MASTER DEVELOPMENT DRAINAGE PLAN FOR OVERALL DUBLIN NORTH SUBDIVISION ADDENDUM COLORADO SPRINGS, COLORADO

June 2013

Prepared For:

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COLORADO SPRINGS, COLORADO

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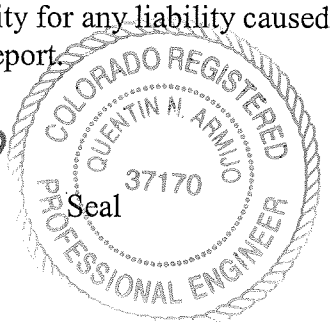
ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

6/19/13

Name



Seal

Developer's Statement:

I, the developer have read and will comply with all of the requirements specified in this drainage report and plan.

Appaloosa Investments, Inc.
Business Name

By: _____

Title: Manager

Address: 5625 Appaloosa Drive Colorado Springs, CO

City of Colorado Springs:

Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

_____ 7-2-13

For City Engineer Date

Conditions

MASTER DEVELOPMENT DRAINAGE PLAN FOR OVERALL DUBLIN NORTH SUBDIVISION ADDENDUM COLORADO SPRINGS, COLORADO

PURPOSE

The purpose of this drainage report is to identify and analyze the proposed drainage patterns, determine proposed runoff quantities, size and type of drainage structures for conveyance of developed runoff, and present solutions to drainage impacts on-site and off-site resulting from this change to the site layout to the since the original MDDP.

GENERAL DESCRIPTION

This MDDP Plan consists of approximately 52 acres. This increase from 42 acres in the original MDDP is the addition of 2-5 acres county parcels that the owner has now purchased. The site is currently platted in the city as Dublin North Filings 1 through 3 with future plans for filings 4 & 5. The two new 5 acre parcels are platted in El Paso County as Lots 5 and 14 AA Subdivision off of Vickie Lane. There are plans in the future to annex these 2 lots into the City of Colorado Springs and for them to be platted as Filings 6 & 7. We have included these future filings now to better analyze and prepare the overall storm drain systems. In the original "Master Development Drainage Plan for Overall Dublin North Subdivision and Final Drainage Report for Filing No. 1" Filing 5 was a multi-family site this has since changed to be a single family layout. Also since the original report the order of the Filings has been revised please reference the proposed drainage map in the appendix for the revised Filings.

The site is located in a portion of Section 7, Township 13 South, Range 65 West of the 6th Principal Meridian currently within El Paso County, Colorado. The entire site is bounded to the west by the remaining lots in the AA Subdivision. To the north is un-platted county land and a high school site. To the south is Dublin Boulevard, and to the east is Greenhaven Filing No. 2 residential subdivision.

The site is contained within the Sand Creek Basin. Flows from this site are tributary to Sand Creek.

Soils for this project are delineated by the map in the appendix as Blakeland loamy sand (8). Soils in

the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area" and are primarily of Hydrologic Group A. The study area consists of large lot residential development with existing natural, grasses and native vegetation. A ridge splits the site with the eastern half of the existing topography sloping from the northwest to the southeast with slopes ranging from 2% to 33%. The western half slopes from the northeast to the southwest ranging from 2% to 25%.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C0537 F dated March 17, 1997 (see appendix).

EXISTING DRAINAGE CONDITIONS

Part of this site was most recently studied in the "Greenhaven Filing No. 1 and 2 Preliminary/ Final Drainage Report," and was also studied in the "Master Development Drainage Plan Amendment No. II for the Easterly Portion of Ridgeview Subdivision and Preliminary Drainage Report for the Northeasterly Portion of Ridgeview Subdivision and Phase II Sand Creek Channel Improvements" (MDDP Amend II) by JR Engineering dated February 2004. The site was originally studied in the "Sand Creek Drainage Basin Planning Study Preliminary Design Report" (DBPS) prepared by Kiowa Engineering.

In the previously mentioned study for Greenhaven there were three discharge points along the western boundary. These same discharge points were re-analyzed and as shown below were within their assumed offsite runoff for the Historic Condition. There were a total of 7 offsite discharge points that were analyzed for comparison to the developed runoff. Below is a description of these discharge points.

Design Point EX-1 is at the east boundary of site. Basin EX-A's 18.06 acres and offsite Basin OS-1's 8.18 acres are part of Basin OS-145-2 from the MDDP. The composite C values for these offsite basins were taken from the above mentioned MDDP Amend II. If these upstream basins change in the future they will need to release their runoff at or below the rates calculated in this report. Runoff (Q_5=35.5 cfs and Q_{100}=75.7 cfs) is routed by swales and berms into The Greenhaven Filing No. 2 storm drain system. These flows are in conformance with the previously

mentioned MDDP Amend II and FDR for Greenhaven flows (Q_5=38 cfs and Q_{100}=81 cfs).

Design Point EX-2 is at the north end of the eastern boundary. Basin EX-B's 0.58 acres and offsite Basin OS-2's 1.93 acres are part of Basin OS-145-3 from the MDDP. The composite C values for these basins were taken from the above mentioned MDDP Amend II, which accounted for the development of a proposed high school. Runoff (Q_5=5.2 cfs and Q_{100}=9.3 cfs) sheet flows into a channel installed with Greenhaven Subdivision and then is routed east to a storm drain system in Black Forest Road. The flows from the MDDP Amend II for Basin OS- 145-3 were calculated to be Q_5=140 cfs and Q_{100}=258 cfs, which can not be compared to Dublin 1 due to the insignificant area of EX-2's area.

Design Point EX-3 is at the south end of the eastern boundary. Basin EX-C's 10.61 acres is part of Basin OS-145-1 from the MDDP Amend II. The composite C values for this basin was taken from the MDDP Amend II. In the original MDDP Amend II the calculated runoff was Q_5=20.0 cfs and Q_{100}=41.0 cfs. The calculated runoff (Q_5=17.7 cfs and Q_{100}=35.8 cfs) is routed by a channel into The Greenhaven Filing No. 2 storm drain system and then is routed east to a storm drain system in Black Forest Road.

Design Point EX-4 is at the southern boundary. Basin EX-D's 1.27 acres consists of the small area tributary to Dublin Blvd. Runoff (Q_5=1.5 cfs and Q_{100}=3.3 cfs) sheet flows south offsite into Dublin Blvd and then is routed by curb and gutter east to an inlet and into a storm drain system in Dublin Blvd near Black Forest Road.

Design Point EX-5A is also at the southern boundary. Basin EX-E1's 1.64 acres consists of the small area tributary to Dublin Blvd. This area has increased since the original report with the addition of the new parcels to the Development plan. Runoff (Q_5=1.9 cfs and Q_{100}=4.3 cfs) sheet flows south offsite into Dublin Blvd and then is routed east by curb and gutter and is captured by a 10' D-10R- sump inlet in the north curb section of Dublin Boulevard street drainage system. It is then routed down Tutt Boulevard.

Design Point EX-5B is also at the southern half of the western boundary of the site. Basin EX-

E2's 6.14 acres consists of single family development that sheet flows west offsite. This area has increased since the original report with the addition of the new parcels to the Development plan. Runoff (Q_5=6.4 cfs and Q_{100}=14.4 cfs) is directed into Dublin Blvd and then is routed by a 10' D-10R- sump inlet in the north curb section of Dublin Boulevard street drainage system. It is then routed down Tutt Boulevard.

Design Point EX-6 is also at the northern half of the western boundary of the site. This Design Points Boundary is the actual Boundary being used for the Development Plan. Basin EX-F's 3.69 acres consists of large lot development that sheet flows southwest offsite. Runoff (Q_5=3.7 cfs and Q_{100}=8.4 cfs) is directed towards Dublin Blvd and Tutt Blvd intersection where an 18" rcp stub routes the flow down Tutt Boulevard.

Design Point EX-7 is the area on the west side of the site. Basin EX-G's 10.09 acres consists of large lot development. This area has increased since the original report with the addition of the new parcels to the Development plan. Runoff (Q_5=11.1 cfs and Q_{100}=25.3 cfs) sheet flows southwest offsite.

Design Point EX-8 is the combined runoff (Q_5=14.0 cfs and Q_{100}=31.5 cfs) of Design Points EX-6 & EX-7 at the west boundary of the proposed future site. This was analyzed so we can detain to historic conditions once the annex has taken place. Since the original MDDP the owner of this site has purchased the 2 adjacent 5 acres parcels. The owner also has plans on purchasing more parcels to the west and master planning and annexing these 5 acre county parcels. It was planned that the detention of this area would be incorporated with the downstream property at the time of final platting for this area. As of right now we are planning to put in a temporary detention pond on site over six single family lots. In the future when the downstream area is annexed and a better overall development layout is known it is proposed to add a permanent detention and water quality basin. There is more discussion on this under proposed conditions for Basin F and G. This will be addressed in the Final Drainage Report for Filings 4, 5, 6, and 7, as final design decisions are made.

PROPOSED DRAINAGE CONDITIONS

The Dublin North Subdivision is part of the "Master Development Drainage Plan Amendment No. II for the Easterly Portion of Ridgeview Subdivision and Preliminary Drainage Report for the Northeasterly Portion of Ridgeview Subdivision and Phase II Sand Creek Channel Improvements" (MDDP Amend II) by JR Engineering dated February 2004. The proposed site was part of Basins OS-145-1, OS-145-2 and OS-145-3. As mentioned in the existing conditions these basins were analyzed in this report and the calculated historic flows will be used as the allowable release rates for the developed condition. The developed design points correspond to existing discharge points.

The offsite basins have been calculated using a composite C value based upon assumed land uses per the MDDP Amend II mentioned above. These land uses are based upon 5 acre single family development or "ranchette" as called in the MDDP Amend II and a small area of school site. If these land uses later change and have an increase in runoff due to a change in impervious area these upstream owners will need to restrict flow to the runoff calculated here in this report and the above mentioned MDDP Amend II report.

The following are descriptions of the onsite basins, and the overall proposed drainage characteristics for the development of Dublin North Subdivision.

Design Point 1A is a low point where the combined runoff (Q_5=18.2 cfs and Q_{100}=35.6 cfs) of Basins A1 (5.10 ac), A2 (1.50 ac), A3 (3.28 ac), and OS-1B (0.12 ac) is captured by a 10' D10-R sump inlet. Basins A1 and A2 acreage has been revised since the original MDDP with final onsite grading being nailed down. Pipe Run 1 a 24" RCP transports the runoff to DP-1B. At Design Point 1B, the runoff (Q_5=2.3 cfs and Q_{100}=4.5 cfs) from Basin A4 (1.05 ac) is combined with the runoff from DP-1A. The flow is assumed to be split between 2-10' D10-R sump inlets at DP-1A and DP-1B, the total flow split between 2-10' sump inlets is Q_5=20.2 cfs and Q_{100}=39.3 cfs. Pipe Run 2 a 30" RCP then transports the combined flow east DP-1D, a 10' D10-R sump inlet in Donahue Drive.

Design Point 1C is point at the north boundary where runoff (Q_5=11.0 cfs and Q_{100}=23.5 cfs) from Basin OS-1A (8.14 ac) enters the site. A trapezoidal swale (Section A-A) with a 2' bottom and 4:1 side slopes at a depth of 2' will transport the flow south toward Public Detention Pond 1.

Design Point 1D is a low point where the runoff (Q_5=10.9 cfs and Q_{100}=21.7 cfs) of Basins A5 (5.05 ac) is captured by a 10' D10-R sump inlet. Pipe Run 3 (Q_5=29.6 cfs and Q_{100}=57.8 cfs), a 36" RCP, transports the runoff to DP-1E.

At Design Point 1E, the runoff (Q_5=2.2 cfs and Q_{100}=4.4 cfs) from Basin A6 (1.03 ac) is captured by a 6' D10-R sump inlet. Pipe Run 4 a 36" RCP transports the combined runoff (Q_5=31.5 cfs and Q_{100}=61.5 cfs) from Pipe Run 3 and DP-1E runoff to a storm manhole (STMH-1).

Runoff (Q_5=2.9 cfs and Q_{100}=5.7 cfs) from Basin A8 (1.25 ac) is routed to 20' D10-R at-grade inlet (DP-1F). The inlet captures Q_5=2.1 cfs and Q_{100}=3.7cfs. Pipe Run 5, an 18" RCP, transports the runoff to a junction with Pipe Run 4. Pipe Run 6, a 42" RCP, then transports the combined flow (Q_5=33.2 cfs and Q_{100}=64.4 cfs) of Pipe runs 4 and 5 to Detention Pond 1. The flow-by (Q_5=0.8cfs and Q_{100}=2.0cfs) from DP-1F will go down Crestdale Drive and into Grenhaven's storm system. Being the author and familiar of The Greenhaven Filing No. 2 Final Drainage Report, the small amount of flow-by is not anticipated to negatively affect the existing downstream storm system.

