Klohn Crippen Berger

St. Mary River Irrigation District

Chin Reservoir Expansion Project

Supplemental Information Request #1



Response to Supplemental Information Request

CANADA BEST MANAGED COMPANIES Platinum member

ISO 9001 14001 45001

01A03701E05

August 2025

TABLE OF CONTENTS

1 ACRONYMS 1
2 NATURAL RESOURCES CONSERVATION BOARD 5
2.1 General 5
3 GENERAL 157
3.1 Public Engagement and Aboriginal Consultation 157
3.2 Noise 188
3.3 Socio-Economic 199
3.4 Transportation 215
3.5 Historic Resources 227
3.6 Climate Change 246
3.7 Traditional Ecological Knowledge and Traditional Land Use 250
4 AIR 255
4.1 Air Quality Assessment 255
5 WATER 265
5.1 Water Management 265
5.2 Hydrogeology 302
5.3 Hydrology 356
5.4 Surface Water Quality 405
6 TERRESTRIAL 495
6.1 Land Use and Land Management 495
6.2 Conservation and Reclamation 498
6.3 Terrain and Soils 507
6.4 Vegetation and Wetlands 509
6.5 Wildlife 516
7 HEALTH 520
8 APPROVALS 545
8.1 Public Lands Act 545
9 ERRATA 547
REFERENCES 577

TABLE OF CONTENTS

(continued)

List of Tables

Table 2.1 Monthly average flow (m3/s) and maximum and minimum flow (m3/s) at "Canadian St. Mary Canal near Spring Coulee" as per hydrometric gauge station 05AE026 for the years 1993 to 2023 11
Table 2.2 Monthly average flow (m3/s) and maximum and minimum flow (m3/s) going from MRRR to the SMRID works for the years 1994 to 2023 12
Table 2.3 Percentage (%) of days per month from 1994 to 2023 when Waterton River flow was below the current Water Conservation Objective of 2.27 m3/s 13
Table 2.4 Percentage (%) of days per month from 1994 to 2023 when Belly River flow was below the current Water Conservation Objective of 0.93 m3/s 14
Table 2.5 Percentage (%) of days per month from 1994 to 2023 when St. Mary River flow was below the current Water Conservation Objective of 2.75 m3/s 15
Table 3.1 Estimated GHG emissions from the Chin Reservoir Expansion Project During the Construction Phase 25
Table 3.2 Matching of EIA Landcover Classifications with the ECCC Land-use Categories 26
Table 3.3 Areas of Land Converted to Settlement by Land-use Category (in ha) 27
Table 3.4 Annual and total CO2 emissions from flooding the reservoir 29
Table 3.5 Direct GHG Emissions During the Operations Phase from Flooding the Reservoir 31
Table 4.1 Total annual volume of water diverted from the St. Mary Reservoir to the MRRR (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AE006 "Canadian St. Mary Canal near Spring Coulee" 39
Table 4.2 Summary of the average and range of annual water diversion volumes from the St. Mary Reservoir toward the to the MRRR (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AE006 "Canadian St. Mary Canal near Spring Coulee" 39
Table 4.3 Total annual volume of water flowing in the St. Mary River near Lethbridge (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AE006 "St. Mary River near Lethbridge" 41
Table 4.4 Summary of the average and range of annual water flowing in the St. Mary River near Lethbridge (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AE006 41
Table 4.5 Total annual volume of discharge at the Oldman River near Lethbridge (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AD007 "Oldman River near Lethbridge" 43
Table 4.6 Summary of the average and range of annual discharge at the Oldman River near Lethbridge (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AD007 "Oldman River near Lethbridge" 43

TABLE OF CONTENTS

(continued)

Table 4.7 Total annual volume of discharge at the Oldman River near the Mouth (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AG006 “Oldman River near the Mouth” 45
Table 4.8 Summary of average and range of annual discharge at the Oldman River near the Mouth (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AG006 “Oldman River near the Mouth” 45
Table 4.9 Total annual volume of discharge at the South Saskatchewan River at Medicine Hat (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AJ001 “South Saskatchewan River at Medicine Hat” 47
Table 4.10 Summary of average and range of annual discharge at the South Saskatchewan River at Medicine Hat (1994–2023), based on data from the Water Survey of Canada hydrometric gauge 05AJ001 “South Saskatchewan River at Medicine Hat” 47
Table 7.1 Average annual modelled inflows to the Chin Reservoir under the Base case and Project Case, based on simulated historical inflows (1928–2009) 70
Table 7.2 Average annual modelled releases from the Chin Reservoir under the Base case and Project Case, based on simulated historical inflows (1928–2009) 70
Table 9.1 Societal Economic Indicators for Chin Reservoir Expansion Project (Construction Cost = $190 Million)* 87
Table 9.2 Societal Economic Indicators for Chin Reservoir Expansion Project (Construction Cost = $228 Million)* 87
Table 12.1 Project Component Areas and Soil Volumes 93
Table 12.2 Project Component Areas and Estimated Volumes of Soils Salvaged for Reclamation 95
Table 12.3 Reclamation Areas and Estimated Reclamation Soil Volumes 96
Table 14.1 Watercourse 126419 Flood Return Period Runoff Volume 102
Table 27.1 Alberta Input-Output Coefficients for the Agricultural Processing Sector 131
Table 29.1 Chin Reservoir Catchment Areal PMP Estimates 135
Table 29.2 Chin Reservoir Rainfall Frequency Estimates 136
Table 29.3 Chin Expanded Chin Reservoir Upland PMF Estimate: Runoff vs Water Inputs 137
Table 29.4 Surface Runoff Volumes and Maximum Expanded Chin Reservoir Levels 138
Table 36.2 A Detailed List of Food Processing Industries 147
Table 39.1 Present Value of Benefits and Costs Related to Chin Reservoir Expansion (Revised) . 153
Table 39.2 Financial Analysis Results for the Chin Reservoir Expansion Project (Revised) 153
Table 42.1 Groundwater Petroleum Hydrocarbon Concentrations (Concentrations in mg/L) 156
Table 44.1 Comments and Concerns Raised during the Public Engagement Meetings in November 2022 161
Table 44.2 Comments and Concerns Raised during Various AGMs 171
Table 44.3 Comments and Concerns Raised during the Open House Meetings in December 2024 172

TABLE OF CONTENTS

(continued)

Table 58.1 Irrigation Districts Acronyms as used in Volume 3 of the EIA Submission 199
Table 60.1 Annual Disaggregated Value of Benefits and Costs for the Chin Reservoir Expansion 202
Table 61.1 Definition of Direct Benefits/Costs Particulars Estimated in Volume 3 204
Table 64.1 New East Dam Cost Summary 209
Table 64.2 Estimated Equipment, Materials, and Labour Costs – Construction Stage 210
Table 90.1 Comparison of construction vehicle types and numbers between the Chin Reservoir Expansion Project and the Springbank Off-Stream Reservoir Project 263
Table 100.1 Chin Reservoir Runoff Volume 299
Table 103.1 Abandoned Well Information Summary 304
Table 115.1 Summary of Proposed Project Monitoring and Water Wells for the Observational Monitoring Program 321
Table 126.1 Regional Groundwater Quality Based on Private Well Records (concentrations in mg/L) 338
Table 126.2 Historical Groundwater Quality from Private Wells (concentrations in mg/L) 339
Table 133.1 Summary of Water Wells within the Reservoir Expansion Area 348
Table 160.1 Total annual inflows and outflows and storage at the start and end of the season for the Chin and the Stafford Reservoirs by operational season 399
Table 161.1 Summary of Surface Water Licences 401
Table 165.1 Summary of Guideline Exceedances for Baseline Data from Chin Reservoir, Stafford Reservoir, and Watercourse 126419 411
Table 165.2 Summary of Guideline Exceedances for Historical Data from SMRID Canal Sampling Locations Upstream and Downstream of Chin Reservoir 413
Table 165.3 Mean and Range of Anion and Nutrient Concentrations in Chin Reservoir 416
Table 165.4 Mean and Range of Total Metals Concentrations in Chin Reservoir 417
Table 165.5 Mean and Range of Anion and Nutrient Concentrations in Stafford Reservoir 419
Table 165.6 Mean and Range of Total Metals Concentrations in Stafford Reservoir 421
Table 165.7 Mean and Range of Anion and Nutrient Concentrations in Watercourse 126419 423
Table 165.8 Mean and Range of Total Metals Concentrations in Watercourse 126419 425
Table 165.9 Mean and Range of Anion and Nutrient Concentrations in SMRID System Upstream from Chin Reservoir 428
Table 165.10 Mean and Range of Total Metals Concentrations in SMRID System Upstream from Chin Reservoir 429
Table 165.11 Mean and Range of Pesticide Concentrations in SMRID System Upstream from Chin Reservoir 431
Table 165.12 Mean and Range of Anion and Nutrient Concentrations in SMRID System Downstream from Chin Reservoir 432
Table 165.13 Mean and Range of Total Metals Concentrations in SMRID System Downstream from Chin Reservoir 434

TABLE OF CONTENTS

(continued)

Table 165.14 Mean and Range of Pesticide Concentrations in SMRID System Upstream from Chin Reservoir 435
Table 192.1 IDWQ Project Monitoring Locations 489
Table 200.1 Project Component Names of Conceptual C&R Plan Component Requirements 500
Table 217.1 Receptor Locations for the Chin Reservoir Expansion Assessment 530
Table 219.1 Comparison of Air Quality Criteria from the Canmore Cougar Creek Flood Retention, Tazi Twé Project, and the Springbank Off-Stream Reservoir Project with Current Alberta Ambient Air Quality Objectives 538
Table 234.1 Revised Text Mentioning Historic Resources 556

List of Figures

Figure 2.1 Chin Reservoir Catchment 19
Figure 2.2 Hydrology Baseline Study Regional and Local Study Area 20
Figure 2.3 Regional Water Management System in the Southern Tributaries Watershed 21
Figure 2.4 Irrigation Districts 22
Figure 3.1 Carbon Sink Impact Within the Project Area (Sheet 1 of 4) 34
Figure 3.2 Carbon Sink Impact Within the Project Area (Sheet 2 of 4) 35
Figure 3.3 Carbon Sink Impact Within the Project Area (Sheet 3 of 4) 36
Figure 3.4 Carbon Sink Impact Within the Project Area (Sheet 4 of 4) 36
Figure 4.1 Average annual, minimum and maximum volume of water diverted from the St. Mary Reservoir toward the MRRR (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AE026 “Canadian St. Mary Canal near Spring Coulee” 40
Figure 4.2 Average annual, minimum and maximum volume of water flowing in the St. Mary River near Lethbridge (1994–2021), based on data from the Water Survey of Canada hydrometric gauge station 05AE006 42
Figure 4.3 Average annual, minimum and maximum volume of water discharged from the Oldman River near Lethbridge (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AD007 “Oldman River near Lethbridge” 44
Figure 4.4 Average annual, minimum and maximum volume of water discharged from the Oldman River near the Mouth (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AG006 “Oldman River near the Mouth” 46
Figure 4.5 Average annual, minimum and maximum volume of water discharged from the South Saskatchewan River at Medicine Hat (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AJ001 “South Saskatchewan River at Medicine Hat” 48
Figure 4.6 Annual volume of water (dam3) diverted for the SMRID comparing SOAP Model results for the Base case Scenario and the Expansion Scenario 50

TABLE OF CONTENTS

(continued)

Figure 4.6 Annual volume of water (dam3) diverted for the SMRID comparing SOAP Model results for the Base case Scenario and the Expansion Scenario 50
Figure 4.7 Hydrograph comparing SSROM-simulated flows for St. Mary Reservoir Outflow under the Base case Scenario and the Expansion Scenario 51
Figure 4.8 Hydrograph comparing annual flows for St. Mary River under the Base case Scenario and the Expansion Scenario 53
Figure 4.9 Hydrograph comparing annual flows for St. Mary River under the Base case Scenario and the Expansion Scenario 54
Figure 4.10 Hydrograph comparing SSROM-simulated annual flows for the Oldman River under the Base case Scenario and Expansion Scenario 55
Figure 4.11 Hydrograph comparing SSROM-Simulated annual flows for the South Saskatchewan River under the Base case Scenario and Expansion Scenario 56
Figure 5.1 SMRID Irrigation Parcels 63
Figure 7.1 Project Components of the Project Area 72
Figure 7.2 Stage Storage Curve with Pertinent Elevations 73
Figure 7.3 Simulated Mean and Range of Reservoir Levels for the Existing Chin Reservoir – Base case (1928–2009) 68
Figure 7.4 Simulated Mean and Range of Reservoir Levels for the Expanded Chin Reservoir - Project Case (1928–2009) 69
Figure 8.1 New East Dam Project Schedule 83
Figure 8.2 Monitoring Schedule 84
Figure 13.1 Watercourse 126419 Water Samples and Soil Series 100
Figure 57.1 Noise and Air Quality 198
Figure 76.1 Historic Resources Impact Assessment Archaeology Survey Tracks (Sheet 1 of 4) 232
Figure 76.2 Historic Resources Impact Assessment Archaeology Survey Tracks (Sheet 2 of 4) 233
Figure 76.3 Historic Resources Impact Assessment Archaeology Survey Tracks (Sheet 3 of 4) 234
Figure 76.4 Historic Resources Impact Assessment Archaeology Survey Tracks (Sheet 4 of 4) 235
Figure 76.5 Historic Resources Impact Assessment Palaeontology Survey Tracks (Sheet 1 of 4) .. 236
Figure 76.6 Historic Resources Impact Assessment Palaeontology Survey Tracks (Sheet 2 of 4) . 237
Figure 76.7 Historic Resources Impact Assessment Palaeontology Survey Tracks (Sheet 3 of 4) . 238
Figure 76.8 Historic Resources Impact Assessment Palaeontology Survey Tracks (Sheet 4 of 4) . 239
Figure 77.1 Public Listing of Archaeology Historic Resource Values 242
Figure 78.1 Public Listing of Palaeontology Historic Resource Values 245
Figure 79.1 Projected changes in precipitation and temperature under RCP 4.5 and 8.5 scenarios for the study area, for the periods 2021-2050 and 2051-2080, relative to the 1991–2020 historical baseline (WaterSMART 2023) 247
Figure 92.1 Regional Location Map 367
Figure 92.2 Existing Components 268

TABLE OF CONTENTS

(continued)

Figure 94.1 Change in average annual precipitation in the Waterton, Belly, and St. Mary River watersheds under two climate change scenarios (RCP 4.5 and 8.5) for two future 30-year periods (2021–2050 and 2051–2080), relative to the 1991–2020 historical period (adapted from WaterSMART 2023) 271
Figure 94.2 Change in average peak snow water equivalent in the Waterton, Belly and St. Mary River watersheds under two climate change scenarios (RCP 4.5 and 8.5) for two future 30-year periods (2021–2050 and 2051–2080), relative to the 1991–2020 historical period (adapted from WaterSMART 2023) 272
Figure 95.1 Daily hydrographs for the Southern Tributaries (major study area watersheds) under two climate change scenarios (RCP 4.5 and 8.5) for two future 30-year periods (2021–2050 and 2051–2080), relative to the 1991-2020 period 274
Figure 96.1 Modelled results of Chin Reservoir elevation over the full series of simulation years (1928–2009) comparing the Base case Scenario (blue line) and the Expansion Scenario (red line) 278
Figure 97.1 Modelled results comparing storage in the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1929 through 1933 281
Figure 97.2 Waterton Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1929 through 1933 281
Figure 97.3 St. Mary Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1929 through 1933 282
Figure 97.4 MRRR water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1929 through 1933282
Figure 97.5 Modelled results comparing storage in the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1999 through 2003. 284
Figure 97.6 Waterton Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1999 through 2003 285
Figure 97.7 St. Mary Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1999 through 2003. 285
Figure 97.8 MRRR water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1999 through 2003 286

TABLE OF CONTENTS

(continued)

Figure 97.9 Modelled results comparing storage in the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 2005 through 2009 287
Figure 97.10 Waterton Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 2005 through 2009 288
Figure 97.11 St. Mary Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 2005 through 2009 288
Figure 97.12 MRRR water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 2005 through 2009. 289
Figure 98.1 Monthly storage in the Waterton Reservoir, comparing SOAP Model simulated results for the Base case Scenario (blue line) and the Expansion Scenario (red line), based on historical inflow data (1928–2009) 291
Figure 98.2 Monthly storage in the St. Mary Reservoir, comparing SOAP Model simulated results for the Base case Scenario (blue line) and the Expansion Scenario (red line), based on historical inflow data (1928–2009) 292
Figure 98.3 Monthly storage changes in the MRRR, comparing SOAP Model simulated results for the Base case Scenario (blue line) and the Expansion Scenario (red line), based on historical inflow data (1928–2009)..... 293
Figure 99.1 Hydrograph comparing annual flows for Waterton River under the Base case Scenario and Expansion Scenario 295
Figure 99.2 Average annual canal flow going from Waterton Reservoir to St. Mary Reservoir. ... 296
Figure 99.3 Hydrographs comparing annual flows leaving the St. Mary Reservoir, both to the downstream St. Mary River and to the Waterton-St. Mary Canal under the Base case and the Expansion Scenarios 297
Figure 99.4 Average annual canal flow going from St. Mary Reservoir toward MRRR under the Base case and the Expansion Scenarios 297
Figure 99.5 Average annual canal flow going from MRRR to SMRID under the Base case and the Expansion Scenarios..... 298
Figure 100.1 Chin Reservoir Runoff Volume Comparison 300
Figure 122.1 Sand and Gravel Thickness (after HCL 2007) with 2021–2022 Investigation Data..... 333
Figure 132.1 Piper Plots of Major Ion Chemistry with Water Type 347
Figure 138.1 Projected monthly average changes in precipitation and temperature under RCP 4.5 and 8.5 scenarios for the study area, for the periods 2021-2050 and 2051-2080, relative to the 1991–2020 historical baseline (WaterSMART 2023)..... 357
Figure 139.1 Projected monthly storage in Waterton Reservoir under future climate scenarios with Chin Reservoir Expansion 359

TABLE OF CONTENTS

(continued)

Figure 139.2 Projected monthly elevation in Waterton Reservoir under future climate scenarios with Chin Reservoir Expansion 360
Figure 139.3 Projected monthly storage in St. Mary Reservoir under future climate scenarios with Chin Reservoir Expansion 361
Figure 139.4 Projected monthly elevation in St. Mary Reservoir under future climate scenarios with Chin Reservoir Expansion 362
Figure 139.5 Projected monthly elevation in Chin Reservoir under future climate scenarios with Chin Reservoir Expansion 363
Figure 139.6 Projected monthly storage in Chin Reservoir under future climate scenarios with Chin Reservoir Expansion 364
Figure 139.7 The MRRR elevation rule curve used in the SOAP Model 365
Figure 139.8 The Waterton Reservoir elevation rule curve used in the SOAP Model 366
Figure 139.9 The St. Mary Reservoir elevation rule curve used in the SOAP Model 366
Figure 140.1 Mean and Range of Chin Reservoir Levels Based on Historical Data (1994–2020) 369
Figure 149.1 The number of days each year in the simulation when the flow of the South Saskatchewan River crossing the interprovincial border was below 42.5 m3/s 379
Figure 149.2 The minimum flow of the South Saskatchewan River at the interprovincial border each year of the simulation 379
Figure 149.3 The volume of water shortage for the entire Oldman River watershed demands each year of the simulation 380
Figure 149.4 Cross-border apportionment contribution by sub-basin showing the Base case Scenario and the Expansion Scenario 381
Figure 151.1 Hydrograph comparing SOAP-simulated annual flows for Waterton River under the Base case Scenario and Expansion Scenario 384
Figure 151.2 Hydrograph comparing SOAP-simulated annual flows for St. Mary River under the Base case Scenario and Expansion Scenario 385
Figure 151.3 Hydrograph comparing SOAP-simulated annual flows for the Belly River under the Base case Scenario and the Expansion Scenario 386
Figure 151.4 Hydrograph comparing SSROM-simulated annual flows for Oldman River under the Base case Scenario and Expansion Scenario 387
Figure 151.5 Hydrograph comparing SSROM-simulated annual flows range for South Saskatchewan River under the Base case Scenario and Expansion Scenario 388
Figure 200.1 Pre-Development Land Suitability Rating System for Agriculture in the Soils and Terrain LSA 502
Figure 200.2 Post-Development Land Suitability Rating System for Agriculture in the Soils and Terrain LSA 503
Figure 200.3 Pre-Development Land Use in the LSA 504
Figure 200.4 Post-Development Land Use in the LSA 505
Figure 217.1 Human Health Receptor Locations 534

TABLE OF CONTENTS

(continued)

Figure 220.1 Conceptual Site Model for the Chin Reservoir Expansion Project 540
Figure 236.1 Surface Water Quality Assessment Study Boundaries..... 566
Figure 241.1 Groundwater Sampling Locations 573
Figure 241.2 Monitoring Well Locations and Access Routes..... 574

List of Appendices (Compiled in Separate Volumes)

SIR#1 Appendices: Volume 1

Appendix 1.1 New East Dam Preliminary Design Report (KCB 2023)

SIR#1 Appendices: Volume 2

Appendix 1.2 Hydrological Modelling to Evaluate Changes in Streamflow Availability in the St. Mary River Watershed (WaterSMART 2023)

Appendix 2.1 Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum (SMRID 2025)

Appendix 4.1 Technical Memorandum Regarding Chin Reservoir Expansion Project Supporting SIR Response (WaterSMART 2025)

Appendix 6.1 Updated Concordance Table

Appendix 6.2 2018 Chin Reservoir Dam Safety Review – Chin 1 Dam (West) and Chin 2 Dam (East) (Matrix 2019)

Appendix 13.1 Chin Reservoir Expansion – Water Quality Analysis Technical Memorandum (INTERA 2025a)

Appendix 15.1 Chin Reservoir Expansion – Phenols Modeling Technical Memorandum (INTERA 2025b)

Appendix 17.1 Chin Reservoir Expansion –Historical Canal Inflow and Modeled Arsenic Trend Analysis (INTERA 2025c)

Appendix 24.1 Alberta Transportation and Economic Corridors Highway 36 Bridge (BF 7150) Replacement Letter

Appendix 42.1 Hydrogeology Laboratory Analytical Report

Appendix 44.1 Water Coop Meeting Record (June 20, 2022)

Appendix 44.2 SMRID Proposed Irrigation Expansion Information Package (2022)

Appendix 45.1 November 10, 2022 SAGE Letter

TABLE OF CONTENTS

(continued)

Appendix 46.1	JFK Law LLP Letter to ECCC and IAAC on behalf of the Blood Tribe/Kainai (May 12, 2022)
Appendix 46.2	Blood Tribe Meeting Record (December 15, 2022)
Appendix 49.1	Example of Municipality Notification Package, Chin Reservoir Expansion Project Summary (March 2022)
Appendix 49.2	Chin Reservoir Expansion Slide Deck for Council Presentations
Appendix 49.3	Supplemental Chin Reservoir Expansion Area Poster (2022)
Appendix 49.4	SMRID AIM Program (Modernization Projects and Proposed Chin Expansion) Slide Deck Presented at the November 2022 Open Houses
Appendix 49.5	SMRID Proposed Irrigation Expansion Information Sheet and Invitation to November 2022 Open Houses and Plebiscite Vote
Appendix 49.6	Chin Expansion Projects Information Poster (2024)
Appendix 49.7	October 2022 Invitation and Supporting Figures sent to Mike Oka (Blood Tribe)
Appendix 52.1	Chin Reservoir Expansion Project – Noise Impact Assessment (RWDI 2025)
Appendix 71.1	Chin Reservoir Expansion – East Dam Traffic Impact Assessment (MPE 2025)
Appendix 105.1	Hydrogeology Supplemental Technical Report (KCB 2025)
Appendix 144.1	Naturalized Flow Data
Appendix 163.1	Chin Reservoir Expansion – Sediment Modeling Technical Memorandum (INTERA 2025d)
Appendix 164.1	Chin Reservoir Expansion – Adaptive Management Plan for Water Quality Technical Memorandum (INTERA 2025e)
Appendix 165.1	Summary of Analytical Results for Baseline Surface Water Quality
Appendix 165.2	Summary of Analytical Results for Historical Surface Water Quality
Appendix 169.1	Alberta Agriculture and Forestry Water Quality Index Results

1 ACRONYMS

Abbreviation/Acronym	Definition
AAAQO	Alberta Ambient Air Quality Objectives
AAD	Average Annual Damage
AAF	Alberta Agriculture and Forestry
AAF-IDWQ	Alberta Agriculture and Forestry-Irrigation District Water Quality
ABMI	Alberta Biodiversity Monitoring Institute
ac-ft	acre-foot
ACO	Aboriginal Consultation Office
AEPHIN	Alberta Environmental Public Health Information Network
AER	Alberta Energy Regulator
AGI	Alberta Agriculture and Irrigation
AGM	Annual General Meeting
AGRASID	Agricultural Region of Alberta Soil Inventory Database
AIDA	Alberta Irrigation Districts Association
AIM	Alberta Irrigation Modernization
ALSA	Alberta Land Stewardship Act
APA	Alternate Parcel Agreement
ATCO	ATCO Gas and Pipelines Ltd.
Bison	Bison Historical Services Ltd.
BRID	Bow River Irrigation District
BSFC	Brake Specific Fuel Consumption
BTAP	Blood Tribe Agricultural Project
BUOW	Burrowing Owl
C&R	Conservation and Reclamation
CALA	Canadian Association for Laboratory Accreditation
CBA	Cost Benefit Analysis
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
CEA	Cumulative Effects Assessment
cfu	Colony-forming Unit
CH_4	Methane
CIB	Canada Infrastructure Bank
CLR	Crown Land Reservation
CMIP	Coupled Model Intercomparison Project
CO_2	Carbon dioxide
CO_2e	Carbon Dioxide Equivalent
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
dam^3	Cubic decametres
dam^3/yr	Cubic decametres per year

Abbreviation/Acronym	Definition
dBA	A-weighted decibel
DOM	Dead Organic Matter
dGNSS	Differential Global Navigation Satellite System
EC	Electrical Conductivity
ECCC	Environment Climate Change Canada
ECO	Environmental Construction Operation
EIA	Environmental Impact Assessment
EID	Eastern Irrigation District
EPA	Alberta Environment and Protected Areas
EPP	Environmental Protection Plan
EPTC	S-ethyl dipropylthiocarbamate
ESA	Environmental Site Assessment
ESAR	Environmental Site Assessment Repository
ESC	Erosion and Sediment Control
ESRD	Alberta Environment and Sustainable Resource Development
ET	Evapotranspiration
FEED	Front End Engineering Design
Fortis	Fortis Alberta Inc.
FSL	Full Supply Level
FTE	Full-time Equivalent
fToR	Final Terms of Reference
GCM	General Circulation Model
GDP	Gross Domestic Product
GoA	Government of Alberta
GoC	Government of Canada
GRMP	Geohazard Risk Management Program
ha	Hectare
HCL	Hydrogeological Consultants Ltd.
HHRA	Human Health Risk Assessment
hp	horse power
HRIA	Historic Resources Impact Assessment
HRMB	Historic Resources Management Branch
HRV	Historic Resource Value
IAAC	Impact Assessment Agency of Canada
IDF	Inflow Design Flood
IDM	Irrigation Demand Model
IDP	Intermunicipal Development Plan
IDWQ	Irrigation District Water Quality
IJC	International Joint Commission
INTERA	INTERA Incorporated

Abbreviation/Acronym	Definition
IO	In-stream Objectives
IPCC	Intergovernmental Panel on Climate Change
KCB	Klohn Crippen Berger Ltd.
km	kilometre
km	kilometres
kph	Kilometres per hour
lb/hp-hr	pounds of diesel per horsepower per hour (Brake Specific Fuel Consumption)
LiDAR	Light Detection and Ranging
LOC	Licence of Occupation
LSA	Local Study Area
m	metre
m/s	metres per second
MAC	Maximum Acceptable Concentration
masl	metres above sea level
Matrix	Matrix Solutions Ltd.
MCPA	2-methyl-4-chlorophenoxyacetic acid
MDL	Mean Diversion Level
MDP	Municipal Development Plan
mg/L	milligrams per litre
MK	Mann Kendall
MPE	MPE Engineering Ltd.
MRRR	Milk River Ridge Reservoir
N_2O	Nitrous oxide
NIA	Noise Impact Assessment
NIR	National Inventory Report
NRCB	Natural Resources Conservation Board
OPaC	Online Permitting and Clearance
PA	Project Area
PCAP	Prairie Conservation Action Plan
PDR	Preliminary Design Report
pHRIA	Paleontological Historic Resources Impact Assessment
PMF	Probable Maximum Flood
PMP	Probable maximum Precipitation
PPT	Precipitation
PSL	Permissible Sound Levels
pToR	Proposed Terms of Reference
RCP	Representative Concentration Pathways
RID	Raymond Irrigation District
RSA	Regional Study Area
RWDI	RWDI Air Inc.

Abbreviation/Acronym	Definition
SAGE	Southern Alberta Group for the Environment
SDS	Safety Data Sheet
SIR	Supplemental Information Request
SMK	Seasonal Mann Kendall
SMRID	St. Mary River Irrigation District
SNBB	Saskatchewan Nelson Basin Board
SOAP	St. Mary Operations and Planning Model
SOC	Soil Organic Carbon
SPEI	Standard Precipitation Evapotranspiration Index
SSRB	South Saskatchewan River Basin
SSROM	South Saskatchewan River Operations Model
SSRP	South Saskatchewan Regional Plan
SWQMF	Surface Water Quality Management Framework
TAS	Traffic Accommodation Strategy
TBR	Technical Baseline Report
TDL	Temporary Diversion Licence
TDS	Total Dissolved Solids
TEC	(Alberta) Transportation and Economic Corridors
TEK	Traditional Ecological Knowledge
TID	Taber Irrigation District
TLU	Traditional Land Use
TN	Total Nitrogen
ToC	Table of Contents
TRV	Toxicity Reference Values
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
U.S. EPA	United States Environmental Protection Agency
USBR	U.S. Bureau of Reclamation
VC	Valued Component
WAIR	Wetland Assessment and Impact Regulation
WaterSMART	WaterSMART Solutions Ltd.
WCO	Water Conservation Objective
WQI	Water Quality Index
WSC	Water Survey of Canada
WSTM	Waterton to St. Mary Canal System

2 NATURAL RESOURCES CONSERVATION BOARD

2.1 General

Question 1

Reference:

Environmental Impact Assessment Report Summary, Section 1.3, Page 2 and 3;
Volume 1, Section 1.9, Page 13-15;
Volume 2, Section 2.2.3.2.3, Page 30;
Volume 3, Section 3, Page 34

Rationale/Preamble:

St. Mary River Irrigation District (SMRID) states that the intent of the Project is to *boost the level of resilience of the agricultural sector, municipal water supply, and the environment against the effects of climate change and extreme drought events*. Much of the Project rationale (1-1.9) focuses on enhancing water security and optimizing storage to benefit water users and the environment. SMRID further states that *A key positive effect of the Project is that increased storage will assist in supplying water to the region during water-scarce years, while reducing pressure for GoA to increase diversions from rivers*, referencing studies conducted by WaterSmart Solutions Ltd. (2023) and AMEC (2014). However, the objective of the socio-economic analysis was to assess and contrast the social and economic benefits achieved by expanding the irrigation area by converting existing dryland farms to irrigated acreage, and explicitly did not assess the impacts of climate change. Toward the expansion of irrigated acreage, SMRID refers to modelling work carried about by WaterSmart Solutions Ltd. (2023) that indicated that the Project could support up to 63,333 new acres of irrigated land, but Raymond Irrigation District (RID) and SMRID opted for the Project to support up to 46,500 new irrigated acres.

Information Request:

a. Rank the priorities of the Project as they relate to irrigation expansion, water security, flood and drought mitigation, habitat, or recreation and provide rationale behind this ranking.
b. Describe the volumes of water that will be held in the Expanded Chin Reservoir that will be attributed to the ranked priorities, as live storage volumes.
c. Provide rationale toward not including climate change impacts in the socio-economic modelling when water security in the face of climate change was stated as important rationale behind the Project.
d. Explain why model scenario(s) focusing explicitly on water security for existing users or assessing the economic value of stored water for drought mitigation were not included in the socio-economic assessment.
e. Provide the WaterSmart Solutions Ltd. (2023) and AMEC (2014) reports.

Response:

a. The primary priority of the Project is water security, as it directly addresses the increasing variability of water availability due to climate change and extreme drought events. Drought mitigation is inherently tied to water security, as securing adequate water storage directly supports regional needs during dry periods. Additional off-stream storage will allow the St. Mary River Irrigation District (SMRID) to more effectively capture storage during wet periods to buffer against subsequent drought and increased variability.

   The second priority is irrigation expansion, which builds on the foundation of improved water security. The Project supports 46,500 new irrigated acres, balancing water availability with sustainable water management. The proposed expansion is an aspirational target as there are no specific blocks or infrastructure projects that the SMRID is constructing to accommodate new irrigation acres. Expansion will be done by infill within the constraints of the existing system with irrigators developing works adjacent to existing canals and pipelines, where it is deemed there is capacity. Expansion acres will be released cautiously to ensure that the future demand will not exceed the design capacity of the Main Canal and that existing water users are not put at risk.

   Flood mitigation ranks third in priority and is a secondary benefit of the Project. As per the New East Dam Preliminary Design Report (PDR) prepared by Klohn Crippen Berger Ltd. (KCB), the reservoir expansion is designed to accommodate the 1:1,000 year flood event prior to activation of the Auxiliary Spillway located at the New East Dam (KCB 2023). The New East Dam PDR is appended to this Supplemental Information Request (SIR) #1 Response Document as Appendix 1.1.

   Habitat and recreation considerations are incidental outcomes of the Project rather than explicit priorities. While the Project may contribute to environmental and recreational benefits, there is no dedicated live storage allocation specifically for these purposes.

b. The Expanded Chin Reservoir will provide 103,500 ac-ft of additional live storage, with estimated volumes allocated as follows:

   - Water Security & Irrigation Expansion: 73,500 ac-ft of active live storage will support both priorities, ensuring a reliable supply for existing and new irrigation while enhancing regional water security. This additional volume would be drawn upon as required but not anticipated to be used every year.
   - Additional Water Security: 30,000 ac-ft is specifically allocated to strengthen water security, improving drought resilience. This additional volume of water is to be held as a reserve and used periodically as required.
   - Flood Mitigation: No additional volumes of water that will be held within the Expanded Chin Reservoir will be attributed towards flood mitigation. Flood mitigation is accomplished within the available storage of the reservoir and freeboard, acting as a buffer during runoff events.

While the Project allows for irrigation expansion, the additional acres may not necessarily draw directly from Chin Reservoir but the additional storage within the Expanded Chin Reservoir provides greater flexibility within the SMRID irrigation network both upstream and downstream.

c. Volume 3, Section 1.4 (Page 24) of the Socio-economic Assessment states "This study did not assess the economic impacts of climate change. A modelling study for that component of the overall Chin Reservoir Expansion Project was being carried out by WaterSMART Solutions Ltd. (WaterSMART) concurrently with our study. Discussions between our teams allowed us to assume that future climate change scenarios would not negatively impact the potential development of the increased irrigation acres (46,500 acres) identified in this study.

d. Volume 3, Section 4.2 (Pages 53 and 54) of the Socio-economic Assessment describes the assessment of drought impacts on the proposed irrigation expansion Project. A summary of the results (as shown in Volume 3) states "Based on an 8% drought probability in any given year, the annual irrigation benefits are estimated to generate about $3.3 million to the provincial gross domestic product (GDP) and $3.3 million in labour income. No FTEs are supported. Climate change studies suggest that the likelihood of droughts will increase in this area, although there is little specific data on the probability. If the probability were to double, to 16%, the annual irrigation benefits related to the Chin Reservoir Expansion Area would also double".

e. The *Hydrological Modelling to Evaluate Changes in Streamflow Availability in the St. Mary River Watershed* report prepared by WaterSMART and submitted to the SMRID on February 22, 2023 is provided in Appendix 1.2 of this SIR#1 Response Document.

   The *Water Storage Opportunities in the South Saskatchewan River Basin in Alberta* report prepared by AMEC Environment and Infrastructure (AMEC 2014) is a publicly available publication. The URL to access this report is:

   https://open.alberta.ca/publications/water-storage-opportunities-in-the-south-saskatchewan-river-basin-in-alberta

Question 2

Reference:

Volume 1, Section 1.2.1, Table 1.1 and 1.2, Page 6;
Volume 1, Section 1.6.2, Page 11;
Volume 2, Section 2.2.1, Page 24;
Volume 4-1, Section 1.1, 1.3, Page 1-3

Rationale/Preamble:

SMRID defines the Regional Study Area (RSA) for hydrology as starting from the headworks of the Milk River Ridge Reservoir (MRRR), noting that the MRRR and other upstream reservoirs are operated by the Government of Alberta (GoA). SMRID defends that there will be no expected effects on licensees or river flows because the GoA will not increase water allocations in the basin and controls diversions from reservoirs to meet water conservation objectives (WCO) or in-stream objectives (IO). Maps of the RSA and the Local Study Area (LSA) referred to in Volume 4-1 Hydrology Technical Baseline Report (TBR) as Map Figures 1.1 and 1.2 were not provided. The SMRID states that their combined license allocation is 890,574 dam^3 from the Belly, Waterton and St. Mary Rivers. The water licenses from these systems that are presented in Tables 1.1 and 1.2 have conditions in place that constrain diversions, effectively limiting access to water, should instream flow requirements (per WCOs or IOs) not be met. Consequently, there exists a risk to the Project of utilizing the full extent of Chin Reservoir for additional storage during periods of drought and water shortage; however, this reality is not reflected in the Environmental Impact Assessment (EIA).

