7/15/16	SCALE: NONE
DESIGNED: JHR	DRAWN: MLC
CHECKED:	APPROVED:
PROJECT NUMBER: 542946	
SHEET: 1 OF 1	

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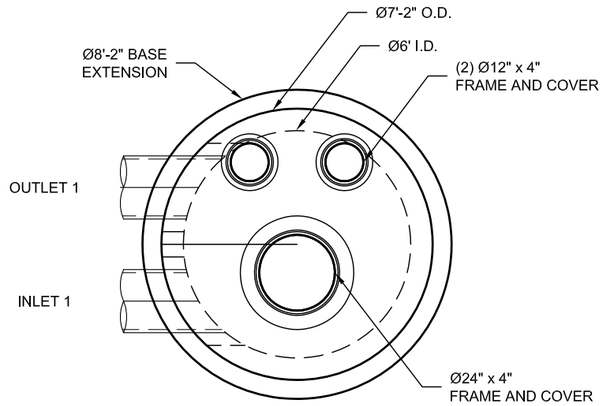
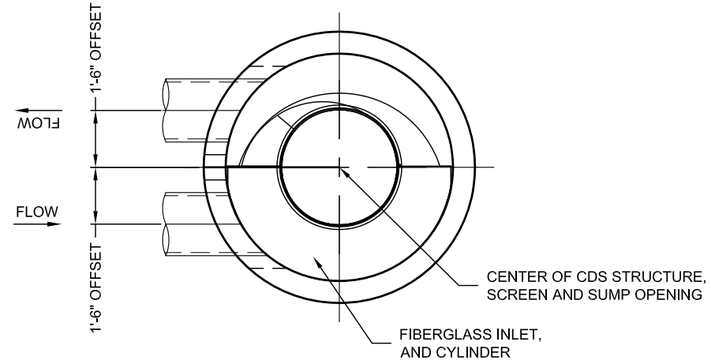
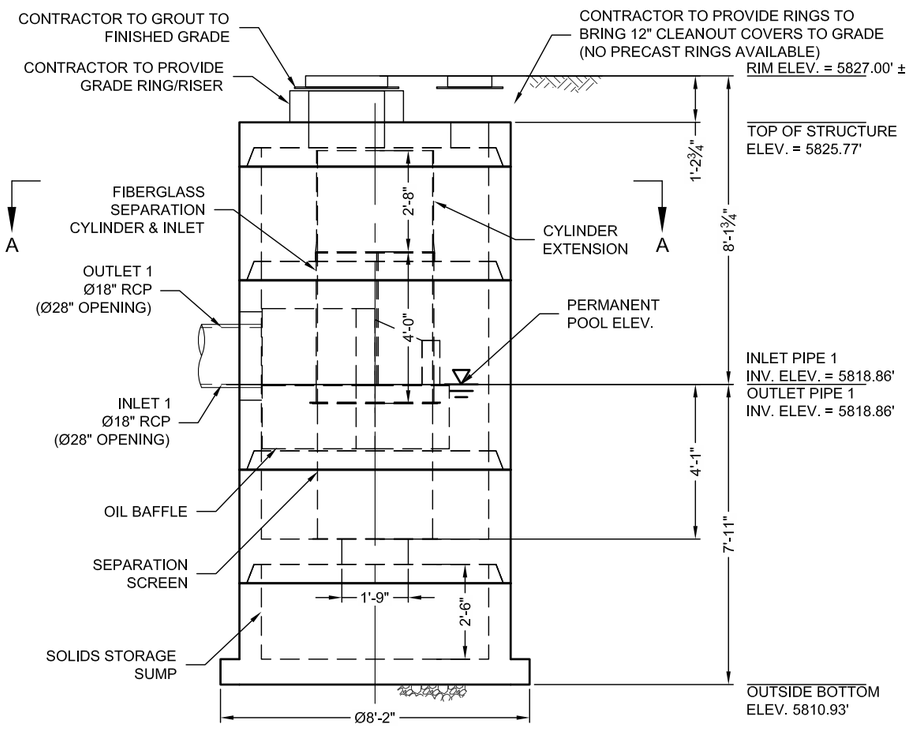


PLAN VIEW



SECTION A-A

• INTERNAL COMPONENTS TO BE INSTALLED BY CONTECH ON SITE



ELEVATION VIEW

MATERIAL LIST (PROVIDED BY CONTECH)

