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Let One Man's Trash Be Another Man's Treasure

To What Extent Can Waste Law Support High-Value, Circular Construction With Gypsum Waste In The Netherlands?

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List Of Abbreviations

ABRVS	Afdeling Bestuursrechtspraak van de Raad van State (*Council of State*)
Barim	Activiteitenbesluit Milieubeheer (*Environmental Management Activities Decree*)
Bor	Besluit omgevingsrecht (*Environmental Law Decree*)
CDW	Construction and Demolition Waste
CJEU	Court of Justice of the European Union
CMP1	Circulair Materialenplan (*Circular Materials Plan*)
EC	European Commission
EoW-status	End-of-waste status
EU	European Union
EWSR	European Waste Shipment Regulation
FGD-gypsum	Flue Gas Desulphurization Gypsum
GCEP 2015	Government-wide Circular Economy Program 2015
GW	Gypsum Waste
GW-lifecycle	Lifecycle of Gypsum Waste
LAP3	Landelijk Afvalbeheerplan 3 (*National Waste Management Plan*)
NPCE 2023-2030	National Program Circular Economy 2023-2030
Wabo	Wet Algemene Bepalingen Omgevingsrecht (*General Environmental Provisions Act*)
WFD	Waste Framework Directive
Wm	Wet Milieubeheer (*Environmental Management Act*)

Foreword

In the past months, I dedicated my efforts to researching the question "to what extent waste law can support high-value, circular construction with gypsum waste in the Netherlands". I stumbled upon this topic in a not-so-straightforward way. At the beginning of this academic year, I wanted my thesis to relate to the housing crisis in the Netherlands. Through fruitful discussions with my supervisor Chris Backes, it became apparent that I wanted to research practical aspects of a circular construction issue. Consequently, I reached out to Heijmans, a prominent construction company. Thijs Huijsmans of Heijmans indicated that high-value, circular utilisation of gypsum waste in practice can be improved. Naturally, I seized the opportunity to explore this topic.

First and foremost, I am grateful to my supervisor, Chris Backes, for suggesting the idea of conducting interviews and challenging me. It allowed me to gain a lot of knowledge and undertake intensive research on a specific area of law that was previously unfamiliar to me.

Additionally, I extend my appreciation to Thijs Huijsmans of Heijmans. Through his help, I not only delved into this topic but also had the privilege of interviewing five other companies.

Also, I would like to express my gratitude to Maarten Hendriks of New West Gypsum Recycling for providing an insightful and fascinating tour of the recycling site in Belgium.

Lastly, I want to thank the interviewed companies for sharing their expertise. Their practical insights are invaluable. I extend my thanks to Thijs Huijsmans, Hewar Marif, and Zeger-Jan Wijnands of Heijmans; Richard Bekker and Yob Woud of Renewi; Ruud van der Stoop of Rabobank; Axel Hendriks of ADEX Group; and Maarten Hendriks of New West Gypsum Recycling and Tom van Engelen of Gyproc.

Introduction

The way humans use resources today, 1.75 earths would be needed to meet human needs.[1] There are insufficient resources to keep up with human needs. A solution is to work towards a circular economy and keep the used resources in their lifecycles.

An increasing amount of legislation and policy relating to circularity is emerging from both the European Union (EU) and the Dutch government. The Netherlands is currently simultaneously facing a housing crisis, nitrogen crisis and climate crisis.[2] In times of scarcity, these crises compel circularity.[3]

Today, we live in a single-use society.[4] Reusing waste can contribute to a circular economy, with waste being used as a resource.[5] "One man's trash is another man's treasure" holds, because waste contains valuable secondary substances. Currently, only 12% of materials used in industry are recycled materials.[6]

A case-study from Heijmans and Rabobank illustrates the use of high-value and circular use of secondary Construction and Demolition Waste (CDW), specifically Gypsum Waste (GW). The case-study is based on a renovation project of the Rabobank headquarters. Rabobank issued a tender procedure for the renovation in which circularity "had to play a role".[7] Heijmans won this tender procedure and started renovating. The plasterboard installed is secondary plasterboard from another office.

This Master's Thesis seeks to answer the following research question: "*To what extent can waste law support high-value, circular construction with GW in the Netherlands?"*

Methodology And Structure

This Master's Thesis focuses on the research for the legal and practical barriers to a high-value, circular use of GW. This thesis criticises the role of waste law in the transition to the use of GW in a high-value, circular manner. To answer the research question, several sub-questions are addressed in the different chapters.

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[1] EarthOvershootDay is the day the earth runs out of natural resources for that year. See: 'EarthOvershootDay', *overshootday.org,* last accessed 29 June 2023.

[2] 'Wonen, stikstof, asiel en klimaat: de crises stapelen zich op', *nosnieuws.nl*, last accessed 29 June 2023.

[3] *GCEP 2015*, p.10.

[4] ibid.

[5] ibid.

[6] 'Revision of the EU's Waste Shipment Regulation', *youtube.com*, last accessed 29 June 2023.

[7] Rabobank, 19 May 2023.

The first sub-question is what the transition to a high-value, circular economy entails for GW. This considers what circular economy and circular construction entail, both at EU- and national level. The definition of high-value is also discussed. Given the national construction crisis, I wanted to focus my thesis on GW generated in residential and commercial construction, because GW is perfectly recyclable but not optimally utilised.[8] To get a better picture of the use of GW in practice, Heijmans and Rabobank introduced me to the beforementioned case-study. Chapter 1 focuses on what circular and high-value use of CDW and GW entails, looking at the definitions and targets for a circular economy, circular construction and circular GW. Additionally, the definition of high-value will be discussed. This is addressed based on relevant literature, legislation and policy.

The second sub-question addresses how waste law can support the high-value, circular use of GW in the Netherlands and the legal barriers. Literature demonstrated that waste law can be a barrier to the circular economy. Waste law is specifically selected to delineate the lifecycle. Regulations on circular construction exist at multiple levels and address different phases of the lifecycle.[9] Other levels of law – product law, contract law, international law, procurement law… – can also be relevant to the GW-lifecycle. These levels of law are not thoroughly discussed in this thesis because of its scope. The thesis sometimes briefly reaches out to these levels of law because it is relevant within the context of an interview or recommendations, but the focus is waste law. Additionally, this thesis focuses on waste law at an EU and Dutch level. As waste is case-specific, it is practical to focus on a Member State and its legislation. The Netherlands is selected because I am Dutch and have a background in Dutch (environmental) law. Moreover, the companies dealt with in the case-study are based in and to a large extent operate in the Netherlands. Chapter 2 elaborates on the second sub-question and demonstrates the national legal obligations, literature, and case-law.

The third sub-question addresses how the high-value, circular use of GW in the Netherlands is supported in practice and the practical barriers. Chapter 3 is based on six interviews, which are summarized in Annex I. the interviews form a complete picture of the GW-lifecycle. The interviewed companies I approached via Thijs Huijsmans from Heijmans. All interviewed companies are relatively well-positioned in the transition to the circular

[8] See more research on GW: 'GtoG Life + Project: First step towards gypsum circular economy', eurogypsum.org, last accessed on 29 June 2023.

[9] Backes and Boeve 2018, p.55.

construction economy.[10] Chapter 3 focuses on researching the practical barriers to a high-value, circular utilisation of GW, based on this qualitative research method.

The final sub-question addresses what the recommendations are for these legal and practical barriers. Recommendations are given based on literature, case-law, legal framework and the interviews. Chapter 4 analyses the answer to the main research question, namely to what extent waste law can support high-value, circular construction with GW in the Netherlands. Annex II provides an overview of all barriers and recommendations.

Limitations

This thesis has certain limitations, as partly indicated in the methodology. The first limitation is the qualitative approach of the interviews. This thesis is based on six interviews from companies that are familiar with each other and share high-value, circular ambitions.[11] My analysis does not entail other companies. This is because of time restrictions and the convenience of the connections of the companies from the case-study. This also entails that the information obtained in the interviews can be biased. Furthermore, the legal framework of this thesis is limited to waste law. Some recommendations in Chapter 4 go beyond waste law, however, the framework for these recommendations has not been thoroughly researched and described in this Chapter 2. Moreover, the legal framework focuses on residential and commercial construction. Lastly, the thesis focuses on the Netherlands and its waste law. Therefore, the conclusions do not apply to all Member States.

[10] Based on their websites.

[11] Kircherr et al., *Ecological Economics* 2018/150, p.264-267.

Chapter 1 – Defining High-Value, Circular Construction With GW

1.1 Introduction

As indicated in the introduction, this thesis originates from a case-study, which is an example of how companies can stimulate the high-value use of GW. To understand the role of waste law in the transition to a high-value, circular construction economy, it is important to understand how "circularity" and "high-value" are defined.

First, the circular economy is defined (1.2). This general interpretation of high-value circularity is discussed because specific ambitions and definitions derive from it. This thesis focuses on the development to a high-value, circular construction with GW, hence high-value circular construction is discussed (1.3). Furthermore, gypsum and its specific characteristics, availability and lifecycle is demonstrated (1.4). This chapter concludes with an interim conclusion (1.5).

1.2 What Is A High-Value Circular Economy?

1.2.1 Ambitions For A Circular Economy

1.2.1.1 International And EU Ambitions

In recent years, the ambitions for a circular economy have been discussed on an international and EU-level.

The international IPCC report of 2022 mentions the circular economy and its implications for the industry. It demonstrates that there are plenty of affordable options worldwide to enable the transition to a circular economy. [12] The more recent IPCC Report of 2023 states that the circular economy can help to achieve CO2 reductions. It does not thoroughly discuss circularity.[13]

[12] 'IPCC Climate Change 2022 Mitigation of Climate Change*', ipcc.ch,* last accessed 29 June 2023.
[13] 'IPCC Climate Change 2023 Synthesis Report', *ipcc.ch,* last accessed 29 June 2023.

At EU-level, the ambitions in the EU Green Deal and the EU Circular Economy Action Plan elaborate on the circular economy.[14] Furthermore, the European Commission (EC) stimulates the market for secondary raw materials by adopting mandatory percentages of recyclables in its legislation.[15] In 2015, the EC published its first action plan on Closing The Loop.[16] There have been numerous developments ever since, like the proposal for new rules on waste shipments[17], the Sustainable Products Initiative[18], Proposal for a revised Construction Products Regulation[19]… This is just a small selection of all EU-developments.[20] Furthermore, the EU underlined the scarcity of raw materials by adopting the recent Critical Raw Materials Act 2023.[21] The circular economy is one of its pillars.[22] These developments demonstrate that the ambitions to transit to a circular economy is existing on an EU-level.

1.2.1.1 Dutch Ambitions

The Dutch legislator has been engaged in circularity in its policy. In its *Government-wide Circular Economy Program 2015 (GCEP 2015)* the Dutch government adopted the ambition to be "fully circular by 2050", with as little waste as possible and no unnecessary waste of raw materials.[23] The *GCEP 2015* has been one of the key policy-documents containing ambitions for the transition towards a circular economy.

Another key document is the *National Program Circular Economy 2023-2030 (NPCE 2023-2030),* which builds on the *GCEP 2015* with more intensive policies, concrete targets and guiding measures.[24] This ambition has developed the past years, as demonstrated by discussing these policy-documents.

The *GCEP 2015* demonstrates three developments stimulating the circular economy. First, the explosive demand for raw materials. The increasing population growth will also

[14] COM(15)614 fin.

[15] *GCEP 2015*, p.31.

[16] 'First circular economy action plan', *environment.ec.europa.eu*, last accessed 29 June 2023.

[17] 'European Green Deal: Commission adopts new proposals to stop deforestation, innovate sustainable waste management and make soils healthy for people, nature and climate', *ec.europa.eu*, last accessed 29 June 2023.

[18] 'Sustainable products', *commission.europa.eu*, last accessed 29 June 2023.

[19] 'Review of the Construction Products Regulation', *single-market-economy.ec.europa.eu*, last accessed 29 June 2023.

[20] 'Circular economy action plan', *environment.ec.europa.eu*, last accessed 29 June 2023.

[21] 'Critical Raw Materials: ensuring secure and sustainable supply chains for EU's green and digital future', *ec.europa.eu*, last accessed 29 June 2023. Gypsum is not a critical raw material, that does not mean GW can continue to be discarded.

[22] COM(2020)474 fin.

[23] *GCEP 2015,* p.7; *NPCE 2023-2030,* p.4.

[24] *NPCE 2023-2030,* p.4.

augment the demand for raw materials. This creates higher environmental pressure, which in turn causes a loss of biodiversity, impending resource exhaustion and climate change.[25] Second, the Dutch dependence on raw materials. The Netherlands imports 68% of its raw materials.[26] Third, the extraction and consumption of raw materials contribute significantly to energy consumption and CO2-emissions. This affects global warming. The Dutch government highlights the importance of coherence between climate policy and the circular economy.[27]

Building on these three developments, the *NPCE 2023-2030* indicates that this need for a circular economy derives from supply risks due to increasing population growth, prosperity and consumption. This is at odds with the need to reduce the environmental pressure.[28]

1.2.2 Defining The Circular Economy

1.2.2.1 Linear Economy

Before defining the circular economy, it is important to recognise the linear economy. In this linear economy, the principle of 'take-make-waste' applies.[29] This entails that resources will not return into their lifecycle. The effects of the linear economy are seen in the numbers of how many earths humans need: 1.75 earths.[30] However, there is no planet B, hence the transition towards a circular economy is urgent.

1.2.2.2 Transition To A Circular Economy

To determine to what extent high-value, circular construction can be supported by waste law, it needs to be clear how "circular" and "high-value" are defined.

Circularity has numerous definitions by the EC, the Dutch government and literature.[31] Circularity is often used as one of many pillars to achieve climate goals, as illustrated in paragraph 1.2.1. Circularity does not ascertain sustainability. Circularity can focus on emission-

[25] *GCEP 2015*, p.11.
[26] Ibid.
[27] Ibid, p.12.
[28] *NPCE 2023-2030,* p.11.
[29] *Report Ellen MacArthur Foundation* 2015.
[30] 'EarthOvershootDay', *overshootday.org,* last accessed 29 June 2023.
[31] Kirchherr et al., *Conservation and Recycling 2017/127*, p.221-232.

reduction, but also on avoiding primary raw materials and/or promoting high-value reuse. Circularity is interpreted broadly, often described as "cradle to cradle" or "closing the loop".[32] Circularity is a policy concept.[33]

EU Definition On A Circular Economy

The EC defines "circular economy" as "maintaining the value of products, materials and resources in the economy for as long as possible, and minimising waste, including through the application of the waste hierarchy as laid down in Article 4 of Directive 2008/98/EC".[34]

"For as long as possible" is not the endless reuse of products, materials and resources. However, not all resources can be used endlessly, so the definition paints a realistic picture. "For as long as possible" should be elaborated based on objective standards per product group, so substances that last longer are reused and recycled longer.[35]

Additionally, the EC aims to "minimise waste", which does not mean that there is no waste. There will always be a small amount of waste. Again, if decided objectively, a certain substance will objectively lead to a certain amount of waste.

The EC defines a circular economy realistically. However, objective standards could guide Member States and companies to know how long substances can be reused and recycled.

Dutch Definition On A Circular Economy

Since circularity is a policy concept, the circular economy is not defined in Dutch legislation but in Dutch governmental policy.[36]

The *GCEP 2015* adopts the ambition for a circular economy by 2050. The Dutch government defines "circular economy" as "an economic system in which the preservation of natural capital is taken as a starting point, using renewable materials and publicly available raw materials as much as possible. To this end, raw materials are optimally deployed and (re)used without risks to health and the environment, and primary raw materials, when they are still needed, are extracted in sustainably".[37]

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[32] Bocken, Bakker and De Pauw, *Sustainable Design & Manufacturing Conference, Seville, 12-14 April 2015,* p.2.

[33] Backes 2020, p.340-342.

[34] COM(18)353 fin.

[35] Most GW can be "endlessly" recycled, depending on its quality. When the GW is used in agriculture after one time use, it is not used "for as long as possible" and that should not be high-value.

