Director's Report

Project Name: 9101 Highland

Description: Revised preliminary site plan approval recommendation

Date on Agenda this packet pertains to: January 16, 2025

☐Public Hearing

☐Initial Submittal

☒Revised Plans

☒Preliminary Approval

☐Final Approval

☐Special Land Use

☐Rezoning

☐Other:

Contact	Consultants & Departments	Approval	Denial	Approved w/Conditions	Other	Comments
Sean O'Neil	Community Development Director	☐	☐	☐	☒	Based on comments from staff & consultants
Mike Leuffgen	DLZ	☒	☐	☐	☐	See letter dated 01/05/2025
Matteo Passalacqua	Carlisle Wortman Associates, Inc	☐	☐	☒	☐	See letter dated 01/06/2025
Jason Hanifen	WLT Fire Marshal	☐	☐	☒	☐	See letter dated 12/30/24

DLZ
ARCHITECTURE • ENGINEERING • PLANNING
SURVEYING • CONSTRUCTION SERVICES

INNOVATIVE IDEAS
EXCEPTIONAL DESIGN
UNMATCHED CLIENT SERVICE

January 7, 2025

Sean O' Neil, Director
Community Development Department
Charter Township of White Lake
7525 Highland Road
White Lake, Michigan 48383

RE: 9101 Highland Road-Proposed Commercial Development- Preliminary Site Plan Review – 3rd Review

Ref: DLZ No. 2445-7696-06 Design Professional: Stonefield Engineering & Design

Dear Mr. O' Neil,

Our office has performed a Preliminary Site Plan review for the above-mentioned revised plan dated December 20, 2024. The plans were reviewed for feasibility based on general conformance with the Township Engineering Design Standards.

General Site Information

This 4.5 acre site is located south of M-59, east of Fisk Road, and west of Sunny Beach Boulevard.

Site Improvement Information:

- Construction of two (2) commercial retail/restaurant buildings. Building containing Suites 1-3 is proposed at 7,094 square feet and building containing Suites 4-6 is proposed at 7,865 square feet.
- Associated paved and curbed parking areas, including a total of six (6) ADA parking spaces.
- One (1) entrance off M-59/Highland Road.
- Water and sanitary sewer service.
- Storm water management facilities.

The following items should be noted with respect to Planning Commission review:

We note that comments from our November 6, 2024 review are in *italics*. Responses to those comments are in **bold**. New comments are in standard font.

a) *Cover sheet C-1- Provide ALTA/NSPS Land Title Survey with next submittal.* **Comment addressed at the preliminary level and remains. The survey has now been provided. Please provide surveyor seal and signature on this sheet on the Final Site Plan/Final Engineering Plan.**
b) *Any work within the existing two (2) watermain easements that run parallel to M-59 shall require permission from the Township.* **Comment remains as a notation.**
c) *ADA parking spaces will need to meet ADA standards in terms of slopes and dimensions; further details will be required at the time of Final Site Plan/Final Engineering Plan submittal/review.* **Comment remains.**
d) *Sheet C-3-The existing sidewalk along M-59 appears to be in disrepair. In addition, the sidewalk does not meet the requirements of the current Township Zoning Ordinance Sections 5.20 and 5.21 in terms of required clear zones. We defer to the Township as to whether a new sidewalk meeting the Zoning Ordinance shall be required. Comment partially addressed and remains. A new 8' wide asphalt pathway is now proposed. The proposed pathway location continues to not meet the required clear zone dimensions. We continue to defer to the Township regarding the inadequacy of the required clear zones. In addition, a portion of the proposed pathway is now shown in a proposed sidewalk easement. The sidewalk easement exhibit(s) will be required to be reviewed by our office prior to execution and recording of the easement.* **The proposed pathway now appears to conform with the required clear zone dimensions as outlined in Township Zoning Ordinance 5.20. We consider the portion of the above comment regarding this to be addressed. The portion of the above comment referencing the sidewalk easement remains.**
e) *Sheet C-3-There is a recorded temporary construction easement shown. Please indicate if this easement has been vacated. If the easement has not been vacated, it shall be required to be vacated prior to FSP/FEP approval.* **Comment remains. Design engineer states that they will coordinate vacation of the easement with the Township prior to FSP/FEP submittal.**
f) *There is a recorded 20' wide easement for ingress and egress that runs semi parallel to Highland Road; this will be required to be vacated prior to FSP/FEP approval.* **Comment remains. Design engineer states that they will coordinate vacation of the easement with the Township prior to FSP/FEP submittal.**
g) *Sheet C-4- What is the grading intent for the northeastern greenspace area of the site? We note that there is an existing storm sewer end section which connects to the existing 12" diameter storm sewer that crosses M-59. It is assumed that this end section is to collect the drainage at the low point of approximately 966' and route the drainage to the north under M-59; however, the existing CB to the north (#70140) shows a higher invert elevation than the existing ES elevation to the south. Please clarify. We also note that the site post- development runoff to this end section shall be < or = to the current runoff (Q) to this area.* **Comment addressed at preliminary level and remains. The existing pipe shall be removed, and the area regraded such that the depression shall be filled. Per the design engineer, calculations are intended to be provided on the FSP/FEP to demonstrate post development runoff to the M-59 right of way be < or = to the current runoff.**
h) *Preliminary grading of the site has been proposed and demonstrates general drainage patterns mainly within the confines of the proposed impervious areas; please provide on the revised*

preliminary site plan general proposed grading for all greenspace areas. A more detailed grading review will be provided at the time of Final Engineering Plan submittal/review. **Comment remains.**

i) *Sheet C-5-Retention basin slope scales to 1:4, which would require a fence around basin. Is the intent to fence in the basin? Comment partially addressed and remains. A fence is now shown around the basin. A 10' wide basin access gate is now shown as well as 10 LF of mountable curbing at the parking space across from the gate. The parking space across from the basin access gate shall be designated as an 'Authorized Vehicles Only' space and /or striped so as to allow maintenance vehicle parking and access to the retention basin.* **Comment addressed. The parking space adjacent to the basin access gate is now shown as striped/cross hatched.**

j) *Sheet C-5- Provide/show retention basin spillway and pathway of overland flow. In addition, 1' of freeboard is required for the basin.* **Comment addressed at the PSP level and remains. A spillway and a general pathway of the overland flow are now shown. 1' of freeboard for basin is now shown. It will be required to be shown/demonstrated on the Final Engineering Plan that an overflow event from the retention basin shall not impact adjacent properties.**

k) *Sheet C-5- Based on basin capacity and storage elevation for a 2-100 year back to back storm event, there would be surcharging in upstream piping with what appears to be storage of stormwater above some of the upstream storm sewer rim elevations. It will be required to be demonstrated on the Final Engineering Plan that the HGL will be contained within or at 1' below storm rim elevations.* **Comment addressed at the PSP level and remains. The basin has been reconfigured and the top of storage of basin has been lowered to match the proposed CB grate/rim elevations. We continue to note that the second half of our above comment regarding HGL will be required to be addressed on the FSP/FEP.**

l) *We note that this property falls within a wellhead protection area. We defer to Township DPS regarding special requirements.* **Comment remains as a notation.**

m) *Sheet C-5- Provide SCS Soil Types. In addition, provide water table information to substantiate that water levels shall return to preexisting conditions at least one time per year. Comment addressed at PSP level and remains. SCS soil types are now shown. Design engineer notes that a geotechnical report will be provided prior to FSP/FEP submittal to confirm the water table level.* **Comment addressed. A geotechnical report prepared by g2 Consulting Group and dated September 24, 2024 has been provided.**

n) *Sheet C-6- Specify size of the proposed grease interceptor for the westernmost building. A minimum capacity of 1000 gallons is required. Comment outstanding. Although a detail for the GB-75 grease trap has now been provided on plan, it appears that the capacities (liquid-125 gal, grease-118 gal, and solids-31 gal) fall significantly short of the 1000 gallon minimum volume requirement.* **Comment addressed. The capacity of the grease interceptor, as well as a schematic(showing acceptable volume) of the proposed grease trap for the westernmost building has now been provided; the interceptor size of 1,500 gallons is acceptable.**

o) *We defer to the Township Fire Department regarding hydrant coverage.* **Comment remains as a notation.**

p) *Sheet C-8- There is an existing tree that is shown to remain in the area of the proposed retention basin. Tree will likely be required to be removed, or basin location revised so as to avoid tree In basin.* **Comment partially addressed. Existing tree within the basin shall be removed per the design engineer; however, please cross out this tree on Sheet C-2.**

q) Sheet C-3-Proposed pedestrian access sidewalk from M-59 path to the eastern building-Show crosswalk hatching/striping across internal traffic circulation lane. This item can be addressed on the FSP/FEP.

Recommendation

The majority of our above comments have been addressed. Any remaining comments can be addressed on the Final Site Plan/ Final Engineering Plan. We recommend approval of the Preliminary Site Plan.

Please feel free to contact our office should you have any questions.

Sincerely,

DLZ Michigan

Michael Leuffgen, P.E.
Department Manager

Victoria Loemker, P.E.
Senior Engineer

Cc: Andrew Littman, Community Development, *via email*
Hannah Kennedy-Galley, Community Development, *via email*
Matteo Passalacqua, Carlisle Wortman, *via email*
Aaron Potter, DPS Director, White Lake Township, *via email*
Jason Hanifen, Fire Marshall, White Lake Township, *via email*

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Carlisle | Wortman
ASSOCIATES, INC.
117 NORTH FIRST STREET SUITE 70 ANN ARBOR, MI 48104 734.662.2200 734.662.1935 FAX

TO: White Lake Township Planning Commission

FROM: Matteo Passalacqua, Associate Planner

DATE: January 6, 2025

RE: 9101 Highland Road Special Land Use / PSP Revisions

At the December 5th Planning Commission meeting, the Planning Commission reviewed the preliminary site plan and special land use application for 9101 Highland Road. The commission was generally agreeable to use of the property for retail however cited concerns regarding site noise, traffic, and potential nuisance to neighboring residential areas. After reviewing consultant materials, hearing from the applicant, and receiving feedback from the community, the following motions regarding the proposed development passed/failed:

> *MOTION by Commissioner, seconded by Commissioner Meagher, to approve the special land use for 9101 Highland, identified as parcel number 12-23-227-003, accepting all the concessions made by the applicant concerning lighting, sidewalk, hours of operations, idling trucks, and the sewer stub and all comments from staff and consultants, including the two outdoor seating areas and the drive through and pick up windows. The motion failed with a voice vote: (5 no votes).*
>
> *MOTION by Commissioner Carlock, seconded by Commissioner Seward, to approve the special land use for 9101 Highland, identified as parcel number 12-23-227-003, accepting all the concessions made by the applicant concerning lighting, sidewalk, hours of operations, idling trucks, and the sewer stub and all comments from staff and consultants, including the two outdoor seating areas and one drive-thru. The motion carried with a roll call vote: (8 yes votes).*
>
> *MOTION by Commissioner Meagher, seconded by Commissioner Seeley to recommend the Township Board approve the preliminary site plan for 9101 Highland, identified as parcel number 12-23-227-003 subject to the specifications outlined in the special land use approval. The motion failed with a roll call vote: (5 no votes).*

Via the motions, the Planning Commission conditionally approved the special land use but denied the preliminary site plan. This allowed the applicant to revise the site plan to better meet the criteria of the special land use and modify site layout and specifications to address the community and commission concerns.

Carlisle | Wortman
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January 6, 2025

Preliminary Site Plan / Special Land Use Review for White Lake Charter Township, Michigan

Applicant:	Affinity 10 Investment, LLC
Project Name:	9101 Highland Road
Plan Date:	July 24, 2024
First Revision Date:	October 17, 2024
Second Revision Date:	December 20,2024
Location:	South side of Highland Road (M-59), West of Sunny Beach Boulevard. Parcel ID: 12-23-227-003
Action Requested:	Preliminary site plan and special land use review

PROJECT NARRATIVE

The applicant is requesting to construct two (2) multi-tenant retail and restaurant buildings on a 4.5-acre parcel along Highland Road (M-59). The site was recently rezoned from R1-C, Single Family Residential to RB, Restricted Business. The special land use and preliminary site plan were reviewed by the Planning Commission during the December 5th, 2024, regular meeting. Several nearby residents voiced concerns regarding the proposal citing apprehensions about traffic generated from the dual drive thrus and general noise production. The applicant was amenable to working with the Township on hours of operation for tenants as well as site lighting being turned off within an hour of tenants closing for business.

The Planning Commission voiced concerns with traffic generated by the drive thrus as well as site layout and circulation. After discussion, the following motions were made:

> *MOTION by Commissioner, seconded by Commissioner Meagher, to approve the special land use for 9101 Highland, identified as parcel number 12-23-227-003, accepting all the concessions made by the applicant concerning lighting, sidewalk, hours of operations, idling trucks, and the sewer stub and all comments from staff and consultants, including the two outdoor seating areas and the drive through and pick up windows. The motion failed with a voice vote: (5 no votes).*

MOTION by Commissioner Carlock, seconded by Commissioner Seward, to approve the special land use for 9101 Highland, identified as parcel number 12-23-227-003, accepting all the concessions made by the applicant concerning lighting, sidewalk, hours of operations, idling trucks, and the sewer stub and all comments from staff and consultants, including the two outdoor seating areas and one drive-thru. The motion carried with a roll call vote: (8 yes votes).

MOTION by Commissioner Meagher, seconded by Commissioner Seeley to recommend the Township Board approve the preliminary site plan for 9101 Highland, identified as parcel number 12-23-227-003 subject to the specifications outlined in the special land use approval. The motion failed with a roll call vote: (5 no votes).

Via the motions, the Planning Commission conditionally approved the special land use but denied the preliminary site plan. Per these actions, the applicant was given an opportunity to revise the site plan to better meet the criteria of the special land use and modify site layout and specifications to address the community and commission concerns.

Both structures will retain outdoor patios, however the drive-thru pickup window on the east building has been removed. The east building has been modified to accommodate up to four (4) tenants instead of the originally proposed three (3). Restaurants with drive-thru's and outdoor dining areas are a special land use and subject to the standards set forth in Sections 4.17, 4.18 and 6.10 of the zoning ordinance.

The site currently contains one principal building and one accessory structure as well as a parking lot and fenced-in side yard. The principal structure is the Calvary Lutheran Church of White Lake. The current plan calls for the razing of all existing structures and improvements to accommodate the new use and proposed buildings. All existing utilities as well as some periphery trees are to remain and be protected during construction.

The proposed retail buildings have been modified in size. The west building has been reduced from seven thousand two hundred twenty-seven (7,227) sqft to seven thousand ninety-four (7,094) sqft. The east building has been increased from six-thousand four-hundred eighteen (6,418) sqft to seven thousand eight hundred sixty five (7,865) sqft. The west building would continue to offer three (3) suites, one with drive thru facilities. The east building offers four (4) suites with no drive-thru amenities.

Sheet C-3 indicates the applicant is requesting a waiver for site access. We note later in this review that the Planning Commission may waive this requirement per certain criteria.

Preliminary site plans are reviewed by the Planning Commission with recommendations then provided to the Township Board for approval, approval with conditions or denial. Final site plan review and approval is conducted solely by the Planning Commission. The Planning Commission is the review and approval authority for special land uses.

Items to be Address: *None.*

SITE DESCRIPTION

Lot Area:	4.5 gross acres
Frontage:	Approx. 458 feet along Highland Road (M-59).
Address:	9101 Highland Road
Current Use:	Institutional (Place of Worship)

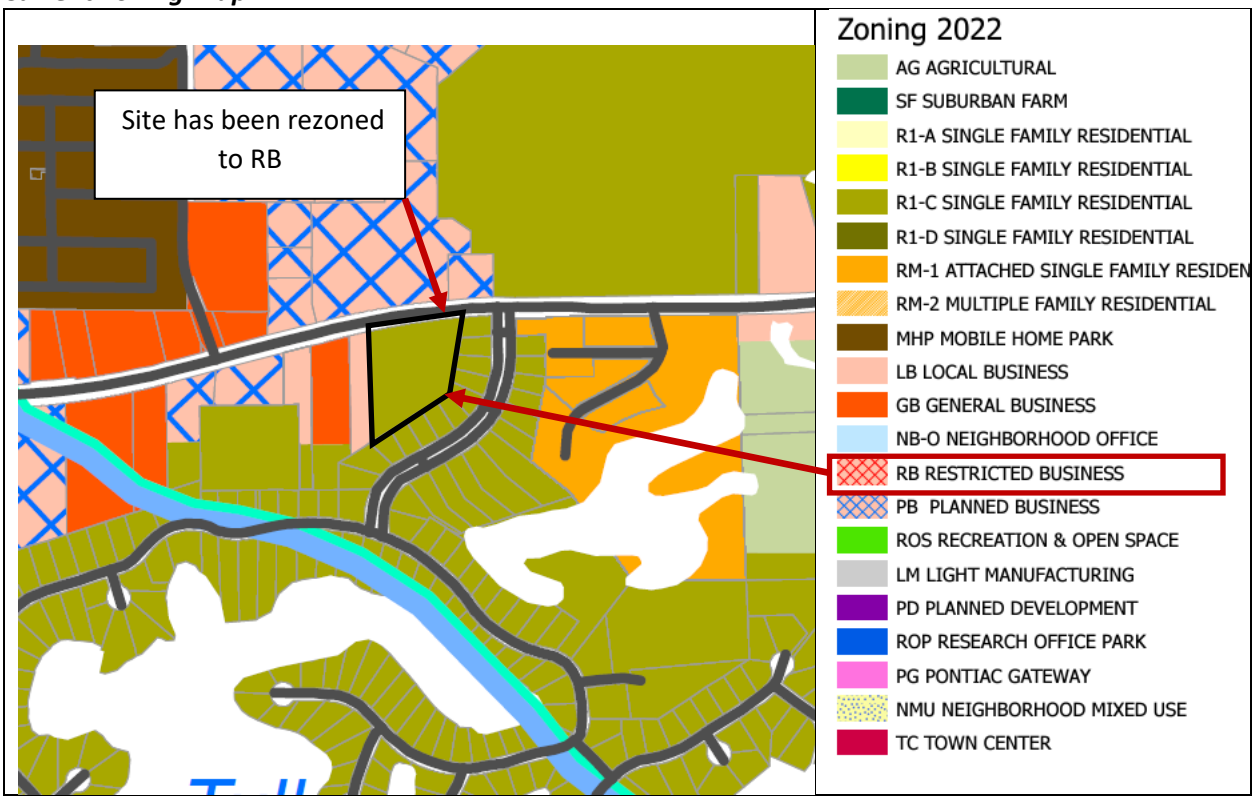
Aerial image of the site

Source: NearMap June 8, 2024

	North	East	South	West
Surrounding Zoning	*PD, Planned Business*	*R1-C, Single Family Residential*	*R1-C, Single Family Residential*	*LB, Local Business*
Surrounding Land Uses	*Big Box Retail*	*Single Family Homes*	*Single Family Homes*	*Child Daycare*
Future Land-Use Map	*Commercial Corridor*	*Neighborhood Residential*	*Neighborhood Residential*	*Commercial Corridor*

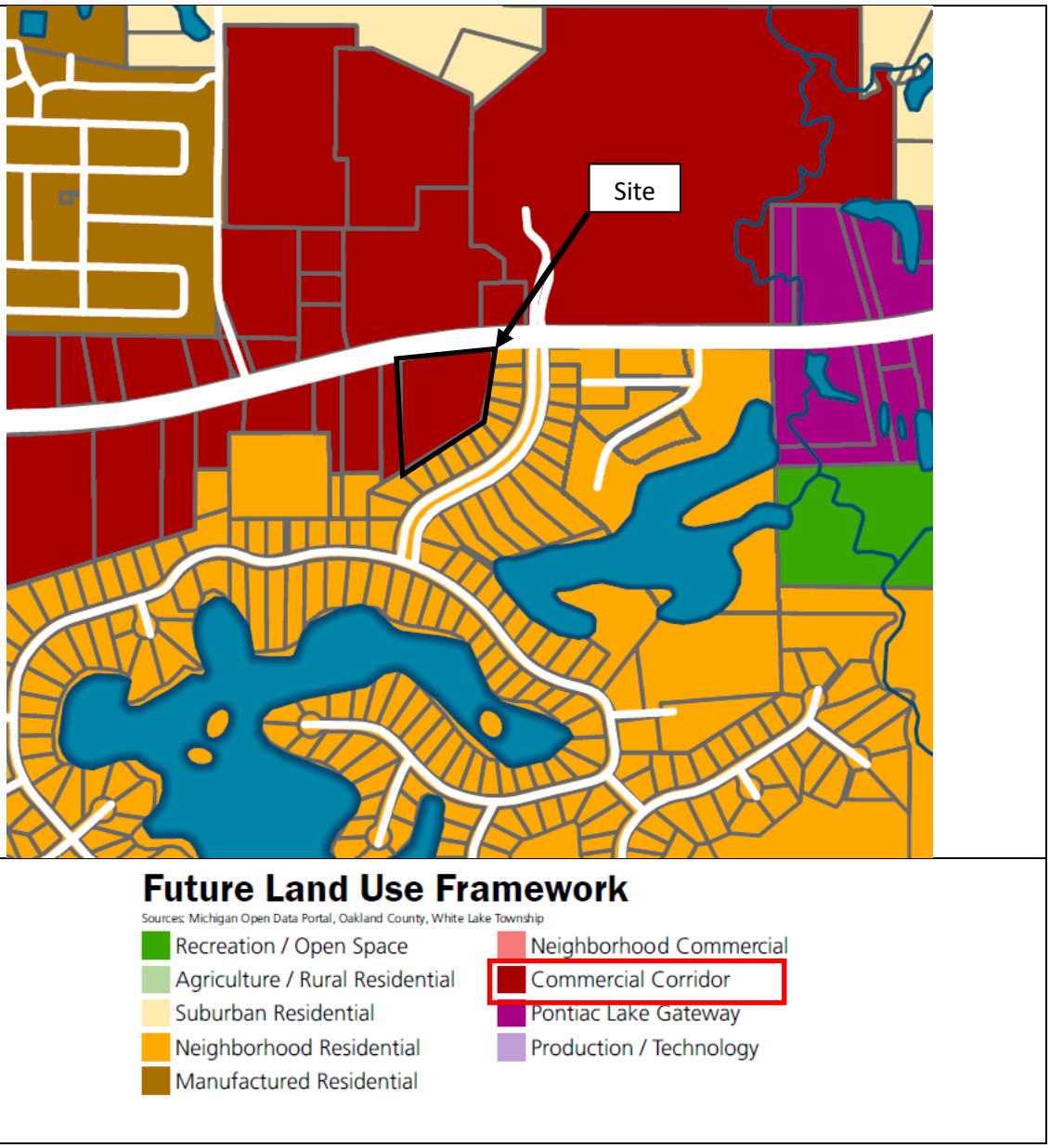
Current Zoning	**RB, Restricted Business** *The intent of the Restricted Business District is to provide a uniform set of regulations that will provide for and encourage retail and office development in accordance with the unique character of White Lake Township, with emphasis on preservation and enhancement of landscaping and natural areas. The Restricted Business District should contain diverse types of retail and office business, but it is not intended that the district become an intensive, high-volume commercial strip.*

Current Zoning Map



Future Land Use	**Commercial Corridor** *Commercial Corridor: Provides regional goods and services to residents and non-residents. Includes large box stores and drive thrus.*

Future Land Use Map



Item to be Addressed: *None*

NATURAL RESOURCES

Topography: Sheet C-4 show existing site topography as well as the proposed grading. With the exception of a natural depression along Highland Road (M-59) on the east side of the site, the lot is predominantly flat. Minor grading will be required to support proposed structures and site improvements with more extensive excavation required for the proposed detention pond south of the development.

We defer to Township Engineering for any concerns with the proposed grading plans as well as any issues cited regarding stormwater management and natural environment protection.

Wetlands: Per the Department of Environment, Great Lakes and Energy (EGLE), no wetlands are present onsite.

Woodland: The site is relatively clear of mature tree clusters. Individual mature trees are located along the periphery. It appears that approximately sixteen (16) of these trees are slated to be preserved and protected during construction.

Soils: Oshtemo, Boyer, Urban Land and Spinks soils are all present onsite and suitable for development.

Water: No waterbodies are present onsite.

General Notes: None.

Items to be Addressed: *Any cited concerns from Township Engineering.*

AREA, WIDTH, HEIGHT, SETBACKS

Proposed building envelopes and setback standards are shown on Sheet C-3 as well as district bulk and lot regulations. Standard bulk and lot regulations for the RB zoning district are set forth in Section 3.1.14.

RB Restricted Business District Developmental Standards

RB, Restricted Business	Required:	Proposed:	Complies
Building Setbacks			
Front (Sec. 4.17.A)	60 foot minimum	103.8 feet	Yes
Side	15 feet on one side / 30 foot total of two sides	81 feet to the west / 56 feet to the east / 137 feet combined	Yes
Rear	20 feet	154.6 feet	Yes
Wetland	25 feet	N/A	N/A

Building Height			
	35 feet or 2 stories (whichever is less)	20 feet / 1 story	Yes
Lot Standards			
Minimum Lot Area	1 acre	4.5 gross and net acres	Yes
Minimum Lot Width	120 feet	458.4 feet	Yes
Maximum Lot Coverage	TBD	6.75%	TBD
Depth to Width	4 to 1	Approx. 1 to 1	Yes

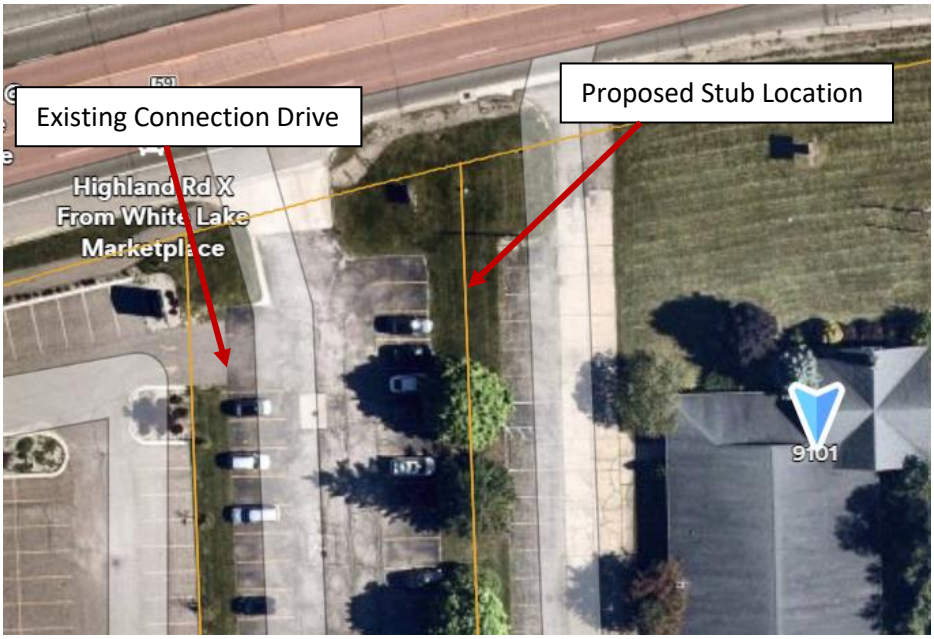
Items to be Addressed: *None.*

ACCESS & CIRCULATION

Vehicle Access & Circulation

Section 6.4 outlines site access requirements. However, the site's sole access is from Highland Road (M-59) which is under jurisdiction of the Michigan Department of Transportation (MDOT).

Sheet C-3 shows a proposed stub access drive at the west end of the property. A note indicates the drive is a proposed twenty-four (24) foot access drive and easement to be stubbed at the property line. The aerial image below shows the neighboring site to the west does not currently have a stub to the subject property. The neighboring property does share an internal drive with the adjacent property to the west. The applicant indicates the stub road will be connected to the neighboring site when that site is redeveloped. Concrete parking blocks are shown to detour vehicles from entering the temporary stub.



Source: NearMap June 8, 2024

Page 7 of the traffic impact study (TIS) dated April 22nd, 2024 indicates the site's proposed driveway distance from existing driveways and/or intersections. The only distance requirement that is met relates to the Ross Drive entrance way to the shopping center opposite Highland Road (M-59). We defer to Engineering on their assessment of this deficiency but note the applicant has incorporated a dedicated left hand turn egress lane and deceleration lane to the site plan per MDOT requirements.

The west building drive thru remains in the same configuration as the original site plan. Circulation issues may present with traffic entering the site so close to the drive thru exit assuming traffic leaving the drive thru will be attempting to exit the site as well.

The east building has expanded in square footage but has not altered the width and location of the eastern drive aisle.

Sheet C-10 provides circulation for fire trucks. We defer to Township Public Safety on concerns with emergency vehicle maneuverability.

Non-Motorized Access and Circulation

Sections 5.20 and 5.21 provide requirements for site sidewalks and pathways. A sidewalk is present across the Highland Road (M-59) frontage of the site. The applicant is proposing to demolish the sidewalk and install an eight (8) foot wide asphalt pathway mostly within the ROW. Pathways along the corridor are required to be eight (8) feet wide with two (2) foot clear zones on each side and at least six (6) feet from the curb of the adjacent road. Dimensions on Sheet C-3 indicate the pathway will be no closer than eight (8) feet to Highland Road (M-59) which is complaint.

An easement will be provided for the portion of the pathway that occupies the applicant's property. Pedestrian access from the proposed pathway to the site is provided via a walkway in front of the east and west building however only the west building has a crosswalk. We recommend a crosswalk be added to the east pedestrian access to provide safe crossing of the drive aisle.

Public Transit

Public Transit access is available via the SMART Bus Highland Road Route 759. The line runs east/west between Oakland University and Bogie Lake Road along Highland Road (M-59). The accessible Westbound stop is located at the Highland Road (M-59) and Sunny Beach Boulevard intersection. The accessible eastbound stop is located along Highland Road (M-59) at the White Lake Marketplace development. The route operates from approximately 6:00am until 11:00pm on weekdays and 9:00am until 6:00pm on Saturdays.

White Lake Township is also served by the Western Oakland Transportation Authority which provides schedule transportation for Township residents with specific needs.

Items to be Addressed*: 1.) Any concerns cited by Public Safety 2.) Any concerns cited by Engineering. 3.) MDOT will need to approve the pathway along Highland Road (M-59). 4.) The east building pedestrian connection should contain a crosswalk so pedestrians can cross the drive aisle safety. 5.) An easement will be required to grant the Township access rights to the portions of the safety path that are outside of the ROW.*

PARKING & LOADING

Section 5.11 outlines requirements for off-street parking. Sheet C-3 provides parking locations and calculations for the various retail and restaurant functions anticipated for the site. Parking is placed predominantly around the periphery of the two buildings with a limited number of spaces located between the structures. Parking lot and drive aisles will be constructed of asphalt. Concrete is proposed for limited portions of the drive thru and dumpster pads.

Only the west building offers drive thru facilities which wrap around the entire building. The stacking lane has two bailout drives. A loading zone is located behind the west building at the end of the central drive aisle. One loading zone is provided and meets the dimensional requirements of the ordinance. Refuse and Delivery truck circulation is provided on Sheet C-11. Two pedestrian crosswalks are shown with dashed markings to allow delivery personnel to access the rear of each building.

The site plan indicates there will be seven (7) total tenants between both buildings. Of the seven (7), two (2) are identified as retail totaling two thousand three hundred eighty seven (2,387) sqft. The remaining five (5) are identified as restaurants (one with drive thru amenities). Total restaurant square footage is twelve thousand five hundred seventy two (12,572). Based on these uses, one hundred forty six (146) parking spaces are required. One hundred twenty (120) parking spaces are proposed, which is within the 75% parking reduction allowance. Mobile order pickup spaces have been reduced from seven (7) to two (2) and now are only present across from the west building patio.

All spaces and dimensions for stacking lanes meet ordinance requirements.

Included in the provided parking are six (6) handicap accessible spaces. Count and dimension requirements for accessible spaces, as well as van accessibility space requirements, have been met.

We note that the site plan does not show dual white striped parking space paint however details on Sheet C-12 specify dual striped paint.

***Items to be Addressed**: None.*

ESSENTIAL SERVICES & UTILITIES

Sheet C-5 and 6 provide information on existing and proposed utilities. Stormwater management is proposed to be directed into a ground infiltration detention pond. Gas, water, sewer and electric services are proposed underground. We defer to Township Engineering for any concerns with utility layouts and calculations.

We note underground electric routes along the eastern property line conflict with proposed landscaping. Over time, large tree roots can cause problems for underground utilities.

Fire lane locations are required for preliminary site plan review and should be shown on Sheet C-3 as well as proposed fire department building hookups and/or water sources to confirm corresponding locations. We defer to Township Public Safety for any utility capacity or locations concerns.

Items to be Addressed: *1.) Any cited concerns of Township Engineering. 2.) Any cited concerns of Township Public Safety.*

LANDSCAPING & SCREENING

Landscape and screening information is required at final site plan review. The applicant has provided a detailed landscape plan on Sheet C-8. Per this information, we will provide a full review of the landscape plan. Any deficiencies noted should be addressed at final site plan review.

Landscaping originally proposed to line the east building drive thru has been relocated predominately along the southern end of the east building and rear parking area.

Section 5.19.B outlines general provisions for site landscaping. We note that no trees are to be planted closer than four (4) feet from any property line. While distance dimensions were not provided, it appears several trees along the southern and eastern property line may encroach this setback requirement.

Section 5.19.D provides requirements for screening along property lines as it relates to adjacent districts. Those standards are reviewed below:

Greenbelts

Property Line	Required	Provided	Complaint
North (ROW)	Depth: 20 feet 14 large deciduous or evergreen trees AND 110 shrubs	Depth: 25.4 feet 14 large deciduous trees AND 110 shrubs	Yes
East & South (R1-C)	Depth: 20 feet 56 large deciduous or evergreen trees AND 223 shrubs 5 foot visual barrier	Depth: 30 feet 56 large deciduous trees (49 new / 7 existing) AND 223 shrubs 8 foot obscuring fence	Yes
West (LB)	None	N/A	N/A

We note that several areas along the perimeter of the site show existing tree canopies and cite that they will remain. An aerial of the site is provided below for reference.

Source: NearMap June 8, 2024

Interior Landscaping

Interior landscaping areas are required to equal at least fifteen (15) percent of the total lot area. One (1) large deciduous, small ornamental deciduous, or evergreen tree and five (5) shrubs shall be planted for every three hundred (300) square feet of required interior landscaping area.

Standard	Required	Provided	Complaint
Lot Area	29,335 sqft (15%)	110,896 sqft (56%)	Yes
Deciduous Trees	97 trees	97 trees (81 new / 16 existing)	Yes
Shrubs	489 shrubs	489 shrubs	Yes

Parking Lot Landscaping

Any off-street parking areas containing ten (10) or more parking spaces shall have parking lot landscaping as prescribed in the table provided in Section 5.19.G. Additional standards require:

1. *One (1) large deciduous tree or small deciduous ornamental tree and three (3) shrubs for every one hundred (100) square feet of required parking lot landscaping area.*

2. *Parking lot landscaping areas shall be curbed with 6-inch concrete curbing. Planting islands containing trees shall not be less than fifty (50) square feet in area and not have any dimension across the island of less than five (5) feet.*

Commercial Use	Required	Provided	Complaint
Lot Area	2,340 sqft	7,199 sqft	Yes
Deciduous or Ornamental Trees	23 trees	23 trees	Yes
Shrubs	70 shrubs	70 shrubs	Yes
Curbs	6 inch concrete	2’	Yes
Lot Islands	50 sqft area minimum and at least 5 feet wide	4 Islands	Yes

Minimum Plant Size

All tree and plant material meet size requirements.

Trash Receptacles

Trash enclosures are to be contracted of similar materials as the principal structure on the site. Brickform concrete or stained, decorative CMU block may be permitted where the principal building is not masonry, however, plain CMU block is not allowed. Details on Sheet C-13 indicate enclosure walls are constructed of split face block CMU but do not indicate a staining or decorative treatment. Sheet A-302 provides enclosure details that reference enclosure walls as CMU and gates materials as stained wooded with a metal frame. The applicant should remove the trash enclosure detail from Sheet C-13 and clarify the CMU enclosure wall decorative feature on Sheet A-302 for final site plan.

Mechanical Equipment Screening

Sheet A-400 provides an elevation showing the rooftop mechanical equipment and the parapet dimensions which provide screening. Other onsite mechanical equipment is screened via landscaping.

Fencing

Sheet C-3 shows a six (6) foot high vinyl fence around the detention basin. Per landscaping buffer requirements between specific zones, an eight (8) foot obscuring fence is proposed along the eastern and southern lot lines where the property abuts residential districts. Specification of screening materials are required for final site plan.

Items to be Addressed: *1.) Dimensions between trees and property lines should be included on Sheet C-8 and conform to the four (4) foot setback requirement. 2.) The applicant should remove the trash enclosure detail from Sheet C-13 and clarify the CMU enclosure wall decorative feature on Sheet A-302 for final site plan. 3.) Specification of screening materials proposed for the eight (8) foot property line fence are required for final site plan.*

LIGHTING & NOISE

Lighting Requirements

The applicant has provided site lighting information on Sheets C-7 and 14. Lighting standards are provided in Section 5.18.G and required at final site plan review however this review will note any deficiencies with the proposed lighting plan.

Given the site will have multiple tenants, Sheet C-7 should have a note stating that there shall be no flashing, oscillating, moving or intermittent type of lighting or illumination on the site.

All site lighting is provided via LED fixtures mounted to twenty (20) foot poles. Footcandle requirements at the property lines and fixture height requirements are met. No building wall pack lighting is proposed at this time. Section 5.18.G.viii outlines footcandle maximums for specific areas of the site. The site plan offers footcandle measurements for the overall site and property lines as well as driveway, parking, walkways, and loading areas. All areas are below or at maximum footcandle allowances.

Noise Requirements

Noise standards are provided in Section 5.18.A and required at final site plan review.

Items to be Addressed: *Sheet C-7 should have a note stating that there shall be no flashing, oscillating, moving or intermittent type of lighting or illumination on the site*

SIGNAGE

Sheet C-3 provides the basic location of a proposed monument sign at the development's entrance. Basic dimension parameters are provided in the "Signage Requirements" table. We note the sign should complement both the design and construction materials of the principal structures on-site. Signs are approved administratively but complete sign information outlined in Section 5.9 is required at final site plan review.

Items to be Addressed: *None.*

ARCHITECTURE & LAYOUT

Sheets A100 through A301 provide general floorplans and elevations of the buildings. As stated earlier, the east building has been modified to accommodate four (4) tenants instead of the originally proposed three (3). The east building also no longer provides drive thru facilities. We do note that sheets are not stamped and sealed by a licensed architect.

Elevations of all building sides is required at preliminary site plan. Architectural information required at final site plan review includes the types of facing materials to be used on structures. Interior layouts are open to allow flexibility for potential user interior design but will be required to meet building codes during the permitting process.

Section 6.8.E provides architectural requirements for developments along the Highland Road (M-59) corridor. Proposed exterior materials for the buildings are fiber cement planes, metal coping, EFIS, brick veneer, prefinished aluminum and metal awnings. We recommend color renderings showing exterior construction materials in place for final site plan review. Window coverage along front facades must be at least 30%. These calculations should be added to the final site plan.

Exterior construction material boards will be required for Planning Commission review during final site plan as well as samples of furniture, fixtures or equipment to be located on the proposed patios.

Items to be Addressed: *1.) Window coverage calculations should be added to exterior elevations facing Highland Road (M-59). 2.) Architectural drawings should be stamped and sealed by the professional that prepared them.*

SPECIAL LAND USE

Restaurants with drive-thru' s and outdoor dining areas are a special land use and subject to the standards set forth in Sections 4.17, 4.18 and 6.10 of the zoning ordinance. Special land uses are reviewed and approved/denied by the Planning Commission.

General and special use requirements are provided in Section 6.10. Use standards specific to drive-in or drive-thru window services are outlined in Section 4.17. Use standards for eating establishments with

outdoor dining are provided in Section 4.18. The following information is a review of each requirement for this use as prescribed in the Zoning Ordinance.

Section 4.17 / Drive-In or Drive-Thru Window Services

A. *A front yard setback of at least sixty (60) feet shall be required.*

CWA Comment: Standard met.

B. *Entrance and exit drives shall be at least one hundred (100) feet from any street intersection and two hundred (200) feet from any residential district.*

CWA Comment: Standard met.

C. *An outdoor lighting plan shall specify the type of fixtures to be used, light intensity, and method of shielding the fixtures so that light does not project onto adjoining properties or on any public or private street or right-of-way. Dropped fixtures shall not be allowed. The site plan shall include a photometric plan and catalog details for all proposed fixtures. Outdoor lights must meet the performance standards of Section 5.18.*

CWA Comment: Standard met.

D. *An obscuring fence, screen wall, or land form buffer shall be provided in accordance with the provisions of Section 5.19 on all sides abutting a residential district.*

CWA Comment: Standard met.

E. *Adequate off-street waiting space shall be provided to prevent drive-through customers from waiting on a public or private street. A minimum of four (4) spaces per drive-up window, including order windows or per ATM machine, shall be required. The Planning Commission may increase this requirement up to seven (7) spaces per window based on the circumstances of individual uses and sites.*

CWA Comment: Standard met.

Section 4.18 / Eating Establishments with Entertainment and/or Outdoor Dining

These requirements are intended to regulate restaurants with large outdoor eating areas and possible entertainment that the applicant has stated no outdoor entertainment is to occur onsite for restaurant patrons. For this reason, we have only applied the standards applicable to casual outdoor eating within the patio areas specified for each building.

i. *The establishment may operate only during the following hours: Monday thru Thursday 8 am—12 midnight, Friday 8 am—2 am, Saturday 10 am—2 am, Sunday 10 am—10 pm.*

CWA Comment: The applicant has provided a list of anticipated tenants for the site as well as their possible hours of operation. Some operating times are beyond the window permitted for outdoor dining however we do not anticipate the patrons of these potential

tenants utilizing outdoor patios to a disruptive degree. The outdoor patio areas are modest in size and not meant for large amounts of customers.

ii. *The use of exterior loudspeakers is prohibited where the site abuts a residential district or use. The noise level at the lot line shall not exceed 70 dB.*

CWA Comment: No noise or speaker systems were included in the site plan. The applicant should be aware of this requirement when considering tenant types. The west building is the only building with drive thru facilities.

Section 6.10 / General SLU Standards

i. *The proposed special land use shall be of such location, size and character that it will be in harmony with the appropriate and orderly development of the surrounding neighborhood and/or vicinity and applicable regulations of the zoning district in which it is to be located.*

CWA Comment: The proposed use of the site is conducive with that found along the corridor and other major thoroughfares.

ii. *The proposed use shall be of a nature that will make vehicular and pedestrian traffic no more hazardous than is normal for the district involved, taking into consideration vehicular turning movements in relation to routes of traffic flow, proximity and relation to intersections, adequacy of sight distances, location and access of off-street parking and provisions for pedestrian traffic, with particular attention to minimizing child-vehicle interfacing.*

CWA Comment: Site access approval will be required from MDOT however the applicant has implemented a deceleration lane, dedicated left turn lanes, new roadside pathway and internal pedestrian paths to improve vehicle and pedestrian circulation.

iii. *The proposed use shall be designed as to the location, size, intensity, site layout and periods of operation of any such proposed use to eliminate any possible nuisance emanating therefrom which might be noxious to the occupants of any other nearby permitted uses, whether by reason of dust, noise, fumes, vibration, smoke or lights.*

CWA Comment: Per comments provided in the Special Land Use 4.18 requirements portion of this review, areas for outdoor dining are modest in size and the applicant should ensure tenants are aware of noise requirements. The applicant has eliminated the drive thru for the east building in response to nuisance concerns cited by the Planning Commission and community.

iv. *The proposed use shall be such that the proposed location and height of buildings or structures and location, nature and height of walls, fences and landscaping will not interfere with or discourage the appropriate development and use of adjacent land and buildings or unreasonably affect their value.*

CWA Comment: Standard met.

v. *The proposed use shall relate harmoniously with the physical and economic aspects of adjacent land uses as regards prevailing shopping habits, convenience of access by prospective patrons, continuity of development, and need for particular services and facilities in specific areas of the Township.*

CWA Comment: The proposed food service and retail uses are conducive to major thoroughfares and are similar or complementary to other commercial uses in the area.

vi. *The standards of density and required open spaces for the proposed special land use shall be at least equal to those required by this Ordinance in the Zoning District in which the proposed special land use is to be located.*

CWA Comment: Standard met.

vii. *The public services and facilities affected by a proposed special land use or activity shall be capable of accommodating increased service and facility loads caused by the land use or activity.*

CWA Comment: We defer to Township Engineering and Township Public Safety relating to public facilities and service concerns.

viii. *Protection of the natural environment and conservation of natural resources and energy.*

CWA Comment: No items of concern.

ix. *The proposed use is necessary for the public convenience at the proposed location.*

CWA Comment: The proposed use of the site is conducive with that found along the corridor and other major thoroughfares and will provide services to Township residents.

x. *The proposed use is so designed, located, planned and to be operated that the public health, safety and welfare will be protected.*

CWA Comment: No items of concern.

xi. *The proposed use shall not cause substantial injury to the value of other property in the neighborhood in which it is to be located and will not be detrimental to existing and/or other permitted land uses in the zoning district.*

CWA Comment: The proposed use is more intense than the current institutional use but not uncommon to major thoroughfares and/or proximity to residential uses. Appropriate landscaping and screening requirements have been met to ensure a buffer between the development and adjacent residential uses. Drive thru facilities have been reduced from two (2) to one (1) to accommodate concerns of the community.

Community Impact Statement

Section 3.1.14 and 6.6 of the zoning ordinance outline the need for a Community Impact Statement (CIS) for special land uses, planned developments and the like. Given the proposed use is an increase in intensity from the current use as well as the adjacency to residential districts, the applicant has provided a CIS for the proposed development.

The original CIS is dated November 12th, 2024 and was prepared by Stonefield Engineering and Design, LLC. The revised CIS provides updated information, however, is still dated November 12th, 2024. This should be amended to reflect the new date of the report. Chipotle is no longer listed as a potential tenant. The west building drive thru is proposed for Starbucks.

General

The CIS provides relevant information about the development regarding site layout, uses, and general hours of operation for tenants. Information provided is consistent with typical multi-tenant retail centers. As noted in the statement and this review, the use and zoning are consistent with the 2024 Master Plan. Surrounding uses are provided and are not uncommon when adjacent to retail along large thoroughfares (M-59).

Community Facilities and Services

The applicant states the site is anticipated to have a low to medium impact on police and fire services. No establishments are proposed to sell alcohol and fire department inspections are required to ensure the site is compliant with life safety standards. The fire department has provided preliminary approval of the site plan. No concerns are cited with the estimated demand on water and sewer systems.

Deliveries for tenants are expected to be once to twice per week. With the potential of up to seven(7) tenants, this could generate seven (7) to fourteen (14) deliveries per week. Single axle box trucks are anticipated to provide the majority of deliveries to the site. Given the loading zone is located in the rear of the development, we suggest a possible condition that trucks not be allowed to idle while loading, unloading or staging.

Economics

The site is anticipated to generate approximately fifty (50) to sixty (60) temporary jobs (construction) and approximately fifty (50) permanent service jobs. It is estimated that the proposed development will contribute roughly $70,000 per year to White Lake Township and local schools from annual property taxes.

Environment

The site is relatively free of major natural features such as clustered woodlands or bodies of water. The primary source of pollution to the site would be particulate matter during construction and personal vehicle operation once built. No major hazardous materials are expected to be kept onsite. The CIS does acknowledge that some tenants will likely be food service business that will

generate kitchen odors from cooking operations. It should be discussed as to whether any mitigation is available to reduce the impact of odors generated from tenant activities.

Noise

The CIS still notes that drive thru facilities in the east building will be pickup window only thus eliminating noise from order kiosks that utilize loudspeakers to communicate with drivers. These facilities have been removed from the east building on the revised site plan. This section should be updated to reflect the change as well as clarify if the drive thru for west building will be a traditional drive thru or pickup window. This is a positive step to help reduce noise pollution. The stipulation that no order kiosk or loudspeaker system shall be constructed for the east building should be added to the site plan to avoid future tenants requesting installation of such equipment.

Traffic

Traffic information does indicate that levels of service are anticipated to remain relatively the same after the site is operating. The traffic impact study does indicate that vehicles attempting to make a left turn out of the site may find the maneuver difficult during peak PM hours.

Mapping

The overhead image provided in the CIS highlights the character of uses along the corridor. Retail uses are prevalent to the west of the site with varying densities of residential throughout the area.

Items to be Addressed: *1.) Condition that trucks not be allowed to idle during loading, unloading, or staging while onsite. 2.) Mitigation techniques to reduce the impact of kitchen odors should be implemented. 3.) No order kiosk or loudspeaker system shall be constructed for the east building should be added to the site plan to avoid future tenants requesting installation of such equipment. 4.) Date of revised CIS should be updated. 5.) The CIS noise section should be updated to reflect the revised site plan indicating no drive thru facilities will be offered on the east building. The drive thru facilities for the west building should be identified as either a traditional drive thru or pickup window.*

SUMMARY

The revised preliminary site plan is substantially complete. We recommend a public hearing be noticed and the application be placed on the Planning Commission's agenda.

Should the Planning Commission approve the preliminary site plan, special land use, and CIS, we recommend conditions listed below:

Potential Conditions of Approval

1. *Any cited concerns from Township Engineering are addressed.*
2. *Any cited concerns from Township Public Safety are addressed.*
3. *MDOT will need to approve the pathway along Highland Road (M-59)*

4. *The east building pedestrian connection should contain a crosswalk so pedestrians can cross the drive aisle safety.*
5. *An easement will be required to grant the Township access rights to the portions of the safety path that are outside of the ROW.*
6. *Trucks not be allowed to idle during loading, unloading, or staging while onsite.*
7. *Mitigation techniques to reduce the impact of kitchen odors should be implemented.*
8. *No order kiosk or loudspeaker system shall be constructed for the east building should be added to the site plan to avoid future tenants requesting installation of such equipment.*
9. *Date of revised CIS should be updated.*
10. *The CIS noise section should be updated to reflect the revised site plan indicating no drive thru facilities will be offered on the east building. The drive thru facilities for the west building should be identified as either a traditional drive thru or pickup window.*

Waivers / Modifications / Determinations

Below is a list of waivers, modifications or determinations necessary from the Planning Commission for the current proposal to be approved.

1. *Planning Commission may grant/deny waiver request for placement of access drive per lot and placement restrictions however site access is under the jurisdiction of MDOT.*

Final Site Plan Items (Notations / Not Required for PSP Approval)

The items listed below are not required for preliminary site plan approval but will need to be addressed prior to final site plan consideration.

PLEASE NOTE: Should the Planning Commission grant approval or conditional approval of the preliminary site plan, these items should not be included in the motion.

1. *Sheet C-7 should have a note stating that there shall be no flashing, oscillating, moving or intermittent type of lighting or illumination on the site*
2. *Dimensions between trees and property lines should be included on Sheet C-8 and conform to the four (4) foot setback requirement.*
3. *The applicant should remove the trash enclosure detail from Sheet C-13 and clarify the CMU enclosure wall decorative feature on Sheet A-302 for final site plan. Exterior construction material boards will be required for Planning Commission review during final site plan as well as samples of furniture, fixtures or equipment to be located on the proposed patios.*
4. *Window coverage calculations should be added to exterior elevations facing Highland Road (M-59).*
5. *Architectural drawings should be stamped and sealed by the professional that prepared them.*
6. *Material specifications for the proposed eight (8) foot obscuring fence should be provided at final site plan review.*

Respectfully,

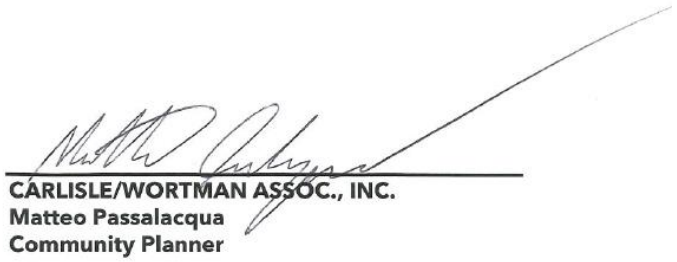
CARLISLE/WORTMAN ASSOC., INC.
Matteo Passalacqua
Community Planner

Our full review is included in the Planning Commission's packet. To supplement the review, we have summarized the notable changes to the site plan below:

- Drive-thru facilities have been eliminated for the east building.
- The east building is now proposed to house four tenants instead of three.
- The west building has decreased in size from 7,227 sqft to 7,094 sqft.
- The east building has increased in size from 6,418 sqft to 7,865 sqft.
- The safety path along M59 has been moved away from the road and is in conformance with distance requirements from the curb.
- Parking spaces have increased to 120 from 116.
- Mobile order pickup spaces have been reduced from seven to two.
- Landscaping originally proposed to line the east building drive thru has been relocated predominantly along the southern end of the east building and rear parking area.
- Additional lighting information has been provided and meets ordinance standards.
- Chipotle is no longer listed as a potential tenant.

Thank you for your time.

Respectfully,



CARLISLE/WORTMAN ASSOC., INC.
Matteo Passalacqua
Community Planner

Fire Department
Charter Township of White Lake

7420 Highland Road
White Lake, MI 48383
Office (248) 698-3993
www.whitelaketwp.com/fire

Site / Construction Plan Review

To: Sean O'Neil, Planning Department Director

Date: 12-30-2024

Project: 9101 Highland Road

Job #: DET-230229

Date on Plans: 12-20-2024

The Fire Department has the following comments with regard to the 3rd review of preliminary site plans for the project known as 9101 Highland Road.

1. The access drive and parking lot shall be designed and maintained to support the imposed loads of fire apparatus and shall be surfaced to provide all weather driving capabilities.

2. The required turning radius shall accommodate the largest Fire Department apparatus (40') and provide a turn radius profile showing apparatus movement on all future plans. **Needs to be shown throughout the entire site.** (Movement needs to be shown between the East and West buildings turning to the East and West in the front of the buildings as well as the rear of the buildings)

3. The angle of approach/Departure to and from White Lake roads shall not exceed 8 degrees.

4. Wall mounted KNOX Box required, location to be determined.

5. One additional fire hydrant with bollard protection will be required on the south side of the buildings, centrally located, possibly on the island east of the proposed loading zone.

6. Fire lanes must be posted and remain unobstructed at all times.

Jason Hanifen
Fire Marshal
Charter Township of White Lake
(248)698-3993
jhanifen@whitelaketwp.com

Plans are reviewed using the International Fire Code (IFC), 2015 Edition and Referenced NFPA Standards.

SITE DEVELOPMENT PLANS

FOR

9101 HIGHLAND ROAD

PROPOSED COMMERCIAL DEVELOPMENT

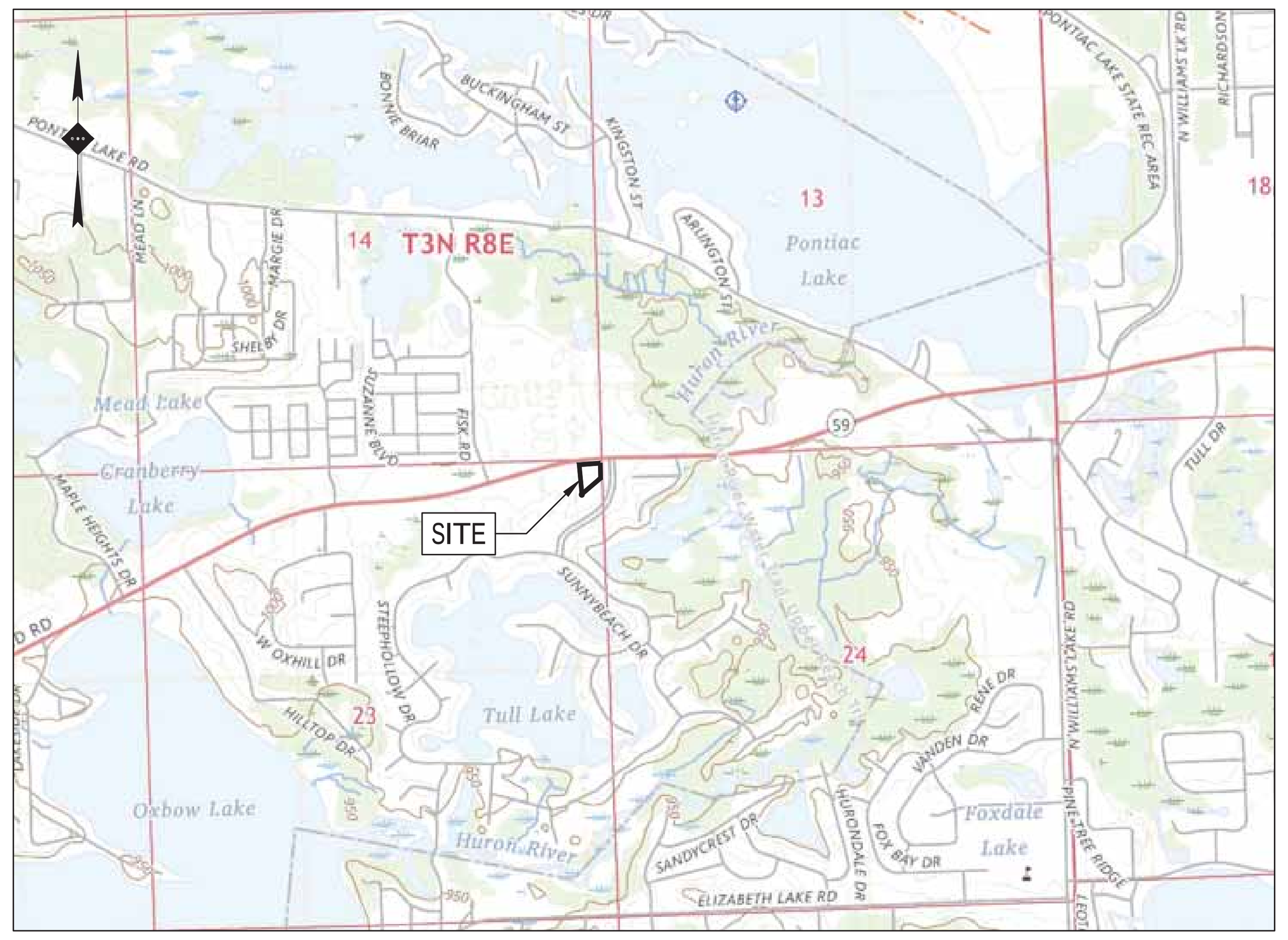
PID: 12-23-227-003
9101 HIGHLAND ROAD (M-59)
WHITE LAKE TOWNSHIP, OAKLAND COUNTY, MICHIGAN

APPLICANT / OWNER

AFFINITY 10 INVESTMENT LLC
44512 SOUTH SHORE STREET
WATERFORD, MICHIGAN 48328
248-702-0624
THANNAWA@ENCOREIS.COM

ARCHITECT

BOWERS + ASSOCIATES, INC
2400 SOUTH HURON PARKWAY
ANN ARBOR, MICHIGAN 48104
734-975-2400
SUSANB@BOWERSARCH.COM



SOURCE: USGS MAPPING SYSTEM

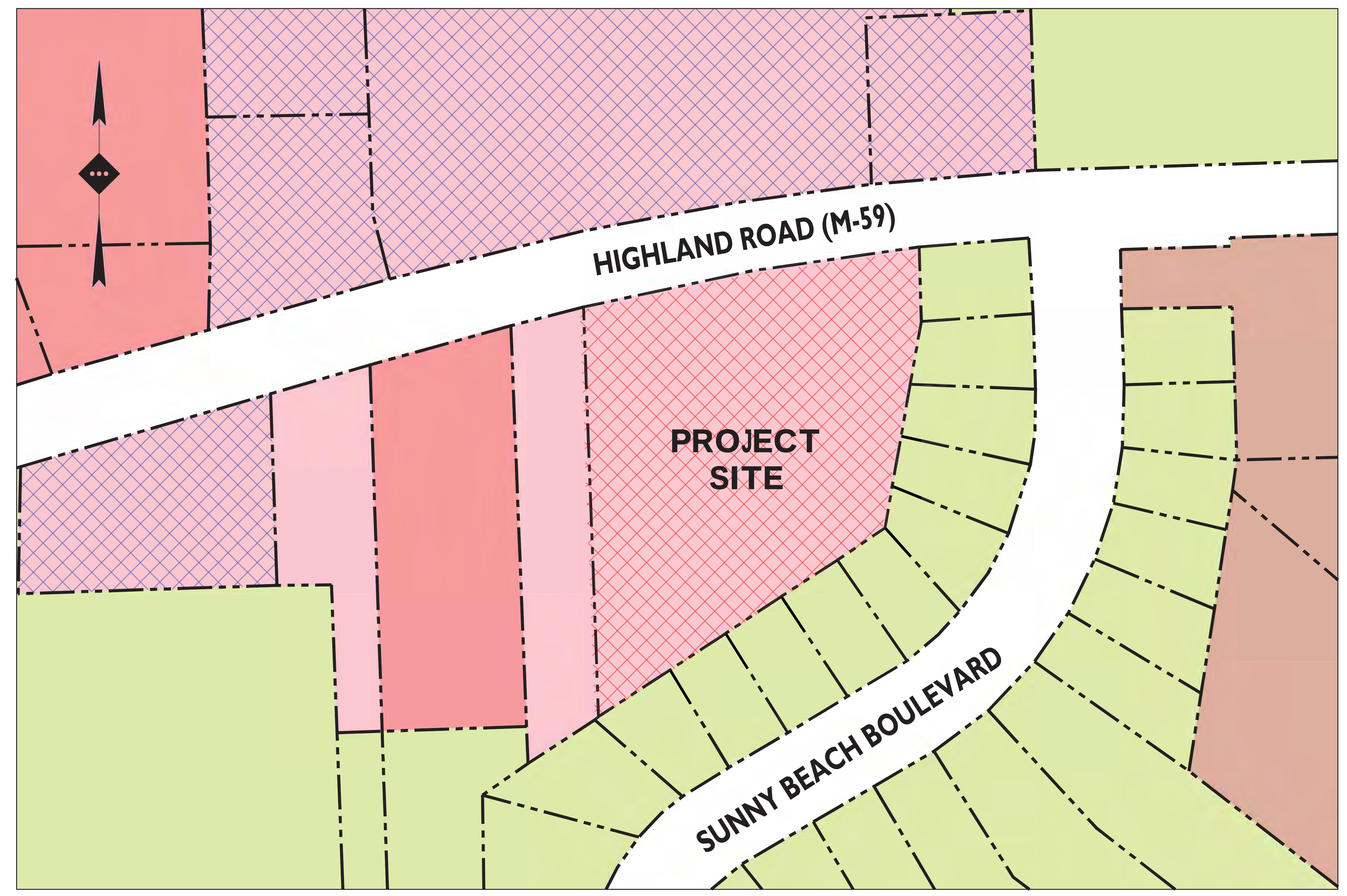
LOCATION MAP

SCALE: 1" = 2,000'±

SOURCE: GOOGLE EARTH PRO. DATE RETRIEVED 12/11/2023

AERIAL MAP

SCALE: 1" = 150'±



SOURCE: TOWNSHIP OF WHITE LAKE OFFICIAL ZONING MAP. DATED 10/10/2022 & TOWNSHIP BOARD MEETING MINUTES FROM 9/17/2024 APPROVING THE REZONE TO RESTRICTED BUSINESS

ZONING KEY

- R1-C SINGLE FAMILY RESIDENTIAL
- RM-1 ATTACHED SINGLE FAMILY RESIDENTIAL
- GB GENERAL BUSINESS
- RB RESTRICTED BUSINESS
- PB PLANNED BUSINESS
- LB LOCAL BUSINESS

ZONING MAP

SCALE: 1" = 150'±

PLANS PREPARED BY:

STONEFIELD
engineering & design

Birmingham, MI • New York, NY • Boston, MA
Princeton, NJ • Tampa, FL • Rutherford, NJ
www.stonefieldeng.com

555 S. Old Woodward Avenue, Suite 12L, Birmingham, MI 48009
Phone 248.247.1115

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PLAN REFERENCE MATERIALS:

1. THIS PLAN SET REFERENCES THE FOLLOWING DOCUMENTS INCLUDING, BUT NOT LIMITED TO:
   - ALTA/NSPS LAND TITLE SURVEY PREPARED BY KEM-TEC ASSOCIATES DATED 09/28/2023
   - ARCHITECTURAL PLANS OBTAINED FROM BOWER & ASSOCIATES, INC DATED 12/19/2024
   - AERIAL MAP OBTAINED FROM GOOGLE EARTH PRO 10/10/2022
   - LOCATION MAP OBTAINED FROM USGS ONLINE MAPPER 08/07/2023
   - TRAFFIC STUDY OBTAINED FROM FLEIS & VANDENBRINK DATED 04/22/2024
2. ALL REFERENCE MATERIAL LISTED ABOVE SHALL BE CONSIDERED A PART OF THIS PLAN SET AND ALL INFORMATION CONTAINED WITHIN THESE MATERIALS SHALL BE UTILIZED IN CONJUNCTION WITH THIS PLAN SET. THE CONTRACTOR IS RESPONSIBLE TO OBTAIN A COPY OF EACH REFERENCE AND REVIEW IT THOROUGHLY PRIOR TO THE START OF CONSTRUCTION.

SHEET INDEX

DRAWING TITLE	SHEET #
COVER SHEET	C-1
DEMOLITION PLAN	C-2
SITE PLAN	C-3
GRADING PLAN	C-4
STORMWATER MANAGEMENT PLAN	C-5
UTILITY PLAN	C-6
LIGHTING PLAN	C-7
LANDSCAPING PLAN	C-8 & C-9
FIRE TRUCK TURNING ANALYSIS	C-10
REFUSE TRUCK TURNING ANALYSIS	C-11
CONSTRUCTION DETAILS	C-12 TO C-14

ADDITIONAL SHEETS

DRAWING TITLE	SHEET #
ALTA / NSPS LAND TITLE SURVEY	1 OF 1
WHITE LAKE TWP WATERMAIN DETAILS	1 OF 1
WHITE LAKE TWP STORM SEWER DETAILS	1 OF 1
WHITE LAKE TWP SANITARY DETAILS	1 OF 1
OAKLAND COUNTY SOIL EROSION DETAILS	1 OF 1

ISSUE	DATE	BY	DESCRIPTION
6	12/20/2024	EM	REVISED FOR PRELIMINARY SITE PLAN APPROVAL
5	10/17/2024	EM	REVISED PER PRELIMINARY SITE PLAN REVIEW #1
4	07/22/2024	EM/JP	FOR SITE PLAN REVIEW
3	04/22/2024	JRC/JP	SUBMISSION FOR REVISED REZONING REQUEST
2	04/15/2024	EM	FOR PRELIMINARY MDOT REVIEW
1	11/29/2023	JRC/JP	SUBMISSION FOR REZONING

NOT APPROVED FOR CONSTRUCTION

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555 S Old Woodward Suite 12L Birmingham, MI 48009
Phone 248.247.1115

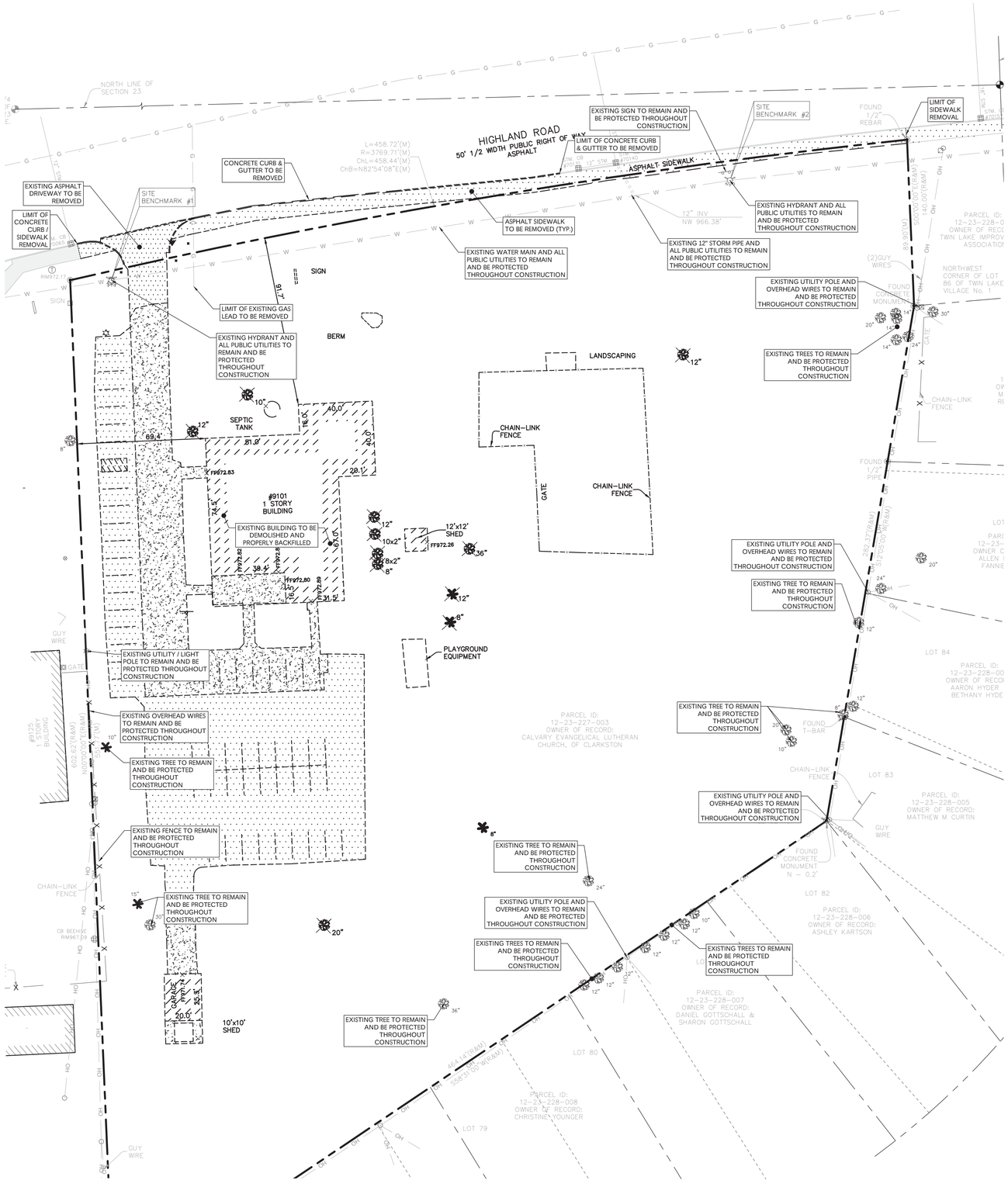
SITE DEVELOPMENT PLANS
9101 HIGHLAND ROAD
PROPOSED COMMERCIAL DEVELOPMENT
PARCEL ID:12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
PROFESSIONAL ENGINEER

SCALE: AS SHOWN | PROJECT ID: DET-230229

TITLE: COVER SHEET

DRAWING: C-1



SYMBOL	DESCRIPTION
— — — —	PROPERTY LINE
— — — —	FEATURE TO BE REMOVED / DEMOLISHED

BENCHMARK

SITE BENCHMARK #1
ARROW ON HYDRANT, WEST SIDE OF ASPHALT ENTRANCE.
ELEVATION = 975.36' (NAVD 88)

SITE BENCHMARK #2
ARROW ON TRAFFIC SIGNAL POST, EAST SIDE OF PROPERTY.
ELEVATION = 974.20' (NAVD 88)

ALL SITE FEATURES WITHIN THE PROPERTY LINE INDICATED ON THIS PLAN ARE TO BE REMOVED / DEMOLISHED UNLESS OTHERWISE NOTED. THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IF SIGNIFICANT DISCREPANCIES ARE DISCERNED BETWEEN THIS PLAN AND FIELD CONDITIONS

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DEMOLITION NOTES

1. THE WORK REFLECTED ON THE DEMOLITION PLAN IS TO PROVIDE GENERAL INFORMATION TOWARDS THE EXISTING ITEMS TO BE DEMOLISHED AND/OR REMOVED. THE CONTRACTOR IS RESPONSIBLE TO REVIEW THE ENTIRE PLAN SET AND ASSOCIATED REPORTS/RREFERENCE DOCUMENTS, INCLUDING ALL DEMOLITION ACTIVITIES AND INCIDENTAL TASKS NECESSARY TO COMPLETE THE SITE IMPROVEMENTS.
2. THE CONTRACTOR IS RESPONSIBLE TO DETERMINE THE MEANS AND METHODS OF DEMOLITION ACTIVITIES.
3. EXPLOSIVES SHALL NOT BE USED UNLESS WRITTEN CONSENT FROM BOTH THE OWNER AND ANY APPLICABLE GOVERNING AGENCY IS OBTAINED. BEFORE THE START OF ANY EXPLOSIVE PROGRAM, THE CONTRACTOR IS RESPONSIBLE TO OBTAIN ALL LOCAL, STATE, AND FEDERAL PERMITS. ADDITIONALLY, THE CONTRACTOR WILL BE RESPONSIBLE FOR ALL SEISMIC TESTING AS REQUIRED AND ANY DAMAGES AS THE RESULT OF SAID DEMOLITION PRACTICES.
4. ALL DEMOLITION ACTIVITIES SHALL BE PERFORMED IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL CODES. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING ALL UTILITIES ARE DISCONNECTED IN ACCORDANCE WITH THE UTILITY AUTHORITY'S REQUIREMENTS PRIOR TO STARTING THE DEMOLITION OF ANY STRUCTURE. ALL EXCAVATIONS ASSOCIATED WITH DEMOLISHED STRUCTURES OR REMOVED TANKS SHALL BE BACKFILLED WITH SUITABLE MATERIAL AND COMPACTED TO SUPPORT SITE AND BUILDING IMPROVEMENTS. A GEOTECHNICAL ENGINEER SHOULD BE PRESENT DURING BACKFILLING ACTIVITIES TO OBSERVE AND CERTIFY THAT BACKFILL MATERIAL WAS COMPACTED TO A SUITABLE CONDITION.
5. DEMOLISHED DEBRIS SHALL NOT BE BURIED ON SITE. ALL WASTE/DEBRIS GENERATED FROM DEMOLITION ACTIVITIES SHALL BE DISPOSED OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REQUIREMENTS. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN ALL RECORDS OF THE DISPOSAL TO DEMONSTRATE COMPLIANCE WITH THE ABOVE REGULATIONS.

30' 0' 30' 60'
GRAPHIC SCALE IN FEET
1" = 30'

ISSUE	DATE	BY	DESCRIPTION
6	12/20/2024	EM	REVISED FOR PRELIMINARY SITE PLAN APPROVAL
5	10/17/2024	EM	REVISED PER PRELIMINARY SITE PLAN REVIEW #1
4	07/22/2024	EM/JP	FOR SITE PLAN REVIEW
3	04/22/2024	JR/CJP	SUBMISSION FOR REVISED REZONING REQUEST
2	04/15/2024	EM	FOR PRELIMINARY MDOT REVIEW
1	11/29/2023	JR/CJP	SUBMISSION FOR REZONING

NOT APPROVED FOR CONSTRUCTION

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555 S Old Woodward Suite 12L Birmingham, MI 48009
Phone 248.247.1115

SITE DEVELOPMENT PLANS

9101 HIGHLAND ROAD

PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID:12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TO WNSHIP
OAKLAND COUNTY, MICHIGAN

STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL ENGINEER

STONEFIELD engineering & design

SCALE: 1" = 30' | PROJECT ID: DET-230229

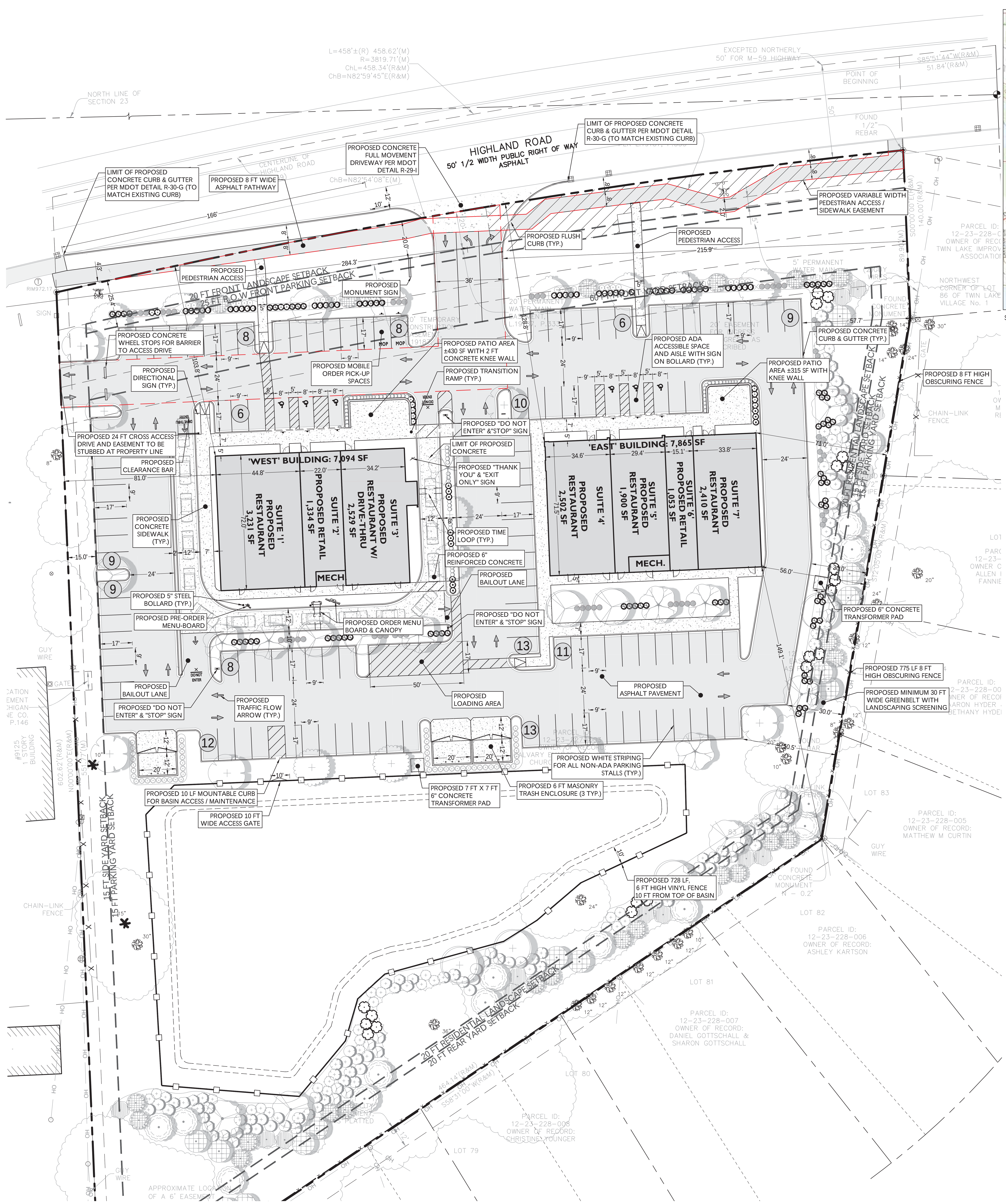
TITLE:

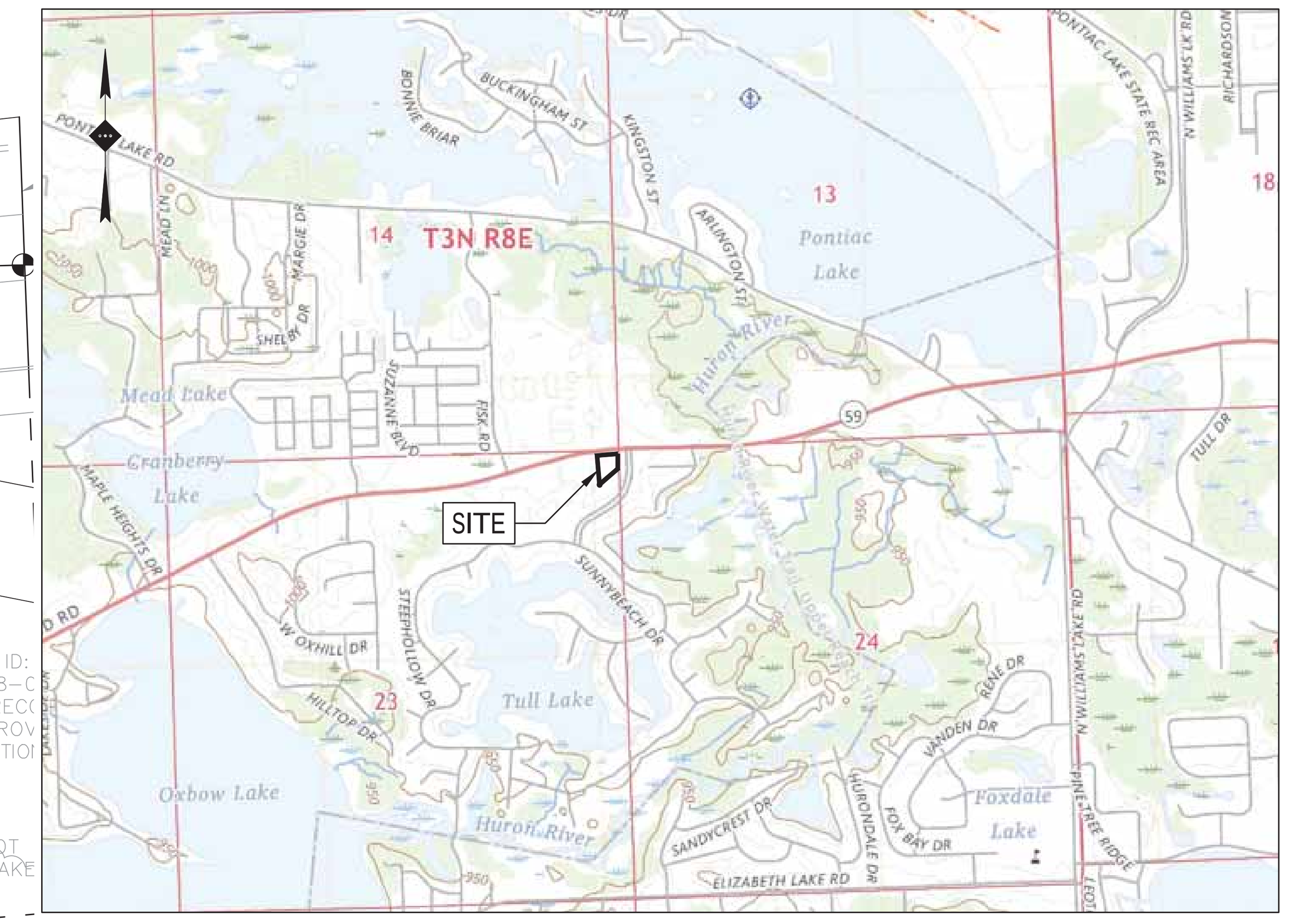
DEMOLITION PLAN

DRAWING:

C-2

V:\DET\2023\DET-230229-ASTARTY 3X INVESTMENT 9101 HIGHLAND ROAD, WHITE LAKE, MI\CAD\PLOT\DP-01 DEMO.DWG





SOURCE: USGS MAPPING SYSTEM

LOCATION MAP

SCALE: 1" = 2,000'±

SYMBOL	DESCRIPTION
	PROPERTY LINE
	SETBACK LINE
	PROPOSED CURB & GUTTER
	PROPOSED SIGNS / BOLLARDS
	PROPOSED BUILDING
	PROPOSED CONCRETE
—— X —— X ——	PROPOSED 8 FT OBSCURING FENCE

LAND USE AND ZONING

PID:12-23-227-003

EXISTING ZONE: R1-C SINGLE FAMILY RESIDENTIAL

2024 MASTER PLAN: COMMERCIAL COORIDOR

PROPOSED REZONE: RESTRICTED BUSINESS DISTRICT (RB)

PROPOSED USE	
RESTAURANT OR FAST FOOD	PERMITTED USE
DRIVE-THRU WINDOW	SPECIAL LAND USE (4)
RETAIL STORE	PERMITTED USE

ZONING REQUIREMENT	REQUIRED	PROPOSED
MINIMUM LOT AREA	1 AC	195,568 SF (4.5 AC)
MINIMUM LOT WIDTH	200 FT	458.4 FT
MAXIMUM BUILDING HEIGHT	35 FT (2 STORIES)	20 FT (1 STORY)
MINIMUM FRONT YARD SETBACK	60 FT(1)	103.8 FT
MINIMUM SIDE YARD SETBACK (ONE)	15 FT	56.0 FT
MINIMUM SIDE YARD SETBACK (BOTH)	20 FT	137.0 FT
MINIMUM REAR YARD SETBACK	20 FT	149.1 FT
MINIMUM DRIVEWAY FROM RESIDENTIAL	200 FT (1)	215.8 FT
MINIMUM FRONT LANDSCAPE SETBACK	20 FT	25.4 FT
MINIMUM R.O.W PARKING SETBACK	25 FT(2)	25.4 FT
INTERIOR LANDSCAPING AREA	15% (29,335 SF)	>15%
MINIMUM DRIVEWAY SPACING (HIGHLAND ROAD)	455 FT	±284.3 FT TO WEST (W)
TRASH ENCLOSURE SETBACK	103.8 FT (3)	COMPLIES
MINIMUM SIDE PARKING SETBACK	15 FT	15.0 FT

(W) WAIVER

(1) REQUIREMENT FOR RESTAURANT WITH DRIVE-THRU

(2) NO PARKING STALL SHALL BE LOCATED ADJACENT TO R.O.W LINE, STREET EASEMENT OR SIDEWALK WHICHEVER IS CLOSER

(3) NO ENCLOSURES SHALL BE PERMITTED CLOSER TO THE FRONT LOT LINE THAN THE PRINCIPAL BUILDING

(4) PLANNING COMMISSION APPROVED SPECIAL LAND USE FOR ONE (1) DRIVE-THRU TENANT DECEMBER 5, 2024

OFF-STREET PARKING REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
§ 5.11.M	MAXIMUM REQUIRED PARKING: *FAST FOOD:* 1 SPACE PER 75 OF GFA (2,529 SF)(1 SPACE / 75 SF) = 34 SPACES *RESTAURANT, NOT INCLUDING ALCOHOL :* 1 SPACE PER 100 SF OF GFA (10,043 SF)(1 SPACE / 100 SF) = 100 SPACES *RETAIL PARKING:* 1 SPACE PER 200 SF OF GFA (2,387 SF)(1 SPACE / 200 SF) = 12 SPACES **TOTAL: 34 + 100 + 12 = 146 SPACES**	120 SPACES
§ 5.11.M	MINIMUM REQUIRED PARKING SPACES: (146 SPACES)(0.75) = **110 SPACES** (2)	120 SPACES
2010 ADA STANDARDS FOR ACCESSIBLE DESIGN	ADA ACCESSIBLE PARKING: 101 TO 150 SPACES = 5 ACCESSIBLE SPACES	6 ACCESSIBLE SPACES
§ 5.11.M	STACKING (FAST FOOD W/ INDOOR SEATING): 8 VEHICLES INCLUSIVE OF VEHICLE AT THE WINDOW (9 FT X 19 FT)	15 SPACES (12 FT X 19 FT)
§ 5.11.Q	90° PARKING: 9 FT X 19 FT WITH 24 FT AISLE (1)	9 FT X 17 FT W/ 24 FT AISLE
§ 5.19	LANDSCAPE REQUIREMENT: 20 FT WIDTH ALONG RESIDENTIAL 6-8 FT OBSCURING FENCE	30 FT WIDTH 8 FT FENCE
§ 5.11.P.I	LOADING AREA: 10 FT X 50 FT WITH 15 FT CLEARANCE	17 FT X 50 FT

(1) PARKING SPACE LENGTH MAY BE REDUCED TO 17 FT WHERE 7 FT SIDEWALK OR LANDSCAPE IS PROVIDED.

(2) AT LEAST 75% OF THE MAXIMUM ALLOWABLE NUMBER OF PARKING SPACES SHALL BE PROVIDED.

ANTICIPATED TENANTS / HOURS OF OPERATION

- NOTHING BUNDT THE CAKE: 9:30 AM TO 8PM
- FIVE GUYS: 11 AM TO 10 PM
- STARBUCKS: 5 AM TO 8 PM
- JERSEY MIKE'S: 10 AM TO 9 PM

SIGNAGE REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
§5.9.J.I.B	MULTI-TENANT SIGN HEIGHT: 15 FT(2)(3)	<15 FT
§5.9.J.I	SIGN AREA: 6 SF PER 1 FT OF SETBACK	<150 SF
§5.9.J.I	MAXIMUM SIGN AREA: 150 SF(1)	<150 SF
§5.9.J.I.A	SIGN SETBACK: 10 FT	20.0 FT
§5.9.J.I.A	RESIDENTIAL SETBACK: 100 FT	>200 FT

(1) MAXIMUM SIGN AREA SHALL NOT INCLUDE DECORATIVE ELEMENTS SUCH AS BASES, COLUMNS OR CAPS

(2) MINIMUM HEIGHT OF A SIGN BASE SHALL BE 2 FT IN HEIGHT

(3) EACH INDIVIDUAL TENANT SIGN SHALL NOT EXCEED 4 FT IN HEIGHT

GENERAL NOTES

1. THE CONTRACTOR SHALL VERIFY AND FAMILIARIZE THEMSELVES WITH THE EXISTING SITE CONDITIONS AND THE PROPOSED SCOPE OF WORK (INCLUDING DIMENSIONS, LAYOUT, ETC.) PRIOR TO INITIATING THE IMPROVEMENTS IDENTIFIED WITHIN THESE DOCUMENTS. SHOULD ANY DISCREPANCY BE FOUND BETWEEN THE EXISTING SITE CONDITIONS AND THE PROPOSED WORK THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. PRIOR TO THE START OF CONSTRUCTION.
2. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS AND ENSURE THAT ALL REQUIRED APPROVALS HAVE BEEN OBTAINED PRIOR TO THE START OF CONSTRUCTION. COPIES OF ALL REQUIRED PERMITS AND APPROVALS SHALL BE KEPT ON SITE AT ALL TIMES DURING CONSTRUCTION.
3. ALL CONTRACTORS WILL, TO THE FULLEST EXTENT PERMITTED BY LAW, INDEMNIFY AND HOLD HARMLESS STONEFIELD ENGINEERING & DESIGN, LLC. AND IT'S SUB-CONSULTANTS FROM AND AGAINST ANY DAMAGES AND LIABILITIES INCLUDING ATTORNEY'S FEES ARISING OUT OF CLAIMS BY EMPLOYEES OF THE CONTRACTOR IN ADDITION TO CLAIMS CONNECTED TO THE PROJECT AS A RESULT OF NOT CARRYING THE PROPER INSURANCE FOR WORKERS COMPENSATION, LIABILITY INSURANCE, AND LIMITS OF COMMERCIAL GENERAL LIABILITY INSURANCE.
4. THE CONTRACTOR SHALL NOT DEVIATE FROM THE PROPOSED IMPROVEMENTS IDENTIFIED WITHIN THIS PLAN SET UNLESS APPROVAL IS PROVIDED IN WRITING BY STONEFIELD ENGINEERING & DESIGN, LLC.
5. THE CONTRACTOR IS RESPONSIBLE TO DETERMINE THE MEANS AND METHODS OF CONSTRUCTION.
6. THE CONTRACTOR SHALL NOT PERFORM ANY WORK OR CAUSE DISTURBANCE ON A PRIVATE PROPERTY NOT CONTROLLED BY THE PERSON OR ENTITY WHO HAS AUTHORIZED THE WORK WITHOUT PRIOR WRITTEN CONSENT FROM THE OWNER OF THE PRIVATE PROPERTY.
7. THE CONTRACTOR IS RESPONSIBLE TO RESTORE ANY DAMAGED OR UNDERMINED STRUCTURE OR SITE FEATURE THAT IS IDENTIFIED TO REMAIN ON THE PLAN SET. ALL REPAIRS SHALL USE NEW MATERIALS TO RESTORE THE FEATURE TO ITS EXISTING CONDITION AT THE CONTRACTORS EXPENSE.
8. CONTRACTOR IS RESPONSIBLE TO PROVIDE THE APPROPRIATE SHOP DRAWINGS, PRODUCT DATA, AND OTHER REQUIRED SUBMITTALS FOR REVIEW. STONEFIELD ENGINEERING & DESIGN, LLC. WILL REVIEW THE SUBMITTALS IN ACCORDANCE WITH THE DESIGN INTENT AS REFLECTED WITHIN THE PLAN SET.
9. THE CONTRACTOR IS RESPONSIBLE FOR TRAFFIC CONTROL IN ACCORDANCE WITH MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION.
10. THE CONTRACTOR IS REQUIRED TO PERFORM ALL WORK IN THE PUBLIC RIGHT-OF-WAY IN ACCORDANCE WITH THE APPROPRIATE GOVERNING AUTHORITY AND SHALL BE RESPONSIBLE FOR THE PROCUREMENT OF STREET OPENING PERMITS.
11. THE CONTRACTOR IS REQUIRED TO RETAIN AN OSHA CERTIFIED SAFETY INSPECTOR TO BE PRESENT ON SITE AT ALL TIMES DURING CONSTRUCTION & DEMOLITION ACTIVITIES.
12. SHOULD AN EMPLOYEE OF STONEFIELD ENGINEERING & DESIGN, LLC. BE PRESENT ON SITE AT ANY TIME DURING CONSTRUCTION, IT DOES NOT RELIEVE THE CONTRACTOR OF ANY OF THE RESPONSIBILITIES AND REQUIREMENTS LISTED IN THE NOTES WITHIN THIS PLAN SET.

30' 0' 30' 60'

GRAPHIC SCALE IN FEET
1" = 30'

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SITE DEVELOPMENT PLANS

9101 HIGHLAND ROAD

PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID:12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

STATE OF MICHIGAN JONATHAN REID COOKSEY ENGINEER PROFESSIONAL

STONEFIELD engineering & design

SCALE: 1" = 30' PROJECT ID: DET-230229

TITLE: SITE PLAN

DRAWING: C-3

SYMBOL	DESCRIPTION
	PROPERTY LINE
100	PROPOSED GRADING CONTOUR
RIDGELINE	PROPOSED GRADING RIDGELINE
	PROPOSED DIRECTION OF DRAINAGE FLOW
G 100.00	PROPOSED GRADE SPOT SHOT
TC 100.50 / BC 100.00	PROPOSED TOP OF CURB / BOTTOM OF CURB SPOT SHOT
FC 100.00	PROPOSED FLUSH CURB SPOT SHOT

GRADING NOTES

1. ALL SOIL AND MATERIAL REMOVED FROM THE SITE SHALL BE DISPOSED OF IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS. ANY GROUNDWATER DE-WATERING PRACTICES SHALL BE PERFORMED UNDER THE SUPERVISION OF A QUALIFIED PROFESSIONAL. THE CONTRACTOR IS REQUIRED TO OBTAIN ALL NECESSARY PERMITS FOR THE DISCHARGE OF DE-WATERED GROUNDWATER. ALL SOIL IMPORTED TO THE SITE SHALL BE CERTIFIED CLEAN FILL. CONTRACTOR SHALL MAINTAIN RECORDS OF ALL FILL MATERIALS BROUGHT TO THE SITE.
2. THE CONTRACTOR IS REQUIRED TO PROVIDE TEMPORARY AND/OR PERMANENT SHORING WHERE REQUIRED DURING EXCAVATION ACTIVITIES, INCLUDING BUT NOT LIMITED TO UTILITY TRENCHES, TO ENSURE THE STRUCTURAL INTEGRITY OF NEARBY STRUCTURES AND STABILITY OF THE SURROUNDING SOILS.
3. PROPOSED TOP OF CURB ELEVATIONS ARE GENERALLY 4 INCHES TO 7 INCHES ABOVE EXISTING GRADES UNLESS OTHERWISE NOTED. THE CONTRACTOR WILL SUPPLY ALL STAKEOUT CURB GRADE SHEETS TO STONEFIELD ENGINEERING & DESIGN, LLC. FOR REVIEW AND APPROVAL PRIOR TO POURING CURBS.
4. THE CONTRACTOR IS RESPONSIBLE TO SET ALL PROPOSED UTILITY COVERS AND RESET ALL EXISTING UTILITY COVERS WITHIN THE PROJECT LIMITS TO PROPOSED GRADE IN ACCORDANCE WITH ANY APPLICABLE MUNICIPAL, COUNTY, STATE AND/OR UTILITY AUTHORITY REGULATIONS.
5. MINIMUM SLOPE REQUIREMENTS TO PREVENT PONDING SHALL BE AS FOLLOWS:
   - CURB GUTTER: 0.50%
   - CONCRETE SURFACES: 0.50%
   - ASPHALT SURFACES: 1.00%
6. A MINIMUM SLOPE OF 1.00% SHALL BE PROVIDED AWAY FROM ALL BUILDINGS. THE CONTRACTOR SHALL ENSURE POSITIVE DRAINAGE FROM THE BUILDING IS ACHIEVED AND SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IF THIS CONDITION CANNOT BE MET.
7. FOR PROJECTS WHERE BASEMENTS ARE PROPOSED, THE DEVELOPER IS RESPONSIBLE TO DETERMINE THE DEPTH TO GROUNDWATER AT THE LOCATION OF THE PROPOSED STRUCTURE. IF GROUNDWATER IS ENCOUNTERED WITHIN THE BASEMENT AREA, SPECIAL CONSTRUCTION METHODS SHALL BE UTILIZED AND REVIEWED/APPROVED BY THE CONSTRUCTION CODE OFFICIAL. IF SUMP PUMPS ARE UTILIZED, ALL DISCHARGES SHALL BE CONNECTED DIRECTLY TO THE PUBLIC STORM SEWER SYSTEM WITH APPROVAL FROM THE GOVERNING STORM SEWER SYSTEM AUTHORITY.

ADA NOTES

1. THE CONTRACTOR SHALL MAINTAIN A MAXIMUM 2.00% SLOPE IN ANY DIRECTION WITHIN THE ADA PARKING SPACES AND ACCESS AISLES.
2. THE CONTRACTOR SHALL PROVIDE COMPLIANT SIGNAGE AT ALL ADA PARKING AREAS IN ACCORDANCE WITH STATE GUIDELINES.
3. THE CONTRACTOR SHALL MAINTAIN A MAXIMUM 5.00% RUNNING SLOPE AND A MAXIMUM OF 2.00% CROSS SLOPE ALONG WALKWAYS WITHIN THE ACCESSIBLE PATH OF TRAVEL (SEE THE SITE PLAN FOR THE LOCATION OF THE ACCESSIBLE PATH). THE CONTRACTOR IS RESPONSIBLE TO ENSURE THE ACCESSIBLE PATH OF TRAVEL IS 36 INCHES WIDE OR GREATER UNLESS INDICATED OTHERWISE WITHIN THE PLAN SET.
4. THE CONTRACTOR SHALL MAINTAIN A MAXIMUM 2.00% SLOPE IN ANY DIRECTION AT ALL LANDINGS. LANDINGS INCLUDE, BUT ARE NOT LIMITED TO, THE TOP AND BOTTOM OF AN ACCESSIBLE RAMP, AT ACCESSIBLE BUILDING ENTRANCES, AT AN AREA IN FRONT OF A WALK-UP ATM, AND AT TURNING SPACES ALONG THE ACCESSIBLE PATH OF TRAVEL. THE LANDING AREA SHALL HAVE A MINIMUM CLEAR AREA OF 60 INCHES BY 60 INCHES UNLESS INDICATED OTHERWISE WITHIN THE PLAN SET.
5. THE CONTRACTOR SHALL MAINTAIN A MAXIMUM 8.33% RUNNING SLOPE AND A MAXIMUM 2.00% CROSS SLOPE ON ANY CURB RAMPS ALONG THE ACCESSIBLE PATH OF TRAVEL. WHERE PROVIDED, CURB RAMP FLARES SHALL NOT HAVE A SLOPE GREATER THAN 10.00% IF A LANDING AREA IS PROVIDED AT THE TOP OF THE RAMP. FOR ALTERATIONS, A CURB RAMP FLARES SHALL NOT HAVE A SLOPE GREATER THAN 8.33% IF A LANDING AREA IS NOT PROVIDED AT THE TOP OF THE RAMP. CURBS RAMPS SHALL NOT RISE MORE THAN 6 INCHES IN ELEVATION WITHOUT A HANDRAIL. THE CLEAR WIDTH OF A CURB RAMP SHALL BE NO LESS THAN 36 INCHES WIDE.
6. ACCESSIBLE RAMPS WITH A RISE GREATER THAN 6 INCHES SHALL CONTAIN COMPLIANT HANDRAILS ON BOTH SIDES OF THE RAMP AND SHALL NOT RISE MORE THAN 30” IN ELEVATION WITHOUT A LANDING AREA IN BETWEEN RAMP RUNS. LANDING AREAS SHALL ALSO BE PROVIDED AT THE TOP AND BOTTOM OF THE RAMP.
7. A SLIP RESISTANT SURFACE SHALL BE CONSTRUCTED ALONG THE ACCESSIBLE PATH AND WITHIN ADA PARKING AREAS.
8. THE CONTRACTOR SHALL ENSURE A MAXIMUM OF ¼ INCHES VERTICAL CHANGE IN LEVEL ALONG THE ACCESSIBLE PATH. WHERE A CHANGE IN LEVEL BETWEEN ¼ INCHES AND ½ INCHES EXISTS, CONTRACTOR SHALL ENSURE THAT THE TOP ¼ INCH CHANGE IN LEVEL IS BEVELED WITH A SLOPE NOT STEEPER THAN 1 UNIT VERTICAL AND 2 UNITS HORIZONTAL (2:1 SLOPE).
9. THE CONTRACTOR SHALL ENSURE THAT ANY OPENINGS (GAPS OR HORIZONTAL SEPARATION) ALONG THE ACCESSIBLE PATH SHALL NOT ALLOW PASSAGE OF A SPHERE GREATER THAN ½ INCH.

30' 0' 30' 60'
GRAPHIC SCALE IN FEET
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SITE DEVELOPMENT PLANS

9101 HIGHLAND ROAD

PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID: 12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
PROFESSIONAL ENGINEER

STONEFIELD engineering & design

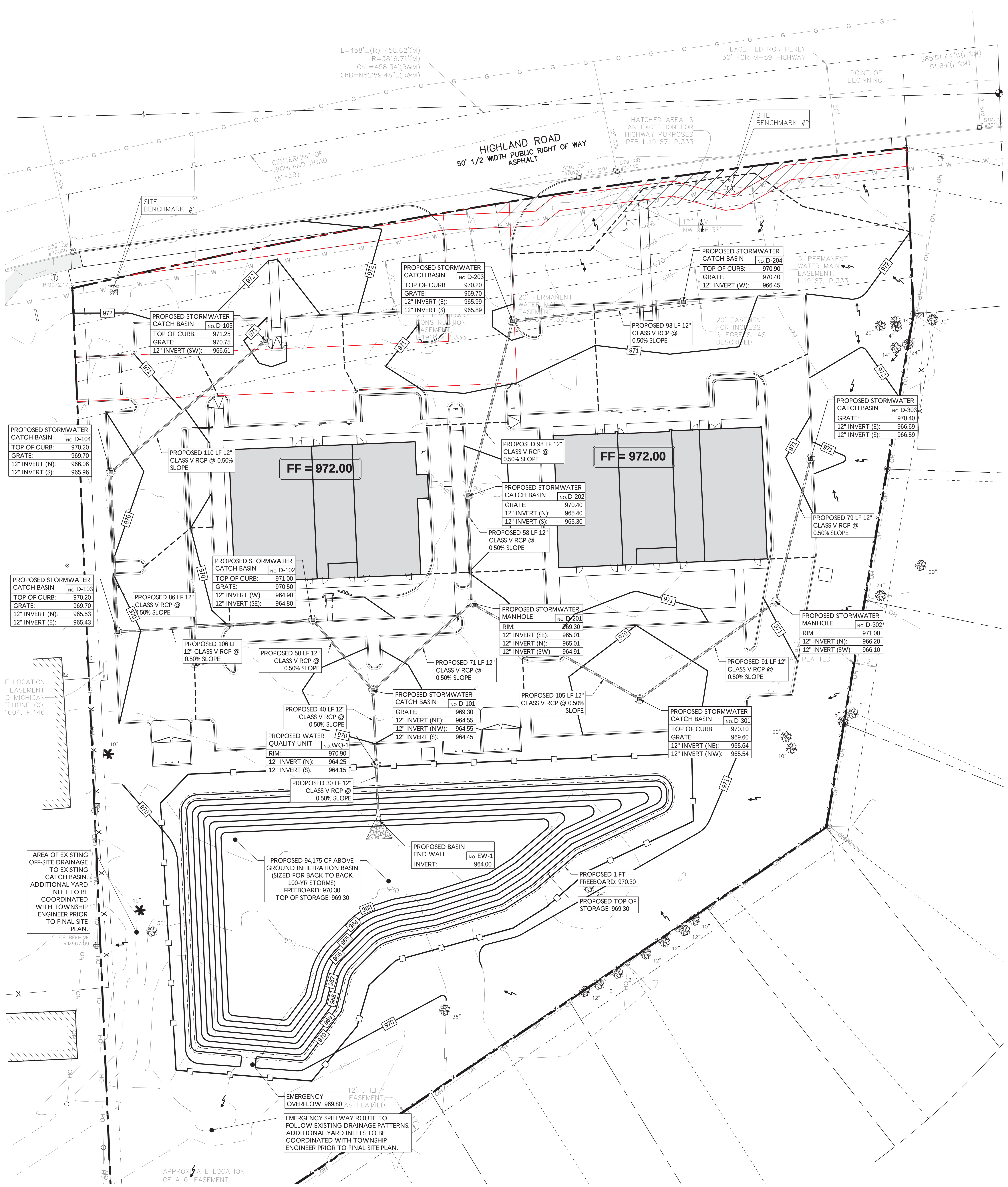
SCALE: 1" = 30' PROJECT ID: DET-230229

TITLE:

GRADING PLAN

DRAWING:

C-4



SYMBOL	DESCRIPTION
	PROPERTY LINE
100	PROPOSED GRADING CONTOUR
RIDGELINE	PROPOSED GRADING RIDGELINE
	PROPOSED STORMWATER STRUCTURES
	PROPOSED STORMWATER PIPING
	PROPOSED UNDERGROUND OUTLET STRUCTURE

WHITE LAKE DETENTION VOLUME REQUIREMENT

V = (33,000)(C)(A)

C (VALUE)	0.590
A (AREA)	195,568 SF (4.49 AC)
V =	**87,413 CF**

SOIL CHARACTERISTICS CHART

TYPE OF SOIL	OSHTEMO-BOYER LOAMY SANDS (13B)	URBAN LAND-SPINKS COMPLEX
PERCENT OF SITE COVERAGE	68.3%	31.7%
HYDROLOGIC SOIL GROUP	A	A
DEPTH TO RESTRICTIVE LAYER	> 80 INCHES	> 80 INCHES
SOIL PERMEABILITY	1.98 TO 5.95 IN / HR	1.98 TO 5.95 IN / HR
DEPTH TO WATER TABLE	> 80 INCHES	> 80 INCHES

STORMWATER MANAGEMENT CALCULATIONS

(Based on Oakland County Stormwater Management Regulations (11-21-2021 ordinance)

Project: 9101 Highland Road White Lake Twp, MI **Designer:** JRC **Date:** 10/14/24

Determination of Surface Runoff

Landcover		Area (AC)	Area (SF)		C-Value*		Weighted Value
Building / Pavement		1.98	86,236	x	0.95	=	81,924
Basin Area		0.47	20,572	x	1.00	=	20,572
Landscaped Areas	HSG A	2.04	88,760	x	0.15	=	13,314
Subtotals		**4.49**	**195,568**				115,810

C-values obtained from Oakland County Standards, Section III, Part 'A'

$I_{WQ} = 30.20P^{0.22} / (9.17+T)^{0.81}$

T_C, Time of Concentration:

- Residential - Assume 20 min
- Commercial/Industrial - Assume 15 min
- Sites < 5 acres - Assume 10 min

Composite C Value, C:	0.590	
Water Quality Intensity, I_{WQ}:	2.76	IN/HR
Design Storm Period, P:	1	YEARS
Time of Concentration, T_C:	10.0	MINS

Detention Volume Requirement (White Lake)

V= 33,000 x C x A

Detention Volume Required, V: 87,412.97 CF

Proposed Basin Volume

Elevation	Surface Area (SF)	Total Volume (CF)	
963.00	9315	0	
964.00	10,887	10,101	
965.00	12,617	21,853	
966.00	14,470	35,397	
967.00	16,451	50,857	
968.00	18,502	68,334	
969.00	20,605	87,887	
969.30	21,317	**94,175**	Top of Storage Elevation
970.30	23,495	116,581	Freeboard

Basin volume calculated based on a trapezoidal prism

DEWATERING CALCULATIONS

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Discarded (cfs)
0.00	0.00	0	963.00	0.00
2.50	0.00	0	963.00	0.00
5.00	0.00	0	963.00	0.00
7.50	0.03	12	963.04	0.02
10.00	0.47	924	963.43	0.21
12.50	4.88	55,657	967.60	1.28
15.00	1.30	62,686	967.99	1.37
17.50	0.83	59,565	967.82	1.33
20.00	0.57	54,215	967.52	1.26
22.50	0.51	48,056	967.16	1.18
25.00	0.00	40,776	966.71	1.08
27.50	0.00	31,645	966.12	0.95
30.00	0.00	23,622	965.55	0.83
32.50	0.00	16,593	965.01	0.73
35.00	0.00	10,535	964.51	0.62
37.50	0.00	5,426	964.04	0.52
40.00	0.00	1,754	963.59	0.29
42.50	0.00	131	963.16	0.07
45.00	0.00	0	963.00	0.00
47.50	0.00	0	963.00	0.00
50.00	0.00	0	963.00	0.00
52.50	0.00	0	963.00	0.00
55.00	0.00	0	963.00	0.00
57.50	0.00	0	963.00	0.00
60.00	0.00	0	963.00	0.00
62.50	0.00	0	963.00	0.00
65.00	0.00	0	963.00	0.00
67.50	0.00	0	963.00	0.00
70.00	0.00	0	963.00	0.00
72.50	0.00	0	963.00	0.00
75.00	0.00	0	963.00	0.00
77.50	0.00	0	963.00	0.00
80.00	0.00	0	963.00	0.00

* *PER HYDROCAD MODEL, STORMWATER BASIN DEWATERS IN 45 HOURS ASSUMING AN INFILTRATION RATE OF 2.00 IN / HR (INFILTRATION TO BE CONFIRMED WITH GEOTECHNICAL INVESTIGATION PRIOR TO FINAL SITE PLAN.*

DRAINAGE AND UTILITY NOTES

1. THE CONTRACTOR TO PERFORM A TEST PIT PRIOR TO CONSTRUCTION (RECOMMEND 30 DAYS PRIOR) AT LOCATIONS OF EXISTING UTILITY CROSSINGS FOR STORMWATER IMPROVEMENTS. SHOULD A CONFLICT EXIST, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IN WRITING.
2. CONTRACTOR SHALL START CONSTRUCTION OF STORM LINES AT THE LOWEST INVERT AND WORK UP-GRADIENT.
3. THE CONTRACTOR IS REQUIRED TO CALL THE APPROPRIATE AUTHORITY FOR NOTICE OF CONSTRUCTION/EXCAVATION AND UTILITY MARK OUT PRIOR TO THE START OF CONSTRUCTION IN ACCORDANCE WITH STATE LAW. CONTRACTOR IS REQUIRED TO CONFIRM THE HORIZONTAL AND VERTICAL LOCATION OF UTILITIES IN THE FIELD. SHOULD A DISCREPANCY EXIST BETWEEN THE FIELD LOCATION OF A UTILITY AND THE LOCATION SHOWN ON THE PLAN SET OR SURVEY, THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IMMEDIATELY IN WRITING.
4. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN A RECORD OF THE AS-BUILT LOCATIONS OF ALL PROPOSED UNDERGROUND INFRASTRUCTURE. THE CONTRACTOR SHALL NOTE ANY DISCREPANCIES BETWEEN THE AS-BUILT LOCATIONS AND THE LOCATIONS DEPICTED WITHIN THE PLAN SET. THIS RECORD SHALL BE PROVIDED TO THE OWNER FOLLOWING COMPLETION OF WORK.