COUNT	DESCRIPTION	INSTALLED BY
1	FIBERGLASS INLET AND CYLINDER	CONTECH
1	2400 micron, 3' O.D. x 3.58' SEP. SCREEN	CONTECH
1	CYLINDER EXTENSION	CONTRACTOR
1	SEALANT FOR JOINTS (BY PRECASTER)	CONTRACTOR
1	Ø24" x 4" FRAME & COVER, EJ#41600389, OR EQUIV.	CONTRACTOR
2	Ø12" x 4" FRAME & COVER, EJ#41610201, OR EQUIV.	CONTRACTOR

SITE DESIGN DATA

WATER QUALITY FLOW RATE	0 CF
PEAK FLOW RATE	88 CF
RETURN PERIOD OF PEAK FLOW	100 YRS

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO HS-20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
6. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

STRUCTURE WEIGHT
APPROXIMATE HEAVIEST PICK = 10000 LBS.
STRUCTURE IS DELIVERED IN 5 PIECES

MAX FOOTPRINT = Ø8'-2"

CONTECH
CONTRACT
DRAWING

LPICO
LAYOUT 1A
3035-6-FGIS
1026 / FI72886

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MARK	DATE	REVISION DESCRIPTION	BY

CDS3035-6-C - 542946-20
COMPARK SOUTH
PARKER, CO
for SYSTEM: STMH 1-4A

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
11815 NE Glenn Widing Drive, Portland, OR 97220
503-240-3393 800-561-1271 FAX
800-548-4667

THE PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 4,788,046; 5,641,120; 5,811,068; 6,681,782; RELATED FOREIGN PATENTS, OR OTHERS PENDING WORLDWIDE.

DATE:	SCALE:
07/18/16	1/4" = 1'-0"
DESIGNED: JHR	DRAWN: MLC
CHECKED: XXX	APPROVED: ----
PROJECT No.: 542946	SEQUENCE No.: 20
SHEET: 1 OF 1	

\\AD.CONTECH-CPI.COM\ROOT\MER\INPROJECT\ACTIVE\542900\542946\542946-20-CDS\DRAWINGS\PRE-542946-20-CDS3035-6 CONFAB.DWG 8/16/2016 2:59 PM

OFFLINE CONCENTRIC CDS HYDRAULIC CALCULATIONS

Compark South

Parker, CO

542946

STMH 1-4

DESIGN PARAMETERS

CDS Model No. =	CDS3035-6	
Design Treatment Flow =	3.8	cfs
Peak Design Flow =	88	cfs
Peak Design Return Interval =	100	year
Rim Elev. @ CDS (diversion) =	5827.00	ft
Required FB @ CDS Unit =	1.00	ft
Rim Elev. @ 1st U/S Structure =	5825.81	ft
Reqd. FB @ 1st U/S Structure =	1.00	ft

HYDRAULIC RESULTS SUMMARY

Estimated FB at CDS Unit =	1.31	ft	(OK)
Est. FB at 1st U/S structure =	0.52	ft	(Flood Potential)

DETAILED CALCULATIONS

TREATMENT FLOW

Estimated HGL at Outfall

$EL_{D/S\ Inv.}$ = 5817.99 ft (based on CDS Invert unless provided)

$HGL_{D/S}$ = 5,818.37 ft (unless provided, $D/S_{INV} + d_{n\text{-}WQ}$)

Exit Loss from DownStream Pipe, h_1

$$h_1 = k * [V^2 / (2*g)]$$

where,

k = 0.40

V = Q / A_F

= 7.31 fps

h_1 = 0.33 ft

$EGL_1 = EL_0 + h_1$

= 5818.70 ft

Head Loss Through Downstream Pipe, h_2

Friction Losses, h_2

$$h_2 = S_{EGL} * L$$

where,

$L_{D/S}$ = 33 ft

$$S_{EGL} = [(Q * n) / (1.49 * A_F * R^{2/3})]^2$$

where,

D/S Pipe Characteristics

Dia. = 36 in

S_{PIPE} = 0.0261 ft/ft

n = 0.013

Flow Characteristics

d_F = 0.38 ft

A_F = 0.52 sf

P_W = 2.18 ft

R = 0.24 ft

S_{EGL} = 0.0275 ft / ft

h_2 = 0.91 ft

$EGL_2' = EGL_1 + h_2$

= 5819.61 ft

Check Entrance Condition for Critical Depth Control

$EL_{CDS\ Inv.}$ = 5818.85 ft

d_c = 0.62 ft

$EGL_C = EL_{CDS\ Inv.} + d_c + V_{dc}^2 / (2*g)$

= 5819.67 ft

Identify Controling EGL

Flow enters pipe at critical depth, EGLc controls.

