24 November 2025

Re: RO Water Treatment Plant paper

1. Overview of the RO plant function

The RO plant or the Water Treatment Plant (WTP) is located south of the mine and is identified by a yellow block in **Figure 1**.

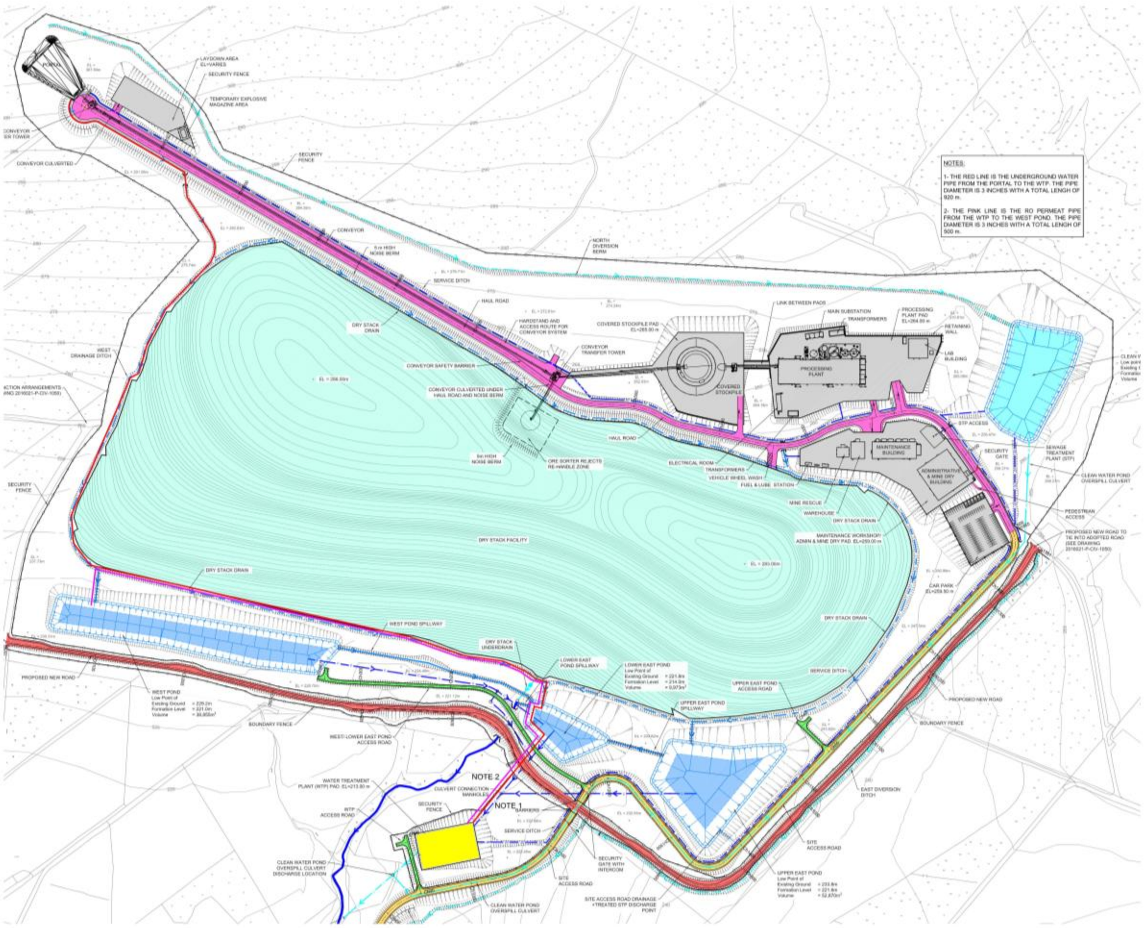

Figure 1 - Dalradian site layout plant

1.1. General Water Balanced

From the document Site Water Balance – ES Appendix C4[1], the water balance schematic outlines multiple water supplies and reception areas across the mine site. Water is collected and

[1] Kaya Consulting Limited. (2020, October). *Curraghinalt Gold Mine Project: Site water balance – 2020 update* (Prepared for Dalradian Gold Limited).

directed into various ponds. Water from the West and East Water Ponds is routed to the WTP for treatment prior to discharge.

Figure 2 illustrates the overall water management system for the site, showing that:

- West and East Water Ponds collect both contact water (such as underground mine water, Dry Stack Facility (DSF) water and sewage) and non-contact water (natural runoff water that flows in the pond).
- DSF water originates from the paste plant and rainfall that flows through the Active and Reclaimed DSF.
- The Clean Water Pond is a basin that collects only runoff water from areas without industrial or mining activities.
- Water from the West and East Water Ponds is treated at the WTP before discharge to the receiving environment, while water from the Clean Water Pond water is discharged directly to the receiving environment without treatment.

