Concession Application
Form 3b – Private/commercial facility/structures

The Department recommends that you contact the Department of Conservation Office closest to where the activity is proposed to discuss the application prior to completing the application forms. Please provide all information requested in as much detail as possible. Applicants will be advised if further information is required before this application can be processed by the Department.

This form is to be used when the proposed activity is the building or use of any private or commercial facility or structure on public conservation land managed by the Department of Conservation. Examples may include lease of land to erect an information centre; authorisation to erect a weather station; or construct or lease a private/commercial campground or lodge. This form is to be completed in conjunction with either Applicant Information Form 1a (longer term concession) or Applicant Information Form 1b (one-off concession) as appropriate.

Please complete this application form, attach Form 1a or Form 1b, and any other applicable forms and information and send to permissions@doc.govt.nz. The Department will process the application and issue a concession if it is satisfied that the application meets all the requirements for granting a concession under the Conservation Act 1987.

If you require extra space for answering please attach and label according to the relevant section.

A. Description of Activity

Please describe the proposed activity in detail – where the site is located, please use NZTM GPS coordinates where possible, what you intend to use the building for, whether you intend to make any changes to the infrastructure.

Please include the name and status of the public conservation land, the size of the area for which you are applying and why this area has been chosen.

If necessary, attach further information including a map, a detailed site plan and drawings of proposal and label Attachment 3b:A.

The proposed activity Taupō District Council (TDC) is requesting approval for the construction and on-going operation of a new Drinking Water Treatment Plant (WTP) with the following

- Overall site area is expected to be 30m x 30m – 900m^2 to provide adequate space for the below
- Construction of a 170 m^2 building to house the Hatepe WTP.
- Hard surface (asphalt/concrete) around the WTP and associated processes and tanks on the outside of the building – Treated water tank, Feed water tank, Clarifier, Backwash tanks and CIP Waste.
- Hard surface access Road (asphalt) – estimated 4m wide and 165m long
- Perimeter fence around access road and WTP permitter – 2.4m high
- Vehicle gate at the entrance off SH1
- Buried water pipelines (treated and raw-water) - as outlined in in the below attachment
- Buried electrical & communication services

Please refer to attachment X for the proposed draft layout and attachment X for an outline of the process description and plant requirements

B. Alternative sites considered

If your application is to **build, extend or add** to any permanent or temporary structures or facilities on public conservation land, please provide the following details:

- Could this structure or facility be reasonably located outside public conservation land? Provide details of other sites/areas considered.
- Could any potential adverse effects be significantly less (and/or different) in another conservation area or another part of the conservation area to which the application relates? Give details/reasons

TDC has investigated all alternative sites within the wider vicinity of Hatepe Village. There is no suitable TDC land within the village and surrounding reserves.

As a result of the lack of Council owned land TDC worked in partnership with Opawa Rangitoto 2C and local whanau and hapū.

After a robust process it was clear there was also no suitable land within the Opawa Rangitoto 2C Trustee's land or owned by local whanau/hapū. Due to this lack of suitable land for the WTP Council are seeking this concession to ensure we can supply the residents and local whanau/hapū with a safe and secure water source.

It's important to note that the current WTP process is not compliant with the NZ Drinking Water Standards and the location of the existing WTP process building is to small and not suitable to build a suitable plant the meets the required standards for Hatepe.

A summary below outlines the limitations of the land within the vicinity of Hatepe Village

TDC Reserve Land:

TDC own 2 sections of land in the surrounding area of the village (Hinemaia Stream Recreation Reserve & Hatepe Esplanade Reserve). These 2x areas are either to small, have limited access, or pose a natural hazard from flood risk, resulting in them being not suitable for key Council infrastructure.

Hinemaiaia Stream Recreation Reserve – not suitable due to poor natural hazard assessment (flood risk) & limitations with suitable access

Hatepe Esplanade Reserve – unsuitable due to the small size and proximity to the Lake

Hatepe State Highway 1 Reserve – unsuitable due to the small size, lack of access and proximity to the Papakāinga

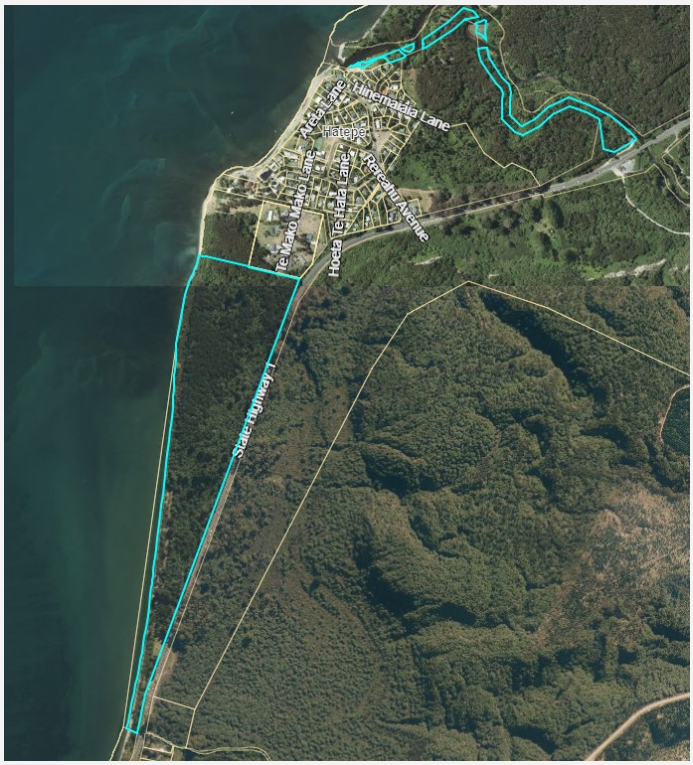
Māori Trust land

56 Rereahu Avenue Hatepe, Proprietors of Opawa Rangitoto 2G – This trust did not provide TDC with security of a long-term lease for a key Council asset.

The Proprietors of Opawa Rangitoto 2C Inc – Main landowner in the Village & in support the project. The trust has offered some potential sites, one being the old fire station location at the end of Hoeta Te Hata Lane, however this is too small and is in close proximity to residential properties. There is no other suitable land within their control.

112 Te Mako Mako Lane Part Te Makomako Block – Note suitable, Maori Reservation land

Paaka Recreation Reserve – Note suitable, settled as part of Ngāti Tūwharetoa Deed of Settlement, administered by Te Kotahitanga o Ngāti Tūwharetoa Trust



C. Larger area

Is the size of the area you are applying for **larger** than the structure/facility **YES**

If **yes**, please detail the size difference in the box below, and answer the following 3 questions, if **no** please go on to the next section:

As per the layout attachment the total required area is m^2 – this is broken down as below

- Access Road 660 m^2
- Site 900m^2
- Building (within site) 170m^2

Please refer to draft site layout maps for the extent of this – as per 2x attachments "Draft Site Layout - Sheet 1 & Sheet 2"

Is this necessary for safety or security purposes? **YES**

Is this necessary as an integral part of the activity? **YES**

Is this essential to carrying on the activity? **YES**

If the answer to any of the above is yes, please provide details and attach supporting evidence if necessary and label Attachment 3b:C.

- Access Road: This is essential to provide safe access to the facility
- Site: this is larger than the building as it is required to provide vehicle parking and for the external process tanks and process equipment (as detailed in the draft layout)

D. Exclusive possession

Do you believe you need **exclusive possession** of the public conservation land on which your structure/building is located, ie no one else can use the land during your use of it? **YES**

(Exclusive occupation requires a lease which requires public notification of the application)

If **yes**, please answer the following 3 questions, if no please go to the next section:

Is exclusive possession necessary to protect public safety? **YES**

Is exclusive possession necessary to protect physical security of the activity? **YES**

Is exclusive possession necessary for the competent operation of the activity? **YES**

If the answer to any of the above is yes, please provide details and attach supporting evidence if necessary and label Attachment 3b:D.

Yes, to all of the above

- TDC are required to protect this site from the public, this is a controlled site with a number of hazards that the public are required to be protected from.
- For water supply safety the water treatment plant is also required to have restricted access to ensure the public cannot easily access the treated water supply.
- TDC are also required to ensure the site is secure to reduce the chance of vandalism.

To protect the public and the water treatment process TDC propose installing a vehicle gate at the entrance off SH1 and a 2.4m perimeter fence around the wider site – this will also potentially reduce the current illegal dumping of waste within the reserve.

Please refer to draft site layout maps for the extent of this – as per 2x attachments “Draft Site Layout - Sheet 1 & Sheet 2”

E. Technical Specifications **(for telecommunications sites only)**

Frequencies on which the equipment is to operate

N/A

Power to be used (transmitter output)

N/A

Polarisation of the signal

N/A

Type of antennae

N/A

The likely portion of a 24 hour period that transmitting will occur

N/A

Heaviest period of use

N/A

F. Term

Please detail the length of the term sought (i.e. number of years or months) and why.

Note: An application for a concession for a period over 10 years must be publicly notified, an application for a concession up to 10 years will not be publicly notified unless the adverse effects of the activity are such that it is required, or if an exclusive interest in the land is required.

30 Years –Taupō District Council are seeking the 30-year period due to the fact the treatment plant is critical infrastructure and security of site due to the importance of this, and the large investment in this water treatment plant ($4-5million).

G. Bulk fuel storage

Under the Hazardous Substances and New Organisms Act 1996 (HSNO Act) 'Bulk fuel storage' is considered to be any single container, stationary or mobile, used or unused, that has a capacity in excess of 250 litres of Class 3 fuel types. This includes petrol, diesel, aviation gasoline, kerosene and Jet A1. For more information on Hazardous Substances, go to: http:/www.business.govt.nz/worksafe/information-guidance/legal-framework/hsno-act-1996

Do you intend to store fuel in bulk on the land as part of the activity? **NO**

If you have answered yes, then please provide full details of how and where you intend to store the fuel, and label any attachments including plans, maps and/or photographs as Attachment 3b:G. If your concession application is approved you will be required to provide a copy of your HSNO compliance certification to the Department before you begin the activity.

Nil

H. Environmental Impact Assessment

This section is one of the most important factors that will determine the Department's decision on the application. Please answer in detail.

In column 1 please list all the locations of your proposal, please use NZTM GPS coordinates where possible. In column 2 list any special features of the environment or the recreation values of that area. Then in column 3 list any effects (positive or adverse) that your activity may have on the values or features in column 2. In column 4 list the ways you intend to mitigate, remedy or avoid any adverse effects noted in column 3. Please add extra information or supporting evidence as necessary and label Attachment 3b:H.

Refer to Steps 1 and 2 in your Guide to Environmental Impact Assessment to help you fill in this section.

Location on public conservation land	Special feature or value	Potential effects of your activity on the feature or value (positive or adverse)	Methods to remedy, mitigate or avoid any adverse effects identified
Hinemaiaia Scenic Reserve. NZTM 5694806, 1861846	Possible bat roost trees - Large eucalyptus, pine and poplar trees	Loss of potential bat roosts due to construction.	Felling of large trees will be avoided wherever practicable, and only selective trimming carried out if required. A survey using bat recording devices may be required if it is found that any large tees require felling
Hinemaiaia Scenic Reserve. NZTM 5694806, 1861846	Significant Natural Area - Indigenous dominant kānuka forest, and whauwhaupaku-kōhūhū forest	Adverse potential effect – loss of indigenous dominant vegetation. Adverse potential effect – spread of weeds within the site due to construction. Positive potential effect – reduction of weeds and increase in the overall indigenous dominance of this site.	Loss of indigenous dominant forests avoided, as WTP site was selected within cotoneaster-blackberry-Japanese honeysuckle scrub following initial ecological survey to avoid areas of ecological significance. To prevent the spread of weeds from the site the cotoneaster-blackberry-Japanese honeysuckle scrub within the site footprint will be sprayed with herbicide, and any mulching will be done to leave all material on site (chop and drop), not transport it from site. Spread of weeds within the site avoided through good vehicle hygiene practices during construction. Removal of at least 900m2 of cotoneaster-blackberry-Japanese honeysuckle scrub within WTP footprint. Search and destroy survey for all climbing spindleberry within the 8.9 ha between

			State Highway 1, and the Hinemaiaia Cliffs
Hinemaiaia Scenic Reserve. NZTM 5694806, 1861846	Scenic values – Scenic Reserve	Possible visual impact.	The proposed location of the WTP 100m back from the road will minimise visual impacts, as the existing vegetation will shield it from view. The proposed location of the WTP is within exotic within cotoneaster-blackberry-Japanese honeysuckle scrub of low scenic value. Paint colour and building material colour will be chosen that will blend into the surroundings and reduce visual impact of the plant

I. Other

Is there any further information you wish to supply in support of your application? Please attach if necessary and label Attachment 3a:I.

Please see attachments for letters of support from Hatepe Residents association and local hapū. Additionally, please also see attached full Ecological assessment related to this project

Application for an Easement on Public Conservation Land

Department of Conservation
Te Papa Atawhai
New Zealand Government

Is this the right application for me?

Use this application form if you seek an easement concession across public conservation land, either to benefit other land or in gross (e.g. right of way), for the following purpose:

- a right to convey water.
- a right to drain water.
- a right to drain sewage.
- a right of way.
- a right to convey electricity.
- a right to convey telecommunications.
- a right to convey gas.

Use this form for new applications and variations to an existing easement concession across land administered by the Department of Conservation (DOC).

How do I complete this application form?

- Complete all sections of this form.
- DOC encourages electronic applications (e.g. a typed Word document), rather than handwritten applications. Electronic applications are easier to read and less likely to be returned to you for clarification.
- If you need extra space, attach or include extra documents and label them according to the relevant section. Record the document details in section **L Attachments**.
- It is recommended that you read the standard and optional terms and conditions in the concession (easement) template[1] to inform your application.

Personal information will be managed by DOC confidentially. For further information check DOC's privacy and security statements.

If I need some help, where do I get more information?

- Check DOC's Access/Easement[2] webpage.
- Arrange a pre-application meeting (either face to face or over the phone) by contacting the local DOC office[3] closest to where your activity is taking place. You can use DOC maps[4] to identify which District Office you should contact. Or arrange a meeting with any of our offices that process concessions[5] – choose the one closest to where the activity is proposed.
- It is recommended that you seek legal advice for guidance when completing this form.

[1] https://www.doc.govt.nz/globalassets/documents/about-doc/concessions-and-permits/concessions/concession-contract-easement.pdf
[2] https://www.doc.govt.nz/get-involved/apply-for-permits/business-or-activity/access-easements/
[3] https://www.doc.govt.nz/footer-links/contact-us/office-by-name/
[4] http://maps.doc.govt.nz/mapviewer/index.html?viewer=docmaps
[5] https://www.doc.govt.nz/get-involved/apply-for-permits/contacts

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Have you considered DOC's statutory planning documents?

Your easement concession must not be inconsistent with DOC's relevant statutory planning documents[6] as they set out how DOC and our Treaty partners manage public conservation land. Statutory planning documents can have a direct impact on your application.

Book a pre-application meeting with DOC staff if you require assistance navigating DOC's statutory planning documents.

Have you considered the environmental effects of your easement concession?

It is your responsibility, as the applicant for the concession (easement), to **provide a detailed description** of the:

- Activity.
- The potential effects.
- Ways that you can remedy, mitigate or avoid any potential adverse effects.

A list of potential effects is supplied in this application form, under section **K Effects Assessment** for you to consider and attach to this application. The size and scale or your environmental effects assessment should be in proportion with the size and sale of the activity and its potential effects. You will need to describe the existing environment, the potential effects and describe your methods to avoid, remedy or mitigate these effects. For further information check DOC's Environmental Impact Assessment[7] and DOC's guide to preparing your environmental impact assessment[8]. We also recommend that you read the standard conditions in the concession (easement) template[9] about protecting the environment to inform your application. In many cases an Assessment of Environmental Effect (AEE) prepared for a resource consent under the Resource Management Act 1991 may be sufficient.

Book a pre-application meeting with DOC staff if you require assistance in scoping the environmental effects you will need to consider in your application.

How do I submit my application?

Email your completed application, recommended location forms, and any other attachments to:

permissions@doc.govt.nz

What happens next?

Once received, your application will be assessed by DOC. If your application is complete, DOC will begin processing.

If your application is incomplete it will be returned to you for more information.

Why does DOC ask for this information?

The questions in this application form are designed to cover the requirements set out in conservation legislation. Your answers allow us to assess:

- The effects of your activity and your proposed methods to avoid, remedy or mitigate any adverse effects of the activity.
- Your qualifications, resources, skills and experience to adequately conduct the activity on public conservation land.

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[6] https://www.doc.govt.nz/about-us/our-policies-and-plans/statutory-plans/

[7] https://www.doc.govt.nz/get-involved/apply-for-permits/managing-your-concession/environmental-impact-assessment/

[8] https://www.doc.govt.nz/globalassets/documents/about-doc/concessions-and-permits/concessions/guide-to-environmental-impact-assessments.pdf

[9] https://www.doc.govt.nz/globalassets/documents/about-doc/concessions-and-permits/concessions/concession-contract-easement.pdf

- Your creditworthiness is a factor in determining whether DOC should extend credit to you and set up a DOC customer accounts receivable credit account for cost recovery. To make this assessment DOC will supply your information to a credit checking agency.

Note: Information collected by DOC will be supplied to a debt collection agency in the event of non-payment of payable fees.

Treaty Partner consultation

DOC has a statutory responsibility to give effect to the principles of the Treaty of Waitangi. One component of this may be DOC consulting with Treaty Partners about your application. This consultation will feed into DOC's decision-making process. More information can be found on the DOC website on our iwi/hapū/whānau consultation[10] page.

Contact your local DOC office[11] if you require further information about consultation.

What fees will I pay?

You may be required to pay a **processing fee** for this application regardless of whether your application is granted or not. You may request an estimate of the processing fees for your application. If you request an estimate, DOC may require you to pay the reasonable costs of the estimate prior to it being prepared. DOC will not process your application until the estimate has been provided to you. In addition, if you are granted an easement concession over public conservation land you may also be required to pay a **bond, insurance, monitoring fees and ongoing concession easement activity[12] and management fees**. Minor easement concession fees are listed on the Access/Easement[13] page on the DOC website.

DOC will invoice your processing fees after your application has been considered. If your application is large or complex, DOC may undertake billing at intervals periodically during processing until a decision is made. If you withdraw your application DOC will invoice you for the costs incurred up to the point of your withdrawal.

Your application will set up a credit account with DOC. See the checklist at the end of the form for the terms and conditions you need to accept for a DOC credit account.

Will my application be publicly notified?

- Your application for an easement concession may be publicly notified if having regard to the effects of the activity it is considered appropriate to do so.[14]

What does DOC require if my application is approved?

If your application is approved DOC may require:

- **Insurance** to indemnify the Minister of Conservation against any claims or liabilities arising from your actions. The level of insurance cover will depend on the activity.
- A **bond** may be required to be in place before undertaking your activity.[15]

Note: The Minister can vary the easement concession if the information on which the easement concession was granted contained material inaccuracies. DOC may also recover any costs incurred.

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[10] https://www.doc.govt.nz/get-involved/apply-for-permits/iwi-consultation/
[11] https://www.doc.govt.nz/footer-links/contact-us/office-by-name/
[12] https://www.doc.govt.nz/get-involved/apply-for-permits/managing-your-concession/ongoing-concession-fees/
[13] https://www.doc.govt.nz/get-involved/apply-for-permits/business-or-activity/access-easements/
[14] http://www.legislation.govt.nz/act/public/1987/0065/latest/DLM7475509.html
[15] http://www.legislation.govt.nz/act/public/1987/0065/latest/DLM104654.html

Registration

If you wish to register the easement concession on the Record of Title (formerly known as a Certificate of Title) you need to:

- Discuss with DOC your intention to register your application.
- Record your intent to register in section **M Registration on a Record of Title**.
- Gain DOC's permission to register your application.
- Engage your own legal advice to complete your registration.
- Check the conditions in the concession (easement) template.
- Provide detailed plans to DOC (GIS shapefiles (.shp) are recommended).

Note: The applicant will be responsible for registering the easement concession and all the costs of registration.

A. Applicant details

Legal status of applicant (tick)	☐ **Individual** (Go to ❶)		
	☐ **Registered company** (Go to ❷)	☐ **Trust** (Go to ❷)	
	☐ **Incorporated society** (Go to ❷)	☒ **Other** (Go to ❷)	

❶	**Applicant name (individual)**			
	Phone		**Mobile phone**	
	Email			
	Physical address		**Postcode**	
	Postal address (if different from above)		**Postcode**	

❷	**Applicant name (full name of registered company, trust, incorporated society or other)**	Taupō District Council		
	Trading name (if different from applicant name)			
	NZBN (To apply go to: https://www.nzbn.govt.nz)	9429000034876	**Company, trust or incorporated society registration number**	N/A
	Registered office of company or incorporated society (if applicable)	72 Lake Terrace, Taupo, New Zealand, 3330		
	Company phone	+64 07 3760899	**Company website**	http://www.taupodc.govt.nz
	Contact person and role	Sec 9(2)(a)		
	Phone	Sec 9(2)(a)	**Mobile phone**	Sec 9(2)(a)
	Email	Sec 9(2)(a)		
	Postal address	Private Bag 2005, Taupo	**Postcode**	3352
	Street address (if different from postal address)	46 Horomatangi Street, Taupō 3330	**Postcode**	3330

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B. Variation of an existing easement concession.

Is this application *varying* an existing easement concession?

No	☑
Yes	☐
Easement concession number you wish to vary	

C. Pre-application meeting

Have you had a pre-application meeting or spoken to someone in DOC in relation to this application?

No	☐
Yes	☑

If yes, state when and who you met/spoke with.

Lisa Loughlin – 23/08/2023

D. Location and nature of the proposed easement concession

Name (physical description/common name) and land status of public conservation land on which the concession (easement) will cover.

Hinemaiaia Scenic Reserve - Part Section 2 Block I Waitahanui SD – Reserve (Public Conservation Land)

Will your easement concession benefit other land?

No	☑
Yes	☐

If yes, provide the Lot, Deposited Plan (DP) and record of title of the other land that the easement concession will benefit.

Published 29 October 2019

Provide the following documents (as attachments) and record the document details in the section L Attachments of this form:

- **Detailed site plan** - with proposed easement, for example:
    - For a road: the length, width, area and position where the easement will be situated.
    - For a pipe: length, width, diameter of the pipe, area and position where the easement will be situated.
    - For telecommunications: mast dimensions and type, including height, site footprint (m²) and position where the easement facility will be situated.
- **Map** of the site
- **Aerial photo** of the site
- **Drawings of the proposal (**DOC's recommendation is for a GIS shapefiles (.shp) especially if you are going to register the easement on the title of the land)
- **GPS coordinates** (if available) and **provisional survey plan** (if available).

Record the document details in the section L Attachments of this form.

E. Description of activity

Select (by ticking the box) all the easement concession types you are applying for:

A right to convey water:	☒
A right to drain water:	☒
A right to drain sewage:	☐
A right of way:	☒
A right to convey electricity:	☒
A right to convey telecommunications:	☒
A right to convey gas:	☐

Describe in detail the reasons for your proposed easement concession, including why an easement is required (as opposed to a lease, license or permit). Location details can be completed in section D.

An easement is required for Taupō District Council to build the new Hatepe Water Treatment plant. This will result in the Hatepe Residents being able to be supplied with a safe and consistent water supply that meets New Zealand's Drinking Water Standards.

To construct and operate this plant Taupō District Council are seeking the easements outlined above which will ensure the plant can operate as required and assess is supplied for staff to safely attend site.

F. Permanent or temporary structures or facilities

As part of your easement, do you wish to build, extend or add to any permanent or temporary structures or facilities on public conservation land (e.g. pipes, pumps, pump sheds, storage tanks, towers, poles, fences, storage facilities)?

No	☐
Yes	☑

If yes, answer the following four questions.

❶ Provide full details about the structure or facility (e.g. dimensions, materials, location, purpose) and methods of construction (e.g. number of people and vehicles involved).

Permanent WTP Features:

- Overall site area is expected to be 30m x 30m – 900m^2 to provide adequate space for the below:
- Construction of a 170 m^2 building to house the Hatepe WTP (water treatment plant) – this will be constructed out of timber framing, clad in profiled steel with a colour that blends in with the surrounding environment. Noting it will not be visible from the road.
- Hard surface (asphalt/concrete) around the WTP and associated processes and tanks on the outside of the building – Treated water tank, Feed water tank, Clarifier, Backwash tanks and CIP Waste; these will be constructed out of a mixture of materials, from bolted steel, steel and High-Density Polyethylene (HDPE).
- Any chemicals stored on site will be contained in a sealed bund (with no outlets) hat can hold at least 110% of the chemical stored in that bund, these bunds will also have switches that alert TDC operators if there has been a spill.
- There will be no external waste streams on site – waste streams such as building amenities, filter backwash & CIP process waste streams will be stored on site in a 10m^3 tank/vault that will be periodically emptied by a tanker (expected to be weekly emptying)
- Stormwater from hard surfaces and the building roof will be disposed of within the site by way of on-site storage that meets the Building Consent requirements.
- Hard surface access Road (asphalt) – estimated 4m wide leading from SH1
- Perimeter fence around access road and WTP permitter – 2.4m high
- Vehicle gate at the entrance off SH1
- 2X Buried water pipelines; treated and raw-water; Approx. 150mm HDPE pipes – these will follow the alignment of the access road off SH1
- Buried electrical & communication services

- Once the WTP is complete, 1x TDC staff will be expected to attend site daily – however this is only anticipated to be for 1-2hrs at a time

Please refer to draft site layout maps – as per 2x attachments “Draft Site Layout - Sheet 1 & Sheet 2”

Additionally, for the Technical requirements of the plant please refer to attachment “Hatepe WTP Principal Requirements”

Construction Activities

- If the concession/lease is granted, prior to finalising the design TDC will need to undertake some geotechnical testing around the building footprint – this will be approximately 2 bore holes and 2 – 4 cone penetration tests.
- TDC are also happy to work with DOC to ensure they are comfortable with the build methodology and plan, as it progresses.
- Construction will be for a duration of 10-12months.
- There is expected to be between a range of contractors on site during this construction time – with a peak of 15-20 people on site during the peak of this construction period.
- Site will have all the required temporary amenities to support these staff (ablutions etc).
- A full site environmental management plan is required to be submitted and approved by the council prior to works commencing.
- TDC will be required to be granted a Resource Council from the Waikato Regional Council and a Building Consent for this work – works won’t commence until these are granted.
- Prior to construction approximately 1000m^2 of exotic vegetation will be required to be cleared (as per Ecological Assessment) for the site and approximately 1000m^2 for the construction of the access road.

❷ Will you or do you own the structure?
- If yes, will you have co-sitees located on the structure?
- If yes, provide details of any co-sitees.
- If no, provide details of who owns the structure.

Yes, TDC will own this structure and we have co-sitees located as per an existing easement with DOC for the Hatepe Drinking Water Reservoirs – Concession No# TT-29376-OTH, granted 13th December 2010.

❸ Could your structure or facility, or addition/extension to an existing structure or facility, be reasonably located outside public conservation land?
- If yes, provide details of other sites/areas that have been considered.
- If no, provide reasons why existing structures or facilities outside of public conservation land are not suitable.

TDC has investigated all alternative sites within the wider vicinity of Hatepe Village. There is no suitable TDC land within the village and surrounding reserves.

As a result of the lack of Council owned land TDC worked in partnership with Opawa Rangitoto 2C and local whanau and hapū.

After a robust process it was clear there was also no suitable land within the Opawa Rangitoto 2C Trustee's land or owned by local whanau/hapū. Due to this lack of suitable land for the WTP Council are seeking this concession to ensure we can supply the residents and local whanau/hapū with a safe and secure water source.

It's important to note that the current WTP process is not compliant with the NZ Drinking Water Standards and the location of the existing WTP process building is to small and not suitable to build a suitable plant the meets the required standards for Hatepe.

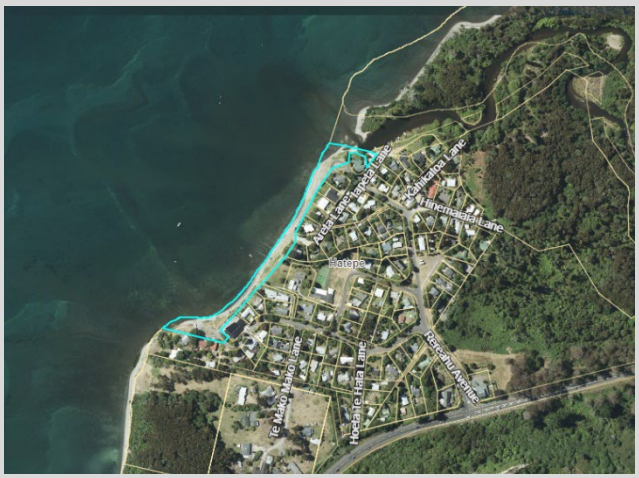
A summary below outlines the limitations of the land within the vicinity of Hatepe Village

TDC Reserve Land:

TDC own 2 sections of land in the surrounding area of the village (Hinemaia Stream Recreation Reserve & Hatepe Esplanade Reserve). These 2x areas are either to small, have limited access, or pose a natural hazard from flood risk, resulting in them being not suitable for key Council infrastructure.

Hinemaiaia Stream Recreation Reserve – not suitable due to poor natural hazard assessment (flood risk) & limitations with suitable access

Hatepe Esplanade Reserve – unsuitable due to the small size and proximity to the Lake



Published 29 October 2019

Hatepe State Highway 1 Reserve – unsuitable due to the small size, lack of access and proximity to the Papakāinga

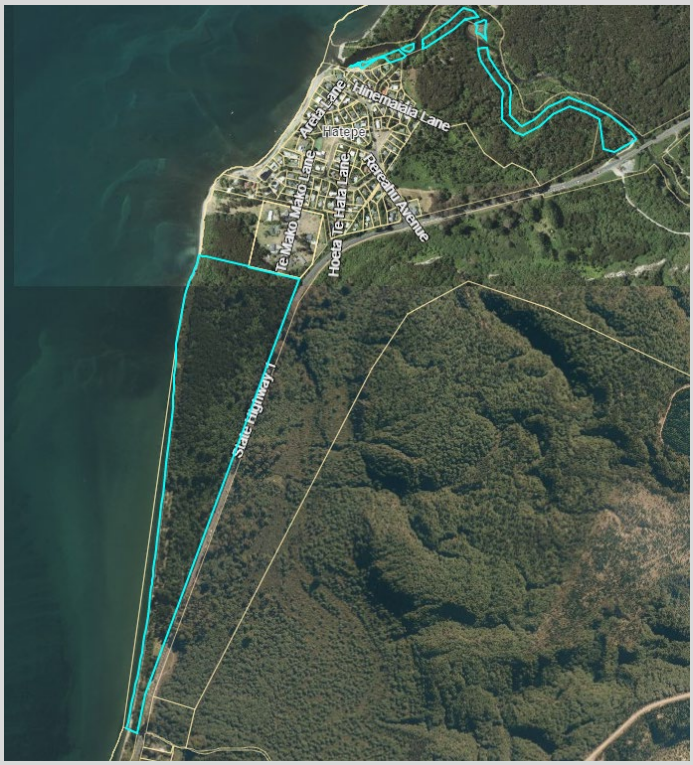
Māori Trust land

56 Rereahu Avenue Hatepe, Proprietors of Opawa Rangitoto 2G – This trust did not provide TDC with security of a long-term lease for a key Council asset.

The Proprietors of Opawa Rangitoto 2C Inc – Main landowner in the Village & in support the project. The trust has offered some potential sites, one being the old fire station location at the end of Hoeta Te Hata Lane, however this is too small and is in close proximity to residential properties. There is no other suitable land within their control.

112 Te Mako Mako Lane Part Te Makomako Block – Note suitable, Maori Reservation land

Paaka Recreation Reserve – Note suitable, settled as part of Ngāti Tūwharetoa Deed of Settlement, administered by Te Kotahitanga o Ngāti Tūwharetoa Trust



❹ Could any potential adverse effects of your structure or facility (or addition/extension to an existing structure or facility) be significantly less (and/or different) in another conservation area or another part of the conservation area you are applying for? Give details/reasons.

No, TDC have identified a location that is deemed to have low adverse effects to the conservation values within the Hinemaiaia Scenic Reserve – Please refer to the Ecological impact assessment reports for an outline of this.

Attachment: Hinemaiaia Water Treatment Ecological Assessment - NSES report16a

❺ Could you use an existing structure or facility? Could you use the existing structure or facility without any additions?

- If yes, provide details of any existing structures or facilities that you have considered using, or how your activity might be undertaken without making an addition to the existing structure or facility.
- If no, provide reasons why any existing structure or facility could not be used without any additions.

No, the current Water treatment plant facility is located in the Hatepe Esplanade Reserve, this is a thin strip adjacent the foreshore. Building a water treatment facility here would not be suitable due to a raft of factors, namely Public Safety and safe operations of the treatment plant. Not to mention the loss of a significant portion of the foreshore for residents and local hapū and increase environmental impacts.

G. Technical Specifications (for telecommunications easements only)

If you are applying for telecommunications sites, you must provide full details about the following information:

Radio frequencies	N/A
Transmitter power output	N/A
Polarisation of the signal	N/A
Type of antennae	N/A
Likely portion of a 24-hour period that transmission will occur	N/A
Likely heaviest period of use during a 24-hour period	N/A
Describe how the site(s) will be accessed (e.g. by foot along x track, by x road, or by a helicopter landing at x)	N/A

H. Are you applying for any other DOC permissions?

Are you applying for other DOC permissions in addition to this easement?

No	☐
Yes e.g. Permanent and temporary structures (that are not part of your easement)	☑

If yes, state the other permits you are applying for?

Concession application for the building of the WTP – Form 3B

I. Duration (term of easement)

In accordance with section 17Z(3)(a)(c) of the Conservation Act 1987, an easement may be granted for a term not exceeding 30 years, except:

(a) In exceptional circumstances, the Minister may grant a term not exceeding 60 years

(b) Where the easement provides a right of way access to a property to which there is no other practical access, the term may be for such longer period as the Minister considers appropriate

(c) Where the easement is for a public work (as defined in the Public Works Act 1981), the term may be for the reasonably foreseeable duration of that public work.

Detail the length of the term sought (i.e. **must be** number of years or months) and why *(Note: in perpetuity/forever or similar meaning is not a term under the Act and not able to be granted)*:

30 years

If you are seeking over 30 years, explain why:

Taupō District Council are seeking the 30-year period. This is due to the fact the treatment plant is critical infrastructure and we are seeking security of site due to this importance and the large investment in this water treatment plant ($4-5million).

J. Consultation undertaken

DOC has a statutory obligation to give effect to the principles of the Treaty of Waitangi. This often requires consultation with our Treaty Partner (iwi/hapū/whānau of local Maori) on your application. If you have already consulted with our Treaty Partner, or with other interested stakeholders (including other parties already located at your proposed location), DOC would like to know about it.

We recommend you discuss consultation with a DOC staff member before starting your application.

Have you carried out any consultation?

No	☐
Yes	☑

If yes, supply details of each Treaty Partner or interested stakeholders consulted with.

Copy and paste the table below and complete for each Treaty Partner or other interested stakeholders. If you received a written response to consultation attach a copy and record all attachments in section 'L Attachments', including:

- Additional pages with the required information
- Written responses to your consultation with Treaty Partners or other interested stakeholders.

Whānau/hapū/iwi or other interested party consulted with:	Taupō District Council contacted Ngāti Tūwharetoa PSGE - Te Kotahitanga o Ngāti Tūwharetoa Trust (TKNT). TKNT directed Taupō District Council to engage with Sec 9(2)(a) (Ngāti Te Rangiita). She subsequently requested that we engage with Sec 9(2)(a) (Whanau contact for Hatepe)
Name of individual you consulted with:	Sec 9(2)(a)
Date of consultation:	Various – approval email 30/07/2023

Form of consultation (e.g. email, meeting):	Various meetings, phone calls and emails
Outcome of consultation:	Support of the site as outlined in our concession application - please refer to attachment "*Hatepe WTP - whanau and hapu support"*

Other interested stakeholders consulted with e.g. Conservation Boards or community groups:	Hatepe Residents Association
Name of individual you consulted with:	Sec 9(2)(a) (Chairperson)
Date of consultation:	27/05/2023
Form of consultation (e.g. email, meeting):	Meeting and email
Outcome of consultation:	Support of the project – please refer to attachment "*Hatepe WTP - Hatepe Residents Association"*

K. Consistency with DOC statutory plans

List the DOC's statutory planning documents[16] relevant to your application.

Tongariro/Taupo Conservation Management Strategy – 2002; noting the Land Inventory sheet for the Hinemaiaia Reserve references the current Water tanks and pipeline

Are you aware of any potential inconsistency of your easement concession with DOC's statutory planning documents?

No	☑
Yes	☐

If you have answered yes, explain why it is inconsistent with the statutory planning documents

N/A

L. Effects assessment

Identify actual or possible effects of the easement concession applied for. Describe the actions you propose to take to avoid, remedy or mitigate any adverse effects. For further information check DOC's Environmental Impact Assessment[17] and DOC's guide to preparing your environmental impact assessment[18].

[16] https://www.doc.govt.nz/about-us/our-policies-and-plans/statutory-plans/
[17] https://www.doc.govt.nz/get-involved/apply-for-permits/managing-your-concession/environmental-impact-assessment/
[18] https://www.doc.govt.nz/globalassets/documents/about-doc/concessions-and-permits/concessions/guide-to-environmental-impact-assessments.pdf

Published 29 October 2019

If you have identified effects or mitigation measures for adverse effects not included in the table below or you have a full Environmental Impact Assessment attach this information to your application. Record this additional information in the table below and in section K as an attachment.

Have you attached a full Environmental Impact Assessment?

Yes	☑
No	☐

If you have answered **no** provide a **description of environmental effects** of your easement concession in the table below including details of the:

- Existing environment
- Potential effects
- Proposed methods to avoid, remedy or mitigate the adverse effect/s.