EGL_2 = 5819.67 ft

Re-entry Loss into DownStream Pipe, h_3

$h_3 = k * [V^2 / (2*g)]$

where,

k = 0.40

V = Q / A

= 3.59 fps (flow area based on critical depth)

h_3 = 0.08 ft

$EGL_3' = EGL_2 + h_3$

= 5819.75 ft

Check for CDS outlet control

$EL_{CDS\ Inv.}$ = 5818.85 ft

CDS I/O Diam. = 18.00 in

$L_{CDS\ out}$ = 5.00 ft

$L_{CDS\ in}$ = 5.00 ft

$d_{c\ (CDS\ out)}$ = 0.74 ft

$EGL_C = EL_{CDS\ Inv.} + d_{c\ (CDS\ Out)} + V_{dc}^2 / (2*g)$

= 5819.89 ft

Identify Controling EGL

The greater value controls

EGL_3 = 5819.89 ft

Determine CDS Weir Height

$HL_{CDS\ Op}$ = 2.00 ft

$V_{CDS\ out}$ = 2.91 ft (partial pipe)

$HL_{CDS\ out}$ = 0.012 ft

$V_{CDS\ in}$ = 2.15 ft (full pipe)

$HL_{CDS\ in}$ = 0.008 ft

$HL_{CDS\ I/O}$ = 2.02 ft

$EL_W' = EGL_3 + HL_{CDS\ Op} + HL_{CDS\ I/O}$

= 5821.91 ft

$H_W' = EL_W' - EL_{CDS\ Inv.}$

= 3.06 ft, or 36.7 in

Adjust for constructability

Use H_W = 36.5 in, or 3.04 ft

$EL_W = EL_{CDS\ Inv.} + H_W$

= 5821.89 ft

PEAK CONVEYANCE FLOW

Estimated HGL at Outfall

$HGL_{D/S}$ = 5,820.00 ft (water level at D/S outlet per engineer, 100-yr)

Exit Loss from D/S Pipe, h_1

$h_1 = k * [V^2 / (2*g)]$

where,

k = 0.40

V = Q / A_F

= 17.10 fps

h_1 = 1.82 ft

$EGL_1 = EL_0 + h_1$

= 5821.82 ft

Head Loss Through D/S Pipe, h_2

Friction Losses, h_2

$h_2 = S_{EGL} * L_{D/S}$

where,

$L_{D/S}$ = 33 ft

$S_{EGL} = [(Q * n) / (1.49 * A_F * R^{2/3})]^2$

where,

D/S Pipe Characteristics

Dia. = 36 in

S_{PIPE} = 0.0261 ft/ft

n = 0.013

Flow Characteristics

d_n = 2.05 ft

A_F = 5.15 sf

P_W = 5.84 ft

R = 0.88 ft

S_{EGL} = 0.0263 ft / ft

h_2 = 0.87 ft

$EGL_2' = EGL_1 + h_2$

= 5822.68 ft

Check Entrance Condition for Critical Depth Control

$EL_{CDS\ Inv.}$ = 5818.85 ft

d_c = 2.99 ft

$EGL_C = EL_{CDS\ Inv.} + d_c + V_{dc}^2 / (2*g)$

= 5824.25 ft

Identify Controling EGL

Cannot enter at less than minimum energy, EGLc controls.

EGL_2 = 5824.25 ft

Re-entry Loss into D/S Pipe, h_3

$h_3 = k * [V^2 / (2*g)]$

where,

$k =$ 0.40

$V = Q / A_F$

$=$ 12.45 fps (area based on critical depth)

$h_3 =$ 0.96 ft

$EGL_3 = EGL_2 + h_3$

$=$ 5825.21 ft

$HGL_3 = EGL_3 - [(V_P/4)^2 / (2*g)]$

$=$ 5825.06 ft (velocity assumed 25% of pipe velocity)

Head over Diversion Weir, h_4

$EL_{Weir} =$ 5821.89 ft (established above)

$L_{Weir} =$ 8.00 ft

(weir is submerged)

Headloss for Free Discharge Condition

$h_{4a} = [Q / (C * L)]^{2/3}$

where,

$C =$ 3.43

$h_{4a} =$ 2.18 ft

$EGL_{4a} = EL_{Weir} + h_{4a}$

$=$ 5824.07 ft

Headloss for Submerged Condition

$d_{Sub} =$ 3.17 ft (depth of submergence)

$h_{4b} =$ 0.48 ft (separate submerged weir calc.)

