MVE, INC.
ENGINEERS SURVEYORS
1903 lelaray street, suite 200
colorado springs, co 80909
719.635.5736

Drainage Letter

Bunting MultiFamily Filing No. 1

Project No. 61072

May 30, 2018

PCD File No. PPR-17-037

Drainage Letter

for

Bunting MultiFamily Filing No. 1

Project No. 61072

May 30, 2018

prepared for

GNC Bunting LLC
205 Sedona Drive
Colorado Springs, CO 80921
719.646.5907

prepared by

MVE, Inc.
1903 Lelaray Street, Suite 200
Colorado Springs, CO 80909
719.635.5736

Statements and Acknowledgments

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 County for drainage reports and said report is in conformity with the applicable 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.

David R. Gorman, P.E. Colorado No. 31672
For and on Behalf of MVE, Inc.

6/29/18
Date

Developer's Statement

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

7/2/18
Date

George E. Bunting, Manager
GNC Bunting LLC
205 Sedona Drive
Colorado Springs, CO 80921

El Paso County

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

Jennifer Irvine, P.E.,
County Engineer / ECM Administrator

Date

MVE, Inc.

May 30, 2018

El Paso County
Planning and Community Development Department
2880 International Circle, Suite 110
Colorado Springs, CO 80910

Re: Drainage Letter for Bunting MultiFamily Filing No. 1 **(PPR-17-037, VR-17-009)**
Project No. 61072

Planning and Community Development Department:

The purpose of this Drainage Letter is to address the County's Drainage Report requirements for the proposed replat of Lot 5, a portion of Lot 4 and a portion on Lot 6, Stratmoor South Subdivision in El Paso County, Colorado. The replat is to be known as "Bunting MultiFamily Filing No. 1". The site is located within the Southeast Quarter of Section 5, Township 15 South, Range 66 West of the 6th P.M. The site is located west of Interstate 25, approximately one-half mile north of South Academy Boulevard and includes the existing street addresses of 1724 and 1728 Hampton South. The parcels being replatted have existing El Paso County Assessor Parcel Numbers 65054-08-034 and 65054-08-035. A Vicinity Map is attached with this letter.

The site is 0.485 +/- acres (21,143 square feet) in area and is vacant residential property, zoned RM-30 (Residential Multi-Dwelling). The adjacent public street, Hampton South (60' R.O.W.), is located to the south of the site. The adjacent street contains an existing 15 ft long grated inlet near the southwest corner of the site, as well as additional grated inlets on the south side of the street. The developed multi-family residential property of 1720 Hampton South is adjacent on the west side. An unplatted tract of land, zoned RS-5000 (Residential Suburban), is adjacent to the north. This unplatted tract contains the Fishers Canyon Drainageway, which flows west to east towards Fountain Creek. The developed multi-family residential property of 1732 Hampton South is adjacent on the east side.

The neighborhood was platted in 1967 as "Stratmoor South Subdivision". The drainage report for the original subdivision was prepared by Karcich & Weber Inc., titled "Hydrological Engineering Study for Stratmoor South Subdivision, El Paso County and is dated June 1967.

The site is located within the Fishers Canyon Major Drainage Basin (FOFO3600). This basin was last studied in 1991 as detailed in the "Fishers Canyon Drainage Basin Planning Study" (DBPS) by Muller Engineering Company and dated September 1991. The project site is located within Sub-Basin 4B of the study, along with the rest of the surrounding developed subdivision, downstream of Design Point 7. The study does not specify improvements for the project site. However, the DBPS notes potential of stream bank erosion in the channel reach. The project will address stabilization of the adjacent stream bank at the northwest corner of the site. The proposed project is in compliance with the DBPS.

The site is currently vacant and vegetated with natural grasses and small brush. The site generally drains from the sides towards the center and then to the north. The flows exiting the north edge of the site eventually enter the Fishers Canyon Drainageway, located in the off-site property to the north. Existing grades on the site range from about 2% to about 8%. The site was platted with a Drainage Easement between lots 5 and 6, near the west edge of the site, which was meant to contain an open ditch draining to the north from Hampton South (street). The ditch was never constructed, but excess runoff ponds and flows through the site in heavy rainfall events. The public street right-of-way along the southern portion of the site drains south to the curb line of Hampton South roadway. These flows gather and are collected at the existing 15 ft long grated inlet located in the curb near the southwest corner of the site. The collected flows are conveyed to the north by the 30" CMP pipeline located along the west edge of the site. The north edge of the site has undergone recent erosion in two places. The first location is near the northwest corner of the site at the existing 30" CMP outfall. The pipe discharges were causing damage to the outfall and damage to the pipe wall was causing the northwest corner of the site to erode. El Paso County Department of Public Works has recently repaired this condition. The second location is east of the northwest corner of the site and appears to be the result of the offsite flows traveling through the unimproved site and flowing over the northern slope towards the Fishers Canyon Drainageway. These two conditions are both recent occurrences. The existing channel bed of Fishers Canyon Drainageway appears stabilized with large rocks and no apparent bed degradation or deposition. The side bank is eroded as mentioned above. Proposed developed conditions of the site are discussed below.

According to the National Resource Conservation Service, the soil in the area of the Bunting MultiFamily site is made up of Razor-Midway complex (map unit 75). Razor-Midway complex is moderately deep and well drained. Permeability is slow, surface runoff is medium, and the hazard of erosion is moderate. Razor-Midway complex is classified as being part of Hydrologic Soil Group D. The soil is well suited for home sites and other urban uses. The NRCS Soils mapping and soil descriptions are attached.

The current Flood Insurance Study of the region includes a Flood Insurance Rate Map (FIRM), effective on March 17, 1997. The site is included in Community Panel Number 08041C0743F of the Flood Insurance Rate Maps for El Paso County, Colorado and Incorporated Areas. No portion of the site lies within FEMA designated Special Flood Hazard Areas (SFHA's) as shown. An excerpt of the current FEMA Flood Insurance Rate Maps with the site delineated is attached.

The site will be replatted into two lots. The proposed condition for the development includes a two-story fourplex apartment building on each of the two lots, paved parking areas, sidewalks and landscaping. Although it would be desirable to develop the lots in similar manner as the existing adjacent lots on both sides, drainage considerations along the west edge, new off-street parking requirements, access, parking configuration and landscape requirements for new subdivisions prevent exact duplication of the surrounding neighborhood. The proposed narrow two-story buildings will be situated in the northern portion of each lot in a north-south orientation. The access drive and parking area for each building will be located on the south side, adjacent to the street. Landscaping will be provided along the roadway frontage, sides and rear.

The resulting percent imperviousness of the site will be 53.9% as shown on the attached hydrologic calculations. This value is less than the multi-family classification of 65% and nearly the same as the Single Family (6000 sf lots) referenced in El Paso County Engineering Criteria Manual Appendix L, Part 1, Section 3.13a, Table 3-1.

All flows from the proposed site will exit the site to the north, the same as existing conditions. The southern portion of the proposed site, containing the access and parking area, will drain to the west and then be directed to the north in an open grassed swale along the west side of Lot 2. The proposed parking lot grading and grassed swale is also sized with capacity to allow offsite flows, discussed below, to pass through the site as needed. The site will not contribute flows to the existing street inlets or pipe. The central and northern portions of the site will drain to the north, the same as existing conditions. The site generates developed peak discharges of Q5 = 1.2 cf and Q100 = 2.7 cfs which are distributed along the north edge of site and exit the north property boundary into the adjacent property and eventually into Fishers Canyon Drainageway.

The contributing offsite basin to the south of the site produces peak discharges of Q5 = 39 cf and Q100 = 88 cfs. These flows travel northward toward the site in the connecting roadways and are gathered and ponded at the low point in Hampton South adjacent to the site. A portion of these storm flows will continue to be collected in the existing 15 ft long grated inlet on the north side of the road, a 7' grated inlet and 3' grated inlet on the south side of the road. The inlets are in sump condition at the low point and collect a total of 7.8 cfs in the 5-year rainfall event and a total of 16.8 cfs in the 100-year event. The collected flows are conveyed in the existing 30” CMP pipeline along the west side of the site and are discharged into Fishers Canyon Drainageway. The overflow runoff will flow through the site to the north in the proposed grassed swale. The swale is sized to handle the entire 100-year discharges from off-site basin to allow for the case in which the inlets are clogged and the entire storm must travel overland to the drainageway. An easement will be provided for the existing 30” CMP pipe and the emergency overflow path on the west side of Lot 2. The northwestern edge of the site, adjacent to the Fishers Canyon Drainageway will feature rip-rap bank protection.

