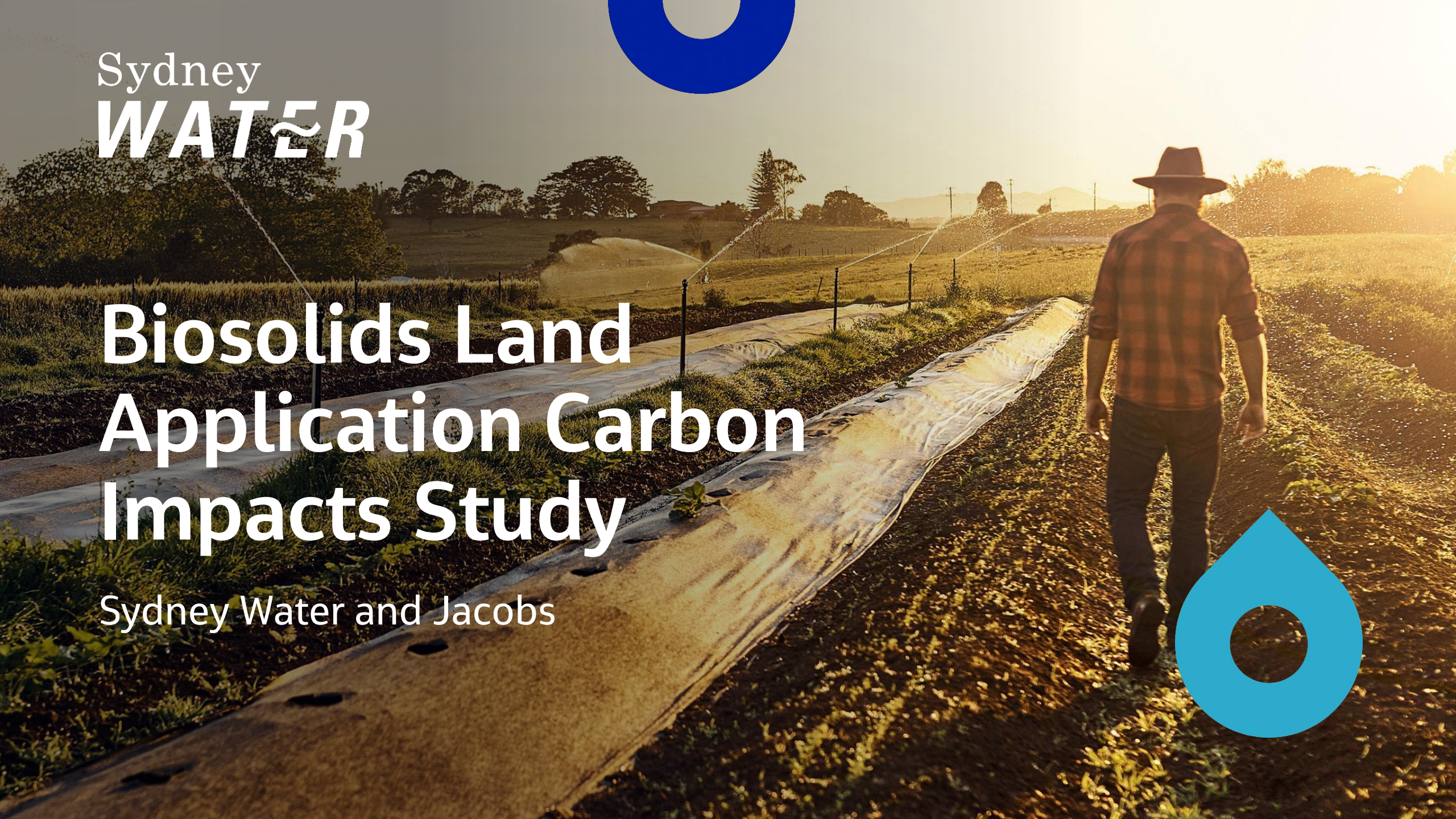
Sydney WATER

Biosolids Land Application Carbon Impacts Study

Sydney Water and Jacobs



A brief history

180,000 wet tonnes

Sydney Water produces about **180,000 wet tonnes** of biosolids per year from 20 plants (16 anaerobic, 4 aerobic) across Greater Sydney, the Blue Mountains and the Illawarra

