Propane by Rail in Michigan's Upper Peninsula

November 30, 2021

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1. Introduction and Background

1.1 INTRODUCTION

This report fulfills a recommendation of the Michigan Upper Peninsula Energy Task Force (Task Force), which was established by Michigan Governor, Gretchen Whitmer, by Executive Order 2019-14 in 2019. The Task Force was charged to assess the Upper Peninsula's energy needs, formulate alternative solutions to the Upper Peninsula's energy needs including alternative sources of supply, sources of energy, and to evaluate potential changes that could occur to energy supply and distribution, including the impacts of those changes. The Task Force identified 14 recommendations to address issues associated with Upper Peninsula energy and potential propane shortages. This study focuses on recommendation #5: "MDOT should pursue a State Planning & Research (SPR) project that would include a survey of U.P. railroad companies to better understand their capabilities in regard to propane delivery and storage. The SPR project should also include ratings/classifications of railroad lines and spurs and needed upgrades to facilitate improved propane distribution in the Upper Peninsula. MDOT, in collaboration with the railroad companies, should provide a summary of the survey results and recommendations regarding needed rail line upgrades to the Michigan Legislature."[1] The purpose of this study is to assess the ability of the Upper Peninsula rail network to handle additional propane traffic and to recommend improvements that would enhance the propane handling capabilities. Per the Task Force recommendation, this report focuses solely on the Upper Peninsula, not the Lower Peninsula and focuses solely on propane, not other energy products.

The report is divided into the following sections:

- Description of the Upper Peninsula's existing rail infrastructure and any characteristics that would limit the movement of propane by rail
- Description of the current propane distribution in the Upper Peninsula
- Summary of differences in propane distribution in the Upper and Lower Peninsulas and the role that rail plays
- Federal regulations that govern the movement and storage of propane
- Overview of railroads' role in rail infrastructure projects
- Identification of capacity or condition improvements for the increased movement of propane by rail in the Upper Peninsula, their costs, map of potential improvements
- Conclusion and recommendations

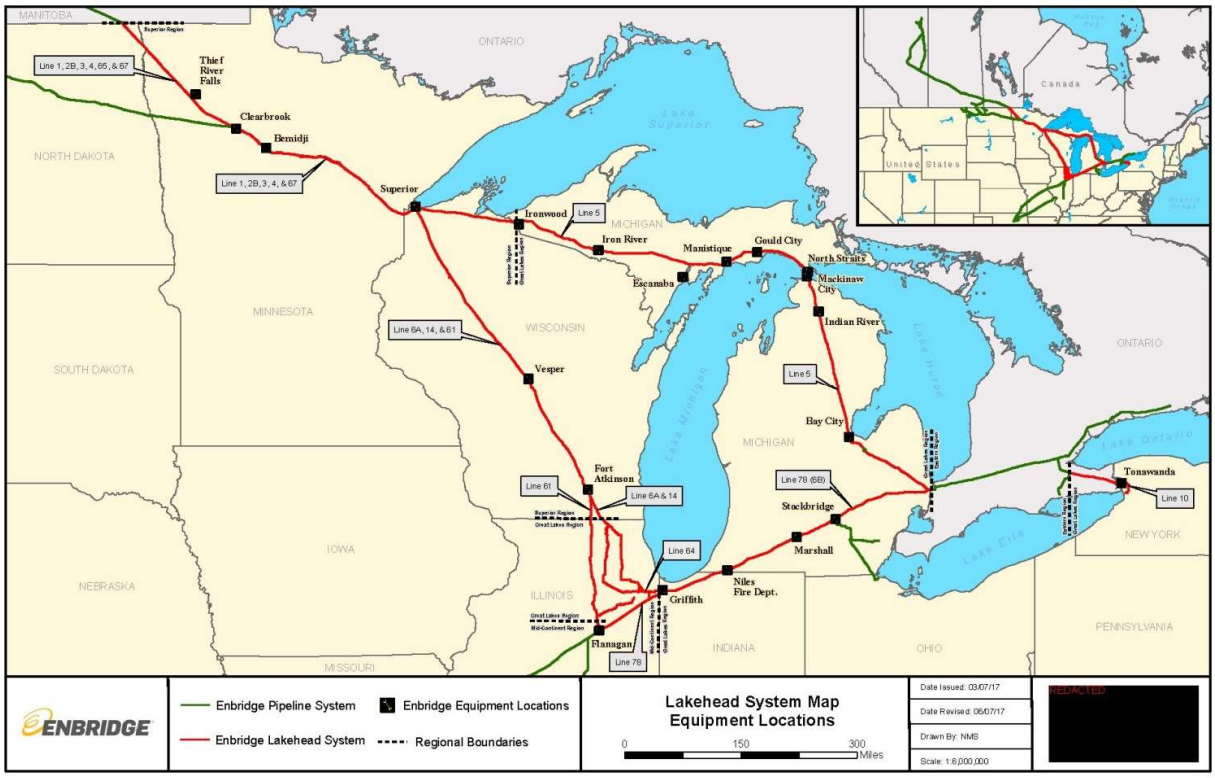
1.2 BACKGROUND

The Task Force found that the Upper Peninsula relies heavily on propane for its heating needs with 18 percent of Upper Peninsula residents using propane to heat their homes.[2] Most propane is supplied through pipelines owned by Enbridge, Inc. These pipelines bring natural gas liquids (NGLs) to fractionator facilities, where the NGLs are

[1]https://www.michigan.gov/documents/egle/Upper_Peninsula_Energy_Task_Force_Committee_Recommendations_Part_1_Propane_Supply_with_Appendices_687642_7.pdf.
[2]Ibid.

extracted from the pipeline, propane is processed, and the remaining NGLs are placed back into the pipelines. The two pipelines on which the Upper Peninsula relies are Line 1 and Line 5 as shown in Figure 1 below. Line 1 brings energy products from western Canada to Superior, Wisconsin, while Line 5 carries energy products from Superior, Wisconsin, through Michigan, to Sarnia, Ontario.

Figure 1. Enbridge Pipeline Network through Michigan



Source: Enbridge

Shown in Table 1 below, the Task Force report estimated that 87.6 percent of the Upper Peninsula's propane is supplied by the Rapid River fractionator facility, which is served by Line 5. Another 6.2 percent is supplied from a fractionator facility in Superior, Wisconsin, where Line 1 and Line 5 meet. The Enbridge pipelines account for 93.8 percent of the Upper Peninsula's propane needs.

Table 1. Upper Peninsula Propane Supply from Upper Peninsula Energy Task Force Report

Facility	Owner	Location	Annual Production (Gal)	% of U.P. Supply
Rapid River Fractionator	Plains Midstream Canada	Rapid River, Michigan	30,660,000	87.60%
Superior Fractionator	Plains Midstream Canada	Superior, Wisconsin	2,170,000	6.20%
Other Propane Supply Sources in Neighboring States			2,170,000	6.20%
Total Upper Peninsula Propane Supply/Demand			**35,000,000**	**100.00%**

Source: Upper Peninsula Energy Task Force

Given the heavy reliance on Line 5 and the Enbridge pipeline network in general, the Task Force report recommended additional research efforts to assess alternative transportation options for propane to the Upper

Peninsula, including this report. Redundancy will help to ensure consistent and dependable supplies are accessible to those in need in case of disruption.

Discussions with rail-served propane retailers and wholesalers in the Upper Peninsula and a review of the U.S. Surface Transportation Board (STB) Carload Waybill Sample suggest that the findings in Table 1 may understate the current role of rail transportation in the Upper Peninsula propane distribution network.[3]

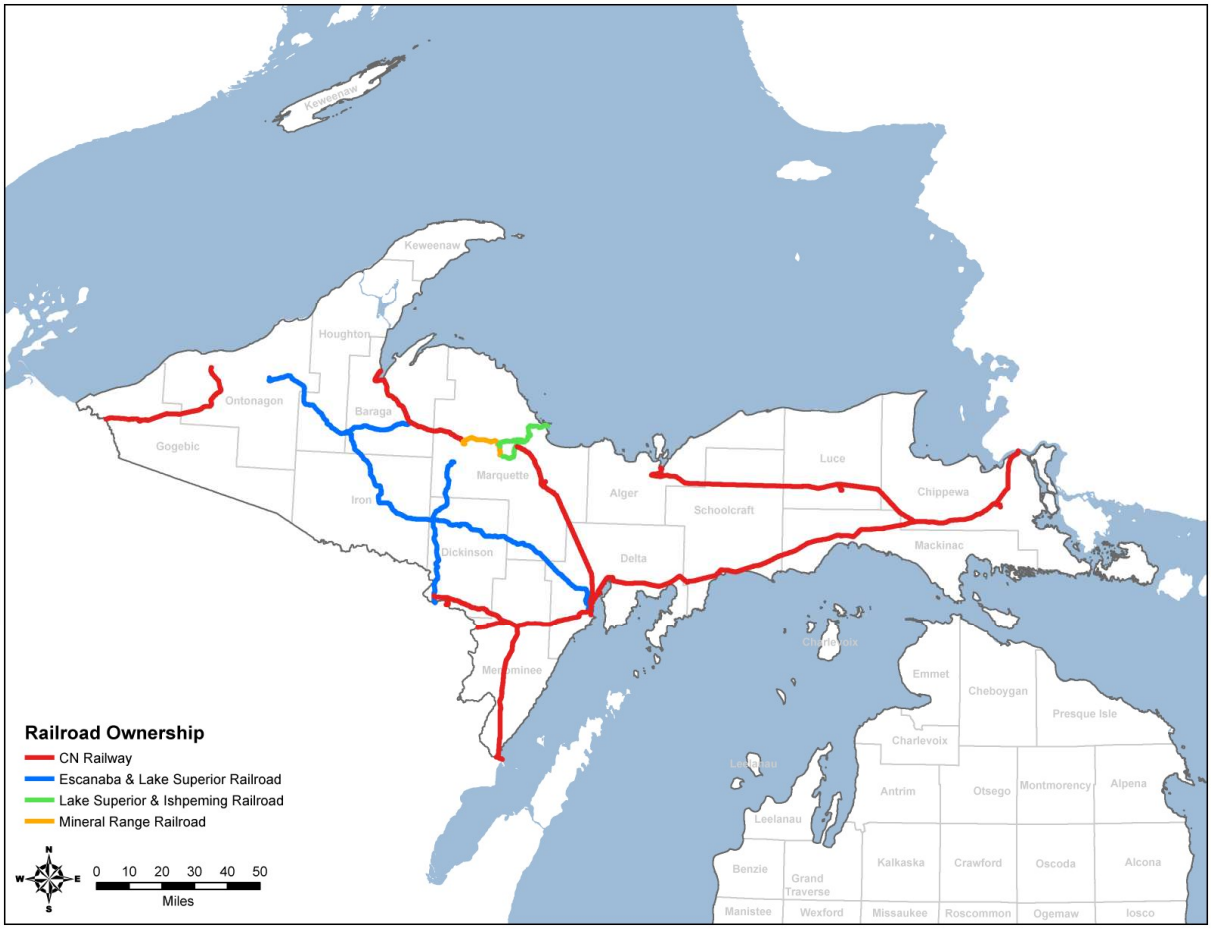
[3] The Carload Waybill Sample is a stratified sample of carload waybills for all U.S. rail traffic submitted by those rail carriers terminating 4,500 or more revenue carloads annually. Waybills are document issued by rail carriers giving details and instructions relating to the shipment of a consignment of goods. The Carload Waybill Sample is the best available source of information regarding flows of rail freight, but is limited by confidentiality. Data from the Carload Waybill Sample can only be made public in an aggregated format so that shipment volumes cannot be traced to a specific shippers or receivers. Waybill data suggests that while pipeline may be the largest source of supply for Upper Peninsula propane, a significant volume also arrives by rail.

2. Upper Peninsula Rail Network

The Upper Peninsula of Michigan has a long history of rail transportation. While the total mileage of rail network under active operations has declined over time, today's network still consists of over 500 miles of active track, offering connections to Wisconsin at several locations, as well as to Canada via Sault Ste. Marie bridge. The majority of the network is owned and operated by the only Class 1 railroad[4] in the region – CN Railway, within the Upper Peninsula are also tracks owned and operated by the Escanaba & Lake Superior Railroad (E&LS), the Mineral Range Railroad (MRR) and the Lake Superior Ishpeming Railroad (LS&I) (Figure 2). Some of the track segments have trackage rights that allow one railroad to operate over the tracks of another. Some of the segments currently owned by the CN Railway (Trout Lake to Munising and out-of-service segment to White Pine) are subject to a sales agreement with Watco Companies [5]. This agreement is pending due to on-going review by the STB.

[4] https://www.aslrra.org/web/About/Short_Line_Definitions.aspx
[5] https://www.watco.com/wp-content/uploads/2021/04/Watco_CN_PR.pdf

Figure 2. Upper Peninsula of Michigan Rail Ownership



In the Upper Peninsula, CN Railway handles most of the traffic entering and leaving the Peninsula, but it has several interchange locations where it can interchange rail cars (receive or deliver) with the other operating railroads. The great majority of rail traffic in the U.S is considered "interchanged", meaning that the carload moves on more than one rail service provider. Table 2 shows the main locations for such interchanges. Per available information, all interchanging arrangements within our region are between CN and one of the other operating railroads.

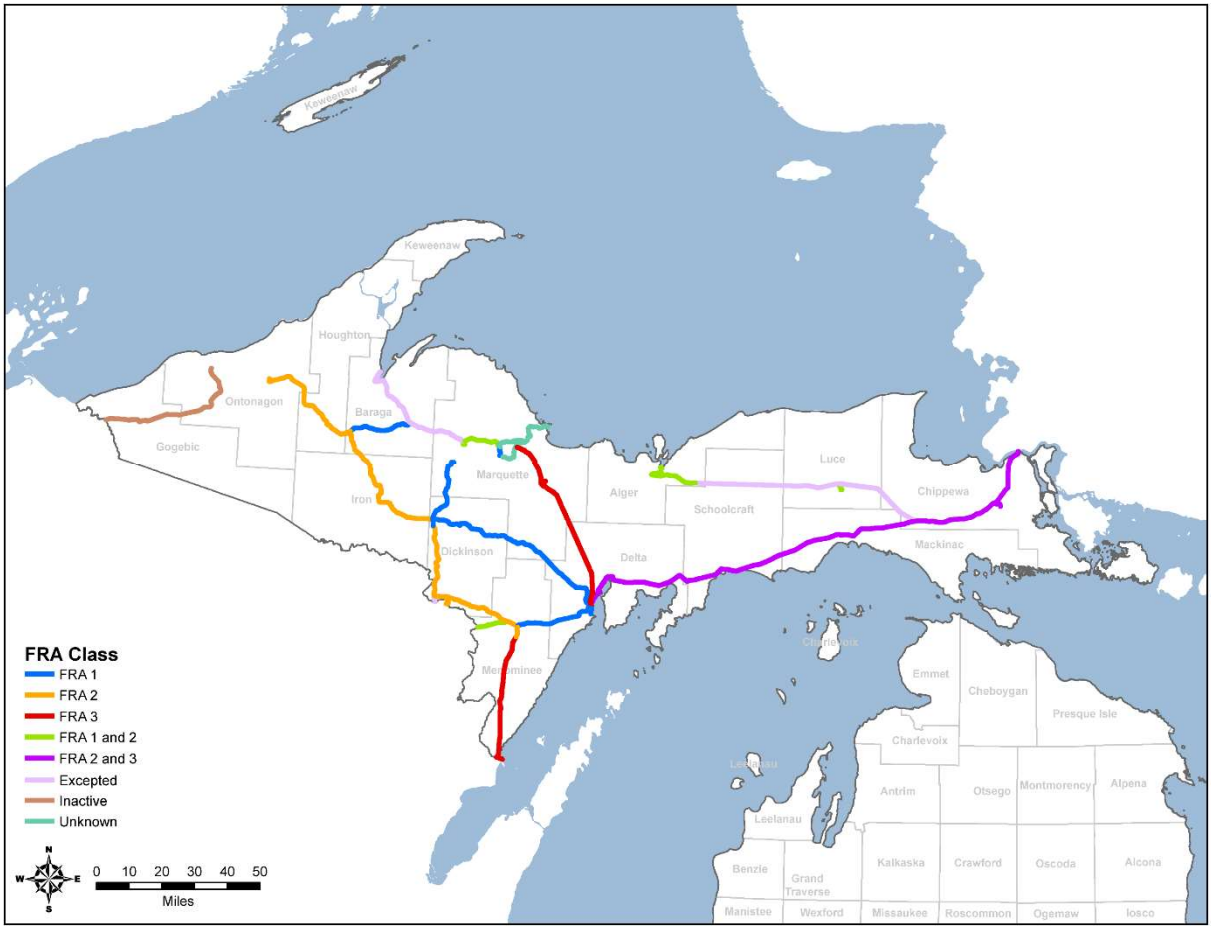
Table 2. CN Interchange Location(s)

Railroad	Interchange Location(s)
Escanaba & Lake Superior Railroad (E&LS)	North Escanaba, Marinette (WI), and Green Bay (WI)
Mineral Range Railroad (MRR)	Soo Junction (Ishpeming)
Lake Superior & Ishpeming Railroad (LS&I)	Eagle Mills (Negaunee)

Figure 3 presents the current Federal Railroad Administration (FRA) track classifications of the Upper Peninsula rail segments. FRA track classifications are based on the level of maintenance, inspections, and track characteristics of each rail line. They determine the speeds at which trains can operate, so that freight trains operating on tracks rated at FRA Class 1 are limited to 10 miles per hour; Class 2, 25 miles per hour; Class 3, 40 miles per hour, and so

on. The great majority of the tracks in the Upper Peninsula are classified as either Class 1 or Class 2, both of which allow propane transportation. While the level of service on Class 1 track segments is limited due to the 10 mile per hour maximum speeds, these segments can nevertheless accommodate propane shipments. Several segments in the Upper Peninsula are rated "Excepted." These can handle propane railcars, but trains are limited to no more than five cars of hazardous materials per train.

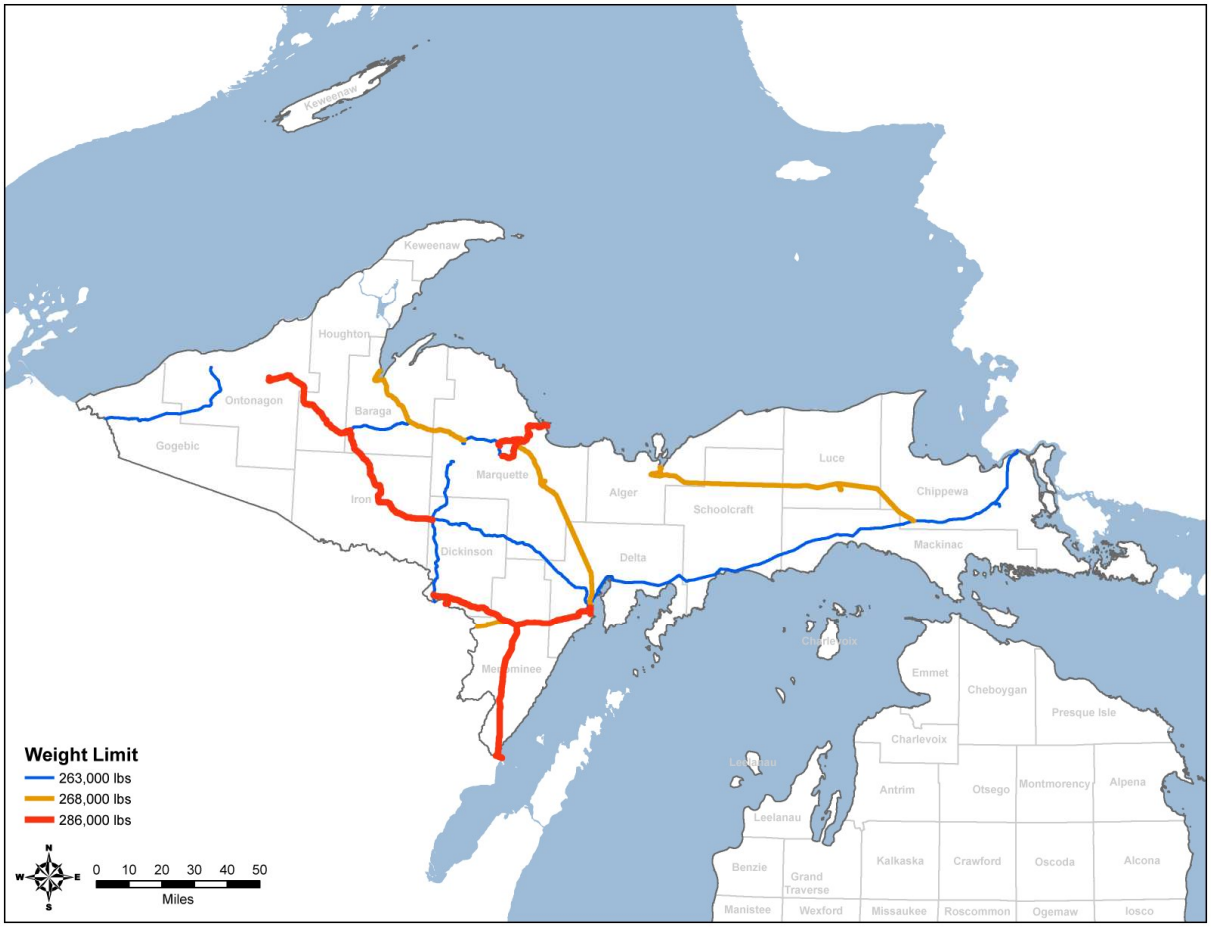
Figure 3. FRA Track Classification



Source: Michigan Technological University

In addition to track classes, rail operations are restricted by the weight limits of track segments. The current industry standard for total car weight, or gross rail load (GRL), is 286,000 lbs. (143 tons), but a significant portion of the UP is restricted to 263,000 lbs gross rail loads, including the cross-border bridge at the Sault Ste. Marie (Figure 4). Weight limitations do not preclude propane transportation, but shippers would use lower capacity tanks cars with 100-ton net capacity versus the 110 tons capacity railcars. As the U.S. tank car fleet trends towards heavier cars, smaller railcars will become increasingly unavailable, so that shippers will need to use heavier, more expensive cars but not use their entire capacity.

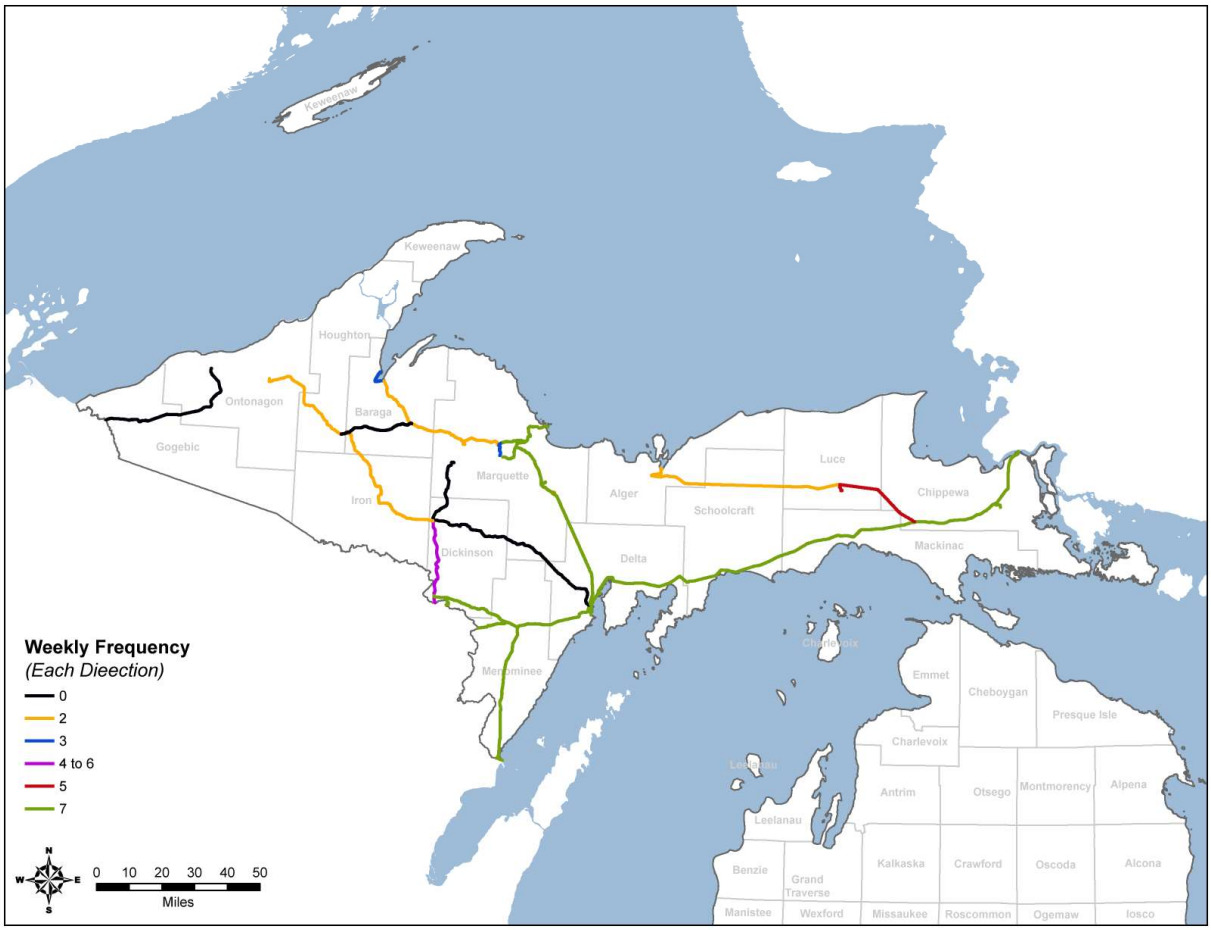
Figure 4. Gross Rail Load (Weight) Limits



Source: Michigan Technological University

Rail service providers currently provide a daily (at least weekday) train service on most rail segments (Figure 5), providing fertile ground for new customers or expanded volumes. Track segments with lower track class often also carry lower freight densities that do not warrant daily services, creating another challenge for regular propane shipments on those lines.

Figure 5. Train Service Frequencies



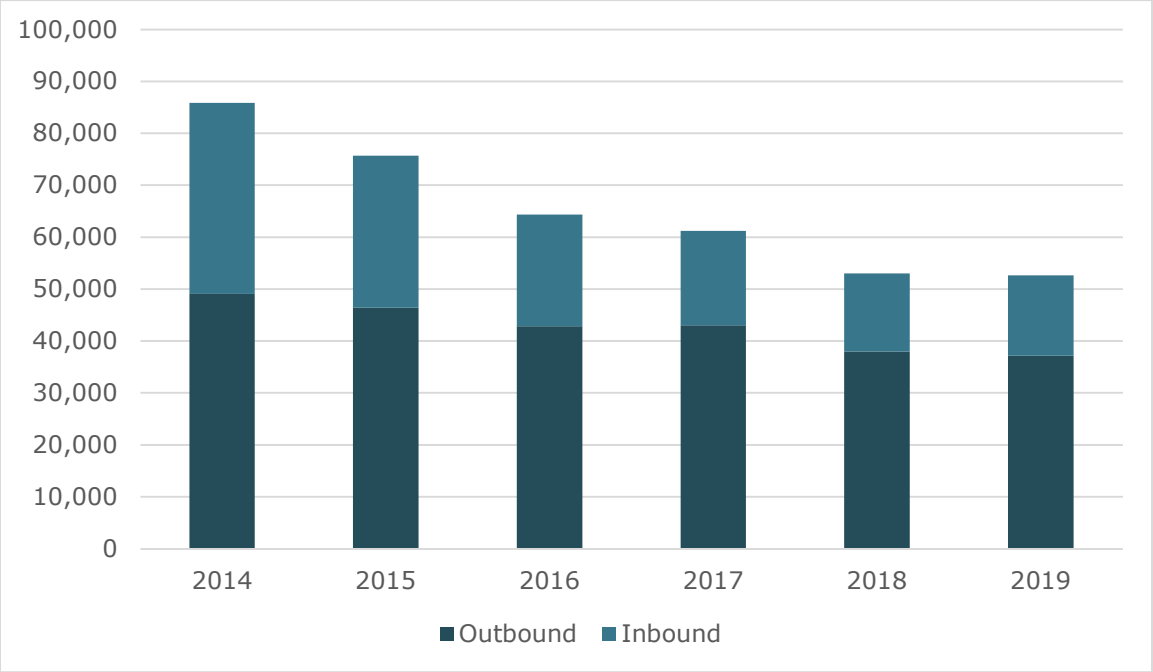
Source: Michigan Technological University

In 2019 railroads originated about 37,000 carloads in the Upper Peninsula and terminated about 15,500, excluding iron ore shipments traveling within the Upper Peninsula. These represented significant declines since 2014, when railroad had originated over 49,000 carloads and terminated nearly 37,000. Originating and terminating tonnage have similarly declined, so that 2.5 million terminating tons in 2014 declined to 1.3 million terminating tons in 2019. Reductions in outbound tonnage were slightly less dramatic, declining from 3.9 million tons in 2014 to 3.3 million tons in 2019.

By far, the greatest volume of freight rail in the Upper Peninsula consists of iron ore shipments from the Cleveland-Cliffs mines to the Marquette dock. These are handled by the LS&I Railroad. Some forest products movements, especially logs, are also intrastate movements, but their portion of the total volume is smaller and have experienced similar decline as the interstate movements. In addition to the LS&I iron ore movements, the heaviest freight rail traffic concentrates on the CN line that crosses the Peninsula from Escanaba to Sault Ste. Marie, as well as on the line between Marquette and Escanaba, which is also dominated by the iron ore movements.

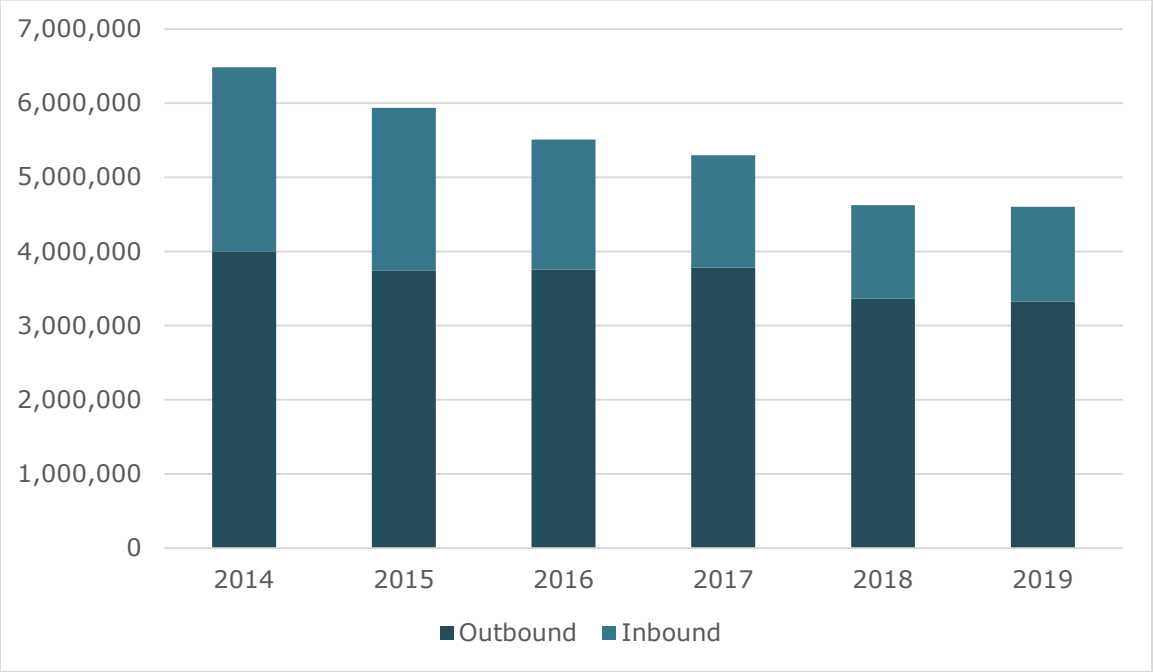
Figure 6, Figure 7, and Figure 8 graphically display rail freight flows and trends for the Upper Peninsula.

Figure 6. Rail Carloads Inbound and Outbound to the Upper Peninsula



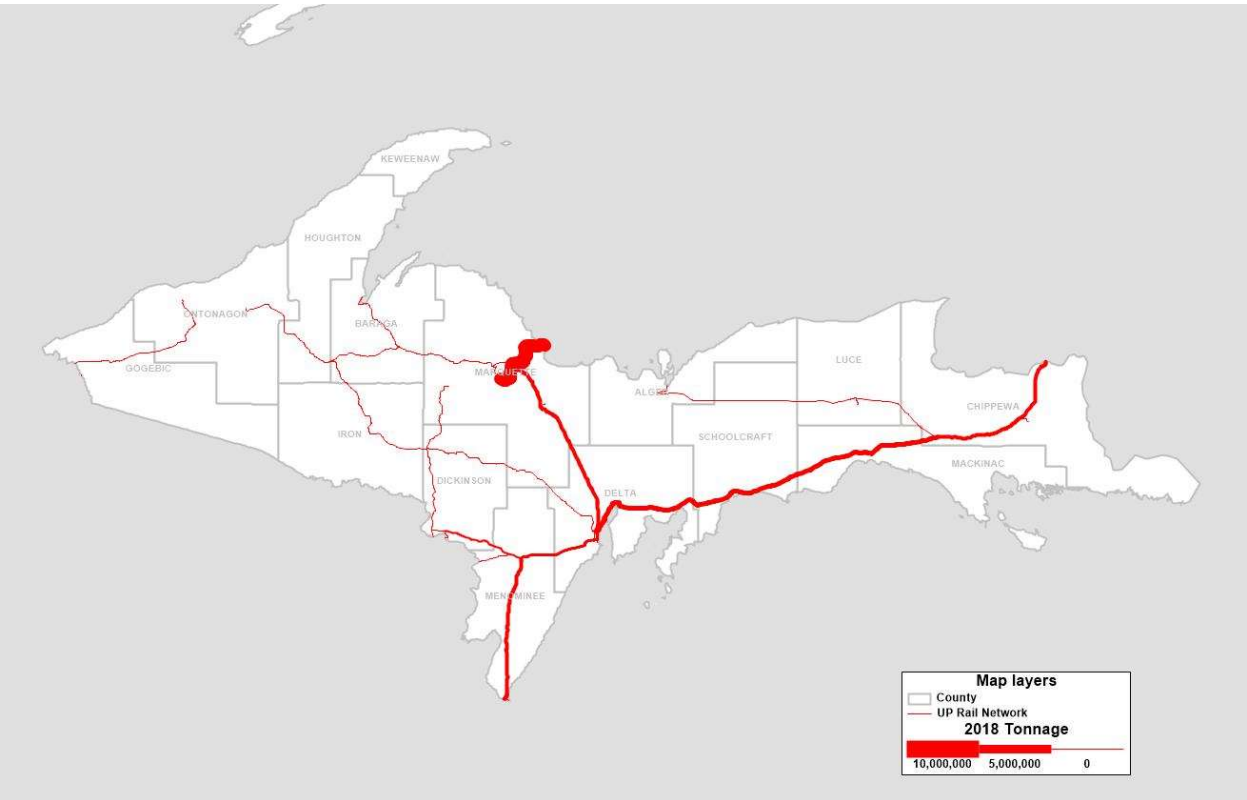
Source: STB Waybill Sample

Figure 7. Rail Tons Inbound and Outbound to the Upper Peninsula



Source: STB Waybill Sample

Figure 8. Tonnage of Rail Traffic on Upper Peninsula Rail Lines in 2018



Source: STB Waybill Sample, MDOT

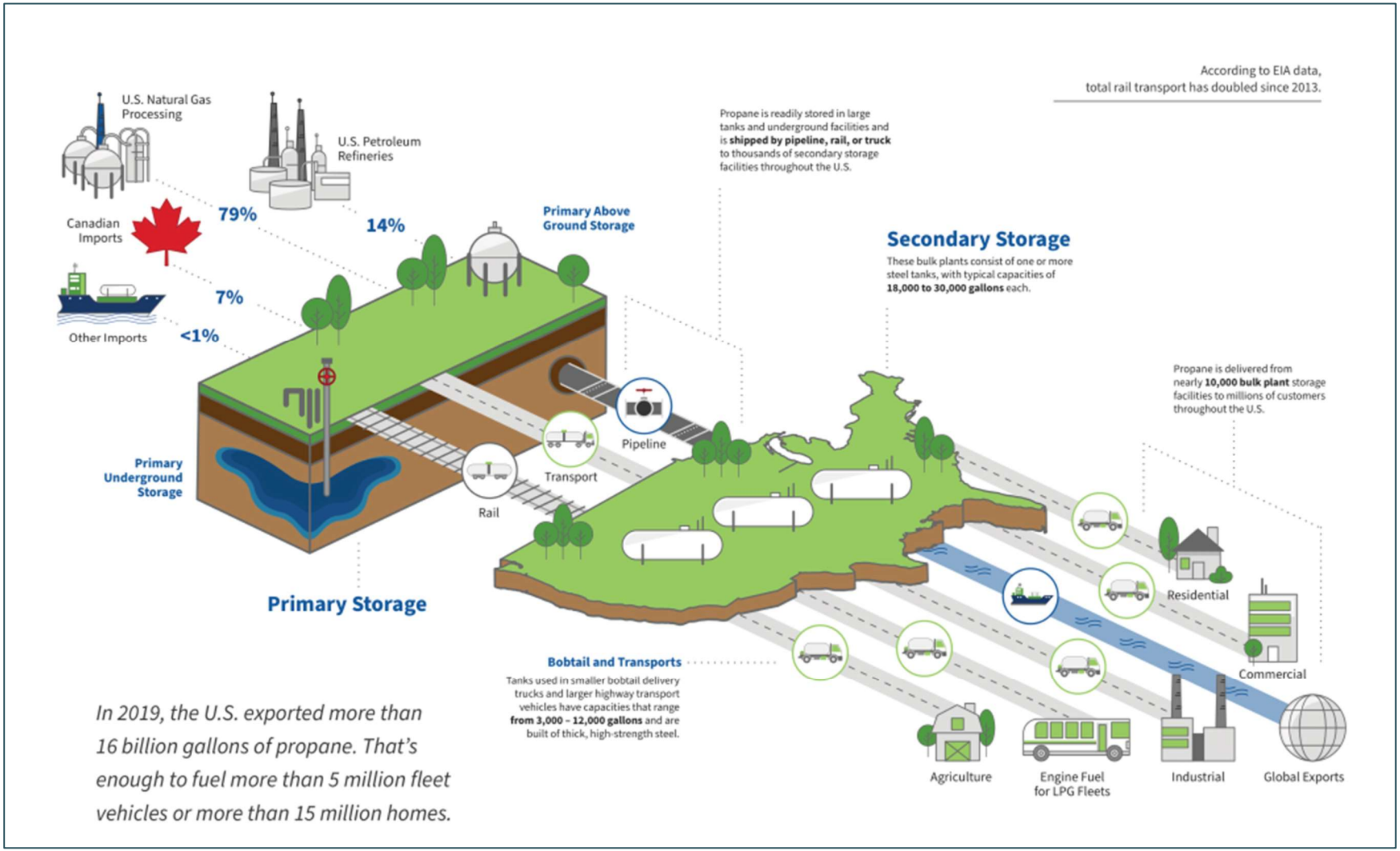
3. Summary of Current Propane Distribution in the Upper Peninsula

3.1 PROPANE SUPPLY CHAIN

According to the National Propane Gas Association, 79 percent of the propane consumed in the U.S. is produced as a byproduct of natural gas processing, while 14 percent is processed through oil refineries. Another seven percent is imported from Canada. Propane can be shipped either from processing facilities or from primary storage. Propane storage includes primary and secondary storage where primary storage consists of refinery, gas plant, pipeline, and bulk terminal stocks that are stored above or below ground. Secondary storage consists of large above-ground tanks owned by retail or wholesale distributors. Homes and businesses also maintain tertiary storage in smaller tanks, which can also represent a significant storage capacity.

In the case of the Upper Peninsula, most propane is shipped from a natural gas liquid processing facility (fractionator plants) in Rapid River or Superior, Propane is then stored in secondary storage tanks that typically have capacities of 18,000 to 30,000 gallons but can be as many as 90,000 gallons. No primary storage facilities are located in the Upper Peninsula. Smaller delivery trucks deliver propane locally to the ultimate retail customers. A schematic of the propane supply chain is shown Figure 9 below.

Figure 9. Propane Supply Chain



Source: National Propane Gas Association

The Task Force report estimated that the least expensive source of propane for the Upper Peninsula is western Canada, which is the existing source of the NGLs used as propane feedstock at the Rapid River and Superior fractionator plants. Discussions with rail-served Upper Peninsula propane marketing companies and a review of the STB Carload Waybill Sample for 2019 both confirmed that western Canada is also a frequent origin of propane shipments to the Upper Peninsula by rail. Rail shipments are also received from sources in Kansas, Illinois, and North Dakota.

Propane or propane feedstock can move from primary storage or initial processing by pipeline, truck, or rail. When considering transporting propane to the Upper Peninsula, each mode has its advantages and disadvantages:

- **Truck transportation** is the most flexible mode of transportation. Trucks can travel almost anywhere there is a road. It is a relatively fast and reliable mode of transportation, often delivering within a window of several hours compared to a delivery window of days for rail. However, trucking is also more expensive, particularly over long distances. Beyond a day's drive (500 – 700 miles) truck drivers must stop for required rest periods or team drivers can alternate driving. This can add additional cost to truck for long-distance hauls. Based on the information from the distributors in the region, the efficiency of local truck deliveries drops if they exceed 150-mile radius from the storage facility. In addition, the availability of drivers within a given area can at times limit shippers' abilities to suddenly increase shipment volumes. Driver availability can also delay shipments, as these shippers wait for drivers and equipment to be made available. Trucking also generates more external impacts relative to rail or pipeline with higher rates of crashes and higher emissions.
- **Railroad transportation** is slower and less flexible than truck transportation, but it is also less expensive, particularly for shipments long distances and in large volumes. While the rail network is smaller than the roadway network, it is still relatively extensive with over 500 miles of active rail lines in the Upper Peninsula. A typical railcar can hold over 33,000 gallons of propane compared to a standard over the road propane truck trailer, which can hold 8,800 gallons (the largest Michigan truck can hold 17,000 gallons[6]). Rail shipments of propane to the Upper Peninsula can be shipped from any rail origin in North America. A single railroad company, CN Railway, controls rail access to and from the Upper Peninsula, but multiple railroads provide "last-mile" access on the Upper Peninsula, including not only CN, but also the ELS, MRR, and the I&LS.
- **Pipeline** is the least costly but the least flexible mode of transportation. The Task Force report estimated that Line 5 transportation cost from Edmonton, Alberta to Rapid River was $0.0853 per gallon of propane in 2019.[7] By contrast, the report estimated that the cost of shipping propane by rail from Edmonton, Alberta to Escanaba (15 miles from Rapid River) would be double the cost at $0.1913 per gallon. On the other hand, pipeline transportation provides fewer options. The origins of shipments on Line 5 are necessarily on the Enbridge Lakehead pipeline system. The Plains LPG Service plant in Rapid River is the only access to the pipeline in the Upper Peninsula. Natural gas liquids must be sequenced with crude oil shipments. Retailers interviewed for this study mentioned instances where the Rapid River facility ran out of propane and closed for periods of time. According to these individuals, reliability has at times been an issue. One retailer from across the border in Wisconsin felt that pipeline was more competitive in the summer when demand was less, but less competitive in the winter, when buyers demand is higher and buyers must concentrate on a single source of supply.

[6] The maximum gross vehicle weight allowed on a "federal-weight-law truck" is 80,000 pounds with four of five axles carrying 17,000 pounds and the steering axle carrying 12,000 pounds. The State of Michigan allows more axles to be added to trucks so that the maximum gross vehicle weight allowed on a "Michigan-weight-law truck" is 164,000 pounds. The heaviest Michigan truck has 11 axles, most of which carry 13,000 pounds.
[7] Ibid.

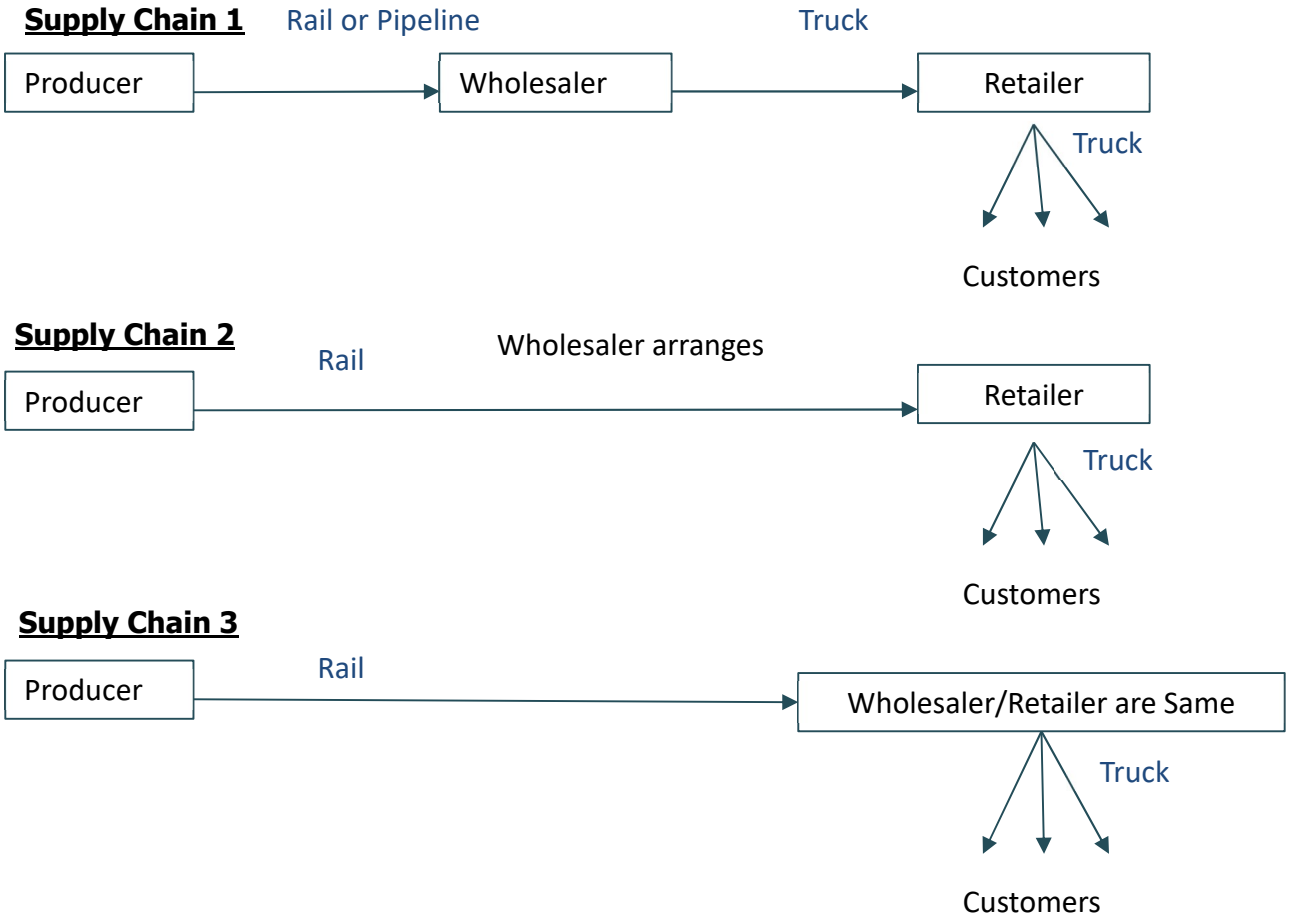
Evidence suggests that all three modes are used to bring propane to the Upper Peninsula. A report conducted for the State of Michigan in 2017 presented data from Enbridge indicating that the Rapid River fractionator plant produced about 28 million gallons of propane per year between 2015 and 2016.[8]

The study team reviewed propane rail shipments to the Upper Peninsula using the STB Carload Waybill Sample for the years 2014 through 2019. During this time period, between 7 and 20 million gallons of propane were shipped by rail to the Upper Peninsula per year, with average annual shipments totaling 11 million gallons. The average is 31 percent of the 35-million-gallon total demand estimated by the Task Force report. Discussions with propane retailers suggests that propane is also trucked to the Upper Peninsula, either from the fractionator facility in Superior, WI or from rail unloading locations in Wisconsin, although the truck modal share is smaller than the pipeline and rail modal share.

Transportation to the Upper Peninsula is arranged by propane wholesalers, with most shipments to the Upper Peninsula arranged by one of two wholesalers: one that serves the Rapid River fractionator facility or by rail by NGL Supply Co. Ltd in Kincheloe. These wholesalers then sell propane to retailers which sell to the ultimate propane customers. The most common arrangement is for the wholesaler to bring propane or natural gas liquids to the Upper Peninsula by rail or pipeline, then transport it to retailer by semi-trucks and finally to customers in smaller trucks (Supply Chain 1 in Figure 10). However, alternative supply chains were also revealed during interviews, such as instances where a wholesaler arranges for propane to be shipped by rail directly to a retailer location (Supply Chain 2 in Figure 10). In another case, a vertically integrated company provides both wholesale and retail services. The company has propane shipped directly to its retail location by the affiliated wholesale company (Supply Chain 3 in Figure 10). These variations in supply chain arrangements also create significant differences in modal costs. Rail is not necessarily more expensive than pipeline if it allows retailers to benefit from a more direct supply chain.

[8] Dynamic Risk for the State of Michigan, *Alternatives Analysis for the Straits Pipeline,* October 26, 2017, Appendix C.

Figure 10. Alternate Propane Supply Chains in the Upper Peninsula

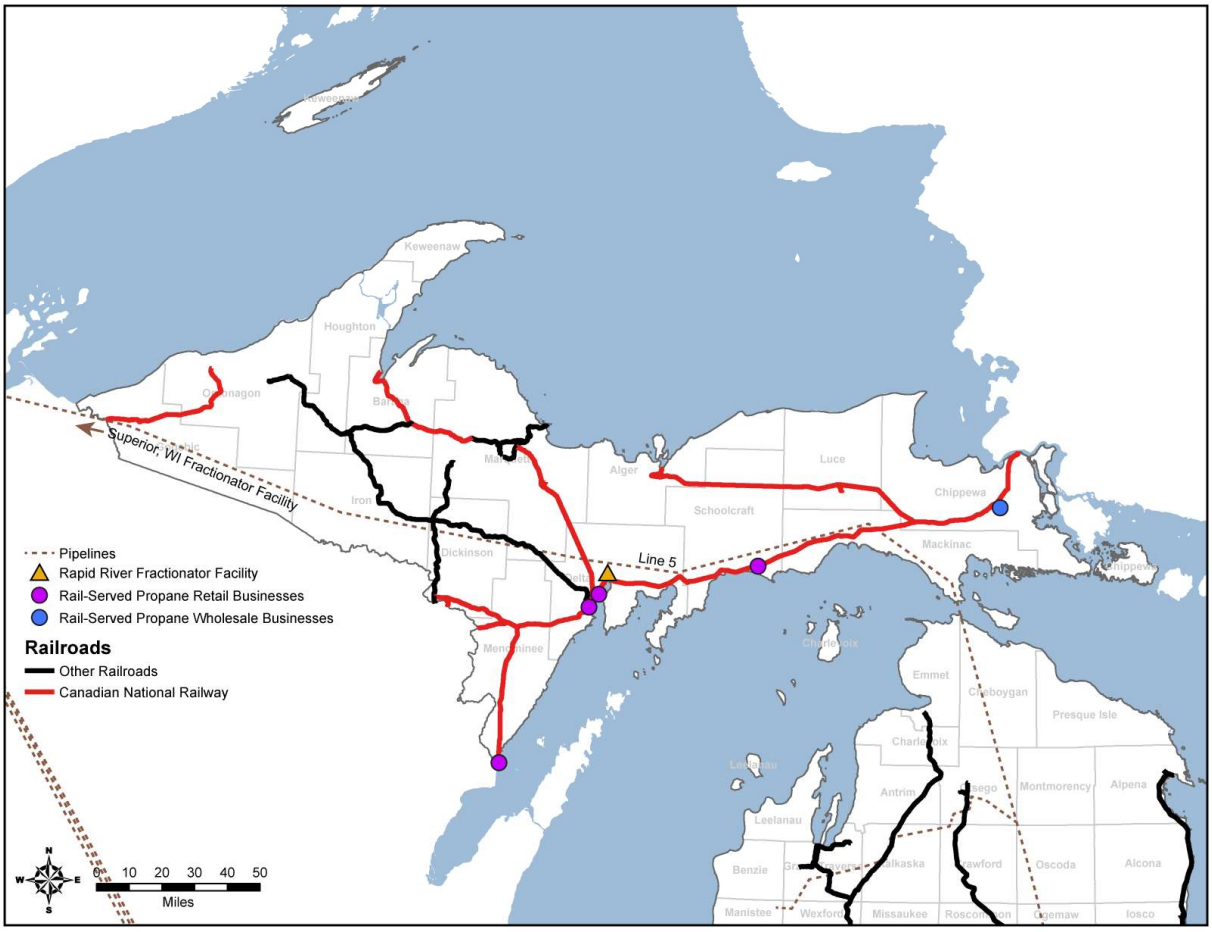


Source: WSP

3.2 SUMMARY OF EXISTING PROPANE UNLOADING FACILITIES

Figure 11 below summarizes current propane unloading infrastructure in the Upper Peninsula. One wholesaler and four retailers were identified as currently being served by rail. Another retailer had previously been served by rail, but the railroad withdrew service in 2012. After planned upgrades, the remaining active rail unloading facilities will be capable of unloading an estimated 45 million gallons of propane per year. The 45 million gallon estimate is based on capacities that propane marketers characterizations of their facilities. For some facilities, propane marketers did not provide an estimated capacity. In these cases, capacity was estimated based on the facility size. The largest rail unloading facility currently operating in the Upper Peninsula is operated by NGL Supply Co. Ltd in Kincheloe. The property owner of this facility, the Chippewa County Economic Development Corporation, is completing a $2.7 million rail enhancement to increase the facility's capacity, which is funded in part by the State of Michigan Freight Economic Development Program (FEDP) and in part through private sector investment. Another facility in Escanaba is being upgraded as well with help from the Michigan FEDP.

Figure 11. Propane Unloading Facilities in the Upper Peninsula



Source: MDOT, WSP Analysis, EIA

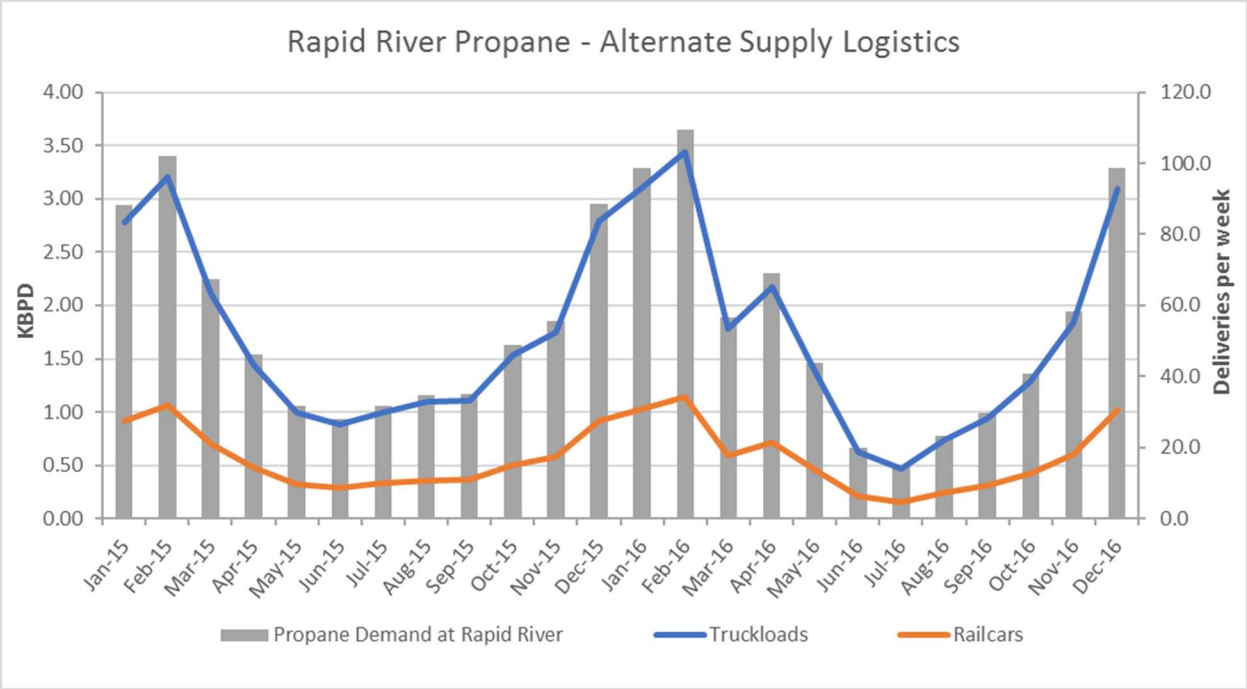
Although the 45 million gallons in rail unloading capacity could theoretically meet the entirety of the 35 million gallon Upper Peninsula propane demand as shown in Table 1, in practice, the geographic distribution of the capacity would make this difficult. Much of the existing unloading capacity is at Kincheloe at the far eastern end of the Upper Peninsula. This is more than 305-miles and more than a five-hour drive from the western border of the Upper Peninsula. With the long drive distances, it would be costly and difficult to serve the central and western portions of the Upper Peninsula from Kincheloe (here defined roughly as Escanaba and west of Escanaba). The trucking industry suffers from chronic driver shortages, and finding qualified drivers would be more challenging if they can only make a single run per day. One retailer interviewed mentioned a 150-mile coverage area as being a more realistic market coverage area.

Propane sales are also seasonal, so that weekly surge capacity requirements may exceed the weekly average capacity needed to unload 35 million gallons per year. Figure 12 below is a reproduction of a previous analysis which estimated the equivalent trucks and railcars required to fulfill production of the Rapid River fractionator plant.[9] Overall average production is 2,000 barrels per day or 84,000 gallons. This is equivalent to 52 truckloads or 17 railcars per week. At peak times during the winter heating months, production increases to 3,600 barrels per

[9]Michigan Public Service Commission, Dynamic Risk for the State of Michigan, *Alternatives Analysis for the Straits Pipeline,* October 26, 2017, Appendix C.

day or equivalent to 94 trucks per week or 31 railcars per week. Peak demand is 82 percent higher than average demand. Whether capacities quoted by propane retailers for this project fully reflect peak requirements is uncertain. On the one hand, quoted capacities may reflect steady demand, or on the other hand, capacities quoted by propane marketers may reflect the fact that they receive more deliveries in the winter. Secondary propane storage in the Upper Peninsula is very limited and does not allow propane markets to cover peaks easily with stored propane. CN Railway mentioned seasonal peaking behavior as a factor to consider when assessing rail unloading capacity. The 35 million gallon demand from Table 1 is also subject to uncertainty. Propane consumption in some years may be significantly higher.

Figure 12. Rapid River Propane – Equivalent Rail and Truck Logistics



Source: Michigan PSC, Dynamic Risk Assessment Systems, Inc.

4. Differences in Upper Peninsula and Lower Peninsula Propane Distribution

Propane distribution in the Upper Peninsula is significantly different from propane distribution in the Lower Peninsula. The two propane markets are different size and scale. As shown in Table 3, the demand for propane in the Lower Peninsula is estimated to be 465 million gallons per year, or 13 times the size of the propane market in the Upper Peninsula.[10]

The sources of supply for the Lower Peninsula are more varied than for the Upper Peninsula. While most propane in the Upper Peninsula is supplied by the Rapid River fractionator facility, followed by rail unloading facilities, and sources within Wisconsin such as the Superior fractionator facility, the Task Force report estimated that about half (48.2 percent) of the Lower Peninsula's propane is sourced from the Plains LPG facility in Sarnia, Ontario. The study estimated that the 41.8 percent of the Lower Peninsula propane demand was brought in from other states, while remainder was supplied through the Marathon Petroleum Corporation Detroit Refinery or the Kalkaska Gas Processing Plant. The Kalkaska plant supplies a relatively small percentage of Lower Peninsula propane, 3.5 percent, but feedstocks for the plant are from Michigan, the Antrim shale formation.

Table 3. Lower Peninsula Propane Supply from Upper Peninsula Energy Task Force Report

Facility	Owner	Location	Annual Production (Gal)	% of U.P. Supply
Kalkaska Gas Processing Plant	Lambda Energy Resources	Kalkaska, Michigan	16,096,500	3.5%
Detroit Refinery	Marathon Petroleum Corporation	Detroit, Michigan	30,660,000	6.6%
Ontario Facilities	Plains Midstream Canada	Sarnia, Ontario	224,093,940	48.2%
Other Propane Supply Sources in Neighboring States			194,149,560	41.8%
Total Upper Peninsula Propane Supply/Demand			**465,000,000**	**100.0%**

Source: Upper Peninsula Energy Task Force

In contrast to the Upper Peninsula, the Lower Peninsula has significant primary storage capacity, so that propane and other types of hydrocarbon gas liquids (includes byproducts from natural gas processing and refineries) do not need to be delivered on an as needed basis to the same extent as in the Upper Peninsula. Rock formations and caverns in the Lower Peninsula provide the ability to store hydrocarbon gas liquids (HGLs) underground, so that the state has 582 million gallons of NGL underground storage capacity as shown in Table 4. An additional 785 million gallons are available in Canada between Windsor and Sarnia, Ontario.

[10] https://www.michigan.gov/documents/egle/Upper_Peninsula_Energy_Task_Force_Committee_Recommendations_Part_1_Propane_Supply_with_Appendices_687642_7.pdf.

Table 4. Hydrocarbon Gas Liquids Underground Storage Capacity

Ower/Operator	Location	Underground Storage
Plains Midstream	St. Clair, Michigan	84,000,000
DCP Midstream	Marysville, Michigan	336,000,000
Marathon Petroleum	Woodhaven, Michigan	73,710,000
Plains Midstream	Alto, Michigan	54,600,000
Sunoco Logistics	Inkster, Michigan	33,600,000
Michigan Total		**581,910,000**
Plains Midstream	Windsor, Ontario	197,400,000
Plains Midstream	Sarnia, Ontario	243,600,000
Alberta Ltd.	Corunna, Ontario	218,400,000
Suncor Energy Products	Sarnia, Ontario	49,560,000
Imperial Oil	Sarnia, Ontario	76,440,000
Sarnia – Windsor, Ontario Total		**785,400,000**

Source: Upper Peninsula Energy Task Force

In 2019 about 60 million gallons of propane were shipped by rail to the Lower Peninsula or about 13 percent of the total demand. While the total volume shipped by rail is higher than what is shipped by rail to the Upper Peninsula, rail's market share appears to be higher in the Upper Peninsula. For example, between 2014 and 2019, the lowest annual rail volumes of propane shipped to the Upper Peninsula was seven million gallons. This is 20 percent of the average demand for propane in the Upper Peninsula, significantly higher than the 13 percent rail modal share in 2019 in the Lower Peninsula.

Rail transportation's relative strength in the Upper Peninsula may reflect the relative lack of competitive options in the Upper Peninsula, so that retailers otherwise rely on a single wholesaler at a single facility, namely Rapid River, or more distant sources in Wisconsin. Retailers in the Lower Peninsula, particularly those in the southern portion of the Lower Peninsula have more options for propane supply within Michigan, Canada and other states. According to retailers testifying before the Michigan Public Service Commission, rates at the Rapid River fractionator facility have increased by over half in 2021 reflecting lack of competition.

5. Federal Regulations Regarding the Movement and Storage of Propane

5.1 GENERAL CONSIDERATIONS

Multiple agencies oversee and regulate railroad operations, maintenance and facilities. Freight rail movements are considered "interstate commerce", and as such are primarily regulated by the federal government. Among the most relevant federal agencies to consider are the STB, the Federal Railroad Administration (FRA) and the Pipeline and Hazardous Material Safety Administration (PHMSA). The FRA and PHMSA are both arms of the U.S. Department of Transportation.

The STB was created in 1996 to replace the Interstate Commerce Commission (ICC), which itself was created in 1887 to regulate railroads. When the ICC ended in 1996, it was succeeded by the STB under the Interstate Commerce Commission Termination Act (ICCTA). Among the responsibilities assigned to the STB are the authority to regulate the construction, operation and abandonment of rail lines. These actions are subject to "Federal Preemption" which gives federal regulation precedence over state, or local, laws and regulations when regulations overlap. Federal preemption extends to truck/rail transload terminals.

The FRA develops and enforces railroad regulations and safety standards. As part of its enforcement responsibility, the FRA and state partners inspect railroad operations, equipment and infrastructure to ensure compliance with federal regulations.

The PHMSA, in addition to regulating pipelines, regulates shipments of hazardous material by rail, truck, air, or waterborne transportation. Trained agents investigate and enforce compliance with safety and security regulations and laws that relate to the transport of hazardous materials. PHMSA also provides technical assistance to state and local agencies and officials in support of hazardous material safety.

As a general matter, the U.S. Department of Transportation (U.S. DOT) defines hazardous materials as "a substance or material which the Secretary of Transportation has determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce." Hazardous materials are categorized by their chemical and/or physical properties into classes and divisions as shown in Table 5.

Table 5. Hazard Classes and Divisions

Classes and Divisions	
1.	Explosives
	1.1 Explosive with mass explosion hazard
	1.2 Explosive with projection hazard
	1.3 Explosive with predominantly fire hazard
	1.4 Explosive with no significant blast hazard
	1.5 Very insensitive explosive; blasting agent
	1.6 Extremely sensitive detonating substance
2.	Gases
	2.1 Flammable gas
	2.2 Spontaneously combustible material
	2.3 Gas poisonous (toxic) by inhalation
3.	Flammable liquids
4.	Flammable solids and reactive solids/liquids
	4.1 Flammable solid
	4.2 Spontaneously combustible material
	4.3 Dangerous when wet material
5.	Oxidizers and Organic Peroxides
	5.1 Oxidizer
	5.2 Organic peroxide
6.	Poisonous (Toxic) Materials and Infectious Substances
	6.1 Poisonous (toxic) material
	6.2 Infectious substance
7.	Radioactive Materials
8.	Corrosive Materials
9.	Miscellaneous Hazardous Materials

Source: FRA

Liquid propane gas is categorized as 2.1 Flammable Gas. The U.S. DOT requires that hazardous materials must be classed, described, packaged, marked, labeled, and placarded before they can be offered, accepted, or transported in commerce. Furthermore, hazardous materials must be handled and transported according to DOT regulations. Some aspects covered by U.S. DOT regulations include:

- Documentation – appropriate paperwork must cover all aspects of the hazardous material shipment, including the commodities, quantities, hazard class, emergency response information, position of hazardous material railcars in the train consist, and other relevant information
- Inspection – railcars must be inspected in a prescribed manner and timing to ensure that they are acceptable for transporting hazardous materials
- Placarding and marking – all railcars appropriately placarded and marked for the type of hazardous materials
- Placement and switching – hazardous material railcars must be appropriately switched and placed into trains

Federal regulations also establish requirement for hazardous material railcar construction, maintenance and design. Employees handling hazardous materials must be appropriately trained.

Several areas that are of specific relevance to this study are discussed below.

5.2 FRA TRACK REQUIREMENTS

The FRA has defined a system of classification for railroad track quality. These are defined as specific track classifications, ranging in value from 1 to 9. The classification of a track dictates construction details, including tolerance requirements for the geometrical measurements of the track. The classifications also specify the frequency of track inspections. These tolerances also determine the speed limits for both freight and passenger trains. Railroads may also gain an exception from the FRA and not operate to FRA standards. In exchange, trains on Excepted track are limited to 10 miles per hour, cannot carry passengers, and cannot contain more than five cars placarded for hazardous materials. Trains are limited to five cars whether those railcars are loaded or not. No track classified as Excepted can be located on a bridge or within 100 feet of a bridge if that track will by carrying hazardous materials. Within the Upper Peninsula, are several segments of FRA Excepted track. While these lines still could carry propane cars, the volume of propane cars carried would be limited.

5.3 MOVEMENT AND STORAGE OF RAILCARS

According to federal regulations, railroads are subject to hazardous materials regulations when the "carrier takes physical possession of the hazardous material for the purpose of transporting it."[11] Railroads continue to be subject to hazardous materials regulations until the railcar is delivered to "a private track or siding." A private track or siding is located outside of the railroad's right-of-way, yards or terminals. The railroad either does not own "the private track or facility" or leases it to a shipper for that shipper's exclusive usage and control. Federal regulations dictate that while propane can be stored in railcars off railroad property, railroads generally cannot store railcars with propane (or other hazardous materials) in any location for longer than 48 hours. Any placement of hazardous material railcars should be considered "stored incidental to movement" and be less than 48 hours. Because of these regulations, it is important to railroads that shippers maintain adequate storage capacity, so that the railroad does not need to keep railcars at its own yards, where the railcar will need to be moved at least every 48 hours. All long-term storage should take place outside the railroad property, but even then, if railcars are to be stored for significant periods of time, they are subject to additional regulations, such as adequate fencing and security.

5.4 PROPANE UNLOADING FACILITY REQUIREMENTS

Facilities used to transfer propane from railcars must be located at least 100 feet away from the rail mainline and 50 feet from the property line. Although not dictated by federal requirements, facilities need to conform to local zoning requirements.

The most comprehensive set of safety standards for propane facilities is the National Fire Protection (NFPA) 58, the Liquified Petroleum Gas Code. NFPA publishes more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks. NFPA 58 is the industry benchmark for safe liquified petroleum gas storage, handling, transportation, and use. It refers to federal requirements throughout the text. It covers standards for areas such as:

- Safety features of propane tanks and transfer piping

[11] U.S. Code of Federal Regulations, Title 49, Part 171.

- Physical protection, such as fencing, lighting, vehicle impact protection, corrosion protection, access control to propane
- Availability of fire extinguishers and spray systems
- Avoidance of any potential sources of ignition
- Separation between tanks, buildings, property lines
- Separation distances between points of transfer and other exposures
- Distance from potential sources of ignition off property under product release scenarios
- Distance from establishments with high density or sensitive occupancies
- Exposure to external hazards
- Response time of fire department, water availability

6. Railroad Company Roles in Railroad Infrastructure Projects

Freight rail services in Michigan are provided by private railroad companies. Private companies own 2,824 miles of rail lines in Michigan, or about 89 percent of the state's rail network. MDOT owns 665 miles of active rail lines (about 19 percent of Michigan's rail network), none of which are located in the Upper Peninsula. MDOT also funds or finances rail infrastructure projects through the Freight Economic Development Program and the Michigan Rail Loan Assistance Program. However, all freight rail services on MDOT-owned rail lines, as well as funding or financing of freight rail infrastructure projects by MDOT are public/private partnerships because freight rail transportation service in Michigan is provided solely by privately owned railroads.

Per federal law, railroads have a common carrier obligation to provide railroad transportation service "upon reasonable request."[12] As a practical matter, railroads have been granted a degree of flexibility to determine what is considered a "reasonable" request. Like other private companies, railroads can price according to whether they consider the business to be desirable or not. As the service providers and in many cases the infrastructure owners, railroads are key participants in any rail projects.

To initiate rail service, new shippers must frequently invest in rail infrastructure so that railroads can access their locations. Generally, railroads dictate the minimum standards of railroad infrastructure that they are willing to serve. CN's requirements are illustrative. Any customer wishing to locate on the CN network will initiate service through a three-phase process:[13]

1. Assessment and Consultation – In this phase, CN staff and prospective customers review requirements of the new service such as origins, destinations, rail volumes, and products. If the customer does not already own a location, CN staff recommend locations, introduce the prospective customers to brokers, economic development officers and other key contacts.

2. Concept and Detailed Design – The customer develops a conceptual design of their intended railroad infrastructure, which is reviewed by CN's Business Development team. Once approved, the customer develops a detailed construction design, which is evaluated by CN staff. Once approved, the design is ready for execution.

3. Construction and Operation – Once the final design is approved, construction proceeds. After construction, CN staff inspect the new track. After successful track inspection and completion of necessary documents, the customer can begin to ship by rail.

Shippers wishing to establish rail service in the Upper Peninsula can also locate on one of the region's other, smaller, railroads, including the E&LS and MRR. While these railroads may have different policies and may in some

[12] Title 49 U.S. Code, Section 11101, https://www.govinfo.gov/content/pkg/USCODE-2019-title49/html/USCODE-2019-title49-subtitleIV-partA-chap111-subchapI-sec11101.htm.
[13] https://www.cn.ca/en/our-services/business-development/

cases have greater flexibility than the CN, all railroads will need to be comfortable with the service and operations that they will be providing, as well as any new shipper-owned rail infrastructure.

CN was consulted during the preparation of this report and provided perspective on the railroad's preference for propane shippers and required infrastructure. CN felt strongly that new shippers must have adequate unloading capacity to be able to store and move railcars within their site limits, as well as the equipment to unload railcars in a timely manner. The railroad would like to avoid situations where customers order more carloads of propane than they can unload, as federal regulations prohibit storage of those cars at CN property.

Railroads require that the revenues from any new business exceed the incremental cost of serving that business. The ideal situation is where a railroad can handle additional railcars with minimal additional operations. For example, if a shipper locates in an area where a railroad is already moving railcars to and from industries, this is preferable to a situation where an entirely new industrial location is established and a new service needs to be established. CN expressed the desire that any new propane unloading capacity be either at existing unloading locations or consist of fewer, larger facilities. Serving numerous small propane facilities would add cost and complicate rail operations.

As discussed earlier, the other option is to locate the propane facility along one of the other operating railroads in the region. Short line railroads specialize in providing the first and last mile connections between railroad customers and the broader rail network and are often more capable of providing regular movement of the rail cars to/from customer locations. They often charge lower assessorial fees such as demurrage and short term storage. On the other hand, the shipments will require interchange arrangements between the terminating/originating railway and CN and may increase overall shipment cost due to interchange fees.

7. Identification of Potential Improvements

7.1 GENERAL NEEDS TO INCREASE RAIL SHIPMENTS OF PROPANE

Discussions with railroads suggest that rail line capacity and track condition would not limit the potential of propane shipments by rail to the Upper Peninsula. Excluding some light-density segments, nearly all the Upper Peninsula rail network is maintained and inspected to the minimum FRA requirements to transport propane. Many segments are already handling propane shipments. The Upper Peninsula has available line capacity for increased shipments. If intrastate rail movements associated with iron ore and other mining operations are excluded, the total average annual carloads terminating in the Upper Peninsula between 2014 and 2019 was about 23,000. Rail traffic in the Upper Peninsula has declined significantly in recent years shrinking from 27,000 terminating carloads in 2014 to 15,000 terminating carloads in 2019. Shifting all Upper Peninsula propane demand to rail might actually help the region in maintaining the viability of rail operations, as it would recover nine percent of the decline that occurred between 2014 and 2019. These additional propane shipments would represent a relatively small addition to the Upper Peninsula rail traffic base and could in most cases be handled with existing locomotive power and train crews, minimizing the impact on railroad operational costs. This report did not assess the rail loading capacities of natural gas processing plants, refineries, or import locations. However, given the relative size of the Upper Peninsula propane market compared to other propane markets in the U.S., it is assumed that additional rail demand from the Upper Peninsula would represent a relatively minor increase in traffic demand. Furthermore, if the loading capacity of one origin were to become constrained, other origins could be substituted.

7.2 POTENTIAL TYPES OF PROPANE UNLOADING FACILITIES

Railroads and shippers consulted for this study agree that the most significant limitation to shipping propane by rail to the Upper Peninsula is unloading capacity. Once upgrades are completed, the propane unloading facility in Kincheloe along with other rail unloading locations will have enough capacity to meet the needs of the eastern portion of the Upper Peninsula, but current unloading capacity in the central/western portion of the Upper Peninsula (generally Escanaba and west of Escanaba) might not have sufficient capacity to meet the entire demand for propane in this area. Several proposed projects could meet this demand. In the alternate, several new smaller facilities could provide needed capacity.

The type of facility and the equipment used for unloading will depend on the situation. If fractionator plants in Rapid River and Superior were to suddenly cease operating and shippers found themselves scrambling for alternate sources of propane supply, the fastest way to add capacity would be with mobile transload equipment. This equipment would transfer propane directly from railcar to truck. The transload operation could be established using existing rail infrastructure. Because transloaders are mobile, no fuel handling infrastructure would need to be constructed, reducing the capital cost. Transloaders would not represent a sunk cost. If pipeline service were disrupted and then restored in several years and the need for rail unloading capacity were to decrease, the transloading equipment could be repurposed elsewhere. Criteria for establishing a transload location would be as follows:

- Roadway access
- Siding that is set back at least 100 feet from the rail line
- Location that minimizes earthwork – flat location
- Location consistent with NFPA 58 – Liquified Petroleum Gas Code
- Local zoning approvals from local jurisdiction
- Electrical supply

Figure 13. Example of Mobile Propane Transload Equipment

Source: SkyEye Measurement

Facilities where propane is loaded from a railcar to storage and then to truck require at least a year to establish. On the other hand, permanent unloading towers with storage tanks offer several benefits over mobile (direct) truck/rail transload operations. While loading times depend on variables such as compressor size, the pumps and compressors on permanent towers tend to be of higher power, so it is generally faster to unload railcars to storage. According to one propane wholesaler, the time needed to unload a railcar to storage is one third the time to unload a railcar directly to trucks using mobile transloaders, and mobile transloaders require regular maintenance to remain operational. Unloading propane from railcars is a two-step process where the petroleum liquid is unloaded first, followed by the remaining vapors. The vapors contain a significant amount of additional propane and represent lost product if not unloaded, but their extraction with mobile transload units is a time-consuming process.

Fixed facilities where propane is unloaded from railcars to storage are also more efficient in loading trucks and enable truckers to self-load their propane. Automated systems are established so that customers enter codes or other identifying data. They can then fill their trucks with propane, process the transaction, and leave the loading facility without requiring any involvement by the sellers' personnel. By contrast, personnel must be present when propane is transferred between railcars and trucks.

Figure 14. Example of Rail to Storage to Truck Operation

7.3 POTENTIAL TRANSLOAD FACILITY LOCATIONS

Each railroad operating in the Upper Peninsula was consulted about potential locations for propane unloading facilities. The results varied by railroad:

- CN indicated that if a new facility were established, CN would prefer the location be an expansion of a propane facility already served by CN. If new facility(ies) were developed, it would be preferable to serve fewer, larger facilities rather than numerous smaller facilities.

- The Lake Superior & Ishpeming Railroad is a subsidiary of Cleveland-Cliffs Inc. Its primary role is to carry iron ore for Cleveland-Cliffs and only serves other shippers where doing so integrates well with Cleveland-Cliffs operations. At the moment, LS&I did not express an interest in serving a new propane unloading facility.

- The Mineral Range Railroad proposed several potential locations for propane unloading facilities (discussed below).

- The Escanaba & Lake Superior Railroad mentioned several improvements to existing locations, as well as several potential new locations (discussed below).

In addition to the potential projects mentioned by railroads, another project has been proposed at the former K. I. Sawyer Air Force Base.

7.3.1 Sawyer Rail Terminal

A new rail unloading facility has been proposed on the site of what had been the K. I. Sawyer Air Force Base in Marquette County. The fully constructed new facility would feature 450,000 gallons of propane storage capacity and sufficient rail unloading capacity to unload over 700 carloads of propane per year. The project is estimated to cost $6.5 million to construct. A conceptual design has been completed, but project sponsors are still seeking funding for the project.

7.3.2 Rapid River Rail Terminal

A rail spur to the propane fractionator facility was previously identified by others as a potential project. CN Railway is supportive of this idea, but the owner of the Rapid River fractionator facility has not expressed interest in the concept. In this respect, this project differs from other projects put forward in this section, which are endorsed by the relevant property owners.

Rail service would be redundant to the pipeline service to Rapid River and to the function of the fractionator facility. Rail service would likely benefit the facility only in cases where pipeline service is interrupted. If rail-served, Rapid River could distribute propane that arrives by rail, fractionation would not be required. For rail service to be extended to this existing facility, a new 1.75-mile rail spur would need to be constructed to connect the facility to the nearest rail line. Construction would likely require right-of-way acquisition and significant environmental remediation. Costs are estimated to be approximately $25 million. .

7.3.3 Potential Locations on the Mineral Range Railroad and Escanaba & Lake Superior Railroad

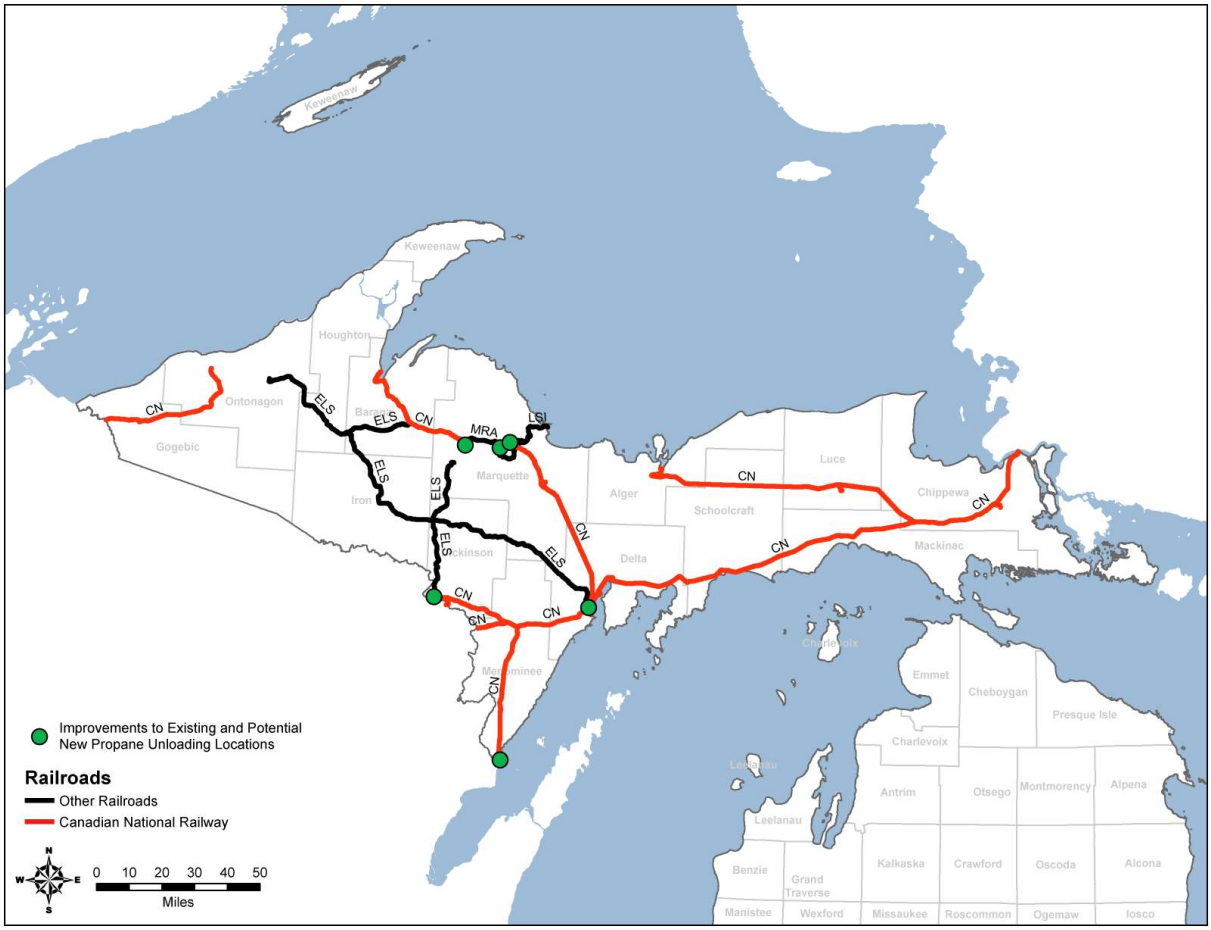
Several locations were recommended on the Mineral Range Railroad (MRR) by stakeholders. One is the location of an existing propane retailer that had previously received propane by rail. The others are zoned industrial and have non-railroad owners who are interested in developing the sites.

Several additional locations were recommended on the Escanaba & Lake Superior Railroad (ELS). One would provide additional storage for an existing customer. Another would expand an existing terminal, and a third would add a new terminal.

Figure 15 below shows the approximate location of the potential sites. The locations are in the following locations:

- Humboldt
- Ishpeming
- Negaunee
- Escanaba
- Menominee
- Iron Mountain

Figure 15. Potential Locations of Propane Unloading Facilities, Improvements to Unloading Facilities on the Mineral Range Railroad and the Escanaba & Lake Superior Railroad



HUMBOLDT

This site is located near the Humboldt Mill operated by Eagle Mine on Marquette County Road 601.. MRR operates on adjacent tracks almost daily. The location is approximately 10 miles west of Ishpeming. The location is relatively remote, so should not raise concerns of adjacent property owners. It has easy access to the all-season road network and is near several of the Upper Peninsula arterial roadways. To establish a propane unloading facility could potentially involve construction of a new two-ended siding. Mineral Range is open to dialogue regarding cost effective and productive design and layout. Many options are open for consideration for any potential track layout. An additional stub track would provide an area for propane cars to be stored and unloaded. The cost of a new facility would depend on numerous factors, but a conservative estimate of rail infrastructure that covers all contingencies is estimated to be $2.4 million.

ISHPEMING

The site is located close to the MRR yard in Ishpeming and is close to the MRR/CN interchange. The current usage of the site is primarily equipment storage. The site would be efficient for the railroad to serve. However, trains would need to cross a recreational trail to access the facility, and trucks servicing the facility would need to pass through a residential neighborhood. A new propane unloading facility would require the construction of a new spur track. The cost of a facility would depend on numerous factors, but a conservative estimate of rail infrastructure that covers all contingencies is estimated to be $2.4 million.

NEGAUNEE:

A major propane shipper had previously been served by rail until the serving railroad withdrew service in 2012. While some of the tracks that had previously served the facility have been removed, rebuilding them should not be difficult. Restoring service would likely require modifications to a highway/rail grade crossing circuitry, but this would not be expected to be a major impediment. A fence would likely need to be built between the access track and an adjacent property owner, unless a new alignment were located further from the adjacent property. The cost of restoring rail access would depend on numerous factors, but a conservative estimate of rebuilding rail infrastructure that covers all contingencies would be $1.9 million. A similarly conservative cost estimate of building a new siding that follows a slightly different alignment would be $2.1 million.

ESCANABA

Providing a nearby storage track would effectively increase the capacity of an existing propane unloading facility in Escanaba. An idle, privately owned siding is several hundred yards from the existing propane retailer that could be leased to the propane retailer to store any cars that cannot fit to the unloading track. The E&LS frequently operates in this area and could easily switch railcars from the siding to the propane retailer location.

MENOMINEE

An existing propane retailer has a single-car siding in Menominee. However, adjacent land is owned by the E&LS and a logistics company and could be repurposed to expand the unloading operation. Because the parameters of an expansion are highly uncertain, it is not possible to provide a cost estimate of expanding the facility.

IRON MOUNTAIN

The E&LS owns several unused parcels in Iron Mountain which could be used for propane unloading facilities. If a propane unloading facility were established, these new sidings would be leased by the railroad to comply with the FRA 48-hour rule for propane storage. Because the parameters of a new facility are uncertain, it is not possible to provide a cost estimate of the new facility.

7.4 ROLE OF MDOT IN ESTABLISHING NEW PROPANE UNLOADING CAPACITY

It is important to note that any additions to propane unloading capacity in the Upper Peninsula will need to be led by the private sector. MDOT does not provide freight rail services, and MDOT does not provide propane transload services. MDOT can play a facilitating role and can help to fund/finance infrastructure projects, but agreements to provide rail and transload service will be between private sector companies. However, MDOT is currently limited by legislation which specifies that no state funding can be used for a freight development project to support the cessation of energy pipeline operations across the Straits of Mackinac.[14]

7.5 CONCLUSIONS

UP Rail Infrastructure is Adequate

- The infrastructure and operations assessment revealed that core rail infrastructure and operations can support expanded movement of propane to the Upper Peninsula
- Majority of lines are FRA Track Class 1 or higher, placing no restrictions for propane movements.
- Most of the lines north of Escanaba are restricted to 263,000-268,000 gross rail weights which somewhat reduces the efficiency of propane transportation by rail (approximately 10% lower payload per rail car)
- The operational conditions allow for expanded propane shipments.
- Railroads provide frequent (almost daily) train services along most of the main network, providing solid foundation for expanded propane deliveries. Per rail service providers, ample capacity is available to increase the number of propane cars handled, either through expanded number of cars in each shipment, or through increased frequency of shipments. Railroads reported no shortage of rail yard and/or siding capacity nor restrictions on increasing train lengths within the Upper Peninsula. Railroad responses suggest that propane shipments could be increased without major capital improvements. Even if railroads handled all the propane demand for the Upper Peninsula, this would account for relatively small portion of Upper Peninsula rail traffic.

Unloading/Storage Facilities May Need to Be Expanded

- Although adequate rail capacity exists to increase propane shipments by rail, the storage and unloading capacity at propane terminals may restrict such increases. Robust propane supply chain by rail would require infrastructure that provides sufficient storage for empty and loaded cars within the terminal, capability by the terminal operator to move the cars within the terminal (outside railroad property) and sufficient unloading/storage capacity to unload the cars within the specific number of days outlined in demurrage contract.
- The expansion requirements are location specific, so each site would be investigated separately. For example, in some locations, it may be necessary to create all storage within the terminal, while in other locations, privately owned tracks that are currently unused near the terminal could be used for expanded storage needs.
- To achieve operational efficiencies, rail service providers prefer expansion of current terminals over the development of new ones. Efficient freight rail transportation is heavily dependent on adequate economies of scale. Since there are no major capacity restrictions within the core rail network in the Upper Peninsula, the railroads prefer adding cars to existing trains (and existing destinations) over adding new terminals to serve.

[14] 2021-PA-0087.pdf (mi.gov).

- The current geographic distribution of rail unloading capacity would leave the central/western portion of the Upper Peninsula underserved. Per interviews, propane rail unloading capacity is adequate to serve the eastern portion of the Upper Peninsula but this capacity is too distant to serve the central and western portion of the Upper Peninsula.

Diversification is Preferred

- During interviews, the importance of diversification and alternative supply chain was highlighted frequently. For example, service disruptions/delays due to weather, mainline congestion, or even employee strikes can cause major disruptions for the rail transportation, reducing its reliability. At the same time, reliance on a single facility, such as a single fractionator plant reduces the possibility to negotiate/compare prices and leaves no safety valve during operational disruptions, or systematic delays at the facility. For those wholesalers/distributors with experience in using rail, diversification of supply was cited as a major benefit.

7.6 RECOMMENDATIONS

To increase the diversity of propane supply, the State may want to consider supporting private sector initiatives to establish additional propane rail unloading facilities or expand existing propane rail unloading facilities in the Upper Peninsula. This could include funding or financing contributions to projects to improve, expand propane rail unloading capabilities where resultant public benefits justify State funding/financing. The existence of a robust rail transportation alternative for propane supply would increase the resiliency of the energy transportation network in the Upper Peninsula, so that if a pipeline disruption were to occur, other cost effective solutions could be available to Upper Peninsula residents and businesses. It could also have an ongoing benefit of promoting competitive options for energy in the Upper Peninsula.