The proposed site consists of two vacant lots having a total area of less than 0.49 acres in a currently platted, established and developed subdivision. The project is an infill project, less than 1.0 acres in area. In accordance with the ECM, Appendix I, Section I.7.1.B, water quality capture volume is not required.

The El Paso County Engineering Criteria Manual (Appendix I, Section I.7.2) requires the consideration of a “Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long term source controls”. The Four Step Process is incorporated in this project and the elements are discussed below.

1) Runoff Reduction Practices are employed in this project. Impervious surfaces have been reduced as much as practically possible. Two-story construction ins employed to reduce building footprint, paved access and prking area is reduced to that minimally accepted by Zoning Code, and additional pavement is used only to minimize potential erosion due to foot traffic. Minimized Directly Connected Impervious Areas (MDCIA) is employed on the project by all runoff from impervious surfaces are directed across grassed swales and buffers before exiting the site.
2) All drainage paths on the site are stabilized with pavement or appropriate landscape treatment. Additionally, the northwest edge of the site will be stabilized with rip rap bank slope protection.
3) The project is significantly less than 0.5 acres in size and contains no potentially hazardous uses. The location and use of the site is not appropriate for inclusion of a WQCV BMP.

4) The site is not industrial or commercial in nature. The site contains no outdoor storage areas or storage of potentially harmful substances. No Site Specific or Other Source Control BMP's are required.
Flood Control detention for this site is not required. The DBPS for Fishers Canyon basin considered this site to already be developed and the developed flows from this site are already accounted for in the DBPS. The project site is less than 0.5 acres in area and the development of the site creates an insignificantly small increase in flows of less than 1.1 cfs for the entire site in the 100-year rainfall event. There are not other individual residential lots in the vicinity of this infill project that have on-site flood detention measures. The presence of storm detention facilities on this residential lot would be of no practical benefit and create a safety concern for residents of the site. Therefore, no flood control detention are included in this site.

Fishers Canyon Drainage Basin Drainage Fees at the time of project submittal are $16,270 per impervious acre. Because there is no record of Drainage Fees being paid at the original platting of this property, Drainage Fees are due. Fishers Canyon has no Bridge Fees. Drainage Fees for the project are calculated as:

Drainage Fees = 0.485 acres x 53.9% Impervious x $16,270 / impervious acre
Drainage Fees = $4,256.52
Bridge Fees = $0.00.

This Drainage Letter presents a drainage concept that includes recommendations to direct and otherwise manage stormwater runoff from the proposed developed site. The development of this site as described in this Drainage Letter is in accordance with the current DBPS. The proposed development of the site will not negatively impact the adjacent properties and downstream drainage facilities.

Respectfully submitted,

M.V.E., Inc.

David R. Gorman, P.E.
DRG:cwg

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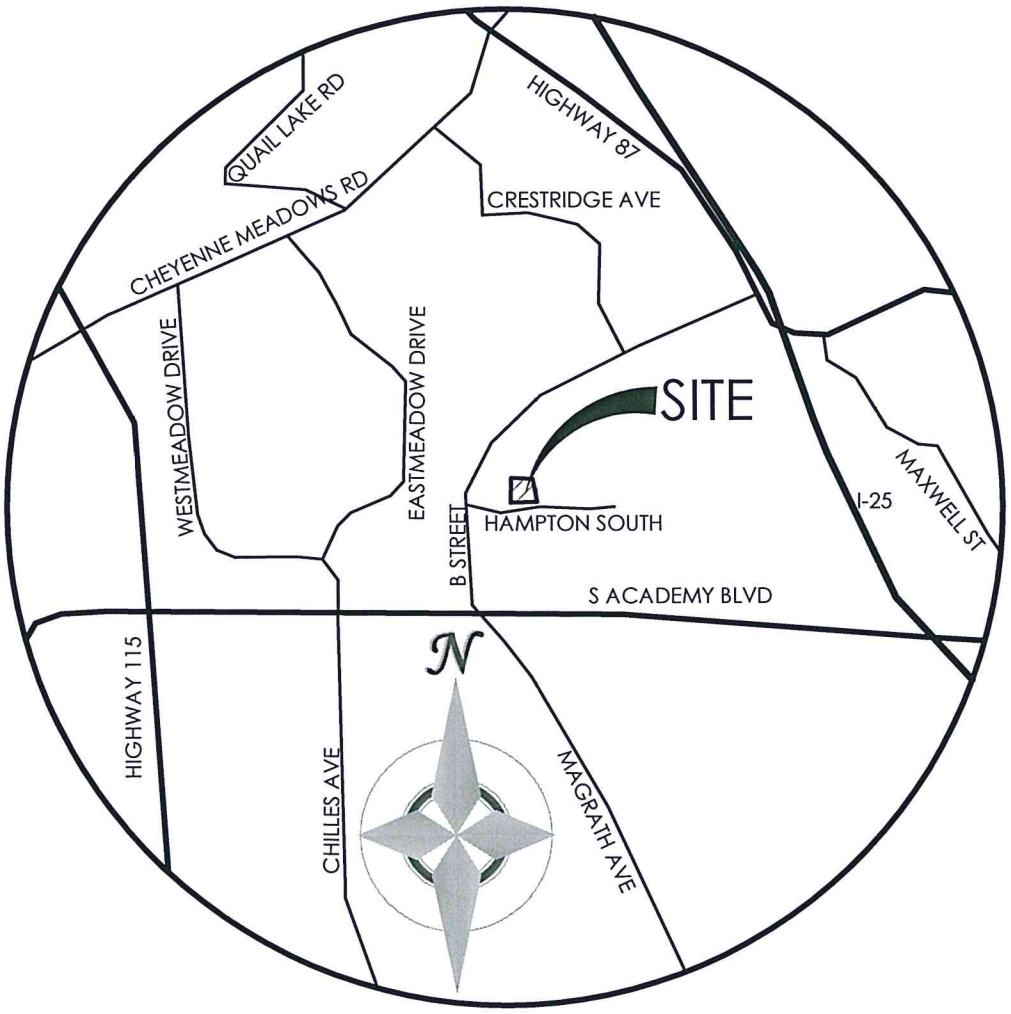
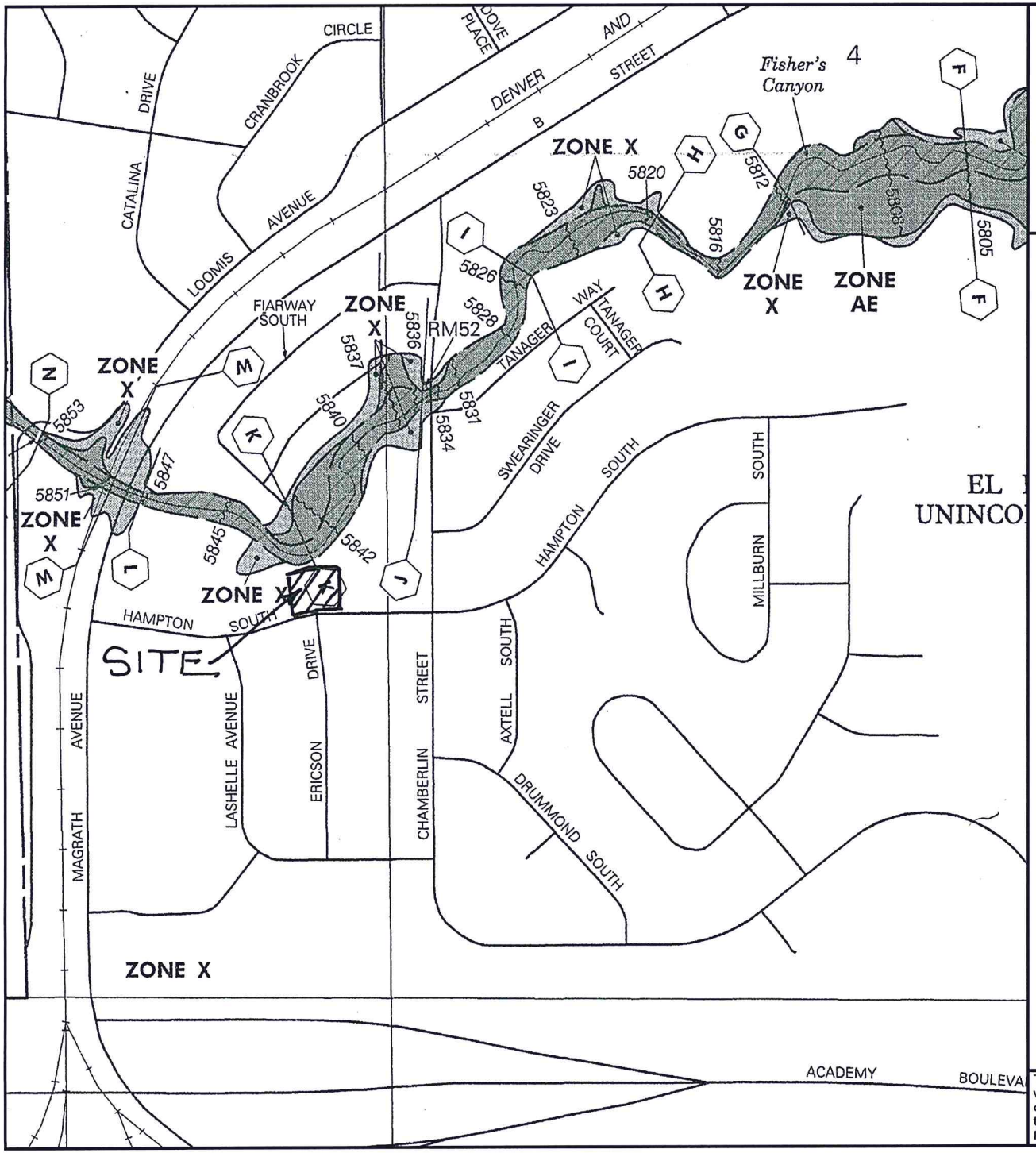