[36] Backes 2020, p.340-342.

[37] *GCEP 2015,* p.15.

The *NPCE 2023-2030* indicates that in a circular economy, almost "only reusable primary, secondary and sustainable bio-resources will circulate". Products are produced and consumed within closed cycles. The value of materials and products is preserved as long as possible, so there is almost no waste. However, in a fully circular economy there will always be a limited amount of waste.[38]

Additionally, the *NPCE 2023-2030* indicates four options in creating circular policies, namely (1) the reduction of raw material use, (2) the substitution of raw materials (avoiding primary substances and using secondary ones in their place), (3) life extension (through repairing) and (4) high-value processing (at the end of the cycle, recycling the substances to reduce incineration or landfill, thus increasing the supply of secondary substances).[39] Circularity is approached multi-layered and can play a role in limiting the use of raw materials, reusing secondary substances, repairing secondary materials and recycling secondary materials. Only recycling does not guarantee that a material will return on the same "level" in the lifecycle. Hence, this is where "high-value" is decisive.

The transition to a circular economy is not a guarantee that the option with the least environmental impact is executed.[40] I am of the opinion that other environmental impacts – like CO2-emissions, water use, land use et cetera – should also be considered within the definition of circularity, more so than is already highlighted in the current programs.[41]

The definitions in the Dutch key-policies are of great value. The documents already take into account the Dutch state of the arts regarding numbers of CDW, GW and recycling. The research question focuses on the high-value, circular use of GW in the Netherlands, hence the definitions by the Dutch government are relevant.

As will be discussed in Chapter 3, definitions are key to taking further steps. Clear definitions are the starting point for setting targets, and therefore the start for companies. For many companies it is not yet clear how to define and approach circularity. It remains to be seen how a circular economy can be promoted if the definition is not unambiguous.[42] Clear laws and regulations can promote innovation and circularity and encourage market changes.[43]

[38] *NPCE 2023-2030,* p.5.
[39] Ibid, p.6 and 16.
[40] *GCEP 2015,* p.11-12.
[41] *NPCE 2023-2030,* p.90.
[42] *Report RIVM 2017-0128*, p.22.
[43] *GCEP 2015,* p.19.

1.2.2.3 Importance Of High-Value

The scope of this thesis focuses not only on circularity but also on a high-value use of secondary resources. If the focus was merely on circularity, any reuse of GW would be sufficient, so turning GW into new plasterboards after reusing or recycling would not be required. However, the aim of this thesis is to research to what extent waste law can support that GW will be reused in a high-value and circular manner.

Regarding the definition of "high-value", as with the "circular economy", it cannot be found in legislation but must be sought in governmental policies. Also corporate reports play a role in defining high-value.

One of the three goals in the *GPCE 2015* reflects high-value reuse, namely the high-value utilisation of raw materials in existing chains.[44] Unfortunately, what is meant by "high-value" utilisation, is not defined anywhere in the *GPCE 2015*.

Dutch companies are developing ways to jointly achieve high-value reuse of materials and attempt to define "high-value". The Cirkelstad[45] defines high-value reuse as "connecting two or more lifecycles (reuse) and preserving or improving the "value" of construction products and materials (high-value) to continue using them permanently and indefinitely". The value of materials must therefore be preserved or improved.[46] Consultancy firm AtOsborne defines high-value reuse as "using the secondary materials at least at the same level".[47] "A used roof tile is reused as a roof tile".[48] So, plasterboard also becomes plasterboard again. Contrary to high-value use is low-value use, resulting in new construction materials still needed for replacement.[49] Platform CB23[50] defines high-value reuse or recycling against the goals of circular construction, determined over multiple cycles, namely the cycle of protecting material resources, protecting the environment by reducing environmental impact and protecting the existing value. When interpreting high-value, CO2-emissions also play a role. "High-value"

[44] Ibid, p.17.

[45] Cirkelstad are people working in the private or public domain that focus on circularity. See: 'Cirkelstad is een beweging', cirkelstad.nl, last accessed 29 June 2023.

[46] *Green Paper Hoogwaardig Hergebruik Bouwproducten en -Materialen* 2021, p.2.

[47] *Circulaire materialen in de bouw* 2021, p.2.

[48] Ibid.

[49] Ibid.

[50] Platform CB'23 aims to connect construction parties with circular ambitions and create national, construction sector-wide agreements on circular construction.

therefore implies that at least an equivalent application of the reused or recycled materials follows.[51]

This paragraph demonstrated how companies define high-value, given the lack of governmental guidance. High-value embodies the use of the materials in the same manner, meaning that plasterboards return as plasterboards.

Additionally, it is important to acknowledge the nuances when it comes to reusing a secondary substance. Article 4 Waste Framework Directive (WFD) provides the waste hierarchy. Recycling of GW is a possibility, however, a "more high-value" option would be reusing.[52] If reusing is not possible, recycling is the next best option.[53] Circular construction in the context of my thesis will focus on both the recycling and reusing.

1.3 What Is High-Value Circular Construction?

1.3.1 Ambitions For A Circular Construction

1.3.1.1 International And EU Ambitions

EU-wide, around 30% of all waste is CDW. In 2011 the Netherlands used 97% of all CDW again for backfilling.[54] The WFD targeted 70% recycling CDW by 2020.[55] The Netherlands leads the way, but not in a high-value manner. The CDW is reused in a low-value manner in infrastructure as a foundation material.[56,57] High-value recycling hardly takes place, unlike in other EU Member States.[58] The 70%-recycling target does not incentivise the Netherlands.[59] What would incentivise, is including high-value within this minimum percentage.[60] This will be elaborated on in paragraph 3.2.1.1.

[51] *Leidraad Toekomstig hergebruik faciliteren* 2022, p.16.
[52] *Green Paper Hoogwaardig Hergebruik Bouwproducten en -Materialen* 2021, p.3; LAP3 Sector Plan 31 Gypsum.
[53] *GCEP 2015,* p.16.
[54] Backes and Boeve 2018, p.59.
[55] Article 11 WFD.
[56] *Green Paper Hoogwaardig Hergebruik Bouwproducten en -Materialen* 2021, p.4.
[57] 'Circulaire economie', *Rijkswaterstaat.nl,* last accessed 29 June 2023.
[58] Backes and Boeve 2018, p.59.
[59] Backes 2017, p.48.
[60] Backes and Boeve 2018, p.59.

1.3.1.2 Dutch Ambitions

The *GCEP 2015* states that construction in the Netherlands accounts for an estimated 50% of raw material consumption, 40% of total energy consumption and 30% of total water consumption. Moreover, a third of all Dutch waste is CDW.[61] This sector accounts for 35% of CO2-emissions.[62] It is mainly low-value recycling, the materials are not reused on their original level.[63] The Netherlands is to be praised for its high percentage of recycling, but in the long run, the low-value reuse of CDW cannot be sustained.[64] Reusing existing CDW has a lower environmental impact than using virgin materials.[65]

To coordinate and plan waste management in the Netherlands, the Dutch regulator has adopted the Landelijk Afvalbeheerplan 3 (*National Waste Management Plan*, LAP3).[66] This is national policy aimed at administrative bodies.[67,68] The LAP3 must be complied with when conducting activities mentioned in the Wet Milieubeheer (*Environmental Management Act,* Wm)[69] and environmental permits for establishments.[70] It sets out minimum standards and promotes the transition to a circular economy by distinguishing more and less high-value applications.[71]

Additionally, there is a private way for construction companies to carry out high-value reuse, namely by contract.[72]

1.3.2 Defining Circular Construction

In this thesis, "construction" will be defined as "all buildings, existing and new, in residential and commercial construction and all objects in which construction products and materials are

[61] Backes 2017, p.44; *GCEP 2015,* p.60.
[62] Ibid.
[63] *Transitie-agenda* 2018, p.10.
[64] Backes 2017, p.61.
[65] *Green Paper Hoogwaardig Hergebruik Bouwproducten en -Materialen* 2021, p.4.
[66] Prescribed by Wm and WFD.
[67] ABRVS 15 January 2014, ECLI:NL:RVS:2014:65.
[68] Article 2.22 Wabo.
[69] Wet milieubeheer (Wm), *Stb*. 1979, 442.
[70] See paragraph 2.3.
[71] Ministry of I&W, LAP3, The Hague 2017, p.8.
[72] See interviews in Chapter 3 and Annex I.

or will be processed".[73] The extraction, processing and transportation of the CDW lead to excessive environmental impact.[74]

Circular construction is more than reusing CDW.[75] Three things should be kept in mind when constructing. First, the reduction of raw materials should be central, with opportunities for high-value use of CDW being decisive.[76] Next, one should consider whether the use of raw materials can be sustainable. This should involve using 'inexhaustible' materials.[77] Finally, the demand for the remaining required materials must be met efficiently.[78]

Circular construction is one of the five priorities of *GCEP 2015*.[79] In 2018, the Dutch government adopted a Transition Agenda for construction.[80] The Transition Agenda defines "circular construction" as "developing, using and reusing buildings, areas and infrastructure without unnecessarily depleting natural resources, polluting the living environment and affecting ecosystems. Building in a way that makes economic sense and contributes to the well-being of people and animals. Here and there, now and later".[81]

Cirkelstad defines "circular construction" as "the way of working in construction where only renewable and as many secondary materials as possible are used. In addition to new construction and demolition, this also involves maintaining, renovating and transforming the existing built environment".[82]

The definition of high-value use of CDW amounts to the same as discussed in paragraph 1.2.1.3, namely that plasterboard remains plasterboard.

[73] *Green Paper Hoogwaardig Hergebruik Bouwproducten en -Materialen* 2021, p.4.
[74] Ibid.
[75] *GCEP 2015,* p.61.
[76] Ibid*,* p.19.
[77] Ibid.
[78] Ibid*,* p.61.
[79] Ibid*,* p.23.
[80] Ibid*,* p.6.
[81] *Transitie-agenda* 2018, p.10.
[82] *Green Paper Hoogwaardig Hergebruik Bouwproducten en -Materialen* 2021, p.4.

1.4 What Is High-Value, Circular GW?

1.4.1 Characteristics Gypsum

The high-value, circular use of GW must be supported because of gypsum's characteristics. Gypsum provides a pleasant living environment through good acoustic, thermal and moisture-regulating characteristics. Gypsum is infinitely recyclable without loss of quality.[83] It is, according to Eurogypsum[84], a "fully recyclable and a "closed loop" material".[85]

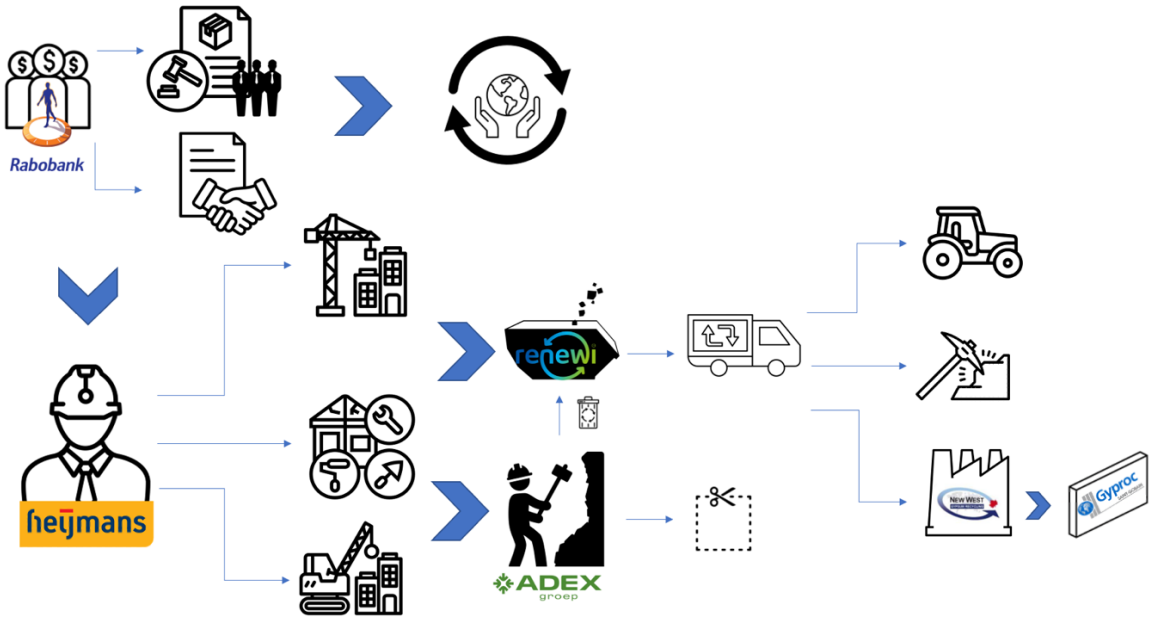
Gypsum can be used in different sectors, like agriculture and construction. In agriculture, gypsum improves the soil. Especially near the sea, gypsum can help against soil desalination.[86] In construction, gypsum is used as a construction material for plasterboard, plastering and cement.[87] Gypsum brings many benefits for sustainable and comfortable construction.[88]

1.4.2 Description GW-Lifecycle

To research how waste law can support a high-value, circular construction with GW, it is crucial to understand the GW-lifecycle. This lifecycle is based on interviews and a case-study.

The case-study originated from a project between Rabobank and Heijmans. Rabobank issued a tender for a renovation project in which circularity "had to play a role".[89] Heijmans won this tender procedure and thus started renovating. The plasterboards installed after the renovation are secondary plasterboards from other offices. Moreover, circularity played a role for other CDW such as concrete and insulation. This case sets an example for more high-value and circular construction with GW in the Netherlands.

[83] 'Gips', *knauf.nl*, last accessed 29 June 2023.
[84] The European manufacturers association for plaster products, see: *eurogypsum.org*, last accessed 29 June 2023.
[85] *Modern, comfortable, decarbonised and circular buildings* 2020, p.3.
[86] New West Gypsum Recycling, 28 April 2023
[87] *Modern, comfortable, decarbonised and circular buildings* 2020, p.1.
[88] Ibid.
[89] Rabobank, 19 May 2023.



This image illustrates the lifecycle of GW. First, an initiator (*Rabobank)* wants to construct, renovate or demolish a building. The initiator will contract a construction company (*Heijmans)*, through a tender procedure or directly. After contracting, the two companies collaborate on a plan for the project. This plan can include circularity targets.[90] Based on this agreement, the construction company will start working.

1.4.2.1 Construction

When constructing a building, contracting parties can agree to use recycled GW instead of primary plasterboard.[91] During construction, "cutting waste" can arise. The GW comes from trimming the plasterboards. These scraps end up in a container from a waste treatment company (*Renewi*). After transporting this container to a gypsum recycling company (*New West Gypsum Recycling)*, the GW can be recycled. Then, the secondary plasterboard will be produced (by Gyproc). If not brought to a gypsum recycling company, GW can also serve another (low-value) purpose, such as agriculture where GW is used to desalinate the soil or to backfill mines abroad.[92] These alternatives are not high-value but illustrate that GW is "used" one more time.[93]

[90] Parties can agree how they consider circularity decisive within a project. Other elements that may play a role include money, time and available materials/resources, see Chapter 3.

[91] Related to product law.

[92] New West Gypsum Recycling, 28 April 2023.

[93] However, it is in line with the Dutch legal definition of recycling in Article 1.1 Wm, see Chapter 2 ("another purpose").

1.4.2.2 Demolition

In demolition, a demolition company (*ADEX Group*) will demolish the building. This can be done circularly by first analysing if parts of the building can be dismantled (when desired between the contracting parties).[94] If there is nothing (more) to dismantle, the building will get demolished. If the plasterboard cannot be cut out (and reused), it will be recycled by the gypsum recycling company, which in turn send it to the plasterboard producer. If the contracting parties do not want to reuse or recycle the GW in a high-value, circular manner, the GW may serve another purpose, such as agricultural desalination or mine backfilling abroad.[95,96]

1.4.2.3 Renovation

Renovation may involve a combination of the consequences of constructing and demolishing a building.

