

APPENDIX U MFS - WATER AND LOAD BALANCE MODEL

Escarpment Extended

Water and Load Balance Model Report

21 July 2026

J-NZ0433-003-R-FINAL

Escarpment Extended

Water and Load Balance Model Report

Document Number: J-NZ0433-003-R-FINAL

Document Date: 21 July 2026

Prepared for:

Bathurst Resources Limited

[REDACTED]

Prepared by:

Mine Waste Management Limited

[REDACTED]

[REDACTED]

www.minewaste.com.au

REVISION	DATE	AUTHOR	RECORD OF REVIEW
J-NZ0433-003-R-FINAL	21/07/26	LM/LN	RB/PW

EXECUTIVE SUMMARY

This report describes the development of a site-wide water and load balance model (WLBM) for Escarpment Extended (ESE) sub-area, which represents the proposed water management activities and infrastructure proposed for the mining operation and which will support the Assessment of Environmental Effects (AEE) for the Buller Plateaux Continuation Project (BPCP or Project) for Bathurst Resources Limited (BRL).

Objectives of this Study

The ESE WLBM was developed to achieve the following objectives:

- Forecast changes to flows within waterways as a result of the Project-related activities at ESE.
- Support design of water management infrastructure.
- Forecast downstream water quality as a result of the Project-related activities at ESE.

The WLBM represents the Construction Phase (final year), Operations Phase, Active Closure Phase, and Post Closure Phase, simulating a duration of 116 years (100 years post-closure) at a daily timestep resolution. Key elements represented in the model included:

- Runoff from background catchments.
- Runoff from mine domains (e.g., pit voids, Engineered Landforms [ELFs], etc).
- Seepage from ELFs.
- Collection and conveyance (channel flow and pumping) of mine impacted water (MIW) water that is affected by total suspended solids (TSS) and/or acid and metalliferous drainage (AMD).
- Loading rates of solutes generated from source terms (both from constant concentrations and constant loads)
- Mixing parameters (conservative) and calculation of concentrations in each flow path.
- Solute load changes through water treatment plant (WTP) and mussel shell bioreactors (MSRs).
- Effects on downstream water quality (for both acute and chronic exposures).

The modelling included the following scenarios:

- Base Case model, with approximate annual average rainfall conditions and typical source terms¹ based on best available empirical water quality datasets. The adopted water management strategy is based on over 25 years of practical experience in similar environments.

¹ Source terms are derived from empirical or analogue site data to characterise water quality associated with different components of the model (e.g., pit surfaces), expressed as constituent concentrations or constant loads.

- Scenario 1, with *high*² annual rainfall conditions and typical source terms.
- Scenario 2, with *variable* rainfall every year (henceforth referred to as stochastic rainfall) and typical source terms.
- Scenario 3, with approximate annual average rainfall conditions and a 30% increase to typical ELF seepage source terms.
- Scenario 4, with approximate annual average rainfall conditions and a 30% decrease to typical ELF seepage source terms.

Findings

The primary outcome of the ESE WLBM is that water quality simulated at compliance locations remained below the proposed guideline values derived for the Project throughout the simulation, including for the Base Case model and the four scenarios which test uncertainties of the model including rainfall variability as well as uncertainty in source terms for ELF seepage water quality (which is the largest influence on solute loads at closure).

Modelling incorporated high intensity rainfall events (24-hour periods) corresponding to a 1 in 10-year event during the Operations Phase and a 1 in 100-year climate adjusted event occurring during the Post Closure Phase (Scenario 2). Dry periods were also incorporated in the model with a maximum dry period of 41 consecutive days included within Scenario 2.

Key findings regarding the results of the water balance model, load balance model, and alternative scenarios are summarised within this section.

Base Case Model Results

The water balance model results suggest the following:

- The proposed mine water infrastructure and treatment systems achieve compliance including when stress tested against high and low rainfall conditions. Under the Base Case the mine captures and treats all MIW flows 95% of the time, with bypass events up to ~5% of the time in a given year (i.e., ~18 days per year). Spills occur up to 5% of the time for years when bypass infrastructure is not established.
- The “WWH” and “CON” ELFs contribute the vast majority of ELF seepage (combined 77% of final ELF surface catchment) during the model simulation.
- The model predicts a total of 358,000,000 m³ of water will be treated by the WTP over the 30 years that it is active.
- Sump volumes, pumping rates, and a maximum WTP throughput of 635 litres per second (L/s) managed the simulated MIW volumes (under approximately annual average conditions), with spilling and bypass occurring 5% of the time or less. Note that spilling and bypass do not occur concurrently for a given sump (as per the water management strategy).

² The wettest year on record for Lake Brazil meteorological station was used to represent high rainfall conditions.

- The following changes to flow dynamics are predicted to environmental flows (at compliance monitoring locations positioned within waterways):
 - o For the Active Treatment Phase³, KEL had the largest mean flow increase (+16%) while W07 had the greatest reduction (-16%).
 - o For the Post Closure Phase, V62 had the largest mean flow increase (+108%) while M-M1 had the greatest reduction (-24%).
 - o For low flow conditions, all sites show an increase for both phases, with M-M1 the highest (+8,650%) during the Active Treatment Phase and V62 the highest (+16,100%) during the Post Closure Phase.

The load balance model results suggest the following:

- Active treatment will be required for ~15 years after mining operations cease before MSRs can treat all ELF seepage loads to meet proposed guideline values. Some ELF seepage will be able to be treated effectively with MSRs earlier than this.
- Screening of model results against acute and chronic guideline values for metals and turbidity (Hickey, 2026) did not suggest exceedance over the proposed exposure periods. Zinc (Zn) and Nickel (Ni) were the parameters that approached closest to guideline values, although always less than 50% of guideline values during the Operations Phase when the WTP is active. Concentrations of Zn and Ni were typically 13-19% below chronic exposure guideline values upon initial release of passive treatment water to compliance sites KEL and V62, before concentrations reduce. Larger margins were simulated both for other monitoring locations and for acute exposure periods. Overall, model results suggest discharge of MIW via bypass and sump spilling at proposed quantities and frequencies (<5%) will not elevate potential constituents of concern (PCOC) above proposed guideline values.
- Peak MIW PCOC loads reporting to the WTP occur in 2036/37, with approximately 4,700 tonnes per year (t/year) of acidity, 460 t/year of Aluminium (Al) and 210 t/year of Iron (Fe). 2035 was the peak year for Total Suspended Solids (TSS) load, with 1,550 t/year.

Alternative Scenario Model Results

The key findings of the scenario modelling are summarised below:

- All scenario model results were below proposed chronic (annual median) and acute (annual 95th percentile (P95)) guideline values for the duration of each simulation. As noted previously, these results incorporate testing of the model against high intensity rainfall events and extended dry conditions.

³ 'Active Treatment Phase' includes the Construction Phase, Operations Phase, and Active Closure while the active WTP is operating.

- Scenario 1 resulted in an increase (19%) in the total water treated by the WTP, although it's noted that this outcome is not significant as cumulative 'wet' years for the duration of the model simulation are improbable. Scenario 2 volumes were similar to the Base Case.
- Scenario 1 and Scenario 2, each resulted in a low number of spill events (10) at the WTP Surge Pond over the ~100 year simulation period. These spill events result in higher concentrations of some PCOCs within the receiving environment (modelled at M-M1), but concentrations remain below guideline values.
- Scenario 1 total water to be treated by the WTP is 428,000,000 m³, and a maximum capacity of 700 L/s is required to be processed through the WTP.
- With Scenarios 1 and 2, higher rates of MIW water capture and WTP capacity were required (compared to the Base Case) for wet years.
- Scenario 3, with higher ELF seepage sources terms showed higher metals concentrations, particularly in the Post Closure Phase. However, toxicity modified guideline values (Hickey, 2026) also increased (due to additional water hardness). Ultimately, modelled downstream concentrations remained below guideline values for the chronic and acute exposure periods.
- Scenario 4, with lower ELF seepage source terms showed lower metal concentrations particularly in the Post Closure Phase. Toxicity modified guideline values also reduced (due to lower water hardness), however modelled downstream concentrations remained below guideline values for the chronic and acute exposure periods.

Operational Management Recommendations

The following management recommendations are proposed for the Operations Phase:

- Active treatment (ESE WTP) is required from the second year of the Construction Phase. Noting that a portable WTP will be used in the Construction Phase to treat MIW until the ESE WTP is commissioned.
- The majority of PCOC loads originate from the ELFs and collection of their seepage is important for minimising potential effects on waterways. As such, it is recommended that design, construction, and ongoing operation of ELFs and associated seepage systems are undertaken at a high standard to ensure high levels of seepage collection are achieved (as per model assumptions).
- Performance monitoring to confirm model inputs and results are reasonable with as-built conditions, including water quality and quantity data from:
 - o Background catchments.
 - o ELF seepage and runoff.
 - o Haul road runoff.
 - o Open pit runoff.
 - o Sump MIW.

- o Sediment control structures.
 - o Sump bypass MIW.
 - o WTP discharge.
 - o MSRs discharge.
- Sump bypass infrastructure should be instrumented such that the frequency, duration, and water volume discharges is recorded and reviewed annually. Similar metrics should be recorded for WTP discharges and direct discharges.
- Demonstrate that adopted net percolation rates can be achieved through a cover system trial. Such a study would provide confidence that water quality closure objectives can be achieved in the proposed timeframes and support closure planning.
- Adaptive management processes should be followed to proactively manage water related risks.
- As more empirical data becomes available as the ESE is developed, the WLBM should be periodically benchmarked to new data and updated as needed to improve confidence in model results.

Closure Management Recommendations

The following management recommendations are proposed for the Active Closure and Post Closure Phases:

- The model suggests active treatment will be required for approximately 15 years following completion of mining and rehabilitation works (Operations Phase) before switching solely to passive treatment in 2058. Performance monitoring during operations will improve understanding of the likely duration of active treatment.
- Passive treatment such as MSRs are an important element of achieving water quality objectives. As such, early implementation of passive treatment systems and associated performance monitoring should be used as an opportunity to monitor treatment performance and inform closure planning.
- The WLBM should be updated on a routine basis to include additional performance monitoring data to calibrate the model (e.g., cover system performance and net percolation rates; source terms; water treatment efficiencies, etc.) to improve confidence in model results for closure.

TABLE OF CONTENTS

1	Introduction	1
1.1	Background.....	1
1.1	Scope and Objectives.....	1
1.2	Project Description.....	1
1.2.1	Mine Schedule.....	2
1.3	Proposed Compliance Monitoring	7
1.3.1	Compliance Monitoring Locations	7
1.3.2	Proposed Water Quality Limits.....	7
1.4	Report Structure	8
2	Mine Water Management Overview	9
2.1	Overview.....	9
2.2	In-pit Water Management.....	12
2.3	Infrastructure Areas	13
2.4	Engineered Landforms	13
2.5	Rehabilitation	14
2.6	Sullivan NAF ELF Water Management	17
2.7	Active Water Treatment.....	17
2.8	Passive Water Treatment	17
3	Model Description	19
3.1	Model Framework.....	19
3.1.1	Model Overview.....	19
3.1.2	Model Platforms.....	20
3.1.3	Timescale	20
3.1.4	Model Scenarios.....	20
3.2	Water Balance Inputs	21
3.2.1	Model Structure	21
3.2.2	Climate Inputs.....	21
3.2.2.1	Base Case Model.....	21
3.2.2.2	Variable Rainfall Scenarios (Scenario 1 and 2)	23
3.2.2.3	Rainfall Statistics.....	25
3.2.3	Catchment Delineations	27
3.2.4	Background Area Runoff	30
3.2.5	Pit Voids	30
3.2.6	Hard Stand and Haul Roads	30
3.2.7	Engineered Landforms	30
3.2.8	Underground Workings	31
3.2.9	MIW Infrastructure.....	32
3.2.9.1	Sump Bypass Mechanism.....	32
3.2.9.2	Sump spilling mechanism	33

3.2.9.3	Sump Pumping and WTP.....	33
3.2.9.4	MSRs.....	35
3.3	Load Balance Inputs.....	35
3.3.1	Source Terms.....	35
3.3.1.1	Background Catchment.....	36
3.3.1.2	Active Pits and Cuts (High walls), and active ELF Runoff	36
3.3.1.3	Highwall Runoff	38
3.3.1.4	Non-rehabilitated Coal Floors	39
3.3.1.5	ELF Surface Runoff: Uncovered and Revegetated	41
3.3.1.6	Hardstand and Haul Roads.....	41
3.3.1.7	Underground Workings	42
3.3.1.8	ELF Seepage	43
3.3.2	Total Suspended Solids	43
3.3.3	Turbidity.....	46
3.3.4	Sump / Void Mixing	46
3.3.5	Hardness	46
3.3.6	Active and Passive Treatment.....	46
3.3.6.1	WTP Ca Calculation.....	47
3.3.6.2	MSR Ca and Mg Calculation.....	48
3.3.7	pH Estimation and Acidity and Alkalinity calculations	48
4	Model Evaluation	49
4.1	Model QA/QC	49
4.2	Model Calibration.....	49
4.3	Model Limitations.....	52
4.3.1	Water Balance	52
4.3.2	Load Balance.....	52
5	Model Results	54
5.1	Overview.....	54
5.2	Base Case Water Balance Results	54
5.2.1	ELF Seepage Flows	54
5.2.2	Surge Pond Water Volume.....	55
5.2.3	In-pit Sump Water Volume	55
5.2.4	Discharge Events	57
5.2.5	Volume of Water Treated at WTP	58
5.2.6	Cessation of active treatment of NSUL seepage in 2046Environmental Flows.....	58
5.2.6.1	KEL.....	59
5.2.6.2	V62.....	60
5.2.6.3	W07	61
5.2.6.4	M-M1	62
5.2.6.5	V37_F.....	63
5.2.6.6	V37_G	64

5.3	Base Case Load Balance Results	65
5.3.1	KEL	67
5.3.1.1	General Water Quality	67
5.3.1.2	Metals	70
5.3.1.3	TSS and Turbidity	76
5.3.2	V62	78
5.3.2.1	General Water Quality	78
5.3.2.2	Metals	81
5.3.2.3	TSS and Turbidity	87
5.3.3	W07	89
5.3.3.1	General Water Quality	89
5.3.3.2	Metals	92
5.3.3.3	TSS and Turbidity	98
5.3.4	M-M1	100
5.3.4.1	General Water Quality	100
5.3.4.2	Metals	103
5.3.4.3	TSS and Turbidity	109
5.3.5	V37_F	111
5.3.5.1	General Water Quality	111
5.3.5.2	Metals	114
5.3.5.3	TSS and Turbidity	120
5.3.6	V37_G	121
5.3.6.1	General Water Quality	121
5.3.6.2	Metals	124
5.3.6.3	TSS and Turbidity	130
5.4	WTP Annual Loads	132
5.5	Alternative Scenarios	133
5.5.1	Water Balance Model Results	133
5.5.1.1	Introduction	133
5.5.1.2	Volume of Water Treated at WTP (scenario comparison)	133
	Discharge Events	134
5.5.2	Load Balance Model Results	136
5.5.2.1	Metals	136
5.5.2.2	TSS and Turbidity	136
5.5.2.3	Water Treatment Plant Influent Loads	139
6	Summary and Recommendations	141
6.1	Summary	141
6.1.1	Water Balance Model Results (Base Case)	141
6.1.2	Load Balance Model Results (Base Case)	142
6.1.3	Alternative Scenario Model Results	142
6.2	Operational Management Recommendations	143

6.3	Closure Management Recommendations	144
7	References.....	145
8	Limitations.....	146
Appendix A	Limitations.....	147
Appendix B	Proposed Water Quality Limits	149
Appendix C	Modelled Catchment Areas	156
Appendix D	Water Quality Results	157

LIST OF TABLES

Table 1: ESE proposed compliance monitoring locations.	7
Table 2: ELF rehabilitation completion year.....	15
Table 3: MSR details.....	18
Table 4: ESE model timescale and mine phases.	20
Table 5: Summary of model scenarios.	21
Table 6: Summary table of Stockton Office Met Station 24-hour rainfall frequency results.	26
Table 7: Maximum observed 24-hour rainfall within the modelled scenarios.	26
Table 8: Maximum periods of consecutive dry days.....	27
Table 9: Catchments areas (baseline and final landform).	27
Table 10: ELF model parameters.	31
Table 11: Underground workings flow rate calculation.	31
Table 12: Adopted sump bypass trigger rates (Base Case).	32
Table 13: Void water capacities (m ³).	33
Table 14: Adopted maximum sump pumping rates (Base Case).	34
Table 15: Source terms - Background catchment.	36
Table 16: Source terms - Active pits.	37
Table 17: Source terms - closure highwalls.	38
Table 18: Source terms - coal floor.....	40
Table 19: ELF surfaces source term.....	41
Table 20: Hardstand and Haul Road source term.	41
Table 21: Underground workings source term.....	42
Table 22: Modelled TSS source terms.....	44
Table 23: Treatment source terms.....	47
Table 24: WM2 flow statistic comparison.....	51
Table 25: Frequency of bypass events past in-pit sumps.....	57
Table 26: Frequency of spill events direct to environment from in-pit sumps.....	57
Table 27: KEL hydrological statistics summary.	59
Table 28: V62 hydrological statistics summary.....	61
Table 29: W07 hydrological statistics summary.....	62
Table 30: M-M1 hydrological statistics summary.....	63
Table 31: V37_F hydrological statistics summary.	64
Table 32: V37_G hydrological statistics summary.....	65
Table 33: WWH Sump - frequency of bypass events during different scenarios (per year bypass is active).....	136
Table 34: CON Sump - frequency of bypass events during different scenarios.....	136
Table 35: ESC Sump - frequency of bypass events during different scenarios.	136

LIST OF FIGURES

Figure 1: Site overview.....	4
Figure 2: Project timelines (by stage and by indicative year).	5
Figure 3: Mine schedule at Escarpment Extended.	6
Figure 4: Water balance flow diagram – Operations and Active Closure Phase.....	10
Figure 5: Water balance flow diagram – Post Closure Phase.	11
Figure 6: Bypass mechanism example.	12
Figure 7: Spilling mechanism example.	13
Figure 8: Sub-ELF basal catchments.....	16
Figure 9: 2019 monthly rainfall data.....	22
Figure 10: Climate change function.	23
Figure 11: Monthly rainfall comparison.	24
Figure 12: Scenario 2 - stochastic rainfall timeseries.	25
Figure 13: Baseline catchments.....	28
Figure 14: EOML Mine Domain Catchments.	29
Figure 15: ESE Closure highwall areas.	38
Figure 16: ESE closure coal floor.	39
Figure 17: Acidity and sulfate concentrations for the ELF.	43
Figure 18: MIW TSS source term derived from MGIU empirical data.	45
Figure 19: Relationship between daily rainfall and TSS removal from sumps.	46
Figure 20: Daily flow rate comparison.....	50
Figure 21: Daily flow rate comparison (log scale).....	50
Figure 22: Flow exceedance comparison.	51
Figure 23: Cumulative water volume comparison.....	51
Figure 24: ELF daily seepage flows.....	54
Figure 25: Surge Pond water volume (reported daily).	55
Figure 26: WWH Sump water volume (reported daily).	56
Figure 27: CON Sump water volume (reported daily).....	56
Figure 28: ESC Sump water volume (reported daily).	57
Figure 29: Cumulative volume of water treated by WTP.	58
Figure 30: KEL modelled flow distribution results.....	59
Figure 31: V62 modelled flow distribution results.	60
Figure 32: W07 modelled flow distribution results.	62
Figure 33: M-M1 modelled flow distribution results.	63
Figure 34: V37_F modelled flow distribution results.	64
Figure 35: V37_G modelled flow distribution results.	65
Figure 36: KEL - 30 day rolling median plots (pH, SO ₄ , DOC, Hardness).....	68
Figure 37: KEL - Exceedance plots (pH, SO ₄ , DOC, Hardness).	69
Figure 38: KEL - Exceedance plots (Zn, Ni, Co, Cd).	71

Figure 39: KEL - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	72
Figure 40: KEL - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	73
Figure 41: KEL - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	74
Figure 42: KEL - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	75
Figure 43: KEL - TSS - 30-day rolling median.	76
Figure 44: KEL - TSS - exceedance plot.	77
Figure 45: KEL – turbidity compared to chronic compliance limits.	77
Figure 46: KEL - turbidity compared to acute compliance limits.	78
Figure 47: V62 – 30 day rolling median plots (pH, SO ₄ , DOC, Hardness).	79
Figure 48: V62 - exceedance plots (pH, SO ₄ , DOC, Hardness).	80
Figure 49: V62 - exceedance plots (Zn, Ni, Co, Cd).	82
Figure 50: V62 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	83
Figure 51: V62 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	84
Figure 52: V62 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	85
Figure 53: V62 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	86
Figure 54: V62 - TSS - 30 day rolling median.	87
Figure 55: V62 - TSS - exceedance plot.	88
Figure 56: V62 - turbidity compared to chronic compliance limits.	88
Figure 57: V62 - turbidity compared to acute compliance limits.	89
Figure 58: W07 - 30 day rolling median plots (pH, SO ₄ , DOC, Hardness).	90
Figure 59: W07 - exceedance plots (pH, SO ₄ , DOC, Hardness).	91
Figure 60: W07 - exceedance plots (Zn, Ni, Co, Cd).	93
Figure 61: W07 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	94
Figure 62: W07 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	95
Figure 63: W07 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	96
Figure 64: W07 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	97
Figure 65: W07 - TSS - 30 day rolling median.	98
Figure 66: W07 - TSS - 30 day rolling median.	99
Figure 67: W07 - turbidity compared to chronic compliance limits.	99
Figure 68: W07 - turbidity compared to acute compliance limits.	100
Figure 69: M-M1 - 30 day rolling median plots (pH, SO ₄ , DOC, Hardness).	101
Figure 70: M-M1 - exceedance plots (pH, SO ₄ , DOC, Hardness).	102
Figure 71: M-M1 exceedance plots (Zn, Ni, Co, Cd).	104

Figure 72: M-M1 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	105
Figure 73: M-M1 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	106
Figure 74: M-M1 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	107
Figure 75: M-M1 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	108
Figure 76: M-M1 - TSS - 30 day rolling median.	109
Figure 77: M-M1 - TSS - exceedance plot.	110
Figure 78: M-M1 - turbidity compared to chronic compliance limit.	110
Figure 79: V37_F - 30 day rolling median plots (pH, SO ₄ , DOC, Hardness).	112
Figure 80: V37_F - exceedance plots (pH, SO ₄ , DOC, Hardness).	113
Figure 81: V37_F - exceedance plots (Zn, Ni, Co, Cd).	115
Figure 82: V37_F - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	116
Figure 83: V37_F - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	117
Figure 84: V37_F - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	118
Figure 85: V37_F - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	119
Figure 86: V37_F - TSS - 30 day rolling median.	120
Figure 87: V37_F - TSS - exceedance plot.	121
Figure 88: V37_G - 30 day rolling median plots (pH, SO ₄ , DOC, Hardness).	122
Figure 89: V37_G - exceedance plots (pH, SO ₄ , DOC, Hardness).	123
Figure 90: V37_G - exceedance plots (Zn, Ni, Co, Cd).	125
Figure 91: V37_G - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	126
Figure 92: V37_G - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	127
Figure 93: V37_G - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).	128
Figure 94: V37_G - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).	129
Figure 95: V37_G - TSS - 30 day rolling median.	130
Figure 96: V37_G - TSS - exceedance plot.	131
Figure 97: Annual acidity loads, and weighted concentrations to WTP.	132
Figure 98: Volume of water treated (scenario comparison).	134
Figure 99: WWH Sump spill event accumulation.	135
Figure 100: WTP Surge Pond spill event accumulation.	135
Figure 101: Annual median turbidity comparing rainfall scenarios.	137
Figure 102: Annual P95 turbidity comparing rainfall scenarios.	138
Figure 103: Daily turbidity results compared to max acute daily limit for different rainfall scenarios.	138

Figure 104: 7-day rolling median turbidity compared to acute compliance limit for different rainfall scenarios.	139
Figure 105. Annual WTP inflowing loads and weighted concentrations for all scenarios.	140

1 INTRODUCTION

Mine Waste Management Limited (MWM) was retained by Bathurst Resources Limited (BRL) to develop a GoldSim based Water and Load Balance Model (WLBm) to support the future management of mine impacted waters for the Escarpment Extended Mine Project sub-area (Figure 1) and assess the environmental effects of mining with comparison to water quality guideline values. This report documents the development of this WLBm and key model outputs.

1.1 Background

Bathurst Resources Limited (BRL) is seeking to obtain authorisation through the Fast-track Approvals Act (FTAA) to progress development and mining of the coal resources across the wider Buller Plateaux. This project is referred to as the Buller Plateaux Continuation Project (BPCP or Project).

The purpose of the BPCP is to re-consent the existing infrastructure and mining operations associated with the existing Stockton Mine and provide access to additional coal mining areas across the Buller Plateaux, as the coal resource in the current Stockton Mine is close to depletion, and further coal resources for blending are required. There are five key project sub-areas:

- Stockton mining area (Stockton)
- Mount Frederick South (MFS)
- Escarpment Extended (ESE)
- Upper Waimangaroa Haul Road (UWHR)
- Cypress mining area (Cypress)

1.1 Scope and Objectives

This report documents the development of the WLBm for the ESE sub-area which comprises a GoldSim-based water balance model, and a Python-based contaminant load balance model.

The WLBm was developed to achieve the following objectives:

- Forecast changes to flows within waterways as a result of the BPCP.
- Support design of water management infrastructure.
- Predict downstream water quality arising from mine development.
- Test model sensitivities to different climate and water quality scenarios.

1.2 Project Description

BRL wish to consent ESE, which incorporates the existing authorised Escarpment Mine, a proposed extension into the adjacent mining areas covered by Mining Permits MP51279 and MP60138, and the Sullivan Coal Mining Licence (CML 37161). Access to this area is currently provided via the existing public road network on the Denniston Road, but it will be connected to the Stockton sub-area by the proposed UWHR.

A site overview of the ESE sub-area is presented in Figure 1, indicating the End of Mine Life (EOML) site area, pit extent, planned landforms as well as sumps and pit voids.

The Project involves the following major activities within the ESE sub-area:

- Open-cast mining of the ESE Pit.
- Construction of engineered landforms (ELFs) to place and store mined rock. ELF development occurs both within the pit and external to the pit.
 - o Mined rock will also be added to the existing Barren Valley (BV) ELF to the east of the pit. This is therefore known as the Barren Valley Extended (BVE) ELF. At year 3 in the mine plan these ELFs join and are referred to within this report as the Central ELF.
 - o An Ex-Pit ELF on the northern side of the Whareatea River, known as the Sullivan non-acid forming (NAF) ELF (NSUL), will be constructed, with a portion of this ELF rehandled prior to closure for use in the cover system for the Central ELF or buffer periods of the mine plan where volumes of NAF materials are limited. All ELFs will be rehabilitated with cover systems through progressive rehabilitation or as part of the mine closure activities.
- Construction of the water treatment plant (WTP) and associated water management infrastructure.
- Construction of operational infrastructure, including roads, maintenance facilities, fuel storage and waste handling facilities, and a coal stockpiling area.
- Excavation of a void east of the ESE Pit to access and seal the historical underground workings with a low permeability barrier. This element is referred to as the Ex-Pit Seal. This (sealed) void will be utilised as a surge pond for the WTP. Construction of the Ex-Pit Seal is expected to prevent acid and metalliferous drainage (AMD) from freely draining to Cascade Creek.
- Creation of an impermeable barrier within an underground drainage drive to the south of the Ex-Pit Seal via stoping methods.
- Construction of five mussel shell bioreactors (MSRs), to passively treat ELF seepage water prior to discharge to surface water receptors.

An overview of the mine water management is presented in Section 2.

1.2.1 Mine Schedule

The Project timeline, which includes ESE, is presented in Figure 2. For the WLBM four mine phases are defined:

- Construction Phase, where site works for establishment of the mine (i.e., construction of ancillary infrastructure, and limited pre-stripping of overburden) are completed ahead of mining. The Construction Phase is complete once the active WTP and all associated WTP ponds are constructed; whilst the ESE WTP is expected to be operational at the start of Stage 0, the associated surge pond (the Ex-Pit Seal) remains under construction, hence the WTP will rely on use of the Pit 3 Pit Lake as a surge pond during this time. Where necessary, localised water

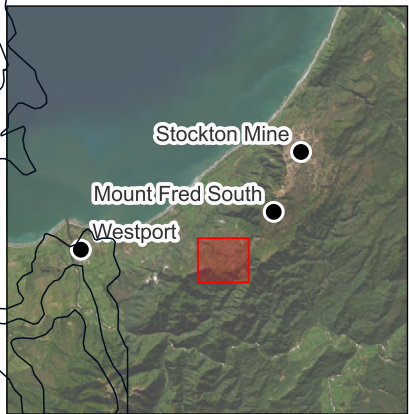
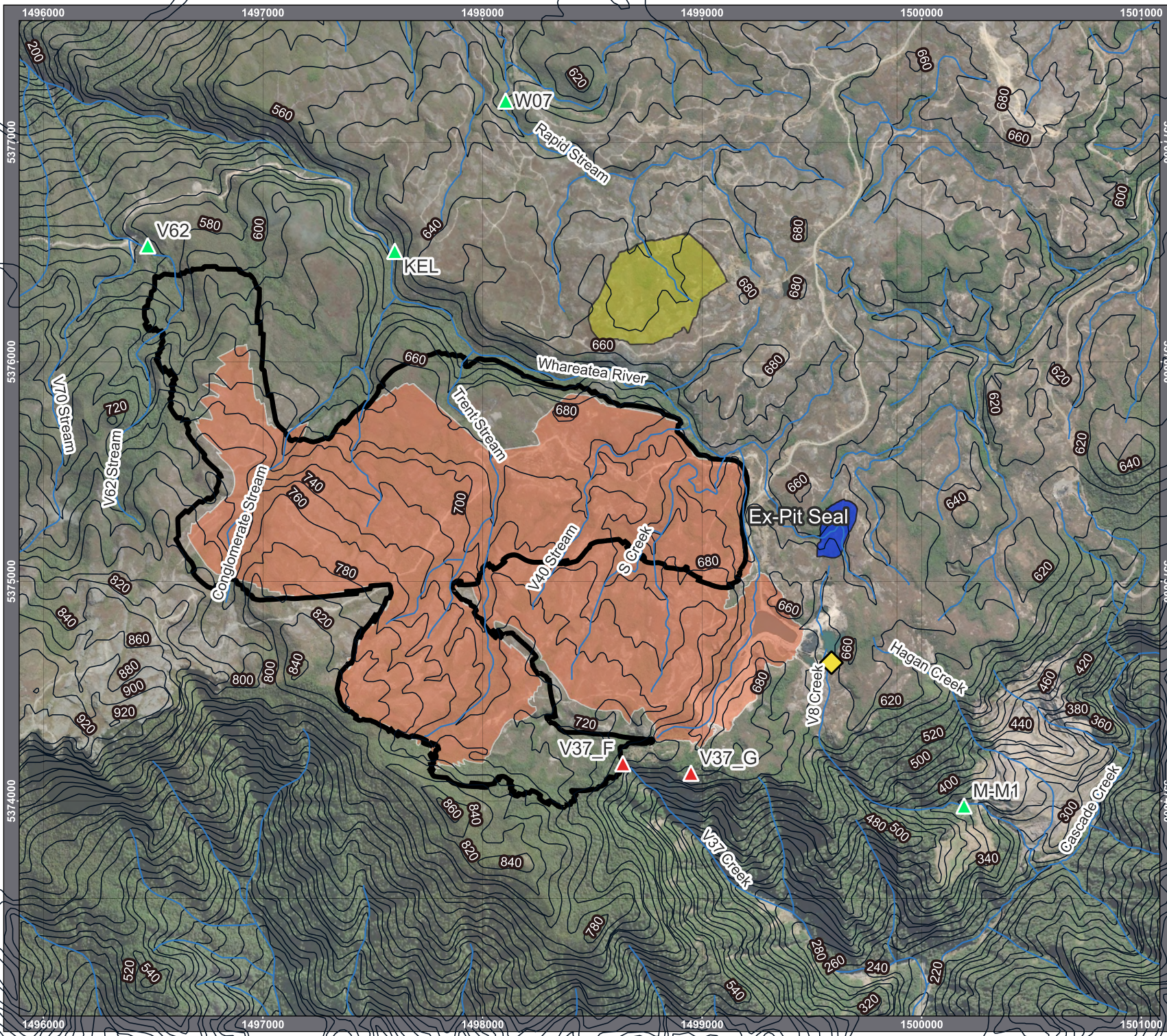
treatment with small portable plants will be employed to manage water quality during this phase including prior to the establishment of the ESE WTP (MWM, 2026a).

- Operations Phase, when active mining and/or rehabilitation works are undertaken. Water management infrastructure, such as sumps, pumps, pipelines, and the WTP are operational. Progressive development and concurrent rehabilitation of ELFs occurs during this phase. A limited number of MSRs become operational during this phase.
- Active Closure Phase, where active mining has ceased and during which mine disturbance is fully rehabilitated (e.g., ELFs). Active treatment via the WTP continues until the mine impacted water (MIW⁴) loads have reduced such that MSR can effectively treat all ELF loads to meet water quality criteria. A limited number of MSRs become operational during this phase.
- Post Closure Phase, where the WTP and associated infrastructure is decommissioned and MIW is treated successfully with MSR to meet water quality criteria.

The WLBM begins during the final year of the Construction Phase prior to commencement of the Operations Phase. Two treatment phases are defined for management of MIW:

- Active Treatment Phase, where active treatment via the WTP occurs until such time that all MIW may effectively be treated via MSRs. A limited number of MSRs become operational during this phase. This phase covers the final year of the Construction Phase when the WTP has been constructed and is operating, and the duration of the Operational and Active Closure (mine) Phases – see above.
- Post Closure Phase, the same as the Post Closure (mine) Phase, where MIW is passively treated through use of MSRs.

⁴ MIW can be affected by total suspended solids (TSS) and/or acid and metalliferous drainage (AMD).



LEGEND

- Monitoring Locations**
- ▲ Compliance
 - ▲ Performance
 - ◆ Lake Brazil Weather Station
 - Pre-mining Waterways
 - Topographic Contours (mRL)
 - ▭ Pit Extent
 - ▭ NSUL ELF
 - ▭ Ex-Pit Seal
 - ▭ Central ELF
- N
- 0 0.2 0.4 0.6 0.8 1 km

Figure 1: Site Overview
Escarpment Extended Mine Project

Scale:	1:23610
Coordinate System:	EPSG:2193
Reference:	
Date:	13/7/2026
Size:	A4
Project #:	J-NZ0433
Figure:	
Revision:	Rev0
Prepared:	
Reviewed:	

Mine Waste Management accepts no liability and gives no representation or warranty, express or implied, as to the information provided including its accuracy, completeness, reasonability or fitness for purpose. All information provided is to be used in accordance with any relevant Licence or Terms and Conditions and all applicable laws.

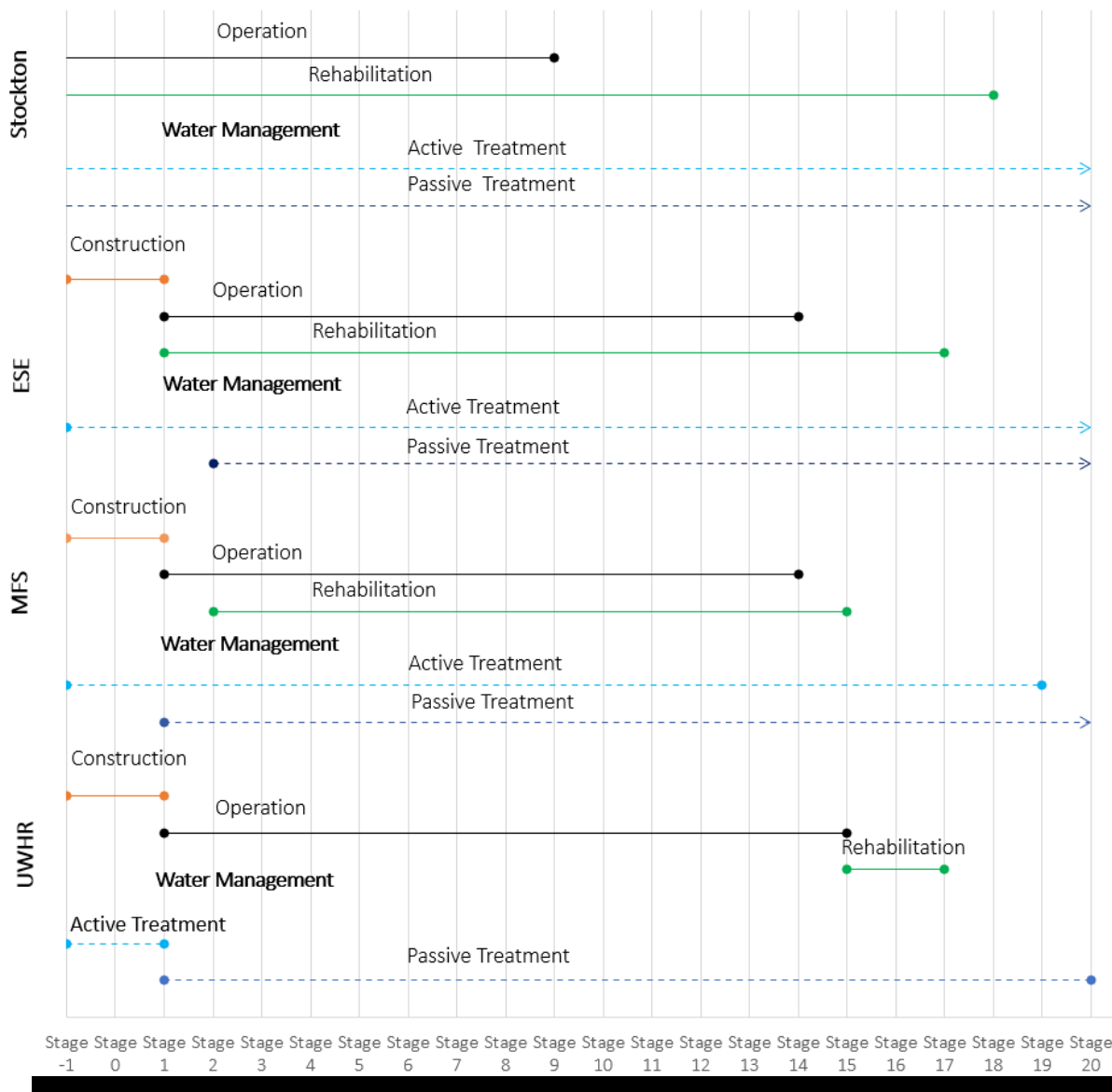


Figure 2: Project timelines (by stage and by indicative year).

Spatial progression of the ESE mine for the Operations Phase is indicated by Figure 3, with annual stage numbers showing progression.

Mining begins in the east portion of the site and initially progresses to the west. Mining of the northwest and southern areas are completed last. Progressive backfilling and rehabilitation will occur during the Operations Phase, with backfill placement within the mined-out voids and in the construction of ex-pit ELF's.

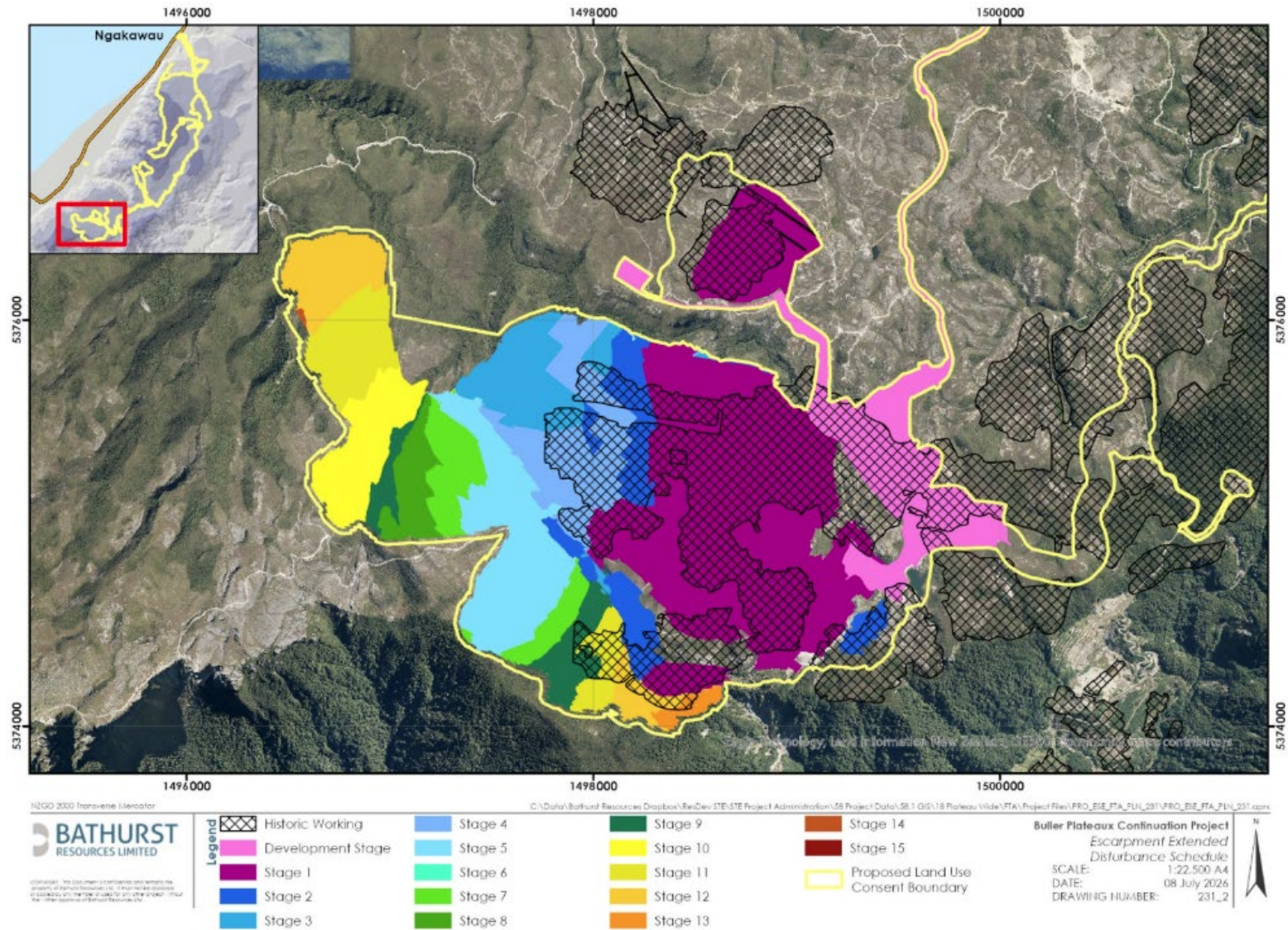


Figure 3: Mine schedule at Escarpment Extended.

1.3 Proposed Compliance Monitoring

1.3.1 Compliance Monitoring Locations

Four compliance monitoring locations are proposed for the ESE sub-area. Two further monitoring sites (within the Cascade Creek Catchment) were selected for performance monitoring. Details of each of these monitoring sites are included in Table 1. The locations are depicted in Figure 1.

Table 1: ESE proposed compliance monitoring locations.

MONITORING LOCATION	RECEIVING WATERWAY	SITE CLASSIFICATION	RECEIVING WATERS
W07	Rapid Stream	Compliance Monitoring	NSUL ELF. Background catchment above Rapid Stream.
KEL	Whareatea River	Compliance Monitoring	All mining activities via WTP. Discharge from WWH Sump. Background catchment above Whareatea River.
V62	V62 Stream	Compliance Monitoring	Western arm of ESE pit (CON area). Background catchment above V62 Stream.
M-M1	V8 Creek	Compliance Monitoring	Lake Brazil discharge. Background catchment above V8 Creek.
V37_F	V37 Creek	Performance Monitoring	Small portion of haul road and background catchment at southern end of site.
V37_G	V37 Creek	Performance Monitoring	Mining at southern end of ESE pit. Background catchment above headwater of V37 Creek.

1.3.2 Proposed Water Quality Limits

Proposed guideline values have been developed by RMA Science (Hickey, 2026) for the following categories:

- Metals – These include guideline values that are adjusted by toxicity modifying factors (TMFs), including pH, hardness, and Dissolved Organic Carbon (DOC). Guideline values were developed for chronic and acute exposure periods, and are to be applied as follows:
 - o Chronic exposure – guideline value to be compared to annual median water quality.
 - o Acute exposure – guideline value to be compared to annual 95th percentile (P95) water quality.
- Turbidity – These are site specific. Where turbidity criteria are related to an increase compared to background (baseline levels), background turbidity was modelled using the background source term for TSS described in Section 3.3.2 and converted to turbidity as described in Section 3.3.3.

These limits were used to screen model results described in Section 5. The full suite of water quality limits are provided in Appendix B.

1.4 Report Structure

The remainder of this report is structured as follows:

- Section 2 provides an overview of planned water management at ESE.
- Section 3 describes the WLBM, including model framework and inputs.
- Section 4 describes how the model was evaluated, including Quality Assurance/Quality Control (QA/QC) checks and model calibration.
- Section 5 presents the key model results.
- Section 6 summarises the report findings and recommendations.

Report limitations are provided in Appendix A.

2 MINE WATER MANAGEMENT OVERVIEW

2.1 Overview

The following catchments will be influenced by the proposed ESE mine with a total disturbance footprint of 460 ha:

- Rapid Stream Catchment
- Cascade Creek Catchment
- Whareatea River Catchment

MIW from the majority of the area disturbed by ESE will report to the Whareatea River Catchment to maintain the rivers flows. Water reporting to Rapid Stream Catchment comprises runoff and seepage from the NSUL ELF, whilst the affected catchment reporting to Cascade Creek is a relatively small area to the east of the ESE pit footprint. During some stages of the Operations Phase of the mine, in-pit water discharges to the Cascade Creek Catchment via V37 Creek will occur. A portion of treated water from the WTP will also be discharged to Cascade Creek via V8 stream.

During the Operations Phase and Active Closure Phases, the mine water management strategy developed for ESE is as follows (Figure 4):

- Limit ingress of clean water into the mine pits during operations with clean water diversions.
- Limit migration of ESE MIW via underground workings by construction of the Ex-Pit Seal, intercepting eastward flowing workings that normally discharge to Cascade Creek catchment. This ensures any seepage from in-pit ELFs is contained.
- Capture AMD from underground workings in active pit sumps for treatment.
- Collect MIW in sumps and pump to the WTP, allowing for bypass of sumps up to 5% of the time for a given year (i.e., ~18 days per year), and spilling up to 5% of the time for years when bypass infrastructure is not in place.
- WTP discharges to the Whareatea River, and Cascade Creek via V8 Creek.
- Progressively rehabilitate ELFs.
- Where practicable, ELF runoff will discharge directly to waterways once rehabilitation has achieved suitable water quality, nominally two years after final rehabilitation with site specific monitoring to confirm.
- As soon as practicable, utilise MSRs to passively treat ELF seepage.

During the Post Closure Phase (Figure 5), active treatment will cease, and ELF seepage will be treated with MSRs, and runoff from the rehabilitated final landform will discharge to receiving waterways, through sediment management structures where needed. Water management planning includes provision to convey water from CON polishing pond to V37 Creek until water quality objectives are met to release water to V62 Stream.

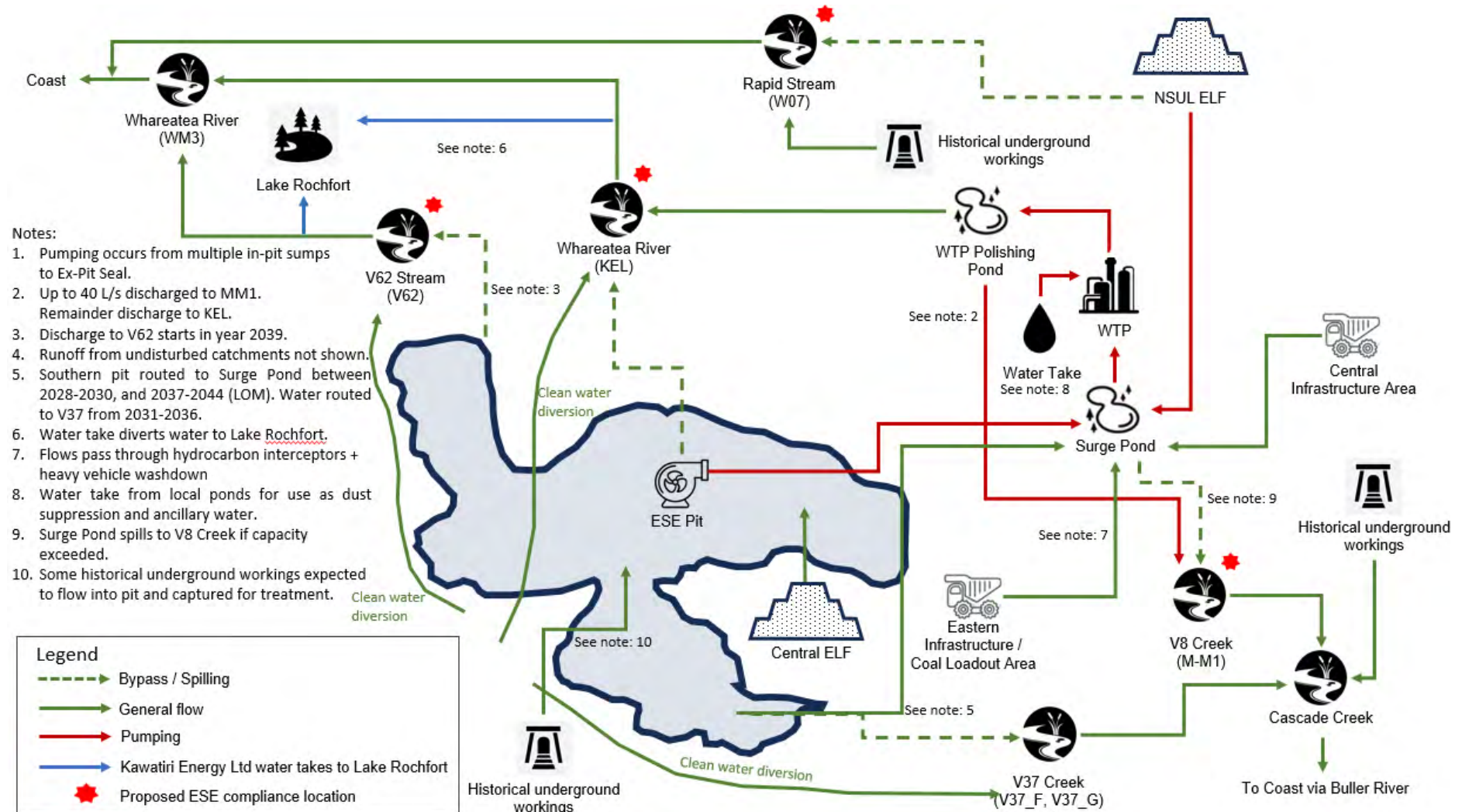


Figure 4: Water balance flow diagram – Operations and Active Closure Phase.

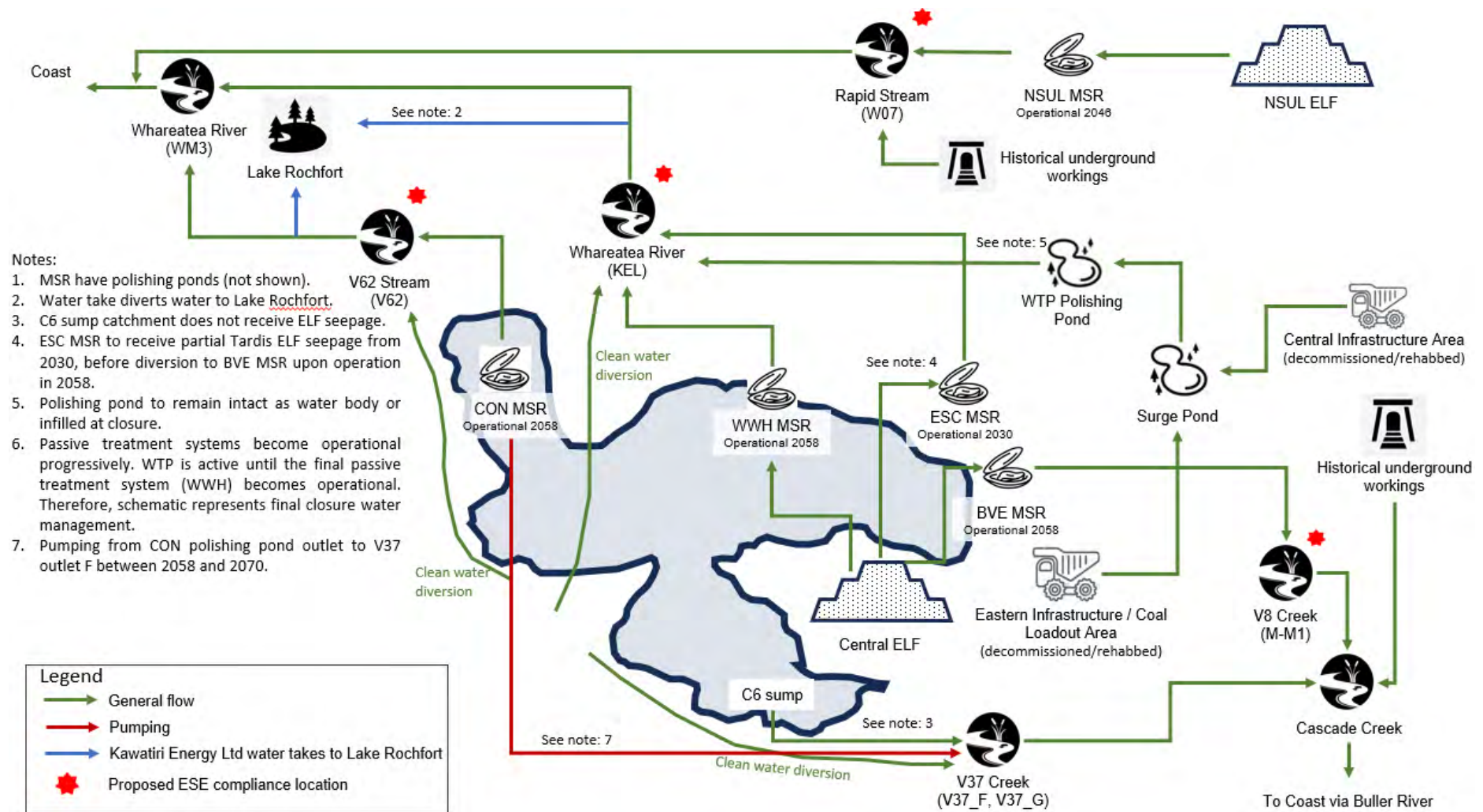


Figure 5: Water balance flow diagram – Post Closure Phase.

2.2 In-pit Water Management

Operational in-pit water will include the following elements:

- MIW will be collected in sumps and gravity fed or pumped to the WTP Surge Pond. Water management at the WTP is described in Section 2.7.
- Mine infrastructure will be designed to facilitate high flow discharge events (sump bypass or spilling) up to 5% of the time. Discharge events will be facilitated by either bypass mechanisms or from pit sump spilling, as described below in order to protect infrastructure during high rainfall events where:
 - o A bypass mechanism will be constructed for each sump to bypass flows above a specified percentile during high rainfall events. The bypass mechanism is represented by the schematic in Figure 6. For some sumps, the bypass mechanism will not be active for all years due to pit geometry constraints.
 - o Where a bypass mechanism is not operational for a particular sump, spilling may occur, with pumping rates configured to allow this to occur up to approximately 5% of the time (Figure 7). It is noted that mine infrastructure will be designed to avoid spilling where a bypass mechanism is implemented for a sump. As such, spilling mechanisms and bypass mechanisms do not occur concurrently.
- The mined-out pit will be progressively backfilled with mined rock, creating ELF. Underdrains will aid collection of ELF seepage.
- The in-pit sumps will be constructed to enable gravity water collection during the mine Operations Phase.

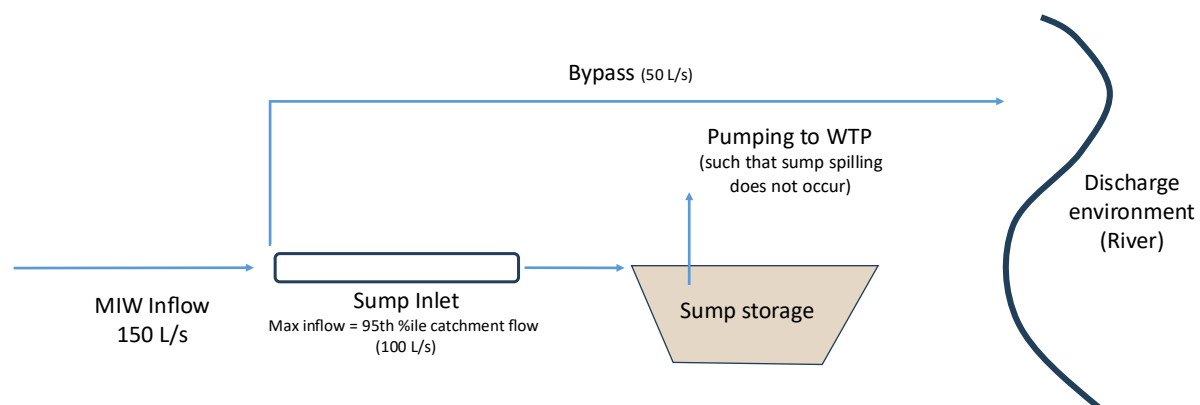


Figure 6: Bypass mechanism example.

Note: Flow rates in schematic are indicative only and do not represent model outputs.

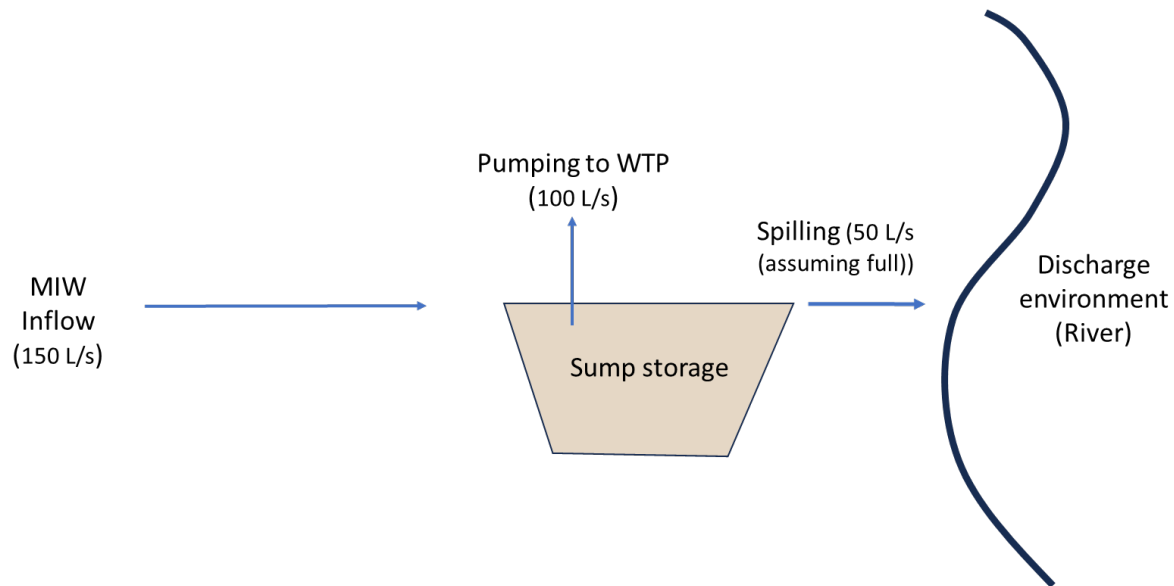


Figure 7: Spilling mechanism example.

Clean water diversions will be developed to minimise the amount of water reporting to the active pits by capturing all upstream water, and therefore reduce the amount of MIW produced, including:

- Cutoff drains along the southern highwall will direct clean water into V37 Creek.
- Cutoff drain along the western highwall will direct clean water into V62 Creek.
- A pipeline, then surface channel, will convey upstream clean water back into Conglomerate Creek.

Operational water management infrastructure will be maintained following completion of mining until full rehabilitation of the final landform has been completed, and water discharge quality meets compliance criteria through use of passive treatment. Once the Post Closure Phase begins and active water treatment has finished, CON sump and WWH sump will act as polishing ponds for MSRs, receiving inflows from MSR discharge, and surface runoff from rehabilitated mine areas (i.e., ELF's, coal floor, highwalls).

2.3 Infrastructure Areas

During the Operations Phase and Active Closure Phase, all runoff from Eastern Infrastructure and Coal Loadout Area and the Central Infrastructure Area will be directed to the Surge Pond for treatment. Sediment control structures will be emplaced to prevent uncontrolled release of sediment to the environment.

During the Post Closure Phase these areas will be rehabilitated and discharge under gravity to the (now full) Surge Pond or directly to receiving waterways.

2.4 Engineered Landforms

ESE includes six ELF's. At the Operations Phase, the ELF's (except for NSUL) join to become the Central ELF. The individual ELF's and associated basal catchments, are indicated in Figure 8.

The ELF's will be constructed with the following aspects to minimise the generation of AMD (BRL, 2026):

- Clean water diversion
- Bottom-up build with short lifts (2-5 m) to minimise segregation, with higher lifts possible if grainsize segregation does not occur and advective oxygen ingress is prevented.
- Traffic compaction on top of each lift.
- Progressively rehabilitated.
- The final landform surface will be constructed and profiled to a rehabilitation angle of 18 degrees.
- ELF heights will vary between 20 to 60 m.
- Where possible, ELFs will be developed in-pit to minimise lateral oxygen ingress where mine rock is placed against pit walls.
- A basal drainage network will be established under the ELFs to collect and convey seepage flows for treatment.
- It is expected, based on previous studies that the ELF construction will result in a 10 m thick (horizontal) outer oxidising zone. Deeper than 10 m, the ELF will be under sub-oxic conditions.
- Cover systems will be constructed as part of rehabilitation to further reduce AMD generation.

In-pit ELF runoff and seepage will be collected and managed as part of In-pit water management (see Section 2.2), while Ex-pit ELFs will have their own dedicated sump for collection of MIW. Prior to full rehabilitation at each ELF, runoff from ELFs will be collected in sumps, conveyed, and treated at the WTP; once desilting is complete, runoff will be diverted directly to waterways.

Initially, ELF seepage will be collected in either in-pit or ex-pit sumps and conveyed to the Surge Pond for treatment. Sub-ELF basal catchments that control where ELF seepage will be collected from are shown in Figure 8. As ELFs are fully rehabilitated and solute loads decay to acceptable levels, ELF seepage will be treated with MSRs. The switch from active treatment to passive treatment occurs for some ELFs during the Operations Phase (see Section 2.8 for further details).

2.5 Rehabilitation

Both in-pit and ex-pit ELFs will be progressively rehabilitated, which includes emplacement of a non-acid forming (NAF) cover over any potentially-acid forming (PAF) waste rock. Topsoil is then placed atop the NAF cover, and vegetation planting, vegetation direct transfer (VDT) or hydroseeding is undertaken to establish a vegetation cover to stabilise the surface. The intention of the cover system is to limit ingress of water and oxygen into the ELF, reduce potential constituents of concern (PCOC) loads from ELF runoff and seepage, and provide a growth medium for the planting. Where practicable, runoff from rehabbed ELFs will be diverted directly to receiving waterways once suitable ground cover is established from the vegetation. Sediment ponds may be installed at the toes of the ELFs or along drainage benches to minimise sediment discharge.

Runoff from rehabilitated portions of an ELF will initially be collected for active treatment (sediment), or where practicable, treated via sediment control structures, until suitable vegetation cover and soil armouring occurs and runoff from rehabilitated areas is suitable for discharge to the receiving environment. BRL estimate this suitable vegetation cover and soil armouring process to take approximately two years following placement of rehabilitation material (BRL pers. comm. email dated

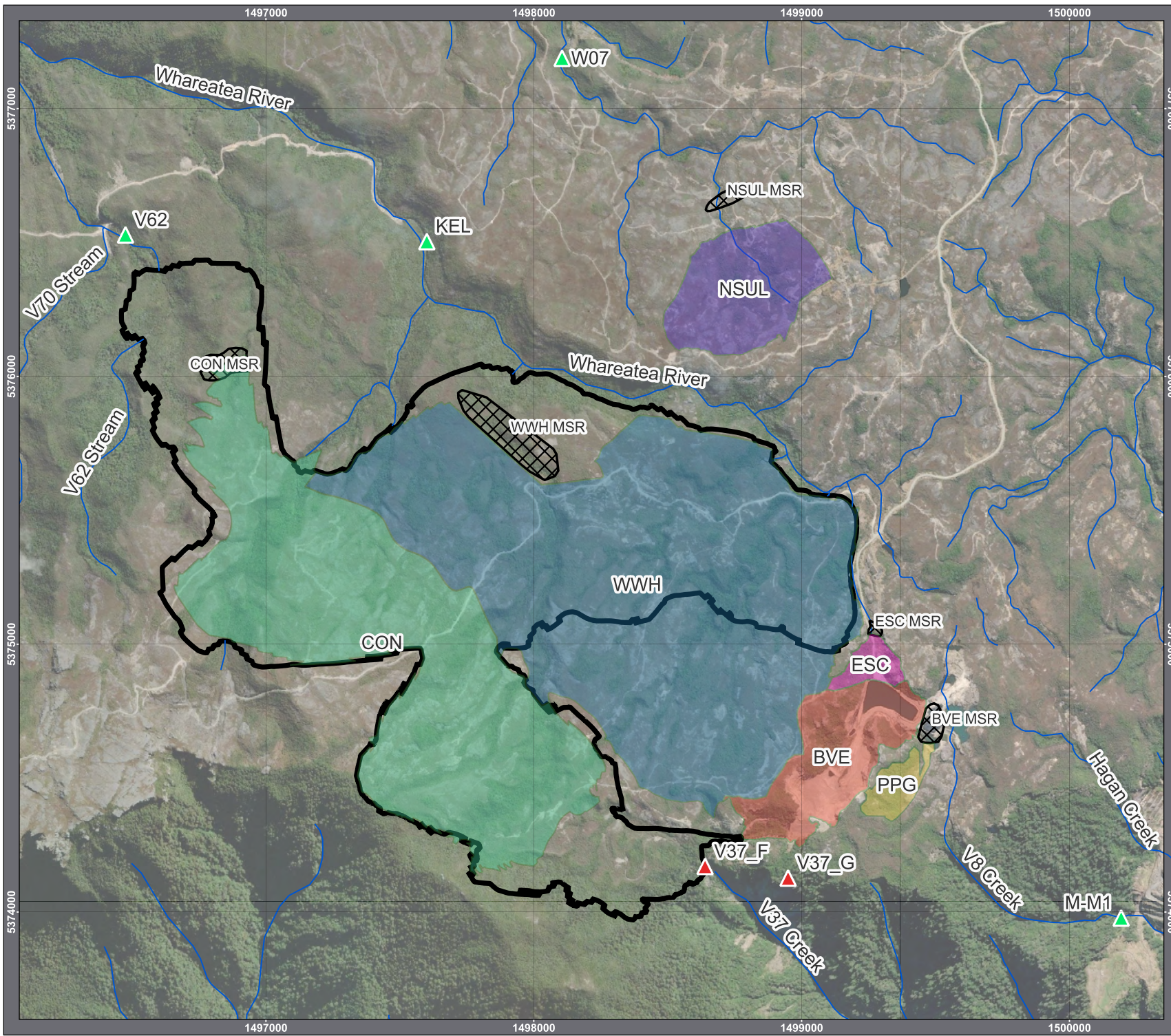
14 May 2025). ELF rehabilitation as defined in this report refers to the year rehabilitations works are complete and soil armouring (assumed as two years) is complete. Table 2 indicates the rehabilitation year for each ELF.

Table 2: ELF rehabilitation completion year.

ELF NAME	REHABILITATION YEAR
WWH	2044
CON	2044
BVE	2031
ESC	2029
PPG	2044
NSUL	2046

Notes: ^aPPG seepage does not have a designated MSR and is directed to BVE (Section 2.8).

Rehabilitation of hardstand areas, such as infrastructure areas, coal stockpile pad, roadways and highwalls, will be undertaken in a similar manner, reducing the risk of erosion and sedimentation in waterways.



LEGEND

- ▲ Compliance Locations
- ▲ Performance

EOML seepage catchments

- BVE
- CON
- ESC
- NSUL
- PPG
- WWH
- MSR
- Waterways (EOML)
- Pit Extent

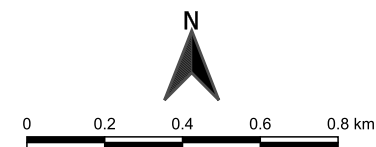


Figure 8: Sub-ELF Basal Catchments
Escarpment Extended Mine Project

Scale: 1:19424
Coordinate System: EPSG:2193
Reference:
Date: 13/7/2026
Size: A4

Project #: J-NZ0433
Figure: 8
Revision: 1
Prepared: [Redacted]
Reviewed: [Redacted]

Mine Waste Management accepts no liability and gives no representation or warranty, express or implied, as to the information provided including its accuracy, completeness, timeliness or fitness for purpose. All information provided is to be used in accordance with any relevant Licence Agreements terms and Conditions and all applicable laws.

2.6 Sullivan NAF ELF Water Management

The NSUL ELF comprises NAF waste rock. Water management will differ between phases.

Operations Phase water management for NSUL comprises the following elements:

- Construction of a sump to collect runoff and seepage from the ELF.
- Pumping of the sump collection water to the WTP Surge Pond for treatment.
- Installation of a bypass mechanism for > 95th percentile flows discharging from the sump to Rapid Stream. Compliance will be monitored at W07 (Figure 1).

Following completion of rehabilitation works for NSUL at the end of the Operations Phase, the water management will include the following elements:

- Installation of a MSR to treat seepage, and cessation of pumping from the sump to the WTP.
- Treated seepage to be released from the passive treatment system to Rapid Stream.
- Rehabilitated ELF Runoff routed directly to Rapid Stream below NSUL.

2.7 Active Water Treatment

The WTP will treat for TSS and metals, and provide pH adjustment. It will be fed from the Surge Pond (Ex-Pit Seal capacity 240,000 m³), which will provide flow buffering. The WTP capacity will be designed to minimise spilling from the Surge Pond directly to the environment.

The WTP key elements include:

- Pontoon mounted pumps in the Surge Pond (Ex-Pit Seal) for plant feed.
- Lime silo for CaO powder delivery, and slurry preparation tank and dosing systems.
- Lamella thickeners and flocculant dosing for removal of suspended solids.
- Flocculant mixing tanks and dosing plant.
- Chemical chelation to reduce dissolved metals concentrations.
- pH correction processes.
- Treated water sump/polishing pond.
- Sludge de-watering equipment.

Treated water from the WTP will discharge into a polishing pond, prior to discharge to receiving waters. Up to 40 L/s of treated water will be pumped to V8 Creek (indicated in Figure 4). The remainder will be discharged to the Whareatea River. This allows maintenance of residual flows to both the Whareatea River and Cascade Creek catchments.

2.8 Passive Water Treatment

Once ELF seepage water quality is able to be suitably treated through use of passive treatment, then passive treatments systems will become the primary method of treatment.

MSRs were selected as the passive treatment technology. They only treat ELF seepage, because surface water from rehabilitated areas can be directly discharged to the environment and sediment can clog the MSR leading to reduced permeability and hence water treatment capacity. Polishing ponds are placed (or else utilise existing sumps) at the outlet of MSRs, to settle any precipitates, and provide capacity for further treatment of some PCOCs.

Five MSRs will be constructed, with their activation years provided in Table 3; locations are shown in Figure 8. WWH and CON MSRs receive the vast majority (~80-85%) of ELF seepage, including all in-pit ELF seepage. The BVE and ESC MSRs receive seepage from the Ex-Pit ELF catchments. As indicated in Table 3, the ESC MSR initially treats seepage from the ESC and BVE seepage catchments. When the BVE MSR becomes active in 2058, the BVE seepage catchment will be diverted to the BVE MSR, which ultimately discharges to V8 Creek and into the Cascade Creek catchment.

Table 3: MSR details.

MSR	EOML SURFACE CATCHMENT AREA ¹ (ha)	ELFs REPORTING TO MSR	MSR ACTIVATION YEAR	RECEIVING CATCHMENT ³
WWH	169.5	WWH	2058	Whareatea River catchment [KEL]
CON	112.8	CON	2058	Whareatea River catchment [KEL]
BVE	25.6	BVE, PPG ²	2058	Cascade Creek catchment [M-M1]
ESC	25 ^a / 3.2 ^b	ESC, BVE	2030	Whareatea River catchment [KEL]
NSUL	21.2	NSUL ²	2046	Rapid Stream [W07]

Note: ¹Catchment area progressively increases over time as backfill is emplaced. Provided values indicate maximum catchment areas at EOML.

²NAF ELF.

³Brackets indicate compliance monitoring locations in receiving catchment.

a. ESC MSR initially captures seepage from both BVE and ESC seepage catchments.

b. When BVE MSR becomes operational (2058), the BVE seepage catchment is diverted to BVE MSR.

3 **MODEL DESCRIPTION**

3.1 **Model Framework**

3.1.1 *Model Overview*

The WLBM was built to mechanistically model the proposed water management system at ESE. Hydrological, geochemical, and operational processes that influence water quality and quantity on site are represented in the model and calibrated against historic monitoring data, where available. Some inputs to the model are derived directly from empirical data, while others (where appropriate) were adopted from literature / technical studies. The model can be used to evaluate factors that affect water management at the site. This information can then be used to make decisions on the design and operation of the AMD and water management system, and the related impacts on discharge water quality.

The ESE sub-area was divided such that each surface water catchment has a unique flow path and source term. The model is driven using daily rainfall and potential evapotranspiration (PET). Daily rainfall was used to estimate flow volume for each defined catchment. Runoff coefficients were used for disturbed areas, based on land cover type to determine runoff as a fraction of precipitation, while runoff from undisturbed catchment areas was modelled using the Australian Water Balance Model (AWBM) by Broughton (2004). The application of the AWBM is described further in Section 3.2.4.

The load balance is based on a mass balance approach and calculates loading rates by assigning source terms that are either concentrations (e.g., mg/L), or constant loads (e.g., kg/day/ha) to the flows calculated in the water balance and generates water quality projections for both onsite and downstream locations. A decay factor for some of the source terms was also applied after closure.

Mechanisms that are represented in the model included:

- Runoff from undisturbed catchments.
- Runoff from mine domains (e.g., pit voids, ELFs, etc.).
- Seepage from ELFs.
- Collection and conveyance of MIW water including bypass and spill mechanisms.
- Loading rates generated from source terms (both from constant concentrations and constant loads).
- Mixing parameters (conservative) and calculation of concentrations in each flow path.
- Sedimentation rates for partial TSS treatment within sumps.
- Parameter load changes through active and passive treatment.
- Effects on downstream water quality (for both acute and chronic exposures).

Model prediction nodes were selected to output model results for key compliance and performance monitoring locations (see Section 1.3.1 for further details):

- KEL (Whareatea River)
- V62 (V62 Creek)
- W07 (Rapid Stream)
- V37_G (V37 Creek)
- V37_F (V37 Creek)
- M-M1 (V8 Creek)

3.1.2 Model Platforms

The ESE WLBW was developed by building the water balance component to estimate flows. The load balance component was then built, utilising the generated flows in the calculation of loads.

The water balance model was developed using GoldSim (GoldSim Technology Group, 2021) and is currently updated for use in Version 15.0 R2 (#257). GoldSim is a dynamic system modelling software package commonly used for simulating mine water balances. The load balance model was developed with the use of Python programming language within the Jupyter Notebook environment, which completes dilution and mixing calculations for the flow values generated from the GoldSim Model.

3.1.3 Timescale

The model is run on a daily time step for the period 01/01/2028 to 31/12/2143. The time scale and mine phase definitions are provided in Table 4.

Active mining at ESE is assumed to cease at the end of 2040, with closure activities complete by the end of 2043. As such, the simulation timeframe accounts for approximately 100 years post-closure.

Table 4: ESE model timescale and mine phases.

MINE PHASE	YEARS (inclusive)	ACTIVITIES
Construction Phase	2028-2029	Construction of ancillary infrastructure and use of portable water treatment plants until the main ESE WTP is established in the second year of the Construction Phase.
Operations Phase	2030-2040	Active mining and/or rehabilitation works underway. Active treatment occurring at the WTP and operation of a limited number of MSRs.
Active Closure Phase	2041-2043	Active mining has ceased. Construction of post-closure infrastructure. WTP continues with limited operation of MSRs.
Post Closure Phase	2044-2143	Active treatment ceases and all ELF seepage treated with MSR.

3.1.4 Model Scenarios

The model has been built to accommodate multiple scenarios to understand impacts to the environment based on changes to model inputs. A total of five model scenarios were applied to the model that

incorporate variability in hydrologic conditions and ELF geochemical source terms, as summarised in Table 5. Climate inputs for scenarios are described further in Section 3.2.2.2.

Table 5: Summary of model scenarios.

MODELLED SIMULATION	HYDROLOGY	ELF SEEPAGE SOURCE TERMS	PURPOSE
Base Case	2019 rainfall applied back-to-back as approximation of average rainfall conditions.	Typical	Applied and evaluated at all model nodes, forming basis of the model assessment.
Scenario 1 (see Section 3.2.2.2)	2021 rainfall applied back-to-back as approximation of wet year rainfall conditions.	Typical	Assess maximum MIW discharges and related potential effects to the receiving environment in terms of flow rates and water quality, for any given year in the simulation.
Scenario 2 (see Section 3.2.2.2)	Stochastic realisation of rainfall.	Typical	Evaluates hydrological variability and related potential effects, particularly for the Post Closure Phase.
Scenario 3	Average annual, as per Base Case.	+30%	Evaluates higher loading rates from ELF seepage to downstream environment and the associated in-stream water quality.
Scenario 4	Average annual, as per Base Case.	-30%	Evaluates lower loading rates from ELF seepage to downstream environment and the associated in-stream water quality.

3.2 Water Balance Inputs

3.2.1 Model Structure

The water balance model structure comprises the following:

- Delineation of sub-catchments. A proportion of each sub-catchment was assigned a land use type (e.g., undisturbed, ELF, active pit).
- Each sub-catchment was assigned a catchment area. These were set as annualised catchment areas for model simplicity.
- Flow paths were specified for each sub-catchment and for directed flows between model domains as indicated by the water management strategy.
- Nodes representing proposed downstream compliance locations were simulated to calculate flows at these nodes.

3.2.2 Climate Inputs

3.2.2.1 Base Case Model

BRL provided a patched historical rainfall record for the Lake Brazil Meteorological Station, with available data spanning 25/01/2013 to 31/12/2023. Where data gaps exist, the Stockton Office meteorological station data were used to fill these by BRL. Potential evaporation (PE) was calculated based on Lake Brazil Meteorological Station patched climate data by MWM (2026b). For modelling purposes, PE was assumed to be similar to PET. Together, these data are henceforth referred to as the 'Project Climate Dataset'.

The Base Case model scenario utilised the 2019 rainfall year from the Project Climate Dataset, with 5,449 mm recorded over that year (illustrated in Figure 9) and with data provided by BRL, aligns with an approximate 50th percentile annual exceedance probability. This aligns with average annual rainfall conditions from the dataset (~5.5 m rainfall). The daily rainfall data for this year was repeated for every year in the Base Case model simulation.

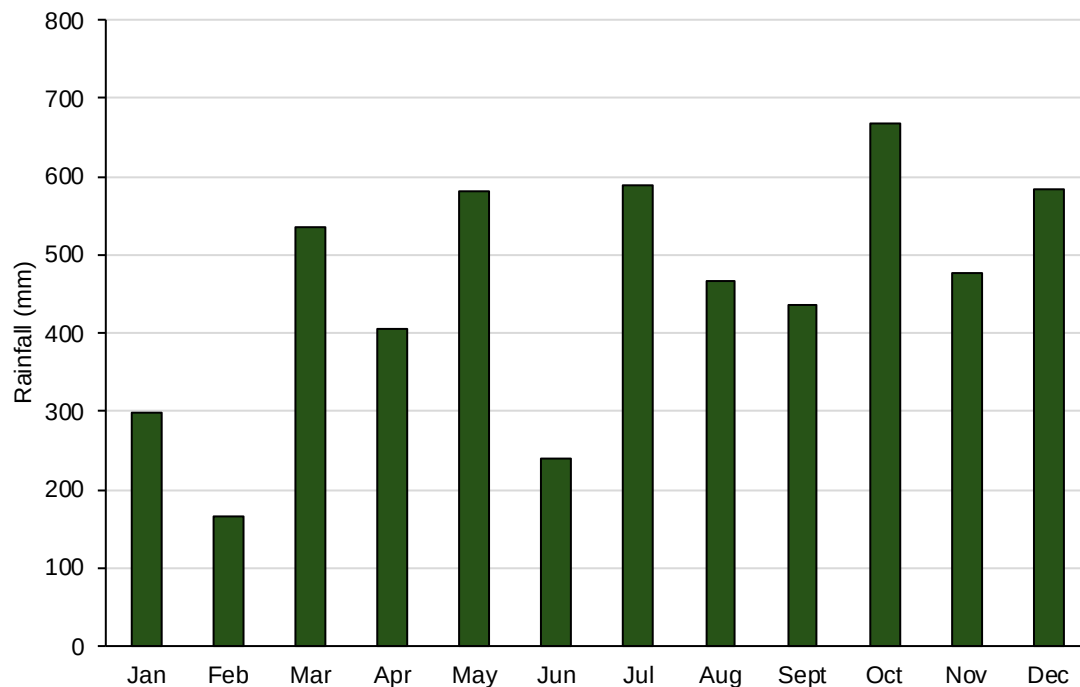


Figure 9: 2019 monthly rainfall data.

Climate change was implemented in the model using a precipitation multiplication factor that was applied to the generated precipitation timeseries. The multiplication factor represents a 9% increase in rainfall between the model start year (2028) and 2100. This was based off climate change projections for New Zealand (Ministry for the Environment, 2018), utilising the RCP 6.0 scenario. PET was not adjusted due to PET being a small proportion of the climatic energy balance (MWM, 2026b). The climate change function (Figure 10) represents a uniform relative increase in rainfall, whereby almost 6 m of rainfall is simulated from 2100 onwards.

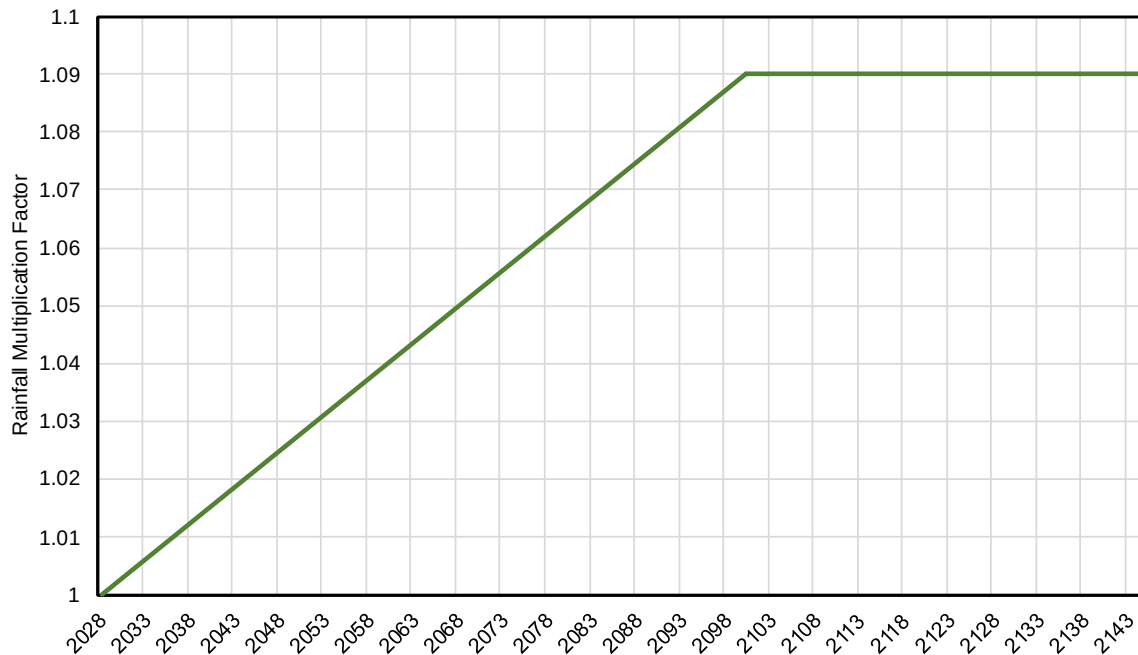


Figure 10: Climate change function.

Source of climate change predictions: Ministry for the Environment, 2018, Table 11, West Coast Hokitika, rcp 6.0

Increase of annual precipitation applied directly to the rainfall dataset with the assumption this is more conservative than the 1986–2005 time series referenced by Ministry for the Environment (2018)

3.2.2.2 Variable Rainfall Scenarios (Scenario 1 and 2)

Scenario 1

Scenario 1 was developed to test the influence of a high rainfall year occurring at any time throughout the simulation period, as opposed to consecutive 'wet' years occurring throughout the simulation period. The year 2021 was selected as it included the highest total annual rainfall in the available Project Climate Dataset. It also included a major rainfall event in July that resulted in regional flooding.

The scenario was implemented by applying the 2021 rainfall record for every year in the simulation, whilst applying the climate change function to increase rainfall in the long term. No other model parameters were altered from the Base Case.

Total rainfall from the 2021 rainfall year was 6,619 mm, 21% higher than the average rainfall year (2019). Figure 11 compares the monthly rainfall distribution between 2019 (Base Case) and 2021.

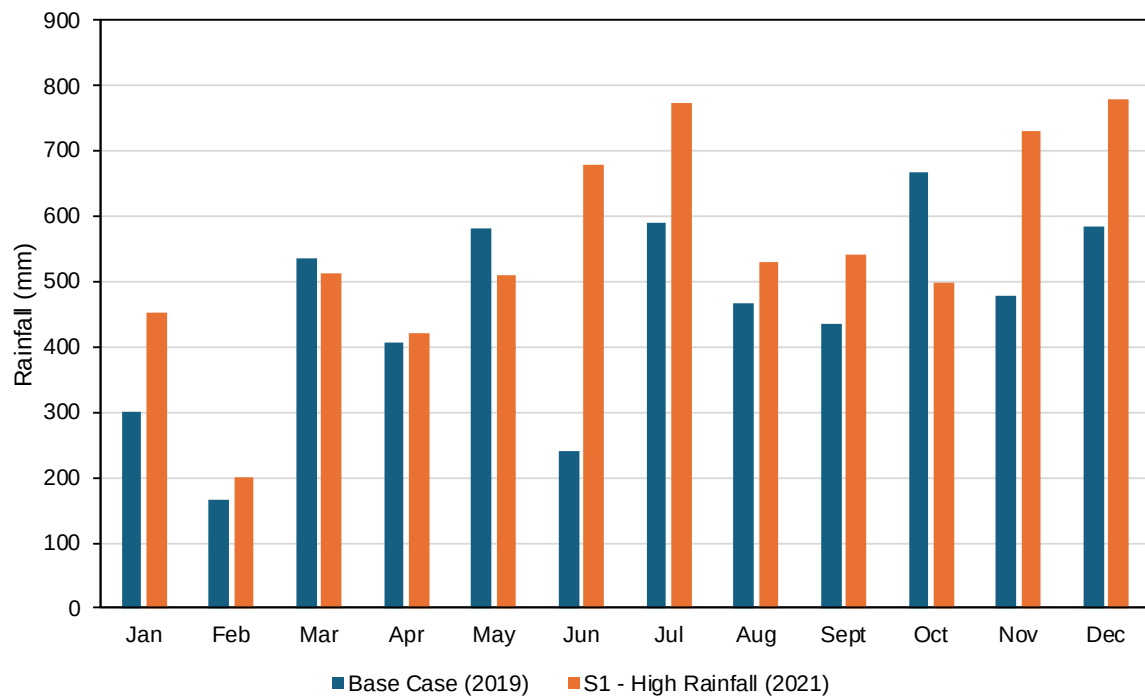


Figure 11: Monthly rainfall comparison.

In comparing the base case annual rainfall to Scenario 1 rainfall, the following comments are made:

- Rainfall was higher in 75% of months in 2021.
- The three highest rainfall months in 2021 exceeded 700 mm. These were July, November, and December.
- Significantly lower rainfall was measured in February 2021 (~200 mm), however, even less was measured in February 2019.

Scenario 2

Scenario 2 incorporates a stochastically generated rainfall time series, developed using statistical parameters derived from the Project Climate Dataset through use of the Stochastic Climate Library v2.2.0 (CRC for Catchment Hydrology, 2006). This approach allows for the representation of background variability in rainfall patterns while maintaining realistic long-term averages and is more representative of long-term rainfall sensitivity than Scenario 1. The annual rainfall for each year of the stochastic rainfall series is illustrated in Figure 12.

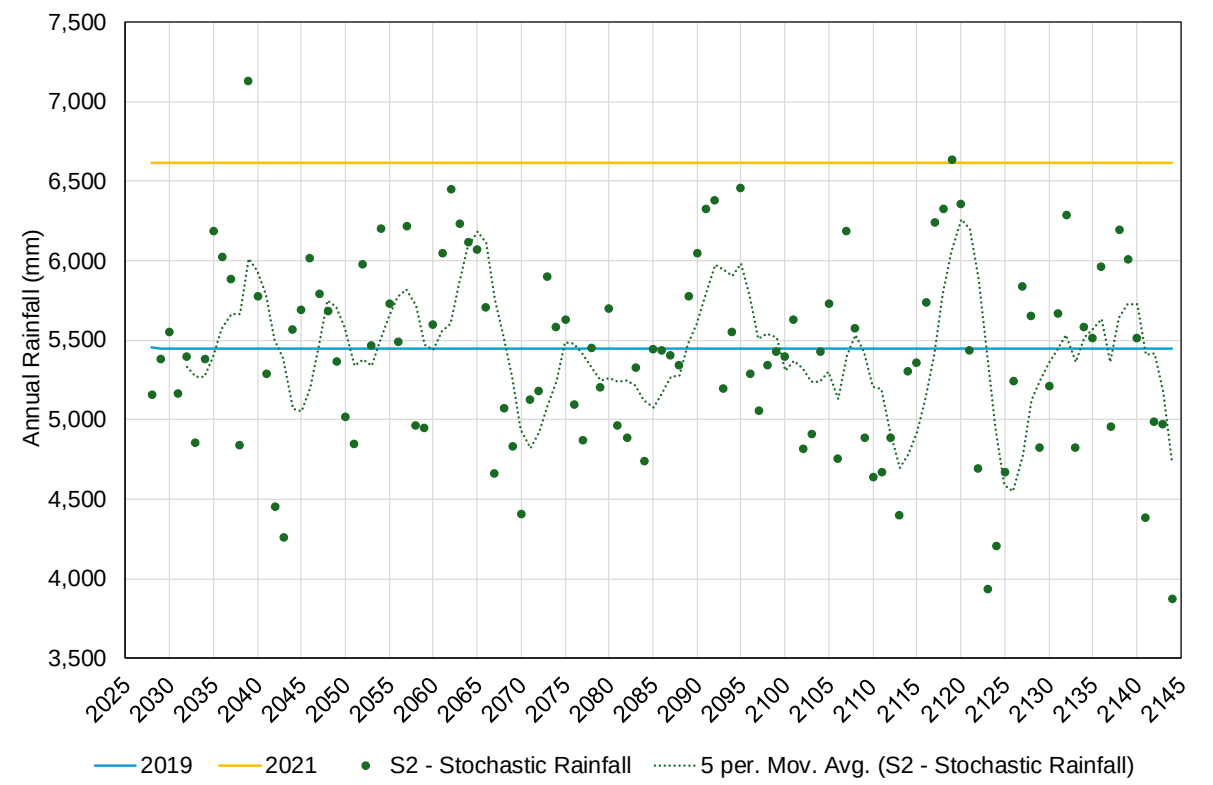


Figure 12: Scenario 2 - stochastic rainfall timeseries.

Notes: Stochastic rainfall timeseries indicated in figure does not include modelled effects of climate change.

2019 and 2021 annual rainfall amounts indicated for reference.

3.2.2.3 Rainfall Statistics

This section relates the input rainfall data for each scenario to high intensity rainfall events and anticipated annual return intervals to provide context for the scale of rainfall events included in model scenarios. Prolong dry periods are also examined.

High Intensity Rainfall

Table 6 describes the rainfall frequency results of Stockton Office Met Station for 24-hour rainfall accumulation, as described in Chater (2024). As per communications with BRL, the Stockton Office Met Station results present similar results to the Lake Brazil rainfall frequency, typically within 5% for the 24-hour accumulation period. In addition, adjustments are made in Table 6 to account for climate change based on Ministry for the Environment (2018). The 2101-2120 period (taken as the closest reporting period to that of the end of the modelled period) presents predicted rainfall frequency results as described in Table 6.

Table 6: Summary table of Stockton Office Met Station 24-hour rainfall frequency results.

RETURN PERIOD	STOCKTON OFFICE MET STATION 24 HR ACCUMULATION (mm) ¹	PERCENTAGE CHANGE FOR 1°C TEMPERATURE INCREASE ³	24 HR ACCUMULATION BASED ON A PREDICTED INCREASE OF TEMPERATURE OF 2.31°C (mm) ⁴
2 years	256.0	7.2	298.6
2.33 years (mean annual)	271.0	7.2	316.1
5 years	333.9	7.8	394.1
10 years	385.1	8.1	457.2
20 years	434.1	8.2	516.3
50 years	497.6	8.4	594.2
100 years ²	545.2	8.6	653.5

Notes: 1 – Source: Chater (2024).

2 – Indicative: see Chater (2024) for further details.

3 – Taken from Table 13, Ministry for the Environment (2018). Note: this takes the most likely percentage change.

4 – Taken from Table 14, Ministry for the Environment (2018).

High intensity 24-hour periods represented within the model are tabulated in Table 7, noting the model runs on a 24-hour timestep. These values include climate change adjustment on the basis of an increase in annual precipitation (see Section 3.2.2.1).

Table 7: Maximum observed 24-hour rainfall within the modelled scenarios.

	MAX. MODELLED 24 HR RAINFALL (mm)	APPROXIMATE HISTORIC RETURN PERIOD	APPROXIMATE CLIMATE ADJUSTED RETURN PERIOD
Base Case	192.9	< 2 years	< 2 years
Scenario 1 (2021)	264.4	2.33 years	< 2 years
Scenario 2 (Stochastic)	529.3	100 years	20 years

Comparison of the modelled maximum 24-hour rainfall values (Table 7) with the climate change adjusted rainfall frequency data indicates the Base Case and Scenario 1 do not model a significant 24-hour high intensity rainfall event, whilst Scenario 2 models an event that is close to a 1 in 20 year return period. This highest 24-hour rainfall values for Scenario 2 occurs in during the Post Closure Phase (2058 to 2143) in year 2098. During the Active Treatment Phase (2028 to 2057), Scenario 2 models a 394 mm event within the year 2035 (close to 1 in 10-year return period based on the unadjusted rainfall frequency data).

Long Term Dry Periods

Long term dry periods, defined as the maximum number of consecutive days of < 1 mm of 24-hr rainfall accumulation for the Project Climate Dataset and modelled rainfall are tabulated Table 8. The Base Case and Scenario 1 rainfall had lower consecutive dry days, but Scenario 2 did have a dry period longer than observed in the Project Climate Dataset. During the Active Treatment Phase (2028 to 2057), Scenario 2 models a 37-day dry period within the year 2042. The 41-day dry period occurs within the Post Closure Phase of Scenario 2 in 2121.

Table 8: Maximum periods of consecutive dry days.

MAX. CONSECUTIVE PERIOD OF DRY DAYS	
Project Climate Dataset	32 ¹
Base Case	10
Scenario 1 (2021)	13
Scenario 2 (Stochastic)	41

Notes: Dry days have been defined as observing less than 1 mm of rainfall over 24 hours

1 - Occurred between February and March of 2013.

Overall, Scenario 2 included the strongest climatic extremes, effectively 'stress testing' the model for high intensity rainfall events and prolong dry periods.

3.2.3 Catchment Delineations

For modelling purposes, the project area and its surroundings were divided into catchment areas. Baseline catchments (representing current / pre-mining conditions) were determined by MWM using LiDAR derived elevation data and are illustrated in Figure 13. BRL provided the mine post-closure catchments, as illustrated in Figure 14. Modelled catchment areas are included in Appendix C.

A comparison of current catchment areas compared to final landform catchments is summarised in Table 9. V37_F and V37_G were omitted from Figure 13 and Table 9 as no catchment reports to these locations during baseline conditions i.e., they are not waterways. Topographic contours and satellite imagery suggest V37 Creek receives water from overland flow paths in the vicinity of the southern extent of the mine. However, whilst the water management indicates V37 Creek will receive mine water via V37_F and V37_G outlets, the creek itself is not included in the model because there are no model nodes (such as compliance monitoring locations) within or downstream of V37 Creek.

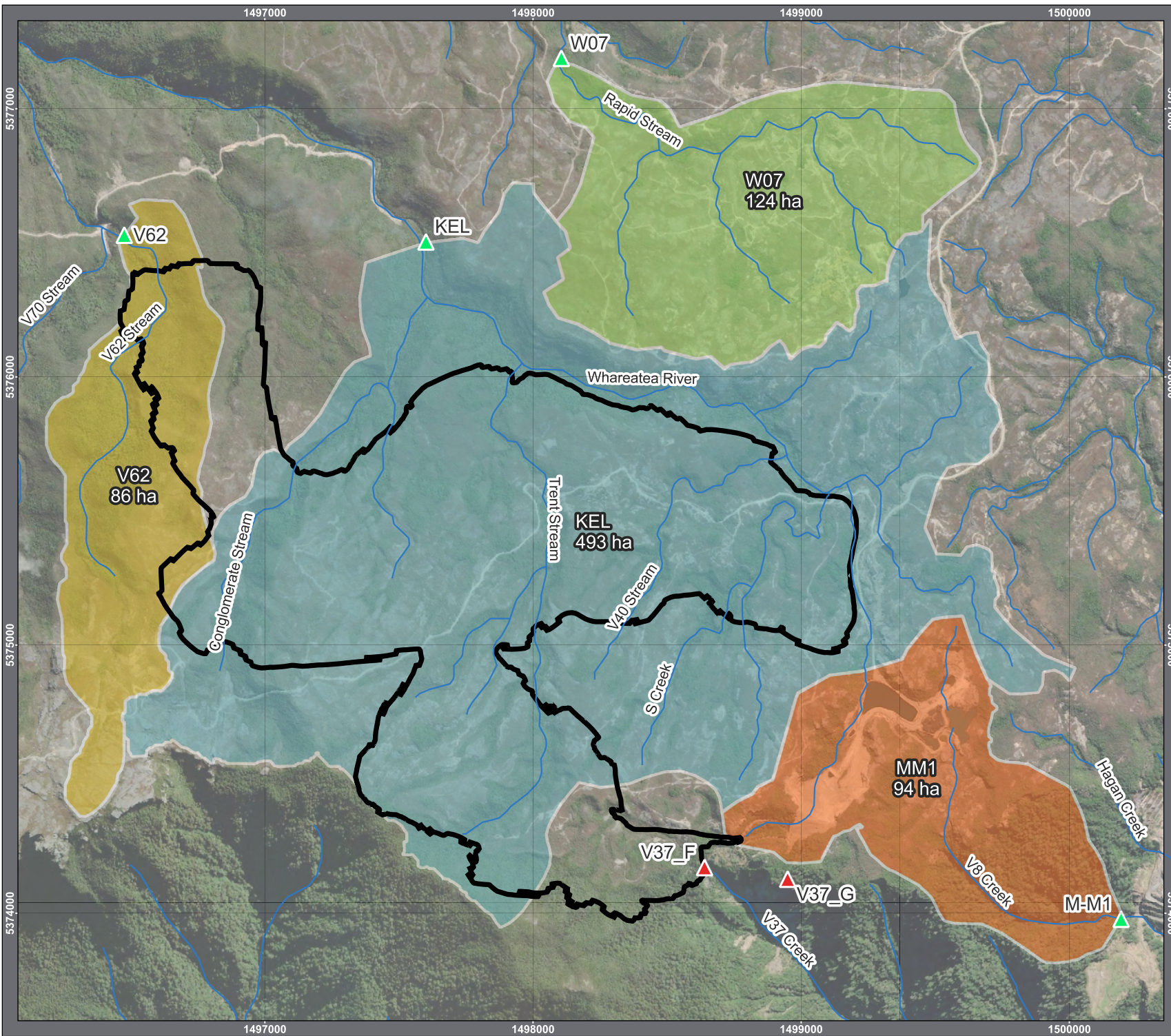
Table 9: Catchments areas (baseline and final landform).

COMPLIANCE MONITORING LOCATION	BASELINE AREA (ha)	FINAL LANDFORM AREA (ha)	CHANGE COMPARED TO BASELINE
KEL	493	482	-2%
V62	86	133	+55%
W07	124	124	0%
M-M1	94	51	-46%

The following is noted regarding Table 9:

- Minimal to no reduction in surface catchment areas are noted for KEL and W07.
- The catchment area reporting to V62 increases by about a third.
- The catchment reporting to M-M1 reduces by almost half. This is a result of a significant portion of the original M-M1 catchment reporting to KEL.

Whilst the change in surface catchment areas can provide an indication of changes in flows, these changes in flows are not directly proportional as they do not account for seepage catchments, historic underground workings, or the change in runoff and percolation rates which are anticipated to change following disturbance of the natural ground.



LEGEND

Monitoring Locations

- ▲ Compliance
- ▲ Performance
- Pre-mining Waterways
- ▭ Pit Extent

Baseline catchments

- KEL
- V62
- MM1
- W07

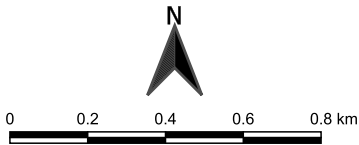


Figure 13: Baseline Catchments
Escarpment Extended Mine Project

Scale: 1:19424
Coordinate System: EPSG:2193
Reference:
Date: 9/2/2026
Size: A4

Project #: J-NZ0433
Figure: 13
Revision: 0
Prepared: [Redacted]
Reviewed: [Redacted]

Mine Waste Management accepts no liability and gives no representation or warranty, express or implied, as to the information provided including its accuracy, completeness, reasonableness or fitness for purpose. All information provided is to be used in accordance with any relevant Licence Agreements, terms and conditions and all applicable laws.

3.2.4 Background Area Runoff

Simulation of runoff from background areas was based on application of the AWBM. The model describes surface runoff to a specific location as a combination of rapid runoff and slower baseflow. The model is forced using precipitation and PET timeseries and requires the following parameters:

- Soil storage capacities (C1, C2, C3): these represent different soil storage capacities of different soil types within the catchment. These are represented in the WLBM as 2, 4, and 90 mm, respectively and were calibrated to observed data (see Section 4.2).
- Fractional Areas (A1, A2, A3): represent the proportion of the catchment area corresponding to each soil storage capacity. These are represented in the WLBM as 0.134, 0.433, and 0.433 respectively. These values were not part of the calibration routine (held fixed), as is typical for calibration of the AWBM.
- Baseflow Index (BFI): represents the proportion of total runoff provided from baseflow. This is represented in the WLBM as 0.05 and was calibrated to observed data (see Section 4.2).
- Recession Constants (Ks, Kb): are the recession constants for surface flow and baseflow respectively, which control the rate at which water drains from soil or sub-surface storages to runoff. This is represented in the WLBM as 0.07 and 0.84, respectively and were calibrated to observed data (see Section 4.2).

Vegetation stripping/soil catchments are modelled the same as background catchment areas. As such, these areas also adopt the AWBM to calculate runoff.

3.2.5 Pit Voids

Runoff generated from pit voids (walls and floor) was simulated by applying a high runoff coefficient of 0.9 to the daily rainfall timeseries (assumed infiltration and flow attenuation to be negligible). The remaining 10% of rainfall is therefore assumed to be lost to evaporation. Rehabilitation of these areas was assumed to not materially change the runoff characteristics of these areas (i.e., coefficient was fixed for the whole simulation).

3.2.6 Hard Stand and Haul Roads

Runoff generated from hard stand areas and haul roads was simulated within the model by applying a high runoff coefficient of 0.8 to the daily rainfall timeseries (assumed infiltration and flow attenuation to be negligible). The remaining 20% of rainfall is therefore assumed to be lost to evaporation. Rehabilitation of these areas was assumed to not materially change the runoff characteristics of these areas (i.e., coefficient was fixed for the whole simulation).

3.2.7 Engineered Landforms

ELFs have been modelled to simulate surface runoff and seepage. Surface runoff was calculated based on a runoff coefficient applied to the daily rainfall timeseries. ELF seepage was simulated with GoldSim reservoir elements where inflows were driven by the daily rainfall timeseries and a net percolation coefficient (proportion of rainfall infiltrating into the mine waste material), while outflows were set such that a small proportion of the volume within the reservoir element was discharged. Table 10 describes these model inputs.

Table 10: ELF model parameters.

PARAMETER	REHABBED ELF	UNREHABBED ELF	RATIONALE
Runoff coefficient	0.45	0.35	Based on modelling results from MWM (2026b) and professional experience.
Net percolation	0.4	0.6	Based on modelling results from MWM (2026b) and professional experience.
Seepage recession coefficient	0.995	0.995	Set to allow seepage to be relatively steady, but with a minor degree of rainfall driven variability.

Net percolation was used to model basal sub-catchment flows, herein referred to as seepage, from the ELF's to the surface water network. Seepage rates were simulated using a GoldSim reservoir element, where outflow was calculated using a relatively high recession coefficient (see Table 10) to represent stable seepage.

Where ELF's are located in-pit, seepage flows into the MIW collection network via gravity, while major ex-pit ELF seepage flows are pumped into the water management circuit. During the Operations and Active Closure Phases, these waters are treated via the WTP. As the mine switches to passive treatment, seepage flows are directed through MSR's and their respective MSR polishing ponds. These are described in Table 3, which present ELF basal sub-catchments reporting to each MSR. The model assumes basal drainage network and lower permeability foundations, resulting in all ELF seepage being captured.

3.2.8 Underground Workings

Historical underground workings associated with the Whareatea Mine will be mined out during excavation of the ESE Pit. Several adits will be exposed along the highwall facilitating flow of AMD impacted water into the pit, which will be managed as outlined in Section 2.2. The majority of the remaining underground workings will be covered by placement of ELF's.

Flows were estimated using flow records from Escarpment Adit, which discharges to V37 Creek. The baseflow was calculated from the dataset following a sustained period (> 2 weeks) of minimal rainfall and stabilised flows. When covered by an ELF, the underground workings will not receive direct rainfall recharge. A flow rate per catchment area was then derived using the estimated underground workings catchment area (provided by BRL) associated with the Escarpment Adit baseflow discharge. Details are included in Table 11.

Table 11: Underground workings flow rate calculation.

ESCARPMENT ADIT BASEFLOW (L/s)	ASSOCIATED CATCHMENT AREA (ha)	BASEFLOW FLOW RATE PER HECTARE (L/s/ha)
0.17	3.25	0.052

Notes: Catchment area provided by BRL, pers. comm., 29 January 2025.

The underground workings flow rate per catchment area was used to estimate flows entering the pit during the Operations Phase. After this point, it was assumed that any underground flow would be dominated by the overlying ELF seepage flowing through the workings.

3.2.9 MIW Infrastructure

High flows are managed at collection sumps with bypass mechanisms or spilling mechanisms at different times. Details included in the model are provided within this section.

3.2.9.1 Sump Bypass Mechanism

Bypass trigger rates are defined as the flow rate above which the bypass mechanism is triggered.

Bypass trigger rates were iteratively refined through the modelling process such that bypass occurred no more than 5% of the time for the Base Case scenario. These bypass trigger rates were changed as required for Scenario 1 and Scenario 2 modelling to maintain bypass occurrences of less than 5% of the time for smaller catchments (V62 Stream and V37 Creek). However, WWH Sump bypass trigger rates were unchanged compared to the Base Case as Whareatea River flows were sufficient to dilute higher bypass rates to achieve water quality objectives. WWH sump bypass trigger rates were reduced significantly from 2039 onwards to coincide with diversion of rehabilitated ELF runoff, thus significantly reducing the total water reporting to the sump.

Adopted values for the Base Case scenario are summarised in Table 12. The NSUL sump bypass trigger was set to a constant value of 120 L/s.

Table 12: Adopted sump bypass trigger rates (Base Case).

	WWH	CON ¹	ESC ²
2028	-	440	64.3
2029	*	440	80.1
2030	*	440	96
2031	-	440	**
2032	-	440	**
2033	1,600	440	**
2036	1,600	440	**
2037	1,600	440	380
2038	1,600	440	375
2039	320	440	370
2040	320	440	348
2041	320	440	362
2042	320	440	362
2043	320	440	363
2044	320	440	0
2045	220	440	0
2046	220	303	0
2058	220	303	0

Note: All values are in units of L/s.

- WWH Sump spills to Whareatea River.

* Spilling from WWH Sump is conveyed to the WTP Surge Pond.

** No bypass active in over these years; sump spills to V37.

The table assumes linear interpolation where years are not indicated.

¹Bypass trigger rate increased by 35% for high rainfall and stochastic rainfall scenarios, compared to Base Case.

²Bypass trigger rate increased by 35% for high rainfall scenario, compared to Base Case.

3.2.9.2 Sump spilling mechanism

Sumps and voids were modelled within GoldSim using reservoir elements with designated capacities and simulating incoming and outgoing water. Spilling occurred in the model where the bypass mechanism is unavailable and sump storage capacity is exceeded, with spill water routed as indicated in the flow diagrams (Figure 4 and Figure 5). The sump and void capacities are indicated in Table 13.

Table 13: Void water capacities (m³).

VOID	CON SUMP	WWH SUMP	ESC SUMP	C12 SUMP	NSUL SUMP	SURGE POND
2028	-	1,000	-	5,000	-	240,000
2029	-	45,887	-	5,000	-	240,000
2030	-	2,161,928	-	-	10,000	240,000
2031	-	529,157	-	-	10,000	240,000
2032	-	79,432	-	-	10,000	240,000
2033	-	705,295	-	-	10,000	240,000
2034	-	846,296	-	-	10,000	240,000
2035	-	846,296	-	-	10,000	240,000
2036	-	846,296	871,306	-	10,000	240,000
2037	-	846,296	911,314	-	10,000	240,000
2038	-	846,296	1,139,701	-	10,000	240,000
2039	96,759	846,296	247,221	-	10,000	240,000
2040	35,943	846,296	670,814	-	10,000	240,000
2041	35,943	846,296	670,814	-	10,000	240,000
2042	35,943	846,296	670,814	-	10,000	240,000
2043	35,943	846,296	670,814	-	10,000	240,000
Post-closure	35,943	846,296	670,814	-	10,000	240,000

Notes:

- indicates void does not exist during that model year.

C12 = Catchment 12

Orange indicates sump spills internally (ultimately to WTP Surge Pond) during this model year.

Blue indicates sump spill to the environment during this model year.

Green indicates sump bypass mechanism is active during this model year.

Surge Pond designed to spill to environment if capacity exceeded, however infrastructure isn't designed to spill ~5% of time as per other spill mechanisms.

Pumping was also modelled within the various in-pit sumps by assigning maximum pumping rates (adjusted annually). Similarly, the WTP treatment capacity was simulated by assigning a maximum treatment capacity for every year. As such, pumping is simulated, so long as water is available.

3.2.9.3 Sump Pumping and WTP

Surge Pond, WTP, and Polishing Pond

The Surge Pond is represented with a 'Pool' element, with the only outflow being water pumped to the WTP or spilling that occurs when the capacity is exceeded. The WTP was set to pump from the Surge Pond up to a maximum defined rate (635 L/s for the Base Case). If there was insufficient water within the Surge Pond, then the actual simulated withdrawal rate was lowered to meet the available volume (i.e., all water is removed from the sump). The maximum WTP capacity adopted was 635 L/s from the

start of the simulation (2028) through to the end of the Active Closure Period (2057). After this the WTP pumping capacity was set to zero and the Surge Pond floods and becomes a flow through water body.

WTP discharge was routed to the Polishing Pond, and then if water volume was available, up to 40 L/s was pumped to MM1 (V8 Creek). Any remainder was allowed to flow into KEL.

Any overflow from the Surge Pond spills to M-M1. Under Base Case conditions this did not occur, but under the rainfall scenarios (Scenario 1 and Scenario 2) this pathway became active on occasion under high inflow conditions.

Sumps

Sump pumping rates varied by year to account for changes in catchment area reporting to each sump. Adopted maximum pumping rates were iteratively refined (using the base case rainfall scenario) to achieve either (i) spilling up to approximately 5% of the time per year when bypass was not active, or (ii) no spilling occurred when bypass was active. Adopted values are summarised in Table 14.

Table 14: Adopted maximum sump pumping rates (Base Case).

YEAR	WWH	CON	ESC	NSUL
2028	520	0	0	0
2029	300	0	0	0
2030	170	0	0	85
2031	280	0	0	90
2032	550	0	0	95
2033	400	0	0	110
2034	450	0	0	110
2035	480	0	0	110
2036	350	0	0	110
2037	360	0	84	110
2038	280	0	84	110
2039	150	135	84	110
2040	155	290	77	110
2041	150	290	77	110
2042	150	290	77	110
2043	155	290	77	110
2044	140	290	0	110
2045	140	290	0	110
2046	140	200	0	0
2057	400*	200	0	0
2058	0	200	0	0
2059	0	200	0	0
2064	0	200	0	0
2080	0	0	0	0

Note: All units are L/s. * This large increase in pumping to 'pump out' the MIW in the sump prior to the Post Closure Phase. The table assumes linear interpolation where years are not indicated.

3.2.9.4 MSRs

The Post Closure Phase sees pumping to the WTP and active treatment cease and a reliance on gravity fed passive treatment systems begin. Here, MSRs are set up to treat ELF seepage through use of an MSR and polishing pond. Where these can gravity feed to existing sumps, such as the WWH Sump, MSR discharge will report to these sumps for polishing. Where MSRs are located ex-pit, these will discharge to specifically constructed polishing ponds.

MSR details are provided in Table 3.

3.3 Load Balance Inputs

The load balance model was developed using the Python programming language within the Jupyter Notebook environment. The Python script used flow outputs from each mine domain generated from the GoldSim model. Ultimately, the load model simulates the transport of solutes through the model following the water balance flow paths.

The load model builds upon the structure of the water balance model to quantify the chemical composition and mass load of dissolved constituents throughout the site's water management system. The inflows of the water balance model are categorised into different groups based on their types for each catchment. Source terms, which are the chemical compositions of these water sources, are derived from historical geochemical assessment data or specific geochemical sub-models.

When multiple inflows converge into a single node of the water balance model, such as a pit sump, the chemical composition of the mixed water is calculated by blending the incoming flows based on their influx proportions. This mixed water can then flow to the next node in the water balance model, carrying its newly calculated chemical signature. By integrating flow rates from the water balance model with these calculated chemical compositions, the model also quantifies the total mass load for each constituent. This approach primarily simulates conservative mixing (dilution and enrichment); however, mass removal rates (or concentration adjustments) are applied at treatment nodes (WTP, MSRs, polishing ponds) to account for non-conservative behaviour. Additionally, the model incorporates simplified reactive logic to estimate pH based on the interaction between alkalinity and acidity (see section 3.3.7).

Water quality results at proposed monitoring points and key points are shown and discussed in Section 5 of this report.

3.3.1 *Source Terms*

The development of source terms is an essential aspect of the WLBM. Detailed descriptions are provided in the Source Term Report (MWM, 2026c), and this section summarises the development and approach used.

The key source-term approaches are listed below:

- Constant Concentration (e.g., mg/L) source terms: The concentration remains constant, so loads vary with the flow rate. This approach is used for background catchment, active pits, rehabilitated areas, ELF seepage and ELF runoffs (NAF and PAF).

- Constant Load (e.g., kg/day/ha): The concentration varies based on flow to achieve a constant load. Higher flow rates result in lower concentrations (more dilution), while low flow rates result in higher concentrations.
- Mixed Approach: Some source terms use a mixed approach. Constant concentrations are applied during the Operations Phase, and a constant load is applied from the Active Closure Phase onwards.

3.3.1.1 Background Catchment

The background catchment source term is assumed to have a constant concentration and represent the water quality originated by the background conditions of the catchment. This assumption is based on the observation that water quality changes are relatively small with flow rate variations. Consequently, the total load for this source term varies according to changes in flow.

Water quality data collected from the W-M2 monitoring location within the Whareatea River were used to derive the source term for background areas for the site. The source term is presented in Table 15. It is noted that Whareatea River does not receive drainage from historic underground workings.

Table 15: Source terms - Background catchment.

ANALYTE ¹	W-M2 CONCENTRATION
Acidity (mg CaCO ₃ /L)	4.2
Alkalinity (mg CaCO ₃ /L)	1.6
Calcium	0.47
Magnesium	0.47
Sodium	2.7
Potassium	0.26
Sulfate	4.9
Aluminium	0.14
Iron	0.15
Nickel	0.0006
Manganese	0.01
Chromium	0.0005
Cadmium	0.00003
Cobalt	0.0004
Copper	0.0006
Lead	0.0005
Thallium	0.0004
Zinc	0.005
Dissolved Organic Carbon (DOC)	3.6
pH (unitless)	4.9

Notes: ¹Units reported in mg/L unless otherwise noted.

3.3.1.2 Active Pits and Cuts (High walls), and active ELF Runoff

The active pit source terms represent the areas within the pit, such as coal floors, high walls, or cuts that release solutes. During operations, the water quality associated with the active pit areas is represented by two datasets derived from the Escarpment Mine (empirical analogue data) collected at the immediate completion of mining activities. Further details on the suitability of this source term are provided in the Source Term Report (MWM, 2026c) The implementation of these source terms uses a

function that applies a probabilistic flow splitting between two end-member conditions over a defined time range. Specifically, the function divides the total flow into two portions (“low” and “high”) following a normal distribution, then assigns the base water quality to one portion and the alternative source term (with higher concentrations) to the other. These are then recombined through a mixing process, producing a gradual transition between the two water quality end-members: one representing high flow conditions (sulfate ~100.1 mg/L) and the other representing higher concentrations associated with lower flow conditions (~121.5 mg/L). These are presented in Table 16.

Table 16: Source terms - Active pits.

ANALYTE ¹	AVERAGE PIT 3 WATER QUALITY ²	90 TH %ILE PIT 3 WATER QUALITY
	HIGH FLOW CONDITION	LOW FLOW CONDITION
pH	3.7	3.6
Acidity (mg CaCO ₃ /L)	44.4	54.5
Alkalinity (mg CaCO ₃ /L)	0	0
Calcium	19.0	29.0
Magnesium	2.63	3.11
Sodium	0.25	0.25
Potassium	10.2	10.2
Sulfate	100.1	121.5
Aluminium	4.41	5.39
Iron	0.835	1.28
Nickel	0.116	0.139
Manganese	0.210	0.255
Chromium	0.0036	0.0044
Cadmium	0.00011	0.00013
Cobalt	0.010	0.013
Copper	0.0029	0.0035
Lead	0.00025	0.00025
Thallium	0.00019	0.00023
Zinc	0.769	0.995
Dissolved Organic Carbon (DOC)	0	0

Notes: ¹Units reported in mg/L unless otherwise noted.

²Average Pit 3 water quality data was derived from February 2016 – November 2016 prior to the installation of the BV ELF MSR.

Data from MWM (2026c)

Post-closure these areas will be rehabilitated with some active pit and cut areas reverting to highwall or coal floor source terms. A separate source term has been developed to represent those conditions (sections 3.3.1.3 and 3.3.1.4). Therefore, during the Post Closure Phase, a rehabilitated source term is used for these surfaces. The following section provides further detail on the non-rehabilitated coal floor surfaces and their corresponding source term assumptions, as well as the source-term assumptions for the rehabilitated areas.

For runoff from active ELFs (during the Operations Phase), the High Flow Active Pit source term is applied.

3.3.1.3 Highwall Runoff

Separate source-terms for runoff from closure highwall surfaces were developed for different areas of the ESE mine, due to the spatial variation in sulfur contents of the highwall surfaces. Figure 15 indicates the various highwalls exposed at EOML that had source-terms developed.

The source-term development involved scaling PCOCs in proportion to sulfur weight percentage, except for pH. The source terms used in the model are presented in Table 17. Highwall ESE_6.2 comprises granite and is also known as the “Granite Highwall.”

These source-terms are based on a constant load (defined in Section 3.1.1), with the exception of ESE_6.2 (Granite Highwall) which is treated as a constant concentration source term.