Information Request:

a. Provide maps of the LSA and RSA (Map Figures 1.1 and 1.2) for the hydrology baseline study.
b. Provide additional detail on how water is diverted from the source systems identified in SMRIDs water licenses (i.e., Belly, Waterton, and St. Mary Rivers) ultimately into the Milk River Ridge Reservoir.
c. Provide the range and average of monthly diversion rates from the Waterton-St. Mary's headworks to the MRRR, and from the MRRR to the SMRID works for a 30-year period up to and including 2023.
d. Present the proportion of time, on a monthly basis, that the flow in the Belly, Waterton, and St. Mary rivers is below the respective WCO/IOs for these systems over a 30-year period up to and including 2023.
e. Present the proportion of time, on a monthly basis, that diversions of SMRID were restricted over a 30-year period up to and including 2023.
f. Justify why the RSA was chosen to only include the SMRID irrigation works in the context of risks to the Project from constrained water supply.

g. Support the assumption that climate change will not substantively impact flows in the source rivers relative to their respective WCO or IO in the context of risks to the Project.

Response:

a. Map Figures 1.1 and 1.2, as referenced in Volume 4-1, Hydrology Technical Baseline Report (TBR), were mistakenly omitted in the compiling of the Environmental Impact Assessment (EIA) document. The intended referenced Map Figures 1.1 and 1.2 have been appended to this SIR#1 Response Document as Figures 2.1 and 2.2, respectively, to illustrate the Chin Reservoir Catchment and the Regional and Local Study Areas.

b. Water diversions into the Milk River Ridge Reservoir (MRRR) originate from three primary southern tributaries: the Waterton River, Belly River, and St. Mary River (Figure 2.3). These diversions are part of an integrated system that channels water from the headwaters of these rivers into the MRRR. The process involves several key reservoirs and infrastructure:

    i. The Waterton River Watershed and Drywood Creek Watershed feed into Waterton Reservoir, which is impounded by Waterton Dam. Water from the reservoir is conveyed downstream via an outlet structure to the Waterton to St. Mary (WSTM) Canal System.

    ii. The WSTM Canal system intersects with the Belly River immediately upstream of the Belly River Diversion, which allows water to be diverted between the Belly River and the WSTM Canal.

    iii. The water continues downstream through the WSTM Canal into St. Mary Reservoir, which is also fed by the St. Mary River. A canal turnout structure, located immediately upstream of the St. Mary River Reservoir, provides irrigation water for the Blood Tribe Agricultural Project (BTAP) (Figure 2.4). The St. Mary River is controlled by the St. Mary Diversion Structure, located near Babb, Montana. This diversion is regulated by the International Joint Commission (IJC) under the Boundary Waters Treaty of 1909 and the IJC Order of 1921, which govern the apportionment and measurement of water crossing the international boundary.

    iv. Water is then released from St. Mary Reservoir via the irrigation outlet structure which discharges to the WSTM Canal system.

    v. The water then flows downstream into the MRRR via the WSTM Canal system. The outlet of MRRR represents the demarcation between SMRID and Alberta Agriculture and Irrigation (AGI) owned infrastructure.

    The Waterton Reservoir, St. Mary Reservoir, MRRR, the Belly River Diversion, and the WSTM Canal system are owned and operated by AGI (refer to Figure 2.3 – reservoir labels indicate the operator). The flow between these reservoirs, utilizing the WSTM Canal is also controlled and operated by AGI. The infrastructure identified above ensures that diverted water from the southern tributaries is efficiently conveyed to MRRR, where it can be utilized by SMRID and downstream water users.

SMRID, AGI, and upstream water users work collaboratively to fulfill regional water demands. However, it is important to note that the operation of the infrastructure and diversion rates are ultimately controlled by AGI, which manages the flow based on operational needs and regulatory constraints.

c. Water from the Waterton and the St. Mary Rivers flows into the St. Mary Reservoir, then travels through the Waterton-St. Mary canal to the MRRR.

   Table 2.1 presents the monthly average, maximum, and minimum flows from the St. Mary Reservoir to the MRRR for each month of each year from 1993 to 2023. The data was sourced from Environment Canada and included the hydrometric gauge station 05AE026 “Canadian St. Mary Canal near Spring Coulee” for the years 1993 to 2023.

   Table 2.2 presents the monthly average, maximum, and minimum flows from MRRR to the SMRID works for each month of each year from 1994 to 2023. The data is from the SMRID flow measuring station known as Drop 1.

Table 2.1 Monthly average flow (m^3/s) and maximum and minimum flow (m^3/s) at "Canadian St. Mary Canal near Spring Coulee" as per hydrometric gauge station 05AE026 for the years 1993 to 2023

	1993			1994			1995			1996			1997			1998			1999			2000			2001			2002		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
Jan	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Feb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mar	0.0	0.0	0.0	0.9	16.1	0.0	1.3	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0
Apr	18.6	50.6	0.0	38.2	56.5	13.1	23.3	56.6	8.5	9.2	46.3	0.0	0.3	5.6	0.0	4.4	26.7	0.0	11.0	45.6	0.0	8.1	31.6	0.0	1.9	24.5	0.0	14.8	60.5	0.0
May	31.5	67.9	0.1	30.9	47.3	15.8	31.7	44.3	28.1	28.6	43.6	25.0	33.4	50.9	5.7	54.6	87.0	27.2	35.9	52.2	28.6	63.1	87.8	26.9	42.1	57.9	24.4	55.6	87.8	33.2
Jun	31.0	55.1	11.1	51.3	68.0	37.0	33.4	49.1	11.1	72.5	91.8	45.5	48.4	86.2	27.0	50.4	68.9	27.2	49.7	78.7	30.2	75.1	88.2	55.1	56.6	88.3	41.4	58.6	89.7	7.7
Jul	9.2	20.0	2.2	68.1	80.2	57.5	40.5	46.6	34.2	84.2	90.6	63.4	69.7	87.0	51.8	34.5	50.8	20.8	62.0	74.7	53.8	63.4	76.4	55.7	67.1	79.2	55.8	72.0	89.7	50.4
Apr	5.8	13.2	2.2	46.3	59.0	36.3	43.6	46.0	40.4	66.5	79.0	56.2	49.9	70.8	31.0	47.6	50.9	44.3	51.0	60.0	44.0	47.5	58.3	40.7	41.7	54.9	32.6	41.3	59.0	35.0
Sep	9.7	17.1	7.0	34.3	37.6	30.1	38.6	42.1	35.6	43.4	59.5	21.4	50.5	61.2	46.7	49.2	51.5	42.4	45.6	50.6	40.7	26.2	39.2	22.3	17.7	32.4	7.3	20.8	35.2	14.1
Oct	4.2	16.4	0.0	13.4	37.7	0.0	12.7	35.6	0.0	6.5	27.5	0.0	26.8	61.5	0.0	15.3	42.9	0.0	15.9	46.8	0.0	7.8	22.1	0.0	3.1	16.9	0.0	3.7	16.6	0.0
Nov	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dec	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	2003			2004			2005			2006			2007			2008			2009			2010			2011			2012		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
Jan	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Feb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mar	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0
Apr	2.5	21.6	0.0	2.9	27.4	0.0	2.4	20.3	0.0	2.3	17.4	0.0	0.0	0.0	0.0	1.8	13.1	0.0	0.1	1.2	0.0	1.5	15.1	0.0	0.0	0.0	0.0	13.6	37.9	0.0
May	22.7	34.9	17.3	31.2	37.2	27.5	59.2	90.9	20.4	41.5	62.0	20.5	38.4	47.7	0.0	27.6	49.8	14.3	33.6	71.4	4.0	14.9	23.3	0.4	8.5	19.7	0.0	35.9	46.0	30.2
Jun	38.0	51.9	29.3	40.1	61.5	29.0	24.7	78.7	3.4	25.3	49.6	3.6	48.0	64.7	31.2	61.7	84.8	42.2	73.5	90.4	56.3	5.7	17.4	1.0	15.1	20.6	8.1	32.4	51.1	23.4
Jul	63.0	66.3	55.2	60.6	70.5	53.9	45.7	58.8	19.5	56.2	63.5	41.4	69.3	71.4	64.6	67.5	83.8	42.5	58.3	73.6	47.6	24.1	44.3	0.9	45.6	55.6	22.4	44.3	56.8	23.4
Apr	57.0	65.0	51.8	45.1	57.5	31.1	40.1	57.5	22.5	48.9	55.8	38.9	61.7	84.2	47.4	44.9	47.4	41.9	33.0	52.6	26.9	30.6	44.7	25.1	41.9	47.8	39.0	36.0	44.8	30.7
Sep	45.1	53.5	33.6	32.5	45.7	30.7	18.9	22.7	15.7	32.3	39.0	28.4	37.5	45.0	28.2	26.8	42.0	21.8	39.1	47.3	32.1	25.4	27.7	24.6	35.8	48.7	31.2	41.9	52.7	32.5
Oct	10.1	32.1	0.0	18.3	45.8	0.0	5.8	16.8	0.0	10.6	35.3	0.0	8.4	29.6	0.0	7.4	25.0	0.0	11.7	47.2	0.0	5.6	24.6	0.0	13.1	48.2	0.0	8.6	50.6	0.0
Nov	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dec	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	2013			2014			2015			2016			2017			2018			2019			2020			2021			2022			2023		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
Jan	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Feb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mar	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	0.0	0.0
Apr	7.3	17.9	0.0	1.3	21.8	0.0	1.4	22.6	0.0	14.8	45.4	0.0	4.8	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	22.7	0.0	6.8	28.3	0.0	9.0	57.9	0.0	0.3	3.9	0.0
May	43.2	58.7	17.9	25.0	35.9	18.0	49.8	68.7	16.7	53.2	70.2	28.2	40.9	68.1	24.4	49.1	90.2	0.0	31.1	53.2	0.0	44.5	61.7	22.8	50.0	80.5	20.2	76.1	88.3	56.6	58.7	89.7	4.7
Jun	40.3	54.4	31.5	36.1	59.8	6.0	78.9	87.5	68.7	63.0	67.3	47.8	59.6	69.7	45.4	70.8	83.5	50.5	77.7	85.4	59.4	48.2	61.8	28.9	78.8	89.8	65.6	71.6	93.9	25.9	80.9	87.4	65.0
Jul	42.1	59.8	29.1	37.4	47.5	18.3	54.4	72.2	42.2	47.7	65.4	35.5	73.8	80.9	63.9	75.8	79.0	65.6	78.4	85.7	62.3	41.6	60.7	20.6	84.8	87.8	80.1	59.4	82.7	45.0	81.2	85.3	74.0
Apr	35.2	41.6	28.9	44.2	45.7	36.4	42.6	45.0	41.1	28.0	35.8	25.5	65.2	80.4	53.2	60.7	74.5	41.8	50.3	64.7	42.2	55.4	60.4	50.1	53.8	79.8	37.6	57.0	62.2	36.7	27.1	71.3	0.0
Sep	28.5	34.7	24.4	28.5	36.4	20.1	40.7	42.9	38.3	26.1	33.1	22.9	47.0	66.7	20.5	42.0	48.2	31.7	38.2	43.1	32.5	44.9	49.9	33.9	45.7	55.4	36.5	54.5	77.8	36.1	17.5	25.8	10.8
Oct	6.7	24.5	0.0	4.9	20.0	0.0	2.4	37.3	0.0	3.4	23.0	0.0	3.9	22.2	0.0	3.3	31.5	0.0	1.5	21.6	0.0	7.7	33.7	0.0	10.2	54.0	0.0	13.0	82.2	0.0	8.5	15.2	0.0
Nov	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NA	0.0	0.0
Dec	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2.2 Monthly average flow (m^3/s) and maximum and minimum flow (m^3/s) going from MRRR to the SMRID works for the years 1994 to 2023.

	1994			1995			1996			1997			1998			1999			2000			2001			2002			2003		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
January	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
February	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
March	10.5	17.1	5.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
April	15.5	19.1	10.6	4.1	12.8	0.0	NA	NA	NA	NA	NA	NA	1.8	7.1	0.0	14.0	18.6	10.0	5.2	8.6	1.4	NA	NA	NA	15.3	24.3	1.4	3.0	5.3	0.9
May	13.1	20.4	8.0	14.0	18.5	12.1	NA	NA	NA	NA	NA	NA	24.9	43.2	11.4	14.1	20.3	2.1	29.2	42.5	9.7	16.6	21.2	4.7	23.6	33.0	14.6	9.9	14.7	7.1
June	20.6	29.3	14.5	18.2	31.1	14.1	NA	NA	NA	NA	NA	NA	22.3	31.4	17.3	22.0	33.5	13.0	32.6	42.3	28.0	21.8	25.9	18.3	24.5	33.5	10.6	16.5	20.8	13.2
July	29.9	32.8	27.9	19.9	23.7	17.8	NA	NA	NA	NA	NA	NA	16.0	22.6	10.6	28.0	32.4	25.3	34.8	41.4	23.8	35.8	40.8	24.0	33.4	42.1	23.4	25.8	31.1	20.1
August	22.8	28.7	20.6	20.7	22.2	19.8	NA	NA	NA	NA	NA	NA	21.5	23.3	19.6	23.2	28.0	19.0	20.8	25.3	18.6	19.4	30.4	13.2	19.8	33.1	14.7	25.4	29.6	23.0
September	20.5	22.6	19.1	18.0	20.0	16.6	NA	NA	NA	NA	NA	NA	23.7	25.3	19.8	21.1	23.8	19.1	17.1	19.0	13.8	9.4	14.3	6.6	10.7	16.8	8.6	20.9	23.6	15.0
October	9.0	20.8	0.0	8.6	17.6	0.0	NA	NA	NA	NA	NA	NA	8.3	19.8	0.0	12.1	23.8	0.0	13.2	18.8	0.0	4.8	7.4	0.0	3.9	9.1	0.0	8.9	14.7	0.0
November	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
December	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	2004			2005			2006			2007			2008			2009			2010			2011			2012			2013		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
January	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
February	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
March	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
April	9.0	9.0	9.0	2.2	4.3	0.7	1.9	8.6	0.0	NA	NA	NA	10.0	11.4	7.1	8.5	11.4	4.3	NA	NA	NA	NA	NA	NA	12.7	17.4	2.9	10.8	13.6	2.9
May	13.9	20.7	9.7	22.0	39.7	7.6	17.7	25.0	8.1	16.2	20.4	0.9	15.7	23.7	11.3	13.8	25.6	7.9	9.4	11.3	2.9	9.6	11.4	4.3	16.1	21.3	12.9	20.3	25.0	13.6
June	17.3	28.1	10.9	15.2	39.7	7.9	13.2	24.7	8.3	22.0	30.0	14.3	23.1	39.8	17.8	29.5	33.6	24.6	4.9	8.9	0.0	8.4	9.3	7.9	12.7	22.0	10.1	15.8	20.9	11.2
July	27.5	39.8	10.1	21.5	27.4	10.1	25.9	28.3	16.1	31.4	32.0	29.7	33.0	39.8	22.7	28.0	34.8	22.8	14.4	21.4	5.0	19.5	23.1	11.1	20.4	25.4	10.5	19.5	24.6	14.3
August	22.2	39.5	11.4	20.0	27.4	11.4	22.4	25.1	16.7	30.0	39.5	23.7	22.0	23.3	20.3	16.9	25.1	12.9	15.8	21.4	12.8	19.3	20.7	18.1	17.9	22.1	15.5	16.4	20.7	12.8
September	16.0	20.7	13.8	10.8	19.1	8.9	15.8	18.1	13.3	18.3	24.0	14.1	14.4	20.3	11.4	19.2	22.6	15.0	12.6	13.9	11.9	17.9	23.6	15.7	19.5	25.4	15.6	14.5	16.9	12.6
October	10.3	24.0	0.0	4.5	10.6	0.0	6.6	18.1	0.0	5.4	14.6	0.0	4.1	11.6	0.0	6.7	23.3	0.0	3.1	12.2	0.0	7.7	24.6	0.0	5.5	25.1	0.0	4.6	12.8	0.0
November	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
December	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	2014			2015			2016			2017			2018			2019			2020			2021			2022			2023		
	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min
January	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
February	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
March	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
April	10.8	14.1	2.9	7.7	12.8	2.9	12.6	22.7	4.3	11.1	12.8	9.6	NA	NA	NA	8.2	15.1	1.3	6.9	13.5	0.9	11.7	16.1	2.5	12.6	28.9	0.7	6.1	8.6	0.8
May	11.4	16.6	8.4	22.2	27.7	12.5	24.1	31.4	12.2	16.2	25.4	10.0	23.4	35.5	9.8	14.3	17.4	11.3	20.9	26.6	12.7	21.9	32.8	14.9	36.4	42.7	28.2	28.1	39.1	7.1
June	14.9	22.1	8.6	33.3	37.3	26.4	27.0	31.6	11.8	25.1	30.5	20.5	31.9	40.3	25.3	33.5	41.2	22.4	20.6	29.4	14.0	31.2	40.1	21.9	25.3	39.6	12.0	33.9	38.1	31.8
July	17.8	22.1	9.3	26.8	34.5	20.2	22.1	30.3	16.0	33.8	37.2	29.6	37.1	40.8	30.4	37.3	41.1	28.6	19.5	27.6	11.1	40.2	40.8	35.7	27.4	35.8	20.4	37.3	37.9	36.8
August	21.8	22.1	18.6	22.4	23.4	20.2	14.6	18.1	12.9	31.8	38.8	26.1	31.2	35.1	25.2	25.0	29.5	21.7	26.0	27.7	23.1	27.4	40.7	18.9	26.3	28.4	20.7	23.2	34.9	8.4
September	15.8	19.4	11.4	20.1	21.8	17.9	13.9	16.8	12.0	27.8	29.5	24.3	22.0	25.1	15.2	19.9	22.4	17.4	22.9	24.7	18.5	21.7	27.1	18.2	26.5	36.3	21.3	7.8	11.8	0.0
October	3.8	12.3	0.0	9.0	18.2	1.7	7.9	13.3	0.3	17.4	24.8	1.6	5.9	15.5	0.2	1.3	15.3	0.0	8.0	17.5	0.2	5.8	25.4	0.0	7.1	37.4	0.0	0.0	0.0	0.0
November	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
December	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

d. The water conservation objectives (WCOs) are 2.27 m^3/s for the Waterton River, 0.93 m^3/s for the Belly River, and 2.75 m^3/s for the St. Mary River (GoA 2006).Table 2.3, Table 2.4and Table 2.5 provide the percentage of time (in days) each month, that the flows in the Belly, Waterton, and St. Mary Rivers were below their respective current WCO. The data was sourced from Environment Canada for the hydrometric gauge stations 05AD028 “Waterton River Near Glenwood”, 05AD041 “Belly River Near Glenwood”, and 05AE006 “St. Mary River near Lethbridge” for the years 1994 to 2023.

Table 2.3 Percentage (%) of days per month from 1994 to 2023 when Waterton River flow was below the current Water Conservation Objective of 2.27 m^3/s

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994	0	0	0	0	0	0	0	0	0	0	23	29
1995	65	39	19	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	35	0	0	0	13	0	0	0	0	0	0	35
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	30	13
2001	0	93	77	0	0	0	3	0	17	23	17	42
2002	19	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	52	40	16
2004	26	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	53	100	3	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	29	0	3	10	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0	0	0
2016	6	3	0	0	0	0	0	0	0	0	0	0
2017	0	14	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0	53	42	77	10
2022	0	0	0	0	23	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0	0	17	97

Table 2.4 Percentage (%) of days per month from 1994 to 2023 when Belly River flow was below the current Water Conservation Objective of 0.93 m^3/s

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994	0	25	0	0	0	0	0	0	0	13	0	6
1995	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	3	0	0
1998	48	32	55	0	0	0	0	0	0	0	0	0
1999	3	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	19
2001	0	79	23	47	0	0	0	0	0	6	0	0
2002	0	0	0	0	0	0	0	0	0	3	0	0
2003	0	14	13	0	0	0	0	0	3	0	0	0
2004	3	0	3	0	0	0	0	16	0	0	0	0
2005	0	0	0	0	16	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	10	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	13	7	23	7	0	0	0	0	0	0	0	6
2009	10	18	19	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	7	0	0	0	0	0	0	0	0	0	0
2012	6	21	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	10	0	0
2016	0	0	0	47	55	0	0	0	0	0	0	3
2017	0	0	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	7	10	6	37	0	0	0
2019	0	0	0	0	3	0	0	19	0	3	0	0
2020	0	0	13	0	0	0	0	0	0	0	0	0
2021	0	0	0	10	10	0	0	3	33	16	0	0
2022	0	0	0	53	16	0	0	0	0	0	7	13
2023	0	11	0	10	0	0	0	0	0	0	0	0

Table 2.5 Percentage (%) of days per month from 1994 to 2023 when St. Mary River flow was below the current Water Conservation Objective of 2.75 m^3/s

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994	0	0	0	0	0	0	0	0	0	0	0	23
1995	81	43	26	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	3	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	29
1999	32	0	0	0	0	0	0	0	0	0	0	0
2000	0	38	29	0	0	0	0	0	0	0	33	42
2001	0	100	65	17	0	0	0	0	0	10	20	55
2002	71	21	45	0	0	0	0	0	0	0	0	0
2003	0	29	6	0	0	0	0	0	0	0	0	0
2004	100	31	13	17	0	0	0	0	0	0	0	0
2005	0	0	26	70	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	13	0
2007	3	18	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0	35
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	40	13
2012	3	7	3	0	0	0	0	0	0	0	0	13
2013	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	3	0
2015	0	0	0	0	0	0	0	0	0	0	0	19
2016	48	10	0	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0	0	3	10
2019	0	0	0	0	0	0	0	0	0	0	53	23
2020	29	0	19	0	0	0	0	0	0	6	0	16
2021	0	0	0	13	0	0	0	0	0	0	10	87
2022	39	0	0	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0	0	0	0

e. The monthly diversions to SMRID are based on water supply and farm gate allocation, which is also based on the water supply available (as determined by AGI). Therefore, there are no supply side restrictions on a monthly basis. There are no formal records, by month, of restriction of diversions to the SMRID because of the system of monitoring and managing water supply for the SMRID, which is based on close communication between various AGI staff and the SMRID operators. The following paragraph provides a summary of the coordination and communication process between SMRID and AGI operators. For a detailed description, please refer to the *Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum* prepared by SMRID and provided in Appendix 2.1 of this SIR#1 Response Document.

The natural water supply each year starts with the accumulation of snow in the mountain headwaters over the winter and spring. The provincial government uses the snow measurement data to calculate how much water will be available when it melts, they also factor in water stored in the headworks reservoirs, the Waterton, St. Mary, and Milk River Ridge Reservoirs. Each year in March, the provincial government communicates how much water is available in the Southern Tributaries system to all irrigation districts, including the SMRID (Figure 2.4). The SMRID uses this information to set the farmgate allocation, which is how much water per acre each of the member irrigators is allowed to ask for. The farmgate allocation can help to inform producer decisions such as crop selection and field rotations. Based on the available water in the system, the SMRID estimates annual irrigation demand and operates its reservoirs accordingly. Meanwhile, AGI operators manage the headworks reservoirs, releasing water to maintain flows in the St. Mary, Belly, and Waterton rivers, support other water users, and supply the SMRID system. Throughout the irrigation season, the AGI staff who operate the headworks reservoirs communicate frequently with the SMRID operators.

f. The Regional Study Area (RSA) was limited to the SMRID irrigation works because this reflects the extent of the SMRID decision-making authority within the overall water management system in the Oldman River Basin. This focus was selected and intended to capture the risks to the Project from constrained water supply, particularly the potential inability to fully utilize the expanded Chin Reservoir during drought conditions. In present-day reality there are frequent occurrences where Chin Reservoir does not fill to the target winter storage level due to a range of decision-making factors for SMRID operators. Failing to fill the expanded Chin Reservoir can be meeting the preferred storage in that year and is not necessarily representing an inability to utilize the full extent of Chin Reservoir. SMRID evaluated the Chin Reservoir Expansion Project under climate change scenarios (RCP 4.5 and RCP 8.5) and found the risk of the reservoir not filling to be within acceptable bounds for its operations. Please see the WaterSMART report *Hydrological Modelling to Evaluate Changes in Streamflow Availability in St. Mary River Watershed* (2023) for details on the climate change scenario analysis (provided as Appendix 1.2 of this SIR#1 Response Document). In the event of a multi-season drought, reservoir storage may be insufficient for standard irrigation demand. In such cases, the increased capacity would support irrigation only as long as water is available. SMRID would then adjust water allocations to irrigators based on available supply from both the headworks system and storage for that year. For a detailed description of how the SMRID makes decisions for managing demand and operating the Chin Reservoir under drought conditions, please refer to the *Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum* provided in Appendix 2.1 of this SIR#1 Response Document.

g. The risk to the Project from climate change-related impacts to water supply was assessed by examining projected changes in flows for the Waterton, Belly, and St. Mary Rivers. Climate change scenarios were evaluated using a hydrological model driven by downscaled climate data from Environment and Climate Change Canada (ECCC). The selected scenarios were based on ensembles of Representative Concentration Pathways (RCP) 4.5 and 8.5.

The modelling results indicate that under both RCP 4.5 and RCP 8.5, annual total precipitation in the headwaters is likely to increase. Between 2021 and 2050, annual total precipitation is expected to increase by approximately 100 mm/year compared to the 1991–2020 baseline, with the most significant increases occurring in the western and northern parts of the watershed, particularly in the Waterton River basin. These increases are most notable at lower elevations, largely due to enhanced summer precipitation.

Given these projections, SMRID anticipates that upstream reservoirs will continue to be operated in a manner that maintains or exceeds the WCOs for the Waterton, Belly, and St. Mary Rivers. With more water expected to be stored in these reservoirs, the SMRID considers the risk to the Project from climate change-driven water supply changes to be minimal under these scenarios, as the increased availability of water will support the WCO and licensed users, including the SMRID.

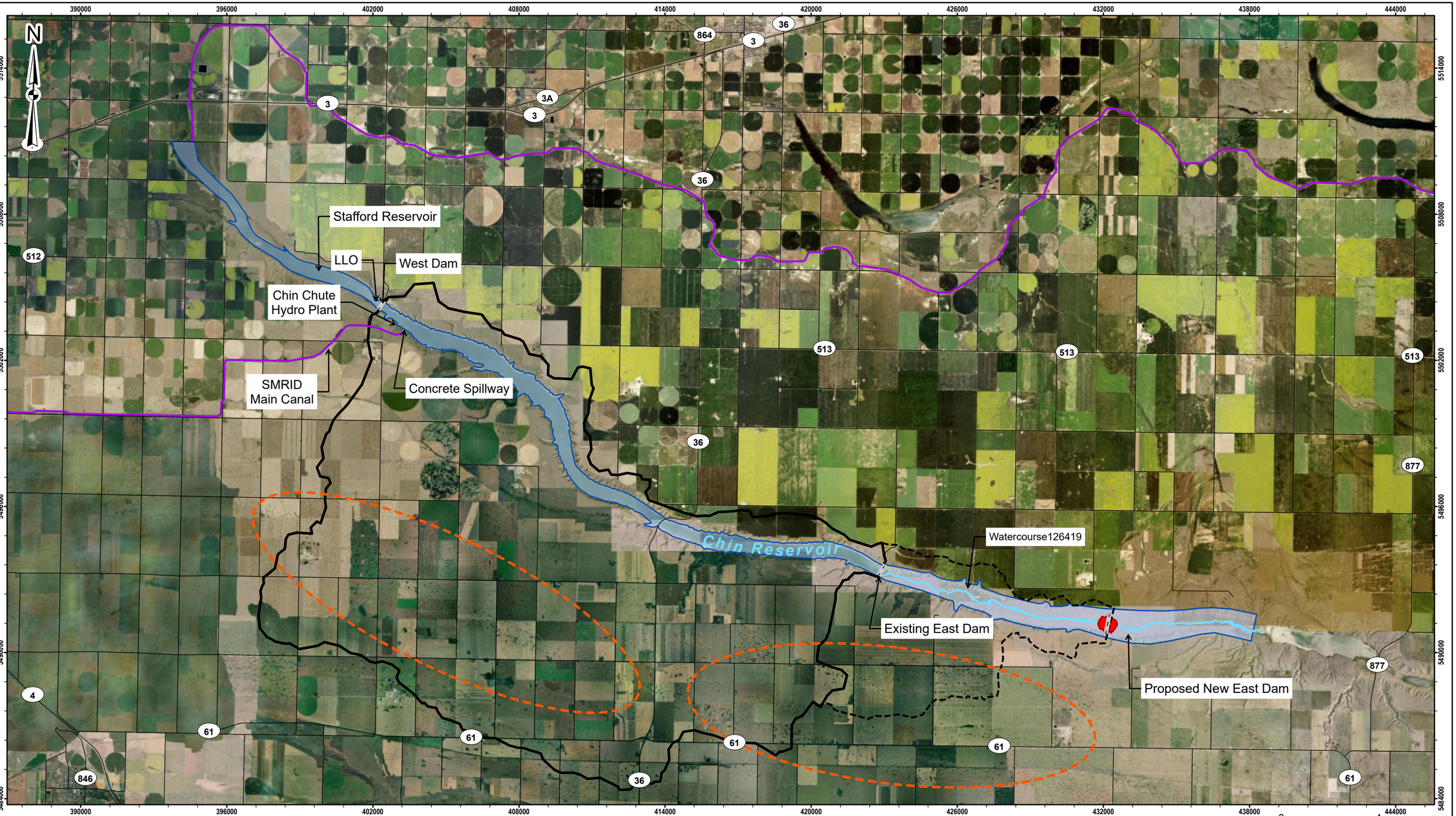
FIGURES

Figure 2.1 Chin Reservoir Catchment

Figure 2.2 Hydrology Baseline Study Regional and Local Study Area

Figure 2.3 Regional Water Management System in the Southern Tributaries Watershed

Figure 2.4 Irrigation Districts



Legend

- Dam Location
- All Weather Road
- Watercourse
- Main Canal
- Pothole Region
- Chin Reservoir Existing Catchment
- Chin Reservoir Expanded Catchment
- New East Dam Footprint
- Local Study Area (LSA)

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, MAXAR

CLIENT: SMRID

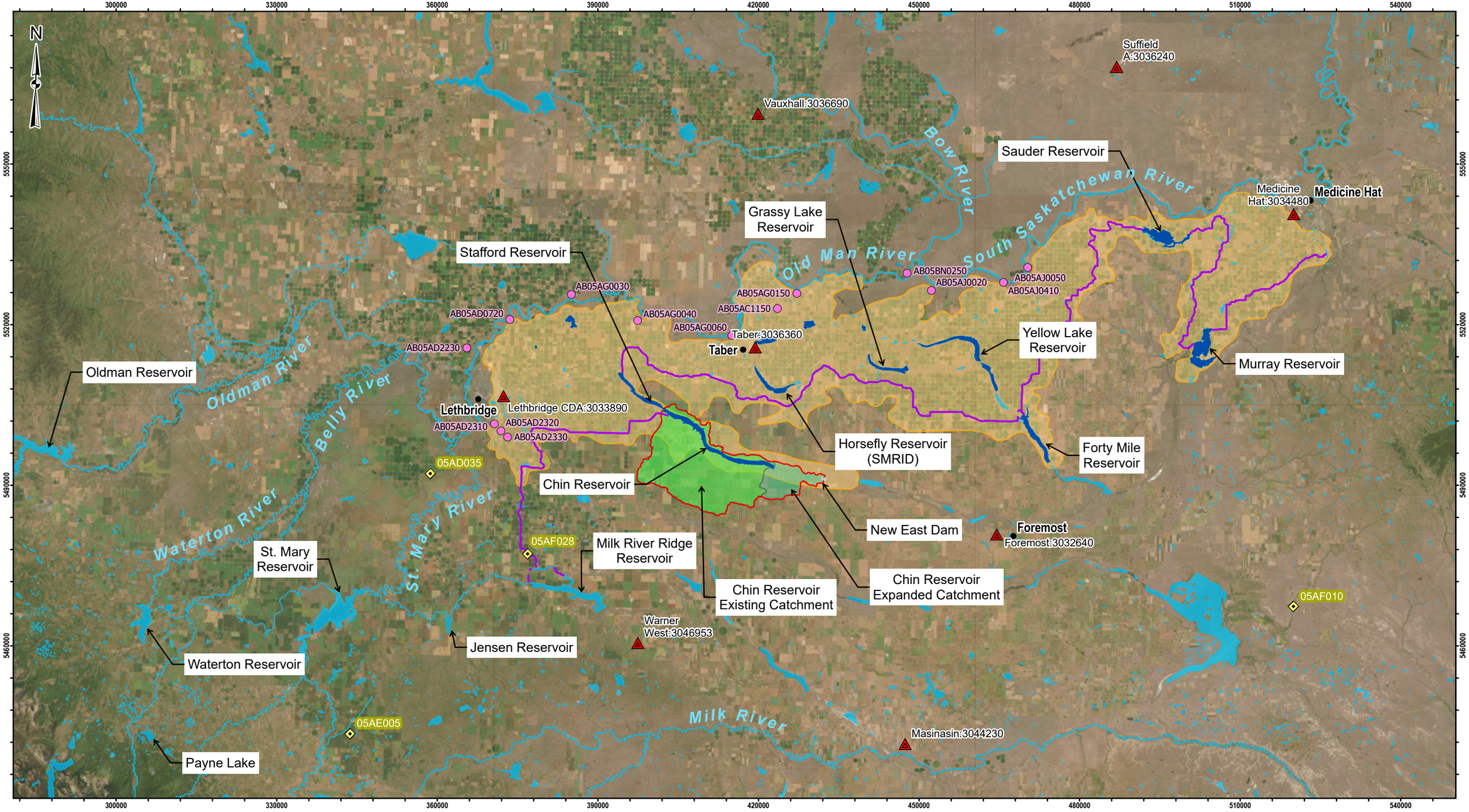
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: CHIN RESERVOIR CATCHMENT

SCALE	PROJECT No.	FIG No.
1:150,000	A03701E05	2.1

File: Z:\AICGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\ChinReservoir_TBRFigures_220802\ChinReservoir_TBRFigures_221114.aprx Creator: : HMianandyan



Legend

- Place Names
- Canal Return Flow Points
- Environment Canada Climate Station
- Water Survey Canada Station
- Proposed Dam Location
- Main Canal
- Water Feature
- SMRID Infrastructure
- Regional Study Area (RSA)
- Local Study Area (LSA)
- Chin Reservoir Expanded Catchment
- Chin Reservoir Existing Catchment

0 30 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: FORTY MILE COUNTY NO.8, TOWN OF PINCHER CREEK, EARTHSTAR GEOGRAPHICS
4. SMRID = SAINT MARY RIVER IRRIGATION DISTRICT

CLIENT: SMRID

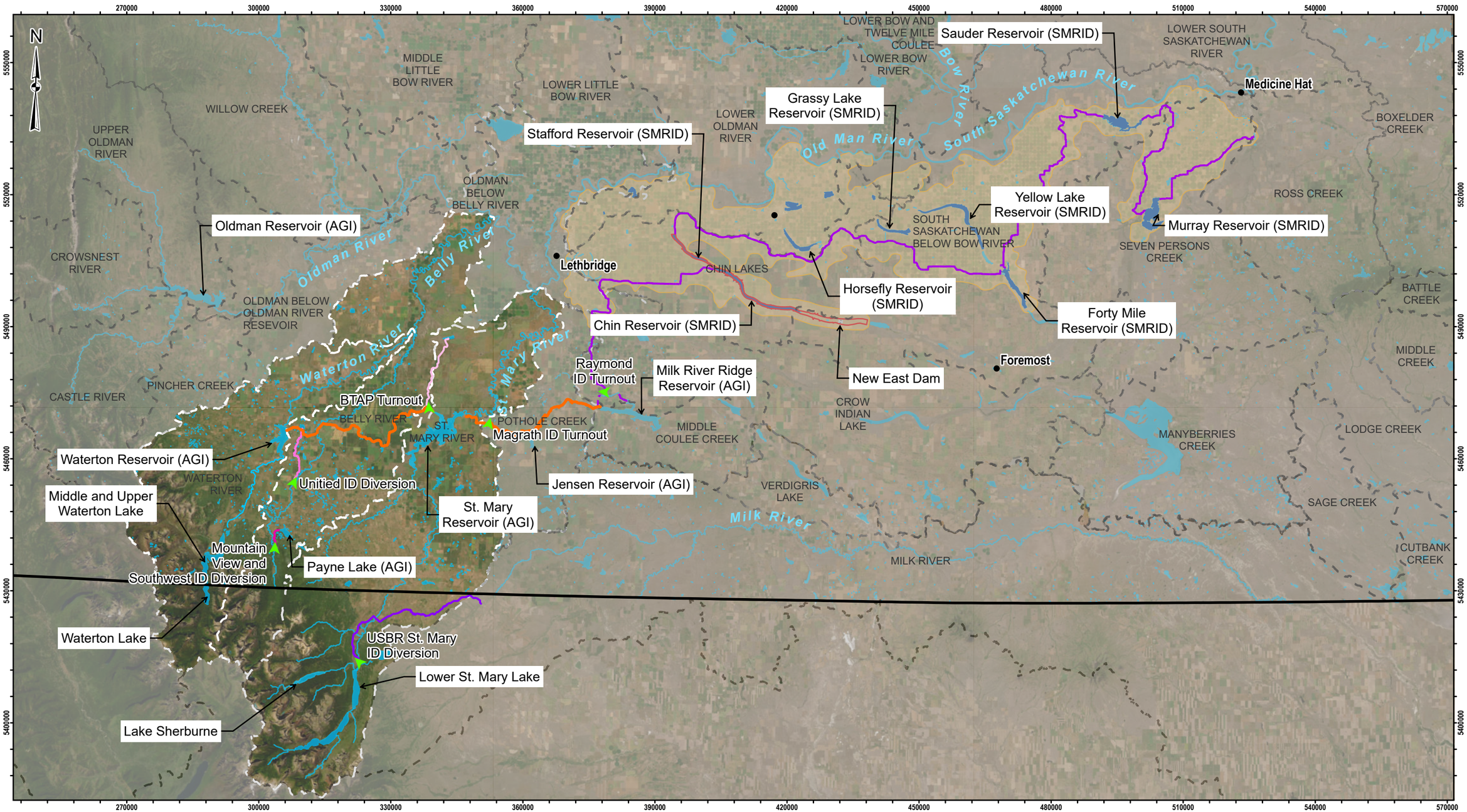
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HYDROLOGY BASELINE STUDY REGIONAL AND LOCAL STUDY AREA

