EPA VICTORIA

Water quality offsets

Goulburn Valley Water
Kilmore case study

Publication 1690 | March 2018

Authorised and published by the Victorian Government, 1 Treasury Place, Melbourne

Foreword

In 2016, Goulburn Valley Water received approval from the Environment Protection Authority Victoria (EPA) to upgrade its wastewater management facility in Kilmore. It was the first EPA works approval and licence amendment application in Victoria to include water quality offsets.

Offsets can be a practical and cost-effective way to manage natural resource degradation. The concept recognises that it may not always be possible for certain activities to avoid some impact on the environment, and that in some cases, increasingly expensive measures deliver diminishing returns in environment protection.

Water quality offsets are a regulatory tool which can enable EPA to apply less stringent discharge limits in a wastewater discharge licence if the proponent can demonstrate that equivalent or greater environmental benefits can be achieved by carrying out alternative measures. Such measures may result in an improved environmental outcome at a lower cost to the community.

EPA recognises that there is a strong interest amongst other water corporations in Victoria in undertaking similar projects, so we have published this detailed case study. It explores the measures that contributed to the success of this application and the lessons learnt by both Goulburn Valley Water and EPA.

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1.1 Context

Victoria's inland waterways are important assets, with multiple uses. One of the major threats to these waterways has historically been associated with the discharge of sewage. In particular, poorly designed or operated wastewater treatment plants or poorly managed onsite wastewater treatment systems have posed significant risks to water quality.

EPA has played a leading role in minimising these threats, in part by encouraging major efforts to maximise the re-use of effluent, and minimise its discharge into local waterways. This has led to the development of wastewater treatment systems to provide recycled wastewater for irrigation.

This was considered to be an effective and appropriate approach to manage risks at a certain stage of regional development in Victoria.

1.2 The challenge

Many of these wastewater treatment facilities in inland Victoria are now facing the challenge of responding to population growth and the need to augment treatment and discharge capacity. The options available to water corporation often involve complex trade-offs, for example:

- Treatment and storage lagoons generally cannot be increased in scale due to competition for land from urban development and the high land prices that come with it. Residents often also have concerns around odour and noise as development expands towards and around the wastewater treatment facilities.
- The increased volume of recycled water can be hard to dispose of, given the limited availability of properties with appropriate soil quality and irrigation practices suitable for its use.
- Constructing a standard tertiary treatment plant to produce Class A recycled water to increase reuse options involves very high capital and ongoing operating costs and still requires continuing disposal arrangements for the biosolids and recycled water.
- Piping recycled water to a major waterway, the coast or an evaporation basin is generally impractical or prohibitively costly.

1.3 Water quality offsets

One alternative approach involves the use of water quality offsets. In the above scenario, this may involve allowing facilities to increase the amount of recycled water that they let flow to local waterways, so long as they offset the resulting increase in nutrients or other pollutants.

Suitable 'offsets' might include stock exclusion from the waterways, enhancement of riparian vegetation, stormwater management, gully erosion works and removal of aquatic weeds. Ideally, these offset measures should address the same nutrient or pollutant threat posed by the discharge and should be located in close proximity.

Such an approach has a range of potential features and challenges.

- It may be cheaper to implement than an infrastructure solution.
- It may be implemented through a scaled program over time to match growth in discharge volumes.
- It may reduce threats to catchment conditions from poor land management practices.
- It may enhance flows in local catchments that are stressed due to water extractions and climate change.
- Environmental benefits must be attributable to the 'offset' activity.
- The activity must be monitored to ensure anticipated benefits are realised and enduring.
- The process must be transparent, enforceable and ensure accountability for the parties involved.

1.4 This document

This case study explains work undertaken by Goulburn Valley Water (GVW) in consultation with EPA to develop a water quality offset scheme for the Kilmore Wastewater Management Facility. The paper is presented as a case-study report and includes a 'check list' of lessons learned which contributed to the success of the project. These lessons could aid other water corporations considering similar proposals.

The paper:

- outlines the process followed by GVW
- identifies those factors that were considered critical to an effective scheme
- lists some of the key elements of the process, namely:
    - a review of strategic options
    - a comprehensive ecological risk assessment which confirm the characteristics of the receiving waters and the likely impact on them of the projected pollutants
    - a framework for how the proposed offsetting works and measures were to be implemented and audited
    - the safety factors and monitoring arrangements to support a robust licensing framework
- explains how GVW provided confidence to EPA that the proposal could met EPA's licensing requirements.

2. Water quality offsets

2.1 Offsets

Offsets can be a practical and cost-effective way to manage natural resource degradation. The concept recognises that it may not always be possible for certain activities to avoid some impact on the environment, and that in some cases, increasingly expensive measures deliver diminishing returns in environment protection.

This approach is now implemented in a wide range of situations, including native vegetation, carbon emissions and salinity.

2.2 Water quality offsets

Under the *Environment Protection Act 1970*, EPA may issue works approvals and licenses for activities that have the potential to make a significant environmental impact. These activities include wastewater discharges.

The *State Environment Protection Policy (Waters of Victoria)* lets EPA use water quality offsets as a regulatory tool when licensing wastewater discharges. These provisions allow EPA to apply less stringent discharge limits than would otherwise be the case if the applicant can demonstrate that equivalent or greater environmental benefits can be achieved through alternative measures.

Considering offset measures in the context of these legal instruments is important, as it provides a clear process for EPA to consider, evaluate and set conditions through a formal statutory instrument. These regulatory tools also provide a framework to ensure that any offset measures are legally enforceable over an agreed period of time, as well as a way for EPA to make successful applicants consult with the community and robustly assess local impacts.

In order to help water corporations assess and propose potential offsetting options, the *Water Quality Offsets Framework*[1] was developed by the Victorian water industry and EPA in 2015. The framework outlined a series of stages that water corporations should consider when developing an offset proposal.

This framework noted that offsets were expected to be considered in instances where water corporations might face significant challenges in meeting existing or projected EPA discharge licence conditions, or recognise a genuine opportunity to deliver a net environmental benefit at a lower community cost. In most instances, the expectation was that offsets would be driven by the need to defer capital expenditure on infrastructure upgrades that might otherwise help meet licence conditions.

