Deltares

Water en Bodem Sturend: Learning from international cases

WBR 10 - WBS international

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Executive Summary

The water and soil system is a natural supplier of clean drinking water, and the basis for fertile agricultural land and nature areas. In 2022, a Parliamentary Letter on water and soil based planning was published in the Netherlands (Ministry IenW, 2022). It focused on the need to base spatial planning and design on the water and soil system and to protect and restore this system as much as possible (in Dutch: Water en Bodem Sturend, WBS). The new Dutch government (2024) later impaired the ‘water and soil based planning’ policy by replacing it with “taking water and soil into account” (Ministry IenW, 2024; In Dutch: rekening houden met water en bodem), but the principles and structural choices in the Letter still stand. Projects have been initiated at different levels of national and regional governments using these principles as a basis. To support and overcome some of the hurdles encountered when implementing WBS, international experiences in other countries were looked for to be used as a source of inspiration for the stakeholders in the Netherlands.

In this study, a longlist of potential cases was prepared from which four cases were selected for further analysis: 1) Cali, Colombia 2) Flanders, Belgium 3) Portland, USA and 4) Tyrol, Austria. The selection was based on scoring across various criteria such as alignment to WBS principles, relevance to the Netherlands and the implementation of legal, spatial and financial instruments. For details on the criteria and scoring see Annex A: Criteria, long list and ranking.

In Cali, Colombia, the instrument of environmental determinants in land use plans was assessed. These determinants include soil, water, flora and fauna. To identify environmental determinants, an elaborated participation process is followed, which leads to effective stakeholder engagement. The instrument supports the integration of water and soil management across various scales (national, regional and municipal). Environmental determinants are mapped, monitored and managed at these three scales. This enables informed decision making both at system-scale (natural system) and object-scale (plot within a land-use plan). Different guidelines from the national government support the successful implementation of the determinants in different spatial plans.

In Flanders, Belgium, the Water Test forms the core of different instruments which embed the interest of the water system into spatial planning. It is an assessment by the competent authority on whether harmful effects may impact the water system due to a specific initiative (e.g. a permit, a plan, a program). In that case, these harmful effects should be prevented, reduced, remedied or compensated. In designated flood prone areas, a stricter Water Test is required. Also measures that prevent the development of buildings and infrastructure in these open areas exist. To inform the society at large, detailed flood risk maps are available. A legal duty to inform potential tenants and buyers of property exists as well.

The city of Portland, USA, has a known environmentally active population and has been a pioneer in climate policy. The city realised the implementation of urban nature-based solutions (bio-swales or green streets, green roofs, and constructed wetlands) and embedded these solutions in public and private investment plans. Four elements are here highlighted that were essential to creating an enabling environment for this transition: a legal basis; cost-effectiveness of nature-based solutions; programmes enabling co-investment; and the environmentally active population.

In the federal state Tyrol, Austria, a regional spatial planning program for the protection of valuable agricultural land was launched in 2015. With this legal basis, the protection of agricultural land is implemented across three scales: state, regional and municipal. The instrument is highly accepted among municipalities. The successful adoption of the instrument by municipalities can be credited in large part to the clear methodology. This means that the logic by which protected agricultural land is identified is clearly understood and explainable to all. The impact of this instrument also contributes to the EU no net land take objective.

What is interesting in each of these cases is how the enabling environment was activated to support transitions. The summary of findings below captures the key aspects across all four cases that activated the enabling environment.

Summary of findings

- Legal Basis

All cases are grounded in legal frameworks, ensuring proper use and increasing the likelihood of implementation compared to voluntary instruments.

- Community Involvement

Active participation of communities enhances ownership, co-investment, and resilience. Local and indigenous knowledge is essential for effective WBS implementation. Examples like Flanders show how localized flood risk scores empower property owners.

- Clear and Understandable Narrative

A compelling and inclusive narrative improves public acceptance and uptake by decentralized authorities. Connecting wellbeing and prosperity to WBS goals helps broaden support.

- Clear Protocols and Methods

Transparent procedures and defined responsibilities foster confidence among decision-makers and ensure consistency.

- Incremental Development of Instruments

Gradual rollout and refinement based on practical experience lead to better-designed tools and stronger stakeholder ownership.

- Distribution of Responsibility

Cases such as Portland demonstrate how non-governmental actors, including property owners, can contribute to WBS through economic and wellbeing-driven investments.

- Boundary-Spanning Instruments

Tools like the Watershed Management Plan (Cali, Colombia) facilitate cross-sector collaboration—bridging public/private, urban/rural, and environmental/spatial planning domains.

- Multi-Benefit, Multi-Audience Projects

Local measures (e.g., green streets) deliver diverse benefits—climate adaptation, wellbeing, biodiversity—and engage a wide range of stakeholders through visible, accessible improvements.

Samenvatting

Het water- en bodemsysteem is een natuurlijke leverancier van schoon (drink-)water en vormt de basis voor vruchtbare landbouwgrond en natuurgebieden. In 2022 werd in Nederland een Kamerbrief over de rol van Water en Bodem bij ruimtelijke ordening (Ministerie IenW, 2022) naar de Tweede Kamer gestuurd. Deze brief richtte zich op de noodzaak om keuzes in de ruimtelijke ordening te baseren op het water- en bodemsysteem en dit systeem zoveel mogelijk te beschermen en te herstellen (*Water en Bodem Sturend, WBS*). In 2024 heeft de Nederlandse regering het ‘water- en bodembeleid’ geherformuleerd en *Water en Bodem Sturend* vervangen door ‘rekening houden met water en bodem’ (Ministerie IenW, 2024). Hierbij blijven de principes en structurele keuzes uit de Kamerbrief van 2022 onverminderd van kracht en dienen als basis voor de projecten die op nationaal en regionaal niveau zijn gestart. Deze projecten ervaren regelmatig uitdagingen bij de implementatie. Daarom is gezocht naar internationale voorbeelden en ervaringen als inspiratiebron voor stakeholders in Nederland.

In deze studie is begonnen met een longlist met mogelijke cases, waaruit vier cases zijn geselecteerd voor verdere analyse: 1) Cali, Colombia; 2) Vlaanderen, België, 3) Portland, Verenigde Staten en 4) Tirol, Oostenrijk. De selectie was gebaseerd op scores van verschillende criteria, zoals de aansluiting bij de WBS-principes, relevantie voor Nederland en de implementatie van juridische, ruimtelijke en financiële instrumenten. Voor details over de criteria en scores zie bijlage A: Criteria, longlist and ranking.

In **Cali, Colombia,** werd het instrument “environmental determinants in land use plans” beoordeeld. Deze milieufactoren omvatten bodem, water, flora en fauna. Om milieufactoren te identificeren, wordt een uitgebreid participatieproces gevolgd, wat leidt tot effectieve betrokkenheid van belanghebbenden. Het instrument ondersteunt de integratie van water- en bodembeheer op verschillende schaalniveaus (nationaal, regionaal en gemeentelijk). Milieufactoren worden op deze drie schaalniveaus in kaart gebracht, gemonitord en beheerd. Dit maakt weloverwogen besluitvorming mogelijk, zowel op systeemniveau (natuurlijk systeem) als op objectniveau (perceel binnen een ruimtelijk plan). Door middel van verschillende richtlijnen van de nationale overheid in Colombia wordt de succesvolle implementatie van de milieufactoren in verschillende ruimtelijke plannen gestuurd en ondersteund.

In het gewest **Vlaanderen, België,** vormt de Watertoets de kern van verschillende instrumenten die het belang van het watersysteem in de ruimtelijke ordening verankeren. De watertoets onderzoekt of een specifiek initiatief (bijvoorbeeld een vergunning, een plan of een programma) een mogelijke (schadelijke) impact kan hebben op het watersysteem. In dat geval moeten er maatregelen worden genomen om deze schadelijke effecten te vermijden, beperken, herstellen of compenseren. Op het moment dat geen aanvaardbaar alternatief of remediëring mogelijk is, moet het initiatief geweigerd worden. In aangewezen overstromingsgevoelige gebieden (signaalgebieden) is een strengere Watertoets vereist. Delen van signaalgebieden, waarin het wenselijk is deze ‘bouwvrij’ te houden, kunnen worden aangewezen als ‘Watergevoelige openruimtegebieden (WORG). In deze gebieden wordt ontwikkeling van gebouwen en infrastructuur zoveel mogelijk verhinderd. Om de samenleving te informeren over overstromingsrisico’s van percelen en bouwwerken, zijn er gedetailleerde overstromingsrisicokaarten beschikbaar. Er bestaat ook een wettelijke verplichting om in het bijzonder potentiële huurders en kopers van onroerend goed te informeren over de overstromingsrisico’s van dat onroerend goed.

De **stad Portland, Verenigde Staten,** staat bekend om haar milieubewuste bevolking en is een pionier op het gebied van klimaatbeleid. De stad implementeerde stedelijke, op de natuur gebaseerde oplossingen (bioswales of groene straten, groene daken en aangelegde wetlands) en verankerde deze oplossingen in publieke en private investeringsplannen. Vier elementen die essentieel waren voor het creëren van een gunstig klimaat voor deze transitie zijn: een wettelijke basis; kosteneffectiviteit van op de natuur gebaseerde oplossingen; programma's die co-investeringen mogelijk maken; en een milieubewuste gemeenschap.

In de **deelstaat Tirol, Oostenrijk,** is in 2015 met een regionaal ruimtelijk ordeningsprogramma voor de bescherming van waardevolle landbouwgrond gestart. Met deze wettelijke basis wordt de bescherming van landbouwgrond op drie niveaus geïmplementeerd: op nationaal, regionaal en gemeentelijk niveau. Het instrument is door de gemeenten geaccepteerd en wordt toegepast. Het succesvolle gebruik van het instrument door de gemeenten is grotendeels te danken aan de duidelijke en consistente methodologie. Dit betekent dat de wijze waarop landbouwgrond als waardevol wordt geïdentificeerd en vervolgens beschermd, voor betrokkenen begrijpelijk en uitlegbaar is. Het effect van dit instrument draagt ook bij aan de 'No Net Land Take' doelstelling van de EU.

Wat in elk van deze gevallen interessant is, is hoe de voorwaarden werden gecreëerd om transities te ondersteunen. Hieronder zijn de bevindingen samengevat.

Samenvatting van de bevindingen
- Wettelijke basis

In alle cases zijn de instrumenten verankerd in een stevige wettelijke basis. Hiermee wordt een correct gebruik van een instrument gewaarborgd en is de kans op implementatie groter dan bij vrijwillige instrumenten.
- Betrokkenheid van de gemeenschap

Actieve deelname van gemeenschappen versterkt het eigenaarschap, de mede-investering en de veerkracht. Lokale en inheemse kennis is daarbij essentieel voor een effectieve implementatie van WBS. Voorbeelden zoals Vlaanderen laten zien hoe gerichte overstromingsrisicoscores eigenaren van onroerend goed meer inzicht geven, hun kennis versterkt en hen een handelingsperspectief bieden.
- Duidelijk en begrijpelijk verhaal (narratief)

Een helder, overtuigend en inclusief verhaal verbetert de acceptatie door het publiek en de implementatie door gedecentraliseerde autoriteiten. Door welzijn en welvaart te koppelen aan WBS-doelstellingen kan de steun worden verbreed.
- Duidelijke protocollen en methoden

Transparante procedures en duidelijk omschreven verantwoordelijkheden bevorderen het vertrouwen onder besluitvormers en zorgen voor consistentie.
- Stapsgewijze ontwikkeling van instrumenten

Geleidelijke invoering en verfijning op basis van praktische ervaring (lessons learned) leiden tot beter ontworpen instrumenten en een sterker gevoel van eigenaarschap bij belanghebbenden.
- Verdeling van verantwoordelijkheid

Voorbeelden zoals Portland laten zien hoe niet-gouvernementele actoren, waaronder vastgoedeigenaren, kunnen bijdragen aan WBS door middel van economische en op welzijn gerichte investeringen.
- Grensoverschrijdende instrumenten

Instrumenten zoals het Watershed Management Plan (Cali, Colombia) vergemakkelijken sectoroverstijgende (integrale) samenwerking en overbruggen de kloof tussen publiek/privaat, stedelijk/landelijk en milieu/ruimtelijke ordening.
- Projecten met meerdere voordelen en meerdere doelgroepen

Lokale maatregelen (bijv. groene straten) leveren meerdere voordelen op – klimaatadaptatie, welzijn, biodiversiteit – en betrokkenheid van een breed scala aan stakeholders door middel van zichtbare, toegankelijke verbeteringen.