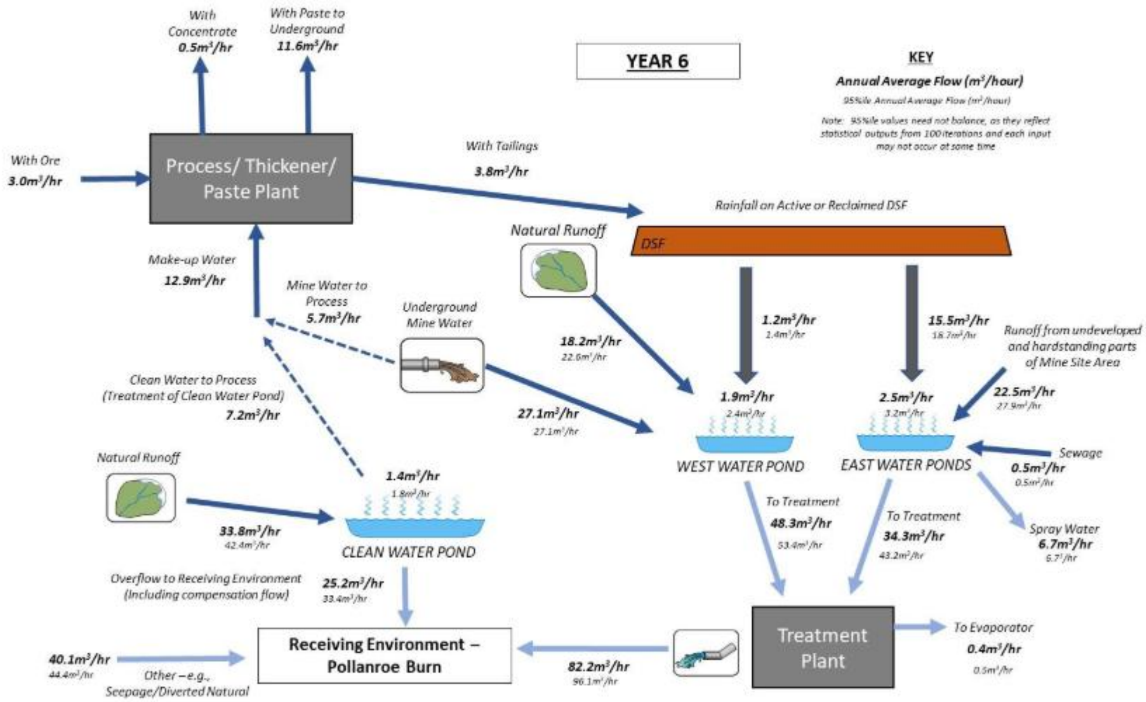

Figure 2 - Water Balance Schematic with Annual Average Flow Rates - Year 6

The combination of contact water from operational areas and DSF, along with non-contact runoff, determines the volume and quality of water entering the WTP and influences pollutant concentrations at the inlet. **Figure 3** represents a simplified schematic of the water balance and focuses on the main streams influencing the water treatment process. According to **Figure 3**, there are two streams entering the WTP: West Pond and East Pond. Both contain contaminants, but the West Pond has a higher concentration in nitrogen species since it collects the largest volume of underground mine water. Underground mine water is contaminated with nitrogen species (ammonia NH_3, nitrate NO_3^-, nitrite NO_2^-) originating from undetonated explosives used in mining. The concentration of these contaminants is influenced by the mass of explosives used, the amount of contact water available, and the percentage of undetonated explosives.

According to the water balance, contaminants are diluted by a ratio of 3 between the underground water and the concentration at the WTP inlet.

Ammonia and nitrate were identified as the critical parameters for meeting discharge limits due to their high inlet concentrations, resulting from the use of unblasted explosives. The main sources of contaminants are underground water for the West Pond and the DSF for the East Ponds.

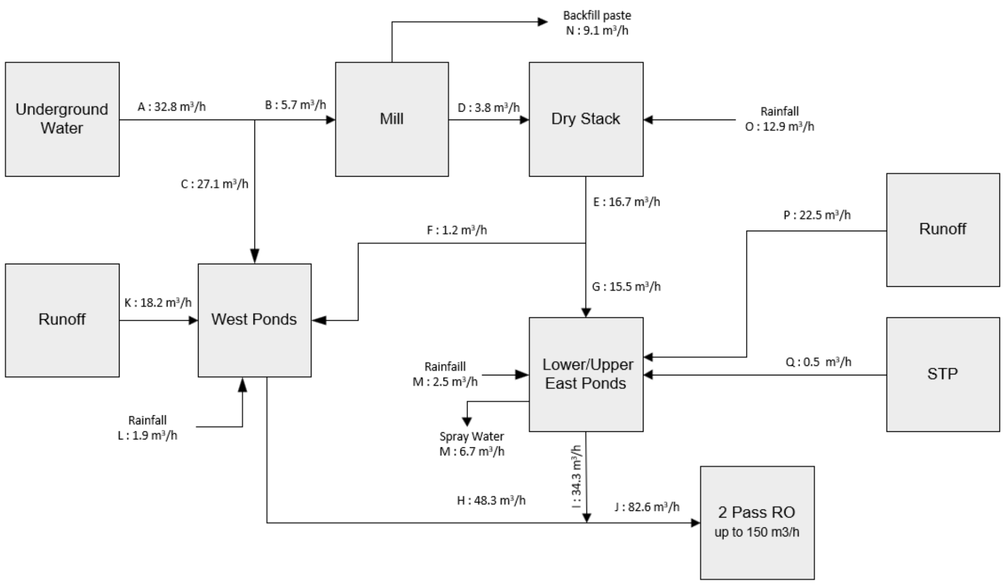

Figure 3 - General water Balance Dalradian Gold Limited - Year 6

Water across the site is managed through a system of ponds and treatment processes designed to segregate clean runoff from contact water:

<u>Clean Water Pond</u>

This pond collects only non-contact runoff water from areas without industrial or mining activities. It acts as a buffer to control flow and discharge rates. Water from this pond is discharged directly to the environment after monitoring.