EXCAVATION, SOIL PREPARATION, AND DEWATERING NOTES

1. THE CONTRACTOR IS REQUIRED TO REVIEW THE REFERENCED GEOTECHNICAL DOCUMENTS PRIOR TO CONSTRUCTION, THESE DOCUMENTS SHALL BE CONSIDERED A PART OF THE PLAN SET.
2. THE CONTRACTOR IS REQUIRED TO PREPARE SUBGRADE SOILS BENEATH ALL PROPOSED IMPROVEMENTS AND BACKFILL ALL EXCAVATIONS IN ACCORDANCE WITH RECOMMENDATIONS BY THE GEOTECHNICAL ENGINEER OF RECORD.
3. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING SHORING FOR ALL EXCAVATIONS AS REQUIRED. CONTRACTOR SHALL HAVE THE SHORING DESIGN PREPARED BY A QUALIFIED PROFESSIONAL. SHORING DESIGNS SHALL BE SUBMITTED TO STONEFIELD ENGINEERING & DESIGN, LLC. AND THE OWNER PRIOR TO THE START OF CONSTRUCTION.
4. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL OPEN EXCAVATIONS ARE PERFORMED AND PROTECTED IN ACCORDANCE WITH THE LATEST OSHA REGULATIONS.
5. THE CONTRACTOR IS RESPONSIBLE FOR ANY DEWATERING DESIGN AND OPERATIONS, AS REQUIRED, TO CONSTRUCT THE PROPOSED IMPROVEMENTS. THE CONTRACTOR SHALL OBTAIN ANY REQUIRED PERMITS FOR DEWATERING OPERATIONS AND GROUNDWATER DISPOSAL.

STORMWATER INFILTRATION BMP CONSTRUCTION NOTES

1. PRIOR TO THE START OF CONSTRUCTION, ANY AREA DESIGNATED TO BE USED FOR AN INFILTRATION BMP (E.G. BASIN, BIORETENTION AREA, ETC.) SHALL BE FENCED OFF AND SHALL NOT BE UTILIZED AS STORAGE FOR CONSTRUCTION EQUIPMENT OR AS A STOCKPILE AREA FOR CONSTRUCTION MATERIALS. NO ACTIVITY SHALL BE PERMITTED WITHIN THE INFILTRATION BASIN AREA UNLESS RELATED TO THE CONSTRUCTION OF THE INFILTRATION BASIN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY ALL SUBCONTRACTORS OF BASIN AREA RESTRICTIONS.
2. THE CONTRACTOR SHALL MAKE EVERY EFFORT, WHERE PRACTICAL, TO AVOID SUBGRADE SOIL COMPACTION IN THE AREAS DESIGNATED TO BE USED FOR AN INFILTRATION BMP.
3. ALL EXCAVATION WITHIN THE LIMITS OF ANY INFILTRATION BMP SHALL BE PERFORMED WITH THE LIGHTEST PRACTICAL EXCAVATION EQUIPMENT. ALL EXCAVATION EQUIPMENT SHALL BE PLACED OUTSIDE THE LIMITS OF THE BASIN WHERE FEASIBLE. THE USE OF LIGHT-WEIGHT, RUBBER-TIRED EQUIPMENT (LESS THAN 8 PSI APPLIED TO THE GROUND SURFACE) IS RECOMMENDED WITHIN THE BASIN LIMITS.
4. THE SEQUENCE OF SITE CONSTRUCTION SHALL BE COORDINATED WITH BASIN CONSTRUCTION TO ADHERE TO SEQUENCING LIMITATIONS.
5. DURING THE FINAL GRADING OF AN INFILTRATION BASIN, THE BOTTOM OF THE BASIN SHALL BE DEEPLY TILLED WITH A ROTARY TILLER OR DISC HARROW AND THEN SMOOTHED OUT WITH A LEVELING DRAW OR EQUIVALENT GRADING EQUIPMENT. ALL GRADING EQUIPMENT SHALL BE LOCATED OUTSIDE OF THE BASIN BOTTOM WHERE FEASIBLE.
6. FOLLOWING CONSTRUCTION OF AN INFILTRATION BASIN, SOIL INFILTRATION TESTING BY A LICENSED GEOTECHNICAL ENGINEER IS REQUIRED TO CERTIFY COMPLIANCE WITH THE DESIGN INFILTRATION RATES IN ACCORDANCE WITH APPENDIX E OF THE NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION'S BEST MANAGEMENT PRACTICES MANUAL, LATEST EDITION. IF THE FIELD INFILTRATION RATES ARE LOWER THAN THE RATE USED DURING DESIGN, THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IN WRITING IMMEDIATELY TO DETERMINE THE APPROPRIATE COURSE OF ACTION.
7. THE CONTRACTOR SHALL NOTIFY THE MUNICIPALITY TO DETERMINE IF WITNESS TESTING IS REQUIRED DURING INFILTRATION BASIN EXCAVATION AND/OR SOIL INFILTRATION TESTING.

30' 0' 30' 60'

GRAPHIC SCALE IN FEET
1" = 30'

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1	11/29/2023	JRC/JP	SUBMISSION FOR REZONING

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Phone 248.247.1115

SITE DEVELOPMENT PLANS

9101 HIGHLAND ROAD

PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID: 12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

STATE OF MICHIGAN JONATHAN REID COOKSEY ENGINEER PROFESSIONAL

STONEFIELD engineering & design

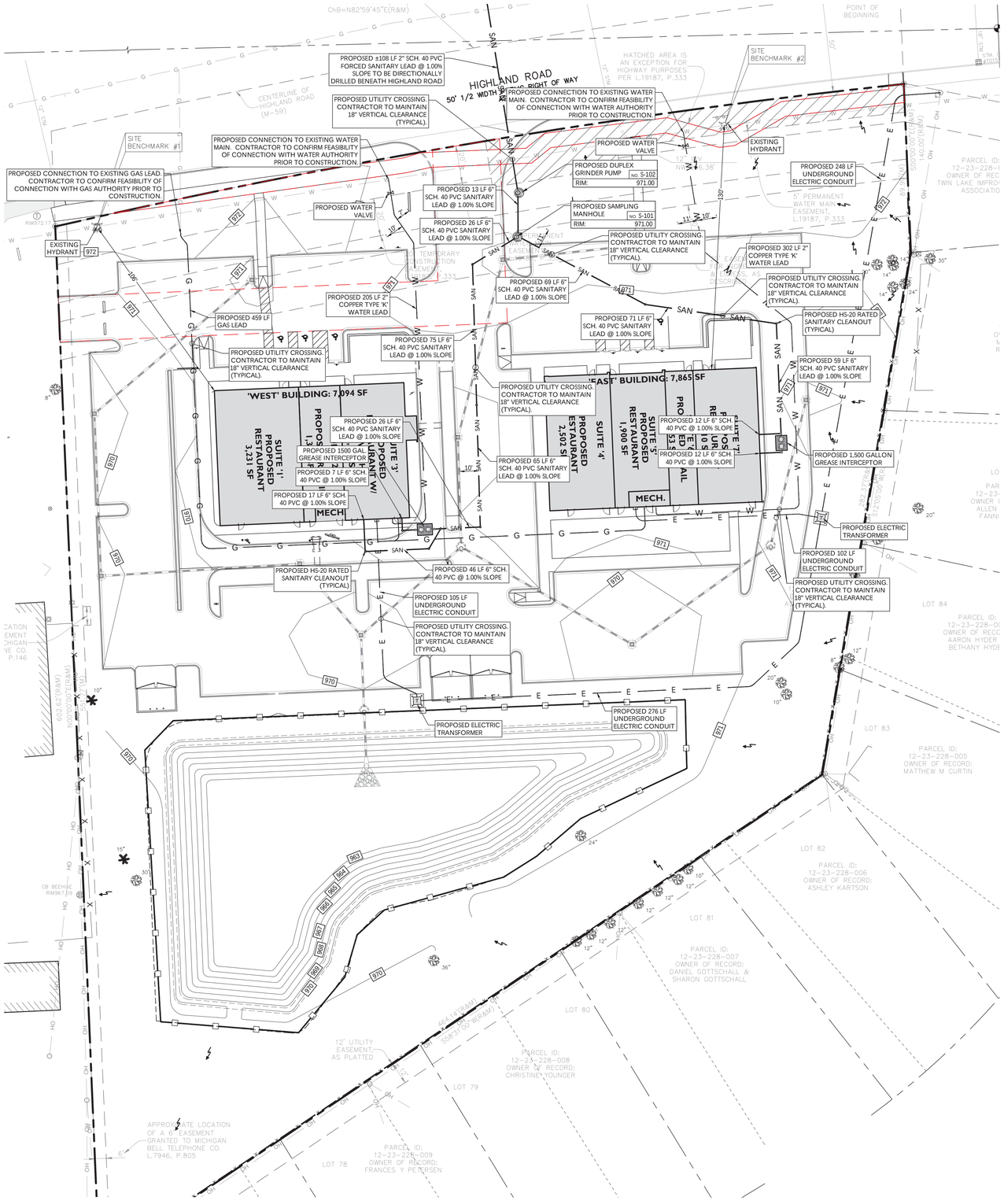
SCALE: 1" = 30' PROJECT ID: DET-230229

TITLE:

STORMWATER MANAGEMENT PLAN

DRAWING:

C-5



SYMBOL	DESCRIPTION
	PROPERTY LINE
SAN	PROPOSED SANITARY LATERAL
W	PROPOSED DOMESTIC WATER SERVICE
E	PROPOSED ELECTRIC CONDUITS
G	PROPOSED GAS LINE
	PROPOSED VALVE
	PROPOSED CLEANOUT
T	PROPOSED TRANSFORMER ON CONCRETE PAD WITH BOLLARDS

MANHOLE SCHEDULE

NUM	TYPE	RIM (FT)	SIZE (IN)	DIR	INV ELEV (FT)
70065	CATCH BASIN	971.68	12	N	968.03
70131	CATCH BASIN	970.71	12	E	966.71
70140	CATCH BASIN	970.70	12	W	966.50
		970.70	12	N	966.45
		970.70	12	S	966.55
70157	CATCH BASIN	971.02	18	N	964.12

DRAINAGE AND UTILITY NOTES

1. THE CONTRACTOR IS REQUIRED TO CALL THE APPROPRIATE AUTHORITY FOR NOTICE OF CONSTRUCTION/EXCAVATION AND UTILITY MARK OUT PRIOR TO THE START OF CONSTRUCTION IN ACCORDANCE WITH STATE LAW. CONTRACTOR IS REQUIRED TO CONFIRM THE HORIZONTAL AND VERTICAL LOCATION OF UTILITIES IN THE FIELD. SHOULD A DISCREPANCY EXIST BETWEEN THE FIELD LOCATION OF A UTILITY AND THE LOCATION SHOWN ON THE PLAN SET OR SURVEY, THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC IMMEDIATELY IN WRITING.
2. THE CONTRACTOR IS RESPONSIBLE TO PROTECT AND MAINTAIN IN OPERATION ALL UTILITIES NOT DESIGNATED TO BE REMOVED.
3. THE CONTRACTOR IS RESPONSIBLE FOR REPAIRING ANY DAMAGE TO ANY EXISTING UTILITY IDENTIFIED TO REMAIN WITHIN THE LIMITS OF THE PROPOSED WORK DURING CONSTRUCTION.
4. A MINIMUM HORIZONTAL SEPARATION OF 10 FEET IS REQUIRED BETWEEN ANY SANITARY SEWER SERVICE AND ANY WATER LINES. IF THIS SEPARATION CANNOT BE PROVIDED, A CONCRETE ENCASEMENT SHALL BE UTILIZED FOR THE SANITARY SEWER SERVICE AS APPROVED BY STONEFIELD ENGINEERING & DESIGN, LLC.
5. ALL WATER LINES SHALL BE VERTICALLY SEPARATED ABOVE SANITARY SEWER LINES BY A MINIMUM DISTANCE OF 18 INCHES. IF THIS SEPARATION CANNOT BE PROVIDED, A CONCRETE ENCASEMENT SHALL BE UTILIZED FOR THE SANITARY SEWER SERVICE AS APPROVED BY STONEFIELD ENGINEERING & DESIGN, LLC.
6. THE CONTRACTOR TO PERFORM A TEST PIT PRIOR TO CONSTRUCTION (RECOMMEND 30 DAYS PRIOR) AT LOCATIONS OF EXISTING UTILITY CROSSINGS FOR WATER AND SANITARY SEWER CONNECTION IMPROVEMENTS. SHOULD A CONFLICT EXIST, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IN WRITING.
7. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING GAS, ELECTRIC AND TELECOMMUNICATION CONNECTIONS WITH THE APPROPRIATE GOVERNING AUTHORITY.
8. CONTRACTOR SHALL START CONSTRUCTION OF ANY GRAVITY SEWER AT THE LOWEST INVERT AND WORK UP-GRADIENT.
9. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN A RECORD SET OF PLANS REFLECTING THE LOCATION OF EXISTING UTILITIES THAT HAVE BEEN CAPPED, ABANDONED, OR RELOCATED BASED ON THE DEMOLITION/REMOVAL ACTIVITIES REQUIRED IN THIS PLAN SET. THIS DOCUMENT SHALL BE PROVIDED TO THE OWNER FOLLOWING COMPLETION OF WORK.
10. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN A RECORD OF THE AS-BUILT LOCATIONS OF ALL PROPOSED UNDERGROUND INFRASTRUCTURE. THE CONTRACTOR SHALL NOTE ANY DISCREPANCIES BETWEEN THE AS-BUILT LOCATIONS AND THE LOCATIONS DEPICTED WITHIN THE PLAN SET. THIS RECORD SHALL BE PROVIDED TO THE OWNER FOLLOWING COMPLETION OF WORK.

30' 0' 30' 60'

GRAPHIC SCALE IN FEET

1" = 30'

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PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID:12-23-227-003
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WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
No. 6201062276
LICENSED PROFESSIONAL ENGINEER

STONEFIELD engineering & design

SCALE: 1" = 30' | PROJECT ID: DET-230229

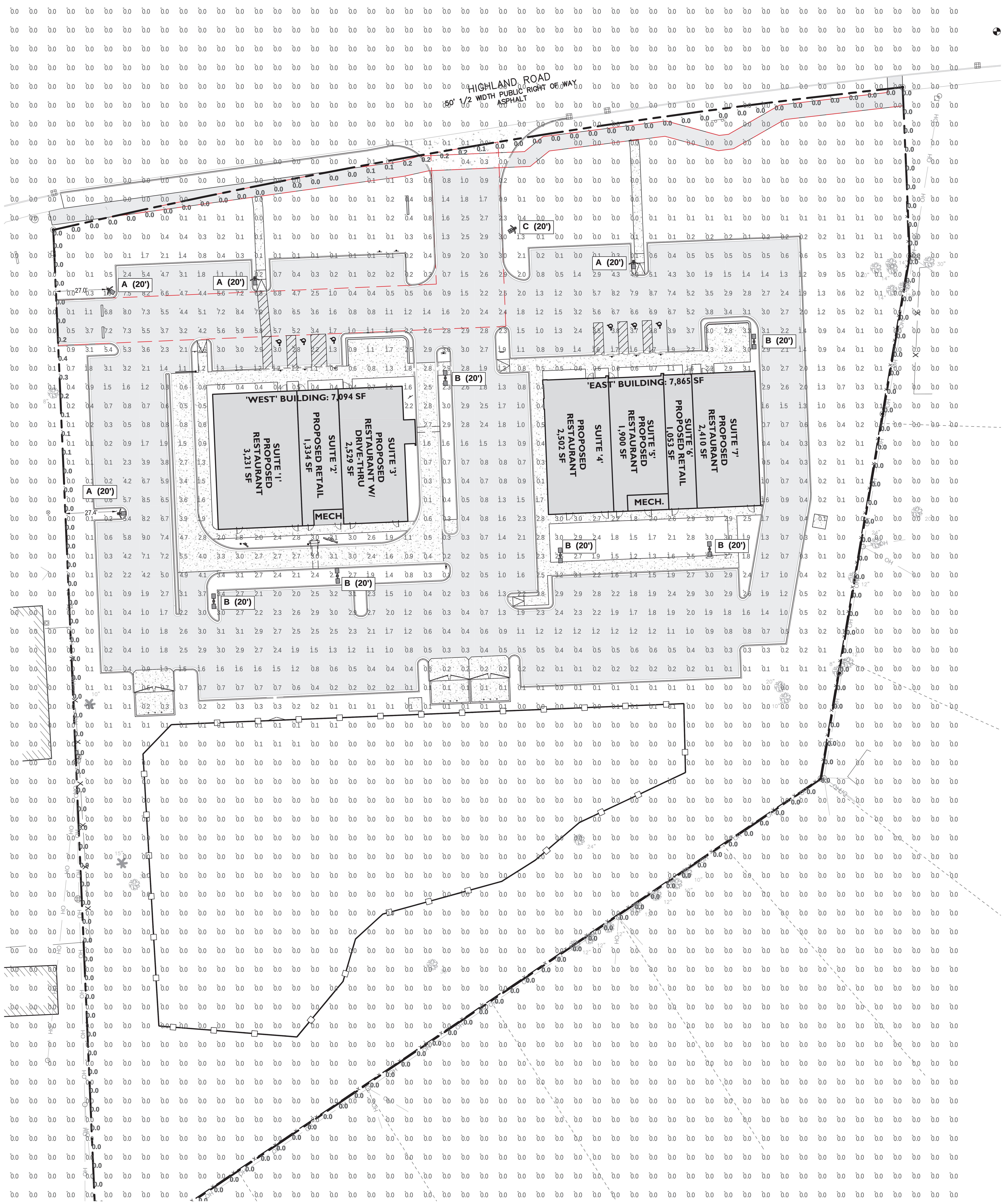
TITLE:

UTILITY PLAN

DRAWING:

C-6

V:\DET\2023\DET-230229-ARTHRITY 1\9 INVESTMENT 9101 HIGHLAND ROAD, WHITE LAKE, MI\CAD\PLOTS\DET-06-UTIL.DWG



SYMBOL	DESCRIPTION
A (XX')	PROPOSED LIGHTING FIXTURE (MOUNTING HEIGHT)
x.x	PROPOSED LIGHTING INTENSITY (FOOTCANDLES)
(symbol)	PROPOSED AREA LIGHT

LIGHTING REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
§ 5.18.G.3	MAXIMUM FC AT PROPERTY LINE (NON-RESIDENTIAL) 1 FC	0.5 FT
§ 5.18.G.3	MAXIMUM FC AT PROPERTY LINE (RESIDENTIAL) 0.2 FC	0.0 FC
§ 5.18.G.7	MAXIMUM HEIGHT WITHIN 26 FT TO 60 FT OF PROPERTY LINE 20 FT	20 FT
§ 5.18.G.3	MINIMUM FIXTURE LIGHT FROM PROPERTY LINE 5 FT	27.0 FT
§ 5.18.G.viii	FOOT CANDLE LIMITS FOR VARIOUS LAND USES AVERAGE FOR ENTIRE SITE:	
	GENERAL: 0.5	N/A
	DRIVEWAY: 2.0	1.66
	PARKING: 2.0	2.00
	WALKS: 1.0	0.79
	PROTECTIVE: 1.0	N/A
	BUILDING: 5.0	N/A
	LOADING AREAS: 1.0	0.97

LIGHTING STATISTICS

DESCRIPTION	AVERAGE	MINIMUM	MAXIMUM
OVERALL PARCEL	1.06 FC	0.00 FC	9.0 FC
PROPERTY LINE (NON-RESIDENTIAL)	0.01 FC	0.00 FC	0.4 FC
PROPERTY LINE (RESIDENTIAL)	0.00 FC	0.00 FC	0.0 FC

PROPOSED LUMINAIRE SCHEDULE

SYMBOL	LABEL	QUANTITY	SECURITY LIGHTING	DISTRIBUTION	LLF	MANUFACTURER	CONTROL	IES FILE
	A	4	MIRADA MEDIUM- MRM OUTDOOR LED AREA LIGHT SINGLE WITH HOUSE SIDE SHIELD	FT	0.9	LSI INDUSTRIES	-	MRM-LED-30L-SIL-FT-40-70CRI-IL.IES
	B	6	MIRADA MEDIUM- MRM OUTDOOR LED AREA LIGHT TWO @ 180 °	FT	0.9	LSI INDUSTRIES	-	MRM-LED-12L-SIL-FT-40-70CRI.IES
	C	1	MIRADA MEDIUM- MRM OUTDOOR LED AREA LIGHT SINGLE WITH HOUSE SIDE SHIELD	FT	0.9	LSI INDUSTRIES	-	MRM-LED-12L-SIL-FT-40-70CRI-IL.IES

(1) CUT OFF FIXTURES ARE REQUIRED

FIXTURES 'A', 'B', 'C'

GENERAL LIGHTING NOTES

1. THE LIGHTING LEVELS DEPICTED WITHIN THE PLAN SET ARE CALCULATED UTILIZING DATA OBTAINED FROM THE LISTED MANUFACTURER. ACTUAL ILLUMINATION LEVELS AND PERFORMANCE OF ANY PROPOSED LIGHTING FIXTURE MAY VARY DUE TO UNCONTROLLABLE VARIABLES SUCH ARE WEATHER, VOLTAGE SUPPLY, LAMP TOLERANCE, EQUIPMENT SERVICE LIFE AND OTHER VARIABLE FIELD CONDITIONS.
2. WHERE APPLICABLE, THE EXISTING LIGHT LEVELS DEPICTED WITHIN THE PLAN SET SHALL BE CONSIDERED APPROXIMATE. THE EXISTING LIGHT LEVELS ARE BASED ON FIELD OBSERVATIONS AND THE MANUFACTURER'S DATA OF THE ASSUMED OR MOST SIMILAR LIGHTING FIXTURE MODEL.
3. UNLESS NOTED ELSEWHERE WITHIN THIS PLAN SET, THE LIGHT LOSS FACTORS USED IN THE LIGHTING ANALYSIS ARE AS FOLLOWS:
   - LIGHT EMITTING DIODES (LED): 0.90
   - HIGH PRESSURE SODIUM: 0.72
   - METAL HALIDE: 0.72
4. THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. IN WRITING, PRIOR TO THE START OF CONSTRUCTION, OF ANY PROPOSED LIGHTING LOCATIONS THAT CONFLICT WITH EXISTING/ PROPOSED DRAINAGE, UTILITY, OR OTHER IMPROVEMENTS.
5. THE CONTRACTOR IS RESPONSIBLE TO PREPARE A WIRING PLAN AND PROVIDE ELECTRIC SERVICE TO ALL PROPOSED LIGHTING FIXTURES. THE CONTRACTOR IS REQUIRED TO PREPARE AN AS-BUILT PLAN OF WIRING AND PROVIDE COPIES TO THE OWNER AND STONEFIELD ENGINEERING & DESIGN, LLC.

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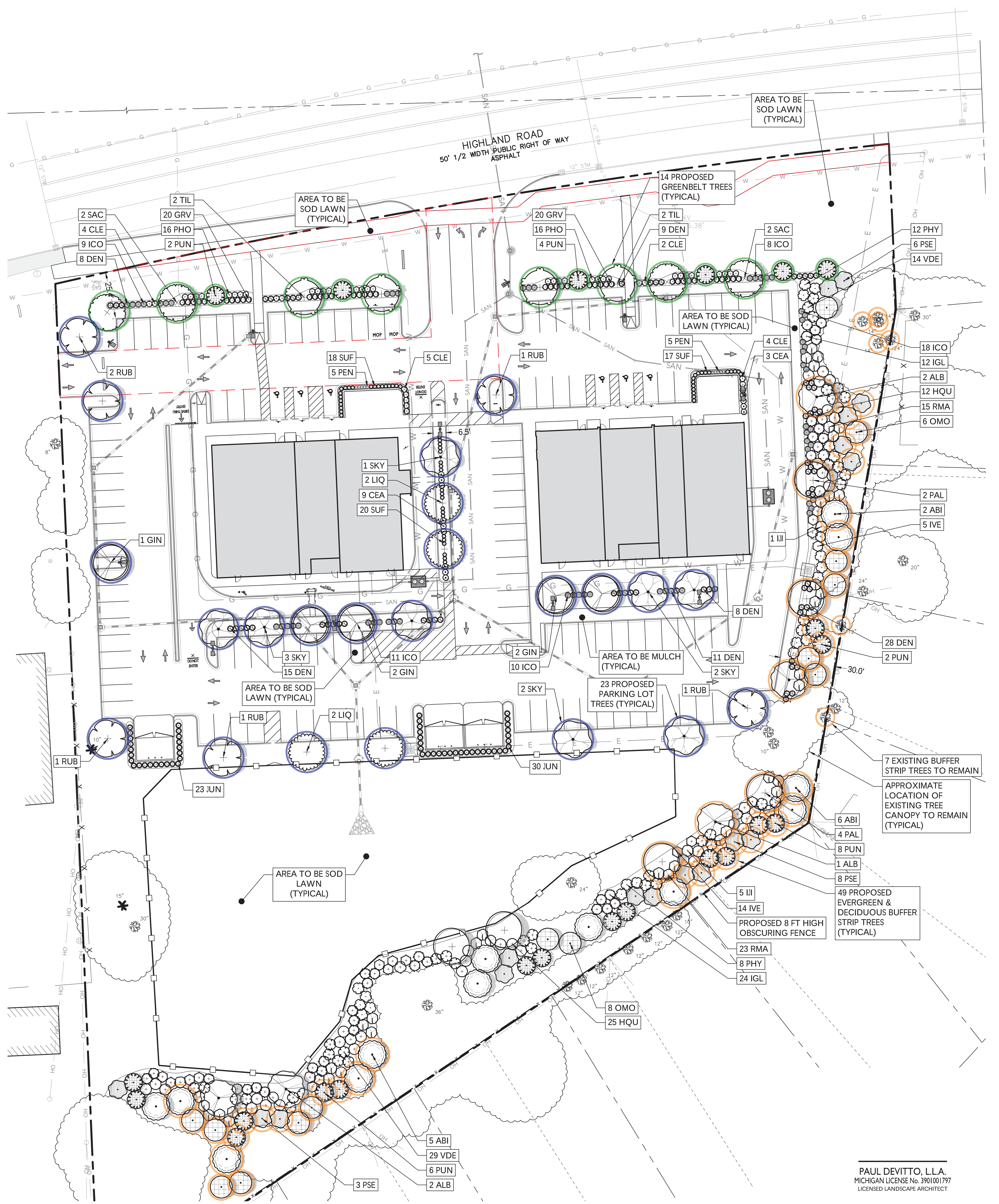
STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
PROFESSIONAL

STONEFIELD engineering & design

SCALE: 1" = 30' | PROJECT ID: DET-230229

TITLE: LIGHTING PLAN

DRAWING: C-7



LANDSCAPING AND BUFFER REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
	BUFFER STRIP STANDARDS (EAST PROPERTY LINE)	
§ 5.19.C.i.	MINIMUM WIDTH: 20 FT	30.0 FT
TABLE 5.19	5 FT HIGH VISUAL BARRIER REQUIRED	COMPLIES
	1 DECIDUOUS/EVERGREEN TREE & 4 SHRUBS FOR EVERY 15 LF	
	EAST: 836 FT	
	(836 FT) * (1 TREE / 15 LF) = 56 TREES	7 EXISTING TREES 49 PROPOSED TREES
	(836 FT) * (4 SHRUBS / 15 LF) = 223 SHRUBS	223 SHRUBS
	FENCE STANDARDS	
	MINIMUM HEIGHT: 6-8 FT	8 FT
	GREENBELT STANDARDS (HIGHLAND ROAD)	
	MINIMUM WIDTH: 20 FT	25.4 FT
	1 DECIDUOUS/EVERGREEN TREE & 8 SHRUBS FOR EVERY 30 LF	
	HIGHLAND ROAD: 414 FT	
	(414 FT) * (1 TREE / 30 LF) = 14 TREES	14 TREES
	(414 FT) * (8 SHRUBS / 30 LF) = 110 SHRUBS	110 SHRUBS
	REQUIRED SCREENING	
§ 5.19.D.i.	RB ZONE ADJACENT TO R1-C: BUFFER STRIP & FENCE REQUIRED	COMPLIES
TABLE 5.19.D	RB ZONE ADJACENT TO ROW: GREENBELT REQUIRED	COMPLIES
	INTERIOR LOT LANDSCAPING	
§ 5.19.E.	MINIMUM LOT AREA LANDSCAPING: 15%	
	(195,568 SF) * (0.15)= 29,335 SF	110,896 SF (56%)
	1 TREE & 5 SHRUBS PER 300 SF OF REQUIRED LANDSCAPING	
	(29,335 SF) * (1 TREE / 300 SF) = 97 TREES	16 EXISTING TREES 81 PROPOSED TREES
	(29,335 SF) * (5 SHRUBS / 300 SF) = 489 SHRUBS	489 SHRUBS
§ 5.19.G.ii	PARKING LOT LANDSCAPING	
	20 SF OF LANDSCAPING PER PARKING SPACE	
	(117 SPACES) * (20 SF / 1 SPACE) = 2,340 SF	7,199 SF
	1 TREE & 3 SHRUBS PER 100 SF OF REQUIRED LANDSCAPING	
	(2,340 SF) * (1 TREE / 100 SF) = 23 TREES	23 TREES
	(2,340 SF) * (3 SHRUBS / 100 SF) = 70 SHRUBS	70 SHRUBS
	MINIMUM AREA (CONTAINING TREES): 50 SF	50 SF
	MINIMUM WIDTH (CONTAINING TREES): 5 FT	6.5 FT

PLANT SCHEDULE

SYMBOL	CODE	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONTAINER
			DECIDUOUS TREES			
	SAC	4	ACER SACCHARUM 'CADDO'	CADDO SUGAR MAPLE	2.5" - 3" CAL	B&B
	GIN	5	GINKGO BILOBA 'AUTUMN GOLD'	AUTUMN GOLD MAIDENHAIR TREE	2.5" - 3" CAL	B&B
	SKY	8	GLEDITSIA TRIACANTHOS INERMIS 'SKYCOLE'	SKYLINE HONEY LOCUST	2.5" - 3" CAL	B&B
	LIQ	4	LIQUIDAMBAR STYRACIFLUA 'MORAINE'	MORAINE SWEET GUM	2.5" - 3" CAL	B&B
	ALB	5	QUERCUS ALBA	WHITE OAK	2.5" - 3" CAL	B&B
	PAL	6	QUERCUS PALUSTRIS	PIN OAK	2.5" - 3" CAL	B&B
	RUB	6	QUERCUS RUBRA	NORTHERN RED OAK	2.5" - 3" CAL	B&B
	TIL	4	TILIA CORDATA	LITTLELEAF LINDEN	2.5" - 3" CAL	B&B
			EVERGREEN TREES			
	ABI	13	ABIES CONCOLOR	WHITE FIR	7` - 8` HT	B&B
	JUN	53	JUNIPERUS SCOPULORUM 'SKYROCKET'	SKYROCKET JUNIPER	7` - 8` HT	B&B
	OMO	14	PICEA OMORIKA	SERBIAN SPRUCE	7` - 8` HT	B&B
	PUN	22	PICEA PUNGENS	COLORADO SPRUCE	7` - 8` HT	B&B
	PSE	17	PSEUDOTSUGA MENZIESII	DOUGLAS FIR	7` - 8` HT	B&B
			SHRUBS			
	CEA	21	CEANOTHUS AMERICANUS	NEW JERSEY TEA	30" - 36"	POT
	CLE	15	CLETHRA ALNIFOLIA 'RUBY SPICE'	RUBY SPICE SUMMERSWEET	30" - 36"	POT
	HQU	37	HYDRANGEA QUERCIFOLIA	OAKLEAF HYDRANGEA	30" - 36"	POT
	IVE	19	ILEX VERTICILLATA	WINTERBERRY	30" - 36"	POT
	IJI	6	ILEX VERTICILLATA 'JIM DANDY'	JIM DANDY WINTERBERRY	30" - 36"	POT
	PHY	20	PHYSOCARPUS OPULIFOLIUS	NINEBARK	30" - 36"	POT
	PHO	32	PHYSOCARPUS OPULIFOLIUS 'LITTLE DEVIL'	LITTLE DEVIL DWARF NINEBARK	30" - 36"	POT
	VDE	43	VIBURNUM DENTATUM	VIBURNUM	30" - 36"	POT
			EVERGREEN SHRUBS			
	SUF	85	BUXUS SEMPERVIRENS 'SUFFRUTICOSA'	SUFFRUTICOSA COMMON BOXWOOD	12" - 15"	POT
	GRV	40	BUXUS X 'GREEN VELVET'	GREEN VELVET BOXWOOD	12" - 15"	POT
	IGL	36	ILEX GLABRA	INKBERRY HOLLY	30" - 36"	POT
	ICO	56	ILEX GLABRA 'COMPACTA'	COMPACT INKBERRY	30" - 36"	POT
	RMA	38	RHODODENDRON MAXIMUM	ROSEBAY RHODODENDRON	30" - 36"	POT
	DEN	74	TAXUS X MEDIA 'DENSIFORMIS'	DENSE ANGLO-JAPANESE YEW	30" - 36"	POT
			GRASSES			
	PEN	10	PENNISETUM ALOPECUROIDES 'LITTLE BUNNY'	LITTLE BUNNY FOUNTAIN GRASS	1 GAL.	POT

NOTE: IF ANY DISCREPANCIES OCCUR BETWEEN AMOUNTS SHOWN ON THE LANDSCAPE PLAN AND WITHIN THE PLANT LIST, THE PLAN SHALL DICTATE.

SYMBOL	DESCRIPTION
(green line)	PROPOSED GREENBELT TREES
(orange line)	PROPOSED BUFFER STRIP TREES
(blue line)	PROPOSED PARKING LOT TREES

811
Know what's **below**
Call before you dig.

IRRIGATION NOTE:

IRRIGATION CONTRACTOR TO PROVIDE A DESIGN FOR AN IRRIGATION SYSTEM SEPARATING PLANTING BEDS FROM LAWN AREA. PRIOR TO CONSTRUCTION, DESIGN IS TO BE SUBMITTED TO THE PROJECT LANDSCAPE DESIGNER FOR REVIEW AND APPROVAL. WHERE POSSIBLE, DRIP IRRIGATION AND OTHER WATER CONSERVATION TECHNIQUES SUCH AS RAIN SENSORS SHALL BE IMPLEMENTED. CONTRACTOR TO VERIFY MAXIMUM ON SITE DYNAMIC WATER PRESSURE AVAILABLE MEASURED IN PSI. PRESSURE REDUCING DEVICES OR BOOSTER PUMPS SHALL BE PROVIDED TO MEET SYSTEM PRESSURE REQUIREMENTS. DESIGN TO SHOW ALL VALVES, PIPING, HEADS, BACKFLOW PREVENTION, METERS, CONTROLLERS, AND SLEEVES WITHIN HARDSCAPE AREAS.

LANDSCAPING NOTES

1. THE CONTRACTOR SHALL RESTORE ALL DISTURBED GRASS AND LANDSCAPED AREAS TO MATCH EXISTING CONDITIONS UNLESS INDICATED OTHERWISE WITHIN THE PLAN SET.
2. THE CONTRACTOR SHALL RESTORE ALL DISTURBED LAWN AREAS WITH A MINIMUM 4 INCH LAYER OF TOPSOIL AND SEED.
3. THE CONTRACTOR SHALL RESTORE MULCH AREAS WITH A MINIMUM 3 INCH LAYER OF MULCH .
4. THE MAXIMUM SLOPE ALLOWABLE IN LANDSCAPE RESTORATION AREAS SHALL BE 3 FEET HORIZONTAL TO 1 FOOT VERTICAL (3:1 SLOPE) UNLESS INDICATED OTHERWISE WITHIN THE PLAN SET.
5. THE CONTRACTOR IS REQUIRED TO LOCATE ALL SPRINKLER HEADS IN AREA OF LANDSCAPING DISTURBANCE PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL RELOCATE SPRINKLER HEADS AND LINES IN ACCORDANCE WITH OWNER'S DIRECTION WITHIN AREAS OF DISTURBANCE.
6. THE CONTRACTOR SHALL ENSURE THAT ALL DISTURBED LANDSCAPED AREAS ARE GRADED TO MEET FLUSH AT THE ELEVATION OF WALKWAYS AND TOP OF CURB ELEVATIONS EXCEPT UNLESS INDICATED OTHERWISE WITHIN THE PLAN SET. NO ABRUPT CHANGES IN GRADE ARE PERMITTED IN DISTURBED LANDSCAPING AREAS.

30' 0' 30' 60'
GRAPHIC SCALE IN FEET
1" = 30'

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JONATHAN REID COOKSEY
ENGINEER
PROFESSIONAL ENGINEER

STONEFIELD
engineering & design

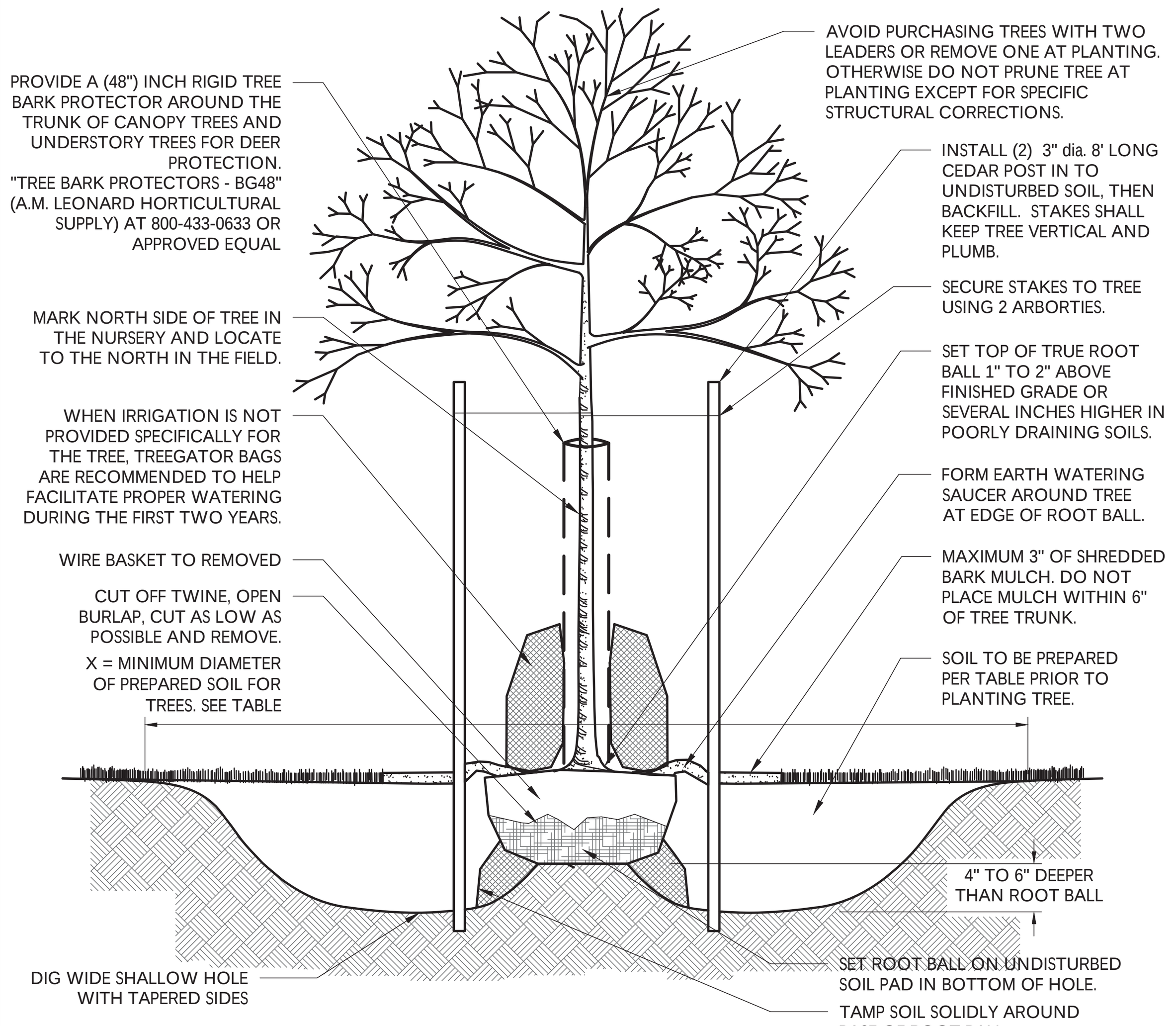
SCALE: 1" = 30' | PROJECT ID: DET-230229

TITLE:
LANDSCAPING PLAN

DRAWING:
C-8

NOTES:

1. FOR CONTAINER-GROWN TREES, USE FINGERS OR SMALL HAND TOOLS TO PULL THE ROOTS OUT OF THE OUTER LAYER OF POTTING SOIL; THEN CUT OR PULL APART ANY ROOTS CIRCLING THE PERIMETER OF THE CONTAINER
2. THOROUGHLY SOAK THE TREE ROOT BALL AND ADJACENT PREPARED SOIL SEVERAL TIMES DURING THE FIRST MONTH AFTER PLANTING AND REGULARLY THROUGHOUT THE FOLLOWING TWO SUMMERS.
3. SOIL AMENDMENTS:
   - MODIFY HEAVY CLAY OR SILT SOILS (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) OR GYPSUM
   - MODIFY EXTREMELY SANDY SOILDS (MORE THAN 85% SAND) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX



DECIDUOUS TREE PLANTING DETAIL

NOT TO SCALE

1

NOTES:

1. FOR CONTAINER-GROWN TREES, USE FINGERS OR SMALL HAND TOOLS TO PULL THE ROOTS OUT OF THE OUTER LAYER OF POTTING SOIL; THEN CUT OR PULL APART ANY ROOTS CIRCLING THE PERIMETER OF THE CONTAINER.
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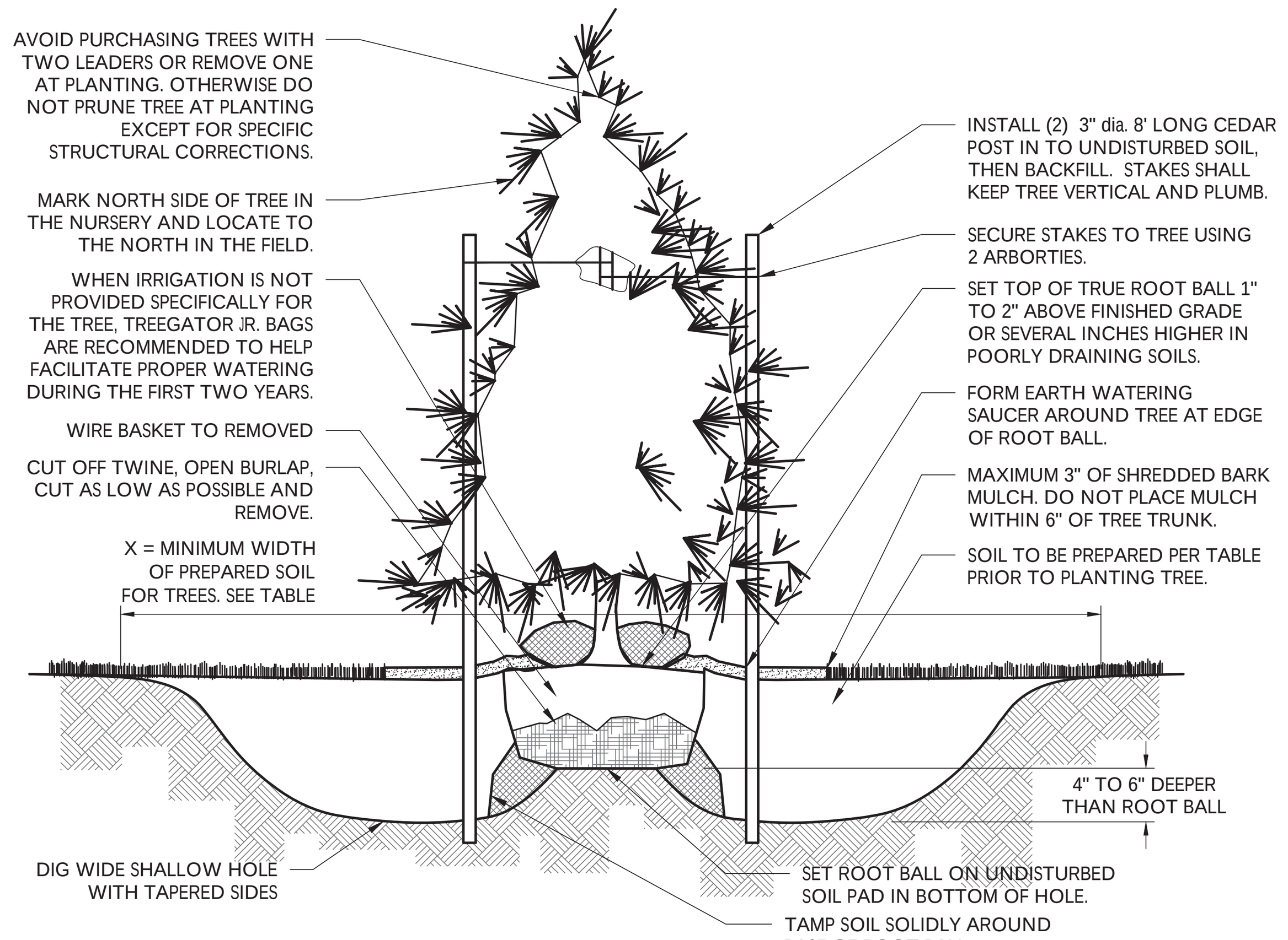
3. SOIL AMENDMENTS:
   - MODIFY HEAVY CLAY OR SILT SOILS (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) OR GYPSUM
   - MODIFY EXTREMELY SANDY SOILS (MORE THAN 85% SAND) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX

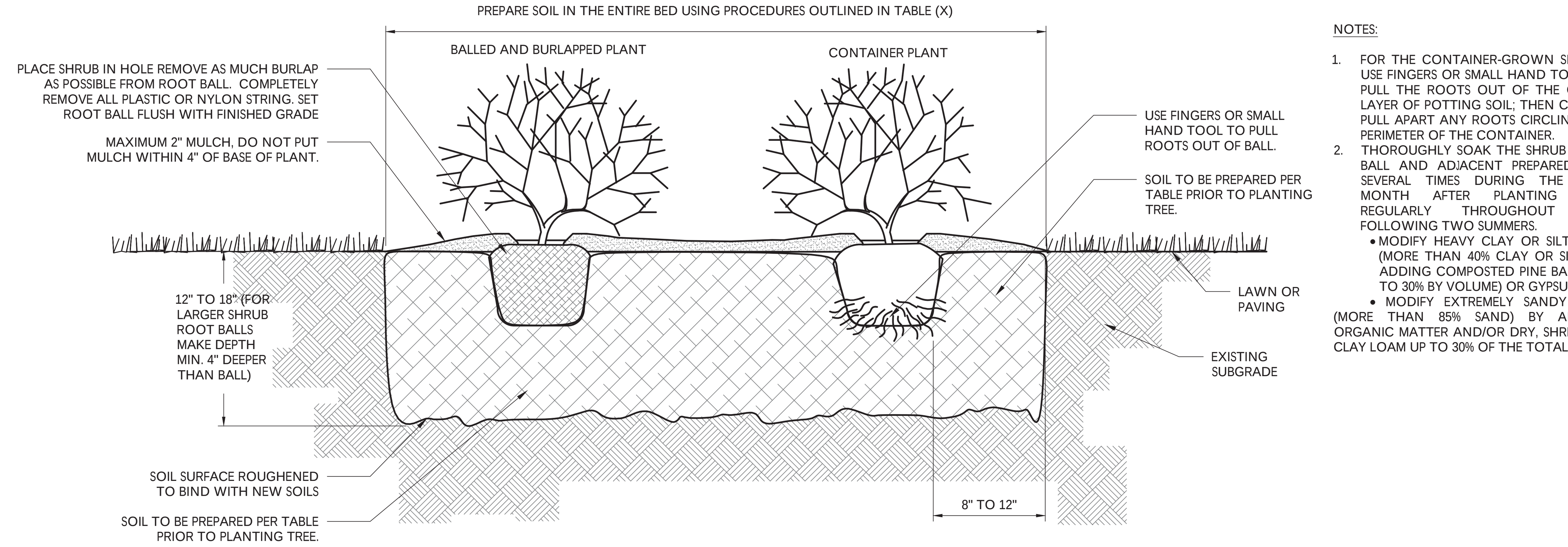


CONIFEROUS TREE PLANTING DETAIL

NOT TO SCALE

2

PREPARE SOIL IN THE ENTIRE BED USING PROCEDURES OUTLINED IN TABLE (X)



NOTES:

1. FOR THE CONTAINER-GROWN SHRUBS, USE FINGERS OR SMALL HAND TOOL TO PULL THE ROOTS OUT OF THE OUTER LAYER OF POTTING SOIL; THEN CUT OR PULL APART ANY ROOTS CIRCLING THE PERIMETER OF THE CONTAINER.
2. THOROUGHLY SOAK THE SHRUB ROOT BALL AND ADJACENT PREPARED SOIL SEVERAL TIMES DURING THE FIRST MONTH AFTER PLANTING AND REGULARLY THROUGHOUT THE FOLLOWING TWO SUMMERS.
   - MODIFY HEAVY CLAY OR SILT SOILS (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) OR GYPSUM
   - MODIFY EXTREMELY SANDY SOILS (MORE THAN 85% SAND) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL

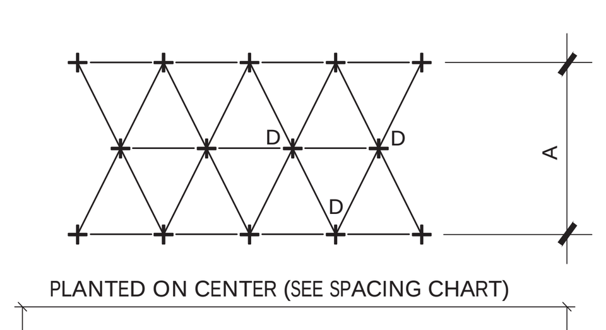
DECIDUOUS AND EVERGREEN SHRUB PLANTING DETAIL

NOT TO SCALE

3

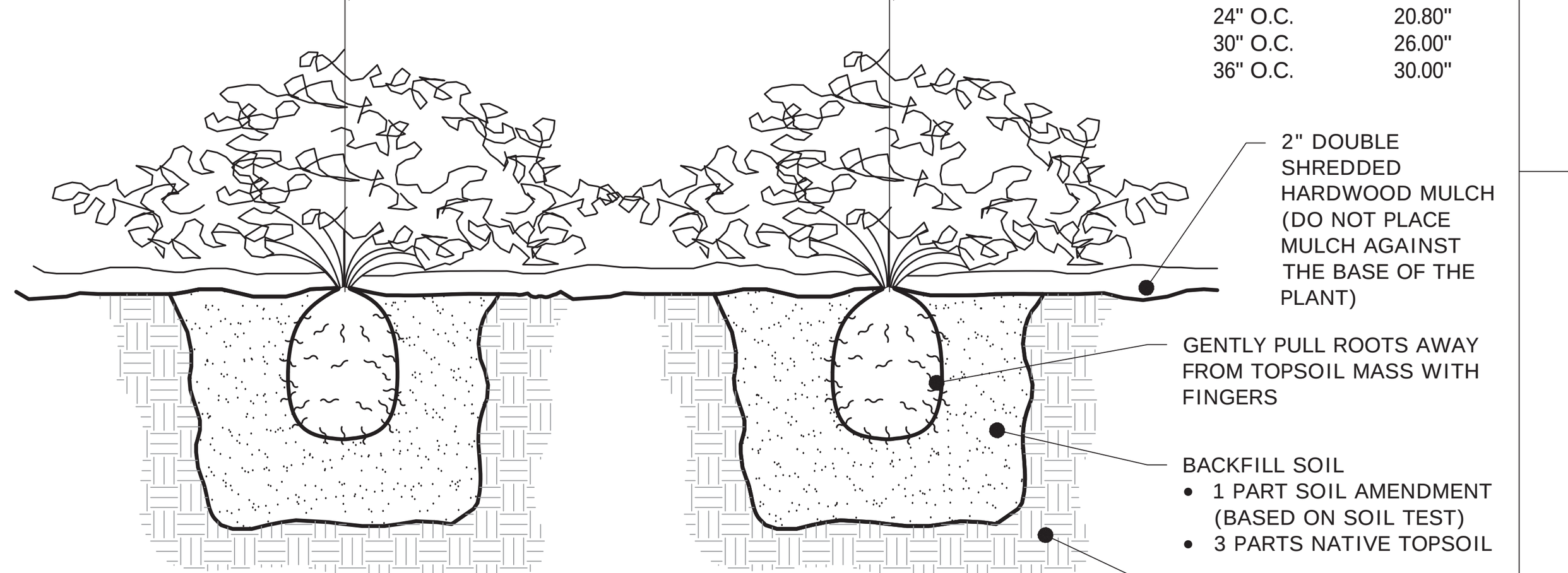
NOTES:

1. THOROUGHLY SOAK THE GROUND COVER ROOT BALL AND ADJACENT PREPARED SOIL SEVERAL TIMES DURING THE FIRST MONTH AFTER PLANTING AND REGULARLY THROUGHOUT THE FOLLOWING TWO SUMMERS.
2. SOIL AMENDMENTS:
   - MODIFY HEAVY CLAY OR SILT SOILDS (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) OR GYPSUM
   - MODIFY EXTREMELY SANDY SOILDS (MORE THAN 85% SAND) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX
3. ALL GROUND COVER AREAS SHALL BE TREATED WITH A PRE-EMERGENT PER MANUFACTURER'S SPECIFICATIONS



SPACING CHART
NOT TO SCALE

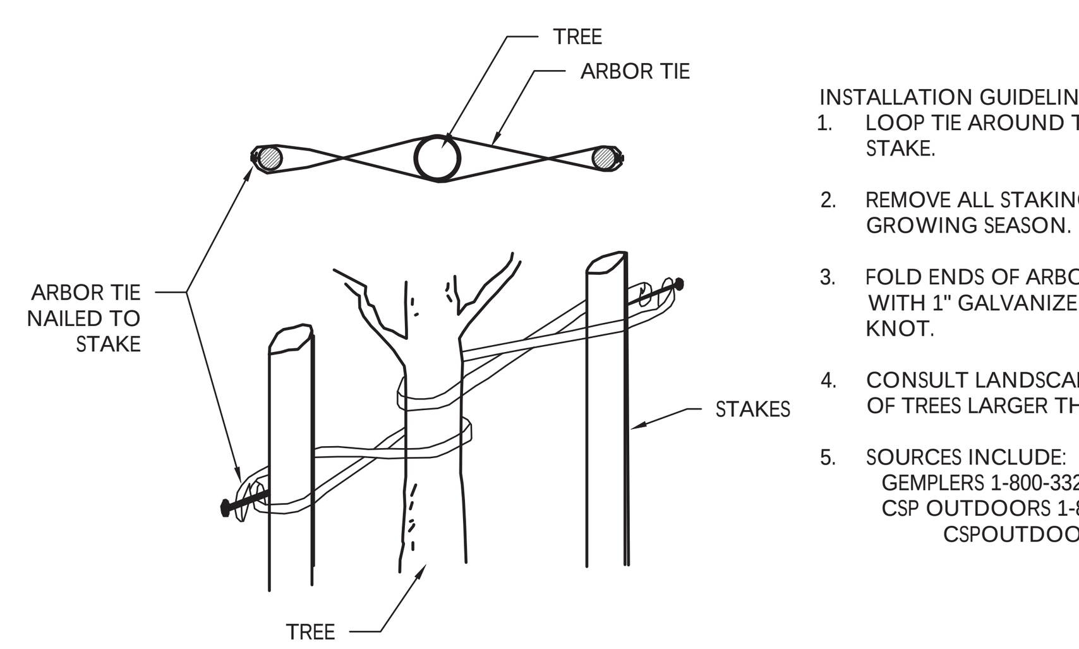
SPACING "D"	ROW "A"
6" O.C.	5.20"
8" O.C.	6.93"
10" O.C.	8.66"
12" O.C.	10.40"
15" O.C	13.00"
18" O.C.	15.60"
24" O.C.	20.80"
30" O.C.	26.00"
36" O.C.	30.00"



GROUND COVER/PERENNIAL/ANNUAL PLANTING DETAIL

NOT TO SCALE

4



INSTALLATION GUIDELINES:

1. LOOP TIE AROUND TREE AND NAIL TO CEDAR STAKE.
2. REMOVE ALL STAKING AND TIES AT END OF FIRST GROWING SEASON.
3. FOLD ENDS OF ARBORTIE BACK. SECURE TO STAKES WITH 1" GALVANIZED ROOFING NAIL OR USE A KNOT.
4. CONSULT LANDSCAPE ARCHITECT FOR STAKING OF TREES LARGER THAN 6".
5. SOURCES INCLUDE:
   GEMPLERS 1-800-332-6744 or GEMPLERS.COM
   CSP OUTDOORS 1-800-592-6940 or
   CSPOUTDOORS.COM

ARBORTIE DETAIL

NOT TO SCALE

5

PAUL DEVITTO, L.L.A.
MICHIGAN LICENSE No. 3901001797
LICENSED LANDSCAPE ARCHITECT

GENERAL LANDSCAPING NOTES:

1. THE LANDSCAPE CONTRACTOR SHALL FURNISH ALL MATERIALS AND PERFORM ALL WORK IN ACCORDANCE WITH THESE SPECIFICATIONS, APPROVED OR FINAL DRAWINGS, AND INSTRUCTIONS PROVIDED BY THE PROJECT LANDSCAPE DESIGNER, MUNICIPAL OFFICIALS, OR OWNER/OWNER'S REPRESENTATIVE. ALL WORK COMPLETED AND MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH THE INTENTION OF THE SPECIFICATIONS, DRAWINGS, AND INSTRUCTIONS AND EXECUTED WITH THE STANDARD LEVEL OF CARE FOR THE LANDSCAPE INDUSTRY.
2. WORK MUST BE CARRIED OUT ONLY DURING WEATHER CONDITIONS FAVORABLE TO LANDSCAPE CONSTRUCTION AND TO THE HEALTH AND WELFARE OF PLANTS. THE SUITABILITY OF SUCH WEATHER CONDITIONS SHALL BE DETERMINED BY THE PROJECT LANDSCAPE DESIGNER OR GOVERNING MUNICIPAL OFFICIAL.
3. IT IS THE RESPONSIBILITY OF THE LANDSCAPE CONTRACTOR, BEFORE ORDERING OR PURCHASING MATERIALS, TO PROVIDE SAMPLES OF THOSE MATERIALS TO THE PROJECT LANDSCAPE DESIGNER OR GOVERNING MUNICIPAL OFFICIAL FOR APPROVAL, IF SO REQUESTED.
4. IF SAMPLES ARE REQUESTED, THE LANDSCAPE CONTRACTOR IS TO SUBMIT CERTIFICATION TAGS FROM TREES, SHRUBS AND SEED VERIFYING TYPE AND PURITY.
5. UNLESS OTHERWISE AUTHORIZED BY THE PROJECT LANDSCAPE DESIGNER OR GOVERNING MUNICIPAL OFFICIAL, THE LANDSCAPE CONTRACTOR SHALL PROVIDE NOTICE AT LEAST FORTY-EIGHT HOURS (48 HRS.) IN ADVANCE OF THE ANTICIPATED DELIVERY DATE OF ANY PLANT MATERIALS TO THE PROJECT SITE. A LEGIBLE COPY OF THE INVOICE, SHOWING VARIETIES AND SIZES OF MATERIALS INCLUDED FOR EACH SHIPMENT SHALL BE FURNISHED TO THE PROJECT LANDSCAPE DESIGNER, OR GOVERNING MUNICIPAL OFFICIAL.
6. THE PROJECT LANDSCAPE DESIGNER OR GOVERNING MUNICIPAL OFFICIAL RESERVES THE RIGHT TO INSPECT AND REJECT PLANTS AT ANY TIME AND AT ANY PLACE.

PROTECTION OF EXISTING VEGETATION NOTES:

1. BEFORE COMMENCING WORK, ALL EXISTING VEGETATION WHICH COULD BE IMPACTED AS A RESULT OF THE PROPOSED CONSTRUCTION ACTIVITIES MUST BE PROTECTED FROM DAMAGE BY THE INSTALLATION OF TREE PROTECTION FENCING. FENCING SHALL BE LOCATED AT THE DRIP-LINE OR LIMIT OF DISTURBANCE AS DEPICTED WITHIN THE APPROVED OR FINAL PLAN SET, ESTABLISHING THE TREE PROTECTION ZONE. FENCE INSTALLATION SHALL BE IN ACCORDANCE WITH THE PROVIDED "TREE PROTECTION FENCE DETAIL." NO WORK MAY BEGIN UNTIL THIS REQUIREMENT IS FULFILLED. THE FENCING SHALL BE INSPECTED REGULARLY BY THE LANDSCAPE CONTRACTOR AND MAINTAINED UNTIL ALL CONSTRUCTION ACTIVITIES HAVE BEEN COMPLETED.
2. IN ORDER TO AVOID DAMAGE TO ROOTS, BARK OR LOWER BRANCHES, NO VEHICLE, EQUIPMENT, DEBRIS, OR OTHER MATERIALS SHALL BE DRIVEN, PARKED OR PLACED WITHIN THE TREE PROTECTION ZONE. ALL ON-SITE CONTRACTORS SHALL USE ANY AND ALL PRECAUTIONARY MEASURES WHEN PERFORMING WORK AROUND TREES, WALKS, PAVEMENTS, UTILITIES, AND ANY OTHER FEATURES EITHER EXISTING OR PREVIOUSLY INSTALLED UNDER THIS CONTRACT.
3. IN RARE INSTANCES WHERE EXCAVATING, FILL, OR GRADING IS REQUIRED WITHIN THE DRIP-LINE OF TREES TO REMAIN, THE WORK SHALL BE PERFORMED AS FOLLOWS:
   - TRENCHING: WHEN TRENCHING OCCURS AROUND TREES TO REMAIN, THE TREE ROOTS SHALL NOT BE CUT, BUT THE TRENCH SHALL BE TUNNELED UNDER OR AROUND THE ROOTS BY CAREFUL HAND DIGGING AND WITHOUT INJURY TO THE ROOTS. NO ROOTS, LIMBS, OR WOODS ARE TO HAVE ANY PAINT OR MATERIAL APPLIED TO ANY SURFACE.
   - RAISING GRADES: WHEN THE GRADE AT AN EXISTING TREE IS BELOW THE NEW FINISHED GRADE, AND FILL NOT EXCEEDING 6 INCHES (6") IS REQUIRED, CLEAN, WASHED GRAVEL FROM ONE TO TWO INCHES (1" - 2") IN SIZE SHALL BE PLACED DIRECTLY AROUND THE TREE TRUNK. THE GRAVEL SHALL EXTEND OUT FROM THE TRUNK ON ALL SIDES A MINIMUM OF 18 INCHES (18") AND FINISH APPROXIMATELY TWO INCHES (2") ABOVE THE FINISH GRADE AT TREE. INSTALL GRAVEL BEFORE ANY EARTH FILL IS PLACED. NEW EARTH FILL SHALL NOT BE LEFT IN CONTACT WITH THE TRUNK OF ANY TREE REQUIRING FILL. WHERE FILL EXCEEDING 6 INCHES (6") IS REQUIRED, A DRY LAID TREE WELL SHALL BE CONSTRUCTED. IF APPLICABLE, TREE WELL INSTALLATION SHALL BE IN ACCORDANCE WITH THE PROVIDED "TREE WELL DETAIL."
   - LOWERING GRADES: EXISTING TREES LOCATED IN AREAS WHERE THE NEW FINISHED GRADE IS TO BE LOWERED, SHALL HAVE RE-GRADING WORK DONE BY HAND TO THE INDICATED ELEVATION, NO GREATER THAN SIX INCHES (6"). ROOTS SHALL BE CUT CLEANLY THREE INCHES (3") BELOW FINISHED GRADE UNDER THE DIRECTION OF A LICENSED ARBORIST. WHERE CUT EXCEEDING 6 INCHES (6") IS REQUIRED, A DRY LAID RETAINING WALL SHALL BE CONSTRUCTED. IF APPLICABLE, THE RETAINING WALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE PROVIDED "TREE RETAINING WALL DETAIL."

SOIL PREPARATION AND MULCH NOTES:

1. LANDSCAPE CONTRACTOR SHALL OBTAIN A SOIL TEST OF THE IN-SITU TOPSOIL BY A CERTIFIED SOIL LABORATORY PRIOR TO PLANTING. LANDSCAPE CONTRACTOR SHALL ALLOW FOR A TWO WEEK TURNAROUND TIME FROM SUBMITTAL OF SAMPLE TO NOTIFICATION OF RESULTS.
2. BASED ON SOIL TEST RESULTS, ADJUST THE RATES OF LIME AND FERTILIZER THAT SHALL BE MIXED INTO THE TOP SIX INCHES (6") OF TOPSOIL. THE LIME AND FERTILIZER RATES PROVIDED WITHIN THE "SEED SPECIFICATION" OR "SOD SPECIFICATION" IS APPROXIMATE AND FOR BIDDING PURPOSES ONLY. IF ADDITIONAL AMENDMENTS ARE NECESSARY, ADJUST THE TOPSOIL AS FOLLOWS:
   - MODIFY HEAVY CLAY OR SILT SOILS (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) OR GYPSUM.
   - MODIFY EXTREMELY SANDY SOILS (MORE THAN 85%) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX.
3. TOPSOIL SHALL BE FERTILE, FRIABLE, NATURAL TOPSOIL OF LOAMING CHARACTER, WITHOUT ADMIXTURE OF SUBSOIL MATERIAL OBTAINED FROM A WELL-DRAINED ARABLE SITE, FREE FROM ALL CLAY, LUMPS, COARSE SANDS, STONES, PLANTS, ROOTS, STICKS, AND OTHER FOREIGN MATERIAL GREATER THAN ONE INCH (1").
4. TOPSOIL SHALL HAVE A PH RANGE OF 5.0-7.0 AND SHALL NOT CONTAIN LESS THAN 6% ORGANIC MATTER BY WEIGHT.
5. OBTAIN TOPSOIL ONLY FROM LOCAL SOURCES OR FROM AREAS HAVING SIMILAR SOIL CHARACTERISTICS TO THAT FOUND AT THE PROJECT SITE.
6. CONTRACTOR SHALL PROVIDE A SIX INCH (6") DEEP LAYER OF TOPSOIL IN ALL PLANTING AREAS. TOPSOIL SHALL BE SPREAD OVER A PREPARED SURFACE IN A UNIFORM LAYER TO ACHIEVE THE DESIRED COMPACTED THICKNESS. THE SPREADING OF TOPSOIL SHALL NOT BE CONDUCTED UNDER MUDDY OR FROZEN SOIL CONDITIONS.
7. UNLESS OTHERWISE NOTED IN THE CONTRACT, THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION OF TOPSOIL AND THE ESTABLISHMENT OF FINE-GRADING WITHIN THE DISTURBED AREA OF THE SITE.
8. LANDSCAPE CONTRACTOR SHALL VERIFY THAT THE SUB-GRADE ELEVATION MEETS THE FINISHED GRADE ELEVATION (LESS THE REQUIRED TOPSOIL), IN ACCORDANCE WITH THE APPROVED OR FINAL GRADING PLAN.
9. ALL LAWN AND PLANTING AREAS SHALL BE GRADED TO A SMOOTH, EVEN AND UNIFORM PLANE WITH NO ABRUPT CHANGE OF SURFACE AS DEPICTED WITHIN THE APPROVED OR FINAL CONSTRUCTION SET UNLESS OTHERWISE DIRECTED BY THE PROJECT LANDSCAPE DESIGNER OR MUNICIPAL OFFICIAL.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER SURFACE AND SUBSURFACE PLANT BED DRAINAGE PRIOR TO THE INSTALLATION OF PLANTINGS. IF POOR DRAINAGE CONDITIONS EXIST, CORRECTIVE ACTION SHALL BE TAKEN PRIOR TO INSTALLATION. ALL PLANTING AND LAWN AREAS SHALL BE GRADED AND MAINTAINED TO ALLOW A FREE FLOW OF SURFACE WATER.
11. DOUBLE SHREDDED HARDWOOD MULCH OR APPROVED EQUAL SHALL BE USED AS A THREE INCH (3") TOP DRESSING IN ALL SHRUB PLANTING BEDS AND AROUND ALL TREES PLANTED BY LANDSCAPE CONTRACTOR. GROUND COVER, PERENNIAL, AND ANNUAL PLANTING BEDS SHALL BE MULCHED WITH A TWO INCH (2") TOP DRESSING. SINGLE TREES OR SHRUBS SHALL BE MULCHED TO AVOID CONTACT WITH TRUNK OR PLANT STEM. MULCH SHALL BE OF SUFFICIENT CHARACTER AS NOT TO BE EASILY DISPLACED BY WIND OR WATER RUNOFF.
12. WHENEVER POSSIBLE, THE SOIL PREPARATION AREA SHALL BE CONNECTED FROM PLANTING TO PLANTING.
13. SOIL SHALL BE LOOSENED WITH A BACKHOE OR OTHER LARGE COARSE-TILING EQUIPMENT UNLESS THE SOIL IS FROZEN OR EXCESSIVELY WET. TILING THAT PRODUCES LARGE, COARSE CHUNKS OF SOIL IS PREFERABLE TO TILING THAT RESULTS IN FINE GRAINS UNIFORM IN TEXTURE. AFTER THE AREA IS LOOSENED IT SHALL NOT BE DRIVEN OVER BY ANY VEHICLE.
14. APPLY PRE-EMERGENT WEED CONTROL TO ALL PLANT BEDS PRIOR TO MULCHING. ENSURE COMPATIBILITY BETWEEN PRODUCT AND PLANT MATERIAL.
15. ALL PLANTING SOIL SHALL BE AMENDED WITH THE FOLLOWING:

MYCRO® TREE SAVER - A DRY GRANULAR MYCORRHIZAL FUNGI INOCULANT THAT IS MIXED IN THE BACKFILL WHEN PLANTING TREES AND SHRUBS. IT CONTAINS SPORES OF BOTH ECTOMYCORRHIZAL AND VA MYCORRHIZAL FUNGI (VAM), BENEFICIAL RHIZOSPHERE BACTERIA, TERRA-SORB SUPERABSORBENT HYDROGEL TO REDUCE WATER LEACHING, AND SELECTED ORGANIC MICROBIAL NUTRIENTS.

- DIRECTIONS FOR USE: USE 3-OZ PER EACH FOOT DIAMETER OF THE ROOT BALL, OR 3-OZ PER INCH CALIPER. MIX INTO THE BACKFILL WHEN TRANSPLANTING TREES AND SHRUBS. MIX PRODUCT IN A RING-SHAPED VOLUME OF SOIL AROUND THE UPPER PORTION OF THE ROOT BALL, EXTENDING FROM THE SOIL SURFACE TO A DEPTH OF ABOUT 8 INCHES, AND EXTENDING OUT FROM THE ROOT BALL ABOUT 8 INCHES INTO THE BACKFILL. APPLY WATER TO SOIL SATURATION.
- MYCOR® TREE SAVER® IS EFFECTIVE FOR ALL TREE AND SHRUB SPECIES EXCEPT RHODODENDRONS, AZALEAS, AND MOUNTAIN LAUREL, WHICH REQUIRE ERICOID MYCORRHIZAE.
- SOIL PH: THE FUNGI IN THIS PRODUCT WERE CHOSEN BASED ON THEIR ABILITY TO SURVIVE AND COLONIZE PLANT ROOTS IN A PH RANGE OF 3 TO 9.
- FUNGICIDES: THE USE OF CERTAIN FUNGICIDES CAN HAVE A DETRIMENTAL EFFECT ON THE INOCULATION PROGRAM. SOIL APPLICATION OF ANY FUNGICIDE IS NOT RECOMMENDED FOR TWO WEEKS AFTER APPLICATION.
- OTHER PESTICIDES: HERBICIDES AND INSECTICIDES DO NOT NORMALLY INTERFERE WITH MYCORRHIZAL FUNGAL DEVELOPMENT, BUT MAY INHIBIT THE GROWTH OF SOME TREE AND SHRUB SPECIES IF NOT USED PROPERLY.

HEALTHY START MACRO TABS 12-8-8

- FERTILIZER TABLETS ARE PLACED IN THE UPPER 4 INCHES OF BACKFILL SOIL WHEN PLANTING TREES AND SHRUBS.
- TABLETS ARE FORMULATED FOR LONG-TERM RELEASE BY SLOW BIODEGRADATION, AND LAST UP TO 2 YEARS AFTER PLANTING. TABLETS CONTAIN 12-8-8 NPK FERTILIZER, AS WELL AS A MINIMUM OF SEVEN PERCENT (7%) HUMIC ACID BY WEIGHT, MICROBIAL NUTRIENTS DERIVED FROM SEA KELP, PROTEIN BYPRODUCTS, AND YUCCA SCHIDIGERA, AND A COMPLEMENT OF BENEFICIAL RHIZOSPHERE BACTERIA. THE STANDARD 21 GRAM TABLET IS SPECIFIED HERE. DIRECTIONS FOR USE: FOR PLANTING BALLED & BURLAPPED (B&B) TREES AND SHRUBS, MEASURE THE THICKNESS OF THE TRUNK, AND USE ABOUT 1 TABLET (21-G) PER HALF-INCH. PLACE THE TABLETS DIRECTLY NEXT TO THE ROOT BALL, EVENLY DISTRIBUTED AROUND ITS PERIMETER, AT A DEPTH OF ABOUT 4 INCHES.

IRRIGATION DURING ESTABLISHMENT

SIZE AT PLANTING	IRRIGATION FOR VITALITY	IRRIGATION FOR SURVIVAL
< 2" CALIPER	DAILY FOR TWO WEEKS, EVERY OTHER DAY FOR TWO MONTHS, WEEKLY UNTIL ESTABLISHED	TWO TO THREE TIMES WEEKLY FOR TWO TO THREE MONTHS
2"-4 CALIPER	DAILY FOR ONE MONTH, EVERY OTHER DAY FOR THREE MONTHS, WEEKLY UNTIL ESTABLISHED	TWO TO THREE TIMES WEEKLY FOR THREE TO FOUR MONTHS
4 >" CALIPER	DAILY FOR SIX WEEKS, EVERY OTHER DAY FOR FIVE MONTHS, WEEKLY UNTIL ESTABLISHED	TWICE WEEKLY FOR FOUR TO FIVE MONTHS

TABLE NOTES:

1. AT EACH IRRIGATION, APPLY TWO TO THREE GALLONS PER INCH TRUNK CALIPER TO THE ROOT BALL SURFACE. APPLY IT IN A MANNER SO ALL WATER SOAKS THE ENTIRE ROOT BALL. DO NOT WATER IF ROOT BALL IS WET/SATURATED ON THE IRRIGATION DAY.

2. WHEN IRRIGATING FOR VITALITY, DELETE DAILY IRRIGATION WHEN PLANTING IN WINTER OR WHEN PLANTING IN COOL CLIMATES. ESTABLISHMENT TAKES THREE TO FOUR MONTHS PER INCH TRUNK CALIPER. NEVER APPLY IRRIGATION IF THE SOIL IS SATURATED.

3. WHEN IRRIGATION FOR SURVIVAL, TREES TAKE MUCH LONGER TO ESTABLISH THAN REGULARLY IRRIGATED TREES. IRRIGATION MAY BE REQUIRED IN THE NORMAL HOT, DRY PORTIONS OF THE FOLLOWING YEAR.

PLANT QUALITY AND HANDLING NOTES:

1. ALL PLANT MATERIAL SHALL CONFORM TO THE AMERICAN STANDARD FOR NURSERY STOCK (ANSI Z60.1-2004) OR LATEST REVISION AS PUBLISHED BY THE AMERICAN NURSERY AND LANDSCAPE ASSOCIATION.
2. IN ALL CASES, BOTANICAL NAMES LISTED WITHIN THE APPROVED OR FINAL PLANT LIST SHALL TAKE PRECEDENCE OVER COMMON NAMES.
3. ALL PLANTS SHALL BE OF SELECTED SPECIMEN QUALITY, EXCEPTIONALLY HEAVY, TIGHTLY KNIT, SO TRAINED OR FAVORED IN THEIR DEVELOPMENT AND APPEARANCE AS TO BE SUPERIOR IN FORM, NUMBER OF BRANCHES, COMPACTNESS AND SYMMETRY. ALL PLANTS SHALL HAVE A NORMAL HABIT OR SOUND, HEALTHY, VIGOROUS PLANTS WITH WELL DEVELOPED ROOT SYSTEM. PLANTS SHALL BE FREE OF DISEASE, INSECT PESTS, EGGS OR LARVAE.
4. PLANTS SHALL NOT BE PRUNED BEFORE DELIVERY. TREES WITH ABRASION OF THE BARK, SUNSCALDS, DISFIGURING KNOTS OR FRESH CUTS OF LIMBS OVER ONE AND ONE-FOURTH INCHES (1-1/4") WHICH HAVE NOT COMPLETELY CALLOUSED SHALL BE REJECTED.
5. ALL PLANTS SHALL BE TYPICAL OF THEIR SPECIES OR VARIETY AND SHALL HAVE A NORMAL HABIT OF GROWTH AND BE LEGIBLY TAGGED WITH THE PROPER NAME AND SIZE.
6. THE ROOT SYSTEM OF EACH PLANT SHALL BE WELL PROVIDED WITH FIBROUS ROOTS. ALL PARTS SHALL BE SOUND, HEALTHY, VIGOROUS, WELL-BRANCHED AND DENSELY FOLIATED WHEN IN LEAF.
7. ALL PLANTS DESIGNATED BALL AND BURLAP (B&B) MUST BE MOVED WITH THE ROOT SYSTEM AS SOLID UNITS WITH BALLS OF EARTH FIRMLY WRAPPED WITH BURLAP. THE DIAMETER AND DEPTH OF THE BALLS OF EARTH MUST BE SUFFICIENT TO ENCOMPASS THE FIBROUS ROOT FEEDING SYSTEMS NECESSARY FOR THE HEALTHY DEVELOPMENT OF THE PLANT. NO PLANT SHALL BE ACCEPTED WHEN THE BALL OF EARTH SURROUNDING ITS ROOTS HAS BEEN BADLY CRACKED OR BROKEN PREPARATORY TO OR DURING THE PROCESS OF PLANTING. THE BALLS SHALL REMAIN INTACT DURING ALL OPERATIONS. ALL PLANTS THAT CANNOT BE PLANTED AT ONCE MUST BE HEELED-IN BY SETTING IN THE GROUND AND COVERING THE BALLS WITH SOIL OR MULCH AND THEN WATERING. HEMP BURLAP AND TWINE IS PREFERABLE TO TREATED. IF TREATED BURLAP IS USED, ALL TWINE IS TO BE CUT FROM AROUND THE TRUNK AND ALL BURLAP IS TO BE REMOVED.
8. PLANTS TRANSPORTED TO THE PROJECT IN OPEN VEHICLES SHALL BE COVERED WITH TARPS OR OTHER SUITABLE COVERS SECURELY FASTENED TO THE BODY OF THE VEHICLE TO PREVENT INJURY TO THE PLANTS. CLOSED VEHICLES SHALL BE ADEQUATELY VENTILATED TO PREVENT OVERHEATING OF THE PLANTS. EVIDENCE OF INADEQUATE PROTECTION FOLLOWING DIGGING, CARELESSNESS WHILE IN TRANSIT, OR IMPROPER HANDLING OR STORAGE SHALL BE CAUSE FOR REJECTION OF PLANT MATERIAL. ALL PLANTS SHALL BE KEPT MOIST, FRESH, AND PROTECTED. SUCH PROTECTION SHALL ENCOMPASS THE ENTIRE PERIOD DURING WHICH THE PLANTS ARE IN TRANSIT, BEING HANDLED, OR ARE IN TEMPORARY STORAGE.
9. ALL PLANT MATERIAL SHALL BE INSTALLED IN ACCORDANCE WITH THE CORRESPONDING LANDSCAPE PLAN AND PLANTING DETAILS.
10. LANDSCAPE CONTRACTOR SHALL MAKE BEST EFFORT TO INSTALL PLANTINGS ON THE SAME DAY AS DELIVERY. IF PLANTS ARE NOT PLANTED IMMEDIATELY ON SITE, PROPER CARE SHALL BE TAKEN TO PLACE THE PLANTINGS IN PARTIAL SHADE WHEN POSSIBLE. THE ROOT BALL SHALL BE KEPT MOIST AT ALL TIME AND COVERED WITH MOISTENED MULCH OR AGED WOODCHIPS. PROPER IRRIGATION SHALL BE SUPPLIED SO AS TO NOT ALLOW THE ROOT BALL TO DRY OUT. PLANTINGS SHALL BE UNTIED AND PROPER SPACING SHALL BE ALLOTTED FOR AIR CIRCULATION AND TO PREVENT DISEASE, WILTING, AND LEAF LOSS. PLANTS THAT REMAIN UNPLANTED FOR A PERIOD OF TIME GREATER THAN THREE (3) DAYS SHALL BE HEALED IN WITH TOPSOIL OR MULCH AND WATERED AS REQUIRED TO PRESERVE ROOT MOISTURE.
11. NO PLANT MATERIAL SHALL BE PLANTED IN MUDDY OR FROZEN SOIL.
12. PLANTS WITH INJURED ROOTS OR BRANCHES SHALL BE PRUNED PRIOR TO PLANTING UTILIZING CLEAN, SHARP TOOLS. ONLY DISEASED OR INJURED PLANTS SHALL BE REMOVED.
13. IF ROCK OR OTHER UNDERGROUND OBSTRUCTION IS ENCOUNTERED, THE LANDSCAPE DESIGNER RESERVES THE RIGHT TO RELOCATE OR ENLARGE PLANTING PITS OR DELETE PLANT MATERIAL FROM THE CONTRACT.
14. IF PLANTS ARE PROPOSED WITHIN SIGHT TRIANGLES, TREES SHALL BE LIMBED AND MAINTAINED TO A HEIGHT OF EIGHT FEET (8') ABOVE GRADE, AND SHRUBS, GROUND COVER, PERENNIALS, AND ANNUALS SHALL BE MAINTAINED TO A HEIGHT NOT TO EXCEED TWO FEET (2') ABOVE GRADE UNLESS OTHERWISE NOTED OR SPECIFIED BY THE GOVERNING MUNICIPALITY OR AGENCY.
15. INSTALLATION SHALL OCCUR DURING THE FOLLOWING SEASONS:
    PLANTS (MARCH 15 - DECEMBER 15)
    LAWNS (MARCH 15 - JUNE 15 OR SEPTEMBER 1 - DECEMBER 1)
16. THE FOLLOWING TREES ARE SUSCEPTIBLE TO TRANSPLANT SHOCK AND SHALL NOT BE PLANTED DURING THE FALL SEASON (STARTING SEPTEMBER 15):

ABIES CONCOLOR	CORNUS VARIETIES	OSTRYA VIRGINIANA
ACER BUERGERIANUM	CRATAEGUS VARIETIES	PINUS NIGRA
ACER FREEMANII	CUPRESSOCYPARIS LEYLANDII	PLATANUS VARIETIES
ACER RUBRUM	FAGUS VARIETIES	POPULUS VARIETIES
ACER SACCHARINUM	HALESIA VARIETIES	PRUNUS VARIETIES
BETULA VARIETIES	ILEX X FOSTERII	PYRUS VARIETIES
CARPINUS VARIETIES	ILEX NELLIE STEVENS	QUERCUS VARIETIES (NOT Q. PALUSTRIS)
CEDRUS DEODARA	ILEX OPACA	SALIX WEEPING VARIETIES
CELTIS VARIETIES	JUNIPERUS VIRGINIANA	SORBUS VARIETIES
CERCIDIPHYLLUM VARIETIES	KOELREUTERIA PANICULATA	TAXODIUM VARIETIES
CERCIS CANADENSIS	LIQUIDAMBAR VARIETIES	TAXUX B REPANDENS
CORNUS VARIETIES	LIRIODENDRON VARIETIES	TILIA TOMENTOSA VARIETIES
CRATAEGUS VARIETIES	MALUS IN LEAF	ULMUS PARVIFOLIA VARIETIES
	NYSSA SYLVATICA	ZELKOVA VARIETIES

17. IF A PROPOSED PLANT IS UNATTAINABLE OR ON THE FALL DIGGING HAZARD LIST, AN EQUIVALENT SPECIES OF THE SAME SIZE MAY BE REQUESTED FOR SUBSTITUTION OF THE ORIGINAL PLANT. ALL SUBSTITUTIONS SHALL BE APPROVED BY THE PROJECT LANDSCAPE DESIGNER OR MUNICIPAL OFFICIAL PRIOR TO ORDERING AND INSTALLATION.
18. DURING THE COURSE OF CONSTRUCTION/PLANT INSTALLATION, EXCESS AND WASTE MATERIALS SHALL BE CONTINUOUSLY AND PROMPTLY REMOVED AT THE END OF EACH WORK DAY. ALL DEBRIS, MATERIALS, AND TOOLS SHALL BE PROPERLY STORED, STOCKPILED OR DISPOSED OF AND ALL PAVED AREAS SHALL BE CLEANED.
19. THE LANDSCAPE CONTRACTOR SHALL DISPOSE OF ALL RUBBISH AND EXCESS SOIL AT HIS EXPENSE TO AN OFF-SITE LOCATION AS APPROVED BY THE LOCAL MUNICIPALITY.
20. A 90-DAY MAINTENANCE PERIOD SHALL BEGIN IMMEDIATELY AFTER ALL PLANTS HAVE BEEN SATISFACTORILY INSTALLED.
21. MAINTENANCE SHALL INCLUDE, BUT NOT BE LIMITED TO, REPLACING MULCH THAT HAS BEEN DISPLACED BY EROSION OR OTHER MEANS, REPAIRING AND RESHAPING WATER RINGS OR SAUCERS, MAINTAINING STAKES AND GUYS IF ORIGINALLY REQUIRED, WATERING WHEN NEEDED OR DIRECTED, WEEDING, PRUNING, SPRAYING, FERTILIZING, MOWING THE LAWN, AND PERFORMING ANY OTHER WORK REQUIRED TO KEEP THE PLANTS IN A HEALTHY CONDITION.
22. MOW ALL GRASS AREAS AT REGULAR INTERVALS TO KEEP THE GRASS HEIGHT FROM EXCEEDING THREE INCHES (3"). MOWING SHALL BE PERFORMED ONLY WHEN GRASS IS DRY. MOWER BLADE SHALL BE SET TO REMOVE NO MORE THAN ONE THIRD (1/3) OF THE GRASS LENGTH. WHEN THE AMOUNT OF GRASS IS HEAVY, IT SHALL BE REMOVED TO PREVENT DESTRUCTION OF THE UNDERLYING TURF. MOW GRASS AREAS IN SUCH A MANNER AS TO PREVENT CLIPPINGS FROM BLOWING ON PAVED AREAS, AND SIDEWALKS. CLEANUP AFTER MOWING SHALL INCLUDE SWEEPING OR BLOWING OF PAVED AREAS AND SIDEWALKS TO CLEAR THEM FROM MOWING DEBRIS.
23. GRASSED AREAS DAMAGED DURING THE PROCESS OF THE WORK SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, WHO SHALL RESTORE THE DISTURBED AREAS TO A CONDITION SATISFACTORY TO THE PROJECT LANDSCAPE DESIGNER, MUNICIPAL OFFICIAL, OR OWNER/OWNER'S REPRESENTATIVE. THIS MAY INCLUDE FILLING TO GRADE, FERTILIZING, SEEDING, AND MULCHING.
24. SHOULD THE OWNER REQUIRE MAINTENANCE BEYOND THE STANDARD 90-DAY MAINTENANCE PERIOD, A SEPARATE CONTRACT SHALL BE ESTABLISHED.
25. LANDSCAPE CONTRACTOR SHALL WATER NEW PLANTINGS FROM TIME OF INSTALL AND THROUGHOUT REQUIRED 90-DAY MAINTENANCE PERIOD UNTIL PLANTS ARE ESTABLISHED. IF ON-SITE WATER IS NOT AVAILABLE AT THE PROJECT LOCATION, THE LANDSCAPE CONTRACTOR SHALL FURNISH IT BY MEANS OR A WATERING TRUCK OR OTHER ACCEPTABLE MANNER.
26. THE QUANTITY OF WATER APPLIED AT ONE TIME SHALL BE SUFFICIENT TO PENETRATE THE SOIL TO A MINIMUM OF EIGHT INCHES (8") IN SHRUB BEDS AND SIX INCHES (6") IN TURF AREAS AT A RATE WHICH WILL PREVENT SATURATION OF THE SOIL.
27. IF AN AUTOMATIC IRRIGATION SYSTEM HAS BEEN INSTALLED, IT CAN BE USED FOR WATERING PLANT MATERIAL. HOWEVER, FAILURE OF THE SYSTEM DOES NOT ELIMINATE THE LANDSCAPE CONTRACTOR'S RESPONSIBILITY OF PLANT HEALTH AND ESTABLISHMENT.

PLANT MATERIAL GUARANTEE NOTES:

1. THE LANDSCAPE CONTRACTOR SHALL GUARANTEE ALL PLANT MATERIAL FOR A PERIOD OF ONE YEAR (1 YR.) FROM APPROVAL OF LANDSCAPE INSTALLATION BY THE PROJECT LANDSCAPE DESIGNER, MUNICIPAL OFFICIAL, OR OWNER/OWNER'S REPRESENTATIVE.
2. THE LANDSCAPE CONTRACTOR SHALL REMOVE AND REPLACE DYING, DEAD, OR DEFECTIVE PLANT MATERIAL AT HIS EXPENSE. THE LANDSCAPE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR ANY DAMAGES CAUSED BY HIS COMPANY'S OPERATIONS.
3. ALL REPLACEMENT PLANTS SHALL BE OF THE SAME SPECIES AND SIZE AS SPECIFIED ON THE APPROVED OR FINAL PLANT LIST. REPLACEMENTS RESULTING FROM REMOVAL, LOSS, OR DAMAGE DUE TO OCCUPANCY OF THE PROJECT IN ANY PART, VANDALISM, PHYSICAL DAMAGE BY ANIMALS, VEHICLES, ETC., AND LOSSES DUE TO CURTAILMENT OF WATER BY LOCAL AUTHORITIES SHALL BE APPROVED AND PAID FOR BY THE OWNER.
4. THE CONTRACTOR SHALL INSTRUCT THE OWNER AS TO THE PROPER CARE AND MAINTENANCE OF ALL PLANTINGS.

LAWN (SEED OR SOD) NOTES:

1. SEED MIXTURE SHALL BE FRESH, CLEAN, NEW CROP SEED. SOD SHALL BE STRONGLY ROOTED, UNIFORM IN THICKNESS, AND FREE OF WEEDS, DISEASE, AND PESTS.
2. SEED OR SOD SHALL BE PURCHASED FROM A RECOGNIZED DISTRIBUTOR AND SHALL BE COMPOSED OF THE MIX OR BLEND WITHIN THE PROVIDED "SEED SPECIFICATION" OR "SOD SPECIFICATION."
3. REFERENCE LANDSCAPE PLAN FOR AREAS TO BE SEEDED OR LAID WITH SOD.
4. SEEDING SHALL NOT BE PERFORMED IN WINDY WEATHER. IF THE SEASON OF THE PROJECT COMPLETION PROHIBITS PERMANENT STABILIZATION, TEMPORARY STABILIZATION SHALL BE PROVIDED IN ACCORDANCE WITH THE "TEMPORARY SEEDING SPECIFICATION."
5. PROTECT NEW LAWN AREAS AGAINST TRESPASSING WHILE THE SEED IS GERMINATING. FURNISH AND INSTALL FENCES, SIGNS, BARRIERS OR ANY OTHER NECESSARY TEMPORARY PROTECTIVE DEVICES. DAMAGE RESULTING FROM TRESPASS, EROSION, WASHOUT, SETTLEMENT OR OTHER CAUSES SHALL BE REPAIRED BY THE LANDSCAPE CONTRACTOR AT HIS EXPENSE. REMOVE ALL FENCES, SIGNS, BARRIERS OR OTHER TEMPORARY PROTECTIVE DEVICES ONCE LAWN HAS BEEN ESTABLISHED.

ISSUE	DATE	BY	DESCRIPTION
6	12/20/2024	EM	REVISED FOR PRELIMINARY SITE PLAN APPROVAL
5	10/17/2024	EM	REVISED PER PRELIMINARY SITE PLAN REVIEW #1
4	07/22/2024	EM/JP	FOR SITE PLAN REVIEW
3	04/22/2024	JRC/JP	SUBMISSION FOR REVISED REZONING REQUEST
2	04/15/2024	EM	FOR PRELIMINARY MDOT REVIEW
1	11/29/2023	JRC/JP	SUBMISSION FOR REZONING

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SITE DEVELOPMENT PLANS

9101 HIGHLAND ROAD

PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID:12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
PROFESSIONAL ENGINEER

STONEFIELD
engineering & design

SCALE: AS SHOWN PROJECT ID: DET-230229

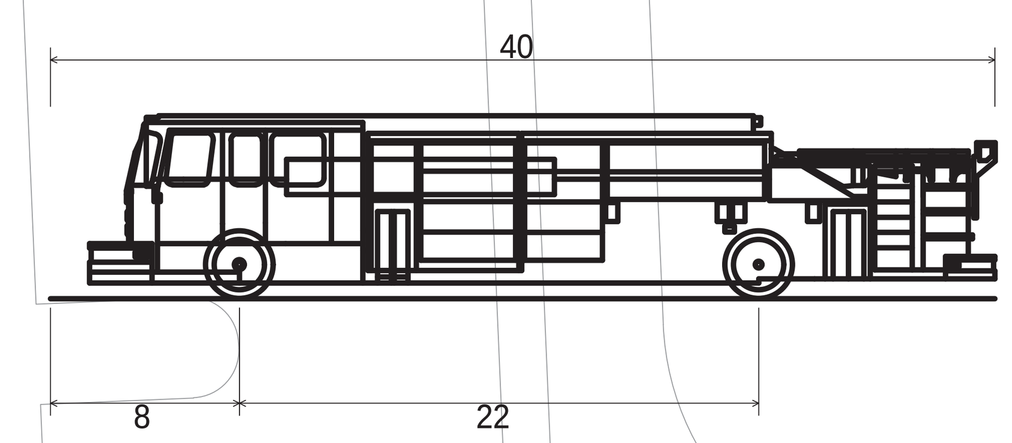
TITLE:

LANDSCAPING DETAILS

DRAWING:

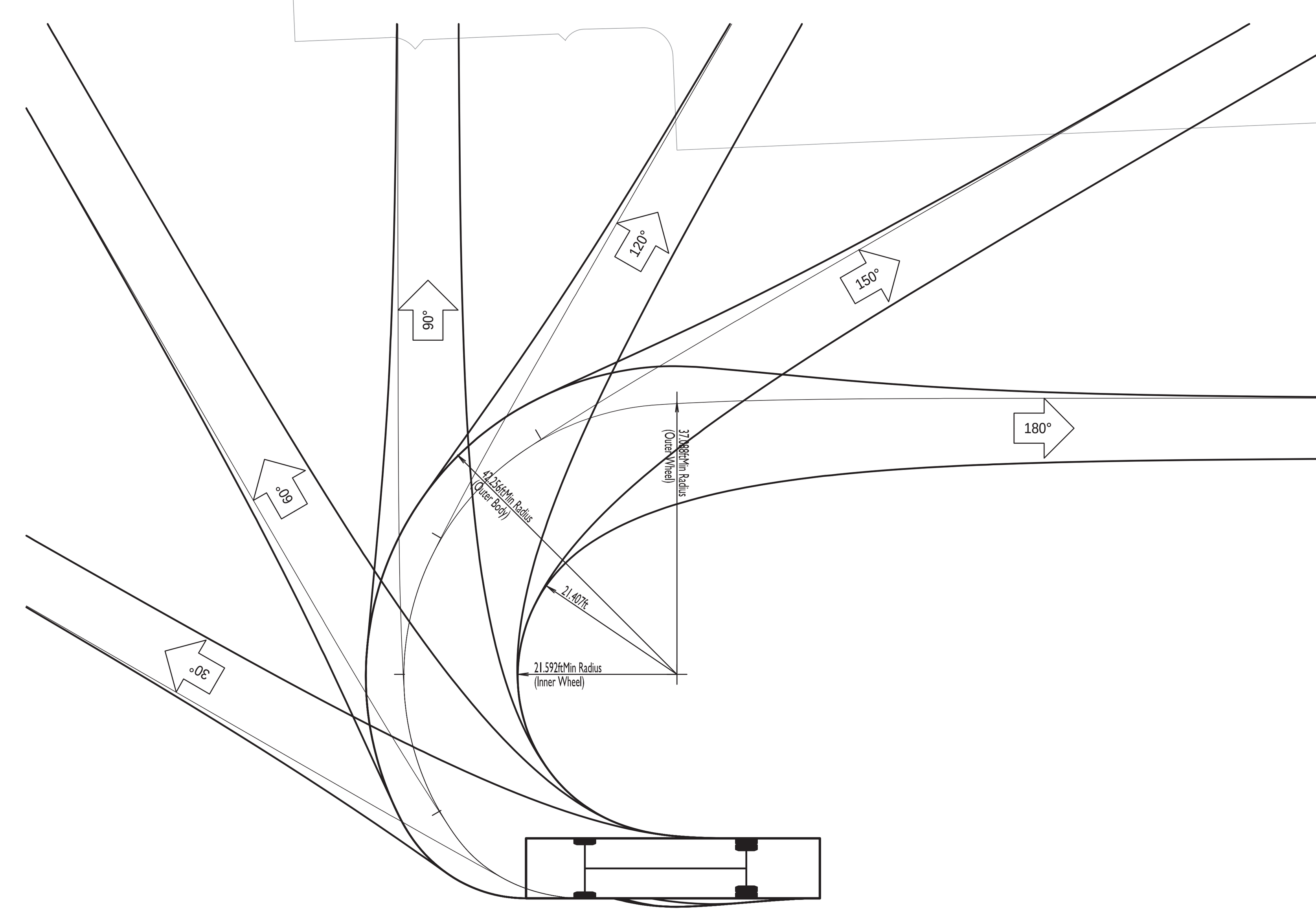
C-9

V:\DET\2023\DET-230229-AFFINITY 10 INVESTMENT-9191 HIGHLAND ROAD, WHITE LAKE, MI\CADD\PLOT\SDP-08-09-LAND.DWG



Pumper Fire Truck

Overall Length	40.000ft
Overall Width	8.167ft
Overall Body Height	7.745ft
Min Body Ground Clearance	0.656ft
Track Width	8.167ft
Lock-to-lock time	5.00s
Max Wheel Angle	45.00°



VEHICLE PROFILE AND TURN TEMPLATE

NOT TO SCALE

GRAPHIC SCALE IN FEET
1" = 30'

ISSUE	DATE	BY	DESCRIPTION
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OAKLAND COUNTY, MICHIGAN

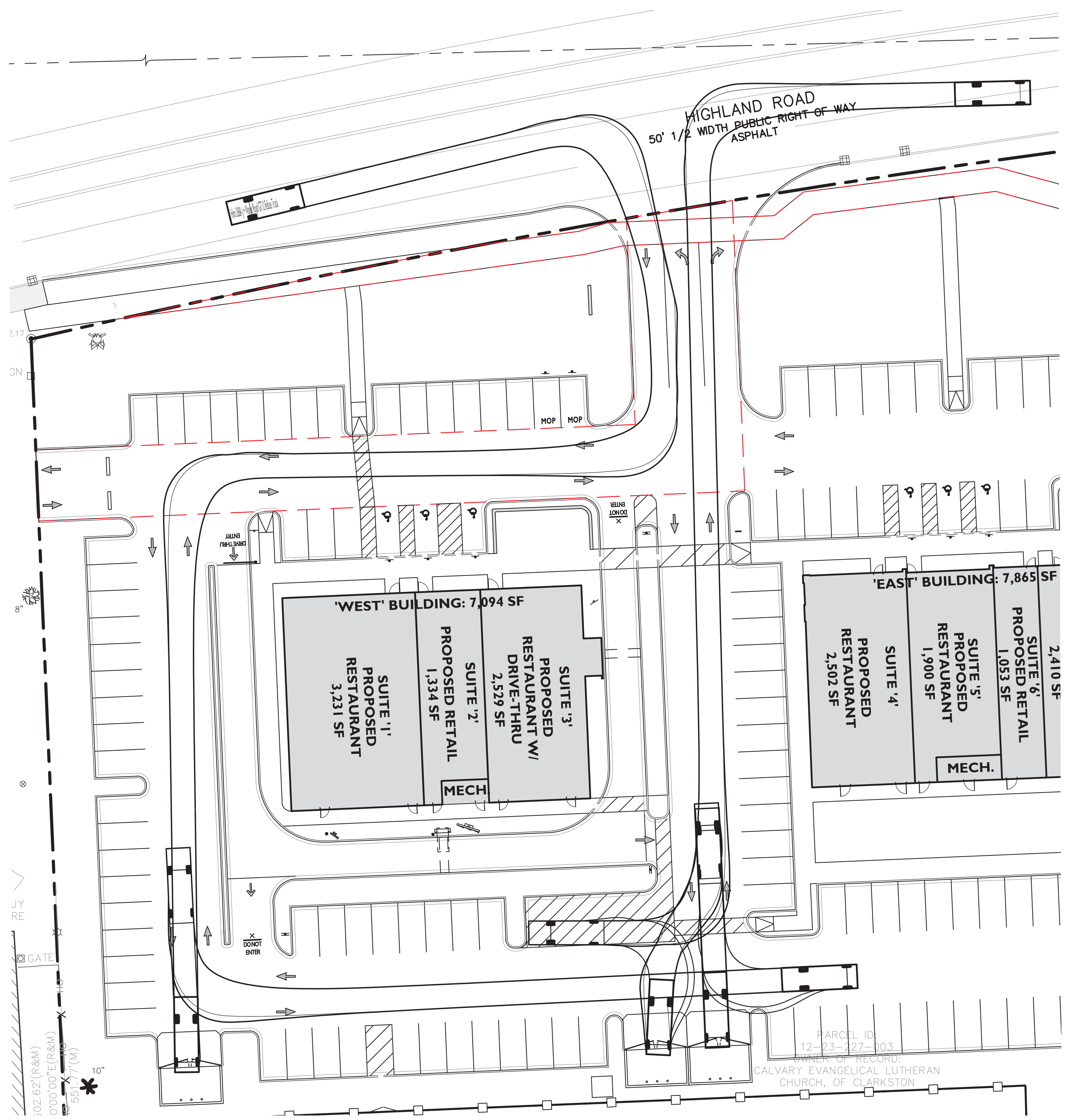
STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
PROFESSIONAL ENGINEER

STONEFIELD
engineering & design

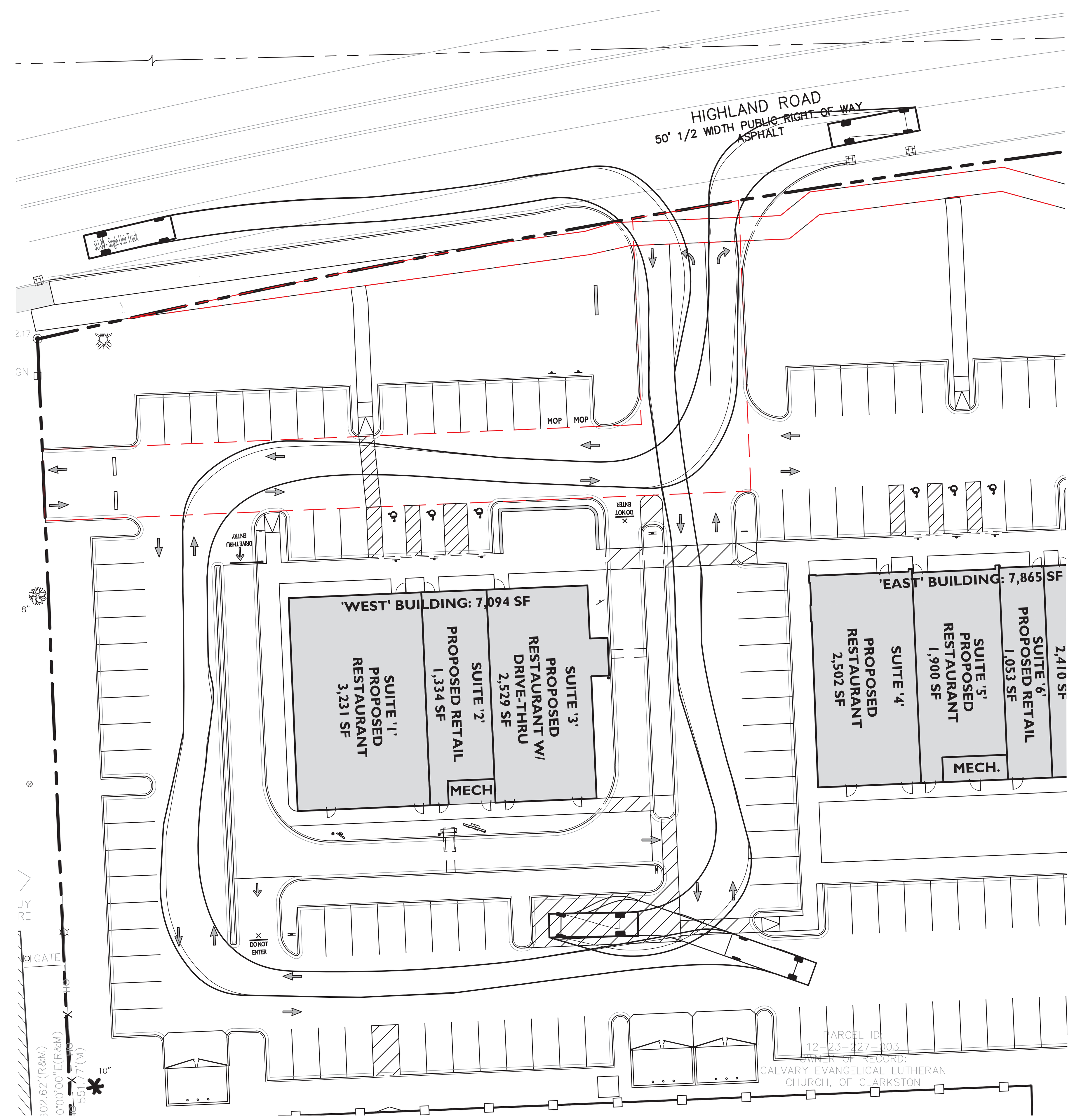
SCALE: 1" = 30' | PROJECT ID: DET-230229