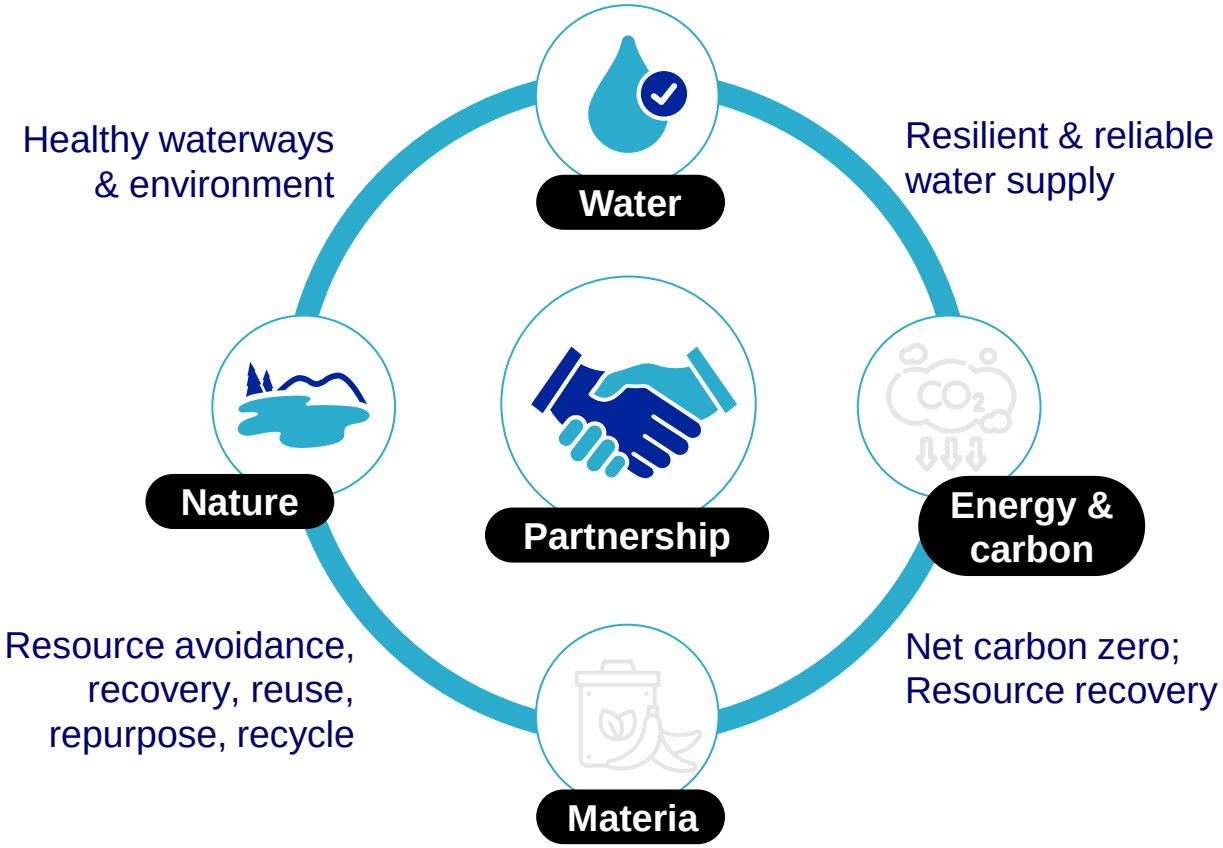
Sydney Water pioneered the land application of biosolids in the mid-1990s

100% of biosolids have been beneficially used since 2003

In 2006, Sydney Water outsourced the entire biosolids program to appropriate contractors

Direct farm application (74%) is the dominant market for Sydney Water biosolids, followed by composting (22%) and forestry (4%)

Circular economy framework



Three principles

Design out
waste and pollution

Efficient business

Keep resources in use at
their highest value

Productive business

Restore and regenerate
natural systems

Responsible business

Net Zero

To protect a future Sydney, we've made a commitment for:

Net zero for operational emissions by 2030

Net zero for supply chain by 2040

Partnership with Jacobs to understand the Australian context

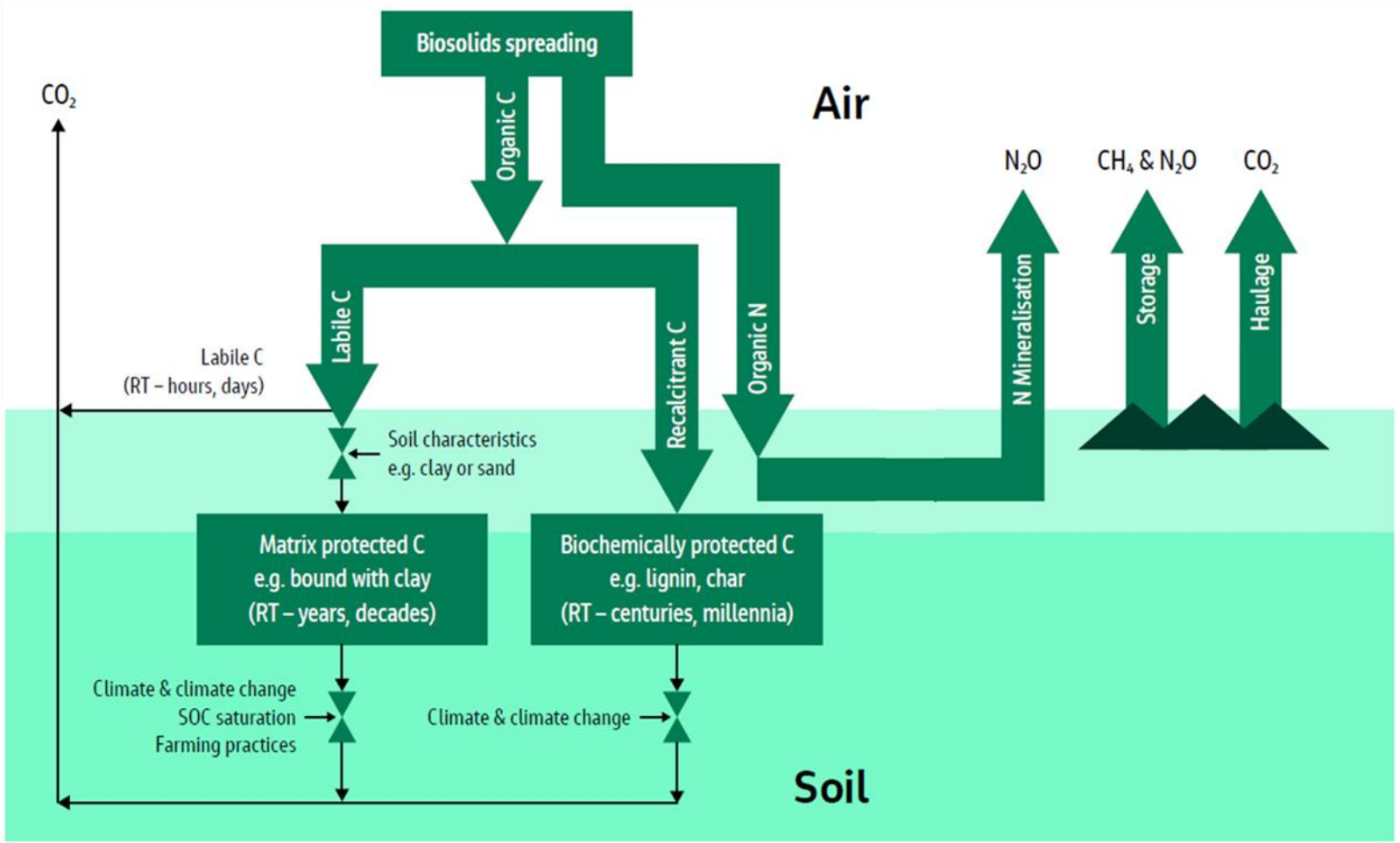
Desktop study to quantify carbon emissions and sequestration benefits from biosolids land application in NSW

Consideration of the unique factors of Sydney Water's operations



Influencing factors including transport, Australian soils and post processing methodologies.

Jacobs' journey on carbon and biosolids to land



Permanence & risk of reversal

- *Intrinsic material properties*
- *Climate & climate change*
- *Soil texture (clay, silt, sand)*
- *Land management practices*

Additionality?

- *Establishing a carbon baseline*
- *Compare future impacts to baseline*
- *Not alternative to acting on emissions*

https://www.jacobs.com/newsroom/news/uk-water-net-zero-carbon-quantifying-benefits-biosolids-land
https://assuredbiosolids.co.uk/wp-content/uploads/2021/12/UK-Water-Net-Zero-Quantifying-the-role-of-biosolids-to-land.pdf

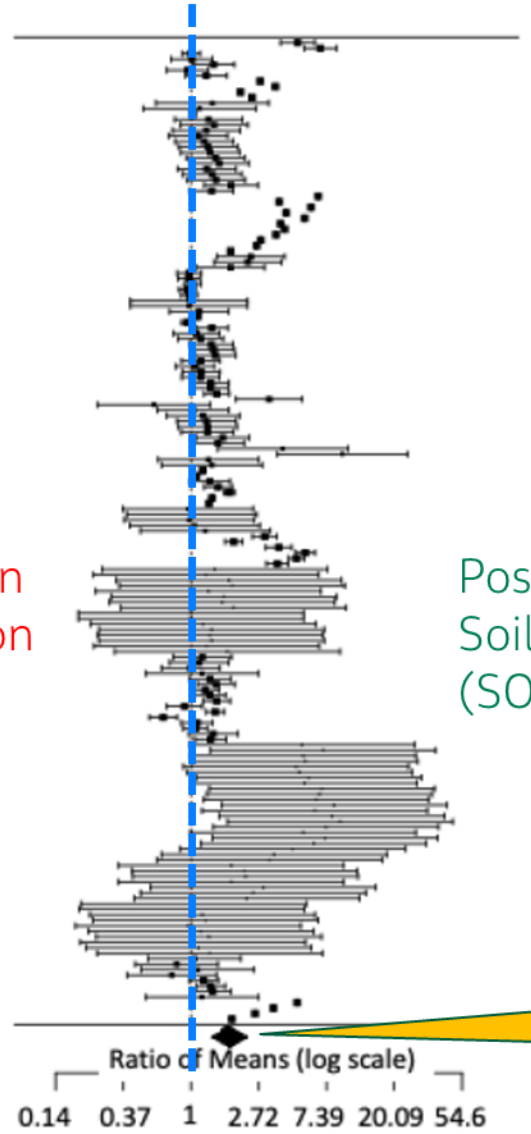
Biosolids build soil carbon – a global meta-analysis