Description of environmental effects

Location on public conservation land	Special feature or value	Potential effects of your activity on the feature or value (positive or adverse)	Methods to remedy, mitigate or avoid any adverse effects identified
Hinemaiaia Scenic Reserve. NZTM 5694806, 1861846	Possible bat roost trees - Large eucalyptus, pine and poplar trees	Loss of potential bat roosts due to construction.	Felling of large trees will be avoided wherever practicable, and only selective trimming carried out if required. A survey using bat recording devices may be required if it is found that any large tees require felling
Hinemaiaia Scenic Reserve. NZTM 5694806, 1861846	Significant Natural Area - Indigenous dominant kānuka forest, and whauwhaupaku-kōhūhū forest	Adverse potential effect – loss of indigenous dominant vegetation. Adverse potential effect – spread of weeds within the site due to construction. Positive potential effect – reduction of weeds and increase in the overall indigenous dominance of this site.	Loss of indigenous dominant forests avoided, as WTP site was selected within cotoneaster-blackberry-Japanese honeysuckle scrub following initial ecological survey to avoid areas of ecological significance. To prevent the spread of weeds from the site the cotoneaster-blackberry-Japanese honeysuckle scrub within the site footprint will be sprayed with herbicide, and any mulching will be done to leave all material on site (chop and drop), not transport it from site. Spread of weeds within the site avoided through good vehicle hygiene practices during construction. Removal of at least 900m2 of cotoneaster-blackberry-Japanese honeysuckle scrub within WTP footprint. Search and destroy survey for all climbing spindleberry within the 8.9 ha between State Highway 1, and the Hinemaiaia Cliffs

Published 29 October 2019

Hinemaiaia Scenic Reserve. NZTM 5694806, 1861846	Scenic values – Scenic Reserve	Possible visual impact.	The proposed location of the WTP 100m back from the road will minimise visual impacts, as the existing vegetation will shield it from view. The proposed location of the WTP is within exotic within cotoneaster-blackberry-Japanese honeysuckle scrub of low scenic value. Paint colour and building material colour will be chosen that will blend into the surroundings and reduce visual impact of the plant

M. Attachments

Attachments should *only* be used if there is:

- A specific question requiring a map or further information
- Not enough space on the form to finish your answer
- You have additional information that supports your answer
- You wish to make an additional request of DOC regarding the application.

Label each document clearly and complete the table below.

Section of the application form the attachment relates to	Document title	Document format (e.g. Word, PDF, Excel, jpg etc.)	Description of attachment
Concession application 3b – Section I *Easement Application form – Section J*	*Hatepe WTP - TKNT advice*	*PDF*	*Advise from Te Kotahitanga O Ngati Tuwharetoa (PSGE) to consult with Ngati Te Rangiita Hapū*
Concession application 3b – Section I *Easement Application form – Section J*	*Hatepe WTP - Ngati Te Rangiita communication*	*PDF*	*Confirmation from Ngati Te Rangiita to support TDC consulting directly with* Sec 9(2)(a) *(Hapū Rep)*
Concession application 3b – Section I *Easement Application form – Section J*	*Hatepe WTP – whānau and hapū support*	*PDF*	*Support from local whānau*
Concession application 3b – Section I *Easement Application form – Section J*	*Hatepe WTP - Opawa Rangitoto 2C Incorporation support*	*PDF*	*Majority landowner of the Hatepe Village – letter of support for the site location*
Concession application 3b – Section I *Easement Application form – Section J*	*Hatepe WTP - Hatepe Residents Association support*	*PDF*	*Letter of support for site location from Hatepe Residents Association*
Easement Application form – Section F1 *Concession application 3b – Section C*	*Draft Site Layout - Sheet 1*	*PDF*	*Draft site layout*

Published 29 October 2019

Easement Application form – Section F4, Section L Concession application 3b – Section A, Section B, Section H	*Hinemaiaia Water Treatment Ecological Assessment - NSES report16a*	*PDF*	*Environmental Impact Assessment*

N. Registration on a Record of Title

Are you going to register your easement concession (if granted) on the Record of Title (formerly known as the Certificate of Title)?

No	☐
Yes	☑

If yes, you will be responsible for registering the easement concession, including all costs.

O. Checklist

Application checklist	Tick
I have completed all sections of this form relevant to my application and understand that the form will be returned to me if it is incomplete.	☑
I certify that the information provided in this application form and any attached additional forms is, to the best of my knowledge, true and correct.	☑
I have supplied maps to accompany my shapefiles (.shp) and/or NZTM GPS locations listed in section E Locations.	☑
I have detailed, in Section 'K Effects assessment', the easements environmental effects or I have supplied a full Environmental Impact Assessment and attached to section 'L Attachments'.	☑
I have indicated in section 'M Do you intend to register the easement concession' that I do or do not want the easement registered.	☑
I understand if I want the easement registered on the Record of Title I will be paying all the costs of the registration including surveying and independent legal advice.	☑
I have appropriately labelled all attachments and completed section 'L. Attachments' to match.	☑

P. Terms and conditions for a credit account with the Department of Conservation

Have you held an account with the Department of Conservation before?	Tick
No	☐
Yes	☑
If "yes", under what name:	Taupō District Council

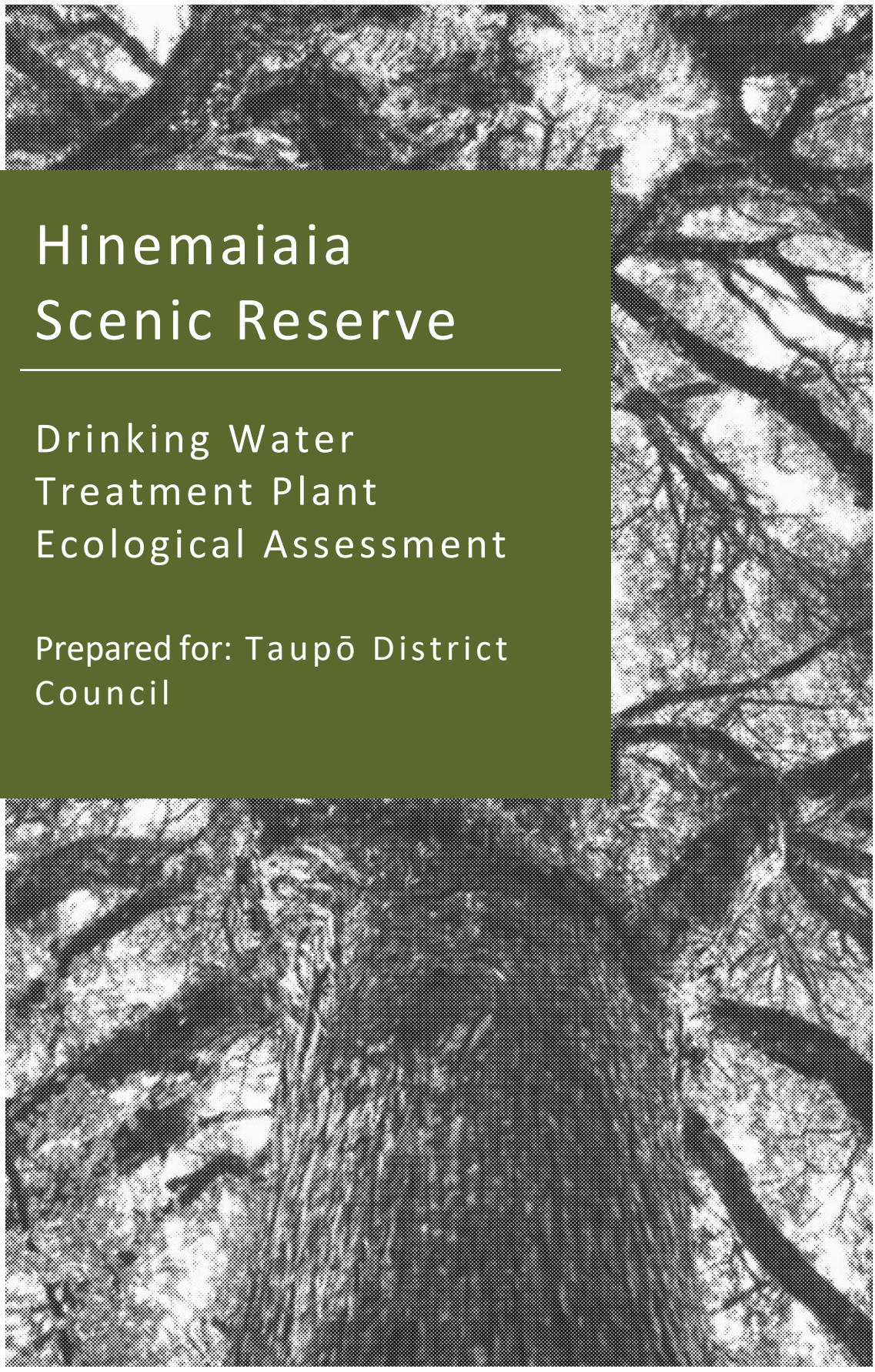
In ticking this checklist and placing your name below you are acknowledging that you have read and agreed to these terms and conditions for an account with the Department of Conservation

Terms and conditions	Tick
I/We agree that the Department of Conservation can provide my/our details to the Department's Credit Checking Agency to enable it to conduct a full credit check.	☑
I/We agree that any change which affects the trading address, legal entity, structure of management or control of the applicant's company (as detailed in this application) will be notified in writing to the Department of Conservation within 7 days of that change becoming effective.	☑
I/We agree to notify the Department of Conservation of any disputed charges within 14 days of the date of the invoice.	☑
I/We agree to fully pay the Department of Conservation for any invoice received on or before the due date.	☑
I/We agree to pay all costs incurred (including interest, legal costs and debt recovery fees) to recover any money owing on this account.	☑
I/We agree that the credit account provided by the Department of Conservation may be withdrawn by the Department of Conservation, if any terms and conditions (as above) of the credit account are not met.	☑
I/We agree that the Department of Conservation can provide my details to the Department's Debt Collection Agency in the event of non-payment of payable fees.	☑

Applicant Name/s (of authorised person/s)	Sec 9(2)(a)	**Date**	

For Departmental use			
Credit check completed			
Comments:			
Signed		**Name**	
Approved (Tier 4 manager or above)		**Name**	

Published 29 October 2019



Hinemaiaia Scenic Reserve

Drinking Water Treatment Plant Ecological Assessment

Prepared for: Taupō District Council

NSES Ltd report 16a:2023/24

SINGERS ECOLOGICAL

Author(s): Sec 9(2)(a) for Nicholas Singers Ecological Solutions Ltd
Date: 12 September 2023

CONTENTS

1. Introduction

Taupo District Council have contracted Singers Ecological to carry out an assessment of the ecological values of Hinemaiaia Scenic Reserve, to inform a request for concession to the Department of Conservation on the location of a new drinking water treatment plant (WTP) for Hatepe Village.

The entire Hinemaiaia Scenic Reserve is 129ha, however, the Taupo District Council outlined an initial area of 8.9 ha between State Highway 1, and the Hinemaiaia Cliffs, opposite Hatepe Village where it would be practical to locate a drinking water treatment plant. Consultation with hapū identified areas where it was not appropriate for a plant to be built for cultural reasons (urupā) and from a perceived health risk (a former greenwaste disposal site which is mapped as a contaminated site in the Taupō District Plan).

Taupo District Council was flexible with regards to location of the plant and was seeking a location within the reserve of low ecological significance, to minimise the ecological impacts of building the plant. An initial survey of the proposed area of the Scenic Reserve was carried out by Alana Delich on the 12th of May 2023, and an initial ecological assessment and vegetation map were produced (NSES Ltd Report 16:2023/24), which identified areas of low ecological value within the reserve. This version of the ecological assessment (NSES Ltd Report 16a:2023/24) is an update on the initial ecological assessment now that the location for the WTP has been finalised.

2. Proposed activity

A replacement drinking water treatment plant is required for Hatepe village. The new drinking water treatment plant will be larger than the existing drinking water treatment plant on the Hatepe Esplanade Reserve, and there is not enough room to locate it at the existing location within the narrow esplanade strip.

Taupo District Council was flexible with regards to location of the plant and have selected an area within the reserve that is of low ecological significance, to minimise the ecological impacts of building the plant. This location and the associated vegetation is mapped in figure 4.1.

The footprint of the drinking water treatment plant will be approximately 30 m x 30 m (900 m^2). An asphalt vehicle access track of 4m width and approximately 165m long will need to be created (660 m^2). A 2.4m high perimeter fence will be erected around the WTP and the access road. All water pipes, electrical and communication cables will be buried and will follow existing routes where possible.

3. Relevant DOC statutory plans

Tongariro-Taupo Conservation Management Strategy 2002.

A conservation management strategy is a statutory document, prepared in accordance with part IIIA of the Conservation Act 1987, which implements general policies and establishes objectives for integrated management of natural and historic resources. The conduct of activities on public conservation land can only take place in accordance with the relevant conservation management strategy.

The Tongariro-Taupo CMS 2002 part 3.8 refers to concessions. Part 3.8.2 deals with non-recreation concessions. Within section 3.8.2, the application for the Hinemaiaia Water treatment plant fits into the definition of an easement.

The objective for easements in the CMS is: To grant easements only where they will not significantly compromise natural or historic values or public use and their purposes cannot reasonably be achieved by other means on private land.

Commentary
Given the objective for easements within the CMS, Taupō District Council proposed to locate the water treatment plant in an area of exotic dominant vegetation with little natural biodiversity value. There is not room for the new water treatment plant at the current location on the Esplanade Strip Reserve. The Hatepe water storage reservoir is already within Public Conservation Land in the Hinemaiaia Scenic Reserve, and the proposed plant is required to be located in the vicinity of Hatepe Village, and the water storage reservoir site.

Reserves Act 1977

Under section 19 (1) (a) of the reserves act 1977 states that a Scenic Reserve is:

"for the purpose of protecting and preserving in perpetuity for their intrinsic worth and for the benefit, enjoyment, and use of the public, suitable areas possessing such qualities of scenic interest, beauty, or natural features or landscape that their protection and preservation are desirable in the public interest"

Section 19 (2)(a) states that "except where the Minister otherwise determines, the indigenous flora and fauna, ecological associations, and natural environment and beauty shall as far as possible be preserved, and for this purpose, except where the Minister otherwise determines, exotic flora and fauna shall as far as possible be exterminated".

Commentary
Due to the above statements in the Reserves Act the Taupō District council proposes to design the water treatment plant to reduce visual impact and maintain the scenic qualities of the Hinemaiaia Scenic Reserve, and to contribute to the management of exotic weed species, including climbing spindleberry (*Celastrus orbiculatus*), during the development of the water treatment plant.

4. Description of Values

Ecological Values

The Hinemaiaia is a Significant Natural Area in the Taupō District Plant (SNA 211). It meets the definition of a Significant Natural Area as it is a legally protected area of indigenous vegetation, that provides habitat for at risk indigenous species, and is a healthy and representative sample of vegetation.

The initial 8.9 ha area of interest within the Hinemaiaia Scenic Reserve is largely indigenous dominated vegetation, with areas of kānuka forest, and whauwhaupaku-kōhūhū forest. These are successional vegetation types, regenerating following historic fires. There are also areas of exotic dominated

vegetation, including blackberry-cotoneaster-Japanese honeysuckle scrub, and mixed trees over mixed exotic scrub. The vegetation within the surveyed area is mapped in Figure 4.1, and described in more detail below.

Indigenous Dominant Vegetation

Kānuka forest (1.79 ha)

Kānuka canopy (12m) over occasional whauwhaupaku (five-finger, *Psuedopanax arboreus*). Subcanopy of māpou (*Myrsine australis*) soft mingimingi (*Leucopogon fasiculatus*) with an understorey of shining karamu (*Coprosma lucida*) hangehange (Geniostoma rupestre) and seedlings of mahoe (Melicytus ramiflorus), kōhūhū (Pittosporum tenuifolium), with a groundcover of kōwaowao (houndstongue fern, *Zealandia pustulata* subsp. *pustulata*), sickle spleenwort (*Asplenium polyodon*), crepe fern (*Leptopteris hymenophylloides*), tūrutu (*Dianella nigra*) and carex species.

This vegetation type is highly indigenous dominant, though occasional blackberry and cotoneaster was present. Considerable pig rooting was observed in places, particularly on the margins of the former dump site.

Whauwhaupaku - kōhūhū forest (5.05 ha)

Whauwhaupaku (6m) and kōhūhū over māpou, with soft mingimingi and Franchett's cotoneaster (*Cotoneaster franchettii*). Understorey of shining karamu, prickly mingimingi (*Cyathodes juniperina*), snowberry (*Gaultheria antipoda*) and blackberry (*Rubus fruticosus* agg.); with a groundcover of hound's tongue fern, sickle spleenwort, crepe fern, tūrutu and carex species.

This vegetation type was largely indigenous dominant, though cotoneaster and blackberry were present.

Exotic Dominated Vegetation

Three exotic dominated vegetation types were identified during the site visit. These were:

Blackberry – cotoneaster – Japanese honeysuckle scrub (1.06 ha)

A dense scrub of Franchett's cotoneaster (*Cotoneaster franchettii*), blackberry (*Rubus fruticosus* agg.) and Japanese honeysuckle (*Lonicera japonica*).

This vegetation was dense to the point of being impenetrable, and it is likely there are few understorey species present due to heavy shading. A few kānuka and a single eucalyptus were present within this vegetation, the lower limbs of the kānuka were being smothered by Japanese honeysuckle. Large poplars (*Populus* sp.) are present on the eastern margin, part of a shelterbelt around the former dump site.

Mixed exotic trees over mixed exotic scrub (0.23 ha)

Eucalyptus and *Pinus radiata*. Over mixed exotic scrub including broom (*Cytisus scoparium*), blackberry, Japanese honeysuckle and cotoneaster. Large poplars present on the eastern margin, part of the shelterbelt of the former dump site.

Mixed exotic trees over whauwhaupaku (0.74 ha)

Gum and pine over whauwhaupaku forest, with weedy understorey. More indigenous species are present within this vegetation type than the previous, however exotic species are dominant.

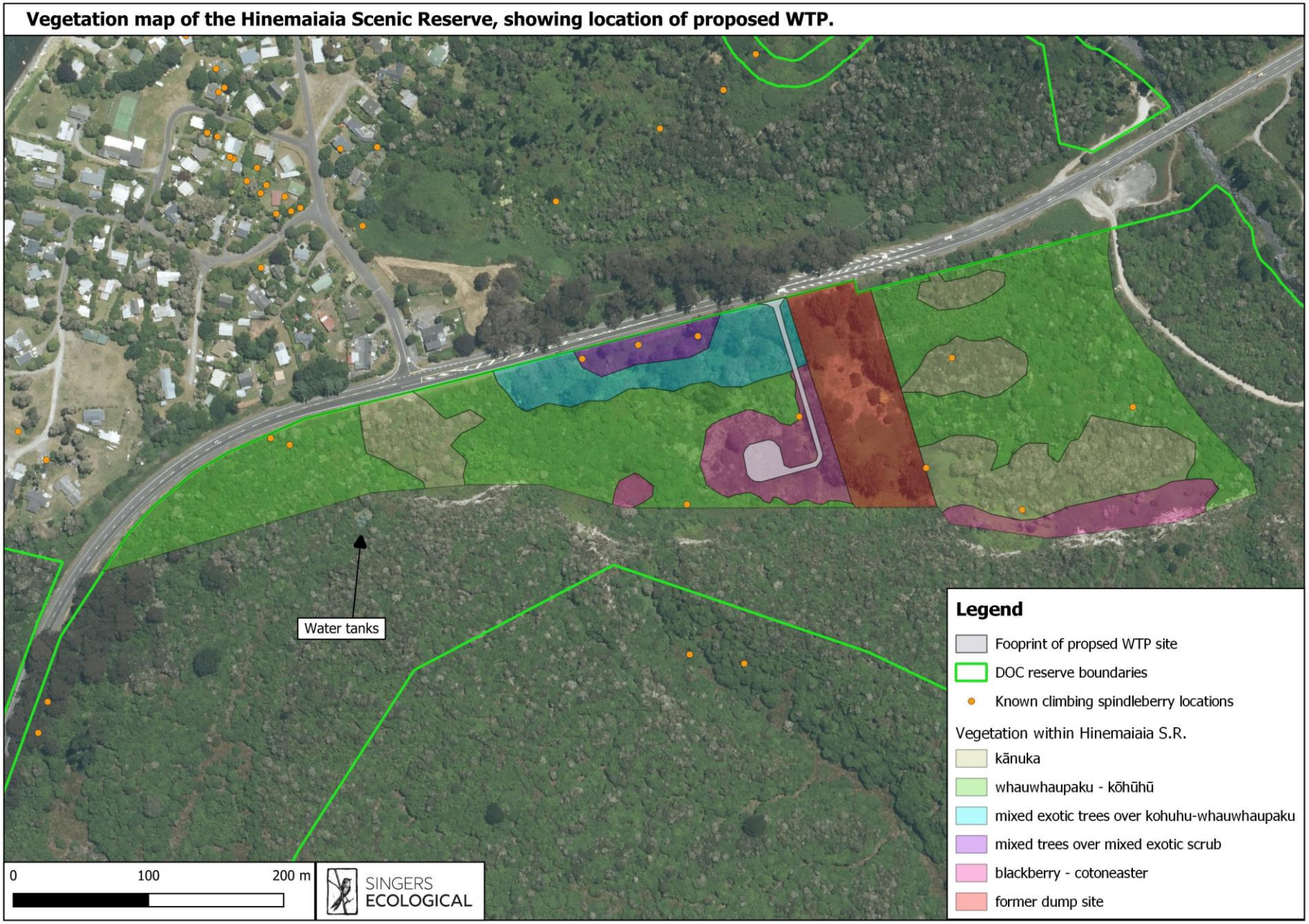


Figure 4.1: Vegetation map of the area of interest at Hinemaiaia Scenic Reserve, and footprint of the proposed WTP, purposefully located within exotic dominated vegetation types. The former dump site (in red) is outside the scope of this report.

Figure 4.2. Kanūka Forest at Hinemaiaia Scenic Reserve.

Figure 4.3. Whauwhaupaku Forest at Hinemaiaia Scenic Reserve.

Figure 4.4. Blackberry – cotoneaster – Japanese honeysuckle scrub in the foreground (with shade of large poplar trees) at Hinemaiaia Scenic Reserve.

Figure 4.5. Mixed exotic trees over mixed exotic scrub in the foreground, with mixed exotic trees over whauwhaupaku in the background; Hinemaiaia Scenic Reserve.

Cliffs

The cliffs within the Hinemaiaia Scenic Reserve are likely to provide habitat for uncommon species and may provide habitat for lizards. *Anaphalioides subrigida* (At-risk – naturally uncommon; deLange et al. 2017), an indigenous everlasting daisy, has been recorded on the pumice batters near SH1[1], and is likely to also be present on the pumice cliffs within the Scenic Reserve.

As it is not proposed to do any construction on the cliffs, this habitat will not be at risk from the WTP construction.

Indigenous fauna

Fantail was seen during the site visit, and records have been made in the area of kereru, tuī, bellbird and whitehead (formerly at-risk declining, now not threatened (Robertson et al. 2021).

As mentioned above, the cliffs may provide habitat for lizards, however no construction will occur in cliff habitat.

Large exotic trees may provide roosting habitat for long-tailed bats. The proposed footprint of the WTP and access road currently avoids large trees. A bat survey may be required if any of the large eucalyptus, poplar or pine trees are found to require felling.

Social/Cultural Values

Urupā

Hapū have been consulted on cultural values at the site. An urupā is located to the North of the area that was surveyed. This area is outside the scope of this project and will not be impacted.

Former greenwaste dump

A former greenwaste dump site (1.02 ha) has been ruled out of scope for locating the drinking water treatment plant. This site is likely to have been a house site prior to becoming a dumping site, as the area has an aging fence, and a shelterbelt of aging poplar trees. The central area is grassy and weedy, with occasional old orchard trees including peach, apple and walnut. The area also has infestations of weeds including Japanese honeysuckle, blackberry and common hops, likely garden escapes from the former dumping.

Although primarily greenwaste dumping occurred at this site, the area is mapped as a contaminated site in the Taupō District Plan, and following consultation with hapū and for reasons of perceived health risk has been ruled out as a location for the water treatment plant. However, the access track to the water treatment plant may be located though this area.

Flood Risk

The proposed footprint of the water treatment plant is approximately 350 m from the Hinemaiaia River and is outside of the Taupō District Plan flood hazard zones. This is mapped below in figure 4.6. Therefore, the flood risk in the proposed location is minimal.

[1] https://inaturalist.nz/observations/17371309

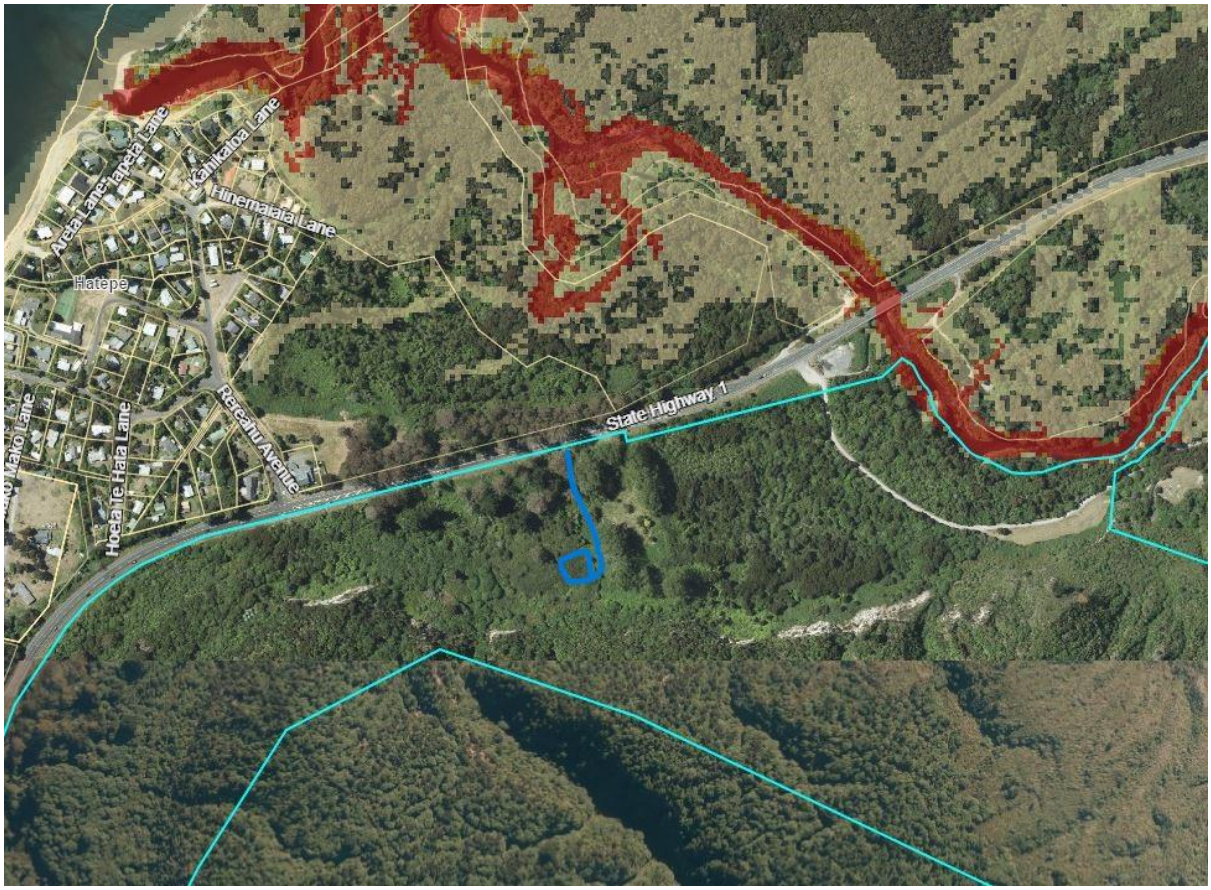


Figure 4.6. A screenshot of the TDC District Plan Flood Hazard data for Hatepe, with the proposed location of the WTP marked in dark blue, showing that the site is outside of the identified flood hazard zones.

5. Potential effects

Positive

The construction of the drinking water treatment plant is likely to result in the removal of at least 900m^2 of cotoneaster-blackberry-Japanese honeysuckle scrub. Removing these exotic species will increase the overall indigenous dominance of this site.

Further positive effects are expected from the mitigation offered. Taupō District Council has offered to carry out an initial search and destroy survey for all climbing spindleberry within the 8.9 ha between State Highway 1, and the Hinemaiaia Cliffs. Climbing spindleberry is best treated by an experienced environmental contractor, by basal spraying with a product such as X-Tree Basal. All climbing spindleberry found and treated will be marked with GPS, and the locations supplied to DOC for their records.

Adverse

If not controlled carefully, the construction of a water treatment plant has the potential to spread weeds within, and out of the site. The weeds at this site include climbing spindleberry (*Celastrus orbiculatus*), which is a Progressive Containment weed species in the Waikato Regional Pest Management Plan. This risk can be mitigated by putting good hygiene in place during construction, and through initial, and ongoing weed control at the site.

Although bats are not known from Hatepe, the large eucalyptus, pine and poplar trees have the potential to provide roosting habitat for long-tailed bats. The proposed footprint of the WTP and access road currently avoids large trees and only selective trimming carried out if required. However, a survey using bat recording devices may be required if it is found that any large tees require felling.

Cumulative

The former greenwaste dump area within the reserve continues to be used for illegal dumping, as recent vehicle tracks along with garden waste, and kina shells were noted during the site visit. Construction of a drinking water treatment plant may open up access into a new area of the reserve, which could also be used for illegal dumping. However, the preliminary plan for the WTP specifies that a 2.4m fence will be constructed around the WTP and access road, and that the access road will be gated with a vehicle gate. This eliminates the risk of increased dumping.

The new fence lines may improve foot access to the reserve. This may have a positive cumulative effect, by improving access for pig hunting. A large area of pig rooting was noted in the kānuka forest to the east of the former dump area. Pig rooting spreads weeds around, as the freshly rooted soil is the ideal place for weed seedlings to germinate. Increased pig hunting in the area would help supress pig numbers and reduce the ecological impacts of pigs in the area.

6. Measures to Avoid, Remedy, mitigate adverse effects.

Taupo District Council will take the following measures to avoid, remedy or mitigate adverse effects:

Location

An initial ecological survey was commissioned in order to locate the water treatment plant to avoid as much indigenous dominant vegetation practicable. The initial ecological survey recommended the proposed location of the water treatment plant in the large area of Blackberry – cotoneaster – Japanese honeysuckle scrub immediately to the west of the former dump site (6090 m^2). See figure 4.1.

Any building materials lay down/staging area, and any earthworks stockpile required during construction will also be located on adjoining Blackberry – cotoneaster – Japanese honeysuckle scrub vegetation of low ecological value. The access track to the proposed site follows the edge of the old greenwaste dump site, which is also primarily blackberry – cotoneaster – Japanese honeysuckle scrub. This further avoid any clearance of indigenous dominant vegetation.

Weed management.

Hinemaiaia Scenic Reserve is an area with a known infestation of climbing spindleberry (*Celastrus orbiculatus*). This is an extremely weedy species, that poses significant ecological risk to regenerating and open indigenous forest types, and is a progressive containment weed under the Waikato Regional Pest Management Plan. The known locations of this weed are mapped in figure 4.1. Taupo District Council will take care not to spread this weed during plant construction. There is an opportunity for TDC to contribute to the ongoing management of this weed at this site.

Fencing and gating the access track into the WTP site will help prevent the ongoing illegal dumping of garden waste that occurs within the old dump site in the reserve and prevent further accidental spread of weeds by the public.

Prior to construction any cotoneaster, blackberry and particularly Japanese honeysuckle in the building footprint area must be sprayed to prevent spread of these weed species by pushing them around during construction. Mulching, and then spraying the regrowth is an alternative approach. To prevent the spread of weeds from the site any mulching should be done to leave all material on site (chop and drop), not transport it from site.

Good hygiene of vehicles used during the construction of the plant is also required to prevent spread of weeds from the site to elsewhere in the Taupō District. Care should be taken to clear all weed fragments from vehicles prior to leaving the construction site. This is particularly important for climbing spindleberry. Japanese honeysuckle is also a particularly invasive weed and care to remove fragments of this weed from vehicles is required.

Effects on fauna

Timing vegetation clearance (e.g. mulching, tree felling) outside key core bird breeding (October - Jan) will reduce risk of destroying nests of common indigenous birds such as fantail and grey warbler.

Although no bats are known from Hatepe, the large eucalyptus, pine and poplar trees are potential bat roost trees. We recommend that bat recording devices are put out prior to felling any large trees.

If any large trees are felled, leaving behind some large logs and tree rounds in the vicinity of the felling site will provide large decaying woody habitat for invertebrates. This decaying woody habitat is currently rare within the young successional forest of the Hinemaiaia S.R.

Visual impact

The plant will be designed to minimise the visual impact on the scenic qualities of the reserve as far as practicable. For example, paint colour and building material colour will be chosen that will blend into the surroundings and reduce visual impact of the plant.

The proposed location of the plant 100m back from the road will also reduce visual impacts, as the existing vegetation will shield it from view.

Alternatives

Taupo District Council commissioned the initial ecological report (NSES Ltd Report 16:2023/24) to identify areas of the reserve with lower ecological significance in which to locate the plant, and minimise the ecological impacts of building the plant. The recommended location from the initial report was adopted, and is mapped in figure 4.1 of this report (NSES Ltd Report 16a:2023/24).

There is not enough room to locate the plant on the current council owned land within Hatepe Village, and no suitable and appropriate private land or māori trust land was available.

The former rubbish dump site was considered. From an ecological perspective this highly modified would have been an excellent site to locate infrastructure. However, from a public health perspective this site was ruled as not appropriate for the WTP location and is not a viable alternative location for the plant.

Monitoring ongoing effects

Recommended monitoring of effects includes:

- Initial search and destroy management of climbing spindleberry in the 8.9ha area between the Hinemaiaia Cliffs and SH1. All climbing spindleberry locations found and treated will be provided to DOC for their records.
- Security monitoring at the site may help reduce public dumping.

Summary of effects and conclusion

The initial ecological assessment identified a recommended location of low ecological value within the area of interest at Hinemaiaia Scenic Reserve in which to locate the WTP.

The proposed WTP is a small area (900m^2), along with the access track (660m^2) that will be located within an area of vegetation that is dominated by exotic weed species. Given the options to locate a water treatment plant within the Hinemaiaia Scenic Reserve, the recommended location is the best sites to minimise impacts from an ecological perspective, and if the plant is built in the recommended area, no indigenous vegetation will be lost.

Construction should be undertaken in such a way as to minimise the potential ecological impacts — by being careful to prevent the spread of weeds within, and outside of the site, and minimising impacts on fauna by undertaking vegetation clearance outside the core bird breeding season of October – January. A bat survey is required only if large trees are to be felled. Visual impacts on the scenic values of the reserve will be minimised through the location of the WTP 100m away from the main road, as the existing vegetation will screen it from view, and can be further minimised through selection of paint colour and building materials.

In conclusion, if the water treatment plant is built in the recommended location, and the measures proposed to avoid, remedy, mitigate and monitor potential ecological effects are implemented, including an initial contribution to weed management, I consider that this application will have a negligible impact on the ecology of the Hinemaiaia Scenic Reserve.

7. References

de Lange, P.J.; Rolfe, J.R.; Barkla, J.W.; Courtney, S.P.; Champion, P.D.; Perrie, L.R.; Beadel, S.M.; Ford, K.A.; Breitwieser, I.; Schönberger, I.; Hindmarsh-Walls, R.; Heenan. P.B.; Ladley, K. (2017). Conservation status of New Zealand indigenous vascular plants, 2017. *New Zealand Threat Classification Series*, *22*, Department of Conversation, Wellington. https://www.doc.govt.nz/Documents/science-and-technical/nztcs22entire.pdf .

Reserves Act 1977. https://www.legislation.govt.nz/act/public/1977/0066/latest/DLM444305.html

Robertson, H.A.; Baird, K.A.; Elliott, G.P.; Hitchmough, R.A.; McArthur, N.J.; Makan, T.D.; Miskelly, C.M.; O'Donnell, C.F.J.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A.; Michel, P. 2021: Conservation status of birds in Aotearoa New Zealand, 2021 . *New Zealand Threat Classification Series 36*. Department of Conservation, Wellington. 43 p.

Taupo District Plan. Operative June 2022. https://taupo.isoplan.co.nz/eplan/rules/0/41/0/4511/0/100

Waikato Regional Pest Management Plan 2022-2032.
https://waikatoregion.govt.nz/services/publications/rpmp-2022-2032/

Principal's Requirements for Separable Portion 4.

Project: Taupo District Council Membrane Water Treatment Plants

Services: Design and Construct

Contract Number: TDC/2021/353

Separable Portion: TDC/2021/353-SP4 – Hatepe WTP

Issue Date: 14th February 2021

Document Approval		
Role	**Name**	**Signature**
Preparers	Sec 9(2)(a)	
Reviewer		
Approver		

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Contract

This Separable Portion forms part of the Contact for Taupo District Council's Membrane Water Treatment Plants (Contract TDC/2021/353) setting out the Principal's Requirements for the Hatepe water treatment plant (WTP). All terms, definitions, abbreviations and references detailed in the Contract and the Specifications are applicable to this Separable Portion and these Principal's Requirements.

The Specifications shall be read in conjunction with and shall be deemed to be part of these Principal's Requirements. Where any conflict or ambiguity exists between these Principal's Requirements and the Specifications, the Principal's Requirements shall take precedence.

1.2 Purpose

These Principal's Requirements for this Separable Portion set out the contractual requirements for the new Hatepe WTP. The appended Principal's Preliminary Process Design and Preliminary Drawings are intended to guide the Contractor in the process engineering aspects of the detailed design and to present a possible site layout. In accordance with clause 5.1.7 of the General Conditions of Contract, if the Contractor elects to adopt any or all elements of the Preliminary Drawings and the Principal's Preliminary Process Design appended to this document, the Contractor shall assume full responsibility for ensuring that the design achieves compliance with these Principal's Requirements and the Specifications in all respects.

1.3 Appendices

The following documents are appended to these Principal's Requirements for this Separable Portion:

- Principal's Preliminary Process Design, including:
    - Principal's Preliminary Process Design Report (TDC010-DB4)
    - Principal's Preliminary Drawings
        - Preliminary Process Flow Diagram (HAT-PFD-1)
        - Preliminary Piping and Instrumentation Diagrams (HAT-PID-1 to HAT-PID-15)
    - Principal's Preliminary Functional Description (TDC010-FD4).
- Schedule 22 - Contractor's Guaranteed Performance Parameters for Hatepe WTP

2 Scope of Works

The general scope of the Contract Works for this Separable Portion is defined in this section and the Contractor is required to provide a complete system that is fit for purpose.

The Contract Works included in the Lump Sum pricing for this Separable Portion excludes geotechnical investigations, ground improvement works (e.g. piling of foundations), civil works, site roading, security fencing, underground services and site landscaping works. Work of this nature, will be undertaken on a cost reimbursement basis.

Construction of plant buildings, building services and structures is included in the Lump Sum scope of the Contract Works in addition to the process, mechanical and electrical scope.

2.1 Objectives

The principle purpose of the Contract Works for this Separable Portion is to provide a robust new WTP to supply treated water to the Hatepe reticulation network. The new WTP must reliably produce, to the specified quality and capacity, potable water compliant with the DWSNZ.

