



**Circular Opportunity
Innovation Launchpad**

ReBUILDING THE ROYAL CITY

System Map Highlights

Zero Waste Economic Transformation Lab
January 2023

Systemic Design Research Project



Raphael Lopoukhine
Research Consultant
Lopoukhine.ca, OCADU MDes
Candidate



About



Through the Circular Economy Innovation Launchpad's Zero Waste Economic Transformation Lab (ZWETL), Guelph- Wellington's Smart Cities initiative is using place-based circular economy strategies to develop and test new opportunities to reduce or redirect waste from sectors across the economy, starting with construction, renovation and demolition (CRD) materials.

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1. Research Process



Questions, objectives, methods, and sample



Research Question

What are the main enablers, barriers, and norms to fostering the circular economy in the construction, demolition, and renovation industry in Guelph and Wellington County

By exploring a Systemic Design analysis to understand individual orientations, the regulatory context, and economic landscape, we uncovered opportunities that could help advance the circular economy.

Research Objectives



Perceptions

Understand how human behaviour impacts the development of a circular economy



Regulation

Explore what are the regulatory levers that could be adjusted to make it easier



Economic

Understand the economic drivers, opportunities and limitations



Shifts

Examine solutions that have helped shift the economic landscape in other jurisdictions



Norms Vs. Alternatives

Understand experiences of people who try to work within vs. outside current waste norms



Barriers

Investigate barriers to scaling the circular economy

Methods

Literature Review

Explore and examine the ideas, systems, and decisions that underpin the current waste system in Ontario and the solutions proposed, debated, and implemented to fix the system.

Environmental Scan

Scan trends and gather information to consolidate an understanding of the circular economy ecosystem around construction, renovation, and demolition waste. Explore and examine the existing innovative solutions used by other regions to tackle this wicked problem.

In-Depth Interviews

Conduct one-on-one interviews with people who have been working within the dominant system and others exploring innovative solutions.

Expert Interviews

Conduct one-on-one interviews with experts in business, government and academia who have dedicated their careers to exploring the problems and solutions.

Sample

Generators of Waste

- Homeowner managing a heritage home renovation,
- Passive House architect,
- City of Guelph real property official,
- Contractors,
- Track home builders,
- Developers,
- Insurance representatives, and
- Renovators

Managers of waste

- Guelph, Wellington, Oxford and Vancouver waste resources officials,
- Guelph building services official,
- Guelph and Toronto planners,
- Haulers, and
- Ontario waste management official

Innovators of waste

- Reuse store manager,
- Owners of two deconstruction companies,
- Recycled content building component manufacturers,
- Zero-waste builder and component manufacturers,
- Source-separation company owner, and
- CRD recycler

Industry experts

- Circular economy experts,
- Consultants,
- Standards officials, and
- Non-profit professionals



Guelph-Wellington
Region

30+
INTERVIEWS

2. Introduction



Systems Map Overview and Key Findings

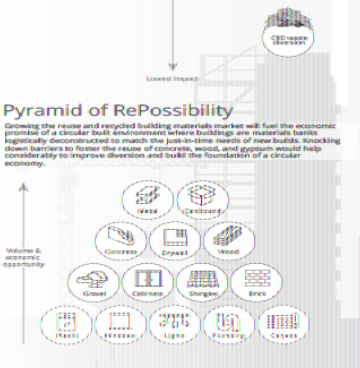
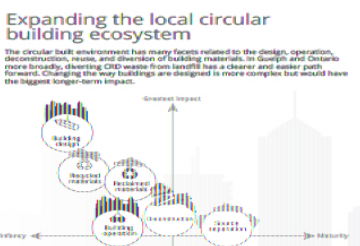
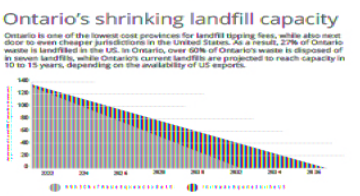
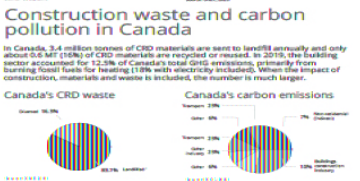
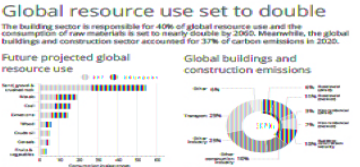
Systems Map

COIL Circular Opportunity Innovation Launchpad
ZERO Zero Emission Transformation Lab

ReBUILDING THE ROYAL CITY

An exploration into diverting construction, demolition and renovation waste and constructing the circular-built environment in Guelph-Wellington.

The Guelph-Wellington construction industry and regulators face established climate and circularity and material circularity (CRD) challenges, such as resource demand in circular, and affordable homes and buildings. Globally, resource demand is increasing, and the Canadian landfill system is struggling with construction, renovation, and demolition (CRD) waste, while Ontario is set to run out of landfill space. Today, construction, demolition, renovation, and repair (CDR) waste is landfilled. Today, construction, demolition, renovation, and repair (CDR) waste is landfilled. A number of interventions can help increase the circularity of CRD materials through deconstruction, source separation, materials reuse, and the design and operation of circular buildings.



2 REGULATING THE STATUS QUO?

Shaped by the provincial government's planning, building, and waste frameworks, competition with neighbouring municipalities, and facing criticism for lengthening delays and process, local governments nevertheless have a number of front-line regulatory interactions with the building and waste industries to shape circular economy policies and outcomes.

The building industry needs to build more homes, faster, while facing rising interest rates and fuel costs, labour shortages, and increasingly delayed municipal processes. To build a more circular economy, provincial leaders would have the biggest and sustained impacts system-wide. Nevertheless, through demolition permits, site plan control, heritage preservation, building permits, zoning, capital workover funding, transfer stations, real property, and programming, municipal governments have a number of levers to support, fund, and mandate the development of the circular built environment in Guelph-Wellington.

3 ADDING ECONOMIC VALUE TO WASTE AND BUILDING CIRCULAR

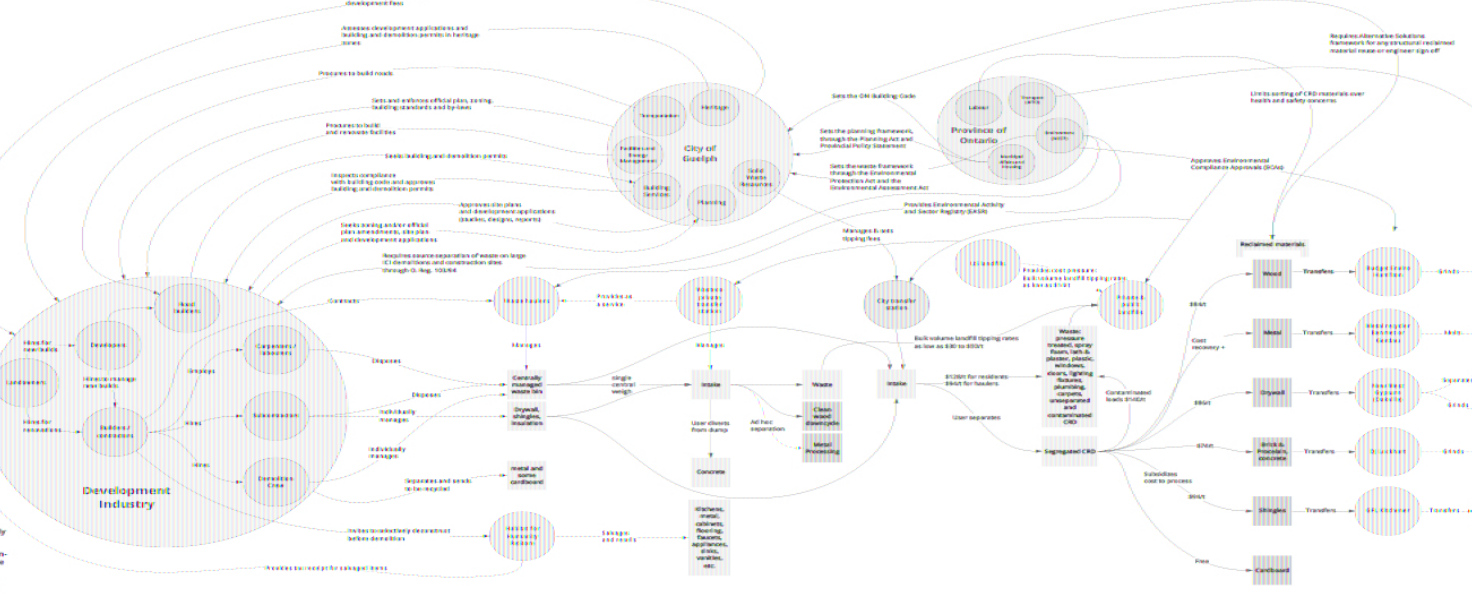
The building industry operates under tight timelines and margins, while avoiding risk to maximize profit. Under existing low landfill tipping fees relative to recycling rates, very little construction and demolition waste is diverted consistently. Some innovators work under the constraints while others look for policy change before committing more resources.

Circularity is not being incorporated into building design. Deconstruction and source separation of waste in small-scale residential projects is virtually non-existent (except in some kitchen renovations and other all-hoc situations). Deconstruction waste in few larger projects and waste source separation is required in large industrial, commercial and institutional projects, recycling is not. Today, only metal is diverted consistently. While builders show some effort to maximize resource efficiency and reduce waste, the demolition industry is needed in a low-bid, fast work, all-waste process. Meanwhile, most materials that are recycled are downcycled (primarily into landfill cover or fuelstocks).

4 WHY DON'T WE BUILD CIRCULAR?

Deep rooted societal myths, backed by structural market forces and entrenched policy pathways, shape our perception of economic value. This status quo is being confronted by crises that challenge this worldview.

Compounding climate, health, and housing crises challenge our current economic and regulatory environments that perpetuate a status-quo mindset. Our development forces work to keep our fear and greed economic thinking in place.