$EGL_{4b} = EGL_3 + h_{4b}$

$=$ 5825.69 ft

Identify EGL U/S of Weir

The discharge condition is Submerged , therefore

$EGL_4 =$ 5825.69 ft

Expansion Loss from U/S Pipe, h_5

$h_5 = k * [V^2 / (2*g)]$

where,

$k =$ 0.40

$V = Q / A_F$

$=$ 12.45 fps

$h_5 =$ 0.96 ft

$EGL_5 = EGL_4 + h_5$

$=$ 5826.65 ft

Head Loss Through U/S Pipe, h_6

Friction Losses, h_6

$h_6 = S_{EGL} * L$

where,

$L_{U/S}$ = 60 ft

$S_{EGL} = [(Q * n) / (1.49 * A_F * R^{2/3})]^2$

where,

U/S Pipe Characteristics

Dia. = 36 in

S_{PIPE} = 0.0261 ft/ft

n = 0.013

Flow Characteristics

d_n = 3.00 ft

A_F = 7.07 sf

P_W = 9.42 ft

R = 0.75 ft

S_{EGL} = 0.0173 ft / ft

h_6 = 1.04 ft

$EGL_6' = EGL_5 + h_6$

= 5827.69 ft

Check Entrance Condition for Critical Depth Control

$EL_{U/S\ Inv.}$ = 5820.42 ft (based on inv & slope unless provided)

d_c = 2.99 ft

$EGL_C = EL_{CDS\ Inv.} + d_c + V_{dc}^2 / (2*g)$

= 5825.82 ft

Identify Controling EGL

Friction based EGL controls.

EGL_6 = 5827.69 ft

$HGL_6 = EGL_6 - [V^2 / (2*g)]$

= 5825.29 ft

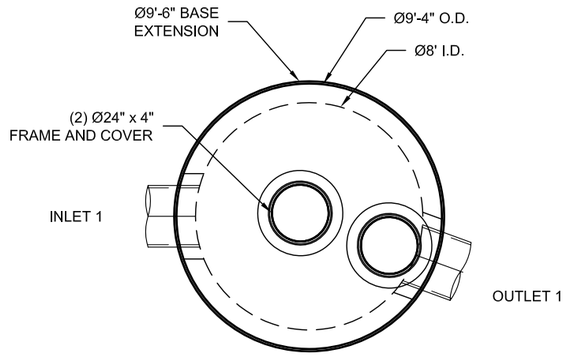
Headloss Across Diversion Structure During Peak Flow