The Principal has the following objectives for the new Hatepe WTP:

- Provide a new WTP to replace the existing Hatepe WTP in full compliance with the DWSNZ:
    - Meet the requirements of the DWSNZ Section 5.11 – Membrane Filtration;
    - Meet the requirements of the DWSNZ Section 4.2.2a – Compliance Criterion 2A for drinking-water disinfected with chlorine;
    - Achieve arsenic concentrations in the treated water consistently below 50% of the maximum-acceptable value (MAV) (0.01 mg/L), as detailed in the DWSNZ Table 2.2;
    - Provide treatment for taste and odour (T&O) compounds and algal toxins that may occur during infrequent algal bloom events to ensure concentrations in the treated water are consistently below 50% of the respective provisional maximum acceptable values (PMAVs) and guideline values (GVs), as detailed in the DWSNZ Tables 2.3 and 2.5;
- Deliver an effective treatment process that enables the plant to produce the required volumes of compliant treated water under all conditions;
- Since there is no point to discharge a waste stream to the sewer, provide onsite treatment for waste streams from the process such that:
    - Clarified supernatant is recycled to the head of the plant;
    - Neutralised CIP waste and thickened sludge is stored and periodically removed from site by means of road tankers;
    - The volume of waste to be periodically removed from site by means of road tankers is minimised as far as practicable;
- To deliver an operationally stable, automated Hatepe WTP that does not require a high level of operator input;
- To proactively manage and programme the new Hatepe WTP construction and commissioning in close liaison with the Principal's operations staff to minimise the impact on the existing operation and the operators;
- To provide a safe, accessible and operationally-friendly Hatepe WTP;
- To meet the New Zealand occupational Health and Safety and hazardous substances legislative requirements;

- To meet all relevant New Zealand and Australian Standards;
- To minimise the whole of life cost of the facility; and
- To meet the Principal's Minimum Service Life Requirements.

The new Hatepe WTP must be capable of continuous operation. The plant will not be continuously manned. The Contract Works will be used to reliably produce (to the specified standard) potable water for domestic water supply purposes.

The existing treatment process shall remain operational throughout the construction and commissioning of the Contract Works and this may limit the amount of water that can be abstracted for commissioning if commissioning coincides with a peak demand period.

2.2 Contract Works Overview

An overview of the Contract Works to provide a new Hatepe WTP is provided in this section. The key components are as follows and must be implemented to meet the capacity and treated water quality requirements:

- Construction of a new WTP at the new WTP site, consisting of:
    - Powdered activated carbon (PAC) dosing;
    - PAC contact tank;
    - Coarse screening, as required by the membrane supplier;
    - Coagulant dosing;
    - Sodium hydroxide dosing for coagulation pH control;
    - Flocculation tank;
    - Membrane filtration for protozoal compliance, with all ancillary equipment and systems;
    - Warm water system;
    - Compressed air system;
    - Clean-in-place (CIP) chemical systems, as required by the membrane supplier;
    - Chlorine dosing (for treated water residual);
    - Sodium hydroxide dosing for treated water pH correction;
    - Chemical delivery, storage and transfer systems;
    - Automated divert-to-waste system;
    - Chlorine contact tank for bacteriological compliance;
    - Treated water wet well;
    - Treated water pumping into the reticulation network;
    - Service water system;
    - Waste balance tank;
    - Backwash water recovery system;
    - Sludge holding tank;
    - All auxiliary systems for the process plant.
- Provision of all ancillary services required to facilitate the above infrastructure, i.e. power supply, PLCs, MCCs;
- Provision of all geotechnical, civil and structural components required for the construction of the new Hatepe WTP;
- Programming and control of the new systems.

2.3 Process and Mechanical

The Contractor's scope for process and mechanical aspects of the Contract Works includes the following:

i) Design, supply and installation of a drinking-water treatment process, entailing all components listed in Section 2.2, to comply with the treated water quality requirements (refer to Section 4.3). After the Hatepe WTP is constructed, the treatment process is required to be capable of producing at least 300 m^3/d of net treated water (defined as treated water produced less service water used), 24 hours a day, 7 days per week, with a maximum waste production of 3 m^3/d (to be removed by tankers) (except during adverse raw water quality conditions). The net treated water production requirements shall be maintained at all times including periods with one membrane train out of service, except during adverse raw water quality conditions (see Section 4.1 for further details). For turndown purposes, the treatment process is required to operate continuously and in a stable manner at a minimum net treated water production of 60 m^3/d.
ii) Unless specifically excluded from the Contract, supply and installation of all ancillary equipment to support the operation of the water treatment process. This will include but not be limited to all pumps, valves, instrumentation, pipework, chemical storage and dosing, backwashing systems, chemical cleaning systems, compressed air systems and service water system.
iii) Provision of a rapid plant shutdown capability based on online monitoring of critical control points (CCPs) at trigger levels and times specified in the Preliminary Functional Description (see Appendix 0).
iv) Tie-in points:
    a) TP1: Connection to the raw water rising main from the lake intake pump station;
    b) TP2: Connection to the treated water main feeding the reticulation network;
    c) TP3: Outlet connection on the sludge holding tank.

2.4 Control and Electrical

2.4.1 Scope of Supply

The Contractor's scope for control and electrical services aspects of the Contract Works includes the following:

i) Design, supply and installation of all new electrical hardware required by the Hatepe WTP and Site except for the transformer and the HV supply to the transformer;
ii) All required SCADA software to control the Hatepe WTP and interface with the Principal's communications and telemetry systems;
iii) Tie-in points:
    a) TP4: Connection to the low voltage terminals on the power supply transformer;
    b) TP5: Connection to the fibre optic cable laid with the new raw water rising main from the lake intake pump station.

2.4.2 Power Supply

There is currently no electrical infrastructure on the Site. The Contractor is to liaise with the Principal for the installation of a new transformer of a capacity to be nominated by the Contractor to suit the total power demand at peak production capacity of the Hatepe WTP. The Principal's power supply company will supply and install the transformer and high voltage cabling to the transformer. The Contractor shall then install all the required low voltage cabling from the low voltage terminals on the transformer to the MCC.

The Contractor shall install a generator changeover switch in the MCC and make provision for the connection of a mobile generator to a generator plug connection point (appropriately sized and IP rated) on the exterior of the

building. Provision shall be made in the layout design for a mobile trailer-mounted generator of an appropriate size to be parked within the securely fenced plant area with sufficient access around it for generator refuelling.

2.5 Buildings and Civil Works

The Contractor shall be responsible for all geotechnical investigations, ground improvement and foundation work required to prepare the Site for the Contract Works. In the absence of having a full geotechnical ground survey available for the tendering process, the Contractor can assume the Site consists of good ground as defined in NZS 3604 with low liquefaction risk potential. Any geotechnical investigations and ground improvement works that may be required to confirm ground conditions, determine liquefaction risk potential and achieve structural importance level seismic resilience requirements will be undertaken on a cost reimbursement basis (refer to Section C18.10.1.3 of the Specifications).

The Contractor shall be responsible for the design and construction of all buildings and building services for the new Hatepe WTP.

The new building(s) shall be purposed for housing the following components of the new Hatepe WTP:

- Membrane filtration stage and all associated components;
- Treated water pumps;
- Chemical systems, including space for the potential future hydrofluorosilicic acid system;
- Power incomer / supply metering, generator changeover and distribution board, MCC and control panels;
- All other items specified in Section C18.10.3.2 and Section C18.10.3.3 of the Specifications.

The plant buildings shall be designed so that the aesthetic is in keeping with the environment surrounding the Site.

2.6 Principal's Scope of Supply

The Principal will supply the following:

- Raw water to the Site boundary at maximum flowrate of 12.5 m^3/h. Pressure requirements for the raw water at the new Hatepe WTP shall be specified by the Contractor;
- Transformer;
- Point of connection to the treated water reticulation network.

3 General Requirements

3.1 Resource Consent

The water abstraction consent is required to be met throughout the construction and commissioning periods. The automated operation of the plant shall consistently meet the abstraction consent requirements.

Table 3.1 – Abstraction Consent

Source	Consent No.	Expiry	Instantaneous Limit (L/s)	24-Hour Limit (m^3/d)
Lake Taupo	105864	1 Jan 2022	12	440

The abstraction consent limits and requirements shall be included in the training for the operators so that they are aware of how to operate the new facility within the constraints imposed by the abstraction consent requirements.

3.2 Site-Specific Hazards

The Site is generally flat and vegetated. The Site will require the clearing and grubbing of trees and other vegetation. There are no known underground services on the Site.

The Site is adjacent to State Highway 1 and access will be from Rereahu Avenue.

Refer to Section C15 of the Specifications for hazard identification and control requirements.

4 Performance Requirements

See Appendix 6.2 for the "Schedule of Contractor's Guaranteed Performance Parameters" for the Hatepe WTP.

4.1 Production Capacity

The net treated water production requirements are shown in Table 4.1. The maximum waste volume takes into account onsite treatment for process waste streams. Waste (thickened sludge and neutralised chemical wash water) will be stored on site and periodically disposed of by tankers.

Table 4.1 – Net Treated Water Production and Maximum Waste Requirements

Parameter	Minimum	Average	Maximum
Net Treated Water (m^3/d)[1]	60	75	300
Maximum Waste Production (m^3/d)[2]	3		

1. Net treated water distributed into the reticulation network taking into consideration service water use within the WTP.

2. Except during adverse raw water quality conditions.

Routine cleaning and maintenance of process equipment, membrane integrity testing, etc. shall not impact on the net treated water production during typical raw water quality conditions. During typical raw water quality conditions, production capacity shall be maintained with at least one membrane train out of service for 24 hours, for CIP or other purposes (N+1).

For turndown purposes, the treatment process is required to operate at a minimum treated water production rate of 60 m^3/d (2.5 m^3/h).

The maximum waste production from the plant shall be no more than 3 m^3/d during typical raw water conditions. The maximum waste production may be increased to no more than 5 m^3/d during adverse raw water quality conditions.

Adverse raw water quality conditions are defined as:

- PAC dosing active OR;
- Total algae concentration > 3,000 cells/mL OR;
- Turbidity > 10 NTU OR;
- Coagulant dose > 5 mg_{active}/L.

During adverse raw water quality conditions, the standby membrane train may be used in an assist capacity. Note that the maximum waste volumes are for a maximum day. The average daily waste volume discharged to the storage tank (averaged over a 4-week period) under typical conditions shall be no more than 1.5 m^3/d.

4.2 Raw Water Quality

The Hatepe WTP will treat raw water abstracted from Lake Taupo near Hatepe. The raw water quality is fairly consistent. The results from four annual samples collected between July 2016 and July 2019 were collated and are summarised in Table 4.2. The concentrations are total values as dissolved values were not available.

Additional raw water sampling was undertaken in July and August 2020. Six samples were collected and analysed for true colour, dissolved organic carbon (DOC), T&O compounds, UV transmissivity and turbidity. The results of this sampling are also presented in Table 4.2.

The raw water quality in Lake Taupo at the Hatepe intake is comparable to that at the Taupo intake (Lake Terrace WTP). Where values for some parameters were not available for the Hatepe intake, values have been included from data for the Lake Terrace intake (see notes at the bottom of Table 4.2).

E. coli results were not available so those provided from monthly sampling of the source water at Kinloch from January 2017 to August 2019 were included.

Sampling for cyanobacteria in Lake Taupo takes place during the warmer months of the year (generally November / December to April / May). A summary of the sampling results from the 2004 to 2020 period is provided in Table 4.2.

The values higher than 50% of their respective MAVs are highlighted in red and those higher than 50% of their respective GVs, outside of the guideline ranges or above detectable limits for taste and odour have been highlighted in orange.

Table 4.2 – Typical Raw Water Quality Envelope

Parameter	Units	MAV / GV	Minimum	Average	Maximum
Cyanobacteria	cells/mL	500	1	131	2,800[1]
Alkalinity (Total, as $CaCO_3$)	mg/L	-	22	26	30
Aluminium	mg/L	0.1	0.0071	0.043	0.064
Arsenic	mg/L	0.01	<0.0036	0.0064	0.0096
Barium	mg/L	0.7	<0.0053	<0.0053	0.0055
Boron	mg/L	1.4	0.03	0.07	0.12
Bromide[2]	mg/L	-	0.024	0.035	0.049
Calcium	mg/L	200	3.3	4.4	5.5
Chloride	mg/L	250	5.6	6.8	8.6
Colour, True[5]	HU	10	0.6	1.3	2.7
Conductivity	mS/m	-	7.7	8.9	10
Copper	mg/L	2 / 1	0.0024	0.011	0.028
Dissolved Organic Carbon (DOC)[5]	mg/L	-	0.6	1.2	2.7
Dissolved Reactive Phosphorus (DRP)	mg/L	-	<0.01	0.014	0.017
E. coli[4]	MPN/100mL	1	<1	33	980
Fluoride	mg/L	1.5	0.1	0.12	0.14
Hardness (Total, as $CaCO_3$)	mg/L	200	4.4	16	23
Iron	mg/L	0.2	0.068	0.097	0.12

Table 4.2 – Typical Raw Water Quality Envelope

Parameter	Units	MAV / GV	Minimum	Average	Maximum
Lead	mg/L	0.01	0.0003	0.0013	0.0036
Lithium	mg/L	-	0.015	0.02	0.028
Magnesium	mg/L	200	1.1	1.6	2.1
Manganese	mg/L	0.4 / 0.04	0.002	0.01	0.023
Molybdenum	mg/L	0.07	<0.0002	<0.0002	<0.0012
Nitrate (as N)	mg/L	50	0.04	0.078	0.113
Nitrite (as N)	mg/L	0.2	<0.002	<0.002	<0.002
pH	-	7.0 – 8.5	7	7.2	7.3
Silica	mg/L	-	30	34	40
Sodium	mg/L	200	6.0	8.1	11
Sulphate[4]	mg/L	250	6.7	6.7	6.7
Sulphur[4]	mg/L	-	2.5	2.5	2.5
Temperature[2]	°C	-	9	15	22
Total Dissolved Solids (TDS)[2]	mg/L	1000	93	97	99
Turbidity[3]	NTU	2.5	0.03	0.24	10
UV Transmissivity @ 254 nm (filtered)[5]	%	-	92.6	96.1	98.4
Zinc (Total)	mg/L	1.5	0.019	0.03	0.057

1. The maximum cyanobacteria cell count at the Lake Terrace WTP (Taupo intake) was 3,397 cells/mL in March 2019.

2. Data from Process Design Report for Lake Terrace WTP and annual source water quality sampling (Taupo intake).

3. Turbidity data is from online monitoring of the raw water turbidity from April 2019 to April 2020 at Hatepe WTP. The 95th-percentile value was 0.58 NTU.

4. Data from Kinloch WTP sample data.

5. Data taken from raw water sampling at Hatepe conducted between 8th July and 12th August 2020.

Data for T&O concentrations in the raw water at the Hatepe intake is limited. The data provided in Table 4.3 is from one observed algal bloom event in 2004 and is from four samples collected at the Hatepe WTP and in the Hatepe distribution system (20 April to 25 June 2004).

Table 4.3 – T&O Compound Sampling Results				
Parameter	**Units**	**Minimum**	**Average**	**Maximum**
Geosmin[1]	ng/L	16	25	31

1. Note that Geosmin is detectable (by taste and odour) in water at concentrations of 5 to 10 ng/L.

The following observations are made concerning the raw water quality:

- The water is soft, with a total hardness as $CaCO_3$ ranging between 4 and 23 mg/L;
- Arsenic concentrations are higher than 50% of the MAV thus requiring arsenic-removal, which can be achieved through coagulation-filtration;
- The water is generally low in turbidity but the turbidity can become elevated during very strong onshore wind conditions due to wave action disturbing sediments in the lake bed;
- The water is generally low in cyanobacteria and associated algal toxins and taste and odour compounds; however, there is a low risk of intermittent cyanobacteria (and other algae) blooms in spring, summer and autumn if clear, warm still weather conditions persist for several days on end;
- Since 2016 there have been two samples with concentrations of iron above the GV (0.84 mg/L on 7 July 2016 and 2.7 mg/L on 2 July 2019). These results have been considered outliers and have been excluded from Table 4.2. All other sample results for iron have been below the GV, thus no additional treatment process will be included for removing iron.
- Concentrations of manganese in the raw water are consistently below the GV of 0.04 mg/L with only two historical samples exceeding 50% of the GV (0.023 mg/L on 7 July 2016 and 2 July 2019). No manganese removal process will be required at the new Hatepe WTP.
- Fluoride is present at low concentrations.

4.3 Treated Water Quality

4.3.1 Treated Water Quality Requirements

Treated water quality must be in compliance with the Drinking-water Standards for New Zealand 2005 (Revised 2018) (DWSNZ). Specifically, the treatment process must be designed and constructed to:

- Provide a minimum of 4 protozoal log credits as per DWSNZ Section 5.11 Membrane Filtration;
- Provide bacteriological compliance as per DWSNZ Section 4.2.2a – Compliance Criterion 2A for drinking-water disinfected with chlorine;
- Comply with the cyanotoxin compliance criteria as per DWSNZ Section 7;
- Comply with the chemical compliance criteria as per DWSNZ Section 8;
- Comply with the aesthetic determinand GVs as per DWSNZ Section 2.3, Table 2.5.

The treated water quality shall be unaffected following CIP or other chemical cleaning.

Table 4.4 – Treated Water Quality Specifications			
Parameter	**Requirement**	**Sample Point**	**Minimum Monitoring Frequency during ToC and TaC[1]**
Permeate Turbidity (NTU) (Individual train monitoring)	Not > 0.10 NTU for any 15-min period Does not exceed the feed water turbidity for the duration of any 3-min period	Feed to the membrane stage Outlet of each membrane train	Continuous (1 min intervals)
Protozoa Removal	4 log credits (meeting the requirements of DWSNZ Section 5.11)		Continuous (1 min intervals)
Arsenic (mg/L)	< 0.005	Treated water wet well outlet	Daily
Aluminium (mg/L)	< 0.05	Treated water wet well outlet	Daily
E. coli (count per 100 mL of sample)	0	Treated water wet well outlet	Daily for ToC Weekly for TaC
Trihalomethanes (THMs) and Haloacetic Acids (HAAs)	< 50% of MAV individually and sum ratio	Treated water wet well outlet plus 24 hours of additional contact time	Once during ToC Weekly for TaC
Treated Water Free Available Chlorine (mg/L)	Set-point ±0.2 (within range: 0.7-1.5)	Chlorine contact tank inlet	Continuous (1 min intervals)
Treated Water pH	Set-point ±0.1 (within range: 7-8)	Chlorine contact tank inlet	Continuous (1 min intervals)
Final Water Free Available Chlorine (mg/L)	Set-point ±0.2 (within range: 0.7-1.5)	Treated water wet well outlet	Continuous (1 min intervals)
Final Water pH	Set-point ±0.1 (within range: 7-8)	Treated water wet well outlet	Continuous (1 min intervals)
Final Water Turbidity (NTU)	< 1.0 for 95% of the time	Treated water wet well outlet	Continuous (1 min intervals)

Table 4.4 – Treated Water Quality Specifications			
Parameter	**Requirement**	**Sample Point**	**Minimum Monitoring Frequency during ToC and TaC[1]**
	Not > 2.0 for more than 3 consecutive minutes		
Chlorine Contact Time (min.mg/L)	> 15[2] for 98% of the time	Treated water wet well outlet	Continuous (1 min intervals)
Net Treated Water Flow	Net daily treated water production of 300 m^3/d	Treated water wet well outlet	Continuous (1 min intervals)

1. ToC: Test on Completion; TaC: Test after Completion.

2. Based on the Australian Drinking Water Guidelines v3.5 and recommendation from the World Health Organization (2011).

4.3.2 Drinking-Water Standards Compliance

4.3.2.1 *Protozoal Compliance*

The Hatepe WTP must be able to provide at least 4 protozoal log credits. The membrane filtration stage shall be operated to meet the compliance criteria of the DWSNZ Section 5.11. The details of these criteria are laid out in Section C.18.11.14.2 of the Specifications. The Contractor's design shall be such that it shall not be possible to bypass the membrane filtration stage.

4.3.2.2 *Bacteriological Compliance*

The Hatepe WTP must provide bacteriological compliance. The bacteriological treatment compliance criterion for the site is DWSNZ Section 4.2.2a – Compliance Criterion 2A for Drinking-Water Disinfected with Chlorine. The requirements that must be met are:

- Free available chlorine (FAC), pH and turbidity must be monitored continuously;
- The chlorine contact tank level and outflow-rate shall be monitored continuously;
- The chlorine C.t value must be at least 6 min.mg/L for at least 98% of the compliance period (one day), taking account of short-circuiting in the contact tank;
- A minimum retention of 5 minutes is required;
- The turbidity must be less than 1 NTU for at least 95% of the compliance period (one day);
- The turbidity must not exceed 2 NTU for the duration of any three-minute period.

According to the DWSNZ Section 3.2, the value of each parameter shall be recorded at a frequency of at least one per minute.

4.3.2.3 *Chemical Compliance*

All concentrations of chemical determinands in the treated water shall be less than 50% of their respective MAVs, as detailed in the DWSNZ Section 2.2 Tables 2.2 and 2.3. The requirements that must be met are:

- < 50% of the MAVs for inorganic determinands of health significance;
- < 50% of the MAVs for organic determinands of health significance.

The identified raw water chemical determinands to which this shall apply are:

- Arsenic.

Parameters that could increase as a result of chemical dosing or treatment:

- Aluminium;
- THMs and HAAs.

4.3.2.4 *Aesthetic Requirements*

This subsection of these Principal's Requirements is applicable if the Principal accepts the Provisional Sum items for a PAC system and PAC contact tank. This subsection does not apply if the Principal does not accept the Provisional Sum items for a PAC system and PAC contact tank.

The Hatepe WTP shall target concentrations of taste and odour compounds (geosmin, 2-MIB and 2,4,6-trichloroanisole) of less than 5 ng/L at the outlet of the treated water wet well. A powdered activated carbon (PAC) dosing system shall be installed by the Contractor to provide for the intermittent removal of taste and odour compounds from the raw water. The PAC dosing system shall achieve a dose of 30 mg/L continuously over a 30-day period at peak production capacity.

The treatment process shall also target less than 50% of the GVs for all aesthetic determinands as detailed in the DWSNZ Section 2.3, Table 2.5.

4.3.2.5 *Cyanotoxin Compliance*

This subsection of these Principal's Requirements is applicable if the Principal accepts the Provisional Sum items for a PAC system and PAC contact tank. This subsection does not apply if the Principal does not accept the Provisional Sum items for a PAC system and PAC contact tank.

The upgraded plant shall target cyanotoxin compliance as per DWSNZ Section 7 i.e. concentrations of algal toxins are less than 50% of the respective PMAVs at the outlet of the treated water wet well (see DWSNZ Table 2.3 for details of specific toxins). A PAC dosing system shall be installed by the Contractor to provide for the intermittent removal of cyanotoxins from the raw water. The PAC dosing system shall achieve a dose of 30 mg/L continuously over a 30-day period at peak production capacity.

4.4 Tests on Completion and Tests after Completion

The parameters that will be tested during ToC and TaC for the new Hatepe WTP are listed in Table 4.4 along with the sampling points, minimum monitoring frequencies and the specific requirements that must be met.

See Sections C19.8 and C19.11 of the Specifications for general information on ToC and TaC and the specific testing periods.

4.5 Redundancy Requirements

The Hatepe WTP must provide multiple barriers to ensure a robust process with a high level of redundancy that minimises risk to treated water quality. Unless otherwise indicated in this document, all systems require capacity for N+1 redundancy on equipment.

4.6 Automation and Minimum Levels of Consumables

The Hatepe WTP must be capable of continuous operation for at least 72 hours at maximum treated water production without manual intervention.

4.7 Process Requirements

4.7.1 Raw Water Pumping

The Principal will be responsible for ensuring the raw water intake pumps are fit for purpose and appropriate for the new Hatepe WTP requirements.

4.7.2 Inlet Screening

Refer to Section C18.11.8 of the Specifications.

4.7.3 Powdered Activated Carbon System

This subsection of these Principal's Requirements is applicable if the Principal accepts the Provisional Sum items for a PAC system and PAC contact tank. This subsection does not apply if the Principal does not accept the Provisional Sum items for a PAC system and PAC contact tank.

The powdered activated carbon (PAC) system (excluding the PAC contact tank) shall be situated in a dedicated room with a dust filtration and exhaust system to prevent airborne carbon particles settling throughout the remainder of the plant. The Contractor shall determine whether a vibrating mechanism is required on the dry PAC hopper. The hopper must have the capacity to hold a minimum of two bags (25 kg per bag) of PAC. Space and access provisions must be included in the Site layout and PAC room design for storage of spare PAC bags (1 pallet equivalent floor space).

The Contractor is to determine whether a gantry crane or vacuum transfer system is more appropriate (taking into account health and safety considerations) for transferring the PAC from the storage bags to the feed hopper.

Given the range of dry feed-rates required, a duty / assist arrangement for the dry-feed mechanism may be required.

The PAC contact tank provided by the Contractor shall provide a minimum contact time of 10 minutes at the peak treated water production and a working volume of 100% full.

The PAC dosing system shall be able to sustain a maximum dose of 30 mg/L for a period of 30 days at peak treated water production.

All PAC system infrastructure shall be capable of being fully emptied/drained and cleaned between use events. The design of the PAC system shall minimise the deposition and release of particulate material and/or provide a mechanism for removal of particulate material without the requirement for the WTP to be taken offline.

4.7.4 Coagulation and Flocculation

Aluminium chlorohydrate (ACH) shall be the coagulant used and sodium hydroxide shall be used for pH correction.

The flocculation tank shall provide a minimum flocculation time of 5 minutes at the peak flowrate and a working volume of 75% full, unless a lower minimum flocculation time is proposed by the Contractor in the Contractor's tender with supporting process performance justifications and is accepted by the Principal.

The Contractor shall ensure that the minimum flocculation time and mixing energy are applied over the full range of flowrates and raw water conditions, without the requirement for any manual intervention to adjust the mixing energy and/or flocculation time.

All flocculation infrastructure must be capable of being fully drained and cleaned. The design of the flocculation system must minimise the deposition of particulate material and/or provide a mechanism for removal of particulate material without the requirement for the WTP to be taken offline for more than 2 hours.

Any ancillary equipment shall be provided as duty / standby.

The waste recovery system's recycle stream shall discharge into the flocculation tank. The discharge stream shall be designed so as to minimise disruption to the flocculation process and shall be limited to no more than 10% of the raw water flowrate.

4.7.5 Membrane Filtration

The membrane filtration system shall meet the requirements of Section C18.11.14 of the Specifications.

The peak production requirement of 300 m^3/d net treated water production shall be achievable at all times with at least one membrane train out of service. The exception to this is during adverse raw water quality conditions (see Section 4.1).

Based on the chemicals selected for CIPs, intervals between each CIP and the frequencies between the disposal of waste, the Contractor shall ensure that chlorine gas is not released through the mixing of sulphuric acid (or another acid) and sodium hypochlorite CIP waste streams. If there is a chance of this occurring based on the Contractor's proposed CIP intervals and frequencies between waste disposal, then the Contractor shall include a sodium bisulfite dosing system (or similar) for dechlorination and pH neutralisation of sodium hypochlorite waste streams to eliminate the risk of chlorine gas release from the waste system.

4.7.6 Treated Water and Bacteriological Compliance

The new chlorine contact tank designed and built by the Contractor shall provide a minimum chlorine contact time (T_{10}) of 30 minutes at peak treated water production and a working volume of 100% full.

The chlorine contact tank shall be designed to operate at 100% full with an overflow outlet into a treated water wet well.

The Contractor shall ensure that the chlorine contact tank is sufficiently baffled to maximise mixing and prevent dead zones and bypassing. The contact tank baffle factor shall be a minimum of 0.5.

The Contractor shall demonstrate to the satisfaction of the Engineer that a minimum baffle factor of 0.5 is achieved in the chlorine contact tank. CFD modelling or tracer testing demonstration methods may be used to demonstrate the minimum chlorine contact time of 30 minutes (T_{10}) at the peak treated water flowrate.

Contact tank bypass systems must be fitted with double block and bleed protection to ensure filtrate cannot bypass the contact tank and enter the water supply network.

The treated water wet well shall be designed to have at least 10 minutes of working water storage capacity (at peak net treated water production).

The instruments used to measure pH, FAC and turbidity of the treated water shall be positioned to allow at least three minutes of lag time from the sodium hydroxide and chlorine dose points.

The treated water pumps shall be capable of achieving the final peak net treated water production requirement of 300 m^3/d at all times with at least one treated water pump out of service (N+1).

4.7.7 Service Water and Potable Water Supply

Refer to Section C14.11.5 of the Specifications.

The Site service water / amenity potable water supply will be connected upstream of the treated water line to the reticulation network tie-in point and downstream of the treated water discharge non return valves. When the WTP is not in production the the Site service water / amenity potable water supply will back feed from the reticulation

network. Flow measurement shall be configured to separately and accurately account for treated water production to supply and service water use.

4.7.8 Waste System

The daily discharge volume of backwash, CIP and other process waste streams to the sludge holding tank shall be no more than 3 m^3/d under typical raw water quality conditions (see Table 4.2), calculated from midnight to midnight. The combined waste to be disposed of must comply with the requirements set out in Section 4.7.5.

The waste balance tank working capacity shall not be less than 10 m^3.

The supernatant pumps (delivering flow to the flocculation tank) shall be controlled to limit recycle flow to no more than 10% of the measured raw water flow to comply with section 5.2.1.3 of the DWSNZ.

The Contractor shall provide strainers on the supernatant return stream to protect the membrane filtration process. The strainers shall be approved by the membrane supplier.

The sludge holding tank shall be provided with a mixing system that is capable of homogenising the full tank contents in 15 minutes from initiation of the mixing system. The mixing system shall be capable of being operated remotely to allow the operators to start the mixing system when a sludge cartage tanker is enroute to the Site. The sludge holding tank shall have a bottom outlet with isolation valve and 100 mm male camlock connection for tanker connection to dispose of the sludge offsite.

The sludge holding tank shall be fitted with a level transmitter.

All waste system infrastructure installed by the Contractor must be capable of being fully drained and cleaned.

All waste from Site amenities (e.g. toilet and handwash facilities) shall be pumped to the sludge holding tank (via a grinder pump) for offsite disposal.

4.7.9 Coagulant Dosing System

The coagulant (ACH) for use in the flocculation and waste recovery processes shall not be diluted with carry-water. A 200 L drum will be delivered to Site and utilised to fill the coagulant dosing tank. There shall be a single chemical tank for dosing and storage of coagulant. The 200 L drum will be placed in the common delivery bund provided by the Contractor, where it may be stored for a period of time prior to the operator making the chemical transfer from the drum to the permanent storage tank.

The coagulant dosing tank provided by the Contractor shall be sized such that a minimum of 30 days of working storage is available at the average dose and peak net treated water production flowrate.

Low head-loss static mixers shall be used at the coagulant dose points to rapidly mix the coagulant with the process flow stream.

All coagulant dosing equipment shall be contained within a bund that can hold at least 110% of the coagulant dosing tank's volume.

A single duty-only installed pump shall be sufficient for the waste recovery coagulant dosing system (N+1 exemption), and a boxed spare waste recovery coagulant dosing pump shall be provided by the Contractor. The main coagulant dosing system shall comply with the critical process redundancy requirements (installed duty and standby dosing pumps with auto duty changeover).

Also refer to Section C18.11.23 of the Specifications.

4.7.10 Sodium Hydroxide Dosing System

The Hatepe WTP shall use sodium hydroxide for pH control of the raw and treated water. Sodium hydroxide will be delivered to site in 200 L drums and transferred to the dosing tank by way of an air diaphragm pump. There shall be a single chemical tank for dosing and storage of sodium hydroxide.

The sodium hydroxide dosing tank shall be sized such that a minimum of 30 days of working storage is available at the average dose and peak net treated water production flowrate.

The coagulation pH shall be controlled to a pH of 7.4, operator adjustable within the range of 7.2 to 7.8. The treated water pH shall be controlled to a pH of 7.8, operator adjustable within the range of 7.4 to 8.0. Dosing control shall be fully automated. The dosing lines shall be able to be isolated at the dosing points.

Heat-tracing and insulation on the tank and pipework around the pump will be required to prevent the sodium hydroxide from freezing.

The Contractor shall ensure that the temperature increase upon dosing the sodium hydroxide into the carry-water lines is acceptable.

All sodium hydroxide dosing equipment shall be contained within a bund that can hold at least 110% of the sodium hydroxide dosing tank's volume.

Also refer to Section C18.11.23 of the Specifications.

4.7.11 Chlorination System

Chlorine gas shall be used for all chlorine dosing requirements. The chlorine system provided shall include a carry-water delivery mechanism and shall be dosed as superchlorinated water. The carry-water shall be supplied from the service water system.

Chlorination of the treated water shall be fully automated with flow-pacing and FAC residual feedback control. It shall also be possible to set the dose manually.

100 kg gas cylinders will be utilised for the delivery and supply of chlorine to the Hatepe WTP.

Also refer to Section C18.11.23 of the Specifications, and in particular Sections C18.11.23.9.1 and C18.11.23.9.2.

4.7.12 Hydrofluorosilicic Acid Dosing System Provision

The Contractor shall allow space for the potential future installation of a hydrofluorosilicic acid (HFA) dosing system. Provision shall be made for the future system to consist of a 250 L dosing tank in a bunded area with duty / standby dosing pumps. The tank shall be replenished by means of a 200 L drum and transfer to the dosing tank by an air diaphragm pump. The provisions for future HFA storage allowed for in the Contractor's design shall comply with current HSNO requirements for HFA storage (e.g. separation distances from incompatible chemicals etc).

4.7.13 Sodium Bisulfite (or similar) Dosing System Provision

Unless the Contractor considers it necessary to install a sodium bisulfilte dosing system for neutralization of sodium hypochlorite CIP waste streams within the scope of the Contract Works in order to eliminate chorine gas evolution risks in the waste system, the Contractor shall allow space for the potential future installation of a sodium bisulfite dosing system (or similar) for dechlorination and neutralization of the CIP waste streams. Provision shall be made for the future system to consist of a dosing tank in a bunded area with duty / standby dosing pumps. There shall be a single chemical tank for dosing and storage of sodium bisulfite. The provisions for future sodium bisulfite (or

similar) storage allowed for in the Contractor's design shall comply with current HSNO requirements for chemical storage (e.g. separation distances from incompatible chemicals etc).

The Contractor shall be responsible for complying with the requirements set out in Section 4.7.5.

5 Site

5.1 Location and Site Boundary

The Site for the new Hatepe WTP is located on the north side of State Highway 1, Hatepe and will be accessed from Rereahu Avenue. The proposed location is shown in Figure 5.1 along with the existing potable water reticulation network supply line (blue) heading south across State Highway 1 towards the storage reservoirs.

Figure 5.1 does not include the tie-in points listed in Section 2, which are to be constructed and in place before the Works detailed in this Separable Portion are complete. If not within the Site boundary, the tie-in points will be within 10 m of the site boundary where the proposed vehicle access to the site intersects with Rereahu Avenue.

Figure 5.1 – Hatepe WTP Proposed Location and Indicative Site Boundary

There is currently no electrical infrastructure on the Site and the Site requires clearing and grubbing of vegetation.

A concept layout for the new Hatepe WTP can be found in the Principal's Preliminary Process Design Report which is appended to this document.

5.2 Plant Building

A plant building shall be designed and built by the Contractor to house some of the components of the new Hatepe WTP. The following items shall be located inside the plant building:

- Membrane filtration stage and all associated components;
- Treated water pumps;
- Chemical systems, including space for potential future hydrofluorosilicic acid system (and sodium bisulfite system if not provided within the scope);
- PAC storage and dosing system (if provided);
- All other items specified in Section C18.10.3.2 and Section C18.10.3.3 of the Specifications.

5.3 Contractor's Site Amenities

The Site does not have any existing facilities. The Contractor shall be responsible for establishing and maintaining the following temporary facilities for the duration of the construction period and disestablishing them as required at completion:

- Potable water;
- Toilet / portaloo;
- Site office;
- Construction power supply;
- Site security.

5.4 Construction and Laydown Areas

The areas required by the Contractor for construction, laydown, temporary amenities and parking must be within the Site's boundaries. The road reserve and other areas outside of the Site's boundaries must not be used for construction, temporary amenities, parking or laydown.

Car parking shall be on the Site.

Construction and laydown areas and all temporary facilities must be set up neatly and in such a way that they do not interfere with construction or commissioning.

6 Appendices

6.1 Principal's Preliminary Process Design

6.1.1 Principal's Preliminary Process Design Report

GREAT LAKE TAUPŌ
Taupō District Council

Lutra.

Principal's Preliminary Process Design.

Hatepe WTP Principal's Preliminary Process Design

Prepared for Taupo District Council

TDC010-DB4-3

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Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Background

The existing Hatepe water treatment plant (WTP) supplies the Hatepe village reticulation network.

The existing infrastructure is owned and operated by Taupo District Council (TDC) and consists of a lake intake system, water treatment plant (chlorination and filtration) and a reticulation network including six treated water storage tanks.

The existing WTP is located on the shoreline of Lake Taupo. The WTP includes two raw water pumps which pump water from the lake intake into a concrete contact tank next to the WTP building. Chlorine gas is dosed into the contact tank via a carry water line.

Two treated water pumps withdraw the water from the contact tank and pump it through an Amiad filter and into the distribution zone. There are six treated water storage tanks located in an elevated position above the village that are replenished via the reticulation network and supply treated water back into the network by gravity when the plant is not operating.

The existing WTP provides no treatment for protozoa or arsenic. As such, TDC has identified the need for treatment of these components, as well as additional treatment of taste and odour (T&O) compounds and algal toxins.

This preliminary process design and concept layout design outlines the intended process and operation of the new WTP and is to be read in conjunction with the Preliminary Piping and Instrumentation Diagrams (P&IDs) and Preliminary Functional Description (FD).

1.2 Purpose

TDC wishes to build a new Hatepe WTP that will provide the required protozoal, bacteriological and chemical treatment as required to meet the Drinking Water Standards for New Zealand 2005 – Revised 2018 (DWSNZ). Additionally, the new WTP will have the capacity to meet the projected treated water demand requirements to 2050. The treated water will be used for domestic water supply purposes.

This design document has been prepared to detail the preliminary design aspects and concept layout design specific to the Hatepe WTP project as developed at the time of writing. The document is intended to supplement the NZS3916 – Design and Construction Contract for the implementation of new WTPs, including the Hatepe WTP. In accordance with clause 5.1.7 of the General Conditions of Contract, if the Contractor elects to adopt any or all elements of the preliminary and concept design set out herein, the Contractor will assume full responsibility for ensuring that the design achieves compliance with the Principal's Requirements in all respects. The details in this report, including process and calculated values as well as the proposed design, are preliminary and are to be examined and confirmed by the Contractor and incorporated into the detailed design, modified appropriately or replaced, with any modifications or replacements clearly set out in the Contractor's Design Documentation.

2 Objectives

The overall project objectives have been detailed in Section 2.1 of the Principal's Requirements (TDC010-SP4) for the new Hatepe WTP. The Principal's Requirements document details the quality and compliance objectives that the Hatepe WTP shall achieve. The Principal's Requirements document shall be referenced for all Hatepe WTP performance criteria.