VICINITY MAP

NOT TO SCALE



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 743 OF 1300

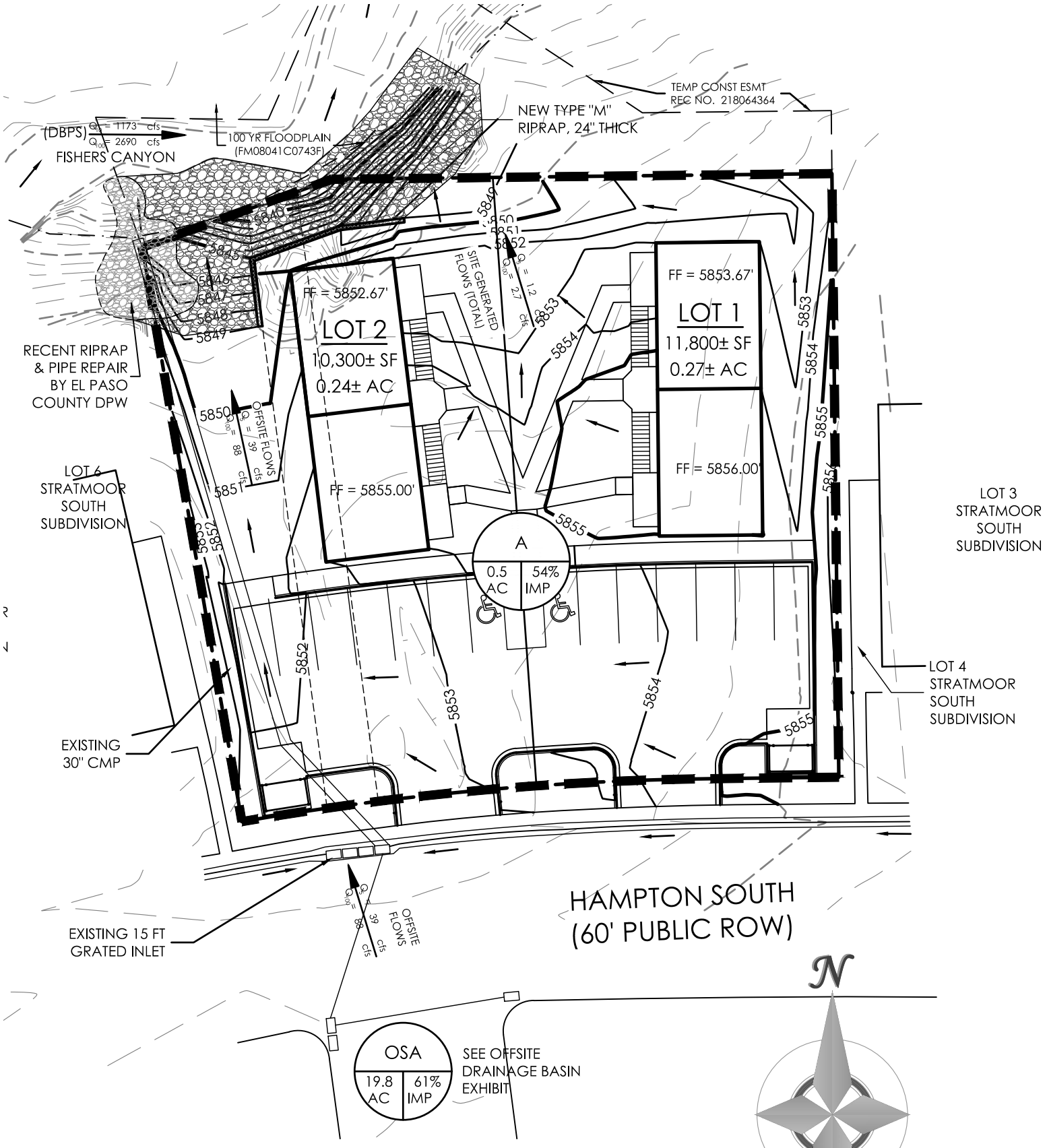
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0743	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0743	F

MAP NUMBER 08041C0743 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency



Bunting MultiFamily Filing No. 1 Drainage Exhibit

May 30, 2017

61072-Drain-Map

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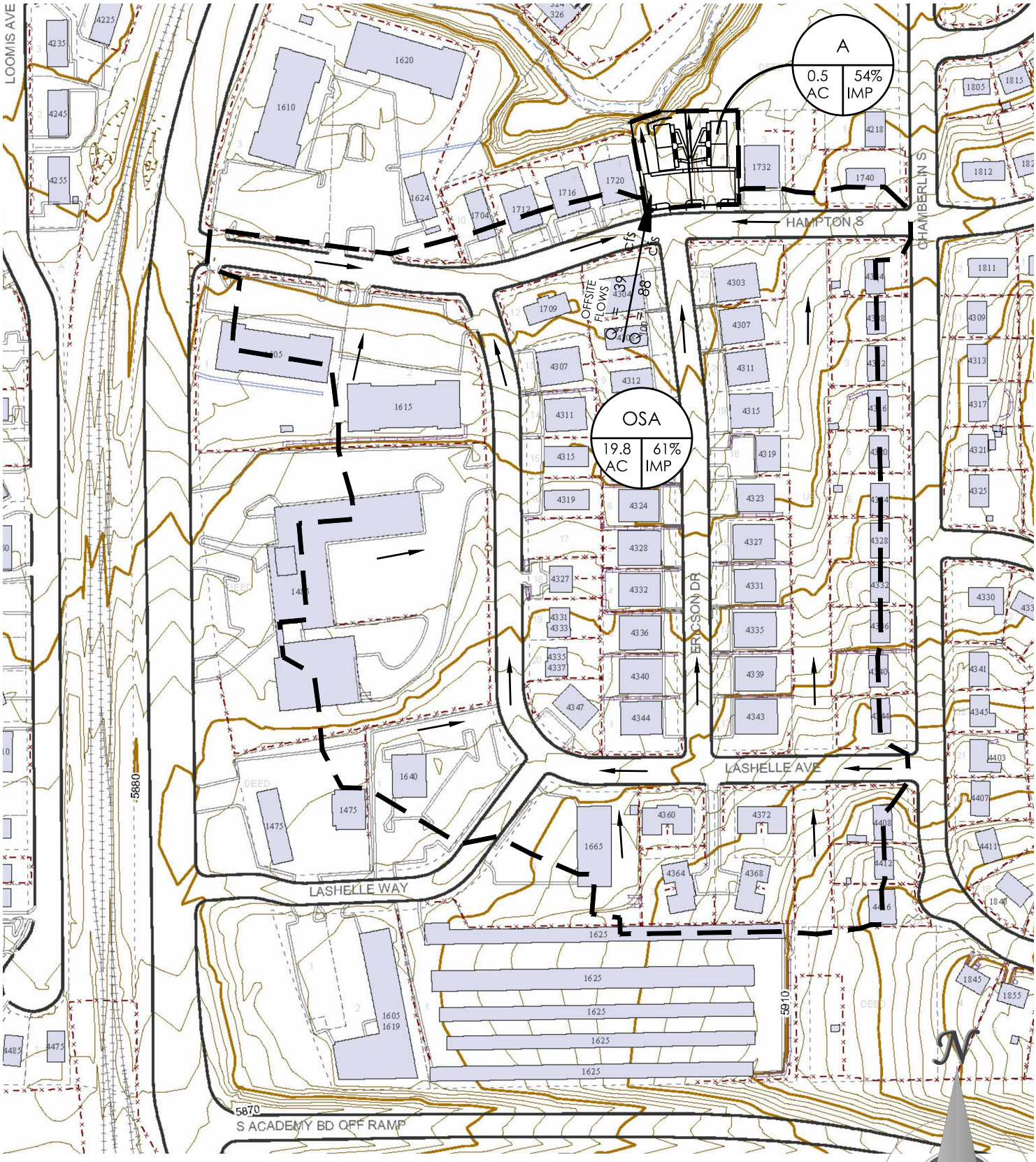

Bunting MultiFamily
Filing No. 1
Offiste Drainage Basin Exhibit

May 30, 2017

61072-Drain-OSMap

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Soil Map—El Paso County Area, Colorado
(Bunting Multi Family)

Map Scale: 1:414 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 20 40 80 120

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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 map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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.

