**LSC TRANSPORTATION CONSULTANTS, INC.**

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January 31, 2013

Mr. Gary Myre
3195 11th Street
Boulder, CO 80304

Re: Boulder Creek Commons
Boulder, CO
(LSC #110320)

Dear Mr. Myre:

We have prepared this memorandum to supplement our December 20, 2012 *Boulder Creek Commons Traffic Impact Analysis* (TIA) based on a request from City staff to help address comments they have received from concerned citizens.

**Assignment of Traffic to Manhattan Drive vs. 55th Street**

The TIA assumed 35 percent of site traffic would be oriented to/from the west on Baseline Road. It assumed 25 percent would use Manhattan Drive and ten percent would use 55th Street between the site and Baseline Road. The City received comments stating that no one will use the 55th Street option to go to/from the west on Baseline Road. A sensitivity analysis was completed to determine the affect of all 35 percent using Manhattan Drive. Figure 1 shows an updated directional distribution estimate reflecting this change. Figures 2, 3, and 4 show updated site-generated traffic, updated existing traffic plus site-generated traffic, and the updated 2032 total traffic. Comparison to the TIA shows very little change in volumes to the intersections of Baseline Road with both Manhattan Drive and 55th Street. Table 1 shows the estimated peak-hour levels of service at the intersection of Baseline Road and Manhattan Drive for the 2032 total traffic. A comparison shows very little difference between the TIA analysis and the sensitivity analysis.

**Assignment of Traffic to Kewanee Street and Cimmaron Way**

The TIA assumed all site traffic to/from Manhattan Drive would use Kewanee Drive. This was to determine if the intersection of Manhattan Drive/Kewanee Drive would operate at an acceptable level of service if it were used by all vehicles oriented west to/from the site. This could have led to the conclusion that no site traffic will use Cimmaron Way. The updated Figures 1 through 4 assume the vehicles oriented north on Manhattan Drive would use Kewanee Drive to Manhattan Drive. They assume the vehicles oriented south on Manhattan Drive would use Cimmaron Way between Manhattan Drive and Kewanee Drive. Figure 2 shows it is expected that about 320 new one-way vehicle-trips per day could be added to

Kewanee Drive between Manhattan Drive and Cimmaron Way and that about 125 new one-way vehicle-trips per day could be added to Cimmaron Way between Manhattan Drive and Kewanee Drive. On Kewanee Drive this would relate to about one vehicle every three minutes during the morning peak-hour and about one vehicle every two minutes during the afternoon peak-hour. On Cimmaron Way this would relate to about one vehicle every six or seven minutes during the morning peak-hour and one vehicle every five minutes during the afternoon peak-hour. Table 1 shows the estimated peak-hour levels of service at the intersection of Manhattan Drive and Cimmaron Way for the 2032 total traffic. This intersection was not analyzed in the TIA, but is expected to operate at very good levels of service with or without the addition of site traffic.

**Potential Change in Traffic Patterns Resulting from Site Development**

The site plan includes a public street connection between Kewanee Drive and 55th Street. This will provide the site with two separate points of access. During site development it was acknowledged that the connection could be used by some existing traffic as an alternate east-west connection. Examples would be a resident in Greenbelt Meadows traveling to/from Manhattan Middle School or a resident along Manhattan Drive traveling to/from East Boulder Community Park. The site plan evolved with several features to discourage use of the connection as a through street. These include two 90-degree bends in the proposed street alignment, bump-outs at all internal street intersections and pedestrian crossings, on-street parking, and on-street bicycle lanes and/or routes. It is LSC's opinion that these features will decrease vehicle speeds through the site and reduce the attractiveness of the connection as a through route. Non-site-generated traffic using the connection is expected to be in the range of 100 to 200 vehicles per day.

* * * * * *

We trust that this memorandum will assist in the planning of the proposed development. Please call if we can be of further assistance.

Respectfully submitted,

LSC Transportation Consultants, Inc.

