4. Projected Transportation Conditions

This section summarizes the projected future transportation conditions within the study area. Evaluation of both no-build and build conditions were conducted in order to summarize the overall impacts of the new roadway extensions. A 20-year design horizon, in accordance with PennDOT practices, has been assumed for this project, and as such, the design year is assumed to be 2030.

Future Traffic Volumes

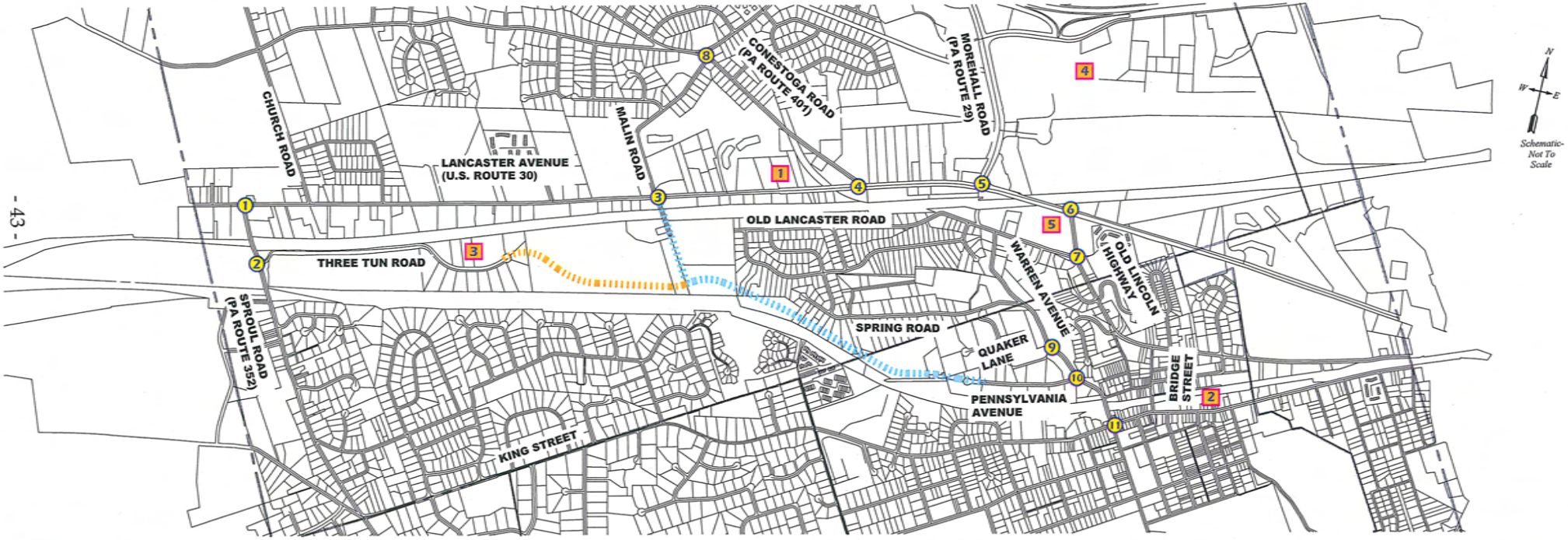
The future traffic volume forecasts include potential traffic increases due to both local and regional traffic growth. Local traffic growth will consist of traffic to be generated by area developments. Accordingly, five major area developments were identified by Malvern Borough and East Whiteland Township, and their locations are highlighted in **Figure 15**. The anticipated traffic to be generated by these local developments has been included in the traffic projections.

Regional traffic growth was estimated based on an annual traffic growth rate of one percent per year. The combined local and regional traffic growth results in effective growth rates between 2.14 percent and 3.58 percent per year for 20 years (until the year 2030) along various roadways in the study area. Economic, land use policies, the availability of develop land within the immediate study area, open space preservation efforts, and various other factors may cause the regional traffic growth to slow from the assumptions utilized in this study resulting in lower 2030 future traffic volumes than forecasted. Nevertheless, these traffic projections and analyses should result in a conservative evaluation for the purposes of this feasibility study.

Future no-build traffic volumes are illustrated in **Figures 16 and 17** for the weekday morning and afternoon peak hours, respectively.

Future Land Use

Future land use in the immediate study area will likely consist of the extension of new industrial uses and the redevelopment of industrial-legacy properties with medium to large-scale commercial uses near the terminal nodes of the new roadway connections. The central portion of the new roadway alignment is relatively narrow and constrained; the Amtrak/SEPTA rail line to the south will limit additional development in that area, while the existing residential properties to the north are already fully built-out – hence, these areas are unlikely to change significantly. Additional density at the Pennsylvania Avenue (Malvern Borough) connection is envisioned, with the potential for mixed-use development occurring in the vicinity of the Malvern Train Station. The possibility for Transit-Oriented Development (TOD) at this locale is presented in more detail later in this report, which includes a hypothetical TOD concept that envisions a mix of residential, retail, and commercial uses at higher densities than currently exist within the study area.



STUDY AREA MAP

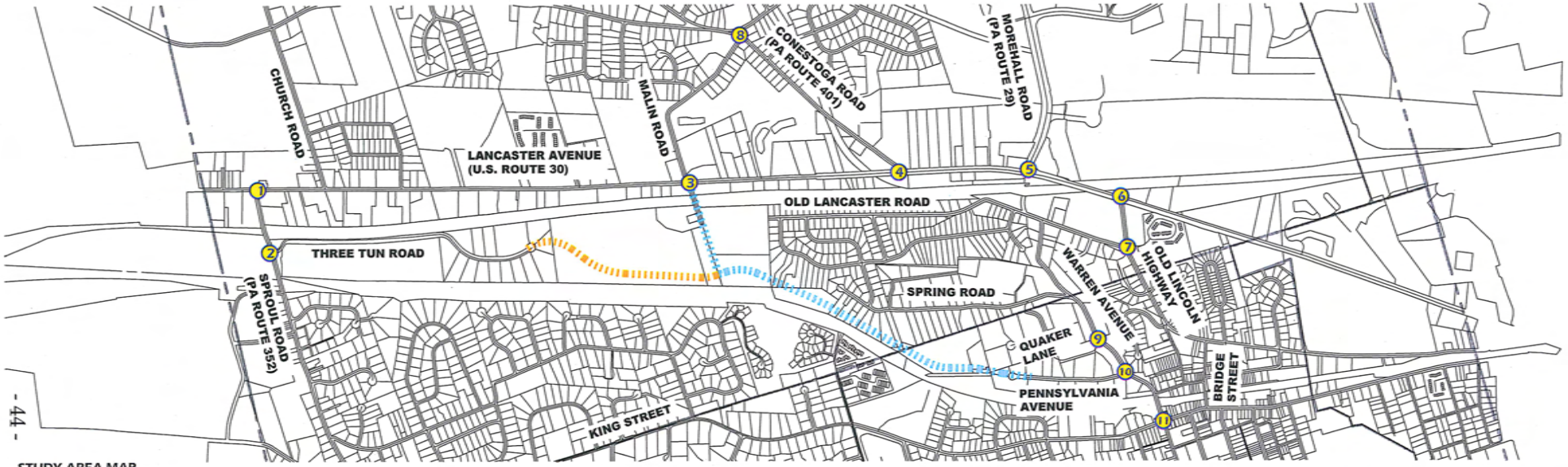
1. THE RUBINO TRACT: 144,000 SQ. FT. OFFICE SPACE AND A 4,200 SQ. FT. BANK
2. EAST KING STREET REDEVELOPMENT: 200 APARTMENT UNITS, 20,000 SQ. FT. OF RETAIL, AND 20,00 SQ. FT. OFFICE SPACE
3. THREE TUN ROAD INDUSTRIAL SUBDIVISION: 35,00 SQ. FT. OF OFFICE SPACE, 112,000 SQ. FT. OF WAREHOUSE SPACE, AND ASSUMED 114,500 SQ. FT. INDUSTRIAL PARK BUILD OUT
4. UPTOWN WORTHINGTON: 300 APARTEMENT UNITS, 300 CONDOMINIUMS, 700,000 SQ. FT. OF OFFICE SPACE, AND 500,000 SQ. FT. OF RETAIL
5. OLD LINCOLN HIGHWAY OFFICE DEVELOPMENT: 86,400 SQ. FT. OF OFFICE SPACE

