Prepared for To Tātou Vai

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Acronyms

AVG	Automatic valveless gravity filter
NES	National Environmental Services
OEMP	Operational environmental management plan
PACl	Poly Aluminium Chloride
SOP	Standard operating procedure
SS	Suspended solids
ST	Settling Tank
TTV	To Tatou Vai
WTP	Water Treatment Plant

Units

µg/L	milligrams per liter
Kg	Kilograms
E. Coli	*Escherichia coli (E. coli)* bacteria normally live in the intestines of people and animals. Most *E. coli* are harmless and actually are an important part of a healthy human intestinal tract. However, some *E. coli* are pathogenic, meaning they can cause illness, either diarrhea or illness outside of the intestinal tract. The types of *E. coli* that can cause diarrhea can be transmitted through contaminated water or food, or through contact with animals or persons. (https://www.cdc.gov/ecoli/general/index.html)

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Explanation

This supplementary plan is informed by the operational environment management plan main report. It provides for the management of environmental hazards and risks outside of the potential hazards and risks caused by the PACl. The plan covers the following:

1. Location of the Taipara Water Treatment Plant;
2. Areas where there are likely significant potential adverse environmental impacts;
3. How the Water Treatment Plant works;
4. Management of potential environmental hazards and risks; and
5. Summary of Recommendations and Monitoring Programme