This Principal's preliminary design has been prepared in order to achieve the performance criteria detailed in the Principal's Requirements and meet the following plant output:

Table 2.1 – Net Treated Water Production

Parameter	Minimum	Average	Maximum
Net Treated Water (m^3/d)	60	75	300

3 Preliminary Process Design

3.1 Contract Works Overview

An overview of the new Hatepe WTP preliminary design is provided in this section. The key upgrade components that have been included to meet the performance criteria of the Principal's Requirements are as follows:

- Powdered activated carbon (PAC) dosing;
- PAC contact tank;
- Coarse screening, as required by the membrane supplier;
- Coagulant dosing;
- Sodium hydroxide dosing (at coagulation point) for pH correction;
- Flocculation tank;
- Membrane filtration for protozoal compliance, with all ancillary equipment and systems;
- Warm water system;
- Compressed air system;
- Clean-in-place (CIP) chemical systems;
- Chlorine dosing (for residual);
- Sodium hydroxide dosing (treated water pH correction);
- Chemical delivery, storage and transfer systems;
- Automated divert-to-waste system;
- Chlorine contact tank;
- Treated water wet well;
- Treated water pumping into the reticulation network;
- Service water system;
- Waste balance tank;
- Backwash water recovery system;
- Sludge holding tank (for sludge storage prior to periodic disposal off Site);
- All auxiliary systems for the process plant.

3.2 Process Overview

An overview of the upgraded plant process schematic is shown in Figure 3.1.

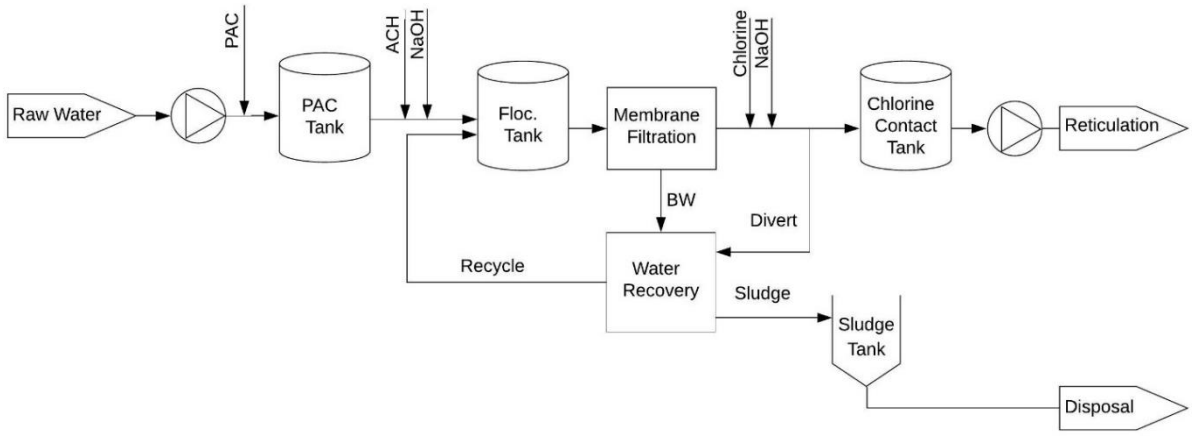


Figure 3.1 – Process Schematic

The following process descriptions should be read in conjunction with the Preliminary Process Flow Diagram (PFD) and Preliminary P&IDs. New and existing equipment are indicated on the PFD and P&IDs.

3.3 Raw Water Monitoring

The raw water flow-rate and turbidity will continue to be monitored at the raw water intake pump station at the lakefront. This does not affect the scope of this project.

3.4 Raw Water Pumping

3.4.1 Process Description

The raw water intake pumps at the existing Hatepe WTP withdraw water from Lake Taupo and transfer it to the WTP. The existing intake pump station will be utilised for delivering water to the new Hatepe WTP if it is deemed fit for purpose. This determination will be made by the Principal once the pressure requirements at the boundary of the new Hatepe WTP are known. Any upgrades to the intake pump station and the installation of a new raw water main to the new Hatepe WTP will take place independently of the current Contract Works.

3.4.2 Upgrade Equipment

The potential upgrade of the raw water intake pump station and the installation of a new raw water main from the pump station to the Site of the new Hatepe WTP is excluded from the scope of this design. Any upgrade will be managed separately to the Contract Works.

The P&IDs show that the new Hatepe WTP will control the intake pump station as part of the new controls system. Note that the P&IDs are indicative only and do not reflect the current layout of the intake pump station.

3.5 Inlet Screening

3.5.1 Process Description

Raw water from Lake Taupo will be pumped via the intake pump station to the Site of the new WTP via a new dedicated raw water main (to be designed and installed outside of the scope of this contract, terminating at the boundary of the WTP Site). There is a PAC dose-point for dosing PAC during algal bloom events (see Section 3.6 for further details on the PAC system).

After the dose-point, the water passes through two (duty / duty) coarse screens which are sized to each process the full plant capacity. The screens serve to remove coarse debris from the raw water to protect the membrane filtration stage from physical damage.

3.5.2 Upgrade Equipment

Two coarse screens with an integrated automated backwashing system have been included in the preliminary design.

Table 3.1 – Preliminary Design Parameters for the Coarse Screens

Parameter	Units	Value
Number of screens	-	2
Capacity per screen	m^3/h	12.5
Maximum screen aperture size	mm	0.5

3.6 Powdered Activated Carbon System

3.6.1 Process Description

PAC is used for the removal of T&O compounds and algal toxins from the raw water. PAC is dosed upstream of the coarse screens.

Downstream of the screens is the PAC contact tank. The contact tank is a pressure vessel so that the head from the raw water pumps is not broken. The contact tank provides additional contact time between the PAC particles and the T&O compounds and/or algal toxins in order to maximise the removal efficiency.

The PAC dosing system consists of a feed hopper, into which PAC is loaded by means of a gantry crane. A vacuum transfer system may be used in place of a gantry crane for transferring the PAC from the storage bags into the feed hopper. Two dry feeders (duty / assist) abstract PAC from the hopper and discharge it into the wetting tank. Service water and PAC are mixed in the wetting tank. The contents of the wetting tank are withdrawn by means of an eductor. The eductor receives its motive water from the service water system.

3.6.2 Upgrade Equipment

The preliminary design consists of a contact tank, dosing point for the PAC, hopper, two dry feeders, dosing tank and eductor. A duty-only dosing system will be sufficient as PAC dosing will be required for no more than a few months per year.

The PAC system (excluding the contact tank) should be situated in a separate room with a dust filtration and exhaust system to prevent airborne particles settling throughout the plant. The Contractor is to determine whether a vibrating mechanism is required on the dry PAC hopper.

Given the range of dry feed-rates required, a duty / assist arrangement for the dry-feed mechanism may be required. This has been included in the preliminary design.

The proposed contact tank live volume is shown in Table 3.2. The contact tank has been sized to provide a minimum contact time of 10 minutes at the final peak flow-rate and a working volume of 100% full.

Table 3.2 – Preliminary Design Parameters for the PAC System

Parameter	Units	Value
PAC contact tank volume (live)	m^3	2
PAC contact tank residence time (Peak flow)	min	10
Average dose	mg_{active}/L	5
Maximum dose	mg_{active}/L	30
Dry feeding capacity (both feeders)	g/h	10 to 375
Carry-water flow-rate	L/h	125
Storage capacity (25 kg bags)	kg	50
Storage period (Average flow, average dose)	days	133
Storage period (Peak flow, maximum dose)	days	6

3.7 Coagulation and Flocculation

3.7.1 Process Description

Downstream of the PAC contact tank a static mixer is installed where aluminium chlorohydrate (ACH) and sodium hydroxide are dosed into the raw water. Analysers for measuring the turbidity and pH of the water are positioned after the static mixer.

The turbidity meter is used for monitoring the raw water turbidity as a compliance requirement of the membrane filtration stage. The pH meter is used for controlling the sodium hydroxide dose for effective coagulation. The coagulant is used primarily for aiding in the removal of arsenic from the water. The optimal coagulation pH is 7.4.

After the sample point for the analysers, the water enters the flocculation tank. The flocculation tank provides sufficient coagulation time and a buffer capacity between the raw water pumps and the Hatepe WTP.

The supernatant recycle stream from the water recovery system is discharged into the flocculation tank.

3.7.2 Upgrade Equipment

The preliminary design includes a flocculation tank, along with a static mixer to ensure adequate mixing between the raw water, coagulant and sodium hydroxide. See Section 1.1 for details of the coagulant dosing system and Section 3.13 for details of the sodium hydroxide dosing system.

The proposed flocculation tank live volume is shown in Table 3.3. The tank has been sized to provide a minimum flocculation time of 5 minutes at the peak flow and a tank level of 75%.

Table 3.3 – Preliminary Design Parameters for Coagulation and Flocculation

Parameter	Units	Value
Static mixer capacity	m^3/h	12.5
Floc. tank volume (live)	m^3	2
Floc. tank residence time (Peak flow, 75% full)	min	7

3.8 Membrane Filtration

3.8.1 Process Description

After the flocculation tank, the water is pumped through the membrane filtration skids (duty / standby) by the membrane feed pumps.

The number of membrane skids and capacity of each membrane skid has been selected so that the Hatepe WTP can facilitate peak flow with one membrane train out of service.

3.8.2 Clean-in-Place

The preliminary design includes a complete CIP system for the membrane plant. The anticipated chemicals that have been included in the CIP system are:

- Citric acid;
- Sodium hypochlorite;
- Sulphuric acid.

As per the Principal's Requirements, the chemical tanks have been sized to ensure at least 30 days of chemical storage is available (at peak production). For preliminary sizing calculations, the sodium hypochlorite strength was assumed to be 12.5%; however, dilution will be an option for the Contractor to further minimise degradation with a corresponding increase in the maximum storage time. The operating concentration of the sodium hypochlorite solution is to be confirmed by the Contractor in accordance with the CIP requirements.

The Contractor can select alternate or additional chemicals for the CIP system if required.

3.8.3 Upgrade Equipment

It is anticipated that two membrane skids will be required. The preliminary design includes the following equipment for each skid:

- Membrane feed pump with variable-frequency drive (VFD);
- Feed pH meter;
- Feed temperature transmitter;
- Permeate turbidity meter;
- Flowmeter;
- Differential pressure transmitter.

A single sodium hydroxide dosing tank has been included in the design for coagulation pH control and treated water pH control.

CIP chemical consumption estimates have been provided in Table 3.4.

Table 3.4 – Preliminary Design Parameters for the Membrane Filtration and Ancillary Systems

Parameter	Units	Value
Number of membrane skids	-	2
Processing capacity per membrane skid	m^3/h	14
Sodium hypochlorite unit size (live)	L	20
Sodium hypochlorite CIP consumption	L/month	20
Sodium hypochlorite storage time[1]	days	30
Citric acid unit size (live)	L	20
Citric acid CIP consumption	L/month	10
Citric acid storage time	days	60
Sulphuric acid unit size (live)	L	20
Sulphuric acid CIP consumption	L/month	5
Sulphuric acid storage time	days	120

1. Contractor can select different unit size to suit storage requirements.

3.9 Treated Water and Bacteriological Compliance

3.9.1 Process Description

The filtered water from the membrane filtration stage is transferred into the chlorine contact tank. Prior to the tank, superchlorinated water and sodium hydroxide are dosed into the filtered water via a static mixer for providing a FAC residual in the treated water for bacteriological protection and for treated water pH correction, respectively.

Downstream of the static mixer, two sample pumps (duty / standby) supply water to FAC and pH analysers. The FAC analyser is used to control the chlorine dose whereas the pH analyser is used to control the sodium hydroxide dose. See Section 3.14 for further details on the chlorination system and Section 3.13 for further details on the sodium hydroxide dosing system.

After the dose-point and analyser sample point, there is a divert-to-waste line. If the plant becomes non-compliant during operation, the divert-to-waste function will be activated until the water quality meets the compliance criteria or the divert time limit has been reached. During the divert operation, no water is to enter the chlorine contact tank.

When the divert operation is active, the plant flow-rate will be restricted to limit water losses. The divert stream is directed to the waste balance tank.

After the divert-to-waste line, the treated water enters the chlorine contact tank. The tank provides a retention time for bacteriological compliance (DWSNZ, Criterion 2A).

A bypass around the chlorine contact tank is included to enable the plant to operate when the tank is offline for maintenance.

The treated water overflows from the chlorine contact tank into a wet well. Three treated water pumps (duty / assist / standby) draw treated water out of the wet well and transfer it into the reticulation network. The pumps are driven by variable-frequency drives.

On the overflow line from the contact tank to the treated water wet well, instrumentation for measuring the turbidity, FAC and pH are installed in accordance with the requirements of DWSNZ Criterion 2A.

3.9.2 Upgrade Equipment

The new equipment will consist of a static mixer, a divert system, a chlorine contact tank, a treated water wet well and three treated water pumps.

The proposed chlorine contact tank live volume is shown in Table 3.5. The chlorine contact tank has been sized to provide a minimum chlorine contact time of 30 minutes at the peak flow-rate and a working volume of 100% full.

Table 3.5 – Preliminary Design Parameters for Treated Water Equipment

Parameter	Units	Value
Static mixer capacity (filtrate)	m^3/h	14
Divert-to-waste design capacity	m^3/h	14
Divert-to-waste typical operating capacity	m^3/h	2.5
Chlorine contact tank volume (live)	m^3	15
Average demand	m^3/h	3
Peak demand	m^3/h	12.5
Number of pumps	-	3
Capacity per pump	m^3/h	6.5
Pump operating head at capacity[1]	m	65 (Contractor to confirm)

1. The preliminary treated water pump sizing is based on an estimated static discharge head to the existing six treated water tanks of 40 m and a discharge line length of approximately 350 m.

3.9.3 Criterion 2A Parameters

Based on the chlorine contact tank volume and demand flow-rates, the Criterion 2A parameters have been estimated and are shown in Table 3.6.

For the preliminary design, a minimum baffle factor of 0.5 has been used.

Table 3.6 – Criterion 2A Parameters

Parameter	Units	Value
Minimum acceptable baffle factor	-	0.5
Retention time (Average flow, 100% full)	min	144
Retention time (Peak flow, 100% full)	min	36
Free available chlorine equivalent (FACE) (average)	mg_{Cl_2}/L	1.0
Free available chlorine equivalent (minimum)	mg_{Cl_2}/L	0.5
C.t value (Average flow, average FACE)	mg·min/L	144
C.t value (Peak flow, minimum FACE)	mg·min/L	18
C.t value minimum required[1]	mg·min/L	15

1. For at least 98% of the compliance period (one day). Based on the Australian Drinking Water Guidelines v3.5 and recommendation from the World Health Organization (2011).

3.10 Service Water

3.10.1 Process Description

Service water is supplied to Site via a pipeline coming off the main treated water line post the treated water pumps. When the treated water pumps are offline, the pressure for the service water system is provided by the reticulation network from the elevation of the treated water tanks.

The service water users include the following:

- Carry-water for the PAC dosing system;
- Carry-water for the sodium hydroxide dosing system;
- Carry-water for the chlorine gas dosing system;
- Safety showers and eyewash stations;
- Hosing points;
- General Site service water users.

3.10.2 Upgrade Equipment

Safety showers and eyewash stations will be required in the chemicals area. The number of safety showers shown is indicative only and dependent on the final layout.

3.11 Waste System

3.11.1 Process Description

3.11.1.1 *Waste Balance Tank*

The waste balance tank receives process waste and overflow streams from various parts of the plant. The balance tank is situated underground to facilitate gravitational flow from the various waste streams. The streams entering the tank are as follows:

- Instrumentation drain lines;
- Coarse screens backwash streams;
- PAC contact tank pressure-relief and drain;
- Flocculation tank overflow and drain;
- Membrane filtration stage backwash streams;
- Warm water tank overflow and drain;
- Divert-to-waste;
- Chlorine contact tank drain;
- Treated water wet well overflow and drain;
- Supernatant tank overflow and drain;
- Supernatant recycle stream when it does not meet the turbidity requirements for recycling to the head of the plant.

Two submersible pumps (duty / standby) transfer the contents of the balance tank to the thickening unit.

3.11.1.2 *Neutralisation Tank*

The neutralisation tank receives the CIP waste streams from the membrane filtration stage. The preliminary design includes two submersible pumps (duty / standby) which transfer the contents of the neutralisation tank to the sludge disposal tank.

Note that for the preliminary design, sodium hydroxide and sodium bisulfite (or another system) for dechlorination and neutralisation of CIP waste streams have not been included; however, space has been allowed in the concept layout for future installation of a neutralisation system(s) if required.

The flow-rate of the neutralised waste stream is measured for performance efficiency requirements.

3.11.1.3 *Sludge Thickening*

The contents of the waste balance tank are pumped to the thickening unit. Coagulant dosing is included in the feed stream to the unit in order to facilitate solids removal. This can be a lamella clarifier, thickener or alternative treatment process. The coagulant used is ACH as to allow compatibility with the main treatment process. The unit thickens the feed, producing a clarified supernatant and a thickened sludge. Refer to Section 1.1 for further details on the coagulant dosing system.

The clarified supernatant is discharged into the supernatant tank from where it is pumped (duty / standby) into the flocculation tank. Strainers on the discharge of each of the supernatant pumps protect the membranes from damaging particulates being sent through from the thickening unit. The flow-rate and turbidity of this recycled stream are measured for compliance and control.

If the supernatant water turbidity is too high to be recycled, then the supernatant can be automatically diverted to the waste balance tank until the turbidity reduces to acceptable levels.

3.11.1.4 *Sludge Storage and Disposal*

The thickened sludge is periodically withdrawn from the thickener via two sludge pumps (duty / standby) and transferred to the sludge holding tank. For the preliminary design, the sludge holding tank is a hopper with a 60° cone bottom and is equipped with a mixer to prevent sludge hold-up.

The waste sludge is periodically removed from the holding tank via a tanker and disposed of off Site.

3.11.2 Upgrade Equipment

The preliminary design includes the following equipment as part of the waste system:

- Waste balance tank and two submersible pumps;
- Neutralisation tank and two submersible pumps;
- Thickening unit and all ancillaries, including two sludge discharge pumps;
- Supernatant tank with two discharge pumps, instrumentation, and automated diversion system to waste balance tank;
- Sludge holding tank with mixer.

Table 3.7 – Preliminary Design Parameters for the Waste System

Parameter	Units	Value
Waste Balance Tank		
Tank capacity (live)	m^3	10
Number of pumps (submersible)	-	2
Capacity per pump	m^3/h	2.5
Neutralisation Tank		
Tank capacity (live)	m^3	10
Number of pumps (submersible)	-	2
Capacity per pump	m^3/h	2.5
Thickening Unit		
Processing capacity	m^3/h	2.5
Total feed volume	m^3/day	4 – 21
Total feed solids	kg/day DS	0.1 – 21
Design solids recovery to sludge stream (minimum)	%	95
Sludge storage capacity (internal to unit)	m^3	1.5
Number of sludge discharge pumps	-	2
Capacity per pump	m^3/h	1
Supernatant Tank		
Tank capacity (live)	m^3	5
Number of pumps	-	2
Capacity per pump	m^3/h	1.25[2]
Sludge Holding Tank		
Tank capacity (live)	m^3	10

1. Contractor to confirm design parameters for the waste system for achieving the performance requirements as detailed in the Separable Portion.

2. Pump maximum capacity chosen to limit recycle flow to 10% of peak raw water flowrate to comply with Section 5.2.1.3 of the DWSNZ.

3.12 Coagulant Dosing System

3.12.1 Process Description

Coagulant dosing assists the membrane filtration process by precipitating dissolved organic carbon and aiding in the removal of turbidity and arsenic. Coagulant is dosed upstream of the flocculation tank through a static mixer. The coagulant dose for the raw water duty will be manually set by the operator and flow-paced to the raw water flow-rate.

Coagulant dosing has been added to the thickening unit's feed stream to assist the solids removal process. The dose is manually set based on the turbidity of the supernatant stream. The dose-rate for this duty is flow-paced to the thickening unit's feed flowrate.

The preliminary design includes delivery of coagulant via 200 L drums and transfer to the dosing tank using an air diaphragm transfer pump.

3.12.2 Upgrade Equipment

The preliminary design includes a coagulant dosing system, consisting of a dosing tank, a dose timer and duty / standby dosing pumps for the raw water duty, and a dose timer and duty-only dose pump for the waste system thickening duty.

As per the Principal's Requirements, the coagulant dosing tank has been sized to ensure at least 30 days of chemical storage is available (at average dose and peak production).

The coagulant dosing tank, dose timers and dosing pumps are contained within a bund, as shown in the preliminary P&IDs.

Table 3.8 – Preliminary Design Parameters for the Coagulant Dosing System

Parameter	Units	Value
Chemical	-	Profloc A23
Active content	$g_{active}/g_{product}$	0.5
Product density	kg/m^3	1,340
Raw Water Dosing Duty		
Average dose	mg_{active}/L	3[1]
Maximum dose	mg_{active}/L	13[1]
Dose-rate (Peak flow, maximum dose)	L/h	0.3
Waste System Dosing Duty		
Average dose	mg_{active}/L	5
Maximum dose	mg_{active}/L	15
Dose-rate (Peak flow, maximum dose)	L/h	0.1
Tank Size and Storage		
Tank size (live)	L	250
Storage period (Peak flow, average dose)	days	153
Storage period (Peak flow, maximum dose)	days	29

1. The average coagulant dose has been estimated based on jar testing that was performed for the Lake Terrace (Taupo) WTP. The maximum coagulant dose has been estimated based on dissolved organics events in the raw water at the Hatepe intake. The Contractor is to confirm the average and maximum doses required.

3.13 Sodium Hydroxide Dosing System

3.13.1 Process Description

Sodium hydroxide is dosed into the raw water static mixer (along with the coagulant) and into the treated water static mixer (along with superchlorinated water).

50% w/w sodium hydroxide is assumed to be used to control the coagulation pH and treated water pH. Other concentrations of liquid sodium hydroxide may be considered if they result in a lower net-present value and operational cost with no detrimental operational effects (bearing in mind lagging, heating and insulation).

A single tank will be used for receiving deliveries and dosing for both coagulation pH control and treated water pH control duties.

Sodium hydroxide product will be dosed by the respective dosing pumps into dedicated carry-water lines to remove the need for lagging of the dosing lines. Carry-water lines have been included in the preliminary design due to the winter temperatures in the area.

The sodium hydroxide doses are controlled by feedback from pH analysers located downstream of the dose-points.

The preliminary design includes replenishment of the dosing tank by means of 200 L drums and transfer to the dosing tank via an air diaphragm pump.

3.13.2 Upgrade Equipment

The sodium hydroxide dosing system consists of a dosing tank, dose timer (for flow verification) and duty / standby dosing pumps.

As per the Principal's Requirements, the sodium hydroxide dosing tank has been sized to ensure at least 30 days of chemical storage is available (at average dose and peak production).

The sodium hydroxide dosing tank, dose timers and dosing pumps are contained within a bund, as shown in the preliminary P&IDs.

Table 3.9 – Preliminary Design Parameters for the Sodium Hydroxide Dosing System

Parameter	Units	Value
Active content	$g_{active}/g_{product}$	0.5
Product density	kg/m^3	1,500
Coagulation pH Control		
Average dose	mg_{active}/L	1.4[1]
Maximum dose	mg_{active}/L	3.9[2]
Dose-rate (Peak flow, maximum dose)	L/h	0.1
Treated Water pH Control		
Average dose	mg_{active}/L	2.5[3]
Maximum dose	mg_{active}/L	3.8[4]
Dose-rate (Peak flow, maximum dose)	L/h	0.1
Tank Size and Storage		
Tank size (live)	L	250
Storage period (Peak flow, average dose)	days	153

Table 3.9 – Preliminary Design Parameters for the Sodium Hydroxide Dosing System		
Parameter	**Units**	**Value**
Storage period (Peak flow, maximum dose)	days	79

1. Based on an average raw water pH of 7.2, average alkalinity of 26 mg/L $CaCO_3$, target coagulation pH of 7.4 and an average coagulant dose.

2. Based on a minimum raw water pH of 7.0, average alkalinity of 26 mg/L $CaCO_3$, target coagulation pH of 7.4 and the maximum coagulant dose.

3. Based on an average raw water pH of 7.2, average alkalinity of 26 mg/L $CaCO_3$, target coagulation pH of 7.4, average coagulant dose and target treated water pH of 7.8.

4. Based on a minimum raw water pH of 7.0, average alkalinity of 26 mg/L $CaCO_3$, target coagulation pH of 7.4, maximum coagulant dose and target treated water pH of 7.8.

3.14 Chlorination System

3.14.1 Process Description

Superchlorinated water will be dosed downstream of the membrane filtration stage and upstream of the divert-to-waste line to provide a residual in the treated water network.

The preliminary design includes two 70 kg chlorine cylinders (duty / standby). An auto-changeover shall provide the chlorine to two chlorinators (duty / standby). Each chlorinator has a dedicated eductor for metering the chlorine gas into the carry-water. The carry-water is suppled from the service water system.

The chlorination system is fully automated with flow-pacing and FAC residual feedback control. It will also be possible to set the dose manually.

3.14.2 Upgrade Equipment

The preliminary design includes a new chlorination system consisting of two chlorine cylinders (duty / standby), two chlorinators and eductors (duty / standby) and other auxiliary equipment.

Table 3.10 – Preliminary Design Parameters for the Chlorination System		
Parameter	**Units**	**Value**
Hazards identification approval number	-	HSR001058
Chlorine content in cylinders	mass-%	100
Disinfection Duty		
Average dose	mg_{Cl_2}/L	1.0
Maximum dose	mg_{Cl_2}/L	2.0
Dose-rate (Average flow, average dose)	g/h	3.5
Dose-rate (Peak flow, maximum dose)	g/h	27
Number of chlorinators	-	2
Chlorinator capacity	g/h	3 to 30
Storage		
Chlorine storage (cylinders)	kg	140 (2x 70)

Table 3.10 – Preliminary Design Parameters for the Chlorination System		
Parameter	**Units**	**Value**
Storage period (Peak flow, average dose, 1 cylinder)	days	218
Storage period (Peak flow, maximum dose, 1 cylinder)	days	109

4 Site

4.1 Plant Concept Layout

A concept layout for the plant is shown in Figure 4.1.

The preliminary layout includes a delivery area for chemicals (200 L drums and small dosing units), with ease of access to the Site and for the safe transfer of chemicals. The layout also includes access for tankers used for removing the sludge from the sludge holding tank.

4.1.1 Plant Building

The preliminary layout includes the following items located inside the plant building:

- Membrane filtration stage and all associated components (including future upgrade components);
- Treated water pumps;
- Chemical systems, including space for potential future hydrofluorosilicic acid and sodium bisulfite dosing systems;
- All other items specified in Section C18.9.3.2 and Section C18.9.3.3 of the Specifications.

The preliminary layout has the following items located outside the plant building:

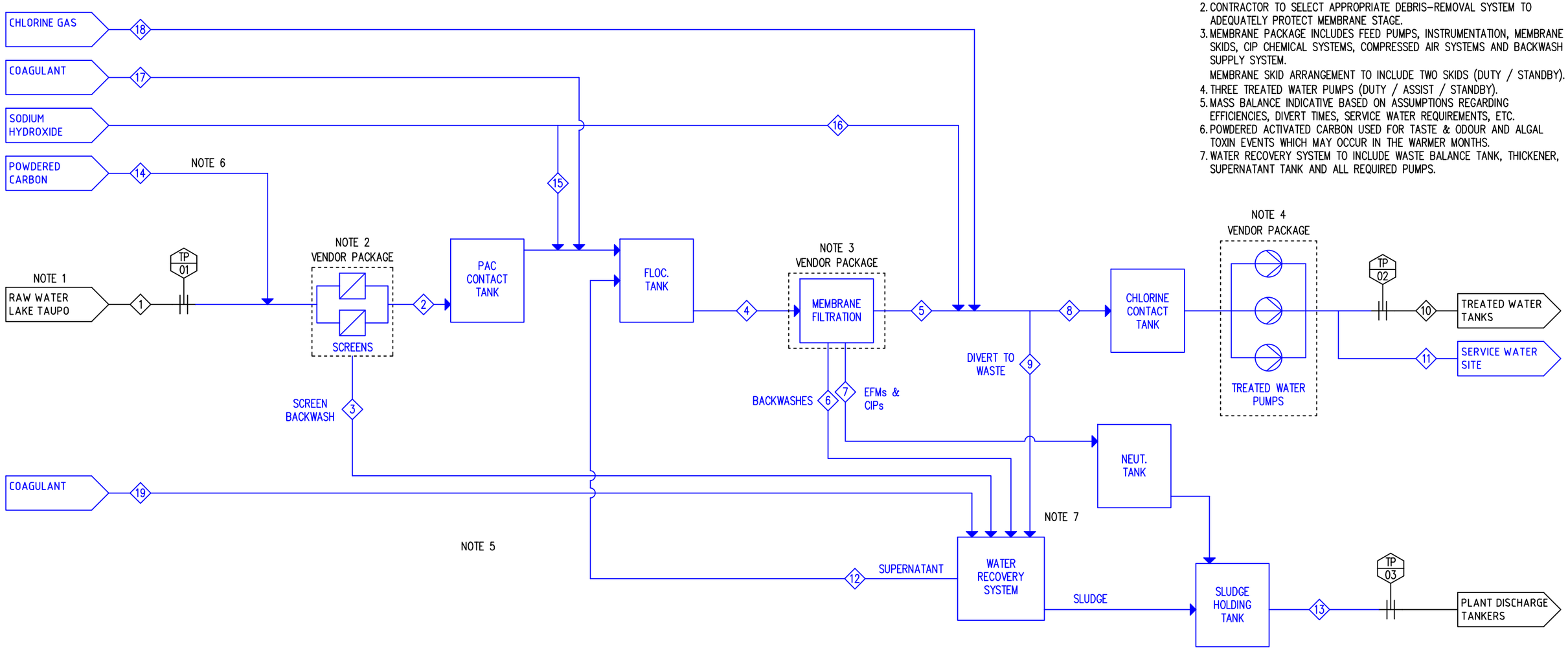
- Coarse screens;
- PAC contact tank;
- Flocculation tank;
- Chlorine contact tank;
- Treated water wet well;
- Waste balance tank and pumps (pumps submerged in tank);
- Neutralisation tank and pumps (pumps submerged in tank);
- Thickening unit and sludge discharge pumps;
- Supernatant tank and pumps;
- Sludge holding tank;
- Space for a mobile generator for running the entire plant at peak production (note that the mobile generator will be stored at the Taupo Wastewater Treatment Plant (WWTP) when not in use).

4.1.2 Future Allowance

Provisional space has been considered for the potential future installation of a hydrofluorosilicic acid dosing system (for fluoridation of the treated water) and a sodium bisulfite dosing system (for dechlorination and neutralisation of the CIP waste stream).

Figure 4.1 – Preliminary Hatepe Water Treatment Plant Concept Layout

6.1.2 Principal's Preliminary Process Flow Diagram



NOTES
1. RAW WATER SUPPLIED FROM EXISTING RAW WATER PUMP STATION.
2. CONTRACTOR TO SELECT APPROPRIATE DEBRIS–REMOVAL SYSTEM TO ADEQUATELY PROTECT MEMBRANE STAGE.
3. MEMBRANE PACKAGE INCLUDES FEED PUMPS, INSTRUMENTATION, MEMBRANE SKIDS, CIP CHEMICAL SYSTEMS, COMPRESSED AIR SYSTEMS AND BACKWASH SUPPLY SYSTEM.
   MEMBRANE SKID ARRANGEMENT TO INCLUDE TWO SKIDS (DUTY / STANDBY).
4. THREE TREATED WATER PUMPS (DUTY / ASSIST / STANDBY).
5. MASS BALANCE INDICATIVE BASED ON ASSUMPTIONS REGARDING EFFICIENCIES, DIVERT TIMES, SERVICE WATER REQUIREMENTS, ETC.
6. POWDERED ACTIVATED CARBON USED FOR TASTE & ODOUR AND ALGAL TOXIN EVENTS WHICH MAY OCCUR IN THE WARMER MONTHS.
7. WATER RECOVERY SYSTEM TO INCLUDE WASTE BALANCE TANK, THICKENER, SUPERNATANT TANK AND ALL REQUIRED PUMPS.

EXISTING EQUIPMENT IN BLACK
NEW EQUIPMENT IN BLUE

REV	DATE	DRAWN	REVISED	APPROVED	REVISION
1	16/10/2020	BC	EC	IR	FOR INFORMATION
2	27/11/2020	BC	EC	IR	FINAL DRAFT
3	01/02/2021	BC	EC	IR	FOR TENDER

DRAWING NUMBER	REFERENCE DRAWING TITLE	AREA

Lutra.

GREAT LAKE TAUPŌ
Taupō District Council

CLIENT: TAUPO DISTRICT COUNCIL

PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE
PROCESS FLOW DIAGRAM
HATEPE WATER SUPPLY

SCALE	DRAWING NO	REV
NTS	HAT-PFD-1	3

6.1.3 Principal's Preliminary Piping and Instrumentation Diagrams

VALVE IDENTIFICATION

PRV0101
- VALVE NUMBER
- PROCESS AREA
- VALVE TYPE

INSTRUMENT IDENTIFICATION

FIT0101
- INSTRUMENT NUMBER
- PROCESS AREA
- INSTRUMENT TYPE

EQUIPMENT IDENTIFICATION

PMP0101
- EQUIPMENT NUMBER
- PROCESS AREA
- EQUIPMENT TYPE

LINE IDENTIFICATION

004–SS–300
- NOMINAL BORE
- PIPE MATERIAL
- LINE NUMBER

DRIVES & ELEC. SUPPLY

DOL	DIRECT ONLINE
FDR	FEEDER CONNECTION
SS	SOFT–STARTER
VSD	VARIABLE–SPEED DRIVE

VALVE POSITIONS

	NORMALLY OPEN
	NORMALLY CLOSED

EQUIPMENT ABBREVIATIONS

BLR	BLOWER
CMP	COMPRESSOR
SSE	SAFETY SHOWER & EYEWASH
SCN	SCREEN
TNK	TANK
VSL	PRESSURE VESSEL
PMP	PUMP
MIX	MIXER
MBS	MEMBRANE SKID
SLC	SILENCER
FLT	FILTER
PDM	PULSATION DAMPENER
HTE	HEATING ELEMENT
CNE	CONE
SPH	SIPHON
CLR	CLARIFIER
HYC	HYDROCYCLONE
DST	DOSE TIMER
PSK	PENSTOCK
UVR	ULTRAVIOLET LIGHT REACTOR
RPZ	BACKFLOW PREVENTION DEVICE

MATERIAL LEGEND

ABS	ABS
CI	CAST IRON
CS	CARBON STEEL
DU	DUCTILE IRON
ELS	EPOXY LINED STEEL
CU	COPPER
HDPE	HDPE
PE	PE (LOW OR MEDIUM DENSITY)
SS	STAINLESS STEEL
PVC	PVC
RC	REINFORCED CONCRETE
CLS	CONCRETE LINED STEEL
MS	MILD STEEL

SERVICE ABBREVIATIONS

AC	COMPRESSED AIR
AS	AIR SCOUR
CO	COAGULANT
CEN	CENTRATE
HP	HYDROGEN PEROXIDE
DR	DRAIN
CL	CHLORINATED
CW	CLARIFIED WATER
SW	SERVICE WATER
SU	SUPERNATANT
FW	FILTERED WATER
HS	SULPHURIC ACID
RW	RAW WATER
BW	BACKWASH WATER
CL	CLARIFIED WATER
CS	CLARIFIED SLUDGE
CW	CARRY WATER
FL	FLOCCULATED WATER
TW	TREATED WATER
PL	POLYMER
LM	LIME
PAC	POWDERED CARBON
VC	VACUUM
MS	MIXED SOLIDS
FTW	FILTER TO WASTE
UV	UV TREATED WATER

INSTRUMENTATION

ANALYTICAL	AI	AIT
FLOW	FI	FIT
LEVEL	LI	LIT
POSITION	ZI	ZIT
PRESSURE	PI	PIT
SPEED	SI	SIT
TEMPERATURE	TI	TIT
SWITCH LOW	xSL	–
SWITCH HIGH	xSH	–
CONTROLLER	xIC	–

SYMBOLS

LINES
- Primary Process
- Electrical
- Instrument
- Pneumatic

LINE FITTINGS
- Concentric Reducer
- Eccentric Reducer
- Flange
- Hose Connection
- Blank Flange
- Cap
- Flexible Hose
- Vent
- Expansion Joint
- Drain
- Y Strainer
- Heat Traced Line

FLOW INSTRUMENTS
- Magnetic
- Venturi
- Orifice
- Rotameter

PUMPS
- Centrifugal
- Sump
- Diaphragm
- Positive Displacement
- Peristaltic
- Compressor
- Rotary Lobe Blower
- Air Blower
- Air Pump
- Motor
- Variable Speed Drive

VESSELS
- Closed Tank
- Roofed Tank
- Open Tank
- Column

GATES
- Flap
- Penstock
- Overflow Weir

VALVES
- Ball
- Butterfly
- Gate
- Globe
- Knife Gate
- Mud
- Needle
- Check
- Angle
- Pressure Relief
- Vacuum Relief
- Loading
- Pressure Reducing
- Diaphragm Valve

ACTUATORS
- Pneumatic
- Control
- Solenoid
- Motorised

EQUIPMENT
- Dose Timer
- Filter/Strainer
- Cartridge Filter
- Screen
- Dry Feeder
- Static Mixer
- Bursting Disc
- Pulsation Dampener
- Siphon
- Fan
- Dryer
- Flexible Hose
- UV Reactor
- Hydrocyclone
- Mixer
- Emergency Shower/ Eyewash Station

INSTRUMENTS
- Local
- Remote
- Auxiliary
- Interlock
- PLC

MISC
- Silencer
- Tie–In Point

VALVE CODES

AAV	AIR–ACTUATED
FCV	FLOW CONTROL
MAV	MANUALLY ACTUATED
MOV	MOTOR–ACTUATED
NRV	NON–RETURN / CHECK
PCV	PRESSURE CONTROL
PRV	PRESSURE–RELIEF
PSV	PRESSURE–SUSTAINING / LOADING
SAV	SOLENOID–ACTUATED

REV	DATE	DRAWN	REVISED	APPROVED	REVISION
1	16/10/2020	BC	EC	IR	FOR INFORMATION
2	02/11/2020	BC	EC	IR	FOR INFORMATION
3	27/11/2020	EC	EC	IR	FINAL DRAFT
4	02/02/2021	EC	EC	IR	FOR TENDER

DRAWING NUMBER	REFERENCE DRAWING TITLE	AREA

Lutra.