5 SHIFTING TO CIRCULAR BEHAVIOUR

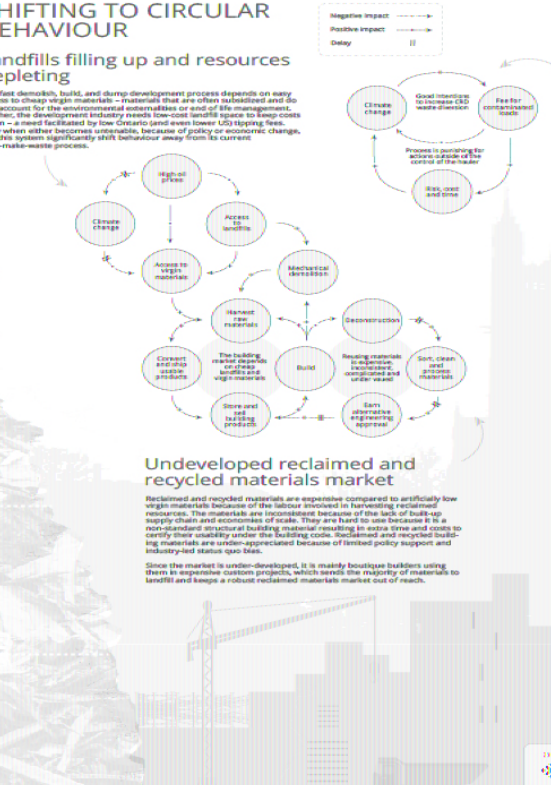
Landfills filling up and resources depleting

The fast demolition, build, and dump development process depends on easy access to cheap virgin materials – materials that are often exhausted and do not account for the environmental externalities or end-of-life management. Further, the development industry needs low-cost landfill space to keep costs down – a need facilitated by low Ontario (and even lower US) tipping fees. Only when either becomes unavailable, because of policy or economic change, will this system significantly shift behaviour away from its current take-make-waste process.

Events and trends

Current issues driving the system and leading to change

Landfill filling capacity reaching limits	Significant cost escalation costs	Expanding global infrastructure and loss of virgin materials	United reach over 100% of virgin materials and price for building	Lack of a replacement market	Labour and technology
Growing demand associated with population and infrastructure	Scarcity and volatility of virgin materials	Climate volatility of resource needs	Labour shortage	Unstable market conditions	Slow, complex government processes and approvals
Growth of green change and policy	Urbanization	Cost volatility waste and resource market	Understand and control North America	Buildings designed for fast and easy operation	High upfront costs between construction and operation
Increasing regulatory and policy changes	Increasing regulatory and policy changes	Growing concerns, costs, and recovery	Low-carbon building	High upfront costs between construction and operation	Slow policy making between government and industry
Housing is human right	Sustainability and business	Value of diversity	Linear economic dependency	New to better standards and concentration	Real estate accessibility
Official reviews and standards	Market review and needs	State open bid	Adaptation and innovation		
Labour, location, and cost recovery	Ecosystem	Antagonism	Teamwork and shared economy		



Key Findings



With available options for recycling, less than one fifth of Canadian CRD materials are diverted, despite data showing that number can be reversed.



Diverting CRD waste from landfill has a clearer and easier path forward since recycling solutions exist in the market, but many of those existing solutions downcycle the materials.



Source separation is required to extract the highest amount of clean materials, reduce contamination, and increase the likelihood of upcycling or reuse.



When the development industry leverages material salvage, it is to limit waste rather than for the economic benefit of the materials or the tax receipt.



Reclaimed and recycled materials are inconsistent, hard-to-use and under-appreciated and as a result are limited to expensive custom projects.



Circular building design and operation are basically non-existent in the region, but would have a greater long-term impact on changing the system.

Key Findings pt2



Cost signal work. Knocking down barriers to foster the reuse of concrete, clean wood, and gypsum would improve diversion rates and help build a reclaimed materials market.



There are few incentives, regulations, or building standards related to deconstruction, material reuse, and circular building design, and operation.



Provincial leadership would have the biggest impact system wide, but local governments have many front-line regulatory interactions with the development and waste industries.



There are businesses working under these tight margins operating using circular processes and developing circular products.



Cheap landfills, low-cost virgin materials, and limited policy support drive most CRD waste to landfill.



A fee on contaminated CRD loads at the City of Guelph transfer station to incentivize clean loads has done the opposite.

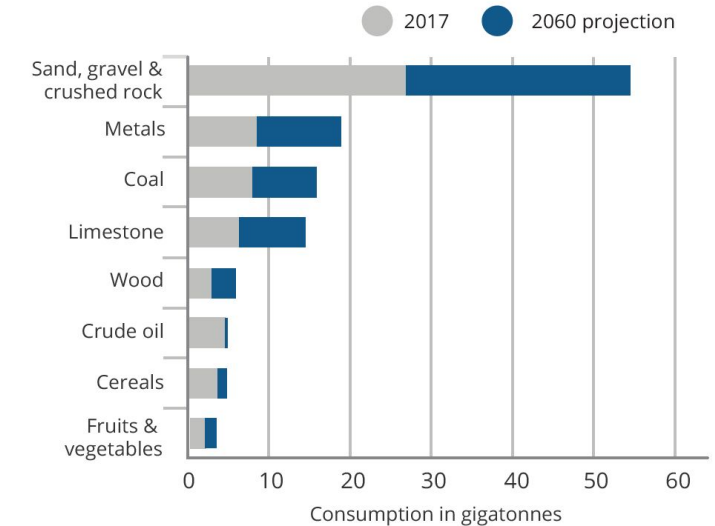
3. Context

Globally, resource demand is expected to double, Canadian landfills are overflowing with construction, renovation, and demolition (CRD) waste, while Ontario is set to run out of landfill space.

Global Resource Use Set To Double

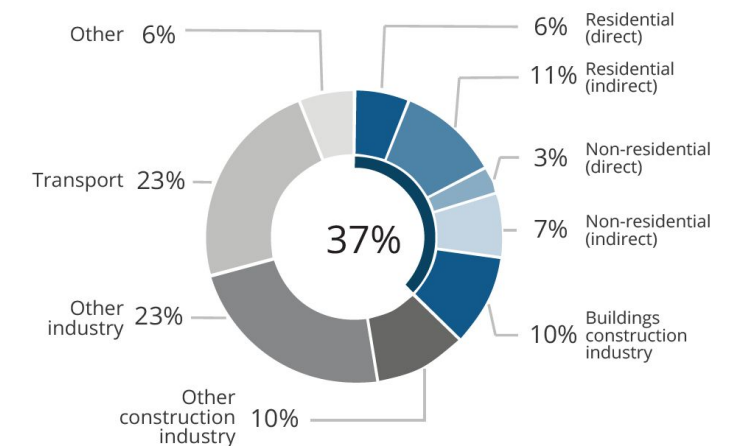
- Global consumption of raw materials is set to near double by 2060
- Buildings and the construction sector accounted for 37% of global carbon emissions.
- The extraction of raw materials, fuels, and food contribute to 90 percent of biodiversity loss and water stress
- G20 countries account for close to 75 percent of global materials use.

Future projected global resource use



Source: OECD, 2019

Global buildings and construction emissions

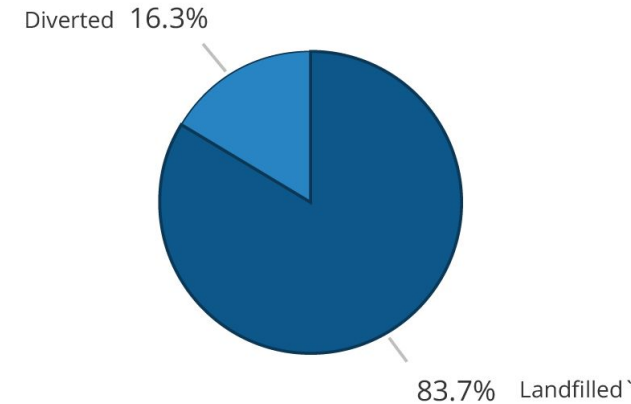


Source: UNEP, 2020`

Landfills Filling Up

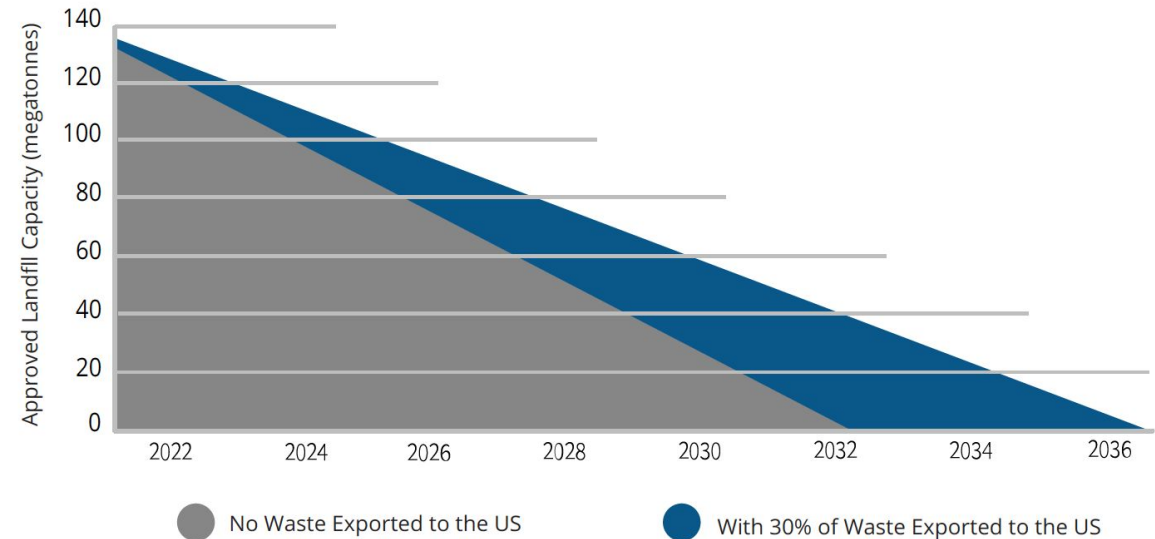
- In Canada, 3.4 million tonnes of CRD materials are sent to landfill annually
- Only about 16% of those materials are recycled or reused.
- Research shows that the reverse amount can be diverted.
- Buildings and related energy account for 18% of carbon emissions.
- Ontario's current landfills are projected to reach capacity in 10 to 15 years, depending on the availability of US exports.