2.3 The Kilmore case study

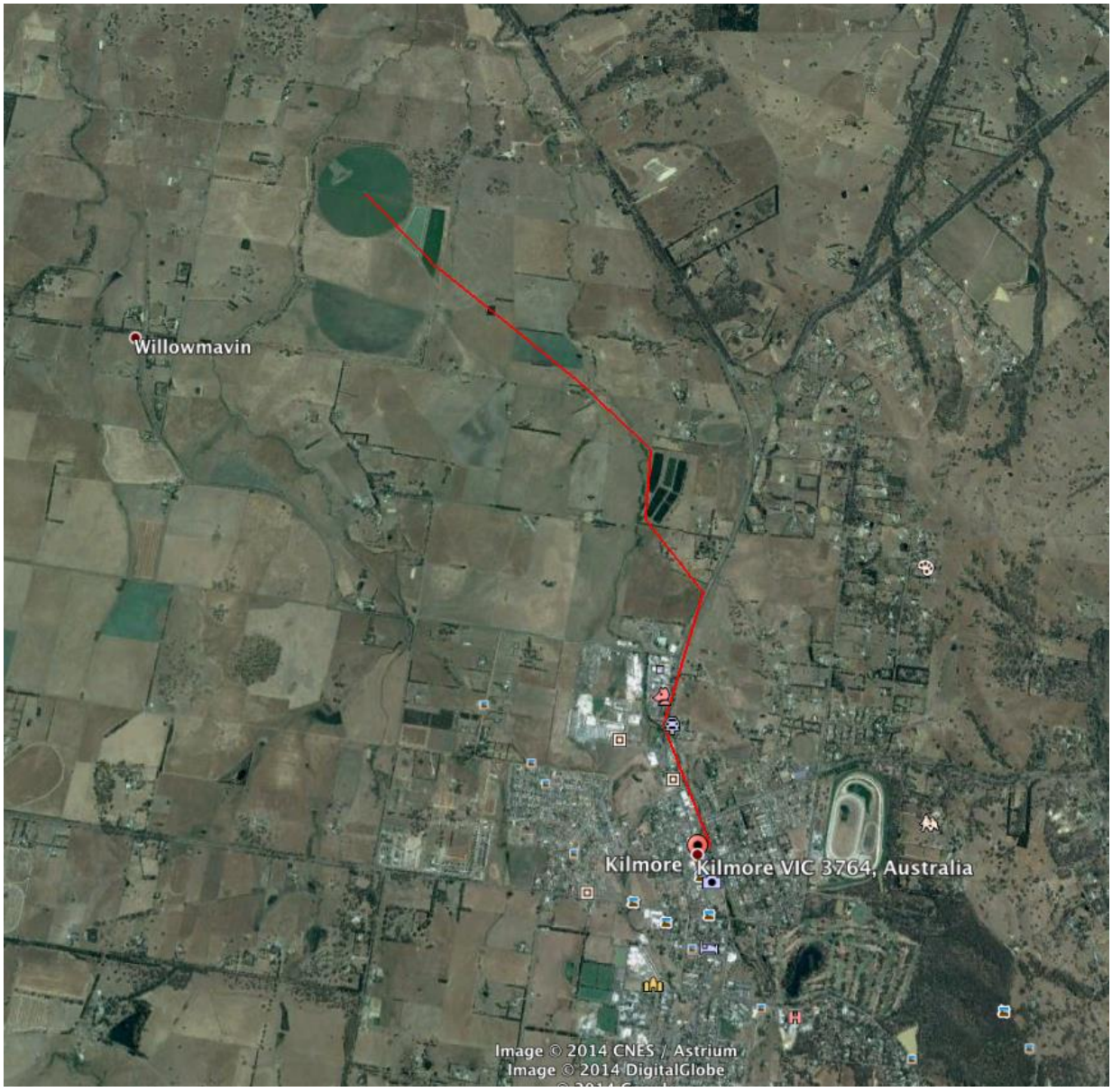
The town of Kilmore is located off the Hume Highway, just north of the Great Dividing Range. Local creeks flow north to intersect with the Goulburn River at Seymour. The town is projected to undergo significant population growth over the next 30 years which will increase the volume

[1] Alluvium 2015, *Water Quality Offsets Framework.:* Final Report for the Victorian Smart Water Fund.

of recycled water requiring management from around 400 ML/yr today to 1,000 ML/yr in the year 2040.

The current treatment process for the Kilmore Wastewater Management Facility involves treatment lagoons. Recycled water is irrigated through a centre-pivot, with an adjacent winter-storage to hold it outside the irrigation season (see Figure 2-1).

Figure 2-1: Kilmore township and wastewater treatment/disposal



In 2011, the Kilmore plant had 381 ML of winter storage and 81 ha of irrigation area. The following table confirms the projected growth in flows to the facility over time and the increase in winter storage and irrigation area that would be required to maintain 90th percentile containment.

Table 2-1: Kilmore – projected growth and infrastructure implications

Year	Inflow (ML/yr)	Winter storage (ML)	Irrigation area (ha)
2011	370	381	81
2015	454	440	102
2020	547	505	125
2025	652	562	151
2035	925	741	217
2060	2,256	1,656	540

The sizing of the winter-storage and irrigation areas in these projections is determined by the EPA licence requirement that:

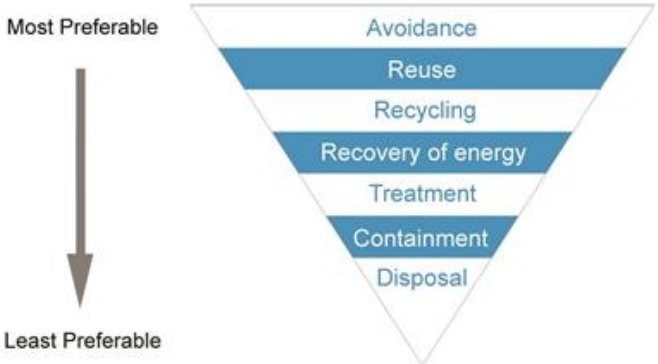
> *discharge is only permissible when an irrigation system including storage lagoon is designed to retain all wastes up to a 90th percentile wet year (DW2.8)*[2]

The projected growth in inflows meant that the site needed to increase both its winter-storage volume and its irrigation area. This triggered a review of what other options might be available to respond to this increased demand. The review identified that a water quality offsets scheme might better meet the needs of the environment and the community, and in a more cost-effective way.