TITLE:
FIRE TRUCK TURNING ANALYSIS

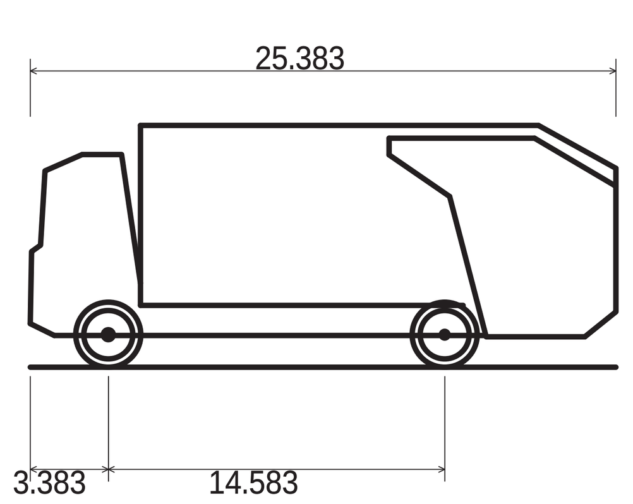
DRAWING:
C-10



REFUSE VEHICLE TURN ANALYSIS

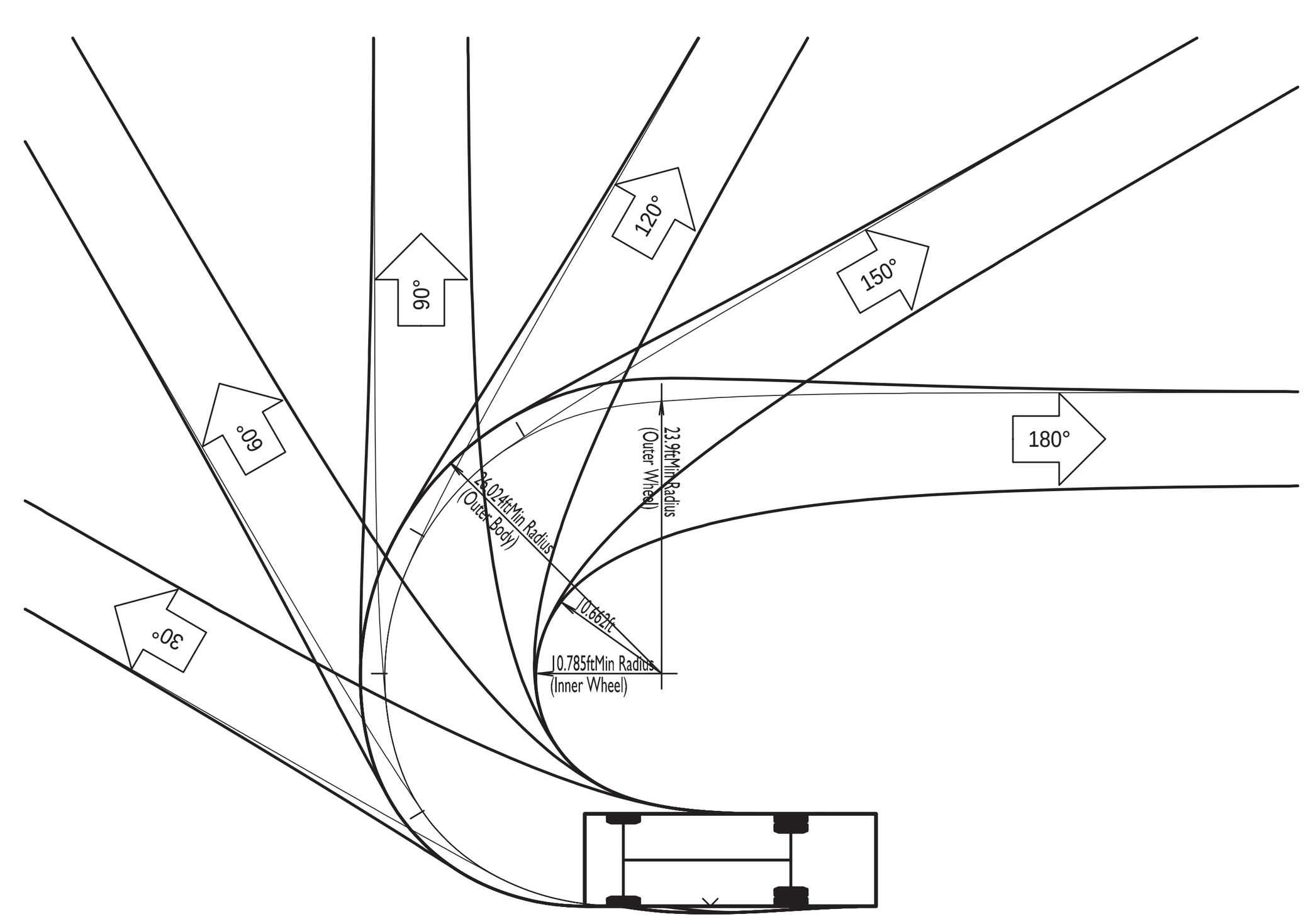


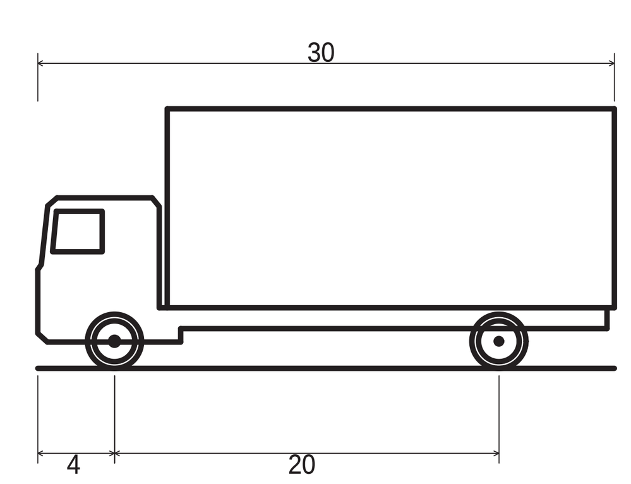
LOADING VEHICLE TURN ANALYSIS



Hino 268A J + Wayne Royal GT12 Refuse Truck

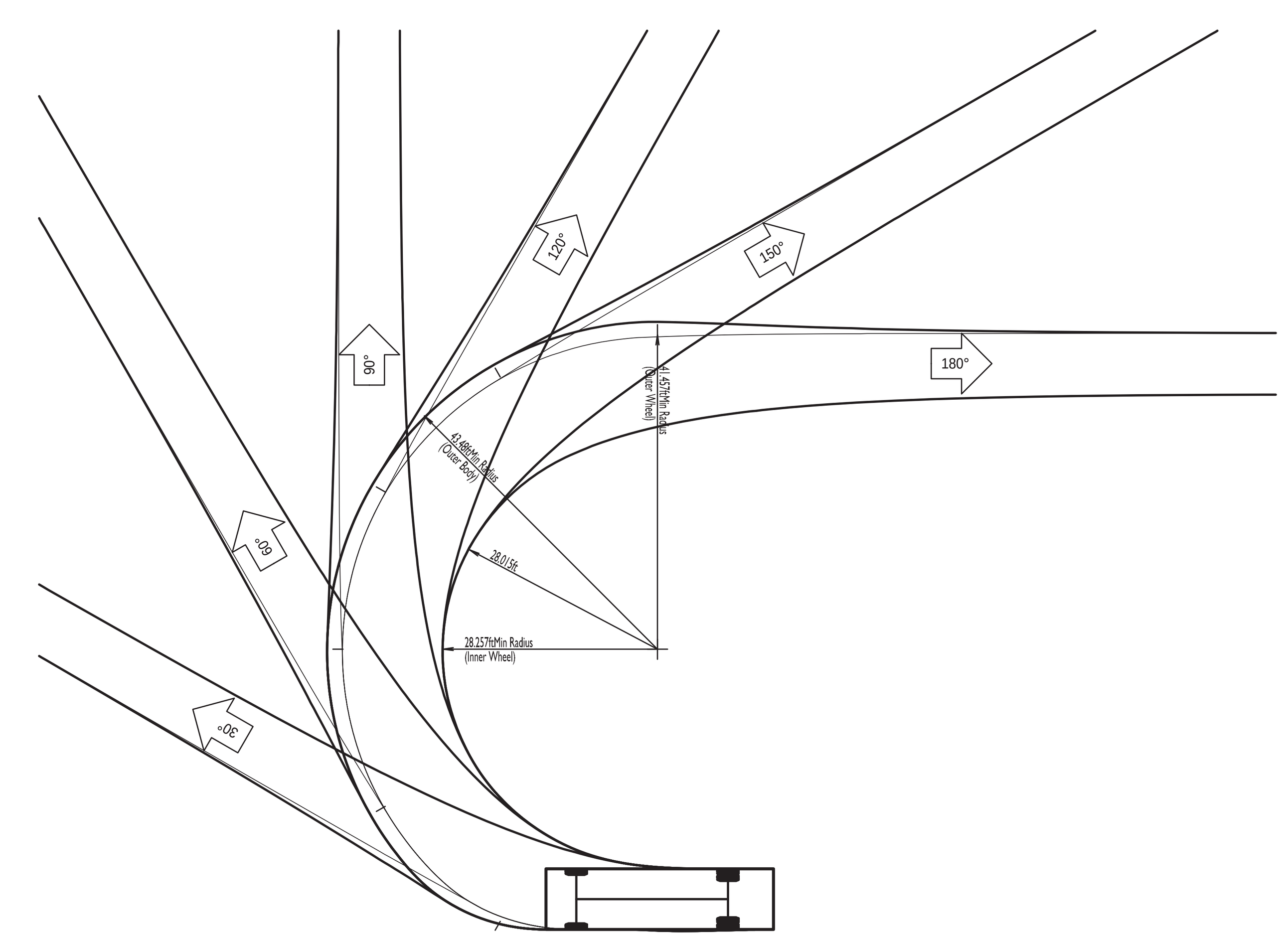
Overall Length	25.383ft
Overall Width	8.042ft
Overall Body Height	10.488ft
Min Body Ground Clearance	1.318ft
Track Width	8.042ft
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	23.900ft





SU-30 - Single Unit Truck

Overall Length	30.000ft
Overall Width	8.000ft
Overall Body Height	13.500ft
Min Body Ground Clearance	1.367ft
Track Width	8.000ft
Lock-to-lock time	5.00s
Max Steering Angle (Virtual)	31.80°



VEHICLE PROFILE AND TURN TEMPLATES
NOT TO SCALE

30' 0' 30' 60'
GRAPHIC SCALE IN FEET
1" = 30'

ISSUE	DATE	BY	DESCRIPTION
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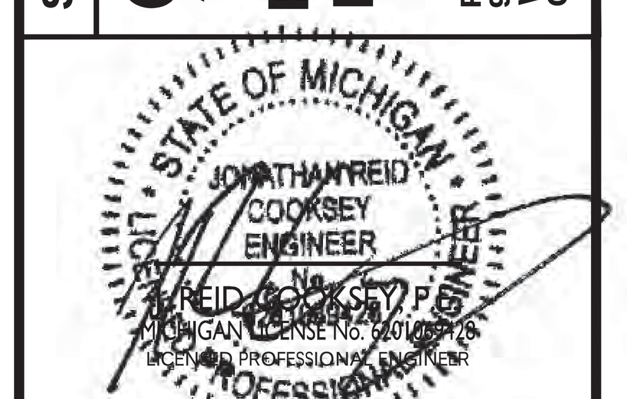
PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID:12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN



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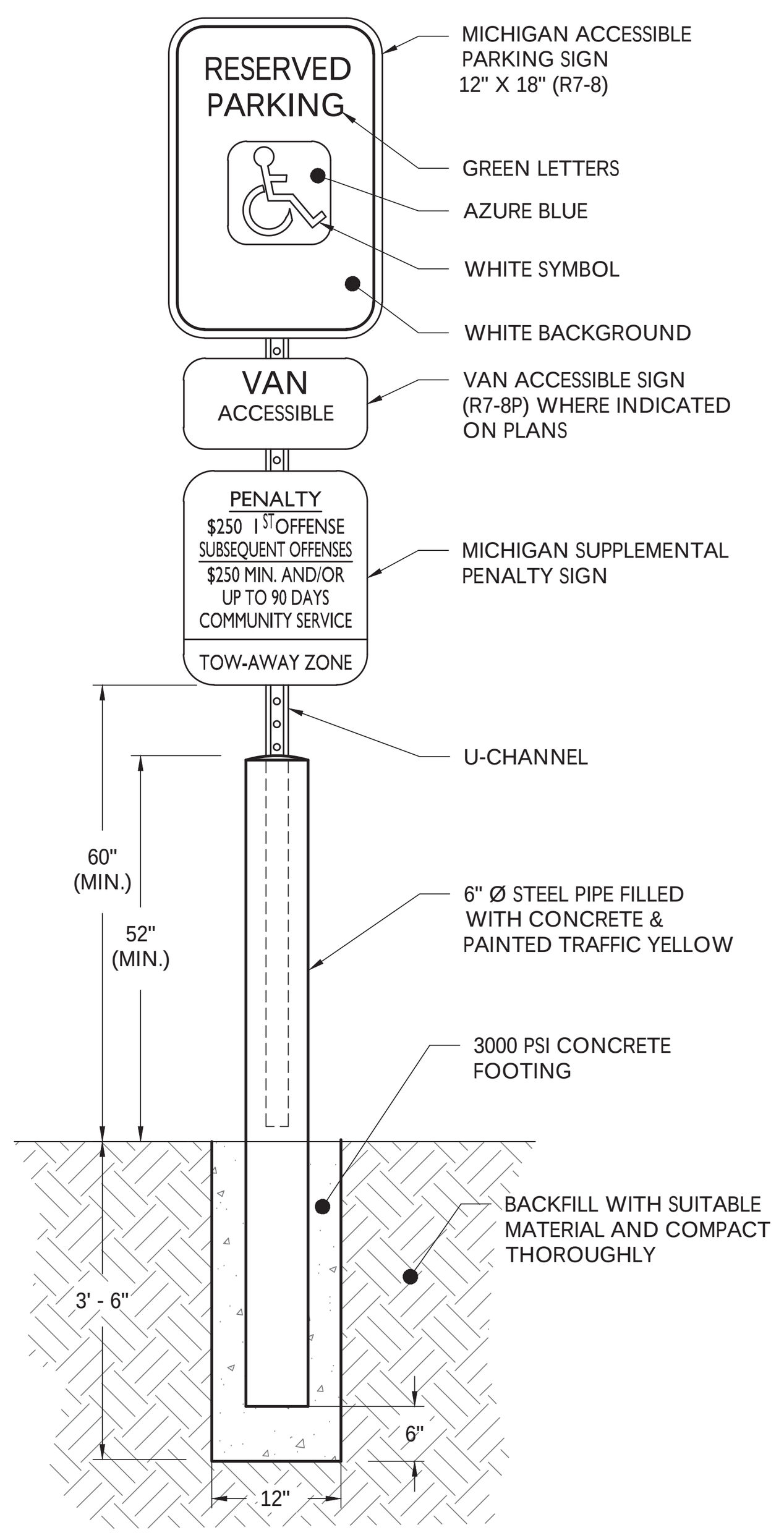
SCALE: 1" = 30' | PROJECT ID: DET-230229

TITLE:
COMMERCIAL TRUCK TURNING ANALYSIS

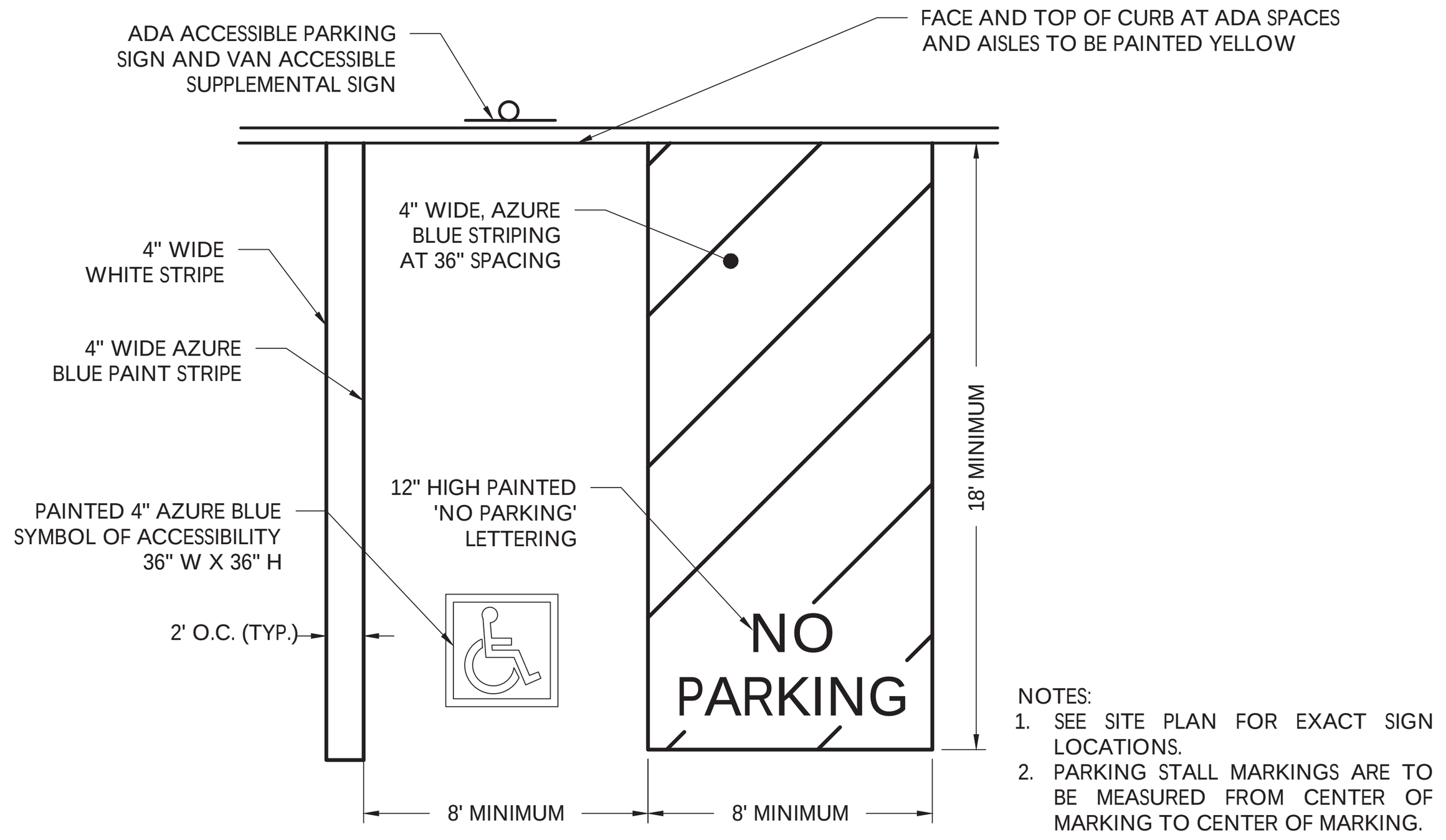
DRAWING:
C-11



ACCESSIBLE PARKING SIGN WITH BOLLARD

NOT TO SCALE

1

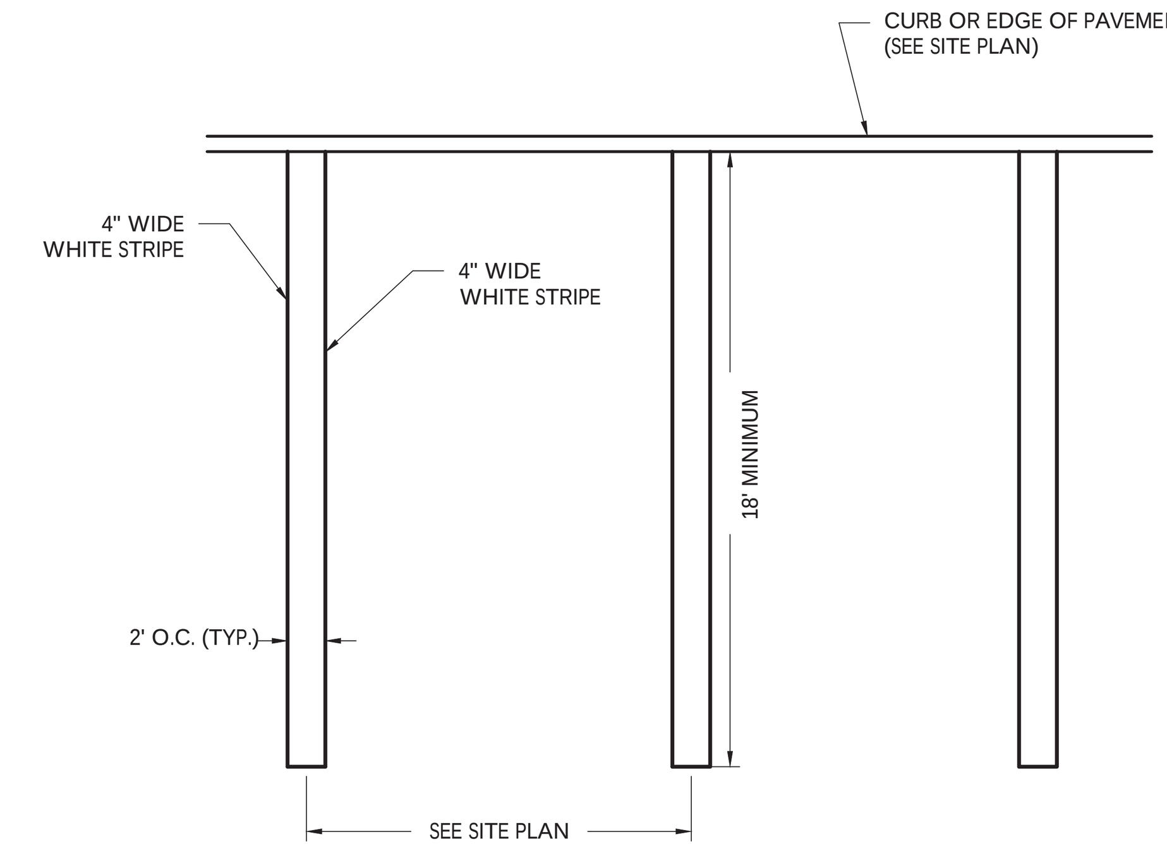


NOTES:
1. SEE SITE PLAN FOR EXACT SIGN LOCATIONS.
2. PARKING STALL MARKINGS ARE TO BE MEASURED FROM CENTER OF MARKING TO CENTER OF MARKING.

ACCESSIBLE PARKING STALL MARKINGS

NOT TO SCALE

2



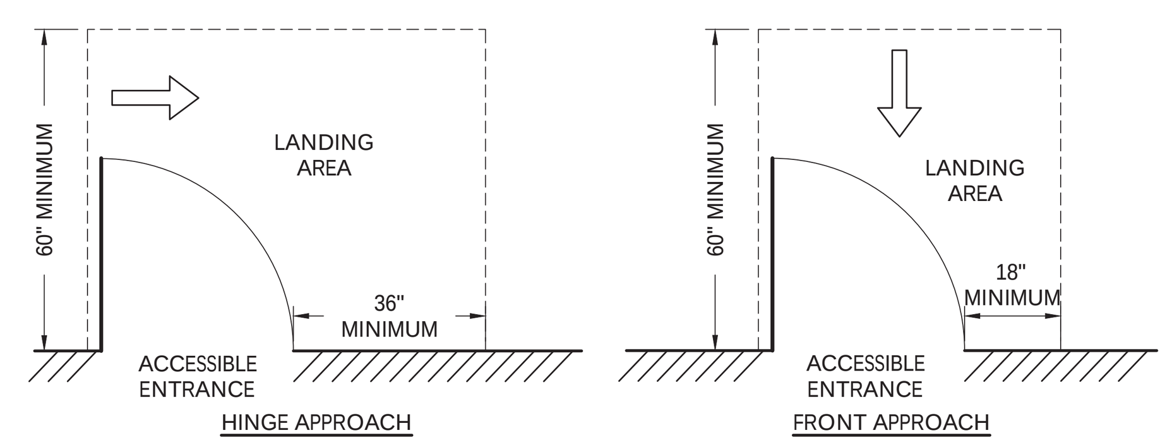
PARKING STALL MARKINGS (DUAL)

NOT TO SCALE

3

PAVEMENT STRIPING & MARKINGS NOTES:
1. ALL SIGNING AND STRIPING IN EXISTING CONDITION IN CONFLICT WITH THE PROPOSED DESIGN PLAN SHALL BE REMOVED.
2. ALL PROPOSED SIGNING AND STRIPING SHALL CONFORM TO THE CURRENT MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) PUBLISHED BY THE FEDERAL HIGHWAY ADMINISTRATION.
3. PAVEMENT STRIPING AND MARKINGS SHALL BE INSTALLED IN CONFORMANCE WITH ALL APPLICABLE LOCAL, COUNTY AND STATE REQUIREMENTS.
4. UNLESS OTHERWISE SPECIFIED, ALL STRIPING AND MARKINGS IN THE PUBLIC RIGHT-OF-WAY SHALL BE OF THERMOPLASTIC PAINT OR PREFORMED THERMOPLASTIC MARKINGS.
5. UNLESS OTHERWISE SPECIFIED, ON SITE PARKING STALL STRIPING, FIRE LANE STRIPING AND DIRECTIONAL ARROWS SHALL BE EPOXY PAINT. ON SITE STOP BARS, "DO NOT ENTER" BARS, AND ASSOCIATED LETTERING SHALL BE THERMOPLASTIC PAINT OR PREFORMED THERMOPLASTIC MARKINGS.

4

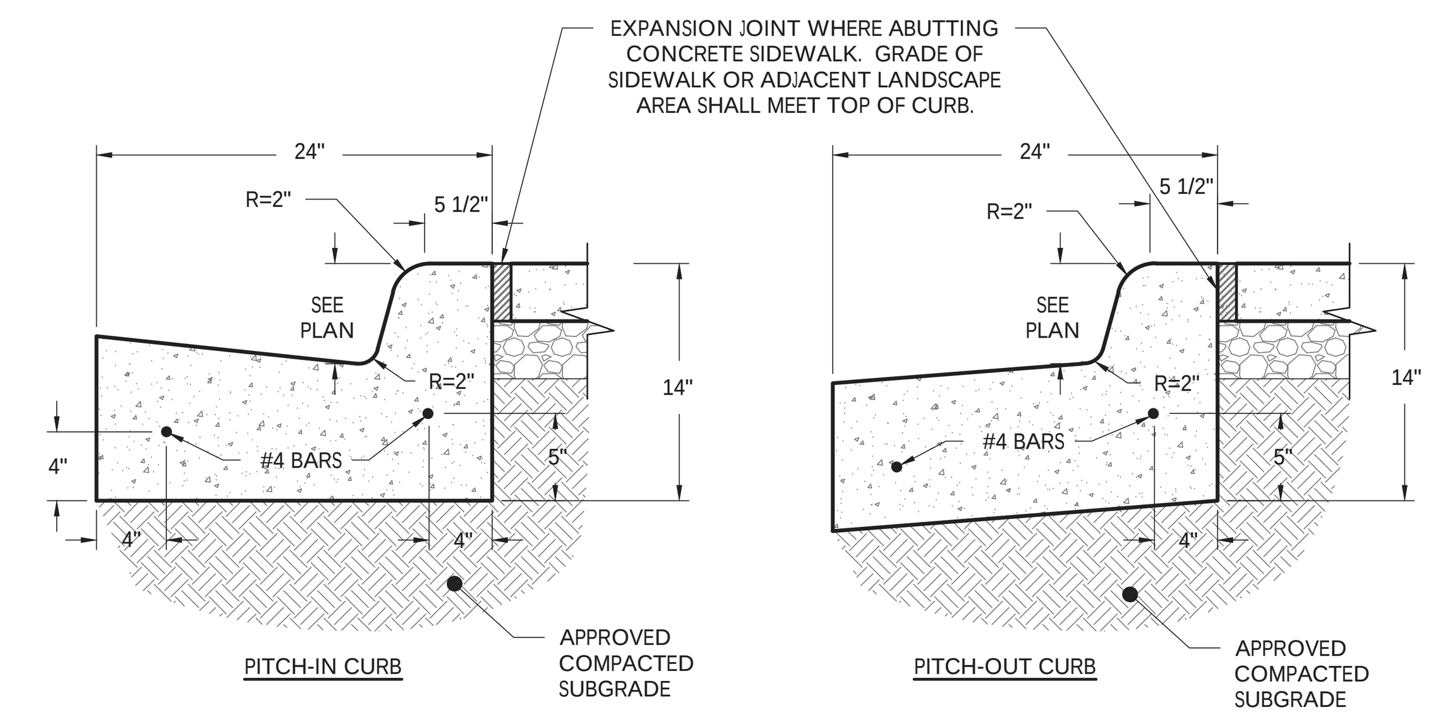


ACCESSIBLE ENTRANCE LANDING

NOT TO SCALE

NOTES:
1. MAXIMUM SLOPE ON LANDING SHALL BE 1:50 IN ALL DIRECTIONS
2. DIMENSIONS SHOWN HERE ARE THE MINIMUM DIMENSIONS REQUIRED FOR AN ADA COMPLIANT LANDING AT THE ACCESSIBLE ENTRANCE. REFER TO SITE PLAN FOR SITE SPECIFIC DIMENSIONS THAT MAY SPECIFY A LARGER LANDING AREA.
3. CONTRACTOR SHALL CONTACT THE ENGINEER BEFORE CONSTRUCTION IF THE ACCESSIBLE ENTRANCE ON SITE DOES NOT MATCH THE SCENARIO SHOWN ABOVE.

5

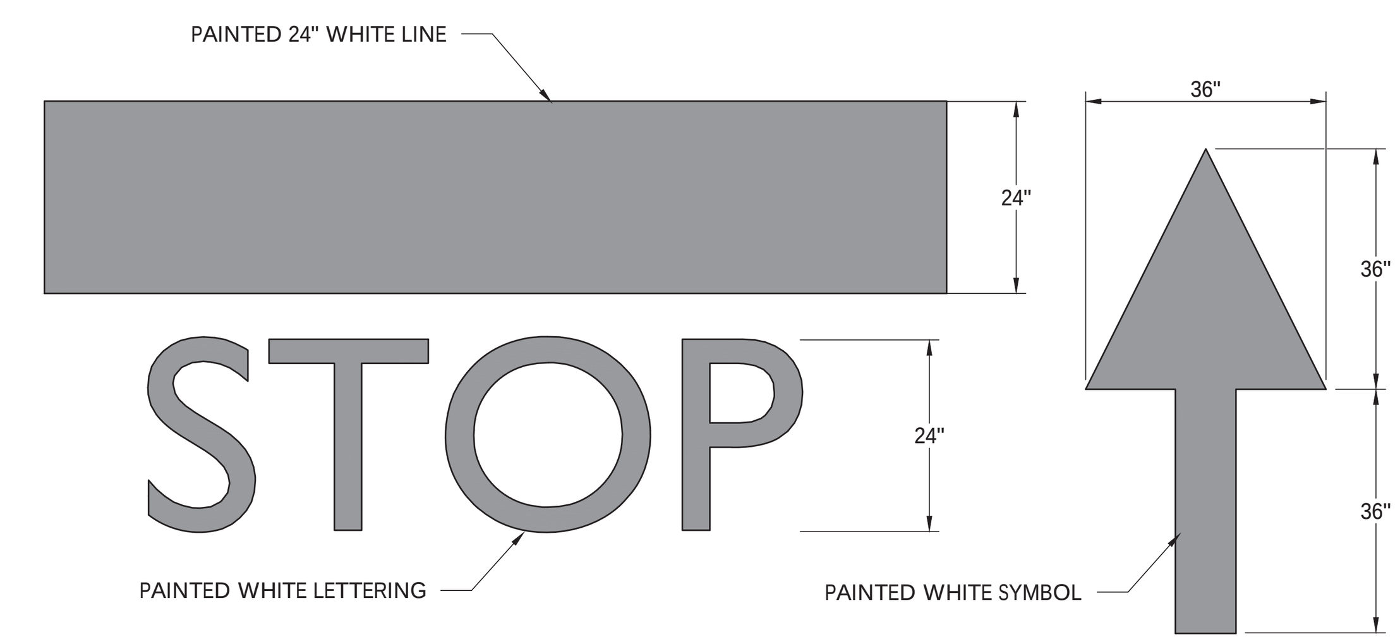


CONCRETE CURB AND GUTTER DETAIL (ON-SITE)

NOT TO SCALE

NOTES:
1. CONCRETE SHALL BE 3500 PSI AT 28 DAYS, AIR-ENTRAINED.
2. TRANSVERSE EXPANSION JOINTS SHALL BE PROVIDED AT 20 FOOT INTERVALS WITH PRE-MOLDED, BITUMINOUS JOINT FILLER, RECESSED ½" FROM SURFACE.
3. HALF DEPTH CONTRACTION JOINTS SHALL BE PROVIDED AT 10 FOOT INTERVALS.
4. 14" CURB DEPTH SHALL BE MAINTAINED AT DEPRESSED OR FLUSH CURBED AREAS.

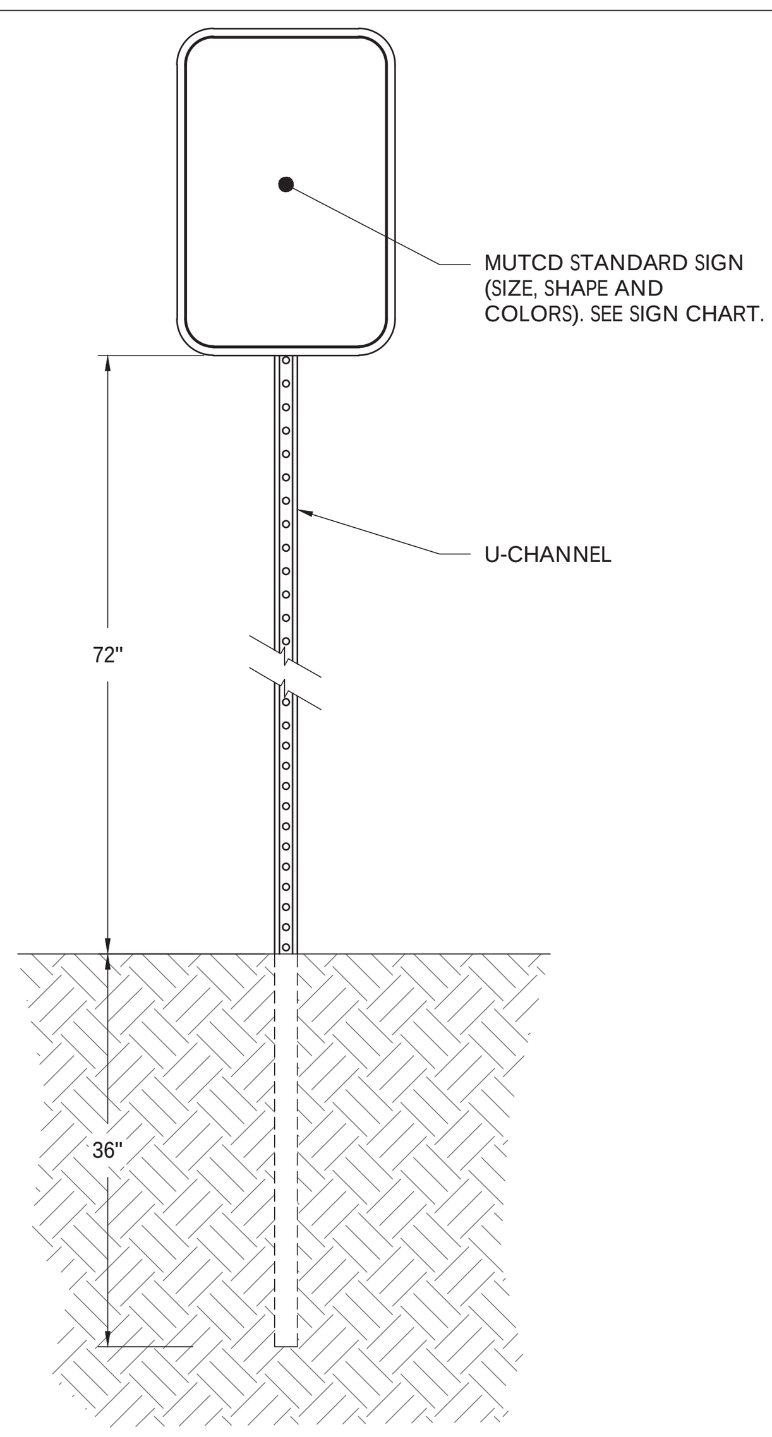
6



STOP BAR & ARROW

NOT TO SCALE

7



SIGN POST

NOT TO SCALE

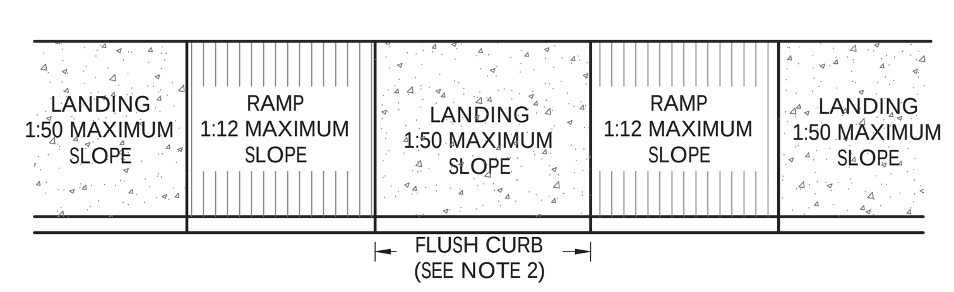
M.U.T.C.D. NUMBER	TEXT	COLOR		SIZE OF SIGN (WIDTH X HEIGHT)	TYPE OF MOUNT
		LEGEND	BACKGROUND		
STOP SIGN (R1-1)	STOP	WHITE	RED	36"x36"	GROUND
DO NOT ENTER (R5-1)	DO NOT ENTER	RED	WHITE	30"x30"	GROUND

NOTE:
1. ALL SIGNS SHALL BE IN ACCORDANCE WITH THE FEDERAL HIGHWAY ADMINISTRATION (FHWA) MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), EXCEPT AS NOTED.
2. ALL SIGNS SHALL BE MOUNTED AS TO NOT OBSTRUCT THE SHAPE OF "STOP" (R1-1) AND "YIELD" (R1-2) SIGNS.

SIGN DATA TABLE

NOT TO SCALE

8



TRANSITION RAMP DETAIL

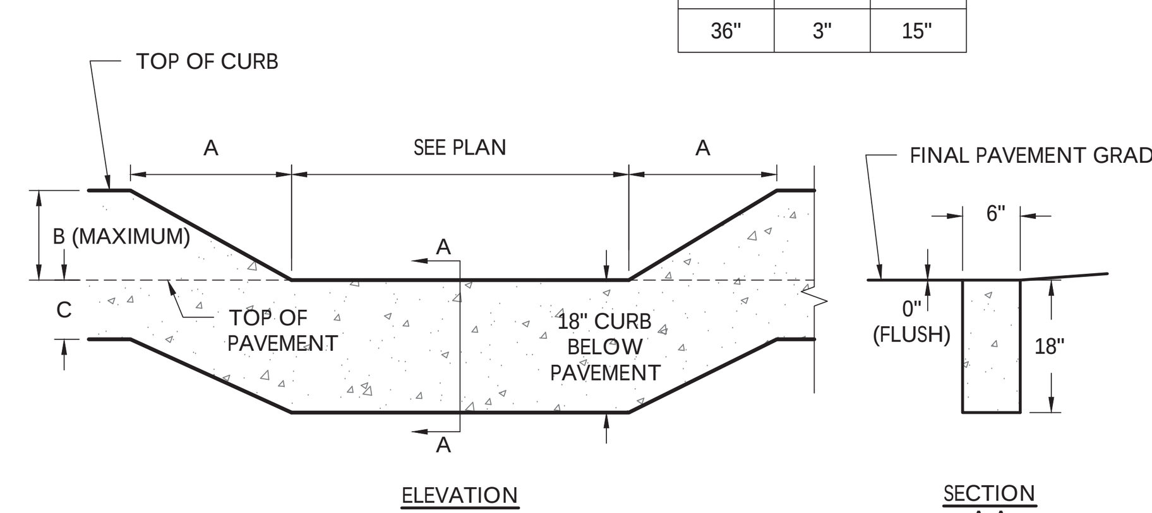
NOT TO SCALE

NOTES:
1. CROSS SLOPE ON RAMP SHALL NOT EXCEED 2%
2. A FLUSH CURB SHALL HAVE A MINIMUM WIDTH OF 36". SEE PLAN FOR EXACT WIDTH.
3. RAMP SHALL HAVE A MAXIMUM RISE OF 6" WITHOUT A HANDRAIL

9

FLUSH CURB DIMENSIONS

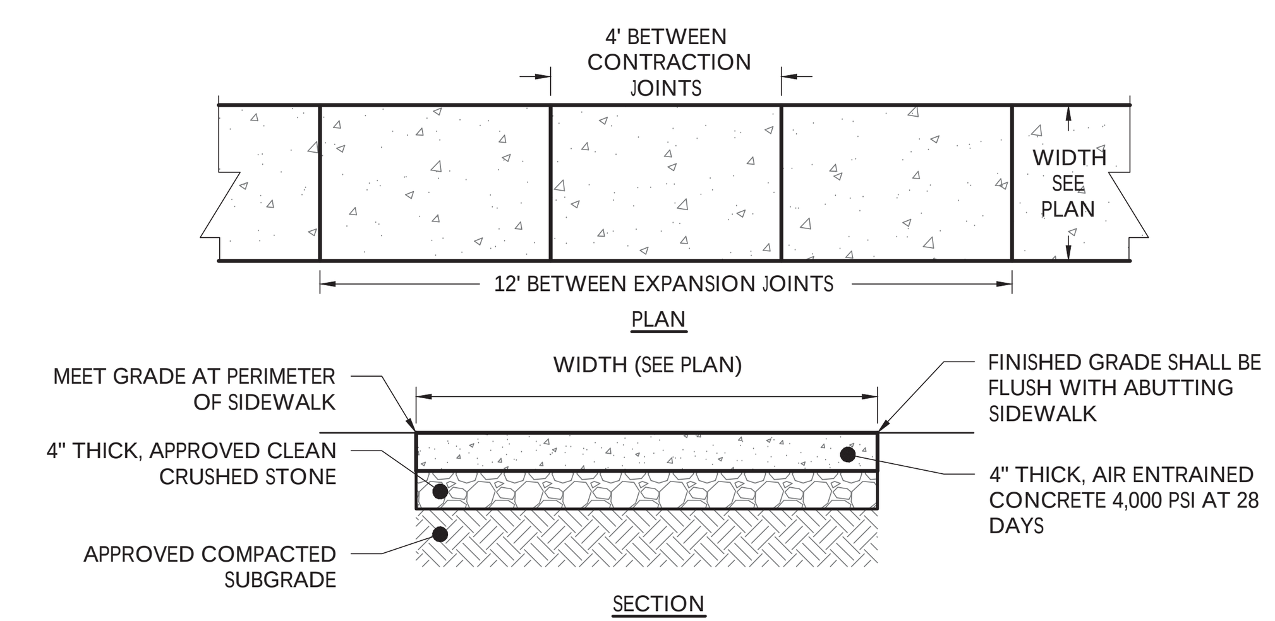
A	B	C
72"	6"	12"
60"	5"	13"
48"	4"	14"
36"	3"	15"



FLUSH CURB

NOT TO SCALE

10

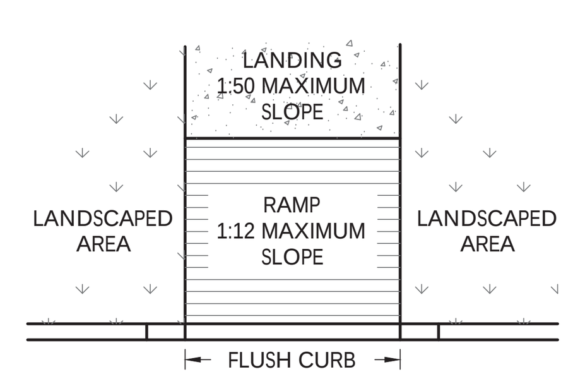


CONCRETE WALKWAY (ON-SITE)

NOT TO SCALE

NOTES:
1. MAXIMUM CROSS SLOPE SHALL BE ¼" PER FOOT.
2. ½" EXPANSION JOINTS SHALL BE PROVIDED AT 12' INTERVALS WITH PRE-MOLDED, BITUMINOUS JOINT FILLER, RECESSED ½" FROM THE SURFACE.
3. 1" DEEP BY ⅛" WIDE, TOOLED CONTRACTION JOINTS SHALL BE PROVIDED AT 4' INTERVALS.
4. EXPANSION JOIN SHALL BE PROVIDED WHERE ADJACENT TO A BUILDING.

11

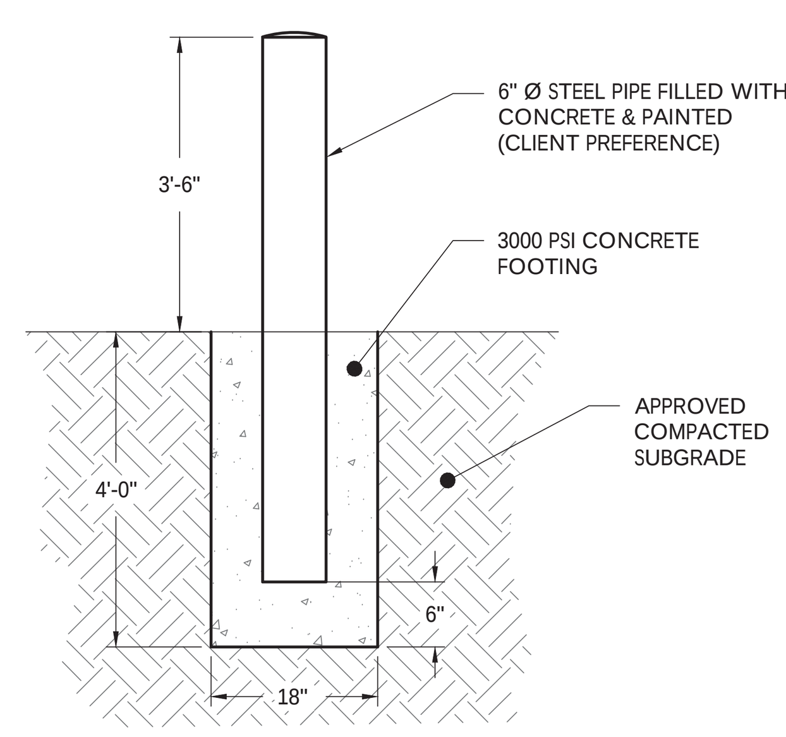


CURB RAMP DETAIL

NOT TO SCALE

NOTES:
1. CROSS SLOPE ON RAMP SHALL NOT EXCEED 2%
2. A FLUSH CURB SHALL HAVE A MINIMUM WIDTH OF 36". SEE PLAN FOR EXACT WIDTH.
3. RAMP SHALL HAVE A MAXIMUM RISE OF 6" WITHOUT A HANDRAIL

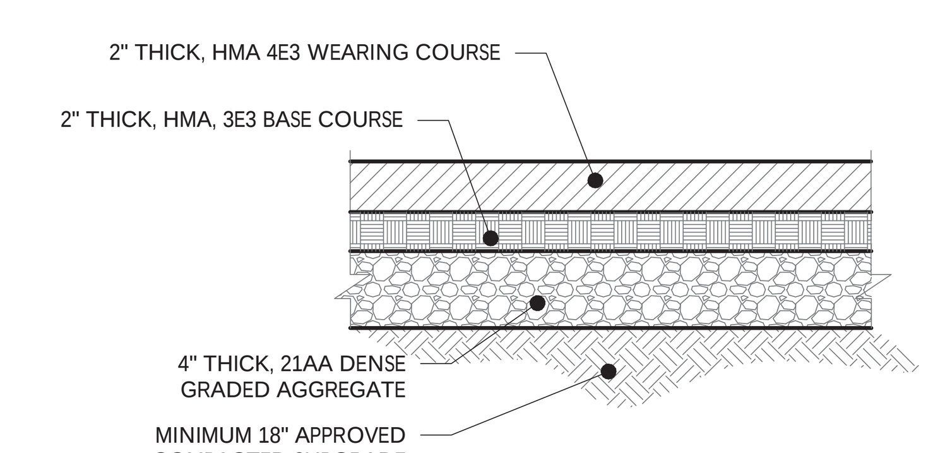
12



BOLLARD

NOT TO SCALE

13



ASPHALT WALKWAY DETAIL (FOR USE WITHIN MDOT ROW)

NOT TO SCALE

NOTES:
1. HMA MIX AND DENSE GRADED AGGREGATE SHALL CONFORM TO THE MICHIGAN DEPARTMENT OF TRANSPORTATION SPECIFICATIONS.

14

ISSUE	DATE	BY	DESCRIPTION
6	12/20/2024	EM	REVISED FOR PRELIMINARY SITE PLAN APPROVAL
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SITE DEVELOPMENT PLANS

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PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID:12-23-227-003
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WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

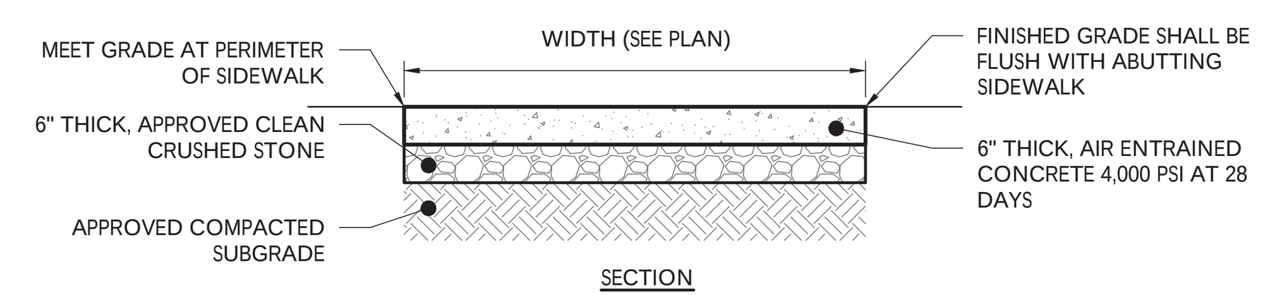
STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
PROFESSIONAL

STONEFIELD engineering & design

SCALE: AS SHOWN | PROJECT ID: DET-230229

TITLE: CONSTRUCTION DETAILS

DRAWING: C-12

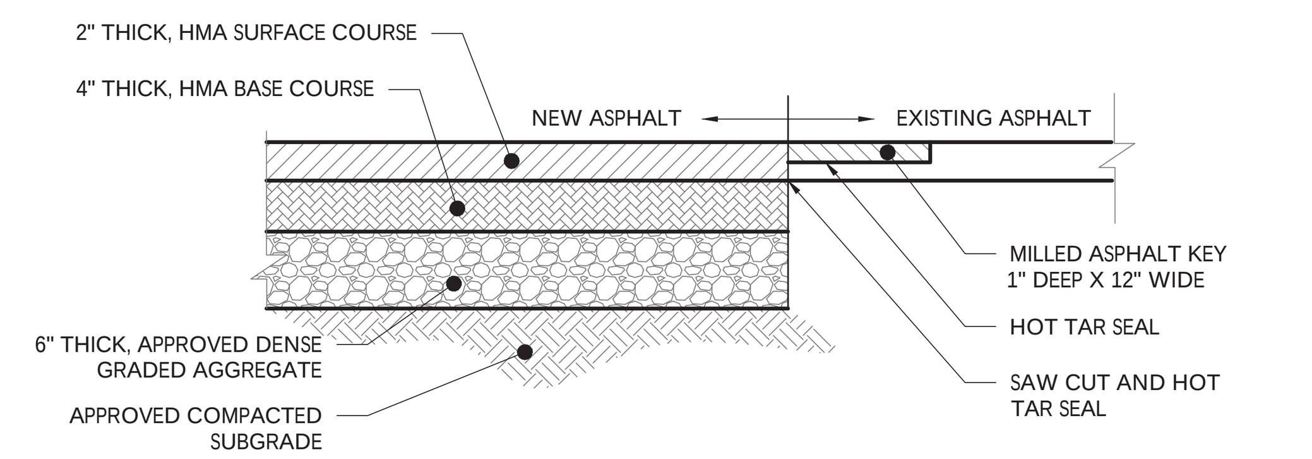


CONCRETE PAVEMENT (ON-SITE)

NOT TO SCALE

NOTES:
1. ½" EXPANSION JOINTS WITH WATER SEAL SHALL BE PROVIDED AT 12' INTERVALS WITH PRE-MOLDED, BITUMINOUS JOINT FILLER, RECESSED ½" FROM THE SURFACE. LONGITUDINAL REBAR TO BE CUT AT EXPANSION JOINTS.
2. 1" DEEP BY ⅜" WIDE, TOOLED CONTRACTION JOINTS SHALL BE PROVIDED AT MID-POINT BETWEEN EXPANSION JOINTS OR 6' INTERVALS MAX.
3. CONCRETE SHALL RECEIVE BROOM FINISH.
4. ALL EXPOSED CORNERS TO HAVE 12" CHAMFER.

1

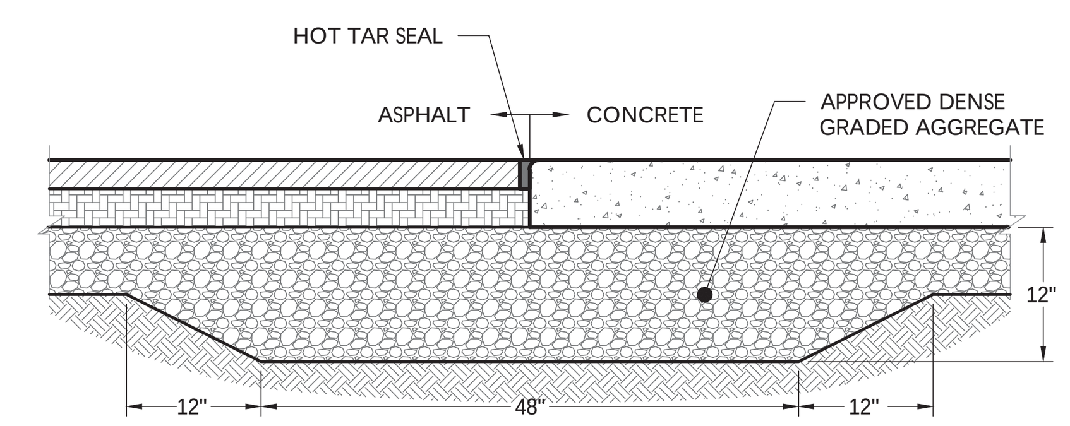


FULL DEPTH ASPHALT PAVEMENT DETAIL (ON-SITE)

NOT TO SCALE

NOTE:
HMA MIX AND DENSE GRADED AGGREGATE SHALL CONFORM TO STATE DEPARTMENT OF TRANSPORTATION SPECIFICATIONS.

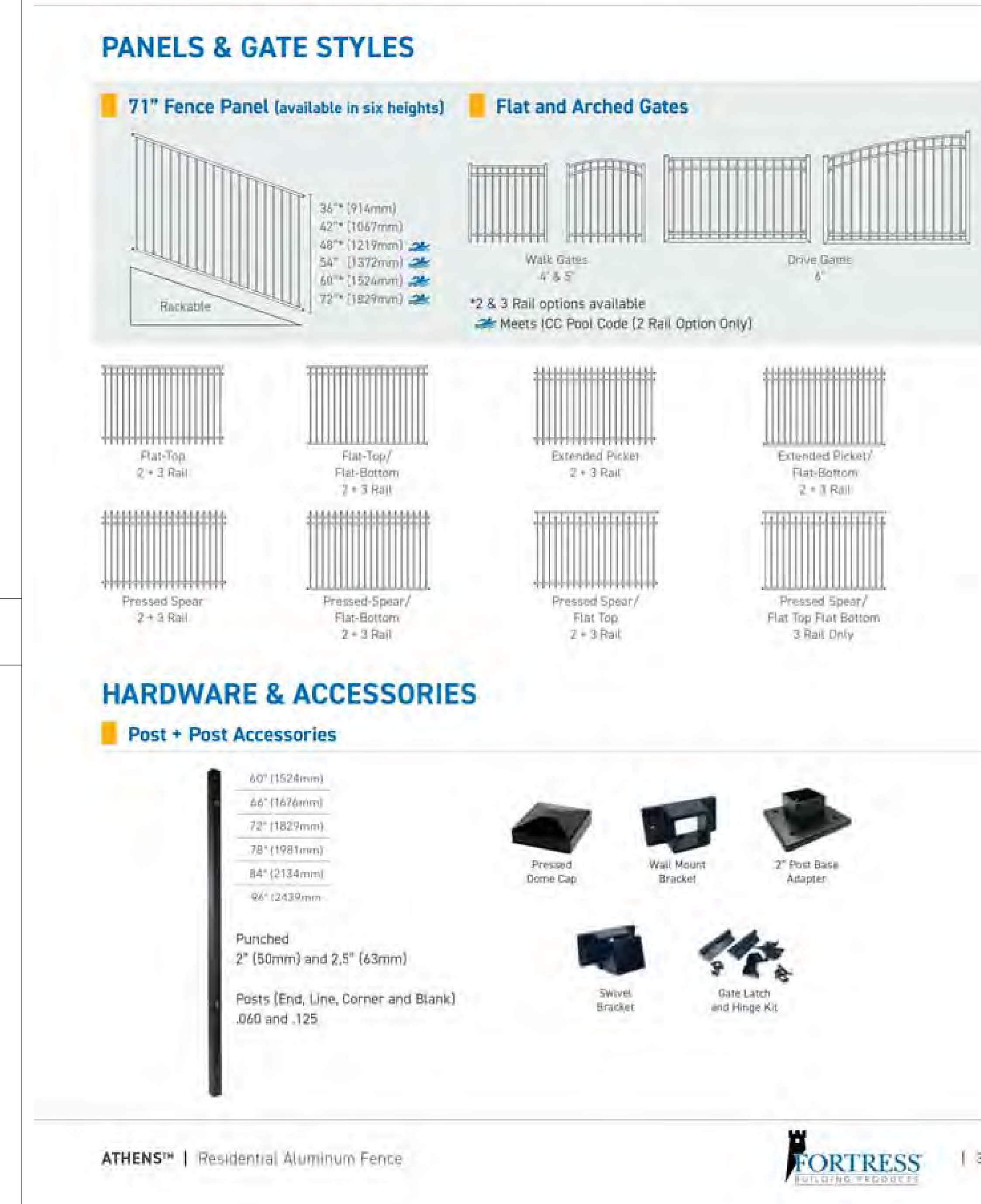
2



CONCRETE TO ASPHALT TRANSITION

NOT TO SCALE

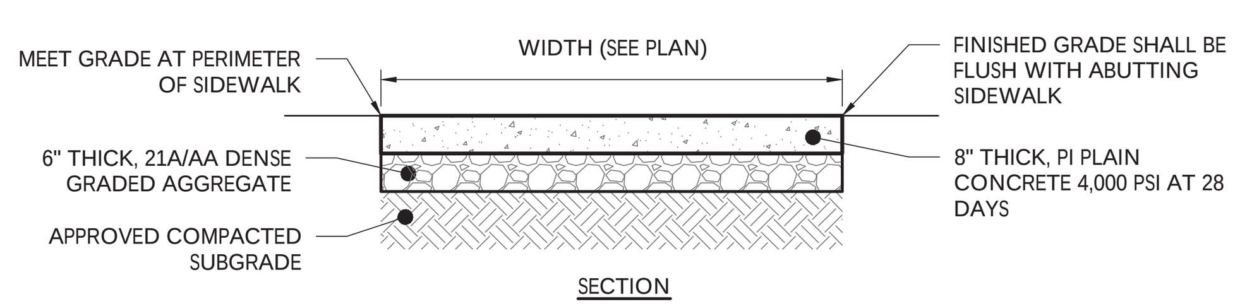
3



4 FT ALUMINUM FENCE SPECIFICATIONS

NOT TO SCALE

7



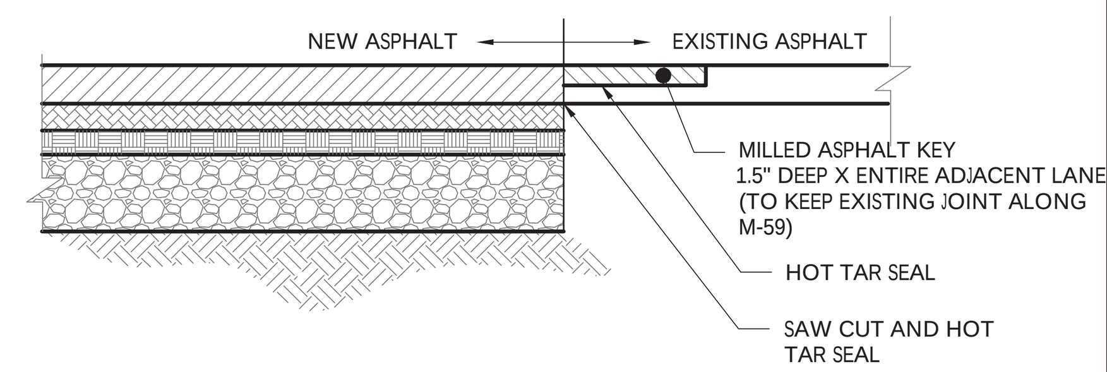
CONCRETE PAVEMENT (FOR MDOT DRIVEWAY)

NOT TO SCALE

NOTES:
1. ½" EXPANSION JOINTS WITH WATER SEAL SHALL BE PROVIDED AT 12' INTERVALS WITH PRE-MOLDED, BITUMINOUS JOINT FILLER, RECESSED ½" FROM THE SURFACE. LONGITUDINAL REBAR TO BE CUT AT EXPANSION JOINTS.
2. 1" DEEP BY ⅜" WIDE, TOOLED CONTRACTION JOINTS SHALL BE PROVIDED AT MID-POINT BETWEEN EXPANSION JOINTS OR 6' INTERVALS MAX.
3. CONCRETE SHALL RECEIVE BROOM FINISH.
4. ALL EXPOSED CORNERS TO HAVE 12" CHAMFER.

4

BELOW PAVEMENT SECTION AS FOLLOWS:
1. 5 EML, TOP COURSE, 165#/SYD, PG 64-22
2. 4 EML, LEVELING COURSE, 220 #SYD, PG 64-22
3. 3 EML, BASE COURSE, 330 #SYD, PG 58-22
4. 16" OGDC, AGGREGATE BASE COURSE
5. 8" CLASS IIA, SAND SUBBASE
6. (6") Ø, SUBGRADE UNDERDRAINS

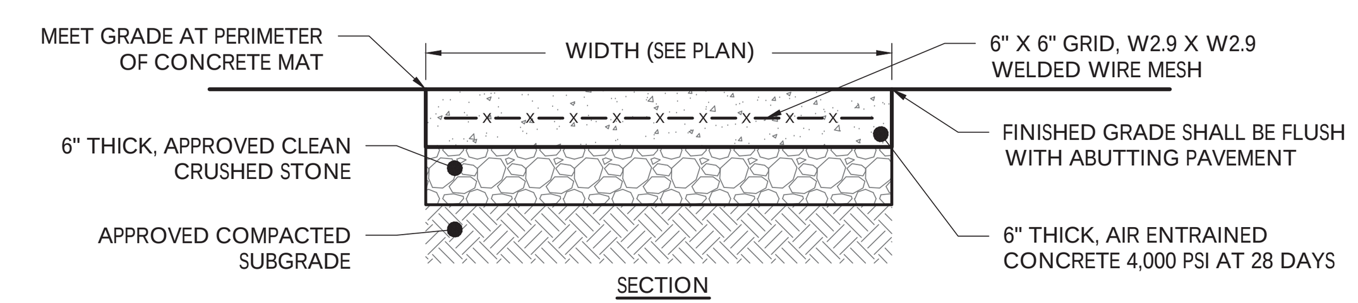


FULL DEPTH ASPHALT PAVEMENT DETAIL (FOR USE WITHIN MDOT ROW)

NOT TO SCALE

NOTES:
1. HMA MIX AND DENSE GRADED AGGREGATE SHALL CONFORM TO THE MICHIGAN DEPARTMENT OF TRANSPORTATION SPECIFICATIONS.
2. IF EXISTING PAVEMENT THICKNESS IS GREATER, CONTRACTOR SHALL MATCH EXISTING CONDITIONS.

5

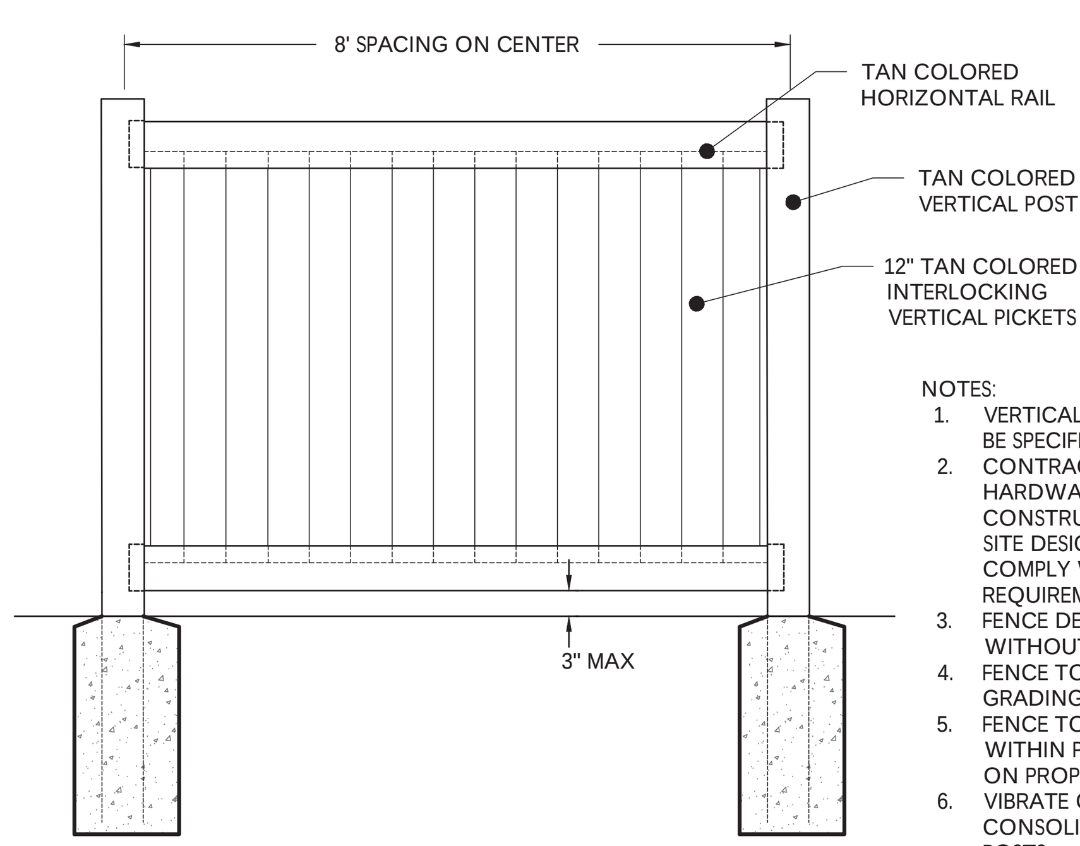


REINFORCED 6" CONCRETE MAT (TRANSFORMER PADS & TRASH APRONS)

NOT TO SCALE

NOTES:
1. ½" EXPANSION JOINTS WITH WATER SEAL SHALL BE PROVIDED AT 12' INTERVALS WITH PRE-MOLDED, BITUMINOUS JOINT FILLER, RECESSED ½" FROM THE SURFACE. LONGITUDINAL REBAR TO BE CUT AT EXPANSION JOINTS.
2. 1" DEEP BY ⅜" WIDE, TOOLED CONTRACTION JOINTS SHALL BE PROVIDED AT MID-POINT BETWEEN EXPANSION JOINTS OR 6' INTERVALS MAX.
3. CONCRETE SHALL RECEIVE BROOM FINISH.
4. ALL EXPOSED CORNERS TO HAVE 12" CHAMFER.

6

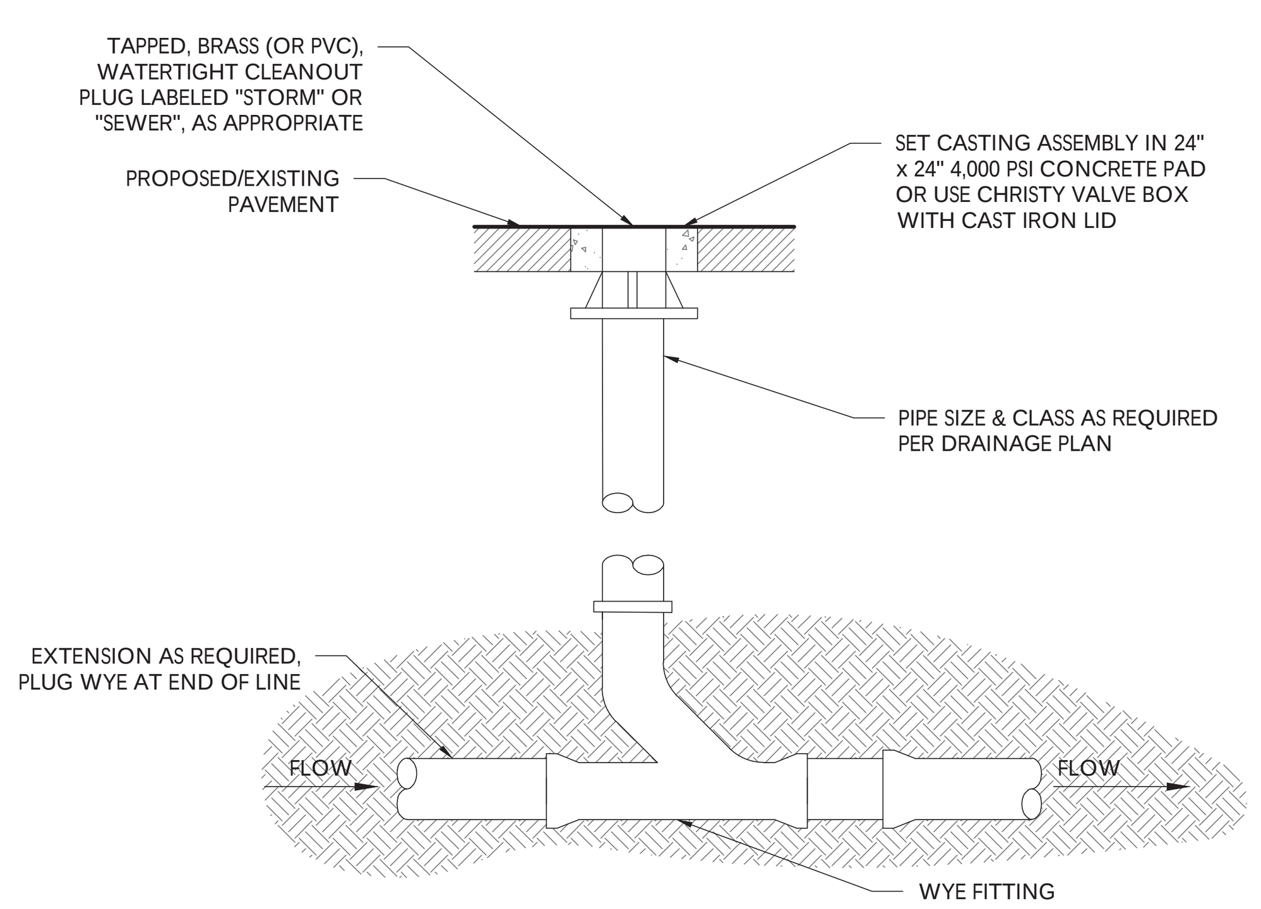


NOTES:
1. VERTICAL AND HORIZONTAL MEMBER TO BE SPECIFIED BY FENCING MANUFACTURER.
2. CONTRACTOR TO PROVIDE ALL HARDWARE NECESSARY FOR FENCE CONSTRUCTION AND OPERATION, PER SITE DESIGN. INSTALLATION SHALL COMPLY WITH MANUFACTURER'S REQUIREMENTS.
3. FENCE DETAIL ONLY APPLIES TO FENCE WITHOUT PRIVACY SLATS.
4. FENCE TO BE INSTALLED FOLLOWING SITE GRADING.
5. FENCE TO BE INSTALLED ONE FOOT WITHIN PROPERTY LINE WHERE SHOWN ON PROPERTY LINE ON SITE PLAN.
6. VIBRATE OR TAMP BACKFILL FOR CONSOLIDATION SURROUNDING FENCE POSTS.

6 FT VINYL FENCE DETAIL

NOT TO SCALE

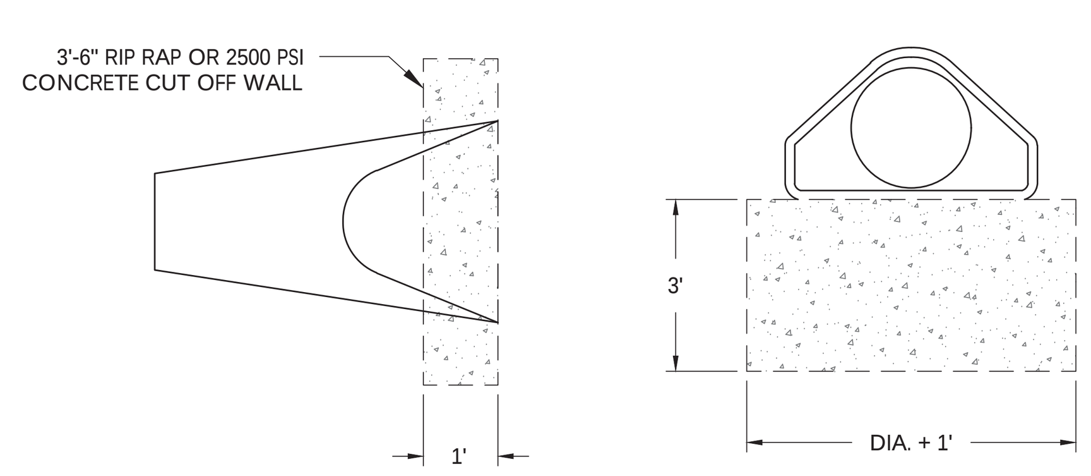
8



HARDSCAPE CLEAN-OUT

NOT TO SCALE

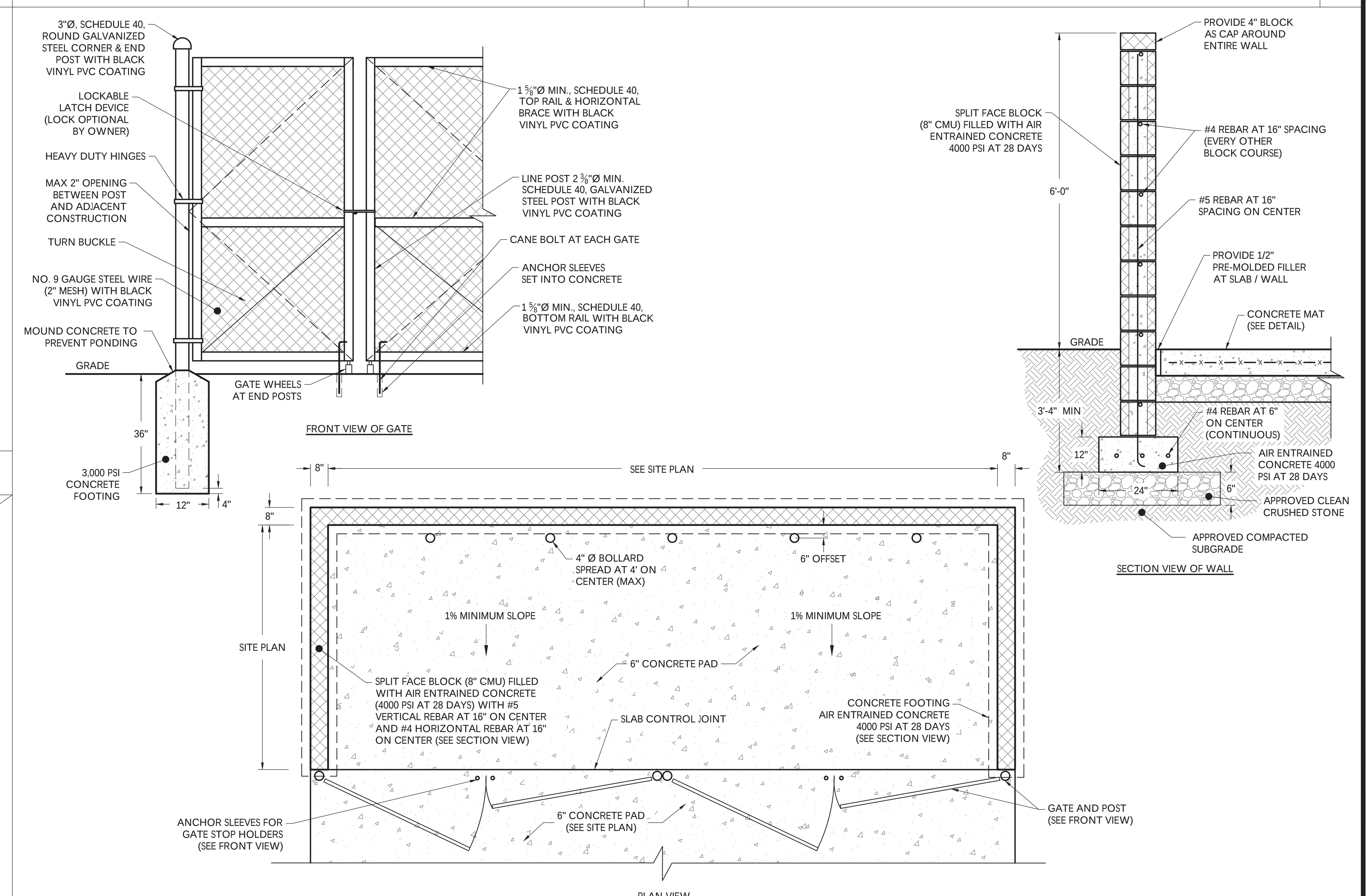
9



FLARED END SECTION DETAIL

NOT TO SCALE

10



NOTE:
BLOCK COLOR TO MATCH BUILDING OR AS SPECIFIED BY OWNER

DOUBLE TRASH / RECYCLE ENCLOSURE DETAIL

NOT TO SCALE

11

ISSUE	DATE	BY	DESCRIPTION
6	12/20/2024	EM	REVISED FOR PRELIMINARY SITE PLAN APPROVAL
5	10/17/2024	EM	REVISED PER PRELIMINARY SITE PLAN REVIEW #1
4	07/22/2024	EM/JP	FOR SITE PLAN REVIEW
3	04/22/2024	JRC/JP	SUBMISSION FOR REVISED REZONING REQUEST
2	04/15/2024	EM	FOR PRELIMINARY MDOT REVIEW
1	11/29/2023	JRC/JP	SUBMISSION FOR REZONING

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SITE DEVELOPMENT PLANS

9101 HIGHLAND ROAD

PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID:12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

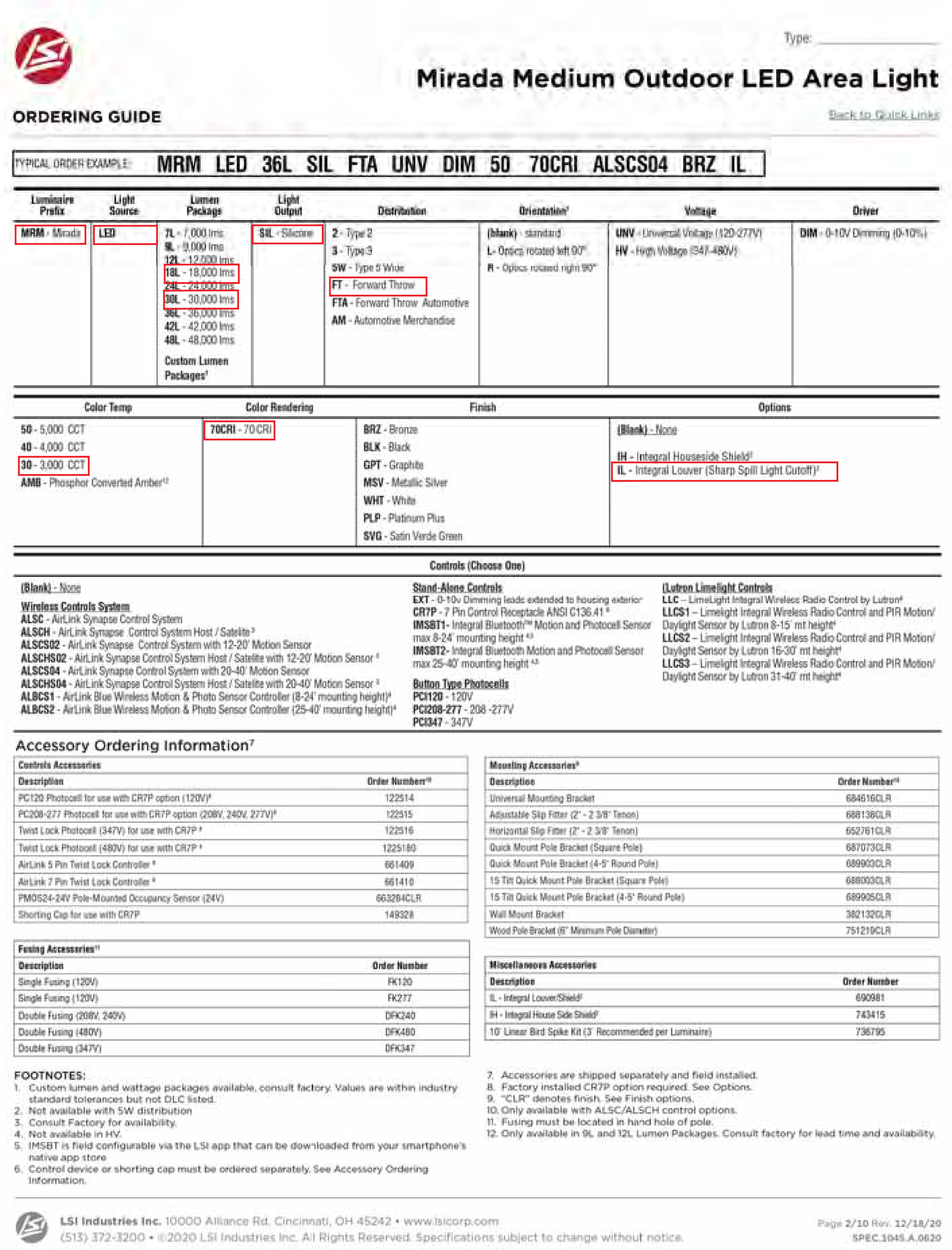
STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
PROFESSIONAL

STONEFIELD engineering & design

SCALE: AS SHOWN | PROJECT ID: DET-230229

TITLE:
CONSTRUCTION DETAILS

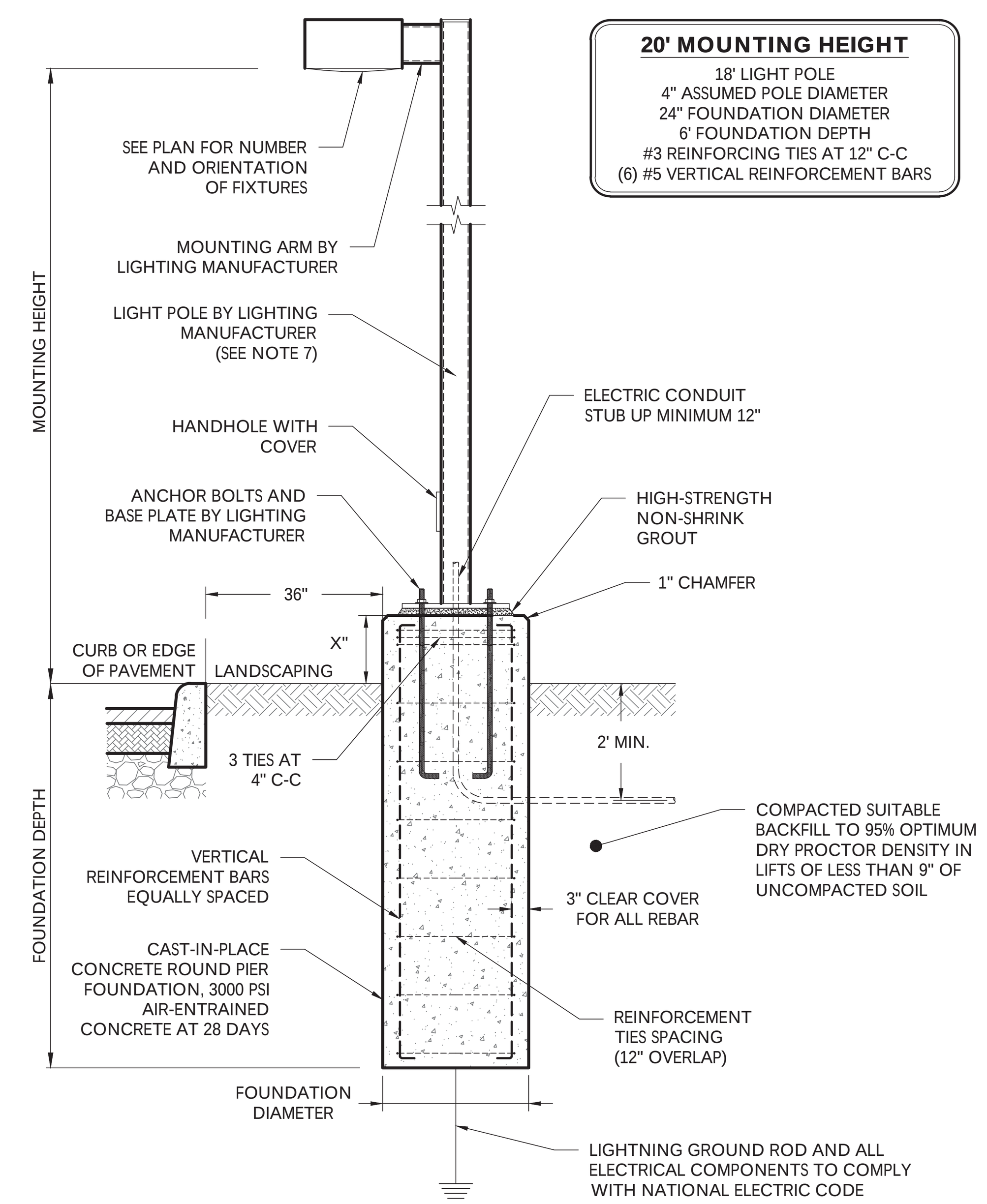
DRAWING:
C-13



SPECIFICATIONS FOR FIXTURES 'A' 'B' 'C'

NOT TO SCALE

1

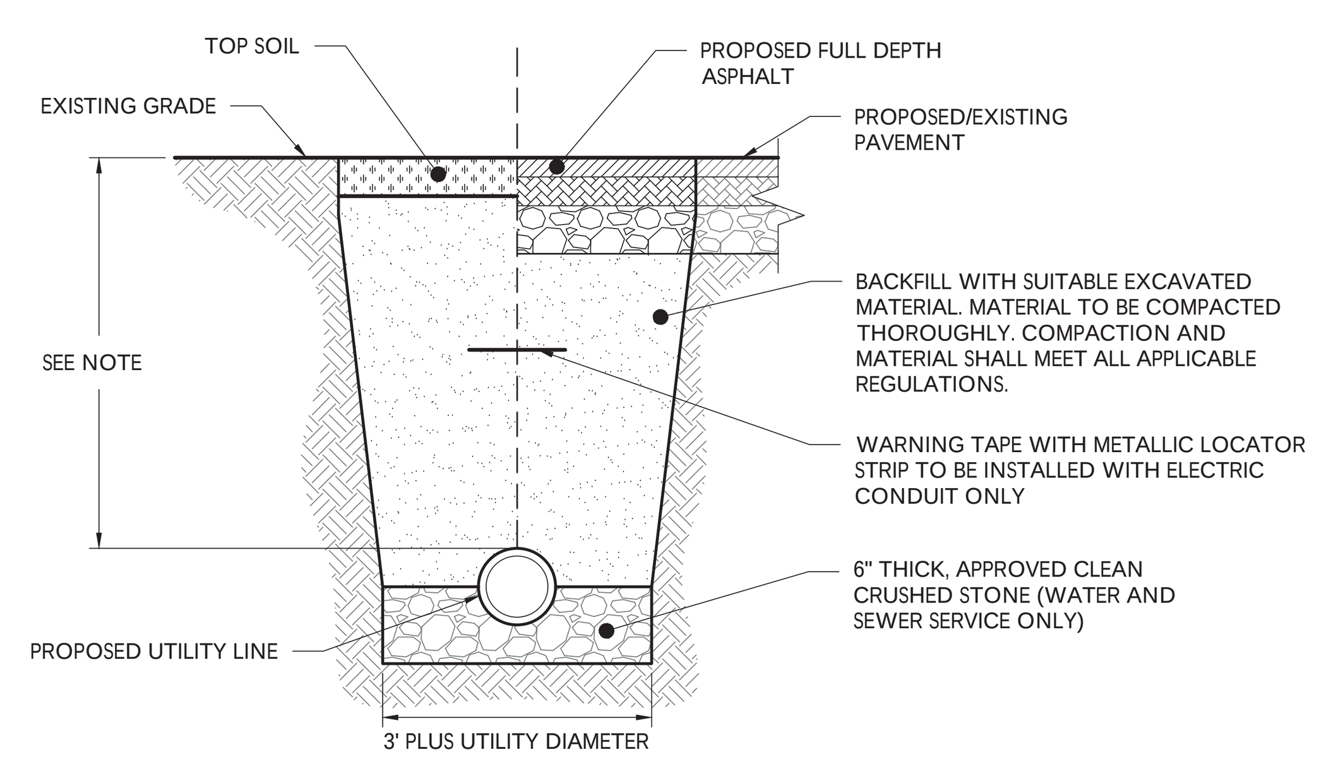


LIGHT POLE INSTALLATION DETAIL

NOT TO SCALE

NOTES:
1. MINIMUM SOIL BEARING PRESSURE OF 1500 PSF, SOIL FRICTION ANGLE OF 30 DEGREES, AND SOIL DRY UNIT WEIGHT OF 120 PCF SHALL BE CONFIRMED IN THE FIELD BY A QUALIFIED PROFESSIONAL.
2. CAST-IN-PLACE CONCRETE SHALL BE CONSOLIDATED USING VIBRATOR.
3. ALL REBAR TO BE NEW GRADE 60 STEEL.
4. PRE-CAST PIERS ACCEPTABLE UPON WRITTEN APPROVAL OF SHOP DRAWING BY ENGINEER.
5. CONCRETE TO BE INSTALLED A MINIMUM OF 7 DAYS PRIOR TO INSTALLING LIGHT POLE. POURED CONCRETE MIX REQUIRED TO OBTAIN 80% OF DESIGN STRENGTH PRIOR TO INSTALLING LIGHT POLE.
6. CONCRETE SHALL HAVE A MAXIMUM SLUMP OF 4" (WITHIN 1" TOLERANCE).
7. POLE SHALL BE RATED FOR 10 MPH HIGHER THAN MAXIMUM WIND SPEED 33FT ABOVE GROUND FOR THE AREA BASED ON ANSI/ASCE 7-93.
8. POUR TO BE TERMINATED AT A FORM.
9. WORK SHALL CONFORM TO ACI BEST PRACTICES FOR APPROPRIATE TEMPERATURE AND WEATHER CONDITIONS.
10. CONTRACTOR TO TEMPORARILY SUPPORT ADJACENT SOIL AND STRUCTURES DURING EXCAVATION IF REQUIRED.

2

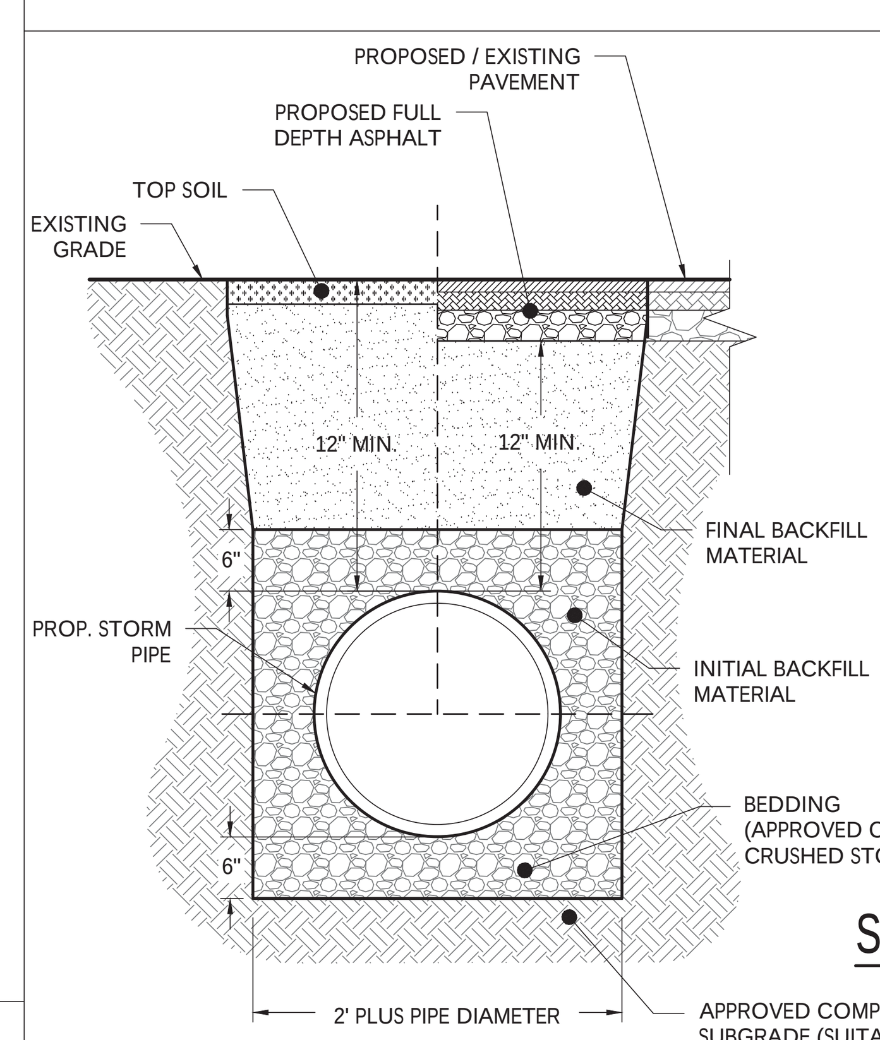


UTILITY TRENCH

NOT TO SCALE

NOTE:
MINIMUM PIPE COVER SHALL BE AS FOLLOW:
- ELECTRIC SERVICE - PER APPLICABLE UTILITY AUTHORITY
- GAS SERVICE - PER APPLICABLE UTILITY AUTHORITY
- SEWER SERVICE - 36" MINIMUM
- WATER SERVICE - 48" MINIMUM

3

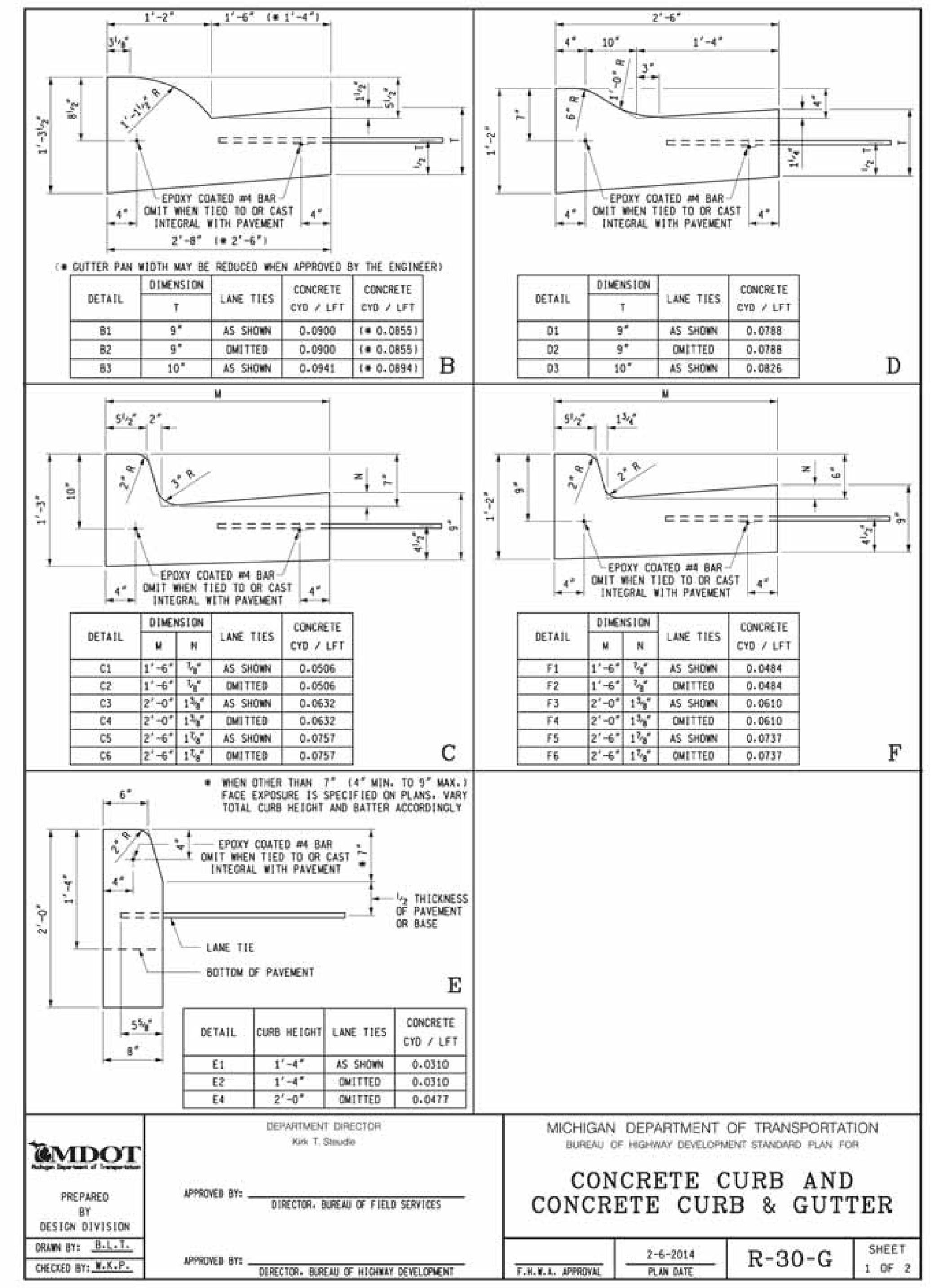


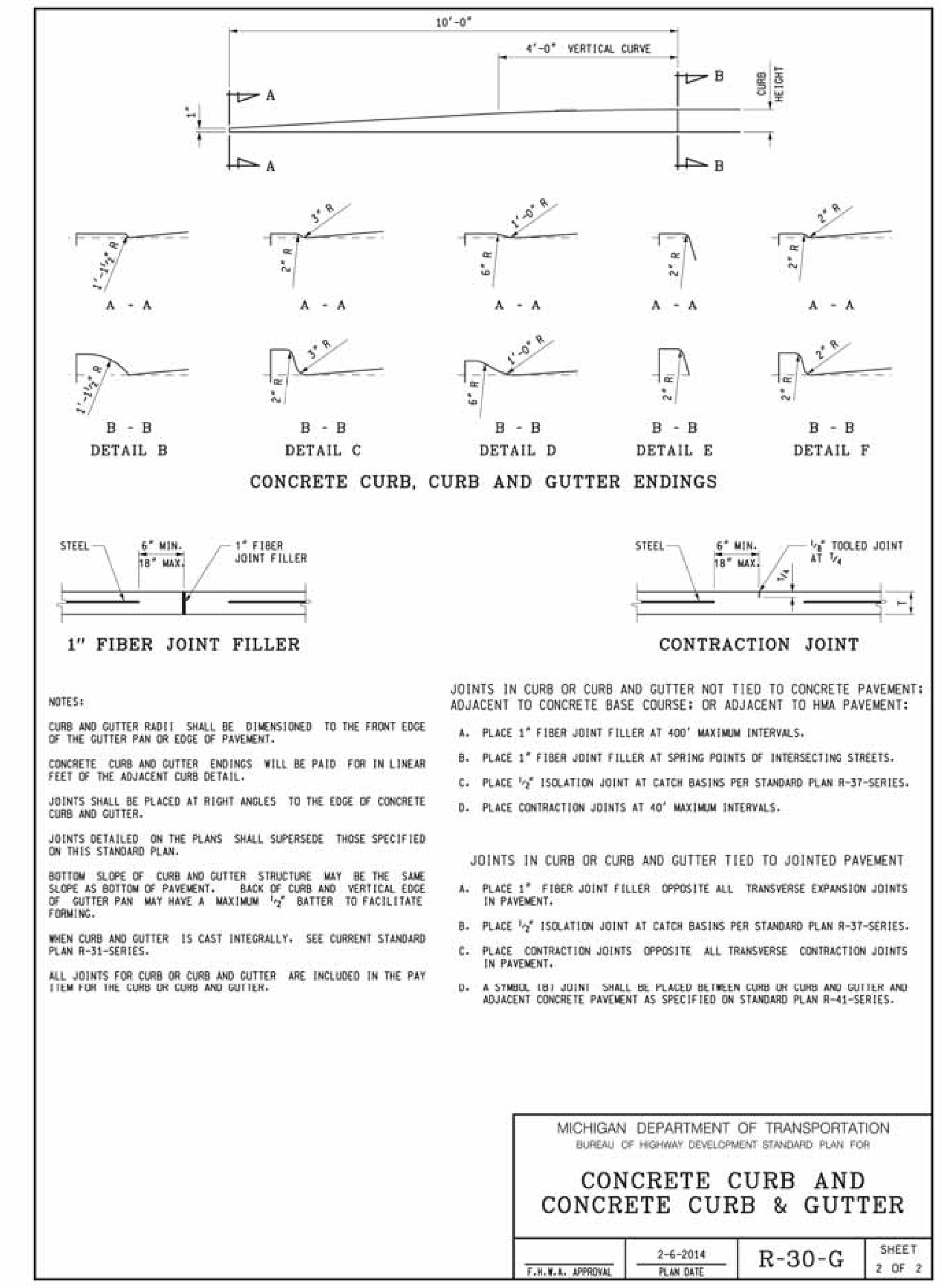
NOTES:
1. ALL PIPE SYSTEM INSTALLATIONS SHALL MEET ALL APPLICABLE STANDARDS AND SPECIFICATIONS.
2. ALL HDPE PIPE SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321, "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS" (LATEST EDITION).
3. ALL RCP PIPE SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM C76-15, "STANDARD SPECIFICATION FOR REINFORCED CONCRETE CULVERT, STORM DRAIN, AND SEWER PIPE" (LATEST EDITION).
4. FOR NON HDPE OR RCP PIPE INSTALLATIONS, CONTRACTOR SHALL INSTALL PIPE IN ACCORDANCE WITH ALL APPLICABLE STANDARDS AND SPECIFICATIONS.
5. WHERE THE TRENCH BOTTOM IS UNSTABLE, CONTRACTOR SHALL PROVIDE SUITABLE BACKFILL MATERIAL AS REQUIRED BY ENGINEER OR PER GEOTECH RECOMMENDATIONS.
6. MINIMUM COVER IN TRAFFIC AREAS IS 12" UP TO 48" DIAMETER PIPE AND 24" FOR 54" - 60" DIAMETER PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.
7. CONTRACTOR SHALL INSTALL SUITABLE MATERIAL FOR INITIAL AND FINAL BACKFILL. BACKFILL COMPACTION SHOULD MEET ALL APPLICABLE STANDARDS AND SPECIFICATIONS.

STORM TRENCH DETAIL

NOT TO SCALE

4

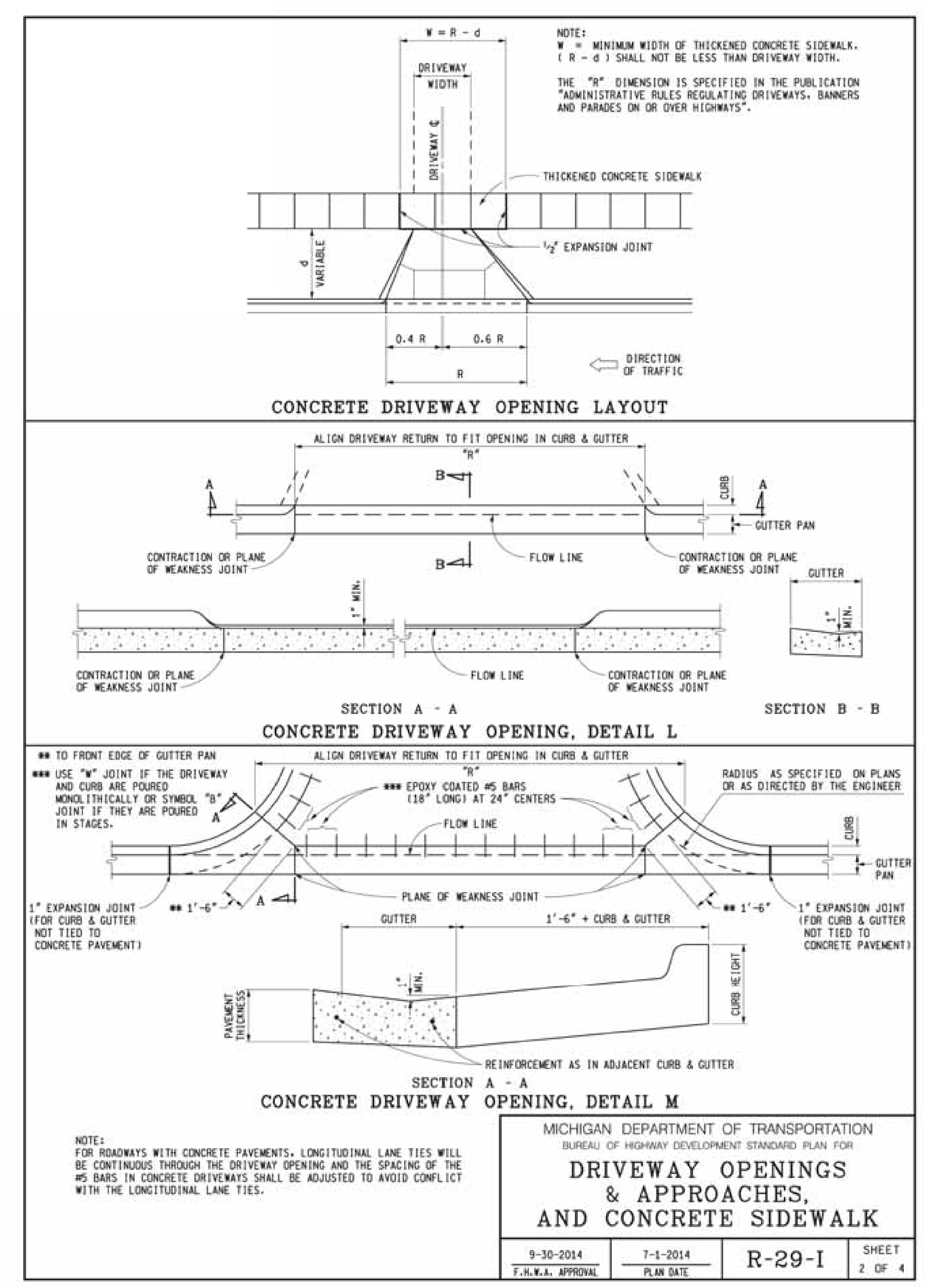




MDOT CONCRETE CURB & GUTTER DETAILS

NOT TO SCALE

5



MDOT DRIVEWAY DETAILS

NOT TO SCALE

6

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SITE DEVELOPMENT PLANS

9101 HIGHLAND ROAD

PROPOSED COMMERCIAL DEVELOPMENT

PARCEL ID:12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

STATE OF MICHIGAN
JONATHAN REID COOKSEY
ENGINEER
PROFESSIONAL ENGINEER

STONEFIELD
engineering & design

SCALE: AS SHOWN | PROJECT ID: DET-230229

TITLE:
CONSTRUCTION DETAILS

DRAWING:
C-14

SPECIFICATIONS

Notes:

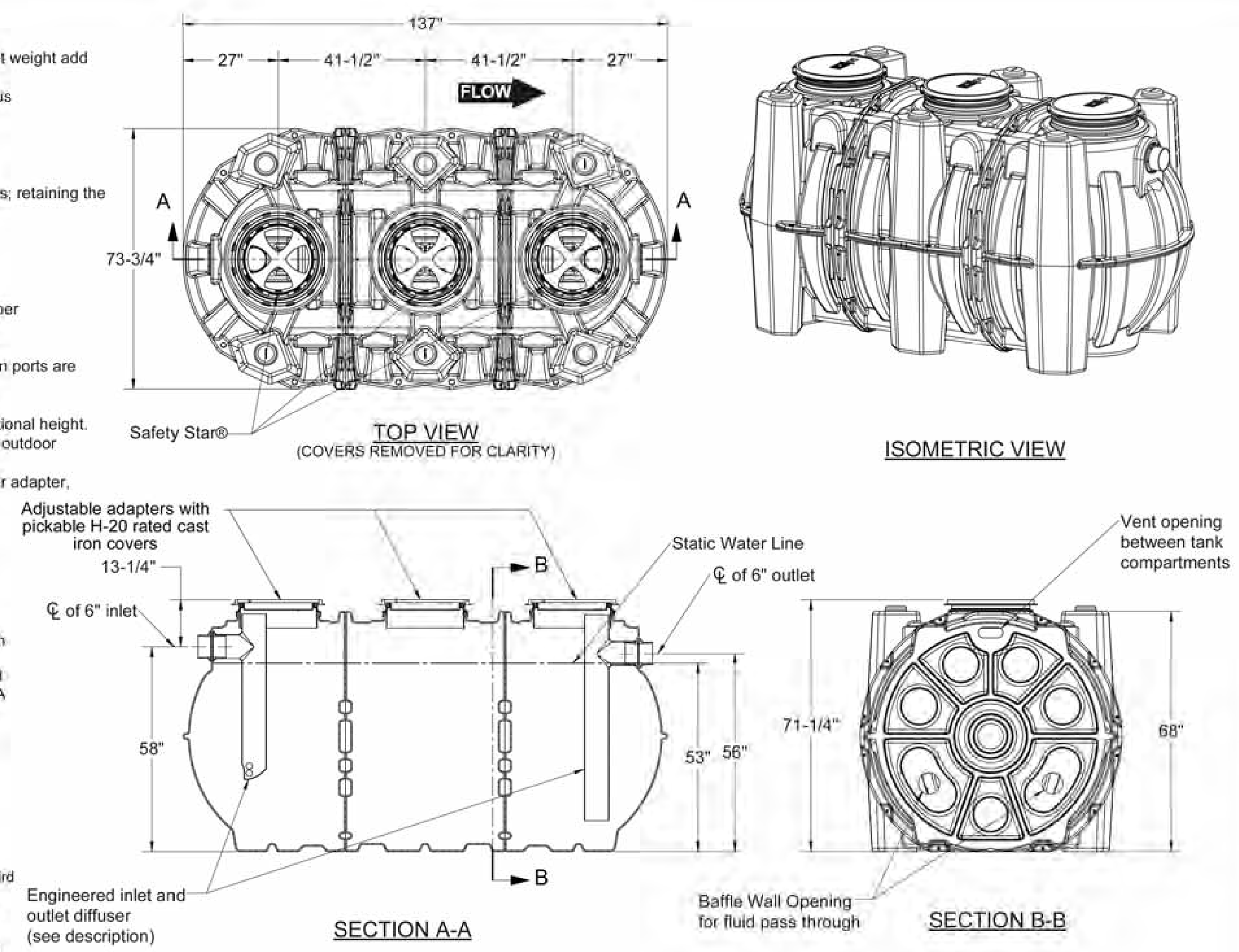
1. 6" plain end inlet/outlet
2. Unit weight - w/ cast iron covers: 1,290 lbs. (for wet weight add 12,525 lbs.)
3. Maximum operating temperature: 150° F continuous
4. Capacities - Liquid: 1,500 gal.;
   Grease: 10,061 lbs. (1,379 gal.) @100GPM
   Grease: 9,446 lbs. (1,294 gal.) @200GPM
   Solids: 318 gal.
5. Satisfies Miami DERM 99% efficiency requirements; retaining the following capacities at 99% efficiency:
   9,897 lbs. (1,356 gal.) @100GPM
   8,093 lbs. (1,109 gal.) @200GPM
6. For gravity drainage applications only.
7. Do not use for pressure applications.
8. Cover placement allows full access to tank for proper maintenance.
9. Vent not required unless per local code.
10. Engineered inlet and outlet diffusers with inspection ports are removable to inspect / clean piping.
11. Integral air relief / Anti-siphon / Sampling access.
12. Adjustable cover adapters provide up to 4" of additional height.
13. Designed for below-grade, above-grade, indoor or outdoor installations.
14. Safety Star®, access restrictor built into each cover adapter, prevents accidental entry to tanks (450 lb rating).