COLORADO LICENSED
CHRISTOPHER S. McGRANAHAN
39018
PROFESSIONAL ENGINEER

By:_____
Christopher S. McGranahan, P.E., PTOE
Principal

1-31-13

Enclosures: Table 1
Figures 1 - 4
Capacity Analysis Worksheets

CSM/wc

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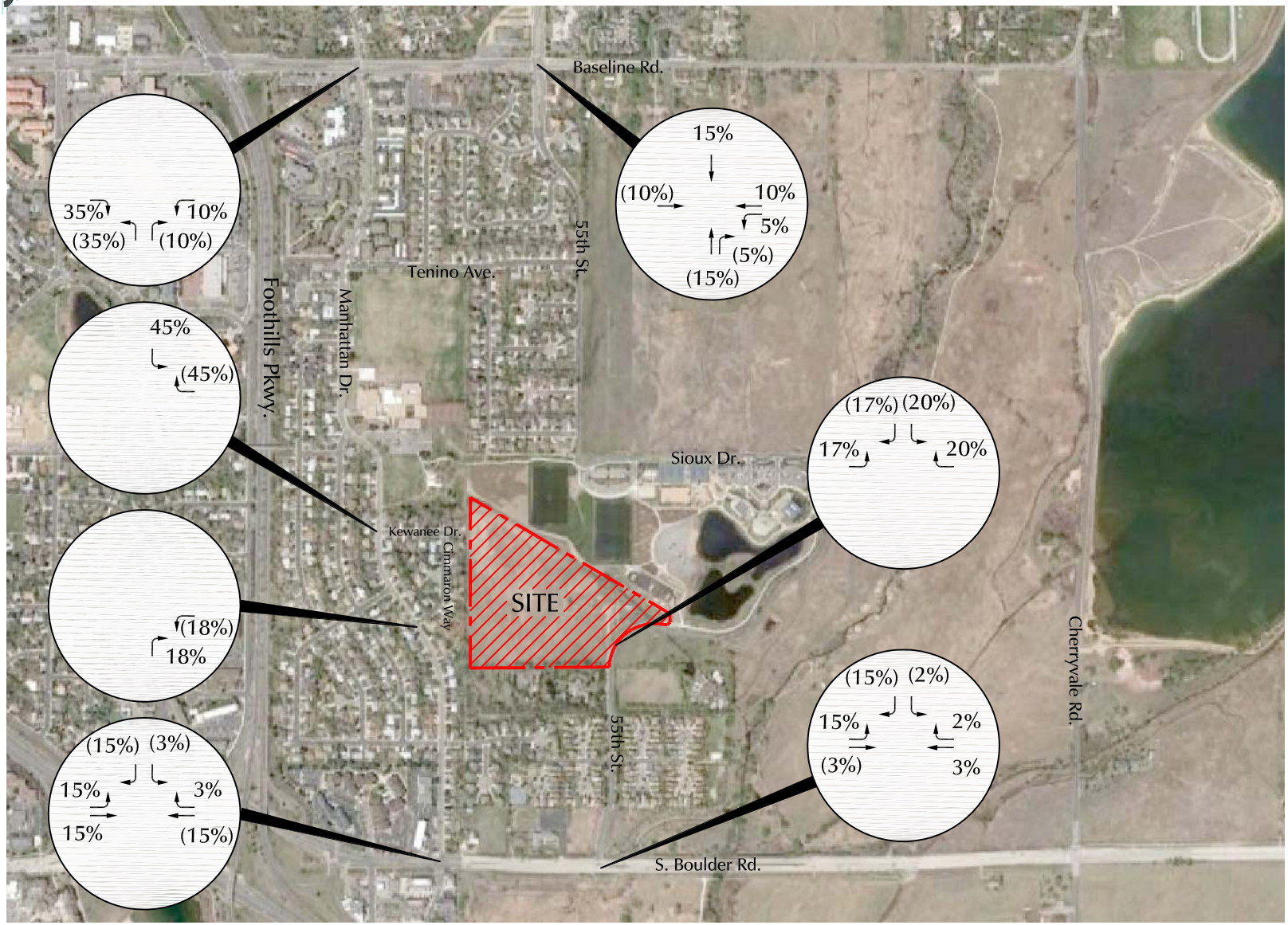
**Table 1 [1]**
**Intersection Levels of Service Analysis**
**Boulder Creek Commons**
**Boulder, Colorado**
**(LSC #110320; January, 2013)**