FIGURE 15
Proposed Major Developments
MALIN ROAD EXTENSION FEASIBILITY STUDY
MALVERN BOROUGH, CHESTER COUNTY, PA

LEGEND:
- # — DEVELOPMENT NUMBER
- # — STUDY INTERSECTION NUMBER

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

(12-7-10) I:\eng\809534\Dwg\Figures\Local Developments.dwg



STUDY AREA MAP
INTERSECTION VOLUMES

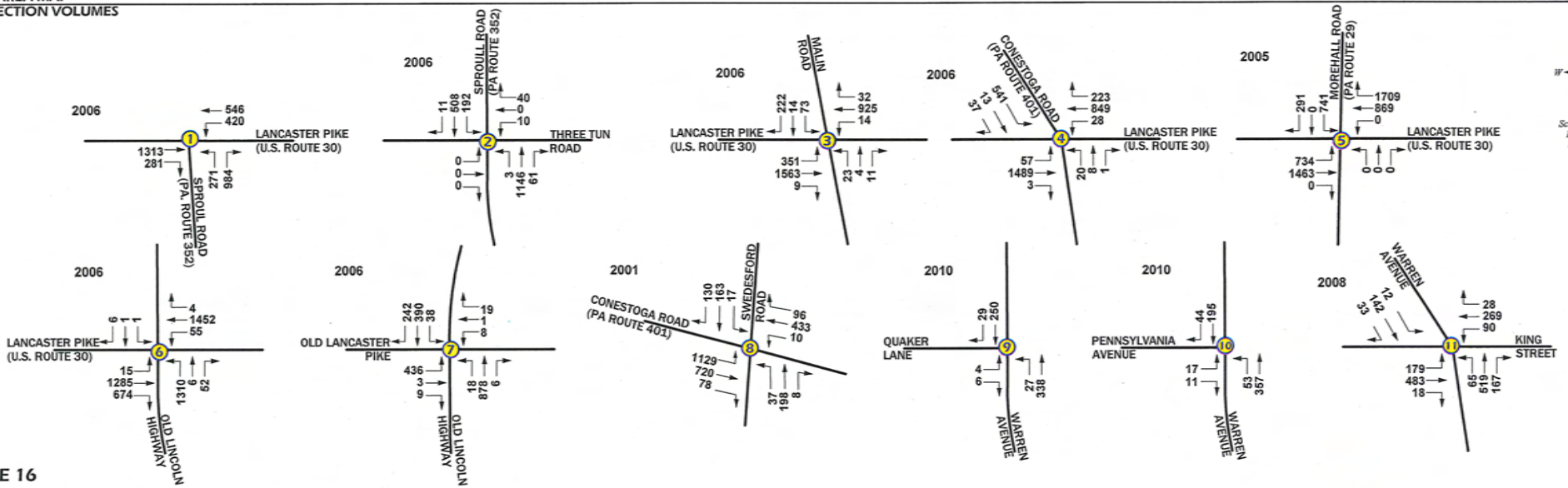


FIGURE 16

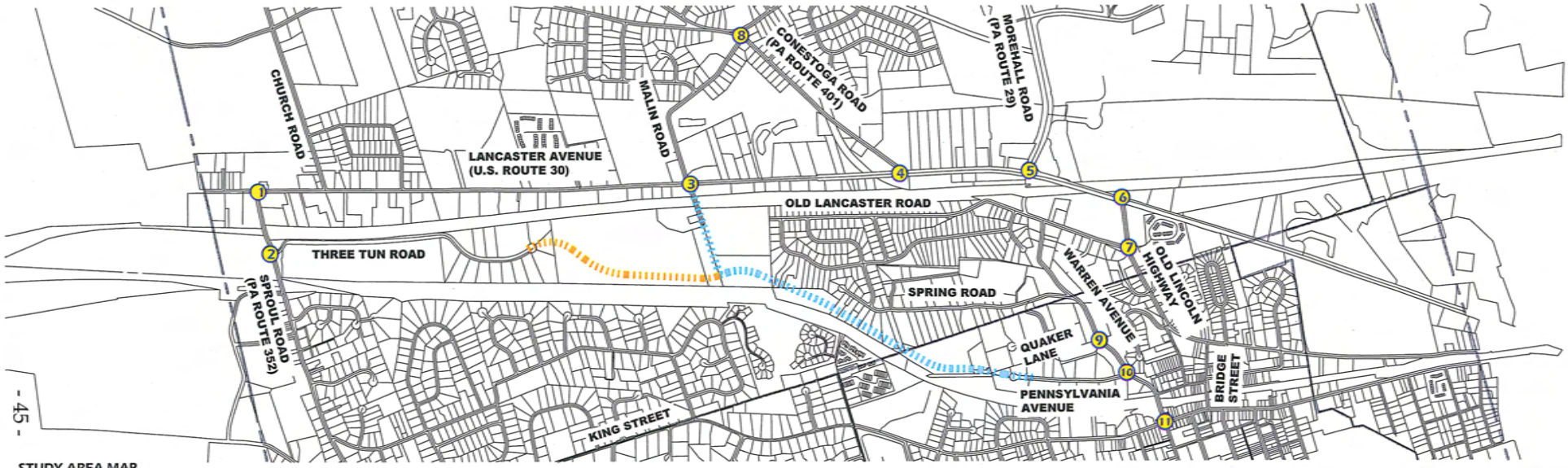
2030 Future Weekday Morning Peak Hour Traffic Volumes - No Build