ENGINEER SPECIFICATION GUIDE

Schier Great Basin™ grease interceptor model # GB-1500 shall be lifetime guaranteed and made in USA of seamless, molded polyethylene with minimum 7/16" uniform wall thickness. Interceptor shall be furnished for above or below-grade installation with adjustable cover adapter and Safety Star® access restrictor built into each cover adapter. This unit is certified for hydromechanical performance to ASME A112.14.3/CSA B481.1-2022 (Type D) as well as certified to ANSI/CAN/IAPMO Z1001-2021 for gravity grease interceptors. Flow control not required. Interceptor flow rate shall be 100 GPM or 200 GPM. Interceptor grease capacity shall be 10,061 lbs. Cover shall provide water/gas-tight seal and have minimum 16,000 lbs. load capacity.

CERTIFIED PERFORMANCE

Great Basin™ hydromechanical grease interceptors are third party performance-tested and listed by IAPMO to ASME A112.14.3/CSA B481.1-2022 (Type D) grease interceptor standards and greatly exceed requirements for grease separation and storage. They are compliant to the Uniform Plumbing Code and the International Plumbing Code.



MIAMI-DADE COUNTY — Satisfies Miami DERM 99% efficiency requirements. Product labels are permanently attached to inside and outside of unit for easy viewing.

SPECIFICATION SHEET

MODEL NUMBER:	PART NUMBER: 4085-001-01	SCHIER
GB-1500	DESCRIPTION: GREASE INTERCEPTOR 100 GPM / 200 GPM, 6" PLAIN INLET/OUTLET, H-20 RATED PICKABLE CAST IRON COVERS	6455 Woodland Dr Shawnee, KS 66218 Tel: 913-951-3300 Fax: 913-951-3399 schierproducts.com
PROPRIETARY AND CONFIDENTIAL	DWG BY: T.ASAY DATE: 12/13/2022 REV: C ECO: 121423CS	

GREASE TRAP SPECIFICATIONS

1

ISSUE	DATE	BY	DESCRIPTION
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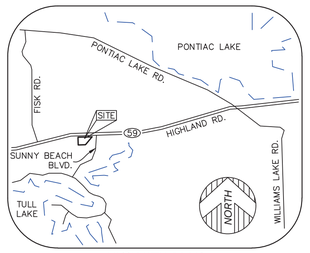
STONEFIELD engineering & design

SCALE: AS SHOWN	PROJECT ID: DET-230229

TITLE: CONSTRUCTION DETAILS

DRAWING: C-15



VICINITY MAP
(NOT TO SCALE)

PARKING
HANDICAP PARKING = 2 STALLS
STANDARD PARKING = 50 STALLS

PARCEL AREA
195,568± SQUARE FEET = 4.49± ACRES

BASIS OF BEARING
SOUTH 85°51'44" WEST, BEING THE CENTERLINE OF HIGHLAND ROAD (M-59), AS DESCRIBED.

BENCHMARK
SITE BENCHMARK #1
ARROW ON HYDRANT, WEST SIDE OF ASPHALT ENTRANCE.
ELEVATION = 975.36' (NAVD 88)

SITE BENCHMARK #2
ARROW ON TRAFFIC SIGNAL POST, EAST SIDE OF PROPERTY.
ELEVATION = 974.20' (NAVD 88)

SURVEYOR'S NOTE
THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. THE SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED ALTHOUGH HE DOES CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE. THE SURVEYOR HAS NOT PHYSICALLY LOCATED THE UNDERGROUND UTILITIES OTHER THAN THE STRUCTURE INVENTORY SHOWN HEREON.

LEGEND

◉	FOUND MONUMENT (AS NOTED)
◔	FOUND SECTION CORNER (AS NOTED)
(R&M)	RECORD AND MEASURED DIMENSION
(R)	RECORD DIMENSION
(M)	MEASURED DIMENSION
×0.00	GROUND ELEVATION
⊠	ELECTRIC METER
◙	ELECTRIC RISER
○	UTILITY POLE
Ⓣ	TELEPHONE MANHOLE
◨	TELEPHONE RISER
◪	CABLE TV RISER
⊗	CLEANOUT
⊕	ROUND CATCH BASIN
▦	SQUARE CATCH BASIN
	FIRE HYDRANT
	WATER GATE MANHOLE
	WATER VALVE
▪	FENCE POST
	FLOOD LIGHT
	SINGLE POST SIGN
	DOUBLE POST SIGN
	HANDICAP PARKING
	DECIDUOUS TREE (AS NOTED)
	CONIFEROUS TREE (AS NOTED)
	PARCEL BOUNDARY LINE
	PLATTED LOT LINE
	ADJOINER PARCEL LINE
	SECTION LINE
	EASEMENT (AS NOTED)
	BUILDING
	BUILDING OVERHANG
	CONCRETE CURB
	RAISED CONCRETE
	PARKING
	EDGE OF CONCRETE (CONC.)
	EDGE OF ASPHALT (ASPH.)
-X-	FENCE (AS NOTED)
	OVERHEAD UTILITY LINE
G	GAS LINE
D	STORM LINE
W	WATER LINE
	MINOR CONTOUR LINE
	MAJOR CONTOUR LINE
	BUILDING AREA
	ASPHALT
	CONCRETE

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

PROPERTY DESCRIPTION
THE LAND SITUATED IN THE TOWNSHIP OF WHITE LAKE, COUNTY OF OAKLAND, STATE OF MICHIGAN, IS DESCRIBED AS FOLLOWS:

PART OF THE EAST 1/2 OF THE SOUTHEAST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 14, AND EAST 1/2 OF THE NORTHEAST 1/4 OF SECTION 23, TOWN 3 NORTH, RANGE 8 EAST, DESCRIBED AS FOLLOWS: COMMENCING AT THE NORTHEAST CORNER OF SECTION 23, WHICH IS ALSO A COMMON CORNER TO SECTIONS 13, 14 AND 24, TOWN 3 NORTH, RANGE 8 EAST, AND RUNNING THENCE NORTH 00 DEGREES 19 MINUTES 10 SECONDS EAST 26.40 FEET TO THE CENTERLINE OF HIGHLAND ROAD (M-59), THENCE SOUTH 85 DEGREES 51 MINUTES 44 SECONDS WEST 51.84 FEET ALONG SAID CENTERLINE TO THE POINT OF BEGINNING OF THIS DESCRIPTION; THENCE SOUTH 140.00 FEET TO A MONUMENT, WHICH IS THE NORTHWEST CORNER OF LOT 86 OF TWIN LAKES VILLAGE NO. 1; THENCE SOUTH 12 DEGREES 05 MINUTES 00 SECONDS WEST 282.37 FEET TO A MONUMENT WHICH IS THE SOUTHWEST CORNER OF LOT 83 OF SAID TWIN LAKES VILLAGE NO. 1, THENCE SOUTH 58 DEGREES 31 MINUTES 00 SECONDS WEST 464.14 FEET; THENCE NORTH 602.62 FEET TO THE CENTERLINE OF HIGHLAND ROAD (M-59), THENCE EASTERLY ALONG SAID CENTERLINE WHICH IS ON A CURVE TO THE RIGHT, WHOSE CHORD BEARS NORTH 82 DEGREES 59 MINUTES 45 SECONDS EAST 458.34 FEET, A DISTANCE ALONG THE CURVE OF 458.00 FEET MORE OR LESS TO THE POINT OF BEGINNING OF THIS DESCRIPTION, EXCEPTING THE NORTHERLY 50 FEET THEREOF SITUATED WITHIN M-59 HIGHWAY.

TOGETHER WITH AN EASEMENT FOR INGRESS AND EGRESS OVER A 20 FOOT PRIVATE ROAD WHOSE CENTERLINE IS DESCRIBED AS FOLLOWS: COMMENCING AT A POINT AT THE INTERSECTION OF THE CENTERLINE OF HIGHLAND ROAD (M-59) AND THE WEST RIGHT OF WAY LINE OF SUNNYBEACH BOULEVARD IN SECTION 13, TOWN 3 NORTH, RANGE 8 EAST, AND RUNNING THENCE SOUTH 00 DEGREES 00 MINUTES 54 SECONDS EAST 29.01 FEET TO THE SOUTH LINE OF SAID SECTION 13; THENCE CONTINUING SOUTH 00 DEGREES 00 MINUTES 54 SECONDS EAST 73.99 FEET OVER AND ACROSS SAID SOUTH SECTION LINE TO A POINT LOCATED IN SECTION 24 WHERE THE CENTERLINE OF THE PRIVATE ROAD RIGHT OF WAY INTERSECTS THE WEST RIGHT OF WAY LINE OF SUNNYBEACH BOULEVARD, WHICH IS THE POINT OF BEGINNING OF SAID PRIVATE ROAD RIGHT OF WAY; THENCE NORTH 76 DEGREES 27 MINUTES 33 SECONDS WEST 154.31 FEET TO THE EAST LINE OF SAID 5 ACRES DESCRIBED AS THE CAPTIONED LAND ABOVE.

SUBJECT TO A 20 FEET EASEMENT FOR INGRESS AND EGRESS OVER THAT PART OF SAID DESCRIBED 5 ACRES OF LAND, THE CENTERLINE OF SAID EASEMENT IS DESCRIBED AS FOLLOWS: COMMENCING AT A POINT ON THE EAST LINE OF SAID 5 ACRE PARCEL OF LAND DISTANT SOUTH 60.00 FEET FROM THE NORTHEAST CORNER THEREOF, THENCE RUNNING ALONG A CURVE TO THE LEFT PARALLEL TO THE STATE HIGHWAY M-59 RIGHT OF WAY TO THE WEST LINE OF SAID 5 ACRES DESCRIBED AS THE CAPTIONED LAND ABOVE.

TITLE REPORT NOTE
ONLY THOSE EXCEPTIONS CONTAINED WITHIN THE OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY FILE NO. 63-18598786-SCM, REVISION 3, DATED AUGUST 21, 2023, AND RELISTED BELOW WERE CONSIDERED FOR THIS SURVEY. NO OTHER RECORDS RESEARCH WAS PERFORMED BY THE CERTIFYING SURVEYOR.

8. RIGHT OF WAY GRANTED TO MICHIGAN BELL TELEPHONE COMPANY FOR CONSTRUCTION, OPERATION AND MAINTENANCE OF LINES OF COMMUNICATION RECORDED IN LIBER 7946, PAGE 805, OAKLAND COUNTRY RECORDS. (AS SHOWN)

9. EASEMENT GRANTED TO MICHIGAN BELL TELEPHONE COMPANY FOR CONSTRUCTION, OPERATION AND MAINTENANCE OF COMMUNICATION FACILITIES RECORDED IN LIBER 11604, PAGE 146, OAKLAND COUNTY RECORDS. (AS SHOWN)

10. EASEMENT GRANTED TO THE CHARTER TOWNSHIP OF WHITE LAKE FOR CONSTRUCTION, OPERATION AND MAINTENANCE OF WATER MAIN RECORDED IN LIBER 19187, PAGE 333, OAKLAND COUNTY RECORDS. (AS SHOWN)

MANHOLE SCHEDULE

NUM	TYPE	RIM (FT)	SIZE (IN)	DIR	INV ELEV (FT)
70065	CATCH BASIN	971.68	12	N	968.03
70131	CATCH BASIN	970.71	12	E	966.71
70140	CATCH BASIN	970.70	12	W	966.50
		970.70	12	N	966.45
		970.70	12	S	966.55
70157	CATCH BASIN	971.02	18	N	964.12

SURVEYOR'S CERTIFICATION
TO AFFINITY 10 INVESTMENTS, LLC, A MICHIGAN LIMITED LIABILITY COMPANY; OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY; ATA NATIONAL TITLE GROUP, LLC; AND STONEFIELD ENGINEERING AND DESIGN:

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2021 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 2, 4, 5, 7A, 8, 9, 11A, AND 11B OF TABLE A, THEREOF. THE FIELD WORK WAS COMPLETED ON 09/14/23.

DATE OF PLAT OR MAP: 09/28/23

DRAFT

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KEM-TEC
PROFESSIONAL ENGINEERING, SURVEYING & ENVIRONMENTAL SERVICES
A GEO-TECH COMPANIES
Eastpointe (800.626.7222)
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www.kemtecgroupofcompanies.com

ALTA / NSPS LAND TITLE SURVEY

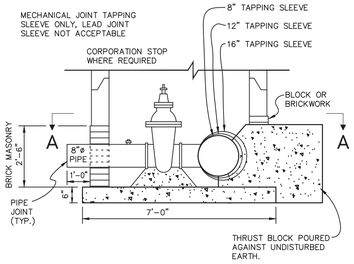
PREPARED FOR: STONEFIELD ENGINEERING AND DESIGN
9101 HIGHLAND ROAD, WHITE LAKE, MICHIGAN,
PART OF SECTION 23,
TOWN 3 NORTH, RANGE 8 EAST

REVISION	DATE	BY	DESCRIPTION

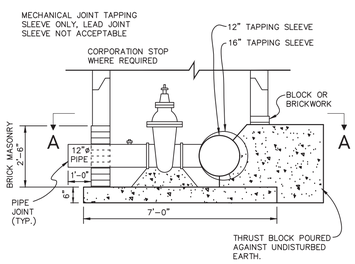
DRAWN BY:	LJ/JV
CHECKED BY:	ATS
DATE:	09/28/23
	SEPTEMBER 28, 2023
SCALE:	1" = 30'
PROJECT NO.	23-01922

1

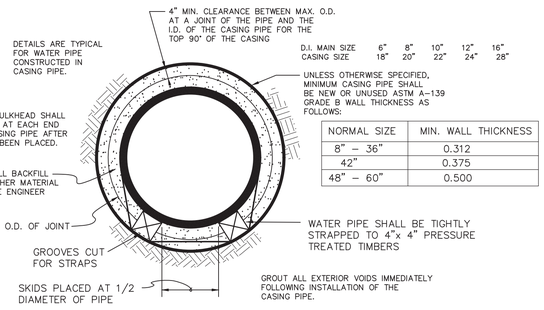
1 OF 1 SHEETS



16" X 8", 12" X 8", 8" X 8"
TAPPING SLEEVE, VALVE & WELL
(B–B)



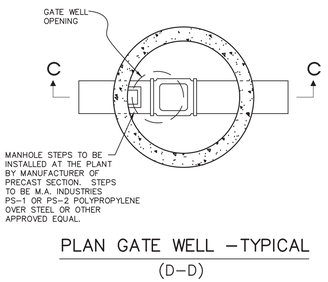
16" X 12", 12" X 12"
TAPPING SLEEVE, VALVE & WELL
(B–B)



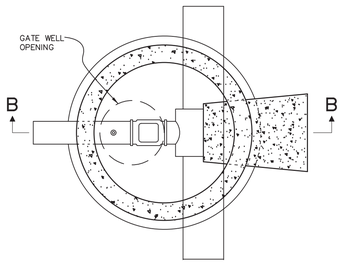
NORMAL SIZE	MIN. WALL THICKNESS
8" – 36"	0.312
42"	0.375
48" – 60"	0.500

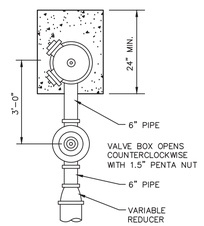
Drawing not to scale.

PIPE BARREL SUPPORT FOR WATER MAIN
CONSTRUCTED IN CASING

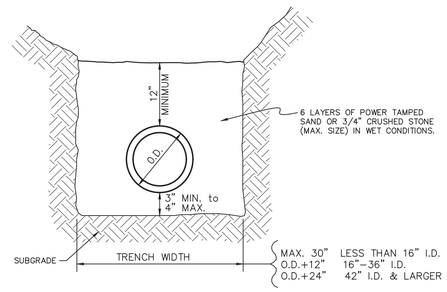


PLAN GATE WELL –TYPICAL
(D–D)

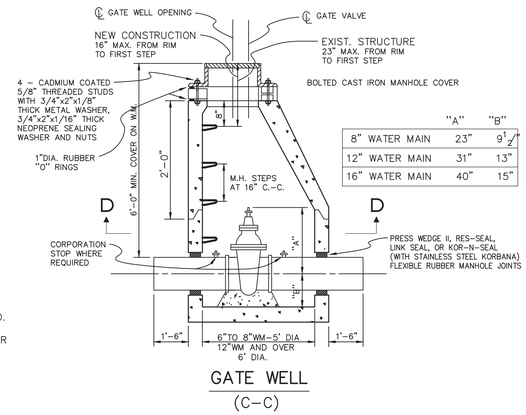




PLAN TAPPING SLEEVE, VALVE & WELL –TYPICAL
(A–A)



Drawing not to scale.
STANDARD BEDDING
FOR WATER PIPE



	"A"	"B"
8" WATER MAIN	23"	9 1/2"
12" WATER MAIN	31"	13"
16" WATER MAIN	40"	15"

GATE WELL
(C–C)

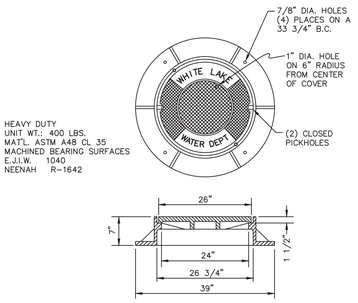
WATER MAIN NOTES

1. All construction procedures and materials used on this project shall conform to White Lake Township current standards and specifications.
2. All hydrants shall be East Jordan Iron Works 5BR–250 traffic model. Self–draining hydrants shall not be used. Valve shall have 1–1/2" pentagon nut and shall open counter–clockwise. Provide two 4.5" pumper outlets with 5" Storz quick connect nozzles (Harrington Integral Hydrant Storz, Model HIHS) as manufactured by Harrington, Inc. of Erie, PA.
3. All hydrants shall be field painted with a heavy coat of bright safety red polyurethane or alkyd gloss enamel, except for the Storz fittings and caps, which shall be left unpainted.
4. Johnson and Anderson, Inc. field personnel will affix to the fixed collar of each Storz connection 1" wide 3M Scotch reflective tape, color coded per NFPA 291 guidelines flow capacity.
5. All water mains shall be ductile iron pipe Class 54, cement lined with push on joints. Mechanical joints allowed only for tapping sleeves, hydrants & hydrant valves. Only Cor–Blue bolts shall be used for assembling mechanical joints. All bends, tees, valves and hydrant tees shall have a poured concrete thrust block as detailed on this sheet. Joints which have thrust blocks bearing on soil of questionable stability shall be fully restrained utilizing Tyler swivel ells and adapters or a system approved by the Township Engineer. HDPE pipe for directional boring, if approved by the Township Engineer, shall meet all of the requirements of the MDEQ and shall be DR9 (200 psi), and shall have two #8 tracer wires, terminated in the nearest gate well at the highest step.
6. Tapping sleeve shall be mechanical joint or approved equal. Ductile Iron or Stainless steel are allowed.
7. Specifications shall include direction of operation of all valves. All valves shall be counter clockwise open.
8. All necessary easements shall be provided in the name of White Lake Township before acceptance of the water distribution system.
9. The design engineer shall furnish White Lake Township with one reproducible sets of "As–Built" water main plans or an AutoCAD file upon completion of the job.
10. All required cross–connection devices shall be installed as required by the local plumbing inspector and in accordance with the standards of the Michigan Department of Public Health.
11. Gate well frame and cover shall be as follows: East Jordan heavy manhole cover, base flange type #1040 or Neenah Foundry heavy duty #R–1642 Manhole frame, solid lid cover shall be non–rocking and marked "White Lake Water Department"
12. Gate valves shall be AWWA approved and of a double disc or resilient wedge design with push on joints, 16" gate valves may be mechanical joint provided Cor–Blue bolts are used. All gate valves with operating nuts greater than 5' below ground surface shall be provided with an extension stem. The length of the extension shall be such that it will be within 5' of the ground surface when an extension is used it shall be held in place by an extension stem guide suitably fastened to the wall of the gate well.
13. 1" corporation stops are to placed on the main at each side of each main line gate valve and at such other locations as may be required by the engineer.
14. All pipe and fittings shall be subjected to a hydro–static pressure test of 150 PSI for a 2 hour duration; Township Engineer must be present. Maximum segment 2000 feet except that longer segments may be tested with allowable leakage based on 2000 feet.
15. 2 consecutive safe bacteria samples shall be taken from the water system approx. 24 hours apart at points established by the Township Engineer. Samples shall be taken by the Township Engineer.
16. Filling, flushing and sampling of water main can only be performed with a "Jumper" Line, the jumper shall be equipped with an approved RPZ type of backflow preventer.
17. Adjustments on gate wells shall be limited to 23" maximum from top of rim to first step in accordance with MIOSHA Rule 341.
18. All new water service lines shall have a minimum nominal size of 1". Services from 1" to 2" may be type K copper tubing or plastic DR–9 (200 PSI rated) meeting ASTM D2737–03 (Standard Specification for Polyethylene (PE) plastic tubing). ASTM Designation and pressure rating shall be stamped on the pipe by the manufacturer. Plastic pipe shall also meet AWWA C–901 Specifications. All sizes shall relate to the copper tubing outside diameter standard size (CTS). Copper pipe joints shall be flared. Fittings shall adapt to the plastic pipe with compression to iron pipe thread adapter. Plastic pipes shall be either compression style with a steel insert or may be fusion welded in the larger sizes.

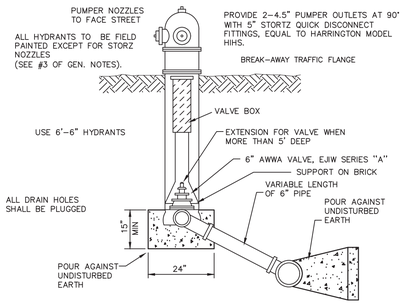
    Plastic water service pipes shall be traced with two #10 copper tracer wires or two #12 copper coated steel or stainless steel wires insulated with a minimum of 30 mils of polyethylene insulation. The tracer wires shall be terminated to supply line so as to be locatable at the building and the curb box without digging.

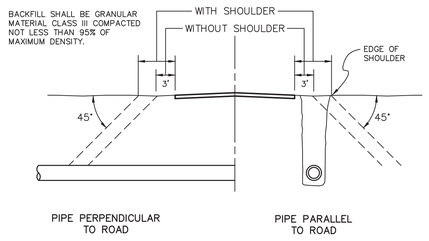
    Water services sizes 3" and greater shall be Class 54 cement lined ductile iron with push on joints or HDPE DR–9 (200 PSI rated) with fusion welded joints and fittings, DIPS (Ductile Iron Pipe Size).

    A stop box shall be installed at the property or easement line and shall be equivalent to an A.Y. McDonald Mfg. 6100 flare regular pattern ball valve. The curb box shall have a 1" riser pipe with an Erie 2–hole pattern cover equivalent to A.Y. McDonald Mfg. 5601L. Stop box shall be protected with a 2"x4" painted blue extending 4 feet above ground.
19. Standard pipe cover shall be 6'–0".
20. Air release manholes shall consist of a standard 5' diameter gate well style structure with a ValMatic Model 25C air release valve mounted on a 1" corporation stop. Air release shall be equipped with the vacuum check option. A 1/2" diameter galvanized pipe air discharge shall be extended to within 12" of the top of the structure. A gooseneck trap shall be installed at the top of the riser to prevent debris & water from entering the valve.

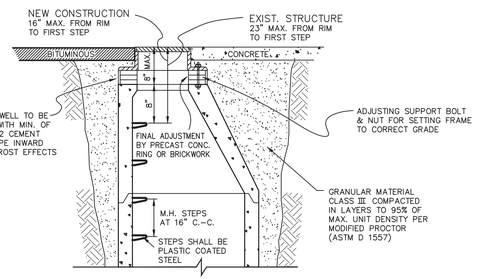


GATE WELL COVER & FRAME



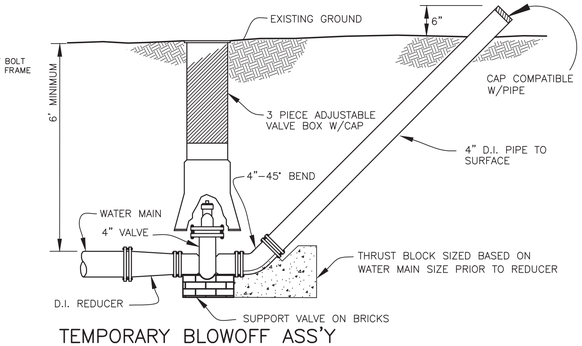


BACKFILL IN THE AREA OF STREETS,
ALLEYS, SIDEWALKS, DRIVES & PARKING AREAS

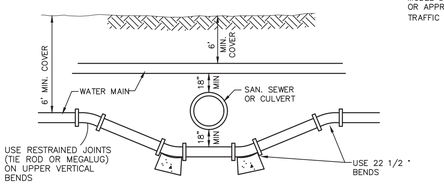


NOTE: 3000 PSI CONCRETE TO BE USED. THRUST BLOCK TO ABUT & REST AGAINST UNDISTURBED SOIL. RESTRAINED JOINTS WILL BE REQUIRED IF SOIL STABILITY IS QUESTIONABLE.

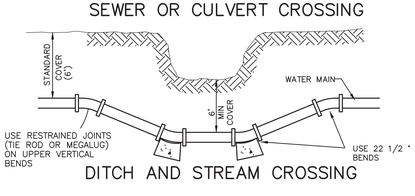
GATE WELL TOPS WITHIN PAVEMENT AREAS



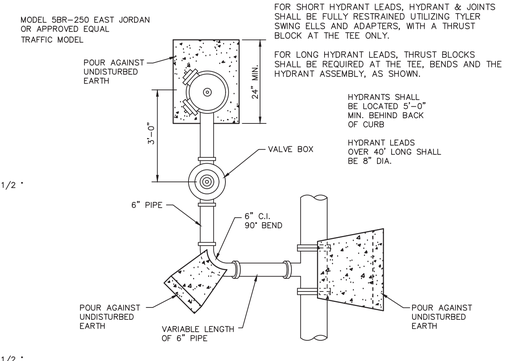
TEMPORARY BLOWOFF ASS'Y



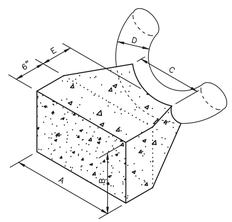
SEWER OR CULVERT CROSSING



DITCH AND STREAM CROSSING

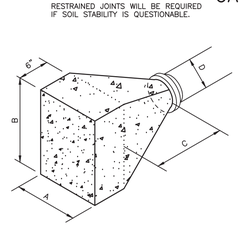


DETAIL OF HYDRANT SETTINGS



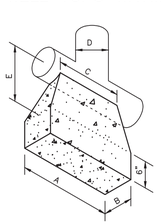
FOR 90° BENDS OR SMALLER

D	A	B	C	E MIN
20"	8"	6.5'	3.5'	2.5"
16"	6"	4'	2.5'	2"
12"	4"	3'	2'	1.75"
10"	3"	3'	2'	1.75"
8"	3'	2'	2'	1.5"
6"	2"	1.5'	2"	1.25"



FOR PLUGS

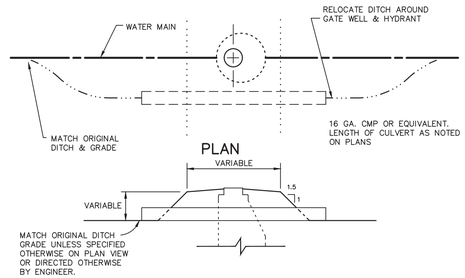
D	A	B	C MIN
20"	7"	5'	2.5"
16"	4.8"	4.8'	2"
12"	4.3"	3'	1.75"
10"	3"	2'	1.75"
8"	2.8"	2.5'	1.5"
6"	1.5"	1.5'	0.25"



FOR TEES

D	A	B	C	E MIN
20"	6.5'	4.5'	3.5'	3"
16"	4.7'	4.7'	2.5'	2.75"
12"	4'	3'	2.5'	2.5"
10"	3'	2'	2'	2.25"
8"	2.7'	2'	2'	2.25"
6"	2'	2'	2'	2.25"

THRUST BLOCK DETAILS



PROFILE
DITCH ENCLOSURE AT GATE WELL

DRAWN: CAD
DESIGN: OA
CHECKED: –

SCALE: VERT. –
HORZ. AS NOTED

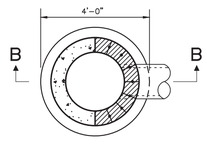
REVISIONS	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE
		GENERAL REVISION TO CAD	12/29/95		GW & NUT SIZE	07/23/98		CLARIFY HYD. SPEC	02/07/01		REV. HYD, THRUST, AIR REL.	03/29/04
		ADD NOTE 17	11/04/97		PIPE CIVER & FLANGE TAPE	05/12/99		5–BR HYD, WS STAKE	02/27/02		HDPE, HYD, VALVES	07/18/05
		REVISE HYD. & THRUSTING	05/18/98		ADD BLOWOFF	07/06/99		ADD NOTE 19	07/23/03		UPDATED TITLE BLOCK	04/30/13

Johnson&Anderson
4494 Elizabeth Lake Road
Waterford, Michigan 48328
tel (248) 681-7800 fax (248) 681-2660
1060 W. Norton Avenue, Suite 7
Muskegon, Michigan 49441
tel (231) 780-3100 fax (231) 780-3115
2291 Water Street, Suite 6
Port Huron, Michigan 48060
tel (810) 987-7820 fax (810) 987-7895

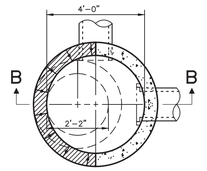
White Lake Township
7525 Highland Road (M-59)
White Lake, Michigan 48383
248-698-3300

WATER MAIN STANDARD DETAILS

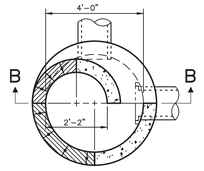
JOB NO.
DATE ISSUED
SHEET NO.



SECTION A–A



SECTION A–A



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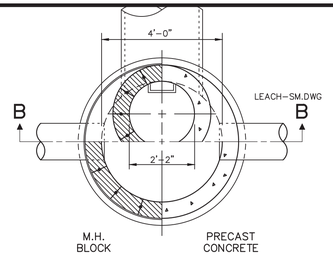
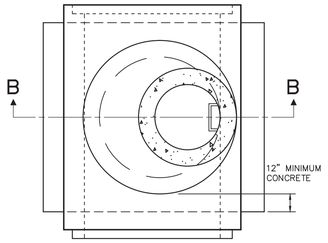
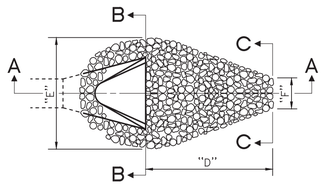


SECTION A–A



SECTION A–A

PIPE DIA.	"D"	"E"	"F"	S.Y.
12"	5'-0"	6'-6"	3'-0"	4
15"	5'-0"	7'-0"	3'-0"	4
18"	5'-0"	7'-6"	3'-6"	4
21"	5'-6"	8'-0"	4'-0"	5
24"	6'-0"	8'-6"	4'-6"	6
27"	6'-6"	9'-0"	5'-0"	7
30"	7'-0"	9'-9"	5'-6"	8
33"	7'-6"	10'-3"	5'-6"	9
36"	8'-0"	10'-9"	6'-0"	10
42"	9'-0"	11'-9"	6'-6"	12
48"	10'-0"	13'-0"	7'-0"	14



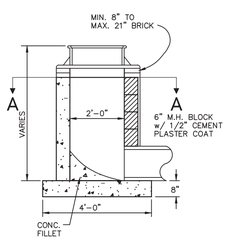
PLAN VIEW

STORM SEWER NOTES

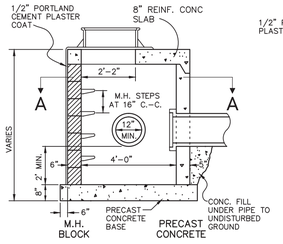
1. PRECAST CONC. RISERS SHALL MEET A.S.T.M. C478
2. DIAMETER OF CONC. BASE: I.D. + 2(WALL) + 8"
3. MANHOLE STEP SPACING SHALL MEET MIOSHA REQUIREMENTS. NO MORE THAN 21" FROM RIM TO FIRST STEP. MAX. 16" O.C. STEPS SHALL BE CAST POLYPROPYLENE REINFORCED WITH A 1/2" STEEL ROD.
4. WALL THICKNESS OF BLOCK STRUCTURES SHALL BE:

DEPTH	THICKNESS
0–8'	6"
8–15'	8"
OVER 15'	12"

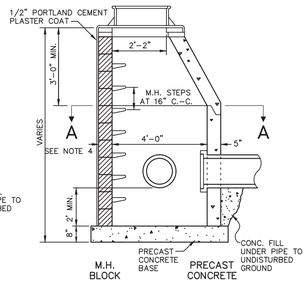
5. MINIMUM I.D. OF STRUCTURE FOR: 36"to 42" = 5'–0"
   48"to 54" = 6'–0"
   LARGER DIAMETER STRUCTURES MAY BE REQUIRED DEPENDING ON PIPING CONFIGURATION.
6. ALL LIFTING HOLES AND VOIDS IN INTERIOR JOINTS SHALL BE FILLED BY MORTAR.
7. THE FINGER DRAIN DETAIL SHALL BE USED AT ALL LOW POINT CATCH BASINS IN PAVEMENT AREAS. THE DETAIL MAY BE OMITTED WITH THE APPROVAL OF THE TOWNSHIP ENGINEER IN AREAS WITH VERY POROUS SOILS AND NO GROUNDWATER PROBLEMS.
8. PRECAST ONE PIECE BASES AND RISERS ARE ACCEPTABLE FOR INLETS, CATCH BASINS AND MANHOLES
9. FRAMES & COVERS WITH INLET CAPACITY (1.0 CFS/90 SQ IN)
   –TRAFFIC AND PARKING AREAS: MDOT "D" (EJIW 5105) 1.9 CFS*
   –REAR YARD AND DITCH INLETS: (EJIW 1040–02) 2.1 CFS*
   –MANHOLES: MDOT "A" (EJIW 1060)
   –CURB AND GUTTER INLETS: MDOT "K" (EJIW 7045) 1.8 CFS*
   –MOUNTABLE CURB & GUTTER: (EJIW 7065) 2.2 CFS*
   –*MAY VARY DUE TO MANUFACTURER CHANGES
10. CONTACT THE TOWNSHIP ENGINEER 48 HOURS PRIOR TO CONSTRUCTION TO SCHEDULE INSPECTION. FULL TIME INSPECTION WILL BE REQUIRED FOR ALL UNDERGROUND STORM SEWER CONSTRUCTION. PHONE (248) 334–9901
11. THE CONTRACTOR SHALL CONTACT MISS DIG 72 HOURS BEFORE CONSTRUCTION AT (800) 482–7171 TO LOCATE EXISTING UNDERGROUND UTILITIES.
12. PRIOR TO START OF CONSTRUCTION, CONTRACTOR SHALL HAVE IN HIS POSSESSION A CURRENT SOIL EROSION CONTROL PERMIT AS ISSUED BY WHITE LAKE TOWNSHIP.
13. A 2' DEEP SUMP SHALL BE USED IN ANY STRUCTURE SUBJECT TO A WATER DROP GREATER THAN 2.0' FROM AN INLET PIPE.
14. ALLOWABLE STORM SEWER PIPE TYPES:
   –12" AND UP: RCP ASTM C–76 MIN. CLASS 3, MIN CLASS 4 UNDER TRAFFIC AREAS, RUBBER JOINT
   –6" TO 15": SCH 40 PVC OR SDR 23.5 PVC WITH RUBBER OR GLUE JOINT
   –6" TO 48": SMOOTH BORE CORRUGATED HIGH DENSITY POLYETHYLENE WITH NEOPRENE LINED JOINTS OR BETTER
15. THE MINIMUM PIPE SIZE IN PUBLIC RIGHT–OF–WAY OR EASEMENTS AND FOR PIPES CARRYING OFF–SITE STORM WATER SHALL BE 12"
16. ALL PIPE ENDS NOT WITHIN A STRUCTURE SHALL HAVE A CONCRETE OR METAL FLARE END SECTION (FES) WITH A BAR SCREEN ON PIPES 18" AND LARGER EXCEPT THOSE WITHIN A SECURE FENCED AREA NEED NO BAR SCREEN.
17. ALL DRAINAGE STRUCTURES WITHIN THE ROAD SHALL BE SEALED WITH WRAPPED GEOTEXTILE PER RCOC STANDARDS



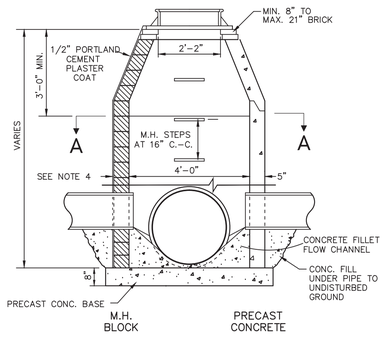
SECTION B–B
24" INLET



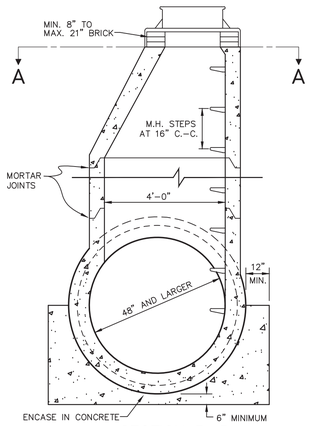
SECTION B–B
STRUCTURE WITH SLAB COVER
(CATCH BASIN SHOWN)



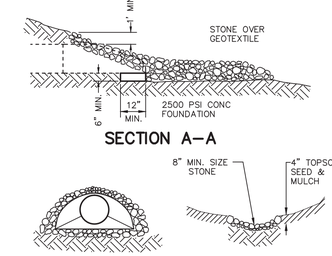
SECTION B–B
STANDARD CATCH BASIN



SECTION B–B
STANDARD STORM MANHOLE

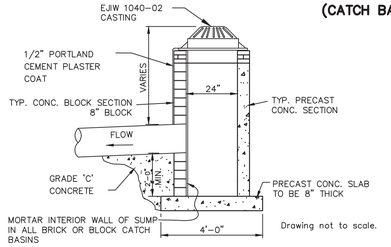


SECTION B–B
STANDARD PRECAST CONCRETE MANHOLE TEE

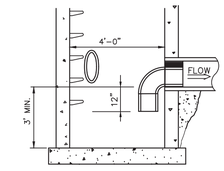


SECTION A–A

SECTION B–B SECTION C–C
PLAIN STONE RIP–RAP



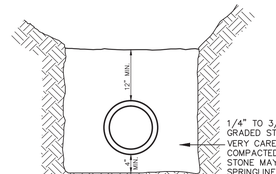
STANDARD REAR YARD CATCH BASIN



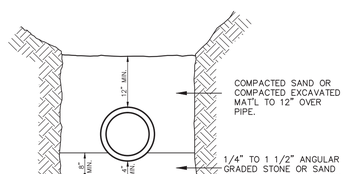
TRAP SHALL BE BULKHEADED IN OUTLET PIPE AND SHALL BE A SCH 40 PVC ASSY WITH A PIPE AREA NO LESS THAN 50% OF THE OUTLET PIPE.

ALTERNATE: USE "THE SNOUT" BASIN TRAP SYSTEM

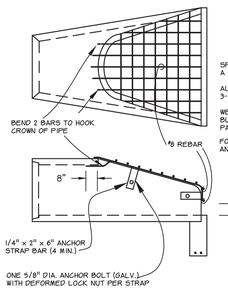
TRAPPED CATCH BASIN



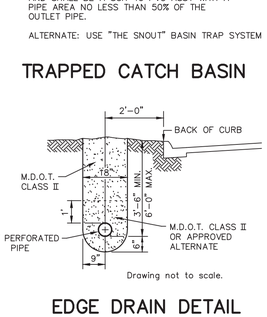
PIPE BEDDING
FOR PLASTIC PIPE



CLASS "B" BEDDING
FOR SEWER PIPE
LESS THAN 48"

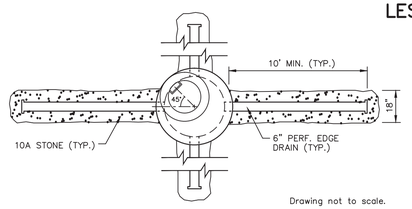


BAR SCREEN DETAIL



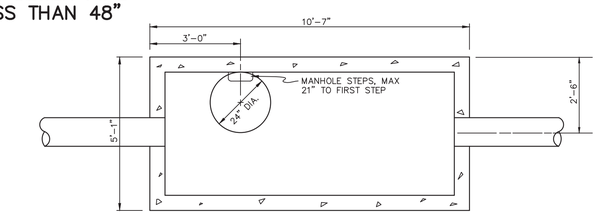
Drawing not to scale.

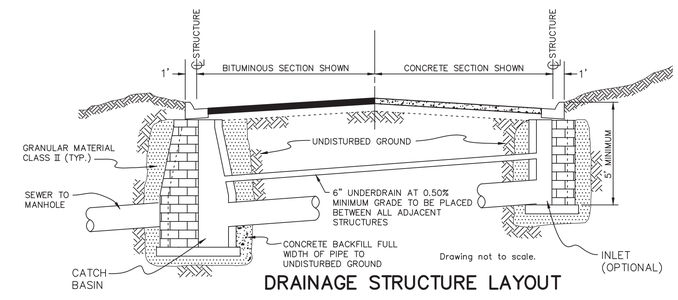
EDGE DRAIN DETAIL



Drawing not to scale.

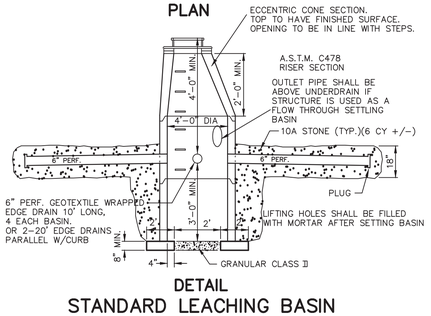
PLAN



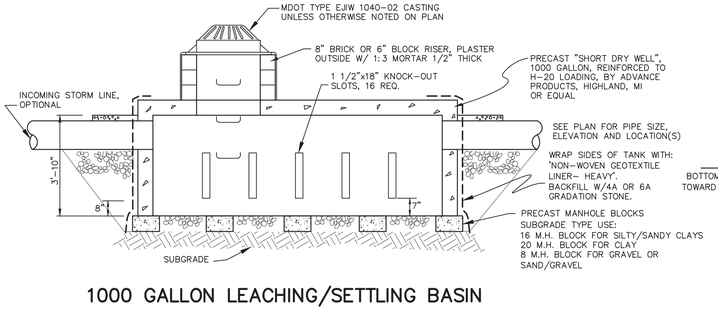


Drawing not to scale.

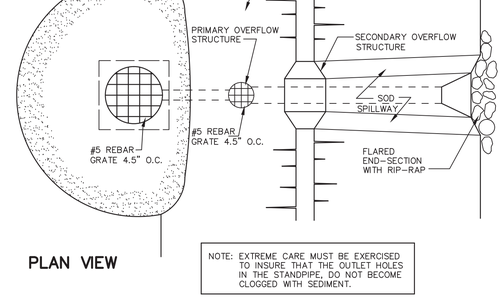
DRAINAGE STRUCTURE LAYOUT



DETAIL
STANDARD LEACHING BASIN

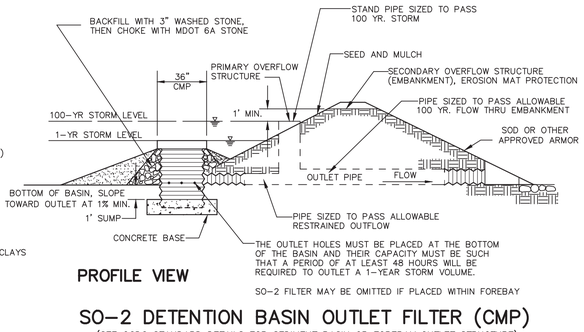


1000 GALLON LEACHING/SETTLING BASIN



PLAN VIEW

NOTE: EXTREME CARE MUST BE EXERCISED TO INSURE THAT THE OUTLET HOLES IN THE STANDPIPE, DO NOT BECOME CLOGGED WITH SEDIMENT.



PROFILE VIEW

SO–2 DETENTION BASIN OUTLET FILTER (CMP)
(SEE OCDC STANDARD DETAILS FOR SEDIMENT BASIN OR FOREBAY OUTLET STRUCTURE)

DRAWN: CAD
DESIGN: OA
CHECKED: –

SCALE: VERT. –
HORZ. AS NOTED

REVISIONS

MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE
	FIRST ISSUE	08/16/95		REVISE	10–03–02		REVISE	06–01–07
	ADD SO–1	06–17–96		REVISE	12–17–03		UPDATED TITLE BLOCK	04/30/13
	NEW BAR GRATE	11–03–97		SEC REFERENCE	05–17–05			

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White Lake, Michigan 48383
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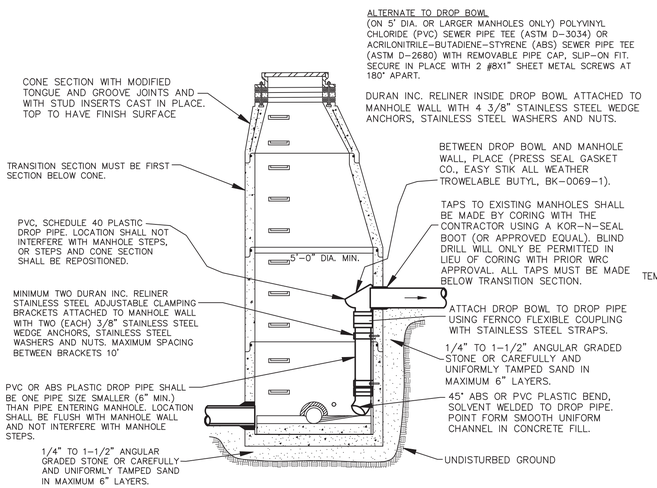
STORM SEWER STANDARD DETAILS

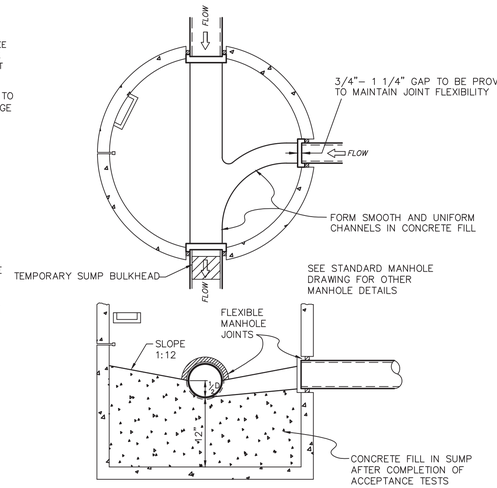
JOB NO.

DATE ISSUED 08/16/95

SHEET NO.

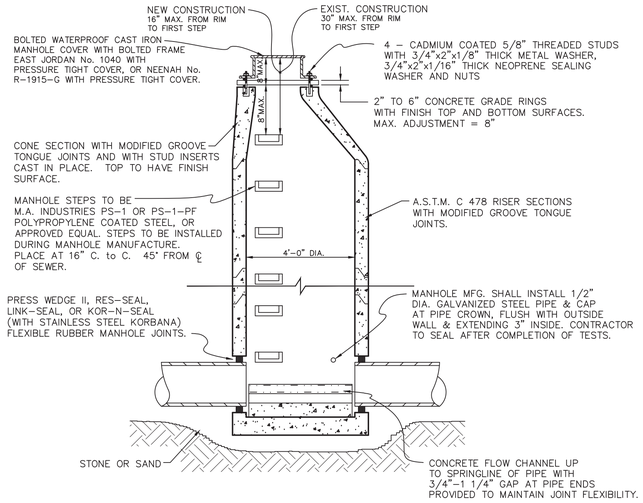


INTERIOR DROP CONNECTION



Drawing not to scale.

SUMP MANHOLE FOR
TESTING, CLEANING, AND DEWATERING



Drawing not to scale.

STANDARD MANHOLE
ON 8" THROUGH 24" DIAMETER SEWERS

SANITARY SEWER CONSTRUCTION NOTES

1. All construction shall conform to the current standards and specifications of the local unit of government and the Oakland County Water Resources Commissioner (OCWRC). All sanitary sewer construction shall have full time inspection supervised by a professional engineer provided by or caused to be provided by the local unit of government.

2. At all connections to Oakland County Water Resources Commissioner's sewers or extensions, and before start of construction, the Contractor must obtain a Sewer Inspection Permit issued by the OCWRC. Gravity sewer permit charges are $250.00 for each connection plus $25.00 for each manhole constructed. Pressure sewer permit charges are $250.00 per 2460 L.F. of force main with a minimum permit fee of $250.00. Failure to pass any test segment will result in an additional charge to the Contractor for each retest, in accordance with the above price schedule. The Contractor shall also have posted with the OCWRC a $5,000.00 surety bond and $500.00 cash deposit. The Contractor shall notify the local unit of government and the OCWRC (248-858-1110) 24 hours prior to the beginning of any construction. Final acceptance tests must be witnessed by County personnel and must be scheduled by Municipality or it's consultant in advance with 24 hour notice at 248-858-1110.

3. No sewer installation shall have an infiltration or exfiltration exceeding 100 gallons per inch diameter per mile of pipe in a 24 hour period, and no single run of sewer between manholes shall exceed 100 gallons per inch diameter per mile. Air tests in lieu of infiltration tests shall be as specified in the OCWRC "Acceptance Tests", dated September, 1972. Only pipe and pipe joints approved by the Oakland County Water Resources Commissioner may be used for sanitary sewer construction.

4. Located in the first manhole upstream from the point of all connections to an existing OCWRC sewer, or extension thereto, a temporary 12-inch deep sump shall be provided in the first manhole above the connection which will be filled in after such successful completion of any acceptance test up to the standard fillet provided for the flow channel. A watertight bulkhead shall be provided on the downstream of the sump manhole.

5. All building leads and risers shall be 6-inch S.D.R. 23.5 ABS OR PVC pipe with chemically fused joints, or an approved equal pipe and joint. Sewer pipe wye shall contain factory installed premium joint material of an approved type compatible with that of the building lead pipe used. Building leads to be furnished with removable air tight and water-tight stoppers.

6. All rigid sewer pipe shall be installed in Class "B" bedding or better. All flexible, semi-flexible or composite sewer pipe shall be installed in conformance to the Oakland County Water Resources Commissioner specifications.

7. All new manholes shall have Oakland County Water Resources Commissioner approved flexible, water-tight seals where pipes pass through walls. Manholes shall be of precast sections with modified groove tongue and rubber gasket type joints. Precast manhole cone sections shall be Oakland County Water Resources Commissioner approved modified eccentric cone type. All manholes shall be provided with bolted, water-tight covers.

8. At all connections to manholes on Oakland County Water Resources Commissioner's sewers or extensions thereto drop connections will be required when the difference in invert elevations exceeds 18-inches. Outside drop connections only will be approved.

9. Taps to existing manholes shall be made by coring. The Contractor shall place a KOR-N-SEAL boot (or OCWRC approved equal) after coring is completed. Blind drilling will not be permitted in lieu of coring.

10. New manholes constructed directly on Oakland County Water Resources Commissioner's sewers shall be provided with covers reading "Oakland County – Sanitary" in raised letters. New manholes built over an existing sanitary sewer shall have monolithic poured bottoms.

11. No ground water, storm water, construction water, downspout drainage or weep tile drainage shall be allowed to enter any sanitary sewer installation.

12. Prior to excavation, the Contractor shall telephone MISS DIG (647-7344) for the location of underground pipeline and cable facilities, and shall also notify representatives of other utilities located in the vicinity of the work.

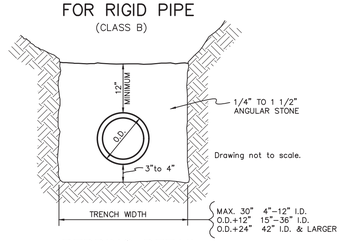
13. 18" minimum vertical separation and 10' minimum horizontal separation must be maintained between sanitary sewer and water main.

14. Manhole frame and cover shall be as follows: East Jordan heavy manhole cover, base flange type #1040 or Neenah Foundry heavy duty #R-1642 manhole frame. Solid lid cover shall be non-rocking and marked "WHITE LAKE TOWNSHIP SEWER DEPARTMENT."

Drawing not to scale.

HOUSE/BUILDING LEAD DETAIL

BEDDING DETAIL
FOR RIGID PIPE
(CLASS B)



BEDDING DETAIL
FOR FLEXIBLE PIPE

Drawing not to scale.

SKETCH OF MINIMUM MANHOLE REQUIREMENTS
ON MANHOLES CONSTRUCTED OVER EXISTING SEWERS

Drawing not to scale.

PIPE BARREL SUPPORT FOR SEWER

MANHOLE COVER & FRAME

Drawing not to scale.

OPTIONAL CONSTRUCTION DETAILS

DRAWN: CAD
DESIGN: OA
CHECKED: –

SCALE: VERT. –
HORZ. AS NOTED

REVISIONS	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE
		FIRST ISSUE	09/11/97		OCWRC COMMENTS	11/06/15			
		UPDATED TITLE BLOCK	04/30/13						
		UPDATED NOTES	02/17/15						

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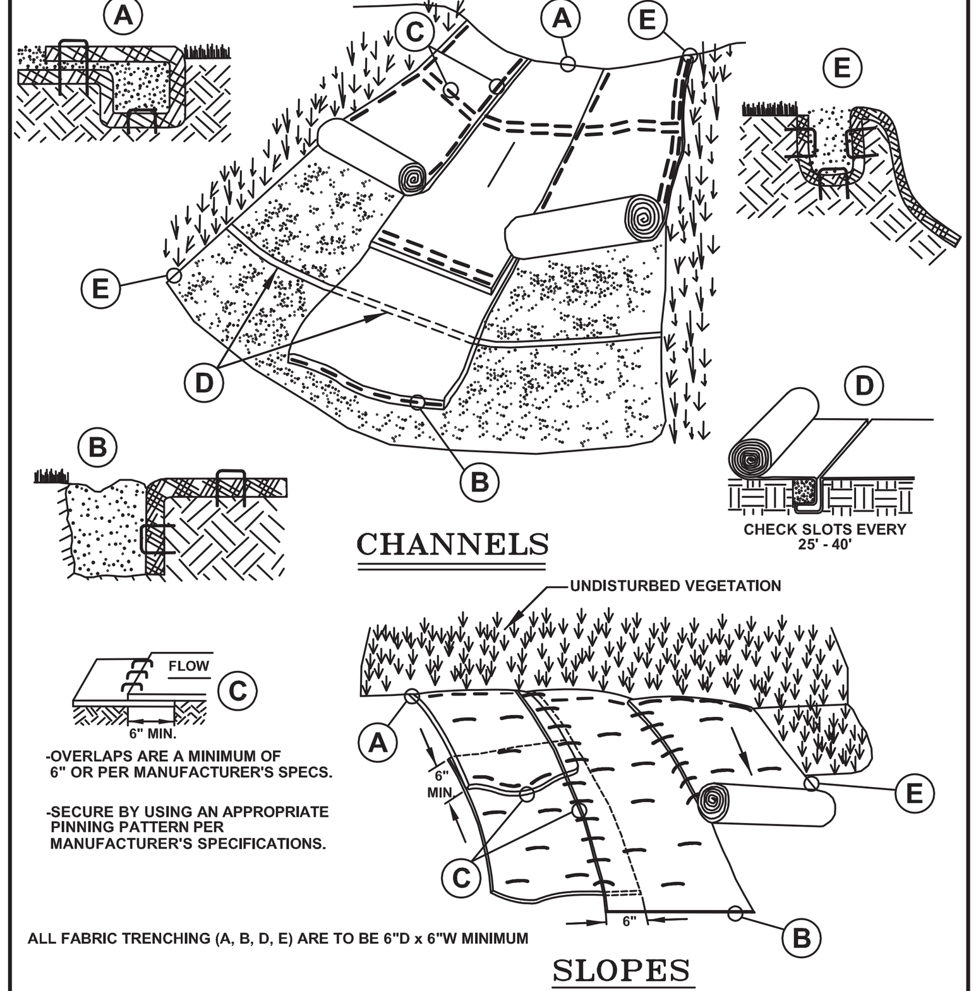
SANITARY SEWER STANDARD DETAILS

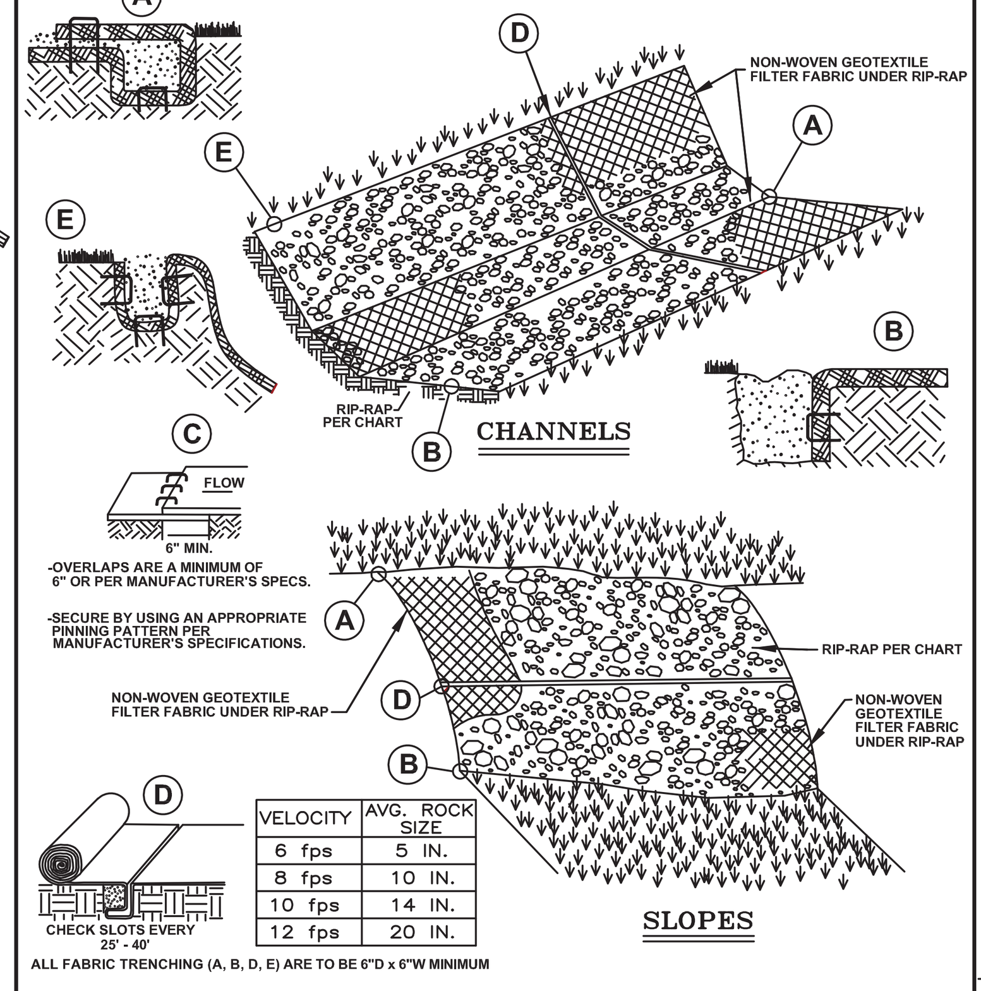
JOB NO.
DATE ISSUED 09/11/97
SHEET NO.

EROSION CONTROL BLANKETS AND TURF MAT LINING (E-9)



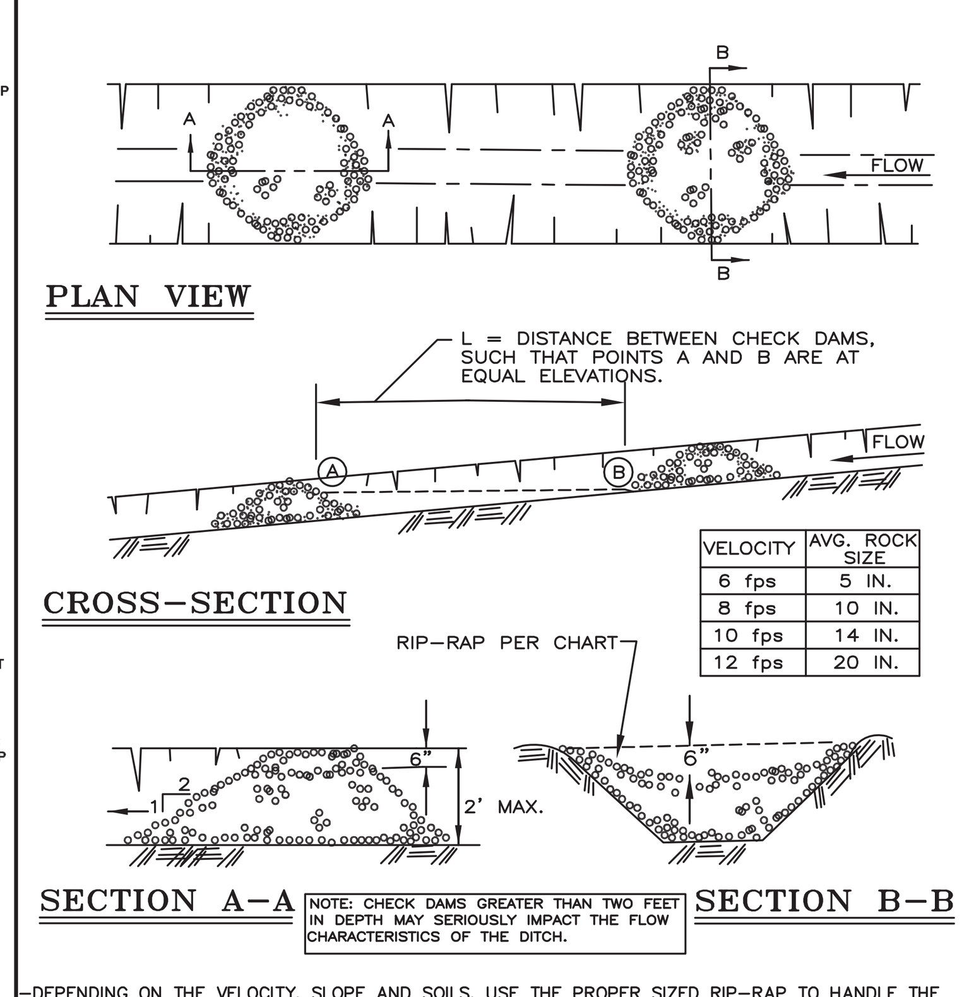
DEPENDING ON THE VELOCITY, SLOPE, SOILS, USE PROPER BLANKET OR TURF MAT LINING PER MANUFACTURER'S SPECIFICATIONS TO HANDLE THE SHEER STRESSES OF THE SLOPE/CHANNEL.

RIP-RAP: CHANNELS AND SLOPES (E-10)



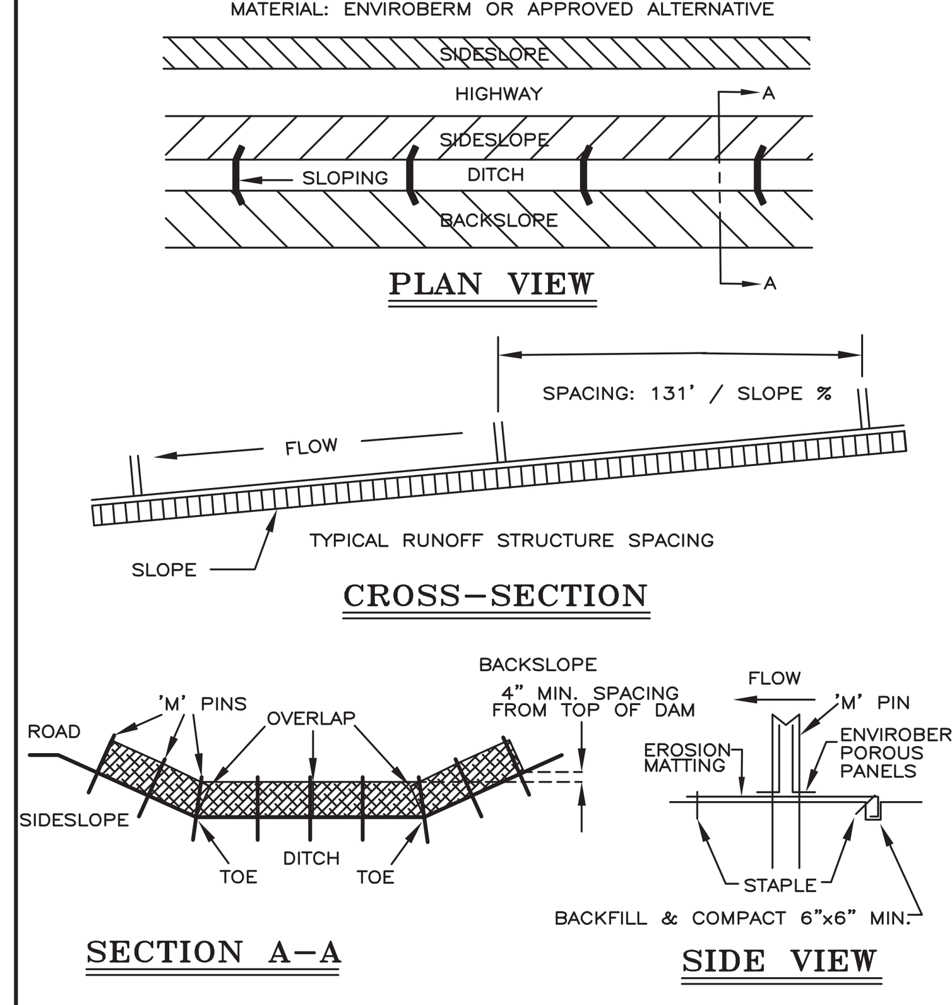
DEPENDING ON THE VELOCITY, SLOPE AND SOILS, USE THE PROPER SIZED RIP-RAP AND NON-WOVEN GEOTEXTILE FABRIC TO HANDLE THE SHEER STRESS OF THE SLOPE/CHANNEL.

CHECK DAMS (E-3)



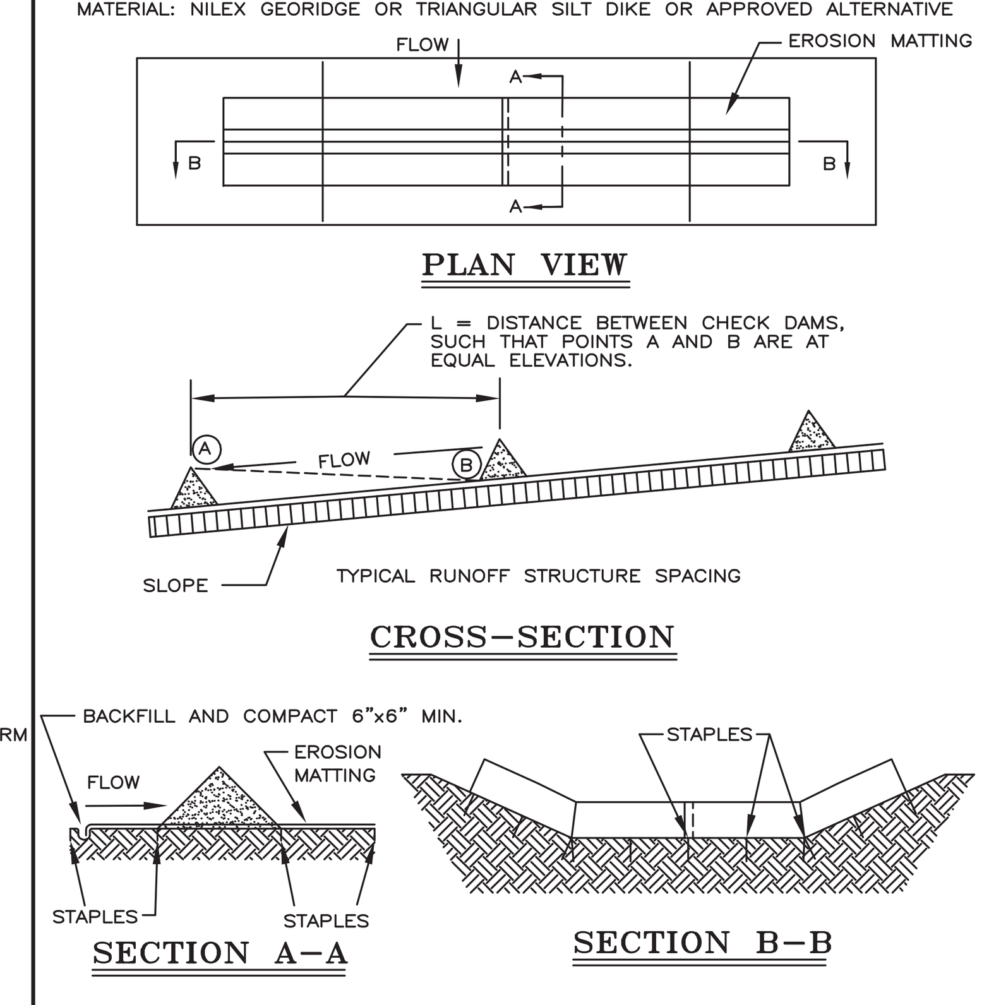
-DEPENDING ON THE VELOCITY, SLOPE AND SOILS, USE THE PROPER SIZED RIP-RAP TO HANDLE THE SHEER STRESS OF THE SLOPE/CHANNEL.
-FOR SLOPE AND/OR CHANNEL PROTECTION SEE OTHER BMP'S ON THIS SHEET OR IN THE WRC SOIL EROSION MANUAL.

CHECK DAMS ALTERNATIVE "A" (E-3A)



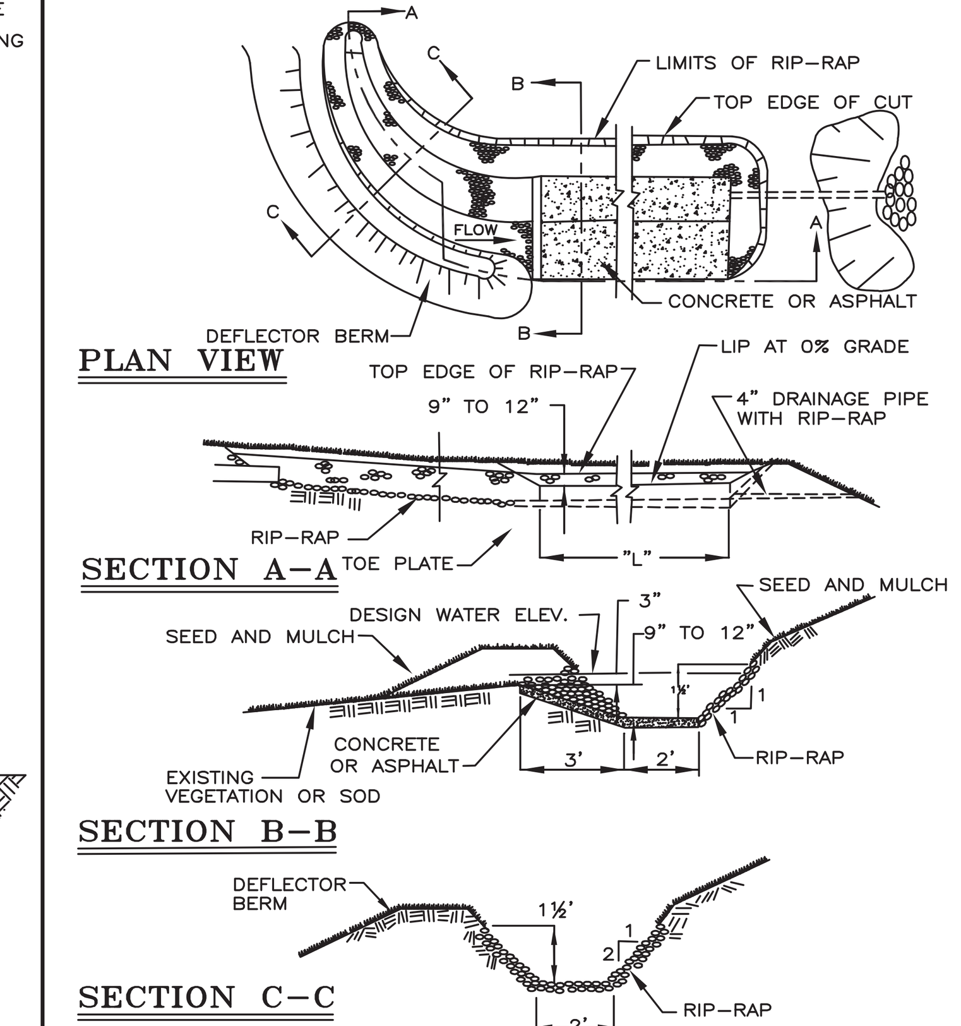
-FOR SLOPE AND/OR CHANNEL PROTECTION SEE OTHER BMP'S ON THIS SHEET OR IN THE WRC SOIL EROSION MANUAL.

CHECK DAMS ALTERNATIVE "B" (E-3B)

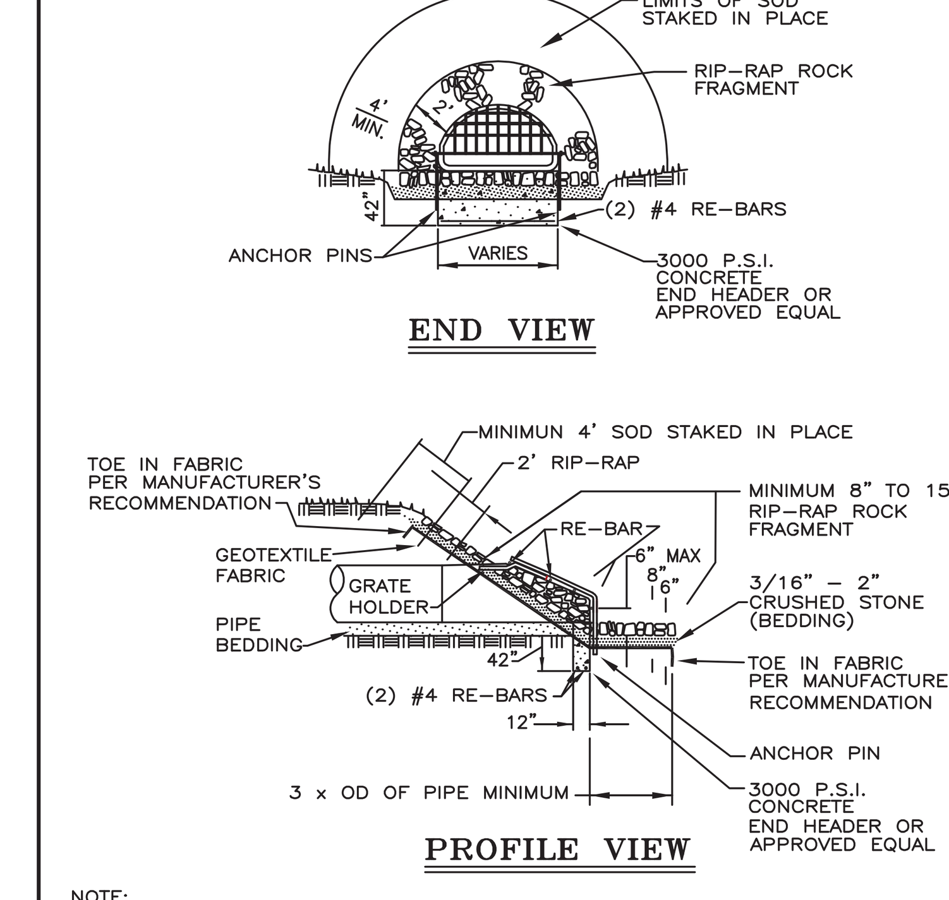


-FOR SLOPE AND/OR CHANNEL PROTECTION SEE OTHER BMP'S ON THIS SHEET OR IN THE WRC SOIL EROSION MANUAL.

LEVEL SPREADER (E-4)



RIP-RAP, END SECTION AND BAR SCREEN DETAIL (E-7)



NOTE:
-BAR SCREEN DETAILS PER MDOT ROAD & BRIDGE STANDARD PLANS, STEEL GRATES FOR END SECTIONS. BARS ARE TO BE CUT OFF AT EDGE OF END SECTION.
-FOR SLOPE AND/OR CHANNEL PROTECTION SEE OTHER BMP'S ON THIS SHEET OR IN THE WRC SOIL EROSION MANUAL.

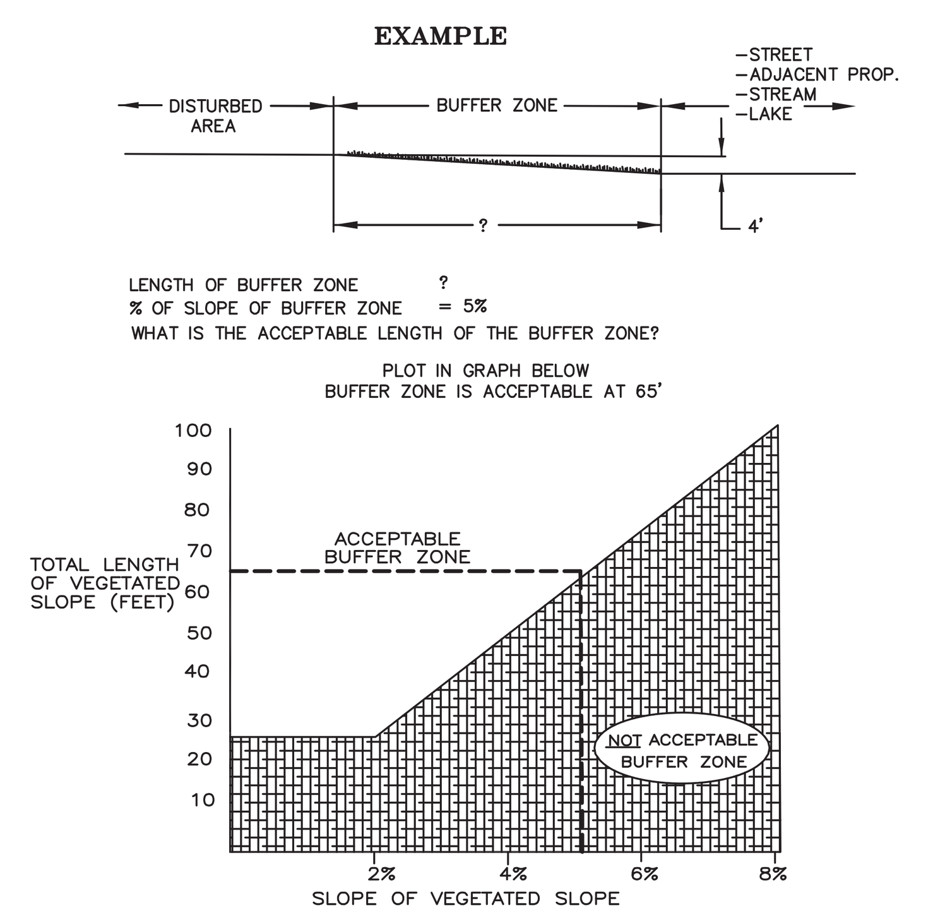
VEGETATIVE BUFFER ZONE (SP-1)

THE GRAPH SHOWN BELOW IS USED TO DETERMINE THE ADEQUACY OF AN EXISTING VEGETATIVE BUFFER ZONE FOR USE AS A SEDIMENT FILTER. THIS GRAPH IS ONLY APPLICABLE IF THE VEGETATION IS 90% DENSE AND AT LEAST 1" IN LENGTH OVER EVERY SQUARE FOOT OF DISTURBED SOIL. AN AREA COVERED WITH WEEDS, OR BUSHES AND TREES WITHOUT A GOOD GROUND COVER IS NOT ACCEPTABLE.

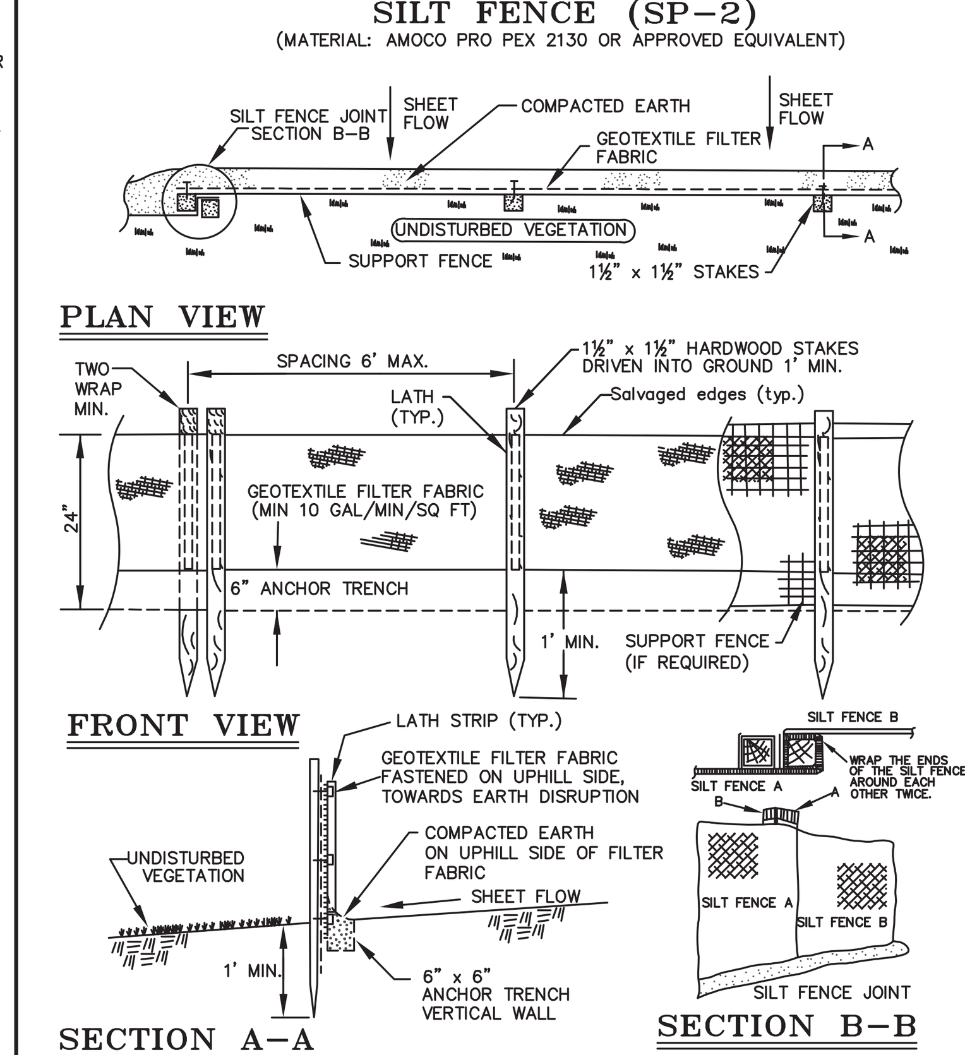
EXAMPLE

LENGTH OF BUFFER ZONE ?
% OF SLOPE OF BUFFER ZONE = 5%
WHAT IS THE ACCEPTABLE LENGTH OF THE BUFFER ZONE?

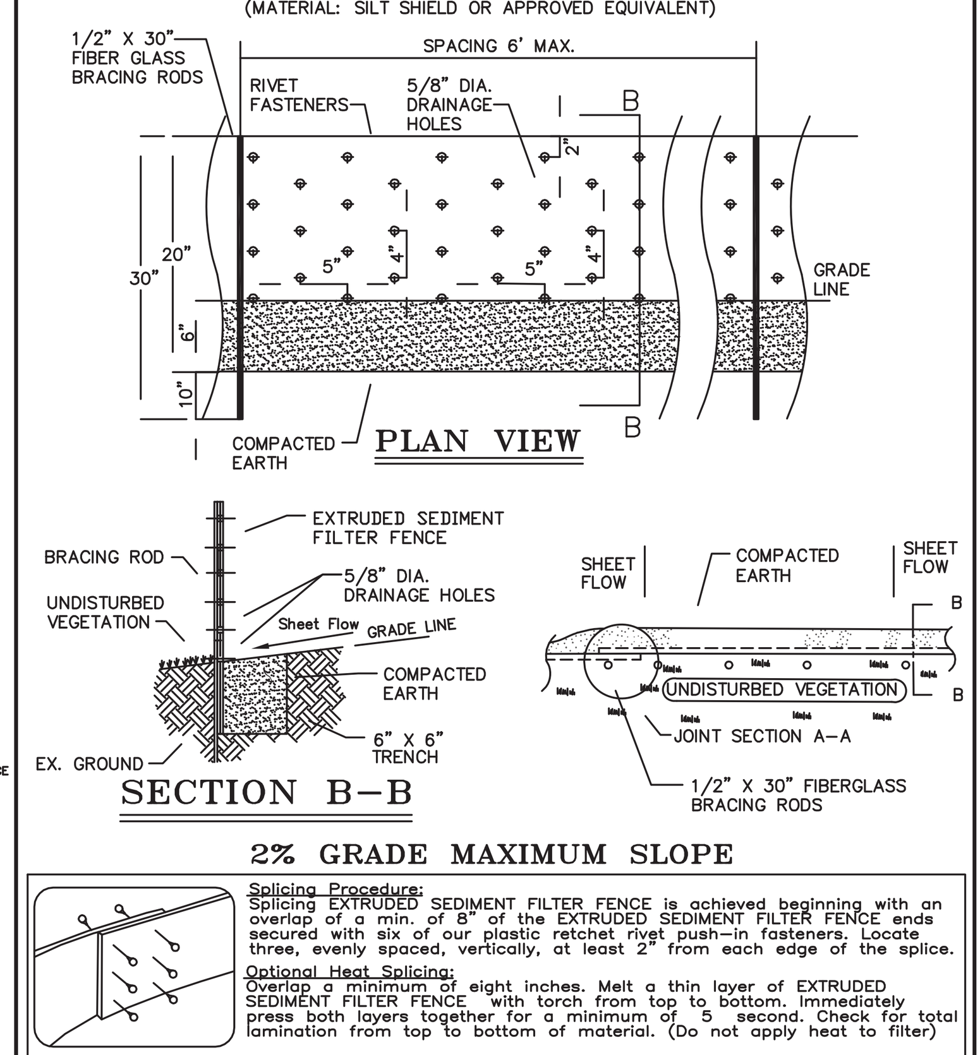
PLOT IN GRAPH BELOW
BUFFER ZONE IS ACCEPTABLE AT 65'



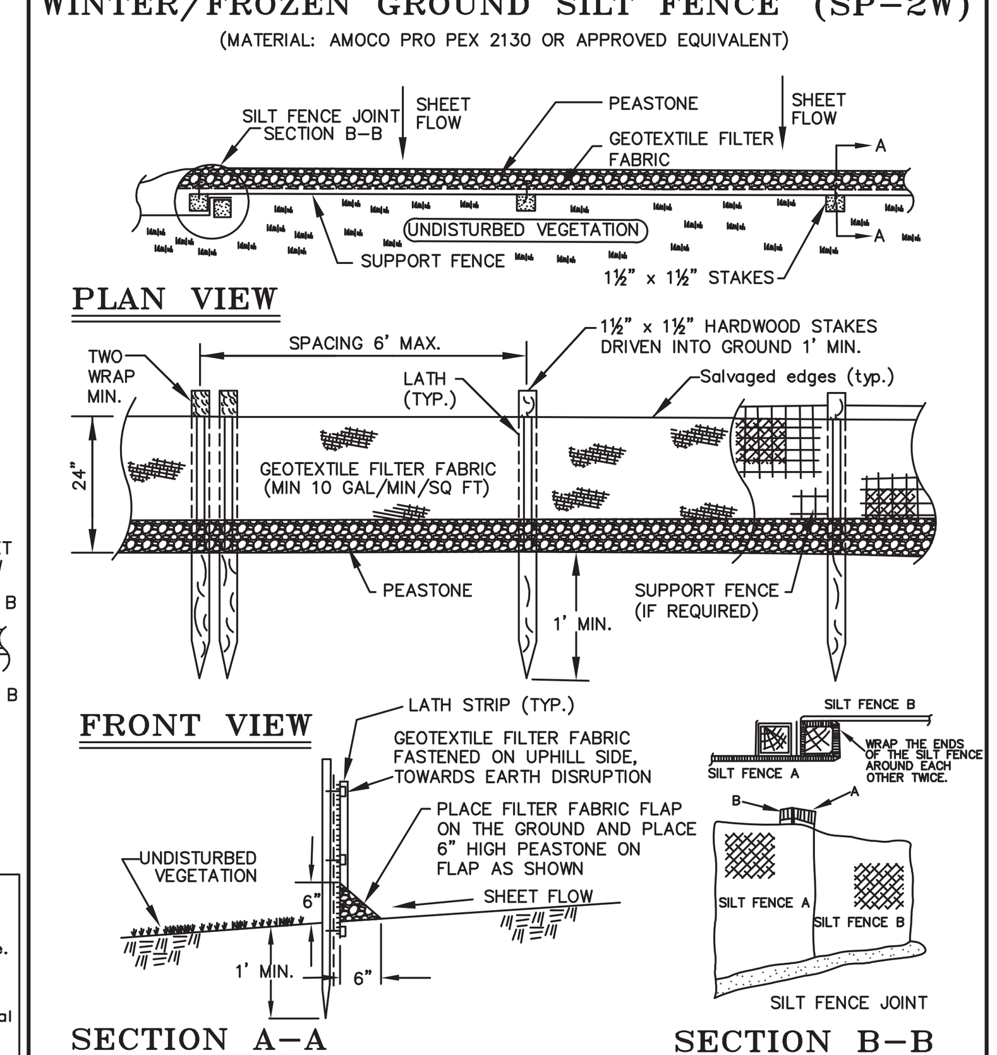
SILT FENCE (SP-2)



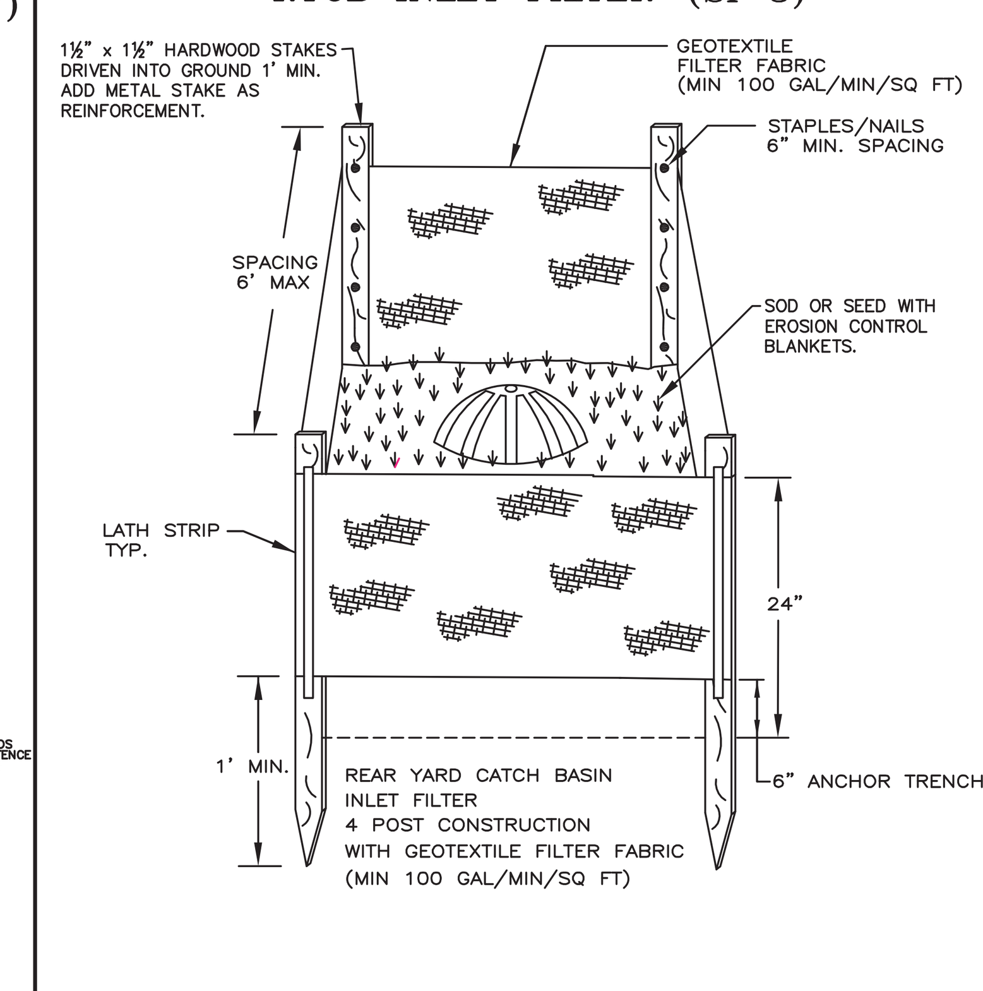
SILT FENCE ALTERNATIVE "A" (SP-2A)



WINTER/FROZEN GROUND SILT FENCE (SP-2W)

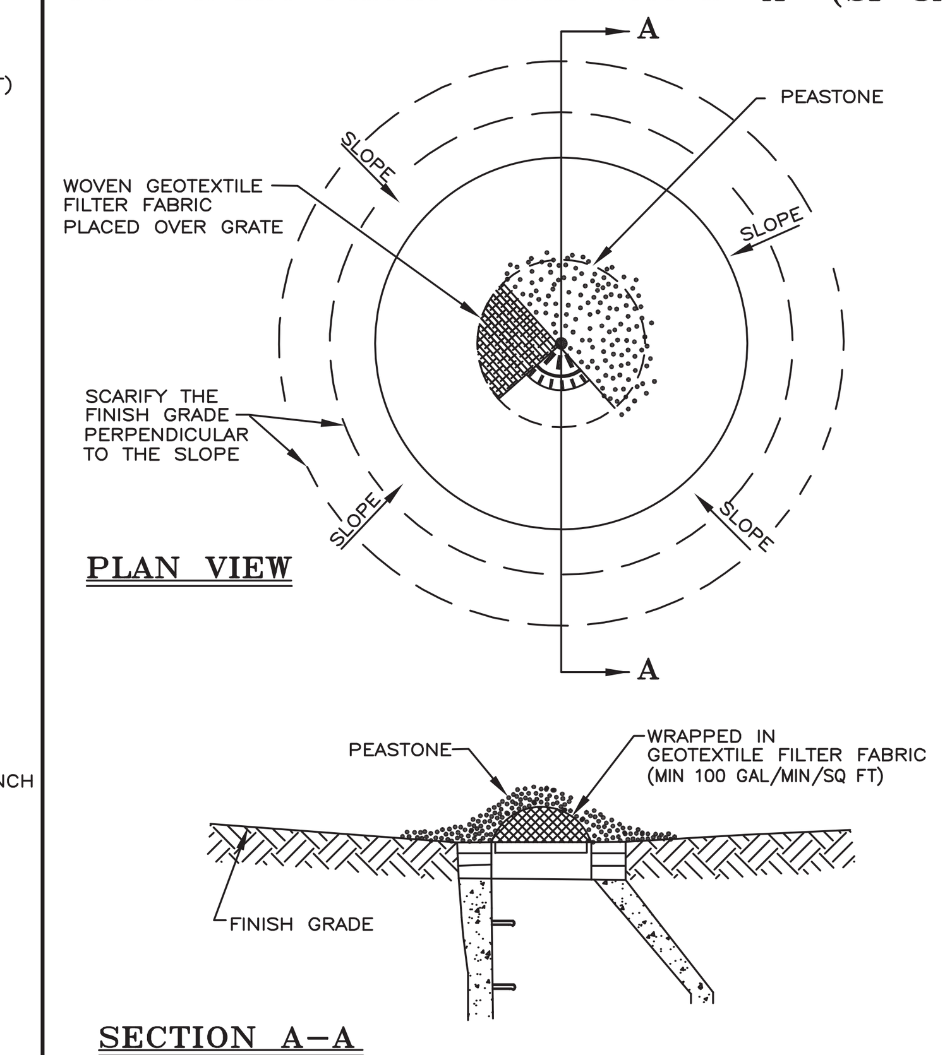


RYCB INLET FILTER (SI-3)

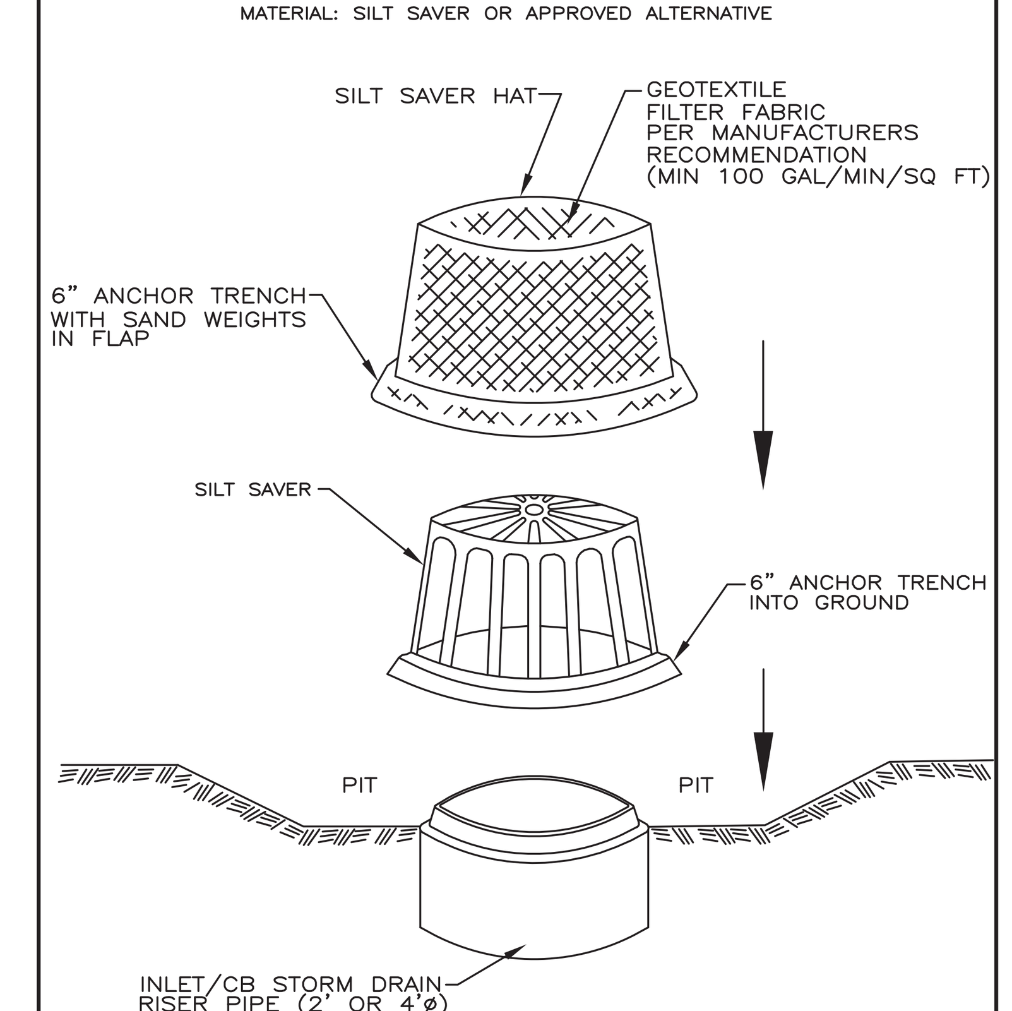


NOTE: MATERIAL IS NOT SILT FENCE MATERIAL

RYCB INLET FILTER ALTERNATIVE "A" (SI-3A)

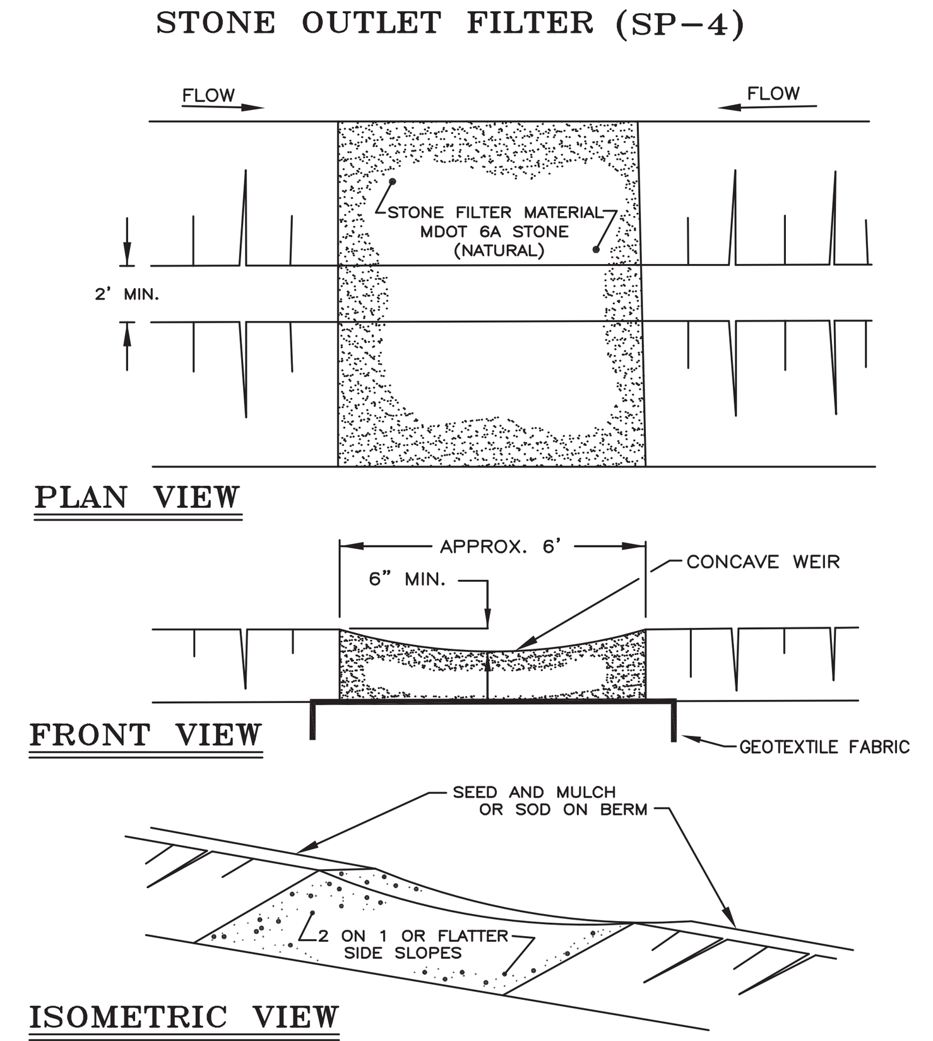


RYCB INLET FILTER ALTERNATIVE "B" (SI-3B)



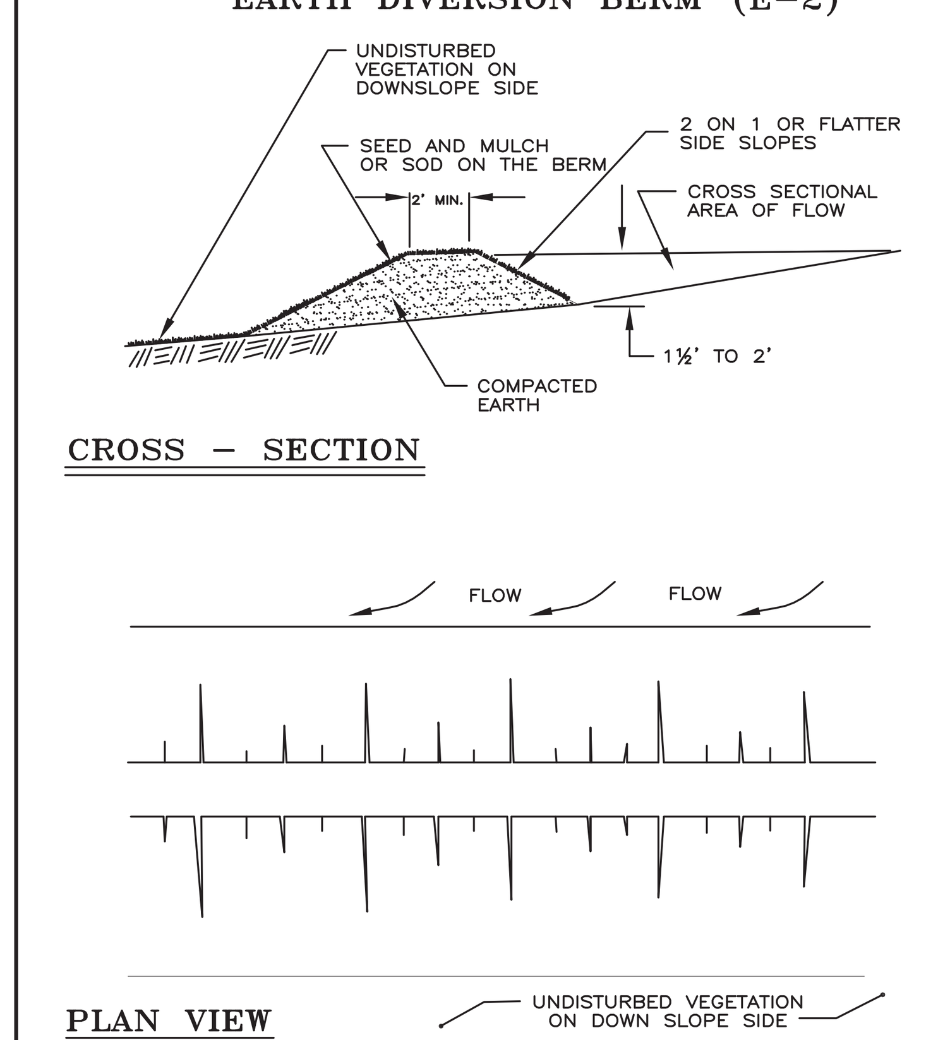
(NOTE: NO PIT REQUIRED WHEN FRAME AND COVER OR GRATE AND COVER ARE IN PLACE.)

EARTH DIVERSION BERM WITH STONE OUTLET FILTER (SP-4)

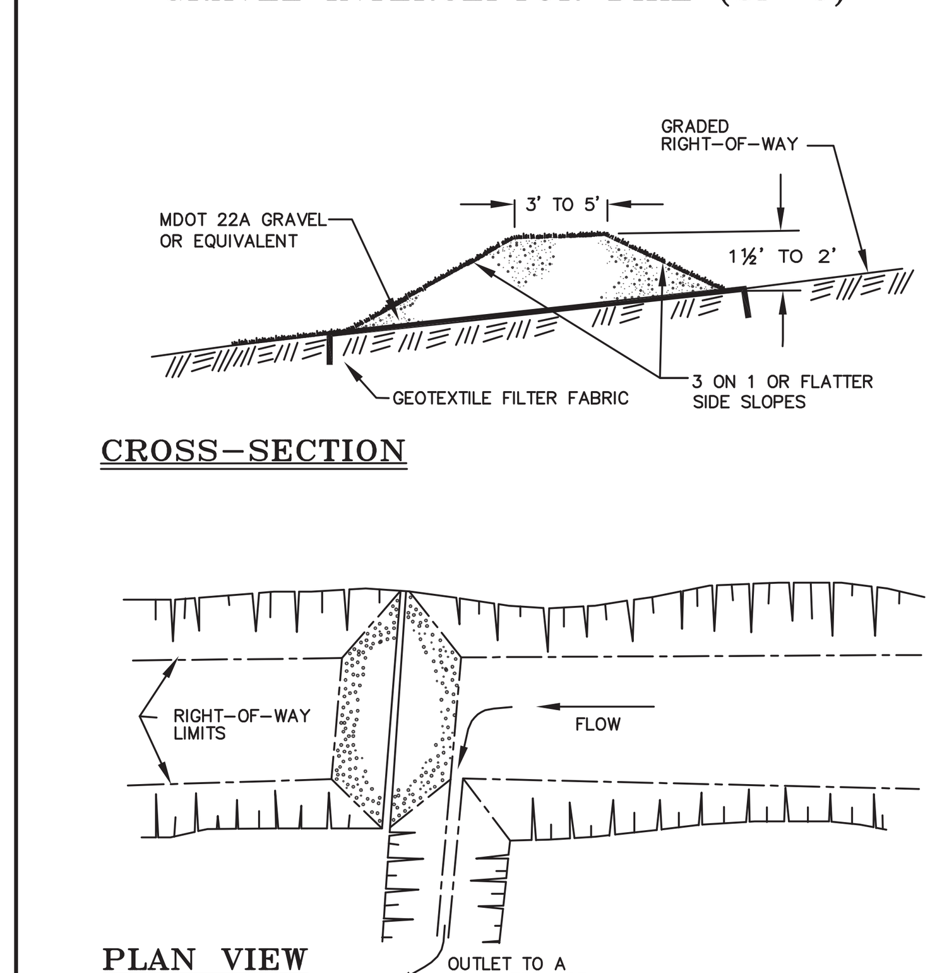


-PLACE GEOTEXTILE FABRIC UNDER STONE WITH 6 INCH MIN. OVERLAP AND TRENCHED IN 6 INCH MIN.

EARTH DIVERSION BERM (E-2)



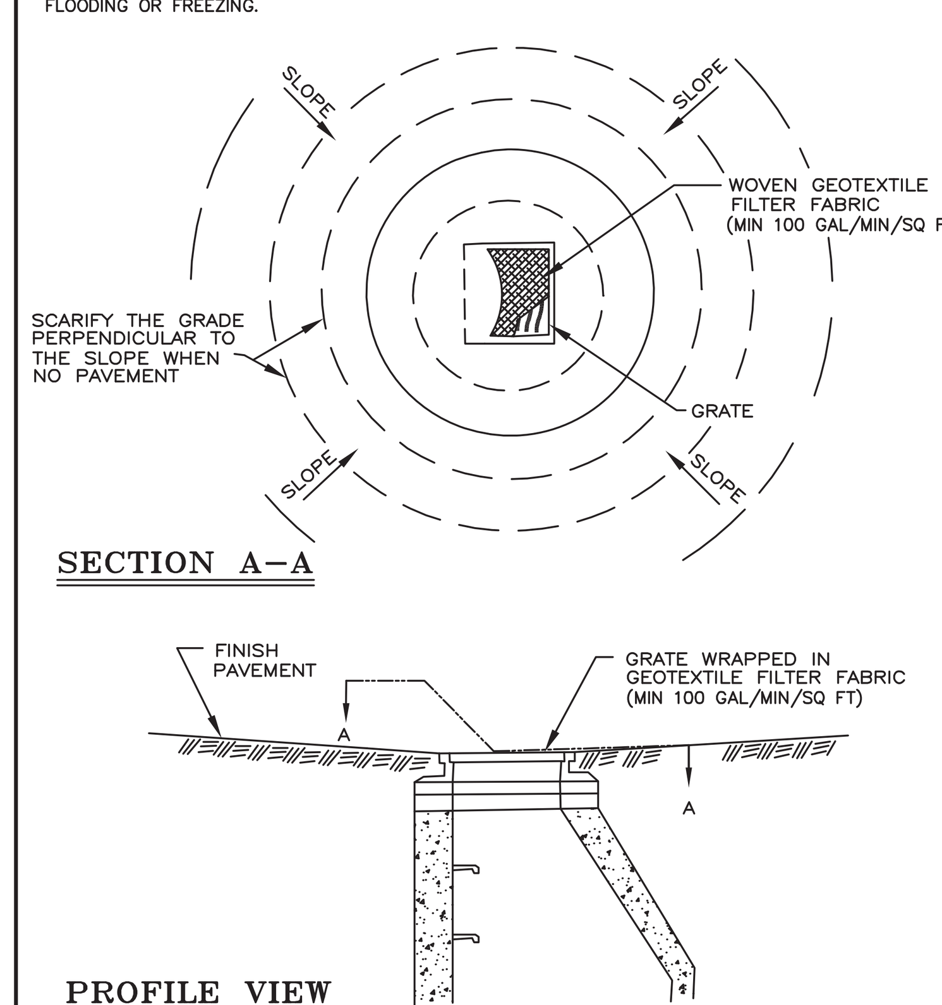
GRAVEL INTERCEPTOR DIKE (SP-6)



-PLACE GEOTEXTILE FABRIC UNDER STONE WITH 6 INCH MIN. OVERLAP AND TRENCHED IN 6 INCH MIN.
-FOR SLOPE AND/OR CHANNEL PROTECTION SEE OTHER BMP'S ON THIS SHEET OR IN THE WRC SOIL EROSION MANUAL.

