berge-brewer & associates, inc.

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ENGINEERS
PLANNERS
SURVEYORS

AMENDMENT TO

THE APPROVED FINAL DRAINAGE REPORT

~~BOTT AVENUE INDUSTRIAL PARK~~

(Spectra Drive Industrial Park MDDP)

PREPARED FOR:

ZEPHYR DEVELOPMENT

620 SOUTH CASCADE AVENUE

COLORADO SPRINGS, CO 80903

PREPARED BY:

BERGE-BREWER AND ASSOCIATES, INC.

711 N. CASCADE AVENUE

COLORADO SPRINGS, CO 80903

Prepared by: Anna C. Sparks, EIT
Reviewed by: Roger G. Berge, PE & PLS
February 26, 2003

CERTIFICATION:

Engineers Statement:

This attached drainage plan and report for "Amendment to the Approved Final Drainage Report, Bott Avenue Industrial Park" were prepared under my direction and supervision and is correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City of Colorado Springs\El Paso County for drainage reports and said report is in conformity with the master plan of the 21st Street Drainage Basin. I accept responsibility for any liability caused by any acts, errors of omissions on my part in preparing this report.

Roger G. Berge, Professional Engineer No. 9646
For and on behalf of Berge-Brewer & Associates, Inc.

Developers Statement:

The developer has read and will comply with all of the requirements specified in this report and plan.

Business Name: [illegible]

By: [illegible]

Title: Owner

Address: 511 W. Tejon

CS, CO 8090[illegible]

City of Colorado Springs:

Filed in accordance with Section 15-3-906 the Code of the City of Colorado Springs, 1980, as amended.

BY: [illegible] For The City Engineer

4/1/03
DATE

CONDITIONS:

LOCATION AND PURPOSE:

"Bott Avenue Industrial Park" is a replat of "Vac. Plat Por. Calvert Hgts & Resub. South Colo. City & Calvert Hgts" (vacated 4/1977) located in the Northwest Quadrant of Section 14, Township 14 South, Range 67 West of the Sixth P. M. in the City of Colorado Springs, El Paso County, Colorado. This 13.46± acre site is zoned M-1 (Light Industrial). This report is an amendment to the approved "Final Drainage Report, Bott Avenue Industrial Park" prepared by Berge-Brewer and Associates, Inc. dated April 18, 2002. A subsequent filing for this project is entitled "Spectra Drive Industrial Park Filing No. 2" due to the street name change from Bott Avenue to Spectra Drive.

The site is bounded on the northeast by "Seeman-Campbell Sub." zoned M-1/CR, on the north by "Bosch Sub. Fil. No. 2" and unplatted property zoned M-1/CR, on the northwest by "West Nest Industrial Park Fil. No. 1" zoned M-1/CR, on the west by "Colo. City Calvert Heights" zoned M-1/CR, and on the east by Pecan Street. The site is also bounded on the south by "Community at Bear Creek" and "Bear Creek Fil. No. 1" both zoned R-5. Across Pecan Street to the east are "Dr. Cooper Sub." and "21st St. Industrial Park" both zoned M-1. It is located in the 21st Street Drainage Basin.

SITE CHARACTERISTICS:

This site is presently vacant and slopes to the north at grades ranging from 1% to 64%.

SOILS:

The soils in this area consist of Razor-Midway Complex and Chaseville-Midway Complex. Razor Soils are classified as hydrologic group C, Chaseville as group A and Midway as group D. Hydrologic group C was used in determining quantities of runoff. According to the soil survey, the majority of the soils on the site would be Razor.

METHOD:

This drainage report was prepared in accordance with the latest revision of the City of Colorado Springs/El Paso County "Drainage Criteria Manual" dated November 1991 and amended October 1994. Drainage basins were analyzed using the Rational Method to determine runoff peaks for the 5 year and 100 year storms.