1.4.3 Availability Gypsum

Gypsum is increasingly becoming scarce. To fill this "gypsum-gap", GW from construction, renovation or demolition projects should be recycled – as demonstrated in the above paragraph – to facilitate more availability. Besides recycled gypsum, natural gypsum and synthetic gypsum are used.[97] The main sources are natural gypsum and flue gas desulphurization (FGD) gypsum.[98]

Natural gypsum can be obtained from a few places on earth. It is brought to the surface via mines or surface excavation, depending on the depth.[99] Synthetic gypsum has been an important substitute for natural gypsum.[100] A variant of synthetic gypsum is FGD-gypsum. This is generated during the desulphurization of flue gases from power plants, which are fired with fossil fuels. Since the 1980s, gypsum has been created this way, reducing the need to rely on

[94] The ambition of contracting parties is important, see ADEX Group, 4 May 2023 and paragraph 4.2.
[95] Paragraph 3.2.1
[96] New West Gypsum Recycling, 28 April 2023.
[97] Ibid.
[98] 'Gips', *knauf.nl*, last accessed 29 June 2023.
[99] Ibid.
[100] Ibid.

natural gypsum.[101] However, with the transition towards green energy, these plants are closing, resulting in decreasing availability of FGD-gypsum.[102]

Natural gypsum and FGD-gypsum are decreasing in availability, so alternatives must be found.[103] The global need for gypsum will only increase.[104] Recycled GW can be an alternative. Recycled gypsum can be created by harvesting plasterboards before buildings are demolished and separating GW. Literature defines this as *urban mining*.[105] Urban mining is a process of converting discarded waste into secondary resources that can be utilisation sustainably. This approach helps to conserve natural primary resources and mitigate environmental issues caused by conventional methods of solid waste management.[106,107]

1.5 Interim Conclusion

Chapter 1 explored the implications of transitioning to a high-value circular economy for CDW, with a specific focus on GW. In doing so, the first sub-question was addressed. The objective of this chapter was mapping out the definitions and ambitions relevant to the research question and identifying any barriers relating to these definitions and ambitions.

Firstly, the definition of the circular economy was examined, revealing that it is a policy concept. However, this definition is ambiguous and subject to various interpretations. Notably, the reduction of CO2-emissions is not consistently included. The interviews confirm these findings, which will elaborated upon in Chapter 3 and Annex I. Chapter 4 provides recommendations on how to precisely define and achieve circularity.[108]

Furthermore, the definition of high-value is a crucial complement to circularity. If GW is not utilised in a high-value manner additional raw materials are required to produce plasterboards. High-value utilisation is based on the waste hierarchy. There are two options for plasterboard to be reused as plasterboard: either by cutting out and reusing the existing plasterboard or by recycling the GW to produce secondary plasterboard.

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[101] *Modern, comfortable, decarbonised and circular buildings* 2020, p.3.

[102] New West Gypsum Recycling, 28 April 2023; *Modern, comfortable, decarbonised and circular buildings* 2020, p.3; Onderzoek werkgelegenheidseffect van sluiting van kolencentrales in de keten van kolen (Rapportage aan Ministerie van Economische Zaken), bijlage bij *Kamerstukken II* 2016/17, 30196, nr. 505.

[103] Phosphogypsum is seen as a substitute because of the increasing scarcity of natural and FGD-gypsum, however recycled gypsum is a possibility. See: Haneklaus et al., *Resources, Conservation & Recycling* 2022/182, p.1-3.

[104] 'Mineral Commodity Summaries 2023', usgs.gov, last accessed 29 June 2023.

[105] Tejaswini et al., *Journal of Environmental Management* 2022/319, p.1.

[106] Ibid.

[107] Chapter 3 illustrates demolition companies engaging in urban mining.

[108] See Annex II.

The significance of transitioning to a high-value circular use of GW arises from the increasing scarcity of gypsum. Given its importance as a construction material and its full recyclability, the transition to a high-value circular use of GW is imperative.

Moving forward, Chapter 2 will delve into the relevant provisions of both EU- and national waste law. Within this legal framework, several barriers have been identified that impede high-value and circular utilisation of GW.

Chapter 2 – Legal Barriers To High-Value, Circular Construction With GW

2.1 Introduction

To know to what extent waste law can support a high-value, circular construction with GW in the Netherlands, it is important to know what legal waste law provisions apply to the GW-lifecycle.[109]

First, general requirements in waste law are discussed (2.2).[110] The Waste Framework Directive (WFD) and the European Waste Shipment Regulation (EWSR) are important waste law instruments. The WFD is an important tool for the qualification of waste, waste management and recycling (2.2.1). The EWSR plays an important role in transporting waste (2.2.2). These general requirements are discussed because their provisions and their explanation provide important information for understanding the specific legal requirements for the GW-lifecycle (2.3), which is based on the case-study.[111] The legal barriers deriving from the above will be evaluated (2.4). This Chapter concludes with an interim conclusion (2.5).

2.2 General Waste Law Requirements

General waste law must be analysed to understand to what extent it can support the high-value, circular construction with GW. The qualification of waste, the shipment of waste and recycling of waste are all legal acts subject to waste law. The WFD[112] and the EWSR[113] are key-instruments of EU waste law.[114] In the case-study, the construction and demolition of a building leads to secondary gypsum. To be able to qualify these substances as GW, it is crucial to look at relevant provisions. Additionally, the EWSR applies when GW is exported to the Belgian site of gypsum recycling company *New West Gypsum Recycling*.

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[109] The focus of this thesis excludes the discussion of product law, as it is not addressed in the interviews. Certain recommendations in H4 have implications that extend to product law. Then a brief line of thought is provided.

[110] While waste law encompasses various provisions, it is likely that EU regulations and directives include additional measures pertaining to waste. This thesis primarily focuses on the specific GW-lifecycle and the WFD and EWSR, other waste provisions will not be extensively examined.

[111] Paragraph 1.4.2.

[112] Directive (EU) 2018/851.

[113] Regulation (EC) 1013/2006.

[114] Laan 2022, p.309.

2.2.1 Waste Framework Directive

2.2.1.1 Ambitions and Developments

The WFD aims to improve waste management in the EU and stimulate sustainable materials management to protect the environment, safeguard people's health, use natural resources more efficiently, promote the circular economy and improve long-term competitiveness.[115]

The WFD has been amended several times.[116] The 2008-amendment revolved around protecting the environment and human health. This amendment aimed to adopt a clearer definition of "waste".[117] The 2018-amendment aimed the circular economy.[118] Waste policy should aim to reduce the use of resources and promote the practical application of the waste hierarchy.[119] The EC is currently working on revising the WFD to address the increasing amount of waste and inefficient waste management systems, focusing on textile waste and food waste.[120]

2.2.1.2 Definition Of Waste

2.2.1.2.1 Article 3 WFD

Waste law is applied when a substance qualifies as waste.[121] Article 3, paragraph 1, WFD defines waste as "any substance or object which the holder discards, intends to discard or is required to discard".

Since 2008 this definition has remained unchanged. However, the ambition for a circular economy has increased.[122] The 2018-Amendment aimed to improve waste management to promote the circular economy.[123] The definition remained unchanged even though the Amendment emphasised the importance of circularity.

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[115] Backes 2020, p.328.
[116] Ibid, p.328-343.
[117] Directive (EC) 2008/98, recitals 2, 4, 5, 8 and 22.
[118] Ibid, recital 3.
[119] Backes 2020, p.328-329.
[120] 'Waste Framework Directive', *environment.ec.europa.eu*, last accessed 29 June 2023.
[121] Article 2 WFD.
[122] Laan 2022, p.313.
[123] Directive (EU) 2018/851, recital.

Waste law is an area of law that is influenced by case-law.[124] Case-law also revealed much ambiguity regarding the definition of waste. Whether something qualifies as "waste" is difficult to assess and should be considered based on case-specific circumstances.[125] In the end, the burden of proof to not qualify a substance as waste lies with companies.[126] It is therefore important whether or not the holder of the material documents the substance as a waste.[127,128]

The definition of waste is interpreted broadly. Consequences of this qualification are the application of the provisions for permitting, monitoring and enforcement.[129,130]

2.2.1.2.2 Article 1.1 Wm

The Dutch legislator implemented this definition in Article 1.1, paragraph 1, Wm. It defines waste as "all substances, preparations or objects, which the holder discards, intends to discard or is required to discard".[131] The content of the definition at a national level is similar to the one at EU-level. The definition of waste consists of three parts. The first part – "substance, preparation or article" – must be interpreted as broadly as possible.[132] The second part – "holder" – has not been further defined by the Wm, so the EU-interpretation applies. Article 3, paragraph 6, WFD defines "waste holder" as the waste producer or the natural or legal person who is possesses the waste. The third part – "dispose of (intends or is required to)" – is the element that is elaborated in case-law.[133] It results from case-law that this should not be interpreted restrictively.[134,135]

To coordinate and plan waste management in the Netherlands, the Dutch regulator has adopted the LAP3.[136] The LAP3 must be considered when an authority exercises a Wm-competence.[137] The LAP3 is also an assessment framework when deciding on environmental

[124] Laan, *M&R* 2020/3, p.12-17.
[125] CJEU 15 June 2000, C-418/97 and C-419/97 (*ARCO Chemie*), par. 73, 88 and 97.
[126] CJEU 3 October 2013, C-113/12 (*Brady*), par. 61-65.
[127] LAP3, Section B.6.4.5.
[128] Sluiter, *PRO* 2018/4, p.4.
[129] Laan 2022, p.311.
[130] Specific waste law obligations in paragraph 2.3.
[131] Directive (EC) 2008/98.
[132] Tieman 2003, p.185-186.
[133] Sluiter, *PRO* 2018/4, p.5.
[134] CJEU 24 June 2008, C-188/07 (*Commune Mesquer*), par. 38 and 39.
[135] Sluiter, *PRO* 2018/4, p.8.
[136] Derde Landelijk Afvalbeheerplan (LAP3), *Stcrt*. 68028.
[137] Article 10.14 Wm.

permits for establishments.[138] The LAP3 aims to transform the economy into a circular economy, but not at all costs.[139]

The LAP3 consists of two parts, the policy-framework and specific sector plans. The LAP3 policy-framework outlines the national policy on waste prevention and management, the objectives of the waste policy, definitions, and scope. Additionally, it provides insight into monitoring and enforcement. It also elaborates on how high-value recycling can be facilitated, based on the waste hierarchy.[140] The LAP3 sector plans consist of specific plans for specific sectors and determine a minimum standard for those specific sectors of waste.[141,142] Gypsum is described in a Sector Plan.[143] If GW does not appear in a monostream but as a mixed stream, there is a Sector Plan for mixed CDW.[144] In 2025, the LAP3 will be succeeded by the Circulair Materialenplan (*Circular Materials Plan*, CMP1).[145] The relevant parts of the LAP3 are discussed in paragraph 2.3, which analyses the specific legal obligations of the GW-lifecycle.

2.2.1.3 End-Of-Waste Status

2.2.1.3.1 Article 6 WFD

As soon as a substance qualifies as "waste", waste law applies. To be able to reuse the substance that once qualified as waste, it must no longer qualify as waste. This is when all criteria of Article 6 WFD are met. This article provides the criteria for the "End-Of-Waste Status" (EoW-status).[146] These exceptions were included in the 2008-Amendment.[147] The adoption of this article aimed to facilitate a level-playing field and promote circular material flows.[148] In contrast, it led to confusion.[149]

[138] Article 2.14, paragraph 1, subparagraph b, Wabo.
[139] LAP3, section A.4.2.5.
[140] LAP3, section A.4.2
[141] LAP3, section E.
[142] LAP3, section A.4.2.4.
[143] LAP3, Sectoral Plan 31 "Gypsum".
[144] LAP3, Sectoral Plan 28 "Mixed CDW".
[145] 'Kamerbrief over Nota van Antwoord 2e wijziging LAP en Circulair Materialenplan 1', *rijksoverheid.nl*, last accessed 29 June 2023.
[146] This is one out of two exceptions, Articles 5 and 6 WFD.
[147] Laan 2022, p.310.
[148] Johansson, *Environmental Policy and Law* 2023/4, p.2.
[149] Ibid.

As mentioned, Article 6 WFD involves the assessment of EoW-status. Waste ceases to be waste when it has undergone a recovery, including recycling, and complies with specific criteria.[150] One of the criteria is that the use of the substance created by or after recovery "overall does not adversely affect the environment or human health".[151] Article 6, paragraph 1, WFD obliges Member States to take appropriate measures to ensure that waste ceases to be waste.[152] Furthermore, Member States may decide on a case-by-case basis whether a certain waste is no longer waste.[153]

2.2.1.3.2 Article 1.1, Paragraph 6, Wm

The EoW-status is implemented in Article 1.1, paragraph 6, Wm. Substantially, the articles are similar.[154]

As mentioned above, Member States can set EoW-criteria for specific substances.[155] The Dutch government has done so by adopting the Regeling vaststelling van de status einde-afval van recyclinggranulaat *(Order Determining End-of-Waste Status of Recycling Granulate).*[156]

2.2.2 European Waste Shipment Regulation

As seen in paragraph 1.4.2, GW is exported to *New West Gypsum Recycling* in Belgium. The export of GW is subject to the EWSR. The specific consequences and necessary permits are assessed in paragraph 2.3.

2.2.2.1 Ambitions and Developments

The EWSR[157] is a regulation aiming to protect the environment. The EWSR is currently being revised, because of the improper waste management leading to severe consequences for the

[150] Laan, *M&R* 2020/3, p.12-17.
[151] Article 6, paragraph 1, subparagraph d, WFD.
[152] Johansson, *Environmental Policy and Law* 2023/4, p.12.
[153] Article 6, paragraph 2, WFD.
[154] Sluiter, *PRO* 2018/4, p.4-5.
[155] Article 6, paragraph 4, WFD.
[156] Regeling vaststelling van de status einde-afval van recyclinggranulaat van 5 februari 2015, *Stcrt*. 2015, 3498.
[157] Regulation (EC) 1013/2006.

environment and human health.[158] The objective of this proposal is to make the transportation of waste for recycling purposes easier while ensuring sustainable management of waste shipped outside the EU. Furthermore, these measures would promote the uptake of recycled materials within the EU. In conclusion, the EC's proposal seeks to encourage the use of recycled materials, foster a circular economy, and ensure sustainable waste management both within and outside the EU.[159]

2.2.2.2 Provisions Waste-Shipment

The EWSR affects international trade.[160] The EWSR regulates shipments of (non-)hazardous waste within, into and out of the EU.[161] The EWSR aims to strengthen, simplify and clarify waste shipment.

For the applicability of the EWSR, it is important to know that every action with waste must be qualified as disposal or recovery. "Recovery" is any action with waste resulting in a useful purpose by replacing other materials that would otherwise have been used or preparing the waste for a specific function. [162] "Disposal" is any action which is not recovery.[163]

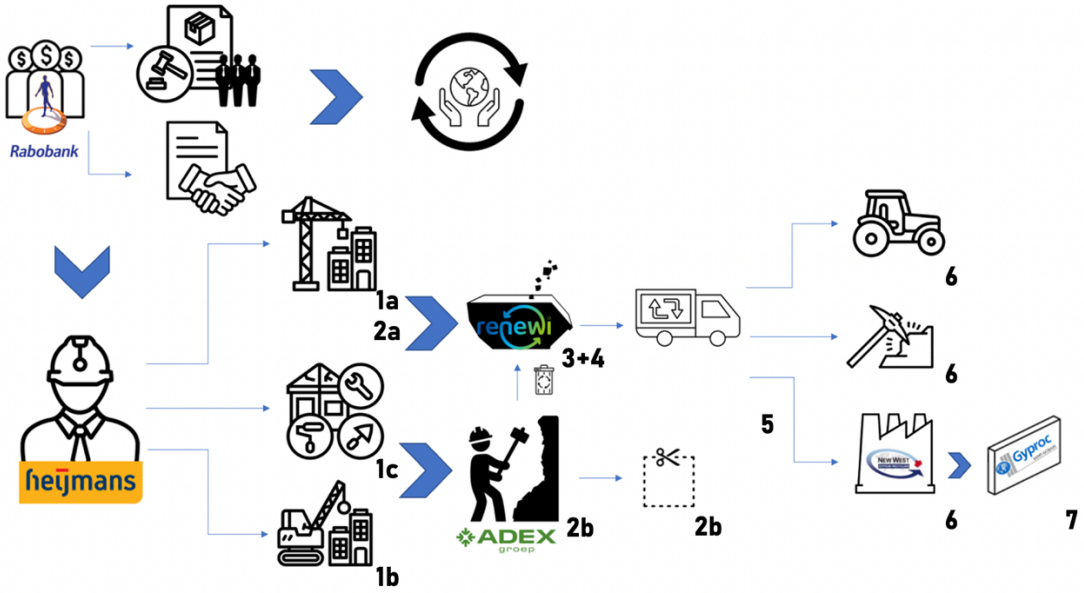
The reason for shipment abroad (disposal or recovery) is important to determine which procedure of the EWSR applies. The EWSR has three lists. The green list (Annex III, IIIA and IIIB) is the list of waste that must be accompanied by certain information. The orange list (Annex IV and IVA) is the list of wastes subject to the procedure of prior written notification and consent. Finally, Annex V, the wastes which are subject to an export ban.