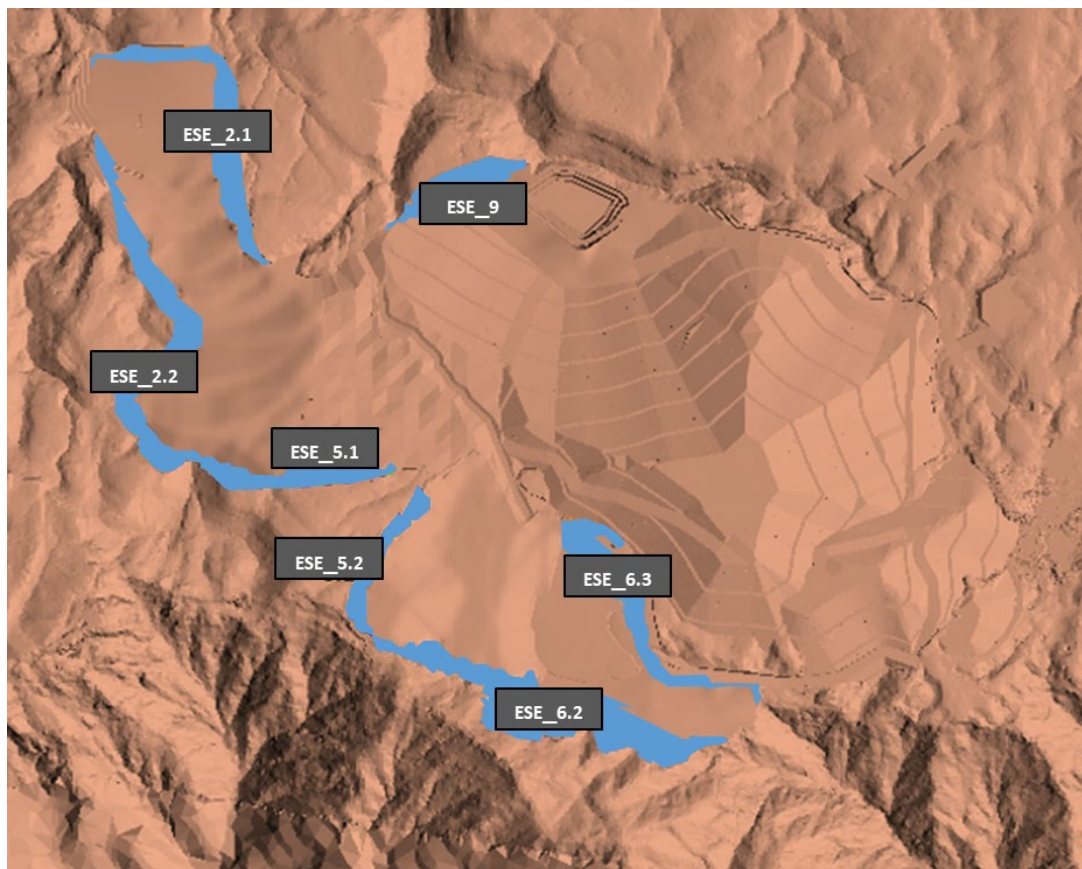


Figure 15: ESE Closure highwall areas.

Source: BRL email dated 10 March 2025 from Jon Gane. Highwall area names and colours adapted by MWM.

Table 17: Source terms - closure highwalls.

ANALYTE ¹	ESE_2.1	ESE_2.2	ESE_5.1	ESE_5.2	ESE_6.2 ²	ESE_6.3	ESE_9
UNITS	kg/ha/day	kg/ha/day	kg/ha/day	kg/ha/day	mg/L	kg/ha/day	kg/ha/day
Sulfur content (wt%)	0.21	0.20	0.32	0.49	0.19	0.34	0.33
Acidity	1.24	1.18	1.88	2.89	1.1	2.00	1.94
Alkalinity	0	0	0	0	41	0	0
Calcium	0.025	0.024	0.038	0.058	33.2	0.040	0.039
Magnesium	0.036	0.035	0.055	0.085	2.2	0.059	0.057

ANALYTE ¹	ESE_2.1	ESE_2.2	ESE_5.1	ESE_5.2	ESE_6.2 ²	ESE_6.3	ESE_9
UNITS	kg/ha/day	kg/ha/day	kg/ha/day	kg/ha/day	mg/L	kg/ha/day	kg/ha/day
Sodium	0.251	0.239	0.383	0.587	4.65	0.407	0.395
Potassium	0.043	0.041	0.065	0.100	1.2	0.069	0.067
Sulfate	1.42	1.35	2.16	3.31	27.6	2.30	2.23
Aluminium	0.070	0.066	0.106	0.162	0.33	0.113	0.109
Iron	0.087	0.083	0.133	0.204	0.402	0.141	0.137
Nickel	0.00048	0.00046	0.00074	0.00113	0.0025	0.00078	0.00076
Manganese	0.0020	0.0019	0.0030	0.0046	0.072	0.0032	0.0031
Chromium	0.000045	0.000043	0.000068	0.000105	0.00032	0.000073	0.000071
Cadmium	0.000011	0.000011	0.000017	0.000026	0.00008	0.000018	0.000018
Cobalt	0.00010	0.00010	0.00015	0.00024	0.00084	0.00016	0.00016
Copper	0.00025	0.00024	0.00038	0.00058	0.00075	0.00040	0.00039
Lead	0.00006	0.00005	0.00009	0.00013	0.0025	0.00009	0.00009
Thallium	0.00002	0.00002	0.00003	0.00005	0.00025	0.00004	0.00004
Zinc	0.0018	0.0017	0.0028	0.0042	0.00395	0.0029	0.0029
DOC	0	0	0	0	0	0	0
pH	3.8	3.8	3.8	3.8	6	3.8	3.8

Notes: ¹Units indicated do not include pH (unitless).

²Highwall ESE_6.2 is also referred to as the Granite Highwall.

3.3.1.4 Non-rehabilitated Coal Floors

Three coal floor areas will be left at closure as part of the ESE Project sub-area (Figure 16). Acid base accounting (ABA) data indicate that the net acid producing potential (NAPP) is low (e.g., low AMD risk) and that the ESC Pit coal floor will be NAF (MWM, 2026c).

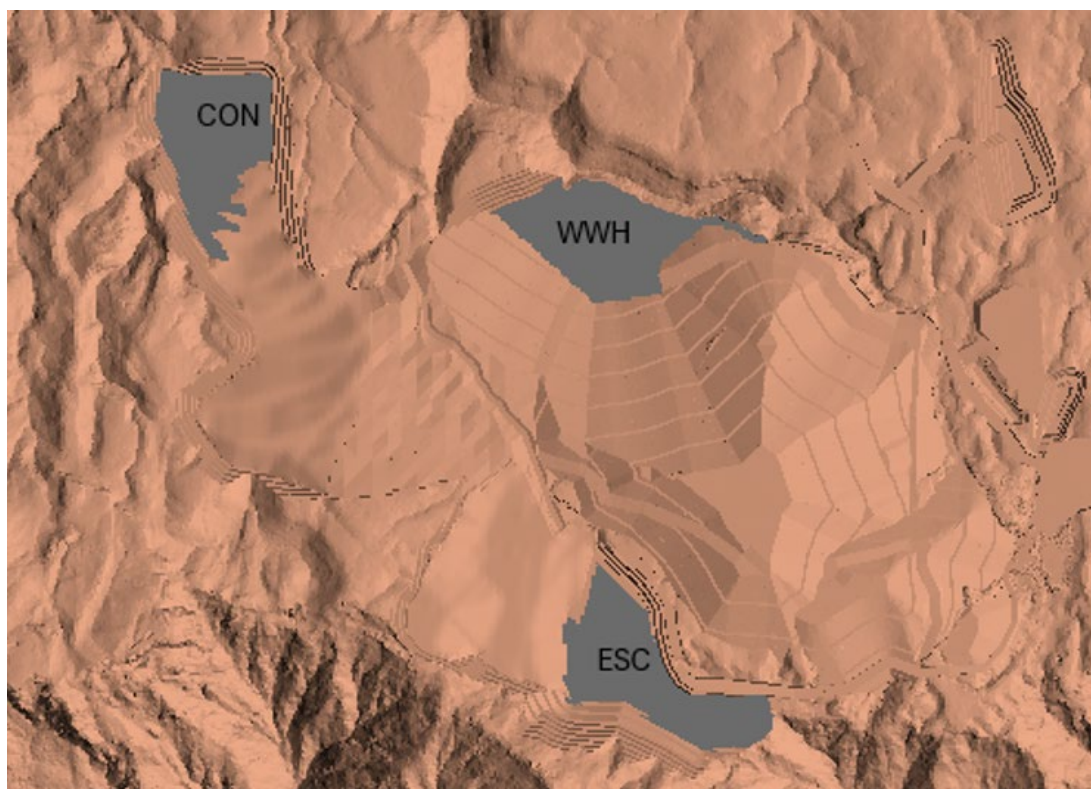


Figure 16: ESE closure coal floor.

Source: BRL email dated 10 March 2025 from Jon Gane.

The sulfur content was used to develop the source term for each coal floor using the same approach that was utilised for the highwalls (Section 3.3.1.3). Due to the ABA characterisation of these surfaces, the ESC coal floor required an adjustment for the non-acid forming nature of the material. Further detail is provided in the Source Term Report (MWM, 2026c).

The coal floor source terms were derived as constant loads. These are presented in Table 18.

Table 18: Source terms - coal floor.

ANALYTE ¹	CON	ESC	WWH
UNITS	kg/ha/day	kg/ha/day	kg/ha/day
Sulfur content (wt%)	0.23	0.04	0.26
Acidity	1.353	0.002	1.529
Alkalinity	0	6.18	0
Calcium	0.027	0.005	0.031
Magnesium	0.040	0.007	0.045
Sodium	0.275	0.048	0.311
Potassium	0.047	0.008	0.053
Sulfate	1.551	0.270	1.753
Aluminium	0.076	0.02	0.086
Iron	0.096	0.017	0.108
Nickel	0.00052	0.00009	0.00059
Manganese	0.0021	0.0004	0.0024
Chromium	0.00005	0.00001	0.00005
Cadmium	0.000009	0.000002	0.000010
Cobalt	0.00011	0.00002	0.00012
Copper	0.00027	0.00005	0.00031
Lead	0.00006	0.00001	0.00007
Thallium	0.000023	0.000004	0.000025
Zinc	0.0020	0.0003	0.0022
DOC	0	0	0
pH	3.8	5.81	3.8

Notes: ¹Units indicated do not include pH (unitless).

Decay rates were applied to closure highwall and coal floor surfaces following completion of closure activities (i.e., completion of highwalls and coal floors to their final closure form). The decay rate was applied using the following function derived from data presented in Pope et al., (2018):

$$\text{Equation 1:} \quad C(t) = C_0 \exp\left(\frac{F1}{F2}(1 - \exp(F2 * t))\right)$$

Where:

- C(t) = Concentration (or load) at year t
- C₀ = Initial concentration (or load, prior to decay)
- F1 = ln (1 - 0.26) (represents an initial 26% yearly decay)
- F2 = ln (1 - 0.05) (represents a 5% yearly decay applied to the 26%)
- t = time in years (with t = 0 representing surface closure year.)

All highwall and coal floor closure surfaces are planned (and therefore modelled) for completion starting 2042, with the exception of WWH coal floor (2046). It is at this stage that the source terms listed in Table 18 are used in the model. Prior to this, the active pit source term is used.

3.3.1.5 ELF Surface Runoff: Uncovered and Revegetated

The source term for uncovered (i.e., no topsoil/rehab) PAF ELF surfaces is presented in Table 19, and is based on Pit 3 (existing sump at Escarpment Mine) water quality. For covered and revegetated ELF surfaces, NAF water quality derived from column leach testing of low sulfur materials was used to derive the water quality (MWM, 2026c). This source term was also applied to NAF surfaces including rehabilitated hardstand and haul road areas post-closure. The source term is also included in Table 19.

Table 19: ELF surfaces source term.

ANALYTE ¹	PAF ELF SURFACES (UNREHABILITATED)	NAF / REHABILITATED SURFACES ³
UNITS	mg/L	mg/L
Acidity (mg CaCO ₃ /L)	44.4	4.2
Alkalinity (mg CaCO ₃ /L)	0	1.2
Calcium	19.0	0.5
Magnesium	2.63	0.5
Sodium	0.25	2.66
Potassium	10.20	0.29
Sulfate	100.1	1.8
Aluminium	4.41	0.15
Iron	0.835	0.15
Nickel	0.116	0.0006
Manganese ²	0.210	0.01
Chromium ²	0.0036	0.001
Cadmium ²	0.00011	0.000025
Cobalt ²	0.010	0.0004
Copper ²	0.0029	0.001
Lead	0.0003	0.0002
Thallium	0.00019	0.0004
Zinc	0.769	0.005
DOC	0	3.7
pH	3.7	4.9

Notes: ¹Units indicated do not include pH (unitless).

²Water quality data derived relationship with sulfate (MWM, 2026d).

³Includes rehabilitated hardstand areas and haul roads.

3.3.1.6 Hardstand and Haul Roads

Hardstand and Haul Road areas at ESE will be comprised of both NAF and PAF classified material. As such, two constant load source terms were derived (MWM, 2026c) to estimate water quality from runoff on these surfaces. These are presented in Table 20.

Table 20: Hardstand and Haul Road source term.

ANALYTE ¹	NAF HARDSTAND AND HAUL ROADS	PAF HARDSTAND AND HAUL ROADS
UNITS	kg/ha/day	kg/ha/day

ANALYTE ¹	NAF HARDSTAND AND HAUL ROADS	PAF HARDSTAND AND HAUL ROADS
Acidity	0.0015	1.53
Alkalinity	6.18	0
Calcium	0.0099	0.031
Magnesium	0.014	0.045
Sodium	0.10	0.31
Potassium	0.017	0.053
Sulfate	0.57	1.75
Aluminium	0.020	0.086
Iron	0.035	0.11
Nickel	0.00019	0.00059
Manganese ²	0.00078	0.0024
Chromium ²	0.000016	0.000051
Cadmium ²	0.0000033	0.000010
Cobalt ²	0.000040	0.00012
Copper ²	0.00010	0.00031
Lead	0.000023	0.000071
Thallium	0.0000082	0.000025
Zinc	0.00072	0.0022
DOC	0	0
pH	5.81	3.8

Notes: ¹Units indicated do not include pH (unitless).

²Water quality data derived relationship with sulfate (MWM, 2026d).

Concentration cap applied to cadmium and copper to ensure excessive concentrations are not artificially generated during very low rainfall events. The concentration cap aligns with the Active Pit source term (see Table 16).

3.3.1.7 Underground Workings

Underground workings that will drain into the ESE pit during operations were assigned a source term obtained from Escarpment Adit average water quality of adit discharge draining to V37 Creek. This approach assumes that the Escarpment Adit is a reasonable representation for water quality of underground workings at the ESE site. This was developed as a constant concentration source term and is presented in Table 21.

Table 21: Underground workings source term.

ANALYTE ¹	ADIT WATER QUALITY
UNITS	mg/L
Acidity (mg CaCO ₃ /L)	117.6
Alkalinity (mg CaCO ₃ /L)	0
Calcium	6.90
Magnesium	1.55
Sodium	2.60
Potassium	1.52
Sulfate	188.0
Aluminium	5.83
Iron	15.90
Nickel	0.03
Manganese ³	0.17

ANALYTE ¹	ADIT WATER QUALITY
UNITS	mg/L
Chromium ³	0.0020
Cadmium ³	0.00007
Cobalt ³	0.016
Copper ³	0.004
Lead	0.002
Thallium	0
Zinc	0.20
Dissolved Organic Carbon (DOC)	0
pH	3.07

Notes: ¹Units indicated do not include pH (unitless).

3.3.1.8 ELF Seepage

The estimation of seepage water quality from the ELFs is described in the MWM (2026e) report and is used as an input for the ESE WLBM.

Sulfate concentrations are derived based on the amount of material, sulfur content, and spatial area of each ELF. The concentrations of other elements are derived from their relationship to sulfate; therefore, the patterns are similar for all elements. Sulfate and acidity concentrations from the ELFs are shown in Figure 17.

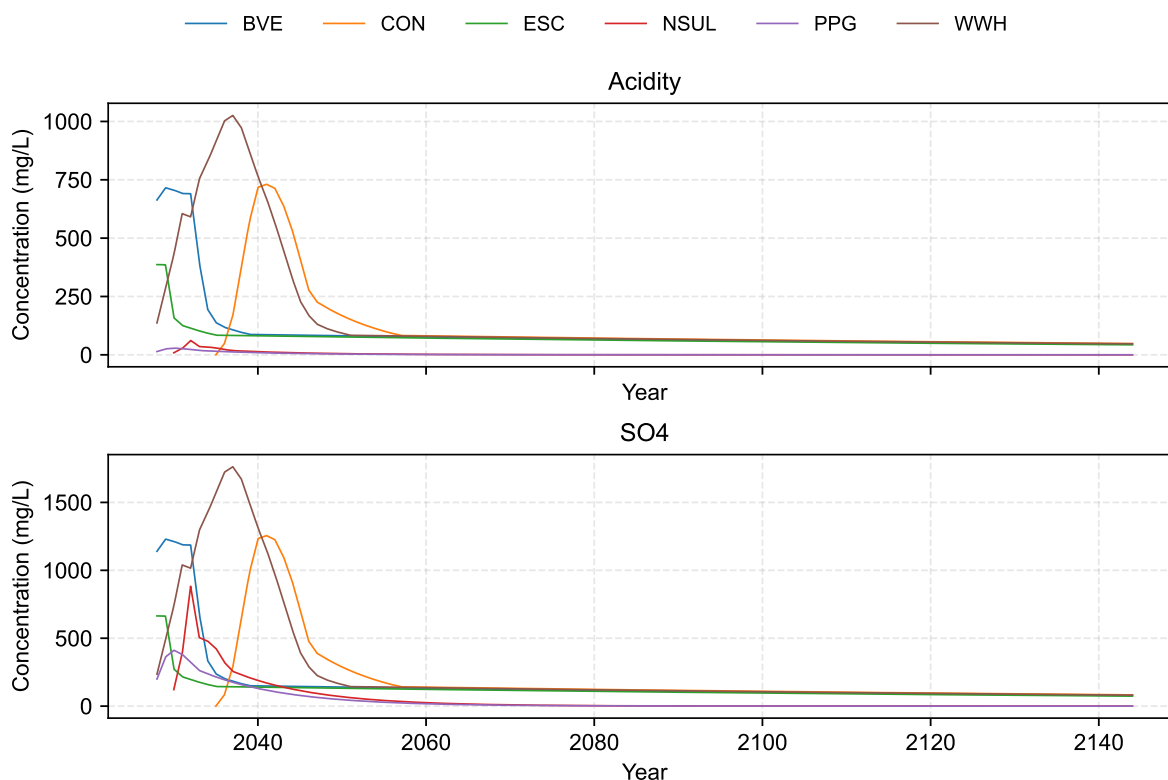


Figure 17: Acidity and sulfate concentrations for the ELFs.

3.3.2 Total Suspended Solids

The derivation of source terms for TSS is based on empirical data documented in the Mangatini (sump) Inlet Untreated (MGIU) TSS Review report (MWM, 2026f) and historically reported data (MWM, 2026c).

Where TSS to rainfall relationships call for use of median and 95th percentile statistics, these have been defined using the Project Climate Dataset as:

- Median Rainfall: 1.6 mm/day
- 95th Percentile: 69.7 mm/day

The key functions included in the simulation of TSS are described in Table 22.

In-pit sumps were modelled as follows:

- All inflowing sources to the sumps were mixed.
- Sump removal factor (Figure 19) applied to TSS load reporting to the sump on a given day. It is assumed that a 24-hour residence time (the modelled timestep) results in all TSS settling out i.e., TSS loads from the previous day are assumed to have settled out.
- Pumping and spilling from the sumps assume the sump removal factor is applied.
- Bypass events are assumed to undergo treatment for TSS, which is modelled by applying the sump removal factor.

MSR Polishing Pond discharge, which includes sources from ELF seepage, coal floor and highwall runoff, has been assigned the TSS relationship identified below as Passive Treatment Discharge.

Table 22: Modelled TSS source terms.

SOURCE TERM	TSS RANGE	SOURCE
Background Water Quality	Rainfall ≤ median, TSS = 1 mg/L Rainfall > median and < 69.7 mm/day = linearly interpolated Rainfall ≥ 69.7 mm/day, TSS = 10 mg/L	Water quality data from the W-M2 site on the Whareatea River. Dynamic source term was adopted in a similar manner to WM Group (2014)
Mine Impacted Water Quality	As per Figure 18 Linear interpolation: Rainfall = 0 mm/day, TSS = 0 mg/L Rainfall = 149 mm/day, TSS = 3,757 mg/L Rainfall = 458 mm/day, TSS = 4,518 mg/L	(MWM, 2026c)
Rehabilitated ELF Runoff	Linear interpolation: Rainfall = 0 mm/day, TSS = 3 mg/L Rainfall = 21.6 mm/day, TSS = 3 mg/L Rainfall = 95.1 mm/day, TSS = 12 mg/L Rainfall = 800 mm/day, TSS = 12 mg/L	WM Group (2014), where hydroseeded rehabilitation is assumed to achieve the same level of erosion management as the ““ELF rehabilitated forest” TSS range is adopted.
Rehabilitated Coal Floor, Highwalls, and Hardstand	Rainfall ≤ 1.6 mm/day, TSS = 3 mg/L Rainfall > 1.6 mm/day and < 69.7 mm/day, TSS = linearly interpolated. Rainfall ≥ 69.7 mm/day, TSS = 30 mg/L	Assumed to achieve this level of required performance naturally or through use of sediment pond structures.
ELF Seepage	Constant 20 mg/L	WM Group (2014) “ELF-Uncovered seepage”
Post Active Treatment (WTP)	Constant 1.5 mg/L	Process Flow report (2026)

Passive Treatment
Discharge (polishing
pond discharge)

Rainfall ≤ 1.6 mm/day, TSS = 3 mg/L
Rainfall > 1.6 mm/day and < 69.7 mm/day,
TSS = linearly interpolated
Rainfall ≥ 69.7 mm/day, TSS = 30 mg/L

Assumed to achieve this level of
required performance as discharge
from the MSRs and polishing
ponds.

Sump Outflow

As per Figure 19
TSS removal rain = $0.0289 \ln(x) + 0.5869$
where x = rainfall over the period of the day

(MWM, 2026f)

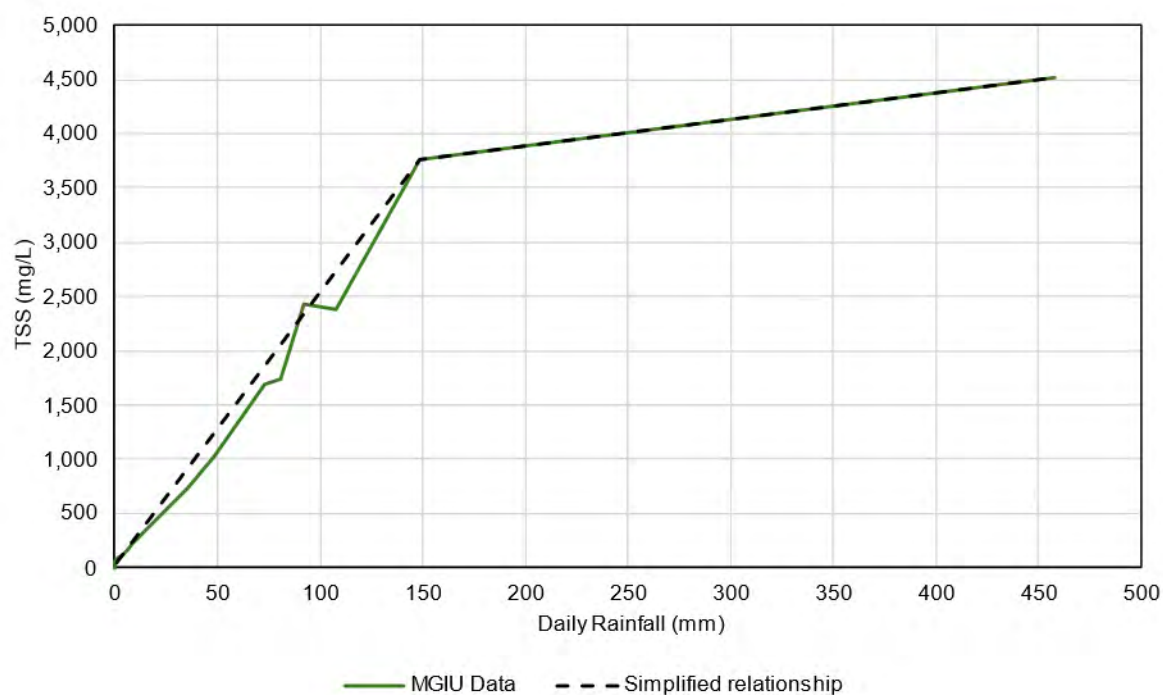


Figure 18: MIW TSS source term derived from MGIU empirical data.

Source: (MWM, 2026f)

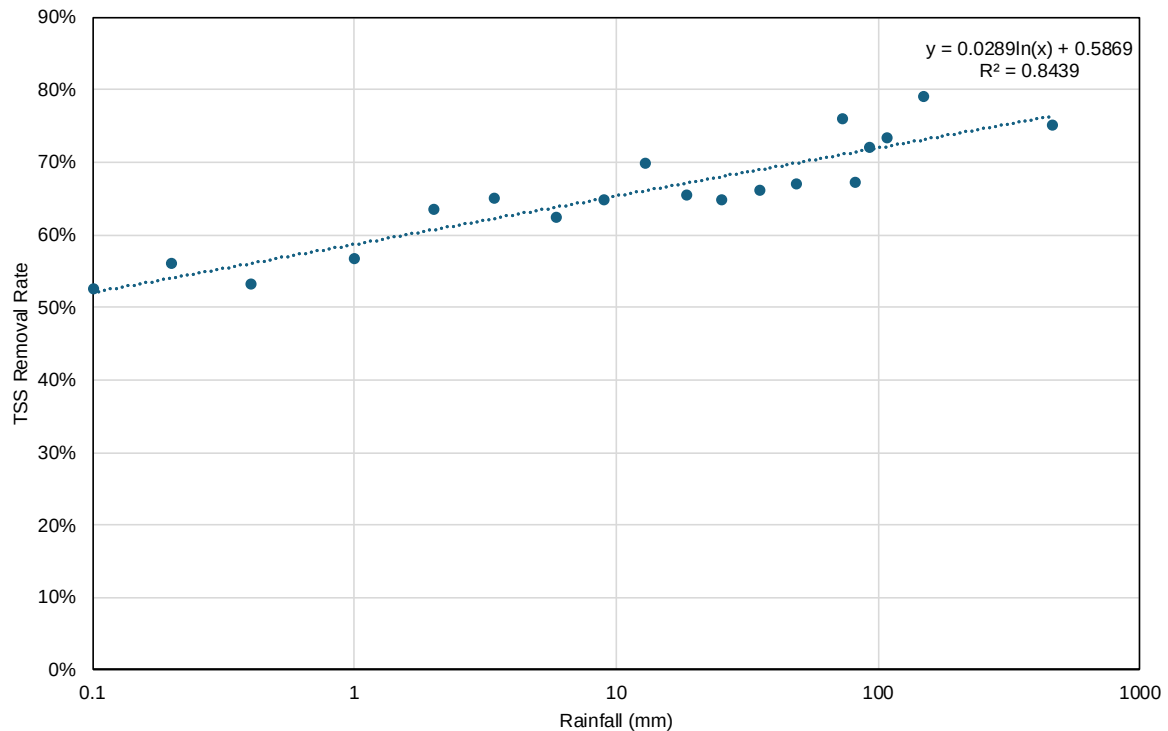


Figure 19: Relationship between daily rainfall and TSS removal from sumps.

Source: (MWM, 2026f)

3.3.3 Turbidity

Turbidity (units of NTU) was estimated from the TSS model results, based on the relationship derived by MWM (2026f) for the S16 site at Stockton Mine:

$$\text{Equation 2: } \text{Turbidity (NTU)} = 0.79 \times \text{TSS} \left(\frac{\text{mg}}{\text{L}} \right)$$

3.3.4 Sump / Void Mixing

A full mix is assumed for the sumps used in the model.

3.3.5 Hardness

Hardness is calculated based on the concentrations of Calcium (Ca) and Magnesium (Mg) and the acidity or alkalinity value of the source water using the following equation:

$$\text{Equation 3: } \text{Hardness} \left(\frac{\text{mg}}{\text{L}} \text{ as } \text{CaCO}_3 \right) = 2.497 \times \text{Ca} \left(\frac{\text{mg}}{\text{L}} \right) + 4.118 \times \text{Mg} \left(\frac{\text{mg}}{\text{L}} \right)$$

In addition, the output of Ca and Mg after MSRs are operational is based on the sulfate concentration, according to relationships established based on empirical data of MSRs in Stockton.

3.3.6 Active and Passive Treatment

During the Operations and Active Closure Phases, the WTP treats the inflowing water based on a design criterion provided by Process Flow (Process Flow, 2026). The treated water quality is assumed

to be constant except for some parameters where the concentration can be either calculated (Ca) or remains the same as the inflow concentration (Mg, Sodium (Na), Potassium (K), sulfate (SO₄)).

As described in Section 2.8, the passive treatment comprises a two-stage treatment system. Seepage initially reports to an MSR, with the MSR discharge proceeding to a designated polishing pond. Treatment at each stage is simulated by applying a set of treatment efficiency factors. This works by multiplying the influent concentration by the treatment efficiency. Treatment efficiency factors are detailed in the Source Term Report (MWM, 2026c).

Both concentrations and factors for active and passive treatment are shown in Table 23.

Table 23: Treatment source terms.

ANALYTE ¹	WTP WATER QUALITY	MSR TREATMENT EFFICIENCY	MSR POLISHING POND TREATMENT EFFICIENCY
UNITS	mg/L	FACTOR	FACTOR
Acidity	5	1	-
Alkalinity	5.5	115.5 mg/L	-
Ca	Calculated	Calculated	-
Mg	=input	=input	-
Al	0.074	0.997	-
Fe	0.01	0.8	0.99
Ni	0.0027	0.402	0.125
Mn	0.18	0.586	-
Cr	0.0011	-	-
Cd	0.000025	0.0189	-
Co	0.001	0.828	-
Cu	0.00025	0.966	-
Pb	0.00005	0.858	-
Tl	0.00117	-	-
Zn	0.0058	0.637	0.59
DOC	0.25	2.9 mg/L	-
TSS	1.5	0	-
pH	6.4 (unitless)	7.9 (unitless)	7.01 (unitless)

Notes: **Red** = Fixed value after treatment step.

- Indicates no treatment / no change.

3.3.6.1 WTP Ca Calculation

Hardness can be affected by the water treatment process due to the addition of Ca from active and passive treatment processes.

The WTP-treated water Ca concentration is calculated using the following equation:

$$\text{Equation 4: } Ca_{WTP-treated} \left(\frac{mg}{L} \right) = \left[\text{Hardness}_{influent} \left(\frac{mg \text{ CaCO}_3}{L} \right) + \text{Acidity}_{influent} \left(\frac{mg \text{ CaCO}_3}{L} \right) \right] \times \frac{40}{100.1}$$

Fundamentally, this calculation applies a stoichiometric mass balance rather than an empirical correlation. It derives the final concentration by summing the baseline calcium load (approximated here by influent hardness) with the specific stoichiometric dosage of lime chemically required to neutralise the influent acidity. Note: the calculation does not remove the magnesium contribution to hardness (to

derive the calcium concentration). Model sensitivity testing where the adjustment was corrected showed that the adjustment to the Ca calculation (i.e., removal of Mg hardness contribution) does not affect water quality compliance (e.g., Hickey, 2026) during the Active Treatment Phase.

3.3.6.2 MSR Ca and Mg Calculation

For the MSR-treated water Ca and Mg concentrations, the following equations are used:

$$\text{Equation 5:} \quad Ca_{MSR-treated} \left(\frac{mg}{L} \right) = SO_{4\text{ Influent}} \times 0.3618 + 39.5 \frac{mg}{L}$$

$$\text{Equation 6:} \quad Mg_{MSR-treated} \left(\frac{mg}{L} \right) = SO_{4\text{ Influent}} \times 0.0185$$

Based on these relationships, a theoretical influent sulfate concentration of 0 mg/L results in an effluent Ca concentration of the MSR-treated water of 39.5 mg/L. This value results from the water interaction with the mussel shells under these conditions and corresponds to a hardness of approximately 100 mg CaCO₃/L. Further details of this relationship are provided in the Source Term Report (MWM, 2026c).

3.3.7 *pH Estimation and Acidity and Alkalinity calculations*

An acidity-alkalinity balance approach is applied to estimate the relative contributions of alkalinity and acidity in water samples. Alkalinity represents the neutralisation capacity of a solution; specifically, the amount of acid required to reduce the sample's pH to 4.5. In contrast, acidity is defined as the amount of base needed to increase the pH of an acidic solution to a standard reference value, typically 8.3.

When an acidic solution (characterised by high acidity) is mixed with a neutral or alkaline solution (characterised by high alkalinity), both parameters decrease proportionally, and the dominant component determines the resulting balance. Accordingly, the following relationships are used:

- Net Alkalinity = Alkalinity – Acidity (= 0 if Acidity > Alkalinity).
- Net Acidity = Acidity – Alkalinity (= 0 if Alkalinity > Acidity).

Then through relationships we estimate the pH based on the values of Net Alkalinity or Net acidity by using the following relationships:

If Net Alkalinity > 1:

$$\text{Equation 7:} \quad pH = 0.55 \times LN(\text{NetAlkalinity}) + 5$$

The derivation of this relationship is provided in MWM (2026b).

If Net Acidity > 0:

$$\text{Equation 8:} \quad pH = \log_{10}(0.0000035 \times \text{Net Acidity} + 0.00001)$$

The derivation of this relationship is provided in MWM (2026d).

If $0 \leq \text{Net Alkalinity} \leq 1$:

$$\text{Equation 9:} \quad pH = 5$$

4 MODEL EVALUATION

4.1 Model QA/QC

Model QA/QC procedures were completed as part of the WLBM review process. The review process included the following steps:

- Checking that data sources are documented.
- Verification that storage, inflows, and outflows are correctly located and allocated to the right source and sink.
- Cross checking flows to ensure they are not duplicated or missed.
- Verification of model functions and expressions to ensure they are working as intended.
- Verification that total model catchment area is constant throughout the model timeframe.
- Verification that the calibration period predictions were evaluated through comparison to monitoring data.
- Sanity checks, including using professional judgement and experience to evaluate whether results reflect the understanding of the project regarding water management processes and source terms.

4.2 Model Calibration

Given the current relatively undisturbed nature of the ESE area, the only data available for model calibration was historic river flow records to calibrate the AWBM for background runoff. The model was calibrated to the Whareatea River flow record, observed at the flow recorder site WM2. The calibration period spanned 24/03/2011 to 31/12/2014, matching to daily average flow data. Calibration of the runoff model was completed using a manual trial and error approach, with a focus on balancing the match between:

- Daily average simulated and observed stream flow rates (Figure 20 and Figure 21).
- Flow exceedance probability (Figure 22).
- Cumulative water volume (Figure 23).

Statistical comparison is summarised in Table 24.

Findings from the calibration effort were as follows:

- A satisfactory match to average and median conditions was achieved.
- High flow conditions were matched to a reasonable extent, but not as well as average and median conditions.
- Low flow conditions could not be matched as well, likely due to the influence of extensive underground workings within the catchment upstream of WM2 (which could not be represented in the AWBM).

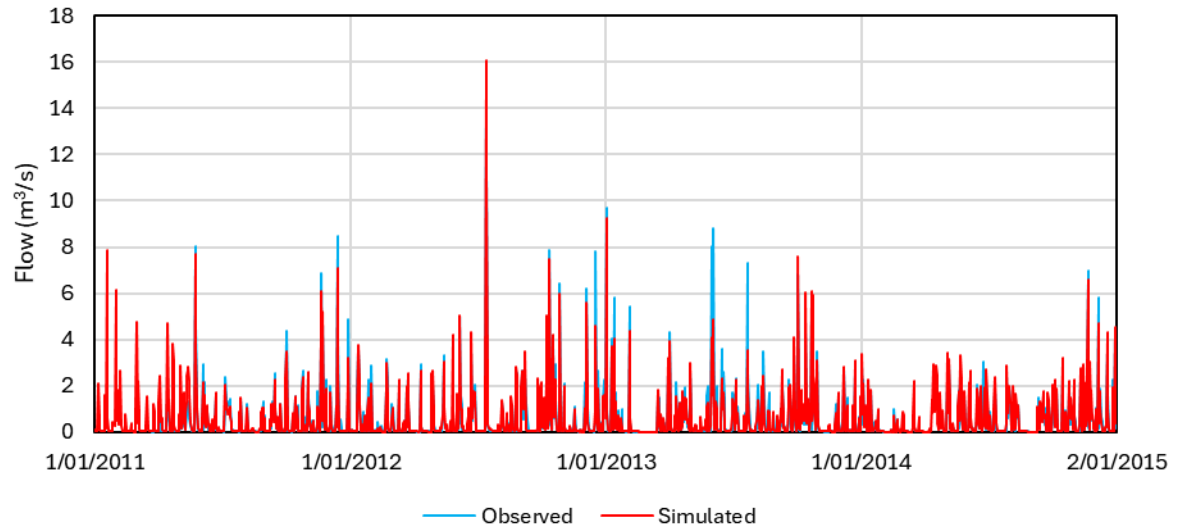


Figure 20: Daily flow rate comparison.

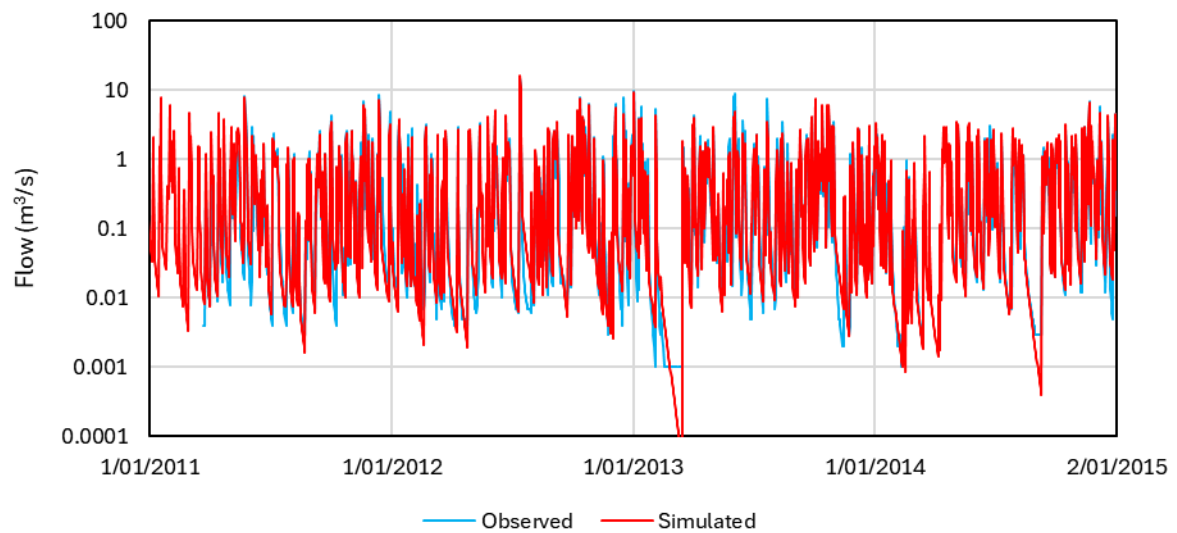


Figure 21: Daily flow rate comparison (log scale).

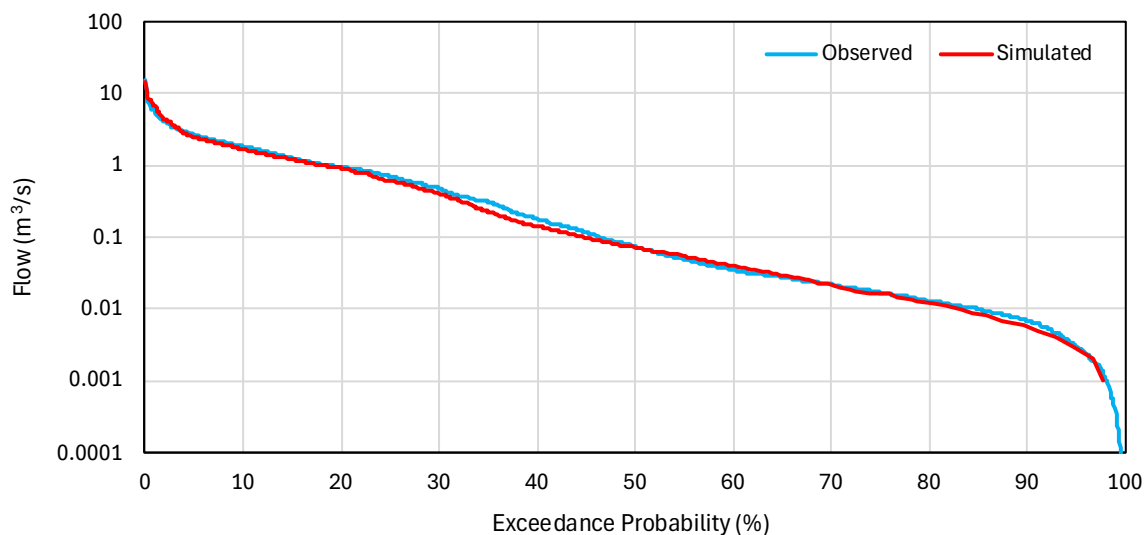


Figure 22: Flow exceedance comparison.

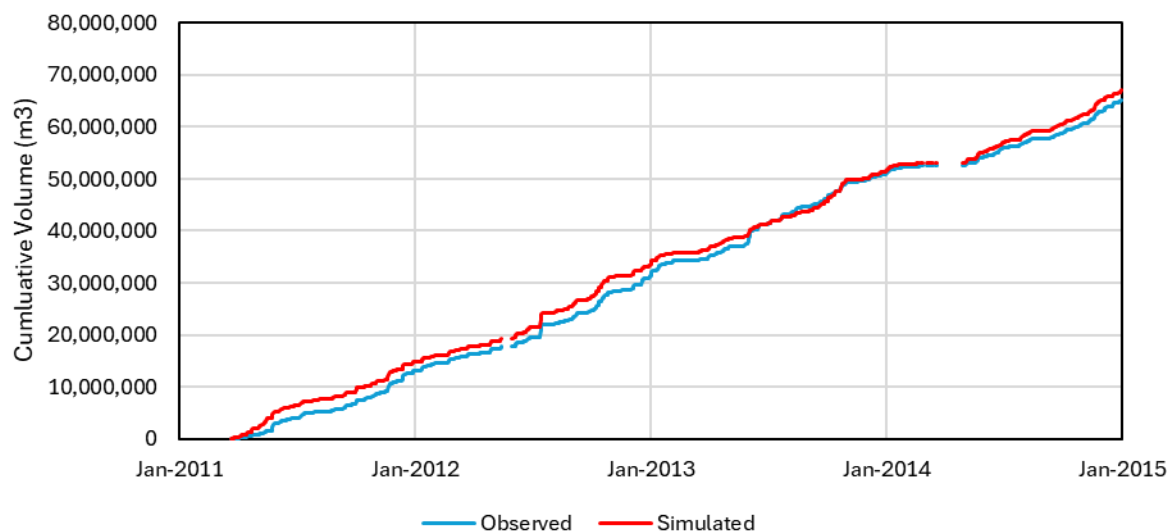


Figure 23: Cumulative water volume comparison.

Table 24: WM2 flow statistic comparison.

METRIC	OBSERVED FLOW	SIMULATED FLOW
Mean Flow	0.59	0.57
Median Flow	0.074	0.072
7-day MALF	0.0018	0.0028
95 th Percentile Flow	2.69	2.53

Notes: All values reported as m³/s. MALF is mean annual low flow.

4.3 Model Limitations

4.3.1 Water Balance

The primary limitations regarding the water balance are listed below:

- Catchment area simplifications: Catchments areas are input on an annual basis. Therefore, smaller changes in catchment area within each year are not accounted for. However, this approach is considered appropriate for the purposes of the model.
- Rainfall accumulation and intensity: Rainfall characteristics such as rainfall accumulation, intensity, and variability, have a major influence on the result of the water balance model. These uncertainties are tested for sensitivity within the scenario modelling section.
- Flow generation parameter simplifications: Parameters used to represent flow generation from mine disturbed areas have not been calibrated and are based on professional experience and judgement.
- High flow events are not considered to be well represented due to limitations with calibration of high flow events (discussed in Section 4.2) and the use of a single runoff coefficient (that is independent of rainfall accumulation) for disturbed areas.
- Undisturbed runoff is calibrated to W-M2 flows, which may not be representative of tributary catchments. Low flow conditions are overestimated. However, for the Whareatea River, the discharge of treated water from the WTP and/or MSRs will act to increase the low flow conditions, making this overestimation insignificant (for locations where treated mine water is constantly discharged).
- Model timestep: The model uses a daily (24-hour) timestep and therefore does not capture sub-daily time step flow variability.
- Net percolation is based on uncalibrated numerical modelling as it is important for simulating water quality from ELF seepage. Empirical data collected as part of performance monitoring to confirm values adopted remain appropriate.

4.3.2 Load Balance

The following limitations are noted regarding the load balance model:

- **Conservative transport assumption:** The model generally assumes that all parameters are transported downstream without accounting for geochemical reactions. This means that processes such as precipitation (e.g. formation of hydroxy-sulfates) and adsorption are not represented. As a result, elements known to be removed from solution, such as Al, Fe, and Arsenic (As), and Cobalt (Co) may be over-estimated in the load model. These processes can occur within pit lakes or along flow pathways. However, the model does include specific “treatment nodes” where water quality is modified where the chemical load is adjusted based on defined removal efficiencies or fixed water quality.
- **pH:** pH is expected to remain neutral to slightly acidic (due treatment and background conditions) in this load balance due to the net effect of active and passive AMD treatment. To account for “pH transport,” the hydrogen ion concentration (estimated from the source terms

using the equation $\text{pH} = -\log_{10}[\text{H}^+]$ is used instead, with some estimations of pH based on the alkalinity and acidity balance based on empirical data.

- **Timestep:** While the simulation is made at a daily timestep, most of the water quality data used for the derivation of source terms are approximately at a monthly scale, therefore daily (or intra-monthly) trends might not be represented well in the water quality source terms, and therefore, nor in the model results.

5 MODEL RESULTS

5.1 Overview

The model results displayed in this section include ELF seepage flow, WTP volumes, environmental flows, and a range of water quality results. Results of scenario modelling are also included to assess sensitivity of input parameters used in the model.

5.2 Base Case Water Balance Results

5.2.1 ELF Seepage Flows

Seepage flows throughout the simulation period have been plotted daily for each of the six ELFs (Figure 24).

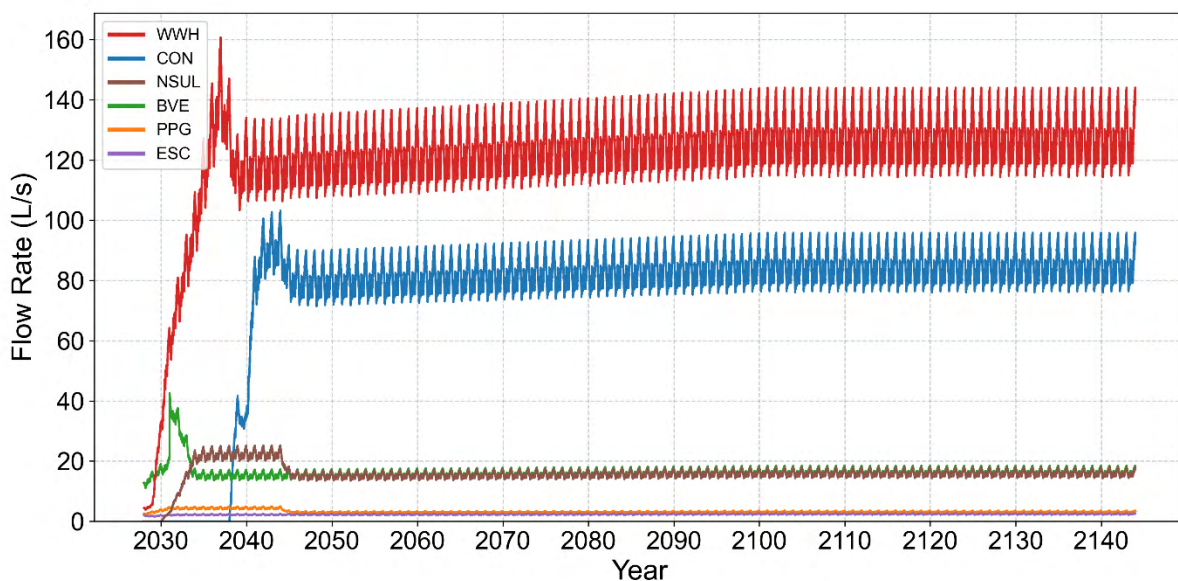


Figure 24: ELF daily seepage flows.

The following is noted regarding Figure 24:

- The WWH ELF is the largest ELF and produces the highest flow rates throughout the simulation.
- Seepage rates are relatively stable on a daily basis (e.g., compared to surface runoff), because the simulated ELFs release water more gradually due to their storage effects. This is simulated using the seepage recession coefficient as detailed in Section 3.2.7.
- Peak seepage flows for some ELFs are observed during the Operations Phase, where rehabilitation has not fully occurred (i.e., net percolation is higher).
- Seepage rates for ELFs gradually increase throughout the Post Closure Phase until 2100, due to the adopted increase in precipitation (which also stabilises in 2100) to account for climate change.

5.2.2 Surge Pond Water Volume

The volume of water within the Surge Pond (Figure 25) does not exceed the sump capacity of 240,000 m³ until 2058 when active treatment ceases and maintains spare capacity for the majority of the WTP operating timeframe. Therefore, no spill events occur during the Operations and Active Closure Phases. This was achieved purposefully, by adjusting the WTP maximum treatment rates on an annual basis to prevent spilling. WTP treatment rates are discussed in Section 5.2.4 below.

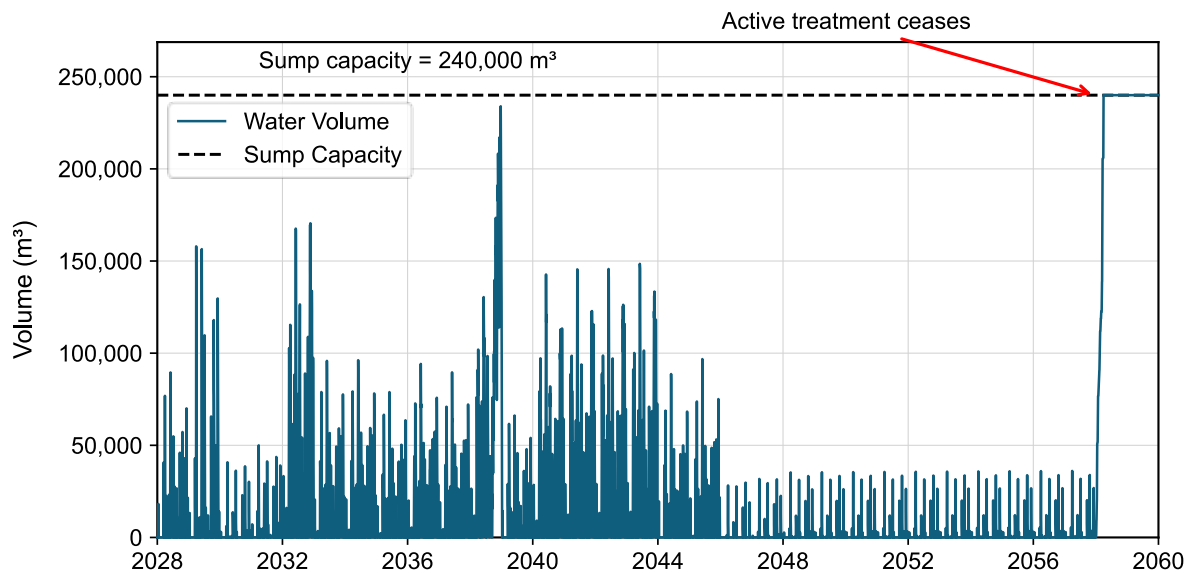


Figure 25: Surge Pond water volume (reported daily).

5.2.3 In-pit Sump Water Volume

The volume of the in-pit sumps are presented in Figure 26, Figure 27, and Figure 28. No spilling occurs during the Operations Phase, except during designed spill years. These years include:

- WWH Sump – 2028 - 2032. Note spilling directly to environment only occurs in 2028, 2031 and 2032. Spilling between 2029 and 2030 ultimately reports to the Surge Pond for treatment at the WTP.
- CON Sump – 2039.

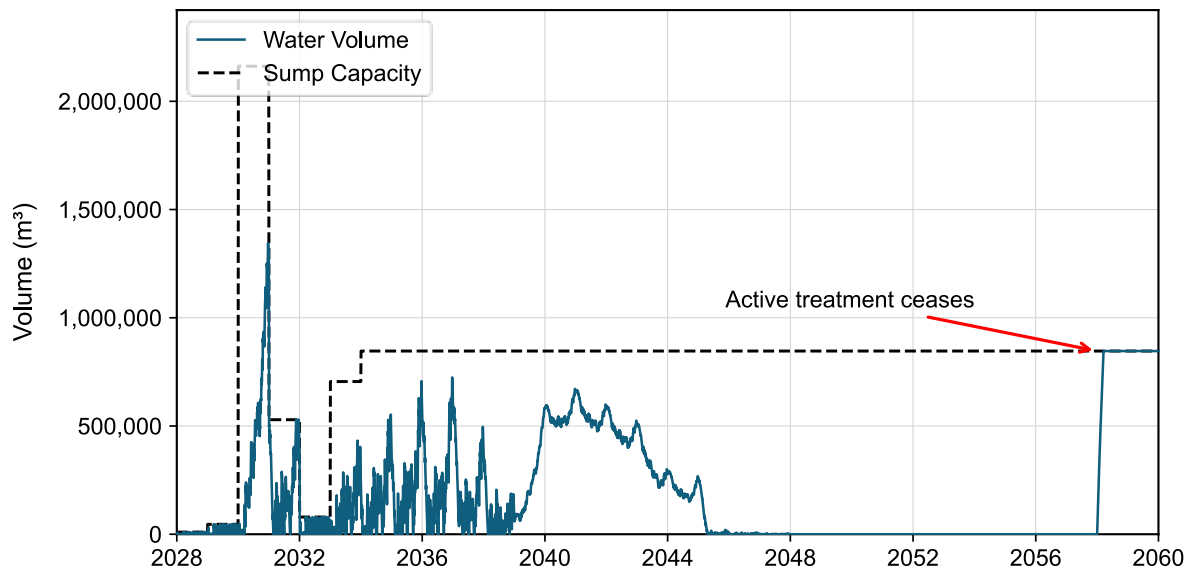


Figure 26: WWH Sump water volume (reported daily).

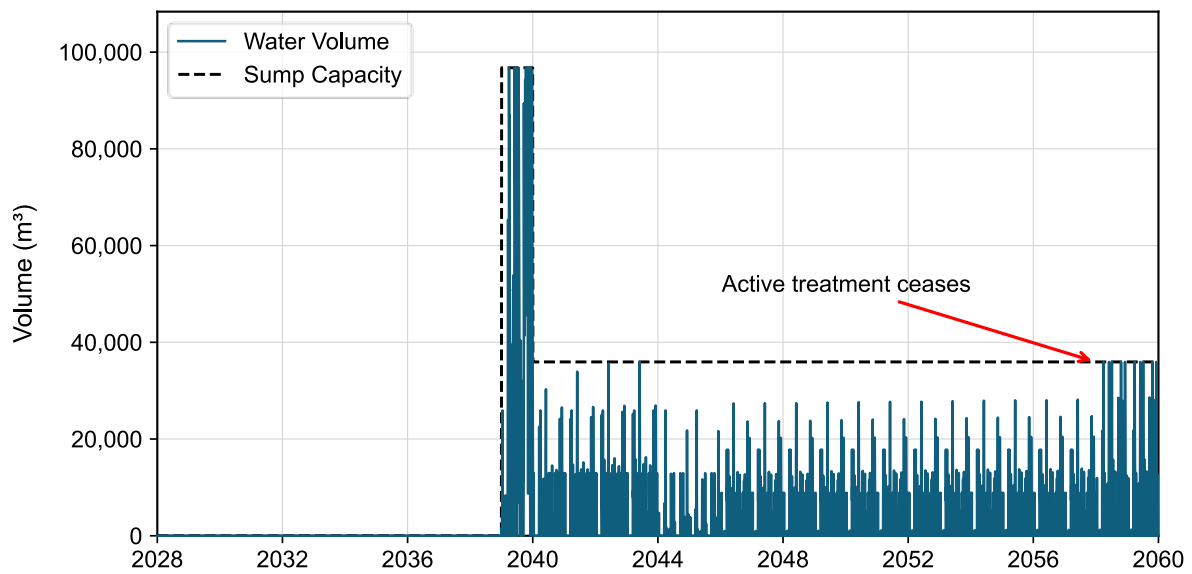


Figure 27: CON Sump water volume (reported daily).

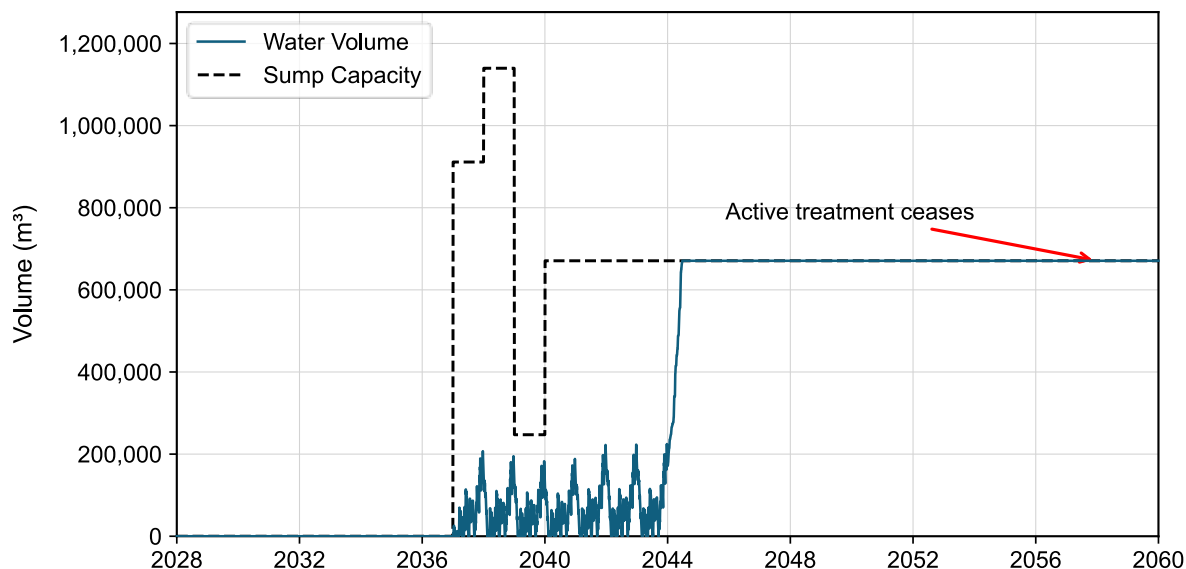


Figure 28: ESC Sump water volume (reported daily).

5.2.4 Discharge Events

There are no spilling events for the Surge Pond for the Base Case.

Sump bypass infrastructure was simulated to ensure bypass events occurred on less than 5% of days in any given year that a bypass mechanism was active. The frequency and duration of bypass events associated with in-pit sumps are included in Table 25.

Table 25: Frequency of bypass events past in-pit sumps.

EVENT DURATION	WWH SUMP	CON SUMP	ESC SUMP
1 day	7.3	11.8	12.0
2 days	1.4	2.5	3.0
3 days	0	0	0
Total days / %	10.2 / 2.8%	16.8 / 4.6%	18 / 4.9%

Note: Bypass events calculated as average number of days per year occurring during years that the bypass is active.

Sump spilling was designed for years where bypass infrastructure was not planned. Modelling ensured spilling did not occur for more than about 5% of days in any given year by adjusting pumping rates. The frequency of spill events occurring directly to the environment are presented in Table 26.

Table 26: Frequency of spill events direct to environment from in-pit sumps.

EVENT DURATION	WWH SUMP	CON SUMP
1 day	4.3	7.0
2 days	2.3	3.0
3 days	0.3	2.0
4 days	0.7	0
5 days	0	0
Total days / %	12.7 / 3.5%	19 / 5.2%

Notes: Spill events calculated as average number of days per year occurring during years that the spilling is planned from sumps.

WWH Sump spilling calculated from 2028, 2031 and 2032.

CON Sump spilling calculated during 2039.

5.2.5 Volume of Water Treated at WTP

The cumulative volume of treated water in the WTP is presented in Figure 29.

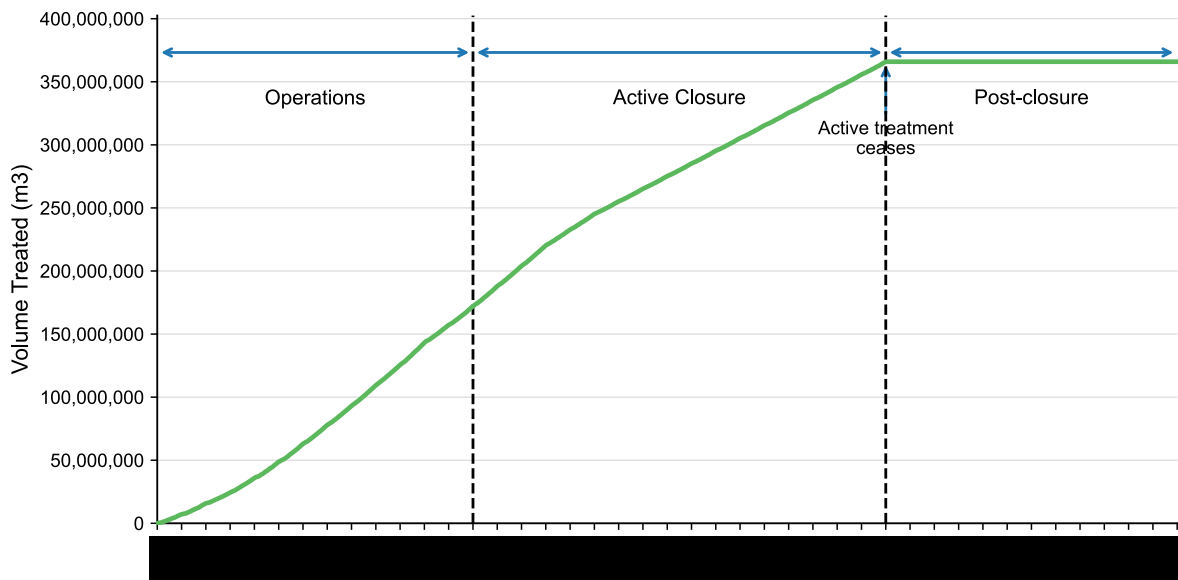


Figure 29: Cumulative volume of water treated by WTP.

The following is noted regarding Figure 29:

- A total of 358,000,000 m³ of water is treated at the WTP within the model over the simulation.
- More than half of the water is treated after the Operations Phase.
- The treatment rate reduces during the Active Closure phase (line slope reduces), largely due to:
 - Completion of rehabilitation works, which reduces ELF net percolation and therefore seepage rates; and

5.2.6 Cessation of active treatment of NSUL seepage in 2046 Environmental Flows

This section focuses on simulated flow distribution results at each of the proposed compliance locations. The presented flow distributions compare baseline conditions and those under the *Active Treatment Phase* (Construction, Operations, and Active Closure phases) and solely Post Closure Phase (passive treatment only). The baseline conditions are presented in plots generated from a GoldSim based model utilising the AWBM and the same parameters as the ESE water balance base case model. The catchment areas used for the baseline model are presented in Figure 13.

The following is noted regarding the environmental flow plots presented in this section:

- Modelled results represent the base case scenario.
- The results are influenced by the modelled gradual increase in rainfall simulating climate change.
- Flow exceedance curves for V37 compliance locations do not have modelled baseline flow distributions as they are proposed mine discharge locations and do not represent stream flows.

- The Active Treatment Phase includes the Construction and Operations phase, and the subsequent period while active treatment continues.
- The Post Closure Phase begins when all water reporting to the respective compliance location switches from active treatment to passive treatment. Therefore, the start of the phase differs by compliance location.

5.2.6.1 KEL

The flow exceedances curve for KEL, located within the Whareatea River, are indicated in Figure 30. Key statistics are included in Table 27.

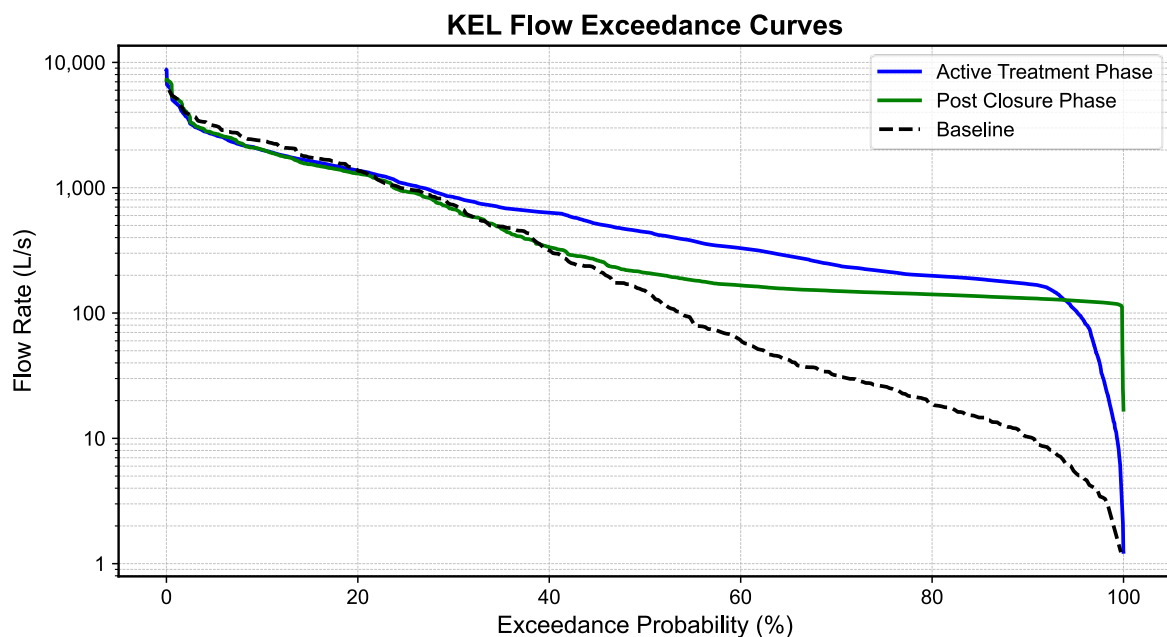


Figure 30: KEL modelled flow distribution results.

Table 27: KEL hydrological statistics summary.

	MEAN FLOW (L/S)	MEDIAN FLOW (L/S)	7D MALF (L/S)
SIMULATED BASELINE	708	151	2.4
ACTIVE TREATMENT PHASE (2028-2057)	818 [+16%]	443 [+193%]	148 [+6,090%]
POST CLOSURE PHASE (2058-2143)	724 [2%]	210 [+39%]	124 [+5,100%]

Notes: Brackets indicate percentage change compared to baseline.

7D MALF = 7 Day Mean Annual Low Flow.

The following is noted regarding the KEL model results:

- Modelling shows that low flow and median flow conditions are likely to increase during the Active Treatment and Post Closure Phases of the Project (noting minimal change in surface catchment area post-closure). However, higher flow conditions (occurring less than 20% of the time) are simulated to reduce compared to baseline flows. These effects are largely a result of

the WTP and the ELFs providing a storage and release effect, such that higher rainfall events are dampened and low flows are buffered by more gradual release of water.

- Mean, median and 7D MALF conditions are simulated to be highest during the Active Treatment Phase. This is because the WTP will be discharging the majority of treated water to the Whareatea River (where KEL is located) over this period. The WTP will have significant live storage capacity, providing flow buffering through sump storage and treating flows at a stable rate.
- Average flows reduce during the Post Closure Phase as the volume of water entering the catchment reduces. This is because active treatment ceases. Low flows remain significantly higher compared to baseline conditions because of the relatively constant seepage flow rates provided by the ELF and passive treatment systems. Polishing pond discharge (including seepage and coal floor and highwall runoff), contributes the following proportion of flows to KEL:
 - o 91% at the 10th percentile flow rate.
 - o 67% at the median percentile flow rate.
 - o 12% at the 90th percentile flow rate.

5.2.6.2 V62

The simulated flow exceedance curves for V62, located within the V62 Stream, are indicated in Figure 31. Key statistics are included in Table 28.

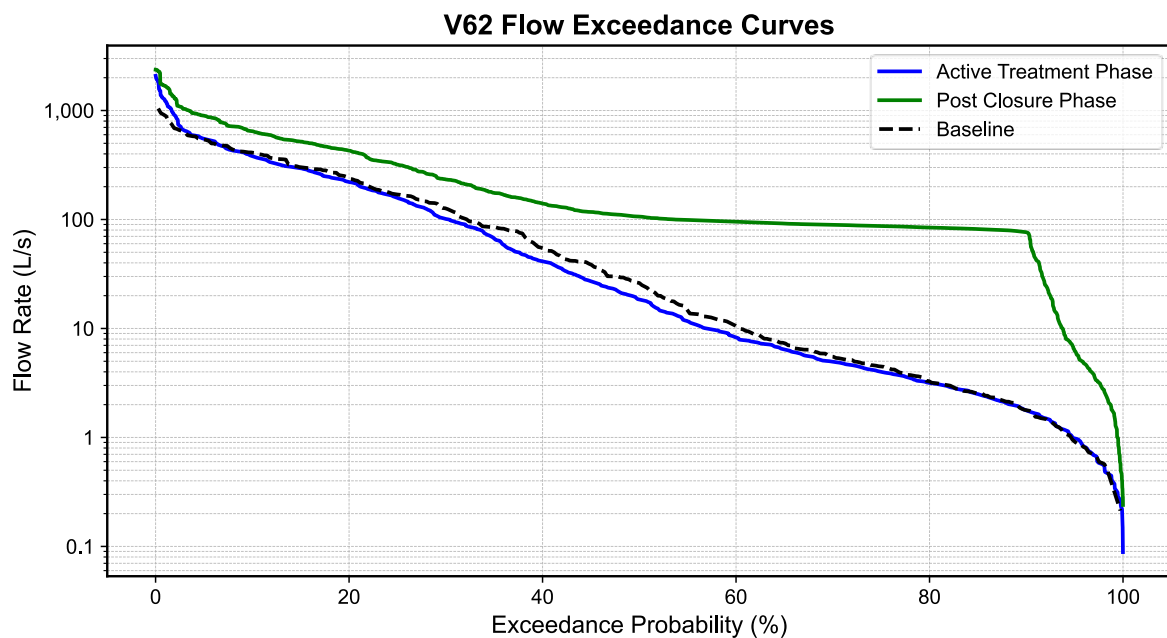


Figure 31: V62 modelled flow distribution results.

Table 28: V62 hydrological statistics summary.

	MEAN FLOW (L/S)	MEDIAN FLOW (L/S)	7D MALF (L/S)
SIMULATED BASELINE	122	26.1	0.4
ACTIVE TREATMENT PHASE (2028-2057)	125 [+2%]	18.4 [-29%]	1.0 [+136%]
POST CLOSURE PHASE (2058-2143)	255 [+108%]	106 [+307%]	67.0 [+16,100%]

Notes: Brackets indicate percentage change compared to baseline.

7D MALF = 7 Day Mean Annual Low Flow.

Post Closure Phase flows impacted by pumping of CON polishing pond treated water to V37 (2058-2070).

The following is noted regarding the V62 model results:

- During the Active Treatment Phase, mean flow conditions remain similar to baseline conditions. The 7D MALF conditions remain relatively low, although increase by about 0.6 L/s. Median flow is notably less, as mine impacted water is pumped away to the WTP instead of being released to V62 Stream.
- A significant increase in mean, median, and 7D MALF conditions is simulated during the Post Closure Phase. This is due to the constant seepage flow rates of the ELF and passive treatment system. Additionally, the catchment area reporting to V62 Stream will increase (by approximately 47 ha) as a result of the Project. The CON MSR will treat seepage from approximately 113 ha of ELF surface area, which is modelled with a high seepage regression coefficient and therefore stable release to environment. Polishing pond discharge (including seepage and coal floor and highwall runoff), contributes the following proportion of flows to V62:
 - 99% at the 10th percentile flow rate.
 - 85% at the median percentile flow rate.
 - 39% at the 90th percentile flow rate.

5.2.6.3 W07

The simulated flow exceedance curves for W07, located within Rapid Stream, are indicated in Figure 32. Key statistics are included in Table 29.

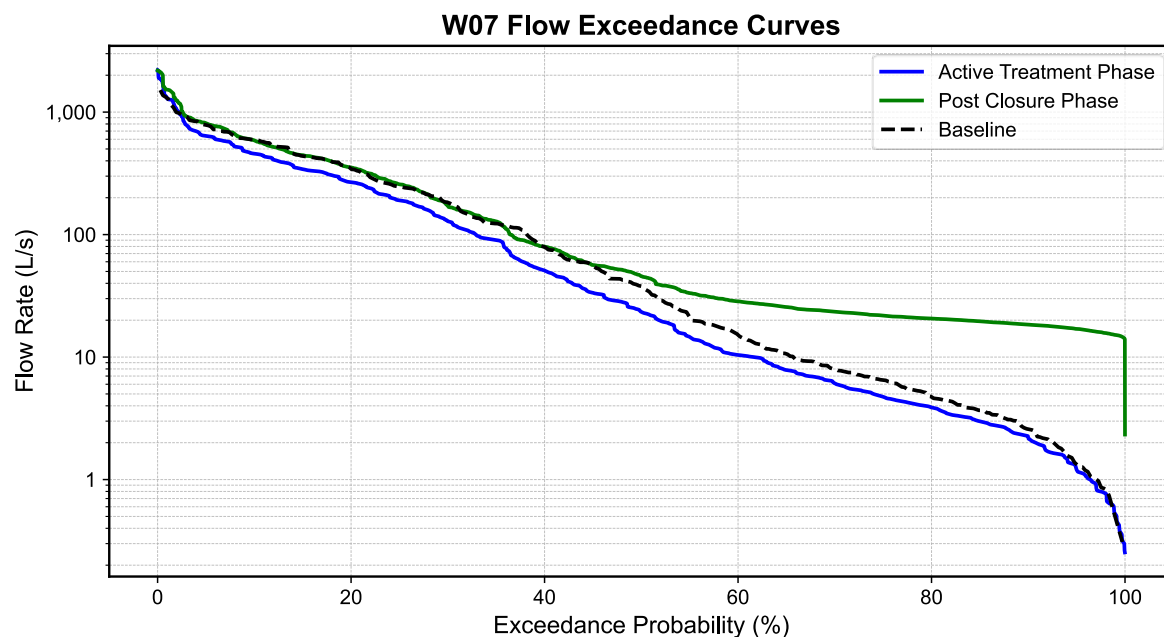


Figure 32: W07 modelled flow distribution results.

Table 29: W07 hydrological statistics summary.

	MEAN FLOW (L/S)	MEDIAN FLOW (L/S)	7D MALF (L/S)
SIMULATED BASELINE	178	37.9	0.6
ACTIVE TREATMENT PHASE (2028-2045)	149 [-16%]	23.3 [-38%]	1.0 [+67%]
POST CLOSURE PHASE (2046-2143)	196 [+11%]	45.7 [+21%]	16.0 [+2,580%]

Notes: Brackets indicate percentage change compared to baseline.

7D MALF = 7 Day Mean Annual Low Flow.

The following is noted regarding the W07 model results:

- Flow rates are simulated to drop overall during the Active Treatment Phase compared to baseline conditions, although with a similar 7D MALF rate. The lower overall flow rates are a result of capture of NSUL seepage and runoff MIW, and routing them to the WTP which feeds into a different catchment (Whareatea River Catchment). Note that there is no change to the baseline catchment area as a result of the Project.
- During the Post Closure Phase, the model simulated similar patterns to baseline conditions below the 40% exceedance probability (higher flow conditions). However, lower flow conditions are significantly higher, owing to the constant seepage flow rate of the NSUL ELF.

5.2.6.4 M-M1

The simulated flow exceedance curves for M-M1, located within V8 Stream, are indicated in Figure 33. Key statistics are included in Table 30.

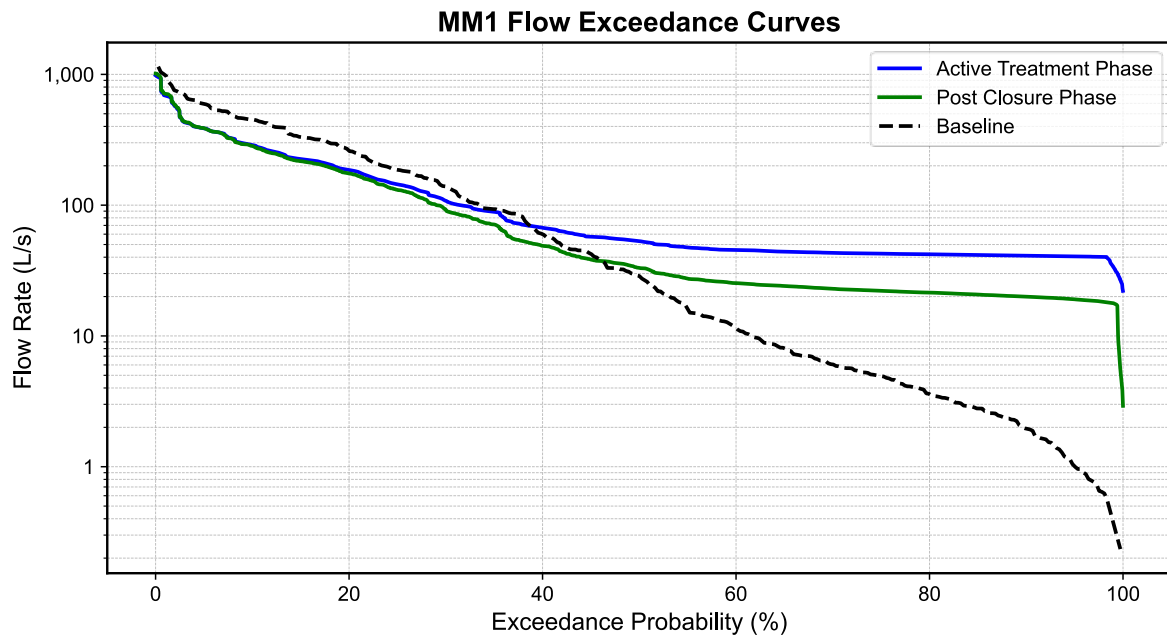


Figure 33: M-M1 modelled flow distribution results.

Table 30: M-M1 hydrological statistics summary.

	MEAN FLOW (L/S)	MEDIAN FLOW (L/S)	7D MALF (L/S)
SIMULATED BASELINE	135	28.7	0.5
ACTIVE TREATMENT PHASE (2028-2057)	118 [-12%]	53.1 [+85%]	39.7 [+8,650%]
POST CLOSURE PHASE (2058-2143)	103 [-24%]	33.0 [+15%]	18.2 [+3,900%]

Notes: Brackets indicate percentage change compared to baseline.

7D MALF = 7 Day Mean Annual Low Flow.

The following is noted regarding the M-M1 model results:

- The Active Treatment Phase is modelled to have higher low flow conditions, although lower high flow conditions compared to baseline. This occurs because of two primary factors:
 - Up to 40 L/s of treated water is pumped to V8 Creek (where M-M1 is located), increasing the 7D MALF.
 - The overall catchment area is reduced compared to baseline (reduction of 43 ha), so that less water flows to the compliance location. This results in a reduction in high flows compared to baseline.
- During the Post Closure Phase, seepage water from BVE ELF is discharged to V8 Creek, increasing the 7D MALF.

5.2.6.5 V37_F

The simulated flow exceedance curves for V37_F, located adjacent to V37 Creek, are indicated in Figure 37. Key statistics are included in Table 31.

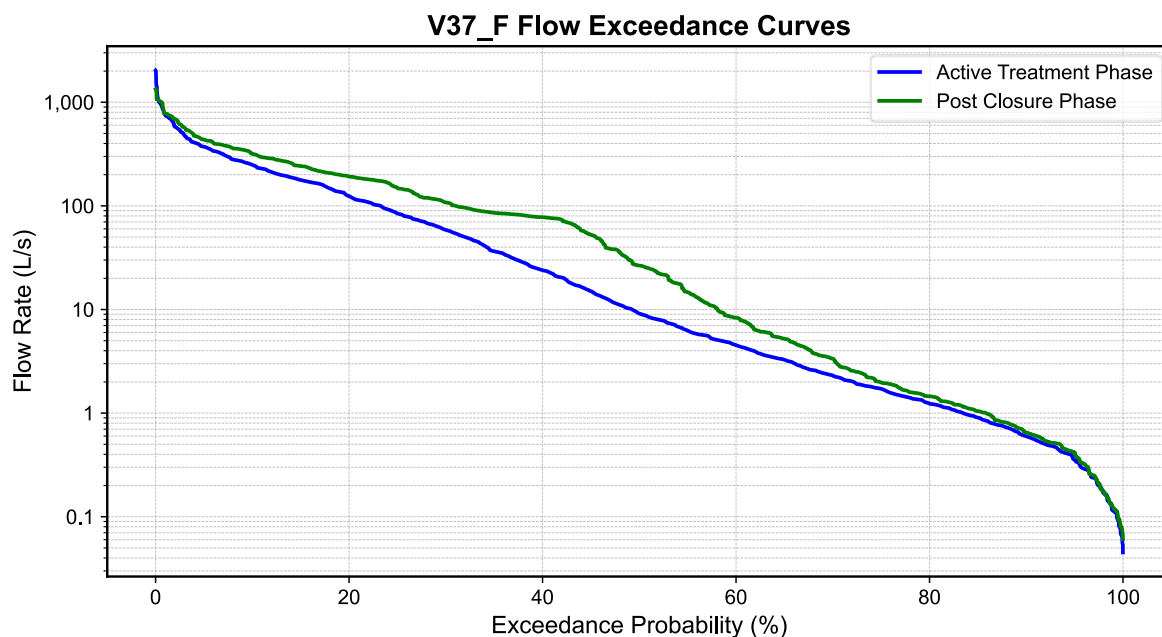


Figure 34: V37_F modelled flow distribution results.

Table 31: V37_F hydrological statistics summary.

	MEAN FLOW (L/S)	MEDIAN FLOW (L/S)	7D MALF (L/S)
SIMULATED BASELINE	N/A	N/A	N/A
ACTIVE TREATMENT PHASE (2028-2057)	79.4	9.1	0.5
POST CLOSURE PHASE (2058-2143)	109	26.6	11.9

Notes: Baseline data not available as compliance location does not represent a natural catchment during baseline conditions.

7D MALF = 7 Day Mean Annual Low Flow.

The following is noted regarding V37_F model results:

- Baseline data was not available as compliance location does not represent a natural catchment during baseline conditions.
- Mean, median, and 7D MALF statistics are simulated to increase compared to the Active Treatment Phase. This increase is influenced by the pumping of CON MSR polishing pond discharge to V37_F during the period 2058 to end of 2070.

5.2.6.6 V37_G

The simulated flow exceedance curves for V37_F, located adjacent to V37 Creek, are indicated in Figure 35. Key statistics are included in Table 32.

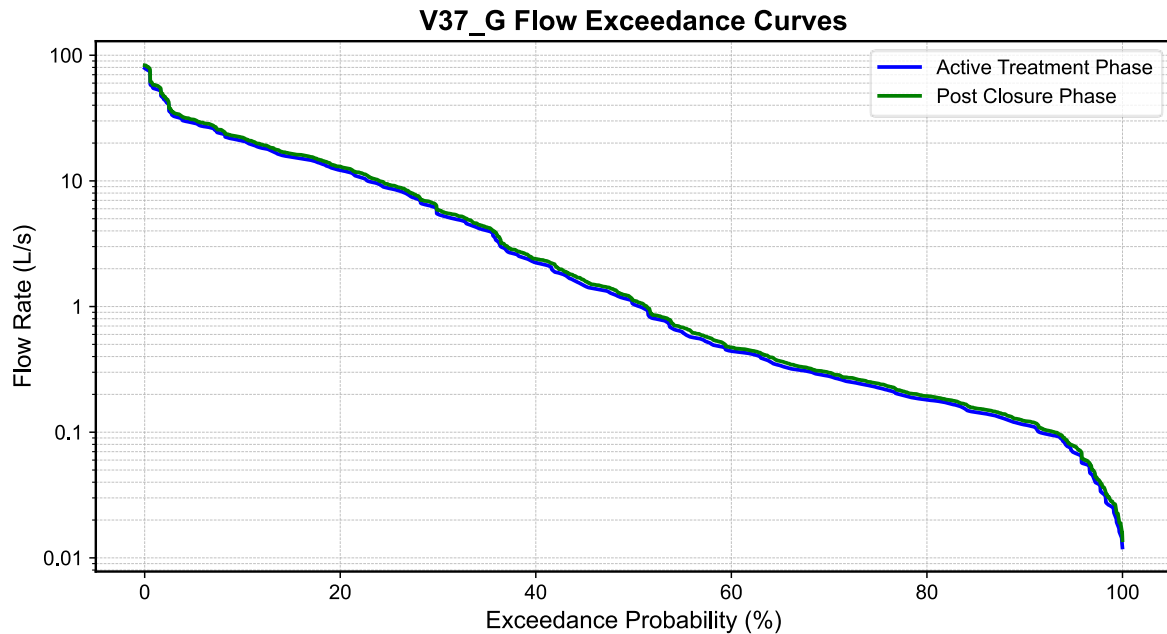


Figure 35: V37_G modelled flow distribution results.

Table 32: V37_G hydrological statistics summary.

	MEAN FLOW (L/S)	MEDIAN FLOW (L/S)	7D MALF (L/S)
SIMULATED BASELINE	N/A	N/A	N/A
ACTIVE TREATMENT PHASE (2028-2057)	6.6	1.0	0.06
POST CLOSURE PHASE (2058-2143)	7.0	1.1	0.07

Notes: Baseline data not available as compliance location does not represent a natural catchment during baseline conditions.

7D MALF = 7 Day Mean Annual Low Flow.

The following is noted regarding V37_G model results:

- Baseline data was not available as compliance location does not represent a natural catchment during baseline conditions.
- Mean, median, and 7D MALF statistics are similar for the Active Treatment Phase and the Post Closure Phase. A minor increase during the Post Closure Phase is associated with the climate change function built into the model, which simulates an overall increase in rainfall.

5.3 Base Case Load Balance Results

This section presents the water quality and load results from the model for PCOCs. The results include general water quality parameters (such as pH, sulfate, DOC, and hardness) to provide an overall chemical overview.

The results relate to the Base Case scenario unless otherwise stated. Alternative scenarios are shown alongside Base Case model results for annual and 95th percentile (P95) plots (plotted together) for comparison and assessment of compliance.

The results present in this section focus on key PCOCs: parameters known to have high concentrations in mine-impacted water from sources like ELF's or active pits. These include Zn, Co, Cadmium (Cd), and Ni, in addition to other relevant metals like Al, Fe, Mn, and Copper (Cu); TSS and turbidity are also presented.

The full suite of results are presented in Appendix D.

Model results were screened against guideline values provided in Section 1.3.2. Model simulated TMFs are used to calculate dynamic guideline values.

Presentation of Results

Model results for water quality are presented in four separate ways in this report:

- As a 30-day rolling median to smooth out daily variability of raw model outputs. General temporal patterns of model results and dynamic chronic guideline values. These are presented for the Base Case only.
- As concentration exceedance probability plots of daily model results to show the percentage of time that concentrations of PCOCs are above a given level for each model phase.
- As annual Metal Eco-toxicity Quotient (MEQ, Weber et al., 2016) plots to assess compliance against proposed chronic and acute guideline values (see Section 1.3.2). These are presented for the Base Case and compared against scenarios to compare effects of the various scenarios.
- Turbidity was plotted as daily probability of exceedance, 7 day rolling median, annual median and 95th percentile values, to compare to chronic acute guidelines values. TSS model results are also presented for context. These are presented for the Base Case only, with the scenario results included in the appendices.

Understanding the MEQ plots

The MEQ value for a given parameter is calculated by dividing its concentration by the compliance limit.

- An MEQ value greater than 1 indicates an exceedance of water quality guidelines.
- An MEQ value of 1 or less indicates the parameter is within compliance limits.

The MEQ plots presented within this section involved calculating the MEQ value for each daily model timestep. For the chronic assessment, the median MEQ value was calculated for each model year and plotted as a time series. For the acute assessment the P95 MEQ values were calculated for each model year and plotted as a time series. Therefore, plots where all annual MEQ values are 1 or less suggest predicted water quality is below proposed limits.

Level of Protection

A level of protection (LoP) was designated for each compliance and performance monitoring location at the Project. RMA Science (Hickey, 2026) developed proposed water quality guidelines for each LoP to screen model results against. These are listed as follows:

- KEL – 95% LoP for metals and 'ecological – continuous' for turbidity.
- V62 – 95% LoP for metals and 'ecological – continuous' for turbidity.

- W07 – 95% LoP for metals and ‘ecological – continuous’ for turbidity.
- V37_F and V37_G – 80% LoP for metals.
- M-M1 – 80% LoP for metals and discrete monitoring criteria for turbidity.

See Appendix B for proposed guideline values for each level of protection.

5.3.1 *KEL*

5.3.1.1 General Water Quality

The general water quality parameters are included in Figure 36 and Figure 37. The observations on general water quality are as follows:

- During the Active Treatment Phase, sulfate and hardness rise to two peaks near the end of the Operations Phase. The first peak is associated with the peak loads generated from the WWH ELF prior to PCOC decay. The second peak is associated with the peak loads generated from the CON ELF, prior to PCOC decay.
- pH is lower during the Active Treatment Phase (generally <5.5) and rises to typically between pH 6.5 and 7.0 once the Post Closure Phase is initiated in 2058, due to excess alkalinity in MSR discharges.
- DOC rises to approximately 3 mg/L during the Post Closure Phase, largely sourced from rehabilitated ELF runoff and MSR discharge.
- The gradual decline in sulfate and hardness beyond 2057 is associated with ELF long-term decay rates.

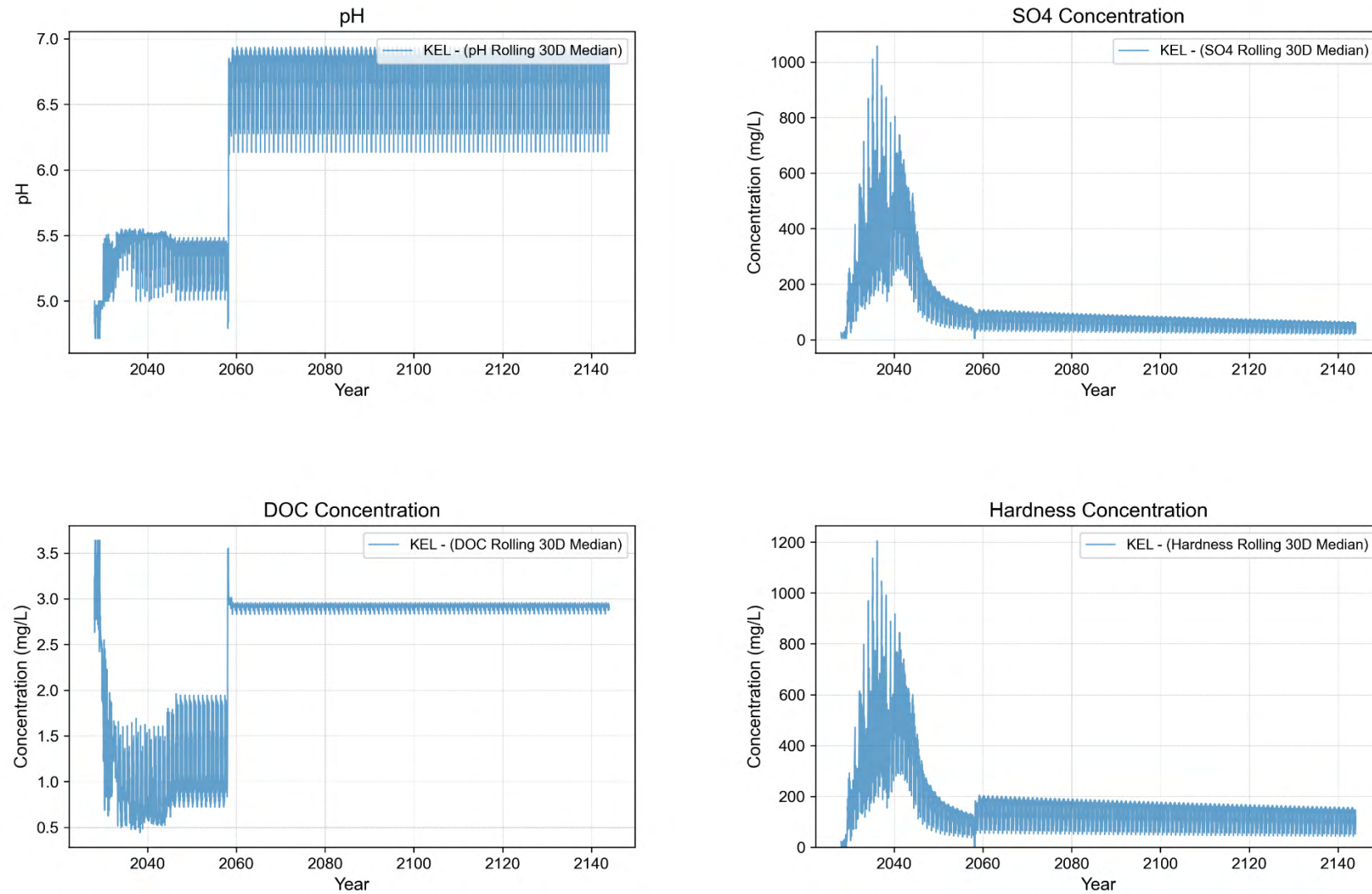
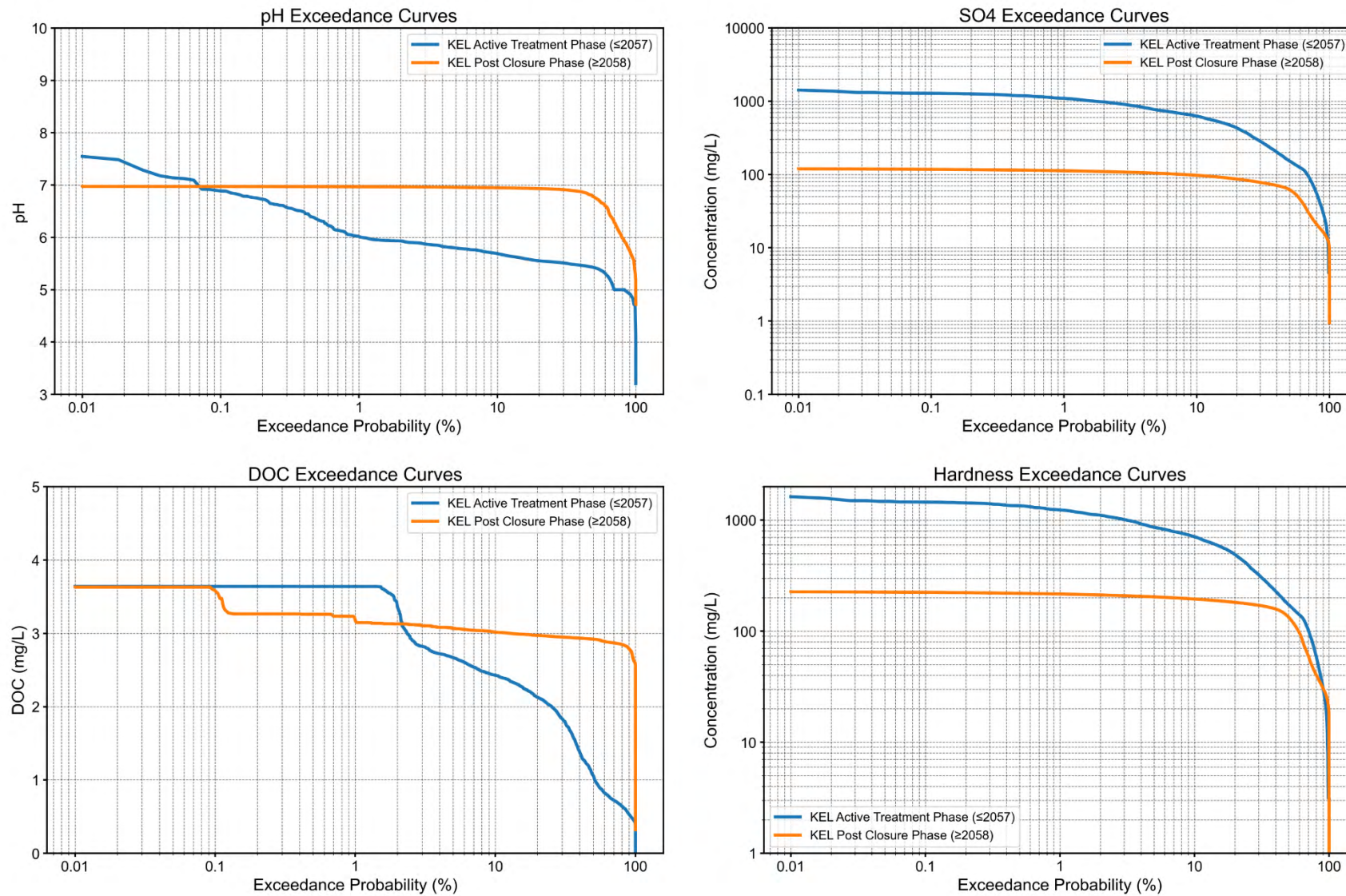


Figure 36: KEL - 30 day rolling median plots (pH, SO₄, DOC, Hardness).

Figure 37: KEL - Exceedance plots (pH, SO₄, DOC, Hardness).

5.3.1.2 Metals

Model results of key PCOCs in relation to metal guideline values are illustrated below. The following observations are noted:

- Concentration exceedance probability plots (Figure 38) show a step increase in concentrations during the Active Treatment Phase (occurring <3% of the time), associated with spill and bypass events from the WWH Sump.
- Annual median (Figure 39, Figure 40), and annual P95 plots (Figure 41, Figure 42) suggest the following:
 - o A notable increase in MEQ values occurs in 2058 following the switch from active to passive treatment.
 - o All MEQ values for the chronic assessment (annual median MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.
 - o All MEQ values for the acute assessment (annual P95 MEQ values) are below 1 during the model simulation for all scenarios.

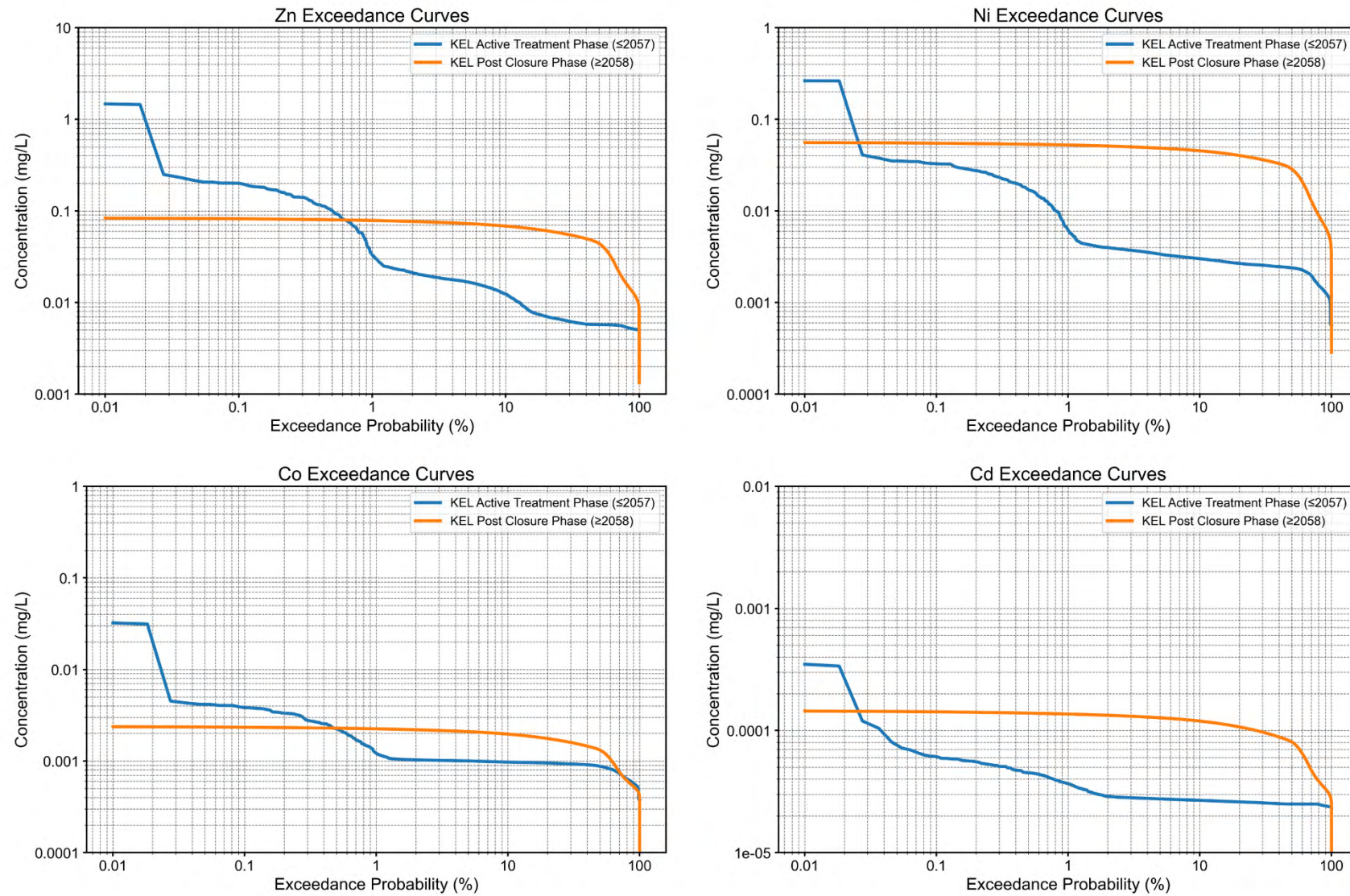


Figure 38: KEL - Exceedance plots (Zn, Ni, Co, Cd).

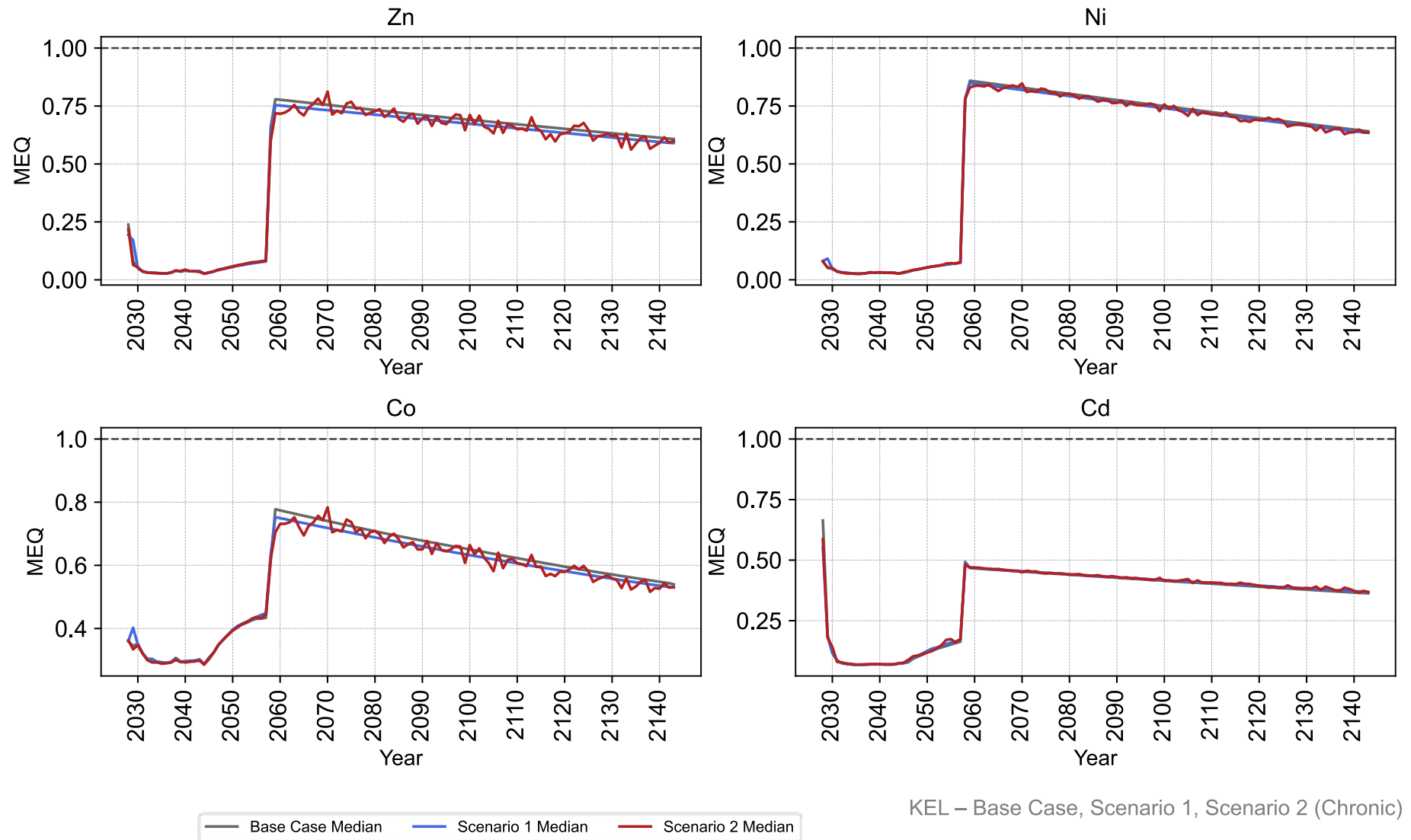


Figure 39: KEL - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

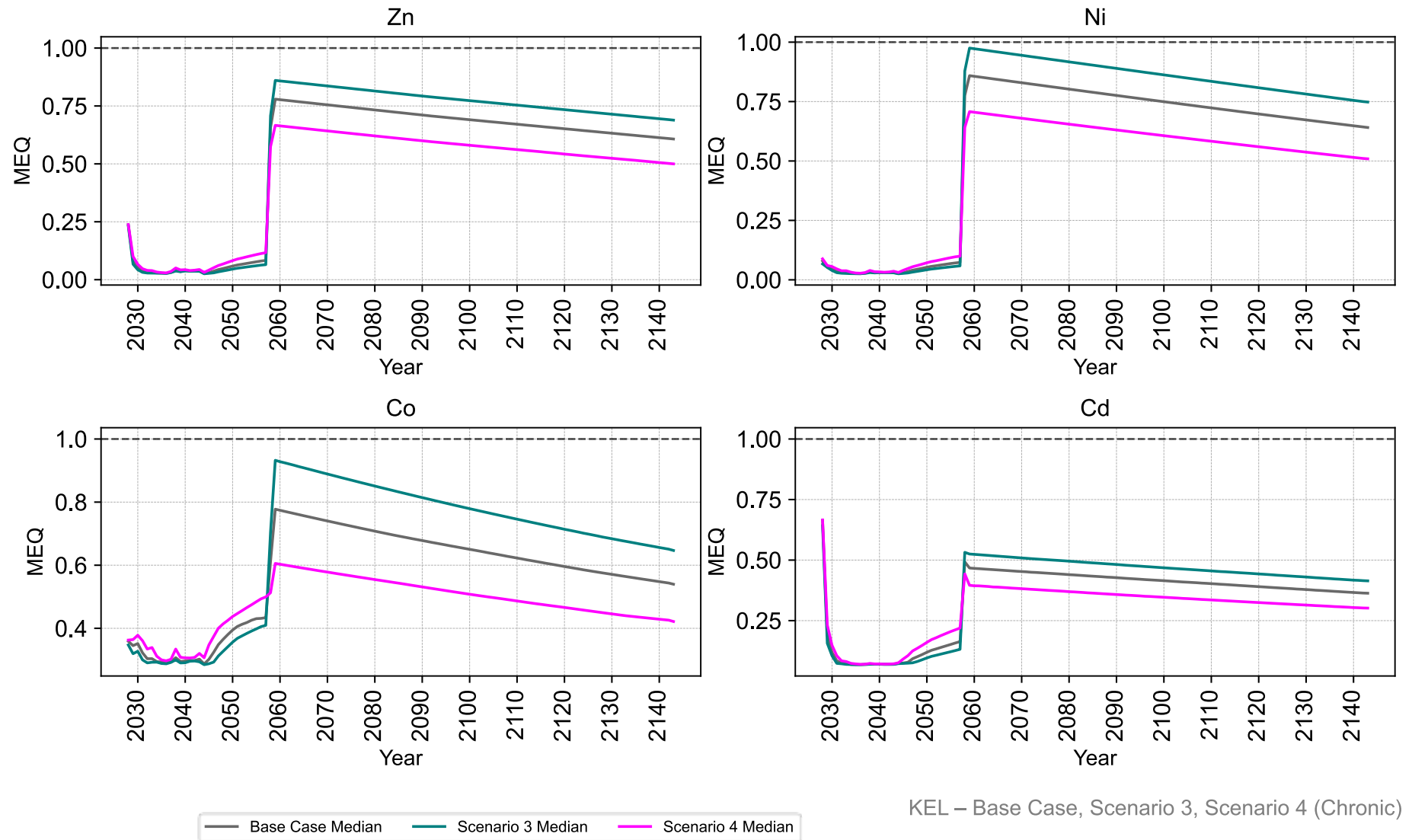


Figure 40: KEL - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

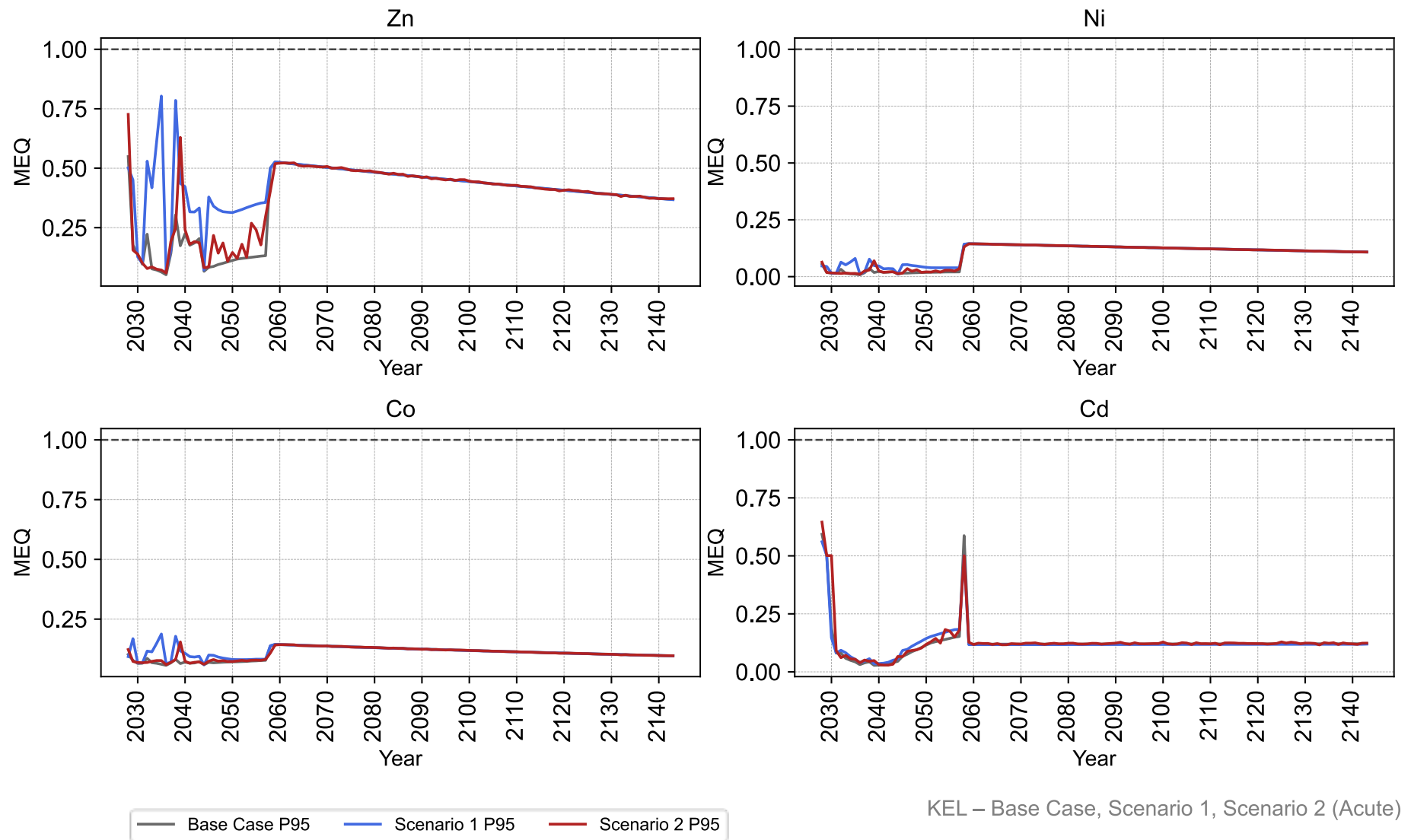


Figure 41: KEL - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

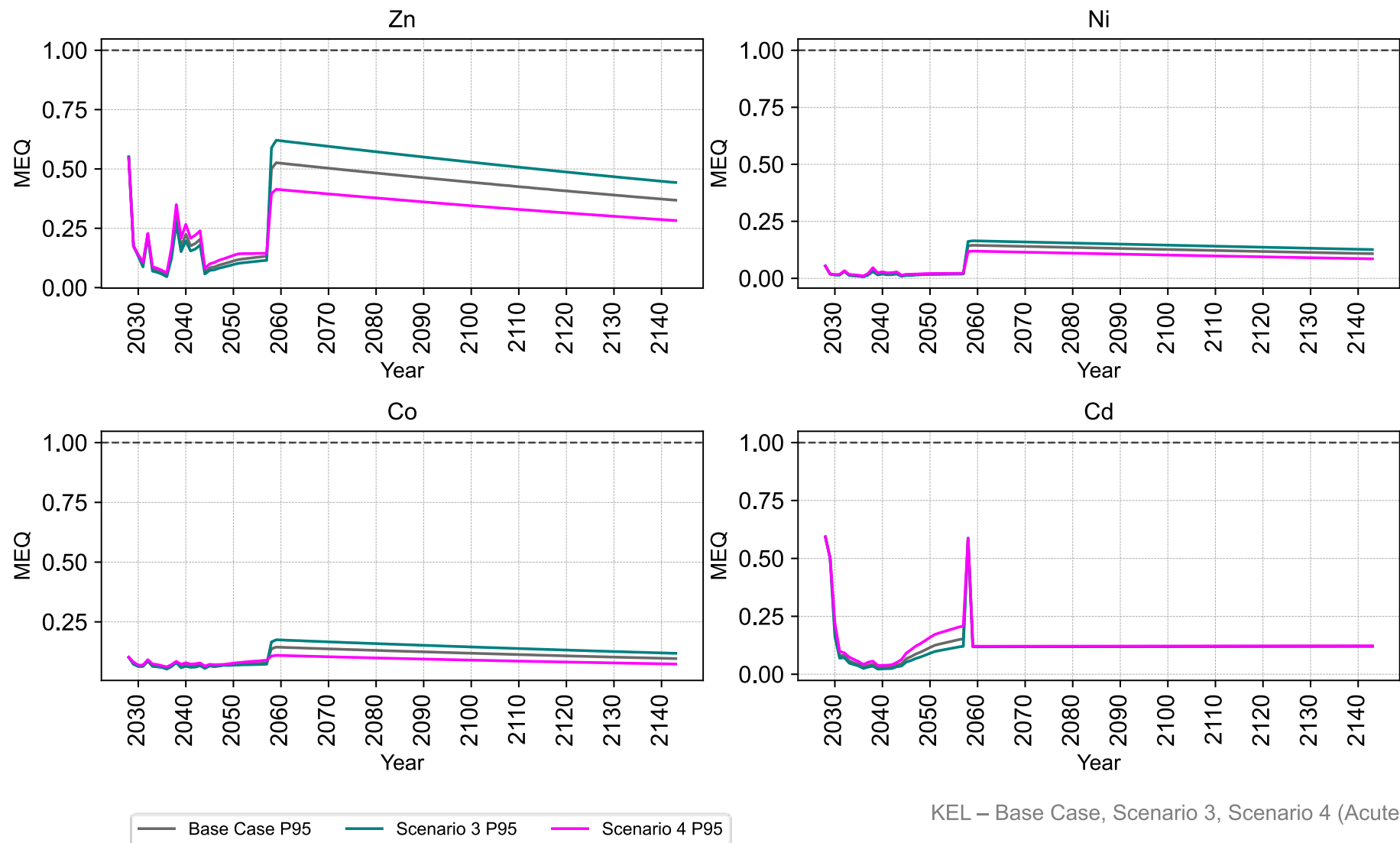


Figure 42 KEL - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

5.3.1.3 TSS and Turbidity

TSS at KEL is plotted in Figure 43 and Figure 44. The following observations are made:

- TSS concentrations differ between the Active Treatment Phase and the Post Closure Phase.
- The Active Treatment Phase is characterised by lower median TSS concentrations. This is due to pumping and treatment of TSS within MIW at the WTP. However, the Active Treatment Phase is also characterised by a larger variation in TSS concentrations over time. Bypass and spill discharge events account for the higher concentrations of TSS at KEL, as larger amounts of TSS are generated during these high rainfall events, which report to the environment without passing through the WTP.
- TSS concentrations increase during the Post Closure Phase, although are more consistent over time. Median concentrations during this phase are calculated in the order of 3.0 – 3.5 mg/L, predominantly sourced from the polishing pond discharge.

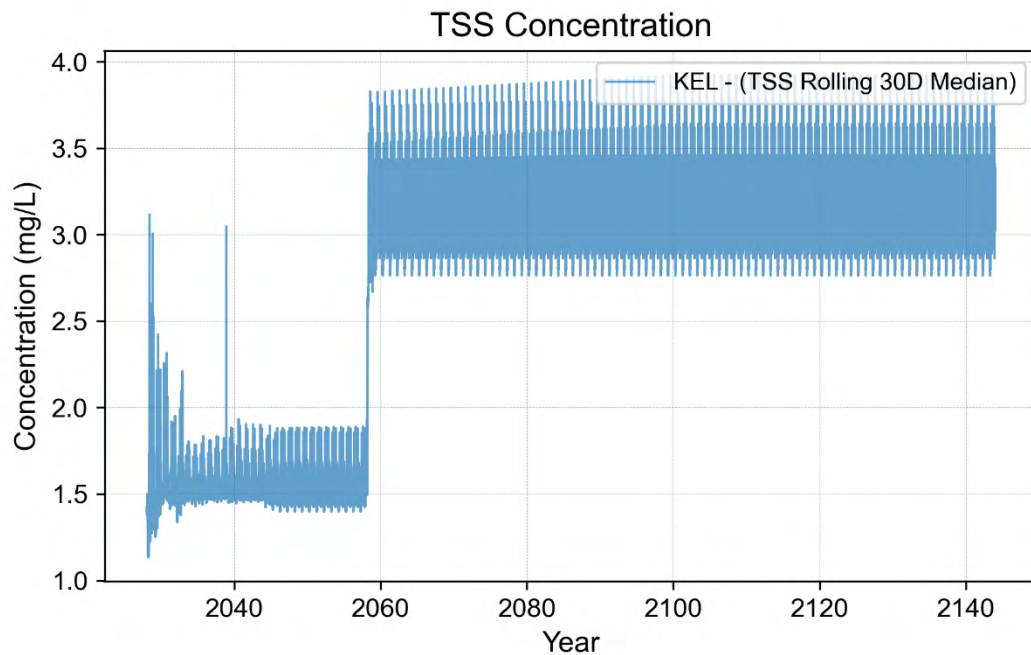


Figure 43: KEL - TSS - 30-day rolling median.

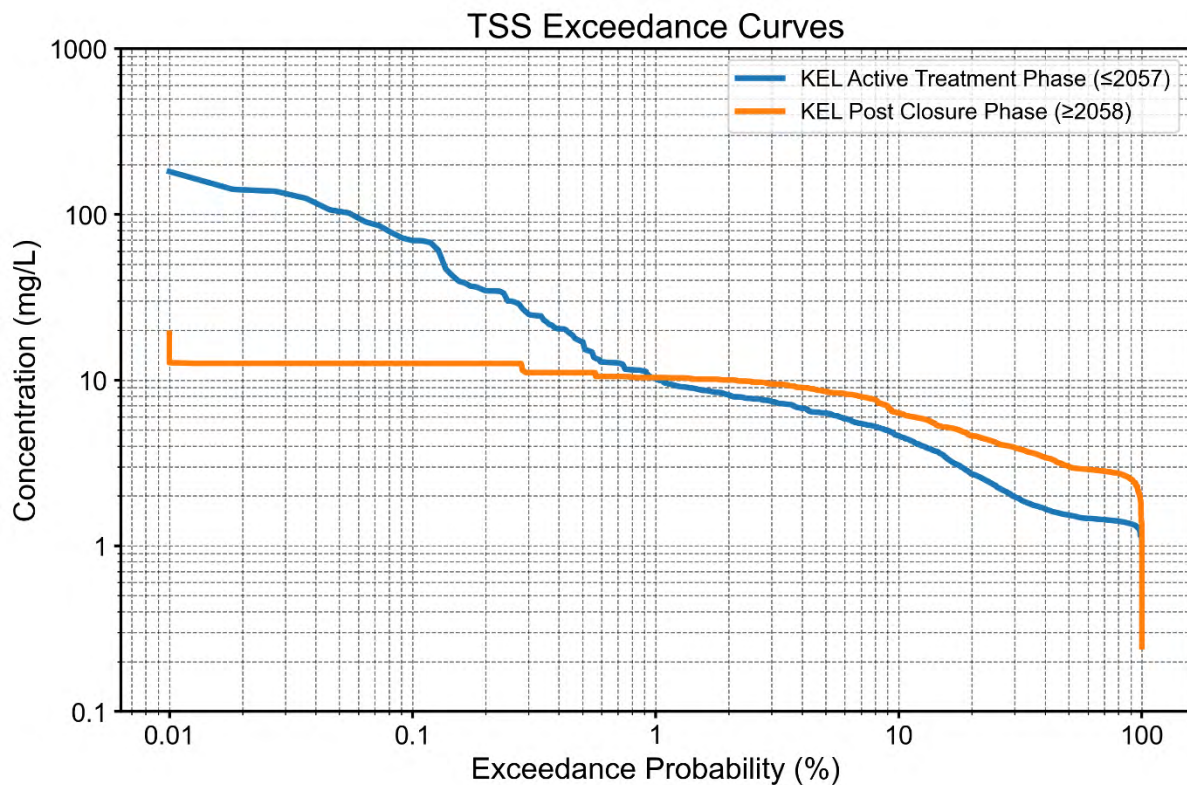


Figure 44: KEL - TSS - exceedance plot.