Snyder MSc thesis,
Ohio State University, 2021

- 84 peer-reviewed studies
- 178 empirical comparisons of SOC stocks from biosolids applications

Negative impact on Soil Organic Carbon (SOC)

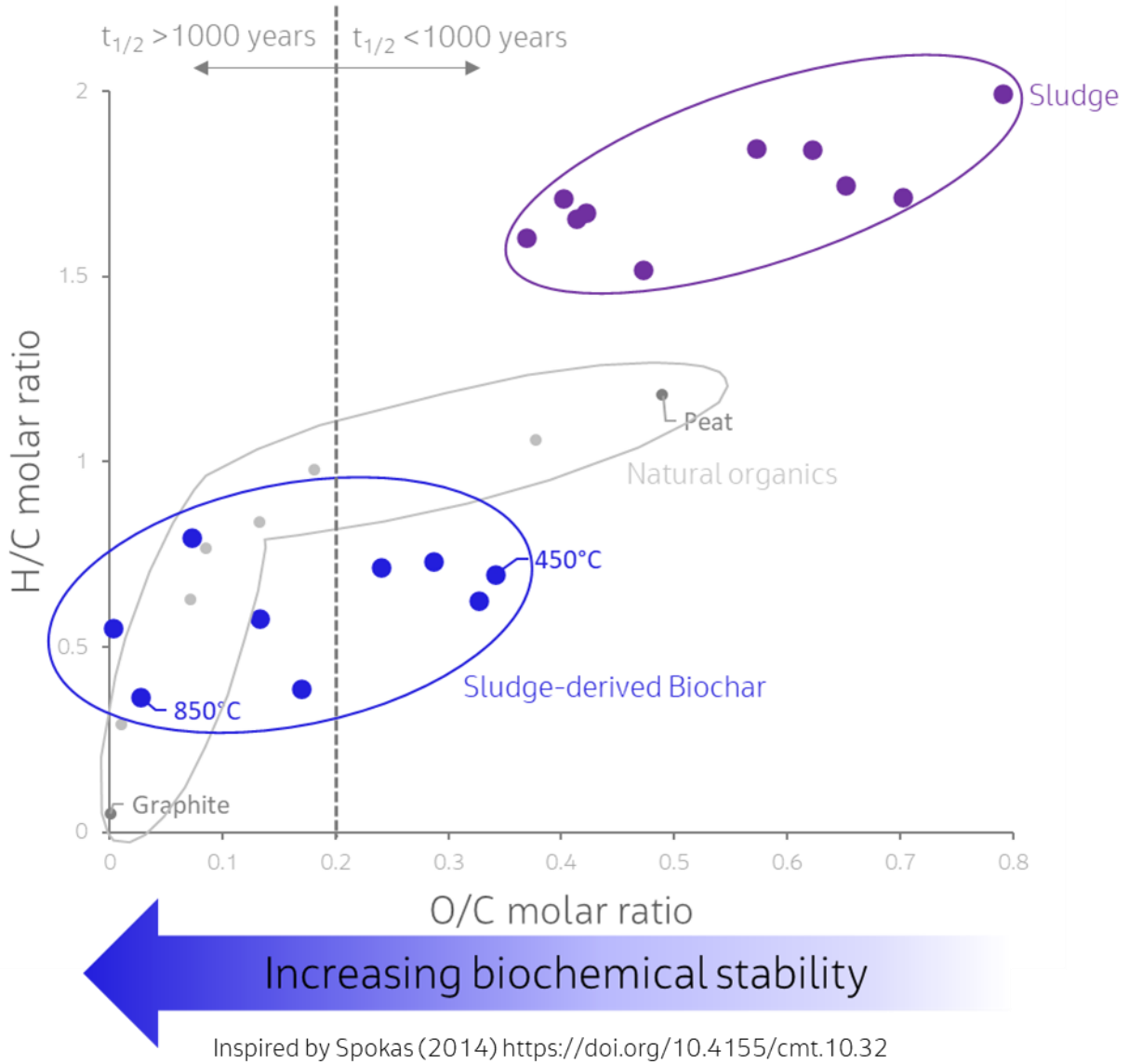
Positive impact on Soil Organic Carbon (SOC)