De voertaal van het rapport is Engels, zodat het ook gedeeld kan worden met de stakeholders van de internationale cases.

Contents

1 Introduction

Background
The Water and soil system is a natural supplier of clean drinking water, fertile agricultural land and nature areas. In 2022, a Parliamentary Letter on water and soil based planning was published (Ministry IenW, 2022). It focused on the need to base spatial planning and design on the water and soil system and to protect and restore this system as much as possible (in Dutch: *Water en Bodem Sturend, WBS*). The new Dutch government (2024) later impaired the ‘water and soil based planning’ policy by replacing it with “taking water and soil into account” (Ministry IenW, 2024; In Dutch: *rekening houden met water en bodem*), but the principles and structural choices in the Letter still stand. Projects have been initiated at different levels of national and regional governments using these principles as a basis. To support and overcome some of the hurdles encountered when implementing WBS, international experiences in other countries are expected to be a source of inspiration for these stakeholders.

Therefore, the Climate Adaptation and Water International programme (KAWI)[1] of the Ministry of Infrastructure and Water Management chose to focus in 2024 and 2025 on an international analysis on water and soil as guiding principles (WBS). This project also serves as a pilot on how KAWI can effectively gain knowledge from abroad.

Objective
The main objective is connecting national and international practices on the topic of “Taking the water and soil system into account in spatial and economic planning”.

This assignment concerns an analysis of what other countries are doing in this field. Because WBS covers a broad range of topics, examples that relate to fresh water supply were primarily chosen. During the project, examples with a focus on flood risk were also added to have a better spread of types of instruments.

The objective is to get answers on:
- How do other countries use water and soil as guiding principles in their spatial and economic planning, what instruments do they use to do so, and how do they ensure public support?
- Which components from these examples can be used to inspire Dutch stakeholders, like municipalities, provinces, waterboards and the national government?

It was explicitly not the intention of this project to make an exhaustive comparison of cases with the Dutch situation.

Methodology
The approach contains two phases.
1. An inception phase to select cases and to test the methodology
2. A full analysis of four cases in 2025, based on the elaborated methodology and lessons learned in the inception phase.

[1] Within DGWB's mission, KAWI gives substance to the global agreements (2030 agenda), focusing on long-term global water security, water safety and climate challenges. KAWI is active in the exchange of knowledge and (scientific) expertise, focusing on sustainable solutions, with the premise that water is the engine for climate adaptation.

In the inception phase, Deltares prepared a list of criteria for the selection of cases, made a longlist of possible cases (see Annex A) and carried out a quick scan for a first case – Cali, Colombia. The results were presented and discussed during a workshop with the ministry of IenW and the Sounding Board. The Sounding board is a group of four WBS experts from different Dutch organizations. Their role was to give feedback on the methodology, the cases chosen and the analysis of the four cases. Based on this discussion in the workshop the other three cases were selected: Flanders, Belgium; Portland, USA and Tyrol, Austria. ‘

The selection was based on scoring across various criteria such as alignment to WBS principles, relevance to the Netherlands and the implementation of legal, spatial and financial instruments. For details on the criteria and scoring see **Error! Reference source not found.**. P reference was given to cases that were more than 10 years old, so that learnings could be captured. The final selection was based on votes collected from the project team and the Sounding board.

Figure 1: Location of cases

In the second phase, the cases were analysed in detail. The results are reported in this document in a concise manner. The specifics of the used instruments are listed, as well as the impact of the instrument and the key insights that can form an inspiration for the Netherlands. The study does not include a detailed analysis that connects the inspiration points from the international cases to the Dutch context. However, a final workshop gathered some preliminary insights on how the findings could benefit the Dutch context.

The results of the project were discussed with the Ministry of I&W, the members of the Sounding Board and stakeholders during the final workshop. The main aim of the workshop was to assess which results are the most relevant to the Dutch stakeholders and whether some additional information or details might be valuable (recommendations for follow-up).

Reading guide
Chapter 2, presents upfront the key insights gathered through the analysis of the four cases. Chapter 3 explores the four cases providing details on the context, instrument and impact of the instrument. Annex A presented the selection criteria and the long list of cases.

2 Key insights and reflections

This chapter presents elements from the four international cases that could serve as an inspiration to stakeholders in the Netherlands. What is interesting in each of these cases is how the enabling environment was activated to support a transition. These case-specific enabling environments included actors, protocols, and different legal or policy instruments. While investigating the design of the enabling environment across all four cases the following common aspects stand out:

1. Legal basis: By linking water as soil based planning to law, the basis for collaboration between all actors is substantiated and does not need to be re-established in every location. This aspect is visible across all cases. The legal basis enables both governmental (Cali and Tyrol) and non-governmental entitles (Portland) to enforce water and soil based planning. Further, the legal basis becomes the starting point for the gradual and incremental development of protocols enabling better communication between actors overtime and being resistant to changes in political positions of governments.
2. Community involvement: The role of the community (or direct beneficiaries) is essential to enable effective water and soil based planning. Communities hold valuable local and indigenous knowledge, which is necessary for the implementation of WBS. Including communities across all stages of WBS enables better ownership of projects (Portland), co-investment in climate adaptation measures (Flanders and Portland), provides necessary resistance if governmental entities are shifting priorities due to political or other developments. The involvement of the community and public also links to the EU water resilience strategy in which empathizes that awareness and public engagement should be strengthened (COM(2025), 280 final, p.11). Communities should be viewed as necessary partners and enablers that have the capacity to make significant contributions to WBS. Community ownership and input is essential for 'scaling deep'.[2]
3. Narrative and clear rationale: To communicate to a wide spectrum of actors it is necessary to ensure that the rationale for decision-making is understandable and explainable to all. This prevents confusion and misunderstanding between actors. In Tyrol the clear and brief criteria for defining agricultural land for protection enabled a good uptake across municipalities. The narrative that open spaces are 'not-yet-developed' was transformed to the urgency to protect agricultural land for national food security.
4. Clarity of protocol: Defining the step-by-step process enables smooth collaboration between actors. The lack of clear protocol can result in delay or inaction. With clear protocols it becomes clear who starts and who finishes, what information is required, who makes decisions and when? A clear protocol also enables scaling up and scaling out of WBS planning. The protocol can be designed to enable simultaneously support and accountability between the involved actors (Cali, Portland). This transforms the nature of implementation from enforcement alone to also include co-creation.

[2] **Scaling up**, **scaling out**, and **scaling deep** are complementary strategies to expand the impact of innovations or interventions. *Scaling up* focuses on broadening the reach by integrating successful solutions into policies or institutional systems. *Scaling out* involves replicating effective practices across different locations or communities. *Scaling deep* targets long-term change by shifting mindsets, cultural values, and social norms to support sustainable outcomes. Together, these approaches help ensure both widespread and lasting impact in addressing complex challenges like climate resilience and flood risk management (Moore et al., 2015; Westley et al., 2014).

5. Equality of rules: Applying the same principle across municipalities or regions eliminates potential discrepancy between authorities on whether their mandate to comply is stricter than the neighbouring municipality or region. When similar standards are applied, high levels of uptake are observed (Tyrol).
6. Developing capacities: By understanding the local capacities and designing the transition based on these capacities higher levels of ownership are enabled. By understanding the technical capacities of certain actors to perform key steps (Tyrol), or by tapping into the enthusiasm and interests of actors (Portland), transition potentials can be unlocked.
7. Incremental process of developing instruments: All the cases demonstrate that the design of transitions, protocols and projects can be done in an iterative, incremental way. By rolling out instruments and gradually developing them, ownership across various actors is built-up and the design is better suited to the needs of all involved parties.

In addition to the general insights a number of specific insights or inspiration points per case are re-iterated below.

2.1 Cali, Colombia: Integration of environmental determinants in land-use plans

- Multi-scalar integration of water and soil management – national, regional and municipal – enables appropriate action at multiple scales.
- A legal basis and a clear legal protocol are developed to ensure action by all relevant actors.
- Local communities and actors are systematically consulted throughout the process.
- A well-developed, clear protocol between the environmental authorities, the municipalities and local actors enables clarity in decision making, roles, accountability and support to ensure that water and soil based planning is achieved.

2.2 Flanders, Belgium: Water Test (Watertoets)

- Prevention (proactive spatial planning) plays an important role in Flemish flood risk management.
- If municipalities are not willing to designate specific flood prone areas as ‘non-buildable’, the Flemish government has a safety net (designate it as a water-sensitive open space area (*watergevoelig openruimte gebied, WORG*) in which the no-construction restriction is legally enshrined.
- Flood risk management is not only the responsibility of the government, but also of the society at large. An instrument as the duty to inform underscores this responsibility of civilians and companies.

2.3 Portland, Oregon, USA: Stimulating Blue-green transitions by enabling communities and private investment.

- Programmes by the government should be designed based on a careful understanding of the enabling environment.
- By working with environmentally active communities, the financial and operational burden to implement and manage projects can be significantly reduced.
- Involving citizens can result in other co-benefits like strengthening of communities and increased ownership of projects.
- Environmentally conscious citizens can have a significant impact on shaping the priorities of the private real estate development within a city.
- Financially vulnerable communities should be considered while designing instruments and projects to ensure equitable benefits for all sections of society.

2.4 Tyrol, Austria: Rolling out a spatial planning instrument for the protection of agricultural land

- Clear protocol and narrative ensure higher uptake of instruments.
- Understanding and building on existing capacities of all involved actors ensures successful implementation of instruments.
- Fairness in implementation ensures that comparison between actors does not restrict action.
- Restriction to development in specific locations is balanced with provisions of other locations for where development can take place.
- Increased awareness within the enabling environment ensures that the impetus for water and soil based planning is distributed across all actors.

2.5 Reflections

The insights from the four cases formed the basis for a discussion with Dutch stakeholders including the Ministry of Infrastructure and Water Management (IenW), the project's Sounding Board, and stakeholders such as Rijkswaterstaat (RWS) and Association of Dutch Municipalities (VNG). The purpose of the workshop was to mainly understand "Which elements from those international cases can inspire Dutch government and other stakeholders involved with implementing WBS?"
The workshop confirmed that several of the key insights highlighted above were relevant to the Netherlands. Specific elements identified and discussed by the participants during the workshop are shared below.

Figure 2 Workshop where Ministry of Infrastructure and Water, the Sounding Board, RWS and VNG provided input on key aspects from the cases that can inspire the Netherlands.