<u>West and East Water Ponds</u>

All contact water will be within West and East Water Ponds and will be treated through the WTP. No bypass of the WTP is planned or included in the design. The end-of-pipe consent discharge limit will be monitored at the effluent of the WTP prior to mixing with the Clean Water Pond. Refer to **Figure 2** for the stream around the WTP.

There was no build-up of contaminants observed in the water model[2]. The majority of the total solids and dissolved solids present at the inlet will be removed by the treatment process and precipitated at the crystallizer for collection and disposal off-site. Total Suspended Solids (TSS) from the backwash water of the ultrafiltration (UF) system will settle in the West Pond.

As to Figure 2 and Figure 3 which show the schematic representation of water flows and treatment processes, there is no other recirculation of contaminants or waste streams within the site-wide water management system.

1.2. Water treatment plant process

The process consists of several advanced steps designed to meet discharge limits:

1. Ultrafiltration (UF) Pretreatment

The first stage uses hollow-fiber UF membranes with a nominal pore size of 0.04 microns. This removes suspended solids, bacteria, algae, and any particles larger than 0.04 microns. UF protects the downstream RO membranes by preventing fouling and scaling. The UF and RO systems are composed of two trains providing up to 150 m^3/h each for a combined treatment capacity of 300 m^3/h, ensuring 100% redundancy during storm events.

2. Reverse Osmosis (RO) – Double Pass System

After UF, water enters the first-pass RO system, which uses membranes with nominal pore sizes of 0.0005 microns. These membranes reject more than 99.5% of salts and metal ions, producing a clean permeate stream and a concentrate stream. The permeate is then treated again in a second-pass RO system to achieve extremely low concentrations of contaminants, including ammonia and nitrate, meeting strict discharge criteria.

This two-pass configuration ensures high-quality effluent suitable for direct discharge. To ensure water quality at all times, online probes continuously monitor permeate conductivity, pH, and TSS in real time, ensuring the RO membranes and related components are functioning properly. If water quality deviates from specifications, permeate is recirculated until corrective actions are taken. Manual sampling and accredited laboratory testing provide additional compliance verification.

3. Brine Treatment

The brine (concentrate) from the RO systems is processed through a High-Density Sludge (HDS) clarifier to precipitate calcium sulfate ($CaSO_4$, gypsum). The supernatant undergoes further UF and high-pressure RO treatment, followed by evaporation and crystallization. This produces solid salts for offsite disposal and distillate water for reuse, minimizing waste and achieving zero liquid waste.

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[2] Kaya Consulting Limited. (2020, October). *Curraghinalt Gold Mine Project: Site water balance – 2020 update* (Prepared for Dalradian Gold Limited).

The chemical products used are sodium hypochlorite (i.e. bleach), citric acid, antiscalant, caustic, sodium bisulphite. They are all products also used in the Municipal wastewater and drinking treatment plants.

WTP uses RO system to treat the water because the discharge limits for this project are extremely low, particularly for nitrogen species (NH_3, NO_3^-, NO_2^-). RO membrane technology is an absolute filter, achieving >99.5% removal efficiency for multivalent metals and salts. Conventional biological or chemical treatments alone cannot meet these limits. For this project, two RO systems in series, i.e. two-pass RO, are planned for the WTP.

RO technology has been used since the 70s to produce potable water, reused water, and ultrapure water used in pharmaceuticals and food and beverage applications. Reverse Osmosis is a Best Available Technique (BAT) described for mine water treatment (covering Operations and Closure) in the EU BAT Reference Document. It is an established methodology that has been applied at selected mine sites globally. The system has been designed by Membrane Development Specialists (MDS), which has delivered a portfolio of at least 17 operating RO sites globally at mine sites. See the list below from Appendix C4 Annex D of the 2020 Surface Water Impact Assessment.

Reference List of Membrane Installations and Experiences of MDS:

- Phelps-Dodge (Freeport-McMoran) El Paso Texas, 40 m^3/h, on line since 1992 MDS Acid Purification with NF and Concentration with RO Zero Liquid Discharge
- Sun Metals Zinc Refinery - 250 m^3/h NF and RO process Townsville, Australia 1999, post physical chemical high pH MDS Zero Liquid Discharge
- Korea Zinc Refinery - 200 m^3/h NF followed by RO Pusong, Korea 2001, post physical chemical MDS
- Newmont Waihi Gold - 250 m^3/h with MDS with Harrison Western Process Technologies (HWPT), 2008, post physical chemical high pH
- Asarco Refinery, Denver, Colorado - 20 m^3/h, MDS Membranes and HWPT 1995, post physical chemical
- Yanacocha Gold Mine Barren Leach - 3500 m^3/h, MDS with HWPT first system installed in 2003
- Phelps-Dodge (Freeport-McMoran) Tucson, Arizona - 150 m^3/h, ARD (acid-rock-drainage) 2003 MDS
- Cananea de Mexicana - 2000 m^3/h, ARD MDS Membranes - HWPT 1997
- Kennecott Copper (Rio Tinto) - 500 m^3/h, ARD MDS Membranes- HWPT 1998
- Zijin Copper 250 m^3/h ARD (acid rock drainage) Xiamen China 2009 MDS
- Seawater Plant Chennai, India Consultant - 6250 m^3/h Hollow Fiber Pretreatment to SWRO 2013
- Cobre Las Crucas Sevilla, Spain - 600 m^3/h, ARD MDS with Spanish partner MP from Sevilla, Spain Zero Liquid Discharge 2011
- Barrick Gold Mine Barren Gold Mine Barren-Lagunas Norte and Pierina, Peru - 910 m^3/h, barren leach post physical chemical treatment installation 2015
- Design and Element supply for a 400 m^3/h wastewater system in Ghana Africa 2016
- Peak Energy Produced Water 500 barrels/day 2015 to Present
- SRG 2200 MW ZLD Power Station Gila Bend, AZ Cooling Tower Blow-down 150 m3/h 2018 to Present
- Rincon Lithium Argentina 10,000 m3/d 2019