Canada's CRD waste



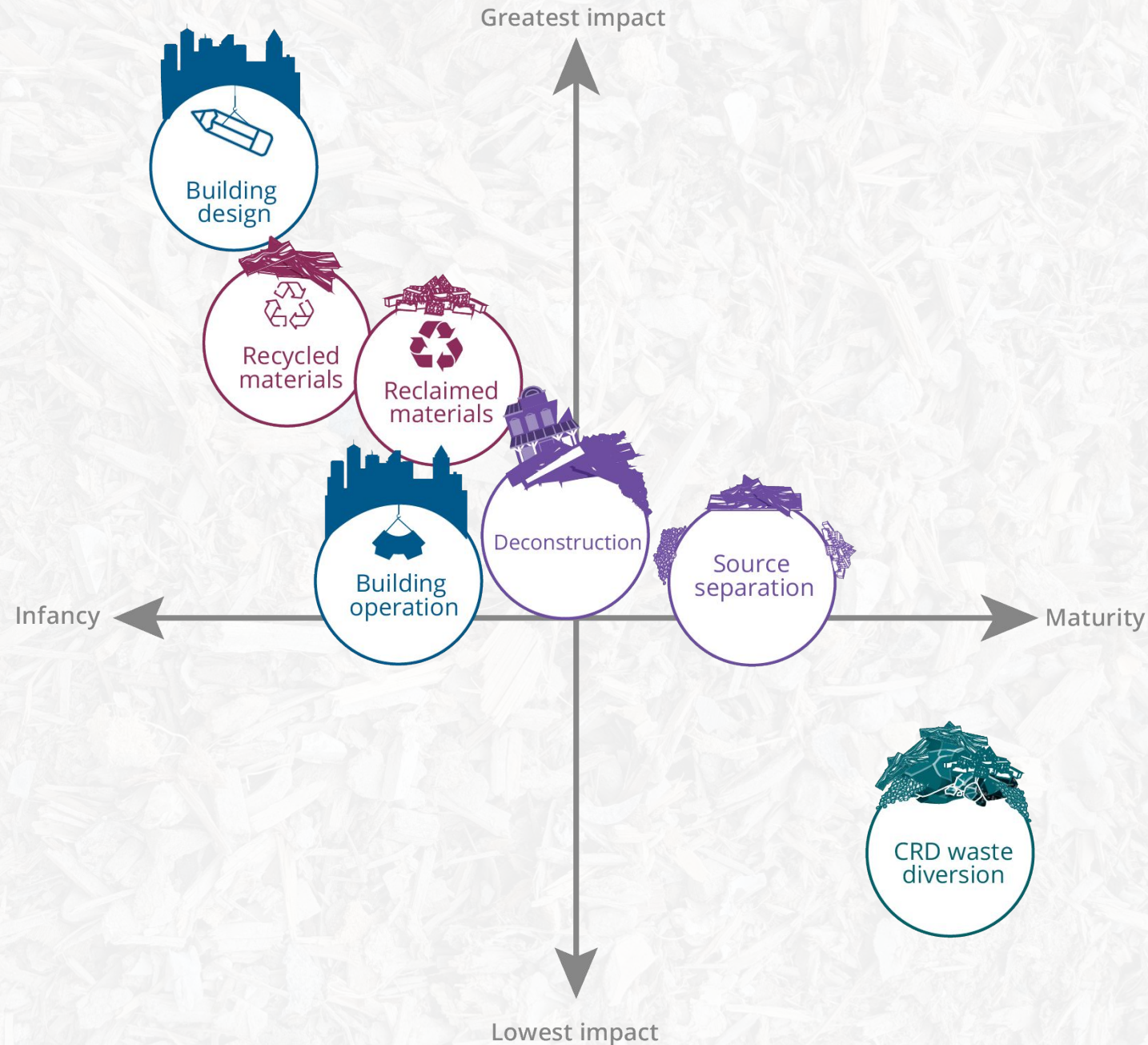
Source: CCME 2019

Ontario's shrinking landfill capacity



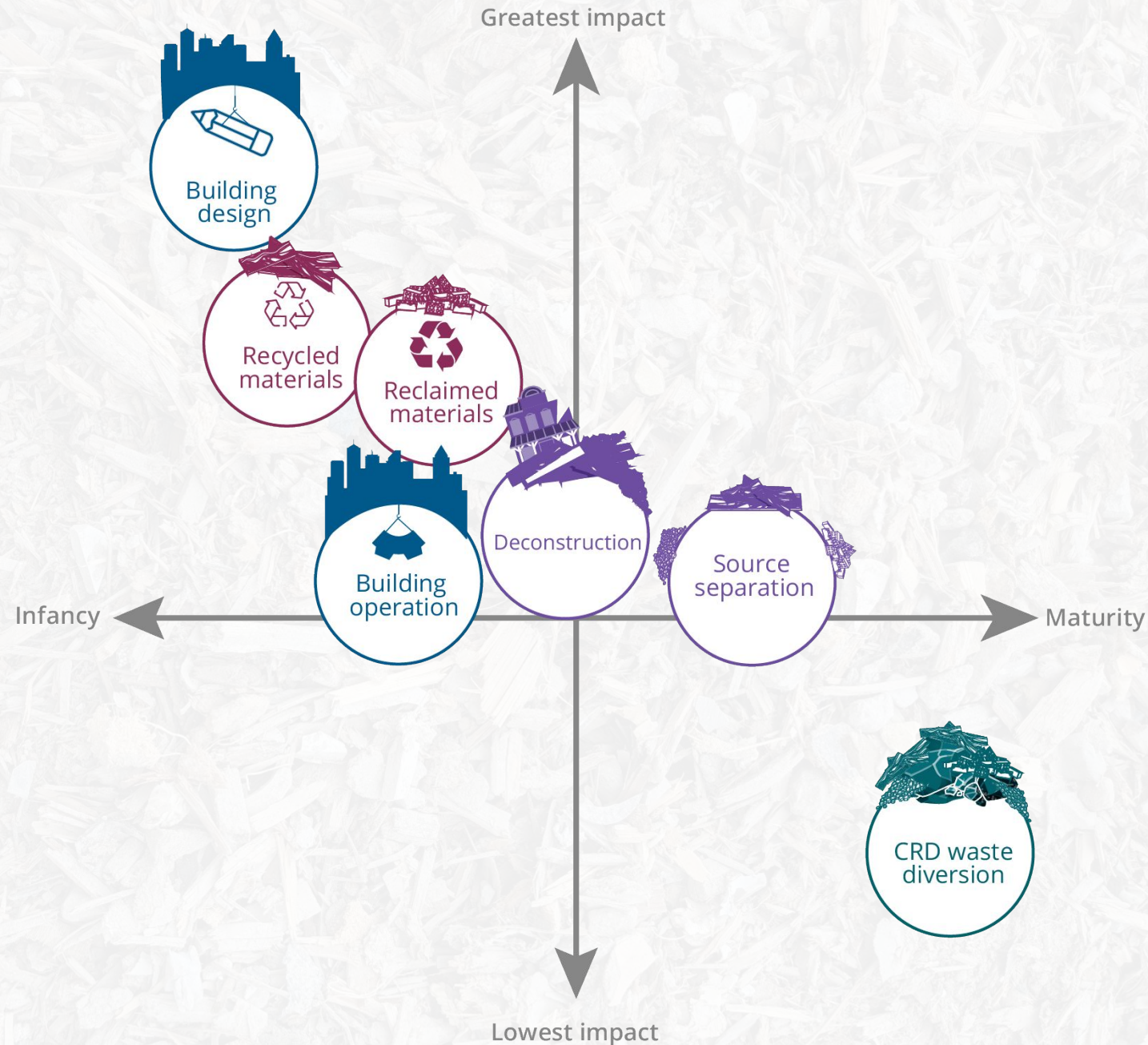
What is the Circular Building Ecosystem?

- Diversion gets waste out of landfill but most options downcycle the materials.
- Source separation of CRD materials enables clean and contamination-free materials to support the creation of secondary markets.
- The deconstruction of buildings, rather than demolition, is needed to support source separation and increase diversion.
- Reclaimed and recycled content materials leverage the used CRD materials to make new products.
- Building use and operations uses techniques to extend the life of buildings.
- Circular building design uses principles and standards to eliminate waste, design for flexible use, modular reuse, durability and the end-of-life disassembly of materials.



What is the Opportunity In Guelph-Wellington?

- Diverting CRD waste from landfill has an easier path forward, but most of that materials gets downcycled.
- As one Circular economy expert reported: *"If you start out with diversion-to-downcycling, then that's what the infrastructure is going to respond with"*
- Changing the way buildings are designed (e.g., for disassembly) is less mature but would have the biggest longer-term impact.
- As a circular building expert said: *"The Design for Disassembly guideline was groundbreaking when it was developed back in 2008...but the problem was we didn't use it in Canada."*



What are the Available Materials?

- Metals have the largest economic opportunity and are diverted at all stages because the cost signal makes it with the investment.
- Concrete's economic opportunity exists due to its weight, which results in a high landfill tipping fee.
- Re-use options exist for windows, doors, cabinets, plumbing and lighting fixtures, but the secondary market exist within a charitable model.
- Knocking down barriers to foster the reuse of some of the most voluminous items – concrete, wood, and gypsum – would help build the foundation of a reclaimed materials market.