| | | December, 2012 TIA | | | | January, 2013 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Year 2032 Total Traffic | | | | Year 2032 Total Traffic | | | |
| Intersection Location | Traffic Control | Level of Service | Move-ment Delay | Level of Service | Move-ment Delay | Level of Service | Move-ment Delay | Level of Service | Move-ment Delay |
| | | AM | | PM | | AM | | PM | |
| Baseline Road/Manhattan Drive | Signalized | | | | | | | | |
| EB Left | | A | 8.4 | A | 9.6 | A | 8.4 | A | 9.6 |
| EB Through/Right | | A | 8.6 | B | 10.3 | A | 8.6 | B | 10.3 |
| WB Left | | B | 11.2 | B | 11.3 | B | 11.2 | B | 11.3 |
| WB Through/Right | | B | 13.3 | A | 7.3 | B | 13.3 | A | 7.3 |
| NB Left | | D | 42.3 | D | 37.6 | D | 42.9 | D | 37.8 |
| NB Through/Right | | C | 27.7 | C | 25.9 | C | 27.6 | C | 25.9 |
| SB Left | | C | 28.3 | C | 28.8 | C | 28.3 | C | 28.8 |
| SB Through/Right | | C | 28.8 | C | 28.8 | C | 28.8 | C | 28.8 |
| Entire Intersection Delay (sec /veh) | | 15.5 | | 12.4 | | 15.6 | | 12.4 | |
| Entire Intersection LOS | | B | | B | | B | | B | |
| Manhattan Drive/Cimmaron Way | All-Way Stop | | | | | | | | |
| WB Approach | | -- | -- | -- | -- | A | 7.6 | A | 7.7 |
| NB Approach | | -- | -- | -- | -- | A | 8.0 | A | 8.0 |
| SB Approach | | -- | -- | -- | -- | A | 7.9 | A | 8.1 |

Note:
(1) Using *Synchro Highway Capacity Manual* output.




Approximate Scale
Scale: 1"= 1,000'

LEGEND:

10% = Inbound Distribution

(10%) = Outbound Distribution Turning Movements

*Figure 1*

# *Trip Distribution*

Boulder Creek Commons (LSC #110320)