Benefits of the RO System:

- High Removal Efficiency: >99.5% rejection of salts, metals, and nitrogen species.
- Compliance Assurance: absolute filter performing as a physical barrier, continuous online monitoring and redundancy ensuring discharge standards are always met.

- Zero Liquid Discharge: Advanced brine treatment minimizes environmental impact by converting waste into solid salts.
- Proven Technology: RO is established globally for mining, industrial, and municipal applications.

In case of power loss, the WTP can be stopped without damage until the power is back. Then the WTP can be restarted. A 1.2 MW emergency generator will be located on-site to supply power for essential mine area loads during potential power outages, primarily to sustain the agitating process, pumping and ventilation in critical areas as well as the WTP. If the power loss lasts several days and then emergency generator onsite has a problem, a standalone generator can be brought to site to power the critical equipment of the WTP. In the worst scenario where the WTP cannot be powered up, there are more than 14 days of storage capacity in the West and East ponds. Pumping Underground water to West Pond can be stopped. The process plant that produces water can also be stopped. Only runoff water will be feeding the West and East ponds and therefore more days of storage will be available.

1.3. Maintenance

WTP is designed with multiple layers of redundancy and preventive measures to minimize the risk of failure and ensure continuous compliance with discharge limits.

Redundancy and Capacity

- The WTP consists of two independent treatment trains, each capable of treating 150 m³/h, providing 100% redundancy. Combined capacity is 300 m³/h, well above the average site flow of 85 m³/h, ensuring resilience during peak flows or storm events.
- Duplex chemical dosing systems are installed for 100% redundancy.

Critical Spares and Rapid Response

- A full set of UF and RO membranes is kept onsite for quick change-out (typically 3–4 hours per train to a day depending on the crew experience and how many stages per Pass are to be changed).
- Critical equipment and instruments such as high-pressure pumps and monitoring probes (pH, conductivity, TSS) will be kept onsite as spare parts.

Preventive and Predictive Maintenance

- A detailed maintenance program will be developed during the final design phase to identify all critical parts and their lead times.
- Preventive maintenance schedules and predictive monitoring will be implemented to reduce unplanned downtime, minimise Mean Time to Repair (MTTR) and increase Mean Time Between Maintenance (MTBM).

- Online monitoring systems continuously track performance indicators (conductivity, pH, TSS, and pressure) to detect early signs of membrane fouling or scaling.
- Maintenance follows best industry standards, including regular inspections, chemical cleaning of membranes, and calibration of monitoring probes.

Contingency and Storage

- In the unlikely event of a plant shutdown, 14 days of storage capacity is available in the site ponds, providing time for investigation and repair without environmental impact.

Process Considerations

- Management of brine is a key aspect of the RO system. The evaporator and crystallizer are designed to handle brine from both RO trains operating at high recovery (80–86%), reducing brine volume. The concentration of TDS in pond water will impact the production of brine. These parameters are affected by the variability of the weather conditions and the amount of precipitation. All these weather parameters have been included in the water balance model.

1.4. Operational flexibility

Events of extreme rainfall/abnormal hydrological conditions

In the event of extreme rainfall or abnormal hydrological conditions, potential scenarios above or close to max operating, the system design can provide operational flexibility. Figure 4 and Figure 5 show the capacity of the ponds. In the event of an extreme storm, the ponds have a retention capacity up to 14 days. Extreme storms are forecasted and required action can be taken, such as starting a few days earlier to treat up to 150 m^3/h through RO 2 to lower the volume of water in the ponds as much as possible. If this is not enough, the West or East Ponds can be redirected to RO 1 with underground water to increase the treatment up to 150 m^3/h through RO 1. To manage the increased water volume due to exceptional precipitation, the treatment rate could be scaled up to 300 m^3/h by operating the two RO trains in parallel.