GREAT LAKE TAUPŌ
Taupō District Council

CLIENT: TAUPO DISTRICT COUNCIL

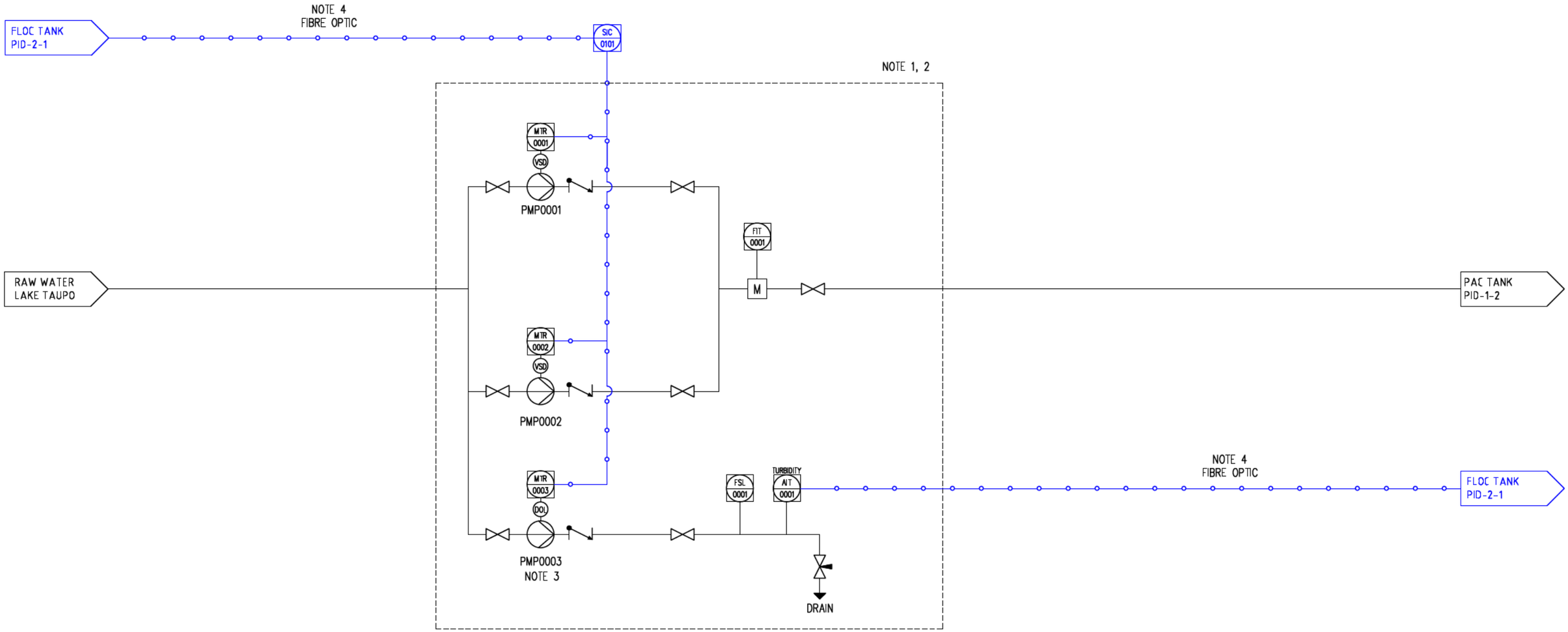
PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE
PIPING AND INSTRUMENTATION DIAGRAM LEGEND AND ABBREVIATIONS

SCALE	DRAWING NO	REV
NTS	LEG–PID–1	4

NOTES
1. REPRESENTATION OF INTAKE PUMP STATION IS INDICATIVE ONLY AND DOES NOT REFLECT THE CURRENT LAYOUT. EXACT CONFIGURATION AND NUMBER OF PUMPS, VALVES AND INSTRUMENTS TO BE CONFIRMED BY THE PRINCIPAL.
2. EQUIPMENT NUMBERING TO BE DETERMINED.
3. SAMPLE PUMP TO BE INSTALLED BY PRINCIPAL. SAMPLE PUMP TO RUN CONTINUOUSLY. BOXED SPARE SAMPLE PUMP TO BE HELD AT INTAKE PUMP STATION.
4. FIBRE OPTIC CABLE TO BE INSTALLED BY PRINCIPAL.



EXISTING EQUIPMENT IN BLACK
NEW EQUIPMENT IN BLUE

REV	DATE	DRAWN	REVISED	APPROVED	REVISION
1	16/10/2020	BC	EC	IR	FOR INFORMATION
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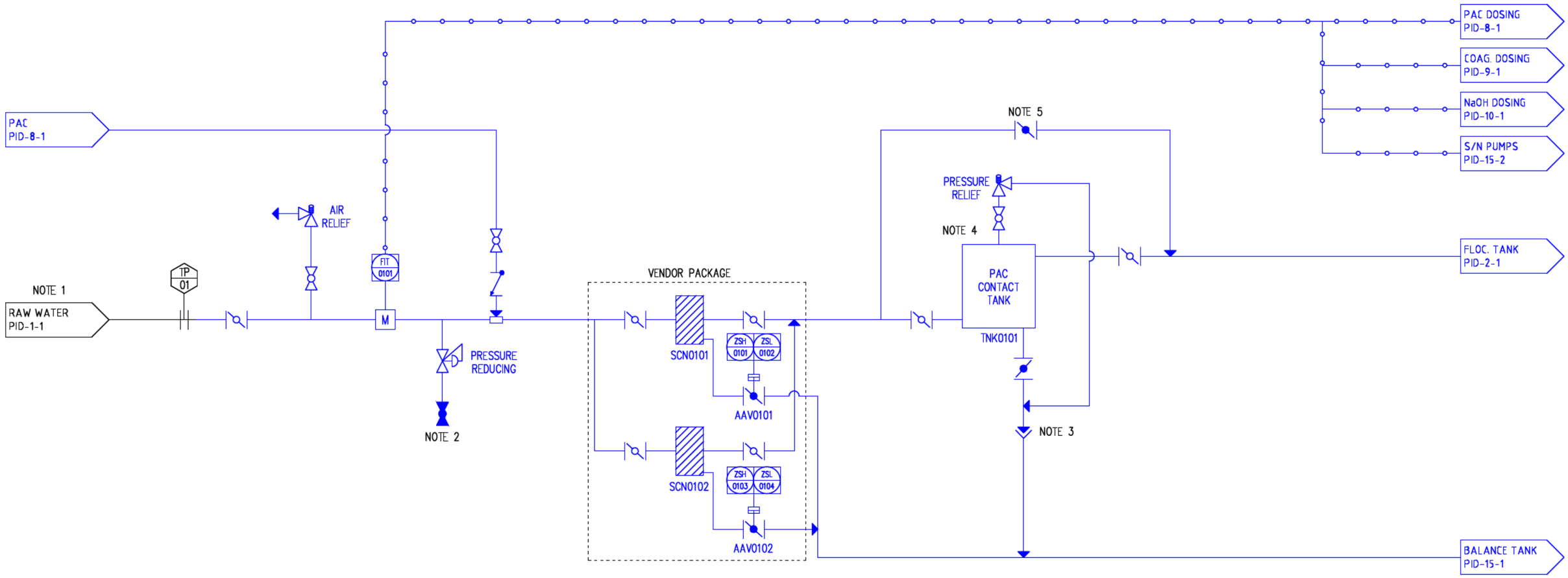
PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
RAW WATER PUMPS

SCALE	DRAWING NO	REV
NTS	HAT-PID-1-1	4

NOTES
1. RAW WATER SUPPLIED TO SITE BOUNDARY.
2. MANUAL SAMPLE POINT.
3. AIR-GAP REQUIRED.
4. PRESSURE VESSEL TO AVOID BREAKING HEAD FROM RAW WATER PUMPS.
5. BYPASS LINE FOR WHEN MAINTENANCE IS BEING PERFORMED ON THE CONTACT TANK.



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DRAWING NUMBER	REFERENCE DRAWING TITLE	AREA

Lutra.

GREAT LAKE TAUPŌ
Taupō District Council

CLIENT: TAUPO DISTRICT COUNCIL

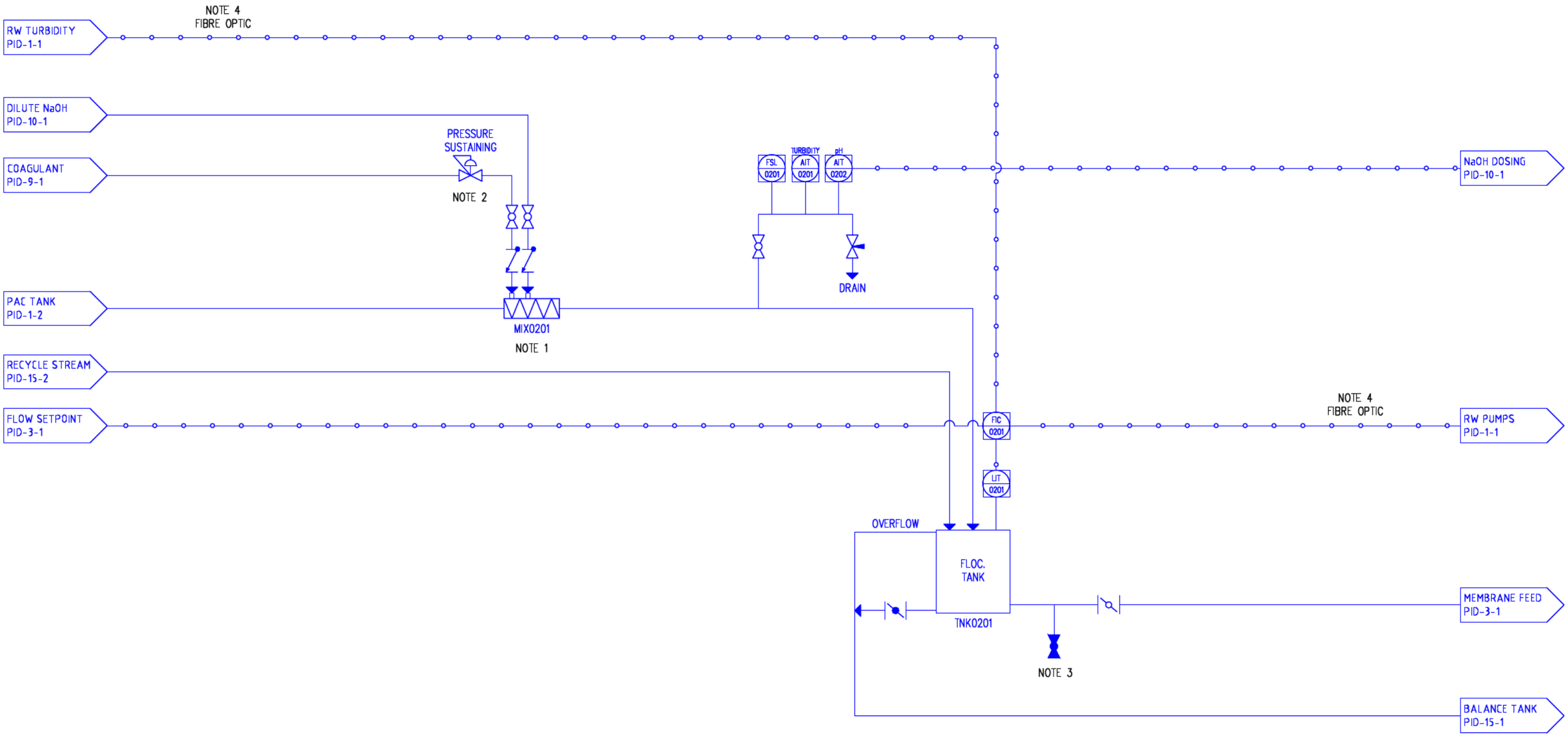
PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
RAW WATER & PAC DOSING

SCALE	DRAWING NO	REV
NTS	HAT-PID-1-2	4

NOTES
1. LOW HEAD–LOSS STATIC MIXER.
2. PRESSURE SUSTAINING VALVE TO BE INSTALLED AT DOSE POINT.
3. MANUAL SAMPLE POINT.
4. FIBRE OPTIC CABLE TO BE INSTALLED BY PRINCIPAL.



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GREAT LAKE TAUPŌ
Taupō District Council

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PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
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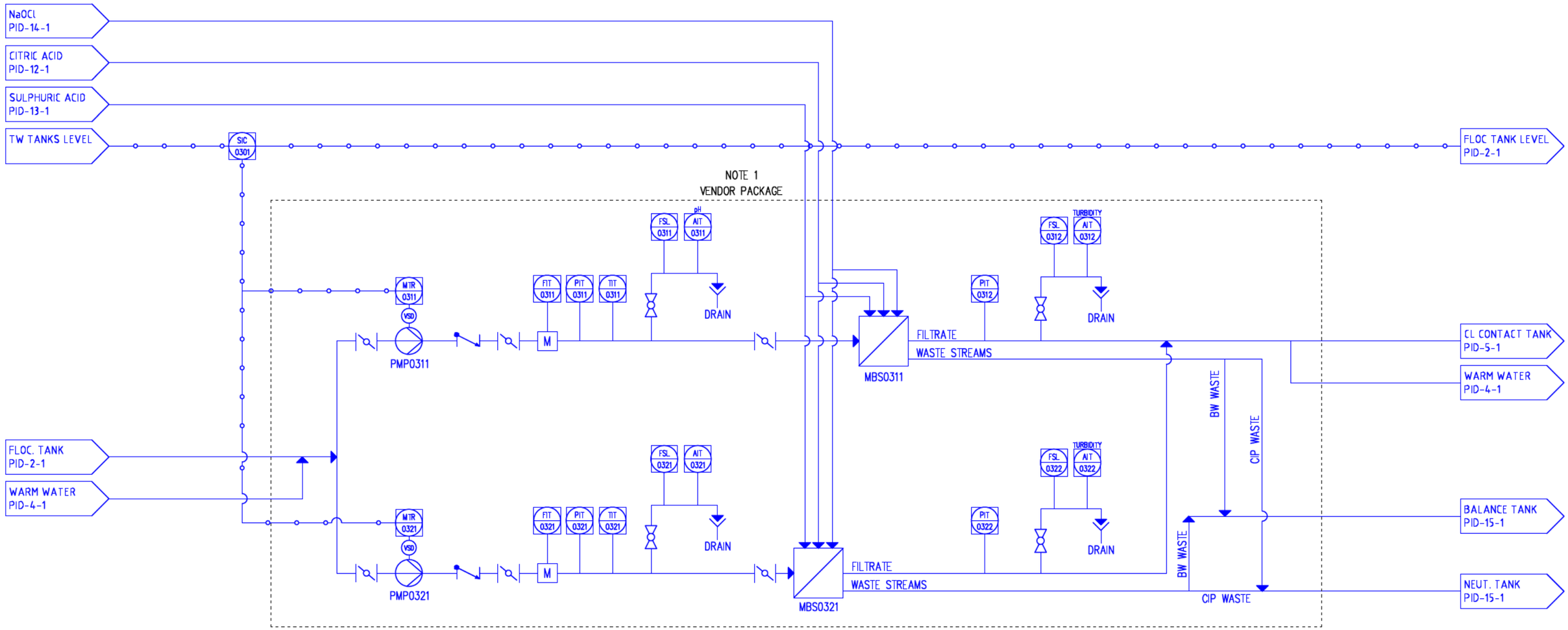
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
FLOCCULATION

SCALE	DRAWING NO	REV
NTS	HAT-PID-2-1	4

NOTES
1. CONTRACTOR TO CONFIRM NUMBER OF MEMBRANE SKIDS AND INCLUDE ALL REQUIRED INSTRUMENTATION, VALVES, PUMPS AND ALL ANCILLARY EQUIPMENT SUCH AS COMPRESSORS, NEUTRALISATION, CIP CHEMICAL SYSTEMS, ETC.



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Taupō District Council

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PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

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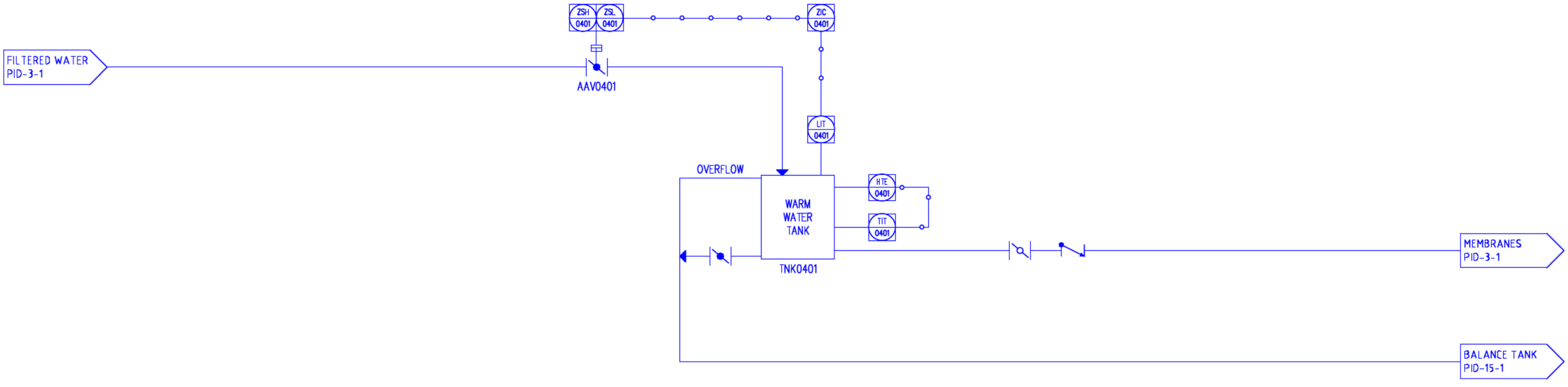
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
MEMBRANE FILTRATION

SCALE	DRAWING NO	REV
NTS	HAT-PID-3-1	4

NOTES
1.



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Taupō District Council

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PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

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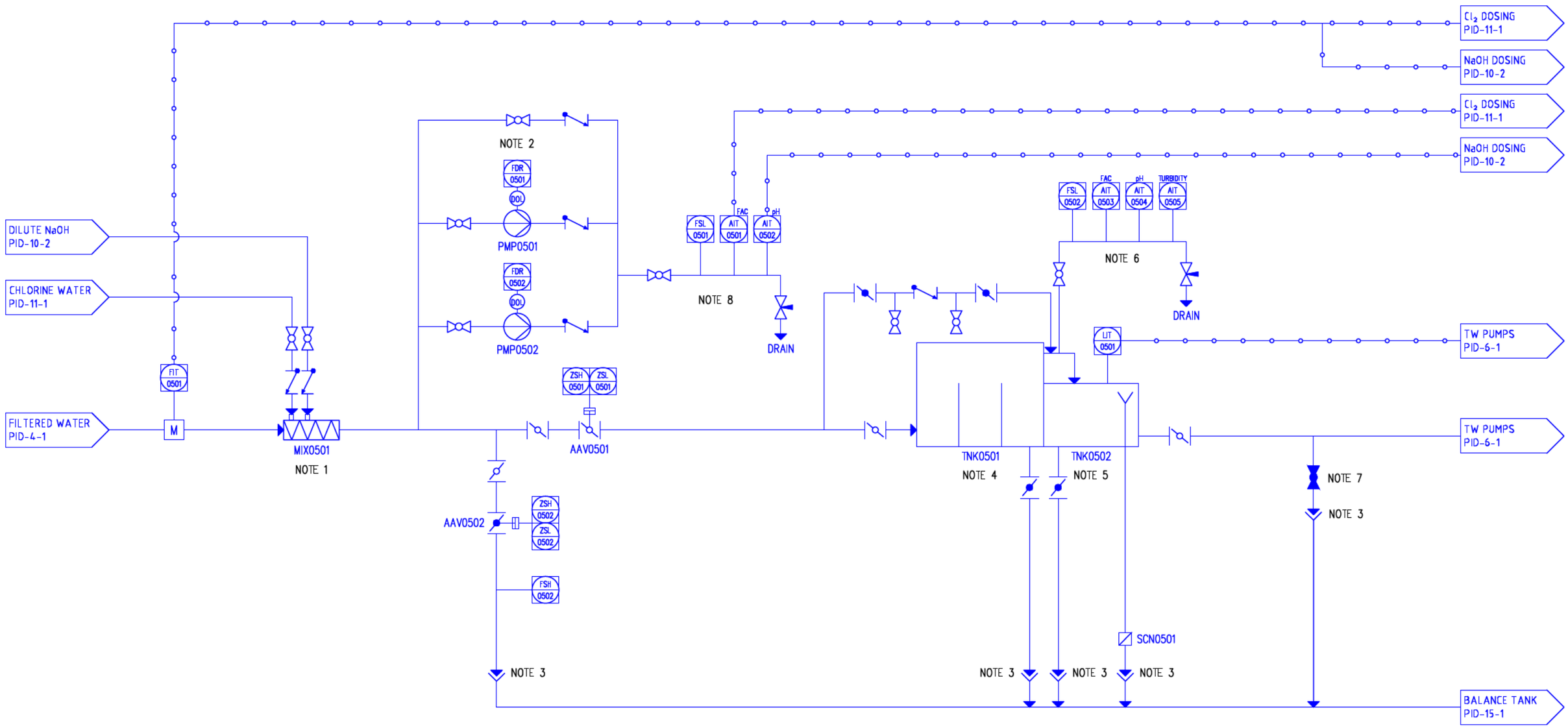
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
WARM WATER SYSTEM

SCALE	DRAWING NO	REV
NTS	HAT-PID-4-1	4

NOTES
1. LOW HEAD–LOSS STATIC MIXER.
2. SAMPLE PUMPS PROVIDE DRIVING HEAD TO INSTRUMENTS.
3. AIR–GAP REQUIRED.
4. CHLORINE CONTACT TANK IS BAFFLED AND FEATURES A BOTTOM INLET AND OVERFLOW OUTLET FOR PROVIDING A MINIMUM OF 30 MINUTES OF CONTACT TIME AT FULL PLANT CAPACITY.
5. TREATED WATER PUMPS DRAW WATER OUT OF WET WELL.
6. FINAL COMPLIANCE INSTRUMENTATION.
7. MANUAL SAMPLE POINT.
8. INSTRUMENTS TO BE INSTALLED TO ALLOW SUFFICIENT DISTANCE FROM THE STATIC MIXER TO ALLOW FULL MIXING AND AT LEAST 2 MINUTES OF LAG TIME BETWEEN THE DOSE POINT AND INSTRUMENTS.



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Taupō District Council

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PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

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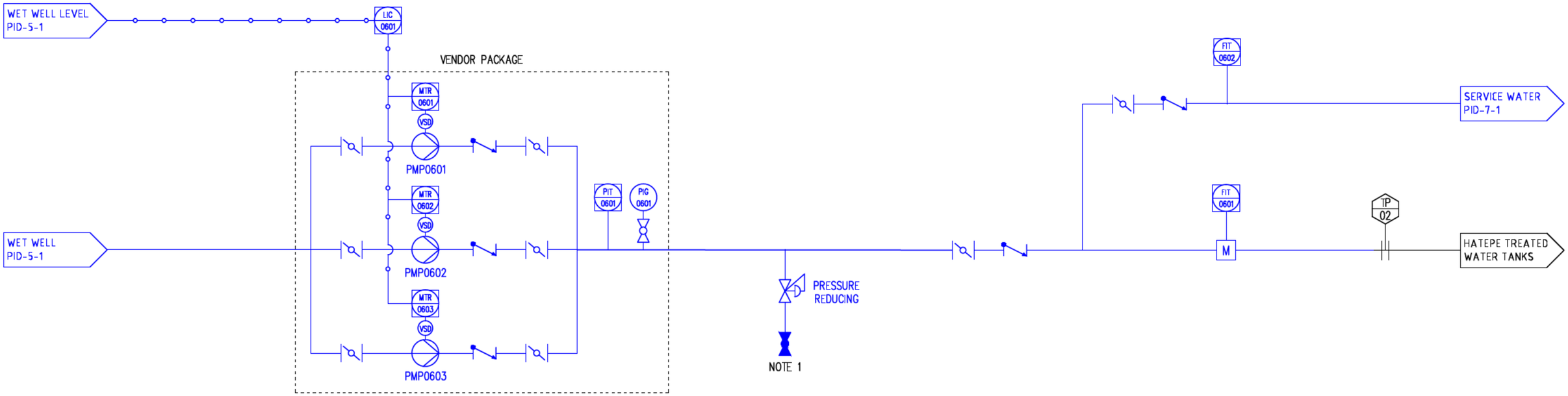
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
CHLORINE CONTACT TANK AND WET WELL

SCALE	DRAWING NO	REV
NTS	HAT–PID–5–1	4

NOTES
1. MANUAL SAMPLE POINT.



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Taupō District Council

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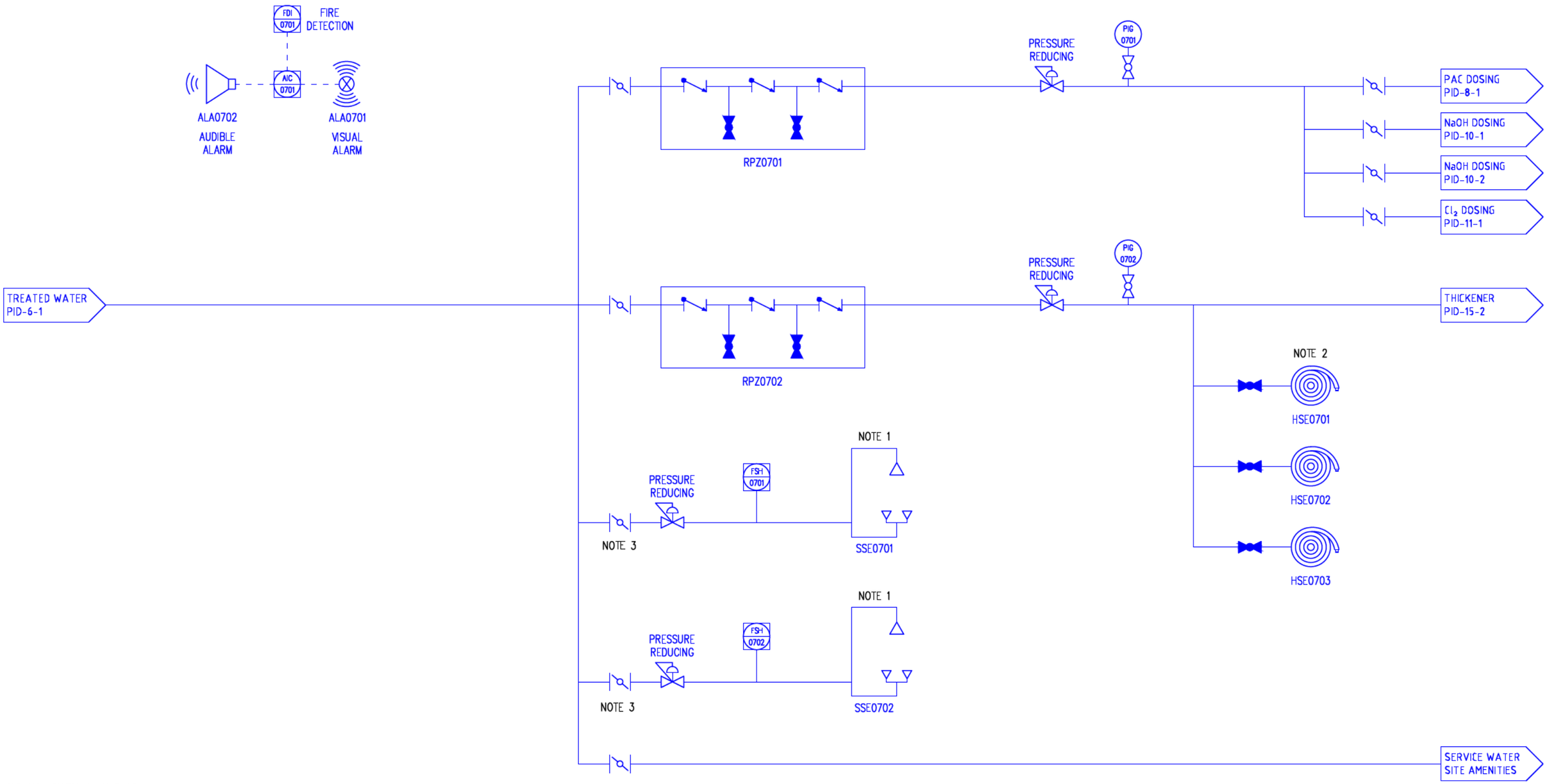
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
TREATED WATER PUMPS

SCALE	DRAWING NO	REV
NTS	HAT-PID-6-1	4

NOTES
1. SAFETY SHOWERS AND EYEWASH STATIONS SITUATED IN SUITABLE LOCATIONS AROUND PLANT. NUMBER TO BE CONFIRMED DURING DETAILED DESIGN STAGE.
2. HOSES LOCATED AROUND THE PLANT WHERE REQUIRED.
3. VALVE HANDLE TO BE REMOVED.



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Taupō District Council

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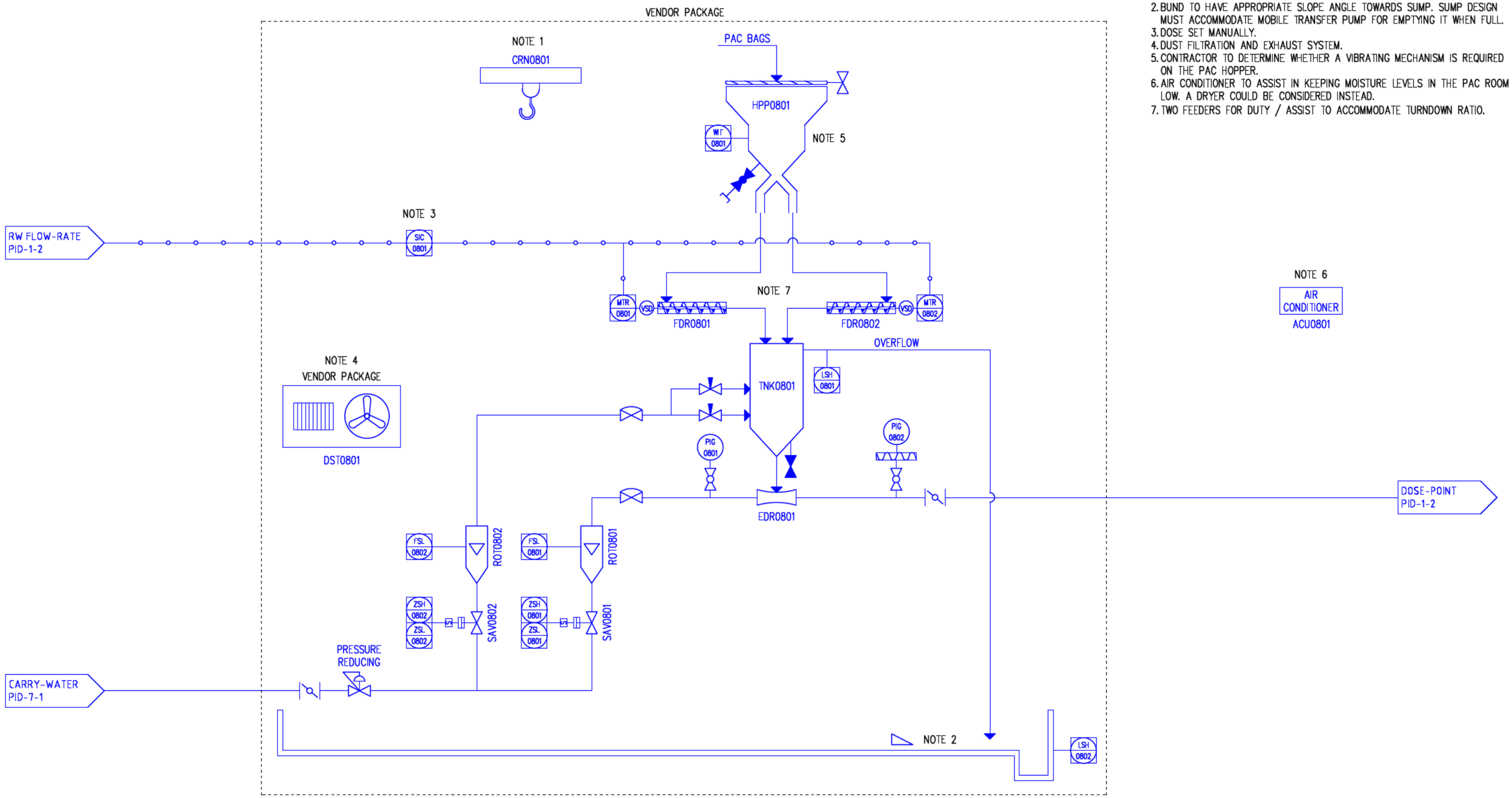
PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS			
DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE		
PIPING AND INSTRUMENTATION DIAGRAM HATEPE WATER SUPPLY SERVICE WATER		
SCALE	DRAWING NO	REV
NTS	HAT-PID-7-1	4

NOTES
1. CARBON BAGS LOADED VIA A GANTRY CRANE. CONTRACTOR TO DETERMINE WHETHER A VACUUM TRANSFER SYSTEM WOULD BE MORE APPROPRIATE.
2. BUND TO HAVE APPROPRIATE SLOPE ANGLE TOWARDS SUMP. SUMP DESIGN MUST ACCOMMODATE MOBILE TRANSFER PUMP FOR EMPTYING IT WHEN FULL.
3. DOSE SET MANUALLY.
4. DUST FILTRATION AND EXHAUST SYSTEM.
5. CONTRACTOR TO DETERMINE WHETHER A VIBRATING MECHANISM IS REQUIRED ON THE PAC HOPPER.
6. AIR CONDITIONER TO ASSIST IN KEEPING MOISTURE LEVELS IN THE PAC ROOM LOW. A DRYER COULD BE CONSIDERED INSTEAD.
7. TWO FEEDERS FOR DUTY / ASSIST TO ACCOMMODATE TURNDOWN RATIO.



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Taupō District Council

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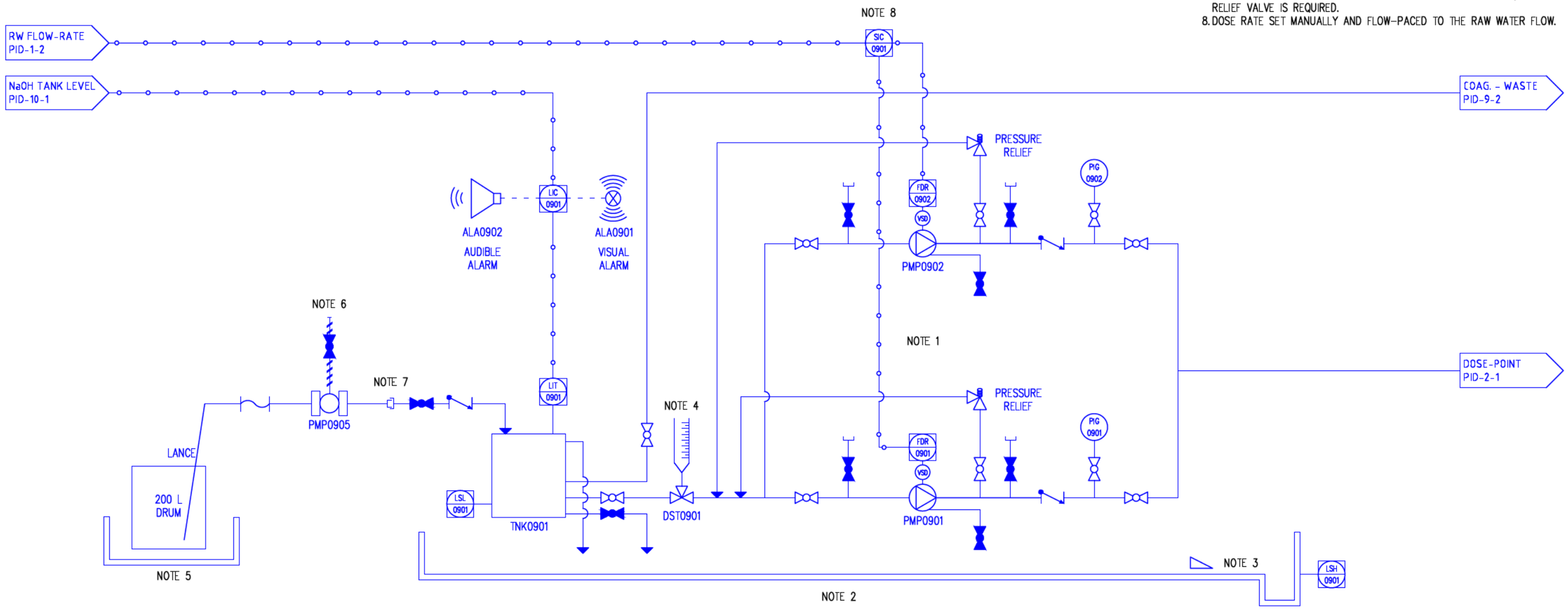
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
POWDERED ACTIVATED CARBON

SCALE	DRAWING NO	REV
NTS	HAT-PID-8-1	4

NOTES
1. DOSE PUMPS TO HAVE VARIABLE-SPEED STEPPER MOTORS AND BACK-FLOW PREVENTION.
2. BUND FOR DOSING TANK AND EQUIPMENT, DRAIN LINES AND ALL DOSING INSTRUMENTATION.
3. BUND TO HAVE APPROPRIATE SLOPE ANGLE TOWARDS SUMP. SUMP DESIGN MUST ACCOMMODATE MOBILE TRANSFER PUMP FOR EMPTYING IT WHEN FULL.
4. DOSE TIMER TO BE POSITIONED AT FLOOR LEVEL OF DOSE TANK SO THAT IT CAN BE FILLED FROM THE TANK. TOP OF DOSE TIMER TO BE HIGHER THAN TOP LEVEL OF DOSING TANK.
5. COMMON BUND FOR DELIVERY OF CHEMICALS. BUND TO BE PARTITIONED TO KEEP ACIDS SEPARATE FROM OTHER CHEMICALS.
6. AIR SUPPLY TO DIAPHRAGM TRANSFER PUMP TO BE PROVIDED BY CONTRACTOR.
7. PIPEWORK DESIGN PRESSURE MUST EXCEED DEADHEAD OF PUMP, OTHERWISE RELIEF VALVE IS REQUIRED.
8. DOSE RATE SET MANUALLY AND FLOW-PACED TO THE RAW WATER FLOW.



