

Isle of Seil: Wastewater Treatment Outline Investment Appraisal

Purpose

This paper summarises our options review and appraisal of the investment required to deliver sustainable wastewater treatment to the Isle of Seil following our announcement to the Community in December 2020 that costs for the Hillside option had increased significantly.

The information below sets out the process and rigorous review that was undertaken over several months to ensure that the existing viable options were revisited, and the other potential option of Ultraviolet treatment was investigated.

There are two distinct output requirements needed to ensure that we build a suitable treatment solution for our existing customers on Seil.

Table 1: Needs and Strategic Outcomes

Need	Description as it relates to benefit categories.	Strategic Outcomes	Programme Outcome
Provision of first-time public sewage treatment to 8 properties at Seaview Terrace currently served by a raw public outfall	Improved water bodies (provides an improvement to water quality in accordance with the Urban Wastewater Treatment Directive (UWWTD) but not a change in status under the Water Framework Directive (WFD))	Service Excellence	Environment supported by the delivery of our service
Treatment Asset Replacement or Planned Refurbishment / Repair to address performance issues at the current Balvicar Wastewater Treatment Works (WwTW)	Improved water bodies (provides an improvement to water quality of Shellfish Waters but not a change in status under the WFD). Less impact from pollution Potential reduced nuisance from Scottish Water assets	Service Excellence	Environment supported by the delivery of our service

1. Relevant background

Figure 2 shows the Isle of Seil and the areas requiring wastewater treatment.

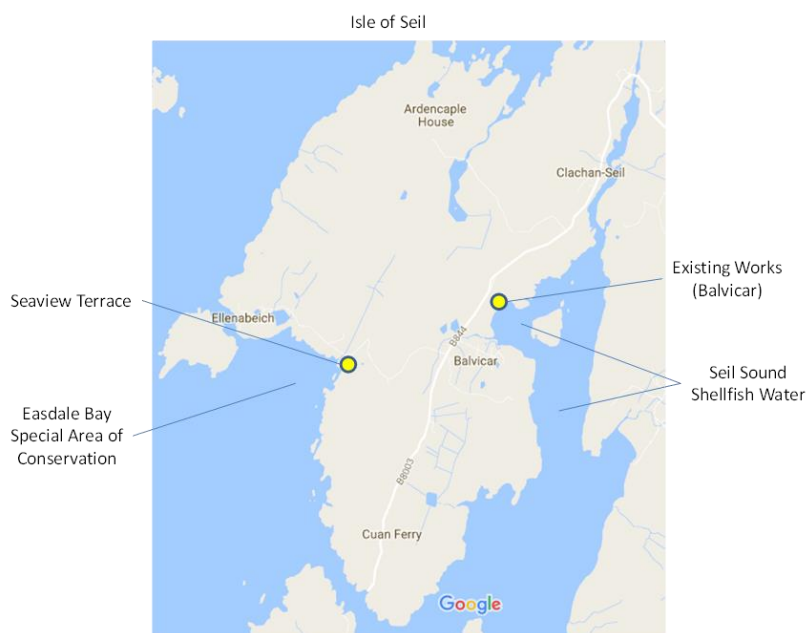


Figure 2: Location of WwTW and discharges

The Isle of Seil sits within the Firth of Lorn off the West coast of Scotland. It is bounded to the East by Seil Sound, a designated Shellfish Water Protected Area, and to the South and West by the Firth of Lorn Special Area of Conservation. There are also specific shellfish harvesting areas through Seil Sound and to the Northern part of the island.

The Isle of Seil is currently served by Balvicar Wastewater Treatment Works (WwTW) with capacity to treat a population equivalent (PE) of around 300. It is located to the East of the Island discharging to Seil Sound. The WwTW is situated on land between the scenic Balvicar Bay and the main tourist route around the Island,

The volume and peak flow of combined foul and surface water flows arriving at Balvicar WwTW is currently more than the capacity that the WwTW can treat, causing the Combined Sewer Overflow (CSO) at the inlet to the WwTW to spill into the Seil Sound which needs to be addressed.