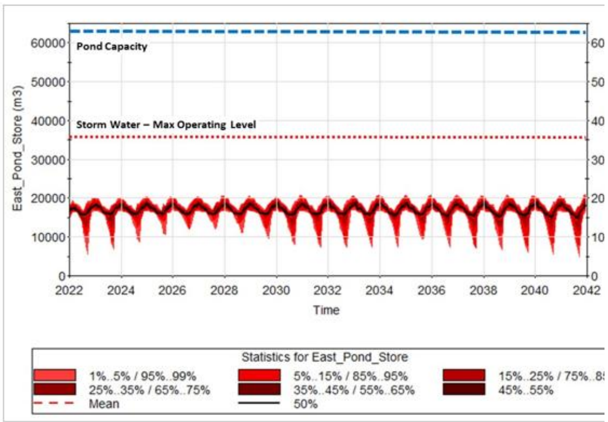

Figure 4 – Monthly Average Volume in East Pond compared to Full and Storm Water Buffer

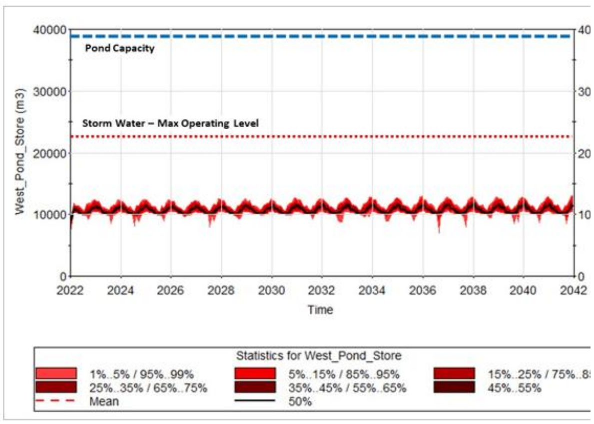

Figure 5 – Monthly Average Volume in West Pond compared to Full and Storm Water Buffer

While the proposed extreme storm configurations could result in a compliant effluent discharge, this outcome remains subject to several operational modifications and design modifications of the current WTP. These constraints include the need to change established operating conditions used in the initial configuration, which may require adjustments in well-controlled strategies and operational procedures. However, in the situation where the volume of the pond becomes critical and/or the concentration of nitrate in the permeate becomes critical and is close to not comply with the maximum discharge limit, the ultimate action is to stop dewatering the mine, stop feeding the underground water to RO 1 and dedicate both ROs (RO 1 and RO 2) to treat the ponds water. Therefore, even during extreme storm events, the concentration of nitrate in the effluent will be achieved.

Figure 6 illustrates the system configuration under large storm conditions. This schematic provides a simplified representation of the RO train process locations during peak hydraulic load scenarios.

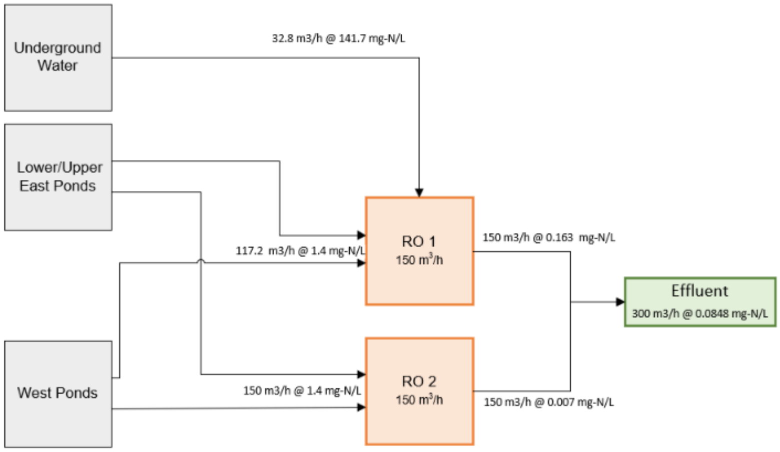

Figure 6 - RO System Configuration during Large Storm for Maximum Operation Capacity

2. RO plant performance and proposed discharge consent:

2.1. RO Feed Water quality

Kaya provided the GoldSim model that provides the concentration of contaminants feeding the RO during operation for the discharge within the Pollanroe burn. The model inputs include the concentration of all contaminants for all water sources of water feeding the West and East ponds that feed the WTP and includes the rainfall variation through the year and through the years of the project life. Figure 1 presents the water balance schematic developed by Kaya, which models the mine site by mixing various streams and estimating the concentration at the inlet of the RO system.

The nitrogen-based contaminants found in the underground water is calculated by ASDR. The first step in estimating the concentration of nitrogen-based contaminants is to determine the annual mass of explosives used, which, in this case, consists of 100% Ammonium Nitrate Emulsion (ANE). When explosives are used, a residual fraction of the emulsion remains undetonated and in liquid form. This soluble portion can migrate into the underground mine water system, contributing to contamination by nitrogenous compounds, particularly ammonia (NH_3) and nitrate (NO_3).

According to various technical documents from the explosive supplier Orica[3], the proportion of undetonated emulsion typically ranges between 2% and 20%. In addition, literature reports an average ammonia generation rate of 7 g-N TAN (Total Ammonia Nitrogen) per kg of ANE, which corresponds to an estimated residual content of 11.4%. This value is consistent with the range reported by Orica. Therefore, based on ASDR experience on other sites, this value could be 15% to 40% lower for a site that has industry standard explosive management protocol plan and a high precision mining plan, such as planned for Curraghinalt project. Therefore, the 11.4% used by ASDR as assumption in the calculation of ammonia and nitrate in the underground water is considered as a conservative assumption. Based on Orica reference[2], it could be as low as 2% and therefore 5 times lower than the 11.4% value used in the calculation below.