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AREA

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Taupō District Council

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PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

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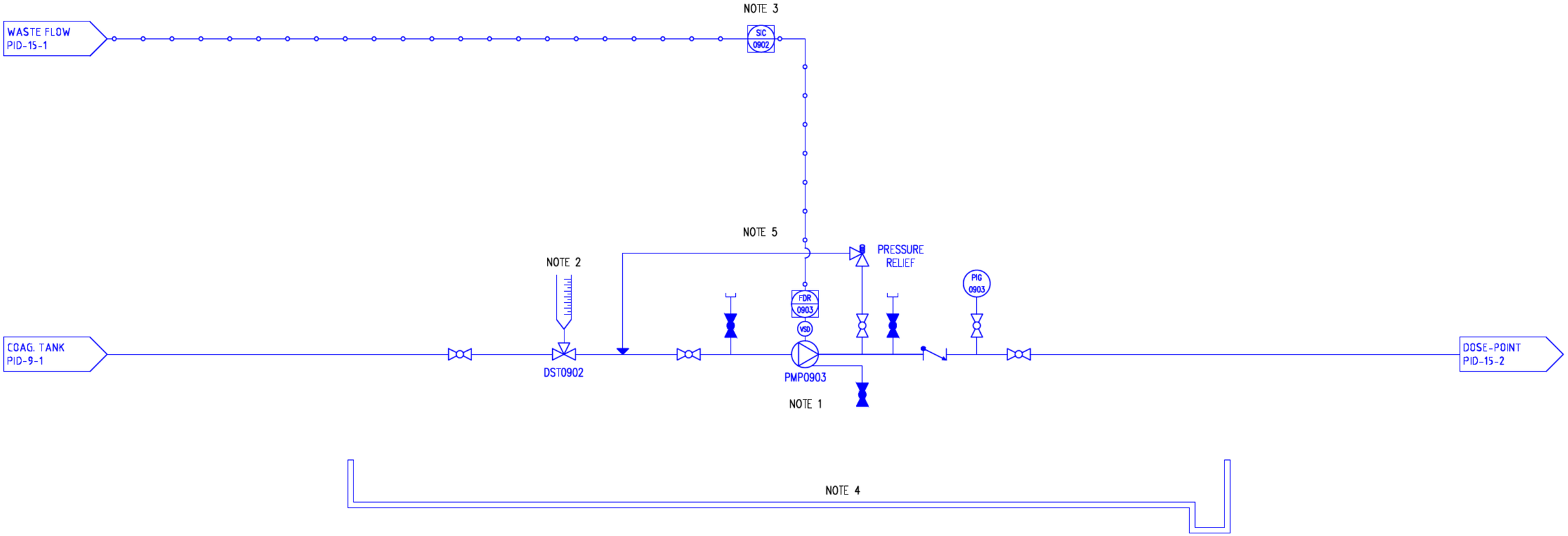
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
COAGULANT SYSTEM - RAW WATER

SCALE	DRAWING NO	REV
NTS	HAT-PID-9-1	4

NOTES
1. DOSE PUMP TO HAVE VARIABLE-SPEED STEPPER MOTOR AND BACK-FLOW PREVENTION.
2. DOSE TIMER TO BE POSITIONED AT FLOOR LEVEL OF DOSE TANK SO THAT IT CAN BE FILLED FROM THE TANK. TOP OF DOSE TIMER TO BE HIGHER THAN TOP LEVEL OF DOSING TANK.
3. DOSE SET MANUALLY AND FLOW-PACED TO THE WASTE FLOW.
4. COMMON BUND SHOWN ON HAT-PID-9-1 (SEE DRAWING FOR DETAILS).
5. STANDBY DOSE PUMP TO BE A BOXED SPARE.



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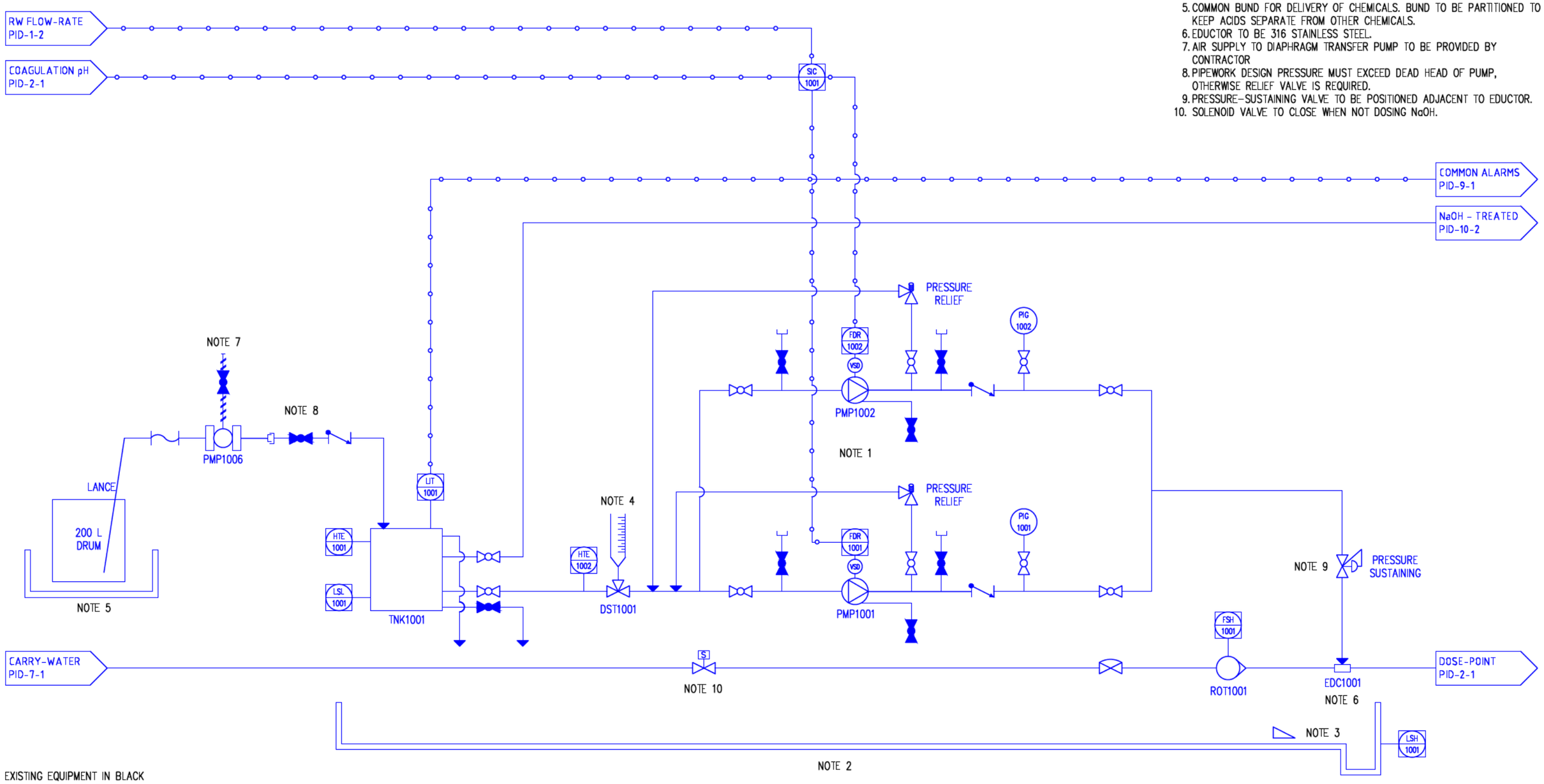
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
COAGULANT SYSTEM - WASTE DOSING

SCALE	DRAWING NO	REV
NTS	HAT-PID-9-2	4

NOTES
1. DOSE PUMPS TO HAVE VARIABLE-SPEED STEPPER MOTORS AND BACK-FLOW PREVENTION. PUMPS OPERATE IN A DUTY / ASSIST MANNER.
2. BUND FOR DOSING TANK AND EQUIPMENT, INCLUDING POST-DOSE PUMP, DRAIN LINES AND ALL DOSING INSTRUMENTATION.
3. BUND TO HAVE APPROPRIATE SLOPE ANGLE TOWARDS SUMP. SUMP DESIGN MUST ACCOMMODATE MOBILE TRANSFER PUMP FOR EMPTYING IT WHEN FULL.
4. DOSE TIMER TO BE POSITIONED AT FLOOR LEVEL OF DOSE TANK SO THAT IT CAN BE FILLED FROM THE TANK. TOP OF DOSE TIMER TO BE HIGHER THAN TOP LEVEL OF DOSING TANK.
5. COMMON BUND FOR DELIVERY OF CHEMICALS. BUND TO BE PARTITIONED TO KEEP ACIDS SEPARATE FROM OTHER CHEMICALS.
6. EDUCTOR TO BE 316 STAINLESS STEEL.
7. AIR SUPPLY TO DIAPHRAGM TRANSFER PUMP TO BE PROVIDED BY CONTRACTOR
8. PIPEWORK DESIGN PRESSURE MUST EXCEED DEAD HEAD OF PUMP, OTHERWISE RELIEF VALVE IS REQUIRED.
9. PRESSURE-SUSTAINING VALVE TO BE POSITIONED ADJACENT TO EDUCTOR.
10. SOLENOID VALVE TO CLOSE WHEN NOT DOSING NaOH.



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Taupō District Council

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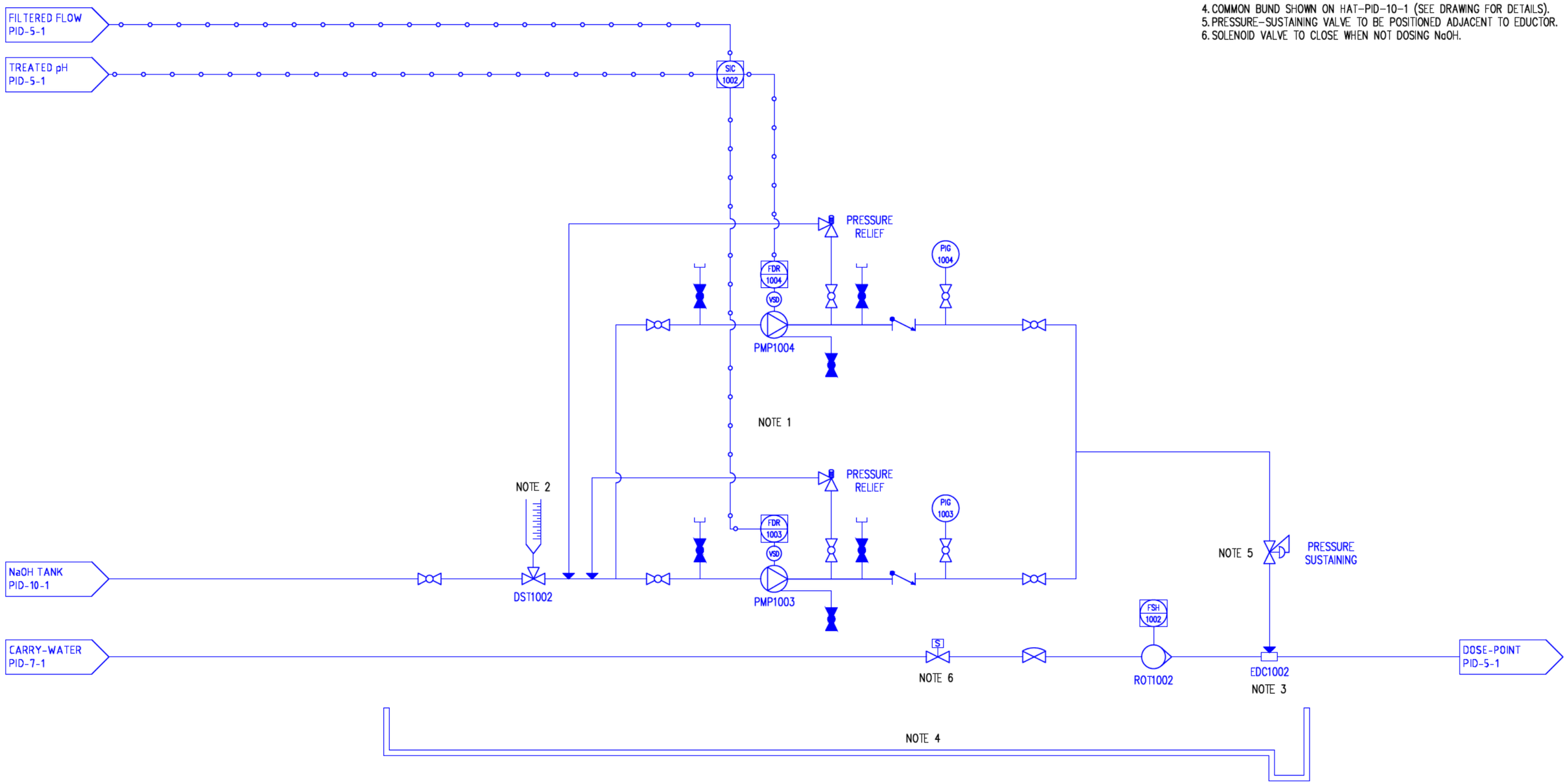
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
SODIUM HYDROXIDE - COAGULATION

SCALE	DRAWING NO	REV
NTS	HAT-PID-10-1	4

NOTES
1. DOSE PUMPS TO HAVE VARIABLE-SPEED STEPPER MOTORS AND BACK-FLOW PREVENTION.
2. DOSE TIMER TO BE POSITIONED AT FLOOR LEVEL OF DOSE TANK SO THAT IT CAN BE FILLED FROM THE TANK. TOP OF DOSE TIMER TO BE HIGHER THAN TOP LEVEL OF DOSING TANK.
3. EDUCTOR TO BE 316 STAINLESS STEEL.
4. COMMON BUND SHOWN ON HAT-PID-10-1 (SEE DRAWING FOR DETAILS).
5. PRESSURE-SUSTAINING VALVE TO BE POSITIONED ADJACENT TO EDUCTOR.
6. SOLENOID VALVE TO CLOSE WHEN NOT DOSING NaOH.



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Taupō District Council

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PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

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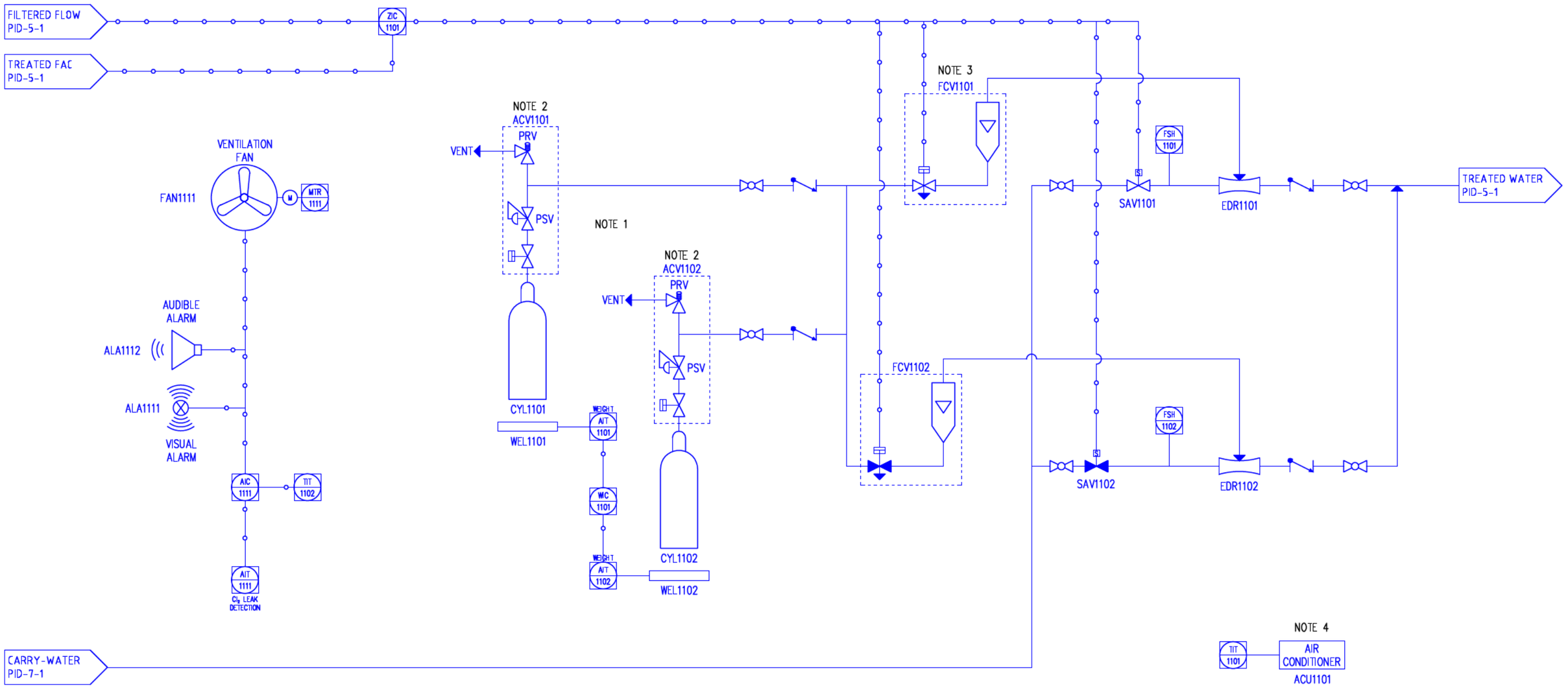
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
SODIUM HYDROXIDE - TREATED WATER

SCALE	DRAWING NO	REV
NTS	HAT-PID-10-2	4

NOTES
1. CONTRACTOR TO CONFIRM BEST CONFIGURATION FOR CHLORINE SUPPLY (SIZE AND NUMBER OF SPARE CYLINDERS).
2. AUTO SHUT-OFF VALVE TO BE INSTALLED ON EACH ONLINE CYLINDER.
3. CONTRACTOR TO CONFIRM BEST CONFIGURATION FOR CHLORINATORS – IF DUTY / ASSIST / STANDBY ARRANGEMENT WOULD BE REQUIRED.
4. CONTRACTOR TO CONFIRM IF AIR CONDITIONER REQUIRED – ROOM TEMPERATURE TO REMAIN ABOVE 10°C.



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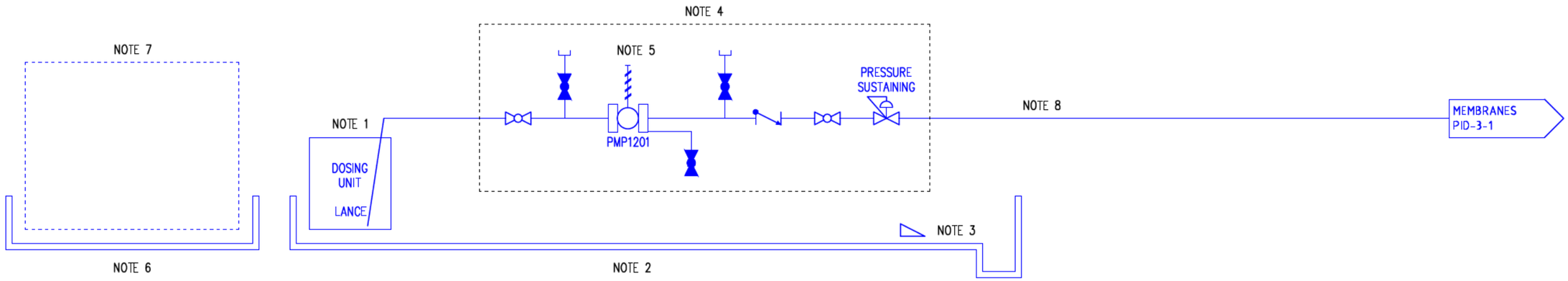
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
CHLORINE GAS SYSTEM

SCALE	DRAWING NO	REV
NTS	HAT-PID-11-1	4

NOTES
1. CONTRACTOR TO CONFIRM DOSES AND UNIT VOLUME.
2. BUND FOR DOSING TANK AND EQUIPMENT, DRAIN VALVE OUTLETS AND ALL DOSING INSTRUMENTATION.
3. BUND TO HAVE APPROPRIATE SLOPE ANGLE TOWARDS SUMP. SUMP DESIGN MUST ACCOMMODATE MOBILE TRANSFER PUMP FOR EMPTYING IT WHEN FULL.
4. CONTRACTOR TO CONFIRM REQUIREMENTS AND INCLUDE ALL EQUIPMENT REQUIRED.
5. CONTRACTOR TO PROVIDE AIR SUPPLY TO TRANSFER PUMP.
6. COMMON BUND FOR DELIVERY OF CHEMICALS.
7. CONTRACTOR TO DETAIL MAKE-UP SYSTEM AND ENSURE ALL REQUIRED EQUIPMENT IS PROVIDED.
8. PIPEWORK DESIGN PRESSURE MUST EXCEED DEAD HEAD OF PUMP, OTHERWISE RELIEF VALVE IS REQUIRED.



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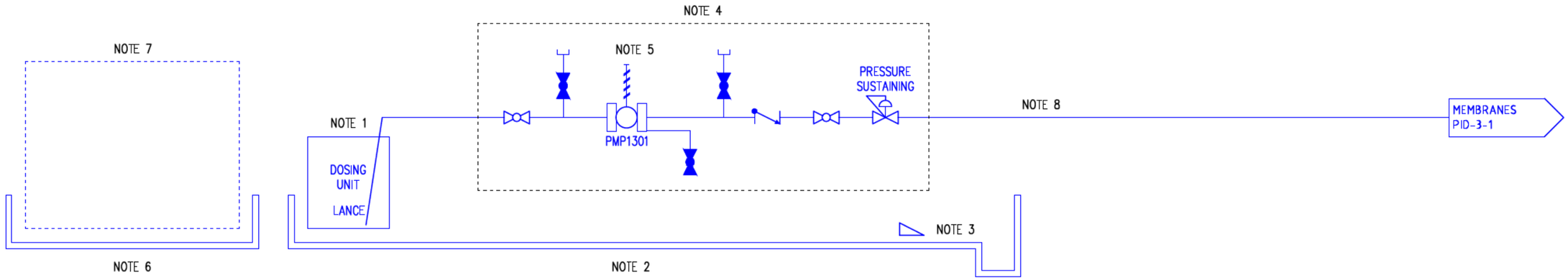
TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
CITRIC ACID SYSTEM

SCALE	DRAWING NO	REV
NTS	HAT-PID-12-1	4

NOTES
1. CONTRACTOR TO CONFIRM DOSES AND UNIT VOLUME.
2. BUND FOR DOSING UNIT AND EQUIPMENT, DRAIN VALVE OUTLETS AND ALL DOSING INSTRUMENTATION.
3. BUND TO HAVE APPROPRIATE SLOPE ANGLE TOWARDS SUMP. SUMP DESIGN MUST ACCOMMODATE MOBILE TRANSFER PUMP FOR EMPTYING IT WHEN FULL.
4. CONTRACTOR TO CONFIRM REQUIREMENTS AND INCLUDE ALL EQUIPMENT REQUIRED.
5. CONTRACTOR TO PROVIDE AIR SUPPLY TO TRANSFER PUMP.
6. COMMON BUND FOR DELIVERY OF CHEMICALS.
7. CONTRACTOR TO DETAIL MAKE-UP SYSTEM AND ENSURE ALL REQUIRED EQUIPMENT IS PROVIDED.
8. PIPEWORK DESIGN PRESSURE MUST EXCEED DEAD HEAD OF PUMP, OTHERWISE RELIEF VALVE IS REQUIRED.



EXISTING EQUIPMENT IN BLACK
NEW EQUIPMENT IN BLUE

REV	DATE	DRAWN	REVISED	APPROVED	REVISION
1	16/10/2020	BC	EC	IR	FOR INFORMATION
2	02/11/2020	BC	EC	IR	FOR INFORMATION
3	27/11/2020	EC	EC	IR	FINAL DRAFT
4	02/02/2021	EC	EC	IR	FOR TENDER

DRAWING NUMBER	REFERENCE DRAWING TITLE	AREA

Lutra.

GREAT LAKE TAUPŌ
Taupō District Council

CLIENT: TAUPO DISTRICT COUNCIL

PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
SULPHURIC ACID SYSTEM

SCALE	DRAWING NO	REV
NTS	HAT-PID-13-1	4

NOTES
1. CONTRACTOR TO CONFIRM DOSES AND UNIT VOLUME.
2. BUND FOR DOSING UNIT AND EQUIPMENT, DRAIN VALVE OUTLETS AND ALL DOSING INSTRUMENTATION.
3. BUND TO HAVE APPROPRIATE SLOPE ANGLE TOWARDS SUMP. SUMP DESIGN MUST ACCOMMODATE MOBILE TRANSFER PUMP FOR EMPTYING IT WHEN FULL.
4. CONTRACTOR TO CONFIRM REQUIREMENTS AND INCLUDE ALL EQUIPMENT REQUIRED.
5. CONTRACTOR TO PROVIDE AIR SUPPLY TO TRANSFER PUMP.
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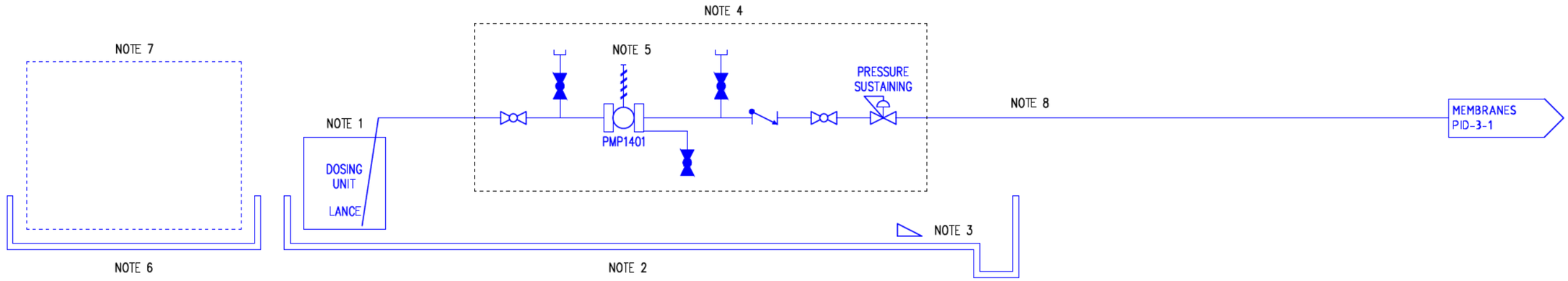

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GREAT LAKE TAUPŌ
Taupō District Council

CLIENT: TAUPO DISTRICT COUNCIL

PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
SODIUM HYPOCHLORITE SYSTEM

SCALE	DRAWING NO	REV
NTS	HAT-PID-14-1	4

NOTES
1. CONTRACTOR TO CONFIRM WASTE BALANCE TANK REQUIREMENTS.
2. CONTRACTOR TO CONFIRM THAT ALL REQUIRED STREAMS CAN FLOW INTO BALANCE TANK UNDER GRAVITY ONLY.
3. VALVE TO DIRECT STREAM TO NEUTRALISATION TANK WHEN THICKENER UNAVAILABLE.
4. PERIODIC DISCHARGE TO TANKERS FOR DISPOSAL.

SLUDGE
PID-15-2

INSTR. DRAINS
SITE

NOTE 2

S/N TANK
PID-15-2

PLANT DIVERT
PID-5-1

WW TANK
PID-4-1

BACKWASH
PID-3-1

FLOC. TANK
PID-2-1

SCREENS
PID-1-2

NOTE 1

NOTE 3

ZSH 1501 ZSL 1501

MAV1501

FIT 1501

COAG. DOSING
PID-9-2

THICKENER
PID-15-2

LIT 1501

LIC 1501

MTR 1501 VSD

MTR 1502 VSD

PMP1501 PMP1502

TNK1501
WASTE BALANCE TANK

FIT 1502

CIP WASTE
PID-3-1

LSH 1501

LSH 1502

MTR 1503 DOL

MTR 1504 DOL

PMP1503 PMP1504

LSL 1502

LSL 1501

TNK1502
NEUTRALISATION TANK

LIC 1502

MTR 1505 VSD

LIT 1502

TNK1503

MIX1501

SLUDGE HOLDING TANK

TP 03

NOTE 4

EXISTING EQUIPMENT IN BLACK
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DRAWING NUMBER	REFERENCE DRAWING TITLE

AREA

Lutra.

GREAT LAKE TAUPŌ
Taupō District Council

CLIENT: TAUPO DISTRICT COUNCIL

PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
WASTE SYSTEM

SCALE	DRAWING NO	REV
NTS	HAT-PID-15-1	4

NOTES
1. INSTANTANEOUS RECYCLED STREAM FLOW-RATE TO NEVER EXCEED 10% OF FRESH RAW WATER FLOW-RATE TO PLANT.
2. UNIT CAN BE A THICKENER, LAMELLA CLARIFIER OR ALTERNATIVE. UNIT TO HAVE SUFFICIENT CAPACITY TO STORE A MINIMUM OF 1 DAYS' SLUDGE PRODUCTION.
3. SUPERNATANT TO BE DIVERTED TO BALANCE TANK WHEN TURBIDITY TOO HIGH.
4. PRESSURE SUSTAINING VALVE TO BE AT DOSE POINT.
5. SUPERNATANT STRAINER IS TO PROTECT MEMBRANES FROM PARTICULATES BEING SENT THROUGH FROM THE WASTE RECOVERY SYSTEM.
6. MANUAL SAMPLE POINT.

RW FLOW-RATE PID-1-2
NOTE 1
SIC 1501
PRESSURE SUSTAINING
COAGULANT PID-9-2
NOTE 4
NOTE 2
VENDOR PACKAGE
MTR 1510
VSD
BALANCE TANK PID-15-1
MIX1511
THK1511
SUPERNATANT
THICKENER
RODDING POINT
LIT 1511
OVERFLOW
SUPERNATANT TANK
TNK1511
AAV1513
ZSH 1513
ZSL 1513
MTR 1511
VSD
NOTE 5
PMP1511
MTR 1512
VSD
NOTE 5
PMP1512
FIT 1511
M
FSL 1511
TURBIDITY AIT 1511
DRAIN
ZSH 1511
ZSL 1511
AAV1511
FLOC. TANK PID-2-1
NOTE 3
AAV1512
ZSH 1512
ZSL 1512
FSH 1511
BALANCE TANK PID-15-1
SERVICE WATER PID-7-1
HSE1511
HOSING CONNECTION
MTR 1513
VSD
PMP1513
MTR 1514
VSD
PMP1514
HOSING CONNECTION
FIT 1512
M
PRESSURE REDUCING
NOTE 6
SLUDGE TANK PID-15-1

EXISTING EQUIPMENT IN BLACK
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GREAT LAKE TAUPŌ
Taupō District Council

CLIENT: TAUPO DISTRICT COUNCIL
PROJECT: TAUPO DC MEMBRANE WATER TREATMENT PLANTS

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE
PIPING AND INSTRUMENTATION DIAGRAM
HATEPE WATER SUPPLY
THICKENER

SCALE	DRAWING NO	REV
NTS	HAT-PID-15-2	4

6.1.4 Principal's Preliminary Functional Description

GREAT LAKE TAUPŌ
Taupō District Council

Lutra.

Preliminary Functional Description.

Hatepe WTP Preliminary Functional Description

Prepared for Taupo District Council

TDC010-FD4-3

04 February 2021

Document Details	
Client	Taupo District Council
Project	Hatepe WTP Upgrade
Project Number	TDC010
Report Title	Hatepe WTP Preliminary Functional Description
Report Number	TDC010-FD4-3
Report Status	For Tender
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Document Control		
Author	Sec 9(2)(a)	
Reviewer		
Approver		

Table of Contents

1 Introduction

This preliminary functional description is appended to the Hatepe water treatment plant (WTP) Principal's Preliminary Process Design.

All values, colours and conventions provided in this preliminary functional description are provisional and are to be confirmed by the Contractor either during detailed design or commissioning, where appropriate.

The functionality described in this preliminary functional description is also provisional and is to be confirmed or updated by the Contractor as appropriate.

The new Hatepe WTP consists of the following components:

- Powdered activated carbon (PAC) dosing;
- Coarse screening;
- PAC contact tank;
- Coagulation by means of aluminium chlorohydrate (ACH);
- Coagulation pH correction by means of sodium hydroxide;
- Flocculation tank;
- Membrane filtration;
- Chlorination by means of chlorine gas;
- Treated water pH correction by means of sodium hydroxide;
- Divert-to-waste function;
- Chlorine contact tank;
- Treated water transfer;
- Service water system;
- Backwash water recovery system;
- Sludge holding tank (for disposal).

2 Process Overview

2.1 Process Description

Raw water is abstracted from Lake Taupo by means of the raw water pumps located in the raw water pump station. The raw water is delivered to the site of the WTP where the flow-rate is measured. The flow-rate set-point is equal to the filtrate flow-rate set-point, with a trim based on the flocculation tank's level.

Powdered activated carbon is dosed into the raw water before the coarse screens. The PAC is used occasionally, mainly in the warmer months, to assist in removing taste and odour (T&O) compounds and algal toxins.

Downstream of the PAC dose-point are the two coarse screens (duty / duty) which screen out coarse material to protect the membrane filtration stage. Each of the coarse screens is backwashed based on pressure-drop. When a screen is being backwashed, the plant flow-rate does not change as each screen can process the full plant flow-rate.

After the screens, the water enters the PAC contact tank. This tank provides the contact time to facilitate the adsorption of the T&O compounds and algal toxins onto the PAC.

After the PAC tank, coagulant and sodium hydroxide are dosed into the raw water via a static mixer. The coagulant dose is set manually. The sodium hydroxide dosing is performed for coagulation pH control. Feedback control is used to achieve the coagulation pH of 7.4, adjustable within the range of 7.2-7.8. The sodium hydroxide and coagulant dose-rates are flow-paced off the raw water flow-rate.

The membrane filtration stage consists of two skids (duty / standby). The membrane feed pumps draw water out of the flocculation tank and pump it through the membrane filtration stage to the chlorine contact tank (CCT). There is a dedicated membrane feed pump per membrane skid. The membrane filtration stage feed pumps operate to achieve the filtered water flow-rate set-point. The filtered water flow-rate set-point is selected manually and is trimmed based on the high- and low-levels in the Hatepe treated water tanks.

The membrane filtration stage has a dedicated programmable logic controller (PLC) which controls which skid operates, clean-in-place washes, warm water tank temperature, etc. The pH and flow-rate of each unit are measured for control and the filtered water turbidity of each unit is measured for compliance.

After the membrane filtration stage, chlorine is dosed into the filtered water via a static mixer for providing a free available chlorine (FAC) residual for bacteriological compliance and providing bacteriological protection in the reticulation network. Sodium hydroxide is also dosed into the filtered water for treated water pH control.

A sample line downstream of the static mixer provides sample flow to the FAC analyser and pH analyser used in controlling the chlorine and sodium hydroxide doses, respectively. The dose-rates are flow-paced to the filtered water flow-rate. Downstream of the treated water static mixer is the divert-to-waste line. The divert-to-waste function is activated when the treated water does not meet the performance requirements.

After the divert-to-waste line, the treated water enters the chlorine contact tank. The CCT is sized and baffled to ensure that the treated water has a minimum chlorine contact time of 30 minutes under all flow conditions. The water from the CCT overflows into the wet well.

There are three treated water pumps (duty / assist / standby) which draw water out of the wet well. The pumps supply treated water to the Hatepe treated water tanks and the plant's service water users. The pumps operate to maintain the level in the treated water wet well.

The final quality instrumentation consists of FAC, turbidity and pH analysers. These analysers receive their feed from the overflow line from the CCT into the wet well. Their measurements are assessed in accordance with the bacteriological compliance Criterion 2A requirements.

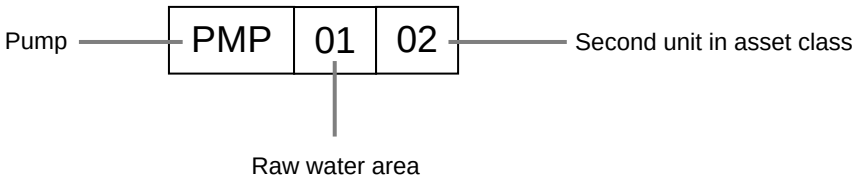
All process residuals (apart from the chemical washwater) are sent to the waste balance tank. The combined waste is then pumped (duty / standby) to a thickener. The clarified water is recycled to the flocculation tank via a supernatant tank and duty / standby pumps. The thickened sludge is pumped (duty / standby) to the sludge holding tank for disposal. The chemical washwater is sent to a neutralisation tank prior to being pumped (duty / standby) to the sludge holding tank.

2.2 Process Area Codes

The following process area codes have been assigned for use in the equipment and instrumentation tags.

Process Area	**Code**		**Process Area**	**Code**
Raw Water	01xx		Coagulant	09xx
Coagulation and Flocculation	02xx		Sodium Hydroxide	10xx
Membrane Filtration	03xx		Chlorine	11xx
Warm Water	04xx		Citric Acid	12xx
Treated Water Dosing and CCT	05xx		Sulphuric Acid	13xx
Treated Water Pumps	06xx		Sodium Hypochlorite	14xx
Service Water	07xx		Waste System	15xx
Powdered Activated Carbon	08xx			

The application of these codes is shown in the following example:



3 Control System Overview

3.1 SCADA Platform

The SCADA system shall operate on the Wonderware Archestra platform.

3.2 Overview Screen

The plant's main SCADA screen shall show an overview of the plant in the form of a process flow diagram. The following key control aspects are present on the overview screen:

- Plant running status;
- Flow-rates:
    - Raw water;
    - Membrane filtration stage feed (per membrane skid);
    - Filtered water;
    - Treated water;
    - Feed to thickening unit;
    - Recycle stream to flocculation tank;
    - Thickened sludge to sludge disposal tank;
    - Neutralised CIP waste to sludge disposal tank.
- Turbidity measurements:
    - Raw water;
    - Filtered water (per membrane train);
    - Final water (post-CCT);
    - Recycle stream to flocculation tank.
- Levels:
    - Flocculation tank;
    - Warm water tank;
    - Treated water wet well;
    - Waste balance tank;
    - Sludge holding tank.
- pH measurements:
    - Coagulation;
    - Treated water (pre-CCT);
    - Final water (post-CCT).
- Free available chlorine measurements:
    - Treated water (pre-CCT);
    - Final water (post-CCT).
- C.t value:
    - Calculated from treated water flow-rate, final free available chlorine equivalent (FACE), and CCT volume.
- Membranes:
    - Skid statuses;
    - Transmembrane pressure;
    - Resistance;

    - Last PDT result.
- Chemical doses:
    - PAC dose;
    - Coagulant dose (raw water);
    - Coagulant dose (waste system);
    - Sodium hydroxide dose (coagulation pH control);
    - Sodium hydroxide dose (treated water pH control);
    - Treated water chlorine dose.
- Valve states and positions:
    - Supply valve;
    - Divert-to-waste valve;
    - Reticulation valve;
    - Waste divert valve;
    - Thickened sludge discharge valve;
    - Supernatant divert valve.
- Production efficiency:
    - Previous day;
    - 7-day rolling average.
- Production:
    - Previous day;
    - 7-day rolling average.

3.3 Drives

Variable-frequency drives (VFDs) will have a default operating range of 20-50 Hz corresponding to a speed of 40-100%. The VFD ramp-rate will be limited to a maximum of 5%/min except during start-up and shutdown.