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
75	Razor-Midway complex	0.8	100.0%
Totals for Area of Interest		**0.8**	**100.0%**

Permeability of this Razor soil is slow. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used mainly as rangeland.

The native vegetation is mainly alkali sacaton, western wheatgrass, and galleta. There are lesser amounts of blue grama. Fourwing saltbush is a common shrub. Needleandthread, junegrass, and side-oats grama are also present where this soil occurs in the northern part of the survey area. The presence of princesplume, two-groove milkvetch, and Fremont goldenweed indicates that selenium-bearing plants are in the stand.

This soil is very difficult to revegetate, and it is especially important that livestock grazing be carefully managed. Fencing helps to control grazing. Where the plant cover has been depleted, pitting aids the recovery of the natural vegetation.

Windbreaks and environmental plantings generally are not suited to this soil. Onsite investigation is needed to determine if plantings are feasible.

This soil is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations for homesites and urban development are slow permeability, moderate depth to shale, and shrink-swell potential. Septic tank absorption fields do not function properly because of the depth to shale and the slow permeability. Special designs for buildings and roads are required to overcome the limitations of limited depth to shale and the shrink-swell potential. Capability subclass VIe.

74—Razor stony clay loam, 5 to 15 percent slopes. This moderately deep, well drained soil formed in residuum derived from calcareous shale on uplands. Elevation ranges from 6,000 to 7,200 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is light brownish gray stony clay loam about 4 inches thick. The subsoil is grayish brown cobbly heavy clay loam about 18 inches thick. The substratum is light brownish gray cobbly clay about 7 inches thick. Gray shale is at a depth of about 29 inches.

Included with this soil in mapping are areas of moderately steep to very steep soils on foothills; hogbacks of limestone and sandstone; Penrose-Manvel complex, 3 to 45 percent slopes; Razor clay loam, 3 to 9 percent slopes; and Jarre-Tecolote complex, 8 to 65 percent slopes.

Permeability of this Razor soil is slow. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is medium to rapid, and the hazard of erosion is moderate. Some gullies have developed along drainageways and trails.

This soil is used as rangeland, for wildlife habitat, and for military maneuvers.

This soil is suited to the production of native vegetation suitable for grazing. The native vegetation is western wheatgrass, blue grama, alkali sacaton, needleandthread, and side-oats grama. The presence of princesplume, two-groove milkvetch, and Fremont goldenweed indicates that selenium-bearing plants are in the stand.

Good grazing management is essential to maintain the desirable grasses. Deferment of grazing early in spring helps to maintain the health and vigor of the cool-season grasses. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings generally are not suited to this soil. Onsite investigation is needed to determine if plantings are feasible.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations for homesite development or urban use are the depth to shale, stoniness, shrink-swell potential, and slope. The limitations of soil depth and stoniness can be overcome through the use of heavy equipment when preparing building sites. Special designs for buildings and roads are needed to overcome the limitations of depth to shale, shrink-swell potential, and slope. Septic tank absorption fields do not function properly because of slow permeability and moderate depth to shale. Capability subclass VIIe.

75—Razor-Midway complex. These gently sloping to moderately steep, clayey soils formed in residuum derived from calcareous shale on uplands. Slope ranges from 3 to 25 percent. Elevation ranges from 5,300 to 6,100 feet. The average annual precipitaton is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

The Razor soil makes up about 50 percent of the complex, the Midway soil about 30 percent, and other soils about 20 percent.

Included with these soils in mapping are areas of Limon clay, 0 to 3 percent slopes; Stoneham sandy loam, 3 to 8 percent slopes; and geological formations called teepee buttes. The teepee buttes are conspicuous cone-shaped piles of marine rubble that rise above the more nearly level plains and occur at random on the landscape. The material of these formations is hard sedimentary rock and some petrified marine life.

The Razor soil is moderately deep and well drained. Typically, the surface layer is light brownish gray clay loam about 3 inches thick. The subsoil is grayish brown heavy clay loam or clay about 15 inches thick. The substratum is grayish brown clay that grades to calcareous shale at a depth of about 31 inches. Visible lime is in the lower part of the subsoil and in the substratum.

Permeability of the Razor soil is slow. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

The Midway soil is shallow and well drained. Typically, the surface layer is light yellowish brown clay loam about 4 inches thick. The substratum is light yellowish brown clay about 4 inches thick over grayish brown clay about 5 inches thick. It grades to calcareous shale at a depth of about 13 inches.

Permeability of the Midway soil is slow. Effective rooting depth is less than 20 inches. Available water capacity is low. Surface runoff is medium to rapid, and the hazard of erosion is moderate to high.

The soils in this complex are used primarily as rangeland and for wildlife habitat.

The native vegetation on these soils is mainly alkali sacaton, western wheatgrass, galleta, and blue grama; there are lesser amounts of blue grama on the Razor soil. Fourwing saltbush is a common shrub. Needleandthread, junegrass, and side-oats grama are also present where these soils occur in the northern part of the survey area. The presence of princesplume, two-groove milkvetch, and Fremont goldenweed indicates that selenium-bearing plants are in the stand.

The Razor soil is very difficult to revegetate, and it is especially important that livestock grazing be carefully managed. Fencing helps to control the distribution of grazing. Where the plant cover has been depleted, pitting aids in the recovery of the native vegetation.

The Midway soil generally is difficult to revegetate, and it is therefore important that livestock grazing be carefully managed. Excessive removal of vegetation can result in severe erosion. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings generally are not suited to the soils in this complex. Onsite investigation is needed to determine if plantings are feasible.

These soils are suited to wildlife habitat. They are best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope and scaled quail, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations for urban use or homesite development are depth to shale, slow permeability, shrink-swell potential, and slope. Special designs for buildings and roads are needed to overcome these limitations. Because of the depth to shale and slow permeability, septic tank absorption fields do not function properly. Community sewerage systems are required in areas of moderate to high population density. Capability subclass VIe.

76—Rizozo-Neville complex, 3 to 30 percent slopes. These gently sloping to moderately steep soils are on uplands, terraces, and fans. Elevation ranges from 6,000 to 6,500 feet. The average annual precipitation is about 14 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 140 days.

The Rizozo soil makes up about 35 percent of the complex, the Neville soil about 25 percent, and other soils about 40 percent.

Included with these soils in mapping are areas of Fortwingate-Rock outcrop complex, 15 to 60 percent slopes; Nederland cobbly sandy loam, 9 to 25 percent slopes; Neville-Rednun complex, 3 to 9 percent slopes; and Rock outcrop.

The Rizozo soil is shallow and well drained. It formed in medium textured residuum weathered from red sandstone. Typically, the surface layer is reddish brown loam about 3 inches thick. The underlying material is reddish brown loam about 7 inches thick. Hard, red, fractured sandstone is at a depth of about 10 inches.

Permeability of the Rizozo soil is moderately rapid. Effective rooting depth is 4 to 20 inches. Available water capacity is low. Surface runoff is medium to rapid, and the hazard of erosion is moderate to high. Soil slippage is common on the steeper slopes.

The Neville soil is deep and well drained. It formed in calcareous loamy alluvium weathered from red-bed sandstone and shale. Typically, the surface layer is reddish gray fine sandy loam about 4 inches thick. The substratum is reddish brown, heavy fine sandy loam about 6 inches thick over light reddish brown loam that extends to a depth of 60 inches or more.

Permeability of the Neville soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate. Some gullies have developed along drainageways.

The soils in this complex are used as rangeland and for wildlife habitat, recreation, and military maneuvers.

Native vegetation on the Rizozo soil consists of an overstory of pinyon and juniper and an understory of blue grama, side-oats grama, western wheatgrass, Scribner needlegrass, and needleandthread. The dominant shrubs are mountainmahogany and skunkbush sumac.

