WEEKLY INFORMATION PACKET
MEMORANDUM

To: Mayor Applebaum and City Council

From: Jane Brautigam, City Manager
Stephanie Grainger, Deputy City Manager
Kirk Kincannon, Director of Parks and Recreation
Felix Gallo, Interim Parks and Planning Superintendent
Perry Brooks, Park Planner

Date: May 26, 2009

Subject: Information Item: East Boulder Community Park

EXECUTIVE SUMMARY:

The purpose of this item is to provide information regarding the East Boulder Community Park (EBCP) Phase Two. Questions regarding the project status and future were raised during the May 19th City Council meeting.

The final concept plan for Phase Two (Attachment A) reflects the intent of the 1989 concept plan (Attachment B) and community input gathered during four public meetings that were conducted in 2008. The Parks and Recreation Advisory Board (PRAB) approved the final Phase Two concept plan in November of 2008 and additional EBCP planning process documents can be found at www.boulderparks-rec.org. The program elements for Phase Two include two artificial turf multi-purpose fields, a restroom/picnic shelter, surface parking, pedestrian and bicycle connections, a sustainable irrigation pond, improvements to the existing handball courts, lighting two tennis courts and infrastructure improvements.

In 2008, the PRAB approved the 2009 Permanent Parks and Recreation Fund (Fund 230) Capital Improvements Program (CIP) to fund the development of Phase Two. A preliminary cost estimate for the development of Phase Two is included in this memo as Attachment C. Currently, $2.3 million is available for the development of this project. Per City Charter, these funds can only be used to fund land acquisitions and park development. The PRAB approved the EBCP Phase Two concept plan in November 2008 and staff is finalizing the site plan and preparing the appropriate submittals for city staff review.

FISCAL IMPACT:

Based on the current program elements, the anticipated initial development costs of EBCP Phase Two are estimated to be in the range of $2.5 - $4 million dollars. Once the construction documents are completed, a more specific cost estimate will be developed. Cost estimates for the on-going maintenance and operations for the park will be developed as the plans are finalized.

COMMUNITY SUSTAINABILITY ASSESSMENTS AND IMPACTS:

- Economic: The development of EBCP Phase Two will provide enhanced and diverse active recreation opportunities for the community and create competitive venues for local, regional and national events that will contribute to the economic vitality of the city of Boulder.
- Environmental: The development of EBCP Phase Two will incorporate low impact and sustainable design and construction practices. Some of the practices that can be implemented in the design include the following: using non-potable ditch water for irrigation; water conservation techniques in the landscape; LEED™ certified building design and sustainable maintenance practices; and encouraging and educating park users to recycle during their visits to the park. The design for EBCP Phase Two will also make provisions that will encourage park users to use alternative means of transportation.
- Social: EBCP Phase Two development will positively contribute to an already successful community park and will enhance the elements that create a great community place – accessibility, activity, comfort, image and sociability. The park will be connected to its surroundings, both visually and physically, and will be easy to reach through a variety of transportation options. The planned program elements are designed to keep users engaged in a wide range of active recreational activities. This phase of park development will enhance the opportunities for Boulder residents and visitors to meet friends but also allow them to feel comfortable interacting with each other in a safe and pleasant setting.

ANALYSIS:

In response to questions regarding the status and future of this project that were raised during the May 19th City Council meeting, staff offers the following information:

Question: Why is the Parks and Recreation Department spending $2.5 million for a parking lot in an area prone to flooding?

The development of the 104 space surface parking lot is anticipated to cost $189,000. While the proposed parking lot is within a 100 year flood zone, current regulations do not prohibit the development of the parking lot in this area.

Question: Why is the Parks and Recreation Department speaking of tough cuts needed in their public forums, yet are planning to add park infrastructure that will add to maintenance operating costs for the Department?

Based on the need to reduce long term maintenance and operating costs, while continuing to provide quality programs and facilities, the Parks and Recreation Department is converting the two existing natural turf multi purpose athletic fields to synthetic turf athletic fields. While the construction of synthetic fields is initially more costly than traditional engineered natural turf fields, the yearly and long term savings is estimated to be approximately 40 to 50 percent over the maintenance costs of an engineered natural turf field. Natural turf fields require regular levels of maintenance that include mowing, trimming, watering, seeding fertilization, aeration and grading that is maintenance intensive and costly. Synthetic fields require significantly lower levels of maintenance and over the long term will reduce the need to increase future operating

budgets for athletic field care. Current field designs are estimated to have a useful life span of approximately 15 years, which over the field's life span will reduce budget impacts (when compared to a similar design for natural turf fields) by several hundred thousand dollars. East Boulder Community Park Phase Two park development will be funded from the Permanent Parks and Recreation Fund, a capital fund that cannot be used for operations and maintenance purposes.

Question: Why is the additional parking lot needed for this park when the recent study presented to the PRAB showed that the existing lot is only used 70 percent of the time? Is the parking lot really needed?

The additional parking lot is needed to handle the anticipated parking needs for the new fields, as well as overflow parking that is currently occurring and impacting the neighborhood to the north and parking in the south lot at Manhattan Middle School. A traffic analysis was conducted by the engineer consulting firm of Fox Higgins Transportation Group in October 2008 (Attachment D). The analysis provided data that led to the new 104 space proposed parking lot that will be located south-east of the proposed multi-purpose fields and accessed from the south from 55th Street. The additional capacity is based on numbers of current and anticipated users of the park including users of the new synthetic fields. The existing parking capacity at the park and the community center will not meet future demand with the improvements planed for the park.

During a PRAB meeting in September 2008, the Board requested that staff explore the possibility of using the existing parking lot north of the East Boulder Community Center rather than building a new parking lot to serve the need of the new fields. With assistance from the engineer consulting firm of Fox Higgins Transportation Group it was determined that there is currently overflow parking from park use in the south lot at Manhattan Middle School and in the neighborhood to the north. In addition the study showed that the current 104 space parking lot on the north side of the existing fields is full during the weekday p.m. use (peak hours) as sports teams overlap during transitioning periods between games. The use of the current lot was shown to be 82 percent capacity on weekend (Saturday) mornings during the month of October. This measurement occurred during post traditional season.

This traffic count was completed during the month of October 2008, which is during non-peak season times for normal field usage. This information was provided to the PRAB during a meeting in November 2008 prior to concept plan approval.

Question: Will the project increase noise, traffic (including speed) and impact wildlife?

While there is an addition of a picnic and pavilion area in the Phase Two plan, a significant increase in noise is not anticipated as a result of the park improvement. The improvements to the park will maintain the same existing uses and will provide an improved park conditions.

Traffic and parking impacts will be reduced in the adjacent neighborhoods with the addition of the new parking lot and the access off of 55th Street. The existing traffic volume on this south section of 55th Street is approximately 1,200 vehicles per day and based on the turning

movement counts at the intersection of 55th and South Boulder Road, the traffic volume on this section of 55th Street is approximately 200 vehicles per hour (vph) during the p.m. peak hour. According to the traffic study, the improvements to the site will generate approximately 200 new vehicles per day, with 100 of these occurring during the p.m. peak hour. The projected daily volume of 1,400 vehicles per day is consistent with traffic volumes for a typical local Boulder street.

As related to concerns about wildlife impacts, the site development is following the City's Urban Wildlife Management Plan (UWMP) regarding prairie dogs. In the UWMP, the site is classified as a near term relocation area, meaning the animals can be removed upon development of the site. At the time of development, staff will be in compliance with the city's wildlife ordinance and will remove the animals (approximately 30 at this time) and provide the necessary mitigation to prevent future migration onto the site. There is no habitat for the endangered Preble's meadow jumping mouse on this property.

Generally, the city shares public concern about minimizing the speed of traffic within our community. With regard to EBCP Phase Two, existing speed data collected for the project did not show a speeding problem in the area (i.e., the neighborhood would not have met the criteria for the Neighborhood Traffic Mitigation Program). Based on this data, staff believes that the improvements to the park will not generate a speeding problem.

Question: Is the completion of Sioux Drive consistent with the city's master planning and commitments?

When the Transportation Master Plan was completed for this area, it was anticipated that the property to the north would be developed into residential housing, requiring the development of 55th Street as an arterial road directly to the north of the community center. Since that time, the land use, property ownership and zoning in this area has changed and therefore, no longer requires this arterial road connection.

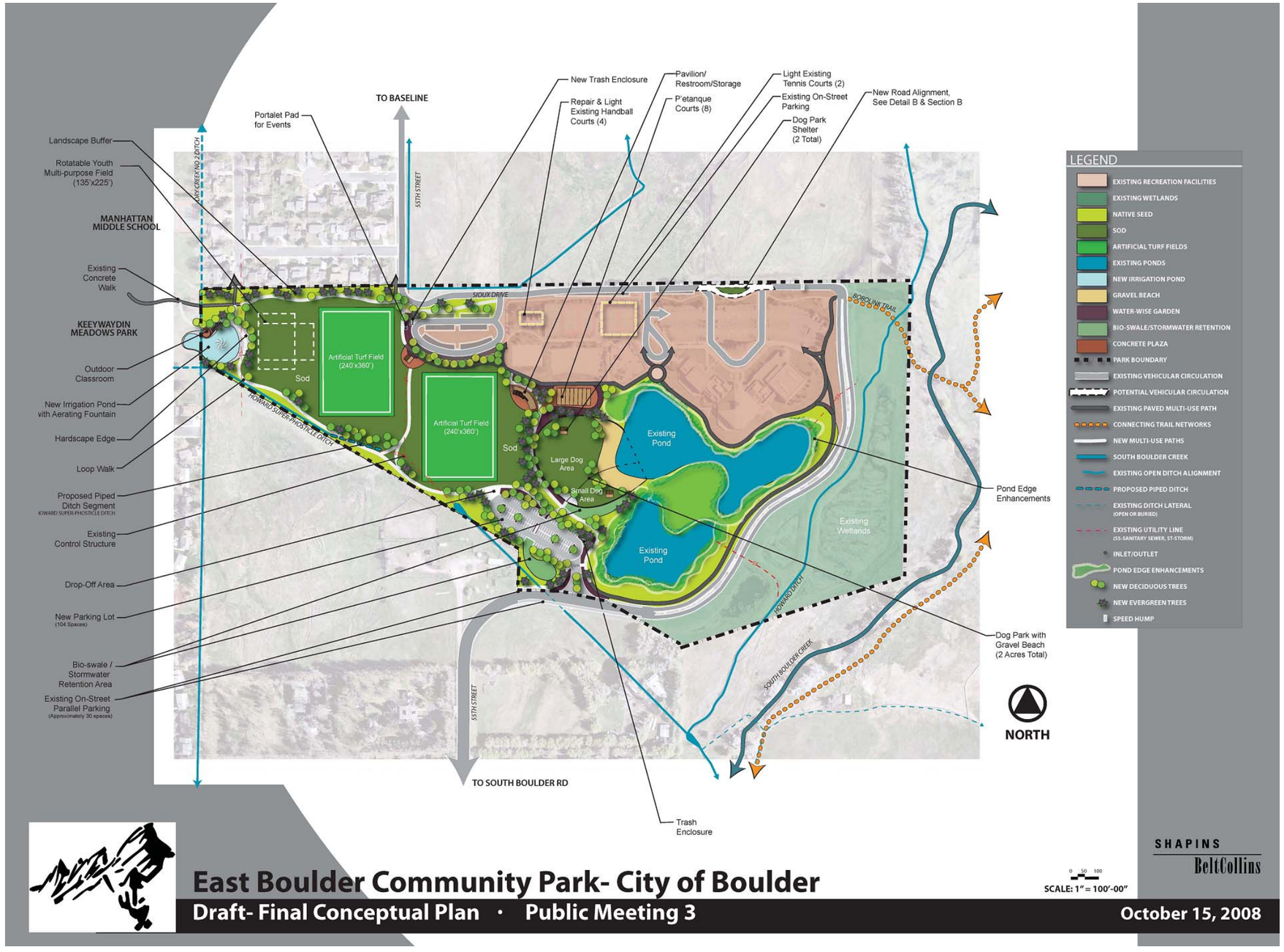
The missing piece of Sioux Drive, proposed to be completed will eliminate the parking lot cut-through that currently exists at the community center and will include traffic mitigation features similar to those on 55th Street. This is consistent with current devices in the parking lot connection and will improve the safety of patrons using the community center.

NEXT STEPS:

Unless otherwise directed, the department will proceed with the adopted plans for the East Boulder Community Park Phase Two, with the development of the project in summer/fall 2009 in order to take advantage of current low commodity prices and a favorable bidding climate.