At Design Point 1G the combined runoff (Q_5=43.5 cfs and Q_{100}=86.3 cfs) from Basins A1 thru A8 and OS-1A thru OS-1C is routed through a proposed Water Quality and Public Detention Pond 1. This combined runoff is more than the allowable historic condition release rate. Per the historic Conditions at DP-EX1, the allowable release rate is Q_5=35.5 cfs and Q_{100}=75.7 cfs. In order to limit the number of ponds and associated maintenance issues, Pond 1 over-detains to account for the increase at Design Points 1G (Pond 1) and 3M (Pond 2) from the developed condition. Per the historic Conditions at DP-EX3 the runoff rate is Q_5=17.7 cfs and Q_{100}=35.8 cfs. In the developed condition the runoff rate is (Q_5=22.4 cfs and Q_{100}=44.9 cfs) at DP-3M (Pond 2). This is an increase of Q_5=4.8 cfs and Q_{100}=9.2 cfs and will was subtracted from the historic allowable release rates of Q_5=35.5 cfs and Q_{100}=75.7 cfs at Pond 1 for a new historic release rate of Q_5=30.7 cfs and Q_{100}=66.6 cfs.

At Detention Pond 1 a two stage inlet riser acts as the outlet structure. The first inlet, a 3' x 3', is set at Grate Elevation of 6790.00, which is 4' higher than the bottom of pond to account for water

quality volume and will pass the 5-year event. The second inlet, a 3' x 3', is set at Grate Elevation 6792.00 and will pass the 100 year event. The pond was modeled in Pond Pack with a top of pond elevation at 6796.00. The results were that in the 5-year event the release is 27.85 cfs with a ponding depth of 6791.66. The 100-year results are a release of 61.9 cfs at a ponding depth of 6793.17. The release rates are below the allowable and account for the undetained release of Basin A9 at DP-1H and the flow by of DP-1F. A 42" RCP will transport the flow to the existing 12' inlet in Greenhaven north of Crestdale Drive. A 36" CMP riser with a grate set at an elevation of 6793.50 will act as an emergency outlet in case of clogging in the 3'x3' grates. A riprap armored 30' emergency weir set at 6795.00 is also installed and will safely pass the 100-year developed flow to the swale in Greenhaven and allow it to be picked up in the 12' inlet.

Design Point 1-H is at the existing 8' inlet in Greenhaven Filing No. 2 where the combined runoff (Q_5=4.6 cfs and Q_{100}=10.3 cfs) from Basin A9 (1.24 ac) will sheet flow offsite and then be directed by a swale and berm in Greenhaven north to the existing inlet along the south side of Crestdale Drive. The flow by (Q_5=0.8 cfs and Q_{100}=2.0 cfs) from DP-1F is routed down Crestdale Drive. The overall flow (Q_5=32.5 cfs and Q_{100}=72.2 cfs) entering Greenhaven system from DP-1H and the pond release is less then the historic flow calculated in the MDDP Amend II (Q_5=38 cfs and Q_{100}=81 cfs) and designed for in Greenhaven's storm drain system.

Design Point 2 corresponds to Historic DP EX-2. Runoff (Q_5=4.8 cfs and Q_{100}=9.1 cfs) from Basin B (0.43 ac) and OS-2 (1.93 ac) sheet flows into the existing channel on Greenhaven's property and follows its historic path offsite in a ditch north of Greenhaven Filing No. 2 to the east and Black Forest Road. Developed runoff is less then the allowable historic (Q_5=5.2 cfs and Q_{100}=9.3 cfs) based upon on Basin B being slightly smaller in the developed condition then the historic.

The basins analyzed below have been revised since the original MDDP. Some of the site has changed from a multi-family to single family development and 2 new 5 acre parcels have been added to the west side of the site. Therefore with these changes and additions some of the Design Points and Pipe Runs have been revised or eliminated.

Design Point 3A is at the boundary of Basin C1 (1.72 ac) where the runoff (Q_5=3.3 cfs and Q_{100}=6.5

cfs) was checked against the street capacity calculations of Donahue Drive (see appendix).

At Design Point 3B, the runoff (Q_5=8.4 cfs and Q_{100}=16.6 cfs) from Basin C2 (2.67 ac) and C1 was checked against the street capacity calculations of Donahue Drive and falls within the allowable street flow capacities (see appendix).

Design Point 3C is also a boundary point where the combined runoff (Q_5=12.0 cfs and Q_{100}=23.6 cfs) from Basin C3 (1.85 ac) and Design Point 3B was checked against the street capacity calculations of Donahue Drive and falls within the allowable street flow capacities (see appendix).

Design Point 3D is a low point in Donahue Drive where the combined runoff (Q_5=16.9 cfs and Q_{100}=33.1 cfs) from Basin C4 (2.52 ac) is captured by a 10' D-10R sump inlet. Pipe Run 10, a 24" RCP, transports the runoff to DP-3E. At Design Point 3E, the runoff (Q_5=5.4 cfs and Q_{100}=10.5 cfs) from Basin C5 (2.96 ac) is captured by a 10' D-10R sump inlet. The flow is assumed to be split between 2-10' D10-R sump inlets at DP-3D and DP-3E, the total flow is split between 2-10' sump inlets is Q_5=21.5 cfs and Q_{100}=41.8 cfs. Pipe Run 16, a 30" RCP, then routes the combined runoff (Q_5=21.5 cfs and Q_{100}=41.8 cfs) of DP-3E and Pipe Runs 10 to an existing 30" RCP stub installed with the original MDDP and Filing 1 report.

At Design Point 3H a low point in the street section, a 6' sump inlets will capture the runoff (Q_5=2.7 cfs and Q_{100}=5.3 cfs) from Basin C8 (1.33 ac). Pipe Run 17, an 18" RCP, transports the runoff to a junction with Pipe Run 18.

At Design Point 3I a low point in the street section, a 6' sump inlets will capture the runoff (Q_5=0.6 cfs and Q_{100}=1.1 cfs) from Basin C9 (0.24 ac). Pipe Run 18, an 18" RCP, transports the runoff to a junction with Pipe Run 17. Pipe Run 19, an 18" RCP, routes the combined flow (Q_5=3.7 cfs and Q_{100}=7.6 cfs) from Pipe Runs 17 and 18 south to a junction with Pipe Run 16. Pipe Run 20 a 30" RCP transports the combined runoff (Q_5=24.3 cfs and Q_{100}=47.4 cfs) of Pipe Runs 16 and 19 south to a 4' storm manhole No. 2 (STMH-2) and Pipe Run 21. Pipe Run 22, a 30" RCP, will route the flow east to Design Point 3K.

At Design Point 3K a low point in the cul-de-sac, a 6' sump inlets will capture the runoff (Q_5=3.3 cfs and Q_{100}=6.6 cfs) from Basin C11 (1.47 ac). Pipe Run 23, a 30" RCP, discharges the runoff (Q_5=27.0 cfs and Q_{100}=52.6 cfs) from Pipe Run 22 and DP-3K into a proposed water quality pond located in the open space of Tract C. The water quality pond was sized based upon the Design Procedure Form for the Extended Detention Basin (see appendix). A 4'x4' outlet structure passes the runoff east through a 30" RCP (Pond Outlet 2) and into the existing 8' sump inlet located in Greenhaven Filing No. 2. In case of overtopping the runoff will be directed overland to the existing 8' sump inlet.

Basin C12's 0.91 acres consists of the open space and the proposed Water Quality Pond (Pond 2). Runoff (Q_5=2.3 cfs and Q_{100}=4.8 cfs) sheet flows into the pond.

At Design Point 3M the combined runoff (Q_5=28.7 cfs and Q_{100}=55.9 cfs) from Basins C1 through C12 is routed through proposed Public Water Quality Pond 2. The top of the pond is set at 6828. Pond 2 is equipped with a 4' x 4' grated storm inlet set at 6826.50. A trash rack and orifice plate with 2 columns of 0.5" holes in 6 rows routes the minor events while providing water quality. A 30" RCP connects to an existing off-site 8' sump inlet located in the Greenhaven Filing 2 subdivision. Along the 30" pipe a 24" CMP riser with a grate set at 6827.00 acts as an emergency outlet in case of failure in the 4' x 4' grate. A 38' weir set at 6827.5 passes the developed 100-year event in case of failure and be routed east down a riprap lined slope into the existing Greenhaven inlet. All flows combine and exit through an existing 30" RCP (pipe run 24), also off-site. This pipe was analyzed with the developed runoff and was found capable of handling the additional runoff. This flow exceeds the historic conditions, however as mentioned above detention was provided in Pond 1 to accommodate the excess. Per the historic conditions at DP-EX3 the allowable release rate is Q_5=17.7 cfs and Q_{100}=35.8 cfs.

Design Point 4 corresponds to Historic DP-EX4. Runoff (Q_5=1.8 cfs and Q_{100}=3.8 cfs) from Basin D's 0.66 acres sheet flows into the Dublin Boulevard and is directed by curb and gutter east to the Dublin and Black Forest Road storm system. Developed runoff is slightly more than the historic but the slight increase (Q_5=0.3 cfs and Q_{100}=0.5 cfs) should not tax the downstream system as it was designed to handle more per the MDDP Amend II mentioned above.

Design Point 5A corresponds to Historic DP-EX5A. Runoff (Q_5=2.4 cfs and Q_{100}=5.2 cfs) from Basin E1's 0.81 acres sheet flows into the Dublin Boulevard and is directed by curb and gutter west to the Dublin storm system. Developed runoff is slightly more than the historic (Q_5=1.9 cfs and Q_{100}=4.3 cfs) but the slight increase (Q_5=0.5 cfs and Q_{100}=0.9 cfs) of the developed flow is offset by the decrease in Design Point 5B's runoff (Q_5=2.3 cfs and Q_{100}=4.6 cfs) from historic (Q_5=6.4 cfs and Q_{100}=14.4 cfs) by (Q_5=4.1 cfs and Q_{100}=9.8 cfs) therefore we are rereleasing less water to Dublin Boulevard in the developed condition then the historic condition.

Design Point 6 corresponds to Historic DP-EX6 (Q_5=3.7 cfs and Q_{100}=8.4 cfs). Runoff (Q_5=5.1 cfs and Q_{100}=10.0 cfs) from Basin F's 2.41 acres flows into the Vickie Lane and is directed by curb and gutter west to Design Point 7C.

Design Point 7A runoff (Q_5=8.1 cfs and Q_{100}=16.0 cfs) from Basin G1's 3.95 acres flows from Finglass Drive to Wexford Drive. This design point is set up to check against the street capacity calculations of Wexford Drive and falls within the allowable street flow capacities (see appendix). It is then is directed by curb and gutter south to Design Point 7C.

At Design Point 7B, the combined runoff (Q_5=17.9 cfs and Q_{100}=35.5 cfs) from Basin G2 (2.41 ac), G1 and F is checked against the street capacity calculations of Vicki Lane (see appendix). The combined flow exceeds the street capacity therefore a 12' D-10R sump inlet will capture the flow and Pipe run 25 will direct it west in Vicki Lane. As mentioned above there are no master plans for the downstream area and no detention or water quality designed at this time. Therefore the client is going to build a temporary water quality basin on the last 6 lots off of Vicki Lane to the west and hold off on installing the 12 sump inlet and the 30" RCP outfall until a downstream drainage plan is detailed. Once any development to the west occurs, a more detailed drainage study must be completed that addresses permanent storm drain system and permanent detention/water quality. The client instead will build a rundown from the curb and gutter in Vicki Lane into a temporary 1.07 ac-ft water quality pond. Vicki Lane will end at the west curb return of Wexford Drive and a 2' high berm will catch all runoff (Q_5=23.2 cfs and Q_{100}=45.9 cfs) from Basins E, F, G1, & G2 The design of the temporary pond was done using the Denver Urban Drainage spreadsheet. A 24" PVC standpipe set at the invert of the pond 6853 .00 will slowly drain the temporary pond and in larger events the runoff

will be caught in the top of the standpipe which is set at 6855.00. The runoff will discharge via a 24" PVC pipe onto a 10' x 10' riprap pad and the flow will be routed via a ditch section down Vicki Lane. See drainage map for details of the outlet structure and appendix for water quality calculations.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual the pertinent data sheets are included in the appendix of this report. The "Manning n" formula was used to analyze the pipe and swale runs. The original 2 permanent ponds were analyzed using PondPack. the temporary pond was analyzed using the Denver Urban Drainage Detention Spreadsheet.

EROSION CONTROL

It is the policy of the City of Colorado Springs that we submit an erosion control plan with the drainage report. At this time we respectfully request that the erosion control plan be submitted in conjunction with the final grading plan. Proposed straw bale check dams, silt fence, vehicle traffic control, and reseeding are proposed as erosion control measures. Water Quality ponds have been sized to account for water quality before the runoff leaves our site where applicable. Extended Detention Basins have been used in the ponds (see appendix).

