





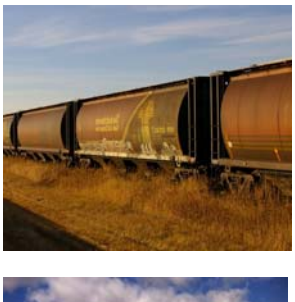


Grain Monitoring Program
Supplemental Study

The Marketing and Logistics Component of the Canadian Grain Supply Chain

Grain Supply Chain Study:

Technical Document

September 2014

Foreword

On March 18, 2011 the Government of Canada announced its response to the Rail Freight Service Review that was undertaken in 2008 to address the ongoing issues with rail freight service raised by users of the rail freight supply chain.

In December 2011 Quorum Corporation was contracted by Agriculture and Agri-Food Canada (AAFC) and Transport Canada (TC) as part of its mandate as the Grain Monitor, to undertake a supplemental program study to analyze the grain supply chain.

This document was prepared as part of the technical, analytical and research component of the study and is presented as a supplemental work item for the Grain Monitoring Program.

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Introduction

In addition to providing a description and analysis of how the system of marketing and moving grain within the Canadian grain supply chain functions, the Grain Supply Chain study also sought a better understanding of how grain supply chain partners share the responsibilities, risks and rewards in the delivery of grain to end customers and an assessment of those risks. All supply chains share a common foundational premise – they consist of businesses operating in an interconnected network focused on the planning and delivery of goods or services to their end customers. Further, in order to succeed, all supply chains require the economic interests of the partners to be aligned and that reliable and timely information on demand, capacity and performance be shared throughout the supply chain. This latter requirement is a major challenge for most supply chains, including the Canadian grain supply chain, as information about future demand and future capacity is always somewhat uncertain. The level of success is often a function of the predictability of this information and the flexibility of the system to respond to variability in demand and performance.

There are aspects of the Canadian grain supply chain that differentiate it from a typical supply chain. First and foremost is the separation of those controlling the production (farmers/ producers) from those who manage and control the primary marketing and selling of grain to the end use customer (grain exporters and dealers). Second is the high dependence of the Canadian grain supply chain on the rail freight logistics system to provide the necessary capacity to position grain to export position at port.

In conducting the research for this study, extensive consultation with stakeholders was undertaken in the examination of supply chain processes. Using structured group and individual consultations issues related to both the operational and market aspects of the supply chain were revealed. These extensive discussions allowed the study team to gain insight into how the supply chain works and what challenges are being faced today. This input also provided the basis for the quantitative analysis of the performance of the Canadian grain supply chains.

As discussed in the main report, the Canadian grain supply chain is vast and includes many different businesses and interconnected infrastructure. Western Canada has four export ports with a total of 15 licensed terminal elevators. These ports are served by two Class 1 railways that are supported by 15 shortline railways. While over 100 separate companies own 394 licensed primary and process elevators in Western Canada, the grain gathering network is dominated by six companies all owning multiple facilities and collectively holding 75% of the country storage capacity. Each year 60,000 farms in Western Canada produce an average 55 million tonnes (past five years) of grains, oilseeds and special crops to be delivered into this network.

Unlike many other competing countries where production is relatively close to export tidewater, in Canada the average rail haul from inland elevator to port is about 1,500 km. Grain must be gathered via a road and rail network and delivered to ports for vessel loading throughout the year. At times, grain gathering, transportation and vessel loading activities must be conducted in the face of a harsh climate with frequent heavy rain, extreme snowfall and prolonged periods of cold temperatures.

The interdependencies between supply chain partners cannot be over emphasized. There are many examples of these interdependencies between stakeholders and the ramifications of when a breakdown occurs. Some that can be considered as critical to the supply chain include the planning of railway resources and assets and the timely and consistent performance of the railways for the movement of grain.

The planning of train crews and rolling stock equipment maintenance personnel and their proper positioning within the railway network are integral to railway operations and the efficient movement of grain. For medium and longer term planning, railways depend on shippers to provide reliable demand forecasts in order to plan asset and resource allocation positioning. Changes to directional traffic flows or planned volumes can result in train crews, locomotives and maintenance staff being out of position to effect efficient train operations. Reallocation of these resources to respond to such changes can sometimes take months to effect.

When planning a sale, grain companies look to railways as far out as three months to confirm they will have the capacity to move the grain to port position. On this basis they negotiate with shipping lines to establish and schedule an ocean charter party agreement as well as the arrangements and scheduling of the port terminal that will load the grain. When car supply in the country fails in the time period scheduled, or variability in railway transit performance occurs impacting the reliable and timely delivery of the cars to port, scheduling of terminal activities and vessel loading activities are impacted, which increases terminal costs, potentially results in vessel demurrage and can result in contract penalties to the seller.

One example that provides a good view of how interdependent the supply chain is can be seen in how the loaded movement of grain from the country to the port can impact country operations. Simply put, this week's unloads at port are next week's empty cars for spotting in the country. While it is accepted that car supply is dependent on the railways' ensuring adequate fleet size exists to meet demand, port grain terminals share in that responsibility as the railways can only supply cars that have been emptied at the terminal. The ongoing supply of grain to port is entirely dependent on the efficient execution of both operations within the supply chain.

This technical document discusses the processes and challenges faced in the marketing and logistics components of the Canadian grain supply chain. It is intended to provide the reader with a better understanding of how each component works and how the two must work in concert to accomplish a successful sales program.

Marketing Canada's Grain

Canadian grains and grain products are marketed and sold in a global marketplace in direct competition with comparable products produced in other countries. The marketing of grain is a long term, ongoing process that includes a number of different activities: market and product development, the development and cultivation of business relationships, identification of customer demand and product needs and the selection of market channels. In global grain markets these activities are undertaken, sometimes jointly, by various stakeholders including government agencies, industry associations and private enterprises.

The marketing of grain is an activity fraught with uncertainty particularly with respect to supply – specifically the quantity, quality and timing of grain and grain products that will be available to meet customers' future demand. Much like producers, much of the uncertainty faced by grain marketers stems from the long lead times between their marketing efforts and final sales execution and delivery and the risks associated with the effects of climate on harvest timing, yield and quality. Grain marketers look to forward sell grain into markets using the best knowledge available to them at the time. Ultimately however what will be sold is what is produced and any significant differences in crop quality, quantity, or availability vis-a-vis what was expected and marketed requires the supply chain to adjust in real time when it is time to deliver on previously negotiated sales contracts.

The marketing and sale of Canadian grain and grain products is a key driver of supply chain activities. The selection of markets and market (distribution) channels, the terms of sale including required product attributes, logistics considerations and the timing of delivery will impact all stakeholders in the supply chain. The types of and quantities of grain in demand and marketed will influence producers' production decisions, drive infrastructure requirements and operating practices in the grain handling system and establish demand for specific transportation services to move grain and grain products from country origins to consuming markets.

The main report discusses specific areas of the supply chain's marketing activities and functions:

- How Canada competes in the global market place
- The market structure of the Canadian grain supply chain
- The principle marketing and sales activities, including market development and sales and contract execution
- The mechanisms for maintaining and sustaining Canada's grain markets

To supplement and expand on certain areas of the marketing processes in the Canadian grain supply chain, this document expands on some of the critical structural elements and processes involved in the marketing and sale of Canadian grains and grain products in domestic and international markets. Principal areas of examination include:

- Canada's competitive position, the markets and the attributes of the types of grains that are grown and sold
- A discussion of the sales and contract execution processes
- A discussion of the pricing processes, particularly as related to hedging
- How the Canadian supply chain stakeholders manage and sustain their positions in the marketplace
- The impact on logistics activities and capabilities stemming from marketing and sales activities

Canada's Competitive Position

Canadian grains and grain products whether wheat, barley, oilseeds and oilseed products or pulse crops compete in domestic and international markets on the basis of numerous factors including price, product quality, product specific characteristics or attributes, security of supply and increasingly on the basis of supply chain efficiency.

Canada is a price taker in most agricultural commodities traded globally as the size and transparency of global markets do not allow Canada – as a relatively small player – to influence price. Despite this pricing is ultimately influenced by product quality, supply reliability, port accessibility and security issues. While some customers do buy Canadian grain based solely on price there are specific markets where consistent and superior product quality is a differentiating factor and an important driver of demand and does yield some measure of premium pricing.[1]

Beyond price and quality considerations Canadian grains and grain products do compete globally on the basis of specific product attributes including health and nutritional value and suitability for downstream manufacturing and processing activities. Some of the product characteristics that influence the attractiveness and demand for Canadian grain products in global markets include:

- Substitutability
- Health & nutritional benefits
- Cleanliness

Table 1 provides a summary of some of the specific product attributes that are important to buyers of Canadian grain and grain products.

[1] Noteworthy examples include the British bakery Warburtons that pays a premium for Canadian AC Barrie wheat because they believe it to be of a higher quality than similar wheat grown in the United Kingdom. Similarly Japanese buyers, including the Japanese Food Agency, are willing to pay a premium for the quality and consistency of Canadian hard red spring wheat and buyers in the Philippines ascribe value to Canada's high phytosanitary standards

Table 1: Key Product Attributes of Canadian Grains and Grain Products

Type of Grain	End Use Markets	Attributes
Wheat Durum (semolina)	• milling flour industry (domestic & export) • manufacture of flour based products for human consumption – e.g. bakery products, pasta	• kernel hardness • gluten content • protein content • falling number (water absorption) • presence of toxins and chemical contaminants
Barley (malt)	• malting industry for production of malt ➢ e.g. domestic market - Canada Malt ➢ e.g. export market - Sapporo • brewed products (beer)	• protein content • moisture content • gluten content
Barley (feed)	• cattle and hog industries (domestic & export)	• protein content
Oats	• breakfast cereal manufacturing ➢ e.g. Quaker Oats and General Mills • equine feed	• protein content • linoleic acid (omega -6 fatty acid) • high vitamin content
Canola Seed	• crushing industry for manufacture oil and meal	• low saturated fats
Canola oil	• first by-product of crushing process • cooking oil and other human consumption manufactured foods (e.g. margarine) • bio fuels industry (lower quality)	• low saturated fats • oleic and linoleic acids (omega 6 fatty acid) • purity and clarity of oil (green vs. clear)
Canola meal	• livestock (primarily dairy) industry	• protein content • mineral content ➢ phosphorous and selenium • high amino acids
Other oilseeds (soybean and sunflower, linseed)	• human consumption manufactured foods ➢ e.g. margarine • industrial markets (resin, lacquer and epoxy)	• high protein • low linoleic acid content
Peas	• feed market • human consumption (pea flour) • protein supplement in manufactured foods	• protein
Lentils	• human consumption food market • food staple	• high protein content • vitamin content
Flax	• human consumption ➢ e.g. multi grain foods • industrial manufacturing ➢ paints, coating, lacquers (linseed oil) ➢ automobile interiors (fiber)	• high in fiber content • rich in omega-3 fatty acids • drying properties • strength and durability properties

Marketing and Sales

Sales and Contract Execution

The negotiation of sales agreements and the execution of sales contracts are ongoing activities involving buyers and sellers in both international and domestic markets. Commercial negotiations between buyers and sellers do not happen the same way in all circumstances. Negotiations and the execution of transactions can be affected by a number of factors including: the level of sophistication that exists in the destination market, the nature and rigour of purchaser product specifications and the volume of product being sold. In the past the type of grain, specifically whether or not it fell under the purview of the Canadian Wheat Board, could also be a factor.

In spite of these differences certain elements of the sales process are common to all sales, specifically the mechanics of commercial settlements and terms of sale provisions.

Terms of Sale

The commercial grain trade is generally considered to be a "cash business"[2], whereby the purchaser is expected to pay for the product, in cash, at the moment where title of the product changes hands. This can be accomplished in several ways. The simplest and most cost effective approach generally occurs between counterparties that have long standing relations. In these cases the seller will issue the purchaser an invoice who upon receipt, will wire transfer the funds forthwith. A more complex and costly mechanism involves the purchaser setting up an irrevocable Letter of Credit at a bank satisfactory to the seller – a service for which the bank is paid a fee representing a small percentage of the transaction value. Once the bank notifies the seller that the Letter of Credit is in place and the seller provides completed documents showing performance as per the terms of the contract the money is transferred to the seller.

Merchants will set a price for the commodities they are selling —competing against other firms—with the objective of capturing an acceptable gross margin given the risks inherent in the trade. Some of the key terms of trade include:

- Options for Ocean Vessel Charter Structure

  There are various charter structures available to buyers and sellers when arranging for the international movement of grain in ocean vessels. When the seller or exporter arranges for and pays for the ocean freight (a cost that would be reflected in the price of the grain sold), it is commonly referred to as C&F (cost and freight) or CIF (cost insurance and freight), the difference between the two obviously being whether the cost of insurance on the goods in transit is included. The other charter structure is where the buyer pays for the ocean freight, referred to as FOB (free on board),

[2] A distinction must be made between products that trade commercially versus products that trade (or are shipped) for non-commercial reasons. For instance, food aid does not happen due to a commercial relationship. At times, Government has been amenable to providing offering some form of credit to particular purchasers. The discussion of the sales process excludes consideration of non-commercial situations.

where the responsibility of the seller ends when the grain is loaded on the ocean vessel at the port of export. There are many reasons why a buyer will choose one option or the other. If the buyer believes that the seller has the ability to negotiate preferential ocean rates or will be incented to manage the origin logistics in a manner that will better manage the costs, they would likely opt for a C&F or CIF charter structure. If the buyer believes they have a better negotiating position with the ocean carriers, or they have the ability to arbitrage freight so as to lower their overall logistics costs, they will opt for a FOB charter structure. In either case, this decision is typically based upon the relative bargaining strength of one or the other party in obtaining favourable ocean freight terms and upon the desire of the parties to exercise control over their respective logistics process;

- Flat price versus basis

  Trading of grain on international markets is generally transacted in US dollars. Some purchasers seek an offer that provides a fixed "all-in" price. Other purchasers use risk management tools (e.g. futures) and will seek contract terms that involve the parties exchanging futures for physical product at the time the contract is executed.

Grain sales generally conform to the frameworks established by one of two major international associations - the Grain and Feed Trade Association (Gafta) or the North America Export Grain Trade Association (NAEGA).

London based Gafta was founded in 1878 and has over 1250 members located in 86 countries. Gafta promotes international trade in grain, animal feed materials, pulses and rice by providing support and standardized international contracts to members. Critical to trade is confidence. Most international forward and physical contracts are entered into months ahead of harvest, shipment, or delivery. It is critical therefore that parties can rely on accepted, standardized terms of sale and know that should a problem occur there exists an agreed upon process to find a remedy.

Gafta has available standard trading terms set out in a range of 80 standard form contracts that may include clauses for:

- Quality, condition, warranties and guarantees;
- Shipping documents and appropriations;
- Payment terms;
- Problems and exceptional circumstances;
- Insurance;
- Default and damages;
- Supporting rules for: weighing, sampling, analysis methods and insurance;
- Arbitration rules for dispute settlement (included in all standard form contracts).[3]

[3] Gafta Arbitration Rules are incorporated in all Gafta standard form contracts. The rules provide for a two-stage arbitration system. At the first tier, the parties can either agree to the appointment of a sole arbitrator by Gafta, or they may each appoint an arbitrator from the list of Qualified Arbitrators. Gafta will then appoint a third arbitrator, as chairman, to complete a tribunal of three arbitrators. The disputing parties will provide their written statements of claim and responses, with supporting documentary evidence, to the tribunal

While NAEGA coordinates and aligns much of its efforts with Gafta, it also maintains a model contract for Free on Board (FOB) transactions at US ports and provides ancillary arbitration and related services.

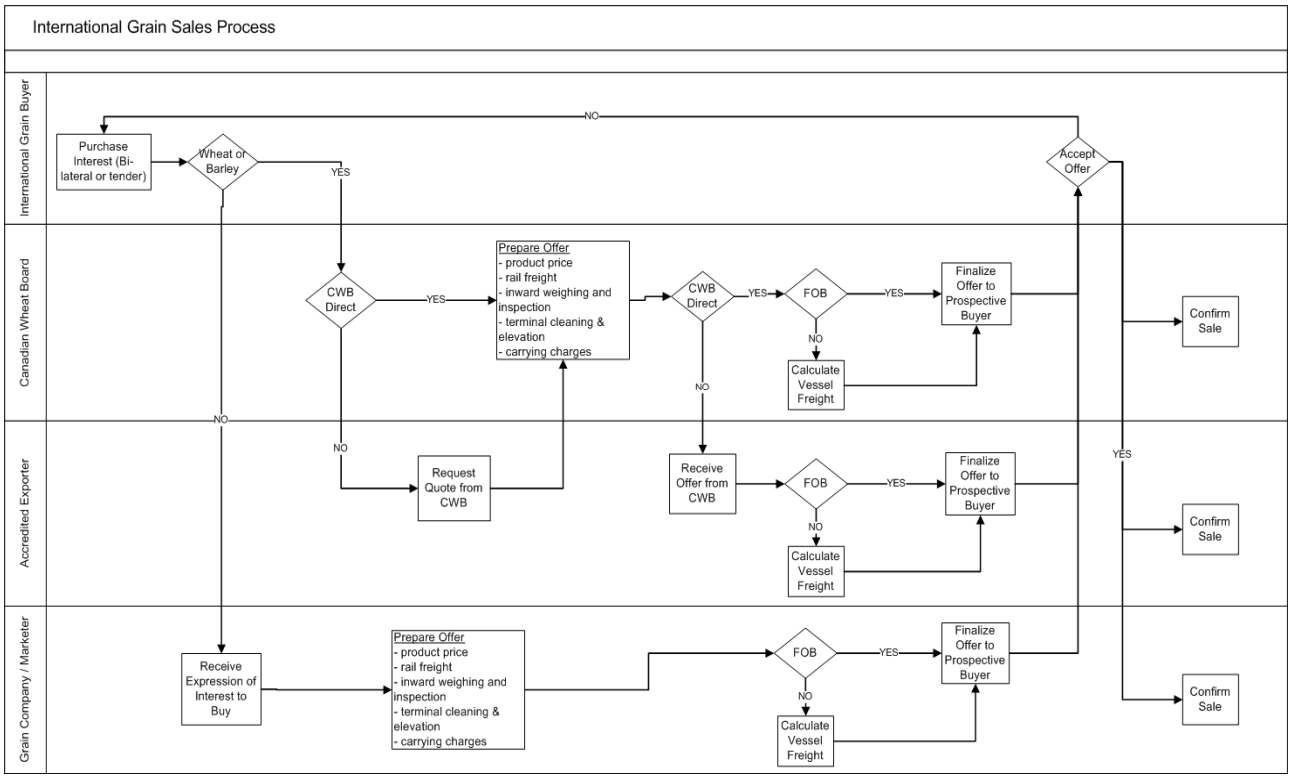
International Sales

The sales process for international grain sales today is the same for all Canadian grains sold in international markets.

A grain transaction begins with the communication of an expression of interest from buyer to seller. This may be a bilateral communication between parties that have previously conducted business or it may involve a broker or some form of referral. In situations where trading relationships are longstanding and highly evolved—for instance, as is the case in canola trade between Canada and Japan—communications can occur on a daily basis. In response to the expression of interest the seller assesses the sales opportunity including the availability of product, strategic fit, profitability and risk. Based on this assessment the seller will determine whether or not to proceed with an offer to the buyer.

Figure 1 below provides a schematic illustration of the main activities involved in the international grain sales process including the process previously used by the Board for sales of wheat and barley.

Figure 1: International Grain Sales Process



via the Association. If either party is dissatisfied with the first tier award they may lodge an appeal with Gafta. A board of appeal will be appointed and a hearing date set down for the parties and/or their representatives to attend.

