



**NORTHERN**  
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## Drainage Letter Report

**Date:** February 28, 2012

**Project:** Fairview Shopping Center Filing Four  
Replat of Lot 1, Fairview Shopping Center  
Fort Collins, Colorado

**Project No.** 688-001

**Attn:** Mr. Wes Lamarque  
City of Fort Collins Stormwater Utility  
700 Wood Street  
Fort Collins, Colorado 80521

### Dear Wes:

This letter serves to address the stormwater impacts of the above referenced multi-family redevelopment. The existing building is situated towards the western portion of the site. The site currently consists of rooftop, concrete walks and patio, asphalt parking areas, some turf, trees, and other vegetation. It presently functions similar to a 'B' lot, with historic drainage being split towards Elizabeth Street to the north and towards an area inlet to the south. The landscaped area adjacent to the western property line has a low point such that it too drains primarily to the south. Flows then reach an area inlet located on the C.B. & Pott's Restaurant and Brewery Property. Historic drainage patterns will generally be preserved. The total impervious area of the existing site is approximately **22,611 square-feet**.

The proposed redevelopment will completely remove all existing above-grade structures and adjacent hardscape. The new project will consist of a larger apartment building, as well as a modified parking area and bioretention rain garden. Concrete pedestrian connections will be made from the units north to the Elizabeth Street sidewalk. The total impervious area of the proposed redevelopment is roughly **22,688 square-feet**.

The existing curb cut and concrete apron to Elizabeth Street will be slightly reconfigured to meet current code requirements. The area of pavement draining north across the Elizabeth sidewalk will be approximately 450 square-feet, which is less than the maximum 750 square-feet allowed by LCUASS.

The site is located in the Old Town master drainage basin, and therefore, on-site detention is not required so long as the increase in impervious area is less than 5,000 square-feet. The total increase in impervious area proposed with this development is approximately **77 square-feet** (22,688 – 22,611). A detailed breakdown of the existing and proposed impervious areas is attached to this letter.


Although stormwater quantity detention is not required, stormwater quality mitigation will be addressed by both temporary and permanent Best Management Practices (BMPs). During construction, the Contractor will follow the appropriate and applicable City of Fort Collins standards for erosion and sediment control. Post construction water quality and erosion control will be achieved by a fully established and stabilized site. All areas disturbed during construction will receive permanent hardscape, landscape, or building structure.

This portion of the Old Town basin does not receive regional water quality treatment; therefore, on-site water quality mitigation is required. Much of the existing landscaped buffers on the west side and north side of the building will be preserved as permeable areas to promote infiltration and treat surface runoff prior to entering the adjacent gutters and inlets. However, the primary water quality treatment method to be employed is the construction of an on-site bioretention rain garden. Water quality computations have been performed for this facility utilizing the UDFCD's UD-BMP Version 3.01 "Rain Garden (RG)" Design Procedure Form. A copy of the RG worksheet is attached to this letter.


The proposed grading concept closely matches existing elevations and drainage patterns, and only varies in an effort to improve the existing condition from a floodplain protection and water quality standpoint. On-site detention is proven to be unnecessary. Stormwater quality has been provided to bring the historic site into compliance in the redeveloped condition. Therefore, it is my professional opinion that the new apartment building proposed with Fairview Shopping Center Filing Four at 1409 W. Elizabeth Street satisfies all applicable stormwater criteria.

Please do not hesitate to contact me if you have questions or require additional information.