MAINTENANCE

The proposed storm drain pipe located in public streets will be dedicated to the city and will be maintained by the City of Colorado Springs. The public detention and water quality ponds located in Tracts C and F, including the outlet works and storm outlets are also public but maintained by the Home Owners Association. Pipe run 2 in Tract A is public and maintained by the City, but the above ground maintenance of the Tract is by the HOA. The temporary detention pond just west of Fling 4 will be private and maintained by the Developer until it is removed.

CONSTRUCTION COST OPINION

FILING No. 1

Public Drainage Facilities Reimbursable

Note: Filing 1 Reimbursable fees are subject to confirmation in the "MDDP for the Easterly Portion of Ridgeview Subdivision."

1.	42" RCP	550 LF	$ 85		$ 46,750
2.	36" RCP	65 LF	$ 75		$ 4,875
3.	30" RCP	95 LF	$ 65		$ 6,175
4.	Pond Outlet	2 EA	$ 10,000		$ 20,000
5.	42" FES	1 EA	$ 250		$ 250
6.	Pond Grading	2 EA	$ 10,000		$ 20,000
7.	Type 1 Manholes	1 EA	$ 4,000		$ 4,000
				Total	**$ 102,050**

Public Drainage Facilities Non-Reimbursable

1.	18" RCP	206 LF	$ 45		$ 22,770
2.	24" RCP	135 LF	$ 50		$ 6,900
3.	30" RCP	1175 LF	$ 60		$ 6,750
4.	6' D-10R Inlet	4 EA	$ 4,000		$ 16,000
5.	10' D-10R Inlet	3 EA	$ 5,500		$ 16,500
6.	20' D-10R Inlet	1 EA	$ 7,200		$ 7,200
7.	Type 1 Manholes	2 EA	$ 4,000		$ 8,000
				Total	**$ 54,450**

FILING No. 2 & No. 3

No Public Drainage Facilities

FILING No. 4

Public Drainage Facilities Non-Reimbursable

1.	30" RCP	38 LF	$ 60		$ 5,880

2.	12' D-10R Inlet	1 EA	$ 6,000		$ 6,000
				Total	**$ 11,880**

FILING No. 5

Public Drainage Facilities Non-Reimbursable

1.	24" RCP	38 LF	$ 50		$ 1,900
2.	30" RCP	108 LF	$ 60		$ 6,480
3.	10' D-10R Inlet	2 EA	$ 6,000		$ 12,000
				Total	**$ 20,380**

FILING No. 6 and No. 7

No Public Drainage Facilities

DRAINAGE FEES

FILING No. 1

The existing site is in the Sand Creek Basin. 2007 Drainage fees paid at the time of final plat for the Dublin North Filing No. 1 are as follows:

DRAINAGE FEES:	10.00 acres	x	$9,041.00	=	$ 90,410.00
BRIDGE FEES:	10.00 acres	x	$ 568.00	=	$ 5,680.00
POND FEES:					
LAND :	10.00 acres	x	$ 1,070.00	=	$ 10,700.00
FACILITIES:	10.00 acres	x	$ 2,717.00	=	$ 27,717.00
				TOTAL	**$ 134,507.00**

FILING No. 2

The existing site is in the Sand Creek Basin. 2012 Drainage fees paid at the time of final plat for the Dublin North Filing No. 2 are as follows:

DRAINAGE FEES:	8.60 ac.	x	$ 9,632.00	=	$82,835.20
BRIDGE FEES:	8.60 ac.	x	$ 596.00	=	$ 5,125.60
POND FEES:					
LAND:	8.60 ac.	x	$ 1,070.00	=	$ 9,202.00
FACILITIES:	8.60 ac.	x	$ 2,881.00	=	$24,776.60
				TOTAL	**$121,939.40**

FILING No. 3

The existing site is in the Sand Creek Basin. 2012 Drainage fees paid at the time of final plat for the Dublin North Filing No. 2 are as follows:

DRAINAGE FEES:	6.36 ac.	x	$ 9,632.00	=	$61,259.52
BRIDGE FEES:	6.36 ac.	x	$ 596.00	=	$ 3,790.56
POND FEES:					
LAND:.	6.36 ac.	x	$ 1,070.00	=	$ 6,805.20
FACILITIES:	6.36 ac.	x	$ 2,881.00	=	$18,323.16
				TOTAL	**$90,178.44**

FILING No. 4

The existing site is in the Sand Creek Basin. 2013 Drainage fees due on the final plat for the Dublin North Filing No. 4 are as follows:

DRAINAGE FEES:	6.140 ac.	x	$ 9,632.00	=	$59,140.48
BRIDGE FEES:	6.140 ac.	x	$ 596.00	=	$ 3,659.44
POND FEES:					
LAND:	6.140 ac.	x	$ 1,070.00	=	$ 6,569.80
FACILITIES:	6.140 ac.	x	$ 2,881.00	=	$17,689.34
				TOTAL	**$87,159.06**

FILING No. 5

The existing site is in the Sand Creek Basin. 2013 Drainage fees due on the final plat for the Dublin North Filing No. 5 are as follows:

DRAINAGE FEES:	9.52 ac.	x	$ 9,632.00	=	$91,696.64
BRIDGE FEES:	9.52 ac.	x	$ 596.00	=	$ 5,673.92
POND FEES:					
LAND:	9.52 ac.	x	$ 1,070.00	=	$10,186.40
FACILITIES:	9.52 ac.	x	$ 2,881.00	=	$27,427.12
				TOTAL	**$134,984.08**

FILING No. 6

The existing site is in the Sand Creek Basin. 2013 Drainage fees due on the final plat for the Dublin North Filing No. 6 are as follows:

DRAINAGE FEES:	5.49 ac.	x	$ 9,632.00	=	$52,879.68

BRIDGE FEES:	5.49 ac.	x	$ 596.00	=	$ 3,272.04
POND FEES:					
LAND:	5.49 ac.	x	$ 1,070.00	=	$5,874.30
FACILITIES:	5.49 ac.	x	$ 2,881.00	=	$15,816.69
				TOTAL	**$77,842.41**

FILING No. 7

The existing site is in the Sand Creek Basin. 2013 Drainage fees due on the final plat for the Dublin North Filing No. 7 are as follows:

DRAINAGE FEES:	6.07 ac.	x	$ 9,632.00	=	$58,466.24
BRIDGE FEES:	6.07 ac.	x	$ 596.00	=	$ 3,617.72
POND FEES:					
LAND:	6.07ac.	x	$ 1,070.00	=	$ 6,494.90
FACILITIES:	6.07 ac.	x	$ 2,881.00	=	$17,487.67
				TOTAL	**$86,066.53**

SUMMARY

Development of this site will not adversely affect the surrounding development. Proposed flows, as detailed in this report, will follow the drainage patterns outlined in this report and will be released at or below historic rates. This report is in conformance with the approved MDDP Amend II mentioned above and the downstream Final Drainage Report for Greenhaven Filings No 1 & 2. As the future filings are platted they will need to analyze each filing with a report. As mentioned above in the proposed drainage section once any development to the west occurs, a more detailed drainage study must be completed that addresses permanent storm drain system and permanent detention/water quality.

PREPARED BY:
TERRA NOVA ENGINEERING, INC.

Quentin N. Armijo, P.E.
Project Manager
Jobs/1304.00/drainage/130400-MDDP

BIBLIOGRAPHY

"El Paso County and City of Colorado Springs Drainage Criteria Manual"

SCS Soils Map for El Paso County

"Master Development Drainage Plan for Overall Dublin North Subdivision and Final Drainage Report for Filing No. 1." Prepared by Terra Nova Engineering, January 2008.

"Master Development Drainage Plan Amendment No. II for the Easterly Portion of Ridgeview Subdivision and Preliminary Drainage Report for the Northeasterly Portion of Ridgeview Subdivision and Phase II Sand Creek Channel Improvements." Prepared by JR Engineering, February 2004.

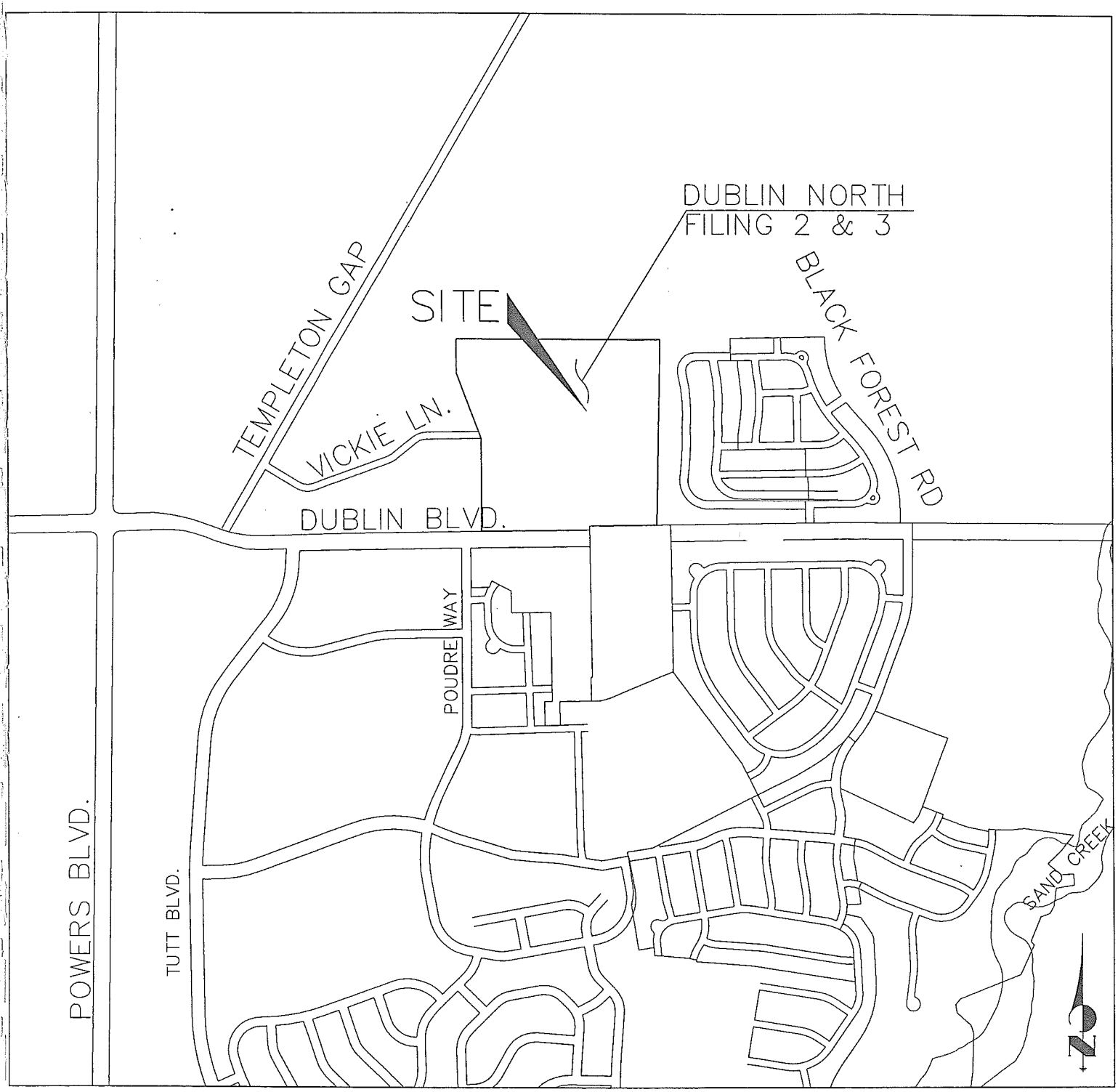
"Final Drainage Report for The Black Forest Road Portion of Greenhaven Filing No. 1, a Portion of Dublin Boulevard and Final Design/ Analysis Report for Black Forest Storm Drain", by JR Engineering, March 10, 2004.

"Final Drainage Report Greenhaven Filing No. 1 and 2 Colorado Springs, Colorado" by Terra Nova Engineering, Inc., dated March 2004.

"Sand Creek Drainage Basin Planning Study Preliminary Design Report" (DBPS) prepared by Kiowa Engineering, revised December 1998.

"Sand Creek Drainage Basin Planning Study Preliminary Design Report Technical Addendum" by Kiowa Engineering, revised October 1995.

VICINITY MAP



VICINITY MAP

N.T.S.

