PRINCETON PARK
JSP17-10 with Rezoning 18.717

PRINCETON PARK JSP 17-10 AND ZONING MAP AMENDMENT 18.717
Public hearing at the request of Pulte Homes of Michigan, LLC for Planning Commission's Recommendation to City Council for a Planned Rezoning Overlay associated with a Zoning Map amendment, from OS-1 (Office Service) to RM-2 (High Density Multi-Family Residential). The subject property is approximately 24-acre and is located on the west of Novi Road and north of Ten Mile Road in Section 22. The applicant is proposing a development of 125-unit multi-family attached condominiums with frontage and access to Novi Road

REQUIRED ACTION
Recommend to the City Council approval or denial of rezoning request OS-1 (Office Service) to RM-2 (High Density Multi-Family Residential) with a Planned Rezoning Overlay.

REVIEW	RESULT	DATE	COMMENTS
Planning	**Approval NOT recommended**	04-24-17	• Additional discussion is needed regarding the offered public benefits, density proposed and conditions of approval and the other issues listed in the review letter • **Reduction of the minimum required building side setback by 35 feet (Required 75 feet, provided 40 feet)** *(Staff does not support)* • **Exceeding the maximum number of rooms (423 allowed, 500 provided)** *(Staff does not support)* • **Not meeting the minimum orientation for all buildings (45 degrees required, varied angles provided)** *(Staff does not support)* • **Reduction of minimum required sidewalk width for bike parking (6 feet required, 5 feet provided)** *(Staff Supports)*
Engineering	Approval recommended	04-25-17	• **Lack of required stub street at 1,300 intervals between proposed streets to provide connection with adjacent property boundary.** *(Staff Supports)* • **Reducing the distance between the sidewalk and back of the curb. 15 feet required, 7.5 feet provided.** *(Staff Supports)* • Items to be addressed at the time of Preliminary Site Plan submittal
Landscaping	Approval recommended	04-11-17	• **Placement of street trees along Novi Road frontage, contingent on RCOC approval** *(Staff Supports)* • **Not meeting the minimum height of landscape berm along North boundary***(Staff does not support)* • **Lack of berms along a part of north boundary**

			(Staff Supports) • **Lack of berms along south property***(Staff Supports)* • **Lack of berms within Novi Road green belt***(Staff Supports)* • **Proposing sub canopy trees in lieu of some of the required Deciduous Canopy of Large evergreen trees** *(Staff Supports)* • Items to be addressed at the time of Preliminary Site Plan submittal
Wetlands	Approval recommended	02-28-16	• City of Novi Wetland Non-Minor Use Permit and Authorization to Encroach is required, MDEQ permit may be required • Items to be addressed at the time of Preliminary Site Plan submittal
Woodlands	Approval recommended	02-28-16	• Woodland Permit will be required for removal of the 20 % of site's regulated trees • Items to be addressed at the time of Preliminary Site Plan submittal
Traffic	Approval recommended	03-03-17	• Items to be addressed at the time of Preliminary Site Plan submittal
Traffic Study	Approval recommended	03-03-17	• Items to be addressed at the time of Preliminary Site Plan submittal
Façade	**Undetermined**		• Unable to make a determination as to the degree of compliance with the Façade Ordinance due to a lack of information • Items to be addressed at the time of Preliminary Site Plan submittal
Fire	Approval recommended	04-12-17	• Items to be addressed at the time of Preliminary Site Plan submittal

Motion sheet

Postpone

In the matter of Princeton Park JSP 17-10 and Zoning Map Amendment 18.717, motion **postpone making a recommendation on the proposed PRO and Concept Plan to allow the applicant time to consider further modifications to the Concept Plan as discussed in the review letters, or provide additional usable open space on site prior to consideration by the City Council** to rezone the subject property OS-1 (Office Service) to RM-2 (High Density Multi-Family Residential) with a Planned Rezoning Overlay This recommendation is made for the following reasons:

a. The Planning Commission would like the applicant to further discuss whether the proposed density and change of use is compatible with the existing and future land use in the surroundings. Existing land use patterns indicate a concentration of commercial and industrial uses along Novi Road. The applicant may consider reducing the density to conform to maximum density for RM-1, as RM-1 would be compatible with the low intensity office/retail development along Novi Road. RM-1 also creates a zone of transition from the nonresidential districts and major thoroughfares to the existing Single-Family development (to west) as intended in our Zoning Ordinance.
b. The Planning Commission may wish to further discuss if the proposed public benefits outweigh the detriments of the zoning change. Most of the benefits offered by the applicant may be considered incidental benefits from the development. Some of the benefits, though substantial, are dependent on other agencies approval. The applicant should initiate preliminary discussions with other agencies involved and provide more information to justify the viability of the benefits being offered.
c. The Concept Plan appears to provide the minimum required usable common open space as required by the code, with the central open space, three pockets and a play area for the enjoyment by the residents. The initial plan reviewed at the Pre-Application meeting included one additional pocket park and additional pedestrian connections on the central courtyard, which have now been removed from the plan.
d. The Concept plan can be revised to address design and layout concerns shared in the Planning review. The proposed layout plans a dense development in order to maximize the number of units on site. Modifications to site design can result in reduction of density, more usable open space, creates interest and breaks the continuous layout. Reduction in density to be consistent with maximum allowed in RM-1 will allow more compatible zoning and reduce deviations with regards to building orientation and number of rooms.
e. Additional discussion is needed regarding the other Traffic and Engineering issues listed in the staff and consultant review letters. The proposed site entry is aligned with the existing Michigan CAT entrance. Traffic Engineers have inquired how proposed signal timing and other optimization changes listed in the Traffic Study will affect the intersection of the existing CAT driveway and site driveway along Novi Road. The proposed density may require additional contractual sewer capacity downstream of Eight Mile Road as the proposed density increase results in higher sanitary sewer discharge.
f. (Additional reasons here if any).

-OR-

Recommend Approval
In the matter of Princeton Park JSP 17-10 and Zoning Map Amendment 18.717, motion to **recommend approval** to the City Council to rezone the subject property OS-1 (Office Service) to RM-2 (High Density Multi-Family Residential) with a Planned Rezoning Overlay

1. The recommendation shall include the following ordinance deviations for consideration by the City Council:
    a. Planning Deviation from Sec. 3.1.8.D of Zoning Ordinance for reduction of the minimum required building side setbacks by 35 feet (Required 75 feet, provided 40 feet);

    b. Planning Deviation from Sec. 3.8.1.B of Zoning Ordinance for exceeding the maximum number of rooms (423 maximum allowed, 500 provided);

    c. Planning Deviation from Sec. 3.8.2.D of Zoning Ordinance for not meeting the minimum orientation for all buildings (45 degrees required, varied angles provided);

    d. Planning Deviation from Sec. 5.16.5.C of Zoning Ordinance for reduction of minimum required sidewalk width for bike parking (6 feet required, 5 feet provided);

    e. Landscape deviation from Sec. 5.5.3.E.i.c and 5.5.3.E.ii of Zoning Ordinance for reduction/absence of street trees along Novi Road frontage; (16 trees required, proposed contingent on RCOC approval);

    f. Landscape deviation Sec. 5.5.3.B.ii and iii of Zoning Ordinance for not meeting the minimum height of landscape berm along North boundary (4.5-6 feet required, 2.5 – 3 feet provided along approximately 950 of 1340 linear feet of boundary);

    g. Landscape deviation Sec. 5.5.3.B.ii and iii of Zoning Ordinance for absence of required berm along the entire northern property boundary (no berm proposed for approximately 390 linear feet) due to location of proposed detention ponds;

    h. Landscape deviation from Sec. 5.5.3.B.ii and iii of Zoning Ordinance for lack of berms along the entire southern property boundary (4.5-6 feet required, 0 feet provided) due to existing wetlands;

    i. Landscape deviation from Sec. 5.5.3.B.ii and iii of Zoning Ordinance for Lack of berms within Novi Road green belt (779 Linear feet frontage required, 0 feet provided) due to distance across detention ponds to buildings and heavy landscaping;

    j. Landscape deviation from Sec 5.5.3.E.ii of Zoning Ordinance for proposing sub canopy trees in lieu of some of the required Deciduous Canopy of Large evergreen trees (Approximately 21 percent of required Canopy trees are replaced with sub canopy trees) as it will provide additional visual and species diversity to the site;

    k. City Council variance from Sec. 4.04, Article IV, Appendix C-Subdivision ordinance of City Code of Ordinances for absence of a stub street required at 1,300 feet interval along the proposed street to provide

connection to the adjacent property boundary, due to conflict with existing wetlands;

l. City Council variance from Chapter 7(c)(1) of Engineering Design manual for reducing the distance between the sidewalk and back of the curb. A minimum of 7.5 feet can be supported by staff;

2. Applicant complying with the conditions listed in the staff and consultant review letters.
3. If the City Council approves the rezoning, the Planning Commission recommends the following conditions be requirements of the Planned Rezoning Overlay Agreement:
    a. The Zoning Map amendment from OS-1 (Office Service) to RM-2 (High Density Multi-Family Residential) limits the maximum residential density to 6.4 dwelling units per acre (DUA) with a maximum of 125 three bedroom units, whereas the maximum allowed for proposed rezoning RM-2 is 15.6 DUA;
    b. Minor modifications to the approved Planned Rezoning Overlay Concept Plan (PRO) can be approved administratively, upon determination by the City Planner, that the modifications are minor, do not deviate from the general intent of the approved PRO Concept plan and result in reduced impacts on the surrounding development and existing infrastructure.
    c. Applicant complying with the conditions listed in the staff and consultant review letters.

This motion is made because

a. The rezoning is a reasonable alternative as the proposed use eliminates a long standing legal non-conforming storage yard and provides more housing in close proximity to Novi Town Center.
b. The rezoning request fulfills some of the objectives of the Master Plan for Land Use by providing opportunities for alternate housing that meets the needs of millennials and young families and protecting natural features on site.
c. The roadways and surrounding intersections are expected to maintain acceptable levels of service with the addition of the site generated traffic;
d. Submittal of a concept plan, and any resulting PRO Agreement, provides assurances to the Planning Commission and to the City Council of the manner in which the property will be developed.
e. (Additional reasons here if any).

-OR-

Recommend Denial

In the matter of Princeton Park JSP 17-10 and Zoning Map Amendment 18.717, motion to **recommend denial** to the City Council to rezone the subject property OS-1 (Office Service) to RM-2 (High Density Multi-Family Residential) with a Planned Rezoning Overlay for the following reasons:

a. *(Additional reasons here if any).*

Maps

Maps

Location

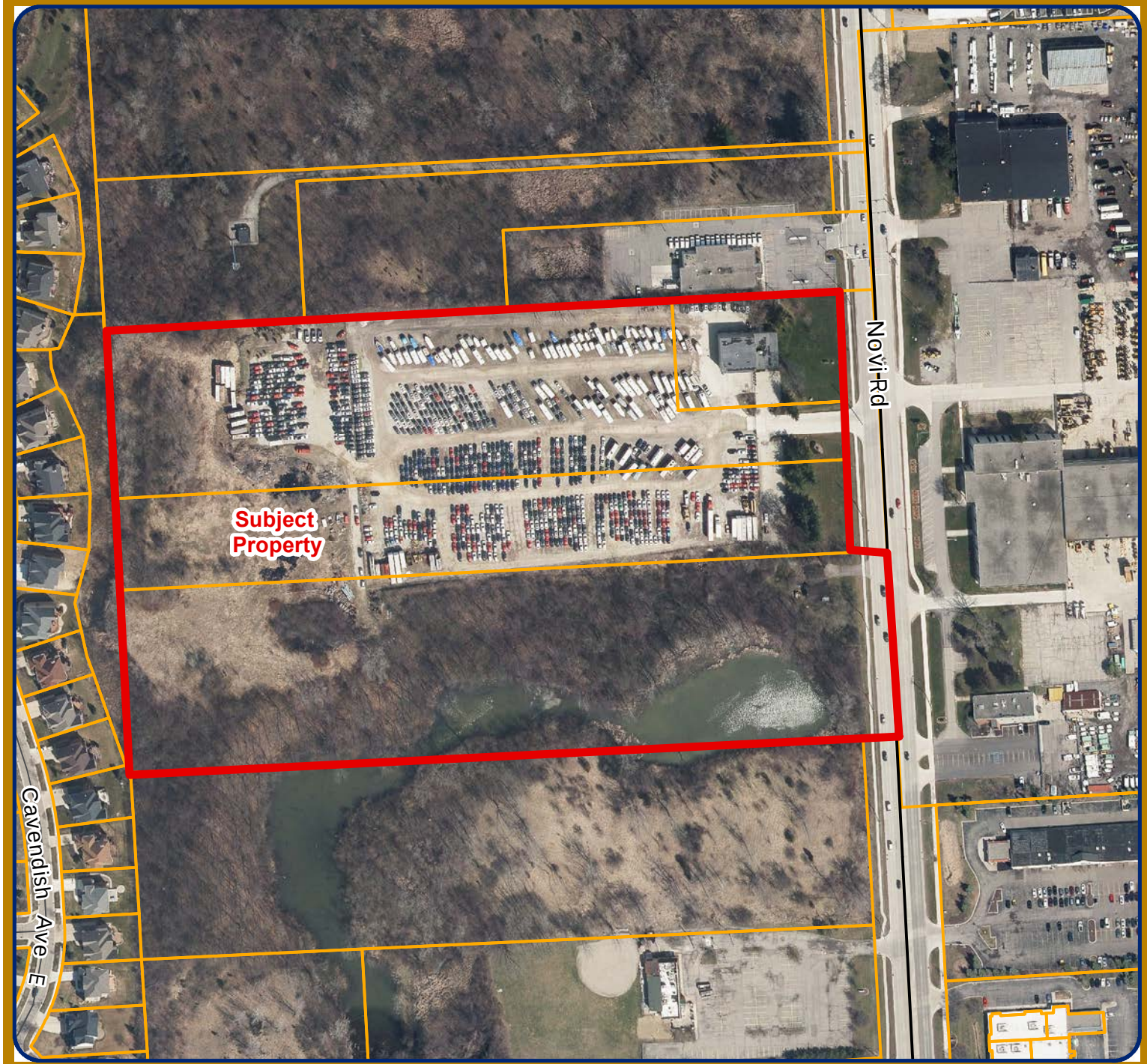
Zoning

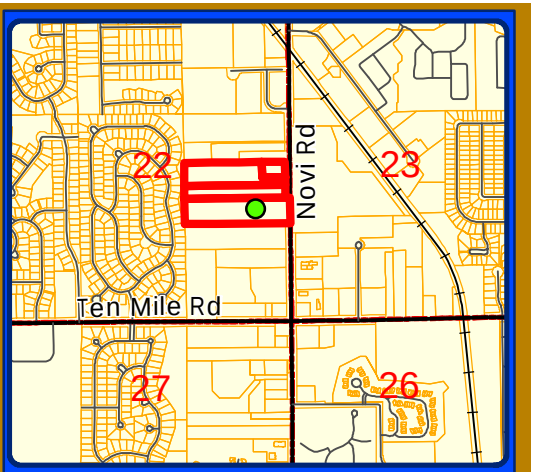
Future Land Use

Natural Features

17-10 Princeton Park

Location Map





LEGEND

Sections

City of Novi

Dept. of Community Development
City Hall / Civic Center
45175 W Ten Mile Rd
Novi, MI 48375
cityofnovi.org

Map Author: Sri Komaragiri
Date: 05/04/17
Project:17-10 Princeton Park
Version #: 1

Feet
0 55 110 220 330

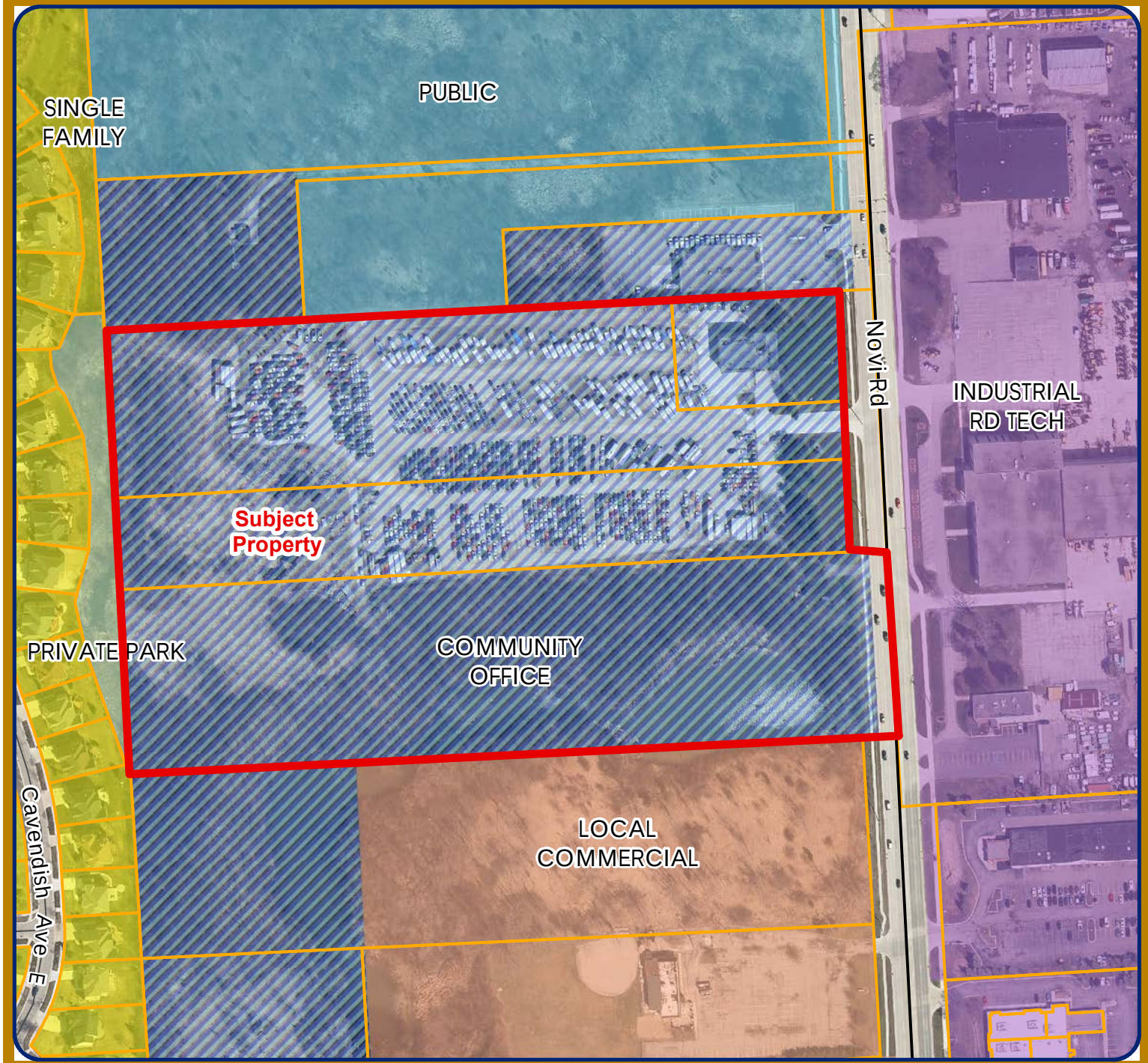
1 inch = 250 feet

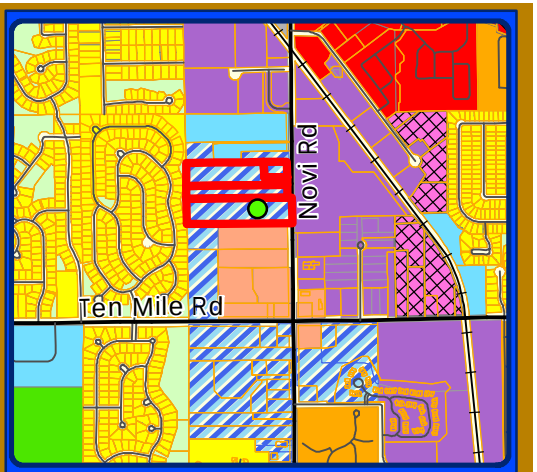
MAP INTERPRETATION NOTICE

Map information depicted is not intended to replace or substitute for any official or primary source. This map was intended to meet National Map Accuracy Standards and use the most recent, accurate sources available to the people of the City of Novi. Boundary measurements and area calculations are approximate and should not be construed as survey measurements performed by a licensed Michigan Surveyor as defined in Michigan Public Act 132 of 1970 as amended. Please contact the City GIS Manager to confirm source and accuracy information related to this map.

17-10 Princeton Park

Future Land Use Map





LEGEND

FUTURE LAND USE

- Single Family
- Multiple Family
- Community Office
- Industrial RD Tech
- Heavy Industrial
- Local Commercial
- TC Commercial
- TC Gateway
- Public
- Public Park
- Private Park
- Cemetry

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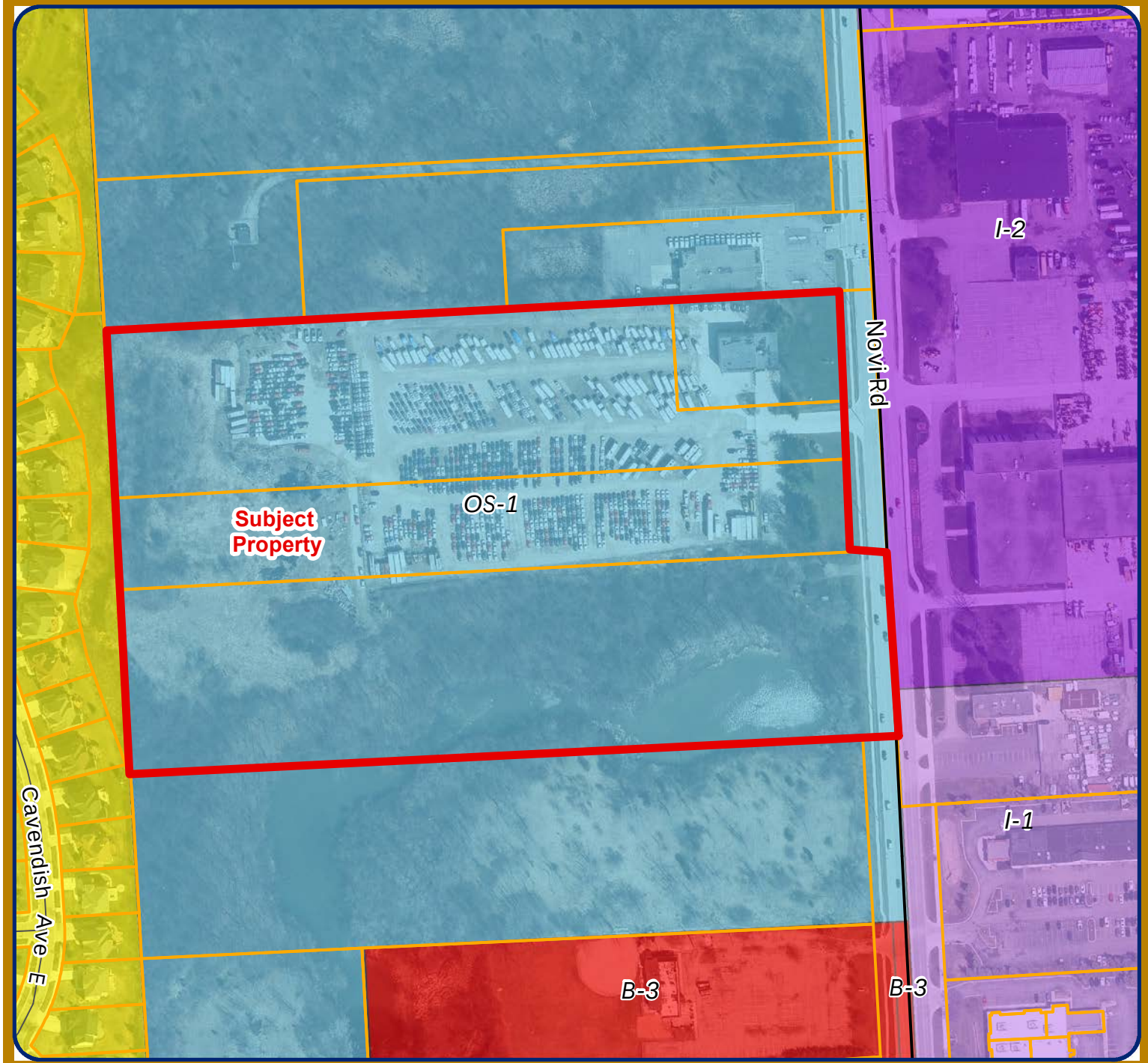
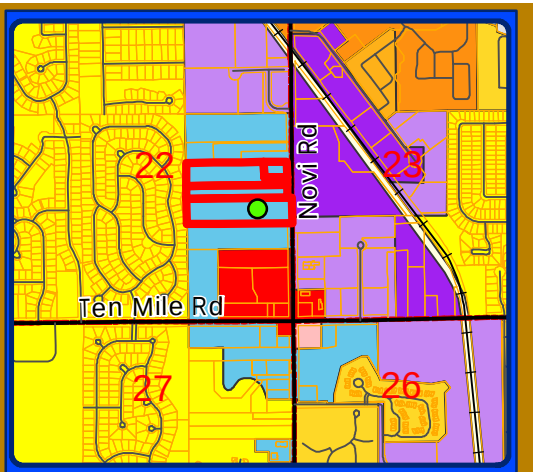
17-10 Princeton Park

Zoning Map





LEGEND

- Sections
- R-4: One-Family Residential District
- RM-1: Low-Density Multiple Family
- RM-2: High-Density Multiple Family
- B-1: Local Business District
- B-3: General Business District
- I-1: Light Industrial District
- I-2: General Industrial District
- OS-1: Office Service District
- P-1: Vehicular Parking District
- TC-1: Town Center -1 District

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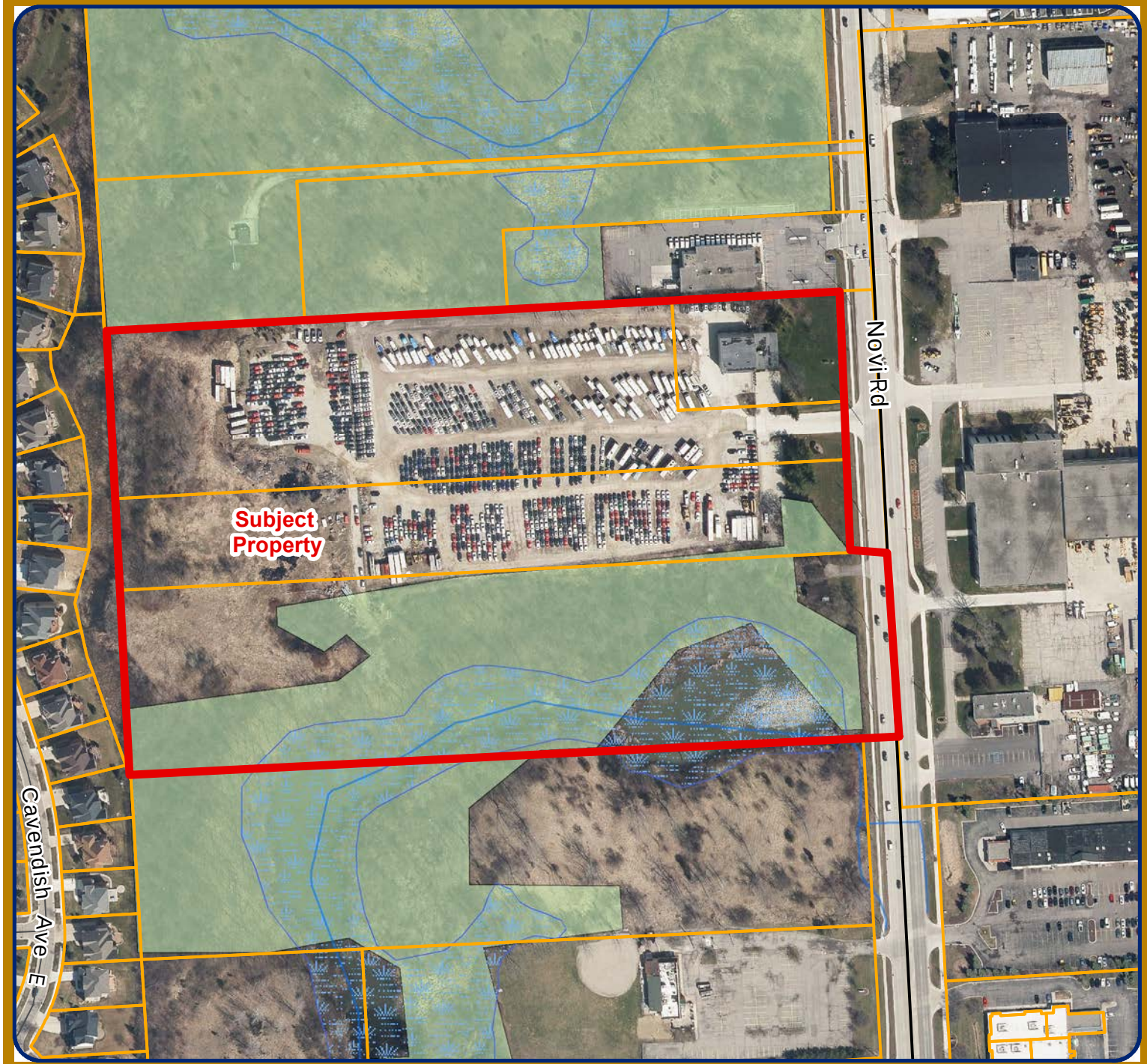
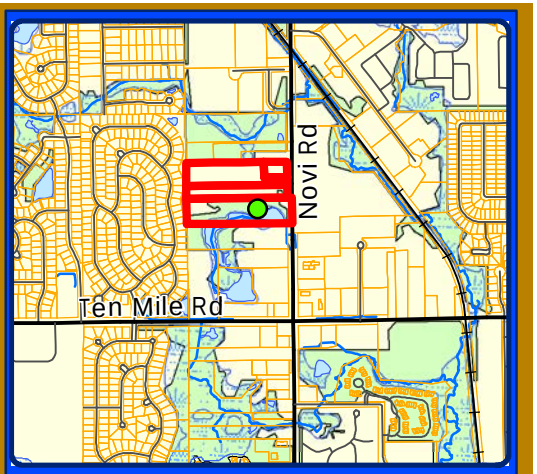
17-10 Princeton Park

Natural Features Map





LEGEND

- WETLANDS
- WOODLANDS

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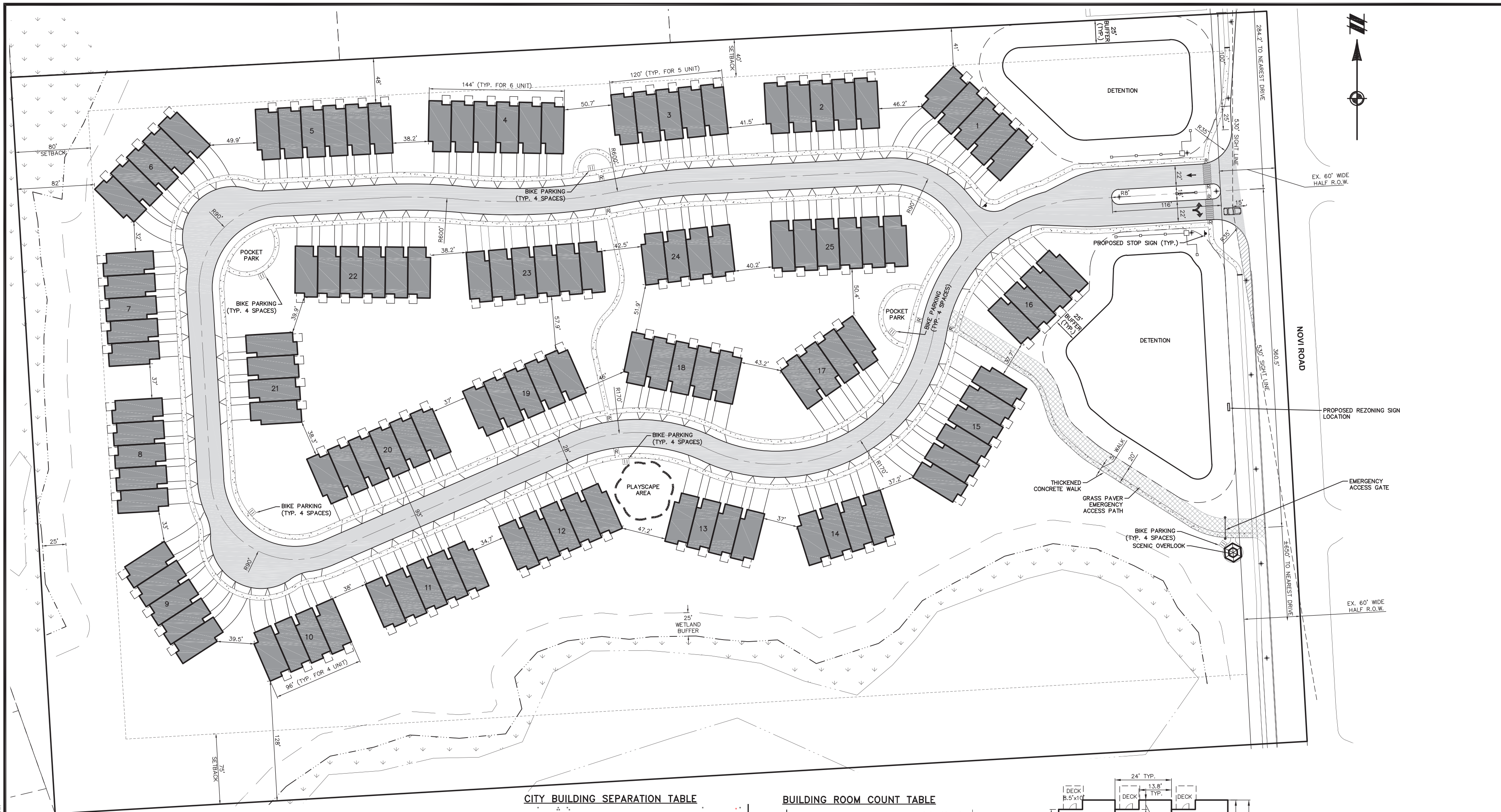
REVISED CONCEPT PLAN

(Full plan set available for viewing at the Community Development Department.)

As submitted for Revised Preliminary Site Plan on April 03, 2017



CITY BUILDING SEPARATION TABLE

[illegible]

* THE MAXIMUM REQUIRED SPACING FOR TWO BUILDINGS ACROSS THE PRIVATE ROAD FROM EACH OTHER (TWO 6-PLEX BUILDINGS DIRECTLY ACROSS FROM EACH OTHER AND PARALLEL) WOULD REQUIRE A 69.3' SEPARATION PER THE ORDINANCE CALCULATION.

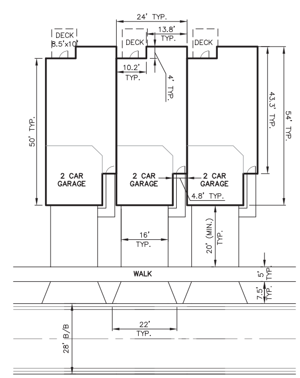
** THE BUILDINGS ACROSS FROM EACH OTHER ON EITHER SIDE OF THE PRIVATE DRIVE HAVE A MINIMUM SEPARATION OF 93' DUE TO THE PROPOSED ROAD SECTION.

BUILDING ROOM COUNT TABLE

[illegible]

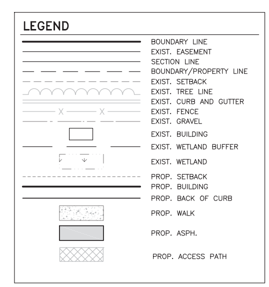
LAYOUT NOTES

1. THE PROPOSED DEVELOPMENT IS PLANNED TO BE DEVELOPED USING THE CITY'S PLANNED REZONING OVERLY DEVELOPMENT OPTION TO ALLOW FOR THE MULTI-FAMILY USE.
2. LANDSCAPE BUFFERS WILL BE PROVIDED ON THE SIDES OF THE DEVELOPMENT AS SHOWN BUFFERING THE PROPERTY FROM THE ADJACENT USES.
3. THE DEVELOPMENT WILL CONTAIN PRIVATE ROADS. THE PROPOSED CONNECTION WILL BE COORDINATED WITH THE ROAD COMMISSION OF OAKLAND COUNTY.
4. ALL SIDEWALKS AND SIDEWALK RAMPS SHALL BE ADA COMPLIANT.
5. SEE DETAIL SHEET FOR EYEBROW DIMENSIONAL DETAIL.
6. SIGHT DISTANCE TRIANGLES SHOWN FOR 3.5' EYE HEIGHT IN ACCORDANCE WITH MDOT TRAFFIC AND SAFETY STANDARDS FEBRUARY 6, 2008 (2004 AASHTO, EXHIBITS 9-55, 661). SIGHT DISTANCE FOR SPEED LIMIT FOR 45 MPH AND 4 LANES OF TRAFFIC IS 530'.
7. NO ON-STREET PARKING IS PROPOSED. UNIT GARAGE AND DRIVE WAY PARKING EXCEEDS CITY PARKING REQUIREMENTS.
8. PROPOSED BUILDING FACADES WILL HAVE A MINIMUM OF 30% BRICK OR STONE.
9. THE TOTAL PROPOSED FLOOR SQUARE FOOTAGE OF EACH DWELLING UNIT IS 1,860 SQUARE FEET.



TYPICAL UNIT DETAIL

NOT TO SCALE



PRELIMINARY - NOT FOR CONSTRUCTION

Know what's **below.** **Call** before you dig.

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NOTICE:
CONSTRUCTION SITE SAFETY IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR; NEITHER THE OWNER NOR THE ENGINEER SHALL BE EXPECTED TO ASSUME ANY RESPONSIBILITY FOR SAFETY OF THE WORK, OF PERSONS ENGAGED IN THE WORK, OF ANY NEARBY STRUCTURES, OR OF ANY OTHER PERSONS.

ATWELL
866.850.4200 www.atwell-group.com
311 NORTH MAIN STREET
ANN ARBOR, MI 48104
734.994.4000

SECTION 22
TOWN 1 NORTH, RANGE 8 EAST
CITY OF NOVI
OAKLAND COUNTY, MICHIGAN

PULTE HOMES OF MICHIGAN, LLC
PRINCETON PARK
PLANNED REZONING OVERLAY

LAYOUT PLAN

DATE FEBRUARY 7, 2017

4-3-2017 PER CITY

REVISIONS

SCALE: 1" = 50 FEET
DRAWN BY: CR
CHECKED BY: SS
P.M.: MB
JOB #: 16002400
FILE CODE: –
SHEET NO. 05

FPA
FELINO A. PASCUAL and ASSOCIATES
Community Land Planner and registered Landscape Architect
24333 Orchard Lake Rd, Suite G
Farmington Hills, MI 48336
ph. (248) 557-5588
fax. (248) 557-5416

seal:

FELINO PASCUAL LANDSCAPE ARCHITECT No. 1343

client:

PULTE HOMES

100 Bloomfiled Hills Parkway, Suite 150, Bloomfield Hills, Michigan 48304

project:

EMERSON PARK

A planned residential community

project location:

City of Novi, MI
Novi Road

sheet title:

COLORED LANDSCAPE PLAN

job no./issue/revision date:

LS17.025.01	PSP	2-7-2017
LS17.025.03	PSP	3-1-2017
LS17.025.05	PSP	5-2-2017

drawn by:
JP, KM, CS

checked by:
FP

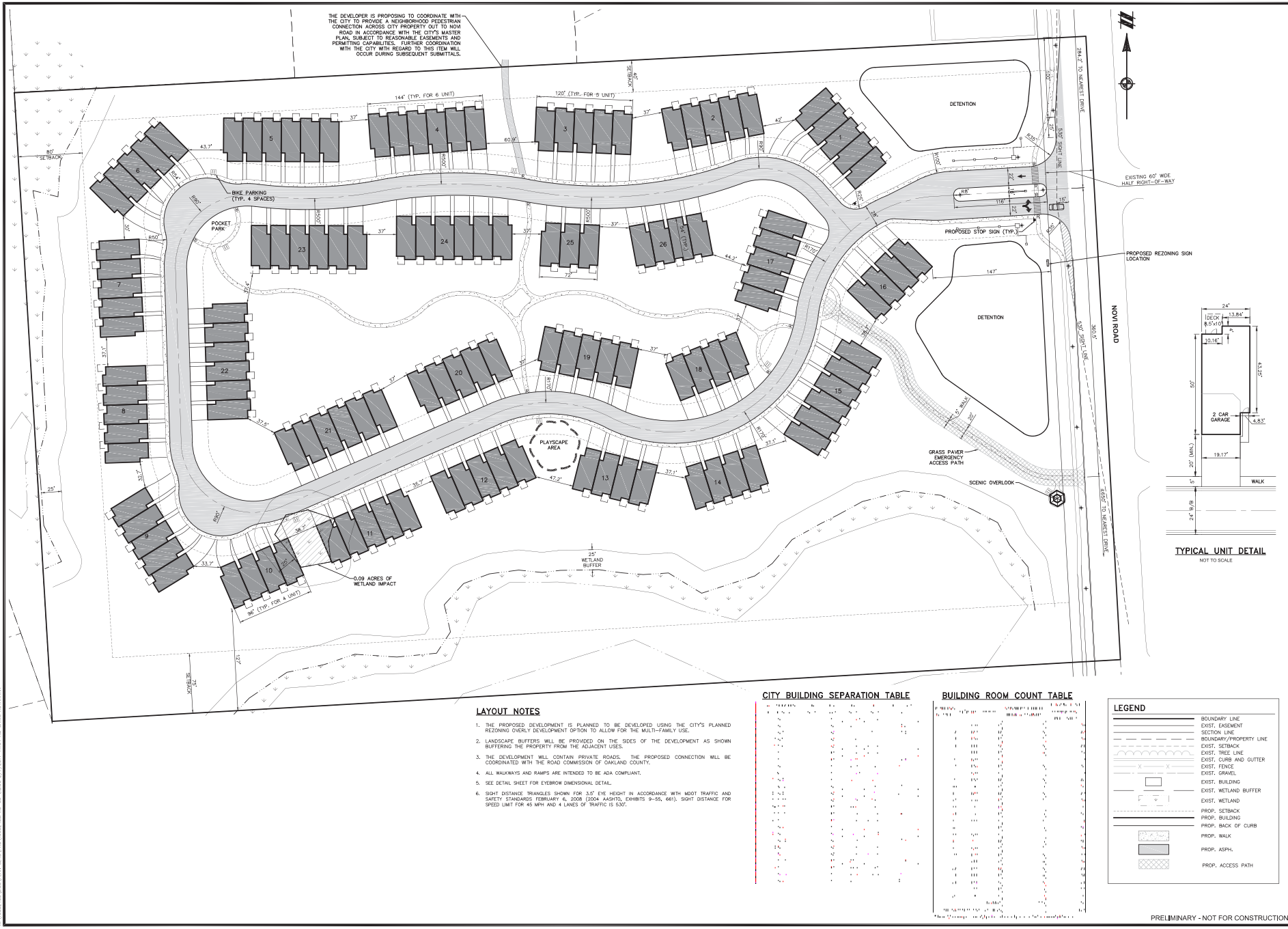
date:
1-19-2017

notice:

project no:
LS17.025.01

sheet no:
LR-1 of 6

ORIGINAL CONCEPT PLAN



LAYOUT NOTES

1. THE PROPOSED DEVELOPMENT IS PLANNED TO BE DEVELOPED USING THE CITY'S PLANNED REZONING OVERLY DEVELOPMENT OPTION TO ALLOW FOR THE MULTI-FAMILY USE.
2. LANDSCAPE BUFFERS WILL BE PROVIDED ON THE SIDES OF THE DEVELOPMENT AS SHOWN BUFFERING THE PROPERTY FROM THE ADJACENT USES.
3. THE DEVELOPMENT WILL CONTAIN PRIVATE ROADS. THE PROPOSED CONNECTION WILL BE COORDINATED WITH THE ROAD COMMISSION OF OAKLAND COUNTY.
4. ALL WALKWAYS AND RAMPS ARE INTENDED TO BE ADA COMPLIANT.
5. SEE DETAIL SHEET FOR EYEBROW DIMENSIONAL DETAIL.
6. SIGHT DISTANCE TRIANGLES SHOWN FOR 3.5' EYE HEIGHT IN ACCORDANCE WITH MDOT TRAFFIC AND SAFETY STANDARDS FEBRUARY 6, 2008 (2004 AASHTO, EXHIBITS 9-55, 661). SIGHT DISTANCE FOR SPEED LIMIT FOR 45 MPH AND 4 LANES OF TRAFFIC IS 530'.

CITY BUILDING SEPARATION TABLE

BUILDING ROOM COUNT TABLE

LEGEND

- BOUNDARY LINE
- EXIST. EASEMENT
- SECTION LINE
- BOUNDARY/PROPERTY LINE
- EXIST. SETBACK
- EXIST. TREE LINE
- EXIST. CURB AND GUTTER
- EXIST. FENCE
- EXIST. GRAVEL
- EXIST. BUILDING
- EXIST. WETLAND BUFFER
- EXIST. WETLAND
- PROP. SETBACK
- PROP. BUILDING
- PROP. BACK OF CURB
- PROP. WALK
- PROP. ASPH.
- PROP. ACCESS PATH

PRELIMINARY - NOT FOR CONSTRUCTION

ATWELL
866.850.4200 www.atwell-group.com
311 NORTH MAIN STREET
ANN ARBOR, MI 48104

SECTION 22
TOWN 1 NORTH, RANGE 8 EAST
CITY OF NOVI
OAKLAND COUNTY, MICHIGAN

PULTE HOMES OF MICHIGAN, LLC
PRINCETON PARK
PLANNED REZONING OVERLAY
LAYOUT PLAN

DATE
FEBRUARY 7, 2017

REVISIONS

0 25 50
SCALE: 1" = 50 FEET
DRAWN BY: CR
CHECKED BY: SS
P.M.: MB
JOB #: 16002400
FILE CODE: --
SHEET NO. 05

K:\16002400\DWG\PLAN SETS\REZ\16002400REZ-03-LAYOUT.DWG 2/7/2017 11:34 AM CHRIS BOSHEAR

PLANNED REZONING OVERLAY NARRATIVE

February 6, 2017
April 3, 2017 (Revised)

Ms. Sri Komaragiri
City of Novi – Planning Department
45175 West Ten Mile Road
Novi, Michigan 48375

Re: Pulte Homes, Princeton Park
Planned Rezoning Overlay (PRO) Submittal Package
JSP 16-72

Dear Ms. Komaragiri,

We are pleased to present to you a proposed "for sale" attached single family home residential development by Pulte Homes of Michigan. Please accept this letter document, accompanying plans, and supplemental information as the Conceptual PRO submittal for our client's Princeton Park development. We are providing these revised plans in response to the City's initial review of the PRO package for your distribution and consideration at the Planning Commission.

PROJECT OVERVIEW

Princeton Park is an exclusive 125 unit residential community located on an approximate 24-acre parcel in Section 22 in the City of Novi, Oakland County, Michigan. The proposed parcel is located on the west side of Novi road, north of 10 Mile Road and south of Grand River Avenue. The property is being acquired and to be developed by land developer and homebuilder, Pulte Homes. The subject parcel is currently zoned OS-1 (Office Service) and is being used as vehicle storage lot. The subject parcel contains woodlands and an open body of water to the south. The open body of water and the higher quality woodland trees are to be preserved with the proposed development. The development is planned to be constructed in two phases.

The development will utilize the City's Planned Rezoning Overly (PRO) development option to allow for a "for sale" attached single family homes housing use under the RM-1 (Low-Density Multiple-Family) zoning overlay. The applicant would also be open to rezoning the property under the RM-2 designation at the discretion of the City to eliminate the density deviations listed below. Large landscape buffers will be provided on the sides of the development buffering the property from the adjacent uses and significant amenities will be provided throughout the development.

The development will contain private roads and is also proposed to be served by public sewer and water located within the Novi Road right-of-way. These public utilities will have the capacity to serve the development. Storm water management is proposed to be addressed through the construction of a detention basin at the frontage of the property, strategically located to act as a large natural buffer from the Novi road right-of-way. The detention pond will be designed in accordance with the City's requirements for 100-year detention.

311 N. Main Street, Ann Arbor, MI 48104 Tel: 734.994.4000 Fax: 734.994.1590
www.atwell-group.com

PROJECT TEAM

Pulte Homes of Michigan – Developer
Atwell – Survey, Land Planning, Engineering and Wetlands
Felino Pascual & Associates – Landscape Architecture and Woodlands
Flies and Vanderbrink – Traffic

MASTER PLAN ANALYSIS

According to the 2016 update to the City of Novi Master Plan, population and business continued to grow in Novi through the recession unlike other communities in southeastern Michigan. Although Novi continued to see substantial housing growth during and after the recession, an increasing share of the City's residents and larger market wanted a different housing pattern for the future. It would appear through the various housing analyses done throughout the Master Plan, that smaller units, clustered together, could potentially be added in well-chosen locations in the City to satisfy that need. Not only does this type of housing describe the proposed development, but other components of the Master Plan call out specific factors that appear to support the proposed PRO, and are discussed below.