Attachments:

Attachment A	Concept Plan - Phase Two
Attachment B	1989 Concept Plan
Attachment C	Cost Estimate – Phase Two
Attachment D	Traffic Analysis



East Boulder Community Park- City of Boulder

Draft- Final Conceptual Plan · Public Meeting 3

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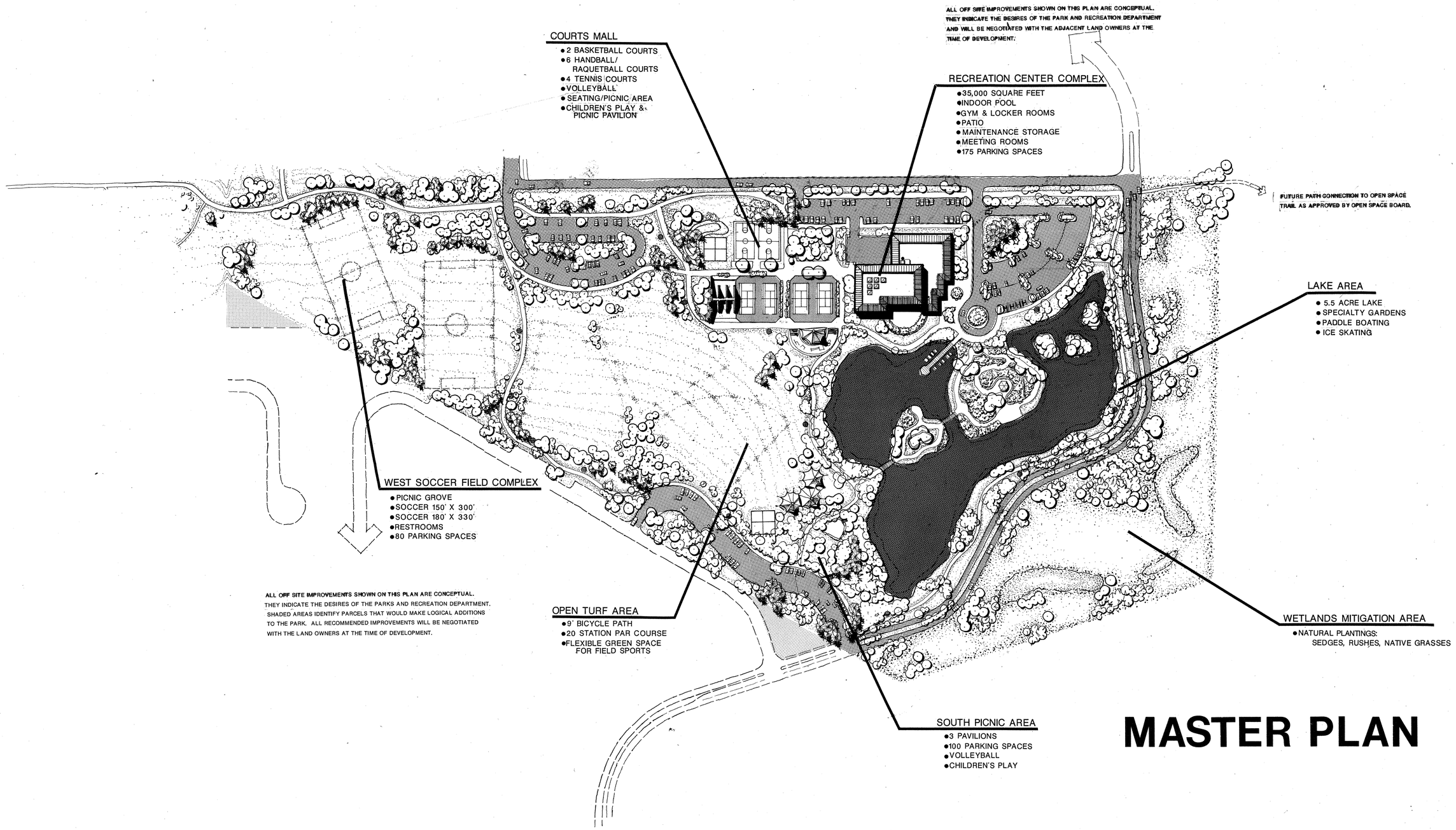


MASTER PLAN

REVISIONS: JANUARY 28, 1987

EAST BOULDER
COM. PK MASTER PLAN

East Boulder Community Park - Phase II

City of Boulder Parks & Recreation

Preferred Conceptual Plan: October 22, 2008
Estimate of Probable Costs

Site Demo, Prep & Earthwork	***Unit***	***Qty.***	***Cost/Unit***	***Cost***
Removal / Screening of Spoils Pile	CY	5,980	$ 6	$35,880
Erosion Control	LS	1	$ 10,000	$10,000
Soil Prep / Fine Grading (Sod)	SF	228,100	$0.25	$57,025
Soil Prep / Fine Grading (Native Seed)	SF	135,100	$0.15	$20,265
Site Grading	CY	21,684	$5	$108,420
				$231,590

Parking & Traffic Calming	***Unit***	***Qty.***	***Cost/Unit***	***Cost***
New Asphalt Parking Area (South)	SF	33,600	$5	$168,000
Curb & Gutter (New Asphalt Parking Area, South)	LF	1,615	$15	$24,225
55TH St. Entry Drive (25' Road with Split Entry & Median)	LF	564	$150	$84,600
New Sioux Road Segment	SF	9,325	$0.75	$6,994
New Sioux Road Segment Median Curbs	LF	693	$15	$10,395
*Bio-swales	SF	8,244	$10.00	$82,440
Speed Table	EA	2	$10,000	$20,000
Landscape Inside Median	SF	2,135	$3.00	$6,405
				$403,059

Park Amenities	***Unit***	***Qty.***	***Cost/Unit***	***Cost***
Two Artificial Turf Fields (240'x360')	SF	210,600	$7	$1,474,200
*Concrete Walk - 8' wide / 6" depth	SF	2,922	$40	$116,880
*Concrete Walk - 12' wide / 6" depth	SF	1,161	$50	$58,050
Pavilion/Restroom/Shelter Building (with Composting Toilets)	EA	1	$390,000	$390,000
Pavilion Plaza (Regular Concrete Flatwork)	SF	2,166	$5	$10,830
Pavilion Plaza (Colored Concrete Flatwork)	SF	9,620	$9	$86,580
*Small Shelter Plaza	SF	1,671	$9	$15,039
*Small Shelter (10'X10')	LS	1	$25,000	$25,000
Outdoor Classroom	LS	1	$25,000	$25,000
Picnic Tables	EA	8	$800	$6,400
Benches	EA	9	$1,000	$9,000
Trash Receptacles	EA	10	$800	$8,000
Dog Waste Disposal Station	EA	3	$400	$1,200
Bike Racks	EA	2	$800	$1,600
Portalet Pad (4" Depth Concrete)	SF	3,565	$4.50	$16,043
*Handball Improvements	LS	1	$30,000.00	$30,000
*Tennis Court Lighting, See alternative #1	EA	2	$40,000.00	$80,000
Trash Enclosure	LS	1	$7,500	$7,500
				$2,361,322

Utilities *(See Add Alternates 2 & 3)*	***Unit***	***Qty.***	***Cost/Unit***	***Cost***
Piped Ditch Segment (Howard Super-Phosticle)	LF	300	$35	$10,500
Site Utilities-Sanitary Sewer	LF	900	$40	$36,000
Site Utilities-Domestic Flow	LF	900	$25	$22,500
				$69,000

Dog Park	***Unit***	***Qty.***	***Cost/Unit***	***Cost***
Fence	LF	2,089	$20	$41,780
Beach (3/4" Gravel)	SF	15,966	$1	$15,966
Sod & Irrigation (Large Dog Park)	SF	48,896	$1.25	$61,120
*Artificial Turf (Small Dog Park)	SF	14,037	$7.00	$98,259
Soil Prep / Fine Grading (Sod)	SF	48,896	$0.25	$12,224
Entry Gate & Paddock	LS	1	$5,000	$5,000
4' Entry Gate (at Beach)	EA	2	$1,000	$2,000
10' Maintenance Gate	EA	2	$2,000	$4,000
Crusher Fines Entry	SF	1,503	$2	$3,006
Shade Shelter (10'x10')	LS	2	$25,000	$50,000
Drinking Fountain with Dog Bowl	EA	1	$7,000	$7,000
Picnic Tables	EA	2	$800	$1,600
Benches	EA	4	$1,000	$4,000
Trash Receptacles	EA	3	$400	$1,200
*Bio-Swales	SF	8,216	$10	$82,160
500-gallon in ground septic system for dog waste disposal	EA	2	$1,500	$3,000
				$392,315

P'etanque Courts	***Unit***	***Qty.***	***Cost/Unit***	***Cost***
Crusher Fines	LS	2	$2	$4
Concrete Edge	LF	704	$20	$14,080
P'etanque Plaza (Colored Concrete)	SF	6,158	$9	$55,422
				$69,506

Landscape	***Unit***	***Qty.***	***Cost/Unit***	***Cost***
Trees(2.5-3" Cal.)	EA	218	$500	$109,000
Sod	SF	216,559	$0.50	$108,280
Shrub & Perennial Beds (including weed barrier & mulch)	SF	35,195	$5	$175,975
Native Seeded Areas	SF	102,365	$0.25	$25,591
*Windbreak	LS	1	$10,000.00	$10,000
Natural Pond Edge (Existing Ponds)	LS	1	$50,000	$50,000
				$478,846

Irrigation Pond*	***Unit***	***Qty.***	***Cost/Unit***	***Cost***
Pond (excavation, lake edge, liner, geotextile fabric, soil cover, aeration system)	LS	1	$100,000.00	$100,000
				$100,000

Irrigation System	**Unit**	**Qty.**	**Cost/Unit**	**Cost**
Pump Station (wet well, intake pipe, intake screen, pump station, filter, controls, sl	LS	1	$150,000	$150,000
Drip Irrigation	SF	37,329	$0.90	$33,596
Turf Irrigation (Does Not Include Dog Park)	SF	225,532	$0.75	$169,149
Native Grass Irrigation	SF	147,058	$0.75	$110,294
				$463,039

SUBTOTAL	**$4,568,676**
General Conditions 8%	$365,494
Mobilization 5%	$228,434
Estimating Contingency 20%	$913,735
GRAND TOTAL	**$6,076,339**

Add Alternate #1	Unit	Qty.	Cost/Unit	Cost
*3 Additional Tennis Court Lighting	LS	3	$40,000	$120,000
				$120,000

Notes:

1. All costs are based on current construction costs as of August 2008. Numbers may need to be adjusted to reflect cost fluctuation/inflation over time. Quantities in this cost estimate are based on conceptual level drawings. Actual quantities will vary. The conceptual level of the plans used for this estimate may result in the addition or removal of items from this estimate.

2. * New items since previous estimate.

3. ** Cost of irrigation pond subject to change per ongoing water capacity investigation. Pump Station Building: Cost will depend on the type of building desired.

East Boulder Community Park Traffic Study

Boulder, Colorado

Submitted To:
Boulder Parks and Recreation Department

Submitted By:
Fox Higgins Transportation Group, LLC
P.O. Box 19768
Boulder, CO 80308

October 6, 2008

1.0 Introduction

The City of Boulder Parks and Recreation Department is developing plans to provide enhancements to the East Boulder Community Park located adjacent to the East Boulder Recreation and Senior Centers. The park location and vicinity are illustrated on Figure 1.

Currently the park has a variety of outdoor court facilities, a playground, a dog park, and a large open turf area approximately the size of one and one half soccer fields. The turf area is used for programmed sports activities with the most active being youth soccer. The park is served by a 104 space parking lot (separate from the recreation center parking lot) located between the soccer field and the court area. A paved multi-use path traverses through the park in an east-west direction. The park currently includes a large unimproved and unused dirt area located between the soccer field and the dog park, south of the parking lot.

This traffic study estimates the additional traffic that will be generated by proposed new uses at the park and analyzes the traffic impact on area roadways. It also evaluates the impact of completing the missing section of Sioux Drive adjacent to the recreation center parking lot.

2.0 Proposed Park Expansion

The proposed park improvement plan includes a number of enhancements to the existing court area, including restrooms, lighting, shelters, and new p'etanque courts. There will also be improvements made to the dog park area. A second 104 space parking lot will be added south of the dog park with access to 55th Street. This new parking area will provide efficient access to the south end of the new turf field and the dog park. The proposed park enhancement plan is illustrated on Figure 2.

