



STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. Box 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

January 12, 2018

Mr. Joe Caloggero
Senior Project Manager
The Traffic Group, Inc.
Suite H
9900 Franklin Square Drive
Baltimore, Maryland 21236

Dear Mr. Caloggero,

The Department has completed its review of the Traffic Impact Study (TIS) for the Hickory Glen development prepared by The Traffic Group, Inc. (TTG), dated April 23, 2014. TTG prepared the report in a manner generally consistent with DelDOT's *Development Coordination Manual*.

The TIS evaluates the impacts of Hickory Glen, proposed to be located on the south side of Delaware Route 14 just west of Holly Hill Road (Kent Road 447), in the City of Milford. Hickory Glen would consist of 159 townhouses and 240 apartment units to be developed on an approximately 71.92-acre assemblage of parcels (Tax Parcels 5-16-173.00-01-21.00, 22.02). Two access points are proposed: one on Delaware Route 14, and one on Holly Hill Road. In 2014, construction was anticipated to be complete by 2020. DelDOT presumes that completion in 2023 is now anticipated.

The land is currently zoned as R-8 (Garden Apartment and Townhouse) in the City of Milford, and the developer does not propose to change the zoning.

DelDOT currently has one relevant project in the study area. It is part of DelDOT's Hazard Elimination Program (HEP), formerly known as the Highway Safety Improvement Program (HSIP). The intersection of US Route 113 and Delaware Route 14 is within Sites M and T of the 2008 HEP. The HEP committee studied safety and operations at this intersection in great detail, and in the HEP Task I Report for this intersection, identified numerous issues of concern, along with recommendations for remedial improvements in the areas of signing, pavement markings, and signals.

In the HEP Task II Report, this intersection was studied more closely and improvement options were evaluated. Capacity analyses were completed and found that lane configuration and signal phasing modifications would be necessary on both approaches of Delaware Route 14. The improvements include modifying the eastbound and westbound lane configurations to provide a left-turn lane, two through lanes, and a right-turn lane on each approach. The HEP committee identified the developers of Homestead, Wexford, and the Draper property as responsible for the implementation of the improvements. In addition to the above-mentioned improvements, the HEP committee recommended that traffic volumes and queues be reevaluated to determine whether the proposed lane configuration and concurrent left-turn phasing

would be appropriate or whether split phasing and/or other lane modifications should be implemented to best address future capacity and safety issues at the intersection.

At the time the subject TIS was completed and reviewed by DeIDOT, there was a second project that involved improvements at the Norfolk Southern railroad crossing located on US Route 113 south of Delaware Route 14. That project has since been completed.

Based on our review, we have the following comments and recommendations:

The proposed development will not meet the DeIDOT level of service (LOS) standards as stated in the *Development Coordination Manual* unless physical roadway and/or traffic control improvements are implemented at the following intersections:

<i>Intersection</i>	<i>Existing Traffic Control</i>	<i>Situations for which deficiencies occur</i>
Delaware Route 15 & Airport Road	Unsignalized	2020 PM without Hickory Glen 2020 AM and PM with Hickory Glen
Delaware Route 15 & Church Hill Road*	Unsignalized	2020 PM without and with Hickory Glen
US Route 113 & Delaware Route 14	Signalized	2020 PM without and with Hickory Glen

* The intersection of Delaware Route 15 and Church Hill Road shows LOS deficiencies during the afternoon peak hour in the year 2020 without and with the Hickory Glen development. While the TIS shows LOS deficiencies without Hickory Glen, those deficiencies would be greater with the addition of traffic generated by Hickory Glen. However, DeIDOT is not requiring the developer to make any contributions because improvements at this intersection are contingent upon the schedule of multiple other developments, some of which contributed more to the need for those improvements and have not moved forward as expected. Because there is not a finite schedule for the improvements at this intersection, DeIDOT has instead agreed to have the developer focus their contributions toward the HEP project at the intersection of US Route 113 and Delaware Route 14.

All other intersections included in the scope of this TIS meet the LOS requirements in the *Development Coordination Manual*.

Should the City of Milford choose to approve the proposed development, the following items should be incorporated into the site design and reflected on the record plan by note or illustration. All applicable agreements (i.e. letter agreements for off-site improvements and traffic signal agreements) should be executed prior to entrance plan approval for the proposed development.

1. The developer should construct the site entrance on Delaware Route 14. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration
Northbound Site Entrance	Approach does not exist	One shared left-turn / right -turn lane
Eastbound Delaware Route 14	One through lane	One through lane and one right-turn lane
Westbound Delaware Route 14	One through lane	One through lane and one left-turn lane

Initial recommended minimum turn-lane lengths (excluding tapers) of the separate turn lanes are listed below. The developer should coordinate with DelDOT's Subdivision Section to determine final turn-lane lengths.

Approach	Left-Turn Lane	Right-Turn Lane
Northbound Site Entrance	N/A	N/A
Eastbound Delaware Route 14	N/A	145 feet*
Westbound Delaware Route 14	145 feet*	N/A

*Turn-lane length based on deceleration + storage length per DelDOT's *Development Coordination Manual*

2. The developer should construct the site entrance on Holly Hill Road. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration
Northbound Amberwood Entrance *	Approach does not exist	One shared left-turn / through / right -turn lane
Southbound Site Entrance	Approach does not exist	One shared left-turn / through / right -turn lane
Eastbound Holly Hill Road *	One through lane	One shared left / through / right-turn lane
Westbound Holly Hill Road *	One through lane	One left-turn lane, one through lane, and one right-turn lane

* The developer is not responsible for improvements related to the Amberwood development.