The Master Plan goals as referenced from the City of Novi 2016 Master Plan Update are to "Provide a wide range of housing options. Attract new residents to the City by providing a full range of quality housing opportunities that meet the housing needs of all demographic groups including but not limited to singles, couples, first time home buyers, families and the elderly. Provide residential developments that support healthy lifestyles; ensure the provision of neighborhood open space within residential developments".

The Master Plan calls for the continued diversification of Novi's housing stock to offer a greater variety of sizes, forms, price points, ownership and tenant models, and configurations. By looking toward parcels of land within the City that have redevelopment potential and cross referencing them with components that address the current needs and desires of a changing population, the proposed development allows the City to address areas of need without compromising the rural character of its larger lot areas. The concentration of denser forms in a specific area, such as the subject parcel, also ensures the proximity to shopping and employment centers that support the Master Plan's action items that address alternative transportation such as walking or biking to work. The City of Novi can boast of thriving single-family neighborhoods, but alternatives to that are few and far between particularly in study areas like the Grand River Corridor and Town Center District which are very close to the subject parcel. Housing types that can serve alternative segments of the population such as millennials and young families are part of the type of diversification called for within the future land use in the Master Plan. The proposed development addresses this missing alternative.

There are several goals and objectives listed in the Master Plan which would be addressed by this proposed development. These are as follows:

1. Provide a wide range of housing options to attract a diverse population: The development proposes a "for sale" attached single family homes product that will attract a variety of demographics. Alternative housing that will fit the low-maintenance needs of age groups such as millennials and young families and attribute to a wide range of housing options.

2. Redevelopment potential of property: The existing property use is an unsightly vehicular storage lot.

3. Strategic Residential Location: The site is located south of the Grand River Corridor and within walkable proximity to Town Center District and Novi Road activity center, offering employment centers, shopping, area wide circulation systems.

4. Promote Economic Development: The residential use is more constant with actual market demand for the specific property. There is very limited demand for quality office or retail developments for the mid-block site. Numerous commercial and retail developers were contacted and declined opportunity to develop the site. Refer to the enclosed letters.

5. Oversaturation of Office Space Inventory: The Master Plan speaks to an oversaturation of office space and the need to remedy current vacant office space within the City. Rezoning for a residential use from an office/retail use that the current zoning would prevent contributing to the oversaturation of office space.

6. Preservation of Natural Resources: The proposed plan has been modified from its initial layout to preserve the on-site wetlands to the south and west in additional to preserving the higher quality woodland areas and limited disturbance to the steep slopes of the south.

7. Pedestrian Enhancement on Novi Road: The developer is proposing to contribute funds in the amount of $90,000 for the City to apply to the enhancement of the pedestrian experience along Novi Road to the Downtown Area.

8. Maintain High Quality Architecture And Design Throughout The City: Pulte Homes is known for its attractive residential developments and is looking to expand on selling quality homes in the City that will contribute positively to the City's image.

9. The CIB Planning PRO Rezoning Analysis, dated March 20, 2017 (attached): The letter concludes that the proposed residential townhome development is a small departure from the current Community Office Master Plan designation; but when looking at the below factors, is an appropriate land use for this property;

    - Site Conditions
    - Competing Office Districts
    - MP Goals and Objectives – need for the "missing middle" housing
    - Proximity to Downtown and Town Center
    - Public Benefit of the pathway connection system

PUBLIC BENEFITS FOR REZONING

The requested RM-1 zoning, with a PRO Development Agreement would be in the public's best interest when compared to development that could occur under the site's current zoning. A required with all PRO requests, we offer the following public benefits with the PRO project;

1. Redevelopment Potential of Property: Removal of unsightly vehicular storage and improvement to storm water treatment and storage. The current parking lot drains direct to the south waterbody.

2. Increased Buffers to West: The development proposes an approximately 160 feet setback to the nearest residential unit to the west and natural wetlands and trees along the property line are being preserved to the greatest extent possible.

3. Strategic Residential Location: The development is located within walkable distance to the south of the Grand River Corridor and within proximity to Town Center District.

4. Providing Alternative Housing: The product proposed with the development will fit the low-maintenance needs of age groups at the younger end of the spectrum, including millennials and young families.

5. Preservation of natural features: The proposed development layout has been modified to preserve the on-site wetlands to the south and west of the site in additional to preserving the higher quality woodland areas and limited disturbance to the steep slopes of the south. In particular, special attention was provided to saving the only higher quality trees located on the south west corner of the site.

6. Site Amenities: The development proposes a number of community pocket parks, a play scape area, and public gathering spaces with a scenic overlook to the existing on-site wetlands. These amenities will provide opportunities for social and passive recreation interaction at these pedestrian nodes.

7. Adding Residential Density to the Downtown area: The proposed development will add meaningful residential density in walking and biking distance to the Novi Downtown district, which will further work to the success of the growing and emerging downtown.

8. Pedestrian Enhancement on Novi Road: The developer is proposing to contribute funds in the amount of $90,000 for the City to apply to the enhancement of the pedestrian experience along Novi Road to the Downtown Area. The Design team will discuss the appropriate enhancements to the pedestrian corridor of Novi Road, and coordinate city and client improvements with the RCOC offices, as appropriate.

REQUESTED ORDINANCE DEVIATIONS

The following deviations from the proposed City Zoning Ordinance overlay are being requested as a condition of the Planned Rezoning Overlay (PRO). These are being requested to preserve the natural features on site, provide for additional screening, while also creating an appropriate density and Townhome character such as is proposed with Princeton Park.

	RM-1 Ordinance Requirements	Requested Deviation
• North Side Setback (3.17.D)	75 feet	40 feet (Existing OS-1: 15 feet)
• Net Density (3.8.1.C)	10.9 to 5.4 DU/acre (1 to 3 bedroom)	6.4 DU/acre (3 bedroom)
• Number of Rooms (3.8.1.A)	423 rooms	500 rooms
• Stub Street (4.04)	Secondary stub road to property	No stub road provided*
• Sidewalk location (Eng 7.4.2.C.1)	15 feet separation from road	7.5 feet*
• Building Orientation (3.8.2.D)	Min. 45 degree along perimeter	Less than 45 degree*

** = staff supported deviation*

We look forward to your earliest review of this development and rezoning proposal. For your record, in additional to the previous submitted documents, included with this re-submittal are the following documents:

- One (1) signed site plan revision application
- Seven (7) copies of the PRO concept plans, signed & sealed
- One (1) copy of an additional master plan and rezoning analysis by CIB Planning

Please also find enclosed our engineering review comment response letter addressed to Darcy for direct responses on how we have addressed or plan to address each of the engineering review comments.

It is noted that the concept plan is **recommended for approval by the landscaping, wetlands, woodlands, traffic, and fire** review disciplines. Direct responses to comments from these disciplines are not included within this specific re-submittal, but **the applicant will continue to work with the City to address the remaining comments from these disciplines and respond to each of the noted comments with the submittal of the Preliminary Site Plan.**

Scaled building elevation drawings, floor plans for the models, and a façade material sample will be provided with supplemental submittals for review when these documents are completed. **It is the applicant's intent to comply with the building façade requirement to have a minimum of 30% brick or stone.**

Thank you for your assistance and cooperation with respect to this project. If you should have any questions or need any additional information, please contact us.

Sincerely,
ATWELL, LLC

Matthew W. Bush, PE, LEED AP
Project Manager / Engineer

cc. Joe Skore, Pulte Homes

LAND USE NARRATIVE
Prepared by: CIB PLANNING

CIB PLANNING

Community Image Builders

March 20, 2017

Mr. Joe Skore
Pulte Group
100 Bloomfield Hills Parkway, Suite 140
Bloomfield, Michigan 48304-290

Subject: **Princeton Park PRO Rezoning,** located on the west side of Novi Road, north of W. Ten Mile Road and south of Grand River Ave, approximately 24 acres.

Dear Mr. Skore:

At your request, we have reviewed the above request to rezone an approximate 24 acre parcel from OS-1, Office Service District to RM-1, Multi-Family Residential with a Planned Rezoning Overlay (PRO). The property is currently used primarily for the outdoor storage of automobiles and recreational vehicles. Proposed is the development of a 125 unit, attached townhouse project with a boulevard entry onto Novi Road, stormwater detention facilities, open space, an interconnected pathway system, a proposed off-site pedestrian pathway, and other site amenities. This letter is submitted as an evaluation of the appropriateness of the proposed rezoning request, understanding the future land use designation for the site is Community Office. Moreover, this letter is in response to the Planning Department request to elaborate on why this project meets the Objectives in the Master Plan and the benefits outweigh possible impacts from the change in use.

For the sake of conciseness, this letter will not re-state the existing land use, zoning, and master plan designation for the subject and surrounding sites. Instead, it will focus on the key factors that relate to implementation of the Goals and Objectives in the Master Plan. Based upon our review of the application and related materials, a visit to the site, and examination of the City of Novi Zoning Ordinance and Master Plan, we offer the following for your consideration:

ANALYSIS OF REQUEST

The PRO Option is provided in the zoning ordinance to allow a change in zoning, with conditions, to provide greater public benefit, offsetting possible impacts from the change in land use. While the current Future Land Use designation of Community Office makes sense from a transitional use perspective, a more detailed examination of the site, market conditions, available land, and surrounding land uses indicates that the proposed townhouse development will prove more beneficial to the community.

17195 Silver Parkway, #309
Fenton, MI 48430

Phone: 810-335-3800
Email: avantini@cibplanning.com

Site Conditions. The southern 1/3 and western edge of the property have steep slopes and wetlands that restrict development to the area generally occupied by the storage facility. These same conditions limit the future development of the remaining area to the south that is also planned and zoned for office use. The result will be a project with small office buildings that lack exposure to Novi Road and are located mid-block, away from other anchor retail and office uses. As indicated in the supporting real estate letters, the market for mid-block commercial development is poor and it is unlikely that developers would take such a risk when better alternatives exist in the area.

Competing Office Districts. Just a short distance from the subject site is the area designated on the Future Land Use Map as Town Center Gateway. This key, vibrant location is designated for a mixture of uses, including office. Most prospective office users would be drawn to the Town Center location over the subject site. Likewise, the City West overlay along Grand River Ave., from Taft Road to Beck Road, indicates a planned mixture of uses including office. As with the Town Center, this area and the properties to the east on Grand River Ave. will be more attractive to office users given nearby anchor uses such as Providence Park and the Novi Town Center.

Master Plan Goals and Objectives. One of the Goals of the Master Plan is to "provide a wide range of attractive housing choices." This is further supported by the corresponding Objective to "Attract new residents to the city by providing a full range of quality housing opportunities that meet the housing needs of all demographic groups including but not limited to singles, couples, first time home buyers, families, and the elderly." These goals and objectives are supported by the Housing Plan section of the Master Plan with a good explanation of the "Missing Middle" housing. This term refers to "housing types that achieve medium-density yields and provide high-quality, marketable options between the scales of single-family homes and mid-rise flats for walkable urban living. They are designed to meet the specific needs of shifting demographics and the new market demand, and are a key component to a diverse neighborhood. They are classified as 'missing' because very few of these housing types have been built since the early 1940's due to regulatory constraints."

The proposed townhouse development not only meets the demand for "missing middle" housing, but also fills a specific niche in the market. A considerable amount of land in Novi is developed for single-family residential use and it is difficult for young families and even "millennials" to purchase property in Novi since available housing options are limited. The development of Princeton Park will help meet this demand and make new construction available to families with children.

Lack of Available Sites. Although areas in the city are designated for multiple-family development, few of them are vacant and available for townhouse development. Most of the RM-1 and RM-2 zoned districts are developed, limiting the ability to build a project like Princeton Park in Novi. Much of the future multiple-family housing will likely be located in the Town Center and City West areas and be higher density in character, such as flats and condominiums. Current and prospective Novi residents may have to look outside the city for townhouse units due to the limited number of available sites.

Close Proximity to Downtown & Town Center. The location of Princeton Park places it within close walking distance to both the Downtown and Town Center areas. The addition of residents to the

area will only strengthen those commercial districts, support local businesses, and continue to create a more vibrant atmosphere.

Provision for Public Improvements. One of the key benefits of the Princeton Park PRO is the Neighborhood Connector Pathway and supporting sidewalks. The proposed pathway system, including the Connector through City land, will not only improve pedestrian connectivity for the subject development, but also for the abutting subdivision to the west. This will encourage those residents to walk to the Town Center and Downtown areas rather than use vehicles to get there. Another side benefit is that less vehicles will be on the road, especially during already congested peak periods.

CONCLUSION

With the proposed benefits, quality site design, and an understanding of the current and future office market, the proposed Princeton Park PRO request represents a small departure from the current Future Land Use Plan designation of Community Office. With single-family residential development to the west, a townhouse project is an appropriate transitional use and allows full development of this long, narrow property. A failed office project could prove problematic for the abutting properties and make development of adjacent land difficult. Moreover, the Princeton Park project meets the goals and objectives of the Master Plan while supporting nearby projects like the Town Center and Downtown area. The introduction of additional "Middle Housing" into the city will further implement the intent of the Master Plan and be a benefit to residents.

If you have any further questions, please contact us at 810-335-3800.

Sincerely,

CIB Planning

Carmine P. Avantini, AICP
President

PLANNING REVIEW

Review based on Revised Concept Site Plan dated April 03, 2017

CONCEPT PLAN SUBMITTAL SCHEDULE		
Type of Submittal	**Date of Submittal**	**Reviewed by**
Concept Plan	February 08, 2017	All Agencies
Revised Concept Plan	March 22, 2017	All Agencies except Traffic, Wetlands, Woodlands and Facade

PLAN REVIEW CENTER REPORT

April 24, 2017

Planning Review

Princeton Park

JSP17-10 with Rezoning 18.717

PETITIONER

Pulte Homes of Michigan, LLC

REVIEW TYPE

Rezoning Request from OS-1 (Office Service) to RM-2 (High Density Multi-Family Residential) with a Planned Rezoning Overlay (PRO)

PROPERTY CHARACTERISTICS

Section	22	
Site Location	West of Novi (on Novi Road); North of W Ten Mile Road; Parcel Id's: 50-22-22-400-006, 007, 019 and 020	
Site School District	Novi Community School District	
Site Zoning	OS-1 Office Service	
Adjoining Zoning	North	OS-1 Office Service
	East	I-2 General Industrial
	West	R-4 One Family Residential
	South	OS-1 Office Service
Current Site Use	RV storage Facility (Non-conforming use)	
Adjoining Uses	North	Postal Office/vacant
	East	Single Family Residences
	West	Churchill Crossing
	South	Vacant
Site Size	24 Acres (Net Site Acreage 19.4 Acres)	
Plan Date	April 3, 2017 (Revision)	

PROJECT SUMMARY

The petitioner is requesting a Zoning Map amendment for a 24-acre property on the west side of Novi Road and north side of Ten Mile Road (Section 22) from OS-1 (Office Service) to RM-2 (high Density Multi-Family Residential) utilizing the City's Planned Rezoning Overlay (PRO) option. The applicant states that the rezoning request is necessary to allow the development of a 125-unit Multi-family residential development.

The applicant has proposed a 125-unit multi-family for-sale residential development with frontage and access to Novi Road. The PRO Concept Plan shows two detention ponds on either side of the proposed entrance Boulevard. The detention ponds also serve as screening from Novi Road frontage. The concept plan also includes pocket parks and pedestrian walks spread throughout the development for active and passive recreation. All proposed internal roads are private. This is not a gated community.

PROJECT REVIEW HISTORY

The applicant submitted for a Pre-Application Meeting, which was held on December 12, 2016. Staff has indicated that the proposed zoning conflicts the future land use designation and requested additional information to make an informed decision.

The plan was presented to Master Planning and Zoning Committee on March 28, 2017. The change from Office to residential use received favorable comments from the Committee with a note to work with the staff on proposed density. The following summarizes briefly the recommendations provided by the Committee and the staff at the meeting:

1. **Change of Zoning:** Committee was favorable to the proposed Zoning change and removal of long standing legal non-conforming storage yard. The applicant is suggested to consider a different floor plan to cater older adults as well.
2. **Density:** Committee was in favor for the residential use in the proposed location and also indicated that slightly higher density would be acceptable as well. However, staff believes that given the style of housing the applicant is proposing, higher density would mean greater lot coverage and less open space for residential amenities. Thus, RM-2 would be more appropriate if the housing style involves apartment style tall buildings.
3. **Usable Open Space**: The applicant is suggested to consider other options to provide more usable open space that are designed for active and passive recreation.
4. **Public benefits:** Staff suggested considering improving pedestrian experience from the proposed development to Main street area with an understanding that the Novi Road falls under Oakland County jurisdiction and any improvements are subject to their review and approval. Committee suggested to reconsider the other benefits proposed.
5. **Neighborhood Connector:** Staff recommends that the residential connector would be a good idea to continue considering. The applicant can work with City parks for alternative options in conjunction with the neighborhood connector, such as location for public display of art. Staff suggests keeping options open if we find any resistance for improvement from RCOC.
6. **Building Elevations:** Staff suggests applicant consider enhanced elevations.

The current revised plan has made the following minor changes compared to the pre-application plan based on the comments from MPZ meeting.

1. The requested rezoning category has been changed from RM-1 to RM-2 as the requested density exceeds the maximum allowed for RM-1.
2. The number of units has been reduced from 129 to 125 to address staff's comments about the distance between buildings.
3. The applicant offered to provide a key neighborhood pedestrian connection for the development and the adjacent developments out to Novi Road as a public benefit. This is no longer being offered based on the discussion with Churchill home Owners Association.
4. A central pocket park and a pedestrian walk running east west have been eliminated from the courtyard as the proposed buildings have been realigned to meet the building separation requirements, thus reducing the depth of the courtyard.
5. The list of public benefits has been modified.
6. Additional narrative is provided by CIB Planning evaluating the appropriateness of the proposed rezoning request. See attached report.

Staff's Comment: The revised plans did not address staff's follow up comments after MPZ meeting on reduction of density, usable open space or building elevations.

PRO Option

The PRO option creates a "floating district" with a conceptual plan attached to the rezoning of a parcel. As part of the PRO, the underlying zoning is proposed to be changed (in this case from OS-1 to RM-2) and the applicant enters into a PRO agreement with the City, whereby the City and the applicant agree to tentative approval of a conceptual plan for development of the site. Following final approval of the PRO concept plan and PRO agreement, the applicant will submit for Preliminary and Final Site Plan approval under standard site plan review procedures. The PRO runs with the land, so future owners, successors, or assignees are bound by the terms of the agreement,

absent modification by the City of Novi. If the development has not begun within two (2) years, the rezoning and PRO concept plan expires and the agreement becomes void.

RECOMMENDATION

The new rezoning category requested by the applicant is currently not supported by the Future Land Use Map. Approval of the ***PRO Concept plan is currently not recommended for approval*** for the reasons stated below (which are further expanded in the letter):

1. **Limit the density under maximum allowed in RM-1:** RM-2 is intended to meet the residential needs of persons desiring the apartment type of accommodation with central services in a midrise configuration. The applicant is proposing low-rise attached townhome buildings with a maximum density of 6.4 dwelling units per acre (maximum density allowed with RM-2 is 15.6 DUA). Staff recommends to limit the density within the maximum allowed for RM-1(5.4 DUA) as RM-1 would be more appropriate zoning district based on the style of proposed housing and other reasons stated below.

2. **Change the proposed rezoning to RM-1:** The applicant is proposing a recommended housing product (catering to millennials) in a location not recommended by the current or draft update to the Master Plan. Current residential land use patterns across adjoining sections of land indicate a gradual transition from one residential zoning to another based on density hierarchy. The proposed rezoning category bypasses two density ranges in making the shift from single family residential (R-4) to high density multi-family residential (RM-2). This does not follow the existing land use patterns.

3. **Compatibility with the Surroundings:** Existing land use patterns indicate a concentration of commercial and industrial uses along Novi Road. RM-1 would be compatible with the low intensity office/retail development along Novi Road and creates a zone of transition from the nonresidential districts and major thoroughfares to the existing Single-Family development (to west) as intended in our Zoning Ordinance. RM-1 will also fit the attached townhome style buildings the applicant is proposing.

4. **Proximity and Connectivity to Town Center:** The proposed use, even though not supported by Master Plan is partly justified by the proximity to the Town Center**.** The applicant has proposed pedestrian enhancements along Novi Road to encourage pedestrian connectivity from the residential development to Novi Town Center. Further information should be provided to reinforce the pedestrian connectivity. The applicant should initiate discussions with Oakland County Road Commission, who has the jurisdiction over Novi Road Right of Way to understand the extent of enhancements that can be approved. Without a proper visual and pedestrian connection to Town Center, the development would be incompatible with the surrounding existing uses along Novi Road. The applicant can reconsider proposing a mixed use development to maintain the office uses along Novi Road as staff initially suggested.

5. **Design and Layout Concerns:** The proposed layout plans a dense development in order to maximize the number of units on site. This results in areas that may be considered unsafe for residents and traffic, reduced opportunities for usable open space, and higher density. The applicant can revise the layout to address the following concerns, which may result in a low density residential development that will be compatible with the surroundings.
    a. The rear patios of units, abutting the wetland and especially the two proposed detention ponds, are located too close to the detention slopes.
    b. The driveways near and in between the paved eyebrows on the west end may create unsafe traffic movements.
    c. The distance between the buildings on either side of the driveway was revised to address staff's comments. This resulted in meeting the separation requirement, but

resulted in narrow courtyard and elimination of a pocket park and a significant internal pathway in the central open space.

d. Additional buffers can be provided between the residents and the existing post office.
e. Additional spaces can be provided for resident's active and passive recreation in addition to the required sidewalks.
f. The elimination of pathway connection to the northern parcel eliminates the opportunity for inter parcel connectivity.

6. **Reconsider public benefits**: Staff recommends that the applicant reevaluate and reconsider the public benefits being offered to meet the objective of the Community benefit. Most of the benefits offered by the applicant are considered incidental benefits from the development. There is opportunity to provide more substantial benefits that would serve the purpose of this PRO requirement. Refer to additional notes on Page 11.

7. **Address Traffic and Engineering Concerns:** The proposed site entry is aligned with the existing Michigan CAT entrance. Traffic is concerned as how proposed signal timing and other optimization changes listed in the Traffic Study will affect the intersection of the existing CAT driveway and site driveway along Novi Road. The proposed density may require additional contractual sewer capacity downstream of Eight Mile Road as the proposed density results in higher sanitary sewer discharge.

COMPARISON OF ZONING DISTRICTS

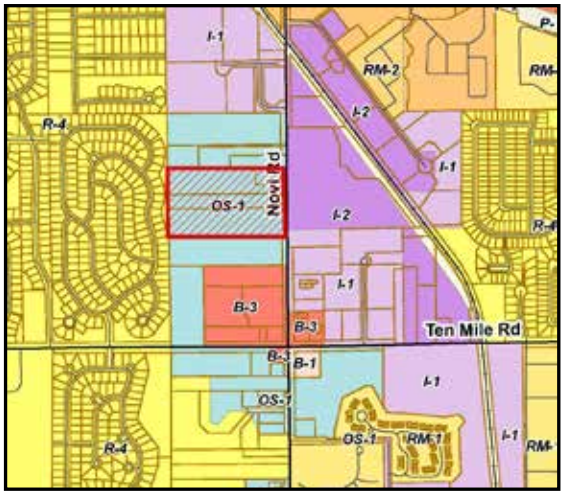
The following table provides a comparison of the current (OS-1) and proposed (RM-2) zoning classifications. The applicant is requesting a change of use from Office Service uses to High Density Multi-Family Residential. The types of uses proposed in these two districts are entirely different from each other. The proposed use has higher setback and open space requirements than the existing zoning.

	OS-1 Zoning (Existing)	RM-2 Zoning (Proposed)
Principal Permitted Uses	See attached copy of Section 3.1.21.B	See attached copy of Section 3.1.8.B Multi-Family Development, as proposed, is a permitted use
Special Land Uses	See attached copy of Section 3.1.21.C	See attached copy of Section 3.1.8.C
Minimum Lot Size	Except where otherwise provided in this Ordinance, the minimum lot area and width, and the maximum percent of lot coverage shall be determined on the basis of off-street parking, loading, greenbelt screening, yard setback or usable open space requirements as set forth in this Ordinance.	Subject to Sec. 3.8.1 (Reviewed in the attached Plan Review Chart)
Maximum Lot Coverage		45%
Building Height	30 feet	5 stories -or- 65 feet whichever is less
Building Setbacks	Front: 20 feet Side: 15 feet Rear: 20 feet	Front: 75 ft. Side: 75 ft. Rear: 75 ft.
Usable Open Space	Not Applicable	200 sq. ft. Minimum usable open space per dwelling unit
Minimum Square Footage	Not Applicable	One bedroom unit: 500 sq ft Two bedroom unit: 750 sq ft. Three bedroom unit: 900 sq ft. Four bedroom unit 1,000 sq ft. Efficiency unit: 400 sq ft.

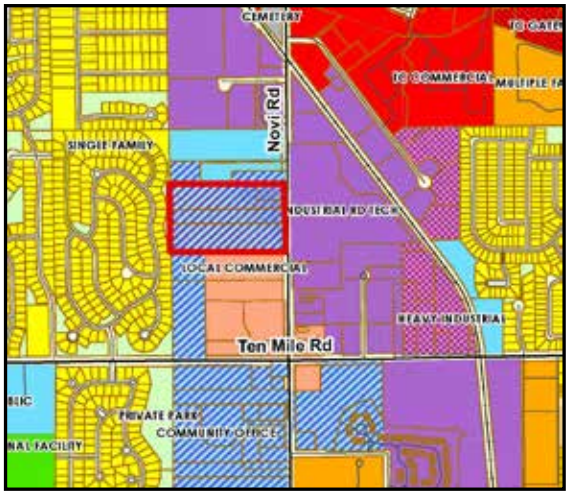
COMPATIBILITY WITH SURROUNDING LAND USE

The surrounding land uses are shown in the above chart. The compatibility of the proposed rezoning with the zoning and uses on the adjacent properties should be considered by the Planning Commission in making the recommendation to City Council on the rezoning request. The following table summarizes the zoning and land use status for the subject property and surrounding properties.

	Existing Zoning	Existing Land Use	Master Plan Land Use Designation
Subject Property	OS-1 Office Service	Vehicle storage lot (legal non-conforming use)	Community Office (uses consistent with OS-1 Zoning District)
Eastern Parcels (across Novi Road)	I-2 General Industrial	Industrial/Research Office	Industrial Research Development and Technology (uses consistent with I-1 Zoning District)
Western Parcels	R-4 One Family Residential	Churchill Crossing (Single family residential development)	Single Family Residential (uses consistent with R Zoning Districts)
Northern Parcels	OS-1 Office Service	Postal Office/vacant	Community Office (uses consistent with OS-1 Zoning District)
Southern Parcels	OS-1 Office Service	Vacant	Local Commercial (uses consistent with B-1 and B-2 Zoning Districts)



Existing Zoning



Future Land Use

The subject parcel is currently zoned OS-1 (Office Service) and is being used as vehicle storage lot as a long standing legal non-conforming use.

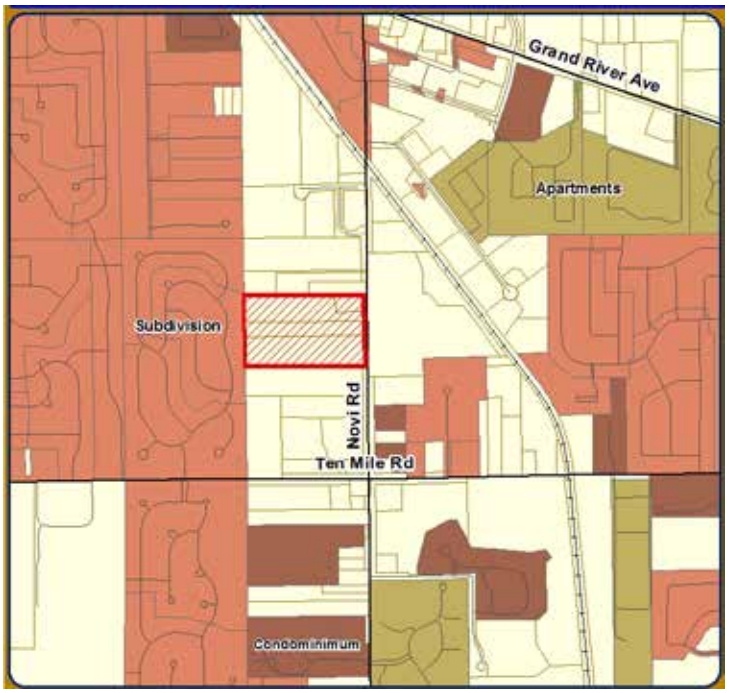
The United States postal service is located on the property directly **north** of the subject property. The other property abutting on north is owned by the City. The remaining property has an existing wireless tower located. The future uses for this property are very unlikely to change.

The property on the **south** is currently vacant and can be developed with existing allowed office uses or rezoned to master planned commercial uses.

The property to the **west** of the subject property is an existing single family development. The applicant has indicated that they have approached the Home owners association and have received favorable responses for the proposed rezoning proposal.

To the **east** across Novi are developed as Industrial/office uses**.**

The image to the right indicates the type of residential development within the vicinity of subject property. A PRO was approved (Ridgeview Villas) on the southeast corner of Ten Mile and Novi Road. This was rezoned from OS-1 to RM-1. The proposed rezoning would be a big shift in terms of density from single family residential to high density residential.



Impacts to the surrounding properties as a result of the proposal would be expected as part of the development of any development on the subject property and could include construction noise and additional traffic. The loss of woodland area on the property would present an aesthetic change but that would also happen with development under the current zoning.

Existing land use patterns indicate a concentration of commercial and industrial uses along Grand River Avenue, Novi Road, Twelve Mile and I-96 corridor. The properties to the north and south are currently vacant. North property is owned by the City and is zoned and master planned for office use. Southern property is zoned for office and master planned for commercial. This opens up a possibility for variety of retail and service uses that could abut the proposed residential use. It could range from a low intensity use such as office to high intensity use such as a hotel or a theater. Compatibility of a residential use with future uses can be ambiguous. The applicant has provided letters from real estate agents to justify their argument that the subject property is best suited for residential development as opposed to commercial. However, the applicant can reconsider proposing a mixed use development to maintain the office uses along Novi Road as staff initially suggested.

DEVELOPMENT POTENTIAL AND DENSITY PROPOSED

The land is currently used as vehicle storage lot, which is a long standing legal non-conforming use. The site plan proposes a development of 125 units with 6.4 DUA for high density multifamily development which is below the maximum density allowed for three bedroom units under RM-2 zoning (15.6 DUA allowed, 6.4 DUA proposed). The master plan designation expects the subject property to be developed as small and medium scale offices. Development under the current OS-1 could result in the construction of a substantial amount of office space. Development under the proposed RM-2 zoning without a PRO option could result in as many as 302 three bedroom units or 401 two bedroom units, based on net acreage provided. Up to 33% of the units are permitted to be one bedroom which would result in additional density on the site.

As is evident, the existing, proposed and anticipated uses are much different from each other. The Master Plan for Land Use does not anticipate residential uses of this property, so no density

guidelines are provided on the plan. Staff analyzed the impacts of the proposed rezoning in the following sections.

The applicant submitted a narrative from CIB planning that assesses and supports the applicant's request for change of use. Staff notes that the market assessment from the current draft update to Master plan indicate that an increasing share of the City's residents and larger market want a different housing pattern. However, staff suggests the applicant consider the comments made under recommendation to make the proposed development more compatible with the surroundings.

REVIEW CONCERNS

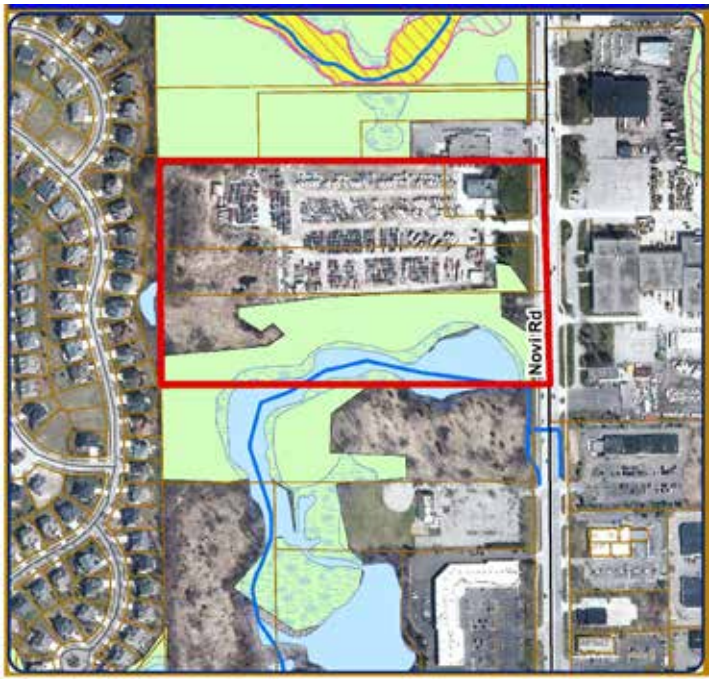
Engineering: An initial engineering review was done as part of the rezoning with PRO application to analyze the information that has been provided thus far. The development will contain private roads and is also proposed to be served by public sewer and water located within the Novi Road right-of-way. Per Engineering review, the existing OS-1 land use for this site is considered equivalent of 2.4 DUA. The proposed rezoning is adding more density for the subject property (6.4DUA) which would create additional impact than anticipated. Based on preliminary analysis, City anticipates no additional improvements to existing utilities infrastructure to accommodate the proposed density. A full scale engineering review would take place during the course of the Site Plan Review process for any development proposed on the subject property, regardless of the zoning.

Traffic: The City's traffic consultant has reviewed the **Rezoning Traffic Impact Study** and notes that additional information is required to determine the impacts of the proposed rezoning as compared to existing land use. Additional improvements along Novi road are warranted. The review states that there were no background developments identified near the study area. The applicant should consider revising the study with the possible development within the vacant southern parcel or future residential developments existing onto Novi Road. Refer to the traffic review letter for additional information.

Non-Motorized Improvements: The developer is proposing to contribute funds in the amount of $90,000 for the City to apply to the enhancement of the pedestrian experience along Novi Road to the Downtown Area, subject to RCOC approval. City of Novi Non-motorized plan planned for an off-road neighborhood connector to the north of the property through the City property connecting the sidewalks along Novi road to the existing single family subdivision on the west of the subject property. Initially, the applicant indicated that they would work with the City to provide this connector. However, it is no longer proposed with the revision as a result of resistance from the neighboring subdivision. Staff recommends keeping the option open as an alternative.

Woodlands: The southern one-third (approximately) of the proposed site contains areas noted as City Regulated Wetlands and City Regulated Woodlands and is currently undeveloped. The Woodland Review letter indicates that about 20 percent of the regulated woodland trees on the site are proposed to be removed, while 80 percent of the regulated woodland trees are proposed to be preserved. The applicant is proposing to provide all required 88 replacements on site and installed in conservation easement. The letter notes that the "upsizing" of Woodland Replacement trees for additional Woodland Replacement credit is not supported by the City of Novi.

Wetlands: The site contains wetlands along the southern property line. The Concept plan is proposing a total of 0.09-acre permanent wetland impacts a total permanent wetland buffer impact of 3.36-acre. The City's threshold for the requirement of wetland mitigation is 0.25-acre of proposed wetland impact. Please refer to the wetland review letter for additional information.



Open Space: The site plan indicates preserving 9.8 acres (50%) of open space excluding wetlands and storm water detention.

Usable Open Space: The usable open spaces are supposed to be designed and intended for the private recreational use of residents of the building. They should be directly accessible by means of common passageway. The layout indicates three pocket parks spread around the development along pedestrian paths, pergola and other amenities near proposed detention ponds and a play scape area. The detail indicated includes all the open space along the southern property line. There is no accessible path to this area. The applicant should provide accurate usable open space calculations that meet the criteria.

MASTER PLAN FOR LAND USE

The Future Land Use Map of the 2010 City of Novi Master Plan for Land Use identifies this property and all surrounding land as Community Office. A part of the northern boundary of the subject property adjoins a property master planned for Public Use.

The proposal would partly follow objectives listed in the Master Plan for Land Use including the following. If additional information is provided per staff's comments, the proposal would have the ability to meet the full intent of the objectives

1. **Infrastructure**
   a. Objective: Continue to strive toward making the City of Novi a more bikeable and more walkable community.

Staff Comment: The proposed concept plan indicates pedestrian improvements along Novi Road.

2. **Land Use**
   a. Objective: Maintain Novi's reputation as an attractive community in which to live
   b. Objective: Maintain structurally safe, attractive housing
   c. Objective: Maintain safe neighborhoods

Staff Comment: In their narrative, the applicant indicates that their developments are usually attractive. However, since enhanced elevations are not proposed as one of the proposed public benefits, the proposed development will be required to meet just the minimum requirements of any permitted use. It will not be subject to higher standards for attractive housing.

   d. Objective: Attract new residents to the City by providing a full range of quality housing opportunities that meet the housing needs of all demographic groups including but not limited to singles, couples, first time home buyers, families and the elderly.

Staff Comment: Per applicant's response letter, the proposal is geared towards young families such as millennials to address their low maintenance needs.

3. Community Character

a. Objective: Encourage residential developments that promote healthy lifestyles.
b. Objective: Encourage the use of functional open space in new residential developments.
c. Objective: Create gathering places for residents and community activity.

Staff Comment: The development proposes multiple opportunities for active and passive recreation through the use of play space, pedestrian walks and pocket parks. Refer to comments on 'Usable Open Space' in the letter. There is opportunity to provide more amenities to meet this objective.

4. Environmental/ Open Space

a. Objective: Encourage developers to utilize development options currently available through Novi Zoning Ordinance to preserve natural features
b. Objective: Protect and maintain open space throughout the community.

Staff Comment: A majority of site is preserved in Open space. Over 99.5% of wetlands are preserved and only 20 % of woodlands are proposed to be removed.

MAJOR CONDITIONS OF PLANNED REZONING OVERLAY AGREEMENT

The Planned Rezoning Overlay process involves a PRO concept plan and specific PRO conditions in conjunction with a rezoning request. The submittal requirements and the process are codified under the PRO ordinance (Section 7.13.2). Within the process, which is completely voluntary by the applicant, the applicant and City Council can agree on a series of conditions to be included as part of the approval.

The applicant is required to submit a conceptual plan and a list of terms that they are willing to include with the PRO agreement. The applicant has submitted a conceptual plan showing the general layout of the internal roads and lots, location of proposed detention ponds, location of proposed open space and preserved natural features and a general layout of landscaping throughout the development. The applicant has provided a narrative describing the proposed public benefits. At this time, staff can identify three conditions to be included in the agreement.

1. Maximum number of units shall be 125
2. The development will have only three bedroom units
3. Maximum Density of the development shall be 6.4 DUA

Staff Comment: Additional conditions will be determined as we move forward. While reconsidering the rezoning category requested, the applicant is suggested to provide additional comments that may be included in the agreement.

ORDINANCE DEVIATIONS

Section 7.13.2.D.i.c(2) permits deviations from the strict interpretation of the Zoning Ordinance within a PRO agreement. These deviations must be accompanied by a finding by City Council that "*each Zoning Ordinance provision sought to be deviated would, if the deviation were not granted, prohibit an enhancement of the development that would be in the public interest, and that approving the deviation would be consistent with the Master Plan and compatible with the surrounding areas*." Such deviations must be considered by City Council, who will make a finding of whether to include those deviations in a proposed PRO agreement. The proposed PRO agreement would be considered by City Council after tentative approval of the proposed concept plan and rezoning.

The concept plan submitted with an application for a rezoning with a PRO is not required to contain the same level of detail as a preliminary site plan. Staff has reviewed the concept plan in as much detail as possible to determine what deviations from the Zoning Ordinance are currently

shown. The applicant may choose to revise the concept plan to better comply with the standards of the Zoning Ordinance, or may proceed with the plan as submitted with the understanding that those deviations would have to be approved by City Council in a proposed PRO agreement. The following are deviations from the Zoning Ordinance and other applicable ordinances shown on the concept plan. The applicant has submitted a narrative describing the requested deviations. **The applicant should consider submitting supplemental material discussing how if each deviation *"...were not granted, [it would] prohibit an enhancement of the development that would be in the public interest, and that approving the deviation would be consistent with the Master Plan and compatible with the surrounding areas*."**

1. Planning Deviations:
    a. Reduction of the minimum required building side setback by 35 feet (Required 75 feet, provided 40 feet)
    b. Exceeding the maximum number of rooms (423 allowed, 500 provided)
    c. Not meeting the minimum orientation for all buildings (45 degrees required, varied angles provided)
    d. Reduction of minimum required sidewalk width for bike parking (6 feet required, 5 feet provided)
2. Engineering DCS Deviations:
    a. Exceeding the maximum allowed distance of 1,300 feet for intervals between streets to the property boundary.
    b. Reducing the distance between the sidewalk and back of the curb. A minimum of 7.5 feet can be supported by staff
3. Traffic Deviations: **The applicant indicated that they will revise the plans to meet the Traffic code.**
    a. Exceeding the maximum length of the boulevard
    b. Absence of exiting taper out of the development
4. Landscape Deviations:
    a. Placement of street trees along Novi Road frontage, contingent on RCOC approval
    b. Not meeting the minimum height of landscape berm along North boundary
    c. Lack of berms along south property
    d. Lack of berms within Novi Road green belt
    e. Not meeting the minimum requirements for detention plantings
    f. Requesting additional woodland replacement credits for upsizing
    g. Proposing sub canopy trees in lieu of some of the required Deciduous Canopy of Large evergreen trees.
5. Façade Deviations:
    Façade was unable to perform a complete review due to minimal information provided. Façade anticipates many deviations that may be required. The applicant shall provide additional information, if the deviations are requested as part of the PRO agreement or conform to the code at the time of site plan review. Refer to additional comments for the proposed public benefits.

Staff Comment: Refer to other review letters for more details on additional information being requested. Further deviations may be identified once more clarification is provided.

APPLICANT BURDEN UNDER PRO ORDINANCE

The Planned Rezoning Overlay ordinance requires the applicant to demonstrate that certain requirements and standards are met. The applicant should be prepared to discuss these items, especially in number 1 below, where the ordinance suggests that the enhancement under the PRO request would be unlikely to be achieved or would not be assured without utilizing the Planned Rezoning Overlay. Section 7.13.2.D.ii states the following:

1. *(Sec. 7.13.2.D.ii.a) Approval of the application shall accomplish, among other things, and as determined in the discretion of the City Council, the integration of the proposed land development project with the characteristics of the project area, and result in an enhancement of the project area as compared to the existing zoning, and such enhancement would be unlikely to be achieved or would not be assured in the absence of the use of a Planned Rezoning Overlay.*

2. *(Sec. 7.13.2.D.ii.b) Sufficient conditions shall be included on and in the PRO Plan and PRO Agreement on the basis of which the City Council concludes, in its discretion, that, as compared to the existing zoning and considering the site specific land use proposed by the applicant, it would be in the public interest to grant the Rezoning with Planned Rezoning Overlay; provided, in determining whether approval of a proposed application would be in the public interest, the benefits which would reasonably be expected to accrue from the proposal shall be balanced against, and be found to clearly outweigh the reasonably foreseeable detriments thereof, taking into consideration reasonably accepted planning, engineering, environmental and other principles, as presented to the City Council, following recommendation by the Planning Commission, and also taking into consideration the special knowledge and understanding of the City by the City Council and Planning Commission.*

PUBLIC BENEFIT UNDER PRO ORDINANCE

Section 7.13.2.D.ii states that the City Council must determine that the proposed PRO rezoning would be in the public interest and the public benefits of the proposed PRO rezoning would clearly outweigh the detriments. The following benefits are being offered by the applicant (as listed in their narrative)

The following are the benefits provided with the original concept plan that remain:

1. *Redevelopment Potential of Property*: Removal of unsightly vehicular storage and improvement to storm water treatment and storage. The current parking lot drains direct to the south waterbody. **There is a redevelopment potential for the property even if the property is developed according to existing zoning, but perhaps not as likely. The benefit of removing a long standing legal non-conforming use can be considered as a public benefit.**

2. *Increased Buffers to West:* The development proposes an approximately 160 feet setback to the nearest residential unit to the west and natural wetlands and trees along the property line are being preserved to the greatest extent possible. **Staff acknowledges that the location of detention creates a good buffer along Novi frontage. However, the options for relocation of the pond within the development are considered to be limited, without compromising the requested density. The current proposed location also considered as the optimal location given the grades on the site.**

3. *Strategic Residential Location:* The development is located within walkable distance to the south of the Grand River Corridor and within proximity to Town Center District. **The proximity of the Grand River Corridor and Town Center District subjects the site to more scrutiny as these areas are prone to generating more traffic. Pedestrian enhancements would further justify the location, but they are subject to RCOC's approval.**

4. *Providing Alternative Housing:* The product proposed with the development will fit the low-maintenance needs of age groups at the younger end of the spectrum, including

millennials and young families. **Staff agrees that there is a need for the proposed type of housing within the City.**

5. *Preservation of natural features:* The proposed development layout has been modified to preserve the on-site wetlands to the south and west of the site in additional to preserving the higher quality woodland areas and limited disturbance to the steep slopes of the south. In particular, special attention was provided to saving the only higher quality trees located on the south west corner of the site. **Any additional impact to the existing wetlands would trigger the mitigation requirements and would decrease the land available for development. The proposed site plan maximizes the development within the site. This is not considered as a public benefit. This happens to be an incidental benefit.**

6. *Site Amenities:* The development proposes a number of community pocket parks, a play scape area, and public gathering spaces with a scenic overlook to the existing on-site wetlands. These amenities will provide opportunities for social and passive recreation interaction at these pedestrian nodes. **The applicant has responded to staff's request and provided better amenities as part of the development. This can be considered public benefit. Revised site plan eliminated a long walk running east-west in the central courtyard along with a central pocket park. Applicant is recommended to consider adding more usable open spaces for the benefit of the residents.**

The following are the benefits added with the revised concept plan after the Master Planning and Zoning Committee meeting

7. *Adding Residential Density to the Downtown area:* The proposed development will add meaningful residential density in walking and biking distance to the Novi Downtown district, which will further work to the success of the growing and emerging downtown. **Staff maintains that the proposed density is not compatible with the surroundings for reasons listed in Page 3 under Recommendation. Staff does not consider this as a public benefit**.

8. *Pedestrian Enhancement on Novi Road:* The developer is proposing to contribute funds in the amount of $90,000 for the City to apply to the enhancement of the pedestrian experience along Novi Road to the Downtown Area. The Design team will discuss the appropriate enhancements to the pedestrian corridor of Novi Road, and coordinate city and client improvements with the RCOC offices, as appropriate. **The applicant should start the initial discussion with RCOC prior to the PRO Concept approval to assess the extent of enhancements. The applicant should provide alternate options if the RCOC limits the possibility of enhancements.**

The following are the benefits removed with the revised concept plan after the Master Planning and Zoning Committee meeting

9. *Neighborhood Connector: The developer proposed to coordinate and work with the City to provide a key neighborhood pedestrian connection for the development and the adjacent developments out to Novi Road. This connector is part the City's non-motorized transportation Master Plan.* **Staff recommends working towards providing alternate options for future neighborhood connections.**

SUMMARY OF OTHER REVIEWS:

Planning, Engineering, Landscape and Fire updated their reviews based on the revised plans. Comments from original Woodlands, Wetlands, Traffic and Façade reviews still apply.

a. Engineering Review (dated 04-25-17): Few deviations are identified in the letter. Additional comments to be addressed with revised concept plan submittal. Engineering is **recommending** approval.
b. Landscape Review: Landscape review has identified deviations that may be required. Staff supports only a few. Refer to review letter for more comments. Landscape recommends approval.
c. Wetland Review (dated 02-28-17): A City of Novi Wetland Minor Use Permit and an authorization to encroach into 25 foot buffer setback are required for this site plan at the time of Preliminary Site Plan review. Additional comments to be addressed with revised Site Plan submittal. Wetlands recommend approval.
d. Woodland Review (dated 02-28-17): A City of Novi woodland permit is required for the proposed plan at the time of Preliminary Site Plan review. Additional comments to be addressed with revised Concept Plan submittal. Woodland is recommending approval.
e. Traffic Review (dated 03-03-17): Few deviations are identified in the letter. Additional Comments to be addressed with the revised concept submittal. Traffic recommends approval.
f. Traffic Impact Study Review (dated 03-03-17): The applicant is required to provide additional information as listed on the review letter.
g. Facade Review (dated 02-29-17): Façade review is not required for Concept PRO plan unless the applicant wants to demonstrate that the buildings will be an enhancement, which would be unlikely to be achieved if it were not a Planned Rezoning Overlay. Applicant did not indicate any additional enhancement to the building elevations. Staff recommends that the applicant reconsider given the prime location of the proposed development.
h. Fire Review (dated 04-12-17): Additional Comments to be addressed with revised concept plan submittal. Fire recommends approval

NEXT STEP: PLANNING COMMISSION

Planning is currently not recommending approval for reasons stated in page 3. However, upon applicant's request the Site Plan is scheduled to go before Planning Commission for public hearing on May 10, 2017. Please provide the following **no later than 9:00am, May 03, 2017** if you wish to keep the schedule.