The EWSR is directly applicable. Nationally, the EWSR is shaped by Title 10.7 Wm. The EWSR has been implemented by the "Waste Shipment Order".[164] Besides the Wm, the LAP3 is also essential.

[158] COM(2021)709.
[159] 'Revision of the EU's Waste Shipment Regulation', *youtube.com*, last accessed 29 June 2023.
[160] Regulation (EC) 1013/2006, recital 1.
[161] Article 1 paragraph 1 EWSR.
[162] Article 3, paragraph 15, WFD; Annex II B of the WFD.
[163] Article 3, paragraph 19, WFD; Annex II A of the WFD.
[164] Regeling EG-verordening overbrenging van afvalstoffen, *Stcrt*. 2007, 130; Competence in Article 10.56 Wm.

2.3 Specific Legal Requirements GW-Lifecycle

As mentioned in Chapter 1, the main research question revolves around a case-study based on six interviews.[165] This paragraph focuses on the waste law provisions and the specific requirements imposed by Dutch legislation applicable to the GW-lifecycle.



In general, any actor that performs operations with waste must consider duty-of-care provisions protecting the environment. Article 1.1a Wm contains a general duty of care and Article 10.1 Wm consists of a general duty of care for waste and a specific duty of care for those from whom waste is generated. Waste processing companies and other actors face waste obligations.[166]

Step 1a – Construction

Before starting construction, a permit for construction is mandatory.[167] This permit is granted when the criteria in article 2.10 Wabo are met.[168] When the permit is granted, the construction company Heijmans starts construction. Two days before starting construction works, the authorities must be notified about the start of construction.[169,170]

[165] These interviews will be discussed in Chapter 3 and Annex I.

[166] LAP3, section C.

[167] Article 2.1, 2.2 and 2.10 Wabo.

[168] If the spatial zoning plan is not complied with, a permit for exemption can be applied (Article 2.10, paragraph 1, subparagraph c and 2.12 Wabo).

[169] Article 1.25 Bouwbesluit 2012.

[170] Section 1.6 Bouwbesluit 2012 contains further procedural construction provisions.

Furthermore, the Building Decree 2012 contains regulations for safety, health, usability, energy efficiency and the environment in buildings. It also includes requirements for the use of construction materials, which may include plaster.

Step 1b – Demolition

The transition towards a more circular use of GW pursues that before actual demolition, the construction is dismantled. This involves removing plasterboard in its entirety from the building walls and reusing it as such before the demolition. Dismantling has not yet been legally established. In Chapter 3, it will be demonstrated that the interviewed the demolition company ADEX Group takes a cautious approach and meets all demolition obligations, even for dismantling. If no more materials can be dismantled or if circular demolition was not aspired in the specific project, the demolition company ADEX Group will demolish the existing construction.

"To demolish" means to demolish in whole or in part.[171] Demolition must be notified to the municipality if more than 10m^3 of waste is released.[172] This notification shall be submitted in writing to the competent authority at least four weeks before the start of the demolition.[173,174] Two working days before the actual start of demolition, the competent authority shall again be notified.[175]

In some cases, notification is not sufficient. Then legislation prescribes permits requirements for demolition.[176] If the construction is on a local, provincial or national monument list, a demolition notification and an environmental permit for demolition of a monument are mandatory. An environmental permit is also mandatory if the structure is in a protected town or village scape, or the spatial zoning plan requires an environmental permit.

Step 1c – Renovation

Renovation may involve a combination of the provisions of construction or demolition, depending on the specific project.

[171] Article 1.1 Wabo.
[172] Article 1.26 Bouwbesluit 2012.
[173] Ibid.
[174] Section 1.7 Bouwbesluit 2012 contains further procedural provisions.
[175] Article 1.33 Bouwbesluit 2012.
[176] Article 2.1, paragraph 1, subparagraph h, f and g, Wabo.

Step 2a – Qualification Waste

When the GW is qualified as waste as in Article 3 WFD and Article 1.1 Wm, waste law (WFD and EWSR) applies. During construction, the "cutting waste" that emerges from trimming the plasterboards to make them fitting can be qualified as GW.

Step 2b – Qualification Waste

In the case of dismantling (urban mining), the released, reusable materials probably cannot qualify as GW, so waste law provisions should not apply. In the case of demolition, the gypsum that is released is GW. Then the WFD and EWSR apply.

Step 3 – Monostream GW On The Construction Site

In construction and demolition projects, GW is available. The Building Decree 2012 and the Order Building Decree 2012 stipulate that waste released during construction and demolition must be separated at the site and separated if it is more than $1m^3$.[177] Legal provisions apply to waste separation.[178] Hazardous waste must always be separated. Non-hazardous waste must be separated when the LAP3 requires this.[179]

GW must be collected as a monostream on the construction site in the container of the waste treatment company like *Renewi.*[180] There is obligation to separate GW as a monostream on the construction or demolition site, when there is more than $1m^3$.[181] It is not only convenient to separate GW for recycling, but also because GW can harm the quality of other CDW.[182] Waste collectors must keep the monostream a monostream.[183]

If there is no monostream of GW, waste processing company *Renewi* can always separate the mixed CDW afterwards.[184] The activities of a waste processing company are focused on the separate collection, sorting/separation and recycling of waste materials with the aim of recycling as much waste as possible at the highest possible value.[185]

[177] LAP3, Sector Plan 31, p.5; Article 4.1 Regeling Bouwbesluit 2012.
[178] Article 2.12 Barim; Article 2.9 Activiteitenregeling milieubeheer (Rarim), *Stcrt*. 2007, 223.
[179] LAP3, Section B.3.4.
[180] LAP3, Sector Plan 31.
[181] Articles 8.8 and 9.9 Bouwbesluit 2012.
[182] LAP3, Sector Plan 31, p.4.
[183] Article 10.48, paragraph 1, Wm; Article 1b Besluit inzamelen afvalstoffen (Biaf), *Stb*. 2004, 127.
[184] LAP3 Sector Plan 28.
[185] Article 1.1 lid 5 Wm; LAP3, Section C.5.

Step 4 – Waste Processing Company

"Establishments" processing waste are subject to a permit requirement.[186] Such establishments usually have specific requirements for the application for an environmental permit. [187,188]

Companies involved in waste management are subject to permit requirements under the environmental permit in Article 2.1, paragraph 1, subparagraph e, Wet Algemene Bepalingen Omgevingsrecht (*General Environmental Provisions Act,* Wabo)[189], unless they fall under Article 28.10 Besluit omgevingsrecht (*Environmental Law Decree,* Bor)[190]. This Article provides a list of waste activities that do not require an environmental permit. A waste processing company like *Renewi* needs an environmental permit for the establishment and operation of the waste treatment plant.[191]

The Activiteitenbesluit Milieubeheer (*Environmental Management Activities Decree*, Barim)[192] provides regulations for the storage, handling, and processing of gypsum and waste materials that contain gypsum. Article 2.14a Barim states that the competent authority is competent to establish specific rules for gypsum and other mentioned materials to prevent or mitigate negative environmental effects. These rules apply when waste materials, including GW, are utilised within a facility for the production, assembly, or repair of products or their components.

Waste cannot be dumped or burned outside an establishment[193], there is a ban on the disposal of industrial and hazardous waste[194] and several reporting and registration obligations apply.[195] Infringing these provisions and regulations can lead to serious penalties.[196]

Step 5 – Monostream GW To Gypsum Recycling Company

The container with monostream of GW will go to a gypsum recycling company (*New West Gypsum Recycling)*. The EWSR applies because their site is in Belgium. The LAP3 Sector Plan 31 Gypsum states that "GW exported for recycling is, in principle, permitted unless a certain

[186] Article 2.1, paragraph 2 and Category 28, Annex I, part c Bor; Section 2.5 Barim.
[187] Regeling Omgevingsrecht (Mor), *Stcrt*. 2010, 7184.
[188] Articles 4.7-4.11 Mor.
[189] Wet algemene bepalingen omgevingsrecht (Wabo), *Stb*. 2009, 570.
[190] Besluit omgevingsrecht (Bor), *Stb*. 2010, 144.
[191] Article 2.1, paragraph 1, subparagraph e, Wabo.
[192] Activiteitenbesluit milieubeheer (Barim), *Stb*. 2007, 415.
[193] Article 10.2 Wm.
[194] Article 10.21 Wm.
[195] Article 10.40 Wm.
[196] For example: Court of Appeal Den Bosch 15 November 2017, ECLI:Nl:GHSHE:2017:4849.

amount of the shipped waste is ultimately landfilled or otherwise disposed of that the degree of recycling does not justify the shipment and/or unless the degree of recovery is lower than is common when processing that waste in the Netherlands".[197]

Non-recyclable GW may also be exported (the non-recyclability is explained in step 5). Recyclable GW may not be exported if it is not recycled but used for another form of recovery, such as backfilling.[198]

GW as a monostream is covered by the Euralcode 170802.[199] Different procedures apply to these monostreams of GW, depending on whether they appear on the green list (Annex III) or the orange list of the EWSR.[200] Both lists have different procedures. Gypsum with Euralcode 170802 is listed on the green list of the EWSR because it corresponds to waste B2040 in Annex IX EWSR. This is part of the green list covered by Annex III EWSR. These gypsum streams can be exported to Member States without notification or registration. Only the general information requirement applies.[201] The general information listed in Annex VII EWSR must be provided and there must be a legally binding contract between the waste holder and collector.[202]

If GW is in a mixed CDW container, the orange list procedure can be followed because unsorted waste does not appear on any of the EWSR lists. In principle, prior written consent and notification are required for imports and exports for recovery.

Step 6 – Recycling GW

When GW arrives at *New West Gypsum Recycling*, it is cleaned and recycled.

If the company is a recycling company operating within the Dutch jurisdiction, the same requirement for an environmental permit mentioned in the previous paragraph applies. However, since the company is based in Belgium and subject to Belgian law, it falls outside the scope of this thesis.

Article 1.1 Wm defines recycling as "the recovery operation by which waste materials are reprocessed into products, materials or substances, for the original purpose *or a different*

[197] LAP3, Sector Plan 31, p.2.

[198] Ibid.

[199] Euralcode 1708 represents a general category for gypsum-based construction materials, 170801 is gypsum-based construction materials that are contaminated with hazardous substances and 170802 is residual category, encompassing all other gypsum-based construction materials that do not fall under the contaminated category.

[200] Paragraph 2.2.2.

[201] Article 3, paragraph 2, subparagraph a, EWSR.

[202] Article 18 EWSR.

purpose, including the reprocessing of organic waste materials, and excluding energy recovery and reprocessing into materials intended to be used as fuel or backfill".

The interviews provided there being two frequently used alternatives for using GW, namely agriculture and mining.[203] Regarding agriculture, the Uitvoeringsregeling Meststoffenwet (*Fertiliser Act Order*) facilitates the option of using GW on farmland.[204] There should be alternatives for desalination of farmland instead of using perfectly recyclable construction materials. With regards to export, the Netherlands should want to interpret "recovery" in the EWSR as high-value and circular as possible. Member States can influence these definitions.

In principle, GW is perfectly recyclable. If GW is sufficiently clean and dry, there are no technical barriers to using GW for processing GW for the production of secondary plasterboard.[205]

The Netherlands decides whether GW is recyclable. According to the LAP3, GW is not recyclable if recycling is not possible "due to the nature or composition of the waste "or if the recycling costs exceed €205,-/tonne.[206] Then low-value processing is allowed. An exemption from the landfill ban[207] must then be obtained.[208] If low-value application is opted abroad, the LAP3 cannot stop it because it is a national policy-document.

After recycling the GW, the GW ceases to be waste and obtains the EoW-status.[209]

Step 7 – GW To Secondary Plasterboard

Gyproc creates secondary plasterboards from recycled GW. If the company is a recycling company operating within the Dutch jurisdiction, the same requirement for an environmental permit mentioned in the previous paragraphs applies, regarding the production of the plasterboards. However, since the company is based in Belgium and subject to Belgian law, it falls outside the scope of this thesis, which focuses on the Dutch regulatory framework.

This thesis does not focus on the product requirements in product law for these new plasterboards. It is important to accentuate that not all GW will be turned into secondary

[203] New West Gypsum Recycling, 28 April 2023.
[204] Uitvoeringsregeling Meststoffenwet, *Stcrt*. 2005, 226.
[205] LAP3, Sector Plan 31, p.5.
[206] Ibid, p.1.
[207] Article 1, paragraph 1, category 35, Besluit stortplaatsen en stortverboden afvalstoffen (Bssaf), *Stb*. 1995, 345.
[208] LAP3, Sector Plan 31, p.6.
[209] Article 6 WFD and 1.1, paragraph 6, Wm.

plasterboard. Only 30% of recycled gypsum can currently be used in the production of secondary plasterboards because of technological reasons.[210]

2.4 Legal Barriers

2.4.1 Criticism General Waste Law Requirements

2.4.1.1 Criticism WFD

Definition Of Waste

Article 3 WFD and Article 1.1 Wm define waste. Waste is generally defined as "all substances, preparations or objects which the holder discards, intends to discard or is required to discard".

This definition is not unambiguous. It is important to be able to apply a clear definition of waste because the qualification of substances as waste has implications. Companies must ensure that certain permit requirements regarding waste are met, which are stringent because waste can harm the environment and human health. This also involves additional costs for permits, acceptance procedures and registration.[211]

Fundamentally, it is also striking that the definition of waste focuses on the waste holder, and not on what a waste user could do with the waste. The waste user must prove that waste can serve as a resource, this requires more effort than merely discarding.[212] Waste still has a negative connotation. The person discarding waste has little incentive to do so carefully.[213]

The definition of waste has been the subject to much criticism.[214] Laan believes that the definition of waste should be revised by restricting the scope.[215] When a substance qualifies as waste, governments must deal with permits, supervision and enforcement, and also companies must obey administrative obligations and extra costs.[216] The definition also is casuistic, which does not serve legal certainty, in particular companies are left guessing whether they are dealing with waste.[217] Additionally, Tieman believes that the definition of waste does not stimulate

[210] Gyproc, 21 April 2023.
[211] Laan 2022, p.311.
[212] Van Ewijk and Stegeman, *Waste Management* 2020/105, p.4.
[213] Ibid.
[214] Tieman 2017, p.17-64.
[215] Laan 2022, p.310.
[216] Ibid, p.310-311.
[217] Laan 2022, p.310.

circularity, because of its broad scope.[218] The broad scope of the definition of waste makes it difficult to promote the goals of a circular economy. Caution can be applied to all substances, also harmless substances.[219] Furthermore, Backes indicates that waste law is an "unsafe area". He refers to the ambiguity of the definition of waste. This unclarity is a barrier to the transition to a circular economy.[220] Lastly, Hoernig confirms that the definition of waste gets in the way of developing businesses going circular.[221]

End-Of-Waste Status

As discussed in paragraph 2.2.1.3, an exception to the broad definition of waste is formulated in Article 6 WFD. The definition of EoW does not come without problems either. Literature demonstrates that the criteria "must be a specified use and a market for the waste" are too narrow. Why does it focus on the market, but not on the circular and resource impact of the product or waste?[222]

Furthermore, although Article 6 WFD is appreciated as a "much-needed tool for circular material flows", it is not always appropriate how the tool is used. Clear guidelines are needed and less subjectivity within the definitions (which also applies to the definition of waste).[223]

2.4.1.2 Criticism EWSR

For the EWSR, it is not possible to ban the export of GW. Member States may give different qualifications to a shipment of waste, hence it is not always straightforward whether the shipment is meant as recovery or disposal.