Initial recommended minimum turn-lane lengths (excluding tapers) of the separate turn lanes are listed below. The developer should coordinate with DeIDOT's Subdivision Section to determine final turn-lane lengths.

Approach	Left-Turn Lane	Right-Turn Lane
Southbound Site Entrance	N/A	N/A
Eastbound Holly Hill Road	N/A	N/A
Westbound Holly Hill Road *	185 feet**	145 feet**

* *The developer is not responsible for improvements related to the Amberwood development.*

** Turn-lane length based on deceleration + storage length per DeIDOT's *Development Coordination Manual*.

3. The developer should contribute an amount of \$119,923.13 to the improvements at the intersection of US Route 113 and Delaware Route 14. The proposed configuration is shown in the table below.

Approach	Current Configuration	Proposed Configuration*
Northbound US Route 113	Two left-turn lanes, two through lanes, and one right-turn lane	Two left-turn lanes, two through lanes, and one right-turn lane
Southbound US Route 113	Two left-turn lanes, two through lanes, and one right-turn lane	Two left-turn lanes, two through lanes, and one right-turn lane
Eastbound Delaware Route 14	One left-turn lane, one shared through / left-turn lane, one through lane, and one right turn lane	One left-turn lane, two through lanes, and one right turn lane
Westbound Delaware Route 14	One left-turn lane, one shared through / left-turn lane, and one right-turn lane	One left-turn lane, two through lanes, and one right-turn lane

* *This is the proposed lane configuration recommended in the 2008 HEP Task II Report.*

4. The following bicycle and pedestrian improvements should be included:
 - a. A right-turn yield to bikes sign (MUTCD R4-4) should be added at the start of the right-turn lane added to eastbound Delaware Route 14 at the site entrance.
 - b. Adjacent to the right-turn lanes added to Delaware Route 14 and on Holly Hill Road at the site entrances, a minimum of a five-foot bicycle lane should be dedicated and striped with appropriate markings for bicyclists through the turn lanes in order to facilitate safe and unimpeded bicycle travel.
 - c. Appropriate bicycle symbols, directional arrows, striping (including stop bars), and signing should be included along bicycle facilities and right-turn lanes within the project limits.
 - d. Utility covers should be made flush with the pavement.
 - e. Bike parking should be provided near each apartment building.
 - f. A minimum of a five-foot wide sidewalk (with a minimum of a three-foot buffer from the roadway) that meets current AASHTO and ADA standards should be constructed along the site frontage on Delaware Route 14 as well as on Holly Hill Road.

- g. ADA compliant curb ramps and crosswalks should be provided at all pedestrian crossings, including all site entrances. Type 3 curb ramps are discouraged.
- h. Internal sidewalks for pedestrian safety and to promote walking as a viable transportation alternative should be constructed within the property. These sidewalks should each be a minimum of five feet wide and should meet current AASHTO and ADA standards. These internal sidewalks should connect to the frontage sidewalks on Delaware Route 14 and Holly Hill Road.

Improvements in this TIS may be considered "significant" under DelDOT's *Work Zone Safety and Mobility Procedures and Guidelines*. These guidelines are available on DelDOT's website at http://www.deldot.gov/information/pubs_forms/manuals/de_muted/index.shtml. For any additional information regarding the work zone impact and mitigation procedures during construction please contact Mr. Adam Weiser of DelDOT's Traffic Section. Mr. Weiser can be reached at (302) 659-4073 or by email at Adam.Weiser@state.de.us.

Please note that this review generally focuses on capacity and level of service issues; additional safety and operational issues will be further addressed through DelDOT's subdivision review process.

Additional details on our review of this TIS are attached. If you have any questions concerning this review, please contact me at (302) 760-2167 or Mr. Claudy Joinville at (302) 760-2124. My email is Troy.Brestel@state.de.us and Mr. Joinville's email is Claudy.Joinville@state.de.us.

Sincerely,



Troy Brestel
Project Engineer

TEB:cjm

Enclosures

cc with enclosures:

Mr. Joe Caloggero, The Traffic Group, Inc.
Mr. Rob Pierce, Planning and Economic Activities Coordinator, City of Milford
Mr. James Galvin, Principal Planner, Dover / Kent County MPO
Ms. Annie Cordo, Deputy Attorney General
Mr. Brad Eaby, Deputy Attorney General
Mr. Robert McCleary, Director, Transportation Solutions (DOTS)
Mr. Drew Boyce, Director, Planning
Mr. Mark Luszcz, Chief Traffic Engineer, Traffic, DOTS
Mr. Michael Simmons, Assistant Director, Project Development South, DOTS
Mr. J. Marc Coté, Assistant Director, Development Coordination
Mr. T. William Brockenbrough, Jr., County Coordinator, Development Coordination
Mr. Peter Haag, Traffic Studies Manager, Traffic, DOTS
Mr. Thomas Greve, Central District Engineer, Central District
Ms. Lisa Collins, Service Development Planner, Delaware Transit Corporation
Mr. Joshua Schwartz, Subdivision Manager, Development Coordination
Mr. Brian Clarke, Kent Traffic Engineer, Traffic, DOTS
Mr. Anthony Aglio, Planning Supervisor, Statewide & Regional Planning
Mr. Claudy Joinville, Project Engineer, Development Coordination

General Information

Report date: April 23, 2014
Prepared by: The Traffic Group, Inc. (TTG)
Prepared for: Hickory Glen
Tax parcels: 5-16-173.00-01-21.00, 22.02
Generally consistent with DelDOT's *Development Coordination Manual*: Yes

Project Description and Background

Description: The proposed Hickory Glen development would consist of 159 townhouses and 240 apartment units.