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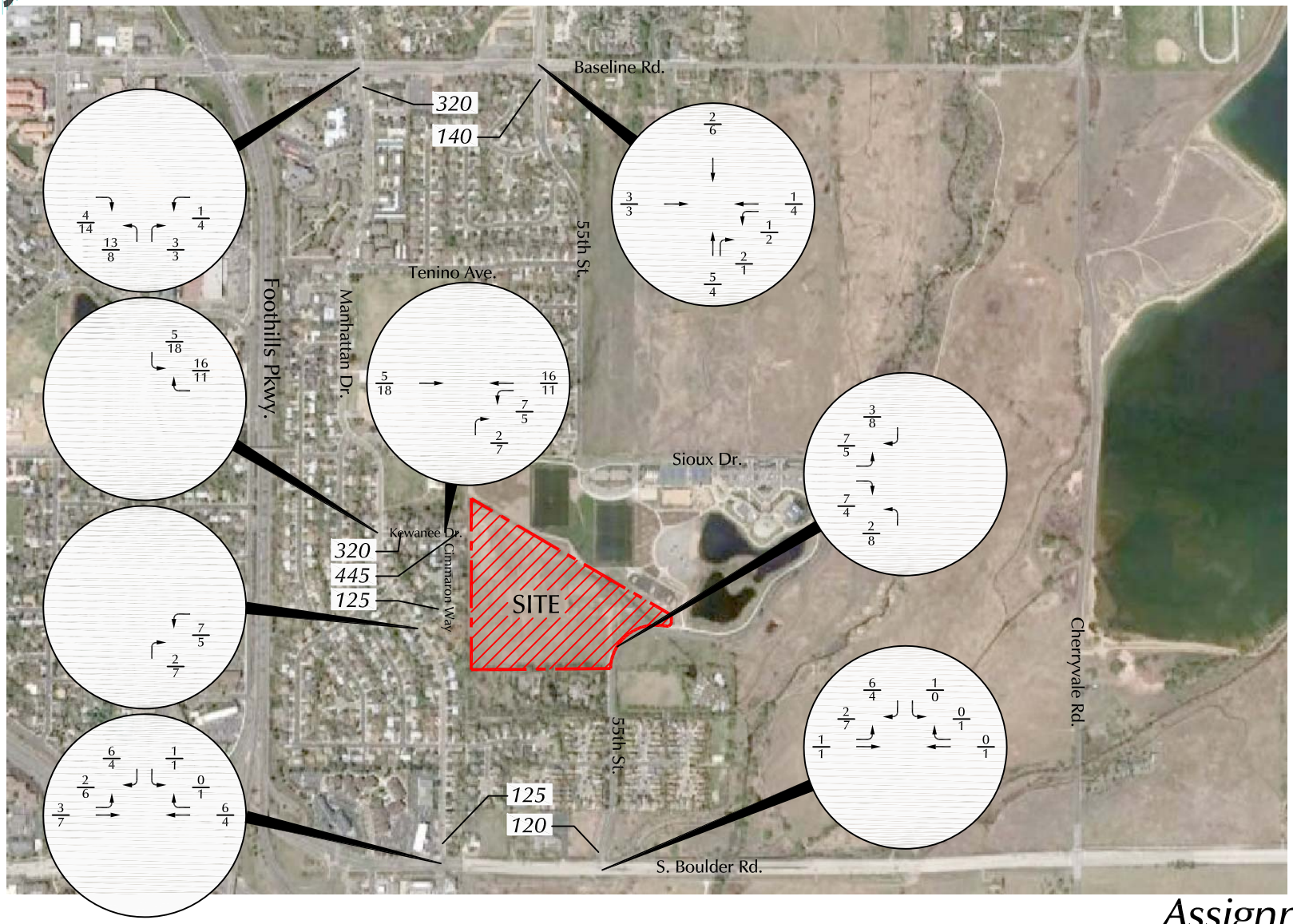



LEGEND:

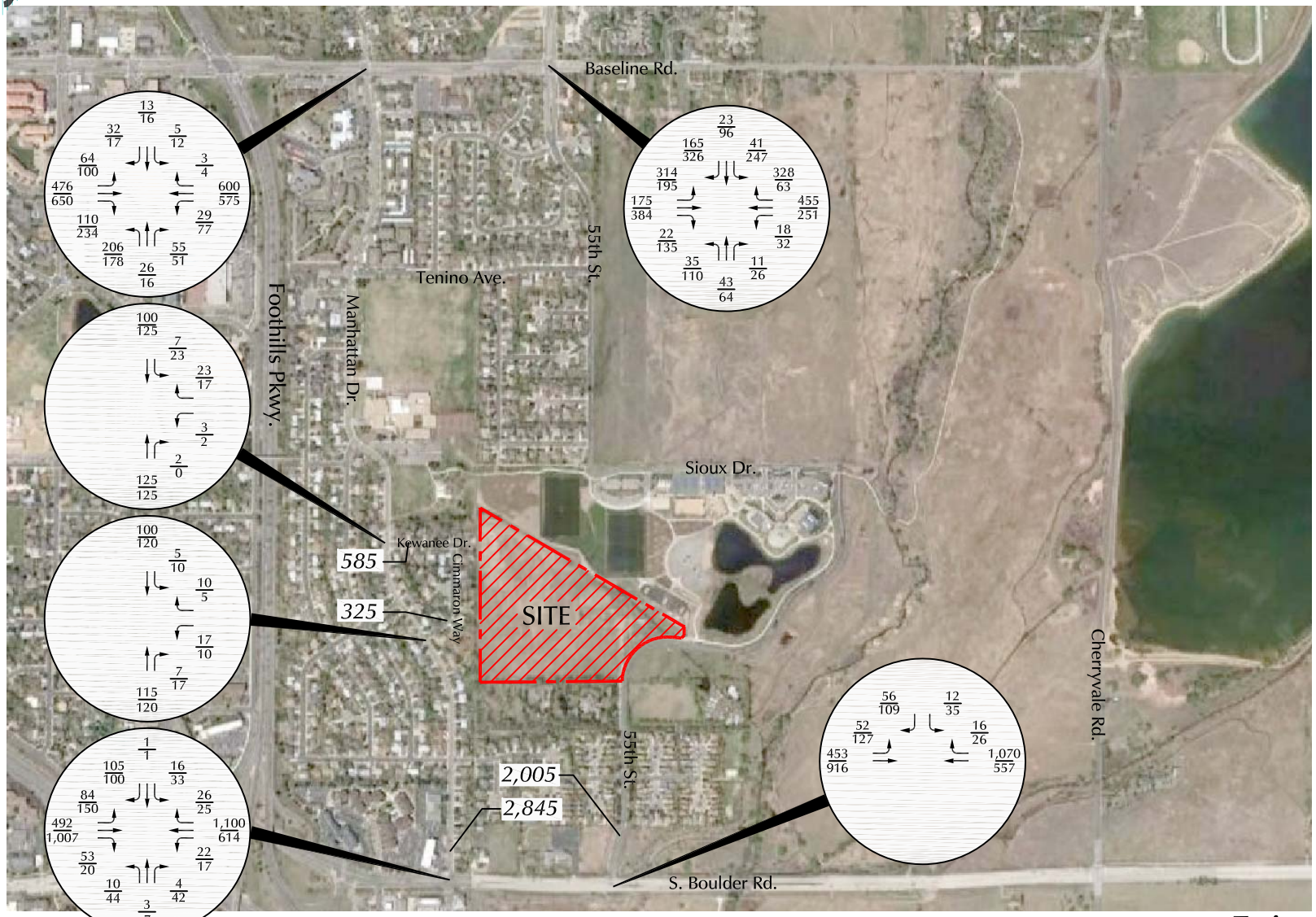
$$\frac{45}{65} = \frac{\text{AM Peak-Hour Traffic}}{\text{PM Peak-Hour Traffic}}$$

Figure 2

# Assignment of Site-Generated Traffic

Boulder Creek Commons (LSC #110320)

LSC TRANSPORTATION CONSULTANTS, INC.




Approximate Scale
Scale: 1"= 1,000'

LEGEND:

$\frac{45}{65}$ = $\frac{\text{AM Peak-Hour Traffic}}{\text{PM Peak-Hour Traffic}}$

*1,150* = Average Daily Traffic

*Figure 3*

# *Existing Plus Site-Generated Traffic*

Boulder Creek Commons (LSC #110320)