Domestic Markets

Canada's own home market is an important end consumption point for cereal grains and oilseeds (less so for pulses and special crops). In recent years the domestic market has accounted on average for slightly less than half of the demand for canola grown and about one fifth of the wheat grown. The proportion of the corn, oats and barley crop consumed domestically is high, but most of this consumption is on-farm, or is in the form of manufactured feed made (normal course) in close proximity to crop production. The purchase and sale of grain for feed manufacturing is considered to be largely a "local trade" and does not generally influence the grain supply chain in a significant way.

For non-local domestic markets, the sales process within Canada closely mirrors the process for export sales—with some small differences in detailed mechanics. Canadian companies that buy milling wheat, durum, or malt barley can today source their product from Canadian grain companies – formerly only from the Canadian Wheat Board – or import product from other countries. Domestic millers and maltsters will engage in negotiations directly with grain companies.

Canola crushers who do not have their own integrated origination capability can purchase product for delivery to the crush plant by truck or rail although truck is the dominant mode of transport for these movements. Integrated companies that own both country elevator assets and crushing operations bid for farmers' canola and then structure and organize delivery to optimize overall truck and rail freight. The offers made by grain companies to farmers for canola are structured the same regardless of whether the end market is within Canada or not.

Executing sales contracts

The process of executing a sales contract varies according to the terms and conditions of the contract—and since there are numerous variations on contracts, so there are numerous variations on the execution process. For illustrative purposes what follows is a generic description of the execution of a hypothetical cargo-sized contract of grain to an Asian buyer, who has purchased grain C&F/ CIF from an exporter for shipment from Vancouver.

The C&F/ CIF terms of sale requires the exporting company to secure vessel freight. The vessel freight market trades through a network of brokers. It is conceivable the exporter may have pre-booked freight based on their expectation of a sale and their view of the freight market at the time. Alternatively the exporter may have booked a vessel on a "time-charter"[4] or not at all in which case he will look to the "re-let" market if it appears others may have surplus freight, relative to what was expected as demand for freight.

At some point in time the exporter will secure a vessel nomination—i.e. the exporter will be able to indicate to others both inside and outside the company (e.g. a railway) - the name and estimated time of arrival (ETA) of the vessel for operational planning purposes. Vessels arriving at Canadian ports require inspection for

[4] Essentially a way of renting a vessel for a period of time to shuttle between two or more destinations

security and phytosanitary reasons. Once the vessel passes inspection, and indicates its readiness to load within the contract period, it is considered to have "presented". As will be described in a following section outlining the order fulfillment process—operations, merchandisers and logistics team members of the exporter will have arranged for the required volume to be commercially cleaned and ready for loading. Meanwhile, if the contract terms call for the purchaser to provide an irrevocable Letter of Credit, the exporter will have been tracking its status.

Presuming the Letter of Credit is in place, vessel loading begins. As the stevedoring team directs the grain, the Canadian Grain Commission collects samples and will ultimately provide a certificate attesting to the weight and grade of the product. The contract may call for a certain volume "plus or minus" a percentage. Or the contract may be for "min/max", i.e. an absolute amount of tonnes—in this circumstance there will have been an understanding struck between the exporter and purchaser as to how to price amounts above/below the contract—generally speaking the exporter wants to ship as close to the contract quantity as possible, as he is responsible for "dead freight" (empty space). If loading is done efficiently and expeditiously, the exporter may earn "dispatch" from the vessel owner, which is a payment made if the exporter completes vessel loading in less than the contracted/expected time. Conversely, if vessel loading is delayed for reasons deemed to be controllable by the exporter, (heavy rainfall is generally excluded) the exporter may incur demurrage.

When vessel loading is complete, a manifest is prepared—containing all of the documents required under the terms of the contract. The manifest is presented to the bank holding the Letter of Credit—if all is in order, the money is released and the vessel is given clearance to depart.

Risk Management

As a general statement market participants including originators, merchants and processors avoid outright speculation in the market. However, risk does exist in grain markets most significantly in the following areas:

- price (risk that the product price will change between the time it is purchased and when it is sold);
- physical loss of product;
- product quality (integrity of inventory and meeting contracted quality standards)

Price

The management of price risk can differ by product. In the case of products such as canola, where there is a liquid price discovery tool, hedging through the use of derivatives such as futures contracts and/or options can provide an effective means of managing price risk for both grain companies and producers. In liquid open market commodities, the absolute price of the product moves virtually all the time. The difference or spread between the futures market price and the actual physical product is known as "the basis". Grain merchants and producers use futures to transfer risk from absolute price risk to a presumably lower risk that "the basis" will change.

Figure 2 below provides an illustration of how price hedging is used by producers to manage risk associated with future commodity prices.

Figure 2: Producer Price Hedging

Forward Price Hedging – Production Planning: Flaxseed[5]

A farmer intends to plant 360 acres of flaxseed. Estimated total production is 200 tonnes and the farmer is willing to sell 50 percent of the anticipated production before planting. If the futures position is greater than the actual production, the farmer faces the risk of holding a speculative position on that portion of the futures position that exceeds actual production.

Therefore, only a portion of the expected crop is hedged due to production uncertainty. Delivery is expected in mid December. The farmer estimates basis to be $15 per tonne under the January flaxseed contract price in mid December and that is what occurs. The farmer places the order to sell 5 January flaxseed futures contracts (100 tonnes) on May 15. This is normally referred to a **forward pricing hedge**.

The farmer sells 5 January flaxseed futures contracts, grows the crop, then delivers and sells the cash flaxseed on December 15. Also on December 15 the farmer buys back the 5 January flaxseed futures contracts at the current price of $295 per tonne, offsetting his/her position in the futures market.

Date	Street Price	January Futures	Basis
May 15	implied $300/t.	$315/t.	Anticipate $15/t.
Dec 15	$280/t.	$295/t.	$15/t.

Date	Action	Cash Position	Futures Position	Basis
May 15	• Plant flaxseed Sell 50% of expected production on January futures	Expect 200 t. Hedge 100t. at expected price of $300/t. ($315 - $15)	Sell 5 Jan flaxseed @$315/t.	Anticipate $15/t.
Dec 15	Sell cash flaxseed Offset futures position	Sell 100 t. @ $280/t.	Buy 5 Jan flaxseed @ $295/t.	$15/t.
	Gains / Losses	Loss: $20/t. (relative to expectation)	Gain: $20/t.	No Change

Final Outcome:

- The price target on the 100 tonnes hedged was achieved because basis was correctly assessed.
- The net price received on the 100 tonnes hedged is $300/t. ($280 from the cash sale plus a $20 gain on the futures position.
- If all 200 tonnes of production are sold on December 15, the average price for the total crop is $290/t. (average of $300/t. for the hedged portion, and $280/t. for the non-hedged portion.

Futures contracts do not exist for special crops therefore buyers of these crops will look to manage price risk by balancing their price exposure between purchases and sales. For example, a merchant may opt to forward sell "X" tonnes of product at "Y" cents per pound, with the remaining product settled at current market prices at time of delivery. In order to hedge the risk associated with the sale that same merchant will endeavor to contract "X" tonnes with farmers, at "Z" cents per pound, with the remaining tonnes settled at current market

[5] Extracted from, *Using futures and options contracts to hedge*. Winnipeg Commodity Exchange

prices. The spread between "Y" and "Z" is critical as it will include not only the trading margin, but also covers direct expenses; including (where applicable) the costs of conditioning, cleaning, bagging, or other value added process.

The CWB continues to offer pooling[6] which provides a risk management tool for producers by providing all pool participants with an average price for their grain. CWB endeavors to time sales to achieve a return that is reflective of anticipated market conditions for the pooling period. While the activity of pooling in and of itself does not protect producers from downside price risk it does ensure that pool participants will all be treated equally.

Product Loss

Insurance provides a mitigating vehicle for dealing with the risk of outright physical product loss. Additionally, in a number of circumstances, shipping tolerances and contractually agreed upon "shrink" allowances are used in recognition of the fact that product can "disappear" through no one's fault—e.g. normal course spillage.

Verification of product weights through inspection also provides a mechanism for dealing with potential product loss issues. Weighing services are provided by independent third parties including the Canadian Grain Commission or private sector companies such as SGS Canada Inc. Certification of product weights is done both at inland transshipment points (e.g. elevators) and port facilities. Depending on the nature of the commercial relationship buyer and seller may simply agree to weigh grain in-transit (e.g. track scale).

Product Quality

The first step in managing risk in this area is the employment of sound warehousing practices. Some products such as canola can spontaneously heat while in storage. When the condition of inventory is conducive to such problems operations management may need to "turn bins" more frequently, or warehouse products differently, slowing down operations and potentially negatively impacting broader supply chain activities.

The affirmation of product quality can be complex and is ultimately driven by the terms and conditions of the contract between buyer and seller. Grain contracts often specify that a certain product quality be supplied with discounts or premiums applicable if there is a deviation from the contractual standard. In some instances the product simply fails to meet the minimum standard—it does not provide appropriate functionality and will be rejected.

Grain grades provide a proxy for affirming that the product meets a certain quality standard which makes it quicker, easier and less expensive for buyer and seller to transact business. In some cases, this proxy may be insufficient and supplementary information may be needed. Grading services provided by the CGC and companies such as SGS are designed to fulfill this requirement.

[6] Pools are not the sole domain of the CWB. Some special crops (e.g. the Alberta beans) have operated under a pooling mechanism for a number of years.

A buyer of No 1 Canada canola shipped from Vancouver will receive a Certificate Final which stipulates both the weight and the final grade of the product loaded on the ocean vessel. The official Grain Grading Guide published by the Canadian Grain Commission identifies the minimum tolerances that must be met for canola to meet No 1 Canada—the tolerances include thresholds for soundness, cleanliness, and other items materially important for crushers (e.g. per cent of distinctly green seeds).

It is noteworthy to underscore that the quality provided on a shipment may not coincide with the terms of a contract. From time to time, exporters may provide "quality" in excess of contract terms, without receiving a corresponding premium. In years past the Canadian Wheat Board, for instance, may have opted to provide 1CWRS 13.0% protein wheat on a contract for 2CWRS 12.5% protein. This may have been done for one of a number of reasons—perhaps because the quality of the entire crop was very high, or protein premiums in the world market were very low, or a large portion of wheat in shippable position at the time of contract execution simply happened to be 1CWRS 14.5% and the Board sought to maintain fluidity in port terminal operations. Having the latitude to deviate from the base quality contract standard improves the flexibility of operations to meet contract specifications and enhances supply chain effectiveness.

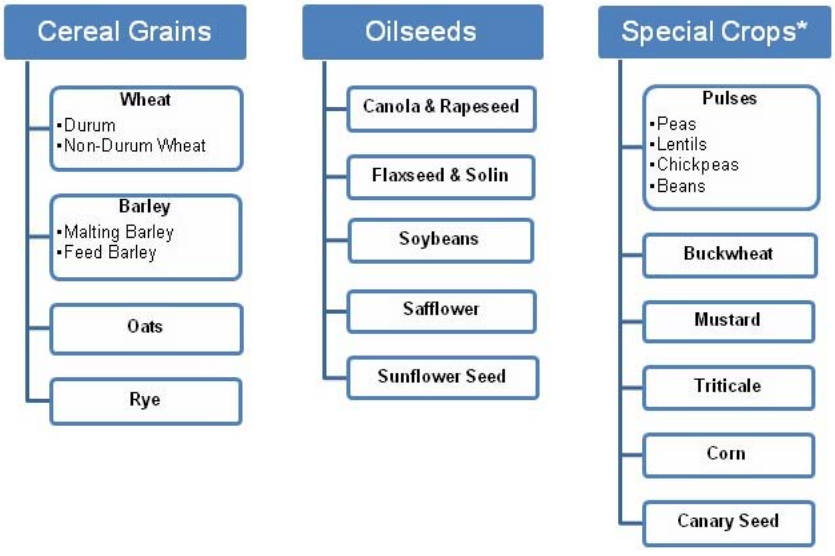
There is only an indirect linkage between grade and the price received by farmers. In the case of open market grains, handlers may blend different grains—it is one way of earning an operating margin. Canola purchased from farmers as No 2 Canada may be blended and ultimately sold as No 1 Canada.

Marketing and sales issues that impact the supply chain

The management of any supply chain requires effective collaboration between the participants. Certain elements of the marketing and sales processes for grain and grain products have important implications for logistics decisions.

Segregation and blending of grain

Figure 3: Grains Grown in Canada



In the Canadian grain handling system, the segregation and blending of grains is an essential operational activity in country and port terminal elevators. The process of segregation is performed in order to differentiate products in accordance with the specifications of the market and to protect the integrity and quality of grain held in elevators. The blending of different lots of grain allows a marketer to match the specifications

of the buyers with the quality and characteristics of the grain available for purchase from producers, while optimizing the overall value of the grain being sold.

Grains produced in Canada fall into three broad groupings: cereal grains, oilseeds and other grains and special crops, as shown in Figure 3 above.

Segregation

There are a number of reasons why grains may be segregated, including:

Product characteristics – The end use of a grain will determine the required attributes a grain buyer is seeking. Grains of a similar class and variety will have varying attributes that can carry differing values (discussed further on in this section). Grains will be segregated by their class and grade as well as by individual attributes (i.e. protein, gluten, falling number etc.).

Flexibility in blending – Individual deliveries of grain either to country or port terminal elevators will be made up of a variety of the characteristics noted above. Where grain companies wish to preserve their flexibility to blend different lots of grain to achieve specific characteristics required by buyers, they may hold inventories of grain at more highly differentiated levels of quality and characteristics than the market will ultimately require, so that they have the flexibility to blend these lots to meet specific sales opportunities as they arise.

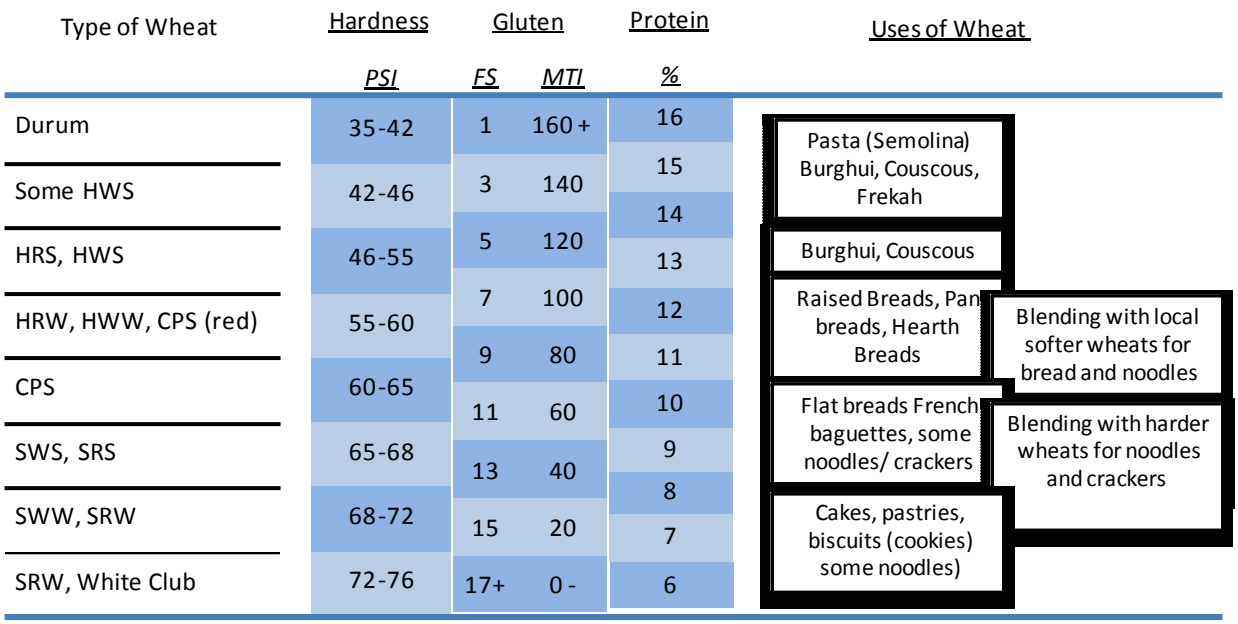
Sanitary and Phytosanitary issues - Some buyers or countries will require a guaranteed absence of certain toxins or foreign contaminants including unapproved genetically modified traits or events (GMO's). Many countries have strict guidelines on the presence of organic particulates to a level as low as zero to less than .05%. As such, all due care is taken to preserve the identity of individual lots of grain through segregation protocols on products moving to destinations where such conditions exist.

Wheat as an example has the greatest number of potential segregations of all the grain types that are produced and sold in Canada. This stems from the distinct milling classes (eight in Western Canada and seven in Eastern Canada) that are typically grown in Canada. Each class has distinct grade levels and attributes and is particularly suited to certain end use products.

Wheat is generally measured in terms of its kernel strength or hardness, gluten and protein content. A harder kernel class will yield better bakery flour for breads where a softer kernel will make for better pastries. Higher gluten and protein content is needed for noodles and pan breads where pastries and flat breads require lower levels. The diagram in Figure 4 portrays the comparison between grain classes, their attributes and end use.

While the end user is typically the baker, the milling company buying the grain will look to find the right grains to meet the baker's requirements, often buying varying grades and qualities to obtain the right mix of attributes. It is those end user requirements, and hence the market demand, that drive the necessity to differentiate wheat classes based on varying attributes and hence the required number of segregations.

Figure 4: Wheat Classes, attributes and end uses



Hardness – Kernel hardness is measured using a Particle Size Index (PSI), the lower the PSI, the harder the kernel
Gluten – The gluten and dough strength of the grain is measured by farinograph stability (FS) and the mixing tolerance index (MTI)
Protein - Protein is measured based on the percentage of protein in the grain

Other commodities also require segregations with some less demanding than others. Canola for instance has only two segregations – Canada Canola 1 and 2. Barley carries with it two classes and four grades and is sold as either malt barley for brewing or as feed for livestock. Other commodities such as oats, flax, rye or corn typically have three or fewer segregations. Special crops will typically move in smaller lots (with the exception of feed peas or certain lentils) and as such will often move in containers or bulk to container transload service, negating the need for segregations in the elevator network. Certain buyers may also have purchase specifications for any commodity that lies outside the normal parameters such as non-commercially clean (NCC) grain or minimum test weight[7] that require segregation.

Blending of Grain

Grain is blended in order to match the grain quality attributes to the conditions of the sale. This is usually done in a manner that enhances the overall value of the grain that is gathered to meet the sale requirements. The blending of grain is a practice than can happen numerous times as it proceeds through the supply chain,

[7] Pounds per bushel or grams per liter.

from the producers bins on the farm through the country and terminal elevator facilities and at the millers factory to meet the milling standards for specific products (type of bread or baked good).

As noted above, a specific type of wheat can be milled individually or in combination with other varieties to provide the desired quality attributes that may be lacking in that individual type. Blending is also undertaken in order to reduce the total cost of the final product.

The blending of grains can be lucrative for the party who is able to do so with the right source product. An example of a grain company blending grain at a country terminal is shown below. Grain companies will often offer premiums to producers if they are able to increase the quality of the grain by blending it with other grains that possess higher quality attributes (grade and protein) at no cost to them. This "attraction premium" allows the grain company to meet the terms of a sale when stocks are scarce. Blending of grain brings both enhanced quality and value to both the buyer and the seller and continues to be a fundamental and important process within the grain supply chain.

Logistics System Impacts of Segregation Strategies

Segregation of grain, most prominently wheat, enhances the flexibility of sellers to meet the specifications of individual buyers through blending activities. As is illustrated above if done correctly it can improve the margin on some grain sales. It is important to understand however that these activities do have implications for the capacity and performance of the logistics system as a whole.

The segregation of grain to allow for future blending requires that individual bin capacity in an elevator be available for each lot that is to be segregated. Where a high degree of segregation is required, it may result in a lower average utilization of bin space in an elevator – thus creating a potential for congestion in highly utilized facilities.