Location: Hickory Glen is proposed to be located on the south side of Delaware Route 14 (Kent Road 36) just west of Holly Hill Road (Kent Road 447), in the City of Milford. A site location map is included on Page 8.

Amount of land to be developed: approximately 71.92 acres of land

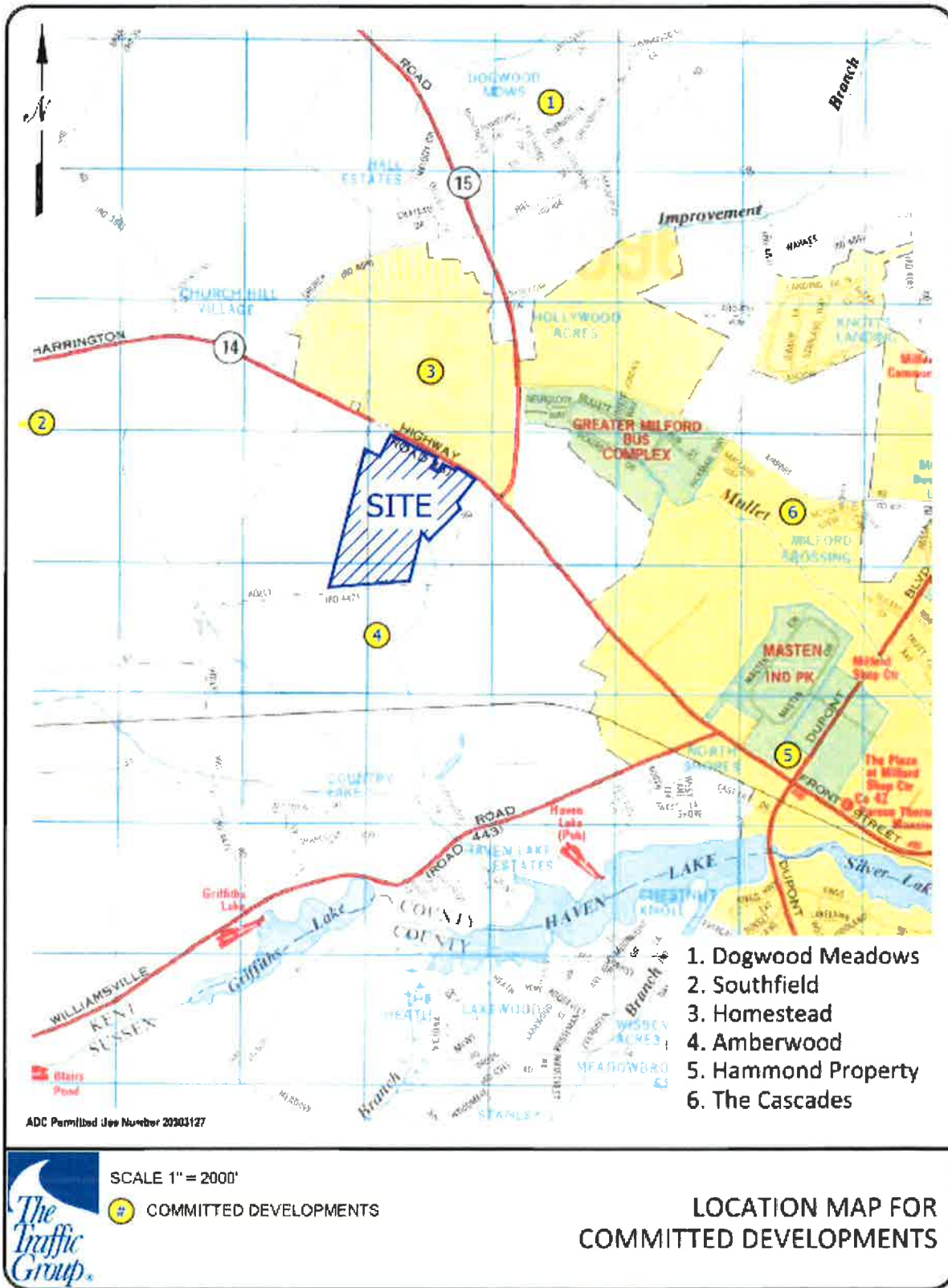
Land use approval(s) needed: Subdivision approval, City of Milford Land Use approval

Proposed completion date: 2020

Proposed access locations: Two full access points: One on Delaware Route 14, and one on Holly Hill Road

Daily Traffic Volumes (per DelDOT Traffic Summary 2012):

- 2012 Average Annual Daily Traffic on Delaware Route 14: 9,691 vpd
- 2012 Average Annual Daily Traffic on Holly Hill Road: 1,422 vpd



Delaware Strategies for State Policies and Spending – 2013 Update

Location with respect to the Strategies for State Policies and Spending Map of Delaware: The proposed Hickory Glen development is located within Investment Level 4 area.