Legal basis
The Legal basis, demonstrated across all four cases, ensures that the instrument is used properly and that it is not easy to deviate from it. A legal instrument is more likely to be used than a voluntary instrument. The WBS Letter is not legally binding. Many of the aspects that are included in the Policy Letter fall under the competences of decentralized authorities. If the Ministry decides to take the lead in the realisation of a particular structural choice, it would be wise, according to the participants, to explore whether a (national) legal basis could facilitate its implementation.

Community involvement
Flood risk management is not only a task and responsibility of the government. In Flanders, flood risks are translated into scores at the scale of buildings and parcels. This allows property owners to implement localized measures to improve the score. This localized score results in both awareness and responsibility distribution to non-governmental entities.

Clear and understandable narrative
It is important to have a clear narrative or explanation why the instrument is needed, what the goal is and how it will be executed (the method). By having a clear and understandable narrative, it is more likely that it will be taken up by decentralized authorities and accepted by the society. Having a clear and defined aim, makes it also easier to evaluate whether the instrument is working.
The narrative should be inclusive and appeal to various actors. There is a need to connect wellbeing and prosperity with green infrastructure and its economic benefits. ‘Liveable streets’, for example, focuses on wellbeing while it also may contain climate resilient components.
Participants also shared that it would be beneficial to connect small local initiatives that contribute to the WBS mindset to increase awareness of the combined impact of these measures.

Clear and understandable method / protocol
If the protocol or method is clear, it is also easier to explain to stakeholders why it leads to a specific decision. This also provides some confidence for the decision-makers that they take the right decision, even if it is a difficult one. During the workshop, the request came to the national level to set clear frameworks and possibly also take certain decisions already, so that at the decentralized level the decision-maker knows where s/he stands. Also, all the presented cases demonstrate a clarity on which party is leading. This is not yet defined under all structural choices for WBS in the Netherlands.

Participants also mentioned that the protection of agricultural land is currently very relevant to the priorities of the ministry in the Netherlands. The learnings from the Tyrol case can be directly applied to the good agricultural soil (*goede landbouwgrond)* discussions in the Netherlands. It would also be interesting to apply it to other land uses like natural areas or water systems. It could be linked to goals to restore biodiversity, nature restoration law, soil health etc.

Incremental process of developing an instrument
By starting with an instrument and gradually improving it through lessons from practice, the tool becomes better and more feasible, because it is precisely through its use in practice that certain problems become visible. Therefore, it is better to start with an instrument that is “good enough” and work on perfecting it in practice, than to strive for perfection and then present it, which greatly delays its entry into force and can hamper its uptake.

Distribution of responsibility between actors
In the Netherlands, the focus to implement WBS is primarily on governmental actors. The cases, especially Portland, show how it is possible to enable people and property owners to make investments from an economic and well-being mindset.

Boundary spanning instruments
The instruments highlighted such as the Watershed Management Plan and consultation moments (Cali, Colombia) enable actors operating in different realms to interact and agree on decisions that cross between different boundaries – public and private, urban and rural, city and regional, environmental planning and spatial planning etc. Designing boundary spanning instruments allows for integrated decision making.

Design projects with multiple benefits and multiple audiences
Implementation of local measures like green streets in neighbourhoods ensures that the benefits gained through projects are visible and accessible to multiple users. The measures achieve multiple purposes like climate adaptation, improved wellbeing, flood mitigation, increased biodiversity etc. Elements like benches do not directly contribute to climate adaptation but are necessary aspects to make measures connect with various stakeholders.

3 The Cases

3.1 Cali, Colombia: Integration of environmental determinants in land-use plans

CONTEXT

Due to its geographic location and a wide variety of climatic regimes, Colombia is among the countries with the greatest wealth of water resources in the world. However, the availability of the resource is decreasing while the population and socioeconomic activities are located in regions with low water supply, there are unmet water needs of ecosystems, and the number of anthropogenic impacts on water is increasing (2010, *Ministerio de Ambiente*). Colombia has a total population with more than 48 million inhabitants.

Law 99 (1993) mandated environmental authorities to support municipalities in incorporating environmental aspects into planning and land use processes, to ensure the preservation of crucial components of the environment including the water system.

INSTRUMENT: Environmental determinants and Watershed management Plans

Law 388 (1997) identified four types of determinants that must be considered while preparing and revising land use plans – environmental determinants, cultural determinants, infrastructural determinants and metropolitan development determinants. These determinants are the connecting bridge between regional environmental planning and municipal land-use. The effectiveness of the determinants in terms of these objectives depends on both the environmental authorities and the municipality (*Minambientale*, 2020). Environmental determinants include soil, water, flora, and fauna.

As per Decree 1640 (2012), Watershed Management Plans (*Planes de Ordenación y Manejo de Cuencas Hidrográficas, POMCA)* define the environmental determinants that should be incorporated in the land-use plans.[3] These plans, drafted by the environmental authorities, identify the environmental determinants and establish environmental standards for their maintenance. Further, they identify projects and programs necessary for the management of environmental determinants.

Since its legal establishment 27 years ago (law 388, 1997), the process of integrating environmental determinants in land-use plans has been developed extensively. The process starts by the regional environmental authorities preparing a Watershed Management plan. Local actors are consulted in the process of formulating the watershed management plan. Among local actors ethnic communities have special rights[4] to decide on projects. Once completed, the Watershed Management plans provide the basis environmental determinants

[3] Watershed management plans are only one of implementation tools to incorporate environmental determinants in land-use planning. Environmental Determinants are categorized into four types related to: natural environment, transformed environment, risk management and climate change, and densification of rural lands. Within environmental determinants there are several sub-categories as well viz. National system of protected areas (SINAP), such as national parks, forest reserves, Areas of Specific ecosystem importance and strategic ecosystems etc.

[4] Consulta Previa or Prior consultation is the fundamental right of ethnic groups to decide on measures (legislative and administrative) or projects, works, or activities to be carried out within their territories, thereby seeking to protect their cultural, social, and economic integrity and guarantee the right to participation. This participation mechanism is a collective constitutional right and a special and mandatory public process that must be carried out beforehand whenever any administrative measure or public or private project is to be adopted, decided, or executed that may directly affect the ways of life of national ethnic groups in their territorial, environmental, cultural, spiritual, social, economic, and health aspects, as well as other aspects that impact their ethnic integrity.

in the land use plans. Then municipalities begin to draw environmental determinants in their land use plans (POTs) in the diagnostic stage. Once drafted, the land use plans are reviewed by the environmental authorities. The environmental authority may be required to additionally provide technical assistance to municipalities for the adequate incorporation of environmental determinants. This ensures that the lack of technical capacity in a municipality does not hinder the process. In parallel, democratic consultations are held with unions and communities (Art 4,24, Law 388, 1997) and other governmental authorities. Environmental authorities follow up on agreements reached to guarantee adequate compliance to the standards defined. Finally, if the environmental authorities observe non-compliance by municipalities they are obligated to inform the national level financial auditing entity (*Contraloría General de la República*, CGR),[5] which may result in financial repercussions for the city.

It is possible that new environmental determinants are identified during the consultation process. In such a situation the environmental authority assesses the applicability of these new determinants. Although new determinants have less weight compared to those identified in the diagnostic stage, they cannot be entirely excluded.

Prior to the implementation of projects at any scale, it is mandated (law 99, 1993) to request for an environmental licence *(licenciamiento ambiental)* by conducting an environmental impact assessment. This assessment includes strategic resources including land and water and measures the magnitude, extent of impact in space, time and on vulnerable communities. Environmental authorities, which also identify environmental determinants, are responsible for evaluating such assessments and granting licences. This licence indicates indicating authorized activities, conditions and restrictions.

Since 2023, the ‘Land use planning around water’ (*Ordenamiento del territorio alrededor del agua*) is a key transformation within Colombia's National Development Plan (PND) for 2023-2026. This additional policy instrument focuses on organizing land use around water resources to promote sustainable development, environmental justice, and social equity. While the Environmental Determinants are implemented across the jurisdiction of the environmental authorities and the municipalities, this instrument will focus on the enforcement of determinants across regions and at the national level. This will involve integrated territorial planning based on the highest-ranking determinant based on Article 33 of Law 2294 of 2023 (which approved the National Development Plan). The process of integrating environmental determinants in land use plans has been schematically represented in Figure 4.

[5] The Comptroller General of the Republic (CGR) is the highest fiscal control body of the State. As such, its mission is to ensure the proper use of public resources and assets and to contribute to the modernization of the State, through continuous improvement actions in the different public entities.

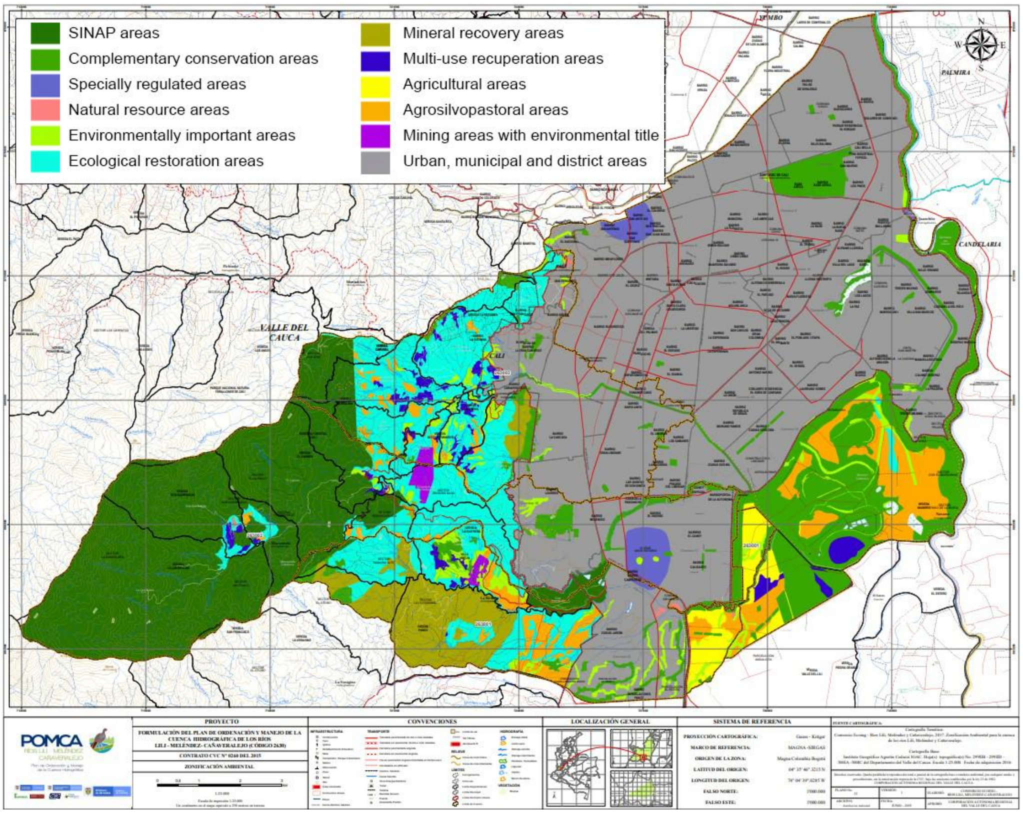

Figure 3: Watershed Management Plan (POMCA), June 2019, for Cali prepared by environmental authorities (Corporación Autónoma Regional del Valle del Cauca or CVC). This plan addresses aspects of surface water and groundwater resources. The green fields on the left and right of the map indicate environmental determinants.