S.C.S. SOILS MAP

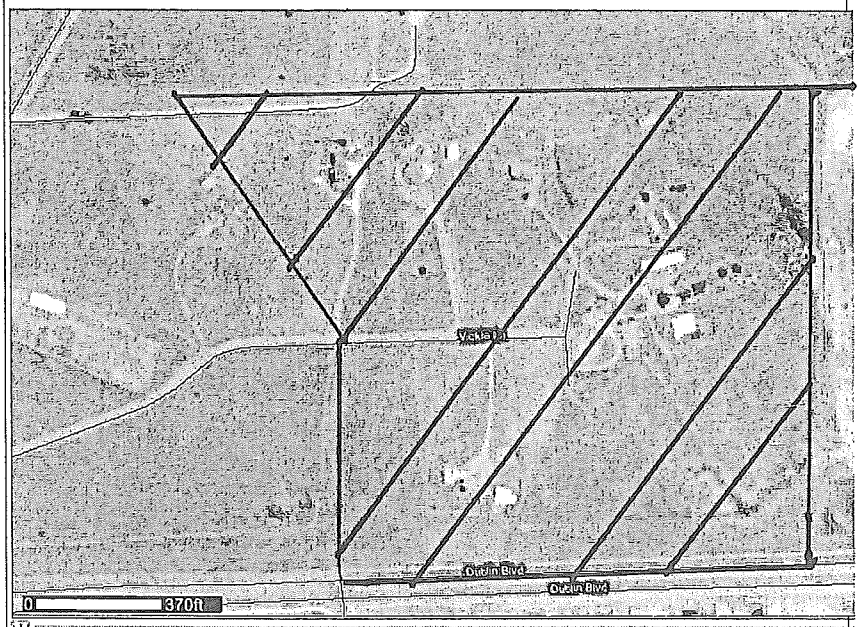
Search

Map Unit Legend

El Paso County Area, Colorado (CO625)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	49.3	100.0%
Totals for Area of Interest		49.3	100.0%

Soil Map



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

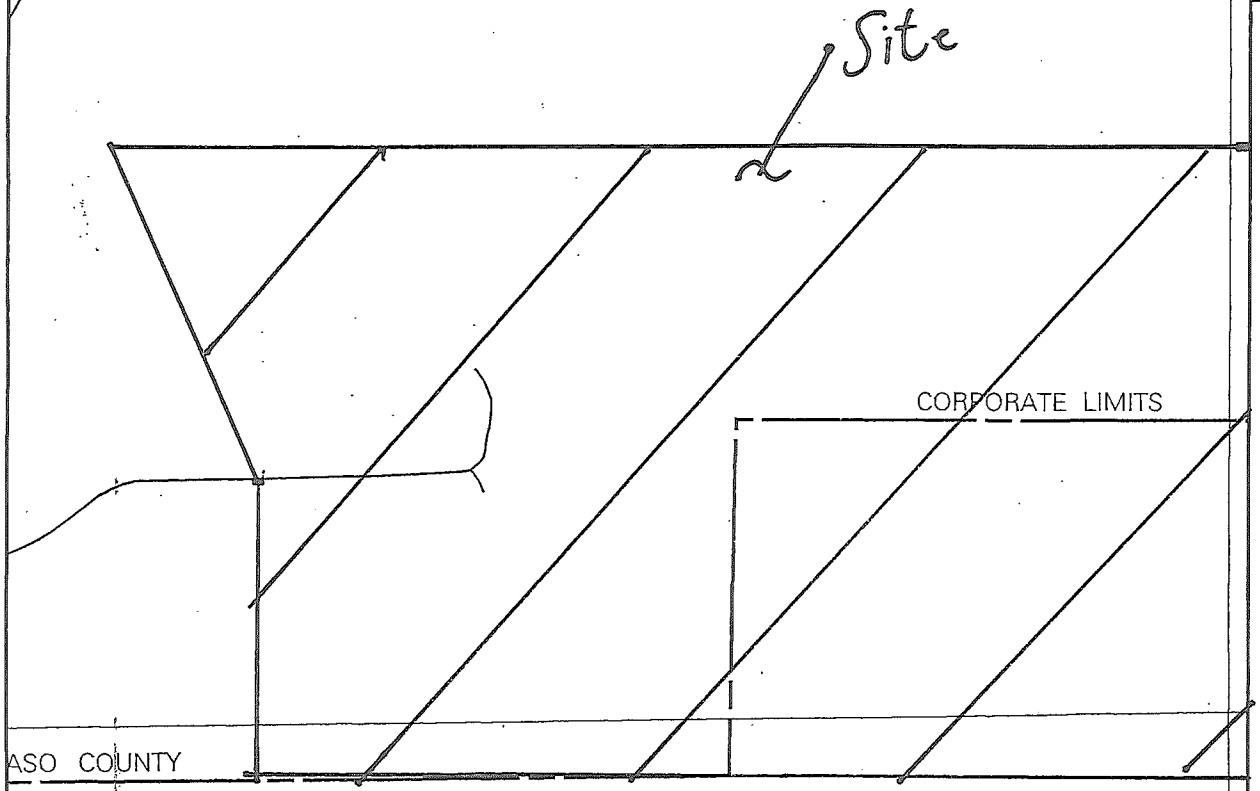
You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Mappi done at a particular scale. The soil surveys that comprise your AOI were mapped at 1:24,000. The des and the level of detail shown in the resulting soil map are dependent on that map scale.

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

FEMA FIRM MAP

7

EL PASO COUNTY
UNINCORPORATED AREAS
080059



APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS

PANEL 537 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0537	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0537	F

MAP NUMBER
08041C0537 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

DUBLIN NORTH SUBDIVISION
MDDP ADDENDUM REPORT
(Area Runoff Coefficient Summary)

		STREETS / DEVELOPED			*OVERLAND / UNDEVELOPED*			*COMPOSITE C*	
BASIN	TOTAL AREA	AREA	C_5	C_{100}	AREA	C_5	C_{100}	C_5	C_{100}
	(Acres)	*(Acres)*			*(Acres)*				
*OS-1**	8.18							0.39	0.49
*OS-2**	1.93							0.64	0.70
*EX-A**	18.06							0.39	0.49
*EX-B**	0.58							0.39	0.49
*EX-C**	10.61							0.50	0.60
EX-D	1.27	1.27	0.30	0.40	0.00	0.30	0.40	0.30	0.40
*EX-E1***	1.64	1.64	0.30	0.40	0.00	0.30	0.40	0.30	0.40
*EX-E2***	6.14	6.14	0.30	0.40	0.00	0.30	0.40	0.30	0.40
EX-F	3.69	3.69	0.30	0.40	0.00	0.30	0.40	0.30	0.40
*EX-G***	10.09	10.09	0.30	0.40	0.00	0.30	0.40	0.30	0.40

*COMPOSITE C INFORMATION TAKEN FROM "MASTER DEVELOPMENT DRAINAGE PLAN AMENDMENT NO. II FOR THE EASTERLY PORTION OF RIDGEVIEW SUBDIVISION AND PRELIMINARY DRAINAGE REPORT FOR THE NORTHEASTERLY PORTION OF RIDGEVIEW SUBDIVISION AND PHASE II SAND CREEK CHANNEL IMPROVEMENTS." BASIN OS-1, EX-A & EX-B CORRESPOND TO OS-145-2 FROM MDDP. BASIN EX-C CORRESPONDS TO OS-145-1 FROM MDDP. BASIN OS-2 IS PART OF BASIN OS-145-3 OF THE MDDP.

**Basin revised from original MDDP

DUBLIN NORTH SUBDIVISION
MDDP ADDENDUM REPORT
(Area Runoff Coefficient Summary)

DEVELOPED CONDITIONS

		STREETS / DEVELOPED			*OVERLAND / UNDEVELOPED*			*COMPOSITE C*	
BASIN	TOTAL AREA	AREA	C_5	C_{100}	AREA	C_5	C_{100}	C_5	C_{100}
	(Acres)	*(Acres)*			*(Acres)*				
OS-1A	8.14	8.14	0.60	0.70	0.00	0.25	0.35	0.39	0.49
OS-1B	0.12	0.12	0.60	0.70	0.00	0.25	0.35	0.39	0.49
OS-1C	0.19	0.19	0.60	0.70	0.00	0.25	0.35	0.39	0.49
OS-2	1.93	1.93	0.60	0.70	0.00	0.25	0.35	0.64	0.70
*A1***	*5.10*	5.10	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*A2***	*1.50*	1.50	0.60	0.70	0.00	0.25	0.35	0.60	0.70
A3	3.28	3.28	0.60	0.70	0.00	0.25	0.35	0.60	0.70
A4	1.05	1.05	0.60	0.70	0.00	0.25	0.35	0.60	0.70
A5	5.05	5.05	0.60	0.70	0.00	0.25	0.35	0.60	0.70
A6	1.03	1.03	0.60	0.70	0.00	0.25	0.35	0.60	0.70
A7	1.55	1.55	0.60	0.70	0.00	0.25	0.35	0.60	0.70
A8	1.25	1.25	0.60	0.70	0.00	0.25	0.35	0.60	0.70
A9	1.24	1.24	0.60	0.70	0.00	0.25	0.35	0.60	0.70
B	0.43	0.00	0.60	0.70	0.43	0.25	0.35	0.25	0.35
*C1***	*1.72*	1.72	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*C2***	*2.67*	2.67	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*C3***	*1.85*	1.85	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*C4***	*2.52*	2.52	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*C5***	*2.96*	2.96	0.60	0.70	0.00	0.25	0.35	0.60	0.70
C6	*C6 BASIN NO LONGER USED*								
C7	*C7 BASIN NO LONGER USED*								
*C8***	*1.33*	1.33	0.60	0.70	0.00	0.25	0.35	0.60	0.70
C9	0.24	0.24	0.60	0.70	0.00	0.25	0.35	0.60	0.70
C10	*C10 BASIN NO LONGER USED*								
C11	1.47	1.47	0.60	0.70	0.00	0.25	0.35	0.60	0.70
C12	0.91	0.91	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*D***	*0.66*	0.66	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*E1***	*0.81*	0.81	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*E2***	*1.13*	1.13	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*F***	*2.41*	2.41	0.60	0.70	0.00	0.25	0.35	0.60	0.70
F Temp	*F TEMP BASIN NO LONGER USED*								
*G1***	*3.95*	3.95	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*G2****	*2.41*	2.41	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*G3****	*1.53*	1.53	0.60	0.70	0.00	0.25	0.35	0.60	0.70
*G4****	*2.02*	2.02	0.60	0.70	0.00	0.25	0.35	0.60	0.70
G Temp	*G TEMP BASIN NO LONGER USED*								

**Basin revised from original MDDP

*** New basin added since original MDDP

Addendum Date: 6/4/13

DUBLIN NORTH SUBDIVISION
MDDP ADDENDUM
(Area Drainage Summary)

HISTORIC CONDITIONS

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_t	Tc USED	*INTENSITY*		*TOTAL FLOWS*	
BASIN	AREA TOTAL (Acres)	C_5	C_{100} * For Calcs See Runoff Summary	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	(min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (cfs)	Q_{100} (cfs)
*OS-1**	8.18	0.39	0.49	0.25	200	12.0	12.4	1000	8.4%	6.5	2.6	15.0	15.0	3.5	5.9	*11.1*	*23.6*
*OS-2**	1.93	0.64	0.70	0.25	100	12.0	7.0	300	6.7%	6.0	0.8	7.8	7.8	4.4	7.8	*5.4*	*10.5*
*EX-A**	18.06	0.39	0.49	0.25	200	12.0	12.4	900	9.3%	6.5	2.3	14.8	14.8	3.5	5.9	*24.6*	*52.6*
*EX-B**	0.58	0.39	0.49	0.25	230	12.0	14.0					14.0	14.0	3.6	6.1	*0.8*	*1.7*
*EX-C**	10.61	0.50	0.60	0.25	165	11.0	10.9	1170	5.0%	3.5	5.6	16.5	16.5	3.3	5.6	*17.7*	*35.8*
EX-D	1.27	0.30	0.40	0.25	150	8.0	11.2	160	5.0%	3.6	0.7	11.9	11.9	3.8	6.6	*1.5*	*3.3*
*EX-E1***	1.64	0.30	0.40	0.25	150	8.0	11.2	161	5.0%	4.6	0.6	11.8	11.8	3.8	6.6	*1.9*	*4.3*
*EX-E2***	6.14	0.30	0.40	0.25	175	5.0	14.9	70	4.3%	3.4	0.3	15.2	15.2	3.4	5.9	*6.4*	*14.4*
EX-F	3.69	0.30	0.40	0.25	200	12.0	12.4	590	3.4%	2.8	3.5	16.0	16.0	3.4	5.7	*3.7*	*8.4*
*EX-G***	10.09	0.30	0.40	0.25	150	8.0	11.2	743	3.2%	3.2	2.0	13.2	13.2	3.7	6.3	*11.1*	*25.3*

**Basin revised from original MDDP

*** New basin added since original MDDP

DUBLIN NORTH SUBDIVISION
MDDP ADDENDUM
(Area Drainage Summary)