Turbidity is plotted against the proposed chronic and acute limits in Figure 45 and Figure 46. The model results suggest that turbidity at KEL is below the proposed guideline values throughout the entire simulation.

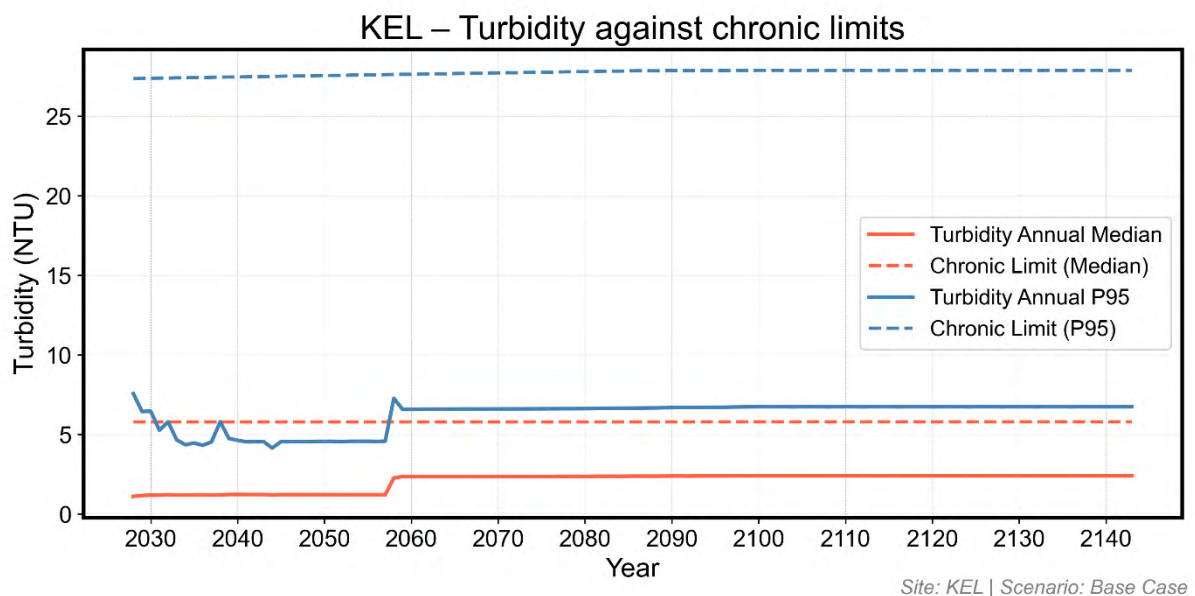


Figure 45: KEL – turbidity compared to chronic compliance limits.

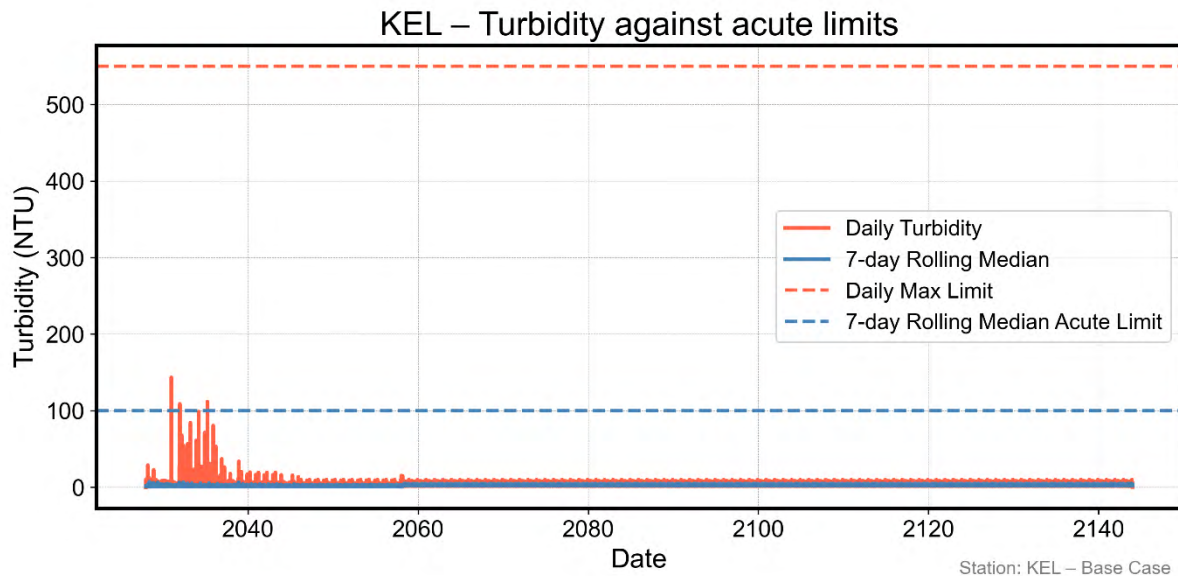


Figure 46: KEL - turbidity compared to acute compliance limits.

5.3.2 V62

5.3.2.1 General Water Quality

The general water quality parameters are included in Figure 47 and Figure 48. The observations on general water quality are as follows:

- During the Active Treatment Phase, very low concentrations are observed most of the time, as sump water containing seepage is pumped to the WTP. Elevated concentrations of sulfate and hardness occur <3% of the time and are associated with bypass discharge events.
- At the start of the Post Closure Phase, between 2058 and 2070, the same patterns as above are observed because the sump water is pumped to V37_F. As a result, seepage does not report to the compliance location during this period.
- pH is lower during the Active Treatment Phase and up until 2071, before rising to between 6.5 and 7.0 once passively treated water is released to V62.
- DOC concentrations lower to 2-3 mg/L during the Post Closure Phase.
- The gradual decline in sulfate and hardness beyond 2071 is associated with ELF long-term decay rates.

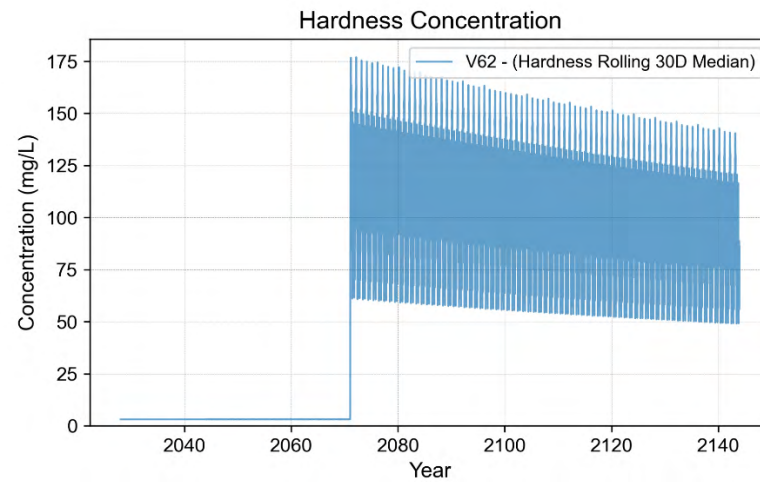
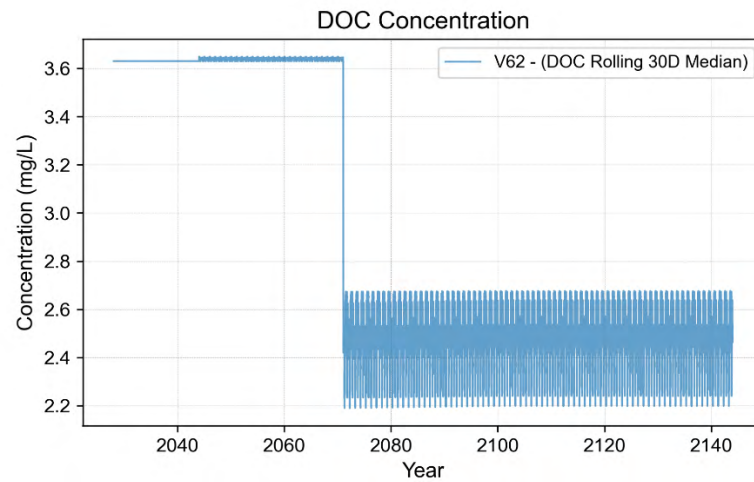
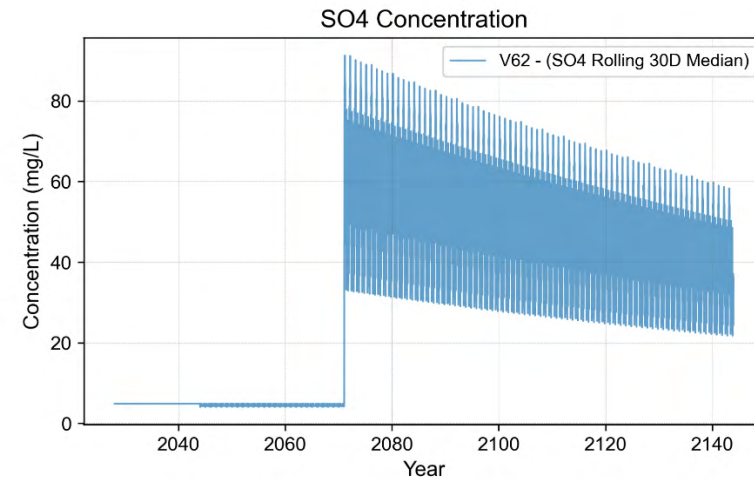
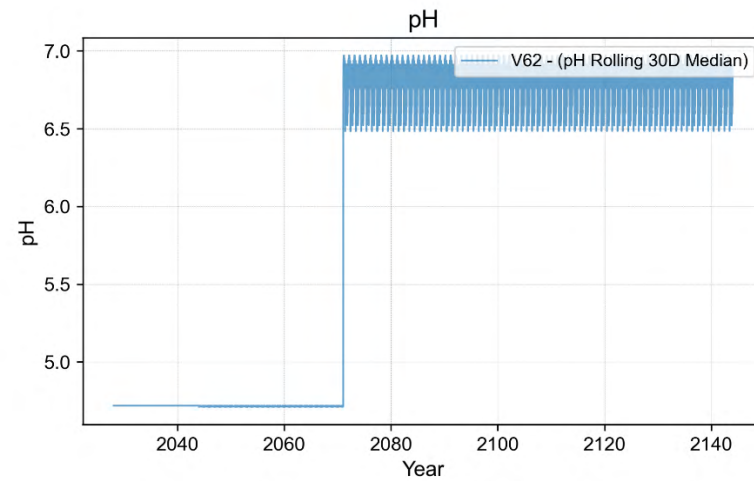
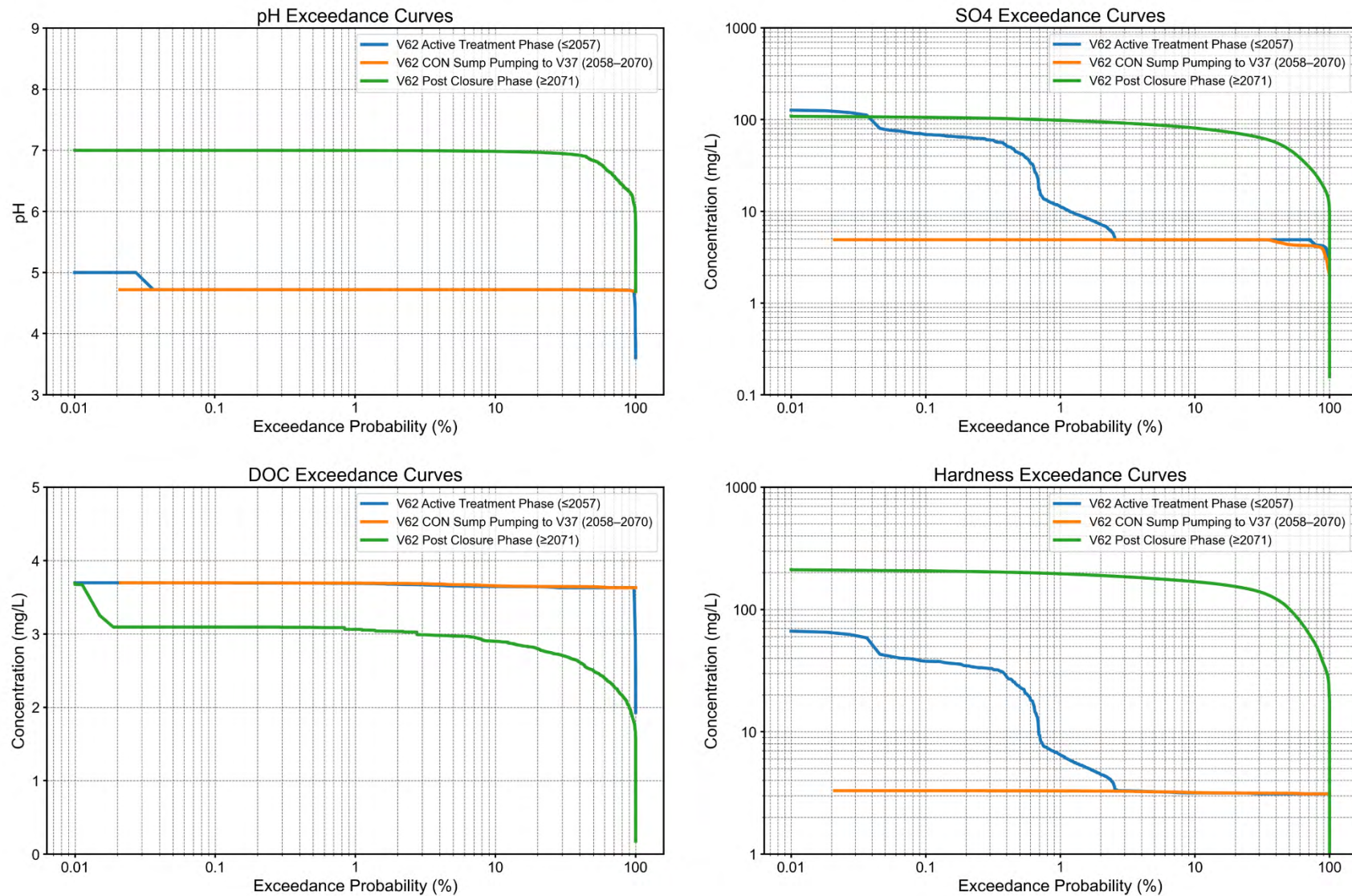


Figure 47: V62 – 30 day rolling median plots (pH, SO₄, DOC, Hardness).

Figure 48: V62 - exceedance plots (pH, SO₄, DOC, Hardness).

5.3.2.2 Metals

Model results of key PCOCs in relation to metal guideline values are illustrated below. The following observations are noted:

- Concentration exceedance probability plots (Figure 49) show a step increase in concentration during the Active Treatment Phase (occurring <3% of the time), associated with spill and bypass events from the CON Sump.
- PCOC concentrations are lowest during the years 2058-2070 when CON Polishing Pond water is pumped to V37_F.
- Annual median (Figure 50, Figure 51), and annual P95 (Figure 52, Figure 53) suggest the following:
 - o A notable increase in MEQ values occurs in 2068 following the switch from active to passive treatment and the cessation of pumping of water from CON Polishing Pond to V37_F. This increase is a result of the polishing pond discharge reporting to V62 Stream.
 - o All MEQ values for the chronic assessment (annual median MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.
 - o All MEQ values for the acute assessment (annual P95 MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.

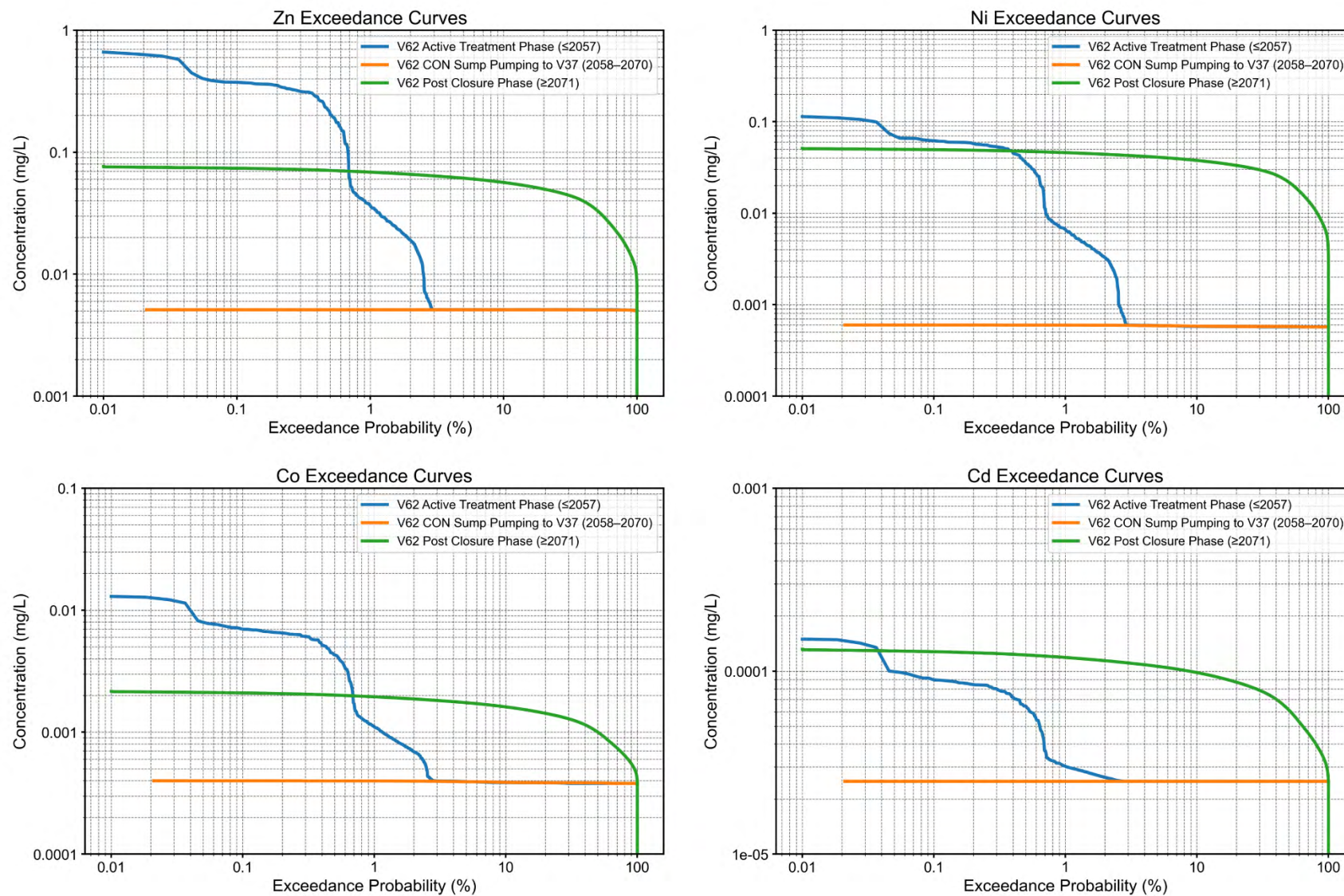


Figure 49: V62 - exceedance plots (Zn, Ni, Co, Cd).

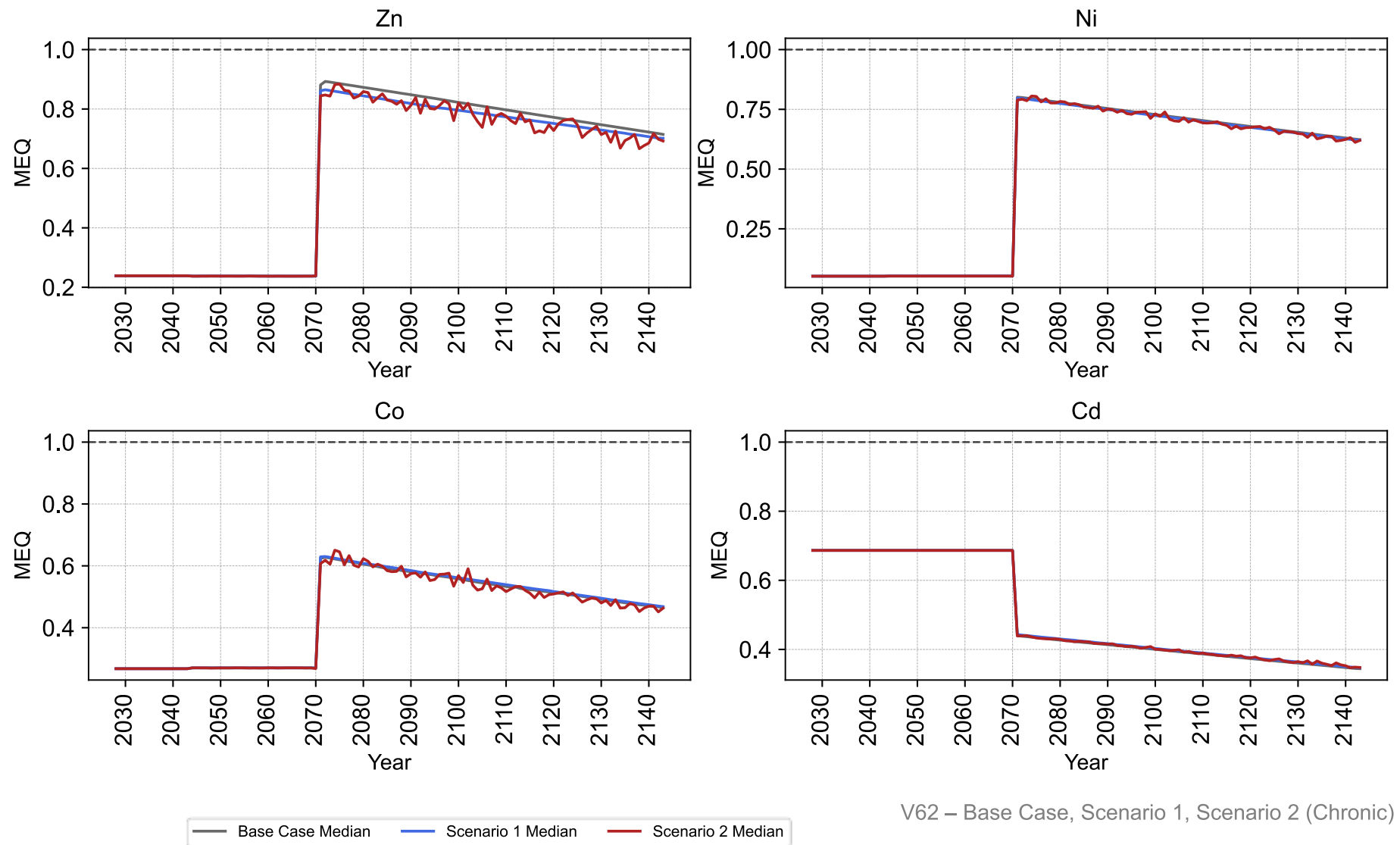


Figure 50: V62 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

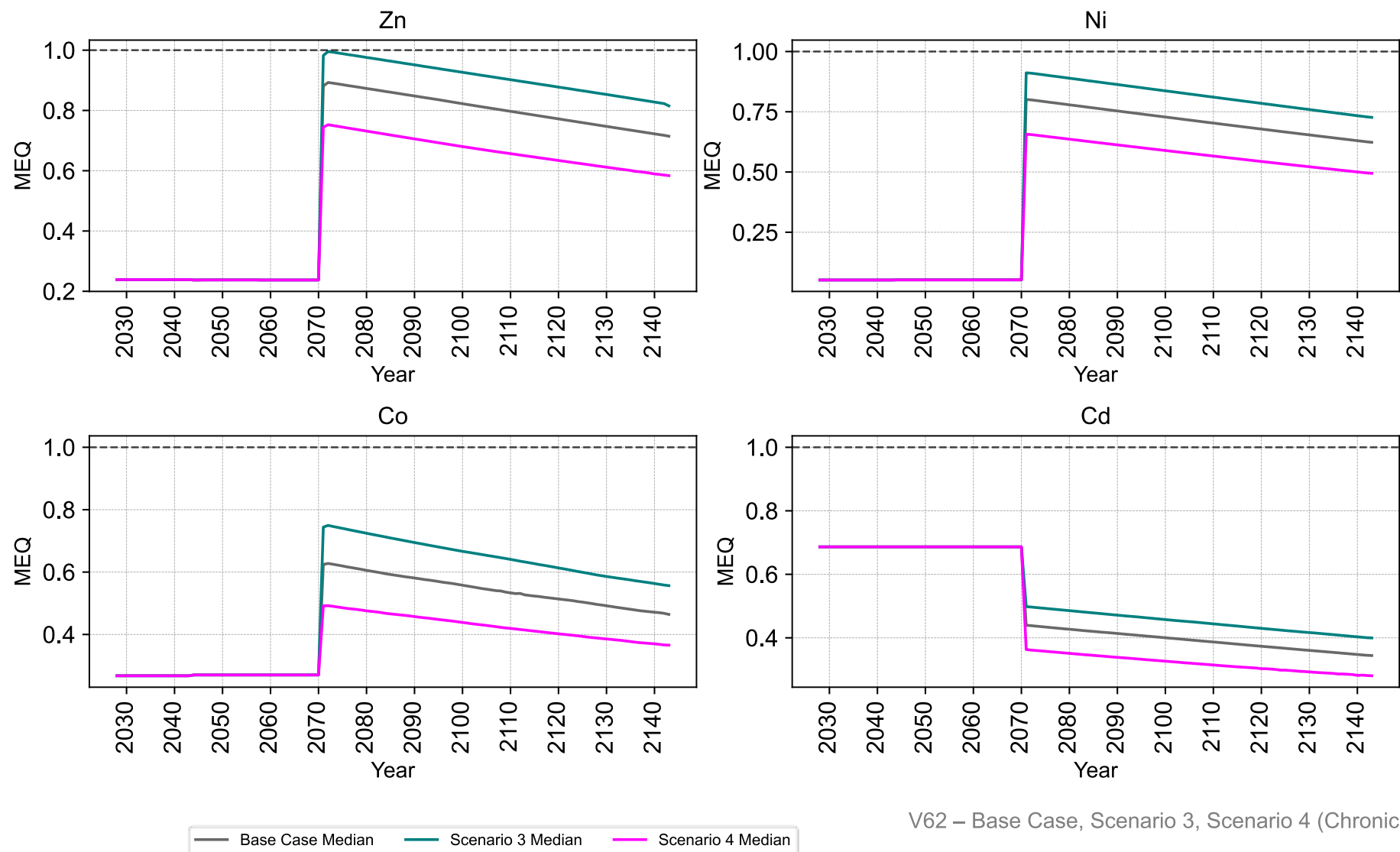


Figure 51: V62 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

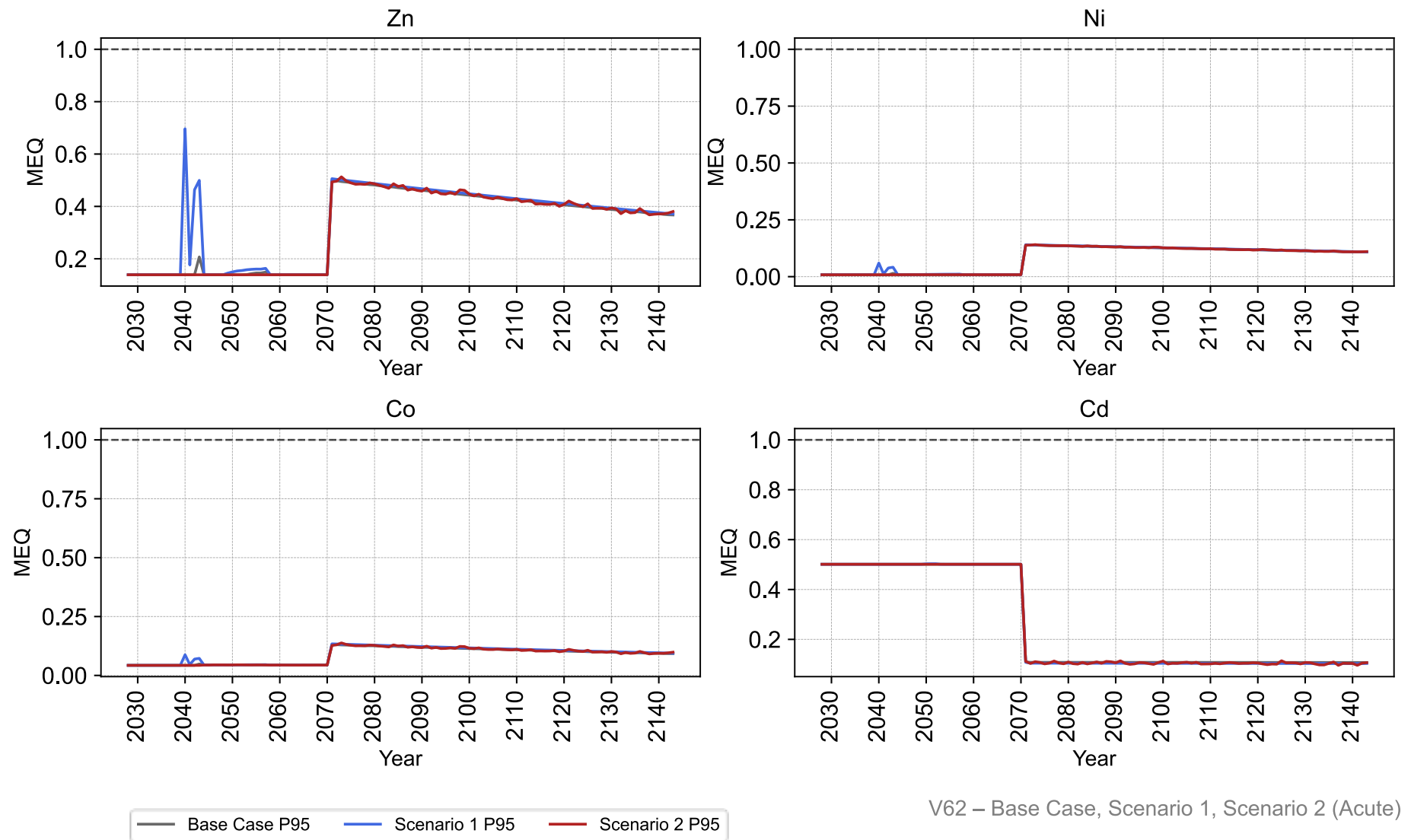


Figure 52: V62 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

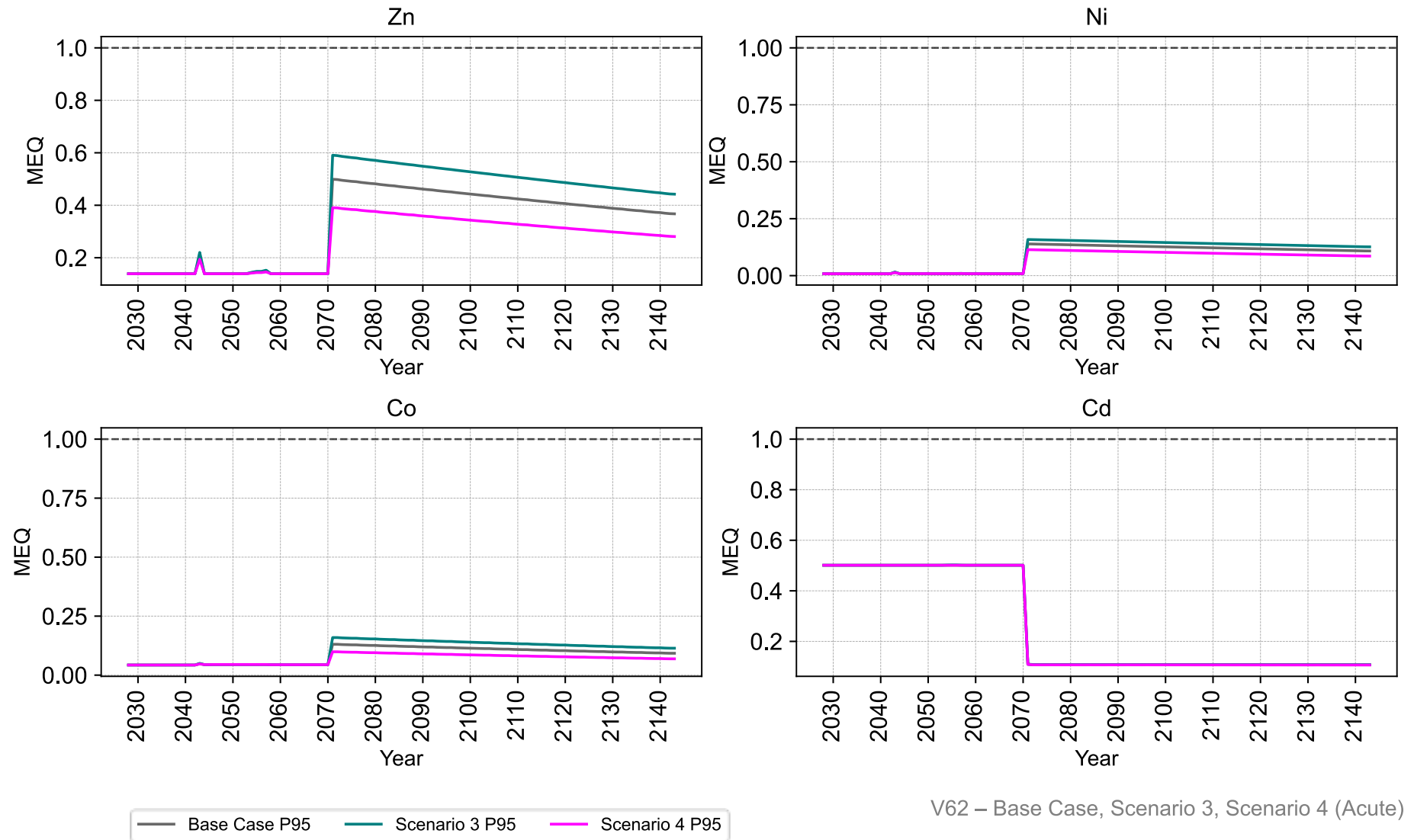


Figure 53: V62 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

5.3.2.3 TSS and Turbidity

TSS at V62 is plotted in Figure 54 and Figure 55. The following observations are made:

- TSS concentrations differ between the Active Treatment Phase and the Post Closure Phase. An increase is noted during the Post Closure Phase which is attributed to polishing pond discharge TSS.
- The Active Treatment Phase is characterised by lower median TSS concentrations. This is due to the pumping of MIW to the WTP during this period. However, the Active Treatment Phase is also characterised by a larger variation in TSS concentrations (observed in Figure 55) over time. Bypass and spill discharge events account for the higher concentrations of TSS at V62, as larger amounts of TSS are generated during these high rainfall events, which report to the environment without passing through the WTP.
- TSS concentrations increase during the Post Closure Phase, although are more consistent over time. Median concentrations during this phase are calculated in the order of 3 mg/L.

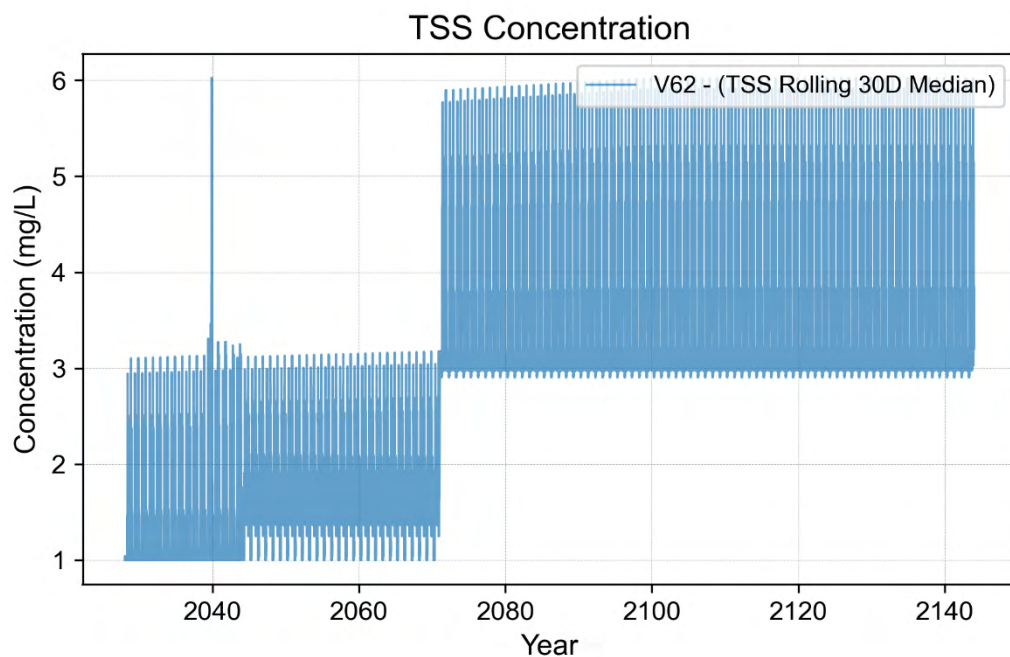


Figure 54: V62 - TSS - 30 day rolling median.

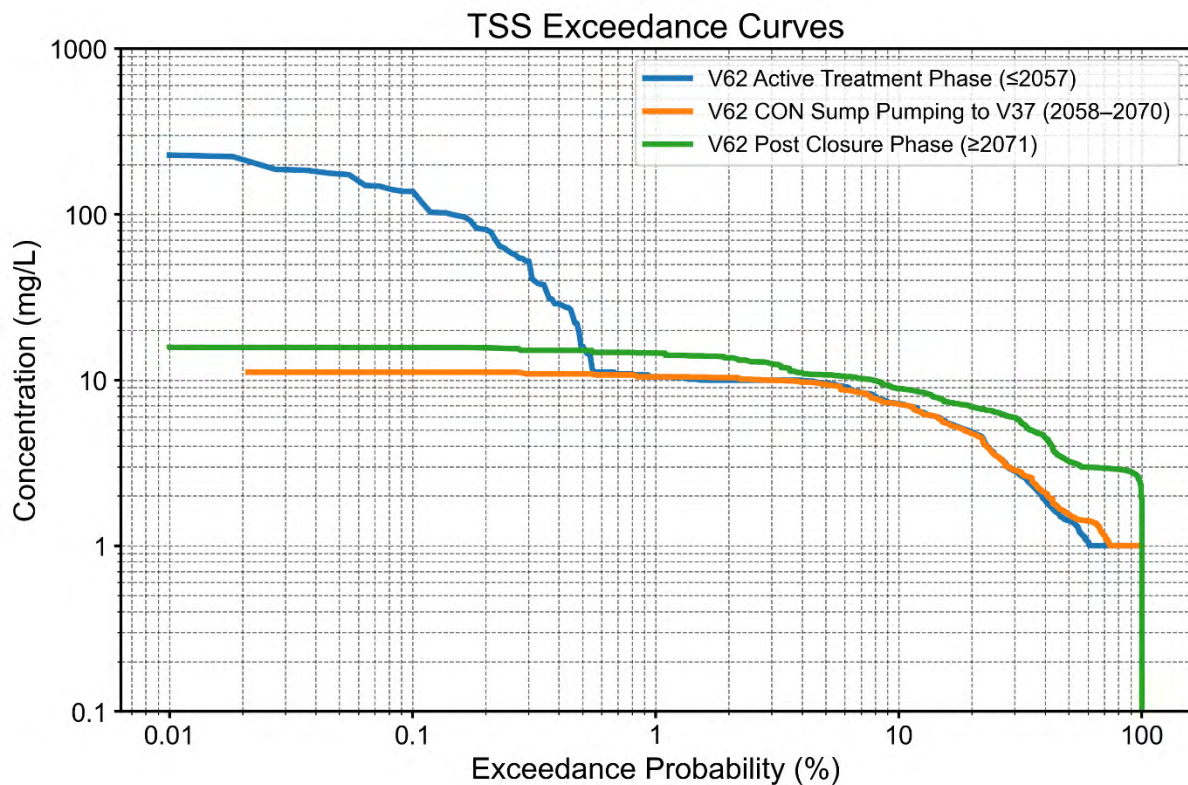


Figure 55: V62 - TSS - exceedance plot.

Turbidity is plotted against the proposed chronic and acute guideline values in Figure 56 and Figure 57. The model results suggest that turbidity at V62 is below the proposed guideline values throughout the entire simulation.

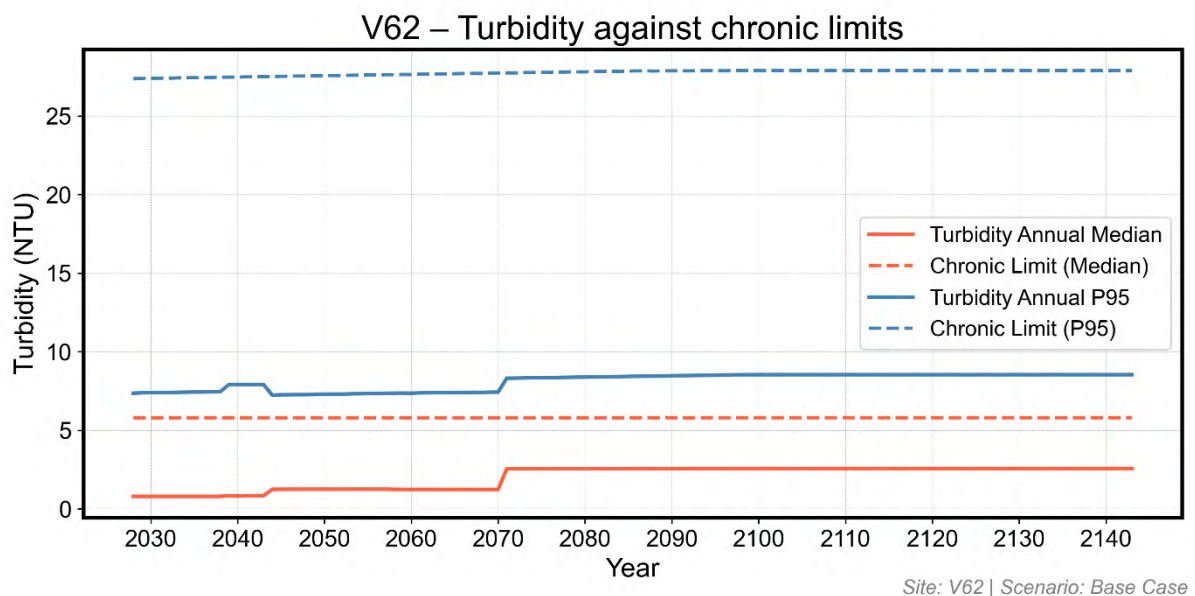


Figure 56: V62 - turbidity compared to chronic compliance limits.

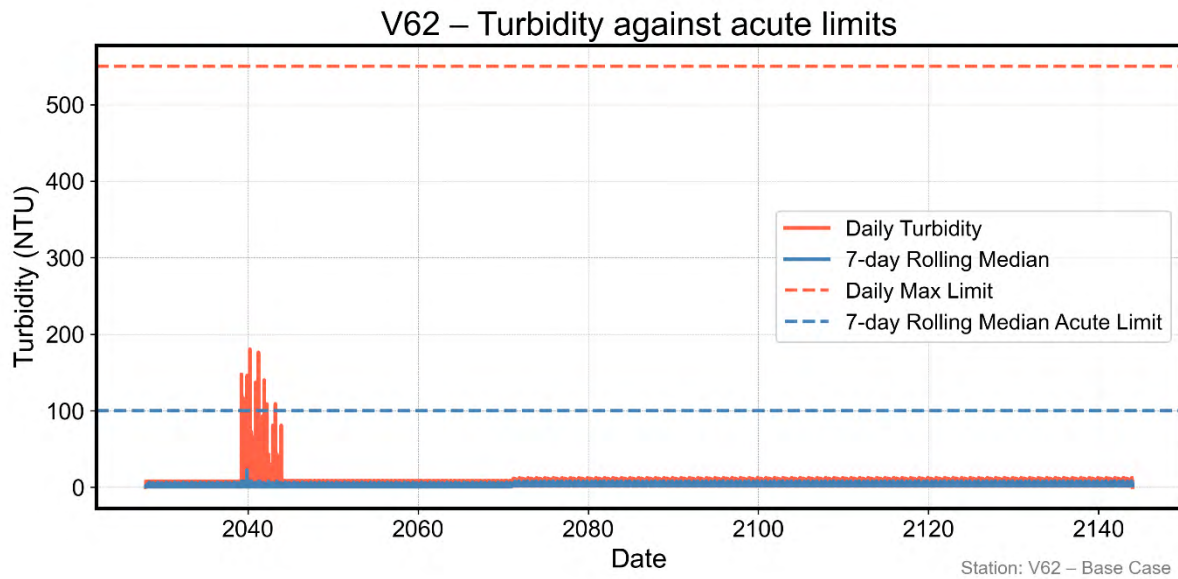


Figure 57: V62 - turbidity compared to acute compliance limits.

5.3.3 W07

5.3.3.1 General Water Quality

The general water quality parameters are included in Figure 58 and Figure 59. The observations on general water quality are as follows:

- During the Active Treatment Phase, very low concentrations are observed most of the time, as sump water containing seepage is pumped to the WTP. Elevated concentrations of sulfate and hardness occur <5% of the time and are associated with bypass discharge events.
- Median pH is lower during the Active Treatment Phase, and reflective of background water quality. pH rises to between 5 and 7 once passively treated water is released to Rapid Stream (i.e., from 2046 onwards).

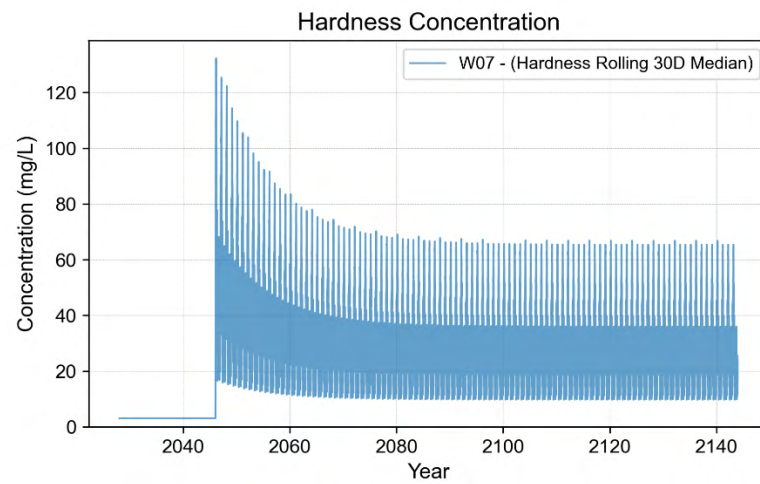
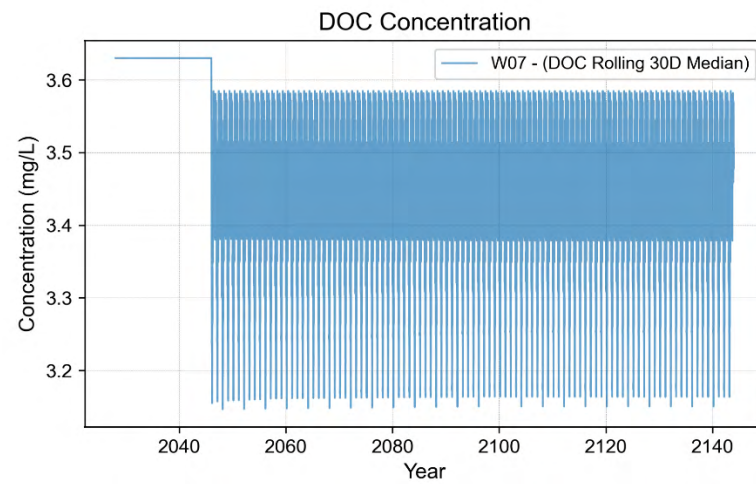
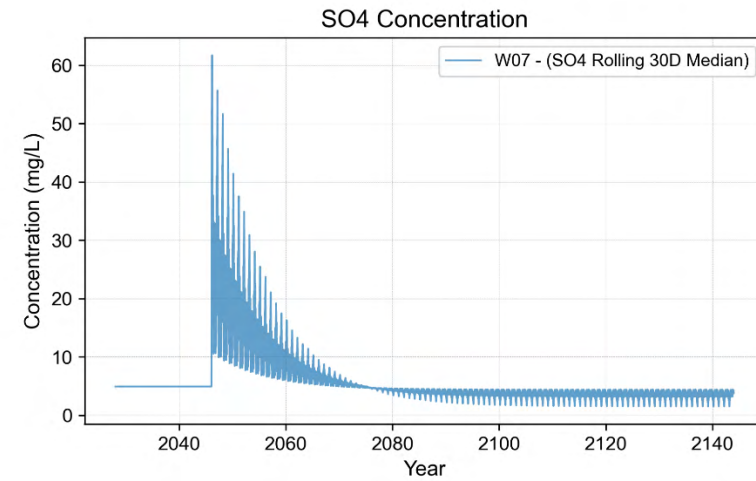
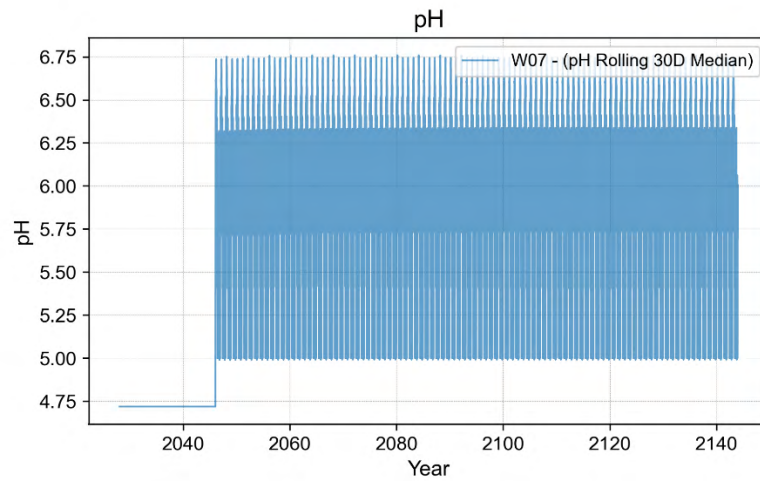
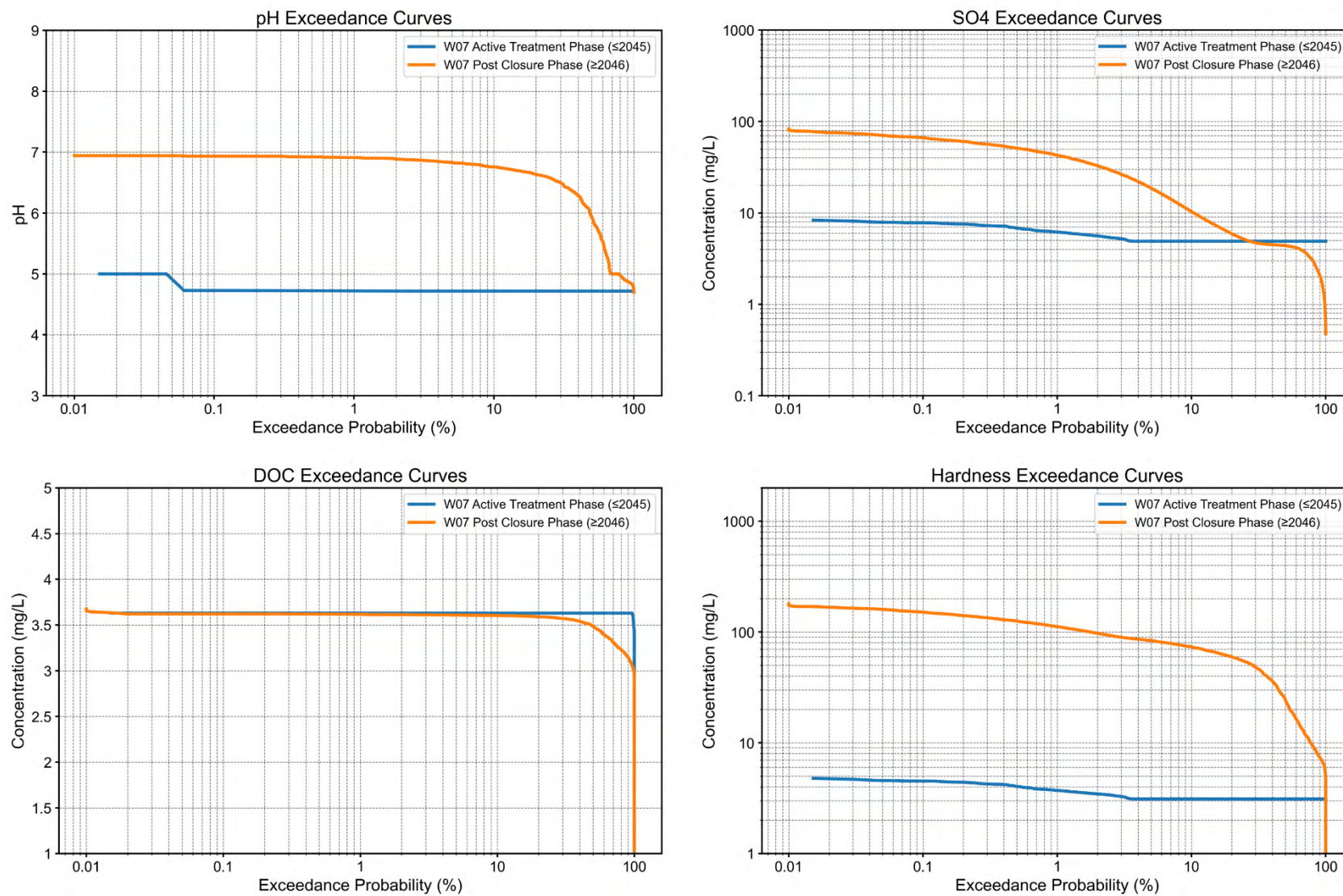


Figure 58: W07 - 30 day rolling median plots (pH, SO₄, DOC, Hardness).

Figure 59: W07 - exceedance plots (pH, SO₄, DOC, Hardness).

5.3.3.2 Metals

Model results of key PCOCs in relation to metal guideline values are illustrated below. The following observations are noted:

- Concentration exceedance probability plots (Figure 60), show a step increase in concentrations for the Active Treatment Phase, associated with spill and bypass events from the NSUL Sump.
- Annual median (Figure 61, Figure 62), and annual P95 plots (Figure 63, Figure 64) suggest the following:
 - o A notable increase in MEQ occurs following cessation of pumping to the WTP, and activation of the passive treatment system (2046).
 - o All MEQ values for the chronic assessment (annual median MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.
 - o All MEQ values for the acute assessment (annual P95 MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.

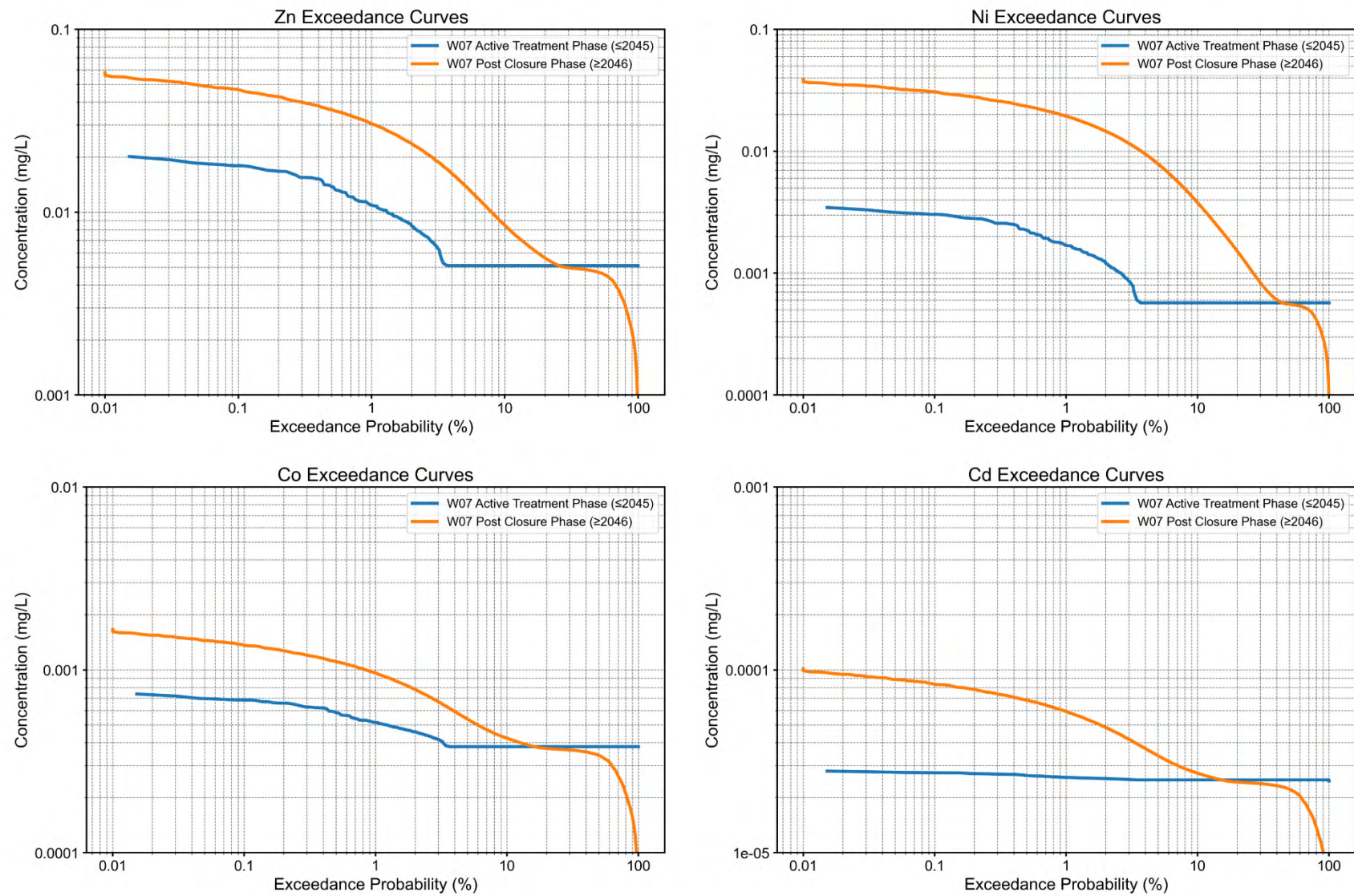


Figure 60: W07 - exceedance plots (Zn, Ni, Co, Cd).

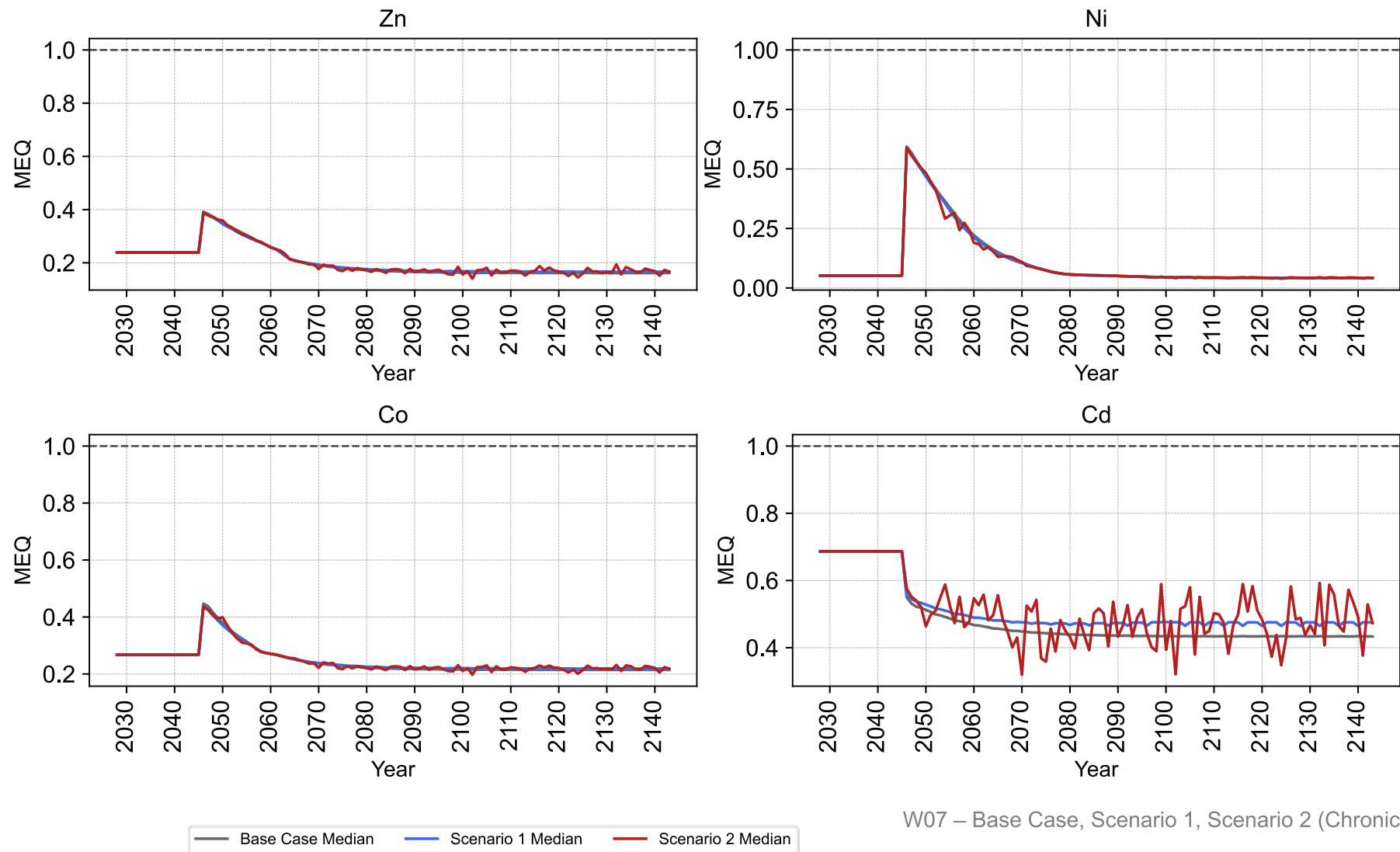


Figure 61: W07 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

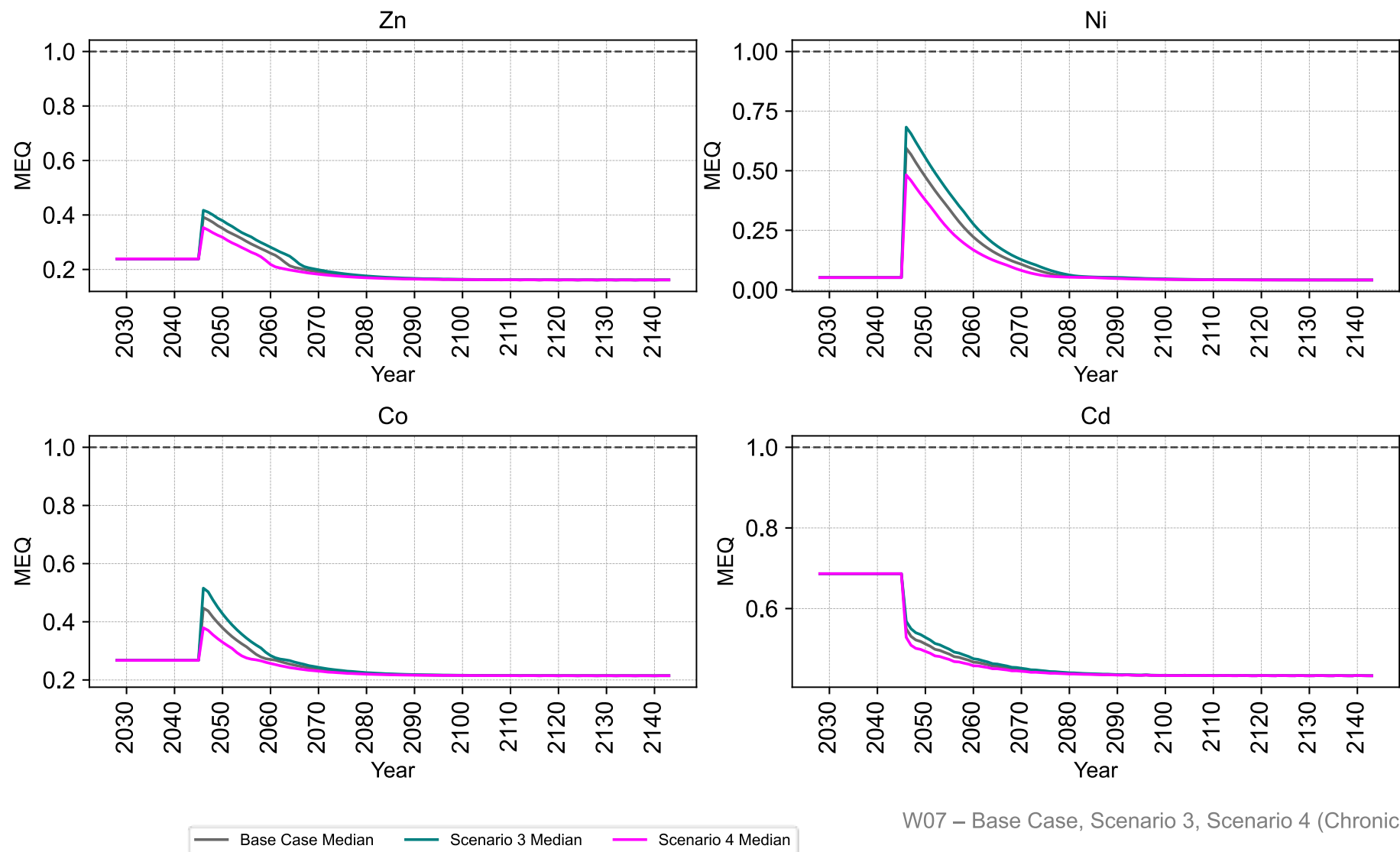


Figure 62: W07 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

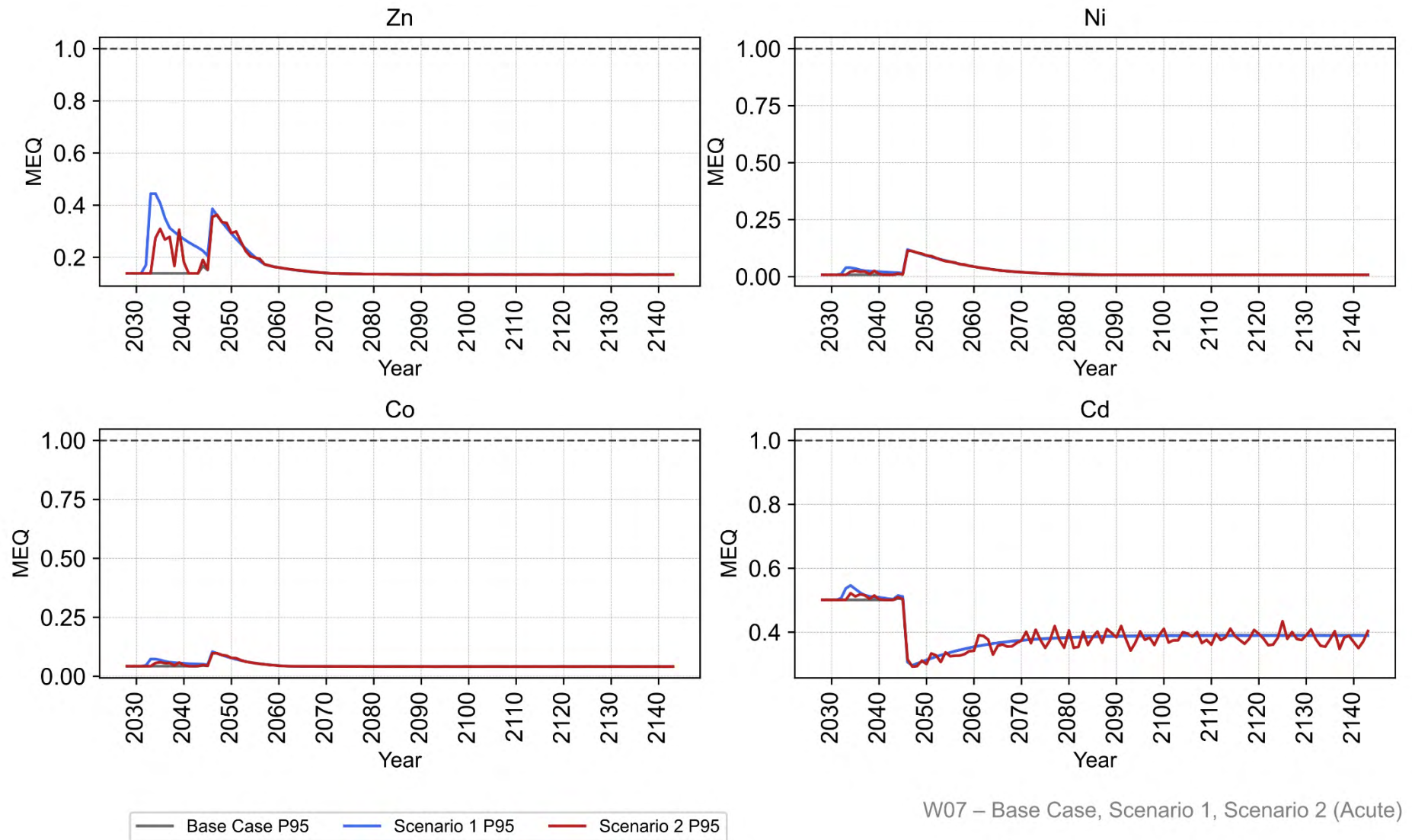


Figure 63: W07 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

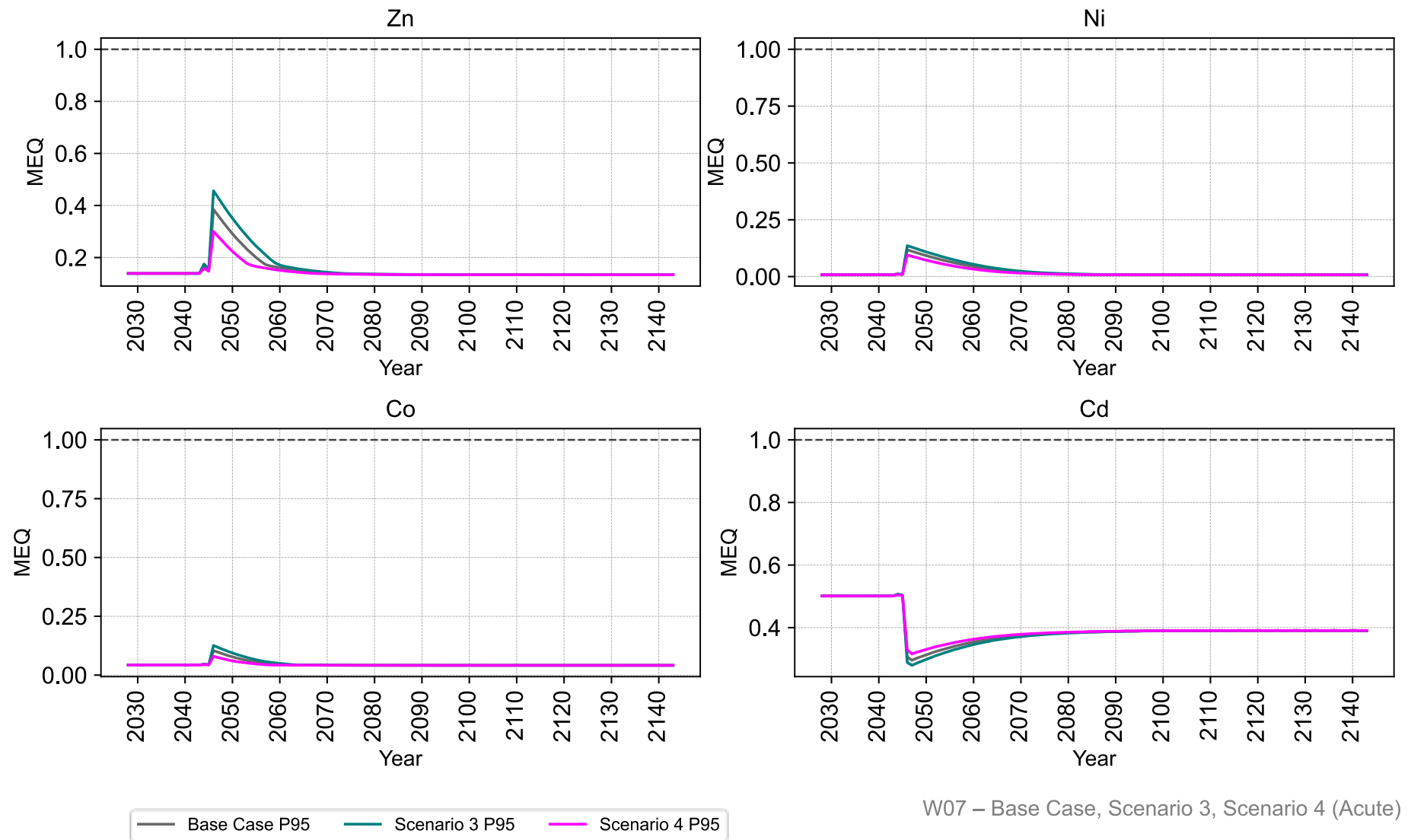


Figure 64: W07 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

5.3.3.3 TSS and Turbidity

TSS at W07 is plotted in Figure 65 and Figure 66. The following observations are made:

- TSS concentrations differ significantly between the Active Treatment Phase and the Post Closure Phase.
- The Active Treatment Phase is characterised by lower median TSS concentrations. This is due to the pumping of NSUL seepage to the WTP during this period. The Active Treatment Phase is also characterised by a larger variation in TSS concentrations over time. Bypass discharge events account for the higher concentrations of TSS at W07, as larger amounts of TSS are generated during these high rainfall events (albeit at low frequencies), which report to the environment without passing through the WTP.
- TSS concentrations increase during the Post Closure Phase, although are more consistent over time. Median concentrations are calculated as ~5-6 mg/L.

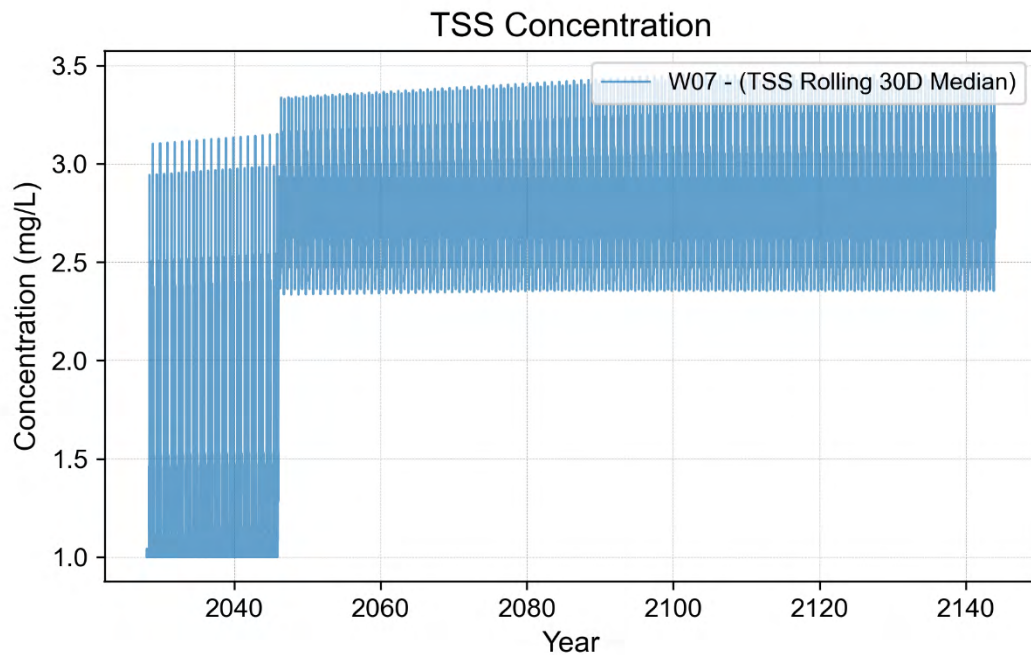


Figure 65: W07 - TSS - 30 day rolling median.

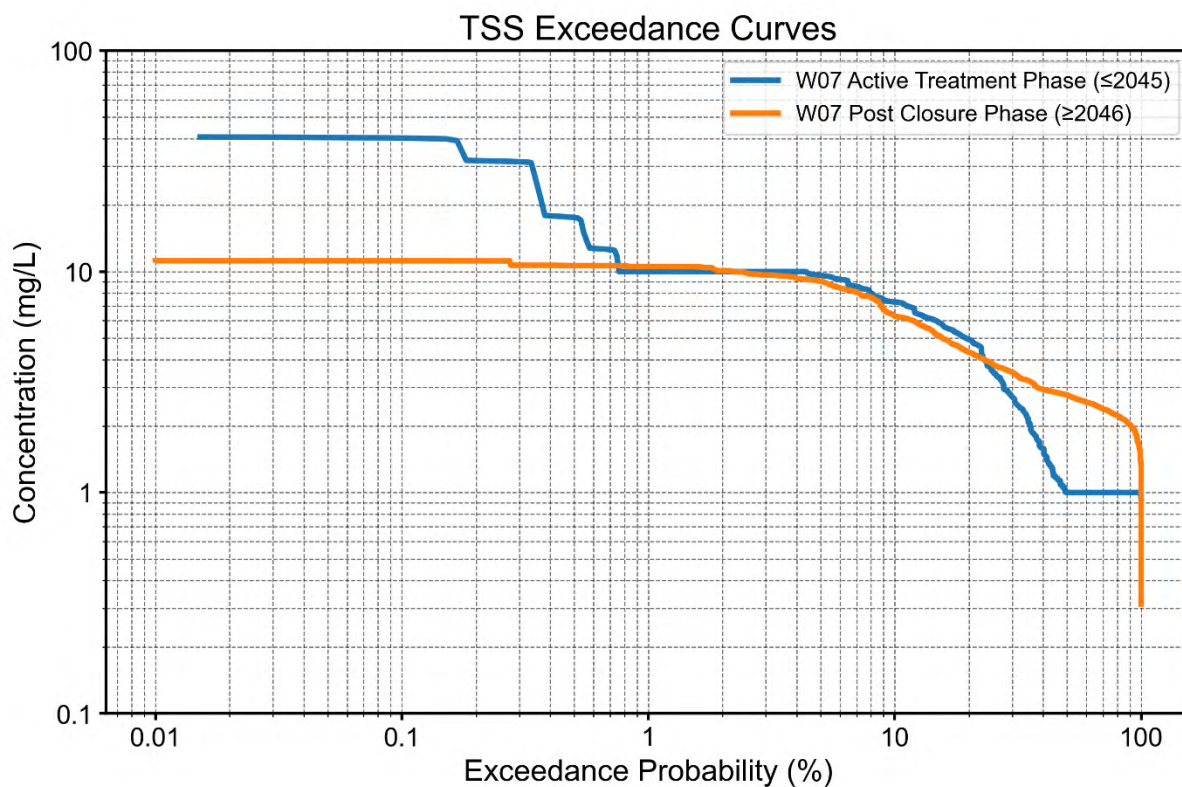


Figure 66: W07 - TSS - 30 day rolling median.

Turbidity is plotted against the proposed chronic and acute guideline values in Figure 67 and Figure 68. The model results suggest that turbidity at W07 is below the proposed guidelines throughout the entire simulation.

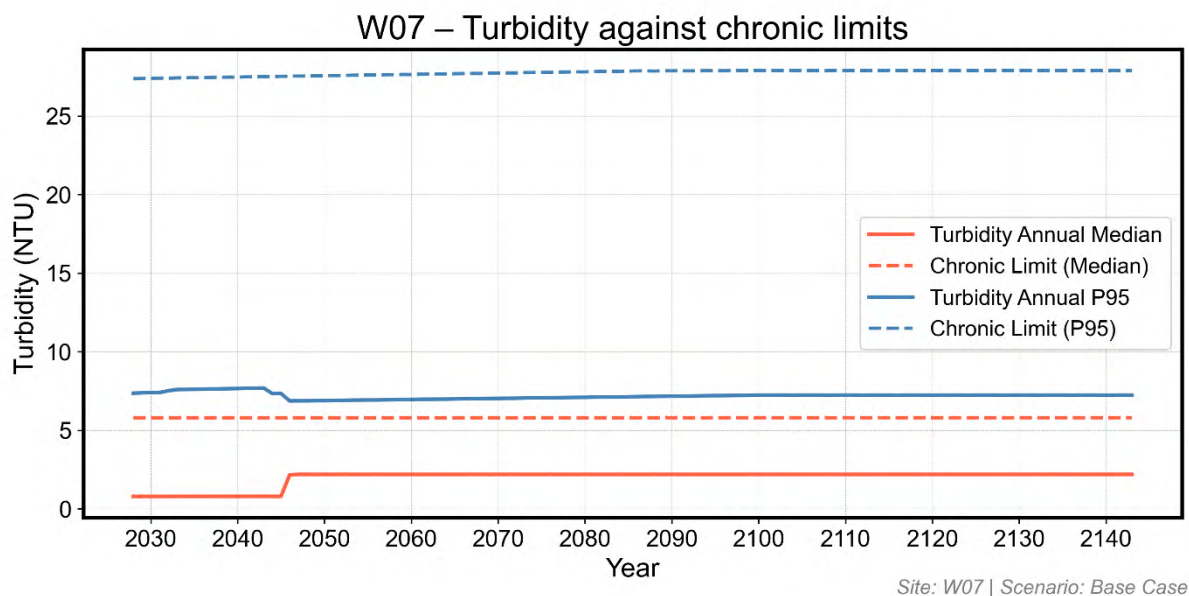


Figure 67: W07 - turbidity compared to chronic compliance limits.

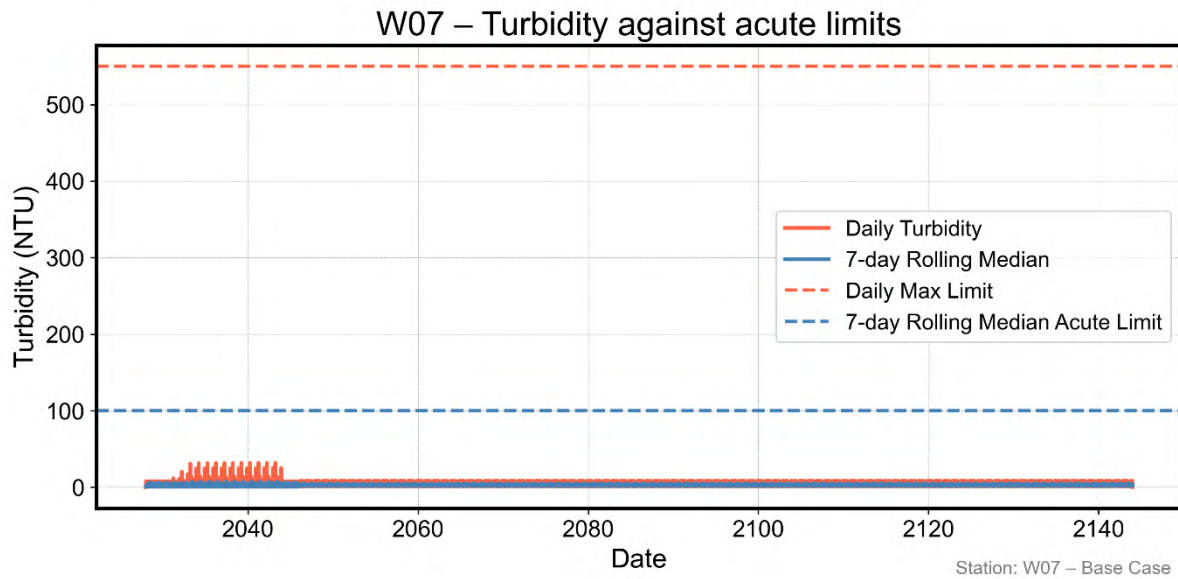


Figure 68: W07 - turbidity compared to acute compliance limits.

5.3.4 M-M1

5.3.4.1 General Water Quality

The general water quality parameters are included in Figure 69 and Figure 70. The observations on general water quality are as follows:

- During the Operations Phase, sulfate and hardness rise to two peaks near the end of the active mining. This pattern reflects KEL and occurs due to the pumping of up to 40 L/s of treated water from the WTP to V8 Creek.
- pH is lower during the Active Treatment Phase and rises to typically between 5.5 and 7.0 once the Post Closure Phase is initiated in 2058.
- DOC rises to approximately 3.0-3.5 mg/L during the Post Closure Phase.
- The gradual decline in sulfate and hardness beyond 2057 is associated with BVE ELF long-term decay rates.

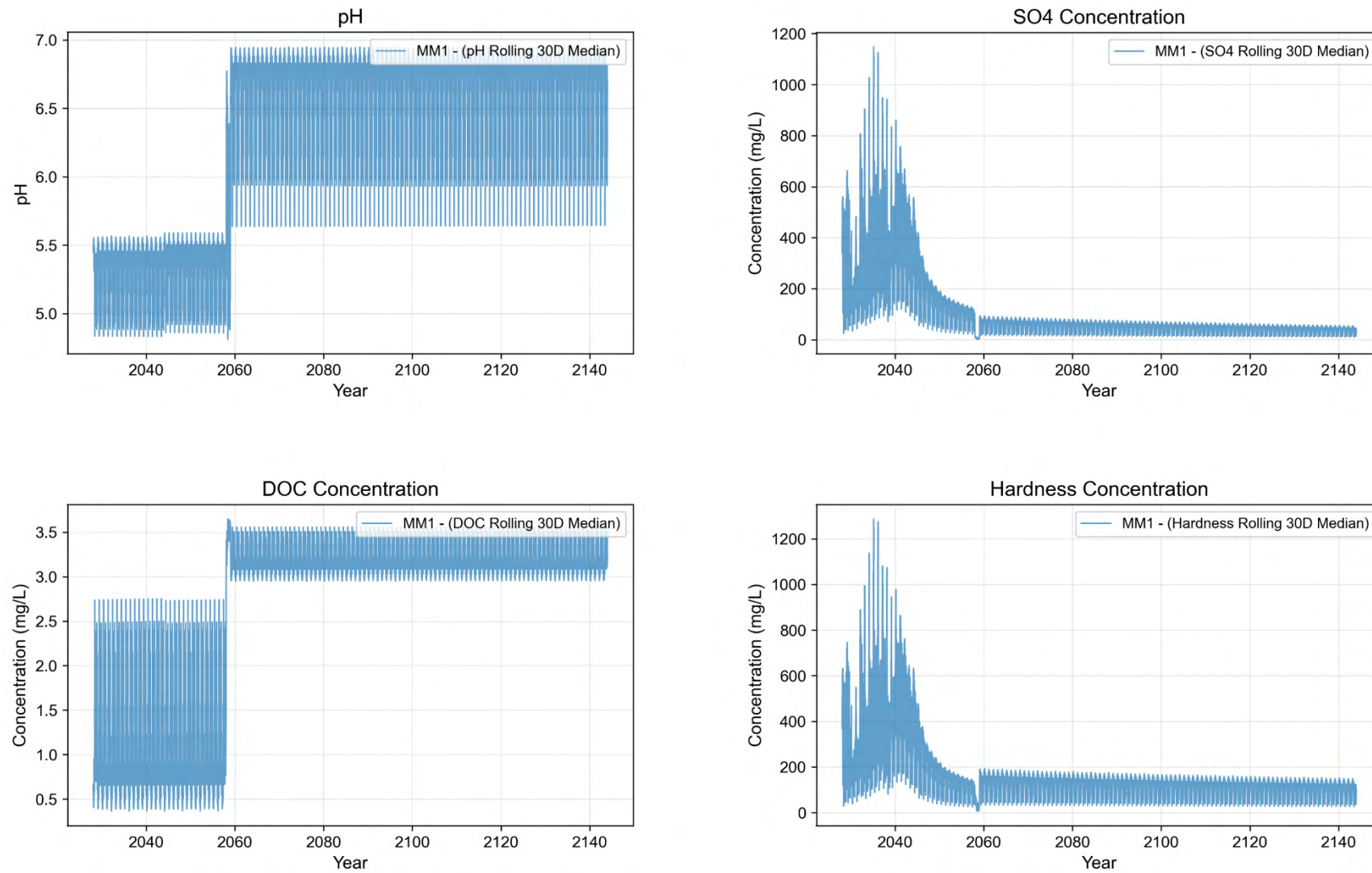
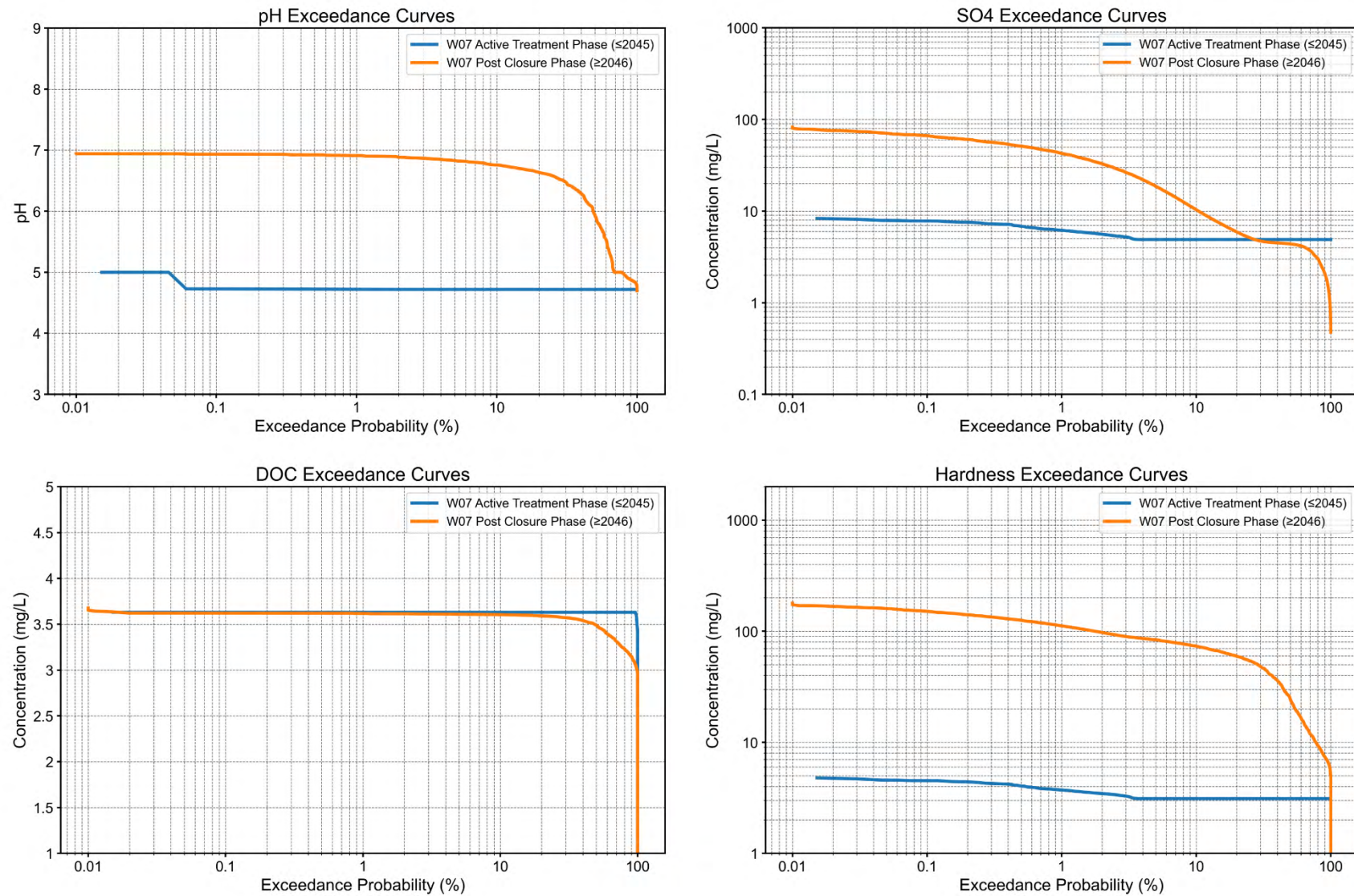


Figure 69: M-M1 - 30 day rolling median plots (pH, SO₄, DOC, Hardness).

Figure 70: M-M1 - exceedance plots (pH, SO₄, DOC, Hardness).

5.3.4.2 Metals

Model results of key PCOCs in relation to metal guideline values are illustrated below. The following observations are noted:

- Dynamic guideline values are highest during the Active Treatment Phase. This is largely a result of hardness sourced from WTP treated water that is routed to M-M1 during this period.
- Concentration exceedance probability plots (Figure 71) suggest an overall increase in concentrations of Zn, Ni, and Cd during the Post Closure Phase. Peak and minimum concentrations of Co occur in the Post Closure Phase.
- Annual median (Figure 72, Figure 73), and annual P95 plots (Figure 74, Figure 75) suggest the following:
 - o An increase in Zinc, Nickel, and Cobalt MEQ values occurs at the initiation of the Post Closure Phase in 2058. These rises in MEQ values are largely associated with higher concentrations of PCOCs in seepage from the BVE ELF.
 - o All MEQ values for the chronic assessment (annual median MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.
 - o All MEQ values for the acute assessment (annual P95 MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.

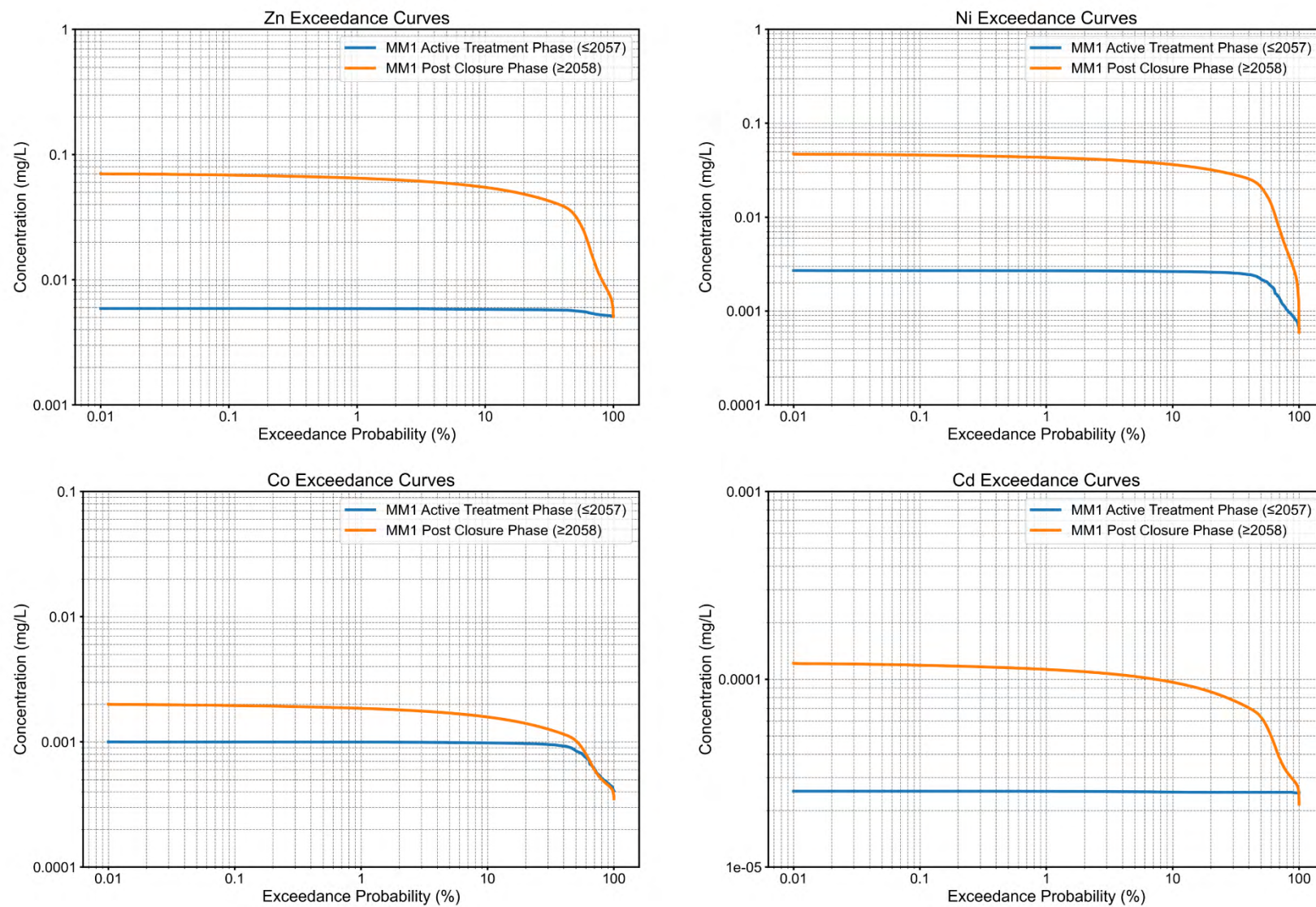


Figure 71: M-M1 exceedance plots (Zn, Ni, Co, Cd).

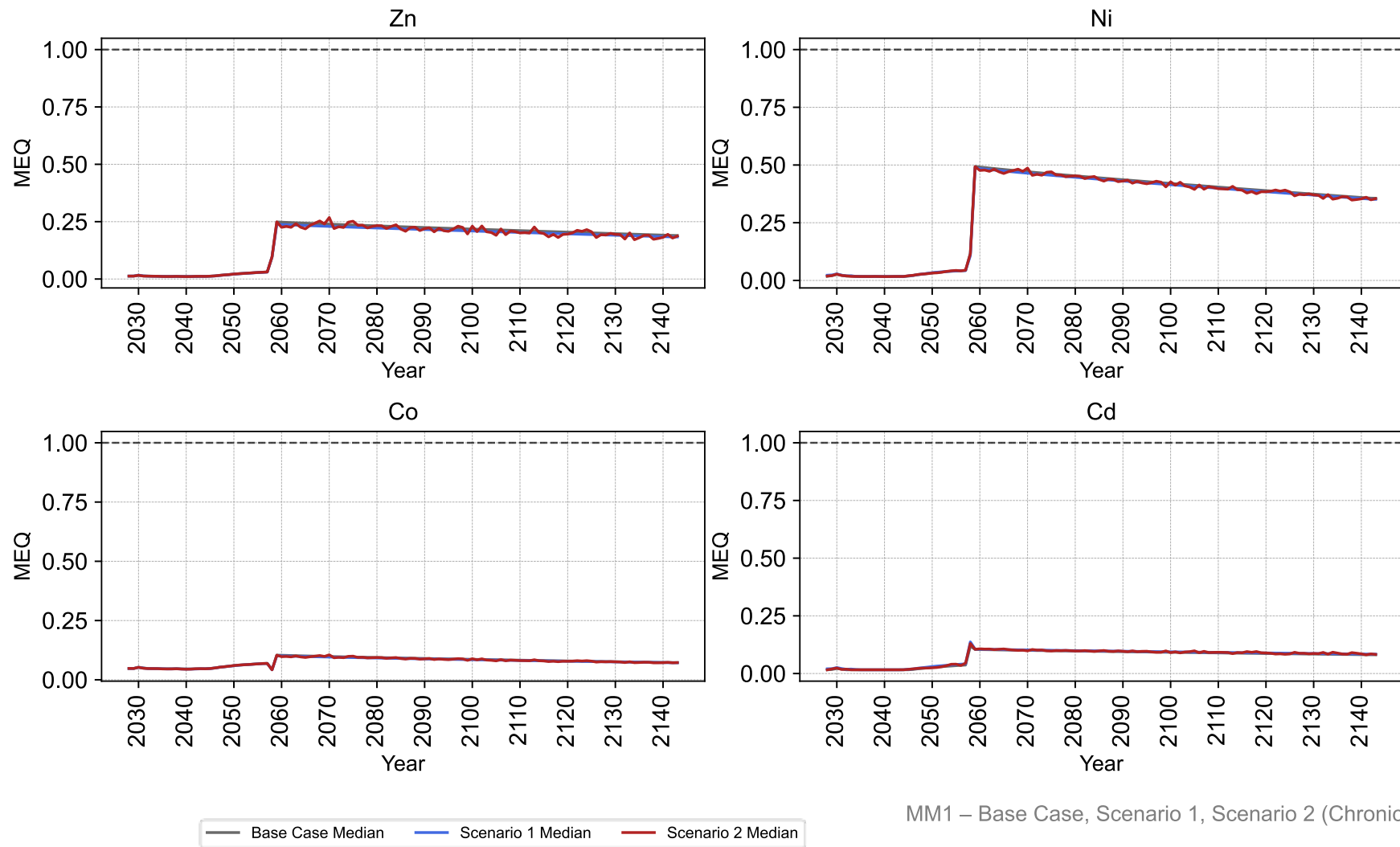


Figure 72: M-M1 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

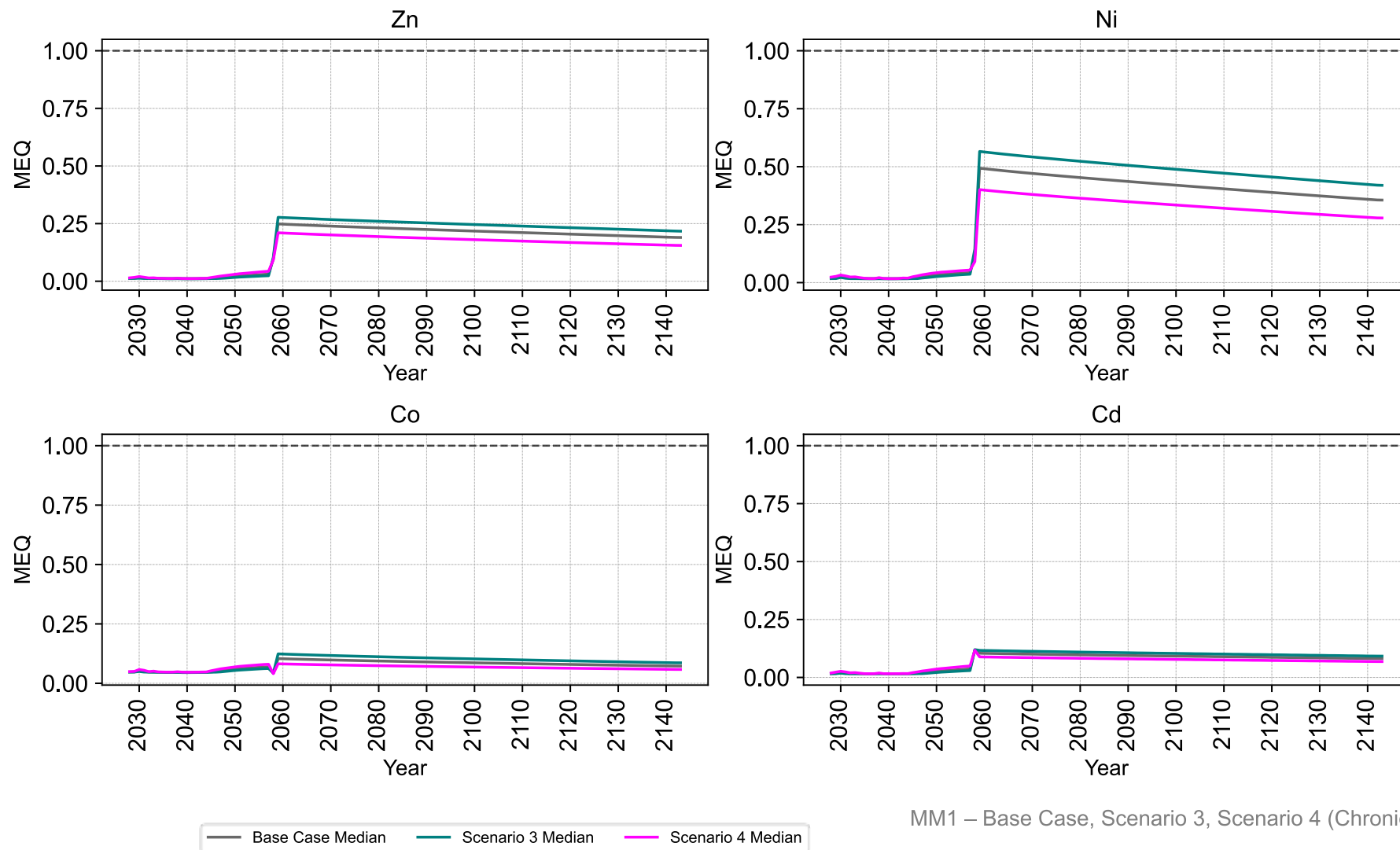


Figure 73: M-M1 - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

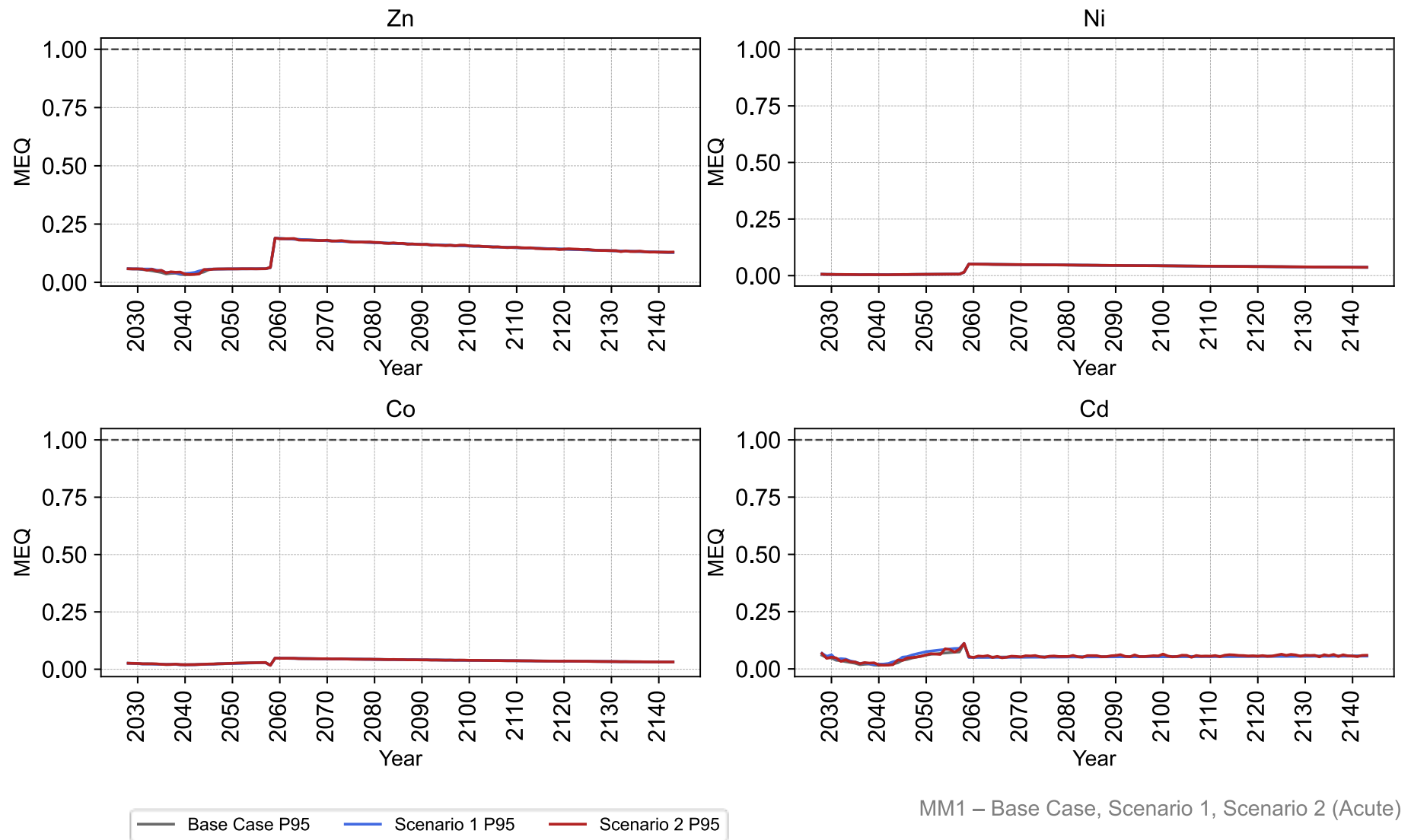


Figure 74: M-M1 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

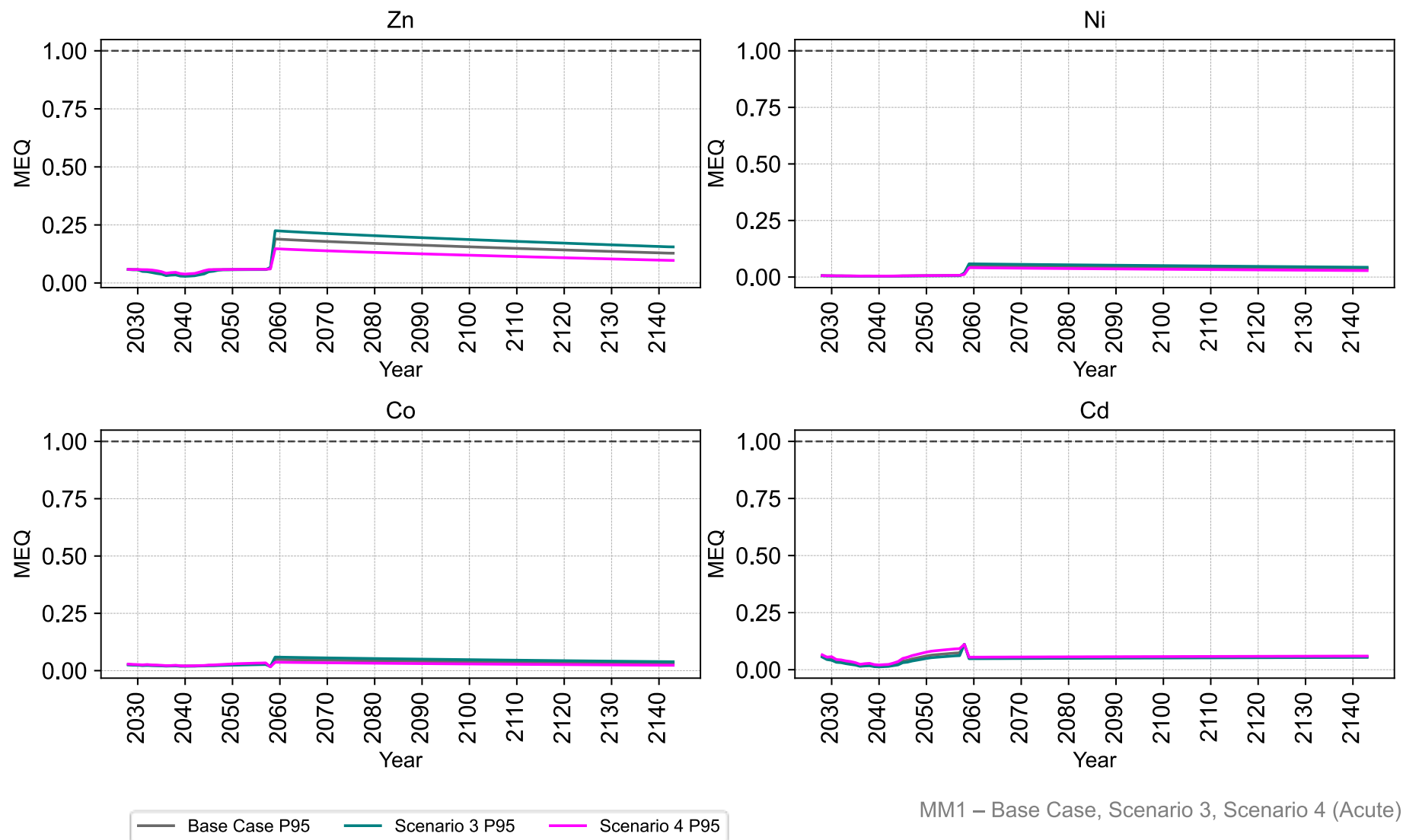


Figure 75: M-M1 - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

5.3.4.3 TSS and Turbidity

TSS at M-M1 is plotted in Figure 76 and Figure 77. The following observations are made:

- TSS concentrations differ significantly between the Active Treatment Phase, and the Post Closure Phase.
- The Active Treatment Phase is characterised by lower median TSS concentrations. This is due to the absence of untreated MIW reported to V8 Creek during this period, and the addition of up to 40 L/s of treated water from the WTP.
- TSS concentrations increase during the Post Closure Phase with median concentrations in the order of 3 mg/L.

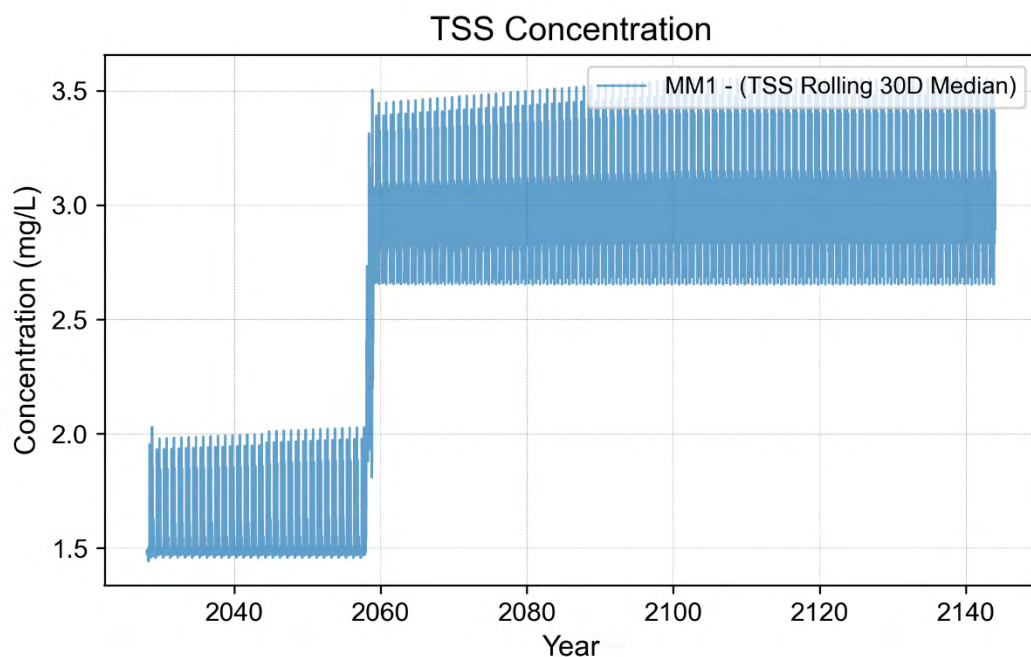


Figure 76: M-M1 - TSS - 30 day rolling median.

Turbidity is plotted against the proposed chronic and acute limits in Figure 67 and Figure 68. The model results suggest that turbidity at M-M1 is below the proposed compliance limits throughout the entire simulation.

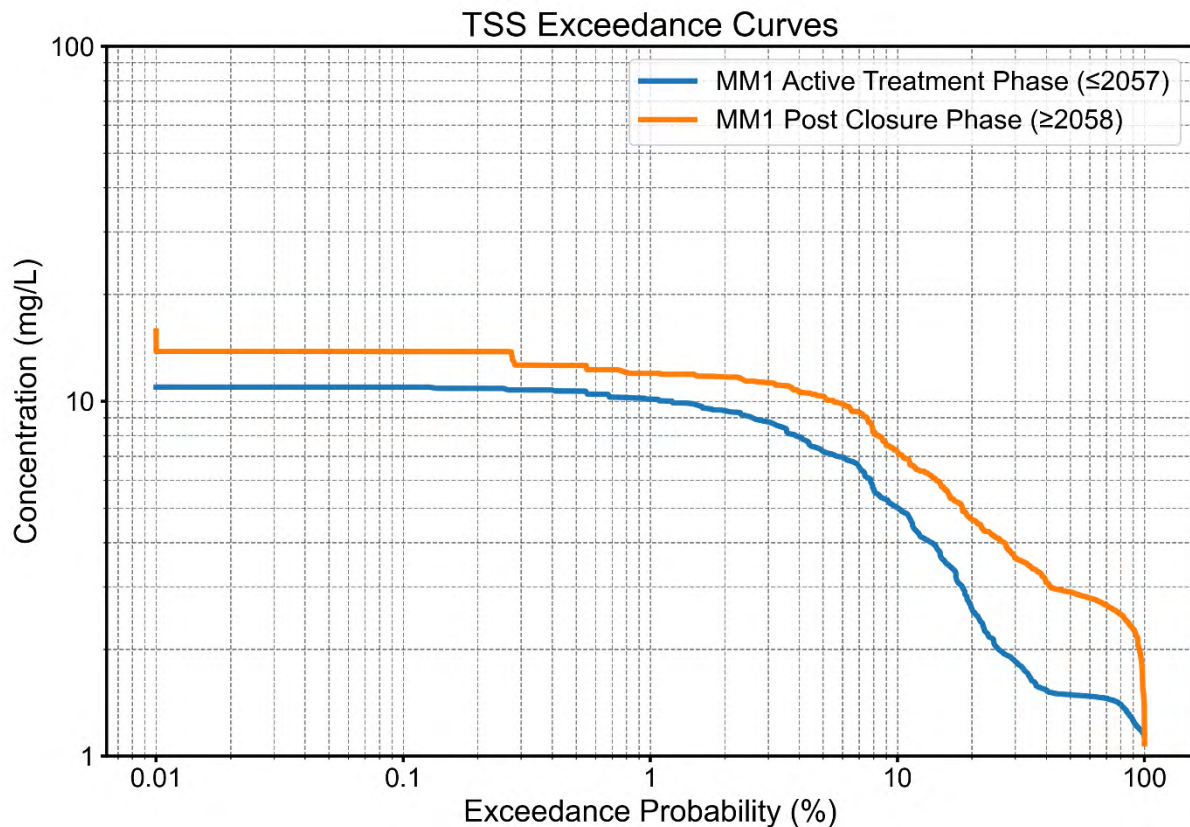


Figure 77: M-M1 - TSS - exceedance plot.

Turbidity is plotted against the proposed chronic limit in Figure 78, which assumes a 15 sample rolling median. The sampling frequency was not defined, therefore the plot assumes a daily sampling frequency to illustrate the simulated results compared to the limit of 25 NTU. The model results suggest that turbidity at M-M1 is below the proposed compliance limits throughout the entire simulation.

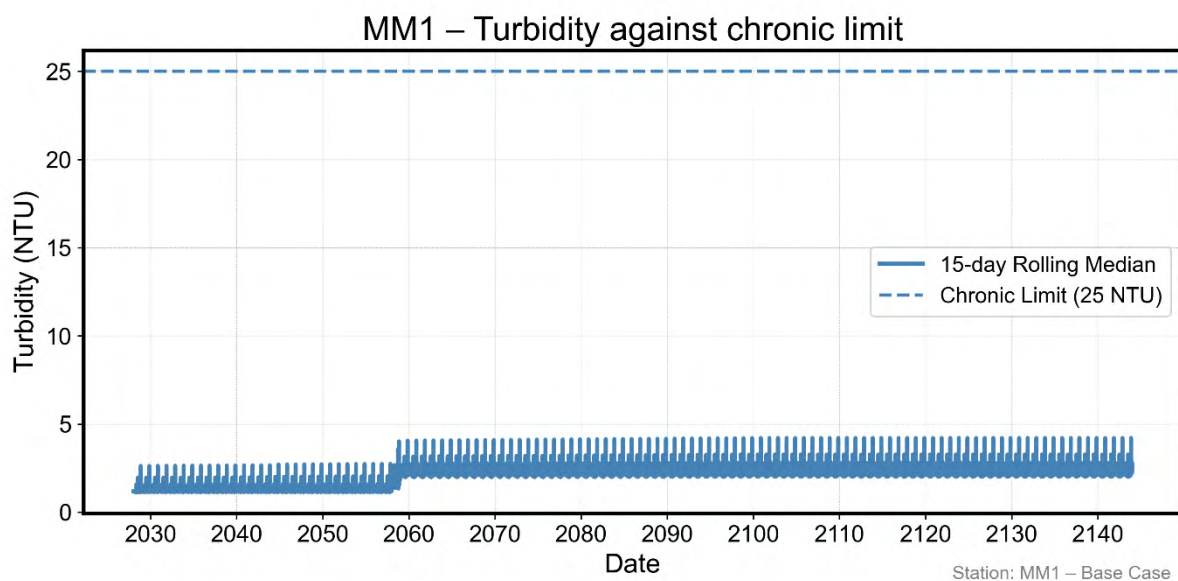


Figure 78: M-M1 - turbidity compared to chronic compliance limit.

5.3.5 V37_F

5.3.5.1 General Water Quality

The general water quality parameters are included in Figure 79 and Figure 80. The observations on general water quality are as follows:

- During the Active Treatment Phase, sulfate and hardness remains low compared to other compliance locations, however, concentrations rise for the period between 2058-2070. This rise coincides with the temporary pumping of CON polishing pond treated water to V37_F.
- Significant changes to pH and DOC also occur as a result of the pumping of CON polishing pond treated water to V37_F. pH rises from below 5.0 to between 6.5 - 7.0 during this period, whilst DOC lowers from 2.9 - 3.7 mg/L, to below 3.0 mg/L.
- Concentrations remain consistent in the Post Closure Phase, from 2071 onwards.