2.4 Framework

In developing its proposal, GVW took account of the waste management hierarchy contained in the *Environment Protection Act 1970*. This establishes an order of preference between approaches, with 'avoidance' being the most preferred option and 'disposal' being the least (Figure 2-2).

Figure 2-2: Wastes hierarchy



[2] Environment Protection Authority Victoria 2017, *Licence Management* (EPA Publication 1322.9).

The principal aim of recycled water management is to achieve beneficial re-use. In regional Victoria, this is mostly achieved by using recycled water to irrigate pasture or crops. Irrigation farms require water and nutrients, and can make use of existing irrigation infrastructure and expertise to generate a beneficial outcome using this water.

However, it is not always possible to establish beneficial re-use. Problems can occur where:

- the wastewater treatment plant is in an area where irrigated farming does not traditionally exist
- the soil condition is poor and not suited for irrigation; or
- rainfall is high and so the demand for recycled water for irrigation is low.

In these situations, recycled water irrigation of a woodlot or other low value product may be established as a 'least cost disposal' option. However, it does not generate the same positive outcomes that true beneficial reuse via irrigation does.

In the Kilmore case, while the first test was whether it was possible to generate beneficial re-use via a traditional route, such as irrigation, ultimately an approach that involved the discharge of recycled water to the waterway combined with suitable offsets was identified as the optimal option.

2.5 Lessons

2.5.1 Building confidence

The major lesson from the Kilmore case study concerns the interaction between GVW and EPA. It is important to recognise that the regulatory framework and licensing regime provided in the *Environment Protection Act 1970* rests on controlling point sources of pollution. This creates a relatively clear enforcement regime which must spell out:

- the entity responsible for the discharge
- the pollutants being discharged
- the controls required to minimise the discharge
- the monitoring arrangements to demonstrate compliance.

Most critically, the entity responsible for discharging the pollutants is also the entity responsible for taking the steps to control that discharge. What this means is that EPA can apply a licensing regime that applies to a known entity within a clear compliance framework. The key elements of such a regime are a:

- works approval which permits a plant and equipment to be installed that will result in discharges
- licence which sets out the discharge volumes and limits allowed
- control regime which includes a mixing zone to manage the residual impact of a discharge
- requirement that the size of the mixing zone be reduced over time.

When it comes to offset schemes, however, compliance issues can be less straightforward. This is because the entity or entities which are responsible for taking the actions required to achieve compliance are third parties, over whom the EPA may not have regulatory authority. EPA cannot require a farmer to reduce grazing pressures on a waterway or revegetate a riparian zone, for example, even if these actions are an essential part of offsetting pollutants upstream.

What this means is that, if a water corporation wishes to progress a water quality offsets scheme, it needs to create mechanisms and arrangements to give confidence to the EPA that the approach proposed will be as effective as its traditional reliance on point source controls.

GVW achieved this in several ways.

- It engaged early in discussions with EPA, and built confidence through continuing dialogue. It recognised that EPA was willing to talk about alternative approaches, provided there was confidence in the process.
- It brought in outside experts. This gave EPA confidence that the statements and proposals were underpinned by specialist knowledge.
- It built partnerships with independent agencies, particularly the local Catchment Management Authority (CMA). The CMA played a critical role both as the regional champion of river health and as an effective intermediary to manage the delivery and monitoring of the proposed third party offsetting actions. This partnership was formalised through a Memorandum of Understanding (MoU) with GVW which confirmed commitments on both sides.
- It completed a rigorous options analysis to confirm that the offsets approach was the most appropriate and cost-effective alternative, in line with the waste management hierarchy.
- It completed a comprehensive ecological risk assessment to validate the risks and benefits.
- It developed an offsets implementation plan that was in line with the *Water Quality Offsets Framework* in that it involved:
    - interventions that would generate 'like-for-like' outcomes
    - interventions that were located in close proximity to the discharge
    - a timescale that would 'over-shoot' in the first ten years
- It developed a detailed implementation and monitoring program designed to provide EPA with evidence that the desired outcomes were being achieved. That program included:
    - an annual review in line with EPA's Annual Performance Statement regime
    - independent audits at five-year intervals to check on the validity of the scheme.

This framework gave EPA confidence it could identify issues if, and when, they arose and limit the initiative if necessary. Equally, it will allow the scheme to be extended if EPA has confidence that the outcomes promised are being achieved in practice.

2.5.2 The key steps for developing an offset proposal

Based on this case study, these are the key steps to developing a successful scheme.

Step 1: Engage with the EPA at an early stage. Build confidence through dialogue. Demonstrate that you understand any risks or concerns.

Step 2: Complete a comprehensive analysis of all the available options in the context of the waste management hierarchy. Demonstrate that the proposed water quality offsets approach would be a valid choice.

Step 3: Develop a comprehensive stakeholder engagement strategy to manage both local community and regulatory requirements. Build understanding and support across the community and key organisations.

- Phase the process so you only engage with local landholders once you have indicative support from EPA.
- Build partnerships with the local CMA.

Step 4: Develop a credible package of offsetting measures that take account of:

- the practicality of generating offsetting measures
- the need to comply with the criteria for environmental equivalence in the *Water Quality Offset Framework*
- appropriate safety factors
- robust governance arrangements.

Step 5: Commission a comprehensive ecological risk assessment from an independent specialist to establish:

- current risks and threats
- the potential impact of the proposed discharge
- the effectiveness of the proposed measures in offsetting any additional threat
- potential benefits to the receiving waterways
- necessary controls to minimise risks.