1. Where is the Taipara Water Treatment Plant?

Figure 1 - Location of Rarotonga's Water Treatment Plants with Taipara in red

2. Taipara Water Treatment Plan – Areas where there are likely significant potential adverse environmental impacts.

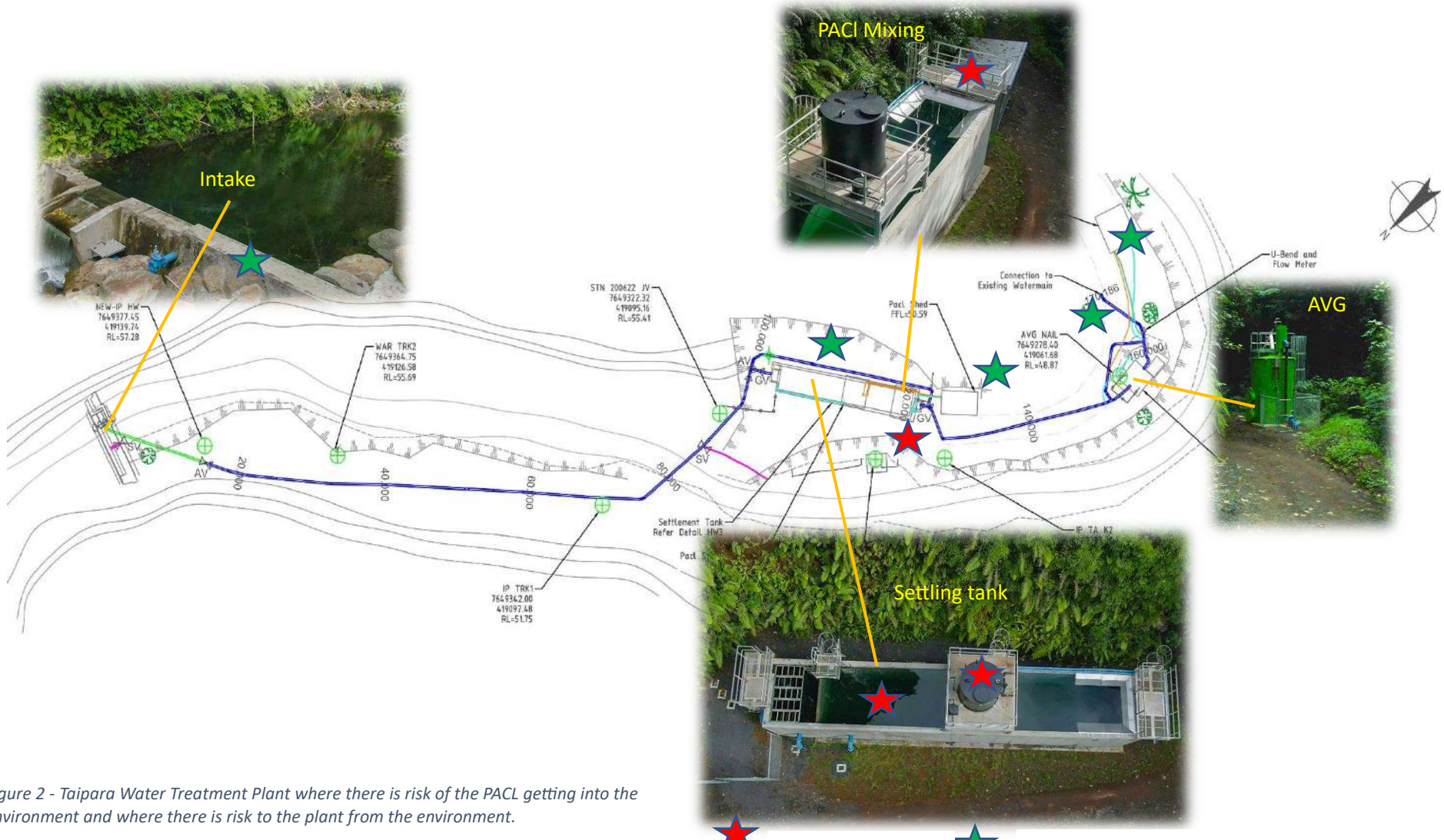


Figure 2 - Taipara Water Treatment Plant where there is risk of the PACL getting into the environment and where there is risk to the plant from the environment.