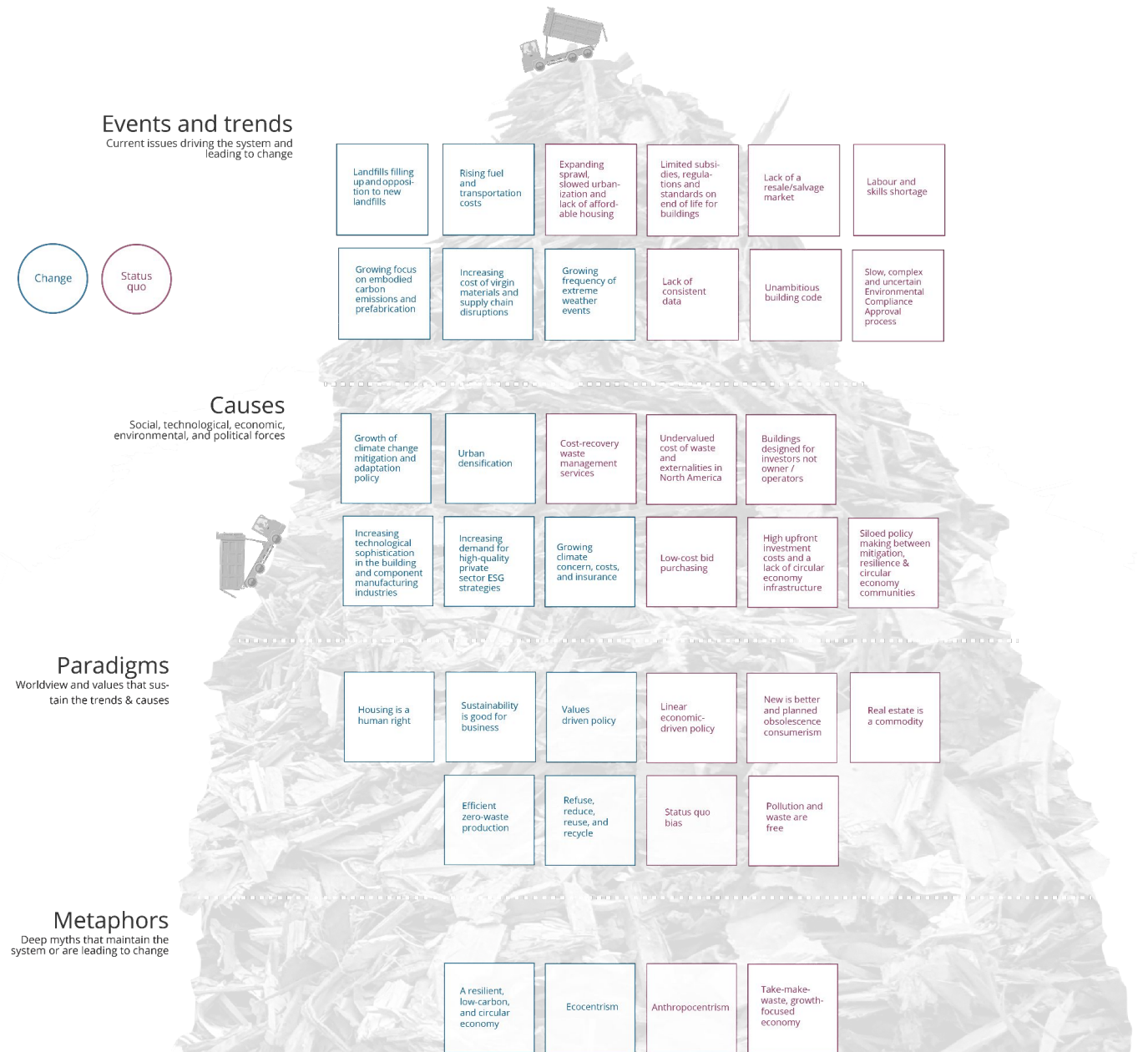


4. Why Don't We Build Circular?

Charting the trends, causes, paradigms and deep myths that underpin the current take-make-waste system, and provides insight on what is driving change in the system.

Why Don't We Build Circular?

- Compounding climate, health and housing crises challenge our current economic and regulatory environment.
- But deep-rooted forces work to keep our linear and siloed economic thinking in place.



Trends: Why Don't We Build Circular?

Events and trends

Current issues driving the system and leading to change

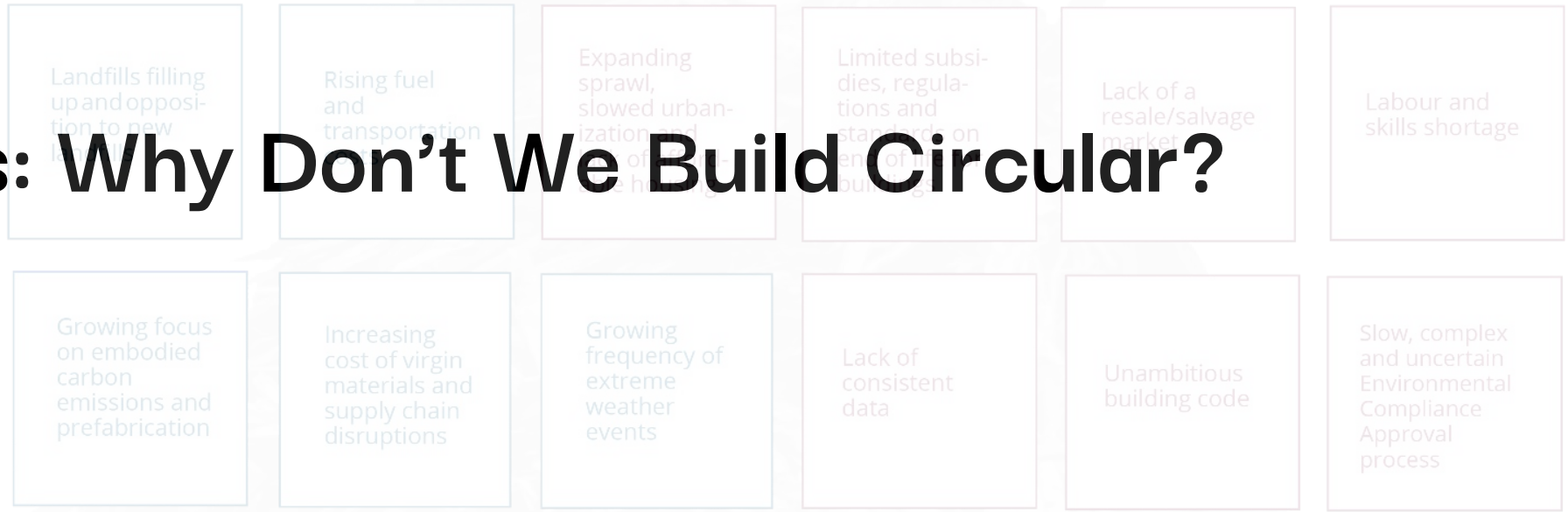


Change

Status quo

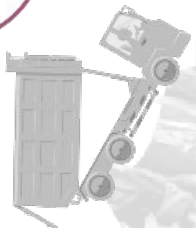
Current issues driving the system and leading to change

Causes: Why Don't We Build Circular?



Causes

Social, technological, economic, environmental, and political forces





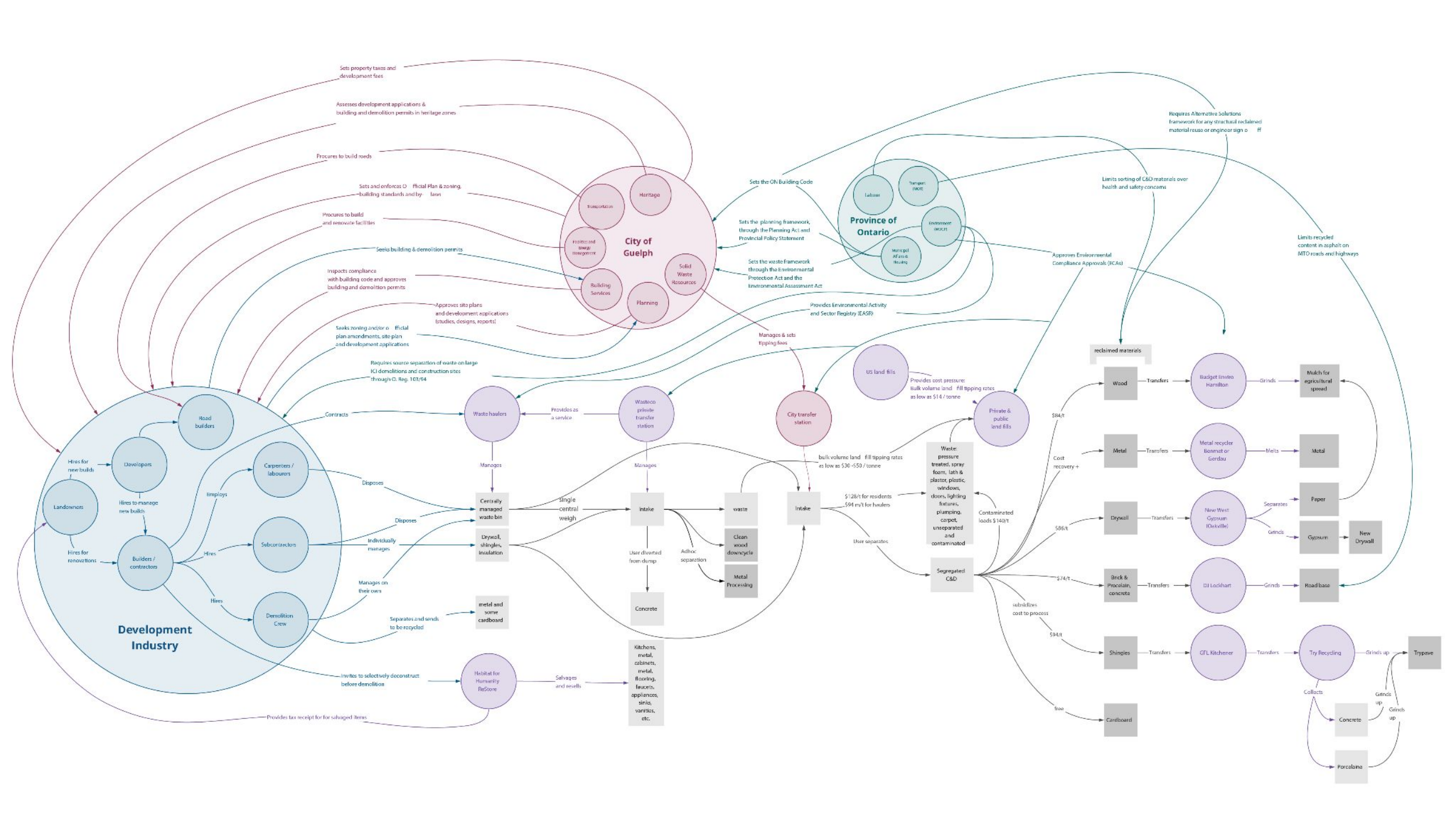
Opportunities

- **Building Code:** Participate in the process to develop building standards, guidelines and code changes to support the use of reclaimed and recycled content building materials.
- **Data:** Collaborate with other municipalities and private-sector partners to explore how municipalities can improve data collection and usage. And advocate to the provincial government to provide collected data from private waste facilities as part of the private facilities' ECAs.
- **Procurement:** Leverage a quality-based selection process for the public procurement of architectural and engineering consulting services.
- **Cost-recovery Framework:** Re-examine a cost-recovery framework in the municipal waste and planning to account for externalities and building a circular economy.