Based on this information, the total mass of nitrogen species over the years in the underground water is calculated. Using typical ratios between these species, specific concentrations are estimated. The concentrations of ammonia, nitrate, and nitrite in the underground water are then determined.

2.2. RO Membrane Rejection Rates

Table 1-1 attached outlines the overall rejection rates for each contaminant by the two-pass RO system. Rejection rates for each contaminant is based on RO membrane manufacturer data sheets. The parameters that were judged critical in regard to meet the discharge limits due to their inlet concentration were ammonia and nitrate. Rejection rate of ammonia is pH dependent. Therefore, two laboratory tests were conducted by ASDR to confirm ammonia and nitrate removal: one at the RO system supplier facility, Membrane Development Specialists (MDS), and another at an external laboratory to validate and optimize the results. ASDR were present

[3] Forsberg & Åkerlund (1999), Sjölund (1997), Bailey (2011), and Sidenko (2018), as cited in *Orica, Nitrate Leaching Information Pack for EMEA*.

at both tests. Using the results from both laboratory tests, the overall rejection rates for ammonia and nitrate were calculated. The rejection rates for all other parameters were sourced from data sheets provided by various RO membrane manufacturers.

2.3. RO System Performance

The RO membranes are modelized for each project to confirm not only performance, but membrane selection, design parameters, and RO system configuration.

RO has been modelized for this project using RO membrane suppliers' data sheets, laboratory results and using proprietary modelisation from MDS. Modelisation results are also compared to similar projects done by MDS and ASDR. Detailed design of the RO system is to be finalized at the phase of the project.

It is important to note that the WTP will be commissioned onsite and a performance test will be undertaken to confirm the ability to meet discharge limits prior to starting the discharge. Discharge consent is to be approved by the Northern Ireland Environment Agency following the performance test period and results. If the RO system cannot meet the discharge limits, adjustments or modifications are to be made prior to discharge.

Based on the design, there is no chance discharge limit will not be met, and measures are being put in place to always meet the discharge limits. To ensure to always meet discharge limits, engineering and operational measures are put in place. There is online monitoring upstream of WTP to observe any trend of contaminant variation to ensure prediction of the required operation adjustment, if required. Metals, BOD, ammonia, nitrate are monitored on site, and prediction of RO performance is then monitored to ensure to meet discharge limit at all times. Onsite laboratory analysis is also performed. There is online monitoring at the effluent for TSS, conductivity, and pH.

Variation of performance will be observed through the parameters mentioned above and in any case of off specification water, the water will be sent back upstream to the water treatment plant via an automatic valve that will close the discharge pipe and will recirculate the water upstream until the correction action is completed, and the water is back within the effluent target.

Furthermore, all parameters of the water treatment plant are monitored and trend over time to observe any subtle change in the process. Preventive actions can then be taken prior to plant failure or off-specification water is produced. RO membranes are a physical barrier, and its performance is monitored online and on a continuous basis at every second.

2.4. Compliance with JNCC and EQS Requirements

All EQS requirements will be met. All JNCC requirements, including the dissolved annual average phosphorus EQS limit of 0.016 mg/L (which is less than the downstream JNCC limit for the Owenkillew SAC river of 0.02 mg/L) will be met with the 2 Pass RO system. Nitrate in the discharge will not exceed current baseline concentrations in the receiving rivers (annual averages of 0.2 mg/L (Owenkillew) and 0.42 mg/L (Owenreagh)). In addition, nitrogen emissions to water from the project will be fully offset by removing agriculture from project lands.

To confirm how WTP will comply with the agreed discharge values, the WTP is designed with online monitoring for instantaneous results and for process control. Samples for onsite analysis are taken on daily and weekly basis to validate operational parameters, system performance, and water quality from the site activities and upstream water source as a preventive monitoring to foresee any contaminant concentration increase and plan for it. Furthermore, calibration and maintenance of the instrument probes are also planned.

On the onsite water analysis, water samples will also be sent to an external laboratory for analysis of the various sources of water, West and East Ponds, the end of pipe of the WTP, and from upstream and downstream of the burn discharge point and upstream and downstream of the main river (as applicable).

Table 1 - Comparison of Proposed Discharge Consent Values and Expected RO System Performance for Curraghinalt during construction phase