$HL_{DW} = EGL_5 - EGL_2$

HL_{DW} = 2.40 ft

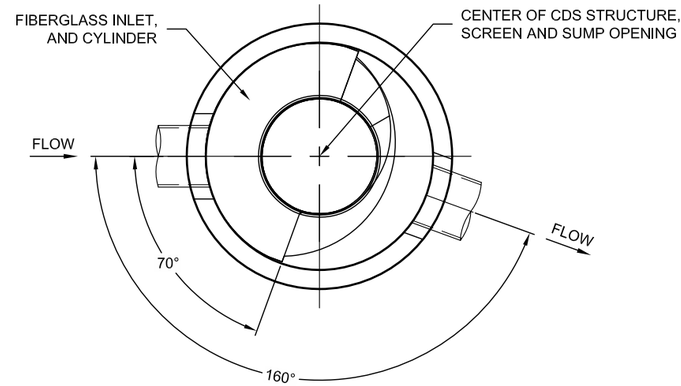
Freeboard at CDS Unit = 1.31 ft

FB at first U/S structure = 0.52 ft

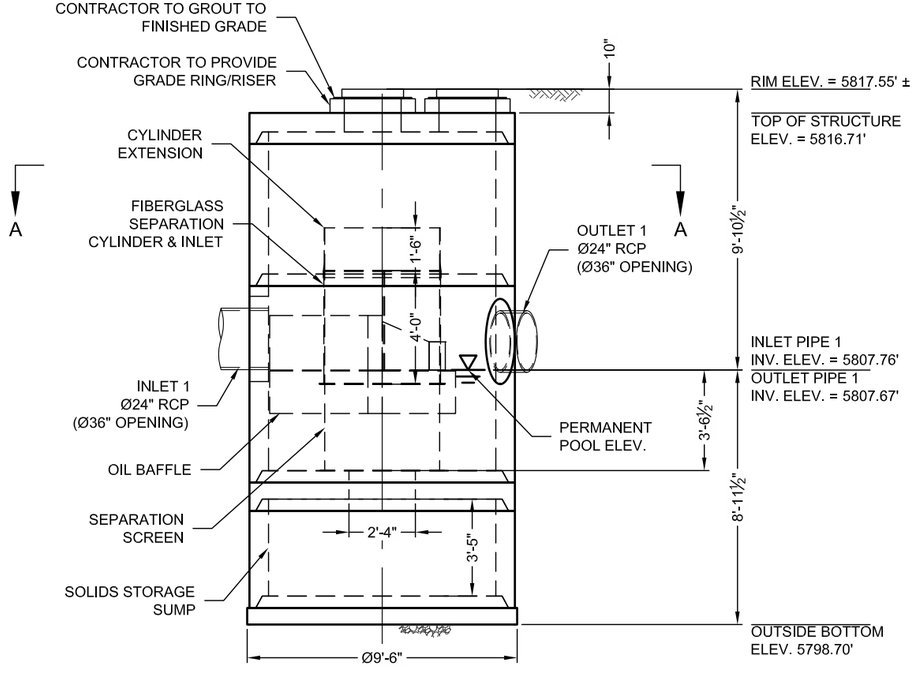


PLAN VIEW

• INTERNAL COMPONENTS TO BE INSTALLED BY CONTECH ON SITE



SECTION A-A



ELEVATION VIEW

MATERIAL LIST (PROVIDED BY CONTECH)

COUNT	DESCRIPTION	INSTALLED BY
1	FIBERGLASS INLET AND CYLINDER	CONTECH
1	2400 micron, 4' O.D. x 3.04' SEP. SCREEN	CONTECH
1	CYLINDER EXTENSION	CONTRACTOR
1	SEALANT FOR JOINTS (BY PRECASTER)	CONTRACTOR
2	Ø24" x 4" FRAME & COVER, EJ#41600389, OR EQUIV.	CONTRACTOR

SITE DESIGN DATA

WATER QUALITY FLOW RATE	0 CF
PEAK FLOW RATE	43.2 CF
RETURN PERIOD OF PEAK FLOW	100 YRS

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO HS-20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
6. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

STRUCTURE WEIGHT
APPROXIMATE HEAVIEST PICK = 20500 LBS.
STRUCTURE IS DELIVERED IN 5 PIECES

MAX FOOTPRINT = Ø9'-6"

CONTECH
CONTRACT
DRAWING

LPICO
LAYOUT 1C
4030-8-FGIS
1026 / FI72886

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MARK	DATE	REVISION DESCRIPTION	BY

CDS4030-8-C - 542946-30
COMPARK SOUTH
PARKER, CO
for SYSTEM: STMH 1-6

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
11815 NE Glenn Widing Drive, Portland, OR 97220
800-548-4667 503-240-3393 800-561-1271 FAX

THIS PRODUCT MAY BE COVERED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 6,511,595; 6,649,052; RELATED FOREIGN PATENTS, OR PATENTS PENDING.

DATE:	SCALE:
07/15/16	3/16" = 1'-0"
DESIGNED: JHR	DRAWN: MLC
CHECKED: XXX	APPROVED: ----
PROJECT No.: 542946	SEQUENCE No.: 30
SHEET: 1 OF 1	

\\AD.CONTECH-CPI.COM\ROOT\MERLIN\PROJECT\ACTIVE\542900\542946\542946-30-CDS\DRAWINGS\PRE-542946-30-CDS4030-8 CONFAB.DWG 8/16/2016 3:02 PM

INLINE
HYDRAULIC CALCULATIONS

COMPARK SOUTH
PARKER, CO
542946-30

DESIGN PARAMETERS

CDS Model No. =	CDS4030	
Design Treatment Flow =	**4.5**	cfs
Peak Design Flow =	43.20	cfs
Peak Design Return Interval =	100	year
Rim Elevation @ US Structure	5821.38	ft