MALIN ROAD EXTENSION FEASIBILITY STUDY

MALVERN BOROUGH, CHESTER COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

(12-7-10) L:\eng\80953-4\Dwg\Figures\Future No Build AM volumes.dwg



STUDY AREA MAP
INTERSECTION VOLUMES

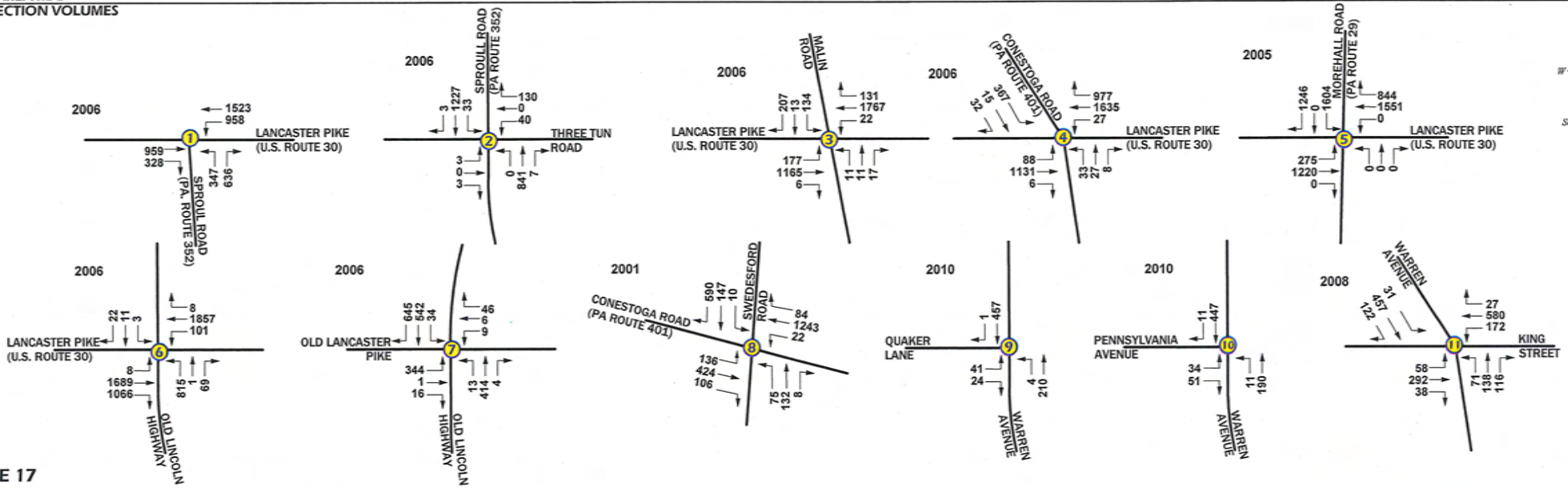


FIGURE 17

2030 Future Weekday Afternoon Peak Hour Traffic Volumes - No Build

MALIN ROAD EXTENSION FEASIBILITY STUDY

MALVERN BOROUGH, CHESTER COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

(12-7-10) I:\eng\80953-6\Dwg\Figures\Future No Build PM volumes.dwg

Traffic Volume Diversions

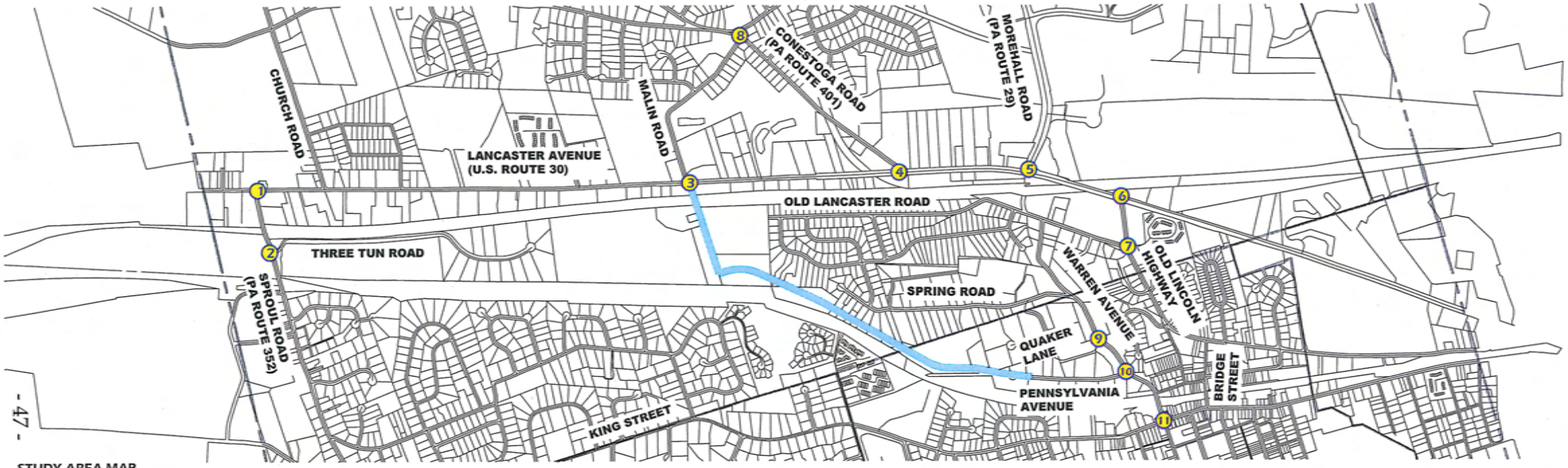
Upon construction of one or both of the new roadway extensions, some portion of the study area traffic will divert to these new roadway segments as they will offer a more-direct, quicker route that their current travel routes. As such, traffic diversions were developed for the *build conditions* scenarios. Since a comprehensive origin-destination study was beyond the scope and budget of this project, traffic diversions were based on maximum anticipated diversions due to travel distance and travel time savings with the proposed roadway.

A survey was distributed to businesses along Pennsylvania Avenue and Quaker Lane, which helped identify traffic characteristics and patterns for a significant portion of the traffic to be served by the proposed roadway extension. Accordingly, maximum anticipated daily and peak hour traffic volumes for the Malin Road extension were derived for design purposes, as well as for key intersections to determine maximum anticipated traffic volumes and potential traffic impacts. It is noted that traffic diversions greater than 50 percent were not utilized so as to not provide a major overestimation of diversions.

Future traffic volumes with the Malin Road (Scenario 1) extension are illustrated in **Figures 18 and 19** for the weekday morning and afternoon peak hours, respectively. Similarly, future traffic volumes with both the Malin Road and Three Tun Road extensions (Scenario 2) are illustrated in **Figures 20 and 21** for the weekday morning and afternoon peak hours, respectively.

As noted, the composition of future traffic will be based on existing traffic, future traffic increases due to regional growth and local development, and traffic diversions (build conditions for Scenarios 1 and 2), as summarized in **Table 3**. As shown, many of the surrounding roadways, which are already congested today, will benefit from traffic diversions to the new roadway extension(s), thereby relieving stress on these roadways and their intersections. Comprehensive analyses of off-site intersections was not performed as part of this study; however, the reduction in traffic volumes will have the most significant benefits to key intersections like the Lancaster Avenue/PA Route 352 and Lancaster Avenue/Old Lincoln Highway intersections. Also, traffic volumes should be reduced along more local roads such as Bridge Street, Broad Street, and King Street in the Borough as well as Warren Avenue and Old Lancaster Road in the Township. However, traffic volumes will likely increase along the segment of Malin Road between Lancaster Avenue and PA Route 401, which traverses through a residential area (closer to PA Route 401), and therefore, should be addressed if the projects progresses.

It is also noted that the Malin Road and the Three Tun Road extensions, whether completed together or separately, will also provide an improved route for truck traffic to and from the industrial areas along Pennsylvania Avenue and Quaker Lane.



