

<b>Date</b>	10 February 2026
<b>To</b>	Jon Bright, Project Director – Waitaha Hydro Scheme Westpower Ltd
<b>From</b>	Rodger Griffiths
<b>Project advice provided for</b>	<i>Waitaha Hydro Scheme</i>
<b>Qualifications</b>	<i>Appendix 3 Project Overview Report, Part 1</i>
<b>Documents referred to</b>	<i>Waitaha Hydro Scheme Substantive Application Appendix 3 Project Overview Report Parts 1 and 2</i>
<b>Signature</b>	

## Introduction

1. The peer review reports of Dr Jon Tunnicliffe and Mr Paul Morgan raise issues that Westpower is aware of, and its expert advisors have considered, throughout the Project's design and development.
2. Throughout the Project's development, highly experienced and qualified engineering input was sought at each key concept design stage. Environmental effects assessments have informed design changes and refinements since 2012. Westpower has used a consistent team of engineers and environmental experts, with independent peer reviews sought as necessary, over the life of the Project to assure and reassure it of the appropriateness of the design and suggest new options to address issues raised.
3. To assist the Panel, the following section outlines the principal design and environmental considerations, as well as the expert input sought during each stage of the engineering design process for the Waitaha Hydro Scheme. While I am not presenting this report as an expert, my qualifications and experience are in paragraph 2.1 of my report.<sup>1</sup>
4. My involvement in the Project was supported internally in Westpower by Stephen Matheson, an experienced hydro civil engineer who was employed by Westpower from 2005 to 2022.
5. In summary the key stages of the project's development have been:

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<sup>1</sup> [Appendix 3 project overview report part1.](#)

- (a) Choosing the river for the scheme:
    - (i) January 2005 - Initial Scoping Study of West Coast Hydro opportunities Identification of Kakapotahi and Waitaha Rivers– Rodger Griffiths and Stephen Matheson;
    - (ii) May 2005 - Initial Civil Pre-Feasibility Study of Kakapotahi and Waitaha Rivers – Selection of Waitaha River – Ian McCahon and Stephen Matheson;
    - (iii) 2006 onward - Understanding the key elements of the Waitaha (hydrology and bedload / sediment / geomorphology involving Mr Doyle and Dr Hicks)
  - (b) Choosing the general location of the powerhouse and intake during the 2012 workshop with all environmental experts providing their design inputs for assessment by Mr McCahon;
  - (c) Weir concept design, location and intake type confirmed by Mr McCahon in 2013 (this design included a sluice channel and side intake to flush bedload past the intake and an underground desander to trap the sediment, with periodic flushes back into Morgan Gorge); and
  - (d) Project design development for the DOC concession process (2015) and updates to the Project design throughout that process.
6. Further design refinement around the intake and location of the Access Tunnel portal prior to lodging a consideration application with DOC 2022 with input from Stephen Matheson and a tunnelling expert (Ant Black from Geotech, the tunnelling contractor that successfully completed the Amethyst tunnel in 2012).
7. A shift from the DOC concession process to the FTAA process began in 2024 with engineering design challenge sessions and AusHydro being engaged, and updating technical assessments for the FTAA process and application (2024 to 2025). The AusHydro design improvements included removal of the upper (above normal water level) intake and increasing the size of the sluice gate to control sluicing flows for bedload into Morgan Gorge. Additionally, the sediment trap sluicing system was changed to use a Sedicon system with an HDPE pipe transporting the suspended sediment down to a discharge point at the powerhouse tailbay, removing the need for a flushing tunnel and discharge point in Morgan Gorge. Both of these design changes reduced the environmental (landscape) footprint in and above Morgan Gorge.

8. For the sake of clarity, the term “concept design” used throughout this report and the reports from Dr Clunie and Mr Kent-Johnston refers to the evolving design from 2013 onwards, and has benefitted from several iterations, so should be understood in the context of the particular timeframe being referred to, The design is currently at a level of early feasibility study as noted in paragraph 17 of My Kent-Johnston’s evidence, but is still referred to by the generic term “concept design”.
9. My evidence responds to the general issues of design inputs and efforts raised in the Tunnicliffe and Morgan reports, alongside the detailed responses of Westpower’s expert team. To be clear, while Westpower has applied a robust process during the Project’s design to this point in time detailed design, and more significant and costly investigatory works (such as the borehole tests and more detailed sediment modelling), is yet to be done. Given the team we have engaged, and my experience with the Amethyst Power Scheme, I am confident that issues that will no doubt arise during this detailed design process can and will be appropriately accommodated within the parameters of the proposed Application including the resource consent conditions.

### **Robust and tested engineering advice**

10. As explained in my report,<sup>2</sup> Westpower has a long history of building run-of-river schemes involving the construction of low weirs across rivers that do not involve large dams or reservoirs. This began right back in 1888 with the first public power supply in the southern hemisphere to Reefton. In recent times, Westpower developed the 7.6MW run-of-the-river Amethyst Power Scheme using engineering advice from Mr Ian McCahon, who was involved in the concept designs of the Waitaha Hydro Scheme between 2005 and 2024.
11. The Amethyst Power Station and the Waitaha Hydro Scheme have many similarities (I address the differences later), noting that Amethyst is a smaller scheme. Constructing and operating Amethyst first (it commenced operation in 2013) has provided Westpower with confidence in constructability of the Project and its ongoing operation. Westpower has sought independent engineering advice from international and national experts (Norway, Australia and New Zealand) in hydro generation and run-of-river schemes, particularly to ensure robust and tested advice about responding to the site’s challenges and particular characteristics, specifically the high bedload and high floods. The engineers involved in design have now included: Mr Stephen Matheson (Westpower civil engineer) (2004 – 2022), Mr Ian McCahon (2005 to 2024), Mr Bryan

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<sup>2</sup> [Appendix 3 project overview report part1](#), at para 3.7.

Leyland (2025), Dr Tom Jacobsen (2024 onwards), Mr Jeremy Kent-Johnston (2024 onwards) and Dr Dougal Clunie (2024 onwards).

12. Mr Martin Doyle begun continuously monitoring the river levels and hydrological characteristics of the site in 2006, using a datalogger on the Waitaha mainstem at the top of Kiwi Flat.<sup>3</sup> This continued for six years. Mr Doyle's Appendix 18 Hydrology Report explains water level data was collected at the entrance to Morgan Gorge to describe the choking effect of the gorge along with time sequenced photos.<sup>4</sup>
13. Dr Hicks has considered the natural sediment transport in the Waitaha since 2013, and effects of the concept scheme design developed by Mr McCahon, since 2012 providing reports for the Concession Application, and this Fast-track Application.
14. From 2013, when Westpower began preparing for the Concession Application, each material change to the concept scheme design was also considered by the full environmental effects expert team.
15. To challenge views and present new ideas, Westpower also sought advice from a landscape expert, Di Lucas who in 2016 supported lowering the structures, while not trying to hide what they are, and reducing the visual effects of the power station (including the roof design, lowering its siting, and reducing its footprint).<sup>5</sup> In addition, to ensure that the Project headworks design remained fully tested for its stage of development (again I stress detailed design has not been undertaken) we sought engineering challenge and input from:
  - (a) Mr Brian Leyland; and
  - (b) Dr Tom Jacobsen.
16. In developing the Project over 20 plus years, experts have held differing opinions, and during the design process there has been lots of debate within the team (and many compromises made by Westpower to address concerns). However, the expert advisory team has unanimously supported the project as proposed for approval. However, the design for approval, while robustly thought through, is not the detailed design. That design will iteratively become ever more precise should the approvals be granted, and will reflect latest engineering practice, ongoing testing and input from

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<sup>3</sup> [Appendix-18-hydrology-report.pdf](#), at para 3.2.

<sup>4</sup> [Appendix-18-hydrology-report.pdf](#), Figure 1, pg 6.

<sup>5</sup> Refer to "WHS-Revised Landscape Proposal April 2016 – Covering letter, [b141607d58b8c9f95e27002f57e6420694ce8e5f.pdf](#)

further investigations. The conditions require that process, the involvement of appropriate technical expertise so that the environmental outcomes are achieved.

17. As the project sponsor, and an engineer, I have not been informed by the team of experts engaged by Westpower of any fundamental / red flag design / concept issues that cannot be managed through conditions of consent and/or detailed design. There may be costs associated and Westpower has accepted that is necessary to put forward an appropriate application.
18. The costs associated with the development of the Project have been carefully weighed against its anticipated benefits. Throughout the planning and design process, a series of compromises have been made, all of which have incurred costs—some of them considerable. Despite these financial challenges, the Project has maintained its economic viability. Crucially, it continues to promise substantial benefits for the region, ensuring that the investment and compromises made will deliver meaningful positive outcomes for local communities and stakeholders.

#### **Intake location (Morgan Gorge)**

19. As explained my report, Appendix 3 Project Overview Report Part 1, the top of Morgan Gorge was selected to avoid materially greater ecological, landscape and geomorphic impacts associated with upstream alternatives.<sup>6</sup>
20. In summary, during pre-feasibility investigations, six intake general arrangement options were evaluated involving two possible intake sites and three powerhouse locations. This included:
  - (a) four upstream alternatives with an intake location at Waitaha Gorge; and
  - (b) two alternatives based on an intake at Morgan Gorge and is shown in figure 1, page 15 of my report.<sup>7</sup>
21. At an expert workshop in October 2012, the engineers and environmental experts involved used a rating method incorporating a wide range of factors based on information available at the time (including environmental, engineering, planning and economic information) to assess the preferred solution, which resulted in Morgan Gorge being selected.

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<sup>6</sup> [Appendix 3 project overview report part1](#), at para 3.45.

<sup>7</sup> [Appendix 3 project overview report part1](#)

22. While upstream options provided higher potential head, they would have resulted in:
- (a) headpond formation and canal structures within Kiwi Flat;
  - (b) reduced flows through high-value who habitat; and
  - (c) significant landscape modification.
23. If the intake was positioned at the lower end of the Waitaha Gorge, upstream of Kiwi Flat, this would have required an extensive canal through Kiwi Flat and would have effectively dewatered Kiwi Flat for much of the time. As Mr McCahon explains in his evidence dated 10 February 2026, another option of a longer weir much further up Kiwi Flat than the chosen site was considered but not advanced.
24. A further study carried out by Mr Ian McCahon in 2013 entitled "Intake Preliminary Concept and Options – 2013" (appended to his 10 February 2026 statement) considered various options for siting the intake in and around Morgan Gorge and concluded that a side intake at the entrance to the Gorge was optimal given the overall constraints of the site. This design also included a sluice gate as the primary means of bedload and sediment flushing past the intake.
25. This option selection process involved a deliberate trade-off between construction cost and reduced environmental footprint, as explained in para 3.46 of my report. Dr Hicks, with his considerable experience of West Coast rivers, advised on the natural sediment transport at the site, as well as what effects on sediment transport the concept design would create. As described in Appendix 19 Sediment Report, this included catchment aerial inspections in 2013, data collection on turbidity and suspended sediment (2013-2015) and hydraulic modelling of flows along Kiwi Flat and past the Power Station (2013 and 2014).<sup>8</sup>

### **Intake Type (Low Weir Structure)**

26. At the nearby Amethyst River, a stream-bed (or Tyrolean) intake was designed (as explained by Mr McCahon in his evidence dated 10 February 2026) and constructed by Westpower in a very constrained ravine without any road access in 2013. The site was subject to regular flooding events and high bedload transport and, in that regard, the experience gained in designing and building the Project in a dynamic riverbed

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<sup>8</sup> [Appendix-19-sediment-report.pdf](#), at pg 36.

environment is directly applicable to Waitaha. In summary, a low, run-of-river diversion structure was selected for Waitaha to:

- (a) maintain natural bedform conditions;
  - (b) avoid impoundment or permanent inundation;
  - (c) support sediment continuity through Morgan Gorge during natural flood events.
27. No engineers engaged by Westpower have raised concerns with the inability to achieve a detailed design that would deliver the concept scheme designs. At each design stage, improvements to the design have enabled reduced environmental effects (as sought by Westpower's expert team).
28. The concept scheme design included in the Application is effectively the same general design concept Mr McCahon designed in 2013, albeit with some refinements, such as to:
- (a) improve resilience and to ensure the passage of bedload through (using the sluice gate) and over the weir structure, and
  - (b) manage effects on public safety and ecology (the bypass valve and kōaro passage).