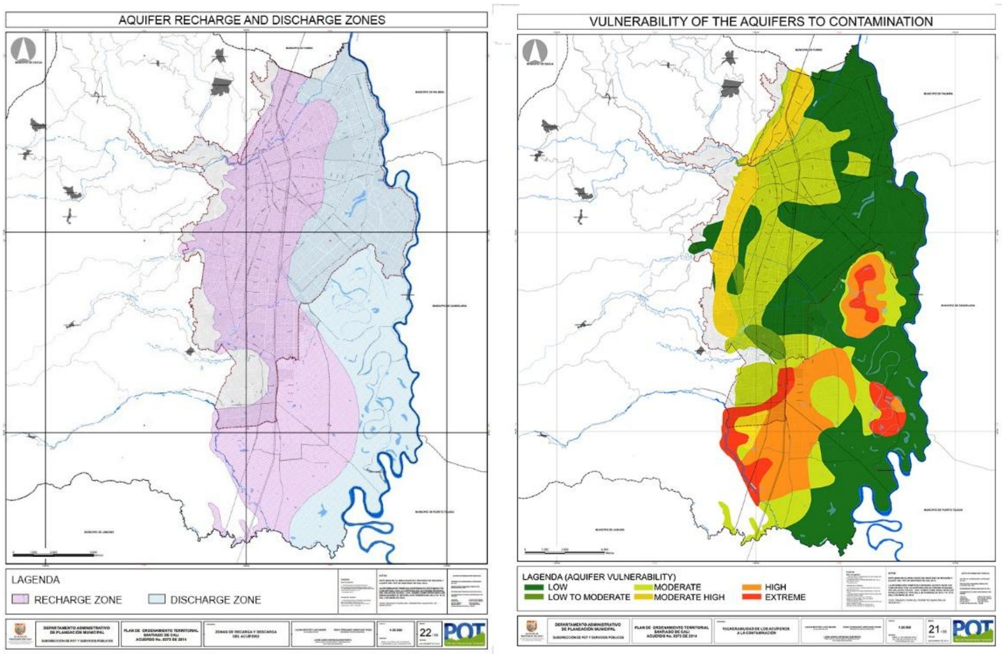

Figure 4: Land-use plan, Cali (POT) 2014-2024, aquifer recharge and contamination zones.

IMPACT
The extent to which the protocol above is implemented varies across Colombia. In Cali, the land-use plan (2014) demonstrates the successful implementation of environmental determinants. As part of the Aquifer Environmental Management plan, prepared by *Corporación Autónoma Regional del Valle del Cauca* (the environmental authority), several components related to groundwater monitoring have been implemented. These include a study to analyse the impact of riverbank filtration on the aquifer, monitoring the interaction between surface water and groundwater to define protection measures for both, preparation of a groundwater contamination risk map, proposing measures to enhance recharge in built and non-built areas.

To enable better country-wide implementation, in 2020 a guideline was published by the Ministry of Environment, specifically directed towards to environmental authorities. The guideline covers the following aspects:

1. Conceptual basis for updating environmental determinants.
2. Detailing of environmental determinants per theme.
3. Detailing type of information and key moments for technical assistance to be provided by environmental authorities.
4. Protocol, consultation tools and advice to enable effective coordination with municipalities and to guide the nature agreements reached between the municipalities and local actors in consultation processes.

INSIGHTS

- The instrument supports integration of water and soil management across various scales. Environmental determinants are mapped, monitored and managed at multiple scales: National, regional and municipal. This enables informed decision making both at system-scale (natural system) and object-scale (plot in land-use plan).
- The management of environmental determinants has a legal basis, and a clear legal protocol is developed to ensure action by all relevant actors.
- Local communities, and other actors are systematically consulted throughout the process.
- A well-developed protocol defines the interaction between the environmental authorities, the municipalities and local actors and demonstrates the following salient features:
    - Clear roles and responsibilities (who does what)
    - Clear decision-making process (who starts and who finishes)
    - Protocol enabling both accountability and support between actors.

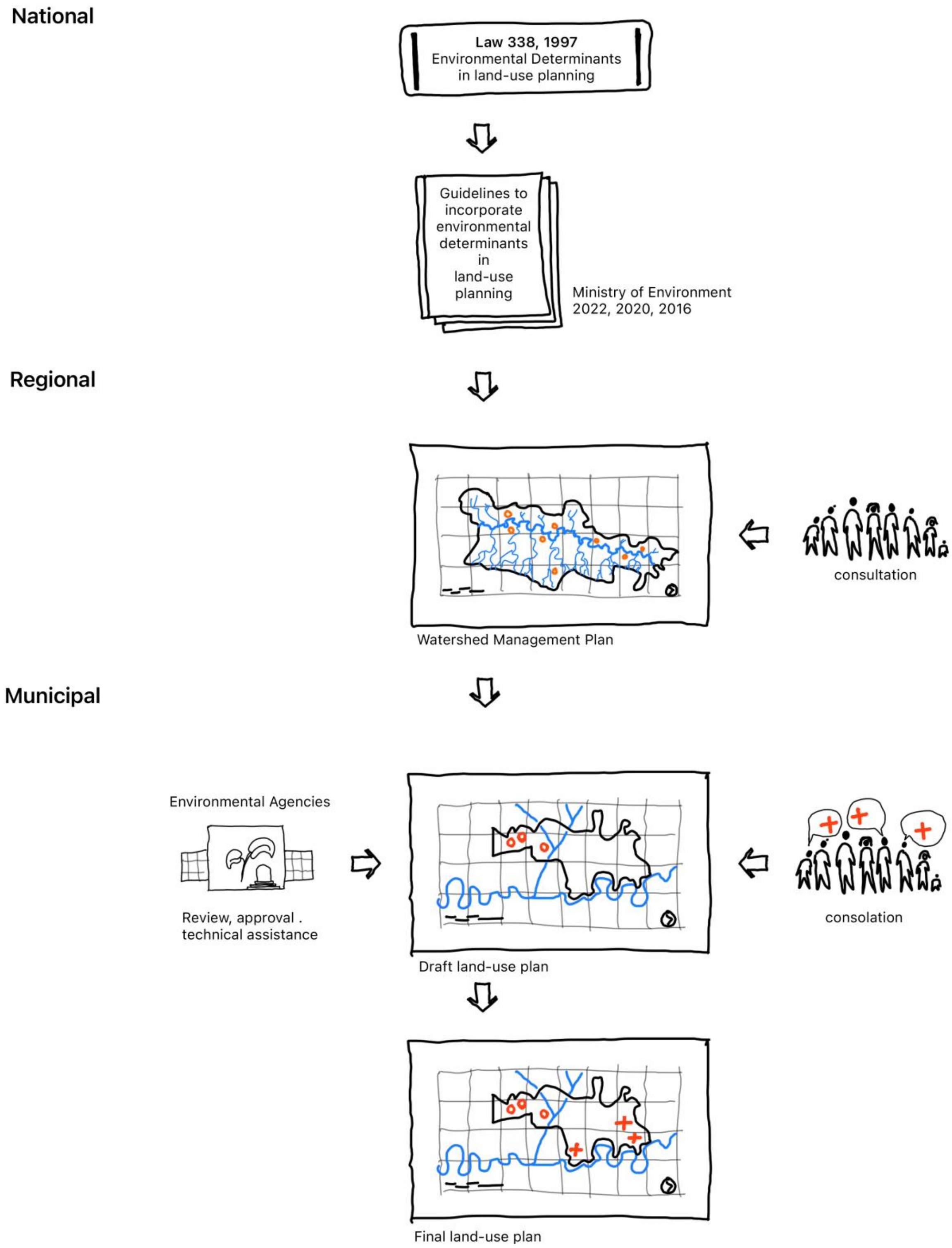

Figure 5. Integration of Environmental Determinants in Land-use plans across scales (source: Deltares)

3.2 Flanders, Belgium: Water Test (Watertoets)

CONTEXT
Belgium is a federal state which consists of three communities and regions: Flanders, Brussels and Wallonia. Around the 6.8 million inhabitants live in Flanders (*Statistiek Vlaanderen*). With a surface of 13.626 km² the Flemish region has a population density of about 501 inhabitants per km². In 2023, approximately 29% of the total area was occupied by built-up land (*Statistiek Vlaanderen {Ruimtegebruik}).*

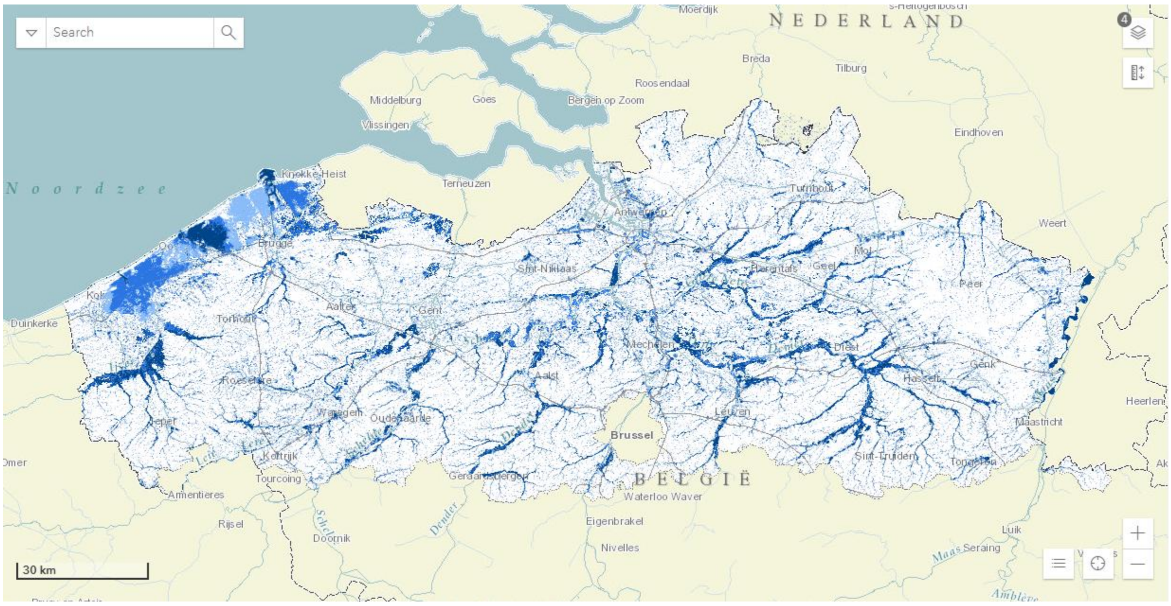

Figure 6. Map with areas prone for fluvial, pluvial and coastal flooding (source: Vlaanderen.be)

INSTRUMENT: Water Test (*Watertoets*)
The interest of the water system is legally embedded in the Integrated Water management Decree (*Waterwetboek* or *Decreet Integraal Waterbeleid*). This interest is reflected in several interrelated instruments: the Water Test, the duty to inform and the signal areas.

The Water Test
The Water Test is the investigation of an authority to the possible harmful effects of an activity to the water system. This investigation results in a water paragraph in the permit, plan or programme.

The authority deciding on a permit, plan or programme must ensure that no harmful effects will occur during its implementation. These harmful effects must be prevented as much as possible by either refusing the permit, or denying approval of the plan or programme, or by imposing appropriate measures, which reduce the harmful effects as much as possible or, if that is not possible, remedy them or, in the case of reduction of infiltration of rainwater, compensate for them. The assessment only addresses activities (permits, plans or programmes), so the aim is not to solve existing problems of the water system (*Groothuijse & De Smedt* 2024).