STUDY AREA MAP
INTERSECTION VOLUMES

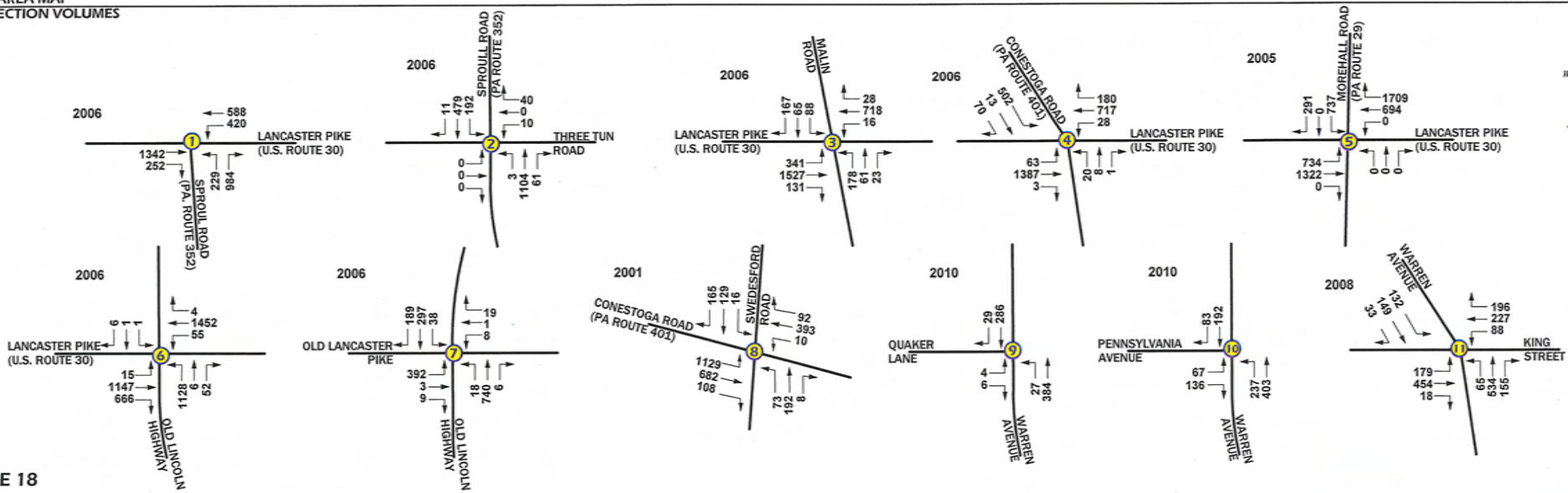


FIGURE 18

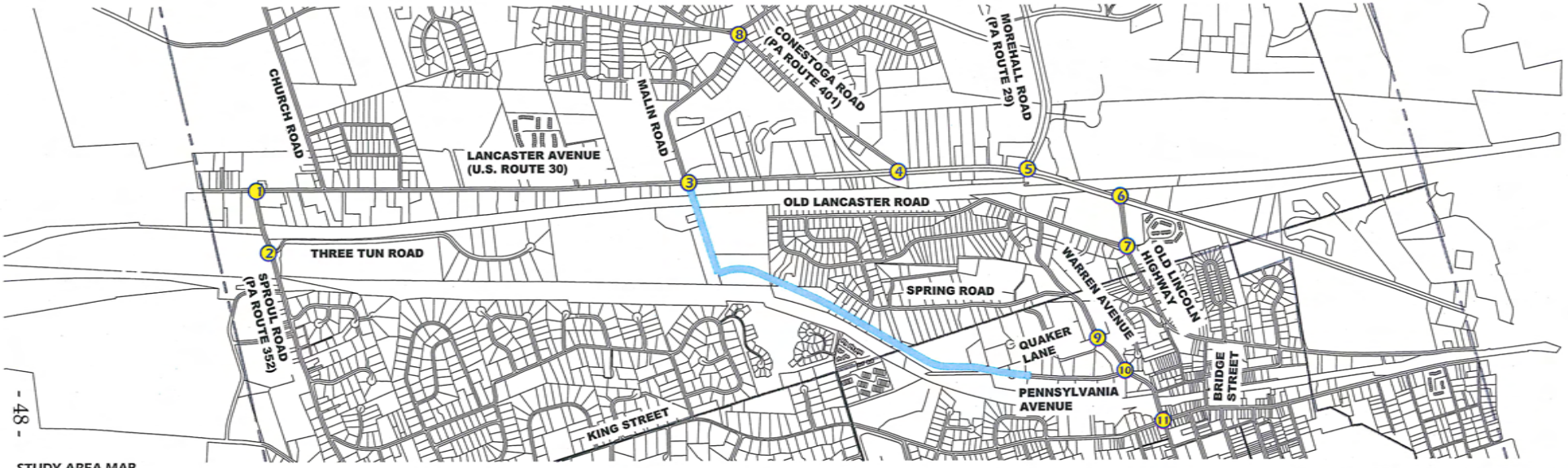
2030 Future Weekday Morning Peak Hour Traffic Volumes - Scenario 1

MALIN ROAD EXTENSION FEASIBILITY STUDY

MALVERN BOROUGH, CHESTER COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

(12-7-10) I:\eng\809534\Dwg\Figures\Future Scenario 1 AM volumes.dwg



STUDY AREA MAP

INTERSECTION VOLUMES

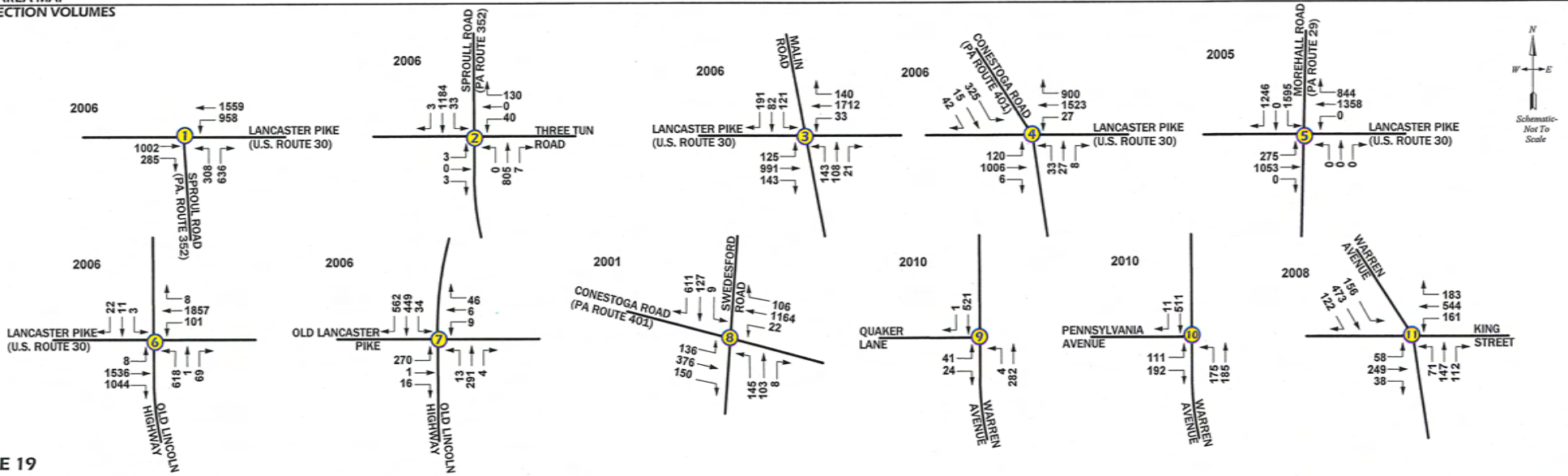


FIGURE 19

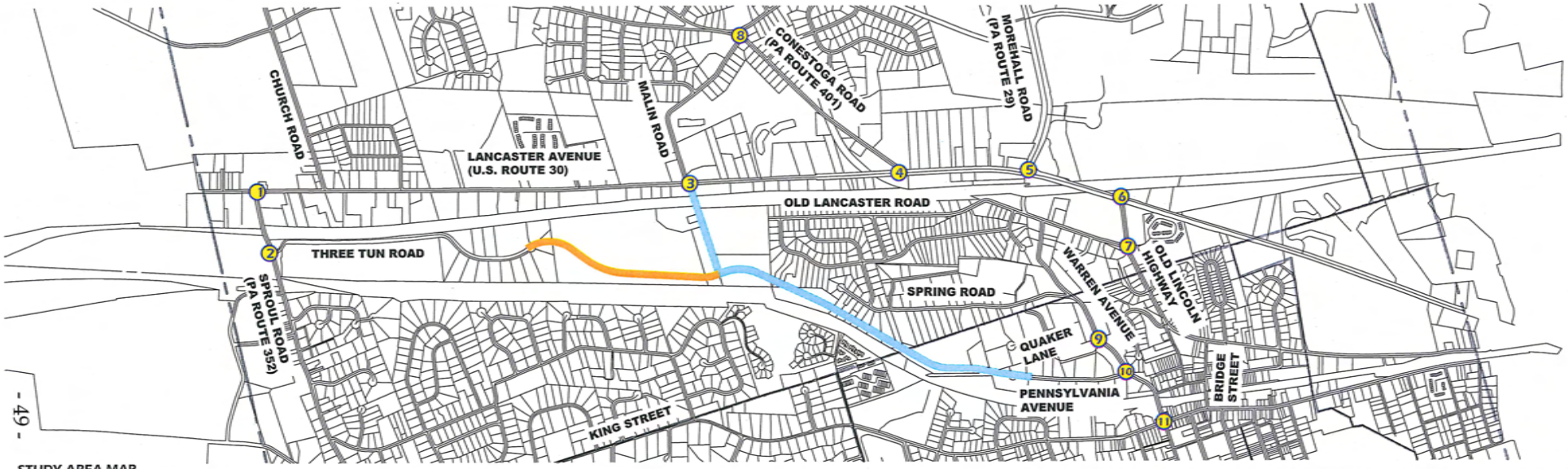
2030 Future Weekday Afternoon Peak Hour Traffic Volumes - Scenario 1