Step 6: Develop a cost-effective package of offsetting measures which:

- identifies a wide range of alternative options
- models each option's practicability, and potential to reduce relevant pollutants
- establishes realistic costs to establish and maintain controls
- specifies the best mix of measures.

Step 7: Develop a robust regulatory package with EPA that involves:

- agreeing on a works approval
- defining the licence amendment required
- liaising over approval for wider package
- agreeing on a medium-term approval period to win cost benefits.

3. Strategic analysis

3.1 Strategic analysis

GVW's first task involved a strategic analysis of all its options, within the framework of the EPA's waste management hierarchy.

This started with a detailed modelling of projected future demands, given the anticipated expansion in housing and population. This established the implications for future sewage flows and stormwater infiltration. The next step was to document and quantify the capacity of the current treatment facility. This provided a base case against which to assess all future options – one which took account of the technical specifications of the treatment process, the practical characteristics of the irrigation scheme and potential future demands for land use.

3.2 Options assessment

A wide range of options were considered by GVW and a shortlist of seven feasible approaches were assessed and modelled in detail.

1. Expanding the current irrigation scheme (base case).
2. Using demand management with customers to reduce flow rates to the wastewater treatment plant.
3. Re-using the recycled water for indirect potable supply or for a third-pipe supply to residential properties and public open space.
4. Piping the recycled water south to connect to Yarra Valley Water's wastewater system at Wallan.
5. Piping the recycled water north to GVW's treatment plant in Seymour and discharging it into the Goulburn River.
6. Looking to aquifer storage and recovery (ASR).
7. Disposing recycled water locally into Kilmore Creek while engaging third parties to implement activities in to offset the increased loads.

In each case, the assessment was structured around three main criteria.

- Feasibility: was the approach practical to implement?
- Cost: was the option financially viable, looking at both the initial capex and on-going opex?
- Risk: what was the likely response from key stakeholders and regulators?

GVW's assessment reached seven key conclusions.

1. **Irrigation:** Long-term expansion of the existing irrigation option was not viable, due to the practical limitations on available sites and the cost of building new capacity. This demonstrated that traditional beneficial re-use was not practical as the sole control measure.
2. **Demand management** was a cost-effective option that would help minimise flows, defer the need for investment and establish regulatory goodwill, irrespective of which other options were chosen. However, it would not be a sufficient option by itself.

3. **Full re-use** of the increased flow within the township was unlikely to be able to find sufficient demand to use the full volume generated, faced high regulatory hurdles, came at a high cost, and was unlikely to be acceptable to new residents.
4. **The pipeline south to Yarra Valley Water** at Wallan, while technically feasible, would incur considerable capital and operating costs as it would involve a vertical lift of 150 metres to carry the effluent south over the dividing range. It would also challenge community expectations to transfer the effluent 95 km to outfall at Werribee South.
5. **A pipeline to Seymour** by way of Broadford would allow construction of an integrated system for the three towns. It would be technically feasible but highly costly to pump the effluent for 40km and provide the necessary pre-treatment at Kilmore.
6. **ASR** would be very costly and face significant regulatory hurdles, given the characteristics and beneficial uses of local aquifers.
7. **Offsets:** Discharging increased flow to the creek and investing in offsetting investments would generate an improved environmental quality outcome. This would be less costly, able to be scaled up incrementally over time, and likely to generate community benefit. However, since this would be a relatively innovative approach, it would need considerable investment in regulatory and stakeholder management.

The following chart summarises the outcome of the options assessment against the three key criteria.

Table 3-1: Kilmore – overview of options analysis

Option	Feasibility	Cost	Stakeholders
Irrigation	High	High	Low
Demand management	Low	Low	Low
Re-use for urban supply	Medium	High	High
Southern pipe to YVW	Low	High	High
Pipeline to Seymour	Low	Medium	Medium
Aquifer storage	Medium	High	High
Kilmore Creek plus offsets	Low	Low	Medium

3.3 Conclusion

The strategic analysis reviewed the full range of alternative options available to GVW. This gave confidence to the GVW Board, the community and regulators that a rigorous process had been followed in selecting the preferred approach.

This also ensured that any offsets scheme would meet the principles set out in the EPA's 2008 discussion paper, *Environmental Offsets*[3], in that it would:

- deliver net environmental benefit compared to actions that would otherwise be required
- be cost-effective and in proportion to the significance of the adverse environmental impact being addressed
- not reward poor environmental management practices that pose significant risk or create inappropriate market distortions.

This alignment was particularly important, given the relative innovation involved and the risk that an offsets scheme might be perceived as being a cheap solution that involved GVW 'handballing' its responsibilities to third parties.

Step 2

Complete a comprehensive review/analysis of options and alternatives to demonstrate the validity of the choice of the water quality offsets approach. Confirm that standard beneficial re-use through irrigation is not feasible as the sole option.

[3] Environment Protection Authority Victoria 2008, *Discussion Paper: Environmental Offsets* (EPA Publication 1202.3)

4. Scheme development

The development of the scheme by GVW involved three key elements:

- engaging with stakeholders
- developing a robust offsets proposal
- completing a comprehensive ecological risk assessment.

4.1 Stakeholder engagement

Once GVW decided to explore an offsets approach, it reached out to a wide range of stakeholders. The key players included:

- EPA Victoria
- Mitchell Shire Council
- Goulburn Broken CMA
- regional Aboriginal communities
- local landholders.

Support, understanding and collaboration with these stakeholders were all critical parts of the process.

4.1.1 EPA

Although EPA had published a discussion paper supporting the introduction of offsets in theory, in practice no such schemes had been formally approved. The Kilmore scheme therefore saw all parties explore new territory as they developed workable solutions that met key principles.

GVW met with EPA very early in the process to establish lines of communication and demonstrate its commitment to a collaborative approach.