SCALE	PROJECT No.	FIG No.
1:700,000	A03701E05	2.2

File: \\int.klohn.com\Proj\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\ChinReservoir_TBRFigures_220802\ChinReservoir_TBRFigures_221114.aprx Creator: - HMamandyan



Legend

- Place Names
- Irrigation District Turnout/Diversion
- WTSM Canal
- SMRID Main Canal
- Mountain View and Southwest ID Canal
- United ID Canal
- BTAP Canal
- USBR St. Mary Canal
- Proposed Dam Location
- Local Study Area (LSA)
- Regional Study Area (RSA)
- SMRID Infrastructure
- Water Feature
- Watershed Boundary
- National Boundary

0 30 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: EARTHSTAR GEOGRAPHICS
4. SMRID = SAINT MARY RIVER IRRIGATION DISTRICT
5. ID = IRRIGATION DISTRICT
6. BTAP = BLOOD TRIBE AGRICULTURAL PROJECT
7. WTSM = WATERTON TO ST. MARY
8. WATERSHED DATA SOURCE: ALBERTA ENVIRONMENT AND PARKS, USGS

CLIENT: SMRID

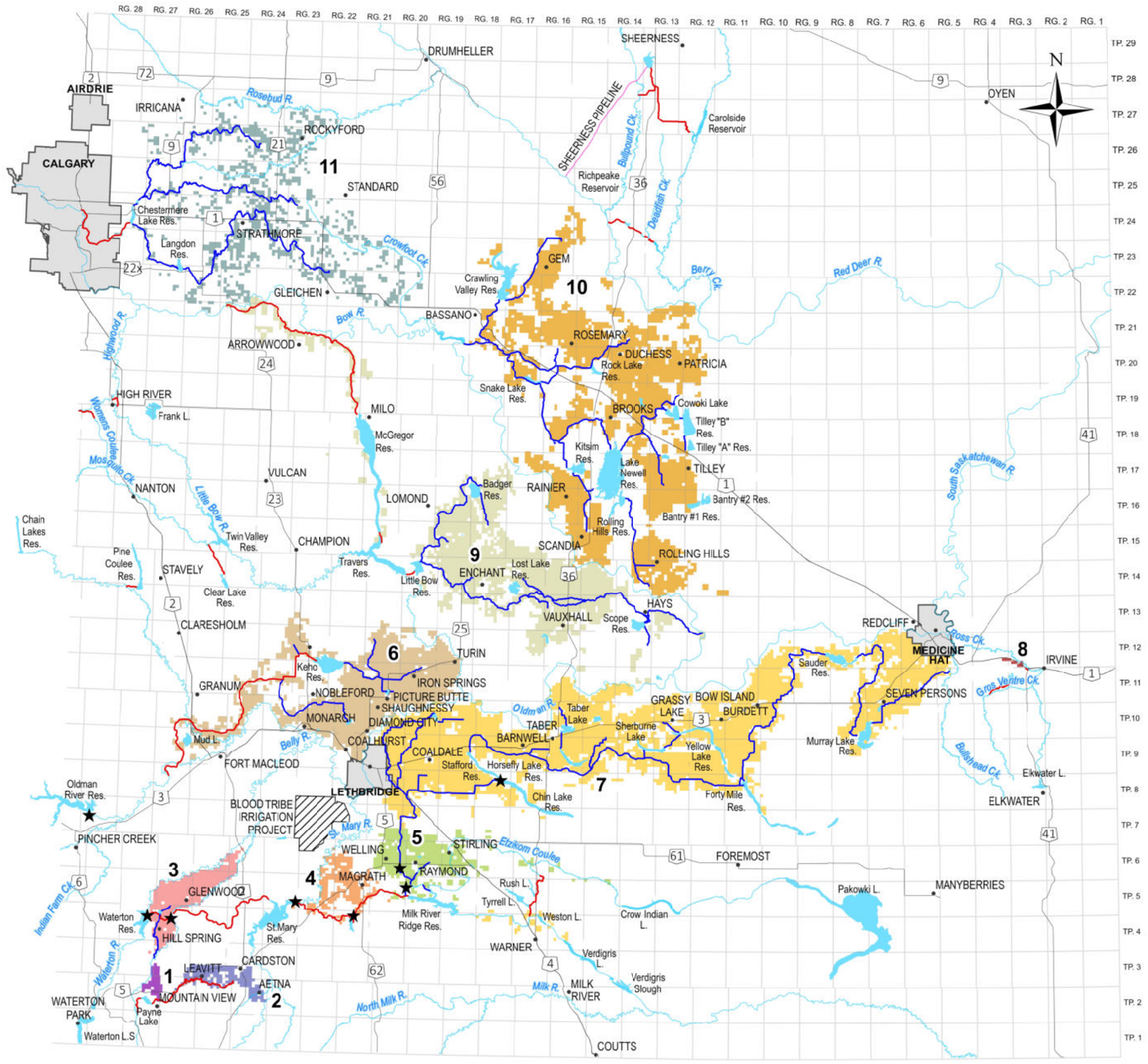
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: REGIONAL WATER MANAGEMENT SYSTEM IN THE SOUTHERN TRIBUTARIES WATERSHED

SCALE	PROJECT No.	FIG No.
1:850,000	A03701E05	2.3

File: \\int.klohn.com\ProjData\AVCGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\ChinReservoir_TBRFigures_221114.aprx Creator: : HMamandyan



Legend

- 1 Mountain View Irrigation District
- 2 Southwest Irrigation District
- 3 United Irrigation District
- 4 Magrath Irrigation District
- 5 Raymond Irrigation District
- 6 Lethbridge Northern Irrigation District
- 7 St. Mary River Irrigation District
- 8 Ross Creek Irrigation District
- 9 Bow River Irrigation District
- 10 Eastern Irrigation District
- 11 Western Irrigation District

★ Hydroelectric Plants Associated with Water Distribution Works

Headworks Owned and Operated by the Government of Alberta

Major Canals (District Owned and Operated)

0 40 Kilometers

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. SMRID = SAINT MARY RIVER IRRIGATION DISTRICT
4. IMAGE SOURCE: ALBERTA IRRIGATION DISTRICTS ASSOCIATION

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: IRRIGATION DISTRICTS

SCALE 1:750,000 | PROJECT No. A03701E05 | FIG No. 2.4

File: Z:\AC\GY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\ChinReservoir_TBRFigures_220802\ChinReservoir_TBRFigures_221114.aprx Creator: : HMarandyan

Question 3

Reference:

Volume 1, Section 1.4-1.8, Page 8-12

Rationale/Preamble:

SMRID mentions carbon sequestration and carbon emissions but did not quantify a carbon balance or assess greenhouse gas emissions during the three phases of the Project.

Information Request:

a. Identify the sources and quantities of greenhouse gas emissions during all three phases of the Project.

b. Provide an estimate of the influence the Project will have on carbon sequestration and/or emissions through changes to the project area.

Response:

a. **Construction**

Greenhouse gas emissions during the construction phase of the Project will be caused by the combustion of diesel fuel in construction equipment. The anticipated Project construction emission sources are discussed in the response to SIR#1 Question 90 and are listed here:

- Light Duty Vehicles: 20
- Earthworks Haul Fleet (Earth Fill):
  - 12 scrapers, or
  - 6 x Cat 777 (100 tonne) offroad rock trucks, or
  - 12 x Cat D400 (40 tonne) offroad rock trucks
- Granular Fill/Riprap Fleet:
  - Truck and trailers haul to site: 10
  - Loaders: 2
  - Offroad Cat D400 dump truck: 3
- Dozers: 10
- Excavators: 7
- Sheepfoot packers/push blades: 5
- Roller/Vibratory Padfoot Packers: 5
- Water Trucks: 6
- Graders: 3

- Skid Steers: 3
- Drill rigs for grouting (Years 1 and 2 only): 2
- Grout plant (Years 1 and 2 only): 2
- Drill rig for instrumentation: 1
- Gensets: 5

The total annual diesel fuel consumption from the equipment was estimated. The calculations excluded light duty vehicles as these are expected to contribute a very small amount of the total greenhouse gas emissions.

Total greenhouse gas emissions from the anticipated fuel consumption were calculated by applying off-road diesel fuel emission factors for carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), and applying global warming potentials for CO_2, CH_4, and N_2O to calculate the total tonnes of carbon dioxide equivalent or CO_2e. The calculations and assumptions are described in more detail below.

Total fuel consumption was estimated based on similar equipment included in the Springbank Off-Stream Reservoir Project EIA (TEC 2018a) (the Springbank Project). As discussed in the EIA for the Chin Project, Volume 2, Appendix 14, the Springbank Project involved the construction of a water retention structure and is thus comparable to the Chin Project in scope, though it was a much larger project. Construction for the Chin Project will involve similar construction activities and utilize similar construction equipment to those used for the Springbank Project. Thus, for the purpose of estimating total greenhouse gas emissions, equipment specifications from the Springbank Project were applied to the equipment that will be used for the Chin Project.

The emission inventory for the Springbank Project is included in its EIA, Volume 4, Appendix E: Air Quality and Climate, Attachment 3A (TEC 2018b). Engine power (measured in horsepower (hp)), brake specific fuel consumption (BSFC) measured by engine power rating (in pounds of diesel per horsepower per hour (lb/hp-hr)), work hours per day, and work days per year were provided for construction equipment in Table 3A-5 of Attachment 3A (Springbank Project EIA) and are used to calculate the fuel usage per equipment. Load factors for the equipment were also provided in Table 3A-5, although the total fuel usage for the Springbank Project was calculated conservatively assuming 100% load for all equipment. In order to be conservative, a similar approach was taken for the Chin Project emission sources in the analysis performed in response to this SIR.

Using analogous equipment specifications from the Springbank emission inventory tables, total fuel consumption for the Chin Project sources was estimated. The total fuel consumption value is shown in Table 3.1. Off-road diesel emission factors from Table A6.1-15, Annex 6 of the National Inventory Report (NIR) (ECCC 2025a) were used and are shown in Table 3.1 as well, along with the corresponding calculated emissions of CO_2, CH_4, and N_2O. Consistent with the NIR, 100-year global warming potential values from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (IPCC 2014) were used to calculate the final

estimated CO_2e of 37,600 tonnes. As mentioned above, the GHG emissions in Table 3.1 were estimated following the conservative methodology used for the Springbank Project (i.e., assuming 100% load for all equipment). Using realistic load factors for the equipment based on Table 3A-5 of Attachment 3A of the Springbank Project assessment, the estimate of total GHG emissions would be approximately 30% lower.

Table 3.1 Estimated GHG emissions from the Chin Reservoir Expansion Project During the Construction Phase

Fuel consumption (kL/year)	Emission factor (g/L) (1)			Emissions (tonnes) (2)			
Off-road diesel	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2e
13,992	2,680.5	0.073	0.022	37,490	1.02	0.31	37,600

Notes: (1) Off-road diesel emission factors from Table A6.1-15, Annex 6 of the National Inventory Report (ECCC, 2025).
(2) CO_2e calculated using 100-year global warming potentials from the IPCC Fifth Assessment Report (AR5) (IPCC, 2014) of 1, 28 and 265 for CO_2, CH_4 and N_2O, respectively.

The residual effect associated with construction emissions is expected to be of low magnitude, far-reaching extent, short-term duration, one-time frequency, irreversible, and predictable. The effect was not considered to be significant.

Operation

Greenhouse gas emissions from the operation phase of the Project will be caused by land-use conversions. These emissions will begin during the filling of the reservoir, which is expected to take at least three years. Therefore, the GHG emissions from land-use conversions are not attributed to the construction phase.

The estimation of direct emissions from land-use change follows the steps in Annex B of the Draft Technical Guide Related to the Strategic Assessment of Climate Change or "the Technical Guide" (ECCC 2021).

Step 1: Quantify areas of ecosystems that are disturbed through project implementation

Table 3.2 shows the matching of the landcover classifications of the EIA to the ECCC land-use categories (based on IPCC 2006).

Table 3.2 Matching of EIA Landcover Classifications with the ECCC Land-use Categories

EIA Landcover Classification	ECCC Land-Use Categories
Campground/Rural	Settlement
Cropland	Cropland
DMGA1	Grassland
DMGA16	Grassland
DMGA2	Grassland
DMGA22	Grassland
DMGA24	Grassland
DMGA3	Grassland
DMGA36	Grassland
DMGA37	Grassland
DMGA38	Grassland
DMGA44	Grassland
DMGA52	Grassland
DMGA69	Grassland
DMGB1	Grassland
DMGB2	Grassland
DMGB3	Grassland
DMGC1	Grassland
DMGC10	Grassland
DMGC16	Grassland
DMGC7	Grassland
DMGC9	Grassland
Dugout	Settlement
Gravel Pit	Settlement
Herbaceous	Settlement
Infrastructure	Settlement
Low Shrub 1	Grassland
Low Shrub 2	Grassland
Reservoir	Settlement
Road	Settlement
Rock/Debris Pile	Settlement
Tall Shrub	Forest Land
Unvegetated	Settlement
Wetland	Wetland
Woody	Forest Land

Figures 3.1 to 3.4 show maps of the ECCC land-use categories impacted by the reservoir expansion (i.e., in the Project Case). According to Figure 4 in the Technical Guide, a Tier 1 approach is appropriate, because the Project Area is greater than 100 ha, but the proportion of carbon dense land is less than 50%.

All disturbed land areas (e.g., work areas, borrow areas, stockpiles, and laydowns) are classified as settlement. In addition, land areas inundated by the reservoir at least part of the year are considered converted to settlement, because no substantial biomass accumulation is expected from inundated land after the reservoir expansion. Therefore, all converted land is assumed to be in the settlement land-use category after the conversion.

Table 3.3 shows the estimated areas of the IPCC (2006) land-use categories converted to settlement. Note that these estimates are conservatively high because some of the areas are disturbed temporarily for construction purposes and will be reclaimed after completion of the construction phase.

Table 3.3 Areas of Land Converted to Settlement by Land-use Category (in ha)

ECCC Land-Use Categories	Baseline	Project Case	Project Case — Baseline
Cropland	2,989.9	2,979.9	-10.0
Grassland	4,386.9	3,639.8	-747.0
Forest Land	94.9	44.7	-50.2
Wetland	75.3	35.1	-40.2
Total	**7,547.1**	**6,699.6**	**-847.5**

Step 2: Within each land class, quantify post-disturbance land-use cover areas

Almost all land-use conversions are caused by the filling of the reservoir. For simplicity, it is assumed that all land-use conversions are from current land-use type to flooded reservoir.

Step 3: Within each infrastructure/post-disturbance land-use cover on site, determine the fate of carbon in pools

In the Project Case, no living biomass, dead organic matter (DOM), and soil organic carbon (SOC) will be removed before the filling of the Reservoir Expansion Area.

Step 4: Apply methodology to calculate emissions over the life of the project

The reservoir will be used for irrigation purposes. The reservoir has a low residence time as water is withdrawn for irrigation or released downstream during times when there is excess water or when water is needed for irrigation downstream. As such, this reservoir's impacts are considered similar to those of a hydroelectric reservoir, according to the Technical Guide (ECCC 2021).

In the case when land is flooded by a hydroelectric reservoir and no carbon stocks are removed from the site prior to flooding, CO_2 and CH_4 emissions from carbon stocks left in place and flooded are calculated using Table 19 of the Technical Guide (ECCC 2021).

Step 4.1: Calculation of CO_2 emissions

The Technical Guide suggests the use of equations A3.5-20 and A3.5-21 in Canada's 2020 National Inventory Report (NIR), Part 2, Section A3.5.6.2. These equations are identical to equations A3.5-25 and A3.5-26 in the latest available version, the NIR 2025 (ECCC 2025b), Part 2, Section A3.5.6.2:

$$CO_{2\ rate\ L_reservoir}(t) = b_0 + b_1 \times \ln(t)$$

where:

- $CO_{2\ rate\ L_reservoir}(t)$ = rate of CO_2 emissions from land converted to flooded land (in $mgCO_2/m^2/day$);
- b_0, b_1 = curve parameters (dimensionless); and
- t = time since flooding (in years).

Total CO_2 emissions from the reservoir are then calculated as the sum of all emissions occurring over time (t):

$$CO_{2\ L_reservoir} = \sum_t CO_{2\ rate\ L_reservoir}(t) \times A_{reservoir} \times Days_{ice\ free} \times 10^{-8} \frac{\mathrm{GgCO_2 \times m^2}}{\mathrm{mgCO_2 \times ha}}$$

where:

- $CO_{2\ L_reservoir}$ = total emissions from lands converted to flooded land (in GgCO2/yr);
- $A_{reservoir}$ = total reservoir area (in ha);
- $Days_{ice\ free}$ = number of days per year without ice (in days/yr); and
- $10^{-8} \frac{\mathrm{GgCO_2 \times m^2}}{\mathrm{mgCO_2 \times ha}}$ = unit conversion factor.

The curve parameters are read from Figure A3.5-19 of NIR 2025 (ECCC 2025b) and were based on 34 measurements from 25 reservoirs:

$$b_0 = 4{,}709.5 \text{ and } b_1 = -1{,}265.$$

Given the relatively low biomass, DOM, and SOC in the Project region in comparison with other parts of Canada, it is likely that these curve parameters yield conservatively high estimates of CO_2 emissions from the reservoir expansion.

We conservatively assume that the entire converted area is flooded, i.e., $A_{reservoir}$ = 847.5 ha.

The number of days per year without ice is extracted from NRCan (1978). Mean freeze-over date is shortly before December 15, mean ice-free date is soon after April 15. The records in NRCan (1978) are at least half a century old and there is a continuing winter warming trend in southern Canada. Simulations reported in ECCC (2019), Section 5.5, indicate that fall freeze-up

will be delayed by 5 to 15 days and spring lake ice breakup will occur 10 to 25 days earlier by mid-century, depending on the emission scenario. To account for this potential increase in the number of ice-free days over the next few decades, we assumed an average lake freeze-up on January 1 and spring mean ice-free date of March 20, corresponding to $Days_{ice\ free}$ = 276 days/yr.

We follow the approach taken in ECCC (2025b) to calculate total emissions from lands converted to flooded land for the entire lifetime of the reservoir based on emissions occurring during the first ten years after flooding (i.e., the summation in the above equation will be from t = 1 to t = 10. The underlying assumption is that the lower carbon emissions occurring in subsequent years will eventually be compensated by carbon uptake which begin roughly after 40 years based on the curve parameters and field observations. The results are presented in Table 3.4.

Table 3.4 Annual and total CO_2 emissions from flooding the reservoir

Time t (yr)	$CO_{2\ rate\ L_reservoir}(t)$ ($mgCO_2/m^2/day$)	$CO_{2\ L_reservoir}$ (in $GgCO_2/yr$)
1	4,710	11.016
2	3,833	8.965
3	3,320	7.765
4	2,956	6.914
5	2,674	6.254
6	2,443	5.714
7	2,248	5.258
8	2,079	4.863
9	1,930	4.514
10	1,797	4.203
Total	N/A	**65.467**

Total CO_2 emissions of 65,467 tCO_2 are expected to occur over the lifetime of the reservoir from the flooding of lands.

Step 4.2: Calculation of CH_4 emissions

The Technical Guide suggests the use of equations 7.15 and 7.10 in IPCC (2019) for the calculation of CH_4 emissions from the reservoirs within years 1-20 and 21-100 after filling the reservoir. No guidance is provided for emissions beyond 100 years, but annual emissions would likely be negligible at this late age of the reservoir.

Since equations 7.15 and 7.10 are identical except for an emission factor, we calculate emissions during both periods at the same time. We drop here the summations over climate zones and reservoirs and adopt the default factors for a Tier 1 approach:

$$F_{CH_4tot} = F_{CH_4res} + F_{CH_4downstream}$$

$$F_{CH_4res} = EF_{CH_4} \times A_{tot}$$

$$F_{CH_4downstream} = F_{CH_4res} \times R_d$$

where:

- F_{CH_4tot} = total annual emissions of CH4 from reservoir (in kgCH_4/yr);
- F_{CH_4res} = annual reservoir surface emissions of CH4 (in kgCH_4/yr);
- $F_{CH_4downstream}$ = annual emissions of CH4 originating from the reservoir but emitted downstream of dam (in kgCH_4/yr);
- EF_{CH_4} = emission factor for CH_4 emitted from the reservoir surface (in kgCH_4/ha/yr);
- A_{tot} = total area of reservoir water surface (in ha); and
- R_d = a constant equal to the ratio of total downstream emission of CH_4 to the total flux of CH_4 from the reservoir surface (dimensionless).

As for CO_2 emissions, we conservatively assume that the entire converted area is flooded, (i.e., A_{tot} = 847.5 ha). Under a Tier 1 approach, R_d = 0.09 by default. The emission factor EF_{CH_4} differs for year 1-20 and 21-100 and are taken from Tables 7.15 and 7.9, respectively, in IPCC (2019), for the cool temperate climate zone:

- $EF_{CH_4\ age\leq 20}$ = 84.7 kgCH_4/ha/yr; and
- $EF_{CH_4\ age>20}$ = 54.0 kgCH_4/ha/yr.

Combining all parameters, total annual emissions of CH_4 from the reservoir are calculated to be F_{CH_4tot} = 78,244 kgCH_4/yr during the first 20 years and F_{CH_4tot} = 49,884 kgCH_4/yr during years 20-100 after filling the reservoir. Consistent with the NIR 2025 (ECCC 2025b), the 100-year global warming potential value 28 for CH_4 from the 2014 IPCC Fifth Assessment Report (AR5) was used to calculate the CO_2 equivalent (CO_2e). After multiplying by 20 and 80 years, respectively, the total CH_4 emissions from the reservoir were calculated to be 43,816 tCO_2e in its first 20 years and 111,740 tCO_2e over years 21-100. Total CH_4 emissions during the operations phase of the Project are therefore estimated to be 155,556 tCO_2e.

All direct GHG emissions from land-use conversions, estimated to occur during the operation of the reservoir, are summarized in Table 3.5 below.

Table 3.5 Direct GHG Emissions During the Operations Phase from Flooding the Reservoir

Years	CO_2 (tCO_2e)	CH_4 (tCO_2e)	Total GHG
1-10	65,467	0	65,467
1-20	0	43,816	43,816
21-100	0	111,740	111,740
Total	**65,467**	**155,556**	**221,023**

The residual effect associated with operations emissions is expected to be of low magnitude, far-reaching extent, medium-term duration, one-time frequency, irreversible, and predictable. The effect was not considered to be significant.

It should be noted that several conservative assumptions were made to derive these estimates. In addition, it is expected that over the lifetime of the reservoir, new riparian forests will form at the edge of the Expanded Chin Reservoir and serve as carbon sinks until they reach maturity. The extent of these new forest lands is currently difficult to estimate; therefore, these changes were not included in the estimation of direct GHG emissions and reductions from land-use conversions.

b. The influence of the Project on carbon sequestration was estimated following the Draft Technical Guide Related to the Strategic Assessment of Climate Change (ECCC 2021), specifically Section 4 and Annex D.

The carbon sink impact was estimated using Equation 5 of the Technical Guide:

$$CSI = \sum_{i,j} \left[(NatFlux - PostDFlux)_{i,j} \cdot T_{i,j} \cdot A_{i,j} \right]$$

where:

- CSI is the estimated carbon sink impact (in tC or tonnes of carbon);
- i is the land-use class;
- j is the disturbance activity for each phase of the project (construction, operation, decommission including, e.g., site restoration or reclamation);
- $NatFlux$ is the natural annual carbon accumulation rate of the land being impacted (in tC/ha/year);
- $PostDFlux$ is the post-disturbance (i.e. post conversion) flux rate impacted by the project (in tC/ha/year);
- T is the time interval (in years); and
- A is the land area (in ha).

Disturbance and inundation will progress through the construction phase and remain stable during Project operations. In addition, since there are no decommissioning plans for the

Expanded Chin Reservoir, annual estimates of impacts on carbon sinks are calculated here as steady and ongoing for the Project operations and the index j in the equation above can be dropped.

In addition to disturbed land areas (e.g., work areas, borrow areas, stockpiles, and laydowns), land areas inundated by the reservoir at least part of the year are considered converted to the settlement land-use category, because no substantial biomass accumulation or biomass decay is expected from inundated land after the reservoir expansion. Therefore, all converted land is assumed to be in the settlement land-use category after the conversion and the carbon accumulation of the disturbed or inundated lands to be $PostDFlux = 0$.

Following the Technical Guide, only land-use categories forest land and wetland are considered as carbon sinks. Therefore, the index i refers to the two land-use categories forest land and wetland that are converted to settlement.

The above considerations simplify the equation from the Technical Guide to:

$$CSI = \sum_{i=Forest\ Land,Wetland} \left(NatFlux_i \cdot T_{i,j} \cdot A_i\right)$$

To determine the natural annual carbon accumulation rate of the forest lands converted to settlement as a result of the Project, we note here that the forest lands in the Project Area are riparian forested areas around the shoreline of the reservoir as well as some areas in the secondary coulees where shrubs have reached greater heights than 1 m. In these areas, the forest stand is mature and has reached maximum carrying capacity (i.e., the above-ground biomass of the forest stand has reached a plateau in growth and the carbon uptake associated with tree growth is approximately balanced by carbon releases from decaying dead organic matter). Therefore,

$$NatFlux_{Forest\ Land} \approx 0.$$

The wetlands are classified as semi-permanent moderately brackish marshes (Alberta Wetland Classification System). The Technical Guide only considers impacts on carbon sinks for bogs and fens, which have substantial carbon accumulation in their peat, and neglect marshes, shallow open waters, and swamps. Therefore,

$$NatFlux_{Wetland} \approx 0.$$

Overall, the Project is not expected to substantially impact carbon sinks.

$$\mathrm{CSI} \approx 0.$$

FIGURES

Figure 3.1 Carbon Sink Impact Within the Project Area (Sheet 1 of 4)

Figure 3.2 Carbon Sink Impact Within the Project Area (Sheet 2 of 4)

Figure 3.3 Carbon Sink Impact Within the Project Area (Sheet 3 of 4)

Figure 3.4 Carbon Sink Impact Within the Project Area (Sheet 4 of 4)

Stafford Reservoir

Existing West Dam

Range Road 182

35-08-18-W4M

34-08-18-W4M

36-08-18-W4M

31-08-17-W4M

32-08-17-W4M

33-08-17-W4M

27-08-18-W4M

25-08-18-W4M

26-08-18-W4M

30-08-17-W4M

29-08-17-W4M

28-08-17-W4M

24-08-18-W4M

22-08-18-W4M

23-08-18-W4M

19-08-17-W4M

20-08-17-W4M

21-08-17-W4M

Chin Reservoir

15-08-18-W4M

14-08-18-W4M

13-08-18-W4M

18-08-17-W4M

16-08-17-W4M

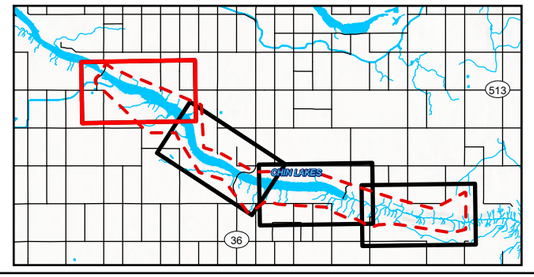
N

Legend

- Dam Location
- All Weather Road
- Alberta Township Section
- Local Study Area (LSA)
- Project Area (PA)

ECCC Category

- Cropland
- Forest
- Grassland
- Settlement
- Wetland



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: CARBON SINK IMPACT WITHIN THE PROJECT AREA SHEET 1 OF 4

SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	3.1

File: \\int.klohn.com\Proj\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir ECDB.aprx Date:6/25/2025 11:30 AM Creator: HMamandyan

21-08-17-W4M
14-08-17-W4M
15-08-17-W4M
12-08-17-W4M
11-08-17-W4M
10-08-17-W4M
1-08-17-W4M
2-08-17-W4M
16-08-17-W4M
9-08-17-W4M
3-08-17-W4M
8-08-17-W4M
4-08-17-W4M
5-08-17-W4M
33-07-17-W4M
34-07-17-W4M
35-07-17-W4M
26-07-17-W4M
27-07-17-W4M
36-07-17-W4M
31-07-16-W4M
6-08-16-W4M
32-07-16-W4M
24-07-17-W4M
Chin Reservoir
Highway 36 Bridge
36
513

Legend

- Dam Location
- All Weather Road
- Alberta Township Section
- Local Study Area (LSA)
- Project Area (PA)

ECCC Category

- Cropland
- Forest
- Grassland
- Settlement
- Wetland

0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR

CLIENT: SMRID

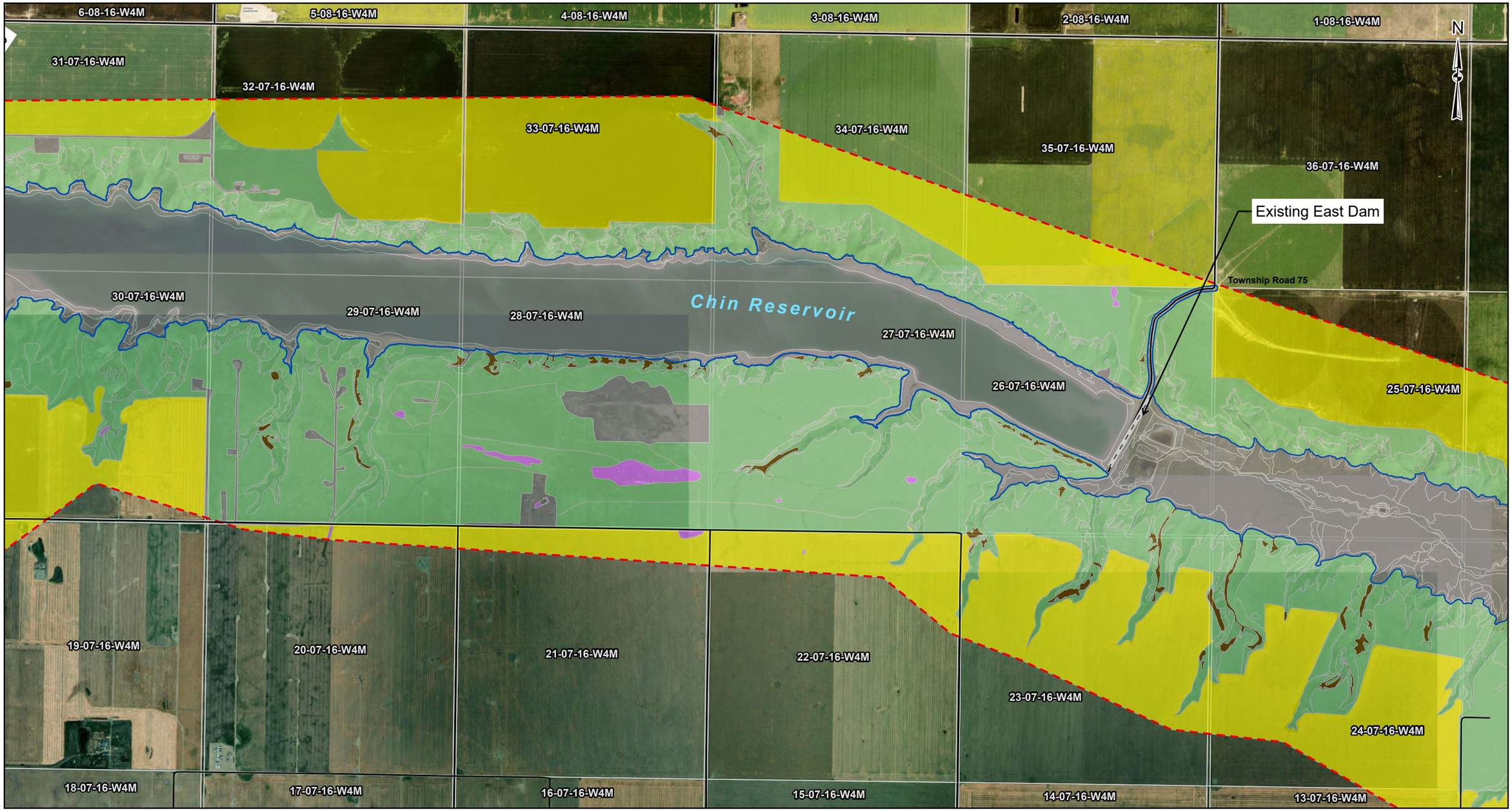
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: CARBON SINK IMPACT WITHIN THE PROJECT AREA SHEET 2 OF 4

SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	3.2

File: \\int.klohn.com\Proj\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Res

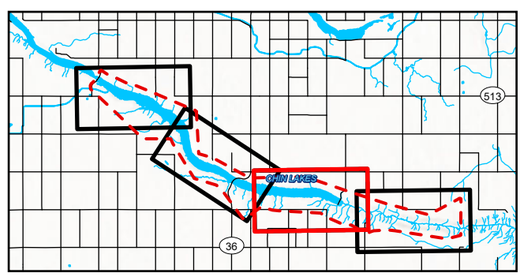


Legend

- Dam Location
- All Weather Road
- Alberta Township Section
- Local Study Area (LSA)
- Project Area (PA)

ECCC Category

- Cropland
- Forest
- Grassland
- Settlement
- Wetland



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: CARBON SINK IMPACT WITHIN THE PROJECT AREA SHEET 3 OF 4

SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	3.3

File: \\int.klohn.com\ProjData\A\C\GY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir ECDB.aprx Date:6/25/2025 11:30 AM Creator: HManandyan

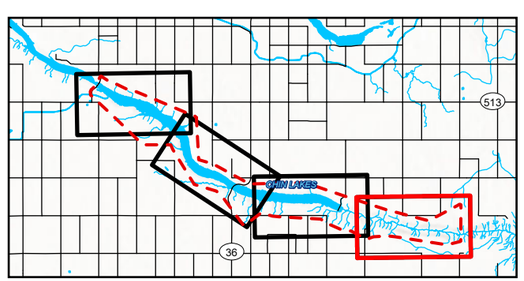
25-07-16-W4M
30-07-15-W4M
29-07-15-W4M
28-07-15-W4M
27-07-15-W4M
Range Road 152
26-07-15-W4M
Range Road 151
36-07-15-W4M
25-07-15-W4M
N
21-07-15-W4M
22-07-15-W4M
23-07-15-W4M
24-07-15-W4M
24-07-16-W4M
19-07-15-W4M
20-07-15-W4M
13-07-16-W4M
18-07-15-W4M
17-07-15-W4M
16-07-15-W4M
15-07-15-W4M
14-07-15-W4M
13-07-15-W4M
New East Dam
12-07-16-W4M
7-07-15-W4M
8-07-15-W4M
9-07-15-W4M
10-07-15-W4M
11-07-15-W4M
12-07-15-W4M

Legend

- Dam Location
- All Weather Road
- Alberta Township Section
- Local Study Area (LSA)
- Project Area (PA)

ECCC Category

- Cropland
- Forest
- Grassland
- Settlement
- Wetland



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: CARBON SINK IMPACT WITHIN THE PROJECT AREA SHEET 4 OF 4

SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	3.4

File: \\int.klohn.com\ProjData\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir ECDB.aprx Date:6/25/2025 11:30 AM Creator: HManandyan

Question 4

Reference:

Volume 1, Section 1.4-1.8, Page 8-12;
Volume 2, Section 2.2.3.2.1, Page 30

Rationale/Preamble:

SMRID states that *potential effects of the Project on the water supply for licensees, river flows, or the sustainability of waterbodies downstream of the diversion are not expected to be attributed to the project* and that *Project-related effects on river flows, transboundary apportionment, riverine and riparian habitat, communities, recreation, and water licencees downstream from the Waterton-St. Mary Headworks System are not expected*.