The most significant expansion to the park that will impact traffic access is the addition of a new soccer/turf field south of the existing parking lot. In addition, both soccer/turf fields (new and existing) will be surfaced with artificial turf. The new turf/soccer field will allow for an expansion of the existing programmed recreational sports use on any given day, and the artificial turf will likely extend the use of the fields over a long season.

3.0 Existing Roadway and Traffic Conditions

All traffic accessing the park and recreation center from outside the immediate neighborhoods must use 55th Street from either Baseline Road on the north or South Boulder Road on the south. 55th Street is classified as a collector and has a 25 mph speed limit. Portions of 55th Street in this segment are narrow, curving, and have landscaped medians. The 55th Street alignment is not continuous across the park, and the southern portion winds to the east around the recreation center. Sioux Drive travels along the north edge of the park and connects the north and south portions of 55th Street but even it is not continuous adjacent to the recreation center. A short segment of Sioux Drive was not completed historically, but a connection through the recreation center parking lot is

physically possible. The net result is a very disjointed and indirect roadway connection between Baseline Road and South Boulder Road in the 55th Street corridor.

Existing traffic conditions in the vicinity of the park were documented this spring during the youth soccer season (historically the peak use period of the park), including:

- Weekday PM peak hour traffic in the Baseline/55th Street intersection and the South Boulder Road/55th Street intersection
- 24-hour traffic volume on 55th Street both north and south of the park on weekdays and weekends
- Parking lot utilization during weekday PM and Saturday morning peak hours when youth soccer was in session
- Parking occupancy on adjacent residential roadways and school parking lot during periods of youth soccer activity
- East-west cut-through traffic in the recreation center parking lot adjacent to the missing section of Sioux Drive.

Existing traffic conditions are summarized in Figures 3 and 4. Significant observations include the following:

- There are approximately 2,500 vehicles per weekday using 55th Street just north of the park and 1,200 vehicles per day just south of the park.
- Weekend traffic on 55th Street is typically 20 to 25% lower than on weekdays.
- Existing traffic on 55th Street is well below the daily roadway capacity which is typically considered to be at least 10,000 vehicles per day on 2-lane collectors.
- The 104 space parking lot is full during the weekday PM peak hour when inbound and outbound soccer teams overlap when the fields are transitioning between the early and late afternoon programmed use periods. The parking lot utilization peaked at 82% on Saturday mornings during the soccer turnover period.
- No significant park related parking was observed on any of the surrounding neighborhood streets. There was some park related parking in the south lot at the Manhattan School to the west of the existing turf area.

Existing weekday PM peak hour traffic level of service (LOS) was calculated for the Baseline/55th and South Boulder Road/55th intersections using calculation procedures detailed in the Federal Highway Association's Highway Capacity Manual. The LOS scale uses letter grades between A and F, with A representing little or no congestion, and F representing periods with significant congestion and vehicular delay. A detailed description of traffic conditions associated with each letter grade is attached in the Appendix. The LOS is calculated for each intersection approach movement (left, through, or right as appropriate), and summarized for the entire intersection. Intersection peak hour LOS in the A-D range is typically considered acceptable, while LOS E or F may indicate the need for mitigation measures (although it should be noted that it is common for stop sign controlled side street approaches to arterial roadways to operate in the LOS E or F range at accepted levels of delay) .

Table 1 summarizes the LOS in each intersection and detailed calculation sheets are included in the Appendix. It can be seen that the signalized Baseline/55th Street intersection currently operates acceptably at LOS D, with individual southbound movements experiencing congestion (using the same signal timing inputs as programmed by City of Boulder staff in the field). The South Boulder Road/55th Street intersection currently operates well, with the southbound stop controlled movement at LOS C.

4.0 Connecting Sioux Drive to Avoid Parking Lot Cut-Through

As noted above, the discontinuous segment of Sioux Drive results in through traffic cutting through the recreation center parking lot. This cut-through movement was documented during the weekday PM peak hour and the Saturday morning peak hour when there were programmed soccer activities at the park. Figure 4 illustrates the cut-through route in the parking lot. Approximately 100 vehicles were observed during the weekday PM peak with half traveling in each direction. Approximately 60 vehicles were observed on Saturday morning cutting through the lot.

It is not known how much of this traffic cutting through the parking lot might have been destined to/from the west parking lot and the soccer field. Similarly, it is also not known how much traffic is from adjacent neighborhoods, or how much is traveling all the way between Baseline Road and South Boulder Road. But what is known is that this through traffic in a parking lot is not desirable and potentially an unsafe mix with autos and pedestrians accessing parking stalls at the recreation center. While we are not aware of a documented accident problem, it is our understanding from recreation center staff that there are numerous close calls and associated complaints.

The proposed park improvement plan includes the connection of the missing piece of Sioux Drive. It is our opinion that this will be a significant safety improvement in the vicinity of the recreation center. It is understood that adjacent neighborhood residents may be concerned that this connection will "attract" traffic traveling through between Baseline Road and South Boulder Road. To address this concern, the Parks Department has proposed that a median and speed humps be constructed in Sioux Drive to add "travel impedance or friction" and discourage cut-through travel. It is our understanding that the Boulder Fire Department does not object to these traffic calming measures because this section of the 55th Street corridor is not a Critical Emergency Response Route and the speed humps will be placed so as to not impede their response route to the west access of the recreation center parking lot.

Finally, a serious of timed trips between Baseline Road and South Boulder Road (both directions) were conducted on Foothills Highway, 55th Street, and Cherryvale Road. Results indicate that it takes more than twice as long to travel along 55th Street, with over a two minute penalty relative to either of the other two routes. On this basis we do not believe this connection on Sioux Drive will attract any new cut-through traffic from outside the area, and we strongly support its implementation.

5.0 Trip Generation

Studies at many other parks in Boulder and other communities have indicated that each park and the traffic that they generate tends to be unique to each location and there is no established "trip generation rate" that would accurately predict what the proposed park expansions at this location will generate. Since the proposed expansion of this park is predominantly adding more of the existing park uses, we have estimated the automobile trips that will be generated based on a detailed observation of the traffic accessing the existing park. In addition to the traffic data listed above, this study has included observations of the pedestrian interaction between the existing 104 space parking lot and the adjacent recreational facilities to help with estimation of future park traffic.

As noted above, the predominant new or expanded use at the park will be the addition of a new soccer/turf field. The new field will increase the available space for programmed soccer by approximately 70%.

It is estimated, base on our observations of park access, that the current soccer activity generates 100 inbound and 100 outbound automobile trips during the weekday PM peak hour when youth soccer is in operation. For purposes of this study it is estimated that the new park enhancements and expansions will add an additional 100 inbound and 100 outbound automobile trips during the weekday PM peak hour. Most of this traffic will be related to the new turf field but some will also be generated by the enhancements to the rest of the park. Weekend traffic increases will likely be 70 to 80% of the weekday increases, at a time when the adjacent roadways are carrying less traffic.

6.0 Trip Distribution

Based on the location of the new soccer/turf field within the park, the addition of a new 104 space parking lot on the south side of the park, existing traffic patterns, and the general location of the park relative to the rest of the community, it is estimated that:

- 50% of the new park traffic will be oriented to/from Baseline Road, and 50% will be oriented to/from South Boulder Road.
- There will be no significant increase (and possibly a slight decrease) in traffic accessing the park from the Manhattan Drive corridor.

The anticipated directional distribution of new park access traffic is illustrated in Figure 5.

7.0 Traffic Assignment

The anticipated new PM peak hour traffic accessing the park has been assigned to the adjacent roadways using the directional distribution assumptions discussed above. The result is illustrated in Figures 6A and 6B. It is anticipated that the location of the new parking lot will minimize the amount of park traffic that circulates around the recreation center, but will not eliminate it.

8.0 Existing Plus Site Generated Traffic Conditions

The new park traffic was added to the existing peak traffic during the weekday PM peak hour. The result is illustrated on Figure 7. The 55th Street intersections at Baseline Road and South Boulder Road were then evaluated, using the same procedures described above, to determine the impact of the additional park traffic (calculation sheets in the Appendix). It can be seen in Table 1 that the additional park traffic will add marginally (less than a second per vehicle) to the overall delay at the Baseline intersection, and none of the individual intersection approaches will drop a letter grade. The slight increase in overall delay results in the intersection LOS dropping into the E range, but just slightly. No improvements are needed to accommodate the additional park traffic at this intersection.

The delay for the southbound approach at the South Boulder Road/55th Street intersection will increase by approximately 4 seconds per vehicle, which drops this approach's LOS into the D range. This intersection will continue to operate acceptably with the existing stop sign control.

9.0 Year 2030 Background Traffic Conditions

Traffic projections have been made for a long range planning horizon (Year 2030) to allow an evaluation of the additional park traffic in the future when area traffic has increased. Background traffic projections (without the addition of new park traffic) have been made by using projections on area roadways in the City's regional travel model, and by incorporating the potential traffic increase related to the residential development of the vacant parcel immediately southwest of the park. This residential development is currently in the planning process and traffic projections for that site have been incorporated into this study. That project is currently evaluating two access scenarios, with and without a local roadway connection to Kiwanne Drive and the Manhattan corridor. To be conservative relative to 55th Street traffic, this study has used the projections that do not include a local connection to Kiwanne Drive. The resultant Year 2030 background traffic projections are illustrated in Figure 8 at the Baseline/55th and South Boulder Road/55th Street intersections.

The LOS at the major intersections serving the park site was evaluated for this future year background condition using the same procedures described above. The results are included in Table 1. It can be seen that the signalized Baseline/55th intersection will

continue to operate in the LOS E range with only a marginal increase in average vehicle delay.

At the South Boulder Road/55th intersection the southbound approach drops into the LOS E range. This is due to the addition of the new residential traffic and the increases in background traffic on South Boulder Road which make it harder to turn out onto South Boulder Road from 55th during the peak hour. The relative need for a traffic signal or other intersection improvement at this location is discussed in a following section of this report.

10.0 Year 2030 Plus Site Traffic Conditions

New park traffic has been added to the Year 2030 background traffic discussed above to yield the projected Year 2030 total traffic illustrated on Figure 9. A LOS evaluation at the Baseline/55th intersection indicates that the intersection will continue to operate in the LOS E range with most individual traffic movements remaining at the same LOS. The northbound left turn is projected to drop into the LOS E range with the addition of both the new park and new residential traffic.

The South Boulder Road intersection will experience an increase in delay on the southbound approach with the addition of the new park traffic (on top of the new residential traffic). This approach is calculated to operate in the LOS F range (although we typically observe that the LOS software and calculation procedures tend to overestimate the delay for side streets at stop signs). The next section of this report discusses potential mitigation measures for this condition.

11.0 Traffic Control at the South Boulder Road / 55th Street Intersection

The LOS analysis at the South Boulder Road/55th Street intersection has concluded that the southbound stop sign controlled approach to this intersection currently operates acceptably at LOS D. This approach will drop to LOS E in the PM peak hour in the Year 2030 with the addition of the adjacent residential project (or the park expansion without the residential project), and it will drop to LOS F with both the park expansion and the residential project's traffic added.

While this level of side street delay exists today at many other intersections in town, it does suggest that potential mitigation measures be identified. Two choices are described below:

- 55th Street is approximately 40 feet wide north of South Boulder Road with single northbound and southbound travel lanes. The existing pavement could be restriped to maintain a single northbound lane but add a separate short (say 40 feet plus transition) southbound left turn lane. This restriping would require prohibiting on-street parking along 55th for some distance north of South Boulder Road in an area where the adjacent land area is vacant. This southbound left turn lane would allow the higher right turning southbound traffic

the ability to access westbound South Boulder Road more efficiently. In the Year 2030 Total traffic scenario, this improvement would allow the southbound right turns to operate at LOS B and the overall southbound approach would operate at LOS E (calculation sheet in the Appendix). This would be a significant improvement for southbound traffic, although given the width of the roadway, this side-by-side southbound approach may already be occurring to some extent.