The interconnected nature of the grain logistics system relies on each element of the system working efficiently as the performance of one element can impact the performance of another. For instance congestion in port terminal operations resulting from a high level of segregated stocks for an extended period of time will impact terminal capacity which may in turn reduce the ability of the terminal to unload railcars in a timely manner. Reduced productivity in railcar unloading at port will directly impact the available capacity for loading of grain in the country as it will result in fewer cars being available to meet customer orders, potentially resulting in congested country elevators and limited opportunities for producers to deliver the grain from their farms. Furthermore it can result in congestion in the rail network as grain traffic cannot be delivered to terminals for unloading at the rate required to maintain system fluidity.

In the country elevator system average elevator utilization levels are much lower than they are at the highly utilized port terminal elevators – particularly on the West Coast. Thus, the choice of where supply chain stakeholders hold highly segregated stocks in order to preserve blending flexibility is of critical importance to the performance of the grain supply chain. In general, if segregations beyond those required for an immediate sale are held in the most highly utilized facilities – it creates the potential for sub-optimization of the supply chain.

Contractual Elements

Ocean Vessel Charter structure

The terms for an ocean vessel's charter are part of the terms of sale. The decision on the ocean freight terms, whether the seller accrues the freight costs and includes them in the price (C&F/ CIF) or if the buyer wishes to arrange and pay (FOB), will be based upon the two parties' relative bargaining strength in obtaining favourable ocean freight terms.

Merchants selling bulk quantities of grain will book vessel freight shortly after contract terms are agreed to. A C&F/ CIF contract obliges the seller to load the vessel within a defined period of time or "call period"—for instance "last half May" or May 10-15. Because of weather or other factors, a vessel's ETA may shift. The exporter selling C&F/ CIF probably has more degrees of freedom to adjust the time of actual shipment to coincide with the arrival at port of railcars as they control the contract for ocean freight—or the merchant may swap a freight position with another exporter for mutual logistical advantage. Contracts involving the sale of grain FOB involve the purchaser committing to provide a vessel. The exporter has less "freedom to operate" because he does not control the timing of vessel loading. Contracts may be "buyers call" which implies the exporter has to be ready to perform on the FOB should the purchaser present a vessel at the beginning, middle, or end of the call period.

Contract call period

As noted in the section above, call periods are a matter of negotiation. In some circumstances, exporters have sold grain for very wide call periods—e.g. "full May", meaning the entire month of May. This has the potential to create congestion in the port as grain has to be available any time during May, at the call of the purchaser. This results in stock either being pre-positioned in the terminal for what can be an extended period, to await vessel arrival, or risk is created that vessel demurrage will be incurred if a vessel arrives and not all stock is available to satisfy the contract. Shorter call periods (10 – 14 days) are preferred as they encourage "just in time" movement. However, as noted in the above example the counterbalancing risk is vessel demurrage if the grain is not positioned in the port terminal in time.

Volume and specification

Very large or very small sales can affect supply chain efficiency. A very large sale involving a large vessel may require consolidating inventory at port position, lowering total available storage space. It also may require a seller to enter into a grain purchase or "trading of position[8]" with another seller in order to assure an adequate grain supply to load a vessel within an efficient period of time. In the case of smaller vessels or small lot sizes, the product moving through the bulk handling system may require special binning, lowering

[8] Trading of position refers to a practice where one grain company or exporter will arrange to secure product from another seller who has that product readily available and in their local inventory, with a commitment that they will replace the identical product at no marginal cost within a specific timeframe in the future.

effective terminal working space. Likewise, products that have special characteristics (e.g. malt barley) may need to be handled in a particular way. Movement via container for smaller volumes or special crops can be a cost effective alternative to the bulk system.

Shipping tolerances

The issue of contaminants entering the grain supply chain has increasingly been a concern in recent years of many stakeholders at all points in the grain supply chain. Certain destination countries and specific buyers place requirements that stipulate threshold levels on the amount of adventitious material allowable in any shipment of grain (either through a regulatory act or through the contractual terms of the sale). This may involve a non-approved genetically modified organism (GMO), certain categories of foreign material, or even something as innocuous as sunflower seeds in a shipment of malting barley. In these cases the establishment of very strict tolerances within the supply chain will be necessary to satisfy customer demand and may prevent potential problems when standard CGC and CFIA grading, sampling and testing of grain takes place at terminal elevators.

Counterparty difficulties

While the trading of grain is administered through various contracts, as has been noted, it is also a form of commercial activity where trust and good faith are paramount. For example, a counterparty who has purchased grain FOB—only to see the market tumble—may find various and sundry "reasons" for failing to present a vessel during the agreed upon call period. While arbitration and legal recourse may be an option, in the short run there may be impacts on the supply chain.

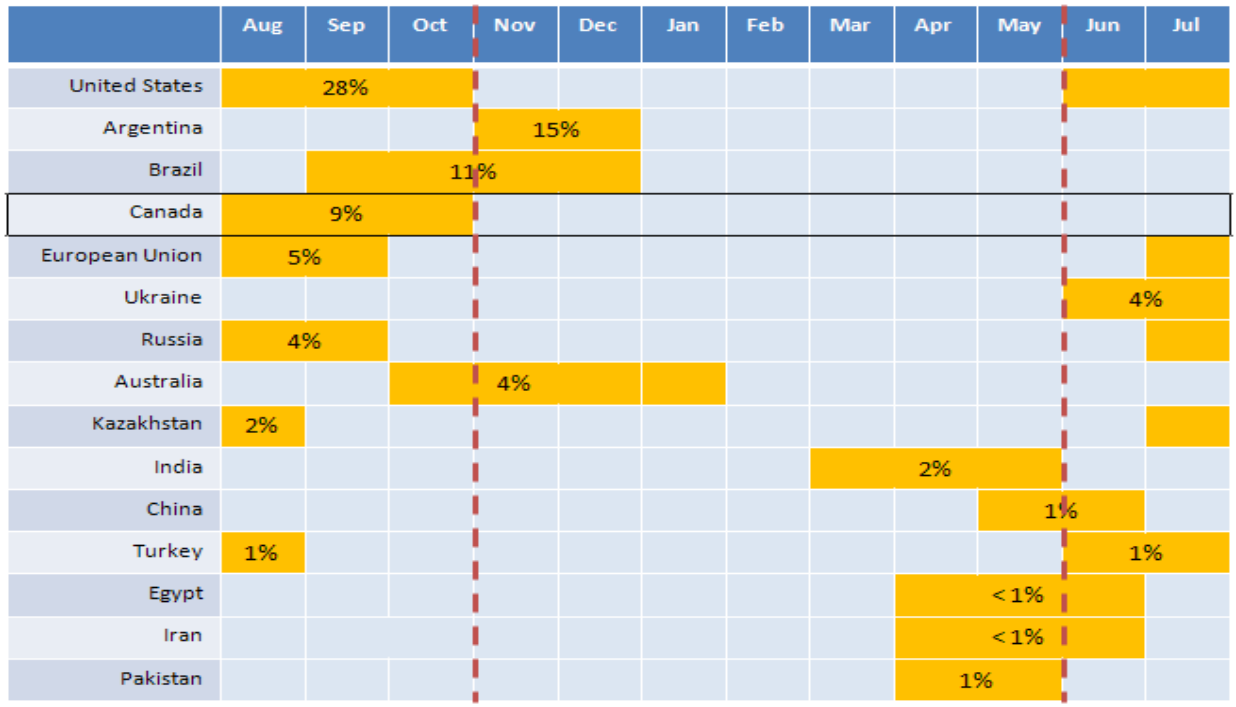
Financial liquidity

Trade in grain depends upon the existence of a robust global trading and financial infrastructure. From time to time (e.g. financial challenges within Asia in the late 1990's) currency markets can become illiquid. Difficulties within the banking industry can also decrease liquidity, as banking counterparties adopt risk-averse behavior that may (for instance) result in difficulties in opening Letters of Credit.

Seasonality

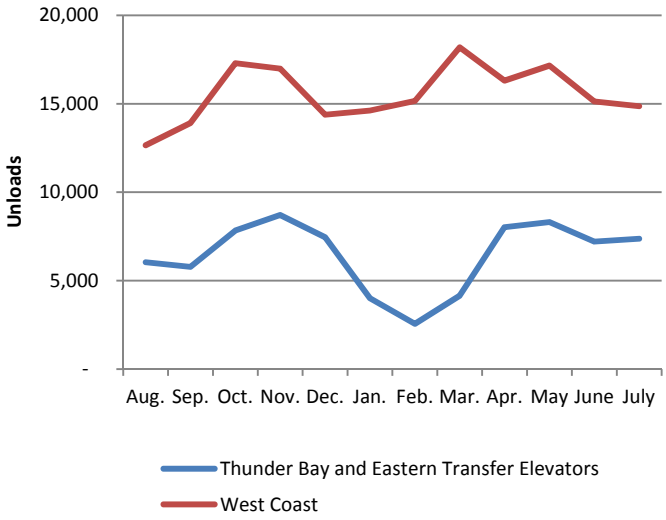
Canadian grains compete in global markets with crops produced and traded in those same markets by other countries around the world. The table in Figure 5 shows the timing of the various harvest periods of wheat around the world and the percentage of global wheat trade that is accounted for by each of the countries shown. It can be seen that Canada's harvest occurs at approximately the same time as the other major northern hemisphere exporters such as the USA, Europe, the Ukraine and Russia. However, major southern hemisphere exporters such as Argentina and Australia and, to a certain extent, Brazil, have harvests that are completed later in the calendar year.

Figure 5: Global harvest periods and the percentage of the global export trade they represent



Canadian grain harvest occurs between August and October each year. While grain traffic flows through the logistics system throughout the year, there are typically two peak shipping periods. Figure 6 shows the average monthly railcar unloads at all grain terminals on the west coast and separately for grain terminals in Thunder Bay and at the eastern transfer elevators for the eight crop years from 2003-04 to 2010-11. As can be seen by the graph the two peak shipping periods for Canadian grain – September to December and February to April - at their highest point, average monthly unloads in Vancouver can exceed 13,000 cars as compared to an average of 10,600 cars per month in non peak periods.

Figure 6: Average Monthly Railcar unloads (2003-04 to 2010-11) – (Monitoring Canada's Grain Handling and Transportation System. Quorum Corporation. 2011)



These peaks are indicative of pressure that can be placed on various components of the logistics system including; country elevator networks, railways and port terminals. This can make the system more fragile during peak periods in the event of a disruption somewhere in the logistics system and may require a greater overall investment in infrastructure to handle peaks versus a lower average level of shipping that might exist if the drivers of such peaks could be addressed.

While the timing of the harvest of competing countries, as displayed earlier, can explain some of the reasons for peak and off-peak timing – there are many factors that can contribute to volume peaks including:

- A desire to maximize shipments early in the crop year to capture available pricing premiums that may be available prior to the delivery of major southern hemisphere producers in later months
- The closure of the St. Lawrence seaway due to ice conditions between December and March
- The annual reduction in operations at west coast elevators during the Christmas period, with correspondingly reduced rail service
- The reduced efficiency of trucking operations to primary elevators in inland areas due to the imposition of annual spring road ban limits
- The desire of farmers and grain companies to limit carryover of stocks from the previous crop year and provide room for on-farm storage in preparation for Canada's annual harvest
- Cash flow considerations by producers in preparation for seeding and production of new crop
- A generally reduced plan for rail shipments and ship loading at ocean terminals in the winter months due to expectations of reduced railway capacity due to winter conditions and reduced port throughput capacity due to weather related ship loading delays on the west coast

Summary

Canadian grains and grain products whether wheat, barley, oilseeds and oilseed products or pulse crops compete in domestic and international markets on price and quality as well as a number of other product specific attributes. While Canada is the 8th largest producer and 4th largest exporter of grain and grain products in the world with 8.5% of total global trade, with few exceptions it cannot claim dominance in international markets.

Generally speaking industry stakeholders in Canada believe that because of this lack of market dominance and the transparency of global grain markets that Canada is generally a "price-taker" in global markets – selling commodity products that are largely interchangeable with those of its competitors. Having said this there is recognition that for certain niche markets (in wheat for instance) product quality is a driver of premium pricing although these stakeholders question whether this results in better margins due to the increased supply chain costs involved in preserving these attributes.

The dynamics of Canada's grain marketing and market development efforts have changed substantially with the removal of the Canadian Wheat Board's monopoly on the sale of wheat and barley. Whereas in the past the Board was the principal player in the development of wheat and barley markets and the maintenance of Canadian competitiveness in conjunction with government and private industry this is no longer the case. The removal of the Board's monopoly position has altered the way in which these grains are marketed and sold, who can sell them and may change the nature of market development efforts in the future.

Grain marketing involves the identification and selection of distribution channels to support the sale and movement of grains between sellers and buyers. There exist a number of different distribution channels within the Canadian grain supply chain each of them placing demands on a common logistics system. Differences in the structure of distribution channels to handle bulk movements as opposed to small lot containerized shipments have implications for not only the kinds of assets and infrastructure needed to support grain movements but also the types of services.

Grain products are sold based on their nutritional characteristics and their suitability for intermediate processing and end use markets. These consideration along with other issues such as sanitary and phytosanitary considerations create the need for segregation of lots of grain products within the logistics system. Much higher levels of segregation have been required in the markets for wheat than for most other bulk grains due to the variety of characteristics demanded by grain buyers in various markets.

Where grains must be highly segregated the logistics system must have the capability, primarily within primary and terminal elevators, to hold such segregations. Small lot segregations have the potential to reduce the throughput potential of the elevator system, especially if such small lots are held in highly utilized facilities such as the west coast port terminal elevators. Segregation does provide flexibility in blending of lots to achieve the characteristics required for specific applications however there is a trade off in terms of the total logistics costs and the performance of the system that can arise from the reduction of throughput capacity.

Moving Canada's Grain: The Logistics Chain Process Description

The following section provides a more detailed view of the primary grain logistics systems in Canada. Each of the four primary logistics systems is discussed separately. They are: bulk export by rail to ocean port or direct to customer, bulk export via the St. Lawrence Seaway, containerized export, and the movement by rail of processed grain products. For each logistics system, cross-functional process maps have been developed that show the stakeholders along the left axis and the major processes and linkages between the processes within each of the horizontal stakeholder bands. These process maps can be found in Appendix 1.

Extensive discussions with most participants in the supply chain were undertaken as part of this study to ensure that process descriptions were accurate and properly portrayed. Included in those discussions were railways, elevator managers in the country and port, container transloaders, grain processors, as well as producers and industry associations.

The processes and activities that facilitate the movement of grain from producers to consumers require a high degree of integrated planning and operations across all stakeholder groups. The primary logistics processes for the various grains and grain products shipped in Canada are described in this section of the report. In reviewing these processes we explore the current approaches as known today and make note where processes have changed as a consequence of the elimination of the Canadian Wheat Board's marketing monopoly.

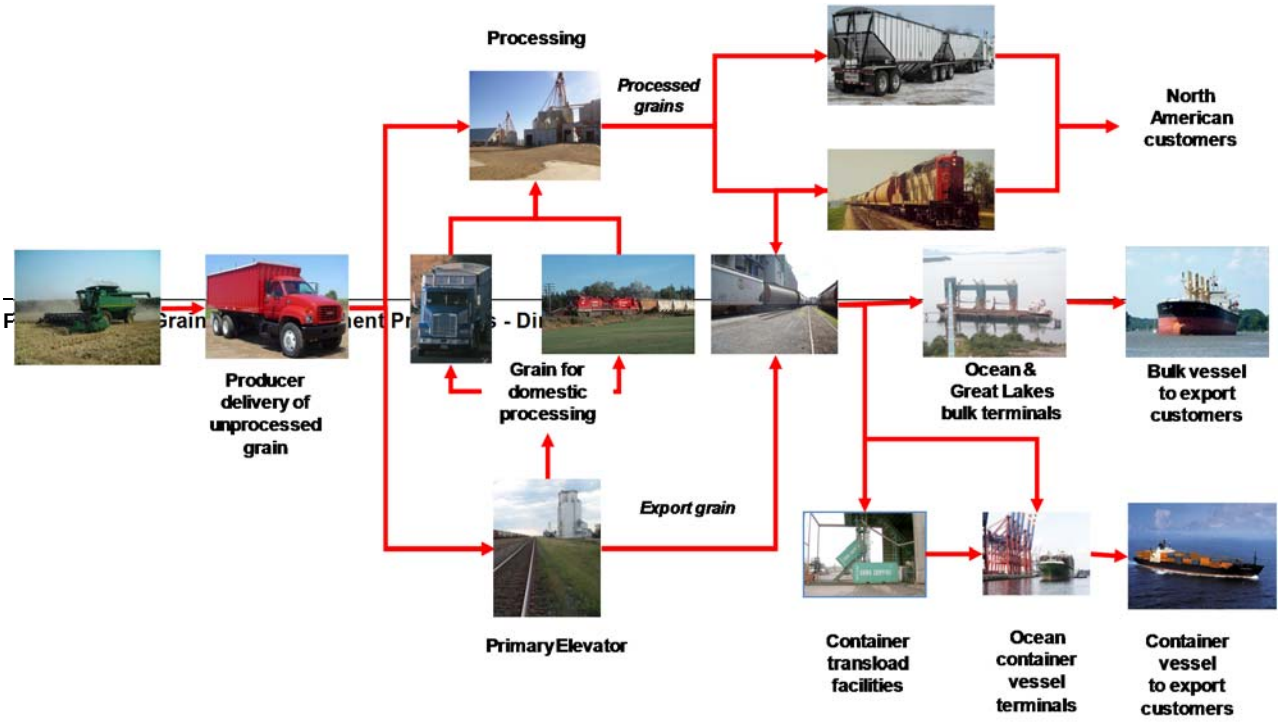
A high level illustration of the system is shown in Figure 7 below. This shows that grain is almost always delivered by truck to a primary elevator or a processing facility. From there it can move via rail or truck either directly to customers or to terminals and facilities for loading to bulk and container vessels for shipment to overseas customers.

While the processes and activities are somewhat different based on the type of grain and the market to which it is destined, in general there are common processes that must be coordinated for the supply chains to work effectively. For export movements, these processes are: sales, grain sourcing, inland transportation, and port and ocean activities. For domestic sales the processes are similar but they do not require the coordination of inland and ocean logistics activities. Where grain must be processed before sale; production planning processes must also be considered.

This document provides the reader with a high level understanding of how the key processes work and how the participants in the supply chain relate to one another. However, this section also provides insight into the areas where the supply chain is vulnerable, and where problems can occur. As noted previously, there are some important areas of uncertainty and system constraints that stakeholders must take into account when planning their marketing and logistics activities.

