Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: January 17, 2024

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Samantha Beaupre; 3502 Woodview Trace, Ste 150, Indianapolis, IN 46268

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:

Olio Road will be widened from a two-lane road into a four-lane boulevard. The road will consist of four 12-ft lanes with a 20-ft raised grass median. The roadway will have curb and gutter and two 10-ft multi-use paths on each side of the road. The bridge over Sand Creek (Bridge #29-00170) will be replaced as part of the project as well. The proposed bridge will consist of four 12-ft lanes with two 2-ft shoulders and two 10-ft multi-use paths. It is anticipated that the new bridge will be approximately 21 feet, 8 inches long by 52 feet wide with an out-to-out coping of 75 feet. In addition, construction of a roundabout is proposed at the intersection of 156th Street and Olio Road. Two streams, Sand Creek and UNT to Sand Creek, were identified within the investigation area. Four wetlands, Wetlands 1-4, were identified within the investigation area. Only Wetland 1 is likely jurisdictional.

(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: IN County/parish/borough: Hamilton City: Noblesville

Center coordinates of site (lat/long in degree decimal format):

Lat.: 40.0120771 Long.: -85.9190035

Universal Transverse Mercator: 592258.20 E 4429657.2517 N 16T

Name of nearest waterbody: Sand Creek

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:

☐ Field Determination. Date(s):

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
Sand Creek	40.0157201	-85.9175102	782 lft (0.12 acre)	Non-wetland	Section 404
UNT to Sand Creek	40.0163124	-85.9175102	45 lft (0.005 acre)	Non-wetland	Section 404
Wetland 1	40.0115000	-85.9190280	0.15 acre	Wetland	Section 404
Wetland 2	40.0098999º	-85.9193771	0.52 acre	Wetland	Section 404
Wetland 3	40.0083486	-85.9190860	0.01 acre	Wetland	Section 404
Wetland 4	40.0023167	-85.9188858	0.02 acre	Wetland	Section 404

1) The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.

2) In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there *"may be"* waters of the U.S. and/or that there *"may be"* navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for PJD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

- ☒ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
  Map: State Location, USGS quad, NWI, SSURGO Streamstats, Floodplain.
- ☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report. Rationale: _____.
- ☐ Data sheets prepared by the Corps: _____.
- ☐ Corps navigable waters' study: _____.
- ☒ U.S. Geological Survey Hydrologic Atlas: Hydrography_LocalRes_Flowline_Classified_NHD_IN.
  - ☒ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: USGS 1:24,000 Riverwood.
- ☒ Natural Resources Conservation Service Soil Survey. Citation: Hamilton Co. 2020 SSURGO.
- ☒ National wetlands inventory map(s). Cite name: IN_Wetlands Geodatabase.
- ☐ State/local wetland inventory map(s): _____.
- ☐ FEMA/FIRM maps: _____.
- ☒ 100-year Floodplain Elevation is: _____.(National Geodetic Vertical Datum of 1929)
- ☒ Photographs: ☒ Aerial (Name & Date): 2022 Aerial Imagery.
  or ☒ Other (Name & Date): Photos taken September 14, 2022 and October 30, 2023.
- ☐ Previous determination(s). File no. and date of response letter: _____.
- ☐ Other information (please specify): _____.

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

_____	Samantha Beaupre Digitally signed by Samantha Beaupre Date: 2024.01.17 14:53:58 -05'00'
Signature and date of Regulatory staff member completing PJD	Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

[1] Districts may establish timeframes for requestor to return signed PJD forms. If the requestor does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, LOUISVILLE DISTRICT
INDIANAPOLIS REGULATORY OFFICE
8902 OTIS AVENUE, SUITE S106B
INDIANAPOLIS, IN 46216

August 2, 2024

Regulatory Division
North Branch
ID No. LRL-2024-00481-jde

Mr. Jim Hellmann
City of Noblesville
16 South 10th Street
Noblesville, IN 46060

Dear Mr. Hellmann:

This letter is in regard to the electronic correspondence received June 24, 2024, requesting an Approved Jurisdictional Determination (AJD) on your behalf from Lochmueller Group for a 22-acre review area located at 40.0121, -85.9190 near Noblesville, Hamilton County, Indiana. A location map of the review area is enclosed.

The site was reviewed pursuant to Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899. Section 404 of the CWA requires that a Department of the Army (DA) permit be obtained for the placement or discharge of dredged and/or fill material into "waters of the United States (U.S.)," including wetlands, prior to conducting the work (33 U.S.C. 1344). Section 10 of the Rivers and Harbors Act of 1899 requires that a DA Permit be obtained for structures or work in or affecting navigable "waters of the U.S.," prior to conducting the work (33 U.S.C. 403).

Based on the information provided to this office, the site contains Wetland 2, Wetland 3, and Wetland 4 which are not considered to be "waters of the U.S." and are not regulated under Section 404 of the Clean Water Act. However, this determination does not relieve you of the responsibility to comply with applicable state law. We urge you to contact the Indiana Department of Environmental Management, Office of Water Quality at WetlandsProgram@idem.in.gov to determine the applicability of state law to your project.

This letter contains an AJD for the aforementioned site. If you object to the AJD, you may request an administrative appeal under Corps regulations at 33 C.F.R. Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and Request for Appeal (RFA) form. If you request to appeal the AJD, you must submit a completed RFA form to the Lakes and Rivers Division Office at the address listed on the enclosed NAP RFA form.

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR Part 331.5, and that it has been received by the Division Office within **60 days** of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **October 1, 2024.** It is not necessary to submit an RFA form to the Division office if you do not object to the determination in this letter.

This jurisdictional determination is valid for a period of five years from the date of this letter unless new information warrants revision of the determination before the expiration date.

The delineation included herein has been conducted to identify the location and extent of the aquatic resource boundaries and/or the jurisdictional status of aquatic resources for purposes of the Clean Water Act for the particular site identified in this request. This delineation and/or jurisdictional determination may not be valid for the Wetland Conservation Provisions of the Food Security Act of 1985, as amended. If you or your tenant are USDA program participants, or anticipate participation in USDA programs, you should discuss the applicability of a certified wetland determination with the local USDA service center prior to starting work.

If we can be of any further assistance, please contact me by calling 317-543-9424 or emailing Justin.D.Eshelman@usace.army.mil. Any correspondence on this matter should refer to our ID Number LRL-2024-00481-jde.

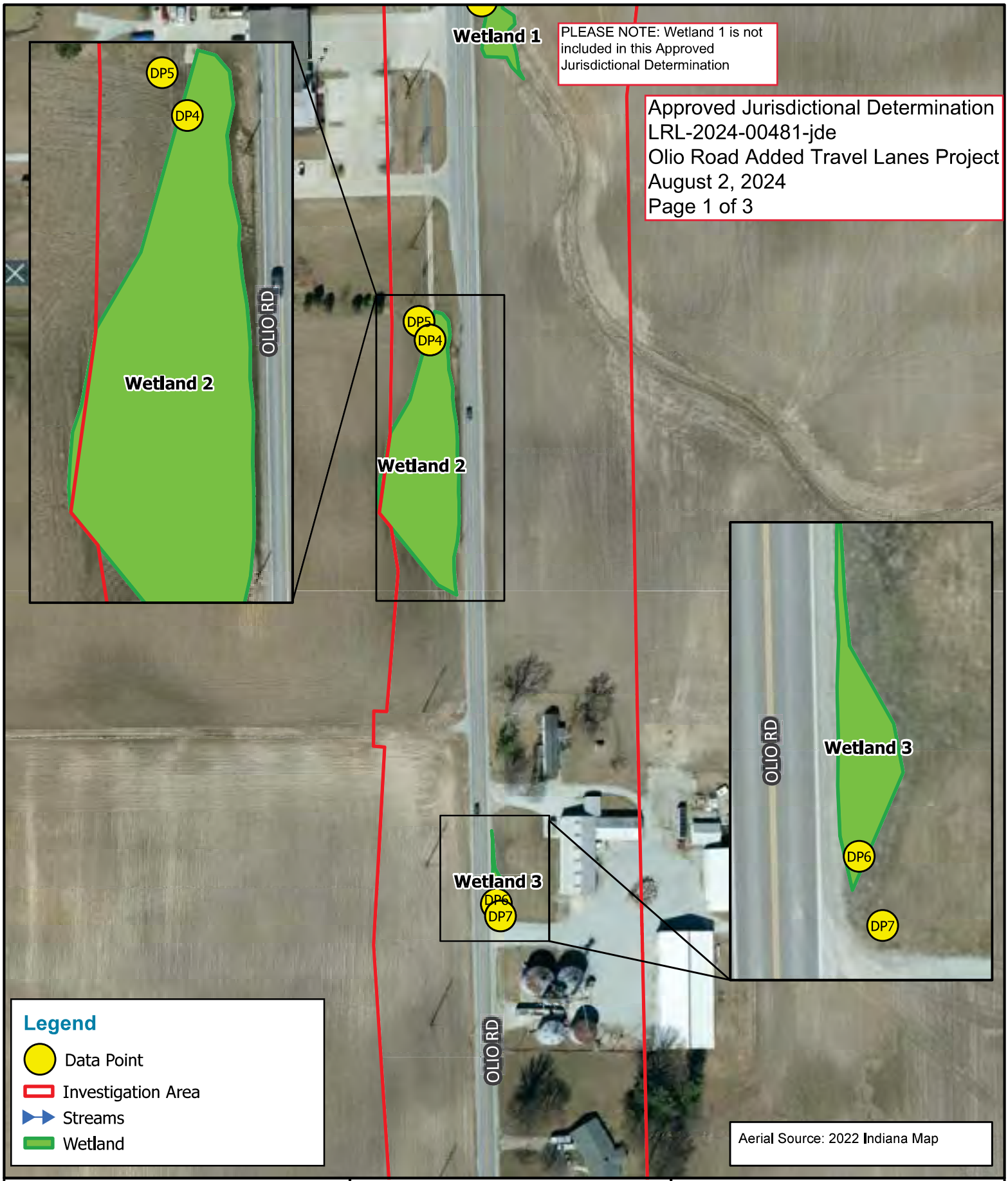
Sincerely,

Date:
2024.08.02
11:52:55 -04'00'

Justin Eshelman
Project Manager
Indianapolis Regulatory Office

Enclosures

Copy Furnished: IDEM (Harriman)
Lochmueller Group (Duncan)



LOCHMUELLER GROUP
3502 Woodview Trace, Suite 150
Indianapolis, IN 46268
Phone: (317) 222-3880
Fax: (317) 222-3881

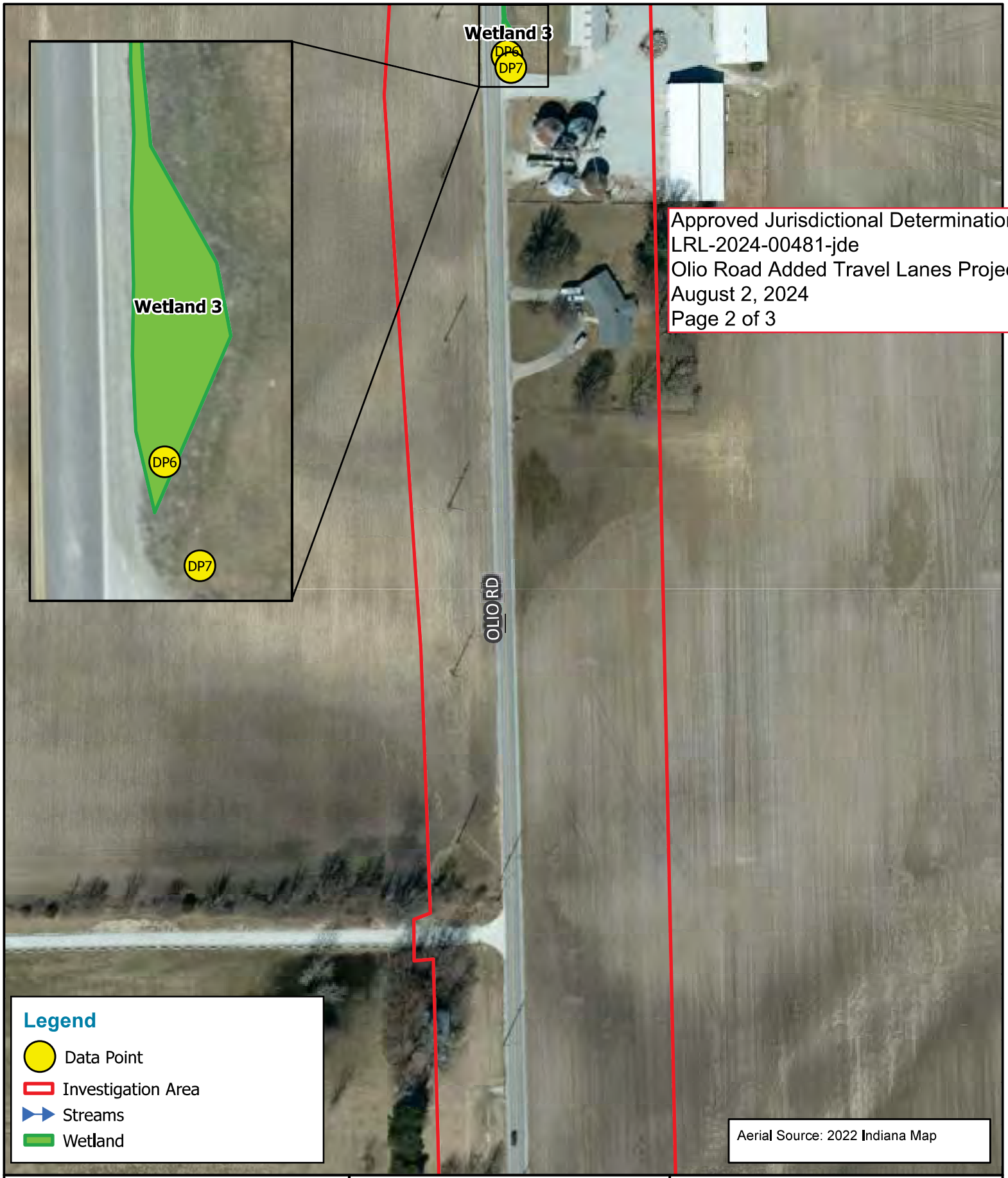
Water Resources Map
Des. No. 2101733
Waters of the U.S. Report

0 100 200 Feet

N

County: Hamilton
Township: Wayne Page Number: 4 of 6
State: Indiana

Olio Road, 146th St to 156th St
Added Travel Lanes
Created: 11/15/2023, SBeaupre



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Water Resources Map
Des. No. 2101733
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0 100 200 Feet

N

County: Hamilton
Township: Wayne Page Number: 5 of 6
State: Indiana

Olio Road, 146th St to 156th St
Added Travel Lanes
Created: 11/15/2023, SBeaupre

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Water Resources Map
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Waters of the U.S. Report

0 100 200 Feet

N

County: Hamilton
Township: Wayne Page Number: 6 of 6
State: Indiana

Olio Road, 146th St to 156th St
Added Travel Lanes
Created: 1/16/2024, SBeaupre

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: City of Noblesville	File Number: LRL-2024-481	Date: 08/02/2024
Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL WITHOUT PREJUDICE	C
	PERMIT DENIAL WITH PREJUDICE	D
X	APPROVED JURISDICTIONAL DETERMINATION	E
	PRELIMINARY JURISDICTIONAL DETERMINATION	F

SECTION I

The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at https://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/appeals/ or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C. PERMIT DENIAL WITHOUT PREJUDICE: Not appealable
You received a permit denial without prejudice because a required Federal, state, and/or local authorization and/or certification has been denied for activities which also require a Department of the Army permit before final action has been taken on the Army permit application. The permit denial without prejudice is not appealable. There is no prejudice to the right of the applicant to reinstate processing of the Army permit application if subsequent approval is received from the appropriate Federal, state, and/or local agency on a previously denied authorization and/or certification.

D: PERMIT DENIAL WITH PREJUDICE: You may appeal the permit denial
You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information for reconsideration

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice means that you accept the approved JD in its entirety and waive all rights to appeal the approved JD.

- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

- RECONSIDERATION: You may request that the district engineer reconsider the approved JD by submitting new information or data to the district engineer within 60 days of the date of this notice. The district will determine whether the information submitted qualifies as new information or data that justifies reconsideration of the approved JD. A reconsideration request does not initiate the appeal process. You may submit a request for appeal to the division engineer to preserve your appeal rights while the district is determining whether the submitted information qualifies for a reconsideration.

F: PRELIMINARY JURISDICTIONAL DETERMINATION: Not appealable
You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also, you may provide new information for further consideration by the Corps to reevaluate the JD.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision you may contact:
Justin Eshelman
U.S. Army Corps of Engineers – Louisville District
Indianapolis Regulatory Office
8902 Otis Avenue, S106B
Indianapolis, IN 46216
Office Phone: 317-543-9424
e-mail: Justin.D.Eshelman@usace.army.mil

If you have questions regarding the appeal process, or to submit your request for appeal, you may contact:
Katherine A. McCafferty
Regulatory Administrative Appeals Officer
U.S. Army Corps of Engineers,
Great Lakes and Ohio River Division
550 Main Street, Room 10780
Cincinnati, Ohio 45202-3222
Office Phone: 513-684-2699, FAX: 513-684-2460
e-mail: katherine.a.mccafferty@usace.army.mil

SECTION II – REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. Use additional pages as necessary. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15-day notice of any site investigation and will have the opportunity to participate in all site investigations.

_____ Signature of appellant or agent.	Date:
Email address of appellant and/or agent:	Telephone number:

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, LOUISVILLE DISTRICT
8902 OTIS AVENUE, SUITE S106B
INDIANAPOLIS, IN 46216

CELRL - RDN 02 August 2024

MEMORANDUM FOR RECORD

SUBJECT: US Army Corps of Engineers (Corps) Pre-2015 Regulatory Regime Approved Jurisdictional Determination in Light of *Sackett v. EPA*, 143 S. Ct. 1322 (2023) ,[1] LRL-2024-00481-jde.

BACKGROUND. An Approved Jurisdictional Determination (AJD) is a Corps document stating the presence or absence of waters of the United States on a parcel or a written statement and map identifying the limits of waters of the United States on a parcel. AJDs are clearly designated appealable actions and will include a basis of JD with the document.[2] AJDs are case-specific and are typically made in response to a request. AJDs are valid for a period of five years unless new information warrants revision of the determination before the expiration date or a District Engineer has identified, after public notice and comment, that specific geographic areas with rapidly changing environmental conditions merit re-verification on a more frequent basis.[3] For the purposes of this AJD, we have relied on section 10 of the Rivers and Harbors Act of 1899 (RHA),[4] the Clean Water Act (CWA) implementing regulations published by the Department of the Army in 1986 and amended in 1993 (references 2.a. and 2.b. respectively), the 2008 *Rapanos-Carabell* guidance (reference 2.c.), and other applicable guidance, relevant case law and longstanding practice, (collectively the pre-2015 regulatory regime), and the *Sackett* decision (reference 2.d.) in evaluating jurisdiction.

This Memorandum for Record (MFR) constitutes the basis of jurisdiction for a Corps AJD as defined in 33 CFR §331.2. The features addressed in this AJD were evaluated consistent with the definition of "waters of the United States" found in the pre-2015 regulatory regime and consistent with the Supreme Court's decision in *Sackett*. This AJD did not rely on the 2023 "Revised Definition of 'Waters of the United States,'" as amended on 8 September 2023 (Amended 2023 Rule) because, as of the date of this decision, the Amended 2023 Rule is not applicable in Indiana due to litigation.

1. SUMMARY OF CONCLUSIONS.

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[1] While the Supreme Court's decision in *Sackett* had no effect on some categories of waters covered under the CWA, and no effect on any waters covered under RHA, all categories are included in this Memorandum for Record for efficiency.
[2] 33 CFR 331.2.
[3] Regulatory Guidance Letter 05-02.
[4] USACE has authority under both Section 9 and Section 10 of the Rivers and Harbors Act of 1899 but for convenience, in this MFR, jurisdiction under RHA will be referred to as Section 10.

a. Provide a list of each individual feature within the review area and the jurisdictional status of each one (i.e., identify whether each feature is/is not a water of the United States and/or a navigable water of the United States).

i. Wetland 2 is not a water of the U.S. or a navigable water of the U.S.

ii. Wetland 3 is not a water of the U.S. or a navigable water of the U.S.

iii. Wetland 4 is not a water of the U.S. or a navigable water of the U.S.

2. REFERENCES.

a. Final Rule for Regulatory Programs of the Corps of Engineers, 51 FR 41206 (November 13, 1986).

b. Clean Water Act Regulatory Programs, 58 FR 45008 (August 25, 1993).

c. U.S. EPA & U.S. Army Corps of Engineers, Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States & Carabell v. United States* (December 2, 2008)

d. *Sackett v. EPA*, 598 U.S. _, 143 S. Ct. 1322 (2023)

3. REVIEW AREA. An approximately 22-acre review area located at 40.0121, -85.9190 near Noblesville, Hamilton County, Indiana. See attached AJD Map.

4. NEAREST TRADITIONAL NAVIGABLE WATER (TNW), INTERSTATE WATER, OR THE TERRITORIAL SEAS TO WHICH THE AQUATIC RESOURCE IS CONNECTED. N/A. The subject aquatic resources are not connected to a TNW, interstate water, or the territorial seas.

5. FLOWPATH FROM THE SUBJECT AQUATIC RESOURCES TO A TNW, INTERSTATE WATER, OR THE TERRITORIAL SEAS. N/A. The subject aquatic resources do not flow to a TNW, interstate water, or the territorial seas.

6. SECTION 10 JURISDICTIONAL WATERS[5]: Describe aquatic resources or other features within the review area determined to be jurisdictional in accordance with

[5] 33 CFR 329.9(a) A waterbody which was navigable in its natural or improved state, or which was susceptible of reasonable improvement (as discussed in § 329.8(b) of this part) retains its character as "navigable in law" even though it is not presently used for commerce, or is presently incapable of such use because of changed conditions or the presence of obstructions.

Section 10 of the Rivers and Harbors Act of 1899. Include the size of each aquatic resource or other feature within the review area and how it was determined to be jurisdictional in accordance with Section 10.[6] N/A

7. SECTION 404 JURISDICTIONAL WATERS: Describe the aquatic resources within the review area that were found to meet the definition of waters of the United States in accordance with the pre-2015 regulatory regime and consistent with the Supreme Court's decision in *Sackett*. List each aquatic resource separately, by name, consistent with the naming convention used in section 1, above. Include a rationale for each aquatic resource, supporting that the aquatic resource meets the relevant category of "waters of the United States" in the pre-2015 regulatory regime. The rationale should also include a written description of, or reference to a map in the administrative record that shows, the lateral limits of jurisdiction for each aquatic resource, including how that limit was determined, and incorporate relevant references used. Include the size of each aquatic resource in acres or linear feet and attach and reference related figures as needed.

   a. TNWs (a)(1): N/A

   b. Interstate Waters (a)(2): N/A

   c. Other Waters (a)(3): N/A

   d. Impoundments (a)(4): N/A

   e. Tributaries (a)(5): N/A

   f. The territorial seas (a)(6): N/A

   g. Adjacent wetlands (a)(7): N/A

8. NON-JURISDICTIONAL AQUATIC RESOURCES AND FEATURES

   a. Describe aquatic resources and other features within the review area identified as "generally non-jurisdictional" in the preamble to the 1986 regulations (referred to as "preamble waters").[7] Include size of the aquatic resource or feature within

[6] This MFR is not to be used to make a report of findings to support a determination that the water is a navigable water of the United States. The district must follow the procedures outlined in 33 CFR part 329.14 to make a determination that water is a navigable water of the United States subject to Section 10 of the RHA.
[7] 51 FR 41217, November 13, 1986.

the review area and describe how it was determined to be non-jurisdictional under the CWA as a preamble water. N/A

b. Describe aquatic resources and features within the review area identified as "generally not jurisdictional" in the *Rapanos* guidance. Include size of the aquatic resource or feature within the review area and describe how it was determined to be non-jurisdictional under the CWA based on the criteria listed in the guidance.

- Wetland 3 is a 0.01-acre emergent wetland that developed within and is fully contained to a roadside ditch. The wetland is located within a ditch along the east side of Olio Road adjacent to a residential lawn. The roadside ditch was excavated in dry land, drains only dry land, and does not carry relatively permanent water. As such, Wetland 3 is not a water of the U.S.

- Wetland 4 is a 0.02-acre emergent wetland that developed within and is fully contained to a roadside ditch. The wetland is located within a ditch along the east side of Olio Road adjacent to an agricultural field. The roadside ditch was excavated in dry land, drains only dry land, and does not carry relatively permanent water. As such, Wetland 4 is not a water of the U.S.

c. Describe aquatic resources and features identified within the review area as waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA. Include the size of the waste treatment system within the review area and describe how it was determined to be a waste treatment system. N/A

d. Describe aquatic resources and features within the review area determined to be prior converted cropland in accordance with the 1993 regulations (reference 2.b.). Include the size of the aquatic resource or feature within the review area and describe how it was determined to be prior converted cropland. N/A

e. Describe aquatic resources (i.e. lakes and ponds) within the review area, which do not have a nexus to interstate or foreign commerce, and prior to the January 2001 Supreme Court decision in "*SWANCC*," would have been jurisdictional based solely on the "Migratory Bird Rule." Include the size of the aquatic resource or feature, and how it was determined to be an "isolated water" in accordance with *SWANCC*. N/A

f. Describe aquatic resources and features within the review area that were determined to be non-jurisdictional because they do not meet one or more categories of waters of the United States under the pre-2015 regulatory regime consistent with the Supreme Court's decision in *Sackett* (e.g., tributaries that are

non-relatively permanent waters; non-tidal wetlands that do not have a continuous surface connection to a jurisdictional water).

- Wetland 2 is a 0.52-acre emergent wetland that does not have a continuous surface connection to a jurisdictional water. The wetland is located within an isolated depression along the west side of Olio Road within an existing agricultural field. No potential connections to other waters were found during the delineation or identified on LiDAR and aerial imagery. As such, Wetland 2 is not a water of the U.S.

9. DATA SOURCES. List sources of data/information used in making determination. Include titles and dates of sources used and ensure that information referenced is available in the administrative record.

   a. Office evaluation conducted on 7/18/2024 and 07/22/2024.

   b. Olio Road Added Travel Lanes Final Waters of the U.S. Report dated January 17, 2024 (Includes Location Map; USGS Quad and HUC12 Maps; USDA SSURGO Soils Map; 2018 Aerial and NWI Map; StreamStats Watershed Map; BA Flood Hazard & NHD Line Map; 2022 Aerial Imagery Maps; Site photos dated 09/14/2022 and 10/30/2023; Wetland Determination Data Forms dated 09/14/2022).

   c. LRL-2024-00481-jde LiDAR accessed from NRV on 07/18/2024.

10. OTHER SUPPORTING INFORMATION.

    United States v. Cundiff, 555 F.3d 200 (6th Cir.), cert. denied, 130 S. Ct. 74 (2009)

11. NOTE: The structure and format of this MFR were developed in coordination with the EPA and Department of the Army. The MFR's structure and format may be subject to future modification or may be rescinded as needed to implement additional guidance from the agencies; however, the approved jurisdictional determination described herein is a final agency action.

Categorical Exclusion

Appendix G

Public Involvement

THE CITY OF
NOBLESVILLE
EST. 1823

August 18, 2022

Sample Notice of Survey

Property Owner

VIA USPS

RE: Notice of Survey
Roadway Improvements on Olio Road from just north of 146th Street to 156th Street

The City of Noblesville has identified the above stated as needing improvements and has been awarded federal aid funds for Olio Road between 146th Street and 156th Street. Therefore, we are starting the design process for the roadway segment and intersection of 156th Street and Olio Road.

Our records indicate you have property near the project. We are in the very beginning, so we do not know exactly what the improvements will look like, but are happy to answer any questions you may have.

Please do not hesitate to contact me at the information below. You are also welcome to contact the design team at Lochmueller Group or United Consulting. Their contact information is in the attached letter.

Sincerely,

Jim Hellmann, PE
Assistant City Engineer
jhellmann@noblesville.in.us
Ph: 317-776-6330

Enclosures: Survey Notice Letter
Approximate Survey Limits Map

UNITED Consulting

ENGINEERING
ENVIRONMENTAL
INSPECTION
LAND SURVEYING
LAND ACQUISITION
PLANNING
WATER & WASTEWATER
SINCE 1965

OFFICERS
Steven W. Jones
Christopher R. Pope, PE
B. Keith Bryant, PE
Michael A. Rowe, PE
Jon E. Clodfelter, PE
Paul D. Glotzbach, PE

PROFESSIONAL STAFF
Andrew T. Wolka, PE
Devin L. Stettler, AICP
Michael S. Oliphant, AICP
Timothy J. Coomes, PLS
Steven R. Passey, PE
Brian J. Pierson, PE
Christopher L. Hammond, PE
Brian S. Frederick, PE
Jay N. Ridens, PE
Christopher J. Dyer, PE
Jeromy A. Richardson, PE
Heather E. Kilgour, PE
Adam J. Greulich, PLS
Caleb C. Ross, PE
Dann C. Barrett, PE
Scott G. Minnich, PE
Michael D. Farrell, CPA
Kelton S. Cunningham, PE
Braun S. Rodgers, PE
Chris J. Andrzejewski, PE
Eric S. Hamed, PE
Andrew J. Allison, PE
Abigail I. Browder, PE
Gretchen A. Meyer, PE
Brian S. Haefliger, PE
Ricardo J. Paredes, PE
Corbin A. Schwiebert, PE
Hogan W. Sills, PE
Rob B. Iversen, PE
Jeffrey E. Lazzell, PE
Kyle D. Kent, PE
John D. SanGiorgio, PE
Troy A. Casey, PE
Michael D. Labitzke, PE
Mitchell D. Lankford, PE
Joy L. Bosse, PE

8440 Allison Pointe Blvd., Suite 200, Indianapolis, IN 46250 (317) 895-2585 www.ucindy.com

August 18, 2022

RE: Olio Road (Des. No. 2101733) – from 146th Street to 156th Street
Design Survey
Noblesville, Indiana

Sample Notice of Survey

Dear Property Owner:

County records indicate that you own or occupy property near this potential roadway improvement project. We have been retained by the City of Noblesville for this project and our employees will be doing a field survey of the project area in the upcoming weeks. It may be necessary for them to come onto your property to complete the survey work. They will show you their identification, if you are available, before coming on to your property. If you have sold this property, or it is occupied by someone else, please let us know the name and address of the new owner or current occupant so we can contact them about the survey.

At this stage, we generally do not know what effect, if any, the project may eventually have on your property. If it is determined later that your property is involved, you will be contacted with additional information.

This survey work will include mapping the location of such features as streets, utilities, buildings, trees, fences, drives, obtaining ground elevations, identifying wetlands, archaeological resources, historic sites and other environmental resources. This work is needed for the proper planning and design of this roadway improvement project.

Please be assured of our sincere desire to cause you as little inconvenience as possible during this survey. If you have any questions or concerns, please contact the undersigned, or the Project Manager, Beth Carter at Lochmueller Group, at (317) 334-6822.

Sincerely,
UNITED CONSULTING

Tim Coomes, PLS
Manager, Survey Dept.

C: File (22-421), J. Hellman

Categorical Exclusion

Appendix H

Air Quality

LOG INTO MiTIP

Planning the Transportation Future for the Indianapolis Region

About | **Fed Approved 24-27 IRTIP** | IRTIP Amendments | 18 Month Letting List | Advanced Search | Projects by County | Map

Indianapolis Regional Transportation Improvement Program (IRTIP)

ID 2101733 Lead Agency All Project Category All Road System All Route All **Reset**

1 transportation project(s) **Export to Excel**

ID	Lead Agency	Title	Project Category	Total Cost	Fed Funds - Info
2101733	Noblesville	Olio Rd Added Travel Lanes from 146th St to 156th St	Road	$14,289,211	STBG Group III

Click here for MPO website

Project Overview | Funding History | Amendment History

<<Go Back

Olio Rd Added Travel Lanes from 146th St to 156th St (2101733)

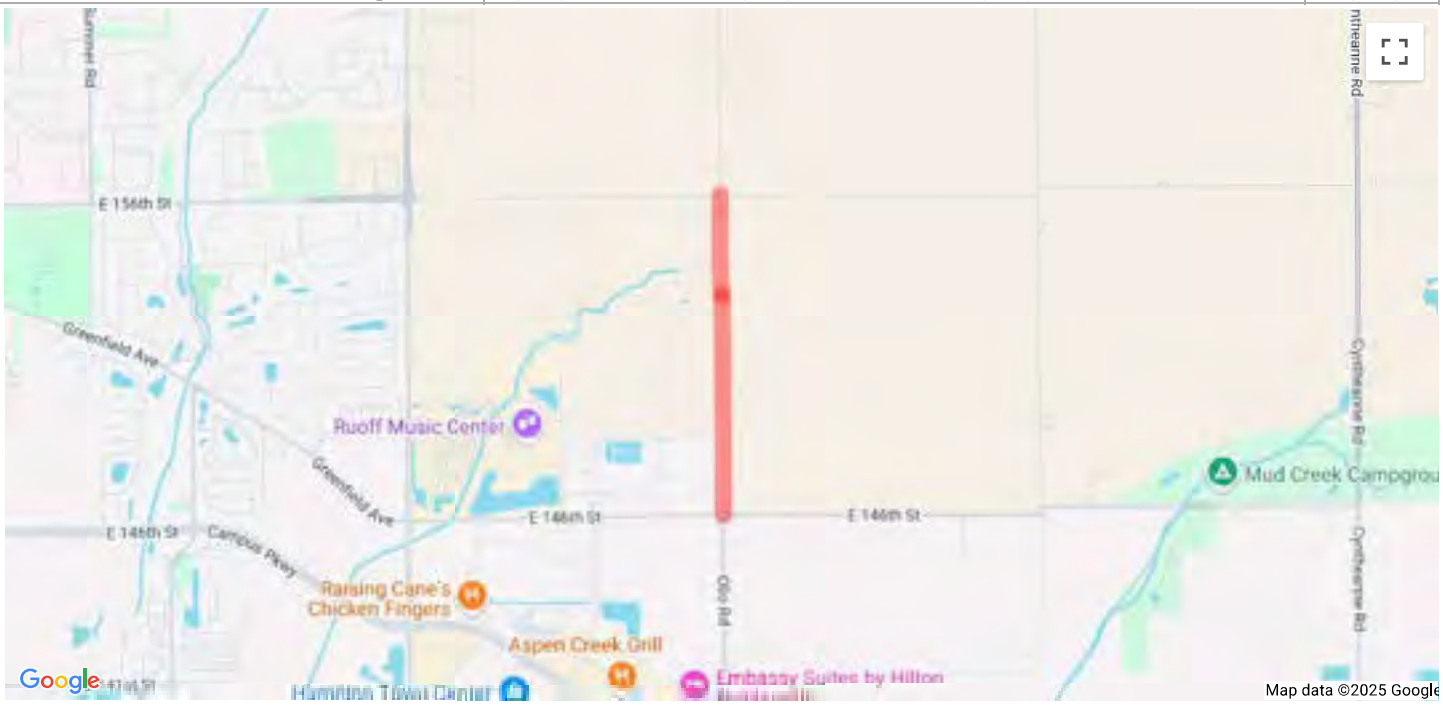
Des Number	2101733	*Amendment*	24-10.2 LOCAL	*Exempt Category*	Non-Exempt	*Est Total Project Cost*	$14,289,211
Lead Agency	Noblesville	*Contact (ERC)*		*INDOT District*	Greenfield	*County*	Hamilton
Project Type	Existing Roadway Widening	*Letting Date*		*Functional Classification*		*Bike/Ped Component(s)*	No
Seconday Des Number							

Title Olio Rd Added Travel Lanes from 146th St to 156th St

Limits From 146th to 156th of Distance (mile) 0.9

Description Extend Olio Road as a four lane roadway from the existing roundabout at 146th Street to just 200' short of 156th Street. Federal Aid awarded funding did not include money for trails.

Phase	Fund Source	Prior SFY	SFY2024	SFY2025	SFY2026	SFY2027	SFY2028	Future SFY	Total
PE	LOCAL - General fund, property taxes	$1,620,000	-	-	-	-	-	-	$1,620,000
	Total Preliminary Engineering	$1,620,000	-	-	-	-	-	-	$1,620,000
RW	FEDERAL - STBG Group III	-	-	$1,264,000	-	-	-	-	$1,264,000
RW	LOCAL - General fund, property taxes	-	-	$336,000	-	-	-	-	$336,000
	Total Right of Way	-	-	$1,600,000	-	-	-	-	$1,600,000
CN	FEDERAL - STBG Group III	-	-	-	-	$6,446,202	-	-	$6,446,202
CN	LOCAL - General fund, property taxes	-	-	-	-	$3,428,259	-	-	$3,428,259
	Total Construction	-	-	-	-	$9,874,461	-	-	$9,874,461
CE	LOCAL - General fund, property taxes	-	-	-	-	$1,194,750	-	-	$1,194,750
	Total Construction Engineering	-	-	-	-	$1,194,750	-	-	$1,194,750
	Total Programmed	**$1,620,000**	**-**	**$1,600,000**	**-**	**$11,069,211**	**-**	**-**	**$14,289,211**



Categorical Exclusion

Appendix I

Other

Land and Water Conservation Fund (LWCF) County Property List for Indiana (Last Updated March 2022)

ProjectNumber	SubProjectCode	County	Property
1800017	1800017	Hamilton	Forest Park & Trail, White River Access Site
1800058	1800058	Hamilton	Forest Park & Trail, White River Access Site
1800128	1800128	Hamilton	Morse Park & Beach
1800198	1800198	Hamilton	Cicero Community Park
1800236	1800236	Hamilton	Forest Park & Trail, White River Access Site
1800493	1800493	Hamilton	Flowing Well Park
1800502	1800502	Hamilton	Cool Creek County Park
1800519	1800519	Hamilton	Taylor Property
1800551	1800551	Hamilton	MacGregor Park
1800581	1800581	Hamilton	MacGregor Park

*Park names may have changed. If acquisition of publically owned land or impacts to publically owned land is anticipated, coordination with IDNR, Division of Outdoor Recreation, should occur.

This analysis was performed for this project prior to the issuance of recent Executive Orders (EO) from January 2025, including EO 14154, EO 14148, and EO 14173. As such, this analysis is included for transparency but is no longer applicable to the impacts analysis for federal projects and this impact was not considered in the federal decision.

Des. No. 2101733: Olio Road Added Travel Lanes Project
Draft Environmental Justice (EJ) Analysis

March 13, 2024

Environmental Justice Analysis

Under FHWA Order 6640.23A, FHWA and the project sponsor, as a recipient of funding from FHWA, are responsible to ensure that their programs, policies, and activities do not have a disproportionately high and adverse effect on minority or low-income populations. Per the current INDOT Categorical Exclusion Manual, an Environmental Justice (EJ) analysis is required for any project requiring two or more relocations or more than 0.5 acre of new permanent right-of-way (ROW). Because the project is expected to require more than 0.5 acre of new permanent ROW (approximately 15.7 acres) an EJ analysis was conducted.

Potential EJ impacts are detected by locating minority populations and low-income populations in and near the project area, calculating their percentage in the area relative to a reference population to determine if, in fact, populations of EJ concern do exist, and determining whether there will be disproportionate adverse impacts to them. The reference population may be a county, city, or town that houses the project area and is called the community of comparison (COC). For this project, the COC is Hamilton County. The community that overlaps the project limits is called the affected community (AC). For this project, AC 1 is Census Tract 1101.01 and AC 2 is Census Tract 1101.02 in Hamilton County.

An AC has a population of concern for EJ if the population is more than 50% low-income or minority or if the low-income population or minority population is greater than 125% of the population in the COC. A review of American Community Survey five-year estimates data (2018-2022) was completed on January 15, 2024. The data was obtained from the U.S. Census Bureau's webpage (https://data.census.gov/). The data collected for minority and low-income populations within the AC's are summarized in the below table.

3502 Woodview Trace, Suite 150
Indianapolis, Indiana 46268
PHONE: 317.222.3880 • TOLL FREE: 888.830.6977

	COC	AC 1	AC 2
	Hamilton County, Indiana	Census Tract 1101.01, Hamilton County, Indiana	Census Tract 1101.02, Hamilton County, Indiana
LOW-INCOME POPULATION			
Total Population for Whom Poverty Status is Determined	347,349	8,880,	4,329
Total Population Below Poverty Level	14,697	1,125	161
Percent Low-Income	4.2%	12.7%	3.7%
125 Percent of COC	5.3%		
AC Percent Low-Income Greater Than 125 Percent of COC?		Yes	No
AC Percent Low-Income Greater Than 50 Percent?		No	No
Population of EJ Concern?		Yes	No
MINORITY POPULATION			
Total Population	349,527	8,917	4,329
Minority Population	65,762	2,367	322
Percent Minority	18.8%	26.5%	7.4%
125 Percent of COC	23.5%		
AC Percent Minority Greater Than 125 Percent of COC?		Yes	No
AC Percent Minority Greater Than 50 Percent?		No	No
Population of EJ Concern?		Yes	No

Low-Income Population Summary

AC-1, Census Tract 1101.01, has a percent low-income of 12.7%, which is below 50% and is above the 125% COC threshold (5.3%). AC-2, Census Tract 1101.02, has a percent low-income of 3.7%, which is below 50% and is below the 125% COC threshold. Therefore, AC-1 has a low-income population of EJ Concern.