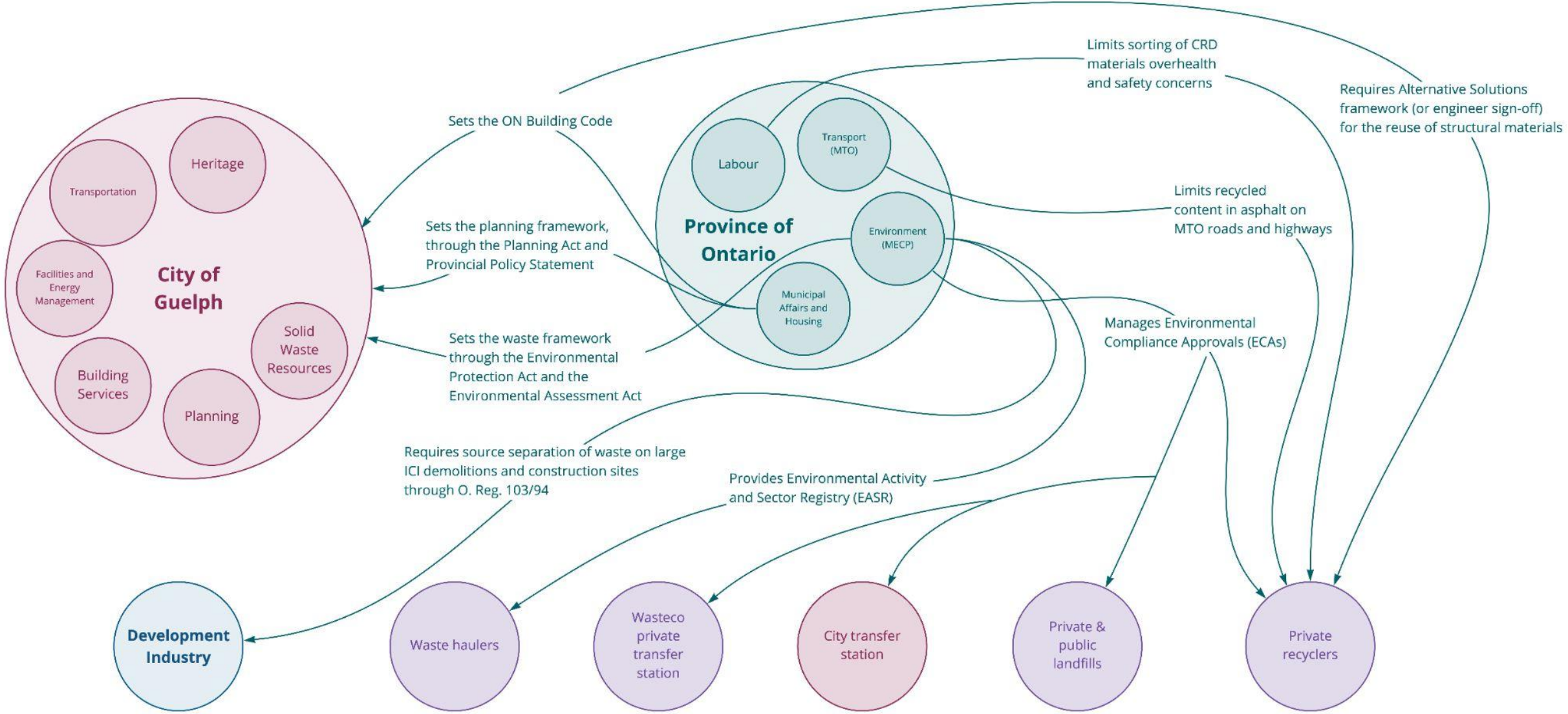
5. Regulating the Status Quo?



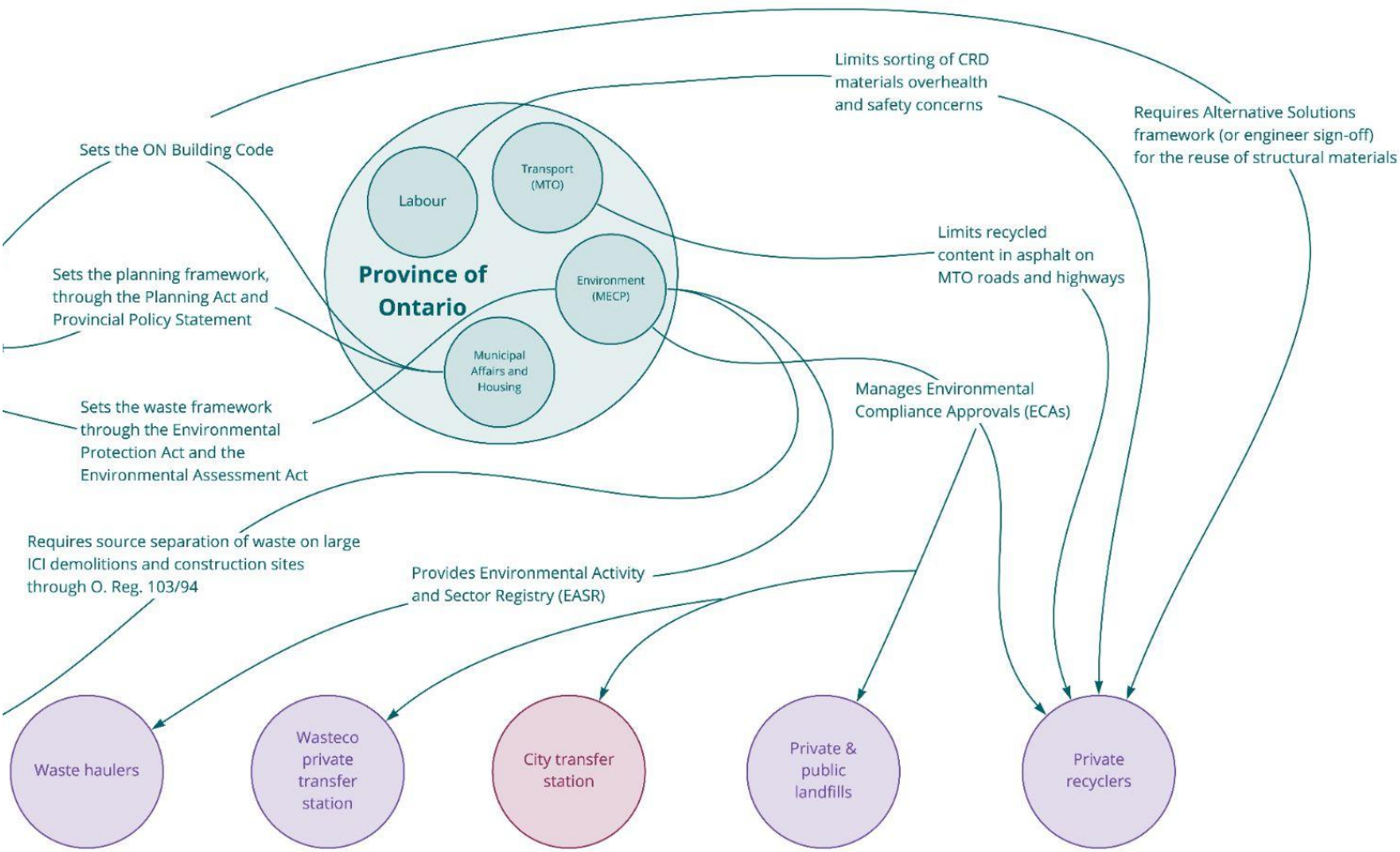
Shaped by the provincial government's planning, building, and waste frameworks, in competition with neighbouring municipalities, and facing criticism for lengthening delays and process, local governments nevertheless have a number of front-line regulatory interactions with the building and waste industries to shape circular economy policies and outcomes.



Regulating the Status Quo? - The Province



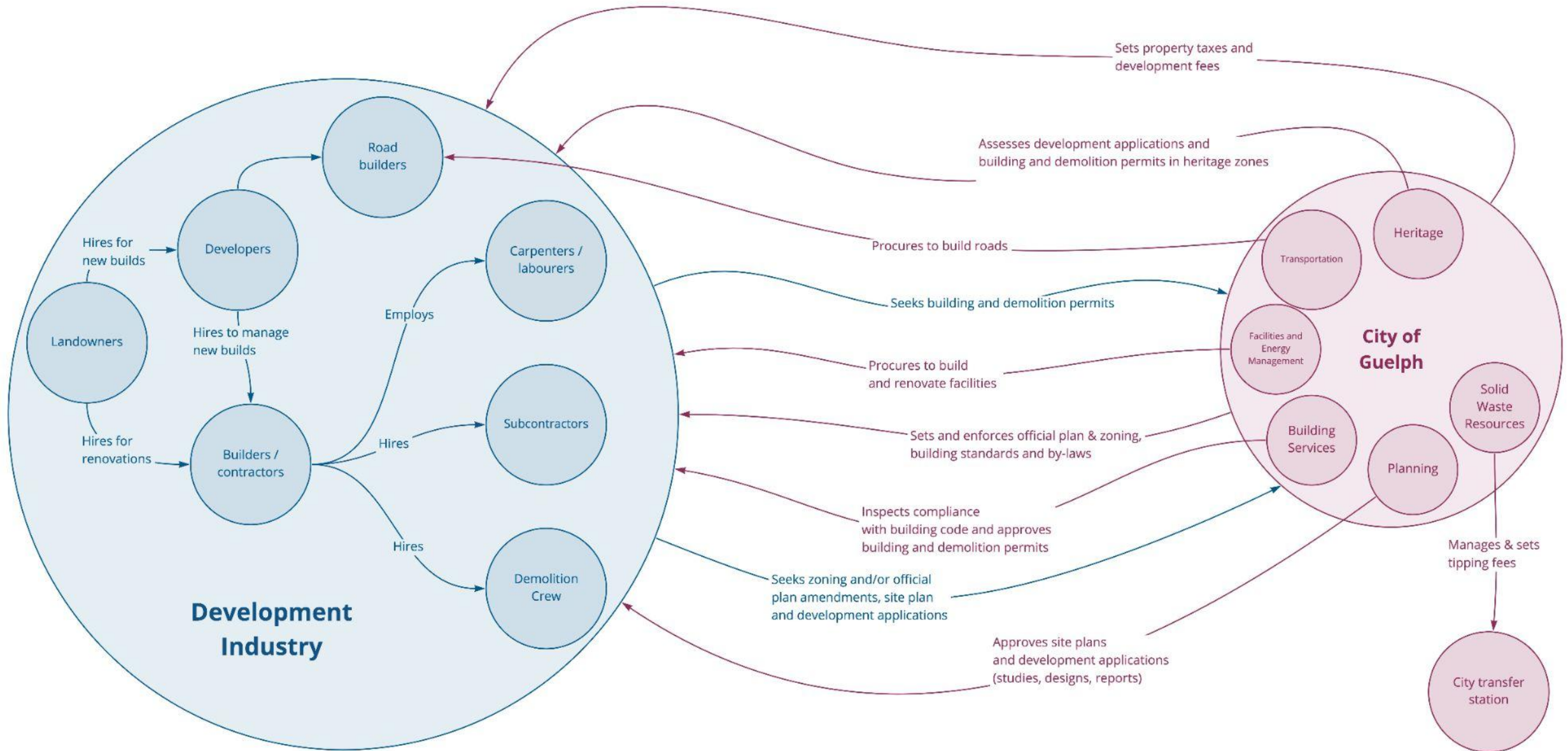
Regulating the Status Quo? - The Province