EXISTING DRAINAGE:

Bott Avenue Industrial Park is within the 21st Street Drainage Basin. Historic flows for Basin A, established using the previous zoning of the property, are Q_5 = 13.10 cfs/Q_{100} = 32.00 cfs. Historic flows for Basin B (includes historic flows from Basin A as well) are Q_5 = 14.06 cfs/Q_{100} = 34.29 cfs. Basin A includes runoff from the adjacent subdivision to the south and continues in a northerly direction. The adjacent property to the Northwest of the

site is elevated forming a berm that channels Basin A historic flows to the Northeast corner of the site. Because of this berm, Basin A historically flows into Basin B prior to exiting the site. An existing storm water system flows in a northerly direction through the western side of the site. Basin B historically receives Basin A runoff and continues in a northerly direction. An earthen berm just South of the adjacent property to the North, channels water along the northern boundary of the site. Because of this berm, Basin B runoff historically flows out of the northeastern corner of the property in a natural swale. Once the site's runoff reaches the northeastern corner of the property and prior to reaching the northern property border, the channel flow in the swale transitions into sheet flow without a defined channel or swale. The historical sheet flow from the site then continues into the Busch Avenue existing storm system. The 15' D-10-R inlet on the North side of Busch Avenue is directly in the path of any water that exits the site. The Busch Avenue inlet is in the lowest spot on the street, directly across from the "Bosch Sub. Fil. No. 2" eastern driveway that was formerly platted as Spruce Street.

Part of Calvert Street proposed in the approved report is now being proposed as a private drive containing a 30' access and public utility easement. The basin including the private drive is Basin C. The stormwater from Basin C historically flows in a northerly direction, northerly along property lines of "West Nest Industrial Park Fil. No. 1", and into the Busch Avenue existing inlets.

PROPOSED DRAINAGE:

Basin A developed flows, $Q_5 = 17.25$ cfs/$Q_{100} = 41.73$ cfs, are based upon the M-1 zoning (developed conditions). Basin A is located South of the proposed Spectra Drive and the runoff will flow into the two proposed 13' D-10-R curb inlets that will be conveyed to the existing storm sewer system on-site. Basin B developed flows, $Q_5 = 5.12$ cfs/$Q_{100} = 12.44$ cfs, are also based upon the M-1 zoning (developed conditions). Basin B is located North of the proposed Spectra Drive. Basin B runoff will continue to flow, as it does historically, to the Northeast edge of the property along the natural swale and then sheet flow into the Busch Avenue existing storm sewer system. The developed flows from Basin B exiting the site are less than the historic flows for Basin B. Basin C developed flows, $Q_5 = 0.89$ cfs/$Q_{100} = 1.87$ cfs, will continue to flow northerly.

Basin 1 was delineated to accommodate future Arch Street improvement with curb and gutter. Arch Street improvements would increase stormwater flows to the proposed D-10-R on Spectra Drive, just East of Arch Street. The property within Basin 1 is zoned M-1. Basin 1 is expected to generate $Q_5 = 5.8$ cfs\$Q_{100} = 13.3$ cfs. A proposed 8' D-10-R and 24" RCP will be installed on Spectra Drive, just East of Arch Street. The stormwater captured by the proposed 8' D-10-R will be conveyed to the existing storm sewer system on-site.

Drainage Basin Design Points are included on the drainage plan to represent the 100-year return period stormwater flows after completion of the proposed construction for this project. Drainage Basin Design Point 1 includes the 100-year return period stormwater

from the proposed Spectra Drive inlets. Drainage Basin Design Point 2 includes the 100-year return period stormwater from Basin B flowing into the existing Busch Avenue inlets. Drainage Basin Design Point 3 includes the 100-year return period stormwater from the possible Arch Street improvements.

FLOODPLAIN STATEMENT:

This site is not located in the 100-year floodplain according to Panel No. 08041C0728 F of the Federal Emergency Management Agency's Flood Insurance Rate Map dated March 17, 1997.

DRAINAGE IMPROVEMENTS:

The following private drainage improvements will be installed as a result of this development.

D-10-R Inlet – 3 ea. @ $4,000.00 ea.	$12,000.00
24" RCP – 218 l.f. @ $40.00\l.f.	$ 8,720.00
30" RCP – 215 l.f. @ $45.00\l.f.	$ 9,675.00
Sub Total	$30,395.00
15% Engineering & Contingencies	$ 4,559.25
TOTAL	$34,954.25

FEES:

Since this site was previously platted, drainage fees are not required.

EROSION CONTROL:

Erosion control in conformance with an approved Grading and Erosion Control Plan will be installed during the construction phase of this development.

REFERENCES

1. City of Colorado Springs/El Paso County Drainage Criteria Manual dated November 1991.

2. "Soil Survey for El Paso County Area," Soil Conservation Service.