Original Site plan submittal in PDF format. **NO CHANGES MADE**

1. A response letter addressing ALL the comments from ALL the review letters and **a request for waivers as you see fit.**
2. A color rendering of the Site Plan, if any.

If the applicant has any questions concerning the above review or the process in general, do not hesitate to contact me at 248.735.5607 or skomaragiri@cityofnovi.org.

Sri Ravali Komaragiri – Planner

Attachments: Planning Review Chart
Section 3.1.8.B – RM-2 Permitted Uses
Section 3.1.8.C - RM-2 Special Land Uses
Section 3.1.21.B – OS-1 Permitted Uses
Section 3.1.21.C – OS-1 Special Land Uses

PLANNING REVIEW CHART

Review Date: April 18, 2017
Review Type: Planner Rezoning Overlay Concept Plan: 1st Revisison
Project Name: JSP 17-10 Princeton Park (18.717)
Plan Date: April 03, 2017
Prepared by: Sri Komaragiri, Planner
E-mail: skomaragiri@cityofnovi.org; **Phone:** (248) 735-5607

Items in **Bold** need to be addressed by the applicant and/or the Planning Commission Public hearing for the PRO Concept Plan. Underlined items need to be addressed on the Preliminary Site Plan.

tem	Required Code	Proposed	Meets Code	Comments
Zoning and Use Requirements				
Master Plan *(adopted August 25, 2010)*	Community Office	125 Unit residential development with PRO overlay; The proposed units will be "for sale" 6.4 maximum dwelling units per acre (Three Bedrooms)	No	**Planning Commission recommendation & City Council approval PRO Concept Plan – City Council approval PRO agreement – Site Plan or Plat normal approval process**
Area Study	The site does not fall under any special category	NA	NA	
Zoning *(Effective December 25, 2013)*	OS-1 Office Service	RM-2 High Density Multi-Residential District	No	
Uses Permitted (Sec 3.1.21.B & C)	Office and Service Uses Sec. 3.1.21.B. - Principal Uses Permitted. Sec. 3.1.21.C. – Special Land Uses Permitted.	Multi-Family Residential	No	**The proposed rezoning category would allow Multi-family uses**
Phasing		In the response letter, the applicant indicated two phases	Yes	**Show phase lines on the concept plan and add notes in this regard on the plan as well**
Planned Rezoning Overlay Document Requirements (SDM: *Site development Manual*)				
Written Statement *(Site Development Manual)* *The statement should describe the following*	Potential development under the proposed zoning and current zoning	Information not provided	No	**Refer to review letter for staff determination of potential development**
	Identified benefit(s) of the development	Public benefits are identified in the narrative	Yes?	**Refer to review letter for staff comments on the proposed benefits**
	Conditions proposed for inclusion in the PRO Agreement (i.e., Zoning Ordinance deviations, limitation on total units, etc)	Zoning deviations are listed in the narrative, but not the conditions	Yes?	**Refer to review letter for Staff suggestions for conditions and list of deviations**
Sign Location Plan *(Page 23,SDM)*	Installed within 15 days prior to public hearing	Signs are installed at the site	Yes	

tem	Required Code	Proposed	Meets Code	Comments
	Located along all road frontages			
Traffic Impact Study *(Site development manual)*	A Traffic Impact Study as required by the City of Novi Site Plan and Development Manual.	Applicant submitted a Traffic Impact Study	Yes	Refer to Traffic Impact Study Review
Community Impact Statement *(Sec. 2.2)*	- Over 30 acres for permitted non-residential projects - Over 10 acres in size for a special land use - All residential projects with more than 150 units - A mixed-use development, staff shall determine	Not required	NA	
The remainder of the review is against RM-2 standards, which is the requested rezoning district				
Height, bulk, density and area limitations *(Sec 3.1.8.D)*				
Frontage on a Public Street. *(Sec. 5.12)*	Frontage on a Public Street is required	The site has frontage and access to Novi Road	Yes	
Minimum Zoning Lot Size for each Unit: in Acres *(Sec 3.8.1)*	RM-1 and RM-2 Required Conditions			
Minimum Zoning Lot Size for each Unit: Width in Feet *(Sec 3.8.1)*				
Open Space Area *(Sec 3.1.8.D)*	200 sf of Minimum usable open space per dwelling unit For a total of 125 dwelling units, <u>required Open Space: 25,000 SF</u>	Open Space area indicated on sheet LS-3 The layout indicates three pocket parks spread around the development along pedestrian paths, pergola and other amenities near proposed detention ponds and a play scape area. The detail indicated includes all the open space along the southern property line. There is no accessible path to this area. This should be excluded. Only spaces that meet	Yes?	**Refer to definition of usable open space. The usable open spaces are supposed to be designed and intended for the private recreational use of residents of the building. They should be directly accessible by means of common passageway.** **In addition, the southern area abuts regulated wetlands and has steep slopes and cannot be used for common recreation.** **Revise the open space calculations and exhibit accordingly**

tem	Required Code		Proposed	Meets Code	Comments
			the definition in Article 2 such as balconies, courtyard, play areas. The pathway running east to west in the central courtyard is eliminated thus eliminating the interconnectivity between pocket parks.		
Maximum % of Lot Area Covered (By All Buildings)	*45%*		18 %	Yes	
Building Height *(Sec. 3.20)*	65 ft. or 5 stories whichever is less		2 stories and 32 feet	Yes	
Minimum Floor Area per Unit *(Sec. 3.1.8.D)*	Efficiency	400 sq. ft.	Not proposed	NA	
	1 bedroom	500 sq. ft.	Not proposed	NA	
	2 bedroom	750 sq. ft.	Not proposed	Yes	
	3 bedroom	900 sq. ft.	1,860 sq. ft.	Yes	
	4 bedroom	1,000 sq. ft.	Not Proposed	NA	
Maximum Dwelling Unit Density/Net Site Area *(Sec. 3.1.8.D)*	Efficiency	Max 10%	Not proposed	Yes	**The proposed density should be a condition of PRO agreement**
	1 bedroom	31.1 Max 33%	Not proposed		
	2 bedroom	20.7	Not proposed		
	3+ bedroom	15.8	6.4 DUA Total site area: 24 Acres ROW Area: 3.5 Acres Wetlands: 1.1 Acres Net Site Area: 19.4 Acres		
Residential Building Setbacks *(Sec 3.1.8.D)*					
Front (along Novi Road)	75 ft.		147 ft.	yes	**Indicate setbacks excluding decks.** **North setback is considered a deviation**
Rear (West)	75 ft.		82 ft.	Yes	
Side (North & South)	75 ft.		North: 40 ft. South: 127 ft. (including decks)	No	
Parking Setback *(Sec 3.1.8.D) (Sec 3.1.12.D)Refer to applicable notes in Sec 3.6.2*					
Front	20 ft.		20 ft. on all sides. Parking is provided in the garage and in front of the garage.	Yes	
Rear	10 ft.			Yes	
Side	10 ft.			Yes	
Note To District Standards *(Sec 3.6.2)*					
Exterior Side Yard Abutting a Street *(Sec 3.6.2.C)*	All exterior side yards abutting a street shall be provided with a setback equal to front		No exterior side yards	NA	

tem	Required Code		Proposed	Meets Code	Comments
	yard.				
Off-Street Parking in Front Yard *(Sec 3.6.2.E)*	Off-street parking is allowed in front yard		Parking is not proposed in the front yard	NA	
Distance between buildings *(Sec 3.6.2.H)*	It is governed by sec. 3.8.2 or by the minimum setback requirements, whichever is greater		RM-2 code has additional requirements for distance between buildings.	Yes	**See Comments on Page 8**
Wetland/Watercourse Setback *(Sec 3.6.2.M)*	A setback of 25ft from wetlands and from high watermark course shall be maintained		Wetlands exist on south and west side of the site. minimal impacts are proposed	Yes?	**Check with Pete**
Parking setback screening *(Sec 3.6.2.P)*	Required parking setback area shall be landscaped per sec 5.5.3.		Parking lots are not proposed	NA	
Modification of parking setback requirements *(Sec 3.6.2.Q)*	The Planning Commission may modify parking setback requirements based on its determination according to Sec 3.6.2.Q		None required	NA	
RM-1 and RM-2 Required Conditions *(Sec 3.8)& (Sec 3.10)*					
Total number of rooms *(Sec. 3.8.1)*	Total No. of rooms < Net site area in SF/2000 8,45,064 SF/2000 = 423		Total number of rooms = 500	Yes	**Total proposed number of rooms is exceeding the maximum number of rooms allowed for this property.** **<u>This is considered a deviation</u>**
Public Utilities *(Sec. 3.8.1)*	All public utilities should be available		All public utilities are available	Yes	
Maximum Number of Units *(Sec. 3.8.1.A.ii)*	Efficiency < 5 percent of the units		Not Proposed	NA	
	1 bedroom units < 20 percent of the units		Not Proposed	NA	
	Balance should be at least 2 bedroom units		All are either 3 bedroom units	Yes	
Room Count per Dwelling Unit Size *(Sec. 3.8.1.C)* **An extra room such as den count towards an extra room*	**Dwelling Unit Size**	**Room Count ***		Yes	For the purpose of determining lot area requirements and density in a multiple-family district, a room is a living room, dining room or bedroom, equal to at least eighty (80) square feet in area. A room shall not include the area in kitchen, sanitary facilities,
	Efficiency	1	Not proposed		
	1 bedroom	2	Not proposed		
	2 bedroom	3	Not proposed		
	3 or more bedrooms	4	4 (2 bedroom units with a den are also calculated as 3 or more bedroom units)		

tem	Required Code	Proposed	Meets Code	Comments
				utility provisions, corridors, hallways, and storage. Plans presented showing one (1), two (2), or three (3) bedroom units and including a "den," "library," or other extra room shall count such extra room as a bedroom for the purpose of computing density.
Setback along natural shore line *(Sec. 3.8.2.A)*	A minimum of 150 feet along natural shore line is required.	No natural shore line exists within the property	NA	
Structure frontage *(Sec. 3.8.2.B)*	Each structure in the dwelling group shall front either on a dedicated public street or approved private drive.	All structures front on proposed private drive	Yes	
Maximum length of the buildings *(Sec. 3.8.2.C)*	A single building or a group of attached buildings cannot exceed 180 ft.	144 ft.	Yes	
Modification of maximum length *(Sec. 3.8.2.C)*	Planning Commission may modify the extra length up to 360 ft. if Common areas with a minimum capacity of 50 persons for recreation or social purposes Additional setback of 1 ft. for every 3 ft. in excess of 180 ft. from all property lines.	Applicant is not proposing extra length than allowed	NA	
Building Orientation *(Sec. 3.8.2.D)*	Where any multiple dwelling structure and/ or accessory structure is located along an outer perimeter property line adjacent to another residential or nonresidential district, said structure shall be oriented at a minimum angle of forty-five (45) degrees to said property line.	Buildings orientation do not meet the minimum requirement for all buildings In response letter, the applicant indicated that it is not feasible to meet the requirement, but did not expand on it	No	<u>This is considered a deviation</u> **Please indicate as why it is not feasible to meet the Orientation requirement**
Yard setback restrictions *(Sec. 3.8.2.E)*	Within any front, side or rear yard, off-street parking, maneuvering lanes, service drives or	No off-street parking or loading area is proposed	NA	

tem	Required Code	Proposed	Meets Code	Comments
	loading areas cannot exceed 30% of yard area			
Off-Street Parking or related drives *(Sec. 3.8.2.F)* Off-street parking and related drives shall be..	No closer than 25 ft. to any wall of a dwelling structure that contains openings involving living areas or	A 25 foot setback line is shown on the plans.	**Yes**	
	No closer than 8 ft. for other walls or	Appears to be in conformance	Yes	
	No closer than 20 ft. from ROW and property line	Appears to be in conformance	Yes	
Pedestrian Connectivity *(Sec. 3.8.2.G)*	5 feet sidewalks on both sides of the Private drive are required to permit safe and convenient pedestrian access.	All sidewalks along the private drive are 5 feet wide.	Yes	
	Where feasible sidewalks shall be connected to other pedestrian features abutting the site.	The plan proposed sidewalks on both sides of the streets, a pathway running north south in the central courtyard. There are sidewalk connections from the central sidewalk system to public sidewalks. An additional connection is provided to Novi Road which is also used as an emergency access path.	Yes	The revised plans eliminated the 5 feet meandering path along with the central pocket park in the courtyard. This limits the pedestrian connectivity through open space between pocket parks. **Landscape plans are still referring to Original concept plan with 129 units and previous pedestrian path system**
	All sidewalks shall comply with barrier free design standards	Unable to determine	Yes?	**Add a note to the plan to verify conformance.** Further review by the Building Department will take place prior to issuance of building permits
Minimum Distance between the buildings *(Sec. 3.8.2.H)*	**(**Total length of building A **+** total length of building B **+** 2(height of building **+** height of building B)**)/**6	All distances are in conformance with the requirement as listed on the plan.	**Yes**	
Minimum Distance between the buildings *(Sec. 3.8.2.H)*	In no instance shall this distance be less than thirty (30) feet unless there is a corner-to-corner relationship in which case the minimum distance shall	Buildings are setback by at least 30 ft. from each other	Yes	

tem	Required Code	Proposed	Meets Code	Comments
	be fifteen (15) feet.			
Number of Parking Spaces Residential, Multiple-family *(Sec.5.2.12.A)*	Two (2) for each dwelling unit having two (2) or less bedrooms and two and one-half (2 ½) for each dwelling unit having three (3) or more bedrooms **For 125 Three or more BR units, required spaces = 313 spaces**	Garage Spaces: 250 In front of Garage: 250 **TOTAL PROVIDED: 500** No parking on street	Yes	
Parking Space Dimensions and Maneuvering Lanes *(Sec. 5.3.2)*	- 90° Parking: 9 ft. x 19 ft. - 24 ft. two way drives - 9 ft. x 17 ft. parking spaces allowed along 7 ft. wide interior sidewalks as long as detail indicates a 4" curb at these locations and along landscaping	None Proposed	NA	
Parking stall located adjacent to a parking lot entrance (public or private) *(Sec. 5.3.13)*	- shall not be located closer than twenty-five (25) feet from the street right-of-way (ROW) line, street easement or sidewalk, whichever is closer	Does not apply	NA	
Barrier Free Spaces *Barrier Free Code*	2 accessible space (including 1 Van accessible) for every 26 to 50 spaces	Residential area does not have handicap spaces proposed	NA	
Barrier Free Space Dimensions *Barrier Free Code*	- 8' wide with an 8' wide access aisle for van accessible spaces - 5' wide with a 5' wide access aisle for regular accessible spaces			
Barrier Free Signs *Barrier Free Code*	One sign for each accessible parking space.			
Minimum number of Bicycle Parking *(Sec. 5.16.1)* Multiple-family residential	One (1) space for each five (5) dwelling units **Required: 25 Spaces**	Total Proposed: 28 Spaces See sheet Ls-5	**Yes**	
Bicycle Parking General requirements *(Sec. 5.16)*	No farther than 120 ft. from the entrance being served	Yes	Yes?	**Label the width of the sidewalk** **The width of sidewalk is considered a deviation**
	When 4 or more spaces are required for a building with multiple	Bicycle Parking is		

tem	Required Code	Proposed	Meets Code	Comments
	entrances, the spaces shall be provided in multiple locations Spaces to be paved and the bike rack shall be inverted "U" design Shall be accessible via 6 ft. paved sidewalk	proposed in multiple (7) locations. All sidewalks appear to be 5 feet wide. It is residential development		
Bicycle Parking Lot layout *(Sec 5.16.6)*	Parking space width: 6 ft. One tier width: 10 ft. Two tier width: 16 ft. Maneuvering lane width: 4 ft. Parking space depth: 2 ft. single, 2 ½ ft. double	Locations are indicated, but the layout is not specified	Yes?	**Provide the layout plan as required**
Accessory and Roof top Structures				
Dumpster *Sec 4.19.2.F*	- Located in rear yard - Attached to the building or - No closer than 10 ft. from building if not attached - Not located in parking setback - If no setback, then it cannot be any closer than 10 ft, from property line. - Away from Barrier free Spaces	Curb side Refuse pick up is being proposed for this residential development	Yes	
Dumpster Enclosure *Sec. 21-145. (c) Chapter 21 of City Code of Ordinances*	- Screened from public view - A wall or fence 1 ft. higher than height of refuse bin - And no less than 5 ft. on three sides - Posts or bumpers to protect the screening - Hard surface pad. - Screening Materials: Masonry, wood or evergreen shrubbery	Not proposed	NA	
Roof top equipment and wall mounted utility equipment *Sec. 4.19.2.E.ii*	All roof top equipment must be screened and all wall mounted utility equipment must be enclosed and integrated into the design and color of the building	Not Applicable	NA	

tem	Required Code	Proposed	Meets Code	Comments
Roof top appurtenances screening	Roof top appurtenances shall be screened in accordance with applicable facade regulations, and shall not be visible from any street, road or adjacent property.	Not Applicable	NA	
Sidewalks and Other Requirements				
Non-Motorized Plan	Proposed Off-Road Trails and Neighborhood Connector Pathways. A residential neighborhood connector is indicated on the master plan connecting Novi Road to residential neighborhood to the west	No Connections to the proposed trails are proposed	No	**Refer to Planning review for more details. The applicant should consider the recommended neighborhood connector.**
Sidewalks *(Subdivision Ordinance: Sec. 4.05)*	Sidewalks are required on both sides of proposed drives	Sidewalks are proposed on only both sides of the proposed private drive	Yes	
Public Sidewalks *(Chapter 11, Sec.11-276(b), Subdivision Ordinance: Sec. 4.05)*	A 5 foot sidewalk is required along Novi Road	Sidewalk existing	Yes	
Entryway lighting *Sec. 5.7*	One street light is required per entrance.	Eight pole lights are proposed along Novi Road frontage Decorative pole and acorn style fixtures are proposed	Yes	**Applicant to work with engineering and DTE on the location and type of the fixtures are proposed in the right of way**
Building Code and Other Requirements				
Building Code	Building exits must be connected to sidewalk system or parking lot.	All exits are connected to internal sidewalk through the driveways	Yes	
Design and Construction Standards Manual	Land description, Sidwell number (metes and bounds for acreage parcel, lot number(s), Liber, and page for subdivisions).	Provided	Yes	

tem	Required Code	Proposed	Meets Code	Comments
General layout and dimension of proposed physical improvements	Location of all existing and proposed buildings, proposed building heights, building layouts, (floor area in square feet), location of proposed parking and parking layout, streets and drives, and indicate square footage of pavement area (indicate public or private).	Provided	Yes	
Economic Impact	- Total cost of the proposed building & site improvements - Number of anticipated jobs created (during construction & after building is occupied, if known)	Information will be provided at a later time	NA	
Other Permits and Approvals				
Development/ Business Sign *(City Code Sec 28.3)* *Sign permit applications may be reviewed an part of Preliminary Site Plan or separately for Building Office review.*	The leading edge of the sign structure shall be a minimum of 10 ft. behind the right-of-way. Entranceway shall be a maximum of 24 square feet, measured by completely enclosing all lettering within a geometric shape. Maximum height of the sign shall be 5 ft.	A monument sign is proposed in the entrance boulevard The proposed sign is located 4 ft. from the Novi Road right-of-way. No dimensions are provided for the lettering placed upon the sign structure. The height of the sign complies with the ordinance allowance of 5 ft.	No	**Revise the location to meet the code.** **Provide additional information to identify deviations**
Development and Street Names	Development and street names must be approved by the Street Naming Committee before Preliminary Site Plan approval	All development and street names are approved	Yes	
Property Split	The proposed property split must be submitted to the Assessing Department for approval.	The subject property is proposing a combination of four lots.	Yes	The applicant must create this parcel prior to Stamping Set approval. Plans will not be stamped until the parcel is created.

tem	Required Code	Proposed	Meets Code	Comments
Other Legal Requirements				
PRO Agreement *(Sec. 7.13.2.D(3)*	A PRO Agreement shall be prepared by the City Attorney and the applicant (or designee) and approved by the City Council, and which shall incorporate the PRO Plan and set forth the PRO Conditions and conditions imposed	Not applicable at this moment	NA	PRO Agreement shall be approved by the City Council after the Concept Plan is tentatively approved
Master Deed/Covenants and Restrictions	Applicant is required to submit this information for review with the Final Site Plan submittal	Not applicable at this moment	NA	A Master Deed draft shall be submitted prior to Stamping Set approval.
Conservation easements	Conservation easements may be required for woodland impacts	Not applicable at this moment	NA	The following documents will be required during Site Plan review process after the Concept PRO approval **Check With Pere on Wetland Easement**
Lighting and Photometric Plan (Sec. 5.7)				
Intent *(Sec. 5.7.1)*	Establish appropriate minimum levels, prevent unnecessary glare, reduce spillover onto adjacent properties & reduce unnecessary transmission of light into the night sky	Site lighting includes pole lighting along Novi road and bollard lighting within the site.		**A lighting and photometric plan is not required until Final site plan.**
Lighting Plan *(Sec. 5.7.A.i)*	Site plan showing location of all existing & proposed buildings, landscaping, streets, drives, parking areas & exterior lighting fixtures			
Building Lighting *(Sec. 5.7.2.A.iii)*	Relevant building elevation drawings showing all fixtures, the portions of the walls to be illuminated, illuminance levels of walls and the aiming points of any remote fixtures.			
Lighting Plan *(Sec.5.7.2.A.ii)*	Specifications for all proposed & existing lighting fixtures			
	Photometric data			
	Fixture height			

tem	Required Code	Proposed	Meets Code	Comments
	Mounting & design			
	Glare control devices *(Also see Sec. 5.7.3.D)*			
	Type & color rendition of lamps			
	Hours of operation			
	Photometric plan illustrating all light sources that impact the subject site, including spill-over information from neighboring properties			
Required Conditions *(Sec. 5.7.3.A)*	Height not to exceed maximum height of zoning district (or 25 ft. where adjacent to residential districts or uses)			
Required Conditions *(Sec. 5.7.3.B)*	- Electrical service to light fixtures shall be placed underground - Flashing light shall not be permitted - Only necessary lighting for security purposes & limited operations shall be permitted after a site's hours of operation			
Security Lighting *(Sec. 5.7.3.H)* Lighting for security purposes shall be directed only onto the area to be secured.	- All fixtures shall be located, shielded and aimed at the areas to be secured. - Fixtures mounted on the building and designed to illuminate the facade are preferred			
Required Conditions *(Sec.5.7.3.E)*	Average light level of the surface being lit to the lowest light of the surface being lit shall not exceed 4:1			
Required Conditions *(Sec. 5.7.3.F)*	Use of true color rendering lamps such as metal halide is preferred over high & low pressure sodium lamps			
Min. Illumination *(Sec. 5.7.3.k)*	Parking areas: 0.2 min			
	Loading & unloading areas: 0.4 min			

tem	Required Code	Proposed	Meets Code	Comments
	Walkways: 0.2 min			
	Building entrances, frequent use: 1.0 min			
	Building entrances, infrequent use: 0.2 min			
Max. Illumination adjacent to Non-Residential *(Sec. 5.7.3.K)*	When site abuts a non-residential district, maximum illumination at the property line shall not exceed 1 foot candle			
Cut off Angles *(Sec. 5.7.3.L)*	when adjacent to residential districts - All cut off angles of fixtures must be 90° - maximum illumination at the property line shall not exceed 0.5 foot candle			

NOTES:
1. This table is a working summary chart and not intended to substitute for any Ordinance or City of Novi requirements or standards.
2. The section of the applicable ordinance or standard is indicated in parenthesis. Please refer to those sections in Article 3, 4 and 5 of the zoning ordinance for further details
3. Please include a written response to any points requiring clarification or for any corresponding site plan modifications to the City of Novi Planning Department with future submittals.

3.1.8 RM-2 High Density, Mid-Rise Multiple-Family District

A. INTENT

The RM-2, High Density, Mid-Rise Multiple-Family Residential district is designed to provide for the residential needs of persons desiring the apartment type of accommodation with central services in a mid-rise configuration. It is the intent of the RM-2 districts to provide high density living facilities in areas, or adjacent to areas, of intense commercial or office development. RM-2 districts should be of sufficient size to accommodate necessary recreation, open space, off-street parking and other on-site amenities. The RM-2 district is not intended for isolated residential areas.

User Note: For uses listed in **bold blue**, refer to Article 4, or click on use, for use-specific standards

B. PRINCIPAL PERMITTED USES

i. Multiple-family dwellings
ii. **Accessory buildings and uses** §4.19 customarily incident to any of the above uses

The following uses are regulated according to the standards and regulations in the **RM-1 Low-Density, Low Rise Multiple-Family (Section 3.1.7):**

iii. **Independent and congregate elderly living facilities** § 4.20
iv. **Accessory buildings and uses** §4.19 customarily incident to any of the above uses

The following uses are regulated according to the standards and regulations in the **RT Two-Family Residential District (Section 3.1.6):**

v. Two-family dwellings (site built)
vi. **Shared elderly housing** § 4.20
vii. **Accessory buildings and uses** §4.19 customarily incident to any of the above uses

The following uses are regulated according to the standards and regulations in the **R-4 One Family Residential District (Section 3.1.5):**

viii. One-family detached dwellings
ix. **Farms and greenhouses** § 4.1
x. Publicly owned and operated parks, parkways and outdoor recreational facilities
xi. **Cemeteries** § 4.2
xii. **Home occupations** § 4.4
xiii. **Keeping of horses and ponies** § 4.8
iv. **Family day care homes** § 4.5
v. **Accessory buildings and uses** §4.19 customarily incident to any of the above uses

C. SPECIAL LAND USES

i. **Retail commercial services and office uses** §4.22

3.1.21 OS-1 Office Service District

A. INTENT

The OS-1, Office Service District is designed to accommodate uses such as offices, banks, facilities for human care and personal services which can serve as transitional areas between residential and commercial districts and to provide a transition between major thoroughfares and residential districts.

User Note: For uses listed in **bold blue**, refer to Article 4, or click on use, for use-specific standards

B. PRINCIPAL PERMITTED USES

i. Professional office buildings
ii. Medical office, including laboratories and clinics
iii. **Facilities for human care** §4.64
iv. Financial institution uses with drive-in facilities as an accessory use only
v. Personal service establishments
vi. Off-street parking lots
vii. Places of worship
viii. Other uses similar to the above uses
ix. **Accessory structures and uses** 🕮 §4.19 customarily incident to the above permitted uses
x. Publicly owned and operated parks, parkways and outdoor recreational facilities
xi. **Public or private health and fitness facilities and clubs** §4.34

C. SPECIAL LAND USES

i. **Mortuary establishments** §4.17
ii. Publicly owned buildings, telephone exchange buildings, and public utility🕮 offices, but not including storage yards, transformer stations, or gas regulator stations
iii. **Day Care Centers**🕮 **and Adult Day Care Centers**🕮 §4.12.2
iv. **Public or private indoor and private outdoor recreational facilities** §4.38
v. An **accessory use**🕮 §4.19 customarily related to a use authorized by this Section

ENGINEERING MEMO

MEMORANDUM

TO: BARBARA MCBETH, CITY PLANNER

FROM: DARCY RECHTIEN, STAFF ENGINEER

SUBJECT: REVIEW OF REZONING IMPACT ON PUBLIC UTILITIES
REZONING REQUEST 18.717
PRINCETON PARK

DATE: MAY 5, 2017

In response to your request, we have reviewed the proposed rezoning of the parcel west of Novi Road, north of Ten Mile Road for availability and potential impacts to public utilities. It is our understanding that the applicant is requesting that 24 acres be rezoned from OS-1 (Office service) to RM-2 (high-density multi-family). The Master Plan for Land Use indicates OS-1 as the master planned land use for this site, with a density of 2.8 Residential Equivalent Units (REU) per acre. The applicant is requesting a Planned Rezoning Overlay to rezone to RM-2 with a density of 6.4 REU per acre.

Water Service

The proposed development is in the Twelve Oaks Pressure District. Water service would be provided by tapping the existing 24-inch water main on the west side of Novi Road. The proposed rezoning would have minimal impact on available capacity, pressure and flow and the water supply system.

Sanitary Sewer Service

The development is located in the Interceptor Sewer District. Service would be provided by connection to an existing manhole on the 8-inch sanitary gravity main on the west side of Novi Road. The City's existing infrastructure has sufficient capacity to accommodate the increased density in this proposed development, however, any time parcels are rezoned to a use that results in a higher sanitary sewer discharge, acquisition of additional contractual sewer capacity downstream of Eight Mile Road may be required at the time of build-out.

Summary

In summary, the water main facilities that are in place are adequate to serve the proposed change in zoning with little or no impact on the rest of the water system and the water master plan. The City's sanitary sewer facilities have capacity to support the additional flows that would be anticipated with a higher use residential zoning. Therefore, we conclude that the rezoning would have a minimal impact on the public utilities; however any increase in sanitary flow may require the acquisition of additional capacity downstream of Eight Mile Road at the time of build-out.

cc: George Melistas.; Engineering Senior Manager
Ben Croy, P.E.; Water & Sewer Senior Manager

ENGINEERING REVIEW

Review based on Revised Concept Site Plan dated April 03, 2017

CONCEPT PLAN SUBMITTAL SCHEDULE		
Type of Submittal	**Date of Submittal**	**Reviewed by**
Concept Plan	February 08, 2017	All Agencies
Revised Concept Plan	March 22, 2017	All Agencies except Traffic, Wetlands, Woodlands and Facade

PLAN REVIEW CENTER REPORT

April 25, 2017

Engineering Review

JSP17-0010
Princeton Park PRO

Applicant
Pulte Homes

Review Type
Revised Concept plan review

Property Characteristics

- Site Location: N. of 10 Mile Road and W. of Novi Road
- Site Size: 24 acres
- Plan Date: April 3, 2017
- Design Engineer: Atwell – Matt Bush, P.E.

Project Summary

- Construction of a 129 unit attached multi-family subdivision on approximately 24 acres. Site access would be provided by a new roadway with a single curb cut onto Novi Road.
- Water service would be provided by tapping the existing 24-inch water main on the west side of Novi Road.
- Sanitary sewer service would be provided by connection to an existing manhole on the 8-inch sanitary sewer on the west side of Novi Road.
- Storm water would be collected on site and detained in a proposed on-site basin.

Recommendation

The revised Concept Plan can be recommended for conditional approval, subject to the comments included in this review.

Comments on the Concept Plan set:

The revised Concept Plan and/or Preliminary Site Plan submittal should address the following:

General

1. A stub street to the property boundary at intervals not to exceed 1,300 feet along the perimeter is required by ordinance. Request a deviation from Appendix C Section 4.04(A)(1) of the Novi City Code. City staff supports this request.

Water Main

2. Note that hydrants shall be placed no less than seven (7) feet, but no more than fifteen (15) feet, from the back of curb or the edge of pavement where there is no curb. Hydrants shall be placed approximately five hundred (500) feet apart.
3. Provide a stub for connection to future development to south to create a looped system.

Sanitary Sewer

4. Provide the diameter and material type for all proposed and existing sanitary sewer at the time of Preliminary Site Plan submittal.

Storm Sewer

5. Revise the plan set to provide rear yard drainage systems to minimize the distance that surface drainage must pass through to reach a drainage structure. **Untreated sheet flow into wetland areas is not permitted.**
6. Provide the location for all residential sump leads. All leads must discharge into the subdivision's storm sewer network.
7. Provide an oil/gas separator with a four (4) foot sump at the last structure prior to discharge into the basins.

Paving & Grading

8. The location of the sidewalk adjacent to the curb is not in accordance with the Engineering Design Manual section 7.4.2.C.1, which requires that sidewalk on private roadways to be placed 15 feet from the back of curb. Given the constraints of the site, a deviation to provide minimum of 7.5 feet from back of curb to edge of sidewalk is supported by staff.

9. The emergency access path should be paved with asphalt, which facilitates snow clearing to maintain all-season emergency access. If grass pavers are used, the emergency access path must be delineated along the edges to easily identify the route.
10. The emergency access drive must be 20 feet wide, not including the adjacent sidewalk. The 5 foot sidewalk can be adjacent to the emergency access route.

11. A plan for snow clearing and year round maintenance of the emergency access path should be addressed in the master deed.

Storm Water Management Plan

12. The Storm Water Management Plan for this development shall be designed in accordance with the Storm Water Ordinance and Chapter 5 of the Engineering Design Manual.
13. The SWMP must detail the storm water system design, calculations, details, and maintenance as stated in the ordinance. The SWMP must address the discharge of storm water off-site, and evidence of its adequacy must be provided. This should be done by comparing pre- and post-development discharge areas, rates and volumes. The area being used for this off-site discharge should be delineated and the ultimate location of discharge shown. The applicant is responsible for verifying that the proposed discharge point(s) has adequate capacity to accept the designed drainage flows.
    a. Revise the plan set to provide a pre- and post-development tributary area map.
    b. Include in the post-development tributary map details to account for all disturbed areas that are not maintained in their respective natural states.
    c. Explain how the developed c factor of 0.6 is calculated.
    d. Clarify the detention basin elevations for first flush and bank full volumes to make the table of elevations consistent with the volumes calculated.
    e. Show the calculations used to determine the existing and proposed run off rates and volumes.
14. Clearly delineate the 25-foot vegetated buffer around the full perimeter of each storm water basin. This buffer cannot encroach on adjacent lots or property or public right-of-way.
15. Revise the plan set to provide a minimum length to width ratio of 3 to 1 for the proposed detention basins. Additional pretreatment may be required if this requirement cannot be met.

Off-Site Easements

16. Any off-site easements must be executed prior to final approval of the plans. Drafts shall be submitted at the time of the Preliminary Site Plan submittal.
17. Off-site construction easements and sidewalk easements will be required and the easements shown on the plans.

A letter from either the applicant or the applicant's engineer must be submitted with future submittals highlighting the changes made to the plans addressing each of the comments listed above and indicating the revised sheets involved.

General Notes to consider for future submittals:

1. A full engineering review of the revised Concept plan set was not performed due to the limited information provided in this submittal. A more detailed

review of utilities, easements, site layout, grading, storm water management and soil erosion control will be performed as the design progresses into preliminary and final site plan submittals.

2. The Master Plan for Land Use indicates OS-1 as the master planned land use for this site, with a density of 2.8 Residential Equivalent Units (REU) per acre. The applicant is requesting a Planned Rezoning Overlay to rezone to RM-1 with a density of 6.6 REU per acre. The City's existing infrastructure has sufficient capacity to accommodate the increased density in this proposed development, however, any time parcels are rezoned to a use that results in a higher sanitary sewer discharge, acquisition of additional contractual sewer capacity downstream of Eight Mile Road may be required at the time of build-out.
3. The site plan shall be designed in accordance with the Design and Construction Standards (Chapter 11).
4. Soil borings shall be provided for a preliminary review of the constructability of the proposed development (roads, basin, etc.). Borings identifying soil types, and groundwater elevation should be provided at the time of Preliminary Site plan.
5. A right-of-way permit will be required from the City of Novi and Oakland County. Novi Road is under the jurisdiction of the Road Commission for Oakland County.
6. Site grading shall be limited to 1V:4H (25-percent), excluding landscaping berms.
7. Provide at least 3-foot of buffer distance between the sidewalk and any fixed objects, including hydrants. Note on the plan any location where the 3-foot separation cannot be provided.
8. Provide location dimensions for all proposed water main, sanitary sewer, and storm sewer from a proposed fixed point.
9. Generally, all proposed trees shall remain outside utility easements. Where proposed trees are required within a utility easement, the trees shall maintain a minimum 5-foot horizontal separation distance from any existing or proposed utility. All utilities shall be shown on the landscape plan, or other appropriate sheet, to confirm the separation distance.
10. The grade of the drive approach shall not exceed 2-percent within the first 25 feet of the intersection. Provide spot grades as necessary to establish this grade.
11. Provide top of curb/walk and pavement/gutter grades to indicate height of curb adjacent to parking stalls and/or drive areas.
12. Provide curb returns with a maximum slope of 3% at intersections.
13. Show the overland routing that would occur in the event the basin cannot accept flow. This route shall be directed to a recognized drainage course or drainage system.

To the extent this review letter addresses items and requirements that require the approval of or a permit from an agency or entity other than the City, this review shall

not be considered an indication or statement that such approvals or permits will be issued.

Please contact Darcy Rechtien at (248) 735-5695 with any questions.

Darcy N. Rechtien

Darcy N. Rechtien, P.E.

LANDSCAPE REVIEW

Review based on Revised Concept Site Plan dated April 03, 2017

CONCEPT PLAN SUBMITTAL SCHEDULE		
Type of Submittal	**Date of Submittal**	**Reviewed by**
Concept Plan	February 08, 2017	All Agencies
Revised Concept Plan	March 22, 2017	All Agencies except Traffic, Wetlands, Woodlands and Facade

PLAN REVIEW CENTER REPORT

April 11, 2017

Revised PRO Concept Plan Landscape Review

Review Type	**Job #**
Revised PRO Concept Plan Landscape Review	JSP17-0010

Property Characteristics

- Site Location: West side of Novi Road, just south of Post Office
- Site Zoning: OS-1 – proposed RM-1
- Adjacent Zoning: OS-1 to north, I-2 to east, B-3 to south, R-4 to west
- Plan Date: 2/7/2017 – NO CHANGE

Ordinance Considerations

This project was reviewed for conformance with Chapter 37: Woodland Protection, Zoning Article 5.5 Landscape Standards, the Landscape Design Manual and any other applicable provisions of the Zoning Ordinance. Items in **bold** below must be addressed and incorporated as part of the Preliminary Site Plan submittal. Underlined items must be addressed in Final Site Plans. Please follow guidelines of the Zoning Ordinance and Landscape Design Guidelines. This review is a summary and not intended to substitute for any Ordinance. Please also see the accompanying landscape chart for additional comments.

Recommendation:

This project is **recommended for approval**. The conceptual landscape plans have a number of landscape deviations proposed, some of which are supported, and others are not, as detailed in this letter. The basic concept and layout indicate that there is sufficient room provided to meet city requirements.

NOTE: The landscape plans submitted with this are identical to what was reviewed for the previous PRO Concept review. No changes based on the previous review have been made. Therefore, all items in this review are also identical. Please understand that while the concept may have been recommended for approval, the changes below will need to be implemented in order to gain a recommendation for Preliminary and Final Site Plan approval, unless a PRO deviation is approved by the city planning commission and city council.

Landscape Deviations on Plan:

(NOTE: These do not include errors or omissions on the plan which are not assumed to be intentional deviations and which will need to be corrected during Preliminary and Final Site Plan Review)

1. A number of required street trees adjacent to the Novi Road entry will not be allowed per the Road Commission for Oakland County sight distance standards. The full extent of the deviation will be determined when the plans are reviewed by the RCOC. This deviation is supported by staff.
2. Landscaped berm to north does not meet minimum requirement of 4.5-6'. Staff does not support this deviation as there appears to be room for a taller buffer, and there is a need for the buffer, especially adjacent to the post office.
3. Landscaped buffer is not provided along the south property line. A 6-8 foot high berm is required along the B-3 boundary. The existing wetland/pond/vegetation provides sufficient

screening and the topography makes creating the required berm impractical so this deviation is supported by staff.

4. The required four foot tall berms in the Novi Road greenbelt are not provided. While the proposed landscaping and distance provide separation between the units and Novi Road and all off-street parking and vehicular use areas are screened from view of Novi Road by the landscaping and buildings. Staff supports this deviation.
5. Large native shrubs do not cover 70% of the detention basins' perimeter (only 43% of the north basin and 40% of the south basin). Staff does not support this deviation.
6. Applicant is requesting additional woodland replacement credits for upsized evergreen trees planted throughout the site. This is a deviation and is not allowed per the Landscape Design Manual. Staff does not support this deviation.
7. Applicant is proposing 82 subcanopy trees to be included in total of 384 trees required (21%). The requirement is for deciduous canopy or large evergreen trees, not subcanopy trees. The deviation is supported by staff as it provides additional diversity of plantings.

Existing Soils (Preliminary Site Plan checklist #10, #17)

Soil information is provided.

Existing and proposed overhead and underground utilities, including hydrants.(LDM 2.e.(4))

Utilities are shown on the Landscape Plans.

Existing Trees (Sec 37 Woodland Protection, Preliminary Site Plan checklist #17 and LDM 2.3 (2))

Existing trees and proposed removals have been shown on Sheets 2 through 4.

Proposed trees to be saved (Sec 37 Woodland Protection 37-9, LDM 2.e.(1))

1. **Show proposed tree fencing at a minimum of 1' outside of tree driplines.**
2. **Include tree planting detail that shows fencing at 1' outside of tree driplines.**

Woodland Replacement Trees

As noted above, upsizing of trees cannot be used to reduce the number of replacement trees required. Please revise the calculations to remove the upsizing credit. The upsizing would require a landscape deviation in the PRO agreement, which is not supported by staff.

Proposed topography. 2' contour minimum (LDM 2.e.(1))

Provided.

Adjacent to Public Rights-of-Way – Berm (Wall) & Buffer (Zoning Sec. 5.5.3.B.ii and iii)

1. **The required berm along Novi Road is not provided. As there is much greater distance between the homes and the Road than is required (a minimum of 150 feet is provided whereas only 34 feet is required) and the buildings and a significant amount of landscaping is proposed in that area to screen the buildings from the road, this deviation is supported by staff.**
2. The required quantities of greenbelt landscaping are provided.
3. **Please ensure that tree species and locations for Novi Road greenbelt trees are compatible with the overhead utility lines. If necessary, subcanopy trees can be used as substitutes for canopy trees at a rate of 2 subcanopy trees per 1 canopy tree.**

Street Tree Requirements (Zoning Sec. 5.5.3.E.i.c and 5.5.3.E.ii)

1. **The required number of street trees along Novi Road is provided. Please add the sight distance triangles per the Road Commission for Oakland County Road requirements. If the RCOC prohibits any or all of those trees, a waiver for the prohibited trees will be supported. A copy of their review will need to be provided.**
2. **Please add the clear vision zone for the interior road intersection and move the trees outside of that zone.**

4. The required number of interior street trees is provided. Unfortunately, a number of these are placed in areas between driveways, which appear to be a maximum of 5 feet apart. The clear vision zone for driveways is 10 feet. It is not clear whether the trees are outside of those zones. Also, the long-term survival of the trees in that situation is doubtful, given the small area for roots to collect air and water. Furthermore, some species are known to cause upheaval in paved surfaces. **Please provide additional spacing between the driveways and be sure to place the trees outside of the clear vision zone. Only use tree species that are not likely to damage the sidewalks or driveways.**
5. **Please ensure that tree species and locations for Novi Road greenbelt trees are compatible with the overhead utility lines. If necessary, subcanopy trees can be used as substitutes for canopy trees at a rate of 2 subcanopy trees per 1 canopy tree.**

Multi-family Landscaping Requirements (Zoning Sec 5.5.3.E.ii)

1. The street tree requirement is discussed above.
2. **Based on 129 ground level dwelling units, 387 deciduous canopy or large evergreen trees are required as site landscaping. 384 new trees and 6 existing trees are provided, 82 of which are subcanopy trees (21%). This variance is supported, but the applicant is asked to add at least one more native species to the mix of subcanopy trees to provide a greater percentage of native species in the plan.**

Transformer/Utility Box Screening (Zoning Sec 5.5.3.D.)

When proposed transformers/utilities/fire hydrants are available, add them to the landscape plan and adjust plant spacing accordingly.

Plant List (LDM 1.d.(1).(d) and LDM 2.h. and t.)

1. **Plant lists have been provided that meet the city requirements.**
2. **Please use a non-invasive species to replace the Crimson King Norway Maples.**
3. **Please verify all plant counts shown on the plans and plant lists. I found some discrepancies between the two.**

Planting Notations and Details (LDM)

1. **Details provided meet City of Novi requirements.**
2. **Please add a multi-stem tree planting detail.**
3. **Include all standard City of Novi landscape notes on plans. Available upon request.**
4. For final site plans, costs per the City of Novi Community Development Fee Schedule need to be provided for all plants, including seed and sod, and mulch proposed to be used on the site.

Irrigation (LDM 1.a.(1)(e) and 2.s)

Irrigation plan for landscaped areas is required for Final Site Plan.

Snow Deposit Areas (LDM.2.q.)

Please indicate areas to be used for snow plowing that won't harm existing or proposed landscaping.

If the applicant has any questions concerning the above review or the process in general, do not hesitate to contact me at 248.735.5621 or rmeader@cityofnovi.org.

Rick Meader

Rick Meader – Landscape Architect

LANDSCAPE REVIEW SUMMARY CHART – MULTI-FAMILY RESIDENTIAL

Review Date: March 1, 2017
Project Name: JSP17 – 0010: PRINCETON PARK PRO
Plan Date: 2/7/2017
Prepared by: Rick Meader, Landscape Architect E-mail: rmeader@cityofnovi.org;
Phone: (248) 735-5621

Items in **Bold** need to be addressed by the applicant before approval of the Preliminary Site Plan.
Underlined items need to be addressed for Final Site Plan.