The native vegetation on the Neville soil is mainly cool- and warm-season grasses such as western wheatgrass, side-oats grama, and needleandthread. Smaller amounts of other grasses, such as little bluestem, junegrass, mountain muhly, and blue grama, are scattered throughout the stand.

Careful management of plant cover is essential on these soils, because the reestablishment of vegetation is difficult. Properly locating livestock watering facilities helps to control grazing. Proper range management is needed to prevent excessive removal of the plant cover. Interseeding is used to improve the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability.

The soils in this complex are suited to the production of firewood. They are capable of producing 7 cords per acre in a stand of trees that average 5 inches in diameter at a height of 1 foot. The main limitations for the production of wood crops are the presence of stones on the surface and a high hazard of erosion. Stones on the surface interfere with felling, yarding, and other operations involving the use of equipment. Measures must be taken to minimize erosion when harvesting timber. The low availa-

Hydrologic Soil Group—El Paso County Area, Colorado
(Bunting Multi Family)

Map Scale: 1:414 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 20 40 80 120

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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 — El Paso County Area, Colorado (CO625)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
75	Razor-Midway complex	D	0.8	100.0%
Totals for Area of Interest			**0.8**	**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

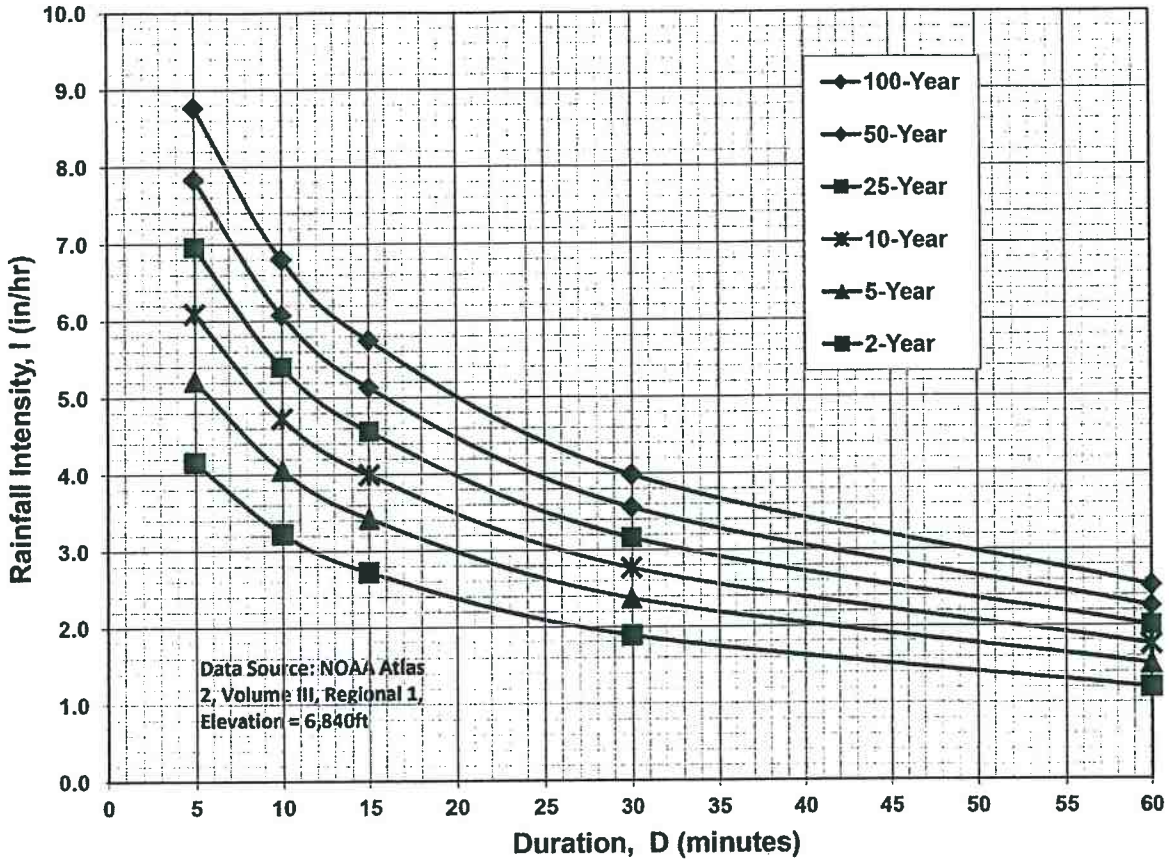
Component Percent Cutoff: None Specified

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

Job No.: **61072**
Project: **Bunting Multi-Family**

Date: **2/16/18 13:11**
Calcs By: **D. Gorman**
Checked By:

Time of Concentration (Modified from Standard Form SF-1)

Sub-Basin	Sub-Basin Data				Overland			Shallow Channel				Channelized				t_c Check		t_c
	Area (Acres)	C_5	C_{100}/CN	% Imp.	L_0 (ft)	S_0 (%)	t_i (min)	L_{0t} (ft)	S_{0t} (ft/ft)	v_{0sc} (ft/s)	t_t (min)	L_{0c} (ft)	S_{0c} (ft/ft)	v_{0c} (ft/s)	t_c (min)	L (min)	$t_{c,alt}$ (min)	(min)
EXISTING																		
OSA	19.82	0.47	0.65	61%	100	6%	6.3	85	0.018	2.7	0.5	1060	0.030	6.1	2.9	1245	16.9	9.7
EX-A	0.49	0.15	0.50	0%	75	3%	10.7	65	0.023	3.0	0.4	95	0.079	1.9	0.8	235	11.3	11.3
DEVELOPED																		
OSA	19.82	0.47	0.65	61%	100	6%	6.3	85	0.018	2.7	0.5	1060	0.030	6.1	2.9	1245	16.9	9.7
PP-A	0.49	0.54	0.73	54%	75	3%	6.3	65	0.023	3.0	0.4	95	0.079	1.9	0.8	235	11.3	7.5

Job No.: **61072**
Project: **Bunting Multi-Family**
Design Storm: **5-Year Storm** *(20% Probability)*
Jurisdiction: **UDFCD**

Date: **2/16/18 13:11**
Calcs By: **D. Gorman**
Checked By:

Sub-Basin and Combined Flows (Modified from Standard Form SF-2)

				Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
DP	Sub-Basin	Area (Acres)	C5	t_c (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	t_c (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	V_{Osc} (ft/s)	t_t (min)
	EXISTING																					
	OSA	19.82	0.47	9.7	9.38	4.11	38.5															
	EX-A	0.49	0.15	11.3	0.07	3.86	0.3															
EX Total		20.31	0.42					10.0	8.57	4.06	34.8											
	DEVELOPED																					
	OSA1																					
	PP-A	0.49	0.54	7.5	0.26	4.51	1.2															
PP Total		19.82	0.43					10.0	8.53	4.06	34.7											

Rainfall Intensity: $I = (28.5 * P1) / (10 + tc)^{0.786}$
P1: 1.5

Job No.: 61072
Project: Bunting Multi-Family
Design Storm: 100-Year Storm *(1% Probability)*
Jurisdiction: UDFCD

Date: 2/16/18 13:11
Calcs By: D. Gorman
Checked By:

Sub-Basin and Combined Flows (Modified from Standard Form SF-2)

				Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
DP	Sub-Basin	Area (Acres)	C100	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	v_{0sc} (ft/s)	t_t (min)
	EXISTING																					
	OSA	19.82	0.65	9.7	12.81	6.90	88.4															
	EX-A	0.49	0.50	11.3	0.24	6.49	1.6															
EX Total		20.31	0.57					10.0	11.65	6.82	79.5											
	DEVELOPED																					
	OSA1																					
	PP-A	0.49	0.73	7.5	0.36	7.57	2.7															
PP Total		19.82	0.58					10.0	11.48	6.82	78.3											

Rainfall Intensity: I = (28.5 * P1) / (10 + tc)^0.786
P1: 2.52

Sub-Basin OSA Runoff Calculations (Offsite)

Job No.: 61072 Date: 2/12/18 22:12

Project: Bunting Multi-Family Calcs by: D. Gorman

Checked by:

Soil Type D

Urbanization Urban

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
1/8 Ac Res or less & MF	468,720	10.76	0.45	0.49	0.54	0.59	0.62	0.65	65%
1/4 Ac Res	43,560	1.00	0.28	0.35	0.42	0.5	0.54	0.58	40%
Pasture/Meadow	59,465	1.37	0.04	0.15	0.25	0.37	0.44	0.5	0%
Neighborhood Comm	291,740	6.70	0.49	0.53	0.57	0.62	0.65	0.68	70%
Combined	**863,485**	**19.82**	**0.43**	**0.47**	**0.52**	**0.58**	**0.61**	**0.65**	**61.0%**