- Another way to minimize congestion for southbound traffic (at the expense of east-west traffic on South Boulder Road) would be to install a traffic signal. The Manual on Uniform Traffic Control Devices (MUTCD) includes a set of traffic signal "warrants" to determine if a traffic signal may be needed, and typically a number of these warrants must be met before the City would consider installing a traffic signal. The Peak Hour Warrant is one that can be evaluated at the traffic study stage and is often used as an indicator for future traffic mitigation needs and measures. Figure 10 includes the peak hour warrant graph with plotted points for each of the traffic scenarios evaluated in this study. A review of this peak hour warrant graph indicates that:

  - Existing traffic does not warrant a traffic signal in the PM peak hour.
  - The "Existing Plus Site" and "Year 2030 Background" scenarios both may warrant a signal in the PM with the single southbound lane, and both would not warrant a signal if a second southbound lane were added.
  - The "Year 2030 Total" traffic scenario may warrant a signal even with the addition of a second southbound approach lane, but the City would need to confirm at the time (looking at all the warrants based on actual traffic volumes, accident history, etc.). It should be noted that not all intersections meeting a peak hour signal warrant are actual candidates for traffic signal installation.

12.0 Conclusions and Recommendations

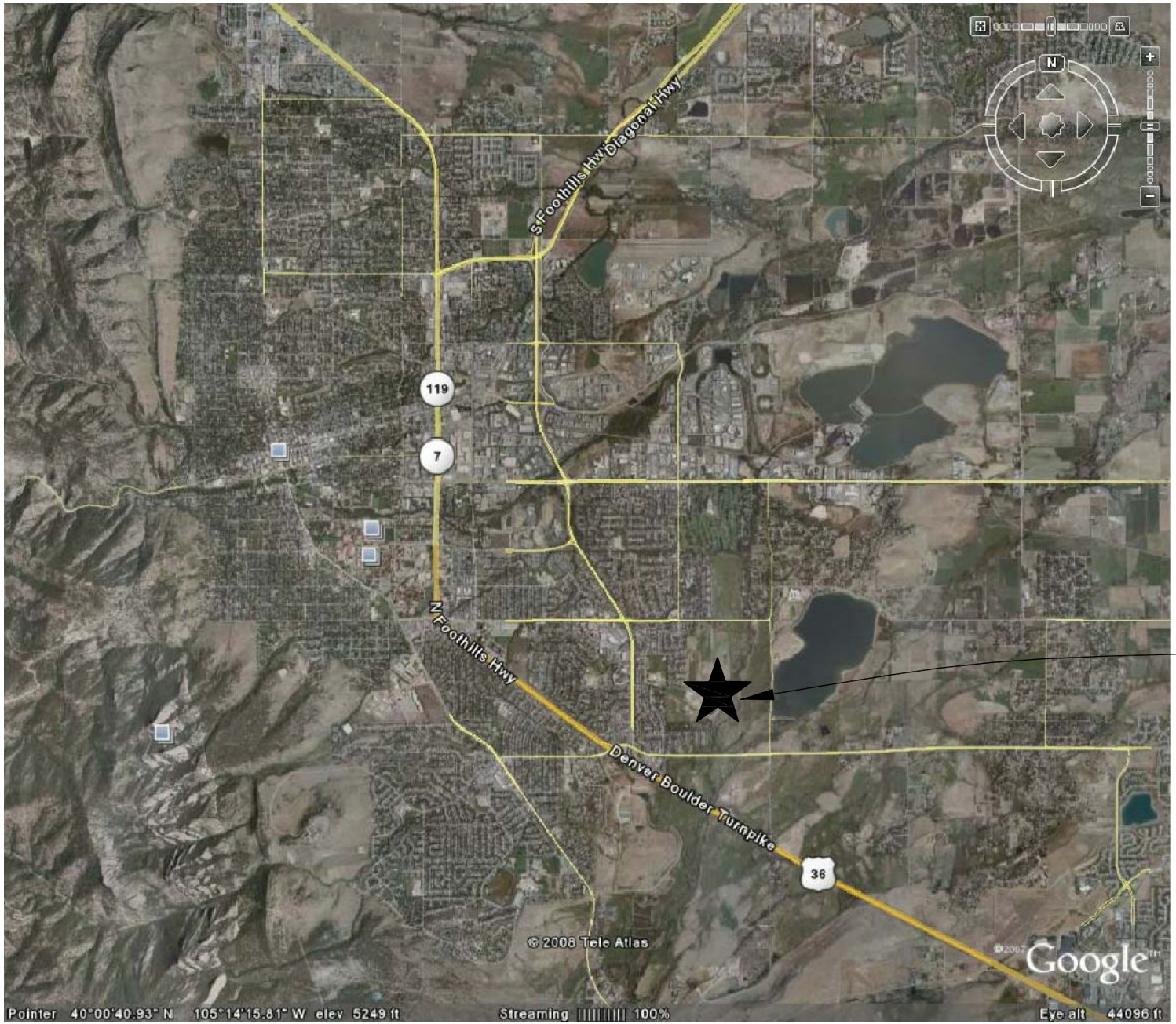
This traffic study has evaluated the anticipated traffic impacts associated with the expansion of the East Boulder Community Park. The most significant new traffic generator during peak traffic access times will be the addition of another soccer/turf field. Traffic projections have been made for near term and long term planning horizons, and the addition of traffic from the potential new residential development south of the park has been included. Significant observations and recommendations include:

- New park uses may add approximately 100 inbound and 100 outbound vehicle trips during the weekday PM peak hour when the turf fields are programmed for youth soccer.
- Peak weekend traffic is less than peak weekday traffic, and the background traffic on adjacent roadways is also less on weekends.
- The 55th Street corridor will be able to easily accommodate the additional traffic generated by the park from a volume-to-capacity perspective.
- New traffic will likely be distributed equally from the Baseline and South Boulder Road corridors, and no significant increase on Manhattan Drive is anticipated.
- The new 104 space parking lot should be able to accommodate the increased parking demand generated by proposed enhancements.
- The missing piece of Sioux Drive should be completed to eliminate the parking lot cut-through that currently exists at the recreation center. We do not anticipate that this connection will attract any new cut-through traffic between Baseline Road and South Boulder Road, but we do support the proposed traffic calming treatments on Sioux Drive to manage traffic speed in this area.
- The signalized intersection of Baseline Road and 55th Street will be able to accommodate the increased traffic projected from all sources in the Year 2030 with marginal increase in overall vehicle delay.
- The southbound approach to the stop sign on 55th Street at South Boulder Road will experience increased delay over time as traffic grows on South Boulder Road and the park expansion and the adjacent residential project are implemented. It is questionable whether the City's traffic signal warranting procedure (based on the MUTCD) would actually be met at this intersection, but it is certain that delay can be minimized with the addition of a short southbound left turn lane. This new lane could be striped in the existing roadway width with minimal disruption of on-street parking and would greatly improve the unsignalized LOS at this location. It is recommended that this improvement be pursued.
- Residents in the area have expressed concerns about pedestrian safety in the crosswalks near Ontario Place, and at the multi-use path crossing of 55th Street just south of Sioux Drive. It is recommended that the City's transportation division staff tours these crossings to make sure that the signing and marking is appropriate or if any improvements are needed.

Table 1 - Peak Hour Intersection Level of Service Summary

Intersection and Critical Movements	Existing PM Peak Hour Delay (a)	Existing PM Peak Hour LOS	Existing + Site PM Peak Hour Delay (a)	Existing + Site PM Peak Hour LOS	2030 Background PM Peak Hour Delay (a)	2030 Background PM Peak Hour LOS	2030 + Site PM Peak Hour Delay (a)	2030 + Site PM Peak Hour LOS
STOP SIGN CONTROL								
South Boulder Road / 55th Street	**1.5**	**A**	**2.6**	**A**	**3.2**	**A**	**6.7**	**A**
Eastbound Left	*0.8*	*A*	*1.1*	*A*	*1.1*	*A*	*1.4*	*A*
Southbound Left-Right	*21.2*	*C*	*25.3*	*D*	*39.1*	*E*	*68.2*	*F*
SIGNAL CONTROL								
Baseline / 55th Street	**54.5**	**D**	**55.3**	**E**	**57.8**	**E**	**61.8**	**E**
Eastbound Left	*9.2*	*A*	*9.1*	*A*	*10.9*	*B*	*10.8*	*B*
Eastbound Through	*11.6*	*B*	*11.5*	*B*	*13.2*	*B*	*13.1*	*B*
Eastbound Right	*10.6*	*B*	*10.8*	*B*	*9.6*	*A*	*9.8*	*A*
Westbound Left	*13.1*	*B*	*13.3*	*B*	*14.2*	*B*	*14.4*	*B*
Westbound Through-Right	*13.8*	*B*	*13.8*	*B*	*15.0*	*B*	*15.0*	*B*
Northbound Left	*37.2*	*D*	*43.5*	*D*	*43.2*	*D*	*70.1*	*E*
Northbound Through	*33.7*	*C*	*34.0*	*C*	*34.1*	*C*	*34.4*	*C*
Northbound Right	*32.7*	*C*	*32.8*	*C*	*32.7*	*C*	*32.8*	*C*
Southbound Left	*>90*	*F*	*>90*	*F*	*>90*	*F*	*>90*	*F*
Southbound Through	*40.9*	*D*	*41.5*	*D*	*41.1*	*D*	*41.6*	*D*
Southbound Right	*>90*	*F*	*>90*	*F*	*>90*	*F*	*>90*	*F*

(a) Delay represented in average seconds per vehicle.