72% increase in SOC stocks, on average

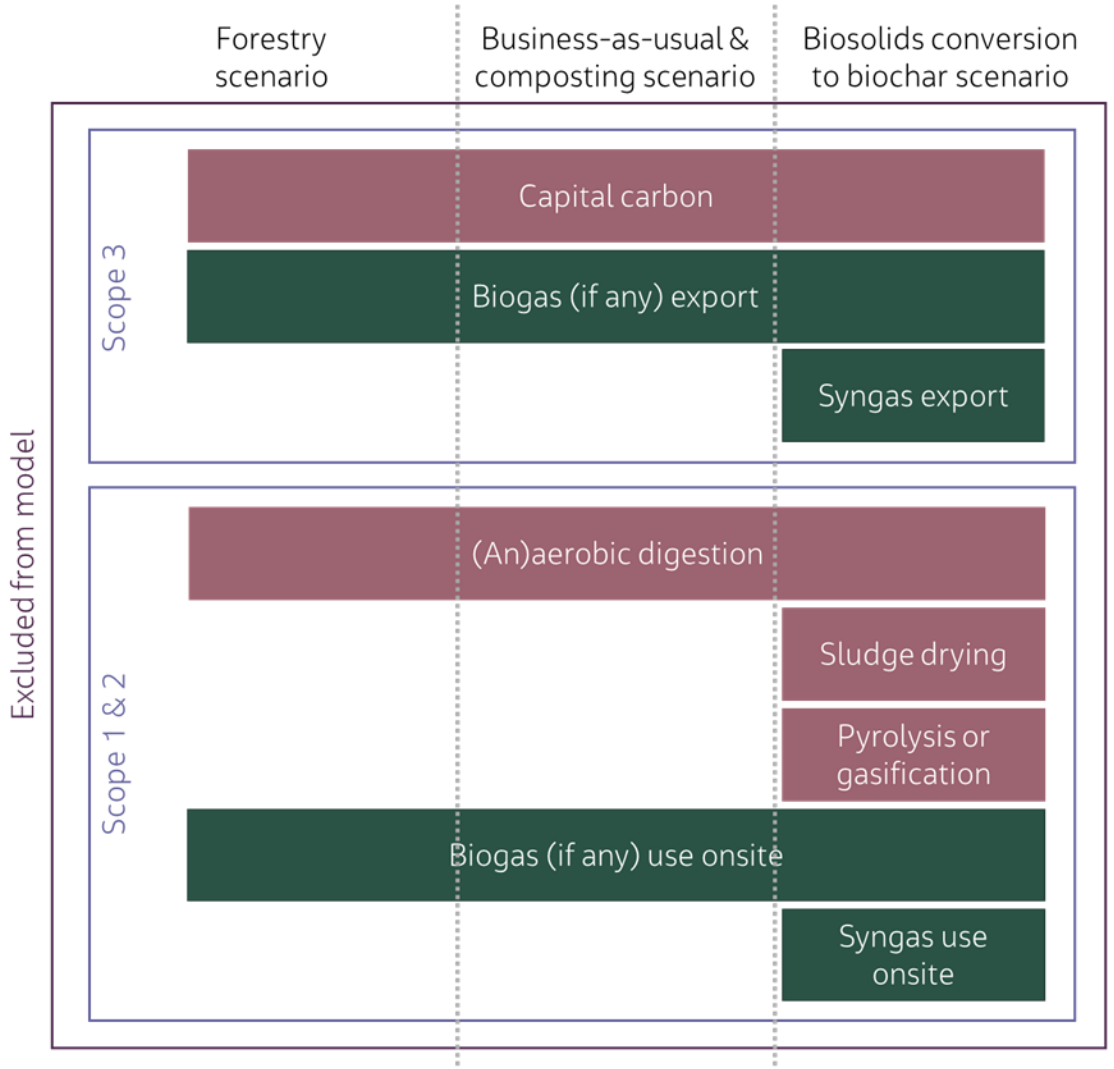
https://etd.ohiolink.edu/apexprod/rws_etd/send_file/send?accession=osu1609963500878275&disposition=inline