Minority Population Summary

AC-1, Census Tract 1101.01, has a percent minority of 26.5%, which is below 50% and is above the 125% COC threshold (23.5%). AC-2, Census Tract 1101.02, has a percent minority of 7.4%, which is below 50% and is below the 125% COC threshold. Therefore, AC-1 has a minority population of EJ Concern.

The proposed project is expected to require the acquisition of approximately 15.7 acres of permanent ROW. Within AC-1, 7.85 acres of permanent ROW will be acquired. Within AC-2, 7.85 acres of permanent ROW will be acquired. Land use within the proposed permanent ROW consists of residential and agricultural land use. Overall, the negative impacts to property owners within the project area will be minimal and consist primarily of short-term construction impacts and the loss of strip ROW. No relocations are

anticipated. The ROW to be acquired will not substantially diminish the existing use by the affected property owners.

The maintenance of traffic (MOT) is anticipated to involve a closure of Olio Road and a detour. The detour will utilize 146th Street, Boden Road, and 166th Street. The length of the detour is 4 miles, and the added travel time is approximately 7 minutes. The MOT impacts to the EJ population and non-EJ population will be temporary and will cease after construction. Property owners will be provided access throughout the duration of the project to reduce impacts as much as possible. No permanent impacts to community cohesion are anticipated.

Impacts from the project to any EJ community in this area will be beneficial due to providing adequate capacity for the projected vehicular demand and sufficient geometric design for a major collector roadway. It is expected the project will not have a disproportionately high and adverse environmental or health impact to low-income or minority populations of EJ concern when compared to non-EJ populations.

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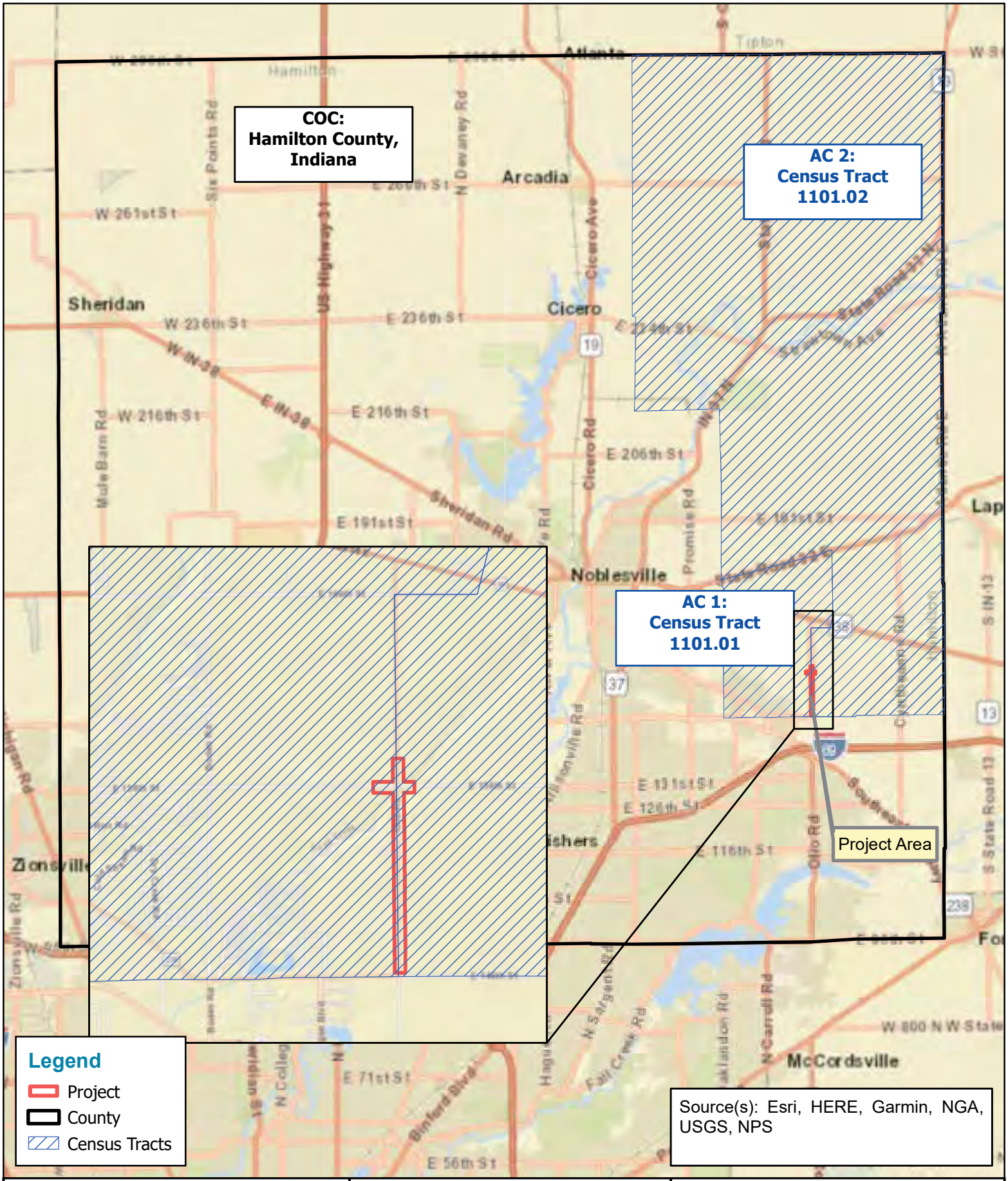

LOCHMUELLER GROUP

3502 Woodview Trace, Suite 150
Indianapolis, IN 46268
Phone: (317) 222-3880
Fax: (317) 222-3881

EJ Analysis Map

Des. No. 2101733

County: Hamilton
Township: Wayne
State: Indiana

0 2.25 4.5 Miles

N

Olio Road, 146th St to 156th St
Added Travel Lanes
Created: 3/13/2024, SBeaupre

Olio Road Added Travel Lanes Project - EJ Analysis

		COC	AC 1	AC 2
		Hamilton County, Indiana	Census Tract 1101.01, Hamilton County, Indiana	Census Tract 1101.02, Hamilton County, Indiana
	LOW INCOME			
B17001001	Population for whom poverty status is determined: Total	347,349	8,880	4,329
B17001002	Population for whom poverty status is determined: Income in past 12 months below poverty level	14,697	1,125	161
	Percent Low-Income	**4.2%**	**12.7%**	**3.7%**
	125% Reference Increment (Applied to COC Only and Compared Against the AC)	**5.3%**	**AC > 125% COC**	**AC < 125% COC**
	AC Percent Low-Income > 125% of COC?		**YES**	**NO**
	AC Percent Low-Income > 50%?		**NO**	**NO**
	Elevated Low-Income Population Present?		**YES**	**NO**
	MINORITY			
B03002001	Total Population: Total	349,527	8,917	4,329
B03002002	Total Population: Not Hispanic or Latino	333,867	8,379	4,140
B03002003	Total Population: Not Hispanic or Latino; White Alone	283,765	6,550	4,007
B03002004	Total Population: Not Hispanic or Latino; Black or African American Alone	14,118	543	11
B03002005	Total Population: Not Hispanic or Latino; American Indian or Alaska Native Alone	130	18	0
B03002006	Total Population: Not Hispanic or Latino; Asian Alone	22,566	78	10
B03002007	Total Population: Not Hispanic or Latino; Native Hawaiian and Other Pacific Islander Alone	139	0	18
B03002008	Total Population: Not Hispanic or Latino; Some Other Race Alone	1913	0	0
B03002009	Total Population: Not Hispanic or Latino; Two or More Races	11,236	1190	94
B03002010	Total Population: Hispanic or Latino	15,660	538	189
B03002011	Total Population: Hispanic or Latino; White Alone	7,115	382	189
B03002012	Total Population: Hispanic or Latino; Black or African American Alone	142	0	0
B03002013	Total Population: Hispanic or Latino; American Indian or Alaska Native Alone	126	0	0
B03002014	Total Population: Hispanic or Latino; Asian Alone	0	0	0
B03002015	Total Population: Hispanic or Latino; Native Hawaiian and Other Pacific Islander Alone	0	0	0
B03002016	Total Population: Hispanic or Latino; Some Other Race Alone	2,304	39	0
B03002017	Total Population: Hispanic or Latino; Two or More Races	5973	117	0
	Number Non-White / Minority (Sum B03002004 thru B03002010)	**65,762**	**2,367**	**322**
	Percent Non-White / Minority	**18.8%**	**26.5%**	**7.4%**
	125% Reference Increment (Applied to COC Only and Compared Against the AC)	**23.5%**	**AC > 125% COC**	**AC < 125% COC**
	AC Percent Minority > 125% of COC?		**YES**	**NO**
	AC Percent Minority > 50%?		**NO**	**NO**
	Elevated Minority Population Present?		**YES**	**NO**

	Hamilton County, Indiana		Census Tract 1101.01; Hamilton County; Indiana		Census Tract 1101.02; Hamilton County; Indiana	
Label	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error
Total:	347,349	±344	8,880	±585	4,329	±678
Income in the past 12 months below poverty level:	14,697	±1,608	1,125	±697	161	±150
Male:	5,911	±633	330	±252	86	±90
Under 5 years	482	±157	108	±112	0	±13
5 years	177	±140	0	±18	9	±15
6 to 11 years	1,016	±302	44	±58	10	±15
12 to 14 years	255	±112	0	±18	0	±13
15 years	116	±102	0	±18	15	±23
16 and 17 years	129	±84	0	±18	0	±13
18 to 24 years	667	±234	0	±18	24	±41
25 to 34 years	608	±224	52	±73	0	±13
35 to 44 years	723	±242	82	±118	18	±21
45 to 54 years	691	±183	44	±55	0	±13
55 to 64 years	467	±211	0	±18	10	±15
65 to 74 years	306	±118	0	±18	0	±13
75 years and over	274	±141	0	±18	0	±13
Female:	8,786	±1,223	795	±483	75	±66
Under 5 years	396	±187	53	±62	0	±13
5 years	98	±80	0	±18	0	±13
6 to 11 years	690	±296	9	±19	0	±13
12 to 14 years	440	±191	138	±131	8	±14
15 years	70	±67	0	±18	0	±13
16 and 17 years	302	±129	100	±102	0	±13
18 to 24 years	1,382	±408	28	±50	30	±37
25 to 34 years	1,272	±367	126	±101	18	±19
35 to 44 years	1,125	±360	75	±106	9	±15
45 to 54 years	757	±249	8	±18	0	±13
55 to 64 years	1,092	±295	142	±134	10	±16
65 to 74 years	530	±190	78	±103	0	±13
75 years and over	632	±223	38	±58	0	±13
Income in the past 12 months at or above poverty level:	332,652	±1,729	7,755	±847	4,168	±675
Male:	165,289	±715	3,680	±492	2,224	±410
Under 5 years	10,194	±175	218	±115	73	±98
5 years	2,491	±434	155	±154	131	±104
6 to 11 years	15,211	±793	452	±224	112	±70
12 to 14 years	7,697	±725	5	±14	78	±73
15 years	2,826	±542	16	±55	8	±16
16 and 17 years	5,476	±542	80	±91	72	±78
18 to 24 years	13,748	±249	442	±337	200	±158
25 to 34 years	19,390	±229	1,019	±273	151	±136
35 to 44 years	24,911	±245	441	±134	284	±128
45 to 54 years	24,141	±179	399	±135	363	±157
55 to 64 years	19,800	±224	171	±97	426	±298
65 to 74 years	12,728	±193	282	±140	206	±118
75 years and over	6,676	±186	0	±18	120	±174
Female:	167,363	±1,270	4,075	±551	1,944	±377
Under 5 years	9,919	±204	448	±192	32	±43
5 years	2,145	±417	70	±63	5	±10
6 to 11 years	14,570	±881	339	±138	134	±79
12 to 14 years	7,653	±733	78	±64	54	±44
15 years	2,872	±367	0	±18	43	±54
16 and 17 years	4,993	±349	19	±27	68	±68
18 to 24 years	12,513	±408	449	±260	142	±96
25 to 34 years	19,676	±367	1,161	±279	232	±146
35 to 44 years	25,669	±349	354	±145	253	±96
45 to 54 years	23,820	±269	579	±233	262	±113
55 to 64 years	19,925	±303	364	±176	473	±325
65 to 74 years	14,135	±227	162	±136	74	±61
75 years and over	9,473	±267	52	±95	172	±151

Poverty Status in the Past 12 Months by Sex by Age

United States Census Bureau

Note: The table shown may have been modified by user selections. Some information may be missing.

DATA NOTES	
TABLE ID:	B17001
SURVEY/PROGRAM:	American Community Survey
VINTAGE:	2022
DATASET:	ACSDT5Y2022
PRODUCT:	ACS 5-Year Estimates Detailed Tables
UNIVERSE:	Population for whom poverty status is determined
MLA:	U.S. Census Bureau. "Poverty Status in the Past 12 Months by Sex by Age." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B17001, 2022, https://data.census.gov/table/ACSDT1Y2022.B17001?q=B17001: Poverty Status in the Past 12 Months by Sex by Age&g=050XX00US18057_1400000US18057110101,18057110102. Accessed on January 15, 2024.
FTP URL:	None
API URL:	https://api.census.gov/data/2022/acs/acs5
USER SELECTIONS	
TABLES	B17001
GEOS	Hamilton County, Indiana; Census Tract 1101.02; Hamilton County; Indiana; Census Tract 1101.01; Hamilton County; Indiana
EXCLUDED COLUMNS	None
APPLIED FILTERS	None
APPLIED SORTS	None
PIVOT & GROUPING	
PIVOT COLUMNS	None

PIVOT MODE	Off
ROW GROUPS	None
VALUE COLUMNS	None
WEB ADDRESS	https://data.census.gov/table/ACSDT5Y2022.B17001?q=B17001:%20Poverty%20Status%20in%20the%20Past%2012%20Months%20by%20Sex%20by%20Age&g=050XX00US18057_1400000US18057110101,18057110102&tid=ACSDT1Y2022.B17001
TABLE NOTES	
	Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, the decennial census is the official source of population totals for April 1st of each decennial year. In between censuses, the Census Bureau's Population Estimates Program produces and disseminates the official estimates of the population for the nation, states, counties, cities, and towns and estimates of housing units for states and counties.
	Information about the American Community Survey (ACS) can be found on the ACS website. Supporting documentation including code lists, subject definitions, data accuracy, and statistical testing, and a full list of ACS tables and table shells (without estimates) can be found on the Technical Documentation section of the ACS website. Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.
	Source: U.S. Census Bureau, 2018-2022 American Community Survey 5-Year Estimates
	Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see ACS Technical Documentation). The effect of nonsampling error is not represented in these tables.

	The 2018-2022 American Community Survey (ACS) data generally reflect the March 2020 Office of Management and Budget (OMB) delineations of metropolitan and micropolitan statistical areas. In certain instances, the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB delineation lists due to differences in the effective dates of the geographic entities.
	Estimates of urban and rural populations, housing units, and characteristics reflect boundaries of urban areas defined based on 2020 Census data. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.
	Explanation of Symbols:- The estimate could not be computed because there were an insufficient number of sample observations. For a ratio of medians estimate, one or both of the median estimates falls in the lowest interval or highest interval of an open-ended distribution. For a 5-year median estimate, the margin of error associated with a median was larger than the median itself.N The estimate or margin of error cannot be displayed because there were an insufficient number of sample cases in the selected geographic area. (X) The estimate or margin of error is not applicable or not available.median- The median falls in the lowest interval of an open-ended distribution (for example "2,500-")median+ The median falls in the highest interval of an open-ended distribution (for example "250,000+").** The margin of error could not be computed because there were an insufficient number of sample observations.*** The margin of error could not be computed because the median falls in the lowest interval or highest interval of an open-ended distribution.***** A margin of error is not appropriate because the corresponding estimate is controlled to an independent population or housing estimate. Effectively, the corresponding estimate has no sampling error and the margin of error may be treated as zero.
COLUMN NOTES	None

	Hamilton County, Indiana		Census Tract 1101.01; Hamilton County; Indiana		Census Tract 1101.02; Hamilton County; Indiana	
Label	**Estimate**	**Margin of Error**	**Estimate**	**Margin of Error**	**Estimate**	**Margin of Error**
Total:	349,527	*****	8,917	±612	4,329	±678
Not Hispanic or Latino:	333,867	*****	8,379	±621	4,140	±675
White alone	283,765	±832	6,550	±861	4,007	±690
Black or African American alone	14,118	±1,092	543	±233	11	±22
American Indian and Alaska Native alone	130	±80	18	±26	0	±13
Asian alone	22,566	±921	78	±81	10	±20
Native Hawaiian and Other Pacific Islander alone	139	±52	0	±18	18	±28
Some other race alone	1,913	±733	0	±18	0	±13
Two or more races:	11,236	±1,721	1,190	±748	94	±107
Two races including Some other race	2,038	±707	347	±391	7	±13
Two races excluding Some other race, and three or more races	9,198	±1,510	843	±648	87	±107
Hispanic or Latino:	15,660	*****	538	±213	189	±165
White alone	7,115	±989	382	±135	189	±165
Black or African American alone	142	±97	0	±18	0	±13
American Indian and Alaska Native alone	126	±126	0	±18	0	±13
Asian alone	0	±30	0	±18	0	±13
Native Hawaiian and Other Pacific Islander alone	0	±30	0	±18	0	±13
Some other race alone	2,304	±596	39	±53	0	±13
Two or more races:	5,973	±1,089	117	±133	0	±13
Two races including Some other race	5,088	±979	117	±133	0	±13
Two races excluding Some other race, and three or more races	885	±389	0	±18	0	±13

Hispanic or Latino Origin by Race

United States Census Bureau

Note: The table shown may have been modified by user selections. Some information may be missing.

DATA NOTES	
TABLE ID:	B03002
SURVEY/PROGRAM:	American Community Survey
VINTAGE:	2022
DATASET:	ACSDT5Y2022
PRODUCT:	ACS 5-Year Estimates Detailed Tables
UNIVERSE:	Total population
MLA:	U.S. Census Bureau. "Hispanic or Latino Origin by Race." American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B03002, 2022, https://data.census.gov/table/ACSDT5Y2022.B03002?q=b03002&g=050XX00US18057_1400000US18057110101,180571101
FTP URL:	None
API URL:	https://api.census.gov/data/2022/acs/acs5
USER SELECTIONS	
TABLES	B03002
GEOS	Hamilton County, Indiana; Census Tract 1101.02; Hamilton County; Indiana; Census Tract 1101.01; Hamilton County; Indiana
EXCLUDED COLUMNS	None
APPLIED FILTERS	None
APPLIED SORTS	None
PIVOT & GROUPING	
PIVOT COLUMNS	None
PIVOT MODE	Off

ROW GROUPS	None
VALUE COLUMNS	None
WEB ADDRESS	https://data.census.gov/table/ACSDT5Y2022.B03002?q=b03002&g=050XX00US18057_1400000US18057110101,18057110102
TABLE NOTES	
	Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, the decennial census is the official source of population totals for April 1st of each decennial year. In between censuses, the Census Bureau's Population Estimates Program produces and disseminates the official estimates of the population for the nation, states, counties, cities, and towns and estimates of housing units for states and counties.
	Information about the American Community Survey (ACS) can be found on the ACS website. Supporting documentation including code lists, subject definitions, data accuracy, and statistical testing, and a full list of ACS tables and table shells (without estimates) can be found on the Technical Documentation section of the ACS website. Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.
	Source: U.S. Census Bureau, 2018-2022 American Community Survey 5-Year Estimates
	Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see ACS Technical Documentation). The effect of nonsampling error is not represented in these tables.
	The Hispanic origin and race codes were updated in 2020. For more information on the Hispanic origin and race code changes, please visit the American Community Survey Technical Documentation website.

	The 2018-2022 American Community Survey (ACS) data generally reflect the March 2020 Office of Management and Budget (OMB) delineations of metropolitan and micropolitan statistical areas. In certain instances, the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB delineation lists due to differences in the effective dates of the geographic entities.
	Estimates of urban and rural populations, housing units, and characteristics reflect boundaries of urban areas defined based on 2020 Census data. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.
	Explanation of Symbols:- The estimate could not be computed because there were an insufficient number of sample observations. For a ratio of medians estimate, one or both of the median estimates falls in the lowest interval or highest interval of an open-ended distribution. For a 5-year median estimate, the margin of error associated with a median was larger than the median itself.N The estimate or margin of error cannot be displayed because there were an insufficient number of sample cases in the selected geographic area. (X) The estimate or margin of error is not applicable or not available.median- The median falls in the lowest interval of an open-ended distribution (for example "2,500-")median+ The median falls in the highest interval of an open-ended distribution (for example "250,000+").** The margin of error could not be computed because there were an insufficient number of sample observations.*** The margin of error could not be computed because the median falls in the lowest interval or highest interval of an open-ended distribution.***** A margin of error is not appropriate because the corresponding estimate is controlled to an independent population or housing estimate. Effectively, the corresponding estimate has no sampling error and the margin of error may be treated as zero.
COLUMN NOTES	None

Samantha Beaupre

From: Fair, Terri <TFair@indot.IN.gov>
Sent: Wednesday, March 20, 2024 3:46 PM
To: Samantha Beaupre
Subject: EJ Analysis- Olio Road Added Travel Lanes Project (Des. No. 2101733)
Attachments: Olio Road Added Travel Lanes Project (Des. No. 2101733) EJ Analysis.pdf

EXTERNAL

INDOT-Environmental Services Division (ESD) has reviewed the project information along with the Environmental Justice (EJ) Analysis for the above referenced project. With the information provided, the project may require right-of-way, requires no relocations, and would not disrupt community cohesion or create a physical barrier. With the information provided, INDOT-ESD would not consider the impacts associated with this project as causing a disproportionately high and adverse effect on minority and/or low-income populations of EJ concern relative to non-EJ populations in accordance with the provisions of Executive Order 12898 and FHWA Order 6640.23a. No further EJ Analysis is required.

Olio Road Added Travel Lanes and Intersection Improvement 146th Street to 156th Street Highway Noise Analysis Noblesville, Hamilton County, Indiana

September 25, 2023
Revised January 29, 2024

Prepared for:

THE CITY OF NOBLESVILLE
EST. 1823

INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

INDOT Des. No.: 2101733

LOCHMUELLER GROUP

Lochmueller Group, Inc.
6200 Vogel Road
Evansville, Indiana 47715
Phone: 812.479.6200

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Olio Road Added Travel Lanes and Intersection Improvement
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Noblesville, Hamilton County, Indiana
Des. No. 2101733
Indiana Department of Transportation
Federal Highway Administration

1 Introduction

The current Indiana Department of Transportation (INDOT) Traffic Noise Analysis Procedure (2022) was released in October 2022 and became effective January 1, 2023. The INDOT policy applies to all Type I Federal highway projects (as defined by 23 CFR 772) in the State of Indiana, which encompasses all Federal or Federal-aid Highway Projects authorized under title 23, United States Code, including: any highway project or multimodal project that requires Federal Highway Administration (FHWA) approval regardless of funding sources; any Federal-aid projects that are administered by INDOT or Local Public Agencies (LPAs); and any project on roadways leased from the State of Indiana to the private sector.

The Olio Road Added Travel Lanes (ATL) project qualifies as a Type I project due to added travel lanes throughout the length of the project and the 156th Street intersection improvement to a roundabout. This highway traffic noise analysis has been conducted in accordance with 23 CFR 772 (as amended) as implemented through the INDOT Traffic Noise Analysis Procedure (2022) and the FHWA Traffic Noise Analysis and Abatement Guidance (U.S. Department of Transportation. 2018).

2 Project Description

The City of Noblesville proposes reconstruction of Olio Road involving additional travel lanes between 146th Street and 156th Street, and the 156th Street intersection improvement to a roundabout along approximately 1.1 mile of Olio Road in Hamilton County, Indiana. The project is located in Sections 11, 12, 13, and 14, Township 18 North, Range 5 East; in Wayne Township as depicted on the Riverwood Quadrangle U. S. Geological Survey 1:24,000 scale quadrangle. The southern terminus of the Olio road ATL project is approximately 180 feet north of the 146th Street roundabout center (Appendix A, Figure 1). The northern terminus is approximately 630 feet north of the 156th Street intersection center. Photographs of Olio Road and existing conditions of the surrounding landscape are provided in Appendix B.

2.1 Olio Road Existing Roadway Description

Olio Road is classified as a Major Collector. The typical section of the existing roadway consists of two 10-foot wide through lanes with 0 to 2-foot wide aggregate shoulders. Intersecting roadways within the project area are limited to 146th Street at the south end and 156th Street at the north end, both of which are two-lane east/west roadways. Additionally, there is an unnamed access lane (Gate 8) that connects Olio Road to the Ruoff Music Center venue approximately 0.5-mile to the west. There is also an access lane (Gate 6) to Ruoff Music Center event parking between Gate 8 and 146th Street. Elsewhere, direct access to Olio Road is

provided at multiple locations for residential driveways and Noblesville Fire Station 77. Olio Road crosses Sand Creek via a 22-foot long concrete bridge (Bridge #29-00170) with a 32-foot wide deck supporting two 11-foot lanes. The posted speed limit on Olio Road between 146th Street and 156th Street is 45 mph. North of 156th Street the posted speed limit on Olio Road is 55 mph. The posted speed limit on 146th Street and 156th Street is 45 mph.

2.1.1 146th Street Roundabout

The 146th Street intersection with Olio Road was reconstructed as a two-lane roundabout in 2020/21. The current configuration includes two northbound and two southbound lanes for Olio Road south of the roundabout. For Olio Road north of the intersection, there is a single lane exiting the roundabout and two lanes entering the roundabout. For 146th Street east and west of the intersection, there is a single lane exiting the roundabout and two lanes entering the roundabout. 146th Street services primarily automobile traffic with some limited industrial/commercial serving the businesses west of Olio Road. The Olio Road ATL project will tie into the 146th Street roundabout with no modifications to the existing roundabout.

2.1.2 156th Street Intersection

The 156th Street intersection at Olio Road is a two-way stop condition for vehicles on 156th Street. 156th Street consists of two 8-foot lanes in both directions east and west of the intersection with a 2-foot aggregate shoulder to the west and no shoulder to the east. 156th Street crosses Sand Creek via twin 10-foot wide steel culverts east of the Olio Road intersection.

2.2 Olio Road ATL Proposed Roadway Description

Olio Road will be widened from a two-lane facility to a four-lane boulevard. The road will consist of four 12-foot lanes with a 20-foot raised grass median. The roadway will have curb and gutter and two 10-foot multi-use paths on each side of the road. The bridge over Sand Creek will be replaced with a concrete bridge supporting four 12-foot lanes with 2-foot shoulders and two 10-foot multi-use paths, a 4-foot median, two 1-foot barrier rails, and two 7-inch curbs. It is anticipated that the new bridge will have an out-to-out coping of 83 feet 2 inches. The 156th Street intersection will be reconstructed to a roundabout to accommodate two northbound and two southbound lanes for Olio Road and a single eastbound and westbound lane for 156th Street. All current direct access to Olio Road and 156th Street will be maintained. The design speed of the new road will be 45 mph to match the existing posted speed limit.

3 Identification of Noise Sensitive Areas (NSA)

In 23 CFR 772 (as amended), FHWA has established seven Activity Categories to define Noise Abatement Criteria (NAC) for conducting highway noise analyses. These Activity Categories have been adopted by INDOT in their current Traffic Noise Analysis Procedure (2022). Each Activity Category is defined in terms of the type of land use that occurs on the property. Because there are differing expectations for acceptable noise levels based on land use, each Activity Category has a unique NAC noise threshold that determines the level at which roadway noise is considered to result in an impact to its designated use. Appendix C, Table 1 includes a listing of the Activity Categories with descriptions and the NAC threshold level.

Land use within 500 feet of the outside lanes for the Olio Road ATL project area is predominantly agricultural and undeveloped greenspace areas (Category G) with scattered small clusters of residential properties (Category B) and Noblesville Fire Station 77 (Category F). Appendix A, Figure 2 provides an illustration of land use by Activity Category within the Olio Road ATL study area.

The Olio Road ATL project area has been subdivided into three noise sensitive areas based on distribution and clustering of Category B properties. All potential noise receptors within 500-foot of the proposed travel lanes were included in the respective NSA boundaries.

3.1 NSA 1 – Southwest corner of Olio Road and 156th Street intersection

NSA 1 encompasses approximately 8.7 acres and includes three single-family residential properties (Category B) along 156th Street north of Sand Creek (Appendix A, Figure 2; Appendix B Photographs 1 through 10). Land use to the west, north (across 156th Street), and east (across Olio Road) is agricultural. NSA 2 is immediately to the south across Sand Creek.

3.2 NSA 2 – West side of Olio Road south of Sand Creek

NSA 2 encompasses approximately 24.8 acres and includes seven single-family residential properties (Category B) and Noblesville Fire Station 77 (Category F) along the west side of Olio Road (Appendix A, Figure 2; Appendix B Photographs 11 through 17). Land use to the west, south, and east (across Olio Road) is agricultural. NSA 1 is immediately to the north across Sand Creek.

3.3 NSA 3 – East side of Olio Road

NSA 3 encompasses approximately 4.9 acres and includes two single-family residential properties (Category B) along the east side of Olio Road approximately midway between 146th Street and 156th Street (Appendix A, Figure 2; Appendix B Photographs 18 and 19). The northernmost residence is associated with Deer Creek Specialty Farms. Land use in all directions surrounding NSA 3 is agricultural.

3.4 Ruoff Music Center

The Ruoff Music Center is a large amphitheater located approximately 0.5 mile to the west of Olio Road and north of 146th Street (Appendix A, Figure 2). The proposed shift in alignment of Olio Road to the west would only move the road approximately 80 feet closer to amphitheater. Due to the distance from the roadway, this noise sensitive concert venue (Category C) was excluded from the Olio Road noise analysis.

3.5 Finch Creek Development

The Finch Creek housing development is a planned residential community by Pulte Homes of Indiana, LLC on approximately 55 acres of land northwest of the Olio Road and 156th Street intersection (Appendix A, Figures 2 and 3). Preliminary plans for the development (Appendix I) indicate the housing area would include in excess of 1,300 single-family residences, amenity centers, woodland, ponds, and multiple green space common areas. Access to the development would be provided via Olio Road, 156th Street, 166th Street, and Boden Road. As of the date of this noise analysis, no infrastructure construction has been initiated on the project and no building permits have been issued for the residential properties. Therefore, specific potential receptors within 500 feet of the Olio Road project (i.e., the 156th Street roundabout) have not

been included in this analysis. See Section 11 Noise Compatible Future Development for additional information.

3.6 Gatewood Development

Gatewood is a golf community proposed by Henke Development Group on approximately 59 acres of land east of Olio Road between 146th Street and 156th Street, and an additional 11 acres southeast of the Olio Road and 146th Street roundabout (Appendix A, Figures 2 and 3). Preliminary plans for the development are not currently available from Henke Development Group to review the residential property spatial layout. As of the date of this noise analysis, no infrastructure construction has been initiated on the project and no building permits have been issued for the residential properties. Therefore, specific potential receptors within 500 feet of the Olio Road project have not been included in this analysis. See Section 11 Noise Compatible Future Development for additional information.

4 Ambient Noise Measurements

In accordance with the 2022 INDOT Traffic Noise Procedure, ambient noise measurements are required to establish the existing noise levels resulting from current traffic conditions and for use in validating the FHWA Traffic Noise Model program (TNM 2.5) set-up in conditions where roadway traffic is the predominant contributing noise source. Sound pressure levels are typically measured in decibels (dB) which are based on a logarithmic scale. INDOT has adopted the equivalent hourly sound level descriptor (Leq(h)) for measurement and use in analysis on highway noise studies in Indiana. The Leq is defined as the equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with Leq(h) being the hourly value of Leq. Additionally, because the human ear is differentially sensitive to varying sound frequencies, an A-weighted response curve is used to mimic the human response to the range of frequencies that emanate from roadway traffic sources. A-weighted decibels are expressed as dB(A).

One ambient measurement location was selected to represent each of the three NSAs delineated within the study area. Measurements were conducted in accordance with the FHWA Noise Measurement Handbook (U.S. Department of Transportation Federal Highway Administration 2011). These measurements are to be taken during the worst (noisiest) traffic hour under conditions that would yield the greatest Leq(h). This is typically during the greatest traffic volume periods, providing traffic is free-flowing (i.e., LOS of C or better). Since traffic on Olio Road is generally free-flowing from 7:00am until 6:00pm, field measurements were conducted during this time period. Because this data is principally being used to validate the existing condition model, conducting measurements outside of absolute peak hour periods is considered acceptable.

Ambient Leq(h) measurements were obtained on March 29, 2023 using a Larson-Davis DSP82 Type 1 Integrating sound level meter (SLM). Three measurement sessions were conducted at each location on these dates. The SLM was calibrated with the acoustic calibrator at 94 dB(A) at the beginning of the each individual monitoring period. The Certificate of Calibration and Conformance for the CAL200 Acoustic Calibrator from Larson-Davis Laboratories is included in Appendix D. Each measurement period was 15 minutes in duration. During each measurement period, traffic on Olio Road and any other roadway potentially contributing to traffic noise was real-time counted and/or video recorded using a GoPro Hero 4. Traffic video files were later converted into vehicle class volumes (automobiles, medium trucks, and heavy trucks) by individual travel lanes for later use in

validation of the TNM 2.5 model set-up. General weather conditions and non-roadway related sources of sound in the immediate vicinity of the monitoring station were also documented. Field measurement data sheets are included in Appendix E.

The traffic data and Leq(h) measurements for the three locations are provided in Appendix A, Figure 3 and in Appendix C, Table 2. Measured sound levels ranged from 56.8 dB(A) at the 13775 156th Street residential property in NSA 1 to 66.5 dB(A) at the 15411 Olio road residential property in NSA 2.

5 TNM 2.5 Existing Condition Model Set-Up

The Olio Road project noise analysis used the latest FHWA TNM Version 2.5 software approved for use on INDOT projects. Roadways, receptors, and terrain lines were constructed in TNM 2.5 to replicate the 3D landscape relationship between Olio Road, 146th Street, 156th Street, and potential noise sensitive receptors in the study area. A variety of data sources (i.e., CAD base layers, field survey surface models, Hamilton County Digital Elevation Model (DEM) data, Google Earth, Google Maps, and aerial photographs) were used to obtain the information required to set-up the current condition noise analysis. The model was constructed in the local Hamilton County coordinate system (NAD 1983 (2011) INGCS Hamilton (ftUS)). Roadway, terrain line, and receptor features were generated from ArcGIS Pro 2.9.5 and imported into TNM 2.5 from ArcGIS tabular point files.

5.1 Roadways

Existing Olio Road, 146th Street, and 156th Street were included in the existing condition model. Each through lane for Olio Road and 156th Street was included in the TNM 2.5 existing condition model as 10 and 9-foot wide lanes, respectively. All movements within the 146th Street roundabout were modeled as 12-foot lanes. The default TNM 2.5 average pavement type was used for all roadways. Existing aggregate shoulders, where present, were not included in the model. The posted speed limit for Olio Road is 45mph; however, maximum speed for many vehicles along Olio Road between 146th Street and 156th Street was observed at closer to 50 mph. Traffic on 146th Street entering and leaving the roundabout was modeled at 30 mph, as was traffic on 156th Street entering and leaving the Olio Road intersection.

The *Olio Road Project Traffic Memo* (Lochmueller Group 2023) includes 2012 detailed am and pm peak hour turning movement data for 156th Street. The 2012 data was adjusted to year 2022 using a 0.65 percent per year growth rate. The traffic study turning movement data and the percent truck data was used to generate total hourly vehicle volumes for each of the modeled roadway segments. The 5:00 pm peak hour data was used because it exhibited the greatest volume of through traffic on Olio Road. Truck volumes were determined at 8 percent of the total hourly through traffic volume. Since a breakdown of truck volumes by class was not available, all trucks were considered heavy trucks in the model, thus representing a worst-case scenario. Similarly, since no data was available on buses and motorcycles, all non-truck traffic was designated as automobiles. Appendix C, Table 3 includes a general breakdown of the hourly traffic volumes used as input in the existing condition 2022 base year TNM 2.5 analysis.

5.2 Receptors

For the 2022 existing condition noise analysis, all potential noise sensitive receptors were identified within 500 feet from the edge of pavement for the outside lanes of the proposed

roadway configuration and were included in the model. To generate Leq(h) levels for all potential noise sensitive receptors within the study area, 13 receptor data points were included in the TNM 2.5 set-up (Appendix A, Figure 3). The receptor position was determined by assessing the most likely area of exterior human occupancy proximal to the roadway at each location using aerial photographs and field observations. The elevations of the receptors were obtained using the Hamilton County DEM data with ArcGIS Pro. The TNM 2.5 default receptor height elevation of 4.92 feet was used for ground level receptors. There are 12 Category B residential receptors and one Category F receptor (Noblesville Fire Station 77) within the three designated NSAs. The remainder of the landscape within 500 feet of the roadway is classified as undeveloped Category G.

5.2.1 NSA 1 Receptors

NSA 1 includes three single-family residential receptors (Category B) along 156th Street in the southwest corner of the Olio Road intersection and north of Sand Creek. Elevations of the receptors in NSA 1 are generally at the same level as the roadway or slightly depressed.

5.2.2 NSA 2 Receptors

NSA 2 includes seven single-family residential receptors (Category B) and the Noblesville Fire Station 77 (Category F) along the west side of Olio Road and south of Sand Creek. Elevations vary from 826 feet near Sand Creek to 839 feet at the south end of NSA 2. Receptors are generally level with or slightly elevated above Olio Road.

5.2.3 NSA 3 Receptors

NSA 3 includes two single-family residential receptors (Category B) along the east side of Olio Road. Topography is generally flat with elevations ranging from 836 feet to 839 feet.

5.3 Barriers

For the existing condition model, there are no concrete traffic control barriers (TCB) or other existing structures that would function to affect sound propagation between the roadway and receptors. Therefore, no barrier features were included in the model.

5.4 Terrain Lines

Terrain lines define where topographic break line features influence the propagation of sound across the landscape. The landscape terrain of the Olio Road study area is relatively flat with very little change in relief between the roadway and nearby receptors. Gradual slope features between the edge of the right-of-way and the receptors were not modeled. Terrain lines were only included in the TNM 2.5 model to depict Sand Creek west of Olio Road and south of 156th Street.

5.5 Building Rows

The building row feature of TNM allows for shielding of second and third row receptors where first row buildings provide some level of attenuation. Since all receptors are considered first row receptors, the use of building rows was not warranted for the Olio Road model.

5.6 Ground Zones and Tree Zones

The default ground type set for all of the TNM 2.5 runs was lawn. The large concrete footprint associated with the Noblesville Fire Station 77 location was the only feature modeled as a hard reflective ground surface. Elsewhere, smaller hard surfaces were not anticipated to have a perceptible effect on sound pathways between roadway and receptor. No tree zones were included in the model.

6 TNM 2.5 Validation of Model Based on Field Measurements

The validation process attempts to check the predicted results from TNM 2.5 against field measurements to determine if the program appears to accurately represent the 3D acoustic conditions that exist within the noise assessment analysis area. A single residential receptor (Category B) location was selected for each NSA to validate the existing condition TNM 2.5 set-up (Appendix A, Figure 3 and Appendix C, Table 2). Appendix E includes photographs of each ambient measurement location.

For each of the three field measurement sessions, the traffic count data for Olio Road and other relevant roads was adjusted to an hourly volume for automobiles, medium trucks, heavy trucks, buses, and motorcycles based on the duration of the field measurement period (i.e., 15 minute traffic counts were multiplied by four). Three measurements were taken at each of the locations at different time periods throughout the day. Vehicle class traffic volumes were assigned to each individual lane on Olio road based on data obtained from real-time counts and video recordings. Traffic volumes used in the validation run of TNM 2.5 for each field measurement location are shown in Appendix C, Table 2.

For all three locations, at least one of the three field measurements recorded with the SLM were within ±3 dB(A) of the TNM predicted Leq(h) levels for the traffic volume experienced during the monitoring session (Appendix A, Figure 3 and Appendix C, Table 2). Therefore, the model was considered to be validated for all areas.