Information Request:

a. Provide a quantitative water balance to justify these statements, including:
    i. the range and average of total annual diversion from the Waterton-St. Mary's Headworks toward the Milk River Ridge Reservoir over a 30-year period up to and including 2023.
    ii. the range and average of total annual discharge from Waterton-St. Mary's Headworks into St. Mary's River over a 30-year period up to and including 2023.
    iii. the range and average total annual discharge at the St. Mary River near Lethbridge, Oldman River near Lethbridge, Oldman River near the Mouth, and South Saskatchewan River transboundary hydrometric stations over a 30-year period up to and including 2023.
    iv. estimated annual volumes of water diverted from Waterton-St. Mary's Headworks to SMRID as a result from the project, with respect to the increased amount required to fill Chin Reservoir following expected annual drawdowns.
    v. the estimated change in annual water discharged to the St. Mary's River downstream of Saint Mary's Reservoir resulting from the Project.
b. Assess the significance of impact of the Project Case on water quantity at downstream locations.

Response:

a.
    i. Table 4.1 presents the total annual volume of water diverted from the St. Mary Reservoir to the MRRR from 1994 to 2023, based on data from the Water Survey of Canada hydrometric gauge station 05AE006 "Canadian St. Mary Canal near Spring Coulee". Table 4.2 and Figure 4.1 illustrate the calculated average annual total volume (659,600 dam^3) and observed range (285,993 – 900,757 dam^3).

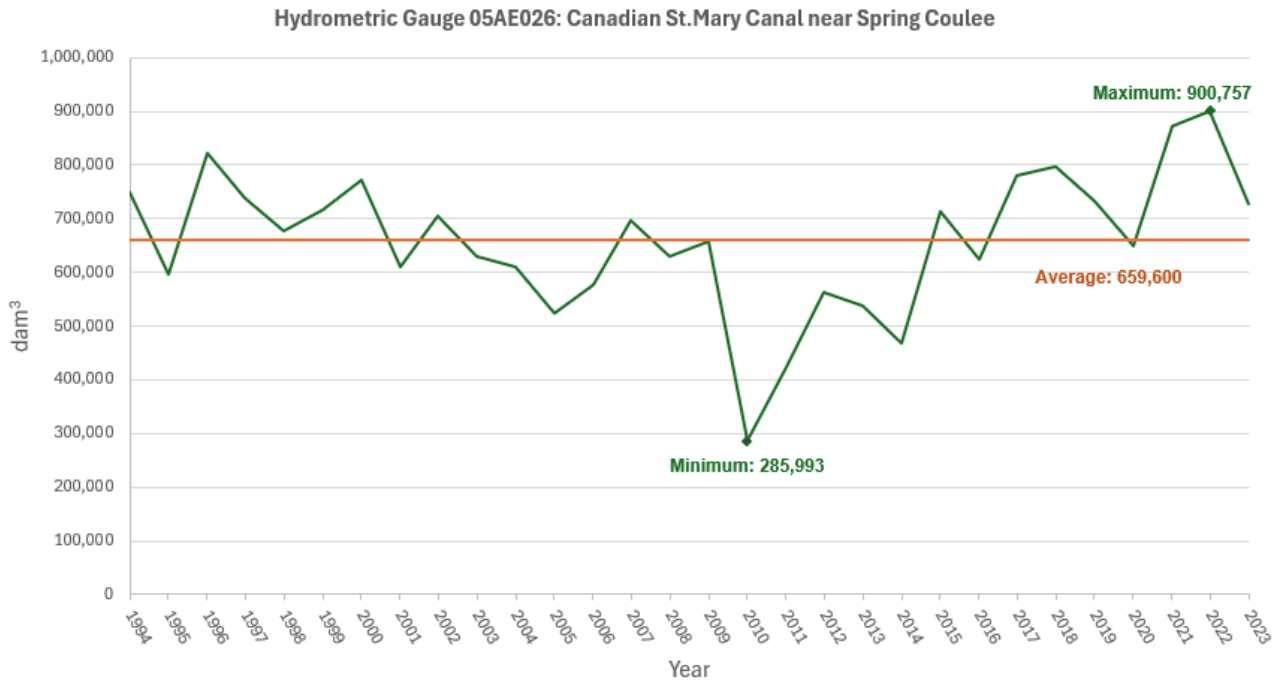
Table 4.1 Total annual volume of water diverted from the St. Mary Reservoir to the MRRR (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AE006 "Canadian St. Mary Canal near Spring Coulee"

Year	Total annual volume (dam^3)	Year	Total annual volume (dam^3)	Year	Total annual volume (dam^3)
1994	748,387	2004	611,298	2014	469,255
1995	595,102	2005	523,485	2015	713,393
1996	821,801	2006	575,917	2016	623,517
1997	738,589	2007	697,766	2017	781,330
1998	676,406	2008	628,533	2018	798,172
1999	717,257	2009	657,594	2019	732,486
2000	770,563	2010	285,993	2020	649,893
2001	610,459	2011	424,145	2021	872,679
2002	706,231	2012	562,042	2022	900,757
2003	630,991	2013	537,948	2023	726,023

Table 4.2 Summary of the average and range of annual water diversion volumes from the St. Mary Reservoir toward the to the MRRR (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AE006 "Canadian St. Mary Canal near Spring Coulee"

Gauge Station	Average total diversion volume (dam^3/yr)	Maximum total diversion volume (dam^3/yr)	Minimum total diversion volume (dam^3/yr)
05AE006 Canadian St. Mary Canal near Spring Coulee	659,600	900,757	285,993

Figure 4.1 Average annual, minimum and maximum volume of water diverted from the St. Mary Reservoir toward the MRRR (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AE026 "Canadian St. Mary Canal near Spring Coulee"



ii. There is no gauge station to directly measure the discharge from St. Mary Reservoir to the St. Mary River; however, the flow in the St. Mary River near Lethbridge is a reasonable proxy as there are minimal inflows and withdrawals in the stretch between the St. Mary Reservoir and the Water Survey of Canada (WSC) gauge near Lethbridge.

Table 4.3 presents the range and average annual volume of water flowing in the St. Mary River near Lethbridge from 1994 to 2023, based on data from the Water Survey of Canada hydrometric gauge station 05AE006 "St. Mary River near Lethbridge". Table 4.4 and Figure 4.2 illustrate the calculated average annual total volume (410,591 dam^3) and the observed range (106,638 – 1,012,662 dam^3).

Table 4.3 Total annual volume of water flowing in the St. Mary River near Lethbridge (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AE006 "St. Mary River near Lethbridge"

Year	Total annual flow (dam^3)	Year	Total annual flow (dam^3)	Year	Total annual flow (dam^3)
1994	343,792	2004	133,195	2014	788,427
1995	860,687	2005	462,635	2015	307,375
1996	528,849	2006	446,399	2016	325,991
1997	476,828	2007	244,842	2017	No data
1998	263,741	2008	249,918	2018	241,278
1999	377,415	2009	180,090	2019	135,880
2000	135,815	2010	1,012,662	2020	602,463
2001	106,638	2011	968,760	2021	167,046
2002	528,225	2012	535,614	2022	Incomplete data
2003	249,747	2013	411,654	2023	788,427

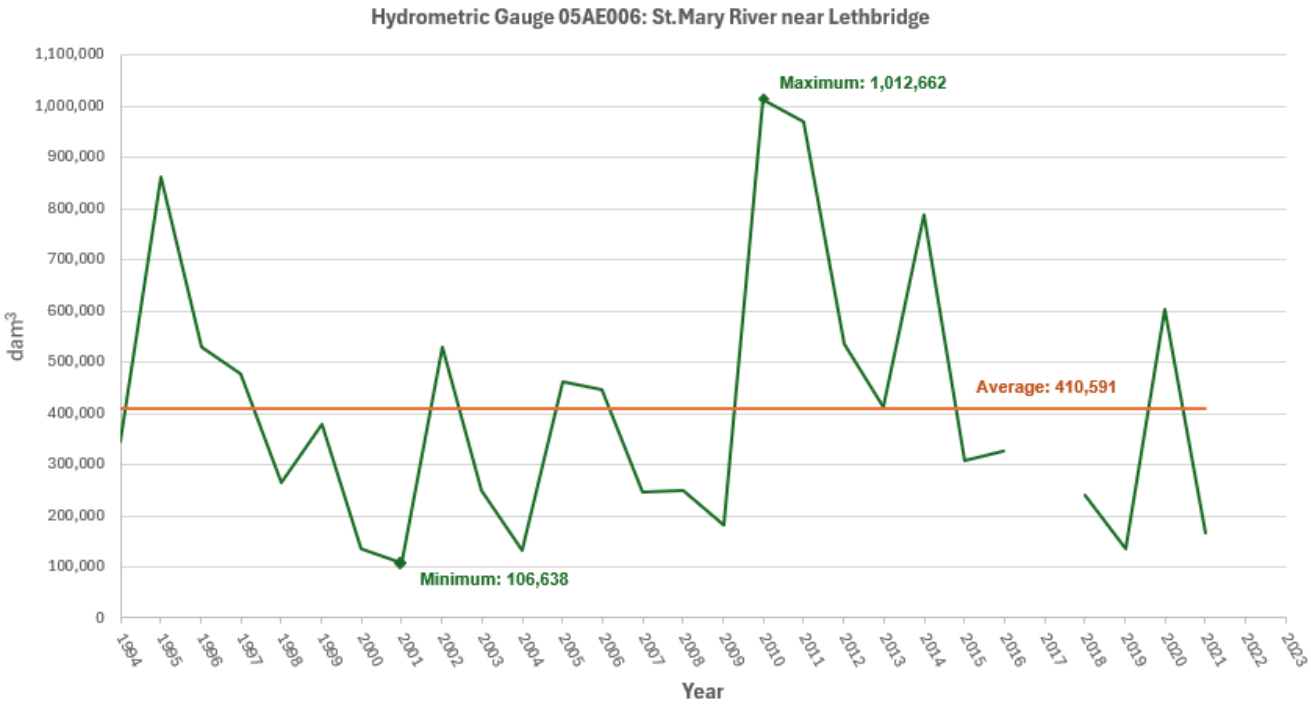
Note: Years with missing or incomplete data were excluded from the calculations.

Table 4.4 Summary of the average and range of annual water flowing in the St. Mary River near Lethbridge (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AE006

Gauge Station	Average total flow (dam^3/yr)	Maximum total flow (dam^3/yr)	Minimum total flow (dam^3/yr)
05AE006 St. Mary River near Lethbridge	410,591	1,012,662	106,638

Note: Years with missing or incomplete data were excluded from the calculations.

Figure 4.2 **Average annual, minimum and maximum volume of water flowing in the St. Mary River near Lethbridge (1994–2021), based on data from the Water Survey of Canada hydrometric gauge station 05AE006**



Note: Years with missing or incomplete data were excluded from the calculations.

iii. Data from Water Survey of Canada hydrometric gauge stations 05AE006 “St. Mary River near Lethbridge,” 05AD007 “Oldman River near Lethbridge,” 05AG006 “Oldman River near the Mouth,” and 05AJ001 “South Saskatchewan River at Medicine Hat” (transboundary gauge) were used to determine total annual discharge from 1994 to 2023, as shown in Table 4.3, Table 4.5, Table 4.7, and Table 4.9. Corresponding summary tables including Table 4.4, Table 4.6, Table 4.8, and Table 4.10, and Figures 4.2 through 4.5 illustrate the average annual, maximum and minimum volumes. Years with missing or incomplete data were excluded from the calculations.

From Table 4.6, the average annual total volume of discharge at 05AD007 “Oldman River near Lethbridge” is 2,116,300 dam^3 and the range is 640,094 – 4,251,865 dam^3. From Table 4.8, the average annual total volume of discharge at 05AG006 “Oldman River near the Mouth” is 2,207,174 dam^3 and the range is 696,813 – 4,401,138 dam^3. From Table 4.10, the average annual total volume of discharge at 05AJ001 “South Saskatchewan River at Medicine Hat” is 5,051,187 dam^3 and the range is 1,737,176 – 8,784,392 dam^3.

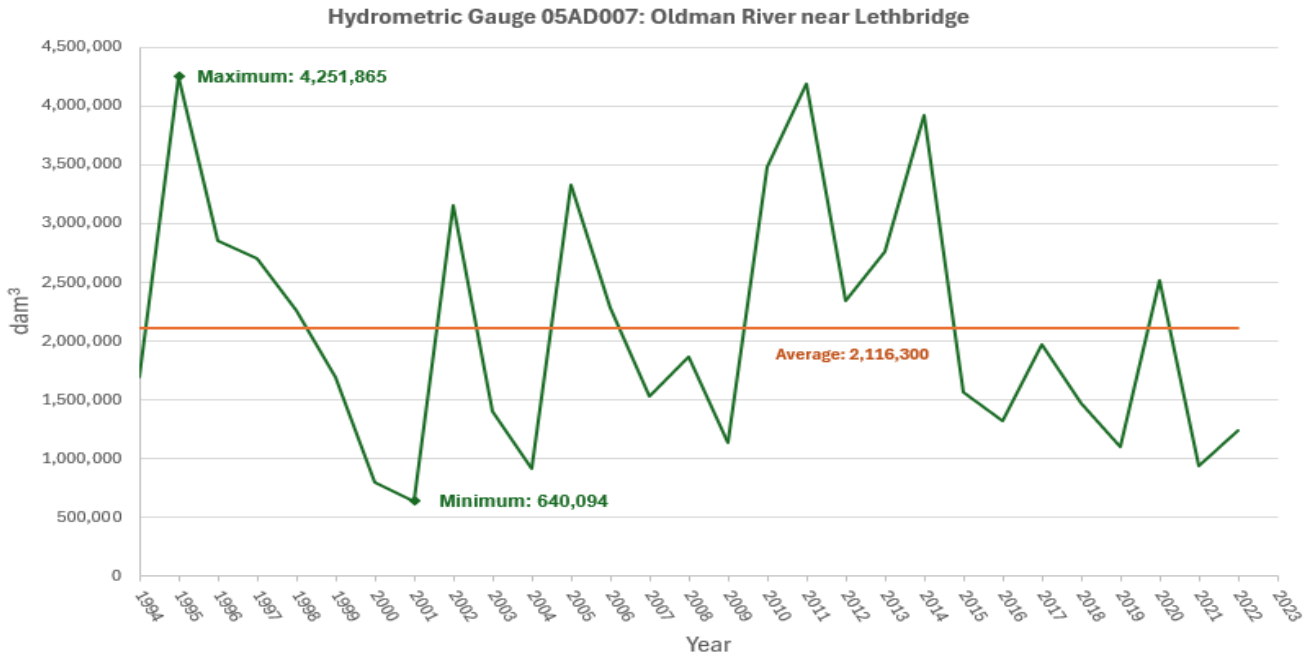
Table 4.5 **Total annual volume of discharge at the Oldman River near Lethbridge (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AD007 "Oldman River near Lethbridge"**

Year	Total annual discharge (dam^3)	Year	Total annual discharge (dam^3)	Year	Total annual discharge (dam^3)
1994	1,695,151	2004	914,268	2014	3,924,374
1995	4,251,865	2005	3,333,347	2015	1,570,778
1996	2,856,626	2006	2,284,597	2016	1,317,911
1997	2,702,540	2007	1,534,524	2017	1,971,346
1998	2,264,634	2008	1,870,479	2018	1,468,843
1999	1,693,207	2009	1,141,716	2019	1,105,199
2000	803,392	2010	3,483,881	2020	2,522,284
2001	640,094	2011	4,185,864	2021	934,839
2002	3,157,288	2012	2,338,308	2022	1,243,581
2003	1,398,047	2013	2,763,706	2023	3,924,374

Table 4.6 **Summary of the average and range of annual discharge at the Oldman River near Lethbridge (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AD007 "Oldman River near Lethbridge"**

Gauge Station	Average total discharge (dam^3/yr)	Maximum total discharge (dam^3/yr)	Minimum total discharge (dam^3/yr)
05AD007 Oldman River near Lethbridge	2,116,300	4,251,865	640,094

Figure 4.3 **Average annual, minimum and maximum volume of water discharged from the Oldman River near Lethbridge (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AD007 "Oldman River near Lethbridge"**



Note: Years with missing or incomplete data were excluded from the calculations.

Table 4.7 **Total annual volume of discharge at the Oldman River near the Mouth (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AG006 "Oldman River near the Mouth"**

Year	Total annual discharge (dam^3)	Year	Total annual discharge (dam^3)	Year	Total annual discharge (dam^3)
1994	1,865,096	2004	1,032,166	2014	4,185,302
1995	4,398,875	2005	3,547,584	2015	1,782,994
1996	2,940,443	2006	2,449,647	2016	1,496,111
1997	2,739,960	2007	1,637,919	2017	2,082,093
1998	2,329,086	2008	1,961,172	2018	1,692,049
1999	1,774,060	2009	1,230,094	2019	1,216,676
2000	906,775	2010	3,658,323	2020	2,699,067
2001	696,813	2011	4,401,138	2021	1,078,488
2002	3,218,298	2012	2,443,617	2022	1,356,454
2003	1,591,134	2013	2,898,003	2023	905,792

Table 4.8 **Summary of average and range of annual discharge at the Oldman River near the Mouth (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AG006 "Oldman River near the Mouth"**

Gauge Station Name	Average total discharge (dam^3/yr)	Maximum total discharge (dam^3/yr)	Minimum total discharge (dam^3/yr)
05AG006 Oldman River near the Mouth	2,207,174	4,401,138	696,813

Figure 4.4 **Average annual, minimum and maximum volume of water discharged from the Oldman River near the Mouth (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AG006 "Oldman River near the Mouth"**

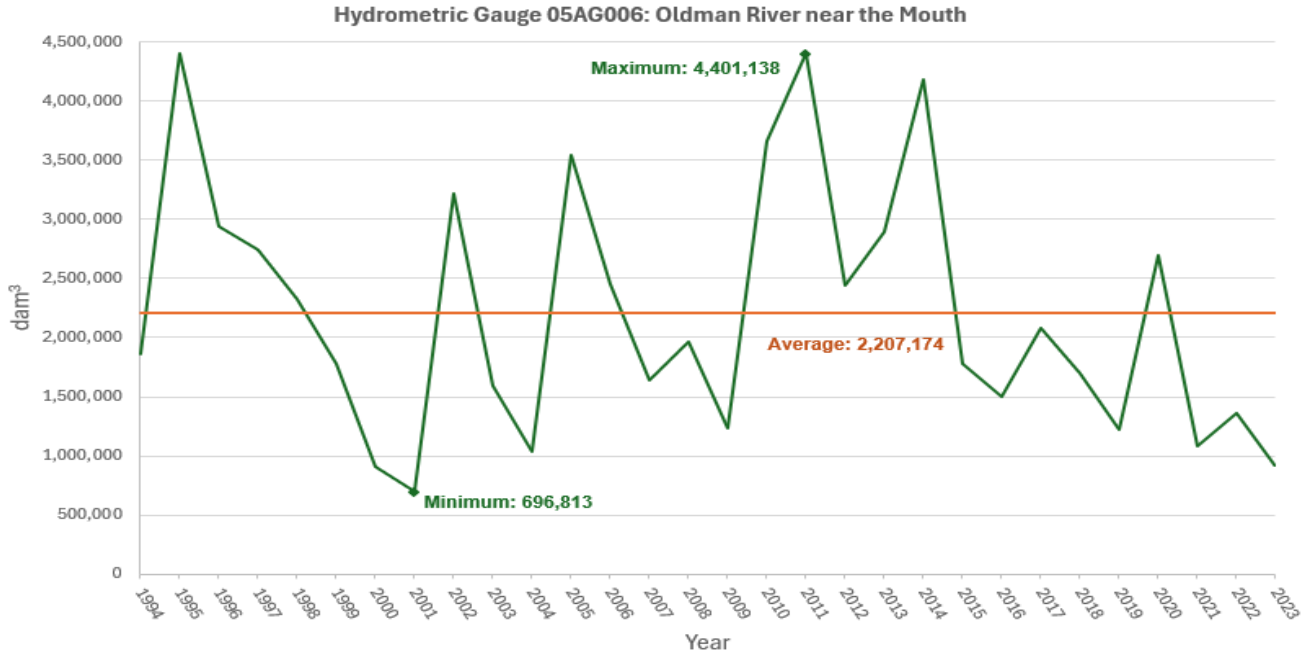


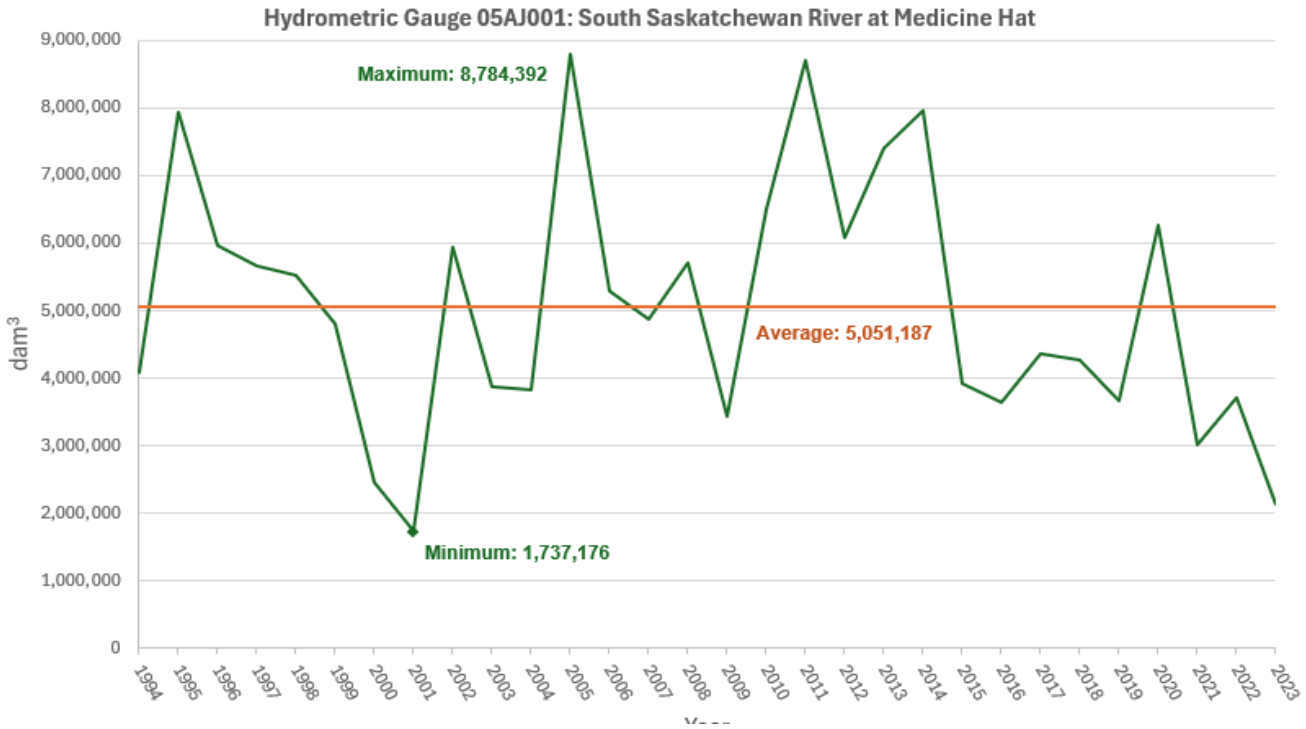
Table 4.9 **Total annual volume of discharge at the South Saskatchewan River at Medicine Hat (1994–2023), based on data from Water Survey of Canada hydrometric gauge station 05AJ001 "South Saskatchewan River at Medicine Hat"**

Year	Total annual discharge (dam^3)	Year	Total annual discharge (dam^3)	Year	Total annual discharge (dam^3)
1994	4,078,849	2004	3,837,275	2014	7,962,909
1995	7,926,500	2005	8,784,392	2015	3,909,946
1996	5,952,347	2006	5,301,323	2016	3,651,178
1997	5,662,172	2007	4,881,177	2017	4,361,351
1998	5,530,680	2008	5,707,809	2018	4,258,094
1999	4,807,400	2009	3,437,493	2019	3,657,511
2000	2,460,577	2010	6,501,816	2020	6,259,766
2001	1,737,176	2011	8,695,555	2021	3,018,012
2002	5,935,334	2012	6,073,730	2022	3,716,461
2003	3,885,745	2013	7,411,755	2023	2,131,272

Table 4.10 **Summary of average and range of annual discharge at the South Saskatchewan River at Medicine Hat (1994–2023), based on data from the Water Survey of Canada hydrometric gauge 05AJ001 "South Saskatchewan River at Medicine Hat"**

Gauge Station Name	Average total discharge (dam^3/yr)	Maximum total discharge (dam^3/yr)	Minimum total discharge (dam^3/yr)
05AJ001 South Saskatchewan River at Medicine Hat	5,051,187	8,784,392	1,737,176

Figure 4.5 **Average annual, minimum and maximum volume of water discharged from the South Saskatchewan River at Medicine Hat (1994–2023), based on data from the Water Survey of Canada hydrometric gauge station 05AJ001 "South Saskatchewan River at Medicine Hat"**



iv. SOAP Model simulations are used to estimate changes in annual water diversions from the Waterton-St. Mary headworks to SMRID resulting from the Chin Reservoir Expansion Project.

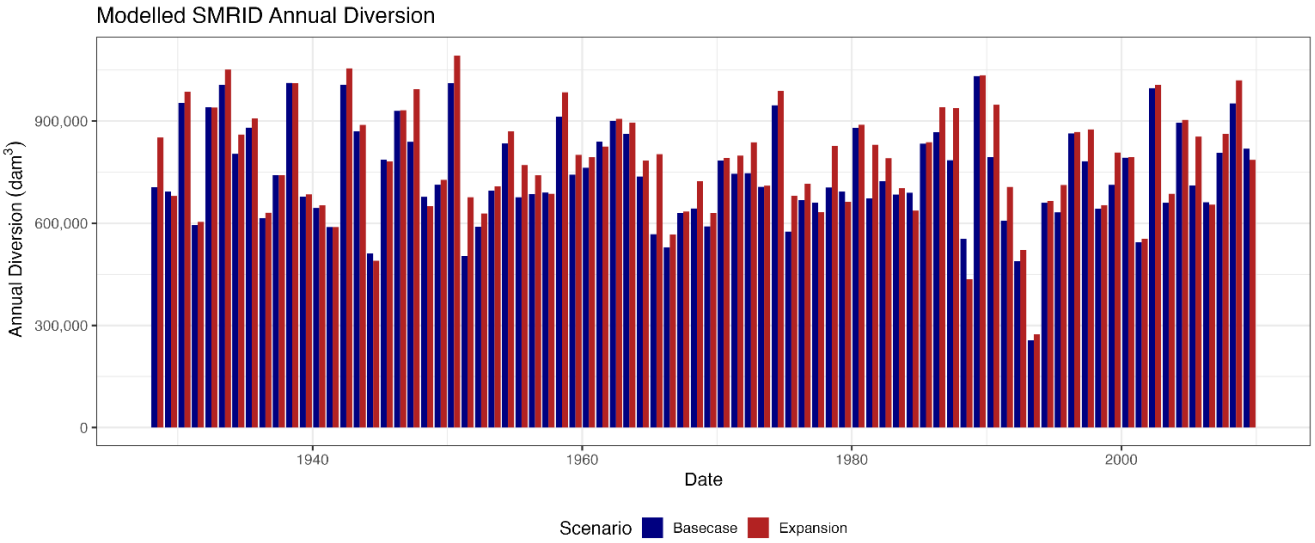
The SOAP Model represents the simplified operations of the AGI reservoirs, conveyance canal network, SMRID irrigation network, and SMRID-owned and operated reservoirs. It incorporates current operating rules, instream objectives, and infrastructure design. While the model uses historical inflow data from 1928 to 2009, it applies present-day operational conditions. As a result, the modelled outputs do not match historical observations; instead, they reflect how the current system would have performed under past hydrologic conditions. Further details on the model and its assumptions are provided in WaterSMART's *Technical Memorandum Regarding Chin Reservoir Expansion Project Supporting SIR Response* provided in Appendix 4.1 of this SIR#1 Response Document.

Potential changes from the Chin Reservoir Expansion Project were assessed by comparing two scenarios: the Base case Scenario, representing the current system, and the Expansion Scenario, which includes 127,650 dam^3 (103,500 ac-ft) of additional storage in the Chin Reservoir and 46,500 additional irrigated acres.

Model results, as illustrated in Figure 4.6, indicate that the Chin Reservoir Expansion Project would increase average annual diversions from the Waterton – St. Mary headworks by approximately 31,710 dam^3 (25,704 ac-ft).

The potential increase in diversion volume varies annually; for example, in simulation year 1995, the diversion was 149,990 dam^3 (121,655 ac-ft) higher than the Base case Scenario, whereas in 1984 it was 74,758 dam^3 (60,596 ac-ft) less. This variability is a result of the variation in water supply and demand which is based on the crop mix and weather data input to the model for that simulation year. In years where there is high demand and high-water availability there will be more water diverted.

Figure 4.6 Annual volume of water (dam^3) diverted for the SMRID comparing SOAP Model results for the Base case Scenario and the Expansion Scenario



v. The SOAP Model was developed from the original SSROM with the objective of evaluating SMRID internal operations. The SOAP Model was intentionally limited to operations that have no impact to downstream flows. Further details on the SSROM and the SOAP Model are found in Appendix 4.1.

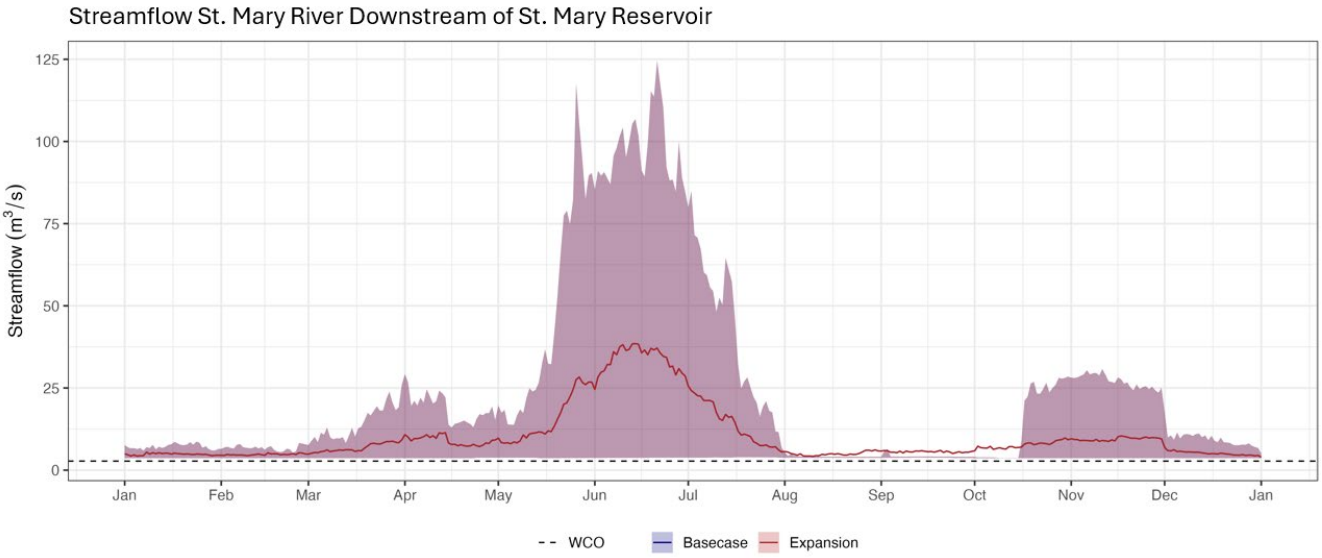
One of the assumptions of the SOAP Model is that flows downstream of the Waterton and St. Mary reservoirs are consistent with SSROM (the larger, watershed scale model). Timeseries from the SSROM Base case were used as an input to the SOAP Model for the Waterton and St. Mary Rivers and the SOAP Model aimed to always match that timeseries.

A primary objective in the SSROM and SOAP Model is to maintain minimum flow requirements in the Southern Tributaries system. The Water Conservation Objectives (WCOs) are set at 2.27 m^3/s for the Waterton River, 0.93 m^3/s for the Belly River, and 2.75 m^3/s for the St. Mary River. Maintaining these flows is a high priority and the models are designed to uphold them whenever possible.

The results described below show no change in annual discharge in the St. Mary River downstream of St. Mary Reservoir. Impacts to the basin are therefore limited to storage differentials in the Waterton Reservoir and the St. Mary Reservoir. AGI would be responsible for allocating impacts in the basin between storage and instream flows. Please see the response to SIR#1 Question 98 for a discussion of the modelled impacts to storage in the Waterton and St. Mary Reservoirs.

Figure 4.7 illustrates that the SOAP-simulated St. Mary River average flow and flow range under both the Base case and Expansion Scenarios overlay each other exactly, confirming that the Chin Reservoir Expansion Project can be operated without impact to the streamflow in the St. Mary River.

Figure 4.7 Hydrograph comparing SSROM-simulated flows for St. Mary Reservoir Outflow under the Base case Scenario and the Expansion Scenario



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Note that where no blue is visible, it is because the red is overlaying it.

b. The estimated change in average water quantity and timing at downstream locations resulting from the Chin Reservoir Expansion Project was assessed using model simulations. Downstream locations include the Waterton River, St. Mary River, Oldman River, and the South Saskatchewan River. For a detailed description of water flow in this region and why these five rivers are considered downstream of the SMRID water license diversion, please refer to the *Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum* provided in Appendix 2.1.

   Water availability, streamflow, and system operations were simulated using the SOAP Model for the Southern Tributaries system (as previously noted, a primary objective is to maintain flows provided by SSROM). The SSROM was used to evaluate flows in the for the Oldman and South Saskatchewan rivers.

   The SOAP Model represents the operations of the AGI reservoirs, conveyance channel network, SMRID irrigation network and SMRID owned and operated reservoirs. The SSROM model, developed collaboratively with subject matter experts—including major water users, water managers, and the provincial government—represents the operations of the South Saskatchewan River System at a larger scale than the SOAP Model, and includes the Bow, Oldman, and Red Deer sub-basins. The SOAP Model was created from the SSROM for analysis focused on the SMRID system.

   Both models use historical naturalized inflow data from 1928 to 2009 but apply current operating rules, instream objectives, and infrastructure design. Therefore, the modelled outputs will not match historical observations but instead reflect how the current systems would have

operated under past hydrologic inflow conditions. Refer to the accompanying technical memorandum for further details on the model and the assumptions underlying these results (WaterSMART 2025).

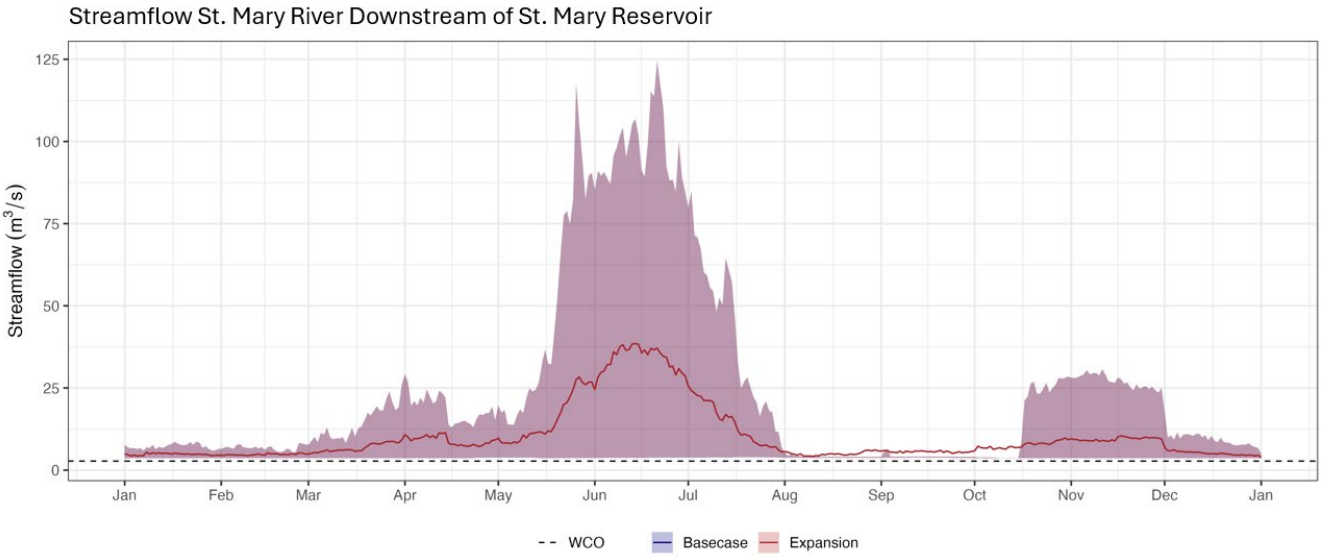
The two scenarios evaluated were the Base case Scenario, representing the current system, and the Expansion Scenario, which includes 127,650 dam^3 (103,500 ac-ft) of additional storage in the Chin Reservoir and 46,500 additional irrigated acres. The comparison illustrates the potential impacts of the Chin Reservoir Expansion Project on downstream flows.

St. Mary River and Waterton River

Figures 4.8 and 4.9 show the SOAP Model simulations of the St. Mary River and Waterton River, respectively, with the average streamflow and flow ranges under the Base case Scenario and the Expansion Scenario. As noted above in response to SIR 4.a.v., the SOAP Model preserves the minimum flows in the rivers by drawing on storage in the Waterton Reservoir and the St. Mary Reservoir, which are operated by AGI.