In this section, the key constraints of railway and port operations are emphasized. For both railways and

Figure 7: Canadian Grain Logistics Supply Chain: Summary View



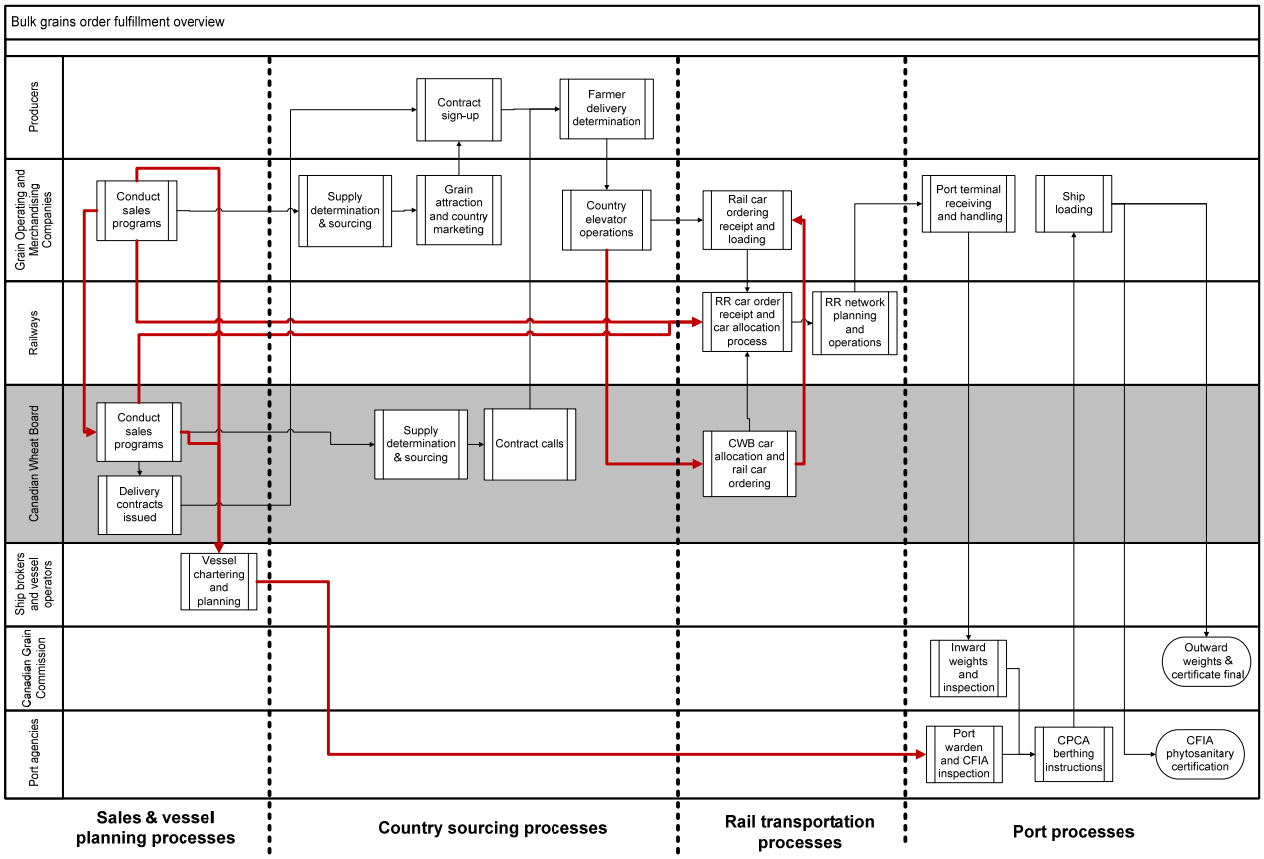
ports, their infrastructure must be used for all shippers of all products and therefore all users of this infrastructure are subject to the variability and potential forecast and operating uncertainties of a wide range of shippers.

Market forces and the marketing strategies of grain companies can also have important impacts on system efficiency. For example domestic and international grain customers may have exacting specifications for quality and end use characteristics resulting in the need for grains to be segregated according to these specifications. If highly disaggregated inventories are held at port terminals, it can reduce the effective storage capacity of these terminals, potentially reducing their flexibility and throughput.

For shippers of grain products that move in containers, rather than in bulk, there are similar constraints and interdependencies between marketing and logistics systems. The availability of inland transportation capacity by rail, the limited storage and throughput capacity of transloaders at the ports and the reliance of the entire system on the efficiency of port container terminals are reviewed below.

Bulk exports via direct rail (to port or North American customer)

Figure 8 below displays a cross functional process map of the movement of grain via direct rail to bulk export terminals in Vancouver, Thunder Bay, Prince Rupert and the ports of the Lower St. Lawrence. The map provides a view of the high level of inter-dependence between different stakeholders. On the map, process dependencies (i.e. this process follows from that process) are shown in black lines and key communication linkages where data from one process is required for subsequent processes, is shown using red lines.



The process map is based on extensive discussion with industry stakeholders.

The discussion below is based upon the movement of product via direct rail to a port terminal for export. For bulk grain products that move via rail to North American customers, the process is virtually identical without the complicating factors associated with the movement through port terminals at destination. Key logistics processes described include sales and vessel planning, country sourcing operations, producer car movements and shortline railway operations, railway transportation and port terminal processes.

Sales and vessel planning

Responding to longer term marketing strategies, grain marketing companies conclude sales agreements with domestic and international buyers. This is done with consideration of the current supply available from stocks held in their primary elevator system, stocks that they have available through production or delivery contracts with producers, and stocks that they believe they can attract to their elevator networks through marketing programs in the country sourcing process. An additional critical determination in the sales process is the estimation of future capacity within the logistics system that grain companies expect to have available to move product to market. This includes the expected rail car supply, rail pipeline capacity, port terminal elevator storage and throughput capacity and the availability of ocean vessel capacity and its contractual terms.

While the planning horizon for each grain company will be specific to the freight and commodity markets in which the company is active, in general, approximately 50% of a sales and vessel charter program might be

booked 90 days in advance, with the balance split between 60 and 30 day windows. As a result, grain companies must be able to predict the capacity that will exist in the country, railway and port logistics systems well in advance of the arrival of vessels at the port. If they commit greater sales than the logistics system is ultimately capable of handling – congestion will arise in the system resulting in possible penalties on sales commitments, damage to the reputation for reliability of the company and possible vessel demurrage charges when vessels are delayed at port awaiting loading.

It is important to note that many exporters will not manage their own vessel chartering but will deal with ship brokers who manage this on their behalf.

Charter agreements will generally specify the type and capacity of the vessel required, the origin and destination ports and any conditions with respect to the specific needs of the commodity being shipped. The agreement may not be for a specific vessel – but for a vessel that meets the specifications in the contract. In addition, the contracted arrival window of the vessel at the loading port will customarily be approximately 14 days, reflecting the variability of loading and transit times of bulk vessels. The identification of the actual vessel for a charter contract may occur at the time the contract is executed or only days before its arrival at port.

Country sourcing processes

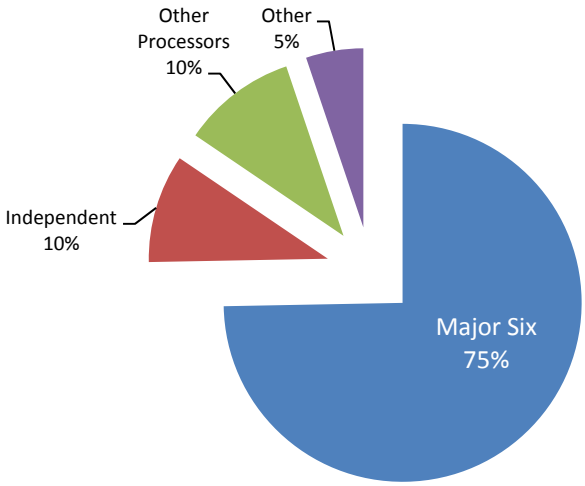
Grain companies must source grain in the country based upon the demand created by sales commitments. Grain is currently drawn into the system through an active marketing program managed by grain companies and other marketers and exporters of Canadian grain. This is accomplished through ongoing interaction with grain producers and the establishment of a basis price that is paid to the producer upon delivery of their grain. The practice of using forward contracts has been in use with non-Board grains for a number of years, and has been increasing in popularity as it is one way for both producers and buyers to mitigate risk. This process sees a producer enter into a contract with a grain company or exporter to grow a specific type or variety of grain before seeding commences, with a price established based on a futures market basis.

Prior to the change in the Board's marketing mandate, grain companies had no control over the price for wheat and barley. The statutory obligation imposed on grain companies and the desire to garner revenues from the handling fees generated by moving cereal grains incented elevator companies to use a combination of grade and trucking premiums to attract grain to their elevators.

At that time, as they continue to do, grain companies would also provide trucking services for the movement of grain from producer farms to country elevators and for the movement of grain between elevators. These services are either delivered directly by the grain companies themselves or through the contracting of third-party trucking companies. The reason for grain companies to offer this service is that it provides a greater certainty of product supply and further enhances the relationship between the grain buyer and producer. It should also be noted that beginning in 2011, some grain companies offered forward contracts for the production of wheat and durum for the 2012-2013 crop year.

In addition to delivery contracts, some producers can have production contracts that require them to deliver a proportion of their production to a specific grain company. No statistics are available to precisely determine their importance but Quorum's discussion with industry sources suggest that they may account for 10%-15% of seeded acreage for canola. They were used much less frequently for wheat and durum under the Canadian Wheat Board single desk, however the forward contracting offered by the grain companies (as discussed above) saw some limited use.

Figure 9: Western Canada Licensed Elevator Capacity



In Canada's grain supply chain, the country elevator network no longer plays just a warehousing function but now lies at the centre of the grain sourcing and procurement process. Now more than ever elevator management is playing a critical role in the facilitation and maintenance of the relationship between a grain company and the producer.

There are 108 separate entities that own the 394 licensed elevators in the western Canadian country elevator network. Nearly all (99%) Canadian export grain moves through this country elevator network.[9]

That network has a capacity of 6.573 million metric tonnes of stored grain. Figure 9 depicts the structure of the country system by type of company.

Like all major processes within the grain logistics system, the attraction of grain into the processors' facilities must be coordinated with the activities of stakeholder partners that provide capacity for downstream components of the logistics stream.

Rail car supply performance problems can complicate both primary and terminal elevator planning when cars are not available to move stocks that are required to meet sales commitments at ports. Capacity and market signals are important to grain companies in order to draw the right grain into their facilities in advance of receiving cars for shipment. This involves both indications from the railways as to what car supply will be available and information regarding commodity demand for their needs.

The railways' weekly total empty car supply plans for the western Canadian grain industry provide an indication of railways' weekly capacity. Individual companies are made aware of their own car spotting plans through the railways' internet based car order systems.

[9] Source: CGC Licensed Elevators

Internal marketing information is important for all commodities. Notwithstanding the systems in place, shippers often express concern that communication and information from all parts of the supply chain is inadequate to optimize their operations.

Producer Cars

The legal right of farmers to load their own product to railcars stemmed from a series of events that began when they believed they were unjustly treated by the railways and grain companies in the late 19th century. The issue was based on the railways' frequent refusal to furnish boxcars to farmers who wished to load these railcars directly from their wagons, and compelled the farmer to sell his grain to the local elevator operator at whatever price and terms he could secure. This led to the appointment of a Royal Commission, and ultimately the passage of the Manitoba Grain Act in 1900, which, among other things, stipulated that the railways were to furnish farmers with the railcars they needed to ship their own grain.[10]

By 1999, total producer car shipments amounted to approximately 3,400 carloads per year[11]. The majority of these were single car movements, loaded by individual producers using basic farm equipment, such as trucks and augers. The economic advantage for a producer to load his own car lies in the ability to avoid the cost associated with commercial elevation, estimated in 2011 at almost $14 per tonne for 1CWRS wheat.[12] When other offsetting administrative costs and forgone benefits such as trucking premiums and grade promotions are factored in the producer's net saving by loading the car himself may be $7 to $10 per tonne[13].

In recognition of these potential savings, a number of producers looked to make producer car loading more efficient leading to the establishment of the earliest producer car loading groups in the mid 1990s. This evolved into more structured approaches, with a pooling of capital to invest in fixed trackside storage and producer car loading facilities. The success of these first installations led to the creation of others with some expanding their activities to form new shortline railways with the acquisition of rail lines proposed to be abandoned by the major railways. Through this period of expansion and innovation, tens of millions of dollars have been invested in track and wayside infrastructure. These efforts and investments are largely responsible for spurring producer car loading to the current level of approximately 13,000 carloads annually.

The Producer Car Process

A producer looking to load and ship his own product begins by making application to the Canadian Grain Commission (CGC) who is responsible for the administration of producer cars. The CGC charges a handling

[10] The railways largely ignored this requirement in the face of a bumper crop in 1901, and again gave preference to the grain companies when distributing railcars for grain loading. Similar circumstances provided for much the same treatment in 1902, leading producers to move against the Canadian Pacific Railway in a lawsuit that became known as the "Sintaluta Case." This effectively cemented the producers' rights, which were affirmed yet again in the passage of the *Grain Act* in 1912. In the aftermath of the Sintaluta Case, producer-car loading increased substantially, ultimately reaching some 51,000 carloads in the 1912-13 crop year. From that high point, however, producer-car shipments began to steadily decline. (Source: King vs. Benoit (1903) Territories Law Reports, Vol 5, 442 - Sintaluta)

[11] Based on Grain Monitoring Program data

[12] Costs and discussion on the Sintaluta case from GMP Annual Report of 2010-11

[13] Analysis of economics of producer loading from GMP undertakings over the course of the program

fee of $20/rail car for the administration of the application. It is incumbent upon the producer to supply proof to the CGC that he has a sale (or destination) for the grain he intends to load in the producer car.

A producer can assume the responsibility for the administration of the producer car or he can hire another party to do so for a fee. Those involved in providing the administration services can be producer loading cooperatives (e.g. West Central Road and Rail or Great Western Railway) or an independent terminal operator (e.g. Southwest Terminals or Great Sandhills Terminal).

As noted above, a critical step in the process is the establishment of a buyer for the grain to be shipped. All grain for movement requires the producer to consummate a sale and obtain the authorization of the destination terminal or consignee to ship the goods. In the single desk era, the Canadian Wheat Board would control and allocate port terminal space for the handling of producer cars. Today, if the grain is not contracted to CWB, the responsibility of doing so is incumbent upon the producer shipping the grain. When the application is approved, the CGC will notify both the producer and railway. The railway will advise the producer of the spotting date of the car. It is the producer's obligation to ensure the car is loaded in a timely fashion and that a bill of lading with shipping instructions is completed and submitted to the railway. There are presently 366 producer loading sites in Western Canada, 234 on CN and CP and 132 located on shortlines.

The change in the Canadian Wheat Board's mandate effective August 1, 2012 has changed the transportation environment for producer car shippers. Historically producer car shippers relied almost exclusively on the Board which marketed over 95% of producer cars loaded in Western Canada, with the remaining 5% being devoted primarily to the movement of oats into the American market.

Equally important to producers was the ability of the Board to minimize a producer's risk exposure through its ability to absorb a producer car mis-grade through blending with other product at the port terminal – a strategy made possible by virtue of the Board's control of all wheat and barley flowing through a terminal. Going forward, new CWB has been clear in its communication with producers that they will no longer be able to continue this practice. This means that producers will now assume a greater proportion of the risk associated with producer car shipments including being responsible for shipping costs, all costs related to the risk of loss, ensuring the accurate reporting of the contents of a car and all risk associated with the grade and quality of the product.

Shortlines

Shortline railways have become an integral part of the producer car loading network in Western Canada. The impetus for the development of the shortline industry in Canada was the decision of Class 1 railways to reduce the size of their networks and in some cases to lower the operating costs on lines with low traffic density. Early railway network rationalization efforts in the 1990's resulted in a number of sales being concluded between CN and CP and existing shortline railway operating companies that served as operating

agents of their former Class 1 owners with CN and CP generally handling most of the marketing, rate setting and interline railway business support processes on behalf of the shortline[14].

Many of these shortlines commenced operations with a high proportion of their business based on grain shipments. However, as the grain companies pushed forward with their own network rationalization plans and shut down grain delivery points on these lines the underlying economics of the shortlines were compromised. In some cases the shortline companies ceased operations and the rail lines were abandoned. In other cases CN and CP have repurchased their previously divested lines and invested capital to upgrade them – particularly lines in Northern Alberta that support increasing bulk resource shipments and oil sands related development.

An important trend in the western Canadian shortline industry has been the move by producer groups to purchase railway lines for the explicit purpose of supporting producer loading initiatives. The means by which these groups use shortline railways to support their producer loading operations has evolved. In some cases, particularly in southern Saskatchewan, shortlines have diversified their business into non grain markets by providing services for crude oil transloading and transportation, fertilizer and other industrial products. Appendix 2 contains a map that displays the western Canadian rail network identifying the location of shortline railways.

In recent years, over 80% of grain that has originated on shortlines has been wheat and barley that was marketed through the Board[15]. Most stakeholders believe that for shortlines to continue to prosper in grain markets going forward, they will need to diversify their business model to utilize marketing channels in addition to whatever continuing interest new CWB will have in producer loading of rail cars.

Rail transportation processes

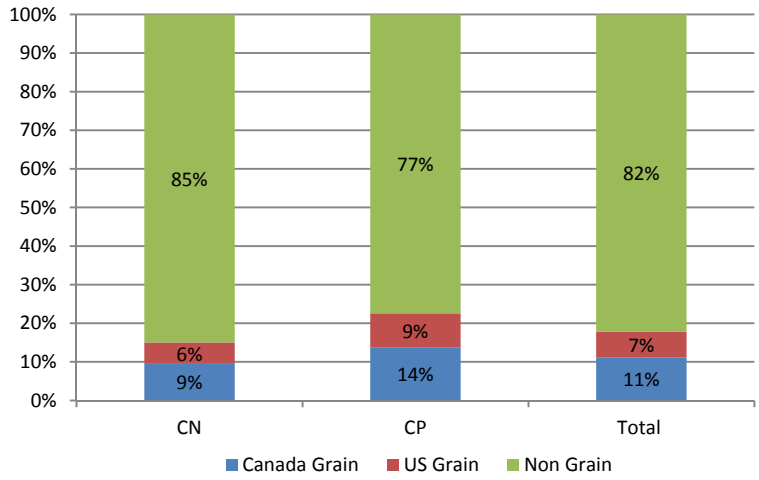
For this study, extensive discussions with both Canadian Class 1 railways and all major grain companies were conducted in order to allow for a description of the processed described blow. In addition, supporting data from the Grain Monitoring program was used to help describe and support these discussions.

[14] Based on Grain Monitoring Program data

[15] From Grain Monitoring Program data

The vast majority of grain shipped from primary elevators and processing facilities in Canada uses rail transportation.[16] CN and CP are the two largest and principal railway stakeholders in the Canadian grain supply chain.

Figure 10: Breakdown of Railway Commodity Mix



This rail traffic must share the use of the railway network with all other users of the system. Figure 10 shows that grain makes up 18% of total CN and CP revenue.[17] Of this approximately $1.4 billion was earned in the movement of Canadian originated grain.

Grain traffic must share the track, locomotives, crews, signal and control systems that railways use to move all of their other traffic. As railways will have limited excess capacity to handle very wide swings in volume, the need for all users to share railway capacity can limit a railway's ability to quickly react in cases of rapid changes in demand for transportation or to disruptions to the network that can be caused by weather, labour, or mechanical issues.

Car Order Processes[18]

In order to plan and execute the movement of grain products from primary elevators to destination (be that ports or direct to a domestic customer) railways rely on forecasted demand information from the grain companies. Grain companies provide their rail car orders to railways from 1 week to a few months in advance of their desired shipping day. Shippers will order cars for a particular origin location and for a particular destination corridor to be placed for loading within a given 7 day Sunday-Saturday period known as a grain week.

Both CN and CP utilize a web-based open order book to receive car orders from grain companies allowing shippers to place origin-specific car orders with "want dates" up to 16 weeks in the future for CN and 17

[16] Canadian railways operate over 47,000 km of track in Canada – of which 12% is designated as "grain dependent" trackage. Grain dependent lines are generally those for which grain makes up more than 60% of the volume of traffic on the line or where revenues less variable costs for traffic other than grain do not exceed the costs associated with running the line. Sources: Rail in Canada 2007, Statistics Canada – and Canadian Transportation Agency: www.cta.gc.ca.

[17] Source: CN and CP published financial and operating data. For CP, the proportion of carloads represented by Canadian and US grain products was 17% versus 22% of revenues as shown above. CN does not publish data on the total volume of grain movements in tonnage or carloads but combines this information with data on combined grain and fertilizer shipments.

[18] Quorum undertook extensive discussions with both Class 1 railways in order to understand and describe the railcar ordering processes. It should be noted that both CN and CP look to continually improve and update their systems. This reflects the systems as they operated in the 2012-13 crop year.

weeks for CP. Notwithstanding these four month availability windows, both carriers indicate that most orders are currently being placed with a maximum of two to three weeks lead time.