3. South 21st Street Master Drainage Basin Plan prepared by R. Keith Hook and Associates, Inc. dated 1974.

4. Bear Creek Filing No. 1 Final Drainage Report prepared by Nolte and Associates dated May 1995.

5. Community at Bear Creek Final Drainage Report prepared by MVE and dated June 1985.

6. The approved "Final Drainage Report, Bott Avenue Industrial Park" prepared by Berge-Brewer and Associates, Inc. dated April 18, 2002.

INLET SIZING:

Capacity of Curb-opening Inlets in a Sump Condition:

$Q_i = 3.0\, l_i\, d_i^{1.5}$

Where:
Q_i = capacity of the inlet, cfs;
L_i = length of clear opening, ft (minimum);
d_i = depth of water above inlet lip, ft (assume 6" for Q_5 and 8" for Q_{100})

$$L_i = \frac{Q_i}{3.0 d_i^{1.5}}$$

Q_i = Basin 1 Q_{100} = 13.25 cfs

$$L_i = \frac{13.25 \text{ cfs}}{3.0\ (.7)^{1.5}}$$

L_i = 8' D-10-R

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	Proposed Pipe
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Slope	0.010000	ft/ft
Diameter	24	in

Results		
Depth	2.00	ft
Discharge	22.62	cfs
Flow Area	3.1	ft²
Wetted Perimeter	6.28	ft
Top Width	0.00	ft
Critical Depth	1.69	ft
Percent Full	100.0	%
Critical Slope	0.009461	ft/ft
Velocity	7.20	ft/s
Velocity Head	0.81	ft
Specific Energy	2.81	ft
Froude Number	0.00	
Maximum Discharg	24.33	cfs
Discharge Full	22.62	cfs
Slope Full	0.010000	ft/ft
Flow Type	N/A	

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Return period (yrs)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	5.83	1	18	6,299	5	----	------	------	Basin 1
2	Rational	13.25	1	15	11,921	100	----	------	------	Basin 1

Hydrograph Report

English

Hyd. No. 1

Basin 1

Hydrograph type	= Rational	Peak discharge	= 5.83 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Drainage area	= 2.7 ac	Runoff coeff.	= 0.7
Intensity	= 3.05 in	Time of conc. (Tc)	= 18 min
I-D-F Curve	= colorado.IDF	Reced. limb factor	= 1

Total Volume = 6,299 cuft

Hydrograph Discharge Table

Time (hrs)	Outflow (cfs)	Time (hrs)	Outflow (cfs)
0.02	0.32	0.55	0.97
0.03	0.65	0.57	0.65
0.05	0.97	0.58	0.32
0.07	1.30		
0.08	1.62		
0.10	1.94	*...End*	
0.12	2.27		
0.13	2.59		
0.15	2.92		
0.17	3.24		
0.18	3.56		
0.20	3.89		
0.22	4.21		
0.23	4.54		
0.25	4.86		
0.27	5.18		
0.28	5.51		
0.30	5.83 <<		
0.32	5.51		
0.33	5.18		
0.35	4.86		
0.37	4.54		
0.38	4.21		
0.40	3.89		
0.42	3.56		
0.43	3.24		
0.45	2.92		
0.47	2.59		
0.48	2.27		
0.50	1.94		
0.52	1.62		
0.53	1.30		

Hydrograph Report

English

Hyd. No. 2

Basin 1

Hydrograph type	= Rational	Peak discharge	= 13.25 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 2.7 ac	Runoff coeff.	= 0.8
Intensity	= 6.06 in	Time of conc. (Tc)	= 15 min
I-D-F Curve	= colorado.IDF	Reced. limb factor	= 1

Total Volume = 11,921 cuft

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)
0.02	0.88
0.03	1.77
0.05	2.65
0.07	3.53
0.08	4.42
0.10	5.30
0.12	6.18
0.13	7.06
0.15	7.95
0.17	8.83
0.18	9.71
0.20	10.60
0.22	11.48
0.23	12.36
0.25	13.25 <<
0.27	12.36
0.28	11.48
0.30	10.60
0.32	9.71
0.33	8.83
0.35	7.95
0.37	7.06
0.38	6.18
0.40	5.30
0.42	4.42
0.43	3.53
0.45	2.65
0.47	1.77
0.48	0.88

...End