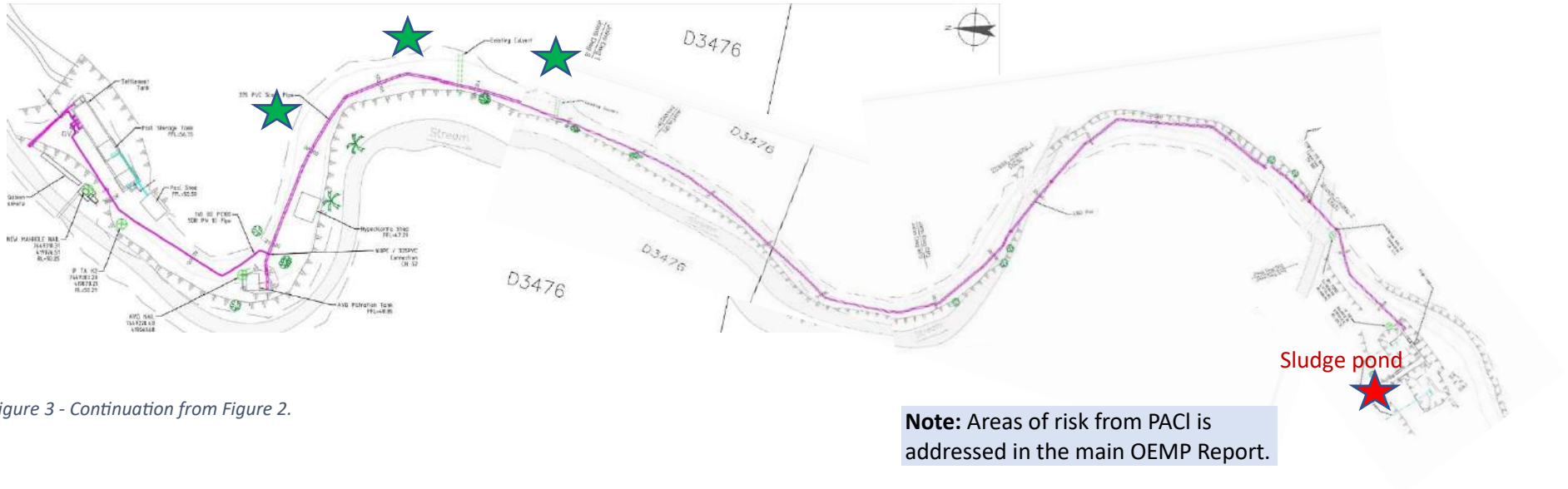
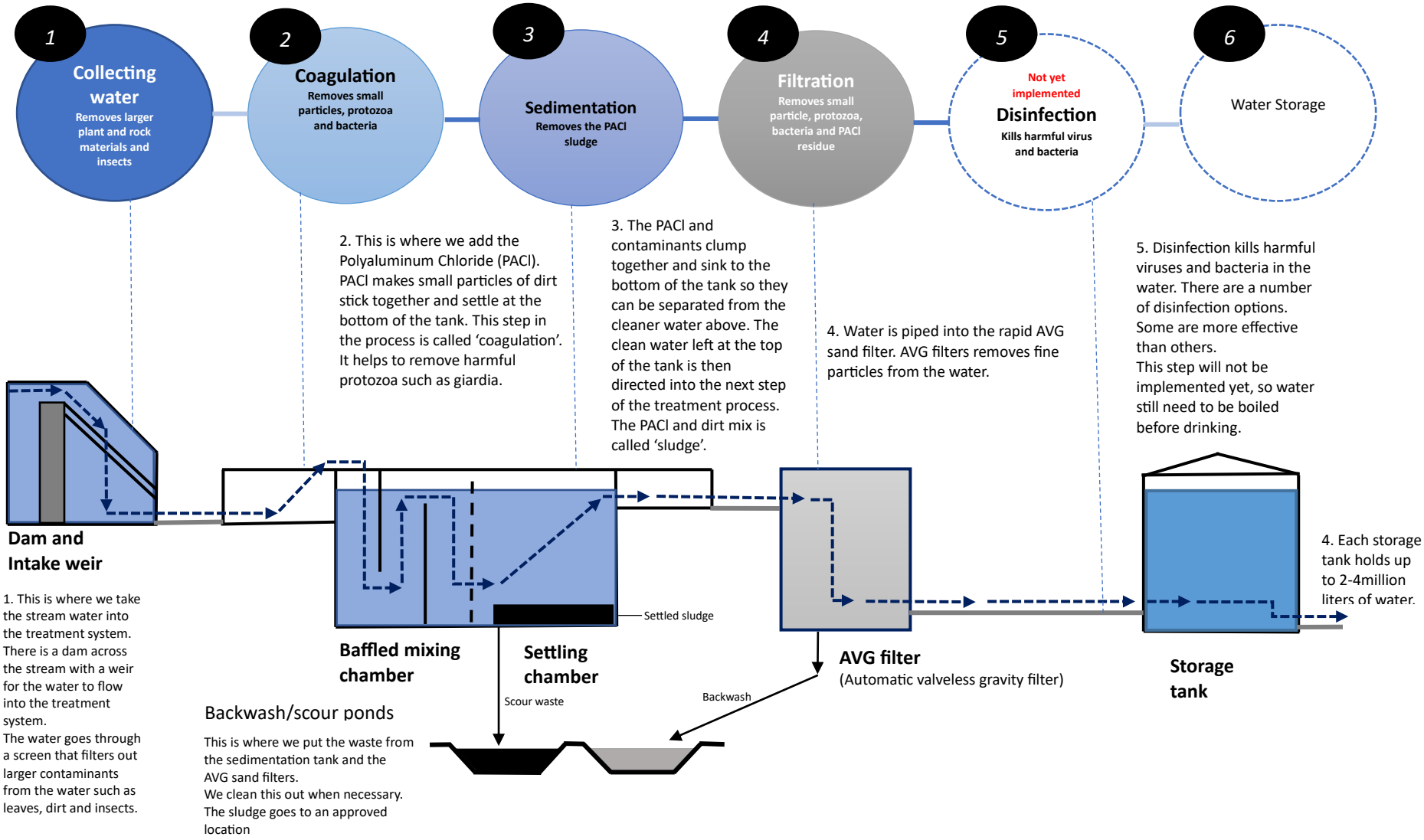


Figure 3 - Continuation from Figure 2.