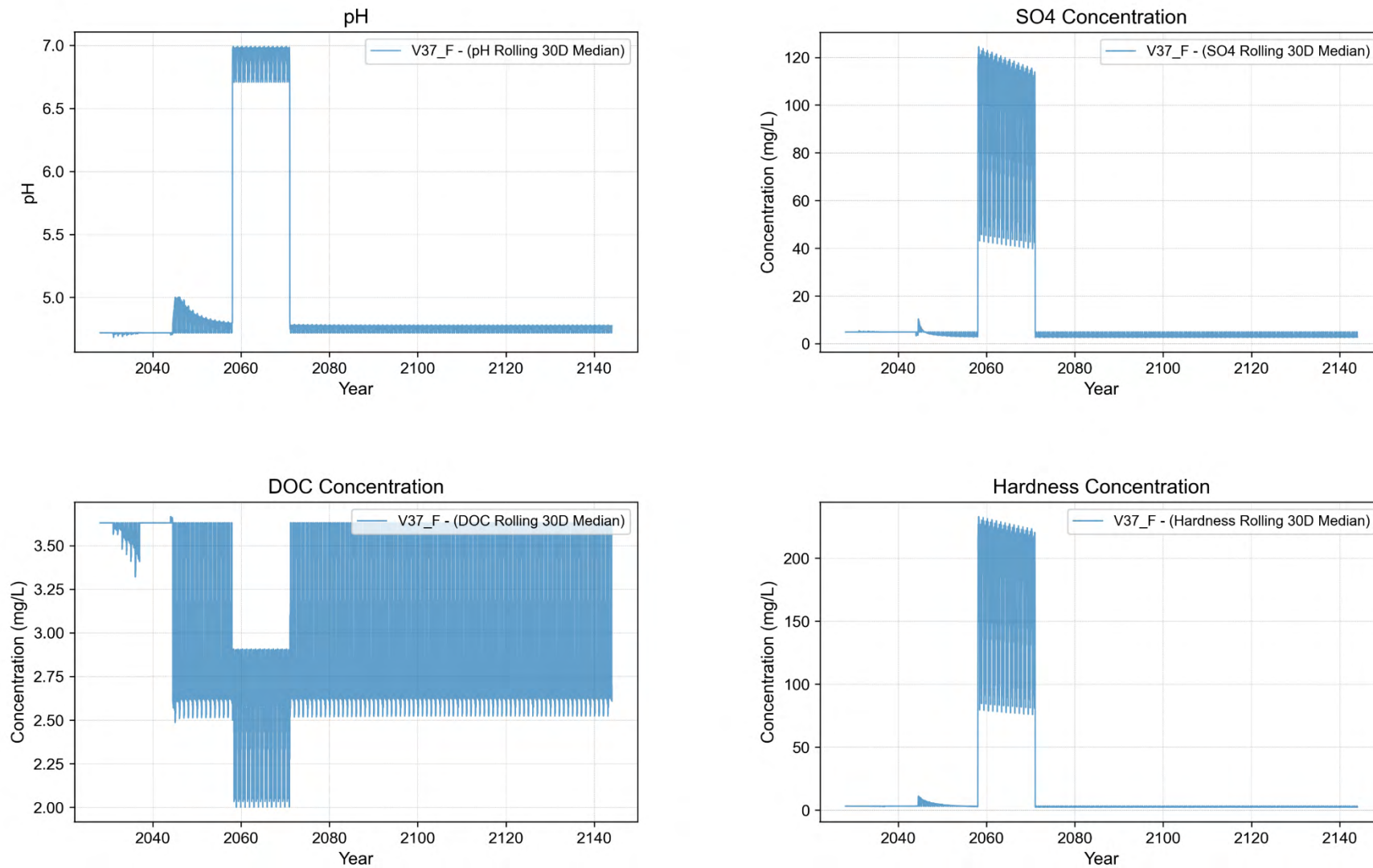
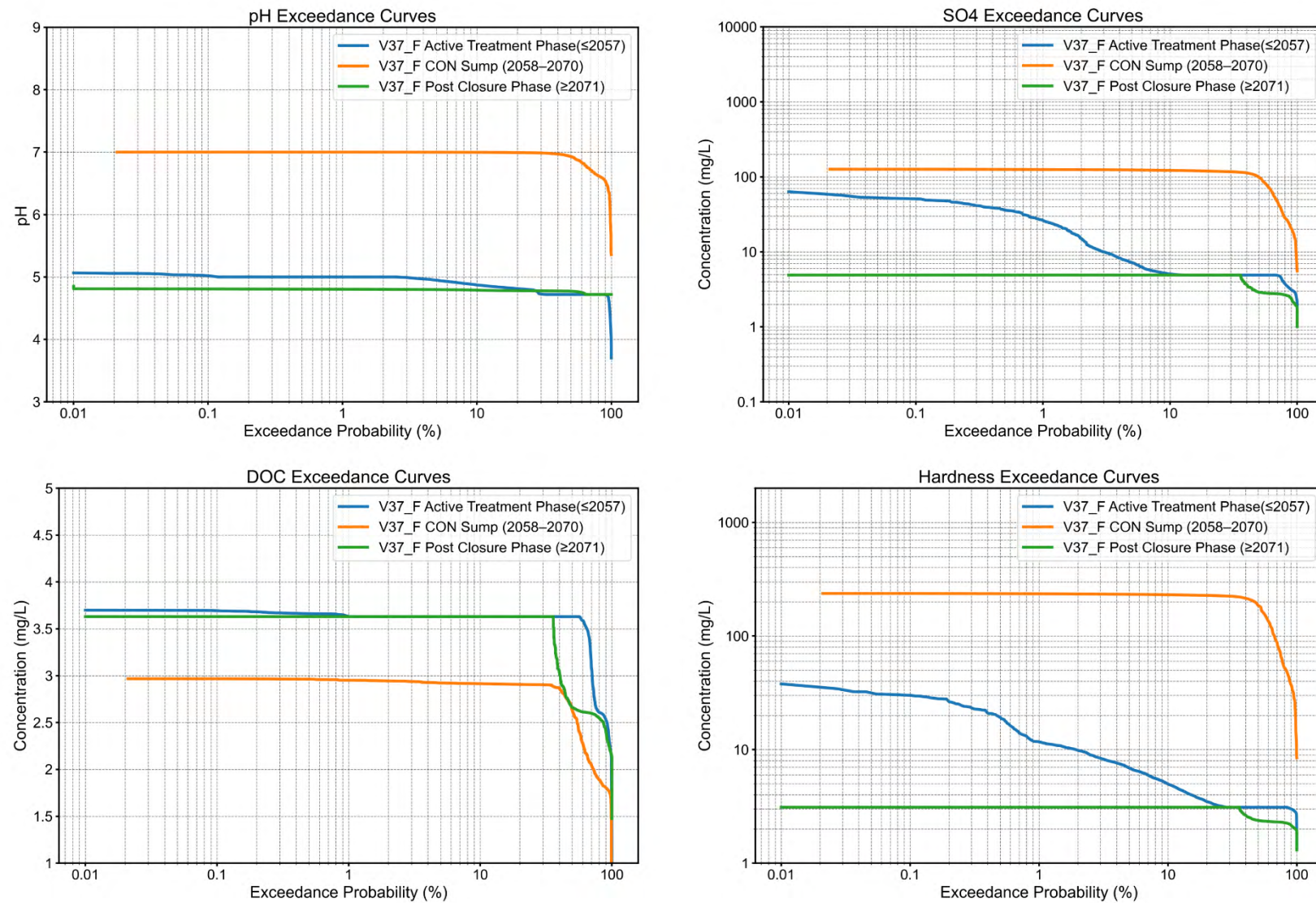


Figure 79: V37_F - 30 day rolling median plots (pH, SO₄, DOC, Hardness).

Figure 80: V37_F - exceedance plots (pH, SO₄, DOC, Hardness).

5.3.5.2 Metals

Model results of key PCOCs in relation to metal guideline values are illustrated below. The following observations are noted:

- Concentration exceedance probability plots (Figure 81) suggest the largest range of PCOC concentrations occurs in the Active Treatment Phase. This is a result of higher concentrations occurring during bypass events.
- Concentrations are less variable in the Post Closure Phase as they stabilise following closure of the mine.
- An increase in Zinc, Nickel, Cobalt, and Cadmium concentrations occurs concurrently with the pumping of the CON polishing pond treated water to V37_F between 2058-2070. These higher concentrations are largely associated with seepage from the CON ELF.
- Annual median (Figure 82, Figure 83), and annual P95 plots (Figure 84, Figure 85) suggest the following:
 - o All MEQ values for the chronic assessment (annual median MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.
 - o All MEQ values for the acute assessment (annual P95 MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.

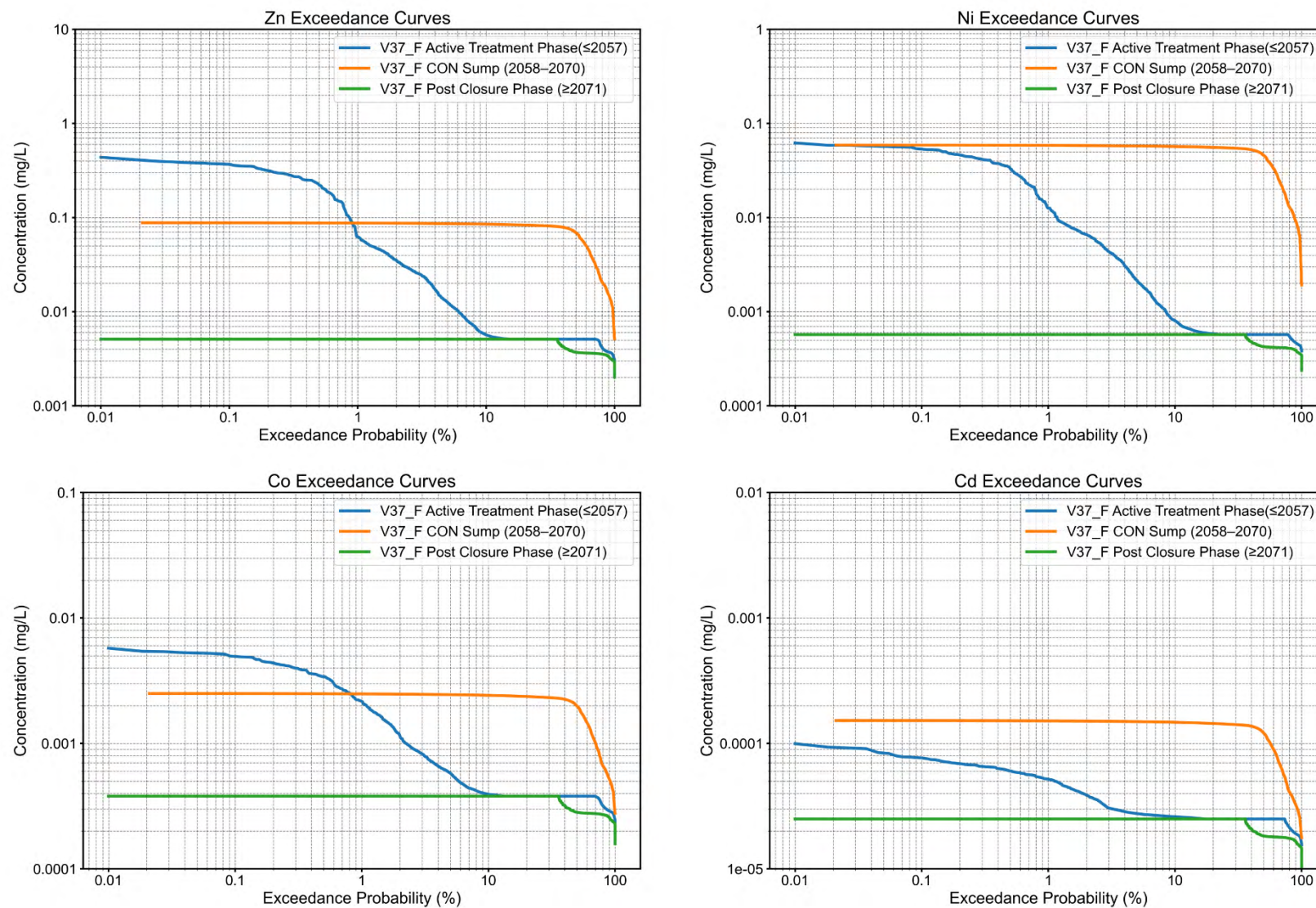


Figure 81: V37_F - exceedance plots (Zn, Ni, Co, Cd).

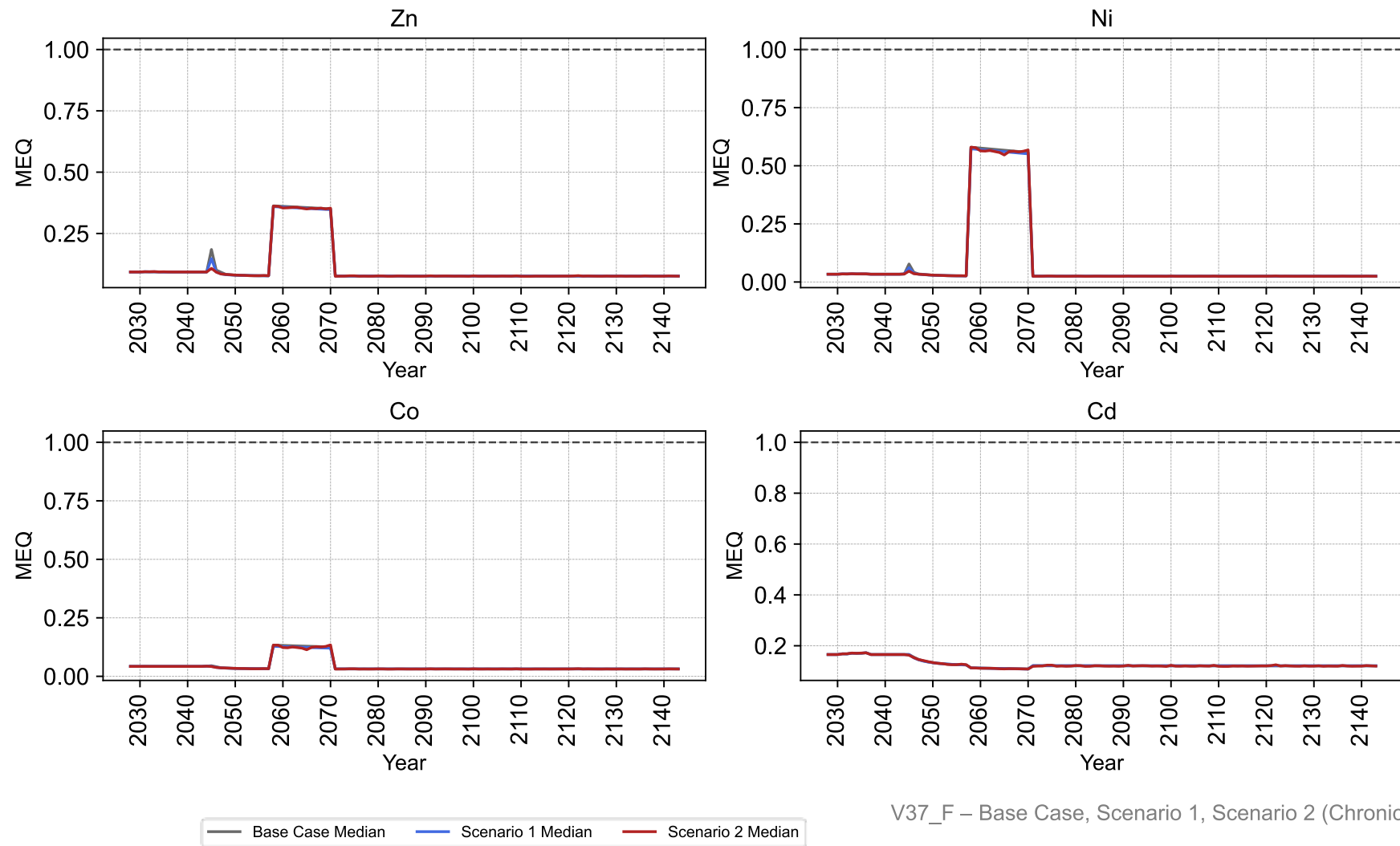


Figure 82: V37_F - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

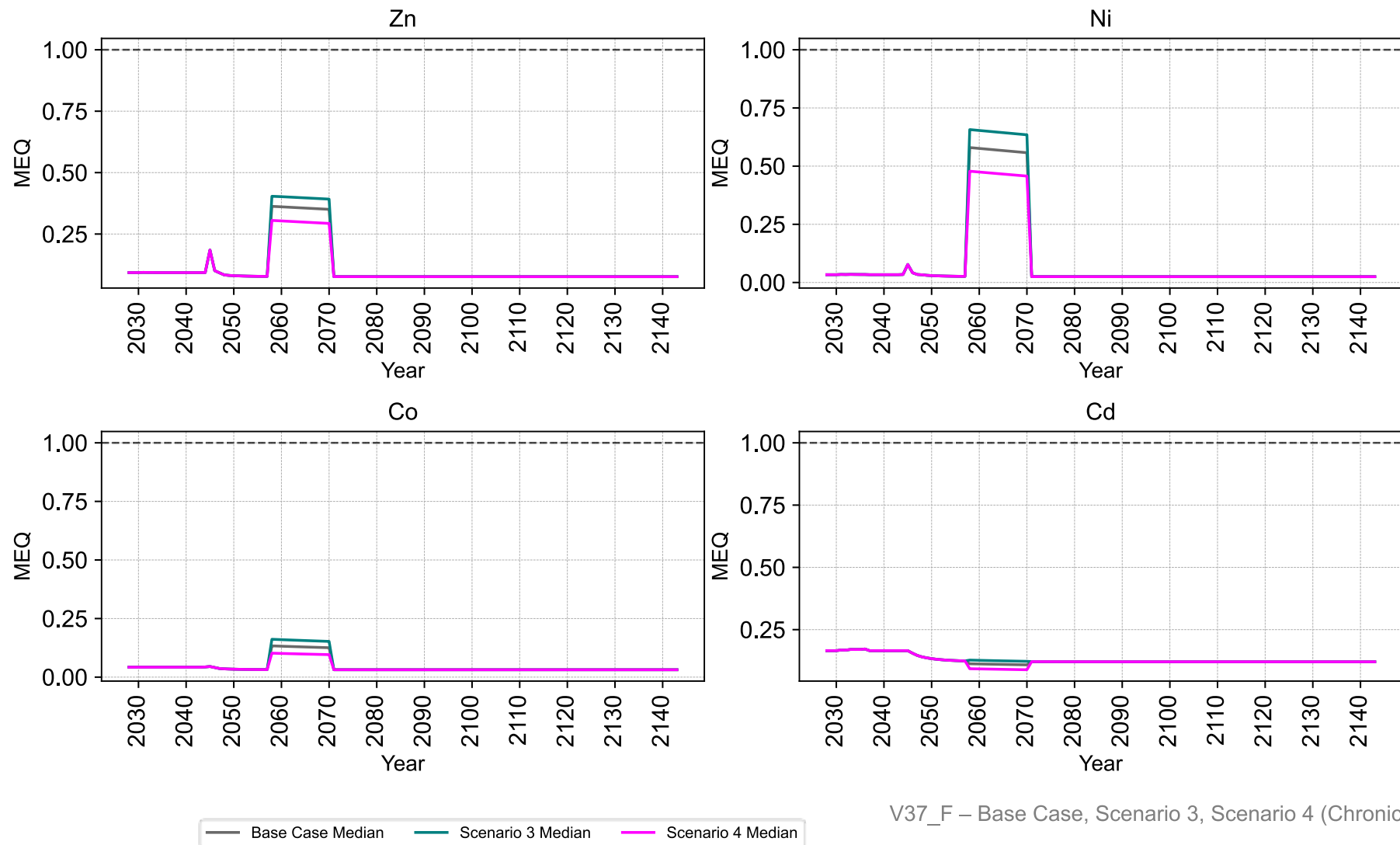


Figure 83: V37_F - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

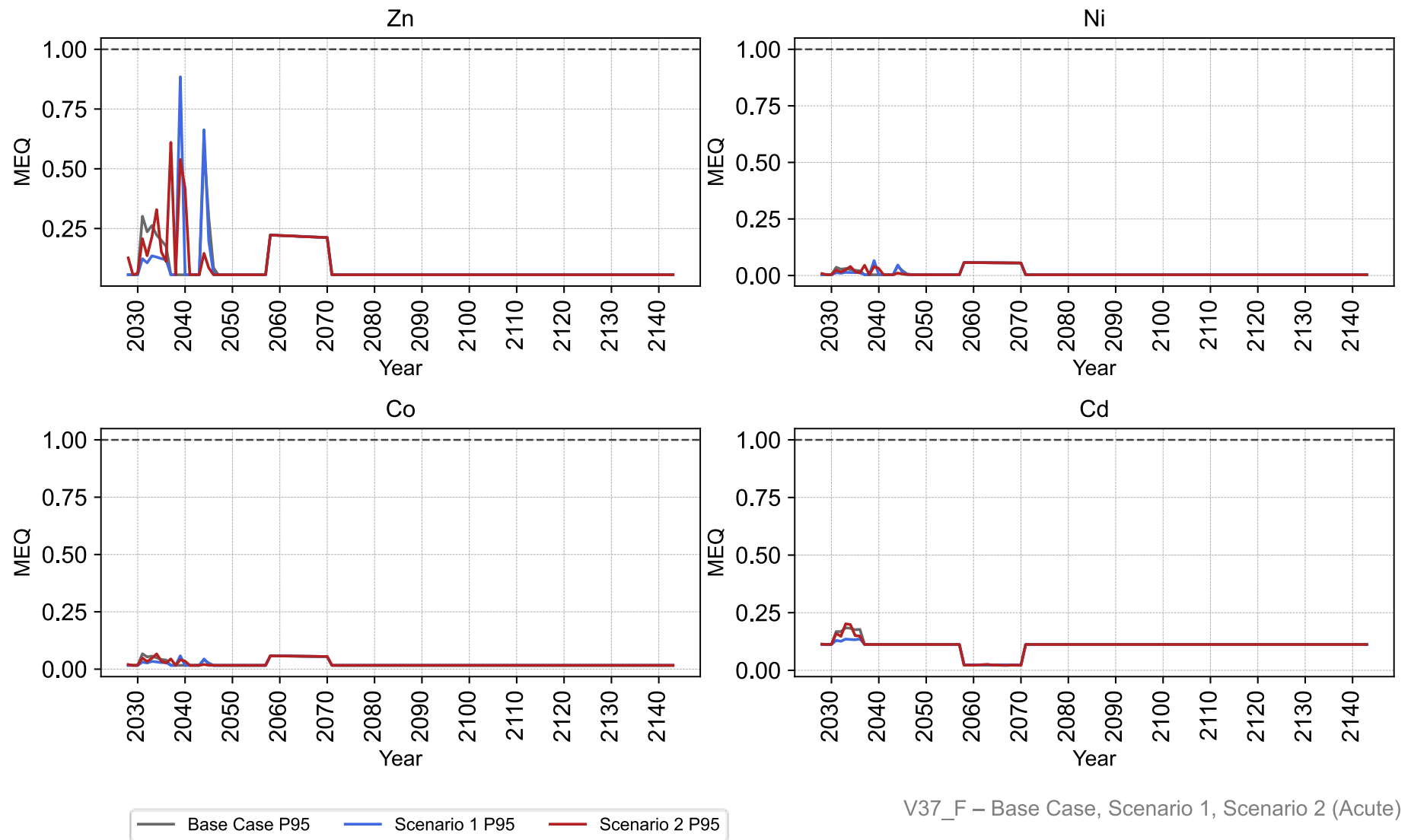


Figure 84: V37_F - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

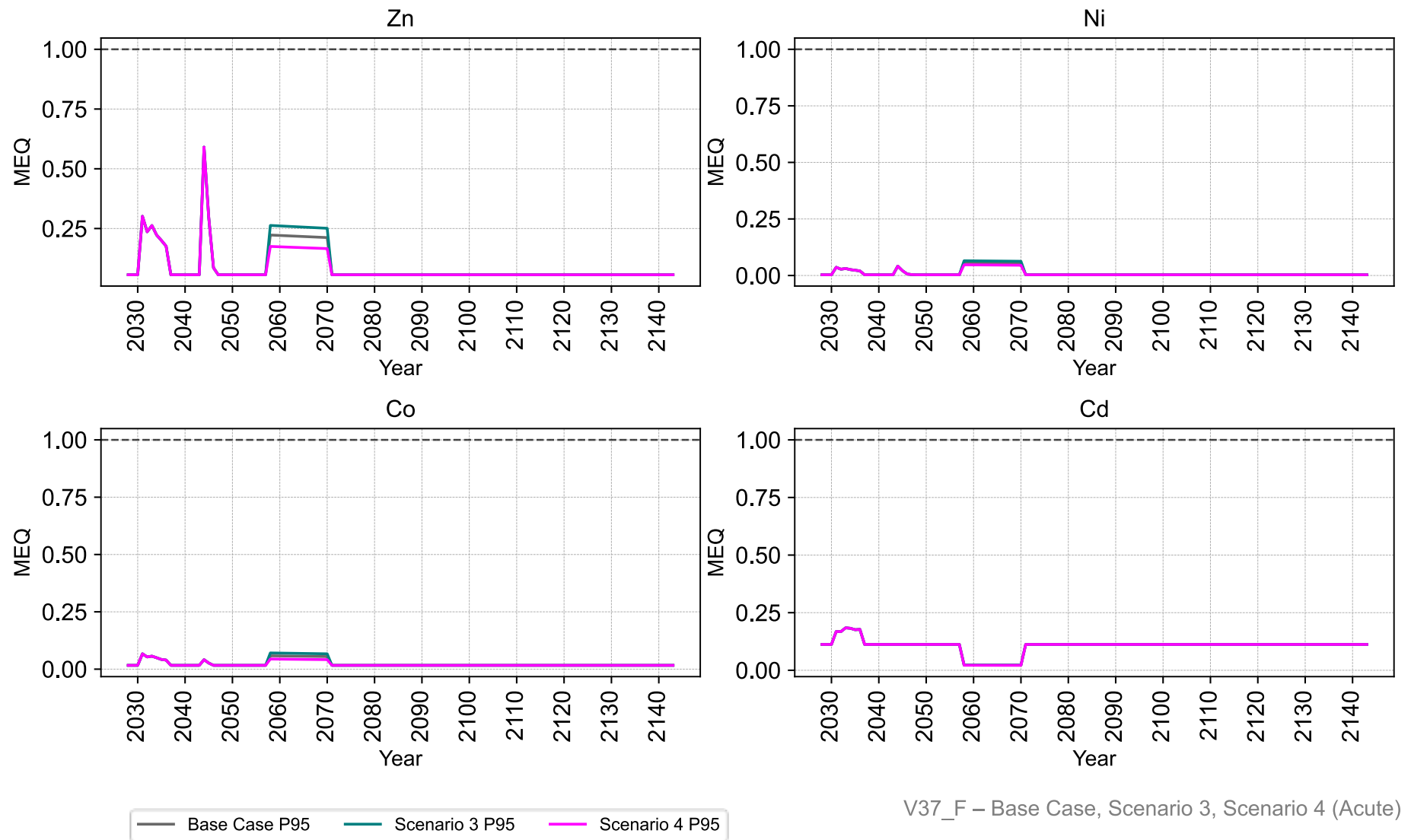


Figure 85: V37_F - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

5.3.5.3 TSS and Turbidity

TSS at V37_F is plotted in Figure 86 and Figure 87. The following observations are made:

- Four distinct periods are noted regarding TSS concentrations:
 - o Active Treatment Phase (2028-2043): generally low TSS values due to clean water diversion comprising most of the discharge.
 - o Active Treatment Phase (2044-2057): TSS is temporarily elevated once the sump begins spilling to V37_F.
 - o Post Closure Phase (2058-2070): TSS concentrations increase due to loads reporting from CON polishing pond treated water that is pumped to V37_F.
 - o Post Closure Phase (2071 onwards): Pumping from CON polishing pond ceases, and TSS concentrations reduce to the those experienced during the initial Post Closure Phase.
- Peak TSS concentrations occur during the Active Treatment Phase and are associated with bypass discharge events during higher rainfall events.

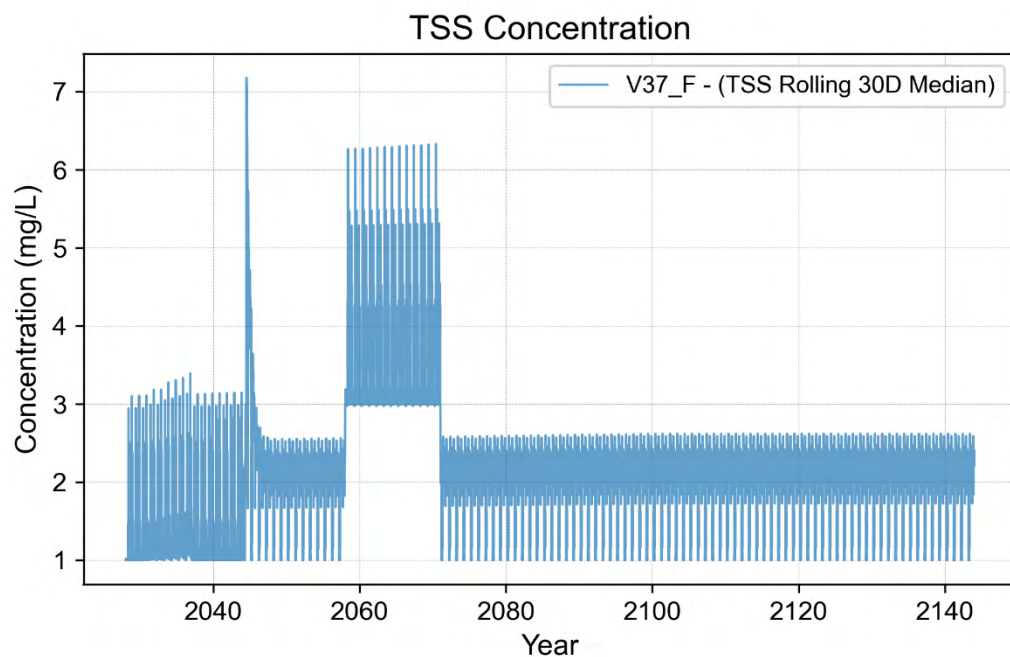


Figure 86: V37_F - TSS - 30 day rolling median.

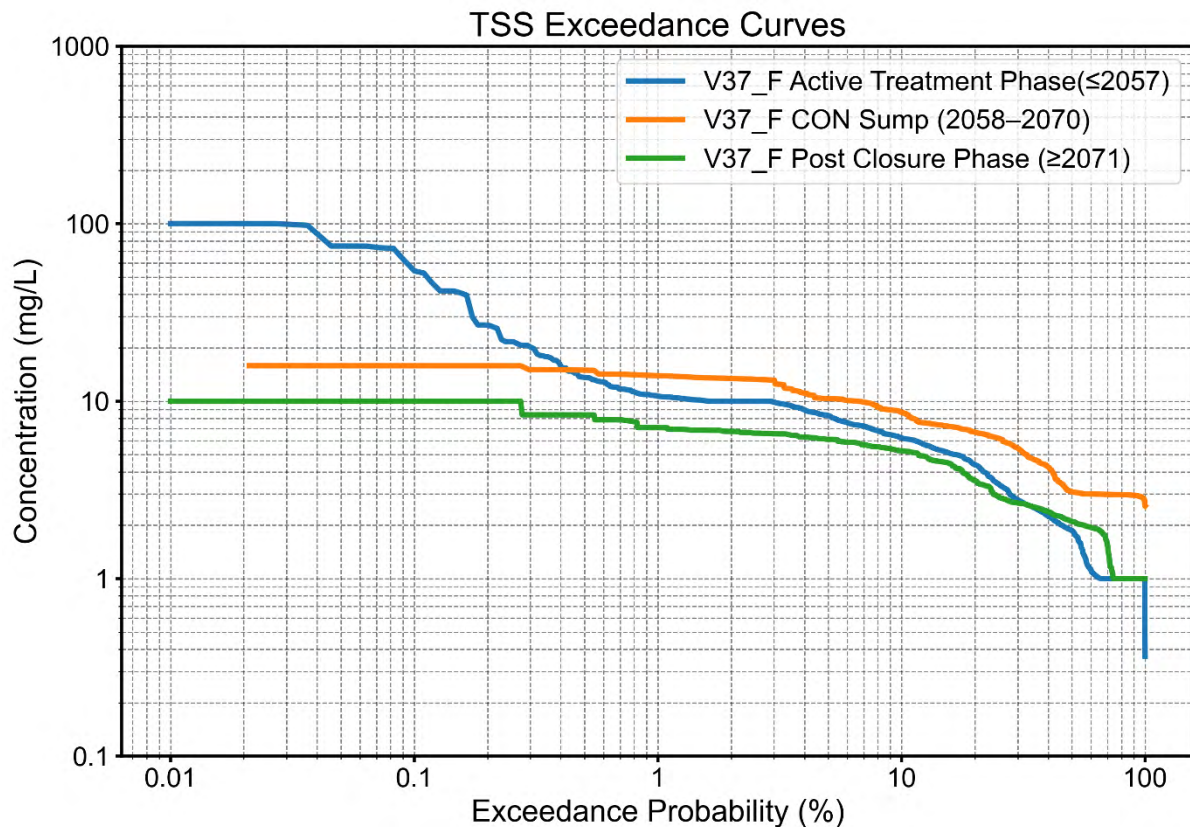


Figure 87: V37_F - TSS - exceedance plot.

5.3.6 V37_G

5.3.6.1 General Water Quality

The general water quality parameters for V37_G (which is a discharge point above V37 Creek) are included in Figure 88 and Figure 89. The observations on general water quality are as follows:

- Throughout the simulation period, sulfate and hardness are relatively low. No MIW or passive treatment discharge reports to V37_G (see Table 1).
- All four parameters fluctuate during the Operation Phase and then remain stable in Active Closure from 2044 onwards. The fluctuations are a result of the constant load source term which was applied to the hardstand areas forming part of the V37_G catchment, because the concentration of the discharge fluctuates depending on the flow rate in order to achieve a constant load. A constant concentration was applied to hardstand areas post-closure.
- The general water quality following closure of the mine is reflective of an unimpacted catchment.

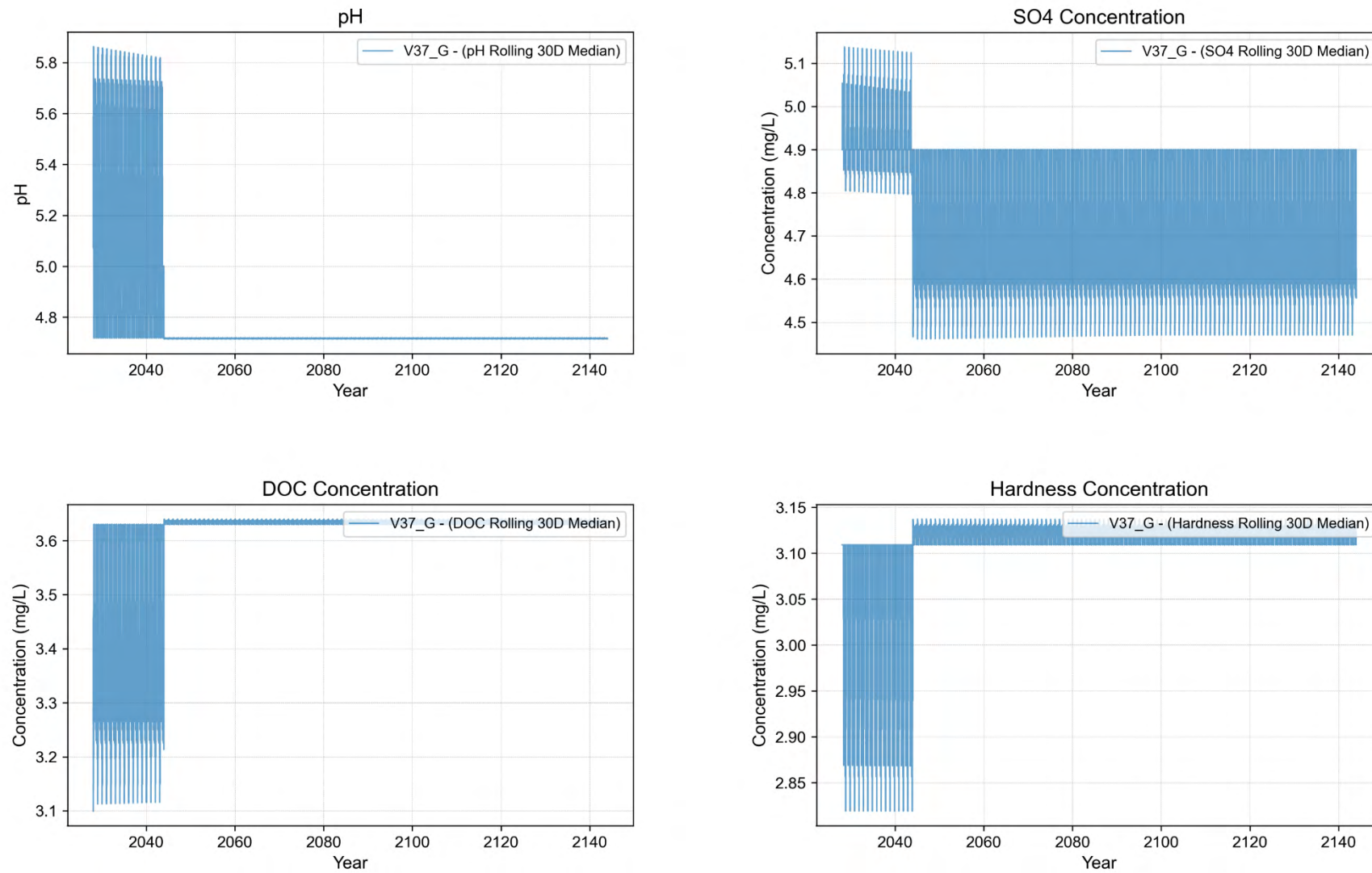
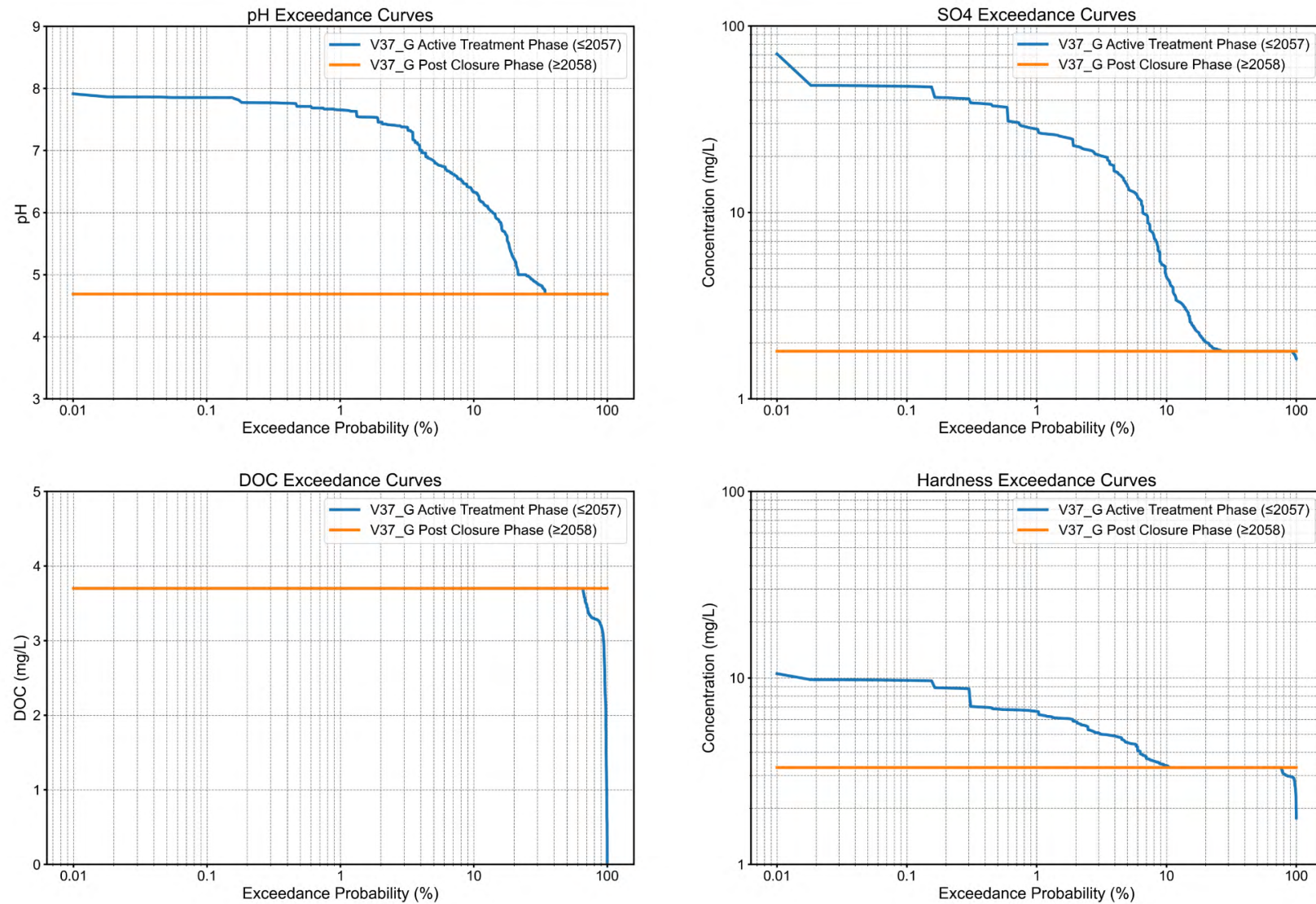


Figure 88: V37_G - 30 day rolling median plots (pH, SO₄, DOC, Hardness).

Figure 89: V37_G - exceedance plots (pH, SO₄, DOC, Hardness).

5.3.6.2 Metals

Model results of key PCOCs in relation to metal guideline values are illustrated below. The following observations are noted:

- Concentration exceedance probability plots (Figure 90) suggest highest concentrations occur during the Active Treatment Phase. PCOC loads are largely associated with haul road runoff, which reduce in the Post Closure Phase following rehabilitation.
- Annual median (Figure 91, Figure 92), and annual P95 plots (Figure 93, Figure 94) suggest the following:
 - o Scenario 3 and Scenario 4 (seepage concentration scenarios) show no change in MEQ compared to the baseline as seepage does not report to this catchment.
 - o All MEQ values for the chronic assessment (annual median MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.
 - o All MEQ values for the acute assessment (annual P95 MEQ values) are below 1 during the model simulation for all scenarios, indicating compliance.

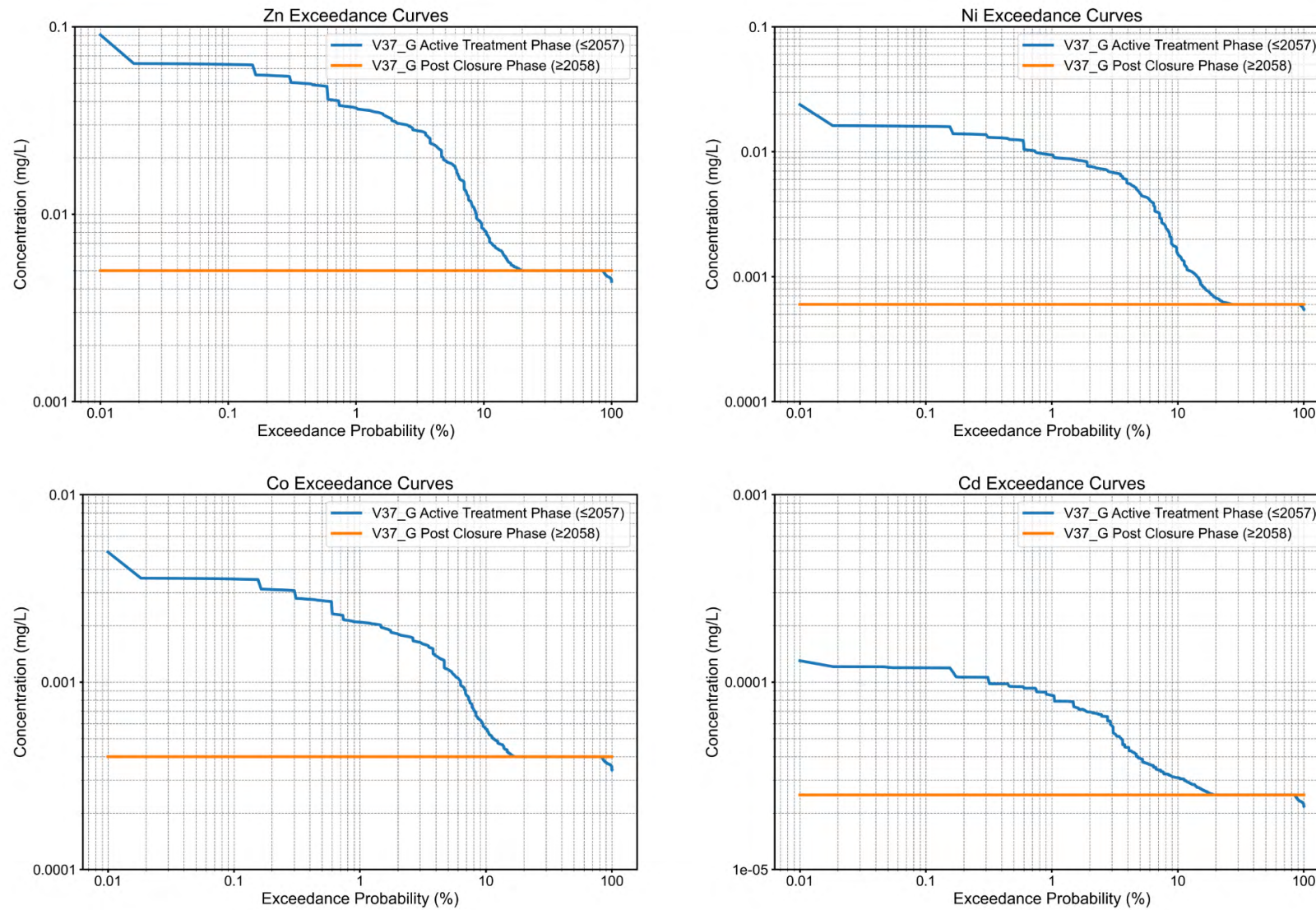


Figure 90: V37_G - exceedance plots (Zn, Ni, Co, Cd).

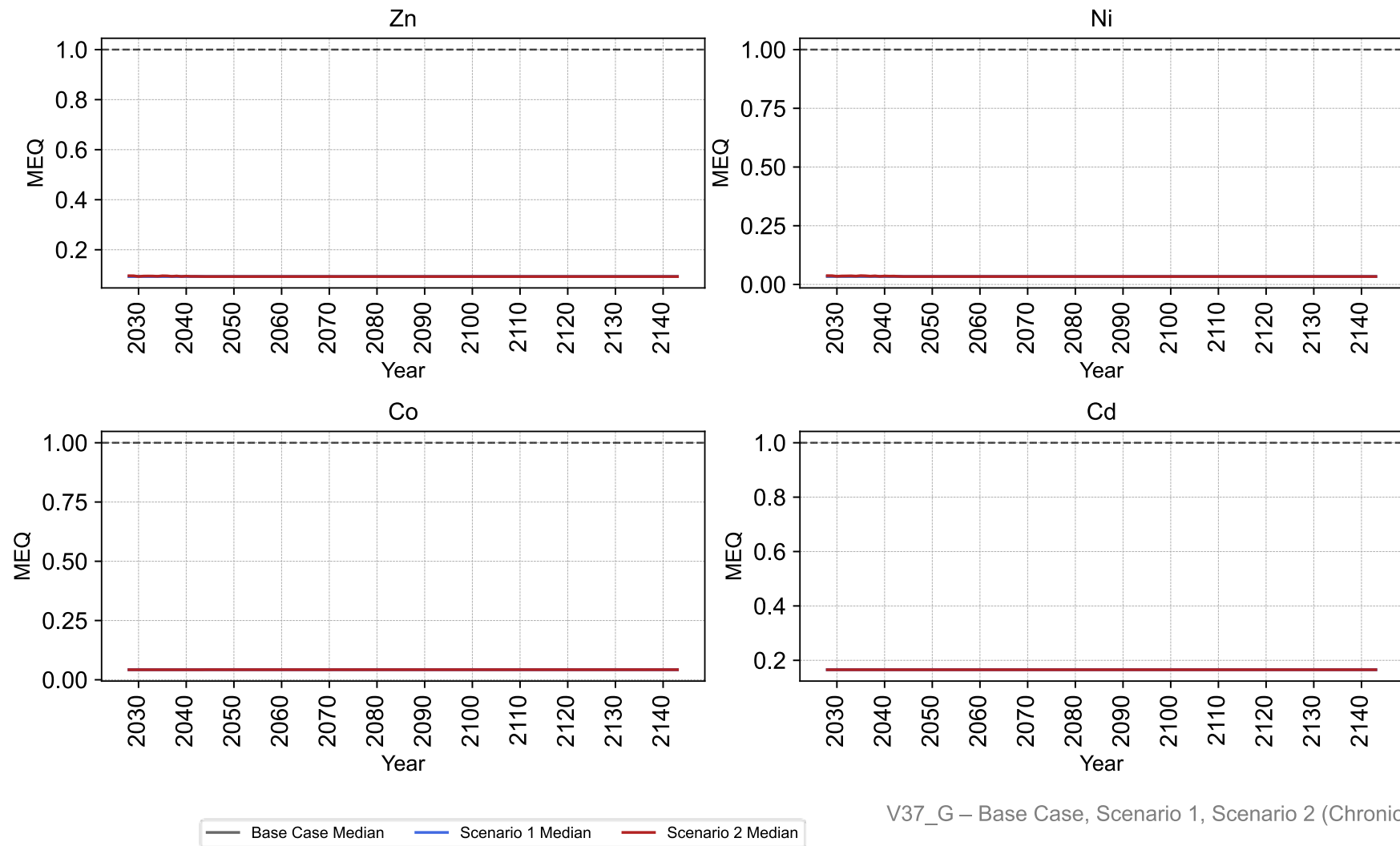


Figure 91: V37_G - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

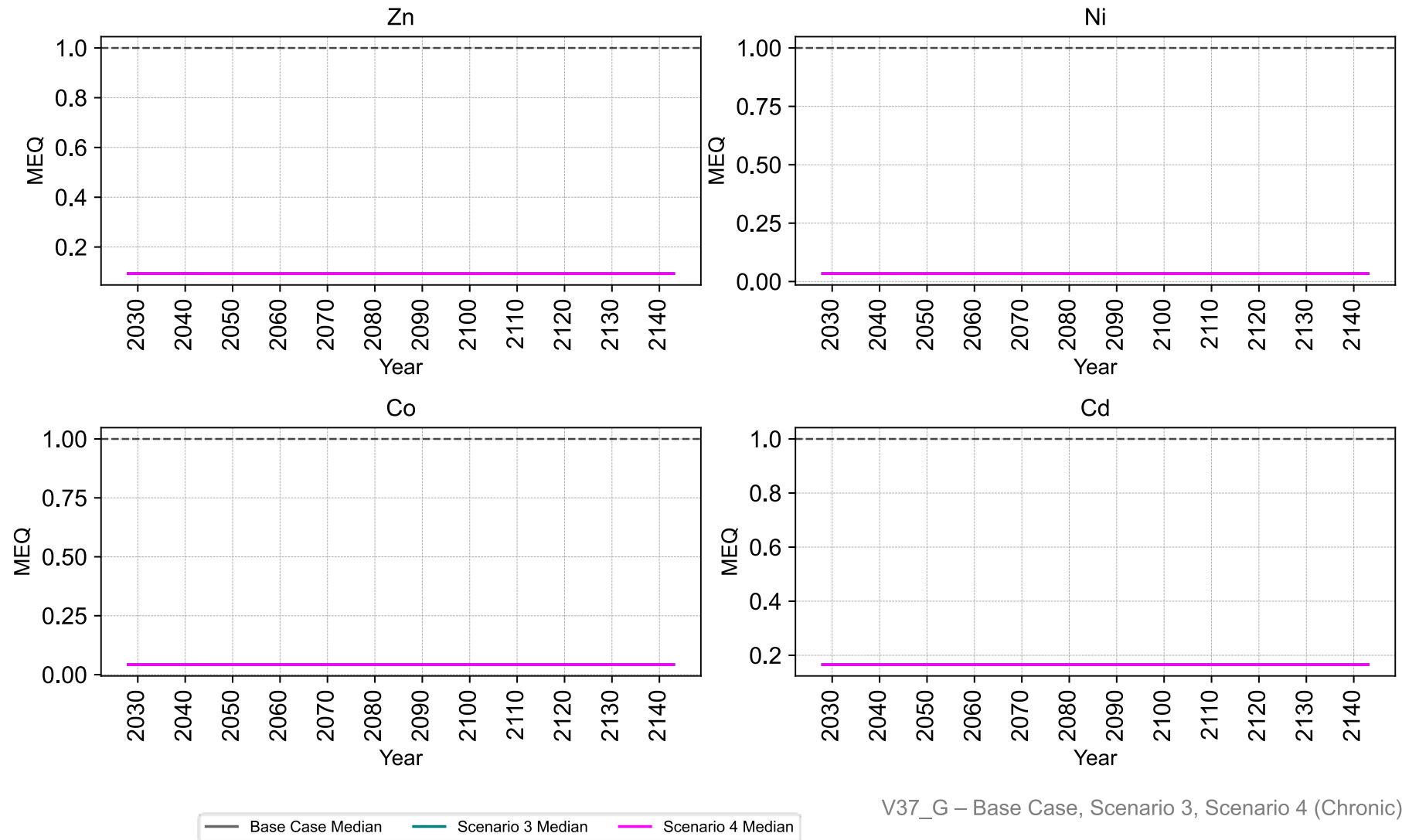


Figure 92: V37_G - annual median MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

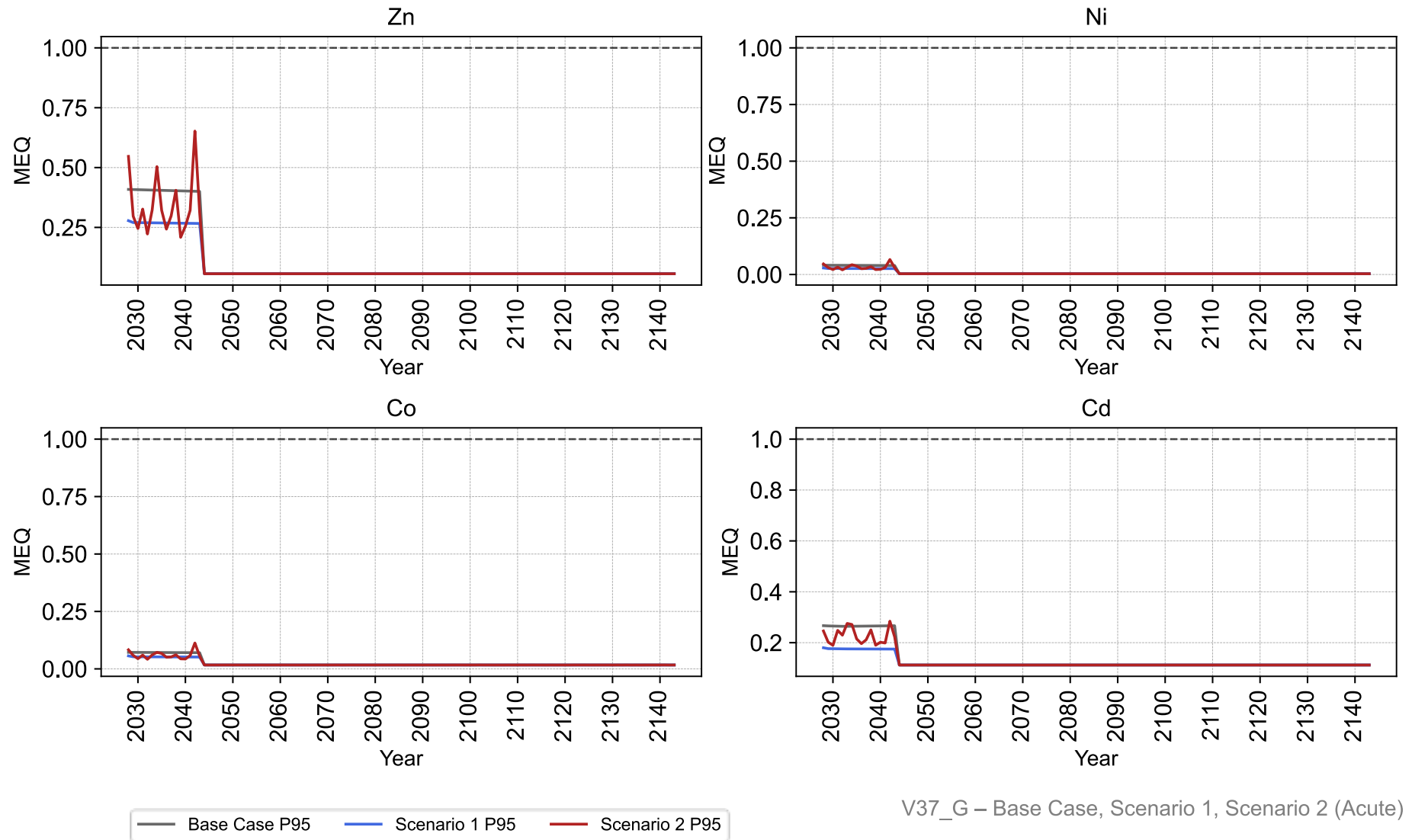


Figure 93: V37_G - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 1 and 2).

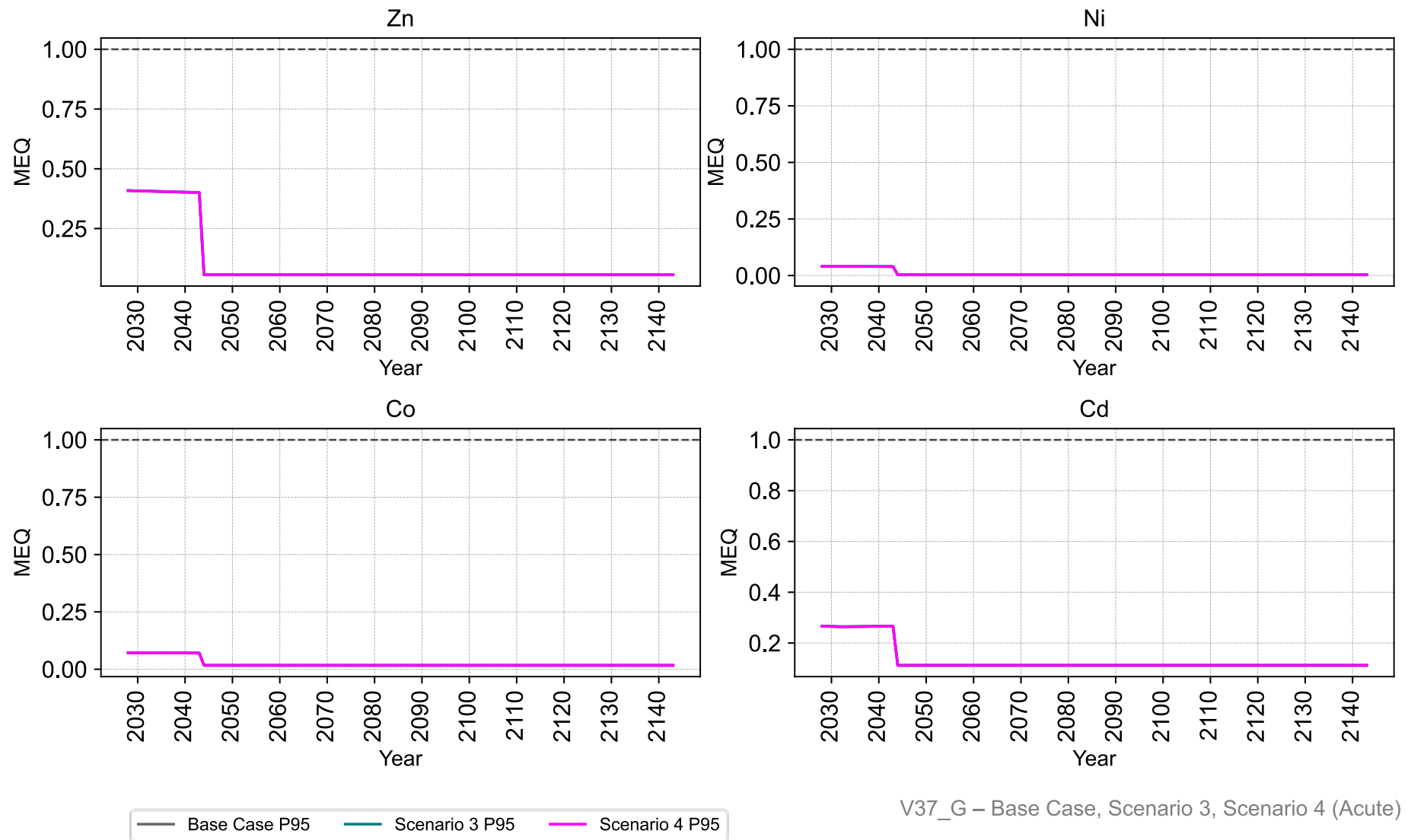


Figure 94: V37_G - annual P95 MEQ calculated for Zn, Ni, Co, and Cd (Base Case with Scenarios 3 and 4).

5.3.6.3 TSS and Turbidity

TSS at V37_G is plotted in Figure 95 and Figure 96. The following observations are made:

- TSS concentrations do not differ significantly between the Active Treatment Phase and the Post Closure Phase. This is because MIW does not report to this location. Haul road and hardstand runoff does report here and is modelled on the assumption that sediment control is undertaken.
- A slight gradual increase in TSS concentration is observed over time, reflecting the simulated climate change of increased rainfall.
- Median TSS concentrations are in the range of 1-4 mg/L throughout the model simulation.

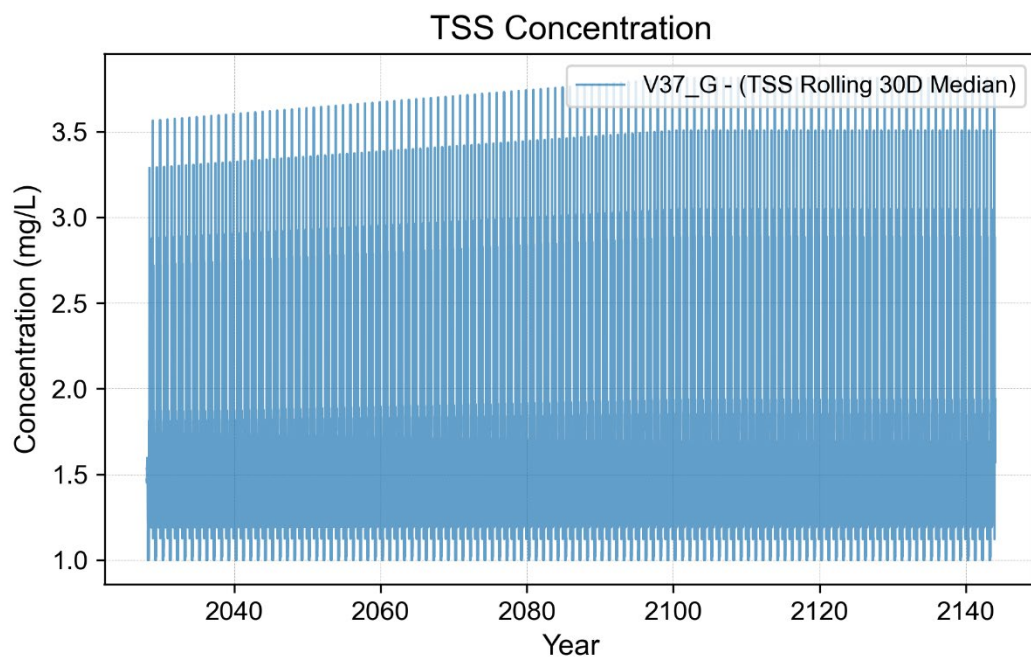


Figure 95: V37_G - TSS - 30 day rolling median.

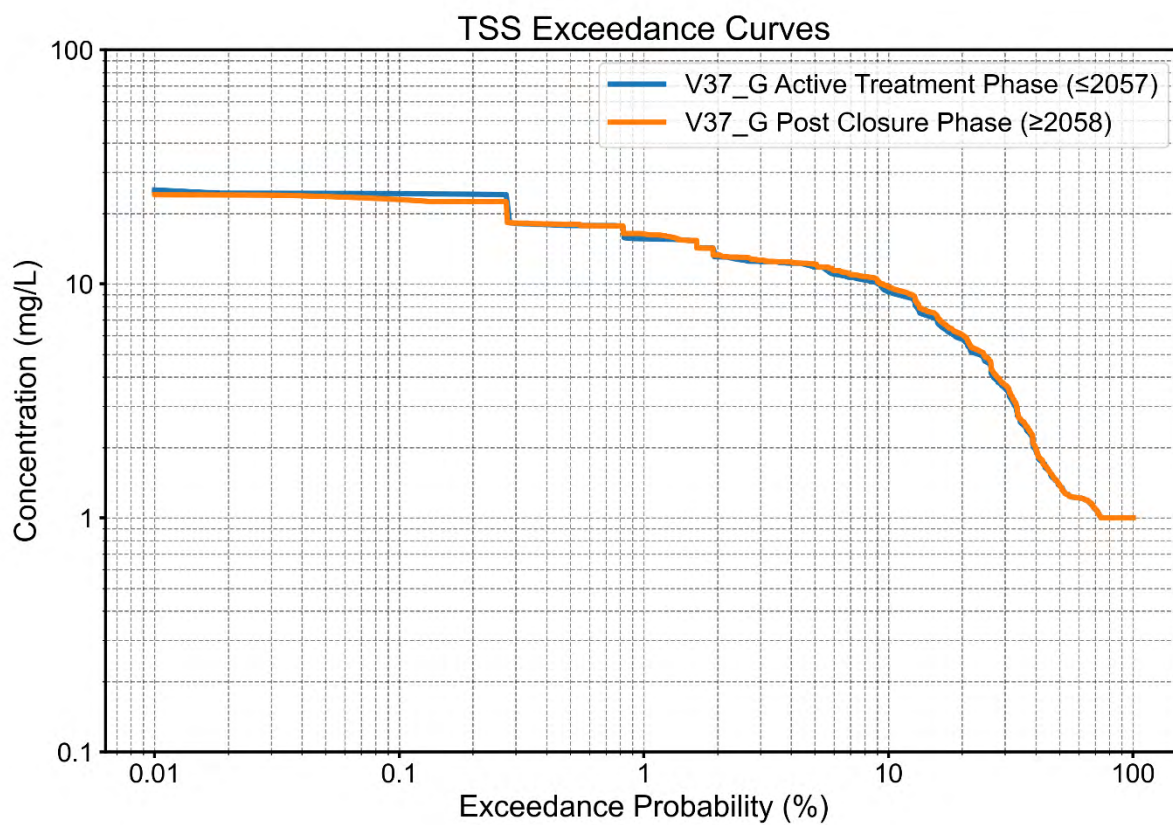


Figure 96: V37_G - TSS - exceedance plot.

5.4 WTP Annual Loads

Annual loads of acidity, TSS, Al, and Fe entering the WTP were calculated from the WLBW for the Base Case. These are key parameters for the WTP design and estimation of sludge generation at the WTP and are included in Figure 97.

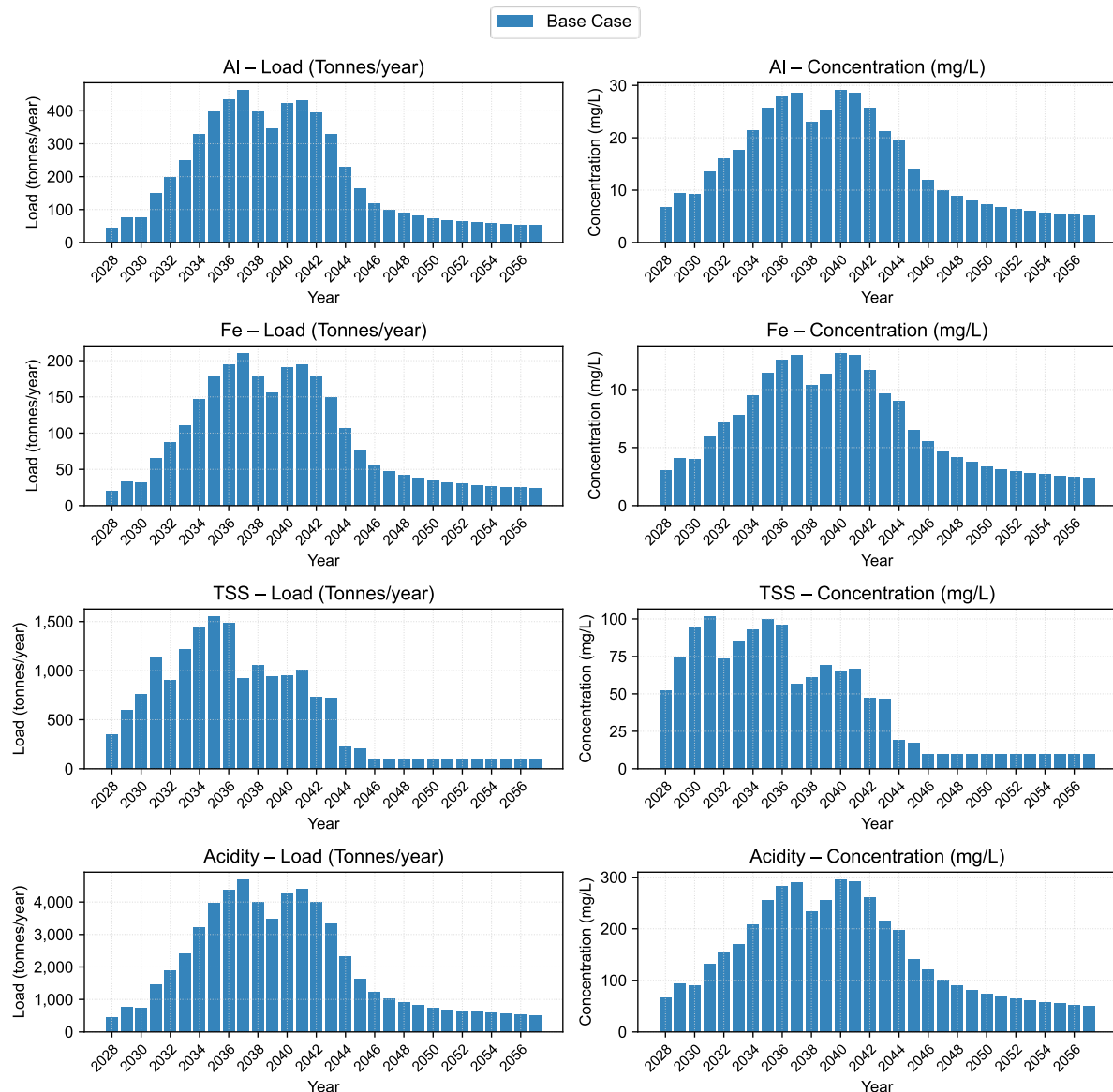


Figure 97: Annual acidity loads, and weighted concentrations to WTP.

Weighted concentrations are calculated as total load per year divided by total water volume per year.

The model results suggest the following:

- Two distinct peaks are illustrated in the data for acidity, Al, and Fe.
 - o The first peak (2036 to 2037) is largely attributed to peak loads generated from the WWH ELF. Loads from this ELF reduce after this point as rehabilitation progresses (reducing net percolation), and decay processes occur.

- o The second peak in 2041 coincides with peak loads generated from the CON ELF. Construction of this ELF begins in 2039 and is complete (including rehabilitation works) by 2044 when all rehabilitation activities are complete.
- TSS loads peak in 2035 and reduce to a lower level in 2037. This reduction is influenced by significant progress in rehabilitation occurring during 2036. Rehabilitation (e.g., establishment of vegetation) significantly reduces erosion and therefore production of TSS compared to disturbed mine areas.
- A significant drop in TSS load is noted in 2044, which coincides with closure of the mine.

5.5 Alternative Scenarios

5.5.1 Water Balance Model Results

5.5.1.1 Introduction

This section illustrates the resultant differences in WTP treatment volumes, pit sump trends, and site hydrology between the Base Case and scenarios 1 and 2 (rainfall scenarios).

Early iterations of the model indicated the requirement to increase the modelled collection of water within sumps under Scenario 1 and 2 to maintain water quality below acute guideline values. The following changes were made:

- Scenario 1
 - o The maximum WTP capacity was increased from 635 L/s to 700 L/s.
 - o The CON Sump bypass trigger rate was increased by a factor of ~1.35 to activate ~5% of the time under this 'wet' year scenario. The maximum sump pumping was also increased to avoid spilling, increased by a factor of ~1.44. The ESC Sump infrastructure was increased by a similar amount.
 - o The WWH Sump maximum pumping rate was increased by a factor of 1.2.
- Scenario 2
 - o The CON Sump bypass trigger was increased by a factor of ~1.35 to activate ~5% of the time. The sump pumping was also increased to avoid spilling, increased by a factor of ~1.44.
 - o The ESC Sump pumping was increased by a factor of 1.17 for 2039, the wettest year for the stochastic rainfall record.
 - o The WWH Sump pumping rate was increased by a factor of 1.2.
 - o The WTP capacity was increased to 650 L/s which was 15 L/s higher than the Base Case (635 L/s).

5.5.1.2 Volume of Water Treated at WTP (scenario comparison)

The cumulative volume of treated water for the Base Case and Scenarios 1 and 2 is presented in Figure 98. The following is observed:

- Whilst an extra 19% more water (compared to Base Case) is treated by the WTP during the high rainfall scenario (S1) at the end of active treatment, this outcome is not significant as cumulative wet years for the model simulation is improbable.
- The stochastic rainfall simulation resulted in slightly higher volumes of water being treated by the WTP (<1% difference).

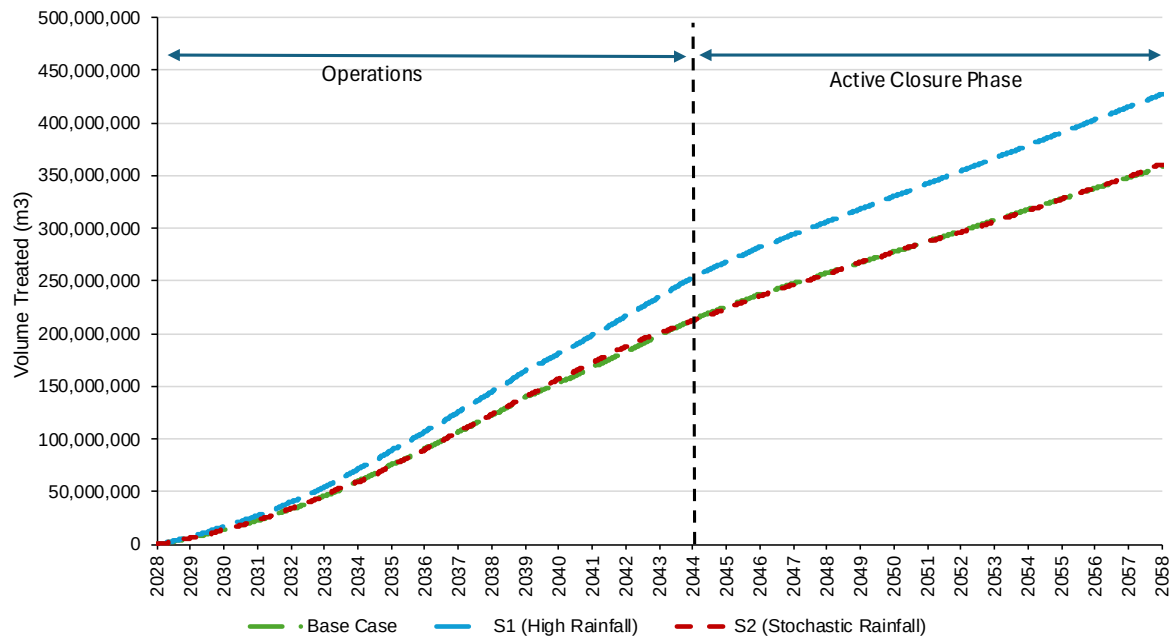


Figure 98: Volume of water treated (scenario comparison).

Discharge Events

The effect of different rainfall scenarios on sump spilling is illustrated for the WWH Sump (Figure 99), and the Surge Pond (Figure 100) and the following is noted:

- Scenario 1 resulted in slightly more spill events at the WWH Sump compared to the Base Case. Scenario 2 resulted in the lowest number of spill events at the WWH sump because the pumping rate was increased in line with Scenario 1 to prevent excessive spilling during high rainfall periods. No spilling occurred in any scenario beyond 2032 when the water management strategy switches from a spilling mechanism to a bypass mechanism.
- No spilling occurred at the WTP Surge Pond during the Base Case scenario. Both the high rainfall scenario (Scenario 1) and the Stochastic rainfall scenario (Scenario 2) resulted in a limited number of spill events (10). These outcomes are a result of higher rainfall volumes (consistently during Scenario 1 and in some years during Scenario 2) and therefore increased pumping from the ESE in-pit sumps to the Surge Pond.
- Despite the increase in spill events in Scenario 1 and 2, results suggest the modelled water quality at compliance locations would remain below proposed guideline values.

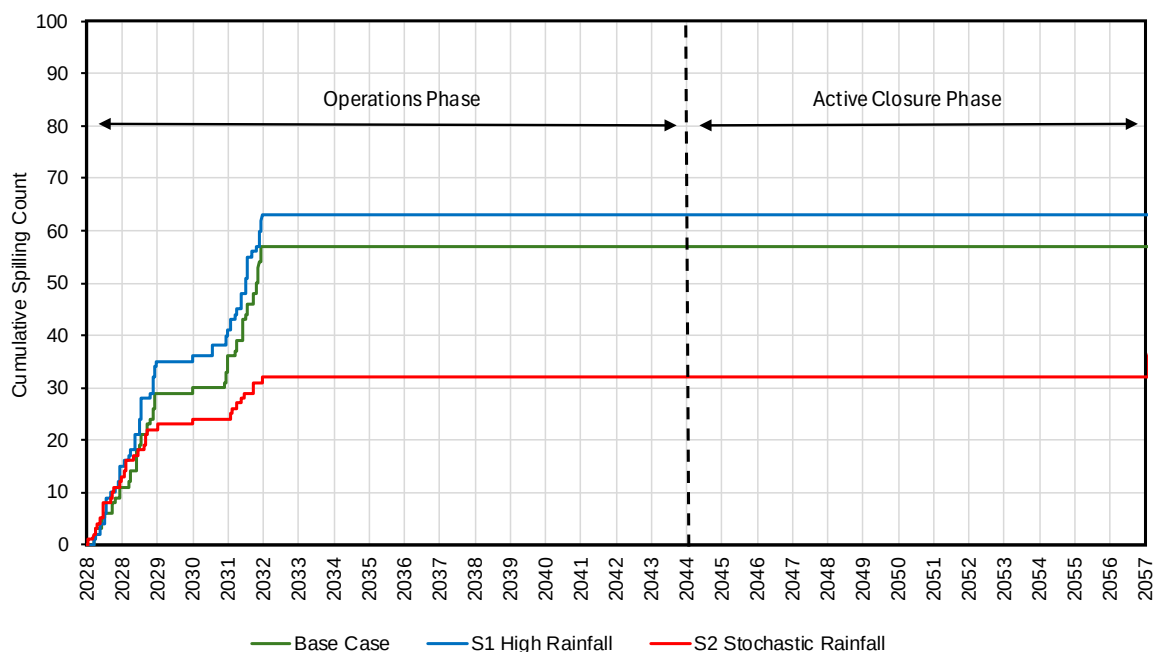


Figure 99: WWH Sump spill event accumulation.

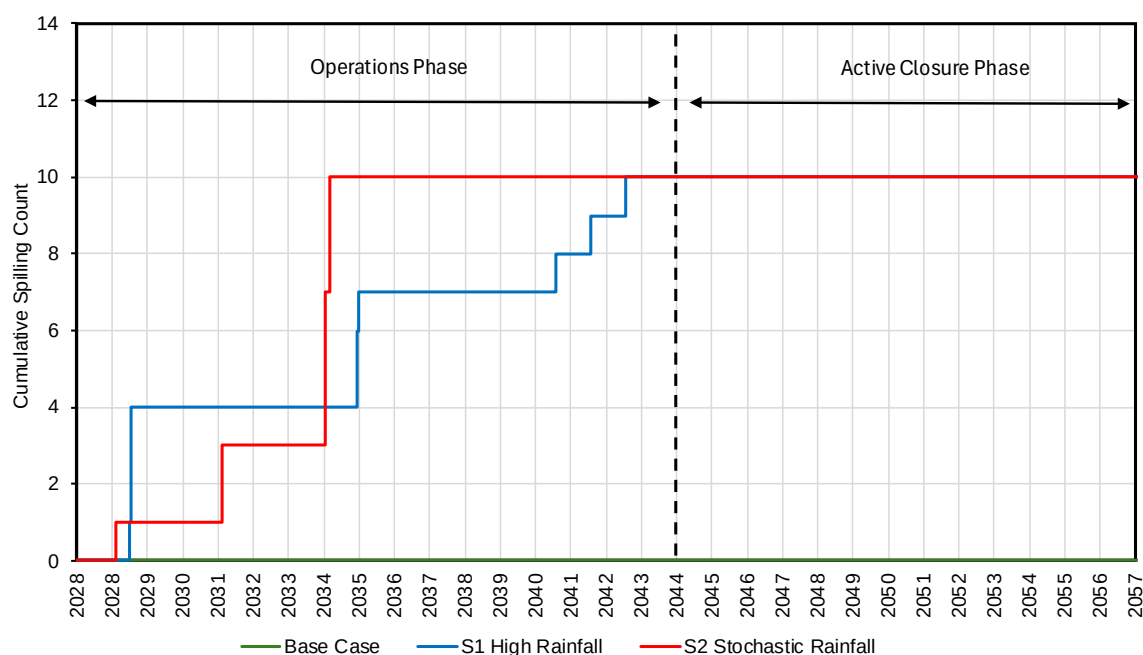


Figure 100: WTP Surge Pond spill event accumulation.

Bypass trigger event rates and pumping rates were adjusted for the rainfall scenarios for some sumps (CON Sump and ESC Sump) to maintain bypassing ~5% of the time or less. The remainder were left unchanged compared to the Base Case model as compliance with water quality criteria could be achieved using the same model settings. The frequency of bypass events for different scenarios are presented in this section.

The bypass event frequency for WWH Sump is presented in Table 33 below. A significant increase in bypass events was noted for Scenario 1, increasing by approximately 20 days per year. During Scenario 2, a smaller increase to approximately seven days occurs.

Table 33: WWH Sump - frequency of bypass events during different scenarios (per year bypass is active).

EVENT DURATION	BASE CASE	S1 – HIGH RAINFALL	S2 – STOCHASTIC RAINFALL
1 day	7.3	19.8	14.6
2 days	1.4	3.3	1.2
3 days	0	0.9	0.1
Total days / %	10.2 / 2.8%	29.1 / 8.0%	17.2 / 4.7%

The bypass event frequency for CON Sump is presented in Table 34 below. For both Scenario 1 and Scenario 2, bypass trigger rates were increased by a factor (resulting in higher volumes bypassing overall) to ensure that on a yearly basis, the bypass events occurred on less than 5% of the time. This resulted in some years having significantly less bypass events and lowering the average occurrence to 2-3% of the time for both scenarios.

Table 34: CON Sump - frequency of bypass events during different scenarios.

EVENT DURATION	BASE CASE	S1 – HIGH RAINFALL	S2 – STOCHASTIC RAINFALL
1 day	11.8	6.6	9.7
2 days	2.5	1.1	0.4
3 days	0	0.2	0
Total days / %	16.8 / 4.6%	9.4 / 2.6%	10.6 / 2.9%

The bypass event frequency for ESC Sump is presented in Table 35 below. All bypass trigger rates were increased by a factor for Scenario 1 to account for significantly higher rainfall amounts, whilst trigger rates for Scenario 2 only required adjustment for significantly higher rainfall years. Bypass frequencies remained under 5% of days throughout the year for all scenarios.

Table 35: ESC Sump - frequency of bypass events during different scenarios.

EVENT DURATION	BASE CASE	S1 – HIGH RAINFALL	S2 – STOCHASTIC RAINFALL
1 day	12.0	10.0	15.6
2 days	3.0	2.0	1.0
3 days	0	0.4	0.12
Total days / %	18 / 4.9%	14.4 / 3.9%	18.0 / 4.9%

5.5.2 Load Balance Model Results

5.5.2.1 Metals

Scenario results for metals were presented alongside Base Case model results in Sections 5.3.1 through 5.3.6. All scenario results were below chronic or acute guideline values for the relevant exposure period.

However, it is noted that higher rates of MIW water capture and WTP capacity were required (compared to the Base Case) for wet years, particularly for compliance locations with little dilutive capacity (e.g., V62).

5.5.2.2 TSS and Turbidity

Turbidity was calculated from TSS using the relationship described in Section 3.3.3 to allow comparison of the proposed guideline values. Median and P95 turbidity values were calculated annually and plotted

in Figure 101 and Figure 102. The plots include the compliance monitoring locations with associated guideline values for turbidity. Minor changes were noted regarding annual median and P95 turbidity values between the rainfall scenarios. No exceedances of the annual median and P95 chronic guideline values were noted for all rainfall scenarios.

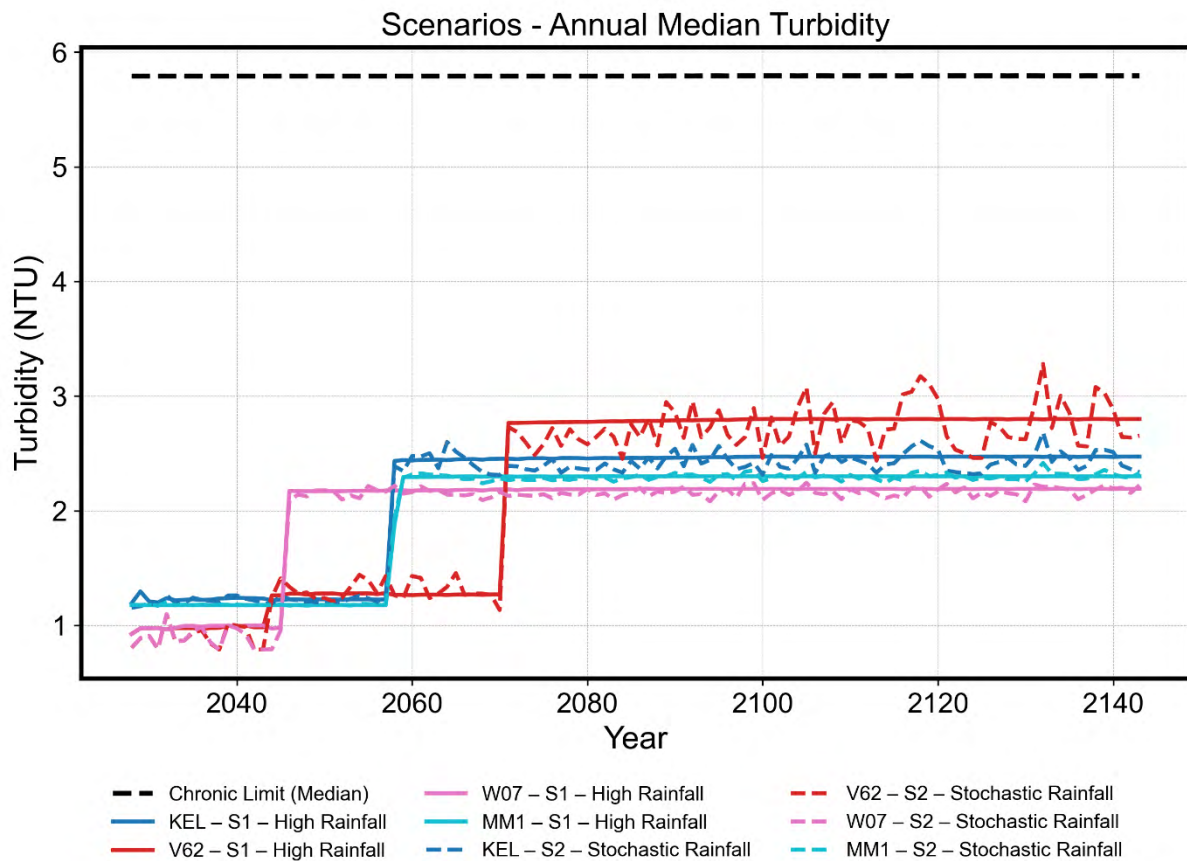


Figure 101: Annual median turbidity comparing rainfall scenarios.

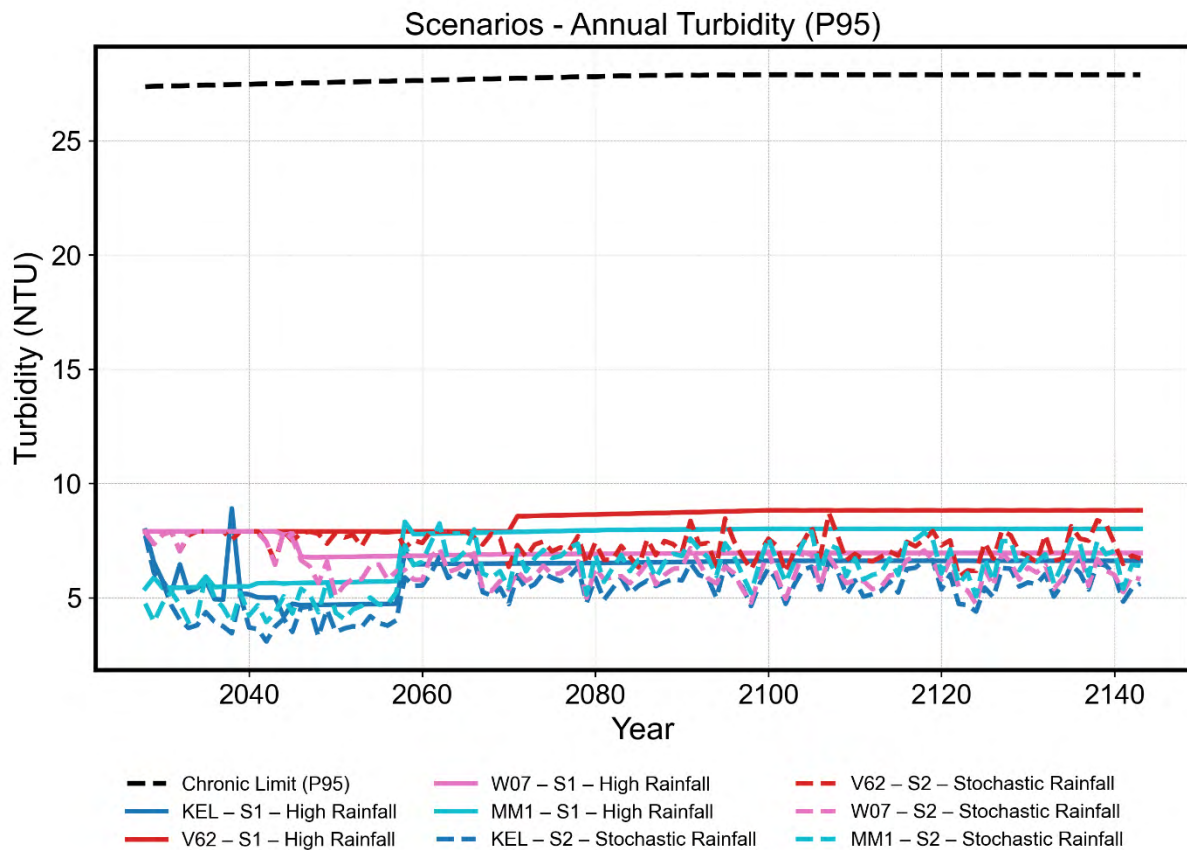


Figure 102: Annual P95 turbidity comparing rainfall scenarios.

The following plots (Figure 103 and Figure 104) compare turbidity against acute guideline values. There are no instances of simulated turbidity exceeding acute guideline values under any of the scenarios.

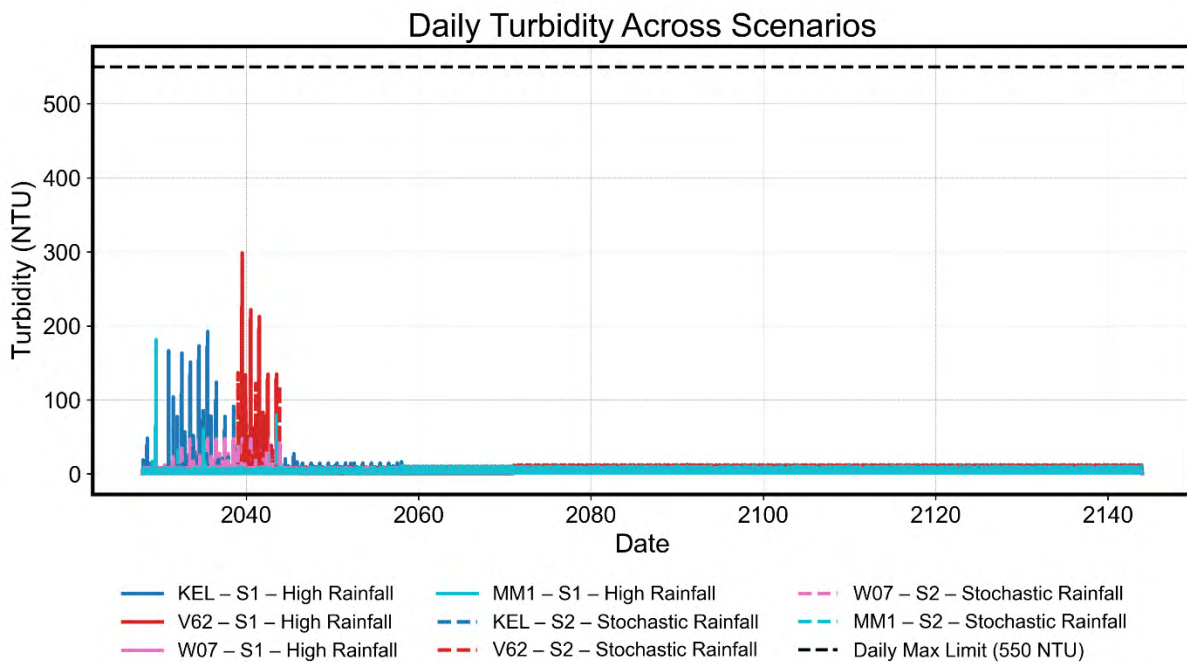


Figure 103: Daily turbidity results compared to max acute daily limit for different rainfall scenarios.

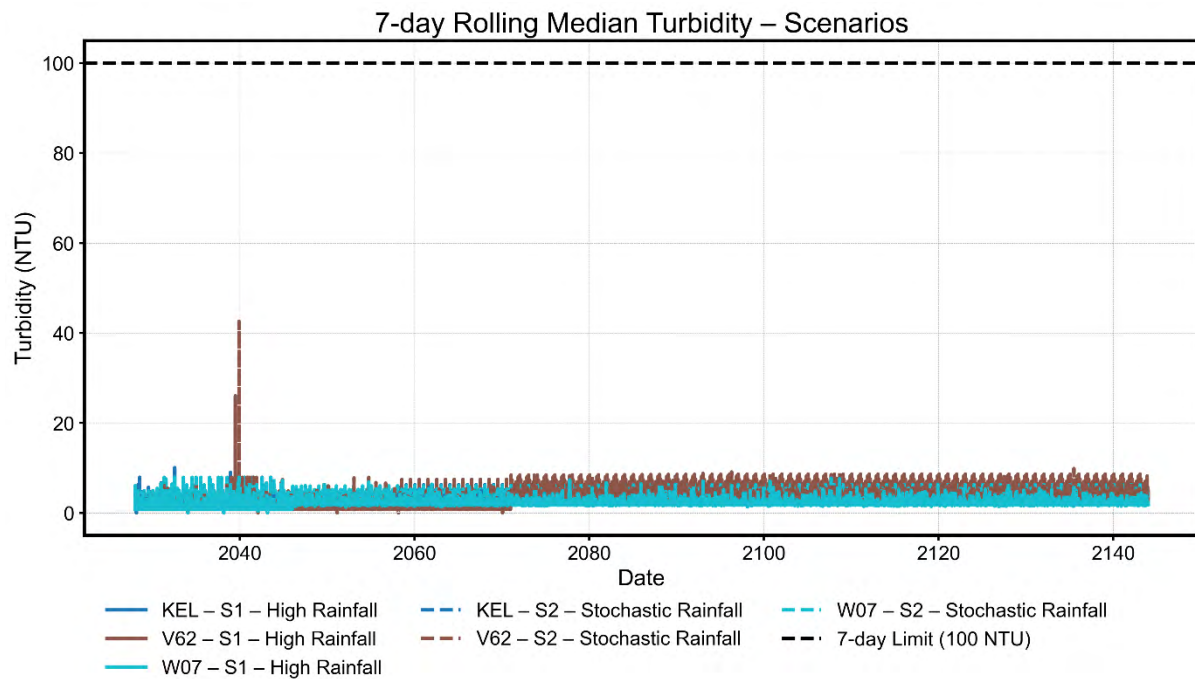


Figure 104: 7-day rolling median turbidity compared to acute compliance limit for different rainfall scenarios.

5.5.2.3 Water Treatment Plant Influent Loads

Variability in WTP annual influent loads and average concentrations between the Base Case and scenarios is shown in Figure 105. The following is noted:

- The highest Al, Fe and Acidity loads occurred under Scenario 3 (approximately 30% higher during the Operations Phase due to higher seepage loads), closely followed by Scenario 1. Scenario 2 and Base Case showed little difference, while as expected, Scenario 4 showed the lowest load (approximately 30% less during Operations Phase) as ELF seepage concentrations were less. These patterns are reflected at the downstream compliance location (KEL) in Figure 40 and Figure 42.
- For TSS, Scenario 1 resulted in the highest load, as expected since TSS in the model is driven by daily rainfall depth. Scenario 2 results showed greater variability in TSS. Results were similar between the Base Case and Scenarios 3 and 4.

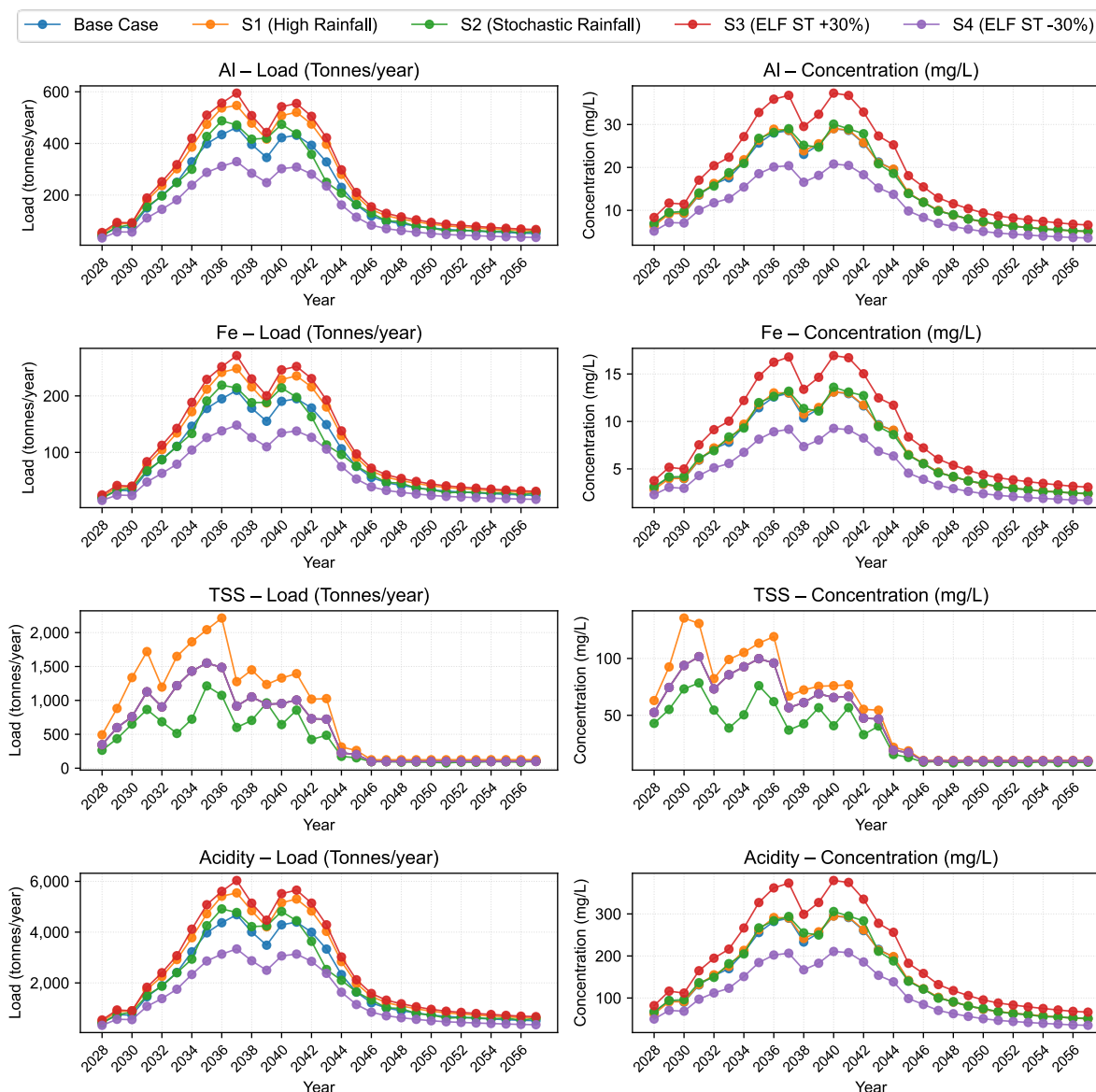


Figure 105. Annual WTP inflowing loads and weighted concentrations for all scenarios.

Note: Weighted concentrations are calculated as total load per year divided by total water volume per year.

Base Case and Scenario 3 TSS loads and concentration obscured behind Scenario 4 (no change modelled).

Base Case concentrations for Al, Fe and acidity partially obscured behind Scenario 1 (similar concentrations).

6 SUMMARY AND RECOMMENDATIONS

6.1 Summary

The primary outcome of the ESE WLBM is that water quality simulated at compliance locations remained below the proposed guideline values derived for the Project throughout the simulation, including for the Base Case model and the four scenarios which test uncertainties of the model including rainfall variability as well as uncertainty in source terms for seepage water quality.

Key findings regarding the results of the water balance model, load balance model, and alternative scenarios are summarised within this section.

6.1.1 Water Balance Model Results (Base Case)

The key findings from the water balance model results are as follows:

- The proposed mine water infrastructure and treatment systems can achieve compliance including when stress tested against high and low rainfall conditions. Under the Base Case the mine captures and treats all MIW flows 95% of the time, with bypass events up to ~5% of the time in a given year (i.e., ~18 days per year). Spills occur up to 5% of the time for years when bypass infrastructure is not established.
- The “WWH” and “CON” ELFs contribute to the vast majority of ELF seepage (combined 77% of final ELF surface catchment) during the model simulation.
- The model suggests a total of 358,000,000 m³ of water will be treated by the WTP over the 30 years that it is active.
- Sump volumes, pumping rates, and a maximum WTP throughput of 635 L/s managed the simulated MIW volumes (under approximately annual average rainfall conditions) with spilling and bypass occurrence 5% of the time or less. Note that spilling and bypass do not occur concurrently for a given sump (as per the water management strategy).
- The following changes to flow dynamics are predicted to environmental flows (at compliance monitoring locations positioned within waterways):
 - o For the Active Treatment Phase, KEL had the largest mean flow increase (+16%) while W07 had the greatest reduction (-16%).
 - o For the Post Closure Phase, V62 had the largest mean flow increase (+108%) while M-M1 had the greatest reduction (-24%).
 - o For low flow conditions, all sites show an increase for both phases, with M-M1 the highest (+8,650%) during the Active Treatment Phase and V62 the highest (+16,100%) during the Post Closure Phase.

6.1.2 Load Balance Model Results (Base Case)

The key findings from the load balance model are:

- Active treatment will be required for ~15 years after mining operations cease before MSRs can treat all ELF seepage loads to meet proposed guideline values. Some ELF seepage will be able to be treated effectively with MSRs earlier than this.
- Screening of model results against acute and chronic guidelines values for metals and turbidity did not suggest exceedance above these values over the proposed exposure periods at the compliance monitoring locations. Zn and Ni were the parameters closest, but still below, guideline values. Overall, model results suggest discharge of MIW via bypass and spilling at proposed quantities and frequencies (<5% of the time in a given year) will not elevate PCOCs above proposed guideline values at the modelled compliance monitoring locations.
- Peak MIW PCOC loads reporting to the WTP occur in 2036/37, with approximately 4,700 t/year of acidity, 460 t/year of Al and 210 t/year of Fe. 2035 was the peak year for TSS load, with 1,550 t/year.

6.1.3 Alternative Scenario Model Results

The key findings of the scenario modelling are summarised below:

- All scenario model results were below proposed chronic (annual median) and acute (annual P95) guideline values (see MEQ plots) for the duration of each simulation. This incorporated testing of the model against a high rainfall year (Scenario 1), and a stochastic simulation (Scenario 2) that included high intensity rainfall 24 hour events corresponding to a 1 in 10 year event during the operations phase and a 1 in 100 year climate adjusted event (see Section 3.2.2). Dry periods were also incorporated in the model with a maximum dry period of 41 consecutive days included within Scenario 2.
- Scenario 2 resulted in similar treated volumes to the Base Case. Whilst Scenario 1 resulted in an increase (19%) in the total water treated by the WTP this is not significant as cumulative 'wet' years for every year over the Project duration are improbable.
- Scenario 1 and Scenario 2, resulted in a low number of spill events (10) at the WTP Surge Pond,. These spill events result in higher concentrations of some PCOCs within the receiving environment (modelled at M-M1), but concentrations remain below guideline values.
- Scenario 3, with higher ELF seepage source terms showed higher metals concentrations, particularly in the Post Closure Phase. However, toxicity modified guideline values (Hickey, 2026) also increased (e.g., due to additional water hardness). Ultimately simulated downstream concentrations remained below guideline values for the chronic and acute exposure periods.
- Scenario 4, with lower ELF seepage source terms showed lower metal concentrations particularly in the Post Closure Phase. Toxicity modified guideline values also reduced (e.g., due to lower water hardness), however simulated downstream concentrations remained below guideline values for the chronic and acute exposure periods.

6.2 Operational Management Recommendations

The following management recommendations are proposed for the Operations Phase:

- Active treatment (ESE WTP) is required from the second year of the Construction Phase. Noting that a portable WTP will be used in the Construction Phase to treat MIW until the ESE WTP is commissioned.
- Alternative scenarios (rainfall scenarios 1 and 2) suggest that repeat wet years (or wet periods) may lead to increased frequency of spilling from pit sumps without increasing pumping rates accordingly. For example, WWH Sump pumping rates were increased by 20% for the rainfall scenarios to maintain similar spill event occurrences (<~5%). As such, it is recommended that where practical, sump water volumes are kept low to allow for sufficient storage to minimise the risk of spilling. Additional WTP capacity may be required as a buffer for periods where the WTP is under maintenance and capacity is reduced.
- The majority of PCOC loads originate from the ELF's and collection of their seepage is important for minimising potential effects on waterways. As such, it is recommended that design, construction, and ongoing operation of ELF's and associated seepage systems are undertaken at a high standard to ensure high levels of seepage collection are achieved (as per model assumptions).
- The Base Case model assumed sump bypassing will occur up to ~5% of the time. However, in practice, mine water management operators will not know ahead of time if a given rainfall event will trigger a bypass event. As such, it may be more practical to operate the bypass pathway in tandem with real time hydrological conditions in a reference creek. For example, bypass activates when V70 Creek is at a 95th percentile flow condition.
- A performance monitoring programme needs to be developed and implemented to confirm model inputs and results are in line with as-built conditions and operational practice, including water quality and quantity data from:
 - o ELF seepage and runoff.
 - o Haul road runoff.
 - o Open pit runoff.
 - o Sump MIW.
 - o Sediment control structures.
 - o Sump bypass MIW.
 - o WTP Feed water quantities and qualities, and discharge quality.
 - o MSR discharge.
- Sump bypass infrastructure should be instrumented such that the frequency, duration, and water volume discharges is recorded and reviewed annually. Similar metrics should be recorded for WTP discharges and direct discharges.

- Demonstrate that adopted net percolation rates can be achieved through a cover system trial. Such a study would provide confidence that water quality closure objectives can be achieved in the proposed timeframes and support closure planning.
- Adaptive management processes should be followed to proactively manage water related risks.
- As more empirical data becomes available as the ESE is developed, the WLBM should be periodically benchmarked to new data and updated as needed to improve confidence in model results.

6.3 Closure Management Recommendations

The following management recommendations are proposed for the Active Closure and Post Closure Phases:

- The model suggests active treatment will be required for approximately 15 years following completion of mining and rehabilitation works (Operations Phase) before switching to solely treatment by MSRs. Performance monitoring during operations will improve understanding of the likely duration of active treatment.
- Passive treatment such as MSRs are an important element of achieving water quality objectives in the Post Closure Phase. As such, early implementation of passive treatment systems and associated performance monitoring should be used as an opportunity to monitor treatment performance and inform closure planning.
- The WLBM should be updated on a routine basis to include additional performance monitoring data are available to calibrate the model (e.g., cover system performance and net percolation rates; source terms; water treatment efficiencies, etc.) to improve confidence in model results for closure.

7 REFERENCES

- BRL, 2026. Buller Plateaux Continuation Project - Summary Project Description. Section 5 - Project Description. January 2026.
- Broughton, W., 2004. The Australian Water Balance Model. *Environmental Modelling & Software* 19 (10), 943-956.
- Chater, M., 2024. Rainfall Frequency Analysis Methodology - Stockton and Denniston Mine Site. Memo. Dated September 2024.
- CRC for Catchment Hydrology, 2006. SCL User Guide.
- GoldSim Technology Group, 2021. GoldSim User's Guide (Version 14.0).
- Hickey, C.W., 2026. Buller Plateaux Continuation Project: Water quality protection guidelines. Report prepared by RMA Science Ltd for Bathurst Resources Ltd.
- Ministry for the Environment, 2018. Climate Change Projections for New Zealand - Atmospheric projections based on simulations undertaken for the IPCC 5th Assessment, 2nd edition. Wellington.
- MWM, 2026a. Construction Phase Report - Buller Plateaux Continuation Project. Mine Waste Management Report: J-NZ0453-007-R-FINAL.
- MWM, 2026b. Cover System Technical Report - Buller Coal Plateaux Continuation. Mine Waste Management Report: J-NZ0349-013-R- FINAL.
- MWM, 2026c. Water and Load Balance Model - Source Term Definition - Buller Plateaux Continuation Project. Mine Waste Management Report: J-NZ0433-004-R- FINAL.
- MWM, 2026d. Escarpment Mine - Barren Valley ELF Water Quality Model. Mine Waste Management Report: J-NZ0349-008-R- FINAL.
- MWM, 2026e. ELF Water Quality and MSR Design Summary - Buller Plateaux Continuation Project. Mine Waste Management Report: J-NZ0453-006-R- FINAL.
- MWM, 2026f. MGIU TSS Review. Mine Waste Management Report: J-NZ0433-013-M- FINAL.
- Pope, J., Christenson, H., Gordon, K., Newman, N., & Trumm, D., 2018. Decrease in acid mine drainage release rate from mine pit walls in Brunner Coal Measures. *New Zealand Journal of Geology and Geophysics*.
- Process Flow, 2026. Active Water Treatment Testing Report - Summary of Tests. Process Flow Report: PFL-2408-PRO-RPT-00001.
- Weber, P and Olds, W, 2016. Optimised water assessment for the environmental management of mining projects. In: Fergusson, D (ed). Proc. AusIMM NZ Branch 2016 Conference, Wellington, p. 455–466.
- WM Group, 2014. Escarpment Mine Project - Assessment of Revised Water Management Approach. Prepared for Buller Coal Limited, February 2014. Report 12001-036-R-002.

8 LIMITATIONS

Attention is drawn to the document “Limitations”, which is included in Appendix A of this report. The statements presented in this document are intended to provide advice on what the realistic expectations of this report should be, and to present recommendations on how to minimise the risks associated with this project. The document is not intended to reduce the level of responsibility accepted by Mine Waste Management, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in doing so.

APPENDIX A LIMITATIONS

This Document has been provided by Mine Waste Management Ltd (MWM) subject to the following limitations:

This Document has been prepared for the particular purpose outlined in MWM's proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

The scope and the period of MWM's services are as described in MWM's proposal, and are subject to restrictions and limitations. MWM did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in this Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by MWM in regards to it.

Conditions may exist which were undetectable given the limited nature of the enquiry MWM was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.

In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. MWM's opinions are based upon information that existed at the time of the production of this Document. It is understood that the services provided allowed MWM to form no more than an opinion of the actual conditions of the site at the time the site was reviewed and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by MWM for incomplete or inaccurate data supplied by others.

MWM may have retained subconsultants affiliated with MWM to provide services for the benefit of MWM. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any direct legal recourse to, and waives any claim, demand, or cause of action against, MWM's affiliated companies, and their employees, officers and directors.

This Document is provided for sole use by Bathurst Resources Limited and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of this Document will be accepted to any person other than the Client. Any use which a third party makes of this Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. MWM accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Document.

MWM acknowledges that this report will be relied on by a Panel appointed under the Fast-track Approvals Act 2024 and these disclaimers do not prevent that reliance.

APPENDIX B PROPOSED WATER QUALITY LIMITS

Table B1: Bioavailability guideline value (GV) equations for chronic GVs and acute GVs for differing levels of protection (LoP). Toxicity modifier factor (TMF) range for pH, hardness (as CaCO₃) and dissolved organic carbon (DOC) indicated (Hickey, 2026).

Application (Note 1)	Guideline Value (µg/L) (Note 2)	TMF range (Note 3).	Derivation notes
Dissolved Aluminium Guideline Values (µg/L)			
	Chronic Al GV		
95% LoP. pH ≤ 6.5	500	pH: ≤ 6.5 (Note 4)	See “Note 4” for basis of change of pH threshold. This reduces set change at this pH transition. Eqn at pH 6.5, H=10, DOC=5 → 160 µg/L
95% LoP. pH > 6.5	exp(0.645×ln(DOC) + 2.255×ln(Hardness) + 1.995×pH + (-0.284×ln(Hardness)×pH) -9.898) *Note if algorithm is ≤ pH 6.5 use 500.	pH: 6.5 – 8.7 Hardness: 10 – 430 mg/L DOC: 0.08 – 12.3 mg/L	
90% LoP	95% LoP / 0.79		The adjustment factor is calculated from the Canadian chronic SSD.
80% LoP	95% LoP / 0.58		As above
Dissolved Copper Guideline Values (µg/L)			
	Chronic Cu GV		
95% LoP	DGV _{0.5} x (DOC/0.5)^0.70 where DGV _{0.5} = 0.73	pH: 6 – 8.5 Hardness: 2 – 400 mg/L DOC: 0.1 – 20 mg/L	
90% LoP	DGV _{0.5} x (DOC/0.5)^ 0.70 where DGV _{0.5} = 0.89		
80% LoP	DGV _{0.5} x (DOC/0.5)^ 0.70 where DGV _{0.5} = 1.4		
	Acute Cu GV		
95% LoP	exp (-6.6 + 0.78xpH + 0.58×ln(Hardness) + 0.70×ln(DOC)	pH: 5 – 8.8 Hardness: 3.9 – 898 mg/L DOC: 0.1 – 30 mg/L	
90% LoP	exp (-6.3 + 0.78xpH + 0.58×ln(Hardness) + 0.70×ln(DOC)		
80% LoP	exp (-5.8 + 0.78xpH + 0.58×ln(Hardness) + 0.70×ln(DOC)		
Dissolved Iron Guideline Values (µg/L)			
All LoP	500	All conditions	
Dissolved Zinc Guideline values (µg/L)			
	Chronic Zn GV		
95% LoP	exp(0.947xln(Hardness) - 0.815xpH + 0.398xln(DOC) + 4.63)	pH: 5.7 – 8.1 Hardness: 15 – 399 mg/L DOC: 0.3 – 22.9 mg/L	
90% LoP	95% LoP / 0.67		
80% LoP	95% LoP / 0.39		
	Acute Zn GV		
95% LoP	exp (2.5 - 0.12×pH + 0.6×ln(Hardness) + 0.13×ln (DOC)	pH: 5.4 – 8.5 Hardness: 14 – 826 mg/L DOC: 0.1 – 22 mg/L	
90% LoP	exp (2.9 - 0.12×pH + 0.6×ln(Hardness) + 0.13×ln (DOC)		
80% LoP	exp (3.4 - 0.12×pH + 0.6×ln(Hardness) + 0.13×ln (DOC)		
Dissolved Cobalt Guideline values (µg/L)			
	Chronic Co GV		
95% LoP	Exp((0.414xLn(hardness)-1.285)	Hardness range: 52-396 mg/L	CCME (2017). Equations for 90% and 80% protection calculated from CCME chronic data. Note: This has hardness modifier which was not in the ANZECC (2000) guidelines.
90% LoP	Exp((0.414xLn(hardness)-0.427)		
80% LoP	Exp((0.414xLn(hardness)+0.557)		
	Acute Co GV		
95% LoP	95%Chronic CoGV/0.16	Hardness range: 52-396 mg/L	Acute peak estimated based on zinc no effect acute and chronic ratio for index water quality conditions.
90% LoP	95%Chronic CoGV/0.11		
80% LoP	95%Chronic CoGV/0.062		
Dissolved Nickel Guideline values (µg/L)			
	Chronic Ni GV		
95% LoP	11x(Hardness/30)^0.85	Hardness range: 30-400 mg/L. No guidance for pH application range. Normally taken as physiological pH range as used for testing (pH 6.5-8.5)	ANZG (2018) guideline.
90% LoP	13x(Hardness/30)^0.85		
80% LoP	17x(Hardness/30)^0.85		
	Acute Ni GV		

Application (Note 1)	Guideline Value (µg/L) (Note 2)	TMF range (Note 3).	Derivation notes
95% LoP	95%Chronic NiGV/0.16	Hardness range: 30-400 mg/L	Acute peak estimated based on zinc no effect acute and chronic ratio for index water quality conditions.
90% LoP	95%Chronic NiGV/0.11		
80% LoP	95%Chronic NiGV/0.062		
	Dissolved Manganese Guideline values (µg/L)		
	Chronic Mn GV		
95% LoP	$\text{Exp}((0.411 \times \text{Ln}(\text{hardness}) + 4.46))$	Hardness range: 25-670 mg/L Simplified equation for hardness only calculated at pH 7.5. Look-up tables provided for pH 5.8 to 8.4.	CCME (2019). Equations for 90% and 80% protection calculated from CCME chronic data and used to adjust from 95% protection. Note: This has hardness modifier which was not in the ANZECC (2000) guidelines.
90% LoP	$\text{Exp}((0.411 \times \text{Ln}(\text{hardness}) + 4.89))$		
80% LoP	$\text{Exp}((0.411 \times \text{Ln}(\text{hardness}) + 5.38))$		
	Acute Mn GV		
95% LoP	$(\text{Exp}((0.878 \times \text{Ln}(\text{hardness}) + 4.84)))/2.13$	Hardness range: 25-250 mg/L	CCME (2019). Equations for 90% and 80% protection calculated from CCME chronic data and used to adjust from 95% protection. Adjustment factor of 2.13 converts the acute EC50 to acute no effect based on the zinc ratio (from Gadd et al 2024).
90% LoP	$(\text{Exp}((0.878 \times \text{Ln}(\text{hardness}) + 6.90))/2.13$		
80% LoP	$(\text{Exp}((0.878 \times \text{Ln}(\text{hardness}) + 7.20))/2.13$		
	Dissolved Cadmium Guideline values (GVs, µg/L)		
	Chronic Cd GV		CCME (2014)
95% LoP	$10^{(0.83 \times \text{LOG}_{10}(\text{Hardness}) - 2.46)}$	Hardness range: 17-280 mg/L	CCME (2014). Equations for 90% and 80% protection calculated from CCME chronic data and used to adjust from 95% protection.
90% LoP	$(10^{(0.83 \times \text{LOG}_{10}(\text{Hardness}) - 2.46)}) \times 1.84$		
80% LoP	$(10^{(0.83 \times \text{LOG}_{10}(\text{Hardness}) - 2.46)}) \times 4.15$		
	Acute Cd GV		
95% LoP	$(10^{(1.016 \times \text{LOG}_{10}(\text{Hardness}) - 1.71)})/2.13$	Hardness range: 5.3-360 mg/L	CCME (2014) acute dataset. Equations for 90% and 80% protection calculated from CCME chronic data and used to adjust from 95% protection. Adjustment factor of 2.13 converts the acute EC50 to acute no effect based on the zinc ratio (from Gadd et al 2024).
90% LoP	$(10^{(1.016 \times \text{LOG}_{10}(\text{Hardness}) - 1.71)})/2.77$		
80% LoP	$(10^{(1.016 \times \text{LOG}_{10}(\text{Hardness}) - 1.71)})/9.58$		
	Nitrate-N (ANZG – hardness (H)-dependent; guideline)		
	Chronic Nitrate-N GV		
95% LoP	1100 (H<30); 2600 (H30-150); 29,000 (H >150)	Hardness dependent	ANZG (2025a)
90% LoP	1500 (H<30); 4200 (H30-150); 38,000 (H >150)		
80% LoP	2300 (H<30); 7100 (H30-150); 56,000 (H >150)		
	Acute Nitrate-NGV		
	Not available		
	Nitrate-N (NPS-FM; standard)		
	Chronic Nitrate-N Standard (median standard)		MfE (2020)
95% LoP	2400		
90% LoP	Below “bottom line”		
80% LoP	Below “bottom line”		
	Acute Nitrate-N Standard (95th percentile standard)		
95% LoP	3500		
90% LoP	Below “bottom line”		
80% LoP	Below “bottom line”		
	Chronic ammoniacal-N (ANZG guideline)		
95% LoP	1200	pH and temperature dependent. Values at pH 7 and 15°C.	ANZG (2026)
90% LoP	2000		
80% LoP	3600		
	Acute ammoniacal-N (ANZG guideline)		

Application (Note 1)	Guideline Value (µg/L) (Note 2)	TMF range (Note 3).	Derivation notes
	Not available		
	Chronic ammoniacal-N (NPS-FM median standard)		
95% LoP	580	pH dependent. Values at pH 7.	
90% LoP	Below "bottom line"		
80% LoP	Below "bottom line"		
	Acute ammoniacal-N (NPS-FM 95th percentile standard)		
95% LoP	968	pH dependent. Values at pH 8.	
90% LoP	Below "bottom line"		
80% LoP	Below "bottom line"		
	pH		
	Maintain in range 4.5 – 7.0 for WTP discharge		pH: Upper pH to be confirmed from bryophyte analysis for sites with differing levels of protection.