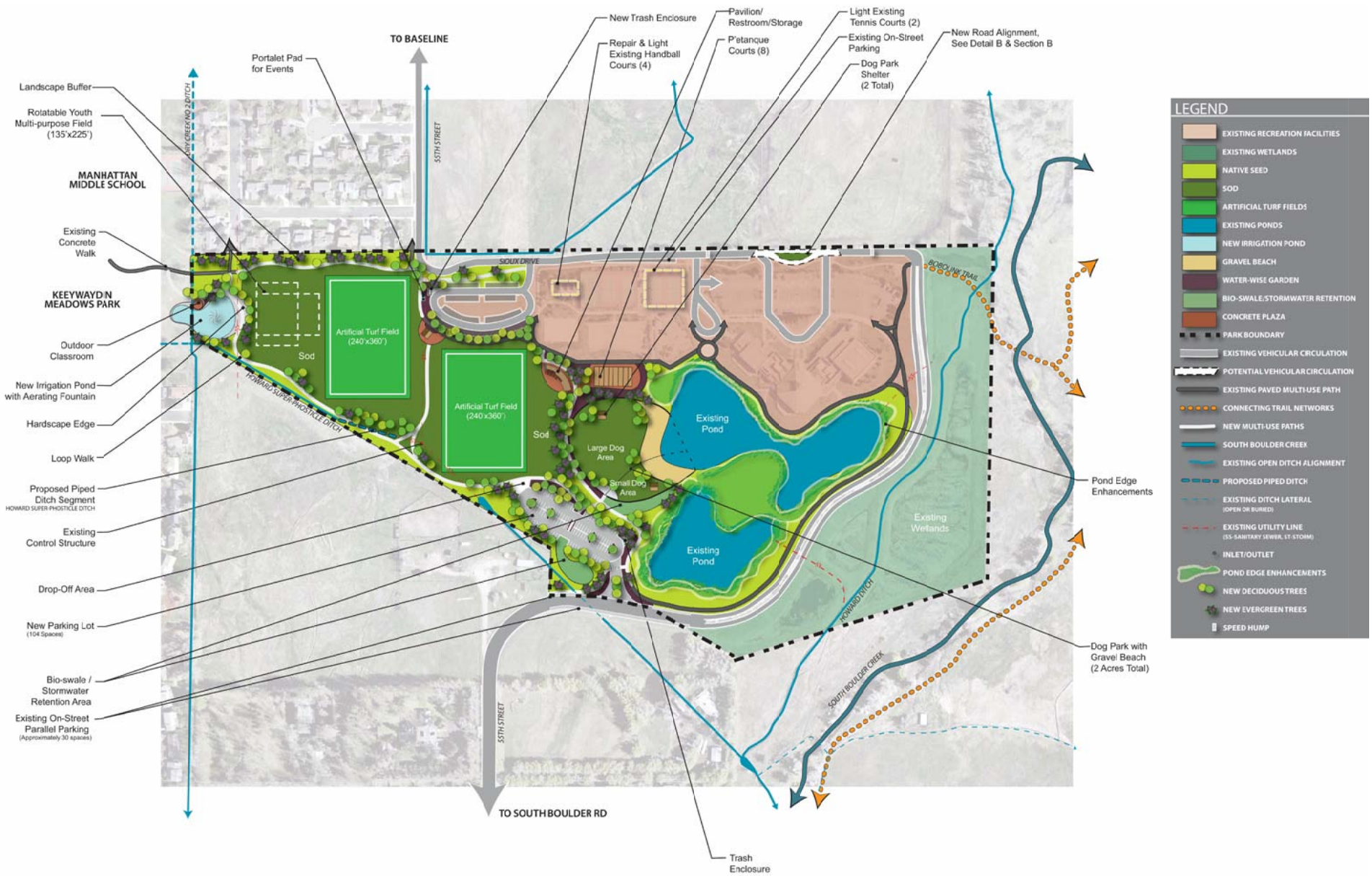
EAST BOULDER COMMUNITY PARK

FOX HIGGINS
TRANSPORTATION GROUP

EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

VICINITY MAP

FH Project #	08016	Original Scale	NONE	Date	09-26-2008	Drawn by	WCF	Figure #	1

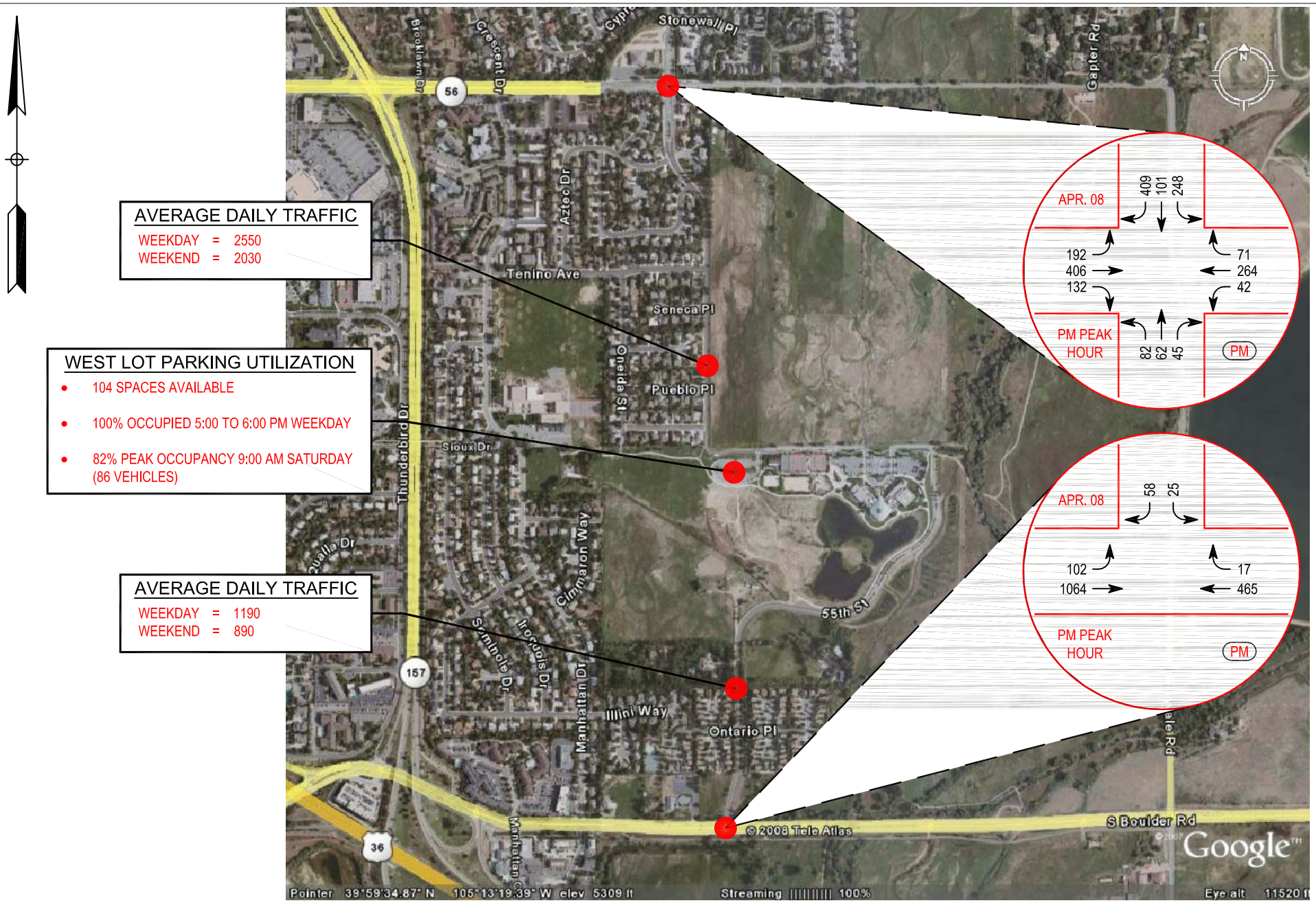


FOX HIGGINS
TRANSPORTATION GROUP

EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

SITE PLAN

FH Project #	08016	Original Scale	NONE	Date	09-26-2008	Drawn by	WCF	Figure #	2



FOX HIGGINS
TRANSPORTATION GROUP

EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

EXISTING TRAFFIC CONDITIONS

FH Project #	08016	Original Scale	NONE	Date	9-26--2008	Drawn by	WCF	Figure #	3

PARKING LOT CUT-THROUGH		
	WEEKDAY * 5:00 - 6:00 PM	SATURDAY * 9:30 - 10:30 AM
EB:	48	39
WB:	50	23
TOTAL:	98	62

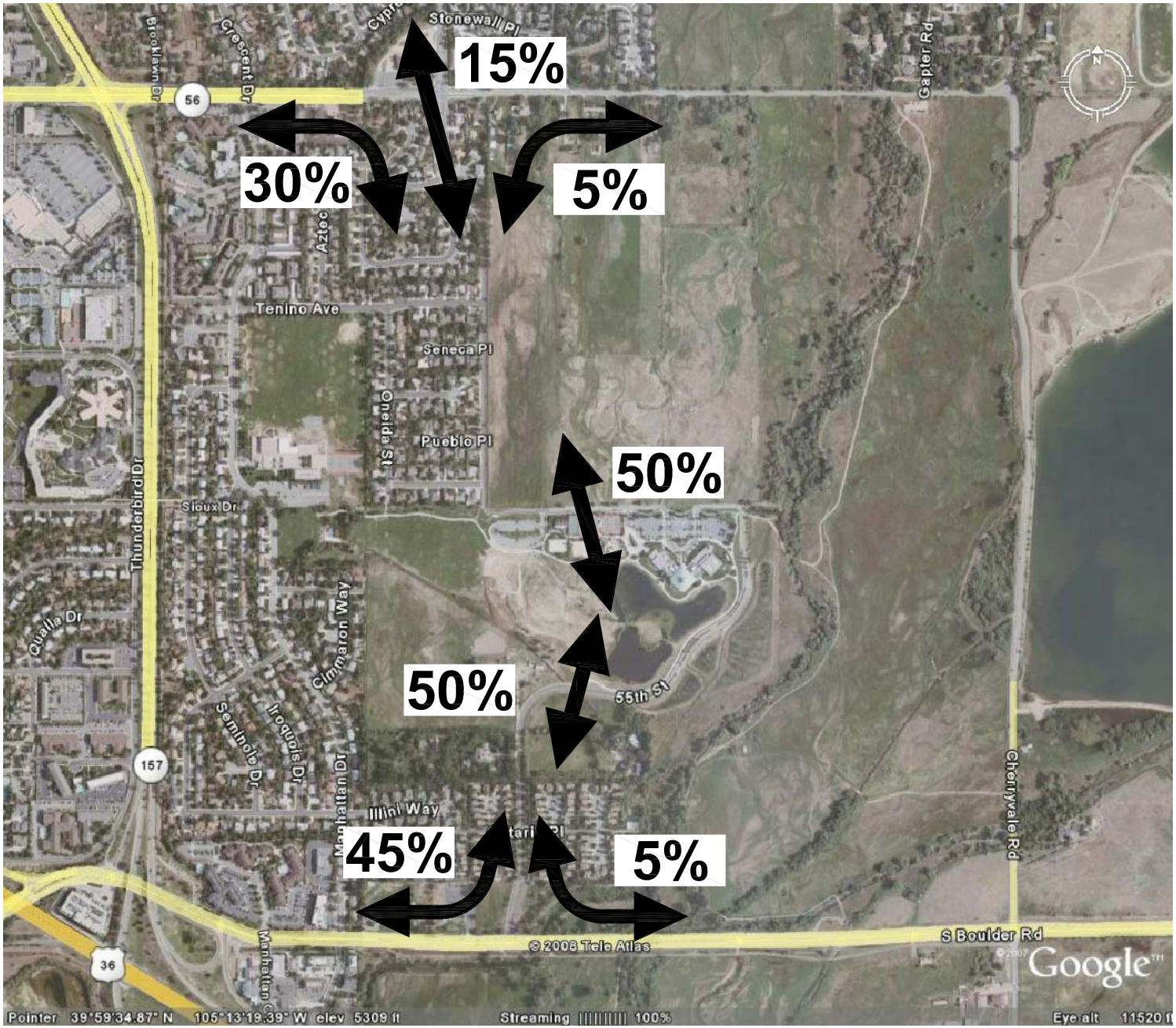
* includes vehicles accessing west lot which may not be "cut-throughs"

FOX HIGGINS
TRANSPORTATION GROUP

EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

PARKING LOT CUT-THROUGH

FH Project #	08016	Original Scale	NONE	Date	9-26--2008	Drawn by	WCF	Figure #	4



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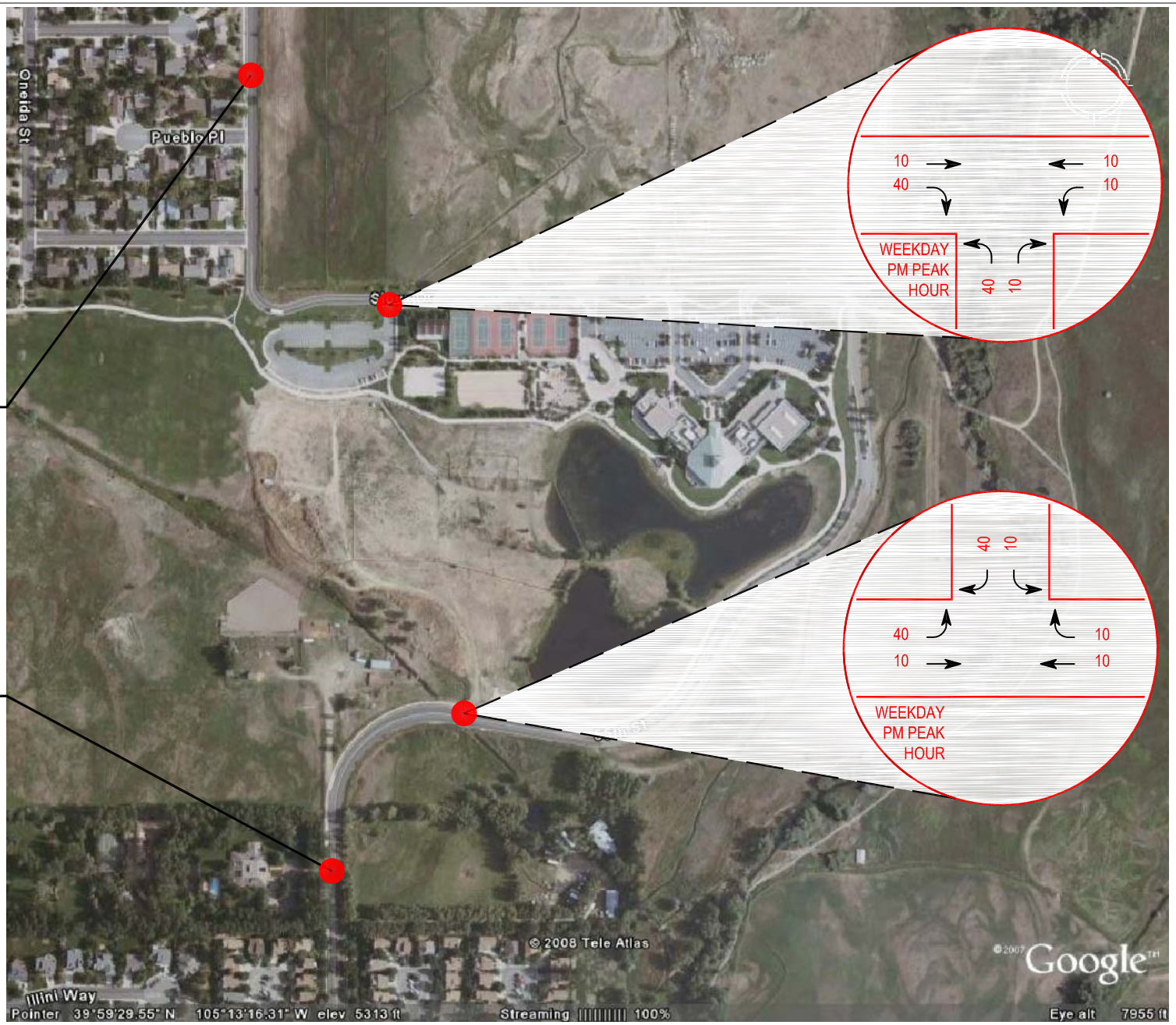
EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