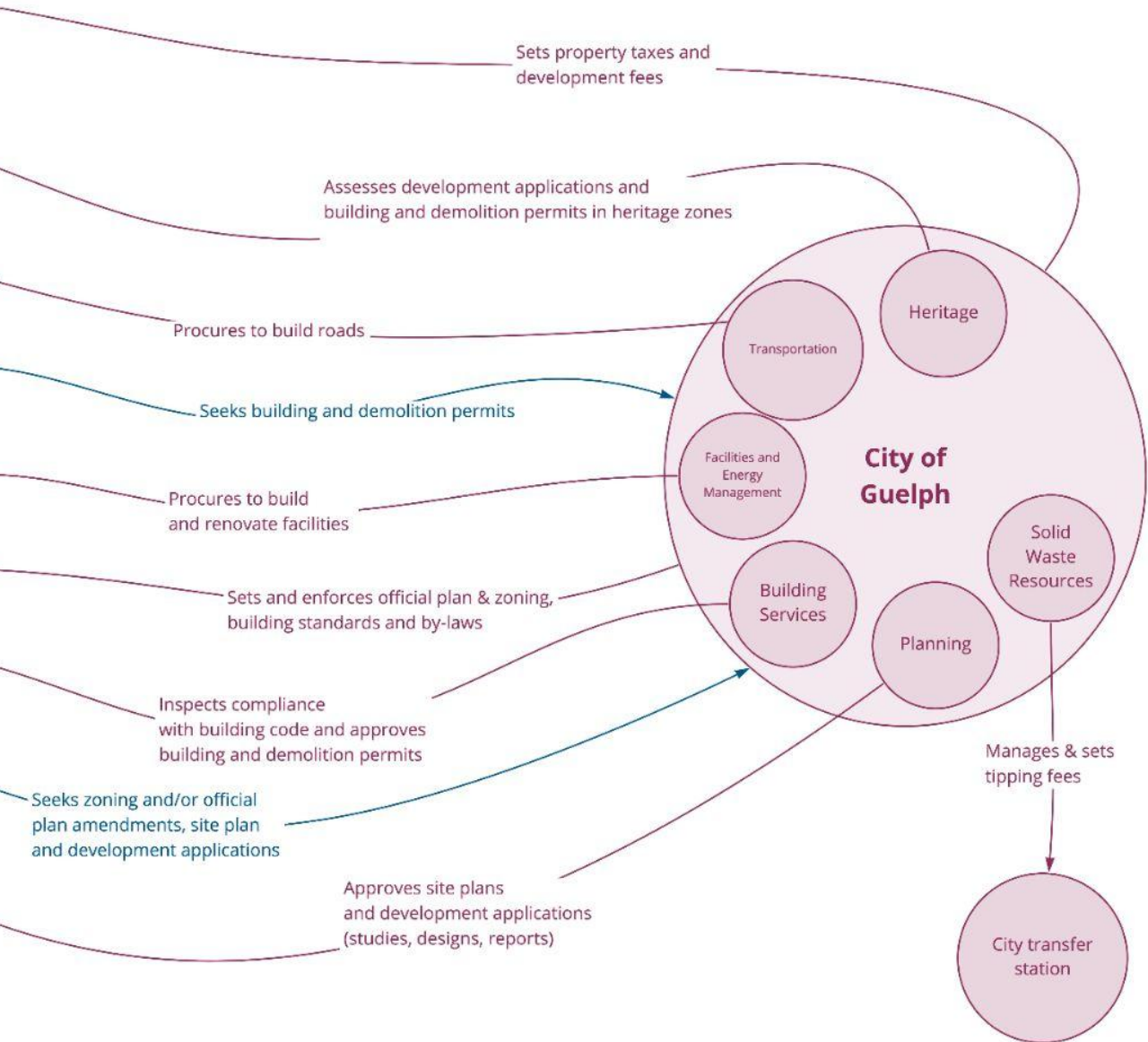
Provincial leadership would have the biggest impact system wide (e.g landfill bans)

- Seeking an ECA is a long, complex and uncertain process
- In Ontario, source separation is required for large ICI buildings (O. Reg 103/94), but diversion is not.
 - Ontario AG: in ten years, the ministry had not inspected any demolition sites for compliance
- Building code process is regulatory captured and results in unambitious code
 - Alternative Solutions framework often run by municipalities through a cost-recovery basis penalizes innovators.
- MTO highway standards, widely adopted by municipalities, limits recycled content.

Regulating the Status Quo? - Municipal



Regulating the Status Quo? - Municipal



- Bylaws can kick-start new businesses but planning delays are hindering development
 - Canada ranks 67 out of 190 countries for ease of getting building permits, dropping from 54th in 2013
- In 2018, the City of Richmond initiated a pilot to use recycled asphalt in municipal roads to build market confidence.
- A number of West Coast municipalities have enacted deconstruction bylaws that require the deconstruction, source separation, and diversion of building materials from buildings before a certain age (e.g., 1950).
- Nine Ontario Municipalities have developed tiered green development standards for new mid- and high-rise builds. The Toronto Green Standard contains circular criteria in the upper tier of the standard.



Opportunities

Provincial

- **Landfill Ban:** Develop support for a landfill ban on clean wood, gypsum and concrete.
- **Expand O.Reg 103/94:** Expand the reach and increase inspections of O.Reg 103/94 to include more sites and to require diversion.
- **MTO Specs:** Advocate for the updating of Ontario Ministry of Transportation highway specifications to increase the use of recycled asphalt and concrete aggregate.

Municipal

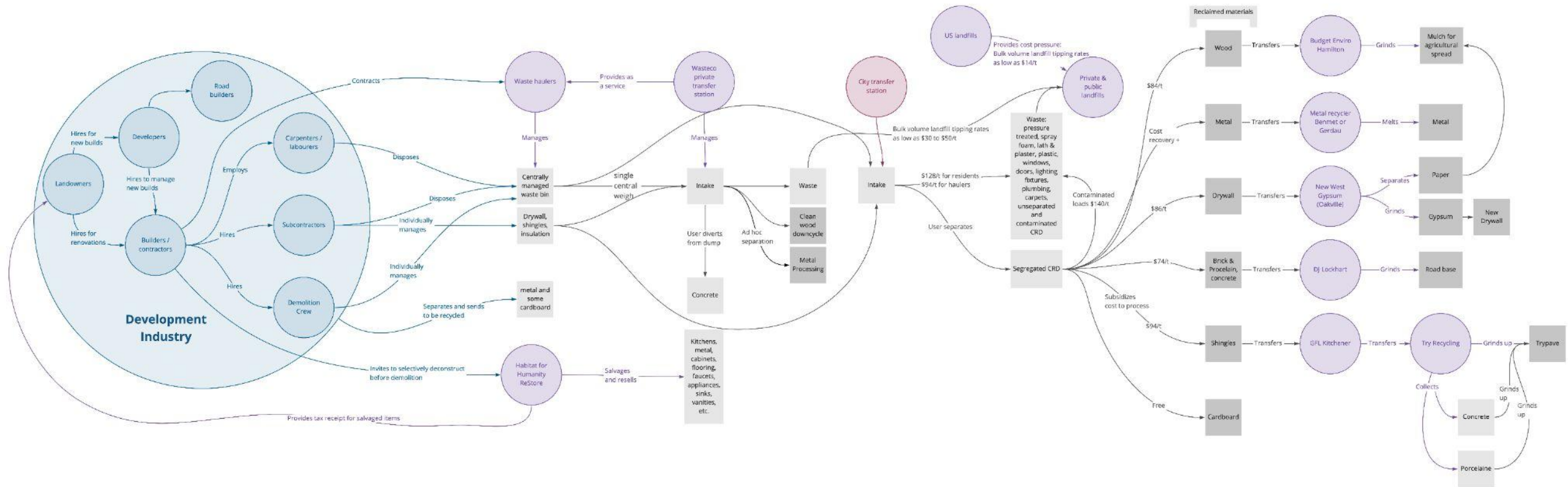
- **Recycled Content:** Study engineering data from existing case studies to inform the piloting of procurement provisions for recycled content in municipal roads and buildings.
- **Demolition Bylaw:** Explore updating the demolition bylaw to require or incentivize deconstruction, source separation, and diversion of building materials.
- **Green Standards:** Understand how various Ontario municipalities have implemented green building standards and how to offer expedited planning approvals.