Note 1: The level of protection (LoP) values are species protection levels based on narrative descriptors from ANZG (2018).

Note 2: The compliance range for pH at Smokestack is 4.5 to 7.0. The equations vary in their calibrated TMF ranges. For monitored water quality values less than the lowest calibrated TMF value the calculated guideline value (GV) will apply to that monitoring occasion.

Note 3: Toxicity modifying factors (TMFs) are pH, hardness (calcium and magnesium concentrations) and dissolved organic carbon (DOC, measured as dissolved purgeable organic carbon (DPOC) in natural waters).

For pH, hardness and DOC values exceeding the TMF range use the lowest or highest calculated LoP value (except for dissolved aluminium where a 500 µg/L LoP applies to waters below pH 6.5 for all hardness and DOC concentrations).

Note 4: pH minimum for aluminium is based on the pH transition for Al³⁺ and Al-DOM (dissolved organic matter) binding which have elevated concentrations at lower pH levels. This pH threshold also corresponds to that used in the ANZG (2018) and ANZECC (2000) guidelines for Australia and New Zealand.

No.	Mine catchment	River/stream	Site name/code	Compliance/performance	Justification	Monitoring type/frequency	Note
1	Escarpment	Whareatea R.	KEL	Compliance	Downstream WM-2. Will receive mine discharges. No upstream reference site on Whareatea – V70 to be used.	Continuous turbidity/discrete weekly turbidity	1
2	Escarpment	Whareatea R.	WM-3	Performance	Aesthetic effects.	Discrete monthly turbidity	1,2
3	Escarpment	Cascade Creek trib. (V8 Creek)	MM1	Compliance (metals & nutrients)/ Performance (turbidity)	Impacted by underground AMD and receives WTP discharge.	Discrete weekly turbidity. Turbidity limit applies.	1,3
4	Escarpment	Whareatea R. trib	V62	Compliance	Drains mining area. Receives bypass discharges. Reference site on V70 to be used.	Continuous turbidity/discrete weekly turbidity	4
5	Escarpment	Whareatea trib	V70	Performance & reference	Reference site for Whareatea R. monitoring (KEL & WM-3).	Continuous turbidity/discrete weekly turbidity	1,5
6	Escarpment	Rapid Stm	W07	Compliance	Mining in upper catchment.	Continuous turbidity/discrete weekly turbidity	4
7	Escarpment	Rapid Stm	W09 (@SH67)	Performance	Aesthetic effects	Discrete monthly turbidity	1,2

No.	Mine catchment	River/stream	Site name/code	Compliance/performance	Justification	Monitoring type/frequency	Note
8	Mount Frederick South	Deep Stream	SW01	Compliance	D/s East Mine sump	Continuous turbidity/discrete weekly turbidity	1
9	Mount Frederick South	Deep Stream	SW03	Compliance	D/s West Mine sump	Continuous turbidity/discrete weekly turbidity	1
10	Mount Frederick South	Waimangaroa R.	Smokestack (SS) (2W)	Compliance	D/s WTP	Continuous turbidity/discrete weekly turbidity	1
11	Mount Frederick South	Waimangaroa R.	WR d/s Deep Stream (17W)	Compliance	D/s WTP and Deep Stm inflow (East and West sump bypass flows.	Continuous turbidity/discrete weekly turbidity	1
12	Mount Frederick South	Waimangaroa R.	u/s Deep Stream & Smokestack (16W)	Performance & reference	Reference site for Waimangaroa R. monitoring (Smokestack (2W), d/s Deep Stream (17W) and @SH67 (18W)).	Continuous turbidity/discrete monthly turbidity	1
13	Mount Frederick South	Waimangaroa R.	Billo Stream tributary (site BIL.L1)	Performance & reference	Reference site for SW01 and SW03 monitoring	Continuous turbidity/discrete weekly turbidity	1,6
14	Mount Frederick South	Waimangaroa R.	@SH67 (18W)	Performance	Aesthetic effects	Discrete monthly turbidity	1,2

Notes:

1. Maintained for duration of active mining in catchment. Annual compliance assessment for median and maximum limits. (Note: this applies to all sites as no lower LoP GVs available for turbidity. Except for the Performance classification for MM1 with Compliance limit of 25 NTU based on a 15-sample rolling median). Trend assessments for Performance sites may be based on annual or 6-yearly monitoring data depending on significance of site.
2. Performance for turbidity and clarity (converted from turbidity – indicative values provided in Table E-2). Monitoring frequency may need to be increased to weekly for initial overburden removal and mining period. Mining-related turbidity/clarity measured at plateau compliance sites could be translated to SH67 sites using flow relationships.⁵ Annual assessment and reporting.
3. Improvement trend monitoring based on implementation of AMD treatment. Note: This AMD treatment not expected to markedly improve variable turbidity in this stream.
4. Background water quality and baseline biological sampling required. Maintained for duration of active mining in catchment – may have delayed start for compliance monitoring as catchment mining planned for late stage. Annual compliance assessment for median and maximum limits.
5. Maintained for duration of active mining in catchment. Continuous monitoring to provide reference turbidity condition for inter-annual variability.
6. Maintained for duration of active mining in catchment. Continuous monitoring to provide reference turbidity condition for inter-annual variability. Note: Billo Stream site (BS01) which has background data will be mined out after 5-years.

⁵ Median flows (L/s): WM-2+CM1 = KEL = 84 L/s; WM-3 = 271 L/s; a 3.5-times adjustment factor; Rapid W07 = 12 L/s, Rapid at SH67 = 189 L/s a 15.7-times adjustment factor; Waimangaroa @ Smokestack = 704 L/s; Waimangaroa @ SH67 = 1389 L/s (calculated) a 1.2-times adjustment factor.

Table B2 - Summary of site-specific turbidity guideline values for short- and long-term protection of ecological communities, aesthetic and “Performance” (Hickey, 2026)

Classification/Nominal protection level	Short-term (acute) turbidity (NTU) maximum/limit, exposure period	Long-term (chronic) turbidity (NTU) median/95 th percentile/exposure reporting period ^{f, g}
Ecological – continuous ^{a,e}	550 max ^a /100, 7-d rolling median	+5 NTU median above background/+20 NTU 95 th percentile/annual
Ecological – discrete ^{b,e}	550 max ^a	As above
Aesthetic ^{c,e}	n/a	+50% change from background for median; [^{>} 1.6 m median clarity (bathing)/annual] ^h
Performance ^{d,e}	n/a	25 NTU 15-sample rolling median

a) Continuous monitoring with 10-min logging frequency and targeting >90% data capture after quality control and clean up procedures for reporting period – to exclude potential spurious instrumental values or debris contacting probe. The 7-d rolling median assessed weekly based on telemetered data. Discrete daily sampling should be used for easily accessible sites upstream and downstream of a WTP. Sites must have reliable access for sample collection during high flow events.

b) Discrete compliance assessment will differ with monitoring frequency (see Hickey (2026)).

c) Aesthetic compliance assessment for mine-related effects based on continuous monitoring at plateaux compliance sites and calculated flow adjustment.⁵⁰ Weekly or monthly discrete sampling at SH67 to validate upstream monitoring adjustments. Annual compliance period for aesthetic assessment. (Indicative Compliance assessment for discrete monitoring sample numbers provided in Hickey (2026)).

d) Proposed limit for “Performance” assumed to be based on weekly or monthly discrete sampling (see Hickey (2026)). Key sites could be assessed based on continuous or discrete monitoring. Trend assessments for Performance sites may be based on annual or 6-yearly monitoring data depending on significance of site. Site MM1 is a Compliance assessment for this turbidity threshold (see Hickey (2026))

e) All measurements to exclude “extreme event” flood conditions. A proposed 1 in 10-year rainfall event is proposed as an extreme event (see Hickey (2026)).

f) Compliance assessment for ecological protection to be based on annual median and 95th percentile for site compared with background from upstream or reference site.

APPENDIX C MODELLED CATCHMENT AREAS

Table D1: WTP annual loads (Base Case).

	ACIDITY LOAD (TONNE)	TSS (TONNE)	AL LOAD (TONNE)	FE LOAD (TONNE)
2028	435	346	44	20
2029	751	598	76	33
2030	729	758	75	32
2031	1,453	1,127	150	66
2032	1,891	903	198	88
2033	2,412	1,217	250	111
2034	3,224	1,432	329	146
2035	3,971	1,551	399	178
2036	4,370	1,487	434	195
2037	4,685	917	462	210
2038	4,007	1,051	396	178
2039	3,485	943	345	155
2040	4,288	954	422	190
2041	4,394	1,005	432	195
2042	3,996	729	393	179
2043	3,333	722	328	149
2044	2,327	226	230	107
2045	1,636	201	162	75
2046	1,216	99	119	56
2047	1,013	99	99	47
2048	904	99	89	42
2049	813	99	80	38
2050	734	99	73	34
2051	678	99	67	31
2052	642	100	64	30
2053	609	100	61	28
2054	579	100	58	27
2055	552	100	55	26
2056	528	100	53	25
2057	514	100	51	24

Table D2: WTP annual loads (Scenario 1 – High Rainfall).

	ACIDITY LOAD (TONNE)	TSS (TONNE)	AL LOAD (TONNE)	FE LOAD (TONNE)
2028	486	492	50	22
2029	865	882	87	38
2030	901	1,336	92	39
2031	1,737	1,720	179	78
2032	2,256	1,196	237	105
2033	2,920	1,650	302	134
2034	3,778	1,864	386	172
2035	4,723	2,042	474	212
2036	5,415	2,214	537	242
2037	5,545	1,277	547	248
2038	4,843	1,450	478	216
2039	4,208	1,235	417	188
2040	5,159	1,330	508	229
2041	5,303	1,395	521	235
2042	4,832	1,018	475	216
2043	4,029	1,026	397	180
2044	2,839	313	280	130
2045	1,978	262	196	91
2046	1,469	124	144	67
2047	1,223	124	120	56
2048	1,092	125	107	50
2049	982	125	97	45
2050	887	125	88	41
2051	819	125	81	38
2052	776	125	77	36
2053	735	125	73	34
2054	699	125	69	33
2055	666	125	66	31
2056	636	126	63	30
2057	619	126	62	29

Table D3: WTP annual loads (Scenario 2 – Stochastic Rainfall)

	ACIDITY LOAD (TONNE)	TSS (TONNE)	AL LOAD (TONNE)	FE LOAD (TONNE)
2028	416	265	43	19
2029	742	435	75	33
2030	853	650	87	37
2031	1,505	865	155	68
2032	1,870	685	196	87
2033	2,400	513	248	111
2034	2,936	723	300	133
2035	4,254	1,213	427	191
2036	4,914	1,074	488	219
2037	4,774	601	471	214
2038	4,218	705	417	188
2039	4,244	964	420	188
2040	4,814	643	474	214
2041	4,450	856	437	198
2042	3,638	423	358	163
2043	2,528	486	249	113
2044	2,102	174	208	96
2045	1,647	153	164	76
2046	1,328	96	130	61
2047	1,021	98	100	47
2048	993	89	98	46
2049	793	91	78	37
2050	737	87	73	34
2051	614	79	61	29
2052	635	89	63	30
2053	634	88	63	30
2054	588	97	59	28
2055	614	94	61	29
2056	536	88	53	25
2057	602	102	60	28

Table D4: WTP annual loads (Scenario 3 - +30% seepage source term)

	ACIDITY LOAD (TONNE)	TSS (TONNE)	AL LOAD (TONNE)	FE LOAD (TONNE)
2028	540	346	55	25
2029	934	598	94	41
2030	903	758	92	40
2031	1,829	1,127	189	84
2032	2,401	903	252	113
2033	3,072	1,217	318	143
2034	4,116	1,432	420	189
2035	5,080	1,551	510	229
2036	5,606	1,487	556	252
2037	6,033	917	595	271
2038	5,141	1,051	508	230
2039	4,472	943	443	200
2040	5,514	954	542	246
2041	5,654	1,005	555	252
2042	5,143	729	505	231
2043	4,289	722	422	193
2044	3,021	226	298	138
2045	2,124	201	210	97
2046	1,585	99	155	72
2047	1,321	99	129	60
2048	1,179	99	116	54
2049	1,061	99	104	49
2050	959	99	94	44
2051	886	99	87	41
2052	840	100	83	39
2053	796	100	79	37
2054	758	100	75	35
2055	722	100	72	33
2056	691	100	68	32
2057	672	100	67	31

Table D5: WTP annual loads (Scenario 4 - -30% seepage source term)

	ACIDITY LOAD (TONNE)	TSS (TONNE)	AL LOAD (TONNE)	FE LOAD (TONNE)
2028	330	346	34	15
2029	567	598	57	25
2030	554	758	57	24
2031	1,078	1,127	111	48
2032	1,382	903	145	63
2033	1,751	1,217	181	79
2034	2,333	1,432	238	104
2035	2,863	1,551	288	126
2036	3,134	1,487	312	138
2037	3,338	917	330	148
2038	2,873	1,051	284	126
2039	2,498	943	248	110
2040	3,062	954	302	135
2041	3,135	1,005	309	138
2042	2,849	729	281	127
2043	2,377	722	235	106
2044	1,633	226	162	75
2045	1,149	201	115	53
2046	847	99	83	39
2047	705	99	70	33
2048	628	99	62	29
2049	564	99	56	26
2050	509	99	51	24
2051	470	99	47	22
2052	445	100	45	21
2053	421	100	42	20
2054	401	100	40	19
2055	382	100	39	18
2056	365	100	37	17
2057	355	100	36	17

APPENDIX D WATER QUALITY RESULTS

1. STATION KEL

Overview & Trends

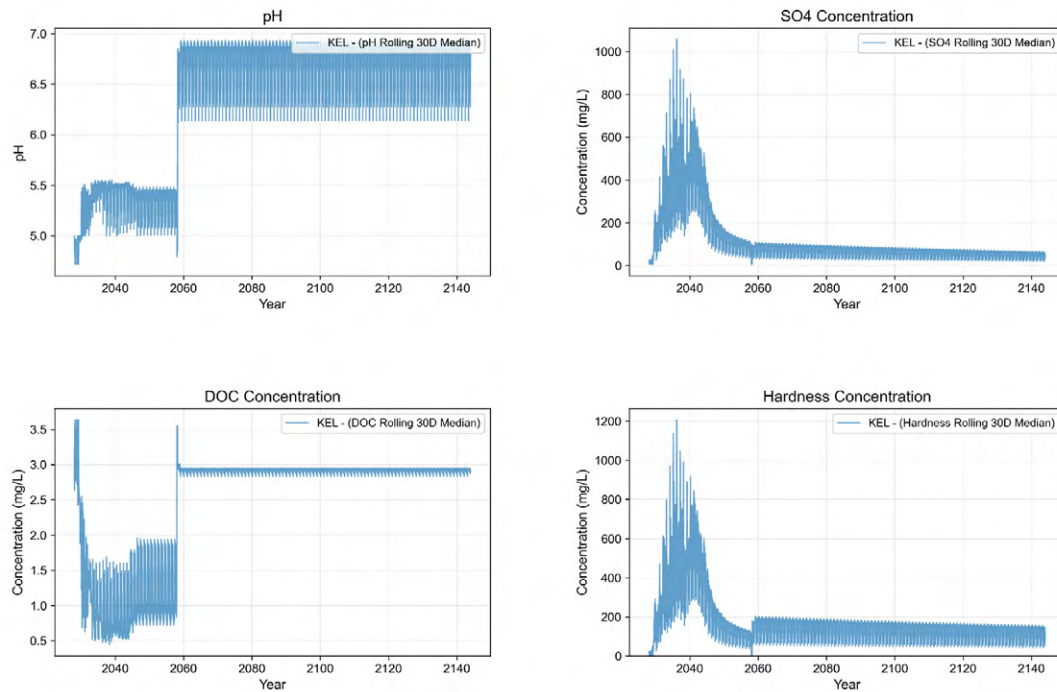


Figure 1: KEL - Base Case - 30 day rolling median (pH, SO₄, DOC, Hardness)

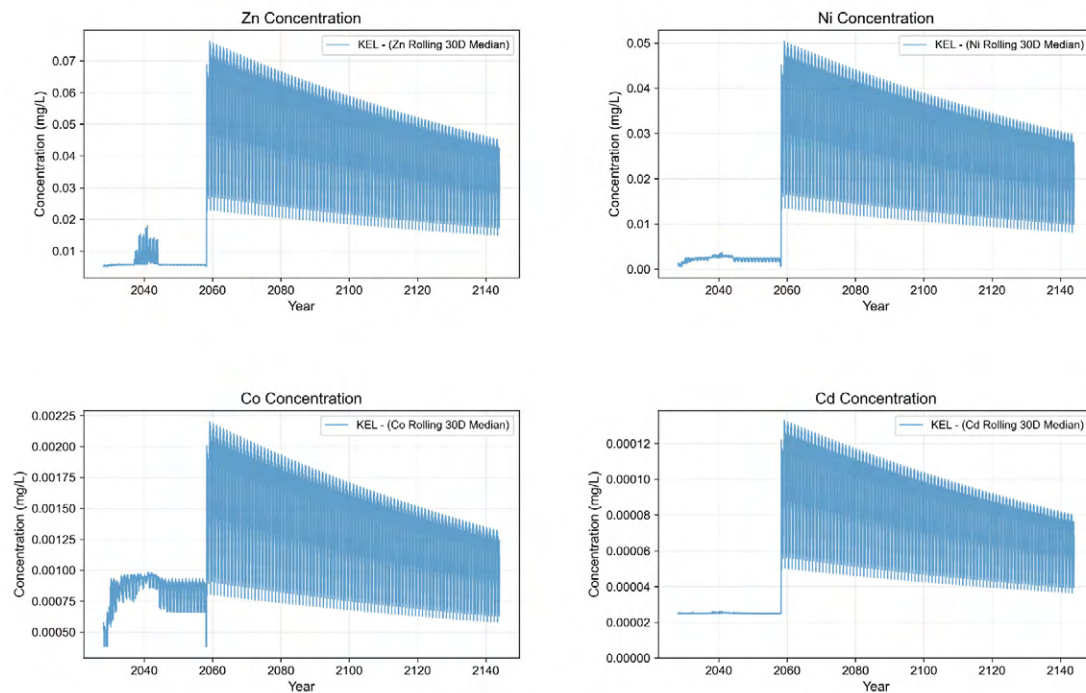


Figure 2: KEL - Base Case - 30 day rolling median (Zn, Ni, Co, Cd)

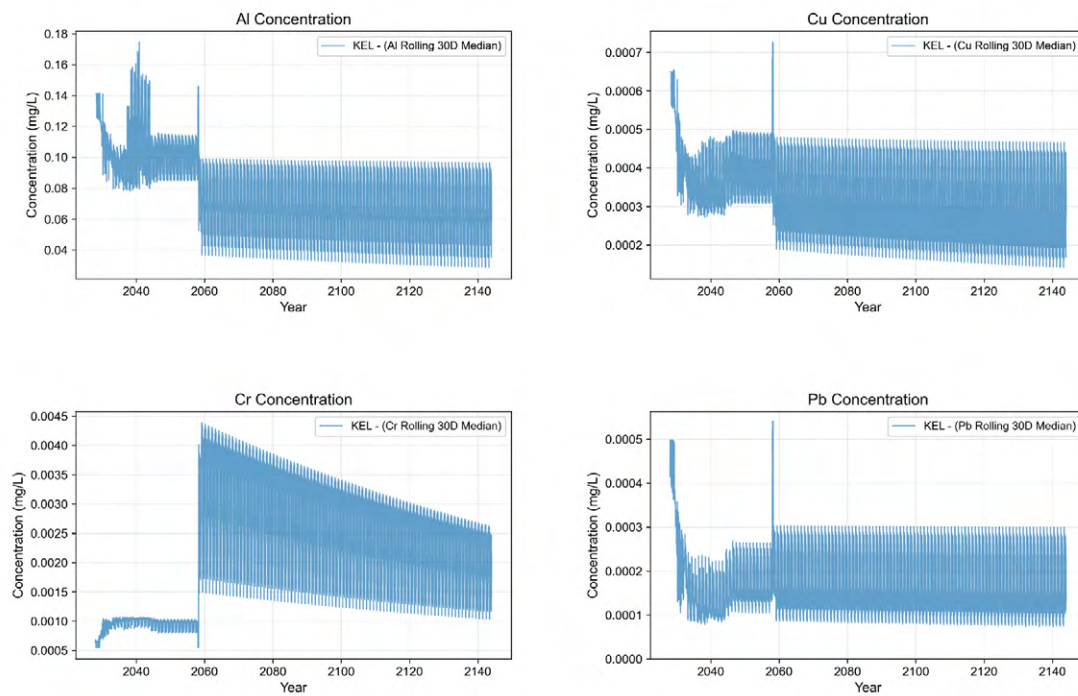


Figure 3: KEL - Base Case - 30 day rolling median (Al, Cu, Cr, Pb)

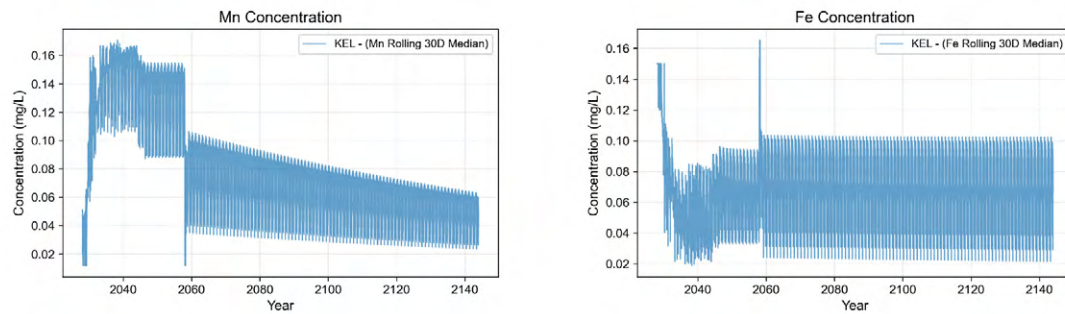


Figure 4: KEL - Base Case - 30 day rolling median (Mn, Fe)

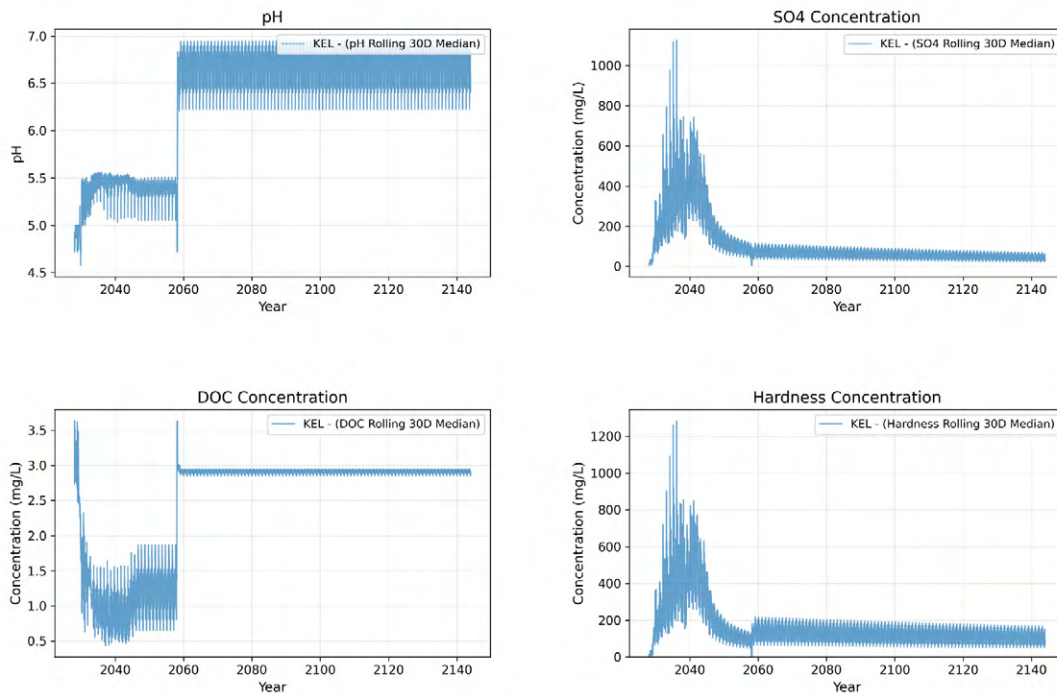


Figure 5: KEL - S1 (High Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

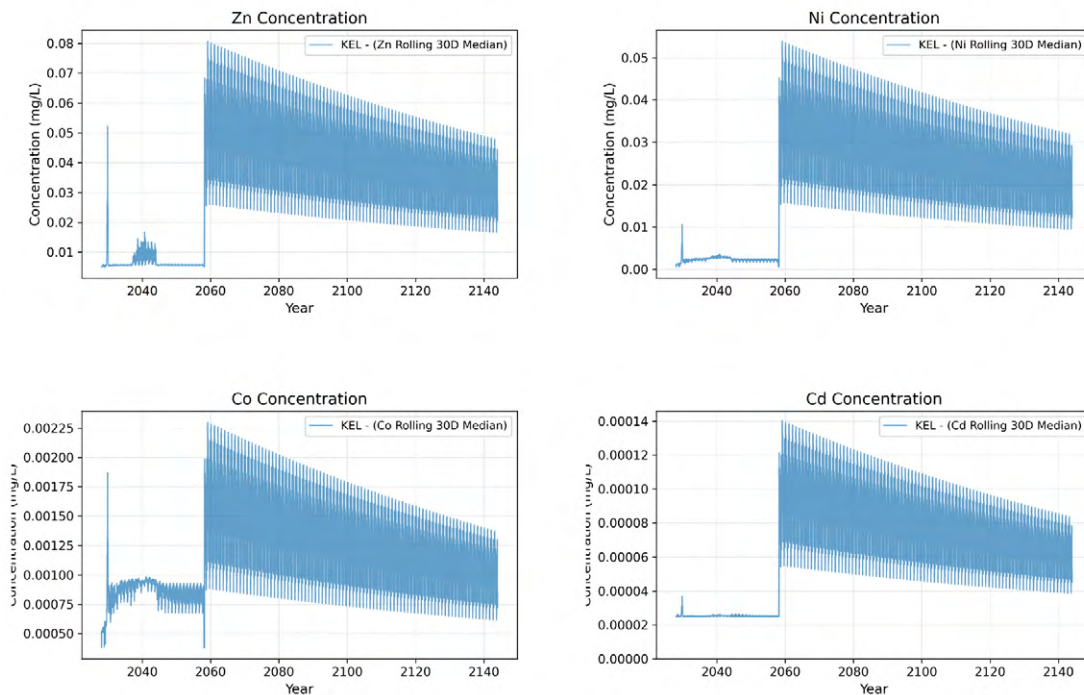


Figure 6: KEL - S1 (High Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

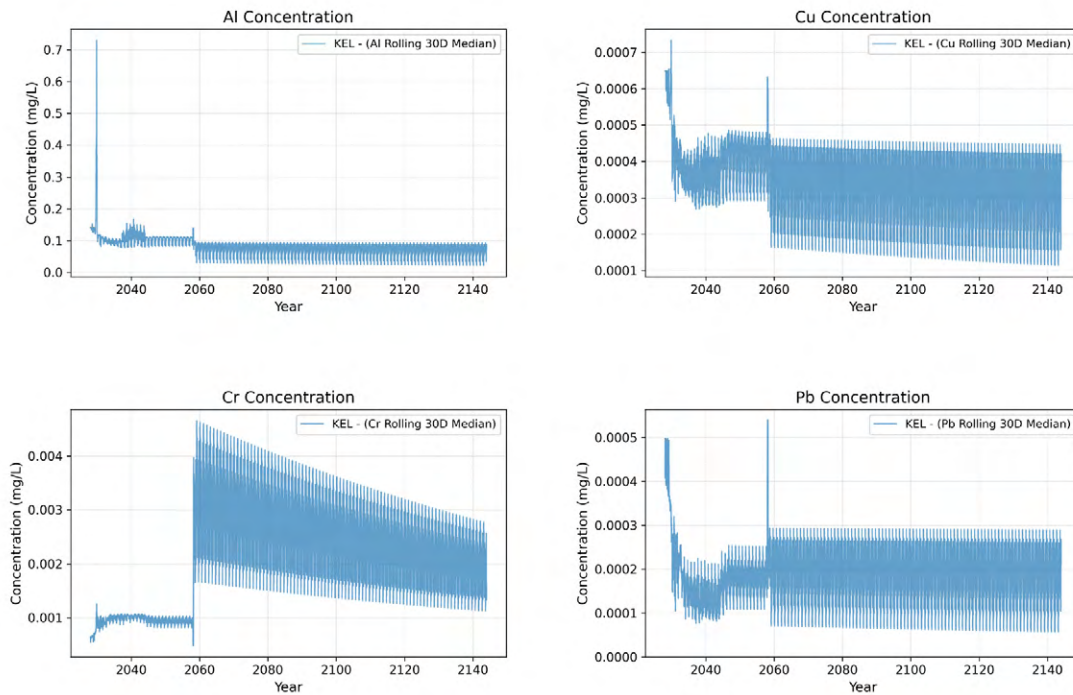


Figure 7: KEL - S1 (High Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

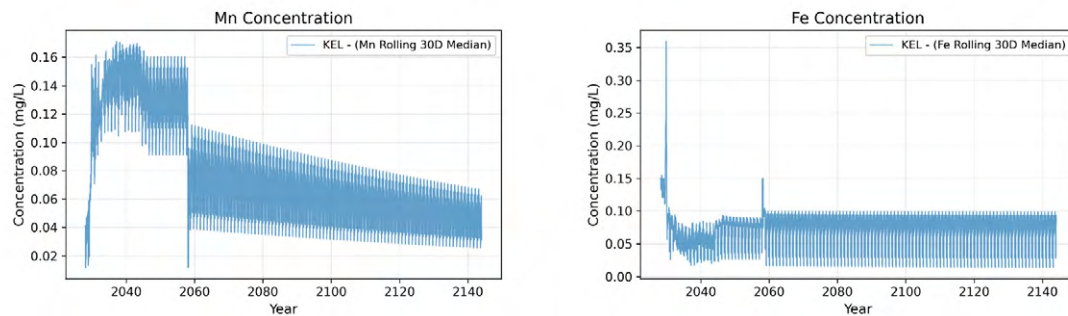


Figure 8: KEL - S1 (High Rainfall) - 30 day rolling median (Mn, Fe)

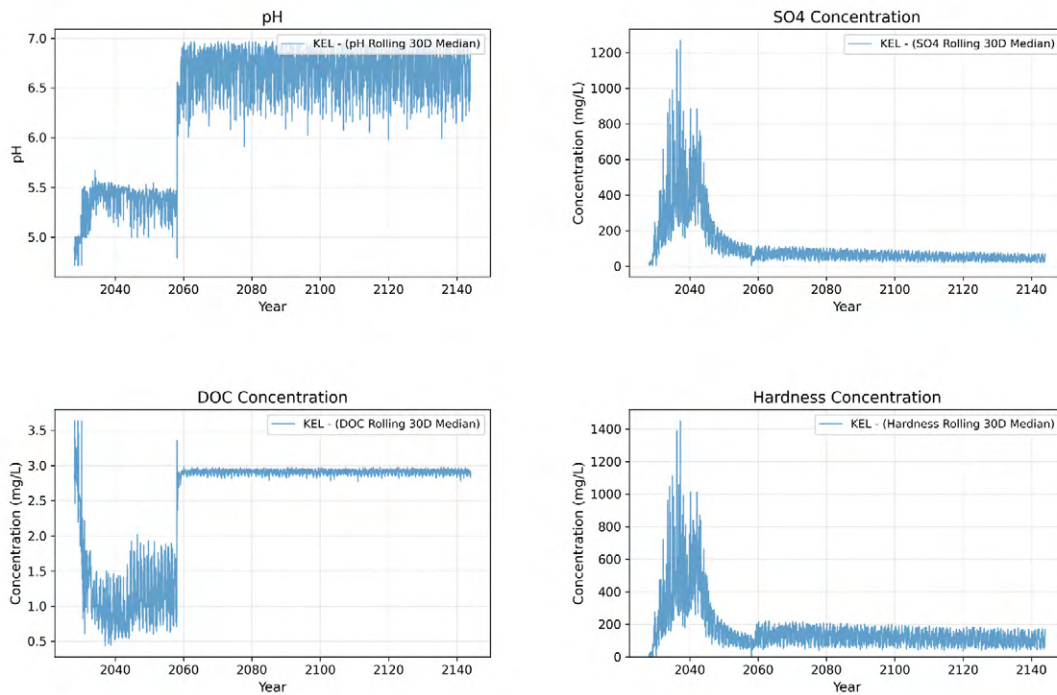


Figure 9: KEL - S2 (Stochastic Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

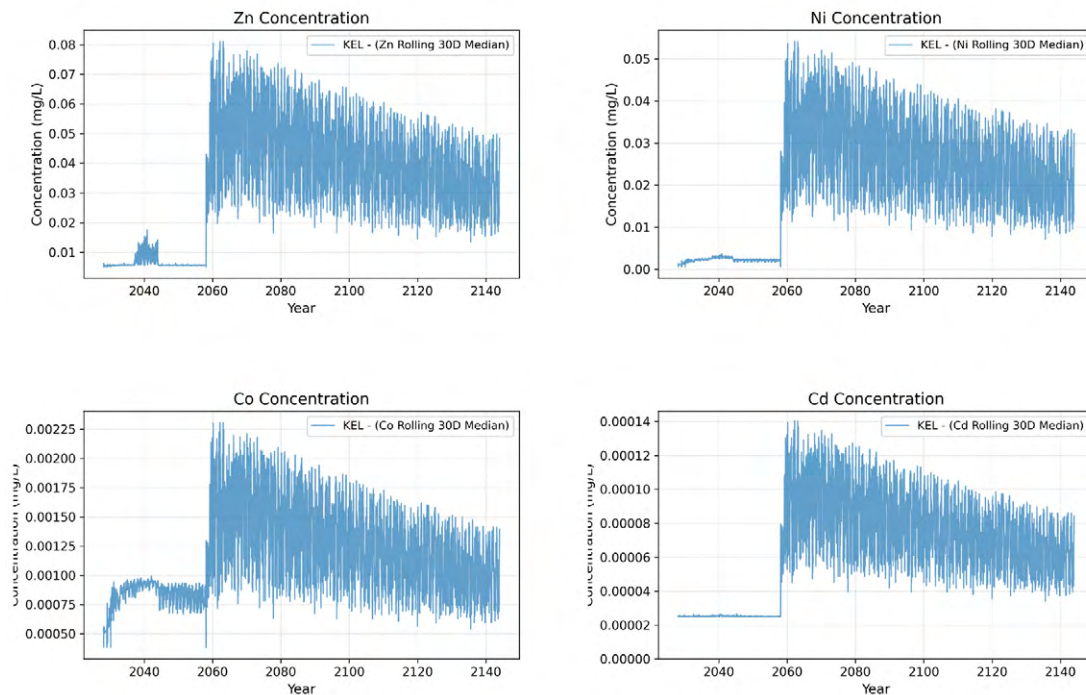


Figure 10: KEL - S2 (Stochastic Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

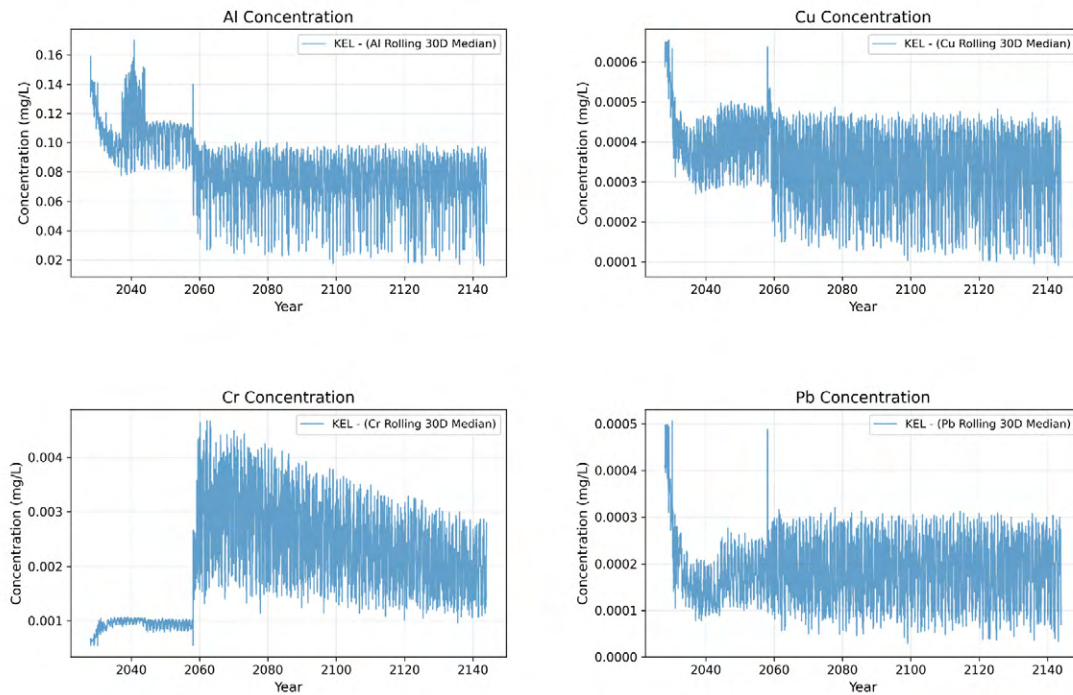


Figure 11: KEL - S2 (Stochastic Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

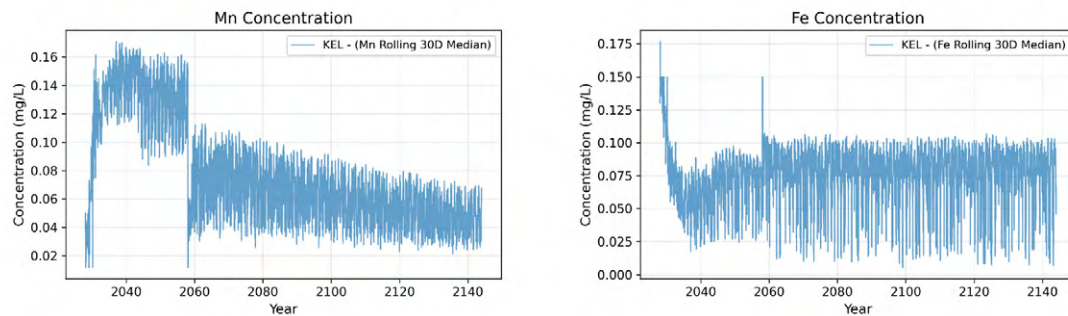


Figure 12: KEL - S2 (Stochastic Rainfall) - 30 day rolling median (Mn, Fe)

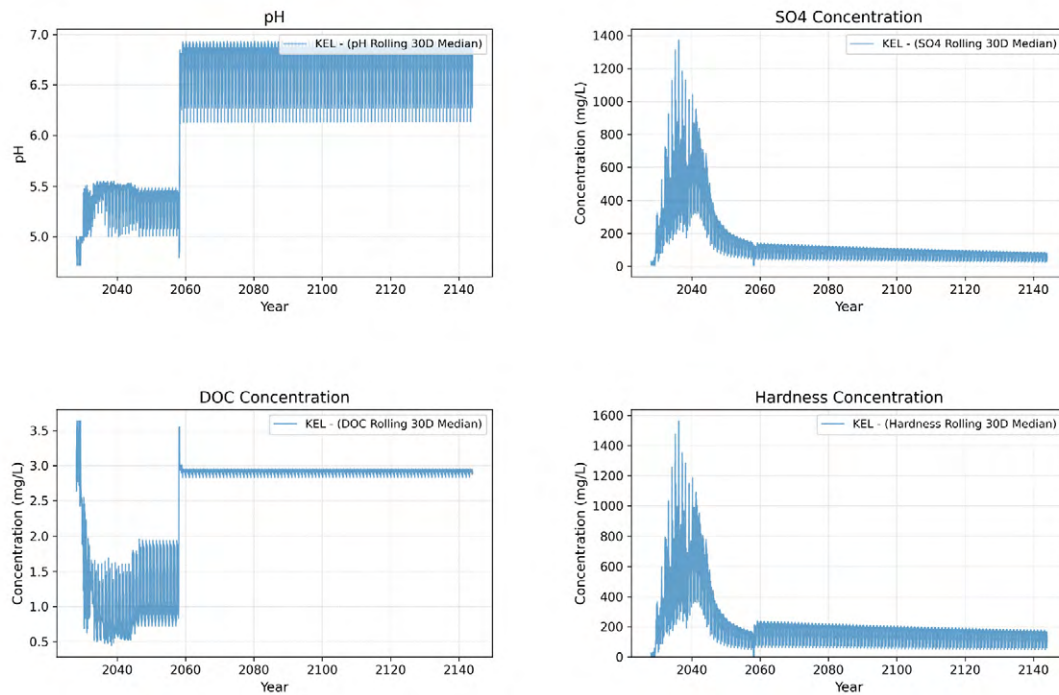


Figure 13: KEL - S3 (ELF ST +30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

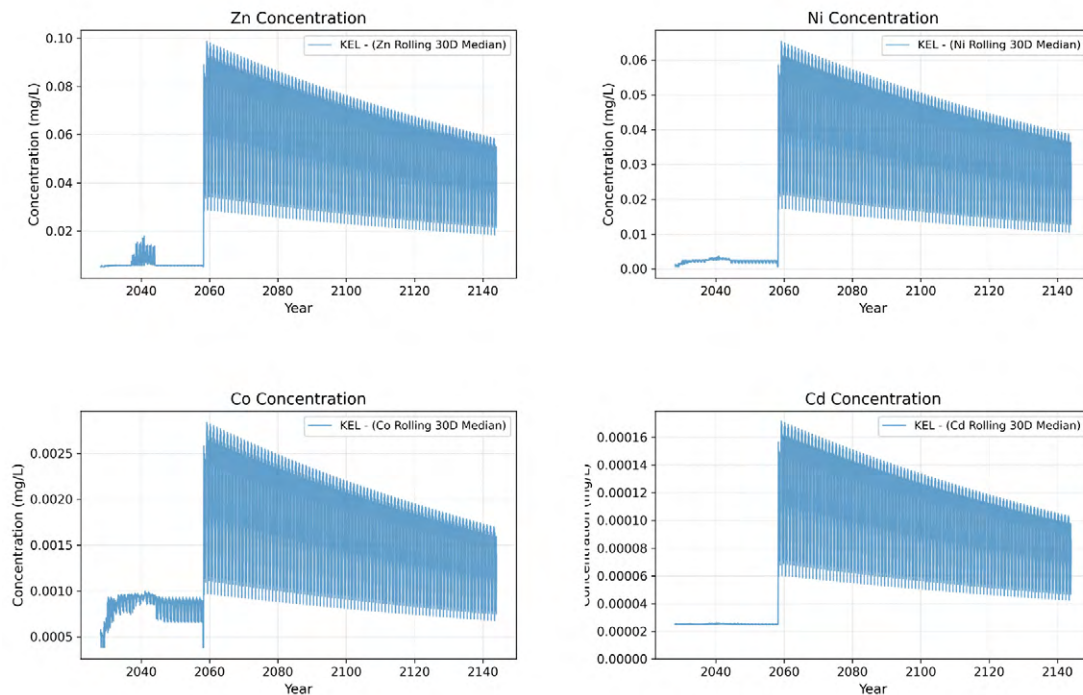


Figure 14: KEL - S3 (ELF ST +30%) - 30 day rolling median (Zn, Ni, Co, Cd)

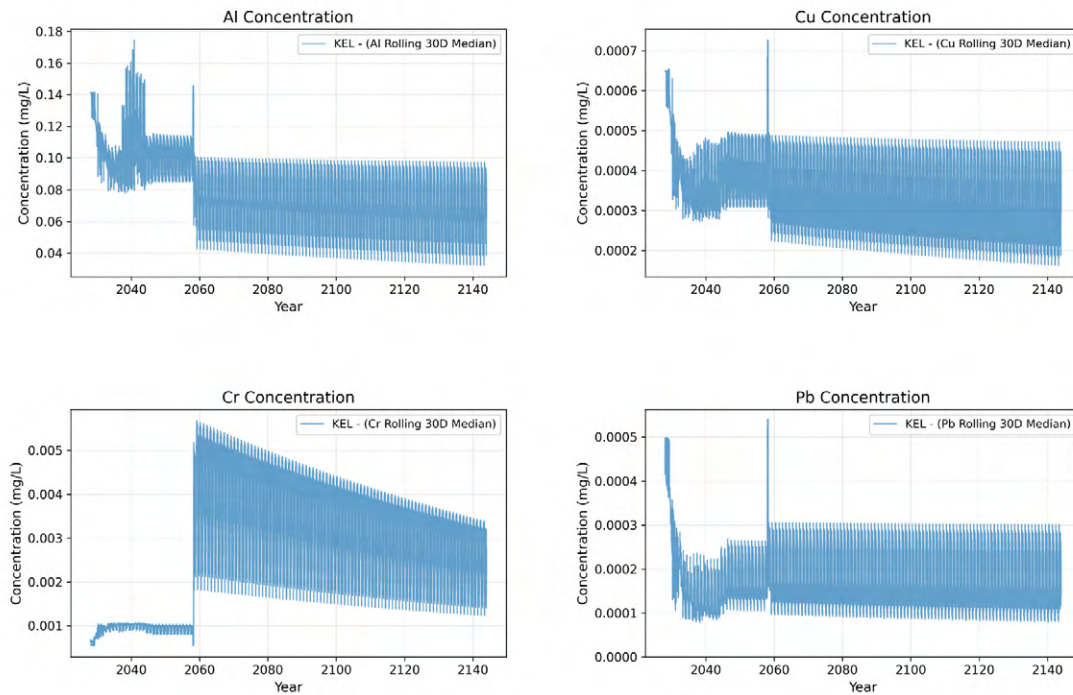


Figure 15: KEL - S3 (ELF ST +30%) - 30 day rolling median (Al, Cu, Cr, Pb)

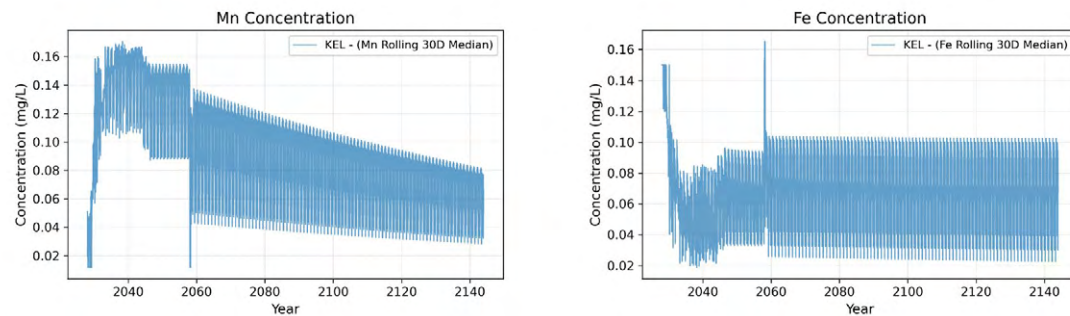


Figure 16: KEL - S3 (ELF ST +30%) - 30 day rolling median (Mn, Fe)

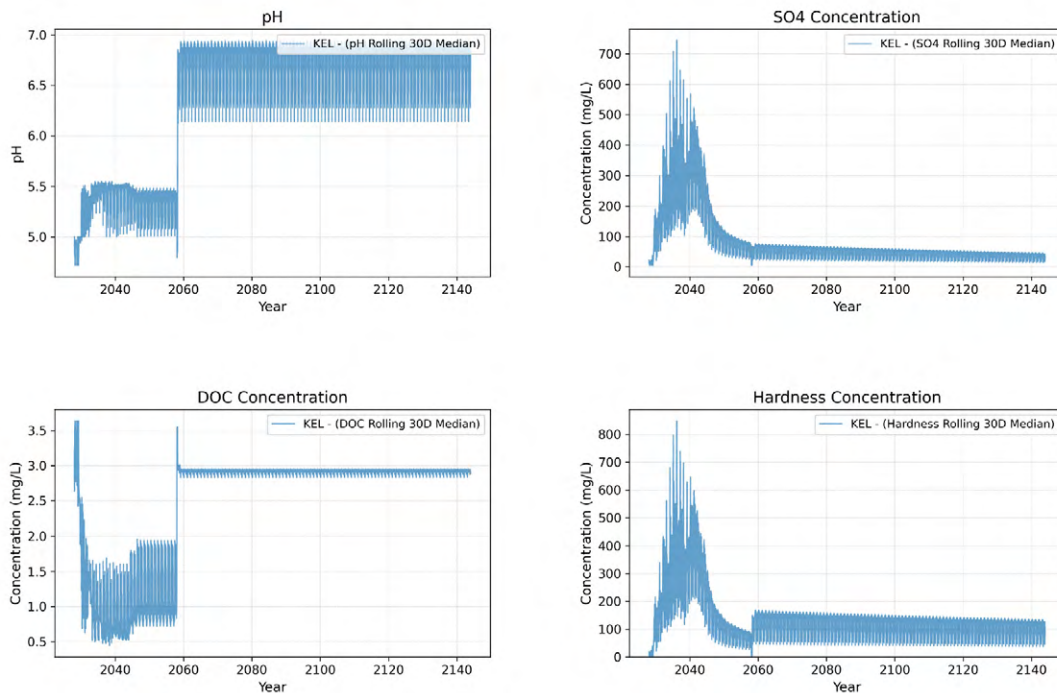


Figure 17: KEL - S4 (ELF ST -30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

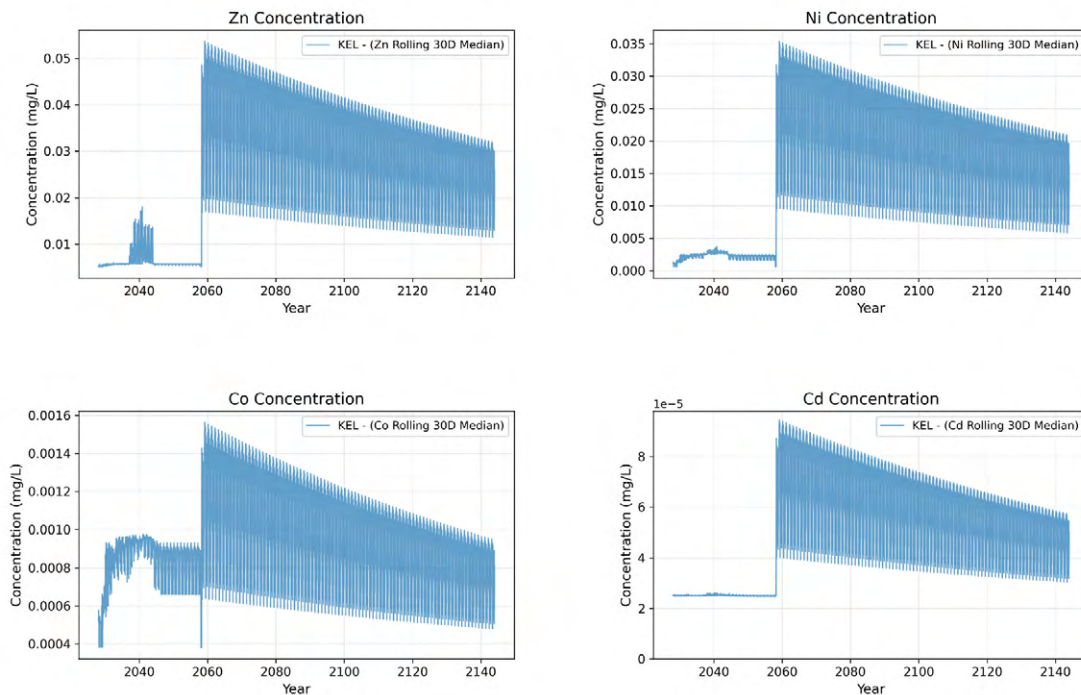


Figure 18: KEL - S4 (ELF ST -30%) - 30 day rolling median (Zn, Ni, Co, Cd)

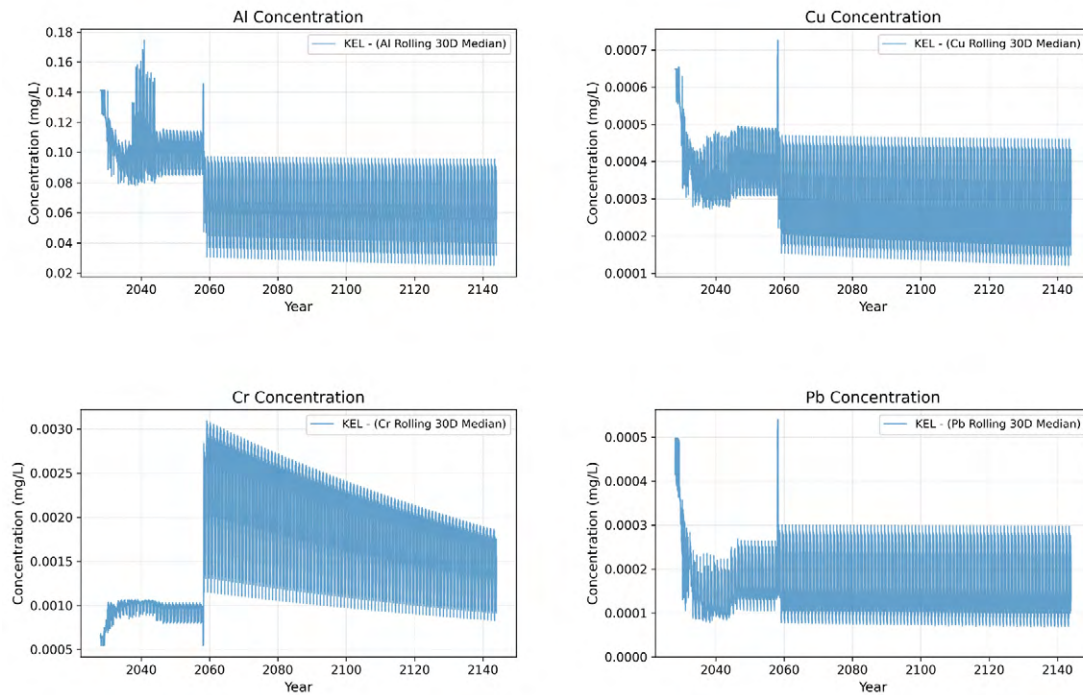


Figure 19: KEL - S4 (ELF ST -30%) - 30 day rolling median (Al, Cu, Cr, Pb)

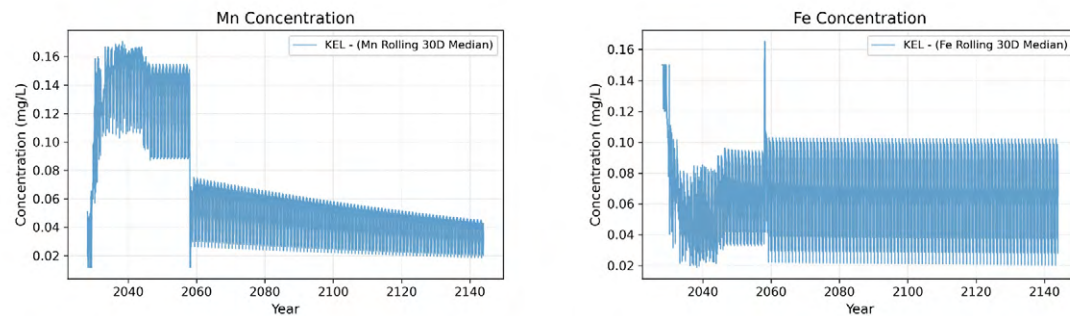
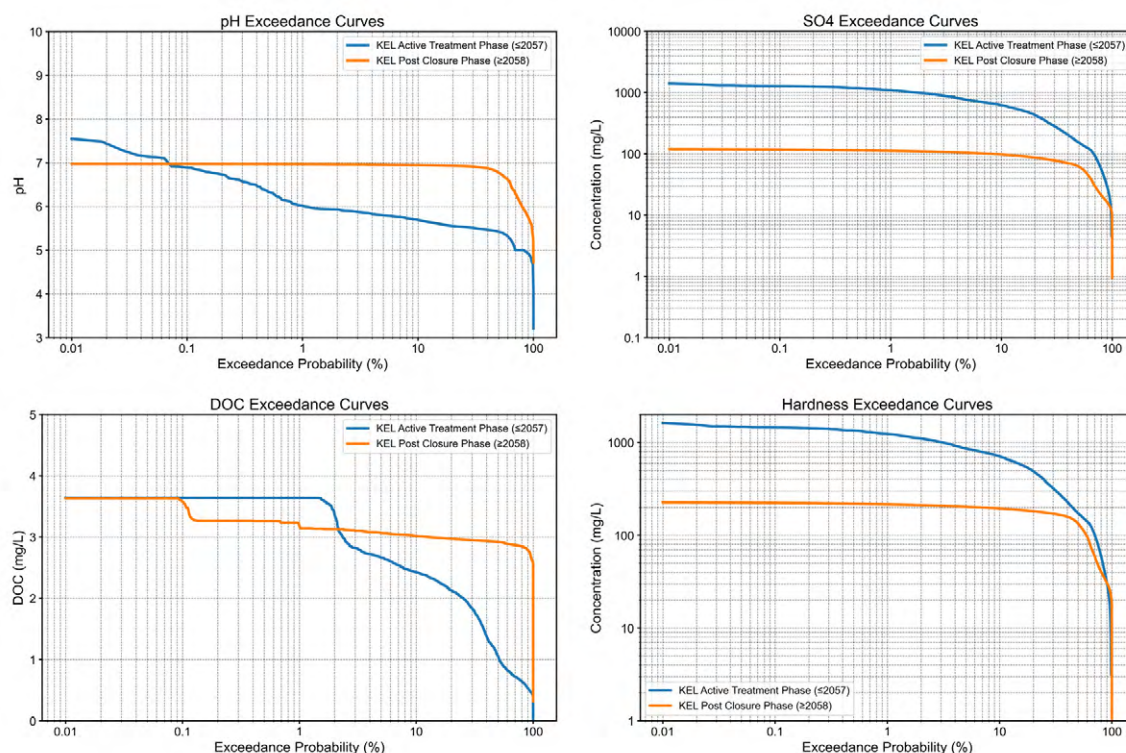
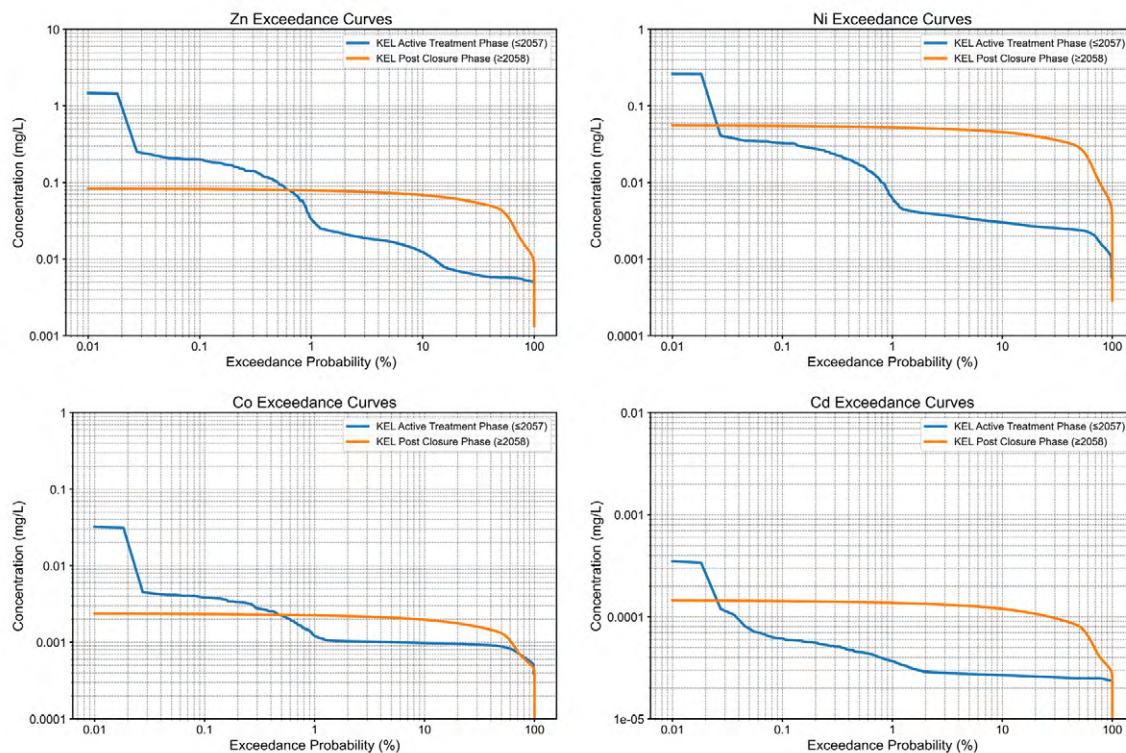


Figure 20: KEL - S4 (ELF ST -30%) - 30 day rolling median (Mn, Fe)

Probability Exceedance**Figure 21: KEL - Base Case - Exceedance probability plots (pH, SO4, DOC, Hardness)****Figure 22: KEL - Base Case - Exceedance probability plots (Zn, Ni, Co, Cd)**

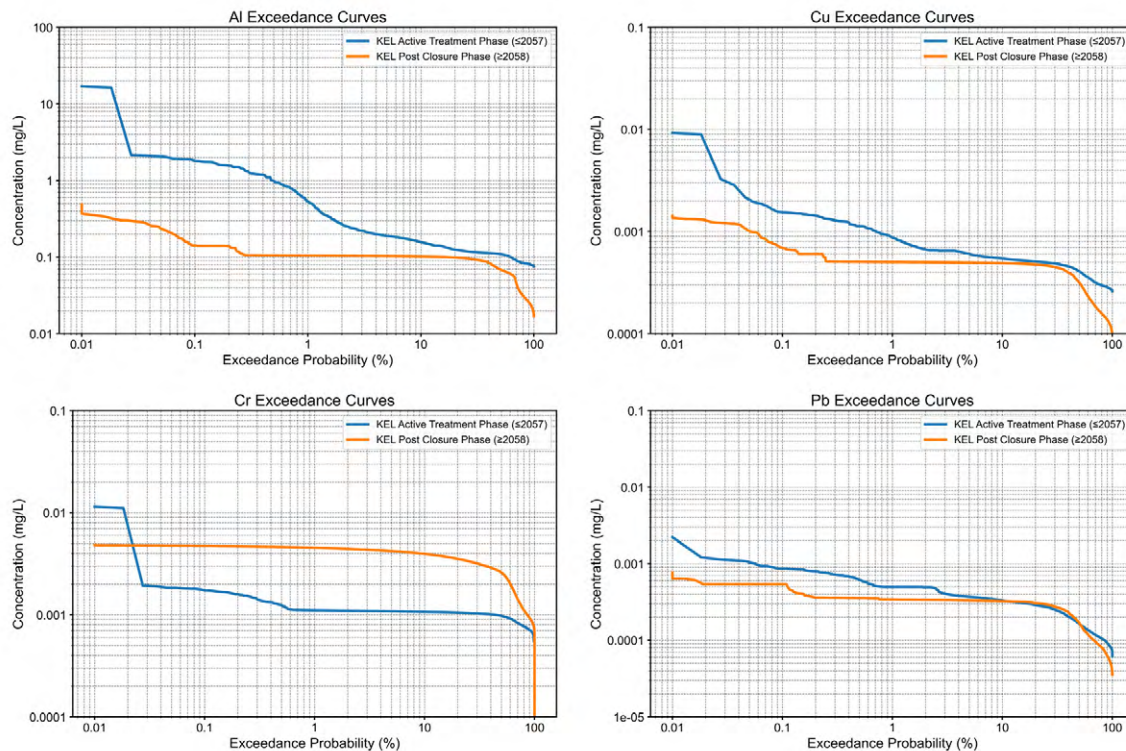


Figure 23: KEL - Base Case - Exceedance probability plots (Al, Cu, Cr, Pb)

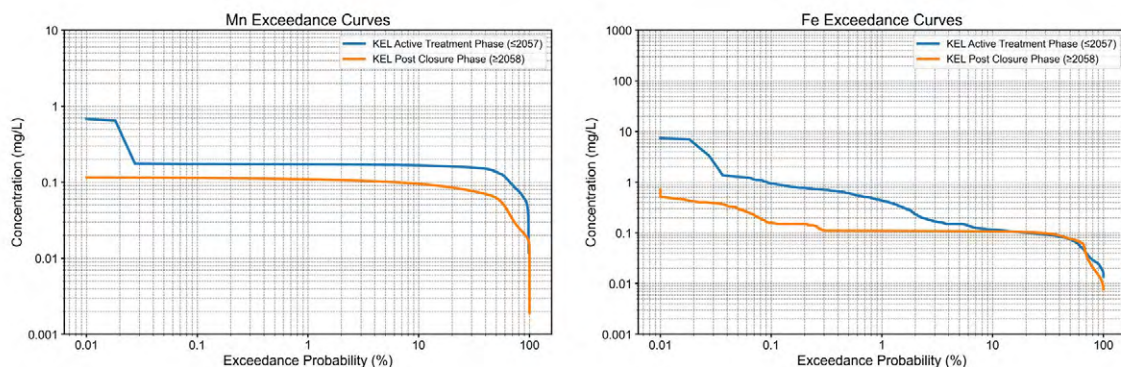
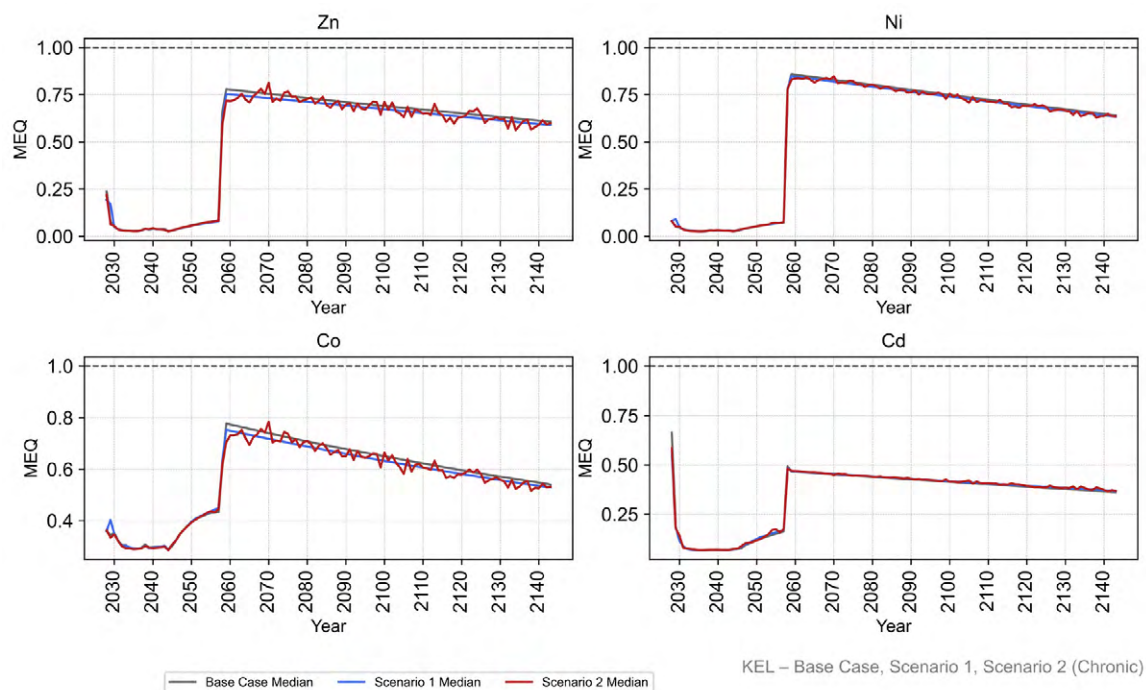
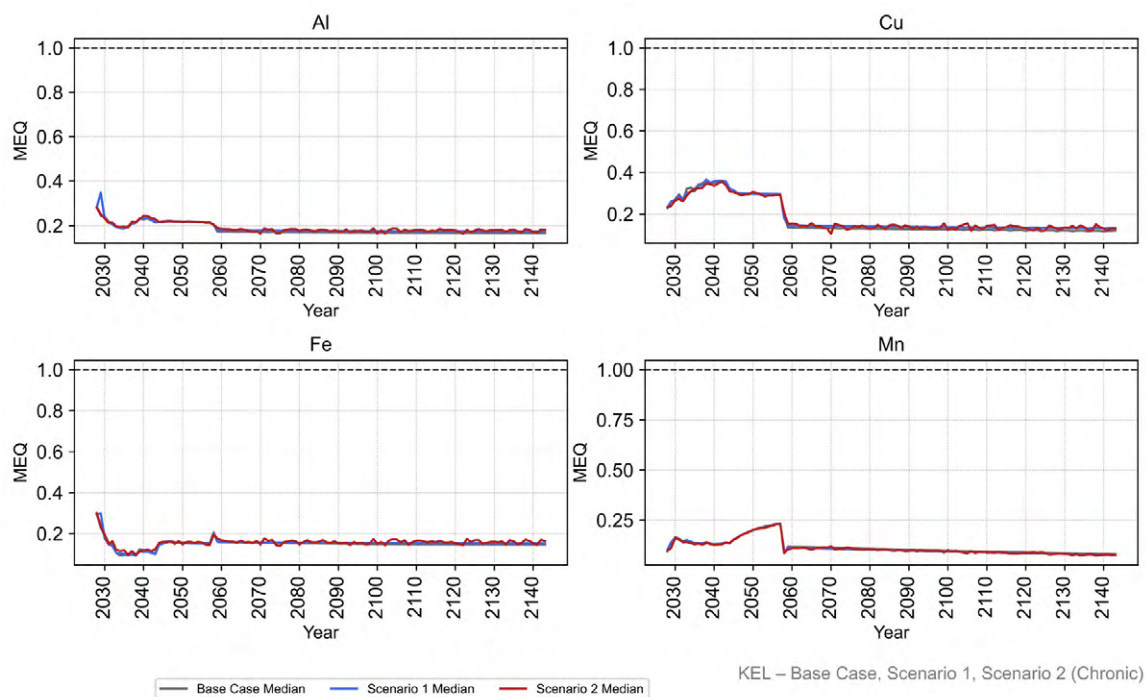


Figure 24: KEL - Base Case - Exceedance probability plots (Mn, Fe)

Compliance & WQ Standards**Figure 25:** KEL - Rainfall Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)**Figure 26:** KEL - Rainfall Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

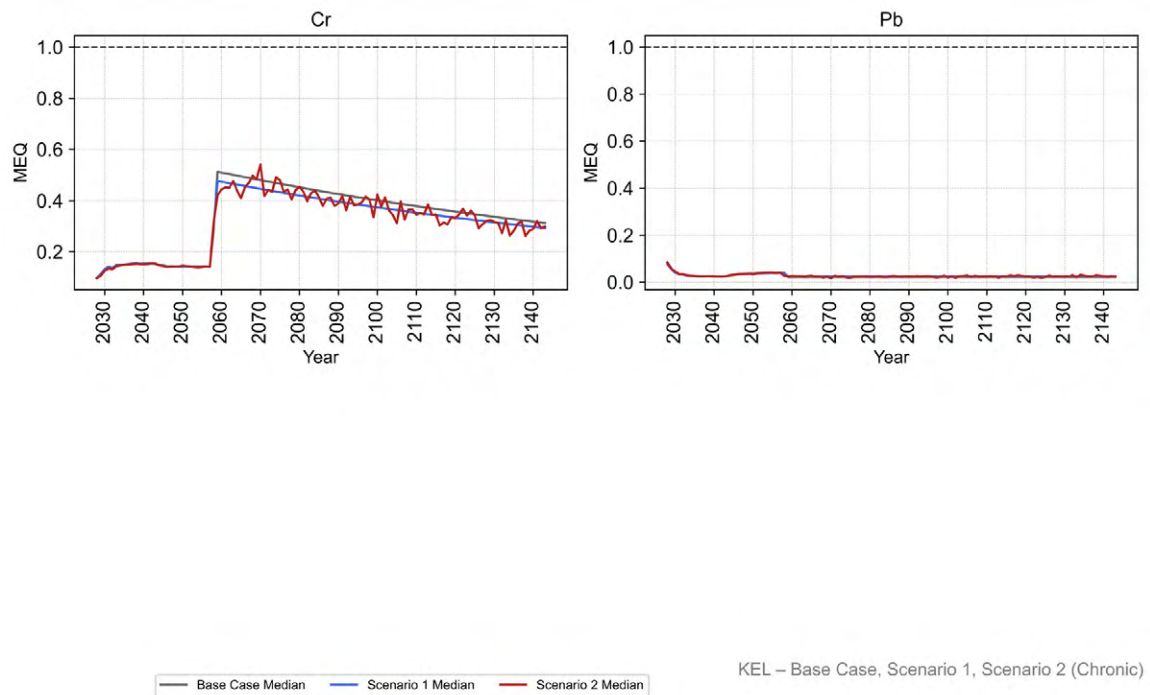


Figure 27: KEL - Rainfall Scenarios - Chronic criteria compliance (Cr, Pb)

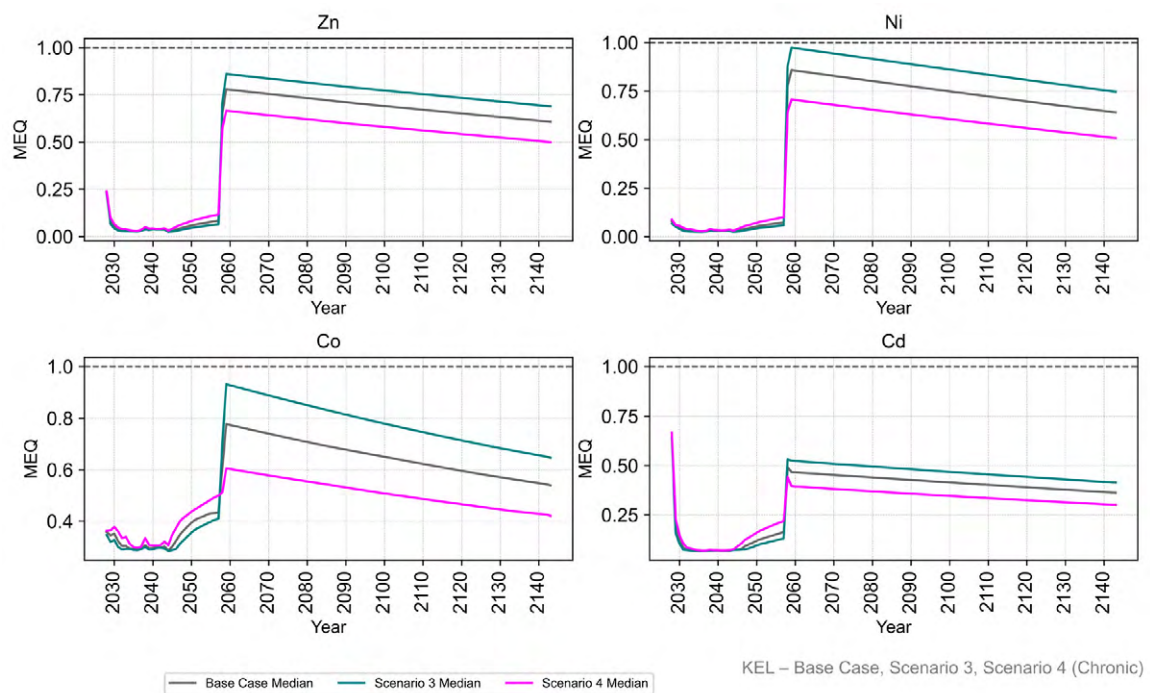


Figure 28: KEL - Source Term Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)

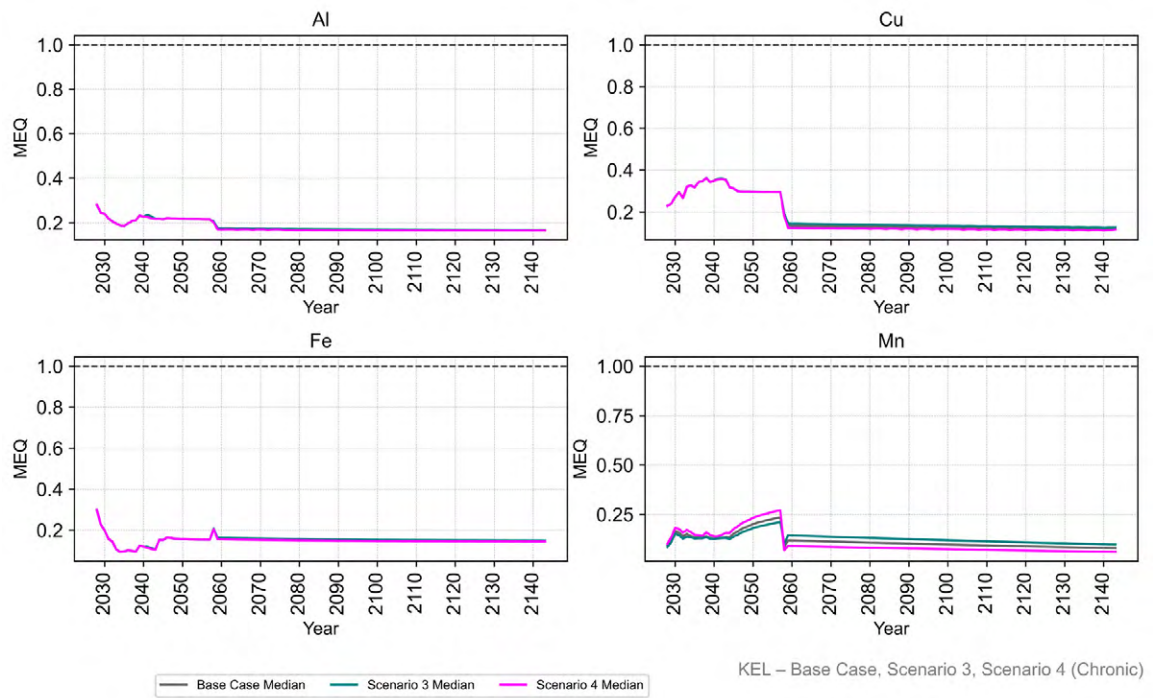


Figure 29: KEL - Source Term Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

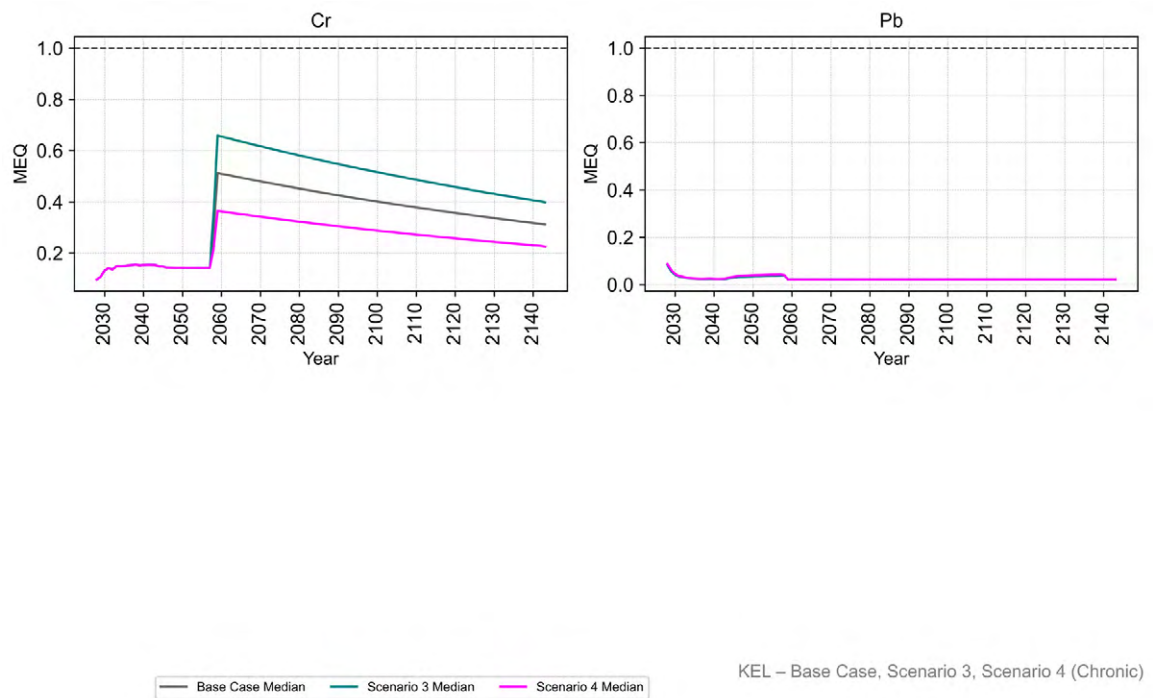


Figure 30: KEL - Source Term Scenarios - Chronic criteria compliance (Cr, Pb)

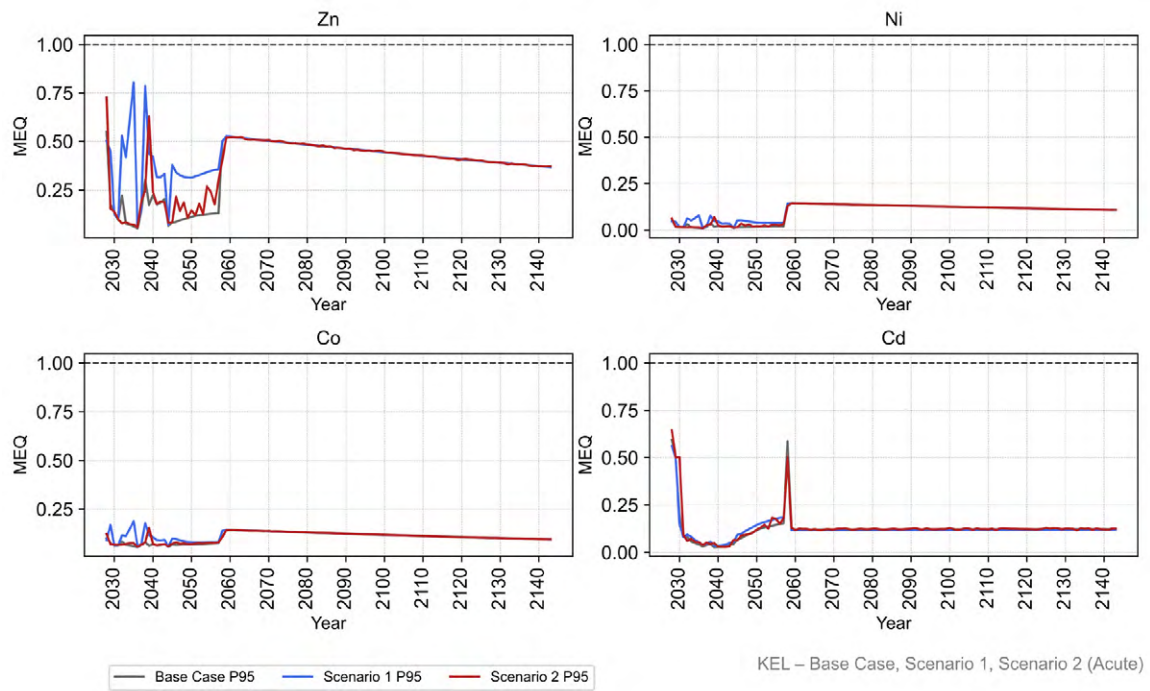


Figure 31: KEL - Rainfall Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

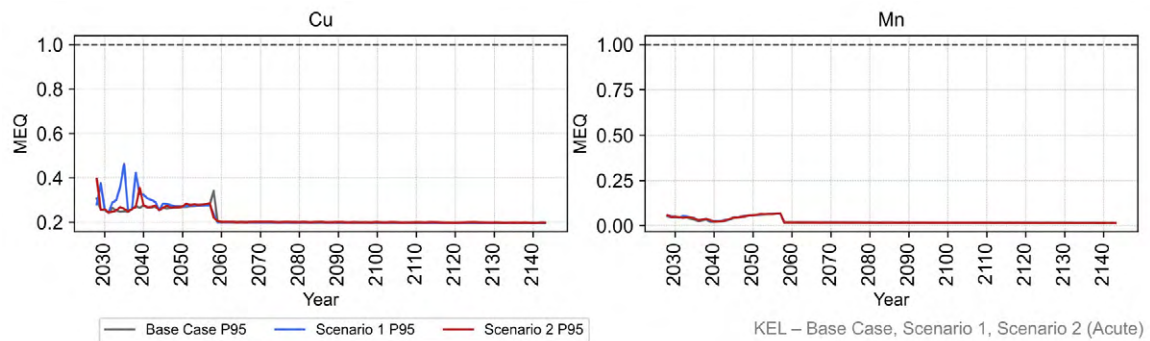


Figure 32: KEL - Rainfall Scenarios - Acute criteria compliance (Cu, Mn)

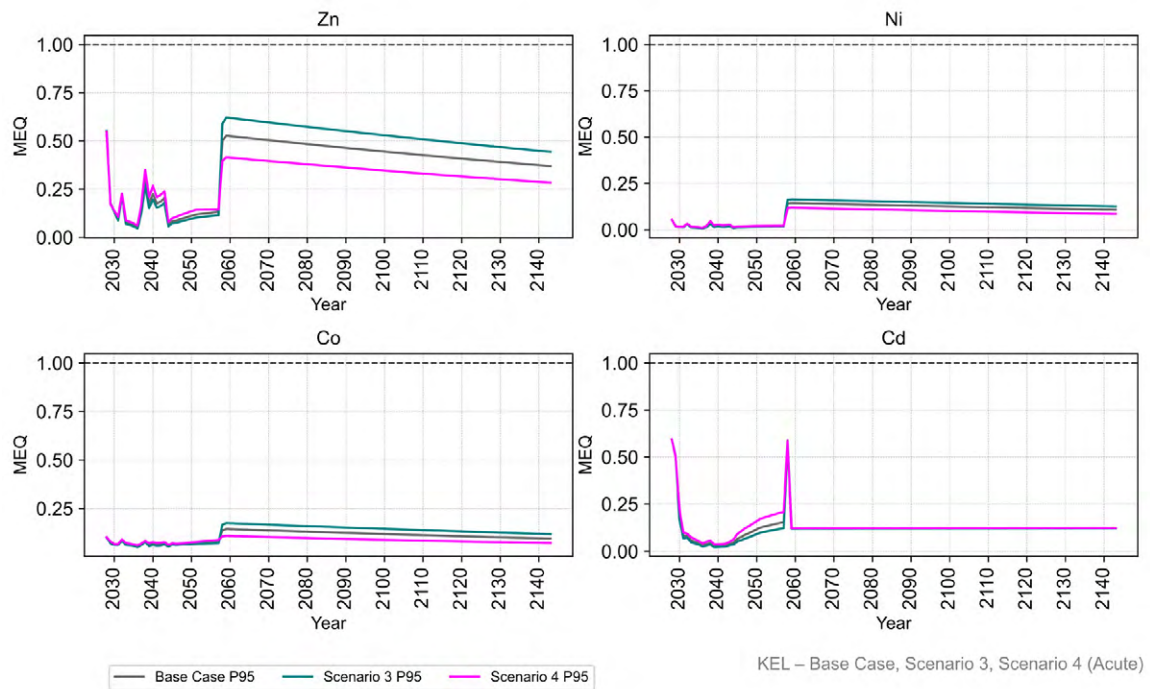


Figure 33: KEL - Source Term Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

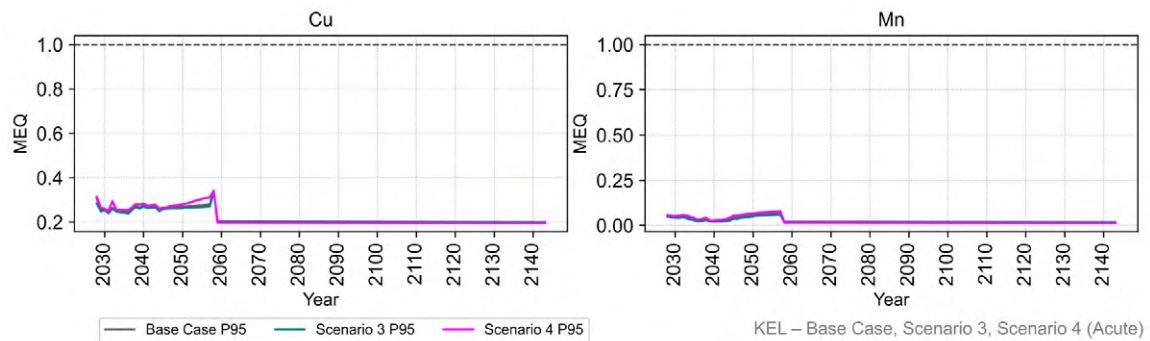


Figure 34: KEL - Source Term Scenarios - Acute criteria compliance (Cu, Mn)

Exceedance Frequencies

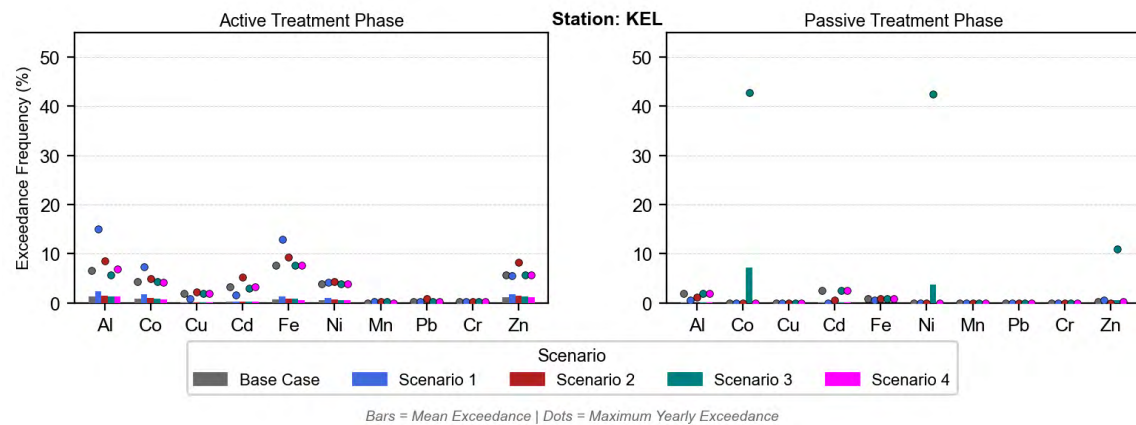


Figure 35: KEL - Chronic exceedance frequencies

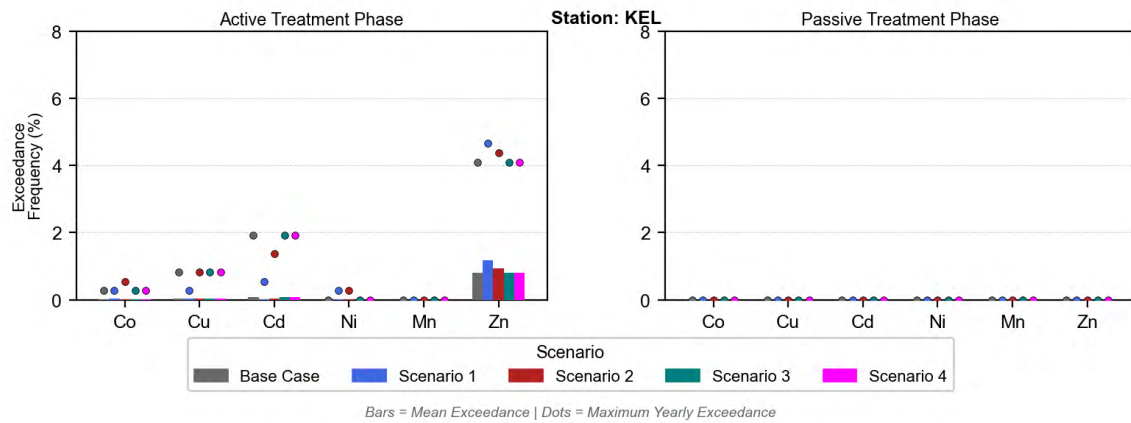


Figure 36: KEL - Acute exceedance frequencies

2. STATION V62

Overview & Trends

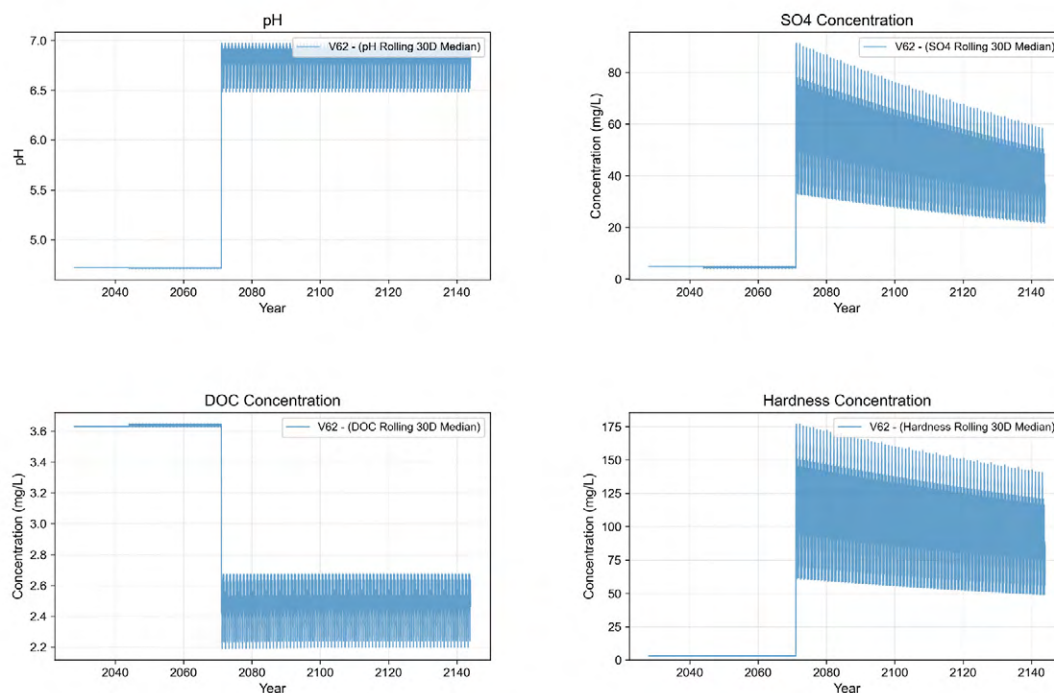


Figure 37: V62 - Base Case - 30 day rolling median (pH, SO4, DOC, Hardness)

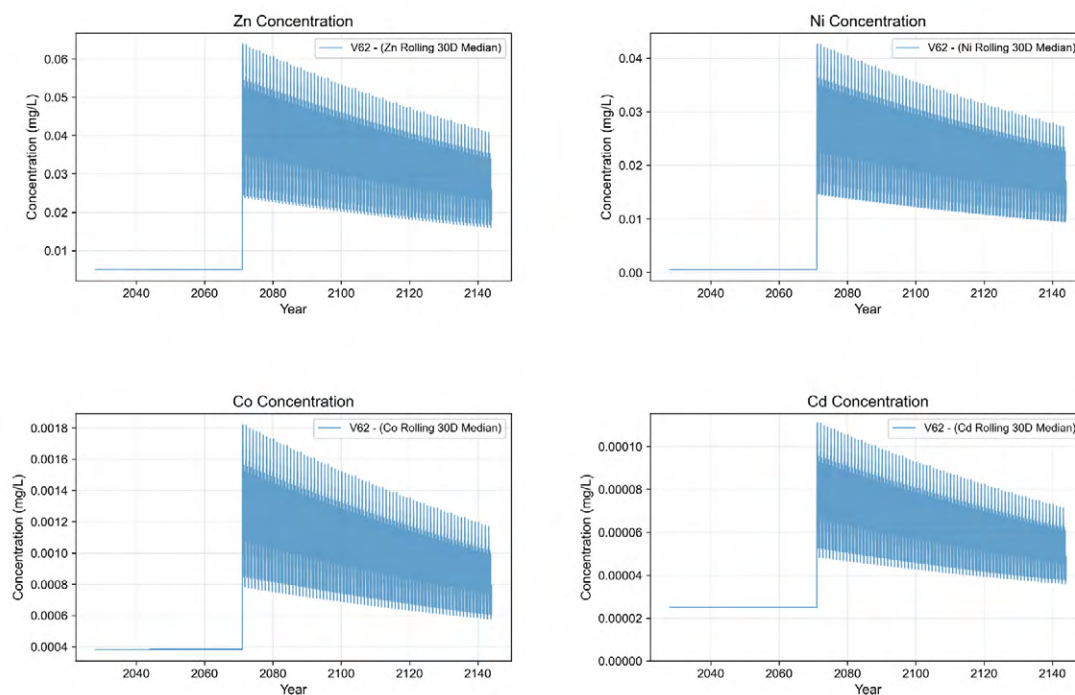


Figure 38: V62 - Base Case - 30 day rolling median (Zn, Ni, Co, Cd)

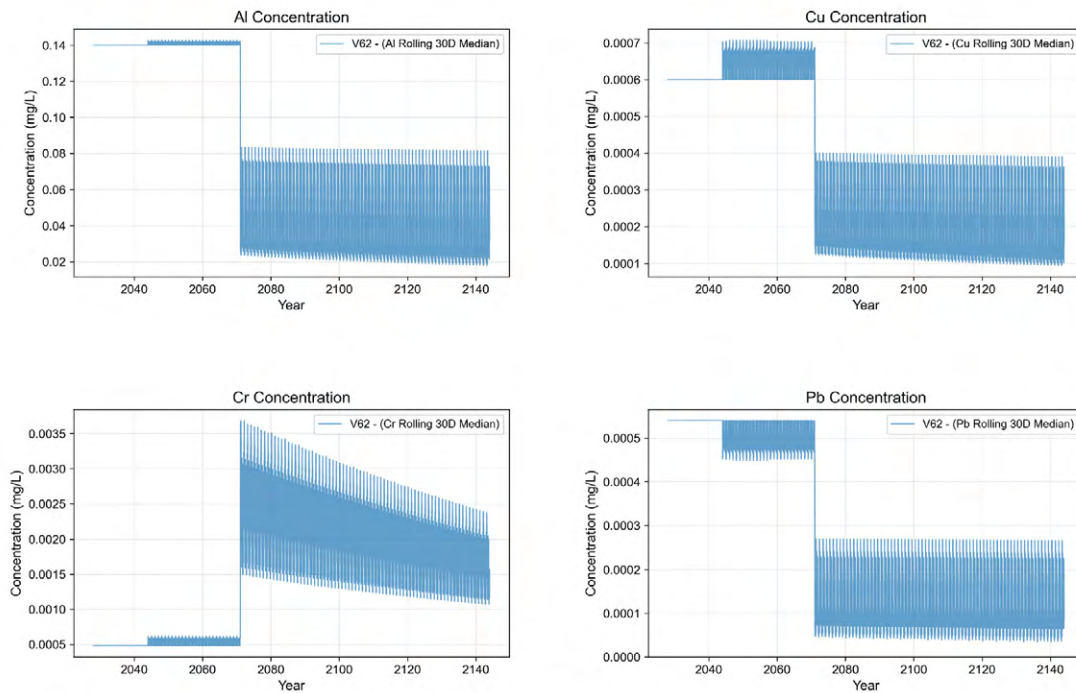


Figure 39: V62 - Base Case - 30 day rolling median (Al, Cu, Cr, Pb)

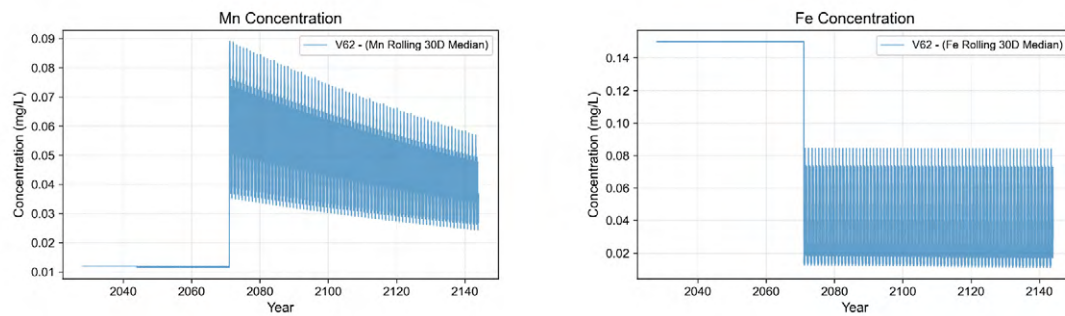


Figure 40: V62 - Base Case - 30 day rolling median (Mn, Fe)

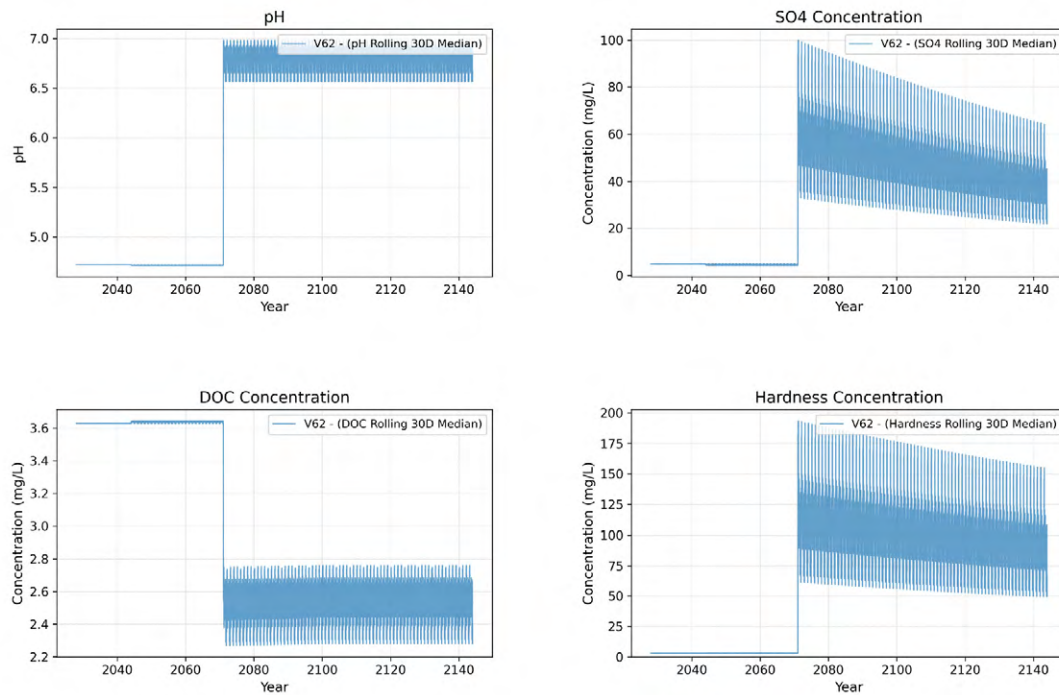


Figure 41: V62 - S1 (High Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

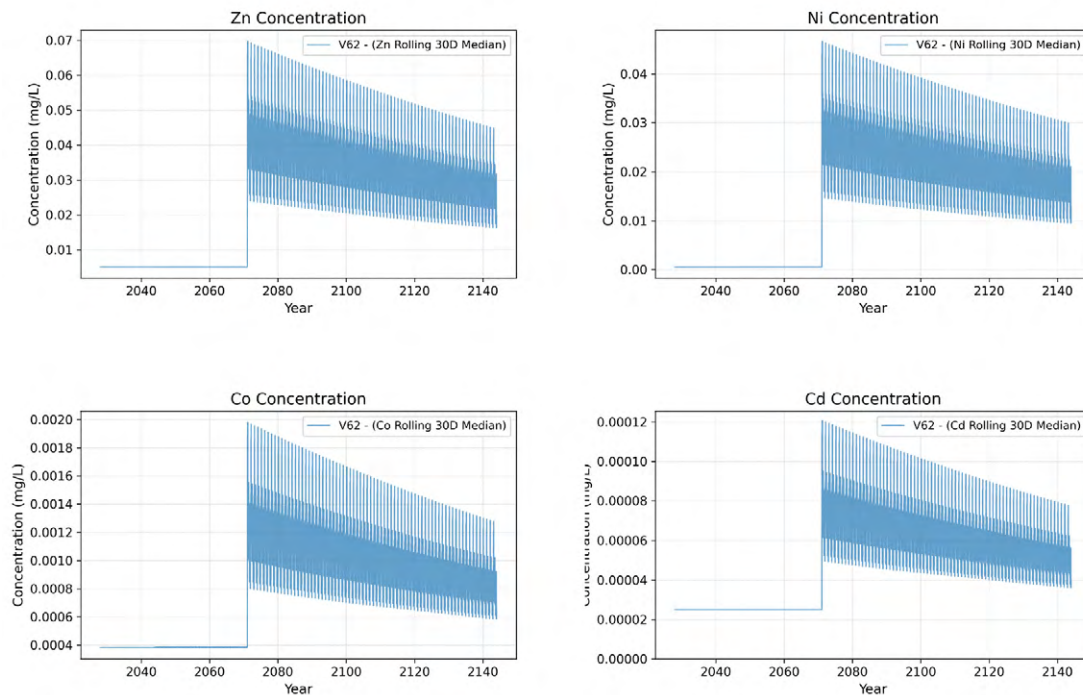


Figure 42: V62 - S1 (High Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

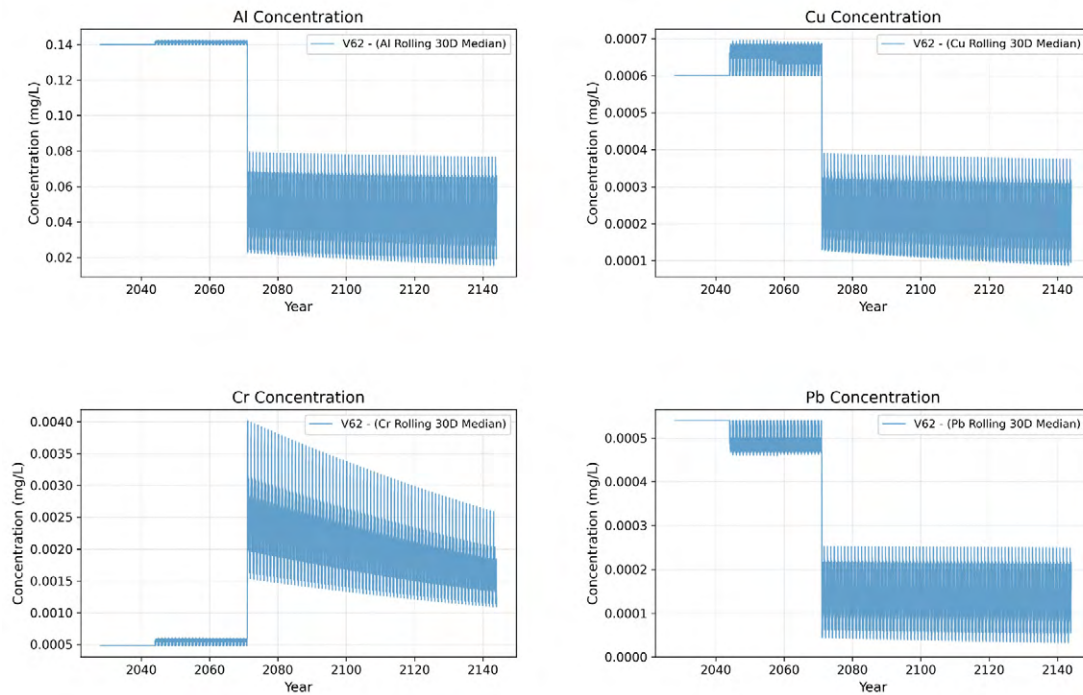


Figure 43: V62 - S1 (High Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

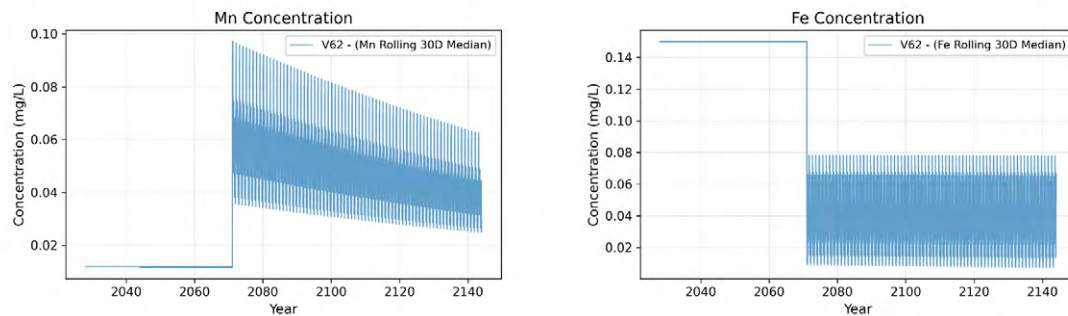


Figure 44: V62 - S1 (High Rainfall) - 30 day rolling median (Mn, Fe)

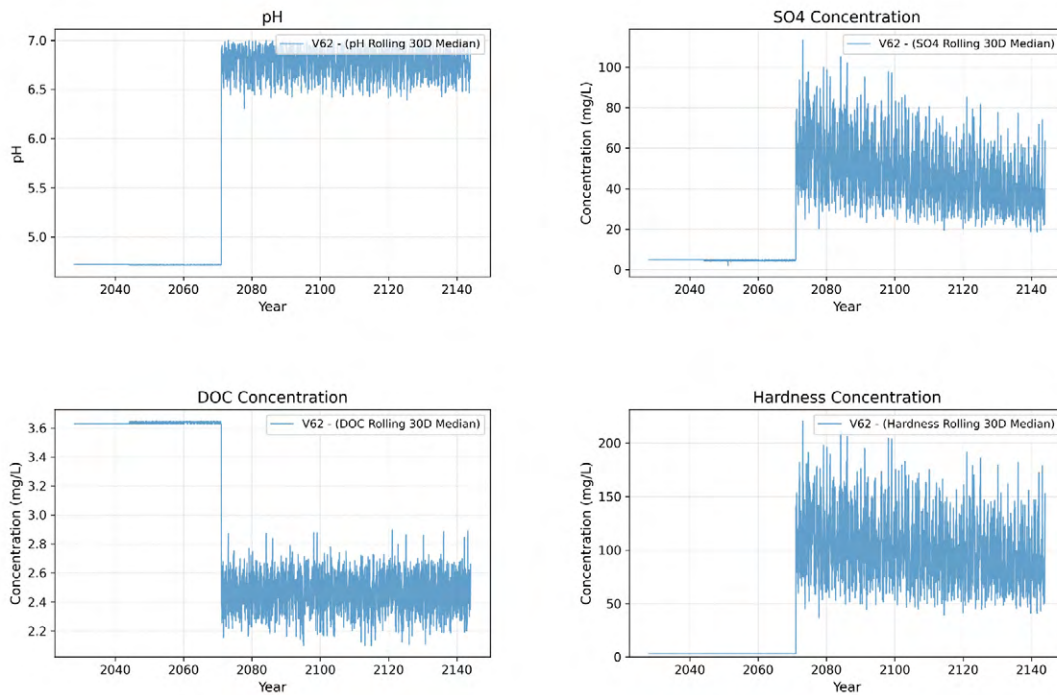


Figure 45: V62 - S2 (Stochastic Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

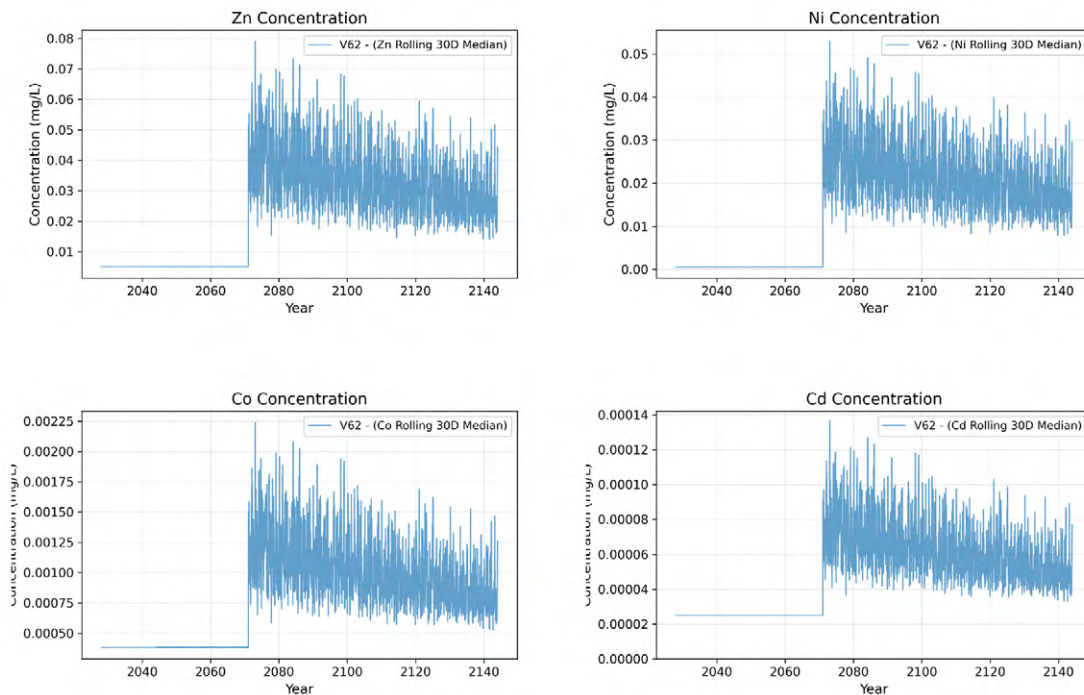


Figure 46: V62 - S2 (Stochastic Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

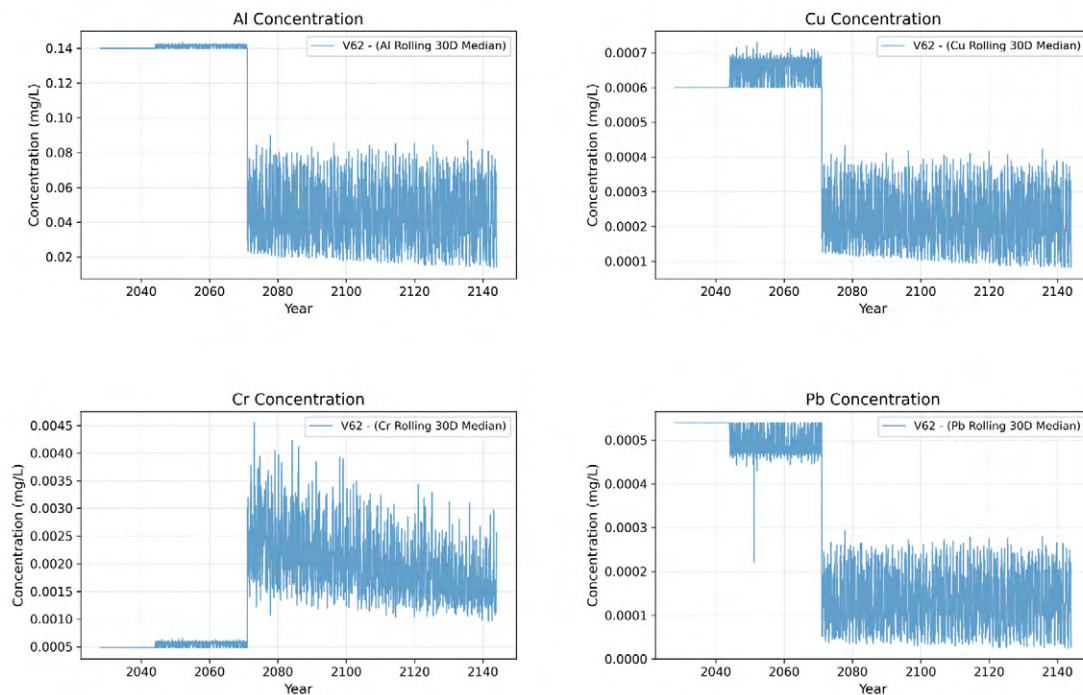


Figure 47: V62 - S2 (Stochastic Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

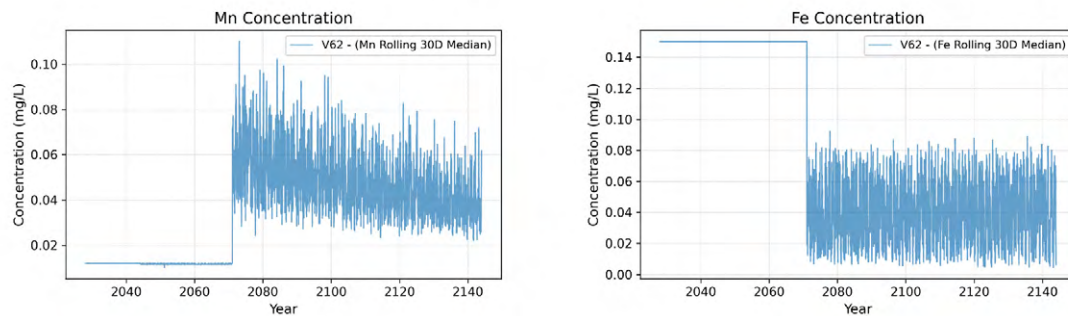


Figure 48: V62 - S2 (Stochastic Rainfall) - 30 day rolling median (Mn, Fe)

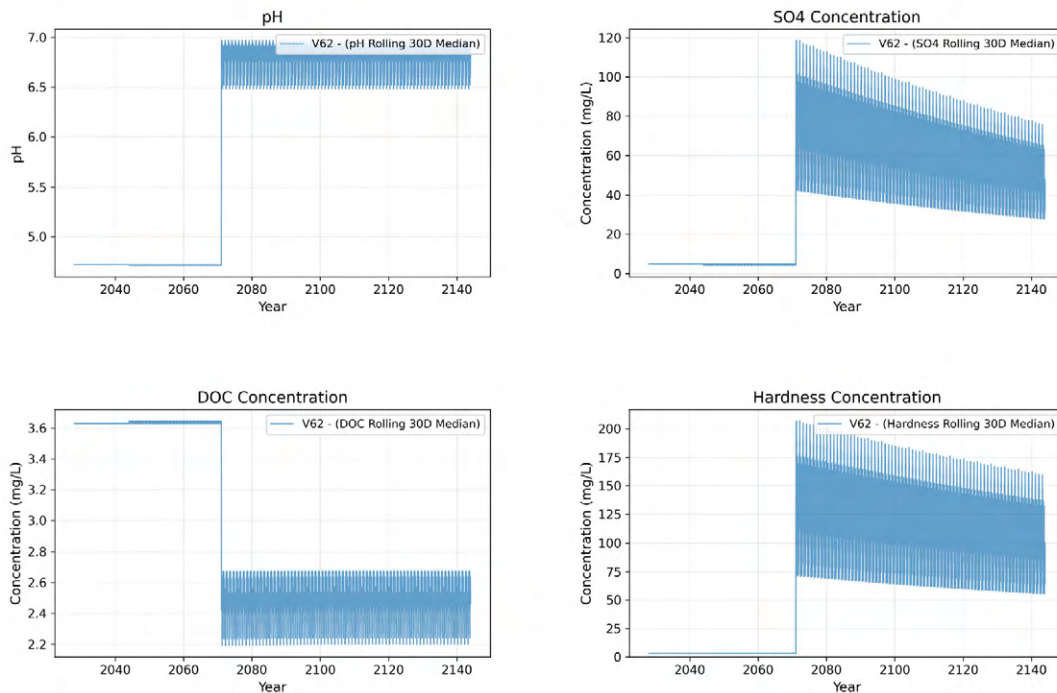


Figure 49: V62 - S3 (ELF ST +30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