In the St. Mary River, there are negligible differences between the Base case and Expansion Scenarios. As shown in Figure 4.8, the scenario outputs overlay each other exactly, indicating that the Chin Reservoir Expansion Project can be operated without impact to the streamflow in the St. Mary River.

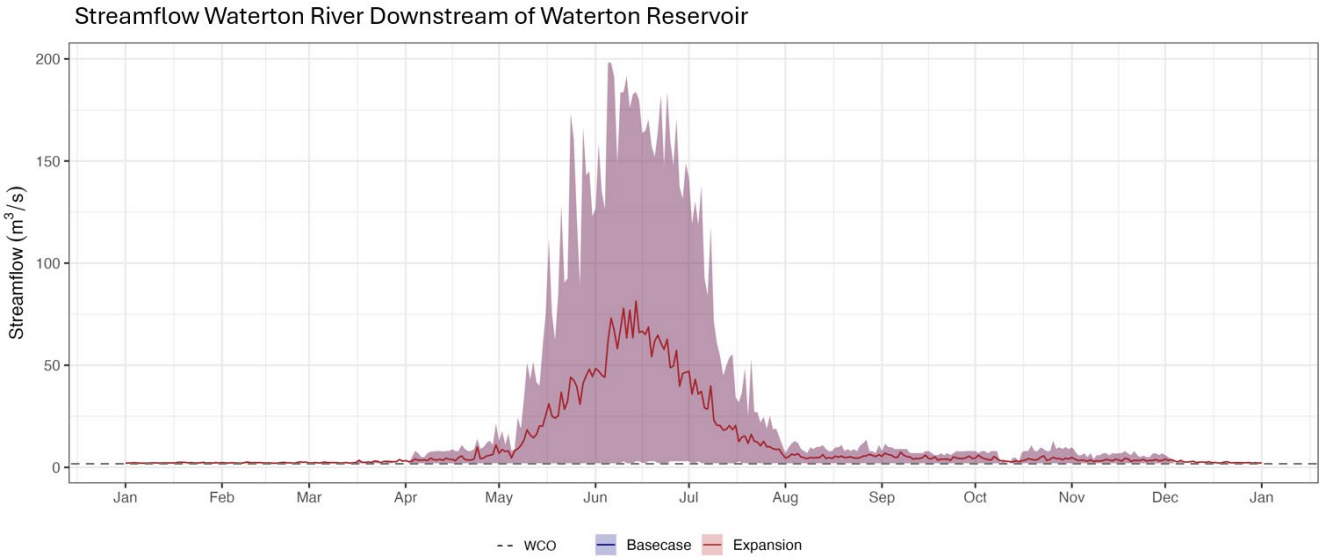
Figure 4.8 Hydrograph comparing annual flows for St. Mary River under the Base case Scenario and the Expansion Scenario



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Note that where no blue is visible, it is because the red is overlaying it.

Figure 4.9 illustrates the SOAP-simulated flow of the Waterton River. The scenario outputs overlay each other exactly, indicating that the Chin Reservoir Expansion Project can be operated without impact to the streamflow in the the Waterton River.

Figure 4.9 Hydrograph comparing annual flows for St. Mary River under the Base case Scenario and the Expansion Scenario



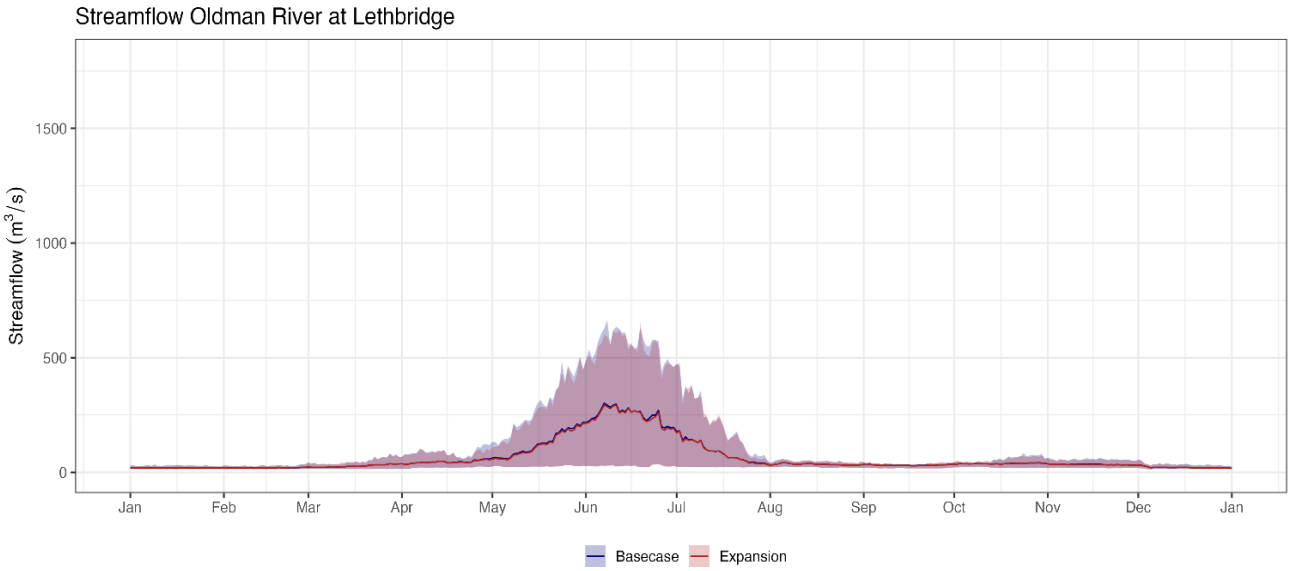
Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Note that where no blue is visible, it is because the red is overlaying it.

Oldman River

Question 4.b. asks about the Oldman and South Saskatchewan Rivers, which are outside the scope of the SOAP Model. As such, these figures are provided from results from a parallel analysis performed in SSROM. SSROM does not model the SMRID system as precisely as SOAP, so these figures should be viewed as representative of the same changes but not identical to SOAP results.

Figure 4.10 illustrates the SSROM simulation of the Oldman River. There are no changes to timing and magnitude shown and therefore there is limited to no impact on the flow in the Oldman River with the Chin Expansion.

Figure 4.10 Hydrograph comparing SSROM-simulated annual flows for the Oldman River under the Base case Scenario and Expansion Scenario

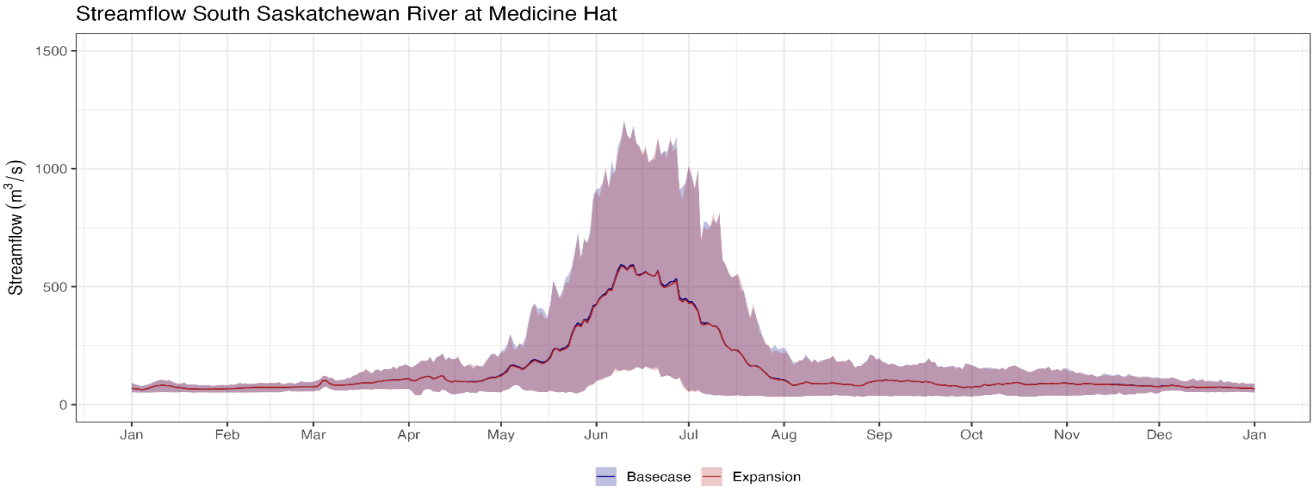


Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Note that where no blue is visible, it is because the red is overlaying it.

South Saskatchewan River

Figure 4.11 illustrates the SSROM simulation results for the South Saskatchewan River. There are no changes to timing and magnitude shown and therefore there is limited to no impact on the flow in the South Saskatchewan River with the Chin Expansion.

Figure 4.11 Hydrograph comparing SSROM-simulated annual flows for the South Saskatchewan River under the Base case Scenario and Expansion Scenario



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Note that where no blue is visible, it is because the red is overlaying it.

Question 5

Reference:

Volume 1, Section 1.10, Page 15;
Volume 3, Section 2.1, Figure 4, Page 26-28;
Volume 3, Section 3.1, Page 34;
Volume 4-5, Section 2.1, Page 2;
Volume 4-6, Section 2.1, Page 2

Rationale/Preamble:

SMRID defines the RSA for the socio-economic assessment to include a conversion of land to irrigated land within the RID and SMRID and identifies four target areas for irrigated agriculture expansion. Volume 4-5 TBR (Soils and Terrain), Section 2.1, broadly includes Chin Coulee and a 100 m buffer as the extent of the LSA and does not describe a RSA. Volume 4-6 TBR (Vegetation and Wetlands), Section 2.1, broadly includes Chin Coulee and a 100 m buffer as the extent of the LSA and does not describe a RSA. SMRID also aligns the Project with components of the South Saskatchewan Regional Plan (SSRP) that refer to water supply, water management, and Alberta's Irrigation Strategy, but does not mention alignment with the conditions placed on converting grasslands to irrigated agriculture.

Information Request:

a. Provide maps of the irrigation expansion areas.
b. Demonstrate that sufficient area is available for irrigation expansion by summarizing land use and land capability in the expansion areas, including:
    i. cumulative areas of dryland agriculture, irrigated agriculture, native grassland, and tame pasture in the expansion areas.
    ii. cumulative areas within each irrigation capability category in the expansion areas.
c. Justify including an assessment of the economic benefits and costs of cropping changes over a regional area without an assessment of soils and vegetation over a regional area.
d. Explain what constraints exist toward irrigation area expansion with respect to irrigation capability and grassland conversions.

Response:

a. The land parcels that are currently irrigated within the SMRID and Raymond Irrigation District (RID) by the existing infrastructure are shown on Figure 5.1.

    The Socio-economic Assessment provided in Volume 3 of the EIA submission identifies four potential areas where dryland producers served by the SMRID and RID could request approval to convert from dryland production to irrigation production. There are no specific parcels identified in these four areas. Some of the potentially converted areas may be within the district

boundaries, adjacent to existing irrigated parcels. Other potential parcels for conversion to irrigation production may be located 1-2 kilometres outside the existing district boundaries.

All producers interested in converting dryland production to irrigation production must have rigorous irrigability land classification analyses completed by accredited professionals to meet strict land and soil suitability requirements for each parcel of land (AAF 2016).

The four areas identified in the Socio-economic Assessment were chosen through discussions with the SMRID and RID, and are based on the following parameters:

- Water supply modelling analyses and results.
- Irrigation districts' understanding and many years of experience related to suitable dryland that could be potentially converted to irrigation in the selected areas.
- Waiting lists of irrigation and dryland producers interested in converting dryland parcels to irrigation.
- Level III irrigability land classification analyses and mapping for these four areas; and
- Capability to provide water from current or future water supply/storage infrastructure.

Based on modelling studies, the 46,500-acre irrigation expansion figure was considered to be a conservative estimate. RID and SMRID want to ensure that water can be supplied to these potential new irrigation acres without negatively impacting existing water users in the districts.

b. Irrigation expansion in the SMRID and RID is structured and constrained within the GoA *Water Act* (R.S.A. 2000, c. W-3) and *Irrigation Districts Act* (R.S.A. 2000, c. I-11). Any irrigation expansion must take place within the existing water license held by each irrigation district (*Water Act*). The SMRID currently has a water license of 880,000 ac-ft, and the RID has a water license of 81,000 ac-ft.

   Since 2000, the SMRID (including the Taber Irrigation District [TID]) has expanded its assessed irrigation acreage by 54,361 acres because of improved efficiencies in water delivery and on-farm water use. The RID expanded its irrigation acreage by about 8,300 acres because of improved efficiencies. The process for these expansions followed rules and regulations in the *Irrigation Districts Act,* which needed to be approved through a plebiscite by the water users in each irrigation district. As discussed in the response to SIR#1 Question 5 (d) below, only lands that have undergone a rigorous land classification assessment can be approved for irrigation development. Specific lands for expansion have not been identified.

   It is anticipated that the proposed 46,500-acre irrigation expansion will only include conversion of existing cultivated dryland parcels to irrigation parcels. This could include cultivated dryland crops, forages, and tame pasture. Conversion of native grassland to irrigation production is not anticipated by the SMRID and RID.

c. SMRID and RID management and staff have many years of experience related to irrigation development, water management, and irrigation expansion issues. This includes:

   - Irrigation land classification requirements.

- Soil capabilities within and adjacent to their respective irrigation districts.
- Water supply capabilities.
- Dryland and irrigation producer interest in irrigation development.

There is usually a waiting list of dryland producers who would like to convert one or more 160-acre parcels to irrigation. In 2023, the SMRID decided to hold a lottery to fairly allocate expansion acres within the district. It is anticipated that the list of dryland producers interested in converting their dryland acres to irrigation will be greater than the available acres for expansion in each of the areas identified in Volume 3.

However, producers realize that conversion of their dryland parcels to irrigation will only be approved if the results of the irrigation land classification are positive.

d. The following describes the process that is required before any new irrigation acres can be added to an irrigation district. This guideline outlines the steps for transferring permanent irrigation acres onto lands that currently do not hold irrigation acres, as per Section 26 of the *Irrigation Districts Act* and the GoA "Procedures Manual for the Classification of Land for Irrigation in Alberta" (AAFRD 2004). These steps must be followed to ensure compliance with legislative requirements and successful integration into the irrigation district.

i. Capacity Assessment

The SMRID and RID must internally confirm their ability to physically service the proposed parcel without negatively impacting existing water users. This ensures the necessary infrastructure and resources are available.

ii. Required Documents

The addition of a new irrigation land parcel requires an application as prescribed by the *Irrigation Districts Act* regulations. A new parcel may necessitate the establishment of either an Irrigable Unit Resolution or a Remote Delivery Agreement, depending on its configuration:

i. Irrigable Unit Resolution

As per Section 23(1) of the *Irrigation District Act*, an Irrigable Unit categorization is required when multiple irrigation parcels share a single water supply delivery point or turnout. After meeting the requirements, the Irrigable Unit Resolution must be filed with the Registrar of Land Titles, which will certify all affected titles with a notice designating the parcels as part of an Irrigable Unit.

ii. Remote Delivery Agreement

As per Section 24 of the *Irrigation Districts Act*, this agreement is required when the district-owned water supply works cannot serve a parcel with irrigation acres. The agreement must be filed with the Registrar of Land Titles, and the parcel will be approved subject to the agreement.

iii. Pipeline Easement

If a Remote Delivery Agreement is needed, the landowner must secure private easements with any intervening parcels. These easements should also be registered with the Registrar of Land Titles.

iv. Irrigation Land Classification

Section 94 of the *Irrigation Districts Act* requires that a site-specific land classification assessment and report be carried out by an accredited registered agrologist to confirm the land is suitable for irrigation. The land classification is based upon existing and predictable limiting characteristics of soil, drainage, and topography for a parcel of land under irrigation (AAFRD 2004).

This land classification process includes drilling test holes, retrieval and laboratory analysis of soil samples, and review of factors such as soil and bedrock characteristics to ensure that future irrigation development is sustainable.

More information is available in the AgriFacts: Land Classification for Irrigation document located here: https://open.alberta.ca/dataset/cff31d54-1cbd-40c2-8536-6ae0e16e54a7/resource/93f06360-6129-4e9a-8d58-b29608f45444/download/agi-agrifacts-agdex-560-3-land-classification-for-irrigation-2022-11.pdf

v. Change of District Area

As per Sections 85 through 89 of the *Irrigation Districts Act,* a parcel of land that contains permanent irrigation acres must hold a notation on the parcel specific Land Title. This notation is completed via the Registrar of Land Titles by registration under Section 22 of the *Land Titles Act* (R.S.A. 2000, c. L-4).

vi. Advertising the Parcel

The parcel must be advertised on the SMRID website for a minimum of 30 days to allow for public feedback. Notices are published here: https://smrid.com/publication-of-notices/

i. Irrigation District Board Approval

If no concerns are received during the 30-day advertising period, the irrigation district Board of Directors reviews the application. Upon approval, a series of documents must be signed by the SMRID General Manager, SMRID Chairman, and the landowner.

ii. Irrigation Council Approval

The Irrigation Council, which is appointed by the Minister of Agriculture and Irrigation, was established by the *Irrigation Districts Act* to advise, monitor and regulate the boards of the irrigation districts.

All completed documents are submitted to the administrative arm (Irrigation Secretariat) of Irrigation Council for final approval. The completed documents must meet the requirements of Section 88 of the regulations.

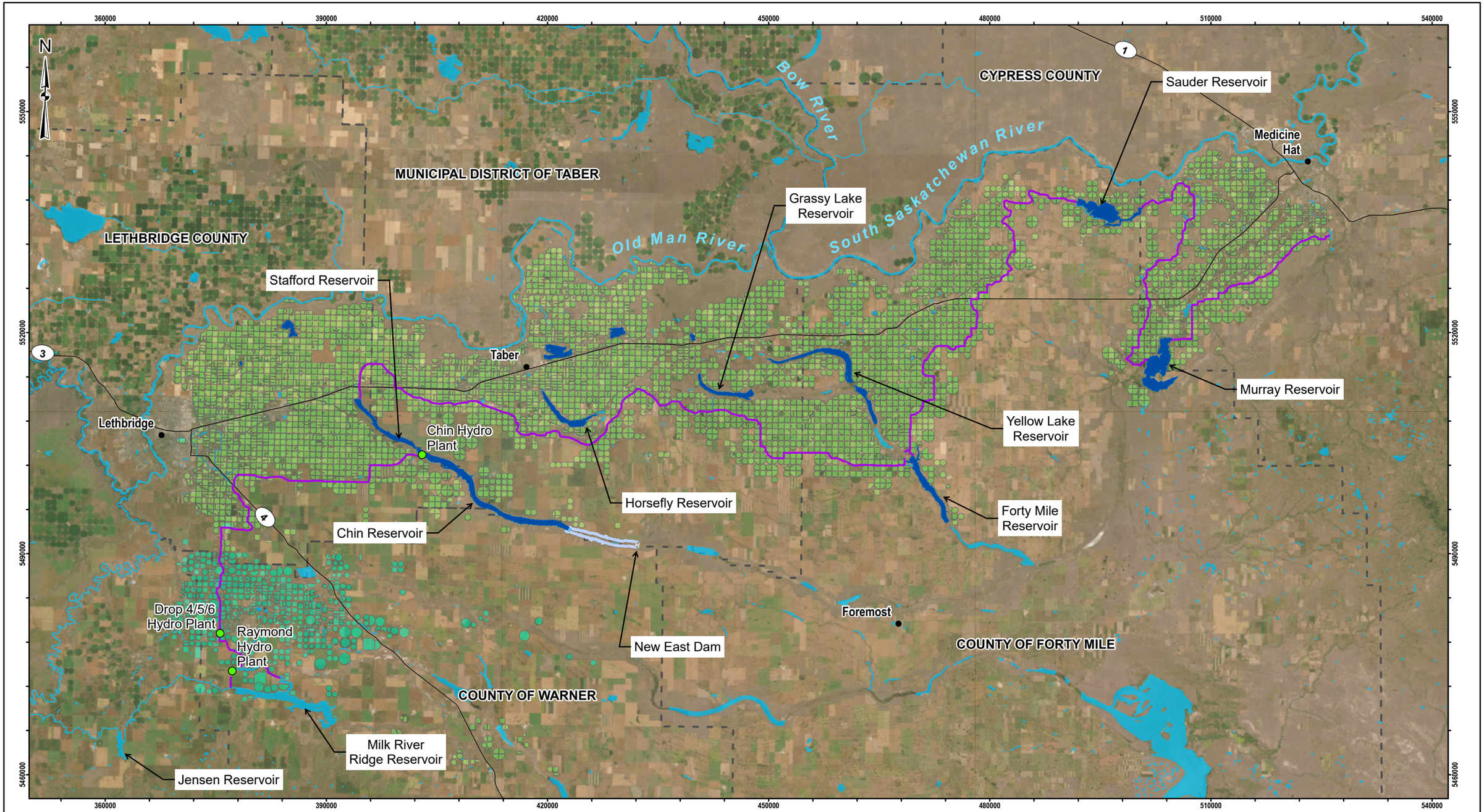
If compliant with legislative requirements, the Irrigation Secretariat submits Form 15 to the Registrar of Land Titles, officially adding the parcel to the irrigation district.

Once all steps are complete, the parcel becomes eligible to hold permanent irrigation acres.

It is anticipated that the proposed 46,500-acre irrigation expansion will only include conversion of existing cultivated dryland parcels to irrigation parcels. This could include cultivated dryland crops, forages, and tame pasture. Conversion of native grassland to irrigation production is not anticipated by the SMRID and RID.

FIGURE

Figure 5.1 SMRID Irrigation Parcels



Legend

- Place Names
- Hydro Plant
- Proposed Dam Location
- Main Canal
- Highway
- SMRID Irrigation Parcel
- RID Irrigation Parcel
- SMRID Infrastructure
- Water Feature
- Chin Reservoir Expansion Area
- Rural Municipality Boundary

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: FORTY MILE COUNTY NO.8, TOWN OF PINCHER CREEK, EARTHSTAR GEOGRAPHICS
4. SMRID = SAINT MARY RIVER IRRIGATION DISTRICT
5. RID = RAYMOND IRRIGATION DISTRICT

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: SMRID AND RID IRRIGATION PARCELS

SCALE	PROJECT No.	FIG No.
1:500,000	A03701E05	5.1

File: Z:\AC\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\ChinReservoir_TBRFigures_220802\ChinReservoir_TBRFigures_221114.aprx Creator: : HMarandyan

Question 6

Reference:

Volume 1, Section 2, Page 27-42;
Volume 2, Section 4.2, 4.3, Page 159-170;
Volume 5, Section 2, 2.6

Rationale/Preamble:

SMRID reports much, but not all, of the information required in final Terms of Reference Section 2.6 and Section 2.3 of the *Information required for Environmental Impact Assessment of the 2018 Alberta Dam and Canal Safety Directive*. Instead of specifics, SMRID refers several supplementary technical reports that are not publicly accessible.

Information Request:

a. Complete and provide final Terms of Reference Section 2.6 and Section 2.3 of the Alberta Dam and Canal Safety Directive.

b. Provide the following reports:

   i. Klohn Crippen Berger Ltd. (KCB). 2023. Chin Reservoir Expansion - New East Dam Preliminary Design Report. Prepare for MPE Engineering Ltd. and St. Mary River Irrigation District. December 2023.

   ii. Matrix Solutions Inc. (Matrix). 2019. 2018 Chin Reservoir Dam Safety Review – Chin 1 Dam (West) and Chin 2 Dam (East). Prepared for the St. Mary Irrigation District by Matrix Solutions Inc. with Tetra Tech Inc, Calgary, Alberta.

   iii. MPE. 2022. Chin Reservoir Expansion, Chin Outlet – Conceptual Design Options. Report for: St. Mary River Irrigation District.

   iv. MPE Engineering Ltd. (MPE). 2020. Chin Reservoir Expansion Conceptual Design Report. September 2020. Final Report for: St. Mary River Irrigation District.

   v. WaterSMART 2023. Hydrological Modelling to Evaluate Changes in Streamflow Availability in the St. Mary River Watershed. Prepared by WaterSMART Water Management Solutions for St. Mary River Irrigation District. Lethbridge, Alberta.

Response:

a. Please refer to the updated concordance table available in Appendix 6.1.

   The final Terms of Reference (fToR) Section 2.6 relates to how the Project will adhere to the Alberta Dam and Canal Safety Directive. The New East Dam PDR prepared by KCB (2023) addresses this term and the requirements of the Directive directly, and the report is appended to this SIR#1 Response Document in Appendix 1.1.

The fToR Section 2.3 relates to Regional and Cooperative Efforts. Please refer to the *Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum* prepared by SMRID and provided in Appendix 2.1 of this SIR#1 Response Document. This technical memorandum provides information pertaining to the region's water management infrastructure and the cooperative operational activities of the various water management operators across the region. Refer to the response to SIR#1 Question 20 for a discussion on the alignment of the Project with the South Saskatchewan Regional Plan (SSRP).

Opportunities for sharing infrastructure with other stakeholders are discussed in the responses to SIR#1 Questions 9, 10, 24, and 69. A summary of the consultation efforts with local municipalities, utility owners, landowners, and other stakeholders is discussed in the responses to SIR#1 Questions 9, 11, 20, 22, and 44.

b. The following reports have been appended to this SIR#1 Response Document.

   i. Appendix 1.1 - Klohn Crippen Berger Ltd. (KCB). 2023. Chin Reservoir Expansion - New East Dam Preliminary Design Report. Prepare for MPE Engineering Ltd. and St. Mary River Irrigation District. December 2023.

   ii. Appendix 6.2 - Matrix Solutions Inc. (Matrix). 2019. 2018 Chin Reservoir Dam Safety Review – Chin 1 Dam (West) and Chin 2 Dam (East). Prepared for the St. Mary River Irrigation District by Matrix Solutions Inc. with Tetra Tech Inc, Calgary, Alberta.

   iii. The MPE Engineering Ltd. (MPE) Chin Reservoir Expansion, Chin Outlet – Conceptual Design Options Report (MPE 2022) relates to the Chin West Dam and is outside of the scope of work for the New East Dam construction and Expanded Chin Reservoir operation. This report has not been provided.

   iv. The MPE Chin Reservoir Expansion Conceptual Design Report (MPE 2020) is superseded by the KCB New East Dam PDR (2023) and has not been provided. Refer to Appendix 1.1 of this SIR#1 Response Document for the KCB 2023 New East Dam PDR.

   v. Appendix 1.2 - WaterSMART 2023. Hydrological Modelling to Evaluate Changes in Streamflow Availability in the St. Mary River Watershed. Prepared by WaterSMART Water Management Solutions for St. Mary River Irrigation District. Lethbridge, Alberta.

Question 7

Reference:

Volume 1, Section 2.1, Page 27;
Volume 1, Section 2.4, Page 31-33;
Volume 1, Section 2.5, Page 34-38;
Volume 1, Section 2.6.1, Page 38 and 39;
Volume 2, Section 2.2.2, Page 25

Rationale/Preamble:

SMRID describes elevations of the pre- and post-construction elements of the Chin Reservoir, but it is difficult to interpret in text format, and states that *the estimated storage volume in the Reservoir Expansion Area (i.e., between the Existing East Dam and the New East Dam) at El. 864 m is approximately 76,400 dam^3.* However, based on the elevations described, the new reservoir appears to hold a significant volume of water that would be rendered inaccessible when the water level goes below the elevation of the decommissioned old East Dam. The volumes of water that would be accessible to the SMRID as live storage versus inaccessible as dead storage with a drop in water level is not clearly defined. Further, there is no clear summary of the water balance for the existing and Expanded Chin Reservoirs presented.

Information Request:

a. Provide cross-sectional figure(s) that clearly represent the design elements of the inlet structure, current east dam, decommissioned old East Dam, New East Dam, and existing and refurbished west dam, including:
    i. base elevations;
    ii. crest elevations;
    iii. full supply level (FSL) elevation;
    iv. spillway elevations;
    v. inlet elevations from Chin chute and the hydropower facility;
    vi. target maintained FSL of Stafford Reservoir;
    vii. elevations of base and crest of the west dam of Stafford Reservoir.
b. Provide expected annual volumes of water that are held as:
    i. live storage volumes in the expanded Chin Reservoir comparing FSL to the mean and minimum drawdown levels;
    ii. dead storage volumes in the expanded Chin Reservoir as the volume that would be rendered inaccessible during low-flow periods.
c. Provide average water balances, in terms of annual cumulative volumes, for the existing and expanded Chin Reservoir, estimating:

i. inputs from the main canal, precipitation, surface runoff, and groundwater discharge.

ii. outflows to Stafford Reservoir, evapotranspiration, and seepage or recharge.

Response:

a. Figure 7.1 presents a plan view of the proposed Chin Reservoir Expansion Project with pertinent elevations of the structure components. Specifically, Figure 7.1 presents: the top of dam elevations for the West Dam and New East Dam; Chin Reservoir full supply level (FSL); New Auxiliary Spillway crest elevation; inlet elevations for Chin Chute and the Chin Hydropower Plant; Stafford Reservoir FSL; minimum elevation of the decommissioned Existing East Dam; and the topographic divide elevation within Chin Reservoir.

   Figure 7.2 presents the Chin Reservoir level versus storage volume complete with pertinent elevations.

b. Figure 2.2 in Volume 1, Section 2.6.1, Page 39 presented the simulated mean and range of reservoir levels for the Expanded Chin Reservoir. The period of record used to generate this figure was 1994 to 2009, which was truncated to allow for a consistent date range to be used for comparison to the baseline condition of the Existing Chin Reservoir, based on the range of historical water level data available. However, we acknowledge that the historical operating conditions cannot be directly compared to the simulated conditions. The SOAP model uses historical naturalized inflow data to simulate operating scenarios for a range of dates extending from 1928 to 2009. Updated figures are presented for both the simulated Base Case (Figure 7.3) and the Project Case (Figure 7.4), for the entire simulation period from 1928 to 2009. These figures present the range of simulated operating conditions, based on the operating rule curves defined for the SOAP model, as discussed further in the response to SIR#1 Question 4 and Appendix 4.1.

   As shown on Figure 7.4 for the simulated Expanded Chin Reservoir, the mean reservoir level varies from 857 m to around 860.5 m. As shown on Figure 7.2, the live storage volume between FSL (864 m) and 857 m is approximately 155,115 dam^3 (125,754 ac-ft). The live storage volume between FSL and 860.5 m is approximately 79,757 dam^3 (64,660 ac-ft).

   As shown on Figure 7.4, the simulated minimum reservoir level is 845.22 m. However, as shown on Figure 7.2, the minimum reservoir level in the Expanded Chin Reservoir at which water is rendered inaccessible via releasing through the new West Dam outlet structure is El. 846 m, suggesting that simulated minimum reservoir levels are lower than the outlet elevation due to evaporative losses in this simulated condition. Figure 7.2 also notes that there is a topographic divide within Chin Reservoir at El. 850 m, and that the Existing East Dam will be decommissioned to an elevation of El. 850 m. The live storage below FSL, accounting for these controlling elevations, is approximately 320,222.8 dam^3 (259,609 ac-ft). The dead storage volume is approximately 70,348 dam^3 (57,032 ac-ft).

Figure 7.3 SOAP Model Simulated Mean and Range of Reservoir Levels for the Existing Chin Reservoir – Base case (1928–2009)

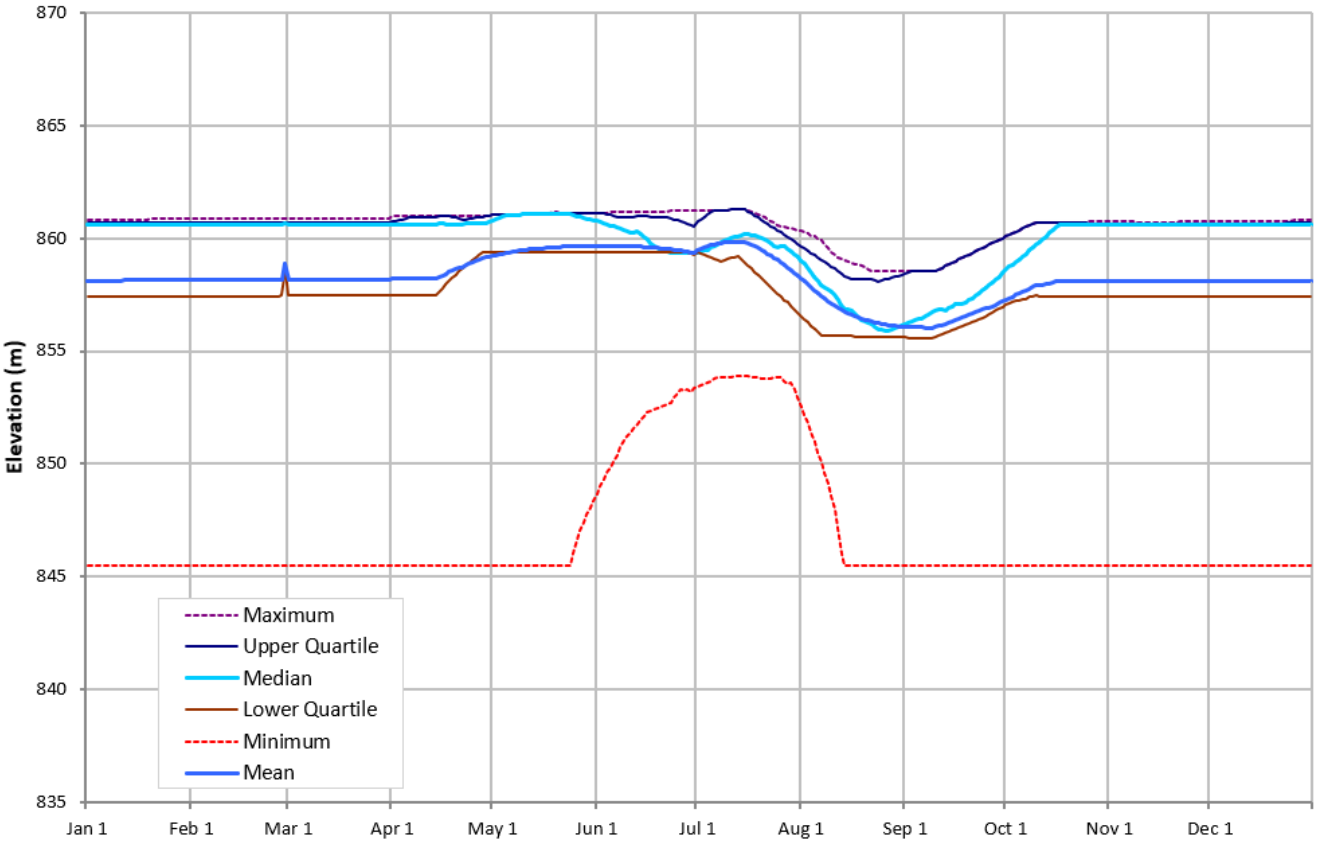
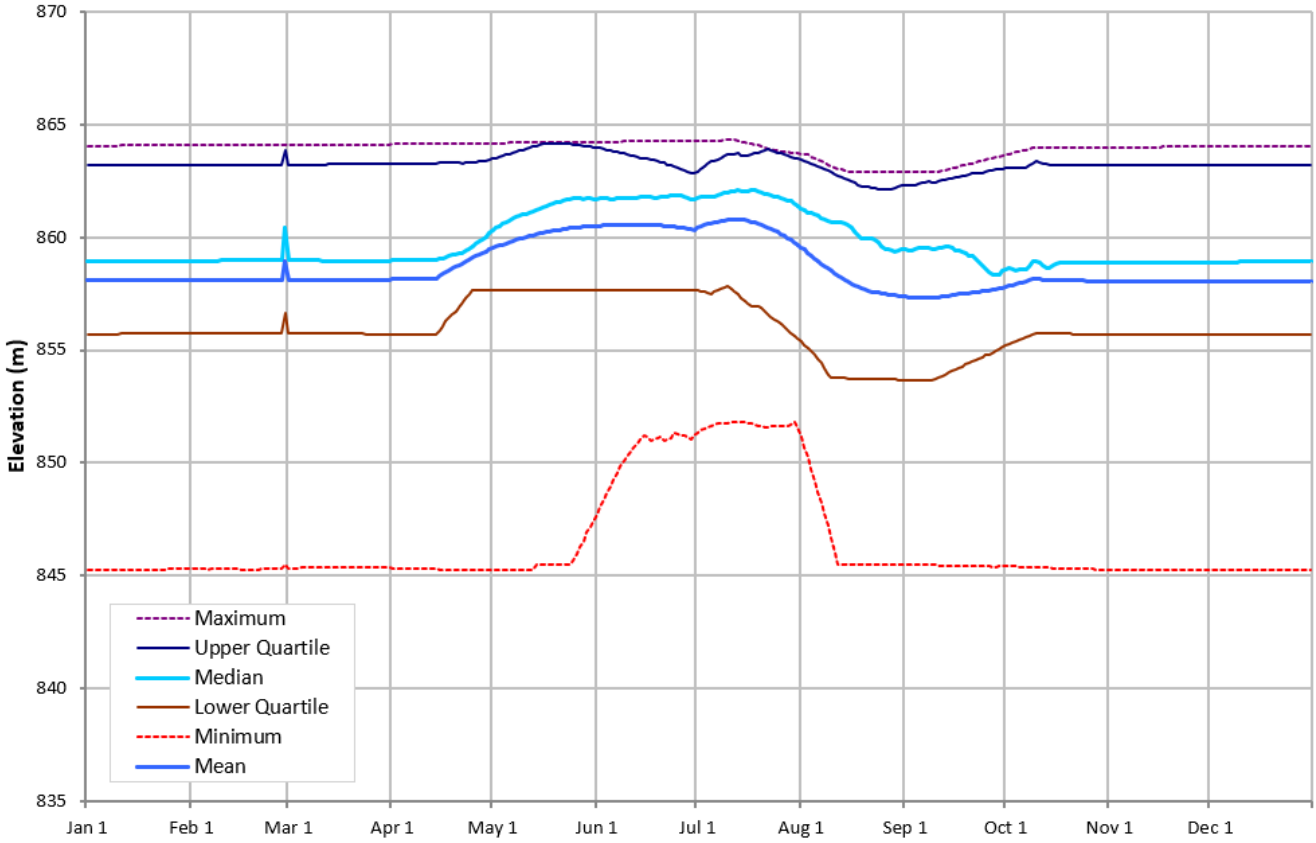


Figure 7.4 SOAP Model Simulated Mean and Range of Reservoir Levels for the Expanded Chin Reservoir - Project Case (1928–2009)



c. A comparison of average annual cumulative inflows and outflows under Existing and Expanded Chin Reservoir conditions provides the basis for estimating the reservoir's water balance. These estimates are derived from model simulations using the SOAP Model.