Basin Travel Time

Shallow Channel Ground Cover: Paved areas/shallow paved swales

$L_{max,Overland}$: 100 ft C_v: 20

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	1,245	40	-	-	-	-	
Initial Time	100	6	0.060	-	6.3	16.9	UDFCD Formula RO-3
Shallow Channel	85	2	0.018	2.7	0.5	-	UDFCD Formula RO-4
Channelized	1,060	32	0.030	6.1	2.9	-	C&G
				t_c	**9.7 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.26	4.11	4.79	5.48	6.16	6.90
Runoff (cfs)	27.6	**38.5**	49.8	63.0	75.0	**88.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	27.6	**38.5**	49.8	63.0	75.0	**88.4**
UDFCD: I = (28.5 * P1) / (10 + tc)^0.786						
P1	1.19	1.5	1.75	2	2.25	2.52

Notes

Sub-Basin EX-A Runoff Calculations - Onsite Generated Flows

Job No.:	61072	Date:	2/16/18 13:11
Project:	Bunting Multi-Family	Calcs by:	D. Gorman
		Checked by:	
		Soil Type	D
		Urbanization	Urban

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Pasture/Meadow	21,143	0.49	0.04	0.15	0.25	0.37	0.44	0.5	0%
Combined	**21,143**	**0.49**	**0.04**	**0.15**	**0.25**	**0.37**	**0.44**	**0.50**	**0.0%**

Basin Travel Time

Shallow Channel Ground Cover: Paved areas/shallow paved swales

$L_{max,Overland}$: 100 ft C_v: 20

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	235	11	-	-	-	-	
Initial Time	75	2	0.027	-	10.7	11.3	UDFCD Formula RO-3
Shallow Channel	65	2	0.023	3.0	0.4	-	UDFCD Formula RO-4
Channelized	95	8	0.079	1.9	0.8	-	Trap Ditch
				t_c	**11.3 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.06	3.86	4.50	5.15	5.79	6.49
Runoff (cfs)	0.1	**0.3**	0.5	0.9	1.2	**1.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.1	**0.3**	0.5	0.9	1.2	**1.6**
UDFCD: I = (28.5 * P1) / (10 + tc)^0.786						
P1	1.19	1.5	1.75	2	2.25	2.52

Notes

Combined Sub-Basin Runoff Calculations (EXISTING)

Includes Basins OSA EX-A

Job No.: 61072 Date: 2/16/18 13:11

Project: Bunting Multi-Family Calcs by: D. Gorman

Checked by:

Soil Type B

Urbanization Urban

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
1/8 Ac Res or less & MF	468,720	10.76	0.41	0.45	0.49	0.54	0.57	0.59	65%
1/4 Ac Res	43,560	1.00	0.23	0.3	0.36	0.42	0.46	0.5	40%
Pasture/Meadow	80,608	1.85	0.02	0.08	0.15	0.25	0.3	0.35	0%
Neighborhood Comm	291,740	6.70	0.45	0.49	0.53	0.58	0.6	0.62	70%
Combined	**884,628**	**20.31**	**0.38**	**0.42**	**0.47**	**0.52**	**0.55**	**0.57**	**59.5%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OSA	-	1,245	40	-	-	-	-	9.7
Channelized-1	V-Ditch	1	152	4	88	0	2	8.9	0.3
Channelized-2									
Channelized-3									
Total			1,397	44					

1 = Man-made, Smooth, Straight

t_c (min) **10.0**

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.22	4.06	4.74	5.42	6.09	6.82
Site Runoff (cfs)	24.79	**34.82**	44.83	57.29	68.04	**79.49**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**34.8**	-	-	-	**79.5**

UDFCD: I = (28.5 * P1) / (10 + tc)^0.786

P1	1.19	1.5	1.75	2	2.25	2.52

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

Sub-Basin PP-A Runoff Calculations - Onsite Generated Flows

Job No.: 61072
Project: Bunting Multi-Family
Date: 2/16/18 13:11
Calcs by: D. Gorman
Checked by:
Soil Type D
Urbanization Urban

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Roofs	3,264	0.07	0.73	0.75	0.77	0.8	0.82	0.83	90%
Driveways & Walks	8,456	0.19	0.89	0.9	0.92	0.94	0.95	0.96	100%
Lawns	9,423	0.22	0.04	0.15	0.25	0.37	0.44	0.5	0%
Combined	**21,143**	**0.49**	**0.49**	**0.54**	**0.60**	**0.66**	**0.70**	**0.73**	**53.9%**

21143

-

Basin Travel Time

Shallow Channel Ground Cover: Paved areas/shallow paved swales

$L_{max,Overland}$ 100 ft C_v 20

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	235	11	-	-	-	-	
Initial Time	75	2	0.027	-	6.3	11.3	UDFCD Formula RO-3
Shallow Channel	65	2	0.023	3.0	0.4	-	UDFCD Formula RO-4
Channelized	95	8	0.079	1.9	0.8	-	Trap Ditch
				t_c	**7.5 min.**		

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.57	4.51	5.26	6.01	6.76	7.57
Runoff (cfs)	0.8	**1.2**	1.5	1.9	2.3	**2.7**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	0.8	**1.2**	1.5	1.9	2.3	**2.7**

UDFCD: I = (28.5 * P1) / (10 + tc)^0.786

P1	1.19	1.5	1.75	2	2.25	2.52

Notes

Combined Sub-Basin Runoff Calculations (DEVELOPED)

Includes Basins OSA PP-A

Job No.: **61072** Date: **2/16/18 13:11**

Project: **Bunting Multi-Family** Calcs by: **D. Gorman**

Checked by:

Soil Type **B**

Urbanization **Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
1/8 Ac Res or less & MF	468,720	10.76	0.41	0.45	0.49	0.54	0.57	0.59	65%
1/4 Ac Res	43,560	1.00	0.23	0.3	0.36	0.42	0.46	0.5	40%
Pasture/Meadow	59,465	1.37	0.02	0.08	0.15	0.25	0.3	0.35	0%
Neighborhood Comm	291,740	6.70	0.45	0.49	0.53	0.58	0.6	0.62	70%
Combined	**863,485**	**19.82**	**0.39**	**0.43**	**0.47**	**0.53**	**0.56**	**0.58**	**61.0%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OSA	-	1,245	40	-	-	-	-	9.7
Channelized-1	V-Ditch	1	152	4	88	0	2	8.9	0.3
Channelized-2									
Channelized-3									
Total			1,397	44					

1 = Man-made, Smooth, Straight

t_c (min) **10.0**

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.22	4.06	4.74	5.42	6.09	6.82
Site Runoff (cfs)	24.76	**34.66**	44.48	56.63	67.15	**78.33**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**34.7**	-	-	-	**78.3**

UDFCD: I = (28.5 * P1) / (10 + tc)^0.786

P1	1.19	1.5	1.75	2	2.25	2.52

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

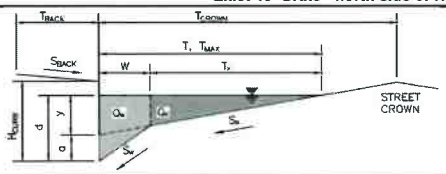
Version 4.05 Released March 2017

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

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

Project: 61072 Bunting Multi-Family

Inlet ID: Exist 15' Grate - north side of Hampton South



Gutter Geometry (Enter data in the blue cells)

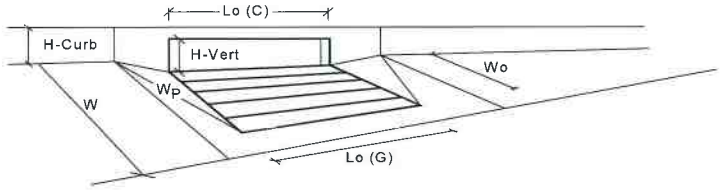
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.055	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	7.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		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**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	4	4	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.0	7.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	N/A	N/A	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.439	0.606	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	N/A	N/A	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.47	0.66	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	3.8	8.5	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms	$Q_{PEAK\ REQUIRED}$ =	38.5	88.4	cfs

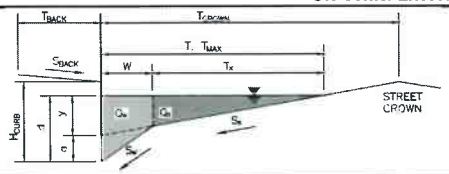
Version 4.05 Released March 2017

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

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

Project: 61072 Bunting Multi-Family

Inlet ID: SW Corner Ericson



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.0	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} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.055	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} =	0.016	