Investment Level 4

Investment Level 4 Areas are areas of the state that are rural in nature with undeveloped natural areas, such as forestlands, and large recreational uses, such as state and county parks and fish and wildlife reserves. In these areas, the state's investments and policies should retain the rural landscape and preserve open spaces and farmlands, support farmland-related industries, and establish defined edges to more concentrated development. Construction of new homes is discouraged in these areas.

Investments in these areas will focus on parkland expansions, and ag-land and open-space preservation. Other facility investments in these areas will be discouraged unless it relates to a specific need. In addition, the focus for the Level 4 Areas will be to preserve and maintain existing facilities in safe working order, corridor capacity preservation, and the enhancement of transportation facilities to support agricultural business.

Proposed Development's Compatibility with Strategies for State Policies and Spending:

The proposed Hickory Glen development is located within Investment Level 4 Area, and is to be developed as 159 townhouses and 240 apartment units. This type of development is not consistent with the character of Investment Level 4 area. It is therefore concluded that the proposed development does not comply with the policies stated in the 2010 update of the "Strategies for State Policies and Spending."

Comprehensive Plan

City of Milford Comprehensive Plan:

(Source: City of Milford Comprehensive Plan Update 2013; currently under review by the Office of State Planning)

The proposed Hickory Glen development is located in an area with future land use designated as Moderate Density Residential.

The parcel is currently zoned R-8 (Garden Apartment and Townhouse), and the developer does not plan to rezone the parcel. According to Section 230-19.4 of the City of Milford Code, characteristics of R-8 zoning are as follows:

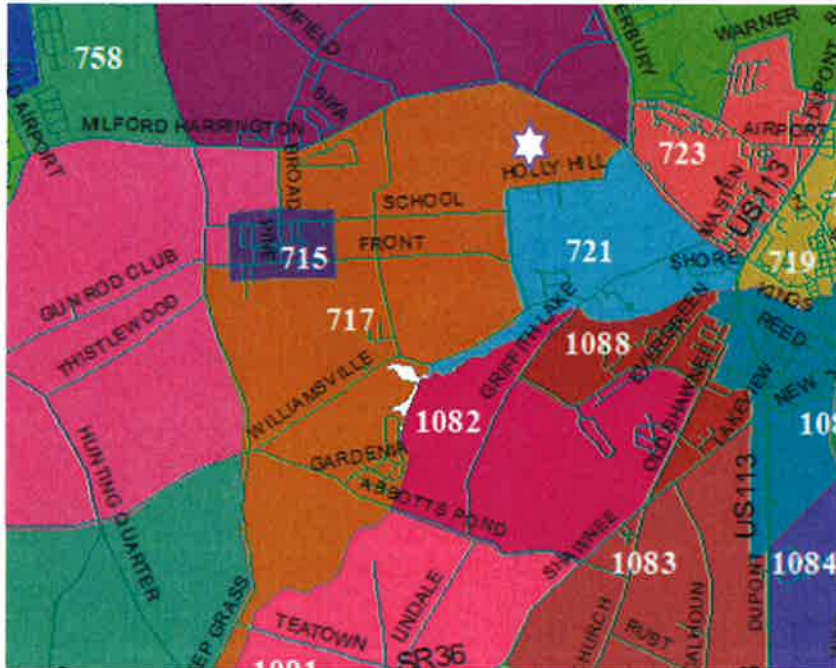
- The purpose of the R-8 District is to provide for the orderly development of existing and proposed medium- to high-density residential areas where adequate public facilities exist.
- The district will permit development of garden-type apartments as well as townhouses that will yield high densities in selected areas, multifamily dwellings and a variety of housing types.

Proposed Development's Compatibility with Comprehensive Plan: The proposed Hickory Glen residential development is planned as 159 townhouses and 240 apartment units. Given that the site's future land use designation and R-8 zoning are both residential in nature, the proposed land uses (townhouse and apartment) are residential; this development is consistent with the City of Milford Comprehensive Plan.

Transportation Analysis Zones (TAZ)

Transportation Analysis Zones (TAZ) where development would be located: 717

TAZ Boundaries:



Current employment estimate for TAZ: 313 jobs in 2013

Future employment estimate for TAZ: 305 jobs in 2035

Current population estimate for TAZ: 1,082 people in 2013

Future population estimate for TAZ: 1,324 people in 2035

Current household estimate for TAZ: 396 houses in 2013

Future household estimate for TAZ: 485 houses in 2035

Relevant committed developments in TAZ: Southfield

Would the addition of committed developments to current estimates exceed future projections: No

Would the addition of committed developments and the proposed development to current estimates exceed future projections: No for employment, yes for households and population

Relevant Projects in the DelDOT Capital Transportation Program (FY 2013 – FY 2018)

DelDOT currently has no relevant projects in the study area.

