



CASE STUDY
KINLOCHEWE TTU

**Scottish
Water**
Trusted to serve Scotland

THE MODULAR

WATER EXPERTS **TREATMENT**

Project Title: *Kinlochewe WTW (TTU)*

Client: *Scottish Water Solutions 2 Limited for Scottish Water*

Project Value: *£2.0M*

Design Start: *15th August 2011*

Manufacture Start: *3rd October 2011*

Delivery to Site: *3rd September 2012*

Works Address: *Kinlochewe to Torridon Road, Kinlochewe IV22 2PE*



Project Overview:

This Works involved the design, construction, installation and commissioning of a new 150m³/d Nanofiltration (NF) Modular and Transportable Treatment Unit (TTU) membrane plant to replace the existing system on site.

Through the Scottish Water Solutions 2, Ross-shire Engineering (RSE) was engaged to design, manufacture and install a 150m³/d NF Transportable Treatment Unit (TTU) membrane plant operating at 80% recovery, on the Kinlochewe site.

An innovative design approach was required due to site topography and access constraints, and has been well received by our clients.

Utilising our group manufacturing capability ensured a collaborative approach for our clients. As Principle Contractor RSE also manufactured and produced the TTU. Ross-shire Engineering's specialist chemical dosing company PSI were engaged to design and manufacture a modular solution for Sodium Hypochlorite disinfection. PSI adopted a pioneering approach which led to bringing the main process line within the dosing unit, negating the need for extensive pipework runs and reduced the installation and maintenance requirements.

The TTU was designed and assembled at Ross-shire Engineering's Modular Facility of Excellence base in Muir of Ord, before undergoing comprehensive testing. The single 12m x 3.6m TTU was then carefully prepared for the 40 mile journey by road to its permanent home via the A835.

The project was successfully completed on time, defect free with acceptance from Scottish Water received in December 2012. Scottish Water operatives are pleased with the plant's performance.

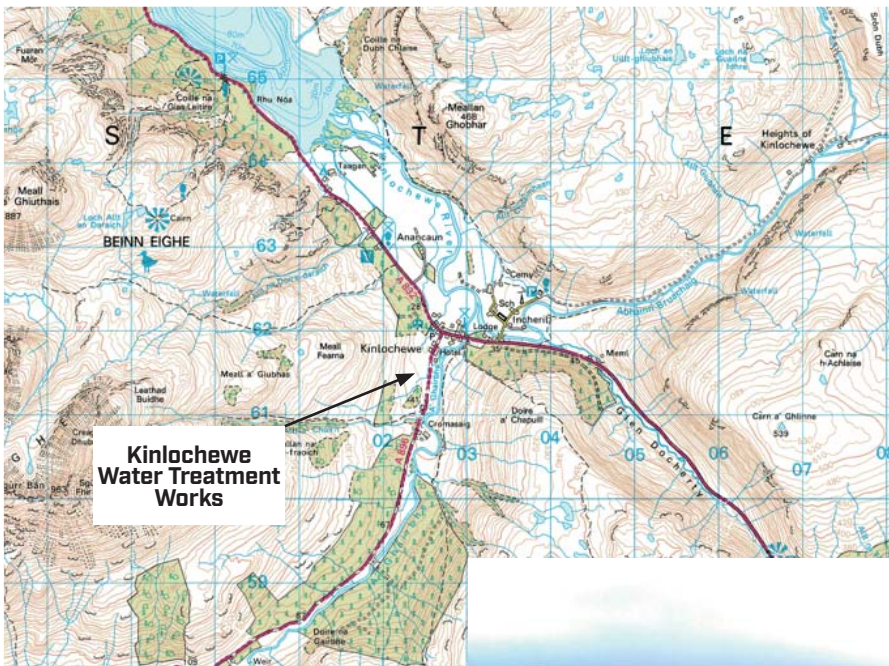
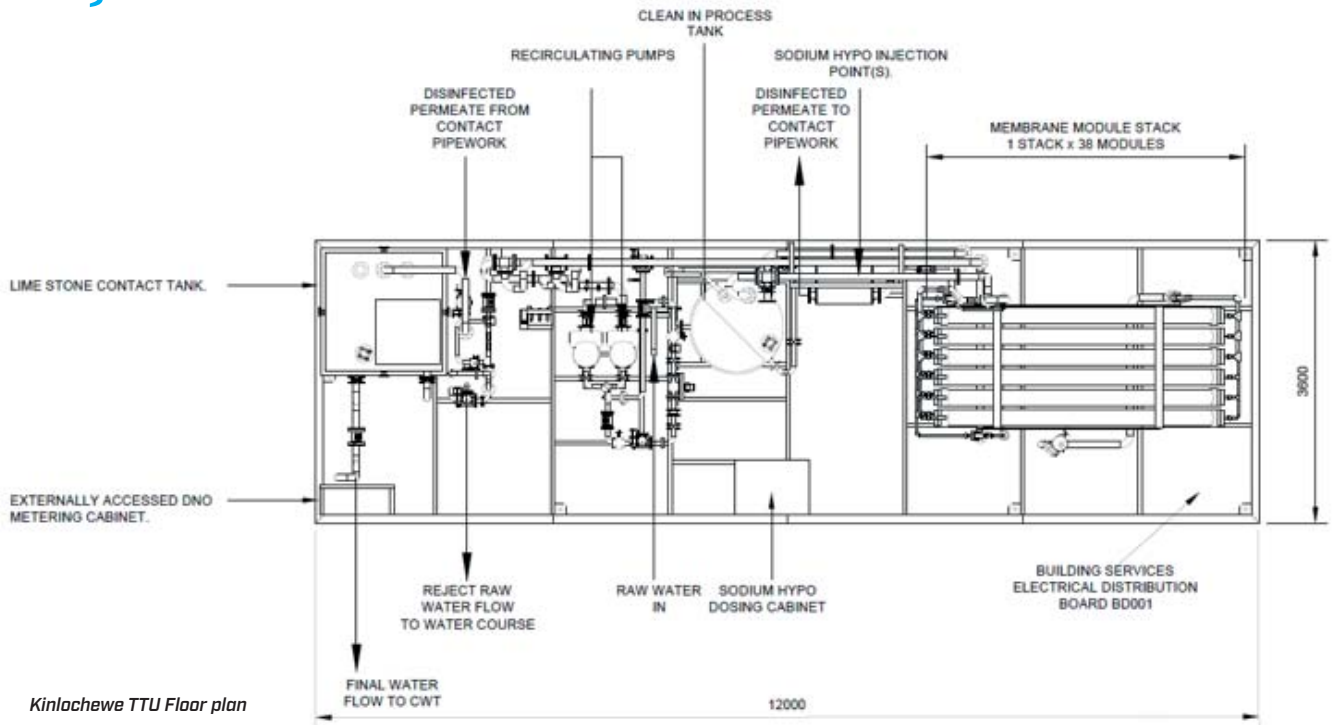


Fig 1.1 Works Location map



Kinlochewe - The existing Water Treatment Works site prior to the construction of the new works.

Project Overview:



Raw Water Quality Envelope used for Design

	No. Samples	Min	Max	Mean ¹	95% Percentile	Design Values ²	
Colour	70	25	48	30.9	38.7	60	Deg Hazen
Turbidity	70	<0.3	2.7	0.6	1.5	5	NTU
pH	72	6.2	7.7	6.9	7.3	5-8	pH unit
Iron	70	91	689 ³	169.9	240	300	µg/l
Dissolved Iron	40	55	126	88.9	107.7	-	
Manganese	70	3.3	737.8 ³	20.4	22.9	30	µg/l
Dissolved Manganese	40	2.2	8	4.4	6.9	-	
Aluminium	70	56	182	78.1	137.7	200	µg/l
TOC	71	3	7.2	4.4	5.6	-	mg/l
Alkalinity	18	4	7	5.6	6.2	-	mg HCO ₃ /l
Conductivity	72	24	35	28.3	32.5	-	µS/cm at 20°C

- The mean and 95%ile values shown are the weighted averages of mean and 95%ile values of each of the raw water sampling data sets used in the analysis.
- The design values are the maximum values (range of values in the case of pH) to be used for design purposes
- It is noted that the maximum values of Iron (689 µg/l) and Manganese (737.8 µg/l) are from the same sample. Both these values are extreme outliers and may not be reliable.

Water Quality Tables

Treated Water Quality Targets

Parameter	Unit	RSE Target	The Public Water Supplies (Scotland) Regs 2014 No. 364	The Water Supply (Water Quality) (England & Wales) Regs 2016 No. 614
Colour	Deg Hazen	5	20	20
Total Iron	µgFe/l	50	200	200
Total Manganese	µgMg/l	10	50	50
Total Aluminium	µgAl/l	50	200	200
Total Organic Carbon	mgC/l	2	No abnormal change	No abnormal change
Total THM	µg/l	40	100	100
Turbidity	NTU	0.4	4	4
Free Chlorine	mg/l	0.2–2.0	-	-
Hydrogen Ion	pH Value	7.8-9.2	6.5-9.5	6.5-9.5

Treated Water – Performance Test Results

Parameter	Unit	Minimum	Maximum	Mean	95th Percentile	Count
Colour	Deg Hazen	<2	2	<2	<2	20
Hydrogen ion	pH value	7.1	8.7	7.8	8.6	20
Turbidity	NTU	0.2	0.7	0.3	0.6	20
THM: Total	mg/l	4.9	6.1	5.5	6	4
Aluminium	µgAl/l	<9	<9	<9	<9	7
Iron	µgFe/l	<7	<7	<7	<7	7
Manganese	µgMn/l	1	1.8	1.3	1.7	7
Coliform bacteria	cfu/100 ml	0	0	0	0	20
E. coli	cfu/100 ml	0	0	0	0	20

Note:- '<' denotes laboratory detection limit.

Membrane Cleaning

Foam Ball Cleaning	Yes
Frequency	Daily (Every 4 hours; duration 10 minutes)
Frequency of CIP Cleaning	Every 3 months
Chemicals used for CIP cleaning	Citric Acid / Sodium Hypochlorite



Groundworks - May 2012



Sodium Hypochlorite dosing

PSI adopted a pioneering approach which led to the main process line within the dosing unit, negating the need for extensive pipework runs and reduced the installation and maintenance requirements.

Client Commendation

Robert White, *Scottish Water team manager said*



Before we had the new plant online our old plant was simple, basic filtration, sand and carbon, which wasn't dealing with the high colours that we were experiencing from a flashy Highland river."

"Since we've had the new plant online we've had no issues with our customers or customer complaints."

"The main benefit that the Transportable Unit brings to us is standardisation. We work with our Manufacturer to develop best practice in the Plant. We've got standardisation of spares, standardisation of control, and probably most importantly for us, our Operators from across the Region are used to working these plants, so we can bring in staff from across our area and they are familiar with the control of the plant."

From a Capital Program point of view one of the big benefits of the plant is there's quick delivery; the bulk of the commissioning is done off site so when the plant comes to site it is in effect a 'plug and play' installation meaning quick delivery for us"

Richard Munday, *Shieldaig Community Council said*



We were concerned with things like visual impact. Will the treatment plant fit in well to the background of the trees? How much screening is it going to be possible to have and we were also concerned about the impact of the track going up to the high level Clear Water Storage Tank, and I must say with Scottish Water and Ross-shire Engineering we were able to sit down and although we are not experts at building plant like this we did feel we were being listened to in terms of how this was going to be sensitively fitted into a sensitive environment."

Ian MacKenzie, *Scottish Water Senior Treatment Operator*



Ross-shire Engineering built this Transportable Treatment Unit and brought it to site. They stuck with us from start to end and made sure that everything was compliant. It was commissioned properly to the highest standard that was required."

"After it was left to Scottish Water to run, it was only a case of picking up the phone if we had any issues. I know fine I could have phoned Ross-shire Engineering, and have done in the past, and they have dealt with my problem straight away. I would give them 10 out of 10 for after sales services."

Andrew Staddon, *Owner of Kinlochewe Hotel*



"When we first came here the water was coming through the old plant. Occasionally it would be stained after storms or snow melt. There would be a brown staining to the water which could be quite dark at times. For people who didn't know the West Highlands and West Highland Water it could be quite off-putting. They would feel getting out of the bath dirtier than when they went in. We did have occasions in the pub where we were serving cups of tea where the tea was presented to the customer and it was returned because it was too chlorinated, which is not good for us, not good for business."

"Since the new plant's been up and running there is no complaint about the water quality. It's just a nice drink of water."



TTU Scope

- **Membrane Plant building**
- **Membrane Filter Feed and Recirculation Pumps**
- **Strainers**
- **Nanofiltration Membrane Modules**
- **Membrane Clean In Place (CIP) and Neutralisation facility**
- **Disinfection (Sodium Hypochlorite dosing)**
- **pH Correction (Limestone Contact Tank)**
- **Final Water Flow Monitoring**
- **Water Quality Sampling for control and Regulatory purposes**
- **Motor Control Centres**
- **Local Control Panels**
- **Telemetry.**

Additional Site Scope

- **Civil Ground works**
- **TTU Building Foundation**
- **Final Water Rising Main**
- **MEICA**
- **Clear Water tank**
- **Services**
- **River Inlet Structure**
- **Course Screen**
- **Fine Mechanical Screen**
- **Raw Water Feed Pump Station**
- **Raw Water Intake Screen**
- **Raw Water Pump Station**
- **Welfare Building**