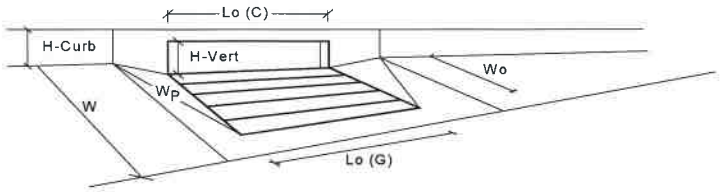
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	7.0	inches

Check boxes are not applicable in SUMP conditions

		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**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate	Type =	CDOT/Denver 13 Valley Grate	
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	2.00	2.00 inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.0	7.0 inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	3.00	3.00 feet
Width of a Unit Grate		W_o =	1.73	1.73 feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	0.43	0.43
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	0.50	0.50
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	3.30	3.30
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	0.60	0.60
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	N/A	N/A feet
Height of Vertical Curb Opening in Inches		H_{vert} =	N/A	N/A inches
Height of Curb Orifice Throat in Inches		H_{throat} =	N/A	N/A inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	N/A	N/A degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	N/A	N/A feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	N/A	N/A
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	N/A	N/A
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	N/A	N/A
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	0.439	0.606 ft
Depth for Curb Opening Weir Equation		d_{Curb} =	N/A	N/A ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	N/A	N/A
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	0.59	0.82
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	2.3	5.3 cfs
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms		$Q_{PEAK\ REQUIRED}$ =	38.5	88.4 cfs

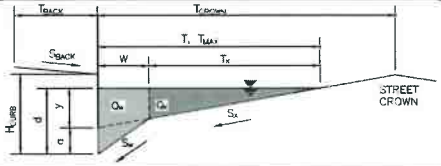
Version 4.05 Released March 2017

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

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

Project: 61072 Bunting Multi-Family

Inlet ID: SE Corner Ericson



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.0	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} =	20.0	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} =	0.016	

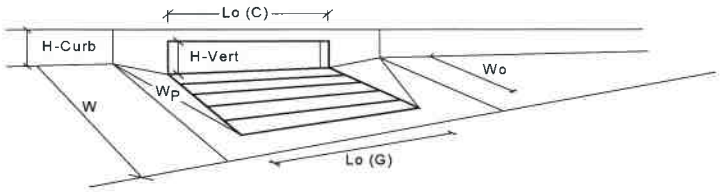
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	7.0	inches

Check boxes are not applicable in SUMP conditions

		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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate	Type =	CDOT/Denver 13 Valley Grate	
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	2.00	2.00 inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.0	6.3 inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	3.00	3.00 feet
Width of a Unit Grate		W_o =	1.73	1.73 feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	0.43	0.43
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	0.50	0.50
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	3.30	3.30
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	0.60	0.60
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	N/A	N/A feet
Height of Vertical Curb Opening in Inches		H_{vert} =	N/A	N/A inches
Height of Curb Orifice Throat in Inches		H_{throat} =	N/A	N/A inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	N/A	N/A degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	N/A	N/A feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	N/A	N/A
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	N/A	N/A
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	N/A	N/A
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	0.439	0.549 ft
Depth for Curb Opening Weir Equation		d_{Curb} =	N/A	N/A ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	N/A	N/A
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	0.78	0.99
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	1.7	3.0 **cfs**
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms		$Q_{PEAK\ REQUIRED}$ =	38.5	88.4 cfs

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 7 2018

Bunting Multi-Family - West Swale 100-yr

Trapezoidal

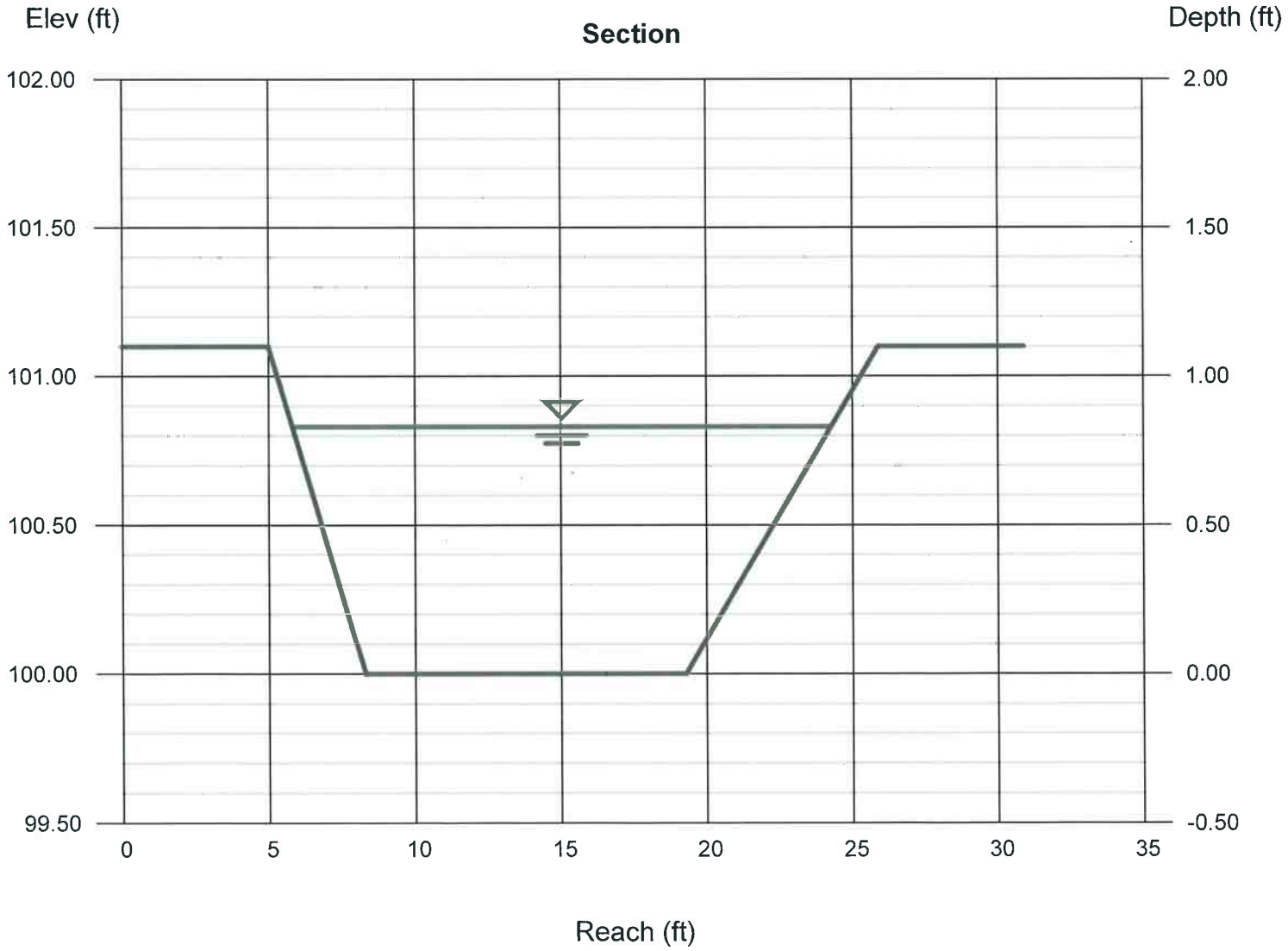
Bottom Width (ft)	= 11.00
Side Slopes (z:1)	= 3.00, 6.00
Total Depth (ft)	= 1.10
Invert Elev (ft)	= 100.00
Slope (%)	= 5.30
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 89.00

Highlighted

Depth (ft)	= 0.83
Q (cfs)	= 89.00
Area (sqft)	= 12.23
Velocity (ft/s)	= 7.28
Wetted Perim (ft)	= 18.67
Crit Depth, Yc (ft)	= 1.09
Top Width (ft)	= 18.47
EGL (ft)	= 1.65