Upon start-up, the pump VFD speed will increase from 0 to 20 Hz in 2 seconds. During shutdown, the pump VFD speed will decrease from the operating speed to 0 Hz in 2 seconds.

When a drive experiences a critical fault, then a critical fault alarm will be raised in the control system and the drive will become unavailable to the control system. Intervention will be required before the drive is again available to the control system.

When a duty-only drive experiences a fault, then this will result in a critical fault alarm being raised in the control system.

3.4 Critical Shutdown

A critical shutdown is when the entire plant is shut down immediately rather than going through the shutdown sequence. Conditions that trigger a critical shutdown are noted in the different areas.

3.5 Power Failure

All PLCs will have uninterruptible power supplies (UPSs), whether shared or dedicated, to allow for at least 10 minutes of uptime after a power failure to ensure that no data is lost. When the power comes back online, the control system must check that the historian has all the data and retrieve the data from the PLCs to eliminate missing minutes for compliance.

3.6 Manual Mode

Each plant device can be placed into manual mode, which allows the device to be directly controlled by an operator from the SCADA. Placing any device into manual mode will cause the plant to automatically stop, thereby preventing the plant from operating in a partially automatic state. This is to prevent the plant from producing non-compliant treated water.

3.7 Alarms

3.7.1 Overview

Alarms are split into two categories:

- A warning alarm is an indicator only, but the warning condition can deteriorate.
- A critical alarm results in a shutdown of the system being alarmed or a divert-to-waste. A critical alarm results in an operator call-out as it requires immediate attention. These alarms include any conditions that will result in DWSNZ non-compliance, overflows, hazardous conditions or system failures. Critical alarms are not audible by default. However, any alarm that initiates a plant shutdown should be audible.

A critical alarm will be raised if:

- Duty-only motors and electrical equipment fail to operate when instructed (default: 5 seconds);
- There is a critical auto-valve fault (default: 5 seconds) and no standby unit available;
- A critical instrument reading goes out of range (default: 5 seconds) and no standby instrument available;
- There is a communication loss between a PLC or equipment / instrument and the plant PLC.

If any of the above instruments, equipment items or systems are essential to compliance, a critical alarm will be raised. Until the alarm is acknowledged and reset, the relevant system shall remain locked out on fault.

Automatic suppression of alarms or where alarms would be inappropriate due to process and / or state of equipment will be provided to block alarms occurring when the monitored plant is out of service, or in a state where operator attention is not appropriate.

3.7.2 Authority Levels

Ordinary-level operators are permitted to change warning alarm values.

Supervisors are permitted to change some critical alarm values. Critical alarm values that supervisors are not permitted to change include start-up faults, equipment faults, auto-valve fault, instrument readings out-of-range and communication loss between local PLC and plant PLC.

4 Overall Plant Production Control

P&ID Sheets: HAT-PID-1-1, -2-1, -5-1

4.1 Operator Input Mode

4.1.1 Filtered Water Flow-Rate

The default overall plant production control is by an operator-entered set-point. In this mode, the entered set-point is used to control the membrane feed pumps and the raw water pumps.

The set-point entered is the value that the filtered water flow-rate (FIT0501) is required to meet. This is the sum of the membrane skids' filtered water flow-rates.

The operator-entered set-point is trimmed by the level in the Hatepe treated water tanks (TWTs). If the tanks' level is between 60% (low level) and 90% (high level), the set-point applies.

If the level is greater than 90% (high level) and less than 95% (high-high level), the set-point is decreased by 2 m^3/h. The plant operates at this new flow-rate set-point for 30 minutes. If the level is still between the high-level and high-high level, the set-point will be decreased by a further 2 m^3/h and the 30-minute timer is restarted.

If the level is greater than 95% (high-high level), the membrane feed pumps are shut down. When the level has decreased to 80% (start level), the membrane feed pumps will restart automatically at the operator-entered set-point.

If the level is less than 60% (low level) and greater than 50% (low-low level), the set-point is increased by 2 m^3/h. This new filtered water flow-rate set-point will apply for at least 30 minutes. If the level is still between the low-level and low-low level, the set-point will be increased by a further 2 m^3/h and the 30-minute timer is restarted.

If the TWTs' level is less than 50% (low-low level), the set-point is set to the maximum flow-rate.

TWTs' Level (%)	Description	Filtered Water Flow-Rate (m^3/h)	Details
> 95	High-High	0	Stop membrane feed pumps
> 90, < 95	High	$Setpoint - Trim$	Decrease set-point by 2 m^3/h; hold new set-point for 30 min and then decrease again
< 90, > 60	-	$Setpoint$	Operator-entered set-point
< 60, > 50	Low	$Setpoint + Trim$	Increase set-point by 2 m^3/h; hold new set-point for 30 min and then increase again
< 50	Low-Low	Maximum	Maximum filtered water flow-rate

The membrane feed pumps operate to achieve the filtered flow-rate set-point. Because there are losses through the membrane skids, the average membrane stage feed flow-rate is higher than the average filtered water flow-rate. The membrane feed pumps take the input value and determine the number of membrane skids to run as per the description in Section 5.2.2.

If there is a communication loss with the Hatepe treated water tanks' level transmitter, the filtered water flow-rate set-point will be reduced to the minimum flow-rate until communication has been re-established.

4.1.2 Raw Water Flow-Rate

The base-case flow-rate set-point used by the raw water pumps is calculated as follows:

$$RW\ SP = 1.05 \cdot FW\ SP$$

Where $RW\ SP$ is the base-case raw water flow-rate set-point and $FW\ SP$ is the operator-entered filtered water flow-rate set-point. The base-case raw water flow-rate set-point is 5% higher than the filtered water flow-rate set-point, to make up for losses.

The raw water flow-rate set-point is trimmed in accordance with the level in the flocculation tank (LIT0201). If the flocculation tank level is between 70% (low level) and 90% (high level), the base-case set-point applies.

If the level is greater than 90% (high level) and less than 95% (high-high level), the set-point is decreased by 2 m^3/h. The plant operates at this new flow-rate set-point for 30 minutes. If the level is still between the high-level and high-high level, the set-point will be decreased by a further 2 m^3/h and the 30-minute timer is restarted.

If the level is greater than 95% (high-high level), the raw water pumps are shut down. When the level has decreased to 80% (start level), the raw water pumps will restart automatically at the base-case set-point.

If the level is less than 70% (low level) and greater than 60% (low-low level), the set-point is increased by 2 m^3/h. This new raw water flow-rate set-point will apply for at least 30 minutes. If the level is still between the low-level and low-low level, the set-point will be increased by a further 2 m^3/h and the 30-minute timer is restarted.

If the flocculation tank level is less than 60% (low-low level), the set-point is set to the maximum flow-rate.

Floc. Tank Level (%)	Description	Raw Water Flow-Rate (m^3/h)	Details
> 95	High-High	0	Stop raw water pumps
> 90, < 95	High	$Setpoint - Trim$	Decrease set-point by 2 m^3/h; hold new set-point for 30 min and then decrease again
< 90, > 70	-	$Setpoint$	
< 70, > 60	Low	$Setpoint + Trim$	Increase set-point by 2 m^3/h; hold new set-point for 30 min and then increase again
< 60	Low-Low	Maximum	Maximum raw water flow-rate

4.2 Level Control Mode

4.2.1 Filtered Water Flow-Rate

In level control mode, the filtered flow-rate set-point is determined by the level in the Hatepe treated water tanks. The flow-rates in the table are adjustable such that the overall minimum and maximum are not exceeded, and each level's flow-rate follows the progression logically (flow-rate corresponding to a higher tank level not higher than flow-rate corresponding to a lower tank level).

TWTs' Level (%)	Description	Flow-Rate (m^3/h) when Level	
		Decreasing	Increasing
> 95	High-High	0	Stop: 0
> 90, < 95	-	0	2.5
90	High	Start: 2.5	2.5
< 90, > 80	-	4	4
< 80, > 70	-	6	6
< 70, > 60	-	8	8
< 60	Low	12.5	12.5

4.2.2 Raw Water Flow-Rate

In level control mode, the raw water flow-rate set-point is determined by the level in the flocculation tank. The flow-rates in the table are adjustable such that the overall minimum and maximum are not exceeded, and each level's flow-rate follows the progression logically (flow-rate corresponding to a higher tank level not higher than flow-rate corresponding to a lower tank level).

Floc. Tank Level (%)	Description	Flow-Rate (m^3/h) when Level	
		Decreasing	Increasing
> 95	High-High	0	Stop: 0
> 90, < 95	-	0	2.5
90	High	Start: 2.5	2.5
< 90, > 80	-	4	4
< 80, > 70	-	6	6
< 70, > 60	-	8	8
< 60	Low	12.5	12.5

4.3 Set-Points

Parameter	Units	Default	Adjustable Range
Filtered Water Flow Control Set-Points			
Treated water tanks high-high level	%	95	90-100
Treated water tanks high level	%	90	80-95
Treated water tanks low level	%	60	50-70
Treated water tanks low-low level	%	50	40-60
Treated water tanks restart level	%	80	70-90
Filtered water flow-rate set-point	m^3/h	4	2-12.5
Minimum filtered water flow-rate	m^3/h	3	2-6
Maximum filtered water flow-rate	m^3/h	12.5	8-12.5
Filtered water flow-rate trim adjustment	m^3/h	2	1-4
Filtered water flow-rate trim timer	min	30	5-60
Raw Water Flow Control Set-Points			
Flocculation tank high-high level	%	95	90-100
Flocculation tank high level	%	90	80-95
Flocculation tank low level	%	70	50-75
Flocculation tank low-low level	%	60	40-65
Flocculation tank restart level	%	80	70-90
Raw water flow-rate set-point multiplier	-	1.05	1-1.15
Raw water flow-rate set-point	m^3/h	4	3-15
Minimum raw water flow-rate	m^3/h	3	2-6
Maximum raw water flow-rate	m^3/h	12.5	10-15
Raw water flow-rate trim adjustment	m^3/h	2	1-4
Raw water flow-rate trim timer	min	30	5-60

4.4 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
TWTs' level high-high	Critical	> 95%	Always on	30	Shut down membrane feed pumps and inhibit raw water pumps from starting
TWTs' level high	Warning	> 90	Always on	60	Clear alarm automatically when level decreases < high
TWTs' level low	Warning	< 60%	Always on	60	Clear alarm automatically when level increases > low
TWTs' level low-low	Critical	< 50%	Always on	60	
TWTs' level transmitter	Critical	Fault or OOR[1]	Always on	5	Shut down membrane feed pumps
Floc. tank level high-high	Critical	> 95%	Always on	30	Shut down raw water pumps and inhibit raw water pumps from starting
Floc. tank level high	Warning	> 90%	Always on	60	Clear alarm automatically when level decreases < high
Floc. tank level low	Warning	< 70%	Always on	60	Clear alarm automatically when level increases > low
Floc. tank level low-low	Critical	< 60%	Always on	60	
Floc. tank level low-low-low	Critical	< 40%	Always on	60	Shut down skid pumps and inhibit skid pumps from starting

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Floc. tank level transmitter	Critical	Fault or OOR[1]	Always on	5	Shut down raw water pumps and membrane pumps

1. OOR = out-of-range.

5 Process Areas

5.1 Raw Water and Flocculation

P&ID Sheets: HAT-PID-1-1, -1-2, -2-1

5.1.1 Description

The raw water pumps abstract water from Lake Taupo and pump it to the water treatment plant. The raw water flow-rate is measured (FIT0101) and totalised daily (midnight to midnight) for abstraction consent purposes.

The turbidiy of the raw water (AIT0001) is measured at the intake pump station. If the raw water turbidity increases above 10 NTU, the raw water pump station will be shut down. This is to prevent high turbidity water from filling the raw water rising main to the WTP prior to the turbidity being measured at the WTP.

PAC is dosed into the raw water and then the water passes through two coarse screens (SCN0101/2) (duty / duty) and into the PAC contact tank (TNK0101). The PAC contact tank is a pressure vessel, thus requiring no pumps on the discharge side.

The coarse screens are backwashed automatically when a differential pressure set-point is reached. This is internal to the screens' functionality.

From the PAC contact tank, the raw water is transferred through a static mixer (MIX0201) and into the flocculation tank (TNK0201).

Coagulant and sodium hydroxide and are dosed into the static mixer. The sodium hydroxide is used for raising the raw water pH to the required coagulation pH and the coagulant is used for precipitating dissolved organic carbon and assisting with the removal of arsenic.

The raw water turbidity (AIT0201) and coagulation pH (AIT0202) are measured downstream of the static mixer. A flow-switch (FSL0201) on this sample line is used to indicate flow to the instruments.

The flocculation tank's level is monitored (LIT0201).

5.1.2 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Raw water flow high-high	Critical	> 15 m^3/h	Always on	30	Shut down raw water pumps
Raw water flow high	Warning	> 13 m^3/h	Always on	60	
Raw water flow low	Warning	< 2 m^3/h	Always on	60	
Raw water abstracted high	Warning	> 400 m^3/d	Always on	5	
Raw water flowmeter	Critical	Fault or OOR[1]	Always on	5	Shut down raw water pumps
Coarse screen 1/2	Warning	Fault	Always on	5	
Intake turbidity high-high	Critical	> 10 NTU	Always on	30	Shut down raw water pumps
Intake turbidity high	Warning	> 2 NTU	Always on	60	
Intake turbidity meter	Warning	Fault or OOR[1]	Always on	5	
Raw water turbidity high-high	Warning	> 10 NTU	When running	30	
Raw water turbidity high	Warning	> 2 NTU	When running	60	
Raw water turbidity meter	Warning	Fault or OOR[1]	Always on	5	
Coagulation pH high-high	Critical	> 8	When running	120	Shut down raw water pumps
Coagulation pH high	Warning	> 7.9	When running	180	
Coagulation pH low	Warning	< 7.1	When running	180	
Coagulation pH low-low	Critical	< 7	When running	120	Shut down raw water pumps
Coagulation pH meter	Critical	Fault or OOR[1]	Always on	5	Shut down raw water pumps
Flow-switch no flow	Critical	-	When running	5	Shut down raw water pumps
Flow-switch	Critical	Fault or OOR[1]	Always on	5	Shut down raw water pumps

1. OOR = out-of-range.

5.2 Membrane Filtration

P&ID Sheets: HAT-PID-2-1, -3-1, -4-1, -5-1, -15-1

5.2.1 Description

The membrane feed pumps (PMP0311/21) (duty / standby) draw water out of the flocculation tank (TNK0201), pump it through the membrane filtration stage and into the chlorine contact tank (TNK0501). Each pump is dedicated to a membrane skid (MBS0311/21). The inlet flow-rate to each membrane skid is measured (FIT0311/21).

A pH instrument at the inlet of each membrane skid (AIT0311/21) is used in controlling the pH during chemical washes to ensure that the required pH is being achieved for effective washing. Each pH meter has a flow-switch (FSL0311/21) to indicate if the instrument is receiving flow.

The temperature is also measured at the inlet to each skid (TIT0311/21) to ensure that the feed temperature is within the range of 5-35°C. The inlet pressure to each membrane skid is also measured (PIT0311/21).

From the membrane feed pumps, the water is transferred into the membrane modules and passes around the microporous, hollow-fibre membranes. Each membrane feed pump provides sufficient driving head to overcome the transmembrane pressure (TMP). The TMP depends on the build-up of suspended material in the membrane, and therefore increases with operating time between backwashes and chemical washes. The TMP is calculated as the difference of the inlet pressure (PIT0311/21) and outlet pressure (PIT0312/22) of each membrane.

A membrane integrity test (MIT), or pressure decay test (PDT), is undertaken within each 24-hour period regardless of whether the unit is in standby or in-service. During the PDT, the pressure loss across the membrane is measured and the test provides online validation of the quality of the membrane. Any deviation from the allowable PDT value will raise an alarm and shut down the skid.

Filtrate, or permeate, is delivered to the chlorine contact tank. A portion of the filtrate is transferred to the warm water tank (TNK0401) for membrane washes.

A turbidity meter (AIT0312/22) is installed on the filtrate stream of each skid for DWSNZ compliance. The range of measurement for the selected instruments is 0.01 to 2.00 NTU. The sample lines on which the turbidity meters are installed have flow-switches (FSL0312/22) to indicate if the instruments are receiving flow.

The raw water turbidity meter (AIT0201) is also used by the membrane filtrated stage for DWSNZ compliance.

Clean-in-place wastewater is discharged to the neutralisation tank (TNK1502). Backwash wastewater is discharged to the waste balance tank (TNK1501).

5.2.2 Flow Allocation Between Skids

The combined flow-rate set-point to the membrane skids is determined by the filtered flow-rate set-point (refer to Section 4), with a trim to ensure that the losses through the membranes are made up to achieve the required filtered water flow-rate.

$$MBS\ flow\ SP = filtered\ flow\ SP + trim$$

Where $MBS\ Flow\ SP$ is the combined flow-rate to the membrane filtration stage and trim is calculated by the control system.

Only one skid will be permitted to operate under most raw water quality conditions, except when there are adverse raw water quality conditions. Adverse conditions are present when one of the following is active:

- PAC dosing active; or
- Total algae concentration > 3,000 cells/mL; or
- Raw water turbidity > 10 NTU; or
- Coagulant dose > 5 mg_{active}/L.

During adverse raw water quality conditions, both skids will be permitted to operate simultaneously. Activating adverse conditions is performed manually. When one of the above conditions is true, then this will be highlighted in the SCADA and the operator will have the choice of activating both skids.

The inlet flow-rate set-point to each in-service membrane skid is calculated as follows:

$$Flow_{MBS\,i} = \frac{MBS\ Flow\ SP}{N}$$

Where $Flow_{MBS\,i}$ is the flow-rate set-point to in-service membrane skid i, $MBS\ Flow\ SP$ is the combined flow-rate set-point to the membrane filtration stage and N is the number of in-service membrane skids.

5.2.3 Membrane Skid Duties

When transitioning from using one skid to two skids, the speed of the duty skid's feed pump will be reduced to half-speed and the speed of the assist skid's feed pump will be ramped up to half-speed. When both pumps' speeds are at half-speed (within 4% difference), the speeds will be ramped up together to meet the flow-rate set-point. The operating pumps' speeds will remain equal to each other, within 4%.

When transitioning from using two skids to one skid, the speed of the assist skid's feed pump will be decreased at 5%/min and the speed of the duty skid's feed pump will be increased at 5%/min. When the speed of the assist skid's feed pump decreases below 30 Hz, it will be shut down, and the speed of the duty skid's feed pump will be controlled to meet the flow-rate set-point.

All pump duties may be changed by an operator.

5.2.4 Parameters to be Displayed on SCADA (per Skid)

Parameter	Units		Parameter	Units
General			**Pressure Decay Test**	
Runtime	h		Filtration time since last test	h
Flow	m^3/h		Target time for PDT	hh:mm
Turbidity	NTU		Test start pressure	kPa
Inlet pressure	kPa		Test end pressure	kPa
Outlet pressure	kPa		Last test result	kPa
TMP	kPa		Remaining test time	min
Inlet temperature	°C		Log reduction value	-
Inlet pH	-			
Backwash (BW)			**Clean-in-Place (CIP)**	
Time since last BW	h		Time since last CIP	h
Time before next BW	h		Target time for CIP	hh:mm
Target time for BW	hh:mm		Target resistance for CIP	kPa
Delta resistance for BW	kPa		Target TMP for CIP	kPa
Target TMP for BW	kPa		Next CIP due	hh:mm
FFI last filtration interval	h		Time in CIP step	min
Valves				
BW valve position	-			
CIP valve position	-			
Warm water tank inlet valve position	-			

5.2.5 Compliance

When a skid shuts down due to high-high filtrate turbidity (AIT0312/22) or loss of flow (FSL0312/22) to the filtrate turbidity for over 10 minutes, the skid must be shut down and a PDT must be performed.

If the PDT passes (result < 4 kPa/min), the skid will be put in the standby position and will be available for filtration when required. If the PDT fails (result > 4 kPa/min), another PDT will be performed. If that PDT also fails, then the skid will be taken out of service and not permitted to resume service until a PDT has been performed and passed. Typically, the skid will require repairs prior to being able to pass another PDT.

5.2.6 Set-Points

Parameter	Units	Default	Adjustable Range
Flow limitation limit	m^3/h	12.5	2-12.5

5.2.7 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Skid feed pump 1/2	Critical	Fault	Always on	5	Shut down skid; change duties
Skid flow 1/2 high	Critical	> 12.5 m^3/h	In filtration	30	Shut down skid
Skid flow 1/2 low	Critical	< 2 m^3/h	In filtration	30	Shut down skid
Skid flowmeter 1/2	Critical	Fault or OOR[1]	Always on	5	Shut down skid; change duties
Skid feed pressure 1/2 high-high	Critical	> 300 kPa	When running	30	Shut down skid; change duties
Skid feed pressure 1/2/high	Warning	> 250 kPa	When running	60	Shut down skid; change duties
Skid feed pressure transmitter 1/2	Critical	Fault or OOR[1]	Always on	5	Shut down skid; change duties
Skid feed temperature 1/2 high	Warning	> 45°C	When running	60	
Skid feed temperature 1/2 low	Warning	< 5°C	When running	60	
Skid feed temperature transmitter 1/2	Warning	Fault or OOR[1]	Always on	5	
Skid feed pH 1/2 high	Warning	> 10	When running	60	
Skid feed pH 1/2 low	Warning	< 2	When running	60	
Skid feed pH meter 1/2	Warning	Fault or OOR[1]	Always on	5	CIP not permitted
Skid feed pH flow-switch 1/2 no flow	Warning	-	When running	5	
Skid feed pH flow-switch 1/2	Warning	Fault or OOR[1]	Always on	5	
Skid filtrate pressure transmitter 1/2	Critical	Fault or OOR[1]	Always on	5	Shut down skid; change duties

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Skid filtrate turbidity 1/2/high-high	Critical	> 0.10 NTU	In filtration	600	Shut down skid and start MIT; change duties
Skid filtrate turbidity 1/2 high	Warning	> 0.09 NTU	In filtration	180	
Skid filtrate turbidity meter 1/2	Critical	Fault or OOR[1]	Always on	5	Shut down skid; change duties
Skid filtrate turbidity 1/2/no flow	Critical	-	In filtration	5	Shut down skid; change duties
Skid filtrate turbidity flow-switch 1/2	Critical	Fault or OOR[1]	Always on	5	Shut down skid; change duties
Skid 1/2 TMP high-high	Critical	> 100 kPa	In filtration		
Skid 1/2 TMP high	Warning	> 80 kPa	In filtration		
Skid 1/2 general warning alarm	Warning	-	Always on	5	
Skid 1/2 general critical alarm	Critical	-	Always on	5	Shut down skid; change duties

1. OOR = out-of-range.

5.3 Warm Water System

P&ID Sheets: HAT-PID-3-1, -4-1

5.3.1 Description

Filtrate is drawn off from the combined filtrate line and used to replenish the warm water tank (TNK0401).

The warm water tank has an actuated inlet valve (AAV0401) with position switches (ZSH/L0401), which opens automatically as determined by the tank level (LIT0401). When the level drops below the low level, the inlet valve opens. When the level increases above the high level, the inlet valve closes.

There is also a heating element (HTE0401) and temperature transmitter (TIT0401) which maintain the temperature in the tank.

5.3.2 Set-Points

Parameter	Units	Default	Adjustable Range
Warm water tank high level	%	95	90-100
Warm water tank low level	%	70	50-80
Warm water tank high temperature	°C	35	30-60
Warm water tank low temperature	°C	30	20-35

5.3.3 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Level high-high	Warning	> 98%	Always on	30	
Level low-low	Critical	< 40%	Always on	30	CIP not permitted
Level transmitter	Critical	Fault or OOR[1]	Always on	5	CIP not permitted
Inlet valve open	Warning	And level > 98%	Always on	30	
Inlet valve closed	Warning	And level < 40%	Always on	30	
Inlet valve	Critical	Fault or OOR[1]	Always on	5	
Temperature high-high	Critical	> 60°C	Always on	30	CIP not permitted
Temperature low-low	Critical	< 20°C	Always on	30	CIP not permitted
Temperature transmitter	Critical	Fault or OOR[1]	Always on	5	
Heater	Warning	Fault or OOR[1]	Always on	5	

1. OOR = out-of-range.

5.4 Treated Water Dosing and Chlorine Contact Tank

P&ID Sheets: HAT-PID-5-1

5.4.1 Description

After the membrane filtration stage the filtered water flow-rate is measured (FIT0501). The filtered water passes through a static mixer (MIX0501) and into the chlorine contact tank (TNK0501).

Superchlorinated water is dosed into the static mixer for providing a FAC residual in the treated water. Sodium hydroxide is dosed into the same static mixer for treated water pH control.

Downstream of the static mixer two sample pumps (duty / standby) (PMP0501/2) provide sample flow to the treated water FAC analyser (AIT0501) and pH analyser (AIT0502). These are used in the feedback dose control in the chlorination and sodium hydroxide dosing systems, respectively. A flow-switch (FSL0501) is installed on this sample line to indicate if the instruments are receiving flow.

5.4.2 Divert-to-Waste

After the sample point and upstream of the CCT there is a divert-to-waste line. The treated water is diverted automatically when key parameters are out of specification.

The supply valve (AAV0501) is fitted with position switches (ZSH/L0501) to indicate when it is open or closed. The divert valve (AAV0502) is fitted with position switches (ZSH/L0502) to indicate when it is open or closed. A flow-switch (FSH0502) is installed on the divert-to-waste line for confirming that the line is in use.

When in divert, the supply valve will be closed and the divert valve will be opened. The plant's flow-rate will be reduced to the minimum flow-rate (2.5 m^3/h). When the parameter that activated the divert-to-waste is once again within specification, the divert will continue for a further 15 seconds. Provided the parameter remains within specification for the duration of this period, the plant will then revert to supplying the CCT.

If the parameter does not return to specification within the maximum divert time, the plant will be shut down.

5.4.3 Set-Points

Parameter	Units	Default	Adjustable Range
Maximum divert-to-waste time	min	5	3-10
Time required for parameter to be within specification before reverting to supply	s	15	5-30

5.4.4 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Filtered water flow high-high	Critical	> 15 m^3/h	Always on	30	Shut down skids
Filtered water flow high	Warning	> 12.5 m^3/h	Always on	60	
Filtered water flow low	Warning	< 2 m^3/h	Always on	60	
Filtered water flowmeter	Critical	Fault or OOR[1]	Always on	5	Shut down skids

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Sample pump 1/2	Critical	Fault	Always on	5	Shut down pump; change duties
Treated water FAC high-high	Critical	> 2.5	When running	30	Divert to waste
Treated water FAC high	Warning	> 2	When running	60	
Treated water FAC low	Warning	< 0.8	When running	60	
Treated water FAC low-low	Critical	< 0.5	When running	30	Divert to waste
Treated water FAC meter	Critical	Fault or OOR[1]	Always on	5	Divert to waste
Treated water pH high-high	Critical	> 8.2	When running	120	Divert to waste
Treated water pH high	Warning	> 8	When running	180	
Treated water pH low	Warning	< 7	When running	180	
Treated water pH low-low	Critical	< 6.8	When running	120	Divert to waste
Treated water pH meter	Critical	Fault or OOR[1]	Always on	5	Divert to waste
Sample flow-switch no flow	Critical	-	When running	5	Divert to waste
Sample flow-switch	Critical	Fault or OOR[1]	Always on	5	Divert to waste
Supply valve open	Critical	And divert valve open	Always on	30	
Supply valve closed	Warning	And divert valve closed	When running	30	Shut down skids
Supply valve	Critical	Fault	Always on	5	Divert to waste
Divert valve	Warning	Fault	Not diverting	5	Divert to waste
Divert valve	Critical	Fault	Diverting	5	Shut down skids
Divert valve open	Warning	Divert flow-switch no flow	When running	5	
Divert flow-switch	Warning	Fault or OOR[1]	Always on	5	

1. OOR = out-of-range.

5.5 Treated Water Transfer and Bacteriological Compliance

P&ID Sheets: HAT-PID-5-1, -6-1, -7-1

5.5.1 Description

The treated water overflows from the chlorine contact tank (TNK0501) into the treated water wet well (TNK0502) (TWWW). The wet well is fitted with a level transmitter (LIT0501).

The treated water pumps (duty / assist / standby) (PMP0601/2/3) draw water out of the wet well and pump it to the Hatepe treated water tanks and supply the service water users at the WTP. The treated water pumps are controlled to maintain a level set-point in the TWWW of 85% with a deadband of 5%.

The pumps are permitted to operate only when the filtered water flow-rate (FIT0501) is greater than 2.5 m^3/h. The maximum flow-rate that the treated water pumps are permitted to pump is 15 m^3/h.

5.5.2 Changing Pump Duties

When transitioning from using one pump to two pumps, the duty pump's speed will be reduced to half-speed and the assist pump's speed will be ramped up to half-speed. When both pumps' speeds are at half-speed (within 4% difference), the speeds will be synchronised and ramped up to meet the level set-point. The speeds of the operating pumps will remain equal to each other, within 4%.

When transitioning from using two pumps to one pump, the assist pump's speed will be decreased at 5%/min and the duty pump's speed will be increased at 5%/min. When the assist pump's speed decreases below 25 Hz, it will be shut down, and the duty pump's speed will be controlled to meet the level set-point.

Pump duty change is automatic. Each week the pump duty will change at a set time. Duty-change will not interfere with the plant operation. In the event of the failure of the duty unit, the assist or standby unit will automatically start.

All pump duties may be changed by an operator.

5.5.3 Production Efficiency

The treated water flow-rate (FIT0601) is monitored. This measurement is used to calculate the plant's production efficiency, ε, calculated daily:

$$\varepsilon(\%) = \frac{Treated(FIT0601)\left(\frac{m^3}{d}\right)}{Raw(FIT0101)(\frac{m^3}{d})} \cdot 100(\%)$$

5.5.4 Service Water

Service water is provided to the following users:

- Carry-water for the PAC dosing system;
- Carry-water for the sodium hydroxide dosing system (coagulation pH and treated water pH duties);
- Carry-water for the chlorine dosing system;
- Safety shower and eyewash stations – a flow-switch (FSH0701/2) on the line to each of the safety showers is used to indicate when the station is in use;
- Hosing points around the plant;
- General service water users, including office facilities.

There is also a fire-detection system (FDI0701) for warning in the case of fires. A visual alarm (ALA0701) and an audible alarm (ALA0702) are controlled by the fire-detection system for alarming.

5.5.5 Criterion 2A

The following instruments are used for bacteriological compliance. They receive their sample flow from the overflow line of the CCT. The instruments monitor the quality of the treated water being transferred into the distribution network:

- Free available chlorine (AIT0503);
- pH (AIT0504);
- Turbidity (AIT0505).

A flow-switch (FSL0502) is installed on the sample line to alarm if there is no flow to the instruments.

The FACE is calculated and displayed on the SCADA screen. The FACE is calculated at both points where the FAC and pH are measured. The FACE is calculated as follows:

If the pH ≤ 8:	$FACE = FAC$
If the pH > 8:	$FACE = \frac{FAC \cdot 3.032326}{1 + \frac{0.0000000203233}{10^{-pH}}}$

The retention time and C.t value (DWSNZ Section 4.2.2 and DWSNZ Appendix A1.3.3) are displayed on the SCADA screen. For all demand flow-rates above 2.5 m^3/h, the retention time is calculated as follows:

$$Retention\ Time(min) = \frac{Vol_{CCT}(m^3)}{FIT0601\left(\frac{m^3}{h}\right) + FIT0602(\frac{m^3}{h})} \cdot 60(\frac{min}{h}) \cdot bf$$

Where Vol_{CCT} is the full live volume of the chlorine contact tank and bf is the baffle factor. The baffle factor will be a minimum of 0.5 (to be confirmed by the Contractor).

The C.t value is calculated as follows:

$$C.t = FACE \cdot Retention\ Time(min)$$

5.5.6 Set-Points

Parameter	Units	Default	Adjustable Range
Treated water wet well level set-point	%	85	70-100
Treated water wet well level set-point deadband	%	5	2-15
Maximum treated water pumps flow-rate	m^3/h	15	12-18

5.5.7 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Retention time low	Warning	< 40 min.	When running	120	
Retention time low-low	Critical	< 32 min.	When running	60	Limit demand flow to 3 m^3/h
C.t value low	Warning	< 30 min·mg/L	When running	120	
C.t value low-low	Critical	< 15 min·mg/L	When running	60	Limit demand flow to 3 m^3/h
TWWW level high	Critical	> 95%	Always on	30	Shut down skids
TWWW level low	Warning	< 60%	When running	120	
TWWW level low-low	Critical	< 50%	When running	30	Stop treated water pumps
TWWW level transmitter	Warning	Fault or OOR[1]	Always on	5	
Treated water pump 1/2/3	Critical	Fault	Always on	5	Shut down pump; change duties
Final pressure high	Warning	> 6 bar (TBC)	Always on	30	
Final pressure low	Warning	< 3 bar (TBC)	Always on	30	
Final pressure transmitter	Critical	Fault or OOR[1]	Always on	5	Shut down pump; change duties[2]
Final water FAC high-high	Critical	> 2.5	When running	30	
Final water FAC high	Warning	> 2	When running	60	
Final water FAC low	Warning	< 0.8	When running	60	
Final water FAC low-low	Critical	< 0.5	When running	30	
Final water FACE low-low	Critical	< 0.5	When running	30	Shut down treated water pumps[2]
Final water FAC meter	Critical	Fault or OOR[1]	Always on	5	Shut down treated water pumps[2]

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Final water pH high-high	Critical	> 8.2	When running	120	
Final water pH high	Warning	> 8	When running	180	
Final water pH low	Warning	< 7.2	When running	180	
Final water pH low-low	Critical	< 7	When running	120	
Final water pH meter	Critical	Fault or OOR[1]	Always on	5	Shut down treated water pumps[2]
Final water turbidity high-high	Critical	> 1 NTU	When running	120	Shut down treated water pumps[2]
Final water turbidity high	Warning	> 0.5 NTU	When running	180	
Final water turbidity meter	Critical	Fault or OOR[1]	Always on	5	Shut down treated water pumps[2]
Flow-switch no flow	Critical	-	When running	5	
Flow-switch	Critical	Fault or OOR[1]	Always on	5	Shut down treated water pumps[2]
Demand flow high	Warning	> 15 m^3/h	Always on	60	
Demand flowmeter	Critical	Fault or OOR[1]	Always on	5	
Demand pressure	Warning	< 3 bar (TBC)	Always on	30	
Safety shower flow on (flow-switch 1/2)	Critical	-	Always on	5	
Fire system activated	Critical	-	Always on	5	Call out fire service

1. OOR = out-of-range.

2. Can be bypassed by the supervisor. Flow limited for demand flow limit duration time.

5.6 Waste Tanks

P&ID Sheets: HAT-PID-15-1, -15-2

5.6.1 Description

Waste streams from the plant are sent to either the waste balance tank (TNK1501) or the neutralisation tank (TNK1502).

5.6.1.1 *Neutralisation Tank*

Only the CIP and maintenance wash waste streams are sent to the neutralisation tank. The contents of the neutralisation tank is pumped to the sludge holding tank (TNK1503) by means of two submersible pumps (PMP1503/4) (duty / standby).

Functionality for neutralising high pH (> 10) and low pH (< 6) in the CIP waste is currently not included in the design.

The flow-rate pumped to the sludge holding tank is monitored (FIT1502). The sludge stream from the thickening unit is also discharged to the sludge holding tank. This flow-rate is measured by a separate flowmeter (FIT1512).

The total waste flow-rate to the sludge holding tank (for disposal) is totalised daily to account for the daily total volume discharged from the plant. The annual volume is also totalised for accounting for how much water is discharged from the plant each compliance year (1 July to 30 June). The total waste discharge is calculated as follows:

$$f_{tot}\left(\frac{m^3}{h}\right) = FIT1502\left(\frac{m^3}{h}\right) + FIT1512\left(\frac{m^3}{h}\right)$$

5.6.1.2 *Waste Balance Tank*

The waste streams that are directed to the waste balance tank are as follows:

- Overflow and drain lines from the:
  - PAC contact tank;
  - Flocculation tank;
  - Warm water tank;
  - Chlorine contact tank (drain line only);
  - Treated water wet well;
  - Supernatant tank;
- Backwash streams from the coarse screening;
- Backwash streams from the membrane filtration stage;
- Divert-to-waste stream;
- Instrument drain lines.

The contents of the waste balance tank are pumped to the thickening unit (THK1511) by means of two submersible pumps (PMP1501/2) (duty / standby). A three-way motorised valve (MAV1501) typically directs the stream to the thickening unit. If the thickening unit is unavailable and the pumps are required to run, the three-way valve can direct the stream to the neutralisation tank. This is selected by the supervisor.

The flow-rate to the thickening unit is monitored (FIT1501).

5.6.2 Pump Operation

5.6.2.1 *Neutralisation Tank*

The neutralisation tank is fitted with four level switches at the following positions:

- High-high level (LSH1501) for a warning alarm;
- High level (LSH1502) for starting the duty pump;
- Low level (LSL1502) for stopping the duty pump;
- Low-low level (LSL1501) for a warning alarm.

The submersible pumps operate as required by the activation of the level switches, regardless of whether the plant is operating. The Contractor is to determine whether four level switches or a level transmitter is more suitable for the design.

5.6.2.2 *Waste Balance Tank*

The waste balance tank is fitted with a level transmitter (LIT1501). The submersible pumps operate as required in accordance with the level. The duty pump starts when the level increases to the high level (default: 90%) and stops when the level drops to the low level (10%). The pump operates as long as the level is within this range and the thickening unit is available.

Pump duty change is automatic. Each week the pump duty will change at a set time. Duty-change will not interfere with the plant operation. In the event of the failure of the duty unit, the assist or standby unit will automatically start.

5.6.3 Set-Points

Parameter	Units	Default	Adjustable Range
Neutralisation tank high-level switch activated	-	Start pump	-
Neutralisation tank low-level switch activated	-	Stop pump	-
Waste balance tank high level	%	90	70-95
Waste balance tank low level	%	10	2-25

5.6.4 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Neutralisation Tank					
Tank level high-high	Warning	-	Always on	30	
Tank level low-low	Warning	-	Always on	30	
Pump 1/2	Critical	Fault	Always on	5	Shut down pump; change duties
Any flow-switch	Warning	Fault or OOR[1]	Always on	5	
Actuated valve	Critical	Fault	Always on	5	

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Valve directed to sludge tank	Critical	And pH > 9.5 or pH < 6.1	Always on	5	Shut down pumps
Flow to sludge tank high	Warning	> 2.5 m^3/h	Always on	30	
Flowmeter	Critical	Fault or OOR[1]	Always on	5	
Daily waste volume high	Warning	> 3 m^3/d	Always on	30	
Cumulative waste volume to sludge tank high	Warning	> 1,825 m^3/year	Always on	30	
Flowmeter to sludge tank	Critical	Fault or OOR[1]	Always on	5	
Waste Balance Tank					
Tank level high-high	Warning	> 95%	Always on	30	
Level transmitter	Critical	Fault or OOR[1]	Always on	5	Shut down pumps and skids
Pump 1/2	Critical	Fault	Always on	5	Shut down pump; change duties
Flow to thickening unit high	Warning	> 2.5 m^3/h	Always on	30	
Flowmeter	Critical	Fault or OOR[1]	Always on	5	Shut down pumps
Actuated valve	Critical	Fault	Always on	5	Shut down pumps
Valve directed to neut. tank	Warning	-	Always on	5	

1. OOR = out-of-range.

5.7 Thickening System

P&ID Sheets: HAT-PID-1-1, -2-1, -9-2, -15-1, -15-2, -15-3

5.7.1 Description

5.7.1.1 *Supernatant*

The contents of the waste balance tank (TNK1501) is pumped (PMP1501/2) to the thickening unit (THK1511) via a static mixer (MIX1511). Coagulant is dosed into the static mixer for aiding in settling of the suspended solids.