6.1 NSA 1 – 13775 156th Street – Receptor 3

The SLM was deployed off the southeast corner of the residence approximately 107 feet from the Olio Road edge of pavement. The three monitoring sessions generated field measurements of 56.8, 58.2, and 59.0 dB(A), which ranged from 2.2 dB(A) below the predicted TNM 2.5 level to 0.6 dB(A) above the model predicted level. There is no readily apparent explanation for the slight over-prediction by TNM for the first two sessions. The third session included higher traffic volumes on Olio Road and 156th Street; therefore, the 0.6 dB(A) discrepancy sufficiently validates the model.

6.2 NSA 2 – 15411 Olio Road – Receptor 6

The SLM was deployed just off the front porch of the residence approximately 60 feet from the Olio Road edge of pavement. The three monitoring sessions generated field measurements of 66.0, 65.3, and 66.5 dB(A), which ranged from 1.0 dB(A) to 4.7 dB(A) above the TNM 2.5 predicted level. Oddly, although the 5:00 pm session had the greatest number of automobiles, it had the least number of heavy trucks and yielded a field measurement more than 3 dB(A) greater than the TNM 2.5 prediction. The discrepancy can be explained in part due to a slow moving vehicle turning into the residential lane and a second slow moving

(idling) vehicle exiting the residential lane during the session. Since the results of the earlier two sessions were within 3 dB(A) of the predicted model levels, the model is considered to be validated for this location.

6.3 NSA 3 – 15000 Olio Road – Receptor 13

The SLM was deployed along the west side of the circle drive at the residence approximately 78 feet from the Olio Road edge of pavement. The three monitoring sessions generated field measurements of 63.4, 65.6, and 64.6 dB(A), which ranged from 0.3 dB(A) to 4.7 dB(A) above the TNM 2.5 predicted level. The early morning session which experienced the greater volume of heavy trucks resulted in a discrepancy of only 0.3 dB(A) between the field measurement and the predicted TNM 2.5 level. The 4.7 dB(A) discrepancy for the afternoon and early evening sessions is likely attributed to elevated wind speeds during these sessions and noise emanating from the grain elevator blowers that were running on the property to the immediate north. Therefore, the model is considered to be validated for this location based on the results of the AM session.

7 2022 Existing Condition TNM 2.5 Results

For the 13 modeled receptor points in the Olio Road study area, the existing base condition 2022 Leq(h) roadway noise levels ranged from 46.6 dB(A) to 63.1 dB(A). The 63.1 dB(A) level was predicted from residential Receptor 12 in NSA 3. Appendix C, Table 5 provides a complete listing of the 2022 TNM 2.5 Leq(h) results for each receptor. The TNM 2.5 2022 base year analysis indicates that under the current conditions there are no Category B residential dwelling unit impacts where the TNM 2.5 Leq(h) levels approach or exceed the 67 dB(A) NAC. TNM 2.5 output for the 2022 year model is included in Appendix G.

7.1 NSA 1 2022 Existing Condition Impacts

For the three NSA 1 Category B receptors in the vicinity of the 156th Street intersection, the existing condition traffic noise levels are all below 59 dB(A). 2022 Leq(h) levels are indicated on Appendix A, Figure 4A and Appendix C, Table 5.

7.2 NSA 2 2022 Existing condition Impacts

For the six NSA 2 Category B receptors along the west side of Olio Road, the existing condition traffic noise levels are all below 63 dB(A). The predicted level at the Noblesville Fire Station 77 (Category F) near the front entrance is 57.2 dB(A). 2022 Leq(h) levels are indicated on Appendix, A Figure 4B and Appendix C, Table 5.

7.3 NSA 3 2022 Existing Condition Impacts

For the two NSA 3 Category B receptors along the east side of Olio Road, the existing condition traffic noise levels are all at or below 63 dB(A). 2022 Leq(h) levels are indicated on Appendix A, Figure 4C and Appendix C, Table 5.

8 TNM 2.5 2045 Design Year Set-Up

The TNM 2.5 set-up for the proposed Olio Road reconstruction and 156th Street intersection improvement was conducted in a similar manner as that discussed in Section 5 for the existing

current condition. The 2045 design year model was developed using the current Stage 2 design plans to construct the roadway geometry in the TNM 2.5 model.

8.1 Roadways

As with the existing condition, each travel lane for the Olio Road ATL design was modeled as a separate roadway. Therefore, two northbound and two southbound lanes were modeled for Olio Road between 146th Street and 156th Street. The 50 mph speeds used for the existing condition on Olio Road were retained in the design; however, the speed was reduced to 30 mph entering and exiting the 156th Street roundabout. Speeds throughout the 146th Street and 156th Street roundabouts were set at 30 mph, the lowest speed available in TNM 2.5.

The 2045 design year traffic data for use as TNM 2.5 input was derived from 5:00 pm peak hour turning movement data available in the *Olio Road Project Traffic Memo* (Lochmueller Group 2023) based on a 1.3 percent per year growth rate. Vehicle classification breakdown was again based on 2045 turning movement traffic data from the report. Automobile volumes were split equally across the two Olio Road northbound and two southbound through lanes. Truck volumes were again determined to be 8 percent of the total hourly traffic volume. All truck volumes were assigned to the outer lanes closest to the adjacent receptors. A comparison of the 2022 and 2045 pm peak hour traffic for Olio Road indicates that the traffic volumes are expected to increase approximately 30 percent over this 23-year span. Appendix C, Table 4 includes a general breakdown of the hourly traffic volumes used as input in the existing condition 2045 design year TNM 2.5 analysis.

8.2 Receptors

Since there are no residential or business relocations anticipated for the Olio Road ATL project, all 13 receptor points included in the 2022 existing condition analysis were also included in the 2045 design year model.

8.3 Barriers

Since the proposed Olio Road ATL design does not incorporate any TCBs or other features that would affect sound propagation between the roadway and receptor, no barriers were included in the 2045 TNM 2.5 model.

8.4 Terrain Lines

The proposed 4-lane typical section for Olio Road does not represent a significant change in elevation of the roadway relative to the adjacent receptors compared to the existing roadway. Therefore, no terrain lines were incorporated into the model to represent notable cut or fill situations. The terrain line used to define the Sand Creek feature in the base year 2022 TNM 2.5 model was retained in the 2045 model with a slight modification to represent the westward expansion of the roadway to accommodate the wider bridge.

8.5 Building Rows

As with the 2022 existing condition model, building row features were not used in TNM 2.5 to account for possible shielding since all receptors are considered first row receptors.

8.6 Ground Zones and Tree Zones

The default ground type set for the 2045 design TNM 2.5 model was lawn. The Noblesville Fire Station 77 pavement was retained as a hard reflective surface in the 2045 model.

9 2045 Design Year Identification of Predicted Impacted Receptors

In 23 CFR 772, FHWA establishes two conditions under which highway traffic noise impacts can occur.

1. The predicted future noise levels approach or exceed the appropriate NAC for the land use. INDOT defines "approach" to be within 1.0 dB(A) of the appropriate noise abatement category.
2. The predicted future traffic noise levels substantially exceed the existing noise levels. INDOT defines "substantial increase" as an increase in noise levels for which the future nose levels exceed the existing noise levels (as predicted by FHWA TNM version 2.5) by 15.0 dB(A).

The results of the 2045 design year Leq(h) level prediction for the receptors within the noise sensitive areas along Olio Road and 156th Street are included in Appendix C, Table 5 and illustrated on Appendix A, Figures 4A through 4D. Collectively, 2045 Leq(h) predicted levels range from 47.5 dB(A) at the most distal residence to Olio Road along 156th Street in NSA 1 to 61.7 dB(A) at two different residences (15411 Olio Road and 15012 Olio Road) in NSA 2 and NSA 3, respectively. There are no Category B NAC 67 dB(A) impacts anticipated to result from the added travel lanes or 156th Street roundabout proposed action. TNM 2.5 output for each 2045 design year model is included in Appendix H.

9.1 NSA 1 2045 Design Year Impacts

For the three residential receptors in NSA 1 along 156th Street, the predicted levels range from 47.5 dB(A) to 57.8 dB(A). At 92 feet, receptor 3 (57.8 dB(A)) in the southwest corner of the 156th Street intersection is the closest receptor to the southbound lane for Olio Road at the proposed roundabout.

9.2 NSA 2 2045 Design Year Impacts

For the seven residential receptors and fire station in NSA 2 along Olio Road, the predicted levels range from 48.6 dB(A) at receptor 9 to 61.7 dB(A) at receptor 6. At 70 feet, receptor 6 (61.7 dB(A)) is the closest receptor to the proposed southbound lane for Olio Road

9.3 NSA 3 2045 Design Year Impacts

For the two residential receptors in NSA 3 along Olio road, the predicted levels range from 59.5 dB(A) to 61.7 dB(A). At 75 feet, receptor 12 (61.7 dB(A)) is the closest receptor to the proposed northbound lane for Olio Road.

10 2045 Design Year Noise Abatement Evaluation

In instances where roadway noise impacts are predicted as a result of a Type I project action, FHWA and INDOT require that consideration be given to noise abatement measures. This process involves an evaluation of the feasibility (both acoustic and engineering feasibility) of implementing abatement that can achieve a 5 dB(A) reduction in predicted Leq(h) levels at the majority of the impacted receptors and do so without compromises to public safety and engineering standards. In situations where mitigation appears to be feasible, this process also requires a reasonableness

evaluation based on the views of residents and property owners, the maximum square footage of abatement criteria, and the ability to achieve INDOT's substantial noise reduction goal of 7.0 dB(A) at the majority of impacted first row receptors through implementation of the abatement measure.

Since none of the 13 receptors within the three NSAs were predicted to experience a noise impact for the proposed roadway design and predicted traffic levels in 2045, no abatement barrier analysis was warranted for these locations. Similarly, since there is no anticipation that future construction of the Finch Creek or the Gatewood housing developments would result in impacts to Category B receptors, no abatement barrier analysis was warranted for these proposed developments (See Section 11 Noise Compatible Future Development).

11 Noise Compatible Future Development

The roadway traffic noise environment along busy thoroughfares is an important element for consideration in the planning of development within travel corridors. Information concerning the anticipated noise levels adjacent to roadways can assist local governments, planners and developers in the appropriate type, location and layout of future development on land that is currently undeveloped. With this information available, less noise sensitive uses such as commercial, industrial, recreational, or green space development can be targeted for areas immediately adjacent to roadways, while future noise impacts to more sensitive development such as housing areas can be avoided.

Currently, the majority of the land use along Olio Road and the 146th Street and 156th Street intersections is undeveloped agricultural fields. As noted in Section 3, the Finch Creek housing development is currently being planned for the agricultural land northwest of the Olio Road and 156th Street intersection. Similarly, the Gatewood golf community development is in the planning stages for the agricultural land east of Olio Road between 156th Street and 146th Street, and south of 146th Street.

To plan for future development, a basic understanding of where potential noise impacts are predicted along the corridor is helpful. In an effort to provide assistance to the City of Noblesville planners in understanding where such impacts can be expected, TNM 2.5 was used to estimate a 66 dB(A) impact zone along Olio Road at the proposed Finch Creek and Gatewood developments, as well as other adjacent undeveloped Category G land.

The 66 dB(A) zone identifies an area within which Leq(h) levels are expected to be at 66 dB(A) or higher. This was accomplished through the use of receptor data points oriented in multiple rows perpendicular to Olio Road at 10-foot intervals from the edge of pavement. The resulting TNM 2.5 data was reviewed to determine the distance from the roadway at which the design year Leq(h) is anticipated to be equal or greater than 66 dB(A) based on 2045 traffic volumes. In general, Leq(h) levels at or above 66 dB(A) are predicted to occur at approximately 20 to 30 feet from the edge of the outside Olio Road lanes (Appendix A, Figures 4A through 4D). The impact zone distance from the roadway is limited primarily due to the low design year traffic volumes and the minimal contribution to highway noise from heavy trucks. Traffic volumes and speeds on 146th Street and 156th Street and within the respective roundabouts are too low to generate 66 dB(A) levels in these areas.

Preliminary plans for the Finch Creek housing development indicate that the "common area" buffer between the residential parcels and Olio Road (Appendix I) is of sufficient distance to place the properties beyond the 66 dB(A) threshold. Although a plat layout for the Gatewood development is

not available for review, it is anticipated that residential properties would be offset from Olio Road a sufficient distance to also avoid encroachment on the predicted 66 dB(A) limit.

12 Statement of Likelihood

Based on the studies completed to date, the City of Noblesville has identified no impacted receptors. As a result, noise abatement was not evaluated. This noise analysis was based on preliminary design criteria. A reevaluation of the noise analysis will occur during final design. If during final design it has been determined that conditions have changed and noise impacts are identified, noise abatement will be evaluated at that time as to whether it is feasible and reasonable.

13 Construction Noise

Construction of the Olio Road ATL Project will result in unavoidable construction noise from equipment such as excavators, backhoes, pavement saws, graders, pavers, concrete trucks, compressors and other miscellaneous equipment. When and where possible, construction noise for this project should be controlled or minimized by measures including, but not limited to:

- Contractors should adhere to all federal, state and local noise abatement and control requirements.
- Limit construction activities in the vicinity of residences to the hours between 7:00 am and 7:00 pm, or as directed by local ordinances.
- Establish a responsive communication process with local residents that provides a contact number where inquiries concerning construction activities can be addressed.
- Enclose equipment such as generators when in operation during periods of residential occupancy in the immediate vicinity.
- Maintain construction equipment in good working order with manufacturer recommended mufflers.
- Coordinate the location of staging areas and other noise generating activities away from residential areas whenever possible.

These measures should be included in the National Environmental Policy Act (NEPA) document as For Further Consideration Commitments.

14 Summary

The proposed Olio Road project includes added travel lanes between 146th Street and 156th Street and reconfiguration of the 156th Street intersection to a roundabout along approximately 1.1 mile of Olio Road. The horizontal alignment will be shifted slightly to the west to avoid residences on the east side of Olio Road midway between 146th Street and 156th Street. Similarly, the alignment will be shifted slightly to the east to avoid residences on the west side of Olio Road just south of 156th Street.

Within 500 feet of Olio Road, the project area consists of a mixture of various single-family residential properties, agricultural fields, and Noblesville Fire Station 77. The project will require the minor acquisition of new right-of-way; however, no relocations are anticipated.

The project area was divided into three NSAs. Ambient roadway traffic noise was monitored at three residences representing the NSAs and used to validate the TNM 2.5 models that were developed for

the study analysis. The existing condition model was validated at all three monitoring sites. A total of twelve residential receptors (Category B) and Noblesville Fire Station 77 (Category F) were included in the existing condition model. Using 2022 base condition traffic data, TNM 2.5 model indicated that there are currently no highway noise impacts along Olio Road.

The proposed Olio Road lane configurations and 156th Street roundabout were modeled with TNM 2.5 using 2045 peak hour traffic volumes to predict the Leq(h) levels for the project in the design year. The analysis predicted that there would be no Category B NAC impacts (approach or greater than the 67 dB(A) NAC threshold) for any of the twelve residences. Therefore, no noise barrier analysis was warranted.

A final determination on noise impacts will be made during the final design phase. At such time, if design elements have changed that warrant a re-evaluation of the predicted noise levels, additional noise analysis will be performed to determine if impacts are anticipated, and if so, noise abatement measures will be further investigated.

15 Literature Cited

23 CFR Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise, August 11, 1997.

Indiana Department of Transportation Traffic Noise Analysis Procedure, 2022

Lochmueller Group, Olio Road Project Traffic Analysis Memo, March 28, 2023.

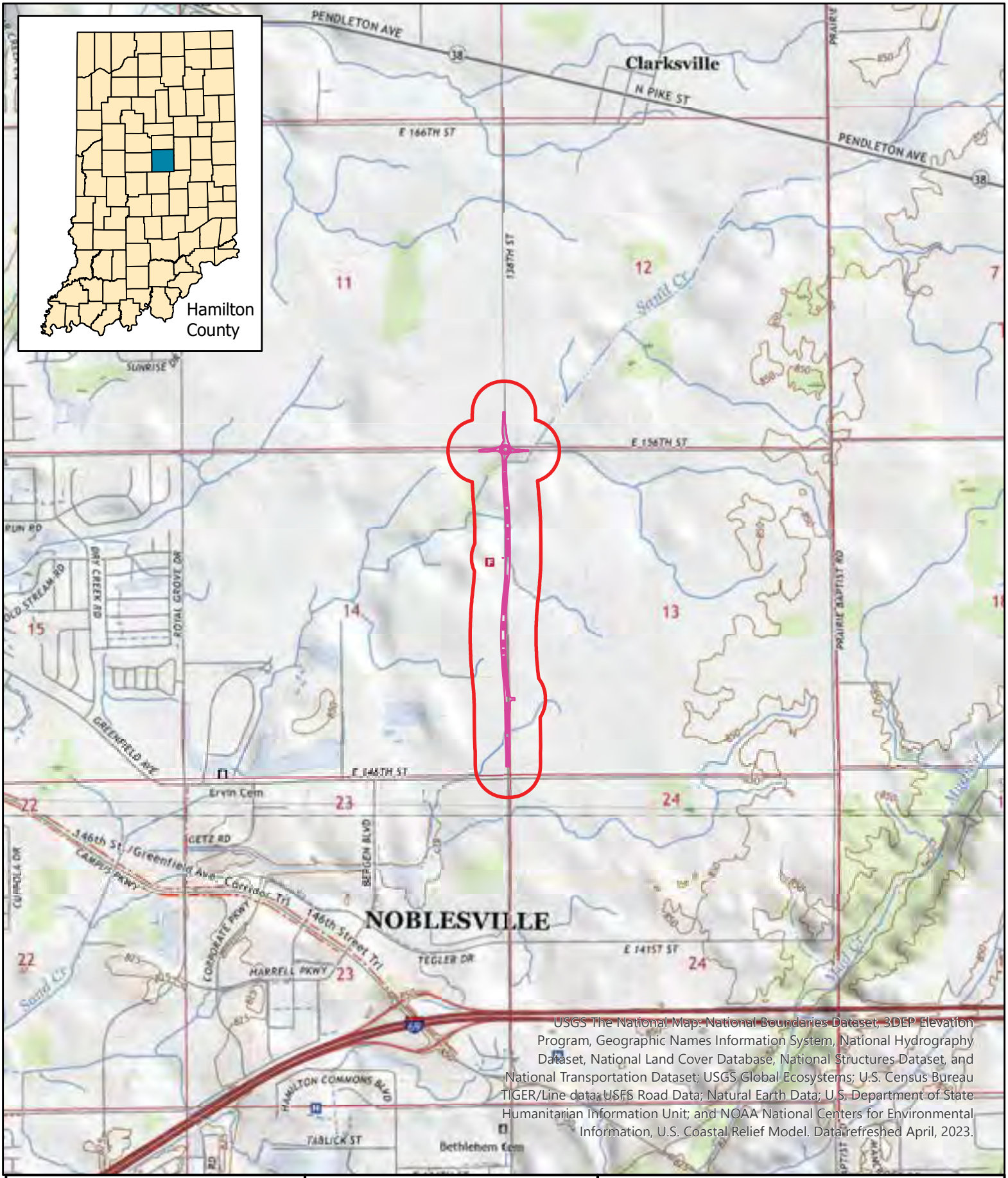
U.S. Department of Transportation. 2018. Highway Traffic Noise Analysis and Abatement Guidance. U.S. Department of Transportation Federal Highway Administration. June 2018

U.S. Department of Transportation. 2011. Noise Measurement Handbook. U.S. Department of Transportation Federal Highway Administration. June 2018

16 List of Preparers

Lochmueller Group, Inc. Staff	Position	Contributing Effort
Rusty Yeager Lochmueller Group, Inc. 6200 Vogel Road Evansville, Indiana 47715 E-mail: ryeager@lochgroup.com	Biologist	Field Data Collection TNM 2.5 Modeling Data Analysis Report Preparation Mapping

Appendix A
Figures



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Created: 8/29/2023
R. Yeager

Figure 1
Project Location Map

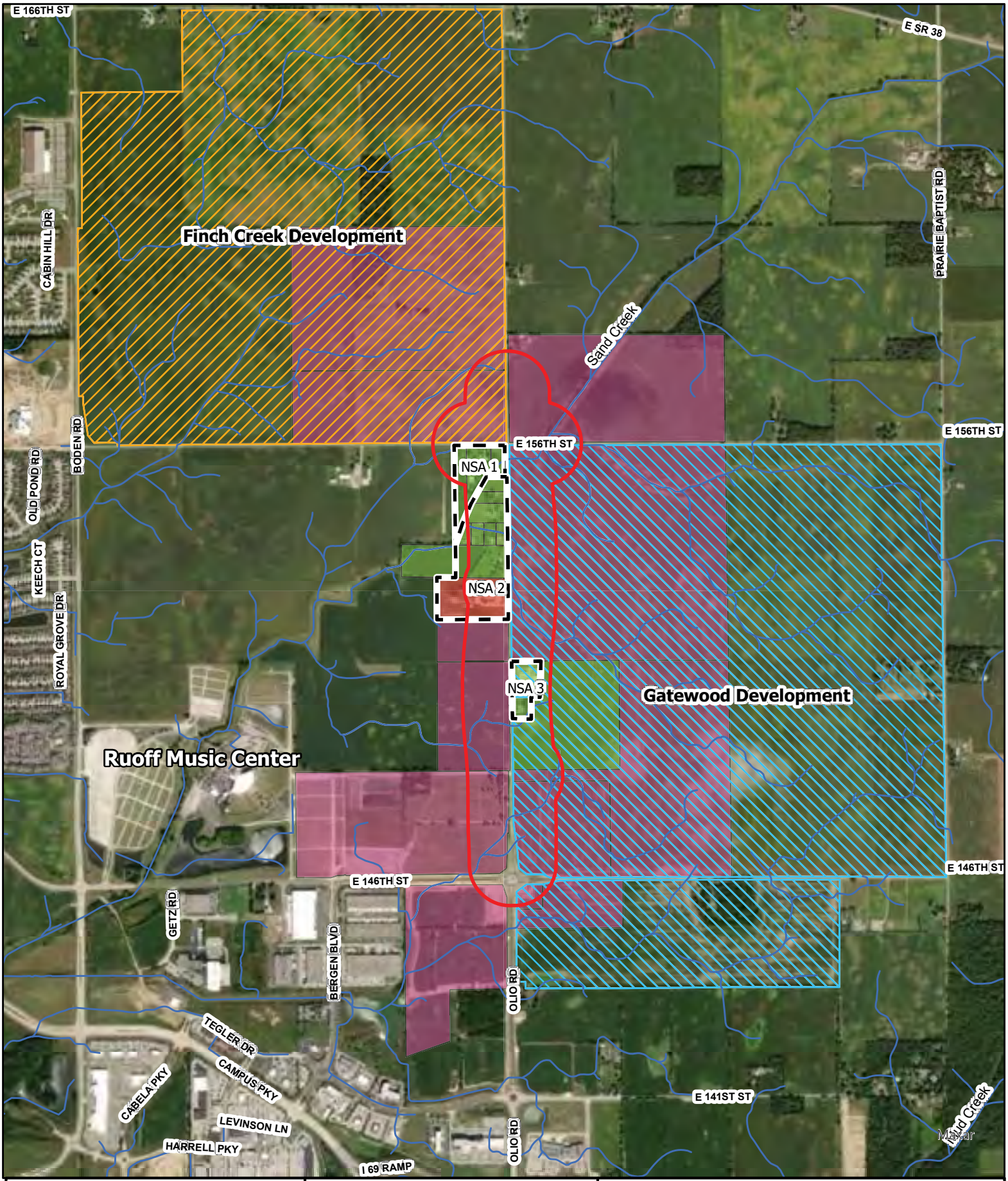
Olio Road ATL limits

500-foot noise survey limits

LOCHMUELLER GROUP

Olio Road ATL Project
146th Street to 156th Street
Des No 2101733

Source: USA Topo Maps



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Created: 8/29/2023
R. Yeager

Figure 2
Noise Sensitive Areas and Proposed Development Locations

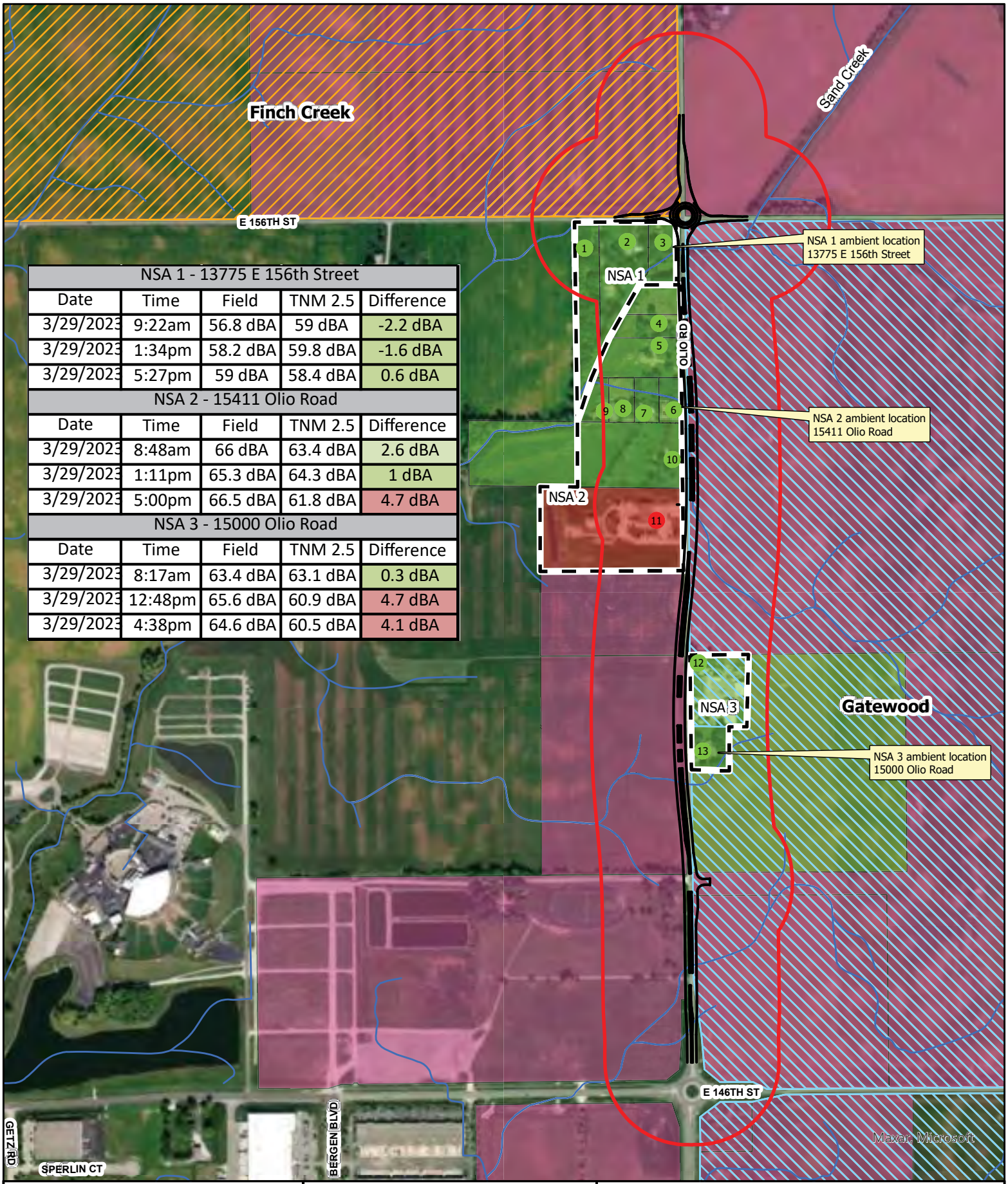
Olio Road ATL Project
146th Street to 156th Street
Des No 2101733

LOCHMUELLER GROUP

NHD Flow Line
500-foot noise survey limits
Finch Creek Development
Gatewood Development

Parcel NAC
NAC B
NAC F
NAC G
Olio NSA

Source: World Imagery



NSA 1 - 13775 E 156th Street				
Date	Time	Field	TNM 2.5	Difference
3/29/2023	9:22am	56.8 dBA	59 dBA	-2.2 dBA
3/29/2023	1:34pm	58.2 dBA	59.8 dBA	-1.6 dBA
3/29/2023	5:27pm	59 dBA	58.4 dBA	0.6 dBA
NSA 2 - 15411 Olio Road				
Date	Time	Field	TNM 2.5	Difference
3/29/2023	8:48am	66 dBA	63.4 dBA	2.6 dBA
3/29/2023	1:11pm	65.3 dBA	64.3 dBA	1 dBA
3/29/2023	5:00pm	66.5 dBA	61.8 dBA	4.7 dBA
NSA 3 - 15000 Olio Road				
Date	Time	Field	TNM 2.5	Difference
3/29/2023	8:17am	63.4 dBA	63.1 dBA	0.3 dBA
3/29/2023	12:48pm	65.6 dBA	60.9 dBA	4.7 dBA
3/29/2023	4:38pm	64.6 dBA	60.5 dBA	4.1 dBA

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Figure 3
Noise Sensitive Areas and Ambient Monitoring Locations

Olio Road ATL Project
146th Street to 156th Street
Des No 2101733

LOCHMUELLER GROUP

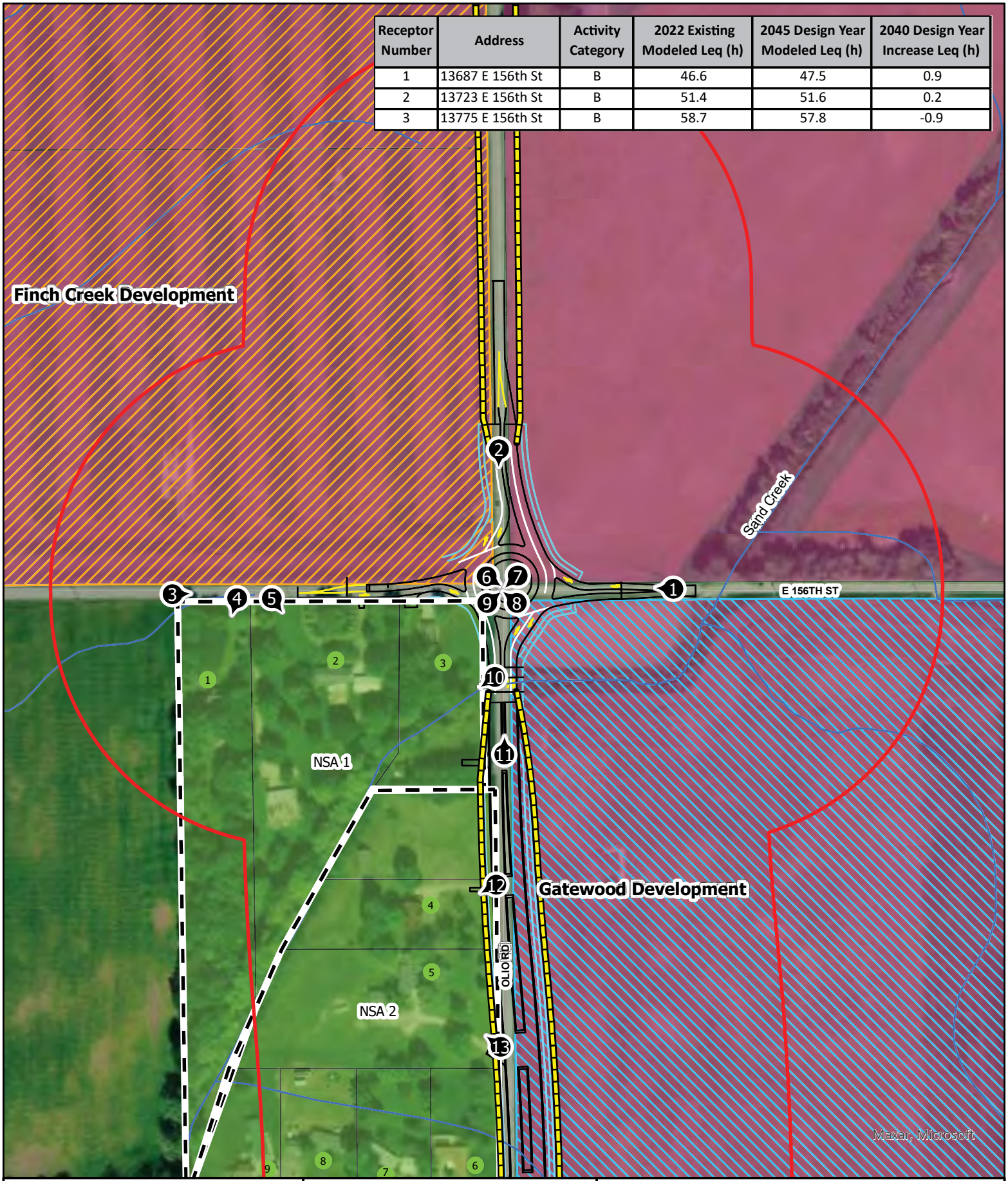
NHD Flow Line
500-foot noise survey limits
Olio Road proposed edge of pavement
Finch Creek proposed development
Gatewood proposed development

Receptor
Category B
Category F
Olio NSA

Parcel NAC
NAC B
NAC F
NAC G

Source: World Imagery

Receptor Number	Address	Activity Category	2022 Existing Modeled Leq (h)	2045 Design Year Modeled Leq (h)	2040 Design Year Increase Leq (h)
1	13687 E 156th St	B	46.6	47.5	0.9
2	13723 E 156th St	B	51.4	51.6	0.2
3	13775 E 156th St	B	58.7	57.8	-0.9



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Created: 8/29/2023
R. Yeager

Figure 4A
NSA 1 Receptor Results and 66 dBA Noise Limits

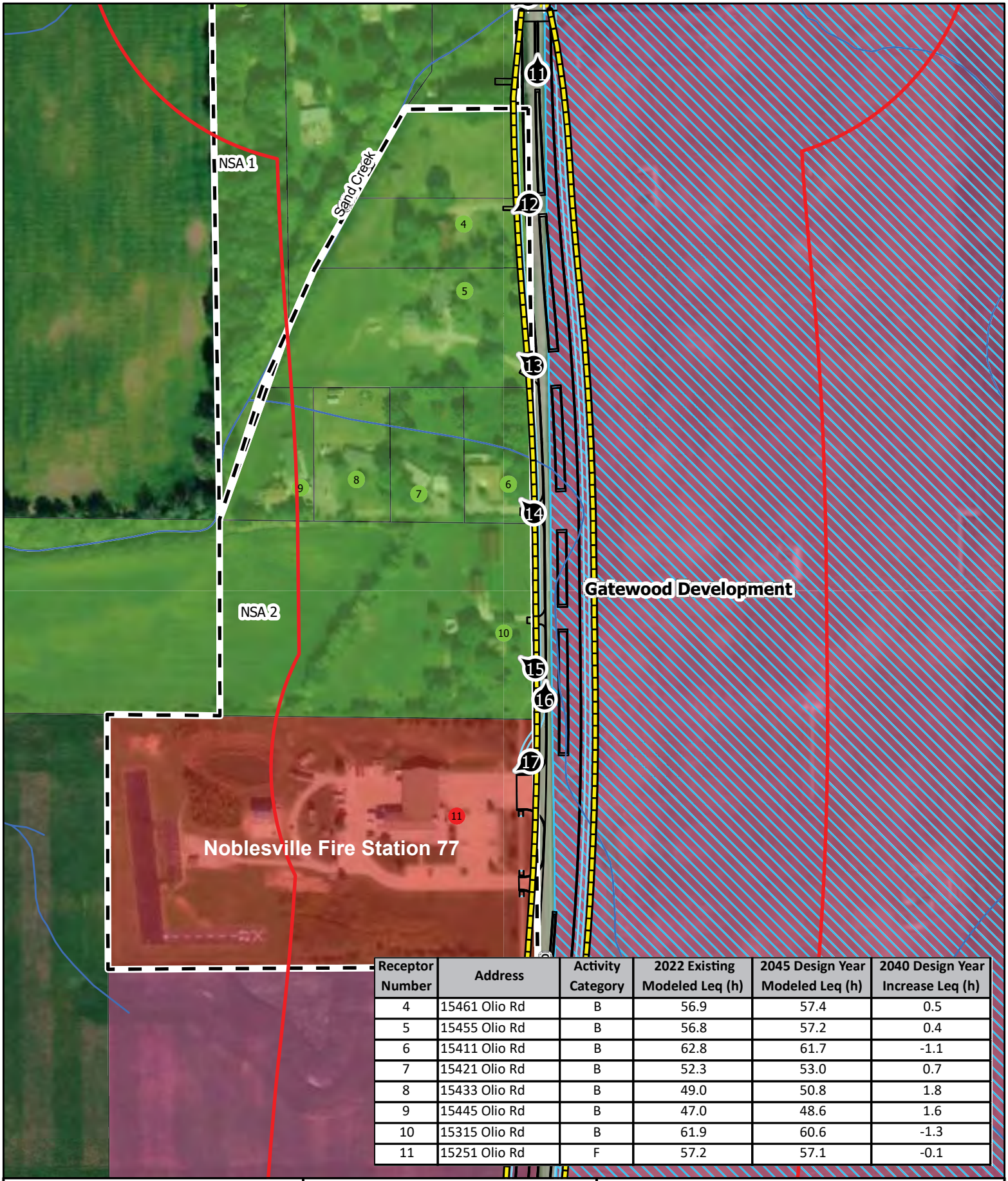
Olio Road ATL Project
146th Street to 156th Street
Des No 2101733

NHD Flow Line
500-foot noise survey limits
Finch Creek Development
Gatewood Development
66 dBA limit

Receptor
Category B
Category F
Olio NSA
Photos

Parcel NAC
NAC B
NAC F
NAC G

Source: World Imagery



Receptor Number	Address	Activity Category	2022 Existing Modeled Leq (h)	2045 Design Year Modeled Leq (h)	2040 Design Year Increase Leq (h)
4	15461 Olio Rd	B	56.9	57.4	0.5
5	15455 Olio Rd	B	56.8	57.2	0.4
6	15411 Olio Rd	B	62.8	61.7	-1.1
7	15421 Olio Rd	B	52.3	53.0	0.7
8	15433 Olio Rd	B	49.0	50.8	1.8
9	15445 Olio Rd	B	47.0	48.6	1.6
10	15315 Olio Rd	B	61.9	60.6	-1.3
11	15251 Olio Rd	F	57.2	57.1	-0.1

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Figure 4B
NSA 2 Receptor Results and 66 dBA Noise Limits

Olio Road ATL Project
146th Street to 156th Street
Des No 2101733

LOCHMUELLER GROUP

NHD Flow Line
500-foot noise survey limits
Finch Creek Development
Gatewood Development
66 dBA limit

Receptor
Category B
Category F
Olio NSA
Photos

Parcel NAC
NAC B
NAC F
NAC G

Source: World Imagery

Receptor Number	Address	Activity Category	2022 Existing Modeled Leq (h)	2045 Design Year Modeled Leq (h)	2040 Design Year Increase Leq (h)
12	15012 Olio Rd	B	63.1	61.7	-1.4
13	15000 Olio Rd	B	60.9	59.5	-1.4

0 500 1,000 Feet

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Created: 8/29/2023
R. Yeager