MALIN ROAD EXTENSION FEASIBILITY STUDY

MALVERN BOROUGH, CHESTER COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

(12-7-10) L:\eng\809534\Dwg\Figures\Future Scenario 1 PM volumes.dwg



STUDY AREA MAP

INTERSECTION VOLUMES

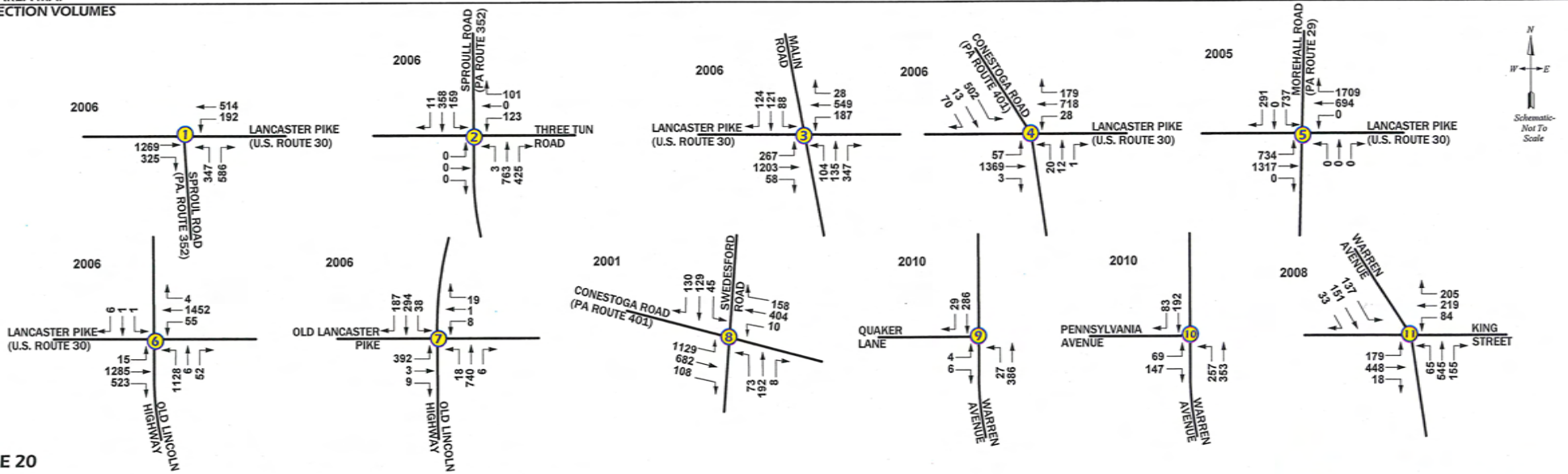


FIGURE 20

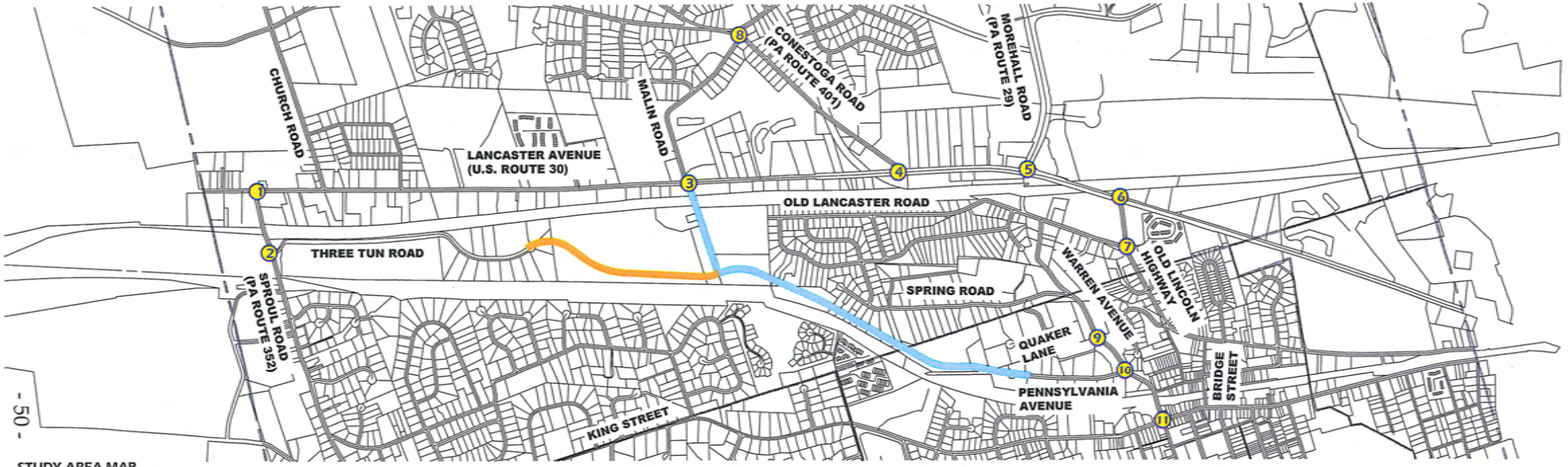
2030 Future Weekday Morning Peak Hour Traffic Volumes - Scenario 2