Sincerely,



Nicholas W. Haws, PE



enc.

cc: Dave Derbes, LEED AP – Brinkman Construction

**EXISTING COMPOSITE % IMPERVIOUSNESS AND RUNOFF COEFFICIENT CALCULATIONS**

CHARACTER OF SURFACE:	Runoff Coefficient	Percentage Impervious			
<i>Streets, Parking Lots, Roofs, Alleys, and Drives:</i>			Project: Fairview Shopping Center Calculations By: A. Reese Date: February 28, 2012		
Asphalt .....	0.95	100			
Concrete .....	0.95	90			
Gravel .....	0.50	40			
Roofs .....	0.95	90			
Pavers.....	0.40	22			
<i>Lawns and Landscaping</i>					
Sandy Soil .....	0.15	0			
Clayey Soil .....	0.25	0	2-year $C_t = 1.00$	10-year $C_t = 1.00$	100-year $C_t = 1.25$

Runoff Coefficients are taken from the City of Fort Collins Storm Drainage Design Criteria and Construction Standards, Table 3-3. % Impervious taken from UDFCD USDCM, Volume I.

Basin ID	Basin Area (s.f.)	Basin Area (ac)	Area of Asphalt (ac)	Area of Concrete (ac)	Area of Roofs (ac)	Area of Gravel (ac)	Area of Lawns and Landscaping (ac)	2-year Composite Runoff Coefficient	10-year Composite Runoff Coefficient	100-year Composite Runoff Coefficient	Composite % Imperv.
H1	29,010	0.67	0.38	0.02	0.11	0.00	0.15	0.80	0.80	0.99	75.9
TOTAL	29,010	0.67	0.38	0.02	0.11	0.00	0.15	0.80	0.80	0.99	75.89

### DEVELOPED COMPOSITE % IMPERVIOUSNESS AND RUNOFF COEFFICIENT CALCULATIONS

CHARACTER OF SURFACE:	Runoff Coefficient	Percentage Impervious			
<i>Streets, Parking Lots, Roofs, Alleys, and Drives:</i>			Project: Fairview Shopping Center		
Asphalt .....	0.95	100	Calculations By: A. Reese		
Concrete .....	0.95	90	Date: February 28, 2012		
Gravel .....	0.50	40			
Roofs .....	0.95	90			
Pavers.....	0.40	22			
<i>Lawns and Landscaping</i>					
Sandy Soil .....	0.15	0			
Clayey Soil .....	0.25	0			
			2-year $C_f = 1.00$	10-year $C_f = 1.00$	100-year $C_f = 1.25$

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Basin ID	Basin Area (s.f.)	Basin Area (ac)	Area of Asphalt (ac)	Area of Concrete (ac)	Area of Roofs (ac)	Area of Gravel (ac)	Area of Lawns and Landscaping (ac)	2-year Composite Runoff Coefficient	10-year Composite Runoff Coefficient	100-year Composite Runoff Coefficient	Composite % Imperv.
A	1,349	0.03	0.00	0.00	0.00	0.00	0.03	0.25	0.25	0.31	0.0
B	8,731	0.20	0.00	0.00	0.20	0.00	0.00	0.95	0.95	1.00	90.0
C	4,743	0.11	0.03	0.03	0.00	0.00	0.04	0.66	0.66	0.83	56.5
D	3,284	0.08	0.04	0.02	0.00	0.00	0.01	0.85	0.85	1.00	82.3
E	10,903	0.25	0.14	0.05	0.00	0.00	0.06	0.79	0.79	0.98	74.8
<b>TOTAL</b>	<b>29,010</b>	<b>0.67</b>	<b>0.22</b>	<b>0.10</b>	<b>0.20</b>	<b>0.00</b>	<b>0.15</b>	<b>0.80</b>	<b>0.80</b>	<b>1.00</b>	<b>73.73</b>

**Design Procedure Form: Rain Garden (RG)**

Sheet 1 of 2

Designer: Andy Reese  
 Company: Northern Engineering  
 Date: February 28, 2012  
 Project: Fairview Shopping Center Filing Four  
 Location: Fort Collins, Colorado