DIRECTIONAL DISTRIBUTION OF NEW PARK TRAFFIC

FH Project #	08016	Original Scale	NONE	Date	9-26--2008	Drawn by	WCF	Figure #	5



DAILY TRAFFIC

WEEKDAY = 200
SATURDAY = 150

DAILY TRAFFIC

WEEKDAY = 200
SATURDAY = 150

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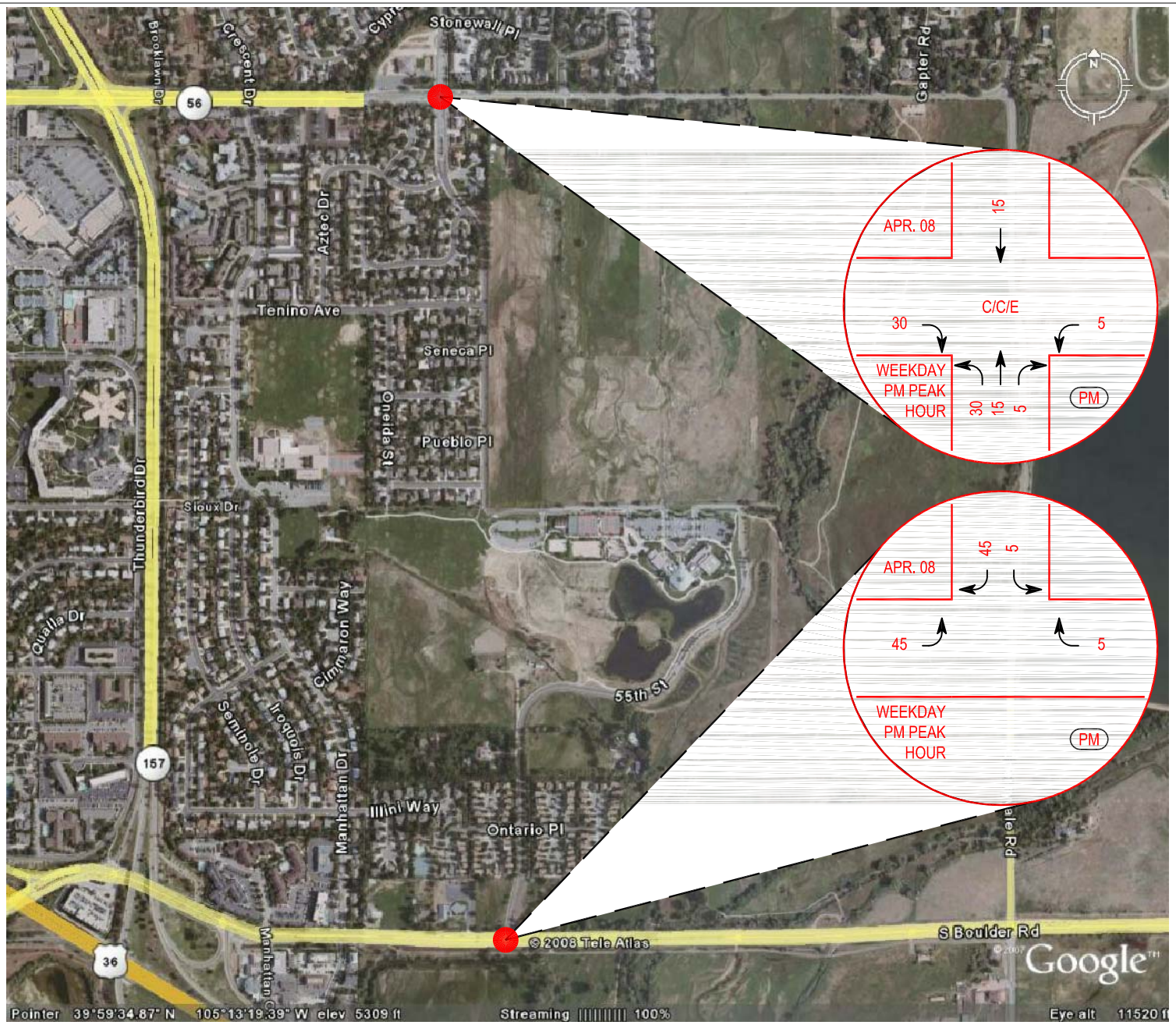
EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

NEW PARK USER TRAFFIC AT SITE ACCESSES

FH Project #	08016	Original Scale	NONE	Date	9-26--2008	Drawn by	WCF	Figure #	6A



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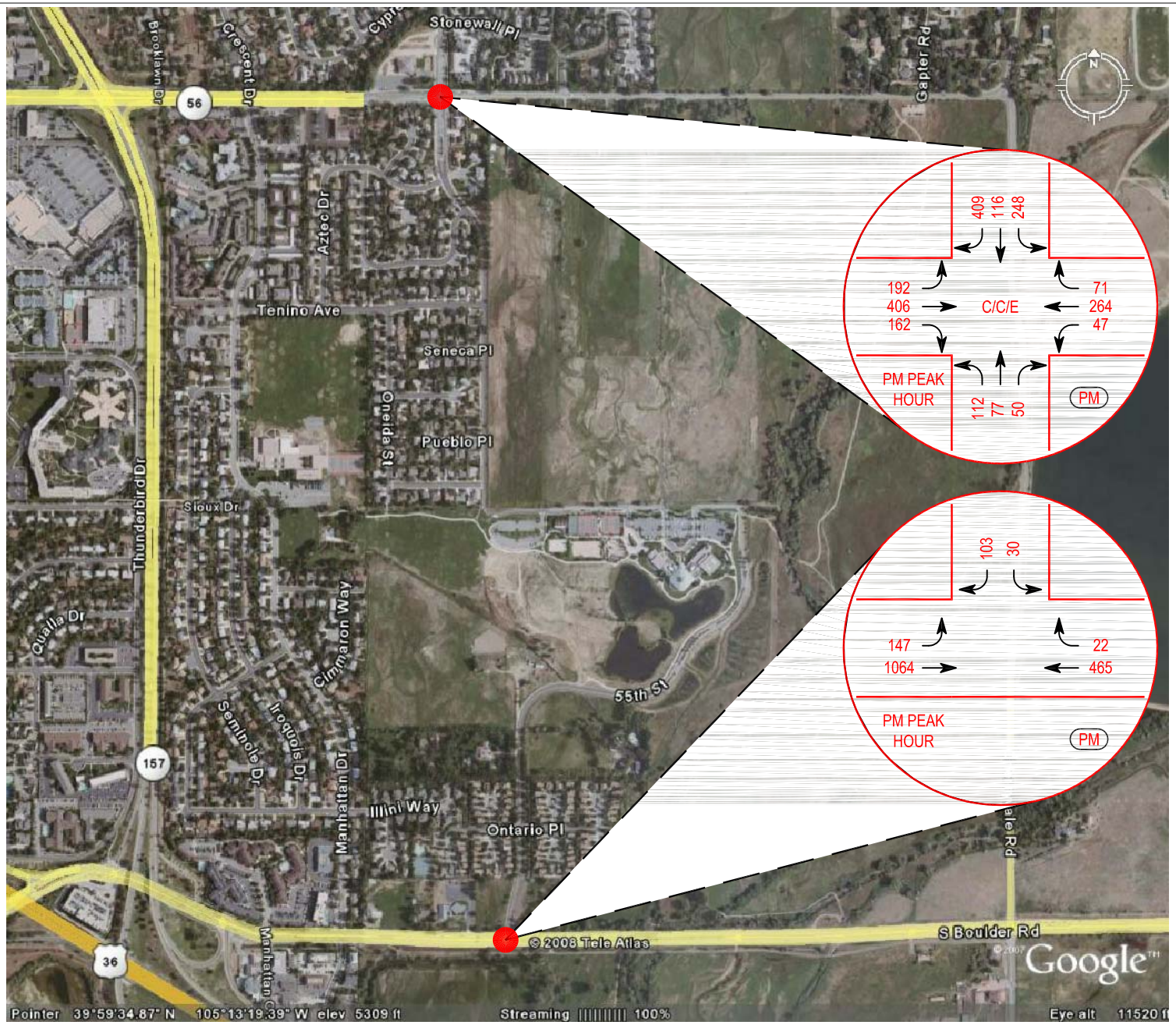
EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

NEW PARK USER TRAFFIC

FH Project #	08016	Original Scale	NONE	Date	9-26--2008	Drawn by	WCF	Figure #	6B



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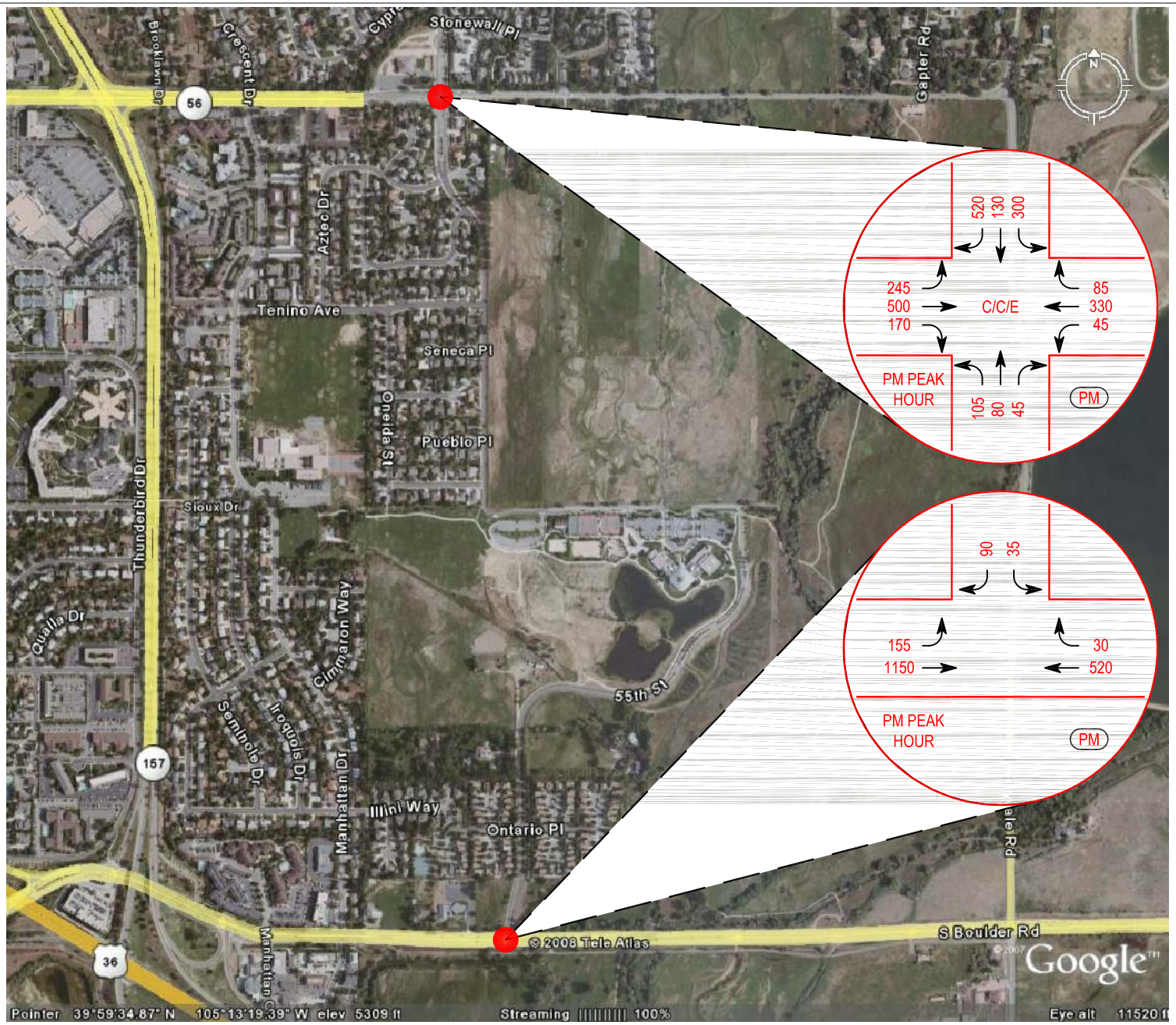
EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