The SOAP Model represents the operations of the AGI reservoirs, conveyance canal network, SMRID irrigation network, and SMRID-owned and operated reservoirs. It incorporates current operating rules, instream objectives, and infrastructure design. While the model uses historical inflow data from 1928 to 2009, it applies present-day operational conditions. As a result, the modelled outputs do not match historical observations; instead, they reflect how the current system would have performed under past hydrologic inflow conditions. Further details on the model and its assumptions are provided in Appendix 4.1.

Potential changes from the Chin Reservoir Expansion Project were assessed by comparing two scenarios: the Base case Scenario, representing the current system, and the Expansion Scenario, which includes 127,650 dam^3 (103,500 ac-ft) of additional storage in the Chin Reservoir and 46,500 additional irrigated acres. This comparison illustrates how the water balance of the Chin Reservoir may change with the Chin Reservoir Expansion Project.

Runoff is captured broadly within the SOAP model for the catchment area of the conveyance system and is not quantified as a separate input term. Analysis of the Chin Reservoir catchment

has identified that depressional storage limits the quantity of stormwater runoff that reports to Chin Reservoir for events lower than the 1:10-year return period.

Groundwater inflow has not been quantified, but it is expected that there would typically be a small net gain in flux of groundwater, based on groundwater gradients flowing towards the low-lying coulee and proposed application of seepage mitigation at the New East Dam.

i. The average annual volume of water entering the Chin Reservoir through the main canal and direct precipitation were determined through SOAP Model simulations. The results shown in Table 7.1 compare the Base case and Expansion Scenarios, based on 82 years of modelled data using historical inflows (1928–2009).

Table 7.1 Average annual modelled inflows to the Chin Reservoir under the Base case and Project Case, based on simulated historical inflows (1928–2009)

Base case: Existing Chin Reservoir		Project Case: Expanded Chin Reservoir	
Main Canal Inflow (dam^3/year)	523,720	**Main Canal Inflow (dam^3/year)**	553,596
Precipitation (dam^3/year)	3,059	**Precipitation (dam^3/year)**	3,192

ii. The values in Table 7.2 represent the SOAP-simulated average annual volumes of water released from the Chin Reservoir – through outflow to Stafford Reservoir and evaporation – under the Base case and Expansion Scenarios, based on 82 years of modelled data using historical inflows (1928-2009).

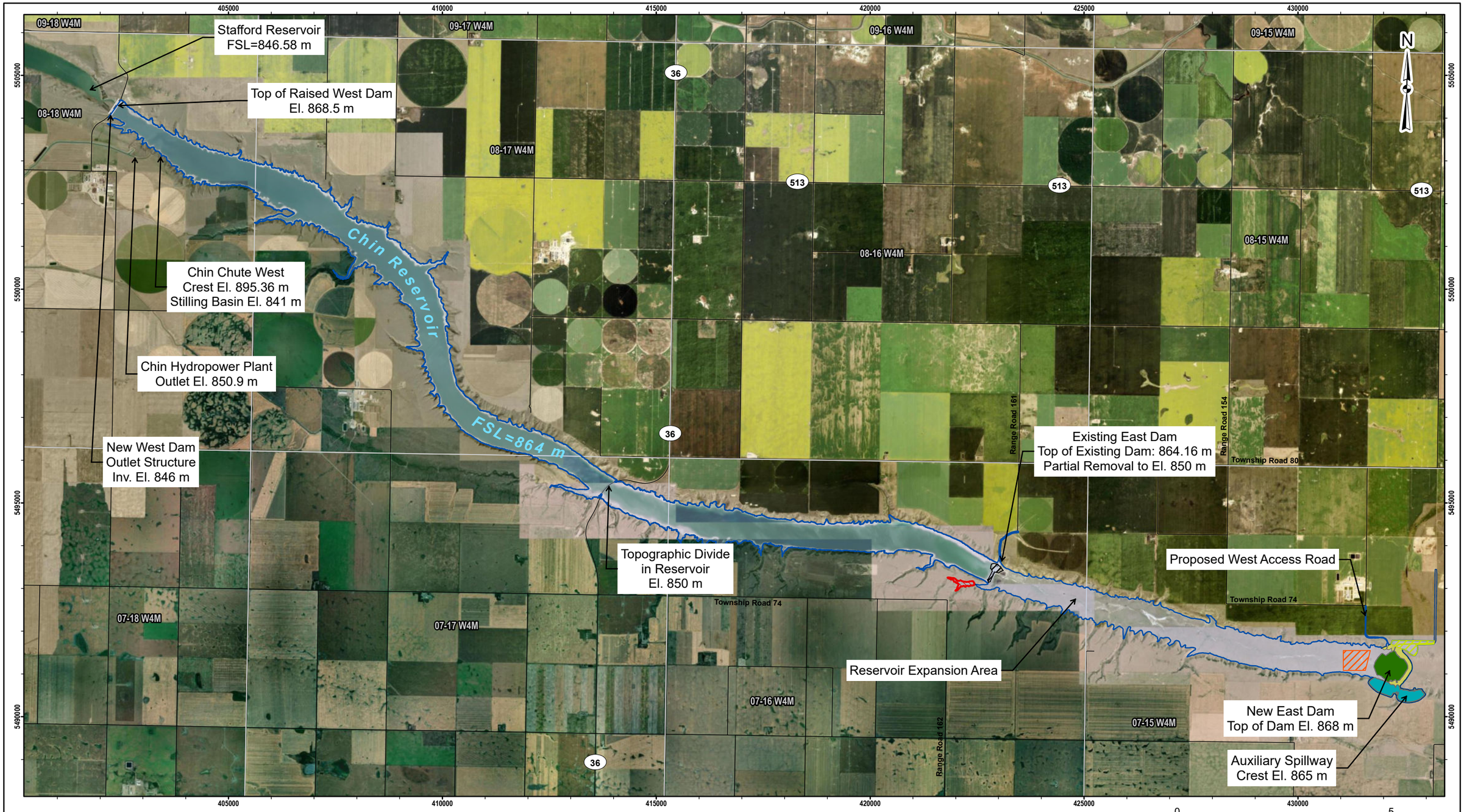
Table 7.2 Average annual modelled releases from the Chin Reservoir under the Base case and Project Case, based on simulated historical inflows (1928–2009)

Base case: Existing Chin Reservoir		Project Case: Expanded Chin Reservoir	
Outflow to Stafford Reservoir (dam^3/year)	537,801	**Outflow to Stafford Reservoir (dam^3/year)**	537,801
Evaporation (dam^3/year)	8,243	**Evaporation (dam^3/year)**	8,788

FIGURES

Figure 7.1 Plan View of Project Components of the Project Area

Figure 7.2 Storage Curve and Pertinent Elevations



Legend

- All Weather Road
- Existing Dam Decommissioning Extent
- New East Dam Footprint
- New East Dam Auxiliary Spillway
- Dam Fill Waste Area
- Project Area (PA)
- Township Boundary (ATS)
- Temporary Work Areas
- Proposed Project Laydown Area
- Temporary Stockpile/Borrow Area

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, MAXAR

CLIENT: SMRID

Klohn Crippen Berger

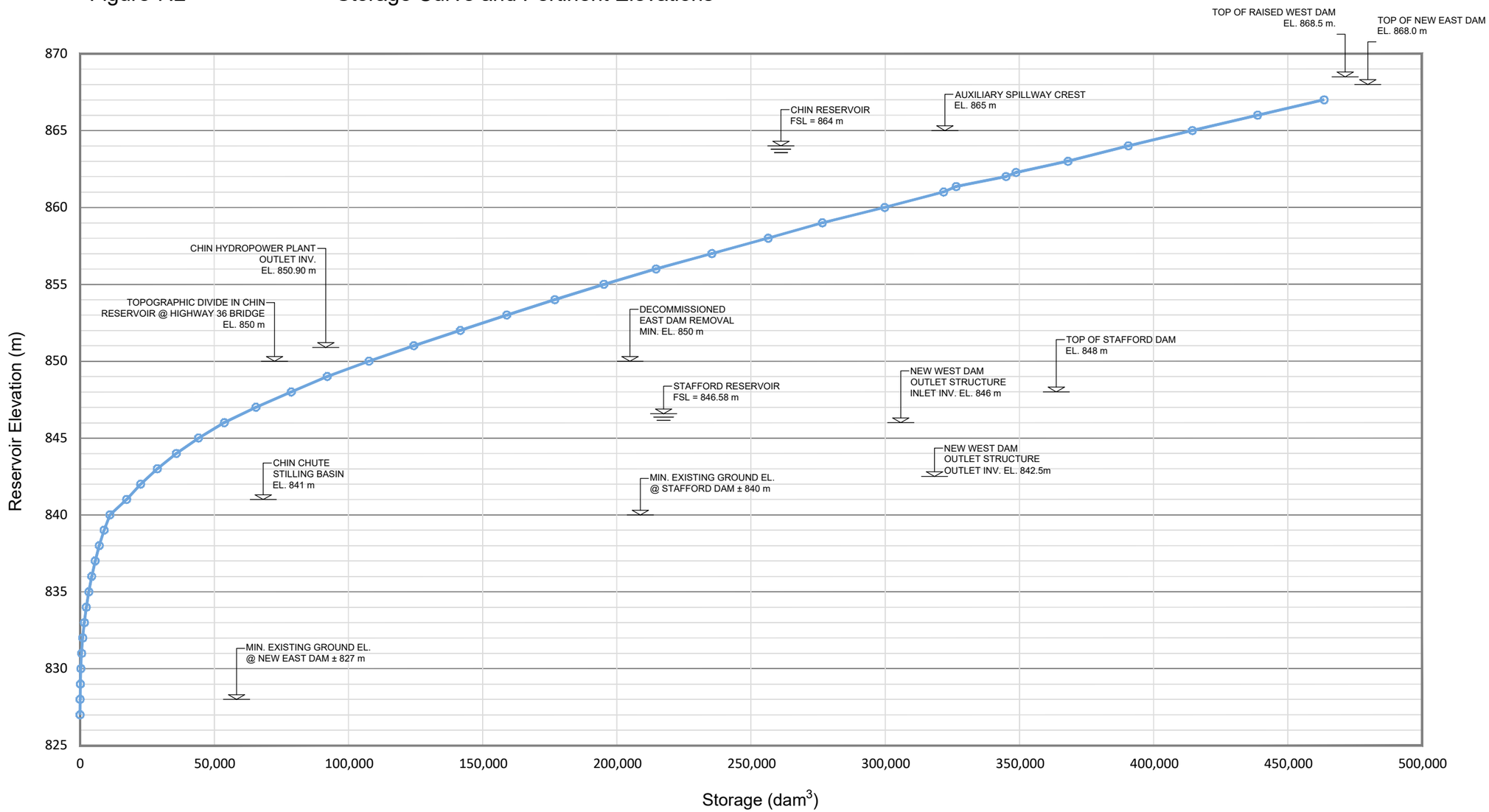
PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: PROJECT COMPONENTS OF THE PROJECT AREA

SCALE	PROJECT No.	FIG No.
1:85,000	A03701E05	7.1

File: \\int.klohn.com\Proj\Data\ACGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_240517.aprx Creator: : HMarandyan

Figure 7.2 Storage Curve and Pertinent Elevations



Z:\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\700 Deliverables\720 Working\Enviro and Regulatory\SIR#1 Response\SIR#1 Figures\SS\

Question 8

Reference:

Volume 1, Section 2.5, Page 34-38;
Volume 1, Section 2.7, Page 40-42;
Volume 2, Section 2.7.4, Page 111-119;
Volume 2, Section 2.8, Page 125-143

Rationale/Preamble:

SMRID estimates that the construction process is expected to occur over four years and proposes an incremental filling schedule to occur over three years. SMRID describes land acquisition and infrastructure relocation requirements to mitigate impacts to existing infrastructure but does not provide details on potential impacts to project scheduling. The filling schedule is prescribed to occur over three years to optimize flow rates into the reservoir with consideration of water supply and restricts reservoir filling between April 1 and August 31 to mitigate potential impacts of filling on migratory birds. SMRID further describes a variety of monitoring and mitigation options to minimize and assess the impacts of construction on ecosystem components. However, the aggregate monitoring actions described in the EIA and the scheduling of the Project phases relative to the monitoring and mitigation actions is difficult to follow.

Information Request:

a. Provide a detailed, consolidated schedule that shows the phasing, overlapping, and dependencies of the Project construction, including:
    i. land clearing;
    ii. access road construction;
    iii. rerouting of transmission lines;
    iv. rerouting of oil and gas pipelines;
    v. replacement of pumphouses and private water intakes;
    vi. decommissioning of water wells;
    vii. abandonment and potential remediation of oil and gas wells;
    viii. refurbishment of the Chin Chute and West Dam of Chin Reservoir;
    ix. construction of temporary works, such as laydown, borrow, stockpile and waste areas;
    x. construction of the New East Dam and Auxiliary Spillway; and,
    xi. old East Dam decommissioning.
b. Provide a detailed, consolidated summary and schedule of monitoring and mitigation activities that corresponds with the construction and operation schedule, including:
    i. scheduling of reservoir filling and monitoring actions for wildlife impact mitigation;

ii. monitoring for aquatic ecosystem impacts and fish mercury content;

iii. monitoring for impacts to groundwater and surface water quality; and,

iv. monitoring for soil erosion, weed control, and revegetation efficacy.

c. Describe how and the frequency with which the results of the monitoring actions will be communicated to affected stakeholders and be used to inform adaptive management practices for the project.

Response:

a. A preliminary Project schedule for the construction of the New East Dam was provided in the New East Dam PDR, Appendix XVII Project Schedule. An updated Project schedule has been provided in response to this question as Figure 8.1 that includes the points requested. The updated Project schedule in Figure 8.1 is based on a construction start date of July 2026 which reflects the timeline for the estimated regulatory approval schedule for EIA review, the Natural Resources Conservation Board (NRCB) public interest hearing, and additional provincial and federal permitting requirements. The updated project schedule estimates that Project approvals will be in place by the end of June 2026.

   Land clearing, access road construction, and construction of temporary work areas will occur during Phase 1 of the New East Dam construction, beginning in July 2026. The rerouting of transmission lines, rerouting of oil and gas pipelines, replacement of pumphouses and private water intakes, decommissioning of water wells, and abandonment and potential remediation of oil and gas wells will commence following land purchase and have the duration of the construction of the New East Dam and its associated Auxiliary Spillway to be completed. These tasks must be completed prior to filling of the expansion footprint of the Expanded Chin Reservoir which is scheduled to commence January 2030.

   The proposed filling of the expansion footprint is speculative as it is based on variations in water availability, reservoir levels, drought conditions, etc. The objective is to fill the expansion footprint to approximately El. 855 m prior to decommissioning the Existing East Dam to reduce the differential head across the Existing East Dam. Reservoir levels within the Existing Reservoir typically drop to around El. 855 m in August. Therefore, the updated schedule proposes that decommissioning of the Existing East Dam will commence in August 2032, allowing for a three-year filling period. In-reservoir construction activities, such as cofferdam construction and East Dam Decommissioning will occur in the fall when reservoir levels are at the lowest and the water level in the expansion footprint is equal. For more information related to the filling of the expansion footprint and the decommissioning of the Existing East Dam, refer to the New East Dam PDR provided in Appendix 1.1 of this SIR#1 Response Document. Appendix II of the New East Dam PDR provides the Reservoir Filling and East Dam Decommissioning Report which documents an assessment of options for filling the expansion footprint, an approximate filling schedule, and the proposed concepts to decommission the Existing East Dam.

The timeline for the refurbishment of Chin Chute and the West Dam is not dependent on the schedule for the construction of the New East Dam. The refurbishment will commence in the spring of 2025 and will be completed in 2028.

b. The proposed monitoring activities through the construction, filling, and initial reservoir operation phases of the Project are described below in a consolidated summary. The schedule for implementing monitoring activities relates to the sequencing of construction activities described in the response to part (a), as well as the application of associated mitigation measures. A schedule of monitoring activities is provided in Figure 8.2.

Construction Phase

Monitoring during the construction phase will be conducted based on the standard practices for construction projects described in Appendices 2-6 of the EIA. These practices will be outlined in contract document specifications and referenced guideline documents, and will form the basis for Contractor, Consultant, and SMRID responsibilities.

Contractor

The Contractor for the Project will be responsible for preparing an Environmental Construction Operation (ECO) Plan describing the proposed environmental management and protection measures, incorporating the recommendations of the EIA and SIR Response documents, and the requirements of the contract and Environmental Protection Plan (EPP), in addition to any site-specific measures deemed necessary. The ECO Plan will include an Erosion and Sediment Control (ESC) Plan designed to control drainage and prevent erosion and transport of sediment throughout all phases of construction, including a detailed description of control structures to be used. The ECO Plan will also provide a means for monitoring of equipment and vehicles to prevent leaks and avoid release of deleterious substances.

The Contractor will be responsible for ensuring that any work within the wetted perimeter of the reservoir is isolated using a turbidity barrier, or other means as appropriate. They will also be responsible for ensuring that turbidity monitoring is conducted during any work within the wetted perimeter of the reservoir in accordance with the measures outlined in the GoA guideline *Turbidity Monitoring for In-stream Construction Activities*, including sampling methodology, location, frequency, and criteria for evaluating compliance (GoA 2022).

The Contractor will also be responsible for ensuring that fish rescue operations are conducted as required when isolation measures are installed. The rescue activities will be managed by an experienced biologist to minimize mortality during handling and transport.

Consultant

The Consultant will act as SMRID's representative on site, managing construction activities and overseeing the implementation of the ECO Plan and environmental management measures.

During construction, the Consultant will be responsible for:

- providing direction on environmental protection measures;
- supervising implementation of mitigation measures and the ESC Plan;

- liaising with the Contractor regarding potential concerns and required environmental protection measure modifications; and,
- preparing monitoring reports to keep SMRID apprised of general construction progress and environmental management activities.

The Consultant will also be responsible for confirming that the conditions of all regulatory approvals are complied with during the construction phase.

SMRID

SMRID will ultimately be responsible for environmental monitoring during the construction phase by ensuring that the delegated monitoring tasks described above are completed. SMRID will define the contract requirements that specify the responsibilities of the Contractor and will provide feedback through the Consultant on any environmental management issues raised.

Construction monitoring requirements are expected to include:

- The Contractor will be required to work under an ECO Plan guided by the direction of the Alberta Transportation's *ECO Plan Framework* (TEC 2020) which would include an ESC Plan to be implemented and monitored by the Contractor.
- Soil handling measures will be required to conserve soil for reuse, including stripping and stockpiling topsoil and subsoil from areas of disturbance.
- Work within the wetted perimeter of the Existing Chin Reservoir must avoid release of sediment to the aquatic environment. Isolation measures will be installed to contain mobilized sediment.
- Water quality monitoring will be implemented to confirm that construction-related introduction of sediment is mitigated, alongside a strategy focused on sediment management. Turbidity monitoring will be conducted to document compliance with water quality guidelines.
- Fish and herptile salvage will occur in isolated in-water work areas, prior to commencing work, to capture and relocate stranded organisms from within the isolation.
- Dust and air quality mitigations have been specified to control the potential for effects. Complaint-based response will be implemented to adaptively address concerns, if noted, during the construction process.
- An additional year of amphibian surveys will be conducted the spring prior to the start of construction to identify locations of suitable breeding sites occupied by Plains Spadefoots.
- Exclusion fencing for herptiles will be installed around the perimeter of suitable habitat within Construction Site Limit with pitfall traps installed on both the inside and outside of the fencing.
- Fencing will be installed at temporary work sites to prevent snakes from encroaching on workers, machinery, and any excavations/holes. Fabric silt fencing is suitable as exclusion fencing. Wire fencing should be avoided.

- A worksite monitor will be designated to survey the worksite for snake presence. Inspection of exclusion fencing should be done daily to ensure effective isolation and function.
- Fencing erected to exclude humans and cattle from construction sites or historical resources sites will limit the use of barbed wire if possible, to avoid effects on pronghorn.
- Pre-disturbance wildlife sweeps will be conducted prior to mobilizing to the construction site, clearing of vegetation, or ground disturbance. Research permits and collection licences are required prior to conducting pre-disturbance wildlife sweeps and wildlife translocations.
- During construction activities, monitoring will include the assessment of the effectiveness of mitigation measures to wildlife and wildlife habitat and identify the need for implementation of additional controls.
- As the bedrock is potentially quite fossiliferous, any construction that impacts bedrock will be monitored during construction, according to the requirements of an *Historical Resources Act* approval.
- Protocols will be established for reporting fires or smoke to the designated safety officer or a Fire Watch Monitor; and
- A Fire Watch Monitor will be designated to patrol the Project during hot work activities, observing high-risk areas during critical construction activities, especially during hot and dry weather conditions.

Reservoir Expansion Area Filling Phase

Filling of the Reservoir Expansion Area will occur in isolation from the Existing Chin Reservoir over multiple years. This is a key mitigation strategy for reducing the potential for effects during the period of active filling while there is increased potential for erosion and leaching from inundated soils. An Adaptive Management Plan (Appendix 164.1) will be implemented which will include monitoring during filling to document the evolution of water quality conditions within the isolated filling area. Any identified concerns will be addressed through the adaptive management measures identified. Monitoring will confirm that the concerns have been addressed before decommissioning of the Existing East Dam and commissioning of the Expanded Chin Reservoir.

Mitigation and monitoring requirements for the filling phase include:

- Phased filling will be conducted to avoid effects on fish and wildlife during sensitive reproductive periods. The proposed filling schedule for the Reservoir Expansion Area is:
  - September 1 to October 31: no limit on release discharge or reservoir drawdown.
  - November 1 to March 31: limit release from the reservoir such that Chin Reservoir drawdown is less than 1 m.
  - April 1 to August 31: no releases.

- The restriction of water releases during April 1 to August 31 is specific to reduce the impact of reservoir filling on flooding migratory bird nests during the breeding season, as well as the spring spawning period for fish present in the Existing Chin Reservoir.
- Limiting drawdown to less than 1 m from November 1 to March 31 is intended to avoid dewatering of the incubating eggs of fall spawning fish, deposited in the Existing Chin Reservoir.
- An additional amphibian salvage will be conducted within the Reservoir Expansion Area in the spring/summer before the first period of filling. The objective would be to translocate as many Plains Spadefoots as possible from within the Reservoir Expansion Area to more suitable habitat.
- Additional monitoring will be conducted each fall once filling has commenced to salvage amphibians and reptiles, where safe to do so, within the Reservoir Expansion Area.
- The multi-year filling process is expected to limit the potential for viable weed seed to be available for dispersal within the irrigation system after commissioning of the Expanded Chin Reservoir.
- An annual inspection will be conducted during filling to examine the coulee walls within the Reservoir Expansion Area to detect exposure of historic resources as filling of the reservoir progresses.
- Water quality monitoring will be conducted within the Reservoir Expansion Area quarterly throughout the filling process to document the evolution of water chemistry towards a condition comparable to the Existing Chin Reservoir prior to commissioning (Appendix 164.1).

Reservoir Operation Phase

Post-construction and operational monitoring will be conducted to verify the prediction of residual effects and to confirm that mitigation and adaptive management measures have been successfully implemented.

The Consultant will be responsible for ensuring that the requirements of the construction contract have been achieved, according to the standard construction warranty. This will typically require a post-construction inspection one year after substantial completion of the work to ensure that earthworks have been constructed to specification, revegetation efforts have been successful, ESC measures have been effective in maintaining site stability, and that all other measures listed in the contract have been carried out to SMRID's specifications. Any deficiencies noted would be rectified in accordance with the conditions of the warranty.

SMRID will be responsible for ensuring that any monitoring related to the conditions of regulatory approval for operation is carried out. This may include verification that compensation measures have been successfully implemented or validation of the residual effects analysis.

A detailed monitoring plan that addresses monitoring criteria for soil erosion, weed control, and revegetation efficacy will be included as a section in the detailed site-specific Conservation and

Reclamation (C&R) Plan. Monitoring reclamation targets will be tied to final land use objectives and soil, vegetation, and landscape criteria as described in the *2010 Reclamation Criteria for Wellsites and Associated Facilities for Native Grasslands* (GoA 2013a). Mitigations will be implemented if site conditions indicate that remedial measures are required to meet reclamation targets. Please refer to the response to SIR#1 Question 200 for additional details related to the C&R Plan.

An annual post-construction monitoring program will be carried out for the first three years of operation (except where noted) following commissioning of the expanded reservoir to verify the residual effects predictions and confirm that mitigation and adaptive management measures have been effective. The monitoring will include:

- An annual assessment will be conducted in July to confirm that weed control and revegetation of disturbed areas have been implemented effectively, in alignment with the contract requirements and the established C&R Plan.
- If rare plants are transplanted, monitoring of establishment will be conducted annually in July to assess survival.
- An annual assessment will be conducted in July to assess the transition of vegetation communities and establishment of riparian and wetland habitat occurring within the expanded drawdown zone.
- An annual inspection will be conducted to monitor for indirect disturbance of historic resources and loss of in situ context for archaeological and palaeontological materials and features at sites adjacent to the expanded reservoir, which could be caused by erosion, undercutting and slumping of the valley walls.
- Water quality monitoring will be conducted quarterly, following the methods and analytical schedule described in Appendix 164.1. Operational water quality monitoring will be integrated with the adaptive management plan implemented during filling of the Reservoir Expansion Area.
- Sampling of fish, benthic invertebrates, and plankton will be conducted annually in the fall (i.e., September - October) to assess changes relative to the baseline condition. Monitoring will also include assessment of substrates and aquatic vegetation as supporting indicators of change in fish habitat potential.
- An observational monitoring program will be implemented to evaluate changes to groundwater conditions downgradient of the New East Dam following construction (refer to SIR#1 Questions 106 and 115). For new monitoring wells, baseline data will be collected for a full twelve-month period for water levels and at least eight samples for groundwater quality at each location prior to commissioning of the Project. Post-construction monitoring will occur during the first two years of operations at all proposed monitoring locations. Data will be collected continuously (daily) for water levels and bi-annually for groundwater quality.

- SMRID will coordinate with Alberta Environment and Protected Areas (EPA) to request that the Chin Reservoir be included in the EPA fish monitoring program so that the data can be shared with Alberta Health for inclusion in their Alberta Fish Consumption Program.

c. An annual report will be prepared to document the results of monitoring activities conducted. This will include a comparison to baseline conditions, assessment of trends, and identification of any concerns, as pertinent to each monitoring program component. This report will identify how noted concerns will continue to be monitored and any recommended adaptive management measures to be applied or changes to management plans.

   The annual report will be submitted by January 31 to EPA and any other relevant regulatory agencies or directly affected stakeholders to provide an update on the monitoring program and any adaptive management measures in place. Review of the submitted reports is expected to facilitate feedback, where required, on the plan and proposed activities. Additional communication will be initiated as required to support a collaborative approach for adaptive management and follow up.

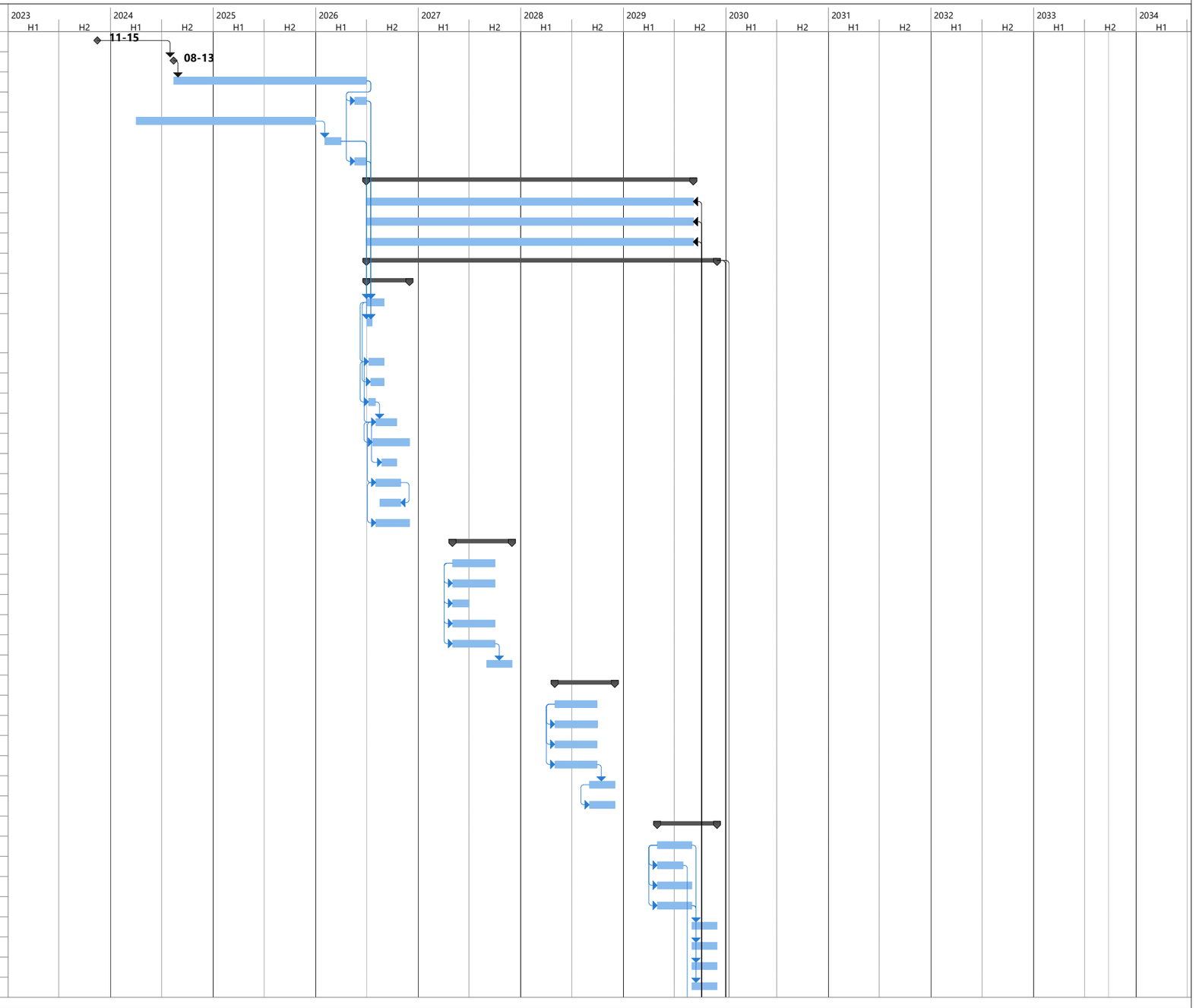
FIGURES

Figure 8.1 New East Dam Project Schedule

Figure 8.2 Monitoring Schedule

Figure 8.1
New East Dam - Project Schedule

ID	Task Name	Start	Finish
1	Receive Final EIA Terms of Reference from AEPA	23-11-15	23-11-15
2	Submit EIA	24-08-13	24-08-13
3	EIA Review and Approval	24-08-13	26-06-30
4	Federal and Provincial Approvals	26-05-20	26-06-30
5	Final Design	24-04-01	25-12-31
6	Tendering	26-02-02	26-03-31
7	Land Purchase	26-05-20	26-06-30
8	**Rerouting and Abandonment of Utilities and Oil and Gas**	**26-06-30**	**29-09-07**
9	Rerouting of Transmission Lines	26-06-30	29-09-07
10	Rerouting of Oil and Gas Pipelines	26-06-30	29-09-07
11	Abandonment and Potential Remediation of Oil and Gas Wells	26-06-30	29-09-07
12	**New East Dam Construction**	**26-07-01**	**29-11-29**
13	**Phase 1: Dam Foundation Preparation / Initial Embankment Fill**	**26-07-01**	**26-11-30**
14	Site Mobilization	26-07-01	26-08-31
15	Construction of Temporary Works (laydown, borrow, stockpiles and waste areas)	26-07-01	26-07-20
16	Topsoil Stripping and Erosion Control Measures	26-07-08	26-08-31
17	Access Road Construction	26-07-15	26-08-31
18	Decommissioning of Water Wells	26-07-08	26-07-31
19	Dam Foundation Preparation	26-08-03	26-10-15
20	Grout Curtain	26-07-22	26-11-30
21	Chimney and Finger Drains	26-08-24	26-10-15
22	Auxiliary Spillway, Core Trench and Borrow Excavation	26-08-03	26-10-30
23	Embankment Fill	26-08-17	26-10-30
24	Instrumentation	26-08-03	26-11-30
25	**Phase 2: Complete Stage 1 Embankment Fill**	**27-05-03**	**27-11-30**
26	Auxiliary Spillway, Core Trench, and Borrow Excavation	27-05-03	27-09-30
27	Dam Foundation Preparation	27-05-03	27-09-30
28	Grout Curtain (Provisional)	27-05-03	27-06-30
29	Chimney and Finger Drains	27-05-03	27-09-30
30	Embankment Fill	27-05-03	27-09-30
31	Instrumentation	27-09-02	27-11-30
32	**Phase 3: Complete Stage 2 Embankment Fill**	**28-05-01**	**28-11-30**
33	Auxiliary Spillway and Borrow Excavation	28-05-01	28-09-28
34	Dam Foundation Preparation	28-05-01	28-09-29
35	Chimney Drain	28-05-01	28-09-28
36	Embankment Fill	28-05-01	28-09-28
37	Gravel Armour Placement	28-09-01	28-11-30
38	Insterumentation	28-09-01	28-11-30
39	**Phase 4: Construction Completion**	**29-05-01**	**29-11-29**
40	Auxiliary Spillway and Borrow Excavation	29-05-01	29-08-31
41	Dam Foundation Preparation	29-05-01	29-07-31
42	Chimney Drain	29-05-01	29-08-31
43	Embankment Fill	29-05-01	29-08-31
44	Bedding Gravel, Gravel Armour, and Riprap Placement	29-09-01	29-11-29
45	Auxiliary Spillway Crest	29-09-01	29-11-29
46	Site Reclamation and Demobilization	29-09-01	29-11-29
47	Instrumentation	29-09-01	29-11-29

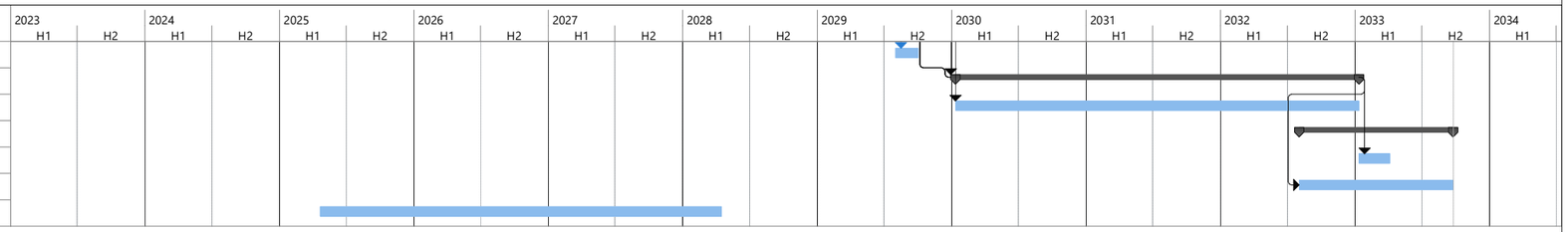


Project Number: A03701E05
Date: 2025-05-06

Task Milestone Summary

Figure 8.1
New East Dam - Project Schedule

ID	Task Name	Start	Finish
48	Construct Temporary Outlet Structure at Existing East Dam	29-08-01	29-09-30
49	**Reservoir Filling**	**30-01-11**	**33-01-10**
50	Adaptive Management Plan - Surface Water Quality Monitoring	30-01-11	33-01-10
51	**Decommissioning of Existing East Dam**	**32-08-02**	**33-09-23**
52	Replacement of Pumphouses and Private Water Intakes	33-01-11	33-04-04
53	Decommissioning	32-08-02	33-09-23
54	**Refurbishment of Chin Chute and West Dam of Chin Reservoir**	**25-04-21**	**28-04-14**