Properties at Seaview Terrace to the East of the Island are currently served by a raw public outfall and are not currently compliant with the Urban Wastewater Treatment Directive. There are other properties at Ellenabeich which are on a private drainage system which are not included within this investment appraisal.

2. SEPA discussions (2021)

Discussions have taken place with SEPA during March 2021. The key messages are:

- SEPA expects Scottish Water to further consider approaches to remove surface water from the combined sewer system to reduce CSO spill frequency so that the existing arrangement is “less non-compliant.”
- SEPA does not have evidence to demonstrate any current impact from spills on the Seil Sound Shellfish Water Protected Area. However, current spill frequency evidence

does suggest that the current arrangement is non-compliant with requirements under the UWWTD (Urban Wastewater Treatment Directive).

- If Scottish Water can implement a solution to reduce spills to <10 per year, the current outfall can continue to be used as a discharge location. However, SEPA will look to include spill frequency limits to formalise this within any revised discharge license.

3. UV feasibility

Since the original Strategic Options Review was undertaken in 2016, further Technical expert support has been obtained, in line with the Community Stakeholder Group's (CSG) feedback in 2017.

Technical Consultants (m²) have provided technical justification supporting the use of UV (ultraviolet) to disinfect discharges from a combined sewer overflow (CSO). A report¹ provides a summary of the feasibility, capability, and limitations of UV irradiation for disinfection of the stormwater discharges, both in terms of technology limits; and also, in terms of demonstration of potential to achieve the requirements likely to be set by SEPA.

The report includes case studies of installations throughout the UK as well as detailing changes to the approach for sizing of UV plants. The new approach has been developed in conjunction with the Environment Agency in England and Wales which enables a much better understanding of the influence of the design parameters, wastewater quality and operational conditions on disinfection performance. Additionally, it allows an understanding of the limitations on performance on a site-specific basis and the opportunity to target specific micro-organisms of concern (such as viruses).

The report highlights that:

- With pre-treatment upstream of UV irradiation for disinfection, the CSO discharge is likely to achieve the target concentrations post disinfection assumed for the assessment (which would be subject to confirmation with SEPA).
- Clearly provision of UV irradiation for disinfection will have no impact on the duration and frequency of the storm flow discharges.
- It does however demonstrate that the UV treatment would be expected to provide a similar or greater reduction in the annual E. coli load discharged from the site than achieving the reduction in spill frequency (<10 per annum) alone.

4. Early engagement with customers and communities

The construction of Balvicar WwTW in 2008/9 caused significant disruption during and after construction and an ongoing concern about the screening of the existing site due to the location of the WwTW being on the main tourist route.

In June 2016 a Community Stakeholder Group (CSG), chaired by Mike Russell MSP, was created with the objective to engage the community in the development of a mutually acceptable option for this project. This was supported by several community information events and the appointment of an independent technical expert (Chris Chubb, former Head of Environmental Quality at the Environment Agency) to support community scrutiny of Scottish Water's proposals.

¹ Clachan-Balvicar Combined Sewer Overflow – Feasibility of UV irradiation for the disinfection of storm water discharges

The Group agreed to a process that would see the range of options developed (including those subsequently suggested by the community) appraised through a commonly understood and transparent project evaluation system Stage 2: Strategic Options Review

The list of strategic intervention options generated in 2016 to address the needs, have been reviewed and re-screened to reflect the changes outlined in Section 1. These have been narrowed down to three possible options highlighted below including the new options (0d and 0e) to reflect the inclusion of UV to provide additional treatment.

As agreed with the Community Stakeholder group in 2016, decision making criteria used for screening was based on two key factors, pre-requisites, and variable factors.

5.1. Preliminary Screening

Pre-requisites that must be met to progress or the option will be discarded:

- Meet the provision of appropriate² wastewater treatment to meet the requirements of the UWWTD at Easdale (8 properties at Seaview)
- Be licensable by the Environmental Regulator (SEPA)
- Fully comply with Scottish Water Health and Safety Requirements

All 3 pre-requisites had to be met to take the option forward for appraisal.