In the single desk era, the Board utilized information on producer car allocation, general allocation and tendering to program grain to meet their sales commitments. Producer car applications were coordinated with the CGC. A formulaic process based on producer contract sign-ups and country elevator receipts was used to allocate cars among grain companies for the general allocation which accounts for over 80% of the program. The tendering program implemented in the 2000-2001 crop year was an effort to introduce commercial mechanisms for sourcing product into the Board export program and was included in the calculation of required car allocation.

To the extent possible, grain companies would attempt to build their non-Board programs (i.e. oilseeds and special crops) in a way that corresponded with their Board allocation. The objective was to maximize the use of high-throughput facilities with larger car spots and utilize the optimal car block incentive offered by the railways - up to $8 per tonne for shipments in large blocks of 100 or more cars on CN and 112 or more cars on CP.[19]

Under the open order process offered by both railways, orders must be placed no later than Tuesday of the week prior to the week for which cars are ordered. Both railways communicate a supply plan to shippers by the end of Friday of the week prior to the planned service date and they attempt to provide updates to any last minute changes to loading plans during the week as changes occur due to railway operational issues.

When determining how a railway will allocate its available car supply, they will be guided by a number of factors. Predominant amongst these is the need to ensure that the terminal or receiving facility is capable of accepting and unloading the cars requested by a shipper. Therefore the railways will closely monitor the unloading capacity, inventory status and "pipeline" of cars en route to a terminal to ensure they do not place more cars for loading than the rail system and destination terminal can handle in the planning period. Ensuring that sufficient empty car supply is available for loading at primary elevators will be largely determined by preventing congestion, delays and maximizing unloads at ports. Beyond seeking to manage possible congestion issues, railways will allocate available car supply based on customers' previous performance in the use of allocated rail equipment, and they may ration cars in periods of high demand based upon shippers' historical percentages of overall demand. Orders that have not been filled in previous periods will usually have a higher priority than new orders as well.

In the single desk era, rail car orders for board grains directed to a particular primary elevator would not be known until 1-2 weeks prior to loading. As a result, it was challenging for the grain company to plan and coordinate rail car orders for grain under their control and originating from their elevators so as to meet their

[19] As of January 2012, CN offered incentives of $8 /tonne on 100 car blocks and $4/ tonne on 50 car blocks. CP's incentives were $4 on 56 cars and $8/ tonne on 112 cars. A car block is a group of cars being placed in a single block for loading at a single origin and destined to a single destination. The grain monitor reports that CN and CP provided combined discounts totaling $145.5 million, or an average earned discount for shippers of $6.74 per tonne, during the 2010-11 crop year.

non-Board grain sales commitments while maintaining elevator fluidity. In today's process, the coordination of grains flowing into and out of the country network is completely under the control of the owning grain company, making it easier for grain companies to plan and coordinate car orders.

Railway Operations Issues

According to the most recently published data by the federal grain monitor, average railway loaded transit time for grain moving between primary and port terminal elevators in Western Canada was 6 days during crop year 2010/11.[20] The grain monitor also calculates a coefficient of variation of transit time which expresses the standard deviation of the variation of transit time as a percentage of the average. For the 2010/11 crop year that variation was 30.8%. Statistically, this means that the average grain shipper moving grain between a single origin and single destination, would expect their transit time to vary between 4 and 9 days for approximately 80% of the rail cars shipped with the remaining 20% of shipments falling outside that range.[21] This variability of performance in the rail system requires port terminal operators to be able to absorb and react to variations in railway performance and to deal with uneven demands for rail car unloading at their facilities. This flexibility can be compromised if the terminal is already congested by performance or planning issues that limit the availability of storage or ship loading capacity in the port terminal.

Rail car supply performance problems can complicate both primary and terminal elevator planning when cars are not available to move stocks that are required to meet sales commitments at ports. Capacity and market signals are important to grain companies in order to draw the right grain into their facilities in advance of receiving cars for shipment. This involves both indications from the railways as to what car supply will be available and information regarding commodity demand for their needs.

There is currently no comprehensive independent data on the performance of Canada's railways with respect to car order fulfillment. Most recently as part of the Rail Freight Service Review undertaken by the federal government in 2008, a quantitative assessment was done of railway performance with respect to the supply of empty cars. The analysis examined performance for the two year period from October 2006 to September 2008.

The analysis yielded two important findings with respect to hopper car fulfillment. The review found that in the aggregate railways supply more than 97% of all hopper cars ordered by grain shippers. However, on a week to week basis there was significant variability in performance with both railways only providing grain shippers with 90% of the cars they ordered at a given location 50% of the time. More recently grain shippers have acknowledged both publically and to Grain Monitoring staff that railway order fulfillment performance has generally improved over the period of the Service Review. However, shippers have complained that there is still significant performance variability for certain fleets – i.e. boxcars for pulse and special crops shippers – and that recovery from operating disruptions caused by weather or other railway operations issues

[20] Monitoring the Canadian Grain Handling and Transportation System. Annual Report 2010-2011 crop year. Quorum Corporation

[21] This calculation is based on the assumption that the distribution of transit times is normally distributed but with a slight shift to towards more of the trips having longer than average times as opposed to shorter than average times.

can

Figure 11: Grain as a proportion of total port activity (excluding autos)

cause periods of extended disruption to supply. It should be noted that as part of this examination, empty rail car supply performance information was requested from the railways and was not available.

Canadian Port Traffic

It is worth noting the role that grain plays in the utilization of Canada's major port resources. Figure 11 below shows that grain in both bulk and containerized form makes up between 1% and 100% of the total throughput of the six major ports that handle grain, aside from the ports on the lower St. Lawrence River. While bulk grain exports do not share terminal facilities with other commodities – as grain moves through terminals that handle only grain - it does share the railway infrastructure, anchorage and pilotage resources required to run

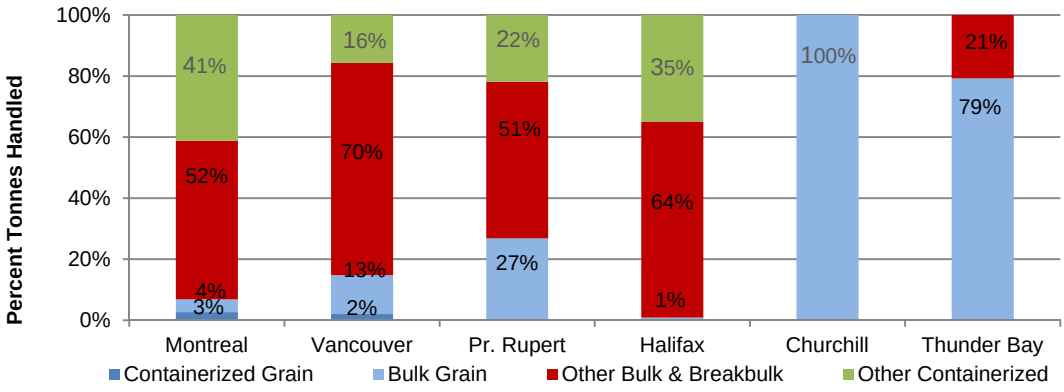


Figure 12: Exports from Canadian Port Terminal Elevators (2010-11) (Source: Clearance of Canadian Grain by Export Position: 2010-2011. Canadian Grain Commission)

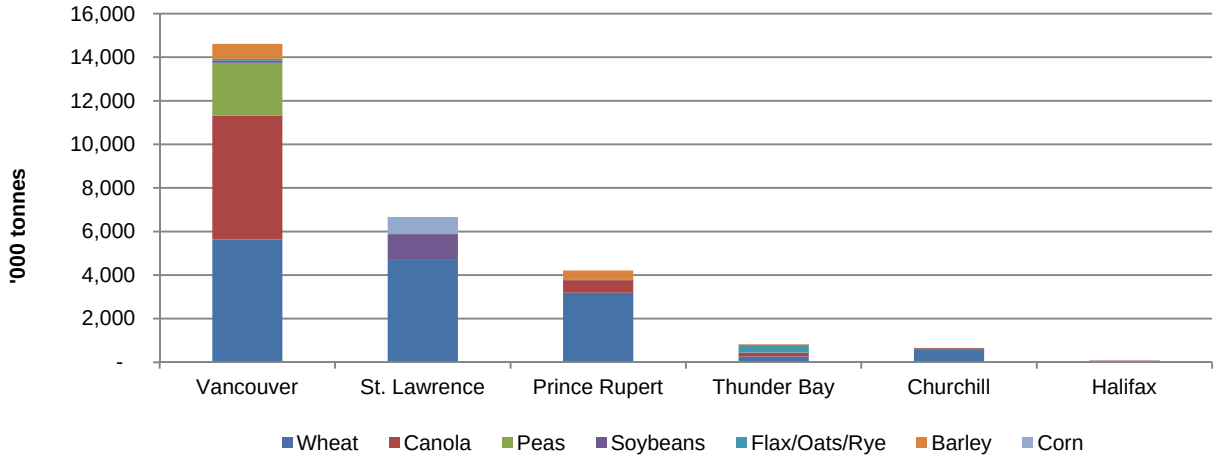
these ports. As with mainline rail infrastructure, the coordination of the demands of multiple commodities and port operations will sometimes restrict the flexibility of any specific port user in responding to short term fluctuations in operational demands.

Bulk Grain Port Terminals

The graph in Figure 12 shows the grain exports handled by the major terminal elevators at ports in Canada. Note that these statistics show only the exports by the region of export clearance. Consequently Thunder Bay totals reflect those shipments that were loaded to ocean vessels directly from Thunder Bay and do not include the loading of grain to lake vessels for movement to transfer elevators in the St. Lawrence. This traffic amounted to 3.6 million tonnes in 2011.

Port Terminal Infrastructure

The port terminal network provides a secondary warehousing role within the supply chain as bulk grains are



stored in these terminals waiting loading and dispatching of ocean vessels at the point of export.

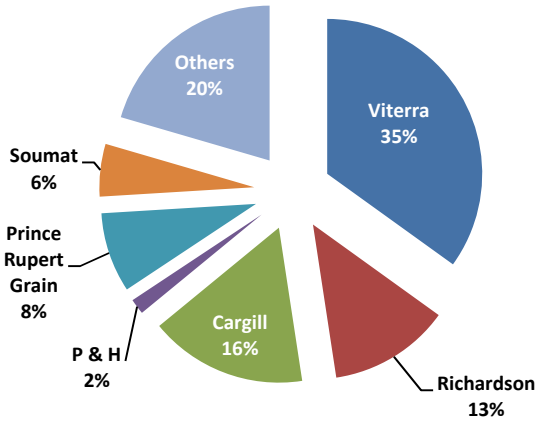
Canada has twenty-nine port terminal facilities at sixteen separate ports from Prince Rupert, BC to Halifax, NS and as far north as Churchill, MB. The utilization, volumes, manner in which they operate and the relationship they have with the port varies from port to port. While these variations are distinctive, typically port terminals are viewed in terms of their eastern and western geographic situation. This has much to do with the fact that western Canadian grain falls under special regulatory provisions in the Canada Transportation Act.

Western Canada

There are fifteen terminals located at the four western ports with total storage capacity of 2.4 million metric tonnes. This ownership is portrayed in Figure 13. The Port of Vancouver is home to six terminals owned by the following companies: Viterra (2), Richardson, Cargill, Kinder Morgan, and Alliance Grain.[22] Vancouver based terminals, as compared to those located at other ports, have a different ownership structure and relationship with the managing port in that the land on which they are located is owned by the Port Authority and leased to the terminal operator.

[22] Alliance Grain Terminal is owned by a consortium consisting of Parrish and Heimbecker, Paterson Global Grain, and independent terminal operators Weyburn, Prairie West, Great Sandhills and Northwest Terminals.

Figure 13: Western Canada Terminal Capacity by Owner



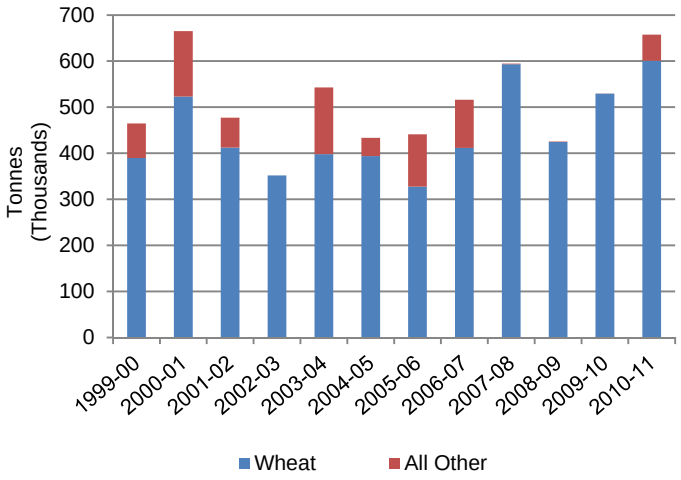
While the terms of these leases are confidential, the very nature of the relationship places the Port of Vancouver in a stronger strategic and operational position than its counterparts. One result of this special relationship is that port operators in Vancouver provide detailed shipment and volume data on a regular basis to the port management – resulting in better publically available data on port traffic than is available at other ports[23]. Rail service to the Port of Vancouver is provided by both Canadian Pacific and Canadian National, while both Burlington Northern and Union Pacific have operating rights to interchange traffic to all grain facilities in the Port.

Similar to Vancouver, Thunder Bay is home to multiple grain terminals. There are seven licenced terminals in Thunder Bay owned by the following companies: Viterra (2), Cargill, Richardson, Parish and Heimbecker, Canada Malt, and Soumat (Mission Terminals). There is also one dockside licensed processing plant owned by Western Grain By-Products

Unlike Vancouver and Thunder Bay the Ports of Prince Rupert and Churchill have only one grain handling facility each. Prince Rupert Grain is owned by the consortium comprised of Viterra, Cargill and Richardson; with Viterra having the majority ownership position. Prince Rupert is captive to CN.

The Churchill grain terminal is owned and operated by OmniTRAX[24] that also owns the Hudson Bay Railway (HBR) that serves the Port. Churchill is also captive to CN by virtue of the HBR's sole connection to CN at The Pas, MB.

Figure 14: Churchill Grain Traffic



The Port of Churchill has traditionally moved primarily wheat and durum sold by the Canadian Wheat Board. Since 1999 Board grains have represented 88% of the 6.1 million tonnes of grain shipped through Churchill.

[23] Based on ongoing discussions as well as interviews held with senior port officials at all major Canadian ports specifically for this study
[24] OmniTRAX is a private corporation owned by the Broe Group of Companies based in Denver, CO.

The dominance of wheat and durum shipments through Churchill has become even more pronounced in recent years accounting for 97% of total shipments since the 2007-2008 crop year[25].

The Port of Churchill is at a competitive disadvantage relative to other ports in two areas. First, Churchill is not, like Canada's other major grain terminals, integrated into the grain supply chain by virtue of ownership by a grain company that also has its own country elevator network. Secondly, because of the short shipping season at Churchill (July to early November) much of the grain shipped through the port is grain that has been stored from the prior year's harvest. In prior years, the Board encouraged shipments through the use of its Churchill Storage Program which paid farmers to retain grain on-farm for later movement through the port. The grain the Board paid to store through this program included very specific types of wheat and durum targeted to meet demand in African and European markets. This program was eliminated with the 2010-11 crop year. For Churchill to be cost competitive requires that other logistics cost savings (including terminal costs and ocean freight) be great enough to compensate for the higher average storage costs for shipments out of Churchill. Concurrent with the change to the Canadian Wheat Board marketing mandate, the Government introduced a $9.00/ tonne subsidy for grain products shipped through the Port of Churchill for a five year period, leaving the Churchill option open to any grain company or grain dealer.

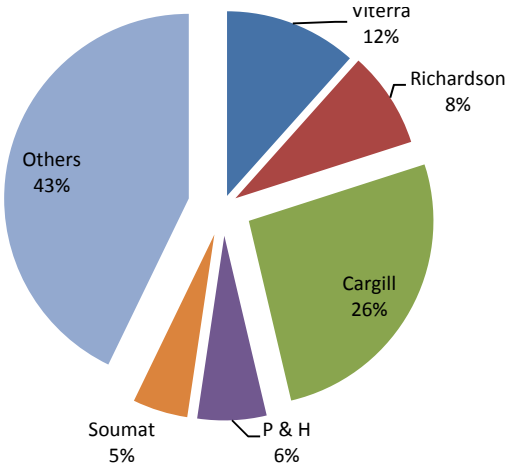
Bulk Grain through the St. Lawrence Seaway

The processes by which grain moves through the St. Lawrence Seaway system to export and North American customers is very similar in many ways to the processes describe above. Certainly, the sales and country sourcing processes are in most cases identical and the issues associated with logistics planning are generally the same. Appendix 1 contains a detailed process map showing how grain moves through this system.

The St. Lawrence Seaway is the largest inland waterway in the world, comprised of 15 locks between Montreal and Lake Huron capable of moving deep draft vessels[26]. The majority of grain seeking to trade from Eastern Canada gateways uses the Seaway to traverse or gain access to the ports of export. This is accomplished in a number of ways, including:

- Direct rail to elevators on the Lower St. Lawrence
- Rail to Thunder Bay for loading to ocean going vessels for export

Figure 15: Eastern Canada Terminal Capacity



[25] From GMP measures program

[26] Source: The St. Lawrence Seaway Management Corp.

- Rail to Thunder Bay for loading to lake vessels for movement to transfer elevators on the Lower St. Lawrence and thence via ocean going vessels for export
- Rail to Thunder Bay for loading to lake vessels for movement to processors in the Great Lakes region

As with movement through the west coast ports, the great majority of grain exports via the eastern ports must move through terminal elevators. In Eastern Canada, there are a total of thirteen terminals located at twelve different eastern ports with a total of 2.3 million metric tonnes of storage capacity. (see figure 15)

Upper/ Lower Lakes

There are six facilities located in the Great Lakes area, four held by major grain companies: Parrish and Heimbecker (P&H) at Hamilton and Owen Sound; Richardson at Hamilton; and Cargill at Sarnia. The remaining two facilities are owned by small private concerns: ThirdCoast Ltd. owns Southpier Terminals at Goderich and the Township of Edwardsburgh/Cardinal owns the terminal at Prescott. These terminals provide export access for eastern Canadian grain producers in much the same way the western Canadian country elevator system does. While all of the terminals are accessible by rail, they also accept a large volume of grain trucked directly from farm gate. These terminals also serve as points of export to both US and offshore markets.

Lower Seaway/ River

There are six terminals located on the Lower St. Lawrence Seaway. The grain terminal at the Port of Montreal, while owned by the Port, has been operated by Viterra since 2011. The Montreal facility has access to both CN and CP rail lines. In much the same manner as the Upper/ Lower lake terminals, Montreal sees a considerable amount of its traffic delivered by truck from the farm gate.

Richardson, Soumat and Bunge own and operate the facilities at Sorel, Trois Rivieres and Quebec City respectively all of which are served by CN or their shortline affiliate. The remaining two facilities are not rail served and receive all grain either by truck or by lake freighters from the upper lakes and seaway. Cargill's Baie-Comeau facility is the largest terminal in Canada at 441,780 tonnes. Louis Dreyfus owns and operates the facility at Port Cartier.

Halifax

Canada's eastern most port grain terminal is located in Halifax and is owned and operated by the Port of Halifax. It is served by rail solely by Canadian National. While the Halifax terminal does see some grain traffic from Western Canada flow through its facility, it is also a hub for the Atlantic Canada grain export trade. [27]

[27] Source: The Port of Halifax

The Halifax facility is also connected to a flour mill operated by P&H that serves the regional market, and utilizes the Halifax terminal as a means to gain access to a supply of grain sourced in both Eastern and Western Canada.