6. Trying to Add Economic Value

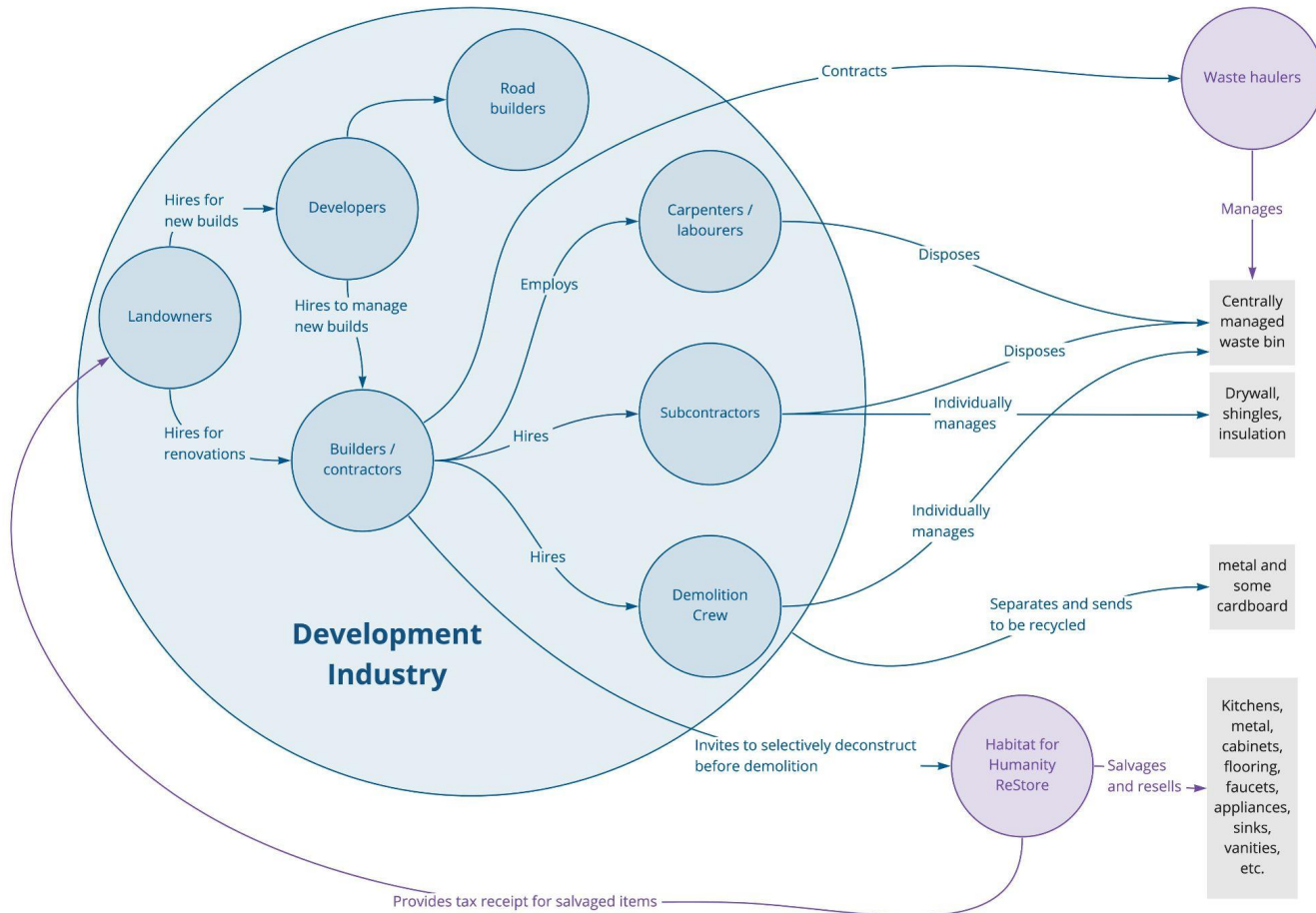


The building industry operates under tight timelines and margins, while avoiding risk to maximize profit. Under existing low landfill tipping fees relative to recycling rates, very little construction and demolition waste is diverted consistently. Some innovators work under the constraints while others look for policy change before committing more resources.

Trying to Add Value to Waste

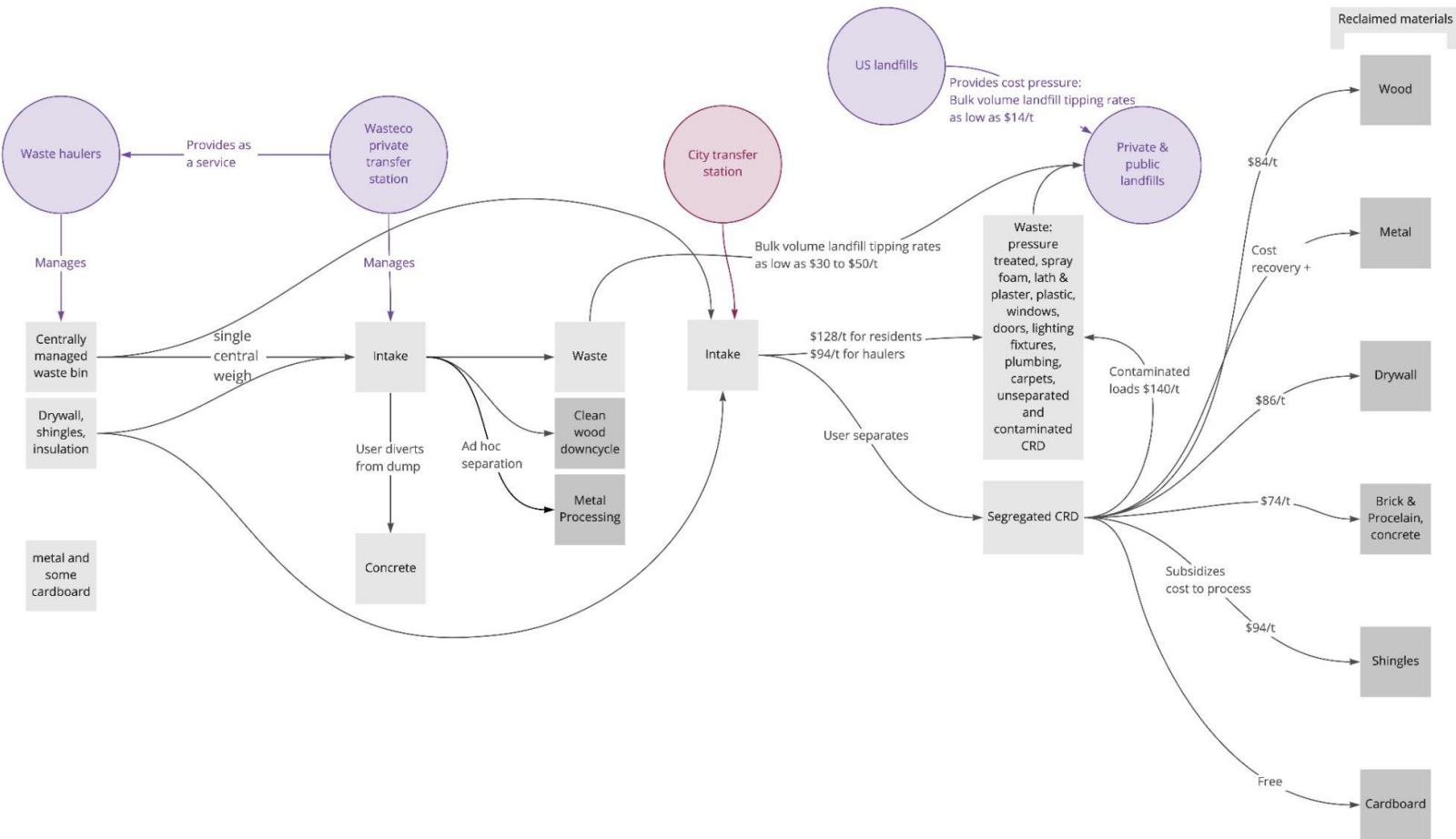


Trying to Add Value to Waste



- Most waste gets put into one bin and landfilled
- The labour, logistics and transportation costs makes deconstruction and separating the waste uneconomical
- Metal is pulled out of the waste stream – cost signals work! (Large concrete loads are pulled because weight)
- Circularity in third-party managed green building standards is also nascent. Data from 678 LEED-certified projects from across Canada reported an average diversion rate of 88%.
- TRUE is a new certification for manufacturers to develop zero-waste products
- Salvage industry is driven more out of a desire to limit waste than an economic benefit of a tax receipt.

Trying to Add Value to Waste



- Ontario, is one of the lowest cost provinces for landfill tipping fees in Canada, while also next door to much lower cost jurisdictions in the United States.
- Some innovators are working to foster new opportunities
 - A B.C. shingle recycler said if they can secure 40,00 tonnes of stock per year, they'd set up a plant in Ontario.
 - A deconstruction firm in B.C. envisions setting up a reclaimed wood manufacturing hub in Ontario, but only if landfill tipping fees were higher
 - An Ontario reclaimed materials re-seller wants to move more substantially into reclaimed wood reselling.
- A new reuse hub in Port San Antonio is offering training courses in the trades, a reclaimed material warehouse, venues for public workshops, and a tool library.



Opportunities

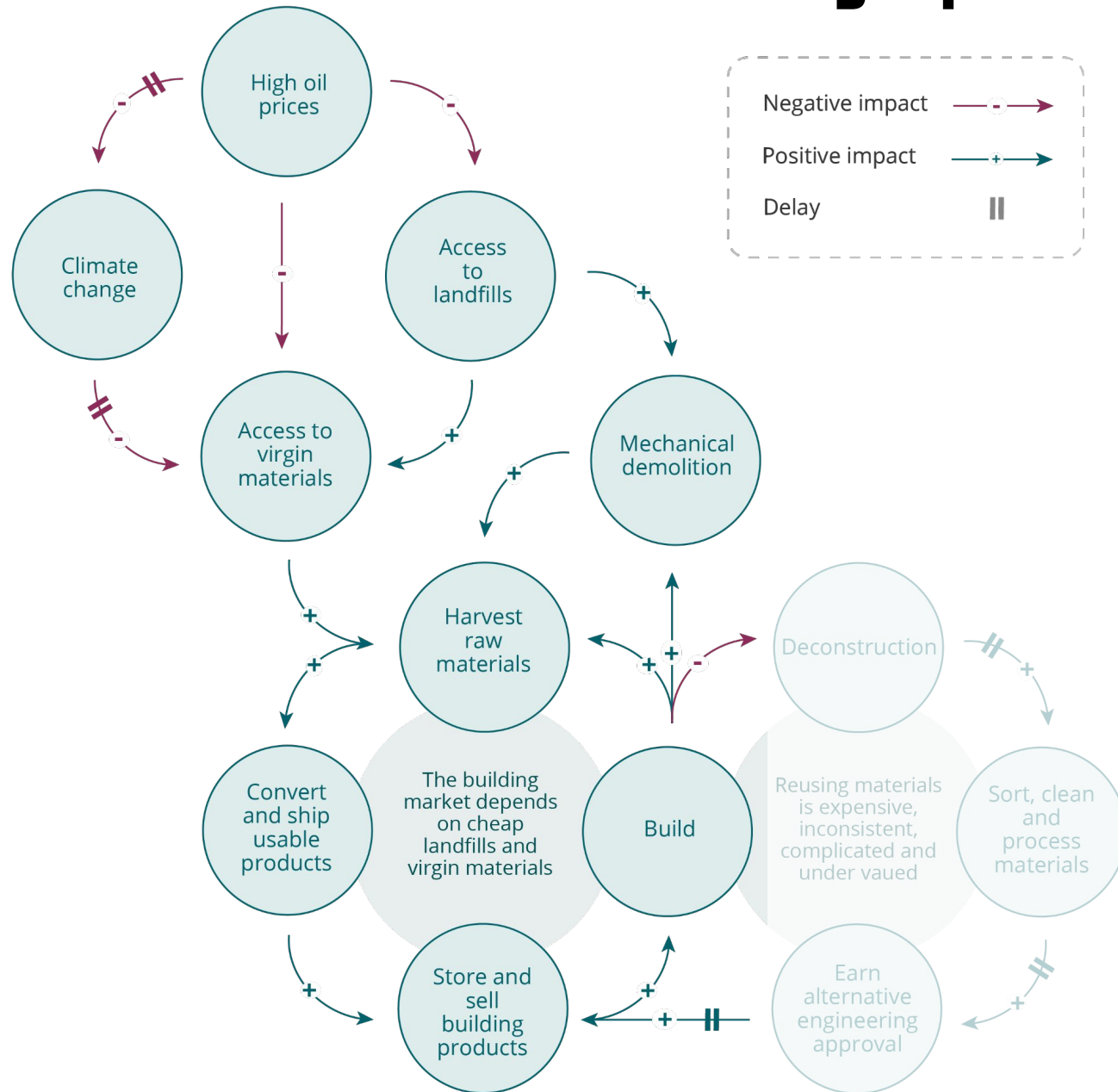
- Develop a coalition of regional corporate leaders in the building industry to phase in zero waste in their operations, similar to Total Resource Use and Efficiency (TRUE) certification.
- Explore working with private sector building certification organisations to incorporate circular building design methodologies into existing certifications, training, and advocacy.
- Explore developing a city-supported upcycling and deconstruction hub. The hub would be space to process materials back into reusable building materials and upcycled into new products.
 - It would be a one-stop-shop to incubate new businesses, provide a place for experiential learning, and provide builders with access to ready-to-use reclaimed materials.