In some cases, the competent authority is obliged to seek advice from the water authority. These cases are listed in Article 3 §2 of the Water Test Implementation Decree (*Uitvoeringsbesluit Watertoets, Besluit van de Vlaamse Regering van 20 juli 2006)*.

The non-flood related aspects of the Water Test are assessed by the VLAREM regulation (Flemish Regulations on environmental permits). For the aspect of drought and water availability, the rainwater regulation (*Gewestelijke stedenbouwkundige verordening inzake hemelwate*r) is important. The guidelines in the regulation place strong emphasis on maximum reuse of rainwater on the one hand to protect other more high-value resources such as groundwater. In addition, the regulation is pushing for above-ground infiltration to ensure sufficient infiltration.

Specifically for flood risk management, the Water Test procedure is very elaborated. Flood prone area maps showing flood risk probabilities are publicly available.
For each source of flooding, the probability of flooding (return period) is recorded on the flood prone areas map (*Overstromingsgevoelige gebieden in Vlaanderen*).[6],[7]

Based on this, each parcel and building are given a score (P (parcel) and G (*gebouw*: building) score), on a scale from A to D. The most critical flood source determines the final score.
A: no flood modelled
B: small probability of flooding under climate change 2050
C: small flood probability under current climate
D: medium flood probability under current climate

Information duty

When someone wants to rent out a property or land for more than 9 years or sell it, (s)he is obliged to inform the prospective buyers or prospective tenants about the probability of flooding (according to the scores that are mentioned above). By taking measures, the scores can be updated and adjusted.

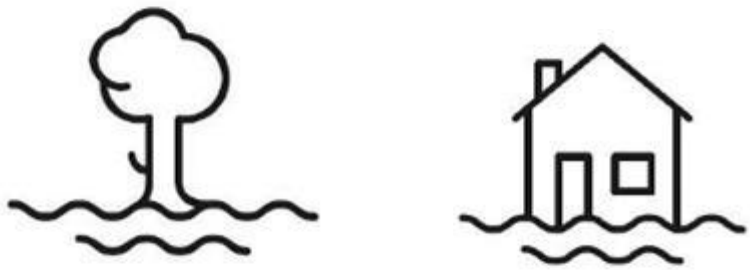

Figure 7. Symbol to indicate plots (left) and buildings (right) classified as category d: medium probability of flooding under the current climate (Annex VI Uitvoeringsbesluit Watertoets).

Signal areas

Also relevant are the signal areas, because in some of these areas, a more intensified Water Test is obligatory.

[6] https://waterinfo.vlaanderen.be/watertoets [last visited: 16 June 2025].
[7] Flood prone areas should not be confused with “flood risk zones”(*risicozones voor overstromingen*). The latter are places where water damage is most likely to occur. These zones are smaller than the flood prone areas, they are indicated on a map of the federal government (and therefore not of the Flemish government). This map is used for insurances against natural disasters. Those who own land in a flood risk zone may face higher fire insurance premiums. New buildings may even be denied the right to coverage against flood damage.

Signal areas are undeveloped areas with a hard land use zoning (*e.g.* residential expansion area, industrial area) which can also fulfil a function in the management of flooding, because they can be flooded or because they act as a natural sponge.

For these areas, different development perspectives exist:

- Intensified Water Test: current zoning remains, with additional conditions for the development of the area.
- Construction-free zone: parts of the signal area must remain construction-free and must consequently be zoned differently. This can be done in 2 ways:
    - preparation of a spatial implementation plan (*ruimtelijk uitvoeringsplan, RUP*)
    - designation as water-sensitive open space area (*watergevoelig openruimte gebied, WORG*)[8]

A schematic representation of the Water test showing inputs and outputs is presented in Figure 7.

IMPACT
The Flemish Water Test was introduced in 2003, when it was included in the Decree on Integrated Water Policy (*Decreet Integraal Waterbeleid*). The instrument was evaluated and adjusted according to the results of the evaluation over time. When it emerged that the Water Test could not prevent parcels in flood-prone areas from being developed anyway, a more stringent water test was introduced in 2013 for signal areas. Also, some changes came into force on 1 January 2023.

For the Signal Areas in which a construction-free zone is necessary, there is not much incentive to lay these down in a RUP by the municipality or province, because of the uncertainty involved and for fear of liability for financial damage (*planschade*). The possibility of designating these areas as a water-sensitive open space area (*watergevoelig openruimte gebied,WORG*) by the Flemish Government is a safety net for this.

Permits, plans and programmes can be adjusted as a result of the Water Test. Should anyone disagree with a decision taken based on the Water Test advice, or if a public body has not followed the Water Test advice, legal protection is available. The Water Test has been submitted for review in several court cases. Case law shows that a public body cannot easily disregard the Water Test advice.[9]

The scope of the Water Test advice is broadened in the changes of the instrument on 1 January 2023. Currently, also other aspects of integrated water management, such as water quality and water availability should be addressed in the assessment. At this moment, it is too early to provide information on how this broadened scope works out in practice.

[8] The goal of the WORG is to prevent development in these areas. Functions, such as water management, nature conservation, forestry, landscape care, agriculture and recreation are still possible, as secondary functions. Owners of land in these areas can be compensated for their loss by the *planschade* regulation (https://navigator.emis.vito.be/detail?woId=87396 [last visited: 3 July 2025]).
[9] E.g. ECLI:BE:RSVCE:2024:ARR.261.760, ECLI:BE:RVSCE:2023:ARR.257.633; ECLI:BE:RSVCE:2023:ARR.256.897.

INSIGHTS
Multilayered safety[10] in Flanders has a focus on the layer of prevention though spatial planning (*Groothuijse & De Smedt*, 2024). The Water Test, together with the signal areas and the water-sensitive open space areas, are important instruments to secure the water interest in spatial planning. The instrument has been evaluated and adjusted overtime in order to become more effective.

The federal government has introduced a safety net for areas that may not be developed because of the flood risks. The moment a municipal government does not designate this area as such in the spatial implementation plan (*ruimtelijk uitvoeringsplan, RUP*), the federal government can designate it as a water-sensitive open space area (*watergevoelig openruimte gebied, WORG*) with which the no-construction restriction is legally enshrined.

Flood risk management is not only a matter for water managers, but also for the society at large. This is underscored by the duty of information, that creates a responsibility for the Flemish population as well.

[10] Multilayered safety involves a multilayer risk approach to flood risk management. Many states have a form of multi-layered safety. In the Netherlands, the layers are *prevention* (preventing flooding by means of hard infrastructure), *spatial planning* (preventing flooding and mitigating consequences through good spatial planning) and *disaster management* (good organisational preparation for flooding).

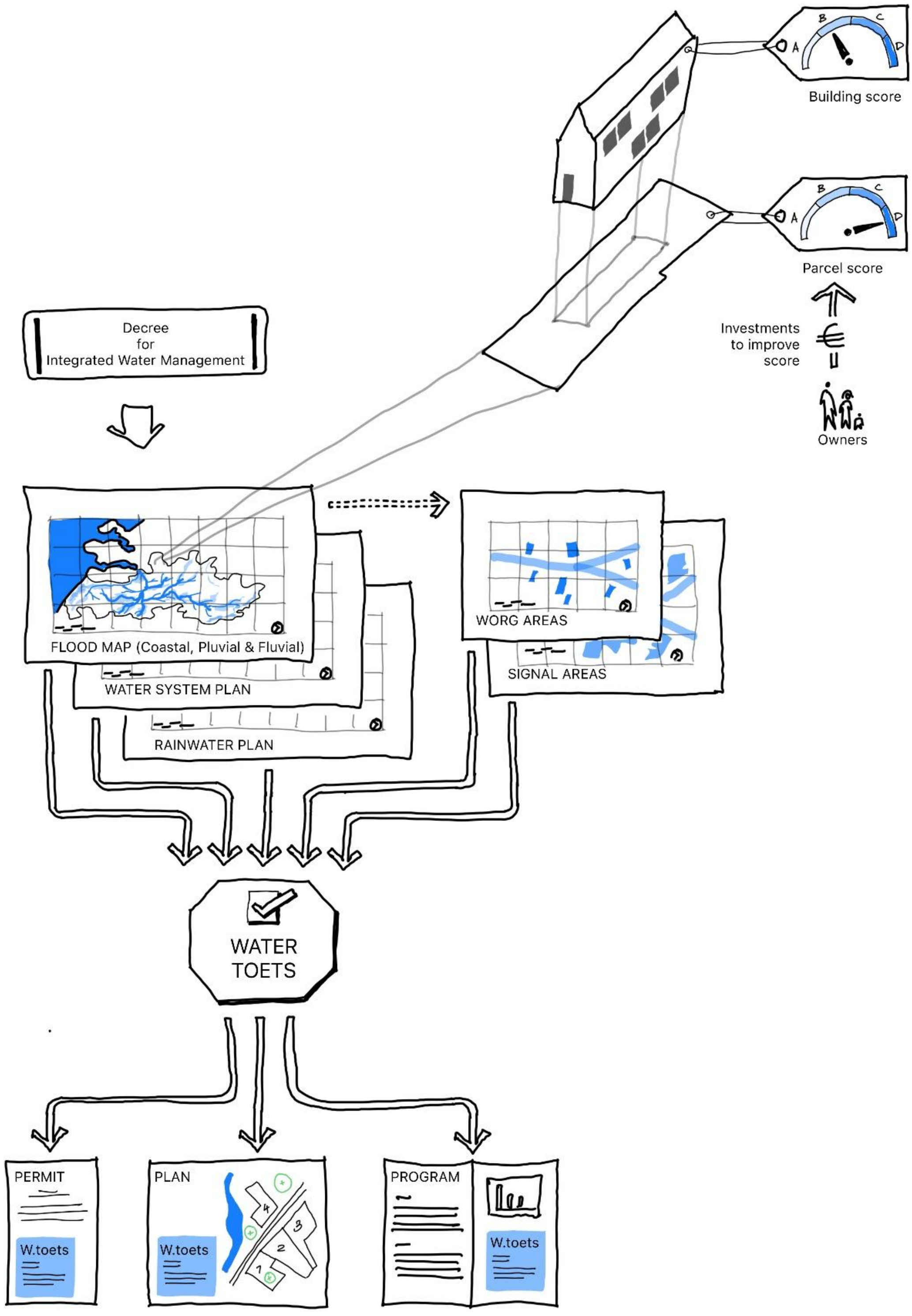

Figure 8. Flows of information through the Water Test (source: Deltares)

3.3 Portland, Oregon, USA: Stimulating Blue-green transitions by enabling communities and private investment

CONTEXT

The city of Portland is located at the confluence of two rivers – Colombia and Willamette. Both these rivers are key ecosystems for endangered species of salmon. Following World War II, Portland, Oregon underwent rapid urbanization due to a population boom, suburban housing development, and increased car ownership (*Abbott* 1983).

This growth led to increased impervious surfaces (for sidewalks, parking lots etc.) resulting in reduced infiltration of rainwater through soil and increased rainwater runoff. In addition, the combined sewer (collecting wastewater and stormwater) was ageing, and its capacity to manage the increased volume of rainwater was diminishing. As a result, the city experienced nuisance by flooding (caused by rain events with a return period of 1,2 and 5 years). Although these flood events did not cause catastrophic damage, they were disrupting everyday activities and affecting the accessibility to roads. Additionally, there were recurring occurrences of combined sewer overflows[11] into the rivers, causing pollution to the protected ecosystems..