DETAILED CALCULATIONS

TREATMENT FLOW

Tailwater Condition at Outfall, EL_0

EL_0 = 5,791.61 ft (invert plus depth of flow at D/S outlet)

Exit Loss from DownStream Pipe, h_1

$h_1 = k * [V^2 / (2*g)]$

where,

k = 1.00

$V = Q / A_F$

= 17.26 fps

h_1 = 4.63 ft

$EGL_1 = EL_0 + h_1$

= 5796.23 ft

Head Loss Through Downstream Pipe, h_2

Friction Losses, h_2

$h_2 = S_{EGL} * L$

where,

L = 70 ft

$S_{EGL} = [(Q * n) / (1.49 * A_F * R^{2/3})]^2$

where,

Pipe Characteristics

Dia. =	24	in
S_{PIPE} =	0.2370	ft/ft
n =	0.013	

Flow Characteristics

d_F =	0.28	ft
A_F =	0.26	sf
P_W =	1.52	ft
R =	0.17	ft

Head Loss Through Downstream Pipe, h_2 (cont.'d)

S_{EGL} = 0.23814 ft / ft

h_2 = 16.6701 ft

EGL_2' = $EGL_1 + h_2$
= 5812.90 ft

Check Entrance Condition for Critical Depth Control

$EL_{CDS\ Inv.}$ = 5807.92 ft

d_c = 0.75 ft

EGL_C = $EL_{CDS\ Inv.} + d_c + V_{dc}^2 / (2*g)$
= 5808.94 ft

Identify Controling EGL

Flow enters pipe at critical depth, EGLc controls.
EGL_2 = 5808.94 ft

Re-entry Loss into DownStream Pipe, h_3

$h_3 = k * [V^2 / (2*g)]$

where,

k = 0.20
V = Q / A
= 4.19 fps (area based on critical depth)

h_3 = 0.05 ft

EGL_3' = $EGL_2 + h_3$
= 5809.00 ft

Oil Baffle Loss, h_4

$h_4 = k * [V^2 / (2*g)]$

where,

k = 1.00
A_{Baffle} = **8.80** sf
V = Q / Abaffle
= 0.51 fps

h_4 = 0.0041 ft

EGL_4 = $EGL_3 + h_4$
= 5809.00 ft

Check Standard Weir Elevation

HL_{CDS} = 0.67 ft

EL_W' = $EGL_4 + HL_{CDS}$
= 5809.67 ft

H_W' = $EL_W' - EL_{CDS\ INV.}$
= 1.75 ft, or 21.01 in

Std. Weir Height = 23 in
Status **OK**

Use H_W = **23** in, or 1.92 ft

EL_W = $EL_{CDS\ INV.} + H_W$
= 5809.84 ft

PEAK CONVEYANCE FLOW

Tailwater Condition at Outfall, EL_0

EL_0 = **5,810.00** ft (tailwater condition per engineer, 100-yr)

Exit Loss from DownStream Pipe, h_1

$h_1 = k * [V^2 / (2*g)]$

where,

k = 1.00

$V = Q / A_F$

= 13.76 fps

h_1 = 2.94 ft

$EGL_1 = EL_0 + h_1$

= 5812.94 ft

Head Loss Through Downstream Pipe, h_2

Friction Losses, h_2

$h_2 = S_{EGL} * L$

where,

L = 70 ft

$S_{EGL} = [(Q * n) / (1.49 * A_F * R^{2/3})]^2$

where,

Pipe Characteristics

Dia. = 24 in

S_{PIPE} = 0.2370 ft/ft

n = 0.013

Flow Characteristics

d_n = 2.00 ft

A_F = 3.14 sf

P_W = 6.28 ft

R = 0.50 ft

S_{EGL} = 0.0363 ft / ft

h_2 = 2.54 ft

$EGL_2' = EGL_1 + h_2$

= 5815.48 ft

Check Entrance Condition for Critical Depth Control

$EL_{CDS\ Inv.}$ = 5807.92 ft

d_c = 2.00 ft

$EGL_C = EL_{CDS\ Inv.} + d_c + V_{dc}^2 / (2*g)$

= 5813.18 ft

Identify Controling EGL

Friction based EGL controls.