The thickening unit has two product streams. The supernatant overflows into the supernatant tank (TNK1511). The level of the tank is monitored (LIT1511). Two pumps (duty / standby) (PMP1511/12) withdraw the supernatant from the tank and pump it to the flocculation tank. The flow-rate of this recycle stream is monitored (FIT1511). The maximum instantaneous flow-rate that this stream is permitted to be is 8% of the raw water flow-rate (FIT0101).

The turbidity of the recycle stream is also monitored (AIT1511). A flow-switch (FSL1511) on this sample line is used to confirm flow to the turbidity meter.

An actuated valve (AAV1511) is installed on the recycle line directed to the flocculation tank. This valve is fitted with two position switches (ZSH/L1511). When the turbidity is less than 10 NTU, this valve is open. Another actuated valve (AAV1512) is installed to direct the recycle stream to the waste balance tank (TNK1501) when the turbidity is greater than 10 NTU or when the supernatant tank level is high and the raw water flow-rate is less than 4 m^3/h. The second valve is fitted with two position switches (ZSH/L1512). The two valves will not be open simultaneously.

A flow switch (FSH1511) is installed on the supernatant tank's overflow line to alarm when the tank is overflowing. The overflow is directed to the waste balance tank (TNK1501).

5.7.1.2 *Sludge*

The sludge stream from the thickening unit is periodically pumped (PMP1513/4) to the sludge holding tank (TNK1503) via an actuated valve (AAV1513). The actuated valve is fitted with two position switches (ZSH/L1513). The flow-rate of the thickened sludge stream is measured (FIT1512) for accounting purposes.

The sludge holding tank is fitted with a mixer (MIX1501) to prevent sludge hold-up in the tank. The level in the tank is measured (LIT1502). The sludge in the holding tank is periodically disposed of via tankers.

When the high level is reached, an alarm message will notify operators to organise a sludge disposal tanker.

5.7.2 Pump Operation

5.7.2.1 *Supernatant Pumps*

When the supernatant tank's level is greater than 10%, the duty pump is permitted to operate. When in recycle mode (AAV1511 open), the duty pump will operate to achieve 5% of the raw water flow-rate. When in supernatant-divert mode (AAV1512 open), the duty pump will operate at maximum speed.

In recycle mode, if the supernatant tank's level is greater that 80%, then the duty pump will operate to achieve 6% of the raw water flow-rate. If the tank level remains above 80% for 30 minutes, the duty pump will operate to achieve 7% of the raw water flow-rate. As long as the tank level remains above 80%, then the ratio will increase by 1% every 30 minutes, up to a maximum of 8%.

When the level decreases below 80%, then the ratio will decrease to the default of 5%.

The duty pump is not permitted to operate if:

- Supernatant tank level low (default: < 10%);
- The recycle valve (AAV1511) is open and the raw water flow-rate is low (default: < 4 m^3/h);
- The supernatant divert valve (AAV1512) is open and the waste balance tank level is high (default: > 90%).

Pump duty change is automatic. Each week the pump duty will change at a set time. Duty-change will not interfere with the plant operation. In the event of the failure of the duty unit, the standby unit will automatically start.

5.7.2.2 *Sludge Pumps*

The sludge pumps (PMP1513/4) are driven by variable-speed drives and operate intermittantly, in accordance with the thickener's desludge frequency.

The duty pump will only be permitted to start if the level in the sludge holding tank is below 75%.

5.7.3 Set-Points

Parameter	Units	Default	Adjustable Range
Supernatant tank high level (above which recycle ratio is increased incrementally)	%	80	50-95
Supernatant tank low level (above which pump permitted to operate)	%	10	2-50
Default recycle ratio ($\frac{FIT1511}{FIT0101}$)	%	5	2-8
Maximum recycle turbidity	NTU	10	1-10
Recycle divert time[1]	min	5	1-30
Time between desludge valve opening	min	180	60-1440
Desludge valve open time	s	30	0-600
Sludge holding tank high level	%	75	50-95

1. When the supernatant tank's level has been higher than its high level or the raw water flow-rate has been less than 4 m^3/h for 60 seconds, the divert is permitted to occur for this listed time.

5.7.4 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Thickening unit	Critical	Fault	Always on	5	Shut down waste balance tank pumps
Supernatant tank level high	Warning	> 95%	Always on	60	Shut down waste balance tank pumps

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Supernatant tank level transmitter	Critical	Fault or OOR[1]	Always on	5	Shut down waste balance tank pumps
Recycle pump 1/2	Warning	Fault	Always on	5	Shut down pump; change duties
Recycle flow-rate high	Warning	> 1.2 m^3/h	When running	30	
Recycle flowmeter	Critical	Fault or OOR[1]	Always on	5	Shut down recycle pumps
Turbidity high-high	Warning	> 10 NTU	When running	30	Close recycle valve; open divert valve
Turbidity high	Warning	> 5 NTU	When running	60	
Turbidity meter	Critical	Fault or OOR[1]	Always on	5	Shut down recycle pumps
Turbidity no flow	Critical	-	When running	5	Shut down recycle pumps
Turbidity flow-switch	Critical	Fault	Always on	5	Shut down recycle pumps
Recycle actuated valve	Warning	Fault	Always on	5	
Recycle divert actuated valve	Warning	Fault	Always on	5	
Supernatant tank overflow flow-switch indicating flow	Warning	-	Always on	5	
Supernatant tank overflow flow-switch	Warning	Fault	Always on	5	
Desludge valve open	Warning	-	Always on	86,400	
Desludge valve	Critical	Fault	Always on	5	
Sludge pump	Critical	Fault	Always on	5	
Sludge flow-rate high	Warning	> 1 m^3/h	When running	30	
Sludge flowmeter	Critical	Fault or OOR[1]	Always on	5	Shut down waste balance tank pumps
Sludge holding tank level high	Warning	> 75%	Always on	60	Message: Organise sludge disposal tanker

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Sludge holding tank level transmitter	Critical	Fault or OOR[1]	Always on	5	Shut down sludge pumps

1. OOR = out-of-range.

5.8 Powdered Activated Carbon Dosing System

P&ID Sheets: HAT-PID-1-2, -8-1

5.8.1 Description

PAC is dosed into the raw water for removing T&O compounds and algal toxins from the water. It is dosed only when required and the dosing is activated manually.

PAC bags are loaded into the hopper (HPP0801) via a gantry crane (CRN0801). The hopper is fitted with a load cell (WIT0801) for indicating the mass in the hopper.

A dry feeder (FDR0801/2) draws dry PAC out of the hopper and discharges it into the wetting tank (TNK0801). The wetting tank is fitted with a high-level switch (LSH0801) to alarm when the tank is overflowing. The PAC and water in the wetting tank are discharged through the bottom of the tank into the eductor (EDR0801).

Water from the service water system is provided to the PAC dosing system. Some of the water is fed into the wetting tank and the rest is transferred through the eductor.

The carry-water to the eductor is transferred through a solenoid valve (SAV0801) fitted with position switches (ZSH/L0801) and passed through a rotameter (ROT0801) with a flow-switch (FSL0801).

The water fed into the tank is transferred through a solenoid valve (SAV0802) fitted with position switches (ZSH/L0802) and passed through a rotameter (ROT0802) with a flow-switch (FSL0802).

The flow-rates to the tank and eductor are adjusted by means of manual valves.

The dosing system is located in a bund which has a high-level switch (LSH0802) to indicate when liquid is in the bund.

A dust extraction system (DST0801) helps minimise dust in the PAC dosing system's room. The dust extraction system runs whenever either feeder is running or either solenoid valve is open.

5.8.2 System Operation

When PAC dosing is activated (performed via a manual selection on the SCADA), the solenoid valve to the tank (SAV0802) is opened, allowing water to flow into the tank. Upon confirmation of flow through this stream, indicated by FSL0802, the solenoid valve providing carry-water to the eductor (SAV0801) is opened. When flow through the eductor is confirmed (FSL0801), the dry feeder (FDR0801/2) will start.

The speed of the operating dry feeder(s) is controlled to achieve the dose set-point. Each feeder has a capacity of 200 g/h. When the dose-rate set-point is less than 200 g/h, then only one dry feeder will operate. When the required dose-rate is greater than 200 g/h, then both dry feeders will operate to achieve the dose-rate set-point. Duty-change between the dry feeders will occur once per week.

When PAC dosing is deactivated, the dry feeder will stop. The solenoid valves will remain open for 30 minutes, after which they will close.

5.8.3 Dose-Rate

The PAC dose is selected manually (default 5 mg/L). The feeder starts when the raw water flow-rate (FIT0101) increases above 2.5 m^3/h and stops when the flow-rate decreases below 2.5 m^3/h. The feeder speed is calculated as follows:

$$feeder\ delivery\ (kg/h) = \frac{dose\left(\frac{g}{m^3}\right) \cdot raw\ water\ flowrate\ \left(\frac{m^3}{h}\right)}{1000\left(\frac{g}{kg}\right)}$$

$$feeder\ speed\ (\%) = \frac{Feeder\ delivery\ \left(\frac{kg}{h}\right)}{Feeder\ capacity\ \left(\frac{kg}{h}\right)} \cdot 100$$

The feeder speed is sent as a 4 to 20 mA signal where 4 mA is 20% and 20 mA is 100%.

5.8.4 Set-Points

Parameter	Units	Default	Adjustable Range
PAC dose	mg/L	5	0-30

5.8.5 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Hopper weight low	Warning	< 25 kg	Always on	30	SCADA message: Load PAC into hopper
Hopper load cell	Warning	Fault or OOR	Always on	5	
Feeder	Warning	Fault	Always on	5	
Tank level high	Warning	-	Always on	5	
Tank level switch	Warning	Fault	Always on	5	
Solenoid valve 1 open	Warning	And no flow	When running	5	
Solenoid valve 1 closed	Warning	And flow detected	When running	5	
Solenoid valve 2 open	Warning	And no flow	When running	5	
Solenoid valve 2 closed	Warning	And flow detected	When running	5	
Solenoid valve 1/2	Warning	Fault	Always on	5	
Rotameter flow-switch 1/2	Warning	Fault or OOR	Always on	5	
Bund level high	Warning	-	Always on	5	

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Dust extraction system not operating	Warning	And solenoid valves open	When running	5	
Dust extraction system	Warning	Fault	Always on	5	

5.9 Coagulant Dosing System

P&ID Sheets: HAT-PID-1-2, -2-1, -9-1, -9-2, 15-2

5.9.1 Description

Aluminium chlorohydrate is used as the coagulant and is dosed into the raw water via the static mixer (MIX0201) upstream of the flocculation tank (TNK0201). The coagulant dose is selected manually.

The ACH solution being used is Profloc A23 and consists of approximately 0.50 g aluminium chlorohydrate per g product and has been used in preliminary calculations. If a different value applies due to a different product quality being obtained, the calculations are to be updated accordingly. The solution's density is 1,340 kg/m^3.

The dosing tank (TNK0901) has a live capacity of 250 L. The tank level is monitored by a level transmitter (LIT0901). A low-level switch (LSL0901) is installed to alarm if the level in the tank is low.

Two pumps (duty / standby) (PMP0901/2) dose coagulant to the dose-point.

One additional pump (duty only) (PMP0903) doses coagulant into the static mixer (MIX1511) upstream of the thickening unit for aiding in the separation of the water and solids in the thickening process.

The dosing equipment is located in a bunded area which has a level switch (LSH0901) to indicate when liquid is in the bund.

5.9.2 Dose-Rate

For both control modes, the dosing pump's dose-rate is flow-paced off the plant flow-rate (raw water duty: FIT0101; waste duty: FIT1501).

The required pump flow-rate (for both duties) is determined as follows:

$$pump\ flowrate\ \left(\frac{L}{h}\right) = \frac{dose\left(\frac{mg_{active}}{L}\right) \cdot flowrate\ \left(\frac{m^3}{h}\right)}{0.5(\frac{g_{active}}{g_{product}}) \cdot 1{,}340(\frac{kg}{m^3})}$$

The dosing pump speed is calculated as follows:

$$pump\ speed\ (\%) = \frac{pump\ flowrate\ \left(\frac{L}{h}\right)}{pump\ capacity\ \left(\frac{L}{h}\right)} \cdot 100$$

The pump speed is sent as a 4 to 20 mA signal where 4 mA is 0% and 20 mA is 100%.

5.9.3 Deliveries

Coagulant is delivered to site in 200 L drums. The chemical is transferred from the drum to the dosing tank by means of an air diaphragm pump (PMP0905). The air operating the pump will be shut off when the tank reaches its high-high level.

During refilling, when the tank level exceeds 99%, after 5 seconds the visual alarm (ALA0901) will be activated. When the tank level exceeds 100%, after 5 seconds the audible alarm (ALA0902) will be activated. The audible alarm will be deactivated after 15 seconds. The visual alarm will be deactivated only after the tank level has stopped increasing and an additional 5 seconds have passed. An override function is provided to silence the audible alarm.

5.9.4 Set-Points

Parameter	Units	Default	Adjustable Range
Raw water coagulant dose	mg_{active}/L	3	0-13
Waste coagulant dose	mg_{active}/L	5	0-30

5.9.5 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Tank level high-high	Critical	> 100%	Always on	5	Activate audible alarm[1]
Tank level high	Warning	> 99%	Always on	5	Activate visual alarm[2]
Tank level low	Warning	< 25%	Always on	60	SCADA message: Order ACH
Tank level transmitter	Warning	Fault or OOR[4]	Always on	5	
Tank low level switch activated	Warning	-	Always on	5	
Dose pump 1/2	Warning	Fault	Always on	5	Shut down pump; change duties
Dose pump 1/2 unavailable[3]	Critical	And standby pump unavailable	Always on	5	
Dose pump 3	Critical	Fault	Always on	5	Shut down pump
RW coagulant dose-rate deviation from set-point	Warning	> 20% of set-point	When running	30	
Waste coagulant dose-rate deviation from set-point	Warning	> 20% of set-point	When running	30	
Bund level high	Warning	-	Always on	5	

1. Audible alarm to continue for only 15 seconds.

2. Visual alarm to stop only after 5 seconds after tank level has stopped rising.

3. If both dose pumps unavailable, this alarm can be overridden.

4. OOR = out-of-range.

5.10 Sodium Hydroxide Dosing System

P&ID Sheets: HAT-PID-1-2, -2-1, -3-1, -5-1, -10-1, -10-2

5.10.1 Description

Sodium hydroxide is dosed into the raw water via a static mixer (MIX0101) upstream of the flocculation tank to achieve the target coagulation pH of 7.4. The coagulation pH is measured by an analyser (AIT0202).

The sodium hydroxide solution being used has a strength of 50%, i.e. 0.50 g NaOH per g product. The solution's density is approximately 1,500 kg/cm^3.

The dosing tank (TNK1001) has a live capacity of 250 L. The tank level is monitored by a level transmitter (LIT1001). A low-level switch (LSL1001) is installed to alarm if the level in the tank is low.

Two pumps (duty / standby) (PMP1001/2) dose sodium hydroxide into the carry-water line that transfers the sodium hydroxide to the raw water static mixer. A solenoid valve on the carry-water line will close when both sodium hydroxide dose pumps are offline. A rotameter (ROT1001) fitted with a high flow switch (FSH1001) indicates flow through the carry-water line.

Two additional pumps (duty / standby) (PMP1003/4) dose sodium hydroxide into the carry-water line that transfers the sodium hydroxide to the treated water static mixer (MIX0501). A solenoid valve on the carry-water line will close when both sodium hydroxide dose pumps are offline. A rotameter (ROT1002) fitted with a high flow switch (FSH1002) indicates flow through the carry-water line.

The dosing equipment is located in a bunded area which has a level switch (LSH1001) to indicate when liquid is in the bund.

5.10.2 Control Modes

For both the raw water dosing duty and treated water dosing duty, there are two operator-selectable control modes:

- Flow-based: The dose is entered manually and no pH set-point is targeted;
- Feedback trim: The dose is adjusted based on feedback from the pH analyser (coagulation pH: AIT0202; treated water pH: AIT0502) to achieve the pH set-point.

5.10.3 Dose-Rate

For both control modes, the dosing pump's dose-rate is flow-paced off the plant flow-rate (raw water duty: FIT0101; treated water duty: FIT0501).

The required pump flow-rate (for both duties) is determined as follows:

$$pump\ flowrate\ \left(\frac{L}{h}\right) = \frac{dose\left(\frac{mg_{active}}{L}\right) \cdot flowrate\ \left(\frac{m^3}{h}\right)}{0.5(\frac{g_{active}}{g_{product}}) \cdot 1{,}500(\frac{kg}{m^3})}$$

The dosing pump speed is calculated as follows:

$$pump\ speed\ (\%) = \frac{pump\ flowrate\ \left(\frac{L}{h}\right)}{pump\ capacity\ \left(\frac{L}{h}\right)} \cdot 100$$

The pump speed is sent as a 4 to 20 mA signal where 4 mA is 0% and 20 mA is 100%.

5.10.4 Temperature Control

The dosing tank is insulated and heated by a heating element (HTE1001) to prevent the sodium hydroxide from freezing during the colder months. The heating element is set to switch on when the temperature decreases to 15°C and switch off when it increases to 20°C.

All piping to the dosing pumps is insulated and heat-traced (HTE1002) to prevent it from freezing. Flushing water can be injected into the lines via hosing points to flush the pumps during maintenance.

Carry-water from the service water system is provided to transfer the sodium hydroxide to the dose-points. The carry-water removes the need for heat-tracing on the pipeline between the dosing pumps and dose-point.

The carry-water flow-rate to the raw water dosing duty is adjusted manually with a rotameter (ROT1001) and flow-switch (FSH1001) is used to indicate the flow-rate.

The carry-water flow-rate to the treated water dosing duty is adjusted manually with a rotameter (ROT1002) and flow-switch (FSH1002) is used to indicate the flow-rate.

For both duties, the carry-water must be flowing (as indicated by FSH1001/2) before the respective duty dose pump is permitted to start.

5.10.5 Deliveries

Sodium hydroxide is delivered to site in 200 L drums. The chemical is transferred from the drum to the dosing tank by means of an air diaphragm pump (PMP1006). The air operating the pump will be shut off when the tank reaches its high-high level.

During refilling, when the tank level exceeds 99%, after 5 seconds the visual alarm (ALA0901) will be activated. When the tank level exceeds 100%, after 5 seconds the audible alarm (ALA0902) will be activated. The audible alarm will be deactivated after 15 seconds. The visual alarm will be deactivated only after the tank level has stopped increasing and an additional 5 seconds have passed. An override function is provided to silence the audible alarm.

5.10.6 Set-Points

Parameter	Units	Default	Adjustable Range
Manual raw water NaOH dose set-point	mg_{active}/L	1.5	0-10
Manual treated water NaOH dose set-point	mg_{active}/L	2.5	0-10
Coagulation pH set-point	-	7.4	7.2-7.8
Treated water pH set-point	-	7.8	7.4-8

5.10.7 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Tank level high-high	Critical	> 100%	Always on	5	Activate audible alarm[1]
Tank level high	Warning	> 99%	Always on	5	Activate visual alarm[2]
Tank level low	Warning	< 25%	Always on	60	SCADA message: Order NaOH
Tank level transmitter	Warning	Fault or OOR[3]	Always on	5	
Tank low level switch activated	Warning	-	Always on	5	
RW dose pump 1/2	Warning	Fault	Always on	5	Shut down pump; change duties
RW dose pump 1/2 unavailable	Critical	And standby pump unavailable	Always on	5	
RW dose pump 1/2 running	Critical	And no carry-water flow	When running	5	Shut down pump; inhibit standby from starting
RW dose dose-rate deviation from set-point	Warning	> 20% of set-point	When running	30	
RW dosing carry-water no flow	Warning	-	When running	5	Inhibit dose pumps from starting
RW dosing carry-water flow-switch	Warning	Fault	Always on	5	
TW dose pump 1/2	Warning	Fault	Always on	5	Shut down pump; change duties

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
TW dose pump 1/2 unavailable	Critical	And standby pump unavailable	Always on	5	
TW dose pump 1/2 running	Critical	And no carry-water flow	When running	5	Shut down pump; inhibit standby from starting
TW dose dose-rate deviation from set-point	Warning	> 20% of set-point	When running	30	
TW dosing carry-water no flow	Warning	-	When running	5	Inhibit dose pumps from starting
TW dosing carry-water flow-switch	Warning	Fault	Always on	5	
Tank heating unit	Critical	Fault	Always on	5	
Line heat-tracing unit	Critical	Fault	Always on	5	
Bund level high	Warning	-	Always on	5	

1. Audible alarm to continue for only 15 seconds.

2. Visual alarm to stop only after 5 seconds after tank level has stopped rising.

3. OOR = out-of-range.

5.11 Chlorination System

P&ID Sheets: HAT-PID-5-1, -11-1

5.11.1 Description

Chlorine is dosed into the treated water for provide a FAC residual for bacteriological protection within the treated water network.

Chlorine is supplied by two online 70 kg cylinders (duty / standby) (CYL1101/2), each positioned on a load cell (WEL1101/2). When the duty cylinder is empty, the standby cylinder will open automatically, ensuring a continuous supply of chlorine. An alarm will be raised to alert the operator that one of the online cylinders is empty and requires replacement.

Two chlorinators (duty / standby) (FCV1101/2) meter the chlorine gas into the carry-water line via a dedicated eductor (EDR1101/2) per chlorinator.

Carry-water is supplied to the eductors from the service water system. Each eductor has a solenoid valve (SAV1101/2) on its carry-water supply line. The supply line also has a flow-switch (FSH1101/2) to indicate flow.

5.11.2 Control Modes

There are two operator-selectable control modes:

- Flow-based: The dose is entered manually and no FAC set-point is targeted;
- Feedback: The dose is adjusted based on feedback from the FAC analyser (AIT0501) to achieve the FAC set-point.

5.11.3 Dose-Rate

The treated water duty's dose-rate is flow-paced to the filtered water flow-rate (FIT0501).

5.11.4 Dose

The dose is determined by the base V-notch position, v_{base}. The base V-notch position is calculated from a curve described by the following table. These base V-notch position set-points should be calibrated during commissioning and are operator-adjustable.

Flow-Rate (m^3/h)	V-Notch Position, v_{base} (%)
0	0
2	6
4	10
6	15
8	21
10	30
12	48
14	100

The chlorine gas flow-rate, m_{Cl_2}, is calculated as follows:

$$m_{Cl_2}(\frac{g}{h}) = \frac{v_{base}}{100}(\%) \cdot m_{FCV}(\frac{g}{h})$$

Where m_{FCV} is the chlorinator capacity of 30 g/h (to be confirmed).

In flow-based control mode, the dose calculated from the conversion in the above table is the dose provided.

In feedback control mode, the dose is calculated from the conversion in the above table and trimmed by means of a PID control loop to achieve the target FAC set-point.

5.11.5 System Operation

When the filtered water flow-rate (FIT0501) increases above 2.5 m^3/h, the carry-water solenoid valve (SAV1101/2) will open and the respective flow-switch (FSH1101/2) will detect flow. If there is no flow, then the carry-water line duty will change to the standby eductor.

When there is flow, the chlorinator (FCV1101/2) will open and chlorine will be transferred into the carry-water line to the dose-point. When the filtered water flow-rate decreases below 2.5 m^3/h, the chlorinator will close. When confirmed closed, the respective solenoid valve will close and its flow-switch will confirm no flow. If flow is detected after the solenoid valve has been directed to close, an alarm will be raised.

5.11.6 Environmental Conditions

The temperature of the chlorine room should be maintained within a band of approximately 10-25°C to ensure sufficiently high draw-off rate (reduced at lower temperatures) and minimise pressure build-up (increased as temperature increases). An air-conditioning unit (ACU1101) is installed to maintain the temperature at approximately 18°C in winter and 22°C in summer. A temperature sensor (TIT1101) is used for control. An independent temperature sensor (TIT1102) is used for alarming.

A gas-leak detector (AIT1111) is used for detecting chlorine gas in the air and will raise the visible alarm (ALA1111) when the measured chlorine level exceeds the high threshold. When the high threshold is exceeded, the fan (FAN1111) will start and run for a maximum of 30 minutes.

When the high-high threshold is exceeded, the fan will stop, the audible alarm (ALA1112) will be activated and the fire service will be automatically alerted.

If the high threshold is exceeded but the high-high threshold is not exceeded, the fan will run for the maximum time, stop for 15 minutes, and then restart if the conditions for restart are met.

5.11.7 Set-Points

Parameter	Units	Default	Adjustable Range
Chlorine dose set-point	mg/L	1.2	0.8-2.5
Room temperature set-point	°C	20	10-25

5.11.8 Alarms

Parameter / Equipment	Alarm	Value	Active	Delay (s)	Action
Cylinder 1/2 nett weight low	Warning	< 10 kg	Always on	60	
Cylinder 1/2 nett weight low-low	Critical	< 2 kg	Always on	60	Close cylinder; open standby unit
Cylinder load cell 1/2	Critical	Fault or OOR[1]	Always on	5	Close cylinder; open standby unit
Chlorinator 1/2	Critical	Fault or OOR[1]	When running	5	Close chlorinator; open standby unit
Calculated dose	Critical	> 3 mg/L	When running	30	Close chlorinator; open standby unit
Solenoid valve 1/2 open	Critical	And flow-switch shows no flow	When running	5	Close valve; open standby unit
Solenoid valve 1/2	Critical	Fault	When running	5	Close valve; open standby unit
Flow-switch 1/2	Critical	Fault	When running	5	Close valve; open standby unit
Room temperature high	Warning	> 25°C	Always on	60	
Room temperature low	Warning	< 10°C	Always on	60	
Room temperature meter	Critical	Fault or OOR[1]	Always on	5	
Air conditioner	Warning	Fault	Always on	5	
Gas leak conc. high-high	Critical	> 0.8 ppm	Always on	5	Critical shutdown; alert fire service
Gas leak conc. high	Warning	> 0.2 ppm	Always on	5	
Gas leak detector	Critical	Fault or OOR[1]	Always on	5	Critical shutdown; alert fire service

1. OOR = out-of-range.

5.12 Citric Acid System

P&ID Sheet: HAT-PID-3-1, -12-1

5.12.1 Description

Citric acid is used for cleaning the membranes during maintenance washes and clean-in-place washes. An air-driven pump (PMP1201) is used for this purpose. The air supplied to the pump is controlled by the membrane PLC.

The dosing unit has a capacity of 20 L. The unit level is not monitored. The dosing unit is located in a bunded area.

5.12.2 Deliveries

Citric acid is delivered to site in 20 L units. When the dosing unit requires replacement, it will be swapped for a new 20 L unit.

5.13 Sulphuric Acid System

P&ID Sheet: HAT-PID-3-1, -13-1

5.13.1 Description

Sulphuric acid is used for cleaning the membranes during maintenance washes and clean-in-place washes. An air-driven pump (PMP1301) is used for this purpose. The air supplied to the pump is controlled by the membrane PLC.

The dosing unit has a capacity of 20 L. The unit level is not monitored. The dosing unit is located in a bunded area.

5.13.2 Deliveries

Sulphuric acid is delivered to site in 20 L units. When the dosing unit requires replacement, it will be swapped for a new 20 L unit.

5.14 Sodium Hypochlorite System

P&ID Sheet: HAT-PID-3-1, -14-1

5.14.1 Description

Sodium hypochlorite is used for cleaning the membranes during maintenance washes and clean-in-place washes. An air-driven pump (PMP1401) is used for this purpose. The air supplied to the pump is controlled by the membrane PLC.

The sodium hypochlorite solution strength is nominally 12.5% and its density is approximately 1.20 g/cm^3.

The dosing unit has a capacity of 20 L. The unit level is not monitored. The dosing unit is located in a bunded area.

5.14.2 Deliveries

Sodium hypochlorite is delivered to site in 20 L units. When the dosing unit requires replacement, it will be swapped for a new 20 L unit.

5.14.3 Environmental Conditions

To minimise the rate of degradation, temperature control shall be in place to maintain the ambient temperature of the sodium hypochlorite dosing system (tank and pumps) below 25°C at all times. If this is performed by means of a fan or air conditioner, it shall be controlled to achieve this ambient temperature.

6 Start-Up and Shutdown

6.1 Start-Up

6.1.1 Requirements

The following are required in order for the plant to start:

- No key instrumentation faults present;
- Coagulant system available (at least one dosing pump available);
- Sodium hydroxide system (for coagulation pH control) available (at least one dosing pump available);
- Chlorination system available (at least one chlorinator available);
- At least one treated water pump (PMP0601/2/3) available;
- Hatepe treated water tanks' level < 85%;
- At least one membrane skid available, including all auxiliary systems (membrane PLC to provide confirmation that membrane stage available);
- Corresponding membrane feed pump(s) (PMP0311/21) available;
- Waste balance tank level < 80%;
- At least one screen (SCN0101/2) available;
- Flocculation tank level (LIT0201) > 50%.

If the flocculation tank level is less than 50%, the plant can receive flow from the raw water system, but the membrane filtration stage's feed pumps will not be permitted to start.

The treated water pumps operate in accordance with the treated water wet well's level (LIT0501). The pumps start and stop as defined by the levels in Section 5.5.1.

6.1.2 Sequence

Plant start-up will usually be manually initiated but can be automatically initiated in the case where the plant has shut down as a result of a high treated water wet well level or high Hatepe treated water tanks' level.

The plant will not be permitted to start automatically if it was shut down due to a fault, critical alarm or manually shut down. If any step fails or any subsystem on which a step depends faults, an alarm will be raised.

The start-up sequence is as follows.

- If the flocculation tank level (LIT0201) > 50%, start the relevant membrane feed pump(s) (PMP0311/21);
- Send command to raw water pump station to provide flow;
- If the flocculation tank level (LIT0201) < 50%, send command to raw water pump station to provide flow and when the flocculation tank level is > 50% then start the duty membrane feed pump(s) (PMP0311/21);
- When the filtered water flow-rate (FIT0501) > 2.5 m^3/h, start the treated water sodium hydroxide and chlorine dosing;
- When the raw water flow-rate (FIT0101) > 2.5 m^3/h, start the raw water sodium hydroxide and coagulant dosing.

6.2 Shutdown

6.2.1 Description

A plant shutdown is where:

- All process pumps are stopped (treated water pumps PMP0601/2/3 stop in accordance with their interlocks; waste system operates independently);
- All auto valves are closed (not reticulation valve);
- All chemical dosing systems are stopped;
- All interlocks remain active.

6.2.2 Sequence

The shutdown sequence is as follows:

- Shut down membrane skids and their feed pumps (PMP0311/21);
- When the flocculation tank level (LIT0201) > 95%, send command to raw water pump station to stop providing flow;
- When the filtered water flow-rate (FIT0501) < 2.5 m^3/h, stop the treated water sodium hydroxide and chlorine dosing;
- When the raw water flow-rate (FIT0101) < 2.5 m^3/h, stop the raw water sodium hydroxide and coagulant dosing.

7 Critical Control Points

Critical control points (CCPs) in accordance with the DWSNZ and target operating parameters shall be programmed into the SCADA. When a parameter is outside of its target range, it is either in the action limits range or critical limits range. The action limits range is the range during which the plant and / or operator shall take steps to correct the issue. The critical limits range is the range during which corrective actions shall be taken and the plant or system is to be shut down. The CCPs shall include, but not be limited to, the following:

Parameter	Units	Action Limits		Critical Limits	
		Values	Activation Time (min)	Values	Activation Time (min)
Coagulation pH	-	> 7.9	3	> 8	2
		< 7.1	3	< 7	2
Membrane filtrate turbidity	NTU	> 0.09	3	> 0.1	10
		-	-	> feed turbidity	1
Treated water FAC	mg/L	> 2	1	> 2.5	0.5
		< 0.8	1	< 0.5	0.5
Treated water pH	-	> 8	3	> 8.2	2
		< 7	3	< 6.8	2
C.t value	min·mg/L	< 18	2	< 15	5
Final water FAC	mg/L	> 2	1	> 2.5	0.5
		< 0.8	1	< 0.5	0.5
Final water pH	-	> 8	3	> 8.2	2
		< 7.2	3	< 7	2
Final water turbidity	NTU	> 0.5	3	> 1	2

6.2 Schedule 22 – Contractor's Guaranteed Performance Parameters for Hatepe WTP

Contract for	**Taupō District Membrane Water Treatment Plants Contract TDC/2021/353**	
Separable Portion	**Hatepe WTP TDC/2021/353-SP4**	
THIS AGREEMENT is made on	*Click to enter a date*	*(insert date)*
BETWEEN	Taupo District Council	*('the Principal')*
AND	*Click to enter text*	*('the Contractor')*

The following performance parameters for the Hatepe WTP must be met by the Contractor. The Contractor shall guarantee the performance of the Hatepe WTP according to the requirements stipulated below.

Item	Units	Requirements	Notes	Guarantee
Treated water quality shall comply with the requirements detailed in Table 4.4[4]	-	Must comply		
Net treated water production capacity [24 h treated water production (to supply)] When raw water quality meeting **typical** conditions (Table 4.2)[1]	m^3/d	300	Must be able to meet requirements with a membrane train either offline or available in standby (N+1)	
Net treated water production capacity [24 h treated water production (to supply)] When raw water quality meeting **adverse** conditions[2]	m^3/d	300	Standby train can be used in assist capacity to meet requirements during adverse raw water quality conditions	
Minimum net treated water production capacity	m^3/d	60	Continuous, stable operation at minimum output	
Daily waste produced (maximum day)	m^3/d	3 (**typical**)[1] 5 (**adverse**)[2]	From all process sources (i.e. backwash and neutralised CIP wastes), excluding	

Item	Units	Requirements	Notes	Guarantee
			staff amenity waste.	
Daily waste produced (averaged over a 4-week period) when raw water quality meeting **typical** conditions[1]	m^3/d	1.5	From all process sources (i.e. backwash and neutralised CIP wastes), excluding staff amenity waste.	
Protozoal treatment	Log removal	The membrane filtration system shall meet the requirements of DWSNZ Section 5.11 and achieve 4 protozoa log credits		
Bacteriological treatment	-	Meet requirements of DWSNZ Section 4.2.2		
Taste and odour treatment (Geosmin, 2-Methylisoborneol, 2,4,6-Trichloroanisole)	-	PAC system to be able to maintain a dose of 30 mg/L for 30 consecutive days at peak treated water flow		
Algal toxin treatment (Anatoxin, Cylindrospermopsin, Microcystin, Nodularin, Saxitoxin)	-	PAC system to be able to maintain a dose of 30 mg/L for 30 consecutive days at peak treated water flow		
Chlorine contact tank baffle factor	-	To be a minimum of 0.5		
Final water pH	-	Set-point ±0.2 (within range: 7-8)	Operator adjustable	
Final water free available chlorine residual	mg/L	Set-point ±0.2 (within range: 0.7-1.5)	Operator adjustable	
Net treated water pumping capacity	m^3/h	12.5		

Item	Units	Requirements	Notes	Guarantee
Treated water pumping operating pressure at capacity	m	65 (Contractor to confirm)		
Minimum unmanned operation	hours	72	Assuming all consumables are fully replenished at start of unmanned period	
Noise limits at Site boundary	dBA L_{eq} (15 min)	Day time (7 am to 10 pm): 55 Night-time (10 pm to 7 am): 40		
Maximum power consumption of all equipment supplied under this Separable Portion when production is at 12.5 m^3/h	kWh/m^3 treated water			
Membrane Replacement / Repair				
Minimum membrane replacement interval	years			
Current cost for membrane replacement	$ per module (excl. GST)			
Membrane repair frequency	module fibres/year			
Maximum number of fibre repairs per module (when exceeded, the module will be at the end of its life and will be replaced)	fibres/ module			
Membrane repair labour[3]	h/year			
Membrane CIP Requirements[5]				
CIP (type 1) period	days			
CIP (type 1) chemical consumption	chemical consumption	Detail all – mass or volume and concentration		
CIP (type 2) period	days			

Item	Units	Requirements	Notes	Guarantee
CIP (type 2) chemical consumption	chemical consumption	Detail all – mass or volume and concentration		
Backwash Water Recovery System				
Maximum recycle stream turbidity	NTU	10		
Maximum recycle stream flowrate (instantaneous)	% of raw water	10		
	m^3/h	1.25		

1. Typical conditions shall include sustained maximum parameters as detailed in Table 4.2 for a period of 168 hours. Attach Table 4.2 to guarantee and signatories to initial those pages.

2. Adverse raw water quality conditions are defined as:

- PAC dosing active OR;
- Total algae concentration > 3,000 cells/mL OR;
- Turbidity > 10 NTU OR;
- Coagulant dose > 5 mg_{active}/L.

Adverse conditions may be sustained for periods of 1 month.

3. Trained, competent repairer (includes module removal, fibre repair, testing, installation and return to service).

4. Attach Table 4.4 to guarantee and signatories to initial those pages.

5. Type 1 and type 2 CIP's are to differentiate between frequent (type 1) and infrequent (type 2) membrane chemical washes (for example, EFM vs full CIP).

In witness of which this agreement has been executed.

SIGNED on behalf of the Contractor by:

Click to enter text or paste signature

Director

Click to enter text or paste signature

Position:

SIGNED on behalf of the Principal by:

Click to enter text or paste signature

Position:

Click to enter text or paste signature

Position:

6.3 WSP Geotechnical Investigation Report

(To follow).

Sec 9(2)(a)

6 August 2023

Sec 9(2)(a)
Infrastructure Project Manager
Taupo District Council

Dear Elijah

Hatepe Water Treatment Plant Proposal

I write this letter in my capacity as chairperson of the Hatepe Resident's Association (HRA). Thank you for joining us at the Hatepe Marae on 27 June to deliver your presentation of the new proposed Hatepe water treatment plant. We have circulated your Hinemaia Scenic Reserve Drinking Water Treatment Plant Ecological Assessment Report to all our residents along with your presentation notes.

The Hatepe settlement is a very unique and special place. We are very appreciative of the Council's proposal and fully support it.

Sec 9(2)(a)

Chairperson - HRA

Cc; Sec 9(2)(a)