Portland is known for its environmentally active population, characterized by strong public support for sustainability and environmental protection. As a result, Portland has been a pioneer in climate policy, adopting the first municipal climate action plan in the United States in 1993.

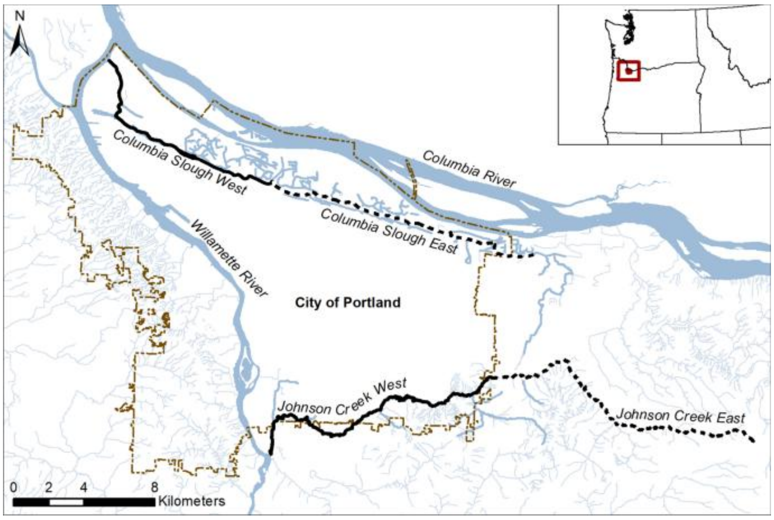

Figure 9 Map showing the city, rivers and creeks of Portland (Maze, Bond, & Mattsson, 2024).

[11] A combined sewer overflow (CSO) occurs when a system that collects both stormwater and sewage exceeds capacity during heavy rainfall, causing untreated wastewater to discharge into nearby water bodies.

INSTRUMENTS: Clean water act and programmes enabling co-investment
Nuisance by flooding and the pollution of endangered river ecosystems gave impetus for a wider blue-green transition in Portland. This resulted in the city-wide implementation of urban nature-based solutions (bio-swales or green streets, green roofs, and constructed wetlands), and embedding of these solutions in public and private investment plans. Four elements are highlighted here that were essential to creating an enabling environment for this transition: a legal basis; cost-effectiveness of nature-based solutions; programmes enabling co-investment; and an environmentally active population.

1. A legal basis
The federal Clean Water Act of 1972, designed to restore and maintain the chemical, physical, and biological integrity of natural water bodies, formed the legal basis to enable the blue-green transition in Portland. In 1964, the Johnson Creek (which empties into the Willamette river) experienced one of its largest floods, and the next several years marked numerous ineffective attempts at flood mitigation, as well as the near total loss of the salmon and trout species in the river. By 1980s, high concentrations of heavy metals, E.coli and elevated stream temperatures led to many reaches of Johnson creek being classified as “impaired” under article 303(d) of the Clean water act.

In 1991, the Northwest Environmental Advocates, a non-profit advocacy group, filed a lawsuit against the City of Portland alleging that the regular discharge of untreated sewage through Combined Sewage Overflows (or CSOs) violated the Federal Clean Water Act, and that the city was not doing enough. As a result, the Oregon Department of Environmental Quality (state level) , mandated the city through a decree to reduce their CSOs. Based on this decree, the city of Portland invested $1.4 billion in what was called the ‘big pipe’ projects to reduce combined sewer overflows. This included three projects – the East Side Big Pipe (completed 2011), West Side CSO Tunnel (completed 2006) and the Columbia Slough Consolidation Conduit (completed 2000) – consisting of concrete tunnels along the riverbanks redirecting a majority of the combined sewage outfalls to sewage treatment plants.

2. Cost-effectiveness of nature-based solutions
The ‘big pipe’ projects, which were completed by 2011, reduced the CSOs significantly, but not entirely. These projects were funded largely by Portland’s utility bills. Further rate increases in utility bills to fund similar projects may not have been politically feasible, so in 2008 the city launched a new strategy, the $55 million ‘Grey to Green program to control stormwater runoff. (Environmental Services City of Portland, 2010a).

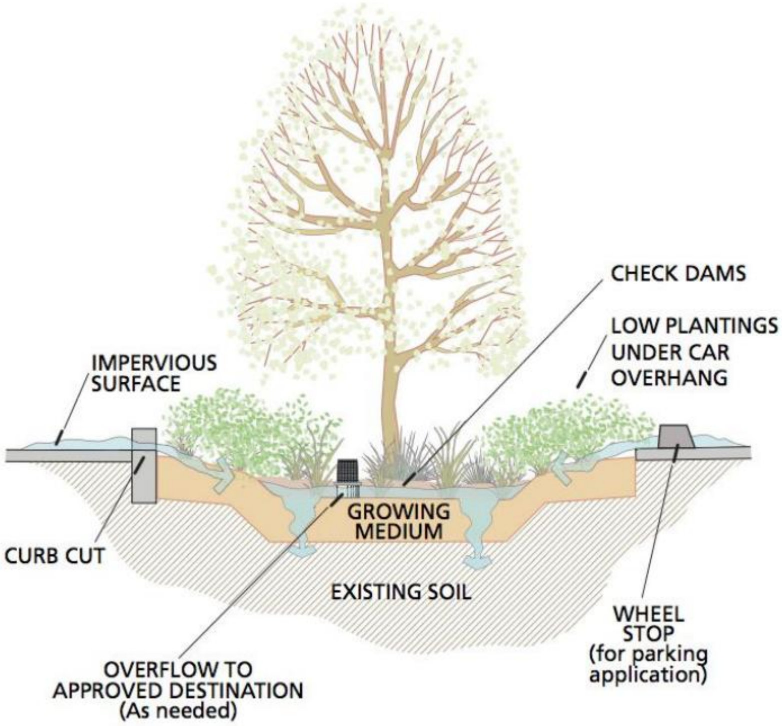

Figure 10 Diagram of the stormwater capture function of a bioswale, with infiltration of captured stormwater into the ground. Reed College (2018).

Green streets, which is a term used by the City of Portland and the Environmental Protection Agency, refer to low-impact development techniques that use vegetated facilities to manage stormwater runoff at its source and include urban nature-based solutions like curb extensions, street planters, and rain gardens as well as green streets, which involve changes to existing planting areas between curbs and sidewalks (Environmental Services City of Portland, 2008). These facilities are "more cost-effective than piping stormwater to a treatment plant" (Environmental Services City of Portland, 2010b). These cost-effective urban nature-based solutions used the capacity of soil and plants to absorb rainwater runoff at source, thereby reducing the load on traditional stormwater infrastructure.

3. Programmes enabling co-investment
Throughout the transition, the city of Portland directly involved residents, NGOs and real estate developers in implementing projects to reduce CSOs. By involving taxpayers, the city was also communicating to them that it was fulfilling its duties to reduce CSOs based on the mandate from the Oregon Department of Environmental Quality. As part of the 'big pipe' projects, the city implemented a downspout disconnection programme (1993-2011). The programme provided compensation for residents who disconnected their rainwater downspouts from the municipal stormwater system. This water was allowed to infiltrate within their properties. This enabled the disconnection of 56,000 downspouts reducing 1.2 billion gallons (= 4,5 billion litres) of stormwater in the municipal system.

Within the Grey to Green programme pilot, projects were implemented by the government to test and demonstrate the efficacy of urban nature-based solutions proposed. In 2007, green streets were mandated to be included in all city-funded development through the Green Street Policy. The policy encouraged both cross-departmental collaboration within the government as well as engaging with the public through the projects.

Under the Grey to Green programme, real estate developers and property owners were first incentivized to build green roofs to slow down the rainwater falling on roofs. By 2016, 410 green roofs were installed by private property owners. In 2018, the Portland government mandated that any building in central Portland with a net floor area of 20,000 sq.ft (= 1858 m^2) or more should have a green roof. As of 2019 there were 1.4 million sqare feet of green roofs in the city of Portland. Several manuals published by the city enabled knowledge sharing within municipal departments and with residents, sustaining the transition beyond the programmes. The Stormwater Management Manual (2014) emphasized that maximum run-off should be retained on site. The greenstreet stewards suggested plant guide (2017) provided guidelines for residents interested in volunteering to maintain green streets.

4. An environmentally active population
The values of the population[12] were a key element in enabling the transition to nature-based infrastructure and its sustenance today. The unlocking of private investment through donations as well as the viability of green-roof mandates on the real estate market, can be largely attributed to the importance citizens attributed to environmental issues. Additionally, the transition also demonstrates how the government engaged with this productively. To actively involving residents during construction, the city government also launched a green steward's programme inviting residents to participate in maintaining the green streets. On average residents spend two hours per month which includes weeding, removing trash, and clearing openings so water can flow and watering plants during dry summer weather. The municipal government facilitates this participation by conducting a training which involves a quick talk and demonstration. With the permission of the Environmental services, green stewards may remove weeds and add additional plants. The community involvement in maintaining green streets substantially reduces the time required for government maintenance staff, however the responsibility still lies with the government.

Figure 11 maps the key elements that enabled the transition from grey to blue-green hybrid infrastructure in Portland, Oregon.

IMPACT

<u>On the environment:</u>

The infrastructure transition in Portland reduced the pollution in the Willamette and Colombia river caused by combined sewage overflows. This was achieved by a combination of traditional grey infrastructure (or 'big pipe') projects as well as blue-green infrastructure. In 2011, the CSOs to the Willamette River reduced from 50 to an average of four times each winter and once every third summer (Environmental Services City of Portland, 2011). Blue green infrastructure implemented since 2011, has further reduced the combined sewer overflows to the rivers, by allowing rainwater to infiltrate into the ground in a distributed manner, while replenishing groundwater reserves. Green streets have been shown to reduce total suspended solids, organic pollutants, and oils found in stormwater by 90%, and heavy metals by more than 90%. The green streets thereby improve water quality and benefit overall watershed health. Other environmental enhancements include urban wildlife habitat and soil rehabilitation. The figure below shows the distribution of green streets in the city.