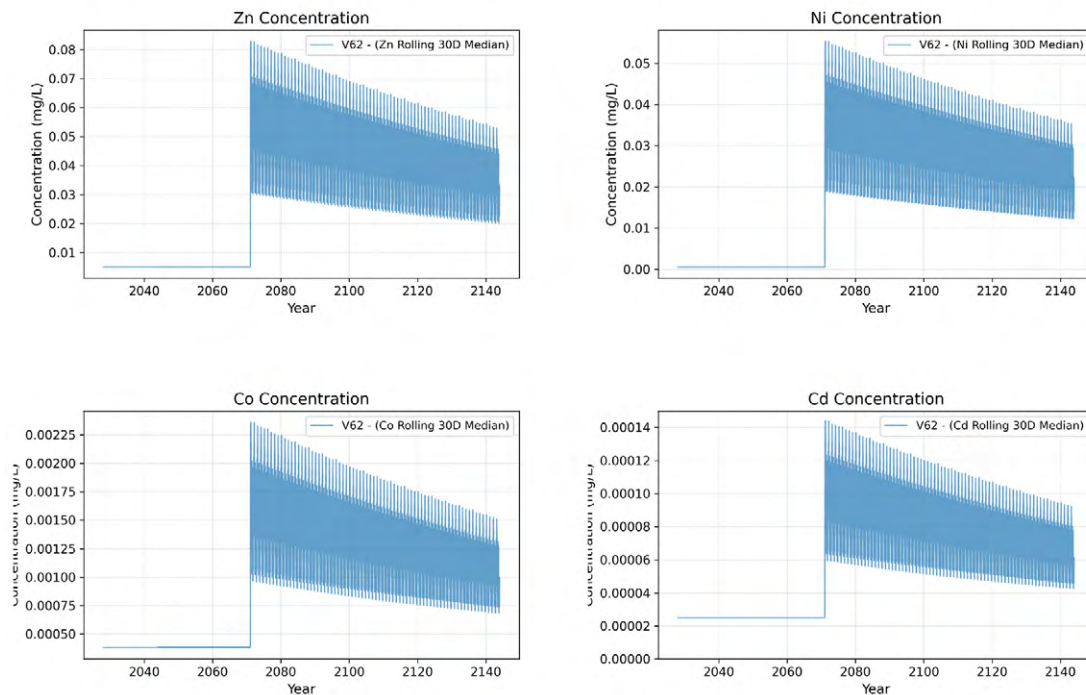


Figure 50: V62 - S3 (ELF ST +30%) - 30 day rolling median (Zn, Ni, Co, Cd)

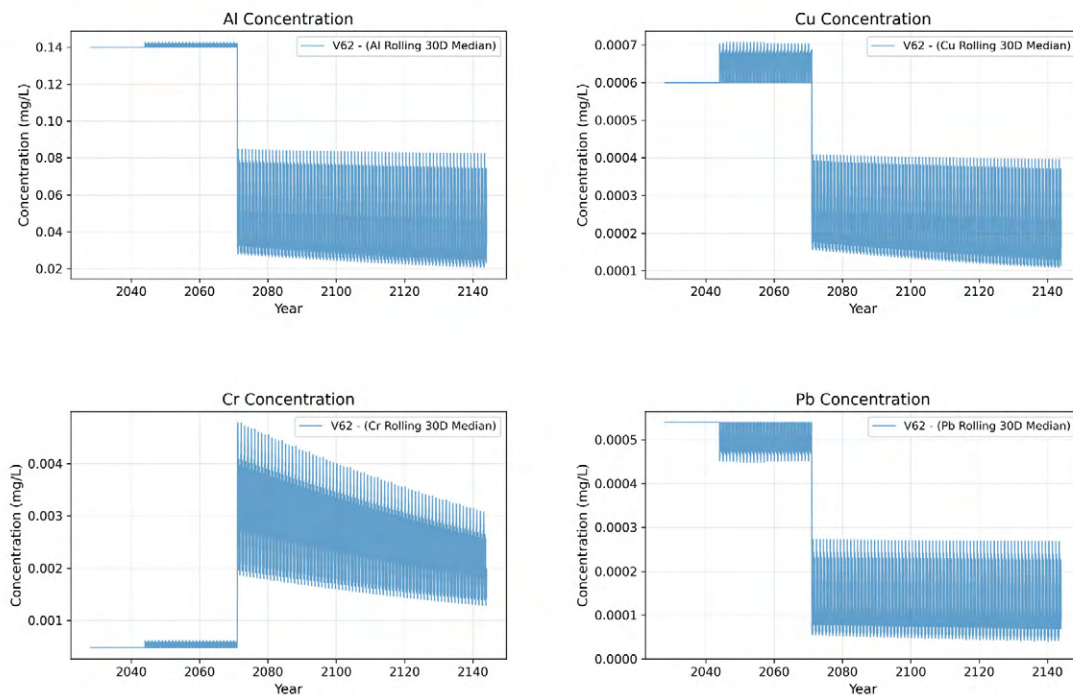


Figure 51: V62 - S3 (ELF ST +30%) - 30 day rolling median (Al, Cu, Cr, Pb)

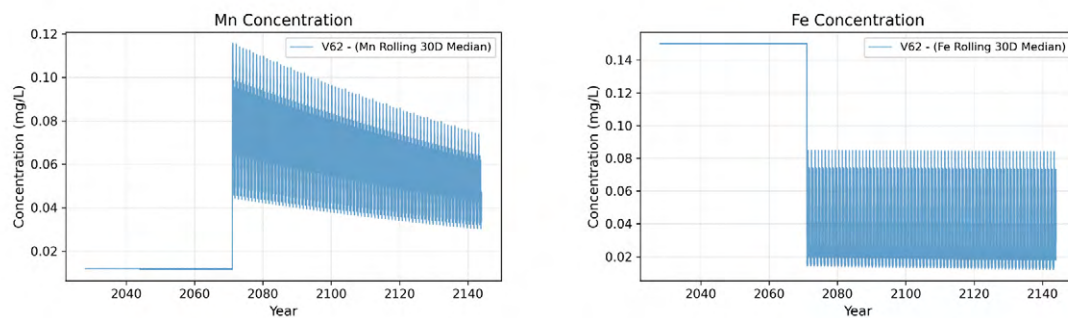


Figure 52: V62 - S3 (ELF ST +30%) - 30 day rolling median (Mn, Fe)

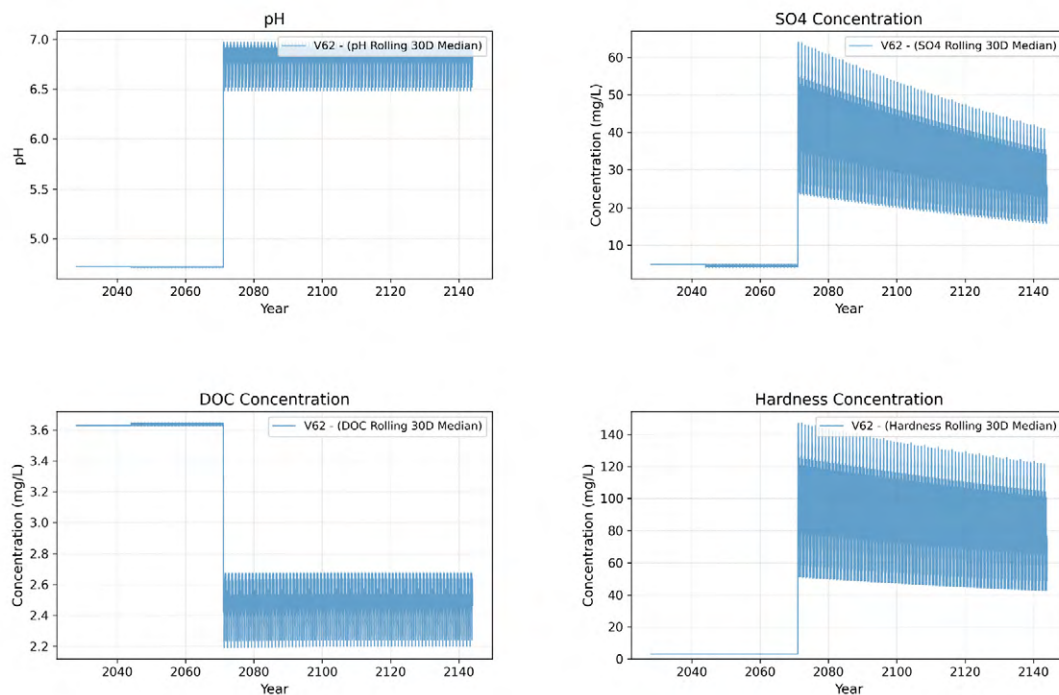


Figure 53: V62 - S4 (ELF ST -30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

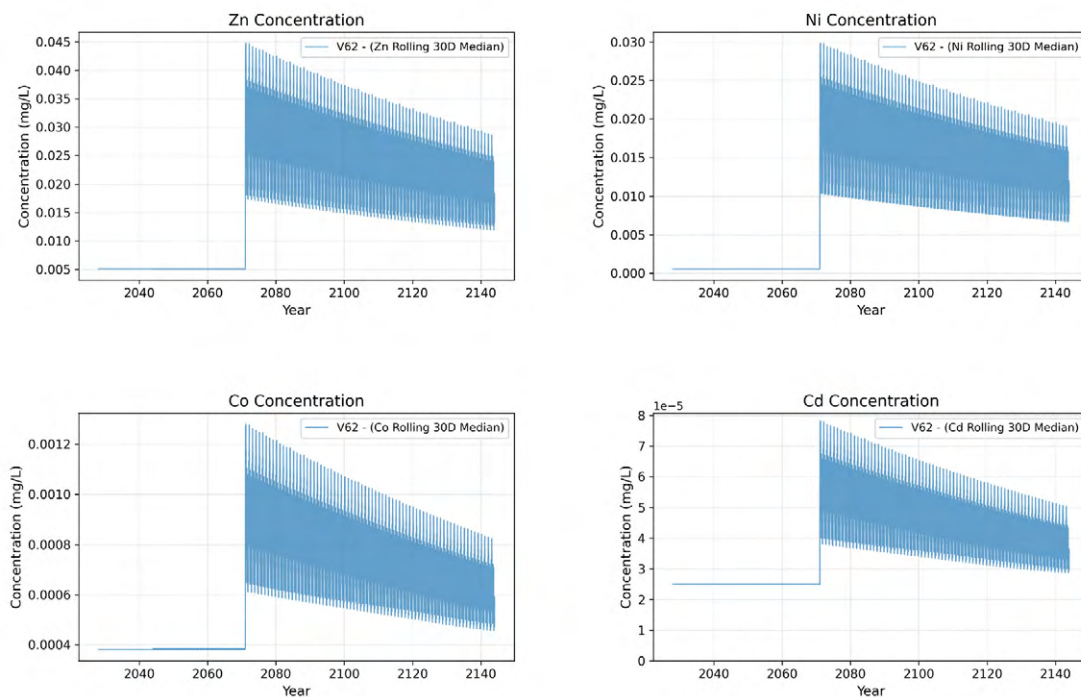


Figure 54: V62 - S4 (ELF ST -30%) - 30 day rolling median (Zn, Ni, Co, Cd)

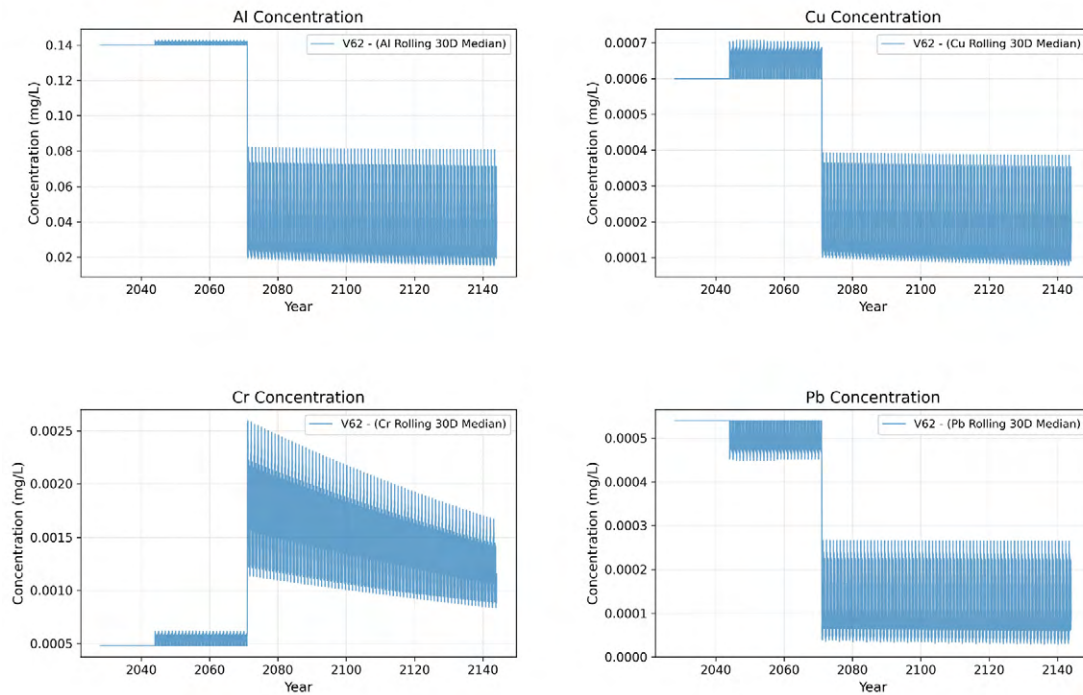


Figure 55: V62 - S4 (ELF ST -30%) - 30 day rolling median (Al, Cu, Cr, Pb)

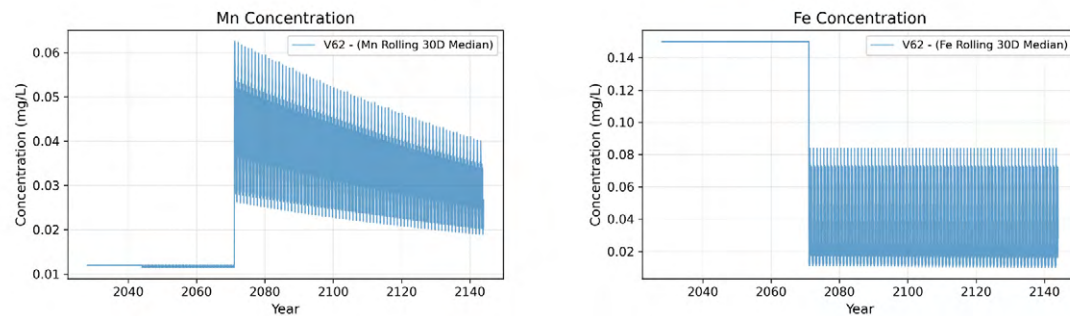
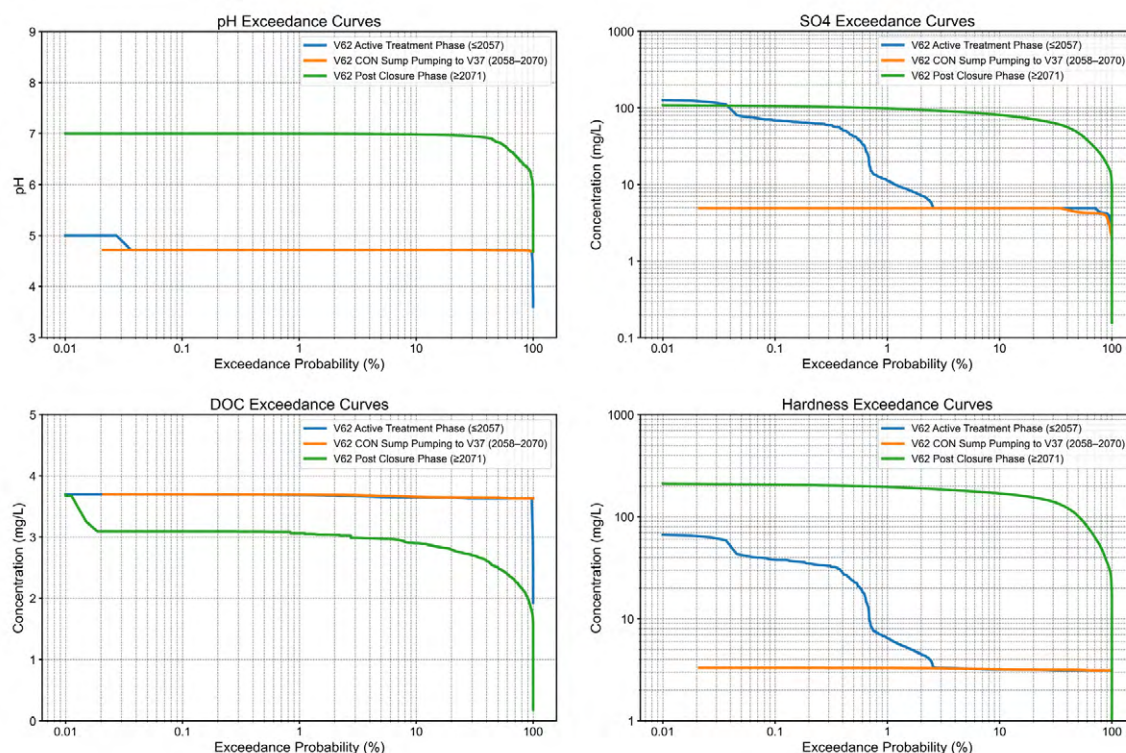
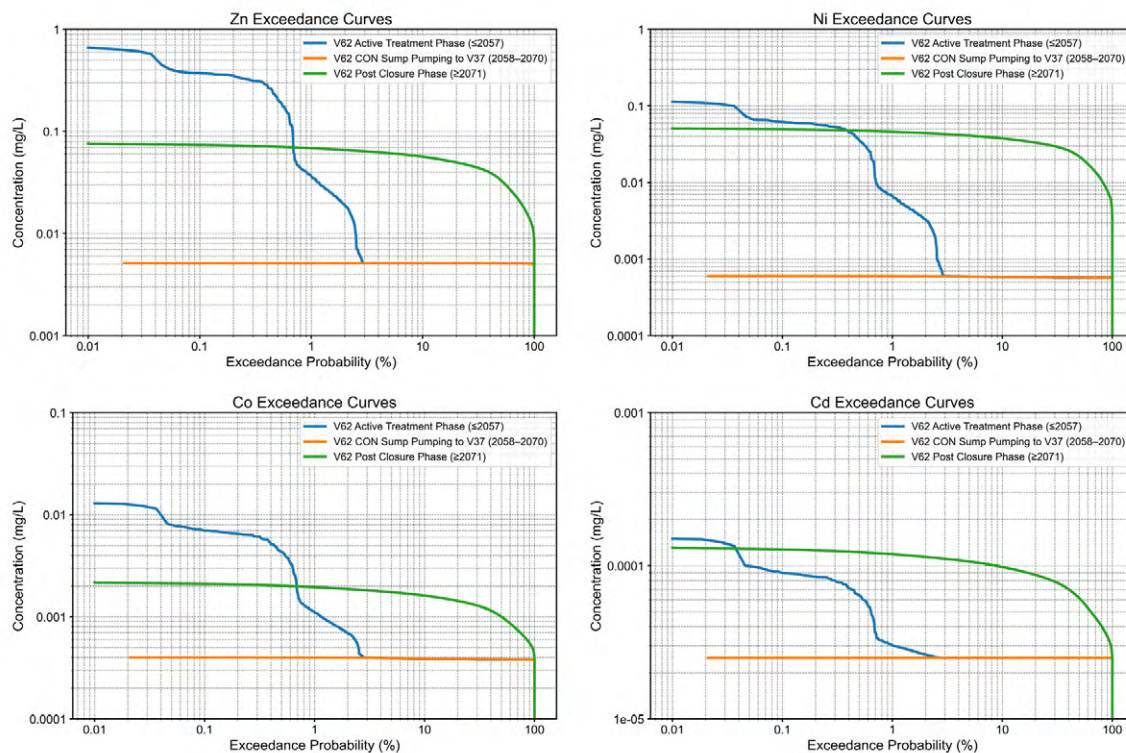


Figure 56: V62 - S4 (ELF ST -30%) - 30 day rolling median (Mn, Fe)

Probability Exceedance**Figure 57: V62 - Base Case - Exceedance probability plots (pH, SO₄, DOC, Hardness)****Figure 58: V62 - Base Case - Exceedance probability plots (Zn, Ni, Co, Cd)**

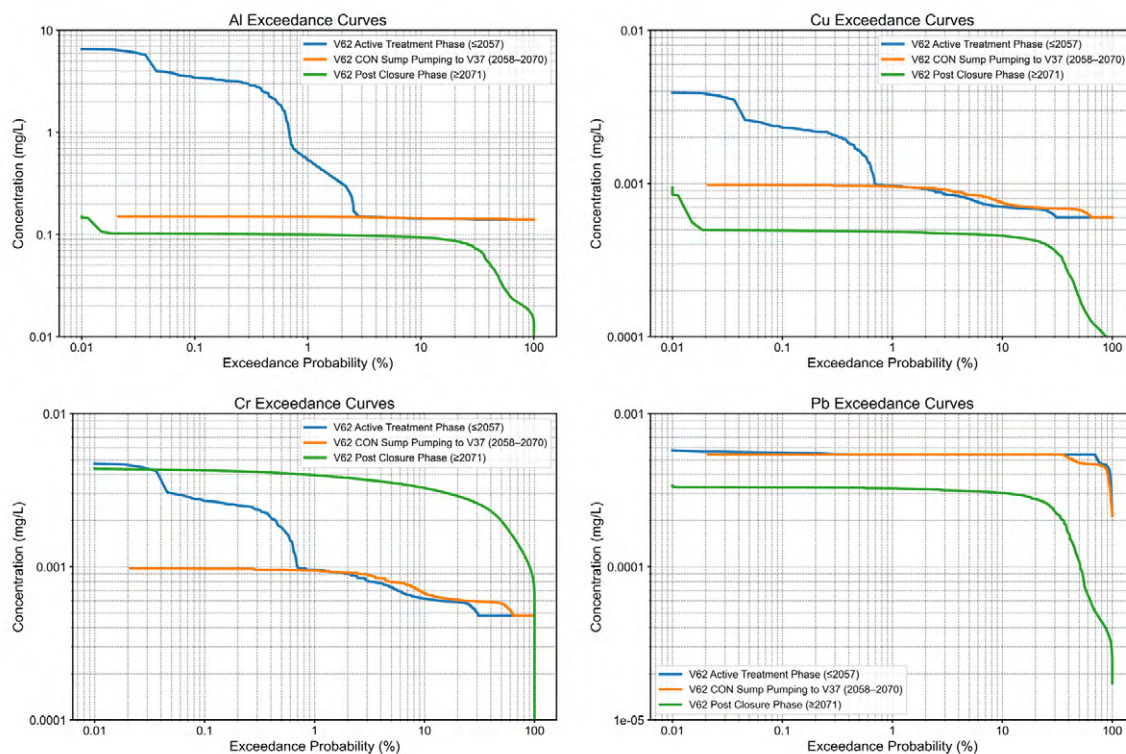


Figure 59: V62 - Base Case - Exceedance probability plots (Al, Cu, Cr, Pb)

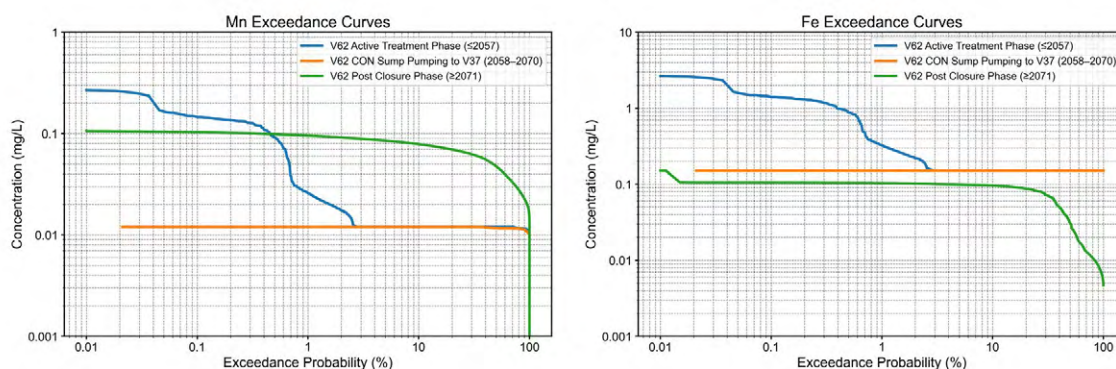
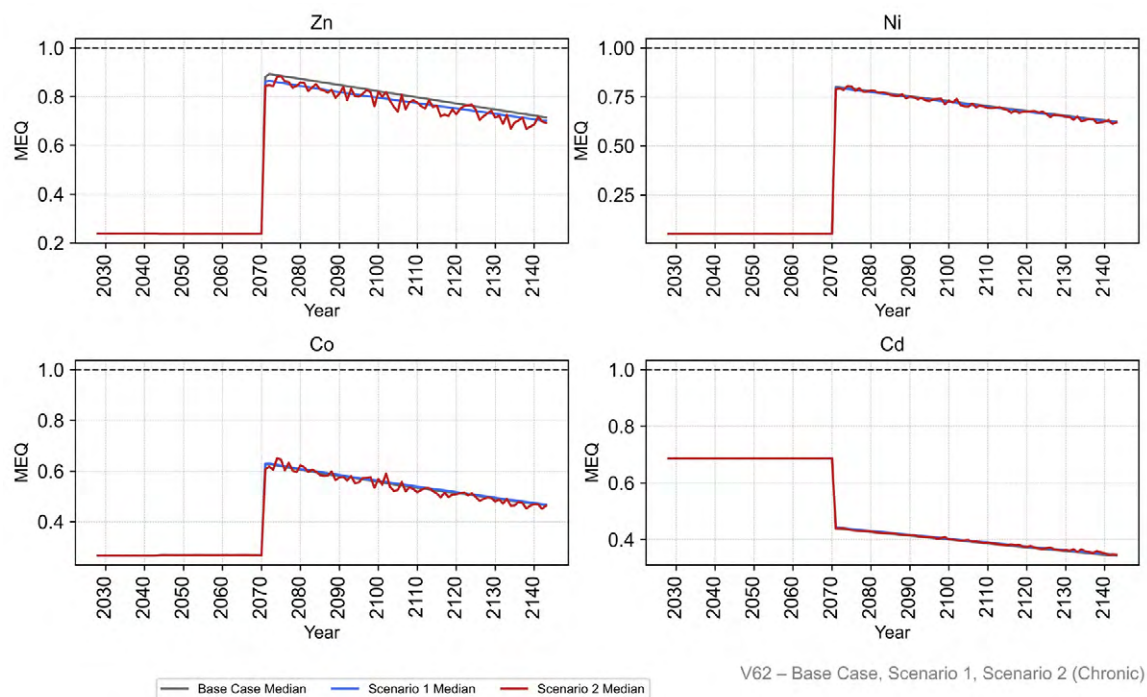
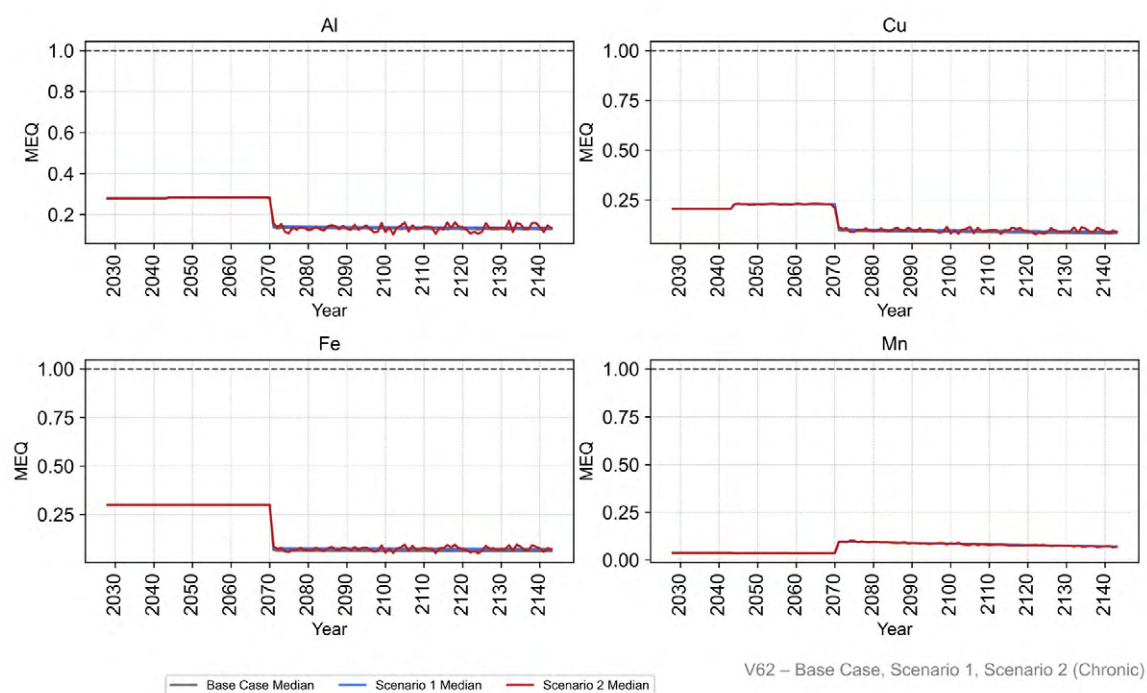


Figure 60: V62 - Base Case - Exceedance probability plots (Mn, Fe)

Compliance & WQ Standards**Figure 61: V62 - Rainfall Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)****Figure 62: V62 - Rainfall Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)**

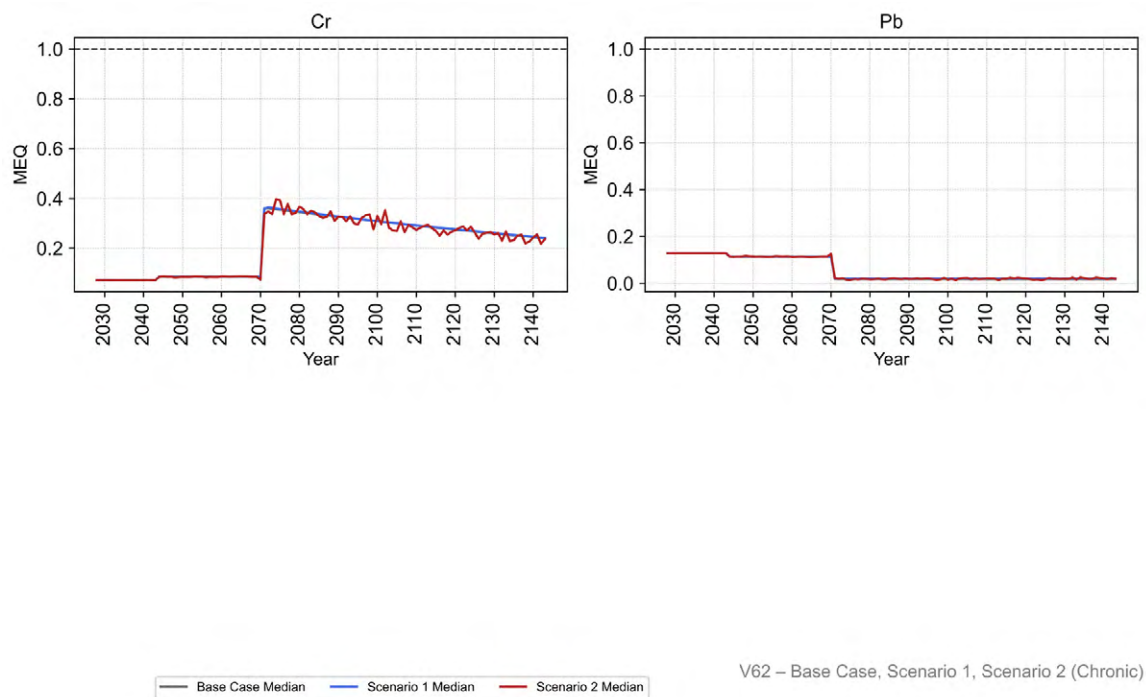


Figure 63: V62 - Rainfall Scenarios - Chronic criteria compliance (Cr, Pb)

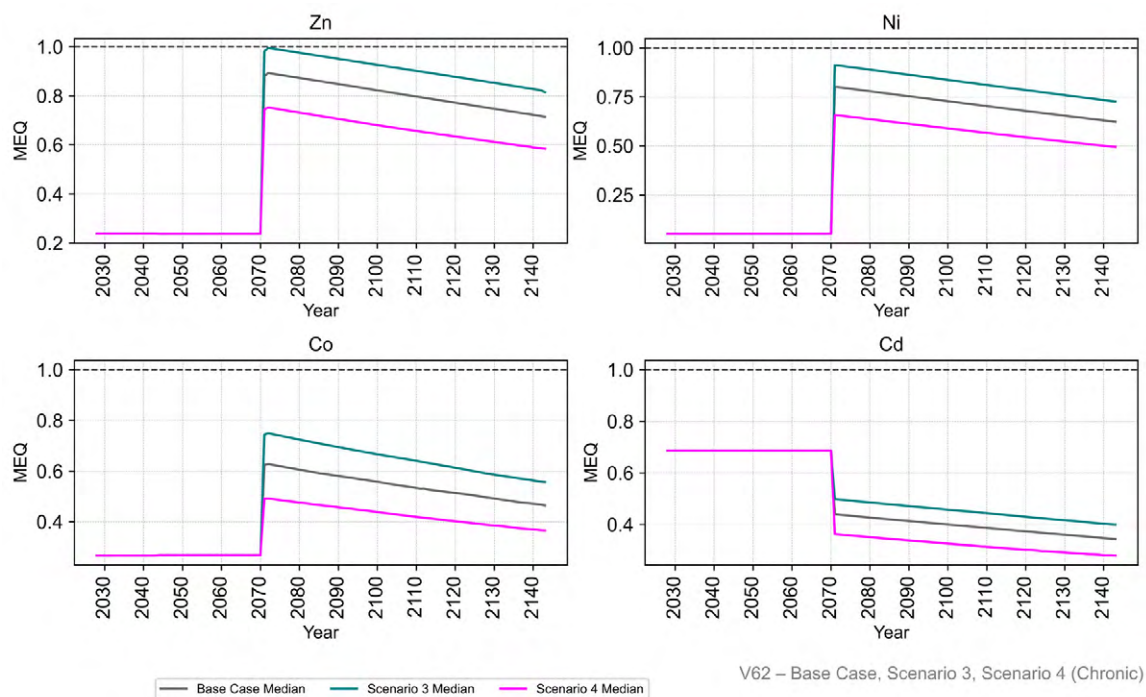


Figure 64: V62 - Source Term Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)

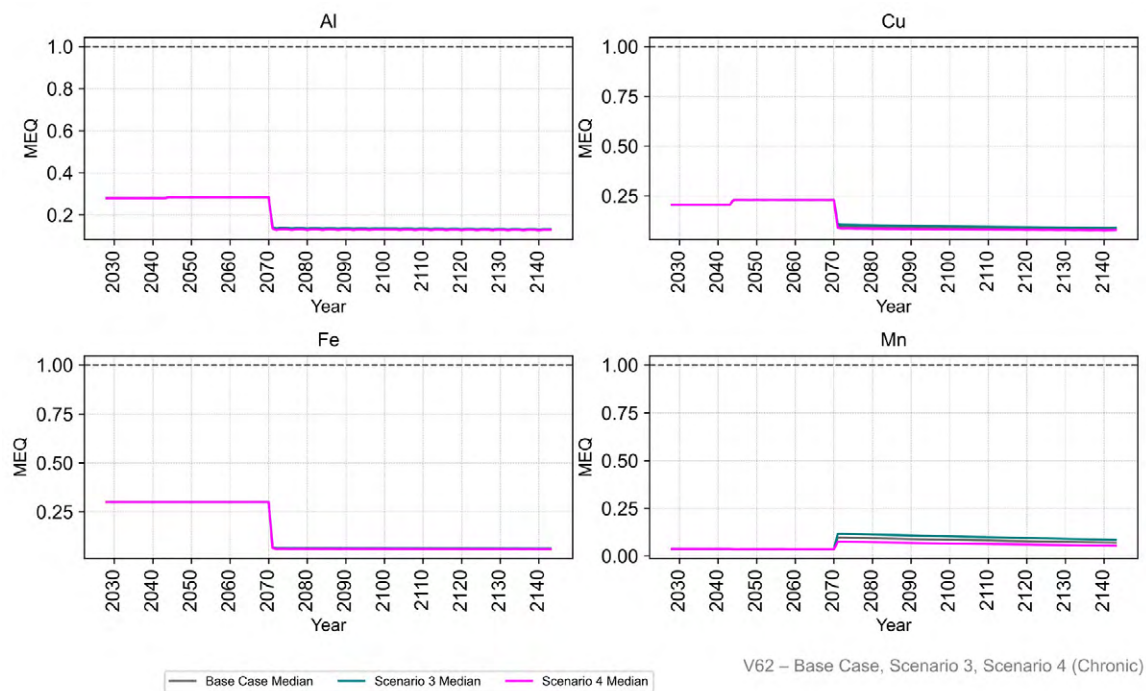


Figure 65: V62 - Source Term Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

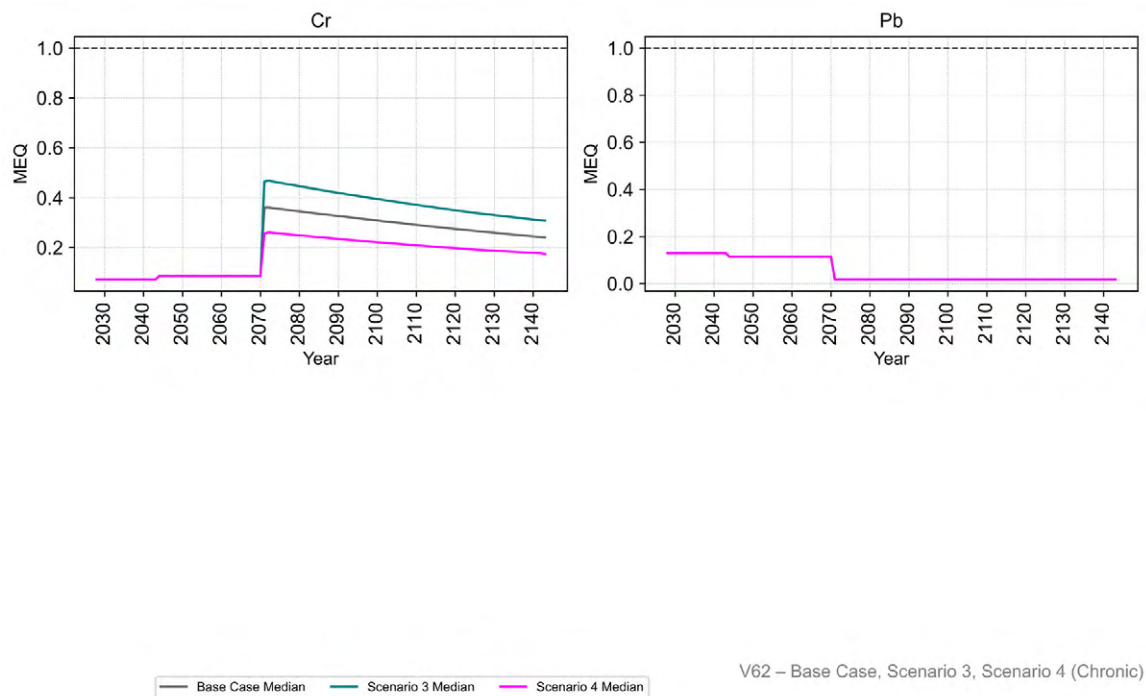


Figure 66: V62 - Source Term Scenarios - Chronic criteria compliance (Cr, Pb)

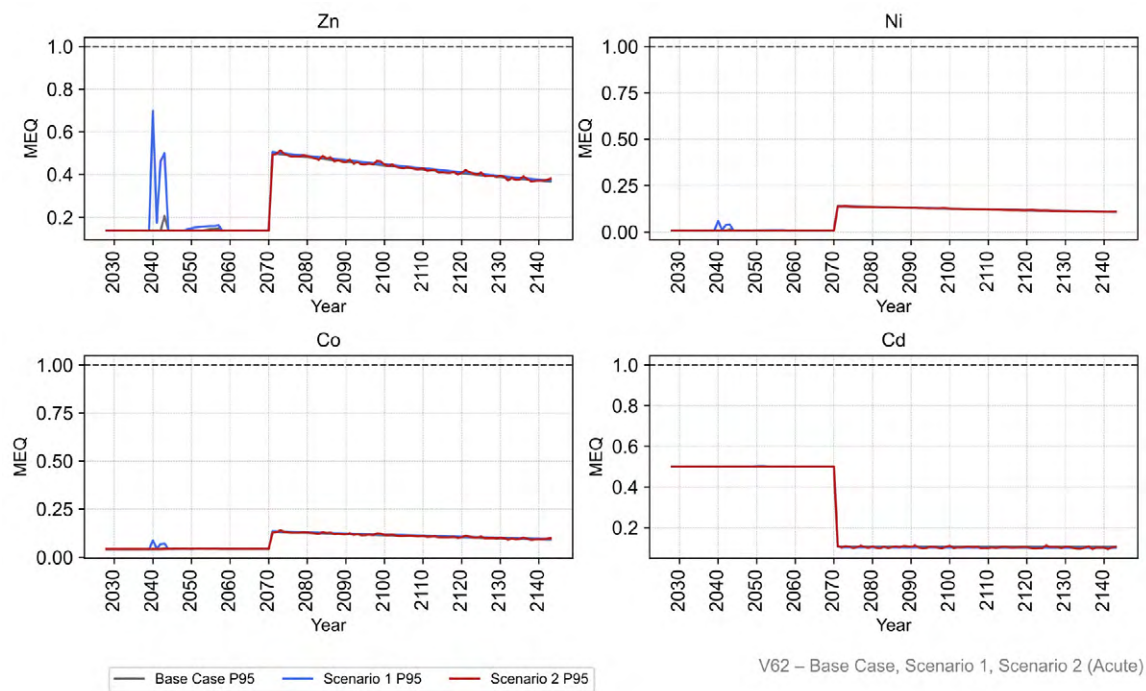


Figure 67: V62 - Rainfall Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

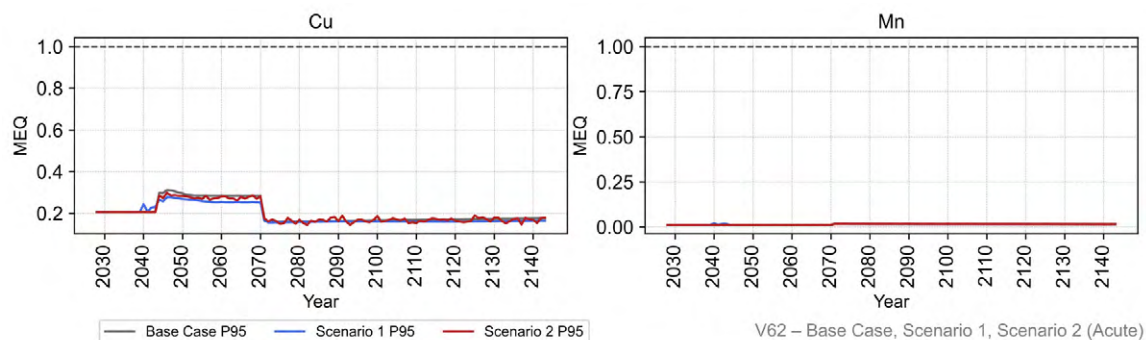


Figure 68: V62 - Rainfall Scenarios - Acute criteria compliance (Cu, Mn)

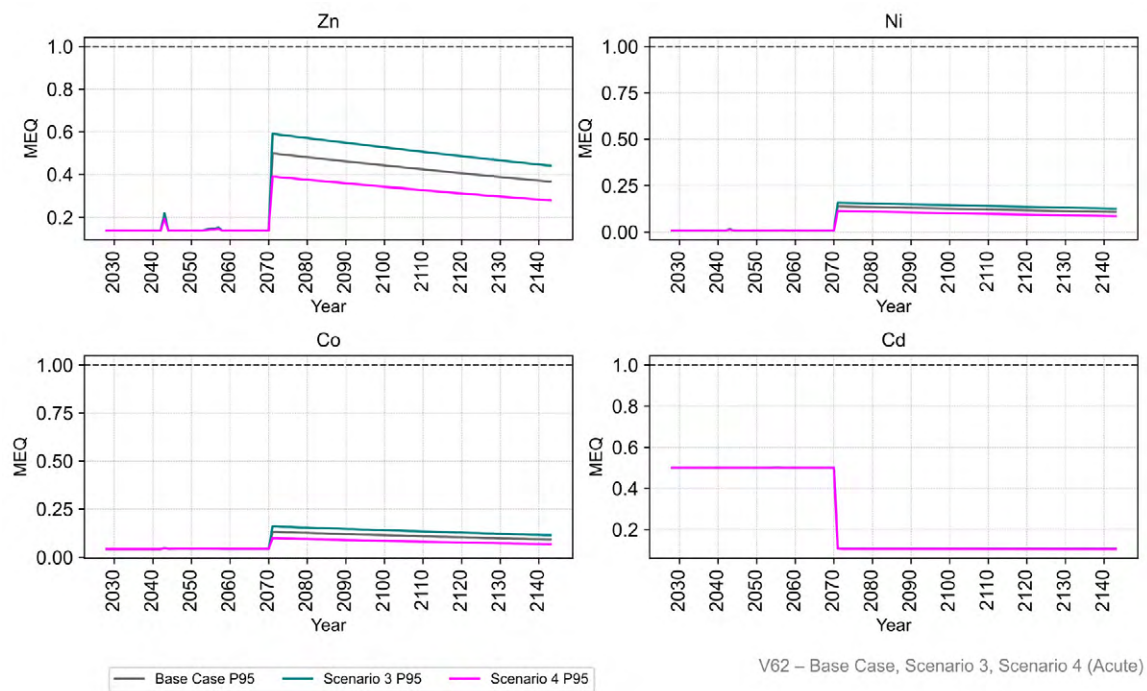


Figure 69: V62 - Source Term Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

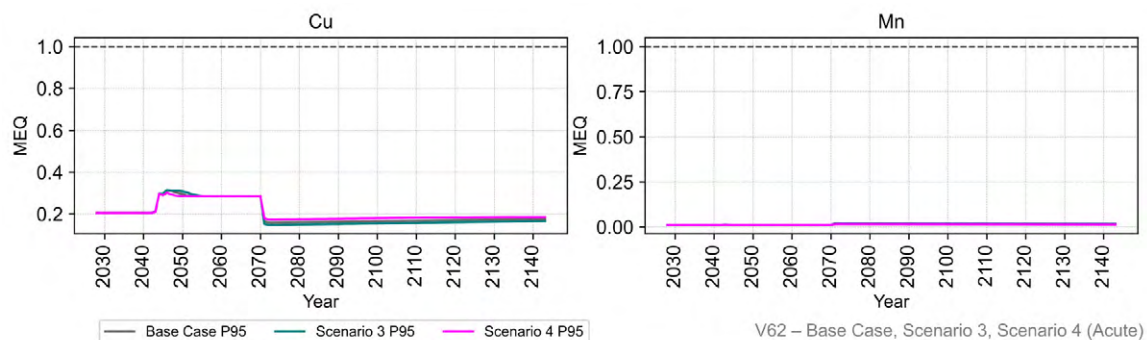


Figure 70: V62 - Source Term Scenarios - Acute criteria compliance (Cu, Mn)

Exceedance Frequencies

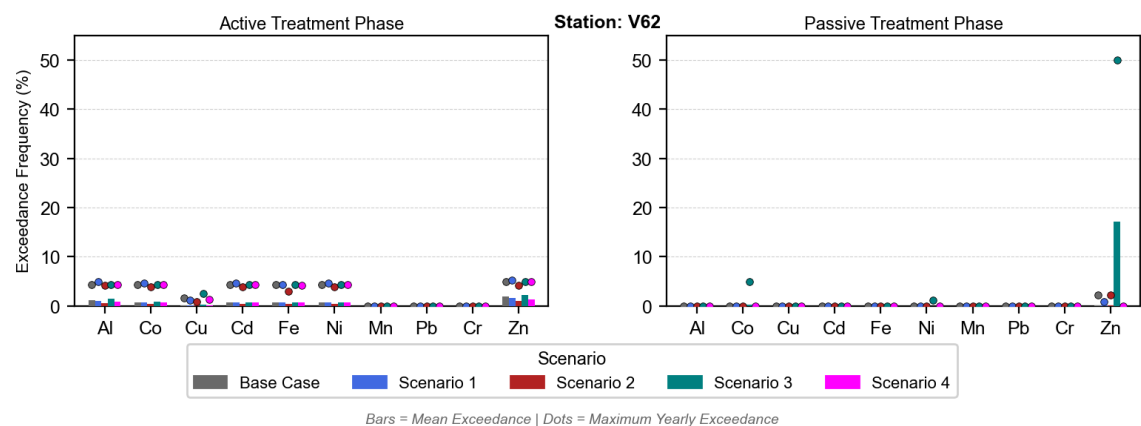


Figure 71: V62 - Chronic exceedance frequencies

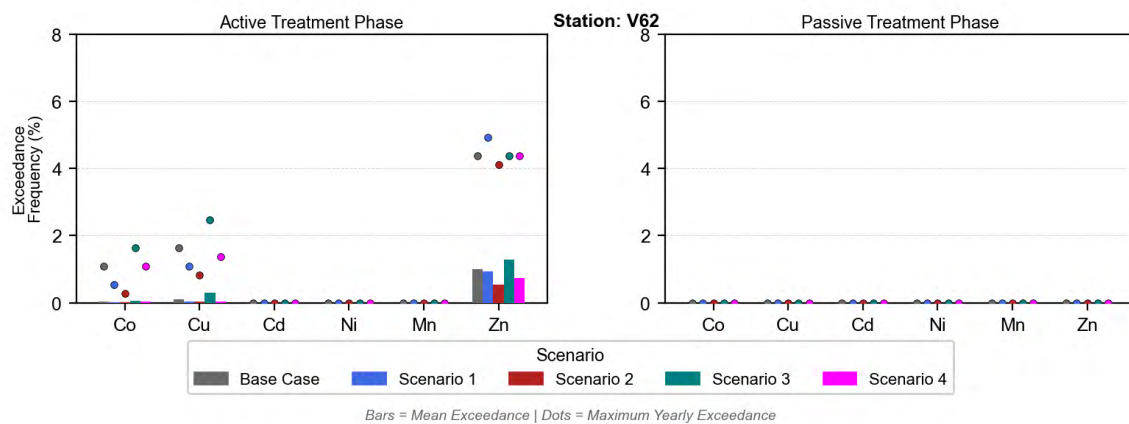


Figure 72: V62 - Acute exceedance frequencies

3. STATION W07

Overview & Trends

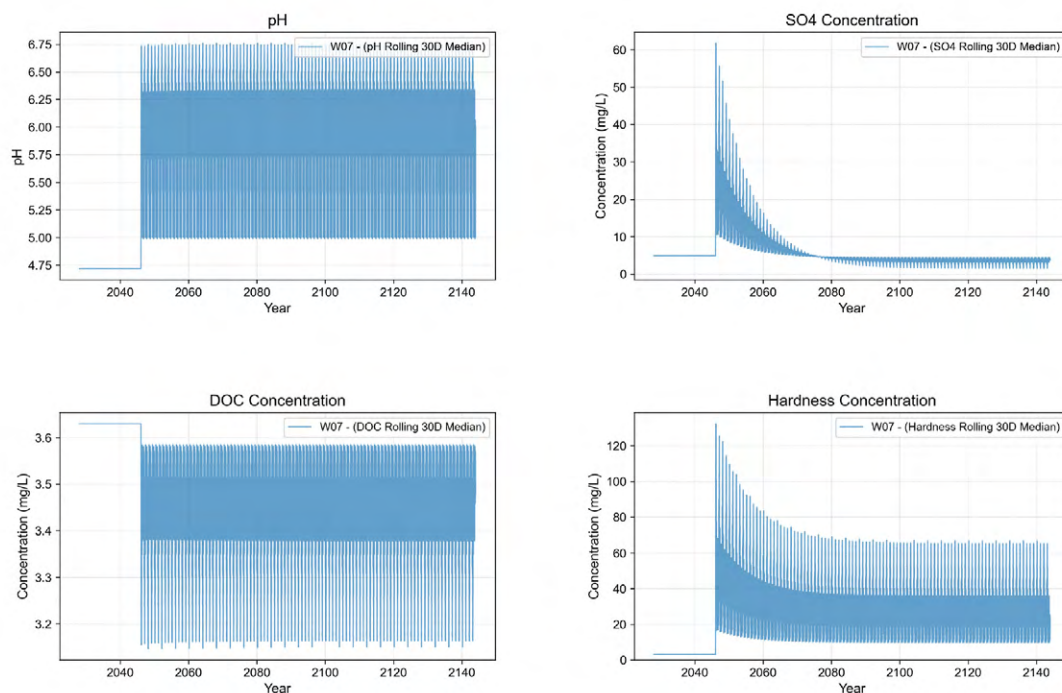


Figure 73: W07 - Base Case - 30 day rolling median (pH, SO₄, DOC, Hardness)

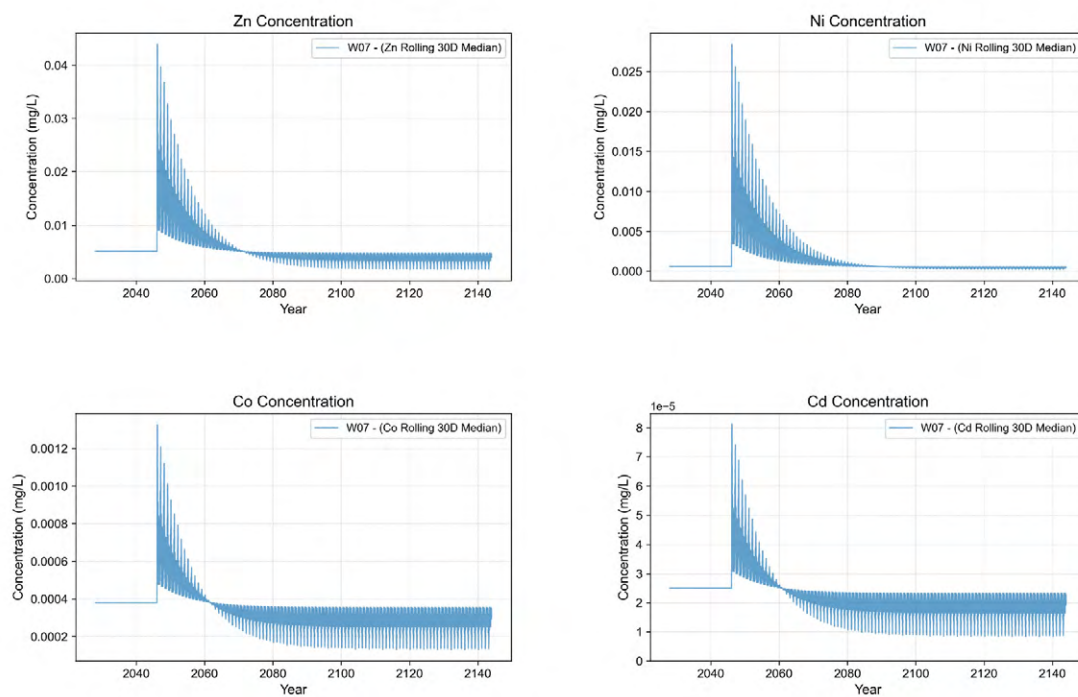


Figure 74: W07 - Base Case - 30 day rolling median (Zn, Ni, Co, Cd)

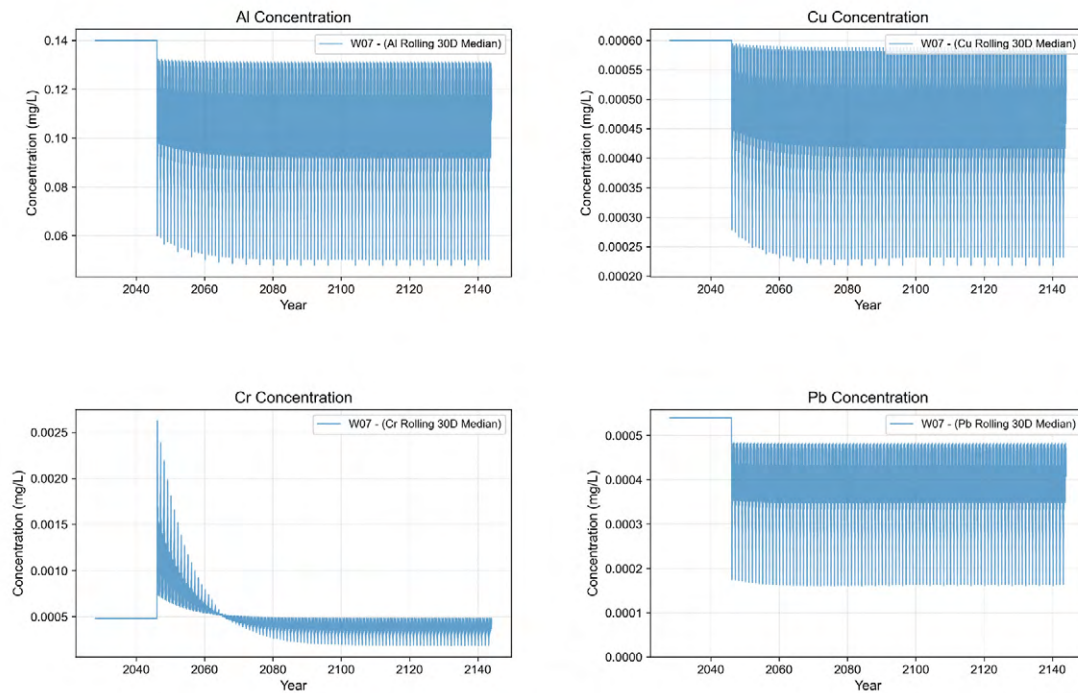


Figure 75: W07 - Base Case - 30 day rolling median (Al, Cu, Cr, Pb)

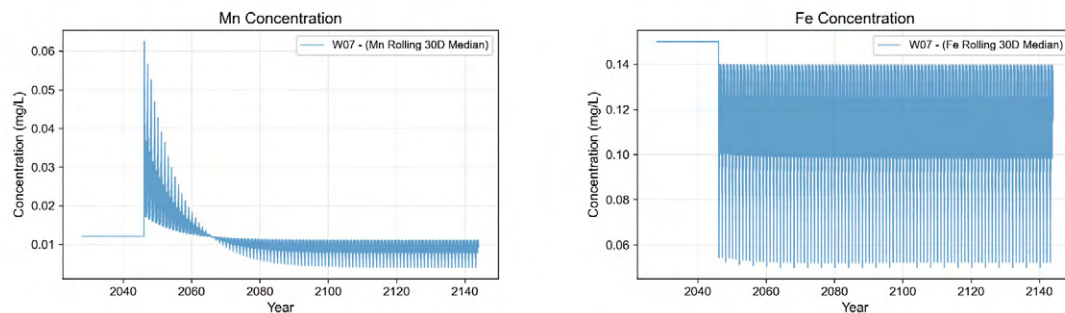


Figure 76: W07 - Base Case - 30 day rolling median (Mn, Fe)

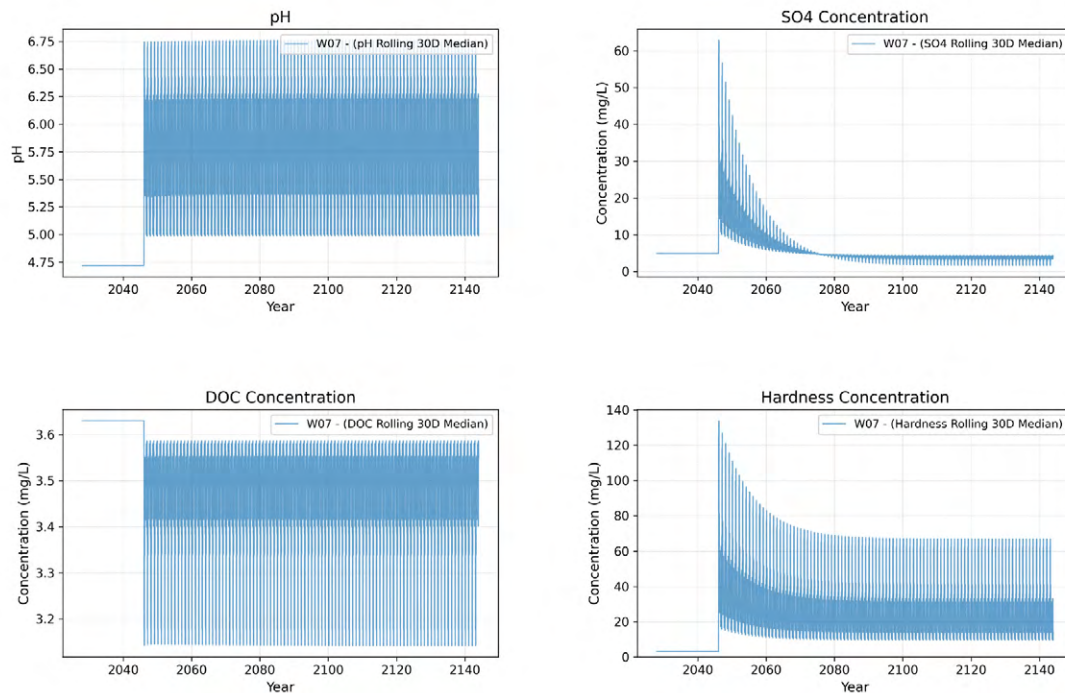


Figure 77: W07 - S1 (High Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

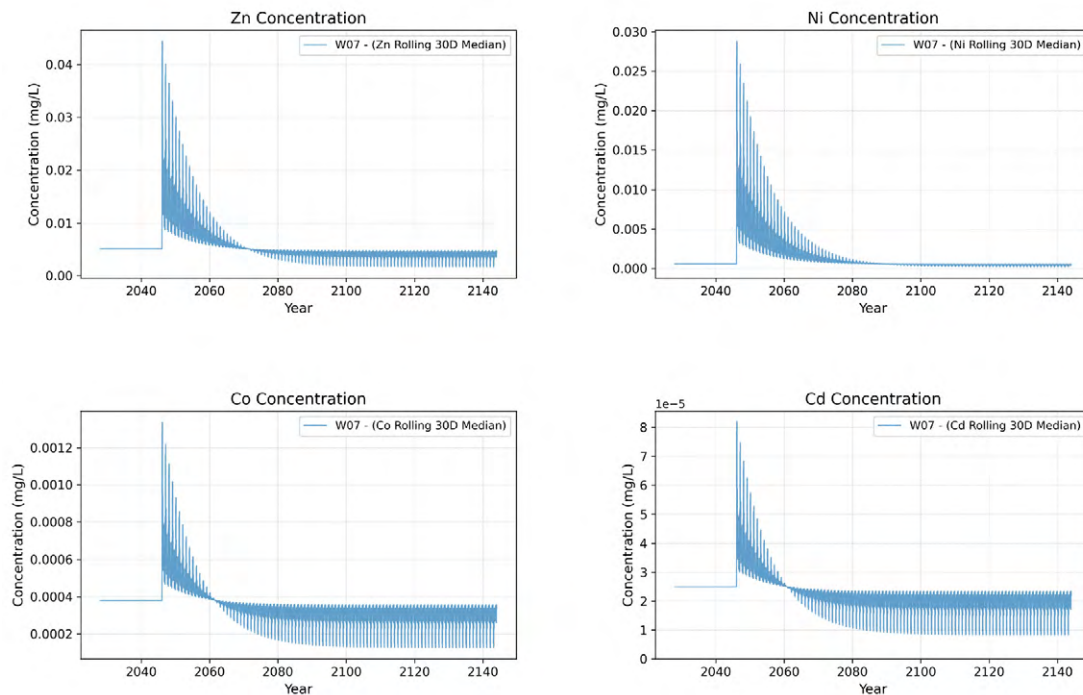


Figure 78: W07 - S1 (High Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

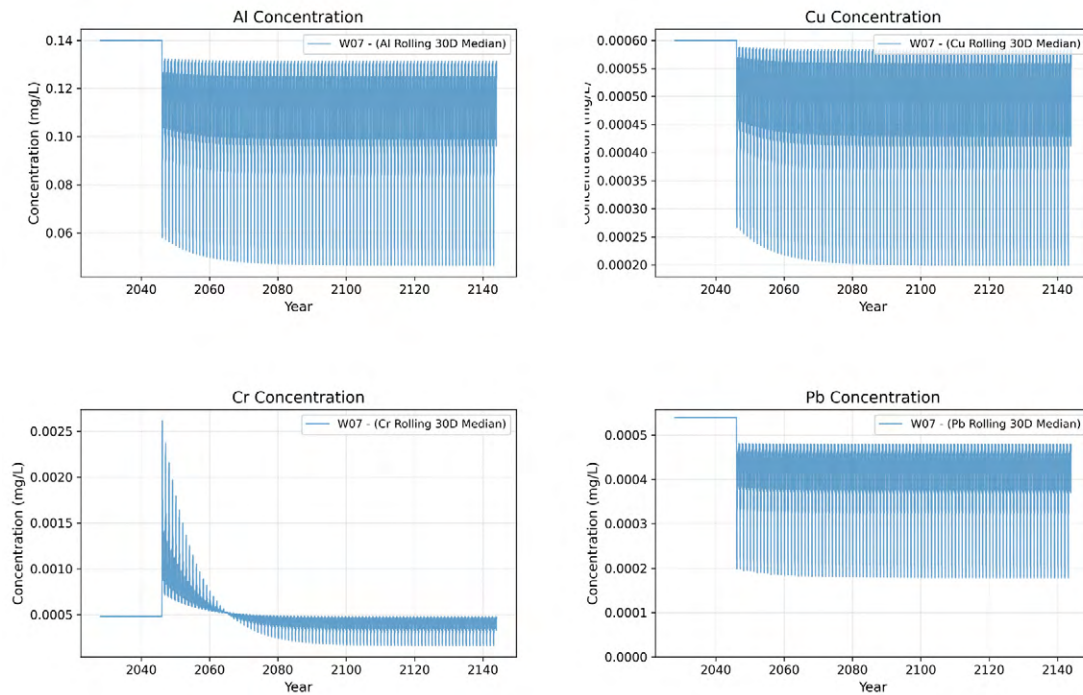


Figure 79: W07 - S1 (High Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

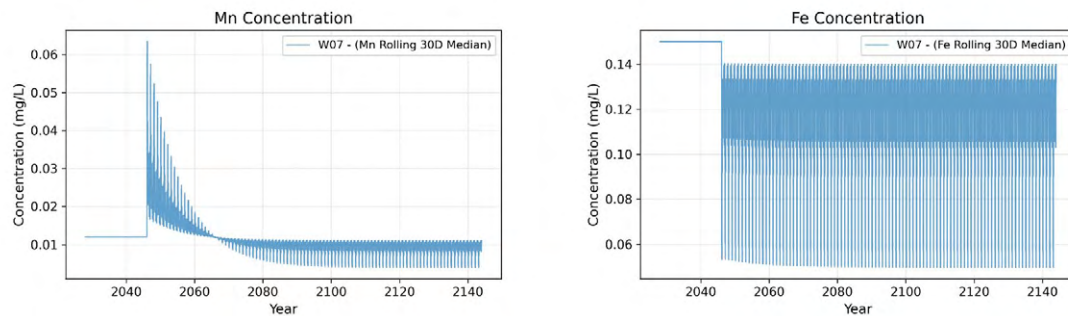


Figure 80: W07 - S1 (High Rainfall) - 30 day rolling median (Mn, Fe)

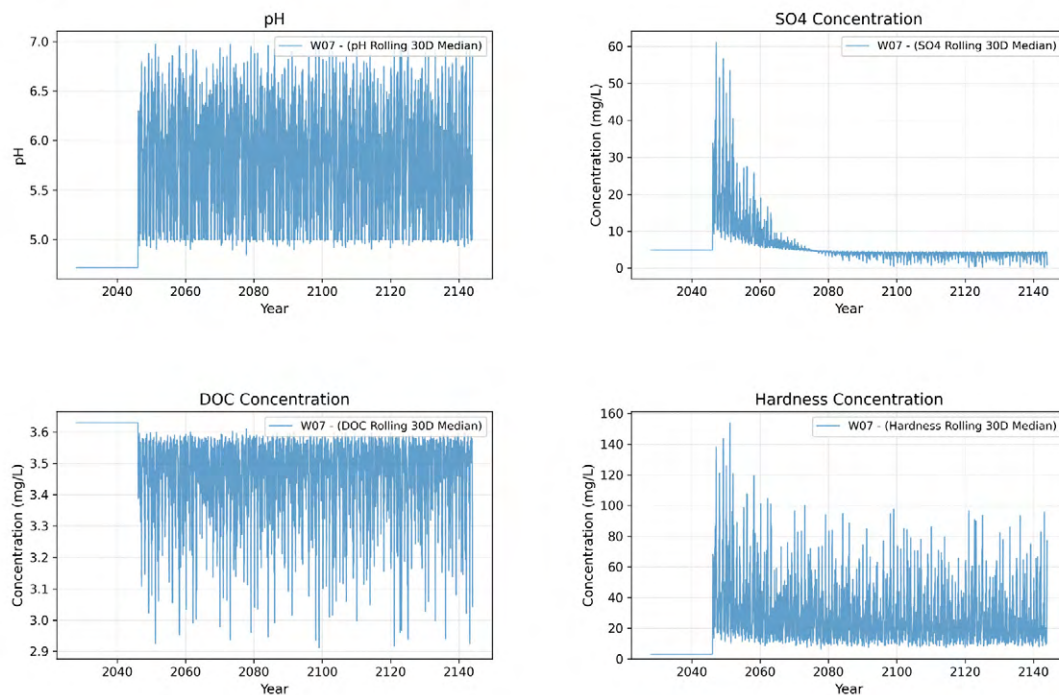


Figure 81: W07 - S2 (Stochastic Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

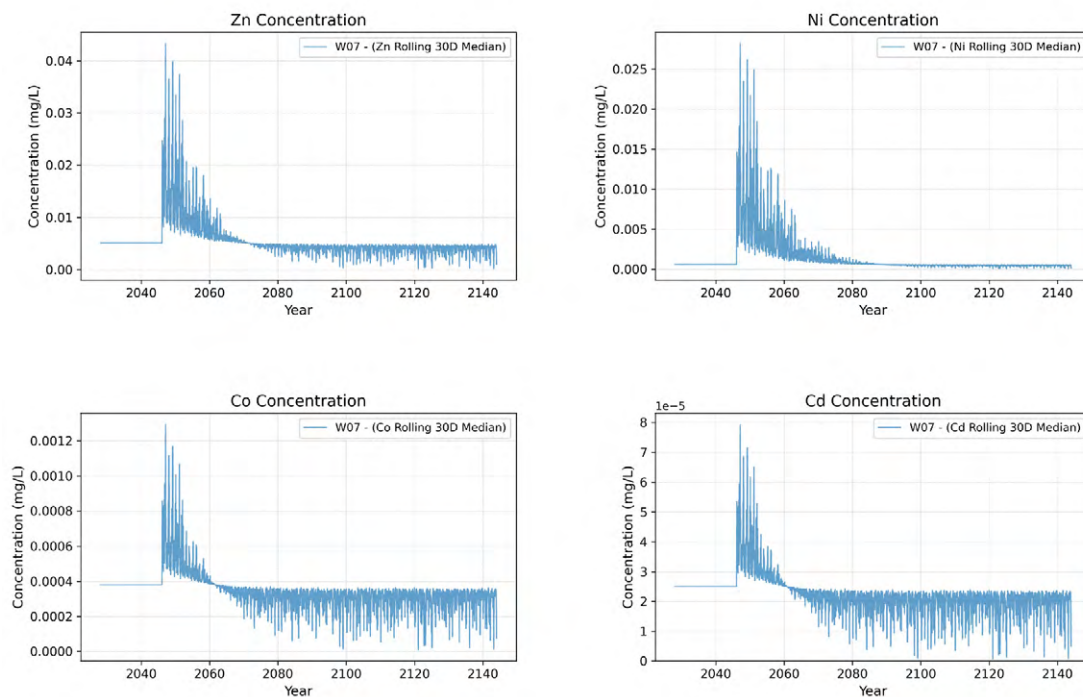


Figure 82: W07 - S2 (Stochastic Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

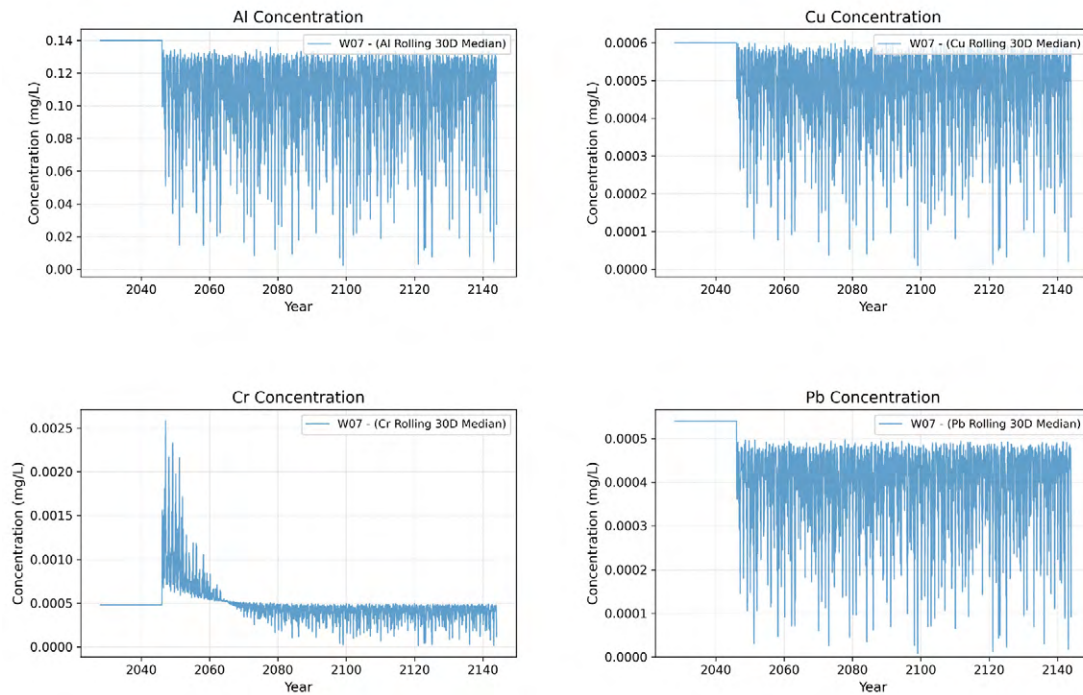


Figure 83: W07 - S2 (Stochastic Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

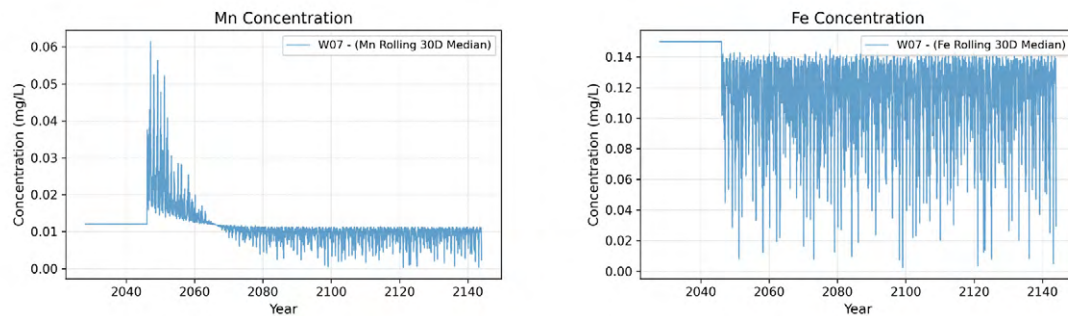


Figure 84: W07 - S2 (Stochastic Rainfall) - 30 day rolling median (Mn, Fe)

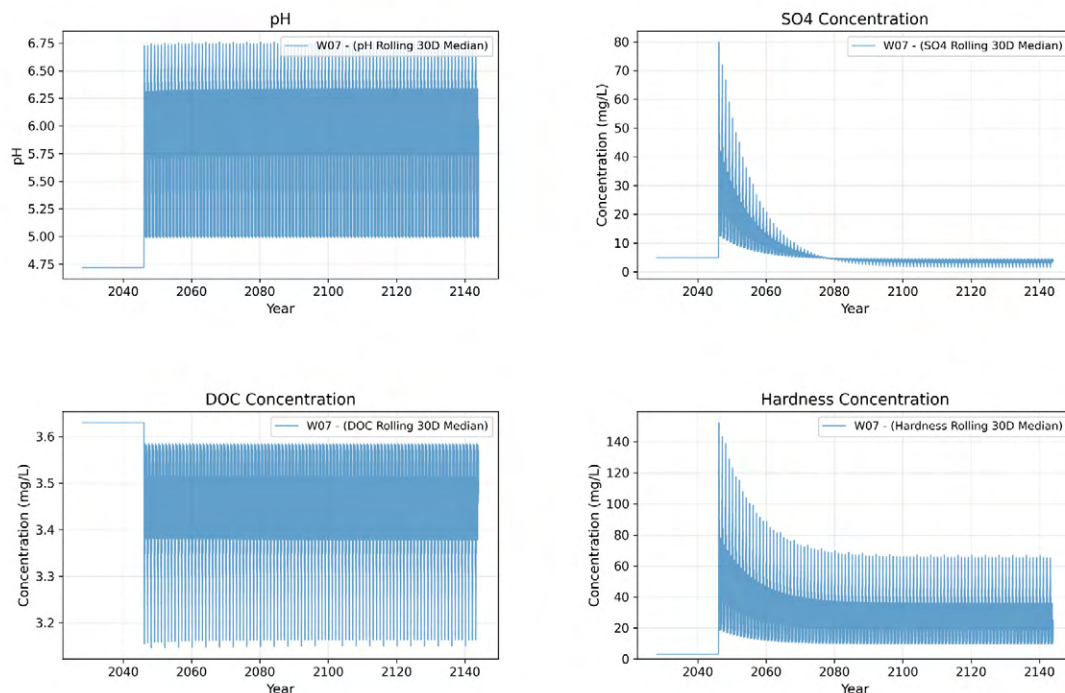


Figure 85: W07 - S3 (ELF ST +30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

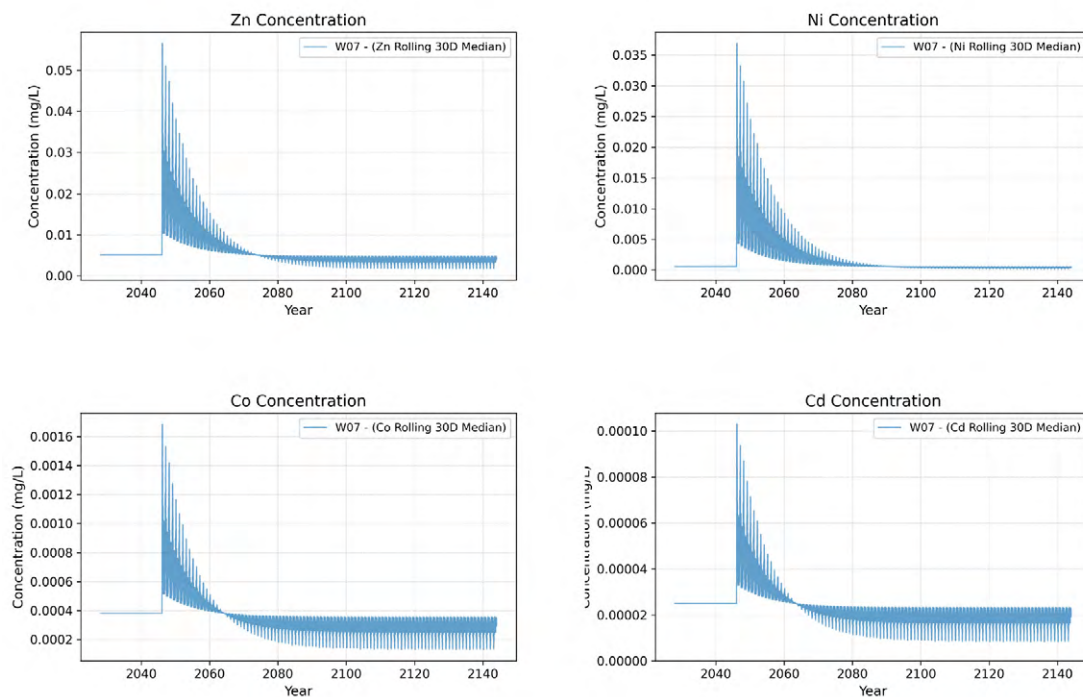


Figure 86: W07 - S3 (ELF ST +30%) - 30 day rolling median (Zn, Ni, Co, Cd)

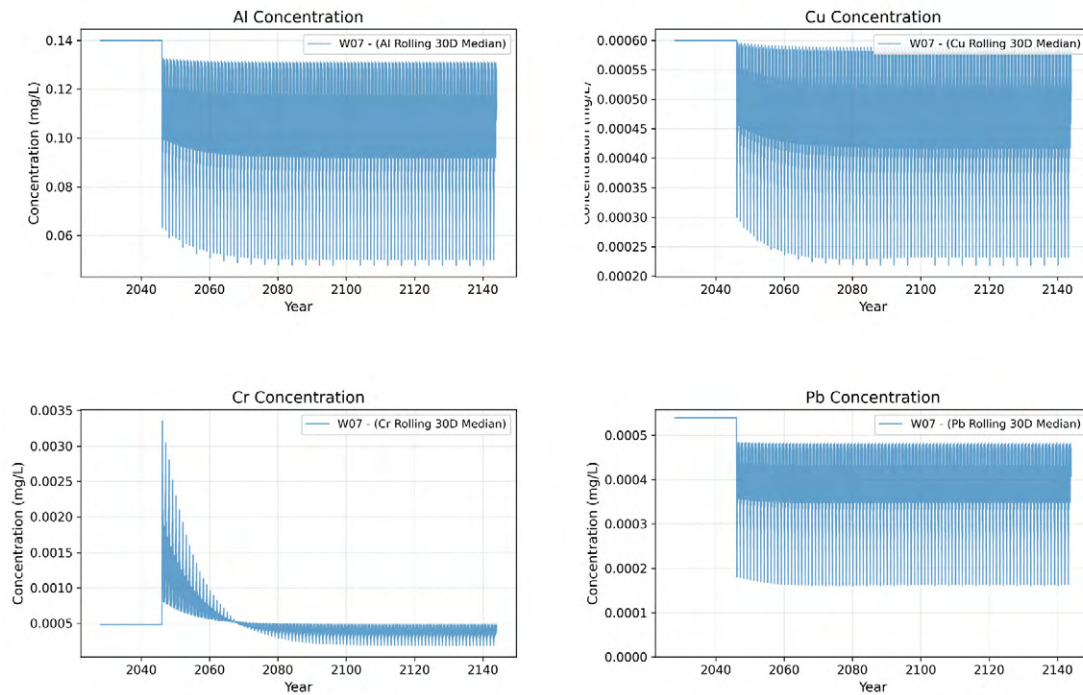


Figure 87: W07 - S3 (ELF ST +30%) - 30 day rolling median (Al, Cu, Cr, Pb)

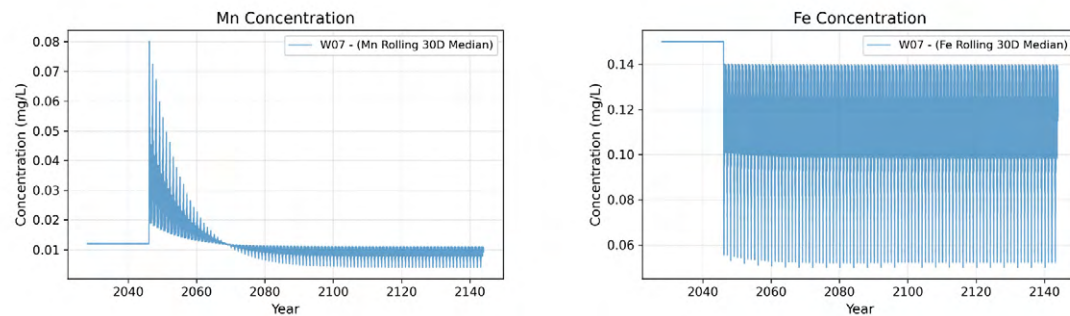


Figure 88: W07 - S3 (ELF ST +30%) - 30 day rolling median (Mn, Fe)

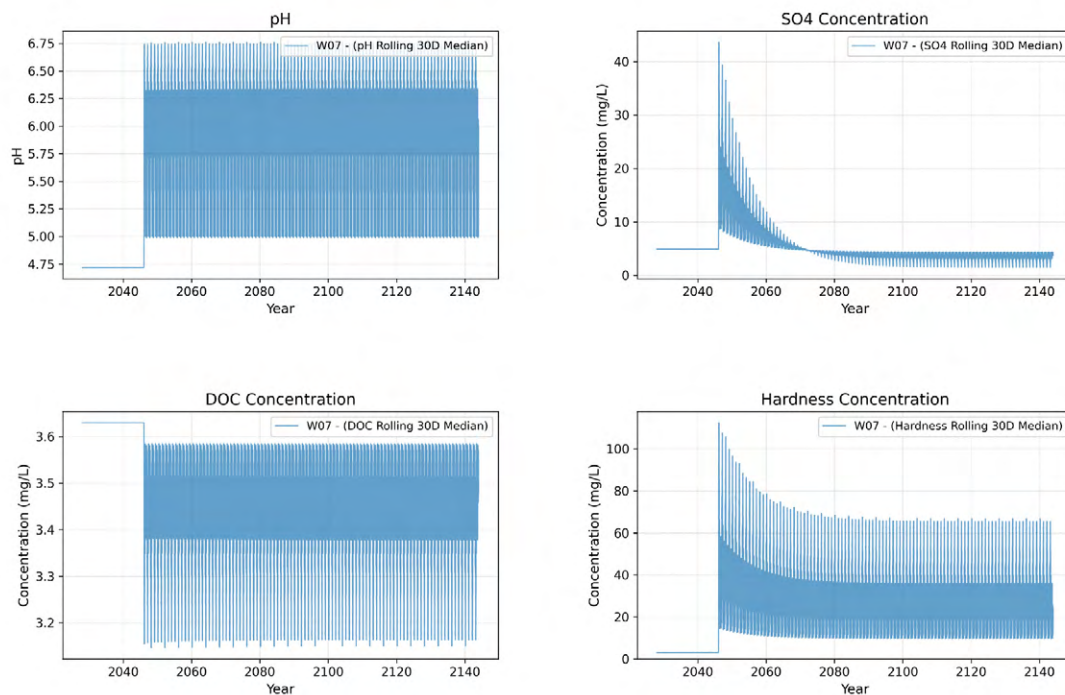


Figure 89: W07 - S4 (ELF ST -30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

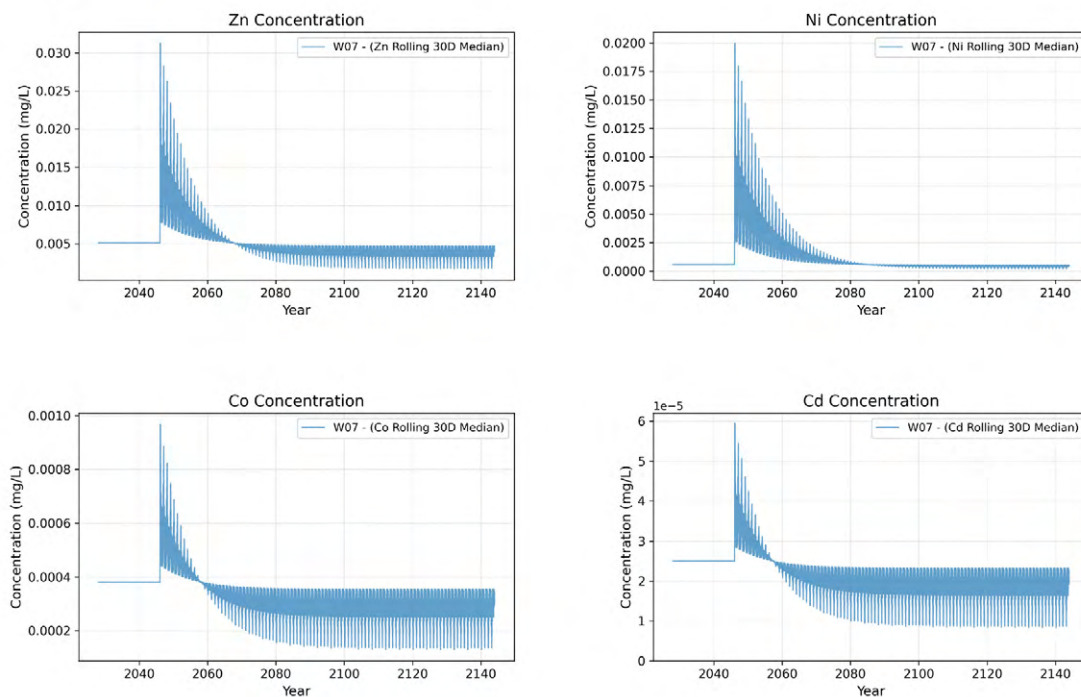


Figure 90: W07 - S4 (ELF ST -30%) - 30 day rolling median (Zn, Ni, Co, Cd)

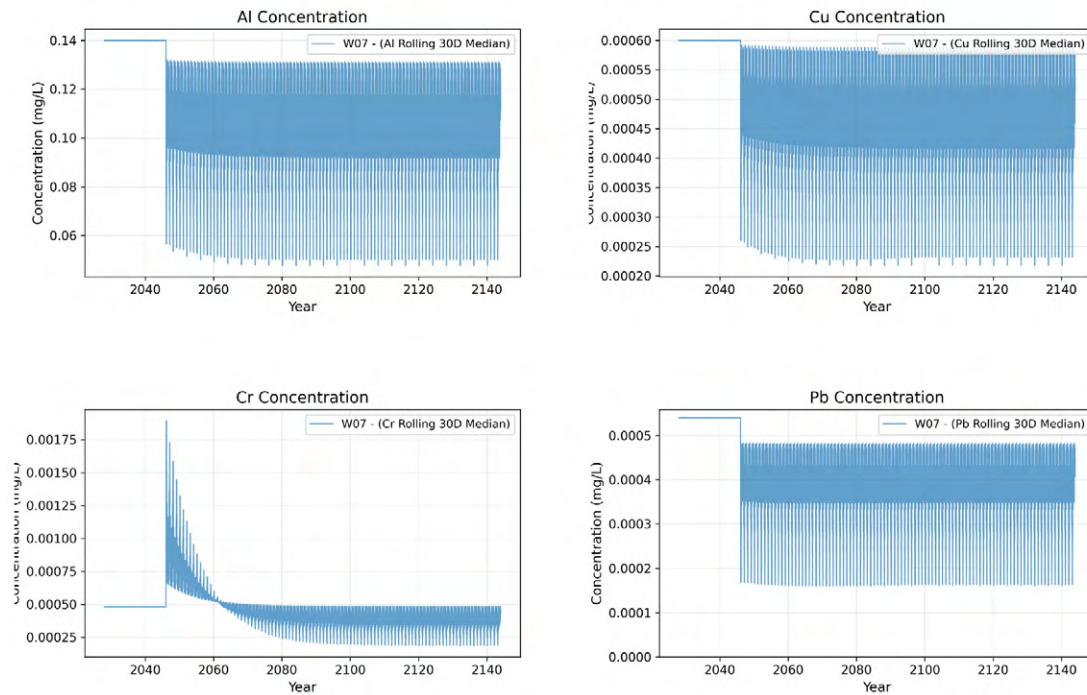


Figure 91: W07 - S4 (ELF ST -30%) - 30 day rolling median (Al, Cu, Cr, Pb)

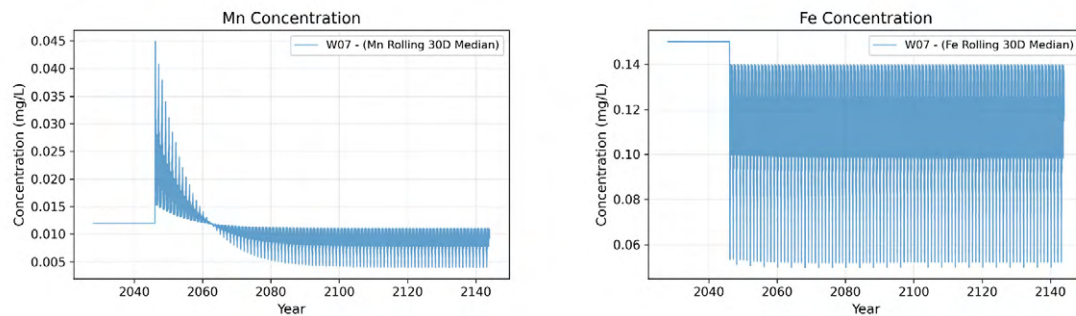
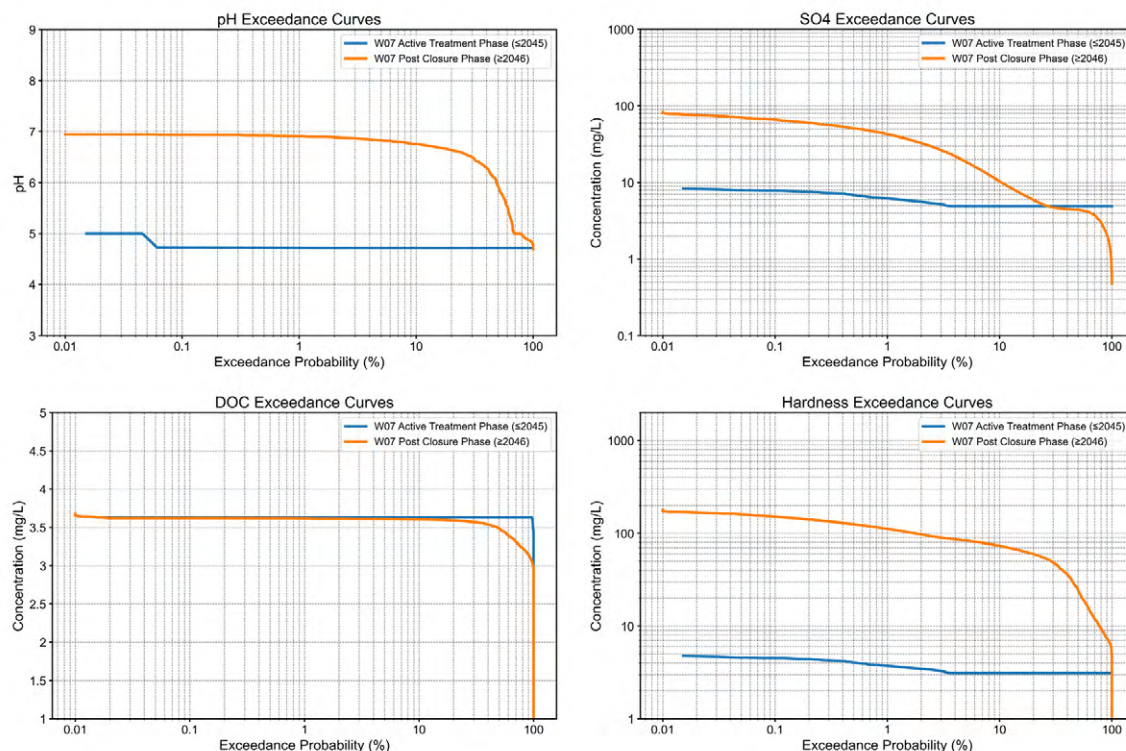
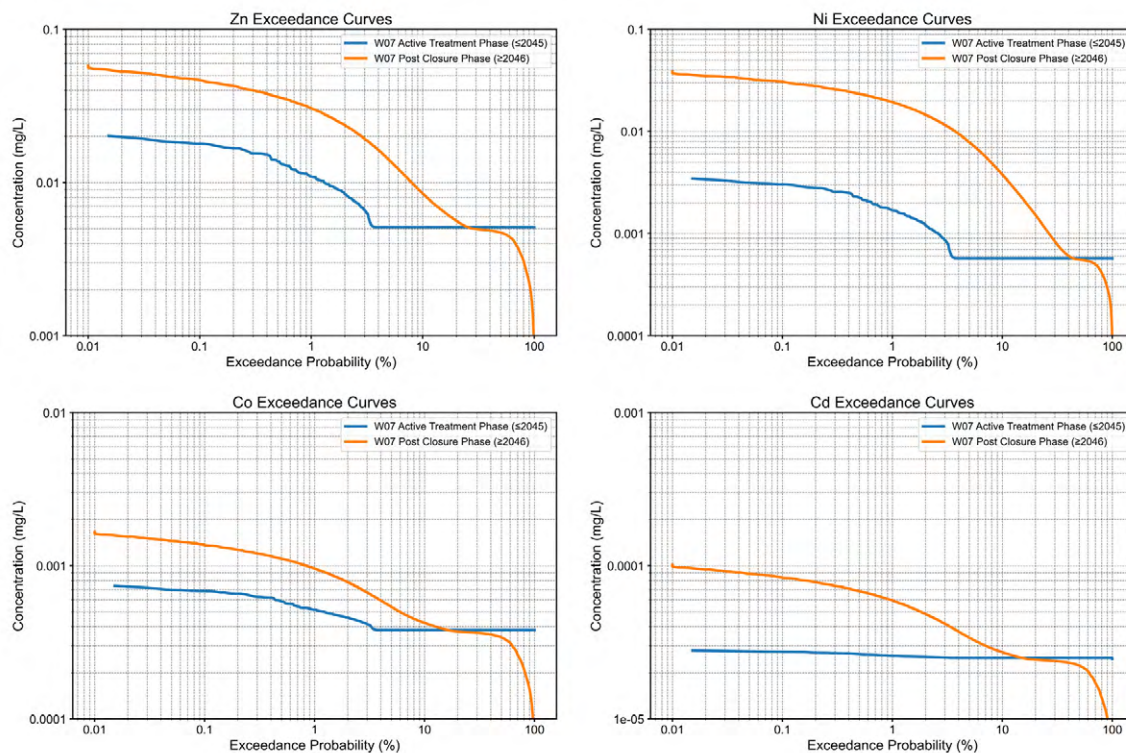


Figure 92: W07 - S4 (ELF ST -30%) - 30 day rolling median (Mn, Fe)

Probability Exceedance**Figure 93:** W07 - Base Case - Exceedance probability plots (pH, SO4, DOC, Hardness)**Figure 94:** W07 - Base Case - Exceedance probability plots (Zn, Ni, Co, Cd)

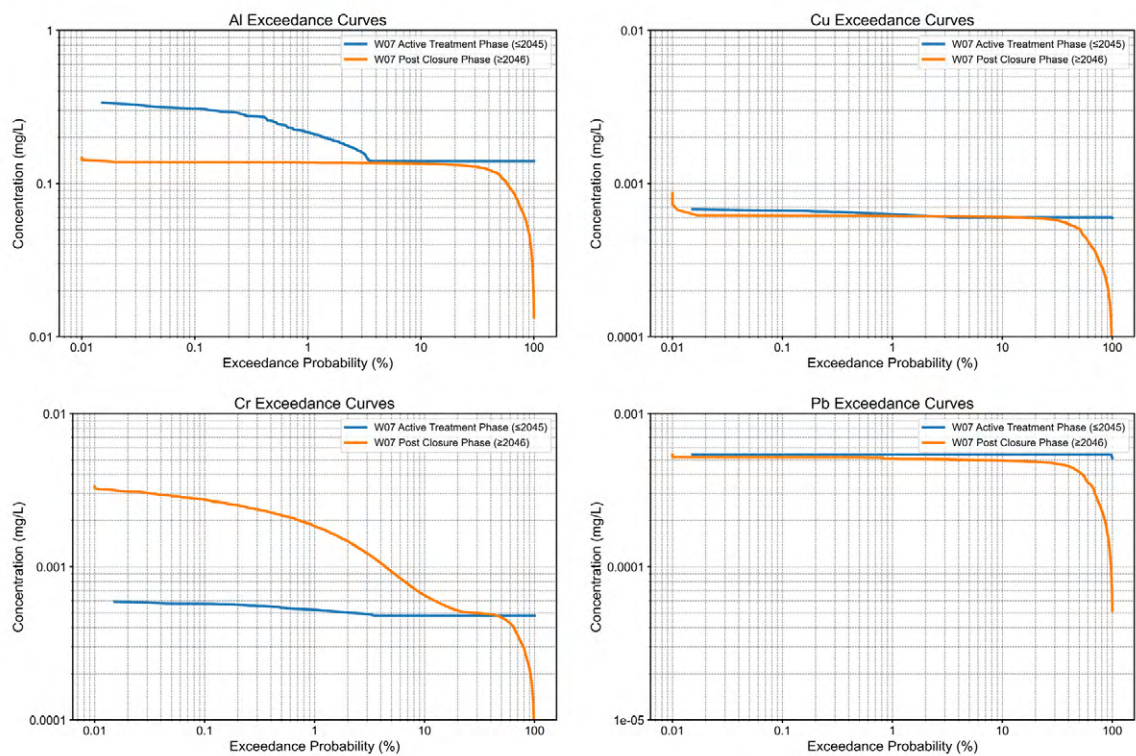


Figure 95: W07 - Base Case - Exceedance probability plots (Al, Cu, Cr, Pb)

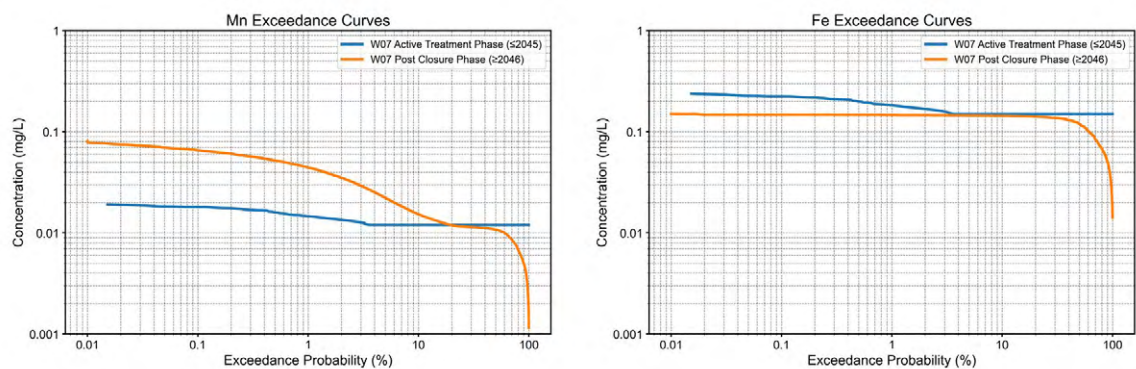
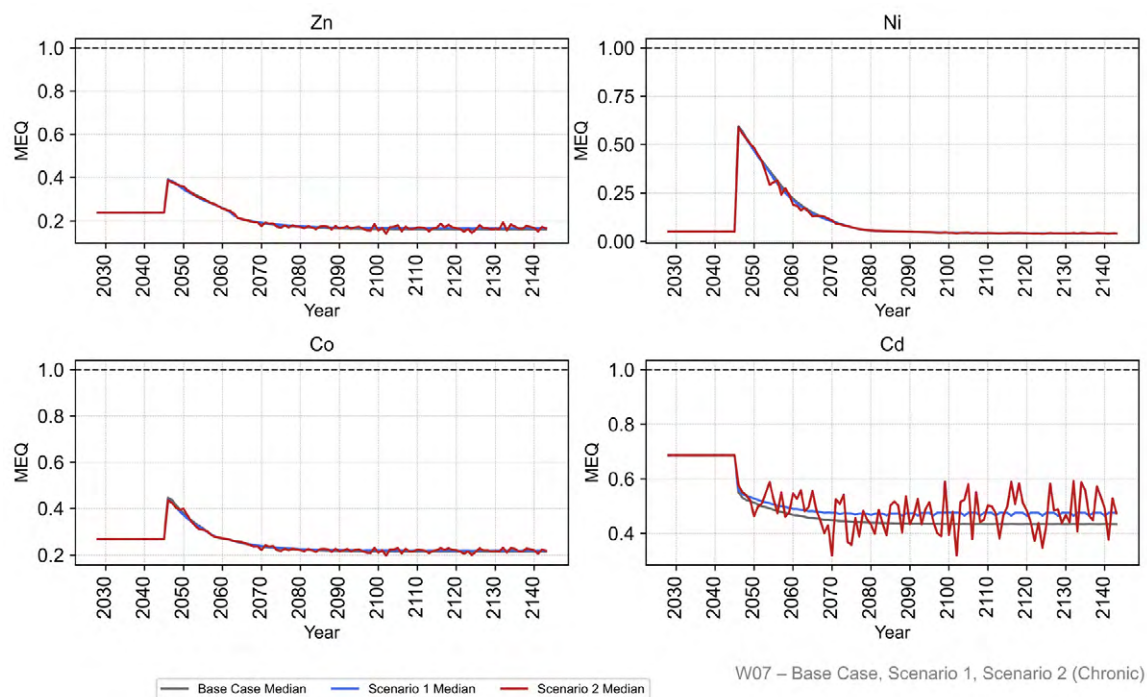
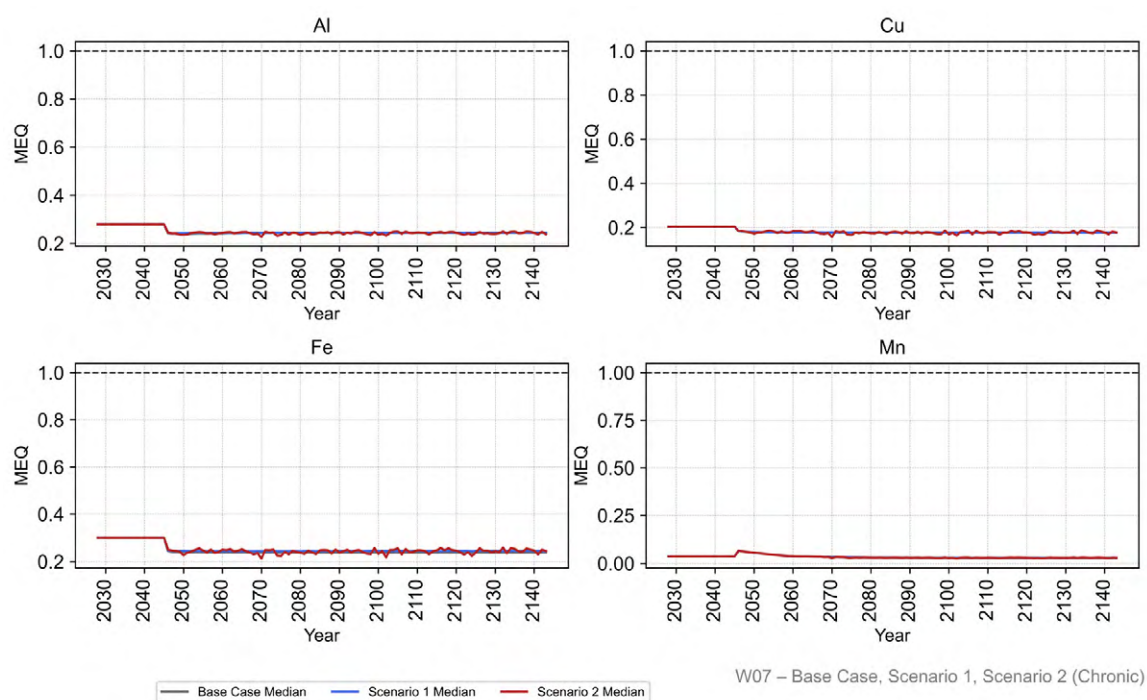


Figure 96: W07 - Base Case - Exceedance probability plots (Mn, Fe)

Compliance & WQ Standards**Figure 97:** W07 - Rainfall Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)**Figure 98:** W07 - Rainfall Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

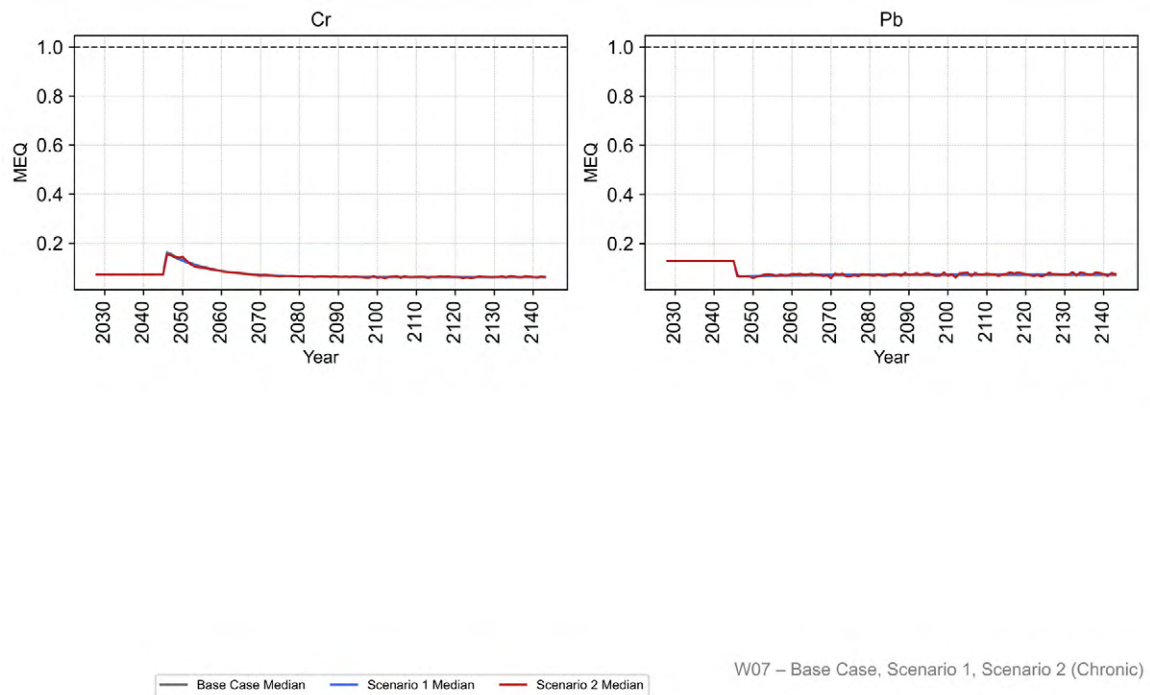


Figure 99: W07 - Rainfall Scenarios - Chronic criteria compliance (Cr, Pb)

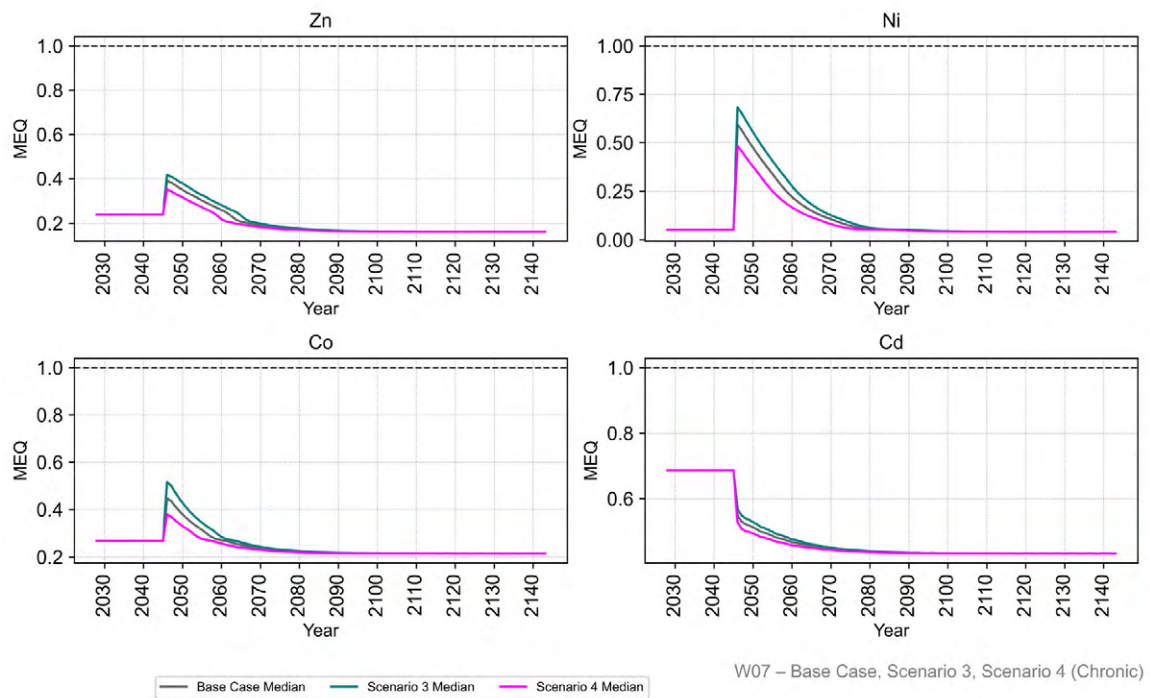


Figure 100: W07 - Source Term Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)

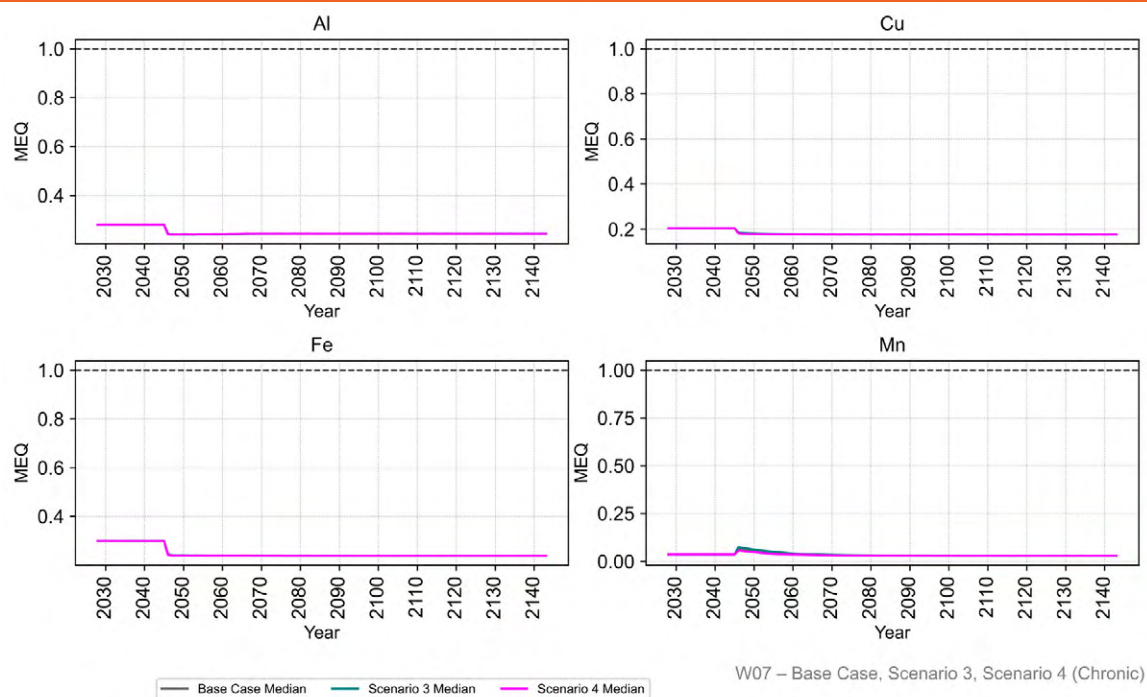


Figure 101: W07 - Source Term Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

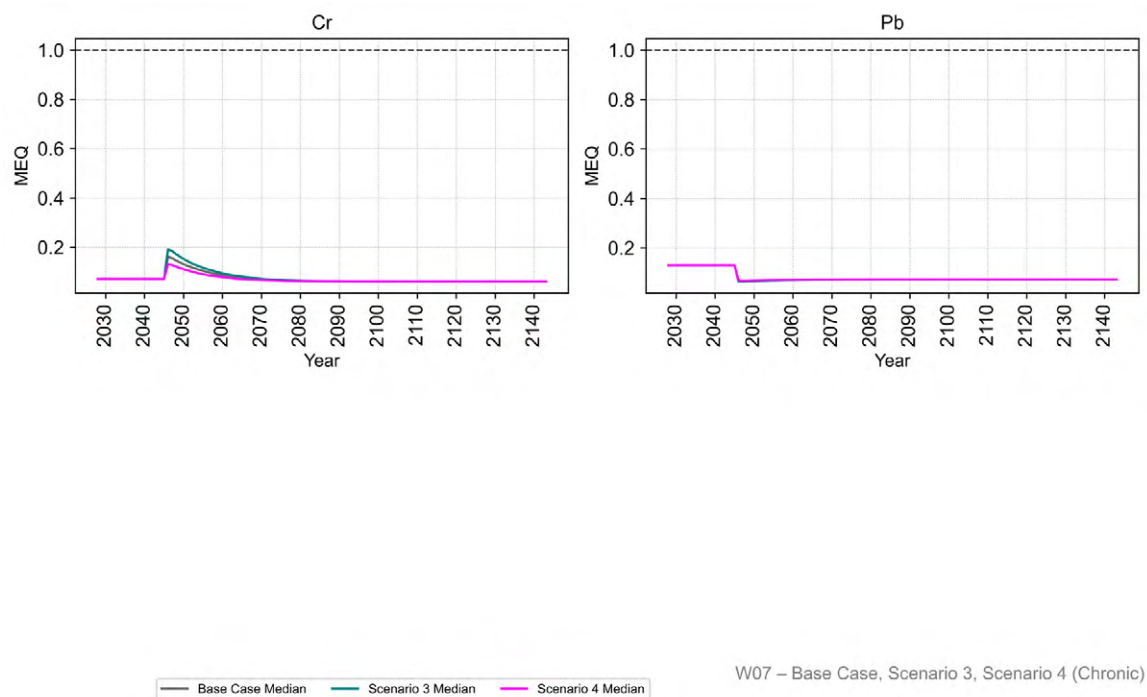


Figure 102: W07 - Source Term Scenarios - Chronic criteria compliance (Cr, Pb)

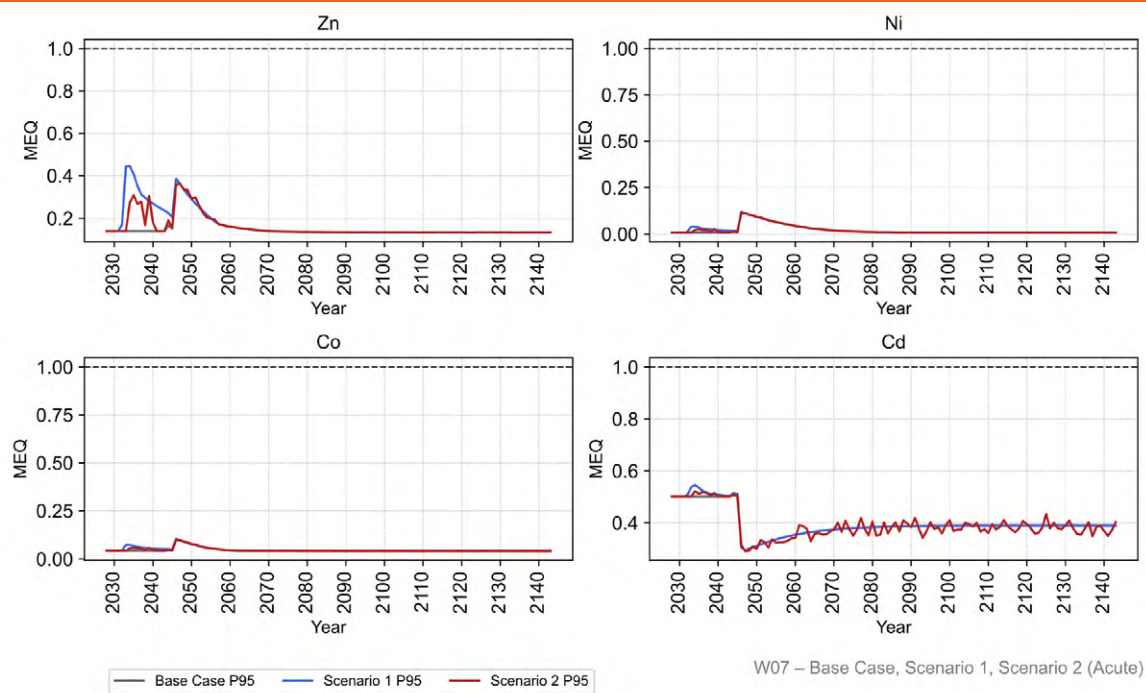


Figure 103: W07 - Rainfall Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

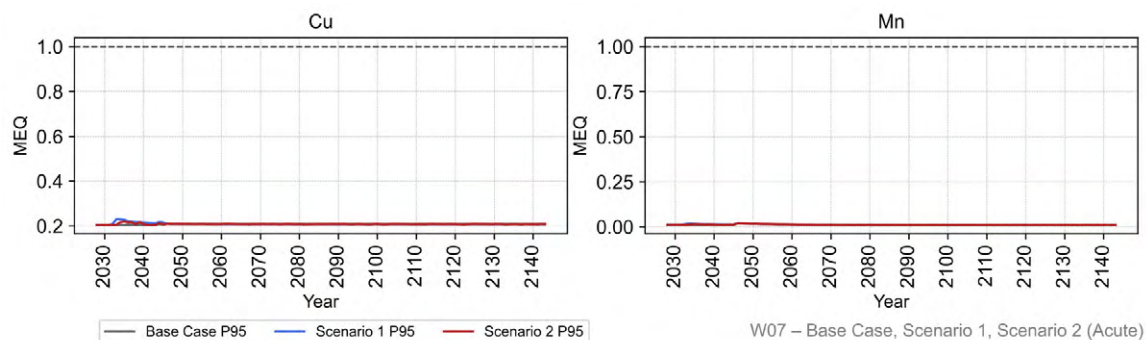


Figure 104: W07 - Rainfall Scenarios - Acute criteria compliance (Cu, Mn)