The scheme raised challenges for the standard regulatory regime of EPA as it changed the licensing from a point source discharge and control system, with well-established monitoring and enforcement protocols, to a much more diffuse control system with multiple players and a less structured enforcement regime. EPA has no authority to require third parties, such as local landholders, to undertake works and had to instead rely on the water corporation and the local CMA to enforce the compliance program. A major challenge for GVW was, therefore, to create mechanisms that would give the EPA confidence that the controls would be effective in achieving compliance.

The approach also raised questions about how the works approval and licence amendment framework could be used to achieve the compliance certainty that the EPA required, and whether and how these two strands could progress simultaneously to deliver an offsets approach.

4.1.2 Mitchell Shire Council

Local councils have a leadership role in planning developments and permits, and are important conduits for local community feeling and concern. It was therefore essential that the Mitchell Shire Council was fully engaged by GVW from the very start, and accepted that the proposed approach was not a 'second-best' solution or an attempt to avoid statutory responsibilities. Indeed, the council was a key player in ensuring local perception that the offsets scheme would create wider community benefits.

Improving the management of urban stormwater may provide potential offset opportunities. Were these options to be considered, then council would have been responsible for these measures, as they would have largely been located on council land within the town centre. Such options were not considered possible in the short term, as council was unable to make firm projections as to the phasing of future growth, or to anticipate future stormwater flows. This was because development in the town was occurring largely based on individual small scale sub-divisions of properties.

4.1.3 Goulburn Broken CMA

The CMA are the local stewards of the riverine environment. They are the regional specialists responsible for establishing and implementing targeted waterway health programs.

It was important for GVW that the CMA considered that the approach would enhance regional waterway heath and reflect its priorities for the region. There was a risk that the CMA would insist that any works were carried out on other waterways, which they considered were of 'higher priority', as neither the Kilmore nor the Kurkuruc Creeks were listed as priority waterways. This could have made the offsets program more complex as it would have resulted in interventions at a greater distance and potentially not on a 'like-for-like' basis. That would have made gaining EPA approval of the offsets scheme more challenging.

This risk was managed by early engagement of the CMA in the process as a trusted partner. They agreed that the proposed interventions would achieve important benefits for regional waterways even if they did not affect priority waterways.

The CMA also served as an independent third party with the skill set needed to implement and monitor landholder agreements involved in the proposed offsetting works. This proved essential in creating the sort of robust implementation and monitoring programs which gave EPA confidence that the scheme would be effective. This role was codified through a formal MoU.

4.1.4 Landholders

Local landholders had an important role to play as the third parties responsible for implementing – or at least supporting – the proposed offsetting works. There would be difficulties in implementing the scheme if the relevant landholders were not supportive.

One challenge was that GVW did not want to approach landholders until it had indicative approval from EPA. Without this indicative approval, GVW were concerned that early consultation might raise community expectations that the project would definitely proceed. On the other hand, GVW needed to provide the EPA with a robust program of works, along with

evidence that it could be implemented. The preferred source of that evidence would have been from discussions with local landholders.

This catch 22 was resolved by relying on the experience and judgment of local specialists, consultants and CMA staff in the early stages. Their understanding of local catchment management practices, and the likely success of assorted offset measures was robust enough to help GVW get indicative EPA approval. Detailed landholder engagement followed once GVW was confident that the scheme was likely to go ahead.

Step 1 and Step 3

Develop a comprehensive stakeholder engagement strategy to manage both local community and regulatory requirements. Build understanding and support across key organisations.

4.2 Offsets

4.2.1 Are there easily established offsetting works?

In Kilmore, there were a number of factors that made an offsets scheme seem both realistic and desirable.

- The existing treatment lagoons could be upgraded at low cost as a demonstration of good faith.
- The local creeks were generally recorded as being in a 'Poor' condition under DELWP's Index of Stream Condition.[4] This was particularly true of Kurkuruc Creek which Kilmore Creek flows into.

Table 4-1: Kurkuruc Creek – Reach 78 – Index of Stream Condition

Hydrology	Physical form	Riparian	Water quality	Aquatic life	ISC Score	Condition
2	6	5	2	7	22	Poor

- Kilmore Creek itself was not assessed in the Index of Stream Condition, but the ecological risk assessment identified that it was in poorer condition than Kurkuruc Creek, with significant threats from reduced flows, livestock access to waterways and stormwater pollution from urban growth.
- The nature of the recycled water discharge was assumed to be of relatively low toxicity (e.g. minimal heavy industry inputs). This meant that its discharge into a mixing zone downstream of the facility carried a low risk of lethality to ecosystems.
- Current land management was poor along waterways immediately downstream of the facility, with evidence of grazing pressure, poor stock control and erosion along the bed and banks of the waterways. These generated adverse waterway impacts that were not dissimilar to the proposed effluent discharge.

[4] This is a link to the Third Index of Stream Condition report on the Department of Environment, Land, Water and Planning website This link will take you to the Department of Environment, Land, Water and Planning website

- Taken together, the above factors provided opportunities to promote interventions that could generate improvements in the stream's condition. These interventions included:
    - fencing off the riparian zone to exclude stock from the waterway
    - revegetating the riparian zone to capture storm water flows and reduce sediment flows
    - gully erosion works and removing aquatic weeds.
- There was also evidence of contaminated stormwater flows into Kilmore Creek from the township roads and stormwater drains. There were opportunities to intercept these flows to reduce the discharge of sediments and other contaminants into the waterway.
- Finally, the local creeks (which the recycled water would be discharged into) were showing raised levels of stress from reduced flows due to water demands for urban supply and irrigation.

When it comes to future proposals, there will be facilities that discharge into waterways which are already in good condition and flow into catchments which are already well-managed. There will also be situations where the discharge creates an immediate risk of lethality. These situations will yield fewer opportunities for effective offsetting measures.