Item	Required	Proposed	Meets Code	Comments
Landscape Plan Requirements – Basic Information (LDM (2))				
Landscape Plan *(Zoning Sec 5.5.2, LDM 2.e)*	▪ New commercial or residential developments ▪ Addition to existing building greater than 25% increase in overall footage or 400 SF whichever is less. ▪ 1"-20' minimum with proper North. Variations from this scale can be approved by LA	Yes	Yes	Scale: 1"=50' Details: 1"=30'
Owner/Developer Contact Information *(LDM 2.a.)*	Name, address and telephone number of the owner and developer or association	Yes	Yes	
Landscape Architect contact information *(LDM 2.b.)*	Name, Address and telephone number of RLA	Yes	Yes	
Survey information *(LDM 2.c.)*	Legal description or boundary line survey	Yes	Yes	Sheet 2
Project Information *(LDM 2.d.)*	Name and Address	Yes	Yes	
Sealed by LA. *(LDM 2.g.)*	Requires original signature	Yes	Yes	Required on Final Site Plans
Miss Dig Note (800) 482-7171 *(LDM.3.a.(8))*	Show on all plan sheets	Yes	Yes	
EXISTING CONDITIONS				
Existing plant material Existing woodlands or wetlands *(LDM 2.e.(2))*	Show location type and size. Label to be saved or removed. Plan shall state if none exists.	Yes	Yes	Sheets 2-4
Soil type *(LDM.2.r.)*	As determined by Soils survey of Oakland county	Yes	Yes	

Item	Required	Proposed	Meets Code	Comments
Zoning *(LDM 2.f.)*	Include site and all adjacent zoning	Yes	Yes	Site:OS-1 rezone to RM-1 North: OS-1; East: I-2; South: B-3; West: R-4
PROPOSED IMPROVEMENTS				
Existing and proposed improvements *(LDM 2.e.(4))*	Existing and proposed buildings, easements, parking spaces, vehicular use areas, and R.O.W	Yes	Yes	
Existing and proposed utilities *(LDM 2.e.(4))*	Overhead and underground utilities, including hydrants	Yes	Yes	
Proposed topography - 2' contour minimum *(LDM 2.e.(1))*	Provide proposed contours at 2' interval	Yes	Yes	Sheet 7
Clear Zones *(LDM 2.e.(5))*	25 ft. corner clearance required. Refer to Zoning Sec 5.5.9	25' clear vision zone at Novi Road entry	No	**1. RCOC sight clearance zone needs to be shown per RCOC standards at the Novi Road entrance. *A landscape deviation or waiver to not plant the trees that would be within the zone will be supported by staff.* If the RCOC does not allow any trees outside of those zones, please provide a copy of their review letter stating that and those trees will also not need to be planted.** **2. Please show the 25' clear vision zone at the intersection of the interior streets.** **3. Please show the 10' clear vision zone for all driveways.**
LANDSCAPING REQUIREMENTS				
Berms and ROW Planting				
All berms shall have a maximum slope of 33%. Gradual slopes are encouraged. Show 1ft. contours Berm should be located on lot line except in conflict with utilities. Berms should be constructed with 6" of top soil.				
Residential Adjacent to Non-residential (Sec 5.5.3.A) & (LDM 1.a)				

Item	Required	Proposed	Meets Code	Comments
Berm requirements *(Zoning Sec 5.5.A)*	Refer to Residential Adjacent to Non-residential berm requirements chart	Yes/No/NA	Yes/No	1. Berms are required along the north and south property boundaries. **2.** The berm along the north boundary should be between 4.5 and 6' tall. The berm provided appears to be a maximum of 3 feet tall. ***A landscape deviation for the shorter height is required.*** **It is preferred that the additional required berm height be provided, at least to 4.5 feet.** 3. There is no berm proposed along the south boundary. The existing pond/ wetland and vegetation provide a sufficient buffer, but ***a landscape deviation is required.*** **This is supported by staff.**
Adjacent to Public Rights-of-Way (Sec 5.5.B) and (LDM 1.b)				
Berm requirements *(Zoning Sec 5.5.3.A.(5))*	Refer to ROW landscape screening requirements chart for corresponding requirements.	4 foot berm with 4 foot crest	No	A landscape deviation is required for the lack of berms provided between the units and Novi Road.
Planting requirements *(LDM 1.a.)*	LDM Novi Street Tree List	Yes	Yes	
Street tree requirements *(Zoning Sec 5.5.3.B.ii)*	No street trees within 25 ft. clear vision triangle	Yes	Yes	**See note above regarding the clear vision zones.**
ROW Landscape Screening Requirements Chart *(Sec 5.5.3.B. ii)*				
Greenbelt width (2)(3) (5)	No parking: 34 ft	150 ft min	Yes	
Min. berm crest width	No parking: 3 ft	No	No	***Not providing required berm is a landscape deviation.***
Minimum berm height (9)	No parking: 3 ft	No	No	***Not providing required berm is a landscape***

Item	Required	Proposed	Meets Code	Comments
				deviation.
3' wall	(4)(7)	No		
Canopy deciduous or large evergreen trees Notes (1) (10)	▪ No Parking: 1 per 35 lf; ▪ 718/35 = 21 trees	23 trees	Yes	
Sub-canopy deciduous trees Notes (2)(10)	▪ No Parking: 1 per 25 lf; ▪ 718/25 = 29 trees	29 trees	Yes	
Canopy deciduous trees in area between sidewalk and curb	▪ No Parking: 1 per 45 lf; ▪ 718/45 = 16 trees	16 trees	Yes	
Snow deposit *(LDM.2.q.)*	Show snow deposit areas on plan	No	No	**Please indicate snow deposit areas on the plan where landscape won't be damaged.**
Parking Area Landscape Requirements LDM 1.c. & Calculations (LDM 2.o.)				
General requirements *(LDM 1.c)*	▪ Clear sight distance within parking islands ▪ No evergreen trees	No		All parking is to be in garages and driveways.
Name, type and number of ground cover (LDM 1.c.(5))	As proposed on planting islands	Yes	Yes	Lawn areas will be hydroseeded.
General *(Zoning Sec 5.5.3.C.ii)*				
Parking lot Islands *(a, b. i)*	▪ A minimum of 300 SF to qualify ▪ 6" curbs ▪ Islands minimum width 10' BOC to BOC	No		All parking is to be in garages and driveways.
Curbs and Parking stall reduction *(c)*	Parking stall can be reduced to 17' with 4" curb adjacent to a sidewalk of minimum 7 ft.	NA		
Contiguous space limit *(i)*	Maximum of 15 contiguous spaces	NA		
Plantings around Fire Hydrant *(d)*	No plantings with matured height greater than 12' within 10 ft. of fire hydrants	Yes	Yes	**1. All hydrants appear to be clear of trees.** **2. Please move trees at least 10 feet away from utility structures and, if possible, 5 feet from underground lines.** **3. Please add note to plans stating that trees are to be at least 10 feet away from any utility**

Item	Required	Proposed	Meets Code	Comments
				structure.
Landscaped area *(g)*	Areas not dedicated to parking use or driveways exceeding 100 sq. ft. shall be landscaped	Yes	Yes	
Name, type and number of ground cover (LDM 1.c.(5))	As proposed on planting islands	Yes	Yes	All disturbed areas shown as being seeded via hydroseed.
Category 1: For OS-1, OS-2, OSC, OST, B-1, B-2, B-3, NCC, EXPO, FS, TC, TC-1, RC, Special Land Use or non-residential use in any R district *(Zoning Sec 5.5.3.C.iii)*				
A = Total square footage of parking spaces not including access aisles x 10%	▪ A = x 10% = sf	NA		
B = Total square footage of additional paved vehicular use areas (not including A) under 50,000 SF) x 5%	▪ B = x 5% = sf ▪ Paved Vehicular access area includes loading areas	NA		
C= Total square footage of additional paved vehicular use areas (not including A or B) over 50,000 SF) x 1 %	▪ C = x 1% = sf	NA		
All Categories				
D = A+B or A+C Total square footage of landscaped islands	A + B + C = x SF	NA		
E = D/75 Number of canopy trees required	x/75 = y Trees	NA		
Perimeter Green space	▪ 1 Canopy tree per 35 lf ▪ Sub-canopy trees can be used under overhead utility lines.	NA		
Parking land banked	NA	NA		
Multi-Family Residential Zoning Sec 5.5.3.E.iii & LDM 1.d (2)				
Interior Street Trees	1 tree per 35 lf, net of driveways, access road 4901-2080=2821 lf 2821/35 = 81 trees	83 trees	Yes	1. While numbers are correct, please ensure that trees are placed in situations in which they can grow, and not damage adjacent driveways 2. 5 foot spacing does

Item	Required	Proposed	Meets Code	Comments
				not leave much room for tree growth (the ordinance requires 10 foot wide landscape spaces in parking lots), and species like Gleditsia triacanthos are known to cause root heave of adjacent hard surfaces. **3. Please provide more room for interior street trees, adjust tree placement and revise species as necessary.**
Building Landscaping *(Zoning Sec 5.5.3.E.ii.)*	• 3 deciduous canopy trees or large evergreen trees per dwelling unit on the first floor. • 129*3 = 387 trees	384 new trees plus 6 existing trees	No	**1. Please clearly show existing trees counted toward this requirement.** **2. 73 subcanopy trees are used in place of canopy trees (20% of the total). This is a landscape deviation which is supported as it creates additional diversity in the site.** **3. Please use additional native subcanopy species in the mix of subcanopy trees.**
Miscellaneous Landscaping Requirements				
Transformers/Utility boxes *(LDM 1.e from 1 through 5)*	▪ A minimum of 2ft. separation between box and the plants ▪ Ground cover below 4" is allowed up to pad. ▪ No plant materials within 8 ft. from the doors	No	No	**1. Please add note on plan or with detail stating that all utility boxes shall be screened per the detail.** **2. If utility box locations are available before stamping sets, please add them to the landscape plan, with required landscaping.**
Detention/Retention Basin Planting requirements *(Sec. 5.5.3.E.iv)*	▪ Clusters shall cover 70-75% of the basin rim area ▪ 10" to 14" tall grass	Yes	No	1. It does not appear that 70% of either pond perimeter at the high water line is

Item	Required	Proposed	Meets Code	Comments
	along sides of basin ▪ Refer to wetland for basin mix ▪ Include seed mix details on landscape plan			landscaped with large native shrubs. **Please increase the coverage.** **2. Some of the shrubs (Tam's Juniper, Mohawk Viburnum, eg) are not native to Michigan and should be substituted for species that are.**
General Landscape Requirements (LDM 3)				
General Conditions *(LDM 3.a)*	Plant materials shall not be planted within 4 ft. of property line	Yes	Yes	**Please add note near plantings along property lines.**
Irrigation plan *(LDM 2.s.)*	A fully automatic irrigation system and a method of draining is required with Final Site Plan	No		Required for Final Site Plan
Other information *(LDM 2.u)*	Required by Planning Commission	NA		
Landscape tree credit *(LDM3.b.(d))*	Substitutions to landscape standards for preserved canopy trees outside woodlands/ wetlands should be approved by LA. Refer to Landscape tree Credit Chart in LDM	No		
Plant Sizes for ROW, Woodland replacement and others *(LDM 3.c)*	Canopy Deciduous shall be 3" and sub-canopy deciduous shall be 2.5" caliper. Refer to section for more details	Yes	Yes	
Plant size credit *(LDM3.c.(2))*	NA	Yes – for replacement evergreens.	No	**Upsizing credit is not available for woodland replacement trees. This is a deviation.**
Prohibited Plants *(LDM 3.d)*		Yes	No	1. Norway maples are not allowed close to regulated woodlands as it is invasive. **2. Please use a different species than Acer platanoides.**
Recommended trees for planting under overhead utilities *(LDM 3.e)*	Label the distance from the overhead utilities	Canopy trees proposed near overhead lines.	TBD	**1. There are some overhead wires along the front of the property. Please**

Item	Required	Proposed	Meets Code	Comments
				ensure that the species selected for use near them will not interfere with the wires, or reach a height that will require the utility company to prune them. **2. If necessary, sub-canopy trees can be used at a rate of 2 trees to 1 canopy tree below or near overhead wires.**
Collected or Transplanted trees *(LDM 3.f)*		No		
Nonliving Durable Material: Mulch *(LDM 4)*	▪ Trees shall be mulched to 4"depth and shrubs, groundcovers to 3" depth ▪ Specify natural color, finely shredded hardwood bark mulch. ▪ Include in cost estimate. ▪ Refer to section for additional information.	No	No	**Please include this information in the planting details to be provided on the plans.**
Landscape Notes and Details– Utilize City of Novi Standard Notes				
Plant List (LDM 2.h.) – Include all cost estimates				
Quantities and sizes		Yes	Yes	**Please double-check plant counts.**
Root type		Yes	Yes	
Botanical and common names	Refer to LDM suggested plant list	Yes	Yes	
Type and amount of lawn		Yes	Yes	1. Seed is indicated for all disturbed areas. **2. If sod is to be used, please clearly indicate those areas on the plan.**
Cost estimate (LDM 2.t)	For all new plantings, mulch and sod as listed on the plan	No		Need for final site plan
Planting Details/Info (LDM 2.i) – Utilize City of Novi Standard Details				
Canopy Deciduous Tree	Refer to LDM for detail drawings	Yes	Yes	

Item	Required	Proposed	Meets Code	Comments
Multi-stem tree		No	No	**Please provide.**
Evergreen Tree		Yes	Yes	
Shrub		Yes	Yes	
Perennial/ Ground Cover		Yes	Yes	
Tree stakes and guys	Wood stakes, fabric guys.	Yes	Yes	
Cross-Section of Berms (LDM 2.j)				
Slope, height and width	▪ Label contour lines ▪ Maximum 33% ▪ Min. crest width ▪ Construction of loam ▪ 6" top layer of topsoil.	No	No	**Please provide berm detail.**
Type of Ground Cover		No	No	**Please indicate on detail.**
Setbacks from Utilities	Overhead utility lines and 15 ft. setback from edge of utility or 20 ft. setback from closest pole, 10 feet from structures, hydrants	No	No	**Please indicate on detail.**
Walls (LDM 2.k & Zoning Sec 5.5.3.vi)				
Material, height and type of construction footing	Freestanding walls should have brick or stone exterior with masonry or concrete interior	No		No walls proposed
Walls greater than 3 ½ ft. should be designed and sealed by an Engineer		NA		
Notes (LDM 2.i) – Utilize City of Novi Standard Details				
Installation date *(LDM 2.l. & Zoning Sec 5.5.5.B)*	▪ Provide intended date ▪ Between Mar 15 – Nov 15	No	No	**Please provide note**
Maintenance & Statement of intent *(LDM 2.m & Zoning Sec 5.5.6)*	▪ Include statement of intent to install and guarantee all materials for 2 years. ▪ Include a minimum one cultivation in June, July and August for the 2-year warranty period.	No	No	**Please provide note Please change City of Novi Landscape General Note #2 to read …"Replace failing material within 6 months or the next appropriate planting period, whichever is less."**
Plant source *(LDM 2.n & LDM 3.a.(2))*	Shall be northern nursery grown, No.1 grade.	No	No	**Please provide note**

Item	Required	Proposed	Meets Code	Comments
Establishment period *(Zoning Sec 5.5.6.B)*	**2 yr. Guarantee**	No	No	**Please provide note**
Approval of substitutions. *(Zoning Sec 5.5.5.E)*	City must approve any substitutions in writing prior to installation.	No	No	**Please provide note**
Item	**Required**	**Proposed**	**Meets Code**	**Comments**

NOTES:

1. This table is a working summary chart and not intended to substitute for any Ordinance or City of Novi requirements or standards.
2. The section of the applicable ordinance or standard is indicated in parenthesis. For the landscape requirements, please see the Zoning Ordinance landscape section 5.5 and the Landscape Design Manual for the appropriate items under the applicable zoning classification.
3. Please include a written response to any points requiring clarification or for any corresponding site plan modifications to the City of Novi Planning Department with future submittals.

WETLANDS REVIEW

Review based on Concept Site Plan

CONCEPT PLAN SUBMITTAL SCHEDULE		
Type of Submittal	**Date of Submittal**	**Reviewed by**
Concept Plan	February 08, 2017	All Agencies
Revised Concept Plan	March 22, 2017	All Agencies except Traffic, Wetlands, Woodlands and Facade

ECT Environmental Consulting & Technology, Inc.

February 28, 2017

Ms. Barbara McBeth
City Planner
Community Development Department
City of Novi
45175 W. Ten Mile Road
Novi, Michigan 48375

Re: Princeton Park (JSP17-0010)
Wetland Review of the Concept Plan (PSP17-0014)

Dear Ms. McBeth:

Environmental Consulting & Technology, Inc. (ECT) has reviewed the Concept Plan (*Conceptual Planned Rezoning Overlay (PRO)*) plan for the proposed Princeton Park multi-family residential development project prepared by Atwell dated February 7, 2017 (Plan). The Plan was reviewed for conformance with the City of Novi Wetland and Watercourse Protection Ordinance and the natural features setback provisions in the Zoning Ordinance.

The project is located west of Novi Road between Ten Mile Road and Grand River Avenue (Section 22), just south of the U.S. Post Office. The northern two-thirds (approximately) of the proposed project site is currently used as a storage facility for cars, boats, trailers and other vehicles. The southern one-third (approximately) of the proposed site contains areas noted as City Regulated Wetlands and City Regulated Woodlands and is currently undeveloped.

The site plan appears to propose the construction of twenty-six (26) multi-family residential buildings (totaling 129 units), associated utilities, parking, and two (2) storm water detention basins located on the east portion of the site. The ultimate outfall for the storm water detention basins is an existing wetland area located on the southern portion of the development site.

ECT recommends approval of the Concept Plan for wetlands with the condition that the Applicant satisfactorily address the items noted in the "Comments" section of this letter at the time of Preliminary Site Plan submittal.

The following wetland related items are required for this project:

Item	Required/Not Required/Not Applicable
Wetland Permit (specify Non-Minor or Minor)	Required (Minor)
Wetland Mitigation	Not necessary as wetland impacts do not exceed 0.25-acre
Wetland Buffer Authorization	Required
MDEQ Permit	To be determined. It is the applicant's responsibility to contact the MDEQ in order to determine the need for a wetland use permit (for direct impact/fill of Wetland #3) and/or stormwater discharge to Wetland #1.
Wetland Conservation Easement	Required

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Based on our review of the Plan, Novi aerial photos, Novi GIS, the City of Novi Official Wetlands and Woodlands Maps (see Figure 1, attached) it appears as if this proposed project site contains City-regulated wetlands and woodlands. The City's wetland and woodland map shows that the overall property contains wetlands to the south. However, a review of aerial photos of the site and the proposed site plan, the site contains three (3) areas of wetland (Wetlands #1, #2, and #3), along both the southern and western portion of the site.

Wetlands

As noted, there appear to be three (3) wetland areas located on the site totaling 3.36 acres:

Wetland #1

Wetland #1 (2.9 acres) is a scrub-shrub/open-water wetland located along the southern portion of the site. This wetland is associated with the existing northern tributary of Chapman Creek.

Wetland #2

Wetland #2 (0.37-acre) is an emergent wetland located along the west side of the site. Wetland #2 was created as part of the Churchill Crossing residential development located west of the subject parcel. This area is located within a Michigan Department of Environmental Quality (MDEQ) conservation easement based on the data provided on the MDEQ Wetlands Map Viewer (http://www.mcgi.state.mi.us/wetlands/mcgiMap.html).

Wetland #3

Wetland #3 (0.09-acre) is an isolated, emergent/scrub-shrub wetland located near the southwest corner of the site. It appears as though during wet periods drainage from Wetland #3 flows through an upland area and eventually drains to Wetland #1.

On-Site Wetland Evaluation

ECT visited the site on Tuesday, February 21, 2017 for the purpose of a Wetland Boundary Delineation. The wetland flagging and tree identification provided on the Plan was completed by Atwell. The wetlands were marked with pink survey tape flagging at the time of our inspection. Based on our site inspection, the wetland boundaries appear to be accurately portrayed on the Plan.

Wetland Impact Review

As noted, three (3) areas of wetland exist on this parcel (Wetland #1, #2, and #3). The proposed site development appears to be partly designed around the existing on-site wetland and 25-foot wetland setback areas. The *Layout Plan* (Sheet 05) indicates that the proposed development will impact Wetland #3 and the storm water outlet is currently planned to be directed to the 25-foot setback of Wetland #1, in the southeast portion of the site. The following table summarizes the existing wetlands and the proposed wetland impacts as shown on the Plan:

Table 1. Proposed Wetland Impacts

Wetland Area	*Wetland Area (acres)*	*City Regulated?*	*MDEQ Regulated?*	*Impact Area (acre)*	*Estimated Impact Volume (cubic yards)*
1	2.90	Yes City Regulated /Essential	To Be Determined	None Indicated	None
2	0.37	Yes City Regulated /Essential	Yes	None Indicated	None
3	0.09	Yes City Regulated /Essential	To Be Determined	0.09	Not Provided
TOTAL	3.36	--	--	0.09	Not Provided

In addition to wetland impacts, the Plan also appears to propose impacts to the 25-foot natural features setback of Wetland #3. The applicant shall indicate the area of all existing on-site wetland buffers/setbacks on the preliminary site plan as well as indicate the area of all proposed impacts to these areas (both permanent and temporary).

The applicant shall show the following information on subsequent site plans:

- Area (square feet or acres) of all on-site wetland areas;
- Area (square feet of acres) of all on-site 25-foot wetland setback areas;
- Area (square feet) and volume (cubic yards) of all wetland impacts (both permanent and temporary);
- Area (square feet) of all wetland buffer impacts (both permanent and temporary).

The Applicant shall provide wetland conservation easements as directed by the City of Novi Community Development Department for any areas of remaining wetland. A Conservation Easement shall be executed covering all remaining wetland areas on site as shown on the approved plans. This language shall be submitted to the City Attorney for review. The executed easement must be returned to the City Attorney within 60 days of the issuance of the City of Novi Wetland and Watercourse permit.

Wetland Mitigation

The MDEQ generally requires mitigation for impacts greater than one-third acre and the City usually requires mitigation for impacts greater than one-quarter acre (0.25-acre). Wetland mitigation is not required for the currently-proposed impacts.

Permits & Regulatory Status

All of the wetlands appear to be considered essential by the City as they appear to meet one or more of the essentiality criteria set forth in the City's Wetland and Watercourse Protection Ordinance (i.e., stormwater storage/flood control, wildlife habitat, etc.). This information has been noted in the *Proposed Wetland Impacts* table, above. Any impacts to wetlands or wetland buffers would require approval and authorization from the City of Novi. The project as proposed will require a City of Novi *Wetland Minor Use Permit* as well as an *Authorization to Encroach the 25-Foot Natural Features Setback.* This permit and authorization are required for the proposed impacts to wetlands and regulated wetland setbacks.

The on-site wetlands may also be regulated by the Michigan Department of Environmental Quality (MDEQ) due to size or proximity to a watercourse (i.e., within 500 feet of the northern tributary of Chapman Creek). Final determination of regulatory status should be made by the MDEQ however. A permit from this agency may be required for any direct impacts, or potentially for stormwater discharge from the proposed detention basin. The current Plan proposes to fill Wetland #3 and includes the outlet of pre-treated stormwater from the proposed detention basin to Wetland #1. It is the applicant's responsibility to contact the MDEQ in order to determine the need for a wetland use permit. It should be noted that a City of Novi Wetland Permit cannot be issued until the applicant receives either authorization or a letter of no jurisdiction from the MDEQ

Comments

Please consider the following comments when preparing the Preliminary Site Plan submittal:

1. The applicant shall indicate the area of all on-site wetland buffers/setbacks on the Plan as well as indicate the area of all proposed impacts to these areas (both permanent and temporary). The plan should include area (square feet or acres) impact quantities for all wetland and wetland buffer impacts as well as volume quantities for all wetland impacts (i.e., cubic yards of wetland cut and/or fill).

2. Please clarify/indicate how any temporary wetland buffer impacts will be restored (i.e., what seed mix will be used in the area of the stormwater outfall construction to Wetland #1). The Details and Plant Material List (Sheet LS-4 of 6) includes a Native Wildflower Seed Mix (from Nativescape, LLC). The Plan should clarify if this seed mix is proposed within areas of temporary wetland buffer impact.

3. It is the Applicant's responsibility to confirm the need for a permit from the MDEQ for any proposed wetland impact and/or proposed stormwater discharge to Wetland #1. A City of Novi Wetland Permit cannot be issued until the applicant receives either authorization or a letter of no jurisdiction from the MDEQ

4. The Applicant shall provide wetland conservation easements as directed by the City of Novi Community Development Department for any areas of remaining wetland. A Conservation Easement shall be executed covering all remaining wetland areas on site as shown on the approved plans. This language shall be submitted to the City Attorney for review. The executed easement must be returned to the City Attorney within 60 days of the issuance of the City of Novi Wetland and Watercourse permit. In addition, all proposed conservation easements shall be indicated and clearly labeled on the Plan. It should be noted that Wetland #2 appear to already be included within an MDEQ Conservation Easement.

Recommendation

ECT recommends approval of the Revised Concept Plan for wetlands with the condition that the Applicant satisfactorily address the items noted in the "Comments" section of this letter at the time of Preliminary Site Plan submittal.

If you have any questions regarding the contents of this letter, please contact us.

Respectfully submitted,

ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.

Pete Hill, P.E.
Senior Associate Engineer

cc: Sri Komaragiri, City of Novi Planner
Richelle Leskun, City of Novi Planning Assistant
Rick Meader, City of Novi Landscape Architect
Kirsten Mellem, City of Novi Planner

Attachments: Figure 1 – City of Novi Regulated Wetland and Woodland Map
Site Photos

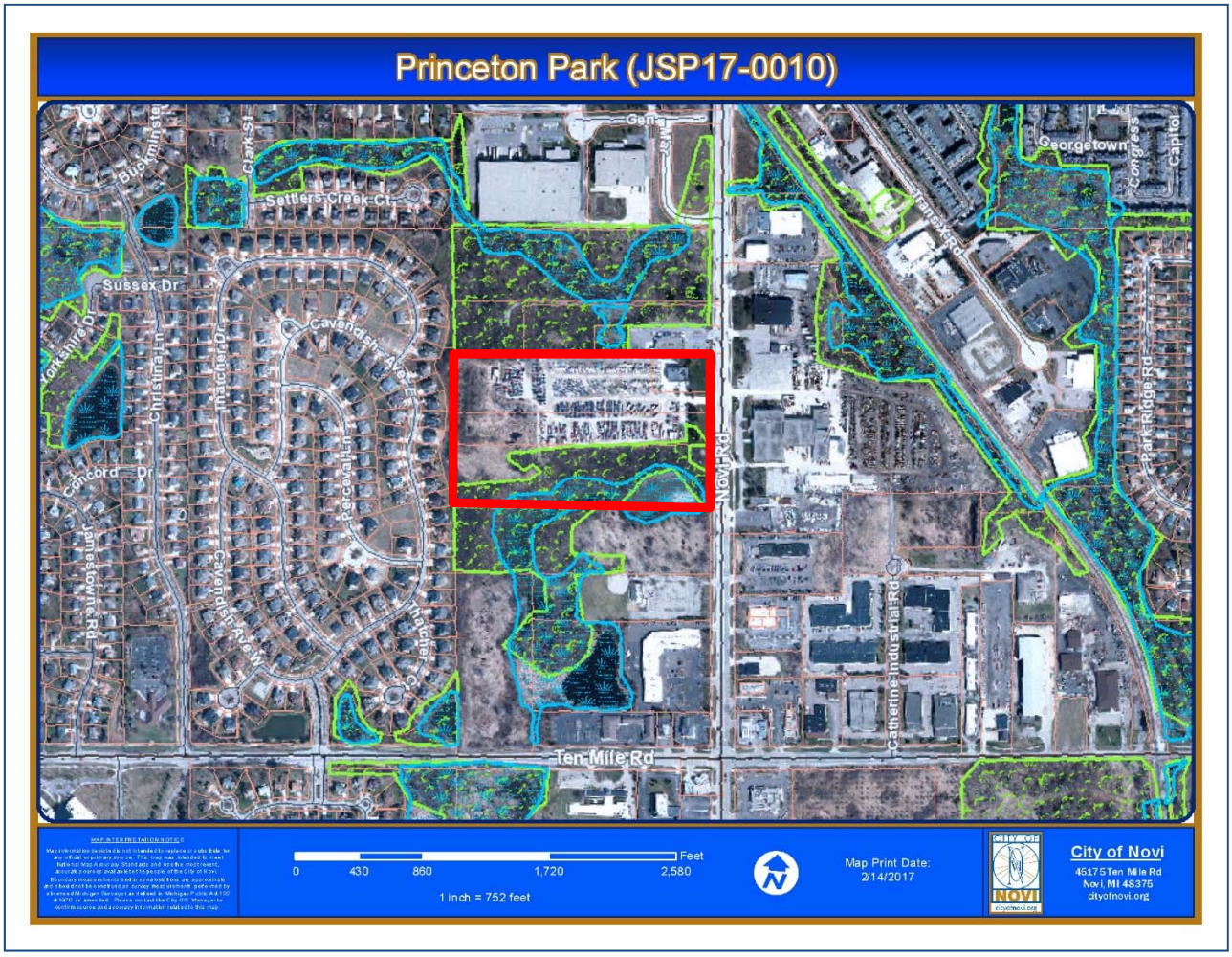

Figure 1. City of Novi Regulated Wetland & Woodland Map (approximate project area is highlighted in red). Regulated Woodland areas are shown in green and regulated Wetland areas are shown in blue).

Site Photos

Photo 1. Looking southwest at Wetland Area #1 on the south side of the site (ECT, February 21, 2017).

Photo 2. Looking west at Wetland Area #2 on the west side of the site (ECT, February 21, 2017).

Photo 3. Looking east at Wetland Area #3 in the south/west section of the Site (ECT, February 21, 2017).

Photo 4. Looking east at upland drainage feature from Wetland Area #3 in the south/west section of the site (ECT, February 21, 2017).

WOODLANDS REVIEW

Review based on Concept Site Plan

CONCEPT PLAN SUBMITTAL SCHEDULE		
Type of Submittal	**Date of Submittal**	**Reviewed by**
Concept Plan	February 08, 2017	All Agencies
Revised Concept Plan	March 22, 2017	All Agencies except Traffic, Wetlands, Woodlands and Facade

ECT Environmental Consulting & Technology, Inc.

February 28, 2017

Ms. Barbara McBeth
City Planner
Community Development Department
City of Novi
45175 West Ten Mile Road
Novi, MI 48375

Re: Princeton Park (JSP17-0010)
Woodland Review of the Concept Plan (PSP17-0014)

Dear Ms. McBeth:

Environmental Consulting & Technology, Inc. (ECT) has reviewed the Concept Plan (*Conceptual Planned Rezoning Overlay (PRO)*) plan for the proposed Princeton Park multi-family residential development project prepared by Atwell dated February 7, 2017 (Plan). The Plan was reviewed for conformance with the City of Novi Woodland Protection Ordinance Chapter 37.

The project is located west of Novi Road between Ten Mile Road and Grand River Avenue (Section 22), just south of the U.S. Post Office. The northern two-thirds (approximately) of the proposed project site is currently used as a storage facility for cars, boats, trailers and other vehicles. The southern one-third (approximately) of the proposed site contains areas noted as City Regulated Wetlands and City Regulated Woodlands and is currently undeveloped.

The site plan appears to propose the construction of twenty-six (26) multi-family residential buildings (totaling 129 units), associated utilities, parking, and two (2) storm water detention basins located on the east portion of the site. The ultimate outfall for the storm water detention basins is an existing wetland area located on the southern portion of the development site.

ECT recommends approval of the Concept Plan for woodlands with the condition that the Applicant satisfactorily address the items noted in the "Comments" section of this letter at the time of Preliminary Site Plan submittal.

The following woodland related items are required for this project:

Item	Required/Not Required/Not Applicable
Woodland Permit	Required
Woodland Fence	Required
Woodland Conservation Easement	Required

What follows is a summary of our findings regarding on-site woodlands associated with the proposed project.

Woodland Evaluation

ECT completed an on-site woodland evaluation on Tuesday, February 21, 2017. As noted above, the site does contain area designated as City of Novi Regulated Woodland. A significant portion of the proposed limits of disturbance for the project is located outside of the areas mapped as City Regulated woodland (see Figure 1). The

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majority of the Regulated Woodland area is located on the southern portion of the project site (see Figure 1). Tree survey information has been provided on the *Tree List* plan (Sheet 03). This sheet includes a tree list that indicates the proposed woodland impacts and required Woodland Replacement tree credits for these removals. The Plan indicates that a total of 328 trees have been surveyed for the project. Of the trees surveyed, 262 trees are located within the area designated as Regulated Woodland (80% of the surveyed trees are located within the regulated woodland area). Fifty percent (50%) of the surveyed trees are comprised of the following tree species:

- Eastern cottonwood (26% of the surveyed trees);
- Silver maple (12% of the surveyed trees);
- Sugar maple (12% of the surveyed trees);

The other 50% of the surveyed trees include the following tree species:

- Siberian elm (8%);
- Black cherry (7%);
- Boxelder (6%);
- Basswood (5%);
- Common apple (5%);
- White pine (4%);
- Bitternut hickory (3%); and
- Norway spruce, black walnut, quaking aspen, eastern red cedar, American elm, black willow, black locust, corkscrew willow, Norway maple, and common pear.

The majority of the trees are listed as being in Good condition.

Woodland Impact Review & Woodland Replacement Credits

It should be noted that the purpose of the City of Novi Woodland Protection Ordinance (Chapter 37) is to:

1. *Provide for the protection, preservation, replacement, proper maintenance and use of trees and woodlands located in the city in order to minimize disturbance to them and to prevent damage from erosion and siltation, a loss of wildlife and vegetation, and/or from the destruction of the natural habitat. In this regard, it is the intent of this chapter to protect the integrity of woodland areas as a whole, in recognition that woodlands serve as part of an ecosystem, and to place priority on the preservation of woodlands, trees, similar woody vegetation, and related natural resources over development when there are no location alternatives;*

2. *Protect the woodlands, including trees and other forms of vegetation, of the city for their economic support of local property values when allowed to remain uncleared and/or unharvested and for their natural beauty, wilderness character of geological, ecological, or historical significance; and*

3. *Provide for the paramount public concern for these natural resources in the interest of health, safety and general welfare of the residents of the city.*

As shown, there appear to be impacts proposed to regulated woodlands associated with the site construction. The Plan notes that a total of 54 of the 262 on-site, regulated trees (approximately 20% of the regulated trees) will be removed as a result of the proposed project.

A *Woodland Summary* Table has been included on the *Tree List* (Sheet 03). The Applicant has noted the following:

- Total Regulated Trees 262
- Regulated Trees Removed: 54 (20% Removal)
- Regulated Trees Preserved: 208 (80% Preservation)

- Stems to be Removed 8" to 11": 30 x 1 replacement (Requiring 30 Replacements)
- Stems to be Removed 11" to 20": 13 x 2 replacements (Requiring 26 Replacements)
- Stems to be Removed 20" to 30": 4 x 3 replacements (Requiring 12 Replacements)
- Stems to be Removed 30"+: 0 x 4 replacements (Requiring 0 Replacements)
- Multi-Stemmed Trees (7 trees): (Requires 20 Replacements)

- Total Replacement Trees Required: 88 Replacements

Sheet LS-6 of 6 (Tree Replacement Planting Plan) states that all tree replacement plantings are to be located and installed in conservation easement areas (greenbelt, park/open space, and detention pond) per City Standards and approval. This Plan notes that the following Woodland Replacement Tree Material will be provided on-site:

- 31 – 2 ½" caliper deciduous trees;
- 29 – 12' evergreen trees;
- 29 – 14' evergreen trees.

The proposed deciduous tree species all appear to be acceptable per the City's Woodland Tree Replacement Chart (swamp white oak, sugar maple, red maple, American sweetgum, northern hackberry, and bur oak).

The applicant has proposed both 12' and 14' tall white spruce and black hills spruce (Picea glauca 'densata'). It should be noted that the black hills spruce is not a species approved by the City for Woodland Replacement.

In addition, per the Landscape Design Manual Section 3.c.(2) no additional Woodland Replacement credits can be gained by using larger plant material than those specified in the table 3.c.(1). As a rule, the standard woodland replacement tree credits listed on the Woodland Replacement Chart in Section 37 must be used, including the 1.5 trees : 1 Woodland Credit evergreen ratio. All deciduous replacement trees shall be two and one-half (2 ½) inches caliper or greater and count at a 1-to-1 replacement ratio. Based on this requirement, it appears as if the Plan is currently proposing 31 deciduous replacement trees (providing 31 credits at 1:1 replacement ratio) and 58 coniferous replacement trees (will provide 38.6 credits at 1.5:1 replacement ratio). As such, the plan appears to provide for a total of 69.6 Woodland Replacement Credits (as opposed to the 107 credits noted in the *Woodland Tree Replacement Summary*). The "upsizing" of Woodland Replacement trees for additional Woodland Replacement credit is not supported by the City of Novi. As such acceptable replacement evergreen trees shall be provided at a 1.5:1 replacement ratio. The applicant should review and revise the calculations on the Plan and the tree replacement plant list as necessary.

City of Novi Woodland Review Standards and Woodland Permit Requirements
Based on Section 37-29 (*Application Review Standards*) of the City of Novi Woodland Ordinance, the following standards shall govern the grant or denial of an application for a use permit required by this article:

No application shall be denied solely on the basis that some trees are growing on the property under consideration. However, the protection and conservation of irreplaceable natural resources from pollution, impairment, or destruction is of paramount concern. Therefore, the preservation of woodlands, trees, similar woody vegetation, and related natural resources shall have priority over development when there are location alternatives.

In addition,

"The removal or relocation of trees shall be limited to those instances when necessary for the location of a structure or site improvements and when no feasible and prudent alternative location for the structure or improvements can be had without causing undue hardship".

There are a significant number of replacement trees required for the construction of the proposed development. While, the overall ecological values of the existing woodlands cannot be immediately replaced through the planting of woodland replacement trees, the applicant shall clarify whether all of the required Woodland Replacement tree credits will be provided on-site or if a portion will be paid into the City of Novi Tree Fund.

Woodland Comments

Please consider the following comments when preparing subsequent site plan submittals:

1. A Woodland Permit from the City of Novi would be required for proposed impacts to any trees 8-inch diameter-at-breast-height (DBH) or greater and located within an area designated as City Regulated Woodland, or any tree 36-inches DBH regardless of location on the site. Such trees shall be relocated or replaced by the permit grantee. All deciduous replacement trees shall be two and one-half (2 ½) inches caliper or greater and all coniferous replacement trees shall be six (6) feet in height (minimum). All Woodland Replacement trees shall be species that are listed on the City's Woodland Tree Replacement Chart (attached).

2. The applicant has proposed both 12' and 14' tall white spruce and black hills spruce (Picea glauca 'densata'). It should be noted that the black hills spruce is not a species approved by the City for Woodland Replacement. Please review and revise the Plan as necessary based on the attached Woodland Tree Replacement Chart.

3. The "upsizing" of Woodland Replacement trees for additional Woodland Replacement credit is not supported by the City of Novi. As such acceptable replacement evergreen trees shall be provided at a 1.5:1 replacement ratio. The applicant should review and revise the calculations on the Plan and the tree replacement plant list as necessary.

4. A Woodland Replacement Performance financial guarantee for the planting of replacement trees will be required. This financial guarantee will be based on the number of on-site woodland replacement trees (credits) being provided at a per tree value of $400. This financial guarantee will be calculated based on the following:

   Number of on-site Woodland Replacements x $400/replacement credit x 1.2).

   This financial guarantee will be $35,200 (88 Woodland Replacements required x $400/credit).

Based on a successful inspection of the installed on-site Woodland Replacement trees, the original Woodland Financial Guarantee shall be returned to the Applicant. Twenty-five percent (25%) of the value of the Woodland Replacement material shall be kept for a period of 2-years after the successful inspection of the tree replacement installation as a *Woodland Maintenance and Guarantee Bond*.

5. The Applicant will be required to pay the City of Novi Tree Fund at a value of $400/credit for any Woodland Replacement tree credits that cannot be placed on-site.

6. Replacement material should not be located 1) within 10' of built structures or the edges of utility easements and 2) over underground structures/utilities or within their associated easements. In addition, replacement tree spacing should follow the *Plant Material Spacing Relationship Chart for Landscape Purposes* found in the City of Novi *Landscape Design Manual.*

7. The Applicant shall provide preservation/conservation easements as directed by the City of Novi Community Development Department for any areas of remaining woodland and woodland replacement trees. The applicant shall demonstrate that the all proposed woodland replacement trees and existing regulated woodland trees to remain will be guaranteed to be preserved as planted with a conservation easement or landscape easement to be granted to the city. This language shall be submitted to the City Attorney for review. The executed easement must be returned to the City Attorney within 60 days of the issuance of the City of Novi Woodland permit.

Recommendation

ECT recommends approval of the Concept Plan for woodlands with the condition that the Applicant satisfactorily address the items noted in the "Comments" section of this letter at the time of Preliminary Site Plan submittal.

If you have any questions regarding the contents of this letter, please contact us.

Respectfully submitted,

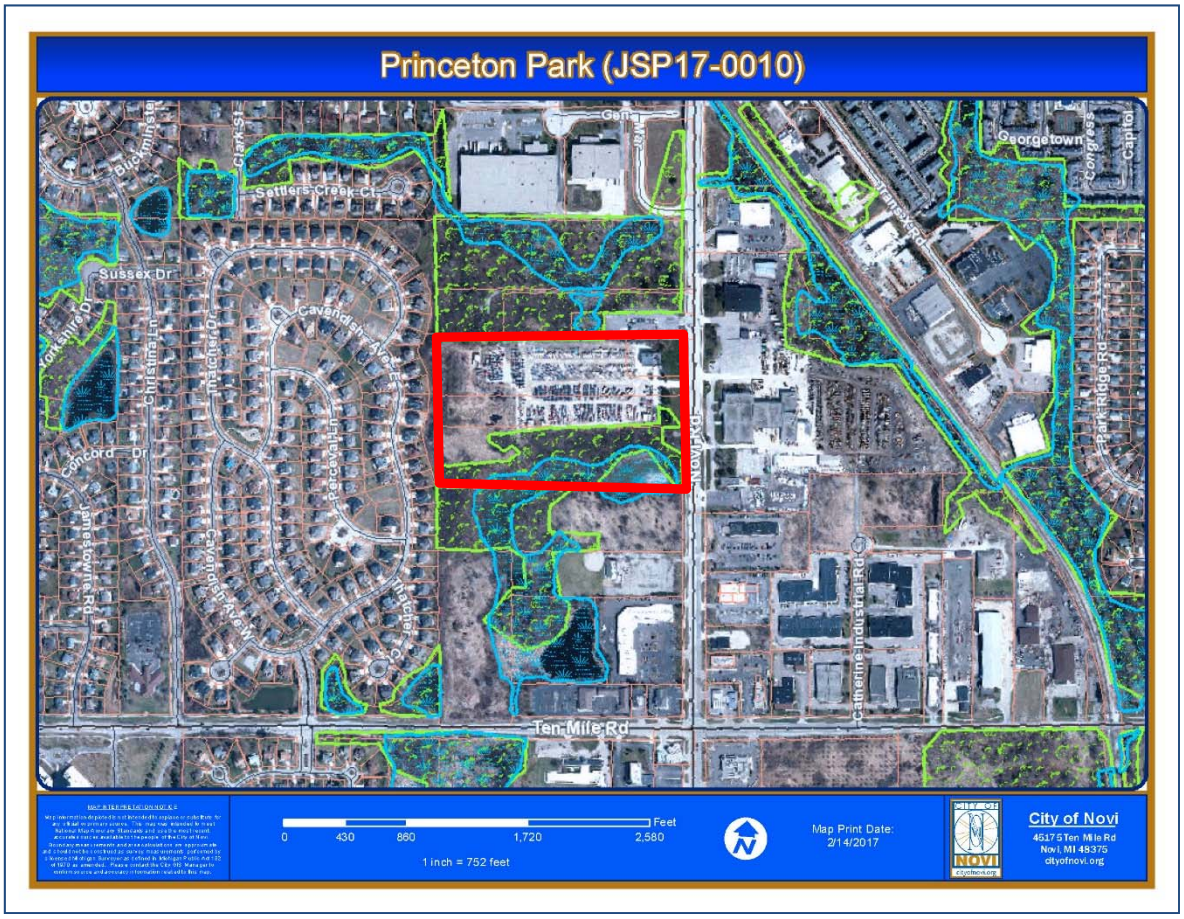
ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.

Pete Hill, P.E.
Senior Associate Engineer

cc: Sri Komaragiri, City of Novi Planner
Richelle Leskun, City of Novi Planning Assistant
Rick Meader, City of Novi Landscape Architect
Kirsten Mellem, City of Novi Planner

Attachments: Figure 1 – City of Novi Regulated Wetland and Woodland Map
Woodland Tree Replacement Chart
Site Photos

Figure 1. City of Novi Regulated Wetland & Woodland Map (approximate project area is highlighted in red). Regulated Woodland areas are shown in green and regulated Wetland areas are shown in blue).



Woodland Tree Replacement Chart

(from Chapter 37 Woodlands Protection)
(All canopy trees to be 2.5" cal or larger, evergreens as listed)

Common Name	Botanical Name
Black Maple	Acer nigrum
Striped Maple	Acer pennsylvanicum
Red Maple	Acer rubrum
Sugar Maple	Acer saccharum
Mountain Maple	Acer spicatum
Ohio Buckeye	Aesculus glabra
Downy Serviceberry	Amelanchier arborea
Yellow Birch	Betula alleghaniensis
Paper Birch	Betula papyrifera
American Hornbeam	Carpinus caroliniana
Bitternut Hickory	Carya cordiformis
Pignut Hickory	Carya glabra
Shagbark Hickory	Carya ovata
Northern Hackberry	Celtis occidentalis
Eastern Redbud	Cercis canadensis
Yellowwood	Cladrastis lutea
Beech	Fagus sp.
Thornless Honeylocust	Gleditsia triacanthos inermis
Kentucky Coffeetree	Gymnocladus diocus
Walnut	Juglans sp.
Eastern Larch	Larix laricina
Sweetgum	Liquidambar styraciflua
Tuliptree	Liriodendron tulipfera
Tupelo	Nyssa sylvatica
American Hophornbeam	Ostrya virginiana
White Spruce_(1.5:1 ratio) (6' ht.)	Picea glauca
Black Spruce_(1.5:1 ratio) (6' ht.)	Picea mariana
Red Pine	Pinus resinosa
White Pine_(1.5:1 ratio) (6' ht.)	Pinus strobus
American Sycamore	Platanus occidentalis
Black Cherry	Prunus serotina
White Oak	Quercus alba
Swamp White Oak	Quercus bicolor
Scarlet Oak	Quercus coccinea
Shingle Oak	Quercus imbricaria
Burr Oak	Quercus macrocarpa
Chinkapin Oak	Quercus muehlenbergii
Red Oak	Quercus rubra
Black Oak	Quercus velutina
American Bladdernut	Staphylea trifolia
Bald Cypress	Taxodium distichum
American Basswood	Tilia americana
Hemlock (1.5:1 ratio) (6' ht.)	Tsuga canadensis

Site Photos

Photo 1. Looking west at area of regulated woodland just north of Wetland Area #1 on the south side of the site (ECT, February 21, 2017).

Photo 2. Looking south at area of regulated woodland just north of Wetland Area #1 on the south side of the site (ECT, February 21, 2017).

TRAFFIC REVIEW

Review based on Concept Site Plan

CONCEPT PLAN SUBMITTAL SCHEDULE		
Type of Submittal	**Date of Submittal**	**Reviewed by**
Concept Plan	February 08, 2017	All Agencies
Revised Concept Plan	March 22, 2017	All Agencies except Traffic, Wetlands, Woodlands and Facade

AECOM
27777 Franklin Road
Southfield
MI, 48034
USA
aecom.com

Project name:
JSP17-0010 Princeton Park Traffic Impact Study Review

To:
Barbara McBeth, AICP
City of Novi
45175 10 Mile Road
Novi, Michigan 48375

From:
AECOM

Date:
March 3, 2017

CC:
Sri Komaragiri, Kirsten Mellem, George Melistas, Theresa Bridges, Richelle Leskun, Darcy Rechtien

Memo

Subject: Princeton Park Traffic Impact Study Review

The traffic impact study was reviewed to the level of detail provided and AECOM **recommends approval** for the applicant to move forward with the condition that the comments provided below are adequately addressed to the satisfaction of the City.

General Comments

1. The applicant, Pulte Homes of Michigan, LLC, is proposing a multi-family residential community located on a 24-acre parcel located on the west side of Novi Road, north of 10 Mile Road and south of Grand River Avenue. The parcel is currently being used for vehicle storage. The development will consist of 129 three-bedroom units. However the impact study was performed for 130 three-bedroom units. AECOM is comfortable accepting the TIS results using 130 units as it is a more conservative approach and the difference in impact should be negligible.
2. The site will be accessed via one driveway to Novi Road.
3. Novi Road is under the jurisdiction of the Road Commission for Oakland County (RCOC).
4. The impact study identifies the impacts at the following locations:
    a. Novi Road and Post Office Drive/Michigan CAT Power Systems Driveway
    b. Novi Road and Michigan CAT Construction Equipment North Drive
    c. Novi Road and Michigan CAT Construction Equipment South Drive
    d. The proposed site access driveway
5. The proposed site driveway offset distance with the U.S. Post Office driveway are in compliance with the City's commercial driveway spacing requirements
6. A right turn deceleration taper for southbound Novi Road traffic is warranted at the site driveway.
7. The study should describe how the proposed signal timing and optimization changes will affect the existing, background, and future delay and queueing at the site driveway and the Michigan CAT Equipment north driveway.
8. The site is currently zoned as OS-1 and will require a zoning change. The impact study should include analysis and results indicating the potential impacts for the maximum building size that is permitted under OS-1 zoning. The traffic impacts for the maximum building size permitted under OS-1 zoning shall then be compared to the proposed site's trip generation estimates and traffic impacts.

Data Collection

1. Turning movement counts were collected on Wednesday, December 14, 2016 from 7:00-9:00AM and 4:00-6:00PM at each study intersection.

2. Existing lane use, traffic control, and signal timing were obtained from RCOC.

Existing Conditions

1. Several minor street approaches and turning movements at the study intersections currently operate below level of service (LOS) D during both peak periods.
2. A queueing analysis determined that significant queueing was not observed during the peak periods at minor street approaches.
3. Reducing the cycle length from 120 seconds to 60 seconds and the optimization of splits at Novi Road and Post Office Drive/Michigan CAT Power Systems Driveway is expected to improve the existing LOS to acceptable conditions at the signalized intersection. However, the following should be considered before any changes are made:
    a. The study does not address how the cycle length and split optimization affects the two study intersections located south of the signal, primarily the approaches at the site development driveway and the Michigan CAT Equipment north driveway.
    b. The reduction of the cycle length may improve the side street delays at the post office/CAT main driveway; however, further analysis would need to be conducted to determine the impact of the changes to the upstream and downstream signalized intersections to review how the corridor progression would be affected by the change.
    c. The proposed cycle length change does not address development-generated impacts, but rather existing condition operations. At this time, the development is not indicating detrimental impacts to Novi Road and the approaches of concern should be contained within the site driveway and the CAT driveway(s), which is relatively consistent with existing conditions.

Background Conditions

1. The study assumes a background traffic growth rate of 1%. The study states that the build-out year is 2019; however, in the calculation of background traffic and the right-turn taper analysis the study uses a build-out year of 2021.
2. There were not any background developments that were identified near the study area.
3. The existing traffic volumes were multiplied with a growth rate of 1% over five years (2021). The resulting background traffic volumes were then balanced. The study text should be updated to include a buildout year of 2021 instead of 2019. Also, provide text that indicates that existing driveway volumes are not expected to increase or decrease and will not be multiplied by the growth rate.
4. Reducing the cycle length from 120 seconds to 60 seconds and the optimization of splits at Novi Road and Post Office drive/Michigan CAT Power Systems driveway is expected to raise the background LOS to acceptable conditions at the signalized intersection. However, the study does not address how the cycle length and split optimization affects the two study intersections located south of the signal, primarily the approaches at the site development driveway and the Michigan CAT Equipment north driveway, or the up- and downstream signalized intersections and corridor progression.