DEVELOPED CONDITIONS

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_t	Tc USED	*INTENSITY*		*TOTAL FLOWS*	
BASIN	AREA TOTAL (Acres)	C_5 * For Calcs See Runoff Summary	C_{100}	C_5	Length (ft)	Height (ft)	T_c (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	(min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (cfs)	Q_{100} (cfs)
OS-1A	8.14	0.39	0.49	0.25	200	12.0	12.4	1000	8.4%	6.5	2.6	15.0	15.0	3.5	5.9	*11.0*	*23.5*
OS-1B	0.12	0.39	0.49	0.25								0.0	5.0	5.0	9.1	*0.2*	*0.5*
OS-1C	0.19	0.39	0.49	0.25								0.0	5.0	5.0	9.1	*0.4*	*0.8*
OS-2	1.93	0.64	0.70	0.25	100	12.0	7.0	300	6.7%	6.0	0.8	7.8	7.8	4.4	7.8	*5.4*	*10.5*
*A1***	5.10	0.60	0.70	0.25	120	3.5	12.2	1155	1.7%	2.5	7.7	19.9	19.9	3.1	5.1	*9.3*	*18.2*
*A2***	1.50	0.60	0.70	0.25	135	12.0	9.0	70	4.3%	4.5	0.3	9.2	9.2	4.2	7.3	*3.8*	*7.7*
A3	3.28	0.60	0.70	0.25	150	4.5	13.5	420	0.7%	1.8	3.9	17.4	17.4	3.2	5.5	*6.4*	*12.5*
A4	1.05	0.60	0.70	0.25	60	1.2	9.8	420	0.7%	1.8	3.9	13.7	13.7	3.6	6.2	*2.3*	*4.5*
A5	5.05	0.60	0.70	0.25	130	3.5	13.1	370	3.8%	4.1	1.5	14.6	14.6	3.5	6.0	*10.6*	*21.1*
A6	1.03	0.60	0.70	0.25	60	1.2	9.8	420	0.7%	1.8	3.9	13.7	13.7	3.6	6.2	*2.2*	*4.4*
A7	1.55	0.60	0.70	0.25	200	12.0	12.4					12.4	12.4	3.7	6.4	*3.5*	*7.0*
A8	1.25	0.60	0.70	0.25	60	1.2	9.8	660	6.4%	5.2	2.1	11.9	11.9	3.8	6.6	*2.9*	*5.7*
A9	1.24	0.60	0.70	0.25	70	10.0	5.5					5.5	5.5	4.9	8.8	*3.6*	*7.6*
B	0.43	0.25	0.35	0.25	230	12.0	14.0					14.0	14.0	3.6	6.1	*0.4*	*0.9*
*C1***	1.72	0.60	0.70	0.25	122	2.4	14.0	510	1.2%	2.2	3.9	17.9	17.9	3.2	5.4	*3.3*	*6.5*
*C2***	2.67	0.60	0.70	0.25	122	2.4	14.0	560	1.8%	2.8	3.3	17.4	17.4	3.3	5.5	*5.2*	*10.2*
*C3***	1.85	0.60	0.70	0.25	122	2.4	14.0	436	3.1%	3.3	2.2	16.2	16.2	3.4	5.7	*3.7*	*7.4*
*C4***	2.52	0.60	0.70	0.25	170	3.4	16.5	165	1.1%	2.1	1.3	17.8	17.8	3.2	5.4	*4.9*	*9.5*
*C5***	2.96	0.60	0.70	0.25	120	2.4	13.9	732		2.0	6.1	20.0	20.0	3.1	5.1	*5.4*	*10.5*
C6	C6 BASIN NO LONGER USED																
C7	C7 BASIN NO LONGER USED																
*C8***	1.33	0.60	0.70	0.25	129	2.6	14.3	188	0.8%	1.8	1.7	16.1	16.1	3.4	5.7	*2.7*	*5.3*
C9	0.24	0.60	0.70	0.25	60	1.2	9.8	120	1.7%	2.5	0.8	10.6	10.6	4.0	6.9	*0.6*	*1.1*
C10	C10 BASIN NO LONGER USED																
C11	1.47	0.60	0.70	0.25	120	4.0	11.7	200	4.0%	4.2	0.8	12.5	12.5	3.7	6.4	*3.3*	*6.6*
C12	0.91	0.60	0.70	0.25	95	6.0	8.4					8.4	8.4	4.3	7.6	*2.3*	*4.8*
*D***	0.66	0.60	0.70	0.25	40	2.0	5.9	180	4.4%	4.5	0.7	6.6	6.6	4.7	8.3	*1.8*	*3.8*
*E1***	0.81	0.60	0.70	0.25	60	1.2	9.8	33	6.1%	2.5	0.2	10.0	5.0	5.0	9.1	*2.4*	*5.2*
*E2***	1.13	0.60	0.70	0.25	100	4.0	10.1	715	1.1%	2.1	5.7	15.7	15.7	3.4	5.8	*2.3*	*4.6*
*F***	2.41	0.60	0.70	0.25	115	3.5	11.8	700	3.7%	4.1	2.8	14.7	14.7	3.5	6.0	*5.1*	*10.0*
F Temp	F TEMP BASIN NO LONGER USED																
*G1***	3.95	0.60	0.70	0.25	56	1.2	9.2	839	1.3%	2.2	6.4	15.6	15.6	3.4	5.8	*8.1*	*16.0*
*G2****	2.41	0.60	0.70	0.25	120	3.5	12.2	405	3.7%	3.5	1.9	14.2	14.2	3.6	6.1	*5.1*	*10.2*
*G3****	1.53	0.60	0.70	0.25	120	2.4	13.9	242	1.0%	2.0	2.0	15.9	15.9	3.4	5.7	*3.1*	*6.1*
*G4****	2.02	0.60	0.70	0.25	62	4.0	6.8					6.8	6.8	4.6	8.2	*5.6*	*11.6*
G Temp	G TEMP BASIN NO LONGER USED																

** Basin revised from original MDDP

*** New basin added since original MDDP

Addendum Date: 6/4/13

DUBLIN NORTH SUBDIVISION
MDDP ADDENDUM REPORT
(Surface Routing Summary)
HISTORIC CONDITIONS

Design Point(s)	Contributing Basins	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity		Flow	
					I_5	I_{100}	Q_5	Q_{100}
EX-1	OS-1 & EX-A	10.23	12.86	15.0	3.5	5.9	35.5	75.7
EX-2	OS-2 & EX-B	1.46	1.52	14.0	3.6	6.1	5.2	9.3
EX-3	EX-C	5.30	6.36	16.5	3.3	5.6	17.7	35.8
EX-4	EX-D	0.38	0.51	11.9	3.8	6.6	1.5	3.3
EX-5A**	EX-E1	0.49	0.65	11.8	3.8	6.6	1.9	4.3
EX-5B**	EX-E2	1.84	2.46	15.2	3.4	5.9	6.4	14.4
EX-6	EX-F	1.11	1.48	16.0	3.4	5.7	3.7	8.4
EX-7**	EX-G	3.03	4.03	13.2	3.7	6.3	11.1	25.3
EX-8**	EX-F & EX-G	4.13	5.51	16.0	3.4	5.7	14.0	31.5

** Design Point revised from original MDDP

DUBLIN NORTH SUBDIVISION
MDDP ADDENDUM REPORT
(Surface Routing Summary)
DEVELOPED CONDITIONS

Design Point(s)	Contributing Basins	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity		Flow	
					I_5	I_{100}	Q_5	Q_{100}
1A**	A1, A2, A3,& OS-1B	5.97	6.97	19.9	3.1	5.1	18.2	35.6
1B	A4	0.63	0.74	13.7	3.6	6.2	2.3	4.5
1A&1B**	A1, A2, A3, A4, & OS-1B	6.60	7.71	19.9	3.1	5.1	20.2	39.3
1C	OS-1A	3.17	3.99	15.0	3.5	5.9	11.0	23.5
1D	A5 & OS-1C	3.11	3.63	14.6	3.5	6.0	10.9	21.7
1E	A6	0.62	0.72	13.7	3.6	6.2	2.2	4.4
1F	A8	0.75	0.87	11.9	3.8	6.6	2.9	5.7
1G	DP-1A THRU 1F, & A7	14.25	16.92	19.9	3.1	5.1	43.5	86.3
1H	A9 & DP-1F FLOW BY	0.95	1.18	5.5	4.9	8.8	4.6	10.3
2	OS-2 & B	1.34	1.50	14.0	3.6	6.1	4.8	9.1
3A**	C1	1.03	1.20	17.9	3.2	5.4	3.3	6.5
3B**	C1 & C2	2.63	3.07	17.9	3.2	5.4	8.4	16.6
3C**	C1, C2 & C3	3.75	4.37	17.9	3.2	5.4	12.0	23.6
3D**	C1, C2, C3 & C4	5.26	6.13	17.9	3.2	5.4	16.9	33.1
3E**	C5	1.77	2.07	20.0	3.1	5.1	5.4	10.5
3D&3E	C1, C2, C3, C4, & C5	7.03	8.20	20.0	3.1	5.1	21.5	41.8

DUBLIN NORTH SUBDIVISION
MDDP ADDENDUM REPORT
(Surface Routing Summary)

3F	NO LONGER USED							
3G	NO LONGER USED							
3H**	C8	0.80	0.93	16.1	3.4	5.7	2.7	5.3
3I	C9	0.14	0.17	10.6	4.0	6.9	0.6	1.1
3J	NO LONGER USED							
3K	C11	0.88	1.03	12.5	3.7	6.4	3.3	6.6
3M**	DP-3D, DP-3E, DP-3H, DP-3I, DP3K & C-12	9.40	10.97	20.0	3.1	5.1	28.7	55.9
4**	D**	0.40	0.46	6.6	4.7	8.3	1.8	3.8
5A**	E1**	0.49	0.57	5.0	5.0	9.1	2.4	5.2
5B**	E2**	0.68	0.79	15.7	3.4	5.8	2.3	4.6
6**	F	1.45	1.69	14.7	3.5	6.0	5.1	10.0
7A**	G1	2.37	2.76	15.6	3.4	5.8	8.1	16.0
7B***	F, G1 & G2	5.26	6.14	15.6	3.4	5.8	17.9	35.5
7C***	G4	1.21	1.41	6.8	4.6	8.2	5.6	11.6
8	F, G1, G2, G3, & E2	6.86	8.00	15.9	3.4	5.7	23.2	45.9

DEV. RUNOFF TO DP-3M		28.7	55.9
HIST. RUNOFF @ DP-EX-3		17.7	35.8
DEV. RUNOFF DP-3M OVER HIST. RUNOFF DP-EX-3		11.0	20.1
HIST. RUNOFF @ DP-EX-1	-	35.5	75.7
NEW ALLOWABLE HIST. RUNOFF	=	24.5	55.6

Addendum Date: 6/4/13

DP-8 Temp was calculated for the intermidiate condition until developed flow to the west can be accomdated for with a detention pond

** Design Point revised from original MDDP

*** New Design Point added since original MDDP

DUBLIN NORTH SUBDIVISION
MDDP ADDENDUM
(Pipe Routing Summary)
DEVELOPED CONDITIONS