EXISTING PLUS SITE TRAFFIC CONDITIONS

FH Project #	08016	Original Scale	NONE	Date	9-26--2008	Drawn by	WCF	Figure #	7



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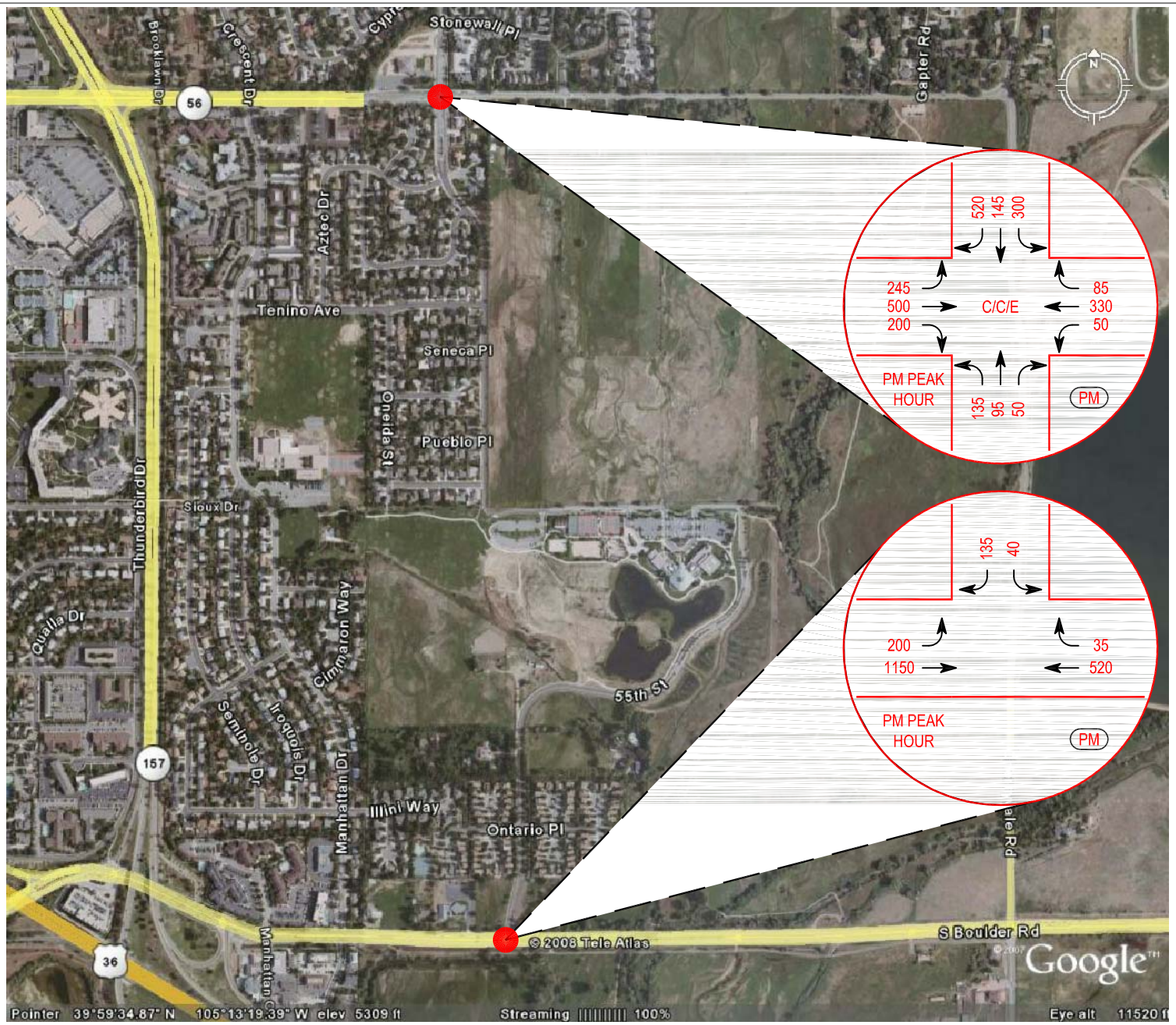
EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

FUTURE YEAR 2030 BACKGROUND TRAFFIC CONDITIONS

FH Project #	08016	Original Scale	NONE	Date	9-26--2008	Drawn by	WCF	Figure #	8



FOX HIGGINS
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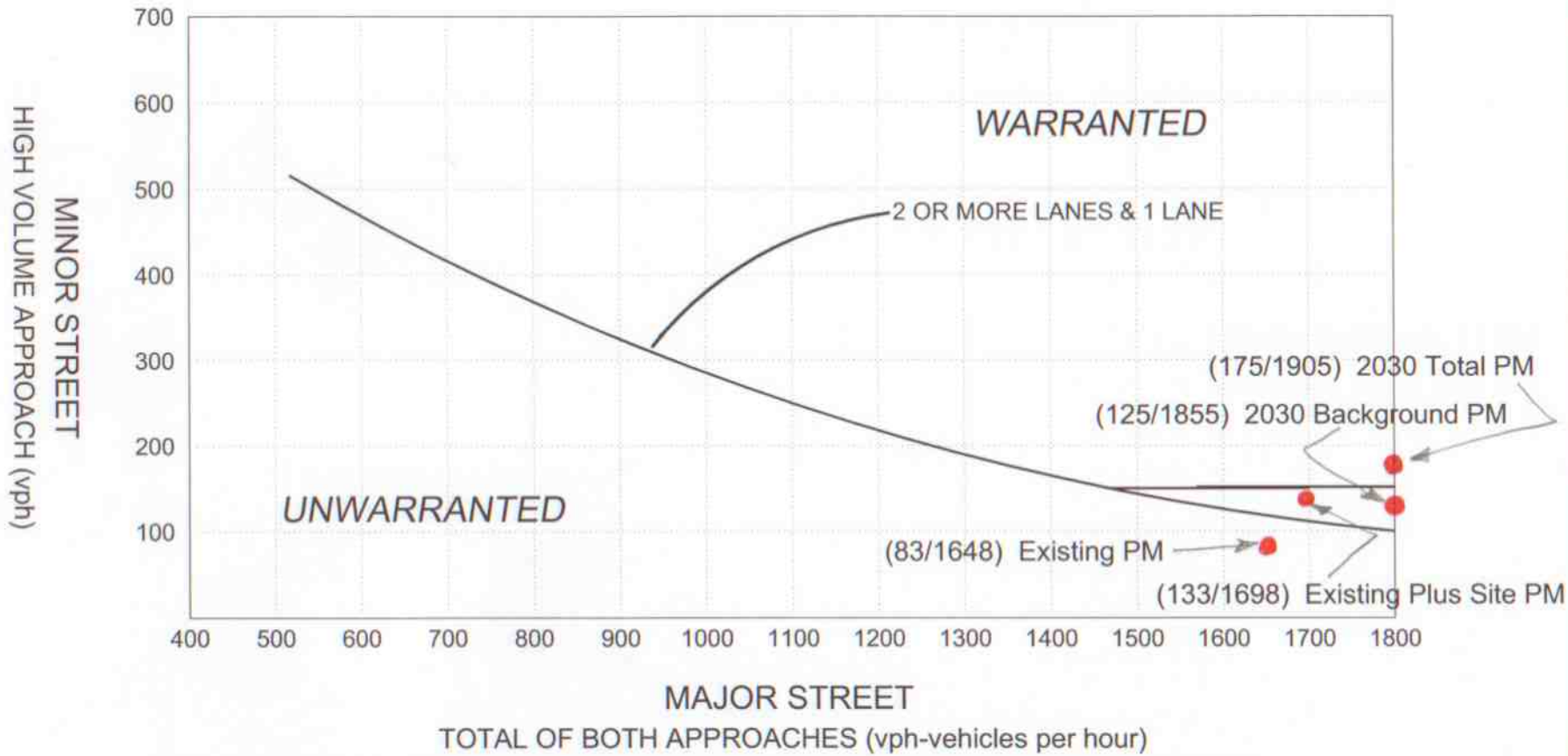
EAST BOULDER COMMUNITY PARK TRAFFIC STUDY

FUTURE YEAR 2030 TOTAL TRAFFIC

FH Project #	08016	Original Scale	NONE	Date	9-26--2008	Drawn by	WCF	Figure #	9

PEAK HOUR VOLUME WARRANT



NOTE: 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

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TRANSPORTATION GROUP

East Boulder Community Park Traffic Study

SOUTH BOULDER ROAD and 55TH STREET

FH Project #	Original Scale	Date	Drawn by	Figure # 10

Appendix

- **Level of Service Definitions**
- **Intersection LOS Calculation Sheets**

LEVEL OF SERVICE DEFINITIONS

In rating roadway and intersection operating conditions with existing or future traffic volumes, "Levels of Service" (LOS) A through F are used, with LOS A indicating very good operation and LOS F indicating poor operation. Levels of service at signalized and unsignalized intersections are closely associated with vehicle delays experienced in seconds per vehicle. More complete level of service definitions and delay data for signal and stop sign controlled intersections are contained in the following table for reference.

Level of Service Rating	Delay in seconds per vehicle *(a)*		Definition
	Signalized	Unsignalized	
A	0.0 to 10.0	0.0 to 10.0	Low vehicular traffic volumes; primarily free flow operations. Density is low and vehicles can freely maneuver within the traffic stream. Drivers are able to maintain their desired speeds with little or no delay.
B	10.1 to 20.0	10.1 to 15.0	Stable vehicular traffic volume flow with potential for some restriction of operating speeds due to traffic conditions. Vehicle maneuvering is only slightly restricted. The stopped delays are not bothersome and drivers are not subject to appreciable tension.
C	20.1 to 35.0	15.1 to 25.0	Stable traffic operations, however the ability for vehicles to maneuver is more restricted by the increase in traffic volumes. Relatively satisfactory operating speeds prevail, but adverse signal coordination or longer vehicle queues cause delays along the corridor.
D	35.1 to 55.0	25.1 to 35.0	Approaching unstable vehicular traffic flow where small increases in volume could cause substantial delays. Most drivers are restricted in ability to maneuver and selection of travel speeds due to congestion. Driver comfort and convenience are low, but tolerable.
E	55.1 to 80.0	35.1 to 50.0	Traffic operations characterized by significant approach delays and average travel speeds of one-half to one-third the free flow speed. Vehicular flow is unstable and there is potential for stoppages of brief duration. High signal density, extensive vehicle queuing, or corridor signal progression/timing are the typical causes of vehicle delays at signalized corridors.
F	> 80.0	> 50.0	Forced vehicular traffic flow and operations with high approach delays at critical intersections. Vehicle speeds are reduced substantially and stoppages may occur for short or long periods of time because of downstream congestion.

(a) Delay ranges based on 2000 Highway Capacity Manual criteria.