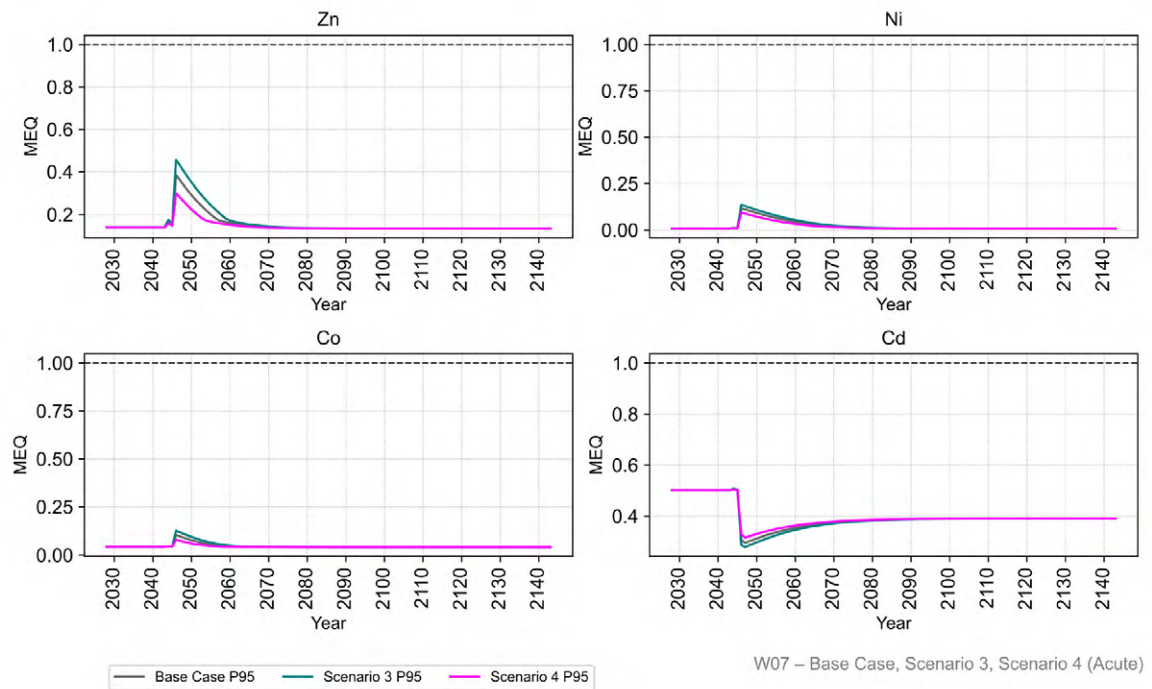


Figure 105: W07 - Source Term Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

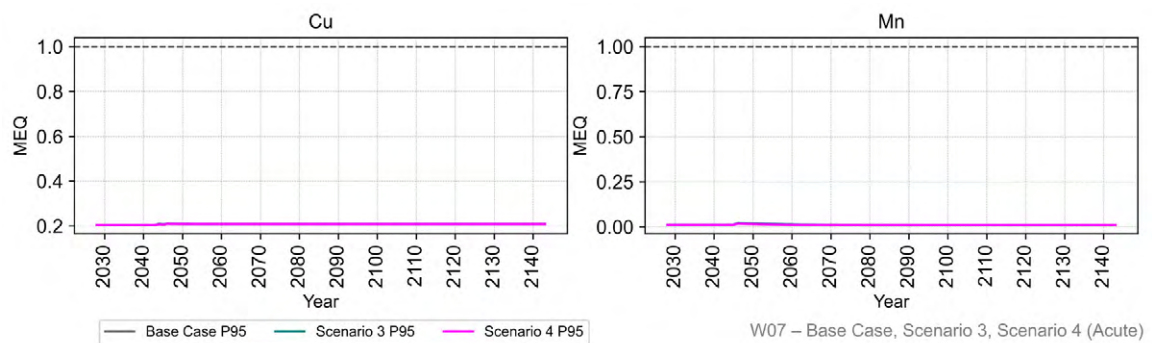


Figure 106: W07 - Source Term Scenarios - Acute criteria compliance (Cu, Mn)

Exceedance Frequencies

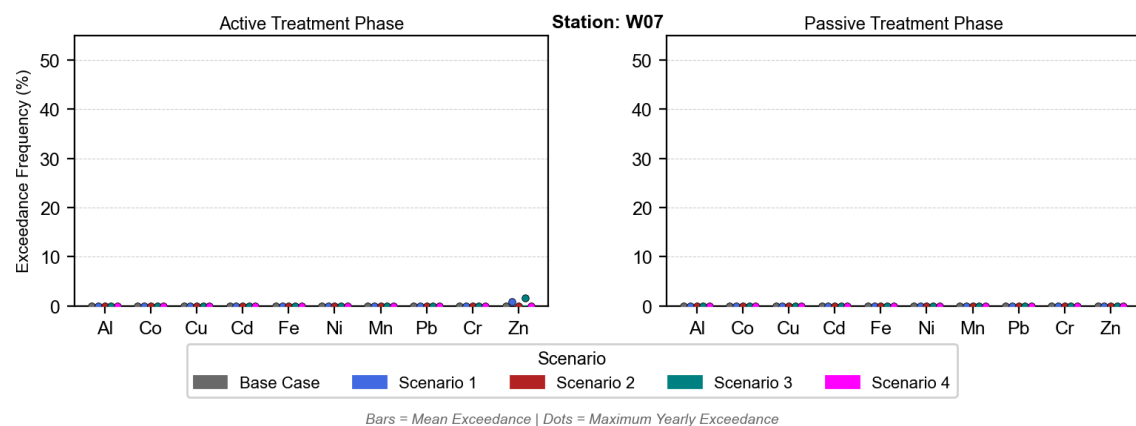
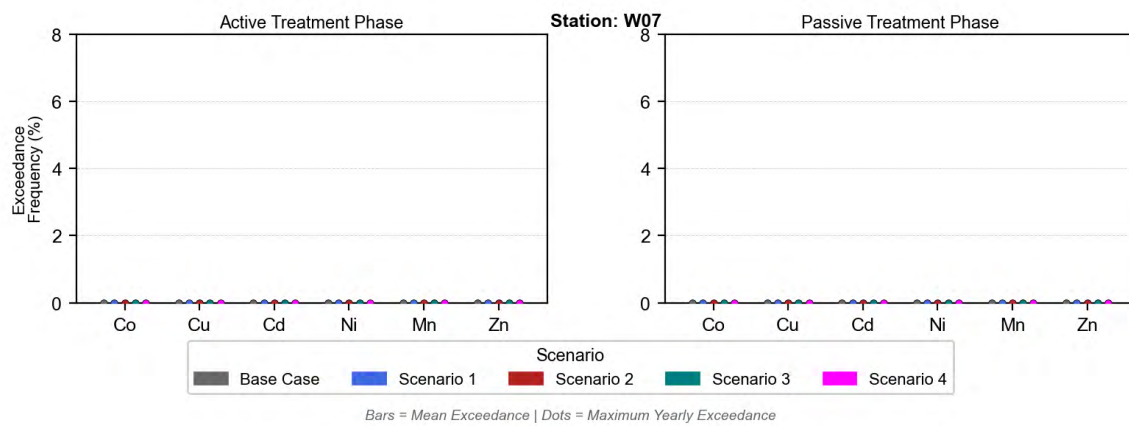


Figure 107: W07 - Chronic exceedance frequencies**Figure 108: W07 - Acute exceedance frequencies**

4. STATION V37_F

Overview & Trends

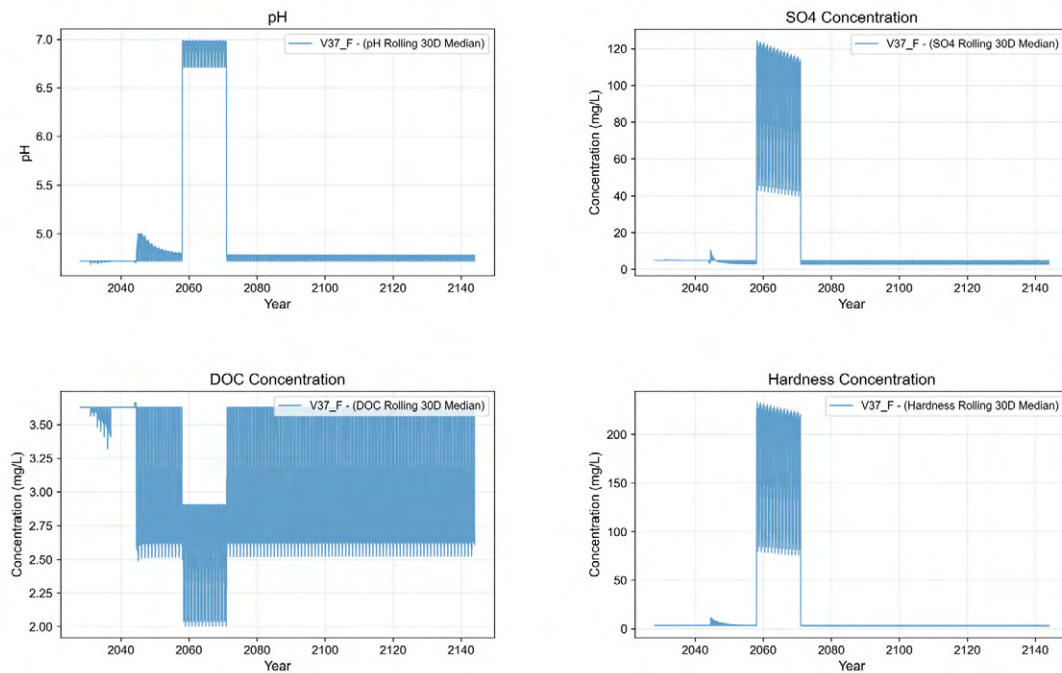


Figure 109: V37_F - Base Case - 30 day rolling median (pH, SO4, DOC, Hardness)

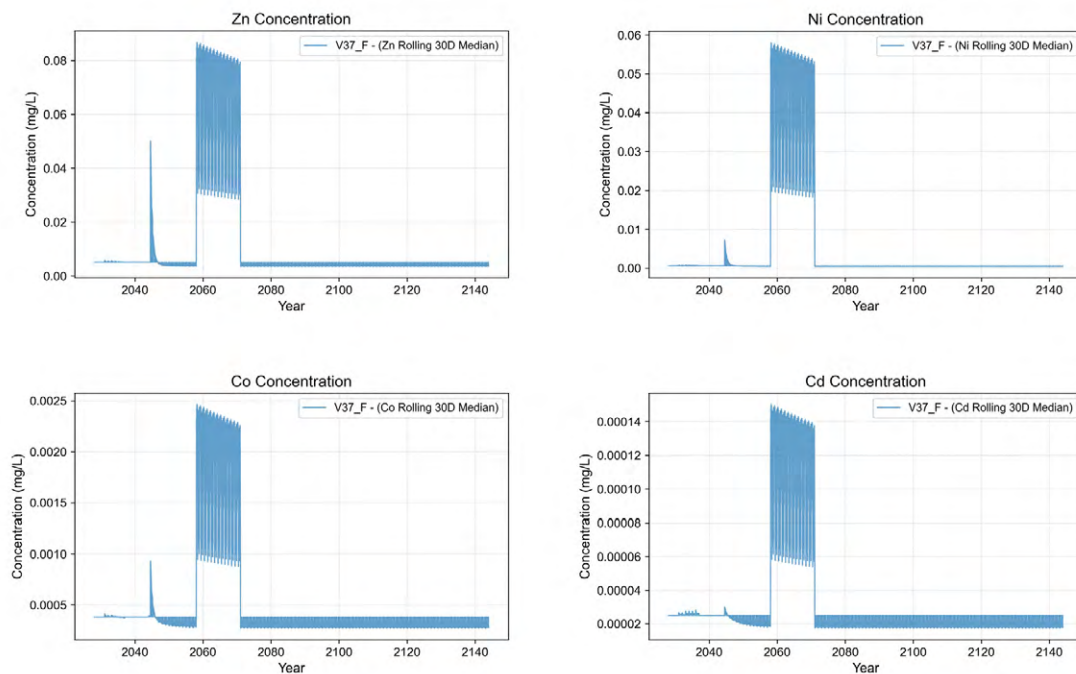


Figure 110: V37_F - Base Case - 30 day rolling median (Zn, Ni, Co, Cd)

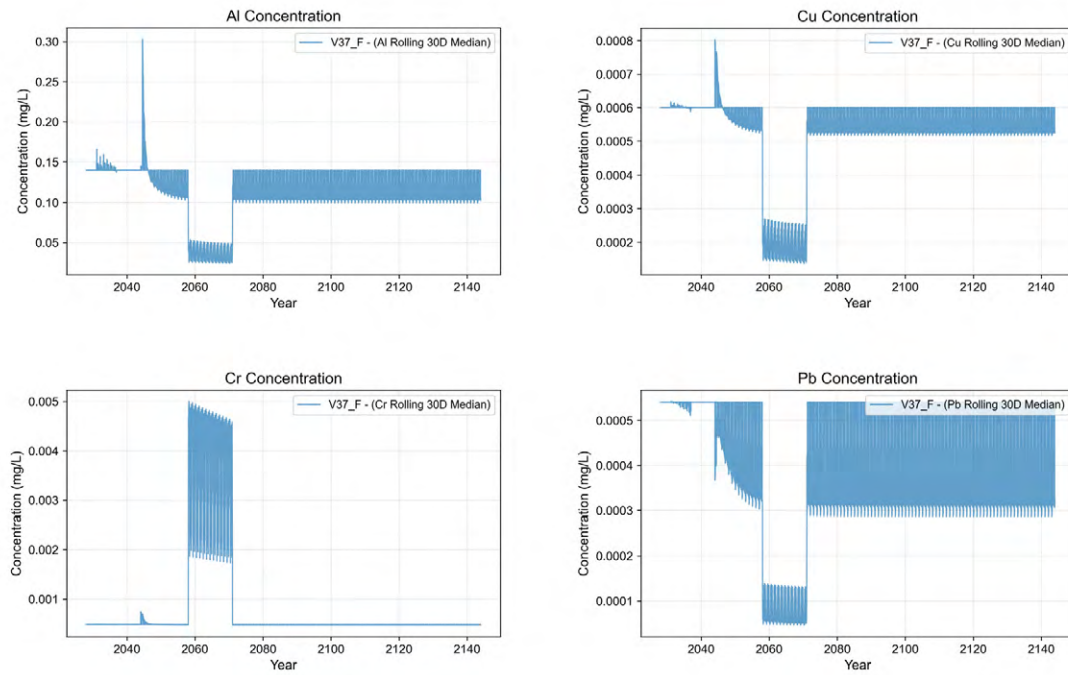


Figure 111: V37_F - Base Case - 30 day rolling median (Al, Cu, Cr, Pb)

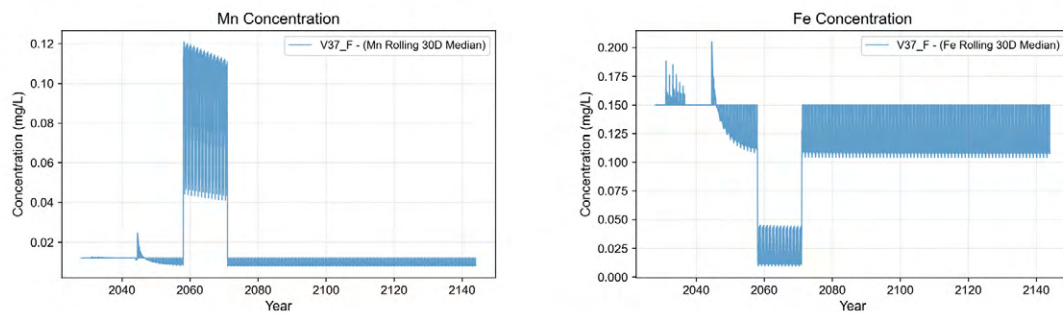


Figure 112: V37_F - Base Case - 30 day rolling median (Mn, Fe)

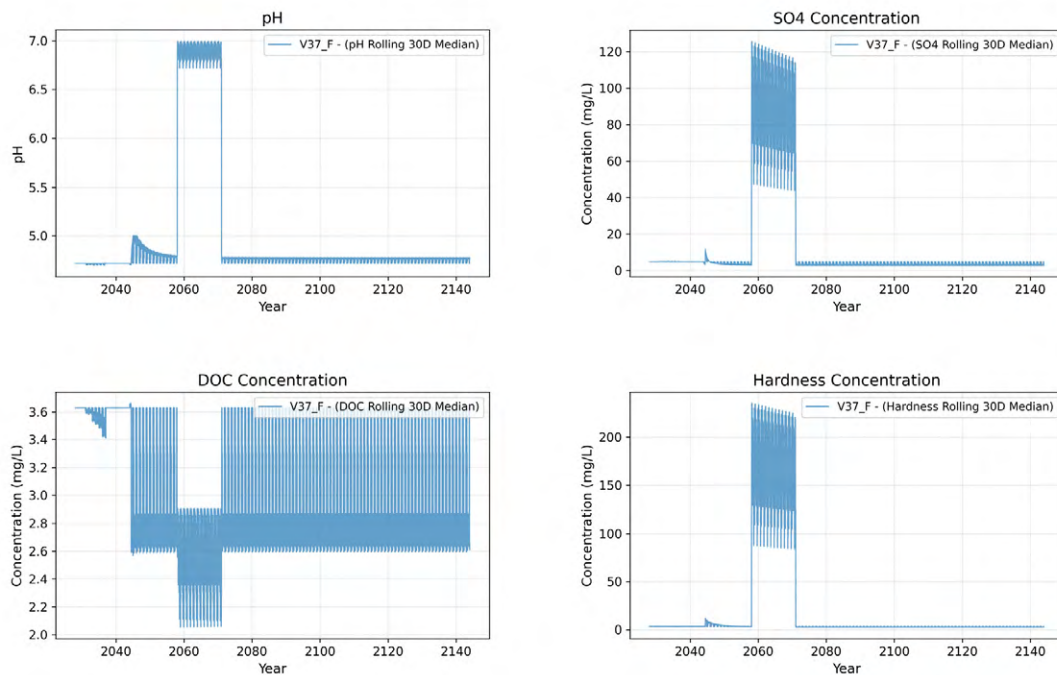


Figure 113: V37_F - S1 (High Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

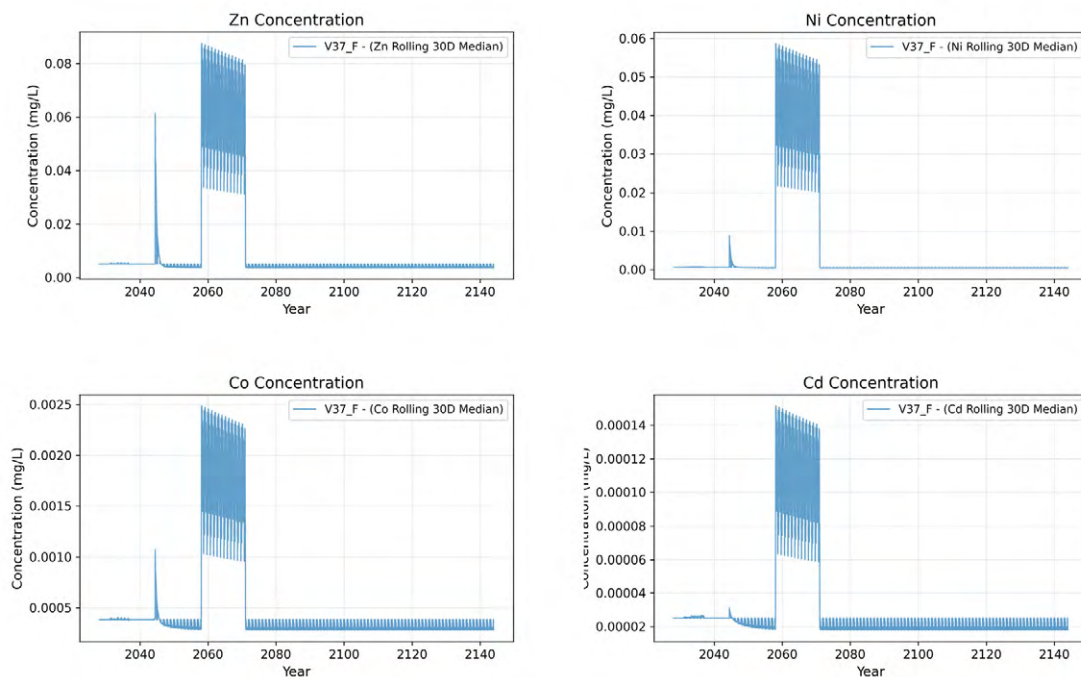


Figure 114: V37_F - S1 (High Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

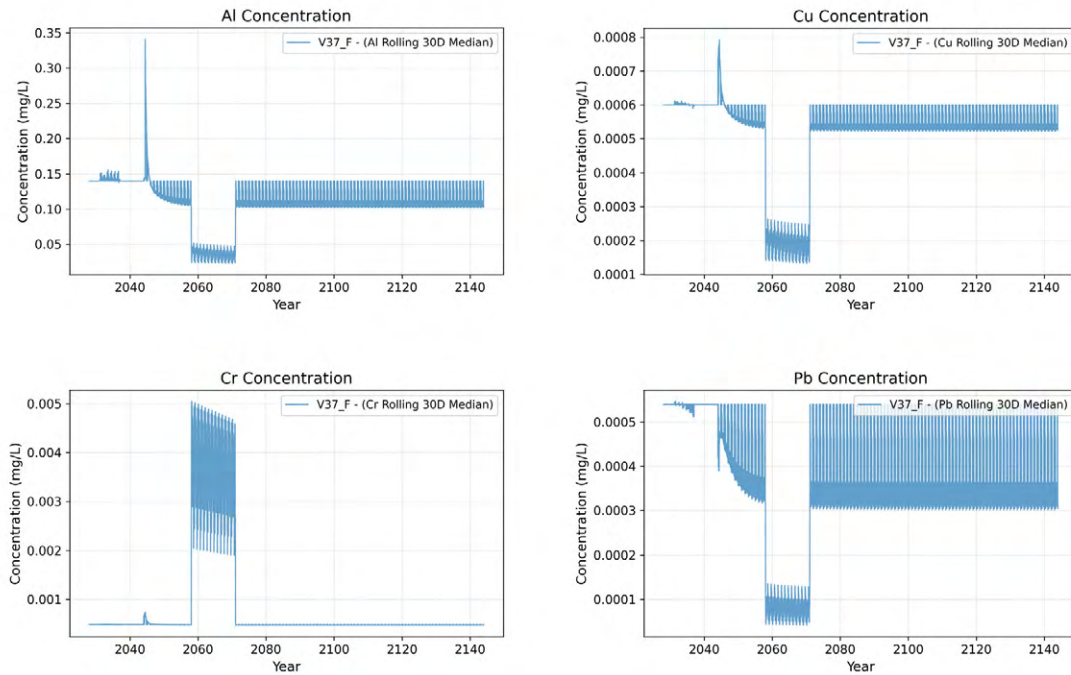


Figure 115: V37_F - S1 (High Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

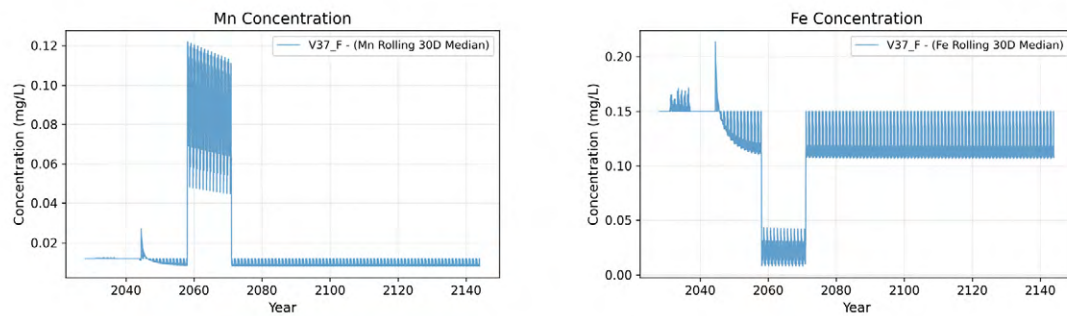


Figure 116: V37_F - S1 (High Rainfall) - 30 day rolling median (Mn, Fe)

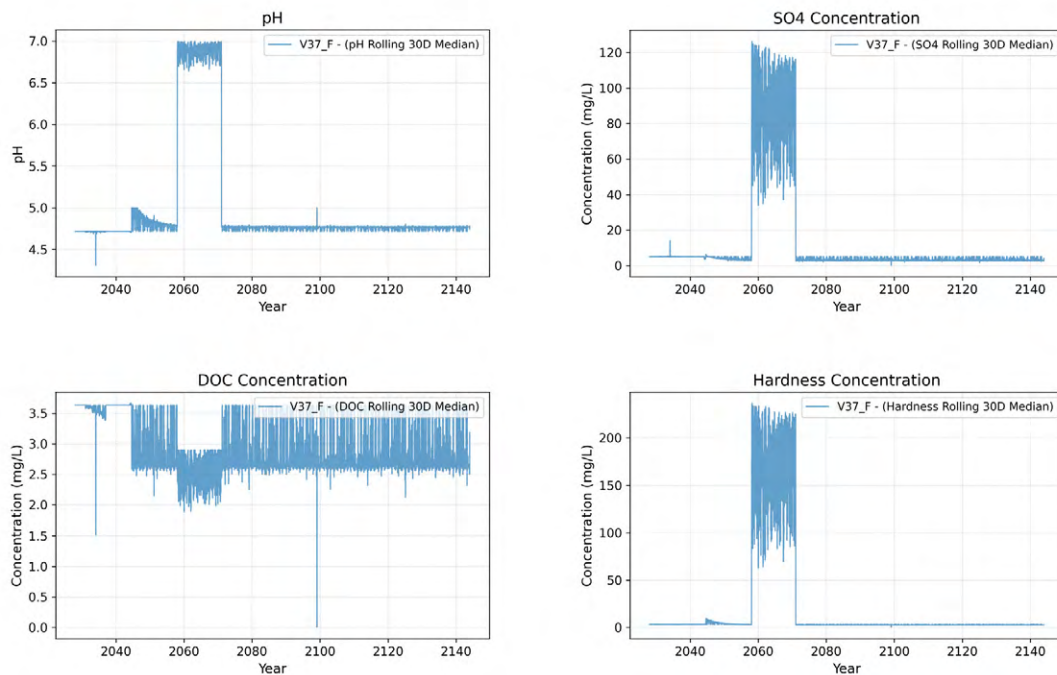


Figure 117: V37_F - S2 (Stochastic Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

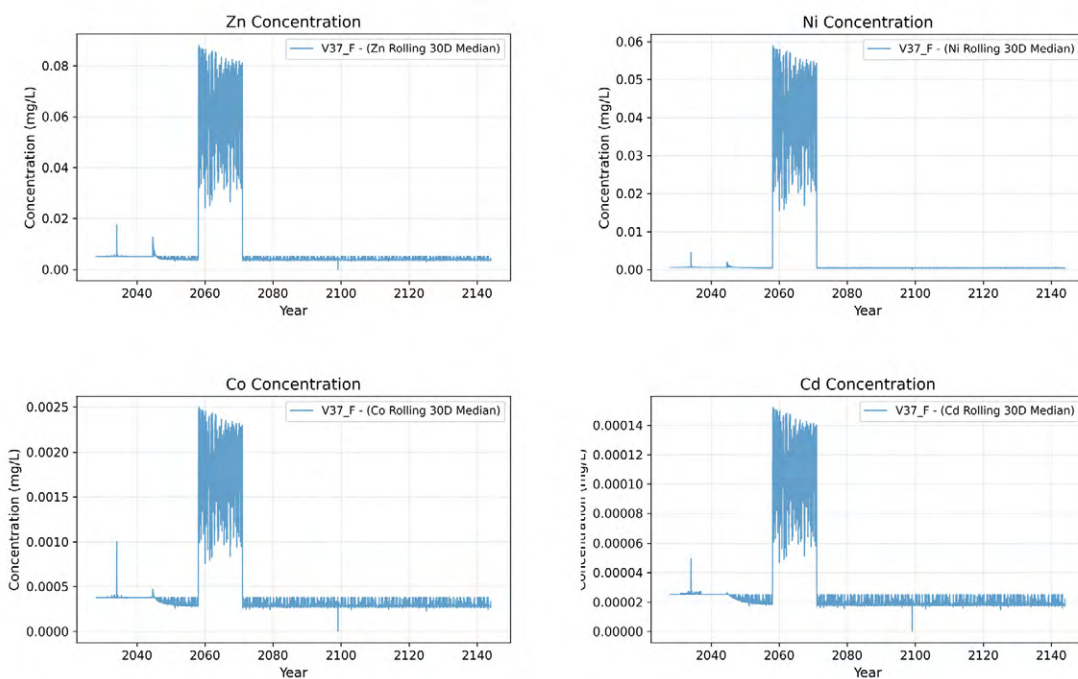


Figure 118: V37_F - S2 (Stochastic Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

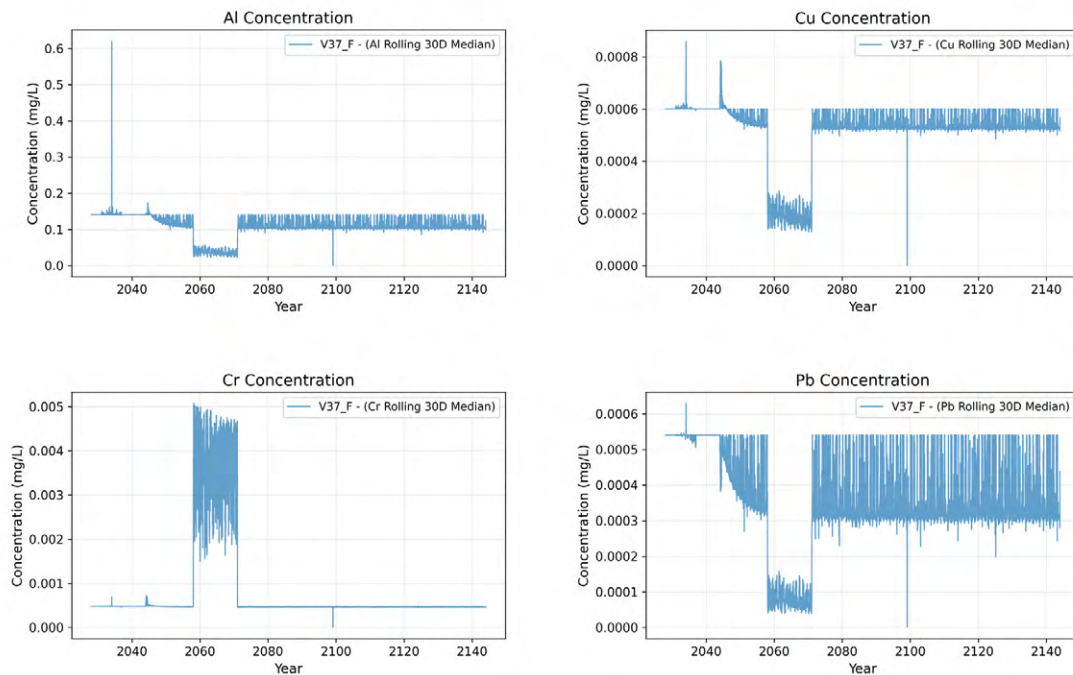


Figure 119: V37_F - S2 (Stochastic Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

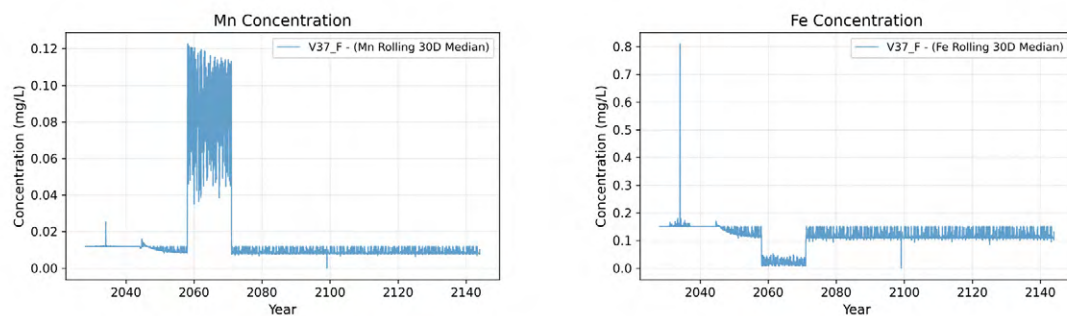


Figure 120: V37_F - S2 (Stochastic Rainfall) - 30 day rolling median (Mn, Fe)

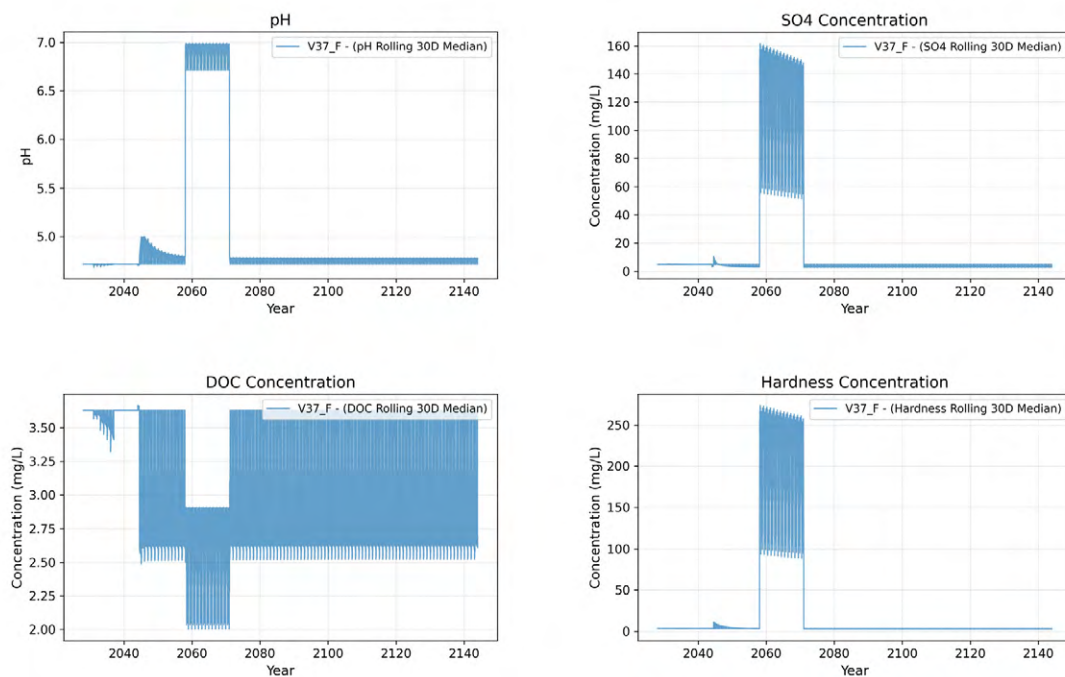


Figure 121: V37_F - S3 (ELF ST +30%) - 30 day rolling median (pH, SO₄, DOC, Hardness)

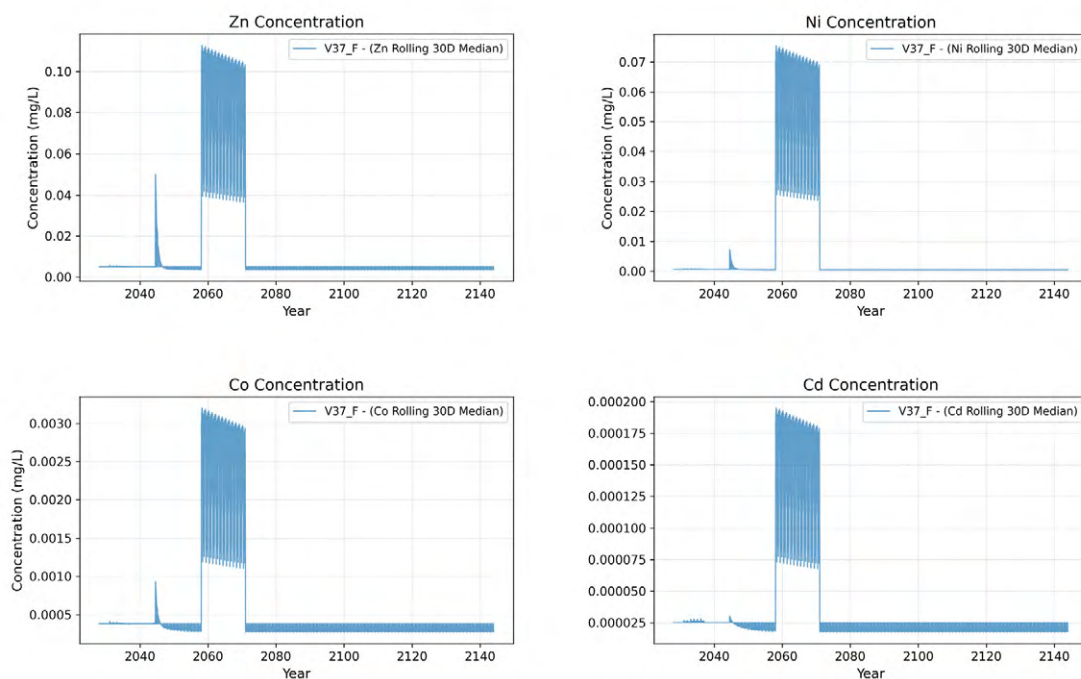


Figure 122: V37_F - S3 (ELF ST +30%) - 30 day rolling median (Zn, Ni, Co, Cd)

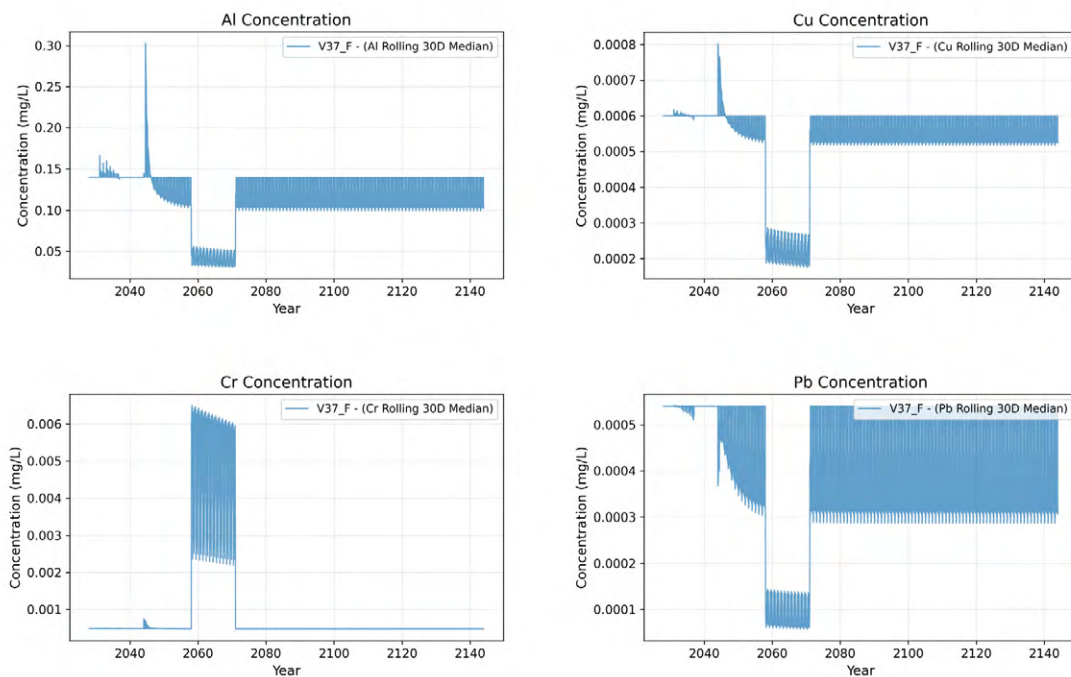


Figure 123: V37_F - S3 (ELF ST +30%) - 30 day rolling median (Al, Cu, Cr, Pb)

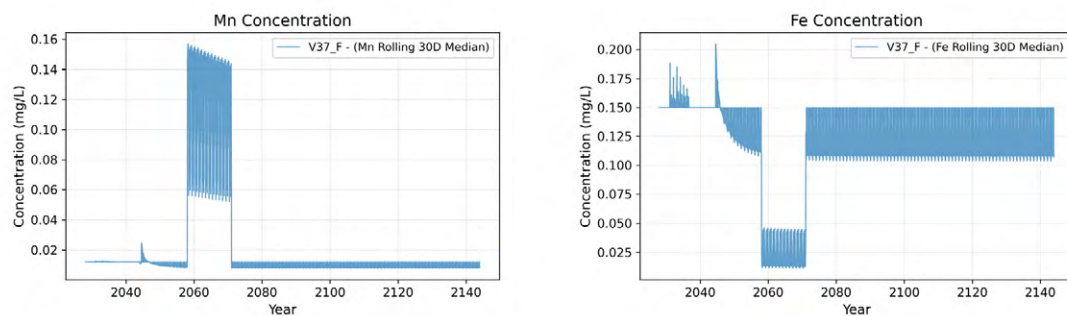


Figure 124: V37_F - S3 (ELF ST +30%) - 30 day rolling median (Mn, Fe)

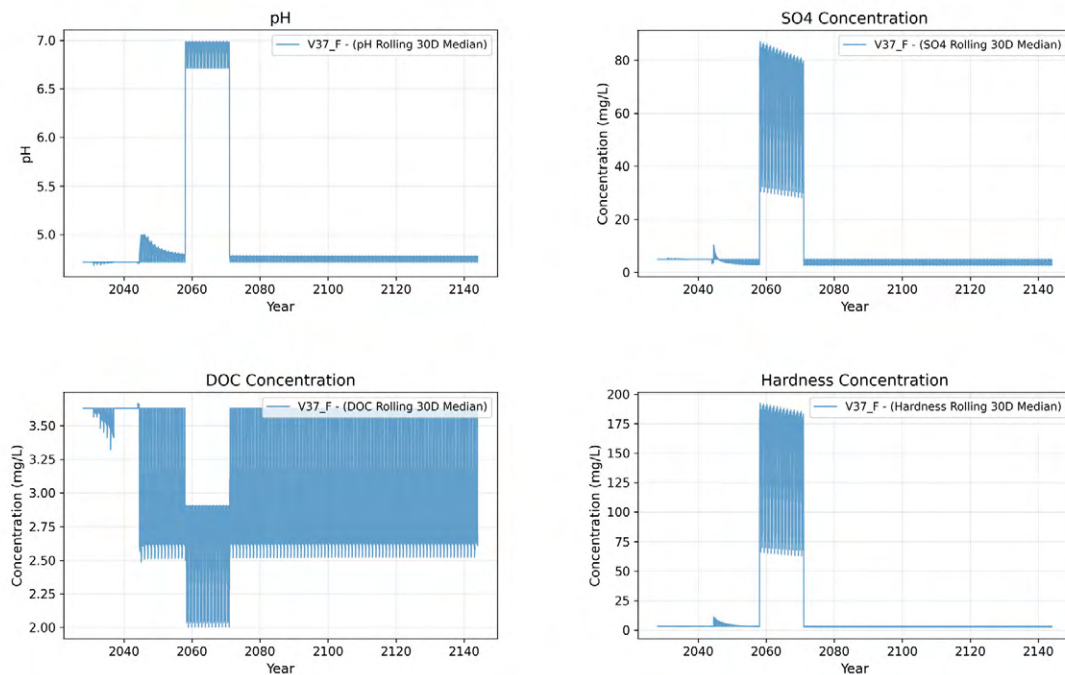


Figure 125: V37_F - S4 (ELF ST -30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

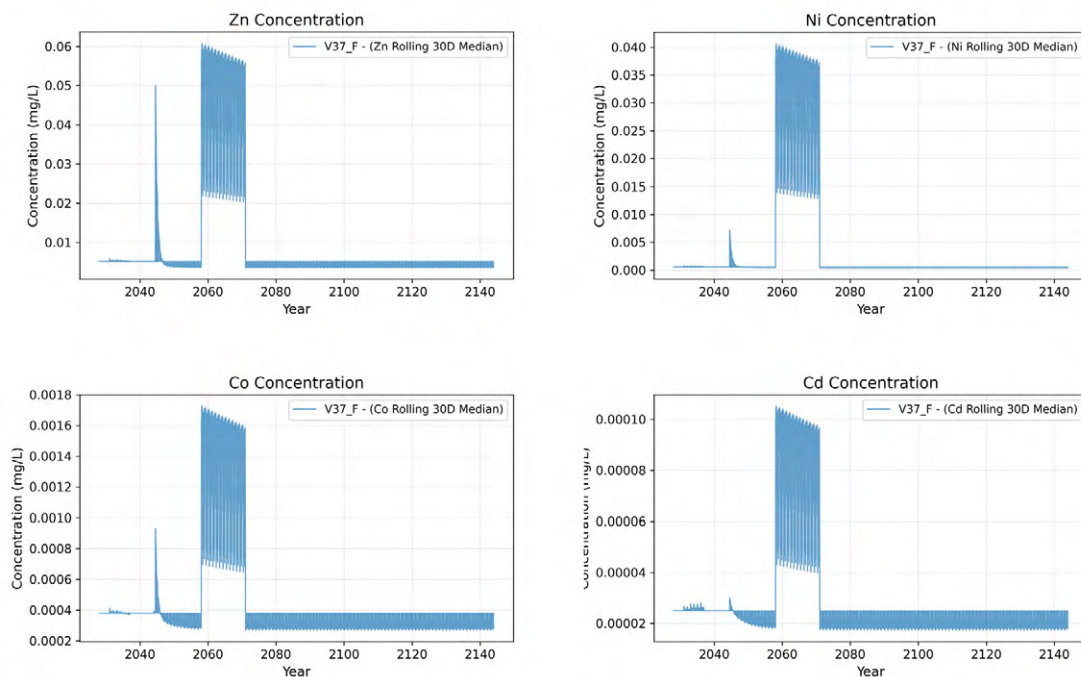


Figure 126: V37_F - S4 (ELF ST -30%) - 30 day rolling median (Zn, Ni, Co, Cd)

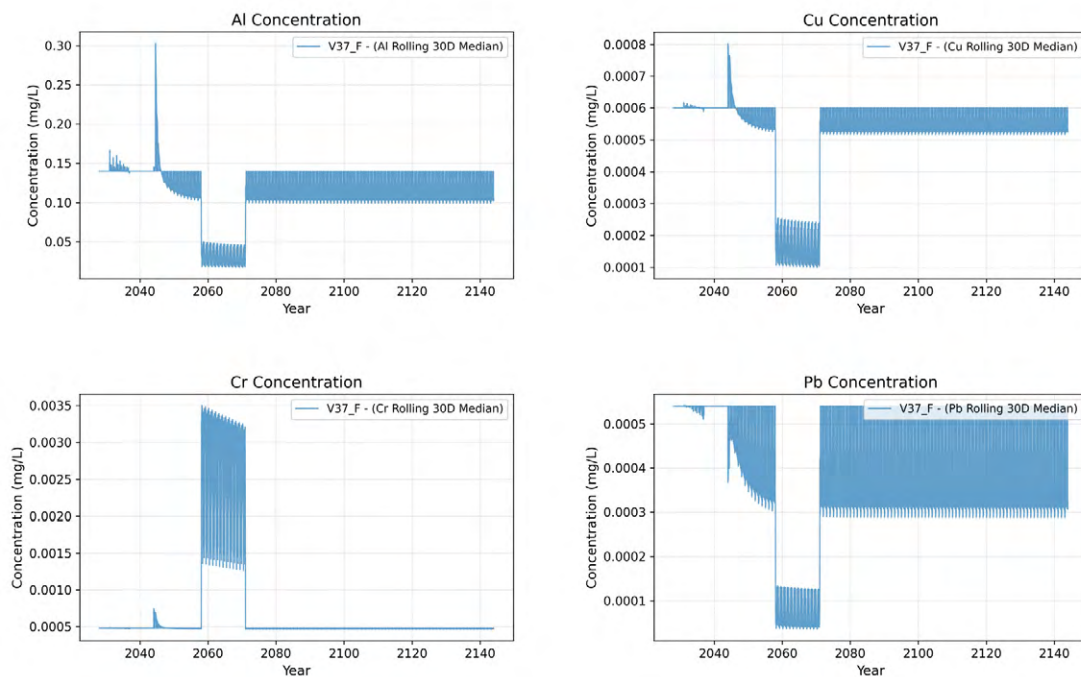


Figure 127: V37_F - S4 (ELF ST -30%) - 30 day rolling median (Al, Cu, Cr, Pb)

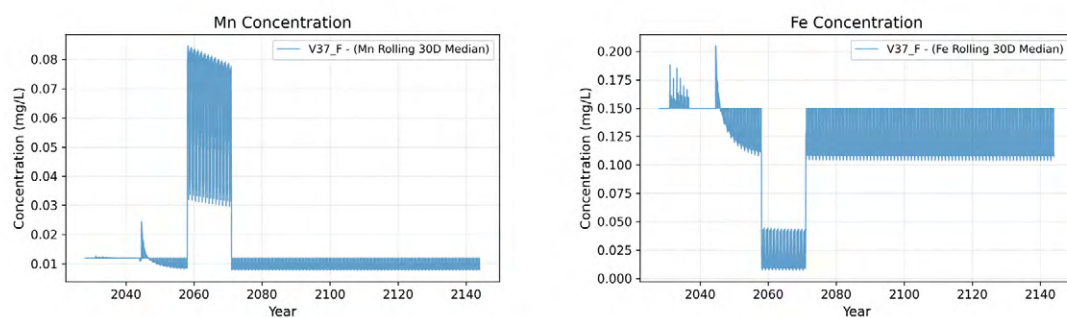
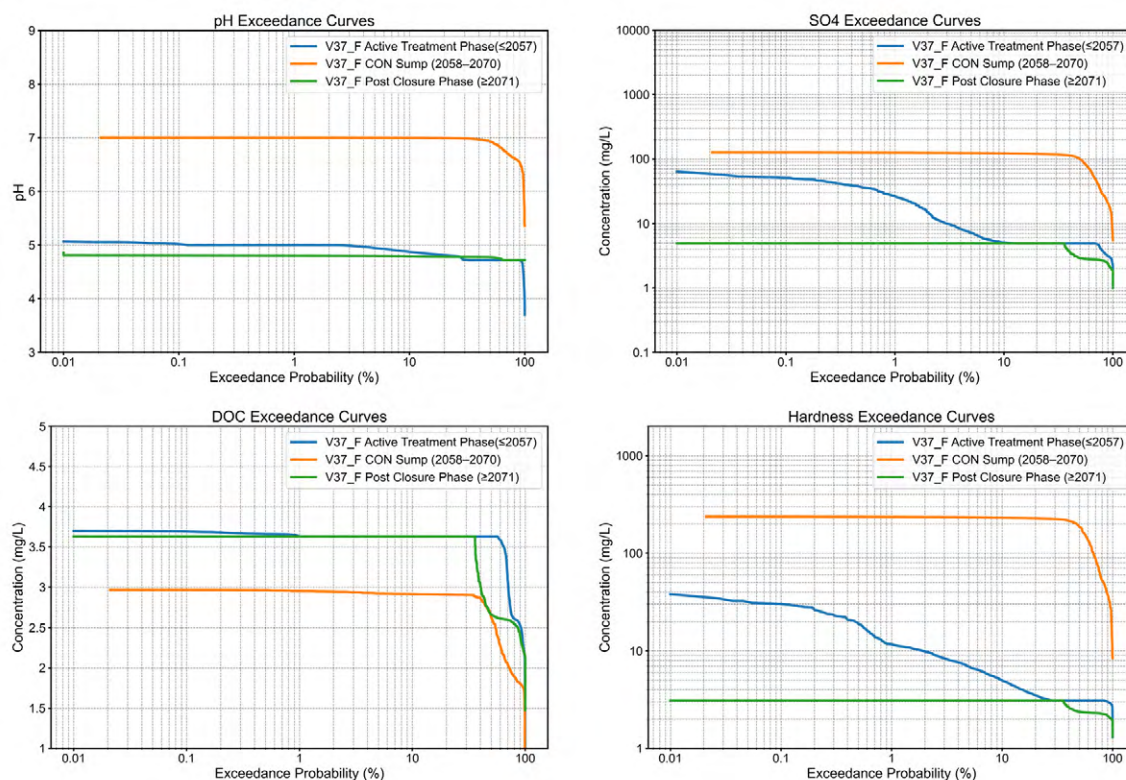
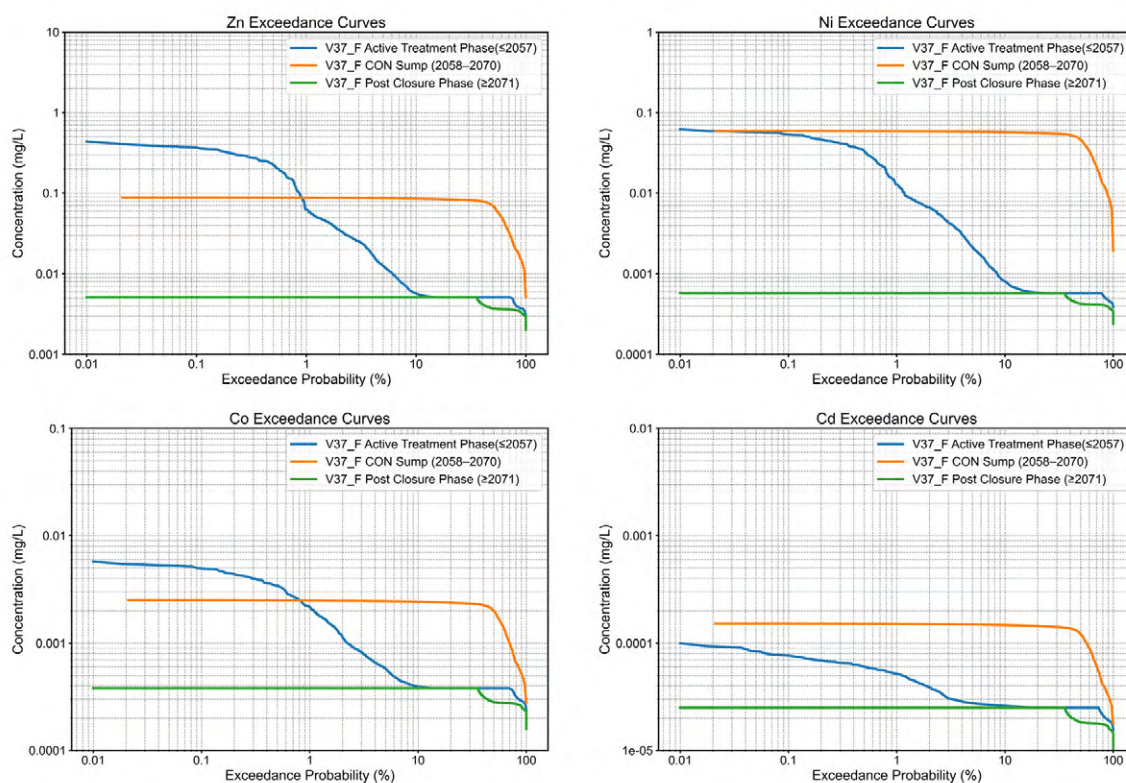


Figure 128: V37_F - S4 (ELF ST -30%) - 30 day rolling median (Mn, Fe)

Probability Exceedance**Figure 129:** V37_F - Base Case - Exceedance probability plots (pH, SO₄, DOC, Hardness)**Figure 130:** V37_F - Base Case - Exceedance probability plots (Zn, Ni, Co, Cd)

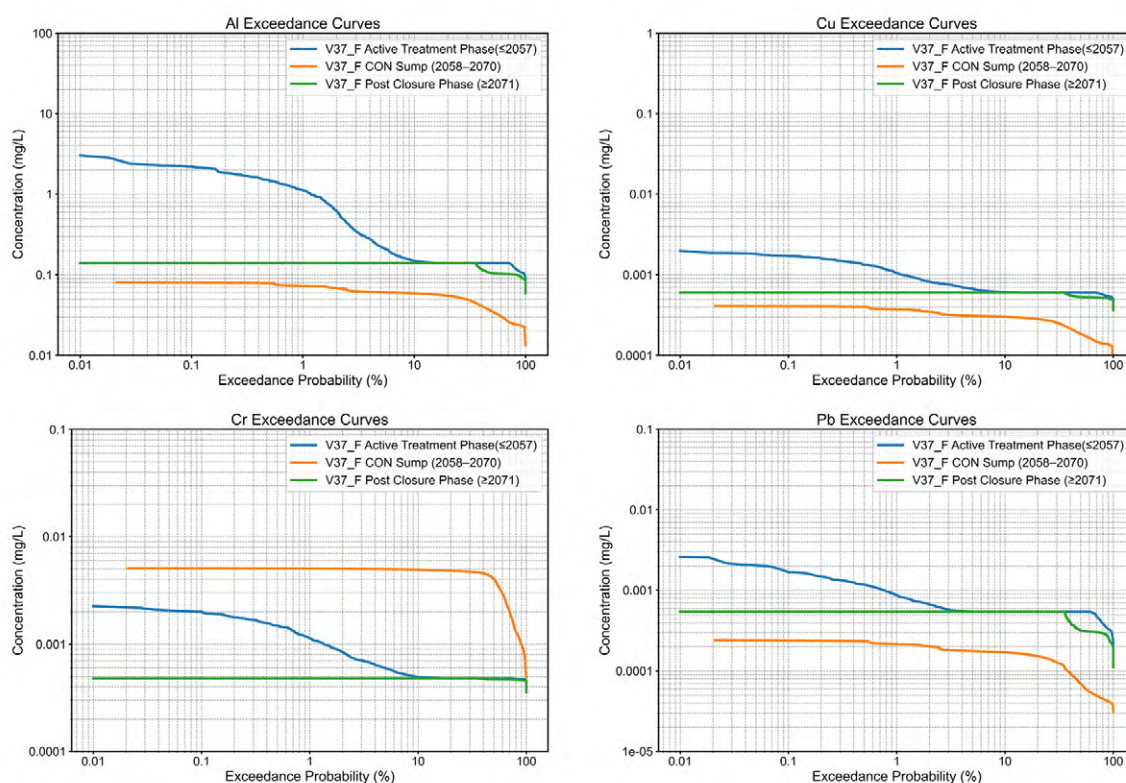


Figure 131: V37_F - Base Case - Exceedance probability plots (Al, Cu, Cr, Pb)

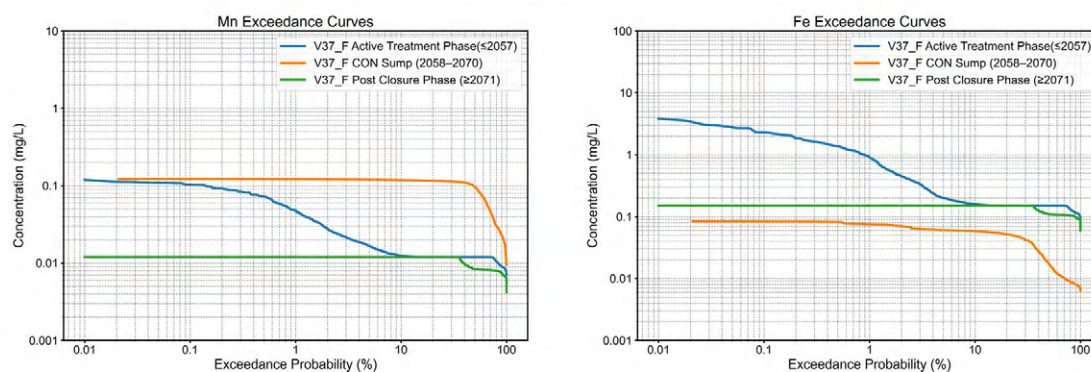
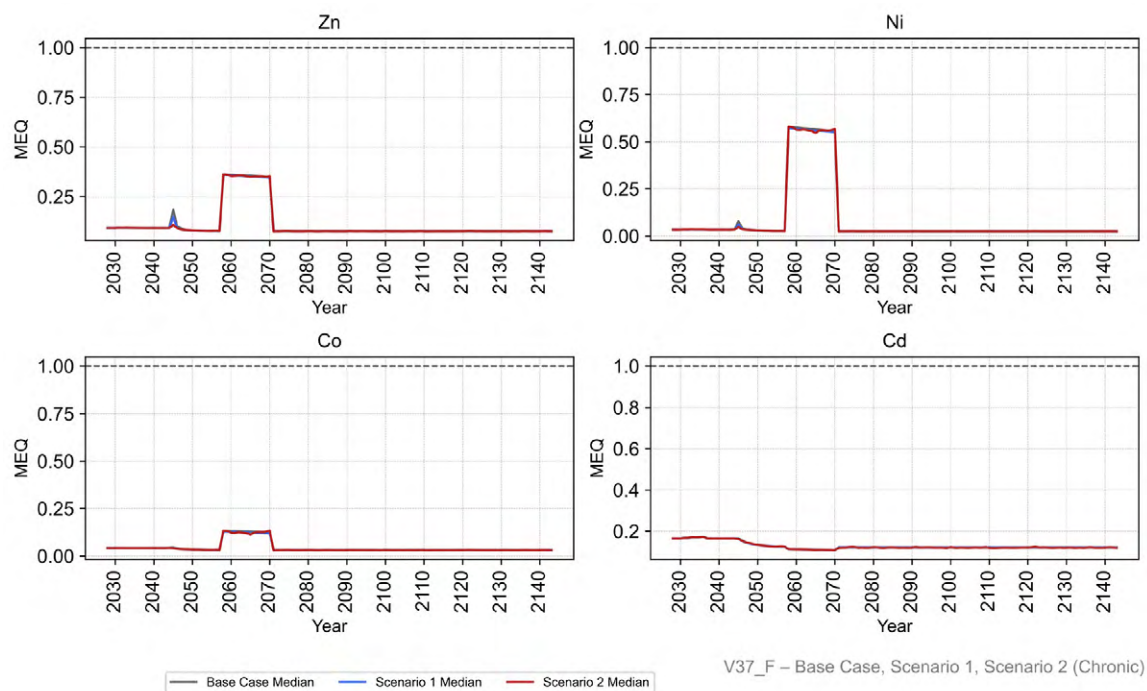
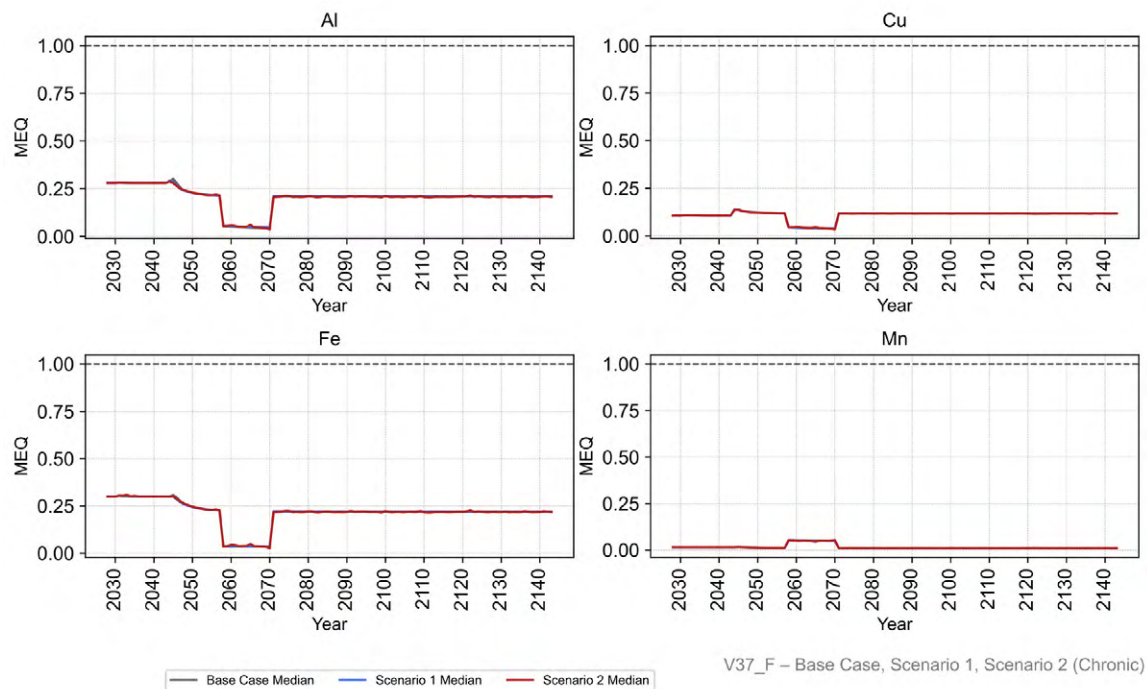


Figure 132: V37_F - Base Case - Exceedance probability plots (Mn, Fe)

Compliance & WQ Standards**Figure 133: V37_F - Rainfall Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)****Figure 134: V37_F - Rainfall Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)**

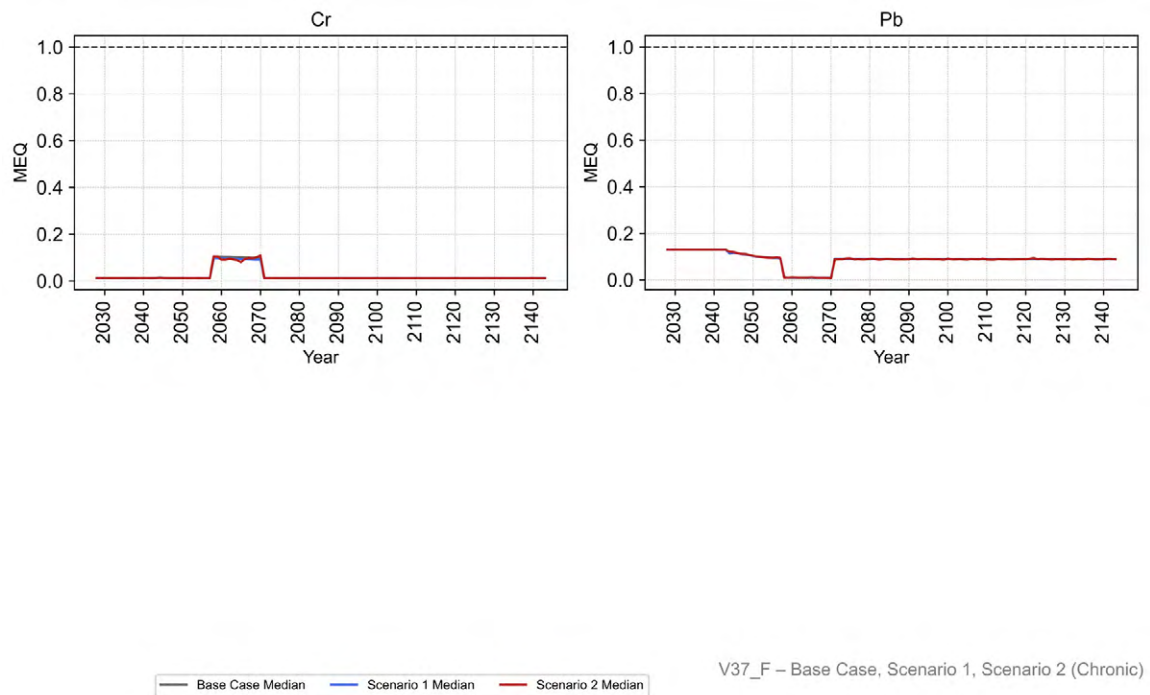


Figure 135: V37_F - Rainfall Scenarios - Chronic criteria compliance (Cr, Pb)

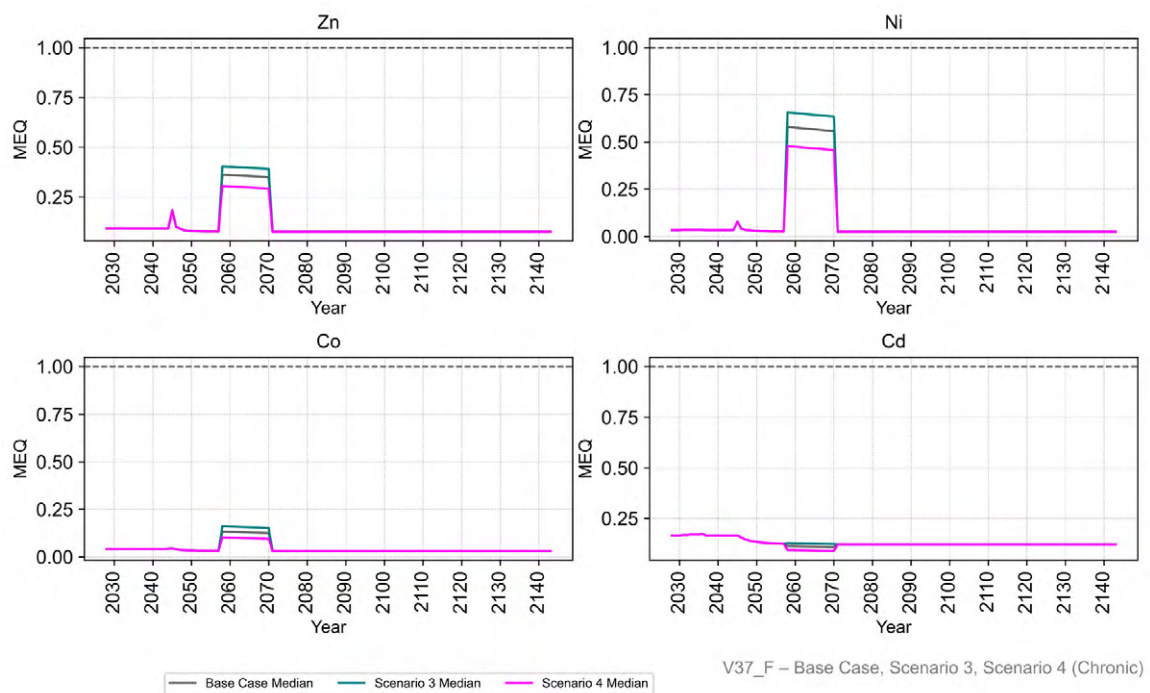


Figure 136: V37_F - Source Term Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)

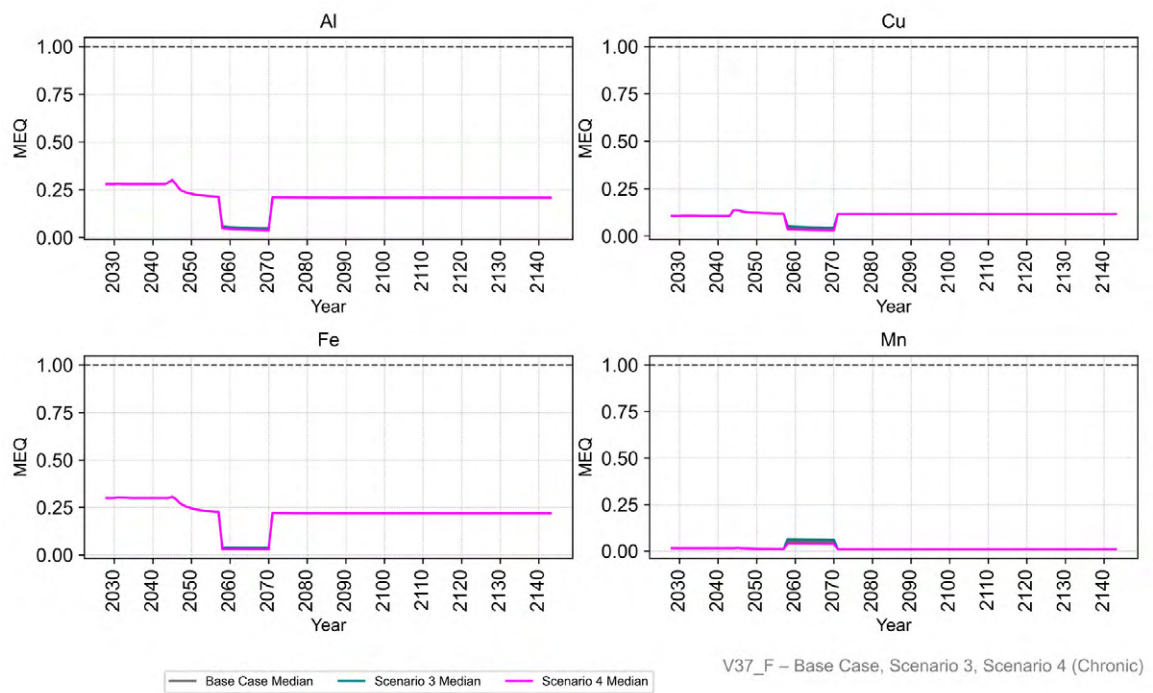


Figure 137: V37_F - Source Term Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

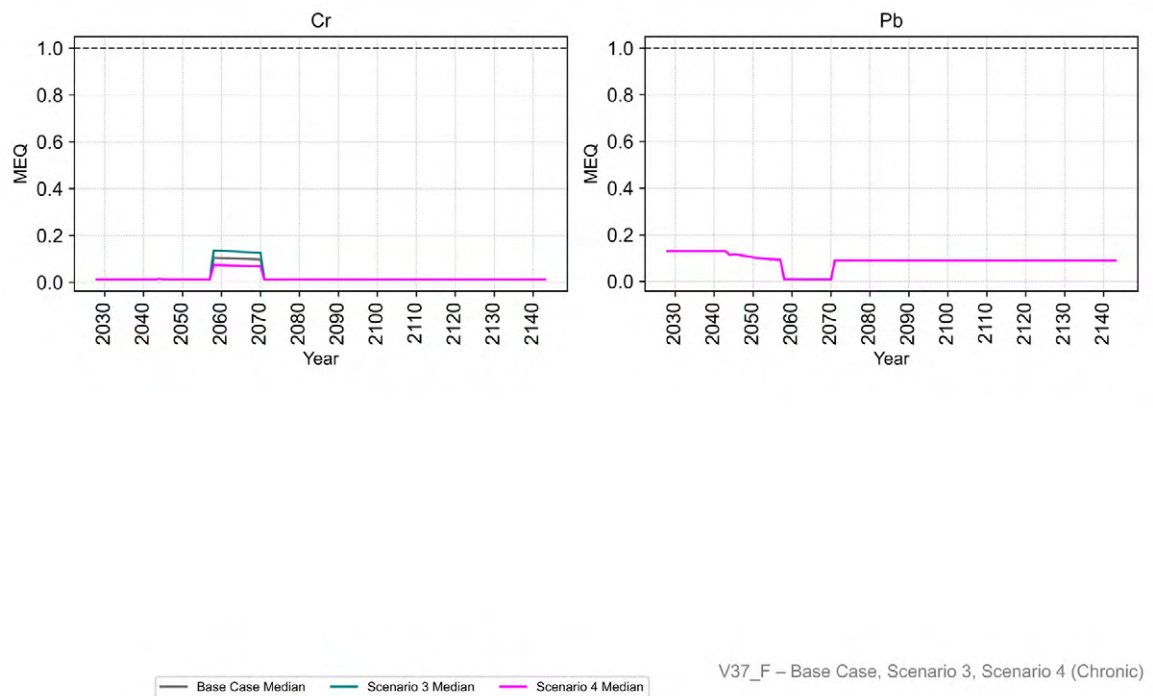


Figure 138: V37_F - Source Term Scenarios - Chronic criteria compliance (Cr, Pb)

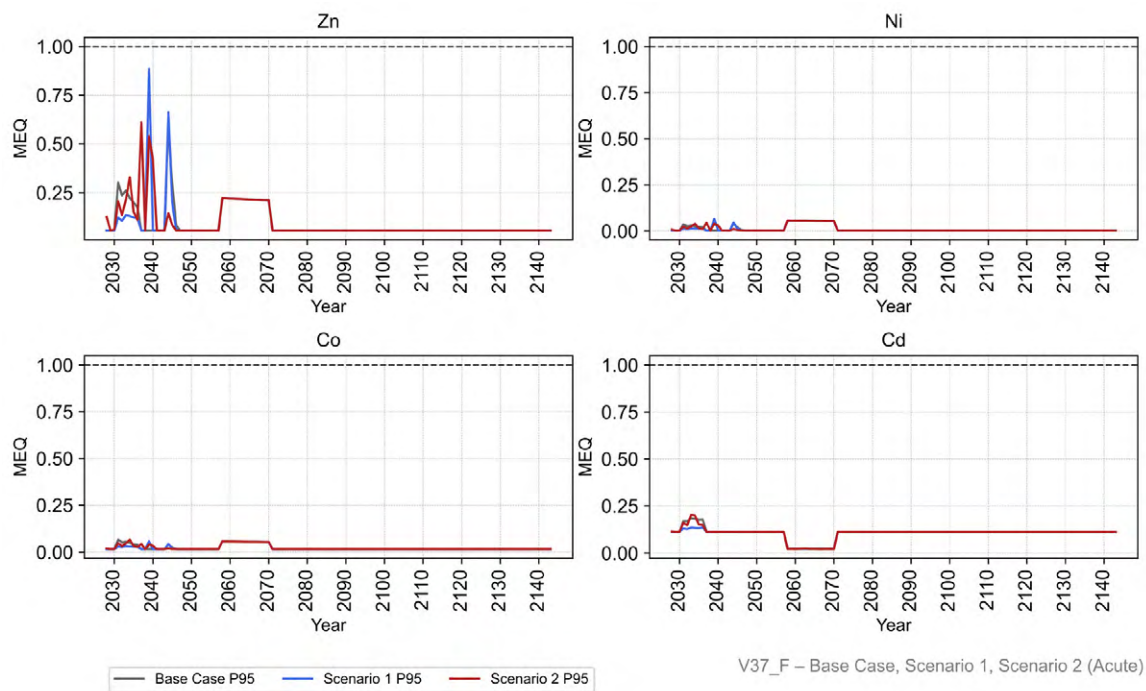


Figure 139: V37_F - Rainfall Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

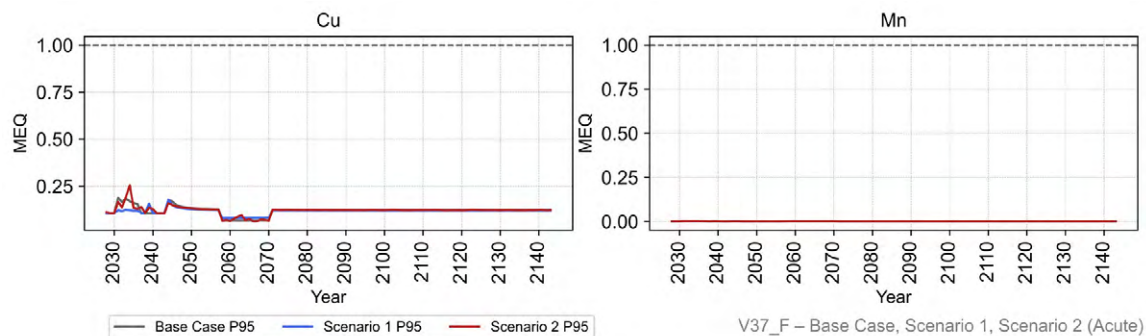


Figure 140: V37_F - Rainfall Scenarios - Acute criteria compliance (Cu, Mn)

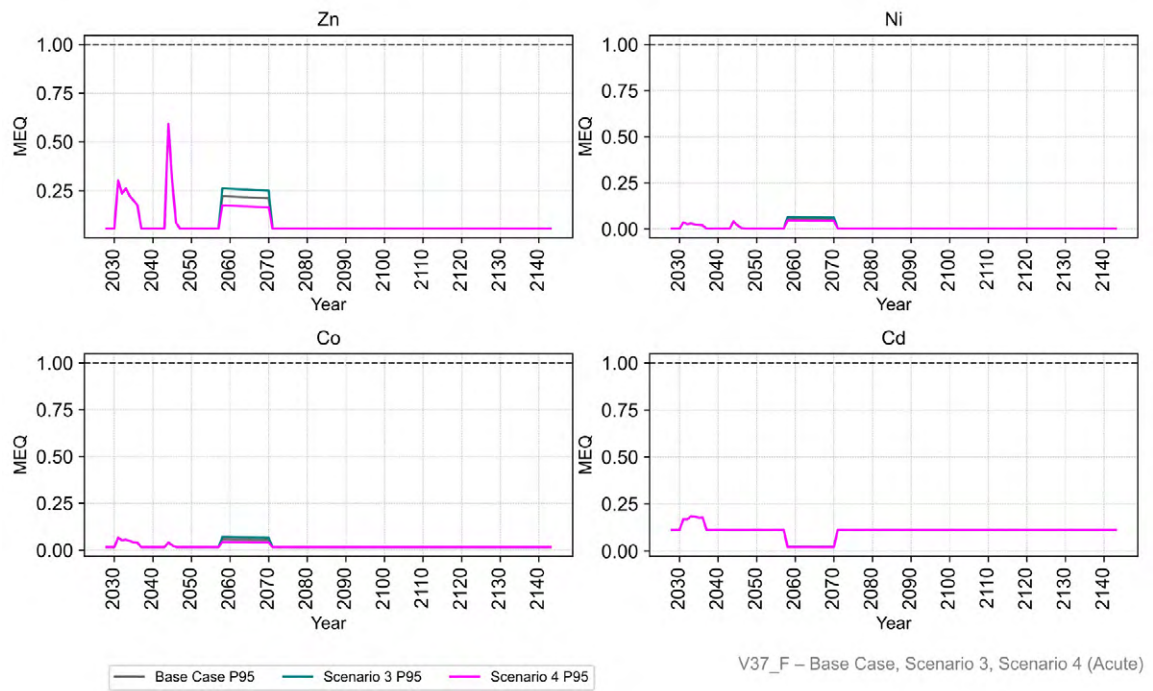


Figure 141: V37_F - Source Term Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

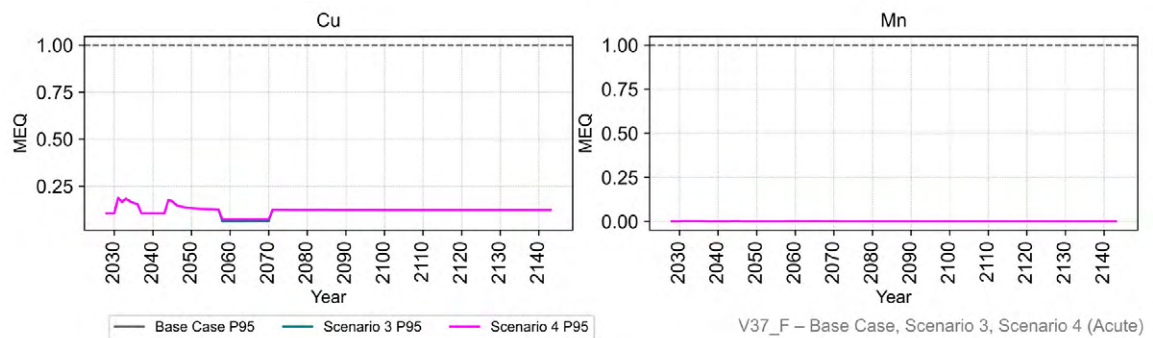


Figure 142: V37_F - Source Term Scenarios - Acute criteria compliance (Cu, Mn)

Exceedance Frequencies

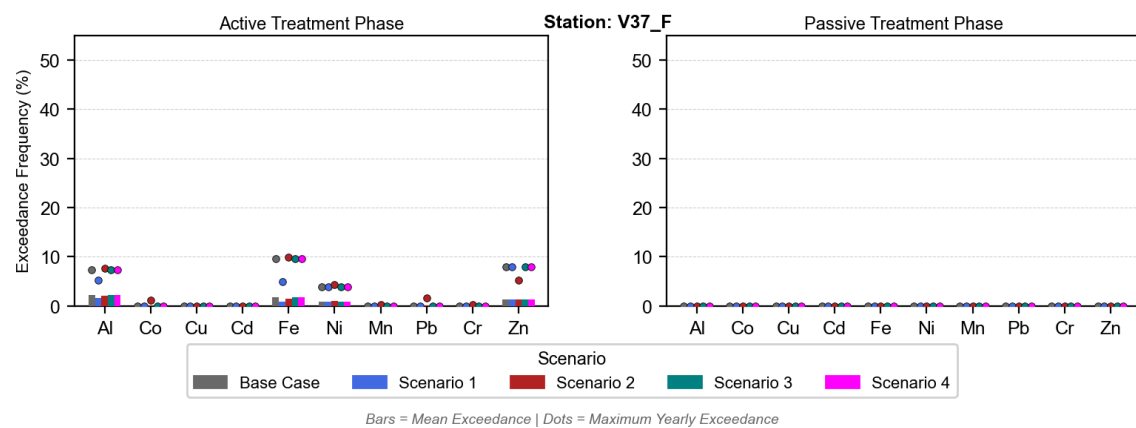


Figure 143: V37_F - Chronic exceedance frequencies

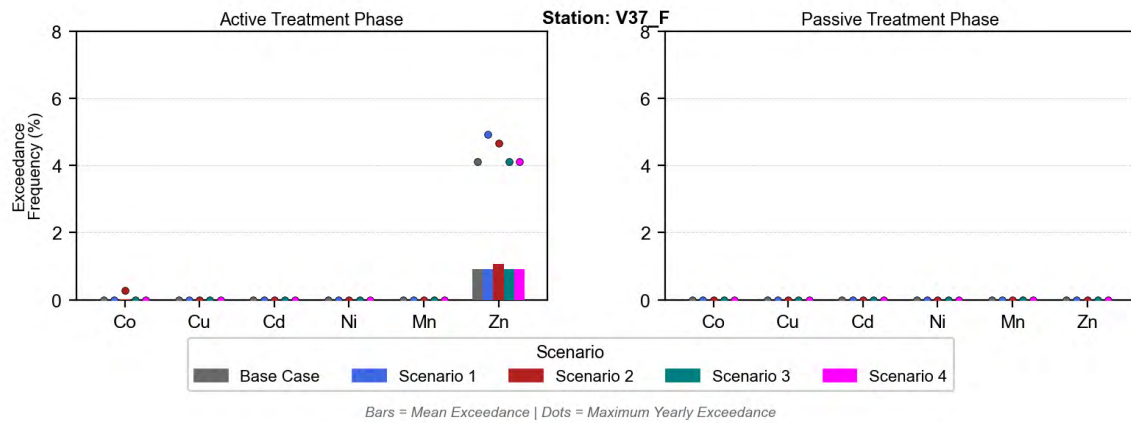


Figure 144: V37_F - Acute exceedance frequencies

5. STATION V37_G

Overview & Trends

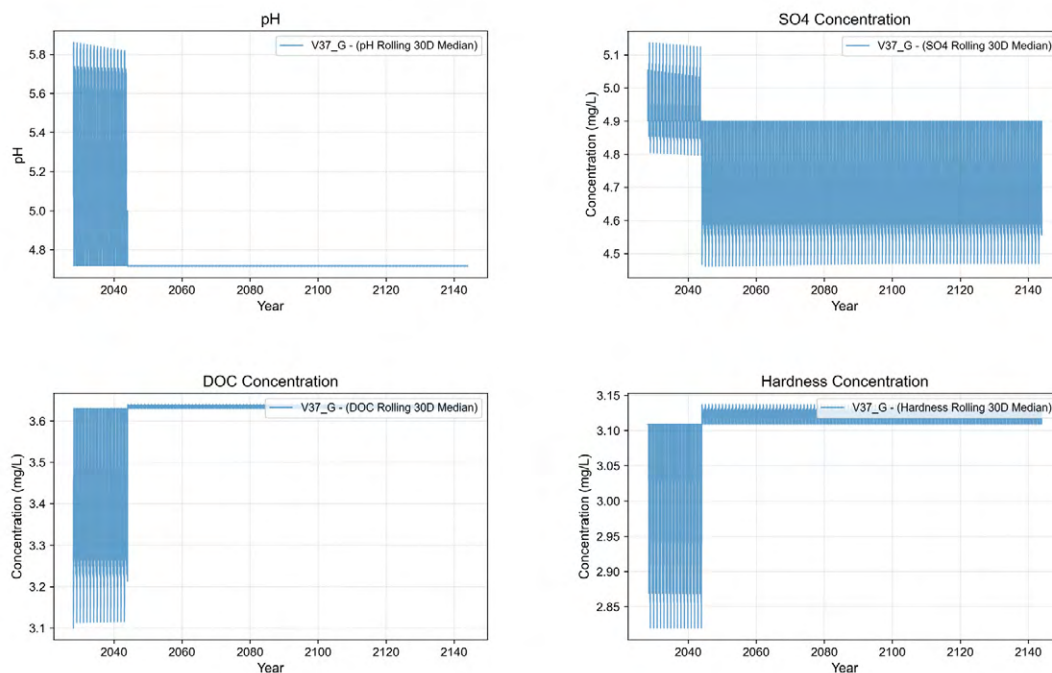


Figure 145: V37_G - Base Case - 30 day rolling median (pH, SO4, DOC, Hardness)

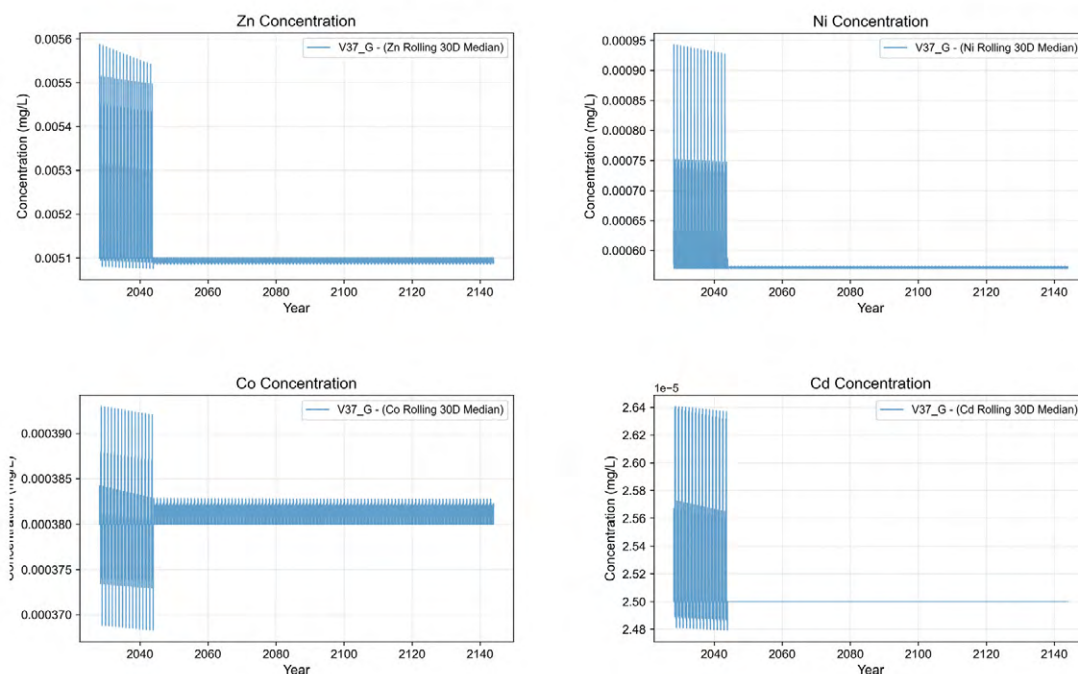


Figure 146: V37_G - Base Case - 30 day rolling median (Zn, Ni, Co, Cd)

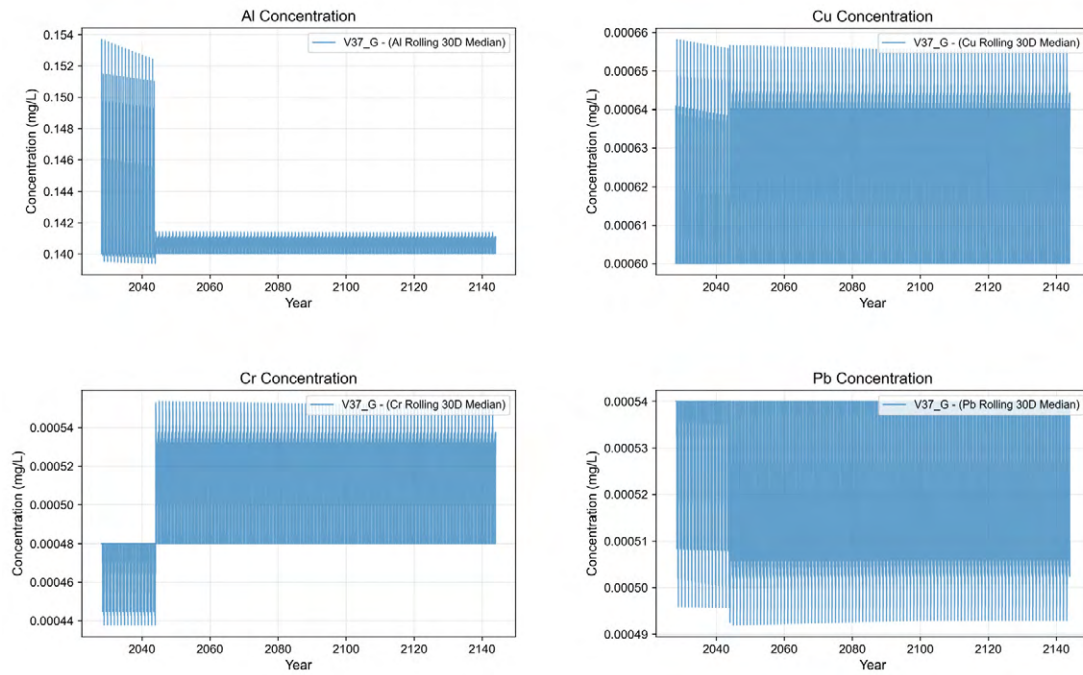


Figure 147: V37_G - Base Case - 30 day rolling median (Al, Cu, Cr, Pb)

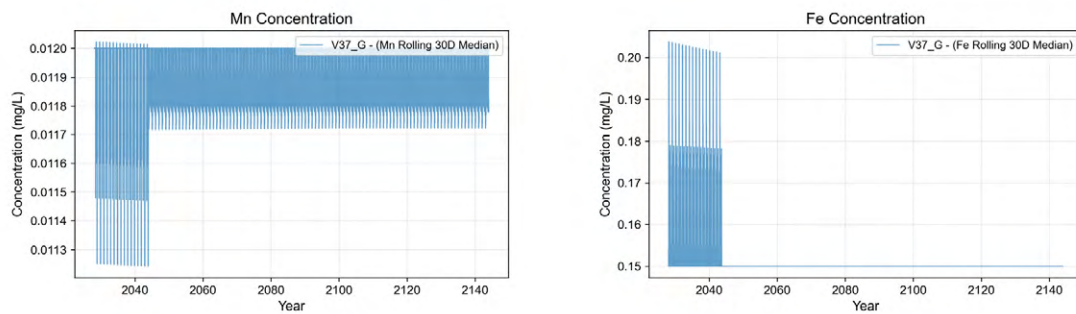


Figure 148: V37_G - Base Case - 30 day rolling median (Mn, Fe)

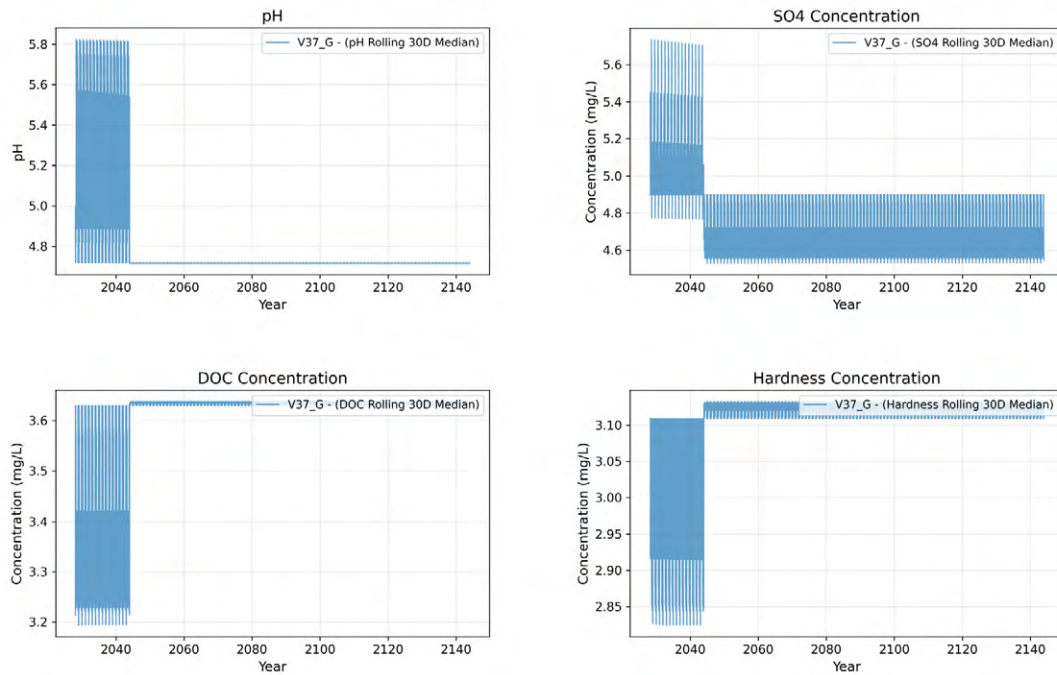


Figure 149: V37_G - S1 (High Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

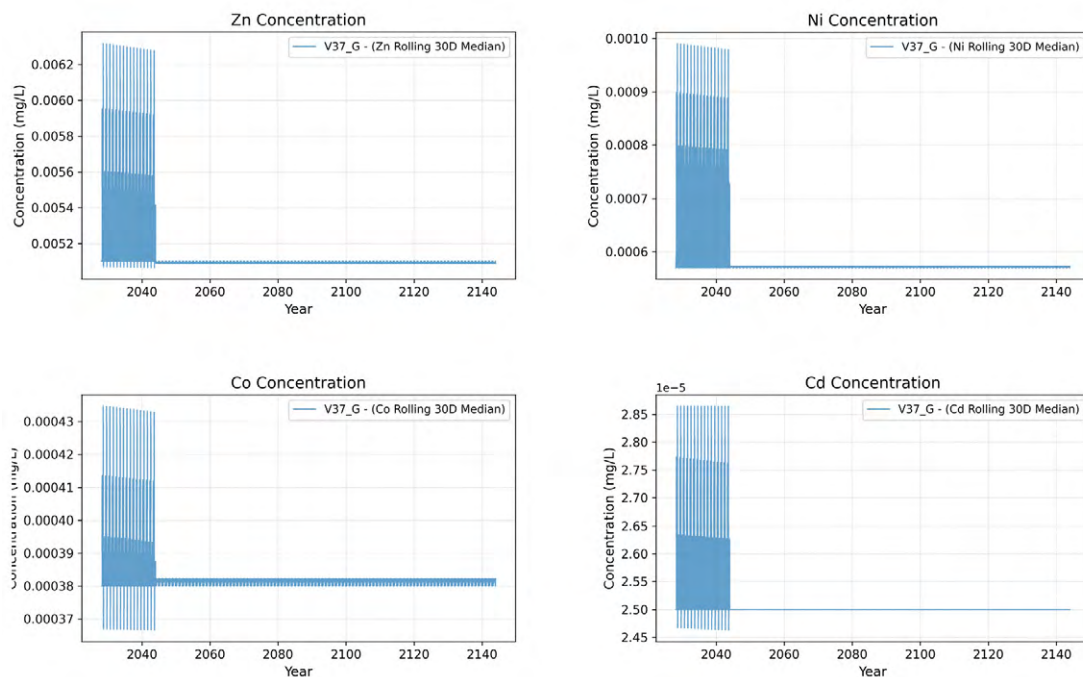


Figure 150: V37_G - S1 (High Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

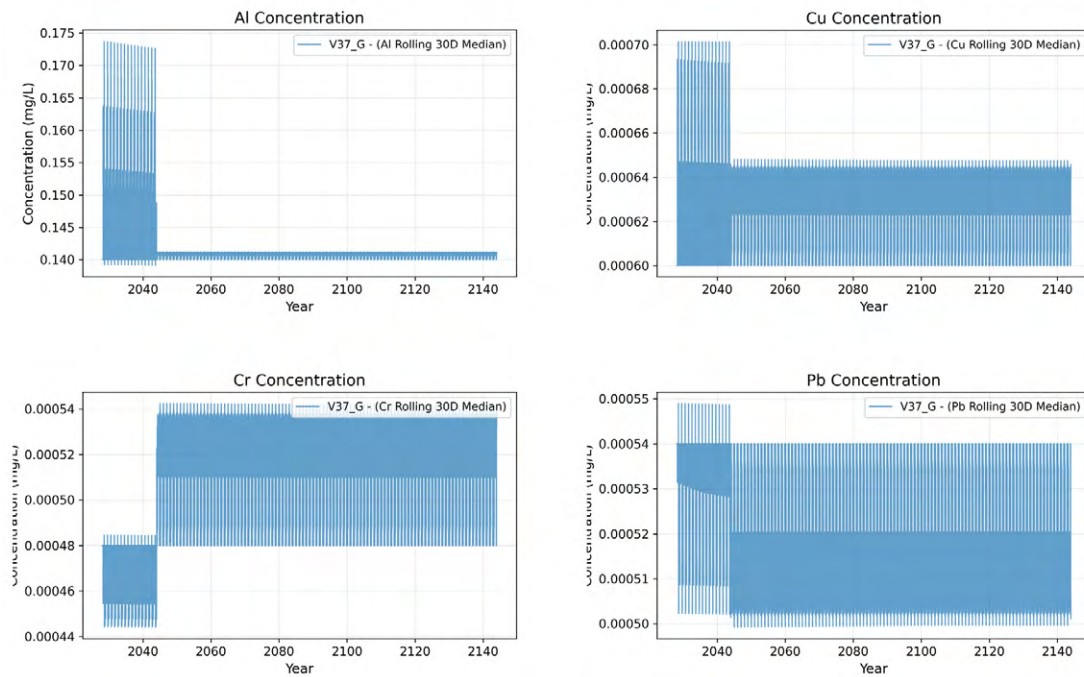


Figure 151: V37_G - S1 (High Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

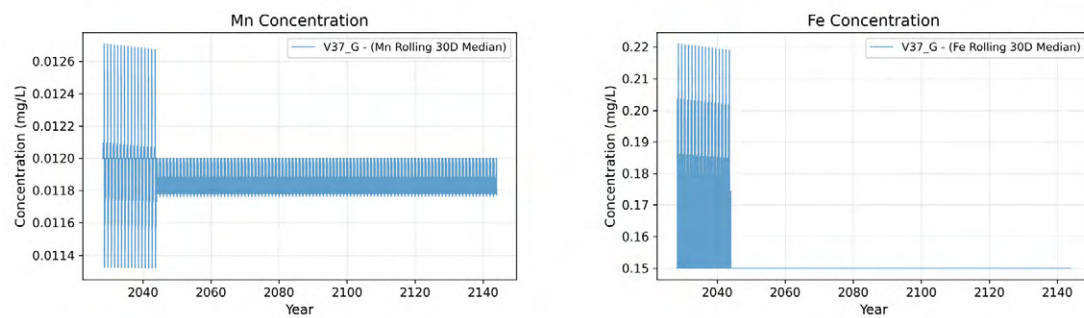


Figure 152: V37_G - S1 (High Rainfall) - 30 day rolling median (Mn, Fe)

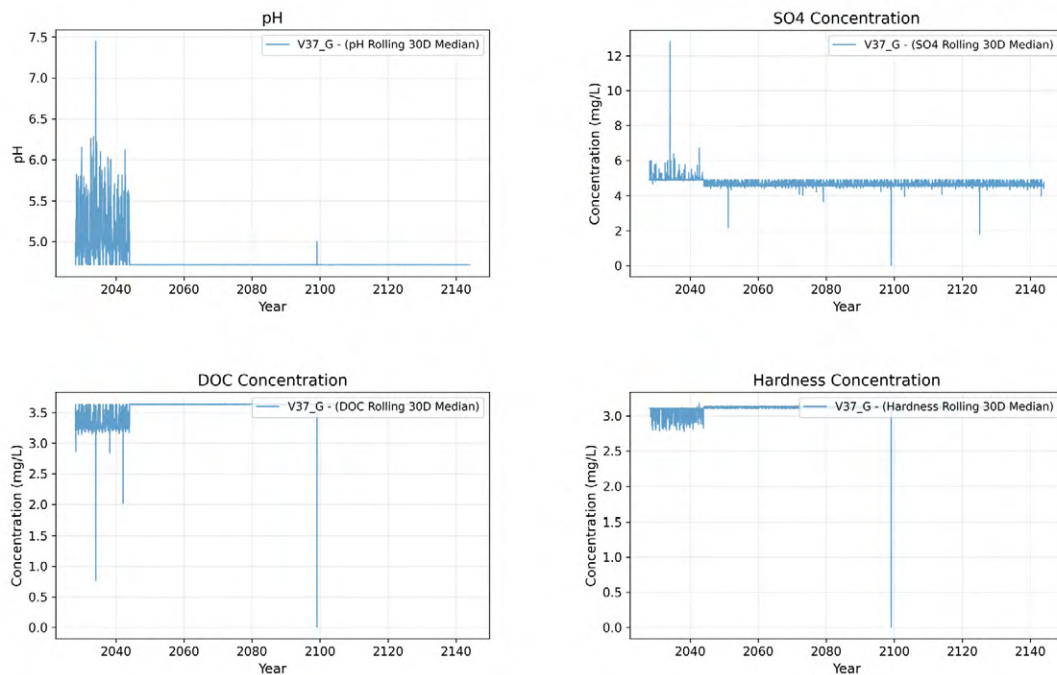


Figure 153: V37_G - S2 (Stochastic Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

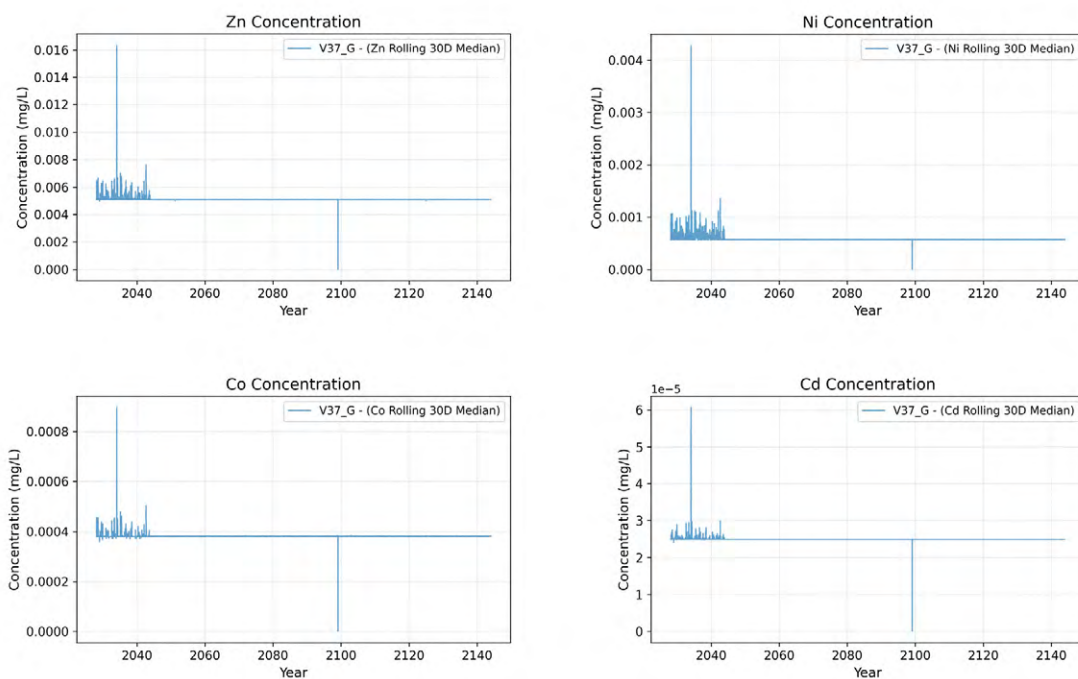


Figure 154: V37_G - S2 (Stochastic Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

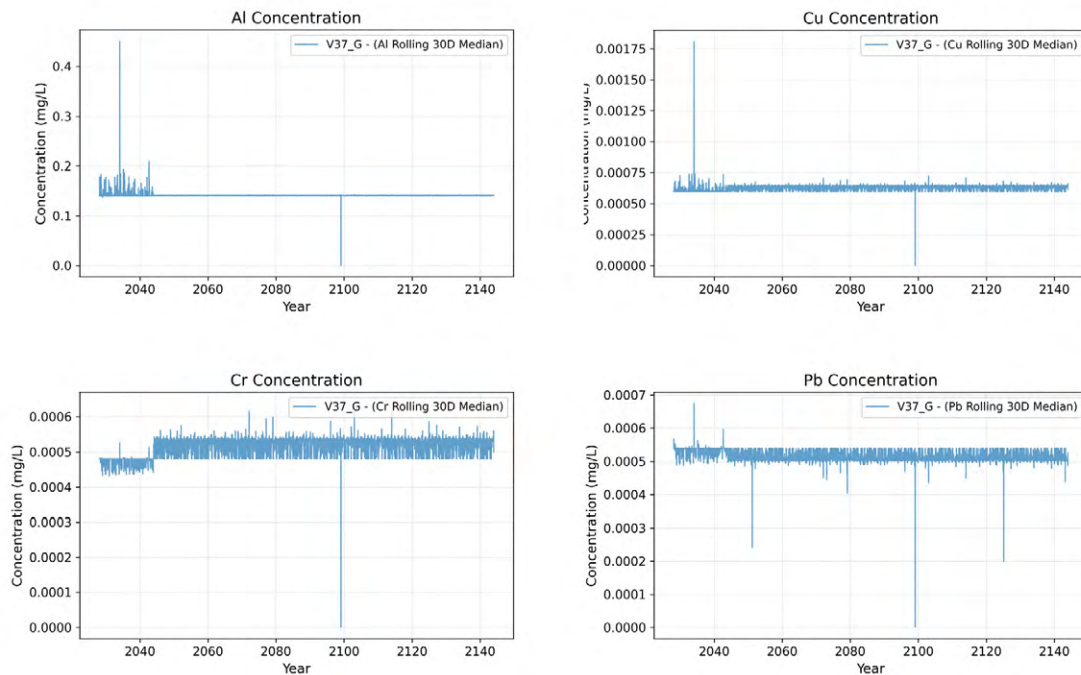


Figure 155: V37_G - S2 (Stochastic Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

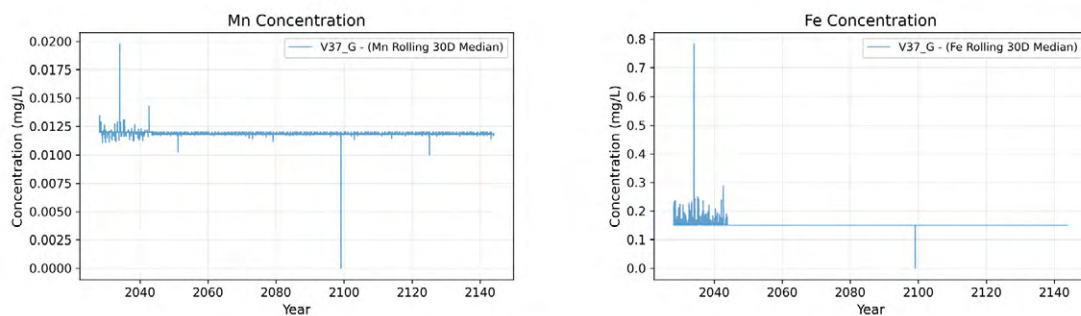


Figure 156: V37_G - S2 (Stochastic Rainfall) - 30 day rolling median (Mn, Fe)

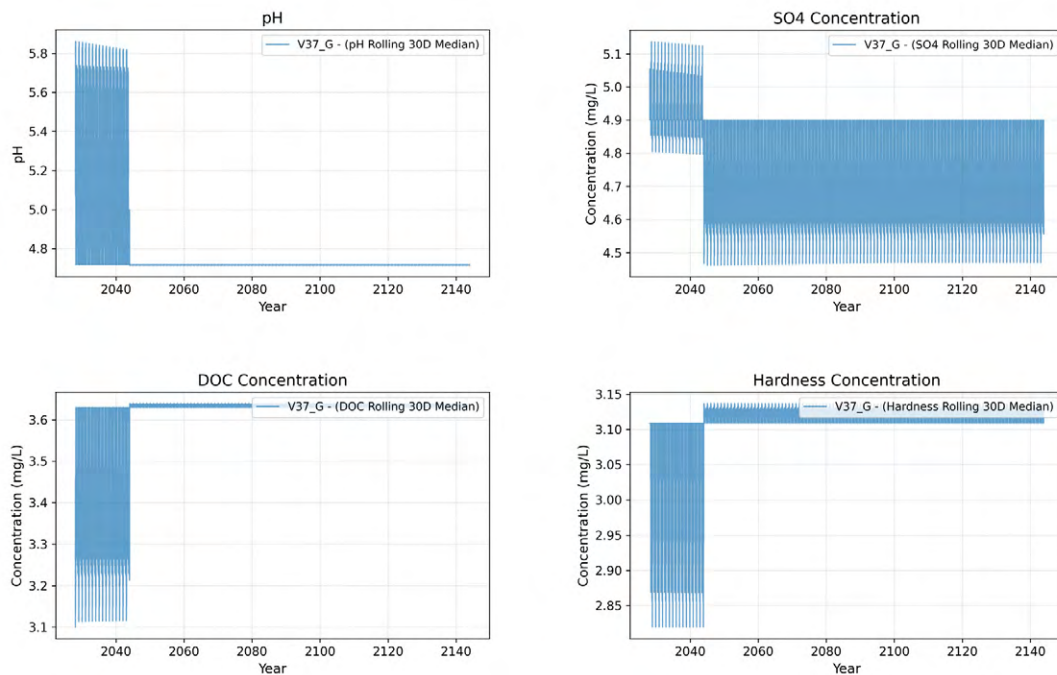


Figure 157: V37_G - S3 (ELF ST +30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

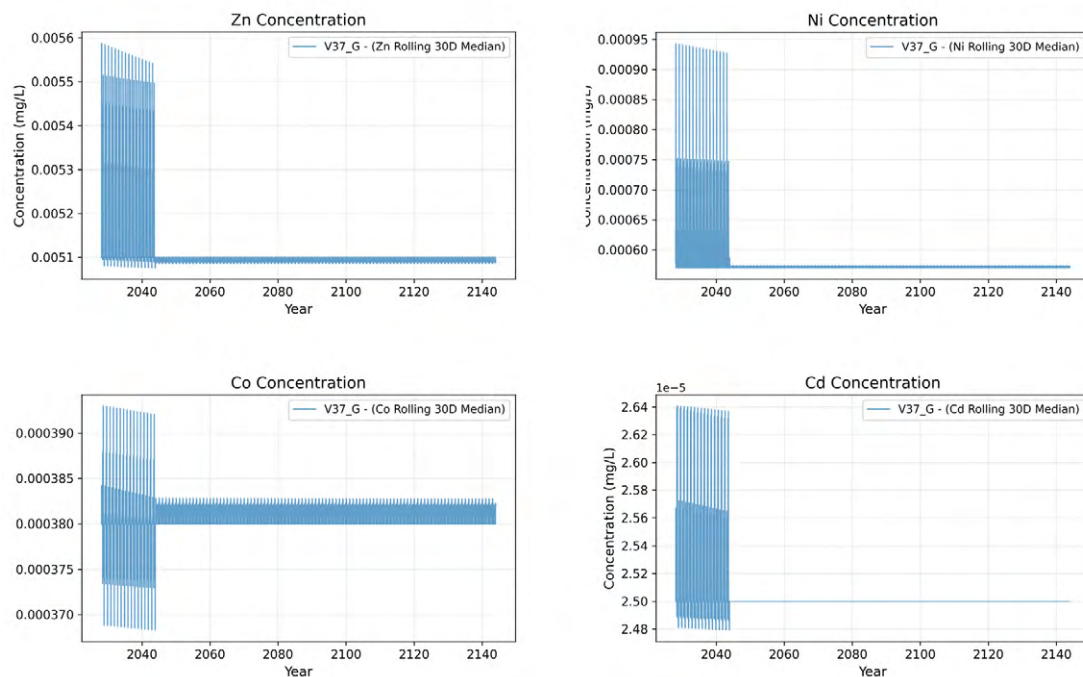


Figure 158: V37_G - S3 (ELF ST +30%) - 30 day rolling median (Zn, Ni, Co, Cd)

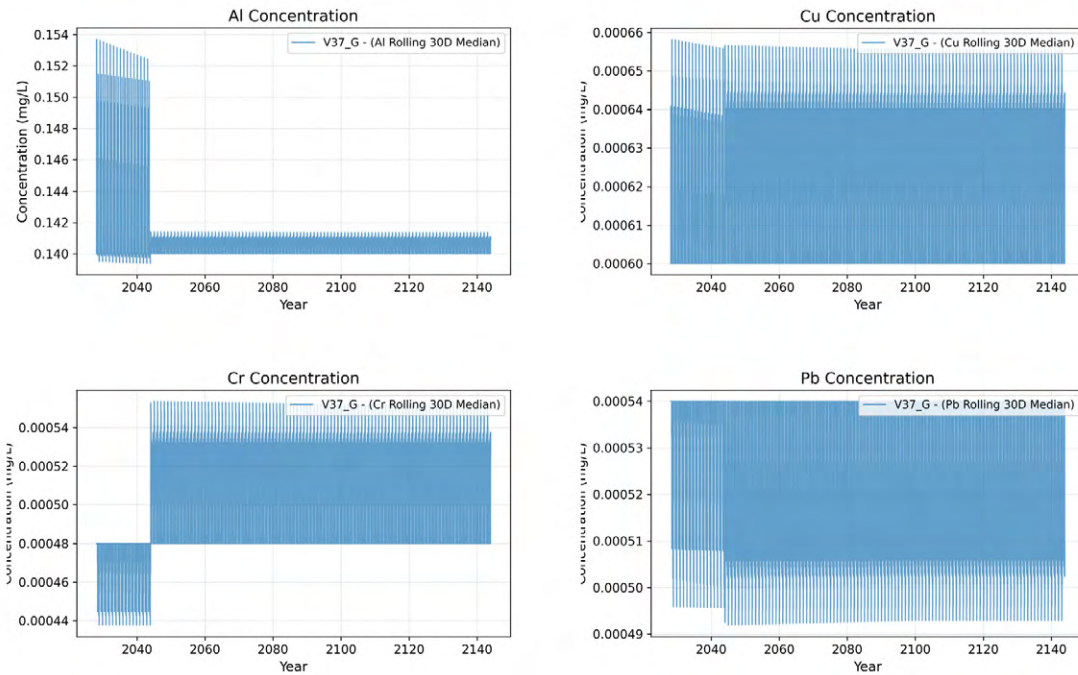


Figure 159: V37_G - S3 (ELF ST +30%) - 30 day rolling median (Al, Cu, Cr, Pb)

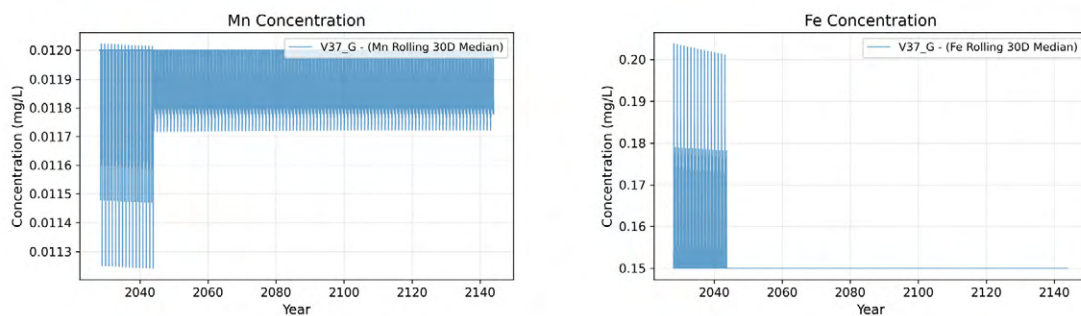


Figure 160: V37_G - S3 (ELF ST +30%) - 30 day rolling median (Mn, Fe)

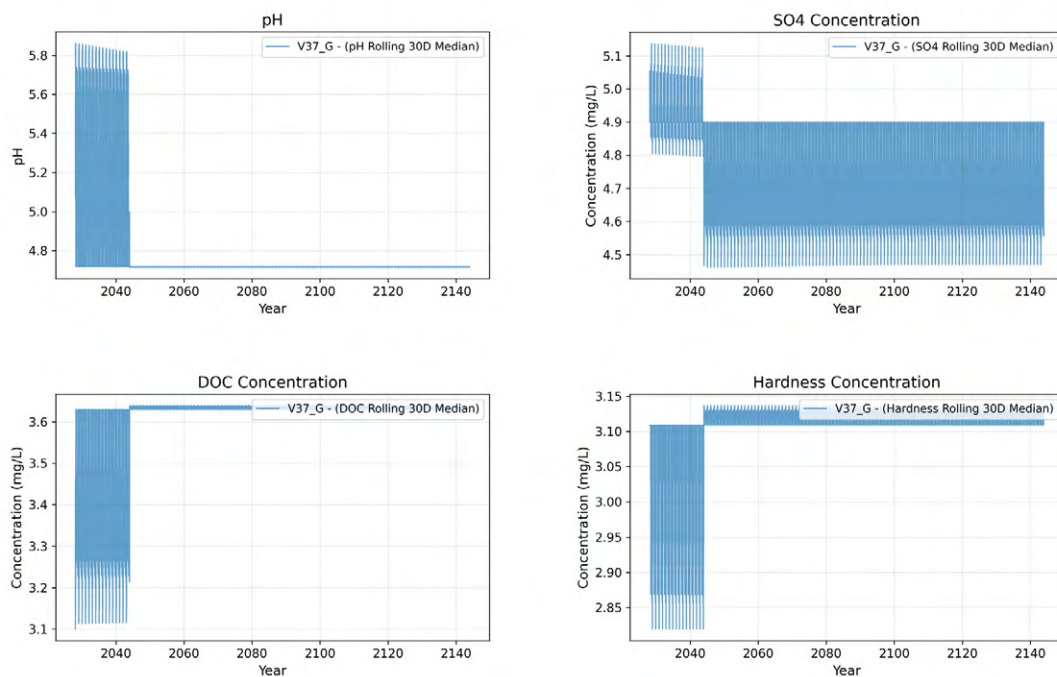


Figure 161: V37_G - S4 (ELF ST -30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