Trip Generation and Future Analysis

1. The study uses ITE code 230 (Residential Condominiums/Townhouse) for 130 dwelling units in order to estimate the site trip generation forecast. The study estimates that the development will generate 808 trips per day with 64 and 75 trips for the AM and PM peak hours respectively.
2. The trip distributions calculated in the site trip distribution table (Table 6) are acceptable based on the methodology described in the study.

3. Reducing the cycle length from 120 seconds to 60 seconds and the optimization of splits at Novi Road and Post Office Drive/Michigan CAT Power Systems Driveway is expected to raise the future LOS to acceptable conditions at the signalized intersection. However, the study does not address how the cycle length and split optimization affects the two study intersections located south of the signal, primarily the approaches at the site development driveway and the Michigan CAT Equipment north driveway, or the up- and downstream signalized intersections and corridor progression.
4. While the added delay to the roadway network from existing conditions may seem significant, the added delay is primarily isolated to the site driveway and the Michigan CAT Power Systems Driveway adjacent to the site driveway.

Should the City or applicant have questions regarding this review, they should contact AECOM for further clarification.

Sincerely,

AECOM

Sterling J. Frazier, E.I.T.
Reviewer, Traffic/ITS Engineer

Matthew G. Klawon, PE
Manager, Traffic Engineering and ITS Engineering Services

AECOM
27777 Franklin Road
Southfield
MI, 48034
USA
aecom.com

Project name:
PSP17-0014 Princeton Park Concept Traffic Review

To:
Barbara McBeth, AICP
City of Novi
45175 10 Mile Road
Novi, Michigan 48375

From:
AECOM

Date:
March 3, 2017

CC:
Sri Komaragiri, Kirsten Mellem, George Melistas, Theresa Bridges, Richelle Leskun, Darcy Rechtien

Memo

Subject: Princeton Park Concept Traffic Review

The concept site plan was reviewed to the level of detail provided and AECOM **recommends approval** for the applicant to move forward with the condition that the comments provided below are adequately addressed to the satisfaction of the City.

GENERAL COMMENTS

1. The applicant, Pulte Homes of Michigan, LLC, is proposing a multi-family residential community located on a 24-acre parcel located on the west side of Novi Road, north of 10 Mile Road and south of Grand River Avenue. The parcel is currently being used for vehicle storage. The development will consist of 129 three-bedroom units.
2. The parcel is currently under OS-1 (Office Service) zoning. However, the developer is using the City's planned rezoning overlay (PRO) option in order to allow for a multi-family housing use (RM-1 zoning).
3. Novi Road is under the jurisdiction of the Road Commission for Oakland County.

TRAFFIC IMPACTS

1. AECOM performed an initial trip generation estimate based on the ITE Trip Generation Manual, 9th Edition, as follows:

   ITE Code: 230 (Residential Townhouses/Condominiums)
   Development-specific Quantity: 129 dwelling units
   Zoning Change: Planned Rezoning Overlay (PRO) from OS-1 to RM-1. The existing land-use of the parcel is vehicle storage. Information to estimate the existing number of trips to and from the parcel is unavailable; however, the traffic impacts incurred from the existing development are expected to be negligible.

Trip Generation Summary			
	City of Novi Threshold	**Estimated Trips**	**Analysis**
AM Peak-Hour, Peak-Direction Trips	100	53	Fitted Curve Equation

PM Peak-Hour, Peak-Direction Trips	100	50	Fitted Curve Equation
Daily (One-Directional) Trips	750	803	Fitted Curve Equation

2. The number of trips does exceed the City's threshold of more than 750 trips per day or 100 trips per either the AM or PM peak hour. AECOM recommends performing the following traffic impact study in accordance with the City's requirements:

Traffic Impact Study Recommendation	
Type of Study	**Justification**
Traffic Impact Study	The applicant has provided a TIS dated 2/6/2017. The TIS will be reviewed separately and comments will be provided in a separate letter to the City and developer.

EXTERNAL SITE ACCESS AND OPERATIONS

The following comments relate to the external interface between the proposed development and the surrounding roadway(s).

1. The applicant has proposed an entrance in alignment with the Michigan CAT construction equipment driveway on the west side of Novi Road.
2. The driveway design is generally compliant with City standards; however, the following items were areas of concern:
    a. The island nose offset was not provided. Please provide dimensions in future submittals.
    b. The island length (116') was greater than the maximum allowable length. Please update to be between 30' and 100'.
    c. See Figure IX.3 in the City of Novi Code of Ordinances for further information on boulevard dimension guidance.
3. **The applicant has provided an exclusive right turn lane into the development. The applicant is also required to provide an exiting taper out of the development.**
4. The applicant has indicated that sight distance is expected to exceed the City's minimum required distance; however, the sight distance measurements were calculated from 15' from the edge of pavement, while the City requires such measurements to be taken from 20' from the edge of pavement. The applicant should re-measure sight distances from the correct location in accordance with Figure VIII-E in the City of Novi Code of Ordinances.
5. Based upon an estimation that the two driveways on the west side of Novi Road located to the north and south of the proposed driveway generate less than 400 trips per peak hour, driveway spacing requirements are in compliance with City standards.
6. The applicant has provided an emergency access path to the development, which is also located off of Novi Road. The following are areas of concern with regard to the proposed emergency access path:
    a. The applicant is proposing turf pavers for the emergency access path. The use of turf pavers shall be approved by the fire Marshal.
    b. The emergency route is also a shared pedestrian path. While the emergency access route is not intended to be used often, the safety of the pedestrians may be a concern.
    c. Emergency vehicles would be required to access the emergency path by mounting the curb on Novi Road and then crossing over several sidewalks to gain access to the main roadway within the site. If the sidewalks and curbs are not designed to support the weight and operation of an emergency vehicle, they

may become damaged. The design of the infrastructure components should be reviewed and updated accordingly to satisfy the needs of the emergency access route.
   d. A gate is required near the entrance to the emergency path.
   e. The applicant should strongly consider paving the emergency access path in its entirety due to the aforementioned concerns.
7. The proposed driveway is located approximately 185 feet south of the stop bar for northbound Novi Road traffic at the signalized intersection with the U.S. Post Office. The impacts of this should be discussed within the TIS.

INTERNAL SITE OPERATIONS

The following comments relate to the on-site design and traffic flow operations.

1. General Traffic Flow
   a. The minimum horizontal curve radius is required to be 100 feet.
   b. On-street parking shall be restricted using signage in areas with curve radii less than 230 feet.
2. Parking Facilities
   a. The development has proposed a two-car garage with each unit in addition to a minimum 20'x19.17' driveway.
   b. The applicant is required to provide one bicycle parking space for every five dwelling units, totaling 26 bicycle parking spaces. The applicant has provided seven bicycle parking areas with four spaces each totaling 28 bicycle parking spaces.
   c. The bicycle parking lot layout detail is in compliance with City standards.
   d. The applicant should indicate whether on street parking will be permitted and any “no parking” areas, as applicable.
3. The roadway width is in compliance with City standards
4. Sidewalk Requirements
   a. Provide dimensions for sidewalk width throughout the development.
   b. Update the sidewalk ramp and detectable warning detail R-28-I to R-28-J.
   c. **The applicant has requested a deviation from the requirement to provide sidewalk on both sides of a roadway. AECOM does not support the deviation.**
   d. The outside edge of the sidewalk shall be a minimum of 15 feet from the back of curb. Based on discussions with the City, a deviation to provide a minimum of 7.5 feet from the back of curb to the edge of sidewalk would be supported.
   e. The applicant should provide ramps on the receiving end of the sidewalk across from which other sidewalk ramps are proposed.
   f. The applicant should provide sidewalk ramps at the T-intersection to provide a crossing area at the intersection.
   g. The applicant could consider providing crosswalks at main crossings on the ring road.
   h. The developer is proposing a pathway connecting the proposed subdivision with the subdivision to the west and Novi Road.
5. All on-site signing and pavement markings shall be in compliance with the Michigan Manual on Uniform Traffic Control Devices. The following is a discussion of the proposed signing.
   a. In future submittals, include a signing quantities table with any applicable details. The proposed stop signs in this submittal have been noted.

Should the City or applicant have questions regarding this review, they should contact AECOM for further clarification.

Sincerely,

AECOM

Sterling J. Frazier, E.I.T.
Reviewer, Traffic/ITS Engineer

Matthew G. Klawon, PE
Manager, Traffic Engineering and ITS Engineering Services

FACADE REVIEW

Review based on Concept Site Plan

CONCEPT PLAN SUBMITTAL SCHEDULE		
Type of Submittal	**Date of Submittal**	**Reviewed by**
Concept Plan	February 08, 2017	All Agencies
Revised Concept Plan	March 22, 2017	All Agencies except Traffic, Wetlands, Woodlands and Facade

DRN & ASSOCIATES, ARCHITECTS, PC
Phone: (248) 880-6523
E-Mail: dnecci@drnarchitects.com
Web: drnarchitects.com
50850 Applebrooke Dr., Northville, MI 48167

February 29, 2017

City of Novi Planning Department
45175 W. 10 Mile Rd.
Novi, MI 48375-3024

Attn: Ms. Barb McBeth – Director of Community Development

Re: FACADE ORDINANCE REVIEW
Princeton Park, PRO Concept Plan, PSP17-0014
Façade Region: 1, Zoning District: OS-1

Dear Ms. McBeth:

The following is the Facade Review of the conceptual elevations provided by the Pulte Group for compliance with the Façade Ordinance, Section 5.15. This submittal includes colored renderings of the front facades (see attached copies) and floor plans for two models. Drawings of the side and rear elevations and material callouts for all facades were not provided. The color sample board required by Section 5.15.4.D of the Façade Ordinance was not provided. The percentages of materials listed below are based solely on visual interpretation of the renderings.

Unit A	Front	Rear	Side	Side	Ordinance Maximum (Minimum)
Stone or Brick	**8%**	**N.P.**	**N.P.**	**N.P.**	100% (30% Min)
Horizontal Siding	45%	**N.P.**	**N.P.**	**N.P.**	50% (Note 11)
Asphalt Shingles	**32%**	**N.P.**	**N.P.**	**N.P.**	25%
Wood Trim	15%	**N.P.**	**N.P.**	**N.P.**	15%

Unit B	Front	Rear	Side (Entrance)	Rear Concealed Units	Ordinance Maximum (Minimum)
Stone or Brick	**5%**	**N.P.**	**N.P.**	**N.P.**	100% (30% Min)
Horizontal Siding	20%	**N.P.**	**N.P.**	**N.P.**	50% (Note 11)
Shake Siding	17%	**N.P.**	**N.P.**	**N.P.**	50%
Asphalt Shingles	**43%**	**N.P.**	**N.P.**	**N.P.**	25%
Wood Trim	15%	**N.P.**	**N.P.**	**N.P.**	25%

Recommendation: We are unable to make a determination as to the degree of compliance with the Façade Ordinance due to a lack of information. The applicant should provide the following information. Please refer to Section 5.15.4 of the Ordnance for specific requirements;

1. Scaled drawings of the front, side and rear elevations with all proposed materials clearly identified.

2. Scaled floor plans for all models and options.

3. Façade material sample board indicating the color and texture of all materials identified on the elevations.

The elevations provided appear to deviate significantly from the requirements of the Façade Ordinance. For example, the Ordinance requires that all facades have a minimum of 30% brick or stone. It appears that less than 10% is provided. Although Section 5.15.9 the Ordinance allows deviations from the strict application of the percentages, we would strongly recommend that the minimum amount of brick or stone be provided. This can generally be achieved by extending brick or stone up to the second floor belt line on all facades.

If you have any questions regarding this application, please do not hesitate to call.

Sincerely,
DRN & Associates, Architects PC

Douglas R. Necci, AIA

Attachment;
Copy, Units A & B

Exterior front rendering

Front Elevation

Unit B
Applecross Phase 5B
TND2 Conditional Use Application

PulteGroup™
PulteGroup - Mid-Atlantic Division
1600 Arrowhead Drive, Farifax, VA 22030

03.27.15

FIRE REVIEW

Review based on Revised Concept Site Plan dated April 03, 2017

CONCEPT PLAN SUBMITTAL SCHEDULE		
Type of Submittal	**Date of Submittal**	**Reviewed by**
Concept Plan	February 08, 2017	All Agencies
Revised Concept Plan	March 22, 2017	All Agencies except Traffic, Wetlands, Woodlands and Facade

April 12th, 2017

TO: Barbara McBeth- City Planner
Sri Ravali Komaragiri- Plan Review Center
Kirsten Mellem- Plan Review Center

RE: Princeton Park Planned Rezoning Overlay

PSP# 17-0037

Project Description:

Multi-family residential on a 24 acre plot of land. The development is planned to be constructed in two phases. 125 units; 25 separate structures; 4-6 units per structure; total of 423 rooms.

Comments:

-Proposed 500 rooms, Novi will only allow 423 (Novi Zoning code - 3.8.1.a)
-Design considerations- secondary access must be a minimum of 20 feet in width and provide all weather access (IFC 503.2.1).
-Permanent Break-away gate shall be provided at secondary access.
- Turf pavers may be allowed for secondary access if:
1. The proposed use of turf pavers shall be evaluated by the fire marshal, which evaluation shall include a review of the standard details for construction established by the city engineer and adopted by resolution of the city council.
2. The pavers proposed will support 35 tons.
3. A secondary access drive constructed of turf pavers shall be designed by landscaping and signage clearly indicating its function and shall be mowed and kept clear of snow at all times.
4. Under no circumstance shall the secondary access drive be permitted under this section be considered suitable or intended for use as a platform for fire engine or ladder truck operations. (Sec. 11-194 (19) c)
- FD roads shall be not less than 20 feet in width and have a vertical clearance of 14 feet or more. (Sec. 503.2.1)
- Fire Department road access must be all weather driving capabilities and support 35 tons. (Sec. 503.2.3)
- The minimum outside turning radius required will be 50 feet. (Sec. 503.2.4)
-Hydrant spacing needs to be 300 feet or closer due to multifamily residential buildings—multi-unit structures. (Sec. 11-68 (f) Fire Hydrants and Appurtenances (c.)

Novi Public Safety Administration
45125 W. Ten Mile Road
Novi, Michigan 48375
248.348.7100
248.347.0590 fax

cityofnovi.org

Recommendation:

APPROVAL WITH CONDITIONS

Sincerely,

Peter Breuhan-Acting Fire Marshal
City of Novi – Fire Dept.

cc: file

APPLICANTS RESPONSE LETTER

May 3, 2017

Sri Komaragiri, Planner
City of Novi
45175 10 Mile Road
Novi, Michigan 48375

RE: Planning Review – Emerson Park (f.k.a. Princeton Park)
JSP17-10 with Rezoning 18.717

Thank you for provided your review and feedback for the above referenced project. For your use, below are our responses to or how we plan to address each of the comments in your letter comment matrix during future submittals. If a comment is not spoken to in this response letter, it shall be assumed that the comment is noted, a variance is not being requested, and the comment will be addressed with future submittals.

PLANNING REVIEW

Zoning and Use Requirements:

Phasing – Show phase lines on the concept plan and add notes in this regard on the plan as well
Response: *Phasing will be shown on the Preliminary Site Plan submittal following Concept PRO approval.*

Planned Rezoning Overlay Document Requirements:

Written Statement – Refer to the review letter for staff comments on the proposed benefits.
Response: *The proposed benefits will be discussed during the public meeting.*

Traffic – Refer to Traffic Impact Study Review:
Response: *The developer intends to comply with the traffic review comments and is not asking for deviations on these items. The TIS will be revised in accordance with the AECOM review and will be submitted with the Preliminary Site Plan following Concept PRO approval.*

Height, bulk, density and area limitations

Refer to definition of usable open space. The usable open spaces are supposed to be designed and intended for the private recreational use of residents of the building. They should be directly accessible by means of common passageway. In addition, the southern area abuts regulated wetlands and has steep slopes and cannot be used for common recreation. Revise the open space calculations and exhibit accordingly.
Response: *We can work through specifics of the definition of useable open space during the preliminary site plan review, but we believe there is well over 25,000 square feet of usable open space on for the current plan. The open space exhibit on the previous plan depicts over 269,200 square feet of open space, which is over 10 times the requirement.*

311 N. Main Street, Ann Arbor, MI 48104 Tel: 734.994.4000 Fax: 734.994.1590
www.atwell-group.com

Residential Building Setbacks:

Indicate setbacks excluding decks. North setback is considered a deviation.
Response: *Dimensions indicating the setbacks excluding decks will be listed on the Preliminary Site Plan. All the setbacks excluding the north setback are greater than those required by ordinance.* ***It is noted that the north setback is a requested deviation.***

Note to District Standards:

Distance Between Buildings – See Comments on Page 8.
Response: *No building distance comments are noted on page 8 of the review. Refer to the revised building separation table on the layout plan.*

RM-1 and RM-2 Required Conditions:

Total Number of Rooms – Total proposed number of rooms is exceeding the maximum number of rooms allowed for this property. This is considered a deviation.
Response: *500 rooms are proposed with the revised layout (125 units x 4 rooms). With the RM-2 zoning, 1,207 rooms are allowed (19.4 * 43,560 / 700).* ***Therefore, this is NOT a requested deviation any longer under the RM-2 zoning.***

Building Orientation – Structure shall be oriented at a minimum angle of forty-five (45) degrees to said property line. This is considered a deviation.
Response: *This is not feasible as the space required to rotate all the buildings at 45 degree angles to the north, west and south property lines (buildings 2-14) would require the elimination of all the internal units (buildings 17-25) and make the driveway interfaces with the proposed roadway to be very awkward.* ***It is noted that this is a requested deviation.***

Pedestrian Connectivity – Landscape plans are still referring to Original concept plan with 129 units and previous pedestrian path system.
Response: *As noted in the previous response letter, concept approval was recommended for the landscaping and direct plan revisions or responses were not included with the re-submittal, but the applicant will continue to work with the City to address the remaining comments, update the plan, and respond to each of the noted comments with the submittal of the Preliminary Site Plan.*

Pedestrian Connectivity – All sidewalks shall comply with barrier free design standards. Add a note to the plan to verify conformance.
Response: *Refer to note #4 on sheet 05 of the previously submitted plans.*

General Requirements – Label the width of the sidewalk. The width of sidewalk is considered a deviation.
Response: *The proposed width of the sidewalk is 5 feet, which meets City requirements. This is labeled on the typical road section on sheet 08 of the previously submitted plans.* ***Therefore, this is NOT a requested deviation.***

Bicycle Parking Lot Layout – Provide the layout plan as required.
Response: *The proposed bicycle parking lot layout detail is depicted on sheet 08 of the previously submitted plans.*

Sidewalks and Other Requirements:

Non-Motorized Plan – No connections to the proposed trails are proposed. The applicant should consider the recommended neighborhood connector.
Response: *The development to the west is not in support of the neighborhood connector. This connector was discussed in the Master Plan and Zoning Committee meeting and the connector was removed from the plan in response to this meeting.*

Other Permits and Approvals / Other Legal Requirements:

Development/Business Sign – Revise the location to meet code. The proposed sign is located 4 ft. from the Novi Road right-of-way. Provide the layout plan as required.
Response: *The proposed development monument sign is greater than 10 feet from the Novi Road Right of Way. The temporary rezoning notification sign location as labeled on sheet 05 is shown at 4 feet from right-of-way, but this is not intended to be a permanent development sign. The developer will work with the City to meet development sign review ordinances during the Preliminary Site Plan process.*

ENGINEERING REVIEW

General:

1. **A stub street to the property boundary at intervals not to exceed 1,300 feet along the perimeter is required by ordinance. Request a deviation from Appendix C Section 4.04(A)(1) of the Novi City Code. City staff supports this request.**
   Response: ***The City staff supported deviation request is noted.***

Water Main:

2. Note that hydrants shall be placed no less than seven (7) feet, but no more than fifteen (15) feet, from the back of curb or the edge of pavement where there is no curb. Hydrants shall be placed approximately five hundred (500) feet apart.
   Response: *Noted. Comment will be addressed with the Preliminary Site Plan submittal.*

3. Provide a stub for connection to future development to south to create a looped system.
   Response: *A water main stub can be provided at the southwest corner of the site as determined appropriate during the Site Plan process. The rest of the south property is wetland.*

Sanitary Sewer:

4. Provide the diameter and material type for all proposed and existing sanitary sewer at the time of Preliminary Site Plan submittal.
   Response: *The requested information will be provided on the Preliminary Site Plan in accordance with City standards.*

Storm Sewer:

5. Revise the plan set to provide rear yard drainage systems to minimize the distance that surface drainage must pass through to reach a drainage structure. **Untreated sheet flow into wetland areas is not permitted.**
   Response: *A catch basin in being provided in between each building, so the requested additional basins does not seem to apply, but we would be open to add addition basins per the direction of the City following further coordination with the City at subsequent Site Plan submittals. The walkout basements are required for buildings 10-15 to make the site grading work in this area with the existing site slope constraints. The roof water discharge would be clean. Impervious runoff from the minimal rear roof areas and small ancillary structures (decks/sunrooms) in the rears of these few buildings will be treated by means of vegetative sheet flow (greater than 100 feet in length) prior to discharge to the large wetland system. This will provide treatment without the need to remove additional existing trees.*

6. Provide the location for all residential sump leads. All leads must discharge into the subdivision's storm sewer network.
   Response: *Sump leads will be shown of the subsequent Site Plan submittals. Buildings 9-15 will plan to have sump discharges out of the front of the building and additional storm sewer will be shown as applicable. Building 16 will plan to have a sump discharge direct to the detention basin or to a storm sewer basin in front of the building.*

7. Provide an oil/gas separator with a four (4) foot sump at the last structure prior to discharge into the basins.
   Response: *The oil/gas separator callouts and a detail will be provided on the Preliminary Site Plan.*

Paving & Grading

8. **The location of the sidewalk adjacent to the curb is not in accordance with the Engineering Design Manual section 7.4.2.C.1, which requires that sidewalk on private roadways to be placed 15 feet from the back of curb. Given the constraints of the site, a deviation to provide minimum of 7.5 feet from back of curb to edge of sidewalk is supported by staff.**
   Response: ***The City requested staff deviation request is noted.***

9. The emergency access path should be paved with asphalt, which facilitates snow clearing to maintain all-season emergency access. If grass pavers are used, the emergency access path must be delineated along the edges to easily identify the route.
   Response: *The applicant would still like to keep the turf pavers option open for the emergency access path, but will continue to work with the City on ensuring applicability and acceptance. Refer to Fire Department review.*

10. The emergency access drive must be 20 feet wide, not including the adjacent sidewalk. The 5 foot sidewalk can be adjacent to the emergency access route.
    Response: *The walk will be revised in accordance with this request on the Preliminary Site Plan.*

11. A plan for snow clearing and year round maintenance of the emergency access path should be addressed in the master deed.

Response: *Noted. This will be addressed with the Master Deed.*

Storm Water Management Plan

12. The Storm Water Management Plan for this development shall be designed in accordance with the Storm Water Ordinance and Chapter 5 of the Engineering Design Manual.
    Response: *Noted.*

13. The SWMP must detail the storm water system design, calculations, details, and maintenance as stated in the ordinance. The SWMP must address the discharge of storm water off-site, and evidence of its adequacy must be provided. This should be done by comparing pre- and post-development discharge areas, rates and volumes. The area being used for this off-site discharge should be delineated and the ultimate location of discharge shown. The applicant is responsible for verifying that the proposed discharge point(s) has adequate capacity to accept the designed drainage flows.
    a. Revise the plan set to provide a pre- and post-development tributary area map.
    b. Include in the post-development tributary map details to account for all disturbed areas that are not maintained in their respective natural states.
    c. Explain how the developed c factor of 0.6 is calculated.
    d. Clarify the detention basin elevations for first flush and bank full volumes to make the table of elevations consistent with the volumes calculated.
    e. Show the calculations used to determine the existing and proposed run off rates and volumes.

    Response: *The requested detailed tributary map and calculations will be provided and further refined with the Site Plan submittals. Proposed discharge outlets within the same wetland system as that in existing conditions and discharges at a reduced rate.*

14. Clearly delineate the 25-foot vegetated buffer around the full perimeter of each storm water basin. This buffer cannot encroach on adjacent lots or property or public right-of-way.
    Response: *The buffer is clearly delineated and no longer encroaches on the adjacent right-of-way (or adjacent lots). We are requesting the acceptance of placing the entrance signs in the buffers at the entrance to the site as these minor vertical structures would not degrade from the overall intent of a vegetative buffer providing for a storm water sheet flow buffer and the entry signs will improve ascetics in the area.*

15. Revise the plan set to provide a minimum length to width ratio of 3 to 1 for the proposed detention basins. Additional pretreatment may be required if this requirement cannot be met.
    Response: *The basins are intended to be wet detention and not constructed wetlands. Therefore, the 3 to 1 ratio does not apply. Note however that the basins are interconnected and the approximated rectangular configuration length the width ratio as a singular basin is much greater than 3 to 1 (closer to 3.5 to 1). Also note that the conveyance inlet is a completely separate detention basin cell than the outlet, providing enhanced treatment.*

LANDSCAPING REVIEW

Response: *Refer to Concept Plan Landscape Review response letter provided by FP&A.*

FIRE REVIEW

Response: *No ordinance deviations are requested.*

The applicant will continue to work with the City to address the remaining comments and will respond to each of the noted comments with the submittal of the Preliminary Site Plan. Of note, the required break away gate will be provided as shown on sheet 05 and the detail as shown on sheet 08. The hydrant spacing will be revised to meet the 300 feet requirement. The applicant would still like to keep the turf pavers option open for the emergency access path, but will continue to work with the City on ensuring applicability and acceptance.

TRAFFIC REVIEW (AECOM)

Response: *No ordinance deviations are requested.*

The applicant will continue to work with the City to address the remaining traffic comments with the submittal of the Preliminary Site Plan. The TIS will also be revised in accordance with the provided traffic comments and resubmitted with the Preliminary Site Plan.

WETLAND REVIEW (ECT)

Response: *No ordinance deviations are requested.*

The applicant will continue to work with the City to address the remaining comments from these disciplines and respond to each of the noted comments with the submittal of the Preliminary Site Plan.

FACADE REVIEW (DRN & ASSOCIATES)

Response: *No ordinance deviations being requested.*

Façade review is not required for Concept PRO. Scaled building elevation drawings, floor plans for the models, and a façade material sample will be provided with supplemental Site Plan submittals for review when these documents are completed. It is the applicant's intent to comply with the building façade requirement to have a minimum of 30% brick or stone.

It is noted that the concept plan is **recommended for approval by the landscaping, wetlands, woodlands, traffic, and fire** review disciplines. Direct responses to comments from these disciplines, with the exception of the landscaping, are not included within this specific re-submittal, but **the applicant will continue to work with the City to address the remaining comments from these disciplines and respond to each of the noted comments with the submittal of the Preliminary Site Plan.**

Scaled building elevation drawings, floor plans for the models, and a façade material sample will be provided with supplemental submittals for review when these documents are completed. **It is the applicant's intent to comply with the building façade requirement to have a minimum of 30% brick or stone.**

Should you have any remaining questions or need anything else from us to help facilitate your review and approvals, please do not hesitate to contact me direct at (810) 923-6878.

Sincerely,
ATWELL, LLC

Matthew W. Bush, P.E.
Project Manager / Engineer

May 3, 2017

Ms. Barbara McBeth
City of Novi Community Development
45175 West Ten Mile Road
Novi, MI 48375

RE: Princeton Park PRO Concept Plan Landscape Review, Job # JSP17-0010

Dear Ms. McBeth:

The following is in response to the city landscape review comments dated April 11, 2017 and offer the following comments:

LANDSCAPE DEVIATION

1. Final number of street trees provided along Novi road to be approved by Oakland County Road Commission per county requirements and standards.
2. A waiver for the required 4 1/2' high berm along north property line will be requested. Stagger row of 10' and 12' high evergreen trees will be provided in-lieu of a berm to provide the buffer screening required.
3. A waiver for the landscape buffer along south property line will be requested. The existing wetland /pond/ trees and vegetation provides sufficient screening required and this deviation is supported by staff.
4. A waiver for the berm will be requested along Novi Road. A minimum 34' wide greenbelt is required and a 130'+ distance is provided between building and sidewalk. The large greenbelt with landscaping will provide sufficient screening from Novi Road. This deviation is supported by staff.
5. Additional detention basin shrub plantings will be provided to meet the perimeter planting requirements.
6. Woodland replacement upsizing credits will be removed. Woodland replacement credit will be revised per city standards and requirements.

- A waiver will be requested to receive credit for ornamental trees for Multi-Family tree plantings requirements. The ornament trees will provide diversity to the plant material list and this deviation is supported by staff.

Proposed trees to be saved

- Tree fencing detail will be added per City of Novi detail standards.

Woodland replacement trees

- Woodland replacement upsizing credits will be removed. Woodland replacement credit will be revised per city standards and requirements.

Adjacent to Public Rights-of-Way – Berm (Wall & Buffer)

- A waiver for the berm will be requested along Novi Road. A minimum 34' wide greenbelt is required and a 130'+ distance is provided between building and sidewalk. The large greenbelt with landscaping will provide sufficient screening from Novi Road. This deviation is supported by staff.
- Sub-canopy trees in-lieu of canopy trees will be utilized as substitute for canopy trees under overhead utility lines per city approval

FPA
FELINO A. PASCUAL and ASSOCIATES
Community Land Planner and registered Landscape Architect

24333 Orchard Lake Rd • Suite G • Farmington Hills, Michigan 48336 • phone (248) 557-5588 • fax (248) 557-5416

Street Tree Requirements

- Clear vison triangles zone be provided/illustrated for the interior road intersection and the trees will be relocated outside of the clear vision zone.
- Final number of street trees provided along Novi road to be approved by Oakland County Road Commission per county requirements and standards.
- A waiver to locate some of the interior street trees between sidewalk and bldg. will be requested. Selected tree species will be utilize to minimize pavement and sidewalk root damage.
- Sub-canopy trees in-lieu of canopy trees will be utilized as substitute for canopy trees under overhead utility lines per city approval.

Multi-family Landscaping requirements

- A waiver will be requested to receive credit for ornamental trees for multi-family tree plantings requirements. The ornament trees will provide diversity to the plant material list. This deviation is supported by staff.

Transformer/Utility Box Screening

- The utility box screening details and plant spacing will provide per city standards/details

Plant List

- Crimson King Norway Maple will be replaced with another tree species.
- All plant count on the plans and plant list will be verified.

Planting Notations and Details

- Multi-stem tree planting detail will be provided on the plan.
- Standard city of Novi landscape notes will be added on the plan.
- Landscape cost estimate will be provided during final site plan approval per city standards.

Irrigation

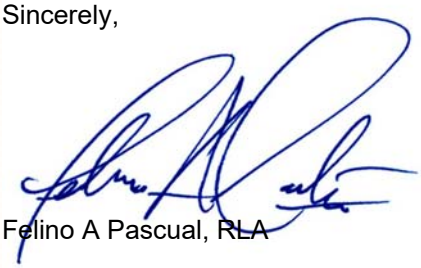
- Irrigation plan will be provided during final site plan approval.

Snow Deposit Areas

- Locations will be provided during site plan approval.

Please do not hesitate to contact me should you have any questions or comments.

Sincerely,



Felino A Pascual, RLA

FPA
FELINO A. PASCUAL and ASSOCIATES
Community Land Planner and registered Landscape Architect

24333 Orchard Lake Rd • Suite G • Farmington Hills, Michigan 48336 • phone (248) 557-5588 • fax (248) 557-5416

LETTERS OF SUPPORT

Steve Schafer

From: Arkan Jonna <ajonna@afjonna.com>
Sent: Wednesday, January 18, 2017 10:14 AM
To: 'Steve Schafer'
Subject: Novi

Good morning Steve, trust all is well. Steve we went to the site that Pulte is proposing to develop on Novi Road. Unfortunately, the site is not well suited for a retail/office use as it is not close enough to the Grand River or 10 mile Road intersections. We have found that mid-block retail that far from an intersection do not perform well for retail use. Thank you for sending us this opportunity but, we have to pass on this one. Good luck with the development I think it will be an excellent site for the Townhomes you are proposing.

Thanks Again,
Arkan

A.F. JONNA
DEVELOPMENT & MANAGEMENT CO

Arkan Jonna
4036 Telegraph Road, Suite 201
Bloomfield Hills, MI 48302
Ph: (248) 593-6200 Ext. 101
Cell: (248) 830-9495
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AJonna@AFJonna.com

To View Our Properties, please visit our website: www.afjonna.com

MID-AMERICA®

Mid-America Real Estate Group 38500 Woodward Avenue, Suite 100

MidAmericaGrp.com Bloomfield Hills, Michigan 48304

Mr. Joe Skore
Pulte Homes
100 Bloomfield Hills Pkwy, Suite 300
Bloomfield Hills, MI 48304

Re: Novi, MI

Dear Joe:

I reviewed the site plan you presented me for the proposed development on Novi Road between 10 mile and Grand River. While this may be a very good residential site I do not believe it is a good site for retail or office. There is enough small retail and small office availability at the corners of both 10 mile and at Grand River and there is really very little demand from "credit worthy" tenants for a mid-block site. This area also competes with the Novi Town Center trade area and that is where most of the quality tenants want to locate. As evidenced by the tenant turnover and vacancies in both centers at the corner of 10 mile and at Grand River I do not believe anymore retail or office should be built in an unanchored mid-block development.

If you have any questions please feel free to call me.

Sincerely,

Bradley S. Rosenberg

Bradley S. Rosenberg
Principal
Mid-America Real Estate – Michigan, Inc.

Steve Schafer

From: Arkan Jonna <ajonna@afjonna.com>
Sent: Wednesday, January 18, 2017 10:14 AM
To: 'Steve Schafer'
Subject: Novi

Good morning Steve, trust all is well. Steve we went to the site that Pulte is proposing to develop on Novi Road. Unfortunately, the site is not well suited for a retail/office use as it is not close enough to the Grand River or 10 mile Road intersections. We have found that mid-block retail that far from an intersection do not perform well for retail use. Thank you for sending us this opportunity but, we have to pass on this one. Good luck with the development I think it will be an excellent site for the Townhomes you are proposing.

Thanks Again,
Arkan

A.F. JONNA
DEVELOPMENT & MANAGEMENT CO

Arkan Jonna
4036 Telegraph Road, Suite 201
Bloomfield Hills, MI 48302
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AJonna@AFJonna.com

To View Our Properties, please visit our website: www.afjonna.com

MID-AMERICA®

Mid-America Real Estate Group
MidAmericaGrp.com
38500 Woodward Avenue, Suite 100
Bloomfield Hills, Michigan 48304

Mr. Joe Skore
Pulte Homes
100 Bloomfield Hills Pkwy, Suite 300
Bloomfield Hills, MI 48304

Re: Novi, MI

Dear Joe:

I reviewed the site plan you presented me for the proposed development on Novi Road between 10 mile and Grand River. While this may be a very good residential site I do not believe it is a good site for retail or office. There is enough small retail and small office availability at the corners of both 10 mile and at Grand River and there is really very little demand from "credit worthy" tenants for a mid-block site. This area also competes with the Novi Town Center trade area and that is where most of the quality tenants want to locate. As evidenced by the tenant turnover and vacancies in both centers at the corner of 10 mile and at Grand River I do not believe anymore retail or office should be built in an unanchored mid-block development.

If you have any questions please feel free to call me.

Sincerely,

Bradley S. Rosenberg

Bradley S. Rosenberg
Principal
Mid-America Real Estate – Michigan, Inc.

TRAFFIC STUDY

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Memo

VIA EMAIL

To:	**Mr. Joe Skore** **Pulte Group**
From:	**Michael J. Labadie, PE** **Julie M. Kroll, PE, PTOE** **Steven J. Russo, PE** **Fleis & VandenBrink**
Date:	**February 6, 2017**
Re:	**Pulte Group Residential Development** **City of Novi, Michigan** **Traffic Impact Study**

Introduction

This memorandum presents the results of the Traffic Impact Study (TIS) for the proposed Pulte Group residential development. The project site is located at 24855 Novi Road in Novi, Michigan. The proposed development includes 130 attached (for sale) residential units. Site access is proposed via one site driveway to Novi Road. Per the City of Novi Community Development Department's *Site Plan and Development Manual (Section 1)*, a Traffic Impact Study (TIS) is required.

Novi Road is under the jurisdiction of the Road Commission for Oakland County (RCOC). This TIS has been completed to identify the impacts (if any) of the proposed development on the following study intersections:

- Novi Road & Post Office Drive/Michigan CAT Power Systems Driveway,
- Novi Road & Michigan CAT Construction Equipment North Drive,
- Novi Road & Michigan CAT Construction Equipment South Drive, and
- The proposed site access location.

The scope of the study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice, and methodologies published by the Institute of Transportation Engineers (ITE). Additionally, F&V solicited input regarding the scope of work from RCOC and the City of Novi traffic consultant, AECOM.

Data Collection

The existing weekday turning movement traffic volume data were collected by F&V subconsultant Traffic Data Collection, Inc. (TDC) on Wednesday, December 14, 2016. Intersection turning movement counts were collected during the weekday AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak periods at all study intersections. This data was used as a baseline to establish existing traffic conditions without the proposed development. The peak hour volumes for each intersection were utilized for this study and the volumes were balanced upward through the study network. Additionally, F&V collected an inventory of existing lane use and traffic controls and obtained existing traffic signal timing information from RCOC. The applicable data referenced in this memorandum are attached.

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Farmington Hills, MI 48334
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Existing Conditions

Existing peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersections using Synchro (Version 9) traffic analysis software. This analysis was based on the existing lane use and traffic control shown on the attached Figure 1, the existing peak hour traffic volumes shown on the attached Figure 2, and the methodologies presented in the *Highway Capacity Manual 2010* (HCM). Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions. Additionally, SimTraffic network simulations were reviewed to evaluate network operations and vehicle queues. The existing conditions results are attached and summarized in Table 1.

Table 1: Existing Intersection Operations

Intersection	Control	Approach	AM Peak Delay (s/veh)	AM Peak LOS	PM Peak Delay (s/veh)	PM Peak LOS
1. Novi Road & US Post Office Drive / Michigan CAT Main Drive	Signalized	EB	60.4	E	58.3	E
		WB	54.8	D	56.4	E
		NB	2.2	A	3.1	A
		SB	2.0	A	2.9	A
		Overall	**5.1**	**A**	**6.9**	**A**
2. Novi Road & Michigan CAT Equipment North Drive	STOP (Minor)	EB	35.4	E	64.8	F
		WB	16.3	C	62.2	F
		NB LT	0*	A	0*	A
		SB LT	10.5	B	0*	A
3. Novi Road & Michigan CAT Equipment South Drive	STOP (Minor)	WB	16.6	C	17.8	C
		NB	Free		Free	
		SB LT	10.4	B	10.9	B

*No traffic demand is present.

The results of the existing conditions analysis show that several approaches and movements at the study intersections currently operate at a LOS E or F during both peak periods. The vehicle simulations were further reviewed and the simulations show that significant vehicle queuing was not observed during the peak periods at minor street approaches. In addition, the adjacent signals on Novi Road at 10 Mile and the Post Office Driveway meter traffic, providing gaps for vehicles to exit the driveways.

Existing Conditions Improvements

In order to improve traffic operations to a LOS D or better for all intersection approaches and movements, mitigation measures were evaluated, as summarized below. It is noted that high delays experienced at the stop-controlled commercial driveways are a result of high traffic volumes on Novi Road. Queuing issues are not present at these locations and operations were observed to be acceptable. Therefore, these unsignalized driveways were not included in the network improvements analysis.

Novi Road & US Post Office Drive / Michigan CAT Main Drive

Signal timing adjustments are expected to mitigate critical LOS under existing conditions. The following improvements should be implemented:

- Reduce cycle length from 120 seconds to 60 seconds to reduce delays experienced by vehicles egressing the commercial drives on the east and west legs, and
- Optimize signal phase splits and coordinate signals with the intersections along the Novi Road corridor.

The existing intersection operations with the proposed mitigation measures are summarized in Table 2.

Table 2: Existing Intersection Operations with Improvements

Intersection	Control	Approach	AM Peak Delay (s/veh)	AM Peak LOS	PM Peak Delay (s/veh)	PM Peak LOS
1. Novi Road & US Post Office Drive / Michigan CAT Main Drive	Signalized	EB	28.7	C	28.1	C
		WB	26.4	C	26.8	C
		NB	3.4	A	4.4	A
		SB	3.0	A	4.1	A
		Overall	**4.6**	**A**	**5.9**	**A**

The results of the existing conditions analysis with improvements show that the signalized study intersection approaches and movements are expected to operate acceptably at a LOS C or better during both peak periods. A review of network simulations showed acceptable traffic operations during both peak hours.

Background Conditions

Historical traffic volume data was reviewed in order to determine the applicable growth rate for the existing traffic volumes to the project build-out year of 2019. The historical growth rates for Novi Road were referenced. RCOC data indicates that between 2010 and 2014, the Average Annual Daily Traffic (AADT) volumes were generally increasing in the 1% to 3% range. In addition, the SEMCOG community profile for the City of Novi was reviewed; this showed a declining population growth from 2015 to 2040 and a marginal employment growth from 2010 to 2040. Therefore, a background traffic growth of 1% per year was assumed for this study for the analysis of background conditions ***without the proposed development.***

In addition to background growth, it is important to account for traffic that is expected to be generated by approved developments within the vicinity of the study area that have yet to be constructed or are currently under construction. No background developments were identified near the study area that are expected to be completed prior to the site buildout of the proposed development.

Background Operations

Background peak hour vehicle delays and LOS were calculated based on the existing lane use and traffic control shown on the attached Figure 1, the background traffic volumes shown on the attached Figure 3, and the methodologies presented in the HCM. The results of the background conditions assessment are attached and summarized in Table 3.

Table 3: Background Intersection Operations

Intersection	Control	Approach	AM Peak Delay (s/veh)	AM Peak LOS	PM Peak Delay (s/veh)	PM Peak LOS
1. Novi Road & US Post Office Drive / Michigan CAT Main Drive	Signalized	EB	60.4	E	58.3	E
		WB	54.8	D	56.4	E
		NB	2.3	A	3.2	A
		SB	2.0	A	3.0	A
		Overall	**5.0**	**A**	**6.8**	**A**
2. Novi Road & Michigan CAT Equipment North Drive	STOP (Minor)	EB	38.5	E	76.6	F
		WB	16.9	C	75.2	F
		NB LT	0*	A	0*	A
		SB LT	10.7	B	0*	A
3. Novi Road & Michigan CAT Equipment South Drive	STOP (Minor)	WB	17.3	C	18.7	C
		NB	Free		Free	
		SB LT	10.6	B	11.2	B

*No traffic demand is present.

The results are summarized in Table 3 and show that all study intersection approaches and movements are expected to continue to operate in a manner similar to existing conditions during both the AM and PM peak hours and minor increases in delay will not be discernable. Review of network simulations also indicates traffic operations will be similar to existing conditions.

Background Conditions Improvements

In order to improve traffic operations to a LOS D or better for all intersection approaches and movements under background conditions, mitigation measures that were identified under existing conditions were applied. The results of the background conditions assessment with improvements are attached and summarized in Table 4.

Table 4: Background Intersection Operations with Improvements

Intersection	Control	Approach	AM Peak Delay (s/veh)	AM Peak LOS	PM Peak Delay (s/veh)	PM Peak LOS
1. Novi Road & US Post Office Drive / Michigan CAT Main Drive	Signalized	EB	28.7	C	28.1	C
		WB	26.4	C	26.8	C
		NB	3.5	A	4.6	A
		SB	3.1	A	4.2	A
		Overall	**4.6**	**A**	**6.0**	**A**

The results of the background conditions analysis with improvements show that all study intersection approaches and movements are expected to operate acceptably at a LOS C or better during both peak periods. A review of network simulations showed acceptable traffic operations during both peak hours.

Site Trip Generation Analysis

The number of AM and PM peak hour vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation Manual, 9th Edition*. The site trip generation forecast for the proposed development is summarized in Table 5.

Table 5: Site Trip Generation

Land Use	ITE Code	Amount	Units	Average Daily Traffic	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Residential Townhouse	230	130	D.U.	808	11	53	64	50	25	75

The vehicle trips that would be generated by the proposed development were assigned to the study road network based on existing peak hour traffic patterns, the proposed site plan, and the methodologies published by ITE. This methodology indicates that new trips will return to their direction of origin. The site trip distributions used in the analysis are summarized in Table 6.

Table 6: Site Trip Distribution

To / From	New Trips Via	AM	PM
North	Novi Road	60%	50%
South	Novi Road	40%	50%
		100%	100%

The site-generated vehicle trips were assigned to the study road network based on these trip distribution patterns and are shown on the attached Figure 4. The site-generated trips were added to the background traffic volumes to calculate the future peak hour traffic volumes shown on the attached Figure 5.

Future Conditions

Future peak hour vehicle delays and LOS ***with the proposed development*** were calculated based on the existing lane use and traffic control, the future traffic volumes, the proposed site access plan, and the methodologies presented in the HCM. Additionally, SimTraffic simulations were reviewed to evaluate network operations and vehicle queues. The results of the future conditions analysis are attached and are summarized in Table 7.

Table 7: Future Intersection Operations

Intersection	Control	Approach	AM Peak Delay (s/veh)	AM Peak LOS	PM Peak Delay (s/veh)	PM Peak LOS
1. Novi Road & US Post Office Drive / Michigan CAT Main Drive	Signalized	EB	60.4	E	58.3	E
		WB	54.8	D	56.4	E
		NB	2.3	A	3.2	A
		SB	2.0	A	3.0	A
		Overall	**5.0**	**A**	**6.8**	**A**
2. Novi Road & Michigan CAT Equipment North Drive / Site Drive	STOP (Minor)	EB	41.4	E	79.5	F
		WB	16.9	C	93.1	F
		NB LT	9.3	A	11.5	B
		SB LT	10.7	B	0*	A
3. Novi Road & Michigan CAT Equipment South Drive	STOP (Minor)	WB	17.4	C	19.1	C
		NB	Free		Free	
		SB LT	10.7	B	11.3	B

*No traffic demand is present.

The results show that all study intersection approaches and movements are expected to continue to operate in a manner similar to background conditions during both the AM and PM peak hour, except the proposed Site Drive intersection with Novi Road. With the addition of the proposed development, the Site Drive operates at a LOS E and F during the AM and PM peak hours, respectively, and the Michigan CAT driveway opposite the site driveway operates at a LOS F during the PM peak hour.

A review of network simulations showed traffic operations which are similar to background conditions with acceptable traffic operations observed during both the AM and PM peak hours. No significant vehicle queues are expected at the proposed Site Drive or the existing Michigan CAT driveway.

Future Conditions Improvements

In order to improve traffic operations to a LOS D or better for all intersection approaches and movements under future conditions, mitigation measures that were identified under existing conditions were applied. The results of the future conditions assessment with improvements are attached and summarized in Table 8.

The results of the future conditions analysis with improvements show that all study intersection approaches and movements are expected to operate acceptably at a LOS C or better during both peak periods. A review of network simulations showed acceptable traffic operations during both peak hours.

Table 8: Future Intersection Operations with Improvements

Intersection	Control	Approach	AM Peak Delay (s/veh)	AM Peak LOS	PM Peak Delay (s/veh)	PM Peak LOS
1. Novi Road & US Post Office Drive / Michigan CAT Main Drive	Signalized	EB	28.7	C	28.1	C
		WB	26.4	C	26.8	C
		NB	3.6	A	4.6	A
		SB	3.1	A	4.3	A
		Overall	**4.6**	**A**	**6.0**	**A**

Access Management

The offset distance at the proposed site driveway to Novi Road was evaluated according to the commercial driveway spacing requirements outlined in Section 11-216 of the City Ordinance. These requirements indicate that the proposed site driveway requires a minimum offset of 230 feet from the existing Post Office driveway to the north and Michigan CAT drive to the south. The proposed site drive on Novi Road meets these driveway spacing requirements and is will align with the existing Michigan CAT drive which consistent with access management best practices..

The RCOC warrants for right-turn lanes were evaluated at the site access point to Novi Road. The results of this analysis show that a right-turn deceleration taper is warranted at the proposed Site Drive. The right-turn deceleration taper should be designed in accordance with RCOC and the City of Novi requirements.

Conclusions

The conclusions of this Traffic Impact Study are as follows:

1. The results of the existing conditions analysis show that several approaches and movements at the study intersections currently operate at a LOS E or F during both peak periods. The vehicle simulations were further reviewed and significant vehicle queuing was not observed during the peak periods at minor street approaches. In addition, the adjacent signals on Novi Road at 10 Mile and the Post Office Driveway meter traffic, providing gaps for vehicles to exit the driveways.
2. The following mitigation measures are recommended under existing conditions in order to improve traffic operations to a LOS D or better for all intersection approaches and movements.