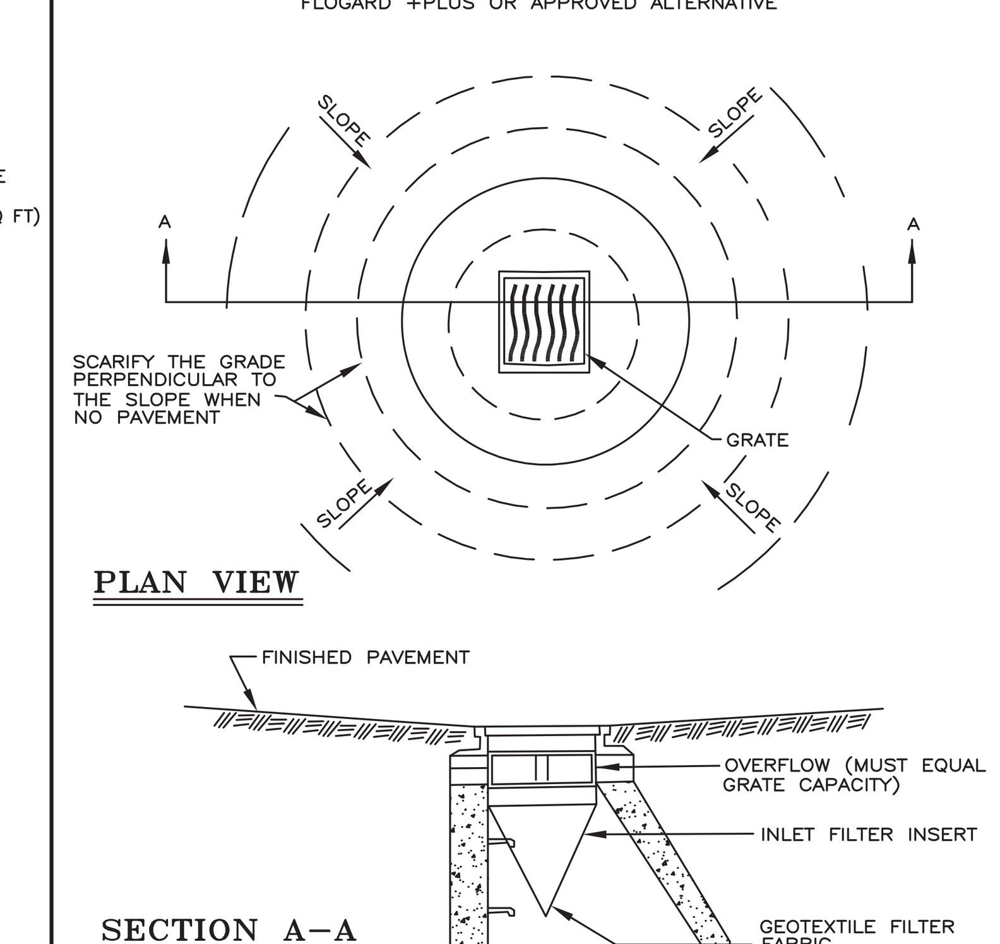
LOW POINT INLET FILTER (SI-2)

ALTERNATIVE INLET FILTER MUST BE USED IN AREAS THAT MAY BECOME A SAFETY HAZARD DUE TO FLOODING OR FREEZING.

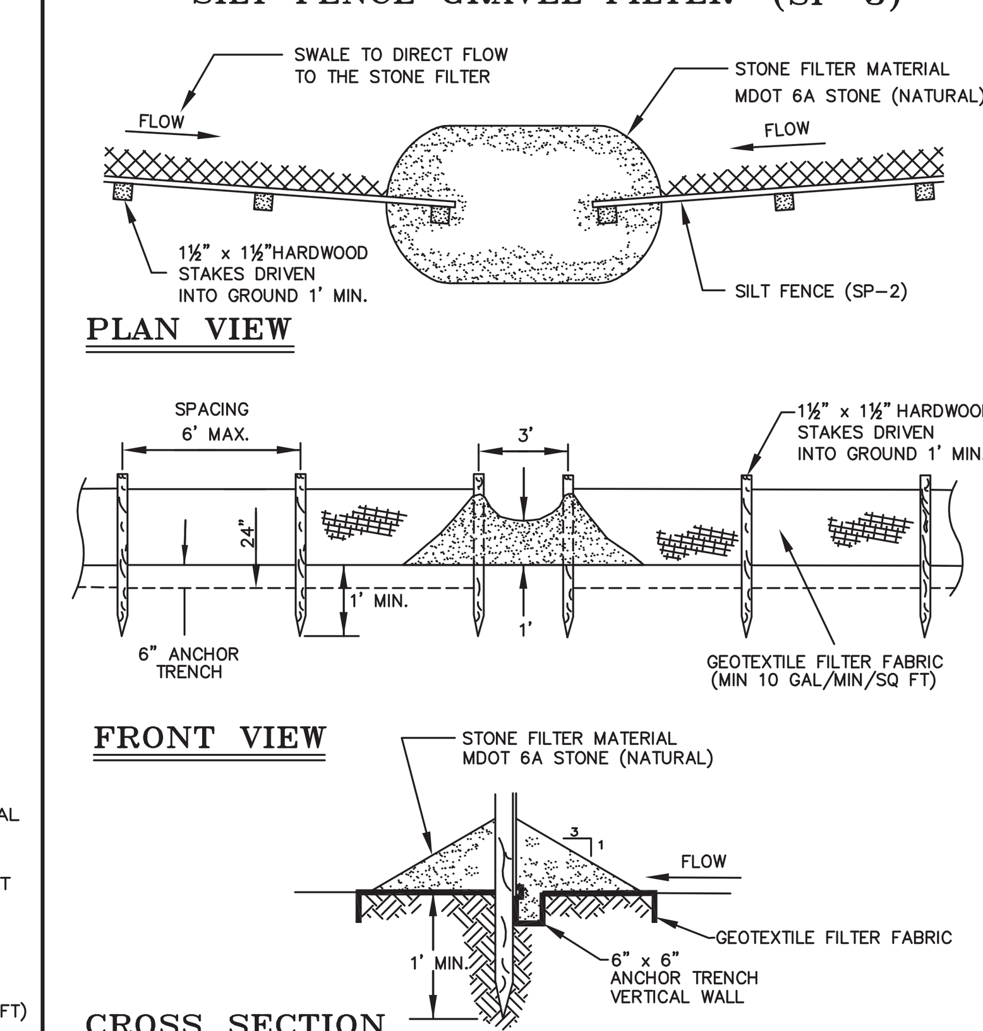


LOW POINT INLET FILTER ALT. "A" (SI-2A)

MATERIAL: CATCH-ALL, ULTRA-URBAN FILTERS, FLOGARD +PLUS OR APPROVED ALTERNATIVE

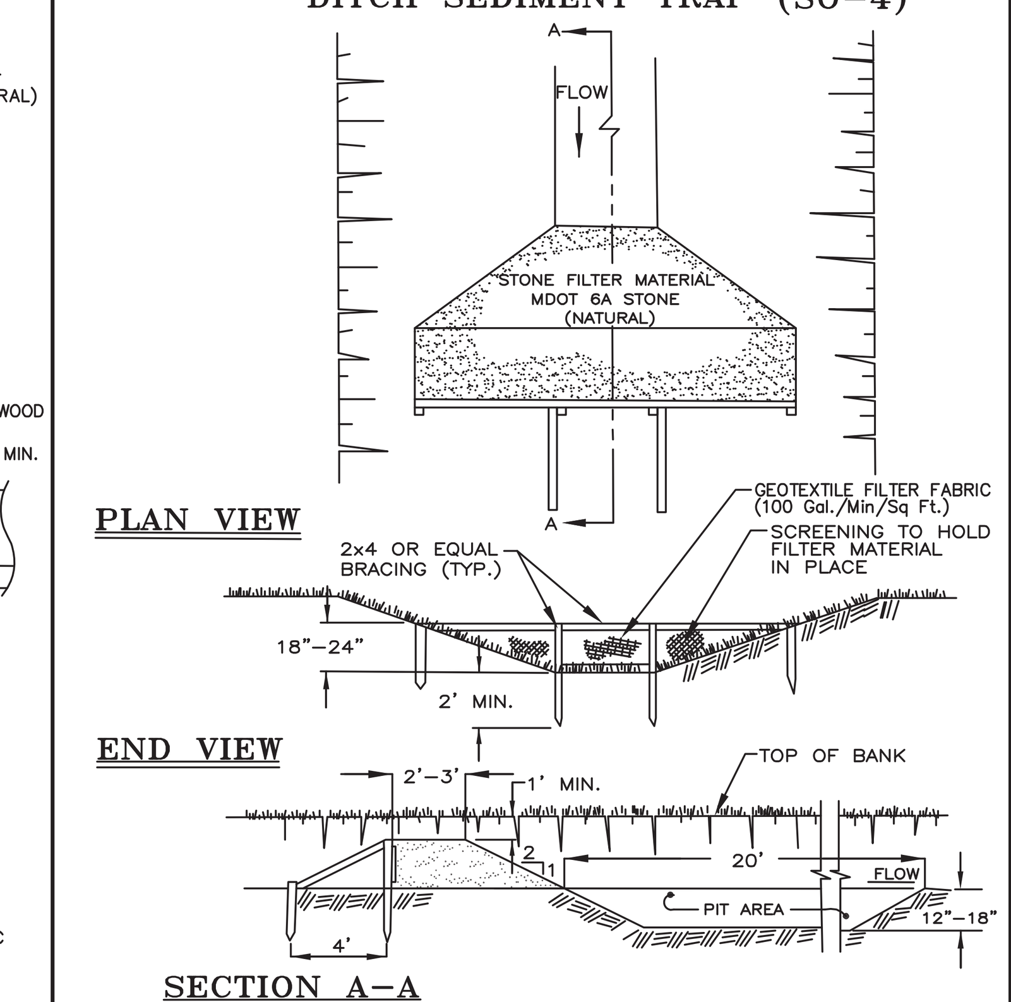


SILT FENCE GRAVEL FILTER (SP-3)



-PLACE GEOTEXTILE FABRIC UNDER STONE WITH 6 INCH MIN. OVERLAP AND TRENCHED IN 6 INCH MIN.

DITCH SEDIMENT TRAP (SO-4)

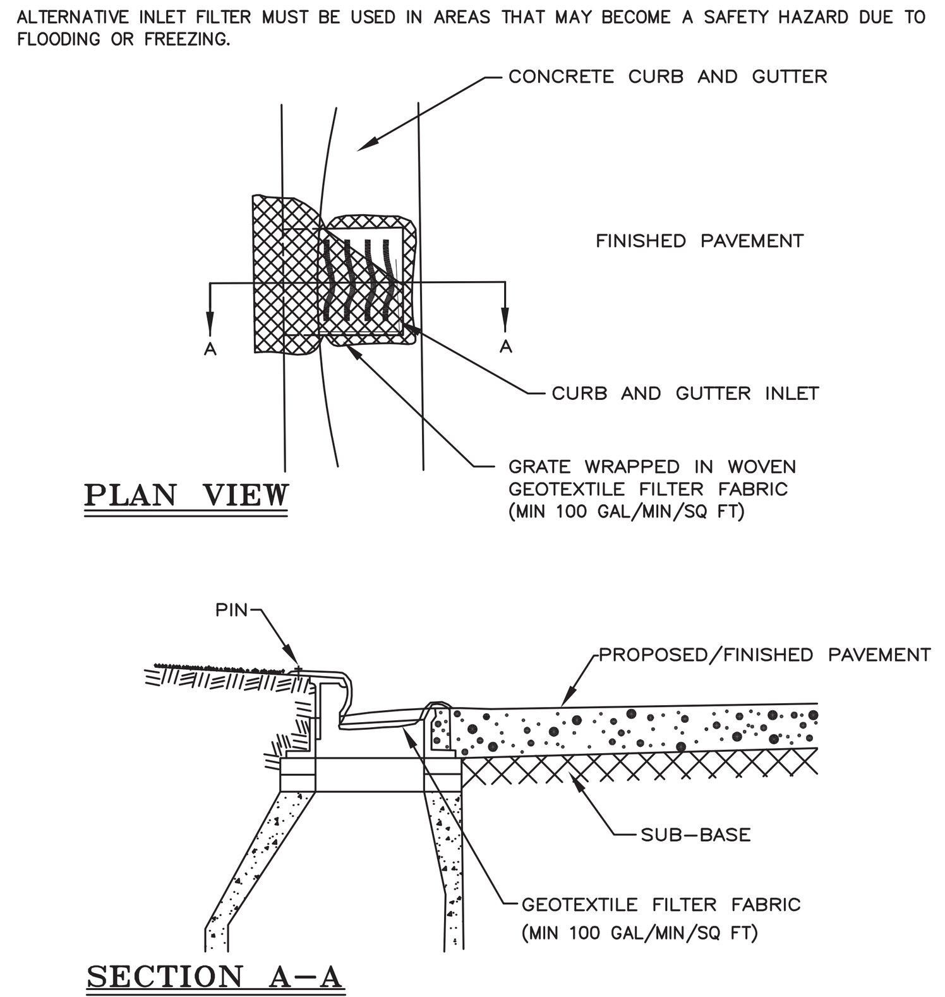


NOTE:
FOR SLOPE AND/OR CHANNEL PROTECTION SEE OTHER BMP'S ON THE SHEET OR IN THE WRC SOIL EROSION MANUAL.

CURB AND GUTTER INLET FILTER (SI-4)

(BEFORE AND AFTER PAVING)

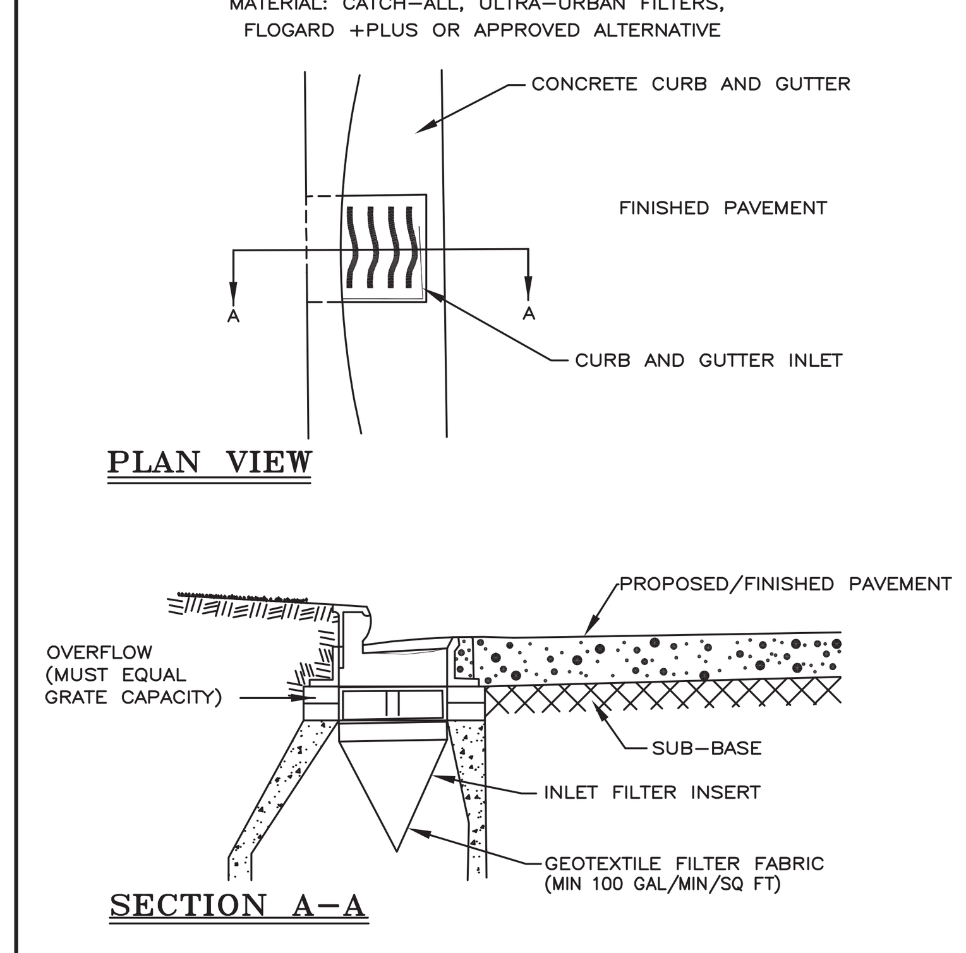
ALTERNATIVE INLET FILTER MUST BE USED IN AREAS THAT MAY BECOME A SAFETY HAZARD DUE TO FLOODING OR FREEZING.



CURB AND GUTTER INLET FILTER ALTERNATIVE "A" (SI-4A)

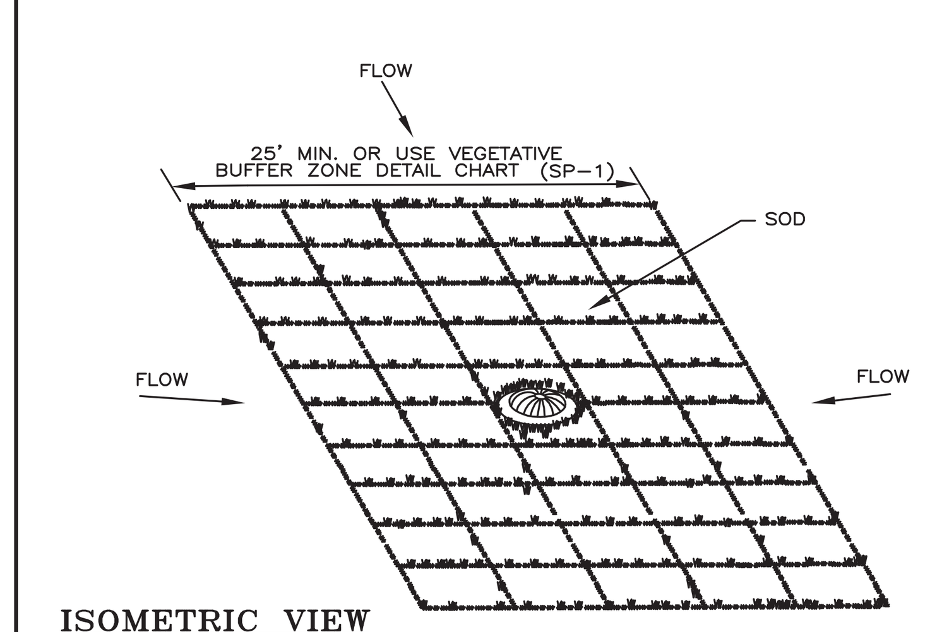
(BEFORE AND AFTER PAVING)

MATERIAL: CATCH-ALL, ULTRA-URBAN FILTERS, FLOGARD +PLUS OR APPROVED ALTERNATIVE

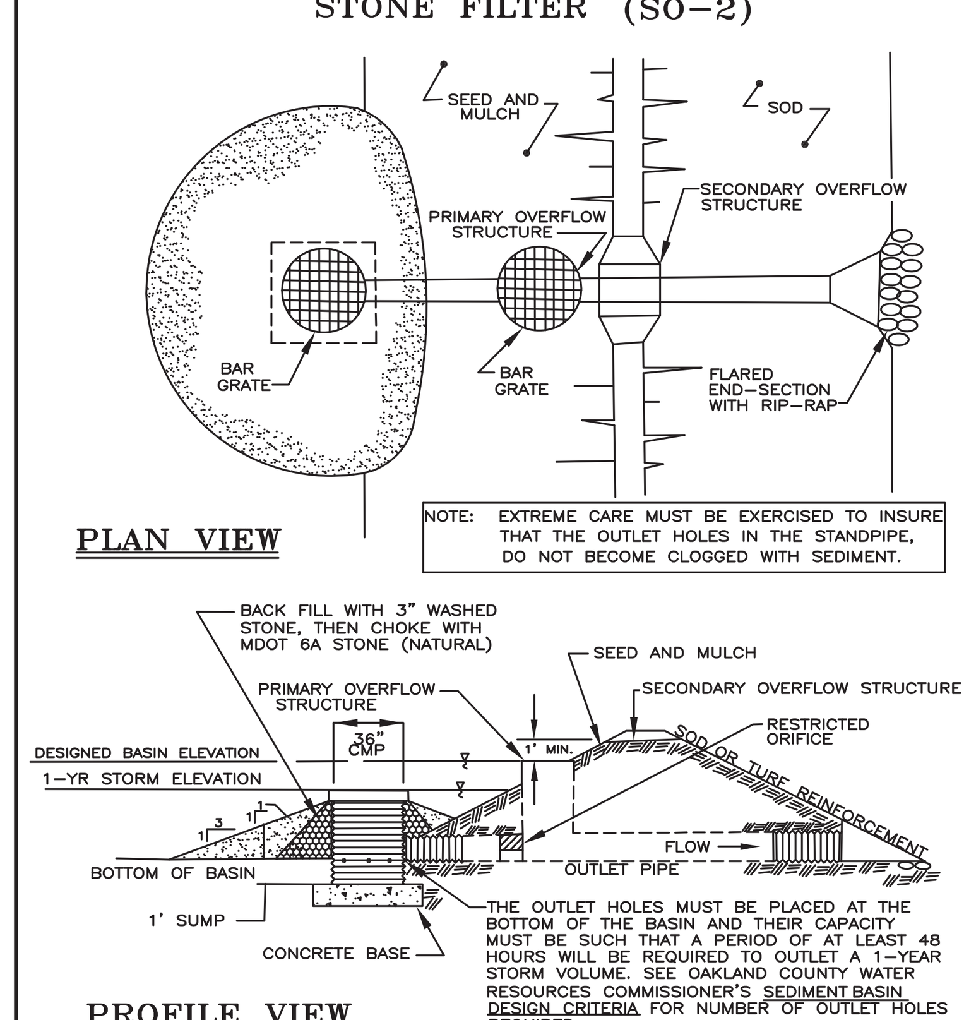


SOD INLET FILTER (SI-1)

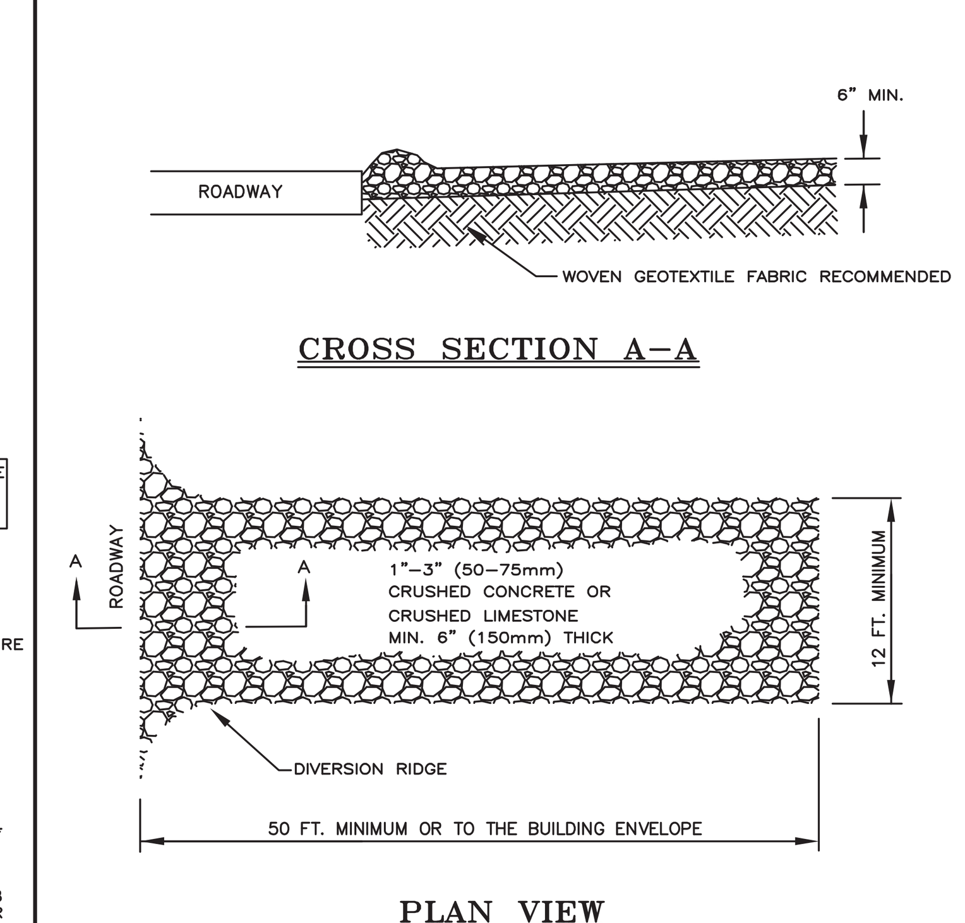
DEFINITION	SOD INLET FILTERS ARE PADS OF SOD PLACED AROUND A STORM DRAIN INLET OR CATCH BASIN.
PURPOSE	SOD INLET FILTERS ARE INSTALLED TO SLOW THE FLOW OF WATER INTO AN INLET OR CATCH BASIN AND TO FILTER OUT SEDIMENT IN THE PROCESS.
WHERE APPLICABLE	SOD INLET FILTERS SHOULD ONLY BE USED TO HANDLE LIGHT CONCENTRATIONS OF SEDIMENT. THEY ARE BEST USED AFTER FINAL GRADING IS COMPLETE AND DURING THE ESTABLISHMENT OF A VEGETATIVE COVER.



TEMPORARY DETENTION BASIN OUTLET STONE FILTER (SO-2)

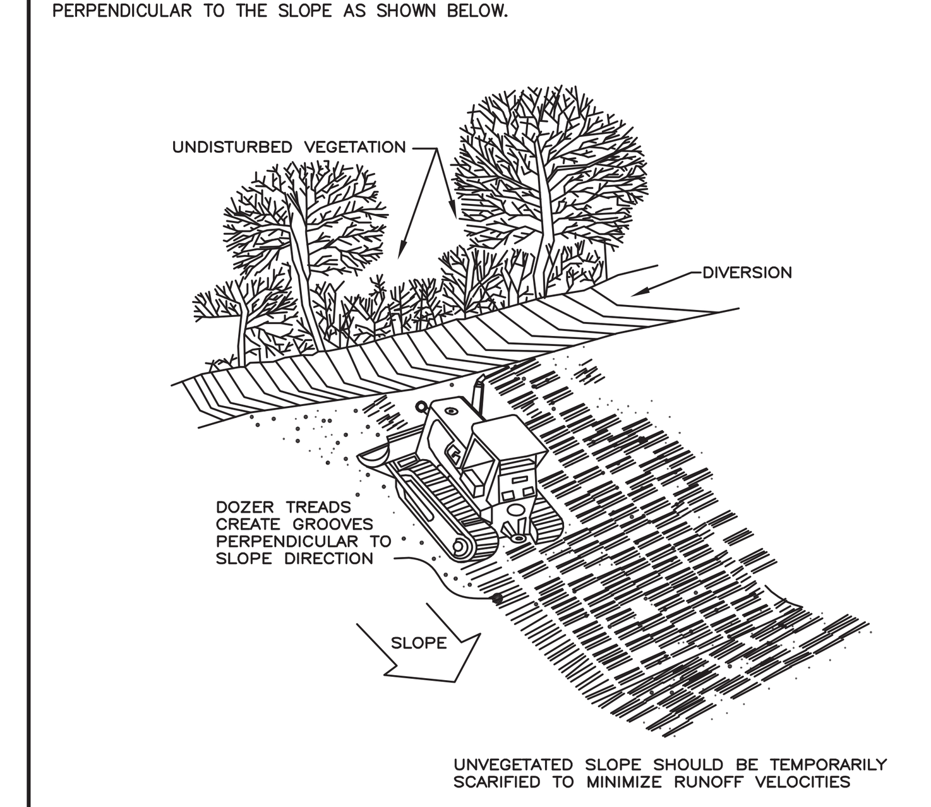


TEMPORARY STONE ACCESS DRIVE (SP-9)



SURFACE ROUGHENING AND SCARIFICATION (E-8)

THIS IS AN EASY AND ECONOMICAL WAY TO REDUCE SOIL EROSION. IT IS SIMPLY THE PLACING OF HORIZONTAL GROOVES IN A SLOPE PERPENDICULAR TO THE FLOW OF RUNOFF. THIS CAN BE DONE BY EITHER DISC HARROWING, BACK BLADING OR JUST RUNNING THE TREADS OF A CRAWLER TRACTOR PERPENDICULAR TO THE SLOPE AS SHOWN BELOW.



NOTE:

WHILE PERFORMING WORK INVOLVING GROUNDS MAINTENANCE AND/OR THE CONSTRUCTION/MAINTENANCE OF ANY INFRASTRUCTURE, INCLUDING ROADS, WATER MAINS, SANITARY SEWERS, STORM DRAINS AND STORM WATER BEST MANAGEMENT PRACTICES (BMPS), CONTRACTORS SHALL MINIMIZE POLLUTION FROM STORM WATER RUNOFF THAT CAN AFFECT WATER QUALITY RELATED TO WORK ACTIVITIES. POLLUTANTS THAT COULD IMPAIR WATER QUALITY MAY INCLUDE FUEL, GREASE AND OIL, NUTRIENTS, BACTERIA AND PATHOGENS, LITTER AND DEBRIS, AND SOIL EROSION AND SEDIMENTATION. APPLICABLE BMPS SHALL BE IMPLEMENTED BY THE CONTRACTOR TO THE MAXIMUM EXTENT PRACTICABLE TO PROTECT WATER QUALITY AND WILDLIFE HABITAT.

SOIL EROSION AND SEDIMENTATION CONTROL DETAILS

REVISION BLOCK

Data Source / Source Date: N/A

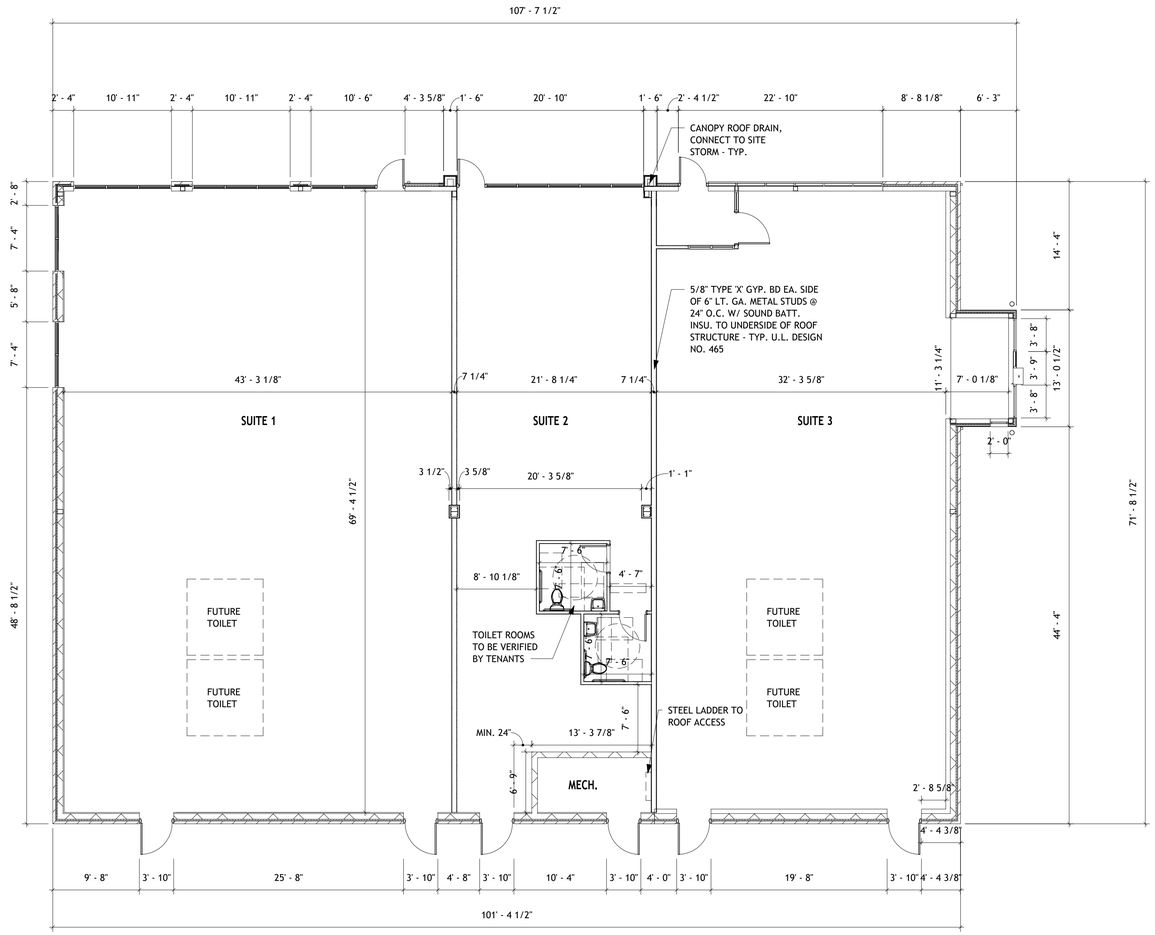
Rev. No.:	Rev. By:	Rev. Date:	Description:
1	lz	3-22-07	PROPOSED DETAIL EDITS
2	lz	2-26-09	STANDARDS COMMITTEE APPROVAL / NAME CHANGES
3	DS	3-25-11	SILT FENCE ALTERNATIVE "A" DETAIL (SP-2A) ADDED
4	DS	4-16-13	STANDARDS COMMITTEE APPROVAL / NOTE CHANGES

ORIG. DATE:	01/01/01
SCALE:	NONE
DESIGNED BY:	WRC
DRAWN BY:	Mapping

WRC WATER RESOURCES COMMISSIONER Jim Nash

ONE PUBLIC WORKS DRIVE, BLDG 95 WEST
WATERFORD, MICHIGAN
48328-1907

SHEET NO.: 1 of 1



FLOOR PLAN - WEST BUILDING

SCALE: 1/8" = 1'-0"

BOWERS+ASSOCIATES, INC.
2400 South Huron Parkway
Ann Arbor, MI 48104
P: 734.975.2400
www.bowersarch.com

CONSULTANT + NAME

PROJECT + INFORMATION

WHITE LAKE RETAIL

9109 HIGHLAND RD

PROJECT + NUMBER

23-306

ISSUE + DATE

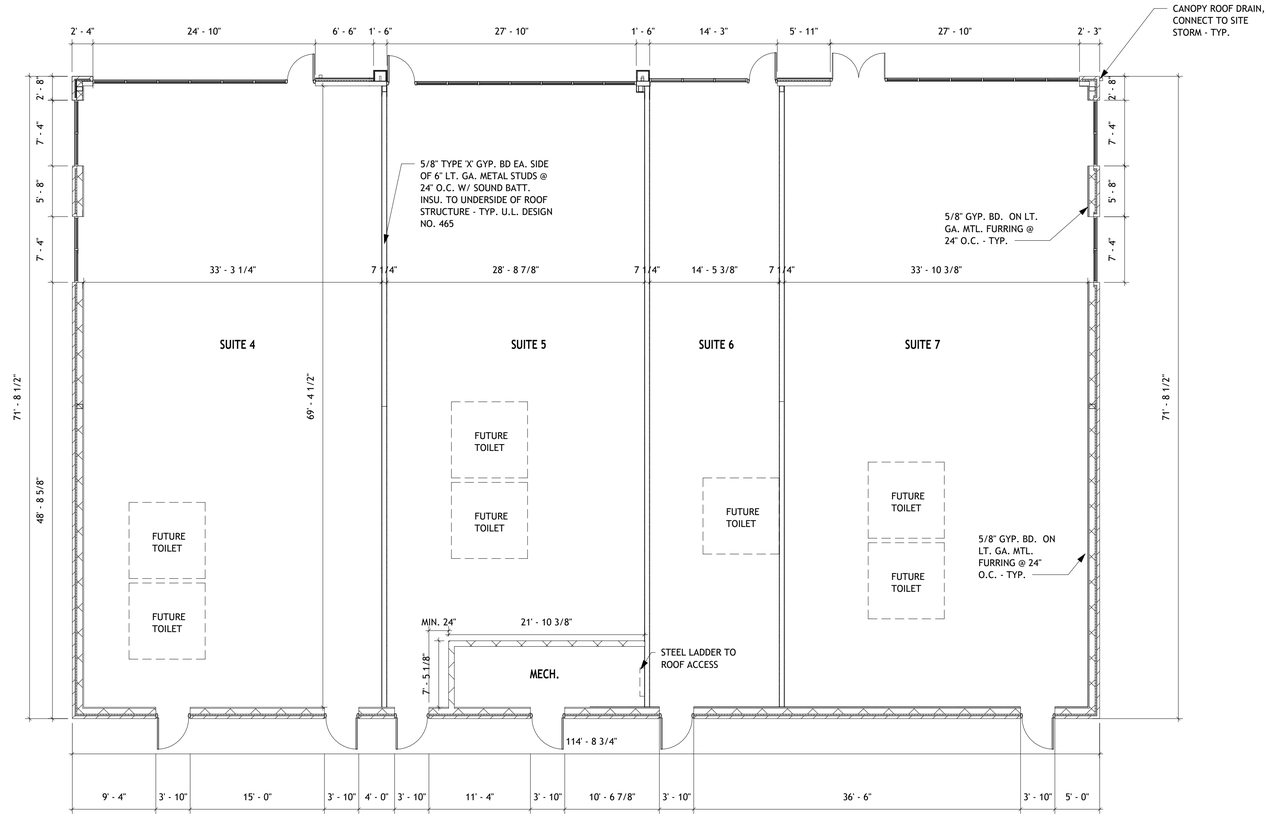
21 FEB 2024	
23 APR 2024	REV
13 MAY 2024	REV
12 JULY 2024	REV
17 JULY 2024	
24 JULY 2024	REV
21 AUG 2024	REV
17 OCT 2024	SPLAN
14 NOV 2024	BID
19 DEC 2024	SPLAN

SHEET + TITLE

FLOOR PLANS - WEST BUILDING

SHEET + NUMBER

A-100



FLOOR PLAN - EAST BUILDING

SCALE: 1/8" = 1'-0"

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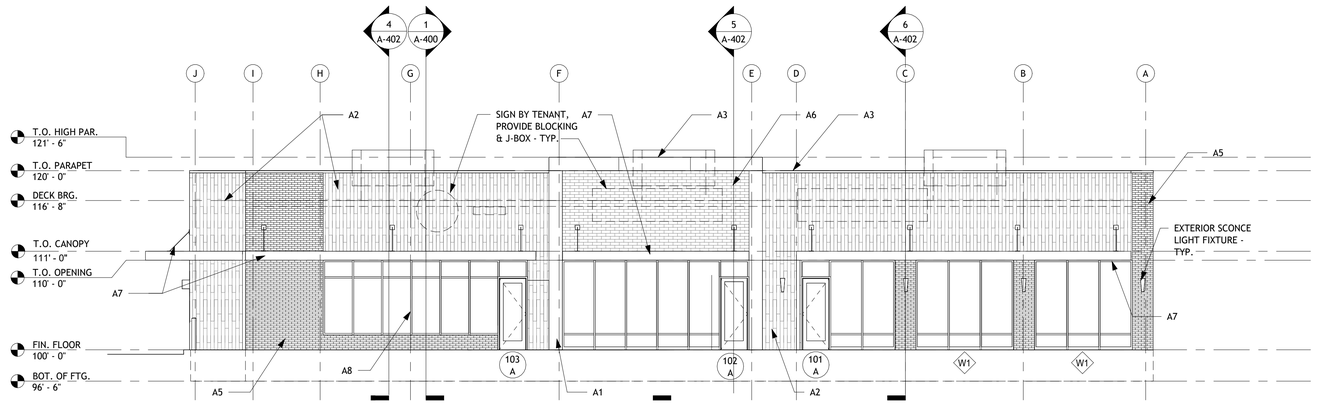
SHEET + TITLE

FLOOR PLAN - EAST BUILDING

SHEET + NUMBER

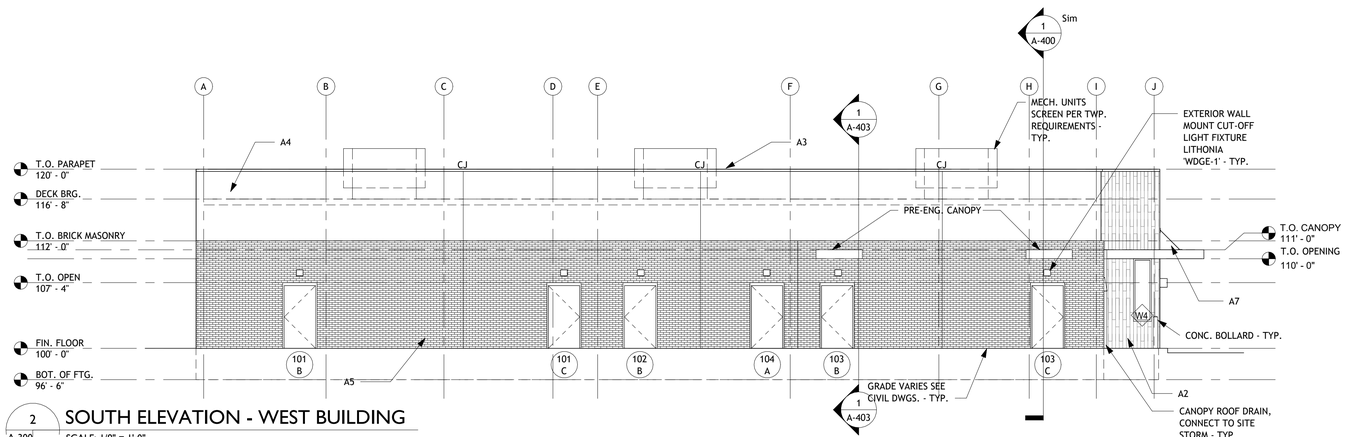
A-101



1 A-300 NORTH ELEVATION - WEST BUILDING

SCALE: 1/8" = 1'-0"

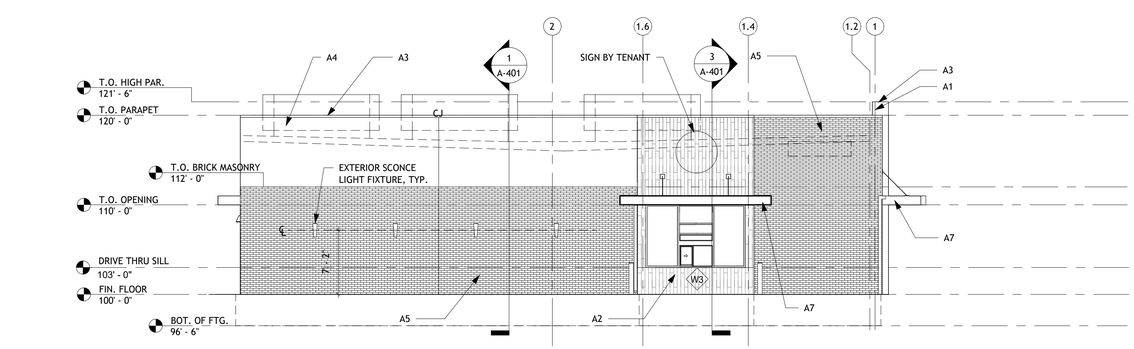
WINDOW COVERAGE: 32.9% OF FACADE



2 A-300 SOUTH ELEVATION - WEST BUILDING

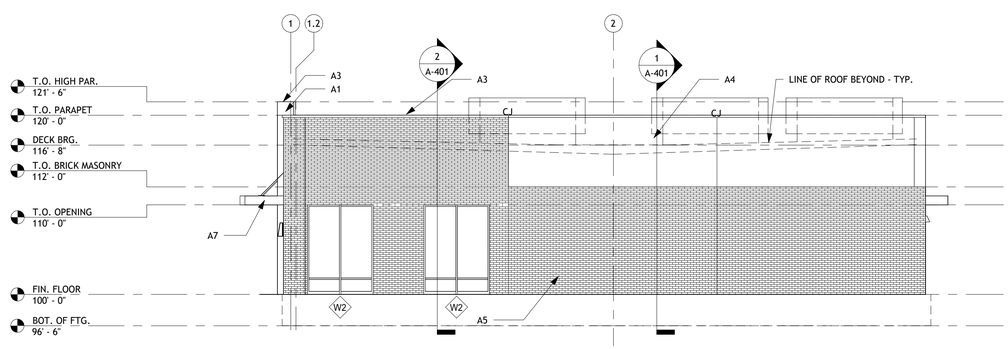
SCALE: 1/8" = 1'-0"

EXTERIOR FINISHES LEGEND					
TAG	MATERIAL	MANUF/STYLE	COLOR	FINISH / STYLE	FASTENER TYPE
A1	FIBER CEMENT PANELS	NICHIHA	DARK METAL		
A2	FIBER CEMENT PANELS	NICHIHA			
A3	PREFIN. METAL COPING	PAC-CLAD OR EQUAL TO MATCH	TO MATCH RAL #7021 MATTE BLACK STEEL - MT0028 - FLAT ROCK	ANODIZED	
A4	EXTERIOR INSULAION FINISH SYSTEM (EIFS)	DRYVIT	COLOR TO MATCH SW 7030 ANEW GRAY	SANDBLAST TEXTURE	
A5	BRICK VENEER	BELDEN BRICK			
A6	BRICK VENEER	GLEN-GERY	ASPEN WHITE		
A7	PREFIN. METAL CANOPY	TBD	TO MATCH RAL #7021	PRE-FINISHED	
A8	PREFIN. ALUM	TBD	TO MATCH RAL #7021	PRE-FINISHED	



3 A-300 EAST ELEVATION - WEST BUILDING

SCALE: 1/8" = 1'-0"



4 A-300 WEST ELEVATION - WEST BUILDING

SCALE: 1/8" = 1'-0"

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Ann Arbor, MI 48104
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CONSULTANT + NAME

PROJECT + INFORMATION

WHITE LAKE RETAIL

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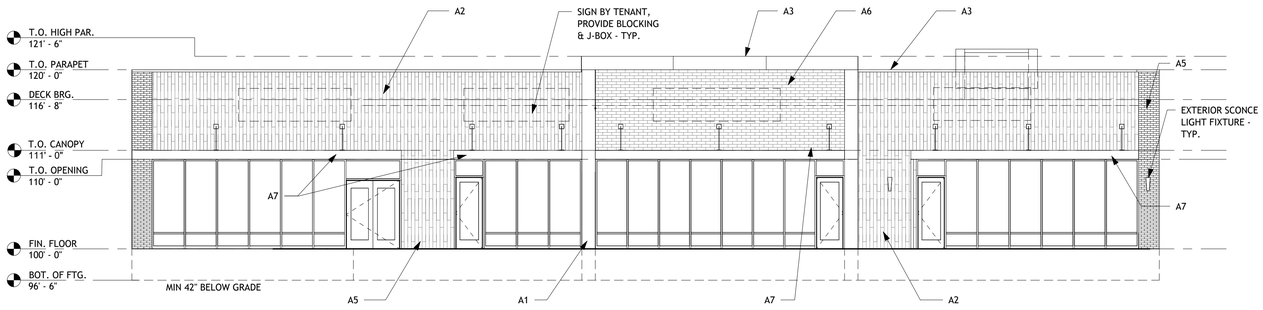
SHEET + TITLE

ELEVATIONS - WEST BUILDING

SHEET + NUMBER

A-300



WINDOW COVERAGE: 35.4% OF FACADE

1 / A-301 NORTH ELEVATION - EAST BUILDING

SCALE: 1/8" = 1'-0"

EXTERIOR FINISHES LEGEND					
TAG	MATERIAL	MANUF/STYLE	COLOR	FINISH / STYLE	FASTENER TYPE
A1	FIBER CEMENT PANELS	NICHIHA	DARK METAL		
A2	FIBER CEMENT PANELS	NICHIHA			
A3	PREFIN. METAL COPING	PAC-CLAD OR EQUAL TO MATCH	TO MATCH RAL #7021 MATTE BLACK STEEL - MT0028 - FLAT ROCK	ANODIZED	
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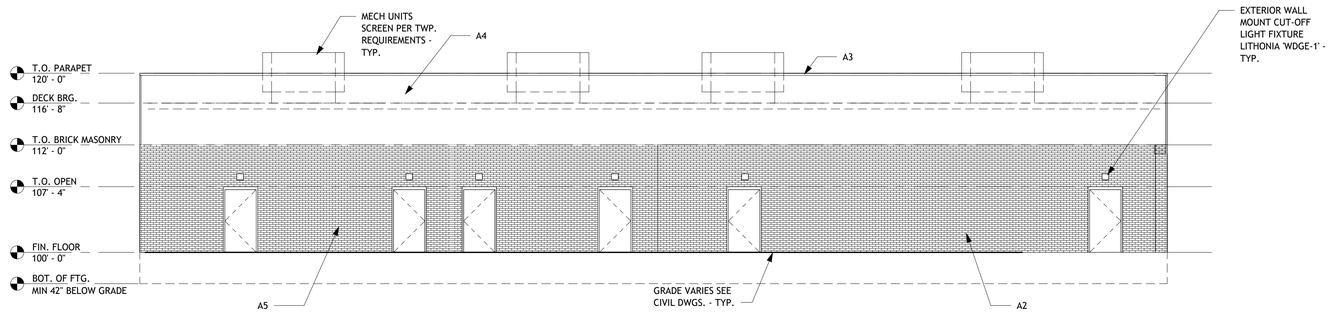
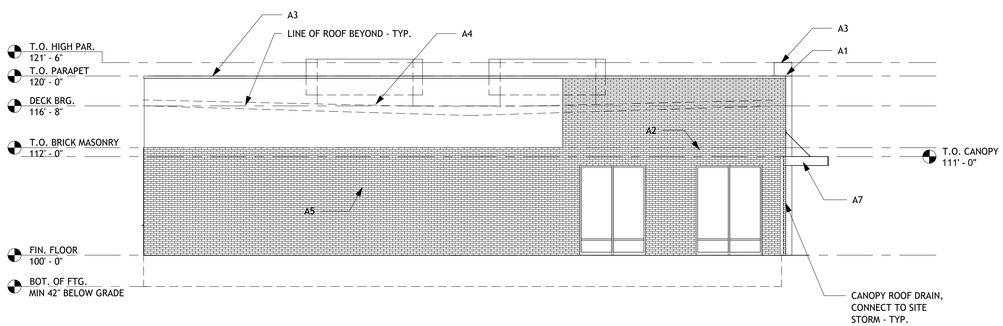
A8	PREFIN. ALUM	TBD	TO MATCH RAL #7021	PRE-FINISHED	



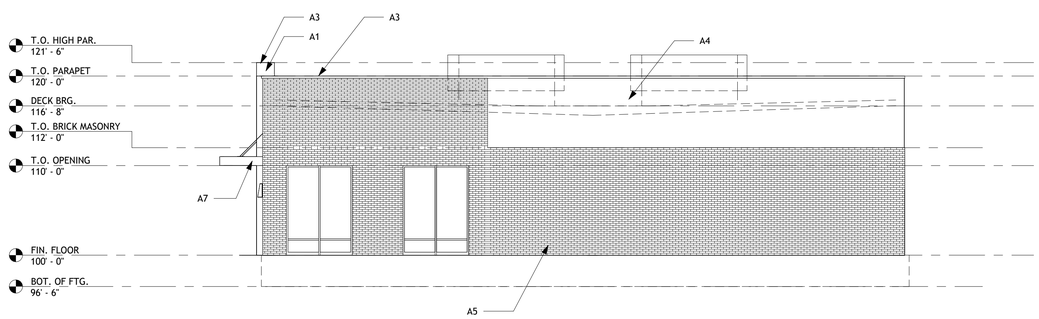
2 / A-301 SOUTH ELEVATION - EAST BUILDING

SCALE: 1/8" = 1'-0"



3 / A-301 EAST ELEVATION -EAST BUILDING

SCALE: 1/8" = 1'-0"



4 / A-301 WEST ELEVATION - EAST BUILDING

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WHITE LAKE RETAIL

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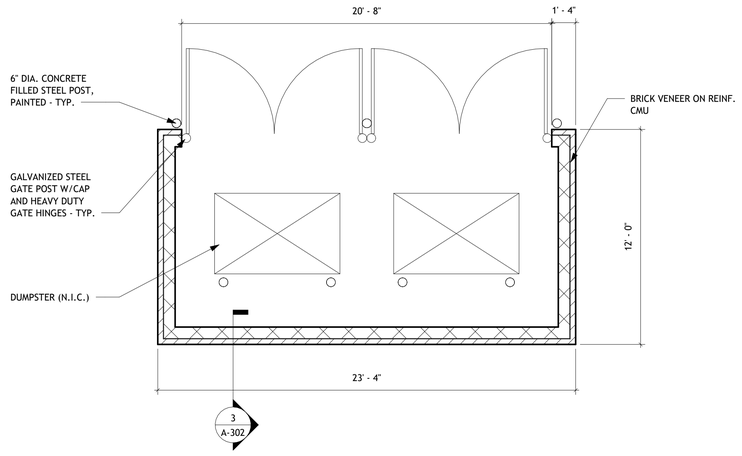
SHEET + TITLE

ELEVATIONS - EAST BUILDING

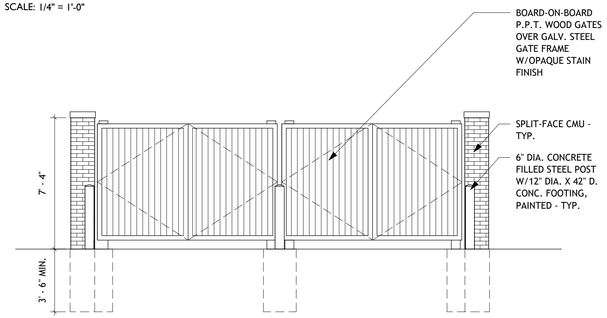
SHEET + NUMBER

A-301



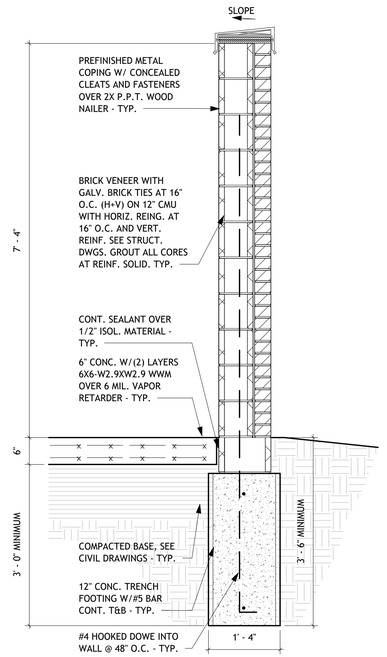
1 DUMPSTER ENCLOSURE PLAN

A-302 A-300 SCALE: 1/4" = 1'-0"



2 DUMPSTER ENCLOSURE ELEV

A-302 SCALE: 1/4" = 1'-0"



3 TYPICAL DUMPSTER SCREEN WALL DETAIL

A-302 A-302 SCALE: 3/4" = 1'-0"

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2400 South Huron Parkway
Ann Arbor, MI 48104
P: 734.975.2400
www.bowersarch.com

CONSULTANT + NAME

PROJECT + INFORMATION
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PROJECT + NUMBER
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SHEET + TITLE
DUMPSTER ENCLOSURE ELEVATIONS

SHEET + NUMBER
A-302

Concept Rendering

White Lake Twp, MICHIGAN

BOWERS+ASSOCIATES
ARCHITECTURE DESIGN

COMMUNITY IMPACT STATEMENT

9101 HIGHLAND ROAD – COMMERCIAL DEVELOPMENT
12-23-227-003
9101 HIGHLAND ROAD (M-59)
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN 48386

PREPARED FOR:
AFFINITY 10 INVESTMENT LLC
44512 SOUTH SHORE STREET
WATERFORD, MI 48328

PREPARED BY:
STONEFIELD ENGINEERING & DESIGN, LLC
555 S OLD WOODWARD AVENUE SUITE 12L
BIRMINGHAM, MICHIGAN 48009

REPORT DATE
NOVEMBER 12, 2024

REPORT CONTENTS

APPENDICES

1.0 GENERAL

1.1 SITE DESCRIPTION

Affinity 10 Investment LLC proposes the construction of two (2) multi-tenant buildings including retail, restaurant, and drive-thru uses. The subject property, Parcel ID: 12-23-227-003, commonly known as 9101 Highland Road (M-59) is located along the south side of Highland Road (M-59) approximately 180 feet from the intersection with Sunny Beach Boulevard. The subject property is located within the White Lake Township Zoning District: RB - Restricted Business and is bounded by Highland Road (M-59) to the north, PD Planned Business Big Box Retail to north across Highland Road, R1-C - Single Family Residential to the east and south, and LB - Local Business, White Lake KinderCare to the west. The total project area is 195,568 SF (4.49 AC).

The existing site is a vacant church consisting of a 1-story building, commercial driveway on Highland Road (M-59), parking facilities, shed, playground and garden. The existing site is to be entirely demolished apart from the protection of 14 existing mature trees and on-site public utility mains. The proposed development includes the construction of two (2) multi-tenant buildings including retail, restaurant, and drive-thru uses and supporting improvements inclusive of parking facilities, landscape, utilities, site lighting, stormwater management facilities and right-of-way streetscape improvements. The West Building totals 7,227 SF including three tenants; Suite #1: 3,283 SF Retail, Suite #2: 1,405 SF Retail, Suite #3: 2,539 SF Restaurant with Drive-Thru (Starbucks). The East Building totals 7,865 SF including four tenants; Suite #4: 2,502 SF Restaurant, Suite #5: 1,900 SF Restaurant (Nothing Bundt the Cake), Suite #6 1,053 SF Retail, Suite #7 2,410 SF Restaurant.

This Community Impact Statement has been prepared per the White Lake Township Zoning Ordinance Section 6.6 requirements to provide a format for applicants to document the anticipated impacts of intensive development projects proposed as Special Land Uses.

1.2 HOURS OF OPERATION

At this time, prospective tenants and hours of operation are as follows:

- Nothing Bundt the Cake: 9:30 am to 8:00 pm
- Five Guys: 11:00 am to 10:00 pm
- Starbucks: 5:00 am to 8:00 pm
- Jersey Mike's: 10:00 am to 9:00 pm

1.3 MASTER PLAN ANALYSIS

Per White Lake Townships "2024 Master Plan" the subject site is designated as "Commercial Corridor". The Commercial Corridor Zones intent is to provide regional goods and services to residents and non-residents. Includes large box stores and drive-thrus.

The proposed development proposes commercial uses including retail, restaurant, and drive-thru which is directly consistent with the Township Master Plan "Commercial Corridor" land use.

Per the Future Land-Use Map, the existing surrounding land uses are designated as follows:

- **North:** Existing Planned Business
  Big-Box Retail
  Future Land Use Map: Commercial Corridor
- **East & South:** Existing R1-C Single Family Residential
  Single Family Homes
  Future Land Use Map: Neighborhood Residential
- **West:** Existing Local Business
  Child Daycare
  Future Land Use Map: Commercial Corridor

2.0 COMMUNITY FACILITIES AND SERVICES

2.1 ESTIMATED DEMAND ON POLICE & FIRE SERVICES

For a commercial development including retail and restaurant uses, a low/moderate demand on police and fire services is expected. Potential increased foot traffic, especially during peak hours, may necessitate occasional police patrols to manage incidents like theft, vandalism, or disturbances. No proposed use is to include the sale of alcohol, which will help keep demand low. Similarly, fire services may be required to conduct safety inspections for code compliance, especially in kitchens and food preparation areas, and respond to potential fire hazards linked to cooking equipment. Overall, the proposed establishments are generally low risk. Approval from the Township of White Lake Fire Marshal shall be obtained prior to construction.

2.2 ESTIMATED SEWER & WATER DEMAND

Department of Public Services (DPS) issued their Site Plan Review on September 25, 2024. The anticipated Residential Equivalent Units (REUs) for the development is about 27 REUs. DPS did not express any concerns at

this time over utility demands. DLZ (Township Engineer) and DPS approvals shall be obtained prior to construction.

2.3 ESTIMATED TRUCK DELIVERIES

The anticipated tenants typically receive deliveries one to two times per week, dependent on the customer demand. Delivery trucks are generally mid-sized refrigerated box trucks (around 18-26 feet), which are small enough to navigate the site as well as be supported by the existing roadways.

3.0 ECONOMICS

3.1 ANTICIPATED JOBS CREATED

Jobs created during the construction phase based on project size and specifications:

- 56 new temporary jobs during construction phase
- 4-5 additional service-related jobs (landscape, snow removal etc…)

Full-Time Equivalent Job

- While not all tenant spaces have signed leases, it would be expected that a commercial development of this size would generate the equivalent of over 50 new full-time jobs.

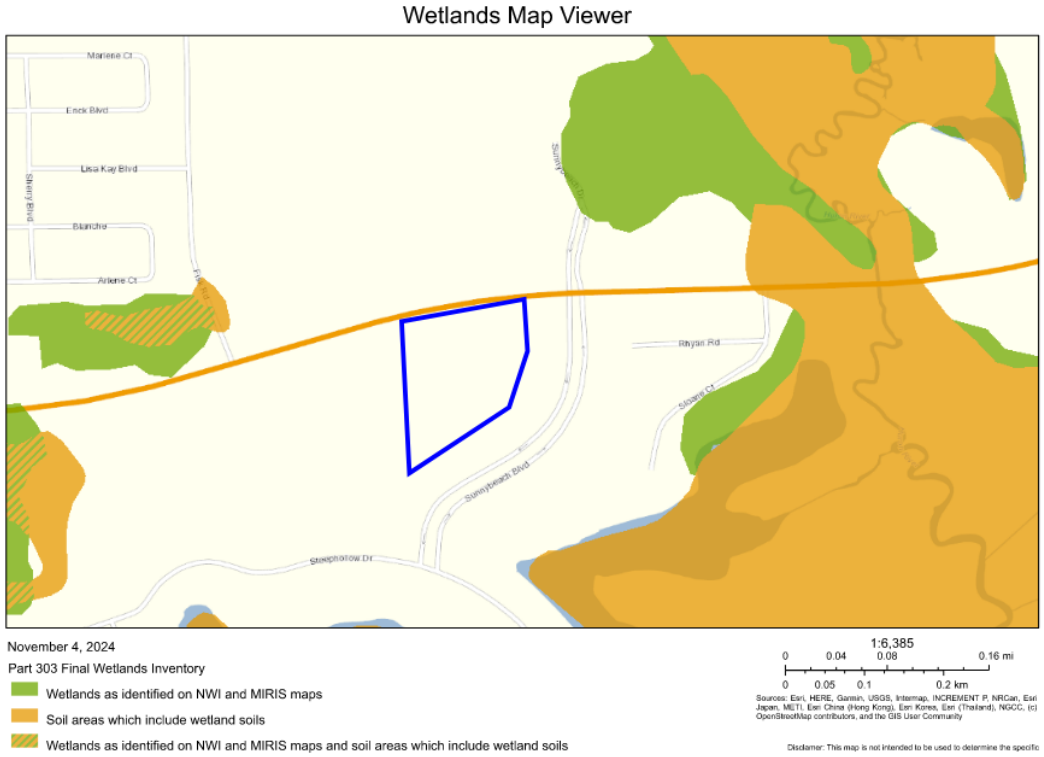
3.2 ANTICIPATED TAX REVENUE

The proposed commercial development will generate substantial new revenue for the Township, replacing the current tax-exempt church property with a taxable asset. It is estimated that the proposed development will contribute around $70,000 per year to White Lake Township and local Schools from annual property taxes. The proposed development will also bring in sales tax on goods or food sales which generate revenue for the state, and the township may benefit indirectly through state-shared revenues. Annual sales tax revenue is estimated to be around $540,000. While not directly benefiting the township, some of this may flow back through state funding allocations.

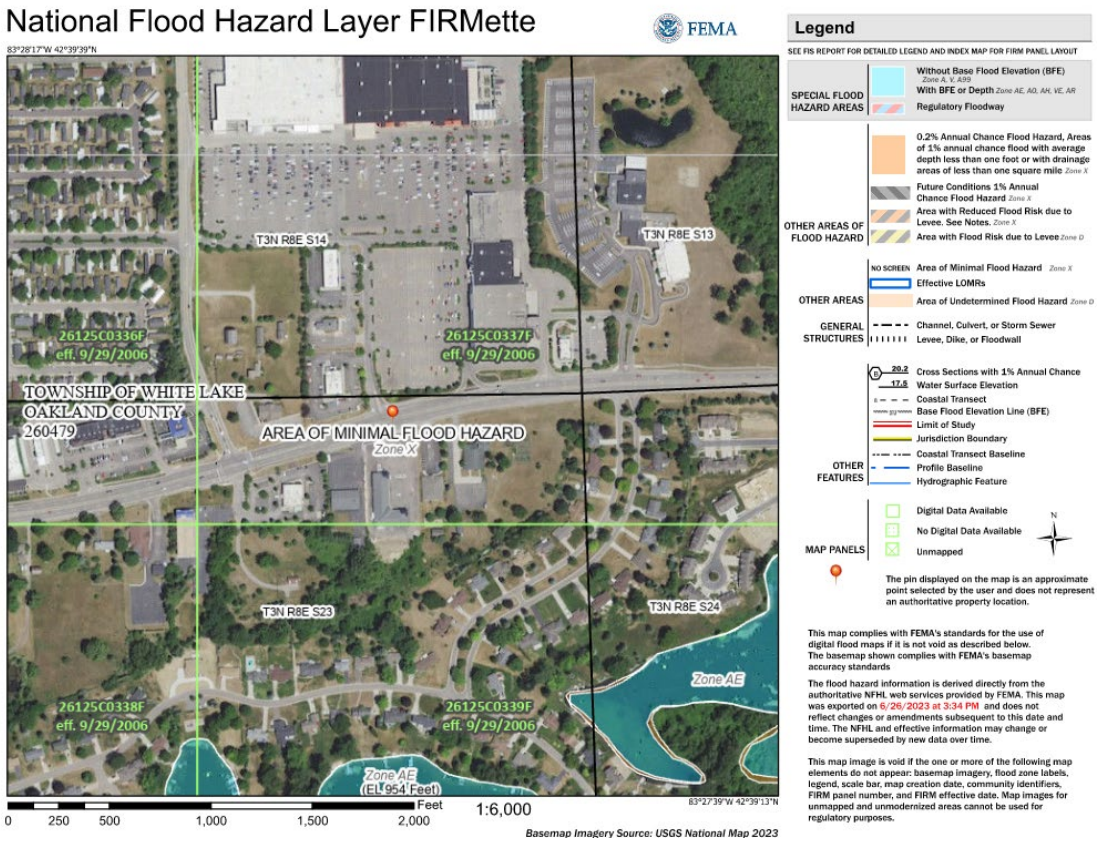
4.0 ENVIRONMENT

4.1 EXISTING NATURAL FEATURES

There are no wetlands on-site per EGLE Wetlands Map Viewer.



Per FEMA flood mapping, the site does not lie within a flood plain / floodway. The site lies within Zone X: Area of Minimal Flood Hazard.



4.2 HAZARDOUS MATERIALS

Hazardous materials in retail and restaurant uses are limited to cleaning supplies, oils, and potentially combustible supplies, all of which require careful handling and storage to prevent spills or accidents. Containment measures include proper labeling, secure storage in designated areas, spill kits on hand for emergencies, and regular training for staff on safe handling procedures.

4.3 AIR POLLUTANTS

Expected air pollutants would be primarily from construction, cooking operations, and vehicle traffic. During construction, dust (particulate matter) is a common pollutant due to site demolition, preparation and excavation. Post-construction, restaurant operations may emit additional particulates, grease, and odors from cooking, particularly if there is grilling or frying involved. Vehicles accessing the development will add to localized air pollution, releasing nitrogen oxides (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs) that contribute to ground-level ozone and smog. Proper mitigation measures, like dust suppression, high-efficiency exhaust systems, and adequate landscaping, can help minimize these emissions and their impact on surrounding areas.

4.4 GROUNDWATER QUALITY & QUANTITY

The proposed development results in an increase in impervious are, therefore stormwater management measures per Oakland County Standards are required. The development includes an aboveground infiltration basin with a mechanical water quality unit will help mitigate potential runoff pollutants, such as oils, grease, and sediments, from entering the groundwater by capturing and treating stormwater before it infiltrates, in line with county standards.

This system should be effective at managing both the volume and quality of stormwater by allowing for infiltration and treating contaminants, reducing the likelihood of groundwater contamination. While overall groundwater recharge may decrease slightly due to paved surfaces, these measures are expected to minimize adverse impacts, helping maintain regional groundwater quality and quantity.

5.0 NOISE

Noise pollution impacts on nearby residential areas are expected to be minimal, especially with the mitigation strategies in place. Since the drive-thru closest to residences is limited to a pick-up window, it will not generate noise from speakers or menu boards, which are typically the primary sources of drive-thru noise. Additionally, the extensive landscaping and 8-foot-high fence will serve as natural and structural sound barriers,

helping to further buffer residential areas from vehicle noise, conversations, and general activity associated with the site. These design elements should effectively reduce noise levels, preserving the tranquility of the surrounding neighborhood.

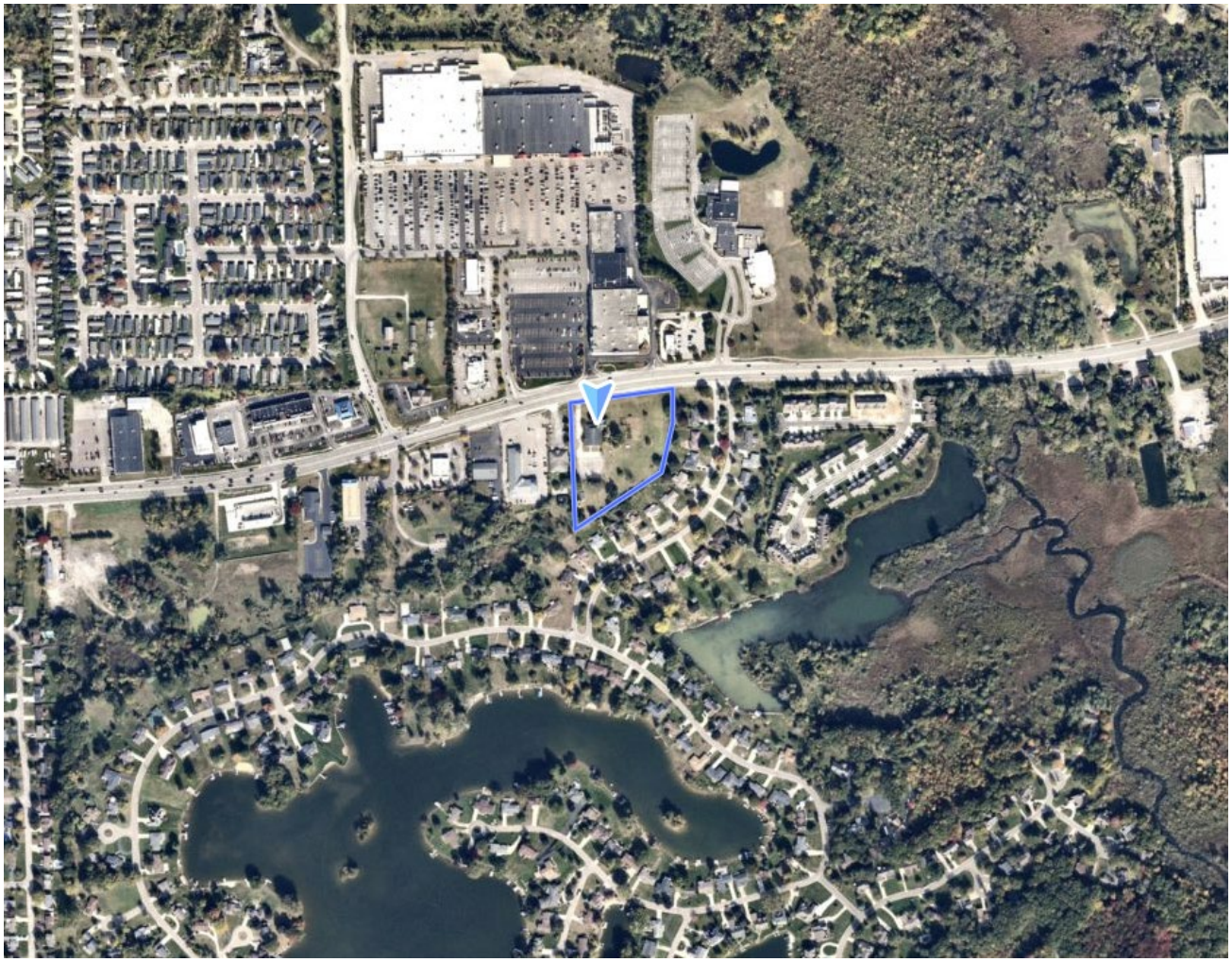
6.0 TRAFFIC

With the addition of the site-generated trips, the study intersections are expected to continue operating in a manner similar to the background conditions analysis, with no additional impacts to LOS. All approaches and movements at the proposed site driveway intersection with Highland Road (M-59) are expected to operate acceptably, at LOS D or better, during both the AM and PM peak hours, with the following exception:

- Highland Road (M-59) & Site Drive: The NB approach is expected to operate at LOS E during the PM peak hour. Review of SimTraffic network simulations indicates that egress vehicles were unable to find adequate gaps within the through traffic along Highland Road (M-59), resulting in long vehicle queues; these vehicle queues do not dissipate and were typically observed to persist throughout the PM peak hour.

Therefore, the results of the future conditions analysis indicates that the site-generated traffic volumes from the proposed development are expected to have a negligible impact to the delay (LOS) and vehicle queueing observed at the off-site study intersections of Highland Road (M-59) with Fisk Road, JOANN Fabric Drive, and Sunny Beach Boulevard. See **Appendix A** for Traffic Impact Study prepared by Fleis & Vandenbrink.

7.0 AERIAL MAP



**Aerial Map obtained from Nearmap November 11, 2024*

APPENDIX A
TRAFFIC IMPACT STUDY

MEMO

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

VIA EMAIL: ewilliams@stonefieldeng.com

To:	**Stonefield Engineering**
From:	**Jacob Swanson, PE, PTOE** **Paul Bonner, EIT** **Fleis & VandenBrink**
Date:	**April 22, 2024**
Re:	**9101 Highland Road (M-59) – Commercial Development** **White Lake Township, Michigan** **Traffic Impact Study**

1 INTRODUCTION

This memorandum presents the results of the Traffic Impact Study (TIS) for the proposed commercial development in White Lake Township, Michigan. The project site is generally located on the south side of Highland Road (M-59), approximately 1,000-feet east of Fisk Road, as shown on the attached **Figure 1**. The proposed commercial development includes the construction of retail and restaurant land uses. The project site is currently vacant and was previously occupied by the Calvary Lutheran Church, which will be razed with the construction of the proposed development. Site access is proposed via one (1) full access driveway on Highland Road (M-59). The study section of Highland Road (M-59) is under the jurisdiction of the Michigan Department of Transportation (MDOT). The purpose of this TIS is to evaluate the impact of the proposed development on the adjacent roadway network, as part of the site plan approval and driveway permitting processes.

Scope of work for this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practices, and information published by the Institute of Transportation Engineers (ITE). Study analyses were completed using Synchro/SimTraffic (Version 11) traffic analysis software. Sources of data for this study include F&V subconsultant Quality Counts (QC), MDOT, the Road Commission for Oakland County (RCOC), White Lake Township, the Southeast Michigan Council of Governments (SEMCOG), and ITE.

2 BACKGROUND

2.1 EXISTING ROAD NETWORK

Lane use and traffic control at the study intersections are shown on the attached **Figure 2** and study roadways are further described below. For purposes of this study, all minor streets and driveways were assumed to have an operating speed of 25 miles per hour (mph), unless otherwise noted.

Highland Road (M-59) generally runs in the east / west directions, adjacent to the north side of the project site. The study section of roadway is classified as an *Other Principal Arterial*, is under the jurisdiction of MDOT, has a posted speed limit of 50-mph, and has an Average Annual Daily Traffic (AADT) volume of approximately 33,400 (MDOT 2022) vehicles per day (vpd). The study section of roadway provides a typical five-lane cross-section, with two (2) lanes of travel in each direction and a center two-way left-turn lane (TWLTL). At the signalized intersection with Fisk Road, Highland Road (M-59) widens to provide an exclusive eastbound right-turn lane. Additionally, Highland Road (M-59) widens to provide an exclusive westbound right-turn lane at the intersection with the JOANN Fabric driveway.

Fisk Road generally runs in the north / south directions, west of the project site, terminating at Highland Road (M-59). The study section of roadway is classified as a *Local Road*, is under the jurisdiction of RCOC, has an assumed prima facie speed limit of 55-mph, and has an AADT volume of approximately 1,256 vpd (MDOT 2022). The study section of Fisk Road provides typical three-lane cross-section, with one (1) lane of travel in each direction and a center TWLTL.

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Sunny Beach Boulevard generally runs in the north / south directions, east of the project site. The study section of roadway is classified as a *Local Road*, is under the jurisdiction of RCOC, has an assumed residential prima facie speed limit of 25-mph, and has an AADT volume of approximately 1,840 vpd (MDOT 2012). The study section of Sunny Beach Boulevard services a residential neighborhood to the south of Highland Road (M-59) and services commercial uses to the north of Highland Road (M-59).

2.2 Existing Traffic Volumes

F&V subconsultant QC collected existing Turning Movement Count (TMC) data on Wednesday, December 13, 2023, during the AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak periods at the following study intersections:

- Highland Road (M-59) & Fisk Road
- Highland Road (M-59) & JOANN Fabric Driveway

Additional TMC data was collected on Wednesday, March 13, 2024, at the following study intersection:

- Highland Road (M-59) & Sunny Beach Boulevard

During collection of the turning movement counts, Peak Hour Factors (PHFs), pedestrian and bicycle volumes, and commercial truck percentages were recorded and used in the traffic analysis. The peak hours of each of the study intersections were utilized and the through volumes were carried through the roadway network and balanced upwards at the proposed site driveways. Therefore, traffic volumes used in the analysis and shown on the attached traffic volume figures may not match the raw traffic volumes shown in the data collection.

The weekday AM and PM peak hours for the adjacent roadway network were observed to generally occur between 7:30 AM to 8:30 AM and 4:15 PM to 5:15 PM, respectively. F&V collected an inventory of existing lane use and traffic controls, as shown on the attached **Figure 2**. F&V also obtained the current signal timing permit for the study intersection of Highland Road (M-59) & Fisk Road from MDOT. The existing 2023 peak hour traffic volumes used in the analysis are shown on the attached **Figure 3**. All applicable background data referenced in this memorandum are attached.

3 Existing Conditions

Existing peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersections using Synchro/SimTraffic (Version 11) traffic analysis software. This analysis was based on the existing lane use and traffic control shown on the attached **Figure 2**, the exiting peak hour traffic volumes shown on the attached **Figure 3**, and methodologies presented in the *Highway Capacity Manual, 6th Edition* (HCM6).

Descriptions of LOS "A" through "F" as defined in the HCM6, are attached. Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions. Additionally, SimTraffic network simulations were reviewed to evaluate network operations and vehicle queues. The results for the exiting conditions analysis are attached and shown in **Table 1**.

Table 1: Existing Intersection Operations

Intersection		Control	Approach	Existing Conditions			
				AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Highland Road (M-59) & Fisk Road	Signalized	EBL	14.0	B	53.1	D
			EBT	27.7	C	18.2	B
			EBR	14.7	B	11.0	B
			WBL	15.9	C	11.6	B
			WBTR	22.7	C	25.3	C
			NBL	25.1	C	47.9	D
			NBTR	22.3	C	38.0	D
			SBL	27.3	C	67.0	E
			SBTR	24.7	C	47.1	D
			Overall	**25.3**	**C**	**28.6**	**C**

Intersection		Control	Approach	Existing Conditions			
				AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS
2	Highland Road (M-59) & JOANN Fabric Drive	Stop (Minor)	EBL	11.1	B	17.2	C
			WB	Free			
			SB	12.2	B	40.6	E
3	Highland Road (M-59) & Sunny Beach Boulevard	Stop (Minor)	EBL	10.8	B	17.0	C
			WBL	9.5	A	15.8	C
			NBL	75.9	F	$	F
			NBTR	12.1	B	17.6	C
			SB	50.3	F	$	F

Note: $ Indicates delays exceeding 1,000 seconds / vehicle.

The results of the existing conditions analysis indicates that all approaches and movements at the study intersections are currently operating acceptably, at LOS D or better during both the AM and PM peak hours, with the following exceptions:

Highland Road (M-59) & Fisk Road

- During the PM peak hour: the southbound left-turn movement currently operates at LOS E.

Review of SimTraffic network simulations indicates generally acceptable operations. Occasional periods of vehicle queues were observed for this movement; however, the majority of vehicle queues were observed to be processed within each cycle length, leaving minimal residual vehicle queueing. Additionally, any remaining vehicle queues were observed to dissipate and were not present throughout the PM peak hour.

Highland Road (M-59) & JOANN Fabric Drive

- During the PM peak hour: the southbound approach currently operates at LOS E.

The southbound approach was designed to prohibit egress left-turns; however, the left-turn traffic from this approach is causing the reported delay. The total volume of southbound egress traffic during the PM peak hour is very low (3 vehicles), which includes two (2) vehicles making an egress left-turn movement. Additionally, although the delay experienced by these vehicles causes the approach to operate at LOS E, review of SimTraffic microsimulations indicates acceptable operations; the 95th percentile queue length reported for this approach was approximately 11-feet (~1 vehicle), which is not significant.

Highland Road (M-59) & Sunny Beach Boulevard

- During both the AM and PM peak periods: The northbound left-turn movement and the southbound approach are both currently operate at LOS F.

Review of SimTraffic network simulations indicates generally acceptable operations during the AM peak hour. Occasional periods of vehicle queues were observed along the stop-controlled minor-street approaches; however, these queues were able to find adequate gaps within the through traffic along Highland Road (M-59), without experiencing significant delays or excessive queueing. Review of SimTraffic microsimulations during the PM peak hour indicates that vehicles along Sunny Beach Boulevard experience difficulty in finding gaps within the through traffic along Highland Road (M-59), resulting in long vehicle queues along the minor street; these vehicle queues do not dissipate and were typically observed to persist throughout the PM peak hour.

4 BACKGROUND CONDITIONS (2025)

Historical population and economic profile data was obtained for White Lake Township from the Southeast Michigan Council of Governments (SEMCOG) database, in order to calculate a background growth rate to project the existing 2023 peak hour traffic volumes to the site buildout year of 2025. Population and employment projections from 2020 to 2050 were reviewed and show average annual growth rates of 0.41% and 0.28%, respectively. Therefore, a conservative background growth rate of **0.5%** per year was applied to the existing peak hour traffic volumes to forecast the background 2025 peak hour traffic volume ***without the proposed development***, as shown on the attached **Figure 4**.

In addition to background growth, it is important to account for traffic that will be generated by approved developments within the study area that have yet to be constructed or are currently under construction. At the time of this study, no background developments were identified within the vicinity of the project site.

Background peak hour vehicle delays and LOS ***without the proposed development*** were calculated at the study intersections based on the existing lane use and traffic control shown on the attached **Figure 2**, the background peak hour traffic volumes shown on the attached **Figure 4**, and methodologies presented in the HCM6. The results of the background conditions analysis are attached and summarized in **Table 2**.

Table 2: Background Intersection Operations

Intersection		Control	Approach	Existing Conditions				Background Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Highland Road (M-59) & Fisk Road	Signal	EBL	14.0	B	53.1	D	14.1	B	56.4	E	0.1	-	3.3	D→E
			EBT	27.7	C	18.2	B	28.1	C	18.3	B	0.4	-	0.1	-
			EBR	14.7	B	11.0	B	14.7	B	11.0	B	0.0	-	0.0	-
			WBL	15.9	C	11.6	B	16.0	C	11.8	B	0.1	-	0.2	-
			WBTR	22.7	C	25.3	C	22.9	C	25.6	C	0.2	-	0.3	-
			NBL	25.1	C	47.9	D	25.2	C	48.1	D	0.1	-	0.2	-
			NBTR	22.3	C	38.0	D	23.3	C	38.0	D	0.0	-	0.0	-
			SBL	27.3	C	67.0	E	27.3	C	67.6	E	0.0	-	0.6	-
			SBTR	24.7	C	47.1	D	24.7	C	47.4	D	0.0	-	0.3	-
			Overall	**25.3**	**C**	**28.6**	**C**	**25.6**	**C**	**29.0**	**C**	**0.3**	**-**	**0.4**	**-**
2	Highland Road (M-59) & JOANN Fabric Dr.	Stop (Minor)	EBL	11.1	B	17.2	C	11.2	B	17.4	C	0.1	-	0.2	-
			WB	Free				Free				N/A			
			SB	12.5	B	40.6	E	12.6	B	41.7	E	0.1	-	1.1	-
3	Highland Road (M-59) & Sunny Beach Boulevard	Stop (Minor)	EBL	10.8	B	17.0	C	10.9	B	17.2	C	0.1	-	0.2	-
			WBL	9.5	A	15.8	C	9.5	A	16.0	C	0.0	-	0.2	-
			NBL	75.9	F	$	F	84.6	F	$	F	8.7	-	-	-
			NBTR	12.1	B	17.6	C	12.2	B	17.8	C	0.1	-	0.2	-
			SB	50.3	F	$	F	52.7	F	$	F	2.4	-	-	-

Note: $ Indicates delays exceeding 1,000 seconds / vehicle.

The results of the background conditions analysis indicates that all approaches and movements at the study intersections are expected to continue operating in a manner similar to the existing conditions analysis, with minor increases in delays and the following additional impacts to LOS:

Highland Road (M-59) & Fisk Road

- During the PM peak hour: The eastbound left-turn movement is expected to operate at LOS E.

Review of SimTraffic network simulations indicates generally acceptable operations. Occasional periods of vehicle queues were observed for the eastbound and southbound left-turn movements during the PM peak hour; however, the majority of vehicle queues were observed to be processed within 1-2 cycle length, leaving minimal residual vehicle queueing. Additionally, any remaining vehicle queues were observed to dissipate and were not present throughout the peak hour.

5 SITE TRIP GENERATION

The number of weekday peak hour (AM and PM) and daily vehicle trips that would be generated by the proposed development were calculated using the rates and equations published by the Institute of Transportation Engineers (ITE) in *Trip Generation, 11th Edition*. For purposes of this study the following land uses were assumed in the analysis: a coffee shop with drive-through, a fast-casual restaurant, a fast-food restaurant with drive-through, and retail space. Additionally, the proposed restaurants will not have breakfast service; however, in order to provide a conservative analysis, the AM peak hour trip generation was included for these land uses. The site trip generation forecast utilized for this study is summarized in **Table 3**.

Table 3: Site Trip Generation Summary

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Strip Retail Plaza (<40k SF)	822	6,184	SF	491	9	6	15	28	27	55
Pass-By (0% AM, 40% PM)				*98*	*0*	*0*	*0*	*11*	*11*	*22*
New Trips				393	9	6	15	17	15	33
Fast Casual Restaurant	930	2,502	SF	243	9	5	14	17	14	31
Pass-By (0% AM, 43% PM)				*104*	*0*	*0*	*0*	*6*	*6*	*12*
New Trips				139	9	5	14	11	8	19
Fast Food Restaurant w/ Drive Through	934	2,402	SF	1,123	55	52	107	41	38	79
Pass-By (50%AM, 55% PM)				*590*	*27*	*27*	*54*	*21*	*21*	*42*
New Trips				533	28	25	53	20	17	37
Coffee Shop with Drive-Through	937	2,522	SF	1,346	111	106	217	49	49	98
Pass-By (50% AM, 55% PM)				*707*	*54*	*54*	*108*	*27*	*27*	*54*
New Trips				639	57	52	109	22	22	44
Total Trips				**3,203**	**184**	**169**	**353**	**135**	**128**	**263**
Total Pass-By				*1,499*	*81*	*81*	*162*	*65*	*65*	*130*
Total New Trips				**1,704**	**103**	**88**	**191**	**70**	**63**	**133**

As is typical of commercial developments, a portion of the trips generated by the proposed development are from vehicles already on the adjacent roadway network that will pass the site on their way from an origin to their ultimate destination. Therefore, not all traffic at the site driveway is necessarily new traffic added to the street system. These trips are therefore reduced from the total external trips generated by a study site. This percentage of the trips generated by the development are considered “pass-by”, which are already present of the adjacent roadway network. The percentage of pass-by used in this analysis was determined based on the rates published by ITE in the *Trip Generation Manual, 11th Edition*.

6 SITE TRIP DISTRIBUTION

The vehicular trips that would be generated by the proposed development were assigned to the study roadway network based on the proposed stie access plan and driveway configurations, the existing peak hour traffic patterns in the adjacent roadway network, and methodologies published by ITE. The ITE trip distribution methodology assumes that new trips will enter the network and access the development, then leave the development and return to their direction of origin, whereas pass-by trips will enter and exit the development in their original direction of travel. The stie trip distributions utilized in the analysis are summarized in **Table 4**.

Table 4: Site Trip Distribution

New Trips				Pass-By Trips		
AM	PM	To/From	Via	Direction	AM	PM
7%	12%	North	Fisk Road			
40%	52%	East	Highland Road (M-59)	Westbound	42%	56%
53%	36%	West	Highland Road (M-59)	Eastbound	58%	44%
100%	**100%**	**Total**			**100%**	**100%**

The vehicular traffic volumes shown in **Table 3** were distributed to the study roadway network according to the distribution shown in **Table 4**. Therefore, the site generated trips shown on the attached **Figure 5** were added to the background peak hour traffic volumes shown on the attached **Figure 4**, in order to calculate the future peak hour traffic volumes, with the addition of the proposed development. Future peak hour traffic volumes are shown on the attached **Figure 6**.

7 FUTURE CONDITIONS (2025)

Future peak hour vehicle delays and LOS ***with the addition of the site-generated trips from the proposed development***, were calculated based on the proposed lane use and traffic controls shown on the attached **Figure 2**, the future peak hour traffic volumes shown on the attached **Figure 6**, and the methodologies presented in the HCM6. Results of the future conditions analysis are attached and summarized in **Table 5**.

Table 5: Future Intersection Operations

Intersection		Control	Approach	Background Conditions				Future Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Highland Road (M-59) & Fisk Road	Signal	EBL	14.1	B	56.4	E	14.5	B	60.8	E	0.4	-	4.4	-
			EBT	28.1	C	18.3	B	30.2	C	18.6	B	2.1	-	0.3	-
			EBR	14.7	B	11.0	B	14.7	B	11.0	B	0.0	-	0.0	-
			WBL	16.0	C	11.8	B	16.8	B	12.0	B	0.8	C→B	0.2	-
			WBTR	22.9	C	25.6	C	23.9	C	26.6	C	0.0	-	0.0	-
			NBL	25.2	C	48.1	D	25.2	C	48.1	D	0.0	-	0.0	-
			NBTR	23.3	C	38.0	D	22.3	C	38.0	D	0.0	-	0.0	-
			SBL	27.3	C	67.6	E	27.6	C	70.7	E	0.3	-	3.1	-
			SBTR	24.7	C	47.4	D	24.7	C	47.4	D	0.0	-	0.0	-
			Overall	**25.6**	**C**	**29.0**	**C**	**27.1**	**C**	**29.9**	**C**	**1.5**	**-**	**0.9**	**-**
2	Highland Road (M-59) & JOANN Fabric Dr.	Stop (Minor)	EBL	11.2	B	17.4	C	11.4	B	17.9	C	0.2	-	0.5	-
			WB	Free				Free				N/A			
			SB	12.6	B	41.7	E	12.9	B	43.7	E	0.3	-	2.0	-
3	Highland Road (M-59) & Sunny Beach Boulevard	Stop (Minor)	EBL	10.9	B	17.2	C	11.1	B	17.7	C	0.2	-	0.5	-
			WBL	9.5	A	16.0	C	9.8	A	16.4	C	0.3	-	0.4	-
			NBL	84.6	F	$	F	95.4	F	$	F	10.8	-	-	-
			NBTR	12.2	B	17.8	C	12.7	B	18.2	C	0.5	-	0.4	-
			SB	52.7	F	$	F	63.5	F	$	F	10.8	-	-	-
4	Highland Road (M-59) & Site Drive	Stop (Minor)	EB	N/A				Free				N/A			
			WBL					11.1	B	10.5	B				
			NB					32.0	D	42.0	E				

Note: $ Indicates delays exceeding 1,000 seconds / vehicle.

Results of the future conditions analysis indicate that all approaches and movements at the study intersections are expected to continue operating in a manner similar to the background conditions analysis, with minor increases in delays and no additional impacts to LOS. Additionally, the proposed site driveway is expected to operate acceptably, at LOS D or better, during both peak periods, with the exception of the following:

Highland Road (M-59) & Site Drive

- <u>During the PM peak hour:</u> The northbound approach is expected to operate at LOS E.

Review of SimTraffic network simulations indicates that egress vehicles were unable to find adequate gaps within the through traffic along Highland Road (M-59), resulting in long vehicle queues; these vehicle queues do not dissipate and were typically observed to persist throughout the PM peak hour.

Therefore, the results of the future conditions analysis indicates that the site-generated traffic volumes from the proposed development are expected to have a negligible impact to the delay (LOS) and vehicle queueing observed at the off-site study intersections of Highland Road (M-59) with Fisk Road, JOANN Fabric Drive, and Sunny Beach Boulevard.

8 ACCESS MANAGEMENT

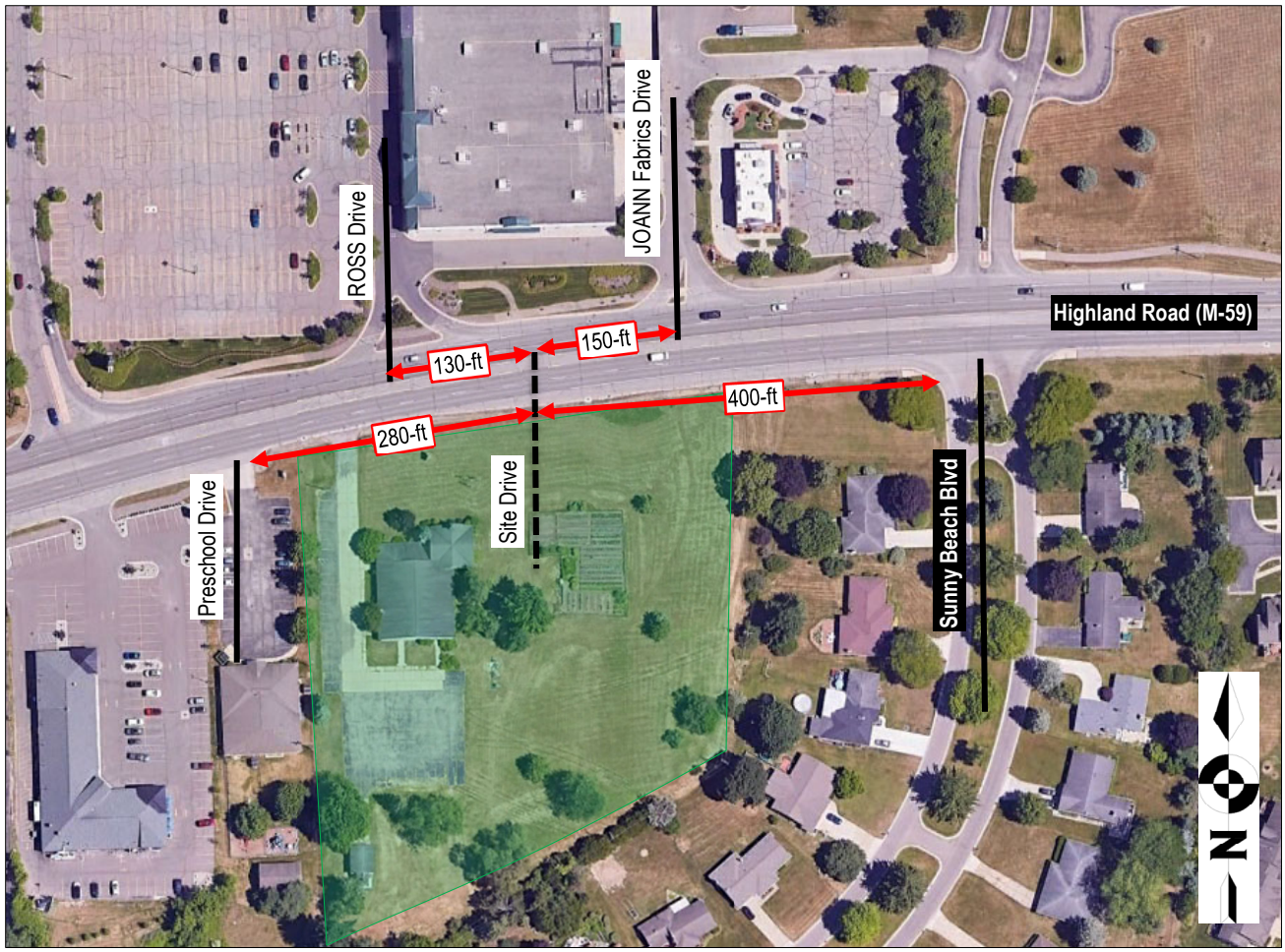
8.1 DRIVEWAY SPACING EVALUATION

The MDOT *Geometric Design Guidance* (Section 1.2.2) criteria were utilized to evaluate the location of the proposed site driveway, in relation to nearby intersections and access points within close proximity to the project site. The intersection corner clearance criteria were evaluated for the 50-mph section of Highland Road (M-59), adjacent to the project site. The distance of the proposed site driveway from nearby intersections and access points, and the warranting criteria are summarized in **Table 6** and displayed in **Exhibit 1**.

Table 6: Desirable Corner Clearance Summary

Adjacent Driveways & Intersections			Distance	Criteria	Meets
Site Drive	to	Preschool Drive	280 feet	455 feet	**NO**
Site Drive	to	Sunny Beach Boulevard	400 feet	170 feet	**YES**
Site Drive	to	JOANN Fabrics Drive	150 feet	750 feet	**NO**
Site Drive	to	ROSS Drive	130 feet	750 feet	**NO**

Exhibit 1: Proposed Driveway Spacing



The results of the driveway spacing analysis indicate that the location of the proposed site driveway on Highland Road (M-59) is not expected to meet the desirable MDOT spacing criteria, in relation to the nearby intersection and driveways. However, there is not sufficient property frontage to meet the recommended spacing criteria. Additionally, the site plan includes proposed future cross access, stubbed at the property line to the west; this would provide improved site access, permitting this cross access between the nearby developments on the south side of Highland Road (M-59), should the adjacent property ever be redeveloped. Furthermore, shared access is not available with the Sunny Beach Boulevard neighborhood to the east.

8.2 Auxiliary Turn Lane Evaluation

The MDOT auxiliary turn lane criteria were evaluated at the proposed site driveway on Highland Road (M-59). Highland Road (M-59) currently provides an existing center two-way left-turn lane (TWLTL); therefore, the left-turn lane criteria was not evaluated at the proposed site driveway. This analysis was based on the future peak hour traffic volumes shown on the attached **Figure 6**. The results of the analysis are shown on the attached chart and are summarized in **Table 7**.

Table 7: Right-turn Treatment Criteria Evaluation Summary

Intersection	Peak Period		Recommendation
	AM Peak Hour	PM Peak Hour	
Highland Road (M-59) at Site Drive	Right-Turn Lane	Right-Turn Lane	**Right-Turn Lane**

The result of the auxiliary turn lane evaluation indicates that a right-turn deceleration lane is warranted along eastbound Highland Road (M-59) at the proposed site driveway.

9 Future Conditions with Improvements Analysis

Mitigation measures were investigated in order to improve the study intersections and mitigate the impact of the proposed development. The mitigation measures that were identified and the impacts to the study intersections are discussed below:

9.1 Highland Road (M-59) & Fisk Road

Signal timing optimizations were reviewed at the study intersection of Highland Road (M-59) & Fisk Road and were determined to adequately improve all approaches and movements to LOS D or better during the PM peak hour. Therefore, the following improvements are recommended:

- Optimize the signal timing splits during the PM peak hour.

9.2 Highland Road (M-59) & Site Drive

The proposed site plan includes shared access to the property to the west of the project site, which would reduce the projected delay for egress traffic; however, the property west would need to be redeveloped to accommodate such a cross access connection. Additionally, providing cross access with the Sunny Beach Boulevard neighborhood to the west would also reduce egress delays; however, this is not feasible. Therefore, the following improvements are recommended:

- Provide exclusive egress left-turn and right-turn lanes at the proposed Site Drive.
- Provide an eastbound right-turn lane along Highland Road (M-59) at the proposed Site Drive.

The results of the future improvements analysis, with the implementation of the recommended mitigation measures, are attached and summarized in **Table 8**.

Table 8: Future Intersection Operations with Improvements

	Intersection	Control	Approach	Future Conditions				Future w/ IMP				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Highland Road (M-59) & Fisk Road	Signal	EBL	14.5	B	60.8	E	No Change		50.8	D	No Change		-10.0	E→D
			EBT	30.2	C	18.6	B			22.6	C			4.0	B→C
			EBR	14.7	B	11.0	B			13.3	B			2.3	-
			WBL	16.8	B	12.0	B			15.7	B			3.7	-
			WBTR	23.9	C	26.6	C			47.3	D			20.7	C→D
			NBL	25.2	C	48.1	D			43.0	D			-5.1	-
			NBTR	22.3	C	38.0	D			34.1	C			-3.9	D→C
			SBL	27.6	C	70.7	E			54.2	D			-16.5	E→D
			SBTR	24.7	C	47.4	D			40.9	D			-6.5	-
			Overall	**27.1**	**C**	**29.9**	**C**			**38.4**	**D**			**8.5**	**C→D**

Intersection		Control	Approach	Future Conditions				Future w/ IMP				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
4	Highland Road (M-59) & Site Drive	Stop (Minor)	EB	Free				Free				N/A			
			WBL	11.1	B	10.5	B	11.1	B	10.5	B	0.0	-	0.0	-
			NBL	32.0	D	42.0	E	30.4	D	46.8	E	-1.6	-	4.8	-
			NBR					12.6	B	13.6	B	-19.4	D→B	-28.4	E→B

The results of the future conditions with improvements analysis indicate that, with the implementation of the recommended improvements, all study intersection approaches and movements are expected to continue to operate acceptably, at LOS D or better during both peak periods, with the following exception:

Highland Road (M-59) & Site Drive

- During the PM peak hour: The northbound left-turn movement is expected to operate at LOS E.

Review of SimTraffic microsimulations indicates improved operations and reduced vehicle queueing at the signalized study intersection of Highland Road (M-59) & Fisk Road and the stop-controlled intersection of Highland Road (M-59) & Site Drive during the PM peak hour.

10 QUEUEING ANALYSIS

The drive-through vehicle queueing was reviewed to determine if the proposed on-site queue lengths provide adequate storage to accommodate the projected operations. The development plan includes two (2) drive-through windows.

The coffee-shop is expected to have a peak trip generation of 111 trips during the AM peak hour. Coffee-shops with drive-through typically have an average service rate of approximately 80 vehicles per hour, with 80% of customers utilizing the drive-through. Therefore, of the total vehicles generated by the proposed coffee-shop during the peak period, it is estimated that approximately 89 vehicles will utilize the drive-through; the remaining vehicles will park and walk-in. The evaluation of the queue length included two criteria:

1. A queueing analysis was performed to determine if the projected demand of the site exceeds the service rate and calculate the projected queueing. The projected demand (89 veh/hr) is greater than the service rate (80 veh/hr) of the site; therefore, there is a potential for vehicles to queue past the pickup window, as the demand exceeds the capacity.
2. A Poisson Distribution was performed to determine the probability of random arrivals. The results indicate a maximum potential of five (5) vehicles arriving at any given time.

The results of the queueing analysis for the coffee shop are summarized in **Table 9**.

Table 9: Coffee Shop Vehicle Queuing Analysis

DRIVE-THROUGH STACKING SPACE CALCULATOR	
Number of Arrivals	86
Time per Vehicle (s)	45
Service Rate (veh/hr)	80
Drive-Through Queue (veh)	9
Peak Arrival (veh)	5
Vehicle Length	25
TOTAL QUEUE (ft)	**350**

The fast-food restaurant is expected to have a peak trip generation of 55 trips during the AM peak hour. Fast-food restaurants with drive-through typically have an average service rate of approximately 90 vehicles per hour and 70% of customers utilizing the drive-through. Therefore, of the total vehicles generated by the proposed fast-food restaurant during the peak period, it is estimated that approximately 39 vehicles will utilize the drive-through; the remaining vehicles will park and walk-in. The evaluation of the queue length included two criteria:

1. A queueing analysis was performed to determine if the projected demand of the site exceeds the service rate and calculate the projected queueing. The projected demand (39 veh/hr) is less than the service rate (90 veh/hr) of the site; therefore, the required queueing for the fast-food restaurant is based on the maximum potential for random arrivals.
2. A Poisson Distribution was performed to determine the probability of random arrivals. The results indicate a maximum potential of four (4) vehicles arriving at any given time.

The results of the queueing analysis for the fast-food restaurant are summarized in **Table 10**.

Table 10: Fast-Food Restaurant Vehicle Queuing Analysis

DRIVE-THROUGH STACKING SPACE CALCULATOR	
Number of Arrivals	39
Time per Vehicle (s)	40
Service Rate (veh/hr)	90
Peak Arrival (veh)	4
Vehicle Length	25
TOTAL QUEUE (ft)	**100**

The results of the projected vehicle queuing analysis indicates that the maximum anticipated arrivals generated by the proposed coffee-shop with drive-through can be adequately accommodated within the available queue length, without impacting internal site circulation or the operations along Highland Road (M-59).

11 CONCLUSIONS

The conclusions of this TIS are as follows:

1. Existing Conditions (2023)

- The results of the existing conditions analysis indicates that all approaches and movements at the study intersections are currently operating acceptably, at LOS D or better, during both the AM and PM peak hours, with the following exceptions:
  - Highland Road (M-59) & Fisk Road: The SB left-turn movement is currently operating at LOS E, during the PM peak hour. Review of SimTraffic network simulations indicates generally acceptable operations. Occasional periods of vehicle queues were observed; however, the majority were observed to be processed within each cycle length, leaving minimal residual vehicle queueing.
  - Highland Road (M-59) & JOANN Fabric Drive: The SB approach is currently operating at LOS E during the PM peak hour. This approach was designed to prohibit egress left-turns; however, this traffic is causing the reported delay. The total volume of southbound egress traffic is very low (3 vehicles), which includes two (2) vehicles making an egress left-turn movement.
  - Highland Road (M-59) & Sunny Beach Boulevard: The NB left-turn movement and the SB approach are both currently operating at LOS F during both peak hours. Review of SimTraffic network simulations indicates generally acceptable operations during the AM peak hour. Occasional periods of vehicle queues were observed along the minor-street approaches; however, these queues were able to find adequate gaps in the through traffic along Highland Road (M-59).

    Review of SimTraffic microsimulations during the PM peak hour indicates that vehicles along Sunny Beach Boulevard experience difficulty in finding gaps within the through traffic along Highland Road (M-59), resulting in long vehicle queues along the minor street; these vehicle queues do not dissipate and were typically observed to persist throughout the PM peak hour.

2. Background Conditions (2025 No Build)

- A conservative annual background growth rate of **0.5%** per year was utilized to project the existing peak hour traffic volumes to the buildout year of 2025.
- The results of the background conditions analysis indicates that the study intersections are expected to continue operating in a manner similar to the existing conditions analysis, with minor increases in delays due increases in background traffic volumes and the following additional impacts to LOS:
  - Highland Road (M-59) & Fisk Road: The EB left-turn movement is expected to operate at LOS E, during the PM peak hour.

3. Future Conditions (2025 Build)

- With the addition of the site-generated trips, the study intersections are expected to continue operating in a manner similar to the background conditions analysis, with no additional impacts to LOS.
- All approaches and movements at the proposed site driveway intersection with Highland Road (M-59) are expected to operate acceptably, at LOS D or better, during both the AM and PM peak hours, with the following exception:
  - Highland Road (M-59) & Site Drive: The NB approach is expected to operate at LOS E during the PM peak hour. Review of SimTraffic network simulations indicates that egress vehicles were unable to find adequate gaps within the through traffic along Highland Road (M-59), resulting in long vehicle queues; these vehicle queues do not dissipate and were typically observed to persist throughout the PM peak hour.
- Therefore, the results of the future conditions analysis indicates that the site-generated traffic volumes from the proposed development are expected to have a negligible impact to the delay (LOS) and vehicle queueing observed at the off-site study intersections of Highland Road (M-59) with Fisk Road, JOANN Fabric Drive, and Sunny Beach Boulevard.

4. Access Management

- The results of the driveway spacing analysis indicates that the location of the proposed site driveway on Highland Road (M-59) is not expected to meet the desirable MDOT spacing criteria, in relation to the nearby intersection and driveway.
  - However, there is not sufficient property frontage to meet the recommended spacing criteria. Additionally, the site plan includes proposed future cross access, stubbed at the property line to the west; this would provide improved site access, permitting this cross access between the nearby developments on the south side of Highland Road (M-59), should the adjacent property ever be redeveloped. Furthermore, shared access is not available with the Sunny Beach Boulevard neighborhood to the east.
- The MDOT auxiliary right-turn treatment criteria were evaluated at the proposed site driveway; the result of the analysis indicates that a right-turn lane is recommended along eastbound Highland Road (M-59) at the proposed Site Drive.