Parameter	Unit	RO inlet concentration		Removal Rate (%)	Expected RO Outlet Concentration		DGL Proposed Discharge Limit Curraghinalt		Compliance
		Mean	Max		Mean	Max	Mean	Max	
BOD	mg/L	18.4	42.1	99.61%	0.07176	0.16419	1	3	✓
Total Suspend Solid (TSS)	mg/L	4.614	4.707	99.99%	0.0004614	0.0004707	10	50	✓
Total Ammonia Nitrogen (TAN)[4]	mg N/L	15.44	20.74	99.61%	0.060216	0.080886	0.2	0.25	✓
Nitrate (NO3)[4]	mg N/L	19.11	25.67	99.51%	0.093639	0.125783	0.2	11.3	✓
Nitrite (NO2)	mg N/L	0.002235	0.002283	99.51%	0.0000110	0.0000112	None	None	✓
Chloride (Cl)	mg/L	12.46	12.69	99.64%	0.044856	0.045684	None	None	✓
Fluoride (F)	mg/L	0.2715	0.2758	99.36%	0.0017376	0.00176512	None	None	✓
Sulphate (SO4)	mg/L	17.68	18.05	99.84%	0.028288	0.02888	None	250	✓
Aluminum (Al)	mg/L	0.04427	0.0452	99.91%	0.00004	0.00004	None	None	✓
Antimony (Sb)	mg/L	0.009186	0.009277	99.91%	0.0000083	0.0000083	None	0.005	✓
Arsenic (As)	mg/L	0.01123	0.01135	99.91%	0.0000101	0.0000102	None	0.01	✓
Barium (Ba)	mg/L	0.2457	0.2478	99.00%	0.0024570	0.002478	None	None	✓
Boron (B)	mg/L	0.04249	0.04316	75.00%	0.0106225	0.01079	None	None	✓
Cadmium (Cd)	mg/L	0.00006193	0.00006291	99.51%	0.0000003	0.0000003	0.00008	0.00045	✓
Chromium III (Cr3+)	mg/L	0.002123	0.002169	96.00%	0.0000849	0.0000868	None	None	✓
Chromium VI (Cr6+)	mg/L	0.006094	0.006204	97.75%	0.0001371	0.0001396	None	None	✓
Total Chromium (Cr)	mg/L	0.006258	0.006405	96.10%	0.0002441	0.0002498	0.0081	0.05	✓
Cobalt (Co)	mg/L	0.006492	0.006649	96.00%	0.0002597	0.000266	None	None	✓
Copper (Cu)	mg/L	0.0076	0.007634	99.84%	0.0000122	0.0000122	0.0145	0.239	✓
Iron (Fe)	mg/L	0.9469	0.9535	99.84%	0.001515	0.0015256	None	2.38	✓
Lead (Pb)	mg/L	0.001022	0.001028	99.75%	0.0000026	0.0000026	0.0072	0.01	✓
Manganese (Mn)	mg/L	0.2908	0.2951	99.84%	0.0004653	0.0004722	None	0.072	✓
Mercury (Hg)	mg/L	0.00007957	0.00008014	99.64%	0.0000003	0.0000003	None	0.00007	✓
Molybdenum (Mo)	mg/L	0.04026	0.04335	99.64%	0.0001449	0.0001561	None	0.07	✓
Nickel (Ni)	mg/L	0.005615	0.005674	99.91%	0.0000051	0.0000051	0.0132	0.02	✓
Selenium (Se)	mg/L	0.00104	0.001061	99.51%	0.0000051	0.0000052	None	None	✓
Silver (Ag)	mg/L	0.002633	0.002642	99.75%	0.0000066	0.0000066	None	None	✓
Sodium (Na)	mg/L	13.17	13.34	99.64%	0.047412	0.048024	None	None	✓
Uranium (U)	mg/L	0.007815	0.007934	99.51%	0.0000383	0.0000389	0.015	0.03	✓
Zinc (Zn)	mg/L	0.09883	0.09954	99.84%	0.0001581	0.0001593	0.0217	0.204	✓
Phosphorus (P)	mg/L	0.28	0.28	99.51%	0.001372	0.001372	0.016	None	✓

[4] TAN and nitrate influent concentrations were estimated based on mass of emulsion consumption during the construction phase on both sides of the hill. During this period, the underground water flow rate is modelled to be 16.2 m^3/h on each side of the hill.

Table 2 - Comparison of Proposed Discharge Consent Values and Expected RO System Performance for Pollanroe during construction and operation phase

Parameter	Unit	RO inlet concentration		Removal Rate (%)	Expected RO Outlet Concentration		DGL Proposed Discharge Limit Pollanroe		Compliance
		Mean	Max		Mean	Max	Mean	Max	
BOD	mg/L	18.4	42.1	99.61%	0.07176	0.16419	1	3	✓
Total Suspend Solid (TSS)	mg/L	4.614	4.707	99.99%	0.0004614	0.0004707	10	50	✓
Total Ammonia Nitrogen (TAN)[5]	mg N/L	18.4	42.1	99.61%	0.07176	0.16419	0.2	0.25	✓
Nitrate (NO3)[5]	mg N/L	49.5	112.8	99.51%	0.24255	0.55272	0.42	11.3	✓
Nitrite (NO2)	mg N/L	0.002235	0.002283	99.51%	0.00001	0.00001	None	None	✓
Chloride (Cl)	mg/L	12.46	12.69	99.64%	0.04486	0.04568	None	None	✓
Fluoride (F)	mg/L	0.2715	0.2758	99.36%	0.00174	0.00177	None	None	✓
Sulphate (SO4)	mg/L	17.68	18.05	99.84%	0.02829	0.02888	None	250	✓
Aluminum (Al)	mg/L	0.04427	0.0452	99.91%	0.00004	0.00004	None	None	✓
Antimony (Sb)	mg/L	0.009186	0.009277	99.91%	0.00001	0.00001	None	0.005	✓
Arsenic (As)	mg/L	0.01123	0.01135	99.91%	0.00001	0.00001	None	0.01	✓
Barium (Ba)	mg/L	0.2457	0.2478	99.00%	0.00246	0.00248	None	None	✓
Boron (B)	mg/L	0.04249	0.04316	75.00%	0.01062	0.01079	None	None	✓
Cadmium (Cd)	mg/L	0.00006193	0.00006291	99.51%	0.00000	0.00000	0.00008	0.00026	✓
Chromium III (Cr3+)	mg/L	0.002123	0.002169	96.00%	0.00008	0.00009	None	None	✓
Chromium VI (Cr6+)	mg/L	0.006094	0.006204	97.75%	0.00014	0.00014	None	None	✓
Total Chromium (Cr)	mg/L	0.006258	0.006405	96.10%	0.00024	0.00025	0.0081	0.03	✓
Cobalt (Co)	mg/L	0.006492	0.006649	96.00%	0.00026	0.00027	None	None	✓
Copper (Cu)	mg/L	0.0076	0.007634	99.84%	0.00001	0.00001	0.014	0.054	✓
Iron (Fe)	mg/L	0.9469	0.9535	99.84%	0.00152	0.00153	None	0.61	✓
Lead (Pb)	mg/L	0.001022	0.001028	99.75%	0.00000	0.00000	0.0072	0.01	✓
Manganese (Mn)	mg/L	0.2908	0.2951	99.84%	0.00047	0.00047	None	0.187	✓
Mercury (Hg)	mg/L	0.00007957	0.00008014	99.64%	0.00000	0.00000	None	0.00007	✓
Molybdenum (Mo)	mg/L	0.04026	0.04335	99.64%	0.00014	0.00016	None	0.068	✓
Nickel (Ni)	mg/L	0.005615	0.005674	99.91%	0.00001	0.00001	0.0122	0.02	✓
Selenium (Se)	mg/L	0.00104	0.001061	99.51%	0.00001	0.00001	None	None	✓
Silver (Ag)	mg/L	0.002633	0.002642	99.75%	0.00001	0.00001	None	None	✓
Sodium (Na)	mg/L	13.17	13.34	99.64%	0.04741	0.04802	None	None	✓
Uranium (U)	mg/L	0.007815	0.007934	99.51%	0.00004	0.00004	0.015	0.03	✓
Zinc (Zn)	mg/L	0.09883	0.09954	99.84%	0.00016	0.00016	0.0207	0.0733	✓