Trip Generation

Trip generation for the proposed development was computed using comparable land uses and equations contained in the Trip Generation Manual, Ninth Edition, published by the Institute of Transportation Engineers (ITE). The following land uses were utilized to estimate the amount of new traffic generated for this development:

- Apartment Units (ITE Land Use Code 220)
- Residential Condominium / Townhouse (ITE Land Use Code 230)

Table 1
 HICKORY GLEN PEAK HOUR TRIP GENERATION

Land Use	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
159-Townhouse	13	62	75	59	29	88
240-Apartment	24	97	121	97	53	150
TOTAL TRIPS	37	159	196	156	82	238

Table 2
 HICKORY GLEN DAILY TRIP GENERATION

Land Use	Weekday ADT		
	In	Out	Total
159-Townhouse	481	482	963
240-Apartment	789	789	1578
TOTAL TRIPS	1270	1271	2541

Overview of TIS

Intersections examined:

- 1) Site Entrance / Delaware Route 14
- 2) Site Entrance / Holly Hill Road (Kent Road 447)
- 3) Delaware Route 14 / Church Hill Road (Kent Road 404)
- 4) Delaware Route 14 / Delaware Route 15 / Holly Hill Road
- 5) Delaware Route 15 / Airport Road
- 6) Delaware Route 15 / Church Hill Road
- 7) US Route 113 / Delaware Route 14

Conditions examined:

- 1) 2013 existing conditions (Case 1)
- 2) 2020 without Hickory Glen (Case 2)
- 3) 2020 with Hickory Glen (Case 3)

Peak hours evaluated:

Weekday morning and afternoon peak hours. As this TIS is for a residential development, the morning traffic counts were conducted from 7:00 AM to 9:00 AM to reflect traffic conditions when morning traffic is at its peak. Additionally, the afternoon peak period designated for traffic counts was 4:00 PM to 6:00 PM to reflect traffic conditions when afternoon traffic is at its peak.

Committed developments considered:

- 1) Dogwood Meadows (124 single-family detached houses)
- 2) Southfield (87 single-family detached houses)
- 3) The Homestead (87 single-family detached houses, 676 townhouses)
- 4) Amberwood (216 townhouses)
- 5) Hammond Property (13,225 square feet Pharmacy with Drive Thru)
- 6) Cascades (66 townhouses)

Intersection Descriptions

1) Delaware Route 14 & Site Entrance

Type of Control: proposed two-way stop-controlled (rights-in/rights-out/lefts-in/lefts-out T-intersection)

Northbound approach: (Proposed Site Entrance) proposed one shared left / right-turn lane

Eastbound approach: (Delaware Route 14) existing one through lane; proposed one shared through/right-turn lane

Westbound approach: (Delaware Route 14) existing one through lane; proposed one shared left/through lane

2) Holly Hill Road & Site Entrance

Type of Control: proposed two-way stop-controlled (four-leg intersection)

Northbound approach: (Proposed Amberwood Entrance) proposed one shared left / through / right-turn lane

Southbound approach: (Proposed Site Entrance) proposed one shared left / through / right-turn lane

Eastbound approach: (Holly Hill Road) existing one through lane; proposed one shared left / through / right-turn lane

Westbound approach: (Holly Hill Road) existing one through lane; proposed one shared left / through / right-turn lane

3) Delaware Route 14 & Church Hill Road

Type of Control: existing two-way stop-controlled (rights-in/rights-out/lefts-in/lefts-out T-intersection)

Southbound approach: (Church Hill Road) one shared through / right-turn lane

Eastbound approach: (Delaware Route 14) one shared left / through lane, and a bypass lane

Westbound approach: (Delaware Route 14) one through lane, and one right-turn lane

4) Delaware Route 14 & Delaware Route 15 / Holly Hill Road

Type of Control: signalized four-leg intersection

Northbound approach: (Holly Hill Road) one left-turn lane, and one shared through / right-turn lane

Southbound approach: (Delaware Route 15) one left-turn lane, one through lane, and one right-turn lane

Eastbound approach: (Delaware Route 14) one left-turn lane, and one shared through / right-turn lane

Westbound approach: (Delaware Route 14) one left-turn lane, one through lane, and one right-turn lane

5) **Delaware Route 15 & Airport Road**

Type of Control: proposed two-way stop-controlled (four-leg intersection)

Northbound approach: (Delaware Route 15) existing one shared through / right-turn lane; proposed one left-turn lane, and one shared through / right-turn lane

Southbound approach: (Delaware Route 15) existing one left-turn lane, and one through lane; proposed one left-turn lane, one through lane, and one right-turn lane

Eastbound approach: (Proposed The Homestead Entrance) proposed one left-turn lane, and one shared through / right-turn lane

Westbound approach: (Airport Road) existing one left-turn lane, and one right-turn lane; proposed one left-turn lane, and one shared through / right-turn lane

6) **Delaware Route 15 & Church Hill Road**

Type of Control: two-way stop-controlled (four-leg intersection)

Northbound approach: (Delaware Route 15) one shared left / through / right-turn lane

Southbound approach: (Delaware Route 15) one shared left / through / right-turn lane

Eastbound approach: (Church Hill Road) one shared left / through / right-turn lane

Westbound approach: (Church Hill Road) one shared left / through / right-turn lane

7) **US Route 113 & Delaware Route 14**

Type of Control: signalized four-leg intersection

Northbound approach: (US Route 113) two left-turn lanes, two through lanes, and one right-turn lane

Southbound approach: (US Route 113) two left-turn lanes, two through lanes, and one right-turn lane

Eastbound approach: (Delaware Route 14) one left-turn lane, one shared through / left-turn lane, one through lane, and one right-turn lane

Westbound approach: (Delaware Route 14) one left-turn lane, one shared through / left-turn lane, and one right-turn lane.