4.2.2 Criteria and safety factor

The *Water Quality Offsets Framework* specifies seven criteria that any scheme would have to meet to achieve net environmental equivalence. The following table reproduces those criteria and then reports on how the Kilmore scheme will meet these requirements:

Table 4-2: Offset criteria (source *Water Quality Offsets Framework)*

Number	Criterion	Definition	Kilmore case study
1.	Equivalence	Offsets have a similar impact on beneficial uses to the action being offset	Offsets target nutrient loads equivalent to the discharge. This is a Type 1 Offset – based on a 'like-for-like' approach
2.	Alignment with management priorities	Offsets are consistent with approved short and long-term management priorities of the system	Riparian zone protection and water quality outcomes are high priorities in the *Regional Waterway Strategy*
3.	Additional	Offsets are additional if they target priorities that are currently planned but not funded	The offsets are additional as riparian zone works and targets are not funded
4.	Timely	Offsets are time-bound (i.e. they have time limits) so that they come to an end and can be reviewed	The contracts for works are time-bound
5.	Located appropriately	Offsets address the impacts to beneficial uses at all geographic scales. Ratios will be used to account for discrepancies in offset lead time and delays in offsetting the impact	Offsets are locally targeted in proximity to the discharge and timed to deliver outcomes ahead of the increased recycled water flows
6.	Enforceable	Offsets are underpinned by an appropriate license or contract	Offsets form part of an approved license amendment from the EPA
7.	Verifiable	Offsets use appropriate industry standards or practices to demonstrate outcomes. Monitoring requirements of the outcomes will be reflective of the degree of confidence in the technology or approach chosen	Offsets provide an explicit rigorous modelling base with safety margins and monitoring capability. CMA provides conduit for robust MER

As noted in the table, the Kilmore scheme is able to demonstrate compliance with each of these criteria. The Type 1 'like-for-like' approach is much more straightforward to design, operate and monitor, and to justify the local community.

A further important issue relates to the safety factor to include in the package of measures to reflect the relative effectiveness of the proposed offsets. The *Water Quality Offsets Framework* identifies three factors to consider when establishing this safety factor:

- the physical proximity of the offsets to the proposed discharge
- the timing of the delivery of the offsets relative to the date of the increased discharge
- the certainty of the offsets being effective.

In the case of Kilmore, the works proposed were in close proximity to the discharge, were to take effect at the same time or in advance of the increased discharge and were judged to be of medium certainty in effectiveness. This scored a safety factor at 1.5 (i.e. the offsets are expected to generate a reduction in nutrients that will be at least 50% greater than the projected increase in the discharge).

4.2.3 Governance

Another critical issue concerns the processes in place to manage the offsetting actions proposed. EPA has no statutory authority to require actions by third parties and water corporations rarely have the skill-set or authority to negotiate contracts and monitor protocols with neighbouring landholders.

In the Kilmore case study, GVW negotiated with the local CMA to act as the intermediary with local landholders. The CMA negotiated the contracts and continues to provide the monitoring and reporting to demonstrate ongoing compliance. This is similar to the routine monitoring and reporting that the CMA already performs for other agencies such as the Federal Department of Energy and Environment.

These skills, roles and contributions were formalised in the form of an MoU between GVW and the CMA. That provided GVW and the EPA with confidence that the works would be delivered and the outputs and outcomes generated with a high degree of certainty.

Step 4

Develop a credible package of offsetting measures that take account of:

- the practicality of generating offsetting measures
- the need to comply with the criteria for environmental equivalence
- an appropriate safety factor
- robust governance arrangements.

4.3 Ecological risk assessment

4.3.1 The ecological risk assessment

A comprehensive ecological risk assessment was completed on Kilmore Creek and its downstream systems. This independent specialist advice was critical in GVW being able to demonstrate to EPA that the offsets concept was sound and able to deliver a net environmental improvement. The ecological risk assessment sought to:

- assess the risk to aquatic ecology and the beneficial uses of the creek system from the discharge of recycled water under an offsets management regime
- confirm the type of offsets that could be undertaken within the catchment to neutralise any potential impacts from the discharge of recycled water
- identify whether there was any potential environmental benefit in the offsets approach
- advise on waterway outcomes regarding flow and quality.

Three risk assessments were undertaken for the Kilmore Creek and downstream systems. They covered:

- the existing threats to the creek system from current land and water use
- the types of threats that would be posed by recycled water discharge to the Kilmore Creek but without any mitigation or offsets
- the types of threats that would be posed by recycled water discharge to the Kilmore Creek with mitigation and offsets.

4.3.2 The findings

The ecological risk assessment identified significant threats to the ecological values of the Kilmore Creek system from the current land and water use. The proposed offsets scheme led to a reduction in the risk rating for low dissolved oxygen concentrations and altered flow regime, and was neutral for elevated nutrients and toxicants. The improved risk ratings resulted from the proposed increased flows to a creek that was dryer than it ought to be, due to land use, water use and climate change.

A summary of the parallel ecological risk assessment for the Kurkuruc and Sugarloaf Creeks is shown below.

Table 4-3: Summary of Ecological Risk Assessment for Kurkuruc and Sugarloaf Creeks

Threat	Current risk rating	Risk rating with discharge	Risk rating with discharge plus mitigation and offsets
Elevated nutrients	Very high	Very high	High
Low dissolved oxygen	Very high	Very high	High
Altered flow regime	High	High	Moderate
Elevated toxicants	Moderate	Very high	Low

The conclusion of the ecological risk assessment was that the proposed recycled water discharge would result in net environmental benefits for the Kilmore, Kurkuruc and Sugarloaf Creeks, and the proposed discharge could be suitably managed via the proposed mitigation controls and offsets. These waterways would therefore be improved as a result of the offsets scheme.

Step 5

A comprehensive ecological risk assessment is essential to establish:

- current risks and threats
- the potential impact of the proposed discharge
- the effectiveness of the proposed measures in offsetting any additional threat
- potential benefits to the receiving waterways
- necessary controls to minimise risks.

5. Works

5.1 The controls

In order to achieve the outcomes sought by the ecological risk assessment, the following control measures needed to be implemented.

- Treatment within the facility to reduce the concentrations of nitrogen, phosphorus, ammonia and oxygen-demanding substances entering the creek.
- The development and management of a mixing zone to further reduce the concentration of nutrients and oxygen-demanding compounds and progressively reduce the size of the mixing zone[5].
- In-stream works to improve contaminant processing.
- Offsets from riparian revegetation, removed stock access points, managed gully erosion and in-creek works (sediment traps, nutrient buffering with aquatic vegetation).
- Managed flow discharges through use of existing storages to mimic natural seasonal variability and add to low-flow scenarios.