Project Number: A03701E05
Date: 2025-05-06

Task Milestone Summary

Klohn Crippen Berger

Figure 8.2
Monitoring Schedule

ID	Task Name	Start	Finish
1	**New East Dam Construction**	**Wed 26-07-01**	**Thu 29-11-29**
2	**Phase 1: Dam Foundation Preparation / Initial Embankment Fill**	**Wed 26-07-01**	**Mon 26-11-30**
3	Pre-disturbance wildlife sweep	Wed 26-07-01	Wed 26-07-01
4	Site mobilization	Wed 26-07-01	Wed 26-07-01
5	Implement ECO Plan and ESC Plan measures	Thu 26-07-02	Fri 26-07-10
6	Herptile exclusion, salvage and ongoing monitoring	Thu 26-07-02	Mon 26-11-30
7	Soil handling to stockpile and conserve topsoil and subsoil	Thu 26-07-02	Mon 26-11-30
8	Dust and air quality mitigations	Thu 26-07-02	Mon 26-11-30
9	Erect pronghorn-safe fencing	Thu 26-07-02	Wed 26-07-15
10	Wildlife mitigations monitoring	Thu 26-07-02	Mon 26-11-30
11	Monitoring for fossils during bedrock excavation	Thu 26-07-09	Mon 26-11-30
12	Establish Fire Watch Monitor for hot work and protocol	Thu 26-07-02	Mon 26-11-30
13	**Phase 2: Complete Stage 1 Embankment Fill**	**Mon 27-05-03**	**Tue 27-11-30**
14	Pre-disturbance wildlife sweep	Mon 27-05-03	Mon 27-05-03
15	Site mobilization	Mon 27-05-03	Mon 27-05-03
16	Implement ECO Plan and ESC Plan measures	Tue 27-05-04	Wed 27-05-12
17	Herptile exclusion, salvage and ongoing monitoring	Tue 27-05-04	Tue 27-11-30
18	Soil handling to stockpile and conserve topsoil and subsoil	Tue 27-05-04	Tue 27-11-30
19	Dust and air quality mitigations	Tue 27-05-04	Tue 27-11-30
20	Erect pronghorn-safe fencing	Tue 27-05-04	Mon 27-05-17
21	Wildlife mitigations monitoring	Tue 27-05-04	Tue 27-11-30
22	Monitoring for fossils during bedrock excavation	Tue 27-05-11	Tue 27-11-30
23	Establish Fire Watch Monitor for hot work and protocol	Tue 27-05-04	Tue 27-11-30
24	**Phase 3: Complete Stage 2 Embankment Fill**	**Mon 28-05-01**	**Thu 28-11-30**
25	Pre-disturbance wildlife sweep	Mon 28-05-01	Mon 28-05-01
26	Site mobilization	Mon 28-05-01	Mon 28-05-01
27	Implement ECO Plan and ESC Plan	Tue 28-05-02	Wed 28-05-10
28	Herptile exclusion, salvage and ongoing monitoring	Tue 28-05-02	Thu 28-11-30
29	Soil handling to stockpile and conserve topsoil and subsoil	Tue 28-05-02	Thu 28-11-30
30	Dust and air quality mitigations	Tue 28-05-02	Thu 28-11-30
31	Erect pronghorn-safe fencing	Tue 28-05-02	Mon 28-05-15
32	Wildlife mitigations monitoring	Tue 28-05-02	Thu 28-11-30
33	Monitoring for fossils during bedrock excavation	Tue 28-05-09	Thu 28-11-30
34	Establish Fire Watch Monitor for hot work and protocol	Tue 28-05-02	Thu 28-11-30
35	**Phase 4: Construction Completion**	**Tue 29-05-01**	**Thu 29-11-29**
36	Pre-disturbance wildlife sweep	Tue 29-05-01	Tue 29-05-01
37	Site Mobilization	Tue 29-05-01	Tue 29-05-01
38	Implement ECO Plan and ESC Plan	Wed 29-05-02	Thu 29-05-10
39	Herptile exclusion, salvage and ongoing monitoring	Wed 29-05-02	Thu 29-11-29
40	Soil handling to stockpile and conserve topsoil and subsoil	Wed 29-05-02	Thu 29-11-29
41	Dust and air quality mitigations	Wed 29-05-02	Thu 29-11-29
42	Erect pronghorn-safe fencing	Wed 29-05-02	Tue 29-05-15
43	Wildlife mitigations monitoring	Wed 29-05-02	Thu 29-11-29
44	Monitoring for fossils during bedrock excavation	Wed 29-05-09	Thu 29-11-29
45	Establish Fire Watch Monitor for hot work and protocol	Wed 29-05-02	Thu 29-11-29
46	Isolation for temporary outlet structure at Existing East Dam	Wed 29-08-01	Fri 29-08-03
47	Fish and herptile salvage within isolation area	Mon 29-08-06	Tue 29-08-14

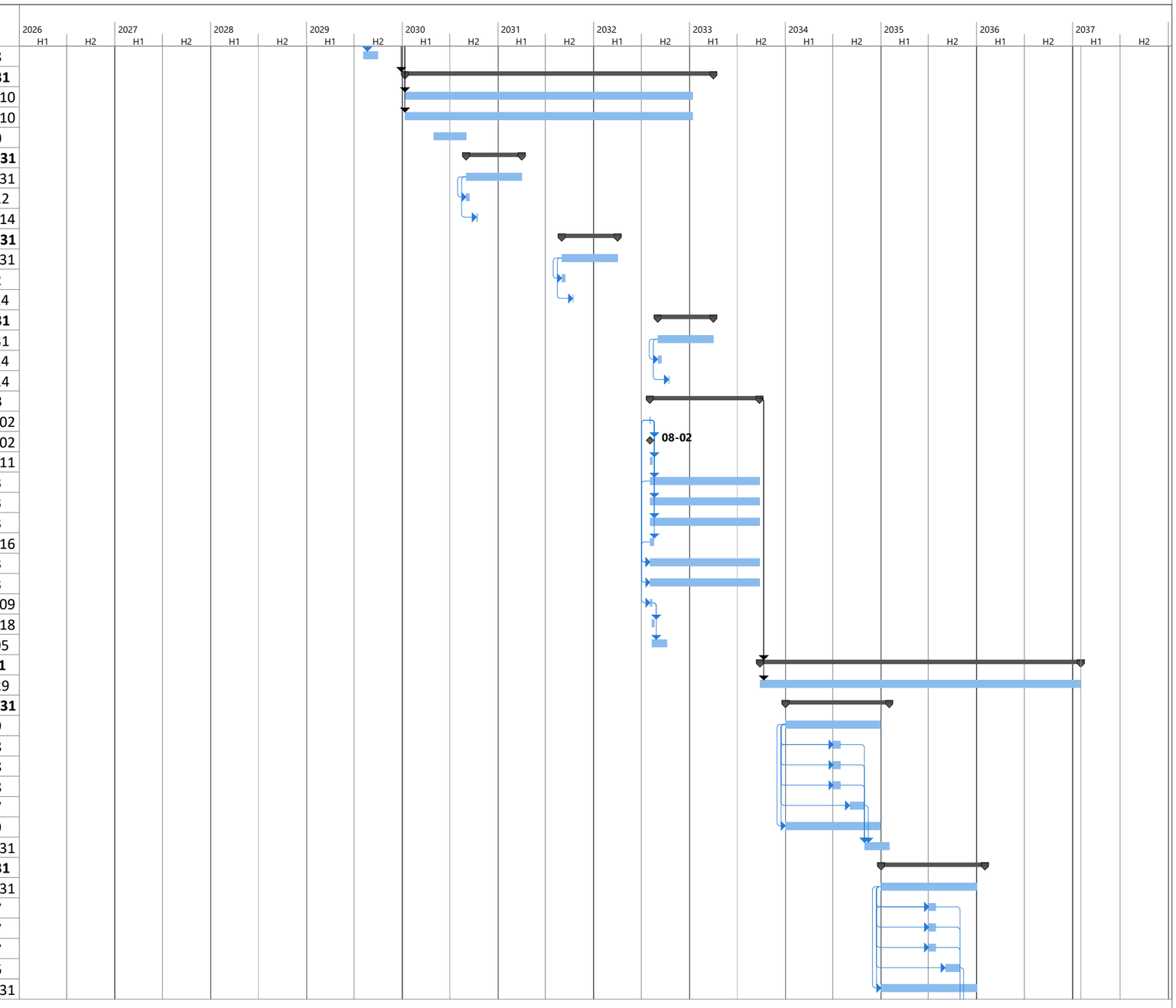


Project Number: A03701E05
Date: 2025-08-06

Task Milestone Summary

Figure 8.2
Monitoring Schedule

ID	Task Name	Start	Finish
48	Turbidity monitoring during in-water work	Mon 29-08-06	Fri 29-09-28
49	**Reservoir Filling**	**Fri 30-01-11**	**Thu 33-03-31**
50	Surface water quality Adaptive Management Plan	Fri 30-01-11	Mon 33-01-10
51	Quarterly surface water quality monitoring	Fri 30-01-11	Mon 33-01-10
52	Herptile salvage within Reservoir Expansion Area	Wed 30-05-01	Fri 30-08-30
53	**Reservoir Filling - Year 1**	**Sun 30-09-01**	**Mon 31-03-31**
54	Year 1 phased filling period to minimize effects on fish/wildlife	Sun 30-09-01	Mon 31-03-31
55	Monitoring and herptile salvage	Sun 30-09-01	Thu 30-09-12
56	Monitoring for exposure of historic resources	Fri 30-10-11	Mon 30-10-14
57	**Reservoir Filling - Year 2**	**Mon 31-09-01**	**Wed 32-03-31**
58	Year 2 phased filling period to minimize effects on fish/wildlife	Mon 31-09-01	Wed 32-03-31
59	Monitoring and herptile salvage	Mon 31-09-01	Fri 31-09-12
60	Monitoring for exposure of historic resources	Mon 31-10-13	Tue 31-10-14
61	**Reservoir Filling - Year 3**	**Wed 32-09-01**	**Thu 33-03-31**
62	Year 3 phased filling period to minimize effects on fish/wildlife	Wed 32-09-01	Thu 33-03-31
63	Monitoring and herptile salvage	Wed 32-09-01	Tue 32-09-14
64	Monitoring for exposure of historic resources	Wed 32-10-13	Thu 32-10-14
65	**Decommissioning of Existing East Dam**	**Mon 32-08-02**	**Fri 33-09-23**
66	Pre-disturbance wildlife sweep	Mon 32-08-02	Mon 32-08-02
67	Site Mobilization	Mon 32-08-02	Mon 32-08-02
68	Implement ECO Plan and ESC Plan measures	Tue 32-08-03	Wed 32-08-11
69	Herptile exclusion, salvage and ongoing monitoring	Tue 32-08-03	Fri 33-09-23
70	Soil handling to stockpile and conserve topsoil and subsoil	Tue 32-08-03	Fri 33-09-23
71	Dust and air quality mitigations	Tue 32-08-03	Fri 33-09-23
72	Erect pronghorn-safe fencing	Tue 32-08-03	Mon 32-08-16
73	Wildlife mitigations monitoring	Tue 32-08-03	Fri 33-09-23
74	Establish Fire Watch Monitor for hot work and protocol	Tue 32-08-03	Fri 33-09-23
75	Install isolation measures at Existing East Dam	Tue 32-08-03	Mon 32-08-09
76	Fish and herptile salvage within isolation area	Tue 32-08-10	Wed 32-08-18
77	Turbidity monitoring during in-water work	Tue 32-08-10	Tue 32-10-05
78	**Operational Monitoring**	**Mon 33-09-26**	**Sat 37-01-31**
79	Surface water quality Adaptive Management Plan - Operation	Mon 33-09-26	Thu 37-01-29
80	**Year 1 Monitoring**	**Sun 34-01-01**	**Wed 35-01-31**
81	Quarterly surface water quality monitoring	Sun 34-01-01	Fri 34-12-29
82	C&R Plan survey of revegetation, weeds, rare plants, erosion	Mon 34-07-03	Fri 34-07-28
83	Survey of vegetation establishment in drawdown zone	Mon 34-07-03	Fri 34-07-28
84	Survey for disturbance of historic resources	Mon 34-07-03	Fri 34-07-28
85	Sampling of fish (tissue), benthic invertebrates, and plankton	Mon 34-09-04	Fri 34-10-27
86	Bi-annual groundwater monitoring and data download	Sun 34-01-01	Fri 34-12-29
87	Year 1 annual report for submission to EPA	Mon 34-10-30	Wed 35-01-31
88	**Year 2 Monitoring**	**Mon 35-01-01**	**Thu 36-01-31**
89	Quarterly surface water quality monitoring	Mon 35-01-01	Mon 35-12-31
90	C&R Plan survey of revegetation, weeds, rare plants, erosion	Mon 35-07-02	Fri 35-07-27
91	Survey of vegetation establishment in drawdown zone	Mon 35-07-02	Fri 35-07-27
92	Survey for disturbance of historic resources	Mon 35-07-02	Fri 35-07-27
93	Sampling of fish (tissue), benthic invertebrates, and plankton	Mon 35-09-03	Fri 35-10-26
94	Bi-annual groundwater monitoring and data download	Mon 35-01-01	Mon 35-12-31



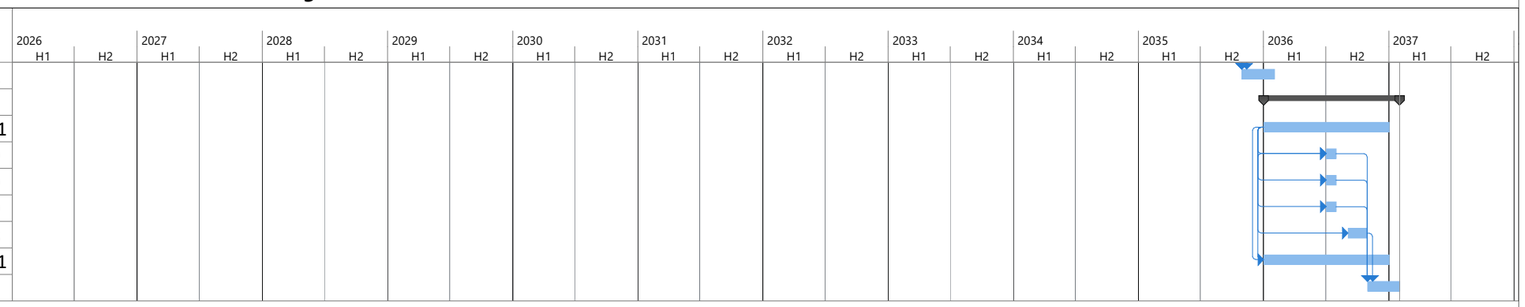
Project Number: A03701E05
Date: 2025-08-06

Task Milestone Summary

Klohn Crippen Berger

Figure 8.2
Monitoring Schedule

ID	Task Name	Start	Finish
95	Year 2 annual report for submission to EPA	Mon 35-10-29	Thu 36-01-31
96	**Year 3 Monitoring**	**Tue 36-01-01**	**Sat 37-01-31**
97	Quarterly surface water quality monitoring	Tue 36-01-01	Wed 36-12-31
98	C&R Plan survey of revegetation, weeds, rare plants, erosion	Wed 36-07-02	Tue 36-07-29
99	Survey of vegetation establishment in drawdown zone	Wed 36-07-02	Tue 36-07-29
100	Survey for disturbance of historic resources	Wed 36-07-02	Tue 36-07-29
101	Sampling of fish (tissue), benthic invertebrates, and plankton	Wed 36-09-03	Tue 36-10-28
102	Bi-annual groundwater monitoring and data download	Tue 36-01-01	Wed 36-12-31
103	Year 3 annual report for submission to EPA	Thu 36-10-30	Sat 37-01-31



Project Number: A03701E05
Date: 2025-08-06

Task Milestone Summary

Klohn Crippen Berger

Question 9

Reference:

Volume 1, Section 2.7, Page 40–42;
Volume 2, Section 2.8.4 and 2.8.5, Pages 131–139;
Volume 3

Rationale/Preamble:

SMRID cites the construction cost of the Project as $190 million as part of the socio-economic assessment. SMRID describes in many cases that compensation will be used as their mitigation option for altered land uses, including acquisition of private crop and grazed lands, and acquisition of land area for oil and gas wells. SMRID also describes the potential need for rerouting of pipelines or other utilities in the inundation zone. However, it is not apparent whether the costs of land acquisition and associated activities (e.g. rerouting utilities or decommissioning oil and gas wells) are factored into the Project costs and into the cost equation for the socio-economic assessment. The estimated costs of land acquisition and other activities may impact the viability of the Project if not adequately addressed in the cost-benefit models.

Information Request:

a. Provide a copy of the report that was used to estimate the Project costs.
b. Provide a rating of the Project design level and the corresponding cost contingency value.
c. Provide a breakdown of estimated project costs, including cost estimates for constructing the New East Dam, decommissioning the old East Dam, land acquisitions, pipeline rerouting or reinforcement, water well decommissioning, oil and gas well decommissioning, utilities rerouting, relocation of water intakes, and any other activities in the Project Area (PA) and LSA.
d. Provide the documentation for the status of communications made with owners of the lands or infrastructure required by the Project regarding potential impacts, relocation requirements, compensation, or any other mitigation measures.
e. Identify the parties responsible for relocating or decommissioning affected infrastructure in the project area.
f. Provide cost-benefit results (i.e., sensitivity analysis) for:
    i. construction costs without contingency, and,
    ii. construction costs including contingency.

Response:

a. The estimated $190 million cost of the Project provided as part of the Socio-economic Assessment was not based on a specific report. The Project cost was a broad estimate developed early in the planning stages of the Project, prior to the development of the PDR. The $190 million comprised of various construction costs, land acquisition costs, and other

miscellaneous costs (i.e., archaeology and site reclamation). The estimated construction costs not only included costs for the construction of the New East Dam, but also costs for rising the West Dam, decommissioning of groundwater wells and oil and gas wells, rerouting of utility lines, and modifications to the hydro plant, private pumpstations, Town of Taber water main, and water coop infrastructure. The estimated project costs reflect the value of materials, labour, and equipment prior to 2022.

A detailed breakdown of the estimated $190 million cost cannot be provided as it includes estimated land acquisition costs. As negotiations with landowners are still ongoing, the detailed Project costs will not be presented.

b. An updated breakdown of the estimated Project costs associated with the construction of the New East Dam and appurtenant structures and decommissioning of the Existing East Dam can be found in the New East Dam PDR, Appendix XVIII – Preliminary Cost Estimate. With the inclusion of a contingency allowance of 15% of construction cost and engineering and environmental services cost of 12% of construction cost plus contingency allowance, the estimated cost summary for the New East Dam was approximately $110 million.

   The initial estimate (as part of the $190 million cost estimate) for the decommissioning of water wells and groundwater wells, relocation of utilities, and modifications to existing infrastructure was set as $8 million. These estimated costs reflect the value of materials, labour, and equipment prior to 2022 with no provision for inflation. More recent discussions with various utility companies have provided much higher cost estimates.

c. A detailed breakdown cannot be provided as it includes estimated land acquisition costs. As negotiations with landowners are still ongoing, the detailed Project costs will not be presented.

d. Pertaining to discussions with landowners, please refer to the responses to SIR#1 Questions 22 and 44. Pertaining to discussions with infrastructure owners and water coops, please refer to the responses to SIR#1 Questions 11, 44, and 198. Discussions with all affected stakeholders are underway and awaiting the outcome of the NRCB Approval following the public interest hearing. Affected utility owners have been notified that completion of their infrastructure improvements, decommissioning, or replacement is required by 2029 prior to the scheduled start of reservoir expansion filling.

e. All infrastructure improvements, decommissioning, or replacement will be carried out by the infrastructure owner, with funding negotiated between the owner and SMRID.

f. A sensitivity analysis was not undertaken as part of the Socio-economic Assessment. It was assumed that because the study represented an early planning assessment, a sensitivity analysis was not considered necessary in making a go/no-go decision. In response to this SIR, a subsequent sensitivity analysis was carried out.

   Assuming the construction costs increased from $190 million to $228 million (20%), the Direct Societal Benefit-Cost Ratio would be reduced from 2.02 to 1.84. The following tables provide more detailed data for comparison.

Table 9.1 Societal Economic Indicators for Chin Reservoir Expansion Project (Construction Cost = $190 Million)*

Indicators	Direct Benefits and Costs	Direct, Indirect and Induced Benefits
Net Present Value ($)	367,923,000	1,528,351,000
Benefit-Cost Ratio (Financial Revenue-Cost Ratio)	2.02	5.23
Internal Rate of Return (%)	10.4	21.5
Return Period (Years)	12	8

*Note – This table is slightly different from the one shown in the Socio-economic Assessment as a result of minor discrepancies ACERA discovered during review.

Table 9.2 Societal Economic Indicators for Chin Reservoir Expansion Project (Construction Cost = $228 Million)*

Indicators	Direct Benefits and Costs	Direct, Indirect and Induced Benefits
Net Present Value ($)	332,425,000	1,492,853,000
Benefit-Cost Ratio (Financial Revenue-Cost Ratio)	1.84	4.76
Internal Rate of Return (%)	9.15	19.37
Return Period (Years)	12	8

*Note – This table is slightly different from the one shown in the Socio-economic Assessment as a result of minor discrepancies ACERA discovered during review.

Question 10

Reference:

Volume 1, Section 2.5.4, Page 36;
Volume 1, Section 2.5.5, Page 36 and 37;
Volume 3, Section E.1, Page 106;
Volume 3, Section E.4, Page 107

Rationale/Preamble:

SMRID states in Volume 1, Section 2.5.4 that *a four-year construction duration is assumed as the Stage 1 embankment construction may not be completed in the first year because the dam foundation preparation, cutoff trench excavation, grout curtain, and blanket drain construction may require the Stage 1 embankment construction to extend to the second year of construction*. SMRID states in Volume 1, Section 2.5.5 that *the filling schedule would have the Reservoir Expansion Area filled to 856 m by the summer of the third annual filling cycle*. However, assumptions made in the cost-benefit analysis of the socio-economic assessment as described in Volume 3, Appendix E were that *The life of the project was assumed to be 50 years after the completion of construction activities. It was assumed that construction would take place during the initial 3 years;* it was *Assumed that construction expenditures would be divided into 3 years as follows: Year 1 – 50%, Year 2 – 25%, and Year 3 – 25%.*; and that *Irrigation activity was assumed to start in the fourth year.*

Information Request:

a. Clarify the expected scheduling of irrigation commencement given an expected four-year construction duration followed by a three-year reservoir filling process.

b. Clarify the beginning of the expected 50-year life of the Project relative to construction completion, end of reservoir filling and/or beginning of irrigation from the Expanded Chin Reservoir.

c. Clarify the timing of benefits expected from flood mitigation, drought mitigation, livestock development, and expanded crop irrigation relative to the construction schedule.

Response:

a. The expected commencement of irrigation from the Expanded Chin Reservoir is contingent upon both the construction timeline and the availability of water for reservoir filling. The New East Dam construction timeframe is anticipated to span approximately four years, with construction beginning as early as July 2026, contingent on regulatory approvals. Please refer to SIR#1 Question 8 (a), Figure 8.1 for an updated Project schedule of the construction of the New East Dam, proposed reservoir filling schedule, and decommissioning of the Existing East Dam

   The development of associated irrigation infrastructure to support the expanded acres can occur in parallel with dam construction. Irrigation producers are now able to submit their applications for new acres. Pending the approval that the applicant has appropriate soils and

capacity, the irrigation producer can begin developing their associated irrigation infrastructure. The financial analysis that was conducted as part of the Socio-Economic Analysis (Volume 3) assumed that full irrigation development of the 46,500-acre irrigation expansion would be in place within 10 years after commissioning of the Project.

Following construction of the New East Dam, the reservoir filling process is estimated to require at least three years, assuming favourable hydrological conditions. Under this best-case scenario—assuming adequate water availability throughout the infilling period—newly allocated irrigation could commence as early as the spring of 2034. This timing reflects the earliest point at which the Expanded Reservoir would have sufficient storage to support new irrigation development.

It is important to note that the reservoir filling schedule is sensitive to multiple variables, including Chin Reservoir levels at the end of construction, annual precipitation or drought conditions, irrigation demands from existing users, and conveyance and evaporation losses. As a result, the start of irrigation from the Expanded Reservoir could be delayed beyond 2034 if water availability during the infill period is constrained. The reservoir filling assumptions are further detailed in Appendix II of the New East Dam PDR, provided in Appendix 1.1 of this SIR#1 Response Document.

In addition, the Highway 36 Bridge Replacement, being undertaken by the provincial agency TEC, will be completed prior to any increase in the reservoir's FSL. SMRID and TEC have engaged in ongoing discussions to coordinate the scope and progress of their respective projects and will continue to collaborate to ensure both design teams remain aligned as each project advances.

b. In the Socio-Economic Analysis (Volume 3), the 50-year Project life cycle was defined as commencing after the completion of construction activities, which was assumed to span three years. However, as noted in the response to SIR#1 Question 10 (a), the start of the Project life cycle will be heavily dependent on the reservoir filling timeline.

c. The timing of each benefit stream is as follows:

- Flood Mitigation: Benefits are realized immediately after construction of New East Dam.
- Drought Mitigation: These benefits are directly tied to the availability of water storage in the Expanded Reservoir. As such, full drought mitigation benefits are expected to begin once the Expanded Reservoir reaches operational levels and the Existing East Dam is decommissioned.
- Livestock Development: New livestock development supported by the Expanded Reservoir storage will commence only after the reservoir is filled to operational levels and the Existing East Dam is decommissioned, anticipated no earlier than 2034 under favourable conditions.
- Expanded Crop Irrigation: New irrigation development supported by the Expanded Reservoir storage will commence only after the reservoir is filled to operational levels and the Existing East Dam is decommissioned, anticipated no earlier than 2034 under favourable conditions.

Question 11

Reference:

Volume 1, Section 2.7.11, Page 40 and 41;
Volume 2, Section 2.8.4.2.3, Map Figure 2.8.19, Page 135 and 136;
Volume 2, Section 4.3.2, Page 169 and 170;
Volume 2, Appendix 1, Table I-3;
Volume 2, Appendix 11;
Volume 2, Appendix 12

Rationale/Preamble:

SMRID states in Section 2.7.11 that *As per Directive 020 issued by the Alberta Energy Regulator (AER 2023), the oil and gas infrastructure found within the coulee is to be removed...* and abandonment of the wells according to AER Directive 020 is discussed as a mitigation measure against the introduction of deleterious substances into the Expanded Chin Reservoir. Section 2.8.4.2.3 (page 135 to 136) states *eight pipelines intersect the PA… six will be affected by the Expanded Chin Reservoir*, a statement supported in Map Figure 2.8.19 that shows six pipelines in the expansion area. However, Section 4.3.2 states *The coulee crossings of two abandoned utility corridors (CNRL and Ridal), and one active pipeline (InterPipeline) are to be inundated* and states that *Should a breach result in pipeline content entering the reservoir, the water would not be released from the reservoir until the water was remediated*. The pipeline stress level of three Inter Pipeline crude oil pipelines is rated as 63% - 79%. No discussion on the more likely or impactful mitigation measures, between rerouting pipelines versus minimizing access to affected water supply until remediated, is made in the EIA.

Information Request:

a. Discuss the status of mitigation measures toward decommissioning and remediation of the oil and gas wells in the inundation zone presented in Appendix 11.

b. Discuss the risk of pipeline failure if the pipelines are left in place given the characteristics and stress levels of the pipelines presented in Appendix 12.

c. Discuss the potential for impact to the reservoir water from pipeline infrastructure in the context of the existing pipeline stress levels, and describe the mitigation options (e.g., rerouting vs. restricted water use, etc.) in terms of likelihood of occurrence and costs of impacts.

d. Discuss the projected cost of impacts owing to the mitigation option of retaining water from a reservoir if a pipeline failure is encountered and compare against the cost of rerouting the pipelines.

Response:

a. All oil and gas wells located within the inundation zone of the Expanded Chin Reservoir will be decommissioned in accordance with Alberta Energy Regulator (AER) Directive 020 (AER 2024a),

which outlines abandonment and reclamation requirements for wells. The owners of the affected wells will be engaged and included in the planning and execution of the decommissioning and remediation activities.

At this stage, formal communication with the well owners has not yet been initiated, as SMRID has elected to complete the regulatory approval process prior to advancing this phase of work. Decommissioning activities are scheduled to begin following the public interest hearing and receipt of the NRCB Approval. To complete this work, SMRID has committed to funding the decommissioning activities and ensuring the work is completed as per the requirements identified in AER Directive 020 (AER 2024a).

The reservoir filling will not commence until the oil and gas wells located within the inundation zone have been decommissioned as per AER Directive 020.

b. With respect to Inter Pipeline Ltd. (Inter Pipeline):

SMRID has engaged in preliminary discussions with Inter Pipeline's engineering team, who are fully aware of the Chin Reservoir Expansion Project and its potential implications for existing pipeline infrastructure. Discussions began in November 2021 when MPE invited Inter Pipeline to meet and discuss the Project. Inter Pipeline is currently undertaking Front End Engineering Design (FEED) for the affected pipelines, and this process explicitly accounts for the proposed reservoir inundation area and the increased FSL of up to 864.00 m. At this time, Inter Pipeline is proposing to replace the affected pipelines (Operating License #4912-96, 4912-103,4912-108); however, this will be confirmed as Inter Pipeline proceeds through their respective engineering design phases.

The stress levels referenced in Volume 2, Appendix 12, which indicate that the three Inter Pipeline crude oil pipelines currently operate at 63% to 79% of their maximum allowable stress, will need to be revisited and validated by Inter Pipeline in the context of the Chin Reservoir Expansion Project. Inter Pipeline remains responsible for assessing, managing, and ensuring the structural integrity and regulatory compliance of their infrastructure, including any modifications required to mitigate risk.

At present, the potential risk of failure cannot be fully characterized without the completion of Inter Pipeline’s detailed engineering assessment. However, Inter Pipeline has indicated that it is considering pipeline replacement in this section as part of its design response to accommodate the Project. The work that is recommended by Inter Pipeline will not be completed until regulatory approvals are in place and the Project has approval from the regulator to proceed.

With respect to ATCO Gas and Pipelines Ltd. (ATCO):

The ATCO gas pipelines (Operating Licences #22327-2 and #22327-3) are currently situated below the Existing Chin Reservoir water level. MPE engaged ATCO in June 2025 to initiate formal discussions regarding the potential impacts of the proposed reservoir FSL increase. MPE has presented the scope of the Project and potential implications to ATCO, noting that the only anticipated change affecting these lines is the proposed increase in reservoir FSL.

As the licensee, ATCO will be responsible for evaluating the implications of the FSL increase on the integrity of its infrastructure. Should ATCO determine that upgrades or modifications are required to maintain safe operation, SMRID has committed to ensuring that any necessary upgrades are completed prior to the reservoir FSL being raised.

c. As discussed in the response to SIR#1 Question 11 (b), the impact of the Project in context of the existing pipeline stress levels and the mitigation options are the sole responsibility of the utility owners (Inter Pipeline or ATCO). The SMRID is committed to working with the respective utility owners throughout the Project. However, design improvements or mitigation options will be assessed by the utility owners.

d. As the infrastructure in question is owned and operated by the asset owners—Inter Pipeline and ATCO—they are ultimately responsible for determining the appropriate mitigation strategy between rerouting compared to responding to a pipeline failure. These decisions will be informed by the outcomes of their respective engineering design processes, which are currently ongoing. Both asset owners are aware of the Chin Reservoir Expansion Project and have been engaged in preliminary discussions regarding the implications of the increased FSL.

   At present, Inter Pipeline is actively advancing FEED for the affected pipelines and has indicated that pipeline replacement is under consideration. The final determination—whether to reroute, replace, or otherwise modify the infrastructure—will be made by Inter Pipeline as they progress through their engineering and risk assessment processes. Similarly, ATCO will assess the impact of the increased reservoir FSL on its gas pipelines and determine any required mitigation measures based on internal engineering assessments.

   In the event of a pipeline failure, SMRID has indicated that reservoir water would be retained and not released until appropriate remediation measures are completed. At this stage, the potential costs associated with remediating the reservoir in such a scenario have not been estimated, as the asset owners are still in the process of evaluating routing and mitigation options through their respective design phases. The SMRID is committed to working with asset owners throughout the engineering design phase and will discuss the remediation options with the asset owners once an alignment is selected.

Question 12

Reference:

Volume 2, Section 2.5, Page 63-73

Rationale/Preamble:

The SMRID describes reclamation suitability ratings for soils within the project area and quantifies soil volumes by broad management classes but omits details with regards to overall soil management and placement for the project.

Information Request:

a. Provide the estimated volumes of soil and surface land area that are associated with each operational area of the Project (e.g. dam fill waste area, auxiliary spillway).

b. Provide the calculated volume of soil that is expected to be salvaged for reclamation purposes from each operational area.

c. Provide details on which operational project areas will undergo reclamation and estimate the volume of soil needed for reclamation purposes.

Response:

a. Construction quantities for the New East Dam, Auxiliary Spillway, access road, and decommissioning of the Existing East Dam are described in the New East Dam PDR found in Appendix 1.1 of this SIR#1 Response Document. The estimated volumes of soil and surface land area that are associated with each operational area of the Project are summarized in Table 12.1.

Table 12.1 Project Component Areas and Soil Volumes

Description	Unit	Quantity
New East Dam		
Component Area	m^2	1,048,932.58
Total Excavation Volume	m^3	1,147,000
Auxiliary Spillway		
Component Area	m^2	309,948.63
Total Excavation Volume	m^3	4,973,000
Access Road		
Component Area	m^2	29,365.78
Total Excavation Volume	m^3	558,000
Existing East Dam Decommissioning		
Component Area	m^2	134,556.92
Total Excavation Volume	m^3	224,400

b. The surface land area and the calculated volume of soil that is expected to be salvaged for reclamation purposes from each operational area is presented in Table 12.2. For these

calculations, topsoil is considered to be the A horizon and subsoil is the B horizon of each soil series presented in Table 12.2.

Table 12.2 Project Component Areas and Estimated Volumes of Soils Salvaged for Reclamation

Project Component	Component Area (m^2)	Soil Series[1]	Area (m^2)	Average Topsoil Depth (m)	Topsoil Salvage Volume Per Soil Series (m^3)	Total Topsoil Salvage Volume (m^3)	Average Subsoil Depth (m)	Topsoil Salvage Volume Per Soil Series (m^3)	Total Subsoil Salvage Volume (m^3)
Proposed Dam Fill Waste Area	56,797.62	BUT	33,802.25	0.06	2,028.14	2,947.95	0.21	7,098.47	10,777.73
		TVS	22,995.37	0.04	919.81		0.16	3,679.26	
Proposed West Access Road	24,688.73	CFMA[2]	21,828.14	0.12	2,619.38	2,733.80	0.13	2,837.66	3,295.35
		TVS	2,860.59	0.04	114.42		0.16	457.69	
Proposed East Access Road	29,365.78	CFMA[2]	3,253.04	0.12	390.36	3,410.25	0.13	422.90	4,847.86
		RAM[3]	24,692.37	0.12	2,963.08		0.17	4,197.70	
		TVS	1,420.37	0.04	56.81		0.16	227.26	
Proposed Project Laydown Area	164,822.05	CFMA[2]	127,939.95	0.12	15,352.79	19,160.92	0.13	16,632.19	22,824.93
		RAM[3]	29,160.58	0.12	3,499.27		0.17	4,957.30	
		TVS	7,721.52	0.04	308.86		0.16	1,235.44	
New East Dam Work Temporary Stockpile and Borrow Area	267,531.70	BUT	267,531.70	0.06	16,051.90	16,051.90	0.21	56,181.66	56,181.66
Auxiliary Spillway	309,948.63	MAB	160,392.93	0.05	8,019.65	14,001.88	0.16	25,662.87	49,591.78
		TVS	149,555.70	0.04	5,982.23		0.16	23,928.91	
Temporary Work Areas (around New East Dam and Auxiliary Spillway)	223,043.11	BUT	87,312.51	0.06	5,238.75	10,990.80	0.21	18,335.63	40,029.85
		CFMA[2]	755.73	0.12	90.69		0.13	98.24	
		MAB	26,237.26	0.05	1,311.86		0.16	4,197.96	
		TVS	108,737.61	0.04	4,349.50		0.16	17,398.02	
Proposed New East Dam Footprint	393,535.72	BUT	383,436.59	0.06	23,006.20	23,410.17	0.21	80,521.68	82,137.54
		TVS	10,099.13	0.04	403.97		0.16	1,615.86	
TOTALS	**1,469,733.34**		**1,469,733.34**			**92,707.67**			**269,686.70**

Notes:
[1]Average topsoil and subsoil depth for each soil series are calculated from data collected at soil inspection locations. See Appendix I, Table I.1 in the Soils and Terrain TBR in Volume 4 for soil inspection data.
[2]Average topsoil and subsoil depth was taken from Component 1 (Cranford soil series) of the CFMA1/U1l Soil Map Unit (Polygon ID 1255) (ASIC 2001).
[3] Average topsoil and subsoil depth was taken from Component 1 (Ramillies soil series) of the RAM13/U1h Soil Map Unit (Polygon ID 1325) (ASIC 2001).
.

c. The operational Project Areas that will undergo reclamation and reclamation soil estimates are presented in Table 12.3. Only the ditches of the Proposed East and West Access Roads and areas of the New East Dam and Auxiliary Spillway above FSL without riprap armouring will be reclaimed with salvaged topsoil and subsoil.