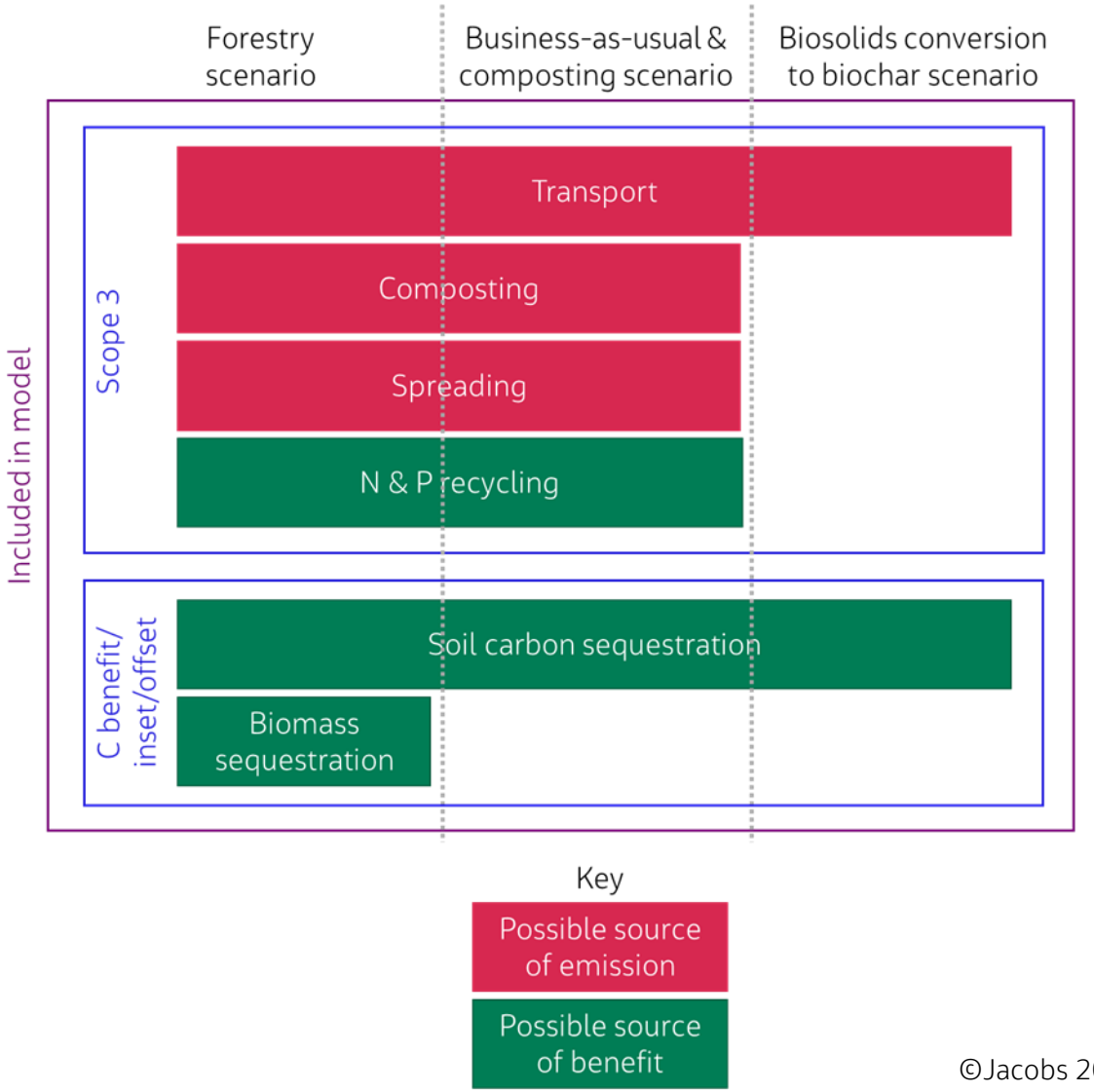
Intrinsic stability of carbon in organic materials



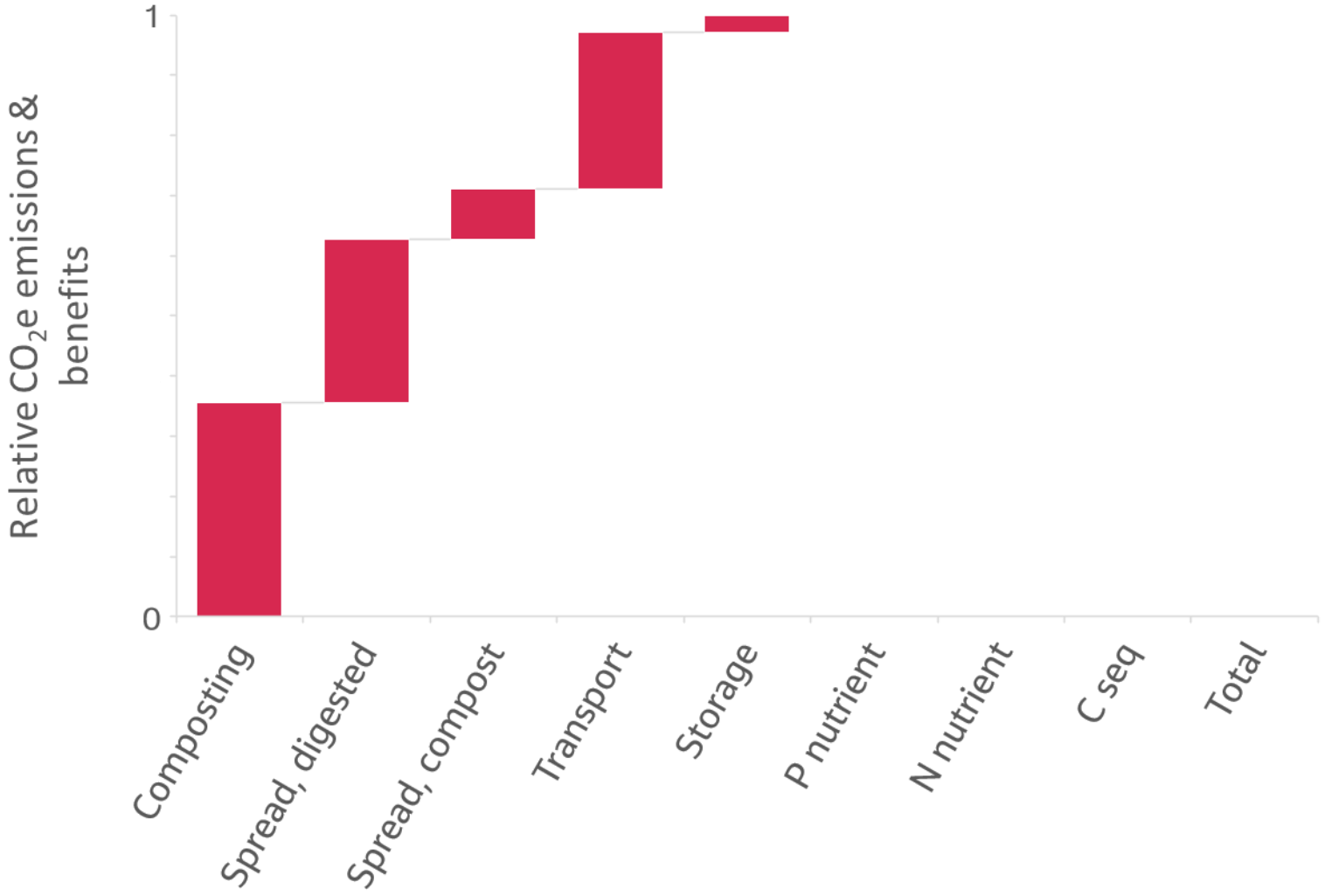
Inspired by Spokas (2014) https://doi.org/10.4155/cmt.10.32