Figure 4C
NSA 3 Receptor Results and 66 dBA Noise Limits

Olio Road ATL Project
146th Street to 156th Street
Des No 2101733

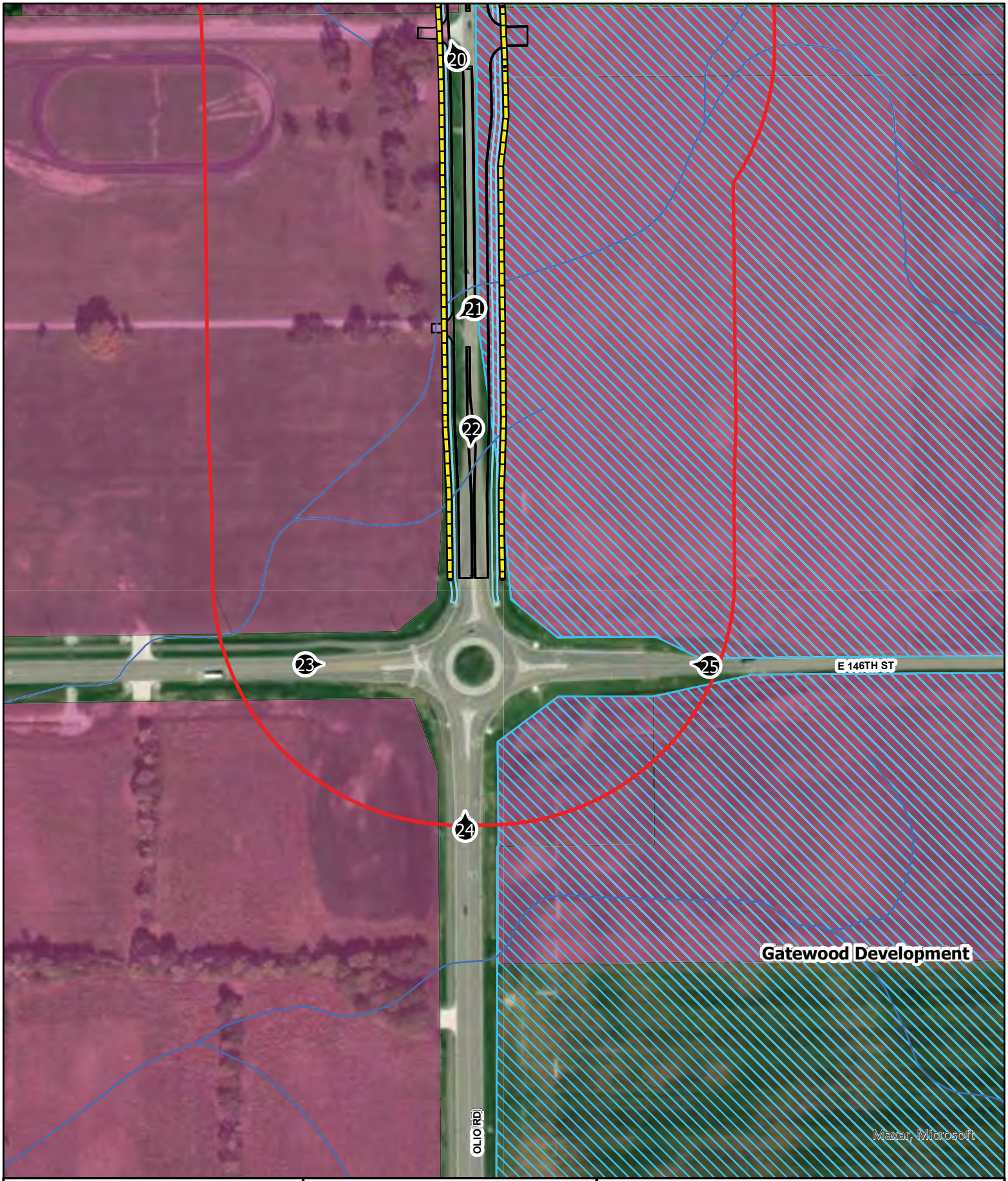
LOCHMUELLER GROUP

NHD Flow Line
500-foot noise survey limits
Finch Creek Development
Gatewood Development
66 dBA limit

Receptor
Category B
Category F
Olio NSA
Photos

Parcel NAC
NAC B
NAC F
NAC G

Source: World Imagery



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Created: 8/29/2023
R. Yeager

Figure 4D
146th Street Roudabout and 66 dBA Noise Limits

LOCHMUELLER GROUP

Olio Road ATL Project
146th Street to 156th Street
Des No 2101733

NHD Flow Line
500-foot noise survey limits
Finch Creek Development
Gatewood Development
66 dBA limit

Receptor
Category B
Category F
Olio NSA
Photos

Parcel NAC
NAC B
NAC F
NAC G

Source: World Imagery

Appendix B
Olio Road Project Photographs

Photo Location 1 - Facing west along 156th Street toward Olio road intersection. 8/25/2023

Photo Location 2 - Facing south along Olio Road toward 156th Street intersection. 8/25/2023

Photo Location 3 - Facing east along 156th Street toward Olio Road intersectton in NSA 1. 8/25/2023

Photo Location 4 - Facing south at 13687 E 156th Street residence (receptor 1) in NSA 1 on south side of road. 8/25/2023

Photo Location 5 - Facing southeast at 13723 E 156th Street residence (receptor 2) in NSA 1 on south side of road. 8/25/2023

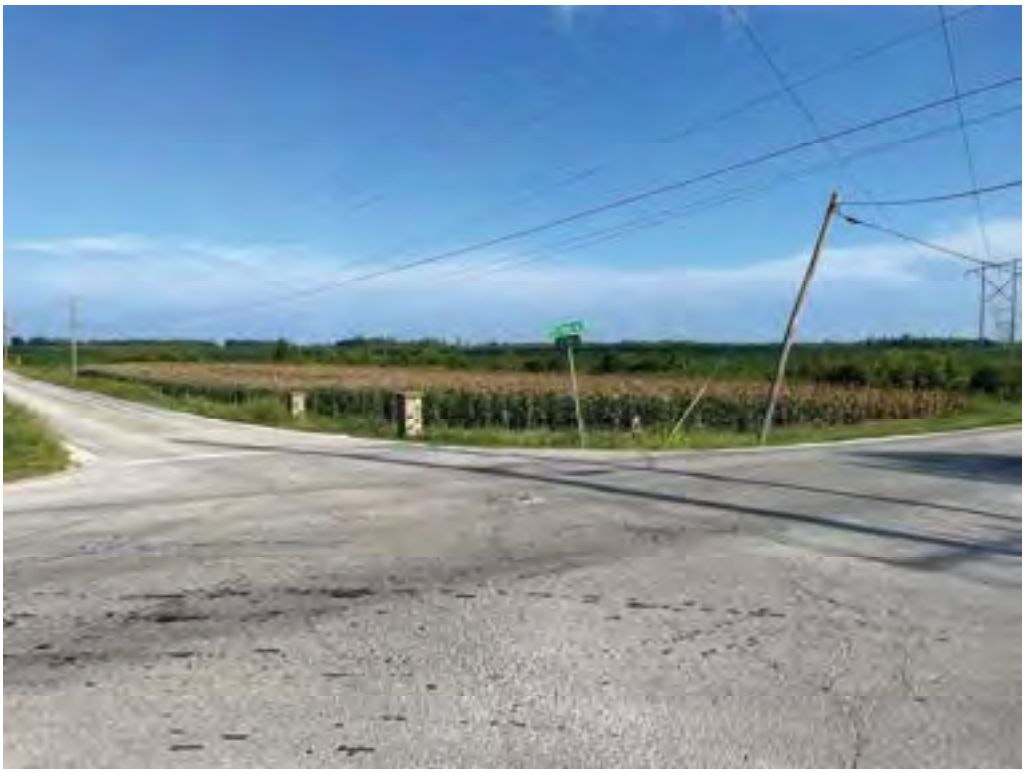


Photo Location 6 - Facing southeast across 156th Street intersection at proposed location for Gatewood development in southeast quadrant. 8/25/2023

Photo Location 7 - Facing southwest across 156th Street intersection at 13775 E 156th Street residence (receptor 3) on west side of Olio Road. 8/25/2023

Photo Location 8 - Facing northwest across 156th Street intersection at proposed location for Finch Creek development in northwest quadrant. 8/25/2023

Photo Location 9 - Facing northeast across 156th Street intersection at agricultural field in northeast quadrant. 8/25/2023

Photo Location 10 - Facing southwest (downstream) along Sand Creek. 8/25/2023

Photo Location 11 - Facing north along Olio Road at southern approach to Sand Creek bridge in NSA 2.
8/25/2023

Photo Location 12 - Facing west at 15461 Olio Road residence (receptor 4) in NSA 2 on west side of road.
8/25/2023

Photo Location 13 - Facing northwest at 15455 Olio Road residence (receptor 5) in NSA 2 on west side of road. 8/25/2023

Photo Location 14 - Facing northwest at 15411 Olio Road residence (receptor 6) in NSA 2 on west side of road. 8/25/2023

Photo Location 15 - Facing northwest at 15315 Olio Road residence (receptor 10) in NSA 2 on west side of road. 8/25/2023

Photo Location 16 - Facing north along Olio Road from north of Noblesville Fire Station 77 entrance in NSA 2. 8/25/2023

Photo Location 17 - Facing southwest at Noblesville Fire Station 77 (receptor 11) in NSA 2 on west side of road. 8/25/2023

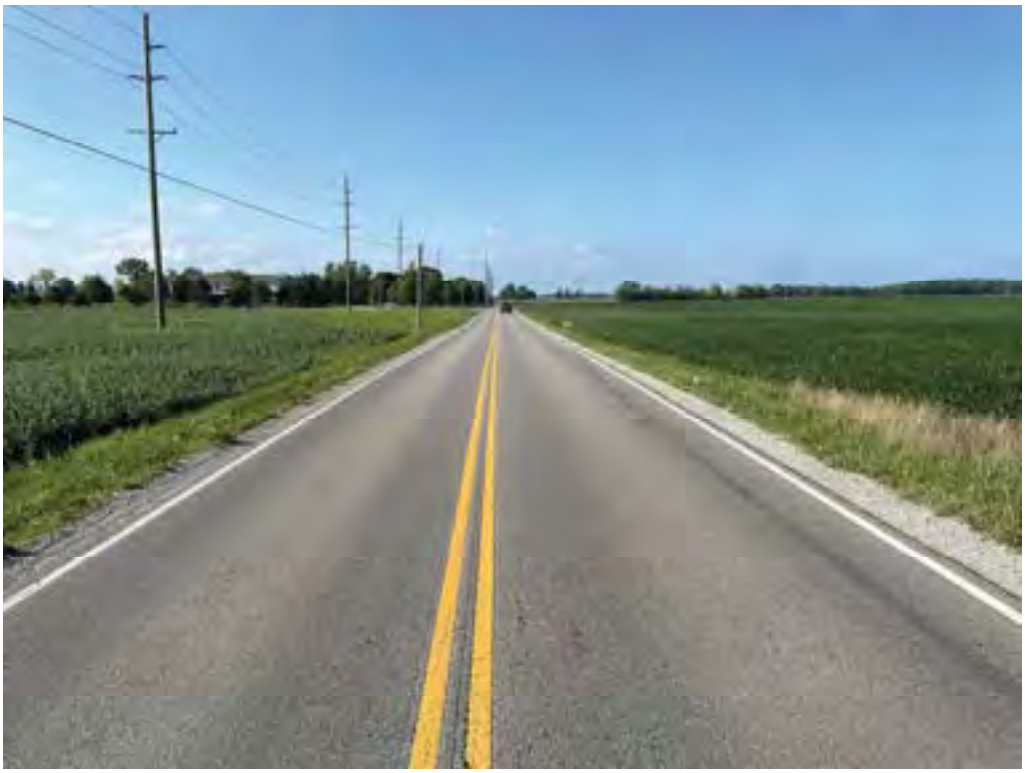


Photo Location 18 - Facing north along Olio Road from north of Deer Creek Specialty Farms. 8/25/2023

Photo Location 19 - Facing southeast at 15012 Olio Road residence (receptor 12) in NSA 3 on east side of Olio Road. 8/25/2023

Photo Location 20 - Facing northwest at Gate 8 entrance to Ruoff Music Center parking area on west side of Olio Road. 8/25/2023

Photo Location 21 - Facing west at Gate 6 entrance to Ruoff Music Center parking area on west side of Olio Road. 8/25/2023

Photo Location 22 - Facing south along Olio Road toward 146th Street roundabout. 8/25/2023

Photo Location 23 - Facing east along 146th Street toward Olio Road roundabout. 8/25/2023

Photo Location 24 - Facing north along Olio Road toward 146th Street roundabout. 8/25/2023

Photo Location 25 - Facing west along 146th Street toward Olio Road roundabout. 8/25/2023

Appendix C
Tables

Table 1. FHWA Activity Categories, Descriptions and Noise Abatement Criteria (NAC)

Activity Category	$L_{eq}(h)$	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Residential
C	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or not profit institutional structures, radio studios, television studios, trails and trail crossings.
D	52 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public and not profit institutional structures, radio studios, recording studios, schools, and television studios.
E	72 (Exterior)	Hotels, motels, offices, restaurant/bars and other developed lands, properties, or activities not included in A-D or F.
F	---	Agriculture, airports, bus yards, emergency services, industrial logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	---	Undeveloped lands that are not permitted.

Table 2. Olio Road Ambient Field Measurement Summary and TNM 2.5 Validation Comparison

Location	Run ID Time	Lane Direction	Hourly Adjusted Traffic Count					Field Measurement	TNM Prediction	Field Measurement Minus TNM Predicted ($L_{eq}(h)$)
			Automobile	Medium Truck	Heavy Truck	Bus	Motorcycle			
NSA 1 13775 156th Street Receptor 3	NSA 1-1 9:22am	Olio NB thru	120	8	20	4		56.8	59.0	-2.2
		Olio NB RT								
		Olio NB LT								
		Olio SB thru	88		16					
		Olio SB RT								
		Olio SB LT								
		156TH EB thru	4							
		156th EB RT	4							
		156th EB LT								
		156TH WB thru	8							
		156th WB RT								
		156th WB LT								
	NSA 1-2 1:34pm	Olio NB thru	108	8	16			58.2	59.8	-1.6
		Olio NB RT								
		Olio NB LT	36			8				
		Olio SB thru	64		24	4				
		Olio SB RT								
		Olio SB LT	4							
		156TH EB thru								
		156th EB RT	28			4				
		156th EB LT								
		156TH WB thru	4							
		156th WB RT								
		156th WB LT								
	NSA 1-3 5:27pm	Olio NB thru	212	4	12			59.0	58.4	0.6
		Olio NB RT								
		Olio NB LT	40							
		Olio SB thru	140		4					
		Olio SB RT								
		Olio SB LT								
		156TH EB thru	16							
		156th EB RT	24							
		156th EB LT								
		156TH WB thru	12							
		156th WB RT								
		156th WB LT								
NSA 2 15411 Olio Road Receptor 6	NSA 2-1 8:45am	Olio NB	120	8	20			66.0	63.4	2.6
		Olio SB	144	4	20	4				
	NSA 2-2 1:11pm	Olio NB	84	4	12			65.3	64.3	1.0
		Olio SB	124	4	48	4				
	NSA 2-3 5:00pm	Olio NB	312		4			66.5	61.8	4.7
		Olio SB	212		4					
NSA 3 15000 Olio Road Receptor 13	NSA 3-1 8:17am	Olio NB	156		20			63.4	63.1	0.3
		Olio SB	168	8	40	8				
	NSA 3-2 12:48pm	Olio NB	128		28			65.6	60.9	4.7
		Olio SB	128	4	4	4				
	NSA 3-3 4:38pm	Olio NB	264		8	4		64.6	60.5	4.1
		Olio SB	188		4					

Green shaded cells indicate monitoring periods where the TNM 2.5 model result was within ±3 dB(A) of the field measurement
Red shaded cells indicate monitoring periods where the TNM 2.5 model result was not within or near ±3 dB(A) of the field measurement

Table 3. Olio Road Base Year 2022 Traffic Data for TNM 2.5

Roadway Section	Movements	Hourly Traffic Volumes					Speed (mph)	
		Cars	Medium Truck	Heavy Truck	Bus	Motorcycle	Posted	Model
146th Street Roundabout	Olio NB LT	139					45	50
	Olio NB Thru	141		12				
	Olio NB RT	14						
	146th EB LT	5					N/A	30
	146th EB Thru	38						
	146th EB RT	148						
	146th WB LT	17					N/A	30
	146th WB Thru	47						
	146th WB RT	0						
Olio Road	Olio NB	243		10			45	50
	Olio SB	169		11				
156th Street Intersection	Olio SB LT	2					45	50
	Olio SB Thru	141		11				
	Olio SB RT	3						
	156th EB LT	2					N/A	30
	156th EB Thru	13						
	156th EB RT	32						
	156th WB LT	7					N/A	30
	156th WB Thru	4						
	156th WB RT	2						

Source: 2022 existing condition traffic data for TNM 2.5 was derived from Olio Road Project Traffic Analysis Memo (Lochmueller Group 2023).

Table 4. Olio Road Design Year 2045 Traffic Data for TNM 2.5

Roadway Section	Movements	Hourly Traffic Volumes					Speed (mph)	
		Cars	Medium Truck	Heavy Truck	Bus	Motorcycle	Posted	Model
146th Street Roundabout	Olio NB LT	184					45	50
	Olio NB Thru	187		16				
	Olio NB RT	19						
	146th EB LT	7					N/A	30
	146th EB Thru	50						
	146th EB RT	196						
	146th WB LT	22					N/A	30
	146th WB Thru	63						
	146th WB RT	22						
Olio Road	Olio NB	318		12			45	50
	Olio SB	220		15				
156th Street Roundabout	Olio SB LT	3					45	50
	Olio SB Thru	169		15				
	Olio SB RT	4						
	156th EB LT	3					N/A	30
	156th EB Thru	17						
	156th EB RT	42						
	156th WB LT	9					N/A	30
	156th WB Thru	7						
	156th WB RT	3						

Source: 2045 design year condition traffic data for TNM 2.5 was derived from Olio Road Project Traffic Analysis Memo (Lochmueller Group 2023).

Table 5. TNM 2.5 2022 Existing Condition and 2045 Design Year Leq(h) Results

Receptor Number	Address	Receptor Description	Dwelling Units	Activity Category	NAC (dB(A))	Substantial Increase Criteria (dB(A))	2022 Existing Modeled Leq (h) (dB(A))	2045 Design Year Modeled Leq (h) (dB(A))	2045 Design Year Increase Leq (h) (dB(A))	2045 Design Year Impacts?
NSA 1										
1	13687 E 156th St	Single-family residence	1	B	66	15	46.6	47.5	0.9	No
2	13723 E 156th St	Single-family residence	1	B	66	15	51.4	51.6	0.2	No
3	**13775 E 156th St**	**Single-family residence**	1	B	66	15	58.7	57.8	-0.9	No
NSA 2										
4	15461 Olio Rd	Single-family residence	1	B	66	15	56.9	57.4	0.5	No
5	15455 Olio Rd	Single-family residence	1	B	66	15	56.8	57.2	0.4	No
6	**15411 Olio Rd**	**Single-family residence**	1	B	66	15	62.8	61.7	-1.1	No
7	15421 Olio Rd	Single-family residence	1	B	66	15	52.3	53.0	0.7	No
8	15433 Olio Rd	Single-family residence	1	B	66	15	49.0	50.8	1.8	No
9	15445 Olio Rd	Single-family residence	1	B	66	15	47.0	48.6	1.6	No
10	15315 Olio Rd	Single-family residence	1	B	66	15	61.9	60.6	-1.3	No
11	15251 Olio Rd	Noblesville Fire Station 77	N/A	F	71	15	57.2	57.1	-0.1	No
NSA 3										
12	15012 Olio Rd	Single-family residence	1	B	66	15	63.1	61.7	-1.4	No
13	**15000 Olio Rd**	**Single-family residence**	1	B	66	15	60.9	59.5	-1.4	No

Bold text indicates receptors where ambient field noise measurements were taken.

Appendix D
Larson-Davis Certificates of Calibration and Conformance
Model CAL200 Acoustic Calibrator

A recent Larson Davis Certificate of Calibration and Conformance was not available for the Larson Davis DSP82 SLM device prior to use in conducting field measurements. The device was returned to Larson Davis in December 2023 to have the unit certified post-use for Olio Road data collection. However, due to the age of the model, Larson Davis was no longer equipped to officially certify the unit. In lieu of a certification, Larson Davis checked the DSP82 against a calibrator and determined that the device was working properly as it was received.

Prior to each use of the Larson Davis DSP82, the device was checked against a Larson Davis CAL200 acoustic calibrator at 94dB in the field and was found to be functioning properly before use. The CAL200 calibrator was returned to Larson Davis for post-use certification in December 2023. It was checked by Larson Davis technicians on December 14, 2023 and found to not be in calibration in accordance with Procedure D0001.8190, IEC 60942:2003. However, the variance of the device was only 0.35 dB at 94 dB and 0.36 dB at 114 dB.

Since the Larson Davis DSP82 was calibrated to the CAL200 at a level potentially 0.35 dB higher than 94 dB, it is expected that the field measurements may also be approximately 0.35 dB greater. Considering this differential, all the comparisons of the measured Leq(h) readings to the TNM model Leq(h) predictions evaluated in Table 2 of Appendix C would still be valid since the difference would be approximately 0.35 dBA less than that reported.

LARSON DAVIS
A PCB DIVISION

Certificate of Calibration and Conformance

Certificate Number 2023-211965

Instrument Model CAL200, Serial Number 0440, was calibrated on 14 Dec 2023. The instrument meets factory specifications per Procedure D0001.8190, IEC 60942:2003.

Instrument found to be in calibration as received: NO
Date Calibrated: 14 Dec 2023
Calibration due:

Calibration Standards Used

MANUFACTURER	MODEL	SERIAL NUMBER	INTERVAL	CAL DUE	TRACEABILITY NO.
Omega	PX329-015A10V	0916211063	12 Months	21 Dec 2023	3754476488.00
Larson Davis	MTS1000/2201	0111	12 Months	22 Feb 2024	SM022223
Larson Davis	2900	0661	12 Months	31 Mar 2024	2023-211384
Larson Davis	2559	2506	12 Months	11 Apr 2024	49430
Hewlett Packard	34401A	3146A10352	12 Months	21 Jun 2024	2023007808
Larson Davis	PRM902	0480	12 Months	4 Aug 2024	2023-009988
Larson Davis	PRM915	0112	12 Months	16 Aug 2024	2023-211672

Reference Standards are traceable to the National Institute of Standards and Technology (NIST)

Calibration Environmental Conditions

Environmental test conditions as shown on calibration report.

Affirmations

This Certificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the U.S. National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at Provo Engineering & Manufacturing Center. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

The results documented in this certificate relate only to the item(s) calibrated or tested. A one year calibration is recommended, however calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of the issuer.

Before: See "As Received" data.
After: Refer to Certificate of Measured Output.

Signed: Scott Montgomery
Technician: Scott Montgomery

Provo Engineering and Manufacturing Center, 1681 West 820 North, Provo, Utah 84601
Toll Free: 888.258.3222 Telephone: 716.926.8243 Fax: 716.926.8215
ISO 9001-2015 Certified

LARSON DAVIS
A PCB PIEZOTRONICS DIV

Larson Davis CAL200 Acoustic Calibrator, SN: 0440
FAILED

Performance at Reference Conditions

Nominal Level (dB SPL):	94	114
Measured Level (dB SPL):	***94.35***	***114.36***
Expanded Uncertainty (dB):	0.145	0.143
Level Error Limit (dB):	±0.44	±0.44
Nominal Frequency (Hz):	1000	1000
Measured Frequency (Hz):	**1000.0**	**999.8**
Expanded Uncertainty (Hz):	0.2	0.2
Frequency Error Limit (Hz):	±10.0	±10.0
Measured Distortion (%):	0.89	1.78
Expanded Uncertainty (%):	0.25	0.25
Distortion Limit (%):	3.0	3.0

The data is aquired by the insert voltage calibration method using the reference microphone's open circuit sensitivity

Environmental Conditions

Temperature (°C):	23	23
Relative Humidity (%):	28	28
Static Pressure (kPa):	101.4	101.3

Reference Microphone

Model: Larson Davis 2559
Serial Number: 2506
Open Circuit Sensitivity: 12.320 mV/Pascal
Uncertainty: 0.120 dB

Influence of Static Pressure

Nominal Level (dB SPL): 114

Nominal Pressure (kPa)	Pressure (kPa)	Level Change (dB)	Frequency Change (Hz)	Distortion (%)
108.0	108.0	0.02	-0.00	1.96
101.3	101.2	0.00	0.00	1.78
92.0	92.0	-0.00	0.00	1.53
83.0	83.0	0.04	0.01	1.30
74.0	74.2	0.14	0.01	1.09
65.0	65.1	0.32	0.02	0.89
Expanded Uncertainty:	1.0	0.04	0.20	0.25
Limit:			±10.0	3.0

Reference microphone corrections applied.

Environmental Conditions

Temperature (°C):	23
Relative Humidity (%):	28

Reference Microphone

Model: Larson Davis 2559
Serial Number: 2506

Static pressure was measured with a calibrated Motorola pressure sensor MPX2100AP.
Temperature and humidity was measured with a calibrated Fluke 1620A sensor.
Expanded uncertainty of environmental measurements: 0.3 °C, 3 %RH, 1.0 kPa
Uncertainty values are given at 95% confidence level (k = 2).

A Sound Level Meter can be calibrated to a level (L) defined as: L = measured level + pressure sensitivity
or if a Sound Level Meter is calibrated using the nominal level, the adjustments to data (X) are defined as:
X = measured level - nominal level - pressure sensitivity

Scott Montgomery | Larson Davis Calibrator Calibration System | 12 / 14 / 2023

Appendix E
Field Measurement Sheets

Ambient/Highway Noise Measurement Data Sheet

Project Information

Project Name: Olio Road

Lochmueller Group Project No: 122-2027-00B

Client No: 2101733

Receptor Information

Receptor ID: Olio 3

Address: 13775 156th Street

Receptor Description: Front yard off of southeast corner of house.

Photo 1 - Receptor 3 at 13775 E 156th Street facing Olio Road from SLM location from side yard (Run 1 at 9:22am)

Photo 2 - Receptor 3 SLM location at 13775 E 156th Street (Run 1 at 9:22am)

Ambient Measurement Information

Run ID: Olio 3-1

Personnel: Rusty Yeager

Date: 3/29/2023 Temperature: 37 deg F Wind speed: 1.3 mph

Time: 9:22:00 AM Relative humidity: 41 % Wind speed max: 8.6 mph

Measurement Duration (mm:ss): 15 min. Cloud cover: 80 % Wind direction: NW

Non-traffic noise sources:

SLM Results

LAeq: 56.8 dBA LAmax: 94.6 dB

Measurement Period Traffic Count Data (adjusted to one hour counts)

Roadway	Cars	Medium Truck	Heavy Truck	Bus	Motorcycle
156th Street EB RT	4				
156th Street EB T	4				
156th Street WB T	8				
Olio Road NB T	120	8	20	4	
Olio Road SB T	88		16		

Ambient/Highway Noise Measurement Data Sheet

Project Information

Project Name: Olio Road

Lochmueller Group Project No: 122-2027-00B

Client No: 2101733

Receptor Information

Receptor ID: Olio 3

Address: 13775 156th Street

Receptor Description: Front yard off of southeast corner of house.

Photo 1 - Receptor 3 at 13775 E 156th Street facing Olio Road from SLM location from side yard (Run 3 at 1:34pm)

Photo 2 - Receptor 3 SLM location at 13775 E 156th Street (Run 3 at 1:34pm)

Ambient Measurement Information

Run ID: Olio 3-2

Personnel: Rusty Yeager

Date: 3/29/2023 Temperature: 52 deg F Wind speed: 2.4 mph

Time: 1:34:00 PM Relative humidity: 20 % Wind speed max: 10.8 mph

Measurement Duration (mm:ss): 15 min. Cloud cover: 0 % Wind direction: NW

Non-traffic noise sources:

SLM Results

LAeq: 58.2 dBA LAmax: 102.3 dB

Measurement Period Traffic Count Data (adjusted to one hour counts)

Roadway	Cars	Medium Truck	Heavy Truck	Bus	Motorcycle
156th Street EB RT	28			4	
156th Street WB T	4				
Olio Road NB LT	36			8	
Olio Road NB RT					
Olio Road NB T	108	8	16		
Olio Road SB LT	4				
Olio Road SB RT					
Olio Road SB T	64		24	4	

Ambient/Highway Noise Measurement Data Sheet

Project Information

Project Name: Olio Road

Lochmueller Group Project No: 122-2027-00B

Client No: 2101733

Receptor Information

Receptor ID: Olio 3

Address: 13775 156th Street

Receptor Description: Front yard off of southeast corner of house.

Photo 1 - Receptor 3 at 13775 E 156th Street facing Olio Road from SLM location from side yard (Run 3 at 5:27pm)

Photo 2 - Receptor 3 SLM location at 13775 E 156th Street (Run 3 at 5:27pm)

Ambient Measurement Information

Run ID: Olio 3-3

Personnel: Rusty Yeager

Date: 3/29/2023 Temperature: 51 deg F Wind speed: 8.5 mph

Time: 5:27:00 PM Relative humidity: 13 % Wind speed max: 14.6 mph

Measurement Duration (mm:ss): 15 min. Cloud cover: 50 % Wind direction: NW

Non-traffic noise sources: Wind.

SLM Results

LAeq: 59.0 dBA LAmax: 107.8 dB

Measurement Period Traffic Count Data (adjusted to one hour counts)

Roadway	Cars	Medium Truck	Heavy Truck	Bus	Motorcycle
156th Street EB LT					
156th Street EB RT	24				
156th Street EB T	16				
156th Street WB LT					
156th Street WB RT					
156th Street WB T	12				
Olio Road NB LT	40				
Olio Road NB RT					
Olio Road NB T	212	4	12		
Olio Road SB LT					
Olio Road SB RT					
Olio Road SB T	140		4		

Ambient/Highway Noise Measurement Data Sheet

Project Information

Project Name: Olio Road

Lochmueller Group Project No: 122-2027-00B

Client No: 2101733

Receptor Information

Receptor ID: Olio 6

Address: 15411 Olio Road

Receptor Description: Front yard straight off front porch deck.

Photo 1 - Receptor 6 at 15411 Olio Road facing Olio Road from SLM location in front yard off deck (Run 1 at 8:45am)

Photo 2 - Receptor 6 SLM location at 15411 Olio Road (Run 1 at 8:45am)

Ambient Measurement Information

Run ID: Olio 6-1

Personnel: Rusty Yeager

Date: 3/29/2023 Temperature: 37 deg F Wind speed: 1.1 mph

Time: 8:45:00 AM Relative humidity: 43 % Wind speed max: 2.6 mph

Measurement Duration (mm:ss): 15 min. Cloud cover: 0 % Wind direction: NW

Non-traffic noise sources: Dog, birds, one car leaving to south from drive.

SLM Results

LAeq: 66.0 dBA LAmax: 101.5 dB

Measurement Period Traffic Count Data (adjusted to one hour counts)

Roadway	Cars	Medium Truck	Heavy Truck	Bus	Motorcycle
Olio Road NB	120	8	20		
Olio Road SB	144	4	20	4	

Ambient/Highway Noise Measurement Data Sheet

Project Information

Project Name: Olio Road

Lochmueller Group Project No: 122-2027-00B

Client No: 2101733

Receptor Information

Receptor ID: Olio 6

Address: 15411 Olio Road

Receptor Description: Front yard straight off front porch deck.

Photo 1 - Receptor 6 at 15411 Olio Road facing Olio Road from SLM location in front yard off deck (Run 2 at 1:11pm)

Photo 2 - Receptor 6 SLM location at 15411 Olio Road (Run 2 at 1:11pm)

Ambient Measurement Information

Run ID: Olio 6-2

Personnel: Rusty Yeager

Date: 3/29/2023 Temperature: 52 deg F Wind speed: 3.3 mph

Time: 1:11:00 PM Relative humidity: 20 % Wind speed max: 10.7 mph

Measurement Duration (mm:ss): 15 min. Cloud cover: 0 % Wind direction: NW

Non-traffic noise sources: Wind shielded by house. Strong gusts.

SLM Results

LAeq: 65.3 dBA LAmax: 108.1 dB

Measurement Period Traffic Count Data (adjusted to one hour counts)

Roadway	Cars	Medium Truck	Heavy Truck	Bus	Motorcycle
Olio Road NB	84	4	12		
Olio Road SB	124	4	48	4	

Ambient/Highway Noise Measurement Data Sheet

Project Information

Project Name: Olio Road

Lochmueller Group Project No: 122-2027-00B

Client No: 2101733

Receptor Information

Receptor ID: Olio 6

Address: 15411 Olio Road

Receptor Description: Front yard straight off front porch deck.

Photo 1 - Receptor 6 at 15411 Olio Road facing Olio Road from SLM location in front yard off deck (Run 3 at 5:00pm)

Photo 2 - Receptor 6 SLM location at 15411 Olio Road (Run 3 at 5:00pm)

Ambient Measurement Information

Run ID: Olio 6-3

Personnel: Rusty Yeager

Date: 3/29/2023 Temperature: 51 deg F Wind speed: 4.0 mph

Time: 5:00:00 PM Relative humidity: 15 % Wind speed max: 9.8 mph

Measurement Duration (mm:ss): 15 min. Cloud cover: 60 % Wind direction: NW

Non-traffic noise sources: Slow moving vehicle turned into residential lane from north. Car left lane to south.

SLM Results

LAeq: 66.5 dBA LAmax: 104.6 dB

Measurement Period Traffic Count Data (adjusted to one hour counts)

Roadway	Cars	Medium Truck	Heavy Truck	Bus	Motorcycle
Olio Road NB	312		4		
Olio Road SB	212		4		

Ambient/Highway Noise Measurement Data Sheet

Project Information

Project Name: Olio Road

Lochmueller Group Project No: 122-2027-00B

Client No: 2101733

Receptor Information

Receptor ID: Olio 13

Address: 15000 Olio Road

Receptor Description: Front yard from within horseshoe driveway.

Photo 1 - Receptor 13 at 15000 Olio Road facing Olio Road from SLM location along horseshoe drive (Run 1 at 8:17am)

Photo 2 - Receptor 13 SLM location at 15000 Olio Road (Run 1 at 8:17am)

Ambient Measurement Information

Run ID: Olio 13-1

Personnel: Rusty Yeager

Date: 3/29/2023 Temperature: 37 deg F Wind speed: 1.9 mph

Time: 8:17:00 AM Relative humidity: 49 % Wind speed max: 5.2 mph

Measurement Duration (mm:ss): 15 min. Cloud cover: 0 % Wind direction: NW

Non-traffic noise sources:

SLM Results

LAeq: 63.4 dBA LAmax: 94.3 dB

Measurement Period Traffic Count Data (adjusted to one hour counts)

Roadway	Cars	Medium Truck	Heavy Truck	Bus	Motorcycle
Olio Road NB	156		20		
Olio Road SB	168	8	40	8	

Ambient/Highway Noise Measurement Data Sheet

Project Information

Project Name: Olio Road

Lochmueller Group Project No: 122-2027-00B

Client No: 2101733

Receptor Information

Receptor ID: Olio 13

Address: 15000 Olio Road

Receptor Description: Front yard from within horseshoe driveway.

Photo 1 - Receptor 13 at 15000 Olio Road facing Olio Road from SLM location along horseshoe drive (Run 2 at 12:48pm)

Photo 2 - Receptor 13 SLM location at 15000 Olio Road (Run 2 at 12:48pm)

Ambient Measurement Information

Run ID: Olio 13-2

Personnel: Rusty Yeager

Date: 3/29/2023 Temperature: 52 deg F Wind speed: 9.6 mph

Time: 12:48:00 PM Relative humidity: 21 % Wind speed max: 16.1 mph

Measurement Duration (mm:ss): 15 min. Cloud cover: 0 % Wind direction: NW

Non-traffic noise sources: Strong wind. Grain elevator on adjacent property running. All truck traffic dump trucks.

SLM Results

LAeq: 65.6 dBA LAmax: 113.7 dB

Measurement Period Traffic Count Data (adjusted to one hour counts)

Roadway	Cars	Medium Truck	Heavy Truck	Bus	Motorcycle
Olio Road NB	128		28		
Olio Road SB	128	4	4	4	

Ambient/Highway Noise Measurement Data Sheet

Project Information

Project Name: Olio Road

Lochmueller Group Project No: 122-2027-00B

Client No: 2101733

Receptor Information

Receptor ID: Olio 13

Address: 15000 Olio Road

Receptor Description: Front yard from within horseshoe driveway.

Photo 1 - Receptor 13 at 15000 Olio Road facing Olio Road from SLM location along horseshoe drive (Run 3 at 4:38pm)

Photo 2 - Receptor 13 SLM location at 15000 Olio Road (Run 3 at 4:38pm)

Ambient Measurement Information

Run ID: Olio 13-3

Personnel: Rusty Yeager

Date: 3/29/2023 Temperature: 51 deg F Wind speed: 11.4 mph

Time: 4:38:00 PM Relative humidity: 15 % Wind speed max: 15.5 mph

Measurement Duration (mm:ss): 15 min. Cloud cover: 100 % Wind direction: NW

Non-traffic noise sources: Strong wind. Grain elevator on adjacent property running.