EGL_2 = 5815.48 ft

Re-entry Loss into DownStream Pipe, h_3

$h_3 = k * [V^2 / (2*g)]$

where,

$k =$ 0.20

$V = Q / A_F$

$=$ 13.76 fps (area based on flow depth)

$h_3 =$ 0.59 ft

$EGL_3 = EGL_2 + h_3$

$=$ 5816.07 ft

Oil Baffle Loss, h_4

$h_4 = k * [V^2 / (2*g)]$

where,

$k =$ 0.00 (Skirted-baffle model)

$A_{Baffle} =$ 8.80 sf

$V = Q / A_{Baffle}$

$=$ 4.91 fps

$h_4 =$ 0.00 ft

$EGL_4 = EGL_3 + h_4$

$=$ 5816.07 ft

$HGL_4 = EGL_4 - [V_P^2 / (2*g)]$

$=$ 5813.13 ft

Head over Diversion Weir, h_5

Elevation of Weir

$EL_{Weir} =$ 5809.84 ft (established above)

Headloss for Free Discharge Condition

$h_{5a} = [Q / (C * L)]^{2/3}$

where,

$C =$ 3.1

$L =$ 4.00 ft

$h_{5a} =$ 2.30 ft

$EGL_{5a} = EL_{Weir} + h_{5a}$

$=$ 5812.14 ft

Headloss for Submerged Condition

$d_{Sub} =$ 3.29 ft (depth of submergence)

$h_{5b} =$ 0.40 ft (separate submerged weir calc.)

$EGL_{5b} = EGL_4 + h_{5b}$

$=$ 5816.47 ft

Identify EGL U/S of Weir

The discharge condition is Submerged, therefore

$EGL_5 =$ 5816.47 ft

Expansion Loss from U/S Pipe, h_6 7/26/2016

$h_6 = k * [V^2 / (2*g)]$

where,

$k =$ 0.30

$V = Q / A_F$

$=$ 13.76 fps

$h_6 =$ 0.88 ft

$EGL_6 = EGL_5 + h_6$

$=$ 5817.35 ft

Head Loss Through Upstream Pipe, h_7

Friction Losses, h_7

$h_7 = S_{EGL} * L$

where,

$L =$ 133 ft

$S_{EGL} = [(Q * n) / (1.49 * A_F * R^{2/3})]^2$

where,

Pipe Characteristics

Dia. = 24 in

$S_{PIPE} =$ 0.0297 ft/ft

$n =$ 0.013

Flow Characteristics

$d_n =$ 2.00 ft

$A_F =$ 3.14 sf

$P_W =$ 6.28 ft

$R =$ 0.50 ft

$S_{EGL} =$ 0.0363 ft / ft

$h_7 =$ 4.83 ft

$EGL_7' = EGL_6 + h_7$

$=$ 5822.18 ft

Check Entrance Condition for Critical Depth Control

$EL_{U/S\ Inv.} =$ 5811.87 ft

$d_c =$ 2.00 ft

$EGL_C = EL_{CDS\ Inv.} + d_c + V_{dc}^2 / (2*g)$

$=$ 5817.13 ft

Identify Controling EGL

Friction based EGL controls.