   Novi Road & US Post Office Drive / Michigan CAT Main Drive

   - Reduce cycle length from 120 seconds to 60 seconds to reduce delays experienced by vehicles egressing the commercial drives on the east and west legs, and
   - Optimize signal phase splits and coordinate signals with the intersections along the Novi Road corridor.
3. The analysis of background conditions ***without the proposed development*** show operations similar to existing conditions and any increases in delay would not be discernable.
4. The analysis of future conditions ***with the proposed development*** shows that operations would be similar to background conditions. A review of network simulations showed traffic operations which are similar to background conditions with acceptable traffic operations observed during both the AM and PM peak hours. No significant vehicle queues are expected at the proposed Site Drive or the existing Michigan CAT driveway. The development is not expected to have a significant impact on the study intersections.
5. A right turn deceleration taper is warranted at the site access point on Novi Road.
6. The proposed site driveway should be designed in accordance with RCOC and City of Novi requirements.

Attached: Figures 1-5
Traffic Volume Data
SEMCOG Data
Synchro / SimTraffic Results
RCOC Auxiliary Lane Warrants

SJR:jmk

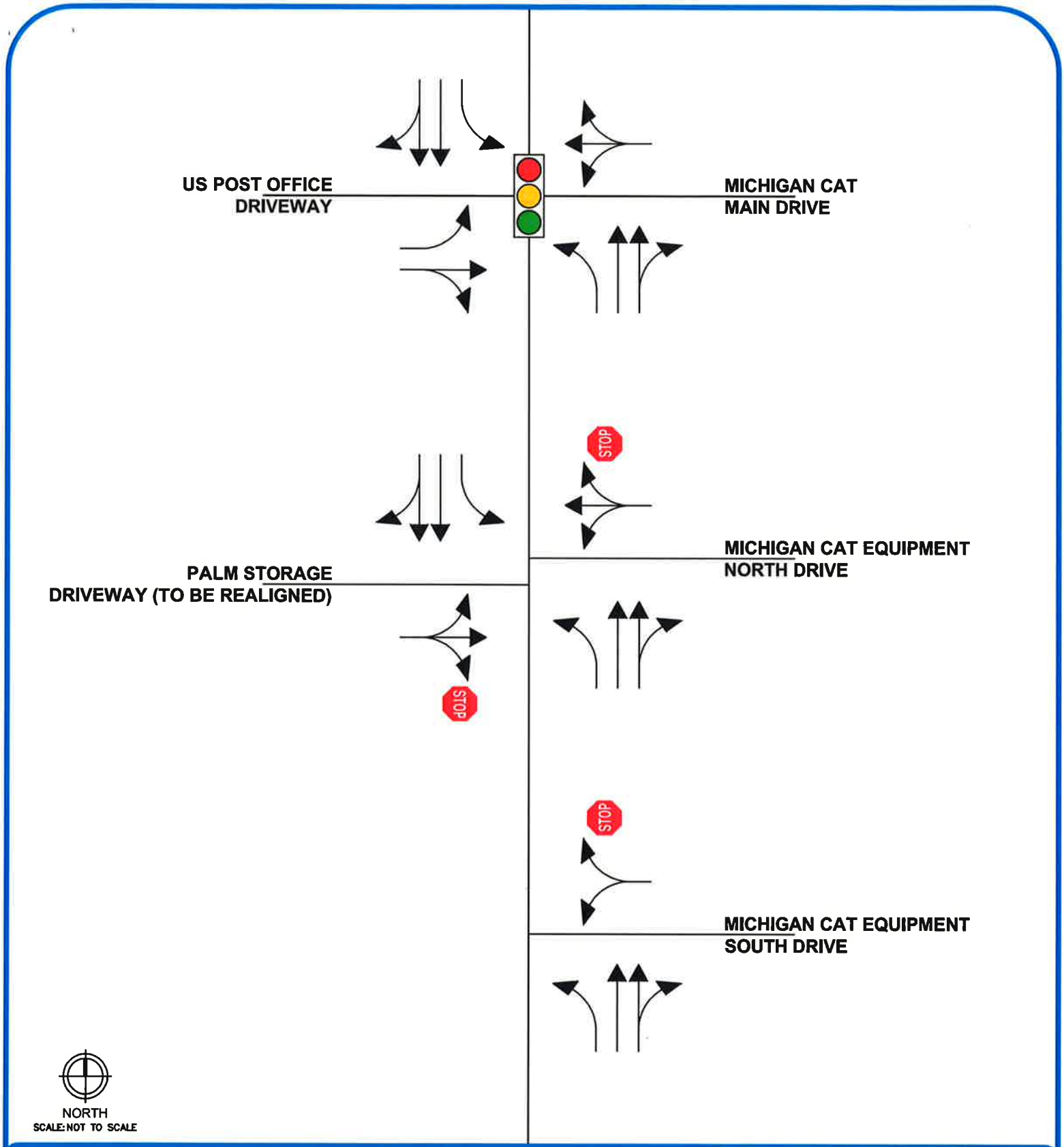

FIGURE 1
LANE USE AND TRAFFIC CONTROL

PULTE GROUP RESIDENTIAL DEVELOPMENT - NOVI, MI

LEGEND

- ROADS
- LANE USE
- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION

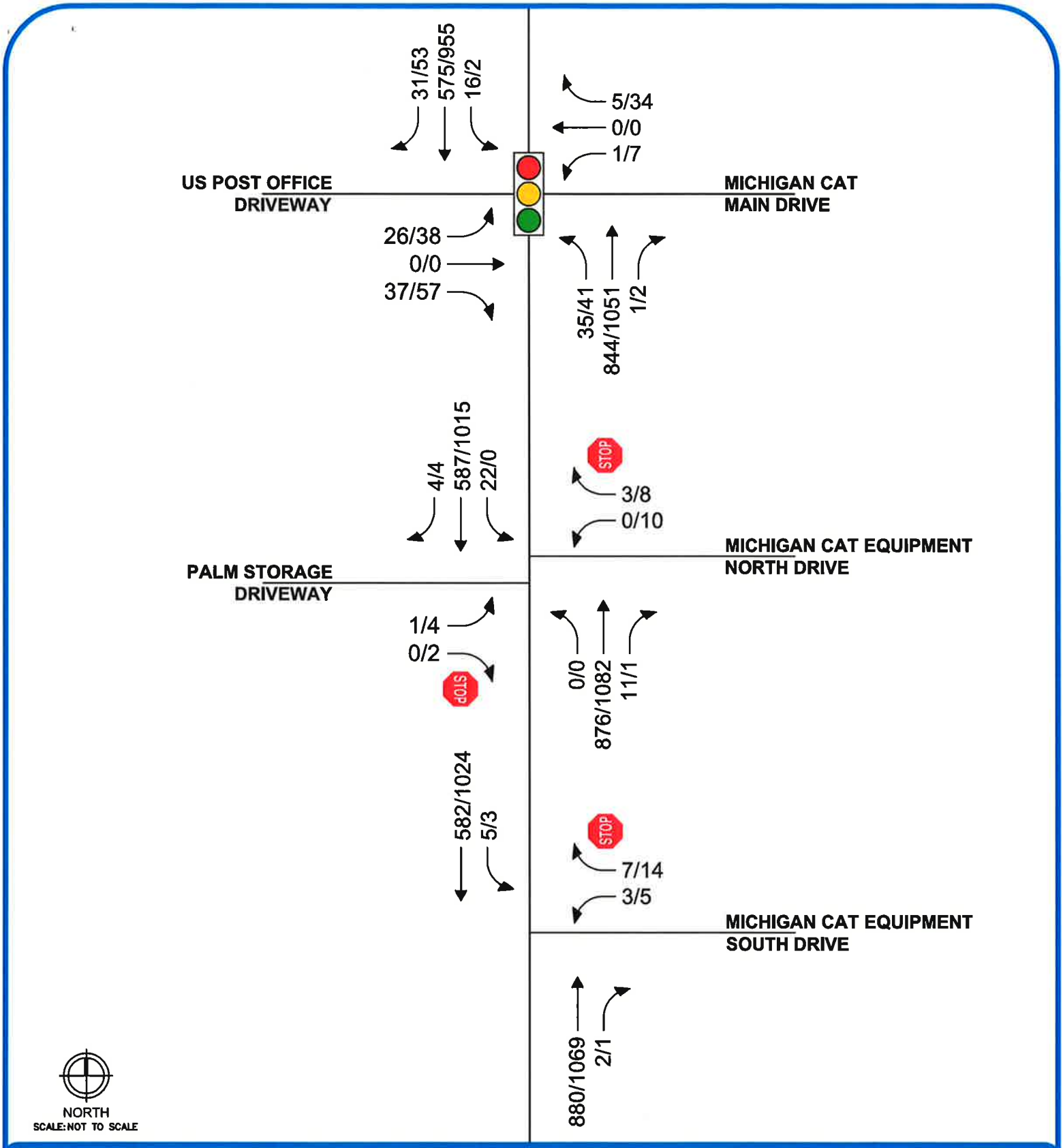

FIGURE 2
EXISTING TRAFFIC VOLUMES

PULTE GROUP RESIDENTIAL DEVELOPMENT - NOVI, MI

LEGEND

- ROADS
- TRAFFIC VOLUMES (AM/PM)
- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION

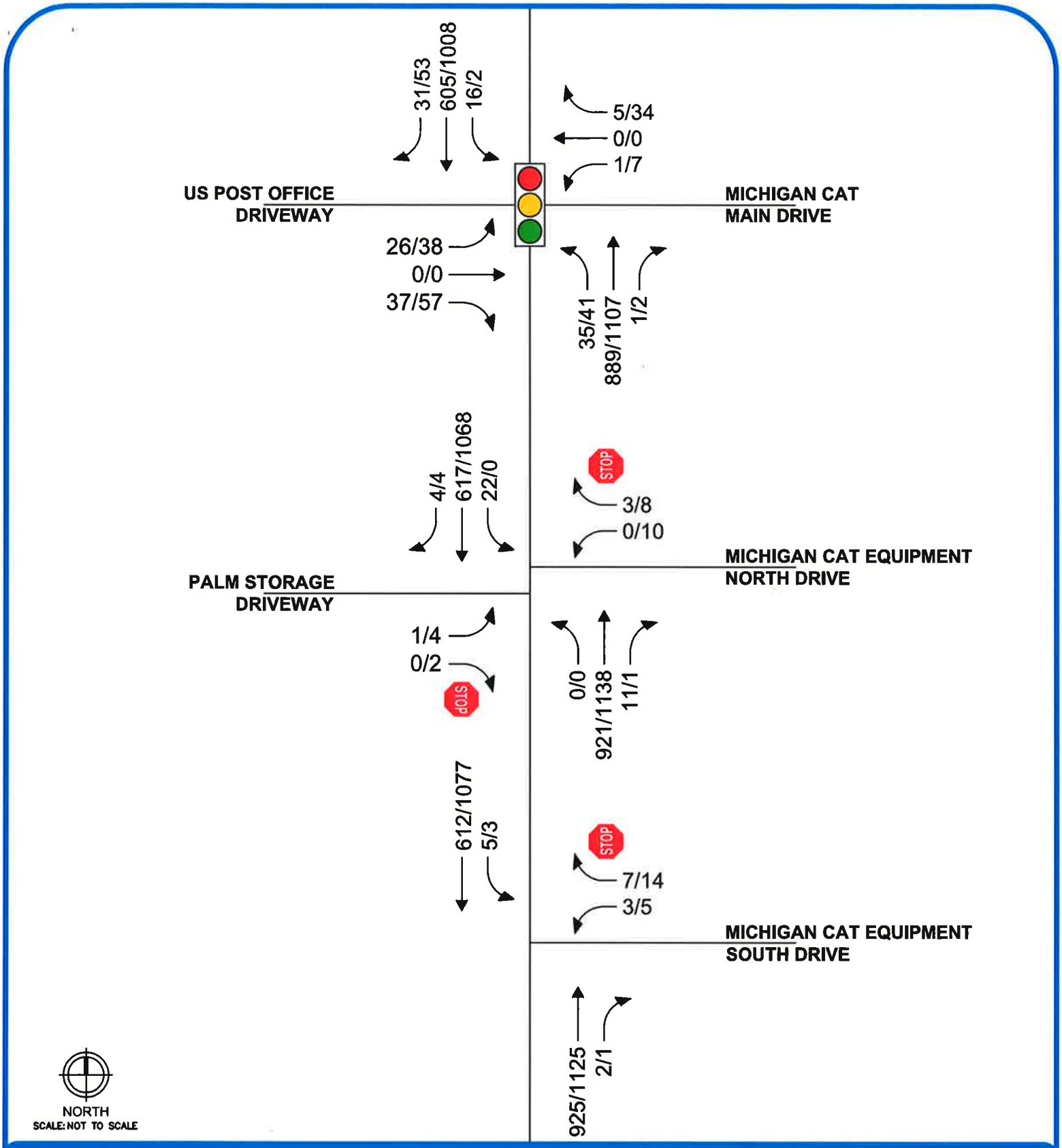

FIGURE 3
BACKGROUND TRAFFIC VOLUMES

PULTE GROUP RESIDENTIAL DEVELOPMENT - NOVI, MI

LEGEND

- ROADS
- TRAFFIC VOLUMES (AM/PM)
- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION

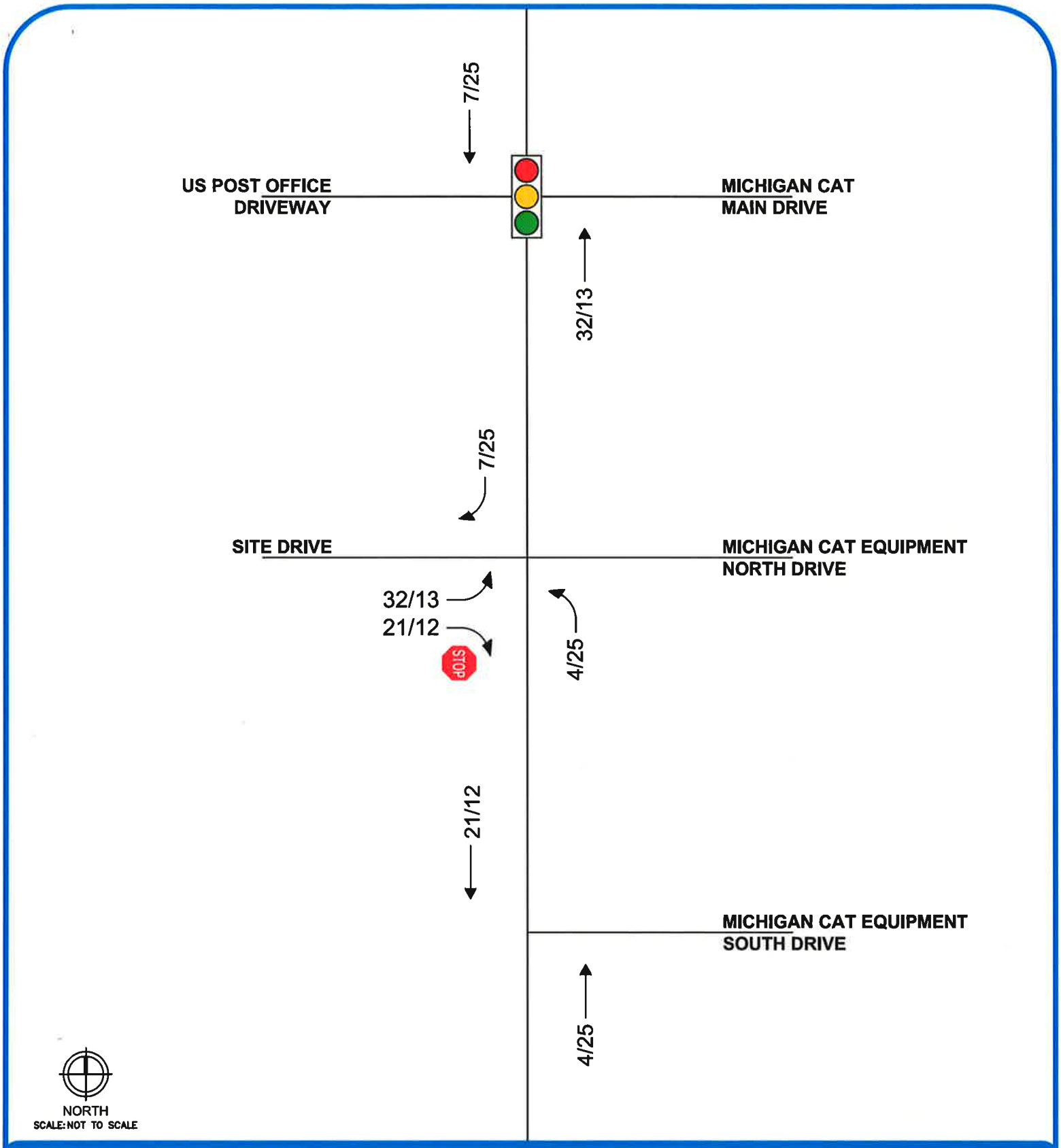

FIGURE 4
SITE-GENERATED TRAFFIC VOLUMES

PULTE GROUP RESIDENTIAL DEVELOPMENT - NOVI, MI

LEGEND

- ROADS
- TRAFFIC VOLUMES (AM/PM)
- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION

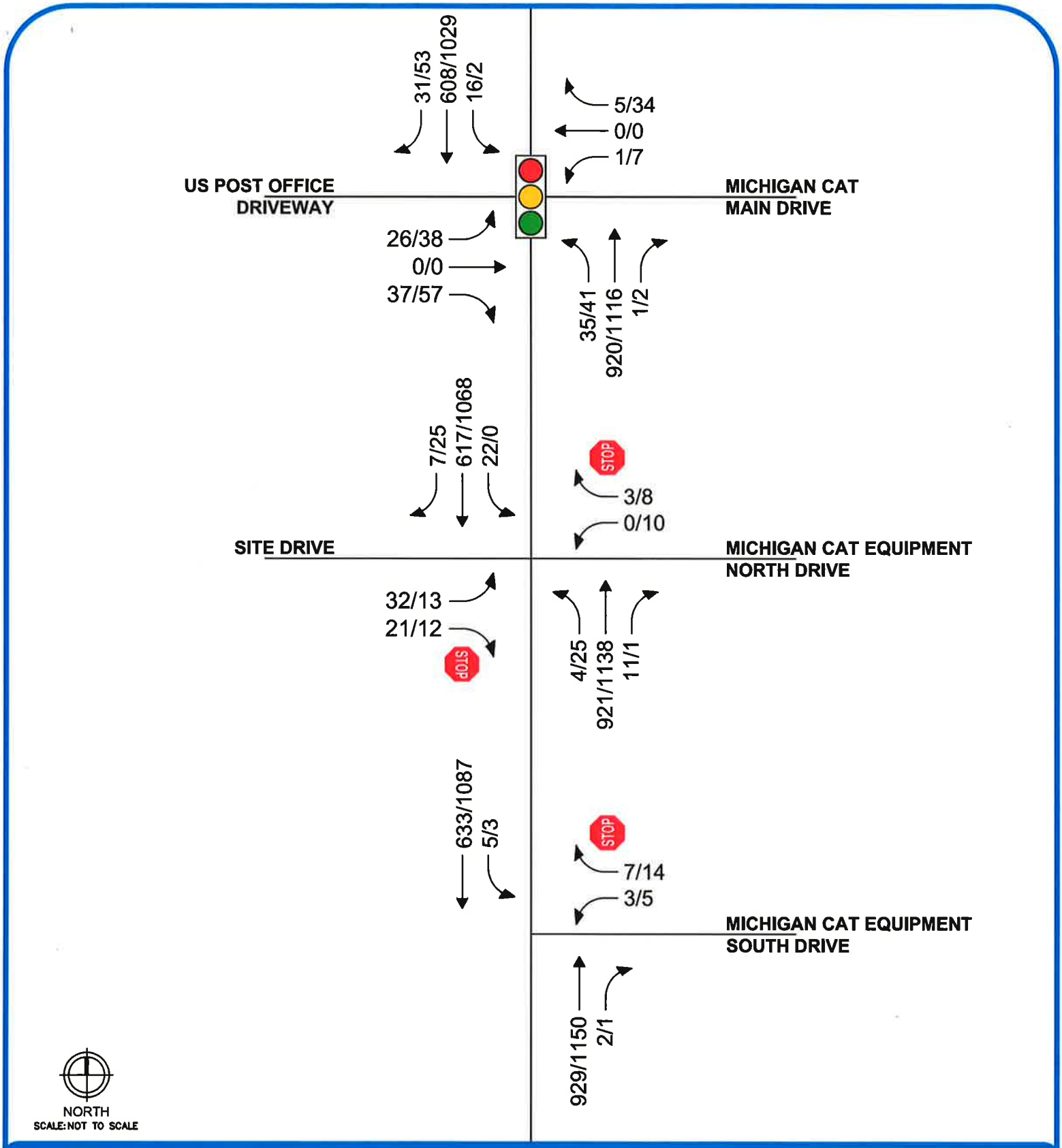

FIGURE 5
FUTURE TRAFFIC VOLUMES

PULTE GROUP RESIDENTIAL DEVELOPMENT - NOVI, MI

LEGEND

- ROADS
- TRAFFIC VOLUMES (AM/PM)
- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION

Traffic Data Collection, LLC

tdcounts.com
Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 5DV

File Name : TMC_1 Novi & USPostOffice_12-14-16
Site Code : TMC_1
Start Date : 12/14/2016
Page No : 1

Groups Printed- Pass Cars - Single Units - Heavy Trucks

	Novi Road Southbound					Michigan CAT Power Systems Driveway Westbound					Novi Road Northbound					US Post Office Driveway Eastbound					
Start Time	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	8	124	6	0	138	0	0	0	0	0	0	173	4	0	177	1	0	5	0	6	321
07:15 AM	8	114	7	0	129	2	0	0	0	2	2	183	7	0	192	6	0	3	0	9	332
07:30 AM	6	145	3	0	154	1	0	0	0	1	0	196	9	0	205	4	0	13	0	17	377
07:45 AM	5	175	3	0	183	0	0	0	0	0	0	240	7	0	247	8	0	5	0	13	443
Total	27	558	19	0	604	3	0	0	0	3	2	792	27	0	821	19	0	26	0	45	1473
08:00 AM	11	134	7	0	152	1	0	1	0	2	1	203	5	0	209	16	0	6	0	22	385
08:15 AM	7	130	4	0	141	2	0	0	0	2	0	185	10	0	195	5	0	7	0	12	350
08:30 AM	8	135	2	0	145	2	0	0	0	2	0	211	12	0	223	8	0	8	0	16	386
08:45 AM	9	127	2	0	138	0	0	0	0	0	0	227	11	0	238	14	0	6	0	20	396
Total	35	526	15	0	576	5	0	1	0	6	1	826	38	0	865	43	0	27	0	70	1517
**** BREAK ****																					
04:00 PM	11	215	1	0	227	2	0	0	0	2	0	218	13	0	231	17	0	11	0	28	488
04:15 PM	19	234	2	0	255	4	0	1	0	5	0	227	17	0	244	21	0	12	0	33	537
04:30 PM	22	182	2	0	206	4	0	1	0	5	0	272	19	0	291	27	0	14	0	41	543
04:45 PM	17	237	0	0	254	7	0	1	0	8	0	232	17	0	249	16	0	15	0	31	542
Total	69	868	5	0	942	17	0	3	0	20	0	949	66	0	1015	81	0	52	0	133	2110
05:00 PM	9	245	0	0	254	12	0	1	0	13	0	295	9	0	304	14	0	7	0	21	592
05:15 PM	11	247	1	0	259	6	0	2	0	8	1	239	6	0	246	19	0	9	0	28	541
05:30 PM	16	226	1	0	243	9	0	3	0	12	1	284	9	0	294	8	0	7	0	15	564
05:45 PM	7	262	2	0	271	1	0	0	0	1	0	202	4	0	206	4	0	9	0	13	491
Total	43	980	4	0	1027	28	0	6	0	34	2	1020	28	0	1050	45	0	32	0	77	2188
Grand Total	174	2932	43	0	3149	53	0	10	0	63	5	3587	159	0	3751	188	0	137	0	325	7288
Apprch %	5.5	93.1	1.4	0		84.1	0	15.9	0		0.1	95.6	4.2	0		57.8	0	42.2	0		
Total %	2.4	40.2	0.6	0	43.2	0.7	0	0.1	0	0.9	0.1	49.2	2.2	0	51.5	2.6	0	1.9	0	4.5	
Pass Cars	171	2873	38	0	3082	47	0	9	0	56	5	3492	158	0	3655	186	0	135	0	321	7114
% Pass Cars	98.3	98	88.4	0	97.9	88.7	0	90	0	88.9	100	97.4	99.4	0	97.4	98.9	0	98.5	0	98.8	97.6
Single Units	2	37	3	0	42	6	0	1	0	7	0	74	0	0	74	2	0	0	0	2	125
% Single Units	1.1	1.3	7	0	1.3	11.3	0	10	0	11.1	0	2.1	0	0	2	1.1	0	0	0	0.6	1.7
Heavy Trucks	1	22	2	0	25	0	0	0	0	0	0	21	1	0	22	0	0	2	0	2	49
% Heavy Trucks	0.6	0.8	4.7	0	0.8	0	0	0	0	0	0	0.6	0.6	0	0.6	0	0	1.5	0	0.6	0.7

Comments: 4 hour video traffic study conducted during typical weekday (Wednesday) from 7:00-9:00 AM morning & 4:00-6:00 PM afternoon peak hours, while school was in session. Non-signalized driveway intersection. Video SCU camera was located within NW intersection quadrant.

Traffic Data Collection, LLC

tdcounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
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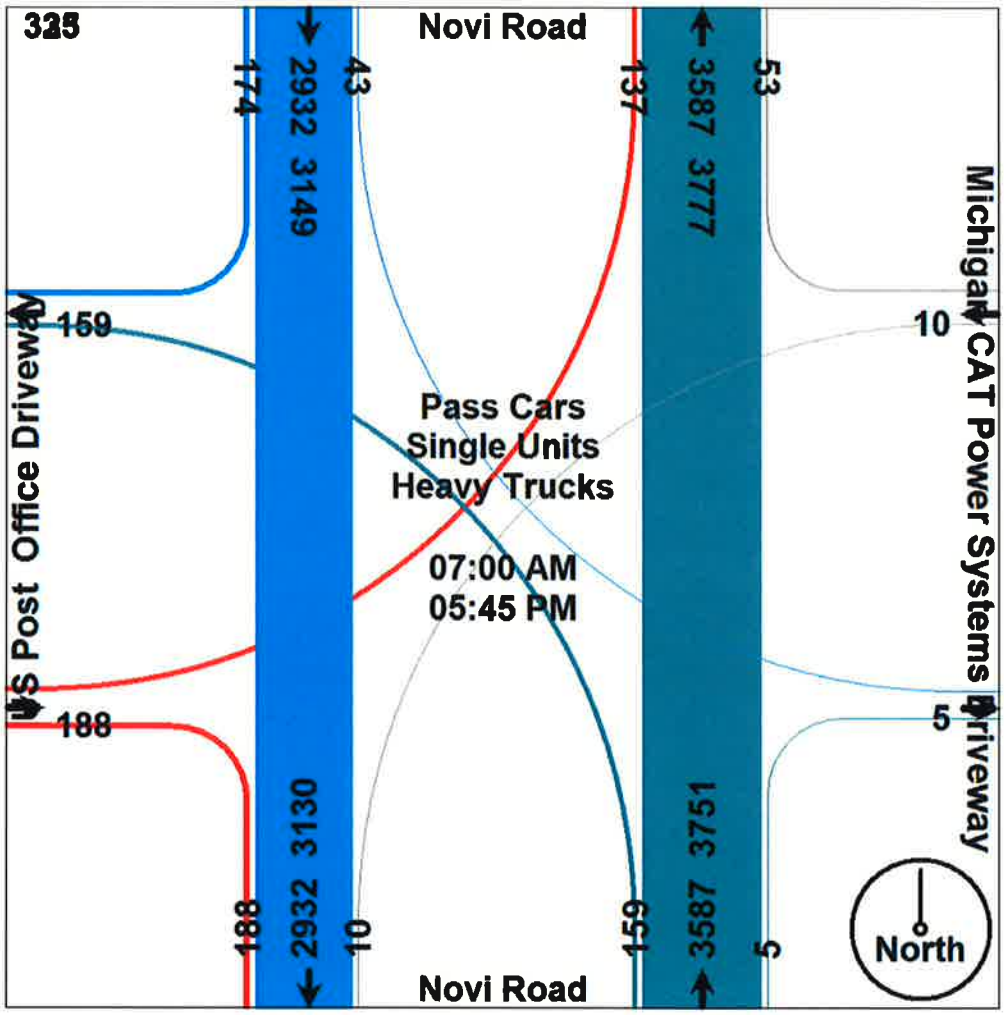

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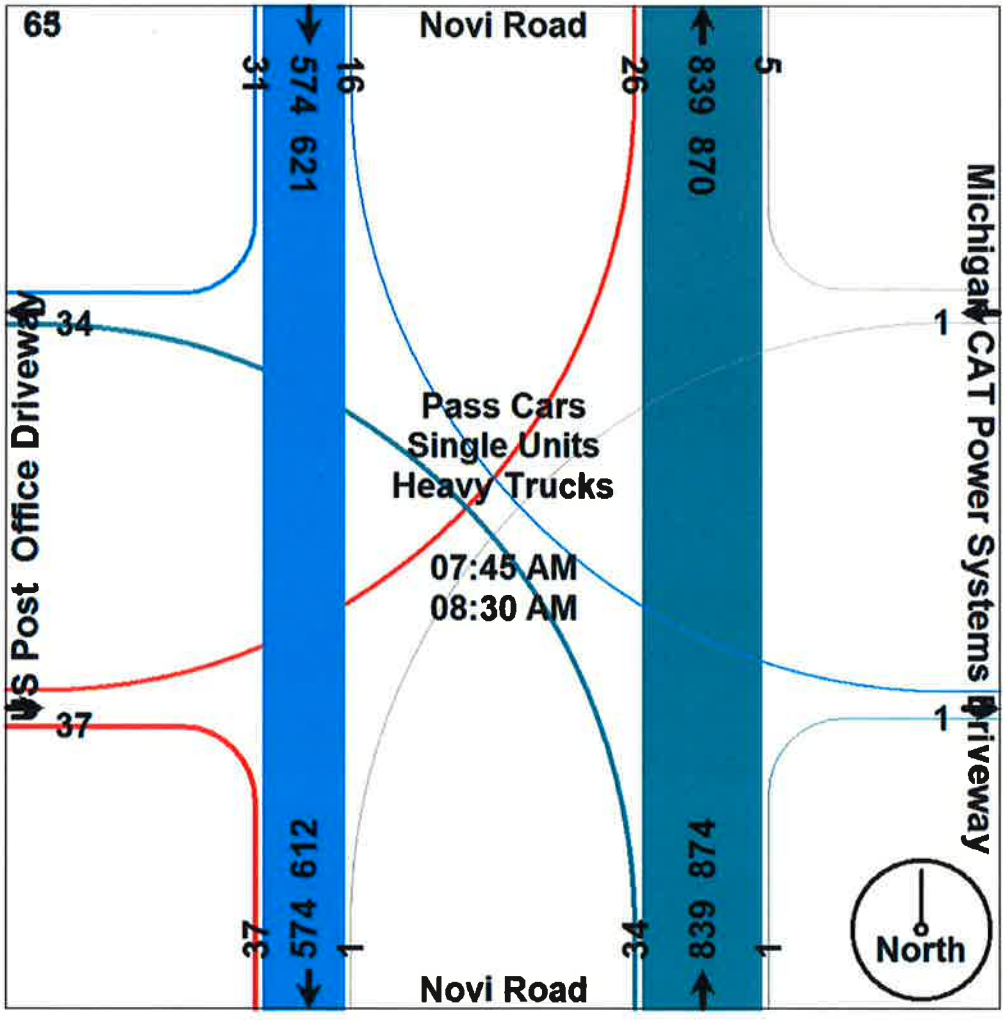
Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 5DV

File Name : TMC_1 Novi & USPostOffice_12-14-16
Site Code : TMC_1
Start Date : 12/14/2016
Page No : 3

	Novi Road Southbound				Michigan CAT Power Systems Driveway Westbound				Novi Road Northbound				US Post Office Driveway Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 12:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	5	**175**	3	**183**	0	0	0	0	0	**240**	7	**247**	8	0	5	13	**443**
08:00 AM	**11**	134	**7**	152	1	0	**1**	**2**	**1**	203	5	209	**16**	0	6	**22**	385
08:15 AM	7	130	4	141	**2**	0	0	2	0	185	10	195	5	0	7	12	350
08:30 AM	8	135	2	145	2	0	0	2	0	211	**12**	223	8	0	**8**	16	386
Total Volume	31	574	16	621	5	0	1	6	1	839	34	874	37	0	26	63	1564
% App. Total	5	92.4	2.6		83.3	0	16.7		0.1	96	3.9		58.7	0	41.3		
PHF	.705	.820	.571	.848	.625	.000	.250	.750	.250	.874	.708	.885	.578	.000	.813	.716	.883
Pass Cars	30	556	15	601	4	0	1	5	1	812	34	847	36	0	26	62	1515
% Pass Cars	96.8	96.9	93.8	96.8	80.0	0	100	83.3	100	96.8	100	96.9	97.3	0	100	98.4	96.9
Single Units	1	12	1	14	1	0	0	1	0	22	0	22	1	0	0	1	38
% Single Units	3.2	2.1	6.3	2.3	20.0	0	0	16.7	0	2.6	0	2.5	2.7	0	0	1.6	2.4
Heavy Trucks	0	6	0	6	0	0	0	0	0	5	0	5	0	0	0	0	11
% Heavy Trucks	0	1.0	0	1.0	0	0	0	0	0	0.6	0	0.6	0	0	0	0	0.7



Traffic Data Collection, LLC

tdcounts.com

Phone: (586) 786-5407

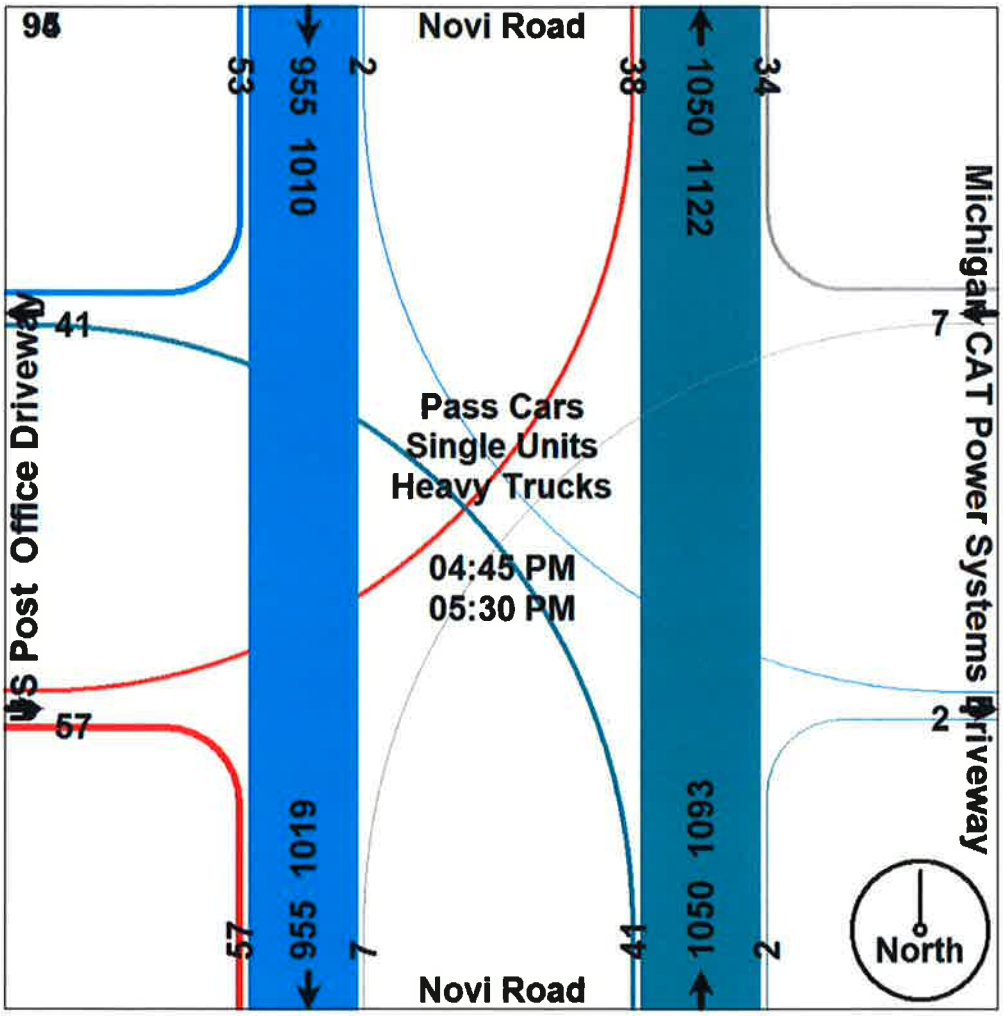
Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 5DV

File Name : TMC_1 Novi & USPostOffice_12-14-16
Site Code : TMC_1
Start Date : 12/14/2016
Page No : 4

	Novi Road Southbound				Michigan CAT Power Systems Driveway Westbound				Novi Road Northbound				US Post Office Driveway Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:45 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	**17**	237	0	254	7	0	1	8	0	232	**17**	249	16	0	**15**	**31**	542
05:00 PM	9	245	0	254	**12**	0	1	**13**	0	**295**	9	**304**	14	0	7	21	**592**
05:15 PM	11	**247**	**1**	**259**	6	0	2	8	**1**	239	6	246	**19**	0	9	28	541
05:30 PM	16	226	1	243	9	0	**3**	12	1	284	9	294	8	0	7	15	564
Total Volume	53	955	2	1010	34	0	7	41	2	1050	41	1093	57	0	38	95	2239
% App. Total	5.2	94.6	0.2		82.9	0	17.1		0.2	96.1	3.8		60	0	40		
PHF	.779	.967	.500	.975	.708	.000	.583	.788	.500	.890	.603	.899	.750	.000	.633	.766	.946
Pass Cars	52	943	1	996	31	0	6	37	2	1030	41	1073	56	0	37	93	2199
% Pass Cars	98.1	98.7	50.0	98.6	91.2	0	85.7	90.2	100	98.1	100	98.2	98.2	0	97.4	97.9	98.2
Single Units	1	9	0	10	3	0	1	4	0	12	0	12	1	0	0	1	27
% Single Units	1.9	0.9	0	1.0	8.8	0	14.3	9.8	0	1.1	0	1.1	1.8	0	0	1.1	1.2
Heavy Trucks	0	3	1	4	0	0	0	0	0	8	0	8	0	0	1	1	13
% Heavy Trucks	0	0.3	50.0	0.4	0	0	0	0	0	0.8	0	0.7	0	0	2.6	1.1	0.6



Traffic Data Collection, LLC

tdcounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 5DW

File Name : TMC_2 Novi & CAT North Dw_12-14-16
Site Code : TMC_2
Start Date : 12/14/2016
Page No : 1

Groups Printed- Pass Cars - Single Units - Heavy Trucks

	Novi Road Southbound					Michigan CAT Construction Equipment North Driveway Westbound					Novi Road Northbound					Storage Driveway Eastbound					
Start Time	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	1	123	1	0	125	1	0	0	0	1	2	174	0	0	176	0	0	0	0	0	302
07:15 AM	0	118	1	0	119	1	0	0	0	1	4	194	0	0	198	1	0	0	0	1	319
07:30 AM	0	143	4	0	147	0	0	0	0	0	2	204	1	0	207	0	0	0	0	0	354
07:45 AM	4	179	6	0	189	0	0	0	0	0	4	240	0	0	244	0	0	0	0	0	433
Total	5	563	12	0	580	2	0	0	0	2	12	812	1	0	825	1	0	0	0	1	1408
08:00 AM	0	142	8	0	150	0	0	0	0	0	3	206	0	0	209	0	0	1	0	1	360
08:15 AM	0	132	4	0	136	1	0	0	0	1	3	193	0	0	196	0	0	0	0	0	333
08:30 AM	0	134	4	0	138	2	0	0	0	2	1	218	0	0	219	0	0	0	0	0	359
08:45 AM	1	135	1	0	137	0	0	0	0	0	2	236	0	0	238	0	0	0	0	0	375
Total	1	543	17	0	561	3	0	0	0	3	9	853	0	0	862	0	0	1	0	1	1427
**** BREAK ****																					
04:00 PM	3	223	1	0	227	3	0	3	0	6	0	225	0	0	225	0	0	2	0	2	460
04:15 PM	2	253	1	0	256	0	0	0	0	0	1	245	0	0	246	0	0	1	0	1	503
04:30 PM	1	210	0	0	211	1	0	0	0	1	0	286	1	0	287	0	0	4	0	4	503
04:45 PM	3	251	0	0	254	2	0	1	0	3	0	247	0	0	247	2	0	2	0	4	508
Total	9	937	2	0	948	6	0	4	0	10	1	1003	1	0	1005	2	0	9	0	11	1974
05:00 PM	1	243	0	0	244	3	0	4	0	7	0	301	0	0	301	0	0	2	0	2	554
05:15 PM	0	276	0	0	276	0	0	3	0	3	1	246	0	0	247	0	0	0	0	0	526
05:30 PM	0	242	0	0	242	3	0	2	0	5	0	288	0	0	288	0	0	0	0	0	535
05:45 PM	0	264	0	0	264	0	0	2	0	2	0	208	0	0	208	0	0	0	0	0	474
Total	1	1025	0	0	1026	6	0	11	0	17	1	1043	0	0	1044	0	0	2	0	2	2089
Grand Total	16	3068	31	0	3115	17	0	15	0	32	23	3711	2	0	3736	3	0	12	0	15	6898
Apprch %	0.5	98.5	1	0		53.1	0	46.9	0		0.6	99.3	0.1	0		20	0	80	0		
Total %	0.2	44.5	0.4	0	45.2	0.2	0	0.2	0	0.5	0.3	53.8	0	0	54.2	0	0	0.2	0	0.2	
Pass Cars	14	3013	27	0	3054	12	0	15	0	27	20	3627	2	0	3649	2	0	12	0	14	6744
% Pass Cars	87.5	98.2	87.1	0	98	70.6	0	100	0	84.4	87	97.7	100	0	97.7	66.7	0	100	0	93.3	97.8
Single Units	2	36	2	0	40	2	0	0	0	2	3	64	0	0	67	1	0	0	0	1	110
% Single Units	12.5	1.2	6.5	0	1.3	11.8	0	0	0	6.2	13	1.7	0	0	1.8	33.3	0	0	0	6.7	1.6
Heavy Trucks	0	19	2	0	21	3	0	0	0	3	0	20	0	0	20	0	0	0	0	0	44
% Heavy Trucks	0	0.6	6.5	0	0.7	17.6	0	0	0	9.4	0	0.5	0	0	0.5	0	0	0	0	0	0.6

Comments: 4 hour video traffic study conducted during typical weekday (Wednesday) from 7:00-9:00 AM morning & 4:00-6:00 PM afternoon peak hours, while school was in session. Non-signalized driveway intersection. Video SCU camera was located within SE intersection quadrant.