### **Peer reviewer's concerns**

29. The Morgan report questions whether the intake included in the Application is "best" for this location.<sup>9</sup>
30. In the 2005 pre-feasibility investigation led by Mr McCahon, a range of general intake sites were considered. Mr McCahon, then carefully evaluated a range of intake types before the current intake design and location was selected. (Mr McCahon was the same experienced designer employed to design the Amethyst intake). This is covered in more detail in Mr McCahon's statement dated 10 February 2026 with his original recommendation appended.
31. In early 2025, prior to the submission of the Fast-track Application, Westpower carried out an engineering challenge review of the overall scheme design, with a particular focus on the intake responding to the high amounts of bedload and sediment and

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<sup>9</sup> Morgan review, pp. 4-6: comments on the selection of intake type e.g. on page 5 "Is a weir structure perpendicular to the flow blocking all flow in the river the best intake type for this location? That is a very traditional solution and there are many issues an option like this creates in a steep and very active river system."

extremely high flood ranges. Mr Kent-Johnston and Dr Clunie were responsible for the concept scheme design at this point, but Mr McCahon (who had retired) was involved again to peer review and test the designs.

32. We also invited Mr Bryan Leyland, an experienced hydro design engineer, to be a part of this challenge exercise. After robust discussions between himself, Mr McCahon and the current design consultants (AusHydro) – Mr Jeremy Kent-Johnston and Dr Dougal Clunie, there was agreement that the intake type selected for the Waitaha Hydro Scheme is the most appropriate approach. A side intake with a weir perpendicular to the flow was confirmed as preferable as the project design for approval (and to take into the detailed design).

### **Landscape design parameters**

33. Following the concerns raised during the Concession process about landscape effects, Westpower sought input from an independent landscape expert, Ms Di Lucas, to help further refine the design of the powerhouse and intake.
34. Key outputs from a workshop in March 2016 involving Ms Lucas, the design engineers (Ian McCahon and Steven Matheson) and James Bentley, resulted in a change to a double mono pitch roof at the powerhouse as well as a decision not to try and camouflage the intake structures with artificial features such natural rock facings. The view was that the intake structure would sit better in the environment by acknowledging what it is, rather than trying to make it look like something more natural.
35. There was also a change to lower the power station and reduce its footprint. This adjustment was provided to DOC in April 2016.<sup>10</sup>
36. To ensure Westpower would 'tread lightly on the land', in May 2022, the overall landscape impact was internally challenged again, with a site visit for the engineers, landscape architects, tunnelling expert and a surveyor to further refine the intake arrangement and ensure that the minimum practical footprint was being used. The experts included
  - (a) Stephen Matheson
  - (b) James Bentley, Boffa Miskell

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<sup>10</sup> Refer to *WHS-Revised Landscape Proposal April 2016 – Covering letter*, [b141607d58b8c9f95e27002f57e6420694ce8e5f.pdf](https://www.doc.govt.nz/assets/Uploads/WHS-Revised-Landscape-Proposal-April-2016-Covering-letter.pdf)

- (c) Corey Murray, Boffa Miskell
  - (d) Blake Neale, WSP
  - (e) Ant Black, Geotech (tunnelling).
37. In February 2024 Ian McCahon, Geotech Consulting, and Jeremy Kent-Johnston, AusHydro, visited the site as a handover and to have a further discussion about the design., ultimately leading to the following refinements to the concept design for the intake by AusHydro
- (a) removal of the top water intake,
  - (b) introduction of the slotted pipe desander,
  - (c) relocation of sediment discharge to tailbay;
  - (d) relocation and change in size of the access tunnel portal.

### **Sediment Management Approach**

38. In 2012, it was decided by Mr McCahon that an underground desander is needed to provide:
- (a) efficient separation of fine sediments (to avoid undue wear and therefore high maintenance on the turbine components);
  - (b) flushing during natural high-flow events; and
  - (c) minimisation of visible structures.
39. During the initial civil design phase for this Fast-track Application in early 2024, 2D flow modelling by AusHydro identified an issue where extreme river level rises in Morgan Gorge during flood events (of 20 m or more) would make it very challenging to maintain freeboard in the desander without the need for very complicated and duplicated hydraulic gate arrangements. Moreover, there would be an inherent risk of flooding the desander due to technical or mechanical failure of the upstream gate. This necessitated further investigation by AusHydro, including a review of international best practice for dealing with this issue.
40. Westpower and AusHydro consulted Dr Tom Jacobsen, the CEO and Technical Director of SediCon Norway, who has wide international experience in the design of hydro intake structures and sluicing systems for high-sediment environments, including

ones that are considered much more challenging than Waitaha. Dr Jacobsen confirmed that a fully-pressurised desander situated below water level has been successfully used elsewhere and would be a sensible solution in our case. He also provided several reference sites where such systems had operated well, as detailed in Westpower's memo 6 dated 16 January 2026 in response to Question 8 of Request For Information #2. Dr Jacobsen has provided a memo at **Appendix A** regarding the handling of sediment and bedload by the Scheme.

41. Mr Jeremy Kent-Johnson of AusHydro met with Dr Jacobsen during a trip to Norway in November 2024 to explain the current desander design features. The outcome of the meeting were several optimisations to the design based on Dr Jacobson's experience. This resulted in improved performance in terms of handling the high bedload and sediment content of the river.
42. A key engineering design parameter of the desander is its cross-sectional area, which needs to be large enough to slow the water velocity down to allow sediment to fall out of suspension, and the effective length of the desander, which combine to provide the necessary trap efficiency. As a result of the dimensions finally chosen for this purpose, a substantial storage volume for settled sediment was also created, which works out to approximately 12 months' worth of sediment. This provided a significant secondary benefit to the redesign by greatly increasing the flexibility around when and how long flushing events would need to last. As a result, flushing will only need to take place sporadically, during significant flood events when the natural suspended sediment in the river is already greater than the additional amount of sediment introduced by the flushing process. It also allows finer control of flushing flows back into the river without interruption to the normal generation of the hydro plant, requiring only 5% of overall scheme flow when flushing is underway.
43. Further recommendations by Dr Jacobsen led to the outlet of the sluicing system being shifted from Morgan Gorge downstream of the weir to the tail race instead, with the sediment laden water being transported by means of a 500 mm HDPE pipe down the tunnel to create additional head for the siphoning action. This had a secondary advantage of obviating the need for a separate flushing tunnel that had originally been proposed to flush the sediment back into the Gorge, thereby avoiding the landscape impact of a man-made tunnel high up in the lower gorge discharging flushing flows into the gorge.

## **Other engineering improvements for the Application**

44. For completeness, in addition to confirming the intake design and improvements to manage the high bedload and high flood characteristics of the site, in preparation of the Application Mr Doyle and Ms Murtie focussed Westpower on the potential public safety and ecology effects of ramping rates in an emergency shutdown and changes in water level. Mr Jeremy Kent-Johnston investigated this with input from Mr Martin Doyle (hydrology) and it led to Westpower's decision to install a 10 cumec bypass valve at the power station, something that had not previously been included in the design. This improved the safety outcomes for river users and reduced potential adverse effects on freshwater ecology.

**APPENDIX A MEMO FROM DR TOM JACOBSEN**

# Memo



Date: 09.02.2026	Doc no:	Project no.	80300
Project name / employer	Waitaha / AusHydro		

## Regarding design and sediment handling at Waitaha

I am Tom Jacobsen and live in Norway. I have worked with sediment handling since starting my PhD on sediment problems in 1993 (summary of experience and CV attached). I was engaged by AusHydro in June 2024 to advise on sediment handling for the Waitaha HPP.

Waitaha is a particularly interesting project due to the hydraulic control in the downstream Morgan Gorge, which causes inundation of the intake and upstream Kiwi Flats during high floods. Other important factors include extreme rainfall, high sediment transport, tunnel-only access to the intake, and the need for a pressurized desander.

A key issue is the passage of bedload. Based on experience from several intakes with comparable hydrology, topography, and sediment transport, I am confident that the current layout, with final adjustments, will pass bedload downstream of the weir (into Morgan Gorge) and will not adversely affect Kiwi Flat. The main principle is guiding the flow and maintaining sufficient velocity toward the sluice gate to take advantage of secondary currents that scour bedload away from the intake. The present design allows for such adjustments. Given the much steeper slope of Morgan Gorge, flushed sediments will, in my opinion, be transported through the gorge without deposition.

Another important issue is potential gravel deposition in front of and inside the intake. I have seen many intakes fail due to sluice gates being too small or located too high, leading to sediment accumulation. SediCon has supplied boulder and gravel excluders to several projects, including small hydropower and secondary intakes in Norway, Laxa in Iceland, San Enrique in Chile, and Dariali in Georgia. I am confident that a similar system will perform equally well at Waitaha and keep the gravel trap inside the trash rack free of sediments. The system has no movable parts and operates automatically at predefined water levels, without reliance on operators, sensors, or automation.

Floating and submerged debris and trash rack cleaning are often underestimated. Continuous sediment removal through sluice gates and gravel excluders keeps sediments away from the trash rack and ensures access for effective cleaning when required.

Finally, I would like to comment on flushing of sand and gravel from the pressurized desander, an area where I have more than 25 years of experience, starting with the installation of SediCon Sluicers at the pressurized sand trap in the headrace tunnel at Khimti Hydropower Plant in Nepal. The SediCon Sluicer system, which I invented in 1993, is particularly suited for pressurized desanders because it: a) has no movable parts, b) can remove particles up to 150 mm, c) maintains high sediment concentration without exceeding the transport capacity of the outlet pipe, and d) can be operated independently of sediment level.

Based on the current plans and the extensive knowledge and experience of the specialists involved, I consider that we have an excellent basis for proceeding with the detailed design of a robust and well-functioning hydropower plant.

AO		TJ			08.02.2026
Rev.	Purpose of issue	Prepared	Checked	Approved	Date
Project n. 8030	Waitaha	Memo	Page 1/2		

**Summary of relevant experience:**

From 1981 to 1993, in parallel and between studies, I worked for the construction company Skanska, mainly with tunnelling. The work included most types of manual work as well as surveying and project management. In 1990, I graduated with an MSc in Civil Engineering from the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway.

**PhD studies**

Since 1993, I have had the privilege of working with sediment handling in more than 30 countries. During my PhD studies (1993–1997), I tested methods for sediment removal at Jhimruk Hydropower Plant in Nepal and visited Andhi Khola as well as sites for the Kala Gandaki and Khimti hydropower projects. The latter project I know well, as my company SediCon (established in 1999) supplied sediment removal systems both for the tunnel desander in 2000 and for the intake desander in 2010.

**Establishing SediCon and developing technologies**

I have worked full time with SediCon from 2002 to the present. SediCon supplies solutions, consultancy, and in-house developed equipment for sediment removal. I have developed a range of sediment handling technologies, including more than ten patents for sediment removal from reservoirs, intakes, tunnels, and desanders. Working with SediCon has allowed me to visit and assess sediment problems at hundreds of hydropower plants and to propose suitable solutions.

**Design of intakes and desanders**

Although SediCon mainly retrofits solutions to existing hydropower plants (clients often need to learn the lesson before investing in proper sediment management), I have also contributed to the conceptual design of intakes and desanders for new projects. These range from Rubagabaga (400 kW) through Laxa III and Deralok to Coca Codo Sinclair (1,500 MW), projects for which SediCon has supplied equipment.