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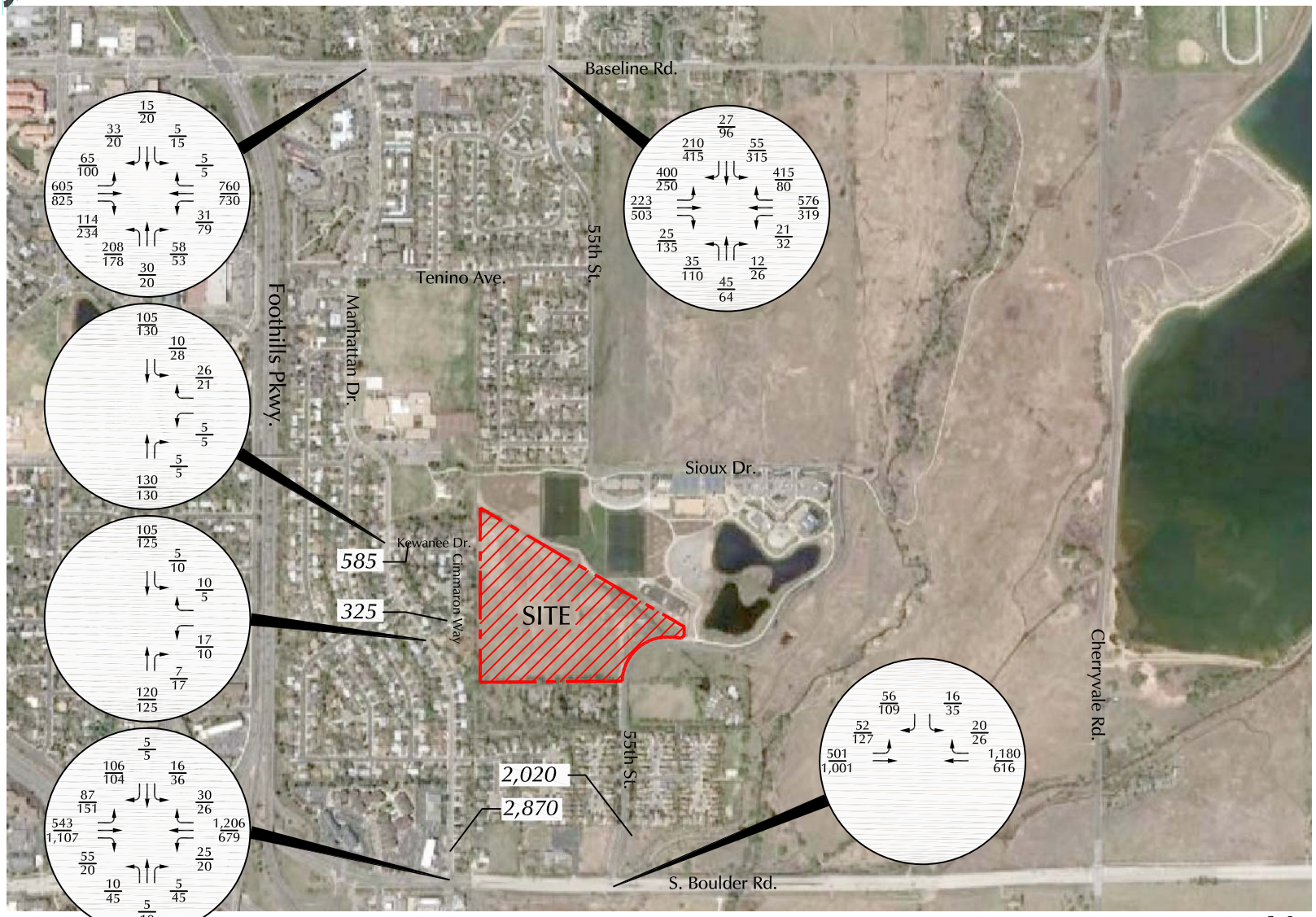


Approximate Scale
Scale: 1"= 1,000'

LEGEND:

$\frac{45}{65}$ = $\frac{\text{AM Peak-Hour Traffic}}{\text{PM Peak-Hour Traffic}}$

*1,150* = Average Daily Traffic

*Figure 4*

# *Year 2032 Total Traffic*

Boulder Creek Commons (LSC #110320)

TRANSPORTATION CONSULTANTS, INC.