Traffic Data Collection, LLC

tdcounts.com

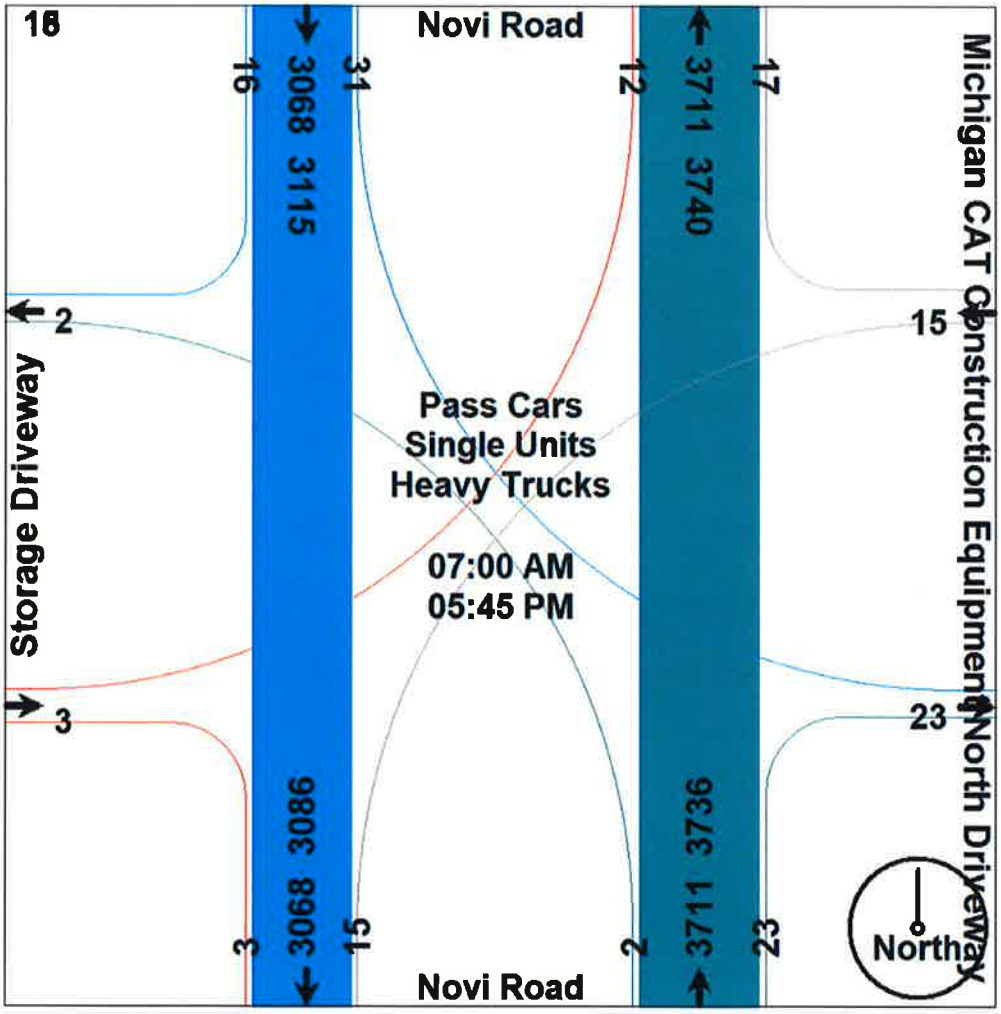
Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 5DW

File Name : TMC_2 Novi & CAT North Dw_12-14-16
Site Code : TMC_2
Start Date : 12/14/2016
Page No : 2



Traffic Data Collection, LLC

tdcounts.com

Phone: (586) 786-5407

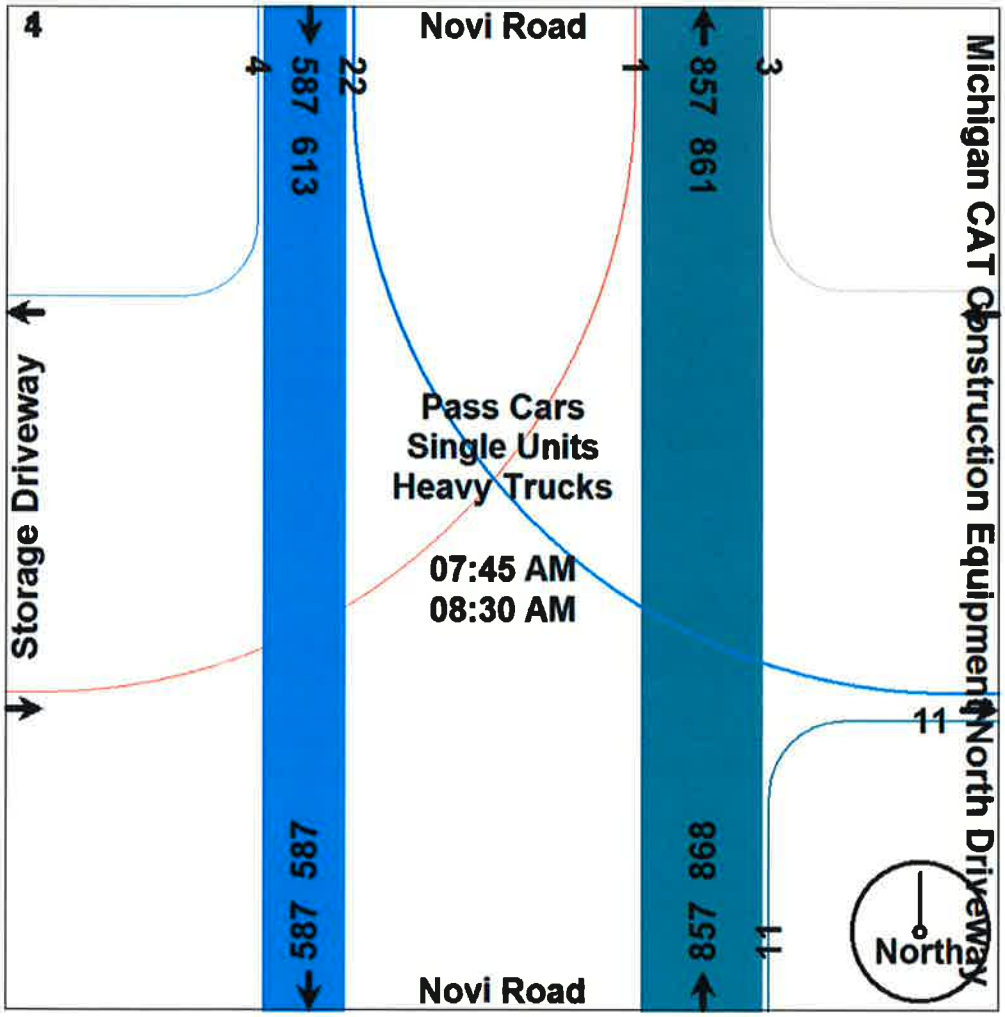
Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 5DW

File Name : TMC_2 Novi & CAT North Dw_12-14-16
Site Code : TMC_2
Start Date : 12/14/2016
Page No : 3

	Novi Road Southbound				Michigan CAT Construction Equipment North Driveway Westbound				Novi Road Northbound				Storage Driveway Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 12:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	**4**	**179**	6	**189**	0	0	0	0	**4**	**240**	0	**244**	0	0	0	0	**433**
08:00 AM	0	142	**8**	150	0	0	0	0	3	206	0	209	0	0	**1**	**1**	360
08:15 AM	0	132	4	136	1	0	0	1	3	193	0	196	0	0	0	0	333
08:30 AM	0	134	4	138	**2**	0	0	**2**	1	218	0	219	0	0	0	0	359
Total Volume	4	587	22	613	3	0	0	3	11	857	0	868	0	0	1	1	1485
% App. Total	0.7	95.8	3.6		100	0	0		1.3	98.7	0		0	0	100		
PHF	.250	.820	.688	.811	.375	.000	.000	.375	.688	.893	.000	.889	.000	.000	.250	.250	.857
Pass Cars	4	571	19	594	0	0	0	0	10	833	0	843	0	0	1	1	1438
% Pass Cars	100	97.3	86.4	96.9	0	0	0	0	90.9	97.2	0	97.1	0	0	100	100	96.8
Single Units	0	11	2	13	2	0	0	2	1	19	0	20	0	0	0	0	35
% Single Units	0	1.9	9.1	2.1	66.7	0	0	66.7	9.1	2.2	0	2.3	0	0	0	0	2.4
Heavy Trucks	0	5	1	6	1	0	0	1	0	5	0	5	0	0	0	0	12
% Heavy Trucks	0	0.9	4.5	1.0	33.3	0	0	33.3	0	0.6	0	0.6	0	0	0	0	0.8



Traffic Data Collection, LLC

tdcounts.com

Phone: (586) 786-5407

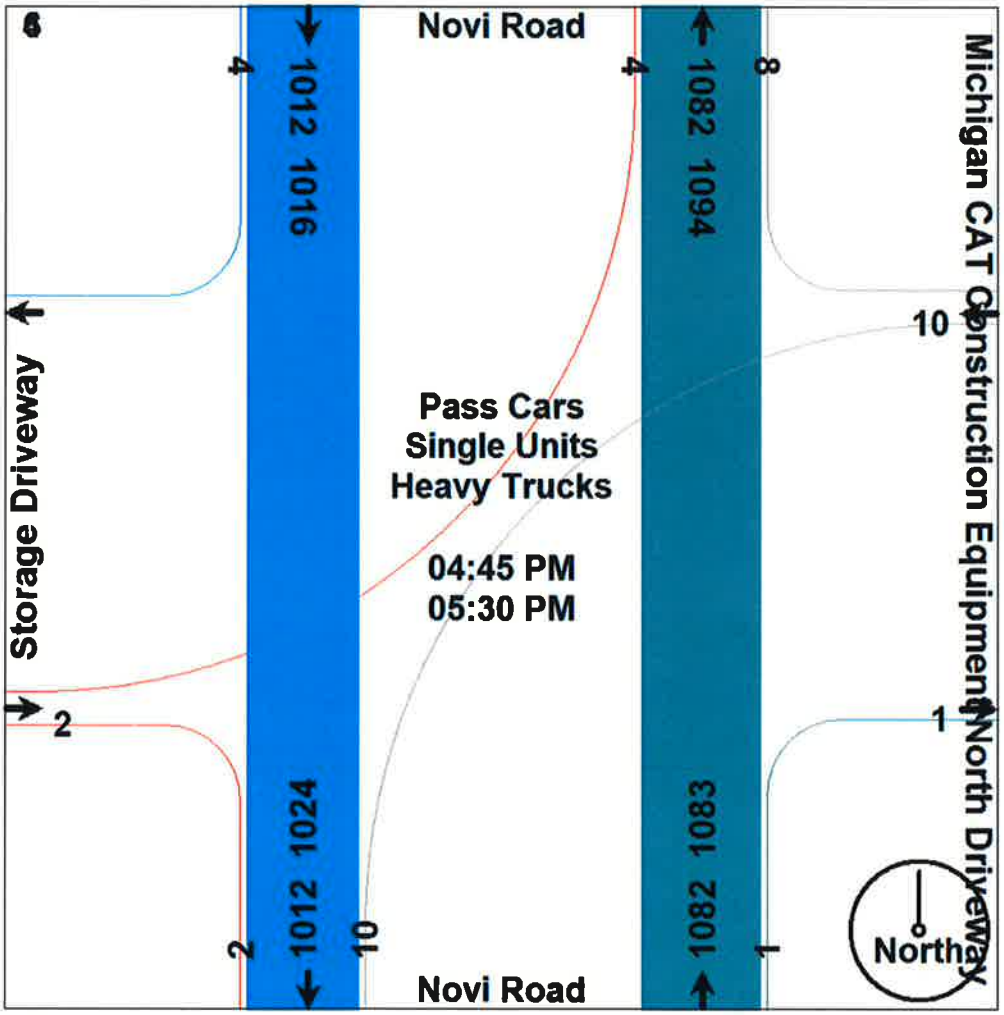
Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 5DW

File Name : TMC_2 Novi & CAT North Dw_12-14-16
Site Code : TMC_2
Start Date : 12/14/2016
Page No : 4

	Novi Road Southbound				Michigan CAT Construction Equipment North Driveway Westbound				Novi Road Northbound				Storage Driveway Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:45 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	**3**	251	0	254	2	0	1	3	0	247	0	247	**2**	0	**2**	**4**	508
05:00 PM	1	243	0	244	**3**	0	**4**	**7**	0	**301**	0	**301**	0	0	2	2	**554**
05:15 PM	0	**276**	0	**276**	0	0	3	3	**1**	246	0	247	0	0	0	0	526
05:30 PM	0	242	0	242	3	0	2	5	0	288	0	288	0	0	0	0	535
Total Volume	4	1012	0	1016	8	0	10	18	1	1082	0	1083	2	0	4	6	2123
% App. Total	0.4	99.6	0		44.4	0	55.6		0.1	99.9	0		33.3	0	66.7		
PHF	.333	.917	.000	.920	.667	.000	.625	.643	.250	.899	.000	.900	.250	.000	.500	.375	.958
Pass Cars	2	1001	0	1003	8	0	10	18	1	1063	0	1064	1	0	4	5	2090
% Pass Cars	50.0	98.9	0	98.7	100	0	100	100	100	98.2	0	98.2	50.0	0	100	83.3	98.4
Single Units	2	8	0	10	0	0	0	0	0	10	0	10	1	0	0	1	21
% Single Units	50.0	0.8	0	1.0	0	0	0	0	0	0.9	0	0.9	50.0	0	0	16.7	1.0
Heavy Trucks	0	3	0	3	0	0	0	0	0	9	0	9	0	0	0	0	12
% Heavy Trucks	0	0.3	0	0.3	0	0	0	0	0	0.8	0	0.8	0	0	0	0	0.6



Traffic Data Collection, LLC

tdcounts.com

Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 6H3

File Name : TMC_3 Novi & CAT South Dw_12-14-16
Site Code : TMC_3
Start Date : 12/14/2016
Page No : 1

Groups Printed- Pass Cars - Single Units - Heavy Trucks

	Novi Road Southbound					Michigan CAT Construction Equipment South Driveway Westbound					Novi Road Northbound					NA Eastbound					
Start Time	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Rgt	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	116	2	0	118	3	0	0	0	3	0	185	0	0	185	0	0	0	0	0	306
07:15 AM	0	117	0	0	117	5	0	1	0	6	0	184	0	0	184	0	0	0	0	0	307
07:30 AM	0	143	0	0	143	0	0	0	0	0	0	206	0	0	206	0	0	0	0	0	349
07:45 AM	0	168	2	0	170	2	0	0	0	2	1	252	0	0	253	0	0	0	0	0	425
Total	0	544	4	0	548	10	0	1	0	11	1	827	0	0	828	0	0	0	0	0	1387
08:00 AM	0	138	2	0	140	2	0	1	0	3	0	212	0	0	212	0	0	0	0	0	355
08:15 AM	0	133	1	0	134	3	0	1	0	4	0	198	0	0	198	0	0	0	0	0	336
08:30 AM	0	138	0	0	138	0	0	1	0	1	1	218	0	0	219	0	0	0	0	0	358
08:45 AM	0	138	0	0	138	2	0	2	0	4	0	231	0	0	231	0	0	0	0	0	373
Total	0	547	3	0	550	7	0	5	0	12	1	859	0	0	860	0	0	0	0	0	1422
**** BREAK ****																					
04:00 PM	0	228	1	0	229	1	0	0	0	1	0	233	0	0	233	0	0	0	0	0	463
04:15 PM	0	253	1	0	254	3	0	0	0	3	0	243	0	0	243	0	0	0	0	0	500
04:30 PM	0	206	0	0	206	4	0	0	0	4	1	292	0	0	293	0	0	0	0	0	503
04:45 PM	0	253	3	0	256	2	0	0	0	2	1	243	0	0	244	0	0	0	0	0	502
Total	0	940	5	0	945	10	0	0	0	10	2	1011	0	0	1013	0	0	0	0	0	1968
05:00 PM	0	254	0	0	254	9	0	3	0	12	0	286	0	0	286	0	0	0	0	0	552
05:15 PM	0	270	0	0	270	0	0	1	0	1	0	254	0	0	254	0	0	0	0	0	525
05:30 PM	0	238	0	0	238	3	0	1	0	4	0	286	0	0	286	0	0	0	0	0	528
05:45 PM	0	267	0	0	267	0	0	1	0	1	0	206	0	0	206	0	0	0	0	0	474
Total	0	1029	0	0	1029	12	0	6	0	18	0	1032	0	0	1032	0	0	0	0	0	2079
Grand Total	0	3060	12	0	3072	39	0	12	0	51	4	3729	0	0	3733	0	0	0	0	0	6856
Apprch %	0	99.6	0.4	0		76.5	0	23.5	0		0.1	99.9	0	0		0	0	0	0		
Total %	0	44.6	0.2	0	44.8	0.6	0	0.2	0	0.7	0.1	54.4	0	0	54.4	0	0	0	0	0	
Pass Cars	0	3008	8	0	3016	25	0	9	0	34	4	3650	0	0	3654	0	0	0	0	0	6704
% Pass Cars	0	98.3	66.7	0	98.2	64.1	0	75	0	66.7	100	97.9	0	0	97.9	0	0	0	0	0	97.8
Single Units	0	33	4	0	37	13	0	3	0	16	0	60	0	0	60	0	0	0	0	0	113
% Single Units	0	1.1	33.3	0	1.2	33.3	0	25	0	31.4	0	1.6	0	0	1.6	0	0	0	0	0	1.6
Heavy Trucks	0	19	0	0	19	1	0	0	0	1	0	19	0	0	19	0	0	0	0	0	39
% Heavy Trucks	0	0.6	0	0	0.6	2.6	0	0	0	2	0	0.5	0	0	0.5	0	0	0	0	0	0.6

Comments: 4 hour video traffic study conducted during typical weekday (Wednesday) from 7:00-9:00 AM morning & 4:00-6:00 PM afternoon peak hours, while school was in session. Non-signalized driveway intersection. Video SCU camera was located within NE intersection quadrant.

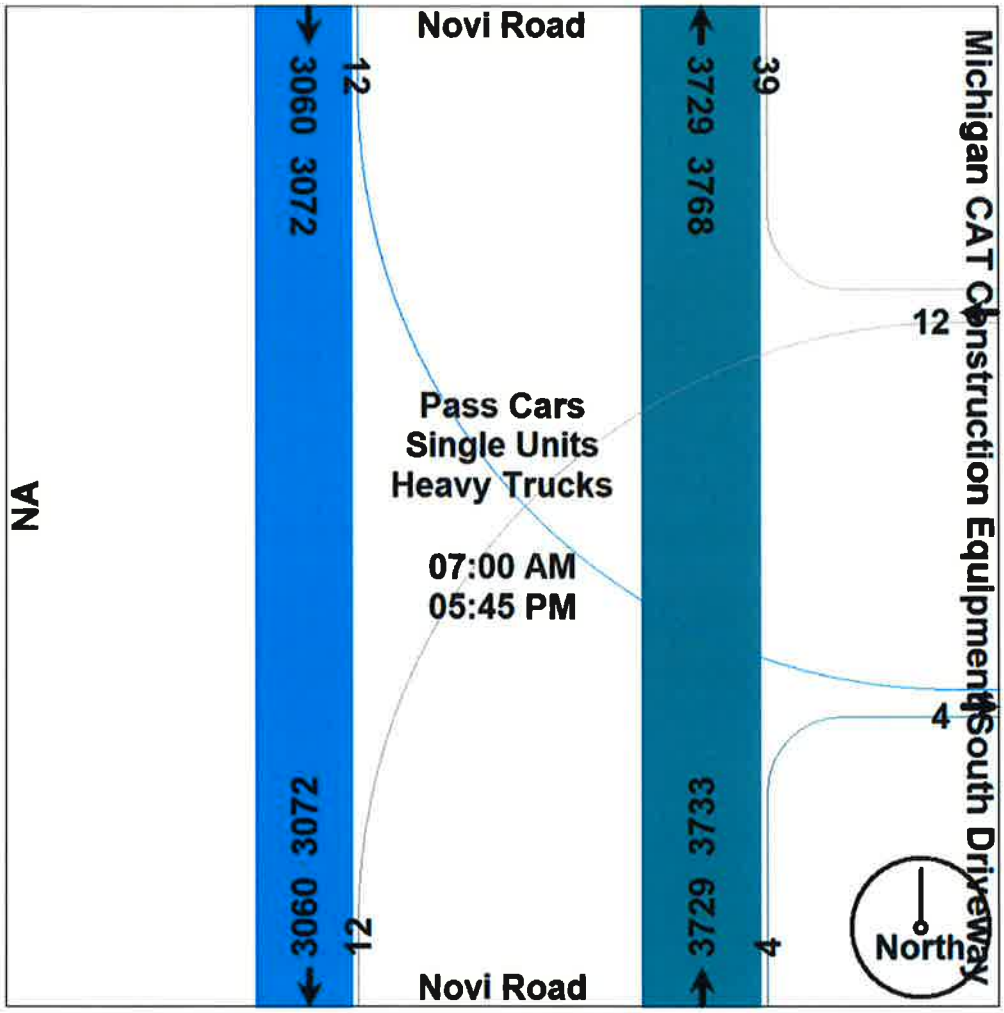
Traffic Data Collection, LLC
tdcounts.com
Phone: (586) 786-5407

Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 6H3

File Name : TMC_3 Novi & CAT South Dw_12-14-16
Site Code : TMC_3
Start Date : 12/14/2016
Page No : 2



Traffic Data Collection, LLC

tdcounts.com

Phone: (586) 786-5407

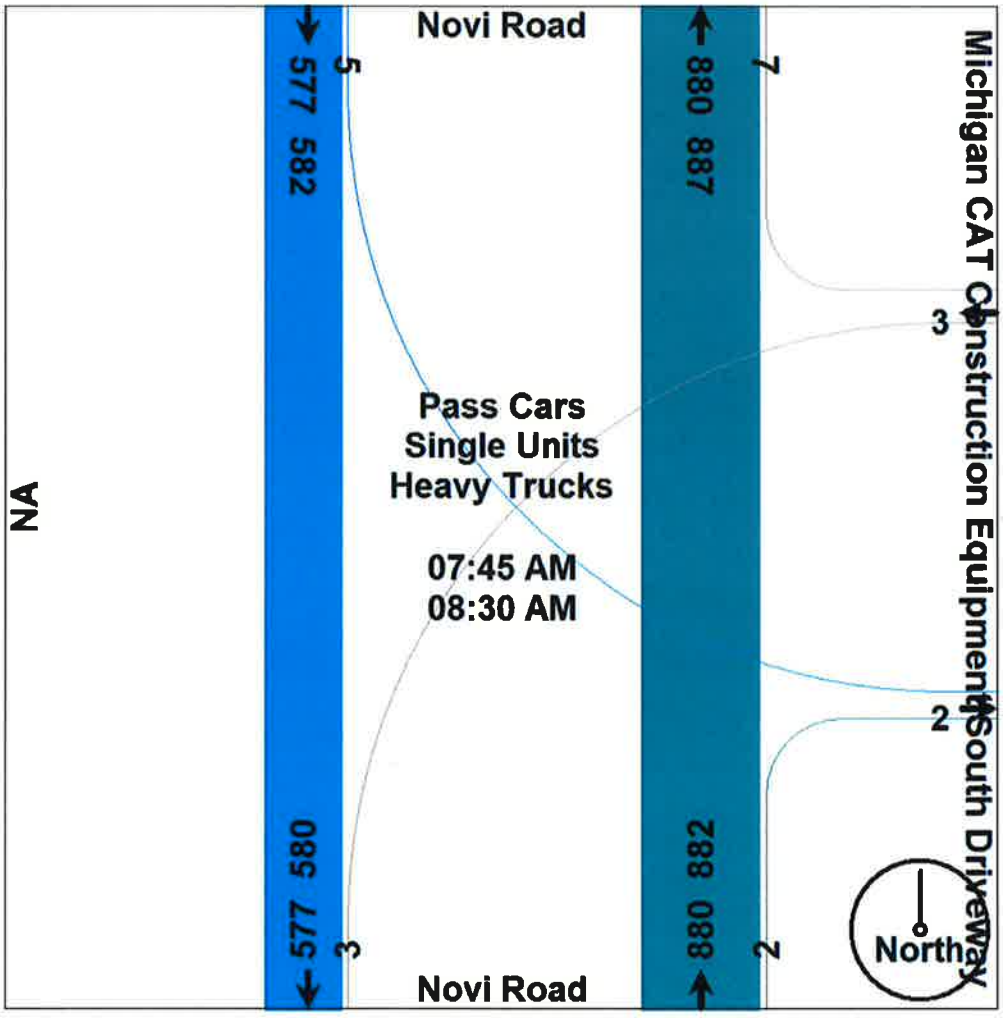
Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 6H3

File Name : TMC_3 Novi & CAT South Dw_12-14-16
Site Code : TMC_3
Start Date : 12/14/2016
Page No : 3

	Novi Road Southbound				Michigan CAT Construction Equipment South Driveway Westbound				Novi Road Northbound				NA Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 12:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	0	**168**	**2**	**170**	2	0	0	2	**1**	**252**	0	**253**	0	0	0	0	**425**
08:00 AM	0	138	2	140	2	0	**1**	3	0	212	0	212	0	0	0	0	355
08:15 AM	0	133	1	134	**3**	0	1	**4**	0	198	0	198	0	0	0	0	336
08:30 AM	0	138	0	138	0	0	1	1	1	218	0	219	0	0	0	0	358
Total Volume	0	577	5	582	7	0	3	10	2	880	0	882	0	0	0	0	1474
% App. Total	0	99.1	0.9		70	0	30		0.2	99.8	0		0	0	0		
PHF	.000	.859	.625	.856	.583	.000	.750	.625	.500	.873	.000	.872	.000	.000	.000	.000	.867
Pass Cars	0	562	4	566	5	0	2	7	2	854	0	856	0	0	0	0	1429
% Pass Cars	0	97.4	80.0	97.3	71.4	0	66.7	70.0	100	97.0	0	97.1	0	0	0	0	96.9
Single Units	0	10	1	11	2	0	1	3	0	21	0	21	0	0	0	0	35
% Single Units	0	1.7	20.0	1.9	28.6	0	33.3	30.0	0	2.4	0	2.4	0	0	0	0	2.4
Heavy Trucks	0	5	0	5	0	0	0	0	0	5	0	5	0	0	0	0	10
% Heavy Trucks	0	0.9	0	0.9	0	0	0	0	0	0.6	0	0.6	0	0	0	0	0.7



Traffic Data Collection, LLC

tdcounts.com

Phone: (586) 786-5407

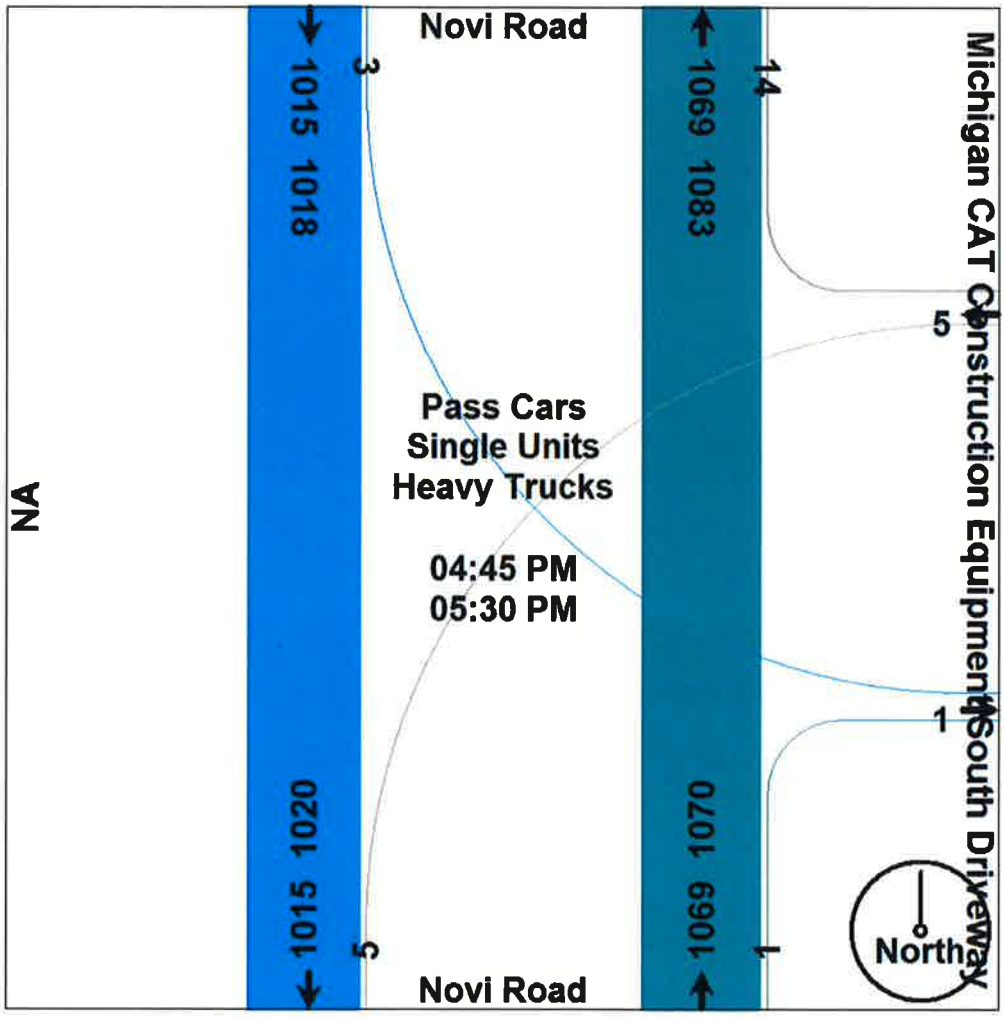
Traffic Study Performed For:

Fleis & VandenBrink

Project: Novi Pulte Traffic Study
Type: 4 Hr. Video Turning Movement Count
Weather:.Clear AM Cldy PM Dry, Temp 10's
Count By: Miovision Video VCU 6H3

File Name : TMC_3 Novi & CAT South Dw_12-14-16
Site Code : TMC_3
Start Date : 12/14/2016
Page No : 4

	Novi Road Southbound				Michigan CAT Construction Equipment South Driveway Westbound				Novi Road Northbound				NA Eastbound				
Start Time	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Rgt	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 12:45 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	0	253	**3**	256	2	0	0	2	**1**	243	0	244	0	0	0	0	502
05:00 PM	0	254	0	254	**9**	0	**3**	**12**	0	**286**	0	**286**	0	0	0	0	**552**
05:15 PM	0	**270**	0	**270**	0	0	1	1	0	254	0	254	0	0	0	0	525
05:30 PM	0	238	0	238	3	0	1	4	0	286	0	286	0	0	0	0	528
Total Volume	0	1015	3	1018	14	0	5	19	1	1069	0	1070	0	0	0	0	2107
% App. Total	0	99.7	0.3		73.7	0	26.3		0.1	99.9	0		0	0	0		
PHF	.000	.940	.250	.943	.389	.000	.417	.396	.250	.934	.000	.935	.000	.000	.000	.000	.954
Pass Cars	0	1003	2	1005	11	0	5	16	1	1054	0	1055	0	0	0	0	2076
% Pass Cars	0	98.8	66.7	98.7	78.6	0	100	84.2	100	98.6	0	98.6	0	0	0	0	98.5
Single Units	0	9	1	10	3	0	0	3	0	7	0	7	0	0	0	0	20
% Single Units	0	0.9	33.3	1.0	21.4	0	0	15.8	0	0.7	0	0.7	0	0	0	0	0.9
Heavy Trucks	0	3	0	3	0	0	0	0	0	8	0	8	0	0	0	0	11
% Heavy Trucks	0	0.3	0	0.3	0	0	0	0	0	0.7	0	0.7	0	0	0	0	0.5



YOU ARE VIEWING DATA FOR:

City of Novi

45175 W 10 Mile Rd
Novi, MI 48375-3024
http://www.cityofnovi.org

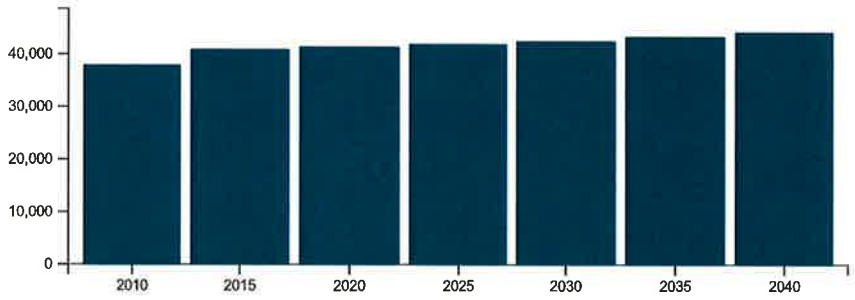
SEMCOG MEMBER

Census 2010 Population: 55,374
Area: 31.2 square miles

Economy & Jobs

Link to American Community Survey (ACS) Profiles: **Select a Year** 2010-2014 ▼ **Economic**

Forecasted Jobs



Source: **SEMCOG 2040 Forecast** produced in 2012.

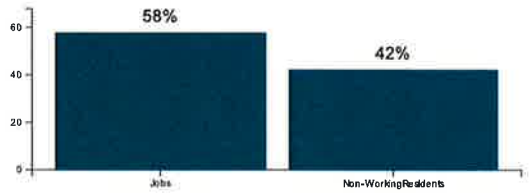
Forecasted Jobs by Industry

Forecasted Jobs By Industry	SEMCOG and ACS 2010	2015	2020	2025	2030	2035	2040	Change 2010 - 2040
Forecasted Jobs By Industry	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**Change 2010 - 2040**
Natural Resources, Mining, & Construction	1,559	1,828	1,904	1,933	1,940	2,009	1,917	358
Manufacturing	1,719	1,807	1,764	1,670	1,639	1,547	1,436	-283
Wholesale Trade, Transportation, Warehousing, & Utilities	4,114	4,268	4,145	4,126	4,064	4,225	4,227	113
Retail Trade	7,823	7,723	7,561	7,569	7,507	7,476	7,413	-410
Knowledge-based Services	6,982	8,035	8,346	8,456	8,398	8,473	8,858	1,876
Services to Households & Firms	3,593	4,064	4,183	4,364	4,697	4,855	4,832	1,239
Private Education & Healthcare	5,342	6,164	6,657	6,914	7,235	7,522	8,026	2,684
Leisure & Hospitality	5,109	5,328	5,133	5,160	5,220	5,473	5,710	601
Government	1,687	1,685	1,726	1,757	1,782	1,801	1,808	121
Total	37,928	40,902	41,419	41,949	42,482	43,381	44,227	6,299

Source: **SEMCOG 2040 Forecast** produced in 2012.
Note: "C" indicates data blocked due to confidentiality concerns of ES-202 files.

Daytime Population

Daytime Population	SEMCOG and ACS 2010
Jobs	37,928
Non-Working Residents	27,701
Age 15 and under	13,391
Not in labor force	12,488
Unemployed	1,822
Daytime Population	65,629



Source: **SEMCOG 2040 Forecast** produced in 2012, **U.S Census Bureau**, and **2010 American Community Survey 5-Year Estimates.**

Note: The number of residents attending school outside Southeast Michigan is not available. Likewise, the number of students commuting into Southeast Michigan to attend school is also not known.

YOU ARE VIEWING DATA FOR:

City of Novi

45175 W 10 Mile Rd
Novi, MI 48375-3024
http://www.cityofnovi.org

SEMCOG MEMBER

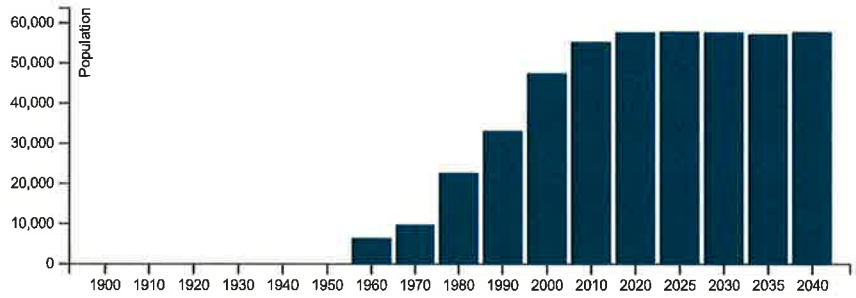
Census 2010 Population: 55,374
Area: 31.2 square miles

Population and Households

Link to American Community Survey (ACS) Profiles: **Select a Year** 2010-2014 ▼ **Social | Demographic**

Population and Household Estimates for Southeast Michigan, August 2016

Population Forecast



Note for City of Novi : Incorporated as of the 1970 Census from Village of Novi. Population numbers prior to 1970 are of the village. The Village of Novi was incorporated in 1958 from the majority of Novi Township. Population numbers not available before 1960 as area was part of Novi Township.

Population and Households

Components of Population Change	Census 2000-2005 Avg.	Change 2000-2010 Avg.	Pct Change 2000-2010	SEMCOG Jul 2016	SEMCOG 2040
Population and Households	Census 2010	Change 2000-2010	Pct Change 2000-2010	SEMCOG Jul 2016	SEMCOG 2040
Total Population	55,374	7,795	16.4%	59,324	57,897
Group Quarters Population	360	93	34.8%	360	407
Household Population	55,014	7,702	16.3%	58,964	57,490
Housing Units	24,286	4,569	23.2%	25,735	-
Households (Occupied Units)	22,317	3,525	18.8%	24,237	24,234
Residential Vacancy Rate	8.1%	3.4%	-	5.8%	-
Average Household Size	2.47	-0.05	-	2.43	2.37

Source: **U.S. Census Bureau** and **SEMCOG 2040 Forecast** produced in 2012.

Components of Population Change

Components of Population Change	2000-2005 Avg.	2006-2010 Avg.
Natural Increase (Births - Deaths)	326	280
Births	586	587
Deaths	260	307
Net Migration (Movement In - Movement Out)	598	355
Population Change (Natural Increase + Net Migration)	924	635

Source: **Michigan Department of Community Health** Vital Statistics **U.S. Census Bureau,** and **SEMCOG.**

Level of Service Criteria for Stop Sign Controlled Intersections

The level of service criteria are given in Table 17-2. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. . . .

Exhibit 17-2. Level of Service Criteria for TWSC Intersections

LEVEL OF SERVICE	AVERAGE CONTROL DELAY (sec/veh)
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

Average total delay less than 10 sec/veh is defined as Level of Service (LOS) A. Follow-up times of less than 5 sec have been measured when there is no conflicting traffic for a minor street movement, so control delays of less than 10 sec/veh are appropriate for low flow conditions. To remain consistent with the AWSC intersection analysis procedure described later in this chapter, a total delay of 50 sec/veh is assumed as the break point between LOS E and F.

The proposed level of service criteria for TWSC intersections are somewhat different from the criteria used in Chapter 16 for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, several driver behavior considerations combine to make delays at signalized intersections less onerous than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, where drivers on the minor approaches to unsignalized intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized than signalized intersections. For these reasons, it is considered that the total delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection. . . .

LOS F exists when there are insufficient gaps of suitable size to allow a side street demand to cross safely through a major street traffic stream. This level of service is generally evident from extremely long total delays experienced by side street traffic and by queueing on the minor approaches. The method, however, is based on a constant critical gap size - that is, the critical gap remains constant, no matter how long the side street motorist waits. LOS F may also appear in the form of side street vehicles' selecting smaller-than-usual gaps. In such cases, safety may be a problem and some disruption to the major traffic stream may result. It is important to note that LOS F may not always result in long queues but may result in adjustments to normal gap acceptance behavior. The latter is more difficult to observe on the field than queueing, which is more obvious.

Source: Highway Capacity Manual, 2010. Transportation Research Board, National Research Council

Level of Service for Signalized Intersections

Level of service for signalized intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average stopped delay per vehicle for a 15-min analysis period. The criteria are given in Exhibit 16-2. Delay may be measured in the field or estimated using procedures presented later in this chapter. Delay is a complex measure and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the *v/c* ratio for the lane group in question.

LOS A describes operations with very low delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

LOS B describes operations with delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of average delay.

Exhibit 16-2. Level-of-Service Criteria for Signalized Intersections

LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (SEC)
A	≤10.0
B	> 10.0 and ≤20.0
C	> 20.0 and ≤ 35.0
D	> 35.0 and ≤ 55.0
E	> 55.0 and ≤ 80.0
F	>80.0

LOS C describes operations with delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with delay greater than 35 and up to 55 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high *v/c* ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with delay greater than 55 and up to 80 sec per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high *v/c* ratios. Individual cycle failures are frequent occurrences.

LOS F describes operations with delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high *v/c* ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Source: Highway Capacity Manual, 2010. Transportation Research Board, National Research Council

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	0	37	1	0	5	35	889	1	16	605	31
Future Volume (veh/h)	26	0	37	1	0	5	35	889	1	16	605	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1709	2000	1942	1942	2000	1942	1942	2000
Adj Flow Rate, veh/h	36	0	51	1	0	7	39	999	1	19	712	36
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.72	0.72	0.72	0.75	0.75	0.75	0.89	0.89	0.89	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	17	17	17	3	3	3	3	3	3
Cap, veh/h	143	0	82	37	5	60	634	3223	3	504	3046	154
Arrive On Green	0.05	0.00	0.05	0.05	0.00	0.05	0.85	0.85	0.85	0.85	0.85	0.85
Sat Flow, veh/h	1403	0	1667	69	105	1219	704	3782	4	556	3574	181
Grp Volume(v), veh/h	36	0	51	8	0	0	39	487	513	19	367	381
Grp Sat Flow(s),veh/h/ln	1403	0	1667	1393	0	0	704	1845	1941	556	1845	1910
Q Serve(g_s), s	0.0	0.0	3.6	0.0	0.0	0.0	1.3	6.4	6.4	0.9	4.4	4.4
Cycle Q Clear(g_c), s	2.2	0.0	3.6	3.6	0.0	0.0	5.7	6.4	6.4	7.2	4.4	4.4
Prop In Lane	1.00		1.00	0.12		0.87	1.00		0.00	1.00		0.09
Lane Grp Cap(c), veh/h	143	0	82	103	0	0	634	1572	1654	504	1572	1628
V/C Ratio(X)	0.25	0.00	0.62	0.08	0.00	0.00	0.06	0.31	0.31	0.04	0.23	0.23
Avail Cap(c_a), veh/h	343	0	319	303	0	0	634	1572	1654	504	1572	1628
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.3	0.0	55.9	54.5	0.0	0.0	2.2	1.8	1.8	2.5	1.6	1.6
Incr Delay (d2), s/veh	0.9	0.0	7.4	0.3	0.0	0.0	0.2	0.5	0.5	0.1	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	1.8	0.3	0.0	0.0	0.3	3.3	3.5	0.1	2.3	2.4
LnGrp Delay(d),s/veh	56.2	0.0	63.3	54.8	0.0	0.0	2.3	2.3	2.3	2.6	2.0	2.0
LnGrp LOS	E		E	D			A	A	A	A	A	A
Approach Vol, veh/h		87			8			1039			767	
Approach Delay, s/veh		60.4			54.8			2.3			2.0	
Approach LOS		E			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		108.1		11.9		108.1		11.9
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 85		23.0		* 85		23.0
Max Q Clear Time (g_c+I1), s		8.4		5.6		9.2		5.6
Green Ext Time (p_c), s		16.9		0.3		16.9		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	5.0
HCM 2010 LOS	A

Notes

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↰	↑↱		↰	↑↱	
Traffic Vol, veh/h	1	0	0	0	0	3	0	921	11	22	617	4
Future Vol, veh/h	1	0	0	0	0	3	0	921	11	22	617	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	60	60	60	89	89	89	81	81	81
Heavy Vehicles, %	0	0	0	100	100	100	3	3	3	3	3	3
Mvmt Flow	2	0	0	0	0	5	0	1035	12	27	762	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1336	1866	383	1476	1862	524	767	0	0	1047	0	0
Stage 1	819	819	-	1041	1041	-	-	-	-	-	-	-
Stage 2	517	1047	-	435	821	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.5	6.9	9.5	8.5	8.9	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	6.5	5.5	-	8.5	7.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	8.5	7.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	4.5	5	4.3	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	114	73	621	36	25	308	836	-	-	654	-	-
Stage 1	340	392	-	122	156	-	-	-	-	-	-	-
Stage 2	515	308	-	371	218	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	109	70	621	35	24	308	836	-	-	654	-	-
Mov Cap-2 Maneuver	109	70	-	35	24	-	-	-	-	-	-	-
Stage 1	340	376	-	122	156	-	-	-	-	-	-	-
Stage 2	507	308	-	356	209	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	38.5	16.9	0	0.4
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	836	-	-	109	308	654	-	-
HCM Lane V/C Ratio	-	-	-	0.015	0.016	0.042	-	-
HCM Control Delay (s)	0	-	-	38.5	16.9	10.7	-	-
HCM Lane LOS	A	-	-	E	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0.1	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	3	7	925	2	5	612
Future Vol, veh/h	3	7	925	2	5	612
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	87	87	86	86
Heavy Vehicles, %	30	30	3	3	3	3
Mvmt Flow	5	11	1063	2	6	712

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1431	533	0	0	1066	0
Stage 1	1064	-	-	-	-	-
Stage 2	367	-	-	-	-	-
Critical Hdwy	7.4	7.5	-	-	4.16	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	3.8	3.6	-	-	2.23	-
Pot Cap-1 Maneuver	97	425	-	-	644	-
Stage 1	238	-	-	-	-	-
Stage 2	595	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	96	425	-	-	644	-
Mov Cap-2 Maneuver	188	-	-	-	-	-
Stage 1	238	-	-	-	-	-
Stage 2	589	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.3	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	308	644	-
HCM Lane V/C Ratio	-	-	0.052	0.009	-
HCM Control Delay (s)	-	-	17.3	10.6	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	0	57	7	0	34	41	1107	2	2	1008	53
Future Volume (veh/h)	38	0	57	7	0	34	41	1107	2	2	1008	53
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1818	2000	1961	1961	2000	1980	1980	2000
Adj Flow Rate, veh/h	49	0	74	9	0	43	46	1230	2	2	1061	56
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.79	0.79	0.79	0.90	0.90	0.90	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	10	10	10	2	2	2	1	1	1
Cap, veh/h	153	0	115	42	8	70	444	3178	5	403	3028	160
Arrive On Green	0.07	0.00	0.07	0.07	0.00	0.07	0.83	0.83	0.83	0.83	0.83	0.83
Sat Flow, veh/h	1358	0	1667	95	117	1014	502	3816	6	455	3636	192
Grp Volume(v), veh/h	49	0	74	52	0	0	46	600	632	2	549	568
Grp Sat Flow(s),veh/h/ln	1358	0	1667	1226	0	0	502	1863	1960	455	1881	1946
Q Serve(g_s), s	0.0	0.0	5.2	0.3	0.0	0.0	2.9	9.5	9.5	0.1	8.3	8.3
Cycle Q Clear(g_c), s	4.2	0.0	5.2	5.5	0.0	0.0	11.1	9.5	9.5	9.7	8.3	8.3
Prop In Lane	1.00		1.00	0.17		0.83	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	153	0	115	120	0	0	444	1551	1632	403	1567	1621
V/C Ratio(X)	0.32	0.00	0.64	0.43	0.00	0.00	0.10	0.39	0.39	0.00	0.35	0.35
Avail Cap(c_a), veh/h	319	0	319	301	0	0	444	1551	1632	403	1567	1621
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.0	0.0	54.4	53.9	0.0	0.0	3.7	2.5	2.5	3.7	2.4	2.4
Incr Delay (d2), s/veh	1.2	0.0	5.9	2.5	0.0	0.0	0.5	0.7	0.7	0.0	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	2.6	1.8	0.0	0.0	0.5	5.2	5.4	0.0	4.4	4.5
LnGrp Delay(d),s/veh	55.2	0.0	60.3	56.4	0.0	0.0	4.2	3.2	3.2	3.7	3.0	3.0
LnGrp LOS	E		E	E			A	A	A	A	A	A
Approach Vol, veh/h		123			52			1278			1119	
Approach Delay, s/veh		58.3			56.4			3.2			3.0	
Approach LOS		E			E			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		105.7		14.3		105.7		14.3
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 85		23.0		* 85		23.0
Max Q Clear Time (g_c+I1), s		13.1		7.2		11.7		7.5
Green Ext Time (p_c), s		30.1		0.7		30.3		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	6.8
HCM 2010 LOS	A

Notes

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	2	10	0	8	0	1138	1	0	1068	4
Future Vol, veh/h	4	0	2	10	0	8	0	1138	1	0	1068	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	64	64	64	90	90	90	92	92	92
Heavy Vehicles, %	17	17	17	0	0	0	2	2	2	1	1	1
Mvmt Flow	7	0	3	16	0	13	0	1264	1	0	1161	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1795	2429	583	1845	2430	633	1165	0	0	1266	0	0
Stage 1	1163	1163	-	1265	1265	-	-	-	-	-	-	-
Stage 2	632	1266	-	580	1165	-	-	-	-	-	-	-
Critical Hdwy	7.84	6.84	7.24	7.5	6.5	6.9	4.14	-	-	4.12	-	-
Critical Hdwy Stg 1	6.84	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.84	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.67	4.17	3.47	3.5	4	3.3	2.22	-	-	2.21	-	-
Pot Cap-1 Maneuver	43	26	420	47	32	427	595	-	-	550	-	-
Stage 1	184	238	-	182	243	-	-	-	-	-	-	-
Stage 2	400	211	-	472	271	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	42	26	420	47	32	427	595	-	-	550	-	-
Mov Cap-2 Maneuver	42	26	-	47	32	-	-	-	-	-	-	-
Stage 1	184	238	-	182	243	-	-	-	-	-	-	-
Stage 2	388	211	-	468	271	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	76.6	75.2	0	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	595	-	-	60	78	550	-	-
HCM Lane V/C Ratio	-	-	-	0.167	0.361	-	-	-
HCM Control Delay (s)	0	-	-	76.6	75.2	0	-	-
HCM Lane LOS	A	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.6	1.4	0	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	14	1125	1	3	1077
Future Vol, veh/h	5	14	1125	1	3	1077
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	94	94	94	94
Heavy Vehicles, %	16	16	1	1	1	1
Mvmt Flow	8	23	1197	1	3	1146

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1776	599	0	0	1198	0
Stage 1	1197	-	-	-	-	-
Stage 2	579	-	-	-	-	-
Critical Hdwy	7.12	7.22	-	-	4.12	-
Critical Hdwy Stg 1	6.12	-	-	-	-	-
Critical Hdwy Stg 2	6.12	-	-	-	-	-
Follow-up Hdwy	3.66	3.46	-	-	2.21	-
Pot Cap-1 Maneuver	63	412	-	-	584	-
Stage 1	222	-	-	-	-	-
Stage 2	486	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	63	412	-	-	584	-
Mov Cap-2 Maneuver	163	-	-	-	-	-
Stage 1	222	-	-	-	-	-
Stage 2	484	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.7	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	294	584	-
HCM Lane V/C Ratio	-	-	0.108	0.005	-
HCM Control Delay (s)	-	-	18.7	11.2	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.4	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	0	37	1	0	5	35	889	1	16	605	31
Future Volume (veh/h)	26	0	37	1	0	5	35	889	1	16	605	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1709	2000	1942	1942	2000	1942	1942	2000
Adj Flow Rate, veh/h	36	0	51	1	0	7	39	999	1	19	712	36
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.72	0.72	0.72	0.75	0.75	0.75	0.89	0.89	0.89	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	17	17	17	3	3	3	3	3	3
Cap, veh/h	227	0	110	74	5	83	593	2788	3	477	2634	133
Arrive On Green	0.07	0.00	0.07	0.07	0.00	0.07	0.74	0.74	0.74	0.74	0.74	0.74
Sat Flow, veh/h	1403	0	1667	98	80	1247	704	3782	4	556	3574	181
Grp Volume(v), veh/h	36	0	51	8	0	0	39	487	513	19	367	381
Grp Sat Flow(s),veh/h/ln	1403	0	1667	1425	0	0	704	1845	1941	556	1845	1910
Q Serve(g_s), s	0.0	0.0	1.8	0.0	0.0	0.0	1.2	5.7	5.7	0.8	3.9	3.9
Cycle Q Clear(g_c), s	1.1	0.0	1.8	1.8	0.0	0.0	5.1	5.7	5.7	6.4	3.9	3.9
Prop In Lane	1.00		1.00	0.12		0.87	1.00		0.00	1.00		0.09
Lane Grp Cap(c), veh/h	227	0	110	162	0	0	593	1360	1431	477	1360	1408
V/C Ratio(X)	0.16	0.00	0.46	0.05	0.00	0.00	0.07	0.36	0.36	0.04	0.27	0.27
Avail Cap(c_a), veh/h	648	0	611	586	0	0	593	1360	1431	477	1360	1408
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.7	0.0	27.0	26.3	0.0	0.0	3.4	2.8	2.8	4.0	2.6	2.6
Incr Delay (d2), s/veh	0.3	0.0	3.0	0.1	0.0	0.0	0.2	0.7	0.7	0.2	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.9	0.1	0.0	0.0	0.3	3.1	3.3	0.1	2.1	2.2
LnGrp Delay(d),s/veh	27.0	0.0	30.0	26.4	0.0	0.0	3.6	3.6	3.5	4.1	3.1	3.1
LnGrp LOS	C		C	C			A	A	A	A	A	A
Approach Vol, veh/h		87			8			1039			767	
Approach Delay, s/veh		28.7			26.4			3.5			3.1	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		50.0		10.0		50.0		10.0
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 26		22.0		* 26		22.0
Max Q Clear Time (g_c+I1), s		7.7		3.8		8.4		3.8
Green Ext Time (p_c), s		10.4		0.3		10.1		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	4.6
HCM 2010 LOS	A