Note: TIS mistakenly analyzed the westbound approach as one left-turn lane, one through lane, and one right-turn lane

Safety Evaluation

Crash Data: Crash data was obtained for September 2010 through September 2013 for the intersections and roadway segments within the study area. This included a total of 89 crashes, of which 43 occurred at or very near the signalized intersections of US Route 113 and Delaware Route 14, and Delaware Route 14 and Delaware Route 15 / Holly Hill Road. As expected for signalized intersection crashes, the majority were either angle crashes or rear-end crashes. About 30% of the crashes resulted in injuries, but there were no fatal crashes reported in the study area during this three-year period.

- US Route 113 & Delaware Route 14
 - 29 crashes reported
- Delaware Route 14 & Delaware Route 15 / Holly Hill Road
 - 14 crashes reported

Sight Distance: The proposed site entrance on Delaware Route 14 would be located on the inside of a horizontal curve, but would appear to have adequate sight distance. The proposed site entrance on Holly Hill Road would be located west of a horizontal curve, but would appear to have adequate sight distance due to the distance of the horizontal curve from the location of the proposed site entrance.

Transit, Pedestrian, and Bicycle Facilities

Existing transit service: There is no existing transit service along Delaware Route 14 and Holly Hill Road. However, the Delaware Transit Corporation (DTC) currently operates one transit route offering service to Milford east of the proposed Hickory Glen development. DART Route 303, which offers weekday service connecting Dover to Milford and Georgetown, travels along US Route 113 which intersects Delaware Route 14 / North Front Street to the east of Hickory Glen. The nearest bus stop to the proposed development is located approximately 1,000 feet north of the intersection of US Route 113 and Delaware Route 14 / North Front Street. DART Route 303 makes 11 round trips each weekday, and none during the weekend.

Planned transit service: Ms. Lisa Collins, a Service Development Planner for the DTC, provided comments on May 1, 2014 regarding DTC's future plans for transit services in this area. DART Route 303 is the only DTC transit service planned for this area at this time. She stated that DTC will request a bus stop pad for this area to plan effectively for future growth on this corridor.

Existing bicycle and pedestrian facilities: According to the bicycle level of service (BLOS) calculator developed by the *League of Illinois Bicyclists* Delaware Route 14 and Holly Hill Road operate at BLOS A and C, respectively. There are currently no designated bicycle and pedestrian facilities in the study area.

Planned bicycle and pedestrian facilities: DelDOT contacted Marco Boyce, Anthony Aglio, and Sarah Coakley via email on May 1, 2014 for comments regarding planned or requested bicycle and pedestrian facilities in the area of this proposed development. Marco Boyce stated that sidewalks will be required along the site frontage on Delaware Route 14 and Holly Hill Road. Along the site frontage on Delaware Route 14, the sidewalks should extend to the intersection of Delaware Route 14 and Delaware Route 15 / Holly Hill Road. In addition, Mr. Boyce indicated that linkage street stubs with the adjoining undeveloped parcel west of the proposed development are needed. DelDOT's Subdivision Manual recommends that linkage street stubs be placed at a ratio of one per 660 linear feet of the boundary line that adjoins the adjacent land. Anthony Aglio stated that if a right-turn lane is required along Delaware Route 14, then a bike lane through the right-turn lane would be needed. It is noted that a right-turn lane is required along Delaware Route 14.

Previous Comments

All comments from DelDOT's Scoping Letter, Traffic Count Review, and Preliminary TIS (PTIS) Review were addressed in the Final TIS submission.

General HCS Analysis Comments

(see table footnotes on the following pages for specific comments)

- 1) For unsignalized intersections, the TIS and DeIDOT applied heavy vehicle (HV) percentages by movement. For signalized intersections, the TIS and DeIDOT applied HV percentages by lane group. For future conditions, the TIS and DeIDOT generally assumed HV percentages to be the same as those for existing conditions.
- 2) For existing conditions, the TIS and DeIDOT determined and applied, for each intersection, the overall peak hour factor (PHF). For existing and future conditions, the TIS and DeIDOT utilized the same PHF.
- 3) Both the TIS and DeIDOT input Right-Turn-on-Red (RTOR) volumes for signalized intersection analyses. The TIS and DeIDOT utilized RTOR volumes that were different in some cases.
- 4) For the signalized intersections, the TIS utilized HCS+ in its analysis, whereas DeIDOT utilized HCS 2010.
- 5) The TIS used cycle lengths of 60 seconds, whereas DeIDOT used cycle lengths of 120 seconds in the analyses of the signalized intersection of Delaware Route 14 and Delaware Route 15 / Holly Hill Road, and the intersection of Delaware Route 14 and Church Hill Road signalized improvements.
- 6) Neither the TIS nor DeIDOT included percent grade in their analyses.

Table 3
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per DelDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 14 & Site Entrance				
2020 with Hickory Glen (Case 3)				
Northbound Site Entrance	C (17.8)	C (17.2)	C (17.8)	C (17.2)
Westbound Delaware Route 14 - Left	A (8.9)	A (8.8)	A (8.9)	A (8.8)
2020 with Hickory Glen (Case 3) <i>With required turn-lane improvements ²</i>				
Northbound Site Entrance	N/A	N/A	C (17.7)	C (16.9)
Westbound Delaware Route 14 – Left	N/A	N/A	A (8.9)	A (8.8)

¹ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

² Improvements include a separate right-turn lane on the eastbound approach of Delaware Route 14 and a separate left-turn lane on the westbound approach of Delaware Route 14, as warranted per DelDOT's Subdivision Manual.

