Written by John Rolfe, Professor of Regional Economic Development, School of Business and Law, CQUniversity Australia

In 2015, the Australian and Queensland governments agreed on targets to greatly reduce the sediment and nutrient pollutants flowing onto the Great Barrier Reef.

What we do on land has a real impact out on the reef: sediments can smother the corals, while high nutrient levels help to trigger more regular and larger outbreaks of crown-of-thorns starfish. This damage leaves the Great Barrier Reef even more vulnerable to climate change, storms, cyclones and other impacts.

Dealing with water quality alone isn't enough to protect the reef, as many others have pointed out before. But it is an essential ingredient in making it more resilient.

The water quality targets call for sediment runoff to be reduced by up to 50% below 2009 levels by 2025, and for nitrogen levels to be cut by up to 80% over the same period. But so far, detailed information about the costs of achieving these targets has not been available.

Both the Australian and Queensland governments have committed more funding to improve water quality on the reef. In addition, the Queensland government established the Great Barrier Reef Water Science Taskforce, a panel of 21 experts from science, industry, conservation and government, led by Queensland Chief Scientist Geoff Garrett and funded by Queensland's Department of Environment and Heritage Protection.

New work commissioned by the taskforce now gives us an idea of the likely cost of meeting those reef water quality targets.

This groundbreaking study , which drew on the expertise of water quality researchers, economists and "paddock to reef" modellers, has found that investing A$8.2 billion would get us to those targets by the 2025 deadline, albeit with a little more to be done in the Wet Tropics.

That A$8.2 billion cost is half the size of the estimates of between A$16 billion and A$17 billion discussed in a draft-for-comment report produced in May 2016, which were reported by the ABC and other media.

Those draft figures did not take into account the reductions in pollution already achieved between 2009 and 2013. They also included full steps of measures that then exceeded the targets. A full review process identified these, and now this modelling gives a more accurate estimate of what it would cost to deliver the targets using the knowledge and technology available today.

A future for farming

Importantly, the research confirms that a well-managed agricultural sector can continue to coexist with a healthy reef through improvements to land management practices.

Even more heartening is the report's finding that we can get halfway to the nitrogen and sediment targets by spending around A$600 million in the most cost-effective areas. This is very important because prioritising these areas enables significant improvement while allowing time to focus on finding solutions that will more cost-effectively close the remaining gap.

Among those priority solutions are improving land and farm management practices, such as adopting best management practices among cane growers to reduce fertiliser loss, and in grazing to reduce soil loss.

While these actions have been the focus of many water quality programs to date, much more can be done. For example, we can have a significant impact on pollutants in the Great Barrier Reef water catchments by achieving much higher levels of adoption and larger improvements to practices such as maintaining grass cover in grazing areas and reducing and better targeting fertiliser use in cane and other cropping settings. These activities will be a focus of the two major integrated projects that will result from the taskforce's recommendations.

A new agenda

The new study , produced by environmental consultancy Alluvium and a range of other

researchers (and for which I was one of the
external peer reviewers
), is significant because nothing on this scale involving the Great Barrier Reef and policy costings has been done before.

Guidelines already released by the taskforce tell us a lot about what we need to do to protect the reef. Each of its ten recommendations now has
formal government agreement and implementation has begun
.

Alluvium's consultants and other experts who contributed to the study – including researchers from CQ University and James Cook University – were asked to investigate how much could be achieved, and at what price, by action in the following seven areas:

1.

Land management practice change for cane and grazing

2.

Improved irrigation practices

3.

Gully remediation

4.

Streambank repair

5.

Wetland construction

6.

Changes to land use

7.

Urban stormwater management

Those seven areas for potential action were chosen on the basis of modelling data and expert opinion as the most feasible to achieve the level of change required to achieve the targets. By modelling the cost of delivering these areas and the change to nutrient and sediments entering the reef, the consultants were able to identify which activities were cheapest through to the most expensive across five catchment areas (Wet Tropics, Burdekin, Mackay-Whitsunday, Fitzroy and Burnett Mary).

Alluvium's study confirmed the water science taskforce's recommendation that investing in some catchments and activities along the Great Barrier Reef is likely to prove more valuable than in others, in both an environmental and economic sense.

Some actions have much lower costs and are more certain; these should be implemented first. Other actions are much more expensive. Of the total A$8.2 billion cost of meeting the targets, two-thirds (A$5.59 billion) could be spent on addressing gully remediation in just one water catchment (the Fitzroy region). Projects with such high costs are impractical and highly unlikely to be implemented at the scale required.

The Alluvium study suggests we would be wise not to invest too heavily in some costly repair measures such as wetland construction for nutrient removal just yet – at least until we have exhausted all of the cheaper options, tried to find other cost-effective ways of reaching the targets, and encouraged innovative landholders and other entrepreneurs to try their hand at finding ways to reduce costs.

The value of a healthier reef

The A$8.2 billion funding requirement between now and 2025 is large, but let's look at it in context. It's still significantly less than the A$13 billion that the Australian government is

investing in the Murray-Darling Basin.

It would also be an important investment in protecting the more than A$5 billion a year that the reef generates for the Australian economy and for Queensland communities.

The immediate focus should be on better allocating available funds and looking for more effective solutions to meet the targets to protect the reef. More work is still needed to ensure we do so.

If we start by targeting the most cost-effective A$1 billion-worth of measures, that should get us more than halfway towards achieving the 2025 targets. The challenge now is to develop new ideas and solutions to deliver those expensive last steps in improving water quality. The Alluvium report provides a valuable tool long-term to ensure the most cost-effective interventions are chosen to protect the Great Barrier Reef.

This article was written with contributions from Geoff Garrett, Stuart Whitten, Steve Skull, Euan Morton, Tony Weber and Christine Williams.

Read more of The Conversation's Great Barrier Reef coverage, including articles by experts including Jon Brodie and Ove Hoegh-Guldberg .

John Rolfe has previously received funding from the National Environmental Research Program and the National Environmental Science Program for economic studies evaluating the costs and benefits of reef protection.

Authors: John Rolfe, Professor of Regional Economic Development, School of Business and Law, CQUniversity Australia

Read more http://theconversation.com/the-8-2-billion-water-bill-to-clean-up-the-barrier-reef-by-2025-and-where-to-start-62685