Notes

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	0	0	0	3	0	921	11	22	617	4
Future Vol, veh/h	1	0	0	0	0	3	0	921	11	22	617	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	60	60	60	89	89	89	81	81	81
Heavy Vehicles, %	0	0	0	100	100	100	3	3	3	3	3	3
Mvmt Flow	2	0	0	0	0	5	0	1035	12	27	762	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1336	1866	383	1476	1862	524	767	0	0	1047	0	0
Stage 1	819	819	-	1041	1041	-	-	-	-	-	-	-
Stage 2	517	1047	-	435	821	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.5	6.9	9.5	8.5	8.9	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	6.5	5.5	-	8.5	7.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	8.5	7.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	4.5	5	4.3	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	114	73	621	36	25	308	836	-	-	654	-	-
Stage 1	340	392	-	122	156	-	-	-	-	-	-	-
Stage 2	515	308	-	371	218	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	109	70	621	35	24	308	836	-	-	654	-	-
Mov Cap-2 Maneuver	109	70	-	35	24	-	-	-	-	-	-	-
Stage 1	340	376	-	122	156	-	-	-	-	-	-	-
Stage 2	507	308	-	356	209	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	38.5	16.9	0	0.4
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	836	-	-	109	308	654	-	-
HCM Lane V/C Ratio	-	-	-	0.015	0.016	0.042	-	-
HCM Control Delay (s)	0	-	-	38.5	16.9	10.7	-	-
HCM Lane LOS	A	-	-	E	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0.1	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	3	7	925	2	5	612
Future Vol, veh/h	3	7	925	2	5	612
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	87	87	86	86
Heavy Vehicles, %	30	30	3	3	3	3
Mvmt Flow	5	11	1063	2	6	712

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1431	533	0	0	1066	0
Stage 1	1064	-	-	-	-	-
Stage 2	367	-	-	-	-	-
Critical Hdwy	7.4	7.5	-	-	4.16	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	3.8	3.6	-	-	2.23	-
Pot Cap-1 Maneuver	97	425	-	-	644	-
Stage 1	238	-	-	-	-	-
Stage 2	595	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	96	425	-	-	644	-
Mov Cap-2 Maneuver	188	-	-	-	-	-
Stage 1	238	-	-	-	-	-
Stage 2	589	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.3	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	308	644	-
HCM Lane V/C Ratio	-	-	0.052	0.009	-
HCM Control Delay (s)	-	-	17.3	10.6	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	0	57	7	0	34	41	1107	2	2	1008	53
Future Volume (veh/h)	38	0	57	7	0	34	41	1107	2	2	1008	53
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1818	2000	1961	1961	2000	1980	1980	2000
Adj Flow Rate, veh/h	49	0	74	9	0	43	46	1230	2	2	1061	56
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.79	0.79	0.79	0.90	0.90	0.90	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	10	10	10	2	2	2	1	1	1
Cap, veh/h	257	0	141	81	9	93	423	2743	4	386	2614	138
Arrive On Green	0.08	0.00	0.08	0.08	0.00	0.08	0.72	0.72	0.72	0.72	0.72	0.72
Sat Flow, veh/h	1358	0	1667	127	103	1099	502	3816	6	455	3636	192
Grp Volume(v), veh/h	49	0	74	52	0	0	46	600	632	2	549	568
Grp Sat Flow(s),veh/h/ln	1358	0	1667	1330	0	0	502	1863	1960	455	1881	1946
Q Serve(g_s), s	0.0	0.0	2.6	0.0	0.0	0.0	2.4	8.0	8.0	0.1	6.9	7.0
Cycle Q Clear(g_c), s	1.5	0.0	2.6	2.6	0.0	0.0	9.4	8.0	8.0	8.1	6.9	7.0
Prop In Lane	1.00		1.00	0.17		0.83	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	257	0	141	183	0	0	423	1339	1409	386	1352	1399
V/C Ratio(X)	0.19	0.00	0.53	0.28	0.00	0.00	0.11	0.45	0.45	0.01	0.41	0.41
Avail Cap(c_a), veh/h	640	0	611	600	0	0	423	1339	1409	386	1352	1399
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.8	0.0	26.3	26.0	0.0	0.0	5.2	3.5	3.5	5.2	3.3	3.3
Incr Delay (d2), s/veh	0.4	0.0	3.0	0.8	0.0	0.0	0.5	1.1	1.0	0.0	0.9	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	1.3	0.9	0.0	0.0	0.4	4.4	4.6	0.0	3.8	4.0
LnGrp Delay(d),s/veh	26.2	0.0	29.3	26.8	0.0	0.0	5.7	4.6	4.5	5.2	4.3	4.2
LnGrp LOS	C		C	C			A	A	A	A	A	A
Approach Vol, veh/h		123			52			1278			1119	
Approach Delay, s/veh		28.1			26.8			4.6			4.2	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		48.9		11.1		48.9		11.1
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 26		22.0		* 26		22.0
Max Q Clear Time (g_c+I1), s		11.4		4.6		10.1		4.6
Green Ext Time (p_c), s		11.5		0.8		12.3		0.8

Intersection Summary	
HCM 2010 Ctrl Delay	6.0
HCM 2010 LOS	A

Notes

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↑↑↔			↑↑↔	
Traffic Vol, veh/h	4	0	2	10	0	8	0	1138	1	0	1068	4
Future Vol, veh/h	4	0	2	10	0	8	0	1138	1	0	1068	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	64	64	64	90	90	90	92	92	92
Heavy Vehicles, %	17	17	17	0	0	0	2	2	2	1	1	1
Mvmt Flow	7	0	3	16	0	13	0	1264	1	0	1161	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1795	2429	583	1845	2430	633	1165	0	0	1266	0	0
Stage 1	1163	1163	-	1265	1265	-	-	-	-	-	-	-
Stage 2	632	1266	-	580	1165	-	-	-	-	-	-	-
Critical Hdwy	7.84	6.84	7.24	7.5	6.5	6.9	4.14	-	-	4.12	-	-
Critical Hdwy Stg 1	6.84	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.84	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.67	4.17	3.47	3.5	4	3.3	2.22	-	-	2.21	-	-
Pot Cap-1 Maneuver	43	26	420	47	32	427	595	-	-	550	-	-
Stage 1	184	238	-	182	243	-	-	-	-	-	-	-
Stage 2	400	211	-	472	271	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	42	26	420	47	32	427	595	-	-	550	-	-
Mov Cap-2 Maneuver	42	26	-	47	32	-	-	-	-	-	-	-
Stage 1	184	238	-	182	243	-	-	-	-	-	-	-
Stage 2	388	211	-	468	271	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	76.6	75.2	0	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	595	-	-	60	78	550	-	-
HCM Lane V/C Ratio	-	-	-	0.167	0.361	-	-	-
HCM Control Delay (s)	0	-	-	76.6	75.2	0	-	-
HCM Lane LOS	A	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.6	1.4	0	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	14	1125	1	3	1077
Future Vol, veh/h	5	14	1125	1	3	1077
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	94	94	94	94
Heavy Vehicles, %	16	16	1	1	1	1
Mvmt Flow	8	23	1197	1	3	1146

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1776	599	0	0	1198	0
Stage 1	1197	-	-	-	-	-
Stage 2	579	-	-	-	-	-
Critical Hdwy	7.12	7.22	-	-	4.12	-
Critical Hdwy Stg 1	6.12	-	-	-	-	-
Critical Hdwy Stg 2	6.12	-	-	-	-	-
Follow-up Hdwy	3.66	3.46	-	-	2.21	-
Pot Cap-1 Maneuver	63	412	-	-	584	-
Stage 1	222	-	-	-	-	-
Stage 2	486	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	63	412	-	-	584	-
Mov Cap-2 Maneuver	163	-	-	-	-	-
Stage 1	222	-	-	-	-	-
Stage 2	484	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.7	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 294	584	-
HCM Lane V/C Ratio	-	- 0.108	0.005	-
HCM Control Delay (s)	-	- 18.7	11.2	-
HCM Lane LOS	-	- C	B	-
HCM 95th %tile Q(veh)	-	- 0.4	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	0	37	1	0	5	35	844	1	16	575	31
Future Volume (veh/h)	26	0	37	1	0	5	35	844	1	16	575	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1709	2000	1942	1942	2000	1942	1942	2000
Adj Flow Rate, veh/h	36	0	51	1	0	7	39	948	1	19	676	36
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.72	0.72	0.72	0.75	0.75	0.75	0.89	0.89	0.89	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	17	17	17	3	3	3	3	3	3
Cap, veh/h	143	0	82	37	5	60	655	3223	3	528	3037	162
Arrive On Green	0.05	0.00	0.05	0.05	0.00	0.05	0.85	0.85	0.85	0.85	0.85	0.85
Sat Flow, veh/h	1403	0	1667	69	105	1219	728	3782	4	583	3563	190
Grp Volume(v), veh/h	36	0	51	8	0	0	39	462	487	19	350	362
Grp Sat Flow(s),veh/h/ln	1403	0	1667	1393	0	0	728	1845	1941	583	1845	1908
Q Serve(g_s), s	0.0	0.0	3.6	0.0	0.0	0.0	1.2	5.9	5.9	0.8	4.1	4.2
Cycle Q Clear(g_c), s	2.2	0.0	3.6	3.6	0.0	0.0	5.4	5.9	5.9	6.7	4.1	4.2
Prop In Lane	1.00		1.00	0.12		0.87	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	143	0	82	103	0	0	655	1572	1654	528	1572	1626
V/C Ratio(X)	0.25	0.00	0.62	0.08	0.00	0.00	0.06	0.29	0.29	0.04	0.22	0.22
Avail Cap(c_a), veh/h	343	0	319	303	0	0	655	1572	1654	528	1572	1626
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.3	0.0	55.9	54.5	0.0	0.0	2.1	1.7	1.7	2.4	1.6	1.6
Incr Delay (d2), s/veh	0.9	0.0	7.4	0.3	0.0	0.0	0.2	0.5	0.5	0.1	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	1.8	0.3	0.0	0.0	0.3	3.2	3.3	0.1	2.2	2.3
LnGrp Delay(d),s/veh	56.2	0.0	63.3	54.8	0.0	0.0	2.3	2.2	2.2	2.5	1.9	1.9
LnGrp LOS	E		E	D			A	A	A	A	A	A
Approach Vol, veh/h		87			8			988			731	
Approach Delay, s/veh		60.4			54.8			2.2			2.0	
Approach LOS		E			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		108.1		11.9		108.1		11.9
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 85		23.0		* 85		23.0
Max Q Clear Time (g_c+I1), s		7.9		5.6		8.7		5.6
Green Ext Time (p_c), s		15.3		0.3		15.3		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	5.1
HCM 2010 LOS	A

Notes

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	0	0	0	3	0	876	11	22	587	4
Future Vol, veh/h	1	0	0	0	0	3	0	876	11	22	587	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	60	60	60	89	89	89	81	81	81
Heavy Vehicles, %	0	0	0	100	100	100	3	3	3	3	3	3
Mvmt Flow	2	0	0	0	0	5	0	984	12	27	725	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1273	1778	365	1407	1774	498	730	0	0	997	0	0
Stage 1	781	781	-	990	990	-	-	-	-	-	-	-
Stage 2	492	997	-	417	784	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.5	6.9	9.5	8.5	8.9	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	6.5	5.5	-	8.5	7.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	8.5	7.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	4.5	5	4.3	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	126	83	638	41	29	324	863	-	-	684	-	-
Stage 1	358	408	-	135	168	-	-	-	-	-	-	-
Stage 2	532	325	-	384	231	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	120	80	638	40	28	324	863	-	-	684	-	-
Mov Cap-2 Maneuver	120	80	-	40	28	-	-	-	-	-	-	-
Stage 1	358	392	-	135	168	-	-	-	-	-	-	-
Stage 2	524	325	-	369	222	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	35.4	16.3	0	0.4
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	863	-	-	120	324	684	-	-
HCM Lane V/C Ratio	-	-	-	0.014	0.015	0.04	-	-
HCM Control Delay (s)	0	-	-	35.4	16.3	10.5	-	-
HCM Lane LOS	A	-	-	E	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0.1	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	3	7	880	2	5	582
Future Vol, veh/h	3	7	880	2	5	582
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	87	87	86	86
Heavy Vehicles, %	30	30	3	3	3	3
Mvmt Flow	5	11	1011	2	6	677

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1363	507	0	0	1014	0
Stage 1	1013	-	-	-	-	-
Stage 2	350	-	-	-	-	-
Critical Hdwy	7.4	7.5	-	-	4.16	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	3.8	3.6	-	-	2.23	-
Pot Cap-1 Maneuver	108	443	-	-	674	-
Stage 1	255	-	-	-	-	-
Stage 2	608	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	107	443	-	-	674	-
Mov Cap-2 Maneuver	202	-	-	-	-	-
Stage 1	255	-	-	-	-	-
Stage 2	603	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.6	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 326	674	-
HCM Lane V/C Ratio	-	- 0.049	0.009	-
HCM Control Delay (s)	-	- 16.6	10.4	-
HCM Lane LOS	-	- C	B	-
HCM 95th %tile Q(veh)	-	- 0.2	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	0	57	7	0	34	41	1051	2	2	955	53
Future Volume (veh/h)	38	0	57	7	0	34	41	1051	2	2	955	53
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1818	2000	1961	1961	2000	1980	1980	2000
Adj Flow Rate, veh/h	49	0	74	9	0	43	46	1168	2	2	1005	56
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.79	0.79	0.79	0.90	0.90	0.90	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	10	10	10	2	2	2	1	1	1
Cap, veh/h	153	0	115	42	8	70	467	3178	5	426	3018	168
Arrive On Green	0.07	0.00	0.07	0.07	0.00	0.07	0.83	0.83	0.83	0.83	0.83	0.83
Sat Flow, veh/h	1358	0	1667	95	117	1014	530	3816	7	482	3624	202
Grp Volume(v), veh/h	49	0	74	52	0	0	46	570	600	2	522	539
Grp Sat Flow(s),veh/h/ln	1358	0	1667	1226	0	0	530	1863	1960	482	1881	1945
Q Serve(g_s), s	0.0	0.0	5.2	0.3	0.0	0.0	2.6	8.9	8.9	0.1	7.7	7.7
Cycle Q Clear(g_c), s	4.2	0.0	5.2	5.5	0.0	0.0	10.3	8.9	8.9	9.0	7.7	7.7
Prop In Lane	1.00		1.00	0.17		0.83	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	153	0	115	120	0	0	467	1551	1632	426	1567	1619
V/C Ratio(X)	0.32	0.00	0.64	0.43	0.00	0.00	0.10	0.37	0.37	0.00	0.33	0.33
Avail Cap(c_a), veh/h	319	0	319	301	0	0	467	1551	1632	426	1567	1619
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.0	0.0	54.4	53.9	0.0	0.0	3.5	2.4	2.4	3.5	2.3	2.3
Incr Delay (d2), s/veh	1.2	0.0	5.9	2.5	0.0	0.0	0.4	0.7	0.6	0.0	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	2.6	1.8	0.0	0.0	0.4	4.7	5.0	0.0	4.2	4.3
LnGrp Delay(d),s/veh	55.2	0.0	60.3	56.4	0.0	0.0	3.9	3.1	3.1	3.5	2.9	2.9
LnGrp LOS	E		E	E			A	A	A	A	A	A
Approach Vol, veh/h		123			52			1216			1063	
Approach Delay, s/veh		58.3			56.4			3.1			2.9	
Approach LOS		E			E			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		105.7		14.3		105.7		14.3
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 85		23.0		* 85		23.0
Max Q Clear Time (g_c+I1), s		12.3		7.2		11.0		7.5
Green Ext Time (p_c), s		27.1		0.7		27.2		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	6.9
HCM 2010 LOS	A

Notes

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↰	↑↑↱		↰	↑↑↱	
Traffic Vol, veh/h	4	0	2	10	0	8	0	1082	1	0	1015	4
Future Vol, veh/h	4	0	2	10	0	8	0	1082	1	0	1015	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	64	64	64	90	90	90	92	92	92
Heavy Vehicles, %	17	17	17	0	0	0	2	2	2	1	1	1
Mvmt Flow	7	0	3	16	0	13	0	1202	1	0	1103	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1706	2308	554	1755	2311	602	1108	0	0	1203	0	0
Stage 1	1105	1105	-	1203	1203	-	-	-	-	-	-	-
Stage 2	601	1203	-	552	1108	-	-	-	-	-	-	-
Critical Hdwy	7.84	6.84	7.24	7.5	6.5	6.9	4.14	-	-	4.12	-	-
Critical Hdwy Stg 1	6.84	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.84	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.67	4.17	3.47	3.5	4	3.3	2.22	-	-	2.21	-	-
Pot Cap-1 Maneuver	50	31	439	55	39	448	626	-	-	581	-	-
Stage 1	200	255	-	199	260	-	-	-	-	-	-	-
Stage 2	419	227	-	491	288	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	49	31	439	55	39	448	626	-	-	581	-	-
Mov Cap-2 Maneuver	49	31	-	55	39	-	-	-	-	-	-	-
Stage 1	200	255	-	199	260	-	-	-	-	-	-	-
Stage 2	407	227	-	487	288	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	64.8	62.2	0	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	626	-	-	70	90	581	-	-
HCM Lane V/C Ratio	-	-	-	0.143	0.313	-	-	-
HCM Control Delay (s)	0	-	-	64.8	62.2	0	-	-
HCM Lane LOS	A	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.5	1.2	0	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	14	1069	1	3	1024
Future Vol, veh/h	5	14	1069	1	3	1024
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	94	94	94	94
Heavy Vehicles, %	16	16	1	1	1	1
Mvmt Flow	8	23	1137	1	3	1089

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1689	569	0	0	1138	0
Stage 1	1138	-	-	-	-	-
Stage 2	551	-	-	-	-	-
Critical Hdwy	7.12	7.22	-	-	4.12	-
Critical Hdwy Stg 1	6.12	-	-	-	-	-
Critical Hdwy Stg 2	6.12	-	-	-	-	-
Follow-up Hdwy	3.66	3.46	-	-	2.21	-
Pot Cap-1 Maneuver	73	431	-	-	615	-
Stage 1	240	-	-	-	-	-
Stage 2	503	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	73	431	-	-	615	-
Mov Cap-2 Maneuver	176	-	-	-	-	-
Stage 1	240	-	-	-	-	-
Stage 2	501	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.8	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	312	615	-
HCM Lane V/C Ratio	-	-	0.101	0.005	-
HCM Control Delay (s)	-	-	17.8	10.9	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	0	37	1	0	5	35	844	1	16	575	31
Future Volume (veh/h)	26	0	37	1	0	5	35	844	1	16	575	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1709	2000	1942	1942	2000	1942	1942	2000
Adj Flow Rate, veh/h	36	0	51	1	0	7	39	948	1	19	676	36
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.72	0.72	0.72	0.75	0.75	0.75	0.89	0.89	0.89	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	17	17	17	3	3	3	3	3	3
Cap, veh/h	227	0	110	74	5	83	612	2788	3	498	2627	140
Arrive On Green	0.07	0.00	0.07	0.07	0.00	0.07	0.74	0.74	0.74	0.74	0.74	0.74
Sat Flow, veh/h	1403	0	1667	98	80	1247	728	3782	4	583	3563	190
Grp Volume(v), veh/h	36	0	51	8	0	0	39	462	487	19	350	362
Grp Sat Flow(s),veh/h/ln	1403	0	1667	1425	0	0	728	1845	1941	583	1845	1908
Q Serve(g_s), s	0.0	0.0	1.8	0.0	0.0	0.0	1.1	5.3	5.3	0.7	3.7	3.7
Cycle Q Clear(g_c), s	1.1	0.0	1.8	1.8	0.0	0.0	4.8	5.3	5.3	6.0	3.7	3.7
Prop In Lane	1.00		1.00	0.12		0.87	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	227	0	110	162	0	0	612	1360	1431	498	1360	1407
V/C Ratio(X)	0.16	0.00	0.46	0.05	0.00	0.00	0.06	0.34	0.34	0.04	0.26	0.26
Avail Cap(c_a), veh/h	648	0	611	586	0	0	612	1360	1431	498	1360	1407
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.7	0.0	27.0	26.3	0.0	0.0	3.3	2.8	2.8	3.8	2.6	2.6
Incr Delay (d2), s/veh	0.3	0.0	3.0	0.1	0.0	0.0	0.2	0.7	0.6	0.1	0.5	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.9	0.1	0.0	0.0	0.3	2.8	3.0	0.1	2.0	2.1
LnGrp Delay(d),s/veh	27.0	0.0	30.0	26.4	0.0	0.0	3.5	3.4	3.4	4.0	3.0	3.0
LnGrp LOS	C		C	C			A	A	A	A	A	A
Approach Vol, veh/h		87			8			988			731	
Approach Delay, s/veh		28.7			26.4			3.4			3.0	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		50.0		10.0		50.0		10.0
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 26		22.0		* 26		22.0
Max Q Clear Time (g_c+I1), s		7.3		3.8		8.0		3.8
Green Ext Time (p_c), s		10.0		0.3		9.8		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	4.6
HCM 2010 LOS	A

Notes

Intersection												
Int Delay, s/veh	0.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	0	0	0	3	0	876	11	22	587	4
Future Vol, veh/h	1	0	0	0	0	3	0	876	11	22	587	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	60	60	60	89	89	89	81	81	81
Heavy Vehicles, %	0	0	0	100	100	100	3	3	3	3	3	3
Mvmt Flow	2	0	0	0	0	5	0	984	12	27	725	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1273	1778	365	1407	1774	498	730	0	0	997	0	0
Stage 1	781	781	-	990	990	-	-	-	-	-	-	-
Stage 2	492	997	-	417	784	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.5	6.9	9.5	8.5	8.9	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	6.5	5.5	-	8.5	7.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	8.5	7.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	4.5	5	4.3	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	126	83	638	41	29	324	863	-	-	684	-	-
Stage 1	358	408	-	135	168	-	-	-	-	-	-	-
Stage 2	532	325	-	384	231	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	120	80	638	40	28	324	863	-	-	684	-	-
Mov Cap-2 Maneuver	120	80	-	40	28	-	-	-	-	-	-	-
Stage 1	358	392	-	135	168	-	-	-	-	-	-	-
Stage 2	524	325	-	369	222	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	35.4	16.3	0	0.4
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	863	-	-	120	324	684	-	-
HCM Lane V/C Ratio	-	-	-	0.014	0.015	0.04	-	-
HCM Control Delay (s)	0	-	-	35.4	16.3	10.5	-	-
HCM Lane LOS	A	-	-	E	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0.1	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	3	7	880	2	5	582
Future Vol, veh/h	3	7	880	2	5	582
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	87	87	86	86
Heavy Vehicles, %	30	30	3	3	3	3
Mvmt Flow	5	11	1011	2	6	677

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1363	507	0	0	1014	0
Stage 1	1013	-	-	-	-	-
Stage 2	350	-	-	-	-	-
Critical Hdwy	7.4	7.5	-	-	4.16	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	3.8	3.6	-	-	2.23	-
Pot Cap-1 Maneuver	108	443	-	-	674	-
Stage 1	255	-	-	-	-	-
Stage 2	608	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	107	443	-	-	674	-
Mov Cap-2 Maneuver	202	-	-	-	-	-
Stage 1	255	-	-	-	-	-
Stage 2	603	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.6	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	326	674	-
HCM Lane V/C Ratio	-	-	0.049	0.009	-
HCM Control Delay (s)	-	-	16.6	10.4	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	0	57	7	0	34	41	1051	2	2	955	53
Future Volume (veh/h)	38	0	57	7	0	34	41	1051	2	2	955	53
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1818	2000	1961	1961	2000	1980	1980	2000
Adj Flow Rate, veh/h	49	0	74	9	0	43	46	1168	2	2	1005	56
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.79	0.79	0.79	0.90	0.90	0.90	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	10	10	10	2	2	2	1	1	1
Cap, veh/h	257	0	141	81	9	93	444	2743	5	407	2605	145
Arrive On Green	0.08	0.00	0.08	0.08	0.00	0.08	0.72	0.72	0.72	0.72	0.72	0.72
Sat Flow, veh/h	1358	0	1667	127	103	1099	530	3816	7	482	3624	202
Grp Volume(v), veh/h	49	0	74	52	0	0	46	570	600	2	522	539
Grp Sat Flow(s),veh/h/ln	1358	0	1667	1330	0	0	530	1863	1960	482	1881	1945
Q Serve(g_s), s	0.0	0.0	2.6	0.0	0.0	0.0	2.2	7.4	7.4	0.1	6.5	6.5
Cycle Q Clear(g_c), s	1.5	0.0	2.6	2.6	0.0	0.0	8.7	7.4	7.4	7.5	6.5	6.5
Prop In Lane	1.00		1.00	0.17		0.83	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	257	0	141	183	0	0	444	1339	1409	407	1352	1398
V/C Ratio(X)	0.19	0.00	0.53	0.28	0.00	0.00	0.10	0.43	0.43	0.00	0.39	0.39
Avail Cap(c_a), veh/h	640	0	611	600	0	0	444	1339	1409	407	1352	1398
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.8	0.0	26.3	26.0	0.0	0.0	5.0	3.4	3.4	4.9	3.3	3.3
Incr Delay (d2), s/veh	0.4	0.0	3.0	0.8	0.0	0.0	0.5	1.0	0.9	0.0	0.8	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	1.3	0.9	0.0	0.0	0.4	4.0	4.2	0.0	3.6	3.8
LnGrp Delay(d),s/veh	26.2	0.0	29.3	26.8	0.0	0.0	5.4	4.4	4.4	5.0	4.1	4.1
LnGrp LOS	C		C	C			A	A	A	A	A	A
Approach Vol, veh/h		123			52			1216			1063	
Approach Delay, s/veh		28.1			26.8			4.4			4.1	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		48.9		11.1		48.9		11.1
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 26		22.0		* 26		22.0
Max Q Clear Time (g_c+I1), s		10.7		4.6		9.5		4.6
Green Ext Time (p_c), s		11.5		0.8		12.1		0.8

Intersection Summary	
HCM 2010 Ctrl Delay	5.9
HCM 2010 LOS	A

Notes

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	2	10	0	8	0	1082	1	0	1015	4
Future Vol, veh/h	4	0	2	10	0	8	0	1082	1	0	1015	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	60	60	60	64	64	64	90	90	90	92	92	92
Heavy Vehicles, %	17	17	17	0	0	0	2	2	2	1	1	1
Mvmt Flow	7	0	3	16	0	13	0	1202	1	0	1103	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1706	2308	554	1755	2311	602	1108	0	0	1203	0	0
Stage 1	1105	1105	-	1203	1203	-	-	-	-	-	-	-
Stage 2	601	1203	-	552	1108	-	-	-	-	-	-	-
Critical Hdwy	7.84	6.84	7.24	7.5	6.5	6.9	4.14	-	-	4.12	-	-
Critical Hdwy Stg 1	6.84	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.84	5.84	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.67	4.17	3.47	3.5	4	3.3	2.22	-	-	2.21	-	-
Pot Cap-1 Maneuver	50	31	439	55	39	448	626	-	-	581	-	-
Stage 1	200	255	-	199	260	-	-	-	-	-	-	-
Stage 2	419	227	-	491	288	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	49	31	439	55	39	448	626	-	-	581	-	-
Mov Cap-2 Maneuver	49	31	-	55	39	-	-	-	-	-	-	-
Stage 1	200	255	-	199	260	-	-	-	-	-	-	-
Stage 2	407	227	-	487	288	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	64.8	62.2	0	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	626	-	-	70	90	581	-	-
HCM Lane V/C Ratio	-	-	-	0.143	0.313	-	-	-
HCM Control Delay (s)	0	-	-	64.8	62.2	0	-	-
HCM Lane LOS	A	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.5	1.2	0	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	14	1069	1	3	1024
Future Vol, veh/h	5	14	1069	1	3	1024
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	94	94	94	94
Heavy Vehicles, %	16	16	1	1	1	1
Mvmt Flow	8	23	1137	1	3	1089

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1689	569	0	0	1138	0
Stage 1	1138	-	-	-	-	-
Stage 2	551	-	-	-	-	-
Critical Hdwy	7.82	7.22	-	-	4.12	-
Critical Hdwy Stg 1	6.82	-	-	-	-	-
Critical Hdwy Stg 2	6.82	-	-	-	-	-
Follow-up Hdwy	3.66	3.46	-	-	2.21	-
Pot Cap-1 Maneuver	53	431	-	-	615	-
Stage 1	192	-	-	-	-	-
Stage 2	452	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	53	431	-	-	615	-
Mov Cap-2 Maneuver	142	-	-	-	-	-
Stage 1	192	-	-	-	-	-
Stage 2	450	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.4	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	281	615	-
HCM Lane V/C Ratio	-	-	0.113	0.005	-
HCM Control Delay (s)	-	-	19.4	10.9	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.4	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	0	37	1	0	5	35	920	1	16	608	31
Future Volume (veh/h)	26	0	37	1	0	5	35	920	1	16	608	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1709	2000	1942	1942	2000	1942	1942	2000
Adj Flow Rate, veh/h	36	0	51	1	0	7	39	1034	1	19	715	36
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.72	0.72	0.72	0.75	0.75	0.75	0.89	0.89	0.89	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	17	17	17	3	3	3	3	3	3
Cap, veh/h	143	0	82	37	5	60	632	3223	3	488	3047	153
Arrive On Green	0.05	0.00	0.05	0.05	0.00	0.05	0.85	0.85	0.85	0.85	0.85	0.85
Sat Flow, veh/h	1403	0	1667	69	105	1219	702	3782	4	538	3575	180
Grp Volume(v), veh/h	36	0	51	8	0	0	39	504	531	19	369	382
Grp Sat Flow(s),veh/h/ln	1403	0	1667	1393	0	0	702	1845	1941	538	1845	1910
Q Serve(g_s), s	0.0	0.0	3.6	0.0	0.0	0.0	1.3	6.7	6.7	0.9	4.4	4.4
Cycle Q Clear(g_c), s	2.2	0.0	3.6	3.6	0.0	0.0	5.7	6.7	6.7	7.6	4.4	4.4
Prop In Lane	1.00		1.00	0.12		0.87	1.00		0.00	1.00		0.09
Lane Grp Cap(c), veh/h	143	0	82	103	0	0	632	1572	1654	488	1572	1628
V/C Ratio(X)	0.25	0.00	0.62	0.08	0.00	0.00	0.06	0.32	0.32	0.04	0.23	0.23
Avail Cap(c_a), veh/h	343	0	319	303	0	0	632	1572	1654	488	1572	1628
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.3	0.0	55.9	54.5	0.0	0.0	2.2	1.8	1.8	2.6	1.6	1.6
Incr Delay (d2), s/veh	0.9	0.0	7.4	0.3	0.0	0.0	0.2	0.5	0.5	0.1	0.4	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	1.8	0.3	0.0	0.0	0.3	3.6	3.8	0.2	2.3	2.5
LnGrp Delay(d),s/veh	56.2	0.0	63.3	54.8	0.0	0.0	2.4	2.3	2.3	2.7	2.0	2.0
LnGrp LOS	E		E	D			A	A	A	A	A	A
Approach Vol, veh/h		87			8			1074			770	
Approach Delay, s/veh		60.4			54.8			2.3			2.0	
Approach LOS		E			D			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		108.1		11.9		108.1		11.9
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 85		23.0		* 85		23.0
Max Q Clear Time (g_c+I1), s		8.7		5.6		9.6		5.6
Green Ext Time (p_c), s		17.6		0.3		17.6		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	5.0
HCM 2010 LOS	A

Notes

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	32	0	21	0	0	3	4	921	11	22	617	7
Future Vol, veh/h	32	0	21	0	0	3	4	921	11	22	617	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	60	60	60	89	89	89	81	81	81
Heavy Vehicles, %	2	2	2	100	100	100	3	3	3	3	3	3
Mvmt Flow	35	0	23	0	0	5	4	1035	12	27	762	9

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1346	1876	385	1485	1875	524	770	0	0	1047	0	0
Stage 1	820	820	-	1050	1050	-	-	-	-	-	-	-
Stage 2	526	1056	-	435	825	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	9.5	8.5	8.9	4.16	-	-	4.16	-	-
Critical Hdwy Stg 1	6.54	5.54	-	8.5	7.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	8.5	7.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	4.5	5	4.3	2.23	-	-	2.23	-	-
Pot Cap-1 Maneuver	110	71	613	35	24	308	834	-	-	654	-	-
Stage 1	335	387	-	120	154	-	-	-	-	-	-	-
Stage 2	503	300	-	371	217	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	104	68	613	33	23	308	834	-	-	654	-	-
Mov Cap-2 Maneuver	104	68	-	33	23	-	-	-	-	-	-	-
Stage 1	333	371	-	119	153	-	-	-	-	-	-	-
Stage 2	492	299	-	342	208	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	41.4	16.9	0	0.4
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	834	-	-	155	308	654	-	-
HCM Lane V/C Ratio	0.005	-	-	0.372	0.016	0.042	-	-
HCM Control Delay (s)	9.3	-	-	41.4	16.9	10.7	-	-
HCM Lane LOS	A	-	-	E	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	1.6	0	0.1	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	3	7	929	2	5	633
Future Vol, veh/h	3	7	929	2	5	633
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	63	87	87	86	86
Heavy Vehicles, %	30	30	3	3	3	3
Mvmt Flow	5	11	1068	2	6	736

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1449	535	0	0	1070	0
Stage 1	1069	-	-	-	-	-
Stage 2	380	-	-	-	-	-
Critical Hdwy	7.4	7.5	-	-	4.16	-
Critical Hdwy Stg 1	6.4	-	-	-	-	-
Critical Hdwy Stg 2	6.4	-	-	-	-	-
Follow-up Hdwy	3.8	3.6	-	-	2.23	-
Pot Cap-1 Maneuver	94	424	-	-	641	-
Stage 1	236	-	-	-	-	-
Stage 2	585	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	93	424	-	-	641	-
Mov Cap-2 Maneuver	186	-	-	-	-	-
Stage 1	236	-	-	-	-	-
Stage 2	580	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.4	0	0.1
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	306	641	-
HCM Lane V/C Ratio	-	-	0.052	0.009	-
HCM Control Delay (s)	-	-	17.4	10.7	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	0	57	7	0	34	41	1116	2	2	1029	53
Future Volume (veh/h)	38	0	57	7	0	34	41	1116	2	2	1029	53
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1818	2000	1961	1961	2000	1980	1980	2000
Adj Flow Rate, veh/h	49	0	74	9	0	43	46	1240	2	2	1083	56
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.79	0.79	0.79	0.90	0.90	0.90	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	10	10	10	2	2	2	1	1	1
Cap, veh/h	153	0	115	42	8	70	435	3178	5	399	3031	157
Arrive On Green	0.07	0.00	0.07	0.07	0.00	0.07	0.83	0.83	0.83	0.83	0.83	0.83
Sat Flow, veh/h	1358	0	1667	95	117	1014	492	3816	6	451	3640	188
Grp Volume(v), veh/h	49	0	74	52	0	0	46	605	637	2	560	579
Grp Sat Flow(s),veh/h/ln	1358	0	1667	1226	0	0	492	1863	1960	451	1881	1947
Q Serve(g_s), s	0.0	0.0	5.2	0.3	0.0	0.0	2.9	9.7	9.7	0.1	8.5	8.5
Cycle Q Clear(g_c), s	4.2	0.0	5.2	5.5	0.0	0.0	11.5	9.7	9.7	9.8	8.5	8.5
Prop In Lane	1.00		1.00	0.17		0.83	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	153	0	115	120	0	0	435	1551	1632	399	1567	1621
V/C Ratio(X)	0.32	0.00	0.64	0.43	0.00	0.00	0.11	0.39	0.39	0.01	0.36	0.36
Avail Cap(c_a), veh/h	319	0	319	301	0	0	435	1551	1632	399	1567	1621
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.0	0.0	54.4	53.9	0.0	0.0	3.8	2.5	2.5	3.7	2.4	2.4
Incr Delay (d2), s/veh	1.2	0.0	5.9	2.5	0.0	0.0	0.5	0.7	0.7	0.0	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	2.6	1.8	0.0	0.0	0.5	5.2	5.4	0.0	4.6	4.8
LnGrp Delay(d),s/veh	55.2	0.0	60.3	56.4	0.0	0.0	4.2	3.2	3.2	3.7	3.0	3.0
LnGrp LOS	E		E	E			A	A	A	A	A	A
Approach Vol, veh/h		123			52			1288			1141	
Approach Delay, s/veh		58.3			56.4			3.2			3.0	
Approach LOS		E			E			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		105.7		14.3		105.7		14.3
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 85		23.0		* 85		23.0
Max Q Clear Time (g_c+I1), s		13.5		7.2		11.8		7.5
Green Ext Time (p_c), s		30.9		0.7		31.2		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	6.8
HCM 2010 LOS	A

Notes

Intersection												
Int Delay, s/veh	2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	0	12	10	0	8	25	1138	1	0	1068	25
Future Vol, veh/h	13	0	12	10	0	8	25	1138	1	0	1068	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	64	64	64	90	90	90	92	92	92
Heavy Vehicles, %	2	2	2	0	0	0	2	2	2	1	1	1
Mvmt Flow	14	0	13	16	0	13	28	1264	1	0	1161	27

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1862	2495	594	1901	2509	633	1188	0	0	1266	0	0
Stage 1	1174	1174	-	1321	1321	-	-	-	-	-	-	-
Stage 2	688	1321	-	580	1188	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.5	6.5	6.9	4.14	-	-	4.12	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.5	4	3.3	2.22	-	-	2.21	-	-
Pot Cap-1 Maneuver	45	29	448	43	29	427	583	-	-	550	-	-
Stage 1	204	264	-	168	228	-	-	-	-	-	-	-
Stage 2	403	224	-	472	264	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	42	28	448	40	28	427	583	-	-	550	-	-
Mov Cap-2 Maneuver	42	28	-	40	28	-	-	-	-	-	-	-
Stage 1	194	264	-	160	217	-	-	-	-	-	-	-
Stage 2	372	213	-	458	264	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	79.5	93.1	0.2	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	583	-	-	74	67	550	-	-
HCM Lane V/C Ratio	0.048	-	-	0.367	0.42	-	-	-
HCM Control Delay (s)	11.5	-	-	79.5	93.1	0	-	-
HCM Lane LOS	B	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.4	1.6	0	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	14	1150	1	3	1087
Future Vol, veh/h	5	14	1150	1	3	1087
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	60	60	94	94	94	94
Heavy Vehicles, %	16	16	1	1	1	1
Mvmt Flow	8	23	1223	1	3	1156

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1809	612	0	0	1224	0
Stage 1	1224	-	-	-	-	-
Stage 2	585	-	-	-	-	-
Critical Hdwy	7.12	7.22	-	-	4.12	-
Critical Hdwy Stg 1	6.12	-	-	-	-	-
Critical Hdwy Stg 2	6.12	-	-	-	-	-
Follow-up Hdwy	3.66	3.46	-	-	2.21	-
Pot Cap-1 Maneuver	60	403	-	-	571	-
Stage 1	215	-	-	-	-	-
Stage 2	483	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	60	403	-	-	571	-
Mov Cap-2 Maneuver	158	-	-	-	-	-
Stage 1	215	-	-	-	-	-
Stage 2	480	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.1	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	286	571	-
HCM Lane V/C Ratio	-	-	0.111	0.006	-
HCM Control Delay (s)	-	-	19.1	11.3	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	0.4	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	0	37	1	0	5	35	920	1	16	608	31
Future Volume (veh/h)	26	0	37	1	0	5	35	920	1	16	608	31
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1709	2000	1942	1942	2000	1942	1942	2000
Adj Flow Rate, veh/h	36	0	51	1	0	7	39	1034	1	19	715	36
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.72	0.72	0.72	0.75	0.75	0.75	0.89	0.89	0.89	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	17	17	17	3	3	3	3	3	3
Cap, veh/h	227	0	110	74	5	83	591	2788	3	463	2635	133
Arrive On Green	0.07	0.00	0.07	0.07	0.00	0.07	0.74	0.74	0.74	0.74	0.74	0.74
Sat Flow, veh/h	1403	0	1667	98	80	1247	702	3782	4	538	3575	180
Grp Volume(v), veh/h	36	0	51	8	0	0	39	504	531	19	369	382
Grp Sat Flow(s),veh/h/ln	1403	0	1667	1425	0	0	702	1845	1941	538	1845	1910
Q Serve(g_s), s	0.0	0.0	1.8	0.0	0.0	0.0	1.2	5.9	5.9	0.8	3.9	3.9
Cycle Q Clear(g_c), s	1.1	0.0	1.8	1.8	0.0	0.0	5.1	5.9	5.9	6.7	3.9	3.9
Prop In Lane	1.00		1.00	0.12		0.87	1.00		0.00	1.00		0.09
Lane Grp Cap(c), veh/h	227	0	110	162	0	0	591	1360	1431	463	1360	1408
V/C Ratio(X)	0.16	0.00	0.46	0.05	0.00	0.00	0.07	0.37	0.37	0.04	0.27	0.27
Avail Cap(c_a), veh/h	648	0	611	586	0	0	591	1360	1431	463	1360	1408
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.7	0.0	27.0	26.3	0.0	0.0	3.4	2.9	2.9	4.1	2.6	2.6
Incr Delay (d2), s/veh	0.3	0.0	3.0	0.1	0.0	0.0	0.2	0.8	0.7	0.2	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.9	0.1	0.0	0.0	0.3	3.2	3.4	0.1	2.1	2.2
LnGrp Delay(d),s/veh	27.0	0.0	30.0	26.4	0.0	0.0	3.6	3.6	3.6	4.2	3.1	3.1
LnGrp LOS	C		C	C			A	A	A	A	A	A
Approach Vol, veh/h		87			8			1074			770	
Approach Delay, s/veh		28.7			26.4			3.6			3.1	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		50.0		10.0		50.0		10.0
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 26		22.0		* 26		22.0
Max Q Clear Time (g_c+I1), s		7.9		3.8		8.7		3.8
Green Ext Time (p_c), s		10.6		0.3		10.3		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	4.6
HCM 2010 LOS	A

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	0	57	7	0	34	41	1116	2	2	1029	53
Future Volume (veh/h)	38	0	57	7	0	34	41	1116	2	2	1029	53
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1961	1961	2000	2000	1818	2000	1961	1961	2000	1980	1980	2000
Adj Flow Rate, veh/h	49	0	74	9	0	43	46	1240	2	2	1083	56
Adj No. of Lanes	1	1	0	0	1	0	1	2	0	1	2	0
Peak Hour Factor	0.77	0.77	0.77	0.79	0.79	0.79	0.90	0.90	0.90	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	10	10	10	2	2	2	1	1	1
Cap, veh/h	257	0	141	81	9	93	415	2744	4	383	2617	135
Arrive On Green	0.08	0.00	0.08	0.08	0.00	0.08	0.72	0.72	0.72	0.72	0.72	0.72
Sat Flow, veh/h	1358	0	1667	127	103	1099	492	3816	6	451	3640	188
Grp Volume(v), veh/h	49	0	74	52	0	0	46	605	637	2	560	579
Grp Sat Flow(s),veh/h/ln	1358	0	1667	1330	0	0	492	1863	1960	451	1881	1947
Q Serve(g_s), s	0.0	0.0	2.6	0.0	0.0	0.0	2.5	8.1	8.1	0.1	7.1	7.1
Cycle Q Clear(g_c), s	1.5	0.0	2.6	2.6	0.0	0.0	9.6	8.1	8.1	8.2	7.1	7.1
Prop In Lane	1.00		1.00	0.17		0.83	1.00		0.00	1.00		0.10
Lane Grp Cap(c), veh/h	257	0	141	183	0	0	415	1339	1409	383	1352	1400
V/C Ratio(X)	0.19	0.00	0.53	0.28	0.00	0.00	0.11	0.45	0.45	0.01	0.41	0.41
Avail Cap(c_a), veh/h	640	0	611	600	0	0	415	1339	1409	383	1352	1400
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.8	0.0	26.3	26.0	0.0	0.0	5.3	3.5	3.5	5.2	3.4	3.4
Incr Delay (d2), s/veh	0.4	0.0	3.0	0.8	0.0	0.0	0.5	1.1	1.0	0.0	0.9	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	1.3	0.9	0.0	0.0	0.4	4.4	4.7	0.0	3.9	4.1
LnGrp Delay(d),s/veh	26.2	0.0	29.3	26.8	0.0	0.0	5.8	4.6	4.6	5.2	4.3	4.3
LnGrp LOS	C		C	C			A	A	A	A	A	A
Approach Vol, veh/h		123			52			1288			1141	
Approach Delay, s/veh		28.1			26.8			4.6			4.3	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		48.9		11.1		48.9		11.1
Change Period (Y+Rc), s		* 5.8		6.0		* 5.8		6.0
Max Green Setting (Gmax), s		* 26		22.0		* 26		22.0
Max Q Clear Time (g_c+I1), s		11.6		4.6		10.2		4.6
Green Ext Time (p_c), s		11.5		0.8		12.4		0.8

Intersection Summary	
HCM 2010 Ctrl Delay	6.0
HCM 2010 LOS	A

Notes

NOVI ROAD & SITE DRIVE RT LANE WARRANT

WARRANTS FOR RIGHT TURN DECELERATION LANE OR TAPER

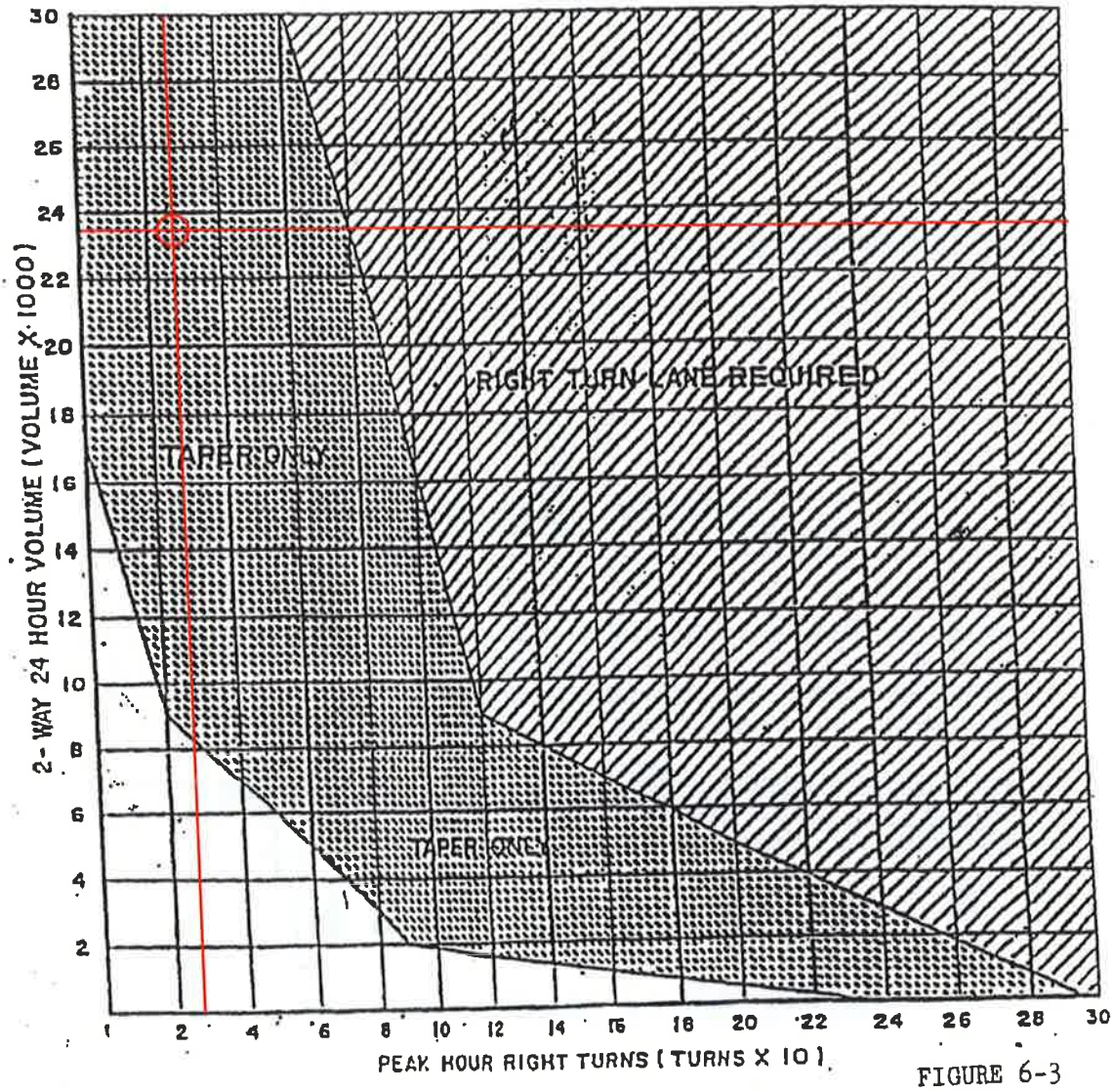


FIGURE 6-3

2012 ADT = 20,692
+ 1% per year to 2021 = 22,631
+ 808 new daily trips
= 23,439 2021 two-way 24 hour volume

AM: 7
PM: 25

RT DECELERATION TAPER REQUIRED