It appears that Germany considers filling mines with GW "recovery", whereas Belgium does not and considers it "disposal".[224] Article 28, paragraph 3, EWSR states that if the competent authorities of the exporting state and the importing state cannot agree on the classification of the waste treatment operation as disposal or recovery, the disposal provisions should be applied. This is unfortunate because disposal is applied where it could have been recovery if Member States were aligned.

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[218] Tieman 2017, p.17.
[219] Johansson, *Environmental Policy and Law* 2023/4, p.1.
[220] Backes 2017, p.24.
[221] Hoerning, *Environmental Law Review* 2022/24, p.11-127.
[222] Johansson, *Environmental Policy and Law* 2023/4, p.13.
[223] Ibid.
[224] New West Gypsum Recycling, 28 April 2023.

2.4.2 Criticism On Specific Legal Requirements

This paragraph will reflect on the barriers to the specific legal requirements in paragraph 2.3.

Step 1a demonstrated the specific legal requirements for construction. The Building Decree provides various requirements, for example, requirements regarding building safety. Perhaps the Building Decree 2012 could include a requirement for recycled materials. Step 1b discussed demolition, which are in principle permit-free but require a notification to the authority. However, the stage before demolition – dismantling – remains unmentioned in the law. This gap in the law was also discussed in the interview with the demolition company ADEX Group.[225] In practice, the dismantling phase leads to uncertainty.

Step 2 addressed the definition of waste in Article 3 WFD and Article 1.1 Wm. As already discussed in paragraph 2.4.1.1, the definition of waste is broad and hinders circularity. The definition does not focus on how to use the waste as a resource but lingers on "discarding". In practice, this definition is also perceived as being too broad and unclear.[226]

Construction projects (step 2a) release cutting waste, which is (most likely) to be qualified as waste. Demolition projects (step 2b) are not as clear, it is more nuanced. In some (circular) cases, dismantling precedes demolition. In my opinion, it is incorrect to qualify the substances released during dismantling as waste. It is merely the reusing of a substance, going from building A to building B.[227] However, the gypsum from demolition qualifies as waste. I do not think it is detrimental to cutting waste and demolition waste to be qualified as waste, it offers opportunities to bring it into the legal framework of recycling.

Step 3 indicates the requirement of separating waste when there is more than $1m^3$ of a particular stream of waste. However, the LAP3 continues to allow for a mixed container with CDW in Sector Plan 28. Additionally, the LAP3 has a separate Sector Plan 31 for gypsum, stating that GW is perfectly recyclable, and it is even disadvantageous for other CDW to be mixed. Moreover, once there is a monostream, this monostream should be retained. When GW constitutes of more than $1m^3$, it must be separated. The $1m^3$-requirement demonstrates in

[225] Chapter 3, paragraph 3.2.3.1 and Annex I.
[226] Ibid.
[227] See interviews in Chapter 3.

practice that a considerable amount of GW still ends up in CDW containers. Some interviewees suggest that there should be a ban on mixed containers, so all GW is utilised and will be recycled.[228]

Step 4 deals with the transport of a monostream of GW to the gypsum recycling company *New West Gypsum Recycling*. Because it is exported, the EWSR applies. Paragraph 2.4.2.1 already discussed the general barriers to the EWSR. The different interpretations of the EWSR amongst Member States also are a barrier in the interviews.[229]

Step 5 involves Gyproc making plasterboards with recycled GW. The LAP3 makes a distinction in Sector Plan 31 between recyclable and non-recyclable GW. In the LAP3, GW is considered non-recyclable if it is too expensive to recycle or when it is non-recyclable "due to its nature or composition". An economic reason is given for non-recyclability. The prevailing economic interest is also reflected in the interviews. Waste goes to the cheapest point. In the end, the linear economy pays for the circular economy. Moreover, paragraph 2.3 discussed that LAP3 does not pursue a circular economy at any cost. It is understandable from the company's perspective to not cross a budgetary line, but ultimately it is peculiar that economic reasons play a role in whether GW is recyclable.

Moreover, step 6 addresses the definition of recycling. Recycling is a form of "recovery". The definition in Article 1.1 Wm states that the recycled substance can be used for *another purpose*. This is unfortunate because as seen in Chapter 1 this would lead GW to go to other sectors, like agriculture. Eventually, GW will be needed for construction again, so constructors must resort to raw gypsum because the GW has already been used in agriculture. The interviews also demonstrate that too often GW goes to other sectors than construction, because the recycling process is less intense and less expensive.

2.5 Interim Conclusion

Chapter 2 has addressed the legal barriers that exist for waste law to support the transition to a high-value, circular use of GW. The legal barriers identified in this Chapter can be summarized as unclear definitions and lenient regulations.

[228] See Chapter 3.
[229] Paragraph 4.2.1.4.

Regarding definitions, it appears that the definition of waste in the WFD (Waste Framework Directive) does not serve circularity. “Waste” is defined in Article 3 WFD. However, this definition is ambiguous, and courts must intervene to interpret this. Several attempts have been made to clarify the distinction between waste and non-waste, but clarity has not yet been achieved. The EoW-status is also unclear. The definitions from the EWSR for “recovery” and “disposal” do not lead to a uniform understanding whether the export of GW for landfilling is “disposal” or “recovery”. The discretion given to Member States leads to discrepancies. Additionally, the definition of recycling in the Wm is not sufficiently focused on the high-value utilisation of GW, as it facilitates alternative applications such as agriculture. Finally, the cost of recycling is given a decisive role in determining the recyclability of GW, which should not be a condition.

Regarding lenient legislation, the following points are raised. The Dutch law already requires that waste must be sorted and collected as a monostream if it exceeds 1m^3. The possibility of not separating it remains, facilitated by the Sector Plan for Mixed CDW. The interviews in Chapter 3 reveal that there is still too much GW ending up in mixed containers. Additionally, the Building Decree 2012 should provide more guidance towards circularity as a requirement in construction.[230]

Chapter 4 addresses the recommendations for these legal barriers.

[230] Since waste law is the focus of this thesis, this will only be touched upon briefly.

Chapter 3 – Practical Barriers To The High-Value, Circular Construction With GW

3.1 Introduction

This Chapter focuses on the practical barriers to a high-value, circular construction with GW. It is based on interviews with six companies involved in construction, renovation and demolition projects. The interviews with these companies have been conducted as a result of the conversations with the construction company Heijmans regarding the case-study described in the introduction. An overview of the GW-lifecycle based on the case-study has been given in paragraph 1.4.2.

First the practical barriers to the process lifecycle of GW as risen in the interviews will be discussed (3.2).[231] This paragraph provides an overview of the main practical barriers, divided into three categories. Some barriers overlap with the legal barriers already discussed in paragraph 2.4. This chapter concludes with an interim conclusion (3.3).

3.2 Practical Barriers To A High-Value, Circular GW-Lifecycle

This paragraph is a summary of the barriers discussed in the interviews. There are three categories of barriers. First, the barriers caused by the company's ambition and the contracting party's ambition to construct circularly will be discussed (3.3.1), then the market barriers (3.3.2), and lastly the barriers caused by the ambition of the Dutch government (3.3.3).

3.2.1 Corporate Ambition

3.2.1.1 Company's Circular Ambition

First, the barriers caused by the company's ambition to construct circularly will be discussed. For companies that want to shape their targets towards the Dutch government's goals of being fully circular by 2050[232], there is insufficient clarity on how to reach this target.[233] It is not clear

[231] An extensive overview of the interviews is included in Annex I.
[232] See paragraph 1.2.1.2.
[233] Rabobank, 19 May 2023

what standards should be used and how the percentages should be achieved. In addition, different companies interpret "circularity" differently.[234] On the one hand, circularity is interpreted as merely reusing GW, even when it serves another purpose in agriculture or mining. On the other hand, circularity is interpreted as ensuring that an old plasterboard becomes a new plasterboard.

Because of this opening, GW disappears, some kind of "gypsum-leakage" Given the scarcity of gypsum mentioned in paragraph 1.4, this is unfortunate.

The ambiguity of the terms also causes companies' ambitions to remain vague. If a company itself says "80% of our waste is recycled circularly", it could also be that 80% is used in agriculture.

One example illustrating the potentially misleading nature of recycling percentages is the case of CDW in the Netherlands. While the Netherlands boasts a 97% recycling rate for CDW, it is crucial to understand that this recycling is low-value. This is because under the Besluit Bodemkwaliteit (*Soil Quality Decree*)[235] and Article 2, paragraph 1, subparagraph 2, Besluit vrijstelling stortverbod buiten inrichtingen[236] (*Exemption from Dumping Ban outside Establishments Decree*) CDW may be used for soil applications.[237] Although the recycling rate may be high, it is not high-value. It is crucial to adopt more nuanced targets, including a differentiation specifically aiming for high-value utilisation.[238] The Besluit Bodemkwaliteit does not apply to CDW from residential and commercial CDW. Nevertheless, this is a clear example of misleading percentages.

Also, there is opening to achieve the percentages because of different measurement methods.[239] It is therefore difficult to interpret the percentages, and they can also be interpreted freely. These targets should therefore be read with a grain of salt.[240]

3.2.1.2 Differing Circular Ambitions Contracting Parties

[234] New West Gypsum Recycling, 28 April 2023; Renewi, 28 April 2023.

[235] Besluit van 22 november 2007, houdende regels inzake de kwaliteit van de bodem (Besluit Bodemkwaliteit), *Stb*. 2007, 469.

[236] Besluit vrijstelling stortverbod buiten inrichtingen (Bvsbi), *Stb.* 1997, 664.

[237] See the exception in Article 10.2 Wet milieubeheer (landfill ban) and Article 2 paragraph 1 subparagraph 2 Besluit vrijstelling stortverbod buiten inrichtingen (exception when Besluit Bodemkwaliteit applies).

[238] Backes and Boeve 2018, p.59.

[239] Heijmans, 19 April 2023.

[240] New West Gypsum Recycling, 28 April 2023.

Second, the barrier that contracting companies encounter when their ambition to construct circularly differs. Not all companies are equally progressive. When companies collaborate on contracts for construction, renovation or demolition projects, their ambitions might not be aligned. Thus, a barrier to developing the circular transition is the ambition of the contracting parties and the dependency of the contracting parties when cooperating.[241]

3.2.1.3 Information and Transparency

After concluding a contract, the other party cannot verify whether the project continues to be circular. For example, a construction company and a demolition company agree to cooperate on a renovation project and decide to do it as circular and high-value as possible. The demolition company dismantles the building first and only demolishes what could not have been saved when dismantling. But the waste, resulting from demolishing, eventually ends up in agriculture or mining. The construction company cannot control where the GW goes. There is (too) little transparency, which should be a must.[242] The government should provide guidelines on how companies should approach circularity.[243] Then the companies would already be more aligned and assess the same approach.

3.2.2 Market Barriers

3.2.2.1 Price Of GW

Third, the barriers in the market for companies to not use secondary gypsum materials in a high-value way. Waste always goes to the cheapest point.[244] It is cheaper not to recycle GW but to use it to desalinate agricultural land or to fill mines abroad. Therefore, much GW disappears, and does not end up high-value. Also, virgin gypsum is currently cheaper, so there is no incentive for high-value circularity.[245]

[241] Heijmans, 19 April 2023; Rabobank, 19 May 2023; Renewi, 28 April 2023.
[242] Heijmans, 19 April 2023; Renewi, 28 April 2023.
[243] Rabobank, 19 May 2023.
[244] New West Gypsum Recycling, 28 April 2023.
[245] Heijmans, 19 April 2023; Renewi, 28 April 2023; New West Gypsum Recycling, 28 April 2023; Gyproc, 21 April 2023.

3.2.2.2 Time Restrictions

Another barrier is that harvesting GW from existing buildings, sorting CDW to create monostreams and inspecting the quality of the GW is time-consuming. Ultimately, time is money, and this can itself be a reason for initiators not to take a high-value circular approach.[246] It is also a time investment to educate the people to dismantle reusable and recyclable materials.

3.2.2.3 Social Responsibility

Moreover, the social desirability of using secondary materials is questionable. After all, overconsumption is the norm, and many people are quick to see something as waste. For example, with second-hand items, a question such as "Does the product work as it should" comes into play.[247] The same thoughts prevail about responsibility in case of defects in secondary materials in general. The concerns surrounding secondary GW in plasterboard do not revolve around its effectiveness but rather the importance on the product being visually appealing and "nice and white".[248] There is an assumption that secondary products are of inferior quality.[249]

However, doing business with a green mindset is becoming increasingly lucrative, and certain companies do want to be frontrunners.[250] This development is still in its infancy.

3.2.2.4 Availability GW

A practical hurdle is that GW is not yet widely available to make secondary gypsum board, because GW disappears. GW disappears in unsorted bins. As long as there is no obligation to create monostreams, many substances get lost.[251] Even if some of the monostream GW ends up at Gyproc to be made into a secondary plasterboard, to date it is technologically possible to only use 30% recycled GW in these plasterboards.[252]

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[246] ADEX Group, 4 May 2023.
[247] 'Terugblik: Academielezing De circulaire paradox', *pbl.nl/nieuws/2022*, last accessed 29 June 2023.
[248] Renewi, 28 April 2023.
[249] Rabobank, 19 May 2023.
[250] Renewi, 28 April 2023; New West Gypsum Recycling, 28 April 2023.
[251] Renewi, 28 April 2023; Heijmans, 19 April 2023; New West Gypsum Recycling, 28 April 2023; Gyproc, 21 April 2023.
[252] Gyproc, 21 April 2023.

However, there is a need for secondary gypsum. Especially as virgin materials, as indicated in Chapter 1, are becoming scarce. With the increase in green energy, fewer energy plants will remain, so less FGD-Gypsum will be created. The GW must come from unsorted containers, agriculture or shipped cargoes.

3.2.3 Circular Ambition And Clarity Dutch Government

Finally, the government does not govern with sufficient clarity, which is a barrier to more high-value, circular use of GW. The companies need the government to reflect clearly on the circularity ambitions.

3.2.3.1 Unclear Definitions

The existing regulations on permit obligations, registration obligations and transport are insufficiently clear to companies. Regarding the definition of waste, it is not always obvious whether something qualifies as waste. The demolition company *ADEX Group* ensures having all permits. If the practice of dismantling and harvesting materials will increase, complying with permit obligations "just in case" will be time-consuming. Dismantling is also not regulated yet. This unclarity is particularly apparent in the interviews with Heijmans and ADEX Group.

3.2.3.2 Stricter Legal Provisions

The government can play a role by banning the use of mixed containers for GW.[253] If there are more monostreams of GW, more volume can be created, and thus more GW can be recycled. However, this is difficult to monitor and enforce, not only for companies but also for the government.

Existing legislation also still facilitates shortcuts of GW to low-value options, such as agriculture and mining.

A faster way than legislation in which the government can incorporate more circularity is to include circularity in tender procedures. The example of Rabobank and Heijmans is

[253] Renewi, 28 April 2023.

illustrative of this. Rabobank wanted “something circular”, which is why Heijmans won the tender at the time.

3.3 Interim Conclusion

This Chapter delved into the practical barriers to the transition to high-value, circular utilisation of GW. The analysis is based on a comprehensive case-study and interviews conducted with six companies in the GW-lifecycle. The detailed results of these interviews can be found in Annex I. This Chapter identified three practical barriers to the realization of high-value, circular GW utilisation: the company’s and contracting party’s ambitions, market barriers and barriers based on the government’s ambitions.