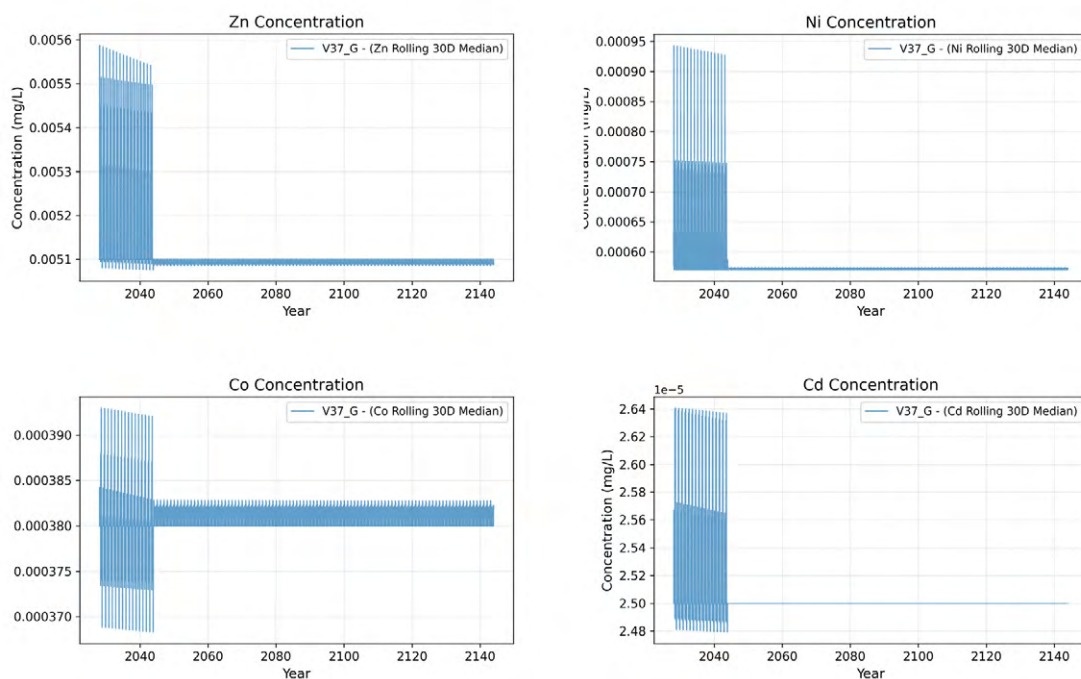


Figure 162: V37_G - S4 (ELF ST -30%) - 30 day rolling median (Zn, Ni, Co, Cd)

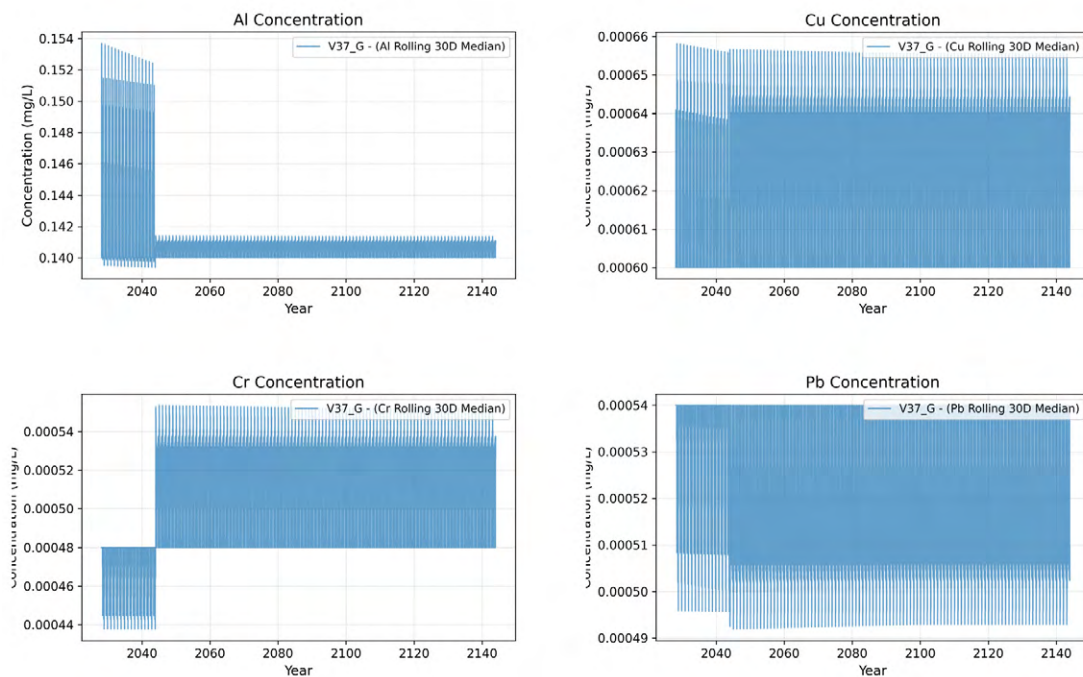


Figure 163: V37_G - S4 (ELF ST -30%) - 30 day rolling median (Al, Cu, Cr, Pb)

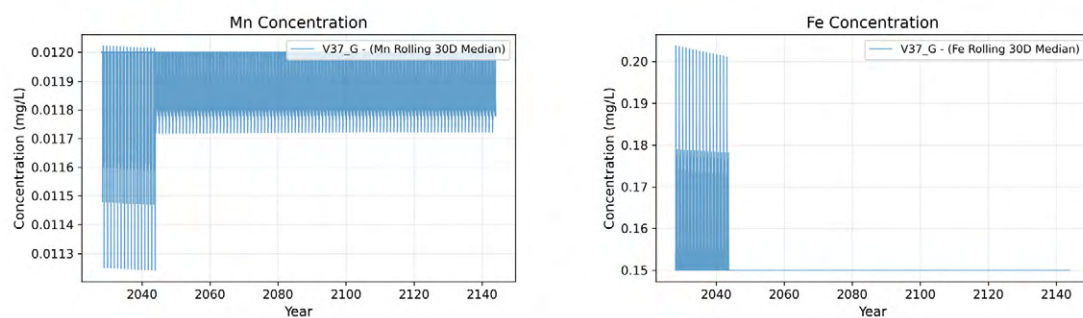
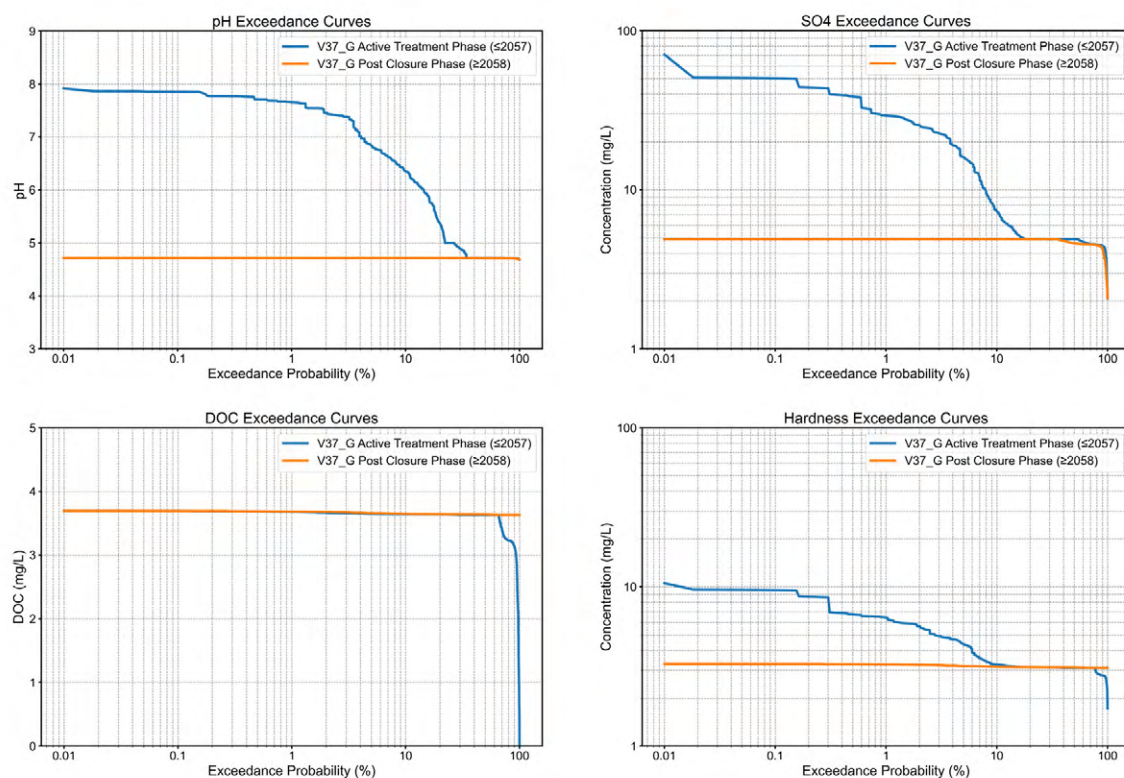
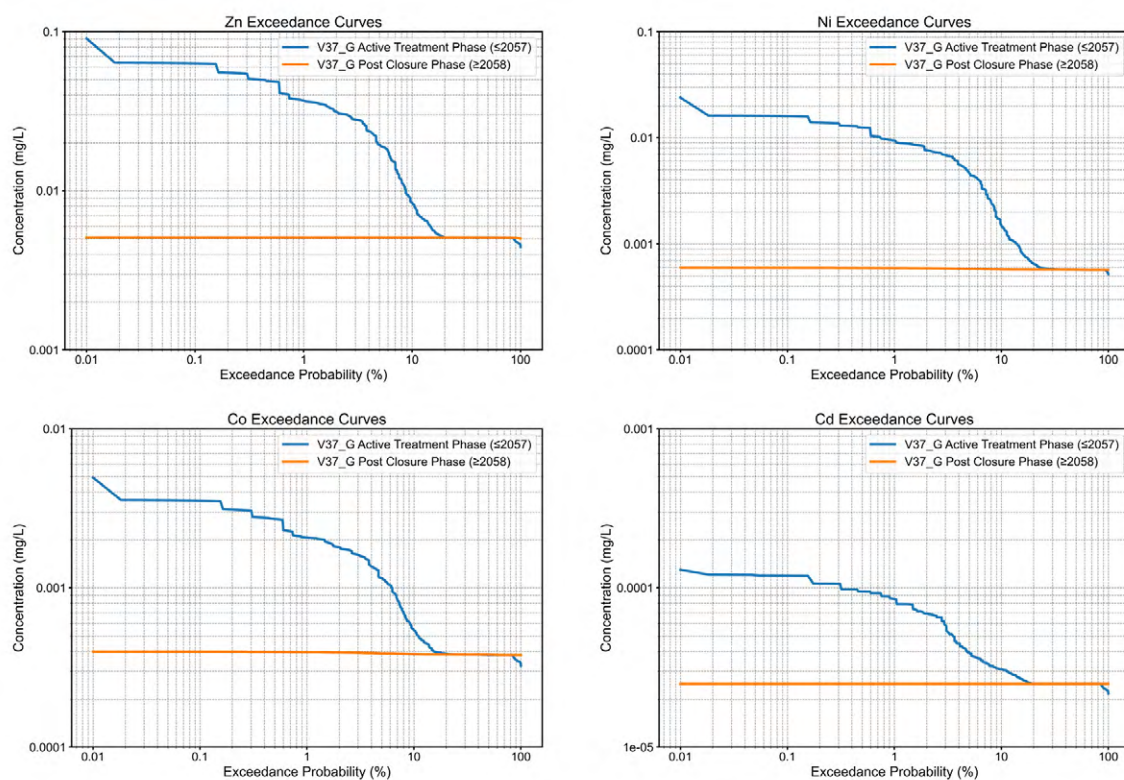


Figure 164: V37_G - S4 (ELF ST -30%) - 30 day rolling median (Mn, Fe)

Probability Exceedance**Figure 165:** V37_G - Base Case - Exceedance probability plots (pH, SO₄, DOC, Hardness)**Figure 166:** V37_G - Base Case - Exceedance probability plots (Zn, Ni, Co, Cd)

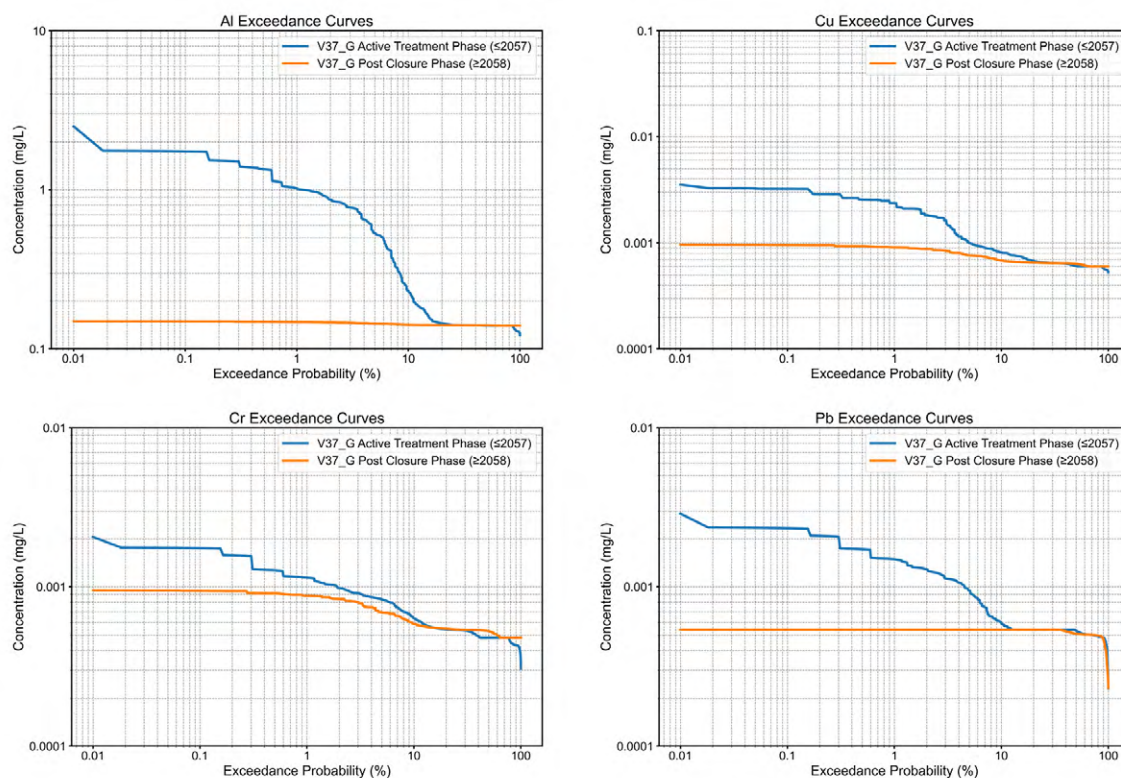


Figure 167: V37_G - Base Case - Exceedance probability plots (Al, Cu, Cr, Pb)

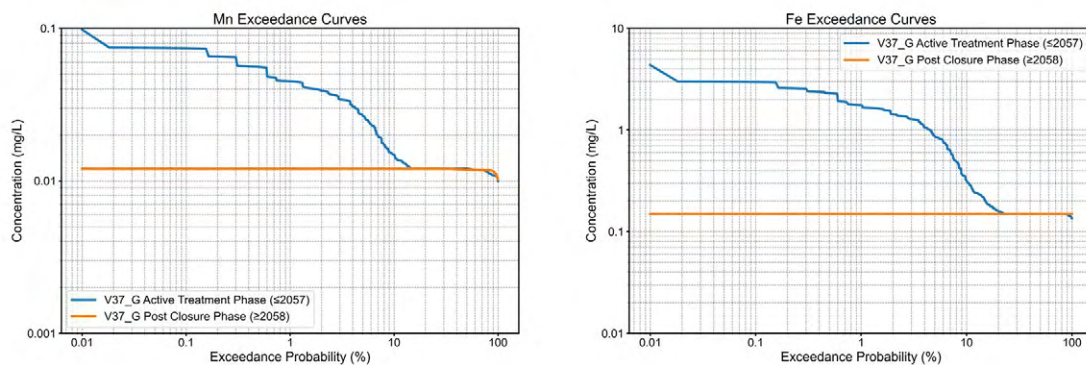
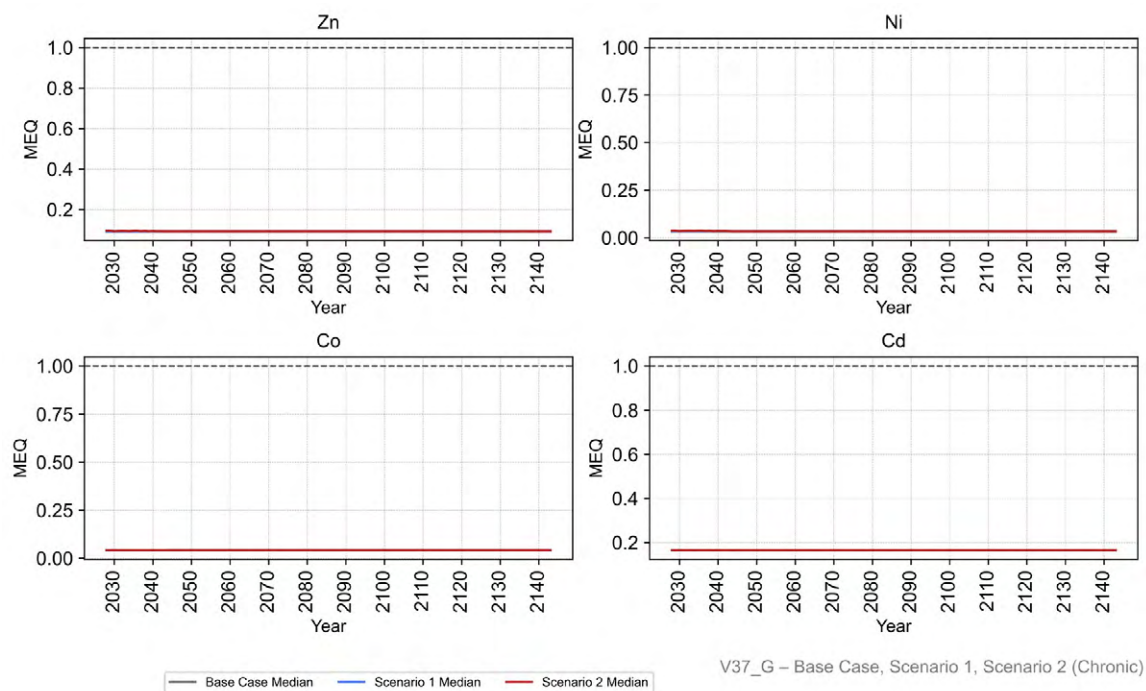
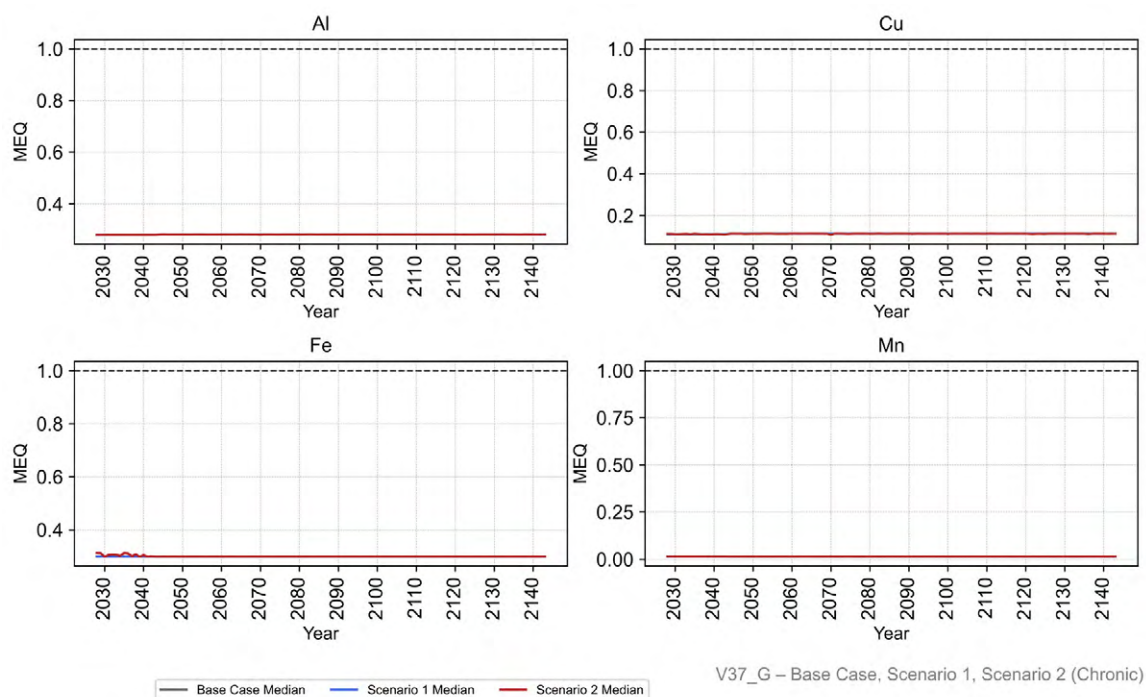


Figure 168: V37_G - Base Case - Exceedance probability plots (Mn, Fe)

Compliance & WQ Standards**Figure 169:** V37_G - Rainfall Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)**Figure 170:** V37_G - Rainfall Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

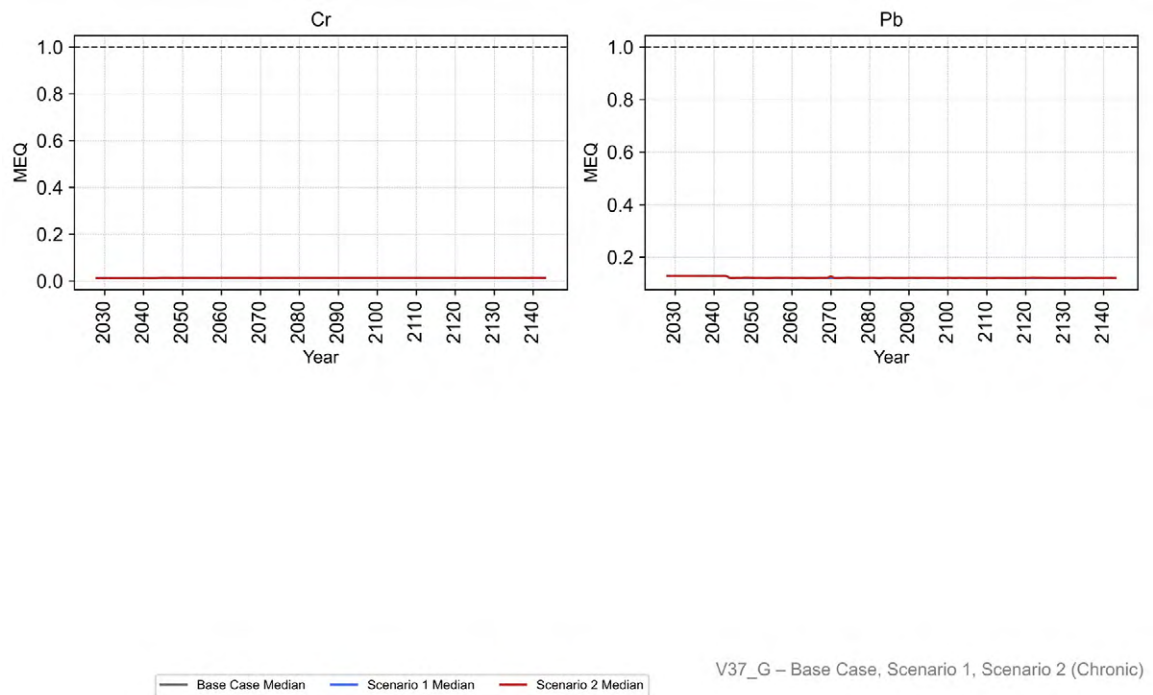


Figure 171: V37_G - Rainfall Scenarios - Chronic criteria compliance (Cr, Pb)

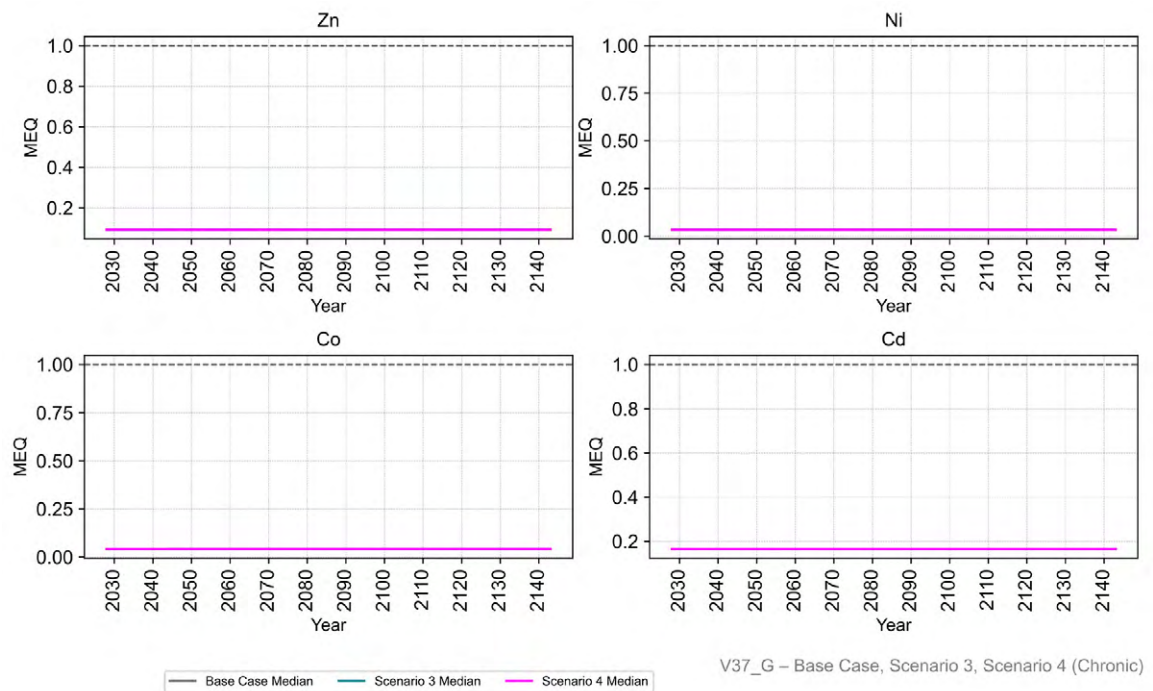


Figure 172: V37_G - Source Term Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)

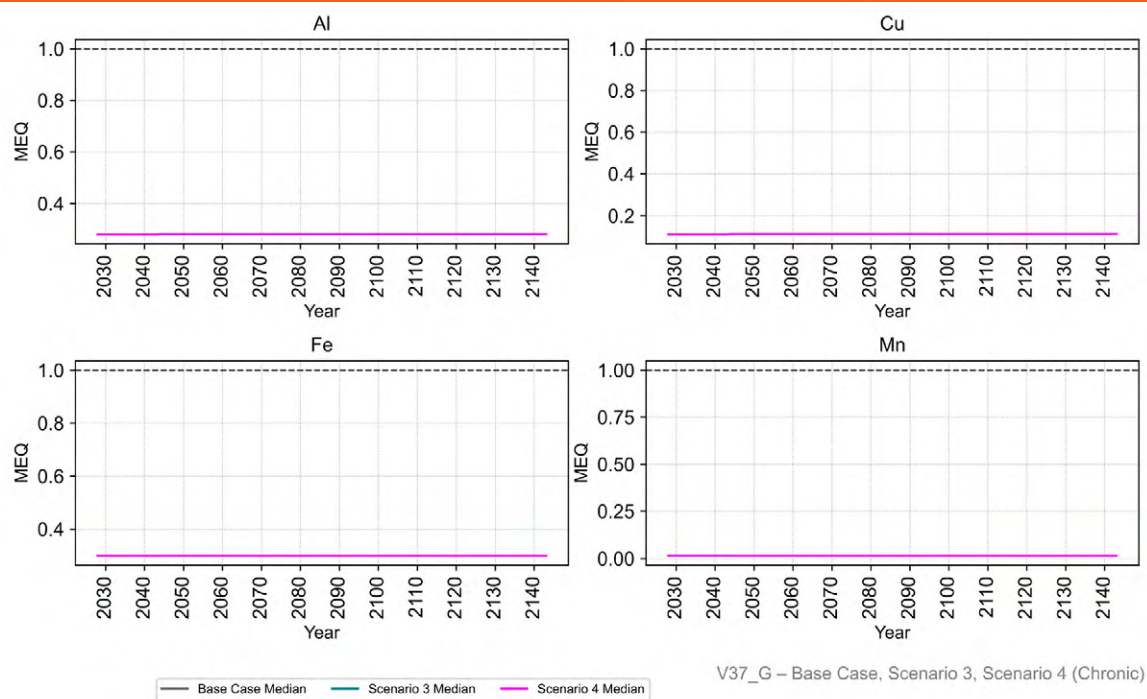


Figure 173: V37_G - Source Term Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

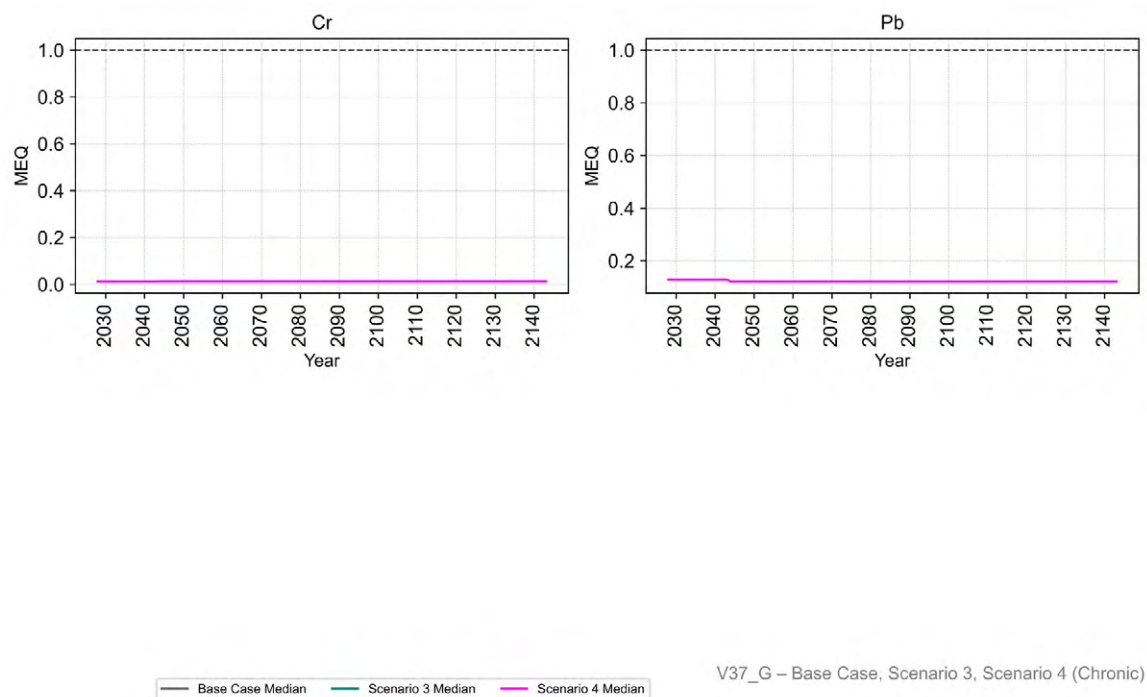


Figure 174: V37_G - Source Term Scenarios - Chronic criteria compliance (Cr, Pb)

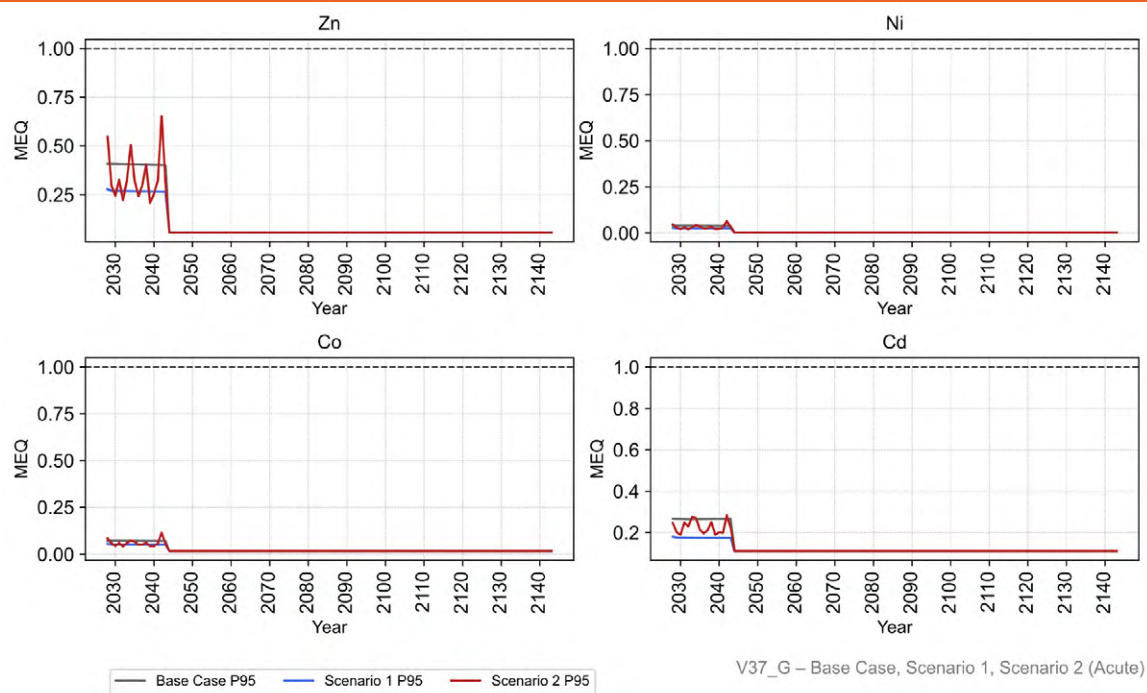


Figure 175: V37_G - Rainfall Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

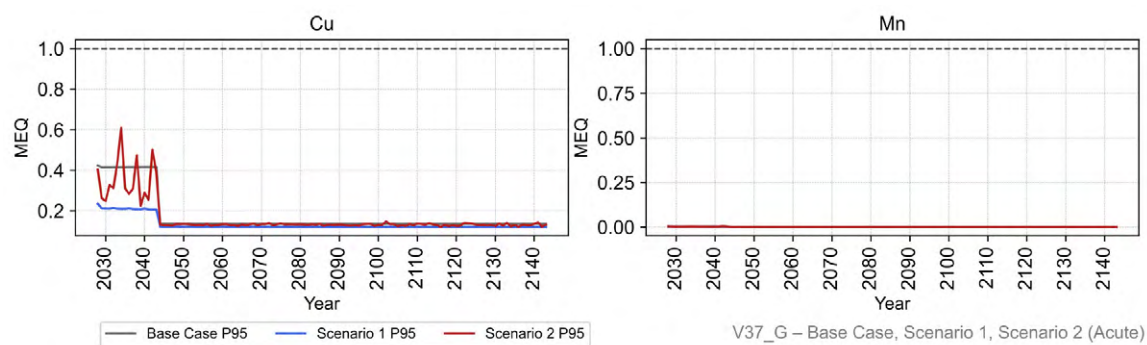


Figure 176: V37_G - Rainfall Scenarios - Acute criteria compliance (Cu, Mn)

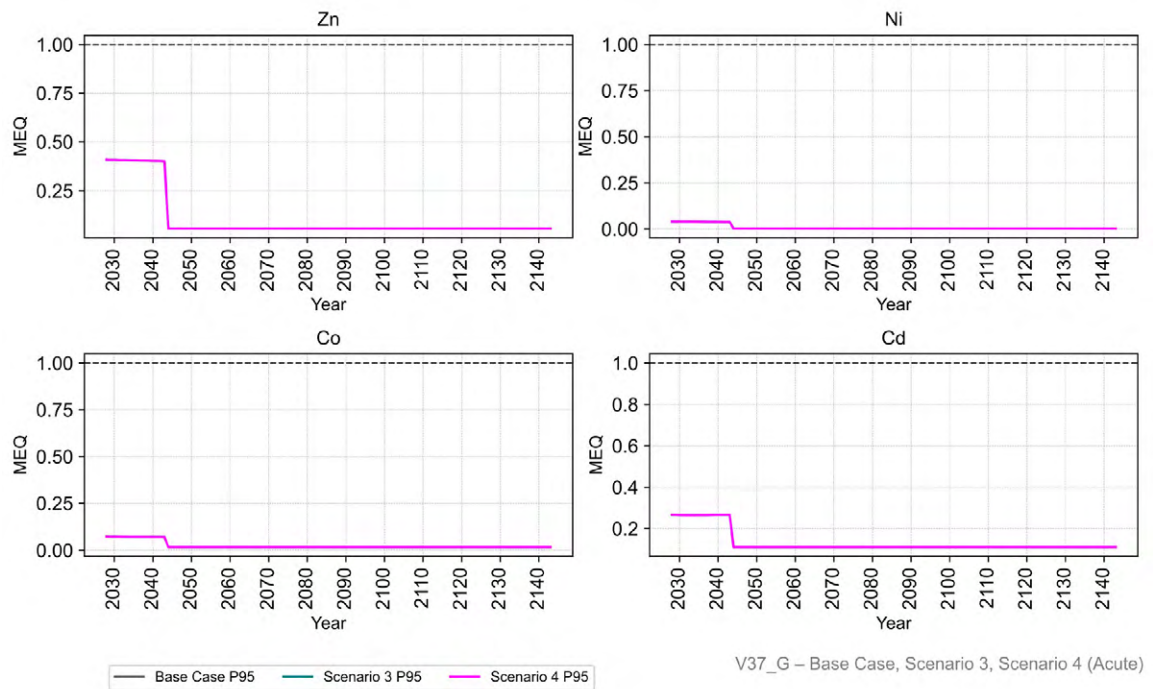


Figure 177: V37_G - Source Term Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

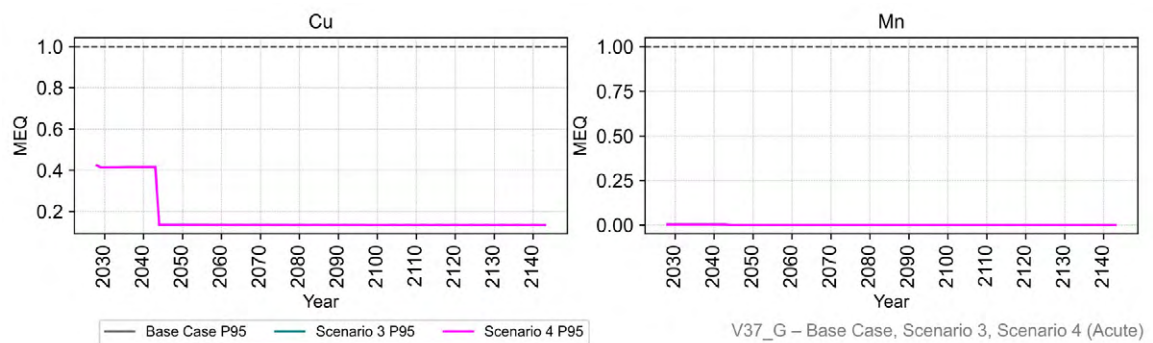


Figure 178: V37_G - Source Term Scenarios - Acute criteria compliance (Cu, Mn)

Exceedance Frequencies

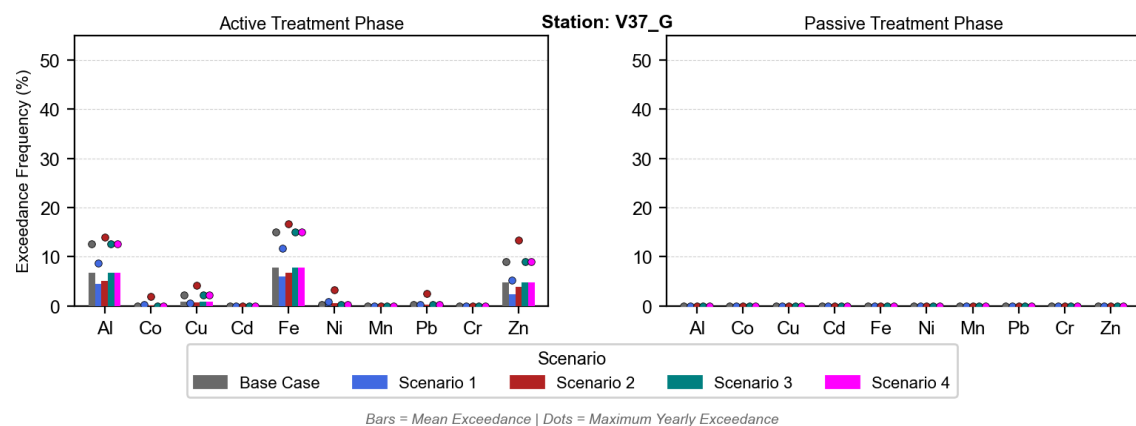


Figure 179: V37_G - Chronic exceedance frequencies

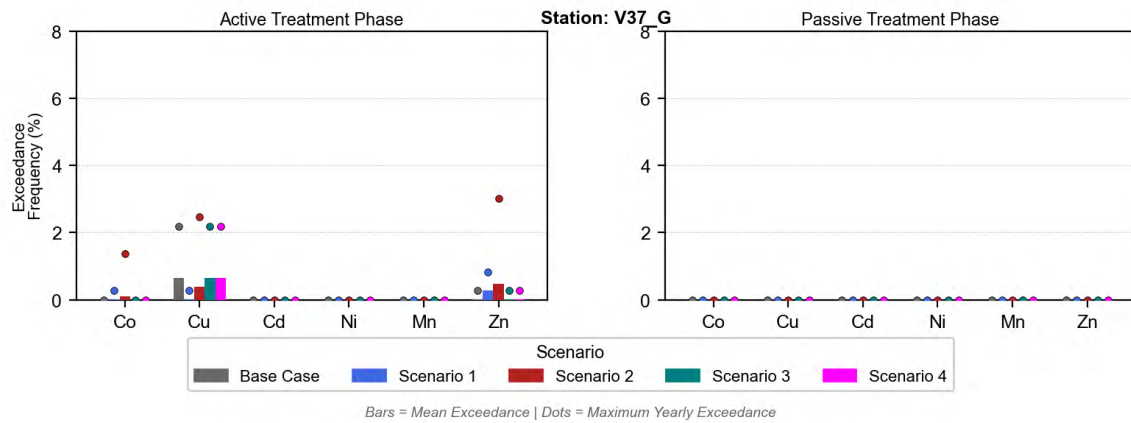


Figure 180: V37_G - Acute exceedance frequencies

6. STATION MM1

Overview & Trends

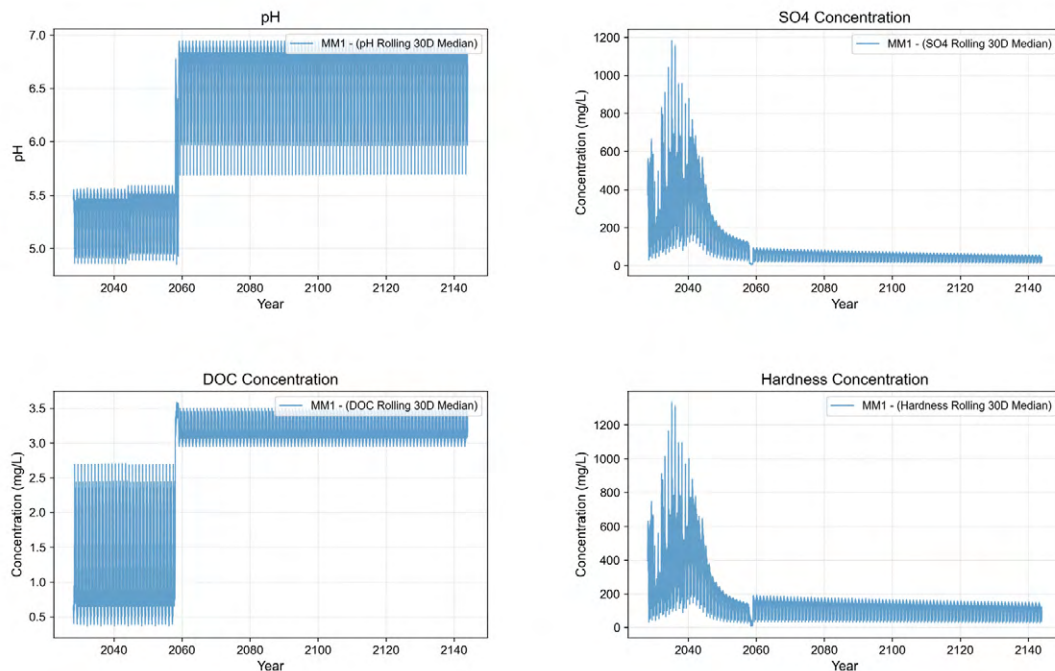


Figure 181: MM1 - Base Case - 30 day rolling median (pH, SO4, DOC, Hardness)

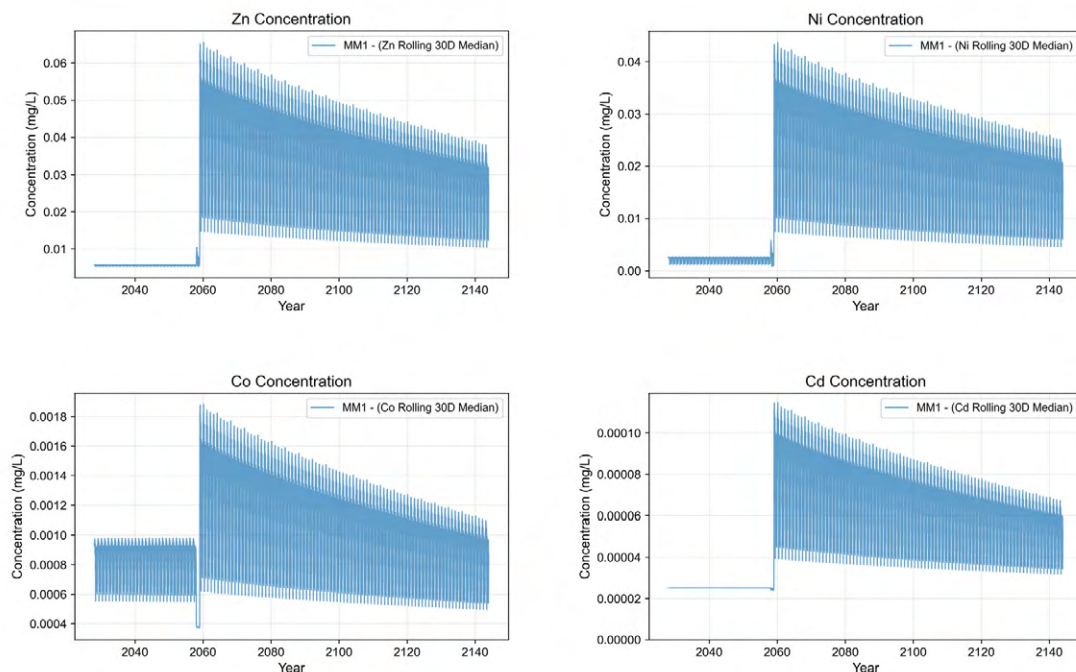


Figure 182: MM1 - Base Case - 30 day rolling median (Zn, Ni, Co, Cd)

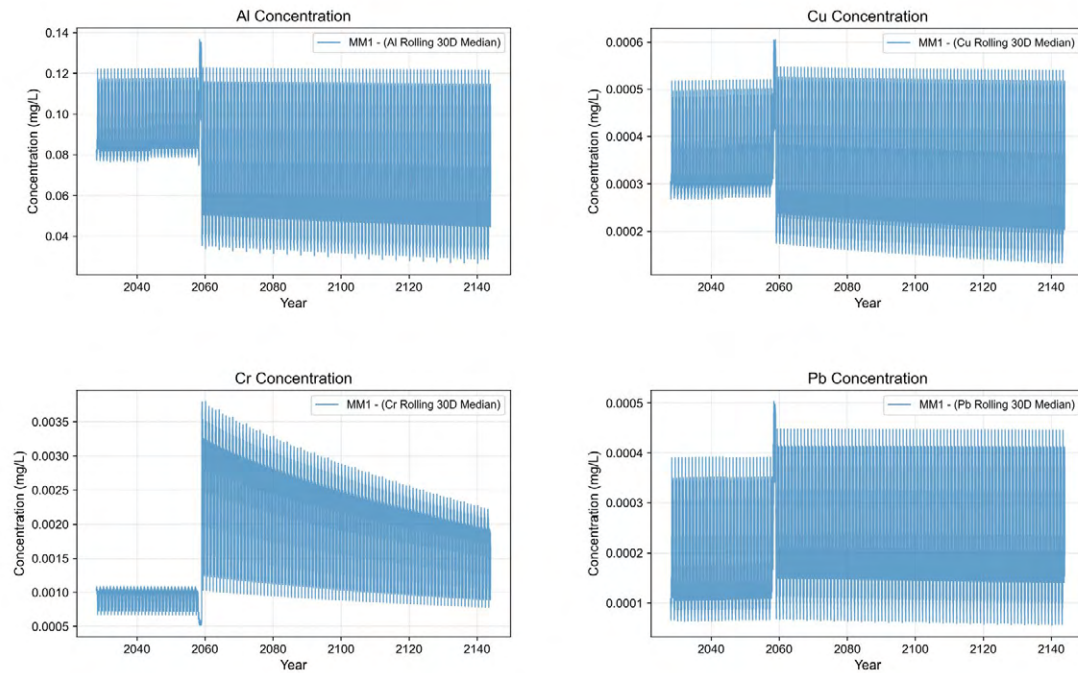


Figure 183: MM1 - Base Case - 30 day rolling median (Al, Cu, Cr, Pb)

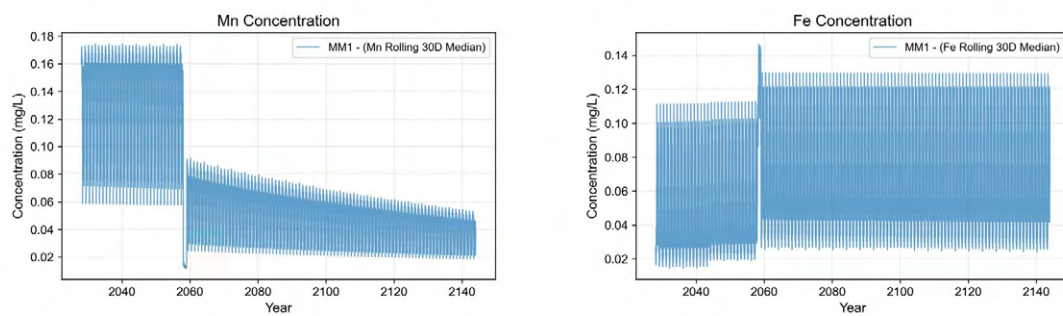


Figure 184: MM1 - Base Case - 30 day rolling median (Mn, Fe)

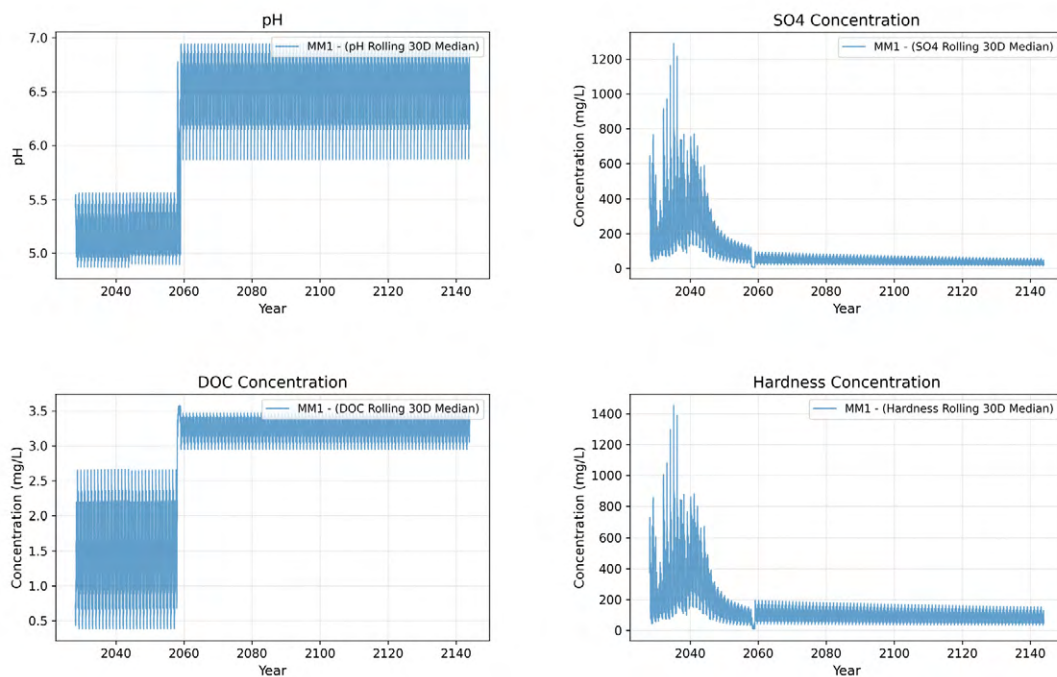


Figure 185: MM1 - S1 (High Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

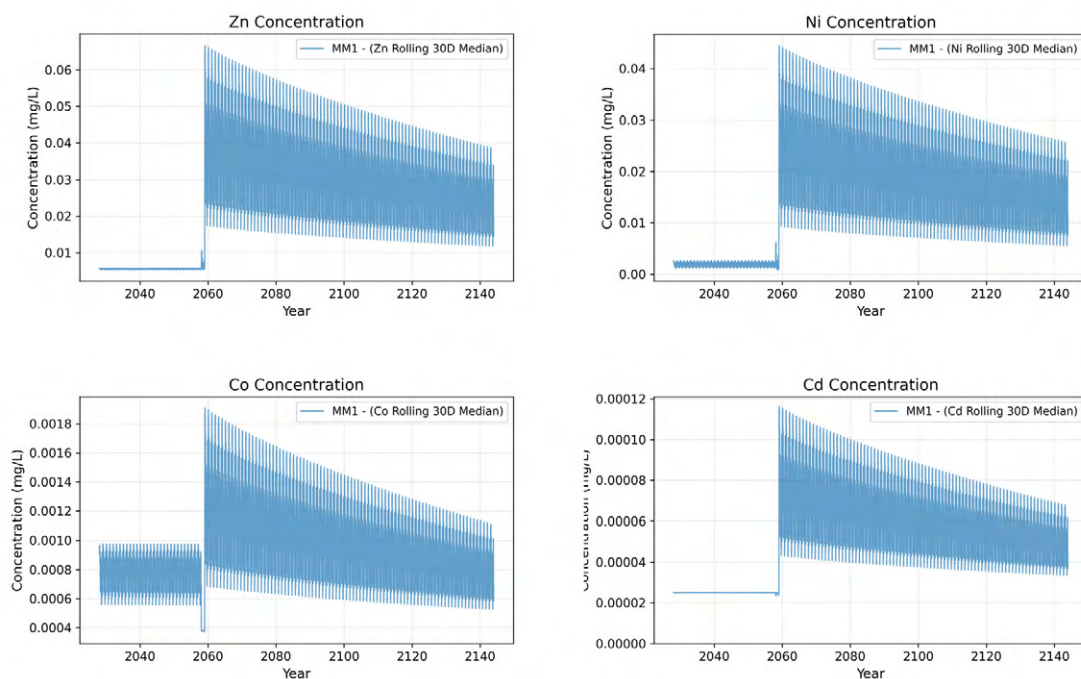


Figure 186: MM1 - S1 (High Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

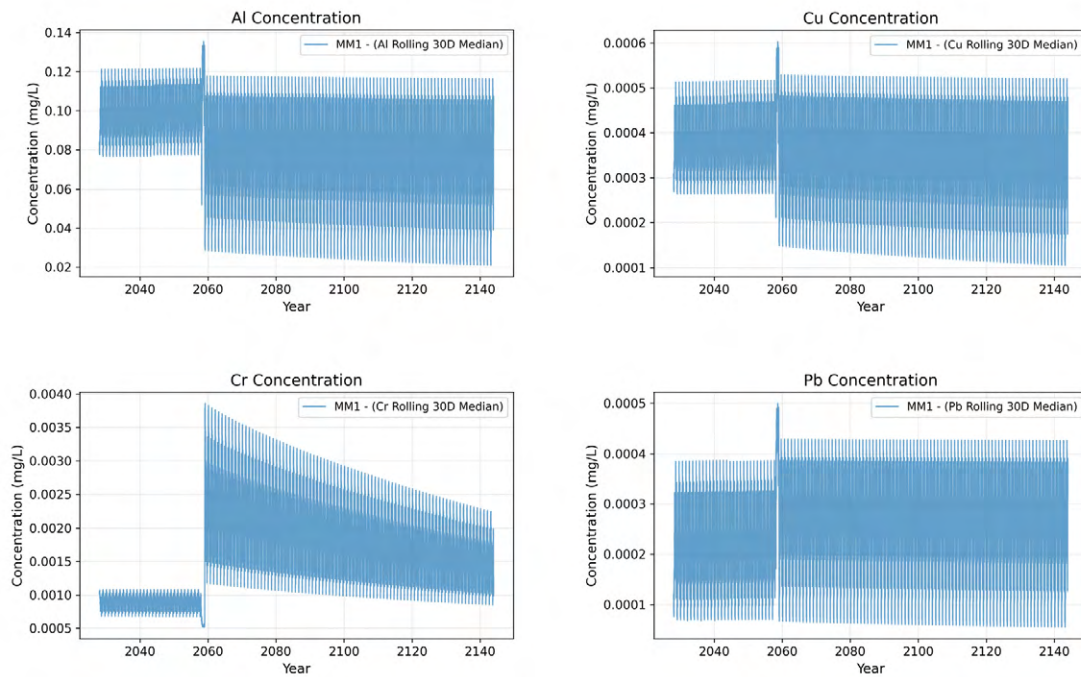


Figure 187: MM1 - S1 (High Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

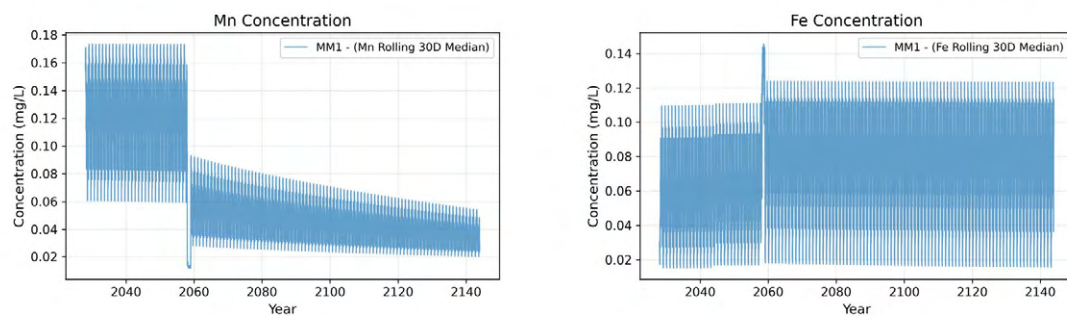


Figure 188: MM1 - S1 (High Rainfall) - 30 day rolling median (Mn, Fe)

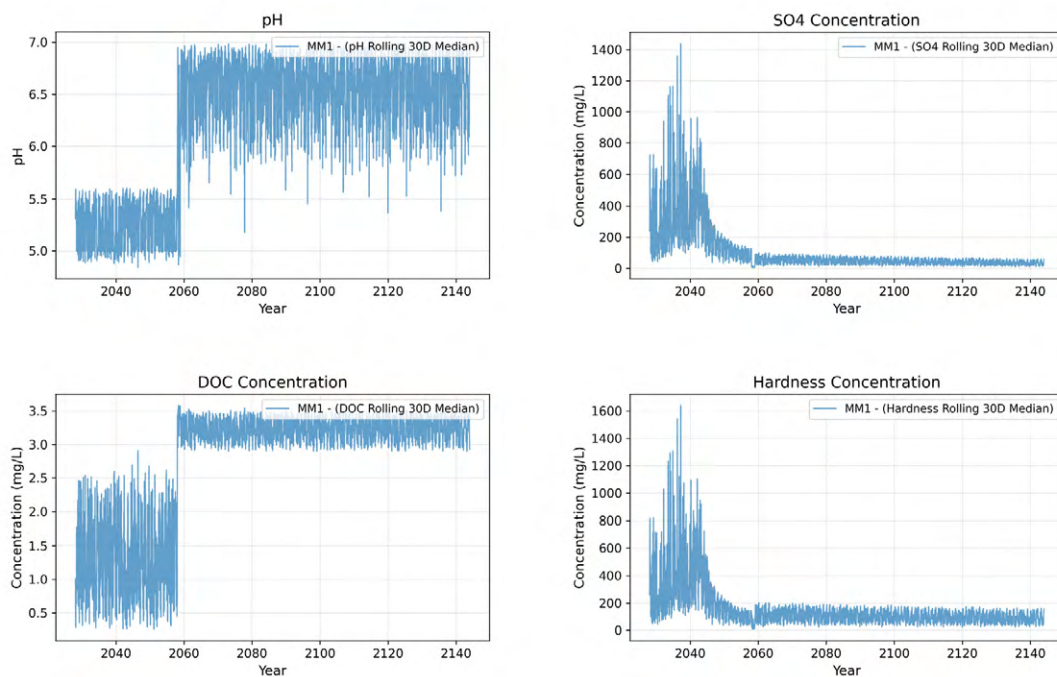


Figure 189: MM1 - S2 (Stochastic Rainfall) - 30 day rolling median (pH, SO4, DOC, Hardness)

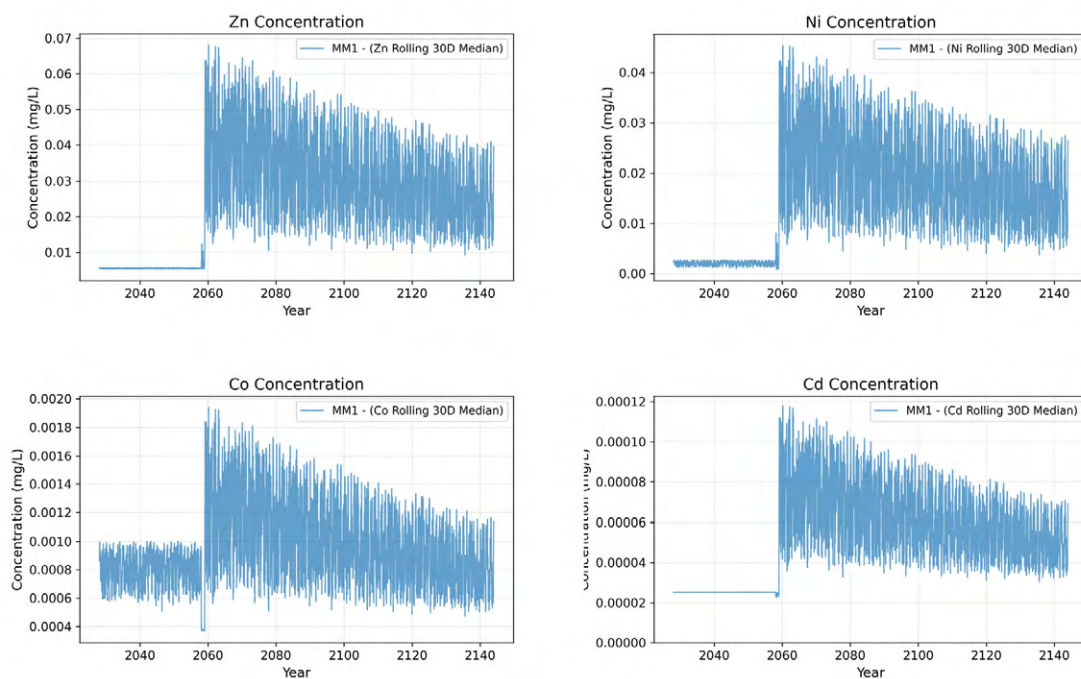


Figure 190: MM1 - S2 (Stochastic Rainfall) - 30 day rolling median (Zn, Ni, Co, Cd)

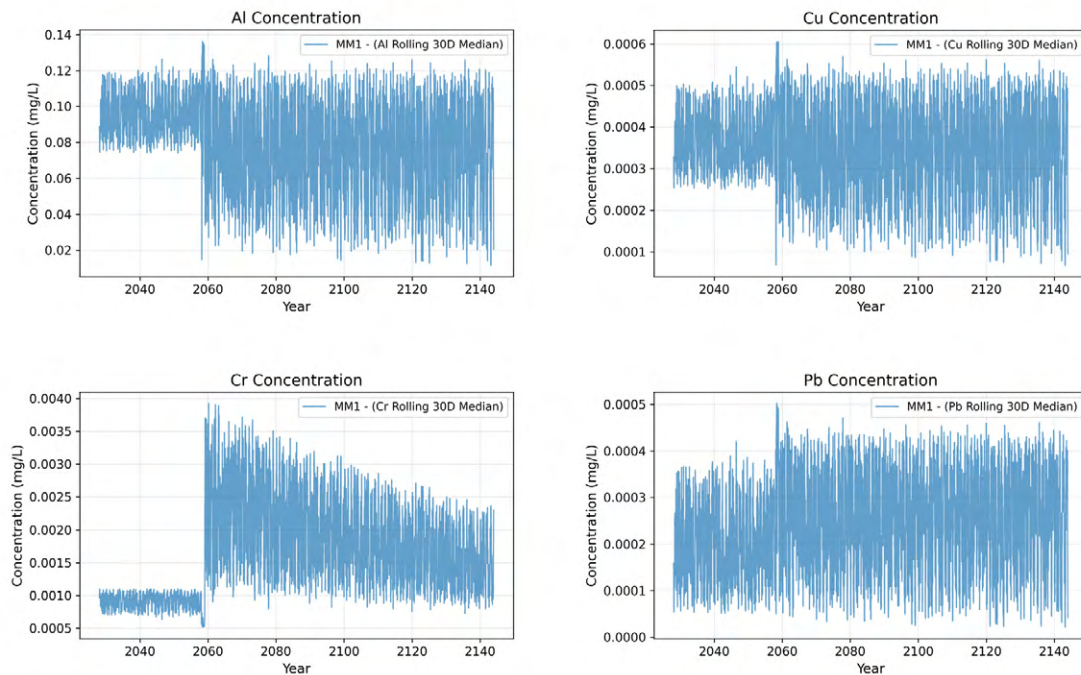


Figure 191: MM1 - S2 (Stochastic Rainfall) - 30 day rolling median (Al, Cu, Cr, Pb)

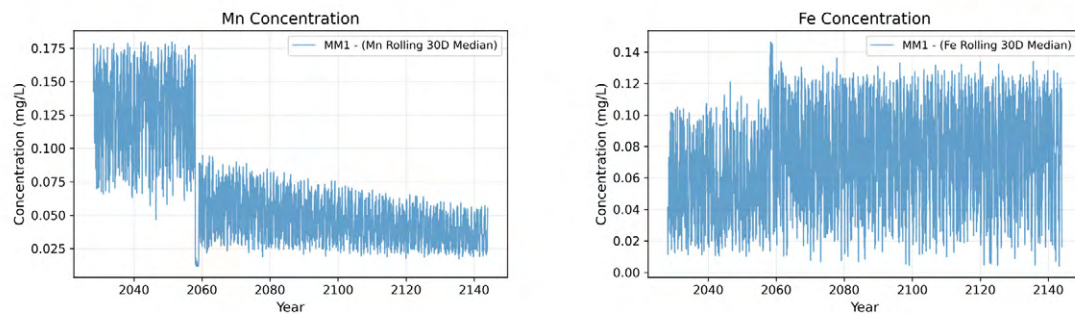


Figure 192: MM1 - S2 (Stochastic Rainfall) - 30 day rolling median (Mn, Fe)

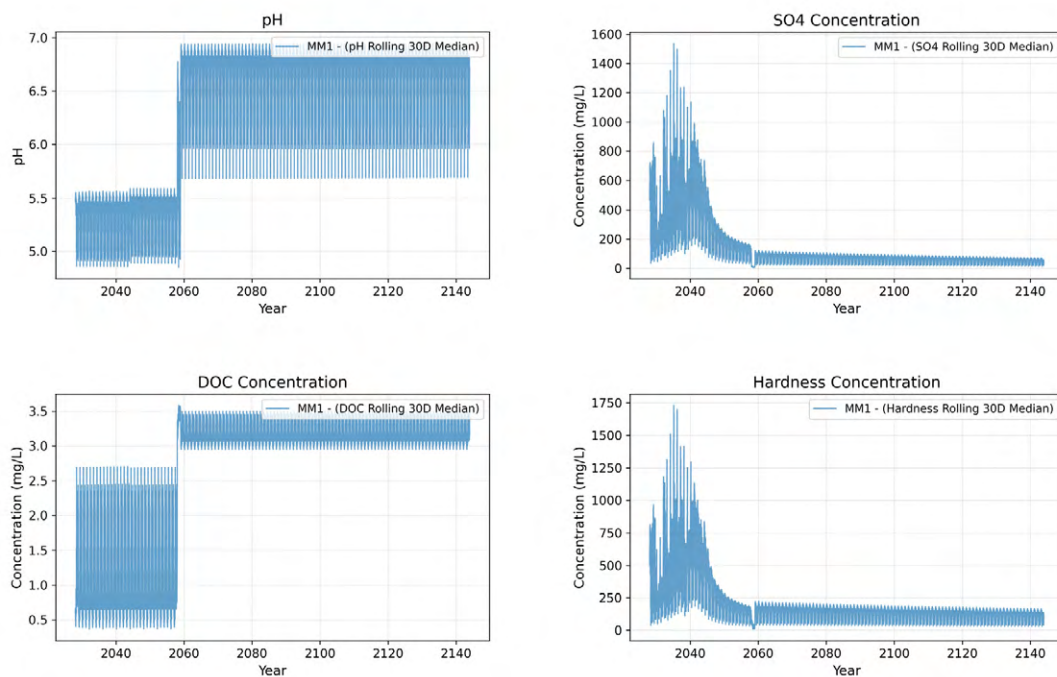


Figure 193: MM1 - S3 (ELF ST +30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

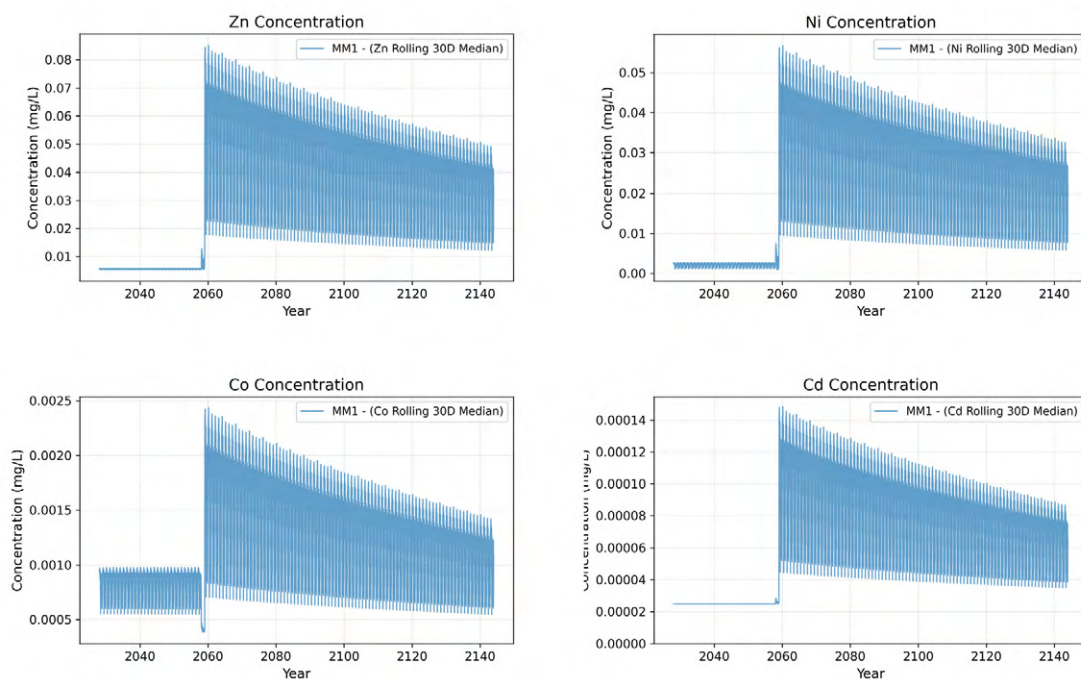


Figure 194: MM1 - S3 (ELF ST +30%) - 30 day rolling median (Zn, Ni, Co, Cd)

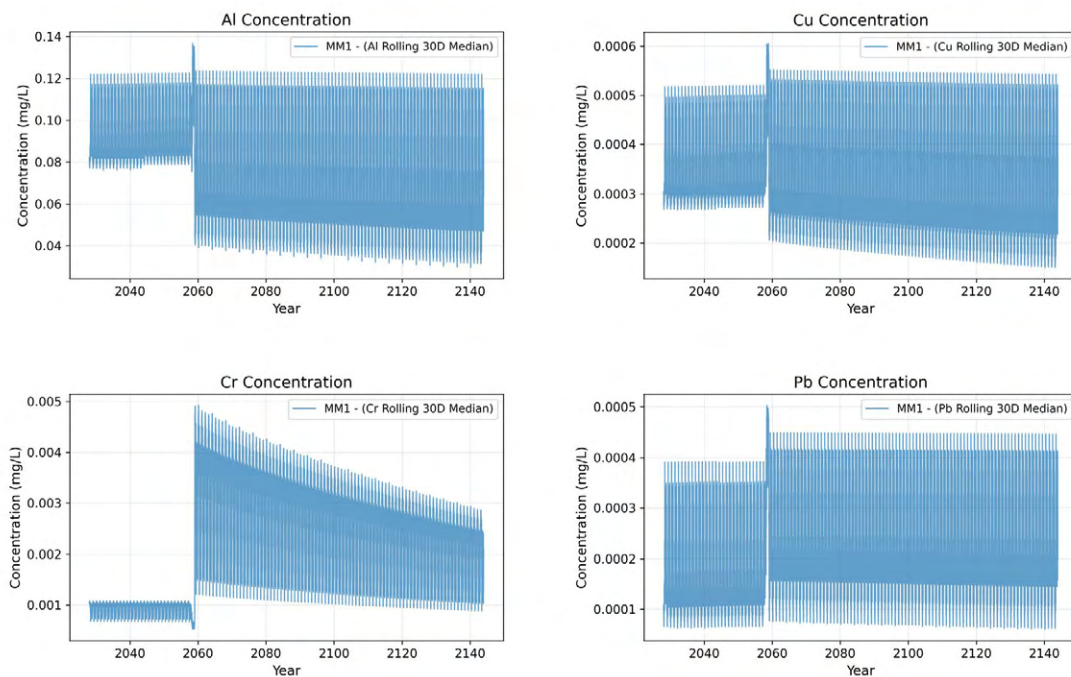


Figure 195: MM1 - S3 (ELF ST +30%) - 30 day rolling median (Al, Cu, Cr, Pb)

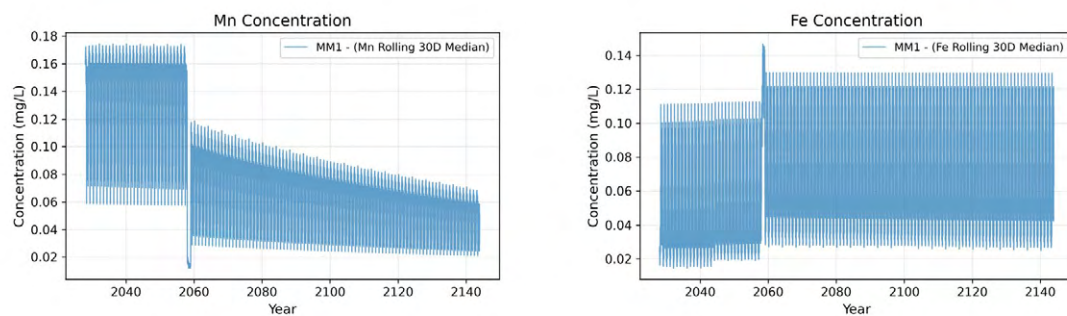


Figure 196: MM1 - S3 (ELF ST +30%) - 30 day rolling median (Mn, Fe)

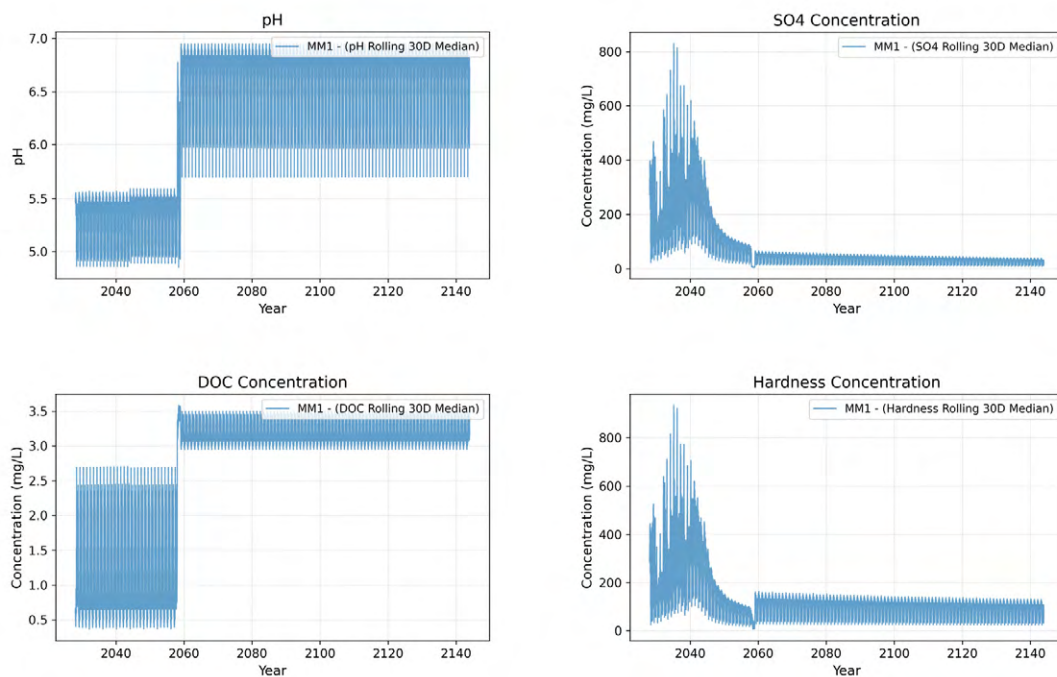


Figure 197: MM1 - S4 (ELF ST -30%) - 30 day rolling median (pH, SO4, DOC, Hardness)

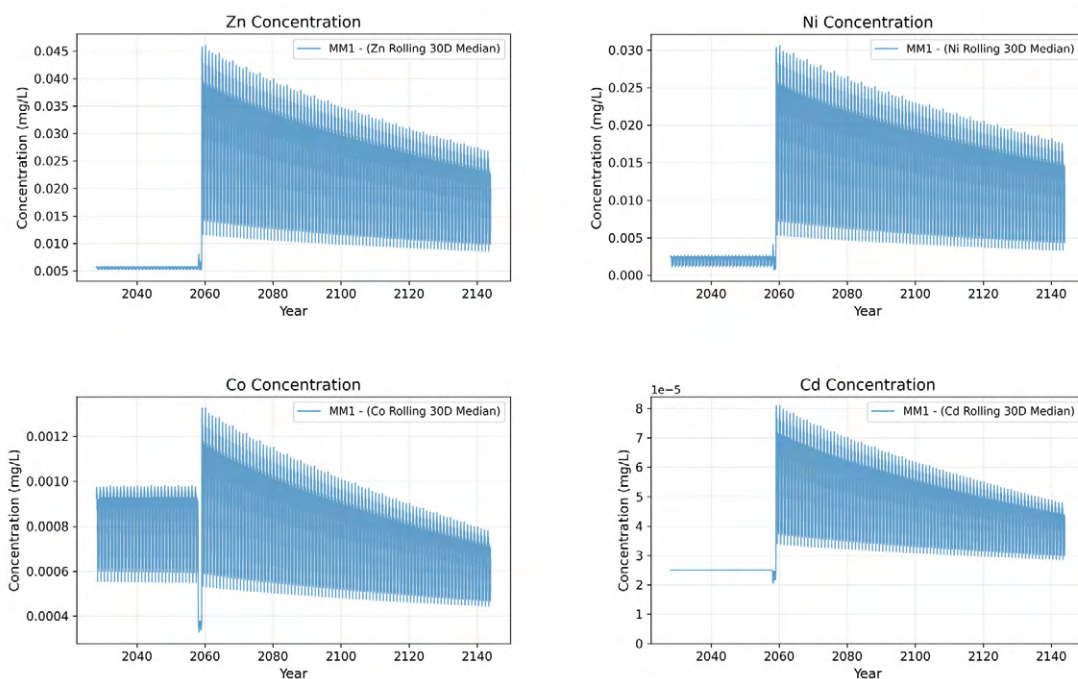


Figure 198: MM1 - S4 (ELF ST -30%) - 30 day rolling median (Zn, Ni, Co, Cd)

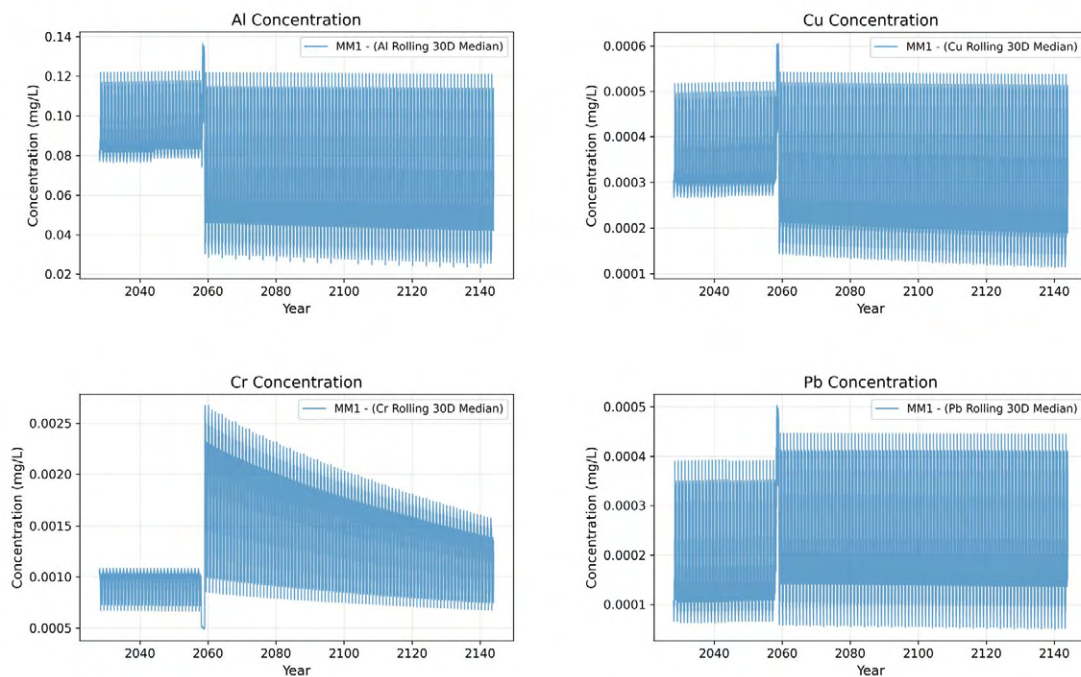


Figure 199: MM1 - S4 (ELF ST -30%) - 30 day rolling median (Al, Cu, Cr, Pb)

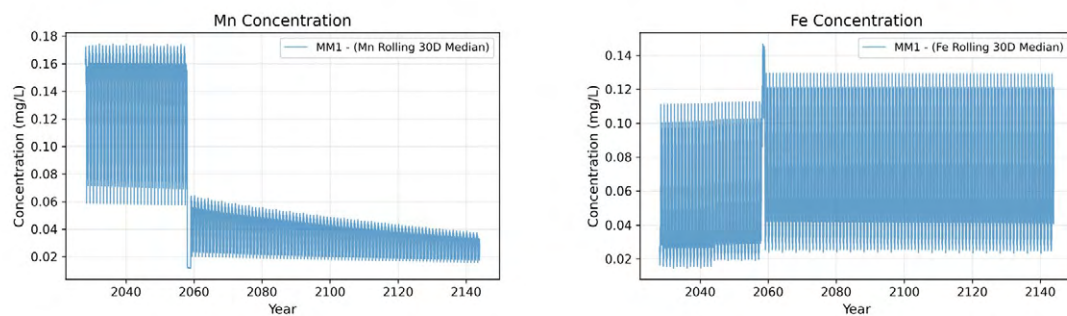
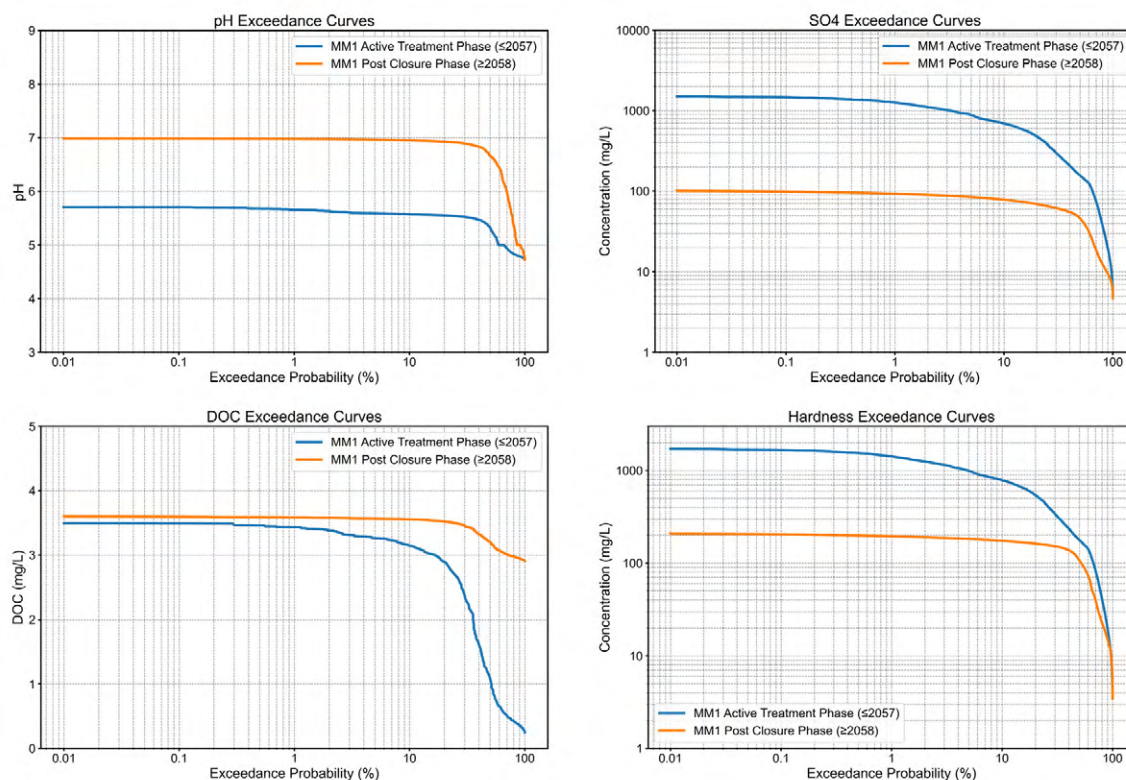
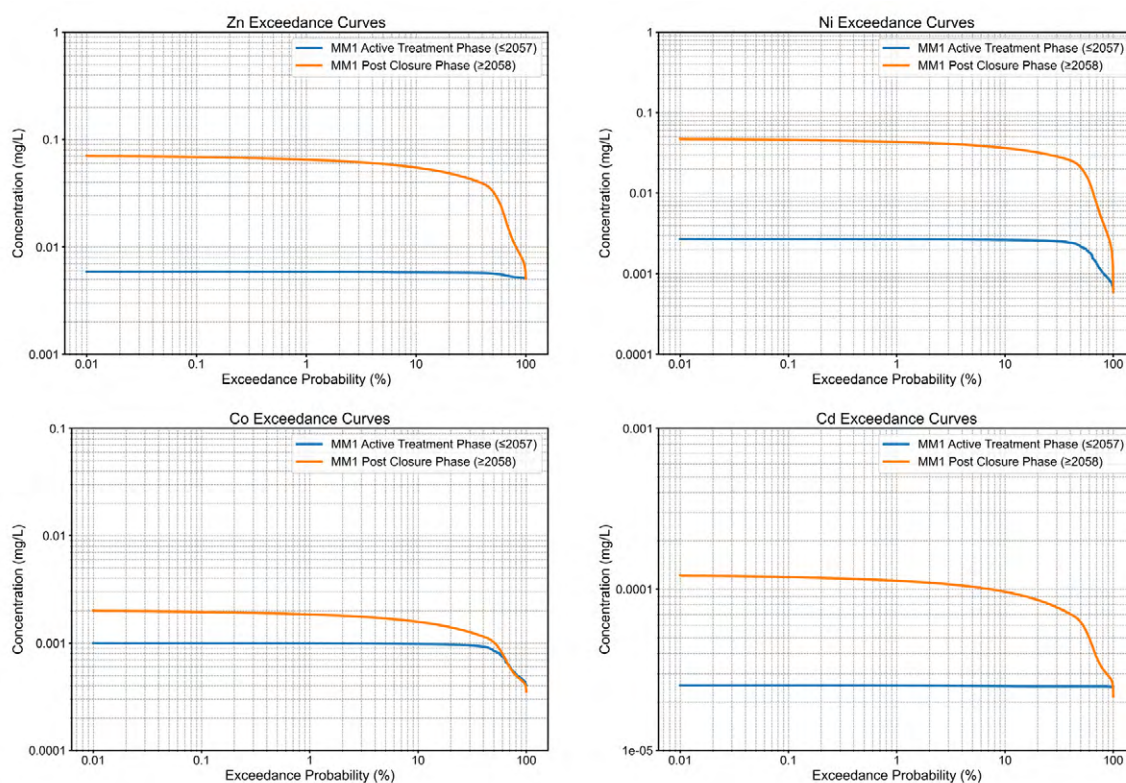


Figure 200: MM1 - S4 (ELF ST -30%) - 30 day rolling median (Mn, Fe)

Probability Exceedance**Figure 201:** MM1 - Base Case - Exceedance probability plots (pH, SO₄, DOC, Hardness)**Figure 202:** MM1 - Base Case - Exceedance probability plots (Zn, Ni, Co, Cd)

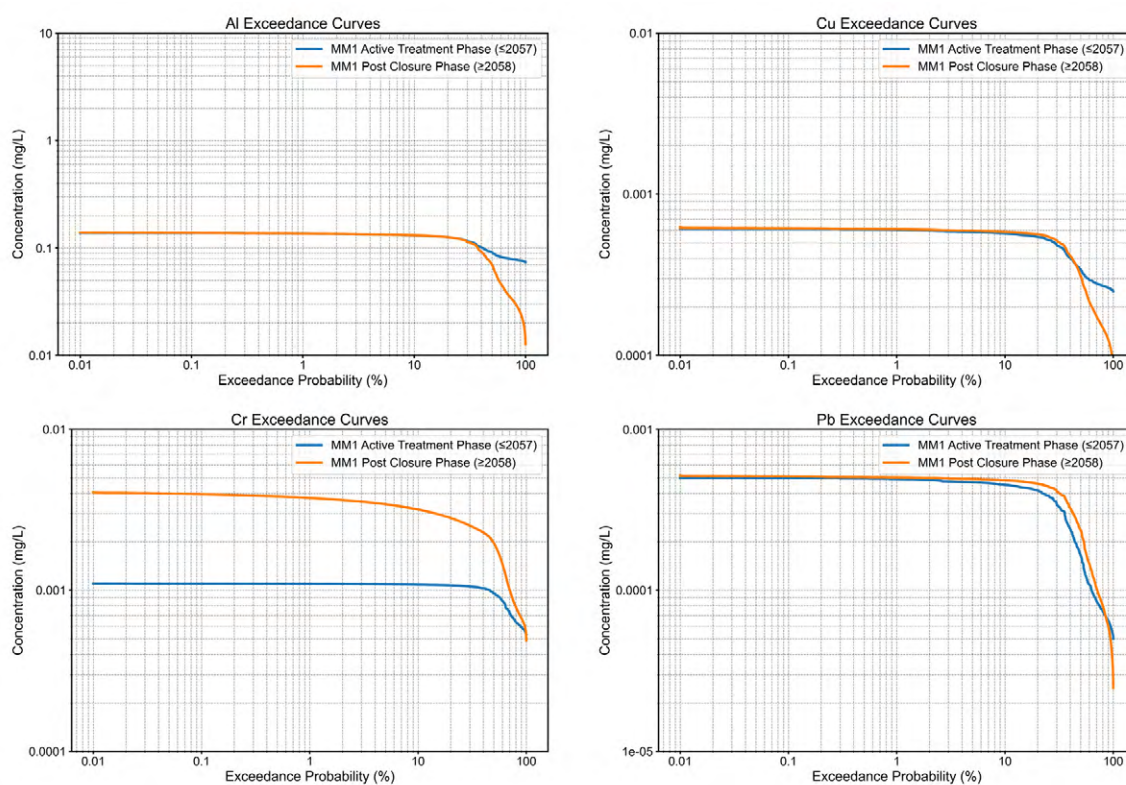


Figure 203: MM1 - Base Case - Exceedance probability plots (Al, Cu, Cr, Pb)

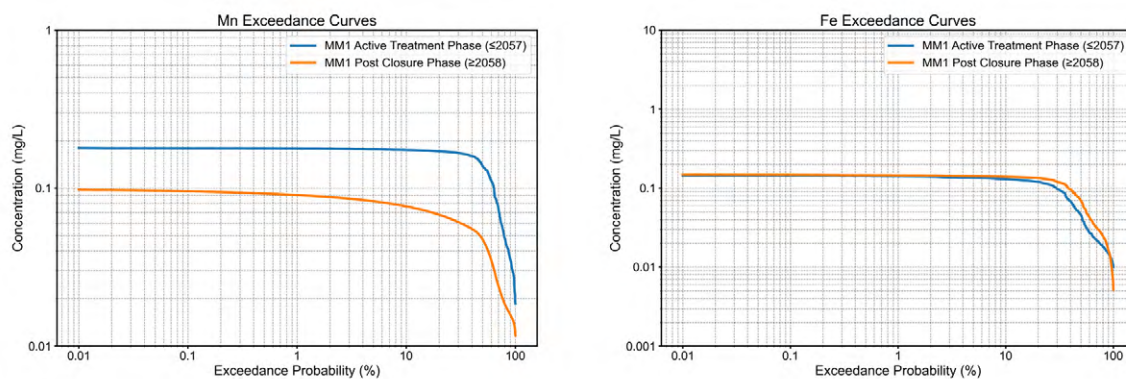
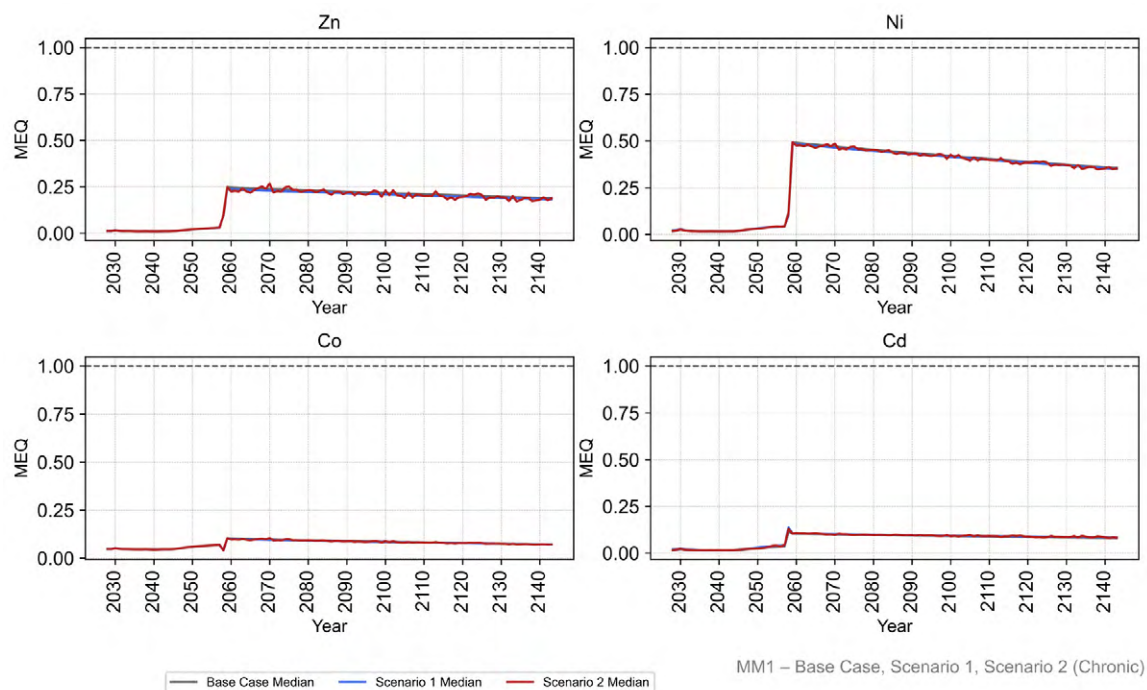
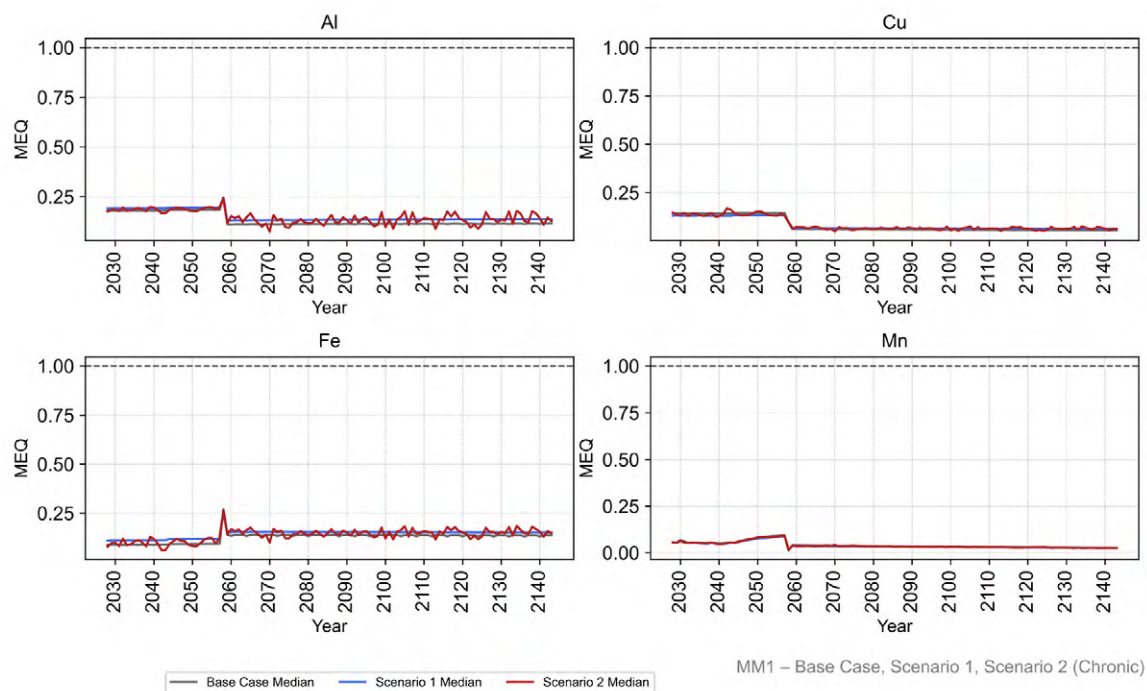


Figure 204: MM1 - Base Case - Exceedance probability plots (Mn, Fe)

Compliance & WQ Standards**Figure 205:** MM1 - Rainfall Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)**Figure 206:** MM1 - Rainfall Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

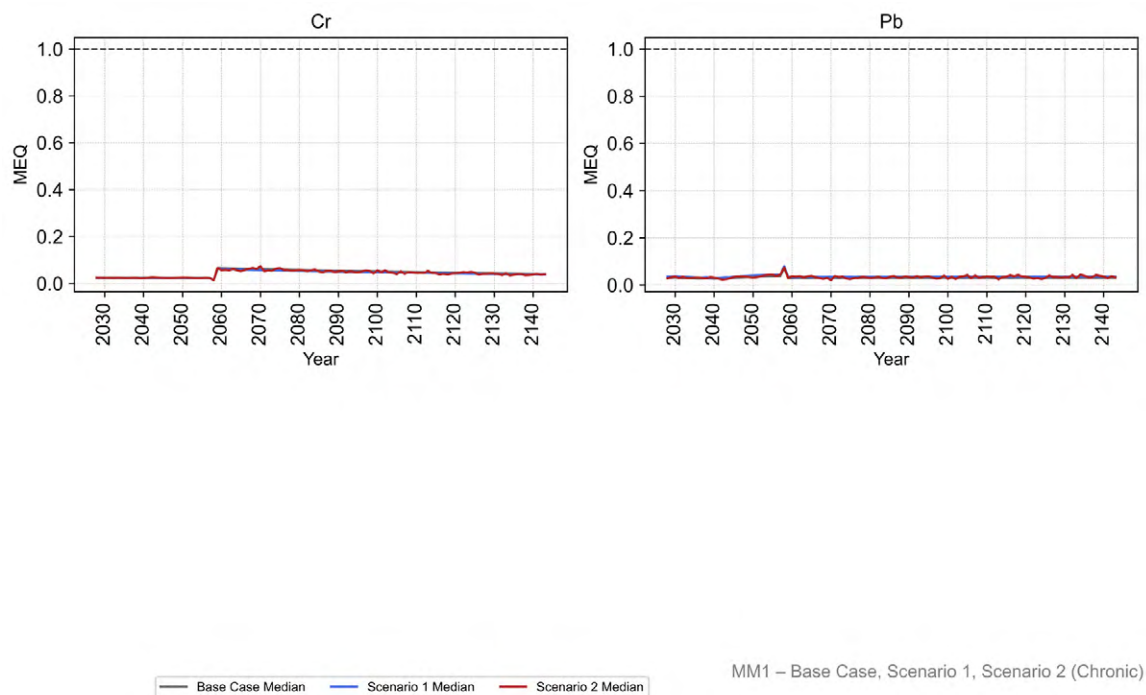


Figure 207: MM1 - Rainfall Scenarios - Chronic criteria compliance (Cr, Pb)

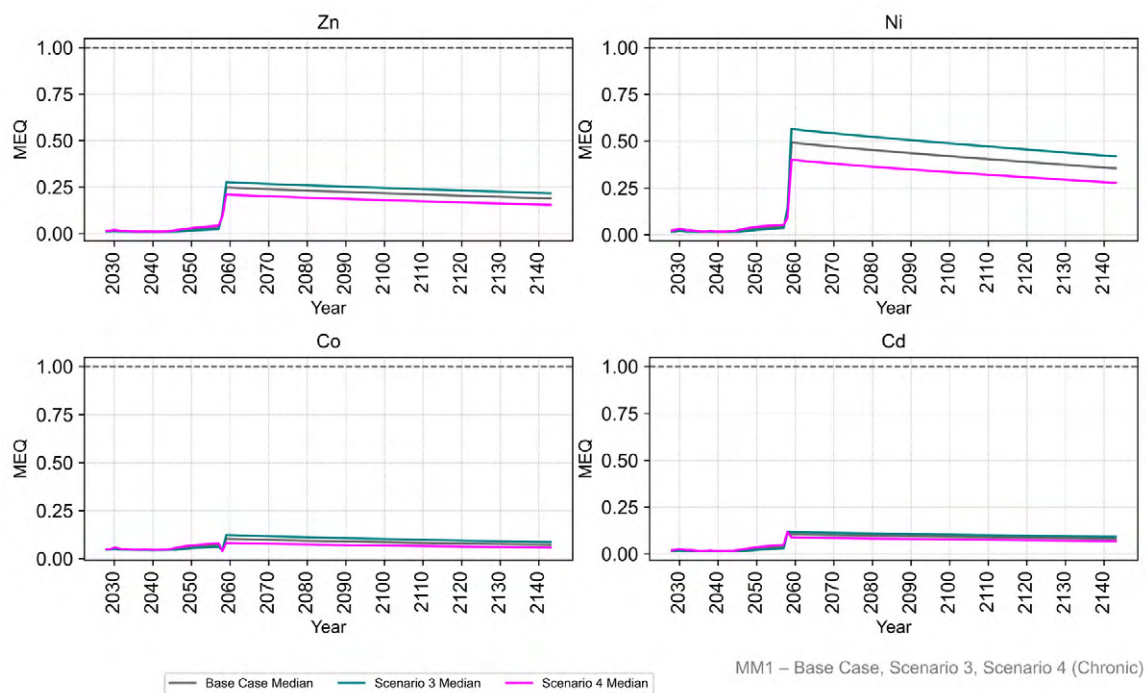


Figure 208: MM1 - Source Term Scenarios - Chronic criteria compliance (Zn, Ni, Co, Cd)

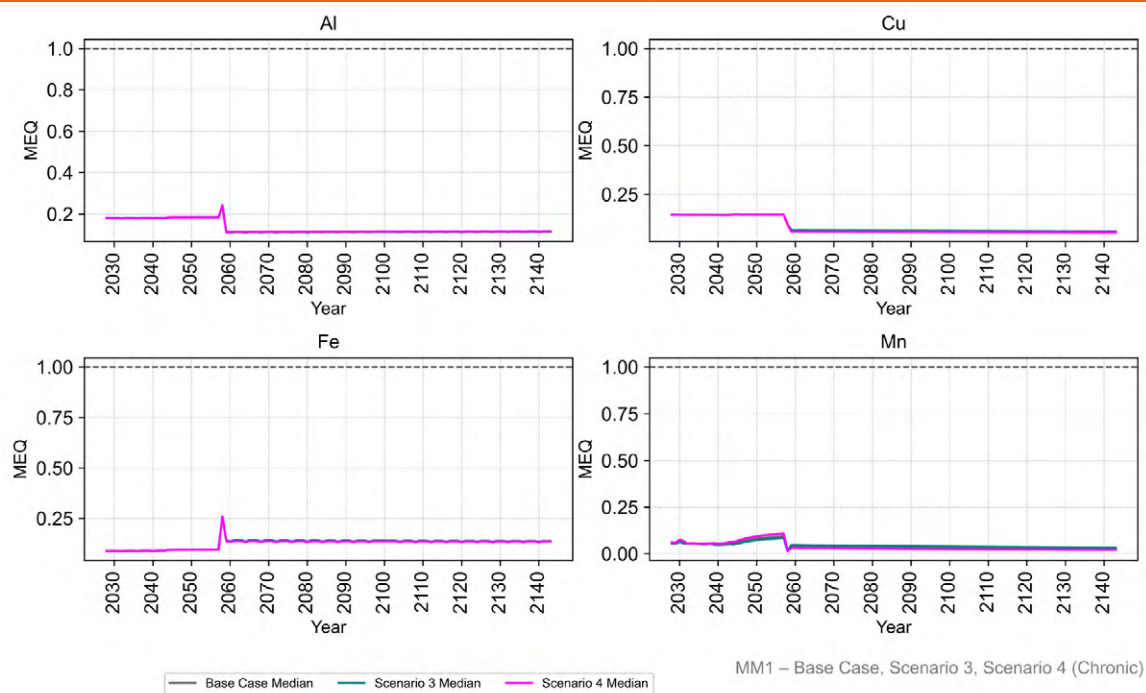


Figure 209: MM1 - Source Term Scenarios - Chronic criteria compliance (Al, Cu, Fe, Mn)

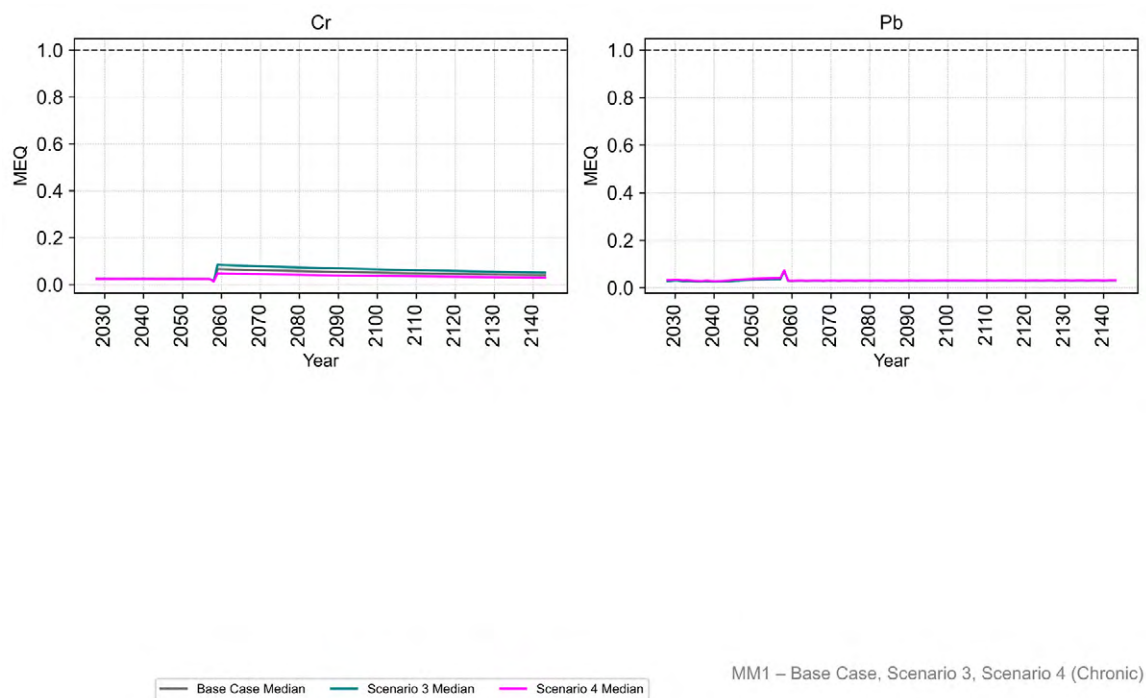


Figure 210: MM1 - Source Term Scenarios - Chronic criteria compliance (Cr, Pb)

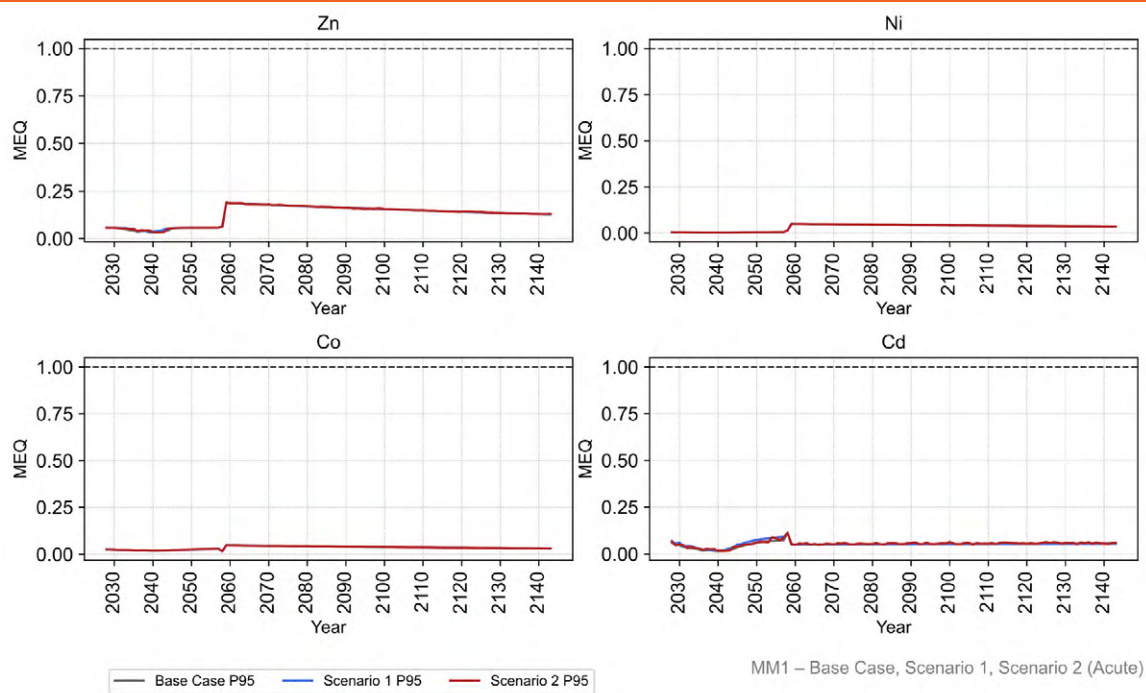


Figure 211: MM1 - Rainfall Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

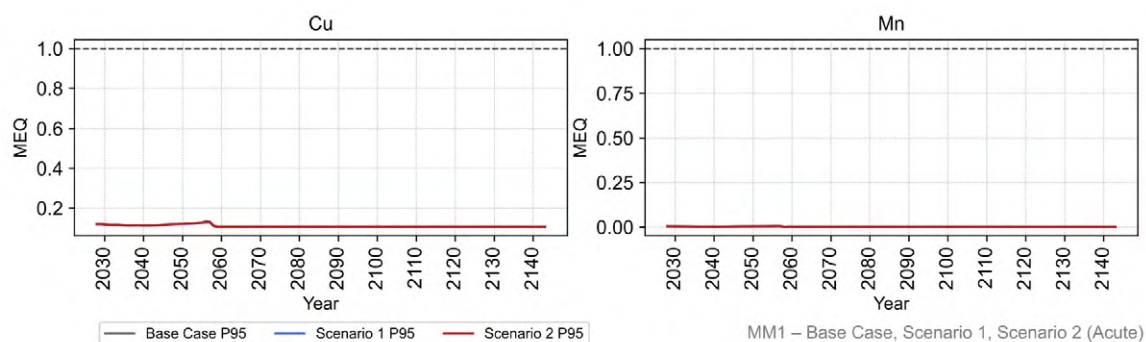


Figure 212: MM1 - Rainfall Scenarios - Acute criteria compliance (Cu, Mn)

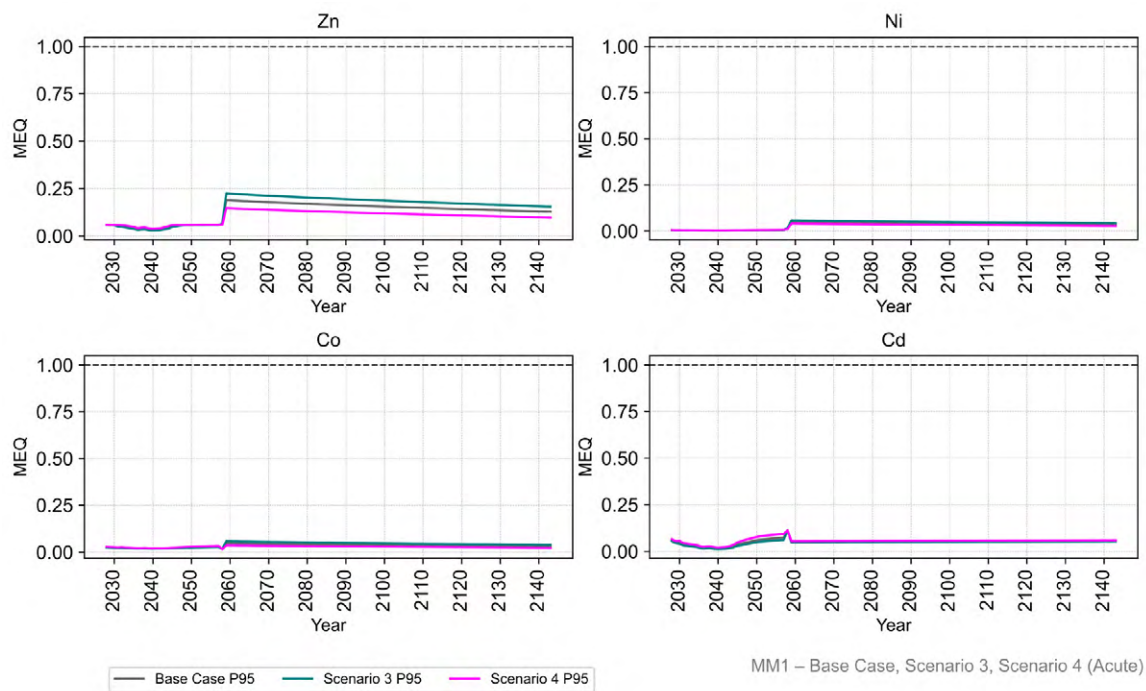


Figure 213: MM1 - Source Term Scenarios - Acute criteria compliance (Zn, Ni, Co, Cd)

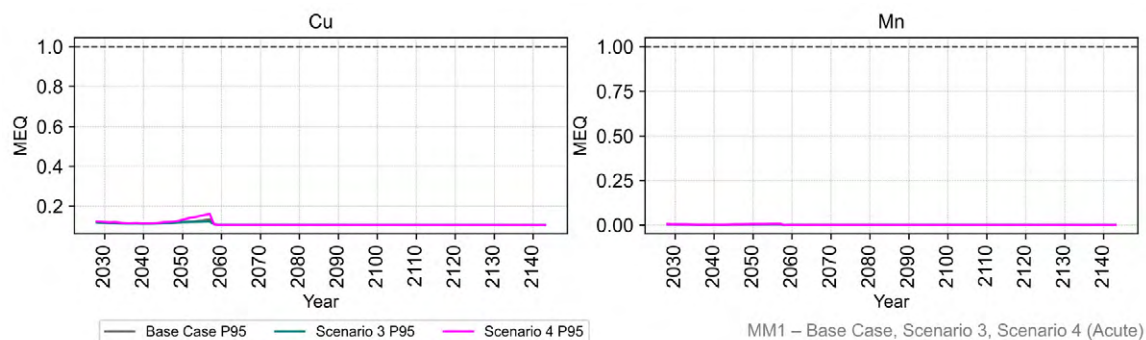


Figure 214: MM1 - Source Term Scenarios - Acute criteria compliance (Cu, Mn)

Exceedance Frequencies

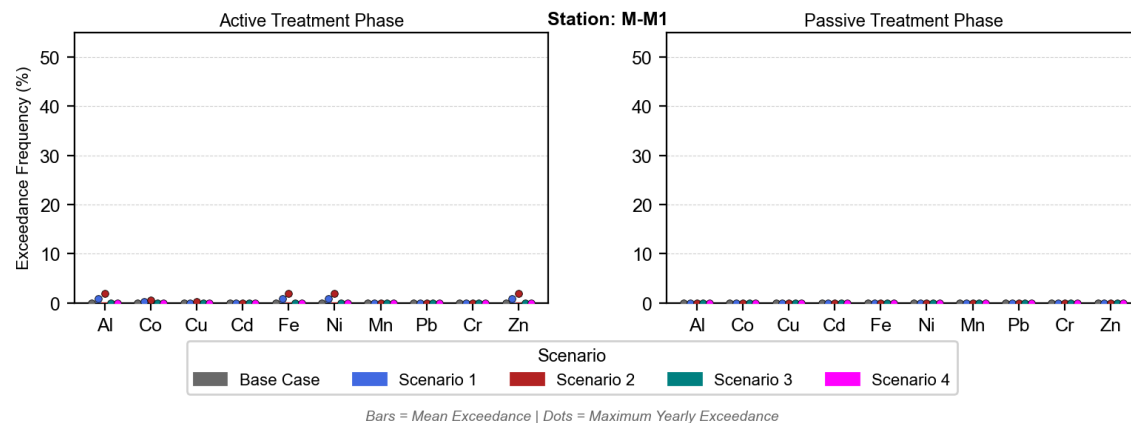


Figure 215: MM1 - Chronic exceedance frequencies

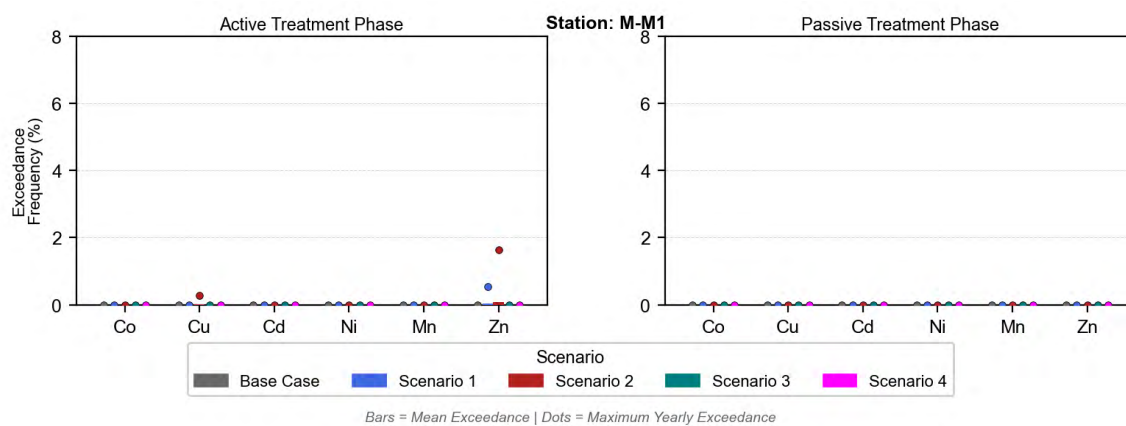


Figure 216: MM1 - Acute exceedance frequencies



MINE WASTE MANAGEMENT

GREENROAD GROUP