5. Future Conditions with Improvements

- Signal timing optimizations were reviewed and were determined to adequately improve the signalized study intersection of Highland Road (M-59) & Fisk Road to LOS D or better during the PM peak hour. Additionally, the vehicle queues at the signalized study intersection were observed to be reduced, with the implementation of the recommended mitigation measures.
- Mitigation measures were investigated at the intersection of Highland Road (M-59) & Site Drive. The results of the improvements evaluation indicates that providing exclusive egress left-turn and right-turn lanes would improve the projected operations Additionally, the warranted eastbound right-turn lane along Highland Road (M-59) was included in the improvements analysis. The results indicate that the northbound left-turn movement is still expected to operate at LOS E during the PM peak hour; however, review of SimTraffic network simulations indicates improved operations.

6. Drive-Through Queueing Evaluation

- The results of the drive-through queueing evaluation indicates that the proposed site plan can adequately accommodate the projected vehicle queueing associated with the proposed coffee-shop and fast-food restaurants, without impacting internal site circulation or the operations along Highland Road (M-59).

12 RECOMMENDATIONS

The recommendation of this TIS are as follows:

- Provide exclusive egress left-turn and right-turn lanes at the proposed Site Drive.
- Provide an eastbound right-turn lane along Highland Road (M-59) at the proposed Site Drive.
- Optimize the PM peak hour signal timing at the Highland Road (M-59) & Fisk Road intersection.

Any questions related to this memorandum, study, analysis, and results should be addressed to Fleis & VandenBrink.

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Michigan.

Attachments: Figures 1 – 6
Proposed Site Plan
Traffic Volume Data
Signal Timing Permits
Synchro / SimTraffic Results
Auxiliary Lane Warrants

FIGURE 1

SITE LOCATION

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

SITE SITE LOCATION

NORTH

SCALE: NOT TO SCALE

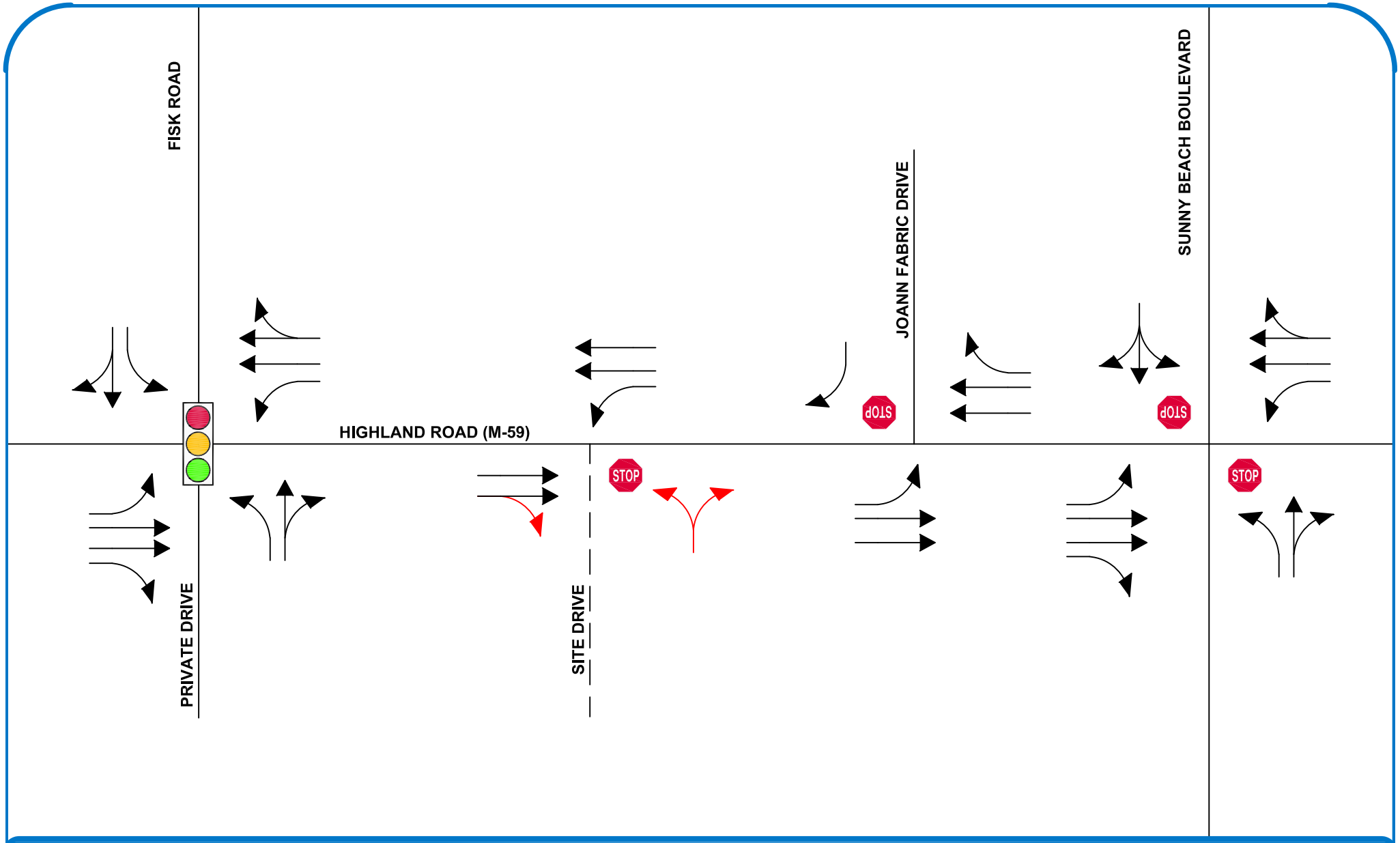


FIGURE 2

LANE USE AND TRAFFIC CONTROL

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

- ROADS
- PROPOSED ROADS
- LANE USE
- PROPOSED LANE USE
- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION

NORTH

SCALE: NOT TO SCALE

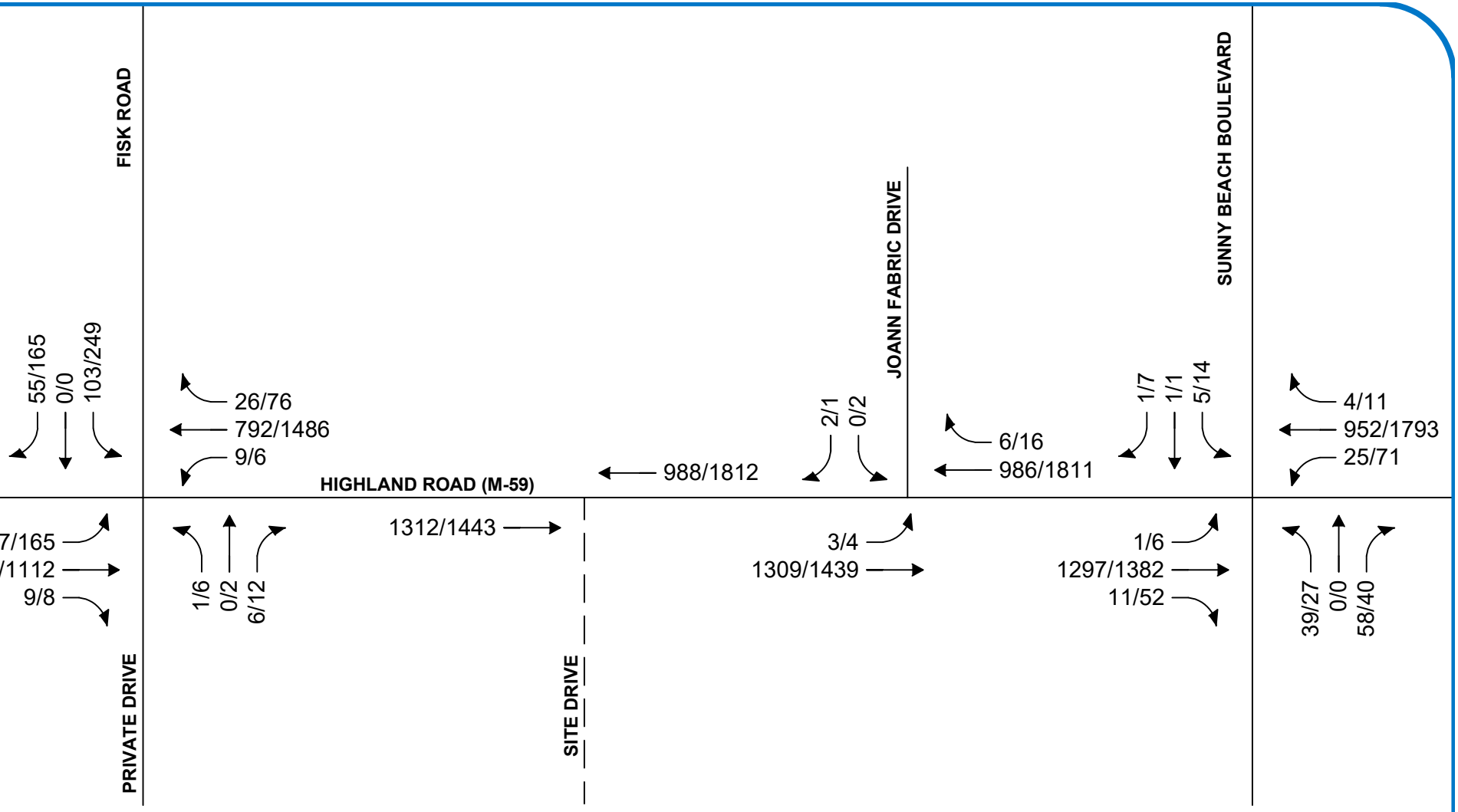


FIGURE 3

EXISTING TRAFFIC VOLUMES

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

ROADS

PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

NORTH

SCALE: NOT TO SCALE

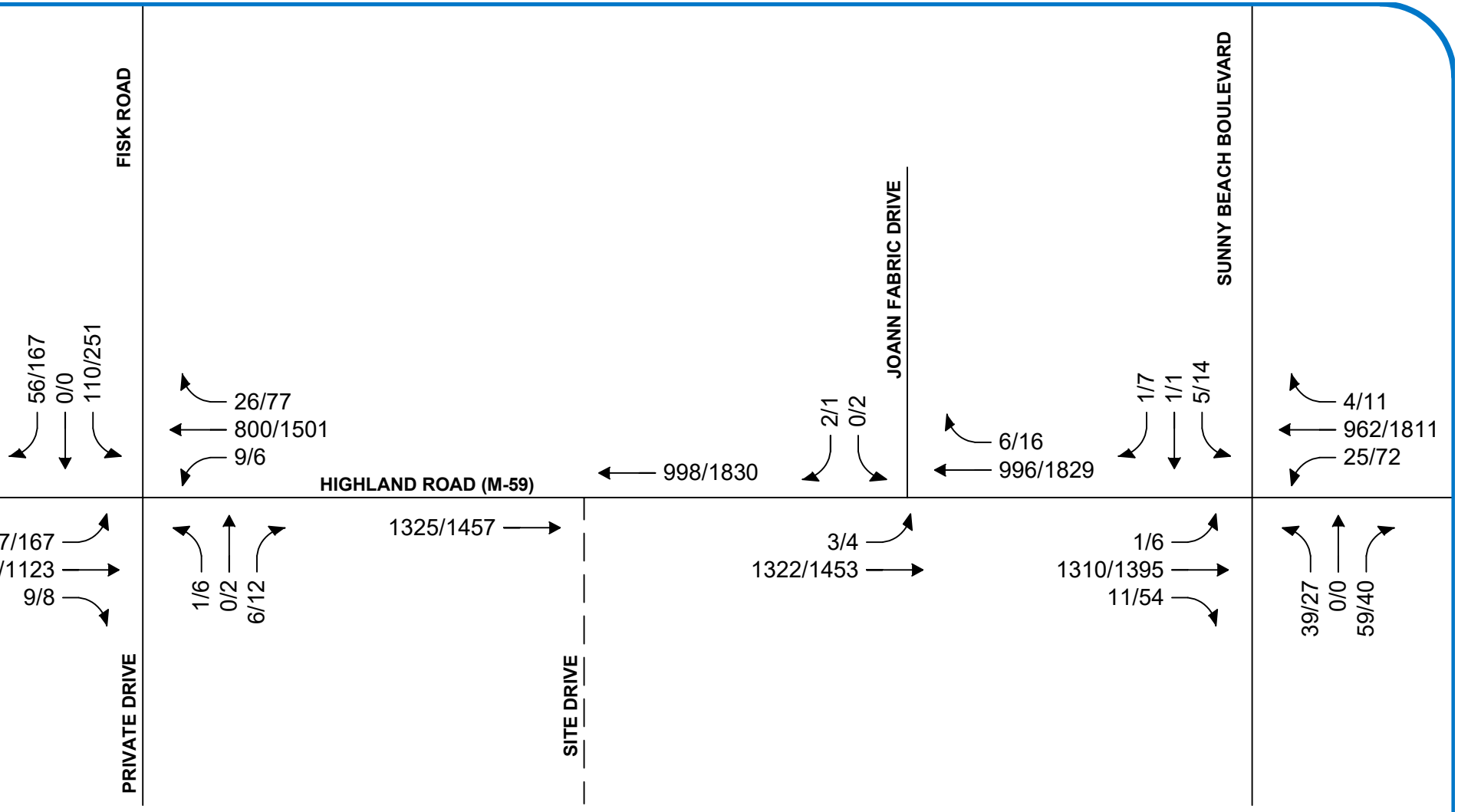


FIGURE 4

BACKGROUND TRAFFIC VOLUMES

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

ROADS

PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

NORTH

SCALE: NOT TO SCALE

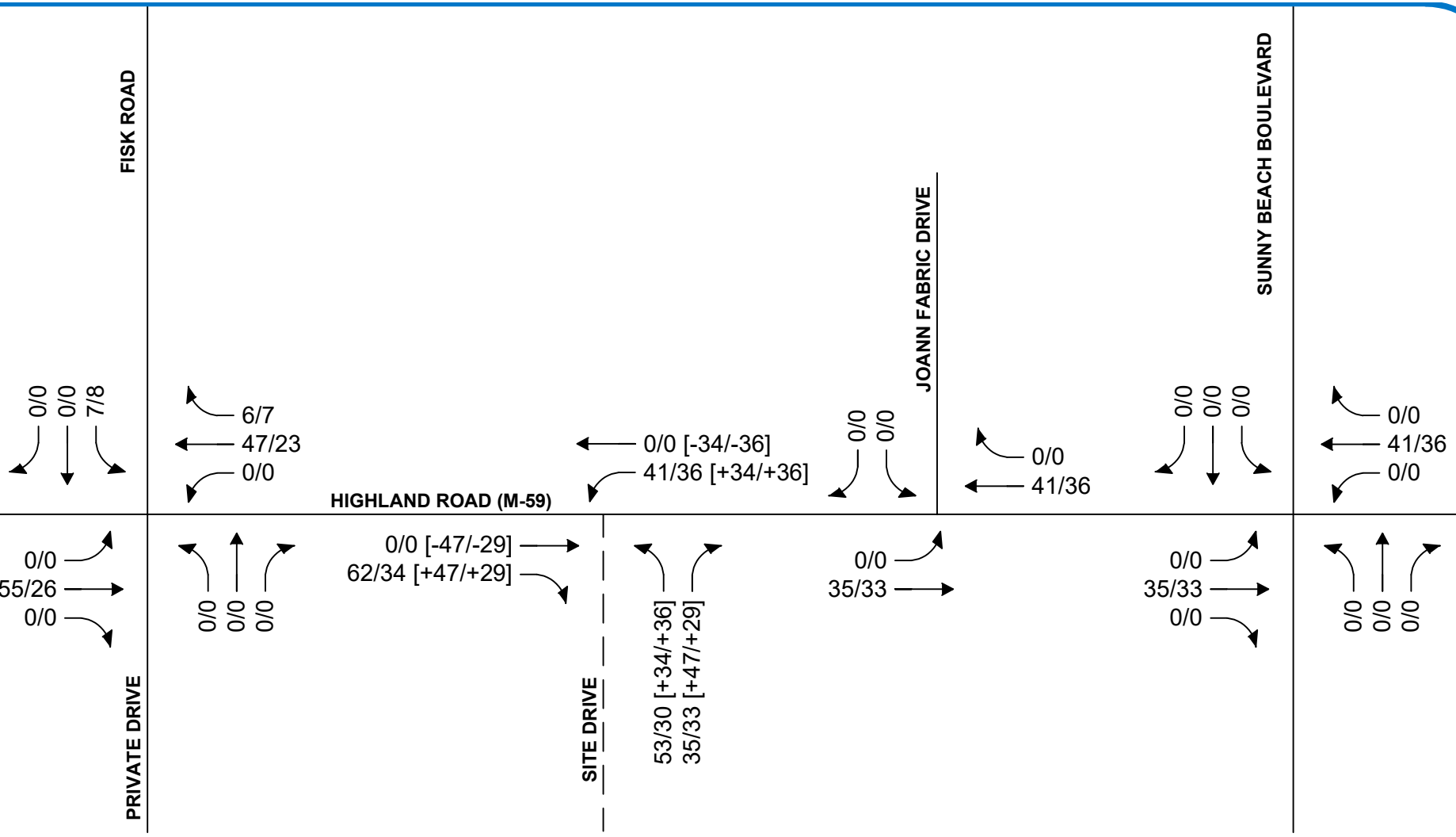


FIGURE 5
SITE-GENERATED TRAFFIC VOLUMES

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

ROADS

PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

+/-[000/000] PASS-BY [AM/PM]

NORTH

SCALE: NOT TO SCALE

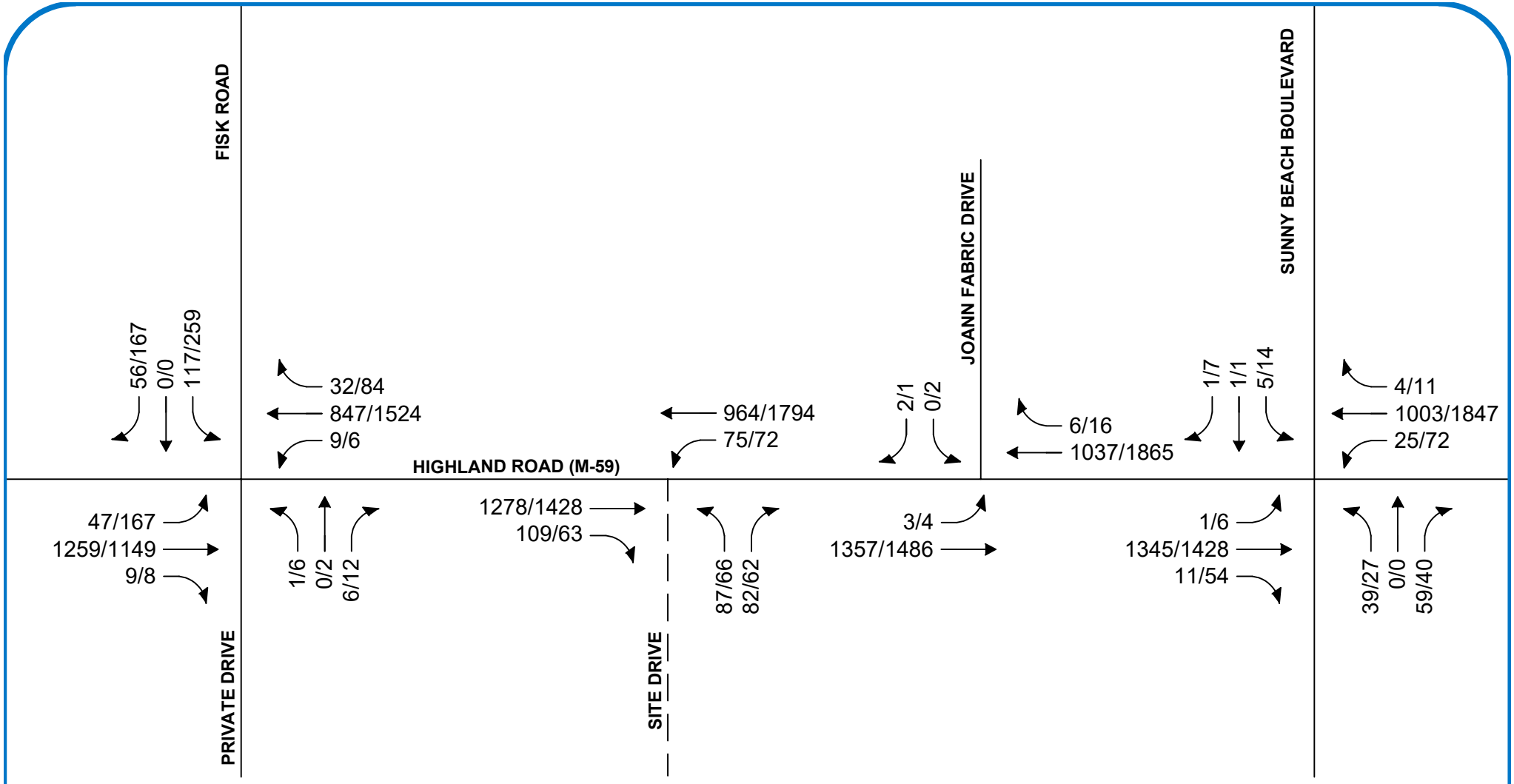


FIGURE 6

FUTURE TRAFFIC VOLUMES

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

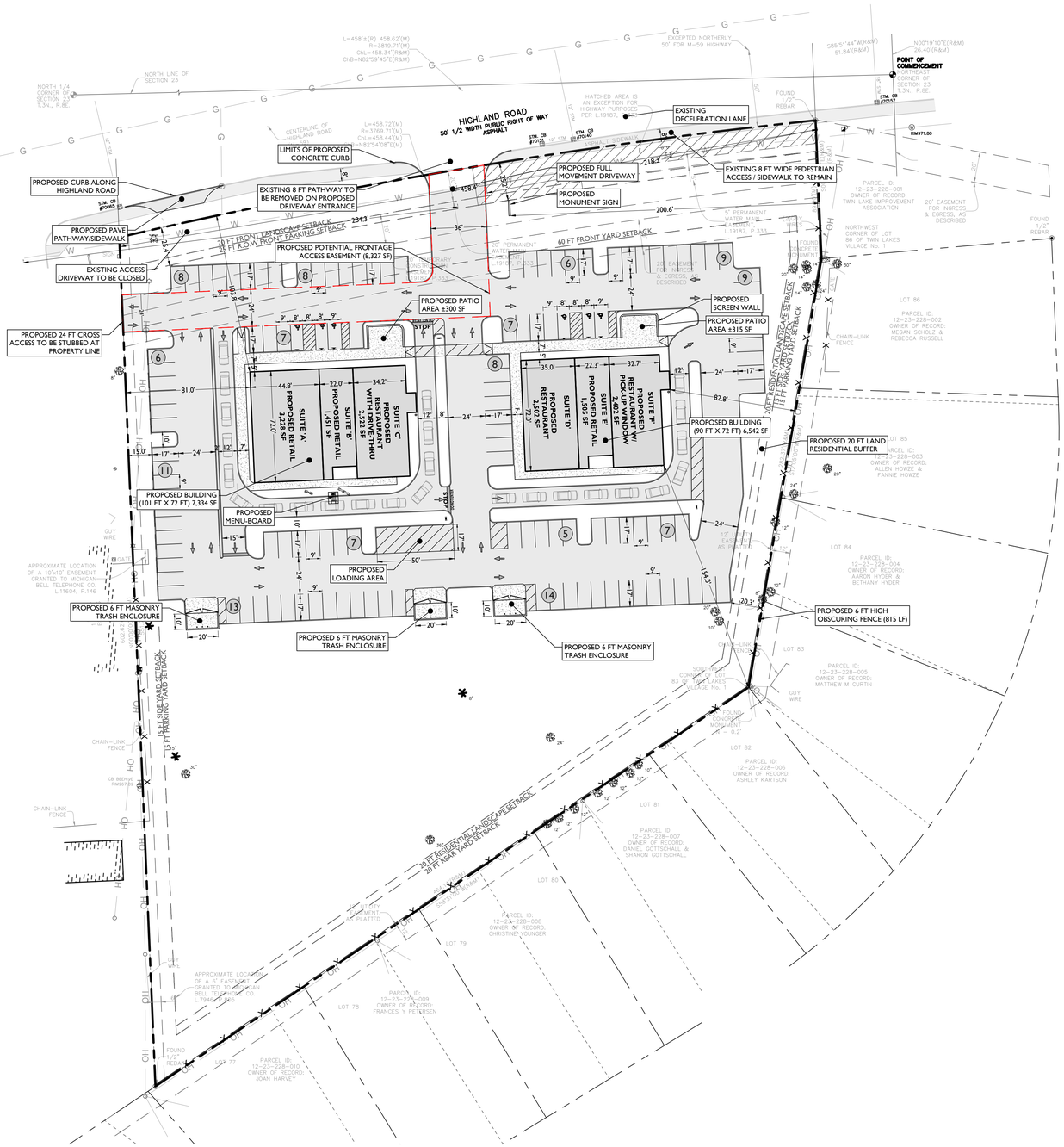
ROADS

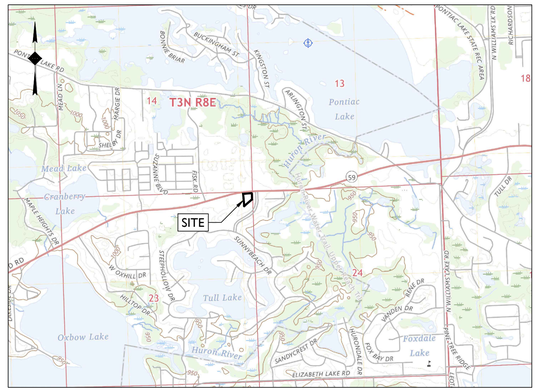
PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

NORTH

SCALE: NOT TO SCALE





SOURCE: USGS MAPPING SYSTEM

LOCATION MAP

SCALE: 1" = 2,000'±

SYMBOL	DESCRIPTION
	PROPERTY LINE
	SETBACK LINE
	PROPOSED CURB
	PROPOSED SIGNS / BOLLARDS
	PROPOSED BUILDING
	PROPOSED CONCRETE
	PROPOSED RETAINING WALL
x x	PROPOSED OBSCURING FENCE

LAND USE AND ZONING

PID:12-23-227-003		
EXISTING ZONE: R1-C SINGLE FAMILY RESIDENTIAL		
REZONED TO GENERAL BUSINESS DISTRICT (GB)		
PROPOSED USE		
RESTAURANT OR FAST FOOD	PERMITTED USE	
DRIVE-THRU WINDOW	SPECIAL LAND USE	
RETAIL STORE	PERMITTED USE	
ZONING REQUIREMENT	**REQUIRED**	**PROPOSED**
MINIMUM LOT AREA	1 AC	195,568 SF (4.5 AC)
MINIMUM LOT WIDTH	200 FT	458.4 FT
MAXIMUM BUILDING HEIGHT	35 FT (2 STORIES)	<35 FT (1 STORY)
MINIMUM FRONT YARD SETBACK	60 FT(1)	103.8 FT
MINIMUM SIDE YARD SETBACK (ONE)	15 FT	81.0 FT
MINIMUM SIDE YARD SETBACK (BOTH)	20 FT	163.8 FT
MINIMUM REAR YARD SETBACK	20 FT	154.3 FT
MINIMUM DRIVEWAY FROM RESIDENTIAL	200 FT (1)	218.3 FT
MINIMUM FRONT LANDSCAPE SETBACK	20 FT	25.4 FT
MINIMUM R.O.W PARKING SETBACK	25 FT(2)	25.4 FT
INTERIOR LANDSCAPING AREA	15% (29,335 SF)	>15%
MINIMUM DRIVEWAY SPACING (HIGHLAND ROAD)	455 FT	±284.3 FT TO WEST (V)
TRASH ENCLOSURE SETBACK	FRONT LOT LINE(3)	REAR YARD
MINIMUM SIDE PARKING SETBACK	15 FT	15.0 FT

(V) VARIANCE

(1) REQUIREMENT FOR RESTAURANT WITH DRIVE-THRU

(2) NO PARKING STALL SHALL BE LOCATED ADJACENT TO R.O.W LINE , STREET EASEMENT OR SIDEWALK WHICHEVER IS CLOSER

(3) NO ENCLOSURES SHALL BE PERMITTED CLOSER TO THE FRONT LOT LINE THAN THE PRINCIPAL BUILDING

OFF-STREET PARKING REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
§ 5.11.M	FAST FOOD PARKING: 1 SPACE PER 75 OF GFA (2,522 SF +2,402 SF) =4,924 SF (4,924 SF)(1 SPACES/ 75 SF)= 66 SPACES RESTAURANT PARKING: 1 SPACE PER 100 SF OF GFA (2,502 SF)(1 SPACE/100 SF)= 25 SPACES RETAIL PARKING: 1 SPACE PER 200 SF OF GFA (3,228 SF + 1,451 SF + 1,505 SF)=6,184 SF (6,184 SF)(1 SPACE/200 SF)= 31 SPACES **TOTAL: 66 + 25 + 31= 122 SPACES**	**125 SPACES**
§ 5.11.M	STACKING SPACES (WEST FAST FOOD): 8 STACKING CARS (9 FT X 18 FT)	15 SPACES (12 FT X 20 FT)
§ 5.11.M	STACKING SPACES (EAST FAST FOOD): 8 STACKING CARS (9 FT X 18 FT)	10 SPACES (12 FT X 20 FT)
§ 5.11.Q	90° PARKING: 9 FT X 18 FT WITH 24 FT AISLE (1)	9 FT X 17 FT W/ 24 FT AISLE
§ 5.19	LANDSCAPE REQUIREMENT: 20 FT WIDTH ALONG RESIDENTIAL 3 FT HIGH BERM WITH A 2 FT CROWN	PROVIDED
§ 5.11.P.I	LOADING AREA: 10 FT X 50 FT WITH 15 FT CLEARANCE	17 FT X 50 FT

(1) PARKING SPACE LENGTH MAY BE REDUCED TO 17 FT WHERE 7 FT SIDEWALK OR LANDSCAPE IS PROVIDED

SIGNAGE REQUIREMENTS

CODE SECTION	REQUIRED	PROPOSED
§5.9.J.I.B	MULTI-TENANT SIGN HEIGHT: 15 FT(2)(3)	<15 FT
§5.9.J.I	SIGN AREA: 6 SF PER 1 FT OF SETBACK	<150 SF
§5.9.J.I	MAXIMUM SIGN AREA: 150 SF(1)	<150 SF
§5.9.J.I.A	SIGN SETBACK: 10 FT	25.2 FT
§5.9.J.I.A	RESIDENTIAL SETBACK: 100 FT	200.6 FT

(1) MAXIMUM SIGN AREA SHALL NOT INCLUDE DECORATIVE ELEMENTS SUCH AS BASES, COLUMNS OR CAPS

(2) MINIMUM HEIGHT OF A SIGN BASE SHALL NE 2 FT IN HEIGHT

(3) EACH INDIVIDUAL TENANT SIGN SHALL NOT EXCEED 4 FT IN HEIGHT

GENERAL NOTES

1. THE CONTRACTOR SHALL VERIFY AND FAMILIARIZE THEMSELVES WITH THE EXISTING SITE CONDITIONS AND THE PROPOSED SCOPE OF WORK (INCLUDING DIMENSIONS, LAYOUT, ETC.) PRIOR TO INITIATING THE IMPROVEMENTS IDENTIFIED WITHIN THESE DOCUMENTS. SHOULD ANY DISCREPANCY BE FOUND BETWEEN THE EXISTING SITE CONDITIONS AND THE PROPOSED WORK THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC. PRIOR TO THE START OF CONSTRUCTION.
2. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS AND ENSURE THAT ALL REQUIRED APPROVALS HAVE BEEN OBTAINED PRIOR TO THE START OF CONSTRUCTION. COPIES OF ALL REQUIRED PERMITS AND APPROVALS SHALL BE KEPT ON SITE AT ALL TIMES DURING CONSTRUCTION.
3. ALL CONTRACTORS WILL, TO THE FULLEST EXTENT PERMITTED BY LAW, INDEMNIFY AND HOLD HARMLESS STONEFIELD ENGINEERING & DESIGN, LLC. AND IT'S SUB-CONSULTANTS FROM AND AGAINST ANY DAMAGES AND LIABILITIES INCLUDING ATTORNEY'S FEES ARISING OUT OF CLAIMS BY EMPLOYEES OF THE CONTRACTOR IN ADDITION TO CLAIMS CONNECTED TO THE PROJECT AS A RESULT OF NOT CARRYING THE PROPER INSURANCE FOR WORKERS COMPENSATION, LIABILITY INSURANCE, AND LIMITS OF COMMERCIAL GENERAL LIABILITY INSURANCE.
4. THE CONTRACTOR SHALL NOT DEVIATE FROM THE PROPOSED IMPROVEMENTS IDENTIFIED WITHIN THIS PLAN SET UNLESS APPROVAL IS PROVIDED IN WRITING BY STONEFIELD ENGINEERING & DESIGN, LLC.
5. THE CONTRACTOR IS RESPONSIBLE TO DETERMINE THE MEANS AND METHODS OF CONSTRUCTION.
6. THE CONTRACTOR SHALL NOT PERFORM ANY WORK OR CAUSE DISTURBANCE ON A PRIVATE PROPERTY NOT CONTROLLED BY THE PERSON OR ENTITY WHO HAS AUTHORIZED THE WORK WITHOUT PRIOR WRITTEN CONSENT FROM THE OWNER OF THE PRIVATE PROPERTY.
7. THE CONTRACTOR IS RESPONSIBLE TO RESTORE ANY DAMAGED OR UNDERMINED STRUCTURE OR SITE FEATURE THAT IS IDENTIFIED TO REMAIN ON THE PLAN SET. ALL REPAIRS SHALL USE NEW MATERIALS TO RESTORE THE FEATURE TO ITS EXISTING CONDITION AT THE CONTRACTORS EXPENSE.
8. CONTRACTOR IS RESPONSIBLE TO PROVIDE THE APPROPRIATE SHOP DRAWINGS, PRODUCT DATA, AND OTHER REQUIRED SUBMITTALS FOR REVIEW. STONEFIELD ENGINEERING & DESIGN, LLC. WILL REVIEW THE SUBMITTALS IN ACCORDANCE WITH THE DESIGN INTENT AS REFLECTED WITHIN THE PLAN SET.
9. THE CONTRACTOR IS RESPONSIBLE FOR TRAFFIC CONTROL IN ACCORDANCE WITH MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION.
10. THE CONTRACTOR IS REQUIRED TO PERFORM ALL WORK IN THE PUBLIC RIGHT-OF-WAY IN ACCORDANCE WITH THE APPROPRIATE GOVERNING AUTHORITY AND SHALL BE RESPONSIBLE FOR THE PROCUREMENT OF STREET OPENING PERMITS.
11. THE CONTRACTOR IS REQUIRED TO RETAIN AN OSHA CERTIFIED SAFETY INSPECTOR TO BE PRESENT ON SITE AT ALL TIMES DURING CONSTRUCTION & DEMOLITION ACTIVITIES.
12. SHOULD AN EMPLOYEE OF STONEFIELD ENGINEERING & DESIGN, LLC. BE PRESENT ON SITE AT ANY TIME DURING CONSTRUCTION, IT DOES NOT RELIEVE THE CONTRACTOR OF ANY OF THE RESPONSIBILITIES AND REQUIREMENTS LISTED IN THE NOTES WITHIN THIS PLAN SET.

40' 0' 40' 80'

GRAPHIC SCALE IN FEET

1" = 40'

ISSUE	DATE	BY	DESCRIPTION
1	11/29/2023	JRC/JP	SUBMISSION FOR REZONING

NOT APPROVED FOR CONSTRUCTION

STONEFIELD engineering & design
Detroit, MI · Rutherford, NJ · New York, NY
Boston, MA · Princeton, NJ · Tampa, FL
www.stonefieldeng.com
607 Shelby Suite 200, Detroit, MI 48226
Phone 248.247.1115

SITE DEVELOPMENT PLANS

9101 HIGHLAND ROAD

PROPOSED MULTI-TENANT BUILDING

PARCEL ID:12-23-227-003
9101 HIGHLAND ROAD
WHITE LAKE TOWNSHIP
OAKLAND COUNTY, MICHIGAN

J. REID COOKSEY, P.E.
MICHIGAN LICENSE No. 6201069428
LICENSED PROFESSIONAL ENGINEER

STONEFIELD engineering & design

SCALE: 1" = 40' | PROJECT ID: DET-230229

TITLE: SITE PLAN

DRAWING: C-3

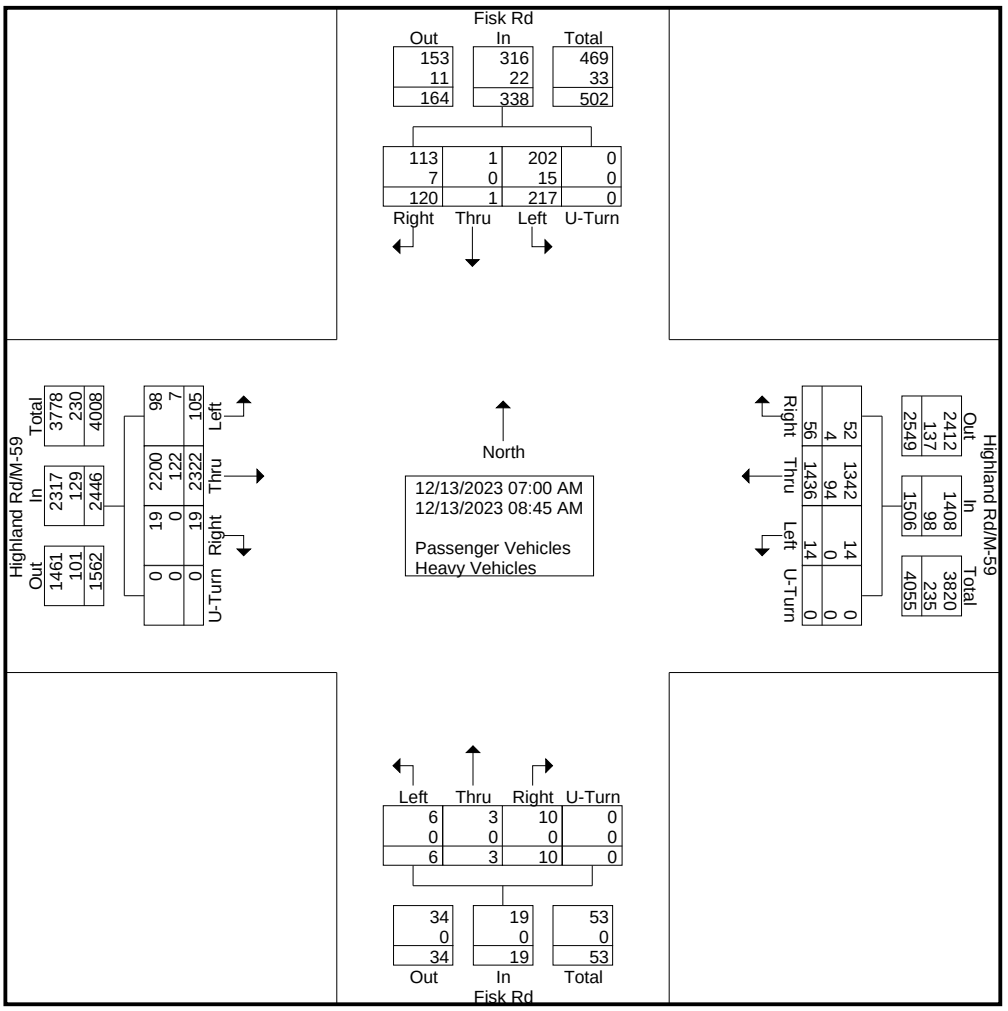
V:\DET\2023\DET-230229-AFFINITY 10 INVESTMENT PPI\ 9101 HIGHLAND ROAD, WHITE LAKE, MI\CAD\PLOT\DP-03 SITE.DWG

TRUE DATA TO IMPROVE MOBILITY

File Name : 16432201 - Fisk Rd -- Highland Rd_M-59
Site Code : 16432201
Start Date : 12/13/2023
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

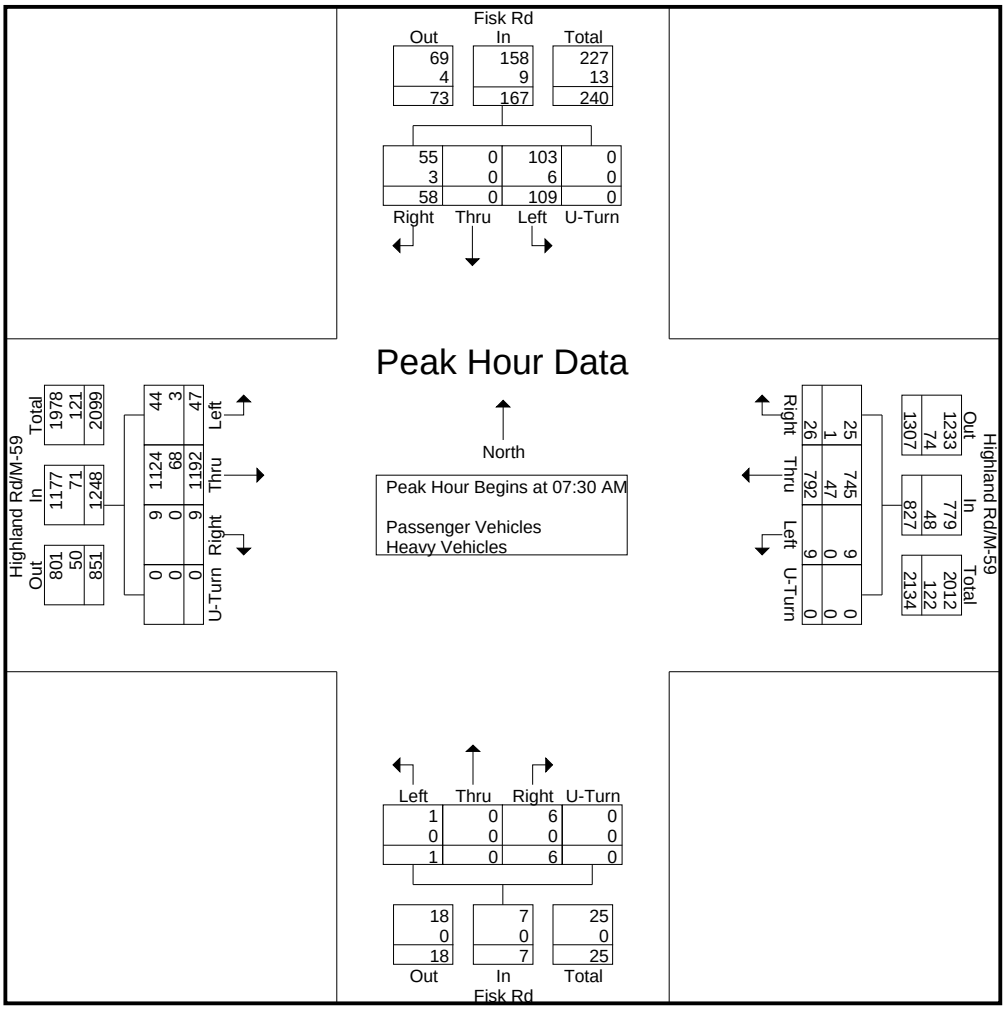
	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Fisk Rd Northbound					Fisk Rd Southbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
07:00 AM	9	298	2	0	309	0	126	6	0	132	0	0	0	0	0	27	0	8	0	35	476
07:15 AM	12	314	2	0	328	0	151	2	0	153	0	0	2	0	2	25	0	15	0	40	523
07:30 AM	12	300	2	0	314	1	193	2	0	196	0	0	1	0	1	25	0	11	0	36	547
07:45 AM	12	319	3	0	334	2	195	6	0	203	0	0	1	0	1	29	0	13	0	42	580
Total	45	1231	9	0	1285	3	665	16	0	684	0	0	4	0	4	106	0	47	0	153	2126
08:00 AM	9	293	2	0	304	5	219	11	0	235	1	0	2	0	3	23	0	17	0	40	582
08:15 AM	14	280	2	0	296	1	185	7	0	193	0	0	2	0	2	32	0	17	0	49	540
08:30 AM	20	264	3	0	287	2	177	11	0	190	4	1	0	0	5	23	0	16	0	39	521
08:45 AM	17	254	3	0	274	3	190	11	0	204	1	2	2	0	5	33	1	23	0	57	540
Total	60	1091	10	0	1161	11	771	40	0	822	6	3	6	0	15	111	1	73	0	185	2183
Grand Total	105	2322	19	0	2446	14	1436	56	0	1506	6	3	10	0	19	217	1	120	0	338	4309
Apprch %	4.3	94.9	0.8	0		0.9	95.4	3.7	0		31.6	15.8	52.6	0		64.2	0.3	35.5	0		
Total %	2.4	53.9	0.4	0	56.8	0.3	33.3	1.3	0	35	0.1	0.1	0.2	0	0.4	5	0	2.8	0	7.8	
Passenger Vehicles	98	2200	19	0	2317	14	1342	52	0	1408	6	3	10	0	19	202	1	113	0	316	4060
% Passenger Vehicles	93.3	94.7	100	0	94.7	100	93.5	92.9	0	93.5	100	100	100	0	100	93.1	100	94.2	0	93.5	94.2
Heavy Vehicles	7	122	0	0	129	0	94	4	0	98	0	0	0	0	0	15	0	7	0	22	249
% Heavy Vehicles	6.7	5.3	0	0	5.3	0	6.5	7.1	0	6.5	0	0	0	0	0	6.9	0	5.8	0	6.5	5.8



TRUE DATA TO IMPROVE MOBILITY

File Name : 16432201 - Fisk Rd -- Highland Rd_M-59
Site Code : 16432201
Start Date : 12/13/2023
Page No : 2

	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Fisk Rd Northbound					Fisk Rd Southbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	12	300	2	0	314	1	193	2	0	196	0	0	1	0	1	25	0	11	0	36	547
07:45 AM	12	**319**	**3**	0	**334**	2	195	6	0	203	0	0	1	0	1	29	0	13	0	42	580
08:00 AM	9	293	2	0	304	**5**	**219**	**11**	0	**235**	**1**	0	**2**	0	**3**	23	0	**17**	0	40	**582**
08:15 AM	**14**	280	2	0	296	1	185	7	0	193	0	0	2	0	2	**32**	0	17	0	**49**	540
Total Volume	47	1192	9	0	1248	9	792	26	0	827	1	0	6	0	7	109	0	58	0	167	2249
% App. Total	3.8	95.5	0.7	0		1.1	95.8	3.1	0		14.3	0	85.7	0		65.3	0	34.7	0		
PHF	.839	.934	.750	.000	.934	.450	.904	.591	.000	.880	.250	.000	.750	.000	.583	.852	.000	.853	.000	.852	.966
Passenger Vehicles	44	1124	9	0	1177	9	745	25	0	779	1	0	6	0	7	103	0	55	0	158	2121
% Passenger Vehicles	93.6	94.3	100	0	94.3	100	94.1	96.2	0	94.2	100	0	100	0	100	94.5	0	94.8	0	94.6	94.3
Heavy Vehicles	3	68	0	0	71	0	47	1	0	48	0	0	0	0	0	6	0	3	0	9	128
% Heavy Vehicles	6.4	5.7	0	0	5.7	0	5.9	3.8	0	5.8	0	0	0	0	0	5.5	0	5.2	0	5.4	5.7

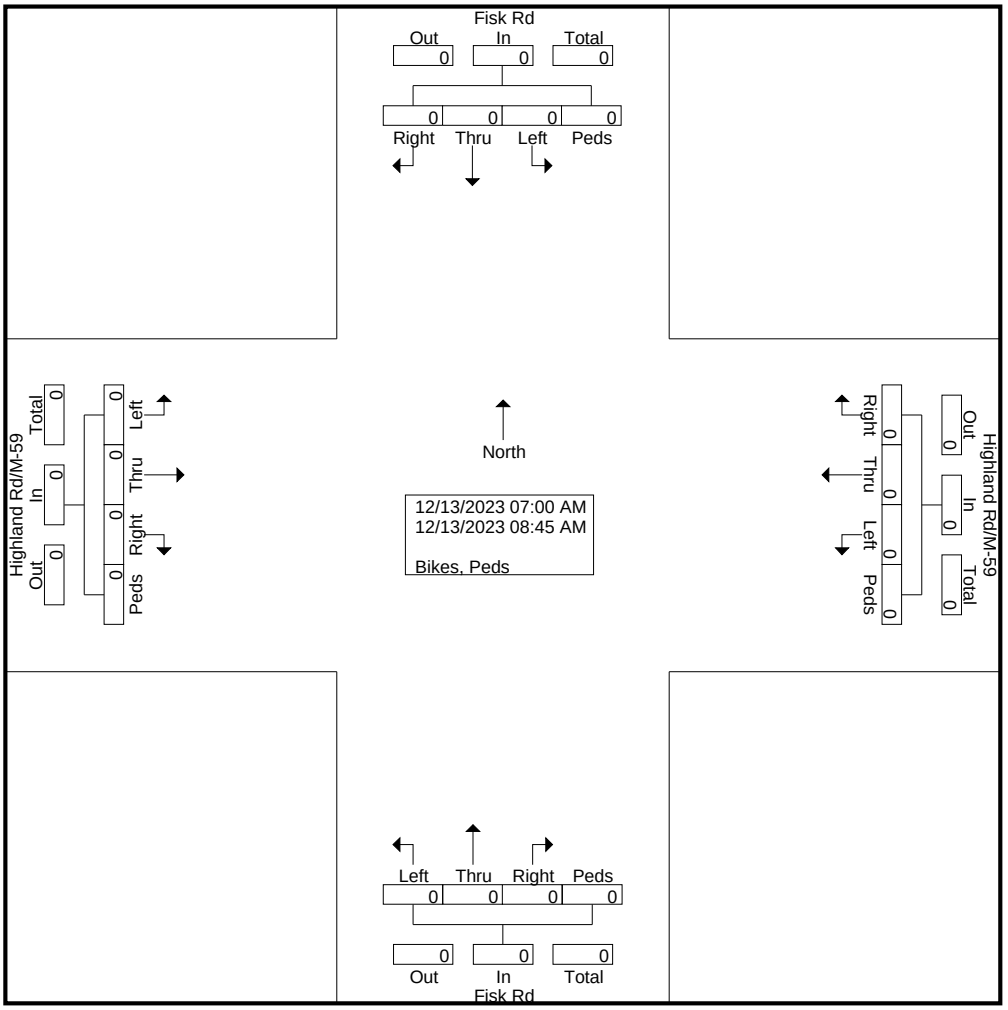


TRUE DATA TO IMPROVE MOBILITY

File Name : 16432201 - Fisk Rd -- Highland Rd_M-59
Site Code : 16432201
Start Date : 12/13/2023
Page No : 1

Groups Printed- Bikes, Peds

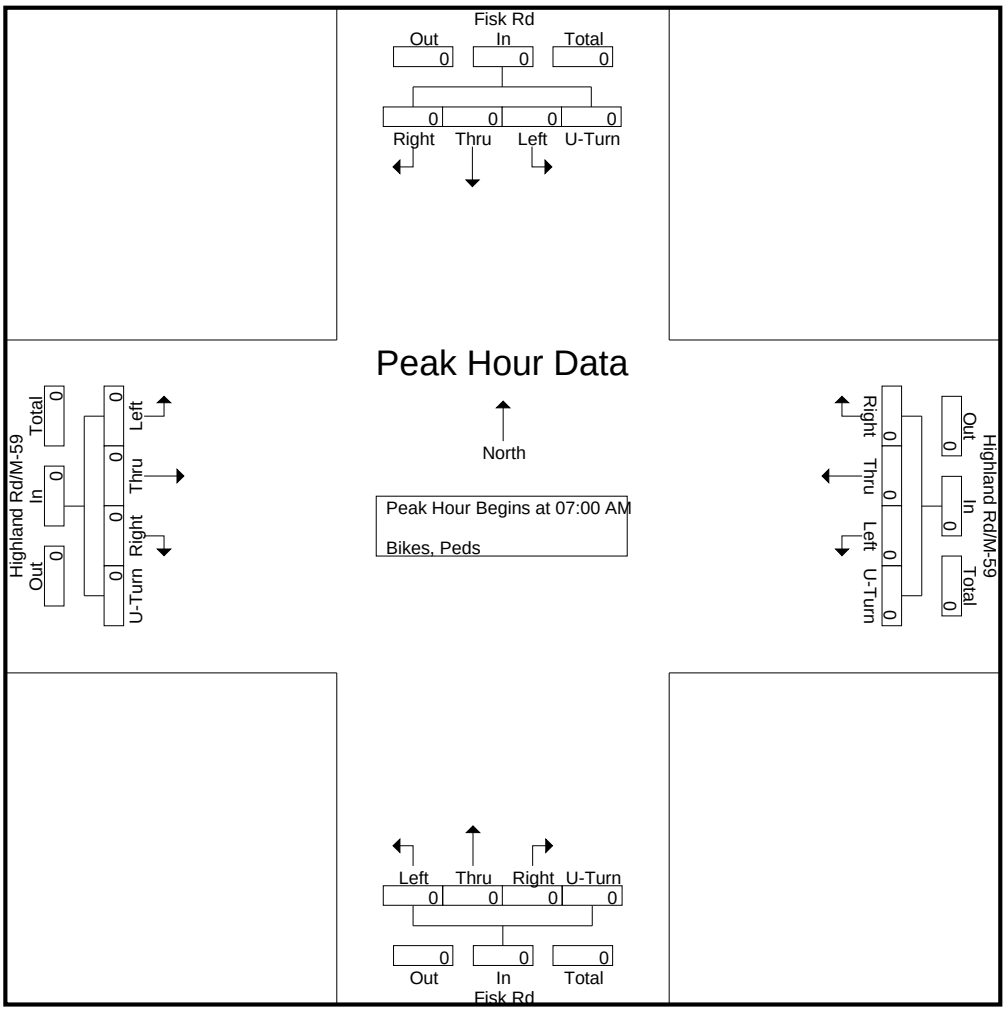
	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Fisk Rd Northbound					Fisk Rd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					



TRUE DATA TO IMPROVE MOBILITY

File Name : 16432201 - Fisk Rd -- Highland Rd_M-59
Site Code : 16432201
Start Date : 12/13/2023
Page No : 2

	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Fisk Rd Northbound					Fisk Rd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

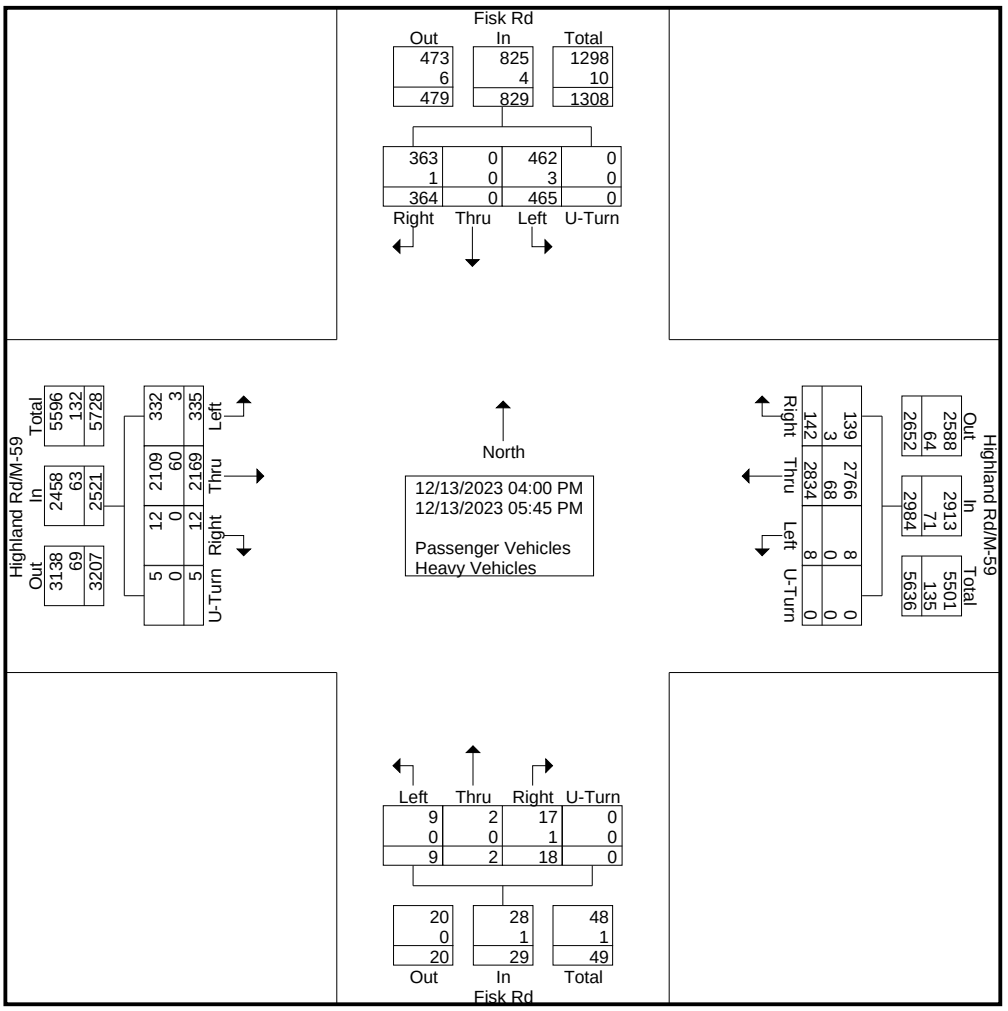


TRUE DATA TO IMPROVE MOBILITY

File Name : 16432202 - Fisk Rd -- Highland Rd_M-59
Site Code : 16432202
Start Date : 12/13/2023
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

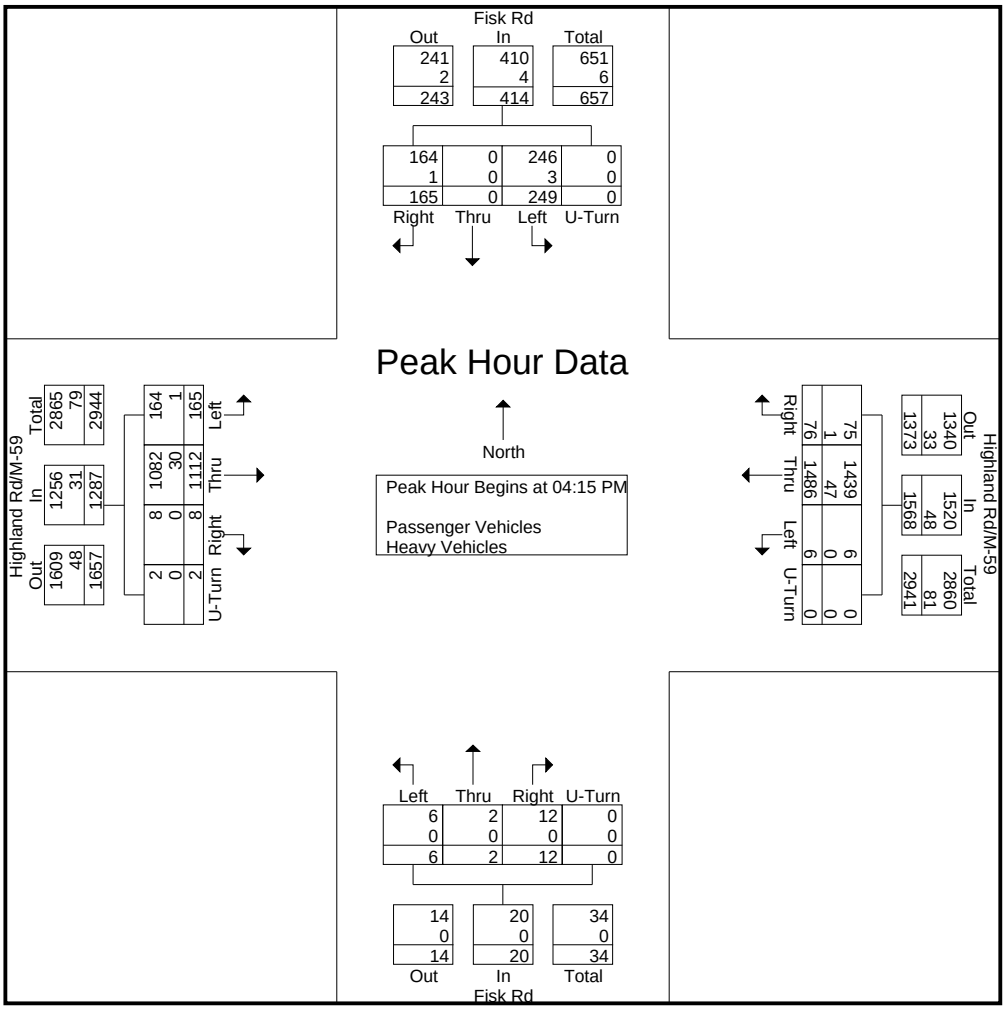
	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Fisk Rd Northbound					Fisk Rd Southbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
04:00 PM	44	269	2	1	316	1	327	22	0	350	1	0	3	0	4	63	0	46	0	109	779
04:15 PM	45	329	3	0	377	2	365	21	0	388	3	0	3	0	6	55	0	44	0	99	870
04:30 PM	32	222	4	1	259	1	363	21	0	385	1	1	2	0	4	64	0	52	0	116	764
04:45 PM	36	268	1	1	306	2	394	24	0	420	2	0	7	0	9	68	0	34	0	102	837
Total	157	1088	10	3	1258	6	1449	88	0	1543	7	1	15	0	23	250	0	176	0	426	3250
05:00 PM	52	293	0	0	345	1	364	10	0	375	0	1	0	0	1	62	0	35	0	97	818
05:15 PM	42	280	1	1	324	0	363	14	0	377	1	0	0	0	1	48	0	55	0	103	805
05:30 PM	39	261	0	0	300	0	339	18	0	357	0	0	1	0	1	58	0	53	0	111	769
05:45 PM	45	247	1	1	294	1	319	12	0	332	1	0	2	0	3	47	0	45	0	92	721
Total	178	1081	2	2	1263	2	1385	54	0	1441	2	1	3	0	6	215	0	188	0	403	3113
Grand Total	335	2169	12	5	2521	8	2834	142	0	2984	9	2	18	0	29	465	0	364	0	829	6363
Apprch %	13.3	86	0.5	0.2		0.3	95	4.8	0		31	6.9	62.1	0		56.1	0	43.9	0		
Total %	5.3	34.1	0.2	0.1	39.6	0.1	44.5	2.2	0	46.9	0.1	0	0.3	0	0.5	7.3	0	5.7	0	13	
Passenger Vehicles	332	2109	12	5	2458	8	2766	139	0	2913	9	2	17	0	28	462	0	363	0	825	6224
% Passenger Vehicles	99.1	97.2	100	100	97.5	100	97.6	97.9	0	97.6	100	100	94.4	0	96.6	99.4	0	99.7	0	99.5	97.8
Heavy Vehicles	3	60	0	0	63	0	68	3	0	71	0	0	1	0	1	3	0	1	0	4	139
% Heavy Vehicles	0.9	2.8	0	0	2.5	0	2.4	2.1	0	2.4	0	0	5.6	0	3.4	0.6	0	0.3	0	0.5	2.2



TRUE DATA TO IMPROVE MOBILITY

File Name : 16432202 - Fisk Rd -- Highland Rd_M-59
Site Code : 16432202
Start Date : 12/13/2023
Page No : 2

	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Fisk Rd Northbound					Fisk Rd Southbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	45	**329**	3	0	**377**	**2**	365	21	0	388	**3**	0	3	0	6	55	0	44	0	99	**870**
04:30 PM	32	222	**4**	**1**	259	1	363	21	0	385	1	**1**	2	0	4	64	0	**52**	0	**116**	764
04:45 PM	36	268	1	1	306	2	**394**	**24**	0	**420**	2	0	**7**	0	**9**	**68**	0	34	0	102	837
05:00 PM	**52**	293	0	0	345	1	364	10	0	375	0	1	0	0	1	62	0	35	0	97	818
Total Volume	165	1112	8	2	1287	6	1486	76	0	1568	6	2	12	0	20	249	0	165	0	414	3289
% App. Total	12.8	86.4	0.6	0.2		0.4	94.8	4.8	0		30	10	60	0		60.1	0	39.9	0		
PHF	.793	.845	.500	.500	.853	.750	.943	.792	.000	.933	.500	.500	.429	.000	.556	.915	.000	.793	.000	.892	.945
Passenger Vehicles	164	1082	8	2	1256	6	1439	75	0	1520	6	2	12	0	20	246	0	164	0	410	3206
% Passenger Vehicles	99.4	97.3	100	100	97.6	100	96.8	98.7	0	96.9	100	100	100	0	100	98.8	0	99.4	0	99.0	97.5
Heavy Vehicles	1	30	0	0	31	0	47	1	0	48	0	0	0	0	0	3	0	1	0	4	83
% Heavy Vehicles	0.6	2.7	0	0	2.4	0	3.2	1.3	0	3.1	0	0	0	0	0	1.2	0	0.6	0	1.0	2.5

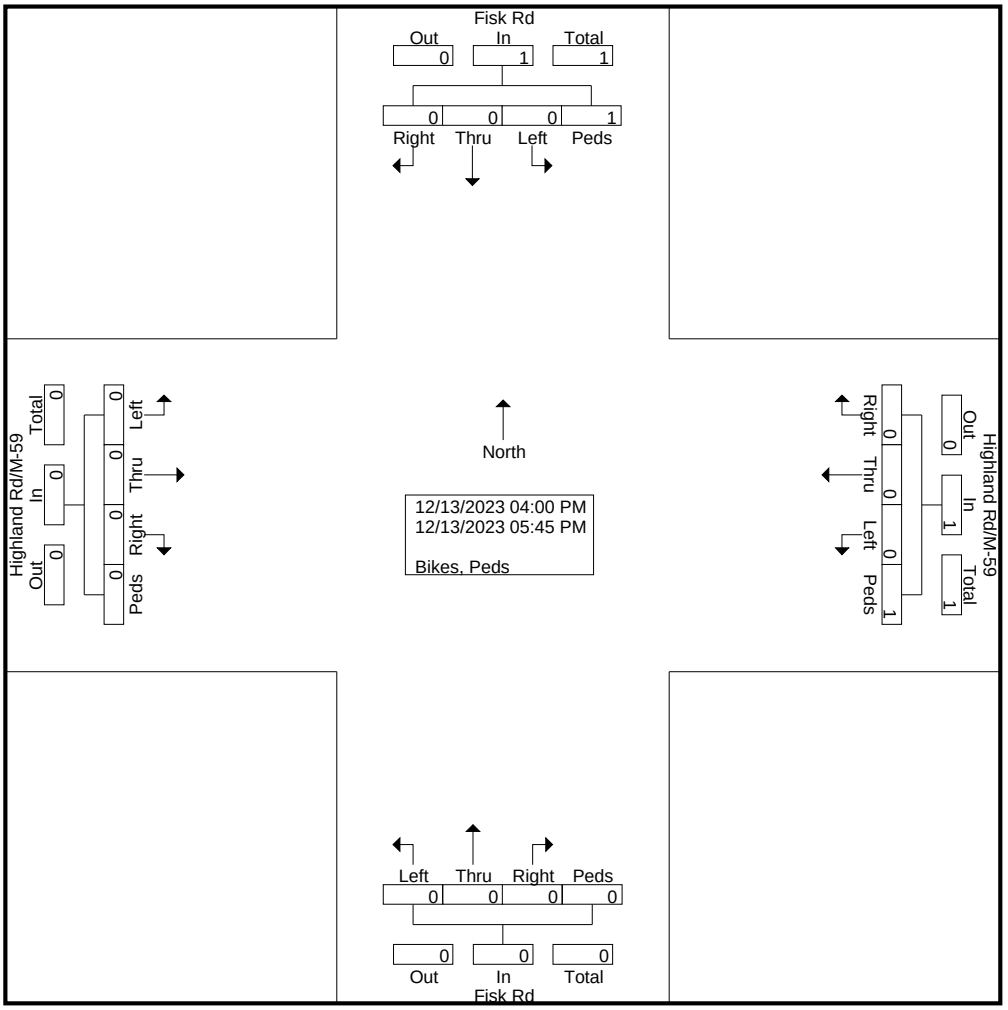


TRUE DATA TO IMPROVE MOBILITY

File Name : 16432202 - Fisk Rd -- Highland Rd_M-59
Site Code : 16432202
Start Date : 12/13/2023
Page No : 1

Groups Printed- Bikes, Peds

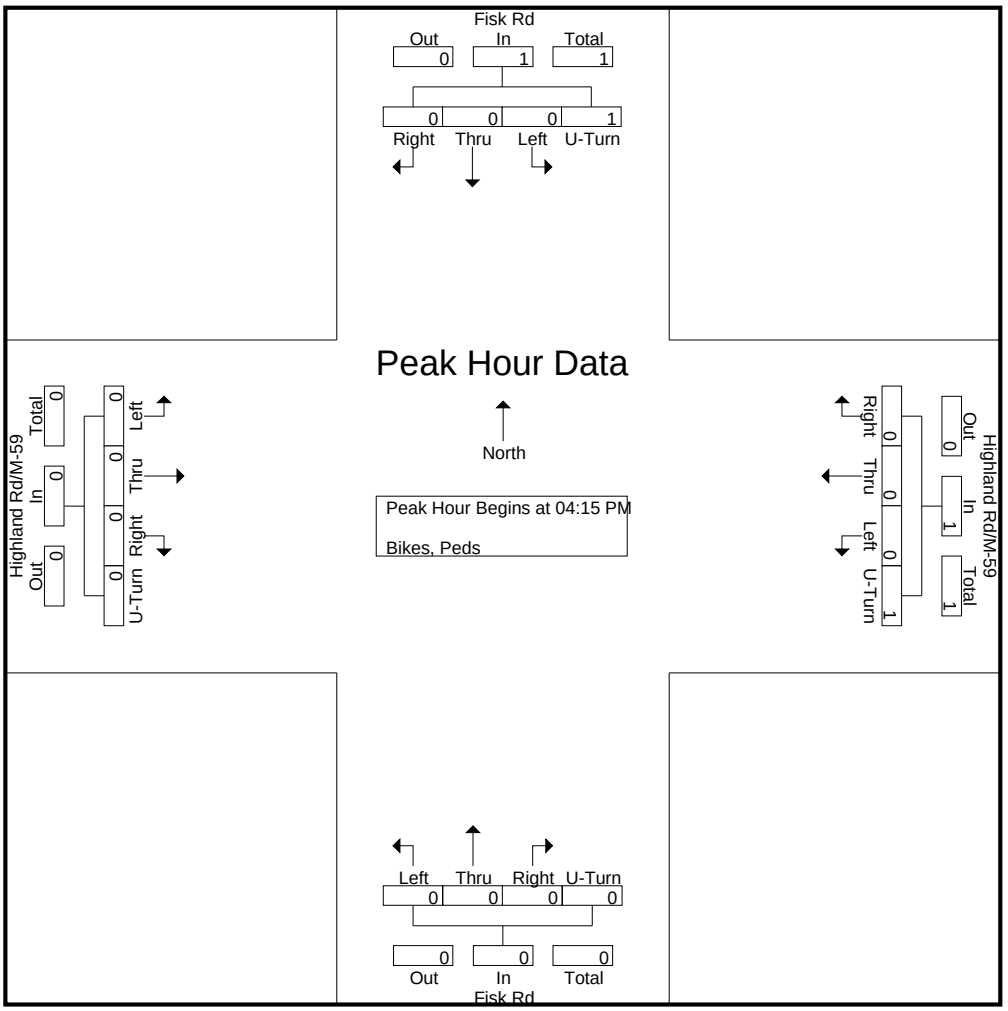
	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Fisk Rd Northbound					Fisk Rd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	2
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	2
Grand Total	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	2
Apprch %	0	0	0	0		0	0	0	100		0	0	0	0		0	0	0	100		
Total %	0	0	0	0	0	0	0	0	50	50	0	0	0	0	0	0	0	0	50	50	



TRUE DATA TO IMPROVE MOBILITY

File Name : 16432202 - Fisk Rd -- Highland Rd_M-59
Site Code : 16432202
Start Date : 12/13/2023
Page No : 2

	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Fisk Rd Northbound					Fisk Rd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	**1**	**1**	0	0	0	0	0	0	0	0	**1**	**1**	**2**
Total Volume	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	2
% App. Total	0	0	0	0		0	0	0	100		0	0	0	0		0	0	0	100		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.250	.250	.000	.000	.000	.000	.000	.000	.000	.000	.250	.250	.250

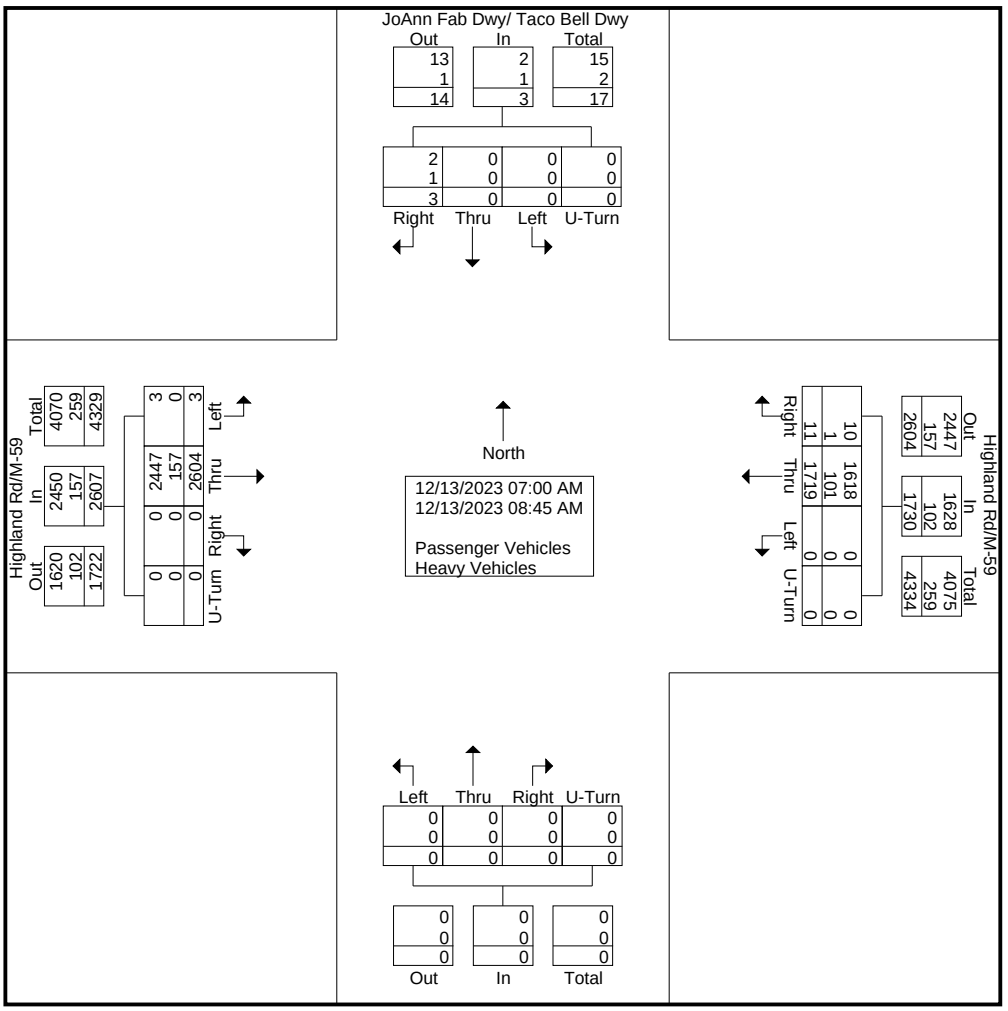


TRUE DATA TO IMPROVE MOBILITY

File Name : 16432205 - JoAnn Fab Dwy_ Taco Bell Dwy -- Highland Rd_M-59
Site Code : 16432205
Start Date : 12/13/2023
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

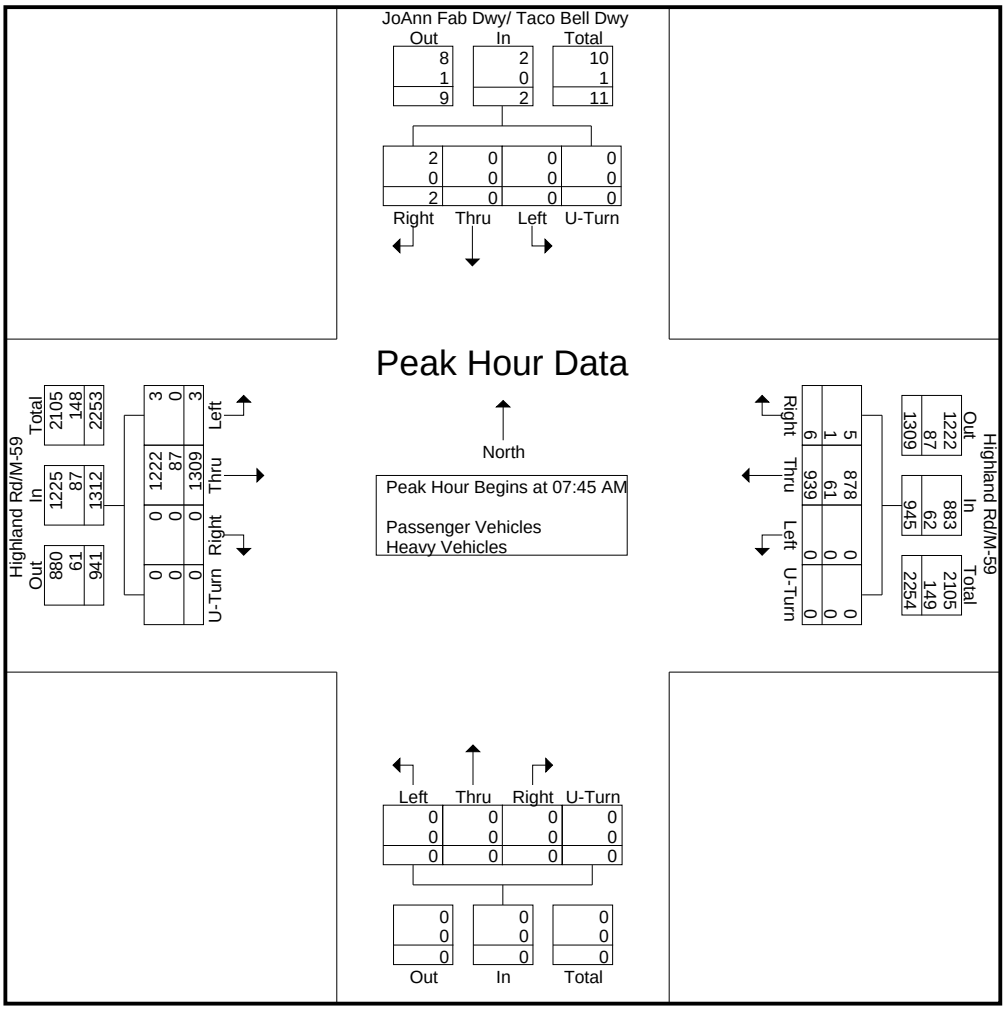
	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Northbound					JoAnn Fab Dwy/ Taco Bell Dwy Southbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
07:00 AM	0	328	0	0	328	0	141	0	0	141	0	0	0	0	0	0	0	0	0	0	469
07:15 AM	0	355	0	0	355	0	172	3	0	175	0	0	0	0	0	0	0	1	0	1	531
07:30 AM	0	327	0	0	327	0	214	1	0	215	0	0	0	0	0	0	0	0	0	0	542
07:45 AM	0	367	0	0	367	0	232	2	0	234	0	0	0	0	0	0	0	0	0	0	601
Total	0	1377	0	0	1377	0	759	6	0	765	0	0	0	0	0	0	0	1	0	1	2143
08:00 AM	0	307	0	0	307	0	265	0	0	265	0	0	0	0	0	0	0	0	0	0	572
08:15 AM	1	320	0	0	321	0	220	1	0	221	0	0	0	0	0	0	0	0	0	0	542
08:30 AM	2	315	0	0	317	0	222	3	0	225	0	0	0	0	0	0	0	2	0	2	544
08:45 AM	0	285	0	0	285	0	253	1	0	254	0	0	0	0	0	0	0	0	0	0	539
Total	3	1227	0	0	1230	0	960	5	0	965	0	0	0	0	0	0	0	2	0	2	2197
Grand Total	3	2604	0	0	2607	0	1719	11	0	1730	0	0	0	0	0	0	0	3	0	3	4340
Apprch %	0.1	99.9	0	0		0	99.4	0.6	0		0	0	0	0		0	0	100	0		
Total %	0.1	60	0	0	60.1	0	39.6	0.3	0	39.9	0	0	0	0	0	0	0	0.1	0	0.1	
Passenger Vehicles	3	2447	0	0	2450	0	1618	10	0	1628	0	0	0	0	0	0	0	2	0	2	4080
% Passenger Vehicles	100	94	0	0	94	0	94.1	90.9	0	94.1	0	0	0	0	0	0	0	66.7	0	66.7	94
Heavy Vehicles	0	157	0	0	157	0	101	1	0	102	0	0	0	0	0	0	0	1	0	1	260
% Heavy Vehicles	0	6	0	0	6	0	5.9	9.1	0	5.9	0	0	0	0	0	0	0	33.3	0	33.3	6



TRUE DATA TO IMPROVE MOBILITY

File Name : 16432205 - JoAnn Fab Dwy_ Taco Bell Dwy -- Highland Rd_M-59
Site Code : 16432205
Start Date : 12/13/2023

	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Northbound					JoAnn Fab Dwy/ Taco Bell Dwy Southbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	0	**367**	0	0	**367**	0	232	2	0	234	0	0	0	0	0	0	0	0	0	0	**601**
08:00 AM	0	307	0	0	307	0	**265**	0	0	**265**	0	0	0	0	0	0	0	0	0	0	572
08:15 AM	1	320	0	0	321	0	220	1	0	221	0	0	0	0	0	0	0	0	0	0	542
08:30 AM	**2**	315	0	0	317	0	222	**3**	0	225	0	0	0	0	0	0	0	**2**	0	**2**	544
Total Volume	3	1309	0	0	1312	0	939	6	0	945	0	0	0	0	0	0	0	2	0	2	2259
% App. Total	0.2	99.8	0	0		0	99.4	0.6	0		0	0	0	0		0	0	100	0		
PHF	.375	.892	.000	.000	.894	.000	.886	.500	.000	.892	.000	.000	.000	.000	.000	.000	.000	.250	.000	.250	.940
Passenger Vehicles	3	1222	0	0	1225	0	878	5	0	883	0	0	0	0	0	0	0	2	0	2	2110
% Passenger Vehicles	100	93.4	0	0	93.4	0	93.5	83.3	0	93.4	0	0	0	0	0	0	0	100	0	100	93.4
Heavy Vehicles	0	87	0	0	87	0	61	1	0	62	0	0	0	0	0	0	0	0	0	0	149
% Heavy Vehicles	0	6.6	0	0	6.6	0	6.5	16.7	0	6.6	0	0	0	0	0	0	0	0	0	0	6.6

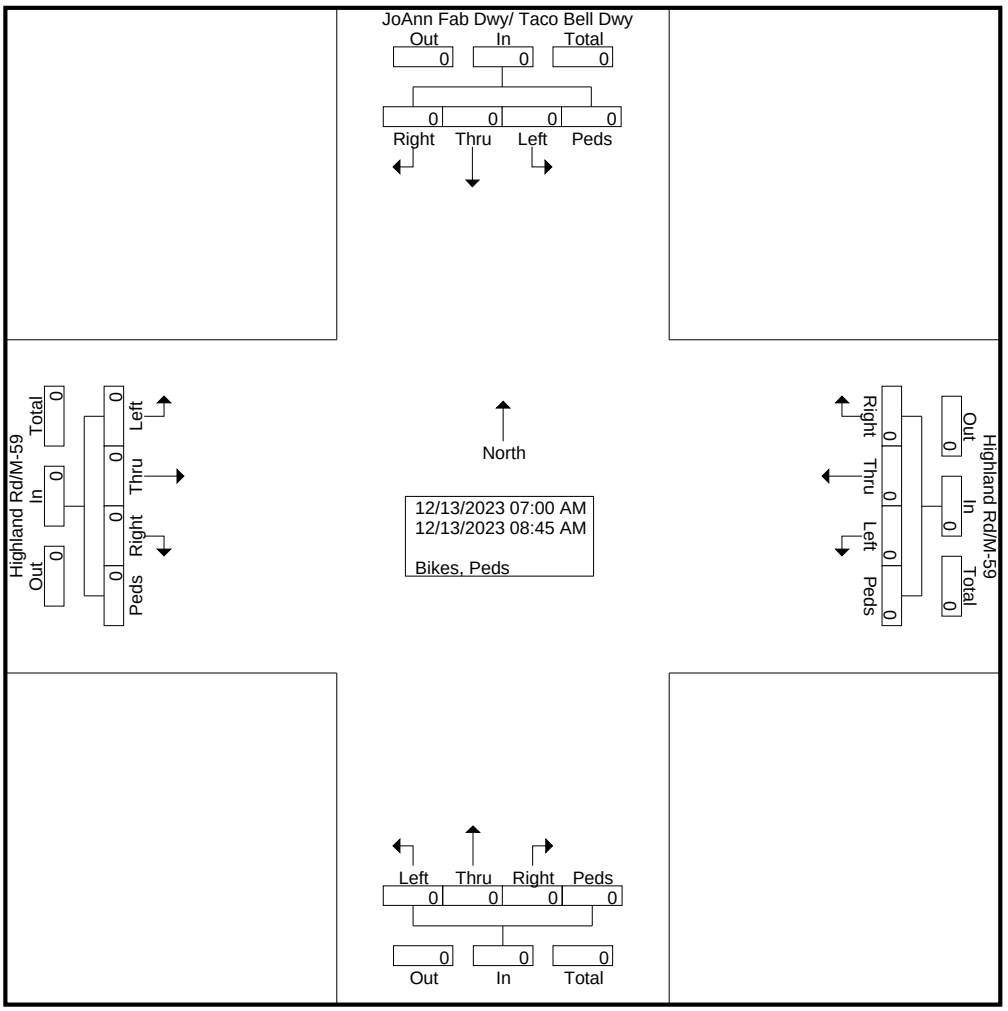


TRUE DATA TO IMPROVE MOBILITY

File Name : 16432205 - JoAnn Fab Dwy_ Taco Bell Dwy -- Highland Rd_M-59
Site Code : 16432205
Start Date : 12/13/2023
Page No : 1

Groups Printed- Bikes, Peds

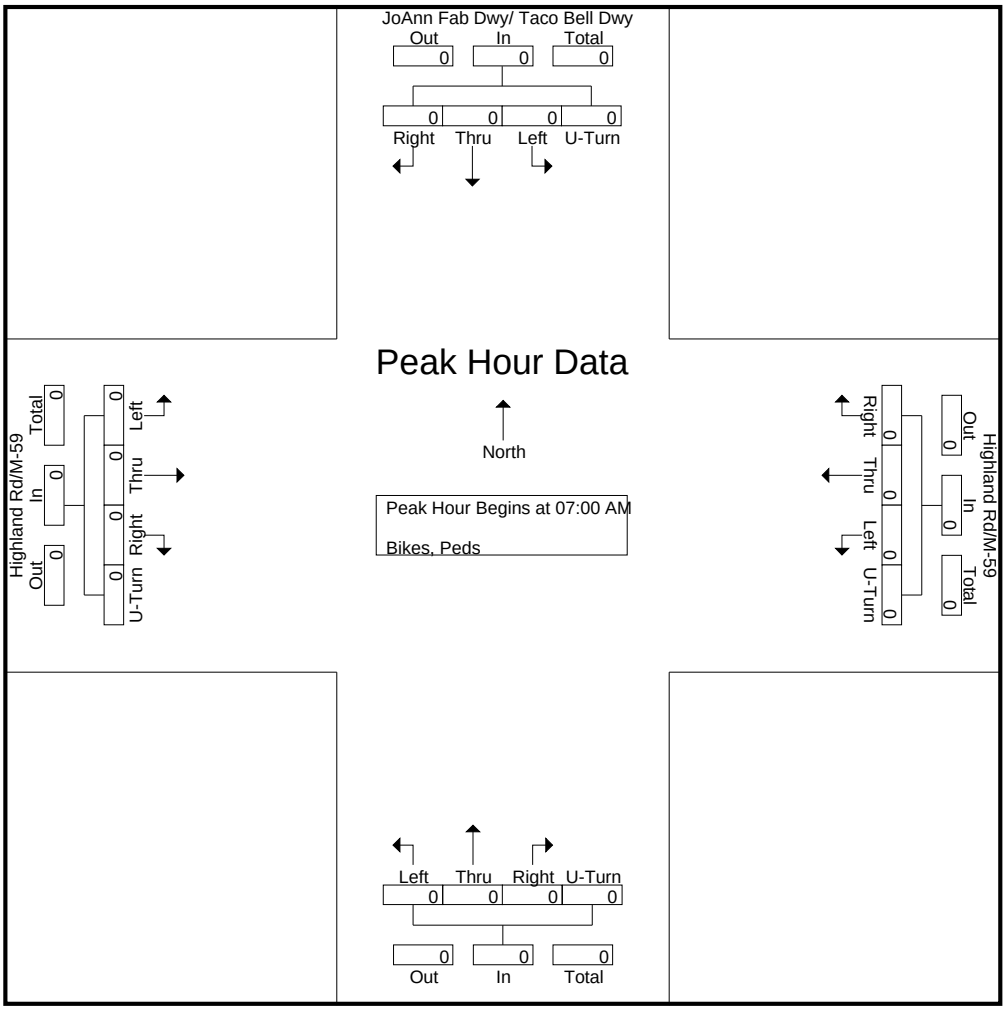
	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Northbound					JoAnn Fab Dwy/ Taco Bell Dwy Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					



TRUE DATA TO IMPROVE MOBILITY

File Name : 16432205 - JoAnn Fab Dwy_ Taco Bell Dwy -- Highland Rd_M-59
Site Code : 16432205
Start Date : 12/13/2023

	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Northbound					JoAnn Fab Dwy/ Taco Bell Dwy Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

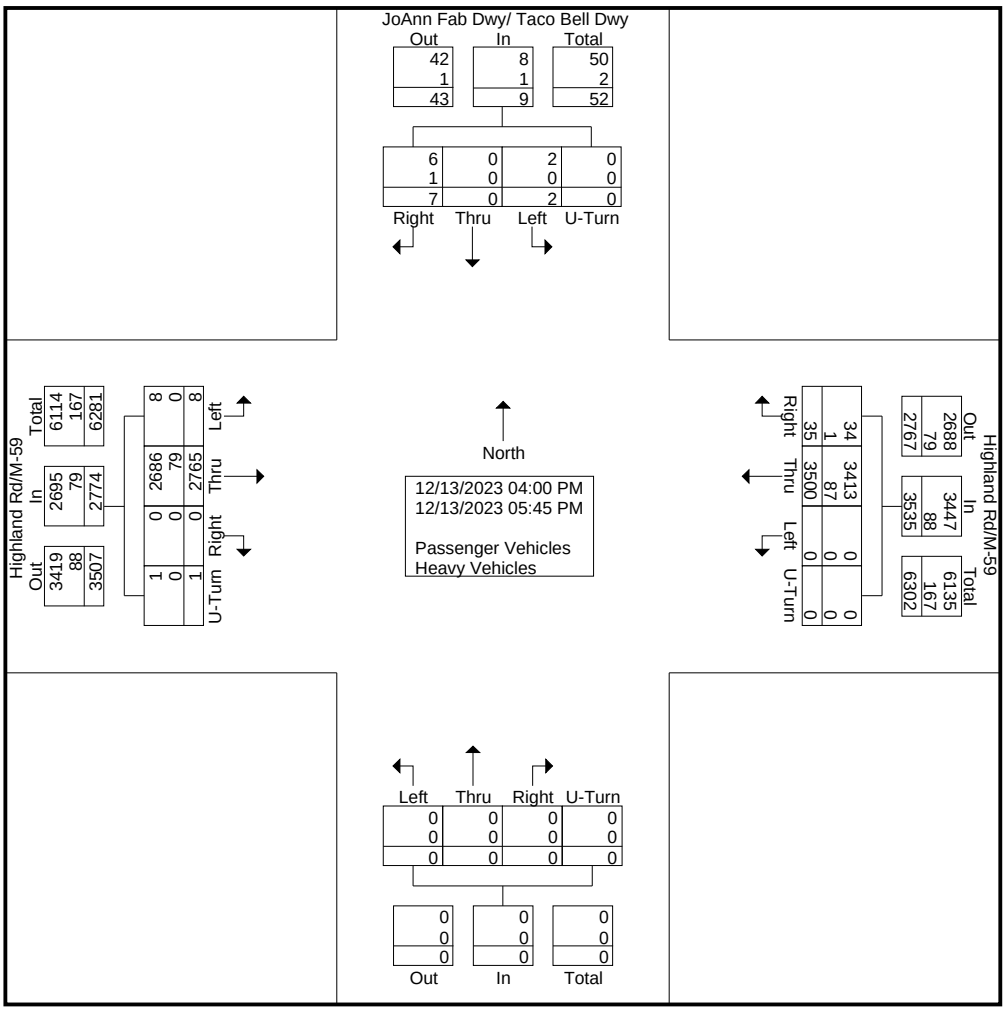


TRUE DATA TO IMPROVE MOBILITY

File Name : 16432206 - JoAnn Fab Dwy_ Taco Bell Dwy -- Highland Rd_M-59
Site Code : 16432206
Start Date : 12/13/2023
Page No : 1

Groups Printed- Passenger Vehicles - Heavy Vehicles

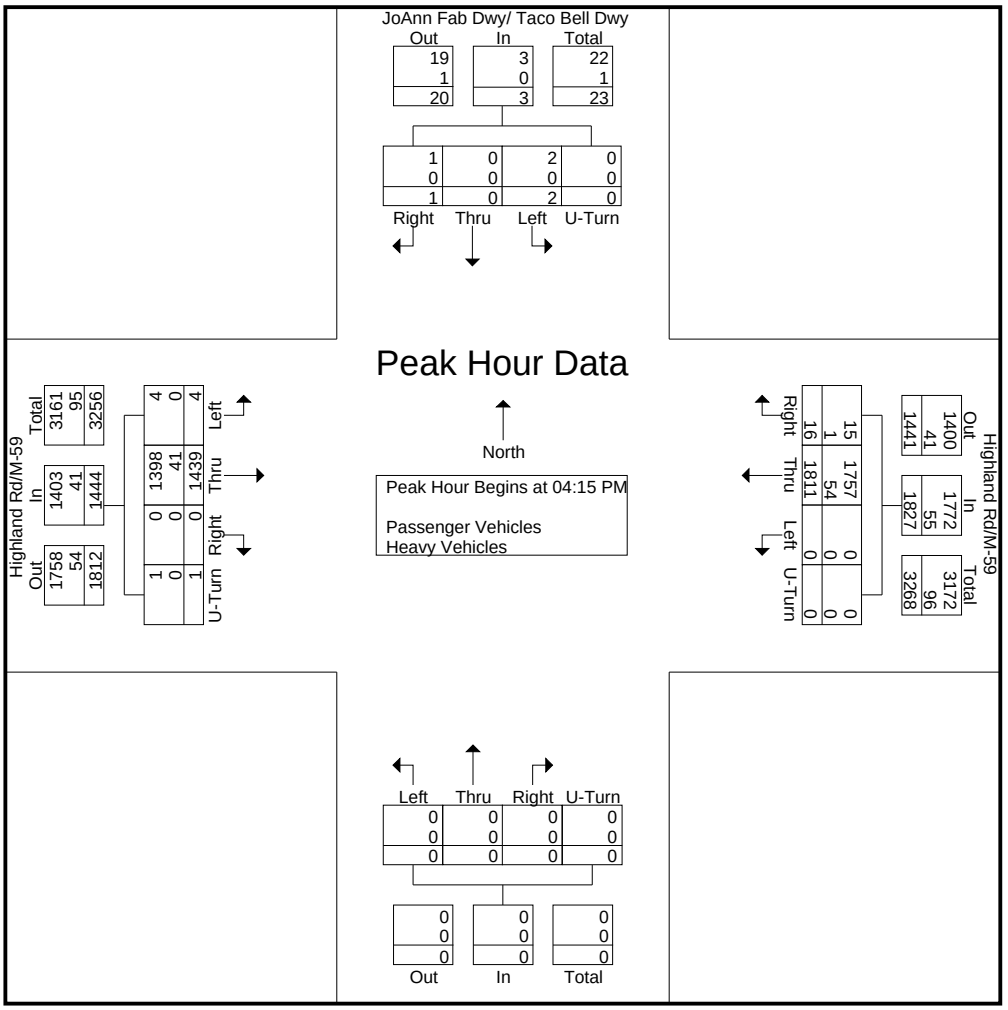
	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Northbound					JoAnn Fab Dwy/ Taco Bell Dwy Southbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
04:00 PM	0	337	0	0	337	0	423	7	0	430	0	0	0	0	0	0	0	0	0	0	767
04:15 PM	3	390	0	0	393	0	442	1	0	443	0	0	0	0	0	1	0	0	0	1	837
04:30 PM	0	326	0	0	326	0	447	5	0	452	0	0	0	0	0	0	0	1	0	1	779
04:45 PM	1	355	0	1	357	0	473	5	0	478	0	0	0	0	0	1	0	0	0	1	836
Total	4	1408	0	1	1413	0	1785	18	0	1803	0	0	0	0	0	2	0	1	0	3	3219
05:00 PM	0	368	0	0	368	0	449	5	0	454	0	0	0	0	0	0	0	0	0	0	822
05:15 PM	1	331	0	0	332	0	442	8	0	450	0	0	0	0	0	0	0	5	0	5	787
05:30 PM	1	350	0	0	351	0	426	0	0	426	0	0	0	0	0	0	0	1	0	1	778
05:45 PM	2	308	0	0	310	0	398	4	0	402	0	0	0	0	0	0	0	0	0	0	712
Total	4	1357	0	0	1361	0	1715	17	0	1732	0	0	0	0	0	0	0	6	0	6	3099
Grand Total	8	2765	0	1	2774	0	3500	35	0	3535	0	0	0	0	0	2	0	7	0	9	6318
Apprch %	0.3	99.7	0	0		0	99	1	0		0	0	0	0		22.2	0	77.8	0		
Total %	0.1	43.8	0	0	43.9	0	55.4	0.6	0	56	0	0	0	0	0	0	0	0.1	0	0.1	
Passenger Vehicles	8	2686	0	1	2695	0	3413	34	0	3447	0	0	0	0	0	2	0	6	0	8	6150
% Passenger Vehicles	100	97.1	0	100	97.2	0	97.5	97.1	0	97.5	0	0	0	0	0	100	0	85.7	0	88.9	97.3
Heavy Vehicles	0	79	0	0	79	0	87	1	0	88	0	0	0	0	0	0	0	1	0	1	168
% Heavy Vehicles	0	2.9	0	0	2.8	0	2.5	2.9	0	2.5	0	0	0	0	0	0	0	14.3	0	11.1	2.7



TRUE DATA TO IMPROVE MOBILITY

File Name : 16432206 - JoAnn Fab Dwy_ Taco Bell Dwy -- Highland Rd_M-59
Site Code : 16432206
Start Date : 12/13/2023

	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Northbound					JoAnn Fab Dwy/ Taco Bell Dwy Southbound					
Start Time	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	**3**	**390**	0	0	**393**	0	442	1	0	443	0	0	0	0	0	**1**	0	0	0	**1**	**837**
04:30 PM	0	326	0	0	326	0	447	**5**	0	452	0	0	0	0	0	0	0	**1**	0	1	779
04:45 PM	1	355	0	**1**	357	0	**473**	5	0	**478**	0	0	0	0	0	1	0	0	0	1	836
05:00 PM	0	368	0	0	368	0	449	5	0	454	0	0	0	0	0	0	0	0	0	0	822
Total Volume	4	1439	0	1	1444	0	1811	16	0	1827	0	0	0	0	0	2	0	1	0	3	3274
% App. Total	0.3	99.7	0	0.1		0	99.1	0.9	0		0	0	0	0		66.7	0	33.3	0		
PHF	.333	.922	.000	.250	.919	.000	.957	.800	.000	.956	.000	.000	.000	.000	.000	.500	.000	.250	.000	.750	.978
Passenger Vehicles	4	1398	0	1	1403	0	1757	15	0	1772	0	0	0	0	0	2	0	1	0	3	3178
% Passenger Vehicles	100	97.2	0	100	97.2	0	97.0	93.8	0	97.0	0	0	0	0	0	100	0	100	0	100	97.1
Heavy Vehicles	0	41	0	0	41	0	54	1	0	55	0	0	0	0	0	0	0	0	0	0	96
% Heavy Vehicles	0	2.8	0	0	2.8	0	3.0	6.3	0	3.0	0	0	0	0	0	0	0	0	0	0	2.9

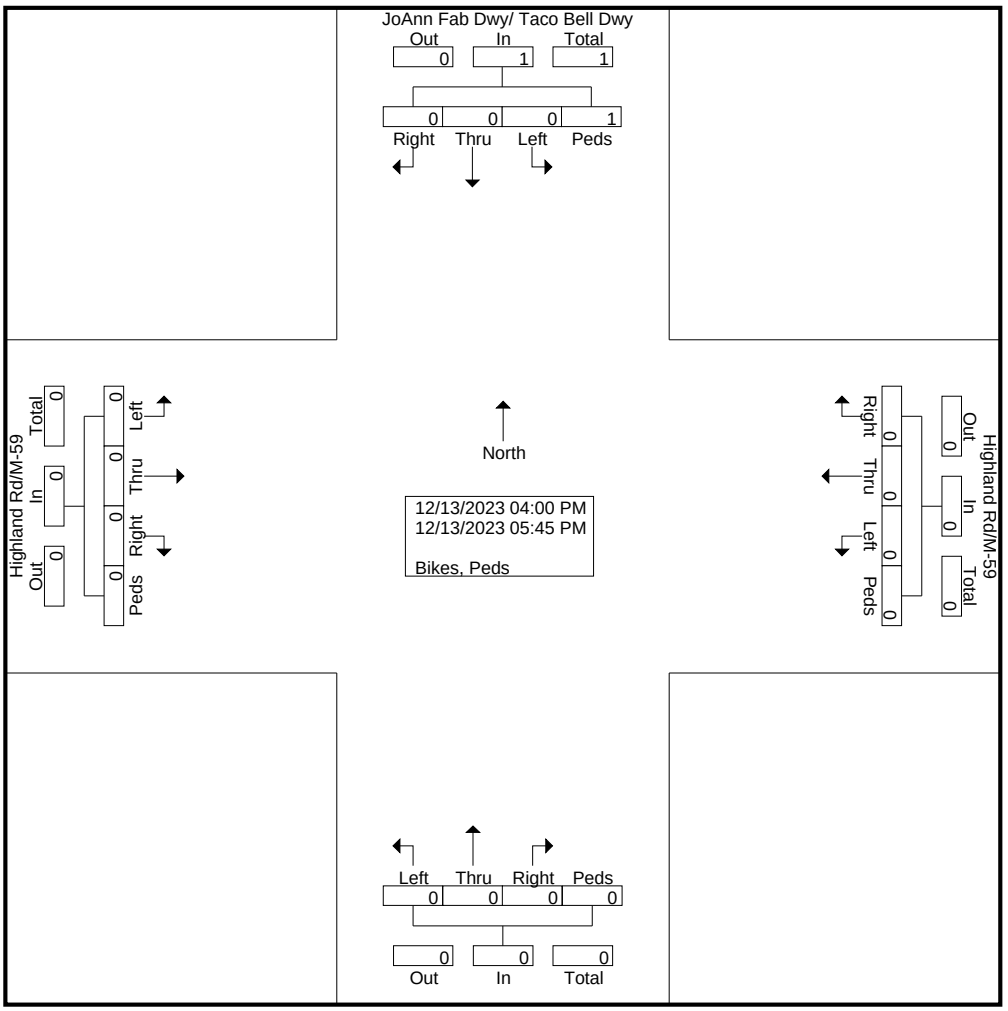


TRUE DATA TO IMPROVE MOBILITY

File Name : 16432206 - JoAnn Fab Dwy_ Taco Bell Dwy -- Highland Rd_M-59
Site Code : 16432206
Start Date : 12/13/2023
Page No : 1

Groups Printed- Bikes, Peds

	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Northbound					JoAnn Fab Dwy/ Taco Bell Dwy Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	100		
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100	



TRUE DATA TO IMPROVE MOBILITY

File Name : 16432206 - JoAnn Fab Dwy_ Taco Bell Dwy -- Highland Rd_M-59
Site Code : 16432206
Start Date : 12/13/2023

	Highland Rd/M-59 Eastbound					Highland Rd/M-59 Westbound					Northbound					JoAnn Fab Dwy/ Taco Bell Dwy Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
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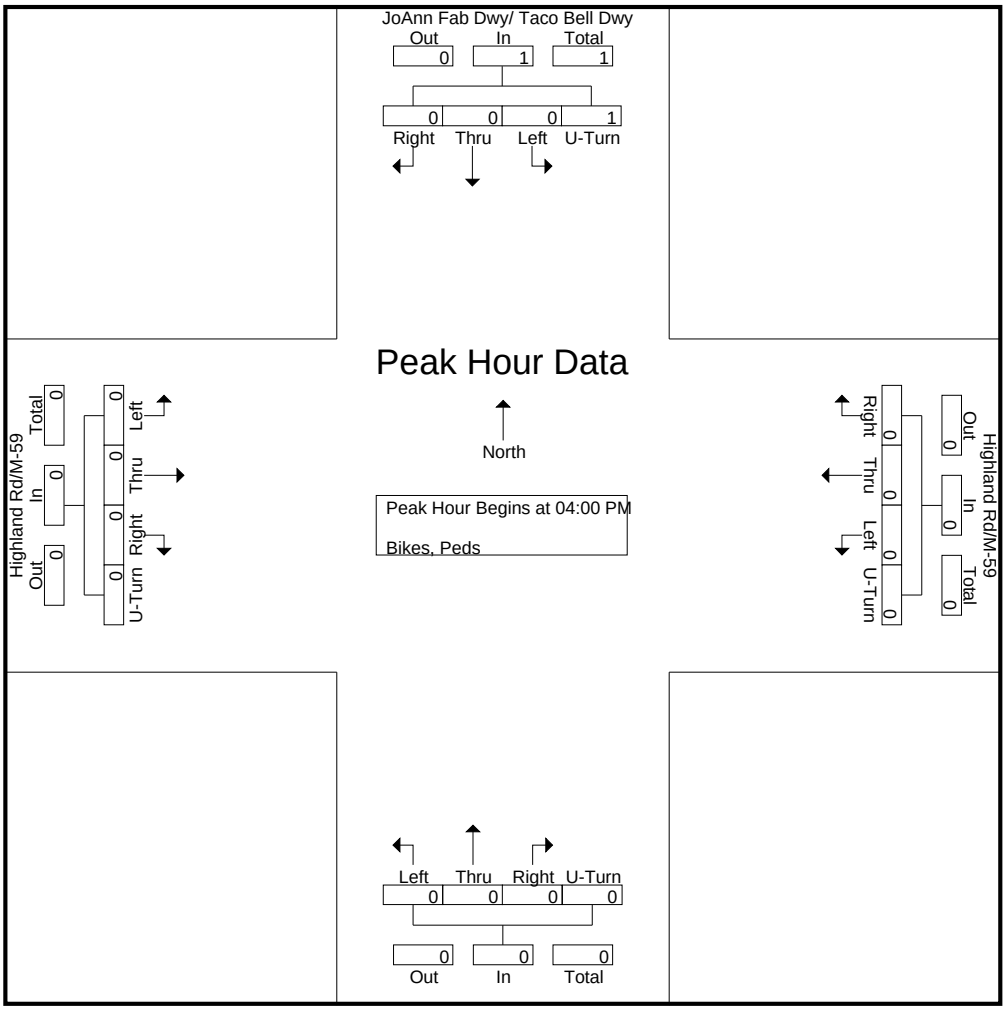
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**1**	**1**
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	100		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.250	.250



MDOT Michigan Department of Transportation

MS2

Transportation Data Management System

Disclaimer: The Michigan Department of Transportation (MDOT) works with individual agencies (cities/villages, counties, metropolitan planning organizations (MPOs), regional planning organizations (RPOs), and other areas of MDOT) to identify existing traffic count programs and/or traffic data. ... more

List View | All DIRs | Report Center

Record 1 of 1 Goto Record go

Location ID	63-0739	**MPO ID**	2717
Type	SPOT	**HPMS ID**	
On NHS	No	**On HPMS**	No
LRS ID	0704601	**LRS Loc Pt.**	0.3140493
SF Group	Local Road	**Route Type**	
AF Group	NoFactor	**Route**	
GF Group	Local Road	**Active**	Yes
Class Dist Grp	NTL_7	**Category**	
Seas Clss Grp			
WIM Group			
QC Group	Default		
Fnct'l Class	(7) Local Road or Street	**Milepost**	
Located On	Fisk Rd		
Loc On Alias			
SOUTH OF	Pontiac Lake Rd		

More Detail

STATION DATA

Directions: 2-WAY | NB | SB

AADT

	Year	AADT	DHV-30	K %	D %	PA	BC	Src
	2022	1,256	130	10		1,194 (95%)	62 (5%)	

VOLUME COUNT

	Date	Int	Total
	Mon 8/22/2022	60	1,274

VOLUME TREND

Year	Annual Growth

CLASSIFICATION

	Date	Int	Total
No Data			

NOTES/FILES

	Note	Date	

SEMCOG | Southeast Michigan Council of Governments

Search...

Crash and Road Data

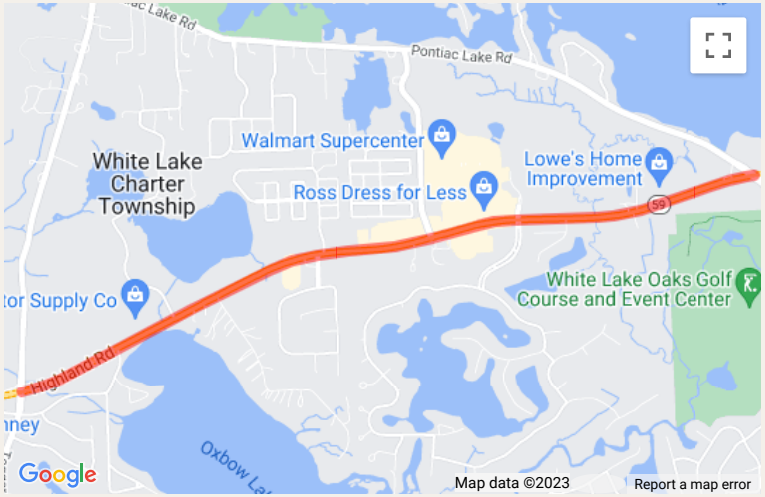
Road Segment Report

Highland Rd, (PR Number 648906)

From:	Teggerdine Rd 9.938 BMP
To:	Pontiac Lake Rd 12.354 EMP
Jurisdiction:	State
FALINK ID:	1797
Community:	White Lake Township
County:	Oakland
Functional Class:	3 - Other Principal Arterial
Direction:	2 Way
Length:	2.416 miles
Number of Lanes:	5
Posted Speed:	50 (source: TCO)
Route Classification:	M-59
Annual Crash Average 2018-2022:	82
Traffic Volume (2022)*:	33,400 (Observed AADT)
Pavement Type (2022):	Asphalt
Pavement Rating (2022):	Fair

* AADT values are derived from **Traffic Counts**

Street View



OAKLAND COUNTY ROAD COMMISSION
TRAFFIC - SAFETY DEPARTMENT
SIGNAL WORK ORDER

JAN 23 2017

LOCATION: M-59 & Fisk DATE: 1-17-17

CITY/TOWNSHIP: White Lake BY: ELA

COUNTY#: 4135 STATE#: 63041-01-026 CHARGES: WO 168612

PLEASE PERFORM THE FOLLOWING:

____ ELECTRICAL DEVICE: ____ INSTALL ____ MODERNIZE ____ MAINTENANCE

____ UNDERGROUND: _____

____ EDISON OK: ____ YES ____ NO JOB#: _____

____ COORDINATE W/DISTRICT 7: _____

	DIAL..	1	1	1	1		2	2	2	2		3	3	3	3		4	4	4	4
	SPLIT.	1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
X	CHANGE TIMING../MODE.....	X					X					X								
X	CHANGE OFFSET.....											X								
____	CHANGE CYCLE LENGTH.....																			
____	ADD DIAL/SPLIT.....																			