**Consultancy**

I worked as consultant at Sweco from 1998 – 2002, mainly with feasibility studies for small hydro in Norway. After joining SediCon in 2002 I have supplied consultancy services on sediment handling in hydropower projects for a wide range of companies, including Norconsult, SN Power, Sweco, Lahmeyer, Sinohydro, Cemig, Hydro Chile, the Kansas Water Office, EPM, Compañía Eléctrica El Platanal S.A., and Norwegian Statkraft SF. My most recent assignment for Statkraft was a study on retrofitting SediCon Sluicers in the 240-metre-long underground desander at the glacier-fed Svartisen Hydropower Plant in northern Norway.

**Solving sediment problems for hydropower plants**

My experience also includes the supply of sediment-handling equipment to more than 50 hydropower plants in 23 countries. Most of these are existing plants where a key part of the work is to understand the sediment problems and identify appropriate remedies. Dariali 108 MW run-of-river hydropower plant, which until recently experienced one to two weeks of shutdown every summer due to sediment deposition at the intake is especially relevant. A SediCon Sluicer system was installed in spring 2025 and operated continuously throughout the summer, resulting in no downtime being required.

SediCon has installed sediment removal systems (SediCon Sluicers) in tunnel desanders for 25 years, since the first installation at Khimti in Nepal in 2000. Other projects include Cuyamel in Honduras, Laxa III in Iceland, and Tonstad in Norway.

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<b>Profession/Job Title:</b>	Doctor Engineer
<b>Year of Birth:</b>	1964
<b>Nationality:</b>	Norwegian
<b>Education:</b>	<p>1997 Ph.D., the Norwegian University of Science and Technology, Trondheim (NTNU)  Title of theses: Sediment problems in reservoirs – control of sediment deposits. The study included:</p> <ul style="list-style-type: none"> <li>• Distribution and magnitude of sediment problems.</li> <li>• Numerical simulation of sediments and water in reservoirs.</li> <li>• Development of sediment removal technologies for reservoirs, intakes, desanders and offshore/subsea use. (Commercialized through several companies)</li> <li>• Hydraulic transport of sediment in pipes and open channels.</li> </ul> <p>1990 University of Trondheim, The Norwegian Institute of Technology (NTH) Graduate Civil Engineer M.Sc.</p>
<b>Other training:</b>	1991 Philosophicum, ½ year university course.
<b>Languages:</b>	English (fluent), French and German (limited)
<b>Countries of project work Experience:</b>	Brazil, Costa Rica, Ethiopia, Honduras, India, Japan, Nepal, New Zealand, Norway, Peru, the Philippines, Turkey, Chile and Guatemala.
<b>Founder of companies:</b>	GTO Subsea group, G-Flow AS, SediCon AS, Deep C Solutions group.
<b>Social work:</b>	2009 - 2023: Main financial supporter of PDRC (Professional Development and Research Centre) in Nepal including financing of scholarships for higher education of 200 Nepalese students, mainly from the Dalit community.
<b>Publications:</b>	See last page.

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**Key Qualifications:**

Hydraulic engineering, reservoir sedimentation and sediment engineering. Innovation, development and patenting of hydraulic systems and sediment handling technologies. Experience from establishing several technology companies.

**Summary**

Tom Jacobsen graduated in Hydraulic engineering from the University of Science and Technology in Trondheim, Norway in 1990, and then worked for a construction company for two years. In 1997 he defended his doctoral thesis “Sediment Problems in reservoirs – control of sediment deposits. From 1998 to 2002 he worked in consultant engineering. From 1995 and onwards he has lectured and advised students at NTNU and been opponent at PhD defence. He has invented several patented sediment handling technologies for use both offshore and in the hydropower sector as well as technology for reducing friction losses in headrace tunnels and technology for Carbon capture and Storage in bogs. He is co-founder of G-Flow AS (2000-2003), GTO Subsea AS (1999, Sold to Oceaneering in 2008) SediCon AS (2001) and Deep C Solutions (2012). He has been working for SediCon AS since 2001, mainly with sediment handling solutions for hydropower projects in approximately 30 countries worldwide. Since 1996 he has also developed sediment handling solutions for many subsea projects within the offshore oil, gas and wind industry.

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**Experience Record:****2002 - now SEDICON AS (until Sept 2008 GTO Sediment AS)**

Owner 2002 – now (Majority owner from 2010)

Technical Director 2002 - 20024

Managing Director 2024 -

**General**

Development and improvement of the sediment removal technologies, technical sale, design and supply of the company's services: Consultancy and sediment studies, design of solutions related to efficient sediment handling and design and manufacturing of equipment for sediment removal from reservoirs, intakes and desanders. Lecturing and supervision of students NTNU and various courses.

**2025**

Design of a SediCon Sluicer system supplied to Hidromontanitas HPP i Colombia, having no movable parts at all and using existing flushing gates for operation.

Development of concept and design of an ejector powered dredge for dredging gravel and rock 200 meter into a pressurised hydropower tunnel i southern Norway. The dredge was operated by a medium sized 500 kg ROV only.

Development of patent for starting siphons, design of sediment removal system for intake canals and forebay at 108 MW Dariali Hydropower Plant in Georgia. The sediment removal system was operated the summer flood season in 2025 resulting in dramatically reduced downtime for sediment removal.

Completion of design and project management for the supply of SediCon sluicer system for underground pressurized desander at 960 MW Tonstad Hydropower plant in Norway.

**2024**

Managing Director of SediCon AS.

**2023**

Development of Flow Monitoring Unit, for on-line measurement of velocity and concentration of sediment-water mixture in pipelines. The flow is at times 3-phase as gas is created under low-pressure conditions.

Design of and heading supply of boulder excluders for secondary intakes at Ulla Førre and Brattset Hydropower plans, as well as gravel excluder for Stubli small hydropower plant, also in Norway.

Conceptual design of SediCon Sluicers for pressurised desander at 960 MW Tonstad Hydropower Plant in Norway. Sediments are discharged while power plant is operated using only one outlet valve.

**2022**

Development and testing of air-powered valve that replaces conventional valves of all sizes, reducing cost by up to 95%.

**2021**

Developing, designing and follow up of supply of boulder excluder to Ulvik Power Plant owned by EVINY. The boulder excluder can remove boulders of more than one metre in size.

Design of SediCon Hydrosuction dredges for Tinguiririca and Alto Maipo reservoirs and Coca Codo Sinclair desanders.

Design and patenting of new methods for subsea sediment removal.

## **2020**

Putting together consortium of 11 Norwegian companies, developing solution for and tendering for repair works at 2500 MW, 220 m high dam Ituango in Colombia: Dredging in front of 50 m deep intakes, clearing removing and reinstallation of trash racks with ROV, design, supply, testing and installation of temporary steel plugs inside intakes.

Design of dredge to remove 16 m deep, 115 years old consolidated sediments in front of hydropower intake at Necaxa Dam in Mexico.

Planning, conceptual solution and design of equipment for several offshore sediment removal projects through Deep C Solutions.

## **2019**

Design of solution and tendering for dredging at 180 m water depth in front of intake gates at Enguri Dam. (European Development bank project)

Re-design of Hydrosuction Dredge for Xacbal in Guatemala.

Design of sediment removal equipment for several projects in Italy, cooperation with ENEL on instruction of hydrosuction dredging technologies in Japan

Planning, conceptual solution and design of equipment for several offshore sediment removal projects through Deep C Solutions.

## **2018**

Design and supply of SediCon dredge for Paso Ancho Hydropower plant in Panama.

Design of equipment for Deep-water archaeological excavation.

Design and patenting of Soil Plug Removal tool (Deep C SPRT) which is since used for removing soil plugs (clay) at 1000+ piles used for wind turbine foundations.

## **2017**

Sinohydro: Model study, detailed design, contract negotiations with Sinohydro and signing of contract for supply of SediCon Sluicer for 15 MW Coca Codo Sinclair, removal for 6 million ton sediments annually. Completion of supply in 2017.

National Hydropower Company, Nepal: Design of SediCon sluicers with 1450 ton/hour removal capacity.

## **2016**

Conceptual design for SediCon supplies of SediCon Sluicers for Upper Solu and Upper Dordi, Nepal, Chacabuquito and Alto Maipo desanders, Chile, Winkeltal, Austria, Laxa III Iceland, Deralok Iraq and Alto Maipo,

Deep C: Conceptual design of Pile dredge for projects offshore Canada and UK.

## 2015

Yogindra Powers: Conceptual design of SediCon Sluicers for Baner Sangam, India.

Statkraft: Detail design and supply of SediCon Dredge outlet for 80m high Banja Dam in Albania. Evaluation of sediment handling strategies for Dugar HPP in India

## 2014

Statkraft: General assessment of sediment transport and sediment handling solutions for Devoll HPP, including conceptual design and offer for a hydrosuction system at Banja and suggestions for design.

Hydroenergia del General: Conceptual design for SediCon's supply of SediCon Dredge

## 2013.

## 2012

Hidroelectric Dona Julia S.R.L: design and supply 122 SediCon Dredge for dredging service for removal of 60 000 m<sup>3</sup> in Dona Julia reservoir in Costa Rica

Norconsult: Sediment study and sediment handling proposals for Cheves HPP in Peru.

Model study of SediCon Sluicer for 1500 MW Coca Codo Sinclair in Ecuador: Design and manufacturing of SediCon Sluicer model.

Conceptual design of SediCon Sluicer for Deralok HPP in Iraqi Kurdistan, 240 m<sup>3</sup>/s.

## 2011

ENEL Green Power: Design of sediment removal system "SediCon Dredge" Installed in El Canada reservoir in Guatemala. Measured sediment removal capacity 15 000 m<sup>3</sup>/month.

Lahmeyer International: Conceptual design of Sediment removal system at Keyal Khwar, the "SediCon Sluicer" which was selected as sediment removal system for underground basins.

SN Power: reservoir sedimentation study for 600 million m<sup>3</sup> Cetin Reservoir in Turkey

Hydro Chile: Assessment of sediment handling for run-of-river projects San Andres and El Paso Hydropower projects in Chile.

For ICE: Planning, design, mobilization, and operation of 10" / 12" SediCon Dredge, for removal of cohesive reservoir sediments in Cebadilla reservoir in Costa Rica.

## 2010

HPL: Design, testing, and commissioning of Sediment removal system for Khimti HPP in Nepal. Sediment removal capacity measured to be 3000 m<sup>3</sup> sediment per hour.

Sweco: Sediment study review for Hydro-Aysen, Chile

For Khowa Engineering / Ministry of Land, Infrastructure and Transport (MLIT) Japan: Design and technology for sediment removal test facility at MIWA dam, using "Hydro I" (same as SediCon Sluicer).

## 2009

Statkraft Development: Aksar Nazar sediment study, Sediment quantities including variability and uncertainty, nature of sediment, intake solution and optimisation of desander at 50 MW HP plant in Turkey

Statkraft: Concept study, sediment removal system for Trollberget underground desanders, Svartisen, Norway.

Sweco / SN Power: Field work and reservoir sedimentation study as part Tamakoshi feasibility study. Nepal.

Norconsult / SN Power Aboitis (Philippines): Field work and reservoir sedimentation studies and sediment removal at Ambuklao and Binga reservoirs, both close to being filled by sediments after half a century of use.

GTO Subsea / Oceaneering AS: Various advisory works for subsea sediment handling projects.

## 2008

For Khowa Engineering / Ministry of Land, Infrastructure and Transport (MLIT), Japan: Design and technology for sediment removal test facility at MIWA dam, using “Hydro Pipe” which is like slotted pipe / SediCon Sluicer.

Statkraft SF: Reservoir Sedimentation analysis for proposed projects Upper Drin – Albania

Committee member at Meg. B. Bishwakarma’s public defence for PhD; Online Sediment Monitoring in Run-of-River Hydropower plants at NTNU, Norway.

## 2007

SN Power / HPL: Design of sediment removal system for Khimti headworks desilting basin.

For Honduras Electric Corporation S.A. DE C.V. (HECO): Design and supply of SPSS sediment removal system for pressurised sand trap at Cuyamel HPP in Honduras.

For SN Power: Assessment of sedimentation, and proposal of solutions for Magat, Ambuklao and Binga reservoirs on the Philippines.

## 2006

For Cemig SA: Feasibility project for Rio de Pedras HPP in Minas Gerais, Brazil.

For West power, New Zealand: Economical optimisation settling basin size at Amethyst river HPP by new in-house developed methodology.

Khowa engineering, Japan: Conceptual design of several sediment removal projects in Japan.

## 2005

For SN Power Sediment study Gallito Ciego reservoir and Cahua HPP in Peru. Sediment sampling and proposals for removal of sediment around intake as well as removal of sediments from tunnel desander.

For LNJ Bhilwara Group: Design of sediment removal system for intake reservoir at Malana HPP in India, used for successful removal of 36 000 m<sup>3</sup> sediment during monsoon 2005.

Lecturing at EVN/NVE seminar at Hoa Bin in Vietnam on “Assessment of reservoir sedimentation” and on “Solutions to reservoir sedimentation”.

For HPC: Assessment of sediment handling at Song Con project.

**2004**

For Khowa Engineering co. Japan. Review of Slotted Pipe Sediment Sluicer for sediment exclusion from desilting basin at Inagawa. For SN Power: Evaluation of sediment problems at Cahua desilting basins and Gallito Ciego reservoir in Peru. For NTNU: Design of system and assistance during field experiment on removal of sediments from Irrigation reservoirs in Ethiopia.

**2001**

Licensing of GTO's sediment handling technologies to Khowa Engineering. Conceptual design of Site Scale Experiment at Sakuma dam and assistance during execution of experiment together with Aoki co., as well as conceptual design of sediment removal systems for several other projects in Japan.

**2001**

Invention and patenting of several sediment handling technologies for use both offshore and for hydropower, irrigation and water supply,

**2012-2026 Deep C Solutions AS / Deep C Holding AS**

General: Design of project specific solutions utilizing Deep C Solutions in-house developed equipment for leveling, deburial, pile dredging etc. at subsea oil, gas, and wind projects.

**2022 - 2026**

Restructuring of the company as majority owner and chairman of the board after financial troubles in 2021. Restructuring was completed in 2025 and delivering successful projects and profits since 2022. Deep C has now seventeen employees and an annual turnover of over 8 MUSD.

**2021**

Design of UXO-Dredge used for dredging / uncovering of UXO's (Unexploded Ordnance) in Germany, used at Minsener Oog UXO removal project.

**2018**

Development and design of Subsea Construction Vehicle, SCV.

**2016**

Deep c: Invention, design and patenting of Soil plug removal tool (SPRT) used for excavation of 450 support piles for 500 MW Beatrice and 700 ME East Anglia One wind farms.

**2013**

Development and design of ROV mounted trencher skid for burial of cables and pipelines in offshore projects.

Deep C: Development, design patenting of Deep C Subsea Blower; including participation in first commercial project where 20 000 m<sup>3</sup> were excavated at the Ekofisk field offshore Norway.

Development and Design of Subsea Utility Vehicle, SUV.

**2001-2006 G-Flow AS**

Invention, development and commercialisation of the “Groner-membrane”, a new technology which can reduce head loss in tunnels by 60-70%. (Patented worldwide) Establishment of G-Flow ltd. in 2001 and managing director of G-Flow ltd. 2001 – 2002 and 2003 to present.

**2001:** Planning, design and project manager for the 6 MNOK full scale test at Haaen Hydro Power plant in 2001. Installation of 400 metre, 3,2 m diameter Groner-membrane as scheduled in four weeks, with project start-up 7 weeks after project was awarded.

**2002 - 2003:** Pre-feasibility studies of use of Groner membrane in water supply tunnels in Oslo and in Trondheim.

**1999-2008 GTO Subsea AS**

Co-founder, partner and board member of GTO Subsea AS, to become Fossura AS with GTO Subsea AS and GTO Sediment AS as subsidiaries.

Conceptual design of subsea dredgers used at a large scale on offshore projects. (Dredges gravel with  $d_{\max}$  of 300 mm at rates up 200 m<sup>3</sup>/hour 300 m below sea level)

Development of several sediment handling techniques for hydropower and subsea dredging. Several international patents / patent applications.

**2001 – 2004:** Overall conceptual design, patenting, stability design and design of suction system on the subsea dredging system “SPIDER” used for pre-dredging in hard and cohesive clay at 300 – 900 m depth at Ormen Lange pipeline (Norsk Hydro as customer). The project was widely promoted by Norsk Hydro as a reference project achieving the impossible.

**2003:** For GTO Subsea / Coflexip: Design of Pile suction Head (PSH) successfully used for excavation inside piles at Valhall Water Injection project May / June 2003.

**2005:** Design of 16” / 400 kW Subsea dredge capable of dredging 300 m<sup>3</sup> stones/gravel per hour. Successfully used at Sakhalin project offshore east Russia summer 2006 for removal of up to 400 mm stones for scour protection.

**2008:** Design of pile dredge successfully used at 1340 metre depth at GOM, for Hereema.

**2008:** Sale of Fossura / GTO Subsea to Oceaneering AS

**1998- 2002 Grøner Trondheim AS**

**Doctor Engineer**

**General**

Pre-feasibility studies of several small-scale hydropower projects in Norway. Licensing of hydropower projects in Norway. Conceptual design of dam, intake and sediment handling facilities for hydropower plant in Costa Rica and Nepal. Roof runoff model and

dimensioning of gutters and down pipes at Nidarosdomen Cathedral. Supervisor and sensor at Norad M.Sc. hydropower course at NTNU.

**1998 → International Centre for Hydropower, ICH**

Lecturing on sedimentation and sediment handling at courses “Hydropower and the Environment”. (Annually)

**1997 Halliburton Energy Group**

Design of sediment removal system for use during drilling of horizontal subsea reaming drilled tunnel.

**1997 Statkraft Engineering as**

Design of sediment removal system for pressurised tunnel sand trap at Khimti II hydropower plant in Nepal. This has been in operation from and working satisfactorily from 2000 to present.

**1995 → NTNU**

1998 → Advisor for several MSc thesis candidates at NTNU's international MSc programme in Hydropower Development.

2001 – 2005: Advisor though not formally appointed for Durga Prasad Sangroula, on his Doctoral Thesis: “Sedimentation and Sustainability of the Kulekhani reservoir. A Himalayan Case”

2003 – 2007: Advisor though not formally appointed for Kiflom Belete, on his doctoral thesis “Sedimentation and Sediment Handling at Dams in Tekeze River basin, Ethiopia.

**1995 BPC Hydroconsult**

Design of sediment removal system for pressurised tunnel sand trap at Jhimruk hydropower plant in Nepal.

**1996-97 Stolt Comex Seaway ASA**

Development of dredging system for removal of coarse gravel and stones covering subsea cables on Draugen oil-field offshore mid-Norway.

**1991-93 Selmer AS**

Civil Engineer. Assistant site manager on rehabilitation works at Fornebu Airport (6 months). Assistant site manager on Skoddeberg storage caverns. Responsible for planning, surveying and construction of 3.2 km public road. (6 months) Surveying and control of data-assisted tunnel jumbos at Ekeberg road tunnel in Oslo.

**1990 Selmer Furuholmen AS**

Tunnel work; surveying, scaling and bolting at Åkrafjorden road tunnel (3 months).

**1986-87 Selmer Furuholmen AS**

Tunnel work; bolting, scaling and blasting (4 months).

Surveyor and engineer (4 months) at Sture underground oil storage plant.

**1985 Selmer Furuholmen AS**

Formwork carpenter at Vigeland factories (2 months).

**1983 Kristiansand Electricity Board (KEV)**

Assistant worker on turbine works, Steinsfoss hydropower plant (8 months).

**Overseas  
experience:**

- 1994-95 Nepal  
3 months field experiments with sediment removal techniques at Jhimruk hydropower plant.
- 1996-97 New Zealand  
5 months research stay at the National Institute of Water and Atmospheric research, NIWA, Christchurch.
- 2001 → Japan. Several visits, Co-operation between GTO and Khowa. Design of participation in site scale experiment, studies of sedimentation problems at numerous hydropower plants, negotiation of and implementation of license agreement
- 2004 Field studies in Costa Rica Field experiment and field studies in Ethiopia. Evaluation of projects and possible solutions to sedimentation problems in Peru.
- 2005 Vietnam: Lecturing at Seminar. Presentations for several consultant engineering companies.
- 2006: Field Study at Rio de Pedras HPP in Brazil, implementation of SPSS at Cuyamel HPP in Honduras.
- 2007: Field Study at Magat, Ambuklao and Binga reservoirs in the Philippines.
- 2008: Project development in Ecuador, Peru and Chile
- 2009: Filed studies in Nepal and Philippines
- 2010: Implementation of SediCon Sluicers at Khimti HPP in Nepal
- 2012: Model study of SediCon Sluicer at CFE laboratory in Cuernavaca, Mexico.
- 2014: Design, Study and successful Contract Negotiations with Sinohydro, and supply of SediCon Sluicers for 1500 MW Coca Codo Sinclair in Ecuador. Until 2016.
- 2015: Establishing subsidiary in India, Signing of contract and supply of sediment handling Equipment to Baner Sangam in India.
- 2016: Signing of contracts and supply of sediment handling Equipment to Chile, Iceland Austria, Iran, Nepal and Canada.
- 2017: Contract negotiations in Nepal, supply of equipment
- 2018: Contract negotiations in Panama and Afghanistan. Supply of Equipment in Panama
- 2019: Contract negotiations and supply of equipment to Necaxa Peru.  
Pre-qualifications for dredging at 180 m depth at Enguri and submission of tender according to European development Bank
- 2020: Establishing consortium of 11 Norwegian and tendering for Ituango repair works.

**Publications:**

- 2019: Javier Zamora & Tom Jacobsen: Experiences of sediment handling using hydrosuction in Latin America, Hydro2019, Porto, Portugal
- 2017: Jacobsen, Tom: Hydrosuction without downstream effects. Enhancing Sustainability in Hydropower development, Medellin, Colombia 27-29.11 2017
- 2015: Jacobsen & Jimenez: Recent experiences from sediment removal projects. Hydro 2015, Bordeaux, Stavanger
- 2015: SediCon Sluicers for sediment removal during operation used at Khimti, Nepal. Norwegian tunnelling society, publication no. 22
- 2015: Installation of 1200 mm casing pipe under Banja Dam in Albania, for high capacity hydrosuction dredging. ICOLD 2015, Stavanger.
- 2015: Alberto JIMÉNEZ, Raúl FIGUEROA & Tom JACOBSEN: Hydrosuction dredging of cohesive sediments, case of El Canada HPP, Guatemala, ICOLD 2015, Stavanger.
- 2014: Tom Jacobsen & Leiv Pedersen. Major savings by tunnel Sand traps at Shuakhevi HPP in Georgia Hydro 2014.
- 2014: Jacobsen T & Luzuriaga G: SediCon Sluicers to remove 6 million ton sand per year at 1500 MW Coca Codo Sinclair Project in Ecuador. Hydro 2014.
- 2011 Khimti – successful sediment handling in the Himalayas. Hydro 2011, Prague.
- 2010 The challenge of predicting reservoir sedimentation Hydro 2010, Lisbon  
Impact of reservoir sedimentation versus storage of new renewable energy. Renewable Energy Conference, Trondheim, June 2010.
- 2008 “Optimisation of desilting basins” Hydro2008, Ljubljana, Slovenia
- 2007 Jacobsen, Jimenez & Jimenez: “SPSS Sediment remover at Cuyamel pressurised sand trap, Honduras”. Hydro 2007, Granada, Spain.
- 2006 “Sediment removal at Malana Reservoir, India” Hydropower and Dams, issue one, 2006
- 2005 “Solutions to reservoir sedimentation problems.” EVN/NVE Seminar on reservoir sedimentation, Hoa Bin, Vietnam, 10 March 2005
- 2005 “Assessment of reservoir sedimentation problems”. EVN/NVE Seminar on reservoir sedimentation, Hoa Bin, Vietnam, 10 March 2005
- 2005 “Sediment handling technologies for desilting basins, tunnel sand traps and reservoirs” International Sediment workshop (IHA/INHA) – Delhi, 19th February 2005
- 2004 “Sediment handling technologies” Hydropower seminar in Hanoi, during state visit 3. November 2004
- 2003 ” The Groner-membrane: Reducing friction losses in tunnels” Hydro 2003, Croatia November 2003
- 2003 ” Sediment handling technologies - experience from projects” Hydro 2003, Croatia November 2003
- 2001 “New technologies for dredging of contaminated reservoir sediments” Hydropower 2001, June 2001, Bergen, Norway.
- 2001 Tom Jacobsen & Lars Jenssen. “The Groner-membrane: a hydraulic superconductor for rough tunnels?” Hydropower 2001, June 2001, Bergen, Norway.
- 2000 “Khimti pressurised tunnel sand trap - Sediment removal during operation by use of Slotted Pipe Sediment Sluicers”. Hydro 2000 - Making Hydro more competitive. Bern, Switzerland 2 - 4 October 2000.
- 2000 ”Reduksjon av falltap i tunneler - Eller 100 tonn presenning i turbinen?”. Produksjonsteknisk konferanse 2000 Haugesund.
- 1999 Reservoir sedimentation. Nepal Hydropower Association Inauguration Seminar 5. 11. 1999

- 1999 Sediment control in small reservoirs - Sediment removal through pipelines or by open channel flow Optimum use of run-of-river hydropower schemes, Trondheim June 1999
- 1999 Sustainable reservoir development: The challenge of reservoir sedimentation Hydropower into the next century, Gmunden, Austria, 18. 20. October 1999
- 1998 "New sediment removal techniques and their applications" Modelling, monitoring and testing for Hydro Power plants III", Aix - en - Provence, October 1998
- 1998 Jacobsen, T and Walsh, J.M.: "A case study of sediment transport in a reservoir under flood drawdown operation" Submitted to ASCE Journal of Hydraulic Engineering.
- 1997 "Removal of sediments from a reservoir with the Saxophone Sediment Sluicer." 19th ICOLD Congress, Florence.
- 1997 "Economic aspects of removal of sediment from reservoirs." Hydropower' 97, Trondheim.
- 1997 Jacobsen, T.: "Sediment problems in reservoirs – Control of sediment deposits." Ph.D. Thesis, Department of Hydraulic and Environmental Engineering, The Norwegian University of Science and Technology (NTNU).
- 1996 Jacobsen, T.: "Removal of sediments from reservoirs." International Conference on Reservoir sedimentation. Fort Collins.
- 1995 Lysne, D.K.L. Olsen, N.R.B. Støle, H. Jacobsen, T.: "Sediment control: Recent development for headworks." Hydropower and Dams.
- 1995 Jacobsen T.: "Slotted Pipe Sediment Sluicing." ICOLD Symposium: Reservoirs in River Basin Development. Oslo.

Figure 1; Indicating how sluice-gate can be optimized to make secondary currents scouring bedload away from the intake. The gravel trap can be optimized to with respect to size and kept continuously clean with a gravel excluder – possibly combined with environmental flow

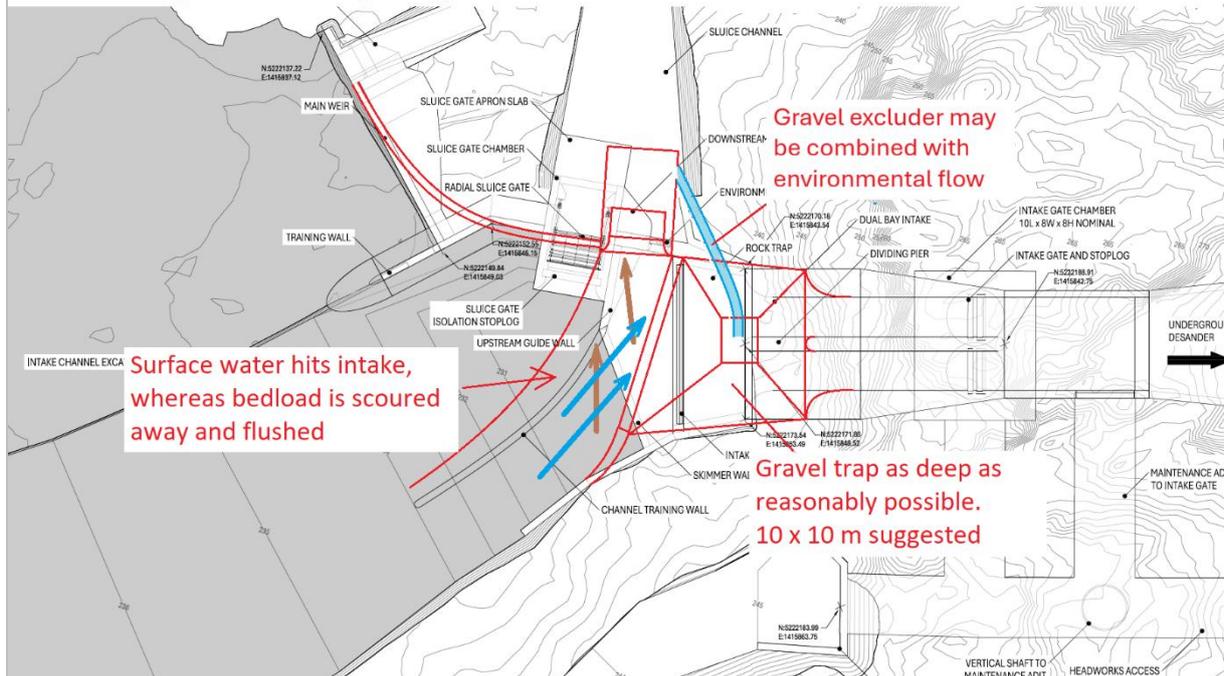


Figure 2: indicates how the level of the intake sill can be adjusted to prevent bedload from entering the intake. The size of the gravel trap should be optimised to ensure a) keeping the downstream intake canal (which may be smaller) reasonably clean b) removing sufficiently coarse material to allow safe operation of the desander

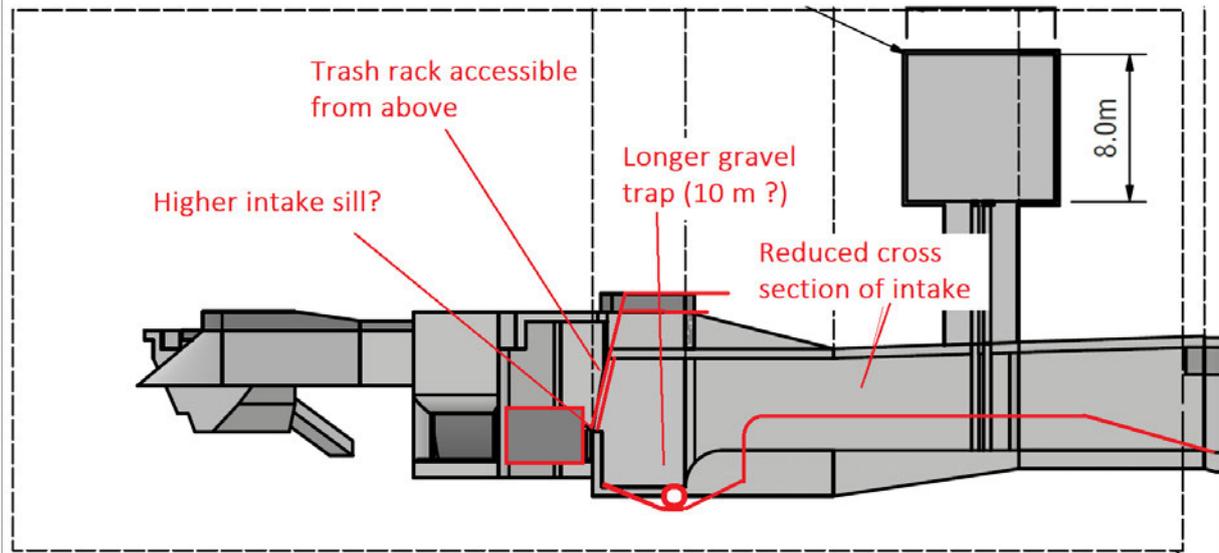


Figure 3 showing possible improvements of the desander. Inlet zone is of special importance as gravel is likely build up quickly here. (Tranquilizer which is good for improving trap efficiency will actually add to this.) This issue can be solved proper design of the sluicer.

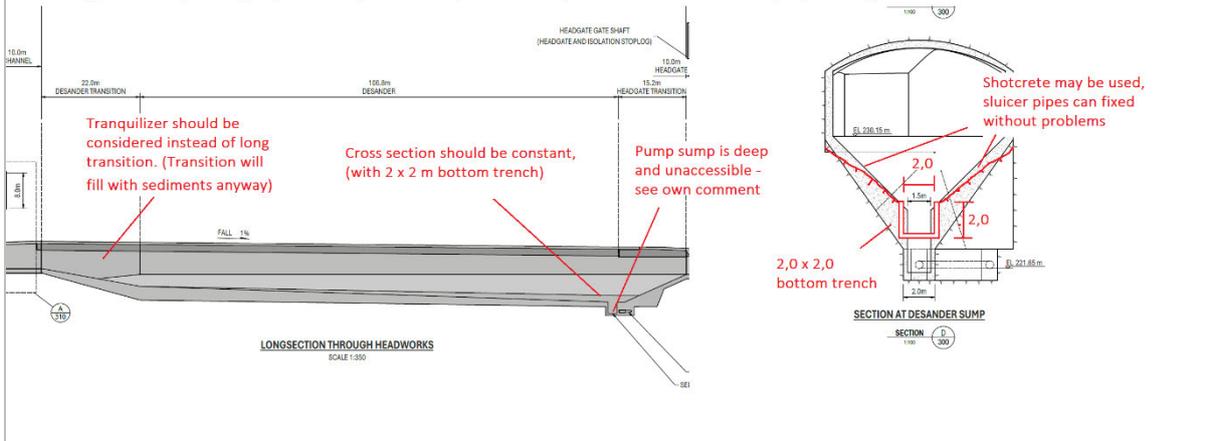
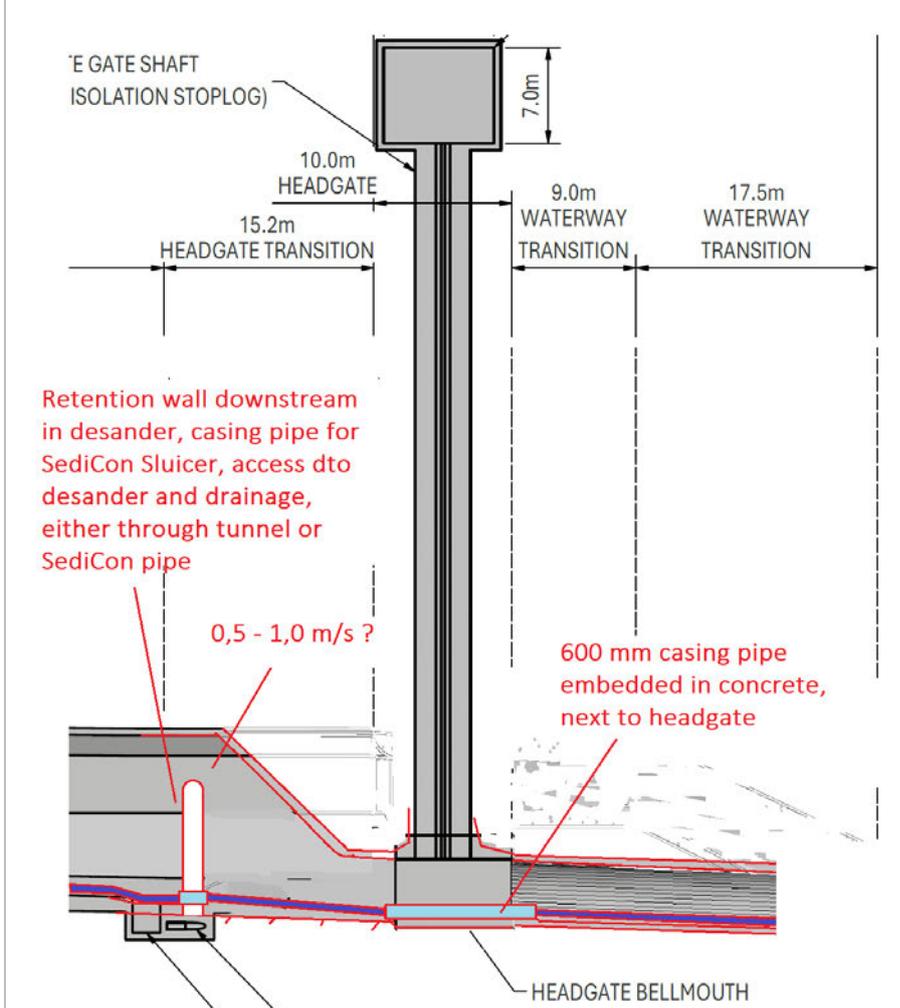


Figure 4 showing possible improvements of tunnel alignment. The purpose is reducing cost of tunnelling and at the same time allowing straight and accessible routing of sediment discharge pipe(s) (Typically coordinated with the contractor)



## Succionador SediCon en la trampa de arena de Khimti

Dos Succionadores SediCon fueron instalados en la trampa de arena presurizada, ubicada en el túnel del Proyecto Hidroeléctrico Khimti, Nepal.



Succionador SediCon dentro del túnel



Tuberías de salida

<b>Descripción del Proyecto</b>	La central a filo de agua de 60 MW utiliza una caída de 680 m en el río Khimti, en Nepal. El proyecto consiste en una toma con desarenadores, un túnel de 8 km con una trampa de arena presurizada en el extremo aguas abajo, un tanque de oscilación y la casa de máquinas.
<b>Ubicación</b>	Río Khimti, Nepal <u>Latitud 27° 33'2.39 N - Longitud 86° 10'10.79 E</u>
<b>Cliente</b>	Himal Power Ltd. junto con Statkraft SF, ABB Kraft y Kvaerner Energy.
<b>Reto de sedimentación</b>	El túnel de 8 km tiene una trampa de arena para detener el material que se desprende de las paredes y en fondo expuesto del túnel. Además, un porcentaje de sedimentos sobrepasan la trampa de arena en la toma. Por lo tanto, sedimentos de hasta 5 mm de diámetro son transportados por el flujo del túnel, causando abrasión en el rodete de las turbinas al impactarlo a más de 100 m/s.
<b>Solución</b>	Dos Succionadores SediCon fueron instalados, con la tubería de descarga atravesando la pared del túnel hacia afuera, donde los sedimentos son desecados.
<b>Implementación</b>	Los Succionadores SediCon fueron instalados en el año 2000.
<b>Resultados</b>	El Sistema ha estado operando semanalmente durante la época de avenidas, y se estima que aproximadamente 200 m <sup>3</sup> de sedimento han sido removidos anualmente desde el año 2000.

SediCon es un proveedor de soluciones para el manejo de sedimentos mundialmente reconocido, suministrando soluciones confiables que poseen bajo consumo de agua y no interrumpen la generación de electricidad.

## SediCon Sluicer for Cuyamel HPP, Honduras

**SediCon Sluicers are used to remove sediments at the pressurized desander without dewatering the tunnel or interfering with power production.**



Tunnel desander during construction



SediCon Sluicer



Cuyamel river

**Project Description:**

Cuyamel is a 7 MW run of river powerplant commissioned in 2007. The annual production is 22.7 GWh, the net head is 133 m and the discharge is 7 m<sup>3</sup>/s. At the beginning of the 525 m long headrace tunnel there is a 53 m long and 4.5 m wide pressurized desander.

**Location:**

Frio river, Municipality of San Pedro Sula, Honduras  
[15°35'38.2\"N 88°09'28.0\"W](https://www.google.com/maps/place/15°35'38.2\)

**Client:**

COHCUY (Compañía Hidroeléctrica Cuyamel S.A.) former HECO.

**Sediment Challenge:**

The tunnel sand trap at Cuyamel is the only sediment removal facility of the power plant. Conventional flushing of the desander would involve dewatering of the tunnel and siphon, together with flushing and meticulously refilling to prevent trapped air in the siphon.

**Solution:**

SediCon has delivered two SediCon Sluicers, that allows sediment removal from the pressurized desander without dewatering the tunnel or interrupting the water supply. Each SediCon Sluicer discharges through a separate outlet pipe that are controlled by a valve at the end of the outlet tunnel.

**Implementation:**

During plant construction, 2006-2007

**Results:**

In addition to reduced time and water consumption, the design became less costly as the flushing tunnel was replaced with a much shorter outlet tunnel. The system has an essential part of the intake structure since 2007 and is activated several times during rainy season and a few times during dry season.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

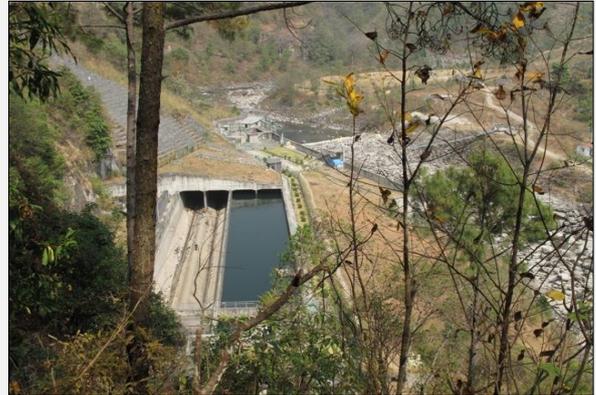
Updated 2023

## SediCon Sluicers for Khimti headworks HPP

The SediCon Sluicers are removing sediments and stones up to 200 mm at a rate of 3.000 m<sup>3</sup> per hour.



Installation of SediCon Sluicers



Khimti HPP

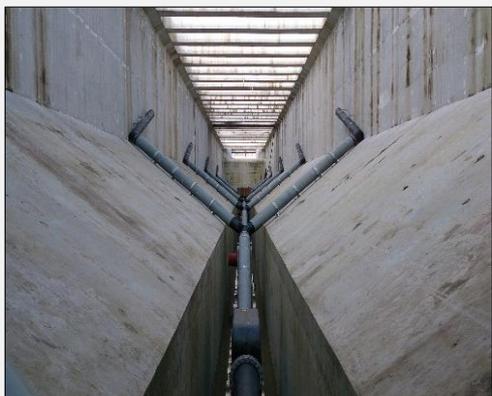
<b>Project Description:</b>	60 MW, Run-of-River, exploits 680 m of head on Khimti Khola. Annual production of 350 GWh, nearly 15% of Nepal's electricity
<b>Location:</b>	Khimti Khola, Nepal <u>Lat 27° 33'2.39 N - Long 86° 10'10.79 E</u>
<b>Client:</b>	Himal Power Limited
<b>Sediment Challenge:</b>	Thick sediment deposits in the expansion zone of the desilting basins has prevented operation of the main flushing system. Manual excavation and flushing have been frequently required.
<b>Solution:</b>	Four SediCon individual Sluicers were installed in expansion zone in upstream end of the desilting basin. The SediCon Sluicers can be operated intermittent or continuously and removes all deposited sediments simply by opening the flushing gates
<b>Implementation:</b>	The SediCon Sluicers were commissioned in September 2010.
<b>Results:</b>	Total capacity of the system was measured to 3 000 m <sup>3</sup> sediment deposits per hour, with an average water consumption of only 5 m <sup>3</sup> water per m <sup>3</sup> sediments. SediCon Sluicer has been working flawlessly since 2010, regularly removing hundreds of cubic meter sand and improving the operation of the desander and the power plant.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

Updated 2023

## Succionadores SediCon para Hidroeléctrica Coca Codo Sinclair, Ecuador

**Los Succionadores SediCon removerán 6 millones de toneladas de sedimento al año, sin interferir con la operación de la central.**



Succionador SediCon en Coca Codo Sinclair



Instalación



Instalación

**Descripción del proyecto:**

Hidroeléctrica a filo de agua de 1500 MW, su construcción se finalizó en 2017  
Producción anual de 8.6 TWh, con una caída neta de 604 m y descarga de 220 m<sup>3</sup>/s.

**Ubicación:**

100 km al este de Quito, Ecuador  
[0°11'56.30 S and 77°40'52.97 W](#)

**Ciente:**

Sinohydro Ltd & Coca Codo Sinclair Ltd

**Reto de sedimentación:**

El río transporta varios millones de toneladas de sedimento al año. El sitio de toma prácticamente no tiene capacidad para almacenar sedimentos y se requiere remover sedimentos de los 8 desarenadores.

**Solución:**

SediCon suplió 5 Succionadores SediCon para cada uno de los 8 desarenadores, en total se instalaron 40 equipos totalmente independientes. Los Succionadores SediCon descargan en un canal de desvío generando una pérdida mínima de caudal. Cinco ecosondas son operadas en cada desarenador, de esta manera es posible conocer el nivel de sedimentos, permitiendo la operación de las compuertas de descarga de manera remota, desde la sala de control.

**Implementación:**

SediCon finalizó la instalación de los Succionadores SediCon y su sistema de monitoreo durante el primer semestre del 2016.

**Resultados:**

Los Succionadores SediCon fueron instalados entre el 2015 y 2016 y 20 de ellos han estado operando de manera exitosa desde Julio del 2016. Los restantes 20 Succionadores SediCon entraron en operación durante el invierno 2016 / 2017.

SediCon es un proveedor de soluciones para el manejo de sedimentos mundialmente reconocido, suministrando soluciones confiables que poseen bajo consumo de agua y no interrumpen la generación de electricidad.

## Succionadores SediCon en Forrest Kerr, Canadá

**Cuatro Succionadores SediCon fueron enviados al cliente en menos de 5 semanas después de la firma del contrato**



Forrest Kerr



Escombros acumulados



Succionadores SediCon

**Descripción del proyecto:**

Forrest Kerr es una central a filo de agua de, puesta en marcha en 2014. Tiene una generación anual de 5 100 GWh, con una caída de 87,2 m y un caudal de 252 m<sup>3</sup>/s. La central tiene 9 turbinas Francis turbinas y cuatro cuencas desarenadoras con dos canales cada una.

**Ubicación:**

Río Iskut, British Colombia, Canadá.  
[Lat 56° 43' N - Long 130° 39' W](#)

**Cliente:**

AltaGas.

**Reto de sedimentación:**

El río transporta altas cantidades de sedimento y escombros. El sistema de limpieza original no funciona satisfactoriamente bajo estas condiciones.

**Solución:**

Cuatro Succionadores SediCon fueron instalados en un desarenador, dos en cada canal, en febrero de 2017. Los Succionadores SediCon fueron diseñados para manejar escombros de hasta 150 mm de espesor y 1200 mm de largo. El sistema utiliza las válvulas de salida existentes.

**Implementación:**

El equipo fue producido y enviado en menos de 5 semanas después de la firma del contrato, y fue instalado en febrero de 2017, durante una parada de mantenimiento de 10 días. Ninguna modificación a las estructuras existentes fue necesaria.

**Resultados:**

SediCon suministró una solución a la medida en un corto plazo y atendiendo las necesidades específicas de los desarenadores, descargando hasta 500 kg de arena por cada m<sup>3</sup> de agua.

SediCon es un proveedor de soluciones para el manejo de sedimentos mundialmente reconocido, suministrando soluciones confiables que poseen bajo consumo de agua y no interrumpen la generación de electricidad.

## SediCon Sluicer for Winkeltal HPP intake, Austria

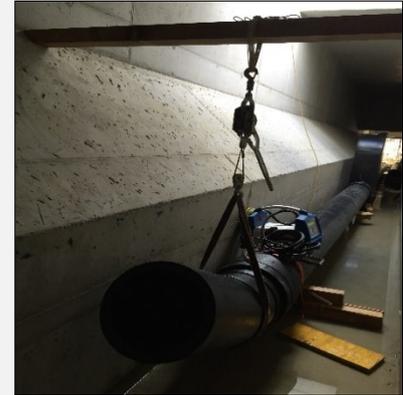
A hydrodynamic SediCon Sluicer was installed in the desander of Winkeltal HPP to clean the deposited sediments, without interrupting the power production.



Winkeltal run-of-river



SediCon unit



Installation of HDPE pipes

- Project Description:** Winkeltal is a 2.6 MW run-of-river hydropower plant commissioned in 2017. The annual production will be 11.1 GWh, using a head of 208 m and a discharge of 1.5 m<sup>3</sup>/s.
- Location:** Winkeltal river, Austria.  
[46.820211](#), [12.461095](#)
- Client:** Gemeinder Ausservilgraten & INFRA project Development GmbH.
- Sediment Challenge:** The river carries a heavy sediment load in spring, due to snow melting. During spring season, the sediments rapidly and constantly fill the small desander, which leads to frequent cleaning to avoid damage on the turbines. The original design considered two desanders; flushing the sediments from one desander while operating the power plant from the other.
- Solution:** The original design was optimized with a new desander configuration, using only one basin desander with a Ø355 SediCon Sluicer. The SediCon Sluicer allows sediment removal without interrupting the power production flow. The system was especially designed with hydrodynamic components to reduce head losses.
- Implementation:** The SediCon Sluicer was installed in 10 days by a SediCon specialist with some local assistance. No embedded parts were required.
- Results:** The system was delivered in 2016, less than 5 months after contract signing. The estimated removal capacity is 30 m<sup>3</sup> per hour of sand and gravel up to 64 mm. The SediCon Sluicer has been operated regularly since commissioning since 2017, having ensured continuous power production and reduced turbine wear.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

Updated 2023

## SediCon Sluicers for Indrawati-III HEP, Nepal

Two custom designed SediCon Sluicers were installed in April 2017 to remove the large amount of sediment income, without interrupting the power production.



Sediment accumulation



Installation of SediCon Sluicer



Discharge of SediCon Sluicer

**Project Description:**

Indrawati III is a 7.5 MW run-of-river project with an annual production of 50 GWh. Net head is 65 m and discharge is 14 m<sup>3</sup>/s.

**Location:**

Sindhupalchowk District, Nepal.  
[27°53'05.04"N 85°36'50.76"E](https://www.google.com/maps/place/27.883054,85.601667)

**Client:**

National Hydro Power Company (NHPC)

**Sediment Challenge:**

Indrawati-III was facing severe sediment deposition in the existing desilting tanks, especially during monsoon periods as heavy silt is brought by the river. This leads to constant closing of the power plant to clean the chambers, producing large economical losses due to loss in production time.

**Solution:**

SediCon supplied two SediCon Sluicers in the existing desilting tanks to remove the sediments that get settled, without interrupting the production.

**Implementation:**

SediCon provided the design, supply, installation, testing and commissioning services for the incorporation of the SediCon Sluicer system in the desander.

**Results:**

The SediCon Sluicers were commissioned in July 2017, with a measured total removal capacity of 2000 ton of sediments per hour. The sediment concentration was exceeding 500 kg/m<sup>3</sup> and average water consumption was less than 4 m<sup>3</sup> water per m<sup>3</sup> sediments. The SediCon Sluicers has been operation since commissioning often removing several thousand tons of sand that can deposit during one night.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

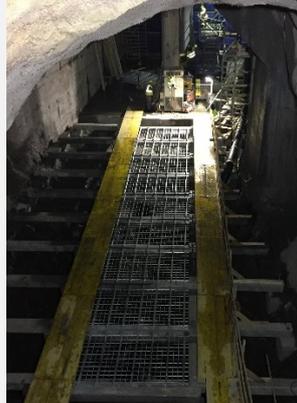
Updated 2023

## SediCon Laxá III tunnel desander, Iceland

A SediCon Sluicer removes sand from the tunnel desander at Laxá III intake. A grating covering the desander prevents rocks and debris from affecting the sluicer system



SediCon Sluicer in the desander



Gravel excluder in front of intake



Sand removed

- Project Description:** Laxá III is a 13.5 MW Run-of-River hydropower plant, estimated to be commissioned in 2017. Annual production is 92 GWh, with a head of 39 m and a discharge of 43 m<sup>3</sup>/s.
- Location:** Laxa river, Iceland.  
[65°48'58.6"N 17°18'33.5"W](https://www.google.com/maps/place/65%2C48%2C58.6%2C17%2C18%2C33.5%2C/W17%2C18%2C33.5%2C/L65%2C48%2C58.6%2C)
- Client:** Landsvirkjun, National Power Company of Iceland
- Sediment Challenge:** During winter, ice covers the bay temporarily and previous settled sediments are eroded and transported to the intake. This hydropower plant suffers from both sedimentation and ice transport. The ice can carry large material, including rocks that can reach the machinery, damaging the turbines.
- Solution:** SediCon proposed a combined solution of a Ø630 SediCon Gravel Excluder and a Ø355 SediCon Sluicer. The Gravel Excluder removes rocks from the intake and the SediCon Sluicer removes finer sediments inside the tunnel. In addition, a monitoring system consisting of pressure cells and piezometers was installed to monitor the sediment levels and a horizontal trash rack was installed to prevent too large particles from entering the sand trap.
- Implementation:** The installation started in October 2016 and was completed in January 2017.
- Results:** The SediCon Sluicer has been operational since January 2017 and is regularly used. According to the client, that it has been a great success in Laxá and the abrasion on the machinery in the power station has been dramatically lowered.

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Updated 2023

## SediCon Sluicer for Rubagabaga HPP, Rwanda

Following a field study SediCon specified design criteria and designed the desander and supplied a SediCon Sluicer for removal of sediments without interrupting power production. The SediCon Sluicer is manually operated with one valve.



Installation of the SediCon sluicer system



Desander and secondary intake

- Project Description:** 400 kW, Run-of-River powerplant with no storage.  
Annual production of 2,8 GWh, Net head is 65 m and design discharge 0,8 m<sup>3</sup>/s.
- Location:** Rubagabaga River, North eastern Rwanda [1° 43'39''S and 29°37'31''E](#)
- Client:** Afritech Ltd Rwanda and Autonom AS, Norway
- Sediment Challenge:** Rubagabaga is a small river but it carries as much as 100 000 ton sediments per year, including bedload, debris and fine silt and sand.
- Solution:** SediCon supplied general sediment consultancy, concept and design of the desander and one SediCon Sluicer for the 4m wide and 20 m long desander. The SediCon sluicer allows removal of sediments just by opening of the outlet valve. Power production is not interrupted by the sediment flushing.
- Implementation:** The SediCon Sluicer that was installed by the end of 2018, and from January 2019.
- Results:** Large amounts of fine sticky sediments and organic materials are removed regularly, only by manually opening an outlet valve. The SediCon Sluicer has been operation since January 2019 without need for any replacement or repair.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

Updated 2023

## Boulder Excluder for Tyso Intake, Norway

**Without any intervention and without any loss of water for production, the SediCon Boulder Excluder at Ulvik hydroelectric plant removes gravel, stones and boulders up to 1,0 m size and maintains the intake open at all times.**



Boulders Excluder discharging



After two years operation including a major flood in November 22

- Project Description:** Tyso intake feeds the transfer tunnel that supplies water to the main reservoir of the Ulvik Hydroelectric Powerplant in western Norway. The Hydroelectric Plant has an installed capacity of 20 MW, with a design flow of 10 m<sup>3</sup>/s and a gross head of 387 m.
- Location:** Ulvik, Hordaland, Norway.
- Sediment Challenge:** Material transported as bedload to Tyso intake can be up to almost a meter in size and often causes partial blockage of the intake. The structure is 3 km from the road, without electricity or communication, limiting the solutions that can be implemented.
- Solution:** SediCon supplied a 1200 mm outer diameter Boulder Excluder, capable of removing rocks up to 1,0 m in diameter. The Boulder Excluder uses the siphon principle and removes sediments in front of the intake every time there is flood, and thus surplus water and sediment transport. It is made with no moving parts and works entirely without any intervention or monitoring. It is primed (started) only when there is sufficient surplus water in the river and stops automatically when the water level drops.
- Implementation:** Installation of the Boulder Excluder was successfully completed during October 2020. Due to lack of access by road, the HDPE components were flown in by helicopter, assembled and installed in the intake structure with light tools.
- Results:** The Boulder Excluder has been working flawlessly during its first two years of operation, including the second-largest flood ever recorded, which hit the area 11<sup>th</sup> November 2022. The intake is still completely free from any stones or debris and has 100 % capacity.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

## SediCon Sluicer for Weerbach HPP desander, Austria

**One SediCon Sluicer was installed in the desander of Weerbach HPP to remove sediments without interrupting the power production. The SediCon Sluicer was integrated with an HDPE spillway section and connection to an environmental flow outlet, all being designed by SediCon.**



Weerbach desander



HDPE components



Combined Sluicer outlet and spillway

- Project Description:** Weerbach is a 2.0 MW run-of-river hydropower plant commissioned in 2022. The power plant operates at a gross head of 397 m and with a discharge of 1.5 m<sup>3</sup>/s.
- Location:** The water intake (Tiroler Wehr) is located in the municipal area of both Weerberg and Kolsassberg
- Client:** FRÖSCHL AG & Co.KG, Austria.
- Sediment Challenge:** The river carries a heavy sediment load in spring, due to snow melting. During spring season, the sediments rapidly and constantly fill the small desander, which leads to frequent cleaning to avoid damage on the high head Pelton turbine.
- Solution:** The original design was optimized with a new desander configuration with a shorter and wider desander where SediCon Sluicer outlet, overflow outlet and environmental flow outlet is combined into one HDPE unit. The design significantly reduced construction costs. The SediCon Sluicer can remove stones and debris up to 100 mm at up to 30 m<sup>3</sup>/hour capacity. The life expectancy of components > 100 years.
- Implementation:** The SediCon Sluicer was installed by the client with remote supervision and advice from SediCon.
- Results:** The system was delivered on schedule and has worked to the client's fullest satisfaction since commissioning in 2022

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

## Boulder Excluder for brook intake at Brattset HPP, Norway

**Without any intervention and without any loss of water for production, the SediCon Boulder Excluder at Nova brook intake maintains the intake and removes boulders up to 800 mm.**



Boulder Excluder installed and ready for decades of service



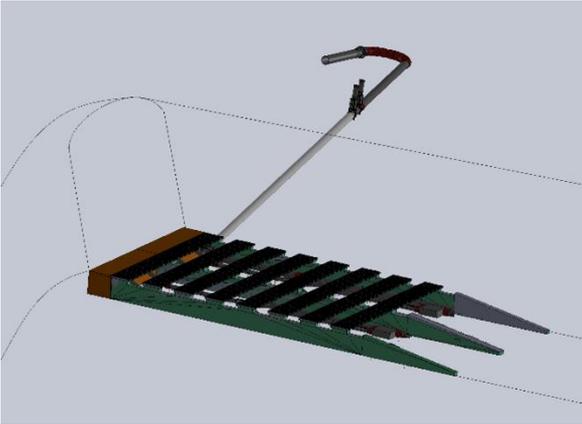
Challenging installation in a narrow gorge!

- Project Description:** Nova brook intake is a major brook intake at Brattset Hydropower plant in central Norway. The intake is located in a deep canyon and the river carries a significant amount of gravel, stones and boulders that frequently blocks the intake.
- Location:** Ulsberg, 100 km south of Trondheim, Norway.
- Client** TrønderEnergi AS, Norway
- Sediment Challenge:** Material transported as bedload to the intake can be nearly a meter in size and often causes partial blockage of the intake. The structure is in a deep canyon, without permanent electricity or communication, limiting the solutions that can be implemented.
- Solution:** SediCon custom designed and supplied a 1000 mm Boulder Excluder, capable of removing rocks up to 800 mm in diameter. The Boulder Excluder uses the siphon principle and removes sediments in front of the intake only when there is surplus water. (This is when sediments come as well). It has no moving parts and works entirely without any intervention or monitoring.
- Implementation:** Installation of the Boulder Excluder was successfully completed in September 2023. Due to lack of access by road, being in steep gorge and with a power line above, the HDPE components were lifted down with a temporary timber winch and assembled and installed on the intake structure with light tools.
- Results:** The Boulder Excluder was installed days before writing this reference sheet. However, installation went smooth despite very challenging access to the site, and nothing indicates it shouldn't work just as well as all other SediCon Boulder Excluders.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

## SediCon Sluicers for Tunnel Desander and Tonstad HPP

**A SediCon Sluicer removes sediments from the tunnel desander at Tonstad HPP. A grating covering the sluicer prevents large stones and debris from affecting the sluicer system.**



Downstream part of the desander where the chambers with 4 SediCon Sluicers are installed. The common outlet pipe passes through 32 m of rock before discharging in dedicated settling basin.

- Project Description:** Tonstad HPP is Norway's most-producing power plant with 960 MW installed capacity and an annual power production of 3,8 TWh.
- Location:** Part of the Sira-Kvina Scheme in Sirdal, South-western Norway.
- Client** Sira Kvina Kraftselskap AS, Norway
- Sediment Challenge:** The 180 m long, 11 m wide desander collects sand and gravel but much of the sand is believed to re-suspended and passing the turbines. Until now, sediments have been mechanically removed from a dewatered desander which is costly and in practice only done when power production can be stopped for other reasons.
- Solution:** Eight SediCon Sluicers in specially designed chambers covered with slabs as well as coarse grating which prevents larger stones and debris from interrupting the Sluicers. The stainless-steel grating is also design for traffic. The SediCon Sluicers discharges through an embedded steel pipe through the rock into settling basins outside the desander. SediCon has supplied design of chambers as well as design and supply of steel grating, SediCon sluicers, embedded hardox pipe, pipes for grouting and monitoring and outlet structure.
- Implementation:** The SediCon Sluicers was installed during scheduled maintenance of the powerplant and has been in operation since SAT was successfully completed, May 2025.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

## Boulder Excluder for brook intake at Ulla Førre, Norway

**Without any intervention and without any loss of water for production, the SediCon Boulder Excluder at a brook intake at Ulla Førre maintains the intake and removes boulders up to 600 mm.**



A nice summer day for interesting work



Commissioned and discharging sediments in June 2023

- Project Description:** Nyastølbekken is one of nearly 50 brook intakes at Norway's largest hydropower scheme, Ulla Førre. The brook intakes collect as much as 1 TWh of energy annually, which is stored in Blåsjø, 3000 Mm<sup>3</sup> and nearly 8 TWh of energy.
- Location:** Suldal, South-western Norway.
- Client** Statkraft SF, Norway
- Sediment Challenge:** The brook carries gravel and stones which partly fills the tiny intake pond and reduces its capacity perhaps especially in winter conditions when snow cover is several meters high and fills the intake as well. Gravel and small rocks that pass the trash rack enters into the tunnel system where a build-up of sediments is believed to reduce its capacity.
- Solution:** SediCon custom designed and supplied a 720 mm Boulder Excluder, capable of removing boulders up to 600 mm. The Boulder Excluder uses the siphon principle and removes sediments in front of the intake only when there is surplus water. (This is when sediments come as well). It has no moving parts and works entirely without any intervention or monitoring.
- Implementation:** Installation of the Boulders Excluder was successfully completed in June 2023. The HDPE components were flown in by helicopter, assembled and installed with assistance of an excavator and tested and commissioned in less than two days.
- Results:** The SediCon Boulder Excluder can also be primed manually at any time with a vacuum pump. This was done just after installation and removed existing gravel and stones in the pond. At the time of writing this reference sheet there has not been recorded floods large enough to prime the boulder excluder automatically. Please ask us!

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

## Boulder Excluder – Ulla Førre - Norway

**Automatic removal of boulders up to 600 mm with no energy input, no water loss, and no intervention in main structures.**

### Ulla Førre HPP – Nyastølbekken Intake



Statkraft SF, Norway.

Cascade scheme with 4 power plants and nearly 50 brook intakes.

Total installed capacity of 2,100 MW.  
4,500 GWh of annual generation.

The brook carries gravel and stones which fills the small intake pond and reduces its capacity. Gravel and small rocks that pass the trash rack enters the tunnel system where a build-up of sediments reduces its capacity.



### SediCon Boulder Excluder



SediCon custom designed and supplied a 720 mm Boulder Excluder, capable of removing boulders up to 600 mm only with surplus water, using the siphon principle.

Installation of the Boulders Excluder was successfully completed in June 2023. Installation, testing, and commissioning was done in less than 2 days.

#### Benefits of the solution

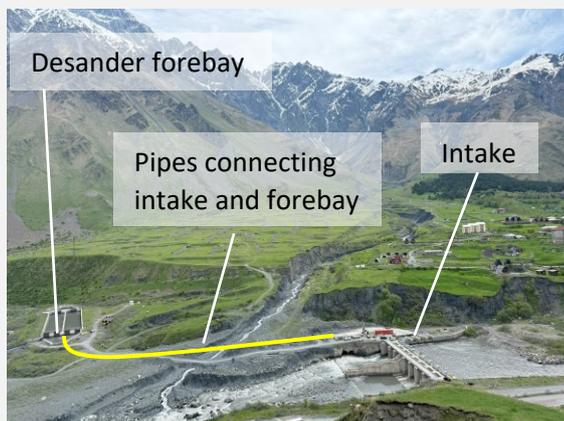
- Low implementation cost and no interference with existing structures was required.
- Automatic removal of sediments during floods with zero cost.
- Substantial reduction of sediments entering the power plant, reducing its maintenance costs.
- Option to prime and operate the system manually when required.

SediCon is the leading supplier of sediment handling worldwide and provides cost-effective and reliable solutions, with low water consumption and uninterrupted power generation.

Contact us to  
evaluate  
your project!

## SediCon Sluicers for Dariali intake, Georgia

Installation of SediCon Sluicers and boulder excluder after the intake have eliminated costly, week-long production stops to remove sediments summer “sediment-season”.



Low dam, intake and desanders



Discharge from SediCon Sluicers in the desander forebay

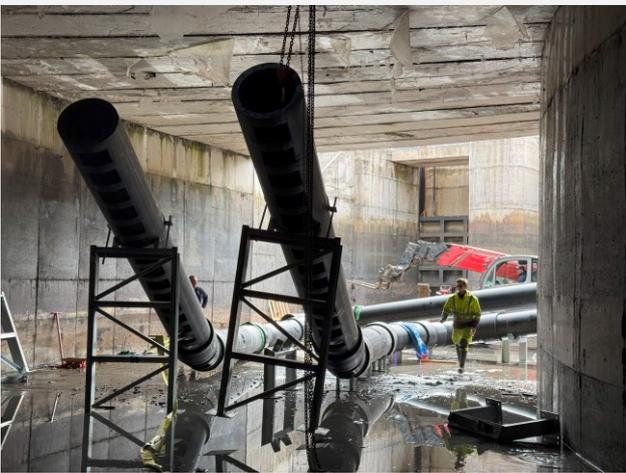
- Project Description:** Dariali is a 106 MW run-of-river hydropower plant commissioned in 2014. The power plant operates at a head of 385 m and with a discharge of 30 m<sup>3</sup>/s.
- Location:** Stepantsminda, Georgia 42° 39' 57" N 44° 38' 40" E
- Client:** Dariali Energy, Republic of Georgia.
- Challenge:** Dariali is a Run-of-River plant with no effective water storage. Huge sediment loads during the snowmelt season enter the intake deposit and blocks waterway and prevent operation. Until now it has been required to stop production to remove sediments or avoid excessive deposition.
- Solution:** Four Large SediCon Sluicers for the intake and one SediCon Sluicer system and one Boulder Excluder in the forebay prior to the desander.  
The systems are capable of removing several 1000 tons of sediment per hour and operate continuously during the sediment season. In the shoulder seasons systems are operated one by one and intermittently, minimizing loss of water.
- Implementation:** Only four months were required for detail design manufacturing, trucking to Georgia and installation, ready for operation in May 2025.  
Three SediCon supervisors together with local staff completed the drawdown and installation of all equipment in less than 100 working hours.  
SediCon systems were started immediately to allow continuous operation during summer 2025.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.

## Intake structure, immediately downstream intake pond and intake



SediCon Sluicers in the intake. Outlet pipes along the wall discharge over the spillway.



630 mm SediCon Sluicers remove sand gravel and stones up to 300 mm. Picture to the right is taken after two weeks of operation and shows that all sediment is removed.



Four SediCon Sluicers discharge over the spillway. A starter system operated by a small water pump allows operation without valves and without any modification of existing structures.

## Forebay prior to desander, 200 m downstream of intake



Forebay with SediCon Sluicers and boulder excluder. Sediment including gravel and stones are effectively prevented from building up and desanders receive only suspended, fine sediments.



2,5 m high siphon and 60 m long outlet from the forebay provides efficient sediment removal without any modifications of civil structures. 630 mm pipes with unrestricted flow and high velocity provide passage of all gravel, stones and debris.



Sand, gravel and stones being discharged at a rate of more than 1000-ton sediments hour.

## Boulder Excluder at Furset Small Hydro, Norway

**Without any intervention and without any loss of water for production, the SediCon Boulder Excluder at Furset maintains the intake and removes gravel, debris and boulders up to 500 mm.**



Installation of boulder excluder – suction inlet to the right



Operation during flood in September 2025

- Project Description:** Furset is a 5 MW hydropower plant at Stranda in Mid-Norway, commissioned in 2007. The river carries substantial amount of gravel which is intercepted in front of the trash rack and removed with the SediCon Boulder Excluder
- Location:** Stranda, Mid-Norway.
- Client** Tussa Energi AS, Norway
- Sediment Challenge:** The river carries large volumes of gravel and stones, partly because of an upstream ski-centre and steep alpine landscape. The gravel has filled the intake pond required frequent drawdowns and mechanical excavation.
- Solution:** SediCon custom designed, supplied and retrofitted a 630 mm Boulder Excluder in the intake. The Boulder Excluder can remove gravel, debris and boulders up to 530 mm. The Boulder Excluder uses the siphon principle and removes sediments in front of the trash rack. It operates during floods when there is surplus water, has no moving parts and works entirely without any intervention or monitoring.
- Implementation:** Installation of the Boulders Excluder was successfully completed in September 2025. The HDPE components was assembled and installed by two workers with assistance of an excavator.
- Results:** The SediCon Boulder Excluder works automatically during floods, with no intervention at all. In spite of the low head (app 2,0 m) all sediments on front of the trash rack are efficiently removed.

SediCon is the leading supplier of sediment handling worldwide and provides reliable solutions with low water consumption and uninterrupted power production.