[12] Everett et al. (2015), titled "Delivering Green Streets: an exploration of changing perceptions and behaviours over time around bioswales in Portland, Oregon", found that residents initially expressed skepticism toward bioswale installations, citing concerns about aesthetics, mosquito breeding, litter, and unclear maintenance responsibilities. Over time, however, perceptions shifted as residents became more familiar with the environmental benefits and functionality of the bioswales. The authors emphasize that increased public engagement and localized maintenance strategies are key to improving acceptance and long-term success of green infrastructure projects

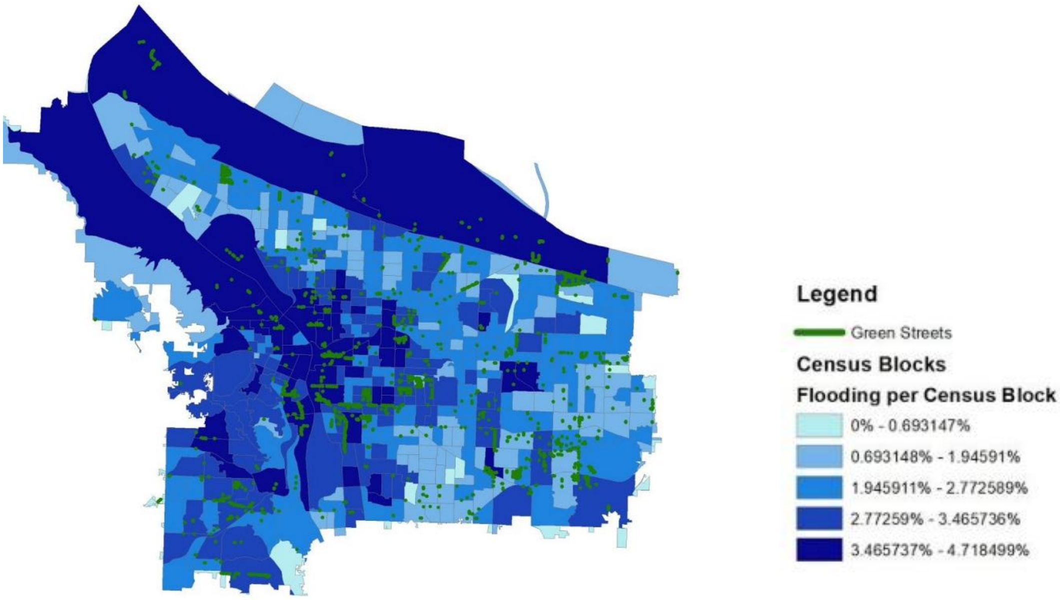

Figure 11. Location of green streets in Portland compared to flooding risk, Reed College (2018).

<u>On the community</u>
Through the green stewards programme, the environmental services in Portland, continue to engage with individuals, business and non-profit organizations. The programme allows green stewards to adopt a green street and care for it. As of 2021, 238 stewards were looking after 590 green streets citywide. Most volunteers find that maintaining green streets provides an opportunity to connect with others in their neighbourhood.

Green streets can also benefit a neighbourhood economically as a cost-effective alternative to sewer pipe replacement. The corresponding increase in utility bills in the neighbourhood is limited. Simultaneously, studies done in Portland show that street trees add $8,870 to the sales price of 23 houses and reduce their time on the market by 1.7 days. Such housing cost escalation can potentially lead to gentrification i.e. the displacement and/or exclusion of economically weaker tenants. Displaced tenants may be forced into neighbourhoods with even fewer resources and/or worse ecological problems.

INSIGHTS

- The context of Portland is marked by an exceptional percentage of environmentally active citizens. While this may be an outlier, it serves as an example of how the government can stimulate such an enabling environment. In Portland the government engaged citizens and businesses by facilitating the implementation of blue green infrastructure on private land and within neighbourhoods. Further, citizens continue to be involved in the maintenance of the blue green infrastructure.
- The value that citizens have for the environment also can be linked to their ‘willingness to pay’ for blue green projects. The projects in large part were financed by increases in utility bills.
- Environmentally conscious citizens also affect the private sector. In Portland, the government was able to use this to first incentivize and then mandate green roof installations in private developments.

Adding blue green infrastructure can have a gentrifying impact on the real estate. To enable climate resilience in low-income neighbourhoods without pushing vulnerable residents to other locations, instruments like rent-control can be used. Additionally, by uniformly distributing blue green infrastructure the price variation within a city can be limited.

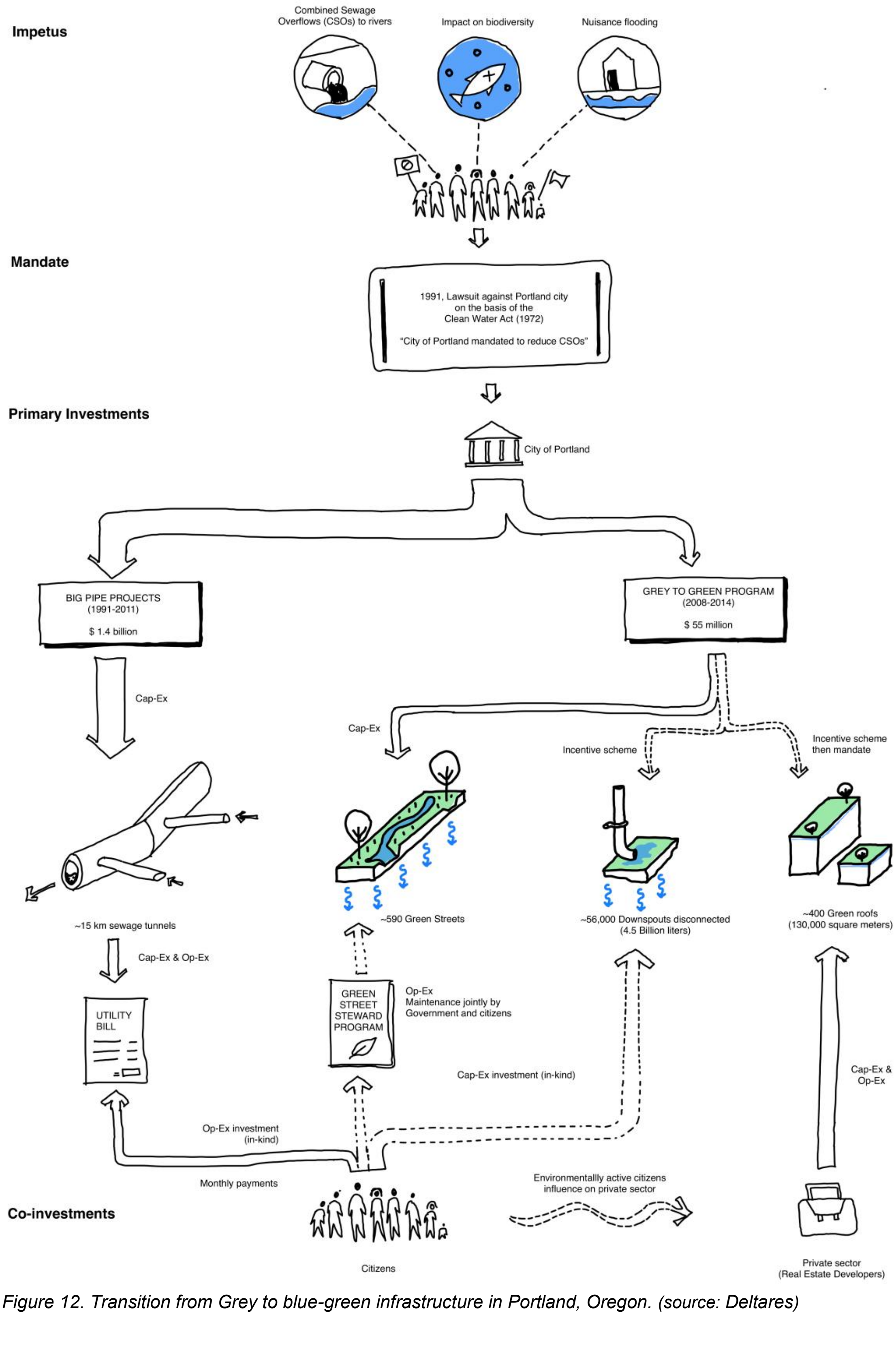

Figure 12. Transition from Grey to blue-green infrastructure in Portland, Oregon. (source: Deltares)

3.4 Tyrol, Austria: Rolling out a spatial planning instrument for the protection of agricultural land

CONTEXT

In Austria, 32% of land is agricultural and 40% of Austria's population (more than 3.5 million people) live in rural areas. The primary sector accounts for 1.2% of the Gross Value Added (GVA) (CAP, 2021). Because of the natural limitations of a mountainous terrain, agriculture is characterized by small holdings. Simultaneously, permanent settlements also occur in the flat valley regions, thereby putting pressure on the valuable and limited agricultural land. In Tyrol, one of the nine federal states, the population density within the restricted valley regions is 475 people per square kilometre.[13] In comparison the Austrian and Dutch average are 280 and 535 respectively.

As part the Climate Action Plan, Austria has allocated 60% of its resources for rural development to strengthen rural infrastructure and to counteract depopulation and ageing in rural areas (CAP, 2024). In this context, the protection of valuable agricultural land through land-use planning is vital.

INSTRUMENT: Regional spatial planning programs for protection of agricultural land

Since 2015, a regional spatial planning program was launched in the state of Tyrol, especially for the protection of valuable agricultural land (*Landwirtschaftliche Vorsorgeflächen;* Agricultural provisioning areas), and was recorded in the 21st ordinance in the State law gazette for Tyrol. This program is intended to ensure food security and to preserve agricultural structures and the cultural landscape (OpenSpaceAlps Planning Handbook, 2022). The instrument focuses on soil protection, and does not explicitly address water management.

With this legal basis, the protection of agricultural land is implemented across three scales: state, regional and local. The federal state of Tyrol is subdivided into 30 planning regions. Each region contains 5-20 municipalities. For each region, a regional map designates the agricultural land to be protected across several municipalities. Then a separate more detailed map at scale 1:10.000 designates the protected agricultural land per municipality. This map allows the precise identification of property boundaries. The map has a simple cartography of three elements: properties assigned as protected agricultural areas, property boundaries and municipal boundaries.

There are three criteria to identify agricultural land for protection. First, it has to have a minimum size of 4 Ha. Second, soil productivity potential using the 'soil climate index'[14] should be greater than 25. It is checked approximately every 20 years by taking soil samples and comparing them with "federal or state samples". For reference, best soils in Tyrol achieve a score of 60. This data is collected by the Austrian Financial Land Valuation agency. Finally, the slope steepness or slope of terrain should be less than 16^0 to allow for mechanical soil management.

[13] In the state of Tyrol, the average is 60 people/km^2. That number includes also the steep mountain terrains which are not inhabited.

[14] This measure assesses the productive potential of agricultural land based on soil quality (*Bodenzahl*) including soil texture, nutrient content, drainage capacity etc, and Climatic Yield Factor (Klimazahl): Accounts for climatic influences on agricultural productivity, including temperature, precipitation, and growing season length. The local tax office is responsible for carrying out the soil estimation, the result of which is the soil climate index. This information is compiled in the Österreichische Bodenzahlkarte (Austrian Soil Value Map).