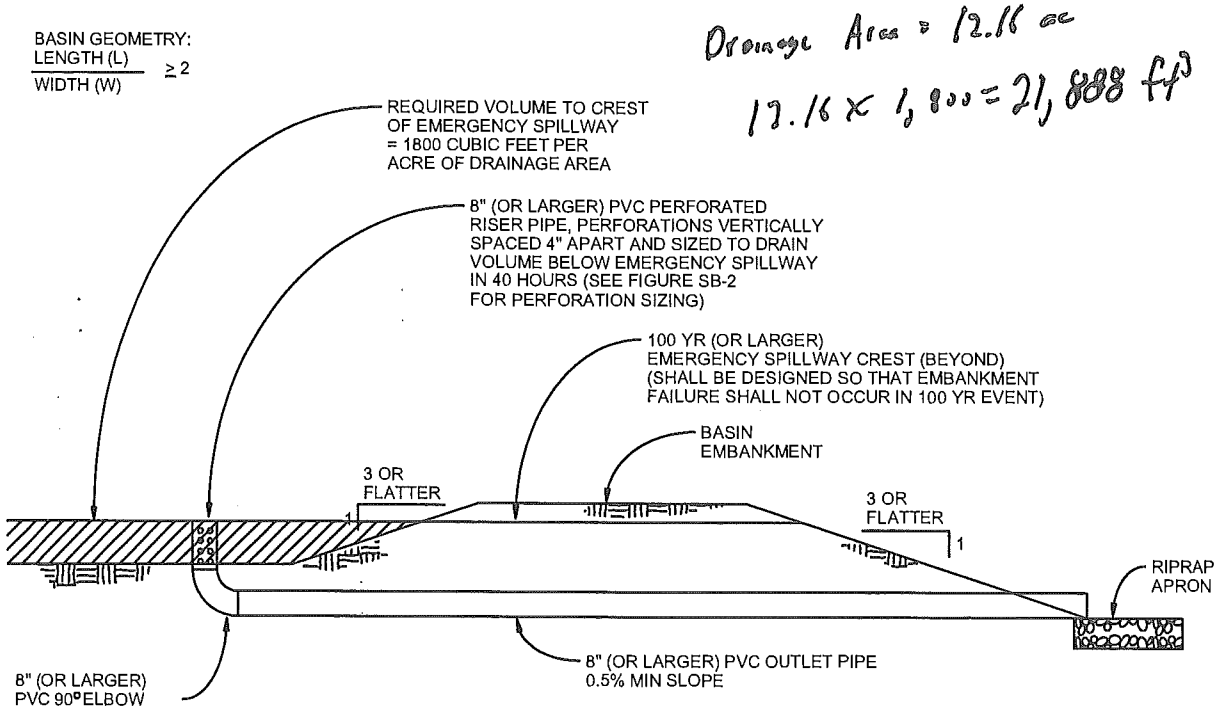
Pipe Runs(s)	Contributing Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity		Flow	
					I_5	I_{100}	Q_5	Q_{100}
1**	DP-1A	3.30	3.85	19.9	3.1	5.1	10.1	19.7
2**	DP-1A & 1B	6.60	7.71	19.9	3.1	5.1	20.2	39.3
3**	DP-1D & PR-2	9.71	11.34	19.9	3.1	5.1	29.6	57.8
4**	DP-1E & PR-3	10.33	12.06	19.9	3.1	5.1	31.5	61.5
5	DP-1F PICK UP	0.54	0.56	11.9	3.8	6.6	2.1	3.7
6**	PR-4 & PR-5	10.87	12.62	19.9	3.1	5.1	33.2	64.4
7	NO LONGER USED							
8	NO LONGER USED							
9	NO LONGER USED							
10**	DP-3D	5.26	6.13	17.9	3.2	5.4	16.9	33.1
11	NO LONGER USED							
12	NO LONGER USED							
13	NO LONGER USED							
14	NO LONGER USED							
15	NO LONGER USED							

DUBLIN NORTH SUBDIVISION
MDDP ADDENDUM
(Pipe Routing Summary)

Pipe Runs(s)	Contributing Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity		Flow	
					I_5	I_{100}	Q_5	Q_{100}
16**	DP-3D & DP-3E	7.03	8.20	20.0	3.1	5.1	21.5	41.8
17	DP-3H	0.80	0.93	16.1	3.4	5.7	2.7	5.3
18	DP-3I	0.14	0.17	10.6	4.0	6.9	0.6	1.1
19	DP-3H & DP-3I	0.94	1.10	10.6	4.0	6.9	3.7	7.6
20**	DP-3D THRU DP-3I	7.97	9.30	20.0	3.1	5.1	24.3	47.4
21	NO LONGER USED							
22**	DP-3A THRU DP-3J	7.97	9.30	20.0	3.1	5.1	24.3	47.4
23**	DP-3A THRU DP-3K	8.86	10.33	20.0	3.0	5.1	27.0	52.6
24**	DP-3A THRU DP-3M	9.40	10.97	20.0	3.1	5.1	28.7	55.9
25**	DP-6 AND DP-7	6.86	8.00	15.9	3.4	5.7	23.2	45.9

** Pipe Run revised from original MDDP

WATER QUALITY POND



SEDIMENT BASIN

NTS

SEDMENT BASIN NOTES

INSTALLATION REQUIREMENTS

1. SEDIMENT BASINS SHALL BE INSTALLED BEFORE ANY CLEARING AND/OR GRADING IS UNDERTAKEN.

2. THE AREA UNDER WHICH THE EMBANKMENT IS TO BE INSTALLED SHALL BE CLEARED, GRUBBED, AND STRIPPED OF ALL VEGETATION AND ROOT MAT.

3. THE OUTLET OF THE BASIN SHALL BE DESIGNED TO DRAIN ITS VOLUME IN 40 HOURS.

4. THE OUTLET IS TO BE LOCATED AT THE FURTHEST DISTANCE FROM THE INLET OF THE BASIN. BAFFLES MAY BE NEEDED TO INCREASE THE FLOW LENGTH AND SETTLING TIME.

5. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL WITH A MINIMUM OF 15% PASSING A #200 SIEVE. EXCAVATED SOIL CAN BE USED IF IT MEETS THIS REQUIREMENT.

6. EMBANKMENT IS TO BE COMPACTED TO AT LEAST 90% OF MAXIMUM DENSITY AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT ACCORDING TO ASTM D 698.

7. WHEN A BASIN IS INSTALLED NEAR A RESIDENTIAL AREA, FOR SAFETY REASONS, A SIGN SHALL BE POSTED AND THE AREA SECURED WITH A FENCE.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT SEDIMENT BASINS AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.

2. SEDIMENT BASINS SHALL BE CLEANED OUT BEFORE SEDIMENT HAS FILLED HALF THE VOLUME OF THE BASIN.

3. SEDIMENT BASINS SHALL REMAIN OPERATIONAL AND PROPERLY MAINTAINED UNTIL THE SITE AREA IS PERMANENTLY STABILIZED WITH ADEQUATE VEGETATIVE COVER AND/OR OTHER PERMANENT STRUCTURE AS APPROVED BY THE CITY.

City of Colorado Springs Stormwater Quality	Figure SB-1 Sediment Basin Construction Detail and Maintenance Requirements

Required Area per Row (in^2)

Design Volume (acre-ft)	Depth at Outlet (ft)							
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
2	15.04	7.71	5.10	3.76	2.95	2.41	2.02	1.73
1	7.52	3.86	2.55	1.88	1.48	1.21	1.01	0.87
0.6	4.51	2.31	1.53	1.13	0.89	0.72	0.61	0.52
0.4	3.01	1.54	1.02	0.75	0.59	0.48	0.40	0.35
0.2	1.50	0.77	0.51	0.38	0.30	0.24	0.20	0.17
0.1	0.75	0.39	0.26	0.19	0.15	0.12	0.10	0.09
0.06	0.45	0.23	0.15	0.11	0.09	0.07	0.06	0.05
0.04	0.30	0.15	0.10	0.08	0.06	0.05	0.04	0.03
0.02	0.15	0.08	0.05	0.04	0.03	0.02	0.02	0.02
0.01	0.08	0.04	0.03	0.02	0.01	0.01	0.01	0.01

TABLE SB-1

Circular Perforation Sizing

Hole Diameter (In)	Hole Diameter (in)	Area per Row (in^2)		
		n = 1	n = 2	n = 3
1/4	0.250	0.05	0.10	0.15
5/16	0.313	0.08	0.15	0.23
3/8	0.375	0.11	0.22	0.33
7/16	0.438	0.15	0.30	0.45
1/2	0.500	0.20	0.39	0.59
9/16	0.563	0.25	0.50	0.75
5/8	0.625	0.31	0.61	0.92
11/16	0.688	0.37	0.74	1.11
3/4	0.750	0.44	0.88	1.33
7/8	0.875	0.60	1.20	1.80
1	1.000	0.79	1.57	2.36
1 1/8	1.125	0.99	1.99	2.98
1 1/4	1.250	1.23	2.45	3.68
1 3/8	1.375	1.48	2.97	4.45
1 1/2	1.500	1.77	3.53	5.30
1 5/8	1.625	2.07	4.15	6.22
1 3/4	1.750	2.41	4.81	7.22
1 7/8	1.875	2.76	5.52	8.28
2	2.000	3.14	6.28	9.42
n = Number of columns of perforations				
Minimum steel plate thickness		1/4"	5/16"	3/8"

TABLE SB-2

HYDRAULIC CALCULATIONS

*DESIGN POINT 1A***

Total Flow:

Q_5 = **10.1** cfs
Q_{100} = **19.7** cfs

FLOW ASSUMED SPLIT BETWEEN DP-1A AND DP-1B

Maximum allowable ponding depth at sump:

D_5 = 0.45
D_{100} = 0.83 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event: **6** foot inlet required

100-Year Event: **6** foot inlet required

(Install a 10' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at design points 1A & 1B.)

** Design Point revised from original MDDP

Calculated by: QNA
Addendum Date: 6/4/13

*DESIGN POINT 1B***

Total Flow:

Q_5 = **10.1** cfs

Q_{100} = **19.7** cfs

FLOW ASSUMED SPLIT BETWEEN DP-1A AND DP-1B

Maximum allowable ponding depth at sump:

D_5 = 0.45

D_{100} = 0.83 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **6** foot inlet required

100-Year Event: **6** foot inlet required

(Install a 10' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at design points 1A & 1B.)

** Design Point revised from original MDDP

Calculated by: QNA

Addendum Date: 6/4/13

DESIGN POINT 1D

Total Flow:	Q_5	=	**10.9** cfs
	Q_{100}	=	**21.7** cfs

Maximum allowable ponding depth at sump:

	D_5	=	0.45
	D_{100}	=	0.83 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event:	**6**	foot inlet required
100-Year Event:	**6**	foot inlet required

(Install a 10' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: QNA
Addendum Date: 6/4/13

DESIGN POINT 1E

Total Flow: Q_5 = 2.2 cfs
Q_{100} = 4.4 cfs

Maximum allowable ponding depth at sump:

D_5 = 0.45
D_{100} = 0.67 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 4 foot inlet required

(Install a 6' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: QNA
Addendum Date: 6/4/13

$$Q = 0.56\ (Z/n)\ d^{(8/3)}\ S^{(1/2)}$$

ENTER:	Manning's "n_b" for road surface=	0.016	
ENTER:	Manning's "n_a" for curb surface=	0.013	
ENTER:	Cross Slope (S_x) =	0.02	ft/ft
ENTER:	Street Slope (S) =	0.04	ft/ft
ENTER:	Gutter Slope (S_g) =	0.0833	ft/ft
ENTER:	Gutter Width =	2	ft
ENTER:	Distance from Flow Line to Crown =	15	ft
	Total Depth at A =	0.0625	ft
	Za = $1/S_x$ =	50	ft/ft
	Zb = $1/S_g$ =	12	ft/ft

As of May 2001, Colorado Springs City Standard Curb and Gutters have the following characteristics:

Type	Gutter Width (feet)	Vertical Change (inches)	Slope
Type I	2	1.5	0.0625
Type III	1	0.5	0.0417
Type V	0.833	0.5	0.0500
	2	2	0.0833

DESIGN POINT 1F

5-YR FLOW					
Q(5)	2.9	I(5)	3.8		
DEPTH	0.25	Fr	2.47	Inlet size ? L(i) =	**20**
SPREAD	11.1	L(1)	21.1	If Li < L(2) then Qi =	2.7
CROSS SLOPE	2.0%	L(2)	12.7	If Li > L(2) then Qi =	2.1
STREET SLOPE	4.0%	L(3)	45.3	FB =	0.8
				CA(eqv.)=	0.21

100-YR FLOW					
Q(100)	5.7	I(100)	6.6		
DEPTH	0.31	Fr	2.59	Inlet size ? L(i) =	**20**
SPREAD	14.1	L(1)	28.1	If Li < L(2) then Qi =	4.1
CROSS SLOPE	2.0%	L(2)	16.9	If Li > L(2) then Qi =	3.7
STREET SLOPE	4.0%	L(3)	60.3	FB =	2.0
				CA(eqv.)=	0.31

*DESIGN POINT 3D***

Total Flow:

Q_5 = **10.7** cfs

Q_{100} = **20.9** cfs

FLOW ASSUMED SPLIT BETWEEN DP-3D AND DP-3E

Maximum allowable ponding depth at sump:

D_5 = 0.45

D_{100} = 0.83 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **6** foot inlet required

100-Year Event: **6** foot inlet required

(Install 2 10' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point on both sides of street.)

** Design Point revised from original MDDP

Calculated by: QNA

Addendum Date: 6/4/13

*DESIGN POINT 3E***

Total Flow: Q_5 = **10.7** cfs
Q_{100} = **20.9** cfs
FLOW ASSUMED SPLIT BETWEEN 2 INLETS

Maximum allowable ponding depth at sump:

D_5 = 0.45
D_{100} = 0.83 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25
Li (1.25) = Length of inlet opening

5-Year Event: **6** foot inlet required

100-Year Event: **6** foot inlet required

(Install 2 10' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point on both sides of street.)