Table 4
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Unsignalized Intersection ³ Two-Way Stop Control Intersection ⁴	LOS per TIS		LOS per DeIDOT	
	Weekday AM ¹	Weekday PM	Weekday AM	Weekday PM
Holly Hill Road & Amberwood / Site Entrance				
2020 without Hickory Glen (Case 2)				
Northbound Amberwood Entrance	A (9.6)	A (9.2)	A (9.5)	A (9.2)
Westbound Holly Hill Road	A (7.6)	A (7.6)	A (7.5)	A (7.6)
2020 with Hickory Glen (Case 3)				
Northbound Amberwood Entrance	A (9.6)	A (9.3)	A (9.6)	A (9.3)
Southbound Site Entrance	B (10.9)	B (12.1)	B (10.9)	B (12.1)
Eastbound Holly Hill Road – Left	A (7.3)	A (7.5)	A (7.3)	A (7.5)
Westbound Holly Hill Road – Left	A (7.6)	A (7.6)	A (7.6)	A (7.6)
2020 with Hickory Glen (Case 3) <i>With required turn-lane improvements</i> ⁵				
Northbound Amberwood Entrance	N/A	N/A	A (9.6)	A (9.3)
Southbound Site Entrance	N/A	N/A	B (10.8)	B (11.9)
Eastbound Holly Hill Road – Left	N/A	N/A	A (7.3)	A (7.5)
Westbound Holly Hill Road – Left	N/A	N/A	A (7.6)	A (7.6)

³ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

⁴ Both DeIDOT and the TIS analyzed this intersection as a T-intersection for the future without project (FWOP) case, and as a four-leg intersection for the future with project (FWP) case. The FWP case accounts for the Amberwood development proposed to be located south of the project site entrance on Holly Hill Road.

⁵ Improvements for this intersection consist of a separate right-turn lane on the westbound approach of Holly Hill Road, as warranted per DeIDOT's Subdivision Manual.

Table 5
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Unsignalized Intersection ⁶ Two-Way Stop Control (T-intersection)	LOS per TIS		LOS per DeIDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 14 & Church Hill Road				
2013 Existing (Case 1)				
Southbound Church Hill Road	B (10.9)	B (11.9)	B (10.9)	B (11.9)
Eastbound Delaware Route 14 - Left	A (7.8)	A (8.4)	A (7.8)	A (8.4)
2020 without Hickory Glen (Case 2)				
Southbound Church Hill Road	B (11.7)	B (13.7)	B (11.7)	B (13.7)
Eastbound Delaware Route 14 - Left	A (8.1)	A (8.9)	A (8.1)	A (8.9)
2020 with Hickory Glen (Case 3)				
Southbound Church Hill Road	B (11.9)	B (13.9)	B (11.9)	B (13.9)
Eastbound Delaware Route 14 - Left	A (8.2)	A (8.9)	A (8.2)	A (8.9)

⁶ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 6
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Signalized Intersection ⁷	LOS per TIS ⁸		LOS per DeIDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 14 & Delaware Route 15 / Holly Hill Road				
2013 Existing (Case 1)	B (15.3)	B (14.8)	B (16.6)	B (16.2)
2020 without Hickory Glen (Case 2)	B (18.0)	B (18.5)	C (21.5)	B (19.3)
2020 with Hickory Glen (Case 3)	B (19.2)	B (20.3)	C (23.2)	C (20.6)

⁷ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

⁸ The TIS used a cycle length of 60 seconds; whereas DeIDOT used a cycle length of 120 seconds in its analysis of this signalized intersection.

Table 7
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Unsignalized Intersection ⁹ Two-Way Stop Control Intersection ¹⁰	LOS per TIS		LOS per DelDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 15 & Airport Road				
2013 Existing (Case 1)				
Southbound Delaware Route 15 - Left	A (8.2)	A (8.3)	A (8.2)	A (8.3)
Westbound Airport Road	B (12.9)	C (16.5)	B (12.9)	C (16.5)
2020 without Hickory Glen (Case 2)				
Northbound Delaware Route 15 - Left	A (7.8)	A (8.0)	A (7.8)	A (8.0)
Southbound Delaware Route 15 – Left	A (8.6)	A (8.5)	A (8.6)	A (8.5)
Eastbound The Homestead Entrance	D (29.0)	D (33.6)	D (29.0)	D (33.3)
Westbound Airport Road	C (20.4)	F (64.8)	C (20.4)	F (64.8)
2020 with Hickory Glen (Case 3)				
Northbound Delaware Route 15 - Left	A (7.8)	A (8.2)	A (7.8)	A (8.2)
Southbound Delaware Route 15 – Left	A (8.9)	A (8.7)	A (8.9)	A (8.7)
Eastbound The Homestead Entrance	E (36.9)	E (43.9)	E (36.9)	E (43.4)
Westbound Airport Road	C (24.9)	F (119.2)	C (24.9)	F (119.2)

⁹ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

¹⁰ Both the TIS and DelDOT analyzed this intersection as a T-intersection for the existing case, and as a four-leg intersection for both the FWOP and FWP cases. The future cases take into account The Homestead to be located west of the intersection of Delaware Route 15 and Airport Road.