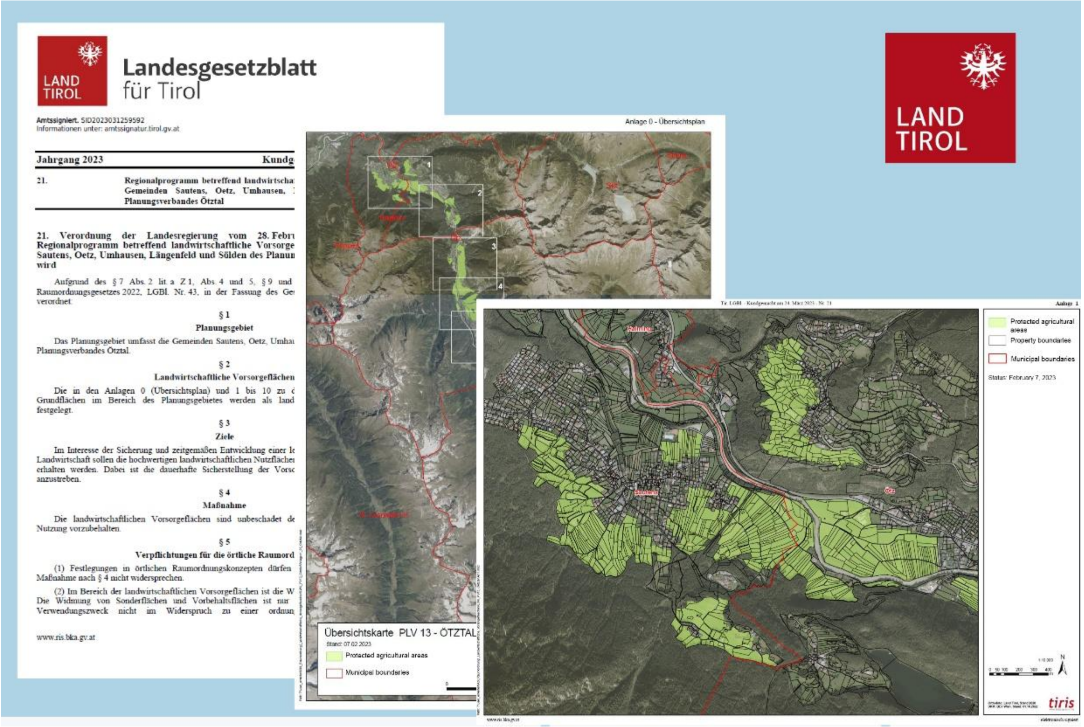

Figure 13. Legal basis and multiscale mapping for protection of agricultural land (Oggl, Land Tyrol, 2023)

The traditional perception of the role of municipalities was limited to the designation of buildable land. This instrument enables municipalities to clearly direct building pressure away from highly productive agricultural land to other land uses. When building permit applications are received, among other steps, municipalities will assess whether the property is designated as protected agricultural land. If this is the case there are two alternatives: Firstly, to build within specific zones designated as settlement expansion areas within the 10-year municipal development plans. Secondly, if the applicant still wants to pursue the conversion of the specific property from agricultural to buildable land, it is possible to request for a specific approval. This approval is made by a politically appointed committee, social partners and environmental entities among others. The committee meets four times a year, ensuring that projects can be approved quickly. In 2020, across the state of Tyrol, 16 amendments were adopted and 3 were rejected. In general, this extra step of approval and the provision of designated build-able land has resulted in limited amendment of the designated properties for protection of valuable agricultural land.

Every 10 years the designated sites are evaluated, and minor adaptations are made. A recent evaluation showed that the total designated land protected under this instrument increased by 95 ha or 4% growth of protected agricultural areas.

Figure 13 presents Key elements for the protection of valuable agricultural land including the legal basis, decision tree and mapping scales.

IMPACT

The regional spatial planning programs for protection of agricultural land are built on the legacy of the open land protection programme (since 1990s). This older programme succeeded at changing the spatial planning culture of seeing open land as ‘not-yet-built’ land. Today, not only building allocation but also protection from building is a serious planning agenda in Tyrol, which is important for the change in society towards a sustainable and climate change appropriate direction.

The instrument is highly accepted among municipalities. It has been successfully applied to 25 of the 30 planning regions. Municipalities know that zoning building land within now protected agricultural areas is more complicated that outside these areas. As a result, there have been intensified building activities in other land-uses. Between 2018 – 2024 only (approx.) 4.3 ha of assigned land was lost = 0.1% of the total area in the planning regions that have adopted this instrument.

INSIGHTS

- The successful adoption of the instrument by municipalities can be credited in large part to the clear methodology. This means that the logic by which protected agricultural land is identified is clearly understood and explainable to all.
- The simple cartography, limited to 3 elements, matches the skill and capacity of small municipalities, which have small teams. The mapping can be done on GIS and does not require the knowledge of new software. There is no need to hire new staff for this task, and the existing team can incorporate the instrument into their daily workflow.
- The uniform methodology applied across all spatial planning regions ensures that the instrument is fair. This has also contributed to the acceptance from mayors and municipalities because the same rules apply to the neighbouring municipalities.
- The instrument restricts the increase of build-up land, but this is balanced out by the designation of where building activity can take place within the 10-year municipal development plans. Through this urban development can be directed in a sustainable way.
- The increased awareness and interest in open space and soil protection among the media has resulted in a higher sensitivity to these topics within federal politics. There have been cases of media reports and protests when protected agricultural land is converted into buildable land. This shows the importance of awareness among the enabling environment to steer political discourse.
- This impact of this instrument also contributes to the EU no net land take objective.

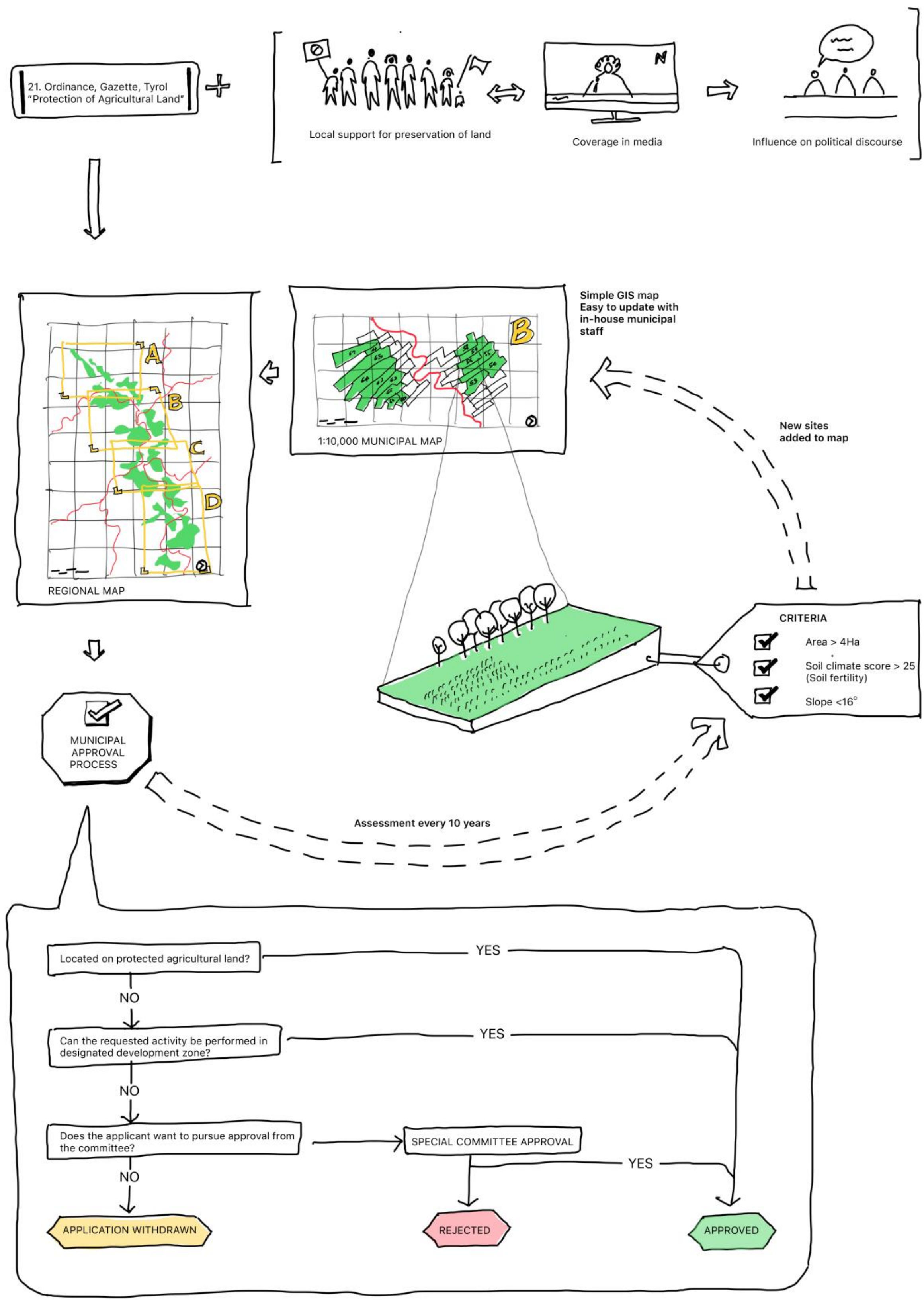

Figure 14. Key elements for the protection of valuable agricultural land in Tyrol, Austria. (source: Deltares)

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ECLI:BE:RVSCE:2023:ARR.257.633
ECLI:BE:RSVCE:2023:ARR.256.89

A Criteria, long list and ranking

Scoring criteria for shortlist (out of 15)

<u>2.5 points: Relevance to the Netherlands</u>

1. Area with extreme weather conditions (drought, heat, extreme rainfall), relevant to future conditions in the Netherlands as result of climate change.
2. Area with comparable subsurface as the Netherlands (sand, clay, peat).
3. Area with comparable water challenges as the Netherlands.

<u>1.5 points: WBS alignment</u>

4. Water and soil (subsurface) as guiding principles for spatial planning with the objective of ecologic and economic improvement
5. Legal/policy instruments implemented.
6. Financial instruments implemented.
7. Spatial planning instruments implemented.

Note: 1,2,3 and 4/5/6 are the only criteria necessary for the selection of a case.

<u>1 point: Other factors</u>

8. Monitoring in place
9. Societal awareness and support present
10. Socio-economic setting that resembles the Netherlands, high population density in a delta area

<u>0.5 points: Past experience IenW, Deltares</u>

11. Countries where IenW has experience through policy operationalization of the Netherlands International Water Ambition and Partners for Water programme. In addition, countries connected to the Freshwater Challenge, EU Water Resilience Initiative and multilateral initiatives.
12. Country where Deltares has experience with the governance setting and where the information is available in a language that the team can speak.

Criteria for selecting five cases

1. Geographical distribution of the 5 cases
2. Landscape distribution of the 5 cases (coastal, urban, rural, delta, border).
3. Diversity in three levels of WBS: Spatial planning, adaptive design and restore the system in good health.
4. Cases that are operational for more than 10 years will be given priority.

Long list and ranking

This table presents an overview of the long list that was used as a basis to select the four cases. Each case is assigned a score based on the criteria above.

Further the overview allowed for a spectrum of cases to be identified across geographical position and topical diversity.

	score	Est since (>10 yrs)	Setting	Scale & impetus	Legal/ facilitiated	Soil	Water	WBS type
Europe								
Austria, protection of agricultural land	**7,5**	2015	RURAL	STATE	LEGAL	QUANTITY		SPATIAL PLN
Switzerland	**5**	2005	RURAL	NATION	LEGAL	Performance	Quantity	SPATIAL PLN
Flanders, Water Toets	**11**	2003	BOTH	STATE	LEGAL	PERFORM.	BOTH	SPATIAL PLN
Flanders, SIGNAAL gebieden	**12**	2013	RURAL	STATE	LEGAL	QUANTITY	QUANTITY	SPATIAL PLN
Berlin, Germany, Sponge city	**4,5**	2018	URBAN	STATE	FACILITATED	PERFORM.	QUANTITY	ADAPT. DES
North America								
Portland, Blue-green Infrastructure	**8**	2008	URBAN	CITY	FACILITATED	PERFORM.	QUALITY	ADAPT. DES
Asia								
Vietnam, PFES	**8,5**	2008	RURAL	NATION	LEGAL	PERFORM.	QUANTITY	SPATIAL PLN
South America								
Colombia, environmental determinant	**7,5**	1997	BOTH	NATION	LEGAL	PERFORM.	QUANTITY	SPATIAL PLN

Deltares is een onafhankelijk kennisinstituut voor toegepast onderzoek op het gebied van water en ondergrond. Wereldwijd werken we aan slimme oplossingen voor mens, milieu en maatschappij.

Deltares