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.6 | 5.6 | | 5.6 | 5.6 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | 1.00 | 1.00 | | 1.00 | 0.90 | | 1.00 | 0.90 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 3455 | | 1770 | 3536 | | 1770 | 1679 | | 1770 | 1669 | |
| Flt Permitted | 0.31 | 1.00 | | 0.33 | 1.00 | | 0.72 | 1.00 | | 0.69 | 1.00 | |
| Satd. Flow (perm) | 574 | 3455 | | 611 | 3536 | | 1347 | 1679 | | 1294 | 1669 | |
| Volume (vph) | 65 | 605 | 114 | 31 | 760 | 5 | 208 | 30 | 58 | 5 | 15 | 33 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 71 | 658 | 124 | 34 | 826 | 5 | 226 | 33 | 63 | 5 | 16 | 36 |
| RTOR Reduction (vph) | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 27 | 0 |
| Lane Group Flow (vph) | 71 | 766 | 0 | 34 | 831 | 0 | 226 | 49 | 0 | 5 | 25 | 0 |
| Turn Type | Perm | | | Perm | | | Perm | | | Perm | | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 66.0 | 66.0 | | 66.0 | 66.0 | | 26.0 | 26.0 | | 26.0 | 26.0 | |
| Effective Green, g (s) | 64.4 | 64.4 | | 64.4 | 64.4 | | 25.0 | 25.0 | | 25.0 | 25.0 | |
| Actuated g/C Ratio | 0.64 | 0.64 | | 0.64 | 0.64 | | 0.25 | 0.25 | | 0.25 | 0.25 | |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 370 | 2225 | | 393 | 2277 | | 337 | 420 | | 324 | 417 | |
| v/s Ratio Prot | | 0.22 | | | c0.23 | | | 0.03 | | | 0.01 | |
| v/s Ratio Perm | 0.12 | | | 0.06 | | | c0.17 | | | 0.00 | | |
| v/c Ratio | 0.19 | 0.34 | | 0.09 | 0.36 | | 0.67 | 0.12 | | 0.02 | 0.06 | |
| Uniform Delay, d1 | 7.2 | 8.1 | | 6.7 | 8.3 | | 33.8 | 29.0 | | 28.2 | 28.6 | |
| Progression Factor | 1.00 | 1.00 | | 1.61 | 1.56 | | 0.97 | 0.93 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.2 | 0.4 | | 0.4 | 0.4 | | 10.1 | 0.6 | | 0.1 | 0.3 | |
| Delay (s) | 8.4 | 8.6 | | 11.2 | 13.3 | | 42.9 | 27.6 | | 28.3 | 28.8 | |
| Level of Service | A | A | | B | B | | D | C | | C | C | |
| Approach Delay (s) | | 8.6 | | | 13.2 | | | 38.4 | | | 28.8 | |
| Approach LOS | | A | | | B | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 56.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 5.6 | 5.6 | | 5.6 | 5.6 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 0.95 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.97 | | 1.00 | 1.00 | | 1.00 | 0.89 | | 1.00 | 0.93 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 3422 | | 1770 | 3536 | | 1770 | 1660 | | 1770 | 1730 | |
| Flt Permitted | 0.32 | 1.00 | | 0.20 | 1.00 | | 0.73 | 1.00 | | 0.70 | 1.00 | |
| Satd. Flow (perm) | 599 | 3422 | | 370 | 3536 | | 1359 | 1660 | | 1313 | 1730 | |
| Volume (vph) | 100 | 825 | 234 | 79 | 730 | 5 | 178 | 20 | 53 | 15 | 20 | 20 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 1.00 |
| Adj. Flow (vph) | 109 | 897 | 254 | 86 | 793 | 5 | 193 | 22 | 58 | 16 | 22 | 20 |
| RTOR Reduction (vph) | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 44 | 0 | 0 | 15 | 0 |
| Lane Group Flow (vph) | 109 | 1125 | 0 | 86 | 798 | 0 | 193 | 37 | 0 | 16 | 27 | 0 |
| Turn Type | Perm | | | Perm | | | Perm | | | Perm | | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | 2 | | | 6 | | |