Firstly, concerning the company’s ambition and the ambitions of the contracting party, it became evident that a strong drive towards circularity is crucial for making changes. However, companies lack motivation because of the lack of clear guidelines to implement their circular ambitions. Clarity is needed. Furthermore, discrepancies in circular ambitions between contracting parties and a lack of transparency impede effective control and management of GW throughout its lifecycle.

Secondly, market barriers that discourage the use of circular gypsum were examined. Currently, virgin materials are, and scarcity increases. Wasteful practices, such as disposing of GW in mixed containers, using it in agriculture, mining operations, or exporting it, persist because of the existing legal loopholes. However, there is an increasing need to explore and develop high-value, circular applications for GW. Time constraints and societal desirability also present barriers within the market.

Lastly, this Chapter highlights the barriers stemming from the circular ambition of the Dutch government in their policies. The legal barriers discussed in Chapter 2 intertwine with the results from the interviews. Clear national targets and guidance are vital for enabling companies to effectively work towards achieving their circular targets.

In conclusion, this Chapter outlines the practical barriers impeding the realisation of a high-value, circular GW-lifecycle, ensuring that plasterboard returns as plasterboard. The next Chapter delves into the recommendations aimed at overcoming these barriers and fostering a high-value and circular approach to GW utilisation. Annex II provides an overview of the barriers and their recommendations.

Chapter 4 – Recommendations: How To Support High-Value, Circular Construction With GW In The Netherlands?

4.1 Introduction

The previous chapters outline various barriers to a high-value, circular gypsum economy, with Chapter 2 discussing the legal barriers in waste law and Chapter 3 the barriers in practice based on six interviews.

This Chapter reflects on the recommendations relating to these barriers, divided into three categories, namely the legal recommendations (4.2), recommendations for corporate circular ambitions (4.3) and recommendations for the market barriers (4.4). This chapter concludes with an interim conclusion (4.5).

4.2 Legal Recommendations

This paragraph displays the recommendations for the legal framework to support the transition to high-value, circular construction with GW.

4.2.1 Clarifying Definitions

Chapters 1 and 2 covered various definitions for key-concepts, such as circularity, high-value, waste, recycling and recyclability. Understanding these definitions is fundamental to answering the research question. However, these definitions are rather ambiguous. This paragraph provides several recommendations for improvement.

4.2.1.1 Circularity

The *NPCE 2023-2030* demonstrates that circularity can be interpreted differently. Currently, "circularity" is merely a policy concept.[254] Not having a legislative definition, leads to different interpretations. This was confirmed in the interviews.[255] It is insufficiently clear for companies

[254] Backes 2020, p.340-342.
[255] Rabobank, 19 May 2023.

how to achieve circularity targets by 2050. This unclarity has two consequences, namely that companies do not know how to accomplish their circularity policies and how to create clear and effective policies.[256]

An unambiguous definition of circularity is needed. It could be clarified EU-wide, but a feasible starting point can be made in the Dutch regulations on circularity.[257] Besides, it is challenging to expect EU-wide refining of circularity right away, as not all Member States are aligned.

Circularity is still merely a policy concept. It would perhaps benefit circularity to have a legislative basis. It should be defined in a national act. Perhaps in Article 1.1 Wm, like "waste" and "recycling". Furthermore, circularity is an aspect taken into consideration when authorities adopt policies and execute their competences. This is because of its basis in the LAP3, which must be considered by authorities when engaging in Wm-activities.

Circularity cannot become a permit requirement or obtain a basis in spatial zoning plans, because not all projects require permits. Furthermore, local authorities cannot require circularity in their spatial zoning plans, because the assessment of the plan is whether it requires as "good spatial planning".[258] Circular construction does not qualify as "good spatial planning" but should be regarded as an "implementation aspect".[259]

However, creating a clear-cut definition of circularity is not easy. On different moments in the lifecycle, choices can be made about how high-value circular companies can act. A way to promote high-value circularity is to introduce a credit system.[260] The system could find a basis in the LAP3, as the LAP3 already prescribes minimum standards on how to deal with GW. Credits can be divided between the various phases of the lifecycle. Credits could be given to company policies aiming at high-value circularity, i.e. plasterboard becomes plasterboard or agreeing to use secondary construction materials, like secondary plasterboard in the project. Companies could also obtain credits for letting high-value circularity play a role in their tenders and contracts. Also, urban mining would obtain credits, where companies first decide to dismantle the building and cut out plasterboards for reuse and, if reuse is not possible, recycle the GW for "new", secondary plasterboards. Credits could be given to companies that decide to separate GW as a monostream on the construction or demolition site and then transports it to

[256] New West Gypsum Recycling, 28 April 2023.
[257] *NCEP 2023-2030* and paragraph 1.2.
[258] Article 2.12 Wabo.
[259] ABRVS 20 February 2013, ECLI:NL:RVS:2013:BZ1678.
[260] Inspired by the BREAAM system. The BREAAM focuses on new construction and is broader than just circularity.

a company that recycles GW into secondary plasterboard. Fewer credits would be obtained when low-value alternatives are used, like using GW for agriculture (which is still circular but not high-value). The system can be applied in tender procedures, but also in negotiations between two parties. Ultimately, the number of credits obtained from construction, demolition and renovation projects increases each time. The longer a company is involved in circular construction, the more credits it needs to achieve on an annual basis. This can be regulated in the LAP3.

4.2.1.2 Waste

"Waste" means any substance or object which the holder discards or intends or is required to discard.[261] As discussed in paragraph 2.4.1.1, this definition is quite broad and not clear. Additionally, its focus is on the person discarding waste instead of the person reusing waste as a resource is outdated.

The definition of waste requires refining. For around 30 years no amendments have been made to the definition or often no alternatives were given.[262] Some suggestions made in literature are presented below.

Regarding the fundamental focus of the definition, as discussed in paragraph 2.4.1.1.[263] It would be beneficial to describe the "use potential" of waste in the definition, by expressing how and to what extent a waste can be used as a resource.[264]

Regarding the broad scope of the current definition, Laan suggests limiting the definition to "disposal". Recovery and disposal are operations that can be applied to waste.[265] The proposal would be: "any substance or object which the holder discards, intends to discard or is required to discard, *followed by disposal*".[266] Precaution must be taken when making changes to ensure that waste legislation continues to apply to substances for which waste legislation adds value. Waste still has a negative value. Opposed to "disposal" is "recovery". "Disposal" implies "any operation that is not recovery, even if the operation has the secondary

[261] Article 3, paragraph 1, WFD.
[262] Tieman, *TO* 2014/2, p.34-35; Sluiter, *PRO* 2018/4, p.5; Laan 2022, p.313.
[263] Van Ewijk and Stegeman, *Waste Management* 2020/105, p.4.
[264] Ibid.
[265] CJEU 27 februari 2002, C-6/00, ECLI:EU:C:2002:121.
[266] Laan 2022, p.313.

effect of recovering substances or energy".[267] Disposal should be done in an environmentally responsible manner.[268] On the contrary, if substances lend themselves to recovery they do not need to be covered by waste law.[269] This proposal does not come out of the blue, as the CJEU ruled similarly on 3 April 2003.[270] Likewise, Houben and Veldkamp demonstrate that the definition of waste should steer towards disposal as well.[271] Thus, as long as recovery is possible, the substances are not subject to waste law. If recovery is impossible, the substances qualify as waste, disposal must follow, and waste law applies. It reduces the pressure on all legal obligations like permit granting and benefits clarity and the circular economy.[272] This line of reasoning does ensure waste is no longer seen as negative and centralises its resource-function. I find this a valuable and realistic delineation. However, as demonstrated in paragraph 2.4.1.2 on EWSR and the critical paragraph below on the definitions of recovery and disposal, these definitions are not crystal-clear either. This should therefore be clarified first so that there is no incongruity between Member States. Otherwise, secondary gypsum is waste in one Member State, but not in another.

The uncertainty of the waste qualification is noticeable in practice.[273] The uncertainty particularly arose for "dismantling". The uncertainty is time-consuming because demolition companies comply with all requirements "just in case". Moreover, dismantling is not legally defined. Defining dismantling increases the application of "circular demolition". Adding the definition of dismantling in Article 1.1 Wm, which also defines demolition, contributes to the recognition of this circular concept and creates wider support in practice.

4.2.1.3 End-Of-Waste Status

The definition of EoW-status in Article 6, paragraph 1, WFD and Article 1.1, paragraph 8, Wm appears to be unclear.[274] Particularly its criteria have been criticised, as they accredit whether there is a market and specific use for the waste. Not important is the environmental benefit of

[267] Article 3, paragraph 19, WFD. Annex I contains a non-limitative list of disposal operations, such as landfill and incineration; Laan 2022, p.311-312.
[268] Laan 2022, p.312.
[269] Article 3, paragraph 15, WFD. Annex II contains a non-limitative list of recovery operations; Laan 2022, p.312.
[270] CJEU 3 April 2003, C-116/01, ECLI:EU:C:2003:193; Laan 2022, p.314.
[271] Houben and Veldkamp 2017, p.81-82.
[272] Laan 2022, p.313.
[273] Heijmans, 19 April 2023; ADEX Group, 4 May 2023.
[274] Paragraph 2.2.1.3 and 2.4.1.1.

reusing a substance that once was waste. The criticism of EoW-status was not further discussed in the interviews.

Literature demonstrates that more guidance is needed.[275] Also, there should be attention to the environmental aspects as well. Moreover, the Dutch government can exercise its competence in Article 6, paragraph 2, WFD and Article 1.1, paragraph 9, Wm once more.[276] A "Regeling" for GW can be created, since the LAP3 confirms that GW is perfectly recyclable. When made into a separate "Regeling", this category no longer qualifies as waste.

4.2.1.4 Disposal And Recovery

Paragraph 2.4.1.2 demonstrates the ambiguity of the EWSR-definitions. Each Member State can interpret recovery and disposal. This creates incongruity. The interview demonstrates how Germany considered filling mines with GW "recovery", whereas Belgium considers it "disposal".[277] Article 28, paragraph 3, EWSR states that if the competent authorities of the exporting state and the importing state cannot agree on the classification as disposal or recovery, disposal should apply. This prioritisation of disposal is unfortunate. It is understandable from a safety perspective, but not from a circularity perspective. If there is more consistency, shipments of GW do not need to be lost this way. Perhaps the EC can give more guidance. The Netherlands already has detailed ways of recovery in the LAP3 Sector Plan 31 for GW but this does not apply elsewhere. The discretion of Member States leads to discrepancies. Additionally, these discrepancies lead to less available GW to recycle.

4.2.1.5 Recycling

One of the definitions that is clear, but does not promote high-value circularity, is the definition of recycling in Article 1.1 Wm. Article 1.1 Wm defines recycling as "the recovery operation by which waste materials are reprocessed into products, materials or substances, for the original purpose *or a different purpose*, …". Chapter 1 also highlighted the importance of high-value, so plasterboard becomes plasterboard again. However, Article 1.1 Wm leaves an opening for alternatives, like using GW in agriculture or mining. Moreover, these alternatives are lawful.

[275] Johansson, *Environmental Policy and Law* 2023/4, p. 9-13.
[276] Backes and Boeve 2018, p.206-110.
[277] New West Gypsum Recycling, 28 April 2023.

This is also discussed in the interviews.[278] It is cheaper to export the GW for mining and to let farmers spread the GW on their farmland.[279] And waste always goes to the cheapest point…These legal loopholes should be erased. Amending the definition by erasing "*or a different purpose"* would benefit GW availability.

For agriculture, the Uitvoeringsregeling Meststoffenwet facilitates that GW can be used in agriculture.[280] The Uitvoeringsregeling Meststoffenwet should be adapted and ensure that GW is not used in agriculture. Moreover, other (raw or secondary) construction materials should not serve this purpose. I am not sure whether there are other suitable (non-construction) substances for desalination. The GW can be used when reusing and recycling in construction are impossible.[281]

Furthermore, regarding the export of GW, the EWSR is important. Member States have discretion in interpreting "disposal" or "recovery". Member States are not always aligned. Some Member States accept low-value reuse or recycling of GW as recovery, while other Member States see it as disposal. There should not be such a discrepancy in qualifying the same act.

4.2.1.6 (Non-)Recyclability

Not only "recycling" is a barrier, but the definition of "recyclability" in the LAP3 is also questionable. The LAP3 sets two conditions for the recyclability of GW, i.e. when it is not possible "due to the nature or composition of the GW" or when it is "too expensive". Just like the interviews, this confirms that economic motives prevail.

The recommendation in this regard is that the LAP3 should not question the recyclability of GW based on money but should stick to GW's physical traits. The LAP3 should state that "in principle, all GW must be recycled unless due to the nature or composition of the GW this is not feasible". The LAP3 is a flexible instrument and relatively easy to adapt.[282] It is unfit to give an economic reason to not recycle. Again, the linear economy must pay for the circular

[278] New West Gypsum Recycling, 28 April 2023.
[279] Ibid.
[280] Category I and Category III, Annex Aa Uitvoeringsregeling Meststoffenwet.
[281] New West Gypsum Recycling, 28 April 2023.
[282] Backes and Boeve 2018, p.206-110.

one. Increasing the amount of GW for recycling, increases the supply and demand for secondary plasterboards.[283]

4.2.2 Stricter Legal Provisions

4.2.2.1 Monostream GW

As discussed in paragraph 2.3, waste should be collected in monostream if more than $1m^3$ of waste is available.[284] Sector Plan 31 indicates that it benefits GW and other CDW to separate GW. However, Sector Plan 28 does still offer the possibility to deliver a mixed container. Interviews indicate that mixed containers should be prohibited because too much GW disappears.[285]

A legal obligation that has emerged is to ban the use of mixed bins, or at least ban GW in mixed containers.[286] Since GW does not benefit other streams, perhaps the flexible LAP3 could modify Sector Plan 28 and remove "gypsum" from being allowed in the mixed containers. Furthermore, Sector Plan 31 should make monostreams for GW mandatory at any volume, so it cannot negatively impact other CDW. Revision of the Bouwbesluit 2012 and the Regeling Bouwbesluit 2012 would be too cumbersome, hence the adaptation of the LAP3 would be more effective given the flexibility of this instrument.[287] Nevertheless, monitoring and enforcement can be challenging.[288]

4.2.2.2 Building Decree 2012

In paragraphs 2.3 and 2.4.2, information about construction permits was given, which can involve product law. This thesis primarily focuses on waste law. Chapter 2 did not delve into product law. Nonetheless, it is worthwhile to consider its recommendations. This paragraph briefly touches upon the existing schools of thought documented in the literature.

[283] Gyproc, 21 April 2023.
[284] Regeling bouwbesluit 2012, *Stcrt*. 2011, 23914; Bouwbesluit 2012, *Stb*. 2011, 416.
[285] Renewi, 28 April 2023.
[286] Ibid.
[287] Backes and Boeve 2018, p.106-110.
[288] Heijmans, 19 April 2023.

The Building Decree 2012 provides various requirements regarding, for example, building safety.[289] Perhaps the Building Decree 2012 encourages a requirement for recycled materials in construction. Backes and Boeve suggest a modification to the Building Decree 2012, specifically Article 5.9, or the inclusion of a separate article, to introduce a requirement for a specified percentage of secondary raw materials in specific construction projects.[290] This amendment aims to enforce national regulations on the minimum use of secondary raw materials, which could be achieved through the existing Building Decree 2012.[291]

4.2.2.3 Tender Procedure

Chapter 2 also lacks detailed elaboration on tender procedures. The origin of the case-study stems from a Rabobank tender procedure won by Heijmans. This required "something with circularity" in the project.

Previous recommendations are mainly legislative changes. A quicker way than legislation in which the government can influence more circularity in projects is to include circularity in tenders.

Tender processes in the public procurement sector are progressively adopting greener practices.[292] It is important not to neglect private tenders in this regard. One way to incorporate more circularity into private tenders is by utilising the credit system mentioned in paragraph 4.2.1.1. This approach enables circularity to be emphasized and refined to a greater extent.