Table 8
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Signalized Intersection ¹¹	LOS per TIS ¹²		LOS per DeIDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 15 & Airport Road <i>With proposed improvements</i>				
2020 with Hickory Glen (Case 3)	B (10.2)	B (12.7)	B (19.7)	C (21.8)

¹¹ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

¹² The TIS used a cycle length of 60 seconds; whereas DeIDOT used a cycle length of 120 seconds in its analysis of this intersection.

Table 9
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Roundabout (Four-leg intersection) ¹³	LOS per TIS¹⁴		LOS per DeIDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 15 & Airport Road <i>With proposed improvements</i>				
2020 with Hickory Glen (Case 3)	N/A	N/A	B (10.5)	B (13.3)

¹³ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

¹⁴ The TIS did not consider roundabout intersection as an improvement option in its analysis.

Table 10
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Unsignalized Intersection ¹⁵ Two-Way Stop Control (four-leg intersection)	LOS per TIS		LOS per DelDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 15 & Church Hill Road				
2013 Existing (Case 1)				
Northbound Delaware Route 15 - Left	A (8.1)	A (7.7)	A (8.1)	A (7.7)
Southbound Delaware Route 15 - Left	A (7.6)	A (8.0)	A (7.6)	A (8.0)
Eastbound Church Hill Road	B (13.3)	B (14.2)	B (13.3)	B (14.2)
Westbound Church Hill Road	B (13.5)	B (14.8)	B (13.5)	B (14.8)
2020 without Hickory Glen (Case 2)				
Northbound Delaware Route 15 - Left	A (8.2)	A (7.8)	A (8.2)	A (7.8)
Southbound Delaware Route 15 - Left	A (8.1)	A (8.4)	A (8.1)	A (8.4)
Eastbound Church Hill Road	C (22.1)	D (25.1)	C (22.1)	C (24.9)
Westbound Church Hill Road	D (25.7)	F (107.4)	C (24.9)	F (106.1)
2020 with Hickory Glen (Case 3)				
Northbound Delaware Route 15 - Left	A (8.2)	A (7.9)	A (8.2)	A (7.9)
Southbound Delaware Route 15 - Left	A (8.2)	A (8.5)	A (8.2)	A (8.5)
Eastbound Church Hill Road	D (32.3)	D (27.4)	D (31.0)	D (27.4)
Westbound Church Hill Road	C (24.9)	F (223.3)	C (24.9)	F (220.9)

¹⁵ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

Table 11
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Signalized Intersection ¹⁶	LOS per TIS ¹⁷		LOS per DeIDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 15 & Church Hill Road <i>With proposed improvements</i>				
2020 with Hickory Glen (Case 3)	B (11.1)	B (16.6)	A (7.8)	B (10.5)

¹⁶ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

¹⁷ The TIS used a signal cycle length of 60 seconds; whereas DeIDOT used a cycle length of 120 seconds in its analysis of this signalized intersection.

Table 12
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Roundabout (Four-leg intersection) ¹⁸	LOS per TIS¹⁹		LOS per DelDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
Delaware Route 15 & Church Hill Road <i>With proposed improvements</i>				
2020 with Hickory Glen (Case 3)	N/A	N/A	A (8.4)	B (11.4)

¹⁸ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

¹⁹ The TIS did not consider roundabout intersection as an improvement option in its analysis.

Table 13
 PEAK HOUR LEVELS OF SERVICE (LOS)
based on Traffic Impact Study for Hickory Glen
Report dated April 24, 2014
 Prepared by The Traffic Group, Inc.

Signalized Intersection ²⁰	LOS per TIS ²¹		LOS per DelDOT	
	Weekday AM	Weekday PM	Weekday AM	Weekday PM
US Route 113 & Delaware Route 14				
2013 Existing (Case 1)	D (40.4)	D (47.3)	D (36.7)	D (46.7)
2020 without Hickory Glen (Case 2)	D (50.8)	E (76.7)	D (39.8)	E (74.2)
2020 with Hickory Glen (Case 3)	E (55.1)	F (85.5)	D (41.3)	E (76.6)
2020 with Hickory Glen (Case 3) <i>With proposed improvements²²</i>	D (54.5)	D (54.9)	D (36.0)	D (53.7)
2020 with Hickory Glen (Case 3) <i>With 2008 HEP improvements²³</i>	N/A	N/A	C (32.1)	D (38.2)

²⁰ For both unsignalized and signalized intersection analyses, the numbers in parentheses following levels of service (LOS) are average delay per vehicle, measured in seconds. For signalized analyses, LOS analysis results are given for only the overall intersection delay.

²¹ The TIS utilized a cycle length of 60.0 seconds for this intersection. After a field visit to that intersection we concur with this cycle length.

²² Per the TIS, the proposed improvements for this intersection include restriping the exclusive left-turn lane and shared through / left-turn lane to reconfigure the westbound approach of Delaware Route 14 as one shared through / left-turn lane, a through lane and a right-turn lane.

²³ The improvements identified in the 2008 Hazard Elimination Program for this intersection include reconfiguring both approaches of Delaware Route 14 to provide one left-turn lane, two through lanes, and one right-turn lane. In addition, the approaches of Delaware Route 14 will operate under protected-only concurrent left-turn phasing, instead of the existing split-phase.