| Actuated Green, G (s) | 66.0 | 66.0 | | 66.0 | 66.0 | | 26.0 | 26.0 | | 26.0 | 26.0 | |
| Effective Green, g (s) | 64.4 | 64.4 | | 64.4 | 64.4 | | 25.0 | 25.0 | | 25.0 | 25.0 | |
| Actuated g/C Ratio | 0.64 | 0.64 | | 0.64 | 0.64 | | 0.25 | 0.25 | | 0.25 | 0.25 | |
| Clearance Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 386 | 2204 | | 238 | 2277 | | 340 | 415 | | 328 | 433 | |
| v/s Ratio Prot | | c0.33 | | | 0.23 | | | 0.02 | | | 0.02 | |
| v/s Ratio Perm | 0.18 | | | 0.23 | | | c0.14 | | | 0.01 | | |
| v/c Ratio | 0.28 | 0.51 | | 0.36 | 0.35 | | 0.57 | 0.09 | | 0.05 | 0.06 | |
| Uniform Delay, d1 | 7.7 | 9.4 | | 8.3 | 8.2 | | 32.8 | 28.8 | | 28.5 | 28.6 | |
| Progression Factor | 1.00 | 1.00 | | 0.89 | 0.84 | | 0.95 | 0.89 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.8 | 0.8 | | 4.0 | 0.4 | | 6.6 | 0.4 | | 0.3 | 0.3 | |
| Delay (s) | 9.6 | 10.3 | | 11.3 | 7.3 | | 37.8 | 25.9 | | 28.8 | 28.8 | |
| Level of Service | A | B | | B | A | | D | C | | C | C | |
| Approach Delay (s) | | 10.2 | | | 7.7 | | | 34.3 | | | 28.8 | |
| Approach LOS | | B | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 12.4 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.53 | | |
| Actuated Cycle Length (s) | 100.0 | Sum of lost time (s) | 10.6 |
| Intersection Capacity Utilization | 64.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Stop | | | Stop |
| Volume (vph) | 17 | 10 | 115 | 7 | 5 | 100 |
| Peak Hour Factor | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| Hourly flow rate (vph) | 21 | 12 | 144 | 9 | 6 | 125 |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 34 | 153 | 131 |
| Volume Left (vph) | 21 | 0 | 6 |
| Volume Right (vph) | 13 | 9 | 0 |
| Hadj (s) | -0.06 | 0.00 | 0.04 |
| Departure Headway (s) | 4.4 | 4.1 | 4.2 |
| Degree Utilization, x | 0.04 | 0.17 | 0.15 |
| Capacity (veh/h) | 749 | 856 | 848 |
| Control Delay (s) | 7.6 | 8.0 | 7.9 |
| Approach Delay (s) | 7.6 | 8.0 | 7.9 |
| Approach LOS | A | A | A |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 7.9 | | |
| HCM Level of Service | A | | |
| Intersection Capacity Utilization | 19.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Stop | | | Stop |
| Volume (vph) | 10 | 5 | 120 | 17 | 10 | 120 |
| Peak Hour Factor | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| Hourly flow rate (vph) | 12 | 6 | 150 | 21 | 12 | 150 |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 19 | 171 | 163 |
| Volume Left (vph) | 13 | 0 | 13 |
| Volume Right (vph) | 6 | 21 | 0 |
| Hadj (s) | -0.03 | -0.04 | 0.05 |
| Departure Headway (s) | 4.6 | 4.1 | 4.2 |
| Degree Utilization, x | 0.02 | 0.19 | 0.19 |
| Capacity (veh/h) | 722 | 867 | 854 |
| Control Delay (s) | 7.7 | 8.0 | 8.1 |
| Approach Delay (s) | 7.7 | 8.0 | 8.1 |
| Approach LOS | A | A | A |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 8.1 | | |
| HCM Level of Service | A | | |
| Intersection Capacity Utilization | 24.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |