Water Treatment Industry Overview

New Zealand's three waters system (drinking water, waste water and storm water) is critical for NZ's public health and safety, environmental protection, and economic prosperity and security. It represents a considerable investment for New Zealand. For example, the water supply infrastructure was estimated in 2009 to be worth $11 billion, with an annual budget of about $605 million on operational expenditure and $390 million on capital expenditure to maintain and manage water supplies[1].

The outbreak of gastroenteritis in Havelock North in August 2016 indicated current practices are not sustainable. This event triggered the Three Waters Review[2]. The GHD-Boffa Miskell report, published as part of this ongoing review, suggested that raising the standards of wastewater treatment plants that discharge into rivers and lakes across the country could cost up to $2 billion. The cost of infrastructure upgrades to meet drinking water standards is in the region of $500 million[3].

The most recent update from the Three Waters Review in June 2019 reports on stakeholder engagement. There was general agreement with the central proposition that the regulation of drinking water requires urgent attention. Concern was expressed about the lack of capability in the water industry and lack of young people coming through. Support is needed for industry training and certifications, including recognition of those with existing skills and knowledge.

Drinking-Water and wastewater treatment throughout New Zealand is undertaken by Local Authorities and companies contracted to them. This includes public institutions such as prisons, military bases, educational facilities and hospitals. Industrial water and wastewater treatment is also undertaken by dairy and meat processing and other food industries and large scale processing and manufacturing industries that have specialist needs that cannot be or are not provided by public systems.

The main responsibility for drinking water treatment operators is to ensure that they provide safe drinking water at all times. However, in a wider context it is to provide water to meet the performance standards that the owner sets (quality, quantity, cost, reliability, environmental etc). The tasks of the drinking water treatment industry are to collect water from raw source, treat it to appropriate, current N.Z.D.W. standard, store it and distribute it.

Drinking Water Assessors assess public health risks of drinking-water supplies and the management of these risks, monitor compliance of drinking-water supplies, and provide advice to water suppliers to safely manage their water supplies. One of the Ministry of Health (MoH) requirements for Drinking Water Assessors is to have a relevant technical qualification, such as the NZD Drinking Water Assessment (Level 5), or any Diploma in Drinking Water that includes unit standards 29995, 24906, 29966, 24897, 18456, 18459, 24907, 24912 (or equivalent from overseas training organisations)[4].

The main responsibility for wastewater treatment operators is to ensure the effluent discharged to the environment complies with the appropriate resource consents so that they minimise impact to

[1] Auditor-General, 2010
[2] DIA, 2019
[3] Mahuta, 2018

the environment. The main Wastewater treatment processes are biologically based. The tasks of the wastewater treatment industry are to receive waste water, treat it and dispose of it within the standards/conditions required by resource consent.

In areas where there is no sewer, households need to use an on-site effluent treatment system (OSET). In some regions, for example Bay of Plenty, Regional Plans require designers of OSET systems to be suitably qualified.

When the water treatment qualifications were last reviewed, the working group identified the demand for a qualified workforce: Investment in water and wastewater treatment capacity will continue to grow to ensure community requirements for drinking water and environmental protection are met. As service standards advance it will drive application of increased technology and the demand for qualified and skilled operational personnel.

In light of the Havelock North event, and the subsequent Three Waters Review, the need for a qualified workforce remains strong.

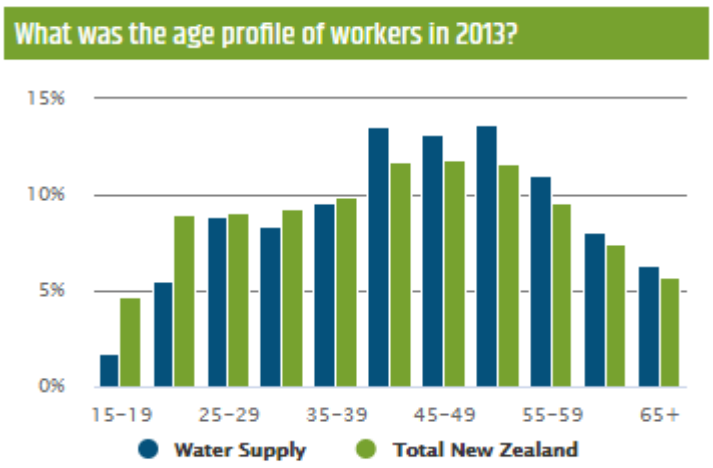
The workforce

Data from Infometrics indicate about 3200 people work in the Water Supply industry (Infometrics includes both drinking water and waste water in this category). The most common occupation is Waste Water or Water Plant Operator (989), followed by Water Inspector (95) and Civil Engineer (94).

Compared to the total workforce in New Zealand, there are fewer young workers (15-24) and more middle-aged workers (40-54). The ethnicity of workers is representative of New Zealand's total workforce. There is a relatively high proportion of female workers in Water Supply (27%) compared to Civil (18%) and Telco (17%).

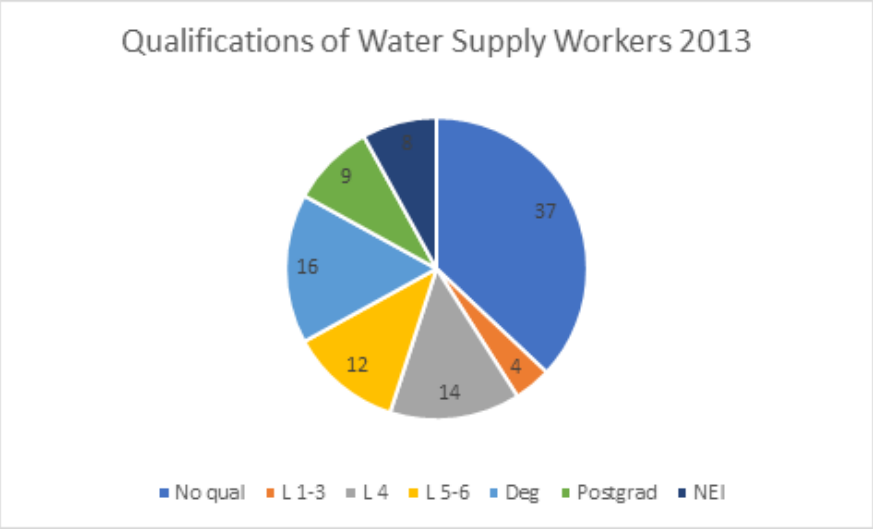
There are 38 Drinking Water Assessors on the Register[4].

In the Bay of Plenty, there are 34 approved wastewater system designers listed on the Regional Council's website.



Source: Infometrics, 2019

[4] MOH, 2019



Approximately half of the workers in Water Supply have no qualifications, Level 1-3 qualifications, or do not indicate any qualification. This is a similar proportion to the total New Zealand workforce.

Remuneration

In late 2018, water treatment plant operators were surveyed by Connexis. 20 people responded, 14 from councils (e.g. Carterton District Council, Wellington Water), 3 working as contractors (e.g. Downer, Citycare), and 3 industrial (e.g. Fonterra, Oceania). Remuneration varied from $30,000 to $130,000, depending on role and experience. Weekly hours of work varied from 32-80, with most responses in the range 40-50 hours/week.

Role	Remuneration range	Average
Starting (up to 2 years)	40 – 70, 000	$48, 000
Operator	50 – 110, 000	$70, 000
Manager	70 – 130,000	$95, 000

Employment roles

The employment positions and pathways in drinking-water and wastewater treatment are parallel, although the treatment methods differ (drinking water treatment is chemically-based whereas waste water treatment is biological). Roles identified by the Review working group in 2012 were plant assistant, small system operator, plant operator, plant supervisor, plant manager, drinking water assessor, lab technician and process engineer.

Refer to Appendix 1 for the job roles and responsibilities in the water treatment industry, originally developed in 2012.

A further role has been identified: wastewater system designers. This role is referred to in a best practice guide being developed by Water NZ which is intended for use by Regional Councils across NZ. This is likely to increase the demand for a qualification to replace the National Certificate in Domestic Wastewater Treatment (On-site Domestic Wastewater System Design) (Level 4) [Ref: 1457], which is now discontinued. This has been added to Appendix 1.

Qualifications and programmes

The working group developed replacement qualifications for the water treatment operator, plant supervisor and drinking-water assessor:

- New Zealand Certificate in Water Treatment (Level 4) with strands in Drinking-Water, Wastewater Drinking-Water Multistage Processes, and Wastewater Multistage Processes. [Ref: 2242]
- New Zealand Diploma in Drinking-Water Assessment (Level 5) [Ref: 2244]
- New Zealand Diploma in Water Treatment (Level 5) [Ref: 2245]

In addition, the working group identified a need for two further qualifications:

- NZC Water Treatment (Drinking-Water/Wastewater) (Level 3) [Ref: 2241], a lower level qualification to ensure the sustainability of industry operators and supervisors coming through the workforce by providing clearer education and employment pathways for young people entering the industry.
- NZC Water Treatment (Small Scale Systems) (Level 3) [Ref: 2240], a qualification for operators of small water treatment systems such as marae, rural community facilities, rural schools, camping grounds, farms and other facilities not on reticulated municipal water supplies.

The qualifications were approved in 2013. Standard setting responsibility was transferred to Connexis in 2016, and programmes leading to each qualification were approved in April 2017.

Standard Setting Body

The qualification standard setting body for Water is Connexis – Infrastructure Industry Training Organisation. There are no approved programmes for organisations other than Connexis.

Moderators and assessors

Connexis has two moderators and 34 assessors. A summary of the moderation activity in 2018-19 is below. The majority of assessors' decisions were supported.

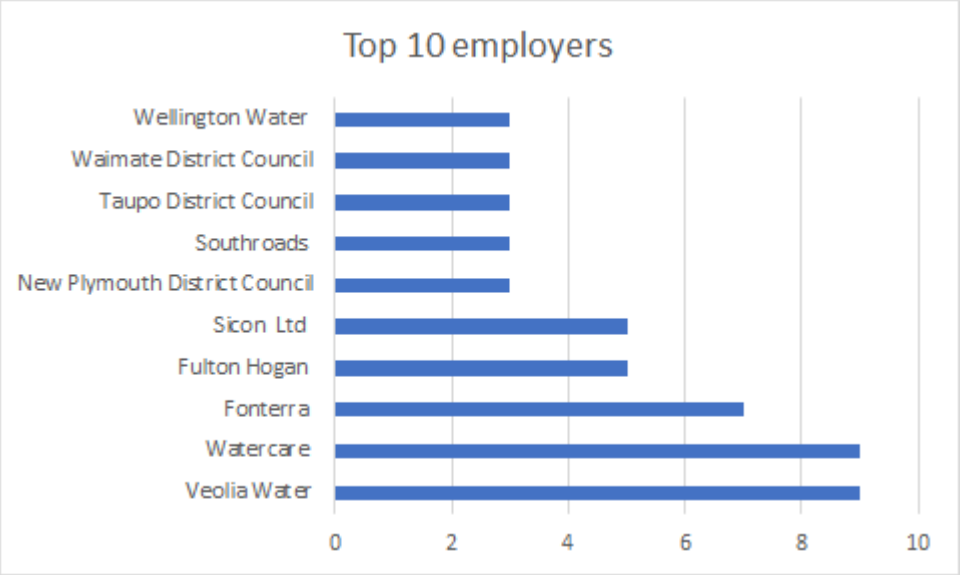
Unit standard	Number moderated	Number supported	Number borderline	Number unsupported	Notes
17877	4	4			
17894	1	1			
24927	5	3	1	1	Incomplete assessments
24950	10	8	2		1 incomplete, 1 insufficient evidence

Current trainees

The New Zealand Certificate in Water Treatment with strands in Drinking-Water, Wastewater, Drinking-Water Multistage Processes, and Wastewater Multistage Processes [Ref: 2242] is the only qualification currently available. The programme for Multistage Processes is also approved by TEC as an apprenticeship, although from April 2019, after industry feedback, it has been advertised as a certificate instead.

There are 98 current trainees (May 2019). Over half those enrolled are in the lower North Island. Most trainees are enrolled in Multistage Processes (Drinking water: 59; Waste water: 31). At 27 June this had increased to 113 trainees.

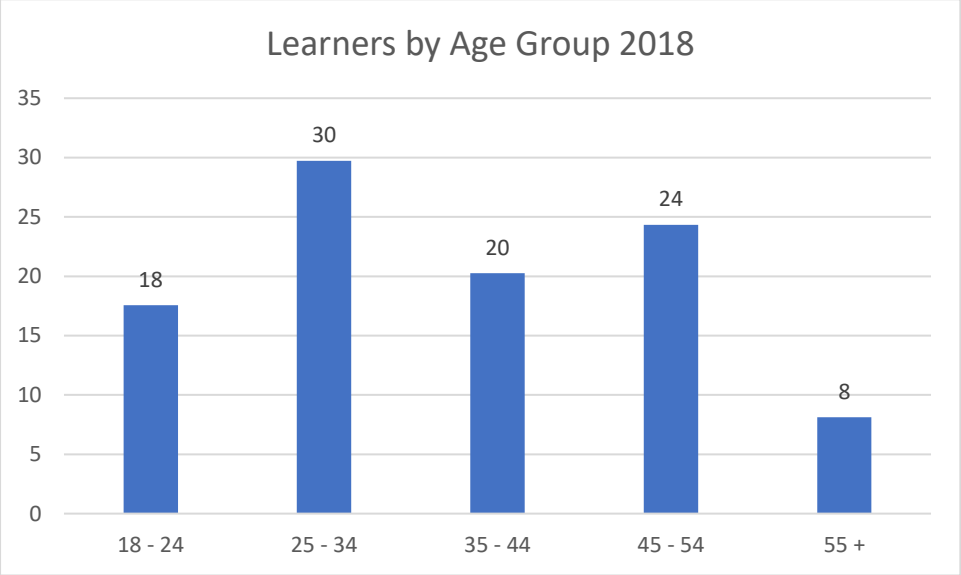
There are 44 companies with current trainees; most with one or two trainees. Companies with three or more trainees (at 15 April 2019) are shown in the bar chart below:



Current trainee numbers are lower than those reported in April 2012 which were 102 for Water and 77 for Wastewater.

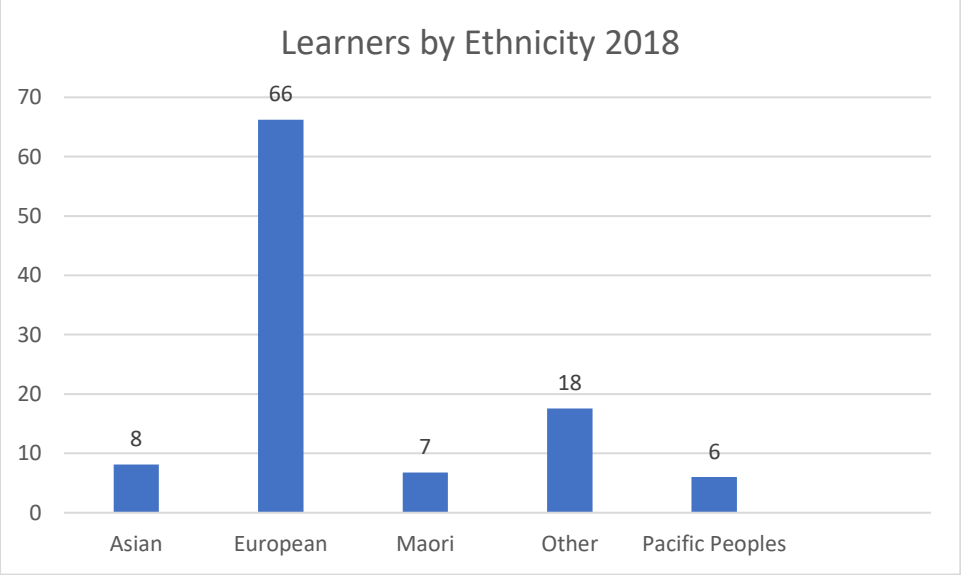
Enrolments by Age Group

The age of people enrolled in the certificate ranges from 18 years old to more than 55. Five people withdrew in 2018, two lost their jobs and three changed programmes (but enrolled in another strand of the same qualification).



Enrolments by Ethnic Group

The ethnic profile of trainees differs to that for New Zealand, with a lower proportion of all ethnic groups except 'Other ethnicities'. For comparison, New Zealand's ethnic profile in 2013 was 77% European, 11% Maori, 11% Asian, 5% Pacific Peoples, 3% Other ethnicities.



Feedback from survey June 2019

A brief survey was conducted in May – June 2019. A link to the survey was sent to employers, trainees, and graduates where an email address was known. 15 responses were received; 5 employers, 9 trainees and 1 graduate. A summary of results is below.

Statement	Strongly agree	Agree	Neither	Disagree
This qualification provides the skills and knowledge required by Water Treatment Operators	2 trainees	9	1 employer	3 trainees
The evidence required for assessments is easily gathered from day-to-day workplace activities.	0	6	6	3 trainees
The assessment materials are relevant to my workplace.	2 trainees	8	3	2 trainees

While most people agreed with the statements, some of the comments revealed dissatisfaction. A number of trainees commented on the lack of course notes or material to keep for future reference. Online learning without printed resources does not suit all learners. Some found the course lacking in content, repetitive, and wordy.

"I am particularly disappointed that block course is now only one week. My best learning is hands on supported by material I can review and as an operator I feel this will be common across the industry. It feels like as a customer I am being cut short compared to those that have gone before me."

Suggestions for improvement included:

- Communication between employer and ITO to give some guidelines on times expected to complete materials and progress
- Not make practice tasks compulsory as these do not always provide any meaningful help for those who are confident in study.
- Sign-off of module by a manager or other tech.

Refer to Appendix 2 for other comments.

Summary

New Zealand's three waters system (drinking water, waste water and storm water) is critical for NZ's public health and safety, environmental protection, and economic prosperity and security.

The regulation of drinking water requires urgent attention. The Water industry needs to support industry training and attract more younger people to replace the ageing workforce.

Job roles and responsibilities in the water treatment industry that were developed in 2012 are equally relevant in 2019, and thus the qualifications remain relevant. Wastewater system designers have been identified as a further role in the water treatment industry.

There are twice as many people enrolled in the Drinking-Water Multistage Processes (59) as in the Wastewater Multistage Processes (31), and low numbers in the other two certificates.

A greater proportion of people in the older age groups completed their certificate in 2018. A greater proportion of Maori completed their certificate. There were low numbers of withdrawals.

Feedback about the qualification indicated some dissatisfaction with online delivery.

Recommendations

1. Retain current qualifications with revised conditions (report, Water Safety Plan).
2. Apply to develop a replacement qualification for NC Domestic Wastewater Treatment (On-site Domestic Wastewater System Design).
3. Review the unit standards used to assess wastewater system designers.

References

Controller and Auditor General. (2010). *Local authorities: Planning to meet the forecast demand for drinking water.* Retrieved from https://www.oag.govt.nz/2010/water/part1.htm on 7 May 2019.

Department of Internal Affairs (DIA). (2019). *The Three Waters Review: key points.* Retrieved from https://www.dia.govt.nz/Three-waters-review on 6 May 2019.

Infometrics. (2019). *Connexis sector profiles.* Retrieved from https://sectors.infometrics.co.nz/Infographics

Mahuta, N. (2018). *Counting the costs of safe, clean water.* Retrieved from https://www.beehive.govt.nz/release/counting-costs-safe-clean-water on 6 May 2019.

Ministry of Health. (2019). *Drinking water legislation.* Retrieved from https://www.health.govt.nz/our-work/environmental-health/drinking-water/drinking-water-legislation on 7 May 2019.

Appendix 1: Water treatment industry – Roles and responsibilities

The following table covers the roles and responsibilities of people working in the water treatment industries, and the knowledge, skills and attributes required from someone who is operating competently in those roles.

Role	Areas of responsibility/description of role	Skills/knowledge/attributes for the role
Small system operator	• Responsible for a small-scale water treatment plant, including community/marae/school water treatment operations. Will be a range of different plant types/treatment processes here. Some of these could be the same treatment processes as larger plants, but on a much smaller scale.	***Skills*** • Operate a basic/small/simple water treatment plant in a community/marae/school context. ***Knowledge*** • Water sources • Legislation (overview) • PHRMP's (basic knowledge) • Water treatment processes • Risks/consequences involved ***Attributes*** • Ability to work autonomously and follow guidelines • Reasonable literacy level • Some communication skills
Plant assistant	• Ensure own safety • Work under supervision • Handle chemicals • Grounds maintenance • General maintenance • General labouring, loading/unloading etc. • Assist in all aspects of operating a water or wastewater treatment plant, as directed by a supervisor.	• Be able to work within a health and safety framework and ensure own compliance with that. • Basic understanding of chemicals, from an H and S perspective. • Vehicle/machinery use (grounds maintenance) • Use of hand tools (maintenance) • Basic knowledge of plant/equipment (for maintenance purposes) • Timeliness/punctuality

Plant operator	• Responsible for day to day operation of treatment processes and plant. This includes:
	  ○ Monitoring
	  ○ Recording
	  ○ Reporting
	  ○ Maintenance
	• Operates under broad guidance
		Skills
		• Sampling *(significantly more in wastewater treatment)*
		• Operation of various treatment processes
		• Keeping records
		• Reporting to supervisor
		• Maintaining plant/equipment.

	• Arrange specialist support as necessary • Dealing with public/visitors • Management of bio solids	• Ensuring safety of plant and staff. Hazard management. • Arrange and manage specialist contractors • Interface with plant visitors (as directed) • Ensure correct management of bio solids ***Knowledge*** • Water or Waste water treatment processes (not just their own plant) • Relevant legislation • Some chemical processes/chemistry • Water quality and what can cause problems ***Attributes*** • Working as part of/leading a team • Fairly high level of literacy and numeracy • Communication skills (e.g. dealing with visitors/staff). • Ability to meet targets.

Plant Supervisor	• Ensure operation of water treatment plant – usually by managing operators but could be more hands on in smaller plants.
	• Have overall responsibility for:
	  ○ Quality of water (water production) or quality and disposal of effluent and biosolids.
	  ○ Efficient running of plant (optimization)
	  ○ Responsibility to meet service delivery targets
	  ○ Staff management (incl contractors)
	  ○ Budgeting – setting and controlling
	  ○ Dealing with public/plant visitors
	  ○ Could be supervising multiple plants
	  ○ Maintenance of plant
	  ○ Managing daily tasks and KPIs
	  ○ Management of biosolids
	  ○ Reports to plant manager
		Skills
		• Set and manage budgets
		• Optimise and manage plant
		• Report to plant manager
		• H.R. Management
		• Management of bio solids
		Knowledge
		• Knowledge of ***the management of*** a range of water treatment processes (different to the operator's knowledge of this, which is more technical).
		• Knowledge of legislation and PHRMP's
		Attributes
		• Manage a team
		• High level communication skills
		• Ability to meet targets

Lab Technician	• Testing and auditing water quality • Data input	Although may be part of a team in a larger plant, the qualifications for this position sit outside the water treatment industry