$EGL_7 =$ 5822.18 ft

$HGL_7 = EGL_7 - [V^2 / (2*g)]$

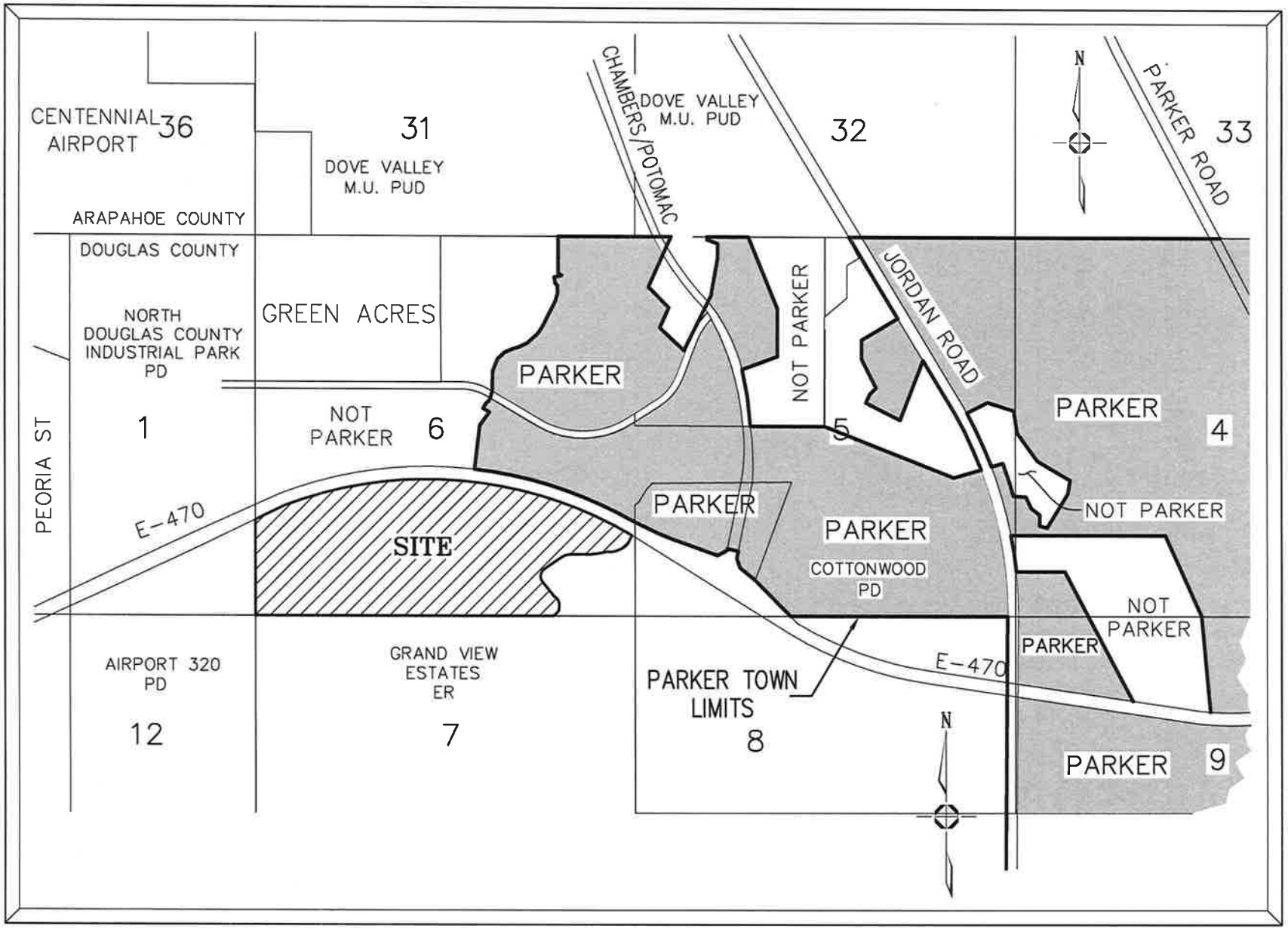
$=$ 5819.24 ft

Freeboard = 2.14 ft (at first upstream structure)

MAPS

Vicinity Map
Overall Basin Drainage Plan

Initially Submitted November 20, 2015
Revised April 11, 2016
Revised May 27, 2016
Revised October 21, 2016



VICINITY MAP

N.T.S.

IMPROVEMENTS TO GREEN ACRES TRIBUTARY

EXISTING CULVERT

PROPOSED REGIONAL POND

EXISTING 10'x12' BOX CULVERT

PROPOSED DETENTION/ WATER QUALITY POND

E-470

BASIN F +/- 45 ACRES

COMPARK SOUTH

PROPOSED BRIDGE

BASIN E +/- 52 ACRES

BASIN D +/- 100 ACRES

60% Imp

20% Imp

SITE BOUNDARY

PROPOSED BOX CULVERT

PROPOSED ROADWAY RIGHT-OF-WAY APPROXIMATE LOCATION

GREEN ACRES TRIBUTARY

BASIN C +/- 88 ACRES

BASIN B +/- 295 ACRES

GRANDVIEW ESTATES

Dogwood Ave

FUTURE MERIDIAN REGIONAL POND

PEORIA STREET

Meridian

BASIN A +/- 345 ACRES

LINCOLN AVENUE

CHAMBERS ROAD

HAPPY CANYON CREEK

GRAPHIC SCALE

(IN FEET)
1 inch = 200 ft.

CARROLL & LANGE-MANHARD
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CHAMBERS CROSSING
PARKER, COLORADO
GREEN ACRES TRIBUTARY DRAINAGE EXHIBIT

PROJ. MGR.: RB
PROJ. ASSOC.: JK
DRAWN BY: JK
DATE: 08/30/11
SCALE: +/- 1"=500'

EXHIBIT
1

CLCPKC3 110482