SLM Results

LAeq: 64.6 dBA LAmax: 115.0 dB

Measurement Period Traffic Count Data (adjusted to one hour counts)

Roadway	Cars	Medium Truck	Heavy Truck	Bus	Motorcycle
Olio Road NB	264		8	4	
Olio Road SB	188		4		

Appendix F
TNM 2.5 Validation Sound Level Results

Lochmueller Group
Rusty Yeager

24 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Validation 2023 NSA 1-1
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc					
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
2 - 13723 E 156th St - NSA1	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
3 - 13775 E 156th St - NSA1	3	1	0.0	59.0	66	59.0	15	----	59.0	0.0	7	-7.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	0.0	71	0.0	15	inactive	0.0	0.0	7	0.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Lochmueller Group
Rusty Yeager

24 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Validation 2023 NSA 1-2
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
2 - 13723 E 156th St - NSA1	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
3 - 13775 E 156th St - NSA1	3	1	0.0	59.8	66	59.8	15	----	59.8	0.0	7	-7.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	0.0	71	0.0	15	inactive	0.0	0.0	7	0.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Lochmueller Group
Rusty Yeager

24 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS

PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Validation 2023 NSA 1-3
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc					
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
2 - 13723 E 156th St - NSA1	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
3 - 13775 E 156th St - NSA1	3	1	0.0	58.4	66	58.4	15	----	58.4	0.0	7	-7.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	0.0	71	0.0	15	inactive	0.0	0.0	7	0.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Lochmueller Group
Rusty Yeager

24 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS

PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Validation 2023 NSA 2-1
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc					
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
2 - 13723 E 156th St - NSA1	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
3 - 13775 E 156th St - NSA1	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	63.4	66	63.4	15	----	63.4	0.0	7	-7.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	0.0	71	0.0	15	inactive	0.0	0.0	7	0.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Lochmueller Group
Rusty Yeager

24 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS

PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Validation 2023 NSA 2-2
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc					
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
2 - 13723 E 156th St - NSA1	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
3 - 13775 E 156th St - NSA1	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	64.3	66	64.3	15	----	64.3	0.0	7	-7.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	0.0	71	0.0	15	inactive	0.0	0.0	7	0.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Lochmueller Group
Rusty Yeager

24 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Validation 2023 NSA 2-3
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc					
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
2 - 13723 E 156th St - NSA1	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
3 - 13775 E 156th St - NSA1	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	61.8	66	61.8	15	----	61.8	0.0	7	-7.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	0.0	71	0.0	15	inactive	0.0	0.0	7	0.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Lochmueller Group
Rusty Yeager

24 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Validation 2023 NSA 3-1
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc					
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
2 - 13723 E 156th St - NSA1	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
3 - 13775 E 156th St - NSA1	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	0.0	71	0.0	15	inactive	0.0	0.0	7	0.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	63.1	66	63.1	15	----	63.1	0.0	7	-7.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Lochmueller Group
Rusty Yeager

24 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Validation 2023 NSA 3-2
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		With Barrier Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc					
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
2 - 13723 E 156th St - NSA1	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
3 - 13775 E 156th St - NSA1	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	0.0	71	0.0	15	inactive	0.0	0.0	7	0.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	60.9	66	60.9	15	----	60.9	0.0	7	-7.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Lochmueller Group
Rusty Yeager

24 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Validation 2023 NSA 3-3
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
2 - 13723 E 156th St - NSA1	2	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
3 - 13775 E 156th St - NSA1	3	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	0.0	71	0.0	15	inactive	0.0	0.0	7	0.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	0.0	66	0.0	15	inactive	0.0	0.0	7	0.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	60.5	66	60.5	15	----	60.5	0.0	7	-7.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Appendix G
TNM 2.5 2022 Base Condition Sound Level Results

Lochmueller Group
Rusty Yeager

23 August 2023
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Existing 2022 50 mph
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	0.0	46.6	66	46.6	15	----	46.6	0.0	7	-7.0
2 - 13723 E 156th St - NSA1	2	1	0.0	51.4	66	51.4	15	----	51.4	0.0	7	-7.0
3 - 13775 E 156th St - NSA1	3	1	0.0	58.7	66	58.7	15	----	58.7	0.0	7	-7.0
4 - 15461 Olio Rd - NSA2	4	1	0.0	56.9	66	56.9	15	----	56.9	0.0	7	-7.0
5 - 15455 Olio Rd - NSA2	5	1	0.0	56.8	66	56.8	15	----	56.8	0.0	7	-7.0
6 - 15411 Olio Rd - NSA2	6	1	0.0	62.8	66	62.8	15	----	62.8	0.0	7	-7.0
7 - 15421 Olio Rd - NSA2	7	1	0.0	52.3	66	52.3	15	----	52.3	0.0	7	-7.0
8 - 15433 Olio Rd - NSA2	8	1	0.0	49.0	66	49.0	15	----	49.0	0.0	7	-7.0
9 - 15445 Olio Rd - NSA2	9	1	0.0	47.0	66	47.0	15	----	47.0	0.0	7	-7.0
10 - 15315 Olio Rd - NSA2	10	1	0.0	61.9	66	61.9	15	----	61.9	0.0	7	-7.0
11 - 15251 Olio Rd - NSA2	11	1	0.0	57.2	71	57.2	15	----	57.2	0.0	7	-7.0
12 - 15012 Olio Rd - NSA3	12	1	0.0	63.1	66	63.1	15	----	63.1	0.0	7	-7.0
13 - 15000 Olio Rd - NSA3	13	1	0.0	60.9	66	60.9	15	----	60.9	0.0	7	-7.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

C:\Users\yeager\Desktop\Olio TNM\Olio Existing 2022\Olio existing 2022 50 mph

Appendix H
TNM 2.5 2045 Design Year Sound Level Results

Lochmueller Group
Rusty Yeager

23 August 2023
TNM 2.5
Calculated with TNM 2.5

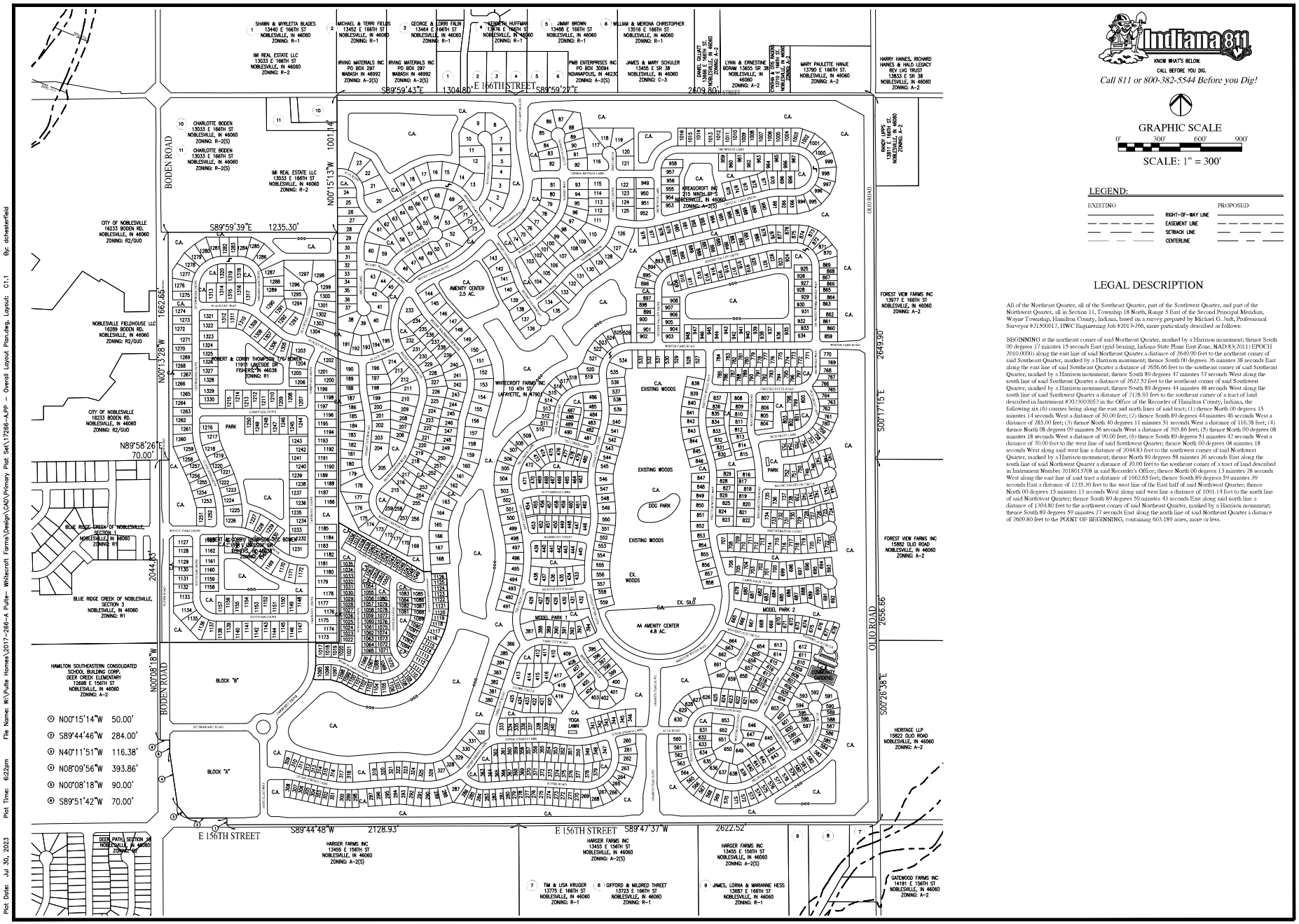
RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Olio Road ATL
RUN: Olio Road Design 2045 50 mph
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
1 - 13687 E 156th St - NSA1	1	1	46.6	47.5	66	0.9	15	----	47.5	0.0	7	-7.0
2 - 13723 E 156th St - NSA1	2	1	51.4	51.6	66	0.2	15	----	51.6	0.0	7	-7.0
3 - 13775 E 156th St - NSA1	3	1	58.7	57.8	66	-0.9	15	----	57.8	0.0	7	-7.0
4 - 15461 Olio Rd - NSA2	4	1	56.9	57.4	66	0.5	15	----	57.4	0.0	7	-7.0
5 - 15455 Olio Rd - NSA2	5	1	56.8	57.2	66	0.4	15	----	57.2	0.0	7	-7.0
6 - 15411 Olio Rd - NSA2	6	1	62.8	61.7	66	-1.1	15	----	61.7	0.0	7	-7.0
7 - 15421 Olio Rd - NSA2	7	1	52.3	53.0	66	0.7	15	----	53.0	0.0	7	-7.0
8 - 15433 Olio Rd - NSA2	8	1	49.0	50.8	66	1.8	15	----	50.8	0.0	7	-7.0
9 - 15445 Olio Rd - NSA2	9	1	47.0	48.6	66	1.6	15	----	48.6	0.0	7	-7.0
10 - 15315 Olio Rd - NSA2	10	1	61.9	60.6	66	-1.3	15	----	60.6	0.0	7	-7.0
11 - 15251 Olio Rd - NSA2	11	1	57.2	57.1	71	-0.1	15	----	57.1	0.0	7	-7.0
12 - 15012 Olio Rd - NSA3	12	1	63.1	61.7	66	-1.4	15	----	61.7	0.0	7	-7.0
13 - 15000 Olio Rd - NSA3	13	1	60.9	59.5	66	-1.4	15	----	59.5	0.0	7	-7.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	13	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Appendix I
Finch Creek
Preliminary Development Plan
Pulte Homes of Indiana, LLC



Indiana 811
KNOW WHAT'S BELOW.
CALL BEFORE YOU DIG.
Call 811 or 800-382-5544 Before you Dig!

GRAPHIC SCALE
0' 300' 600' 900'
SCALE: 1" = 300'

LEGEND:

EXISTING		PROPOSED
	RIGHT-OF-WAY LINE	
	EASEMENT LINE	
	SETBACK LINE	
	CENTERLINE	

LEGAL DESCRIPTION

All of the Northeast Quarter, all of the Southeast Quarter, part of the Southwest Quarter, and part of the Northwest Quarter, all in Section 11, Township 18 North, Range 5 East of the Second Principal Meridian, Wayne Township, Hamilton County, Indiana, based on a survey prepared by Michael O. Judt, Professional Surveyor #21500017, HWC Engineering Job #2017-266, more particularly described as follows:

BEGINNING at the northeast corner of said Northeast Quarter, marked by a Harrison monument; thence South 00 degrees 17 minutes 15 seconds East (grid bearing, Indiana State Plane East Zone, NAD 83(2011) EPOCH 2010.0000) along the east line of said Northeast Quarter a distance of 2649.90 feet to the northeast corner of said Southeast Quarter, marked by a Harrison monument; thence South 00 degrees 26 minutes 38 seconds East along the east line of said Southeast Quarter a distance of 2656.66 feet to the southeast corner of said Southeast Quarter, marked by a Harrison monument; thence South 89 degrees 47 minutes 37 seconds West along the south line of said Southeast Quarter a distance of 2622.52 feet to the southeast corner of said Southwest Quarter, marked by a Harrison monument; thence South 89 degrees 44 minutes 48 seconds West along the south line of said Southwest Quarter a distance of 2128.93 feet to the southeast corner of a tract of land described in Instrument #2017000052 in the Office of the Recorder of Hamilton County, Indiana, the following six (6) courses being along the east and north lines of said tract; (1) thence North 00 degrees 15 minutes 14 seconds West a distance of 50.00 feet; (2) thence South 89 degrees 44 minutes 46 seconds West a distance of 284.00 feet; (3) thence North 40 degrees 11 minutes 51 seconds West a distance of 116.38 feet; (4) thence North 08 degrees 09 minutes 56 seconds West a distance of 393.86 feet; (5) thence North 00 degrees 08 minutes 18 seconds West a distance of 90.00 feet; (6) thence South 89 degrees 51 minutes 42 seconds West a distance of 70.00 feet to the west line of said Southwest Quarter; thence North 00 degrees 08 minutes 18 seconds West along said west line a distance of 2044.83 feet to the southwest corner of said Northwest Quarter, marked by a Harrison monument; thence North 89 degrees 58 minutes 26 seconds East along the south line of said Northwest Quarter a distance of 70.00 feet to the southeast corner of a tract of land described in Instrument Number 2018013708 in said Recorder's Office; thence North 00 degrees 13 minutes 28 seconds West along the east line of said tract a distance of 1662.65 feet; thence South 89 degrees 59 minutes 39 seconds East a distance of 1235.30 feet to the west line of the East half of said Northwest Quarter; thence North 00 degrees 15 minutes 13 seconds West along said west line a distance of 1001.14 feet to the north line of said Northwest Quarter; thence South 89 degrees 59 minutes 43 seconds East along said north line a distance of 1304.80 feet to the northwest corner of said Northeast Quarter, marked by a Harrison monument; thence South 89 degrees 59 minutes 27 seconds East along the north line of said Northeast Quarter a distance of 2609.80 feet to the POINT OF BEGINNING, containing 603.189 acres, more or less.

REVISIONS

DATE	DESCRIPTION	BY

HWC ENGINEERING
INDIANAPOLIS - TERRE HAUTE
LAFAYETTE - MUNCIE - NEW ALBANY
www.hwcengineering.com

FINCH CREEK PRELIMINARY DEVELOPMENT PLAN
NOBLESVILLE, INDIANA
OVERALL LAYOUT PLAN

PRELIMINARY
NOT FOR CONSTRUCTION
BRANDON T. BURKE
REGISTERED
No. 10000075
STATE OF INDIANA
PROFESSIONAL ENGINEER

DRAWN BY	DC
CHECKED BY	BB
DATE	JULY 31, 2023
SCALE	AS SHOWN
JOB NUMBER	2017-266-A
SHEET	C1.1
	OVERALL LAYOUT PLAN

Plot Date: Jul 30, 2023 Plot Time: 6:22pm File Name: W:\Pulte Homes\2017-266-A Pulte- Whitecroft Farms\Design\CAD\Primary Plat Set\17266-A.PP - Overall Layout Plan.dwg, Layout: C1.1 By: dchesterfield

From:	Passmore, Andrew D
To:	Rusty Yeager
Cc:	Bales, Ronald; McGeorge, Tyler B; Trevor Wieseke; Jason DuPont; Jeremy Kieffner; Chad Costa; Passmore, Andrew D; Szewczak, Kimberly
Subject:	Des 2101733 Noise Analysis Submittal - Technical Sufficiency
Date:	Friday, February 2, 2024 7:55:15 AM
Attachments:	image004.png image008.png

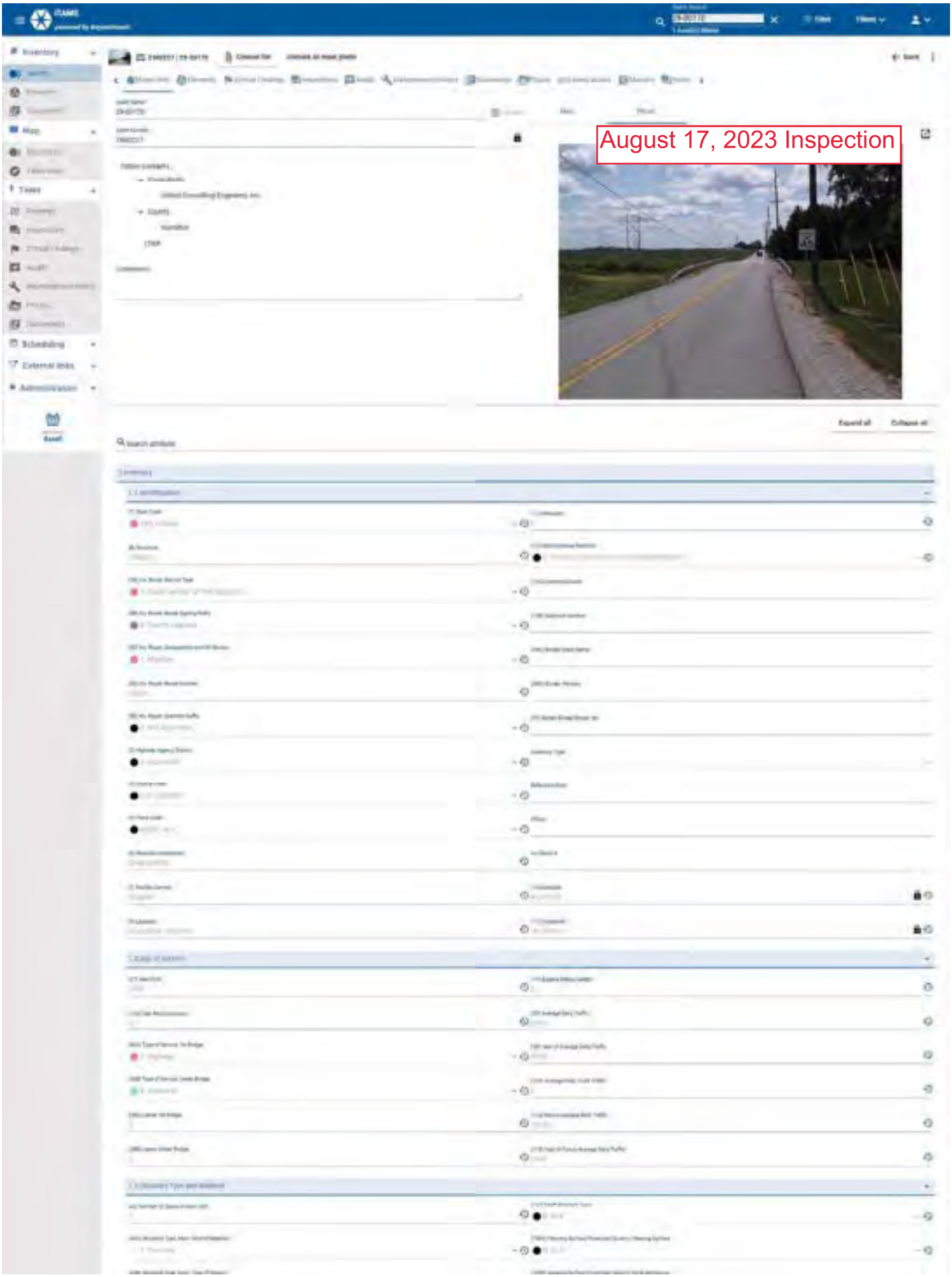
EXTERNAL

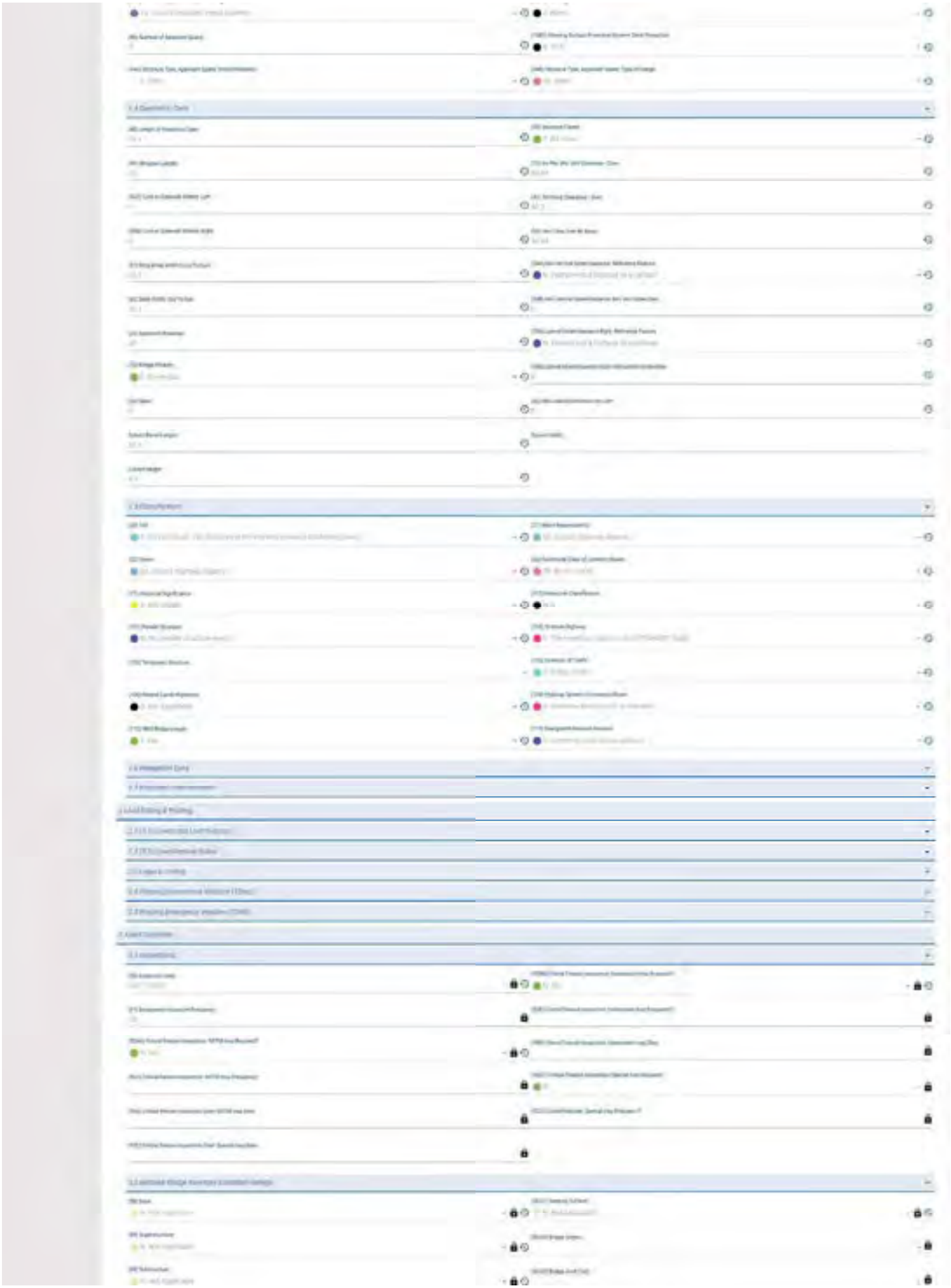
Rusty,

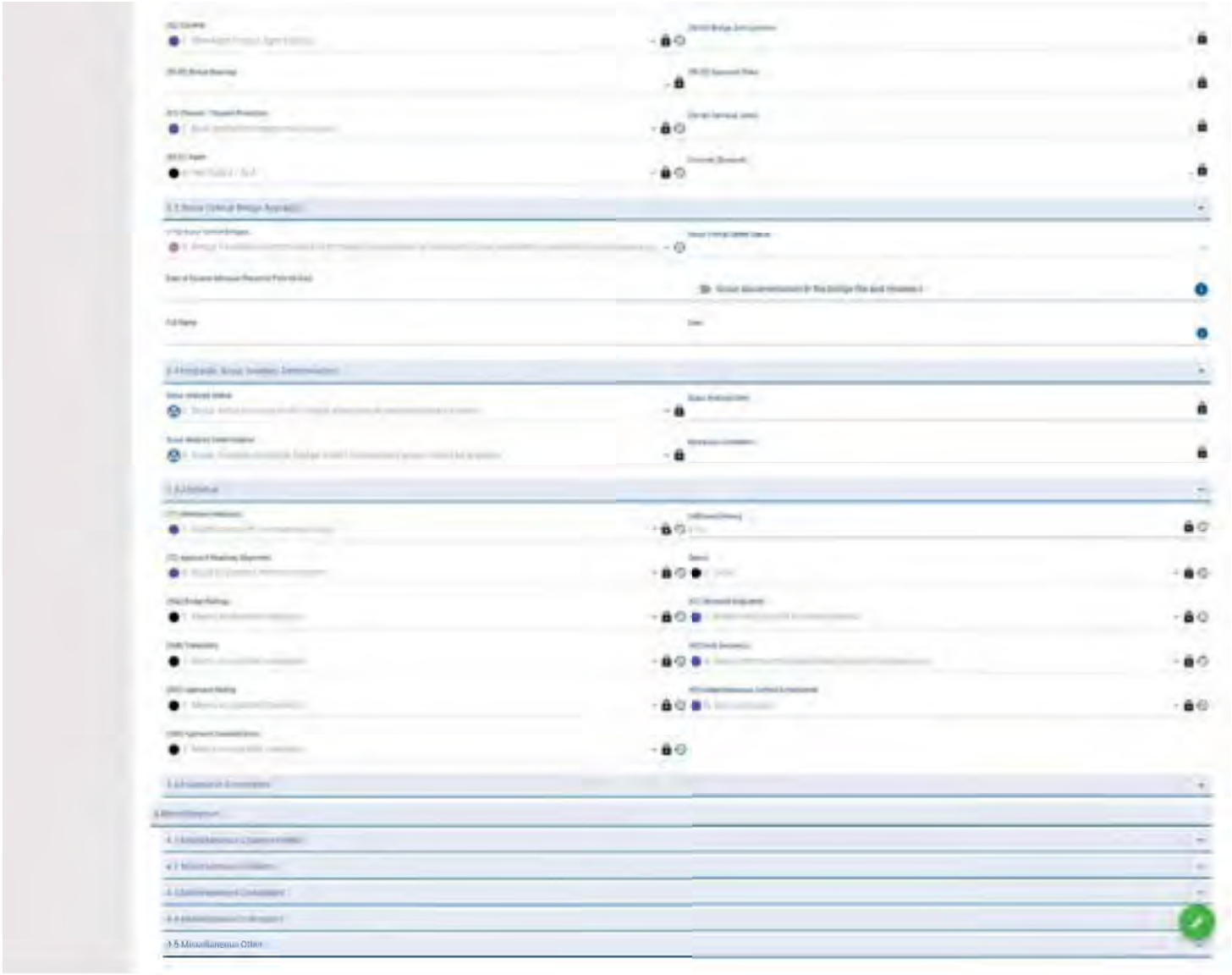
INDOT Environmental Services Division (ESD) has reviewed the noise analysis for the above-referenced project (Des 21101733) and found it to be technically sufficient. As you are aware, INDOT no longer comments on recommendations provided in noise studies for local agency projects. However, it is our assessment that the study has been completed in accordance with federal guidelines and state policy.

The following is required as a firm project commitment: Upon completion of the environmental document phase, the noise study will be provided directly to the county's planning unit by the environmental preparer and/or member of the project team. If the project is in a municipality that has a planning unit, a noise study will also be provided to the municipality's planning unit. INDOT Environmental Services Division shall be copied on this correspondence.

Drew Passmore
NEPA Review Team Lead
Indiana Department of Transportation
100 North Senate Ave., N758 — Environmental Services Division
Indianapolis, IN 46204
Cell: 317-439-7500
Email: APassmore@indot.in.gov


August 17, 2023 Inspection





Design Element				Manual Section	Design Value (By Type of Area)		
					Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Period			40-2.02	20 Years	20 Years	20 Years
	*Design Speed, mph (2)			40-3.0	Curbed: 30 - 50 Uncurbed: 30 - 50	Curbed: 30 - 45 Uncurbed: 30 - 45	Curbed: 30 - 35
	Access Control			40-5.0	None	None	None
	Level of Service			40-2.0	Desirable: C; Minimum: D	Desirable: C; Minimum: D	Desirable: C; Minimum: D
	On-Street Parking			45-1.04	Optional (3)	Optional (3)	Optional (3)
Alignment Elements	Travel Lane	*Width (4)		45-1.01	Curbed: Des: 12 ft; Min: 11 ft Uncurbed: Des: 12 ft; Min: 11 ft	Curbed: Des: 12 ft; Min: 11 ft Uncurbed: Des: 12 ft; Min: 11 ft	Curbed: Des: 12 ft; Min: 10 ft
		Typical Surface Type (5)		Ch. 304	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (6)			45-1.02	2 ft	2 ft	2 ft
	Shoulder	*Paved Width (7)		45-1.02	Curbed Des: 8 ft; Min. 2 ft Uncurbed: 8 ft	Curbed: Des: 6 ft; Min: 2 ft Uncurbed: 6 ft	8 ft
		Typical Surface Type (5)		Ch. 304	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (8)		45-1.01	2%	2%	2%
		Shoulder (8A)		45-1.02	4%	4%	2%
	Auxiliary Lane	Lane Width		45-1.03	Des: 12 ft; Min: 11 ft	Des: 12 ft; Min: 10 ft	Des: 12 ft; Min: 10 ft
		Curb Offset			Des: 1 ft; Min: 0.0 ft	Des: 1 ft; Min: 0.0 ft	Des: 1 ft; Min: 0.0 ft
		Shoulder Width			Des: 8 ft; Min: 2 ft	Des: 6 ft; Min: 2 ft	Des: 4 ft; Min: 2 ft
		Typical Surface Type (5)		Ch. 304	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Width			46-5.0	Des: 16 ft; Min: 12 ft	Des: 14 ft; Min: 12 ft	Des: 14 ft; Min: 12 ft
	Parking-Lane Width (1)			45-1.04	Des: 11 ft; Min: 8 ft	Des: 11 ft; Min: 8 ft	Des: 11 ft; Min: 8 ft
	Median Width	Raised Island		45-2.0	Des: 18 ft; Min: 4 ft (9)	Des: 18 ft; Min: 4 ft (9)	Des: 18 ft; Min: 4 ft (9)
		Flush / Corrugated			Des: 16 ft; Min: 4 ft (9)	Des: 16 ft; Min: 4 ft (9)	Des: 16 ft; Min: 4 ft (9)
	Sidewalk Width (10)			45-1.06	5 ft with 5 ft Buffer (Des)	5 ft with 5 ft Buffer (Des)	Varies, 6 ft Min
	Bicycle-Lane Width (11)			51-7.0	Curbed: 5 ft Uncurbed: Shld. Width +4 ft	Curbed: 5 ft Uncurbed: Shld. Width +4 ft	Curbed: 5 ft
	Clear-Zone Width			49-2.0	(12)	(12)	(12)
	Typical Curbing Type, where used (13)			45-1.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes, Uncurbed (14)	Cut	Foreslope	45-3.0	Des: 6:1; Max: 4:1 (15)	Des: 6:1; Max: 4:1 (15)	N/A
			Ditch Width		4 ft (16)	4 ft (16)	N/A
			Backslope		4:1 for 4 ft; 3:1 Max. to Top (17)	4:1 for 4 ft; 3:1 Max. to Top (17)	N/A
		Fill			Des: 6:1 to Clr Zone; 3:1 Max to Toe Max: 4:1 to Clr Zone; 3:1 Max to Toe	Des: 6:1 to Clr Zone; 3:1 Max to Toe Max: 4:1 to Clr Zone; 3:1 Max to Toe	N/A
	Side Slopes, Curbed	Cut(Backslope)		45-3.0	(18)	(18)	(18)
		Fill (19)			12:1 for 12 ft; 3:1 Max to Toe	12:1 for 12 ft; 3:1 Max to Toe	12:1 for 12 ft; 3:1 Max to Toe

Des: Desirable Min: Minimum
U: Urban SU: Suburban

* Level One controlling criterion, see page 2 of 4

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR

(New Construction or Reconstruction)

Figure 53-8 (Page 1 of 4)

Back

Design Element			Manual Section	Design Value (By Type of Area)			
				Suburban	Intermediate	Built-Up	
Bridges	New or Reconstructed Bridge	*Structural Capacity (20)	Ch. 403	HL-93	HL-93	HL-93	
		*Clear-Roadway Width (21)	45-4.01	Uncurbed: Full Paved Approach Width Curbed: Full Approach Curb-to-Curb Width			
	Existing Bridge to Remain in Place	*Structural Capacity	Ch. 72	HS-20	HS-20	HS-20	
		*Clear-Roadway Width	45-4.01	Uncurbed: Travelway Plus 2 ft on Each Side Curbed: Full Approach Curb-to-Curb Width			
	*Vertical Clearance, Collector under (22)	New or Replaced Overpassing Bridge (22)	44-4.0	14.5 ft	14.5 ft	14.5 ft	
		Existing Overpassing Bridge		14 ft	14 ft	14 ft	
	Vertical Clearance, Collector over Railroad (23)		Ch. 402-6.01	23 ft			
Alignment Element	Design Speed			30 mph	35 mph	45 mph	50 mph
	*Stopping Sight Distance		42-1.0	200 ft	250 ft	360 ft	425 ft
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 620 ft SU: 535 ft	U: 720 ft SU: 625 ft	U: 930 ft SU: 800 ft	U: 1030 ft SU: 890 ft
		Stop Maneuver		490 ft	590 ft	800 ft	910 ft
	Intersection Sight Distance, -3% to +3% (28)		46-10.0	P: 330 ft SUT: 420 ft	P: 390 ft SUT: 490 ft	P: 500 ft SUT: 630 ft	P: 630 ft SUT: 780 ft
	*Minimum Radius for e_{max} = 4% / 6%		43-2.0	270 ft / 250 ft (24a)	430 ft / 400 ft (24a)	610 ft / 560 ft (24a)	760 ft (24b)
	*Superelevation Rate (25)		43-3.0	Up to e_{max} = 6%			e_{max} = 8%
	*Horizontal Sight Distance		43-4.0	(26)			
	*Vertical Curvature, K-value	Crest	44-3.0	19	29	61	84
		Sag		37	49	79	96
	*Maximum Grade (27)	Level	44-1.02	9%	9%	8%	7%
		Rolling		11%	10%	9%	8%
	Minimum Grade		44-1.03	Desirable: 0.5% Minimum: 0.3% (Curbed); 0.0% (Uncurbed)			

U: Urban SU: Suburban

* Level One controlling criterion. Except as noted in this chapter, the values shown in AASHTO's *A Policy on Geometric Design of Highways and Streets* (the *Green Book*) may be used as minimum values if they are lower than similar values shown herein. A controlling criterion that does not meet the minimum value is a design exception and is subject to approval. See Section 40-8.0.

. These criteria apply regardless of funding source.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR

(New Construction or Reconstruction)

Figure 53-8 (Page 2 of 4)

Back

(1) Parking Lane. In a residential area, a parallel parking lane of 7 to 8 ft width should be provided on one or both sides of the street. In a commercial or industrial area, parking-lane width should range from 8 to 11 ft, and lanes should usually be provided on both sides of the street. The minimum value may only be used if the lane is not intended for use as a travel lane in a restricted condition. Where a curb-and-gutter section is used, the gutter-pan width may be considered as part of the parking-lane width. Where practical, the parking-lane width should be in addition to the gutter-pan width.

(2) Design Speed. The minimum design speed should equal the minimum value, the anticipated posted speed limit after construction, or the legal speed limit on a non-posted highway. The legal speed limit in an urban district is 30 mph. Based upon an engineering study, the design speed may be raised to an absolute maximum of 55 mph.

(3) On-Street Parking. In general, on-street parking is discouraged.

(4) Travel-Lane Width. In an industrial area, a 12 ft width should be used. Where right-of-way is restricted, an 11 ft width may be used in an industrial area, or a 10 ft width may be used in a residential area. On a multi-lane facility in a built-up area, the minimum width is 10 ft.

(5) Surface Type. The pavement-type selection will be determined by the INDOT Office of Pavement Engineering.

(6) Curb Offset. The curb offset should be 2 ft. Vertical curbs introduced intermittently should be offset 2 ft. A continuous curb used along a median or channelizing island may be offset 1 ft.

(7) Shoulder Width. The value applies to paved-shoulder width. The following will also apply.

a. For an uncurbed section, the shoulder is paved to the front face of guardrail. The desirable guardrail offset is 2 ft from the usable shoulder width. See Section 49-4.0 for more information.
b. For an uncurbed section, a desirable additional 1 ft of compacted aggregate will be provided.
c. For a curbed section, the curb offset is included in the paved shoulder width.

(8) Cross Slope, Travel Lane. Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(8A) Cross Slope, Shoulder. See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(9) Minimum Median Width. The criteria assume the presence of mountable curbs with a 0 ft curb offset.

(10) Sidewalk Width. A buffer of less than 2 ft wide is not permitted. If no buffer is provided, the sidewalk width should be 6 ft.

(11) Bicycle-Lane Width. The width is in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(12) Clear-Zone Width. The following will apply.

a. Facility with Vertical Curbs. The clear-zone width will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-h parking.
b. Facility with Sloping Curbs or without Curbs. The clear-zone width will vary according to design speed, traffic volume, side slopes, and horizontal curvature.
c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of a curb.
d. Value. See Section 49-2.0 for specific clear-zone-width value

(13) Curbing Type. Vertical curbs may only be used with a design speed 45 mph or lower.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR

(New Construction or Reconstruction)

Figure 53-8 (Page 3 of 4)

Back

(14) Side Slopes, Uncurbed. Value is for new construction. See Sections 45-3.0 and 45-8.0 for more information. For a reconstruction project, see Section 49-3.0

(15) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(16) Ditch Width. A V-ditch should be used in a rock cut.

(17) Backslope. The backslope for a rock cut will vary according to the height of the cut and the geotechnical requirements. See Section 45-3.02 and 107-6.02 for typical rock-cut sections.

(18) Side Slope, Curbed, Cut. A shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf will be 6 ft. Where a sidewalk is present, the toe of the backslope will be 1 ft beyond the edge of sidewalk. See Section 45-3.0 for more information.

(19) Side Slope, Curbed, Fill. If no sidewalks are present or planned, the lateral extent of the 12:1 slope may be reduced to 4 ft.

(20) Structural Capacity, New or Reconstructed Bridge. The following will apply.
a. A State-highway bridge within 15 mi of a Toll-Road gate must be designed for Toll-Road loading.
b. A bridge on an Extra-Heavy-Duty Highway must be designed for the Michigan Train truck loading configuration.
c. See Chapter 403 for additional information on the loading configurations.

(21) Width, New or Reconstructed Bridge. See Section 402-6.02(01) for more information. The bridge clear-roadway width is the algebraic sum of the following:
a. the approach traveled-way width;
b. the approach usable shoulder width without guardrail; and
c. a bridge-railing offset (see Figure 402-6H).

(22) Vertical Clearance, Collector Under. Value includes an additional 6 in. allowance for future pavement overlays. Vertical clearance applies from usable edge to usable edge of shoulder.

(23) Vertical Clearance, Collector Over Railroad. See Chapter 402-6.01(03) for additional information on railroad clearance under a highway.

(24) Minimum Radius. The following will apply.
a. Based on e_{max} = 4% or 6% and low-speed urban street conditions.
b. Based on e_{max} = 8% and open-road conditions.

(25) Superelevation Rate. See Section 43-3.0 for value of superelevation rate based on design speed and radius. See Section 43-3.0 and the INDOT *Standard Drawings* for information on superelevation requirements.

(26) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See the discussion in Section 43-4.0.

(27) Maximum Grade. For a grade along a longitudinal distance of less than 500 ft (PVT to PVC), a one-way downgrade, or a road with AADT < 400, the maximum grade may be up to 2% steeper than the table value. Where adjacent sidewalks are present, the maximum desirable grade is 5%.

(28) Intersection Sight Distance. For a left turn onto a 2-lane roadway: P = Passenger car; SUT = single unit truck. See Figure 46-10G for value for a combination truck.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR

(New Construction or Reconstruction)

Figure 53-8 (Page 4 of 4)

Back

Road Safety Assessment (RSA) Report

Olio Road at 156th Street
Recommended Treatment: Intersection Improvement Project
Date of Site Visit: 08/08/2024

Prepared by:
Sarah Baty, PE, PTOE, RSP1
Lead Traffic Engineer
Lochmueller Group

August 30, 2024

Prepared for the City of Noblesville
16 S 10th Street, Noblesville, IN 46060

Table of Contents

Executive Summary

The purpose of this report is to document the engineering assessment phase of project development, including all coordination that has been completed in preparation for this project. This document outlines the proposal and is intended to serve as a guide for subsequent survey, design, environmental, right of way and other project activities leading to construction. The preferred alternative identified in this document is considered predecisional, pending the outcome of environmental studies. An alternative other than the preferred alternative may not be selected without consultation with the preparer of this report.

Implementing low-cost systemic safety countermeasures at the intersection of Olio Road and (Alternative 4) is recommended as an immediate solution to reduce crashes until a roundabout can be constructed (Alternative 3). The cost of implementing low-cost systemic safety countermeasures is $23,500. The permanent solution is to construct a roundabout, which costs $3.36 Million (year 2027 dollars). The roundabout is currently in Stage 3 design. The roundabout is not currently funded but could be scheduled for a 2026 letting date once funding is secured.

A Level 4 Categorical Exclusion (CE-4) is being prepared in accordance with the National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA), and other relevant state and federal regulations. It is anticipated that the CE-4 will be approved in January 2025.

This location has been studied as a possible candidate for project funding under the federal Highway Safety Improvement Program (HSIP) and therefore 23 U.S.C Section 409 applies.

Project Location

Table 1: Project Location Information

Location Description			
Route	Olio Road	Latitude/Longitude	40.016220 N / 85.919241 W
City	Noblesville		
County	Hamilton	Cross Street	156th Street
District	Greenfield		
Sub District	Tipton	RP	
MPO	Indianapolis (IMPO)	NHS Route?	No
Functional Class	Major Collector	Work Type	Intersection Improvement, Roundabout
Rural or Urban	Urban	Work Category	Intersection Improvement Project
Other Location Info:			

See attachments for a map showing the project location and for other pictures of the site.

Purpose and Need

The purpose of the 156th Street and Olio Road project is to reduce the instance of severe injury crashes. The need is based on the crash history at the intersection and the need to accommodate future traffic growth. The crashes experienced at the intersection between years 2021 through 2023 is roughly 2 standard deviations higher than expected at this intersection based on the roadway classifications, type of intersection, traffic volumes, and number of crashes resulting in severe injuries. The most common crash type was right angle crashes. The crash history is further described in subsequent sections of this report.

Project History

The City of Noblesville is currently overseeing the design of a roundabout at Olio Road and 156th Street as well as added travel lanes along Olio Road between 146th Street and 156th Street. The project is currently in Stage 3 design. The added travel lanes project has been funded and will have a 2026 letting date. The roundabout is not currently funded but could be scheduled for a 2026 letting date once funding is secured.

The Olio Road corridor was identified in Noblesville SS4A Safety Action Plan published in April 2024 as a Tier 1 priority. The corridor appeared on the High Injury Network and the most common crash type on the corridor is rear end crashes.

Existing Conditions

Notes from Field Check

A site visit was conducted on August 8, 2024, and included representatives from the City of Noblesville, INDOT Office of Traffic Safety, INDOT Greenfield District, LTAP, and Lochmueller Group. Meeting notes and photo log are included as attachments. The following key observations/discussions were noted in the field:

- Lochmueller Group presented the crash history, which includes 9 crashes over the 3-year period from 2021 through 2023. A majority of the crashes were right-angle crashes.
- High speeds on Olio Road were observed on-site and noted as a recurring issue by the police department representative. Speed limit signs are close to the intersection, with the speed changing from 45 to 55 mph at the intersection going north. It would be advisable to shift 55 mph sign for northbound traffic approximately 0.5 miles north.
- There is currently a steep shoulder cutoff along Olio Road. This would be addressed as part of the added travel lanes project.
- There is a possible sight distance issue in the northeast corner of the intersection. Consider moving stop bars up closer to the intersection. Crops may also conflict with sight distance, so it would be helpful to purchase right of way as soon as possible and clear the area.
- Lochmueller Group presented 3 solutions, including an all-way stop, intersection conflict warning system (ICWS), and roundabout. Additional solutions discussed were low-cost safety countermeasures that could be implemented in the interim to reduce crashes prior to the completion of the roundabout.
    - An all-way stop could reduce angle crashes; however, the current volumes do not meet volume warrants or warrants based on crashes. It is anticipated that the all-way stop will likely meet the new MUTCD warrant based on crashes. Most participants preferred an all-way stop control as a recommendation; however, there are some concerns with this solution. A stop sign on Olio Road would be inconsistent with driver expectations, as the intersection of Olio Road and 146th Street is a roundabout and the intersection of Olio Road and 166th Street is two-way stop controlled.
    - An ICWS could reduce crashes by raising driver awareness of approaching traffic. There are several ICWS's deployed in Indiana and Indiana specific before/after data is somewhat limited at this point. In other states implementing ICWS has been very successful.
    - Additional solutions discussed were low-cost safety countermeasures that could be implemented in the interim to reduce crashes prior to the completion of the roundabout,

including but not limited to buzz strips, “cross traffic does not stop” plaques, and “stop ahead” signage.