MALIN ROAD EXTENSION FEASIBILITY STUDY

MALVERN BOROUGH, CHESTER COUNTY, PA

McMAHON TRANSPORTATION ENGINEERS & PLANNERS

(12-7-10) L:\eng\809534\Dwg\Figures\Future Scenario 2 AM volumes.dwg



STUDY AREA MAP
INTERSECTION VOLUMES

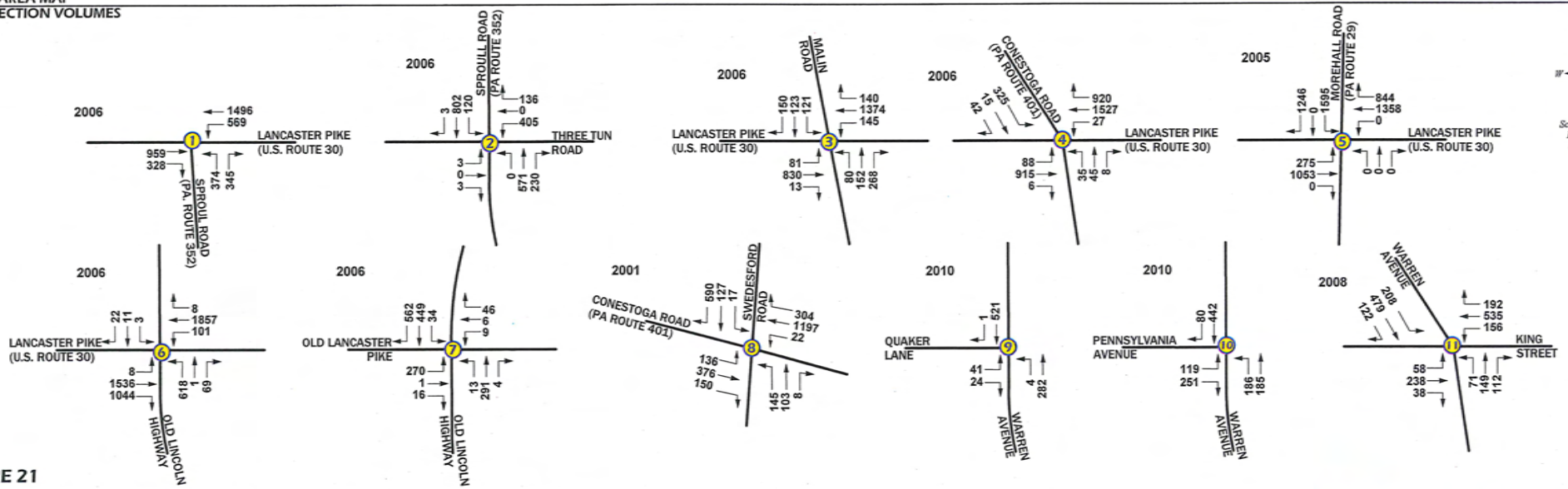


FIGURE 21
2030 Future Weekday Afternoon Peak Hour Traffic Volumes - Scenario 2

MALIN ROAD EXTENSION FEASIBILITY STUDY

MALVERN BOROUGH, CHESTER COUNTY, PA

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

(12-7-10) I:\eng\809534\Dwg\Figures\Future Scenario 2 PM volumes.dwg

Table 3 | Future Traffic Composition

Intersection	Condition	Do Nothing		Scenario 1 Malin Road Extension		Scenario 2 Three Tun Road Extension	
		PM	Daily[1]	PM	Daily[1]	PM	Daily[1]
Lancaster Avenue west of Malin Road	Existing	1,792	16,291	1,792	16,291	1,792	16,291
	Projected Growth	1,541	14,009	1,434	13,036	1,197	10,822
	Diversions	0	0	79	718	-461	-4,191
	Total Future	3,333	30,300	3,305	30,045	2,528	22,982
Lancaster Avenue east of PA Route 401	Existing	2,504	22,764	2,504	22,764	2,504	22,764
	Projected Growth	1,641	14,918	1,622	14,745	1,555	14,136
	Diversions	0	0	-337	-3,064	-337	-3,604
	Total Future	4,145	37,682	3,789	34,445	3,722	33,836
Lancaster Avenue east of PA Route 29	Existing	3,048	33,866[2]	3,048	33,866[2]	3,048	33,866[2]
	Projected Growth	2,171	24,122[2]	2,139	23,736[2]	2,139	23,736[2]
	Diversions	0	0	-337	-3,744[2]	-337	-3,744[2]
	Total Future	5,219	57,988[2]	4,850	57,265[2]	4,850	57,265[2]
PA Route 352 north of Three Tun Road	Existing	1,364	15,156[2]	1,364	15,156[2]	1,364	15,156[2]
	Projected Growth	905	10,055[2]	905	10,055[2]	659	7,322[2]
	Diversions	0	0	-82	-911[2]	-407	-4,522[2]
	Total Future	2,265	25,211[2]	2,187	24,300[2]	1,616	17,956[2]
King Street west of Warren Avenue	Existing	876	7,964	876	7,964	876	7,964
	Projected Growth	285	2,591	285	2,591	265	2,409
	Diversions	0	0	-79	-718	-79	-718
	Total Future	1,161	10,555	1,082	9,837	1,062	9,655
Old Lincoln Highway north of Old Lancaster Road	Existing	1,400	12,727	1,400	12,727	1,400	12,727
	Projected Growth	625	5,682	589	5,355	589	5,355
	Diversions	0	0	-337	-3,064	-337	-3,064
	Total Future	2,025	18,409	1,652	15,018	1,652	15,018
Malin Road north of Lancaster Avenue	Existing	443	4,027	443	4,027	443	4,027
	Projected Growth	230	2,091	189	1,718	189	1,718
	Diversions	0	0	135	1,227	135	1,227
	Total Future	673	6,118	767	6,972	767	6,972
PA Route 401 north of Lancaster Avenue	Existing	1,181	9,842	1,781	14,842	1,181	9,842
	Projected Growth	325	2,708	383	3,192	389	3,242
	Diversions	0	0	-139	-1,125	-135	-1,125
	Total Future	1,506	12,550	2,029	16,909	1,435	11,959
Warren Avenue north of Pennsylvania Avenue	Existing	415	3,773	415	3,773	415	3,773
	Projected Growth	267	2,427	257	2,336	257	2,336
	Diversions	0	0	-146	-1,327	-145	-1,400
	Total Future	682	6,200	526	4,782	526	4,709
Old Lancaster Road west of Old Lincoln Highway	Existing	649	5,900	649	5,900	649	5,900
	Projected Growth	376	3,418	365	3,318	365	3,318
	Diversions	0	0	-146	-1,327	-146	-1,327
	Total Future	1,025	9,318	868	7,891	868	7,891

1 – Based on the weekday afternoon peak hour traffic volumes and a K-Factor of 11 percent unless otherwise noted.

2 – Based on the weekday afternoon peak hour traffic volumes and a K-Factor of 9 percent.

Future Traffic Operations

The future traffic volumes for each of the previously described scenarios (no-build, Malin Road extension only, and Malin Road/Three Tun Road extensions) were subjected to detailed traffic capacity/level-of-service analysis in accordance with standard techniques contained in the Highway Capacity Manual (2000).

The results of the future capacity/level-of-service analyses are summarized in **Table 4**, and compared with existing operating conditions. Additionally, detailed capacity/level-of-service analysis worksheets are contained in **Appendix D**. It is noted that these conditions are based on current intersection geometries/conditions, except as noted. As shown in Table 4, most study area intersections are projected to function at undesirable and unacceptable overall LOS E or F conditions during at lease one peak hour, while most intersection will function unacceptably during both peak hours, without significant roadway/intersection improvements. Furthermore, Smart Transportation, as well as other regional and County policies, recommend consideration of new roadway connections, transit and multi-modal travel opportunities, and land use policy changes as alternatives to roadway widening improvements. With the projected level of failing intersection operations throughout the study area in the future, an alternative to typical corridor and intersection capacity improvements achieved through geometric widening will be desirable due to constraints such as the potential scope of improvements, costs, right-of-way and property impacts, funding availability, etc.

Even without significant improvements throughout the entire study area, the extension of Malin Road will have a predominately positive impact by reducing delay at most study intersections, many of which will (or continue to) operate beyond its available capacity (i.e., congested LOS F conditions) in the future. For example, the overall intersection delay at the Lancaster Avenue/Old Lincoln Highway intersection during the weekday afternoon peak hour is projected to decrease by approximately 30 percent with the Malin Road extension. The Three Tun Road will also provide benefit to the surrounding roadway network. For example, at the Lancaster Avenue/PA Route 352 intersection, weekday afternoon peak hour overall delay is expected to decrease by nearly 37 percent with both the Malin Road and Three Tun Road extensions.

In addition to intersection level of service impacts, travel time reductions and travel distance savings were also evaluated with the proposed roadway extensions for various routes, as noted below in Table 4. As shown in Table 4, traffic which currently travels through the area along Route 1 will travel along Lancaster Avenue, the Malin Road extension, and Pennsylvania Avenue under Scenarios 1 and 2. Similarly, traffic which currently travels along Route 2 through the study area will travel along PA Route 401, Malin Road, the Malin Road extension, and Pennsylvania Avenue under Scenarios 1 and 2. In addition, traffic which currently travels along Route 3 through the study area will travel along Lancaster Avenue, the Malin Road extension, and Pennsylvania Avenue under Scenario 1, and along Lancaster Avenue, PA Route 352, Three Tun Road, the Malin Road extension and Pennsylvania Avenue under Scenario 2. As shown in **Table 5**, the travel distance will decrease for Route 1 and Route 3 under both build scenarios, and will stay the same for Route 2 under both build scenarios.

Table 4 | Delay and Level-of-Service Comparison

	Intersection		2006 Existing					2023 No Build Conditions					Scenario 1 Malin Road Extension					Scenario 2 Malin Road & Three Tun Road Extension				
				AM		PM			AM		PM			AM		PM			AM		PM	
	North/South	East/West	Type	Delay (s)	LOS	Delay (s)	LOS	Type	Delay (s)	LOS	Delay (s)	LOS	Type	Delay (s)	LOS	Delay (s)	LOS	Type	Delay (s)	LOS	Delay (s)	LOS
1	PA Route 352	Lancaster Avenue	Signalized	F		F		Signalized	486.2	F	404.1	F	Signalized	488.2	F	409.4	F	Signalized	317.0	F	253.0	F
2	PA Route 352	Three Tun Road	Unsignalized	N/A		N/A		Unsignalized	19.7	C	92.5	F	Unsignalized	16.4	C	78.9	F	Signalized	17.1	B	36.5	D
3	Malin Road	Lancaster Avenue	Signalized	B		B		Signalized	58.9	E	76.6	E	Signalized	31.1	C	26.9	C	Signalized	31.8	C	32.2	C
4	PA Route 401	Lancaster Avenue	Signalized	C		B		Signalized	175.3	F	261.3	F	Signalized	146.1	F	185.6	F	Signalized	137.0	F	197.6	F
5	PA Route 29	Lancaster Avenue	Signalized	F		D		Signalized	72.7	E	162.9	F	Signalized	71.8	E	142.3	F	Signalized	71.2	E	142.3	F
6	Old Lincoln Highway	Lancaster Avenue	Signalized	E		C		Signalized	119.3	F	128.0	F	Signalized	95.0	F	91.3	F	Signalized	93.7	F	91.3	F
7	Old Lincoln Highway	Old Lancaster Road	Unsignalized	N/A		N/A		Signalized[1]	87.6	F	108.2	F	Signalized[1]	44.9	D	49.4	D	Signalized[1]	44.9	D	43.0	D
8	PA Route 401	Malin Road/Swedesford Road	Signalized	F		E		Signalized	188.7	F	271.1	F	Signalized	184.4	F	260.9	F	Signalized	218.2	F	338.9	F
9	Warren Avenue	Quaker Lane	Unsignalized	0.8	A	2.0	A	Unsignalized	0.8	A	2.2	A	Unsignalized	0.8	A	2.2	A	Unsignalized	0.8	A	2.2	A
10	Warren Avenue	Pennsylvania Avenue	Unsignalized	1.7	A	2.2	A	Unsignalized	1.8	A	2.2	A	Signalized	14.9	B	24.4	C	Signalized	40.8	D	35.3	D
11	Warren Avenue	King Street	Signalized	29.1	C	18.6	B	Signalized	110.8	F	58.4	E	Signalized	50.0	D	28.4	C	Signalized	55.6	E	31.7	C