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)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3420		1770	1863	1583	1770	1863	1583
Flt Permitted	0.44	1.00	1.00	0.46	1.00		0.62	1.00	1.00	0.71	1.00	1.00
Satd. Flow (perm)	813	1863	1583	861	3420		1159	1863	1583	1324	1863	1583
Volume (vph)	192	406	132	42	264	71	82	62	45	248	101	409
Peak-hour factor, PHF	0.91	0.75	0.84	0.79	0.76	0.70	0.58	0.87	0.67	0.68	0.81	0.88
Adj. Flow (vph)	211	541	157	53	347	101	141	71	67	365	125	465
RTOR Reduction (vph)	0	0	40	0	22	0	0	0	49	0	0	341
Lane Group Flow (vph)	211	541	117	53	426	0	141	71	18	365	125	124
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		Perm
Protected Phases	1	6			2			4			8	
Permitted Phases	6		6	2			4		4	8		8
Actuated Green, G (s)	78.4	78.4	78.4	64.9	64.9		30.3	30.3	30.3	30.3	30.3	30.3
Effective Green, g (s)	80.1	80.1	80.1	66.6	66.6		31.9	31.9	31.9	31.9	31.9	31.9
Actuated g/C Ratio	0.67	0.67	0.67	0.55	0.55		0.27	0.27	0.27	0.27	0.27	0.27
Clearance Time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.6
Vehicle Extension (s)	1.0	3.0	3.0	3.0	3.0		2.0	2.0	2.0	2.5	2.5	2.5
Lane Grp Cap (vph)	618	1244	1057	478	1898		308	495	421	352	495	421
v/s Ratio Prot	0.03	c0.29			0.12			0.04			0.07	
v/s Ratio Perm	0.20		0.07	0.06			0.12		0.01	c0.28		0.08
v/c Ratio	0.34	0.43	0.11	0.11	0.22		0.46	0.14	0.04	1.04	0.25	0.29
Uniform Delay, d1	7.9	9.3	7.2	12.7	13.6		36.8	33.6	32.7	44.0	34.7	35.1
Progression Factor	1.15	1.12	1.45	1.00	1.00		1.00	1.00	1.00	1.20	1.18	4.70
Incremental Delay, d2	0.1	1.1	0.2	0.5	0.3		0.4	0.0	0.0	44.6	0.1	0.1
Delay (s)	9.2	11.6	10.6	13.1	13.8		37.2	33.7	32.7	97.6	40.9	165.1
Level of Service	A	B	B	B	B		D	C	C	F	D	F
Approach Delay (s)		10.9			13.8			35.2			123.0	
Approach LOS		B			B			D			F	

Intersection Summary			
HCM Average Control Delay	54.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.1%	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)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3420		1770	1863	1583	1770	1863	1583
Flt Permitted	0.44	1.00	1.00	0.46	1.00		0.59	1.00	1.00	0.69	1.00	1.00
Satd. Flow (perm)	813	1863	1583	861	3420		1100	1863	1583	1279	1863	1583
Volume (vph)	192	406	162	47	264	71	112	77	50	248	116	409
Peak-hour factor, PHF	0.91	0.75	0.84	0.79	0.76	0.70	0.58	0.87	0.67	0.68	0.81	0.88
Adj. Flow (vph)	211	541	193	59	347	101	193	89	75	365	143	465
RTOR Reduction (vph)	0	0	49	0	22	0	0	0	55	0	0	341
Lane Group Flow (vph)	211	541	144	59	426	0	193	89	20	365	143	124
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		Perm
Protected Phases	1	6			2			4			8	
Permitted Phases	6		6	2			4		4	8		8
Actuated Green, G (s)	78.4	78.4	78.4	64.9	64.9		30.3	30.3	30.3	30.3	30.3	30.3
Effective Green, g (s)	80.1	80.1	80.1	66.6	66.6		31.9	31.9	31.9	31.9	31.9	31.9
Actuated g/C Ratio	0.67	0.67	0.67	0.55	0.55		0.27	0.27	0.27	0.27	0.27	0.27
Clearance Time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.6
Vehicle Extension (s)	1.0	3.0	3.0	3.0	3.0		2.0	2.0	2.0	2.5	2.5	2.5
Lane Grp Cap (vph)	618	1244	1057	478	1898		292	495	421	340	495	421
v/s Ratio Prot	0.03	c0.29			0.12			0.05			0.08	
v/s Ratio Perm	0.20		0.09	0.07			0.18		0.01	c0.29		0.08
v/c Ratio	0.34	0.43	0.14	0.12	0.22		0.66	0.18	0.05	1.07	0.29	0.29
Uniform Delay, d1	7.9	9.3	7.3	12.8	13.6		39.2	34.0	32.8	44.0	35.0	35.1
Progression Factor	1.14	1.11	1.44	1.00	1.00		1.00	1.00	1.00	1.20	1.18	4.70
Incremental Delay, d2	0.1	1.1	0.3	0.5	0.3		4.3	0.1	0.0	56.6	0.1	0.1
Delay (s)	9.1	11.5	10.8	13.3	13.8		43.5	34.0	32.8	109.7	41.5	165.1
Level of Service	A	B	B	B	B		D	C	C	F	D	F
Approach Delay (s)		10.8			13.8			38.9			126.1	
Approach LOS		B			B			D			F	

Intersection Summary			
HCM Average Control Delay	55.3	HCM Level of Service	E
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.1%	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)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3423		1770	1863	1583	1770	1863	1583
Flt Permitted	0.38	1.00	1.00	0.38	1.00		0.56	1.00	1.00	0.68	1.00	1.00
Satd. Flow (perm)	702	1863	1583	708	3423		1045	1863	1583	1269	1863	1583
Volume (vph)	245	500	170	45	330	85	105	80	45	300	130	520
Peak-hour factor, PHF	0.91	0.75	0.84	0.79	0.76	0.70	0.58	0.87	0.67	0.68	0.81	0.88
Adj. Flow (vph)	269	667	202	57	434	121	181	92	67	441	160	591
RTOR Reduction (vph)	0	0	42	0	21	0	0	0	49	0	0	357
Lane Group Flow (vph)	269	667	160	57	534	0	181	92	18	441	160	234
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		Perm
Protected Phases	1	6			2			4			8	
Permitted Phases	6		6	2			4		4	8		8
Actuated Green, G (s)	78.4	78.4	78.4	63.9	63.9		30.3	30.3	30.3	30.3	30.3	30.3
Effective Green, g (s)	80.1	80.1	80.1	65.6	65.6		31.9	31.9	31.9	31.9	31.9	31.9
Actuated g/C Ratio	0.67	0.67	0.67	0.55	0.55		0.27	0.27	0.27	0.27	0.27	0.27
Clearance Time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.6
Vehicle Extension (s)	1.0	3.0	3.0	3.0	3.0		2.0	2.0	2.0	2.5	2.5	2.5
Lane Grp Cap (vph)	562	1244	1057	387	1871		278	495	421	337	495	421
v/s Ratio Prot	0.04	c0.36			0.16			0.05			0.09	
v/s Ratio Perm	0.28		0.10	0.08			0.17		0.01	c0.35		0.15
v/c Ratio	0.48	0.54	0.15	0.15	0.29		0.65	0.19	0.04	1.31	0.32	0.56
Uniform Delay, d1	8.5	10.3	7.4	13.4	14.6		39.1	34.0	32.7	44.0	35.4	38.0
Progression Factor	1.26	1.12	1.26	1.00	1.00		1.00	1.00	1.00	1.18	1.16	2.50
Incremental Delay, d2	0.2	1.6	0.3	0.8	0.4		4.1	0.1	0.0	153.0	0.2	0.9
Delay (s)	10.9	13.2	9.6	14.2	15.0		43.2	34.1	32.7	204.9	41.1	95.9
Level of Service	B	B	A	B	B		D	C	C	F	D	F
Approach Delay (s)		12.0			14.9			38.7			128.9	
Approach LOS		B			B			D			F	

Intersection Summary			
HCM Average Control Delay	57.8	HCM Level of Service	E
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
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)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3423		1770	1863	1583	1770	1863	1583
Flt Permitted	0.38	1.00	1.00	0.38	1.00		0.53	1.00	1.00	0.65	1.00	1.00
Satd. Flow (perm)	702	1863	1583	708	3423		985	1863	1583	1212	1863	1583
Volume (vph)	245	500	200	50	330	85	135	95	50	300	145	520
Peak-hour factor, PHF	0.91	0.75	0.84	0.79	0.76	0.70	0.58	0.87	0.67	0.68	0.81	0.88
Adj. Flow (vph)	269	667	238	63	434	121	233	109	75	441	179	591
RTOR Reduction (vph)	0	0	49	0	21	0	0	0	55	0	0	357
Lane Group Flow (vph)	269	667	189	63	534	0	233	109	20	441	179	234
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		Perm
Protected Phases	1	6			2			4			8	
Permitted Phases	6		6	2			4		4	8		8
Actuated Green, G (s)	78.4	78.4	78.4	63.9	63.9		30.3	30.3	30.3	30.3	30.3	30.3
Effective Green, g (s)	80.1	80.1	80.1	65.6	65.6		31.9	31.9	31.9	31.9	31.9	31.9
Actuated g/C Ratio	0.67	0.67	0.67	0.55	0.55		0.27	0.27	0.27	0.27	0.27	0.27
Clearance Time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.6
Vehicle Extension (s)	1.0	3.0	3.0	3.0	3.0		2.0	2.0	2.0	2.5	2.5	2.5
Lane Grp Cap (vph)	562	1244	1057	387	1871		262	495	421	322	495	421
v/s Ratio Prot	0.04	c0.36			0.16			0.06			0.10	
v/s Ratio Perm	0.28		0.12	0.09			0.24		0.01	c0.36		0.15
v/c Ratio	0.48	0.54	0.18	0.16	0.29		0.89	0.22	0.05	1.37	0.36	0.56
Uniform Delay, d1	8.5	10.3	7.5	13.5	14.6		42.4	34.4	32.8	44.0	35.8	38.0
Progression Factor	1.24	1.11	1.25	1.00	1.00		1.00	1.00	1.00	1.18	1.16	2.47
Incremental Delay, d2	0.2	1.6	0.4	0.9	0.4		27.8	0.1	0.0	179.7	0.2	0.9
Delay (s)	10.8	13.1	9.8	14.4	15.0		70.1	34.4	32.8	231.5	41.6	94.8
Level of Service	B	B	A	B	B		E	C	C	F	D	F
Approach Delay (s)		11.9			14.9			54.1			136.7	
Approach LOS		B			B			D			F	

Intersection Summary			
HCM Average Control Delay	61.8	HCM Level of Service	E
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	102	1064	465	17	25	58
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	111	1157	505	18	27	63
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	524				1315	262
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	524				1315	262
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				80	91
cM capacity (veh/h)	1039				134	737

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	111	578	578	337	187	90
Volume Left	111	0	0	0	0	27
Volume Right	0	0	0	0	18	63
cSH	1039	1700	1700	1700	1700	312
Volume to Capacity	0.11	0.34	0.34	0.20	0.11	0.29
Queue Length 95th (ft)	9	0	0	0	0	29
Control Delay (s)	8.9	0.0	0.0	0.0	0.0	21.2
Lane LOS	A					C
Approach Delay (s)	0.8			0.0		21.2
Approach LOS						C

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	147	1064	465	22	30	103
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	160	1157	505	24	33	112
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	529				1415	265
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	529				1415	265
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				70	85
cM capacity (veh/h)	1034				109	734

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	160	578	578	337	192	145
Volume Left	160	0	0	0	0	33
Volume Right	0	0	0	0	24	112
cSH	1034	1700	1700	1700	1700	319
Volume to Capacity	0.15	0.34	0.34	0.20	0.11	0.45
Queue Length 95th (ft)	14	0	0	0	0	56
Control Delay (s)	9.1	0.0	0.0	0.0	0.0	25.3
Lane LOS	A					D
Approach Delay (s)	1.1			0.0		25.3
Approach LOS						D

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	155	1150	520	30	35	90
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	168	1250	565	33	38	98
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	598				1543	299
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	598				1543	299
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	83				56	86
cM capacity (veh/h)	975				87	697

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	168	625	625	377	221	136
Volume Left	168	0	0	0	0	38
Volume Right	0	0	0	0	33	98
cSH	975	1700	1700	1700	1700	236
Volume to Capacity	0.17	0.37	0.37	0.22	0.13	0.58
Queue Length 95th (ft)	16	0	0	0	0	81
Control Delay (s)	9.5	0.0	0.0	0.0	0.0	39.1
Lane LOS	A					E
Approach Delay (s)	1.1			0.0		39.1
Approach LOS						E

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	200	1150	520	35	40	135
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	217	1250	565	38	43	147
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	603				1644	302
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	603				1644	302
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	78				38	79
cM capacity (veh/h)	970				70	694

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	217	625	625	377	226	190
Volume Left	217	0	0	0	0	43
Volume Right	0	0	0	0	38	147
cSH	970	1700	1700	1700	1700	229
Volume to Capacity	0.22	0.37	0.37	0.22	0.13	0.83
Queue Length 95th (ft)	21	0	0	0	0	159
Control Delay (s)	9.8	0.0	0.0	0.0	0.0	68.2
Lane LOS	A					F
Approach Delay (s)	1.4			0.0		68.2
Approach LOS						F

Intersection Summary			
Average Delay	6.7		
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	200	1150	520	35	40	135
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	217	1250	565	38	43	147
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	603				1644	302
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	603				1644	302
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	78				38	79
cM capacity (veh/h)	970				70	694

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	217	625	625	377	226	43	147
Volume Left	217	0	0	0	0	43	0
Volume Right	0	0	0	0	38	0	147
cSH	970	1700	1700	1700	1700	70	694
Volume to Capacity	0.22	0.37	0.37	0.22	0.13	0.62	0.21
Queue Length 95th (ft)	21	0	0	0	0	67	20
Control Delay (s)	9.8	0.0	0.0	0.0	0.0	117.7	11.6
Lane LOS	A					F	B
Approach Delay (s)	1.4			0.0		35.8	
Approach LOS						E	

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		