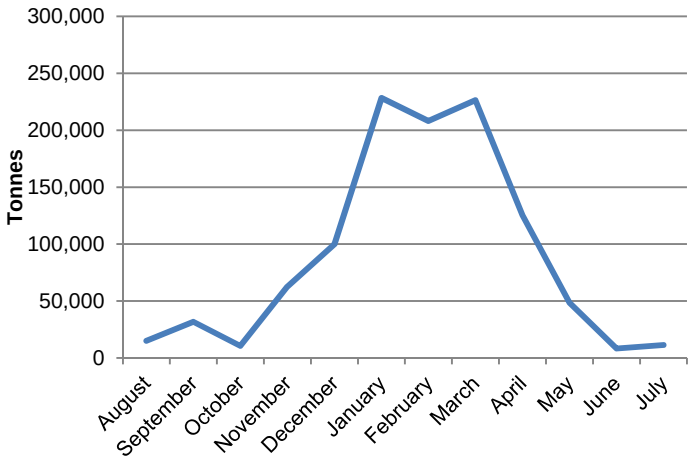
Halifax is also the primary container port in the Canadian Maritime provinces and as such has a large supply of empty containers available for the transloading of grain for furtherance to overseas markets.

Seaway shipping season

A complicating factor for movements via the Seaway is its somewhat limited season. The Seaway generally opens in March and closes in December of each year due to ice conditions. [28] Despite this impediment, it remains a major gateway for Canadian grain exports as it offers much shorter combined vessel movements to major markets in Europe, Africa and the Middle East as well as access to large North American markets within the Great Lakes basin. One relative advantage of the Seaway is the access to high volume available storage capacity though the Thunder Bay and Lower Seaway terminal elevators. The Thunder Bay elevators alone have 23% more storage capacity than the total available in Vancouver while handling 35% to 50% of the throughput that has moved through Vancouver in recent years. This larger available working capacity of these elevators means that vessels are less likely to face delays in loading due to problems coordinating grain shipments between country elevators and the port.

During the months when the Seaway is closed due to ice conditions, transfer elevators at Trois Rivieres, Quebec City and Montreal, which can load ocean going vessels, accept significant volumes of western grain shipments, 99% of which are wheat and durum. While some traffic moves throughout the year by direct rail through these elevators, the majority of volume moves between November and April, as is illustrated by the graph in Figure 16.

Figure 16: Monthly Average Railcar Shipments to Eastern Transfer Elevators (2000/01-2010/11 Average)



The Seaway traffic has changed considerably since its peak in the mid 1960s when more than 300 lake vessels moved over 53 million tonnes of cargo annually. There are presently fewer than 130 vessels and in 2011 tonnages had decreased to 36.5 million tonnes, of which 9.2 million was grain, less than half of what it was at its peak[29].

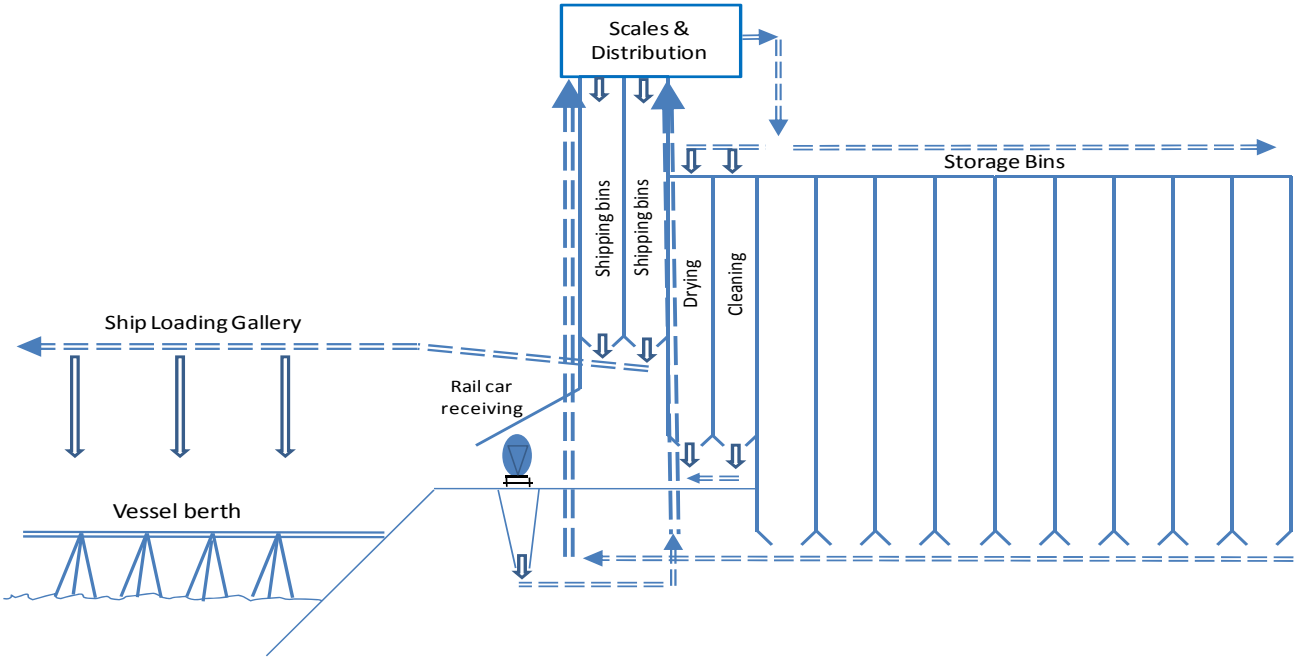
[28] Source: The St. Lawrence Seaway Corp and the Port of Thunder Bay

[29] Source: St. Lawrence Seaway Corp.

While the reasons for the reduction are many, two are most significant: a change in the markets where Canadian grain is sold resulting in the flow of grain products shifting to west coast ports and; the shift in the marine industry to larger, wider, more efficient vessels for the movement of bulk products that are too large to traverse the Seaway.

The reduction in the lake fleet has reduced the available capacity for movement such that it has become the controlling factor on the volume of Seaway traffic. There have been very few new vessels enter the fleet in part due to a federal tariff on the purchase of foreign vessels.[31] That 25% tariff was removed in 2011, resulting in orders for seven new lake vessels, two of which were commissioned by the Canadian Wheat Board in an arrangement with Algoma Central. While the fresh water of the Seaway's lakes and rivers means the lake fleet enjoys a much longer life than its salt water counterparts, the average age of these vessels is pushing the upper limits of 30 years. It is believed that the coming years will see a resurgence of new commissions as companies look to replace this rapidly aging fleet.

Figure 17: A Port Terminal Elevator Process[30]



Port Terminal Elevator and Bulk Vessel Operations

Grain shipped to a port terminal elevator must go through all of the following processes:

- rail car receiving and unloading
- elevation into scaling (weighing) and storage
- transfer from storage to shipping bins
- scaling and ship loading

[30] Diagram from Quorum
[31] The few Canadian shipyards left with capability of building new vessels were priced such that vessels could not be built by the domestic industry in an economically feasible manner.

In addition to these steps, some grain will go through one or more of the following additional processes:

- cleaning
- drying
- blending
- fumigation

Table 2: Elevator throughput and storage - Western Canada (Source: Monitoring the Canadian Grain Handling and Transportation System Annual Report 2011-2012 crop year, Quorum Corporation)

2011/12 throughput		Storage		Turnover	
(000's tonnes)					
Primary	**Port**	**Primary**	**Port**	**Primary**	**Port**
35,339	26,897	5,964	2,214	6.0	11.1

The rail car receiving areas of Canada's port terminals have protection to allow all-weather receiving of rail cars and grain flows from the receiving pits via conveyor to an elevation system (receiving leg) which elevates the grain to the top of the elevator complex where the grain can be scaled, sampled, and directed via spouts and conveyor systems either directly to storage bins or to cleaning or drying bins and facilities.

The port terminal system is a vulnerable element of the supply chain. This is because Canada's port terminals – particularly those on the west coast - are highly utilized and therefore have high throughput to storage ratios as compared to the country elevator system.

Table 2 shows that port terminals in Western Canada, including those in Vancouver, Prince Rupert, Churchill and Thunder Bay have throughput ratios that are nearly twice as high as the corresponding primary elevators that handle the grain destined to the ports. [32] However, these summary statistics understate the much higher than average utilization of the west coast elevators at Vancouver and Prince Rupert which had turnover ratios of 16 and 23 respectively in crop year 2011/12. These high rates of utilization were in contrast to the rates for elevators in Churchill and Thunder Bay which had ratios of 4.7 and 4.6 respectively.

Bulk vessel operators are the principal source of ocean going transportation services for the Canadian grain industry handling an estimated 86% of total Canadian grain exports – approximately 22 million tonnes in 2011. These vessels range in size from 10,000 dead weight tonnes[33] (dwt) up to 200,000 dwt tonnes and may be used to load cargos consisting of a single commodity or multiple commodities. Which vessels are able to service which Canadian ports is principally determined by port infrastructure and the depth of port harbours and navigable channels. The Port of Thunder Bay faces the most significant restrictions on vessel size based on the restrictions of the St. Lawrence Seaway.

[32] Source: GMP Data, CGC Licensed Elevators in Canada

[33] dwt – dead weight tonnes. Indicates the maximum weight of a ship when loaded up to its summer loading limits

The average size and capacity of the various types of bulk vessels are shown in Table 3.

Seawaymax and Handysize vessels (with draft no greater than 8 m) are used within the Great Lakes and on the St. Lawrence Seaway. Larger Handysize, Handymax and Panamax vessels can be loaded at all ocean ports and at transfer elevators on the St. Lawrence River. Suezmax and Capesize vessels can only be loaded at the deep water ports in Quebec but this would only happen in rare circumstances.

Vessel Type	Description	Vessel size
Handysize	Small bulk carriers that make up the majority of the world's short haul fleet.	20,000 – 40, 000 dwt Draft: 9 – 11 metres
Seawaymax	Vessels which are the maximum size that can fit though the canal locks of the St. Lawrence Seaway	Up to 30,000 dwt Draft: 8 metres
Handymax	These are a larger version of the Handysize vessels and popular for both bulk and crude carriers.	30,001 - 50,000 dwt Draft: up to 11 metres
Panamax[34]	This is the maximum size ship that can pass through the locks of the Panama Canal.	50-000 80,000 dwt Draft 12 metres
Suezmax	Maximum size vessel that can negotiate the Suez Canal. The canal does not limit the length of ships but has a maximum beam (width) of 50 metres.	Up to 150,000 dwt Draft approx. 12 – 20 metres depending on beam (width) of vessel
Capesize	Vessels too large for either Suez or Panama canals.	Above 150,000 dwt Draft approx. 17 metres

Table 3: Typical Bulk Ocean Vessel Characteristics

Modal Options for the Movement of Grain

Containerized shipments of grain products

In the last 10 years the proportion of grain exported in containers has grown from 2% to 13% of total Canadian grain exports – amounting to 3.3 million tonnes in 2011. Of this total, approximately 60% is made up of pulse and special crops with smaller but still significant volumes of malt, hay and distillers dried grains.[35] Shippers will utilize containers rather than bulk shipment options in situations where the customer who is purchasing the product can only receive it in small lot quantities or where there are other logistics savings from container utilization. In addition, the process of loading bulk products in containers is accomplished without the use of high speed handling equipment such as is employed in primary and terminal elevators. This results in reduced product degradation for grains that are sensitive to rough handling as is particularly the case for many of the pulse and special crops such as lentils and beans. Container shipping is also amenable to the shipment of shelf ready bagged product, and allows the shipper increased control over product branding and marketing.

[34] The Panama Canal system is presently being expanded with construction expected to be completed in 2014. After that time, the canal system will permit vessels that are 72 metres longer, 16 metres wider and with an increased draft of 3 metres as compared to present limitations.

[35] Data provided by the ports of Vancouver, Montreal, Prince Rupert, and Halifax

There are a number of options for shippers who are exporting grain in containers[36]. These are:

- Source loaded containers

  Ocean containers are provided to shippers at inland loading points in the Prairie Provinces or in central Canada and products are loaded in bulk, or in bagged form at the shippers' processing facilities. The containers then move over the road to railway inland Intermodal terminals for loading to flat car and movement direct to container port terminals in Montreal, Vancouver and Halifax.

- Port transload

  One option is for shippers to load their bulk product in railway hopper cars or their bagged product in railway box cars, at their processing facilities. These cars are then shipped to locations near the ports of Montreal and Vancouver where transloaders unload the railcars and place the bulk or bagged product into ocean containers for movement via roadway to port ocean terminals.

  A second option and one that is being used with increasing frequency, is to load the grain in either 53 foot domestic containers or in 40 foot ocean containers at inland points and then move these containers to facilities near the ports where the grain is transloaded into 20 foot containers, which are more suitable for loading of high density pulse and special crops for ocean transport.[37] No shipping lines operating from Canada utilize 53 foot containers for exports of agricultural products. The 53 foot containers used in Canada for transloading are generally domestic backhaul containers that handle consumer goods both nationally, and as a result of the consolidation of import products from ocean container to domestic container at locations near the ports of Montreal, Halifax and Vancouver.

There are now more than ten permanent grain transloading operations in Canada, nine of which are at port locations (six in Vancouver and three in Montreal)[38]. These operations include land for the storage and staging of ocean containers, front end loading cranes for moving containers to and from truck chassis, rail trackage for receiving and unloading rail cars and moving grain on conveyor systems for elevation and transloading to containers. These facilities may also have warehousing facilities, systems for loading bulk grain to bags, equipment for transloading bagged product from boxcars, domestic containers or trucks to export containers and may provide container storage and maintenance facilities for shipping lines.

Figure 18 at the end of this section is a high level process map illustrating the movement of grain products via railcar from processing facilities to a transload facility for transfer to ocean containers and shipment to

[36] Source: Container Use in Western Canada, Quorum Corporation, 2008

[37] This 40 foot to 20 foot transload system has become popular because there is a surplus of 40 foot ocean containers available in inland areas where they have been rendered empty after being unloaded with imported consumer goods. Railways have begun aggressively marketing the use of surplus 40 foot ocean containers in domestic service since Canadian regulations restricting the use of such containers for domestic service were relaxed in recent years. Shippers benefit from favourable inland rates on 40 foot equipment and can still use transloading to optimize their ocean shipping rates though use of 20 foot equipment, which is available in greater supply in port areas, for their ocean shipments.

[38] Annual review of transloading operations in Canada is undertaken by Quorum

ports. Maps for the source load container process and for the process used when domestic containers are used for inland shipping to a transload are included in Appendix 1.

Container Booking Process

Grain shippers who wish to move their products via container will reserve container capacity through the container booking process. A container booking is a statement of intent by a shipping line to provide a specified type and number of containers, at a particular origin location, for movement on a specified ocean container vessel on a particular date, to a particular location. Container vessels move on scheduled dates in particular trade lanes between specific ports and through transloading hub ports. The booking can be made many weeks in advance of the sailing date or it can be sought within slightly more than a week of sailing. A container booking will also specify the earliest and last receiving days when containers can be accepted at the ocean terminal where the container will be loaded to an ocean vessel. If the container is being picked up at an inland location for rail movement to the ocean terminal, the booking will include the inland shipping cut-off dates associated with the vessel. Customarily, shippers will be looking to book their ocean freight from 30-60 days into the future, to allow the coordination of movement of product from inland areas to ports.

Some shippers may have contracts with shipping lines that specify minimum shipping volume quantities in particular trade lanes or shippers may look for capacity as required with no commitments on either side.

In general, outside of such contractual relationships, a container booking is not a guarantee of capacity and when the time for loading of the container approaches, shippers or their agents will ask the shipping line for a container release to support the booking.[39] The release will specify the location where containers can be picked up and the number available for the booking. If containers are not available, the shipper may cancel the booking, wait to see if containers become available in time to make the scheduled vessel, or have the shipment rolled to the next available vessel on the same routing. Alternatively, the shipper can ignore the booking and seek capacity on another shipping line serving the same market. At present, there are no financial consequences to Canadian shippers for not using container bookings and as a result, it is not uncommon for shippers to book container capacity on multiple shipping lines, for a given shipment, in an attempt to increase their chances of getting container capacity. However, to the extent that competition allows them to do so, shipping lines will reward those customers who have the fewest unused bookings and will be less likely to provide containers to shippers who consistently overbook.

Shippers may make bookings themselves, or use the services of a freight forwarder who will manage the booking and the subsequent shipping documentation process on behalf of the shipper.

[39] In inland areas such as in the Prairie provinces, empty containers will normally be made available at railway intermodal terminals and shippers may not require a container release, but may show up at the container yard and provide their booking information to the yard in order to obtain containers. In some cases, large customers will be permitted to pick up a given allotment of containers reflecting their status as preferred customers of the shipping line, without the need to provide any booking information.

Inland Transportation and Transload Processes

Source loaded containers

If the shipment is being source loaded at an inland origin location (normally from a processing plant), then the container will be loaded and moved via truck to a railway Intermodal terminal for loading to a flatcar and subsequent movement directly to an ocean terminal where the container will be unloaded from the railcar and staged for loading to vessel.

All export containers moving by rail must have their billing information completed prior to the container being accepted into the railway Intermodal terminal. For CN, a reservation of capacity for the container on the train must be made in advance and reservations are available up to 7 days prior to the origin rail cut-off date. Reservations will not be provided to shippers who do not have a container booking reference. This ensures that export containers are not shipped to ocean terminals outside of the planned arrival period for the vessel on which the container is booked. For CP, no reservations are required but as a result the container may not move on the first available train from the inland terminal.

The origin trucking (drayage) may be arranged by the shipping line or freight forwarder or by the shipper. For source loaded shipments of ocean containers, the shipper of record and the rail freight agreement with the railway are both the responsibility of the shipping line that owns or controls the container and not the grain shipper. The grain shipper's commercial contract is with the shipping line and as a result it is the shipping line that must ensure that all billing information is prepared and provided to the railway in advance, with the support of information provided by the shipper or their freight forwarding partner.