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 7 2018

Bunting Multi-Family Exist 30 inch CMP pipe on west side

Circular

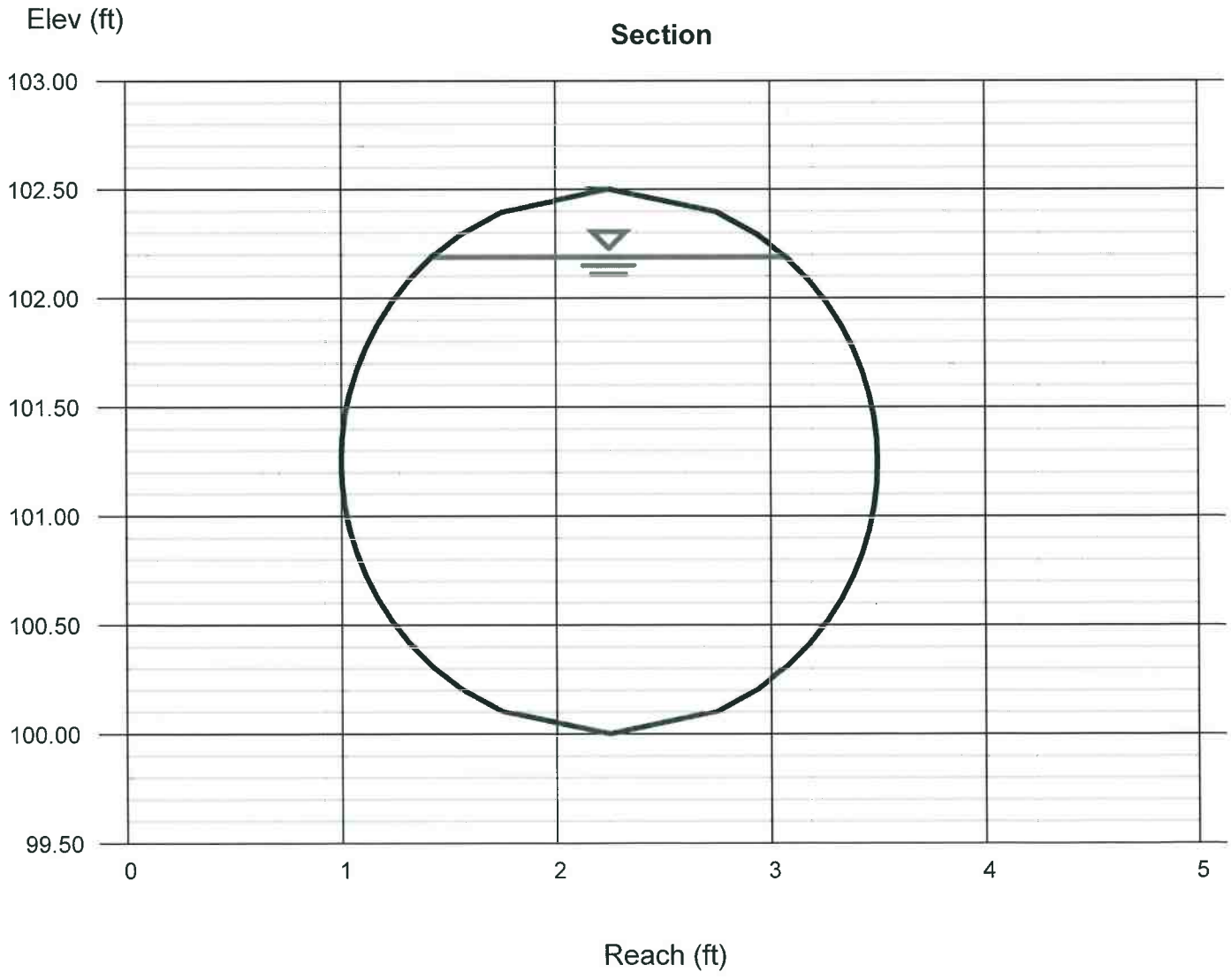
Diameter (ft)	= 2.50
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.018

Calculations

Compute by:	Q vs Depth
No. Increments	= 8

Highlighted

Depth (ft)	= 2.19
Q (cfs)	= 31.13
Area (sqft)	= 4.56
Velocity (ft/s)	= 6.83
Wetted Perim (ft)	= 6.05
Crit Depth, Yc (ft)	= 1.90
Top Width (ft)	= 1.65
EGL (ft)	= 2.91



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Feb 20 2018

Fishers Canyon

Trapezoidal

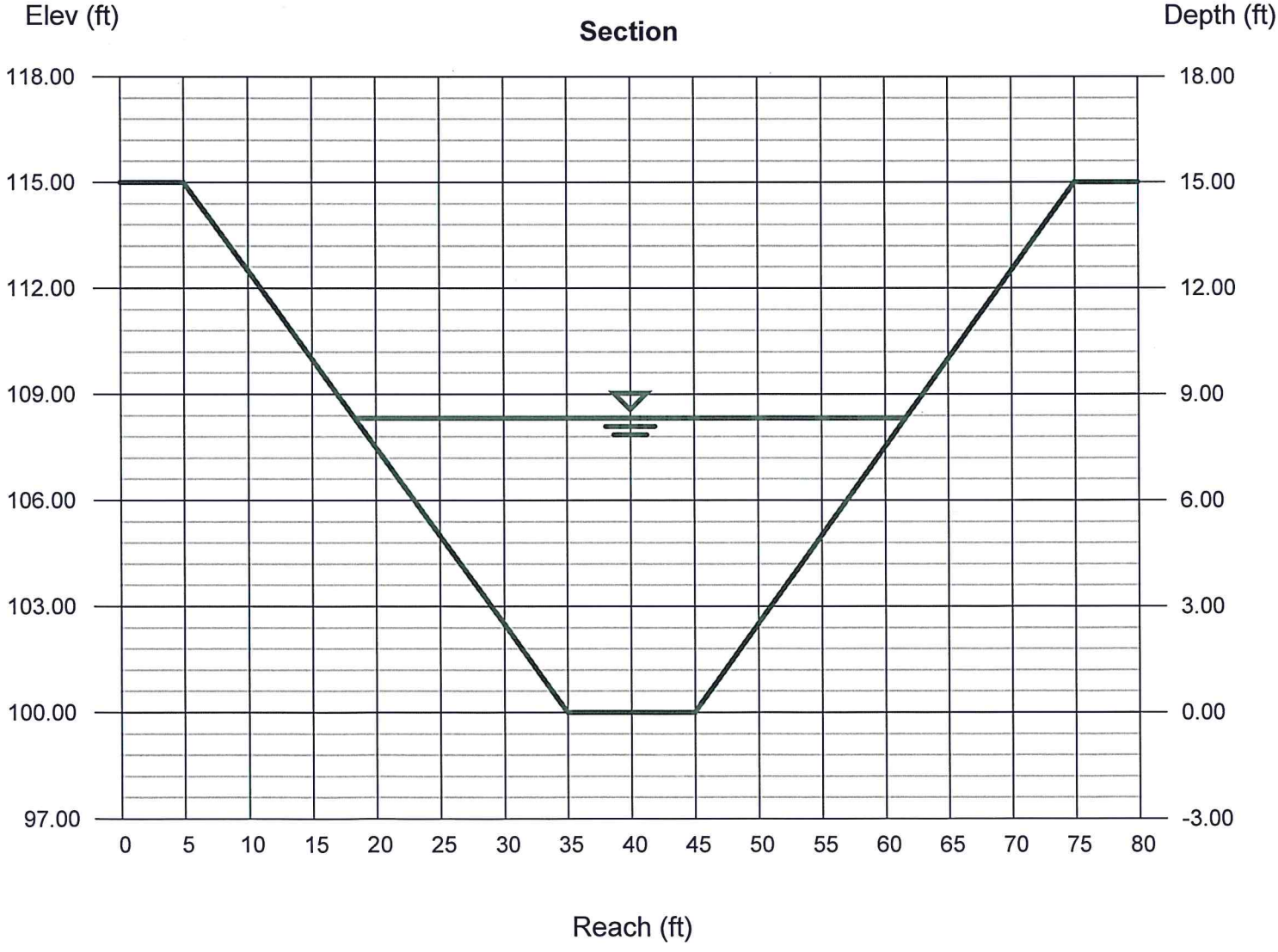
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 15.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.04
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2690.00

Highlighted

Depth (ft)	= 8.32
Q (cfs)	= 2,690
Area (sqft)	= 221.65
Velocity (ft/s)	= 12.14
Wetted Perim (ft)	= 47.21
Crit Depth, Yc (ft)	= 8.10
Top Width (ft)	= 43.28
EGL (ft)	= 10.61



M.V.E., INC.
1903 Lelaray St., Suite 200
COLORADO SPRINGS, CO 80909
(719) 635-5736

JOB C0107Z (ENG) BUNTING MF

SHEET NO. 1 OF 1

CALCULATED BY DMG DATE 2/16/18

CHECKED BY _____ DATE _____

SCALE _____

BUNTING MULT-FAMILY

RIP RAP FOR NORTH SLOPE

$Q = 2690$ cfs (DBPS)

$V = 12.5$ ft/sec

$S = 1.04\%$, $S_s = 2.6$

$VS^{0.17} / (S_s - 1)^{0.666} = 4.2$

USE ~~TABLE~~ TYPE M RIPRAP (TABLE 10-6) DCM