5.2. Secondary Screening

Criteria for secondary screening included; Certainty of Technical performance, Community acceptability based on feedback from the Community Stakeholder Group, Construction and timing, Future flexibility, Resilience, sustainability and the Whole Life Cost.

5.3. Options taken forward for appraisal

Through the preliminary and secondary screening, 12 of the 15 options were discounted. The full appraisal report includes the evidence base, and the reasons for discounting.

The options therefore carried forward for further appraisal as part of this review were:

- **Option 0e** – Retain Balvicar WwTW on existing site, provide additional side stream UV Treatment with a stand-alone septic tank at Seaview
- **Options 1a/1b** - Move Balvicar WwTW to a hillside location away from other properties with a stand-alone septic tank at Seaview
- **Options 3/3a/3b** - Strategic option combining treatment for Balvicar and Seaview discharging to Easdale Bay after septic tank treatment with or without UV

6. Stage 3a: Outline Investment Appraisal

6.1 Options at Stage 3a

A short summary of the 3 remaining options for appraisal are provided below:

- **Option 0e – Retain Balvicar WwTW on existing site, provide additional side stream UV Treatment with a stand-alone septic tank at Seaview.** This retains the Membrane plant to treat the base biological and bacteriological loading from the network and construct a new parallel treatment mechanical treatment stream with a

² This may be a form of primary treatment or septic tank system, or any other treatment system provided it, “allows the receiving waters to meet the relevant quality objectives and the relevant provisions of the Directive and other Community Directives”.

screen, flex-filter (or similar), and UV treatment to treat 10l/s³, ensuring that all discharges are treated and disinfected prior to discharge in a 1 in 5-year storm event. A septic tank will be installed at Seaview to provide first time treatment to 8 properties.

- **Options 1a/1b - Move Balvicar WwTW to a hillside location away from other properties with a stand-alone septic tank at Seaview.** The new SAF (Submerged Aerated Filter) and UV treatment arrangement would treat and disinfect 6l/s with an additional 120m³ storm storage at the existing WwTW site that will be converted into a pumping station. Storm spills should be limited to < 10 significant spills (>50m³) per annum on average which will continue to spill as screened storm overflows. Install a septic tank at Seaview to provide first time treatment to 8 properties.
- **Options 3/3a/3b - Strategic option combining treatment for Balvicar and Seaview discharging to Easdale Bay after septic tank treatment with or without UV.** The existing Balvicar WwTW would be converted to a pumping station and storm storage tank for 6l/s. A new significant transfer sewer would be constructed across farmland to pass flows to the new works in an abandoned quarry across from Seaview Terrace. Seaview. The outfall will either be drilled to a depth that will achieve the necessary more than 60 initial dilutions or extended out beyond the marine protection area.

An appraisal of these options has been undertaken using qualitative benefits, net present costs and carbon. For the purposes of appraisal Option 3a has been considered as it has a UV plant and is therefore more comparable to Options 0e and 1a.

6.2 Benefits Appraisal

The Benefits appraisal focuses on the positive benefits to customers, but disbenefits to the community and environment have also been considered. Table 4 shows the benefits categories that have been considered for this project.

Table 4: Applicable benefits and beneficiaries

Benefit category	Service Impact	Customer	Community	Environment
Less impact from pollution	Outflows: UID/CSO			
Improved waterbodies	UWWTD Shellfish Directive			
Reduced nuisance from Scottish Water assets	Nuisance			
First time/new connections can be quickly facilitated.	Capacity for new connections			

The areas of commonality between the 3 remaining options are:

- Improvement Water Bodies (community) – there are no restrictions in the use of Seil Sound or Easdale Bay for leisure recreation, amenity or tourism and no change to WFD status.
- Improved Water Bodies Seaview (environment) – all meet the UWWTD
- Visual amenity at Seaview – the WwTW is located in a quarry hidden from view

³ Based on modelled flow received at the WwTW.