____CHANGE BREAKOUT OR EPROM: _____

X CHANGE HOURS OF OPERATION:

OLD: 6am - 11pm

NEW: 6am - 10pm

X REPROGRAM TBC (Traffic Events)

____ INSTALL INTERCONNECT: ____ TBC ____ MINITROL ____ TONE

____ MBT OK: ____ YES ____ NO

____ NO CHANGE - RECORD CORRECTION

X OTHER: Rev 4

* MDOT RETIMING - FINAL *

APPROVED BY: _____ DATE: 1/17/17

DATE INSTALLED: 1/21/17

INSTALLED BY: RICHARDSON CASEY

ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

INTERSECTION: M-59 (HIGHLAND) & FISK

CITY/VILLAGE/TOWNSHIP: WHITE LAKE

COUNTY#: 4135 MDOT#: 63041-01-026 REV#: 3 DETROIT EDISON#:

DRAWN BY: E Labiano APPROVED BY: DJO DATE DRAWN: 1/17/17

INSTALLED BY: DATE INSTLD: / /

HOURS OF OPERATION: 7 DAYS: 6AM - 10PM

HOURS OF FLASHING: 7 DAYS: 10PM - 6AM

2. UTILITIES - 1. ACCESS

CODE.....: 1642 CODE: Four digits (0000 - 9999)

4. UNIT DATA - 5. RING STRUCTURE

********** NOTE: INSERT ALL RING #'S FIRST, THEN NXT & CONCUR **********

CHANNEL:	RING	PHNXT	CONCURRENT PHASES																CHANNEL	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	VEH	PED
PHASE 1:	1	2	1				1	1											1	
PHASE 2:	1	4		1			1	1											2	9
PHASE 3:					1															
PHASE 4:	1	1				1				1									4	10
PHASE 5:	2	6	1	1			1												5	
PHASE 6:	2	8	1	1				1											6	11
PHASE 7:									1											
PHASE 8:	2	5				1				1									8	12
PHASE 9:											1									
PHASE 10:												1								
PHASE 11:													1							
PHASE 12:														1						
PHASE 13:															1					
PHASE 14:																1				
PHASE 15:																	1			
PHASE 16:																		1		

CODES:

RING ..... Ring Number for Phase (1-4)
PHNXT ..... Phase Next In Ring (1-16)
CONCUR PH Phases To Be Concurrent (0=NO, 1=YES)

For vehicle channel & ped channel, enter "1" under channel# shown.

3. PHASE DATA - 1. BASIC TIMINGS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	RANGE
Minimum Green	5	10		7	5	10		7									00-99
Passage	3.0			3.0	3.0			3.0									0.0-9.9
Maximum #1	17	80		32	17	80		32									000-999
Maximum #2																	000-999
Yellow Clearance	4.7	4.7		3.0	4.7	4.7		3.0									3.0-9.9
Red Clearance	1.6	1.6		3.5	1.6	1.6		3.5									0.0-9.9

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3. PHASE DATA - 3. PEDESTRIAN TIMINGS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	RANGE (SEC)
Walk		7		7		7		7									00-99
Pedest Clearance		14		18		14		18									00-99
Flashing Walk																	
Extend Ped Clear		0		0		0		0									
Act Rest in Walk																	

3. PHASE DATA - 4. INITIALIZE & NON ACTUATED RESPONSE

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Initial	1	4		1	1	4		1								
NA Response																

CODES:	0	1	2	3	4
Initial	none	inactive	red	yellow	green
NA Response	none	to 1	to 2	both	------

3. PHASE DATA - 5. VEHICLE & PEDESTRIAN RECALLS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Vehicle Recall		3		2		3		2								
Pedestrian Recall		2				2										

CODES:	0	1	2	3	4
Vehicle	none	1 call	min	max	soft
Pedestrian	none	1 call	ped	bot N. A.	------

3. PHASE DATA - 6. NONLOCK & MISC CONTROLS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Nonlock Memory	1				1											
Dual Entry				1				1								
Last Car Passage																
Conditional Service																

CODES: 0 = NO 1 = YES

3. PHASE DATA - 8. SPECIAL DETECTOR - 0. SPC 1-8 (Epac 300/M52)

Detector # on Print	1	2	~~3~~ 5	~~4~~ 6	~~5~~ 7	~~6~~ 8	~~7~~ 4	~~8~~ 3
EPAC/M52 "D" Connector	1	6	7	8	4	5	2	3
Assigned Phase	1	1	8	8	5	5	4	4

See attached detection sheet for D-connector pin assignments

CODES: 0 1 2 3 4
Operation Mode: Norm Veh Norm Ped 1 call St Bar A St Bar B

A. CONTROLS									RANGE (SEC)
Extend Time									00-99
Delay Time									00-999

3. PHASE DATA - 8. SPECIAL DETECTOR - 2. VEH 9-16 (2070)

Detector # on Print	1	2	3	4	5	6	7	8
2070 "D" Connector	9	10	11	12	13	14	15	16
Assigned Phase								

See attached detection sheet for D-connector pin assignments

CODES: 0 1 2 3 4
Operation Mode: Norm Veh Norm Ped 1 call St Bar A St Bar B

A. CONTROLS									RANGE (SEC)
Extend Time									00-99
Delay Time									00-999

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4. UNIT DATA - 1. STARTUP & MISCELLANEOUS

Start up time	: 10	(00-99)	State	: 0	(0 = fl, 1 = red)
Auto ped clear	: 0		Red revert	: 7.0	(2.0 - 9.9)
Stop time reset	: 0	(0 = No, 1 = Yes)			

4. UNIT DATA - 2. REMOTE FLASH

Phase	1	2	3	4	5	6	7	8	A	B	C	D	E	F	G	H
FLASH																
YEL																
ALT																
ENTER				1				1								
EXIT		1				1										

Test A = Remote Flash: 0 (0 = no & 1 = yes)

6. TIME BASE - 0. SPC FUNCTION MAPPING

FUNCTION NAME
AS 8-15 = OLI - P FL G PHS
AS 8-15 = OLI - P FL R PHS

SPC FUNC

1	2	3	4	5	6	7	8

NOTE: Go up after entering to get this screen.

4. UNIT DATA - 6. ALT SEQ. 08-15

EPAC ALT SEQ (PHASE PAIR TO REVERSE)

SEQ	.PP1.	.PP2.	.PP3.	.PP4.	.PP5.	.PP6.
08						
09						
10						
11						

SEQ	.PP1.	.PP2.	.PP3.	.PP4.	.PP5.	.PP6.
12						
13						
14						
15						

4. UNIT DATA - 3. OVERLAP STANDARD

Phase	1	2	3	4	5	6	7	8	CH#
OVL A Phses									13
+GRN Phses		1				1			
OVL B Phses									
+GRN Phses									
OVL C Phses									15
+GRN Phses		1				1			
OVL D Phses									
+GRN Phses									

Phase	1	2	3	4	5	6	7	8	CH#
Overlap I									
Overlap J									
Overlap K									
Overlap L									
Overlap M									
Overlap N									
Overlap 0									
Overlap P									

Enter a "1" in the channel # shown. ----------^----------

0 = Phase not part of overlap; 1 = Phase part of overlap.

4. UNIT DATA - 4. OVERLAP SPECIAL

Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Trail green																
Trail yellow																
Trail red																
-Green / -yellow (-G/Y)	1		5													
+Green (+GRN)																

* Overlap green omitted by # - phase green; Overlap yellow omitted by # - phase yellow
* For FYA operation, '-G/Y' entry defines the phase that is the green arrow
* For FYA operation, '+GRN' entry is the thru phase opposing the FYA phase

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4. UNIT DATA - 8. I/O MISCELLANEOUS

Ring#	1	2	3	4	CONN	MODE
Input Response	1	2			"D"	
Output Select	1	2			"D"	

Connector "D" : 0 = Standard & 1 = Alternate

I/O Modes	INPUT	OUTPUT
"ABC" Connector		
"D" Connector	1	

Controller with Solo Detection:
EPAC300/M52 enter "1" under D Conn Input
2070 enter "0" under D Conn Input

5. COORDINATION DATA - 1. COORD SETUP

		0	1	2	3	4	5
OPER:	1	FRE	AUT	MAN	--------	--------	--------
MODE:	0	PRM	YLD	PYL	POM	SOM	FAC
MAX :	0	INH	MX1	MX2	--------	--------	--------
CORR:	2	DWL	MDW	SWY	SW+	--------	--------
OFST:		BEG	END	OF GREEN			
FRCE:		PLN CYC LE TIME					
MX DWELL:		YIELD PERIOD:					

5. COORDINATION DATA - 2. MANUAL CONTROL

DIAL: _____ SPLIT: _____ OFFSET: _____ SYNC: _____

To set cycle zero in manual control enter "1" for sync then press "E".

5. COORDINATION DATA - 3. DIAL/SPLIT DATA

Mode: 0 = actuated, 1 = coord phase, 2 = minimum recall, 3 = maximum recall, 4 = pedestrian recall, 5 = maximum + pedestrian recall, 6 = phase omit, 7 = dual coord phase.

Sequence: 00 - 15 (Unit data has definition)
Ring Lag: Ring offset from local cycle zero when not barrier locked to Ring #1.
Time: 00 - 99 seconds.

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5. COORDINATION DATA - 3. DIAL/SPLIT DATA

LEVEL 2

DIAL 1 / SPLIT 1 CYCLE LENGTH: 110 secs

PHASE	1	2	3	4	5	6	7	8
TIME	17	61		32	17	61		32
MODE	2	1		2	2	1		2

DIAL 1 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 1 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 1 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

LEVEL 1

OFFSET	1	2	3
TIME	42		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

DIAL 2 / SPLIT 1 CYCLE LENGTH: 90 Secs Program cycle length

PHASE	1	2	3	4	5	6	7	8
TIME	13	45		20	13	45		20
MODE	2	1		2	2	1		2

DIAL 2 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

OFFSET	1	2	3
TIME	22		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

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PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

5. COORDINATION DATA - 3. DIAL/SPLIT DATA

LEVEL 2

DIAL 3 / SPLIT 1 CYCLE LENGTH: 120 secs Program Cycle length

PHASE	1	2	3	4	5	6	7	8
TIME	13	75		27	13	75		27
MODE	2	1		2	2	1		2

DIAL 3 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

LEVEL 1

OFFSET	1	2	3
TIME	115		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

DIAL 4 / SPLIT 1 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

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PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

6. TIME BASE DATA - 2. SET TIME / DATE

-- DATE -- MM/DD/YY	-- TIME -- HH:MM:SS	MON & WEEK:	BEG -- DST -- MM	SW	END MM	SW
/ /	: :		3	2	11	1

CYCLE ZERO: 24 : 00 (HH:MM - EVENT)

STZ DIFF: -18000 (GPS OFFSET)

2. UTILITIES - 8. CONFIGURE PORTS - 8. GPS CONFIGURATION

GPS: 1 (0-NO, 1-YES) PORT: 4

6. TIME BASE DATA - 3. TRAFFIC EVENTS

PRO DAY	TIME HH : MM	COORD PATRN		MAX 2 PHASE #S									OMIT PHASE #S							
* * *	* * * * *	D / S / O		*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*
01	00:00	5/5/																		
01	06:00	1/1/1																		
01	22:00	5/5/																		
	:	/ /																		
02	00:00	5/5/																		
02	06:00	2/1/1																		
02	09:00	1/1/1																		
02	15:00	3/1/1																		
02	19:00	1/1/1																		
02	22:00	5/5/																		
	:	/ /																		
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REFERENCE DATA
PRO DAY = 01 - 99
(Program day)

HH:MM = 24 Hour clock

PATTERN: (D/S/O)
FLASH =5/5/
FREE =0/0/4

MAX2 & OMITS:
Call free, set pattern to 0/0/0.

D = DIAL #
S = SPLIT #
0 = OFFSET #

ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

6. TIME BASE DATA - 4. AUXILIARY EVENTS

PRO DAY	TIME HH : MM	AUX A1	AUX A2	AUX A3	DET VALUE D1	DET VALUE D2	DET VALUE D3	DIM DIM
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
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	:							
	:							
	:							
	:							
	:							

REFERENCE DATA:
PRO DAY = 00 - 99
(Program day)

HH:MM = 24 Hour clock

AUX = Output states
DET VALUE:
1 = Det diag value
2 = Enables report
3 = Repeat multiplier

DIM = Dimming state

ALL: 0 = off, 1 = on

6. TIME BASE DATA - 5. TIME 0F YEAR EVENTS

DATE MM / DD / YY	SPECIAL DAY	SPECIAL WEEK
/ /		
/ /		
/ /		
/ /		
/ /		
/ /		
/ /		
/ /		

DATE MM / DD / YY	SPECIAL DAY	SPECIAL WEEK
/ /		
/ /		
/ /		
/ /		
/ /		
/ /		
/ /		
/ /		

REFERENCE DATA
Special day = Any program day 00 - 99.

Special week:
Week 0 = Pro Day 01-07
Week 1 = Pro Day 11-17
Week 2 = Pro Day 21-27

6. TIME BASE DATA - 6. EQUATE/TRANSFER

CODE: 0 (0 = equate, 1 = transfer)

FROM						
01 = 07						
02 = 03	04	05	06			
=						
=						
=						
=						
=						

DAY EQUATE: Care must be taken to insure days are not equated to undefined days or days that are equated to other days. The result wil be a day without events to run.

ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

7. PREEMPT DATA - 1. ALL PREEMPTS

RING TIMES	1	2	3	4		
MIN GREEN/WALK						
OVERRIDE	FL	1/2	2/3	3/4	4/5	5/6
STATUS						
CODES	0 = NO, 1 = YES					

7. PREEMPT DATA - PREEMPT 1

1. MISC DATA: (0 = no, 1 = yes)

TEST..: ___ N-LOCK.: ___ LINK PR#.: ___
DELAY: ___ EXTEND: ___ DURATION: ___
MXCALL: ___ LOCK OUT: ___

RING	1	2	3	4	5	6	7	8
EXIT								
CALLS								

4. PEDESTRIAN STATUS:

PHASE	1	2	3	4	5	6	7	8
TRK GRN								
DWELL								

(0=dont wlk, 1=wlk, 2=flwlk, 3=dark)

CYCLE | | | | | | | | |

(0 = no, 1 = act, 2 = recall)

2. INTERVAL TIMES:

SEL PED CLR : ____ TRK YEL CHG : __.__
SEL YEL CHG : __.__ TRK RED CLR : __.__
SEL RED CLR : __.__ DWELL GREEN: ____
TRACK GREEN: ____ RET PED CLR : ____
TRK PED CLR : ____ RET YEL CHG : __.__
RET YEL CLR : __.__

5. OVERLAP STATUS:

OVERLAP	A	B	C	D
TRK GRN				
DWELL				

(0=red, 1=grn, 2=flr, 3=fly, 4=dark)

CYCLE | | | | | | | | |

(0 = no, 1 = act)

3. VEHICLE STATUS:

PHASE	1	2	3	4	5	6	7	8
TRK GRN								
DWELL								

(0=red, 1=grn, 2=flr, 3=fly, 4=dark)

CYCLE | | | | | | | | |

(0=no, 1=act, 2=min recall, 3=max recall)

6. LOW PRIORITY: (0=no, 1=yes)

TEST..: __ N-LOCK.: __ SKIP.....: __
DELAY: __ EXTEND: __ DURATION: __
DWELL: __ MXCALL: __ LOCK OUT: __

RING	1	2	3	4	5	6	7	8
DWELL								
CALLS								

SIGNAL PHASING

PHASE#	ROAD	PHASE	LOAD SW	FLASH
1	EB M59 LT (GREEN ARROW)	CL	1	–
2	WB M59	A	2	FLA
3				
4	SB FISK	B	4	FLR
5	WB M59 LT (GREEN ARROW)	AL	5	–
6	EB M59	C	6	FLA
7				
8	NB FISK	D	8	FLR
OLA	EB M59 LT (FLASHING YELLOW ARROW, YELLOW ARROW, RED ARROW)	CL	9	FLA
OLB				
OLC	WB M59 LT (FLASHING YELLOW ARROW, YELLOW ARROW, RED ARROW)	AL	11	FLA
OLD				
1PED				
2PED	WB M59 PED (NORTH LEG)	WA	13	
3PED				
4PED	SB FISK PED (WEST LEG)	WB	14	
5PED				
6PED	EB M59 PED (SOUTH LEG)	WC	15	
7PED				
8PED	NB FISK PED (EAST LEG)	WD	16	

CONTROLLER INFORMATION SHEET
Size P44-16 Cabinet with MOD 52 EPAC w/ FYA

INTERSECTION:	M-59 (Highland) & Fisk
COUNTY NO:	4135
STATE NO:	63041-01-026
PREPARED BY:	Rachel Jones
DATE:	10/10/11

Backpanel :-

Load Switch 1:	EB M59 LT (G: green arrow)	CL	-
Load Switch 2:	WB M-59	A	FLA
Load Switch 4:	SB Fisk	B	FLR
Load Switch 5:	WB M59 LT (G: green arrow)	AL	-
Load Switch 6:	EB M59	C	FLA
Load Switch 8:	NB Fisk	D	FLR
Load Switch 9:	(OLA) EB M59 LT	CL	FLA
	(G: flashing yellow arrow; Y: yellow arrow; R: red arrow)		
Load Switch 11:	(OLC) WB M59 LT	AL	FLA
	(G: flashing yellow arrow; Y: yellow arrow; R: red arrow)		
Load Switch 13:	WB M59 Ped (North Leg)	WA	
Load Switch 14:	SB Fisk Ped (West Leg)	WB	
Load Switch 15:	EB M59 Ped (South Leg)	WC	
Load Switch 16:	NB Fisk Ped (East Leg)	WD	

Jumpers :-
A28-A29,A34-A35,A37-A38,A43-A44,B28-B29,B34-B35,B37-B38,B43-B44,B52-B53, B55-B56,B58-B59,B61-B62,D22-D26, C56-PB10, D56-PB10, 10R-PB9, 12R-PB9.

Signal Monitor :- 1-5, 1-6, 1-9, 1-11, 2-5, 2-6, 2-9, 2-11, 4-8, 5-9, 5-11, 6-9, 6-11, 9-11.
All switches OFF EXCEPT: Dual Select A&B; G&Y Enable; FYA 1-9, 5-11; SSM 2,4,6,8,9,11.
Minimum Flash = 4+2+1

Autoscope SOLO

Mod 50

Co#4135

Mini-Hub II Detector Port Master
Front Panel Input/Output Pin Assignment

The Mini-Hub II has inputs and outputs available through the front panel **Input/ Output** connector and through the back edge connector. The pin assignments for the Mini-Hub II front connector are listed in the following table. Edge connector pins are identified by **NUMBER** on the component (front) side of the board. Edge connector pins are identified by **LETTER** on the backside of board.

) #	Mini-Hub II conn.	Edge conn.	Front Harness	Description	D-Conn. Term #	D- Conn. Detector Descript.	On Print Detector number	Phase
1	Output 1 LED	F	1	EB MSG LT	1	Det 9	1	1
1	Output 2 LED	W	14	EB MSG LT AOV	6	Det 14	2	1
1	Output 3 LED	S	2	EB MSG THRU L				
1	Output 4 LED	Y	15	EB MSG THRU R				
2	Output 5 LED	(JP1)4	3	NB FISK LT	7	Det 15	5	8
2	Output 6 LED	(JP7)5	16	NB FISK THRU & RT	8	Det 16	6	8
3	Output 7 LED	(JP2)8	4	WB MSG LT	4	Det 12	7	5
3	Output 8 LED	(JP8)9	17	WB MSG LT AOV	5	Det 13	8	5
3	Output 9 LED	(JP3)13	5					
3	Output 10 LED	(JP9)14	18					
4	Output 11 LED	(JP4)17	6	SB FISK LT	2	Det 10	11	4
4	Output 12 LED	(JP10)18	19	SB FISK RT	3	Det 11	12	4
	Output 13 LED		7					
	Output 14 LED		20					
	Output 15 LED		8					
	Output 16 LED		21					
	Input 1 LED	(JP5)1	9	LS1-9 RED (C-39)				
	Input 2 LED	(JP11)2	22	LS2 RED (C-30)				
	Input 3 LED	(JP6)3	10					
	Input 4 LED	(JP12)10	23	LS4 RED (C-36)				
	Input 5 LED		11	LS5-11 RED (D-39)				
	Input 6 LED		24	LS6 RED (D-30)				
	Input 7 LED		12					
	Input 8 LED	(withJP14*)	25	LS8 RED (D-36)				

*Input 8 with JP14 inserted becomes 24VDC through Input/ Output Connector on front panel.
Logic Ground is the GREY (pin 13) wire form Input/ Output connector on front panel.

Chapter 5
Connecting Solo MVP Power and Communications Cables

Usually, the Solo cable (the "pigtail" cable from the Solo MVP) is spliced to a Branch Cable, either in a junction box or in the hand-hole at the pole base. The Branch cable runs from the splice point to the cabinet, and terminates to the ACIP. Use the chart below (copy the blank table provided in Appendix A) to record which pairs of the Solo cable are spliced to the Branch cable pairs. For Branch cable lengths of 300 ft or less, a separate cable to power the Solo Pro is not normally necessary.

Be sure to use splicing methods and materials appropriate for low voltage communications splicing. When splicing is completed, properly seal the splice.

When the branch cables are brought into the cabinet, label each cable, starting with cable 1 from the Solo MVP viewing Phases 2 and 5, and working clockwise around the intersection, labeling cables 2, 3, and 4.

Terminate the cables to the ACIP in the same order. Taking care to assign the Sensor numbers (in the Autoscope Properties Editor) in the same order as the cables are terminated will facilitate easier maintenance and troubleshooting.

An example is shown in the table below. In this example, a separate power cable is shown. In installations where a 6-pair branch cable is used, power and communications are usually combined in one cable.

A blank copy of this table is provided for duplication in Appendix A.

DRAIN WIRE of Solo MVP to WHT of GRN/WHT pair of BRANCH CABLE
then at CABINET WHT to Shield

Appendix A

to Ground Lug

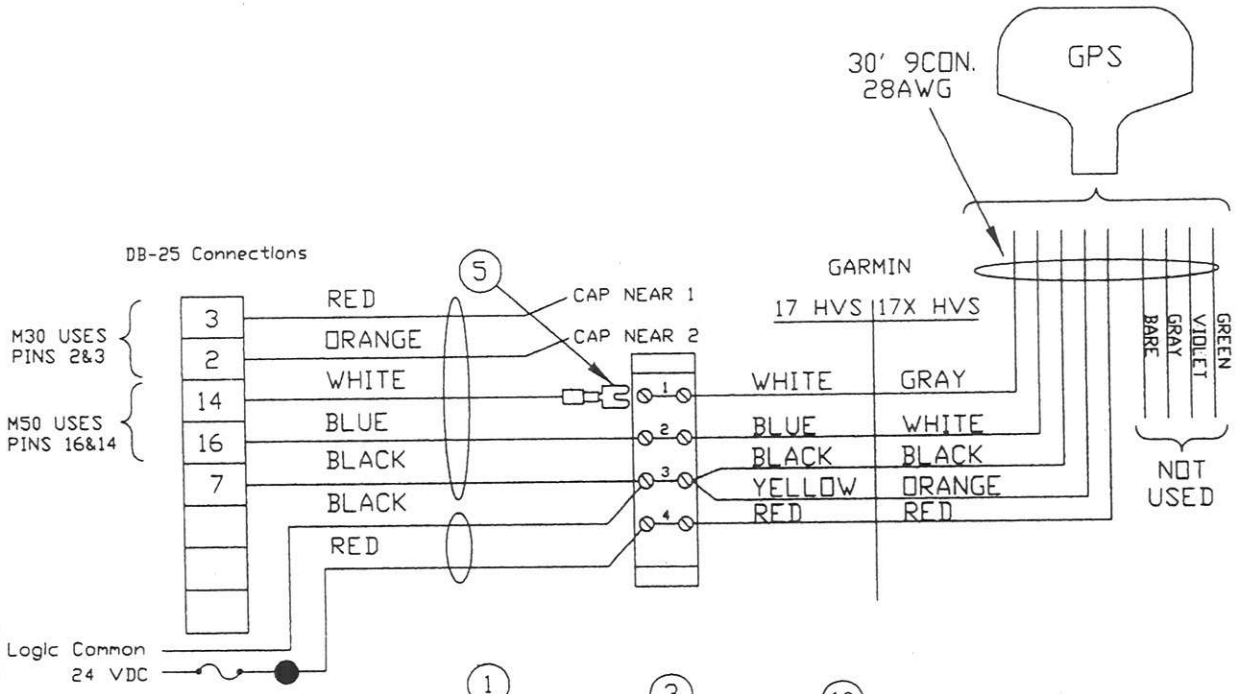
Solo System-Wide Interconnections

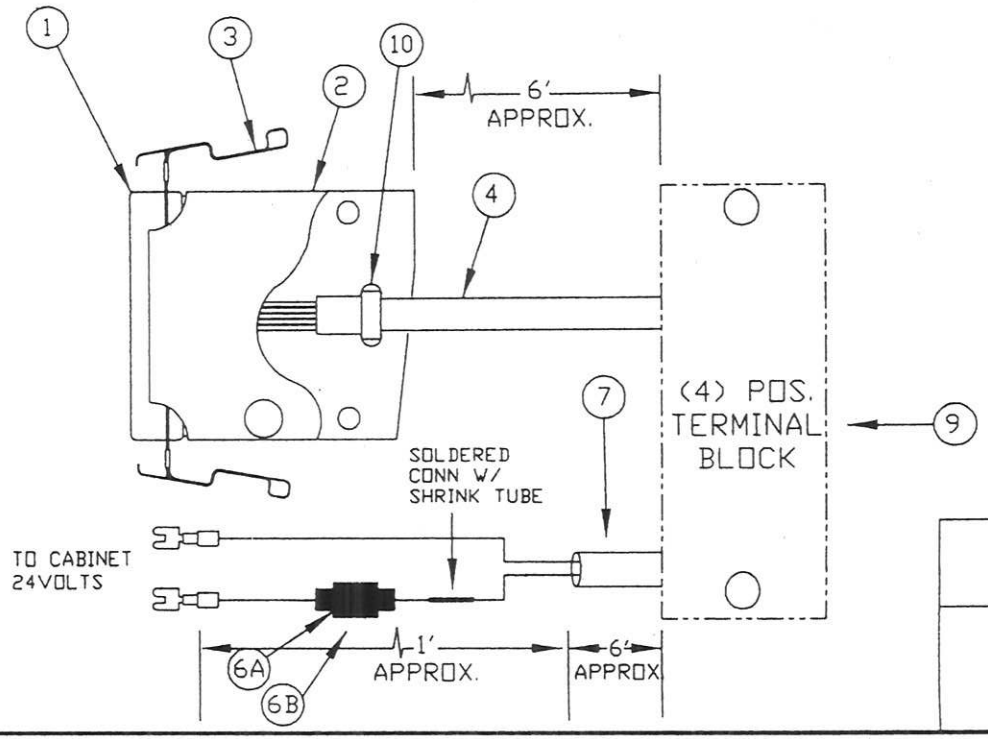
INTERFACE PANEL

Duplicate the following table to keep track of all Solo MVP connections:

Solo MVP ____ (write in sensor number)			Branch Power Cable (write in wire color)	Branch Communications Cable (write in wire color)			Communications Interface Panel	
PIN	PAIR COLOR	WIRE COLOR	WIRE COLOR	PAIR	PAIR COLOR	WIRE COLOR	SIGNAL	TERMINAL
A	BRN/BLK	* BRN *	BRN		BRN/WHT	BRN	24V PWR	1
B	BRN/BLK	* BLK *	WHT		BRN/WHT	WHT	24V RTN	2
N	----	*GRN/YEL*	GRN		GRN/WHT	GRN	EARTH GND	3
P	BLU/BLK	BLU	BLU	1	BLU/WHT	BLU	SUP RX+	4
U	BLU/BLK	BLK	WHT	1	BLU/WHT	WHT	SUP RX-	5
D	RED/BLK	RED	RED	2	RED/BLK	RED	SUP TX+	6
R	RED/BLK	BLK	BLU	2	RED/BLK	BLU	SUP TX-	7
F	YEL/BLK	YEL	ORG	3	ORG/WHT	ORG	DET+	8
E	YEL/BLK	BLK	WHT	3	ORG/WHT	WHT	DET-	9
J	WHI/BLK	WHI	GREY	4	GREY/WHT	GREY	VIDEO+	10
H	WHI/BLK	BLK	WHT	4	GREY/WHT	WHT	VIDEO-	11

* IS SEPERATE POWER FEED BRN — BLK
WHT —



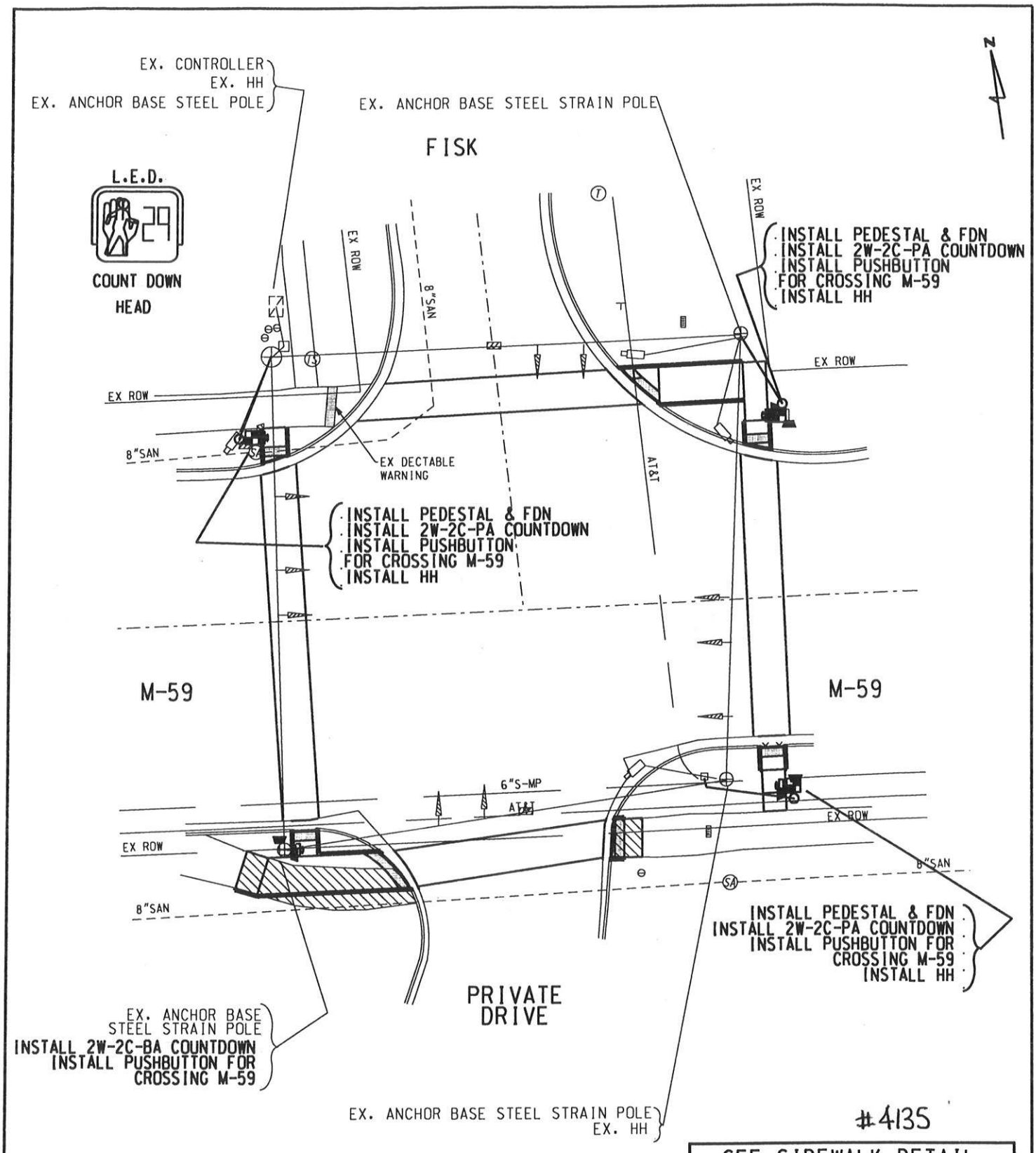


DET. No.	DESCRIPTION	VENDOR	PART No.	QTY.
1	DB-25 MALE	AMP	747912-4	1
2	HOUSING KIT	AMP	207345-1	1
3	SPRING LATCH DB CONNECTOR	NEWARK	44F8751	2
4	6 CONDUCTOR 22AWG	Alpha	1176C	6 FT
5	TERMINAL	3M	MVU18-10FBX	7
6A	FUSE HOLDER NEWARK #67K1434			
6B	FUSE (1/2A), NEWARK #27F654			
7	2 CONDUCTOR BELDEN CABLE # 8205-060			
8	(2) CHANNEL NUTS UNISTRUT TEAL #A4006-1032EG			
8A	(2) Screw 10-32 x 1" pan head phillips SS			
8B	(2ea) #10 lock washer/flat washer/fender washer			
9	4 POSITION TERMINAL BLOCK NEWARK #28F724			
10	TIE-RAP			

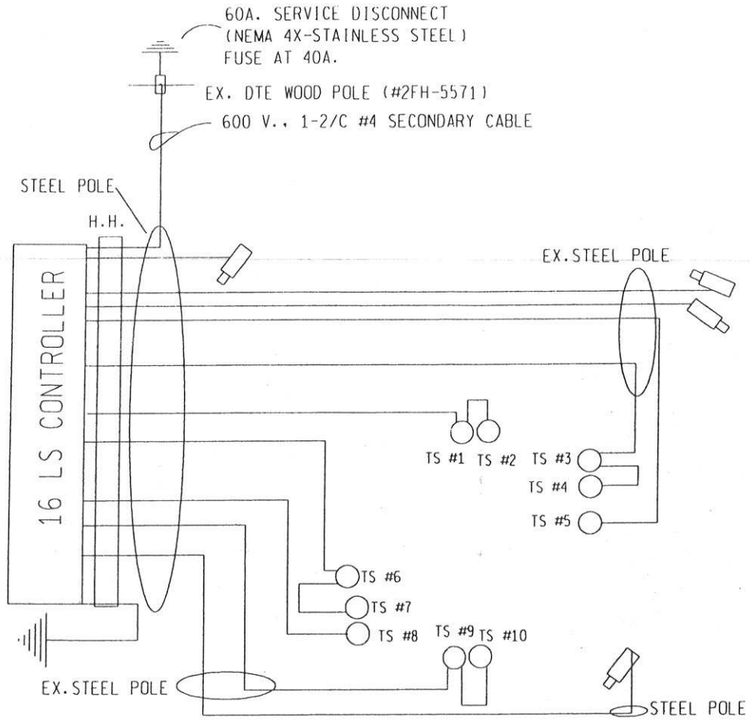
REVISED 11/10/09 DG (17X HVS)

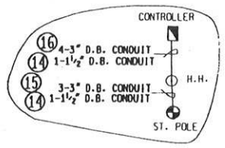
CARRIER AND GABLE INC.
TECH SERVICES

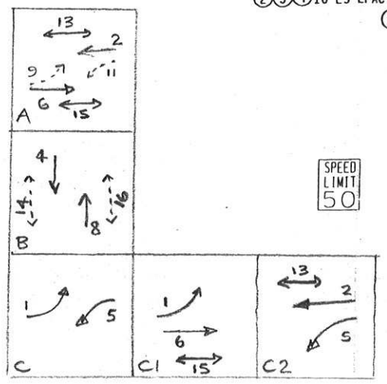
5020
GPS TO SEPAC

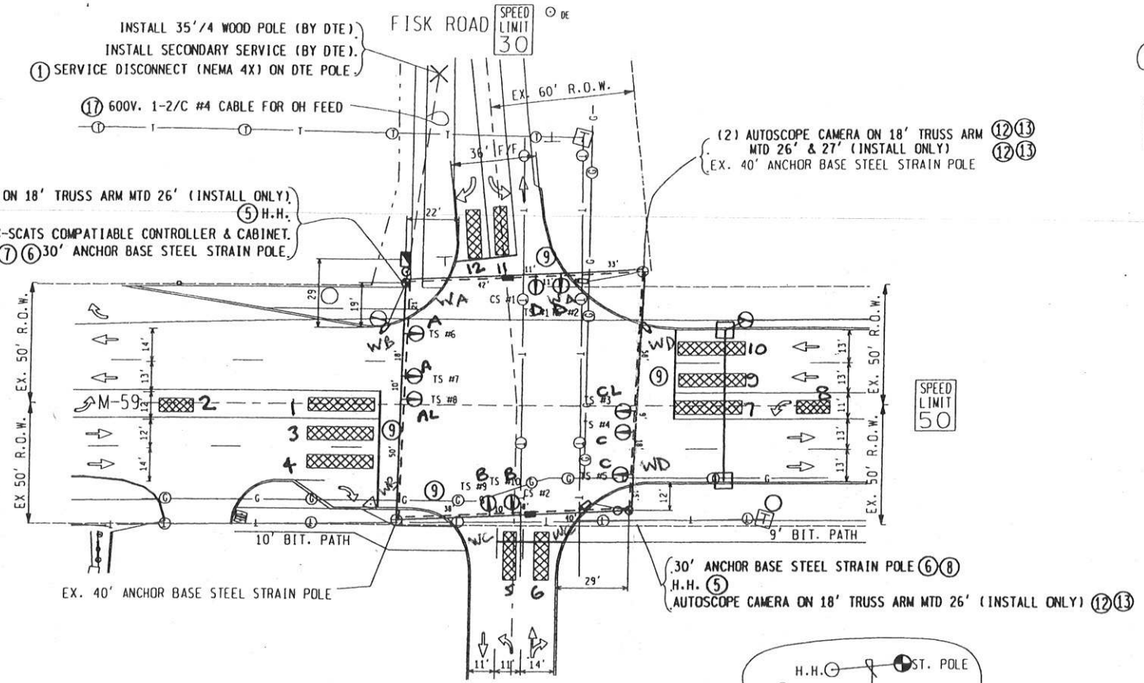


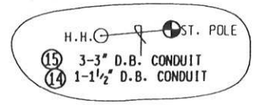
MICHIGAN DEPARTMENT OF TRANSPORTATION TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN DJP	M-59 (HIGHLAND) AT FISK RD WHITE LAKE TOWNSHIP OAKLAND COUNTY
	CONT. SEC. 63041	DATE 03-08-11	
	REF. 110761	SCALE N.T.S.	
	PLAN 63041-01-026	SHEET 363 1 OF 2	











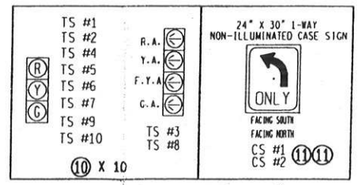
WIRING DIAGRAM
NOT TO SCALE

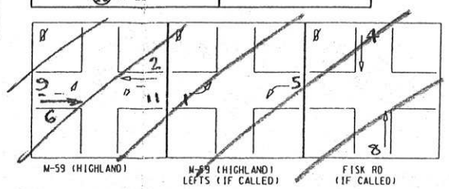
ALL SIGNAL CABLES SHALL BE 1-7/C # 16 P.J.
CAMERA CABLE TO BE YM 49001 OR EQUAL

AUTOSCOPE CAMERAS ARE TO BE PROVIDED BY R.C.O.C. REFER TO SPECIAL PROVISION INCLUDED

CONTACT: MR. DENNIS MERCIER OF DETROIT ENERGY AT 248-427-2954 FOR REMOVAL OF EX. SERVICE & PROVIDE NEW SERVICE.
COST TO CONTRACTOR: $840.64

FOR ELECTRICAL SERVICE INSPECTION CONTACT THE MICHIGAN DEPARTMENT OF LABOR AND ECONOMIC GROWTH AT 248-312-0163
COST TO BE PAID BY THE CONTRACTOR.



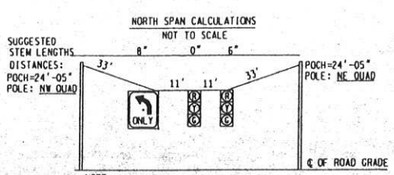


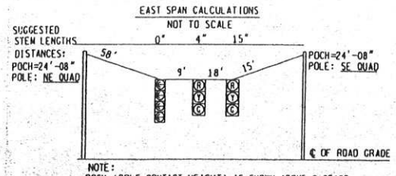
PLAN
30 60 80
0 40 100
30 SCALE

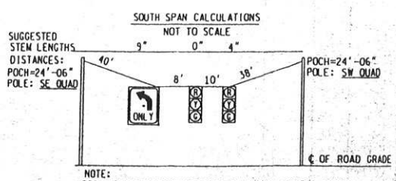
LIST OF MATERIAL

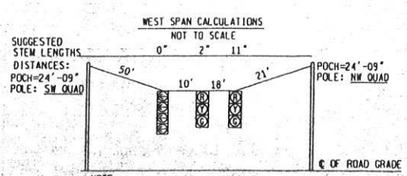
NO.	ITEM	QUANTITIES
(1)	Serv Disconnect	1 Ea
✳ (2)	Controller and Cabinet, Digital Type	1 Ea
✳ (3)	Controller and Cabinet, Digital Type, Delivered	1 Ea
(4)	Controller Fdn, Base Mount	1 Ea
(5)	Hh, Round	2 Ea
(6)	Strain Pole, Steel, Anchor Base, 30 foot	2 Ea
(7)	Strain Pole Fdn, Cased	12 Ft
(8)	Strain Pole Fdn, Uncased	12 Ft
(9)	Span Wire	4 Ea
(10)	TS, One Way Span Wire Mtd (LED)	10 Ea
(11)	Case Sign, One Way, 24 inch by 30 inch, Non-Illuminated	2 Ea
(12)	Bracket, Truss, With 18 Foot Arm	4 Ea
✳ (13)	Autoscope Camera (Solo Pro)	4 Ea
(14)	Conduit, DB, 1, 1 1/2 inch	35 Ft
(15)	Conduit, DB, 3, 3 inch	35 Ft
(16)	Conduit, DB, 4, 3 inch	15 Ft
(17)	Cable, Sec, 600V, 1, 2/C#4	150 Ft

✳ ITEMS TO BE NEGOTIATED, NOT BID









TRAFFIC SIGNAL

MDOT Michigan Department of Transportation	OPENINGS 36	M-59 (HIGHLAND) @ FISK RD	M-59 (HIGHLAND) @ FISK RD
	CYCLIC WATTS 408	WHITE LAKE TOWNSHIP	DATE 11/06/08 · CONT. SEC. 63041 · JOB NO. 100556A · TRAFFIC UNIT SIGNALS · SHEET NO.
	STEADY WATTS 166	OAKLAND COUNTY	
	PLAN 63041-01-026		

DATE: 11/06/08
WORKED ON BY: JJE
DATE:
CHECKED BY:
FILE NAME: 63041010260-py110608ct

Community Profiles

YOU ARE VIEWING DATA FOR:

White Lake Township

7525 Highland Rd
White Lake, MI 48383-2938
http://www.whitelaketwp.com/

SEMCOG MEMBER

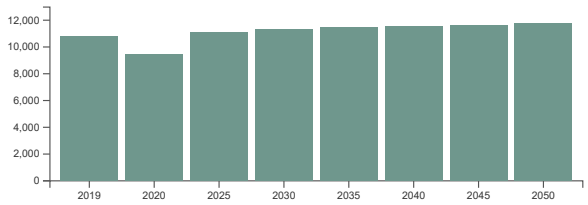
Census 2020 Population: 30,950
Area: 37.1 square miles

VIEW COMMUNITY EXPLORER MAP | VIEW 2020 CENSUS MAP

Economy & Jobs

Link to American Community Survey (ACS) Profiles: **Select a Year** 2018-2022 **Economic**

Forecasted Jobs



Note: The base year for the employment forecast is 2019, as 2020 employment was artificially low due to the COVID recession.

Source: **SEMCOG 2050 Regional Development Forecast**

Forecasted Jobs by Industry Sector

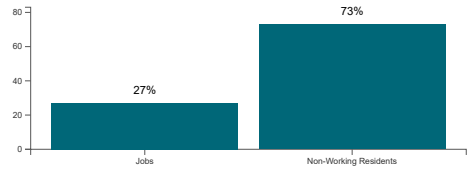
Forecasted Jobs By Industry Sector	2019	2020	2025	2030	2035	2040	2045	2050	Change 2019-2050	Pct Change 2019-2050
Natural Resources, Mining, & Construction	1,022	1,006	1,229	1,253	1,269	1,253	1,236	1,219	197	19.3%
Manufacturing	208	194	223	216	210	195	188	182	-26	-12.5%
Wholesale Trade	293	265	282	297	307	308	307	308	15	5.1%
Retail Trade	2,227	1,940	2,106	2,046	1,930	1,851	1,814	1,768	-459	-20.6%
Transportation, Warehousing, & Utilities	327	319	390	404	415	420	429	434	107	32.7%
Information & Financial Activities	1,716	1,477	1,774	1,793	1,819	1,835	1,846	1,910	194	11.3%
Professional and Technical Services & Corporate HQ	855	813	968	1,023	1,080	1,116	1,168	1,246	391	45.7%
Administrative, Support, & Waste Services	1,132	868	1,051	1,123	1,175	1,207	1,263	1,303	171	15.1%
Education Services	970	897	972	1,016	1,017	1,027	1,033	1,038	68	7%
Healthcare Services	322	284	377	407	433	465	498	532	210	65.2%
Leisure & Hospitality	1,030	762	960	1,004	1,030	1,040	1,045	1,065	35	3.4%
Other Services	557	491	560	587	603	617	621	624	67	12%
Public Administration	158	152	166	172	174	173	173	172	14	8.9%
Total Employment Numbers	10,817	9,468	11,058	11,341	11,462	11,507	11,621	11,801	984	9.1%

Note: The base year for the employment forecast is 2019, as 2020 employment was artificially low due to the COVID recession.

Source: **SEMCOG 2050 Regional Development Forecast**

Daytime Population

Daytime Population	ACS 2016
Jobs	5,496
Non-Working Residents	14,870
Age 15 and under	6,198
Not in labor force	7,856
Unemployed	816
Daytime Population	20,366



Source: **2012-2016 American Community Survey 5-Year Estimates** and **2012-2016 Census Transportation Planning Products Program (CTPP)**. For additional information, visit SEMCOG's **Interactive Commuting Patterns Map**

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

Community Profiles

YOU ARE VIEWING DATA FOR:

White Lake Township

7525 Highland Rd
White Lake, MI 48383-2938
http://www.whitelaketwp.com/

SEMCOG MEMBER

Census 2020 Population: 30,950
Area: 37.1 square miles

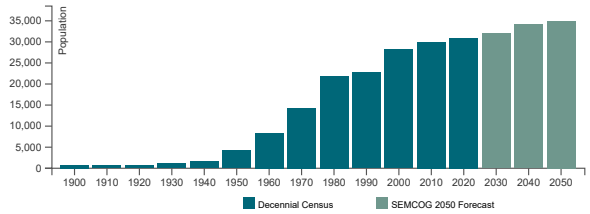
VIEW COMMUNITY EXPLORER MAP | VIEW 2020 CENSUS MAP

Population and Households

Link to American Community Survey (ACS) Profiles: **Select a Year** 2018-2022 **Social** | **Demographic**

Population and Household Estimates for Southeast Michigan, 2022

Population Forecast



Population and Households

Population and Households	Census 2020	Census 2010	Change 2010-2020	Pct Change 2010-2020	SEMCOG Jul 2022	SEMCOG 2050
Total Population	30,950	30,019	931	3.1%	30,739	35,002
Group Quarters Population	88	76	12	15.8%	105	342
Household Population	30,862	29,943	919	3.1%	30,634	34,660
Housing Units	12,776	12,214	562	4.6%	12,949	-
Households (Occupied Units)	12,089	11,262	827	7.3%	12,110	14,325
Residential Vacancy Rate	5.4%	7.8%	-2.4%	-	6.5%	-
Average Household Size	2.55	2.66	-0.11	-	2.53	2.42

Source: **U.S. Census Bureau** and **SEMCOG 2050 Regional Development Forecast**

Components of Population Change

Components of Population Change	2000-2005 Avg.	2006-2010 Avg.	2011-2018 Avg.
Natural Increase (Births - Deaths)	218	89	22
Births	424	309	284
Deaths	206	220	262
Net Migration (Movement In - Movement Out)	112	-59	58
Population Change (Natural Increase + Net Migration)	330	30	80

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

Household Types

Household Types	Census 2010	ACS 2021	Change 2010-2021	Pct Change 2010-2021	SEMCOG 2050
With Seniors 65+	2,520	3,804	1,284	51%	-
Without Seniors	8,742	8,015	-727	-8.3%	-
Live Alone, 65+	882	1,141	259	29.4%	-
Live Alone, <65	1,406	1,127	-279	-19.8%	-
2+ Persons, With children	4,009	3,577	-432	-10.8%	-
2+ Persons, Without children	4,965	5,974	1,009	20.3%	-
Total Households	11,262	11,819	557	4.9%	-

Source: **U.S. Census Bureau**, **Decennial Census**, **2017-2021 American Community Survey 5-Year Estimates**, and **SEMCOG 2050 Regional Development Forecast**

Level of Service Criteria for Stop Sign Controlled Intersections

The level of service criteria are given in Exhibit 20-2. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in queue.

The average total delay for any particular controlled movement is a function three (capacity) factors: distribution of gaps in the major-street traffic stream, driver judgment in selecting gaps through which to execute the desired maneuvers, and the follow-up headways required by each driver in a queue.

The basic capacity model assumes gaps in the conflicting movements are randomly distributed. When traffic signals are present on the major street, upstream of the subject intersection, flows may not be random but will likely have some platoon structure. Although the procedures in this chapter provide a method for approximating the operations of a TWSC intersection with an upstream signal, the operations of such an intersection is arguably best handled by including it in a complete simulation

Exhibit 20-2. Level of Service Criteria for Stop-Controlled Intersections (Motor Vehciles)

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

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

The LOS criteria for TWSC intersections differ somewhat from the criteria used in Chapter 19 for signalized intersections, primarily because user perceptions differ among transportation facility types. The expectation is that a signalized intersection is designed to carry higher traffic volumes and will present greater delay than an unsignalized intersection. Additionally, several driver behavior considerations combine to make delays at signalized intersections less onerous than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, where drivers on the minor approaches to unsignalized intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized than signalized intersections. For these reasons, it is considered that the total delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection.

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

Source: Highway Capacity Manual, 6th Edition. Transportation Research Board, National Research Council

Level of Service for Signalized Intersections

Level of service for signalized intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. LOS can be characterized for the entire intersection, each intersection approach, and each lane group. Specifically, level-of-service (LOS) criteria are stated in terms of the average stopped delay per vehicle. The criteria are given in Exhibit 19-8. Delay may be measured in the field or estimated using procedures presented later in this chapter. Delay is a complex measure and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group in question.

LOS A describes operations with a control delay of 10 s/veh or less. This level is typically assigned when the volume-to-capacity ratio is low and either progression is extremely favorable or the cycle length is very short. If LOS A is the result of favorable progression, most vehicles arrive during a green indication and travel through the intersection without stopping.

LOS B describes operations with control delay between 10 and 20 s/veh. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.

Exhibit 19.8. Level-of-Service Criteria for Signalized Intersections (Motorized Vehicles)

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

1. If the v/c ratio for a lane group exceeds 1.0, a LOS F is assigned to the individual lane group. LOS for approach-based and intersection-wide assessments are determined solely by the control delay.

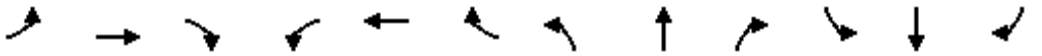
LOS C describes operations with control delay between 20 and 35 s/veh. This level is typically assigned when progression is favorable or the cycle length is moderate. Individual *cycle failures* (i.e. one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number if vehicle stopping is significant, although many vehicles still pass through the intersection without stopping.

LOS D describes operations with control delay between 35 and 55 s/veh. This level is typically assigned when when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.

LOS E describes operations with control delay between 55 and 80 s/veh. This level is typically assigned when when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.

LOS F describes operations with control delay exceeding 80 s/veh or a volume-to-capacity ratio greater than 1.0. This level, considered to be unacceptable to most drivers, often occurs with over-saturation, that is, when arrival flow rates exceed the capacity of the intersection. This level is typically assigned when the volume-to-capacity ratio is high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.

Source: Highway Capacity Manual, 6th Edition. Transportation Research Board, National Research Council



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	47	1192	9	9	792	26	1	0	6	109	0	55
Future Volume (veh/h)	47	1192	9	9	792	26	1	0	6	109	0	55
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1906	1906	1906	1906	1906	1906	2000	2000	2000	1922	1922	1922
Adj Flow Rate, veh/h	51	1282	10	10	900	30	2	0	10	128	0	65
Peak Hour Factor	0.93	0.93	0.93	0.88	0.88	0.88	0.60	0.60	0.60	0.85	0.85	0.85
Percent Heavy Veh, %	6	6	6	6	6	6	0	0	0	5	5	5
Cap, veh/h	354	1558	695	264	1538	51	424	0	480	463	0	461
Arrive On Green	0.07	0.43	0.43	0.07	0.43	0.43	0.28	0.00	0.28	0.28	0.00	0.28
Sat Flow, veh/h	1816	3622	1616	1816	3577	119	1358	0	1695	1371	0	1629
Grp Volume(v), veh/h	51	1282	10	10	456	474	2	0	10	128	0	65
Grp Sat Flow(s),veh/h/ln	1816	1811	1616	1816	1811	1885	1358	0	1695	1371	0	1629
Q Serve(g_s), s	1.3	28.1	0.3	0.2	17.2	17.2	0.1	0.0	0.4	6.7	0.0	2.7
Cycle Q Clear(g_c), s	1.3	28.1	0.3	0.2	17.2	17.2	2.8	0.0	0.4	7.1	0.0	2.7
Prop In Lane	1.00		1.00	1.00		0.06	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	354	1558	695	264	779	811	424	0	480	463	0	461
V/C Ratio(X)	0.14	0.82	0.01	0.04	0.59	0.59	0.00	0.00	0.02	0.28	0.00	0.14
Avail Cap(c_a), veh/h	354	1558	695	264	779	811	424	0	480	463	0	461
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.2	22.6	14.7	15.6	19.5	19.5	25.1	0.0	23.3	25.8	0.0	24.1
Incr Delay (d2), s/veh	0.9	5.1	0.0	0.3	3.2	3.1	0.0	0.0	0.1	1.5	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	11.5	0.1	0.1	7.0	7.3	0.0	0.0	0.2	2.2	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	14.0	27.7	14.7	15.9	22.7	22.6	25.1	0.0	23.3	27.3	0.0	24.7
LnGrp LOS	B	C	B	B	C	C	C	A	C	C	A	C
Approach Vol, veh/h		1343			940			12			193	
Approach Delay, s/veh		27.1			22.6			23.6			26.4	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	45.0		32.0	13.0	45.0		32.0				
Change Period (Y+Rc), s	* 6.3	* 6.3		6.5	* 6.3	* 6.3		6.5				
Max Green Setting (Gmax), s	* 6.7	* 39		25.5	* 6.7	* 39		25.5				
Max Q Clear Time (g_c+I1), s	2.2	30.1		9.1	3.3	19.2		4.8				
Green Ext Time (p_c), s	0.0	5.1		0.5	0.0	5.1		0.0				

Intersection Summary			
HCM 6th Ctrl Delay		25.3	
HCM 6th LOS		C	

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	1309	986	6	0	2
Future Vol, veh/h	3	1309	986	6	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	500	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	89	89	89	89	60	60
Heavy Vehicles, %	7	7	7	7	0	0
Mvmt Flow	3	1471	1108	7	0	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1115	0	-	0	1850	554
Stage 1	-	-	-	-	1108	-
Stage 2	-	-	-	-	742	-
Critical Hdwy	4.24	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.27	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	594	-	-	-	*173	481
Stage 1	-	-	-	-	*282	-
Stage 2	-	-	-	-	*534	-
Platoon blocked, %		-	-	-	1	
Mov Cap-1 Maneuver	594	-	-	-	*172	481
Mov Cap-2 Maneuver	-	-	-	-	*233	-
Stage 1	-	-	-	-	*281	-
Stage 2	-	-	-	-	*534	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	594	-	-	-	481
HCM Lane V/C Ratio	0.006	-	-	-	0.007
HCM Control Delay (s)	11.1	-	-	-	12.5
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.8

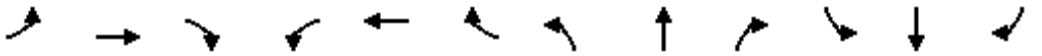
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1297	11	25	952	4	39	0	58	5	1	1
Future Vol, veh/h	1	1297	11	25	952	4	39	0	58	5	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	500	-	330	500	-	120	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	88	88	88	93	93	93	60	60	60
Heavy Vehicles, %	5	5	5	6	6	6	0	0	0	0	0	0
Mvmt Flow	1	1380	12	28	1082	5	42	0	62	8	2	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1087	0	0	1392	0	0	1980	2525	690	1830	2532	541
Stage 1	-	-	-	-	-	-	1382	1382	-	1138	1138	-
Stage 2	-	-	-	-	-	-	598	1143	-	692	1394	-
Critical Hdwy	4.2	-	-	4.22	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.25	-	-	2.26	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	620	-	-	*828	-	-	*98	*28	*566	*158	*27	491
Stage 1	-	-	-	-	-	-	*534	*467	-	*218	*279	-
Stage 2	-	-	-	-	-	-	*461	*277	-	*534	*467	-
Platoon blocked, %		-	-	1	-	-	1	1	1	1	1	
Mov Cap-1 Maneuver	620	-	-	*828	-	-	*90	*27	*566	*137	*26	491
Mov Cap-2 Maneuver	-	-	-	-	-	-	*90	*27	-	*137	*26	-
Stage 1	-	-	-	-	-	-	*533	*467	-	*218	*270	-
Stage 2	-	-	-	-	-	-	*441	*268	-	*474	*467	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	37.8	50.3
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	90	566	620	-	-	* 828	-	-	91
HCM Lane V/C Ratio	0.466	0.11	0.002	-	-	0.034	-	-	0.128
HCM Control Delay (s)	75.9	12.1	10.8	-	-	9.5	-	-	50.3
HCM Lane LOS	F	B	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	2	0.4	0	-	-	0.1	-	-	0.4

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	165	1112	8	6	1486	76	6	2	12	249	0	165
Future Volume (veh/h)	165	1112	8	6	1486	76	6	2	12	249	0	165
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1969	1969	1969	1953	1953	1953	2000	2000	2000	1984	1984	1984
Adj Flow Rate, veh/h	194	1308	9	6	1598	82	10	3	20	280	0	185
Peak Hour Factor	0.85	0.85	0.85	0.93	0.93	0.93	0.60	0.60	0.60	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	3	3	3	0	0	0	1	1	1
Cap, veh/h	231	2142	954	306	2056	105	200	48	319	342	0	357
Arrive On Green	0.06	0.57	0.57	0.06	0.57	0.57	0.21	0.21	0.21	0.21	0.00	0.21
Sat Flow, veh/h	1875	3741	1667	1860	3592	183	1217	225	1502	1398	0	1679
Grp Volume(v), veh/h	194	1308	9	6	822	858	10	0	23	280	0	185
Grp Sat Flow(s),veh/h/ln	1875	1870	1667	1860	1856	1920	1217	0	1727	1398	0	1679
Q Serve(g_s), s	5.1	27.6	0.3	0.1	40.8	41.5	0.9	0.0	1.3	24.0	0.0	11.7
Cycle Q Clear(g_c), s	5.1	27.6	0.3	0.1	40.8	41.5	12.6	0.0	1.3	25.3	0.0	11.7
Prop In Lane	1.00		1.00	1.00		0.10	1.00		0.87	1.00		1.00
Lane Grp Cap(c), veh/h	231	2142	954	306	1062	1099	200	0	367	342	0	357
V/C Ratio(X)	0.84	0.61	0.01	0.02	0.77	0.78	0.05	0.00	0.06	0.82	0.00	0.52
Avail Cap(c_a), veh/h	231	2142	954	306	1062	1099	200	0	367	342	0	357
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.2	16.9	11.0	11.5	19.7	19.8	47.4	0.0	37.7	47.8	0.0	41.8
Incr Delay (d2), s/veh	28.8	1.3	0.0	0.1	5.5	5.5	0.5	0.0	0.3	19.2	0.0	5.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	10.9	0.1	0.1	17.1	17.9	0.3	0.0	0.6	9.7	0.0	5.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.1	18.2	11.0	11.6	25.2	25.3	47.9	0.0	38.0	67.0	0.0	47.1
LnGrp LOS	D	B	B	B	C	C	D	A	D	E	A	D
Approach Vol, veh/h		1511			1686			33			465	
Approach Delay, s/veh		22.6			25.2			41.0			59.1	
Approach LOS		C			C			D			E	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	75.0		32.0	13.0	75.0		32.0				
Change Period (Y+Rc), s	* 6.3	* 6.3		6.5	* 6.3	* 6.3		6.5				
Max Green Setting (Gmax), s	* 6.7	* 69		25.5	* 6.7	* 69		25.5				
Max Q Clear Time (g_c+I1), s	2.1	29.6		27.3	7.1	43.5		14.6				
Green Ext Time (p_c), s	0.0	11.2		0.0	0.0	12.8		0.1				

Intersection Summary			
HCM 6th Ctrl Delay		28.6	
HCM 6th LOS		C	

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	1439	1811	16	2	1
Future Vol, veh/h	4	1439	1811	16	2	1
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	500	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	95	95	75	75
Heavy Vehicles, %	3	3	3	3	0	0
Mvmt Flow	4	1564	1906	17	3	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1924	0	-	0	2697	954
Stage 1	-	-	-	-	1907	-
Stage 2	-	-	-	-	790	-
Critical Hdwy	4.16	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.23	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	299	-	-	-	*14	263
Stage 1	-	-	-	-	*105	-
Stage 2	-	-	-	-	*462	-
Platoon blocked, %		-	-	-	1	
Mov Cap-1 Maneuver	299	-	-	-	*14	263
Mov Cap-2 Maneuver	-	-	-	-	*81	-
Stage 1	-	-	-	-	*104	-
Stage 2	-	-	-	-	*462	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	40.6
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	299	-	-	-	105
HCM Lane V/C Ratio	0.015	-	-	-	0.038
HCM Control Delay (s)	17.2	-	-	-	40.6
HCM Lane LOS	C	-	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	55.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	1382	53	71	1793	11	27	0	40	14	1	7
Future Vol, veh/h	6	1382	53	71	1793	11	27	0	40	14	1	7
Conflicting Peds, #/hr	1	0	0	0	0	1	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	500	-	330	500	-	120	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	95	95	95	80	80	80	60	60	60
Heavy Vehicles, %	3	3	3	3	3	3	8	8	8	4	4	4
Mvmt Flow	7	1519	58	75	1887	12	34	0	50	23	2	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1900	0	0	1577	0	0	2628	3583	760	2812	3629	945
Stage 1	-	-	-	-	-	-	1533	1533	-	2038	2038	-
Stage 2	-	-	-	-	-	-	1095	2050	-	774	1591	-
Critical Hdwy	4.16	-	-	4.16	-	-	7.66	6.66	7.06	7.58	6.58	6.98
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.66	-	6.58	5.58	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.66	-	6.58	5.58	-
Follow-up Hdwy	2.23	-	-	2.23	-	-	3.58	4.08	3.38	3.54	4.04	3.34
Pot Cap-1 Maneuver	306	-	-	409	-	-	~ 11	5	336	~ 8	5	259
Stage 1	-	-	-	-	-	-	115	167	-	57	96	-
Stage 2	-	-	-	-	-	-	218	91	-	353	162	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	306	-	-	409	-	-	~ 6	4	336	~ 6	4	259
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 6	4	-	~ 6	4	-
Stage 1	-	-	-	-	-	-	112	163	-	56	78	-
Stage 2	-	-	-	-	-	-	166	74	-	294	158	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.6	$ 1323.7	$ 2517.5
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	6	336	306	-	-	409	-	-	8
HCM Lane V/C Ratio	5.625	0.149	0.022	-	-	0.183	-	-	4.583
HCM Control Delay (s)	$ 3258.6	17.6	17	-	-	15.8	-	-	$ 2517.5
HCM Lane LOS	F	C	C	-	-	C	-	-	F
HCM 95th %tile Q(veh)	5.7	0.5	0.1	-	-	0.7	-	-	5.9

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection: 1: Private Drive/Fisk Road & Highland Road (M-59)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	69	371	381	123	33	233	242	18	16	129	72
Average Queue (ft)	27	233	215	11	6	127	127	1	2	54	21
95th Queue (ft)	60	338	329	63	22	206	209	8	11	106	52
Link Distance (ft)		1480	1480			471	471		200		1113
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	500			50	500			100		1000	
Storage Blk Time (%)			38	0							
Queuing Penalty (veh)			4	0							

Intersection: 2: Highland Road (M-59) & JOANN Fabric Drive

Movement	EB	WB	SB
Directions Served	L	T	LR
Maximum Queue (ft)	28	4	21
Average Queue (ft)	1	0	2
95th Queue (ft)	11	3	11
Link Distance (ft)		204	320
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	500		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Sunny Beach Boulevard & Highland Road (M-59)

Movement	EB	WB	NB	NB	SB
Directions Served	L	L	L	TR	LTR
Maximum Queue (ft)	8	54	74	69	34
Average Queue (ft)	0	10	29	29	6
95th Queue (ft)	3	34	64	54	26
Link Distance (ft)			520	520	248
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	500	500			
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 1: Private Drive/Fisk Road & Highland Road (M-59)

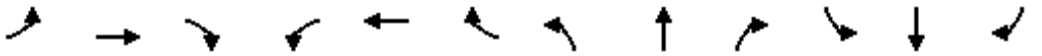
Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	354	339	326	67	32	400	414	26	26	314	155
Average Queue (ft)	149	187	176	4	5	257	257	4	5	169	74
95th Queue (ft)	310	285	274	30	20	354	360	18	19	276	132
Link Distance (ft)		1480	1480			471	471		200		1113
Upstream Blk Time (%)						0	0				
Queuing Penalty (veh)						0	0				
Storage Bay Dist (ft)	500			50	500			100		1000	
Storage Blk Time (%)			26			0					
Queuing Penalty (veh)			2			0					

Intersection: 2: Highland Road (M-59) & JOANN Fabric Drive

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	29	21
Average Queue (ft)	2	2
95th Queue (ft)	15	11
Link Distance (ft)		320
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	500	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Sunny Beach Boulevard & Highland Road (M-59)

Movement	EB	EB	EB	WB	WB	NB	NB	SB
Directions Served	L	T	R	L	T	L	TR	LTR
Maximum Queue (ft)	28	4	8	78	18	432	170	196
Average Queue (ft)	3	0	0	31	1	300	40	99
95th Queue (ft)	17	3	4	66	18	519	162	234
Link Distance (ft)		204			1139	520	520	248
Upstream Blk Time (%)						7	1	11
Queuing Penalty (veh)						0	0	0
Storage Bay Dist (ft)	500		330	500				
Storage Blk Time (%)								
Queuing Penalty (veh)								



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	47	1204	9	9	800	26	1	0	6	110	0	56
Future Volume (veh/h)	47	1204	9	9	800	26	1	0	6	110	0	56
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1906	1906	1906	1906	1906	1906	2000	2000	2000	1922	1922	1922
Adj Flow Rate, veh/h	51	1295	10	10	909	30	2	0	10	129	0	66
Peak Hour Factor	0.93	0.93	0.93	0.88	0.88	0.88	0.60	0.60	0.60	0.85	0.85	0.85
Percent Heavy Veh, %	6	6	6	6	6	6	0	0	0	5	5	5
Cap, veh/h	351	1558	695	261	1539	51	423	0	480	463	0	461
Arrive On Green	0.07	0.43	0.43	0.07	0.43	0.43	0.28	0.00	0.28	0.28	0.00	0.28
Sat Flow, veh/h	1816	3622	1616	1816	3578	118	1357	0	1695	1371	0	1629
Grp Volume(v), veh/h	51	1295	10	10	460	479	2	0	10	129	0	66
Grp Sat Flow(s),veh/h/ln	1816	1811	1616	1816	1811	1885	1357	0	1695	1371	0	1629
Q Serve(g_s), s	1.3	28.5	0.3	0.2	17.5	17.5	0.1	0.0	0.4	6.7	0.0	2.7
Cycle Q Clear(g_c), s	1.3	28.5	0.3	0.2	17.5	17.5	2.8	0.0	0.4	7.1	0.0	2.7
Prop In Lane	1.00		1.00	1.00		0.06	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	351	1558	695	261	779	811	423	0	480	463	0	461
V/C Ratio(X)	0.15	0.83	0.01	0.04	0.59	0.59	0.00	0.00	0.02	0.28	0.00	0.14
Avail Cap(c_a), veh/h	351	1558	695	261	779	811	423	0	480	463	0	461
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.2	22.8	14.7	15.8	19.6	19.6	25.1	0.0	23.3	25.8	0.0	24.1
Incr Delay (d2), s/veh	0.9	5.3	0.0	0.3	3.3	3.2	0.0	0.0	0.1	1.5	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	11.7	0.1	0.1	7.2	7.4	0.0	0.0	0.2	2.2	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	14.1	28.1	14.7	16.0	22.9	22.8	25.2	0.0	23.3	27.3	0.0	24.7
LnGrp LOS	B	C	B	B	C	C	C	A	C	C	A	C
Approach Vol, veh/h		1356			949			12			195	
Approach Delay, s/veh		27.5			22.7			23.6			26.4	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	45.0		32.0	13.0	45.0		32.0				
Change Period (Y+Rc), s	* 6.3	* 6.3		6.5	* 6.3	* 6.3		6.5				
Max Green Setting (Gmax), s	* 6.7	* 39		25.5	* 6.7	* 39		25.5				
Max Q Clear Time (g_c+I1), s	2.2	30.5		9.1	3.3	19.5		4.8				
Green Ext Time (p_c), s	0.0	4.9		0.6	0.0	5.2		0.0				

Intersection Summary			
HCM 6th Ctrl Delay		25.6	
HCM 6th LOS		C	

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	1322	996	6	0	2
Future Vol, veh/h	3	1322	996	6	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	500	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	89	89	89	89	60	60
Heavy Vehicles, %	7	7	7	7	0	0
Mvmt Flow	3	1485	1119	7	0	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1126	0	-	0	1868	560
Stage 1	-	-	-	-	1119	-
Stage 2	-	-	-	-	749	-
Critical Hdwy	4.24	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.27	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	588	-	-	-	*189	477
Stage 1	-	-	-	-	*278	-
Stage 2	-	-	-	-	*502	-
Platoon blocked, %		-	-	-	1	
Mov Cap-1 Maneuver	588	-	-	-	*189	477
Mov Cap-2 Maneuver	-	-	-	-	*235	-
Stage 1	-	-	-	-	*277	-
Stage 2	-	-	-	-	*502	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	588	-	-	-	477
HCM Lane V/C Ratio	0.006	-	-	-	0.007
HCM Control Delay (s)	11.2	-	-	-	12.6
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.9

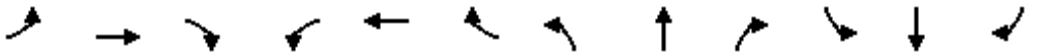
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1310	11	25	962	4	39	0	59	5	1	1
Future Vol, veh/h	1	1310	11	25	962	4	39	0	59	5	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	500	-	330	500	-	120	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	88	88	88	93	93	93	60	60	60
Heavy Vehicles, %	5	5	5	6	6	6	0	0	0	0	0	0
Mvmt Flow	1	1394	12	28	1093	5	42	0	63	8	2	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1098	0	0	1406	0	0	2000	2550	697	1848	2557	547
Stage 1	-	-	-	-	-	-	1396	1396	-	1149	1149	-
Stage 2	-	-	-	-	-	-	604	1154	-	699	1408	-
Critical Hdwy	4.2	-	-	4.22	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.25	-	-	2.26	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	614	-	-	*828	-	-	*92	*26	*566	*149	*25	486
Stage 1	-	-	-	-	-	-	*534	*467	-	*215	*275	-
Stage 2	-	-	-	-	-	-	*457	*274	-	*534	*467	-
Platoon blocked, %		-	-	1	-	-	1	1	1	1	1	
Mov Cap-1 Maneuver	614	-	-	*828	-	-	*84	*25	*566	*129	*25	486
Mov Cap-2 Maneuver	-	-	-	-	-	-	*84	*25	-	*129	*25	-
Stage 1	-	-	-	-	-	-	*533	*467	-	*215	*266	-
Stage 2	-	-	-	-	-	-	*437	*265	-	*473	*467	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	41	52.7
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	84	566	614	-	-	* 828	-	-	87
HCM Lane V/C Ratio	0.499	0.112	0.002	-	-	0.034	-	-	0.134
HCM Control Delay (s)	84.6	12.2	10.9	-	-	9.5	-	-	52.7
HCM Lane LOS	F	B	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	2.1	0.4	0	-	-	0.1	-	-	0.4

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	167	1123	8	6	1501	77	6	2	12	251	0	167
Future Volume (veh/h)	167	1123	8	6	1501	77	6	2	12	251	0	167
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1969	1969	1969	1953	1953	1953	2000	2000	2000	1984	1984	1984
Adj Flow Rate, veh/h	196	1321	9	6	1614	83	10	3	20	282	0	188
Peak Hour Factor	0.85	0.85	0.85	0.93	0.93	0.93	0.60	0.60	0.60	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	3	3	3	0	0	0	1	1	1
Cap, veh/h	228	2142	954	302	2056	105	197	48	319	342	0	357
Arrive On Green	0.06	0.57	0.57	0.06	0.57	0.57	0.21	0.21	0.21	0.21	0.00	0.21
Sat Flow, veh/h	1875	3741	1667	1860	3592	184	1213	225	1502	1398	0	1679
Grp Volume(v), veh/h	196	1321	9	6	830	867	10	0	23	282	0	188
Grp Sat Flow(s),veh/h/ln	1875	1870	1667	1860	1856	1920	1213	0	1727	1398	0	1679
Q Serve(g_s), s	5.2	28.0	0.3	0.1	41.5	42.2	0.9	0.0	1.3	24.2	0.0	11.9
Cycle Q Clear(g_c), s	5.2	28.0	0.3	0.1	41.5	42.2	12.8	0.0	1.3	25.5	0.0	11.9
Prop In Lane	1.00		1.00	1.00		0.10	1.00		0.87	1.00		1.00
Lane Grp Cap(c), veh/h	228	2142	954	302	1062	1099	197	0	367	342	0	357
V/C Ratio(X)	0.86	0.62	0.01	0.02	0.78	0.79	0.05	0.00	0.06	0.82	0.00	0.53
Avail Cap(c_a), veh/h	228	2142	954	302	1062	1099	197	0	367	342	0	357
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.6	17.0	11.0	11.6	19.8	20.0	47.6	0.0	37.7	47.9	0.0	41.9
Incr Delay (d2), s/veh	31.8	1.3	0.0	0.1	5.7	5.8	0.5	0.0	0.3	19.7	0.0	5.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.0	11.1	0.1	0.1	17.4	18.3	0.3	0.0	0.6	9.9	0.0	5.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	56.4	18.3	11.0	11.8	25.6	25.8	48.1	0.0	38.0	67.6	0.0	47.4
LnGrp LOS	E	B	B	B	C	C	D	A	D	E	A	D
Approach Vol, veh/h		1526			1703			33			470	
Approach Delay, s/veh		23.1			25.6			41.1			59.5	
Approach LOS		C			C			D			E	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	75.0		32.0	13.0	75.0		32.0				
Change Period (Y+Rc), s	* 6.3	* 6.3		6.5	* 6.3	* 6.3		6.5				
Max Green Setting (Gmax), s	* 6.7	* 69		25.5	* 6.7	* 69		25.5				
Max Q Clear Time (g_c+I1), s	2.1	30.0		27.5	7.2	44.2		14.8				
Green Ext Time (p_c), s	0.0	11.4		0.0	0.0	12.8		0.1				

Intersection Summary			
HCM 6th Ctrl Delay		29.0	
HCM 6th LOS		C	

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	1453	1829	16	2	1
Future Vol, veh/h	4	1453	1829	16	2	1
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	500	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	95	95	75	75
Heavy Vehicles, %	3	3	3	3	0	0
Mvmt Flow	4	1579	1925	17	3	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1943	0	-	0	2724	964
Stage 1	-	-	-	-	1926	-
Stage 2	-	-	-	-	798	-
Critical Hdwy	4.16	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.23	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	294	-	-	-	*13	259
Stage 1	-	-	-	-	*102	-
Stage 2	-	-	-	-	*462	-
Platoon blocked, %		-	-	-	1	
Mov Cap-1 Maneuver	294	-	-	-	*13	259
Mov Cap-2 Maneuver	-	-	-	-	*78	-
Stage 1	-	-	-	-	*100	-
Stage 2	-	-	-	-	*462	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	41.7
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	294	-	-	-	102
HCM Lane V/C Ratio	0.015	-	-	-	0.039
HCM Control Delay (s)	17.4	-	-	-	41.7
HCM Lane LOS	C	-	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	61.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	1395	54	72	1811	11	27	0	40	14	1	7
Future Vol, veh/h	6	1395	54	72	1811	11	27	0	40	14	1	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	500	-	330	500	-	120	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	95	95	95	80	80	80	60	60	60
Heavy Vehicles, %	3	3	3	3	3	3	8	8	8	4	4	4
Mvmt Flow	7	1533	59	76	1906	12	34	0	50	23	2	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1918	0	0	1592	0	0	2653	3617	767	2839	3664	953
Stage 1	-	-	-	-	-	-	1547	1547	-	2058	2058	-
Stage 2	-	-	-	-	-	-	1106	2070	-	781	1606	-
Critical Hdwy	4.16	-	-	4.16	-	-	7.66	6.66	7.06	7.58	6.58	6.98
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.66	-	6.58	5.58	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.66	-	6.58	5.58	-
Follow-up Hdwy	2.23	-	-	2.23	-	-	3.58	4.08	3.38	3.54	4.04	3.34
Pot Cap-1 Maneuver	301	-	-	403	-	-	~ 10	5	332	~ 8	5	256
Stage 1	-	-	-	-	-	-	113	164	-	55	94	-
Stage 2	-	-	-	-	-	-	214	88	-	350	160	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	301	-	-	403	-	-	~ 5	4	332	~ 6	4	256
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 5	4	-	~ 6	4	-
Stage 1	-	-	-	-	-	-	110	160	-	54	76	-
Stage 2	-	-	-	-	-	-	162	71	-	290	156	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.6	$ 1616	$ 2517.5
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	5	332	301	-	-	403	-	-	8
HCM Lane V/C Ratio	6.75	0.151	0.022	-	-	0.188	-	-	4.583
HCM Control Delay (s)	$ 3983.6	17.8	17.2	-	-	16	-	-	$ 2517.5
HCM Lane LOS	F	C	C	-	-	C	-	-	F
HCM 95th %tile Q(veh)	5.8	0.5	0.1	-	-	0.7	-	-	5.9

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection: 1: Private Drive/Fisk Road & Highland Road (M-59)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	79	399	389	122	36	234	222	17	25	125	70
Average Queue (ft)	27	229	209	8	5	129	124	1	3	57	21
95th Queue (ft)	61	343	322	55	22	199	199	7	15	115	51
Link Distance (ft)		1480	1480			471	471		200		1113
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	500			50	500			100		1000	
Storage Blk Time (%)			39	0							
Queuing Penalty (veh)			4	0							

Intersection: 2: Highland Road (M-59) & JOANN Fabric Drive

Movement	EB	SB
Directions Served	L	LR
Maximum Queue (ft)	30	21
Average Queue (ft)	2	2
95th Queue (ft)	13	11
Link Distance (ft)		320
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	500	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 3: Sunny Beach Boulevard & Highland Road (M-59)

Movement	EB	WB	NB	NB	SB
Directions Served	L	L	L	TR	LTR
Maximum Queue (ft)	4	38	78	65	46
Average Queue (ft)	0	10	30	30	6
95th Queue (ft)	3	31	64	55	29
Link Distance (ft)			520	520	248
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	500	500			
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 1: Private Drive/Fisk Road & Highland Road (M-59)

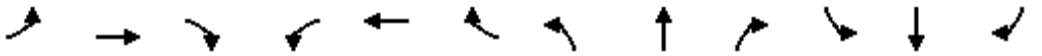
Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	347	396	346	66	32	382	415	22	21	345	174
Average Queue (ft)	180	192	176	7	4	257	260	4	5	182	74
95th Queue (ft)	361	308	288	44	18	354	365	17	17	308	148
Link Distance (ft)		1480	1480			471	471		200		1113
Upstream Blk Time (%)							0				
Queuing Penalty (veh)							0				
Storage Bay Dist (ft)	500			50	500			100		1000	
Storage Blk Time (%)	0	0	26								
Queuing Penalty (veh)	2	0	2								

Intersection: 2: Highland Road (M-59) & JOANN Fabric Drive

Movement	EB	WB	SB
Directions Served	L	T	LR
Maximum Queue (ft)	31	16	21
Average Queue (ft)	4	1	3
95th Queue (ft)	19	11	14
Link Distance (ft)		204	320
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	500		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Sunny Beach Boulevard & Highland Road (M-59)

Movement	EB	EB	EB	WB	NB	NB	SB
Directions Served	L	T	R	L	L	TR	LTR
Maximum Queue (ft)	21	3	18	80	326	74	259
Average Queue (ft)	4	0	1	33	207	25	156
95th Queue (ft)	16	2	10	69	432	57	307
Link Distance (ft)		204			520	520	248
Upstream Blk Time (%)							30
Queuing Penalty (veh)							0
Storage Bay Dist (ft)	500		330	500			
Storage Blk Time (%)							
Queuing Penalty (veh)							



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	47	1259	9	9	847	32	1	0	6	117	0	56
Future Volume (veh/h)	47	1259	9	9	847	32	1	0	6	117	0	56
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1906	1906	1906	1906	1906	1906	2000	2000	2000	1922	1922	1922
Adj Flow Rate, veh/h	51	1354	10	10	962	36	2	0	10	138	0	66
Peak Hour Factor	0.93	0.93	0.93	0.88	0.88	0.88	0.60	0.60	0.60	0.85	0.85	0.85
Percent Heavy Veh, %	6	6	6	6	6	6	0	0	0	5	5	5
Cap, veh/h	335	1558	695	250	1531	57	423	0	480	463	0	461
Arrive On Green	0.07	0.43	0.43	0.07	0.43	0.43	0.28	0.00	0.28	0.28	0.00	0.28
Sat Flow, veh/h	1816	3622	1616	1816	3560	133	1357	0	1695	1371	0	1629
Grp Volume(v), veh/h	51	1354	10	10	489	509	2	0	10	138	0	66
Grp Sat Flow(s),veh/h/ln	1816	1811	1616	1816	1811	1882	1357	0	1695	1371	0	1629
Q Serve(g_s), s	1.3	30.6	0.3	0.2	19.0	19.0	0.1	0.0	0.4	7.3	0.0	2.7
Cycle Q Clear(g_c), s	1.3	30.6	0.3	0.2	19.0	19.0	2.8	0.0	0.4	7.6	0.0	2.7
Prop In Lane	1.00		1.00	1.00		0.07	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	335	1558	695	250	779	809	423	0	480	463	0	461
V/C Ratio(X)	0.15	0.87	0.01	0.04	0.63	0.63	0.00	0.00	0.02	0.30	0.00	0.14
Avail Cap(c_a), veh/h	335	1558	695	250	779	809	423	0	480	463	0	461
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.6	23.3	14.7	16.5	20.0	20.0	25.1	0.0	23.3	26.0	0.0	24.1
Incr Delay (d2), s/veh	1.0	6.9	0.0	0.3	3.8	3.7	0.0	0.0	0.1	1.6	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	12.8	0.1	0.1	7.8	8.1	0.0	0.0	0.2	2.4	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	14.5	30.2	14.7	16.8	23.9	23.7	25.2	0.0	23.3	27.6	0.0	24.7
LnGrp LOS	B	C	B	B	C	C	C	A	C	C	A	C
Approach Vol, veh/h		1415			1008			12			204	
Approach Delay, s/veh		29.6			23.7			23.6			26.7	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	45.0		32.0	13.0	45.0		32.0				
Change Period (Y+Rc), s	* 6.3	* 6.3		6.5	* 6.3	* 6.3		6.5				
Max Green Setting (Gmax), s	* 6.7	* 39		25.5	* 6.7	* 39		25.5				
Max Q Clear Time (g_c+I1), s	2.2	32.6		9.6	3.3	21.0		4.8				
Green Ext Time (p_c), s	0.0	4.0		0.6	0.0	5.4		0.0				

Intersection Summary		
HCM 6th Ctrl Delay		27.1
HCM 6th LOS		C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	1357	1037	6	0	2
Future Vol, veh/h	3	1357	1037	6	0	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	500	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	89	89	89	89	60	60
Heavy Vehicles, %	7	7	7	7	0	0
Mvmt Flow	3	1525	1165	7	0	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1172	0	-	0	1934	583
Stage 1	-	-	-	-	1165	-
Stage 2	-	-	-	-	769	-
Critical Hdwy	4.24	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.27	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	564	-	-	-	*155	461
Stage 1	-	-	-	-	*263	-
Stage 2	-	-	-	-	*502	-
Platoon blocked, %		-	-	-	1	
Mov Cap-1 Maneuver	564	-	-	-	*155	461
Mov Cap-2 Maneuver	-	-	-	-	*216	-
Stage 1	-	-	-	-	*262	-
Stage 2	-	-	-	-	*502	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	564	-	-	-	461
HCM Lane V/C Ratio	0.006	-	-	-	0.007
HCM Control Delay (s)	11.4	-	-	-	12.9
HCM Lane LOS	B	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1345	11	25	1003	4	39	0	59	5	1	1
Future Vol, veh/h	1	1345	11	25	1003	4	39	0	59	5	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	500	-	330	500	-	120	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	88	88	88	93	93	93	60	60	60
Heavy Vehicles, %	5	5	5	6	6	6	0	0	0	0	0	0
Mvmt Flow	1	1431	12	28	1140	5	42	0	63	8	2	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1145	0	0	1443	0	0	2060	2634	716	1914	2641	570
Stage 1	-	-	-	-	-	-	1433	1433	-	1196	1196	-
Stage 2	-	-	-	-	-	-	627	1201	-	718	1445	-
Critical Hdwy	4.2	-	-	4.22	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.25	-	-	2.26	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	589	-	-	*777	-	-	*86	*21	*532	*142	*20	470
Stage 1	-	-	-	-	-	-	*502	*439	-	*201	*262	-
Stage 2	-	-	-	-	-	-	*443	*260	-	*502	*439	-
Platoon blocked, %		-	-	1	-	-	1	1	1	1	1	
Mov Cap-1 Maneuver	589	-	-	*777	-	-	*78	*20	*532	*122	*19	470
Mov Cap-2 Maneuver	-	-	-	-	-	-	*78	*20	-	*122	*19	-
Stage 1	-	-	-	-	-	-	*501	*438	-	*201	*253	-
Stage 2	-	-	-	-	-	-	*423	*251	-	*441	*438	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	45.6	63.5
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	78	532	589	-	-	* 777	-	-	73
HCM Lane V/C Ratio	0.538	0.119	0.002	-	-	0.037	-	-	0.16
HCM Control Delay (s)	95.4	12.7	11.1	-	-	9.8	-	-	63.5
HCM Lane LOS	F	B	B	-	-	A	-	-	F
HCM 95th %tile Q(veh)	2.3	0.4	0	-	-	0.1	-	-	0.5

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2.3

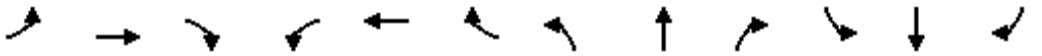
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1278	109	75	964	87	82
Future Vol, veh/h	1278	109	75	964	87	82
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	500	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	92	92
Heavy Vehicles, %	7	7	7	7	2	2
Mvmt Flow	1436	122	84	1083	95	89

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1558	0	2207	779
Stage 1	-	-	-	-	1497	-
Stage 2	-	-	-	-	710	-
Critical Hdwy	-	-	4.24	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.27	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	678	-	~ 61	*563
Stage 1	-	-	-	-	470	-
Stage 2	-	-	-	-	448	-
Platoon blocked, %	-	-	1	-	1	1
Mov Cap-1 Maneuver	-	-	678	-	~ 53	*563
Mov Cap-2 Maneuver	-	-	-	-	219	-
Stage 1	-	-	-	-	470	-
Stage 2	-	-	-	-	392	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	32
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	311	-	-	678	-
HCM Lane V/C Ratio	0.591	-	-	0.124	-
HCM Control Delay (s)	32	-	-	11.1	-
HCM Lane LOS	D	-	-	B	-
HCM 95th %tile Q(veh)	3.5	-	-	0.4	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	167	1149	8	6	1524	84	6	2	12	259	0	167
Future Volume (veh/h)	167	1149	8	6	1524	84	6	2	12	259	0	167
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1969	1969	1969	1953	1953	1953	2000	2000	2000	1984	1984	1984
Adj Flow Rate, veh/h	196	1352	9	6	1639	90	10	3	20	291	0	188
Peak Hour Factor	0.85	0.85	0.85	0.93	0.93	0.93	0.60	0.60	0.60	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	3	3	3	0	0	0	1	1	1
Cap, veh/h	223	2142	954	295	2048	112	197	48	319	342	0	357
Arrive On Green	0.06	0.57	0.57	0.06	0.57	0.57	0.21	0.21	0.21	0.21	0.00	0.21
Sat Flow, veh/h	1875	3741	1667	1860	3578	195	1213	225	1502	1398	0	1679
Grp Volume(v), veh/h	196	1352	9	6	845	884	10	0	23	291	0	188
Grp Sat Flow(s),veh/h/ln	1875	1870	1667	1860	1856	1918	1213	0	1727	1398	0	1679
Q Serve(g_s), s	5.2	29.0	0.3	0.1	42.9	43.8	0.9	0.0	1.3	24.2	0.0	11.9
Cycle Q Clear(g_c), s	5.2	29.0	0.3	0.1	42.9	43.8	12.8	0.0	1.3	25.5	0.0	11.9
Prop In Lane	1.00		1.00	1.00		0.10	1.00		0.87	1.00		1.00
Lane Grp Cap(c), veh/h	223	2142	954	295	1062	1098	197	0	367	342	0	357
V/C Ratio(X)	0.88	0.63	0.01	0.02	0.80	0.80	0.05	0.00	0.06	0.85	0.00	0.53
Avail Cap(c_a), veh/h	223	2142	954	295	1062	1098	197	0	367	342	0	357
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.2	17.2	11.0	11.9	20.1	20.3	47.6	0.0	37.7	48.3	0.0	41.9
Incr Delay (d2), s/veh	35.6	1.4	0.0	0.1	6.2	6.3	0.5	0.0	0.3	22.5	0.0	5.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	11.5	0.1	0.1	18.1	19.1	0.3	0.0	0.6	10.4	0.0	5.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	60.8	18.6	11.0	12.0	26.3	26.6	48.1	0.0	38.0	70.7	0.0	47.4
LnGrp LOS	E	B	B	B	C	C	D	A	D	E	A	D
Approach Vol, veh/h		1557			1735			33			479	
Approach Delay, s/veh		23.9			26.4			41.1			61.6	
Approach LOS		C			C			D			E	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	75.0		32.0	13.0	75.0		32.0				
Change Period (Y+Rc), s	* 6.3	* 6.3		6.5	* 6.3	* 6.3		6.5				
Max Green Setting (Gmax), s	* 6.7	* 69		25.5	* 6.7	* 69		25.5				
Max Q Clear Time (g_c+I1), s	2.1	31.0		27.5	7.2	45.8		14.8				
Green Ext Time (p_c), s	0.0	11.7		0.0	0.0	12.7		0.1				

Intersection Summary			
HCM 6th Ctrl Delay		29.9	
HCM 6th LOS		C	

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	1486	1865	16	2	1
Future Vol, veh/h	4	1486	1865	16	2	1
Conflicting Peds, #/hr	1	0	0	1	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	500	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	95	95	75	75
Heavy Vehicles, %	3	3	3	3	0	0
Mvmt Flow	4	1615	1963	17	3	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1981	0	-	0	2780	983
Stage 1	-	-	-	-	1964	-
Stage 2	-	-	-	-	816	-
Critical Hdwy	4.16	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	2.23	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	284	-	-	-	*11	252
Stage 1	-	-	-	-	*97	-
Stage 2	-	-	-	-	*438	-
Platoon blocked, %		-	-	-	1	
Mov Cap-1 Maneuver	284	-	-	-	*10	252
Mov Cap-2 Maneuver	-	-	-	-	*74	-
Stage 1	-	-	-	-	*96	-
Stage 2	-	-	-	-	*438	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	43.7
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	284	-	-	-	97
HCM Lane V/C Ratio	0.015	-	-	-	0.041
HCM Control Delay (s)	17.9	-	-	-	43.7
HCM Lane LOS	C	-	-	-	E
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	74.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	1428	54	72	1847	11	27	0	40	14	1	7
Future Vol, veh/h	6	1428	54	72	1847	11	27	0	40	14	1	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	500	-	330	500	-	120	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	95	95	95	80	80	80	60	60	60
Heavy Vehicles, %	3	3	3	3	3	3	8	8	8	4	4	4
Mvmt Flow	7	1569	59	76	1944	12	34	0	50	23	2	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1956	0	0	1628	0	0	2708	3691	785	2895	3738	972
Stage 1	-	-	-	-	-	-	1583	1583	-	2096	2096	-
Stage 2	-	-	-	-	-	-	1125	2108	-	799	1642	-
Critical Hdwy	4.16	-	-	4.16	-	-	7.66	6.66	7.06	7.58	6.58	6.98
Critical Hdwy Stg 1	-	-	-	-	-	-	6.66	5.66	-	6.58	5.58	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.66	5.66	-	6.58	5.58	-
Follow-up Hdwy	2.23	-	-	2.23	-	-	3.58	4.08	3.38	3.54	4.04	3.34
Pot Cap-1 Maneuver	291	-	-	391	-	-	~ 9	4	323	~ 7	4	248
Stage 1	-	-	-	-	-	-	107	158	-	52	90	-
Stage 2	-	-	-	-	-	-	208	84	-	341	153	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	291	-	-	391	-	-	~ 4	3	323	~ 5	3	248
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 4	3	-	~ 5	3	-
Stage 1	-	-	-	-	-	-	104	154	-	51	73	-
Stage 2	-	-	-	-	-	-	156	68	-	281	149	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.6	$ 2054.8	$ 2929.4
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	4	323	291	-	-	391	-	-	7
HCM Lane V/C Ratio	8.438	0.155	0.023	-	-	0.194	-	-	5.238
HCM Control Delay (s)	$ 5071.9	18.2	17.7	-	-	16.4	-	-	$ 2929.4
HCM Lane LOS	F	C	C	-	-	C	-	-	F
HCM 95th %tile Q(veh)	5.9	0.5	0.1	-	-	0.7	-	-	6

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1428	63	72	1794	66	62
Future Vol, veh/h	1428	63	72	1794	66	62
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	500	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	95	95	92	92
Heavy Vehicles, %	3	3	3	3	2	2
Mvmt Flow	1552	68	76	1888	72	67

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1620	0	2682	810
Stage 1	-	-	-	-	1586	-
Stage 2	-	-	-	-	1096	-
Critical Hdwy	-	-	4.16	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.23	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	*726	-	*~ 15	*488
Stage 1	-	-	-	-	*460	-
Stage 2	-	-	-	-	*282	-
Platoon blocked, %	-	-	1	-	1	1
Mov Cap-1 Maneuver	-	-	*726	-	*~ 13	*488
Mov Cap-2 Maneuver	-	-	-	-	*154	-
Stage 1	-	-	-	-	*460	-
Stage 2	-	-	-	-	*252	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	42
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	230	-	-	* 726	-
HCM Lane V/C Ratio	0.605	-	-	0.104	-
HCM Control Delay (s)	42	-	-	10.5	-
HCM Lane LOS	E	-	-	B	-
HCM 95th %tile Q(veh)	3.5	-	-	0.3	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection: 1: Private Drive/Fisk Road & Highland Road (M-59)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	179	494	474	106	30	244	234	17	30	139	72
Average Queue (ft)	37	274	260	9	6	134	130	1	4	59	23
95th Queue (ft)	114	424	407	58	24	209	201	7	16	115	52
Link Distance (ft)		1480	1480			471	471		200		1113
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	500			50	500			100		1000	
Storage Blk Time (%)		0	44	0							
Queuing Penalty (veh)		0	4	0							

Intersection: 2: Highland Road (M-59) & JOANN Fabric Drive

Movement	EB	WB	SB
Directions Served	L	T	LR
Maximum Queue (ft)	17	8	20
Average Queue (ft)	1	0	1
95th Queue (ft)	9	6	9
Link Distance (ft)		204	320
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	500		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Sunny Beach Boulevard & Highland Road (M-59)

Movement	EB	WB	NB	NB	SB
Directions Served	L	L	L	TR	LTR
Maximum Queue (ft)	9	39	114	65	38
Average Queue (ft)	1	11	45	26	7
95th Queue (ft)	6	32	105	49	28
Link Distance (ft)			520	520	248
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	500	500			
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 4: Site Drive & Highland Road (M-59)

Movement	EB	WB	WB	NB
Directions Served	TR	L	T	LR
Maximum Queue (ft)	13	86	40	233
Average Queue (ft)	1	35	1	156
95th Queue (ft)	8	74	21	257
Link Distance (ft)	408		134	190
Upstream Blk Time (%)				41
Queuing Penalty (veh)				0
Storage Bay Dist (ft)		500		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

Zone wide Queuing Penalty: 4

Intersection: 1: Private Drive/Fisk Road & Highland Road (M-59)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	327	354	343	105	27	393	408	30	22	352	190
Average Queue (ft)	143	199	182	6	3	262	270	3	5	193	76
95th Queue (ft)	273	294	280	47	17	354	372	17	19	321	145
Link Distance (ft)		1480	1480			471	471		200		1113
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	500			50	500			100		1000	
Storage Blk Time (%)			27								
Queuing Penalty (veh)			2								

Intersection: 2: Highland Road (M-59) & JOANN Fabric Drive

Movement	EB	EB	SB
Directions Served	L	T	LR
Maximum Queue (ft)	35	4	23
Average Queue (ft)	3	0	3
95th Queue (ft)	19	3	15
Link Distance (ft)		134	320
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	500		
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: Sunny Beach Boulevard & Highland Road (M-59)

Movement	EB	EB	EB	WB	NB	NB	SB
Directions Served	L	T	R	L	L	TR	LTR
Maximum Queue (ft)	26	8	12	86	461	160	207
Average Queue (ft)	4	0	0	34	328	44	129
95th Queue (ft)	18	4	5	71	550	195	266
Link Distance (ft)		204			520	520	248
Upstream Blk Time (%)					8	3	21
Queuing Penalty (veh)					0	0	0
Storage Bay Dist (ft)	500		330	500			
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 4: Site Drive & Highland Road (M-59)

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	72	223
Average Queue (ft)	33	197
95th Queue (ft)	63	220
Link Distance (ft)		190
Upstream Blk Time (%)		96
Queuing Penalty (veh)		0
Storage Bay Dist (ft)	500	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Zone Summary

Zone wide Queuing Penalty: 2

Intersection	
Int Delay, s/veh	1.7

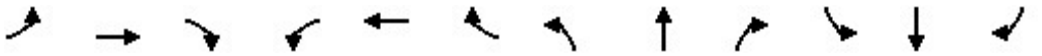
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1278	109	75	964	87	82
Future Vol, veh/h	1278	109	75	964	87	82
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	500	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	92	92
Heavy Vehicles, %	7	7	7	7	2	2
Mvmt Flow	1436	122	84	1083	95	89

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1558	0	2146	718
Stage 1	-	-	-	-	1436	-
Stage 2	-	-	-	-	710	-
Critical Hdwy	-	-	4.24	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.27	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	678	-	*~ 73	*563
Stage 1	-	-	-	-	*531	-
Stage 2	-	-	-	-	*448	-
Platoon blocked, %	-	-	1	-	1	1
Mov Cap-1 Maneuver	-	-	678	-	*~ 64	*563
Mov Cap-2 Maneuver	-	-	-	-	*234	-
Stage 1	-	-	-	-	*531	-
Stage 2	-	-	-	-	*392	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	21.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	234	563	-	-	678	-
HCM Lane V/C Ratio	0.404	0.158	-	-	0.124	-
HCM Control Delay (s)	30.4	12.6	-	-	11.1	-
HCM Lane LOS	D	B	-	-	B	-
HCM 95th %tile Q(veh)	1.8	0.6	-	-	0.4	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	167	1149	8	6	1524	84	6	2	12	259	0	167
Future Volume (veh/h)	167	1149	8	6	1524	84	6	2	12	259	0	167
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1969	1969	1969	1953	1953	1953	2000	2000	2000	1984	1984	1984
Adj Flow Rate, veh/h	196	1352	9	6	1639	90	10	3	20	291	0	188
Peak Hour Factor	0.85	0.85	0.85	0.93	0.93	0.93	0.60	0.60	0.60	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	3	3	3	0	0	0	1	1	1
Cap, veh/h	258	1986	885	269	1750	96	254	57	382	401	0	427
Arrive On Green	0.10	0.53	0.53	0.06	0.49	0.49	0.25	0.25	0.25	0.25	0.00	0.25
Sat Flow, veh/h	1875	3741	1667	1860	3578	195	1213	225	1502	1398	0	1680
Grp Volume(v), veh/h	196	1352	9	6	845	884	10	0	23	291	0	188
Grp Sat Flow(s),veh/h/ln	1875	1870	1667	1860	1856	1918	1213	0	1728	1398	0	1680
Q Serve(g_s), s	7.3	31.9	0.3	0.2	51.3	52.4	0.8	0.0	1.2	23.8	0.0	11.3
Cycle Q Clear(g_c), s	7.3	31.9	0.3	0.2	51.3	52.4	12.1	0.0	1.2	25.1	0.0	11.3
Prop In Lane	1.00		1.00	1.00		0.10	1.00		0.87	1.00		1.00
Lane Grp Cap(c), veh/h	258	1986	885	269	908	938	254	0	439	401	0	427
V/C Ratio(X)	0.76	0.68	0.01	0.02	0.93	0.94	0.04	0.00	0.05	0.73	0.00	0.44
Avail Cap(c_a), veh/h	258	1986	885	269	908	938	254	0	439	401	0	427
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	31.9	20.7	13.3	15.5	28.8	29.0	42.7	0.0	33.8	43.3	0.0	37.6
Incr Delay (d2), s/veh	18.9	1.9	0.0	0.2	17.3	18.3	0.3	0.0	0.2	10.9	0.0	3.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	13.1	0.1	0.1	24.9	26.4	0.3	0.0	0.5	9.0	0.0	4.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	50.8	22.6	13.3	15.7	46.0	47.3	43.0	0.0	34.1	54.2	0.0	40.9
LnGrp LOS	D	C	B	B	D	D	D	A	C	D	A	D
Approach Vol, veh/h		1557			1735			33			479	
Approach Delay, s/veh		26.1			46.6			36.8			49.0	
Approach LOS		C			D			D			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.0	70.0		37.0	18.0	65.0		37.0				
Change Period (Y+Rc), s	* 6.3	* 6.3		6.5	* 6.3	* 6.3		6.5				
Max Green Setting (Gmax), s	* 6.7	* 64		30.5	* 12	* 59		30.5				
Max Q Clear Time (g_c+I1), s	2.2	33.9		27.1	9.3	54.4		14.1				
Green Ext Time (p_c), s	0.0	10.9		0.7	0.1	3.4		0.1				

Intersection Summary			
HCM 6th Ctrl Delay		38.4	
HCM 6th LOS		D	

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1428	63	72	1794	66	62
Future Vol, veh/h	1428	63	72	1794	66	62
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	500	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	95	95	92	92
Heavy Vehicles, %	3	3	3	3	2	2
Mvmt Flow	1552	68	76	1888	72	67

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1620	0	2648	776
Stage 1	-	-	-	-	1552	-
Stage 2	-	-	-	-	1096	-
Critical Hdwy	-	-	4.16	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.23	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	*726	-	*~ 17	*488
Stage 1	-	-	-	-	*460	-
Stage 2	-	-	-	-	*282	-
Platoon blocked, %	-	-	1	-	1	1
Mov Cap-1 Maneuver	-	-	*726	-	*~ 15	*488
Mov Cap-2 Maneuver	-	-	-	-	*155	-
Stage 1	-	-	-	-	*460	-
Stage 2	-	-	-	-	*252	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	30.7
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	155	488	-	-	* 726	-
HCM Lane V/C Ratio	0.463	0.138	-	-	0.104	-
HCM Control Delay (s)	46.8	13.6	-	-	10.5	-
HCM Lane LOS	E	B	-	-	B	-
HCM 95th %tile Q(veh)	2.1	0.5	-	-	0.3	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection: 4: Site Drive & Highland Road (M-59)

Movement	EB	WB	WB	WB	NB	NB
Directions Served	R	L	T	T	L	R
Maximum Queue (ft)	21	89	46	23	189	169
Average Queue (ft)	1	34	3	1	112	52
95th Queue (ft)	9	75	31	16	213	136
Link Distance (ft)			122	122	178	178
Upstream Blk Time (%)			0	0	24	4
Queuing Penalty (veh)			0	0	0	0
Storage Bay Dist (ft)	100	500				
Storage Blk Time (%)			0			
Queuing Penalty (veh)			0			

Zone Summary

Zone wide Queuing Penalty: 0

Intersection: 1: Private Drive/Fisk Road & Highland Road (M-59)

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	R	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	185	323	297	81	24	485	496	21	38	289	166
Average Queue (ft)	87	210	204	5	4	394	398	2	6	159	78
95th Queue (ft)	156	293	280	43	17	524	524	13	23	255	147
Link Distance (ft)		1480	1480			471	471		200		1113
Upstream Blk Time (%)						10	11				
Queuing Penalty (veh)						82	85				
Storage Bay Dist (ft)	500			50	500			100		1000	
Storage Blk Time (%)			31			10					
Queuing Penalty (veh)			3			1					

Intersection: 4: Site Drive & Highland Road (M-59)

Movement	EB	WB	WB	WB	NB	NB
Directions Served	R	L	T	T	L	R
Maximum Queue (ft)	9	96	122	97	193	189
Average Queue (ft)	1	35	27	23	182	83
95th Queue (ft)	7	76	115	103	198	222
Link Distance (ft)			122	122	178	178
Upstream Blk Time (%)		0	3	4	96	38
Queuing Penalty (veh)		0	32	34	0	0
Storage Bay Dist (ft)	100	500				
Storage Blk Time (%)		0	3			
Queuing Penalty (veh)		0	2			

Zone Summary

Zone wide Queuing Penalty: 238

Coffee Shop Drive Through Lane
95th Percentile Probability - Drive Through Queue Length (# of Vehicles)

Volume = 89 vph
service rate = 80 veh/hr
λ = 1.1125

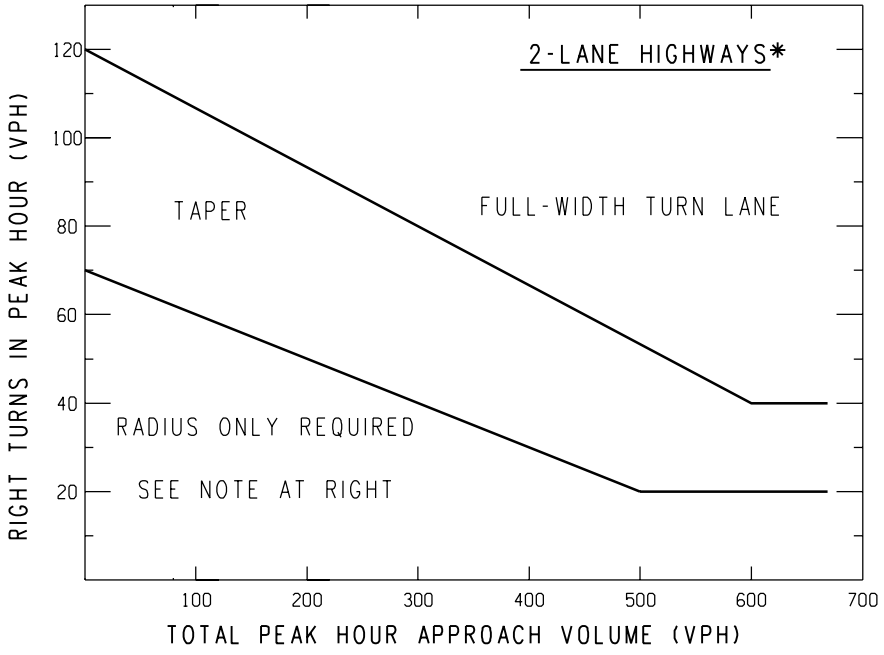
λ^x	1 No Veh in Cycle	2 X	3 X!	4 P = (e^(-λ))(λ^x)/X!	5 ΣP	6 P* # Cycle containing Volume in 1	7 Σ Cycles in 6	8 Volume in Cycle (1*6)	9 Σ volume	Poisson Queue
1.0000	0	0	1	32.87%	32.87%	26	26	0	0	NO
1.1125	1	1	1	36.57%	69.45%	29	56	29	29	NO
1.2377	2	2	2	20.34%	89.79%	16	11	33	62	NO
1.3769	3	3	6	7.54%	97.33%	6	17	18	80	NO
1.5318	4	4	24	2.10%	99.43%	2	19	7	87	NO
1.7041	5	5	120	0.47%	99.90%	0	19	2	88	MET
1.8958	6	6	720	0.09%	99.98%	0	19	0	89	MET
2.1091	7	7	5040	0.01%	100.00%	0	19	0	89	MET
2.3464	8	8	40320	0.00%	100.00%	0	19	0	89	MET
2.6104	9	9	362880	0.00%	100.00%	0	19	0	89	MET
2.9040	10	10	3628800	0.00%	100.00%	0	19	0	89	MET
3.2307	11	11	39916800	0.00%	100.00%	0	19	0	89	MET

Fast-Food Drive Through Lane
95th Percentile Probability - Drive Through Queue Length (# of Vehicles)

Volume = 39 vph
service rate = 90 veh/hr
λ = 0.433333

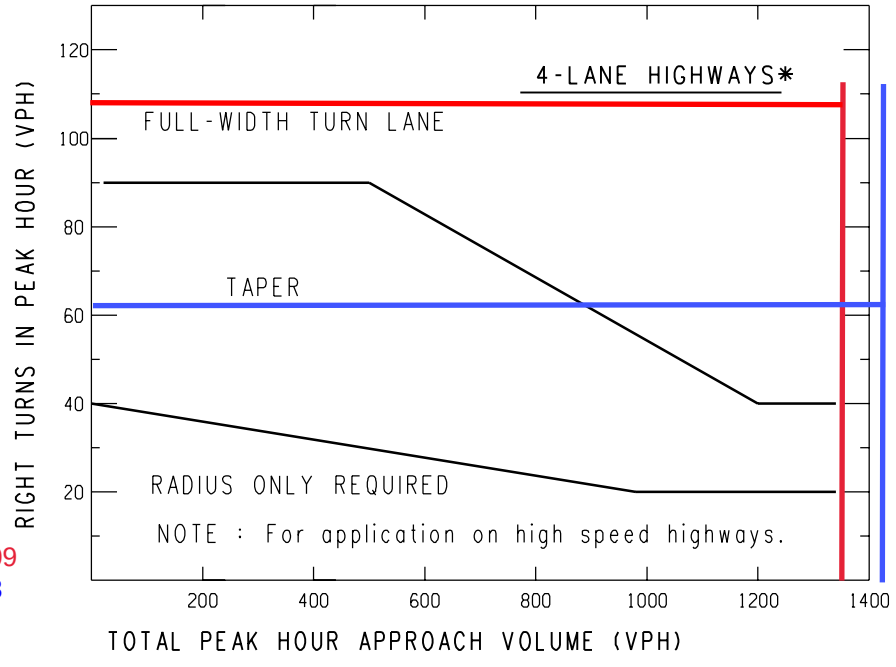
	1	2	3	4	5	6	7	8	9	
λ^x	No Veh in Cycle	X	X!	P = (e^(-λ))(λ^x)/X!	ΣP	P* # Cycle containing Volume in 1	Σ Cycles in 6	Volume in Cycle (1*6)	Σ volume	Poisson Queue
1.0000	0	0	1	64.83%	64.83%	58	58	0	0	NO
0.4333	1	1	1	28.09%	92.93%	25	84	25	25	NO
0.1878	2	2	2	6.09%	99.02%	5	11	11	36	NO
0.0814	3	3	6	0.88%	99.90%	1	12	2	39	NO
0.0353	4	4	24	0.10%	99.99%	0	12	0	39	MET
0.0153	5	5	120	0.01%	100.00%	0	12	0	39	MET
0.0066	6	6	720	0.00%	100.00%	0	12	0	39	MET
0.0029	7	7	5040	0.00%	100.00%	0	12	0	39	MET
0.0012	8	8	40320	0.00%	100.00%	0	12	0	39	MET
0.0005	9	9	362880	0.00%	100.00%	0	12	0	39	MET
0.0002	10	10	3628800	0.00%	100.00%	0	12	0	39	MET
0.0001	11	11	39916800	0.00%	100.00%	0	12	0	39	MET

EB Highland Road (M-59) & Site Drive



NOTE:
For posted speeds at or under 45 mph, peak hour right turns greater than 40 vph, and total peak hour approach less than 300 vph, adjust right turn volumes.