<p>1. Basin Storage Volume</p> <p>A) Effective Imperviousness of Tributary Area, <math>I_a</math> (100% if all paved and roofed areas upstream of rain garden)</p> <p>B) Tributary Area's Imperviousness Ratio (<math>i = I_a/100</math>)</p> <p>C) Water Quality Capture Volume (WQCV) for a 12-hour Drain Time (<math>WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)</math>)</p> <p>D) Contributing Watershed Area (including rain garden area)</p> <p>E) Water Quality Capture Volume (WQCV) Design Volume Vol = (WQCV / 12) * Area</p> <p>F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm</p> <p>G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume</p> <p>H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)</p>	<p><math>I_a =</math> <u>75.8</u> %</p> <p><math>i =</math> <u>0.758</u></p> <p>WQCV = <u>0.24</u> watershed inches</p> <p>Area = <u>29,309</u> sq ft</p> <p><math>V_{WQCV} =</math> <u>        </u> cu ft</p> <p><math>d_e =</math> <u>0.30</u> in</p> <p><math>V_{WQCV\ OTHER} =</math> <u>419.4</u> cu ft</p> <p><math>V_{WQCV\ USER} =</math> <u>        </u> cu ft</p>
<p>2. Basin Geometry</p> <p>A) WQCV Depth (12-inch maximum)</p> <p>B) Rain Garden Side Slopes (<math>Z = 4</math> min., horiz. dist per unit vertical) (Use "0" if rain garden has vertical walls)</p> <p>C) Minimum Flat Surface Area</p> <p>D) Actual Flat Surface Area</p> <p>E) Area at Design Depth (Top Surface Area)</p> <p>F) Rain Garden Total Volume (<math>V_T = ((A_{Top} + A_{Actual}) / 2) * Depth</math>)</p>	<p><math>D_{WQCV} =</math> <u>        </u> in</p> <p><math>Z =</math> <u>        </u> ft / ft</p> <p><math>A_{Min} =</math> <u>        </u> sq ft</p> <p><math>A_{Actual} =</math> <u>        </u> sq ft</p> <p><math>A_{Top} =</math> <u>        </u> sq ft</p> <p><math>V_T =</math> <u>        </u> cu ft</p>
<p>3. Growing Media</p>	<p>Choose One <u>        </u></p> <p><input type="radio"/> 18" Rain Garden Growing Media</p> <p><input checked="" type="radio"/> Other (Explain): <u>City of Fort Collins Standard Planting media</u></p>
<p>4. Underdrain System</p> <p>A) Are underdrains provided?</p> <p>B) Underdrain system orifice diameter for 12 hour drain time</p> <p>i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice</p> <p>ii) Volume to Drain in 12 Hours</p> <p>iii) Orifice Diameter, 3/8" Minimum</p>	<p>Choose One <u>        </u></p> <p><input checked="" type="radio"/> YES</p> <p><input type="radio"/> NO</p> <p><math>y =</math> <u>0.5</u> ft</p> <p><math>Vol_{12} =</math> <u>419</u> cu ft</p> <p><math>D_o =</math> <u>0.63</u> in</p>

**Design Procedure Form: Rain Garden (RG)**

Sheet 2 of 2

Designer: Andy Reese  
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<p>5. Impermeable Geomembrane Liner and Geotextile Separator Fabric</p> <p>A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?</p>	<p>Choose One</p> <p><input type="radio"/> YES</p> <p><input type="radio"/> NO</p>
<p>6. Inlet / Outlet Control</p> <p>A) Inlet Control</p>	<p>Choose One</p> <p><input type="radio"/> Sheet Flow- No Energy Dissipation Required</p> <p><input checked="" type="radio"/> Concentrated Flow- Energy Dissipation Provided</p>
<p>7. Vegetation</p>	<p>Choose One</p> <p><input type="radio"/> Seed (Plan for frequent weed control)</p> <p><input checked="" type="radio"/> Plantings</p> <p><input type="radio"/> Sand Grown or Other High Infiltration Sod</p>
<p>8. Irrigation</p> <p>A) Will the rain garden be irrigated?</p>	<p>Choose One</p> <p><input checked="" type="radio"/> YES</p> <p><input type="radio"/> NO</p> <p><b>NO SPRINKLER HEADS ON THE FLAT SURFACE</b></p>
<p>Notes: _____</p> <p>_____</p> <p>_____</p>	