4.3 Recommendations Corporate Ambition

Not only does the legislator have something to say about how circular should be executed within the Netherlands, but companies themselves also influence their actions and ambitions. The interviews revealed that the definitions are unclear and do not provide sufficient guidance toward the high-value, circular use of GW.

[289] Paragraph 2.3 and 2.4.2.
[290] Backes and Boeve 2018, p.68-71.
[291] Ibid, p.109.
[292] Janssen, M&M 2020/4-5, p.181-183.

4.3.1 Company's Circular Ambition

It is not clear to the companies how the objectives should be achieved[293], how the companies (should) define circularity[294], that the targets adopted by the companies often remain vague[295] and that there is leeway due to different measurement methods[296]. Also, the percentages can often be interpreted and measured differently.[297]

As mentioned in paragraph 4.2.1, definitions need to be clear and guidance is needed. The example of the Besluit Bodemkwaliteit and the exception in the *Besluit vrijstelling stortverbod buiten inrichtingen* demonstrate the importance of nuancing targets. These targets should include a differentiation, aiming for high-value utilisation.

There are already tools and certificates, such as MVI-tool[298] and BREAAM[299], which are not legally binding. The MVI-tool (Maatschappelijk Verantwoord Inkopen, *Socially Responsible Procurement*) means using procurement to buy socially, innovatively and sustainably. This aligns with the government's policy of harnessing the purchasing power of public authorities to facilitate the sustainable transition of the Netherlands.[300] The BREEAM (*Building Research Establishment's Environmental Assessment Method*) is the leading method for assessing the sustainability of projects in construction.[301] However, these tools do not focus on circularity as such. The abovementioned credit system does.[302]

4.3.2 Contracting Party's Circular Ambition

Not all companies are aligned in their ambitions, which means that other elements (especially money and time) can sometimes gain priority.[303] A contracting party's ambition can be influenced, but circularity cannot be enforced. An influential contracting party may be able to achieve more than imagined. In the past, *Heijmans* included in a contract for a project that the

[293] Rabobank, 19 May 2023.
[294] New West Gypsum Recycling, 28 April 2023; Renewi, 28 April 2023.
[295] Rabobank, 19 May 2023.
[296] Heijmans, 19 April 2023.
[297] New West Gypsum Recycling, 28 April 2023.
[298] 'Maatschappelijk verantwoord inkopen met impact doe je hier', *mvicriteria.nl,* last accessed on 29 June 2023.
[299] 'BREEAM NL', *richtlijn.breeam.nl*, last accessed 29 June 2023.
[300] 'Maatschappelijk verantwoord inkopen met impact doe je hier', *mvicriteria.nl,* last accessed on 29 June 2023.
[301] 'BREEAM NL', *richtlijn.breeam.nl*, last accessed 29 June 2023.
[302] Paragraph 4.2.1.1.
[303] Heijmans, 19 April 2023; Renewi, 28 April 2023; Rabobank, 19 May 2023.

used wood must return in the lifecycle. This goes beyond the legal obligations and derives from their ambition.

There are two possibilities, if there will be no legal obligation to the high-value circular use of GW, then the company can decide not to collaborate. The other possibility is that the credit system as explained above could lead to more high-value, circular use of GW in general. Then credits could be contractually stipulated, based on the system in paragraph 4.2.1.1.

4.3.3 Information and Transparency

Another barrier that plays a role in the cooperation with contracting parties is information and transparency. It is impossible to verify contracting parties because there are no guidelines or obligations. Voluntary transparency is the least that contracting parties can offer each other.[304]

Again, clearer guidelines from the government can help, this way companies on both sides can at least know what to minimally expect.[305] It is a matter of trust, the credit system could support it. If the contracting parties agree that "for this project, X number of circularity credits are achieved", then there can be discretion for the companies in how they achieve this.

4.4 Market Recommendations

The market barriers are linked to finances, time, social desirability and availability of the GW. As long as virgin gypsum is cheaper than recycled GW, there will be little to no incentive to use secondary gypsum.[306] It is also cheaper and legally possible to take your GW to agriculture or mining than to a recycling company.[307]

[304] Heijmans, 19 April 2023; Renewi, 28 April 2023.
[305] Heijmans, 19 April 2023.
[306] Heijmans, 19 April 2023; New West Gypsum Recycling, 28 April 2023; Renewi, 28 April 2023; Gyproc, 21 April 2023.
[307] New West Gypsum Recycling, 28 April 2023.

4.4.1 Change Price GW

The government could influence the price of secondary gypsum to make it more attractive. The government could also influence the price of GW. If GW financially benefits companies, it will be separated and recycled.[308]

Changing the price should not hamper EU's free movement. While promoting the utilisation of secondary materials, the Dutch government should be cautious about creating obstacles to imports. Careful consideration should be given to formulating requirements that mandate specific percentages of secondary raw materials in particular building products or materials. Such a mandate could potentially be considered an import barrier, especially for construction products that do not meet this percentage requirement. If such a measure is applied uniformly to both domestic and foreign products, it could be justified on environmental grounds only if the barrier is proportionate.[309]

Taxing virgin resources could increase the utilisation of secondary resources. This would stimulate innovation and the adoption of circular economy practices and reduce reliance on scarce natural resources. There should be caution when imposing taxes on virgin resources as import taxes, because this approach could potentially conflict with international agreements, such as international trade regulations.[310]

4.4.2 Time Restrictions

Dismantling, selecting for recovery and then possibly recycling takes longer than simply slinging a wrecking ball through the building. A dismantling team needs to be educated and prior materials calculations are needed to make dismantling efficient.[311] If there is a legal incentive for increasing circularity, the market will also adjust to it taking more time, provide more education and reducing time.

The more known in advance about materials in a building, the more efficient it could be at demolition if everyone knows what to harvest. There is currently a circular demolition

[308] ADEX Group, 4 May 2023.
[309] Backes and Boeve 2018, p.71.
[310] Stephan, *GAIA* 29/4 (2020), p.215-217.
[311] ADEX Group, 4 May 2023; Heijmans, 19 April 2023.

protocol, however, it is (again) voluntarily.[312] If all demolition companies applied this protocol in the same manner, more GW would be "saved" from buildings.

4.4.3 Social Responsibility

Responsibility for defects in secondary materials in general was also a barrier.[313] Secondary plasterboard must be "nice and white".[314] There is a "convenience gap", which makes it easier to buy new things than to get them second-hand or repaired.[315]

In literature, agreeing on a take-back guarantee is seen as a good way to promote the reuse of construction materials. It can encourage the producer to think about reuse. After all, they have an interest in ensuring that the materials can be reprocessed when taken back.[316]

4.4.4 Availability GW

Because some of the GW disappears into agriculture, mining and abroad, GW is not yet widely available to make secondary plasterboards.[317] GW also gets lost in unsorted containers.[318] For secondary plasterboards, it is currently technologically possible to use 30% recycled materials.[319]

Obliging monostream creates a larger volume of GW, so more is recycled and produced into secondary plasterboard. Limiting the use of agriculture and mining can create more volume. And finally, further developing the technologies and investing in them so that almost 100% is possible.

[312] 'Sloopprojecten circulair aanbesteden', *bouwcirculair.nl,* last accessed 29 June 2023.
[313] Rabobank, 19 May 2023.
[314] Renewi, 28 April 2023.
[315] 'Terugblik: Academielezing De circulaire paradox', *pbl.nl/nieuws/2022*, last accessed 29 June 2023.
[316] R. Aertsen et al., *NJB* 2022/4, p.265-268.
[317] Gyproc, 21 April 2023.
[318] Heijmans, 19 April 2023; Renewi, 28 April 2023; New West Gypsum Recycling, 28 April 2023; Gyproc, 21 April 2023.
[319] Gyproc, 21 April 2023.

4.5 Interim Conclusion

Chapter 4 provides a comprehensive set of recommendations aimed at addressing the barriers discussed in Chapters 2 and 3. The recommendations for achieving high-value, circular gypsum utilisation can be categorised into three main categories: adjustments to the legal framework, recommendations concerning the ambitions of companies and contracting parties, and market recommendations.

Firstly, regarding adjustments to the legal framework, it is essential to address the legal barriers highlighted in Chapter 2 and identified during the interviews. The lack of clarity in definitions poses a significant barrier for companies. To enhance clarity, recommendations have been made to refine the definitions of circularity, waste, EoW-status, recycling and recyclability. It is crucial to ensure alignment between companies and Member States. One potential recommendation arising from this barrier is the implementation of a credit system that rewards high-value and circular steps taken throughout the GW-lifecycle. Additionally, some existing legal obligations, such as the requirement to collect waste in a monostream when it exceeds $1m^3$, are deemed too lenient for GW based on the interviews. Proposals include banning mixed CDW-containers.

Secondly, recommendations are put forth concerning the ambitions of companies and contracting parties. Unclear definitions often lead to inaction or vague actions by companies. Legal obligations are necessary to inspire companies with higher circular ambitions and facilitate collaboration with less circular companies. Transparency is identified as a key element for effective cooperation in achieving high-value and circular practices. Legal obligations play a crucial role in addressing these barriers, and the beforementioned credit system may offer companies more direction.

Lastly, recommendations are made to tackle various market barriers. Economic factors currently dominate the transition to a more high-value, circular economy. Adjusting the price of GW could influence behaviour and encourage high-value, circular utilisation. However, transitioning to a more high-value and circular use of GW requires time and social adaptability. Additionally, ensuring the availability of GW is crucial for facilitating increased recycled gypsum usage, which is covered by the legal recommendations.

In conclusion, this chapter presents various recommendations to overcome the barriers identified in previous chapters. By implementing these recommendations, companies can

actively promote high-value, circular GW utilisation. When these recommendations are followed, a high-value, circular construction with GW is achieved.

Conclusion

This Master's Thesis researches the legal and practical barriers to achieving a high-value, circular utilisation of GW. The thesis examines the role of waste law. To answer the research question, several sub-questions have been explored in different chapters and provide various findings.

Gypsum is a highly recyclable material; however, there is still a significant amount of GW that remains underutilised in construction. Considering the increasing scarcity of gypsum, this is concerning. More gypsum is needed but various legal and practical barriers hinder its high-value and circular utilisation. These barriers and their corresponding recommendations are categorized into three categories.

Beginning with the legal barriers. Existing waste law framework does not adequately support the transition to a high-value, circular construction with GW. This is primarily due to unclear definitions and too lenient provisions. The clarity of definitions plays a crucial role in achieving the objectives. Chapter 1 highlighted how the definitions of circularity and high-value do not align with expectations for developing a high-value utilisation of GW. In Chapter 4, potential solutions were proposed, like a credit system for the GW-lifecycle. This system would allow companies flexibility in determining which aspects they prioritise to achieve high-value circularity. Additionally, Chapter 2 introduced legal definitions that hamper circularity targets. The broad definition of waste needs refinement, with a suggestion to limit it to "disposal only". This shift in focus from discarding to resourcing could be beneficial. The EoW-status, intended to support the circular transition, also suffers from unclarity. Currently, its focus is primarily on the market performance of waste, neglecting important circularity and resource aspects of the waste. Furthermore, the definitions of "disposal" and "recovery" in the WFD and the EWSR lack clarity, leading to different interpretations. Moreover, legal loopholes enable the escape of GW to other sectors, such as agriculture, or even to other countries. These alternatives, enabled by the Dutch definition of recycling, should be eliminated. Lastly, the LAP3 states that circularity should not come at any cost. The conditions for the recyclability of GW confirm this. When recycling is too expensive, recycling is not possible according to the LAP3. Given the current crises highlighted in the introduction, such conditions should not be considered acceptable anymore. Addressing these legal barriers and revising the definitions and provisions within waste law are essential steps to achieving a high-value, circular utilisation of GW.

Moving on to the barriers within companies, it is evident that the interviewed companies demonstrated circular ambition. However, not all construction companies are ambitious. While there are voluntary initiatives among these construction companies, formulating the right circular policies becomes challenging due to the unclear governmental policies. Providing specific and clearer instructions on how to achieve circularity would benefit companies. Additionally, companies do not always encounter contracting parties with similar ambitions. Introducing mechanisms to encourage more circular practices among companies, such as the proposed credit system, could offer discretion to companies while still receiving governmental guidance. Transparency is another significant barrier, as agreements can be made, but the lack of clarity and unity make it challenging for companies to verify what truly happens with GW.

Lastly, market barriers were identified based on the interviews. The most prominent aspect is the tendency for waste to be directed towards the cheapest points, which is facilitated by the existing legal framework. The high-value, circular use of GW arises from the need to create more resources due to the increasing scarcity of gypsum. All these barriers contribute to "gypsum-leakage". To increase recycling habits and improve secondary plasterboard production, more GW is required. However, transitioning the market takes time and requires collaborative efforts from both companies and legislators to drive the change.

Further Research

As mentioned in the introduction, this thesis has several limitations. Firstly, the study employs a qualitative approach, relying on six interviews. These companies share a common goal of transitioning towards a high-value, circular economy. Therefore, the findings may not fully represent the perspectives of other companies. A more quantitative approach could broaden the impact of this research.[320]

Secondly, the focus of the legal framework in this thesis is primarily on waste law. Although some recommendations extend beyond waste law, these broader frameworks have not been extensively explored and described in this thesis. Therefore, further research is required to provide a full comprehensive understanding of these recommendations.

Lastly, the thesis specifically examines waste law and circular GW utilisation within the Netherlands. As a result, the conclusions drawn may not be equally applicable to all Member States. Different Member States may have unique legal frameworks, market dynamics, and challenges affecting the implementation of high-value, circular practices.

[320] Kircherr et al., *Ecological Economics* 2018/150, p.264-267.

It is important to recognise and consider these limitations when interpreting the findings and applying them to specific contexts beyond the scope of this thesis. Further research and analysis are necessary to provide a more comprehensive understanding of high-value, circular GW utilisation.

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Annexes

Annex I – Outcome Interviews

I.1 Initiator – Rabobank

The case-study illustrates Rabobank's role as an initiator for a circular renovation project. Rabobank has written down its objectives in terms of circularity in its annual plan. It is important to properly define terms such as sustainability and circularity. The main goal is CO2-reduction, and circularity can play a role in supporting this. Not all companies discuss circularity and its various components in the same detail and nuanced way as Rabobank does, sometimes other companies merely mention percentages. Drawing up this company policy is also challenging. It is not clear in what way circularity goals should be achieved. Rabobank would like the government to provide more clarity and guidance on this. Some criteria such as the MVI-tool (*Maatschappelijk Verantwoord Inkopen*, Socially Responsible Purchasing) and BREAAM can provide guidance but are not binding.

Rabobank wants to work towards wider use of tools such as the materials passport so that in 20 years it will still be known which materials can be found in what buildings. Therefore, more information is needed. Measurability is also a barrier; it is not clear how the targets are exactly to be achieved. Responsibility in the case of secondary materials is also discussed. Also, the will of contracting parties is decisive in whether circularity is obtained. A greater role should be given to circularity within tender procedures.

The government should play a more guiding role, preferably in advance in how the targets should be tackled by companies. Companies should also start reporting on circularity. If it is clearer how, companies can set more realistic and clear targets. If the targets are clearer, so is the market demand. Thus, the market can be better incentivised to be circular.

I.2 Construction Company – Heijmans

Heijmans is a Dutch construction company. On their website and from interviews, their ambitions for a circular economy are clear. In the circular transition, Heijmans does not want to lag.[321]

Heijmans has several regular partners. These projects may generate waste, which ends up in containers. Heijmans provides partners with guidelines and frameworks, but there is no check on the extent to which waste separation takes place. Moreover, during construction or renovation, there can be cutting losses or excess materials. This CDW goes into the container on site. Heijmans tries to separate CDW as much as possible. Depending on how GW is released, it can be a monostream (stream containing only GW). Should it still be sent along with other CDW, so no monostream, a waste processing company like Renewi can always post-separate it. So it depends on the will of the contracting partners how circular a project is. In most cases, Heijmans collaborates with the same partners, so there could be more willingness for the contracting partners to be influenced by Heijmans' circularity ambitions. But if there is no will, Heijmans cannot enforce it.