Where are the boundaries?





Sydney Water biosolids to land – emissions only



Selecting appropriate Emission Factors

Carbon sequestration factor used	Biosolids spreading N_2O EF used to calculate baseline			
	IPCC	Average	Roman-Perez	Thorman et al.
Willen et al.	-18%	-26%	-30%	-34%
Snyder thesis	-33%	-46%	-55%	-62%
BEAM default	-62%	-87%	-104%	-116%
Zhai et al.	-73%	-103%	-123%	-138%
UKWIR	-90%	-128%	-152%	-171%
Badgery et al.	-154%	-218%	-260%	-292%

BAU baseline net +ve emission

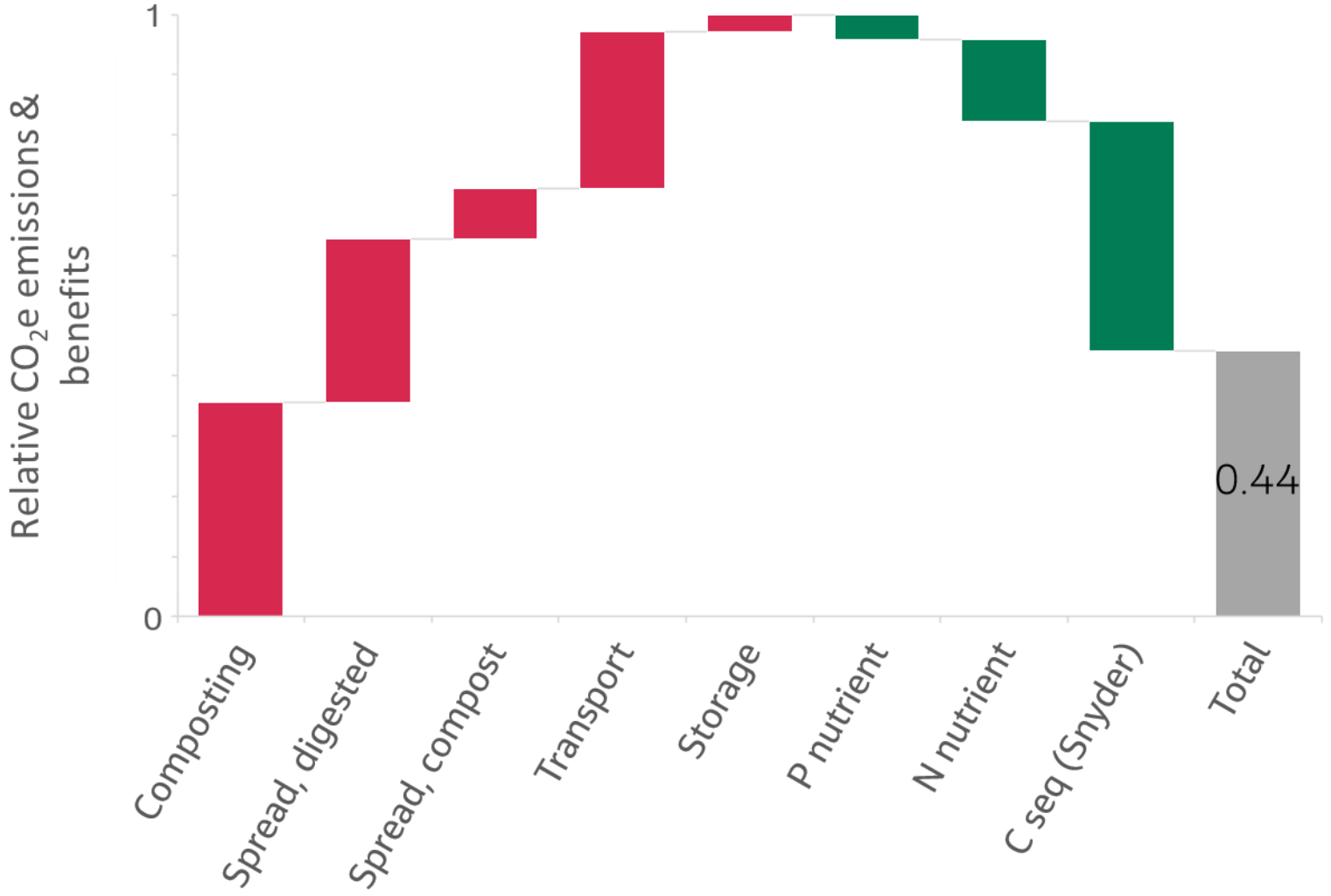
BAU baseline net –ve emission

Selecting a sequestration factor for Sydney Water biosolids

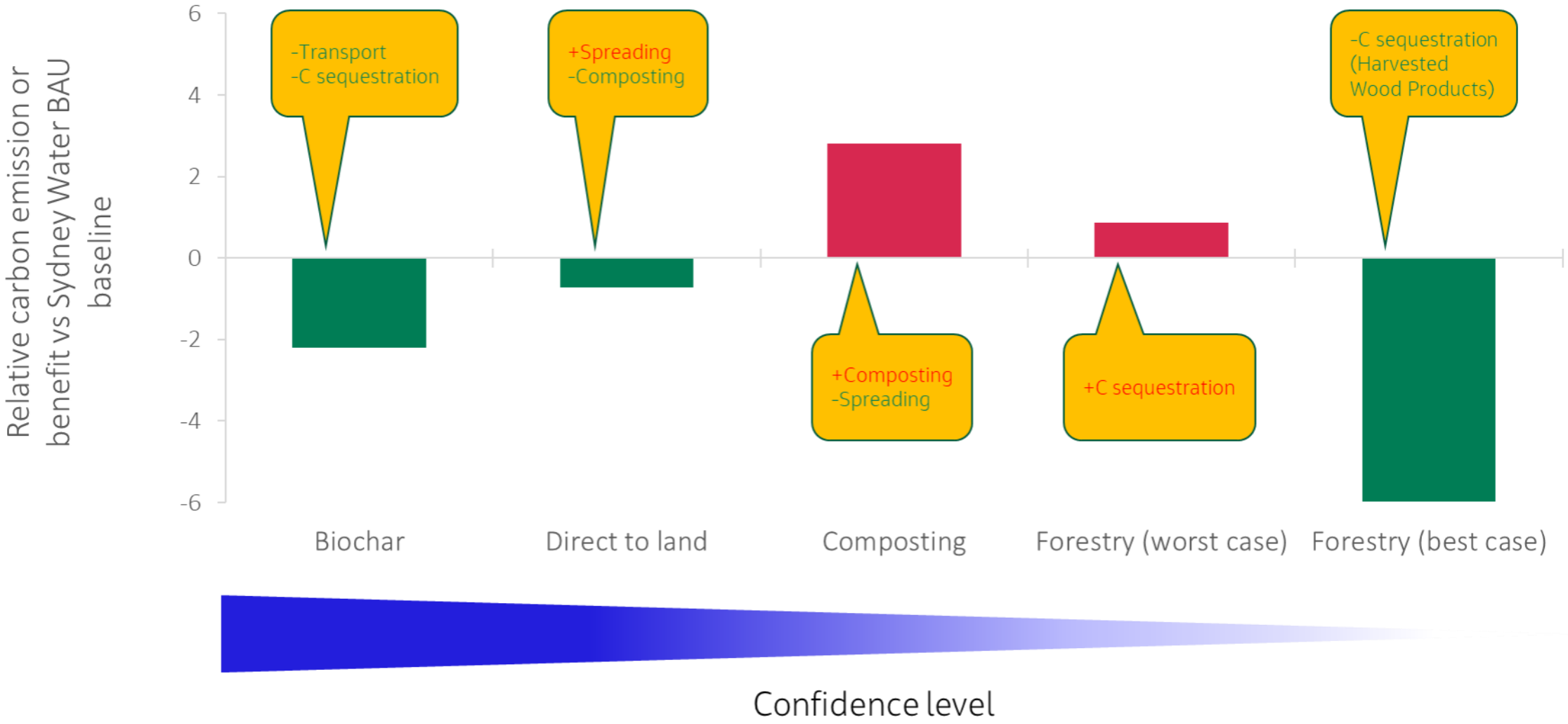
Sequestration factor reference	Study period or projected time period*	Initial carbon retained in soil	One-off biosolids application	Directly comparable climate
Willen *et al.*	100y*	7%	No	No
Snyder thesis	28y	12.7%	Yes	No
BEAM '22 default	-	14.6%	No	No
BEAM '09 default	-	23.8%	No	No
Zhai *et al.*	up to 35y	28.3%	No	No
UKWIR	20y	35%	No	No
Badgery *et al.*	5y	59.8%	Yes	Yes

Not published at time of our work

Sydney Water biosolids to land – BAU baseline



Carbon impact of future scenarios vs BAU baseline



Thank you

Back to Matt

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Questions?
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