Table 5| Travel Route Impacts

Route	Travel Distance (miles)		
	No-Build	Scenario 1	Scenario 2
1	3.1	2.4	2.4
2	1.8	1.8	1.8
3	3.1	2.4	2.4

Route 1 – This route travels through Intersection 1, Intersection3, Intersection 4, Intersection 5, Intersection 6, Intersection 7, Intersection 9, and Intersection 10.

Route 2 – This route travels through Intersection 8, Intersection 4, Intersection 5, Intersection 6, Intersection 7, Intersection 9, and Intersection 10.

Route 3 – This route travels through Intersection 1, Intersection 2, PA Route 352/King Street, Intersection 11, and Intersection 10.

Recommended Intersection Improvements

An evaluation of the future traffic conditions was completed at the Lancaster Aveneu/Malin Road intersection, the Warren Avenue/Pennsylvania Avenue, and PA Route 353/Three Tun Road intersection to determine the traffic impacts of the proposed roadway extensions, in order to identify needed improvements. As such, the improvements that would be required include the following for each scenario:

Scenario 1 - Malin Road Extension

1) **Lancaster Avenue/Malin Road Intersection** – The analysis indicates that the following lane configurations will be needed to accommodate future traffic, in addition to traffic signal timing and phasing modifications:

   - *Northbound Malin Road* – provide a separate left-turn lane and a shared through/right-turn lane.
   - *Southbound Malin Road* – provide separate left-turn, through, and right-turn lanes.

2) **Pennsylvania Avenue/Warren Avenue Intersection** – The analysis indicates with the additional traffic along Pennsylvania Avenue due to the extension, this intersection may likely warrant signalization. It is recommended to provide a separate left-turn lane northbound along Warren Avenue at the intersection to improve capacity and improve visibility of left-turn traffic that is limited by the horizontal curvature of Warren Avenue. Other proposed intersection configurations that can be considered during the preliminary and final design stages include a roundabout intersection; however, such an intersection design would need to be further evaluated to accommodate the truck traffic generated by the industrial park. A third option would be re-configuring the intersection with the north approach of Warren Avenue as the minor approach to the modified "T"

intersection with the extension and the southerly leg of Warren Avenue functioning as the main through road.

Scenario 2 - Malin Road & Three Tun Road Extensions

1) **Lancaster Avenue/Malin Road Intersection** – Generally similar to Scenario 1, the analysis indicates that the following lane configurations will be needed to accommodate future traffic, in addition to traffic signal timing and phasing modifications:

   - *Northbound Malin Road* – provide separate left-turn, through, and right-turn lanes.
   - *Southbound Malin Road* – provide a separate left-turn lane and a shared through/right turn lane.

2) **Pennsylvania Avenue/Warren Avenue Intersection** – No improvements beyond those identified for Scenario 1 will be needed.

3) **Intersection of PA Route 352 and Three Tun Road** – The analysis indicates that the intersection will operate acceptably with signalization, and providing the following configuration:

   - *Northbound PA Route 352* – provide separate left-turn, through, and right-turn lanes.
   - *Southbound PA Route 352* – provide a separate left-turn lane and a shared through/right-turn lane.
   - *Westbound Three Tun Road* – provide separate left- and right-turn lanes.
   - *Coordinate traffic signal with the traffic signal at the Lancaster Avenue/PA Route 352 intersection.*

As shown by Table 3, the traffic volumes along many of the roadways within the vicinity of the study area will be affected by the diversions of traffic to and from the new roadway extensions. In general, these diversions will create a positive impact to roadway network by reducing traffic volumes along already congested roadway segments. However, in some cases, diverted traffic will increase traffic volumes on a few roadway segments (e.g., Malin Road, north of Lancaster Avenue), as well as modify traffic patterns at some intersections (e.g. some eastbound Route 401 traffic will turn right onto Malin Road instead of continuing straight), which must be further evaluated during further phases of the study in order to determine these periphery impacts and needed improvements.

TOD Considerations

In addition to the aforementioned future conditions analyses, a separate review of potential Transit-Oriented Development (TOD) was completed. Glackin Thomas Panzak identified a

potential TOD scenario, whereby TOD occurred along Pennsylvania Avenue and King Street, just to the west of Warren Avenue and adjacent to the Malvern Train Station. Subsequently, McMahon Associates, Inc. reviewed the traffic implications of such a development on the new roadway extensions, as well as their connection points to the adjacent road network.

Potential TOD Development Scenario

In the process of updating the Borough's Comprehensive Plan, the task force group working on the update suggested that any changes to access and circulation in the vicinity of the Malvern train station be considered in the context of potential future land use patterns at this locale. Through the comprehensive plan update process, the Borough is moving forward with changes in their vision of future land use that would encourage a mix of complementary land uses at higher densities in this area, in accordance with transit-oriented development principles. The Borough thought it would be useful to first understand some of the practical design implications that might influence the form of TOD development, based on dimensional factors, proximity to other land uses, and existing and future access in the area surrounding the train station. Glackin Thomas Panzak prepared a conceptual future land use plan for the areas on both sides (north and south) of the railroad right-of-way, to the west of Warren Avenue. This conceptual plan was developed without any engineering data, and simply intends to show how different land uses could be integrated, where they might be located, and at what density each use might be developed.