What happens to the GW released during construction, demolition or renovation largely depends on the agreements made between the parties. Agreements are made, and these also include a "bestek". A "bestek" is a technical document with a description of what needs to be done, which may include a passage on circular and high-value use of GW. There is a possibility to include in such a contract, for example, how to deal with the GW released or left over when demolishing respectively constructing. It varies and depends on the contract, contracting party and building.

Heijmans has the most influence and responsibility on CDW released during construction. A building is constructed layer by layer and various materials may be released, such as plastic, polystyrene foam, wood, cardboard as packaging material, or gypsum due to cutting losses. What is released, Heijmans tries to separate as much as possible on-site, using several containers. A "milieustraat" is set up to separate the waste and create a monostream that goes to a waste treatment company. This requires effort, not only from Heijmans but also from their partners. As much as possible, efforts are made to consider in advance which material flows could be released during demolition, renovation or construction. However, receiving

[321] 'Jaarverslag 2022: Heijmans presenteert sterke jaarresultaten', jaarverslag.heijmans.nl, last accessed 30 June 2023.

information is currently still insufficient. Now, Heijmans has no insight into what happens to the waste.

Apart from contracts, projects can meet certain conditions for certificates. BREEAM is one of these certificates. Circularity is one aspect of BREEAM, but BREEAM does not guarantee circularity. However, this is only possible if the contracting party has a high-value ambition as well. Again, the ambition of contracting parties is decisive for circularity.

Projects with a high circularity priority ensure that the released substances are seen as material flows and not labelled as waste. Once the GW is in the Renewi container, it legally qualifies as "disposing of".

I.3 Demolition Company – ADEX Group

When a building is demolished, a demolition company like ADEX comes into play, depending on the wishes of the parties involved. Demolition companies demolish buildings, so this is an important phase to "harvest" certain materials. To date, this is not done by all demolition companies.

ADEX Group is a demolition company that considers dismantling buildings and harvesting reusable materials in the process important.[322] ADEX Group has three specialised dismantling teams. These are teams that look within the building to be demolished to see which materials can be reused. Ideally, dismantling teams dismantle for the materials to be reused immediately. If reusing is not possible, it has to be recycled in a high- or low-value manner. Before dismantling and demolishing, ADEX Group calculates the cost of the project and whether there is space, time and money to take a circular approach. Some materials cost money to throw away, and some materials make money to reuse. So a comprehensive materials inventory takes place.

But not every demolition company takes such a circular approach. It also (unfortunately) makes ADEX Group unique in this. However, "circular demolition" will become more necessary and important over the years, partly because GW is becoming increasingly expensive, just like virgin materials. It does take more time and manpower, and people also need to be educated to dismantle. Not every ADEX Group project will be like this, again it depends on the ambition of the contracting parties.

[322] 'Over ADEX Group', *adex.nl,* last accessed 30 June 2023.

ADEX Group is a demolition company and already holds the necessary permits to demolish. But a grey area still exists for plasterboard that is released when the buildings are dismantled. It is unclear whether the plasterboard that is dismantled qualifies as waste. ADEX Group has all the necessary permits anyway, as they also apply to the demolition phase. Wouldn't it make more sense for the dismantling phase to be a permit-free phase? Because dismantling certain products is not to be regarded as waste, the legal provisions for waste do not apply. It is a stage before qualifying the materials as waste. There is not enough clarity on this. It is a grey area, and they are taking the safe route.

I.4 Waste Treatment Company – Renewi

Renewi is a waste management company, whose ambition is to bring back as many materials as possible.[323] Their mission is to save as many materials as possible from the incineration pile or landfill, under the slogan "waste no more". At the construction and demolition sites discussed above, Renewi places containers that can be filled with CDW – sorted or unsorted. Whether sorting takes place depends on the volume of materials released or to be released (according to estimates from a prior materials analysis) and the contracts. Again, information and transparency as well as mutual agreements are relevant in the circularity of a project.

Thus, containers can contain mixed or monostreams. The latter is preferred, as this keeps materials the cleanest. Then another company, for instance, a gypsum processing company like New West Gypsum, may accept the materials, depending on whether the GW is clean enough. Often, several containers from different construction and demolition sites meet at Renewi to create sufficient volume. Then it goes to the gypsum processing companies like New West Gypsum.

It is mainly within the power of the demolition company to separate and avoid mixed streams to then be able to proceed to recycling or reuse. When the gypsum then arrives at Renewi as a monostream, it is worth enough to be kept separate as a monostream.

Whatever is in the container, is considered waste by Renewi. It then has a waste status and may only be taken to licensed companies, accompanied by a waste disposal form with the location of origin, owner/disposer, weight and container. There is a waste stream number known

[323] 'Renewi's Duurzaamheidsverslag onthult toonaangevende ESG-prestaties', *renewi.com,* last accessed 30 June 2023.

to the Landelijk Meldpunt Afvalstoffen (LMA). Because of the number, they know where the container comes from. These administrative obligations apply every time the waste is moved.

When the waste arrives at one of Renewi's authorized processors, they know it will be recycled. But how those companies – where the GW is taken to – continue a circular cycle for the GW, is not clear. So, there is no "follow-up" on exactly where the GW ends up. So again, transparency is key.

I.5 Gypsum Processing Company – New West Gypsum

New West Gypsum is a gypsum processing company with a factory in Belgium.[324] Gypsum can come to New West Gypsum from waste processing companies. To deliver the gypsum to New West Gypsum, the gypsum must be clean. If a shipment of waste arrives at New West Gypsum and is rejected, that in turn is also sent to the cheapest alternative, such as agriculture or mining. Contaminated loads can be of value there.

To date, the Uitvoeringsregeling Meststoffenwet allows (contaminated, secondary) gypsum to be spread on agricultural land to combat desalination. Unfortunately, the waste still goes to the cheapest point, so if companies find it too expensive to take the GW to New West Gypsum, it is taken to the cheapest alternative (mining or agriculture).

As long as cheaper options remain, not all GW is going to be put to high-value use for a second time. Waste goes to the cheapest point unless the law prohibits it.

Furthermore, recycling percentages are not reliable. There is also a lack of transparency and information. The EC's recycling targets mentioned in Chapter 1 indicate that the Netherlands recycles 97%. Whether this is done high- or low-value is not mentioned or researched. This is unfortunate and can give a distorted picture of how circular things are. There is a need for a clear definition and more transparency.

I.5 Secondary Gypsum Board Producer – Gyproc

Gyproc is a gypsum producer that turns GW into new plasterboard, Gyproc wants as much as 30% of the plasterboard it produces to be made of GW.[325] From New West Gypsum and others,

[324] 'Our Goal', nwgypsum.com, last accessed 30 June 2023.
[325] 'Duurzaamheid', Gyproc.nl, last accessed 30 June 2023.

Gyproc receives recycled and clean gypsum, which can then be turned into new plasterboard. New West Gypsum, as a Gypsum Processing Company, will pick out the fouls, such as screws, cardboard, etc. Then the pile of secondary gypsum goes on the conveyor toward Gyproc's factory. The gypsum Gyproc eventually uses may come from multiple Gypsum Processing Companies. At least between New West Gypsum and Gyproc, there is a conveyor, so secondary plasterboards can be made within a few hours.

The gypsum is a mixture of new gypsum and recycled material from New West Gypsum and is distributed across the belt as a 300-meter-long plasterboard. That 300 meters allows the gypsum mixture to harden. In the end, that hardened mixture is chopped up and made into several individual secondary gypsum boards. The boards do not consist entirely of 100% recycled gypsum. There are several reasons for this. First, is the technological reason. It is possible with the company's current technology to add 30% recycled gypsum. So the rest is virgin gypsum. The ambition is to increase this percentage, Gyproc wants to make the step of 50% renewed gypsum by 2050. This takes time. A second reason is that not all secondary GW is available for recycling. There is still too much GW that comes in mixed containers and is not sorted or recycled. Or GW that goes to agriculture or mining instead of recycling. Thirdly, if GW is already delivered, not everything can be used, there are standards on the quality of what GW can be used.

Currently, initiators are increasingly choosing circular plasterboard. Not everyone is yet thinking of doing it circularly because they are less engaged with the topic and because there is also a cost component to it – it is still slightly more expensive than standard processes. That will remain with the whole transition to circularity. Ultimately, it is the linear economy that must pay for the circular one.

Annex II – Overview Barriers And Recommendations

Research has been conducted on barriers to a circular economy at the EU level.[326] This research examined the barriers through quantitative analysis. The article demonstrates that cultural barriers, particularly the lack of consumer interest and awareness, along with a cautious company culture, are the main obstacles identified by businesses and policymakers when embracing the circular economy. These cultural barriers are influenced by market challenges, which, in turn, derive from the lack of governmental guidance aimed at accelerating the transition to a circular economy. As revealed in Chapter 4, these findings align with my results obtained from the six interviews.

An overview of the barriers and their recommendations are demonstrated in the below table.

Barrier	**Legal Barrier**	**Practical Barrier**	**Recommendation**
4.2.1 Clarifying Definitions			
Legal uncertainty about how to interpret circularity. 4.2.1.1	Uncertainty in defining circularity because it is a policy concept and is multi-layered. 1.2.2	Circularity is broadly interpreted amongst companies. Rabobank	Legislator should create clearer definition of circularity in Wm. 4.2.1.1 Companies can motivate each other using the proposed credit system for circularity in construction. In the LAP3. 4.2.1.1

[326] Kircherr et al., *Ecological Economics* 2018/150, p.264-267.

Vague ambitions and targets of circularity because of unclear terms 4.3.1	Besluit Bodemkwaliteit and the exception are an example of how numbers can be deceiving, however not applicable to GW in residential and commercial construction. 3.2.1	Percentages can be deceiving and should be nuanced. NWGR Companies can choose how they measure their percentages Heijmans	Legislator should create a clearer definition of circularity in Wm. 4.2.1.1 Specify targets in high-value utilisation of GW. 3.2.1.1
Unclear and outdated waste WFD and Wm 4.2.1.2	Its focus on the person discarding the waste is outdated. 2.4.1.1 Definition is too broad and obstructs circularity. 2.4.1.1	The waste definition brings uncertainty. Heijmans Dismantling is example of uncertainty. It does not create waste but is treated as waste because the definition of waste is too broad. ADEX Group	Shift the focus from discard to waste as a resource. 4.2.1.2 Change definition to be less broad. Several proposals done in 4.2.1.2. Dismantling should be defined in Wm, just like demolition. Do not qualify dismantling substances as waste. 4.2.1.2

Unclarity and disagreement on the definition and conditions of the end-of-waste status 4.2.1.3	Literature shows how the conditions for the EoW-status are focused on having a specified use and a market for waste. 2.4.1.1	/	Let “resource use” impact be a condition. 4.2.1.3 Given that GW is perfectly recyclable, the government should create a “Regeling” based on 6, paragraph 2, WFD that GW is not waste. 4.2.1.3
Unclarity EWSR 4.2.1.4	Article 28, paragraph 3 EWSR let disposal precede instead of recovery in case of uncertainty abroad. 2.4.1.2 Member states are allowed to interpret recovery and disposal in their own way. 2.4.1.2	Germany considered filling mines with GW “recovery”, whereas Belgium considers it “disposal”. NWGR	Change article 28 (3) EWSR and prioritise the use of waste as recovery. Paragraphs 4.2.1.4 Unify the meaning behind recover and stimulate high value recovery. Paragraphs 4.2.1.4
Low-value definition recycling 4.2.1.5	The definition of recycling in article 1.1 Wm mentions alternatives in its definition which fosters the use of GW	Alternative uses of GW. NWGR	The definition of recycling in article 1.1 Wm should not facilitate alternatives use of GW. Paragraphs 4.2.1.5

	in agriculture (Uitvoeringsregeling Meststoffenwet) and mining abroad. 2.3		Adapt Uitvoeringsregeling Meststoffenwet so it does not allow gypsum, GW or other construction materials or CDW to be used as a fertiliser. 4.2.1.5
Economic value definition recyclability 4.2.1.6	In LAP3, GW is considered non-recyclable if it is too expensive to recycle. 2.3	Waste always goes to the cheapest point. NWGR	The recommendation in this regard is that the LAP3 should not question the recyclability of GW based on money but should stick to the physical traits of the GW.
4.2.2 Refining Legal Provisions			
Mandatory monostream gw 4.2.2.1	Waste must be collected in monostream if more than 1m3 of waste is available. However, still the mixed CDW-container possibility in sector plan 28.	No more mixed containers Renewi	Modify Sector Plan 28 and remove “gypsum” from being allowed in the mixed containers. Sector Plan 31 oblige monostreams for GW at any volume, so it cannot negatively impact other CDW.

	Benefits GW and CDW to have a GW monostream. 2.3		
Building decree 2012 and requirements recycled materials in construction. 4.2.2.2	The Building Decree 2012 gives various requirements regarding, for example, building safety. 2.4.2 Perhaps the building decree 2012 encourages a requirement for recycled materials in construction. 4.2.2.2	Generally: more guidance as incentives needed	Backes and Boeve suggest a modification to the building decree 2012, specifically article 5.9, or the inclusion of a separate article, to introduce a requirement for a specified percentage of secondary raw materials in specific construction projects. 2.4.2 and 4.2.2.2
Circularity as a tender procedure criterion. 4.2.2.3	Tender processes in the public procurement sector are progressively adopting greener practices. 4.2.2.3	The case-study is based on a tender between Rabobank and Heijmans 1.4.2	Companies can motivate each other using the proposed credit system for circularity in construction. In the LAP3.

			4.2.1.1
4.3 Recommendations Corporate Ambition			
Companies find circularity targets unclear. 4.3.1	/	Unclarity how to achieve targets (Rabobank), how to define circularity (NWGR, Renewi), often vague company ambitions (Rabobank) and leeway because of different measurement methods (Heijmans) Different interpretation targets (NWGR and Rabobank)	Companies can motivate each other using the proposed credit system for circularity in construction. In the LAP3. 4.2.1.1
Different ambitions contracting parties. 4.3.2	/	Not all companies are aligned in their ambitions. Heijmans, Rabobank and Renewi	Do not collaborate with non-ambitious companies. 4.3.2 Companies can motivate each other using the proposed credit system for circularity in construction. In the LAP3. 4.2.1.1

Transparency or tools to steer each other. 4.3.3	/	Impossible for the other party to verify whether the rest of the lifecycle is circular. There is (too) little transparency, which should be a must. Heijmans and Renewi	Clarity through the credit system. Companies can motivate each other using the proposed credit system for circularity in construction. In the LAP3. 4.2.1.1
4.4 Market Recommendations			
Money 4.4.1	Money still plays a decisive role for the rules, see for example “recyclability” in LAP3 2.3	Virgin gypsum is cheaper than secondary gypsum, so no incentive. Heijmans, Renewi, New West Gypsum Aand Gyproc	Taxing virgin resources would stimulate innovation and the adoption of circular economy practices and reduce reliance on scarce natural resources. 4.4.1
Time 4.4.2	/	Dismantling, selecting for recovery and then possibly recycling takes longer than simply slinging a wrecking ball through the building. ADEX Group	There is a circular demolition protocol, make it legally binding. 4.4.2 Legal basis for dismantling increases

			the practice and standardises it. 4.2.1.2
Social and desirability of using GW. 4.4.3	/	Gypsum must be “nice and white”. Renewi Assumption that secondary products are of inferior quality Rabobank	Take-back guarantee is a good way to promote the reuse of CDW. If something goes wrong, it is easier to solve for producers and consumer. 4.4.3
Availability gypsum and “gypsum leakage” 4.4.4	Less natural and FGD-gypsum. 1.4.1	GW disappears into agriculture, mining and abroad. NWGR GW gets lost in mixed containers. Renewi	Obligation of monostream GW by using competence in 6, paragraph 2, WFD. 4.2.2.1