Structure Information

Structure No. 29-00170 Olio road over Sand Creek is located south of the existing intersection. This bridge will be replaced with as part of the Olio Road added travel lanes project.

Roadway Geometrics and Pavement Information

Table 2: Roadway Geometrics and Pavement Information

Lane Width	9 ft E-W / 10 ft N-S
Curbed	No
Paved Shoulder Width	N/A
Usable Shoulder Width	N/A
Number of lanes in each direction	1
Intersection Traffic Control	Two Way Stop
Speed Limit	55 mph north of intersection, 45 mph south of intersection
Pavement Type	Asphalt
Median Type	None
Drainage Type	Sheet flow
Sidewalks Present?	No
Bike Lanes Present?	No
Guardrail / Barriers Present	N/A

Traffic Data

Traffic turning movement counts used in the forecast were collected in September 2012 for the Noblesville Traffic Impact Fee[1]. The 2012 counts were adjusted to year 2024 by using a 0.65% per year growth rate to “normalize” the counts to match counts collected on Olio Road in 2019 and the project growth rate.

To determine the appropriate traffic growth, traffic counts and output from the Indianapolis Metropolitan Planning Organization (IMPO) travel demand model were reviewed. There are multiple developments adjacent to the Olio Road corridor underway. At the time this report was completed traffic volumes generated by the developments were unknown. To forecast to year 2048

[1] Noblesville Traffic Impact Fee Analysis, December 2015. Retrieved from: https://www.cityofnoblesville.org/egov/apps/document/center.egov?view=item;id=6094

a growth rate of 1.3% per year was applied. Additional information on the forecast is included in the attachments.

Table 3: Olio Road South of 156th Street Traffic Forecasts

2024 AADT	3,438
2048 AADT	4,697
DHV	470
Directional Distribution	52%
Trucks	3.6%

Table 4: 156th Street East of Olio Road Traffic Forecasts

2024 AADT	1,038
2048 AADT	1,418
DHV	142
Directional Distribution	50%
Trucks	8.9%

Crash Data Analysis

ARIES crash records for the years 2021 through 2023 were obtained for this study. Over the 3-year period there were 9 crashes that occurred at the intersection. The ICC and ICF were calculated using RoadHAT software. RoadHAT version 4 software was used for the initial safety analysis along the corridor. It is a crash analysis tool that is compliant with the Highway Safety Manual methodology and is calibrated for Indiana roadways. RoadHAT calculates an Index of Crash Frequency (I_{CF}) and Index of Crash Cost (I_{CC}) for each studied location or segment. The index values represent the number of standard deviations (+/-) above or below the statewide average for the corresponding facility type.

The I_{CC} value is 1.92 and the I_{CF} value is 2.51, which indicates that there were more crashes than expected at this intersection based on the roadway classifications, type of intersection, traffic volumes, and number of crashes resulting in severe injuries.

Table 5 through **Table 9** describe crash patterns by severity, manner of collision, pavement conditions, lighting conditions, weather conditions, time of day, day of the week, and month. The RoadHAT output, crash statistics summary and crash diagrams have been included in the attachments to this report.

A majority of the crashes at the intersection of Olio Road and 156th Street were right angle crashes. There were 6 right angle crashes that occurred at the intersection and 3 of them resulted in incapacitating injuries. These were mostly due to drivers on 156th Street not yielding to traffic on

Olio Road. There were no crashes involving pedestrians or bicyclists recorded at the intersection. The pavement surface condition, lighting condition, and weather attributes were comparable to statewide averages. Additionally, analysis was performed to evaluate time of day or month. More crashes occurred on Monday and Fridays compared to other days of the week but given the number of crashes this may not be statistically significant.

Although data was only used from 2021 to 2023 in this analysis, these trends are consistent with crash data going back to 2018.

Table 5: Crash History

I_{CC}	1.92	Number of Crashes	9
I_{CF}	2.51	Number of Fatal and Incapacitating Crashes	3
First Year of Crash Data	2021	Number of Non-Incapacitating Crashes	2
Last Year of Crash Data	2023	Number of Property Damage Only Crashes	4

Table 6: Crash Patterns: Manner of Collision

Manner of Collision	Incapacitating Injury	Non-Incapacitating Injury	Property Damage Only	Total Crashes	Percent
Ran Off Road	-	1	-	1	11.1%
Rear End	-	-	-	-	-
Backing	-	-	-	-	-
Right Angle	3	1	2	6	66.7%
Left Turn	-	-	-	-	-
Same Direction Sideswipe	-	-	-	-	-
Opposite Direction Sideswipe	-	-	1	1	11.1%
Head On	-	-	-	-	-
Other	-	-	1	1	11.1%
Total	3	2	4	9	100%

Table 7: Crash Patterns: Pavement Condition Percentages

Type	Number	Percent
On Snowy or Icy Pavement	-	-
On Wet Pavement	-	-
On Dry Pavement	9	100.0%
On Other Condition Pavement	-	-

Table 8: Crash Patterns: Lighting Condition Percentages

Type	Number	Percent
Dark (Lighted or Unlighted)	2	22.2%
Dawn/Dusk	1	11.1%
Daylight	6	66.7%
Other	-	-

Table 9: Crash Patterns: Weather Condition Percentages

Type	Number	Percent
Clear	8	88.9%
Cloudy	1	11.1%
Fog (Or Smoke or Smog)	-	-
Rain	-	-
Snow or Sleet	-	-

Community/External Stakeholder Context

Public engagement performed to-date includes communication with individual property owners only, to public meetings have been held. The opportunity for a public hearing will be offered as part of this project moving forward.

Analysis and Alternatives

Description of Alternatives

Alternative 1 – All-Way Stop Control

Converting the intersection to all-way stop control (AWSC) was identified as a safety improvement based on the trend of right-angle collisions. This would involve adding stop signs to the northbound and southbound Olio Road approaches, as eastbound and westbound 156th Street are currently stop controlled. This alternative also includes adding "stop ahead" signage and buzz strips to the northbound and southbound Olio Road approaches.

Alternative 2 – Intersection Conflict Warning System

An intersection conflict warning system (ICWS) was identified as a potential safety improvement based on the trend of right-angle collisions. This would involve adding ICWS signage and upstream vehicle detectors.

Alternative 3 – Single Lane Roundabout (Long-Tern Recommended)

A single lane roundabout was identified as a potential improvement that would improve safety while maintaining capacity for future traffic growth.

Alternative 4 – Low-Cost Systemic Safety Improvements (Short-Term Recommendation)

Systemic application of multiple low-cost countermeasures was identified as a potential safety improvement based on the trend of right-angle collisions. This would involve doubling up the stop signs and adding doubled-up advance "Stop Ahead' intersection warning signs on 116th Street. Olio Road would have doubled-up advance intersection warning signs. Additionally, the stop bar on the east leg would be moved closer to the intersection to improve visibility. The speed limit sign on the north leg would be moved ½ mile north.

Alternative 5 - No Build

The No build option was considered for this project; however, this would not improve traffic safety at this intersection. This option is not beneficial to the motoring public.

Comparison of Alternatives

The alternatives are compared based on crash reduction, traffic operations, cost, and other considerations.

Safety Analysis

The alternatives are compared based on their ability to reduce crashes. Documentation on the crash modification factors used in the analysis is included in the attachments.

- The anticipated reduction in crashes for an all-way stop (Alternative 1) is 68% of all crashes per the countermeasures suitable for Indiana. An all-way stop will be effective at reducing crashes in the near term; however, it may not be a suitable alternative long-term. Widening Olio Road to a 4-lane section would create an all-way stop intersection with multilane approaches, which can be confusing to motorists and is not considered safety best practices.
- Installing an ICWS (Alternative 2) could reduce all crashes by 27% per the Crash Modification Factor Clearinghouse. While this reduction is significant, an ICWS may not address the underlying issue, as they are typically applied to address crashes related specifically to sight distance.

- Converting the two-way stop control intersection to a roundabout (Alternative 3) is anticipated to reduce all crashes by 27% and injury crashes (KABC) by 58% per the countermeasures suitable for Indiana**.** This alternative is compatible with future widening Olio Road.
- Installing low-cost systemic improvements (Alternative 4) could reduce fatal and injury crashes (KABC) by 10%. Additionally, these types of improvements reduce nighttime crashes by 15%. This alternative is compatible with future widening on Olio Road.
- Alternative 5, the no build alternative, will not reduce crashes.

Cost Estimates

Cost estimates were prepared in current year dollars. The roundabout cost was escalated to year 2027 costs to better capture the anticipated cost in the year of expenditure. Refer to the attachments for more detailed information on the estimated cost for each alternative. Economic analysis was performed using RoadHAT for each alternative. The results are included in the attachments.

Table 10: Cost Estimates Summary

Alternative	Funding Category	Estimated Cost
Alternative 1 All-Way Stop Control	CN	$ 20,000
	PE (15% of CN)	$ 3,000
	Utility	$ --
	RoW	$ --
	Total Cost	**$ 23,000**
Alternative 2 Intersection Conflict Warning System	CN	$ 81,000
	PE (15% of CN)	$ 12,150
	Utility	$ --
	RoW	$ --
	Total Cost	**$ 93,150**
Alternative 3 Roundabout*	CN	$ 2,756,400
	PE (15% of CN)	$ 413,460
	Utility	$ 150,000
	RoW	$ 36,000
	Total Cost	**$ 3,355,860**
Alternative 4 Low-Cost Systemic Safety Countermeasures	CN	$ 20,400
	PE (15% of CN)	$ 3,100
	Utility	$ --
	RoW	$ --
	Total Cost	**$ 23,500**
Alternative 5 No Build	CN	$ --
	PE	$ --
	Utility	$ --
	RoW	$ --
	Total Cost	**$ --**

*Escalated to year 2027 dollars

Capacity Analysis

Traffic operating conditions were evaluated using Synchro 11 traffic analysis software, which is based upon the methodologies outlined in the Highway Capacity Manual, 6th Edition (HCM) published by the Transportation Research Board. For the roundabout alternative, SIDRA 9.1 was used to obtain traffic operating conditions in accordance with INDOT standards for roundabout analyses.

Traffic operations for 2024 Existing and Alternatives 1 through 4 are summarized in **Table 11** and **Table 12**. The level of service (LOS) and delay are given for each approach. For more information on the capacity analysis, refer to the reports in the attachments.

Table 11: Capacity Analysis AM Peak LOS and Delay (seconds)

Alternative	AM Peak									
	EB		WB		NB		SB		Overall	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Existing*	**A**	**9.7**	**B**	**10.9**	**-**	**-**	**-**	**-**	**-**	**-**
Alternative 1 AWSC	**A**	**7.9**	**A**	**8.2**	**A**	**8.9**	**A**	**8.9**	**A**	**8.8**
Alternative 3 Roundabout	**A**	**5.3**	**A**	**7.2**	**A**	**4.6**	**A**	**4.6**	**A**	**4.8**
Alternative 2 Alternative 4 Alternative 5 TWSC*	**B**	**10.3**	**B**	**12.0**	**-**	**-**	**-**	**-**	**-**	**-**

*LOS is not reported for free flow approaches at 2-way stop intersection

Table 12: Capacity Analysis PM Peak LOS and Delay (seconds)

Alternative	PM Peak									
	EB		WB		NB		SB		Overall	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Existing*	B	10.0	B	10.9	**-**	**-**	**-**	**-**	**-**	**-**
Alternative 1 AWSC	A	7.8	A	8.0	A	9.1	A	8.1	A	8.6
Alternative 3 Roundabout	A	5.0	A	7.3	A	5.6	A	4.8	A	5.4
Alternative 2 Alternative 4 Alternative 5 TWSC*	B	10.7	B	12.0	**-**	**-**	**-**	**-**	**-**	**-**

*LOS is not reported for free flow approaches at 2-way stop Intersections

The intersection operates acceptably during both peak times for the existing conditions and for all alternatives. The conclusions made of traffic operations are as follows:

- An all-way stop control intersection (Alternative 1) accommodates anticipated traffic growth into the design year. The Olio Road and 156th Street intersection does not meet the all-way stop warrants in the 2011 Indiana MUTCD, including traffic volume thresholds and crash history; however, warrants based on crash history in the Federal MUTCD 11th Edition were met. The Federal MUTCD 11th Edition was published in the Federal Register on January 18, 2024 and states must adopt it as their State standard for traffic control devices within 2 years of that date. At the time this study was developed, Indiana had not adopted the 11th Edition. The AWSC warrant worksheet is included in the attachments. An all-way stop accommodates anticipated growth; however, if traffic grows at a rate higher than the latest travel demand model indicates, there may be excessive delays on Olio Road.
- Installing an ICWS (Alternative 2) will not impact traffic operations.
- A roundabout (Alternative 3) will improve traffic operations and can easily accommodate additional growth beyond what the latest travel demand model indicates.

Recommended Alternative

Implementing low-cost systemic safety countermeasures at the intersection of Olio Road and 156th Street to (Alternative 4) is recommended as an immediate solution to reduce crashes until a roundabout can be constructed (Alternative 3). Alternative 4 is consistent with driver expectations along Olio Road and is compatible with the widening of Olio Road.

Preliminary Maintenance of Traffic Plan (MOT)

This project is not mobility significant, and it is anticipated that a full closure of 156th Street and Olio Road will be required during construction while access to residents and local traffic will be maintained. Traffic on 156th Street will be detoured to 146th Street and traffic on Olio Road will be detoured to Boden Road.

The above information is preliminary and conceptual in nature. The designer of record for this project shall be responsible for the determination of MOT scheme and the full design of that scheme. The above information can be used to inform the decision making of the designer but it does not absolve him of the responsibility of the design.

The provisions of the Indiana Manual on Uniform Traffic Control Devices, the Indiana Design Manual and the INDOT Standard Drawings concerning the design of an MOT zone shall be adhered to. A detailed design showing the MOT layout should be included in the final set of plans. The provisions of the Interstate Highway Congestion Policy shall be followed.

Pavement and Roadway Design

Standard single and double lane roundabout design features should be assumed and incorporated into this project. Additionally, the high approach speeds should be taken into consideration with the addition of sufficient splitter islands and deflection to reduce entry speeds into the roundabout.

The City of Noblesville has a standard pavement design in place which will be used for this project, and it is assumed that all new pavement would be full cross-section replacement. There is incidental resurfacing at the tie ins to existing pavement.

Design Considerations

The roundabout will follow design criteria outlined in Chapter 51 of the Indiana Design Manual. The design vehicle for the roundabout is WB-65 and the assumed inscribed circular diameter is 180 feet. Consideration should be taken with regards to the high speed along each approach of the intersection.

Table 13: Other Design Considerations

Land Survey Location	Intersection of Sections 11-14, T-18-N, R-5-E
Civil Township	Wayne
Federal Aid System	Yes
National Truck Network	No
Urban Area Boundary	No
Adjacent Land Use	Residential and Agricultural

Right-of-Way and Survey

Based on the proposed layout, the Right-of-Way Office estimates that some land acquisition will be necessary for the preferred alternative. Currently, the Right-of-Way is 40 feet from the centerline of the roadway and is surrounded by three agricultural properties and 2 residential properties. Temporary Right-of-Way will be needed for driveway construction. This is estimated to cost about $36,000. No additional survey will be needed for this project.

Table 14: Right of Way Summary

Land Use	Parcel No.	R/W Required	Cost
Farming	12-11-11-00-00-006.000	1.30 acres	$5,311.28
Farming	12-11-12-00-00-011.000	1.50 acres	$4,824.38
Farming	12-11-13-00-00-001.000	0.86 acres	$2,516.04
Residential	12-11-14-00-00-005.000	0.12 acres	$3,698.46
Residential	12-11-14-00-00.006.000	0.40 acres	$19,190.18
		Total	**$35,540.34**

Utilities and Railroads

The following is a list of know aerial and underground utilities in the area based on Indiana 811:

- AT&T Distribution – Aerial facilities along the west side of Olio Road.
- Duke Energy – Aerial facilities along west side of Olio Road with service crossings to the east side
- Duke Transmission – Large aerial power lines on steel lattice towers crossing 156th and Olio intersection.
- Charter – Fiber optic located on the west side of Olio Road.

The roundabout construction will likely have an impact on these overhead lines and will need to work with the utility companies to have relocation plans.

There are no railroads within the project limits.

Hydraulic Recommendations

Standard hydraulic consideration for an urban roundabout will be required in this location. An enclosed-storm system with curb inlets is being provided with this project. The storm system will outfall to an existing drainage system in the northwest corner of the project.

Design Criteria

The design of this project shall adhere to 3R Project, Non-Freeways standards per the Indiana Design Manual.

Environmental and Historic Considerations

A Level 4 Categorical Exclusion (CE-4) is being prepared in accordance with the National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA), and other relevant state and federal regulations. It is anticipated that the CE-4 will be approved in January 2025.

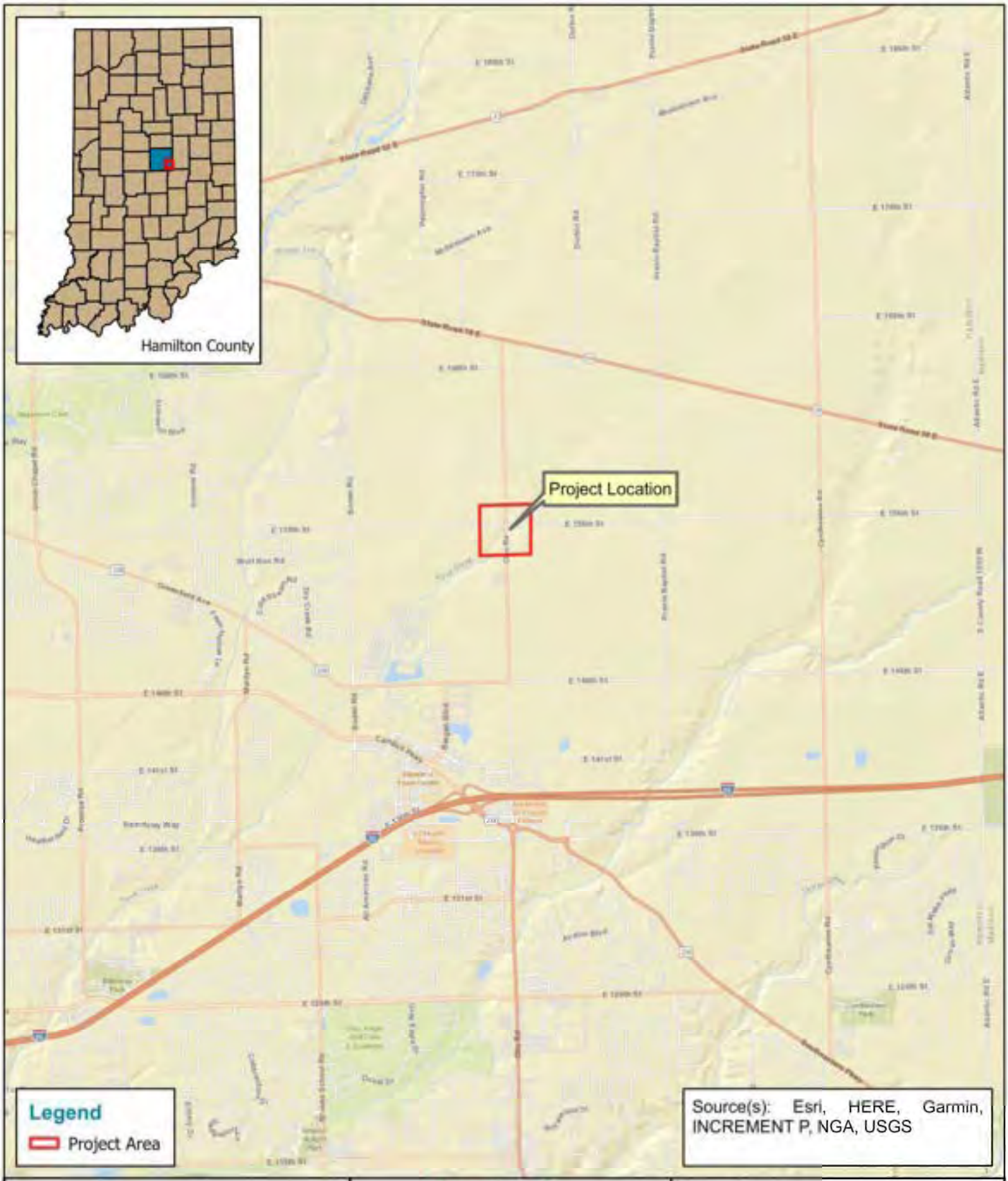
The environmental process has already been initiated and the following reports have been completed:

- Preliminary work, including agency early coordination and red flag investigation (RFI) are completed.
- The Waters of the U.S. Determination / Wetland Delineation Report was completed for the project on January 17, 2024.
- The project is within range of the federally endangered Indiana bat (*Myotis sodalis*) and the federally endangered northern long-eared bat (NLEB) (*Myotis septentrionalis*). An effect determination key was completed on January 9, 2024, and based on the responses provided, the project was found to "not likely to adversely affect" the Indiana bat and/or the NLEB.

Ongoing investigations include the Section 106 process where a "No Adverse Effects" letter has been submitted to the consulting parties and the 800.11/Finding is in review with the INDOT Cultural Resources Office (CRO).

ATTACHMENT A

Location Map



LOCHMUELLER GROUP

2002 Woodview Trace, Suite 150
Indianapolis, IN 46268
Phone: (317) 222-3880
Fax: (317) 222-3881

Location Map

Des. No. 122202701

County: Hamilton
Township: Wayne
State: Indiana

0 0.4 0.8 Miles

156th St & Olio Rd
Intersection Improvements
Created: 8/23/2024, Kaden.Doutt

ATTACHMENT B

Crash Diagram

DIAGRAM OF COLLISION REPORTS

Olio Rd and 156th St

Study Period: 1/1/2018 to 12/31/2022 Location:

District: Greenfield County: Hamilton City/Town: Noblesville

Analyst: Kaden Doutt QC: Date: 07/3/2024

Aerial imagery provided by Google Earth

YEAR	REPORTS
2021	2
2022	4
2023	3
TOTAL	9

NOTES

1) Crashes with determinable location are shown in diagram. Crash total may not match ARIES database.

2) Crashes on diagram do not represent exact crash locations; they are approximated based on available information.

3) Diagram not to scale.

Object Symbols

- MOVING VEHICLE
- TURNING VEHICLE
- BACKING VEHICLE
- OUT OF CONTROL
- PARKED VEHICLE
- PEDESTRIAN
- BICYCLE
- A — ANIMAL
- D — DEBRIS IN ROADWAY
- # — FATAL CRASH
- # — INJURY CRASH – INCAPACITATING
- # — INJURY CRASH – NONINCAPACITATING
- # — PDO CRASHES (IF > 1)
- SIGNALIZED INTERSECTION
- # — FIXED OBJECT (See table for # codes)

Collision Symbols

- REAR END
- HEAD ON
- OVERTAKING / CUT-OFF
- SIDESWIPE – SAME
- SIDESWIPE – OPPOSITE
- RIGHT ANGLE
- LEFT TURN
- OVERTURNED

Fixed Object Codes

01 – BRIDGE or OVERPASS
02 – BUILDING
03 – CULVERT or DITCH
04 – CURB
05 – GUARDRAIL or BARRIER
06 – EMBANKMENT
07 – FENCE
08 – TRAFFIC POLE
09 – UTILITY POLE
10 – SIGN
11 – TREE / SHRUB
12 – CONTRUCTION BARRIER
13 – CRASH ATTENUATOR
88 – OTHER
99 - UNKNOWN

ATTACHMENT C

RoadHAT Crash Data Report

RoadHAT 4D

Index of Crash Frequency and Cost - Form F1

Page 1/2

Settings: Indiana local settings	Version: Version 4.1	
Location	Olio Rd and 156th St	
GIS		
Post		
Analyst	Kaden Doutt	
Date	7/22/2024	

INPUT	
Road Facility Type	City Non- Arterial Intersection No AADT
Busiest Road Principal Arterial Indicator (1 if present, 0 otherwise)	0
Busiest Road Minor Arterial Indicator (1 if present, 0 therwise)	0
Busiest Road Major Collector Indicator (1 if present, 0 otherwise)	1
Busiest Road Minor Collector Indicator (1 if present, 0 otherwise)	0
Crossing Road Principal or Minor Arterial Indicat r (1 if present, 0 otherwise)	0
Crossing Road Major Collector Indicator (1 if present, 0 otherwise)	0
Crossing Road Minor Collector Indicator (1 if present, 0 otherwise)	1
First Year with Crash Data (yyyy)	2021
Last Year with Crash Data (yyyy)	2023
Number of Crashes (crash/period)	
Fatal and Incapacitating Injury Crashes	3
Non-Incapacitating and Possible Injury Crashes	2
Property Damage Only Crashes	4
Route or Road Type	City Non- Arterial Intersection No AADT
Average Crash Costs ($)	
Fatal and Incapacitating Injury Crashes	1840100
Non-Incapacitating and Possible Injury Crashes	393200
Property Damage Only Crashes	40200
Crash Cost Year (yyyy)	2017
OUTPUT	
Expected Crash Frequency (crash/year)	
Fatal and Incapacitating Injury Crashes	0.019
Non-Incapacitating and Possible Injury Crashes	0.02
Property Damage Only Crashes	0.18
All Crashes	0.22

RoadHAT 4D

Index of Crash Frequency and Cost - Form F1

Page 2/2

Settings: Indiana local settings	Version: Version 4.1	
Location	Olio Rd and 156th St	
GIS		

Post		
Analyst	Kaden Doutt	
Date	7/22/2024	

Index of Crash Frequency	**2.51**
Index of Crash Cost	**1.92**

Comments:

ATTACHMENT D

Photo Log

156th St at Olio Rd
Photo Log

Olio Rd northbound approach, at the intersection.

Facing north away from the intersection, along Olio Rd.

156th St westbound approach, at the intersection.

Facing southwest toward the intersection.

Facing northwest toward the intersection.

156th St eastbound approach, at the intersection.

156th St at Olio Rd
Photo Log

Facing north toward the intersection, along Olio Rd

ATTACHMENT E

Meeting Minutes

MEETING MINUTES

Date of Meeting: Thursday, August 8, 2024 **Re:** Road Safety Audit

Location: 156th Street at Olio Road **Issue Date:** August 16, 2024

Submitted By: Sarah Baty, PE, PTOE, RSP1

In Attendance: Jim Hellman, City of Noblesville
Officer Collin Whitesell, Noblesville Police Department
Laura Slusher, LTAP
Tom Ford, INDOT Office of Traffic Safety
Mark Muenz, INDOT Greenfield District
Jacob Sherry, INDOT Greenfield District
Beth Carter, Lochmueller Group
Sarah Baty, Lochmueller Group
Kaden Doutt, Lochmueller Group

ITEMS DISCUSSED:

1) Introductions and Project Status
   a) The City of Noblesville is currently overseeing the design of a roundabout at Olio Road and 156th Street as well as added travel lanes along Olio Road between 146th Street and 156th Street. The project is currently at Stage 3 design and will have a 2026 letting date.
   b) The Olio Road corridor was identified in the High Injury Network as part of the Noblesville SS4A Safety Action Plan.
2) Crash History
   i) Lochmueller Group reviewed 3 years of crash history including the years 2021 through 2023. There was a total of 9 crashes and 3 of those crashes resulted in incapacitating injury. Most of the crashes were right-angle crashes.
   ii) Crash Frequency (I_{CF}) and Index of Crash Cost (I_{CC}) values represent the number of standard deviations (+/-) above or below the statewide average for the corresponding facility type (intersection, segment, or ramp). The I_{CC} and I_{CF} for this location are 1.92 and 2.51, respectively.
   iii) There were no trends of time of day or month. More crashes occurred on Mondays and Fridays compared to other days of the week but given the number of crashes this may not be statistically significant.

3502 Woodview Trace, Suite 150
Indianapolis, Indiana 46268
PHONE: 317.222.3880 • TOLL FREE: 888.830.6977

3) On-Site Observations/Discussion
    i) Lochmueller Group presented 3 solutions, including an all-way stop, intersection conflict warning system (ICWS), and roundabout.
        (1) An all-way stop could reduce angle crashes; however, the current volumes do not meet volume warrants or warrants based on crashes. It is anticipated that the all-way stop will likely meet the new MUTCD warrant based on crashes. Most participants preferred an all-way stop control as a recommendation.
        (2) An ICWS could reduce crashes by raising driver awareness of approaching traffic. There are several ICWS's deployed in Indiana and Indiana specific before/after data is somewhat limited at this point. In other states implementing ICWS has been very successful.
    ii) Additional solutions discussed were low-cost safety countermeasures that could be implemented in the interim to reduce crashes prior to the completion of the roundabout.
    iii) There is a possible sight distance issue in the northeast corner of the intersection. Consider moving stop bars up closer to the intersection. Crops may also conflict with sight distance, so it would be helpful to purchase right of way as soon as possible and clear the area.
    iv) High speeds on Olio Road were observed on-site and noted as a recurring issue by the police department representative. Speed limit signs are close to the intersection, with the speed changing from 45 to 55 mph at the intersection going north. It would be advisable to shift 55 mph sign for northbound traffic approximately 0.5 miles north.
    v) If the intersection remains two-way stop control, add "cross traffic does not stop" signage. Due to high speeds on Olio Road, consider buzz strips on northbound and southbound Olio Road.
    vi) If the intersection meets the new MUTCD warrants and is made all way stop control, consider buzz strips on northbound and southbound Olio Road and "stop ahead" signage to make drivers alert of new stop sign. It
    vii) The new Olio Road right of way will include space for bike lane/path, but it is not going to be constructed initially.
    viii) There is currently a steep shoulder cutoff along Olio Road. This would be addressed as part of the added travel lanes project.
    ix) The City of Noblesville advised that there are drainage issues on Olio Road and there is frequent overtopping.

The above constitutes our understanding of the meeting. If you believe there are omissions, additions, or corrections, please send your written comments within seven working days to Lochmueller Group.

ATTACHMENT F

Traffic Operations Analysis

Summary Table - 2024 Existing

Intersection & Movements	LOS (Delay, sec) [Queue, ft] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
Olio Rd and 156th St (TWSC)		
Eastbound Approach	A (9.7) [<25] <0.05>	B (10.0) [<25] <0.05>
Westbound Approach	B (10.9) [<25] <0.02>	B (10.9) [<25] <0.02>

Intersection & Movements	LOS (Delay, sec) [Queue, ft] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
Olio Rd and 156th St (AWSC)		
Overall	**A (8.8)**	**A (8.6)**
Eastbound Approach	A (7.9) [<25] <0.07>	A (7.8) [<25] <0.07>
Westbound Approach	A (8.2) [<25] <0.03>	A (8.0) [<25] <0.02>
Northbound Approach	A (8.9) [33] <0.31>	A (9.1) [30] <0.30>
Southbound Approach	A (8.9) [25] <0.25>	A (8.1) [<25] <0.13>

Intersection & Movements	LOS (Delay, sec) [Queue, ft] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
Olio Rd and 156th St (RAB)		
Overall	**A (4.8)**	**A (5.4)**
Eastbound Approach	A (5.3) [<25] <0.05>	A (5.0) [<25] <0.04>
Westbound Approach	A (7.2) [<25] <0.02>	A (7.3) [<25] <0.02>
Northbound Approach	A (4.6) [26] <0.20>	A (5.6) [25] <0.19>
Southbound Approach	A (4.6) [<25] <0.15>	A (4.8) [<25] <0.08>

Intersection & Movements	LOS (Delay, sec) [Queue, ft] <v/c ratio>	
	AM Peak Hour	PM Peak Hour
Olio Rd and 156th St (TWSC)		
Eastbound Approach	B (10.3) [<25] <0.08>	B (10.7) [<25] <0.08>
Westbound Approach	B (12.0) [<25] <0.04>	B (12.0) [<25] <0.03>

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	4	30	6	4	2	9	81	90	2	130	2
Future Vol, veh/h	2	4	30	6	4	2	9	81	90	2	130	2
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	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	2	5	34	7	5	2	10	92	102	2	148	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	320	367	149	336	317	143	150	0	0	194	0	0
Stage 1	153	153	-	163	163	-	-	-	-	-	-	-
Stage 2	167	214	-	173	154	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	627	557	890	612	594	897	1413	-	-	1361	-	-
Stage 1	842	765	-	832	758	-	-	-	-	-	-	-
Stage 2	828	720	-	822	764	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	617	551	890	580	588	897	1413	-	-	1361	-	-
Mov Cap-2 Maneuver	617	551	-	580	588	-	-	-	-	-	-	-
Stage 1	835	763	-	825	752	-	-	-	-	-	-	-
Stage 2	814	714	-	784	762	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.7	10.9	0.4	0.1
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1413	-	-	814	619	1361	-	-
HCM Lane V/C Ratio	0.007	-	-	0.05	0.022	0.002	-	-
HCM Control Delay (s)	7.6	0	-	9.7	10.9	7.7	0	-
HCM Lane LOS	A	A	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	13	20	5	4	2	36	123	9	2	67	3
Future Vol, veh/h	2	13	20	5	4	2	36	123	9	2	67	3
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	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	2	15	23	6	5	2	41	140	10	2	76	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	313	314	78	328	310	145	79	0	0	150	0	0
Stage 1	82	82	-	227	227	-	-	-	-	-	-	-
Stage 2	231	232	-	101	83	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	634	597	974	619	600	894	1500	-	-	1413	-	-
Stage 1	919	821	-	769	711	-	-	-	-	-	-	-
Stage 2	765	707	-	898	820	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	614	578	974	579	581	894	1500	-	-	1413	-	-
Mov Cap-2 Maneuver	614	578	-	579	581	-	-	-	-	-	-	-
Stage 1	891	820	-	746	690	-	-	-	-	-	-	-
Stage 2	735	686	-	860	819	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10	10.9	1.6	0.2
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1500	-	-	756	619	1413	-	-
HCM Lane V/C Ratio	0.027	-	-	0.053	0.02	0.002	-	-
HCM Control Delay (s)	7.5	0	-	10	10.9	7.6	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.1	0	-	-

Intersection	
Intersection Delay, s/veh	8.8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	6	40	8	6	3	12	107	119	3	171	3
Future Vol, veh/h	3	6	40	8	6	3	12	107	119	3	171	3
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	3	7	45	9	7	3	14	122	135	3	194	3
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.9	8.2	8.9	8.9
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	5%	6%	47%	2%
Vol Thru, %	45%	12%	35%	97%
Vol Right, %	50%	82%	18%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	238	49	17	177
LT Vol	12	3	8	3
Through Vol	107	6	6	171
RT Vol	119	40	3	3
Lane Flow Rate	270	56	19	201
Geometry Grp	1	1	1	1
Degree of Util (X)	0.307	0.07	0.027	0.247
Departure Headway (Hd)	4.086	4.542	5.059	4.421
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	882	789	708	815
Service Time	2.1	2.568	3.088	2.436
HCM Lane V/C Ratio	0.306	0.071	0.027	0.247
HCM Control Delay	8.9	7.9	8.2	8.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.3	0.2	0.1	1

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	18	27	7	6	3	48	162	12	3	88	4
Future Vol, veh/h	3	18	27	7	6	3	48	162	12	3	88	4
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	3	20	31	8	7	3	55	184	14	3	100	5
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.8	8	9.1	8.1
HCM LOS	A	A	A	A

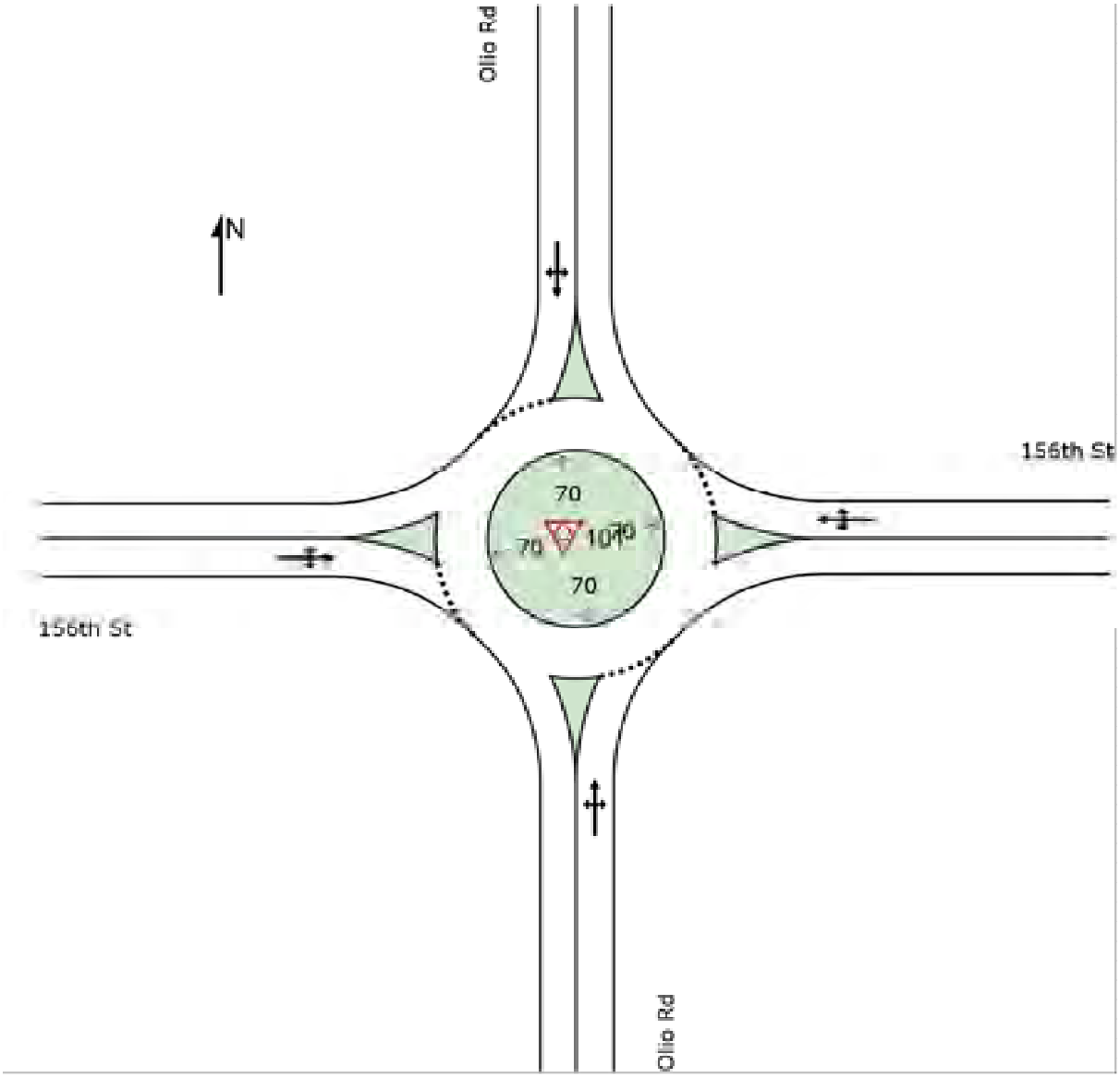
Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	22%	6%	44%	3%
Vol Thru, %	73%	38%	38%	93%
Vol Right, %	5%	56%	19%	4%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	222	48	16	95
LT Vol	48	3	7	3
Through Vol	162	18	6	88
RT Vol	12	27	3	4
Lane Flow Rate	252	55	18	108
Geometry Grp	1	1	1	1
Degree of Util (X)	0.295	0.068	0.024	0.132
Departure Headway (Hd)	4.204	4.485	4.832	4.395
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	843	802	744	819
Service Time	2.291	2.494	2.842	2.403
HCM Lane V/C Ratio	0.299	0.069	0.024	0.132
HCM Control Delay	9.1	7.8	8	8.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.2	0.2	0.1	0.5

SITE LAYOUT

Site: 101 [Olio Rd and 156th St 2048 RAB AM (Site Folder: General)]