7. Shifting to circular behaviour



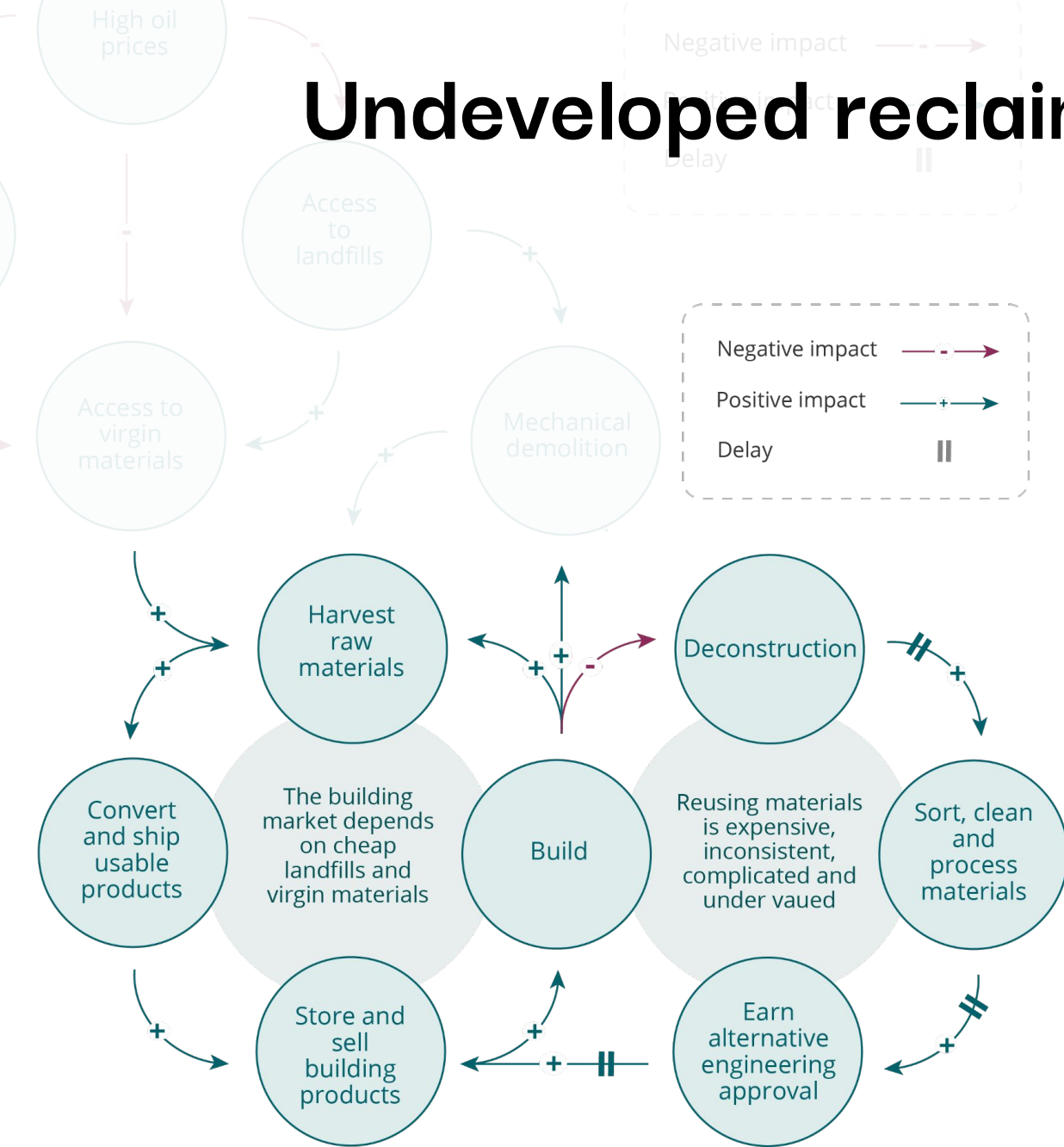
The human behaviour underpinning the current system is well worn from many years of operation that keeps change at bay.

Landfills filling up & resources depleting



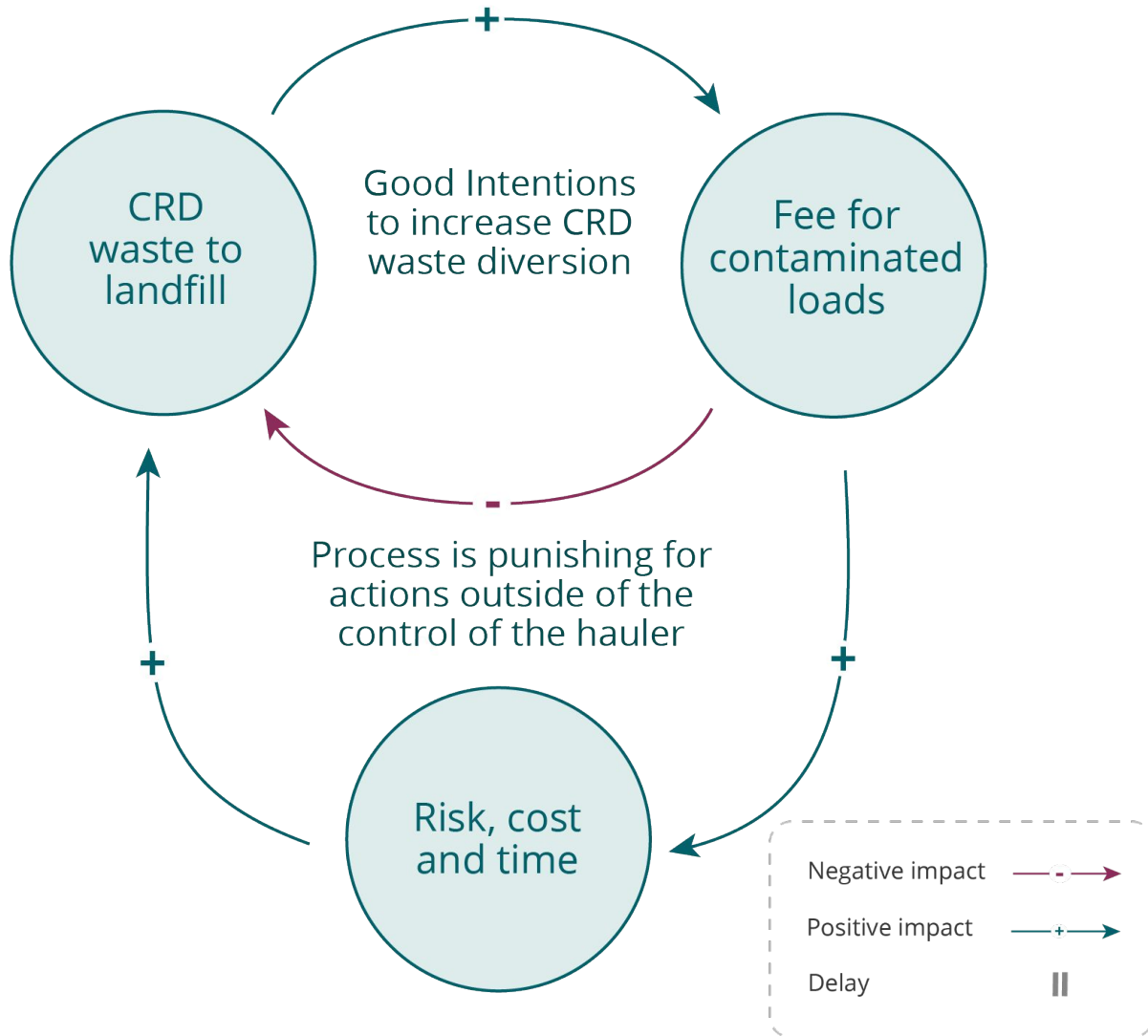
- High oil prices
 - reduces the impact of climate change;
 - increases the cost to send materials to landfill, and
 - boosts the cost to extract natural resources.
- Easy access to landfills makes mechanical demolition (and dumping) and the harvesting of virgin materials the low cost option
- Landfills, in Ontario, are filling up and access to materials is already and will be more constrained by climate, environmental, and societal shocks.

Undeveloped reclaimed materials market



- Deconstruction in small scale residential projects is virtually non-existent and it exists in a few larger ICI projects.
- Considerable labour and time associated with sorting, cleaning, and processing the materials
- Limited economies of scale
- Reclaimed structural materials need engineering approval or Alternative solutions framework
- Store and sell just in time
- Limited policy support
- Results in boutique builder custom projects

Punishing contamination reducing diversion



- Source separation is required but businesses to fulfill this requirement.
- Mixed loads get higher diversion but downcycled
- Signage and awareness of CRD diversion options is low
- Fees on contamination increase risks for haulers and as a result send them to other low-risk operations to dump.



Opportunities

- **Awareness:** Pilot grants and loans to support home renovation waste diversion as part of proposed city-run energy efficiency programs.
- **Social Proof:** Offer residents lawn signs indicating to neighbours that they're committed to a "Low Carbon, Zero Waste Renovation" as part of development approvals that meet particular diversion requirements.
- **Awareness:** Explore issuing a Zero Waste Construction Guide for residents that highlights CRD companies committed to low-waste construction practices.
- **Clean Loads:** Provide supporting labour and infrastructure to encourage clean loads, such as piloting city-owned segregated CRD bins service.
- **Advertise:** Leverage behavioural analysis to redesign municipal transfer station signage and advertising of CRD recycling.