** Design Point revised from original MDDP

Calculated by: QNA
Addendum Date: 6/4/13

DESIGN POINT 3H

Total Flow: Q_5 = **2.7** cfs

Q_{100} = **5.3** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.45

D_{100} = 0.83 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 4 foot inlet required

(Install a 6' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: QNA

Addendum Date: 6/4/13

DESIGN POINT 3I

Total Flow: Q_5 = **0.6** cfs

Q_{100} = **1.1** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.45

D_{100} = 0.83 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **4** foot inlet required

100-Year Event: 4 foot inlet required

(Install a 6' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: QNA

Addendum Date: 6/4/13

DESIGN POINT 3H

Total Flow: Q_5 = **2.7** cfs

Q_{100} = **5.3** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.45

D_{100} = 0.83 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: 4 foot inlet required

100-Year Event: 4 foot inlet required

(Install a 6' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

Calculated by: QNA

Addendum Date: 6/4/13

*DESIGN POINT 8***

Total Flow: Q_5 = **17.9** cfs

Q_{100} = **35.5** cfs

Maximum allowable ponding depth at sump:

D_5 = 0.45

D_{100} = 0.83 (dmax)

Qi = = 1.7(Li+1.8(W))(dmax + w/12)^1.85

Clogging Factor = 1.25

Li (1.25) = Length of inlet opening

5-Year Event: **14** foot inlet required

100-Year Event: **14** foot inlet required

(Install a 10' D-10-R inlet to accept both 5 yr. & 100 yr. developed flows at this design point.)

** Design Point revised from original MDDP

Calculated by: QNA

Addendum Date: 6/4/13

DP 3D & 3E Overflow Swale X-sect C-C

Other Calculators

- Air Flow Conversion Calculator
- Atmospheric Calculator
- Block Wall Calculator
- Concrete Column Calculator
- Concrete Volume Calculator
- Energy Conversion Calculator
- Isentropic Flow Relations Calculator
- Laser Real Time Unit Converter
- Normal Flow Relations Calculator
- Oblique Flow Relations Calculator
- Open-channel Flow Calculator
- Properties of Welds Treated as Lines Calculator
- Shaft Speed Calculator
- Torque Transmitted by Clutch Calculator
- Water Pump Engineering
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- Mathematics

Open-Channel Flow

This calculator uses Chézy and Manning's formula to calculate the wetted perimeter, hydraulic radius, flow area, Chézy coefficient and flow velocity.

For experimental values of Manning's n factor, click here

Required Information

Enter the Slope:	.01	Enter the Channel Top Width (ft):	20
Enter the Channel Bottom Width (ft):	12	Enter the Channel Height (ft):	2
Enter the Flow Depth (ft):	.867	Enter the n value:	.035

Results

The wetted perimeter is	15.877 ft	The flow is	41.8433 ft^3/s
The flow area is	11.907 ft^2	The flow is	18779.30 gal/min
The hydraulic radius is	0.7499 ft	The velocity is	3.51407 ft/s
The C value is	40.5780		

Calculate Reset

Pipe Run 24

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Can you help me translate this calculator to your language or host this calculator at your web site?

		Results:		
		Flow, q	55.9122	cfs
Pipe diameter, d_0	30 inches	Velocity, v	13.4593	ft/sec
		Velocity head, h_v	2.8154	ft
Manning roughness, n ?	.013	Flow area	4.1543	ft^2
Pressure slope (possibly ? equal to pipe slope), S_0	.02 rise/run	Wetted perimeter	5.4676	ft
		Hydraulic radius	0.7598	ft
Percent of (or ratio to) full depth (100% or 1 if flowing full)	78.9 %	Top width, T	2.0401	ft
		Froude number, F	1.66	
		Shear stress (tractive force), tau	2.4632	psf

Please give us your valued words of suggestion or praise. Did this free calculator exceed your expectations in every way?

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Last Modified 03/18/2013 16:11:00

Pipe Run 25

List of Calculators Hydraulics Language

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Can you help me translate this calculator to your language or host this calculator at your web site?

Pipe diameter, d_0	30 inches
Manning roughness, n ?	.013
Pressure slope (possibly ? equal to pipe slope), S_0	.01 rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	57.4 %

Results:

Flow, q	25.7201	cfs
Velocity, v	8.8231	ft/sec
Velocity head, h_v	1.2099	ft
Flow area	2.9152	ft^2
Wetted perimeter	4.2983	ft
Hydraulic radius	0.6782	ft
Top width, T	2.4724	ft
Froude number, F	1.43	
Shear stress (tractive force), tau	0.8960	psf

Please give us your valued words of suggestion or praise. Did this free calculator exceed your expectations in every way?

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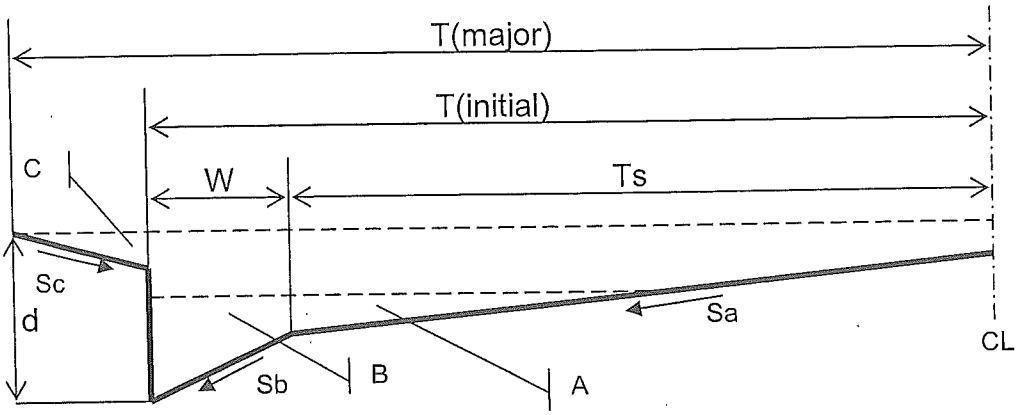
Last Modified 03/18/2013 16:11:00

Street Capacity
Wexford Drive



$$* Q = 0.56/(n*Sx)*S^{(0.5)}*(T*Sx)^{(2.67)}$$

*equation taken from City of Colorado Springs and El Paso County Drainage Criteria Manual Chapter 7.3

where:

Q = flow rate [cfs]
T = width of flow (spread) [ft]
Sx = cross slope [ft/ft]**
S = longitudinal slope [ft/ft]
n = Manning's n coeff.
**shown as Sa in picture and below

Height of Curb = 0.50 ft

-- Initial Storm -- d(max) @ flowline = 0.50 ft

Known:

T(initial) = 15.00 ft
W = 1.33 ft
Sa = 0.02 ft/ft
S = 0.01 ft/ft
Sb = 0.09 ft/ft
n (road) = 0.016

Solution:

Q(A) = 12.8 cfs
Q(B) = 3.1 cfs

Initial Storm Street Capacity, Qcap = Q(A) + Q(B) = **16** cfs/side

-- Major Storm -- d(max) @ flowline = 0.67 ft

Known:

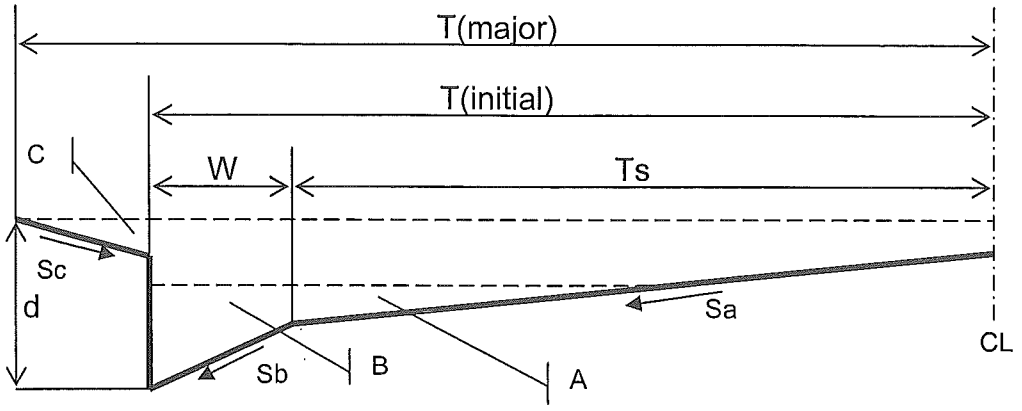
T(major) = 25.00 ft
W = 1.33 ft
Sa = 0.02 ft/ft
S = 0.01 ft/ft
Sb = 0.09 ft/ft
Sc = 0.02 ft/ft
n (road) = 0.016
n (grass)= 0.030

Solution:

Q(A) = 30.5 cfs
Q(B) = 5.4 cfs
Q(C) = 0.8 cfs

Major Storm Street Capacity, Qcap = Q(A) + Q(B) = **37** cfs/side

Street Capacity
Donahue Lane DP-3A, 3B, 3C 3D



* Q = 0.56/(n*Sx)*S^(0.5)*(T*Sx)^(2.67)

*equation taken from City of Colorado Springs and El Paso County Drainage Criteria Manual Chapter 7.3

where:

Q = flow rate [cfs]
T = width of flow (spread) [ft]
Sx = cross slope [ft/ft]**
S = longitudinal slope [ft/ft]
n = Manning's n coeff.
**shown as Sa in picture and below

Height of Curb = 0.50 ft

-- Initial Storm -- d(max) @ flowline = 0.43 ft

Known:

T(initial) =	17.00 ft	Sa =	0.02 ft/ft	Sb =	0.09 ft/ft	n (road) =	0.016
W =	1.33 ft	S =	0.01 ft/ft				

Solution:

Q(A) = 7.7 cfs Q(B) = 2.5 cfs

Initial Storm Street Capacity, Qcap = Q(A) + Q(B) = **10** cfs/side

-- Major Storm -- d(max) @ flowline = 0.67 ft

Known:

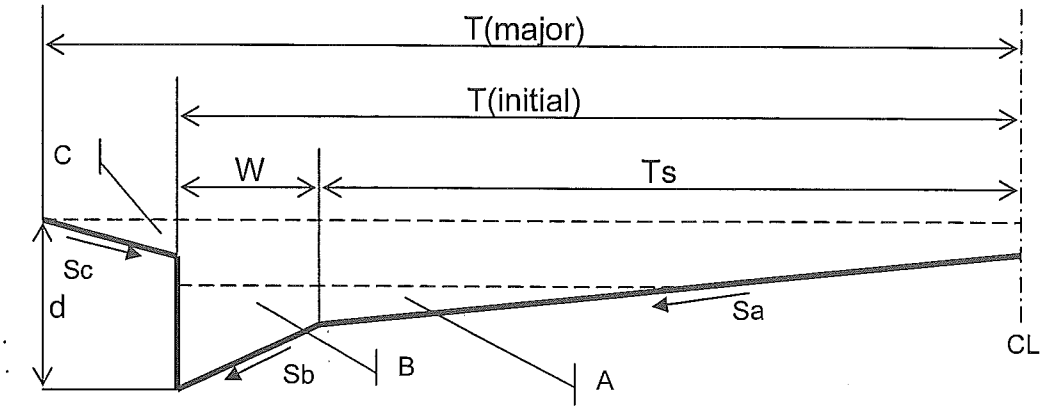
T(major) =	25.00 ft	Sa =	0.02 ft/ft	Sb =	0.09 ft/ft	n (road) =	0.016
W =	1.33 ft	S =	0.01 ft/ft	Sc =	0.02 ft/ft	n (grass)=	0.030

Solution:

Q(A) = 33.6 cfs Q(B) = 5.7 cfs Q(C) = 0.9 cfs

Major Storm Street Capacity, Qcap = Q(A) + Q(B) = **40** cfs/side

Street Capacity
Vicki Lane DP-7B



* Q = 0.56/(n*Sx)*S^(0.5)*(T*Sx)^(2.67)

*equation taken from City of Colorado Springs and El Paso County Drainage Criteria Manual Chapter 7.3

where:

Q = flow rate [cfs]
T = width of flow (spread) [ft]
Sx = cross slope [ft/ft]**
S = longitudinal slope [ft/ft]
n = Manning's n coeff.
**shown as Sa in picture and below

Height of Curb = 0.50 ft

-- Initial Storm -- d(max) @ flowline = 0.45 ft

Known:

T(initial) =	17.00 ft	Sa =	0.02 ft/ft	Sb =	0.09 ft/ft	n (road) =	0.016
W =	2.00 ft	S =	0.01 ft/ft				

Solution:

Q(A) = 4.9 cfs Q(B) = 3.4 cfs

Initial Storm Street Capacity, Qcap = Q(A) + Q(B) = **8** cfs/side

-- Major Storm -- d(max) @ flowline = 0.67 ft

Known:

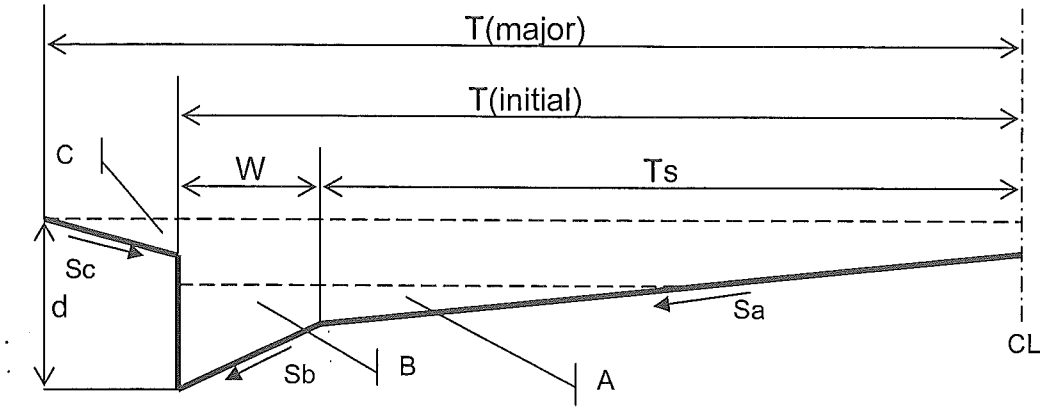
T(major) =	25.00 ft	Sa =	0.02 ft/ft	Sb =	0.09 ft/ft	n (road) =	0.016
W =	2.00 ft	S =	0.01 ft/ft	Sc =	0.02 ft/ft	n (grass)=	0.030

Solution:

Q(A) = 24.0 cfs Q(B) = 7.5 cfs Q(C) = 0.8 cfs

Major Storm Street Capacity, Qcap = Q(A) + Q(B) = **32** cfs/side

Street Capacity
Edmonstown Drive DP-3B DP-6



$$* Q = 0.56/(n*Sx)*S^{(0.5)}*(T*Sx)^{(2.67)}$$

*equation taken from City of Colorado Springs and El Paso County Drainage Criteria Manual Chapter 7.3

where:

Q = flow rate [cfs]
T = width of flow (spread) [ft]
Sx = cross slope [ft/ft]**
S = longitudinal slope [ft/ft]
n = Manning's n coeff.
**shown as Sa in picture and below

Height of Curb = 0.50 ft

-- Initial Storm -- d(max) @ flowline = 0.43 ft

Known:

T(initial) =	15.83 ft	Sa =	0.02 ft/ft	Sb =	0.09 ft/ft	n (road) =	0.016
W =	0.83 ft	S =	0.03 ft/ft				

Solution:

Q(A) = 17.5 cfs Q(B) = 2.6 cfs

Initial Storm Street Capacity, Qcap = Q(A) + Q(B) = **20** cfs/side

-- Major Storm -- d(max) @ flowline = 0.67 ft

Known:

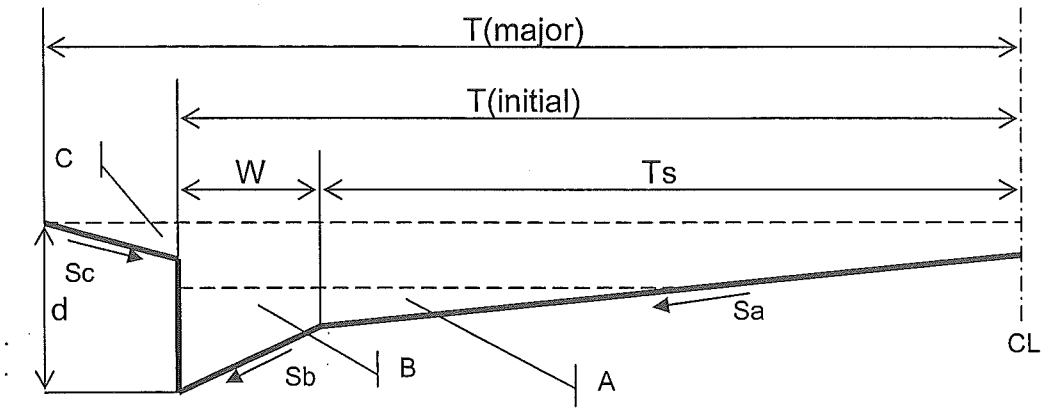
T(major) =	25.00 ft	Sa =	0.02 ft/ft	Sb =	0.09 ft/ft	n (road) =	0.016
W =	0.83 ft	S =	0.03 ft/ft	Sc =	0.02 ft/ft	n (grass)=	0.030

Solution:

Q(A) = 61.0 cfs Q(B) = 5.8 cfs Q(C) = 1.3 cfs

Major Storm Street Capacity, Qcap = Q(A) + Q(B) = **68** cfs/side

Street Capacity
Finglass DP-3C



$$* Q = 0.56/(n*Sx)*S^{(0.5)}*(T*Sx)^{(2.67)}$$

*equation taken from City of Colorado Springs and El Paso County Drainage Criteria Manual Chapter 7.3

where:

Q = flow rate [cfs]
T = width of flow (spread) [ft]
Sx = cross slope [ft/ft]**
S = longitudinal slope [ft/ft]
n = Manning's n coeff.
**shown as Sa in picture and below

Height of Curb = 0.50 ft

-- Initial Storm -- d(max) @ flowline = 0.43 ft

Known:

T(initial) = 15.83 ft Sa = 0.02 ft/ft Sb = 0.09 ft/ft n (road) = 0.016
W = 0.83 ft S = 0.01 ft/ft

Solution:

Q(A) = 10.8 cfs Q(B) = 1.6 cfs

Initial Storm Street Capacity, Qcap = Q(A) + Q(B) = **12** cfs/side

-- Major Storm -- d(max) @ flowline = 0.67 ft

Known:

T(major) = 25.00 ft Sa = 0.02 ft/ft Sb = 0.09 ft/ft n (road) = 0.016
W = 0.83 ft S = 0.01 ft/ft Sc = 0.02 ft/ft n (grass)= 0.030

Solution:

Q(A) = 37.8 cfs Q(B) = 3.6 cfs Q(C) = 0.8 cfs

Major Storm Street Capacity, Qcap = Q(A) + Q(B) = **42** cfs/side

DRAINAGE MAPS

DUBLIN NORTH
COLORADO SPRINGS, COLORADO
MASTER DEVELOPMENT DRAINAGE MAP ADDENDUM
JUNE 2013

EXISTING BASIN SUMMARY

BASIN	ACRES	Q5 CFS	Q100 CFS
OS-1*	8.18	11.1	23.6
OS-2*	1.93	5.4	10.5
EX-A*	18.06	24.6	52.6
EX-B*	0.58	0.8	1.7
EX-C*	10.61	17.7	35.8
EX-D	1.27	1.5	3.3
EX-E1	0.62	1.9	4.3
EX-E2	2.17	6.4	14.4
EX-F	3.69	3.7	8.4
EX-G	4.87	11.1	25.3

* COMPOSITE C INFORMATION TAKEN FROM "MASTER DEVELOPMENT DRAINAGE PLAN AMENDMENT NO. II FOR THE EASTERLY PORTION OF RIDGEVIEW SUBDIVISION AND PRELIMINARY DRAINAGE REPORT FOR THE NORTHEASTERLY PORTION OF RIDGEVIEW SUBDIVISION AND PHASE II SAND CREEK CHANNEL IMPROVEMENTS." BASIN OS-1, EX-A & EX-B CORRESPOND TO OS-145-2 FROM MDDP. BASIN EX-C CORRESPONDS TO OS-145-1 FROM MDDP. BASIN OS-2 IS PART OF BASIN OS-145-3 OF THE MDDP.

EXISTING DESIGN POINT SUMMARY

DP	Q5 CFS	Q100 CFS
EX-1	35.5	75.7
EX-2	5.2	9.3
EX-3	17.7	35.8
EX-4	1.5	3.3
EX-5A	1.9	4.3
EX-5B	6.4	14.4
EX-6	3.7	8.4
EX-7	11.1	25.3
EX-8	14.0	31.5

N

80' 0 80' 160'

SCALE: 1"=80'

LEGEND

- 10' EX CONTOUR — 6810
- 2' EX CONTOUR — 6802
- PROPOSED FLOW DIRECTION
- BASIN BOUNDARY
- TIME OF CONCENTRATION
- BASIN ID — OS-2
- ACREAGE — 0.37
- DESIGN POINT — 3
- FILING LINE

NO.	REVISIONS DESCRIPTION	DATE

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OFFICE: 719-635-6422
FAX: 719-635-6406
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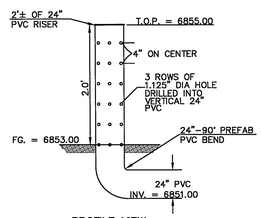
DUBLIN NORTH

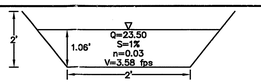
MASTER DEVELOPMENT DRAINAGE MAP ADDENDUM
HISTORIC DRAINAGE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	LDR
H-SCALE	1"=80'
V-SCALE	N/A
JOB NO.	1304.00
DATE ISSUED	6/18/13
SHEET NO.	1 OF 1

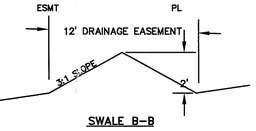
DUBLIN NORTH
COLORADO SPRINGS, COLORADO
MASTER DEVELOPMENT DRAINAGE MAP ADDENDUM
JUNE 2013



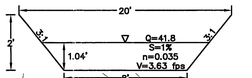
PROFILE VIEW
24" RISER DETAIL
TEMPORARY WATER QUALITY POND



SWALE A-A @ DP-1C
N.T.S.



SWALE B-B



SWALE C-C @ DP-3E
N.T.S.

PROPOSED PIPE RUN SUMMARY

PIPE RUN	SIZE
PR-1	24"
PR-2	30"
PR-3	36"
PR-4	36"
PR-5	18"
PR-6	42"
PR-10	30"
PR-16	30"
PR-17	18"
PR-18	18"
PR-19	18"
PR-20	30"
PR-22	30"
PR-23	30"
PR-24	EXIST. 30"
PR-25	30"
POND 1	42"
POND 2	30"

ALL STORM DRAIN IS RCP

PROPOSED BASIN SUMMARY

BASIN	ACRES	Q5 CFS	Q100 CFS
OS-1A	8.14	11.0	23.5
OS-1B	0.12	0.2	0.5
OS-1C	0.19	0.4	0.8
OS-2	1.93	5.4	10.5
A1**	5.10	9.3	18.2
A2**	1.50	3.8	7.7
A3	3.28	6.4	12.5
A4	1.05	2.3	4.5
A5	5.05	10.6	21.1
A6	1.03	2.2	4.4
A7	1.55	3.5	7.0
A8	1.25	2.9	5.7
A9	1.24	3.6	7.6
B	0.43	0.4	0.9
C1**	1.72	3.3	6.5
C2**	2.67	5.2	10.2
C3**	1.85	3.7	7.4
C4**	2.52	4.9	9.5
C5**	2.96	5.4	10.5
C8**	1.33	2.7	5.3
C9	0.24	0.6	1.1
C11	1.47	3.3	6.6
C12	0.91	2.3	4.8
D**	0.66	1.8	3.8
E1**	0.81	2.4	5.2
E2**	1.13	2.3	4.6
F**	2.41	5.1	10.0
G1**	3.95	8.1	16.0
G2***	2.41	5.1	10.2
G3***	1.53	3.1	6.1
G4***	2.02	5.6	11.6

** BASIN HAS BEEN REVISED SINCE ORIGIAANL MMDP
*** BASIN IS NEW SINCE ORIGINAL MDDP

PROPOSED DESIGN POINT SUMMARY

DP	Q5 CFS	Q100 CFS
1A**	18.2	35.6
1B	2.3	4.5
1A & 1B**	20.2	39.3
1C	11.0	23.5
1D	10.9	21.7
1E	2.2	4.4
1F	2.9	5.7
1G	43.5	86.3
1H	4.6	10.3
2	4.8	9.1
3A**	3.3	6.5
3B**	8.4	16.6
3C**	12.0	23.6
3D**	16.9	33.1
3E**	5.4	10.5
3D & 3E**	21.5	41.8
3H	2.7	5.3
3I	0.6	1.1
3K	3.3	6.6
3M**	28.7	55.9
4**	1.8	3.8
5A**	2.4	5.2
5B**	2.3	4.6
6**	5.1	10.0
7A**	8.1	16.0
7B***	17.9	35.5
7C***	5.6	11.6
8	23.2	45.9

LEGEND

- 10' EX CONTOUR — 6810
- 2' EX CONTOUR — 6802
- 10' PROP. CONTOUR — 6810
- 2' PROP. CONTOUR — 6802
- PROPOSED FLOW DIRECTION
- BASIN BOUNDARY
- TIME OF CONCENTRATION
- BASIN ID — OS-2
- ACREAGE — 0.37
- DESIGN POINT — 3
- TEMPORARY WATER QUALITY POND

REVISIONS

NO.	DESCRIPTION	DATE

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FAX: 719-635-6426
www.tnealco.com

DUBLIN NORTH
MASTER DEVELOPMENT DRAINAGE MAP ADDENDUM
PROPOSED DRAINAGE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	LDR
H-SCALE	1"=80'
V-SCALE	N/A
JOB NO.	1304.00
DATE ISSUED	6/18/13
SHEET NO.	1 OF 1