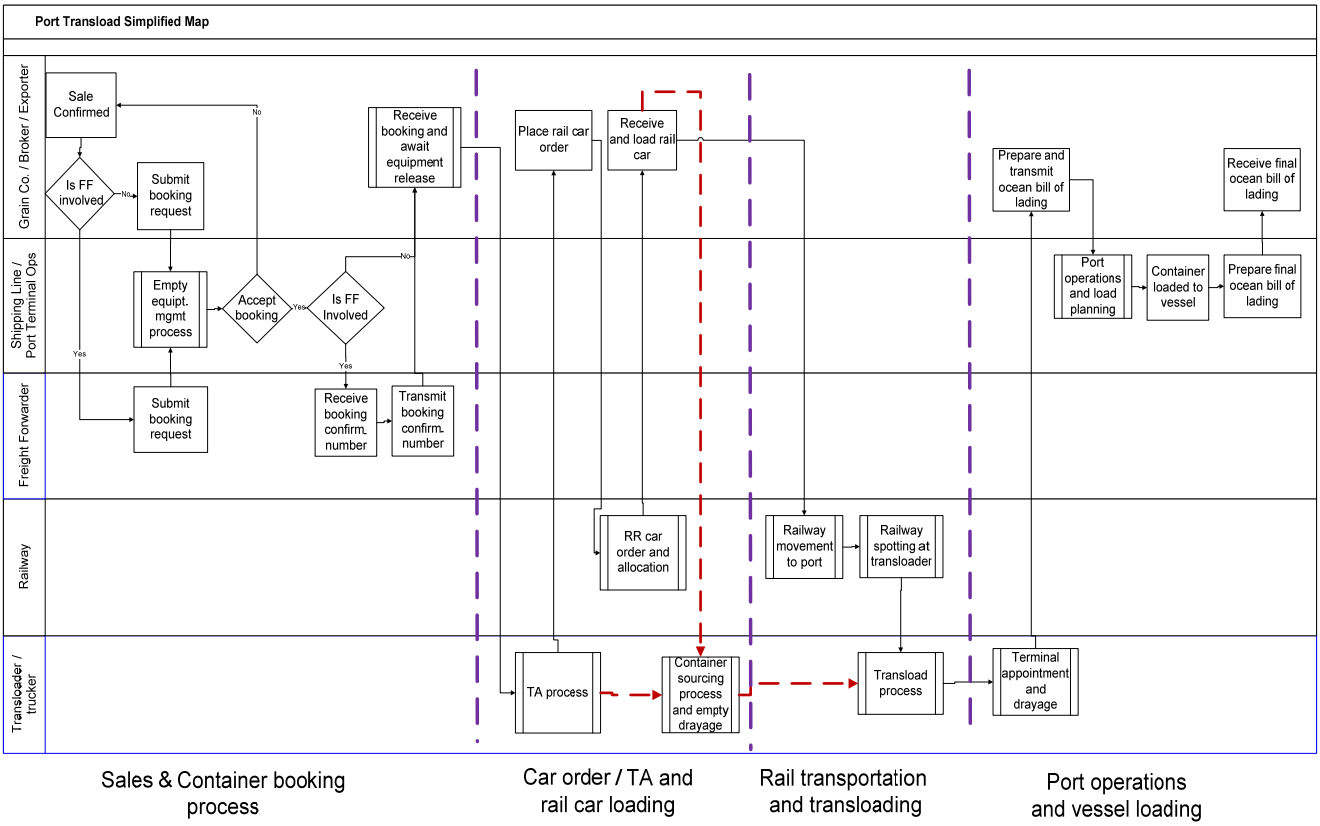
Port transload containers

If the shipment is moving to the port by rail for transload to an ocean container, the shipper will need to coordinate the booking of ocean freight with the ordering of rail cars or domestic intermodal equipment. The transit time on hopper or box car movements is much longer on average than transit time on intermodal movements. For example, a hopper car from a loading location in Saskatchewan may take 4 days on average to move to a transloader in Vancouver but the range of transit times for such moves will be from 3-9 days from the most consistent service locations and will be as wide as 3-12 days for more remote locations with less consistent service. In addition, rail car orders with either railway must be placed no later than Tuesday morning for rail cars wanted during any day the following week starting on Sunday. These two factors widen the advance planning window for transloading export containers to approximately 30 days in many locations – not counting the time required for transloading and delivery to the ocean terminal. With all factors considered, a planning window of up to 60 days is not uncommon for transload traffic moving via railcar.

Some transload operators have a process to help them manage the flow of inbound railcars and domestic intermodal equipment, called Terminal Authorization (TA). In general, a transloader using a TA process will require their customers to request authorization to ship traffic to the transload and will require the shipper's

container booking information including the ocean terminal receiving window for the vessel, information about the services that are being requested of the transloader[40] and the shipper's expected shipping and estimated arrival information. This allows the transloader to ensure that he has the capacity to provide the required services and to track the inbound loads[41] to his facility to ensure he can have the necessary ocean containers, crews and equipment ready to provide the services requested. Regardless of whether a transloader uses a formal TA process or not, most will track inbound equipment to their facility so that they can communicate with their customers in advance of the arrival of rail cars or domestic containers to ensure that arrangements are made to affect the transload to meet delivery windows at the port terminals.

Figure 18: Exports of Grain by Container - Transloading process



In most cases, the transloader will make a container release request of the shipping line approximately 7 days prior to the last receiving date for the container at the ocean terminal.[42] The shipping line will then either identify a location within the metropolitan area of the terminal where containers will be available for

[40] Transloaders may provide one or more of the following services: bulk to bulk transload, bagging of bulk product for transload, bagged to bagged transload, warehousing and storage. Some transloaders will also act as freight forwarders, booking ocean freight for shippers who choose to use the transloader for this purpose.

[41] Transloaders use information provided by the railways through their electronic commerce systems and information from their shippers to identify and track all traffic on railway lines destined to their facilities so that they can plan their operations. In general, transloaders use historical information on average and variation of transit time from key inbound points and origins to predict railway performance. This information is supplemented by any special railway service bulletins that railways may provide in times of service disruptions.

[42] In some cases, transloaders may provide the shipping lines with container maintenance and storage services on the transloader's property. In this case they will not ask for a release but simply advise the shipping line of the container numbers that are being applied to the shippers booking.

pick-up, or will advise that there are no containers for the booking. If there are no containers, the transloader will advise the shipper who will work through the shipping line or freight forwarder to make alternate arrangements, either by having the shipment rolled to a subsequent vessel or by seeking capacity under a booking with another shipping line.

Alternatively, if the transloader has taken on the freight forwarding role on the shipper's behalf, they will also manage the process of seeking alternatives for the shipper.

Port Operations

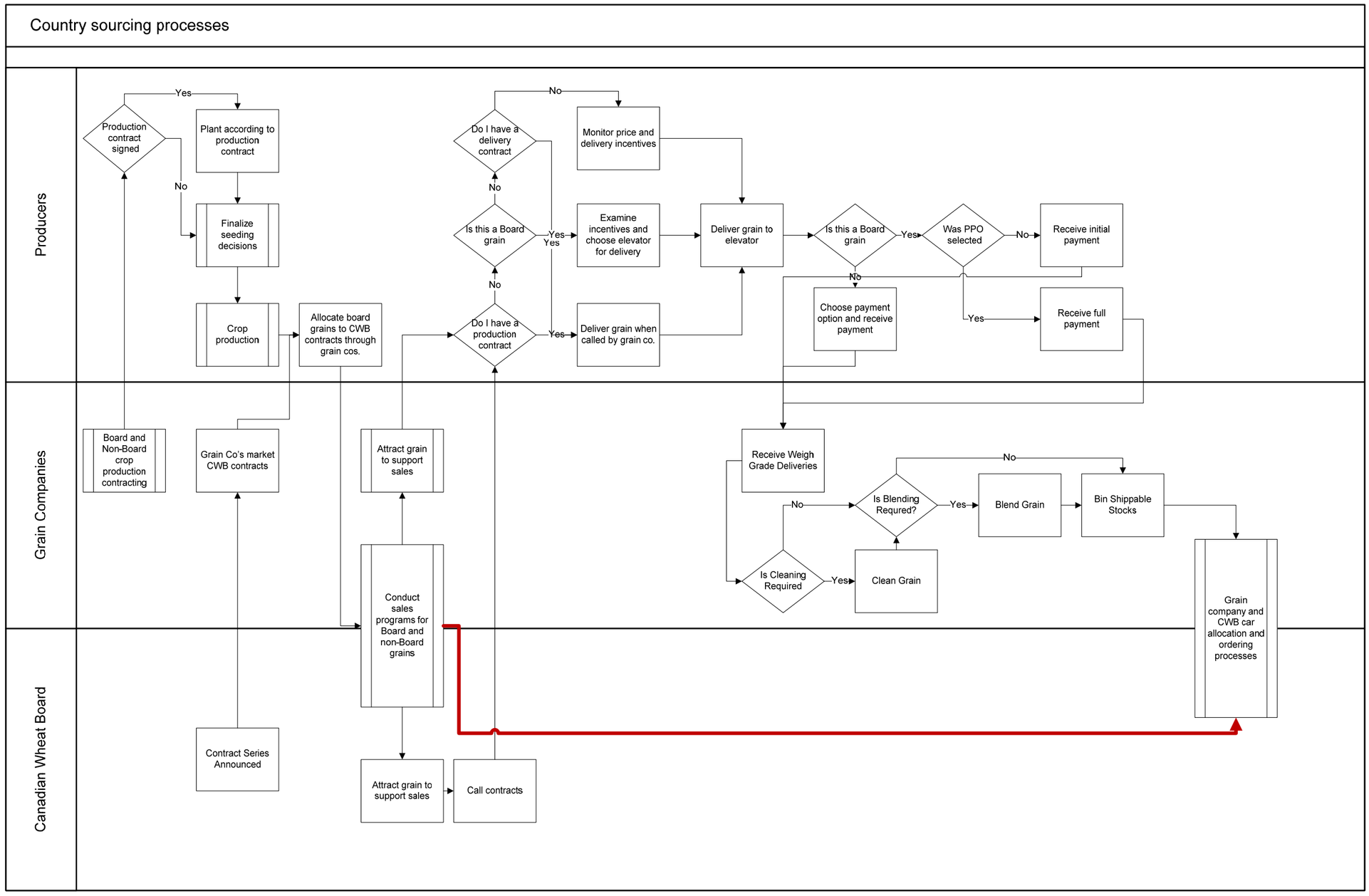
Once the transload process has been completed, the transload operator will advise the shipper of the container identification numbers and the numbers on the seals that have been applied to the loaded container. The shipper must then ensure that the ocean bill of lading information is provided to the shipping line before the documentation cut-off established for the booking. At Vancouver, all container deliveries to ocean terminals via truck must be supported by gate reservations in an attempt to control congestion at the ocean terminals. In Vancouver, in recent years new systems and processes for reservations for gate appointments have been controversial with some users claiming that such systems do not result in a fair allocation of appointment slots to users with legitimate container bookings. At other terminals, queuing procedures and in-gate procedures must be completed by truckers that have security clearance to enter the terminals. Within the terminals, overhead cranes or mobile cranes will lift containers off of the truck chassis and place them in stacks for eventual loading to vessel. Once a container has been loaded to a vessel, the shipping line will provide the shipper or their freight forwarder with the details of the final ocean bill of lading with information about the vessel to which the container is eventually loaded.

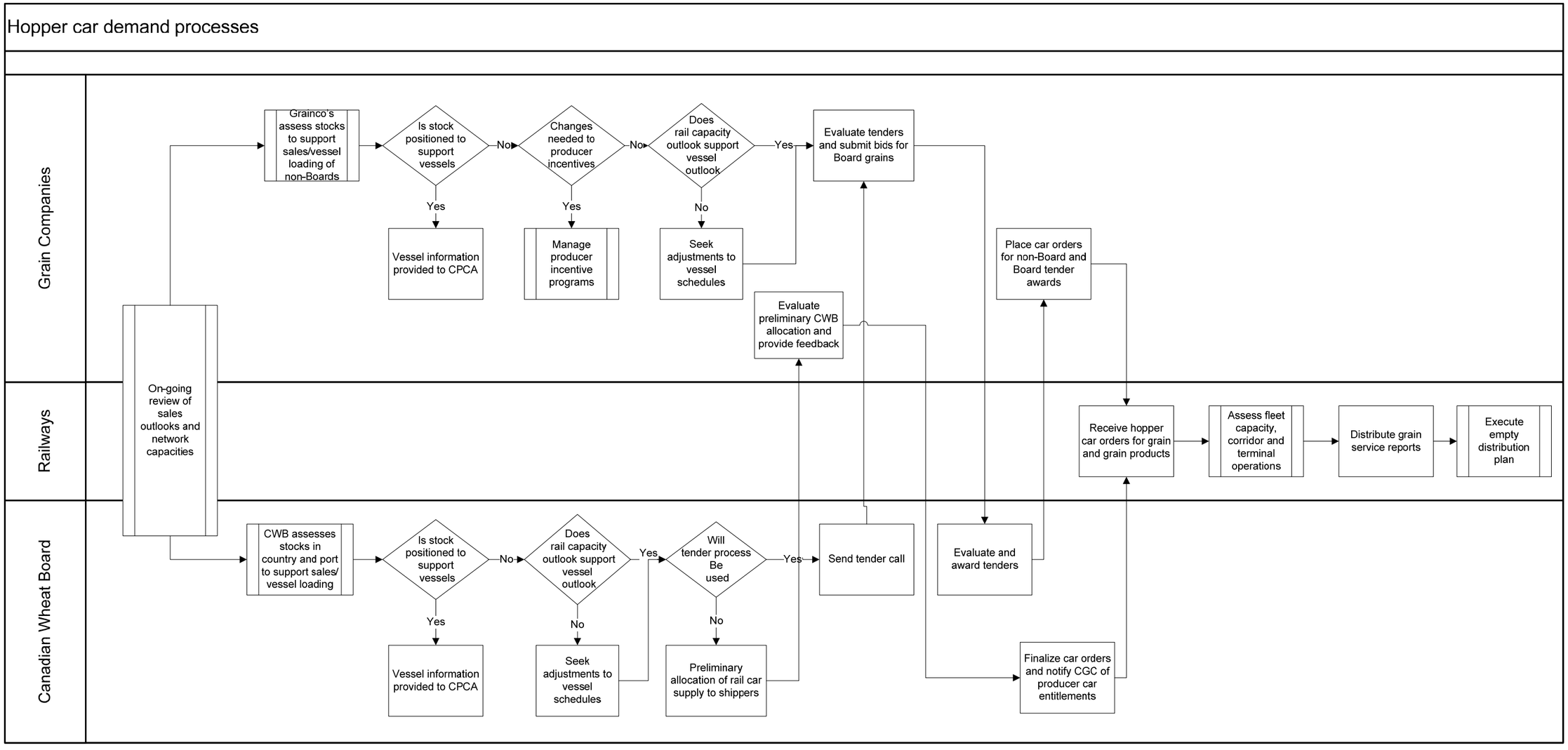
Summary

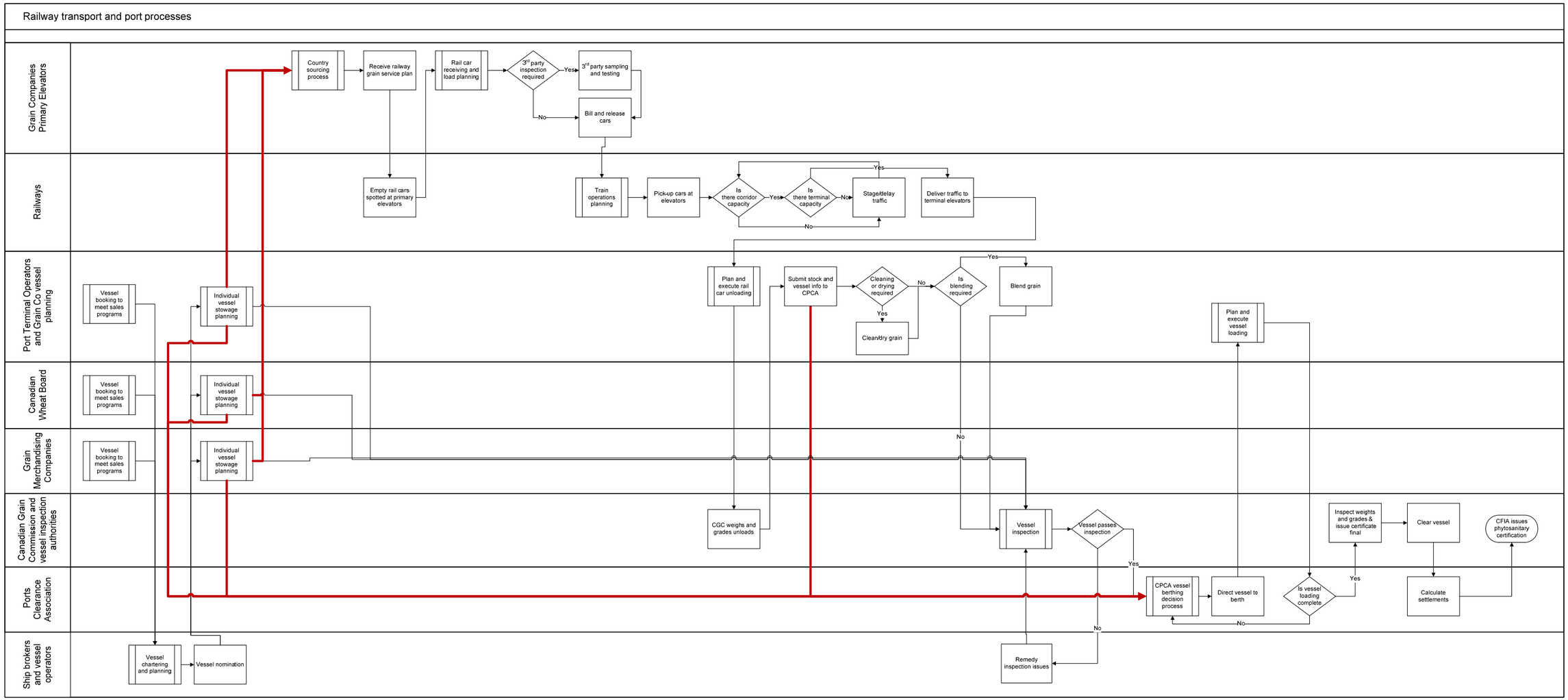
This discussion on the logistics portion of the grain supply chain provided a high level description of the key grain supply chain processes. For each of the primary logistics systems: bulk export, containerized export, and the movement by rail of processed grain products; the role of each participant was described and the interrelationship of the main stakeholders was identified.

While it emphasizes the many layers of interdependence between stakeholders and their subsequent reliance upon each other for predictable forecasts and predictable performance, it is recognized that given the many sources of uncertainty in estimations of demand and capacity, all supply chain systems will face periodic challenges when demand cannot be accommodated with the available capacity.