[5] TAN and nitrate effluent concentrations are based on the maximum concentration at the inlet of the water treatment plant, corresponding to Year 2 according to the water balance model.

Phosphorus (P)	mg/L	0.28	0.28	99.51%	0.00137	0.00137	0.016	None	✓

Based on **Table 1** and **Table 2**, the effluent water quality during the construction phase (discharge into Pollanroe Burn) and the operation phase (discharge into Curraghinalt Burn) complies with their respective discharge limits.

Additionally, the effluent discharge is expected to reduce the annual average of Total Dissolved Solids (TDS) concentration in the burns by approximately 30%, while its effect on the downstream river will remain minimal, at less than 1%. The permeate from the double-pass RO system is designed to maintain a TDS concentration close to or below the minimum levels observed in the burns.

The anticipated TDS range for the RO permeate is 3.5 to 16 mg/L, depending on the TDS concentration of the pond water feeding the RO system. The minimum TDS values recorded in both burns are 12 and 14 mg/L. Out of 42 samples, Curraghinalt Burn TDS concentration varies from 14 mg/l to 288 mg/l with a mean value of 122 mg/l of TDS. Out of 38 samples, Pollanroe Burn TDS concentration varies from 12 to 171 mg/l with a mean value of 91 mg/l of TDS. Consequently, the discharge will align with the lower end of the natural TDS spectrum found in the Curraghinalt and Pollanroe Burns.

The proposed strategy is to target, at the discharge point, the annual average TDS concentration of each burn and apply a tolerance range of ±80%. This will ensure TDS concentration at the end of pipe will always be above the minimal values and below the maximum values recorded in both burns. To ensure compliance and adaptability, the system will include the capability to remineralise the permeate water by adding hardness and alkalinity to maintain the end of pipe TDS within the burns TDS concentration monitored and reported with the Surface Water Baseline Report from SRK Consulting[6]. This adjustment can be made either to match the natural background TDS of the burns or to meet specific discharge consent requirements.

[6] As per the table 10-7 and table 12-11 or U7511 2020 Surface Water Baseline Report – Main Report from SRK Consulting for monitoring location SW04 and SWN05/SW25

2.5. Conclusion

The reverse osmosis membrane system is designed as a robust physical barrier that effectively removes viruses, metals, BOD, ions, and other contaminants, achieving rejection rates up to 99.8% for metals, 99.6% for ammonia, and 99.5% for nitrate. In practical terms, if a contaminant concentration of 100 enters the membrane, only 0.4 will exit. These performance values are supported by RO modeling, manufacturer specifications, laboratory testing, and validation from comparable projects.

To ensure continuous compliance with discharge objectives, RO performance will be monitored in real time using two redundant electrical conductivity (EC) meters. These meters track total dissolved solids (TDS) removal and are linked to an automatic shutdown system. EC is a proven, industry-standard measurement for RO performance and is complemented by routine sample collection and laboratory analysis conducted by both NIEA and the operator.

Additionally, RO membrane performance is continuously monitored through conductivity, pH, and turbidity/TSS across each pass and stage of the system, providing real-time assurance of treatment effectiveness. Untreated water cannot bypass the WTP; all water entering the plant is actively pumped from contact ponds, reinforcing process integrity.

Therefore, based on modelling, laboratory results, and manufacturer data, the RO system is expected to meet or exceed all proposed discharge consent values, with nitrate managed through additional measures to ensure full compliance.