In selecting this suite of works and measures, a parallel driver for GVW was a decision to maintain a passive, low-energy treatment system that had minimal labour requirements. This has even greater significance given the commitment to reduce energy consumption by the water industry required by the 2016 Victorian Government *Water for Victoria* plan[6].

5.2 Lagoon treatment and mixing zone

The first element of the package proposed by GVW involved lagoon treatment augmentation, including:

- an inlet screen upgrade
- an aeration upgrade
- coagulating solids within the final lagoon
- disinfection
- polishing wetland.

These measures were designed to minimise the level of pollutants entering the waterway. Those levels will then be managed through a mixing zone and in-stream works. GVW expected that natural processes would be re-invigorated over time to help optimise this element.

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[5] The concept of a mixing zone recognises that further reduction in the level of the discharge is not practicable and so environmental values near the point of discharge will be compromised but this zone of impact should be made as small as possible and progressively reduced over time.

[6] Department of Environment, Land, Water and Planning 2016, *Water for Victoria*, Victorian Government, Melbourne.

5.3 Offsets

5.3.1 Agreeing the optimal offsets

The effectiveness of alternative offsetting actions was rigorously assessed to identify the most cost-effective offsets to fund. This exercise identified that three types of works offered the best potential to restrict the movement of nutrients from the catchment into the waterways. They were:

- gully rehabilitation
- riparian fencing for stock exclusion
- riparian vegetation.

5.3.2 Calculating the nutrient reduction

A robust model was then used to calculate the annual amount of nutrients (in kilograms) that would be intercepted by the proposed works. The model developed by Central Queensland University for Melbourne Water was adapted for this project. One of the most useful characteristics of this model is its ability to estimate the impact of identified works in specific locations, as most other models tend to work at a wider catchment scale and do not allow individual actions to be tested.

From this model, a mass reduction was calculated for a range of nutrients for each offsetting activity. The table below indicates the projected mass of phosphorous modelled as being intercepted by three offset measures.

Table 5-1: Calculation of phosphorous intercepted (kg)

Activity	Quantity	Reduction	Total
Gully rehabilitation (per gully)	8	30	240.00
Riparian fencing for stock exclusion (per ha)	83.4	12.7	1,059.18
Riparian buffer revegetation (per ha)	88.4	1.2	106.08
Total	N/A	N/A	**1,405.26**

The package of works proposed by GVW also included willow removal to optimise the value of the riparian vegetation and waterway condition.

The modelling demonstrated that the nominated offset activities would have the potential to stop approximately 1,405 kg of phosphorus moving from the catchment into the waterway each year. This provided 50% more than the 945 kg required to offset the increase in phosphorous that is expected to be discharged to the Kilmore Creek in the year 2025 (including the 1.5 safety factor).

The offset activities would also significantly reduce the transportation of nitrogen from the catchment to the waterway. The model shows that at full development, the offset activities will prevent 3,800 kg of nitrogen from reaching the waterway. This was considered by GVW to

represent a significant reduction and would contribute to the overall net environmental benefit that the scheme will generate.

5.3.3 Calculating the costs

A similar approach was adopted in developing the cost of the proposed offsets based on best-practice advice from the CMAs.

Table 5-2: Capital costs of offsets

Activity	Quantity	Cost	Total
Gully rehabilitation (per gully)	8	20,000	160,000
Riparian fencing for stock exclusion (per ha)	83.4	6,600	550,440
Riparian buffer revegetation (per ha)	88.4	5,325	470,730
Willow control (per km)	3	40,000	120,000
Total	N/A	N/A	**1,301,170**

The project also reviewed the projected ongoing costs to ensure continued effective delivery of the offsets. These included the cost of ongoing administration, contracts management and asset maintenance.

Table 5-3: Operating costs of offsets

Cost category	Value
Project administration	375,000
Offset maintenance	133,783
Total	**508,783**

5.3.4 Cost benefit analysis

Finally, the costs under the offsets option were compared with the projected costs of the base case. This showed that the offsets scheme was significantly cheaper, even when highly conservative assumptions were included. The present value cost of the offset option over 15 years (with a 4.5% discount rate) was $20M, compared with a value of $23.2M for the base case. This produced a net benefit of the project of $3.2M, and a benefit cost ratio (BCR) of 1.16.

This cost comparison is heavily affected by assumptions about the regulatory life of the offsets scheme. Strictly speaking, EPA approval was only for a ten-year period. Therefore the $20M cost for the offsets scheme included $11M for the costs of a full mechanical plant in the year 2026, at the expiry of the scheme. Clearly, if the scheme is successful and demonstrates its

value in achieving a net environmental benefit then its life might be extended. In this case, the relative cost benefit of the offsets scheme would be far higher.

As this was the first water quality offsets scheme implemented in Victoria, EPA was careful about the terms of any approval. However, the expectation is that, once a number of such schemes are established and prove successful, the time period for them may be extended. GVW identified that the ideal arrangement would be for a rolling ten-year life-span with five-yearly audits.

GVW recommended that in assessing the relative cost benefit of the offset scheme against the base case, two costings should be included:

- one based on the initial time period of the scheme (as adopted above)
- one based on the assumption that the scheme will operate under a ten-year rolling licence.

This will ensure that the true cost savings will be demonstrated.

5.4 Proposed scheme

Based on the analysis presented above, GVW proposed that the Kilmore scheme would involve:

- maintaining the existing recycled irrigation scheme, as this generates beneficial reuse outcomes and reduces the volume of nutrients to be managed through the offsets scheme;
- augmenting the existing facility to reduce the nutrient concentrations in the recycled water and manage ammonia levels to avoid toxic effects
- establishing a mixing zone and in-stream works to improve contaminant processing
- catchment works to offset any increase in nutrient loads by minimising the transportation of sediments and nutrients from farmland into the waterways
- targeted recycled water releases at times of the year that will support ecological values within the creek systems. The existing winter storages will be utilised to time the releases.