Ministry of Health Drinking Water assessor	Ensure water treatment plants are complying with NZ Drinking water standards, that their PHRMP's are adequate, and that they are complying with their PHRMP. Are generally Public health officers who are qualified drinking water assessors. Careers NZ state it is a requirement of Ministry of Health (MoH) designation for DWA's to have the (discontinued) ND Drinking Water Assessment.	***Skills*** • Ability to apply knowledge of treatment processes and PHRMP's when conduction plant inspections. ***Knowledge*** • Specialist knowledge of legislation, drinking water standards and PHRMP's • Specialist knowledge of water treatment processes ***Attributes*** • Able to communicate well with Plant operators and supervisors • Report writing • Planning skills
Plant Manager	• Often manages multiple plants • Overall responsibility for management of finances, plant, HR, training, water quality, plant efficiency. • High level relationships/ PR e.g. politicians/media/councillors etc • Responsibility for plant and catchment protection/security • Responsibility for PHRMP	As supervisor but at a higher level. Likely to either be Degree qualified or have the Level 5 diploma and have moved up from supervisors to managers. Any extra qualifications they need for this transition are more likely to be management based, rather than water industry.
Process engineer	• Focus on optimisation of water treatment process • Design • Commissioning • Project management	Although may be part of a team in a larger plant, the qualifications for this position sit outside the water treatment industry
Wastewater system designers	• design, installation, monitoring, and regulation of on-site domestic wastewater systems.	***Skills*** • Site and soil evaluation for, and design, an on-site domestic wastewater system. ***Knowledge*** • Domestic wastewater treatment processes, land application systems and their selection, hydraulics and pump types and fittings, and package treatment for wastewater land application systems. ***Attributes*** • Planning and design • Communication

Appendix 2: Feedback from survey

Comments about qualification
not supplied with the relevant course notes
The course lacks in content. Often repeat a topic from one unit to another. To explain a concept they think the more words the better, and they don't go straight to the point. They can say the same with a quarter of the words they use. Many important topics for water treatment have been left out of the course. And some topics only touch the surface, when they explain them. For a 9000 dollar per person certificate they could do a better job. The software to simulate a water treatment plant does not teach me anything but changing timers.
The qualification doesn't seem to go into as much detail as I had hoped. The majority of it is just finding procedures and emailing them to the assessor.
This question is hard to answer as the operators have not finished the inaugural course and because the feedback to the employer is non-existent.
Suggestions for improvement
Communication between employer and ITO to give some guidelines on times expected to complete materials and progress
It feels quite light on content, more of an overview than in detail. Which is good for the videos, but it would be good to have reference material that isn't just links to other websites. I am particularly disappointed that block course is now only one week. My best learning is hands on supported by material I can review and as an operator I feel this will be common across the industry. It feels like as a customer I am being cut short compared to those that have gone before me. The help function on each page doesn't work – clicking it takes you to a generic portal where you can't even log in to. It would be better if you could do a help inquiry about the page you are on rather than the generic help feature as this apparently goes through many people and I was told off for using it rather than calling my assessor. Especially as some pages have spelling mistakes etc, it would be of value to connexis to improve these for future students. I have no motivation to report via a general help feature and am reluctant to call my assessor for small things. I find the course material interesting but have struggled without having the material in printed/offline form, particularly during assessments. I am not a particularly good visual learner and although the videos are good having to go in and out and in and out of videos to assessments is a pain as connexis only allows one window to be open at a time. I understand why it is restricted to one window, however without supplementary material these are a challenge and doesn't assist my learning that much by doing it.
no course notes provided with this course and web site is not fit for purpose
Not all assessments are fair and equal to all students. e.g. being asked to provide a standard operating procedure or policy for a particular task. Some people will have access to this to download but if not being asked to design and type out a new policy or procedure hardly seems like a fair way of assessing especially as we are not being trained in writing policies and procedures. Another suggestion is to not make practice tasks compulsory as these do not always provide any meaningful help for those who are confident in study.
Please don't repeat the same topic 3 times, looks like you lost sight of what you want to teach.
should upload all the unit standard and available to do.
Some material to keep for future reference, as i assume that once I complete the course, access to the E learning will cease?
The old certificate had each module or task being signed up by a manager or other tech. This is more in line with apprenticeships I have done in the past. This qualification requires no input from anyone else.
would be good to have hard paper copy of DWS. do we have a hard paper copy of the course materiel and notes that we can refer to in the future?