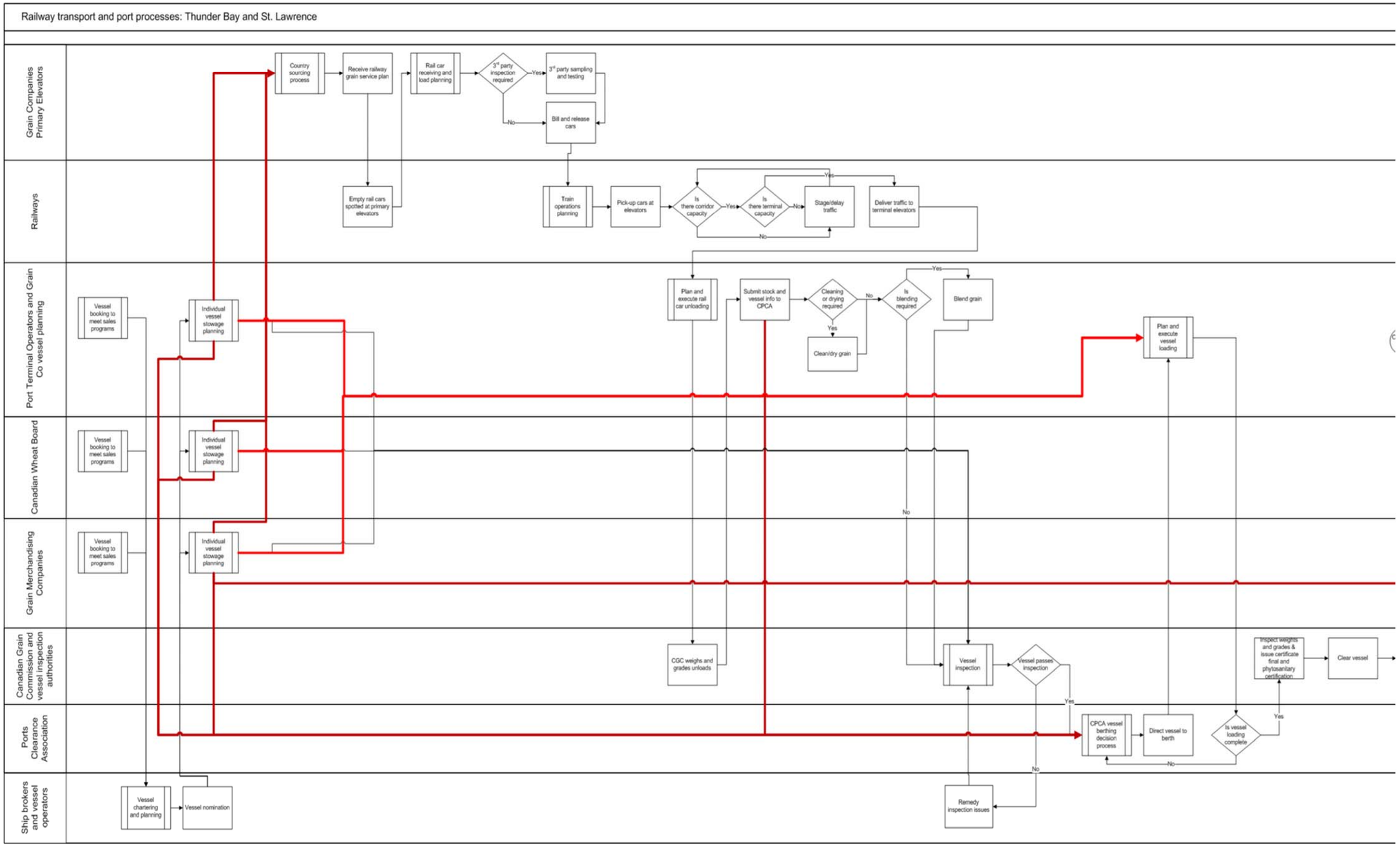
Appendix 1: Process Maps



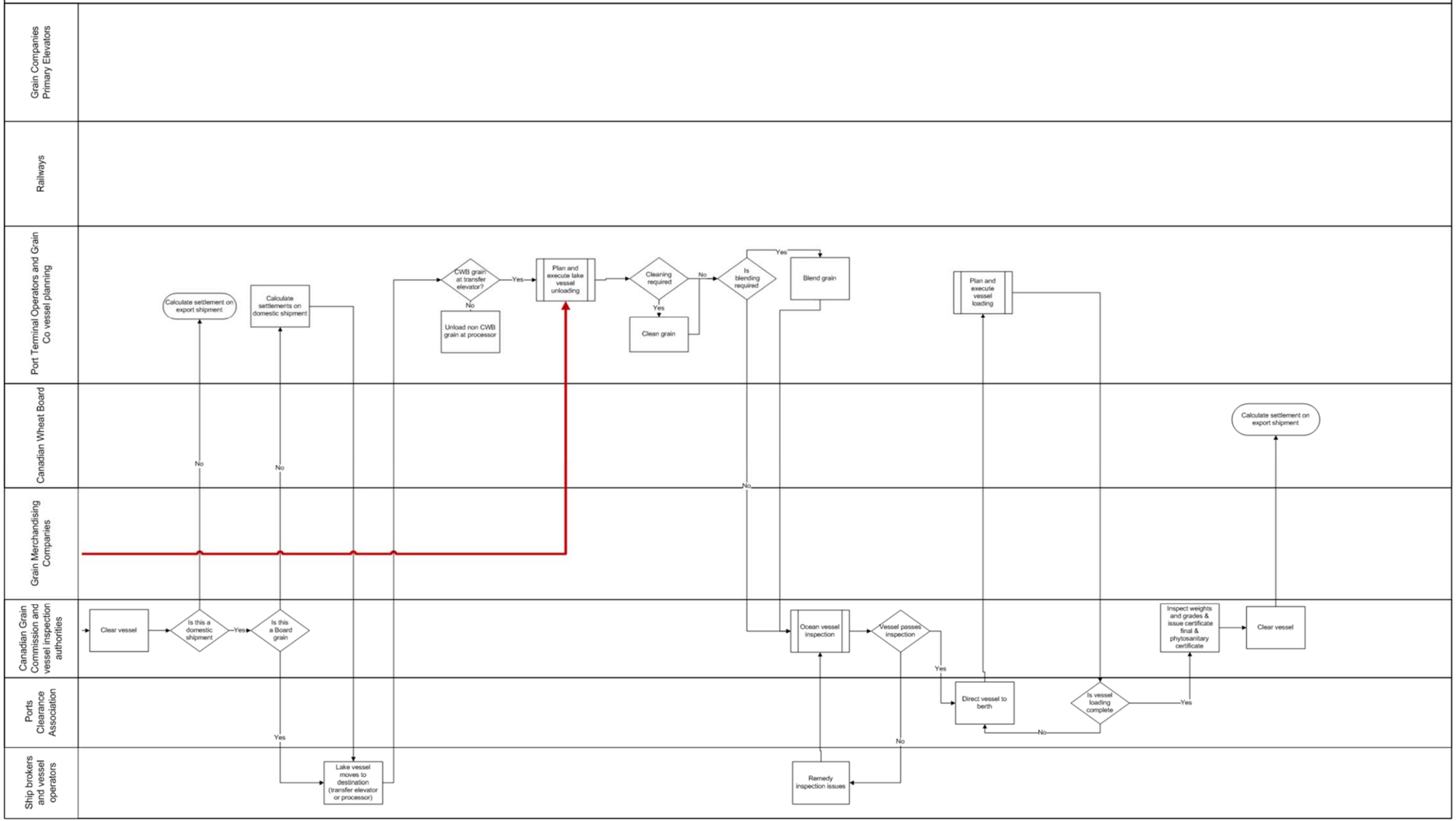

Hopper car demand processes
Grain Companies
Railways
Canadian Wheat Board
Grainco's assess stocks to support sales/vessel loading of non-Boards
Is stock positioned to support vessels
No
Changes needed to producer incentives
No
Does rail capacity outlook support vessel outlook
Yes
Evaluate tenders and submit bids for Board grains
Yes
Vessel information provided to CPCA
Yes
Manage producer incentive programs
No
Seek adjustments to vessel schedules
Evaluate preliminary CWB allocation and provide feedback
Place car orders for non-Board and Board tender awards
On-going review of sales outlooks and network capacities
Receive hopper car orders for grain and grain products
Assess fleet capacity, corridor and terminal operations
Distribute grain service reports
Execute empty distribution plan
CWB assesses stocks in country and port to support sales/ vessel loading
Is stock positioned to support vessels
No
Does rail capacity outlook support vessel outlook
Yes
Will tender process Be used
Yes
Send tender call
Evaluate and award tenders
Yes
Vessel information provided to CPCA
No
Seek adjustments to vessel schedules
No
Preliminary allocation of rail car supply to shippers
Finalize car orders and notify CGC of producer car entitlements


Railway transport and port processes
Grain Companies Primary Elevators
Railways
Port Terminal Operators and Grain Co vessel planning
Canadian Wheat Board
Grain Merchandising Companies
Canadian Grain Commission and vessel inspection authorities
Ports Clearance Association
Ship brokers and vessel operators
Country sourcing process
Receive railway grain service plan
Rail car receiving and load planning
3rd party inspection required
Yes
No
3rd party sampling and testing
Bill and release cars
Empty rail cars spotted at primary elevators
Train operations planning
Pick-up cars at elevators
Is there corridor capacity
Yes
Is there terminal capacity
Yes
No
No
Stage/delay traffic
Deliver traffic to terminal elevators
Vessel booking to meet sales programs
Individual vessel stowage planning
Plan and execute rail car unloading
Submit stock and vessel info to CPCA
Cleaning or drying required
No
Yes
Clean/dry grain
Is blending required
Yes
Blend grain
Plan and execute vessel loading
No
CGC weighs and grades unloads
Vessel inspection
Vessel passes inspection
Yes
No
Remedy inspection issues
CPCA vessel berthing decision process
Direct vessel to berth
Is vessel loading complete
Yes
No
Inspect weights and grades & issue certificate final
Clear vessel
CFIA issues phytosanitary certification
Calculate settlements
Vessel chartering and planning
Vessel nomination

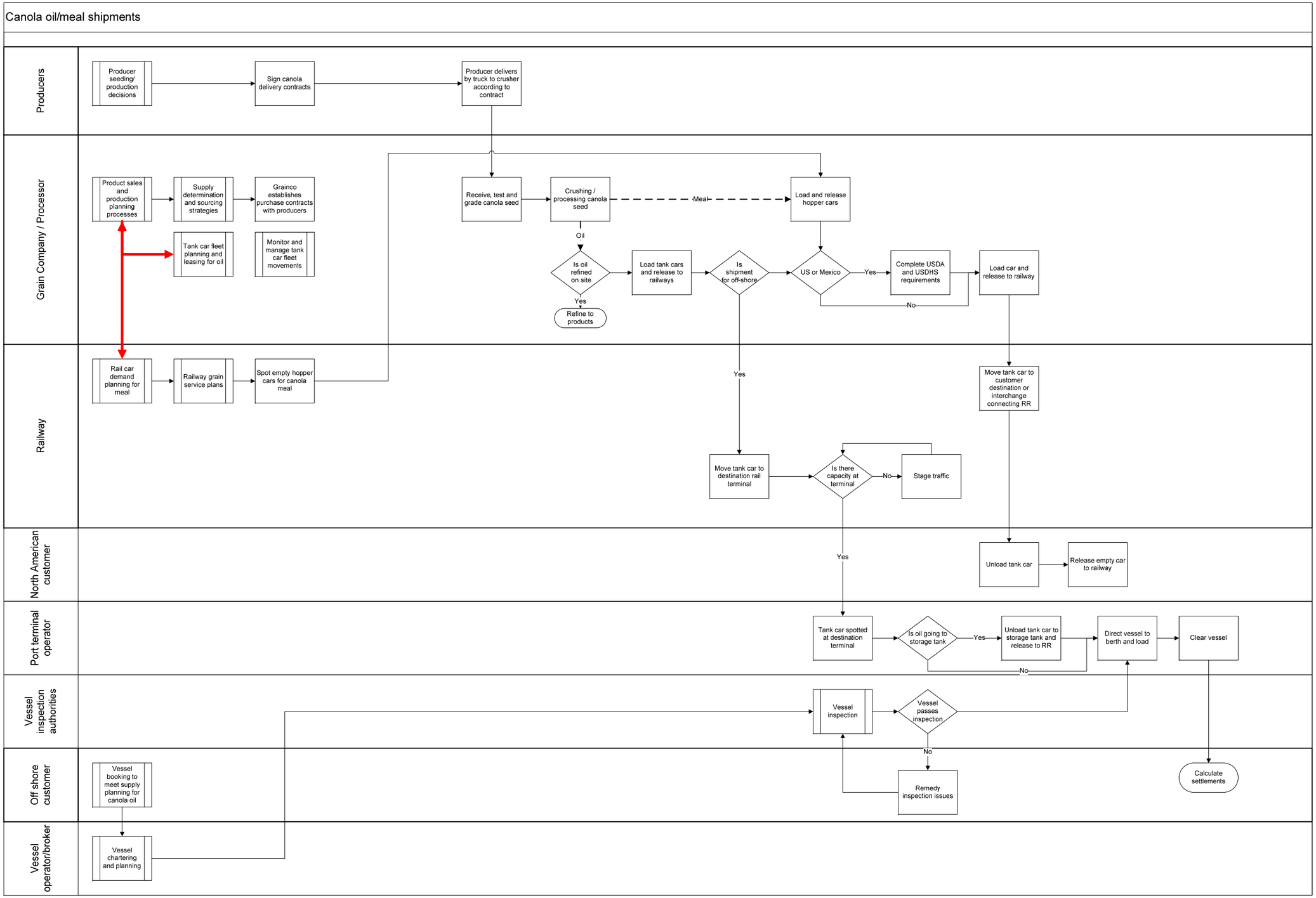
Railway transport and port processes: Thunder Bay and St. Lawrence

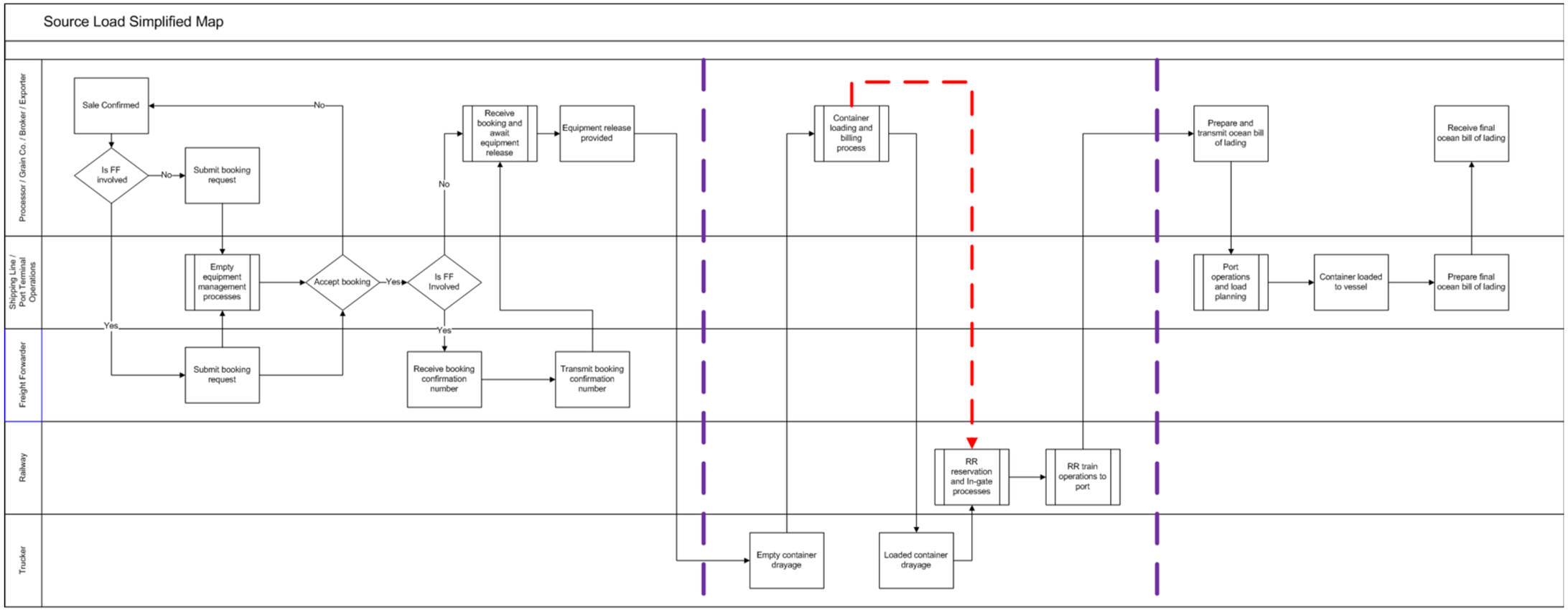


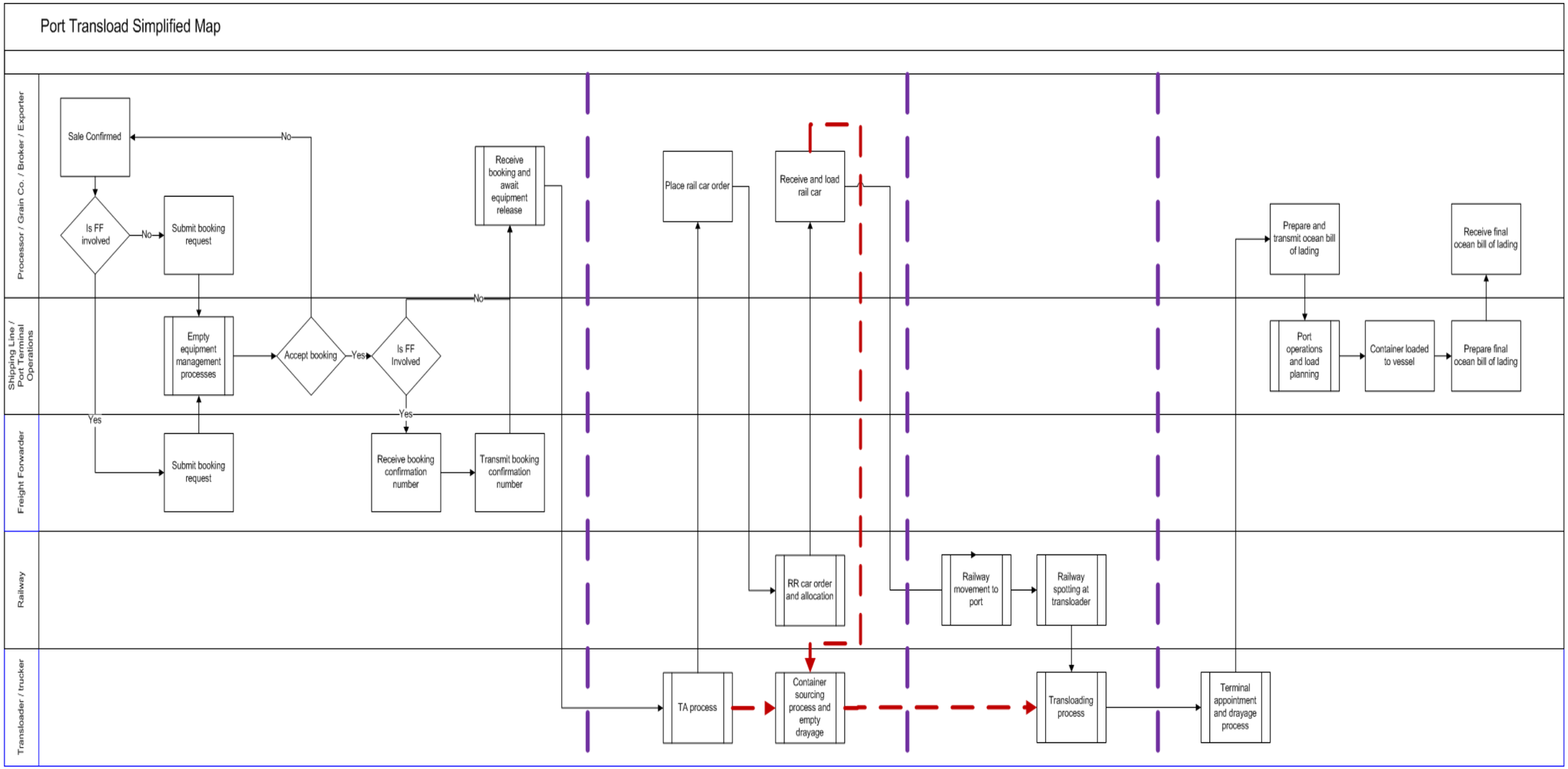
Railway transport and port processes: Thunder Bay and St. Lawrence – Page 2



Canola oil/meal shipments




Source Load Simplified Map
Processor / Grain Co. / Broker / Exporter
Shipping Line / Port Terminal Operations
Freight Forwarder
Railway
Trucker
Sale Confirmed
No
Is FF involved
No
Submit booking request
Empty equipment management processes
Accept booking
Yes
Is FF Involved
No
Receive booking and await equipment release
Equipment release provided
Yes
Submit booking request
Receive booking confirmation number
Transmit booking confirmation number
Container loading and billing process
RR reservation and In-gate processes
RR train operations to port
Empty container drayage
Loaded container drayage
Prepare and transmit ocean bill of lading
Port operations and load planning
Container loaded to vessel
Prepare final ocean bill of lading
Receive final ocean bill of lading
Sales & Container booking process
Loading and transport to port
Port operations and vessel loading


Port Transload Simplified Map
Processor / Grain Co. / Broker / Exporter
Shipping Line / Port Terminal Operations
Freight Forwarder
Railway
Transloader / trucker
Sale Confirmed
No
Is FF involved
No
Submit booking request
Receive booking and await equipment release
Place rail car order
Receive and load rail car
Prepare and transmit ocean bill of lading
Receive final ocean bill of lading
No
Empty equipment management processes
Accept booking
Yes
Is FF Involved
Port operations and load planning
Container loaded to vessel
Prepare final ocean bill of lading
Yes
Yes
Submit booking request
Receive booking confirmation number
Transmit booking confirmation number
RR car order and allocation
Railway movement to port
Railway spotting at transloader
TA process
Container sourcing process and empty drayage
Transloading process
Terminal appointment and drayage process
Sales & Container booking process
Car order / TA and rail car loading
Rail transportation and transloading
Port operations and vessel loading

Appendix 2: The Western Canadian Rail Network