Note: Areas of risk from PACl is addressed in the main OEMP Report.

3. How the WTP work?

Figure 4 - How the Taipara Water Treatment Plant work (Source: TTV sign boards at each WTP)



4. Management of Environmental Hazards and Risks

All hazards and risks are identified and using the risk assessment methodology attached in the Appendices Section as 6.1. The meaning of the color code: Red = Very High Risk, Brown = High Risk, Yellow = Medium Risk, Blue = Low Risk and Green = Very Low Risk.

Hazards and Risks	Potential Impacts	Mitigation Strategy	Monitoring Parameter	Monitoring Programme	Responsibility	Staff and equipment Requirement	Oversight
North side of ST wall, scouring of stream bank. IC = Moderate P = Low	- North side walls of ST threatened, and may crack from instability.	**Short term** + Keep an eye on signs of advance scouring. **Long term** + Prevent advance scouring to protect ST north wall from potential damage, e.g., Gabion baskets or temporary rock revetments. +See engineering division for advice + Keep an eye on potential advance.	- Signs of advance scouring	+ At the moment no checking, but keep an eye out for signs of advance scouring. + Keep side of stream clear for easy visual observation. + Daily checking[1], and especially after major flooding event.	+ Supervisor	+ Operator (s) x2 and vehicle assigned, uses daily check list[2].	+ Manager + Supervisor
Removal of accumulate debris behind intake. IC = Moderate P = Medium	- Erosion in the catchment area. - May increase slips in the catchment area. - Increase sediment entering WTP.	**Short term** + Develop SOP for controlled release of materials downstream. + Controlled release of material downstream. **Long term** + Request for NES approval for controlled release of material downstream. + Investigate and construct silt trap options further inland of the intake and weir to minimize erosion. + No material is removed from site, except for use for roading.	- SOP - Debris deposits and volume of deposits. - When debris level is critical and after major rainfall. - Volume of material released.	+ Daily check + After major rainfall. + Number of truckloads leaving the site for roading (debris leaving the site will require landowner approval).	Supervisor	Removal by contractor, T&M Heather. Supervisor to be present.	Manager and Supervisor
Falling trees. IC = Major P = Medium	- Encroachment onto plant increases risk of falling trees onto the Plant.	Short term + Trim trees + Keep trees low	- Threatening Vegetation.	+ Daily check + Dedicated monthly check for vegetation overgrowth or	+ Supervisor (s)	+ Contractor option is preferred.	+ Manager + Supervisor

[1] Daily Inspection by two (2) operators, two for the southside and 2 for the northside. There is a swap every week and operator rotation work apply.
[2] Checklist reporting attached as evidence.

Hazards and Risks	Potential Impacts	Mitigation Strategy	Monitoring Parameter	Monitoring Programme	Responsibility	Staff and equipment Requirement	Oversight
	- Increase risk of leaves falling into the ST	+ Remove fallen leaves and branches from the ST Long term + Remove trees that are likely to cause risks to the plant whether it be fallen leaves, broken branches or falling trees.	- Invasive species such as pīpī-vai, rau-māniota, albecia, tree hibiscus and creepers like kākā.	vegetation threatening the plant or parts of the plant.			
Land slips are predominant on this site. IC = Major P = Medium	- Access along the access road is impaired. - Risk to health and safety of operators especially during times of heavy rain and the wet season.	**Long term** + Maintain RV radio communication on vehicles making sure they are operational at all times. + Maintain a good relationship with contractor, i.e., Call and pay later to dig and move debris and trees from the road, and pay on time.	- slips - Heavy rainfall.	+ Visual Inspection Especially during the wet season and times with high rainfall and windy conditions.	+ No supervision needed, at this time + Supervisor will be dealing with other priorities to keep the WTP on line.	+ Clearing of access way by contractor, T&M Heather. + Supervisor to be present.	+ Manager + Supervisor

5. Summary of Recommendations and Monitoring Programme

The following are recommended actions to improve the operation and effective management of this WTP.