The proposed package would then create a suite of positive outcomes by:

- promoting sustainable recycled water management
- improving the ecological values of the Kilmore and Kurkuruc Creeks
- enhancing community values
- minimising GVW's capital and operating budget expenditure and so helping to keep water charges affordable.

Step 6

Develop a cost-effective package of offsetting measures.

- Identify a wide range of alternative options.
- Model each for their capability to reduce relevant pollutants and their practicability.
- Calculate realistic costs to establish and maintain controls.
- Agree on the optimal package.

6. Implementation

6.1 Regulatory framework

As identified earlier, having third parties undertaking actions was a challenge for EPA, as it has no authority to ensure their compliance. GVW therefore needed to construct a process and series of mechanisms to provide the EPA with the confidence it required to approve the scheme.

This process included:

- early engagement and dialogue to build confidence
- a rigorous options assessment to confirm that the offsets were a reasonable approach
- a comprehensive ecological risk assessment by a reputable specialist to give credibility to the assumed threats and the benefits of the proposed interventions
- a detailed offsets program with modelled interventions and outcomes
- an implementation plan that included timeframes, milestones, actions, reporting schedules, community consultation, contingency plans, and a monitoring program for the offset measures
- a partnership with the CMA to give confidence in the proposed implementation and monitoring plans underpinned by a formal MoU.
- The proposed offsets scheme still needed to be approved by the EPA within its existing regulatory control regime, which involved two primary regulatory tools. These regulatory tools were important, as they provided a clear process for EPA to consider, evaluate and set conditions through a formal statutory instrument.
    - **A works approval.** This provided approval to proceed with the augmentation of the Kilmore facility so that the recycled water could be treated to the discharge standard established by the ecological risk assessment; and
    - **A licence amendment.** This provided the necessary amendment to GVW's existing Kilmore licence to allow for the revised level of discharge of recycled water to the Kilmore Creek under the proposed scheme.

The licence amendment was only provided once EPA was satisfied that the augmentation works had been constructed to the necessary standard, and the Kilmore facility was capable of producing recycled water that met the ecological risk assessment quality criteria.

However, these standard tools did not adequately deal with the proposed scheme as they did not provide formal authorisation for the offsetting measures proposed. The solution was to cross-link them. This cross-linking was done in two ways.

- The terms of the licence (and so the right to discharge) were made subject to satisfactory demonstration of the effectiveness of the proposed off-setting works.
- Conditions in the works approval required development of an implementation and monitoring program before the final stages of the proposal could progress.

This cross linking gave EPA the confidence that it had the necessary mechanisms in place to control and respond to the scheme as it is implemented.

The standard regulatory tools were also extended to include EPA approval of the overall package of works (i.e. works approval plus licence amendment, plus offset implementation, operation and reporting), so that GVW and the Goulburn Broken CMA could begin the implementation of the offset activities.

This third element was also necessary to provided confidence to GVW that – should they implement the augmentation works to the required standards, and meet the conditions of their amended EPA licence – the scheme would be allowed to proceed. They could therefore begin to establish the offsets. This would assist with the timing of the overall scheme, and help to ensure the offsets were implemented within the nominated timeline.

6.2 Monitoring

The monitoring program proposed by GVW was critical to EPA's confidence in the scheme. An important element of this approach was the central role played by the CMA. GVW signed a formal MoU with the CMA to set out the expectations regarding the design, roll-out and monitoring of the offsets program. This formed the basis for a contract between the two parties in a similar way to the terms on which the CMA implements programs and pays for works funded by government departments at a state and federal level. Payments by GVW to the CMA were predicated on successful implementation and monitoring programs.

EPA also reviewed CMA's credentials and capacity to carry out such works.

Monitoring programs are generally challenging where they involve natural resource management. An ideal program would focus on ecosystem outcomes and draw on long-term data to establish a clear correlation between rainfall, flow levels, activities within the catchment, nutrient levels in the waterway and those ecosystem outcomes. In practice, there is generally a paucity of data on the variability in outcomes between seasons and on the relative impact of different factors river health along the length of particular waterways.

The monitoring program adopted by GVW therefore relied on a hybrid mix of measures.

- Input activities completed – for example, the length of waterway fenced. This demonstrates that the offset activities are being undertaken as planned.
- Immediate outputs achieved – for example:
    - the area of waterway being no longer subject to grazing pressure or the area of riparian zone being re-vegetated. This demonstrates that the offsets are leading to practical outputs
    - a reduction in nutrient levels in the waterway downstream from the works. This demonstrates that the works are achieving the offsetting reduction in nutrients that was projected.
- Outcomes generated: ecosystem health improved, as measured by e.g. the level and health of macroinvertebrates. (The ultimate objective is to restore ecosystem functionality, in the belief that this creates a virtuous cycle, with more effective natural processes being reinvigorated.)

6.3 Timeframe

GVW applied to EPA for approval to operate the offset scheme for ten years, split into two five-year periods. These timelines aligned with the pricing submissions cycles for the Essential Services Commission, and allowed EPA to review the performance of the offsets scheme after ten years.

A formal review/audit of the scheme will be undertaken by GVW after five years of operation, with the outcomes of the review provided to EPA for assessment. Assuming positive outcomes, GVW will then seek approval to continue the scheme for a further five years. Annual reporting will be undertaken to monitor the scheme and assist with the five-yearly audits.

This ten-year approval period was important for the GVW Board's support for the approach, as any uncertainty around the longevity of the scheme would have undermined the relative cost advantage and prompted a more traditional alternative based on a higher-cost infrastructure investment.

Step 7

Develop a robust regulatory package with the EPA.

- Agree on a works approval.
- Define the licence amendment required.
- Liaise over approval for wider package.
- Confirm a robust monitoring program.
- Agree on a medium-term approval period to win cost benefits.

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Authorised and published by the Victorian Government, 1 Treasury Place, Melbourne

EPA0093