- Ability to facilitate new connections quickly

The areas of differentiation between the 3 remaining options are:

Table 5: Differentiation of benefits

Benefits	Level of Benefit			Commentary
	Highest	Mid	Lowest	
Less impact from pollution on Seil Sound to communities and environment	0e	1a and 3a		All options provide a reduction in spills but 0e has no spills.
Improvement in water bodies (environment)	3a	0e	1a	3a has the best load reduction at Seaview and overall. 0e has the best load reduction at Balvicar.
Visual amenity at Balvicar	3a	1a	0e	All options provide an improvement in visual amenity but 3a is located away from view in a quarry. In Options 3a and 1a a pumping station remains on the Balvicar WwTW site and in Option 1a it may be possible to see some of the new WwTW on the hill although due to the topography at the location this should be minimal.
Site visits post construction	1a and 3a		0e	All options have site visits in two locations but the site visits for 1a and 3a will be less frequent but for a longer duration. The site visits for 0e will be same as currently but longer duration.

Table 6: Differentiation of dis-benefits

Dis-Benefits	Level of Dis-Benefit			Commentary
	Lowest	Mid	Highest	
Nuisance during construction	0e	3a	1a	0e will have minor disruption at both Balvicar and Seaview. 1a will have major disruption due to lorry movements (soil movement), rock drilling and construction of pipelines.
Environmental impact on land	0e	3a	1a	0e has the least environmental impact as it is located on the existing site whereas 3a is on a brownfield site and 1a on a greenfield site. Both 1a and 3a involve construction of pipelines across greenfield land.

While Option 3a was ranked the highest in slightly more benefits categories than 0e, Option 0e had less disbenefits than Option 3a. As this is a qualitative assessment it does not reflect the quantification of benefits and the value that communities place on individual benefits. It therefore does not reflect the strength of the CSG's views on Option 3a.

In comparing Option 0e and Option 3a:

- **Option 0e provides:**

- The highest reduction in spills
- The best improvement in water quality of the Seil Sound.
- The lowest impact on the land environment
- The least disruption during construction.

Some additional plant and equipment will be required at the existing WwTW, but it is anticipated that this could be arranged and screened to minimise any change to the visual amenity.

Further development is required in the design of this option to verify if all of the required plant and equipment could be accommodated on the existing site footprint, but if any additional land is required, this is expected to be minimal. The added benefit of this Option is that all spills are eliminated.

- **Option 3a provides:**

- The best improvement in water quality of Easdale Bay and of the Easdale Bay and Seil Sound combined relative to the other Options.
- A reduction in spills into the Seil Sound.
- The best improvement in visual amenity at Balvicar Bay as the WwTW will be moved to brownfield site (quarry) on the other side of the Island, where it will be hidden from view.
- There will be moderate disruption during construction and there will be a pumping station on the existing WwTW site with some evidence of Scottish Water Operations.
- There will be reduction in the frequency of operational visits.

There is considerable objection to this Option by the CSG based on the impact that it could have on the marine protected area. Whilst a marine modelling dispersion study indicates that the Bathing Water standards could be met along the shoreline, UV disinfection included in Option 3a will significantly reduce the extent of the mixing zone that would be required.

6.3 Net present costs assessment

Table 7 shows the net present cost assessment, which is an essential step in determining the value for money of the options. This reflects the total costs of the Options combining operational and capital costs over the total life of the longest asset (60 years) and converted into a present value cost.

Table 7: Net Present Cost Assessment

Option	Description	Overall Investment over 60 years (present value £m)			
		Low	Central	High	High-Low

0e	Existing Balvicar WwTW with additional UV. Stand-alone septic tank at Seaview.	5.4	7.1	9.9	4.6
1a	Move Balvicar WwTW to a hillside location. Stand-alone septic tank at Seaview	9.3	10.3	11.7	2.4
3a	Combine treatment at Seaview with UV	7.0	8.6	10.9	3.9

The appraisal period has been chosen as 60 years because it reflects the life of the pipelines that will be built for Options 1a/b and 3/3a/3b. Option 0e has the lowest capital cost and the lowest overall investment by £1.5m because it avoids construction of long pipelines and minimises the number of treatment works assets constructed by adding processes at the existing WwTW site, rather than replacing them at another location. Option 0e has a higher annual operating cost due to the requirement to visit the site more frequently due to the membrane plant.