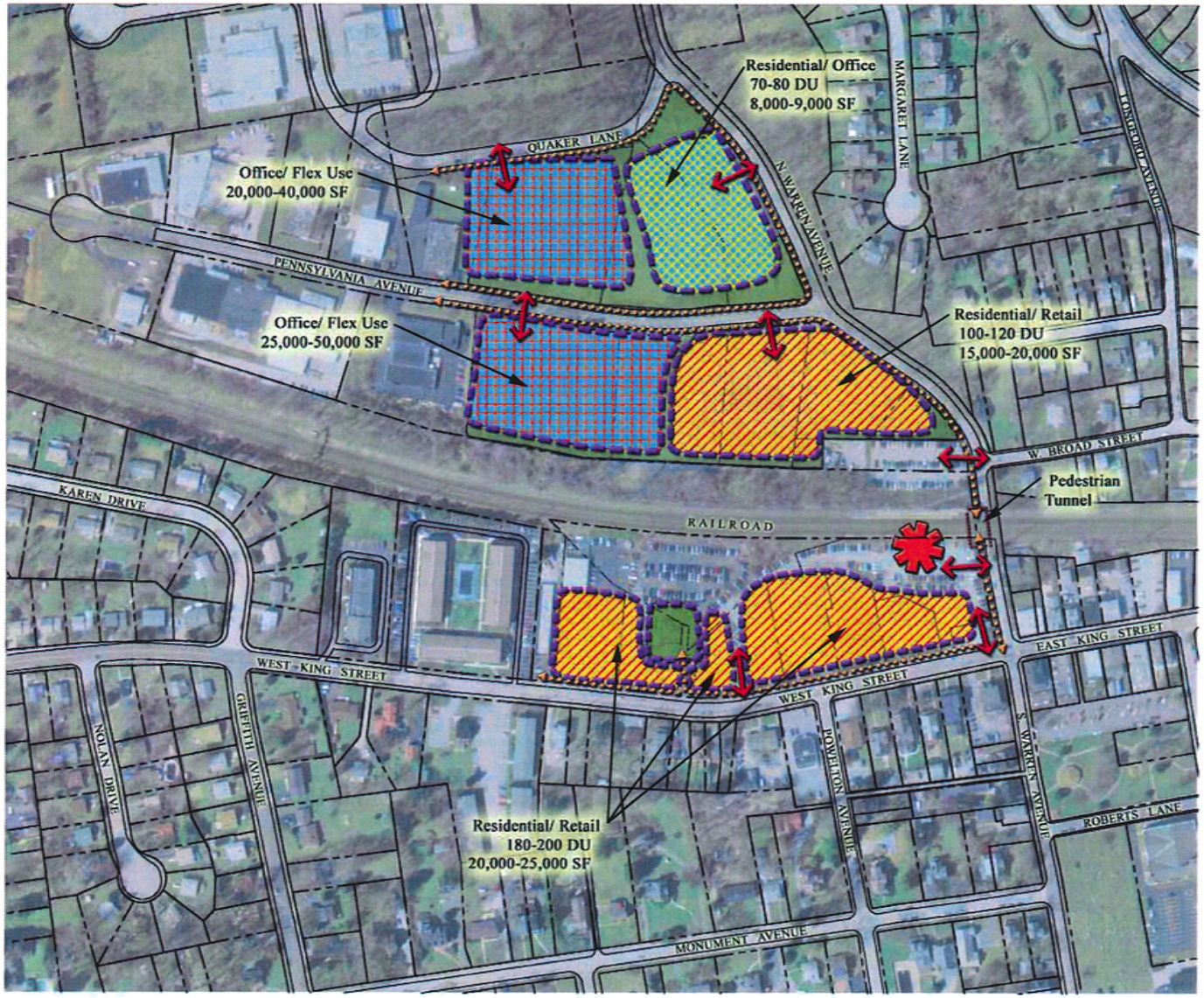
Figure 22 depicts one possible TOD scenario, with a mix of multi-family attached residential units, office, office/industrial flex space, and retail uses. Development intensity was estimated based on mix of vertically-integrated uses configured within assumed building prototypes. This scenario also envisions the redevelopment of specified already-developed areas, assuming that landowners might choose to realize higher densities on their properties in the future if zoning were changed to permit such forms of development. The following uses are shown on Figure 22, at development intensities estimated as ranges of density:

- Residential (multi-family): 350 to 400 dwelling units
- Office: 8,000 to 9,000 square feet of gross floor area
- Office/Flex (warehouse or industrial): 45,000 to 90,000 square feet
- Retail: 35,000 to 45,000 square feet

TOD Traffic Implications

McMahon Associates utilized this potential development mix as part of a separate future traffic analysis, in order to better understand potential access and circulation considerations, and to estimate traffic volumes on existing and proposed roads in the area.

The traffic associated with the potential TOD build-out indicates that the proposed roadway extensions can accommodate the increased traffic. Furthermore, no additional intersection capacity improvements are expected at the Pennsylvania Avenue/Warren Avenue, Lancaster Avenue/Malin Road, and PA Route 352/Three Tun Road intersections, beyond those



TOTAL: Potential Yield

RESIDENTIAL:	350-400 DU
OFFICE:	8,000-9,000 SF
OFFICE/FLEX USE:	45,000-90,000 SF
RETAIL:	35,000-45,000 SF

* Off-street parking is accommodated on-site in a combination of surface and structured parking facilities.

LEGEND:

- RESIDENTIAL/ RETAIL
- RESIDENTIAL/ OFFICE
- OFFICE/ FLEX USE
- GREEN AREAS
- ACCESS POINTS
- PEDESTRIAN CIRCULATION
- MALVERN TRAIN STATION

0 50 100 200 300 FEET
SCALE: 1" = 100'

NORTH

GLACKIN THOMAS PANZAK
LAND PLANNING
LANDSCAPE ARCHITECTURE

CONCEPTUAL DENSITY STUDY
Malin Road Extension
MALVERN BOROUGH, CHESTER COUNTY, PENNSYLVANIA

PROJECT #: 10-010
DATE: 09/17/10(df)
REV.:

SHEET:
Figure 22

previously identified as being needed with the roadway extensions, to accommodate the additional TOD traffic. However, implementation of the TOD plan without the proposed roadway extensions will add to traffic congestion throughout the study area. **Table 6** summarizes the impacts of the TOD development under the no-build (no extensions) and the future build conditions (Scenarios 1 and 2) at key intersections within the area. As shown, without the roadway extensions, traffic conditions will worsen at key intersections and require improvements (if feasible) to offset impacts of the potential TOD development. Alternatively, the Malin Road extension, as well as the Three Tun Road extension, will reduce the impacts of the TOD development on surrounding roadways including along Warren Avenue and Old Lancaster Road and potentially other neighborhood streets, which is a goal of this project. TOD densities beyond those noted above and analyzed in this study will need to be closely reviewed to determine impacts to the surrounding roadway network and particularly at the Lancaster Avenue/Malin Road intersection with respect to queuing conditions between Lancaster Avenue and the railroad underpass.

In summary, the evaluation of future transportation conditions reveals that the benefits of the roadway extensions, as follows:

- Traffic volumes along roadways within the study area will generally decrease with the roadway extensions. However, potential traffic increases to Malin Road, between PA Route 401 and Lancaster Avenue, should be addressed due to the residential properties fronting portions of this roadway segment.
- The roadway extensions will better accommodate truck and bus traffic destined to/from the industrial areas near Warren Avenue and the Malvern Train Station, as well as divert this type of traffic from residential and village streets not designed to accommodate these larger vehicle types, by providing a more convenient route.
- Intersection improvements at those intersections that provide access to the roadway extensions (i.e., Lancaster Avenue/Malin Road, Pennsylvania Avenue/Warren Avenue, and PA Route 352/Three Tun Road) will be necessary, as previously described, but these improvements are relatively minor intersection improvements compared to the scope of improvements needed throughout the overall study area to relieve existing and future traffic congestion.
- Traffic operations within the study will benefit from the potential new road linkages by removing traffic from already congested roadways. Reductions in overall intersection delay (including decreases of as much as nearly 40%) may be experienced in the study area. Some improvements such as turning lanes at intersections may be needed to accommodate turning movements associated with diverted traffic patterns resulting from the new roadways.
- The new roadway extensions will support additional development in the industrial areas along Warren Avenue and near the Malvern train station, including potential TOD scenarios being considered by the Borough, by improving access and providing additional traffic capacity.

Table 6 | Delay and Level-of-Service Comparison with Transit-Oriented Development

	Intersection		2023 No Build Conditions					Scenario 1 Malin Road Extension					Scenario 2 Malin Road & Three Tun Road Extension				
			Type	AM		PM		Type	AM		PM		Type	AM		PM	
	North/South	East/West		Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS		Delay (s)	LOS	Delay (s)	LOS
1	PA Route 352	Lancaster Avenue	Signalized	926.4	F	448.5	F	Signalized	912.1	F	452.6	F	Signalized	468.6	F	260.3	F
3	Malin Road	Lancaster Avenue	Signalized	65.9	E	98.5	F	Signalized	32.5	C	34.5	C	Signalized	39.7	C	34.8	C
6	Old Lincoln Highway	Lancaster Avenue	Signalized	165.0	F	140.7	F	Signalized	118.6	F	111.3	F	Signalized	118.6	F	111.3	F
7	Old Lincoln Highway	Old Lancaster Road	Signalized[1]	125.2	F	127.2	F	Signalized[1]	51.5	D	55.7	E	Signalized[1]	51.5	D	55.7	E
10	Warren Avenue	Pennsylvania Avenue	Unsignalized	1.8	A	2.2	A	Signalized	14.9	B	16.6	C	Signalized	21.2	B	32.1	C
11	Warren Avenue	King Street	Signalized	150.9	F	96.3	F	Signalized	50.0	D	28.5	C	Signalized	66.1	E	35.7	D

1 - With improvements.