Adjust peak hour right turns = Peak hour right turns - 20



*If a center left-turn lane exists(i.e. 3 or 5 lane highway), subtract the number of left turns in approach volume from the total approach volume to get an adjusted total approach volume.

AM=109
PM=63

AM=1388
PM=1491

RT Lane Recommended

Sample Problem:
The Design Speed is 55 mph. The Peak Hour Approach Volume is 300 vph. The Number of Right Turns in the Peak Hour is 100 vph. Determine if a right turn lane is recommended.

Solution:
Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus,a right-turn lane may be recommended.

MDOT Michigan Department of Transportation

TRAFFIC AND SAFETY NOTE

TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS

DRAWN BY: MTS	08/05/2004	604A	SHEET 2 OF 2
CHECKED BY: JAT	PLAN DATE:		
FILE: K:/DGN/ts notes/Note604A tsn.dgn		REV. 08/05/2004	

CONSULTING GROUP

Report on Geotechnical Investigation

Highland Road Commercial Development
9101 Highland Road
White Lake Township, Michigan
48071

Latitude 42.657084° N
Longitude 83.465138° W

Prepared for:

Affinity 10 Investments
44512 South Shore Street
Waterford, Michigan 48328

G2 Project No. 240697
September 24, 2024

g2consultinggroup.com

Headquarters	1866 Woodslee St	Troy, MI 48083	P 248.680.0400	F 248.680.9745
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CONSULTING GROUP

September 24, 2024

Mr. Thomas Hannawa
Affinity 10 Investments
44512 South Shore Street
Waterford, Michigan 48328

c/o Ms. Susan Bowers
Bowers + Associates
2400 South Huron Parkway
Ann Arbor, Michigan 48104

Re: Report on Geotechnical Investigation
Highland Road Commercial Development
9101 Highland Road
White Lake Township, Michigan 48386
G2 Project No. 240697

Dear Mr. Hannawa:

We have completed the geotechnical investigation for the proposed Highland Road Commercial Development in White Lake Township, Michigan. This report presents the results of our observations, analyses, and our recommendations for earthwork operations, foundation and pavement design, and construction considerations as they relate to the geotechnical conditions on site.

We appreciate the opportunity to be of service to Affinity 10 Investments and Bowers & Associates and look forward to discussing the recommendations presented. In the meantime, if you have any questions regarding the report or any other matter pertaining to the project, please call us.

Sincerely,

G2 Consulting Group, LLC

Michael J. Bajorek, P.E.
Staff Engineer

Amy L. Schneider, P.E.
Project Manager

MJB/ALS/ljv

Enclosures

EXECUTIVE SUMMARY

We understand the proposed project consists of demolition of the existing buildings and constructing two new commercial single-story, slab on grade buildings with drive-thrus totaling 13,622 square feet. Portland cement concrete pavement will be constructed in the drive-thru alignments and bituminous concrete pavement will be constructed throughout the remainder of the property. Three dumpster enclosures will be constructed at the south side of the development. Associated utilities will be installed throughout the property, including a detention pond south of the pavements.

Approximately 2 to 3 inches of bituminous concrete underlain by 2 to 6 inches of aggregate base are present at soil borings B-11 and B-14. Approximately 8 to 20 inches of topsoil are present at the remaining boring locations. Very loose silty sand fill with is present below the topsoil and pavement section at borings B-10, B-11, and B-13 and extends to approximate depths ranging from 3 to 6-1/2 feet below grade. At boring B-4, approximately 13-1/2 feet of very loose silty sand fill and hard sandy clay fill are present at the boring location. Native stiff to very stiff sandy clay underlies the topsoil at borings B-1 and B-6 (extending to approximate depths of 3 to 4 feet below grade) and the fill at borings B-10 and B-11 (extending to approximate depths of 6 to 8-1/2 feet). Native very loose to medium compact granular soils, including sand, silty sand, clayey sand, and gravelly sand, underlie the fill, topsoil, native sandy clay, and pavement section and extend to the explored depths of 5, 10, and 15 feet. In general, no groundwater was observed during and upon completion of drilling operations. However, at boring B-11, groundwater was observed during drilling operations at an approximate depth of 3 feet with a wet cave of the borehole measured at 7-1/2 feet approximately 1 hour after completion.

The existing structures must be demolished, any footings and debris resulting from demolition completely removed, and the resulting excavations backfilled with engineered fill. During demolition of the existing building foundations, the deep fill soils encountered in the vicinity of boring B-4 should be completely removed within the zone of influence of the proposed building foundations and replaced with engineered fill. Additionally, it should be noted the topsoil encountered at the boring locations is thicker than typical (up to 20 inches in thickness) and the contractor should budget for removal and replacement of these extensive deposits.

The existing fill soils are not suitable for support of building foundations. Following removal and replacement of the deep fill in the zone of influence of the building foundations in the vicinity of boring B-4, we recommend the proposed buildings be supported on shallow strip and spread footings extending through any shallow fill (such as encountered at boring B-11) and bearing on the native very loose to loose sand, silty sand, and clayey sand, very stiff sandy clay, and engineered fill overlying native soils. A net allowable bearing capacity of 1,500 pounds per square foot (psf) may be used for design of foundations bearing on native soils or engineered fill overlying native soils. The bottom of the foundation excavations should be compacted prior to placement of concrete. Exterior footings should bear at a minimum depth of 3-1/2 feet below finished grade for protection against frost heave. Interior foundations can bear at shallower depths provided suitable bearing soils are present and foundations are protected from frost during construction. We recommend a G2 Consulting Group, LLC (G2) engineer or technician be on site during construction to observe the excavations, measure the bearing depths, observe foundation installation, and verify the adequacy of the bearing soils.

Subgrade soils for support of floor slabs are anticipated to consist of native very loose to loose granular fill with up to 1.1 percent organic matter, native very loose to loose granular soils, very stiff sandy clay, or engineered fill to raise site grades and replace topsoil deposits. If the risk of some floor slab settlement can be tolerated, the existing fill soils that pass the proof compaction/proof roll evaluation as described in the SITE PREPARATION section of this report may be used to support the proposed floor slabs. If the potential for floor slab settlement cannot be tolerated, the existing fill must be completely removed from the proposed building footprint and replaced with engineered fill for support of the building floor slab and engineered fill to raise site grades.

This summary is not to be considered separate from the entire text of this report, with all the conclusions and qualifications mentioned herein. Details of our analysis and recommendations are discussed in the following sections and in the Appendix of this report.

PROJECT DESCRIPTION

We understand the proposed project consists of demolition of the existing single-story building, shed, garden, and pavements and constructing two (2) new single-story, slab on grade buildings totaling 13,622 square feet. Both buildings will have a drive-thru on the south and east side of the structures. The existing building is situated within the footprint of the proposed west building and associated drive-thru. Portland cement concrete pavement will be constructed in the drive-thru alignments and bituminous concrete pavement will be constructed throughout the remainder of the property. Three dumpster enclosures will be constructed along the south side of the property. Associated utilities will be installed throughout the property including a detention pond south of the parking lot.

Based on the Grading Plan (C-4) prepared by Stonefield Engineering & Design dated July 22, 2024, the proposed buildings will have finished floor elevations of 972.00 feet each, top of pavement will range from approximately 969-1/2 feet to 972 feet, and the bottom of the pond will have an elevation of approximately 964 feet.

No information regarding structural loading conditions was available at the time of this investigation. We anticipate structural loads will be relatively light with wall loads ranging from 1 to 1-1/2 kips per linear foot. Once structural loading conditions and/or traffic loading conditions become available, G2 should be notified so that we can review the recommendations herein.

SCOPE OF SERVICES

The field operations, laboratory testing, and engineering report preparation were performed under the direction and supervision of a licensed professional engineer. Our services were performed according to generally accepted standards and procedures in the practice of geotechnical engineering in this area. Our scope of services for this project is as follows:

1. We drilled a total of fifteen soil borings throughout the property. Soil borings B-1 through B-8 were drilled within or adjacent to proposed building corners and extended to a depth of 15 feet each below existing grade. Boring B-9 was drilled at the proposed sanitary sewer connection along Highland Road and extended to a depth of 15 feet below existing grade. Boring B-10 was drilled within the footprint of the proposed detention pond and extended to a depth of 15 feet below existing grade. Borings B-11 and B-12 were drilled at the proposed dumpster pads and extended to a depth of 10 feet each below existing grade. Borings B-13, B-14, and B-15 were drilled within proposed pavement areas and extended to a depth of 5 feet each below existing grade.

2. We performed laboratory testing on representative samples obtained from the soil borings. Laboratory testing included visual engineering classification, moisture content, organic matter content (loss-on-ignition) moisture content, and unconfined compressive strength determinations.

3. We prepared this engineering report. The report includes recommendations regarding foundation types, allowable bearing capacity, estimated settlement, pavement recommendations, and construction considerations related to site development.

FIELD OPERATIONS

G2, in conjunction with Bowers & Associates, selected the number, depth, and location of the soil borings based on the proposed site layout. The soil boring locations were determined in the field by a G2 engineer prior to drilling using GPS mobile technology in conjunction with measuring from existing site features using conventional taping methods. The approximate soil boring locations are shown on the Soil Boring Location Plan, Plate No. 1. Ground surface elevations at the boring locations were interpolated from the contour lines and spot elevations presented on the aforementioned Grading Plan.

Soil borings were drilled using a truck-mounted drilling rig. Continuous flight 2-1/4 inch inside diameter, hollow-stem augers were used to advance the boreholes to the explored depths. Within each soil boring, soil samples were obtained at intervals of 2-1/2 feet within the upper 10 feet and an additional sample was obtained at 15 feet, where applicable. The samples were obtained by the Standard Penetration Test method ASTM D 1586, which involves driving a 2-inch diameter split-spoon sampler into the soil with a 140-pound weight falling 30 inches. The sampler is generally driven three successive 6-inch increments with the number of blows for each increment recorded. The number of blows required to advance the sampler the last 12 inches is termed the Standard Penetration Resistance (N). The blow counts for each 6-inch increment and the resulting N-value are presented on the individual soil boring logs.

The soil samples were placed in sealed containers in the field and brought to the laboratory for testing and classification. During drilling operations, the drilling crew maintained logs of the encountered subsurface conditions, including changes in stratigraphy and observed groundwater levels to be used in conjunction with our analysis of the subsurface conditions. The final boring logs are based on the field logs and laboratory soil classification and test results. After completion of the drilling operations, the boreholes were backfilled with auger cuttings and capped with cold patch, where applicable.

LABORATORY TESTING

Representative soil samples were subjected to laboratory testing to determine soil parameters pertinent to foundation design and site preparation. An experienced geotechnical engineer classified the samples in general conformance with the Unified Soil Classification System.

Laboratory testing on representative samples included moisture content, organic matter content (L.O.I.), and unconfined compressive strength determination. The organic matter content of representative samples was determined in accordance with ASTM Test Method D 2974, “Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils”. The unconfined compressive strengths were determined using a spring-loaded hand penetrometer. The hand penetrometer estimates the unconfined compressive strength to a maximum of 4-1/2 tons per square foot (tsf), which is converted to psf, by measuring the resistance of the soil sample to the penetration of a calibrated spring-loaded cylinder.

The results of the moisture content, organic matter content, and unconfined compressive strength laboratory tests are indicated on the boring logs at the depths the samples were obtained. We will hold the soil samples for 60 days from the date of this report, after which time they will be discarded. If you would like to retain the samples beyond that date, please let us know.

SITE CONDITIONS

The site is located at 9101 Highland Road in White Lake Township, Michigan. An existing single-story building is present on the west side of the property, situated in the footprint of the west building. A concrete drive extends to the west side of the building from Highland Road. Bituminous pavements extend west and south of the concrete drive. Two sheds are present on the site, one east of the existing building and one at the southwest corner of the property. A large garden is located east of the building, situated in the footprint of the east building. A playground and mature trees are present throughout the property.

Based on the Grading Plan, existing grades throughout the site slope downward to the south ranging from approximately 973 feet along Highland Road to 969 feet at the southwest corner of the property. Existing grades within the footprints of the proposed buildings range from 971 to 972-1/2 feet. Based on historical Oakland County aerial imagery, the site appears to have been constructed in the early 1960s with a building addition and pavement improvements completed in the 1980s. Surrounding properties are generally commercial and residential in nature.

SOIL CONDITIONS

Approximately 2 to 3 inches of bituminous concrete underlain by 2 to 6 inches of aggregate base are present at soil borings B-11 and B-14. Approximately 8 to 20 inches of topsoil are present at the ground surface of the remaining boring locations. Silty sand fill is present below the topsoil and pavement section at borings B-10, B-11, and B-13 and extends to approximate depths ranging from 3 to 6-1/2 feet below grade. At boring B-4, approximately 13-1/2 feet of sandy clay fill and silty sand fill are present below the topsoil. Native sandy clay underlies the topsoil at borings B-1 and B-6 (extending to approximate depths of 3 to 4 feet below existing grade) and the fill at borings B-10 and B-11 (extending to approximate depths of 6 to 8-1/2 feet). Native granular soils, including sand, silty sand, clayey sand, and gravelly sand, underlie the fill, topsoil, native sandy clay, and pavement section and extend to the explored depths of 5, 10, and 15 feet.

The silty sand fill soils are very loose in compactness with Standard Penetration Test (SPT) N-values ranging from 1 to 4 blows per foot (bpf) and organic matter contents ranging from 0.5 to 1.1 percent. The sandy clay fill at boring B-4 is hard in consistency with a moisture content of 9 percent and an unconfined compressive strength of 9,000 psf. The native sandy clay is generally stiff to very stiff in consistency with moisture contents ranging from 11 to 12 percent and unconfined compressive strengths ranging from 2,500 to 5,000 psf. However, the native sandy clay at boring B-11 is medium in consistency with a moisture content of 24 percent and an unconfined compressive strength of 1,500 psf. The native granular soils within the upper 6 feet are generally very loose to loose in compactness with SPT N-values ranging from 2 to 9 bpf. The native granular soils below 6 feet are generally loose to medium compact with SPT N-values ranging from 7 to 24 bpf.

The stratification depths shown on the soil boring logs represent the soil conditions at the boring locations. Variations may occur between borings. Additionally, the stratigraphic lines represent the approximate boundaries between soil types. The transitions may be more gradual than what are shown. We have prepared the boring logs on the basis of laboratory classification and testing as well as field logs of the soils encountered.

The Soil Boring Location Plan, Plate No. 1, and Soil Boring Logs, Figure Nos. 1 through 15, are presented in the Appendix. The soil profiles described above are generalized descriptions of the conditions encountered at the boring locations. General Notes Terminology defining the nomenclature used on the boring logs and elsewhere in this report is presented on Figure No. 16.

GROUNDWATER CONDITIONS

In general, no groundwater was observed during and upon completion of drilling operations. However, at boring B-11, groundwater was observed at an approximate depth of 3 feet during drilling operations. Approximately 1 hour after completion of drilling operations and following removal of the augers, a wet borehole cave was measured at an approximate depth of 7 feet. Fluctuations in perched and long-term groundwater levels should be anticipated due to seasonal variations and following periods of prolonged precipitation.

SITE PREPARATION

Based on the existing conditions, we anticipate a moderate amount of earthwork will be required to develop the site. Earthwork operations are anticipated to consist of demolition of the existing building, shed, foundations, floor slabs, and utilities, backfilling associated excavations with engineered fill, removing existing pavements, playground, garden, topsoil, vegetation, and trees, proof-compacting / proof rolling the resulting subgrade, placement of engineered fill to raise grades or replace topsoil, and excavating for foundations and utilities. We recommend all earthwork operations be performed in accordance with comprehensive specifications and be properly monitored in the field by G2 geotechnical engineers or technicians under the direction of a licensed professional engineer.

The existing structures must be demolished and any footings and debris resulting from demolition of the existing structures completely removed. The existing soils at the base of demolished foundations must be evaluated by a G2 engineer to confirm soil conditions are consistent with those encountered within the soil borings and native, stable soils are present for support of backfill. The resulting excavations should be backfilled with granular engineered fill. Any existing utilities present within the footprint of the proposed building should be removed and the resulting excavations backfilled with engineered fill. Abandoned utilities outside the influence of the zone of influence of the building may be grouted in place.

During demolition of the existing building foundations, the deep fill soils encountered at boring B-4 should be evaluated to determine the extent of the material and ensure any fill within the zone of influence of the proposed foundations is undercut and backfilled with engineered fill as depicted in Figure 1 below. It may be necessary to remove and replace up to 13-1/2 feet of fill.

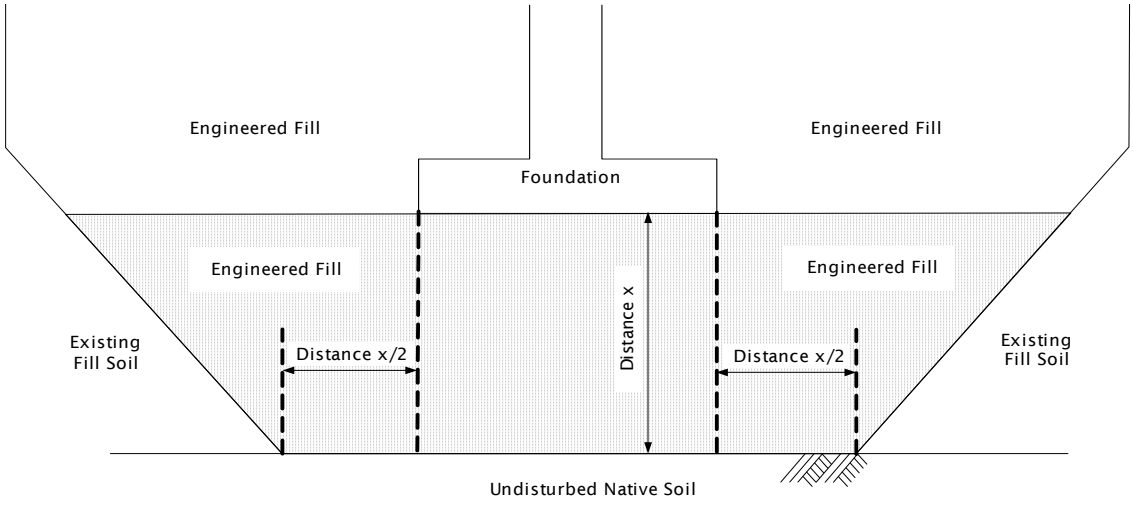


Figure 1

Following demolition of the existing structures, the existing trees and root structures, vegetation, topsoil, pavements, garden, playground, and concrete sidewalk must be completely removed. It should be noted topsoil deposits at the boring locations are up to 20 inches in thickness and the contractor should budget for the significant topsoil deposits. In addition to the engineered fill required to replace the topsoil, up to 2 feet of grade cuts and 6 inches of fill are required to achieve finished grades.

Prior to placement of any engineered fill, the resulting subgrade (anticipated to primarily consist of granular fill or native granular soils) should be thoroughly proof compacted with a heavy vibratory roller making a minimum of 10 passes in two perpendicular directions. Any cohesive soils should be thoroughly proof-rolled with a fully loaded tri-axle dump truck. During proof compaction / proof roll operations, the subgrade should be visually inspected by a qualified engineering technician or engineer for instability and/or unsuitable soil conditions. Unstable soils or soils exhibiting excessive instability should be undercut to expose stable soils or improved with further compaction. Resulting undercut excavations should be backfilled with engineered fill. The contractor should anticipate and budget for undercuts and tri-axial geogrid based on the existing fill soils and clayey sand throughout the site.

Engineered fill should be free of organic matter, frozen soil, clods, or otherwise harmful material. The fill should be placed in uniform horizontal layers, not to exceed 9 inches in loose thickness. The engineered fill should be compacted to achieve a density of at least 95 percent of the maximum dry density as determined by the Modified Proctor Compaction test (ASTM D1557). Any engineered fill should be placed at the approximate optimum moisture content. Frozen material should not be used as fill, nor should fill be placed on a frozen subgrade. The existing fill soils are not suitable for reuse as

engineered fill due to the organic matter in the material. The native soils are acceptable for use as engineered fill.

We recommend using imported granular engineered fill within confined areas such as demolished foundation or utility trenches, adjacent to foundation walls, or new utility trenches. Granular engineered fill is generally more easily compacted than cohesive soils within these confined areas. Additionally, the proper placement and compaction of backfill within these areas is imperative to provide adequate support for overlying foundations, floor slabs, and pavements.

FOUNDATION RECOMMENDATIONS

The existing fill soils encountered at boring B-4 are not suitable for support of building foundations. Therefore, the existing fill should be evaluated and removed and replaced with engineered fill as discussed in the SITE PREPARATION section of this report prior to foundation excavation operations.

Following removal and replacement of the existing fill in the zone of influence of the proposed buildings, we recommend the proposed buildings be supported on shallow strip and spread footings bearing at conventional depths on the native very loose to loose sand, silty sand, and clayey sand, very stiff sandy clay, and engineered fill overlying native soil. The dumpster enclosure foundations must extend through any existing fill (such as encountered at boring B-11) must extend through any existing fill soils and bear on the underlying native medium sandy clay or native very loose to loose sand. A net allowable bearing capacity of 1,500 psf may be used for design of foundations bearing on native soils or engineered fill overlying native soils. The bottom of the foundation excavations should be compacted prior to placement of concrete.

Exterior footings should bear at a minimum depth of 3-1/2 feet below finished grade for protection against frost heave. Interior foundations can bear at shallower depths provided suitable bearing soils are present and foundations are protected from frost during construction. We recommend a G2 engineer be on site during construction to observe the excavations, measure the bearing depths, observe foundation installation, and verify the adequacy of the bearing soils.

Continuous wall or strip footings should be at least 16 inches in width and isolated spread footings should be at least 30 inches in their least dimension. We recommend all strip and spread footings be suitably reinforced to minimize the effects of differential settlements associated with local variations in subsoil conditions. Adjacent spread footings at different levels should be designed and constructed so the least lateral distance between them is equivalent to or more than the difference in their bearing levels. To achieve a change in the level of the strip footings, the footings should be gradually stepped at a grade no steeper than two units horizontal to one unit vertical.

If the recommendations outlined in this report are adhered to, total and differential settlements for the completed structure should be within 1 inch and 1/2 inch, respectively. We expect settlements of these magnitudes will be within tolerable limits for the type of structure proposed.

FLOOR SLAB RECOMMENDATIONS

Subgrade soils for support of floor slabs are anticipated to consist of native very loose to loose granular fill with up to 1.1 percent organic matter, native very loose to loose granular soils, very stiff sandy clay, or engineered fill to raise site grades and replace deep topsoil deposits. If the risk of some floor slab settlement can be tolerated, the existing fill soils that pass proof compaction/proof roll evaluation as described in the SITE PREPARATION section of this report may be used to support the proposed floor slabs. We recommend a subgrade modulus (k) of up to 90 pounds per cubic inch (pci) may be used in the design of floor slab supported on the existing fill soils, native soils, and engineered fill.

If the potential for floor slab settlement cannot be tolerated, the existing fill must be completely removed from the proposed building footprint and replaced with engineered fill for support of the

building floor slab and engineered fill to raise site grades. A subgrade modulus of 150 pci be used for floor slabs supported by engineered fill overlying native soils and/or native loose granular soils.

We recommend at least 4 inches of clean coarse sand or pea gravel be placed between the subgrade and the bottom of the floor slab for use as a capillary break to reduce moisture transmission through the concrete floors and to reduce the potential for concrete curling. If moisture sensitive floor coverings are planned or if greater protection against vapor transmission is desired, a vapor barrier consisting of 10-mil plastic sheeting, or equivalent, may be placed on the sand layer beneath floor slabs. However, additional floor slab curing techniques will be required if a vapor barrier is used. The floor slab should be isolated from the foundation system to allow for independent movement.

PAVEMENT RECOMMENDATIONS

We understand the project includes construction of new bituminous concrete pavement throughout the property. In addition, Portland cement concrete pavement will be constructed in the drive-thru lanes. Subgrade soils will consist of very loose to loose silty sand and clayey sand, very loose silty sand fill, native very stiff sandy clay, and engineered fill used to raise grades or replace topsoil deposits. The existing subgrade should be properly proof compacted / proof rolled and prepared as outlined in the SITE PREPARATION section of this report.

The predominantly granular subgrade soils are typically good for support of the proposed pavement sections. Based on the primarily granular soils and completion of the subgrade preparation recommendations, we recommend the subgrade soils be assigned an effective roadbed modulus of 7,000 pounds per square inch (psi) for use in pavement design. No information regarding anticipated traffic volumes was made available at the time of this writing. Therefore, we have assumed that traffic will consist mainly of passenger vehicles.

We performed pavement design analyses in accordance with the "AASHTO Guide for Design of Pavement Structures" with an assumed load of 75,000 equivalent single-axle loads (ESALS) over a 20-year design life for standard-duty pavements. Once actual traffic loading information becomes available, G2 must be notified so that we may review our design assumptions. For purposes of design, we recommend a serviceability loss of 2.0, a standard deviation of 0.45 for flexible pavements and 0.39 for rigid pavements, and a reliability factor of 0.95. Based on the results of our analysis and construction consideration, we recommend the minimum following pavement design cross-sections:

Standard-Duty Flexible Pavement Section		
Material	**Thickness**	**Structural Coefficient**
MDOT 5E1 Bituminous Wearing Course	2 inches	0.42
MDOT 4E1 Bituminous Leveling Course	2 inches	0.42
MDOT 21AA Limestone Dense-Graded Aggregate	8 inches	0.14

Standard-Duty Rigid Pavement Section	
Material	**Thickness**
MDOT P1 Portland Cement Concrete	6 inches
MDOT 21AA Limestone Dense-Graded Aggregate	6 inches

Large front-loading refuse trucks can impose significant concentrated wheel loads within trash dumpster pick-up areas. Therefore, we recommend 8 inches of Portland cement concrete pavement be used in these areas and be large enough to accommodate the entire truck during pick-up operations.

All pavement materials are specified within the 2020 Standard Specifications for Construction from the Michigan Department of Transportation. The bituminous pavement materials are described in Sections 501 and 904 and can be assigned a structural coefficient number of 0.42. The Portland cement concrete pavement materials are described in Section 601. We recommend that bituminous concrete utilize grade PG 64-22 binder, with no more than 17 percent of the overall binder content from reclaimed asphalt pavement (RAP) within the top wearing course layer.

Proper drainage is an important consideration for pavement design. The pavement and subgrade should be properly sloped to promote effective surface and subsurface drainage and prevent water ponding.

Regular timely maintenance should be performed on the pavement to reduce the potential deterioration associated with moisture infiltration through surface cracks. The owner should be prepared to seal the cracks with a hot-applied elastic crack filler as soon as possible after cracking develops and as often as necessary to block the passage of water to the subgrade soils. In addition, regular joint maintenance should be performed.

CONSTRUCTION CONSIDERATIONS

We anticipate the building foundations and utility excavations can be completed in dry conditions and any surface runoff can be controlled by sumps and pumps. We anticipate perched groundwater will be encountered within foundation excavations for the west dumpster enclosure. Prior to excavation operations, we recommend groundwater be removed in the fill soils using properly constructed sumps and pumps.

Caving and sloughing of the granular soils will occur during foundation excavation. Therefore, the contractor should be prepared to over excavate and form foundations within the granular soils, as necessary. The sides of the spread and/or strip footing foundations should be constructed straight and vertical to reduce the risk of frozen soil adhering to the concrete and raising the foundations.

For excavations that extend below a depth of 5 feet, we recommend a maximum slope of two horizontal units to one vertical unit (2H:1V) within the existing fill soils and native granular soils and 1H:1V within the stiff to very stiff sandy clay. If seepage from excavation cuts is observed, the slopes must be flattened sufficiently to achieve stability, but in no case left steeper than 3H:1V at and below the seepage level. All excavations should be safely sheeted, shored, sloped, or braced in accordance with OSHA requirements. If material is stored or equipment is operated near an excavation, stronger shoring must be used to resist the extra pressure due to the superimposed loads.

Care should be exercised when excavating near existing structures to avoid undermining adjacent utilities and pavements. Under no circumstances should excavations extend below the level of existing utilities or pavements unless underpinning is planned.

GENERAL COMMENTS

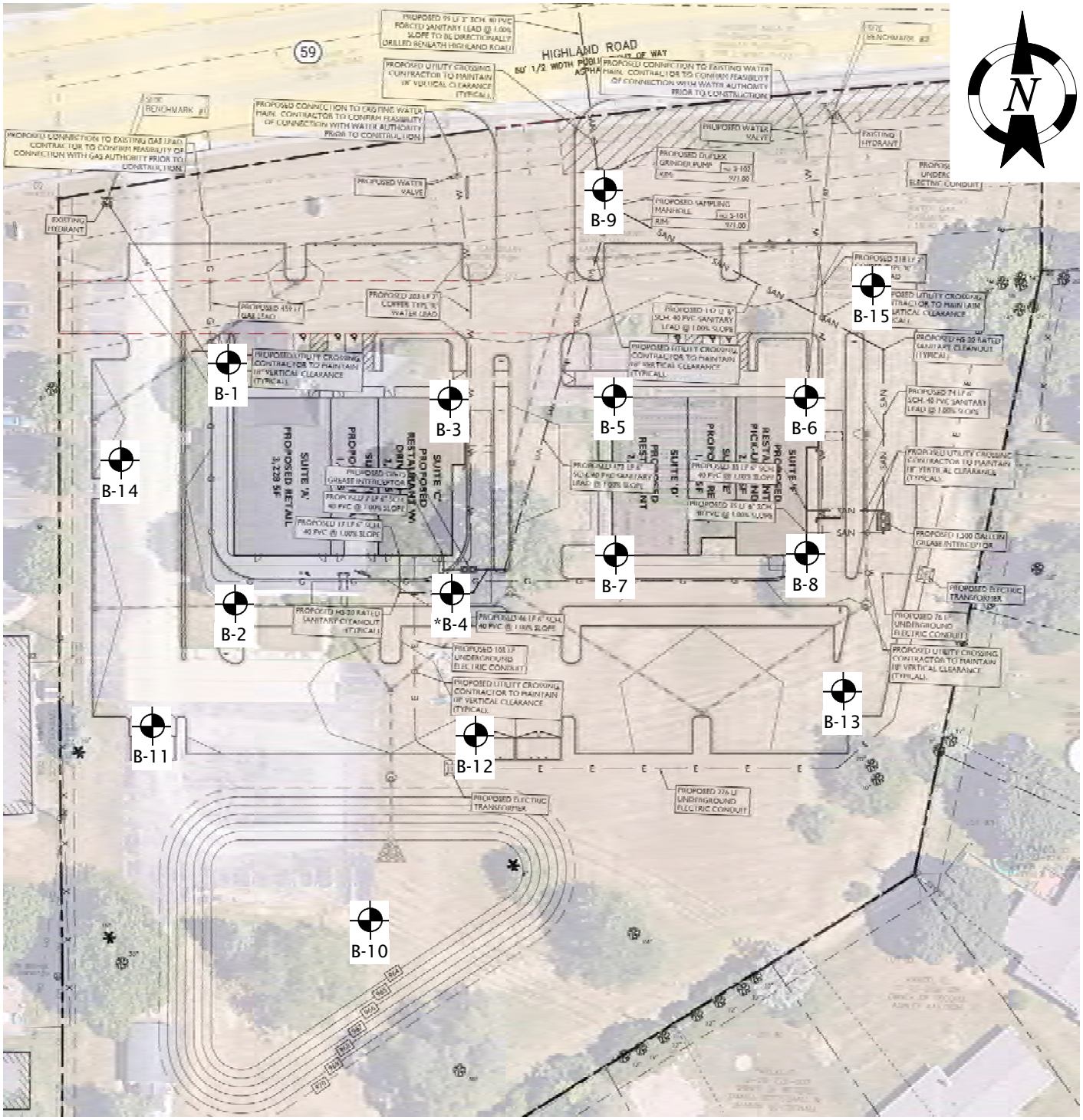
We have formulated the evaluations and recommendations presented in this report relative to site preparation and foundations on the basis of data provided to us relating to the project location, type of structure, and surface grade for the proposed site. Any significant change in this data should be brought to our attention for review and evaluation with respect to prevailing subsurface conditions. Furthermore, if changes occur in the design, location, or concept of the project, conclusions and recommendations contained in this report are not valid unless G2 Consulting Group, LLC reviews the changes. G2 Consulting Group, LLC will then confirm the recommendations presented herein or make changes in writing.

The scope of the present investigation was limited to evaluation of subsurface conditions for the support of proposed buildings and pavements and other related aspects of the development. No chemical, environmental, or hydrogeological testing or analyses were included in the scope of this investigation.

We base the analyses and recommendations submitted in this report upon the data from the soil borings performed at the approximate locations shown on the Soil Boring Location Plan, Plate No. 1. This report does not reflect variations that may occur between the actual boring locations and the actual structure locations. The nature and extent of any such variations may not become clear until the time of construction and upon completion of the building demolition. If significant variations then become evident, it may be necessary for us to re-evaluate our report recommendations.

We recommend G2 Consulting Group, LLC observe all geotechnical related work, including foundation construction, subgrade preparation, and engineered fill placement. G2 Consulting Group, LLC will perform the appropriate testing to confirm the geotechnical conditions given in the report are found during construction.

APPENDIX



Legend

Soil Borings Drilled by Strata Drilling Inc. on August 26 & 27, 2024

**B-4 offset from building corner 20 feet south due to overhead trees*

Soil Boring Location Plan

Highland Road Commercial Development
9101 Highland Road
White Lake Township, Michigan 48386

2G CONSULTING GROUP

Project No. 240697	
Drawn by: MJB	
Date: 09/18/24	Plate No. 1
Scale: NTS	

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-1

G2 CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 972.5 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (20 inches)							
		1.7		S-1	3 2 2	4	10.8		4000*
		Stiff Reddish Brown Sandy Clay with trace silt and gravel							
		4.0							
967.5			5	S-2	1 3 3	6			
				S-3	7 9 10	19			
962.5		Loose to Medium Compact Brown Sand with trace silt and gravel	10	S-4	7 6 7	13			
957.5		15.0	15	S-5	7 6 6	12			
		End of Boring @ 15 ft							
952.5			20						

Total Depth: 15 ft
Drilling Date: August 27, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
Dry during and upon completion of drilling operations

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings

Figure No. 1

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-2

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 972.5 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (8 inches) 0.7							
		Loose Reddish Brown Silty Sand with trace clay and gravel 2.0		S-1	3 3 3	6			
		Loose Brown Clayey Sand with trace silt and gravel 3.5							
967.5			5	S-2	2 2 4	6			
				S-3	5 5 6	11			
962.5		Loose to Medium Compact Brown Sand with trace silt and gravel	10	S-4	5 6 7	13			
957.5		15.0	15	S-5	5 6 6	12			
		End of Boring @ 15 ft							
952.5			20						

Total Depth: 15 ft
Drilling Date: August 27, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 2

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-3

G2 CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 972.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (20 inches)							
		1.7		S-1	1 2 3	5			
		Loose Reddish Brown Clayey Sand with trace silt and little gravel							
		3.0		S-2	1 2 2	4			
967.0		Very Loose Reddish Brown Silty Sand with little gravel	5						
		7.0		S-3	0 1 1	2			
				S-4	2 3 4	7			
962.0			10						
		Very Loose to Loose Brown Sand with trace silt and gravel							
		15.0		S-5	3 4 6	10			
957.0			15						
		End of Boring @ 15 ft							
952.0			20						

Total Depth: 15 ft
Drilling Date: August 26, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 3

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-4

G2 CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 972.5 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (11 inches) 0.9							
		Fill: Hard Reddish Brown Sandy Clay with trace silt and gravel, occasional sand layers		S-1	2 4 6	10	9.5		9000*
		4.0							
967.5			5	S-2	3 2 1	3			
				S-3	2 1 1	2			
		Fill: Very Loose Brown and Reddish Brown Silty Sand with trace clay, gravel, and roots							
962.5			10	S-4	2 1 1	2			
		13.5							
		Medium Compact Brown Sand with trace silt and gravel							
957.5		15.0	15	S-5	8 10 11	21			
		End of Boring @ 15 ft							
952.5			20						

Total Depth: 15 ft
Drilling Date: August 26, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
Dry during and upon completion of drilling operations

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings

Figure No. 4

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-5

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 971.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (8 inches) 0.7							
		Loose Reddish Brown Clayey Sand with trace silt and gravel		S-1	5 4 4	8			
		3.0							
966.0			5	S-2	4 5 6	11			
				S-3	7 9 7	16			
		Loose to Medium Compact Brown Sand with trace silt and gravel		S-4	4 4 4	8			
961.0			10						
				S-5	6 7 7	14			
956.0		15.0	15						
		End of Boring @ 15 ft							
951.0			20						

Total Depth: 15 ft
Drilling Date: August 26, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 5

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-6

G2 CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 971.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (18 inches)							
		1.5							
		Very Stiff Reddish Brown Sandy Clay with trace silt and gravel		S-1	1 2 3	5	11.7		5000*
		3.0							
966.0		Very Loose Reddish Brown Silty Sand with trace gravel	5	S-2	1 1 1	2			
		6.0							
		Very Loose Brown Sand with trace silt and gravel		S-3	1 1 1	2			
		8.0							
961.0			10	S-4	2 3 5	8			
		Loose to Medium Compact Brown Sand with trace silt and gravel							
956.0		15.0	15	S-5	8 13 11	24			
		End of Boring @ 15 ft							
951.0			20						

Total Depth: 15 ft
Drilling Date: August 26, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
Dry during and upon completion of drilling operations

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings

Figure No. 6

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-7

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 971.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (11 inches) 0.9							
		Very Loose Reddish Brown Silty Sand with trace clay and gravel		S-1	4 2 2	4			
		4.0							
966.0		Very Loose Brown Sand with trace silt and gravel	5	S-2	1 1 1	2			
				S-3	1 1 2	3			
		8.0							
961.0		Loose to Medium Compact Brown Sand with trace silt and gravel	10	S-4	3 5 5	10			
			15	S-5	6 9 9	18			
956.0		15.0							
		End of Boring @ 15 ft							
951.0			20						

Total Depth: 15 ft
Drilling Date: August 26, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 7

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. **B-8**

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 971.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (11 inches) 0.9							
		Very Loose Reddish Brown Silty Sand with little gravel, occasional clay layers 3.0		S-1	1 2 2	4			
966.0		Very Loose Brown Sand with trace silt and gravel 6.0	5	S-2	2 1 2	3			
				S-3	3 6 7	13			
961.0		Medium Compact Brown Sand with trace silt and gravel 15.0	10	S-4	5 7 8	15			
956.0			15	S-5	6 9 11	20			
951.0		End of Boring @ 15 ft	20						

Total Depth: 15 ft
Drilling Date: August 26, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 8

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. **B-9**

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 971.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (14 inches) 1.2							
		Very Loose Reddish Brown Clayey Sand with trace silt and little gravel 3.0		S-1	3 2 2	4			
966.0			5	S-2	4 6 9	15			
				S-3	7 8 8	16			
		Medium Compact Brown Sand with trace silt, gravel, and cobbles		S-4	4 6 5	11			
961.0			10						
				S-5	10 8 10	18			
956.0		15.0	15						
		End of Boring @ 15 ft							
951.0			20						

Total Depth: 15 ft
Drilling Date: August 26, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 9

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. **B-10**

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 970.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (12 inches) 1.0							
		Fill: Very Loose Dark Brown Silty Sand with trace gravel and organic matter (Organic Matter Content = 1.1%)		S-1	2 1 3	4			
		3.5							
965.0		Stiff Reddish Brown Sandy Clay with little silt and trace gravel	5	S-2	2 1 2	3	11.4		2500*
		6.0		S-3	3 4 6	10			
960.0			10	S-4	4 5 6	11			
		Loose to Medium Compact Brown Sand with trace silt and gravel							
955.0		15.0	15	S-5	5 6 6	12			
		End of Boring @ 15 ft							
950.0			20						

Total Depth: 15 ft
Drilling Date: August 27, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
Dry during and upon completion of drilling operations

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings and capped with cold patch

Figure No. 10

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. **B-11**

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 971.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (2 inches) 0.2							
		Aggregate Base: Brown Silty Sand 0.3							
		Fill: Very Loose Dark Brown and Brown Silty Sand with trace organic matter (Organic Matter Content = 0.9%)		S-1	3 2 2	4			
		3.0							
966.0		Fill: Very Loose Dark Brown Silty Sand with little gravel (Organic Matter Content = 0.5%)	5	S-2	1 1/12"	---			
		6.5							
		Medium Reddish Brown Sandy Clay with trace silt and little gravel		S-3	0 1 1	2	23.7		1500*
		8.5							
961.0		Loose Brown Gravelly Sand with trace silt 10.0	10	S-4	2 3 4	7			
		End of Boring @ 10 ft							
956.0			15						
951.0			20						

Total Depth: 10 ft
Drilling Date: August 27, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
3 feet during drilling, 7-1/2 feet wet cave 1 hour after completion of drilling

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings and capped with cold patch

Figure No. 11

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-12

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 972.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (10 inches) 0.8							
		Very Loose Brown Silty Sand with trace clay and gravel 3.0		S-1	2 2 2	4			
967.0			5	S-2	2 3 5	8			
		Loose to Medium Compact Brown Sand with trace silt and gravel		S-3	4 5 8	13			
962.0		10.0	10	S-4	4 8 8	16			
		End of Boring @ 10 ft							
957.0			15						
952.0			20						

Total Depth: 10 ft
Drilling Date: August 26, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 12

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-13

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 972.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (13 inches) 1.1							
		Fill: Very Loose Dark Brown and Brown Silty Sand with trace clay, gravel, roots, and organic matter (Organic Matter Content = 0.7%) 3.0		S-1	1 1 1	2			
967.0		Loose Brown Sand with trace silt and gravel 5.0	5	S-2	2 3 3	6			
		End of Boring @ 5 ft							
962.0			10						
957.0			15						
952.0			20						

Total Depth: 5 ft
Drilling Date: August 26, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 13

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. **B-14**

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 972.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (3 inches) 0.3							
		Aggregate Base: Brown Gravelly Sand with little silt (6 inches) 0.8							
		Loose Brown Silty Sand with trace clay and gravel		S-1	4 3 3	6			
		3.5							
967.0		Loose Brown Sand with trace silt and gravel 5.0	5	S-2	2 2 3	5			
		End of Boring @ 5 ft							
962.0			10						
957.0			15						
952.0			20						

Total Depth: 5 ft
Drilling Date: August 27, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 14

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

Project Name: Highland Road Commercial Development

Project Location: 9101 Highland Road
White Lake Township, Michigan 48386

G2 Project No. 240697

Latitude: N/A Longitude: N/A

Soil Boring No. B-15

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 972.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Silty Sand (14 inches) 1.2							
		Loose Reddish Brown Clayey Sand with little silt and gravel 3.0		S-1	1 3 3	6			
967.0		Loose Brown Sand with trace silt and gravel 5.0	5	S-2	3 4 5	9			
		End of Boring @ 5 ft							
962.0			10						
957.0			15						
952.0			20						

Total Depth: 5 ft
Drilling Date: August 27, 2024
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
Dry during and upon completion of drilling operations

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Figure No. 15

SOIL / PAVEMENT BORING 240697.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 9/25/24

GENERAL NOTES TERMINOLOGY

Unless otherwise noted, all terms herein refer to the Standard Definitions presented in ASTM 653.

PARTICLE SIZE

Boulders		- greater than 12 inches
Cobbles		- 3 inches to 12 inches
Gravel	- Coarse	- 3/4 inches to 3 inches
	- Fine	- No. 4 to 3/4 inches
Sand	- Coarse	- No. 10 to No. 4
	- Medium	- No. 40 to No. 10
	- Fine	- No. 200 to No. 40
Silt		- 0.005mm to 0.074mm
Clay		- Less than 0.005mm

CLASSIFICATION

The major soil constituent is the principal noun, i.e. clay, silt, sand, gravel. The second major soil constituent and other minor constituents are reported as follows:

Second Major Constituent (percent by weight)	Minor Constituent (percent by weight)
Trace - 1 to 12%	Trace - 1 to 12%
Adjective - 12 to 35%	Little - 12 to 23%
And - over 35%	Some - 23 to 33%

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier, i.e. sandy clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils, i.e. silty clay, trace sand, little gravel.

Consistency	Unconfined Compressive Strength (psf)	Approximate Range of (N)
Very Soft	Below 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,000 - 2,000	5 - 8
Stiff	2,000 - 4,000	9 - 15
Very Stiff	4,000 - 8,000	16 - 30
Hard	8,000 - 16,000	31 - 50
Very Hard	Over 16,000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

COHESIONLESS SOILS

Density Classification	Relative Density %	Approximate Range of (N)
Very Loose	0 - 15	0 - 4
Loose	16 - 35	5 - 10
Medium Compact	36 - 65	11 - 30
Compact	66 - 85	31 - 50
Very Compact	86 - 100	Over 50

Relative Density of cohesionless soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

SAMPLE DESIGNATIONS

AS - Auger Sample – Cuttings directly from auger flight
BS - Bottle or Bag Samples
S - Split Spoon Sample - ASTM D 1586
LS - Liner Sample with liner insert 3 inches in length
ST - Shelby Tube sample - 3 inch diameter unless otherwise noted
PS - Piston Sample - 3 inch diameter unless otherwise noted
RC - Rock Core - NX core unless otherwise noted

STANDARD PENETRATION TEST (ASTM D 1586) - A 2.0 inch outside-diameter, 1-3/8 inch inside-diameter split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6-inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).

MEMO

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

VIA EMAIL: ewilliams@stonefieldeng.com

To:	**Stonefield Engineering**
From:	**Jacob Swanson, PE, PTOE** **Haylee Rubin, EIT** **Fleis & VandenBrink**
Date:	**January 2, 2025**
Re:	**9101 Highland Road (M-59) – Commercial Development** **White Lake Township, Michigan** **Traffic Impact Study**

1 INTRODUCTION

This memorandum presents the results of the Traffic Impact Study (TIS) for the proposed commercial development in White Lake Township, Michigan. The project site is generally located adjacent to the south side of Highland Road (M-59), approximately 1,000-feet east of Fisk Road, as shown in the attached **Figure 1**. The proposed development includes the construction restaurant and retail land uses. The project site is currently vacant and was most recently occupied by the Calvary Lutheran Church, which will be razed with the construction of the proposed development. Site access is proposed via one (1) full access driveway on Highland Road (M-59), which is under the jurisdiction of the Michigan Department of Transportation (MDOT). The purpose of this TIS is to evaluate the impact of the proposed development on the adjacent roadway network, as part of the site plan approval and driveway permitting processes.

The scope of work for this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practices, and information published by the Institute of Transportation Engineers (ITE). Study analyses were completed using Synchro/SimTraffic (Version 12) traffic analysis software. Sources of data for this study include F&V subconsultant Quality Counts (QC), MDOT, the Road Commission for Oakland County (RCOC), White Lake Township, the Southeast Michigan Council of Governments (SEMCOG), and ITE.

2 BACKGROUND

2.1 EXISTING ROAD NETWORK

The lane use and traffic control at the study intersections is shown in the attached **Figure 2** and study roadways are further described below. For purposes of this study, all minor streets and driveways were assumed to have an operating speed of 25 miles per hour (mph), unless otherwise noted.

Highland Road (M-59) generally runs in the east / west directions, adjacent to the north side of the project site. The study section of roadway is classified as an *Other Principal Arterial*, is under the jurisdiction of MDOT, has a posted speed limit of 50-mph, and has an Annual Average Daily Traffic (AADT) volume of approximately 33,400 (MDOT 2022) vehicles per day (vpd). The study section of roadway provides a typical five-lane cross-section, with two (2) lanes of travel in each direction and a center two-way left-turn lane (TWLTL). At the signalized study intersection with Fisk Road, Highland Road (M-59) widens to provide an exclusive eastbound right-turn lane. Additionally, Highland Road (M-59) widens to provide exclusive westbound right-turn lanes at all of the unsignalized intersections within the study roadway network.

Fisk Road generally runs in the north / south directions, approximately 1,000-feet west of the project site, terminating to the south at Highland Road (M-59). The study section of roadway is classified as a *Local Road*, is under the jurisdiction of RCOC, has an assumed prima-facie speed limit of 55-mph, and has an AADT volume of approximately 1,256 vpd (MDOT 2022). The study section of Fisk Road provides typical three-lane cross-section, with one (1) lane of travel in each direction and a center TWLTL.

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Sunny Beach Boulevard generally runs in the north / south directions, approximately 500-feet east of the project site. The study section of roadway is classified as a *Local Road*, is under the jurisdiction of RCOC, and has an assumed residential prima-facie speed limit of 25-mph. The study section of Sunny Beach Boulevard services a residential neighborhood, to the south of Highland Road (M-59), and services commercial uses, to the north of Highland Road (M-59).

2.2 Existing Traffic Volumes

F&V subconsultant QC collected existing weekday Turning Movement Count (TMC) data during the AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak periods, at the study intersections as summarized below:

- Highland Road (M-59) & Fisk Road (12/13/2023)
- Highland Road (M-59) & JOANN Fabrick Driveway (12/13/2023)
- Highland Road (M-59) & Sunny Beach Boulevard (3/13/2024)
- Highland Road (M-59) & W. Marketplace Drive (12/11/2024)
- Highland Road (M-59) & E. Marketplace Drive (12/11/2024)

During the collection of the TMC data, Peak Hour Factors (PHFs), pedestrian and bicycle volumes, and commercial truck percentages were recorded and used in the traffic analysis. The peak hours of each of the study intersections were utilized and the through volumes were balanced upwards through the study roadway network and carried through at the proposed site driveway. Therefore, the traffic volumes used in the analysis and shown in the attached figures may not match the raw traffic volumes shown in the data collection.

The weekday AM and PM peak hours for the adjacent study roadway network were observed to generally occur between 7:30 AM to 8:30 AM and 4:15 PM to 5:15 PM, respectively. Additionally, F&V obtained the current signal timing permit for the study intersection of Highland Road (M-59) & Fisk Road from MDOT. The existing 2024 peak hour traffic volumes used in the analysis are shown in the attached **Figure 3**. All applicable background data referenced in this memorandum are attached.

3 Existing Conditions (2024)

Existing peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersections using Synchro/SimTraffic (Version 12) traffic analysis software. This analysis was based on the existing lane use and traffic control shown in the attached **Figure 2**, the exiting peak hour traffic volumes shown in the attached **Figure 3**, and methodologies presented in the *Highway Capacity Manual, 7th Edition* (HCM7).

Descriptions of LOS "A" through "F" as defined in the HCM, are attached. Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions. Additionally, SimTraffic network simulations were reviewed to evaluate network operations and vehicle queues. The results for the exiting conditions analysis are attached and summarized in **Table 1**.

Table 1: Existing Intersection Operations

Intersection		Control	Approach	Existing Conditions			
				AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Highland Road (M-59) & Fisk Road	Signalized	EBL	14.4	B	57.6	E
			EBT	27.7	C	18.5	B
			EBR	14.7	B	11.0	B
			WBL	15.9	C	11.9	B
			WBTR	23.5	C	26.3	C
			NBL	25.2	C	47.9	D
			NBTR	23.3	C	38.0	D
			SBL	27.3	C	67.0	E
			SBTR	24.8	C	47.1	D
			Overall	**25.6**	**C**	**29.2**	**C**

	Intersection	Control	Approach	Existing Conditions			
				AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS
2	Highland Road (M-59) & W. Marketplace Drive	Stop (Minor)	EBL	10.9	B	17.0	C
			WBL	10.9	B	12.3	B
			NB	9.6	A	201.8	F
			SBTL	56.7	F	$	F
			SBR	12.3	B	21.4	C
3	Highland Road (M-59) & E. Marketplace Drive	Stop (Minor)	EBL	0.0*	A	17.3	C
			WB	Free			
			SB	16.5	C	25.5	D
4	Highland Road (M-59) & JOANN Fabric Drive	Stop (Minor)	EBL	11.1	B	17.3	C
			WB	Free			
			SB	12.5	B	39.5	E
5	Highland Road (M-59) & Sunny Beach Boulevard	Stop (Minor)	EBL	10.8	B	17.1	C
			WBL	11.0	B	12.9	B
			NBL	194.3	F	$	F
			NBTR	10.4	B	10.7	B
			SB	72.9	F	$	F

Note: $ Indicates delays exceeding 1,000 seconds / vehicle.

The results of the existing conditions analysis indicates that all approaches and movements at the study intersections are currently operating acceptably, at LOS D or better during both the AM and PM peak hours, with the following exceptions:

Highland Road (M-59) & Fisk Road

- During the PM peak hour: the eastbound left-turn movement and southbound left-turn movement are both currently operating at LOS E.

Review of SimTraffic network simulations indicates generally acceptable operations. Occasional periods of vehicle queues were observed for these movements; however, the majority of vehicle queues were observed to be processed within each cycle length, leaving minimal residual vehicle queueing. Additionally, any remaining vehicle queues were observed to dissipate and were not present throughout the PM peak hour.

Highland Road (M-59) & W. Marketplace Drive

- During the AM peak hour: the southbound shared left/through lane currently operates at LOS F.
- During the PM peak hour: the northbound approach and the southbound shared left/through lane are both currently operating at LOS F.

Review of SimTraffic microsimulations during the AM peak hour indicates generally acceptable operations. During the PM peak hour, periods of long vehicle queues were observed for the southbound shared left/through lane-turn movement; these queues were typically observed to persist throughout the PM peak hour. However, review of the TMC data collection videos indicates that adequate gaps are provided within the through traffic along Highland Road (M-59), in order to accommodate egress traffic from the minor street.

Highland Road (M-59) & JOANN Fabric Drive

- During the PM peak hour: the southbound approach currently operates at LOS E.

The southbound approach was designed to prohibit egress left-turns; however, the left-turn traffic from this approach is causing the reported delay. The total volume of southbound traffic during the PM peak hour is very low (3 vehicles), which includes two (2) vehicles making a left-turn movement. Additionally, although the reported delay results in LOS E, review of SimTraffic indicates acceptable operations; the 95th percentile queue length reported for this approach was approximately 11-feet (~1 vehicle), which is not significant.

Highland Road (M-59) & Sunny Beach Boulevard

- During both the AM and PM peak periods: The northbound left-turn movement and the southbound approach are both currently operating at LOS F.

Review of SimTraffic network simulations indicates generally acceptable operations during the AM peak hour. Review of SimTraffic microsimulations during the PM peak hour indicates that vehicles along Sunny Beach Boulevard experience difficulty in finding gaps within the through traffic along Highland Road (M-59), resulting in long vehicle queues along the minor street; these vehicle queues do not dissipate and were typically observed to persist throughout the PM peak hour. However, as previously mentioned, review of the TMC data collection videos indicates traffic is able to find adequate gaps within the through traffic; therefore, SimTraffic is providing a more conservative evaluation, as it does not account for motorists making two-stage left-turns.

4 Background Conditions (2026)

Historical population and economic profile data was obtained for White Lake Township from the Southeast Michigan Council of Governments (SEMCOG) database, in order to calculate an annual background growth rate to project the existing 2024 peak hour traffic volumes to the site buildout year of 2026. Population and employment projections from 2020 to 2050 were reviewed and show average annual growth rates of approximately 0.41% and 0.28%, respectively.

In addition to background growth, it is important to account for traffic that will be generated by approved developments within the study area that have yet to be constructed or are currently under construction. At the time of this study, no background developments were identified within the vicinity of the project site. Therefore, a conservative annual background growth rate of **0.5%** per year was applied to the existing peak hour traffic volumes, in order to forecast the background 2026 peak hour traffic volumes ***without the proposed development***, as shown in the attached **Figure 4**.

Background peak hour vehicle delays and LOS ***without the proposed development*** were calculated at the study intersections based on the existing lane use and traffic control shown in the attached **Figure 2**, the background peak hour traffic volumes shown in the attached **Figure 4**, and methodologies presented in the HCM7. The results of the background conditions analysis are attached and summarized in **Table 2**.

Table 2: Background Intersection Operations

Intersection		Control	Approach	Existing Conditions				Background Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Highland Road (M-59) & Fisk Road	Signal	EBL	14.4	B	57.6	E	14.5	B	61.5	E	0.1	-	3.9	-
			EBT	27.7	C	18.5	B	28.1	C	18.7	B	0.4	-	0.2	-
			EBR	14.7	B	11.0	B	14.7	B	11.0	B	0.0	-	0.0	-
			WBL	15.9	C	11.9	B	16.0	B	12.1	B	0.1	C→B	0.2	-
			WBTR	23.5	C	26.3	C	23.7	C	26.7	C	0.2	-	0.4	-
			NBL	25.2	C	47.9	D	25.3	C	48.1	D	0.1	-	0.2	-
			NBTR	23.3	C	38.0	D	23.3	C	38.0	D	0.0	-	0.0	-
			SBL	27.3	C	67.0	E	27.3	C	67.6	E	0.0	-	0.6	-
			SBTR	24.8	C	47.1	D	24.8	C	47.7	D	0.0	-	0.6	-
			Overall	**27.1**	**C**	**29.2**	**C**	**25.8**	**C**	**29.7**	**C**	**-1.3**	**-**	**0.5**	**-**
2	Highland Road (M-59) & W. Marketplace Drive	Stop (Minor)	EBL	10.9	B	17.0	C	11.0	B	17.2	C	0.1	-	0.2	-
			WBL	10.9	B	12.3	B	11.0	B	12.4	B	0.1	-	0.1	-
			NB	9.6	A	201.8	F	9.6	A	227.5	F	0.0	-	-	-
			SBTL	56.7	F	$	F	59.8	F	$	F	3.1	-	-	-
			SBR	12.3	B	21.4	C	12.3	B	21.8	C	0.0	-	-	-
3	Highland Road (M-59) & E. Marketplace Dr.	Stop (Minor)	EBL	0.0*	A	17.3	C	0.0*	A	17.5	C	0.0*	-	0.2	-
			WB	Free				Free				N/A			
			SB	16.5	C	25.5	D	16.6	C	25.9	D	0.1	-	-	-

Intersection		Control	Approach	Existing Conditions				Background Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
4	Highland Road (M-59) & JOANN Fabric Dr.	Stop (Minor)	EBL	11.1	B	17.3	C	11.2	B	17.5	C	0.1	-	0.2	-
			WB	Free				Free				N/A			
			SB	12.5	B	39.5	E	12.6	B	40.3	E	0.1	-	0.8	-
5	Highland Road (M-59) & Sunny Beach Boulevard	Stop (Minor)	EBL	10.4	B	17.1	C	10.9	B	17.3	C	0.5	-	0.2	-
			WBL	11.0	B	12.9	B	11.1	B	13.1	B	0.1	-	0.2	-
			NBL	194.3	F	$	F	214.5	F	$	F	20.2	-	-	-
			NBTR	10.4	B	10.7	B	10.4	B	10.7	B	0.0	-	0.0	-
			SB	72.9	F	$	F	77.2	F	$	F	4.3	-	-	-

** Indicate no vehicle volume present. $ Indicates delays exceeding 1,000 seconds / vehicle*
Note: Decreased delays are the result of improved progression and/or HCM weighting methodology

The results of the background conditions analysis indicates that all study intersections approaches and movements are expected to continue operating in a manner similar to the existing conditions analysis, with minor increases in delays.

5 SITE TRIP GENERATION

The number of weekday peak hour (AM and PM) and daily vehicle trips that would be generated by the proposed development were calculated using the rates and equations published by the Institute of Transportation Engineers (ITE) in *Trip Generation, 11th Edition*. For purposes of this study the following land uses were assumed in the analysis: a coffee shop with drive-through, a fast-casual restaurant, and retail space. Additionally, the proposed restaurants are not anticipated to have breakfast service; however, in order to provide a conservative analysis, the AM peak hour trip generation was included for these land uses. The site trip generation forecast utilized for this study is summarized in **Table 3**.

Table 3: Site Trip Generation Summary

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Strip Retail Plaza (<40k SF)	822	2,387	SF	330	4	2	6	14	14	28
Pass-By (0% AM, 40% PM)				*66*	*0*	*0*	*0*	*5*	*5*	*10*
New Trips				264	4	2	6	9	9	18
Fast Casual Restaurant	930	10,043	SF	976	36	21	57	69	57	126
Pass-By (0% AM, 43% PM)				*210*	*0*	*0*	*0*	*27*	*27*	*54*
New Trips				766	36	21	57	42	30	72
Coffee Shop with Drive-Through	937	2,529	SF	1,349	111	106	217	50	49	99
Pass-By (50% AM, 55% PM)				*706*	*54*	*54*	*108*	*27*	*27*	*54*
New Trips				641	57	52	109	23	22	45
Total Trips				2,655	151	129	280	133	120	253
Total Pass-By				*984*	*54*	*54*	*108*	*59*	*59*	*118*
Total New Trips				**1,671**	**97**	**75**	**172**	**74**	**61**	**135**

As is typical of commercial developments, a portion of the trips generated by the proposed development are from vehicles already on the adjacent roadway network that will pass the site on their way from an origin to their ultimate destination. Therefore, not all traffic at the site driveway is necessarily new traffic added to the street system. These trips are therefore reduced from the total external trips generated by a study site. This percentage of the trips generated by the development are considered "pass-by", which are already present of the adjacent roadway network. The percentage of pass-by used in this analysis was determined based on the rates published by ITE in the *Trip Generation Manual, 11th Edition*.

6 SITE TRIP DISTRIBUTION

The vehicular trips that would be generated by the proposed development were assigned to the study roadway network based on the proposed stie access plan and driveway configurations, the existing peak hour traffic patterns in the adjacent roadway network, and methodologies published by ITE. The ITE trip distribution methodology assumes that new trips will enter the network and access the development, then leave the development and return to their direction of origin, whereas pass-by trips will enter and exit the development in their original direction of travel. The stie trip distributions utilized in the analysis are summarized in **Table 4**.

Table 4: Site Trip Distribution

New Trips				Pass-By Trips		
AM	PM	To/From	Via	Direction	AM	PM
7%	12%	North	Fisk Road			
41%	52%	East	Highland Road (M-59)	Eastbound	57%	44%
52%	36%	West	Highland Road (M-59)	Westbound	43%	56%
100%	**100%**	**Total**			**100%**	**100%**

The vehicular traffic volumes shown in **Table 3** were distributed to the study roadway network according to the distribution shown in **Table 4**. Therefore, the site generated trips shown in the attached **Figure 5** were added to the background peak hour traffic volumes shown in the attached **Figure 4**, in order to calculate the future peak hour traffic volumes, with the addition of the proposed development. Future peak hour traffic volumes are shown in the attached **Figure 6**.

7 FUTURE CONDITIONS (2026)

Future peak hour vehicle delays and LOS ***with the addition of the proposed development***, were calculated based on the proposed lane use and traffic controls shown in the attached **Figure 2**, the future peak hour traffic volumes shown in the attached **Figure 6**, and the methodologies presented in the HCM7. The results of the future conditions analysis are attached and summarized in **Table 5**.

Table 5: Future Intersection Operations

Intersection		Control	Approach	Background Conditions				Future Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Highland Road (M-59) & Fisk Road	Signal	EBL	14.5	B	61.5	E	14.9	B	66.1	E	0.4	-	4.6	-
			EBT	28.1	C	18.7	B	30.3	C	19.1	B	2.2	-	0.4	-
			EBR	14.7	B	11.0	B	14.7	B	11.0	B	0.0	-	0.0	-
			WBL	16.0	B	12.1	B	16.8	B	12.4	B	0.8	-	0.3	-
			WBTR	23.7	C	26.7	C	24.6	C	27.6	C	0.0	-	0.0	-
			NBL	25.3	C	48.1	D	25.3	C	48.1	D	0.0	-	0.0	-
			NBTR	23.3	C	38.0	D	23.3	C	38.0	D	0.0	-	0.0	-
			SBL	27.3	C	67.6	E	27.3	C	67.6	E	0.0	-	0.0	-
			SBTR	24.8	C	47.7	D	24.8	C	47.4	D	0.0	-	-0.3	-
			Overall	**25.8**	**C**	**29.7**	**C**	**27.3**	**C**	**30.3**	**C**	**1.5**	**-**	**0.6**	**-**
2	Highland Road (M-59) & W. Marketplace Drive	Stop (Minor)	EBL	11.0	B	17.2	C	11.3	B	17.6	C	0.3	-	0.4	-
			WBL	11.0	B	12.4	B	11.4	B	12.7	B	0.4	-	0.3	-
			NB	9.6	A	227.5	F	9.7	A	290.6	F	0.1	-	63.1	-
			SBTL	59.8	F	$	F	72.1	F	$	F	12.3	-	$	-
			SBR	12.3	B	21.8	C	12.6	B	22.4	C	0.3	-	0.6	-
3	Highland Road (M-59) & E. Marketplace Dr.	Stop (Minor)	EBL	0.0*	A	17.5	C	0.0*	A	17.8	C	0.0*	-	0.3	-
			WB	Free				Free				N/A			
			SB	16.6	C	25.9	D	17.4	C	26.7	D	0.8	-	0.8	-

	Intersection	Control	Approach	Background Conditions				Future Conditions				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
4	Highland Road (M-59) & JOANN Fabric Dr.	Stop (Minor)	EBL	11.2	B	17.5	C	11.4	B	17.9	C	0.2	-	0.4	-
			WB	Free				Free				N/A			
			SB	12.6	B	40.3	E	12.9	B	42.1	E	0.3	-	1.8	-
5	Highland Road (M-59) & Sunny Beach Boulevard	Stop (Minor)	EBL	10.9	B	17.3	C	11.1	B	17.8	C	0.2	-	0.5	-
			WBL	11.1	B	13.1	B	11.2	B	13.4	B	0.1	-	0.3	-
			NBL	214.5	F	$	F	261.7	F	$	F	47.2	-	$	-
			NBTR	10.4	B	10.7	B	10.6	B	10.8	B	0.2	-	0.1	-
			SB	77.2	F	$	F	89.7	F	$	F	12.5	-	$	-
6	Highland Road (M-59) & Site Drive	Stop (Minor)	EB	N/A				Free				N/A			
			WBL					13.3	B	13.3	B				
			NBL					42.7	E	66.7	F				
			NBR					10.4	B	10.9	B				

** Indicate no vehicle volume present. $ Indicates delays exceeding 1,000 seconds / vehicle*
Note: Decreased delays are the result of improved progression and/or HCM weighting methodology

The results of the future conditions analysis indicates that all study intersection approaches and movements are expected to continue operating in a manner similar to the background conditions analysis, with minor increases in delays and no additional impacts to LOS. Additionally, the proposed site driveway is expected to operate acceptably, at LOS D or better during both peak periods, with the exception of the following:

Highland Road (M-59) & Site Drive

- During the AM peak hour: The northbound approach is expected to operate at LOS E.
- During the PM peak hour: The northbound approach is expected to operate at LOS F.

Review of SimTraffic network simulations during the AM peak hour indicates acceptable operations. Review of SimTraffic microsimulations during the PM peak hour indicates that vehicles existing the Site Drive approach experience difficulty in finding gaps within the through traffic along Highland Road (M-59), resulting in long vehicle queues. These vehicle queues do not dissipate and were typically observed to persist throughout the PM peak hour. However, as identified during the existing conditions analysis, SimTraffic microsimulations do not account for motorists making two-stage left-turn movements; therefore, SimTraffic network simulations are providing a more conservative evaluation than what drivers can expect to experience.

7.1 Right-Turn Treatment Evaluation

The MDOT right-turn treatment criteria were evaluated at the proposed site driveway on Highland Road (M-59), with the addition of the site-generated traffic volumes. *Note: There is currently an existing center two-way left-turn lane (TWLTL) present along Highland Road (M-59), adjacent to the project site; therefore, only the right-turn lane criteria was reviewed.* This analysis was based on the future peak hour traffic volumes shown in the attached **Figure 6**. The results of the analysis are shown on the attached MDOT warranting chart and is summarized in **Table 6**.

Table 6: Right-turn Treatment Criteria Evaluation Summary

Intersection	Peak Period		Recommendation
	AM Peak Hour	PM Peak Hour	
Highland Road (M-59) & Site Drive	Right-Turn Lane	Right-Turn Lane	**Right-Turn Lane**

The result of the right-turn treatment evaluation indicates that a right-turn deceleration lane is warranted along eastbound Highland Road (M-59) at the proposed site driveway.

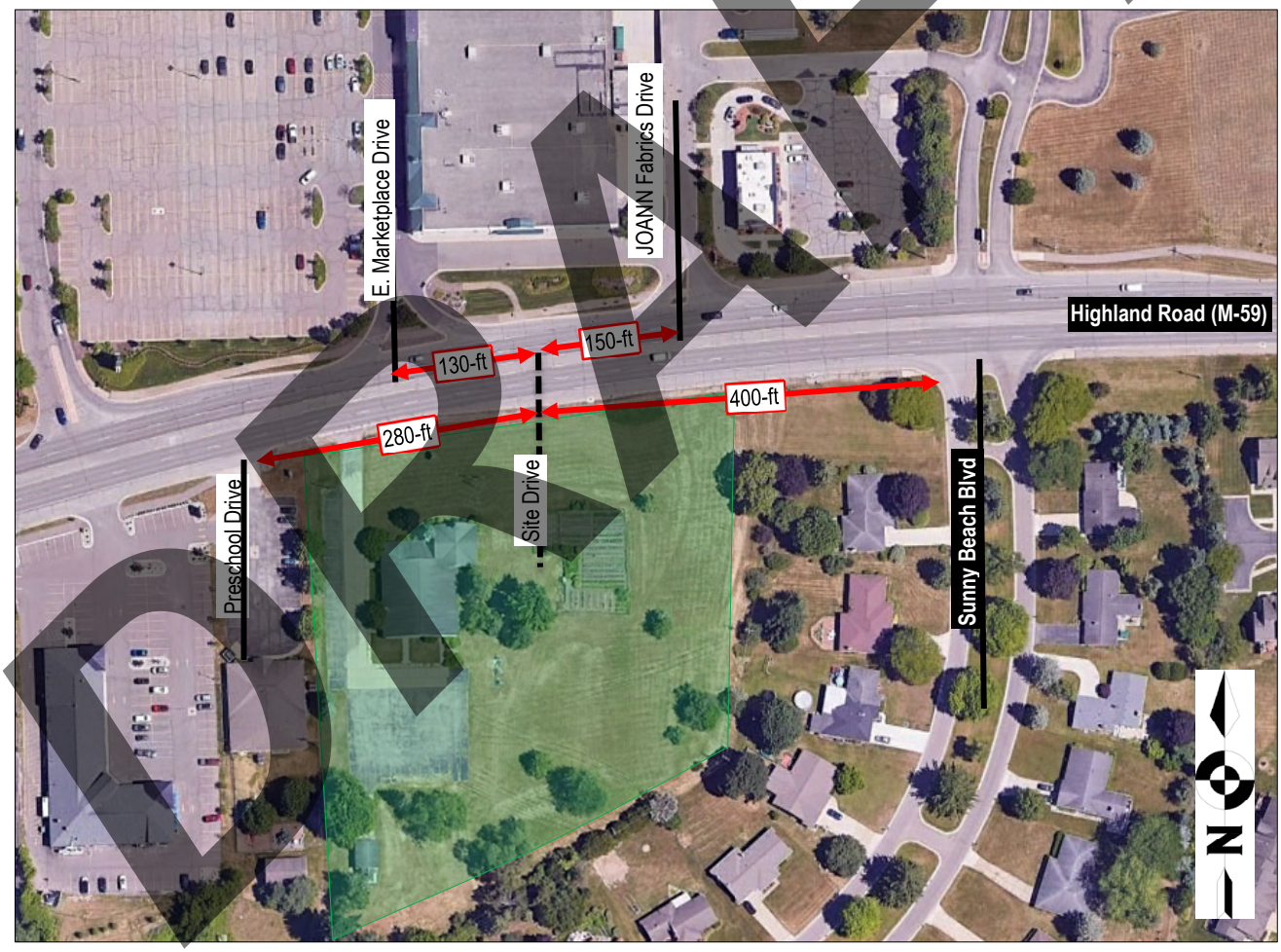
7.2 DRIVEWAY SPACING EVALUATION

The MDOT *Geometric Design Guidance* (Section 1.2.2) criteria were utilized to evaluate the location of the proposed site driveway, in relation to nearby intersections and access points within close proximity to the project site. The intersection corner clearance criteria were evaluated for the 50-mph section of Highland Road (M-59), adjacent to the project site. The distance of the proposed site driveway from nearby intersections and access points, and the warranting criteria are summarized in **Table 7** and displayed in **Exhibit 1**.

Table 7: Desirable Corner Clearance Summary

Adjacent Driveways & Intersections			Distance	Criteria	Meets
Site Drive	to	Preschool Drive	280 feet	455 feet	**NO**
Site Drive	to	Sunny Beach Boulevard	400 feet	170 feet	**YES**
Site Drive	to	JOANN Fabrics Drive	150 feet	750 feet	**NO**
Site Drive	to	ROSS Drive	130 feet	750 feet	**NO**

Exhibit 1: Proposed Driveway Spacing



The results of the driveway spacing analysis indicates that the location of the proposed site driveway on Highland Road (M-59) is not expected to meet the desirable MDOT spacing criteria, in relation to the nearby intersection and driveways. However, there is not sufficient property frontage to meet the recommended spacing criteria. Additionally, the site plan includes future cross access, stubbed at the property line to the west; this would provide improved site access, permitting cross access between the nearby developments on the south side of Highland Road (M-59), should the adjacent property be redeveloped. Furthermore, shared access was investigated and is not available with the Sunny Beach Boulevard neighborhood to the east.

8 FUTURE CONDITIONS WITH IMPROVEMENTS ANALYSIS

Mitigation measures were investigated in order to improve the study intersections and mitigate any of the impacts generated by the proposed development. The mitigation measures that were identified and the impacts to the study intersections are discussed below:

8.1 HIGHLAND ROAD (M-59) & FISK ROAD

Signal timing optimizations were reviewed at the study intersection of Highland Road (M-59) & Fisk Road and were determined to adequately improve all approaches and movements to LOS D or better during the PM peak hour. Therefore, the following improvements are recommended:

- Optimize the signal timing splits during the PM peak hour.

8.2 HIGHLAND ROAD (M-59) & SITE DRIVE

The proposed site plan includes shared access to the property to the west of the project site, which would reduce the projected delay for egress traffic; however, the property to the west would need to be redeveloped, in order to accommodate such a cross-access connection. Additionally, providing cross access with the Sunny Beach Boulevard neighborhood to the east would also reduce egress delays; however, this is not feasible. Therefore, since the egress delay cannot be reduced, the following improvement is recommended:

- Provide an eastbound right-turn lane along Highland Road (M-59) at the proposed Site Drive.

The results of the future improvements analysis, with the implementation of the recommended mitigation measures, are attached and summarized in **Table 8**.

Table 8: Future Intersection Operations with Improvement

	Intersection	Control	Approach	Future Conditions				Future w/ IMP				Difference			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Highland Road (M-59) & Fisk Road	Signal	EBL	14.9	B	66.1	E	No Change		53.4	D	No Change		-12.7	E→D
			EBT	30.3	C	19.1	B			29.2	C			10.1	B→C
			EBR	14.7	B	11.0	B			16.3	B			5.3	-
			WBL	16.8	B	12.4	B			16.3	B			3.9	-
			WBTR	24.6	C	27.6	C			50.9	D			23.3	C→D
			NBL	25.3	C	48.1	D			43.0	D			-5.1	-
			NBTR	23.3	C	38.0	D			34.1	C			-3.9	D→C
			SBL	27.3	C	67.6	E			52.8	D			-14.8	E→D
			SBTR	24.8	C	47.4	D			40.9	D			-6.5	-
			Overall	**27.3**	**C**	**30.3**	**C**			**42.3**	**D**			**12.0**	**C→D**
6	Highland Road (M-59) & Site Drive	Stop (Minor)	EB	Free				Free				N/A			
			WBL	13.3	B	13.3	B	13.3	B	13.3	B	0.0	-	0.0	-
			NBL	42.7	E	66.7	F	39.2	E	63.1	F	-3.5	-	-3.6	-
			NBR	10.4	B	10.9	B	10.4	B	10.9	B	0.0	-	0.0	-

The results of the future conditions with improvements analysis indicates that, with the implementation of the recommended improvements, the study intersection approaches and movements are expected to operate acceptably, at LOS D or better during both peak periods, with the following exception:

Highland Road (M-59) & Site Drive

- During the AM peak hour: The northbound left-turn movement is expected to operate at LOS E.
- During the PM peak hour: The northbound left-turn movement is expected to operate at LOS F.

Review of SimTraffic network simulations indicates generally acceptable operations during both peak periods, with reduced queues from the background conditions analysis. However, as previously identified, SimTraffic microsimulations do not account for motorists making two-stage left-turn movements and therefore provides a more conservative evaluation than what drivers can expect to experience.

9 QUEUEING ANALYSIS

The drive-through vehicle queueing was reviewed to determine if the proposed on-site queue lengths provide adequate storage to accommodate the projected operations. The coffee-shop is expected to have a peak trip generation of 111 trips during the AM peak hour. Coffee-shops with drive-through typically have an average service rate of approximately 80 vehicles per hour (vph), with 80% of customers utilizing the drive-through. Therefore, of the total vehicles generated by the proposed coffee-shop during the peak period, it is estimated that approximately 89 vehicles will utilize the drive-through; the remaining vehicles will park and walk-in. The evaluation of the queue length included two criteria:

1. A queueing analysis was performed to determine if the projected demand of the site exceeds the service rate and calculate the projected queueing. The projected demand (89 vph) is greater than the service rate (80 vph) of the site; therefore, there is a potential for vehicles to queue past the pickup window, as the demand exceeds the capacity.
2. A Poisson Distribution was performed to determine the probability of random arrivals. The results indicate a maximum potential of five (5) vehicles arriving at any given time.

The results of the queueing analysis for the coffee shop are summarized in **Table 9**.

Table 9: Coffee Shop Vehicle Queuing Analysis

DRIVE-THROUGH STACKING SPACE CALCULATOR	
Number of Arrivals	89
Time per Vehicle (s)	45
Service Rate (veh/hr)	80
Drive-Through Queue (veh)	9
Peak Arrival (veh)	5
Vehicle Length	25
TOTAL QUEUE (ft)	**350**

10 CONCLUSIONS

The conclusions of this TIS are as follows:

1. <u>Existing Conditions (2024)</u>

- The results of the existing conditions analysis indicates that all approaches and movements at the study intersections are currently operating acceptably, at LOS D or better, during both the AM and PM peak hours, with the following exceptions:
    - <u>Highland Road (M-59) & Fisk Road:</u> The EB and SB left-turn movements are both currently operating at LOS E, during the PM peak hour. Review of SimTraffic network simulations indicates generally acceptable operations. Occasional periods of vehicle queues were observed; however, the majority were observed to be processed within each cycle length, leaving minimal residual vehicle queueing.
    - <u>Highland Road (M-59) & W. Marketplace Drive:</u> The NB approach and SB shared left/through lane are both currently operating at LOS F, during the AM peak hour. Additionally, the SB shared left/through lane is currently operating at LOS F, during the PM peak hour. Review of SimTraffic microsimulations indicates periods of long vehicle queues during the PM peak hour.
    - <u>Highland Road (M-59) & JOANN Fabric Drive:</u> The SB approach currently operates at LOS E, during the PM peak hour. This approach was designed to prohibit egress left-turns; however, the left-turns are causing the reported delay. The total volume of southbound egress traffic is very low (3 vehicles), which includes two (2) vehicles making an egress left-turn movement.

- Highland Road (M-59) & Sunny Beach Boulevard: The NB left-turn movement and the SB approach are both currently operating at LOS F, during both peak hours. Review of SimTraffic indicates generally acceptable operations during the AM peak hour. Review of SimTraffic during the PM peak hour indicates that vehicles along Sunny Beach Boulevard experience difficulty in finding gaps within the through traffic along Highland Road (M-59), resulting in long vehicle queues along the minor street; these vehicle queues do not dissipate and were typically observed to persist throughout the PM peak hour.
- However, review of the TMC data collection videos indicates traffic is able to find adequate gaps within the through traffic; therefore, SimTraffic is providing a more conservative evaluation, as it does not account for motorists making two-stage left-turns

2. Background Conditions (2026 No Build)

- A conservative annual background growth rate of **0.5%** per year was utilized to project the existing 2024 peak hour traffic volumes to the site buildout year of 2026.
- The results of the background conditions analysis indicates that the study intersections are expected to continue operating in a manner similar to the existing conditions analysis, with minor increases in delays due increases in background traffic volumes.

3. Future Conditions (2026 Build)

- With the addition of the site-generated trips, the study intersections are expected to continue operating in a manner similar to the background conditions analysis, with no additional impacts to LOS.
- All approaches and movements at the proposed site driveway intersection with Highland Road (M-59) are expected to operate acceptably, at LOS D or better, during both the AM and PM peak hours, with the following exception:
  - Highland Road (M-59) & Site Drive: The NB approach is expected to operate at LOS E, during the AM peak hour, and at LOS F, during the PM peak hour. Review of SimTraffic network simulations during the PM peak hour indicates that vehicles existing the Site Drive approach experience difficulty in finding gaps within the through traffic along Highland Road (M-59), resulting in long vehicle queues.
  - However, as identified during the existing conditions analysis, SimTraffic does not account for motorists making two-stage left-turn movements and therefore provides a more conservative evaluation than what drivers can expect to experience
- Therefore, the results of the future conditions analysis indicates that the site-generated traffic volumes from the proposed development are expected to have a negligible impact to the delay (LOS) and vehicle queueing observed at the off-site study intersections along Highland Road (M-59).

4. Access Management

- The MDOT right-turn treatment criteria were evaluated at the proposed site driveway; the result of the analysis indicates that a right-turn lane is recommended along eastbound Highland Road (M-59) at the proposed Site Drive.
- The results of the driveway spacing analysis indicates that the location of the proposed site driveway on Highland Road (M-59) is not expected to meet the desirable MDOT spacing criteria, in relation to the nearby intersection and driveway.
  - However, there is not sufficient property frontage to meet the recommended spacing criteria. Additionally, the site plan includes proposed future cross access, stubbed at the property line to the west; this would provide improved site access, permitting this cross access between the nearby developments on the south side of Highland Road (M-59), should the adjacent property ever be redeveloped. Furthermore, shared access was investigated and is not available with the Sunny Beach Boulevard neighborhood to the east.

5. Future Conditions with Improvements

- Signal timing optimizations were reviewed and were determined to adequately improve the signalized study intersection of Highland Road (M-59) & Fisk Road to LOS D or better during the PM peak hour. Additionally, the vehicle queues at the signalized study intersection were observed to be reduced, with the implementation of the recommended mitigation measures.

6. Drive-Through Queueing Evaluation

- The results of the drive-through queueing evaluation indicates that the proposed site plan can adequately accommodate the projected vehicle queueing associated with the proposed coffee-shop, without impacting internal site circulation or the operations along Highland Road (M-59).

11 RECOMMENDATIONS

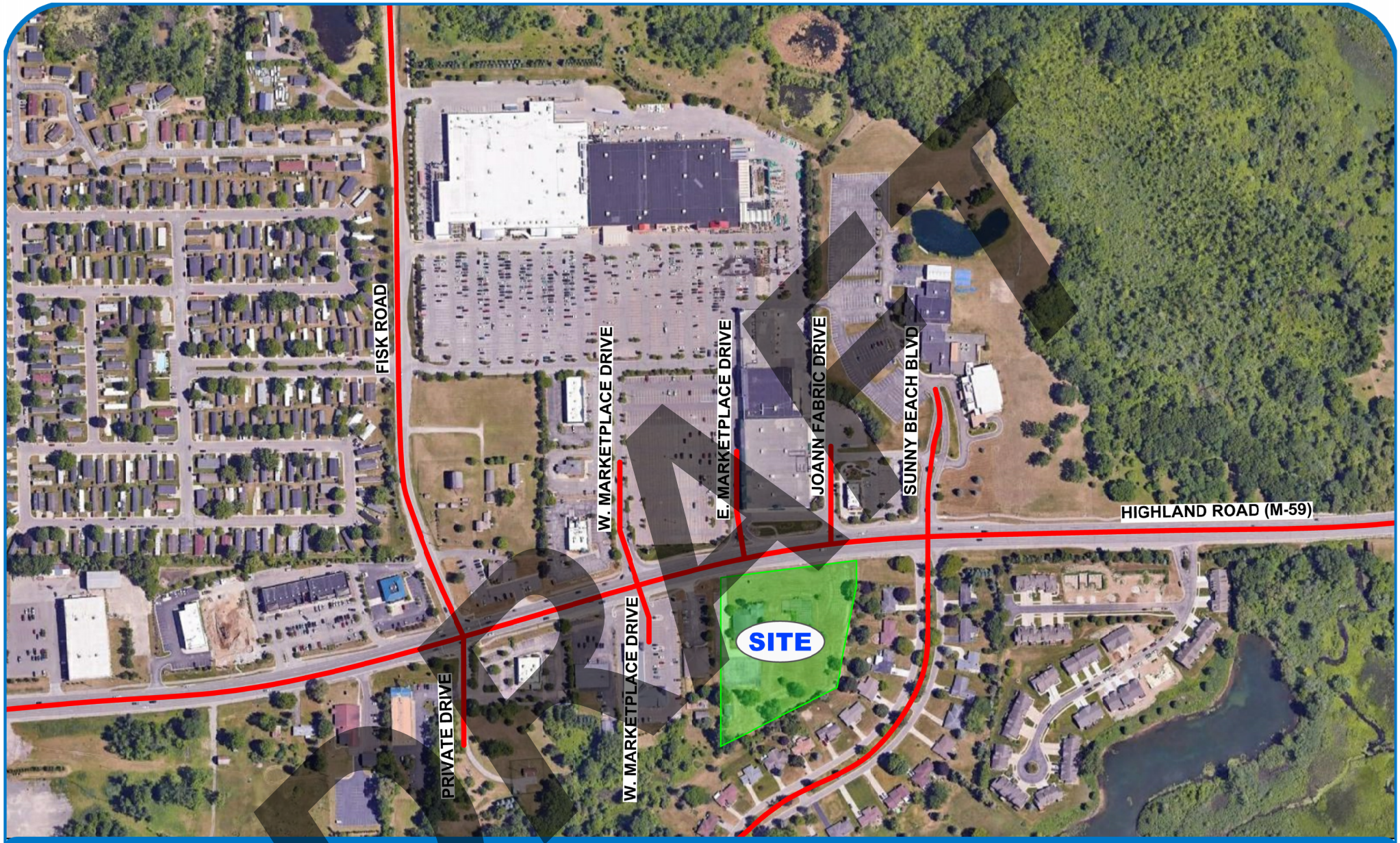
The recommendation of this TIS are as follows:

- Provide an eastbound right-turn lane along Highland Road (M-59) at the proposed Site Drive.
- Optimize the PM peak hour signal timing at the Highland Road (M-59) & Fisk Road intersection.

Any questions related to this memorandum, study, analysis, and results should be addressed to Fleis & VandenBrink.

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Michigan.

Attachments: Figures 1 – 6
Proposed Site Plan
Traffic Volume Data
Signal Timing Permits
Synchro / SimTraffic Results
Auxiliary Lane Warrants



F&V

FIGURE 1

SITE LOCATION

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

SITE — SITE LOCATION

NORTH

SCALE: NOT TO SCALE

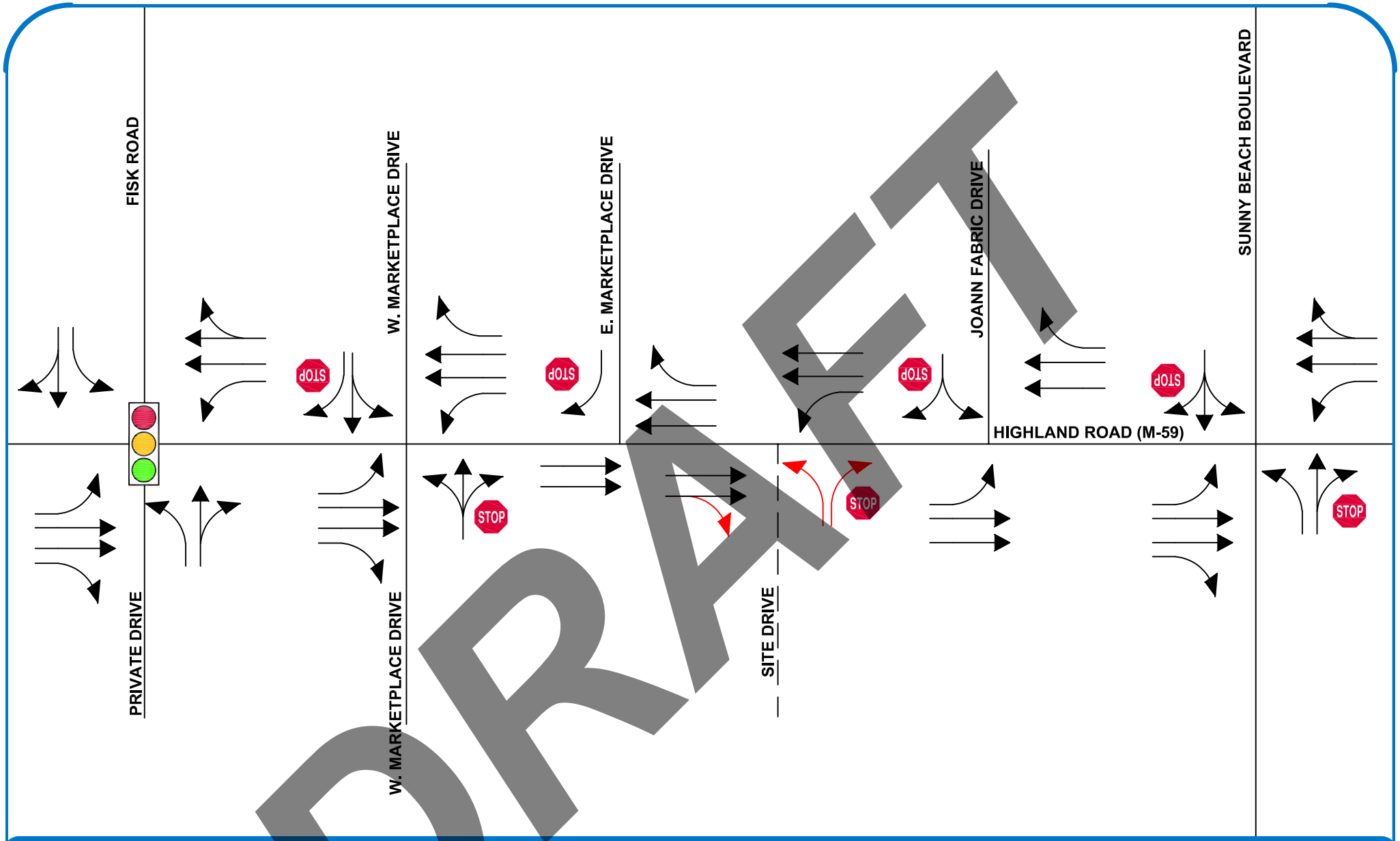


FIGURE 2

LANE USE AND TRAFFIC CONTROL

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

- ROADS
- PROPOSED ROADS
- LANE USE
- PROPOSED LANE USE
- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION

NORTH

SCALE: NOT TO SCALE

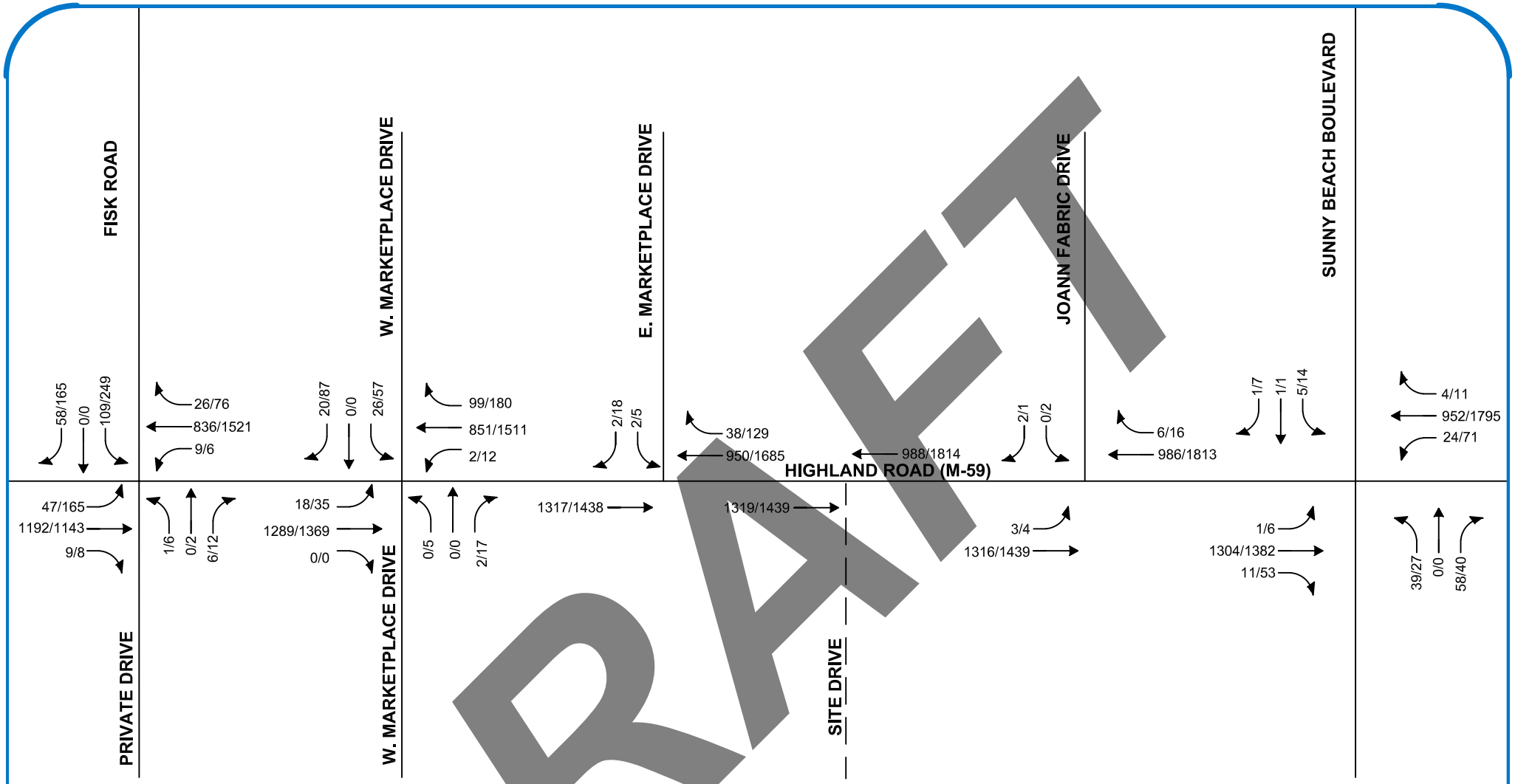


FIGURE 3

EXISTING (2024) TRAFFIC VOLUMES

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

ROADS

PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

NORTH

SCALE: NOT TO SCALE

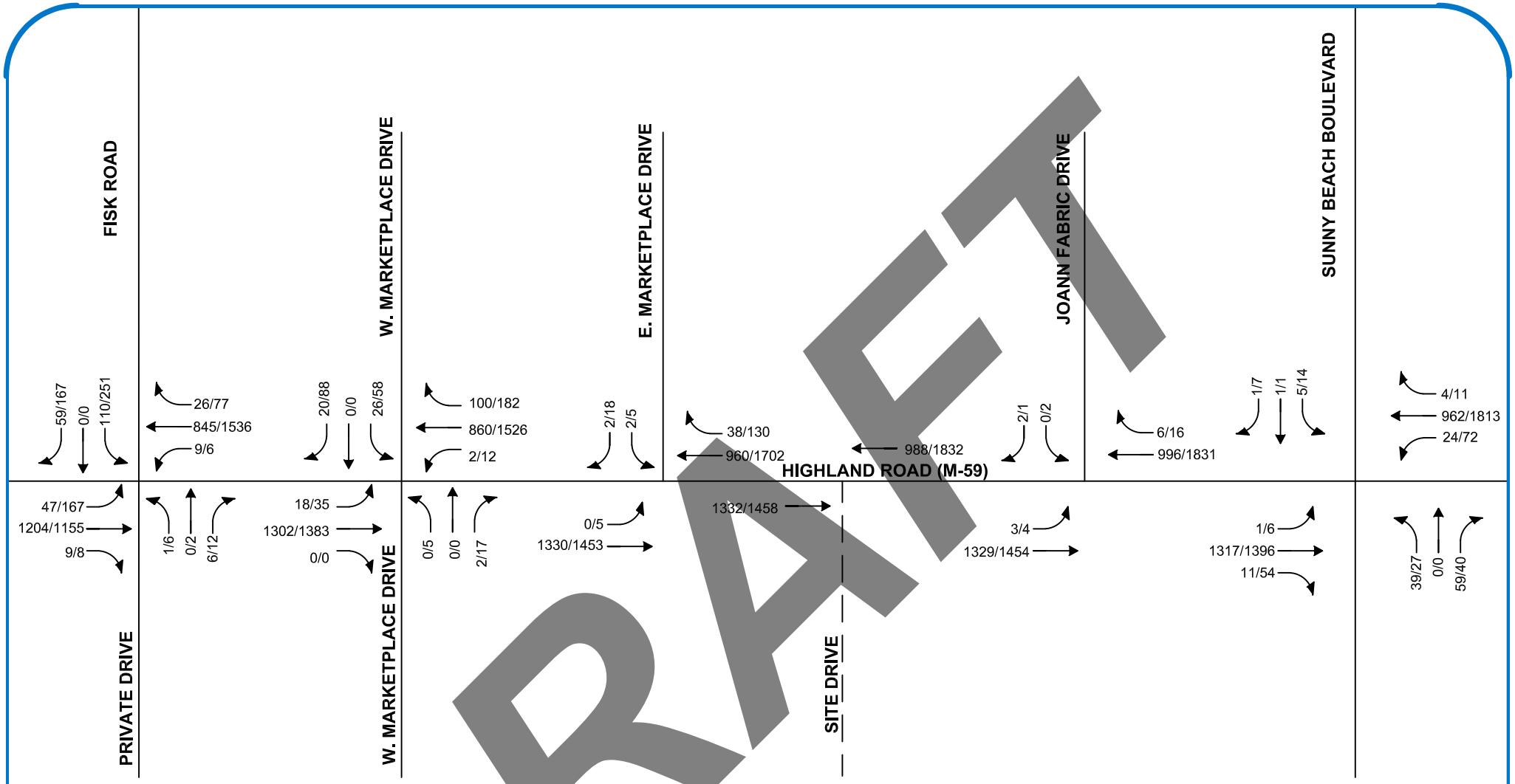


FIGURE 4
BACKGROUND (2026) TRAFFIC VOLUMES

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

ROADS

PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

NORTH

SCALE: NOT TO SCALE

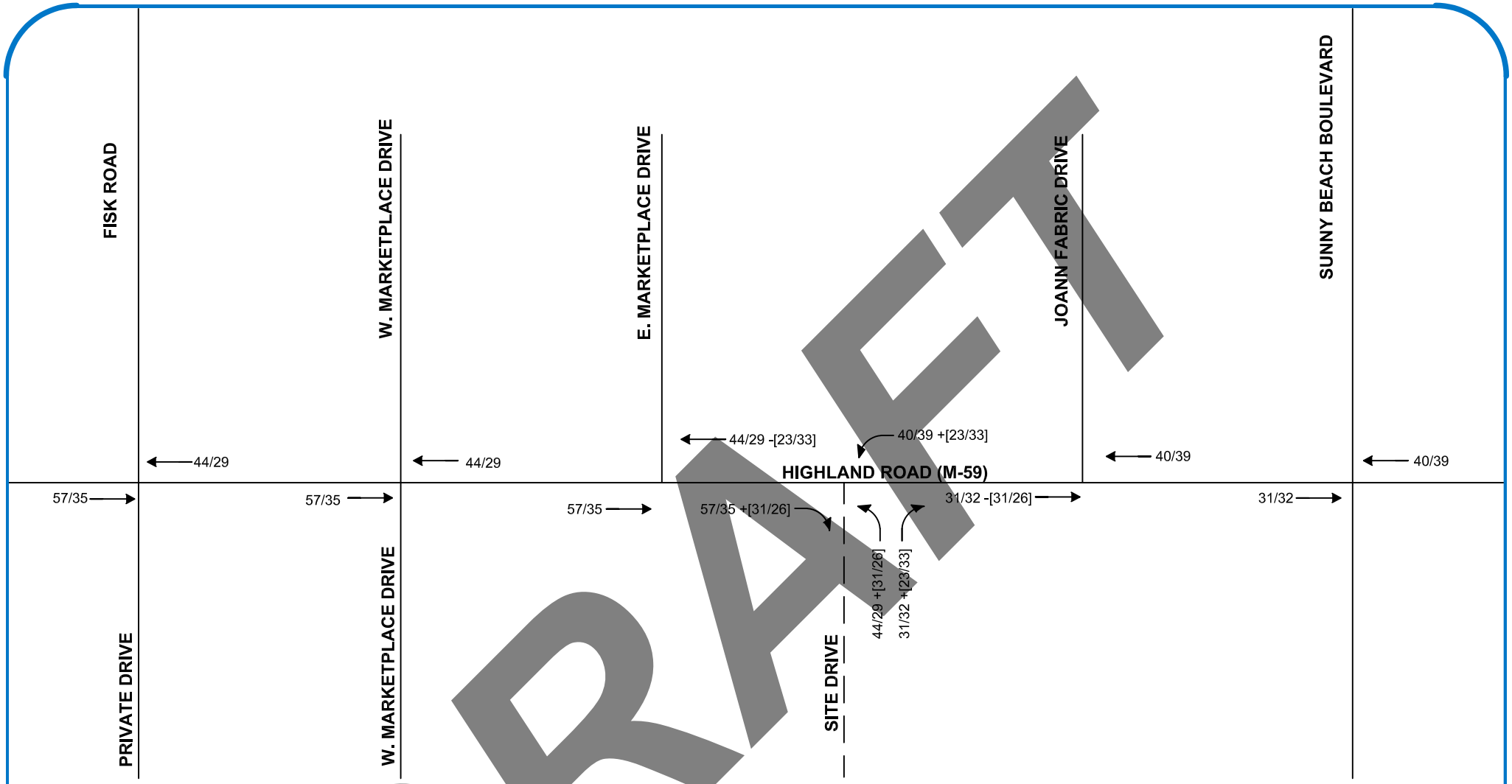


FIGURE 5
SITE-GENERATED TRAFFIC VOLUMES

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

- ROADS
- PROPOSED ROADS
- TRAFFIC VOLUMES (AM/PM)
- +/-[000/000] PASS-BY [AM/PM]

NORTH

SCALE: NOT TO SCALE

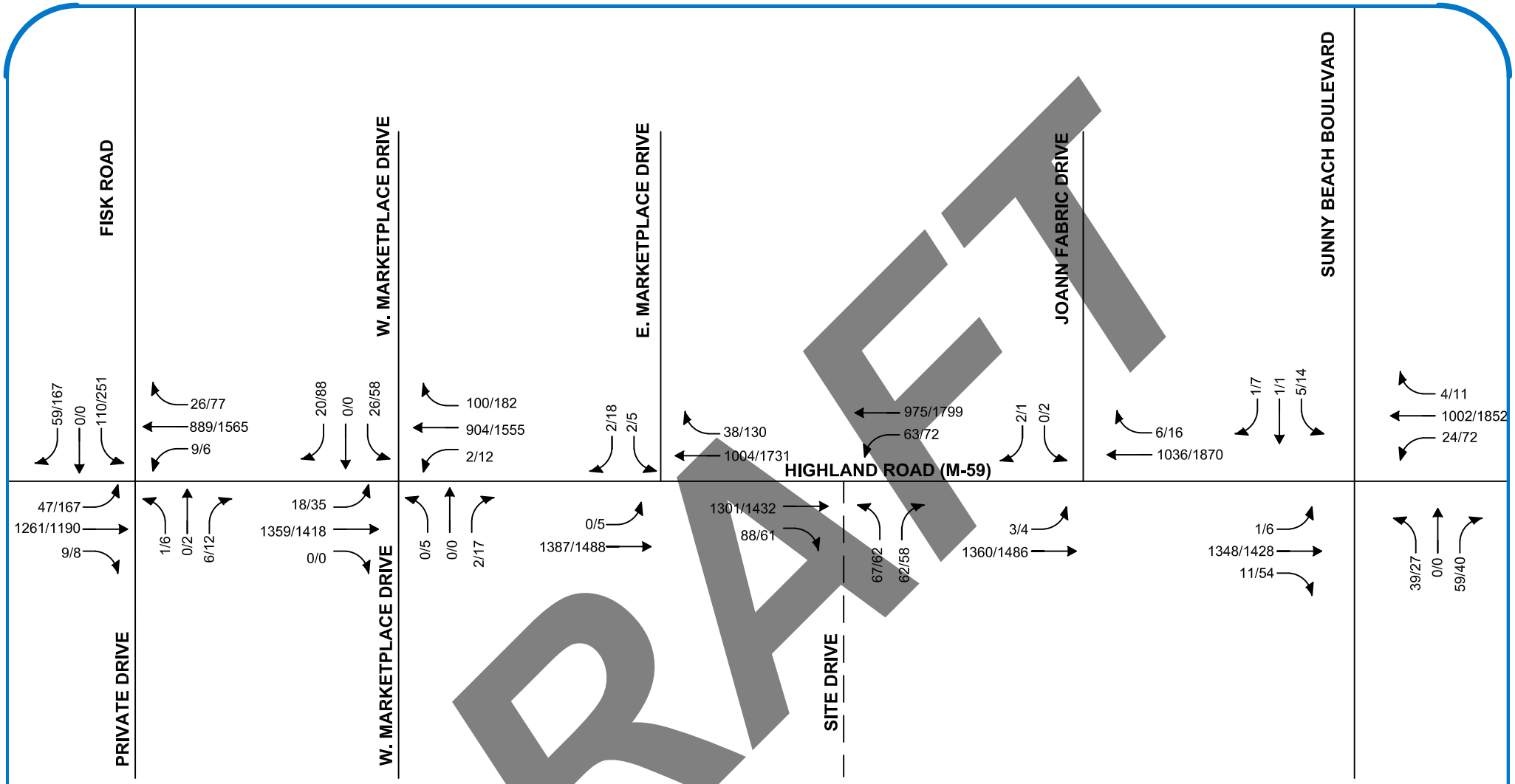


FIGURE 6

FUTURE (2026) TRAFFIC VOLUMES

9101 HIGHLAND ROAD TIS - WHITE LAKE TOWNSHIP, MI

LEGEND

ROADS

PROPOSED ROADS

TRAFFIC VOLUMES (AM/PM)

NORTH

SCALE: NOT TO SCALE