The high low estimates shown in Table 5 are based on the level of design and contractor costing that has been undertaken for each option. For capital costs the assumptions are:

- Option 0e = -30% to +50%
- Option 1a = -10% to +15%
- Option 3a = -20% to +30%

Operational cost sensitivity has been set as +/- 5% based on current design assumptions.

A full list of cost assumptions is contained in Appendix B.

6.4 Carbon assessment

The carbon dioxide emissions have been calculated using the CCAT (Capital Carbon Accounting Tool) tool, which calculates change in whole life carbon.

Table 8: Changes in Whole Life Carbon

	Option 0e	Option 1a/b	Option 3a
Whole Life Carbon (tonnes of CO₂ equivalent)	389	1,111	612

Option 0e has the lowest carbon emissions, it is 36% lower than the next best option because it uses a higher proportion of existing assets and minimises construction of new treatment works and pipelines, and it avoids pumping sewage over long distances.

7. The views of customers and communities –Throughout the process of evaluating the most appropriate options the views of the Seil community have always been important throughout. It is however recognised that no single solution would meet with unanimous approval Scottish Water has tried to listen and take on board the different views and perspectives from people who engaged with us.

In line with customers' wider expectations of any of our capital investment projects⁴ the preferred option aims to:

- **Deliver consistently excellent water and wastewater services.** Concentrate on maintaining water quality and **reducing sewer flooding, with reliability and resilience of their water supplies being vital.**
- Deliver the same quality of service over the next 25 years. Repair or replace ageing assets to protect the environment and **maintain services.**
- **Helping Scotland to prosper.** Recognising the importance of water in perceptions of Scotland and safeguarding the natural environment to support tourism and the wider economy.
- **Engaging with customers and communities.** Providing more advice and information about how they can help support sustainable services.
- **Operate in a sustainable way.** Ensure investment is sympathetic to the natural environment.
- **Promote innovation within the water sector.** Using innovative approaches and technologies and challenging the status quo.

Customers have told us they value the iconic nature of water in Scotland and the benefits this provides in the promotion of tourism. Customers have discussed the quality of water and surroundings of rivers and beaches, linking them to the part they play in our tourism industry and Community Councils also alluded to this in the Impact research, highlighting the importance of this for rural and coastal communities. This is relevant to Isle of Seil due to the impact that any discharges will have on the Seil Sound and the Firth of Lorn Special Area of Conservation.

Option 0e maximises the potential of the current Scottish Water assets, adopting circular economy principles by continuing to utilise a higher proportion of existing assets.

7.1 Other considerations and requirements

All options mentioned about would be subject to receiving planning consent from Argyll and Bute Council and also receiving a waste water discharge consent from SEPA, both of which are independent consent processes.

8. Preferred option

Option 0e has been recommended as the preferred option because:

- It has the best overall reduction in load to the Seil Sound.
- It causes the least nuisance to the community during construction.
- It has the lowest environmental impact on the land.
- It meets the requirements of the UWWTD at Seaview
- It eliminates spills.
- It has 36% lower carbon emissions than the next best Option, as it utilises existing assets and avoids building pipelines which pump sewage over long distances.
- It has the lowest NPC (Net Present Cost) by £1.5m.

⁴ [Customer Insights](#) DSR21 Strategic Plan Supporting document

9. Next steps:

At a meeting with members of the local community council, Jenni Minto MSP, Councillors and a number of other local stakeholders on 21st June we outlined the findings of this review and next steps.

At this stage, we are looking further into the final design, and our desire is to keep any additional apparatus within the existing site footprint, wherever possible. We will also look to install appropriate external site screening, in keeping with the local area

It is also our intention to withdraw our planning application for the hillside option.

When we are in a position to provide a meaningful update as the final designs progress, we will hold an information drop-in session either virtually online, or in the village hall (subject to Covid restrictions).

We have written to all Seil residents to inform them of this information and next steps.