NA
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



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MOVEMENT SUMMARY

Site: 101 [Olio Rd and 156th St 2048 RAB AM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] ft	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed mph
South: Olio Rd															
3	L2	All MCs	13	5.0	13	5.0	0.196	9.3	LOS A	1.0	25.7	0.08	0.46	0.08	35.0
8	T1	All MCs	116	5.0	116	5.0	0.196	4.5	LOS A	1.0	25.7	0.08	0.46	0.08	35.7
18	R2	All MCs	129	5.0	129	5.0	0.196	4.3	LOS A	1.0	25.7	0.08	0.46	0.08	35.4
Approach			259	5.0	259	5.0	0.196	4.6	LOS A	1.0	25.7	0.08	0.46	0.08	35.5
East: 156th St															
1	L2	All MCs	9	5.0	9	5.0	0.015	9.8	LOS A	0.1	1.5	0.24	0.55	0.24	33.6
6	T1	All MCs	7	5.0	7	5.0	0.015	4.9	LOS A	0.1	1.5	0.24	0.55	0.24	34.3
16	R2	All MCs	3	5.0	3	5.0	0.015	4.7	LOS A	0.1	1.5	0.24	0.55	0.24	34.0
Approach			18	5.0	18	5.0	0.015	7.2	LOS A	0.1	1.5	0.24	0.55	0.24	33.9
North: Olio Rd															
7	L2	All MCs	3	5.0	3	5.0	0.147	9.4	LOS A	0.7	17.5	0.12	0.42	0.12	34.9
4	T1	All MCs	186	5.0	186	5.0	0.147	4.5	LOS A	0.7	17.5	0.12	0.42	0.12	35.7
14	R2	All MCs	3	5.0	3	5.0	0.147	4.4	LOS A	0.7	17.5	0.12	0.42	0.12	35.3
Approach			192	5.0	192	5.0	0.147	4.6	LOS A	0.7	17.5	0.12	0.42	0.12	35.6
West: 156th St															
5	L2	All MCs	3	5.0	3	5.0	0.047	10.0	LOS B	0.2	4.6	0.30	0.54	0.30	34.5
2	T1	All MCs	7	5.0	7	5.0	0.047	5.1	LOS A	0.2	4.6	0.30	0.54	0.30	35.2
12	R2	All MCs	43	5.0	43	5.0	0.047	5.0	LOS A	0.2	4.6	0.30	0.54	0.30	34.9
Approach			53	5.0	53	5.0	0.047	5.3	LOS A	0.2	4.6	0.30	0.54	0.30	34.9
All Vehicles			523	5.0	523	5.0	0.196	4.8	LOS A	1.0	25.7	0.13	0.46	0.13	35.4

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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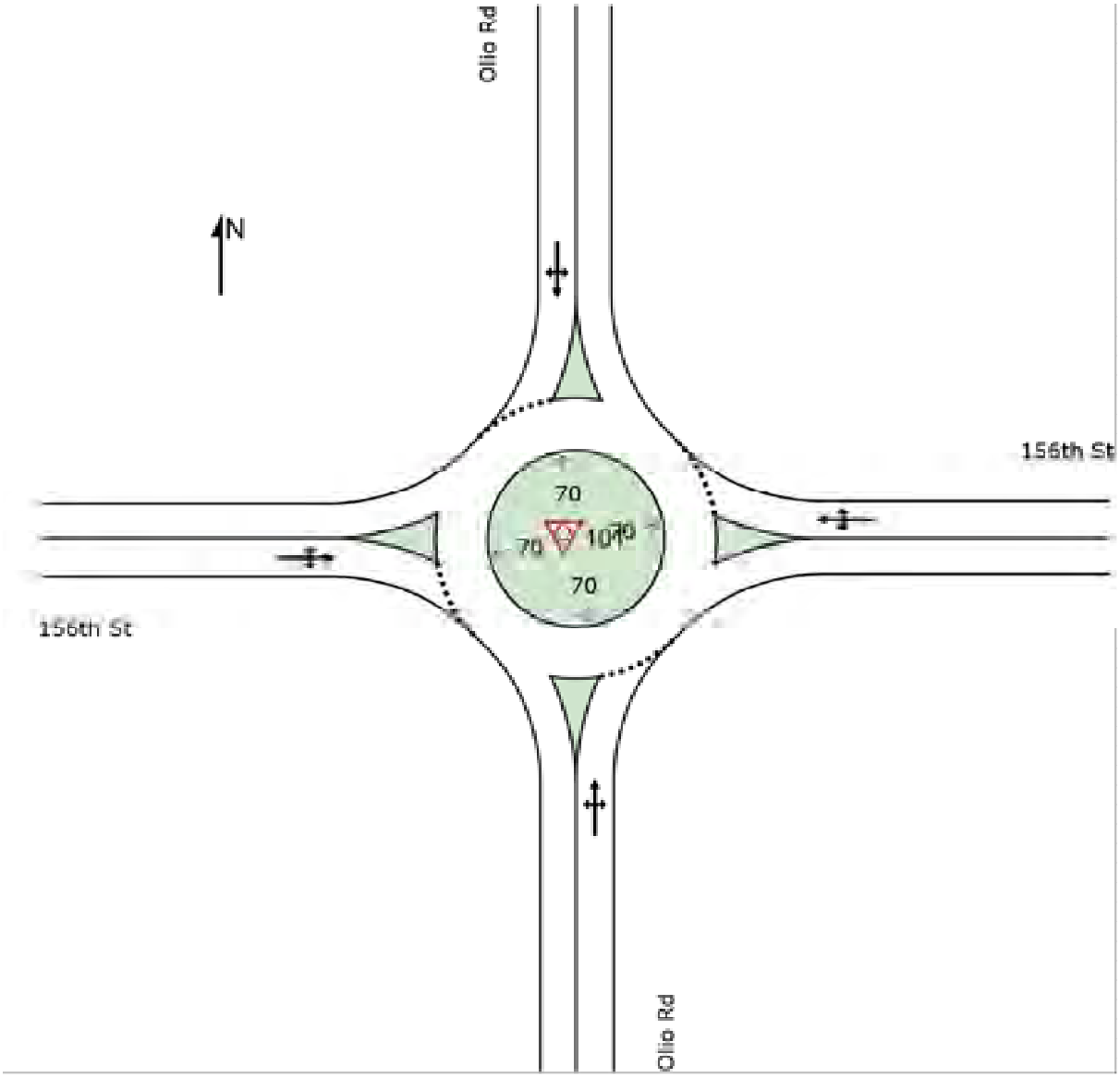
SITE LAYOUT

Site: 101 [Olio Rd and 156th St 2048 RAB PM (Site Folder: General)]

NA
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



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MOVEMENT SUMMARY

Site: 101 [Olio Rd and 156th St 2048 RAB PM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] ft	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed mph
South: Olio Rd															
3	L2	All MCs	52	5.0	52	5.0	0.185	9.4	LOS A	0.9	23.4	0.12	0.48	0.12	34.4
8	T1	All MCs	176	5.0	176	5.0	0.185	4.5	LOS A	0.9	23.4	0.12	0.48	0.12	35.2
18	R2	All MCs	13	5.0	13	5.0	0.185	4.4	LOS A	0.9	23.4	0.12	0.48	0.12	34.8
Approach			241	5.0	241	5.0	0.185	5.6	LOS A	0.9	23.4	0.12	0.48	0.12	35.0
East: 156th St															
1	L2	All MCs	8	5.0	8	5.0	0.016	10.1	LOS B	0.1	1.5	0.32	0.57	0.32	33.5
6	T1	All MCs	7	5.0	7	5.0	0.016	5.2	LOS A	0.1	1.5	0.32	0.57	0.32	34.2
16	R2	All MCs	3	5.0	3	5.0	0.016	5.1	LOS A	0.1	1.5	0.32	0.57	0.32	33.9
Approach			17	5.0	17	5.0	0.016	7.3	LOS A	0.1	1.5	0.32	0.57	0.32	33.9
North: Olio Rd															
7	L2	All MCs	3	5.0	3	5.0	0.082	9.6	LOS A	0.3	8.7	0.18	0.44	0.18	34.7
4	T1	All MCs	96	5.0	96	5.0	0.082	4.7	LOS A	0.3	8.7	0.18	0.44	0.18	35.4
14	R2	All MCs	4	5.0	4	5.0	0.082	4.5	LOS A	0.3	8.7	0.18	0.44	0.18	35.1
Approach			103	5.0	103	5.0	0.082	4.8	LOS A	0.3	8.7	0.18	0.44	0.18	35.4
West: 156th St															
5	L2	All MCs	3	5.0	3	5.0	0.043	9.7	LOS A	0.2	4.4	0.23	0.49	0.23	34.6
2	T1	All MCs	20	5.0	20	5.0	0.043	4.8	LOS A	0.2	4.4	0.23	0.49	0.23	35.3
12	R2	All MCs	29	5.0	29	5.0	0.043	4.7	LOS A	0.2	4.4	0.23	0.49	0.23	35.0
Approach			52	5.0	52	5.0	0.043	5.0	LOS A	0.2	4.4	0.23	0.49	0.23	35.1
All Vehicles			414	5.0	414	5.0	0.185	5.4	LOS A	0.9	23.4	0.16	0.47	0.16	35.1

Site Level of Service (LOS) Method: Delay & Degree of Saturation (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
Intersection and Approach LOS values are based on average delay for all movements (v/c not used).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	3	6	40	8	6	3	12	107	119	3	171	3
Future Vol, veh/h	3	6	40	8	6	3	12	107	119	3	171	3
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	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	3	7	45	9	7	3	14	122	135	3	194	3

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	425	487	196	446	421	190	197	0	0	257	0	0
Stage 1	202	202	-	218	218	-	-	-	-	-	-	-
Stage 2	223	285	-	228	203	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	534	476	838	517	519	844	1358	-	-	1290	-	-
Stage 1	793	729	-	778	717	-	-	-	-	-	-	-
Stage 2	773	670	-	768	728	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	521	469	838	478	511	844	1358	-	-	1290	-	-
Mov Cap-2 Maneuver	521	469	-	478	511	-	-	-	-	-	-	-
Stage 1	783	727	-	769	708	-	-	-	-	-	-	-
Stage 2	753	662	-	717	726	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.3	12	0.4	0.1
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1358	-	-	739	531	1290	-	-
HCM Lane V/C Ratio	0.01	-	-	0.075	0.036	0.003	-	-
HCM Control Delay (s)	7.7	0	-	10.3	12	7.8	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	3	18	27	7	6	3	48	162	12	3	88	4
Future Vol, veh/h	3	18	27	7	6	3	48	162	12	3	88	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	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	3	20	31	8	7	3	55	184	14	3	100	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	415	417	103	435	412	191	105	0	0	198	0	0
Stage 1	109	109	-	301	301	-	-	-	-	-	-	-
Stage 2	306	308	-	134	111	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.15	6.55	6.25	4.15	-	-	4.15	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.545	4.045	3.345	2.245	-	-	2.245	-	-
Pot Cap-1 Maneuver	543	522	944	526	525	843	1468	-	-	1357	-	-
Stage 1	889	799	-	702	660	-	-	-	-	-	-	-
Stage 2	697	655	-	862	798	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	517	499	944	477	502	843	1468	-	-	1357	-	-
Mov Cap-2 Maneuver	517	499	-	477	502	-	-	-	-	-	-	-
Stage 1	852	797	-	673	632	-	-	-	-	-	-	-
Stage 2	658	627	-	811	796	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.7	12	1.6	0.2
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1468	-	-	681	530	1357	-	-
HCM Lane V/C Ratio	0.037	-	-	0.08	0.034	0.003	-	-
HCM Control Delay (s)	7.5	0	-	10.7	12	7.7	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.3	0.1	0	-	-

ATTACHMENT G

CMF Information

Description

This table presents the CRFs/CMFs for safety countermeasures that were identified as being the most suitable for Indiana based on the criteria presented in the Joint Transportation Research Program technical report, “Updating the Crash Modification Factors and Calibrating the IHSDM for Indiana”. The table contains 82 safety countermeasures spanning 16 different categories. For each countermeasure, the applicable areas type (urban and/or rural), facility type, and CRF/CMF values for various crash types and severities are presented. Finally, the state(s) where each study was conducted and the corresponding reference are provided in the table.

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Intersection geometry	Add a left-turn lane on one major approach to a signalized intersection	Urban	Three-leg intersections	Total	7.0	0.930	IA, IL, LA, MN, NE, NC, OR, VA (18)
			Four-leg intersections	Total	10.0	0.900	
		Rural	Three-leg intersections	Total	15.0	0.850	
			Four-leg intersections	Total	18.0	0.820	
Intersection geometry	Add a left-turn lane on one major approach to an unsignalized intersection	Urban	Three-leg intersections	Total	33.0	0.670	IA, IL, LA, MN, NE, NC, OR, VA (18)
			Four-leg intersections	Total	27.0	0.730	
		Rural	Three-leg intersections	Total	44.0	0.560	
			Four-leg intersections	Total	28.0	0.720	
Intersection geometry	Add a right-turn lane on one major approach to a signalized intersection	Urban	Four-leg intersections	Total	4.0	0.960	IA, IL, LA, MN, NE, NC, OR, VA (18)
Intersection geometry	Add a right-turn lane on one major approach to an unsignalized intersection	Rural	Four-leg intersections	Total	14.0	0.860	IA, IL, LA, MN, NE, NC, OR, VA (18)
Intersection geometry	Convert diamond interchange to diverging diamond interchange (DDI)	Urban	Principal arterial, other freeways and expressways	Total	33	0.67	KY, MO, NY, TN (20)
				Injury	41	0.59	
				Angle	67	0.33	
				Rear-end	36	0.64	
				Sideswipe	-27	1.27	
				Single-vehicle	24	0.76	
Intersection geometry	Convert intersection on low-speed road to a roundabout	Urban and rural	Intersections where all approaches are low-speed (less than 45 mph)	Total	-9.9	1.099	WI (31)
				KABC	52.7	0.473	
Intersection geometry	Convert intersection on high-speed road to a roundabout	Urban and rural	Intersections where at least one approach is high-speed (45 mph or greater)	Total	34.1	0.659	WI (31)
				KABC	49.4	0.506	
Intersection geometry	Convert intersection to a single-lane roundabout	Urban and rural	Intersections with low- and high-speed approaches	Total	36.0	0.640	WI (31)
				KABC	18.2	0.818	
Intersection geometry	Convert intersection to a multilane roundabout	Urban and rural	Intersections with low- and high-speed approaches	Total	-6.2	1.062	WI (31)
				KABC	63.3	0.367	
Intersection geometry	Convert two-way stop-controlled intersection to a roundabout	Urban	Intersections on two- or four-lane roads	Total	27.0	0.73	CA, CO, CT, FL, KS, MD, ME, MI, MO, MS, NV, OR, SC, UT, VT, WA WI (31,33)
				KABC	58.1	0.419	
		Rural	Intersections on two- or four-lane roads	Total	48.2	0.518	
				KABC	61.2	0.388	

Category	Countermeasure	Area Type	Facility type	Crash Type	CRF	CMF	States and (reference number)
Intersection traffic control	Change left-turn phasing from permitted or permitted/protected to protected-only phasing	Urban	Signalized intersections	Total	1	0.99	NC (17)
				Left-turn	99	0.01	
Intersection traffic control	Supplement left-turn phasing from at least one permitted approach with flashing yellow arrow	Urban	Four-leg intersections	Total	24.7	0.753	NC, OR, WA (39)
				Left-turn	36.5	0.635	
Intersection traffic control	Change left-turn phasing from protected/permitted to flashing yellow arrow	Urban	Four-leg intersections	Total	7.8	0.922	NC, OR, WA (39)
				Left-turn	19.4	0.806	
Intersection traffic control	Change left-turn phasing from protected to flashing yellow arrow	Urban	Four-leg intersections	Total	-33.8	1.338	NC, OR, WA (39)
				Left-turn	-124.2	2.242	
Intersection traffic control	Convert two-way stop control to all-way stop control	Urban and rural	Four-leg intersections	Total	68	0.32	NC (34)
				KABC	77	0.23	
				Frontal impact	75	0.25	
				Ran stop sign	15	0.85	
Intersection traffic control	Improve signal visibility	Urban	Four-leg intersections on three- to four-lane roads	Daytime PDO	9.9	0.901	British Columbia (9)
				Daytime KABC	-0.4	1.004	
				Nighttime PDO	13.3	0.867	
				Nighttime KABC	9.8	0.902	
Intersection traffic control	Increase yellow change interval (1.0 seconds)	Urban	Three- and four-leg intersections	Total	-14.1	1.141	CA, MD (39)
				KABC	-7.3	1.073	
				Rear-end	6.6	0.934	
				Angle	-7.6	1.076	
Intersection traffic control	Increase all-red clearance interval (average of 1.1 seconds)	Urban	Three- and four-leg intersections	Total	20.2	0.798	CA, MD (39)
				KABC	13.7	0.863	
				Rear-end	19.6	0.804	
				Angle	3.4	0.966	
Intersection traffic control	Increase yellow interval (average of 0.8 seconds) and add all-red interval (average of 1.2 seconds)	Urban	Three- and four-leg intersections	Total KABC	1.0 -2.0	0.990 1.020	CA, MD (39)
				Rear-end	-11.7	1.117	
				Angle	3.9	0.961	

CMF / CRF DETAILS

CMF ID: 8438

INSTALL INTERSECTION CONFLICT WARNING SYSTEMS (ICWS) FOR TWO-LANE AT TWO-LANE INTERSECTIONS

DESCRIPTION:

PRIOR CONDITION: NO INTERSECTION CONFLICT WARNING SYSTEMS

CATEGORY: SIGNS

STUDY: *MULTI-STATE SAFETY EVALUATION OF INTERSECTION CONFLICT WARNING SYSTEMS (ICWS)*, HIMES ET AL, 2016

Star Quality Rating:	[VIEW SCORE DETAILS]
Rating Points Total:	142

Crash Modification Factor (CMF)

Value:	0.73
Adjusted Standard Error:	
Unadjusted Standard Error:	0.04

Crash Reduction Factor (CRF)

Value:	27 *(This value indicates a **decrease** in crashes)*
Adjusted Standard Error:	
Unadjusted Standard Error:	4

Applicability

Crash Type:	All
Crash Severity:	All
Roadway Types:	Not specified
Street Type:	
Minimum Number of Lanes:	2
Maximum Number of Lanes:	2
Number of Lanes Direction:	
Number of Lanes Comment:	
Crash Weather:	Not specified
Road Division Type:	
Minimum Speed Limit:	
Maximum Speed Limit:	

Speed Unit:	
Speed Limit Comment:	
Area Type:	Rural
Traffic Volume:	
Average Traffic Volume:	
Time of Day:	Not specified

If countermeasure is intersection-based

Intersection Type:	Roadway/roadway (not interchange related)
Intersection Geometry:	4-leg
Traffic Control:	Stop-controlled
Major Road Traffic Volume:	
Minor Road Traffic Volume:	
Average Major Road Volume :	
Average Minor Road Volume :	

Development Details

Date Range of Data Used:	
Municipality:	
State:	NC
Country:	
Type of Methodology Used:	Before/after using empirical Bayes or full Bayes
Sample Size (crashes):	613 crashes after
Sample Size (sites):	53 sites before, 53 sites after

Other Details

Included in Highway Safety Manual?	No
Date Added to Clearinghouse:	Jan 17, 2017
Comments:	

VIEW THE FULL STUDY DETAILS

EXPORT DETAIL PAGE AS PDF

This site is funded by the **U.S. Department of Transportation Federal Highway Administration** and maintained by the **University of North Carolina Highway Safety Research Center**

For more information, contact Sarah Weissman Pascual at **sarah.pascual@dot.gov**

U.S. Department of Transportation
Federal Highway Administration

Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections

This systemic approach to intersection safety involves deploying a package of multiple low-cost countermeasures, including enhanced signing and pavement markings, at a large number of stop-controlled intersections within a jurisdiction. These countermeasures increase driver awareness and recognition of the intersections and potential conflicts.

Safety Benefits:

10%
reduction of fatal and injury crashes at all locations/types/areas.

15%
reduction of nighttime crashes at all locations/types/areas.

27%
reduction of fatal and injury crashes at rural intersections.

19%
reduction of fatal and injury crashes at 2-lane by 2-lane intersections.

Average Benefit-Cost Ratio

12:1

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://highways.dot.gov/safety/proven-safety-countermeasures and https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa18047.pdf.

There are several benefits to systemically applying multiple low-cost countermeasures at stop-controlled intersections, including,

- Resources are maximized because the treatments are low cost.
- A high number of intersections can receive treatment.
- Improvements are highly cost-effective, with an average benefit-cost ratio of 12:1, even assuming a conservative 3-year service life.

Example of countermeasures on the through approach.
Source: South Carolina DOT

Example of countermeasures on the stop approach.
Source: South Carolina DOT

The low-cost countermeasures for stop-controlled intersections generally consist of the following treatments:

On the Through Approach

- Doubled-up (left and right), oversized advance intersection warning signs, with supplemental street name plaques (can also include flashing beacon).
- Retroreflective sheeting on sign posts.
- Enhanced pavement markings that delineate through lane edge lines.

On the Stop Approach

- Doubled-up (left and right), oversized advance "Stop Ahead" intersection warning signs (can also include flashing beacon).
- Doubled-up (left and right), oversized Stop signs.
- Retroreflective sheeting on sign posts.
- Properly placed stop bar.
- Removal of vegetation, parking, or obstructions that limit sight distance.
- Double arrow warning sign at stem of T-intersections.

Source: (CMF ID: 8867, 8870, 8874, 8893) T. Le et al. "Safety Effects of Low-Cost Systemic Safety Improvements at Signalized and Stop-Controlled Intersections," 96th Annual Meeting of the Transportation Research Board, Paper Number 17-05379, January 2017.

FHWA-SA-21-031
Des. No. 2101733

ATTACHMENT H

Traffic Forecasts

Olio and 156th Street Request

2022 Daily Flows		
Link ID	AB Flow	BA Flow
48125	279	306
48127	296	314
48130	68	55
48131	50	46

2040 Daily Flows		
Link ID	AB Flow	BA Flow
47883	1,861	1,782
47884	1,863	1,785
49462	35	35
49466	33	32

2050 Daily Flows		
Link ID	AB Flow	BA Flow
47883	1,415	2,691
47884	1,373	2,698
49361	145	152
49363	134	90

AB = EB or NB
BA = WB or SB

Traffic Counts		From Travel Demand Model		
2012 Counts	2019 Counts	2022 Flows	2040 Flows	2050 Flows
3,180	4,137	585	3,643	4,106
1,990	-	611	3,648	4,071
430	-	123	70	297
960	-	97	65	224

2012 to 2019 Calculated AAGR	2022 to 2040 TDM AAGR			2040 to 2050 TDM AAGR			Notes
Total	AB	BA	Total	AB	BA	Total	
1.7%	31.56%	26.80%	29.1%	-2.39%	5.10%	1.3%	Traffic counts are comparable or higher than flows from TDM
0.0%	29.37%	25.98%	27.6%	-2.63%	5.12%	1.2%	
0.0%	-2.66%	-2.04%	-2.4%	30.97%	33.67%	32.3%	
0.0%	-1.89%	-1.73%	-1.8%	30.31%	18.17%	24.3%	

2012 Counts

Turning movement counts collected in 2012 for Noblesville fee impact study

K-factor for daily estimate 10%

AM Peak	L	T	R	Entering	Exiting	Total
NB leg	8	75	83	166	152	318
SB leg	1	120	1	122	77	199
EB leg	1	3	27	31	12	43
WB leg	5	3	1	9	87	96
PM Peak	L	T	R			
NB leg	33	114	8	155	239	394
SB leg	1	62	2	65	181	246
EB leg	1	12	18	31	69	100
WB leg	4	3	1	8	29	37
Daily Estimate						
NB leg	330	1,140	830	2,300	1,520	3,820
SB leg	10	1,200	20	1,230	1,160	2,390
EB leg	10	120	270	400	380	780
WB leg	50	30	10	90	960	1,050

2024 Forecasts (Existing)

AAGR = 0.65%

12 years of straight line growth (2012 to 2024)

K-factor for daily estimate 10%

Assume 5% trucks in analysis

AM Peak	L	T	R	Entering	Exiting	Total
NB leg	*9*	*81*	*90*	180	166	346
SB leg	*2*	*130*	*2*	134	85	219
EB leg	*2*	*4*	*30*	36	15	51
WB leg	*6*	*4*	*2*	12	96	108
PM Peak	L	T	R			
NB leg	*36*	*123*	*9*	168	260	428
SB leg	*2*	*67*	*3*	72	199	271
EB leg	*2*	*13*	*20*	35	78	113
WB leg	*5*	*4*	*2*	11	35	46
Daily Estimate						
NB leg	*360*	*1,230*	*900*	2,490	1,660	4,150
SB leg	*20*	*1,300*	*30*	1,350	1,270	2,620
EB leg	*20*	*130*	*300*	450	430	880
WB leg	*60*	*40*	*20*	120	1,050	1,170

2028 Forecasts

AAGR = 1.30%

4 years of straight line growth (2024 to 2028)

K-factor for daily estimate 10%

Assume 5% trucks in analysis

AM Peak	L	T	R	Entering	Exiting	Total
NB leg	*10*	*86*	*95*	191	176	367
SB leg	*3*	*137*	*3*	143	92	235
EB leg	*3*	*5*	*32*	40	18	58
WB leg	*7*	*5*	*3*	15	103	118
PM Peak	L	T	R			
NB leg	*38*	*130*	*10*	178	277	455
SB leg	*3*	*71*	*4*	78	214	292
EB leg	*3*	*14*	*22*	39	86	125
WB leg	*6*	*5*	*3*	14	41	55
Daily Estimate						
NB leg	*380*	*1,300*	*950*	2,630	1,760	4,390
SB leg	*30*	*1,370*	*40*	1,440	1,360	2,800
EB leg	*30*	*140*	*320*	490	470	960
WB leg	*70*	*50*	*30*	150	1,120	1,270

2048 Forecasts

AAGR = 1.30%

24 years of straight line growth (2024 to 2048)

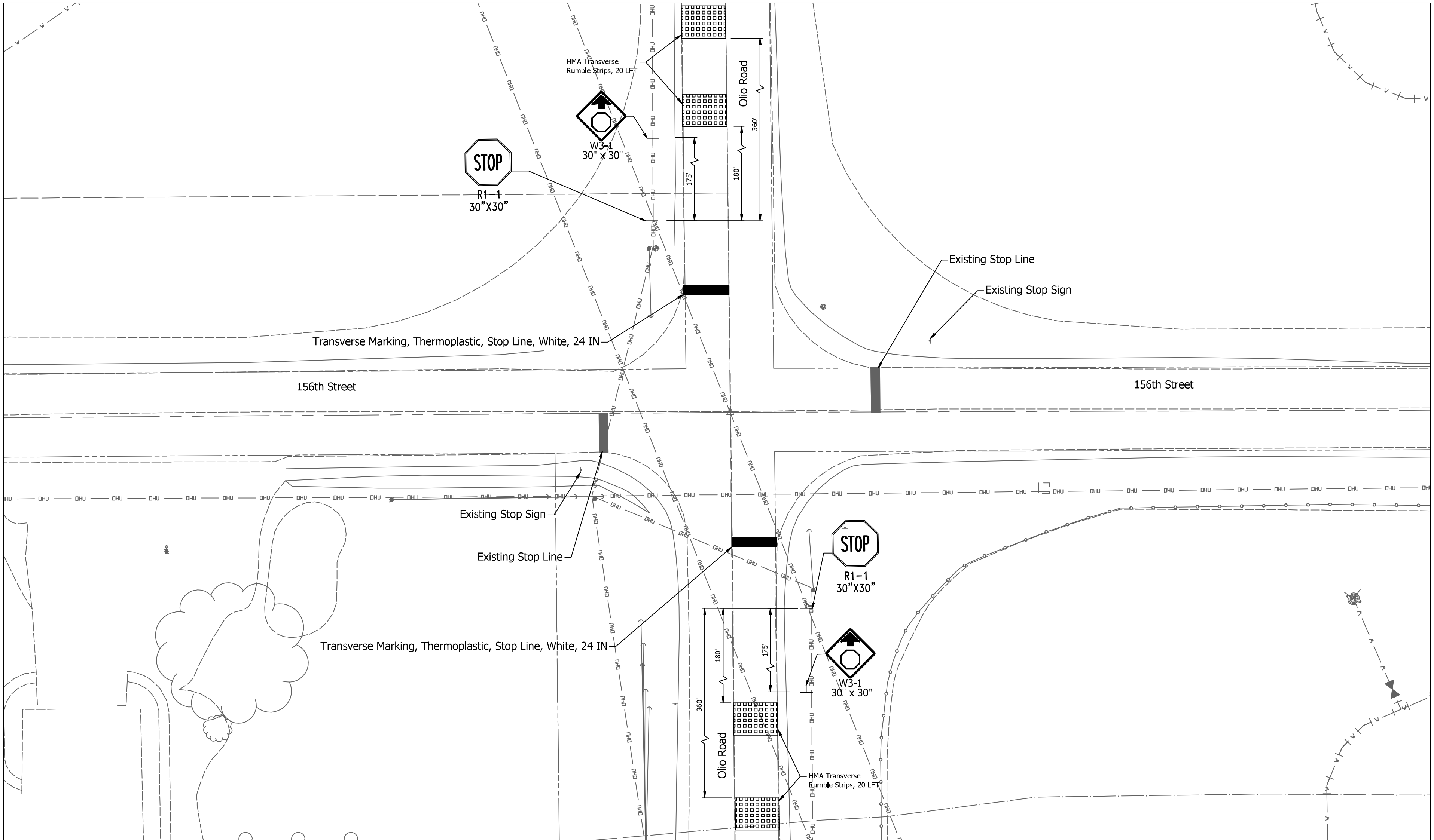
K-factor for daily estimate 10%

Assume 5% trucks in analysis

AM Peak	L	T	R	Entering	Exiting	Total
NB leg	*12*	*107*	*119*	238	219	457
SB leg	*3*	*171*	*3*	177	113	290
EB leg	*3*	*6*	*40*	49	21	70
WB leg	*8*	*6*	*3*	17	128	145
PM Peak	L	T	R			
NB leg	*48*	*162*	*12*	222	344	566
SB leg	*3*	*88*	*4*	95	263	358
EB leg	*3*	*18*	*27*	48	106	154
WB leg	*7*	*6*	*3*	16	49	65
Daily Estimate						
NB leg	*480*	*1,620*	*1,190*	3,290	2,190	5,480
SB leg	*30*	*1,710*	*40*	1,780	1,680	3,460
EB leg	*30*	*180*	*400*	610	580	1,190
WB leg	*80*	*60*	*30*	170	1,400	1,570

ATTACHMENT I

Conceptual Layout and Cost



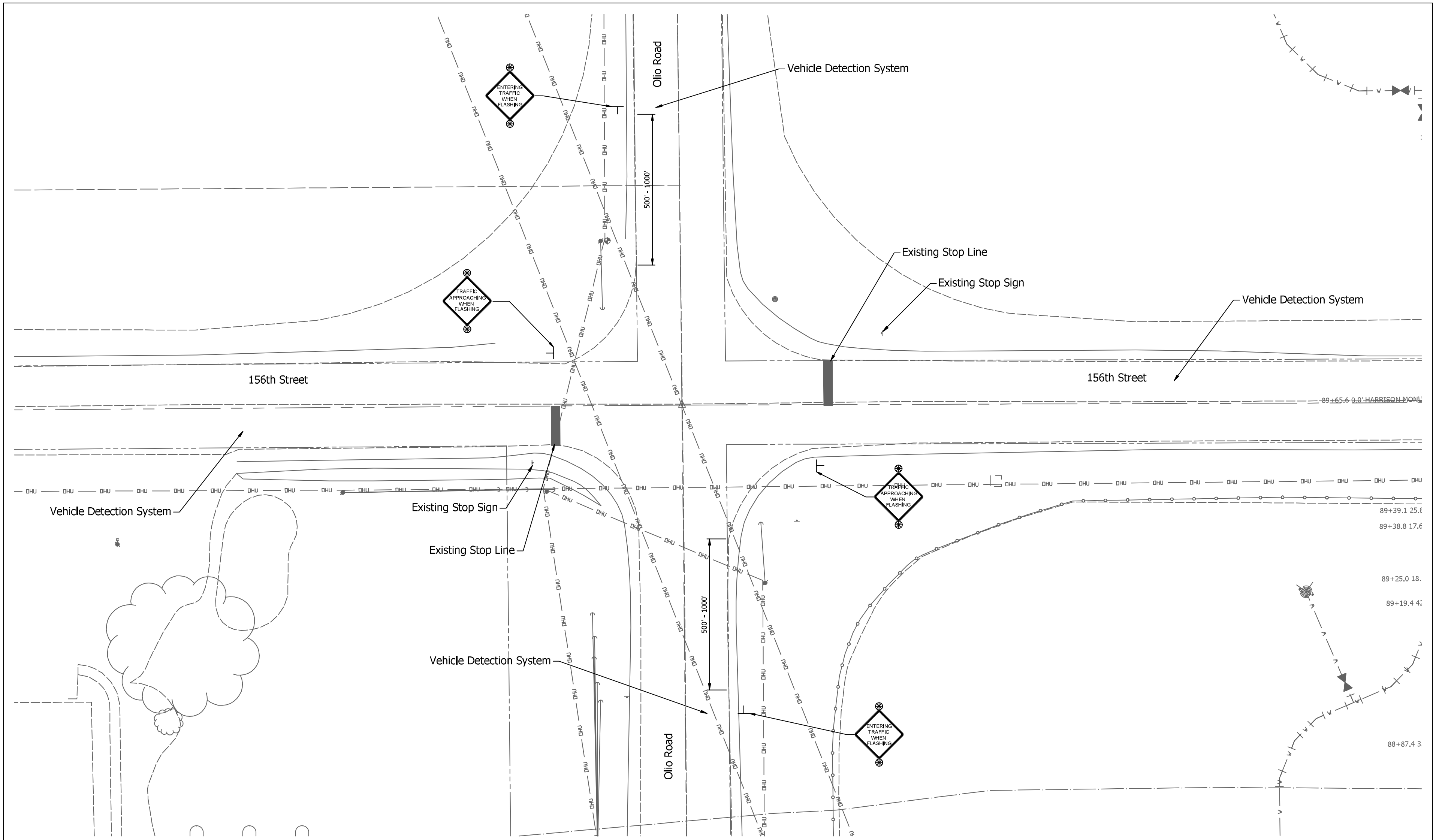
RECOMMENDED FOR APPROVAL — DESIGN ENGINEER — DATE		CITY OF NOBLESVILLE	HORIZONTAL SCALE: 1" = 10' / BRIDGE FILE: N/A / VERTICAL SCALE: N/A / DESIGNATION: 2101733
DESIGNED: KMA / CHECKED: SJS	DRAWN: KMA / CHECKED: SJS	ALTERNATIVE 1 FOUR-WAY STOP	SURVEY BOOK: ELECTRONIC / SHEET: 1 of 3 / CONTRACT: EN-359 / PROJECT: 2101733

Date: Aug 21, 2024, 2:56pm User Name: KAngerer
File: X:\Production\Files\2022\122-2027\CAD\MiscDWG\Sht_RD_All Way Stop Alternative.dwg - (Misc Sheet)

ENGINEER'S ESTIMATE
Alternative 1 - Four Way
Project No.:

ESTIMATED CONSTRUCTION COST	
Sub-Total:	**$15,139.47**
30.0% Contingency:	**$4,541.84**
Total:	**$19,681.31**

ID	ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	ITEM TOTAL
1	105-06845	CONSTRUCTION ENGINEERING	1.00	LS	$627.60	$627.60
2	110-01001	MOBILIZATION AND DEMOBILIZATION	1.00	LS	$1,609.78	$1,609.78
3	402-05494	HMA TRANSVERSE RUMBLE STRIPS	40.00	LFT	$275.00	$11,000.00
4	802-05701	SIGN POST, SQUARE, TYPE 1, REINFORCED ANCHOR BASE	36.00	LFT	$31.79	$1,144.44
5	802-09838	SIGN, SHEET, WITH LEGEND, 0.080 IN. THICKNESS	25.00	SFT	$21.73	$543.25
6	808-75297	TRANSVERSE MARKING, THERMOPLASTIC, STOP LINE, WHITE, 24 IN.	20.00	LFT	$10.72	$214.40



Date: Aug 21, 2024, 2:56pm User Name: KAigerer
File: X:\Production\Files\2022\22-2027\CAD\Misc\DWG\Sht_RD_ICWS Alternative.dwg - (Misc Sheet)

RECOMMENDED FOR APPROVAL ______ DESIGN ENGINEER # DATE		CITY OF NOBLESVILLE	HORIZONTAL SCALE: 1" = 10'	BRIDGE FILE: N/A
			VERTICAL SCALE: N/A	DESIGNATION: 2101733
DESIGNED: KMA	DRAWN: KMA	ALTERNATIVE 2 ICWS MINOR ROAD ALERT	SURVEY BOOK: ELECTRONIC	SHEET: 2 of 3
CHECKED: SJS	CHECKED: SJS		CONTRACT: EN-359	PROJECT: 2101733

ENGINEER'S ESTIMATE
Alternative 2 - ICWS
Project No.:

ESTIMATED CONSTRUCTION COST	
Sub-Total:	**$62,267.74**
30.0% Contingency:	**$18,680.32**
Total:	**$80,948.06**

ID	ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	ITEM TOTAL
1	105-06845	CONSTRUCTION ENGINEERING	1.00	LS	$874.33	$874.33
2	110-01001	MOBILIZATION AND DEMOBILIZATION	1.00	LS	$2,229.53	$2,229.53
3	802-09840	SIGN, SHEET, WITH LEGEND, 0.100 IN. THICKNESS	36.00	SFT	$32.33	$1,163.88
4	805-02262	FLASHER INSTALLATION, NEW, LOCATION NO.	1.00	LS	$18,000.00	$18,000.00
5	805-07842	VEHICLE DETECTION SYSTEM	4.00	EACH	$10,000.00	$40,000.00

RECOMMENDED FOR APPROVAL	DESIGN ENGINEER	# DATE	
DESIGNED: KMA	DRAWN: KMA		
CHECKED: SJS	CHECKED: SJS		

CITY OF NOBLESVILLE

ALTERNATIVE 3 ROUNDABOUT

HORIZONTAL SCALE	BRIDGE FILE
1" = 40'	N/A
VERTICAL SCALE	DESIGNATION
N/A	2101733
SURVEY BOOK	SHEET
ELECTRONIC	3 of 4
CONTRACT	PROJECT
EN-359	2101733

Date: Sep 17, 2024, 4:21pm User Name: KAngerer
File: X:\Production\Files\2022\122-2027\CAD\MiscDWG\Sht_RD_RAB Alternative.dwg - (Misc Sheet)

ENGINEER'S ESTIMATE
156th St/Olio Rd RAB
Project No.:

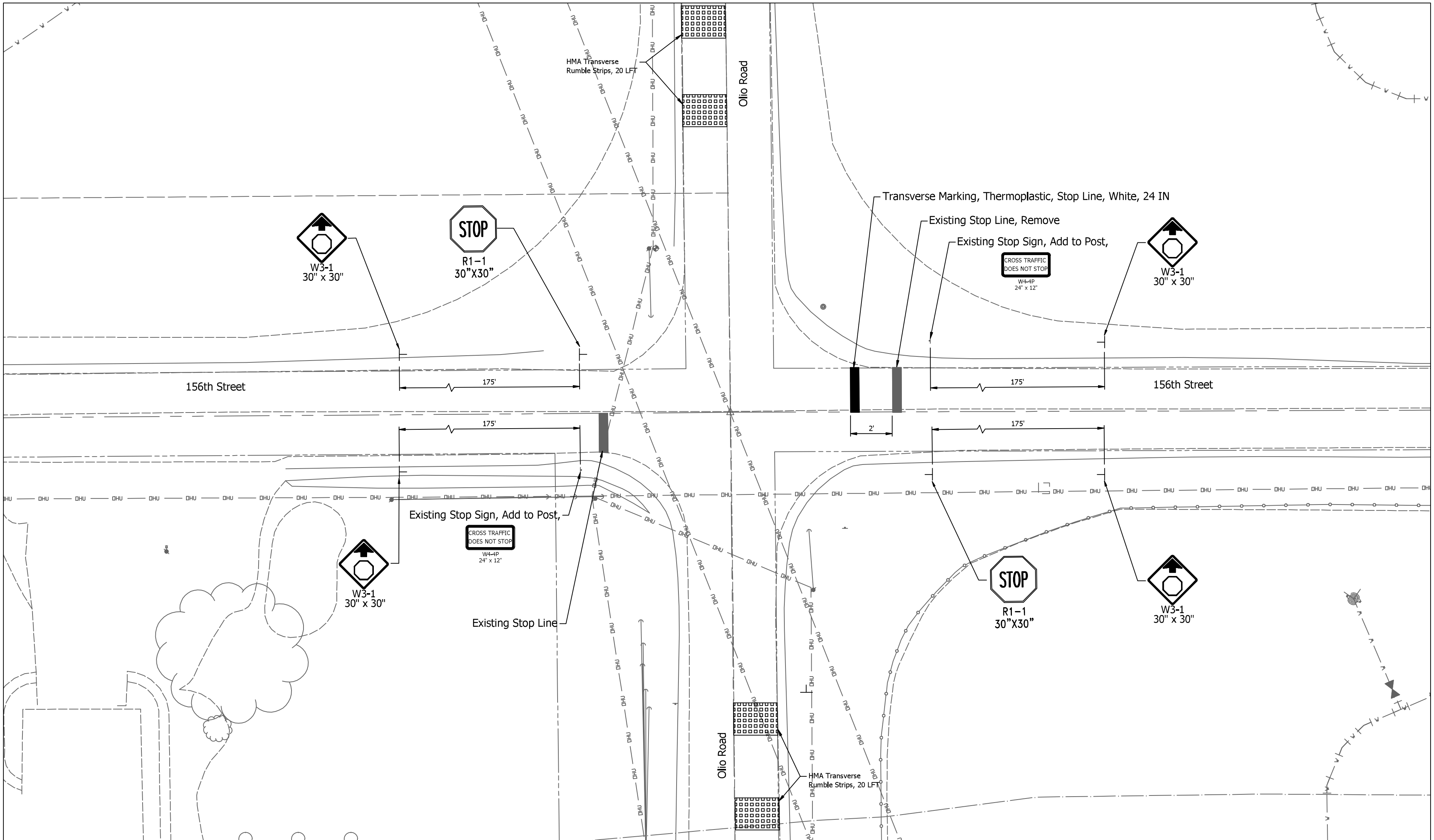
ESTIMATED CONSTRUCTION COST	
Sub-Total:	$2,505,809.34
10.0% Contingency:	$250,580.93
Total:	$2,756,390.27
Inflation to 2027:	$3,190,866.29
Inflation to 2027 (Rounded)	$3,200,000.00

Stage 2 Submittal made on 4/15/2024

ID	ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	ITEM TOTAL
1	105-06845	CONSTRUCTION ENGINEERING	1.00	LS	$44,000.00	$44,000.00
2	109-08440	QUALITY ADJUSTMENTS, HMA	1.00	DOL	$1.00	$1.00
3	109-08443	QUALITY ADJUSTMENTS, TEMPORARY TRAFFIC CONTROL DEVICES	1.00	DOL	$1.00	$1.00
4	109-08444	QUALITY ADJUSTMENTS, FAILED MATERIALS	1.00	DOL	$1.00	$1.00
5	109-09377	QUALITY ADJUSTMENTS, PAVEMENT TRAFFIC MARKINGS	1.00	DOL	$1.00	$1.00
6	109-11362	QUALITY ADJUSTMENTS, FAILURE TO MAINTAIN TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES	1.00	DOL	$1.00	$1.00
7	110-01001	MOBILIZATION AND DEMOBILIZATION	1.00	LS	$143,000.00	$143,000.00
8	201-52370	CLEARING RIGHT OF WAY	1.00	LS	$44,000.00	$44,000.00
9	202-74045	SIGN AND SUPPORTS, CHANNEL POSTS, REMOVE	7.00	EACH	$90.00	$630.00
10	203-02000	EXCAVATION, COMMON	4,367.00	CYS	$48.73	$212,803.91
11	203-02070	BORROW	919.00	CYS	$35.83	$32,927.77
12	205-12108	STORMWATER MANAGEMENT BUDGET	50,000.00	DOL	$1.00	$50,000.00
13	205-12616	STORMWATER MANAGEMENT IMPLEMENTATION	1.00	LS	$16,800.00	$16,800.00
14	205-12618	SWQCP PREPARATION	1.00	LS	$5,000.00	$5,000.00
15	207-08262	SUBGRADE TREATMENT, TYPE I	982.00	SYS	$6.75	$6,628.50
16	207-08264	SUBGRADE TREATMENT, TYPE II	243.00	SYS	$38.45	$9,343.35
17	207-08266	SUBGRADE TREATMENT, TYPE III	1,782.00	SYS	$6.65	$11,850.30
18	207-09935	SUBGRADE TREATMENT, TYPE IC	7,034.00	SYS	$17.34	$121,969.56
19	301-12234	COMPACTED AGGREGATE NO. 53	360.00	CYS	$100.30	$36,108.00
20	302-07455	DENSE GRADED SUBBASE	34.00	CYS	$126.37	$4,296.58
21	304-07494	WIDENING WITH HMA, TYPE C	275.00	TON	$169.34	$46,568.50
22	306-08034	MILLING, ASPHALT, 1 1/2 IN.	1,231.00	SYS	$11.04	$13,590.24
23	401-07328	QC/QA-HMA, 3, 70, SURFACE, 9.5 mm	735.00	TON	$148.49	$109,140.15
24	401-07392	QC/QA-HMA, 3, 64, INTERMEDIATE, 19.0 mm	706.00	TON	$115.50	$81,543.00
25	401-07408	QC/QA-HMA, 3, 64, BASE, 25.0 mm	3,149.00	TON	$97.49	$306,996.01
26	401-10258	JOINT ADHESIVE, SURFACE	3,388.00	LFT	$0.92	$3,116.96
27	401-10259	JOINT ADHESIVE, INTERMEDIATE	3,388.00	LFT	$0.99	$3,354.12

					Inflation to 2027 (Rounded)	$3,200,000.00
ID	**ITEM NO.**	**DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**ITEM TOTAL**
28	401-11785	LIQUID ASPHALT SEALANT	3,388.00	LFT	$0.71	$2,405.48
29	401-11787	QC/QA-HMA, 3, 76, INTERMEDIATE, OG 19.0 mm	613.00	TON	$116.72	$71,549.36
30	406-05520	ASPHALT FOR TACK COAT	9.00	TON	$623.40	$5,610.60
31	502-06327	PCCP, 10 IN.	419.00	SYS	$140.38	$58,819.22
32	502-06330	PCCP, 13 IN.	110.00	SYS	$130.75	$14,382.50
33	503-05240	D-1 CONTRACTION JOINT	240.00	LFT	$28.64	$6,873.60
34	604-05528	HMA FOR SIDEWALK	210.00	TON	$157.55	$33,085.50
35	604-08086	CURB RAMP, CONCRETE	114.00	SYS	$189.72	$21,628.08
36	604-12083	DETECTABLE WARNING SURFACES	29.00	SYS	$306.45	$8,887.05
37	605-06090	CURB, INTEGRAL CONCRETE	277.00	LFT	$50.54	$13,999.58
38	605-06095	CURB, INTEGRAL B CONCRETE	1,832.00	LFT	$31.46	$57,634.72
39	605-06155	CURB AND GUTTER, CONCRETE, MODIFIED, TYPE II	1,797.00	LFT	$42.42	$76,228.74
40	605-06255	CENTER CURB, D CONCRETE	8.00	SYS	$250.78	$2,006.24
41	610-08446	PCCP FOR APPROACHES, 6 IN.	202.00	SYS	$116.85	$23,603.70
42	611-06497	MAILBOX ASSEMBLY, SINGLE	2.00	EACH	$386.87	$773.74
43	615-06527	MONUMENT, SECTION CORNER	1.00	EACH	$1,143.41	$1,143.41
44	621-01004	MOBILIZATION AND DEMOBILIZATION FOR SEEDING	2.00	EACH	$614.10	$1,228.20
45	621-06560	MULCHED SEEDING U	3,815.00	SYS	$2.54	$9,690.10
46	621-06567	WATER	8.00	kGAL	$23.35	$186.80
47	621-06574	SODDING	1,984.00	SYS	$10.09	$20,018.56
48	628-09403	FIELD OFFICE, C	10.00	MOS	$2,978.10	$29,781.00
49	715-05032	PIPE, TYPE 2, CIRCULAR, 15 IN.	347.00	LFT	$98.40	$34,144.80
50	715-05048	PIPE, TYPE 4, CIRCULAR, 6 IN.	1,797.00	LFT	$15.18	$27,278.46
51	715-05149	PIPE, TYPE 2, CIRCULAR, 12 IN.	1,147.00	LFT	$77.54	$88,938.38
52	715-05152	PIPE, TYPE 2, CIRCULAR, 18 IN.	32.00	LFT	$128.74	$4,119.68
53	715-09475	STORMWATER QUALITY STRUCTURE	3.00	EACH	$70,000.00	$210,000.00
54	715-46000	PIPE END SECTION, DIAMETER 12 IN.	1.00	EACH	$1,318.36	$1,318.36
55	718-12305	GEOTEXTILES FOR UNDERDRAIN, TYPE 1A	1,647.00	SYS	$2.54	$4,183.38
56	718-52610	AGGREGATE FOR UNDERDRAINS	162.00	CYS	$95.68	$15,500.16
57	720-01092	MANHOLE, J15 MODIFIED	5.00	EACH	$6,374.81	$31,874.05
58	720-45410	MANHOLE, C4	24.00	EACH	$5,374.75	$128,994.00
59	720-98174	INLET, B15	17.00	EACH	$4,240.54	$72,089.18
60	720-98555	INLET, C15	5.00	EACH	$4,484.75	$22,423.75
61	801-04308	ROAD CLOSURE SIGN ASSEMBLY	8.00	EACH	$325.67	$2,605.36

					Inflation to 2027 (Rounded)	$3,200,000.00
ID	**ITEM NO.**	**DESCRIPTION**	**QUANTITY**	**UNIT**	**UNIT COST**	**ITEM TOTAL**
62	801-06625	DETOUR ROUTE MARKER ASSEMBLY	50.00	EACH	$148.05	$7,402.50
63	801-06640	CONSTRUCTION SIGN, A	16.00	EACH	$231.50	$3,704.00
64	801-06775	MAINTAINING TRAFFIC	1.00	LS	$66,000.00	$66,000.00
65	801-07118	BARRICADE, III-A	120.00	LFT	$17.81	$2,137.20
66	801-07119	BARRICADE, III-B	96.00	LFT	$18.20	$1,747.20
67	808-03439	TRANSVERSE MARKING, THERMOPLASTIC, CROSSWALK LINE, WHITE, 24 IN.	352.00	LFT	$11.57	$4,072.64
68	808-10118	TRANSVERSE MARKING, THERMOPLASTIC, YIELD LINE, WHITE, 24 IN.	96.00	LFT	$20.06	$1,925.76
69	808-11650	LINE, THERMOPLASTIC, DOTTED, WHITE, 6 IN.	156.00	LFT	$4.32	$673.92
70	808-12032	GROOVING FOR PAVEMENT MARKINGS	2,154.00	LFT	$2.02	$4,351.08
71	808-75043	LINE, THERMOPLASTIC, SOLID, WHITE, 6 IN.	903.00	LFT	$2.29	$2,067.87
72	808-75247	LINE, THERMOPLASTIC, SOLID, YELLOW, 6 IN.	1,096.00	LFT	$2.37	$2,597.52
73	808-75320	PAVEMENT MESSAGE MARKING, THERMOPLASTIC LANE INDICATION ARROW	12.00	EACH	$204.33	$2,451.96



RECOMMENDED FOR APPROVAL — DESIGN ENGINEER — DATE	CITY OF NOBLESVILLE	HORIZONTAL SCALE: 1" = 10'	BRIDGE FILE: N/A
		VERTICAL SCALE: N/A	DESIGNATION: 2101733
DESIGNED: KMA — DRAWN: KMA	ALTERNATIVE 4 TWO-WAY STOP	SURVEY BOOK: ELECTRONIC	SHEET: 4 of 4
CHECKED: SJS — CHECKED: SJS		CONTRACT: EN-359	PROJECT: 2101733

Date: Aug 30, 2024, 1:43pm User Name: KAgerer
File: X:\Production\Files\2022\22-2027\CAD\MiscDWG\Sht_RD_Stop Alternative.dwg - (Misc Sheet)

ENGINEER'S ESTIMATE
Alternative 4 - Two Way
Project No.:

ESTIMATED CONSTRUCTION COST	
Sub-Total:	$15,662.40
30.0% Contingency:	$4,698.72
Total:	$20,361.12

ID	ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	ITEM TOTAL
1	105-06845	CONSTRUCTION ENGINEERING	1.00	LS	$372.73	$372.73
2	110-01001	MOBILIZATION AND DEMOBILIZATION	1.00	LS	$955.98	$955.98
3	402-05494	HMA TRANSVERSE RUMBLE STRIPS	40.00	LFT	$275.00	$11,000.00
4	802-05701	SIGN POST, SQUARE, TYPE 1, REINFORCED ANCHOR BASE	54.00	LFT	$31.79	$1,716.66
5	802-07058	SIGN, SHEET ASSEMBLY, RELOCATE	1.00	EACH	$572.17	$572.17
6	802-09838	SIGN, SHEET, WITH LEGEND, 0.080 IN. THICKNESS	42.00	SFT	$21.73	$912.66
7	808-06368	TRANSVERSE MARKING, REMOVE	10.00	LFT	$2.50	$25.00
8	808-75297	TRANSVERSE MARKING, THERMOPLASTIC, STOP LINE, WHITE, 24 IN.	10.00	LFT	$10.72	$107.20

ATTACHMENT J

AWSC Warrant Form

All-Way Stop Sign Analysis Form

Date: 07/11/2024

Major Street: Olio Rd **Posted Speed:** 45 **ADT:** 4150

Minor Street: 156th St **Posted Speed:** 45 **ADT:** 1170

Check which box applies:

Commercial: ☐ Residential: ☒

Criteria A – Traffic Signals

Does this intersection warrant traffic signals? ☐ Yes ☒ No

** If Yes, include a traffic signal warrant for SP-22.*

Criteria B – Traffic Accidents

List the number of accidents occurred in the past 3 years.

Year	No. of Accidents
2021	2
2022	4
2023	3

This intersection has had five (5) or more accidents in a 12-month period of a turning or right angle type accident?

☐ Yes ☒ No

The intersection has had six (6) or more accidents in a 36-month period that were of a type susceptible to correction by installing an AWSC. (MUTCD 11th Edition)

☒ Yes ☐ No

Criteria C – Traffic Volumes

On the Major Street, the highest 8 hours is equal to what Vehicles Per Hour? **314** V.P.H.

Does the vehicular volume entering the intersection from the Major Street average at least 300 vehicles per hour for any 8 hours? (Use the sum of both approaches.) ☒ Yes ☐ No

On the Minor Street, using the 8 hour period above, what is the Vehicles Per Hour? **48** V.P.H.

Does the combined vehicular, pedestrian and bicycle volume from the minor street approaches average at least 200 units per hour for the same 8 hours used above? ☐ Yes ☒ No

Is the average delay on the minor streets at least 30 seconds per vehicle during the highest hours?

☐ Yes ☒ No

Does the intersection have an 85th percentile speed of the major street traffic exceeding 40 mph where the minimum vehicular volume warrants would be 70% of the above values? ☒ Yes ☐ No

Criteria D - Other

None of the criterion listed above is satisfied, but Criteria B & C are satisfied to 80% of the minimum values.

☐ Yes ☒ No

MEMO

To: File

From: Lochmueller Group

Date: January 16, 2025

Subject: Olio Road Project Existing and No Build Traffic Operations
Lochmueller Group 122-2027

Introduction

Lochmueller Group prepared the following existing memorandum on traffic operations for the segment of Olio Road between 146th Street to 156th Street in Noblesville, IN. This 2025 existing conditions and 2048 no build traffic operations were evaluated during the typical weekday morning peak hour and evening peak hour. Olio Road from 146th Street to 156th Street is currently a 2-lane section with 10-foot travel lanes and a 45 mile per hour speed limit.

Traffic Volumes

Traffic volumes were collected on February 27, 2019, to identify the typical weekday morning peak hour occurring between 7:00 AM and 9:00 AM and the weekday evening peak hour between 3:00 PM and 6:00 PM. The weekday morning peak hour begins at 7:00 AM and the weekday evening peak hour begins at 4:00 PM.

The 2025 traffic volumes on Olio Road are based on the counts collected in 2019 with a growth rate of 1.3% per year applied. The growth rate is from the Indianapolis MPO travel demand.

The 2048 traffic volumes on Olio Road are based on traffic forecasts found in the Gatewood Lakes Traffic Impact Assessment that was completed by EMCS in December 2024 and provided by the City of Noblesville. The volumes from this traffic impact study include traffic volumes on the Olio Road segment with the additional from the developments at Gatewood Lakes and Finch Creek. The 2025 and 2048 traffic volumes are provided in **Table 1**.

Table 1 Olio Road Segment Traffic Volumes

Time	2019		2025		2048	
	NB	SB	NB	SB	NB	SB
Morning Peak	222	145	240	157	517	1,065
Evening Peak	173	241	187	261	1,073	675

Traffic Operations

The performance of a transportation system is quantified by levels of service (LOS), which are measures of traffic flow that consider factors such as speed, delay, interruptions, safety, and driver comfort and convenience. There are six levels of service ranging from LOS A ("free flow") to LOS F ("oversaturated"). LOS C is commonly used for design purposes and represents a roadway with volumes utilizing 70 to 80 percent of its capacity. LOS D is typically considered acceptable for peak period conditions in urban and suburban areas.

3502 Woodview Trace, Suite 150
Indianapolis, Indiana 46268
PHONE: 317.222.3880 • TOLL FREE: 888.830.6977

Traffic operating conditions were evaluated using HCS 2025, which is a software tool based on HCM methodologies. Rural 2-lane facilities are divided into two classes, based on speed, in the HCM as follows:

- Higher-Speed Highway: Posted Speed Limit ≥ 50 miles per hour. Commonly encountered as inter-city connecting routes.
- Lower-Speed Highway: Posted Speed Limit < 50 miles per hour. Typically encountered as intra-city route and in scenic and rural-developed areas. Often have few passing opportunities.

For rural 2-lane facilities, LOS is based on follower density, as illustrated in **Table 2**. The level of service for each roadway segment was reported. This methodology reflects "the importance of passing opportunities and its influence on the amount of platooning that occurs" and is defined as "the number of vehicles in a follower state per mile per lane," as stated in Exhibit 15-6, C. 15.2 of the Transportation Research Board's Highway Capacity Manual, 7th Edition (2022).

Table 2 Level of Service Criteria for 2-Lane Highways (Follower Density)

LOS	Higher-Speed Highways	Lower-Speed Highways
A	≤ 2.0	≤ 2.5
B	> 2.0 – 4.0	> 2.5 – 5.0
C	> 4.0 – 8.0	> 5.0 – 10.0
D	> 8.0 – 12.0	> 10.0 – 15.0
E	> 12.0	> 15.0
F	Demand Exceeds Capacity	

Traffic operations on Olio Road for 2025 Existing Conditions and 2048 No Build are summarized in **Table 3** and **Table 4**, respectively. Currently Olio Road operates at LOS B or better during the AM and PM peak hours. By 2048, southbound Olio Road will operate at LOS E during the AM peak hour and northbound Olio Road will operate at LOS E during the PM peak hour.

Table 3 Olio Road 2025 Existing Traffic Operations

Olio Rd 146th St to 156th St	AM		PM	
	LOS	Follower Density (followers/mi/ln)	LOS	Follower Density (followers/mi/ln)
Northbound	B	2.7	A	1.2
Southbound	A	1.8	B	2.7

Table 4 Olio Road 2048 No Build Traffic Operations

Olio Rd 146th St to 156th St	AM		PM	
	LOS	Follower Density (followers/mi/ln)	LOS	Follower Density (followers/mi/ln)
Northbound	C	8.5	E	23.4
Southbound	E	22.6	D	12.3

Attachments

1. Traffic Counts
2. Excerpt from Gatewood Lakes Traffic Impact Assessment December 2024
3. HCS Reports

Per-Vehicle Summary Report: S233

Station ID : S233
Info Line 1 : Olio Rd BT 146th & 156th
Info Line 2 :
GPS Lat/Lon : 40 00.5568,N / 085 55.1532,W
DB File : S233.DB

Last Connected Device Type : OmegaX3
Version Number : 1.43
Serial Number : 0716XC32520
Number of Lanes : 2
Posted Speed Limit : 0.0 mph

Lane Configuration

#	Dir.	Information	Vehicle Sensors	Sensor Spacing	Loop Length
1.	N		Axle-Axle	4.0 ft	
3.	S	Opp -	Axle-Axle	4.0 ft	

Average Daily Traffic (ADT)

	Weekday		Weekend		**Total ADT**	
Cars :	3987	(96%)	Cars :		Cars : **3987**	(96%)
Trucks :	150	(4%)	Trucks :		Trucks : **150**	(4%)
Total :	4137		Total :		Total : **4137**	

Speed Totals

50 % :	42.1 mph	Top Speed :	186.3 mph	Average Truck Speed :	41.0 mph
85 % :	46.9 mph	Low Speed :	12.4 mph	Average Car Speed :	42.2 mph
Avg :	42.1 mph	10mph Pace Speed:	36.3 - 46.2 (72.4%)		

Peak Hour Totals

AM Peak Hour (Volume)
Weekday : 06:45 - 07:45 (Avg 190)
Weekend :

AM Peak Hour (Speed)
03:30 - 04:30 (48.3 mph)

PM Peak Hour (Volume)
Weekday : 16:30 - 17:30 (Avg 224)
Weekend :

PM Peak Hour (Speed)
22:45 - 23:45 (44.6 mph)

Grand Totals

Total Cars :	3987 (3987 ADT)	Average Length : 9.5 ft	Average Headway : 20.7 sec
Total Trucks :	150 (150 ADT)	Average Axles : 2.1	Average Gap : 20.6 sec
Total Volume :	4137 (4137 ADT)		

Volume Summary Report: S233

Station ID : S233

Info Line 1 : Olio Rd BT 146th & 156th
Info Line 2 :
GPS Lat/Lon : 40 00.5568,N / 085 55.1532,W
DB File : S233.DB

Last Connected Device Type : OmegaX3
Version Number : 1.43
Serial Number : 0716XC32520

Number of Lanes : 2
Posted Speed Limit : 0.0 mph

Lane Configuration

#	Dir.	Information	Volume Mode	Volume Sensors	Divide / 2	Comment
1.	N		Normal	Veh.	No	
3.	S	Opp -	Normal	Veh.	No	

Total Count:	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total
Lane #1	3	8	3	0	10	56	153	222	142	111	87	84	91	84	109	133	173	171	138	86	63	15	16	6	1964
Lane #3	7	4	0	4	8	11	65	145	154	83	84	105	116	101	124	198	241	233	168	124	90	61	23	24	2173
TOTAL	10	12	3	4	18	67	218	367	296	194	171	189	207	185	233	331	414	404	306	210	153	76	39	30	4137

Percents:	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
Lane #1	0%	0%	0%	0%	1%	3%	8%	11%	7%	6%	4%	4%	5%	4%	6%	7%	9%	9%	7%	4%	3%	1%	1%	0%
Lane #3	0%	0%	0%	0%	0%	1%	3%	7%	7%	4%	4%	5%	5%	5%	6%	9%	11%	11%	8%	6%	4%	3%	1%	1%
TOTAL	0%	0%	0%	0%	0%	2%	5%	9%	7%	5%	4%	5%	5%	4%	6%	8%	10%	10%	7%	5%	4%	2%	1%	1%

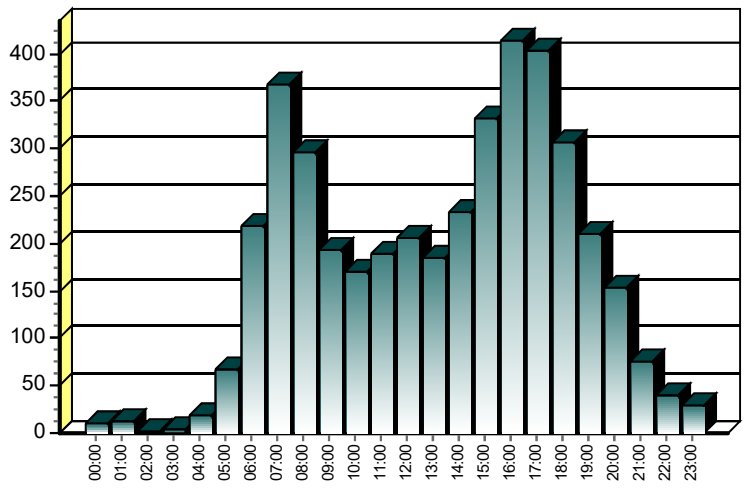
ADT:	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total
Lane #1	3	8	3	0	10	56	153	222	142	111	87	84	91	84	109	133	173	171	138	86	63	15	16	6	1964
Lane #3	7	4	0	4	8	11	65	145	154	83	84	105	116	101	124	198	241	233	168	124	90	61	23	24	2173
TOTAL	10	12	3	4	18	67	218	367	296	194	171	189	207	185	233	331	414	404	306	210	153	76	39	30	4137

ALL LANES

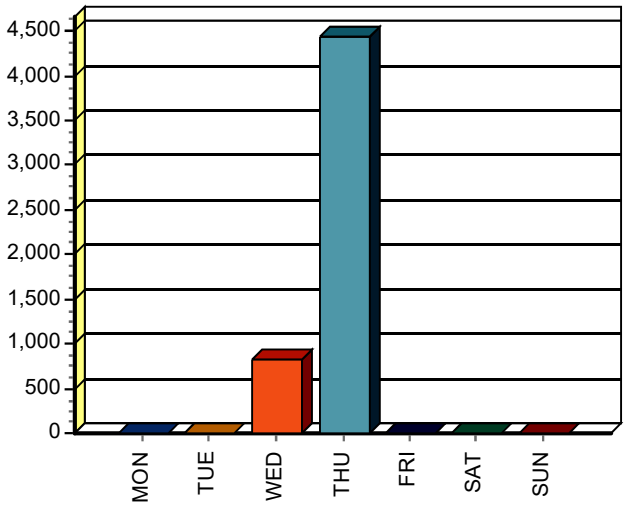
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
DW Totals :	0	0	0	69	4068	0	0
# Days :	0.0	0.0	0.0	0.1	0.9	0.0	0.0
ADT :	0	0	0	828	4438	0	0
Percent :	0%	0%	0%	2%	98%	0%	0%

	Total	Percent
Weekday (Mon-Fri) :	4137	100%
ADT :	4137	
Weekend (Sat-Sun) :	0	0%
ADT :	0	

ADT Volume vs. Time (all lanes combined)



ADT By Day of Week (all lanes)



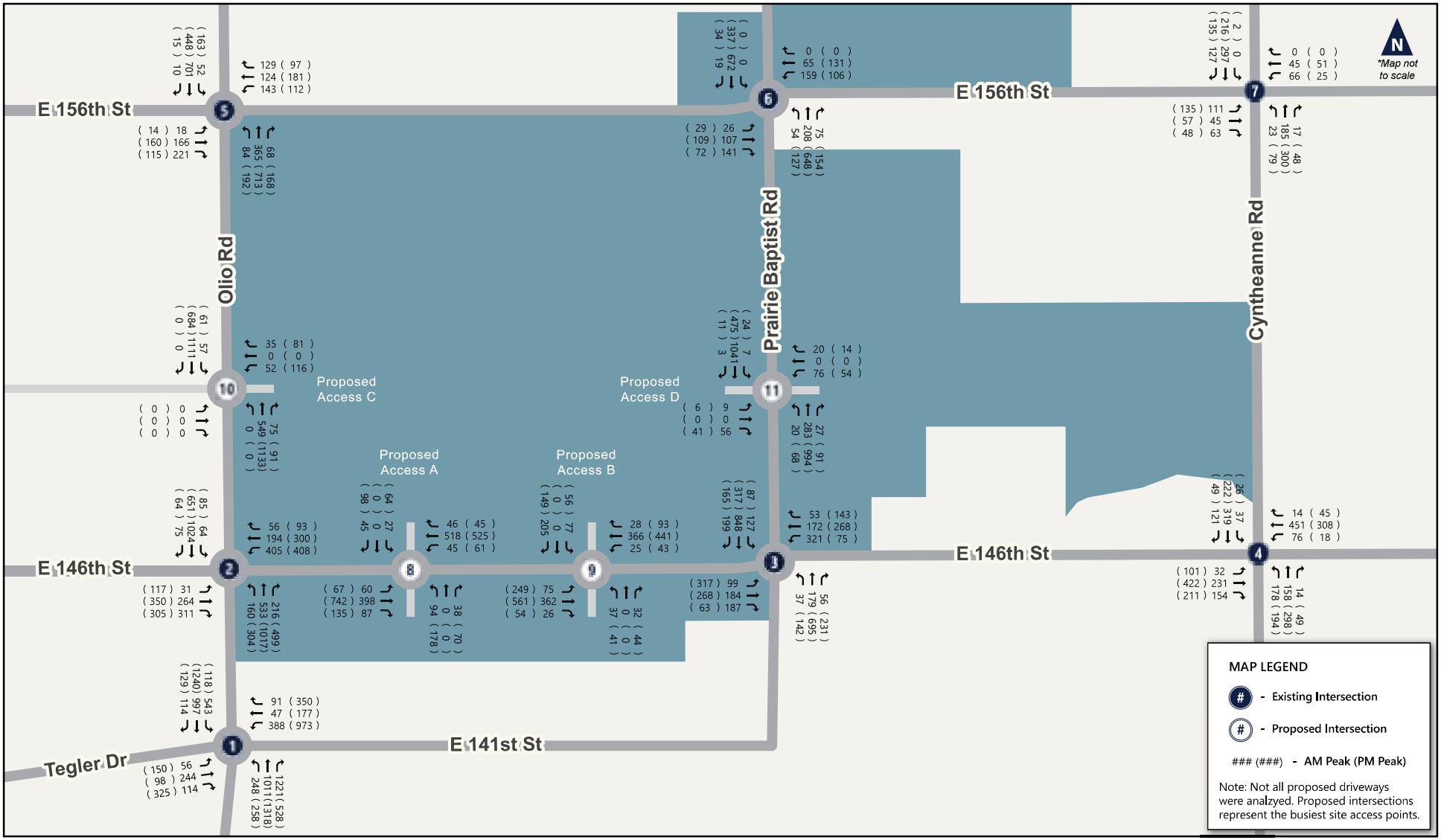


Figure 9: Turning Movement Counts - Scenario 4 - Horizon Year with Proposed Development

HCS Two-Lane Highway Report

Project Information			
Analyst	Ben Schebler	Date	1/14/2025
Agency	Lochmueller Group	Analysis Year	2025 Existing
Jurisdiction		Time Analyzed	AM Peak
Project Description	Olio Rd 2-Lane Section - Northbound	Units	U.S. Customary

Segment 1

Vehicle Inputs			
Segment Type	Passing Constrained	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	45	Access Point Density, pts/mi	10.0

Demand and Capacity			
Directional Demand Flow Rate, veh/h	267	Opposing Demand Flow Rate, veh/h	-
Peak Hour Factor	0.90	Total Trucks, %	0.02
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.16

Intermediate Results			
Segment Vertical Class	1	Free-Flow Speed, mi/h	43.4
Speed Slope Coefficient (m)	2.91242	Speed Power Coefficient (p)	0.41674
PF Slope Coefficient (m)	-1.39238	PF Power Coefficient (p)	0.71038
In Passing Lane Effective Length?	No	Follower Density, followers/mi/ln	2.7
%Improvement to Percent Followers	0.0	%Improvement to Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	42.0

Vehicle Results			
Average Speed, mi/h	42.0	Percent Followers, %	42.0
Segment Travel Time, minutes	1.43	Adj. Follower Density, followers/mi/ln	2.7
Vehicle LOS	B		

HCS Two-Lane Highway Report

Project Information			
Analyst	Ben Schebler	Date	1/14/2025
Agency	Lochmueller Group	Analysis Year	2025 Existing
Jurisdiction		Time Analyzed	AM Peak
Project Description	Olio Rd 2-Lane Section - Southbound	Units	U.S. Customary

Segment 1

Vehicle Inputs			
Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	45	Access Point Density, pts/mi	10.0

Demand and Capacity			
Directional Demand Flow Rate, veh/h	174	Opposing Demand Flow Rate, veh/h	267
Peak Hour Factor	0.90	Total Trucks, %	0.02
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.10

Intermediate Results			
Segment Vertical Class	1	Free-Flow Speed, mi/h	43.4
Speed Slope Coefficient (m)	2.68022	Speed Power Coefficient (p)	0.52244
PF Slope Coefficient (m)	-1.26292	PF Power Coefficient (p)	0.75223
In Passing Lane Effective Length?	No	Follower Density, followers/mi/ln	1.2
%Improvement to Percent Followers	0.0	%Improvement to Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	42.7

Vehicle Results			
Average Speed, mi/h	42.7	Percent Followers, %	28.8
Segment Travel Time, minutes	1.40	Adj. Follower Density, followers/mi/ln	1.2
Vehicle LOS	A		

HCS Two-Lane Highway Report

Project Information			
Analyst	Ben Schebler	Date	1/14/2025
Agency	Lochmueller Group	Analysis Year	2025 Existing
Jurisdiction		Time Analyzed	PM Peak
Project Description	Olio Rd St 2-Lane Section - Northbound	Units	U.S. Customary

Segment 1

Vehicle Inputs			
Segment Type	Passing Constrained	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	45	Access Point Density, pts/mi	10.0

Demand and Capacity			
Directional Demand Flow Rate, veh/h	208	Opposing Demand Flow Rate, veh/h	-
Peak Hour Factor	0.90	Total Trucks, %	0.02
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.12

Intermediate Results			
Segment Vertical Class	1	Free-Flow Speed, mi/h	43.4
Speed Slope Coefficient (m)	2.91242	Speed Power Coefficient (p)	0.41674
PF Slope Coefficient (m)	-1.39238	PF Power Coefficient (p)	0.71038
In Passing Lane Effective Length?	No	Follower Density, followers/mi/ln	1.8
%Improvement to Percent Followers	0.0	%Improvement to Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	42.2

Vehicle Results			
Average Speed, mi/h	42.2	Percent Followers, %	36.6
Segment Travel Time, minutes	1.42	Adj. Follower Density, followers/mi/ln	1.8
Vehicle LOS	A		

HCS Two-Lane Highway Report

Project Information			
Analyst	Ben Schebler	Date	1/14/2025
Agency	Lochmueller Group	Analysis Year	2025 Existing
Jurisdiction		Time Analyzed	PM Peak
Project Description	Olio Rd 2-Lane Section - Southbound	Units	U.S. Customary

Segment 1

Vehicle Inputs			
Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	45	Access Point Density, pts/mi	10.0

Demand and Capacity			
Directional Demand Flow Rate, veh/h	290	Opposing Demand Flow Rate, veh/h	208
Peak Hour Factor	0.90	Total Trucks, %	0.02
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.17

Intermediate Results			
Segment Vertical Class	1	Free-Flow Speed, mi/h	43.4
Speed Slope Coefficient (m)	2.66036	Speed Power Coefficient (p)	0.53709
PF Slope Coefficient (m)	-1.24767	PF Power Coefficient (p)	0.75627
In Passing Lane Effective Length?	No	Follower Density, followers/mi/ln	2.7
%Improvement to Percent Followers	0.0	%Improvement to Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	42.3

Vehicle Results			
Average Speed, mi/h	42.3	Percent Followers, %	38.7
Segment Travel Time, minutes	1.42	Adj. Follower Density, followers/mi/ln	2.7
Vehicle LOS	B		

HCS Two-Lane Highway Report

Project Information			
Analyst	Ben Schebler	Date	1/14/2025
Agency	Lochmueller Group	Analysis Year	2048 No Build
Jurisdiction		Time Analyzed	AM Peak
Project Description	Olio Rd 2-Lane Section - Northbound	Units	U.S. Customary

Segment 1

Vehicle Inputs			
Segment Type	Passing Constrained	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	45	Access Point Density, pts/mi	10.0

Demand and Capacity			
Directional Demand Flow Rate, veh/h	574	Opposing Demand Flow Rate, veh/h	-
Peak Hour Factor	0.90	Total Trucks, %	0.02
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.34

Intermediate Results			
Segment Vertical Class	1	Free-Flow Speed, mi/h	43.4
Speed Slope Coefficient (m)	2.91242	Speed Power Coefficient (p)	0.41674
PF Slope Coefficient (m)	-1.39238	PF Power Coefficient (p)	0.71038
In Passing Lane Effective Length?	No	Follower Density, followers/mi/ln	8.5
%Improvement to Percent Followers	0.0	%Improvement to Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	41.3

Vehicle Results			
Average Speed, mi/h	41.3	Percent Followers, %	60.9
Segment Travel Time, minutes	1.45	Adj. Follower Density, followers/mi/ln	8.5
Vehicle LOS	C		

HCS Two-Lane Highway Report

Project Information			
Analyst	Ben Schebler	Date	1/14/2025
Agency	Lochmueller Group	Analysis Year	2048 No Build
Jurisdiction		Time Analyzed	AM Peak
Project Description	Olio Rd 2-Lane Section - Southbound	Units	U.S. Customary

Segment 1

Vehicle Inputs			
Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	45	Access Point Density, pts/mi	10.0

Demand and Capacity			
Directional Demand Flow Rate, veh/h	1183	Opposing Demand Flow Rate, veh/h	574
Peak Hour Factor	0.90	Total Trucks, %	0.02
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.70

Intermediate Results			
Segment Vertical Class	1	Free-Flow Speed, mi/h	43.4
Speed Slope Coefficient (m)	2.75939	Speed Power Coefficient (p)	0.47280
PF Slope Coefficient (m)	-1.31789	PF Power Coefficient (p)	0.73723
In Passing Lane Effective Length?	No	Follower Density, followers/mi/ln	22.6
%Improvement to Percent Followers	0.0	%Improvement to Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	40.5

Vehicle Results			
Average Speed, mi/h	40.5	Percent Followers, %	77.5
Segment Travel Time, minutes	1.48	Adj. Follower Density, followers/mi/ln	22.6
Vehicle LOS	E		

HCS Two-Lane Highway Report

Project Information			
Analyst	Ben Schebler	Date	1/14/2025
Agency	Lochmueller Group	Analysis Year	2048 No Build
Jurisdiction		Time Analyzed	PM Peak
Project Description	Olio Rd St 2-Lane Section - Northbound	Units	U.S. Customary

Segment 1

Vehicle Inputs			
Segment Type	Passing Constrained	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	45	Access Point Density, pts/mi	10.0

Demand and Capacity			
Directional Demand Flow Rate, veh/h	1192	Opposing Demand Flow Rate, veh/h	-
Peak Hour Factor	0.90	Total Trucks, %	0.02
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.70

Intermediate Results			
Segment Vertical Class	1	Free-Flow Speed, mi/h	43.4
Speed Slope Coefficient (m)	2.91242	Speed Power Coefficient (p)	0.41674
PF Slope Coefficient (m)	-1.39238	PF Power Coefficient (p)	0.71038
In Passing Lane Effective Length?	No	Follower Density, followers/mi/ln	23.4
%Improvement to Percent Followers	0.0	%Improvement to Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	40.4

Vehicle Results			
Average Speed, mi/h	40.4	Percent Followers, %	79.4
Segment Travel Time, minutes	1.49	Adj. Follower Density, followers/mi/ln	23.4
Vehicle LOS	E		

HCS Two-Lane Highway Report

Project Information			
Analyst	Ben Schebler	Date	1/14/2025
Agency	Lochmueller Group	Analysis Year	2048 No Build
Jurisdiction		Time Analyzed	PM Peak
Project Description	Olio Rd 2-Lane Section - Southbound	Units	U.S. Customary

Segment 1

Vehicle Inputs			
Segment Type	Passing Zone	Length, ft	5280
Lane Width, ft	10	Shoulder Width, ft	0
Speed Limit, mi/h	45	Access Point Density, pts/mi	10.0

Demand and Capacity			
Directional Demand Flow Rate, veh/h	750	Opposing Demand Flow Rate, veh/h	1192
Peak Hour Factor	0.90	Total Trucks, %	0.02
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.44

Intermediate Results			
Segment Vertical Class	1	Free-Flow Speed, mi/h	43.4
Speed Slope Coefficient (m)	2.86887	Speed Power Coefficient (p)	0.42735
PF Slope Coefficient (m)	-1.37591	PF Power Coefficient (p)	0.71797
In Passing Lane Effective Length?	No	Follower Density, followers/mi/ln	12.3
%Improvement to Percent Followers	0.0	%Improvement to Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	41.0

Vehicle Results			
Average Speed, mi/h	41.0	Percent Followers, %	67.3
Segment Travel Time, minutes	1.46	Adj. Follower Density, followers/mi/ln	12.3
Vehicle LOS	D		

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