Hazards and Risks	Recommendations	Monitoring Programme
Removal of debris from behind weir.	+ Develop SOP for controlled release of materials downstream. + Request for NES approval for controlled release of material downstream. + Investigate and construct silt trap options further inland of the intake and weir to minimize erosion.	+ Revised SOP + Measure volume of deposits. + Remove debris when debris level is critical and after heavy rain in Taipara. + Measure volume of material released. + Daily check
Falling trees.	+ Trim trees + Keep trees low + Remove fallen leaves and branches from the ST + Remove trees that are likely to cause risks to the plant whether it be fallen leaves, broken branches or falling trees	+ Daily check + Dedicated monthly check for vegetation overgrowth or vegetation threatening the plant or parts of the plant.
Land slips are predominant on this site.	+ Maintain RV radio communication on vehicles making sure they are operational at all times. + Maintain a good relationship with contractor, i.e., Call and pay later to dig and move debris and trees from the road, and pay on time.	+ Visual Inspection Especially during the wet season and times with high rainfall and windy conditions.

6. Appendices

6.1 Risk Assessment Methodology Used

The assessment of risks involved for each hazard is provided below in Tables 1 and 2.

Table 1 Level of risk impact and probability

Risk Criteria	Definition of Rating	Score
Impact (I)	**A:** Extent – The area over which the impact will be experienced	Local = 1; Island = 2; and National = 3
	B: Intensity – The magnitude of the impact, i.e., whether the impact will result in minor, moderate, major or catastrophic environmental, social and economic (including human health) changes	Low = 1; Medium = 2; and High = 3
	C: Duration – The time frame over which the impact will be experienced and its reversibility.	Short Term – 1; Mid Term – 2; and Long Term – 3
Impact Consequences (Combined Score): Minor 3 – 4; Moderate 5 – 6; Major 7 – 8; Massive 9 – 10.		
Probability (P) – Likelihood of the impact occurring	Improbable - Unlikely to occur during project lifetime	1
	Possible - May occur during project lifetime 20%-60% chance of occurring	2
	Probable - Likely to occur during the project lifetime >60-90% chance of occurring	3
	Highly probable - Highly likely to occur, or likely to occur more than once during project lifetime	4

Table 2 Matrix showing overall significance of the impact as a combination of the consequences and probability rating

		Probability of Occurrence			
		Improbable	Possible	Probable	Highly Probable
Consequences of Impact	Minor	Very Low	Very Low	Low	Low
	Moderate	Low	Low	Medium	Medium
	Major	Medium	Medium	High	High
	Catastrophic	High	High	Very High	Very High

6.2 To Tatou Vai (TTV) Water Treatment Plant (WTP) Operator's Daily Check List (Source: TTV Treatment Division)

Date WTP	Sludge Level (%)	Bulk Tank (%)	Dose Rate (mg/L or g/m^3)	Intake (NTU)	ST (NTU)	Post AVG (NTU)	Reservoir (NTU)	Flow Rate (L/Sec)	Reservoir (KPA)	Comments

Note: PACl storage tank (how full it is in %), PACl header tank (Float valve and arm), the sludge level in the settling tank (from bottom of tank to mid-way level in %), adjusting the dosing level of PACl (in mg/L), Intake (NTU), Sediment tank (Float valve arm at the NTU), Post AVG (NTU), RES (NTU)
Flow rate (L/sec)