Table 12.3 Reclamation Areas and Estimated Reclamation Soil Volumes

Project Component	Component Area (m^2)	Estimated Reclamation Area (m^2)	Reclamation Topsoil Depth (m)	Reclamation Topsoil Volume (m^3)	Reclamation Subsoil Depth (m)	Reclamation Subsoil Volume (m^3)
Proposed Dam Fill Waste Area	56,797.62	56,797.62	0.10	5,679.76	0.20	11,359.52
Existing East Dam Access Road	18,996.66	18,996.66	0.10	1,899.67	0.20	3,799.33
Proposed West Access Road	24,688.73	12,344.37	0.10	1,234.44	0.20	2,468.87
Proposed East Access Road	29,365.79	14,682.90	0.10	1,468.29	0.20	2,936.58
Proposed Project Laydown Area	164,822.05	164,822.05	0.10	16,482.21	0.20	32,964.41
New East Dam Work Temporary Stockpile and Borrow Area	267,531.70	0.00	0.00	0.00	0.00	0.00
Auxiliary Spillway	309,948.63	154,974.32	0.10	15,497.43	0.20	30,994.86
Temporary Work Areas (around New East Dam and Auxiliary Spillway)	223,043.11	223,043.11	0.10	22,304.31	0.20	44,608.62
Proposed New East Dam Footprint	393,535.72	196,767.86	0.10	19,676.79	0.20	39,353.57
TOTALS	**1,488,730.01**	**842,428.89**		**84,242.90**		**168,485.76**

Question 13

Reference:

Volume 2, Section 2.3.3.2, Page 35-37;
Volume 2, Section 2.3.5.1, Page 39-42;
Volume 4-2, Section 2.2.2, Page 11 and 12;
Volume 4-5, Section 2.4, Page 4;
Volume 4-5, Section 3.4, Table 3.3, Page 18

Rationale/Preamble:

SMRID states that the incremental filling of the Expanded Chin Reservoir is expected to create water quality conditions … *similar to those observed in Watercourse 126419*… and that *concentrations and behaviors within Watercourse 126419 to serve as a probable analog of the Chin Reservoir Expansion Area* (Volume 2, Section 2.3.5.1.1). In effect, they use two pooled water sources downstream of the existing East Dam in Watercourse 126419 to represent the impact of flooded soils on reservoir water quality during filling. Best practice to assess potential impacts of flooded areas is to characterize and analyze the different soil types existing in the inundation area for all target indicators of soil quality and estimated impacts to surface waters (e.g., heavy metals, salts). However, there are no relationships made to the different soil types that exist in the new flooded area and the two water sources sampled. There exist eight (8) different soil series in the flooded area, and the differences or similarities of these soil types on water quality upon inundation are not made clear.

Information Request:

a. Map and describe the location of the two pooled water samples relative to the soil series identified in the Soils and Terrain baseline report.

b. Using the soil quality and descriptions, justify the representativeness of the two pooled water samples to represent the impact of inundated soil and reservoir water quality.

Response:

a. The location of the water quality sampling stations WQDS1 and WQDS2 are shown overlying the soil series mapping (as described in Volume 4-5) on Figure 13.1. WQDS1 is located within the Bunton (BUT1) soil series. The Historic WQDS2 sample site was originally located upstream from the proposed New East Dam, within the Bunton (BUT10) soil series. The residual pool of water at this location was being influenced by livestock watering by the July 2021 sampling event, so WQDS2 was relocated to the nearest downstream residual pool, which was beyond the extent of the mapped soil series. The Bunton soil series is an Orthic Brown Chernozem developed on moderately well to rapidly drained medium to moderately fine textured, occasionally saline to sodic, low relief inclined or undulating, low to moderate relief single slope landforms associated with fluvial fans and aprons in coulees and meltwater channels.

b. During initial filling of the Reservoir Expansion Area, inundated soils may be prone to erosion and soils in the expanded area could leach metals or salt, which could affect the water quality of

the Reservoir Expansion Area. The primary mechanism for mitigating the potential for adverse effects on water quality will be to fill the expanded portion of the reservoir in isolation from the existing reservoir. Dilution of leached mass will occur given the large volume of water added during filling. Currently, the small residual pools of water associated with Watercourse 126419 are dominated by groundwater inflow and evapo-concentration of solutes. The local inflows and groundwater seepage that influence water quality within Watercourse 126419, in conjunction with evapo-concentration, will have a negligible influence on water quality in the Expanded Chin Reservoir during operation as the load will be negligible compared to the diluting volume of inflows to the reservoir from the main canal. The water chemistry in Watercourse 126419 is not indicative of potential water quality in the Expanded Chin Reservoir as canal inflow dominates the water quality of the reservoir. The best surrogate for the future expansion water quality is the Existing Chin Reservoir, as discussed further in INTERA's *Water Quality Analysis Technical Memorandum*, provided in Appendix 13.1 of this SIR#1 Response Document.

FIGURE

Figure 13.1 Watercourse 126419 Water Samples and Soil Series

426000 429000 432000 435000

5493000

5490000

N

ZDL

WQDS-1

WQDS-2

WQDS-2

Watercourse 126419

New East Dam

0 1 Kilometres

Legend

- Water Quality Monitoring Location
- Historic WQSD2 Location
- Dam Location
- All Weather Road
- Watercourse
- Local Study Area (LSA)

Soil Series

Bunton
- BUT1
- BUT3
- BUT7
- BUT10
- BUT13

Cranford
- CFD1

Cranford/Maleb
- CFMA1

Gleddies/Bunton
- GLBU1

Maleb
- MAB1
- MAB2
- MAB4
- MAB6

Ramillies
- RAM13

Travers
- TVS4
- TVS7

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: WATERCOURSE 126419 WATER SAMPLES AND SOIL SERIES

SCALE: 1:35,000 | PROJECT No.: A03701E05 | FIG No.: 13.1

File: \\int.klohn.com\ProjData\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Creator: : HMarandyan

Question 14

Reference:

Volume 2, Section 2.2.3.1.2, Table 2.3, Page 29;
Volume 4-2, Section 2.2.1, Table 2.1, Page 6-9

Rationale/Preamble:

SMRID presents a comprehensive list of surface and groundwater water licenses in the LSA and RSA for surface water quality and a list of local water users that draw water from the Chin Reservoir shoreline as part of their assessment of effects from the Project. However, the information is not presented clearly to support a decision of impacts to surface and groundwater licensees directly affected by an expansion of Chin Reservoir. Further, the potential project effects on local water users does not specify impacts to surface and groundwater users in the reservoir expansion area or downstream of the New East Dam on Watercourse 126419.

Information Request:

a. Tabulate the surface water and groundwater license holders that exist in the project area (i.e., reservoir inundation zone) that would be directly affected by the reservoir expansion, including the authorization number, date, licensee name, license volume, water source, and purpose of the water use.

b. Estimate the project effects on and mitigation options for downstream surface water users within Watercourse 126419 through the reduction of catchment area directing runoff to the downstream impoundments, including details on:

    i. total remaining allocations for surface water uses in Watercourse 126419 following the Project; and

    ii. estimating the reduction in annual water volumes in Watercourse 126419 owing to the reduction of catchment area to this watercourse.

c. Estimate the impacts to and mitigation options for groundwater users in the LSA and RSA in or adjacent to reservoir expansion area in terms of direct impacts through the loss of water wells in the inundation area and indirect impacts due to expected impact of the reservoir on local aquifers.

Response:

a. There are no existing surface water or groundwater licenses within the Reservoir Expansion Area. The groundwater wells that exist within the Reservoir Expansion Area are summarized in the response to SIR#1 Question 133. An inventory of surface water users within the broader RSA was provided in Table 2.1 of the Surface Water Quality TBR (Volume 4-2). An inventory of groundwater well records was provided in Appendix I of the Hydrogeology TBR (Volume 4-3).

b. Reservoir expansion will reduce the local catchment area of Watercourse 126419 from 799 km2 to 749 km2, a reduction of 6%. The existing catchment area was estimated from the coulee confluence near Foremost, extending upstream to the Existing East Dam.

The anticipated change in runoff volume from the catchment has been estimated as shown in Table 14.1. Flow within Watercourse 126419 is expected to be limited to periods of active runoff during snow melt and storm events and depressional losses are expected to limit surface runoff that reports to the Watercourse 126419 below the 1:10-year return period. Therefore, the change in water availability under non-flood conditions is expected to be negligible.

The reduction in catchment area is expected to result in a minor decrease in discharge reporting to Watercourse 126419. The magnitude of the potential adverse effect is considered to be within the range of natural variability, resulting in no measurable effect on surface water users drawing from downstream impoundments.

Table 14.1 Watercourse 126419 Flood Return Period Runoff Volume

Return Period	Precipitation (mm)	Runoff Coefficient		Base Case Runoff Volume (dam^3)	Project Case Runoff Volume (dam^3)	Percent Decrease
		Base Case	Project Case			
1000	131	0.29	0.32	3,300	3,090	6.4%
750	127	0.28	0.31	3,110	2,920	6.1%
500	120	0.27	0.29	2,820	2,640	6.4%
350	115	0.26	0.29	2,620	2,460	6.1%
300	113	0.26	0.28	2,530	2,370	6.3%
200	107	0.24	0.27	2,290	2,150	6.1%
100	96	0.22	0.24	1,850	1,730	6.5%
75	91	0.21	0.23	1,690	1,580	6.5%
50	86	0.19	0.22	1,490	1,400	6.0%
35	80	0.18	0.20	1,300	1,220	6.2%
20	71	0.15	0.17	990	930	6.1%
10	61	0.12	0.14	670	630	6.0%
5	50	0.09	0.11	430	400	7.0%
2	33	0.08	0.09	240	220	8.3%

c. Effects on groundwater users are discussed in detail in the Hydrogeology components of the assessment, including Volume 2, Section 2.1.3 and the responses to SIR#1 Questions 104, 116, 133, 135, and 137.

Question 15

Reference:

Volume 2, Section 2.3.2.2, Page 34;
Volume 4-1, Table 2.1, Page 5;
Volume 4-2, Appendix I, Table I.1 - I.9, Page I-1 - I-9

Rationale/Preamble:

SMRID concludes that the *Water in the Chin Reservoir was neutral to slightly alkaline, hard, with moderately low TDS. No guideline exceedances reported for several parameters (CCME 1999, GoA 2018a), except for fecal coliforms in July 2021*. This conclusion does not specify the water use that the guidelines referred to and appears to assume irrigation water uses. In all Chin Reservoir samples, at least one sample exceeded livestock water guidelines for phenols, but no discussion on these exceedances are presented in the EIA. No reference was made to drinking water quality guidelines, despite water users drawing water directly from the reservoir for consumption.

Information Request:

a. Provide an estimated total volume of livestock water use from the Chin Reservoir or downstream SMRID canals, based on the surface water licenses presented in Table 2.1 of Volume 4-1 TBR.

b. Discuss the relative impact of phenols on livestock health at the concentrations observed in the reservoir or other SMRID monitoring stations.

c. Compare the measured values of water quality parameters to the Canadian Drinking Water Quality Guidelines (Health Canada 2022a).

Response:

a. Livestock water use would be captured under the category of “Agricultural” use for water licenses summarized in Table 2.1 of Volume 4-1 Water Quality TBR. However, there is no further distinction that can be made to determine what proportion of agricultural allocation is associated with livestock watering. Likewise, it is not possible to determine accurately which licenses are drawing directly from Chin Reservoir or the Main Canal. The majority of the water that is drawn from Chin Reservoir or the Main Canal for livestock watering is likely distributed under SMRID’s licensed allocation of water. However, SMRID also does not differentiate uses for the distributed water. As a result, use of water for livestock watering cannot be accurately distinguished from license information. As an alternative approach, INTERA estimated potential livestock water use based on the total catchment area, referring to Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (CCME 1999) for stock and intake rates for potentially occurring livestock (refer to INTERA’s *Phenols Modeling Technical Memorandum* provided in Appendix 15.1 of this SIR#1 Response Document).

Based on a total catchment area of 332 km^2, the total livestock water use for cattle, pig, sheep, goat, and horse is estimated to be 650,720 L/day (range of 46,480 to 227,420 L/day for goat and cattle, respectively).

b. The relative potential for phenols to affect livestock health is discussed in the *Phenols Modeling Technical Memorandum* (Appendix 15.1). Only March 2022 Chin Reservoir samples had phenol concentrations exceeding the 0.002 mg/L guideline threshold for livestock water use. Phenol is quickly metabolized and would not be expected to result in acute or chronic effects at the reported reservoir concentrations.

c. A comparison to the Canadian Drinking Water Quality Guidelines (Health Canada 2022a) is provided in the *Phenols Modeling Technical Memorandum* (Appendix 15.1). Only total dissolved solids (TDS) exceeded the Maximum Acceptable Concentration (MAC) level of 500 mg/L; however, the guideline criterion for TDS does not represent a potential health risk and is for odor and taste only. Furthermore, it is not expected that water is drawn directly from the reservoir for consumption; rather, withdrawn water is treated prior to human consumption.

Question 16

Reference:

Volume 2, Section 2.2-2.3, Page 24-42;
Volume 5, Section 2, 2.7.1 [B]

Rationale/Preamble:

Information on the process and/or potable water needs during construction, operation and/or decommissioning was not provided.

Information Request:

a. Discuss the process water and potable water requirements for construction and operation of the reservoir as requested in the final Terms of Reference.

Response:

a. The contractor conducting construction of the Project will require process water for moisture conditioning during dam fill placement, for dust control to mitigate generation of dust from roads and active work areas, and for grout and concrete batch plant preparation. Potential sources for process water include drawing from groundwater wells, local canals, and Chin Reservoir. The contractor must secure a temporary diversion licence (TDL) to draw water from surface or groundwater sources. Any wastewater generated through processes such as grouting must be collected and hauled offsite for disposal at an appropriate facility.

   Potable water requirements during construction will likely be limited to the personal needs of the construction crew, which would be met by bringing water to site. It is considered unlikely that an onsite camp would be established and there are no utilities onsite. Self-contained portapotties will likely be used at the construction site and domestic waste would be hauled offsite for disposal at an appropriate facility. However, management of potable water and domestic waste will be at the discretion of the contractor, in accordance with the contract requirements.

   There are no process or potable water needs during operation of the Project. Decommissioning is not considered as the Project is intended to serve as permanent water management infrastructure.

Question 17

Reference:

Volume 2, Section 2.3.6, Page 41 and 42;
Volume 2, Section 2.4.2.2.4, Page 48;
Volume 2, Section 2.4.4.2.4, Page 58 and 59;
Volume 2, Appendix 7, Page 1-18;
Volume 4-3, Section 4.1, Page 22 and 23;
Volume 4-3, Section 5.1, Page 50;
Volume 4-3, Section 3.5.2.2, Page 20;
Volume 5, Section 3, 3.4.2 [D]

Rationale/Preamble:

SMRID states that the *reservoir is expected to reach equilibrium with no significant difference in water quality within a year* based upon a mass-balance study conducted by INTERA Incorporated. However, SMRID also estimates that *… it is expected that mercury concentrations in fish at Chin Reservoir will increase for approximately 4–6 years before beginning to decline*, based on observations at other regional reservoirs. The water quality analysis conducted by INTERA was used, in part, to assess methylation of mercury. INTERA states that a simple linear relationship exists between concentrations and flow for the inflows, which was used as rationale to average the different inflow types and for deciding that storm events did not have to be explicitly modeled. INTERA further deemed sediment exchange as a negligible input and did not address whether this included the potential for groundwater inputs. Best practice is to maintain distinct input and outputs into the mass-balance model, regardless of overall importance to the results, and to incorporate a storm hydrograph into the modeled loading via surface inflows.

Information Request:

a. Provide a summary of all input data used in the model, including concentration and flow for each:
    i. input type including canal inflow, runoff, precipitation, and sediment exchange (or groundwater discharge); and
    ii. output type including outflow to Stafford Reservoir, evapotranspiration, and leakage (or groundwater recharge).
b. Provide justification as to why groundwater input was not considered in the mass balance model, considering the presence of four flowing artesian wells exist in the reservoir expansion area (Volume 4-3 TBR: Section 4.1, Section 5.1) and shallow discharge from shallow overburden flow (Volume 4-3 TBR: Section 3.5.2.2).
c. Justify the assumption of linearity in the concentration and flow relationship for all inputs into the reservoir.

d. Explain how the mass (g) of each parameter can effectively double for all indicator parameters while concentrations remain effectively unchanged.

e. Justify the use of the mass-balance model toward addressing the potential for transformation and methylation of the indicator metals, requested per final Terms of Reference 3.4.2 [D].

Response:

a. The mass balance models are based on the inflows, outflows and climate time series provided from the SOAP model. As described in the response to SIR#1 Question 7, the total inflow is the main canal inflow and precipitation on the reservoir. The inflow concentrations used for canal inflow are based on the average of data collected for station SMW-P1, while precipitation was assumed to have no mass or concentration of constituents.

   Runoff is captured broadly within the SOAP model for the catchment area of the conveyance system and is not quantified as a separate input term. Analysis of the Chin Reservoir catchment has identified that depressional storage limits the quantity of stormwater runoff that reports to Chin Reservoir for events lower than the 1:10-year return period. Water quality impacts associated with large storm events have been specifically assessed (see response to SIR#1 Question 166).

   Groundwater inflow has not been quantified, but it is expected that there would typically be a small net gain in flux of groundwater, based on groundwater gradients flowing towards the low-lying coulee and proposed application of seepage mitigation at the New East Dam. As discussed in part b) of this response, groundwater inflow has been considered through a separate mass balance modeling assessment.

   The total outflow includes discharge to Stafford Reservoir and evaporation (see response to SIR#1 Question 7).

b. The *Water Quality Analysis Technical Memorandum* (Appendix 13.1) provides estimates for the relative magnitude of groundwater contribution for the Existing Reservoir, which has been scaled to account for reservoir expansion. The data shows that there are some increases in water quality load as the average reservoir concentrations are higher than canal inflow concentrations for some parameters. Based on this relationship, the relative inflow of groundwater was inferred to be very small at 0.4% of total inflow. A mass balance water quality model was developed for a subset of constituents to represent the interaction between surface water and groundwater. In the model, the groundwater inflow was set at 0.4% of the total inflow and the canal inflow was set at 99.6% of the total inflow as specified by the SOAP model. As noted in the *Water Quality Analysis Technical Memorandum*, a significant difference in groundwater concentration is necessary to produce a noticeable impact on model results, given the large differential in input volumes from these sources. For example, sulfate concentrations in groundwater are much higher than in surface water, and serve as an indicator of the potential influence that groundwater inflow may have on reservoir water chemistry. Groundwater sulfate concentrations are approximately 100 times higher than those in the canal inflow. Although groundwater contributes only a small portion of the total inflow, its high

concentration (nearly 2,000 mg/L of sulfate) increases the reservoir sulfate concentration by 7 mg/L on average, raising the average concentration to 26 mg/L.

c. A trend analysis was conducted to assess whether temporal or seasonal trends were evident in the baseline water quality data (refer to INTERA's *Chin Reservoir Historical Canal Inflow and Modeled Arsenic Trend Analysis* provided in Appendix 17.1 of this SIR#1 Response Document). Some parameters did exhibit seasonal build up and wash off characteristics where the first flush had elevated concentrations. However, significant trends were not noted. The frequency of data collection and number of available records does not allow for the accurate representation of potential seasonal variability. Ideally observed flows would be used to determine the volume of water that acts on the water quality parameter. The early flows would begin the dilute and flush the built-up water quality concentrations. Since observed flows are not available, we would need to use the hydrology model results thus adding additional uncertainty and noise. The vast reservoir storage would act as a buffering mechanism and balance the inflow concentration. The average concentration will preserve mass entering the reservoir. The average concentration will underestimate the initial wash off concentration, but it will also overestimate the late season concentrations.

d. Mass is the product of volume and concentration. The mass of solutes within the reservoir will increase proportionately with increased storage volume even if the concentrations remain the same.

e. As described in Volume 2, Appendix 14 – Assessment of the Potential Risks to Human Health, modeling of the transformation of metals, with mercury being of key interest, was not considered to be practical given the complex nature of the potential interactions. Fish tissue mercury concentrations have been noted to exceed guideline criteria for human consumption at baseline, suggesting that mercury content is an existing concern. As a result, mitigation has been proposed (i.e., filling of the reservoir in isolation) and monitoring recommended. Management of fish tissue mercury concentrations is discussed further in the response to SIR#1 Question 214.

Question 18

Reference:

Volume 2, Section 2.4, Page 43-62;
Volume 5, Section 3, 3.5.2 [A] (i) and [K]

Rationale/Preamble:

While the information provided in Section 2.4 of Volume 2 covers most of the potential impacts regarding fish, fish habitat and other aquatic resources, some topic areas requested in the final Terms of Reference were not referenced.

Information Request:

a. Discuss whether there is potential for thermal plumes, and if relevant, how it would affect aquatic habitat.

b. Discuss potential changes in the aquatic environment based on the climate change scenarios, within and without the Project.

Response:

a. There has been no identified potential for thermal plumes to occur within Chin Reservoir under baseline conditions and the Project is not expected to cause changes that would increase the potential for thermal plumes. The temperature of water delivered within the inflow canal is not expected to vary significantly from the temperature in the reservoir, and the reservoir is typically well mixed, with limited seasonal stratification observed during baseline sampling (Volume 4, Surface Water Quality TBR, Section 3.3.2). The maximum rate of inflow canal discharge will not change, so there is no anticipated potential for the Project to affect thermal properties within the reservoir in the vicinity of the canal inlet at Chin Chute.

b. The response to SIR#1 Question 139 describes the SOAP Model simulated storages and elevations in the Waterton Reservoir, St. Mary Reservoir, and the Expanded Chin Reservoir in the two climate change scenarios, with glaciers and no glaciers, for both Base case and Expansion Scenario. No difference in Waterton Reservoir level or storage was predicted for any of the climate change scenarios. The Project would result in a larger drawdown of the St. Mary Reservoir, where the Expansion Scenario is consistently lower than the Base case Scenario under both climate change scenarios and with or without glaciers. Chin Reservoir has higher overall storage in the Expansion Scenario, but the Expansion Scenario also varies less than the Base case Scenario on a seasonal scale under climate change scenarios.

   Based on this information, it is considered likely that the influence of climate change could result in a wider range of drawdown in St. Mary Reservoir with the Project as compared to without the Project. This could represent a shift in availability of aquatic habitat within the reservoir. However, St. Mary Reservoir is subject to a large range of reservoir drawdown under baseline conditions, as it functions as a balancing reservoir within the system. Conversely,

climate change scenarios are projected to reduce the level of variation in Chin Reservoir with the Project in place, resulting in less seasonal variability in habitat availability.

Question 19

Reference:

Volume 2, Section 2.5.2, Page 64;
Volume 2, Section 3.1, Page 151;
Volume 4-5, Section 3.6.2, Table 3.10-3.11, Page 22-24;
Volume 5, Section 3, 3.1.1 [C];
Volume 5, Section 3, 3.1.2 [C]

Rationale/Preamble:

SMRID states in Section 3.1 that *Air emissions from the Project would be limited to the construction phase only, as no air emissions will be associated with the operation of the Project* and states in Section 2.5.2 states *Wind erosion risk for the LSA soil map units range from low on low relief moderately fine textured soils, to moderate and high in areas of moderately coarse to coarse textured soils.* SMRID discusses that the majority of soils in the LSA have a moderate wind erosion risk. However, the intent of the air quality assessment requested in the final Terms of Reference question it is about estimating the magnitude, extent, frequency, and duration of soil drifting during drawdown at the current and Expanded Chin Reservoirs; in effect, creating air emissions during the operational phase of the project.

Information Request:

a. Discuss baseline soil drifting from the footprint of the reservoir during current reservoir drawdown.

b. Assess the probability of soil drifting during reservoir drawdown from the existing reservoir and the Expanded Chin Reservoir in the operational phase of the Project.

Response:

a. Soil drifting is the erosion of exposed soils due to wind action. Wind erosion occurs when strong winds blow over smooth, exposed, loose, and dry soil surfaces. Wind speeds that are required to initiate erosion vary between 25 to 50 km per hour measured at 30 cm above the soil surface (GoC 2020). Particulate matter smaller than 2.5 µm ($PM_{2.5}$) are most susceptible to wind erosion. The particulate matter that becomes airborne then “drifts”. Wind erosion is curtailed when the wind dies down and no longer has the energy to transport the particulate matter, allowing the matter to be deposited on the soil surface. The potential for wind erosion is decreased when moist, compacted, or frozen soil conditions are encountered.

   Under the existing operating regime of Chin Reservoir, the water level within the reservoir fluctuates throughout the irrigation season. At the onset of the irrigation season, inflows from the Main Canal increase and the reservoir level is raised to near the FSL (861.3 m) by approximately mid-June. The reservoir is then drawn down through summer to meet downstream irrigation demands, fluctuating between FSL and the Mean Drawdown Level (MDL), or to a minimum of approximately 849.0 m (refer to Figure 140.1 in the response to

SIR#1 Question 140). The MDL was interpreted as the minimum of the mean annual reservoir level calculated based on review of historical reservoir water levels, which was equal to approximately 856.2 m, which would typically occur in mid-August. When water is available, the reservoir level is raised before the end of the irrigation operating season to a target winter elevation of 860.6 m. The reservoir level is typically stable through the winter while the system is shut down. Once the irrigation system is re-commissioned in early spring, the water level will again begin to increase once inflows exceed outflows.

Seasonal water level fluctuations have resulted in steep, eroded coulee slopes with expanses of exposed shoreline. Within this drawdown zone around the reservoir's shoreline, there is limited to no riparian areas. Therefore, the exposed soils within this drawdown zone are susceptible to soil drifting during periods of increased winds oriented along the coulee axis (easterly or westerly winds) that coincide with drawn down water levels.

Although the exposed soils within the drawdown zone are susceptible to wind erosion, other factors mitigate some of the winds effect such as the shape and orientation of the shoreline/coulee walls in relation to the wind direction, presence of natural wind breaks, and soil moisture conditions. During strong wind events that align with the axis of the coulee, large waves are created that crash up on the shoreline, continually wetting the exposed soils within the drawdown zone and limiting the potential for small particulate matter to become airborne. The predominant wind direction reported at the Chin Reservoir is west-southwest (ECCC 2025c; Windy Weather World 2025), which does not align with the orientation of the reservoir.

The magnitude of any one event is also highly dependent on the level of drawdown and whether it coincides with extended periods of strong easterly or westerly winds. In southern Alberta, periods of sustained high winds typically occur during the spring and fall as weather systems change. The strongest winds typically occur in the fall and early winter months (i.e., October through January (ECCC 2025c)). Reservoir levels are typically at their highest during the spring, minimizing the extent of exposed soils in the drawdown zone. Through the summer months as the reservoir is drawn down, wind speeds are at their lowest (ECCC 2025c). During the early fall, when reservoir levels are still drawn down, the exposed soils within the drawdown zone are most susceptible to wind erosion. Although periods of drought may increase the length of time the material is exposed through the fall, maximal reservoir drawdown is a temporary condition. Reservoir levels are raised towards the end of the irrigation season and the onset of snowfall events and frozen ground conditions mitigate the soils susceptibility to wind erosion.

Under the current operating regime of the Existing Chin Reservoir, soil drifting from the reservoir drawdown zone is localized and limited to within the confines of the coulee itself (refer to the response to SIR#1 Question 89). The shape of the coulee can influence wind patterns inside the coulee, making dispersion of airborne particulate matter less efficient and largely re-depositing the particulate matter back into the reservoir in the immediate area. As a result, wind erosion of the drawdown zone has not been noted as a concern for air quality within areas adjacent to the Existing Chin Reservoir. Wind erosion from agricultural areas

outside of the confining coulee is expected to represent a more significant influence on air quality in comparison, particularly during harvest.

b. The Expanded Chin Reservoir will be operated at a higher FSL of 864.0 m (2.64 m higher than the existing FSL). The increase in FSL relative to the Existing Chin Reservoir will coincide with a shift in water levels to maintain an operating regime similar to the existing condition, but with the potential for a broader range of fluctuation (refer to Volume 1, Section 2.3.4, Page 31 and Section 2.6.1, Pages 38 and 39 of the EIA submission). The Expanded Chin Reservoir will be raised in the spring to near the new FSL (864.0 m) by approximately mid-June. During the irrigation season, the Expanded Chin Reservoir is expected to fluctuate between FSL and the MDL, to a minimum of around 849.0 m (refer to Figure 7.4 in the response to SIR#1 Question 7). The MDL was interpreted as the minimum of the predicted mean annual reservoir level, equal to approximately 857.3 m (based on the full range of simulation (i.e., 1928 to 2009)), which would occur in mid-August. Soil drifting is expected to continue in a similar manner to what has been observed within the Existing Chin Reservoir. The wider range of reservoir fluctuation will result in a larger drawdown zone. As noted in the response to SIR#1 Question 19 (a), soil drift is considered to represent a minor potential influence on air quality, and the potential incremental effect during operation of the Expanded Chin Reservoir is expected to be negligible.

Question 20

Reference:

Volume 2, Section 2.8.4.5, Page 137 and 138;
Volume 2, Section 2.8.6, Page 139–143

Rationale/Preamble:

SMRID describes a regulatory details section that states *…identify the municipal and provincial regulations and policies that were considered pertinent to the proposed Project design*. However, SMRID does not indicate whether the Project is in alignment with the presented municipal and provincial policies or any foreseeable constraints that may be imposed on the Project by these policies.

Information Request:

a. Explain why relevant provincial directives or policies related to the abandonment of oil and gas wells are not presented in this section.

b. For each Municipal Development Plan (MDP) or Intermunicipal Development Plan (IDP) presented, provide a discussion on alignment of the Project with the bylaws or outcomes of the plans and describe any constraints to development associated with these plans.

c. For each provincial legislation, framework, or plan in Section 2.8.6, discuss the alignment of the Project with the outcomes of the policy tools, and whether any foreseeable constraints on project outcomes exist.

Response:

a. Relevant provincial directives or policies associated with the abandonment of oil and gas wells (i.e., AER Directive 020 [AER 2024a]) is discussed in Volume 1, Section 2.7 of the EIA. The process for abandonment of oil and gas wells is discussed further in the response to SIR#1 Questions 11 and 103.

b. The alignment of the Project with the Municipal Development Plans (MDPs) and Intermunicipal Development Plans (IDPs) is being promoted through consultation with each of the municipalities. The municipalities manage their land use and development through a number of plans and bylaws, according to the *Municipal Government Act* (R.S.A. 2000, c. M-26), and in alignment with the SSRP which provides long-term guidance for development in southern Alberta, aligning economic, environmental, and social goals across the region. The IDPs involve formal agreements between the neighbouring municipalities to help coordinate land use, infrastructure, and growth in bordering areas. The MDPs set out the council's long-term goals for how the municipalities will grow and evolve. Once a regional plan is enacted, every local government body and decision-maker must review its regulatory instruments and make any necessary changes, or implement new initiatives to comply with the regional plan.

As noted in Volume 1, Section 1.12.3 of the EIA and in the response to SIR#1 Question 44, SMRID provided notification packages of the Chin Reservoir Expansion Project to the nearby municipalities in the fall of 2022. This included the County of Warner, Municipal District of Taber, Town of Taber, Lethbridge County, and the County of Forty Mile. Consultations with the municipalities were conducted individually and included in-person meetings. Meetings before the municipal councils of the County of Warner and the Municipal District of Taber occurred in the fall of 2022. All municipalities have expressed support for the Project and no concerns were raised during the consultations. SMRID will ensure that the affected municipalities continue to be consulted throughout Project planning and development. Potential constraints associated with MDP and IDP requirements have not been identified, but will be discussed during future consultation with the municipalities.

c. Please refer to Volume 1, Sections 1.9 through 1.14 of the EIA for discussion on the Project rationale, alignment with the SSRP, provincial and federal regulatory framework, government agency consultations, stakeholder engagement, and Indigenous consultations.

The SSRP is a land use planning document that provides a framework under the Alberta Land-Use Framework (GoA 2008) for managing growth and development in the South Saskatchewan River Basin (SSRB). Pursuant to Section 13 of the *Alberta Land Stewardship Act* (S.A. 2009, c. A-26.8), regional plans are legislative instruments and, for the purpose of any other enactment, are considered to be regulations (GoA 2018b). The *Alberta Land Stewardship Act* (2009) and Regulation (GoA 2011a) provide the legislative framework and legal authority for implementation of the Alberta Land-use Framework and regional plans. This Act is the legislative foundation for land-use planning in the province. The Project must adhere to the applicable regional plan (i.e., the SSRP) under this Act. The *Alberta Land Stewardship Act* Regulation provides the process of review requests, various applications, and compensation applications in relation to a regional plan. Should the Project require any of the previously listed processes, the regulation will provide guidance (discussed further below).

The SSRP uses a cumulative effects management approach to balance economic development opportunities and social and environmental considerations, setting desired outcomes and objectives for the region. The SSRP describes strategies, actions, approaches, and tools required to achieve the desired outcomes and objectives. Monitoring, evaluation, and reporting commitments are established to assess the progress in achieving outcomes and objectives. Planning and decision-making in the region are then carried out by a range of decision makers under various provincial legislation and policies, including GoA departments, boards, and agencies and the municipal governments.

The Project will align with the Principles for Minimizing Surface Disturbances in Native Grassland (GoA 2016) and the Alberta Prairie Conservation Action Plan (Prairie Conservation Forum 2021) by incorporating the guiding principles of these plans for restoration of temporary disturbance areas in native prairie habitat within the detailed site-specific C&R Plan.

The Chin Reservoir Expansion Project is part of the Alberta Irrigation Modernization (AIM) program, an investment in Alberta's irrigation infrastructure meant to stimulate the Alberta economy and increase irrigation in Alberta. The AIM program is a shared investment between

the GoA and the participating irrigation districts across the region. The Chin Reservoir Expansion Project is a joint project between the SMRID and RID meant to add additional off-stream water storage.

The AIM program aims to enhance productivity, sustainability, and economic resilience in the province's agricultural sector, aligning with the SSRP's desired economic and social outcomes and objectives for the region. Each of the modernization and off-stream water projects proposed under the AIM program are subject to all applicable regulatory processes and the off-stream water projects are subject to significant regulatory review as determined by the GoA and federal regulators. The development of the fToR for the provincially-mandated review process (i.e., EIA) allows for the assessment, management, and monitoring of effects to economic, environmental, and social values (refer to Volume 1, Section 1.12.1.1 of the EIA).

As mentioned above, the Project will be subject to applicable provincial and federal regulatory processes. Formal application and written authorization from a number of Minister's will be required prior to construction. As stated in Volume 1, Section 1.12.1.2 and Volume 2, Section 2.8.6.2, the Project will require approval for the inundation of Chin Coulee Provincial Recreation Area and the creation of any new Provincial Park within the PA (as per the *Provincial Parks Act* (R.S.A. 2000, c. P-35)). Any foreseeable constraints on Project outcomes will be discussed with EPA, Alberta Forestry and Parks, and TEC (please refer to the response to SIR#1 Question 69).

As stated in Volume 2, Section 2.8.6.2 and also discussed in the response to SIR#1 Question 197, the Project will require a Licence of Occupation (LOC) disposition application under the *Public Lands Act* (R.S.A. 2000, c. P-40) for the occupation of bed and shore for the newly created dam structure that is on crown lands. The disposition is expected to include approval conditions that align with the Public Lands Administration Regulation (A.R. 187/2011) (GoA 2011b). Any foreseeable constraints on Project outcomes will be discussed with EPA and Alberta Forestry and Parks.

As stated in Volume 2, Section 2.6.4.1.3 and in the response to SIR#1 Question 206, impacts to wetlands will be described in a Wetland Assessment and Impact Report (WAIR) submitted as part of a *Water Act* (R.S.A. 2000, c. W-3) application for Approval. In addition, the Project will be subject to review requirements related to dam safety considerations. Any foreseeable constraints on Project outcomes will be included as part of the terms and conditions of the *Water Act* Approval and License.

As discussed in Volume 2, Section 2.9.2.1, the Project will require approval under the *Historical Resources Act* (R.S.A. 2000, c. H-9) from the Historic Resources Management Branch (HRMB). Any foreseeable constraints will be included as part of the requirements document issued by the HRMB to inform the Historic Resources Impact Assessments (HRIA) carried out prior to the issuance of the *Historical Resources Act* approval.

Please refer to the response to SIR#1 Question 8 for a consolidated summary and schedule of monitoring and mitigation activities proposed for the Project and how the results of the monitoring actions will be communicated to inform adaptive management practices and assess alignment with the SSRP.

Question 21

Reference:

Volume 2, Section 4.2.1, Table 4.1 and 4.2, Page 159 and 160;
Volume 2, Section 4.2.2.5, Page 165;
Volume 5, Section 6, 6.1 [A] (b)

Rationale/Preamble:

SMRID references the New East Dam breach inundation study as presented in the Preliminary Design Report (KCB 2023) and had applied a 1D HEC-RAS model to estimate breach outflow hydrographs for fair-weather and flood-induced failures, culminating in a table of peak discharge and volumes for the flood scenarios. SMRID states *For a fair-weather breach (with and without Hwy 879 failure), four permanent residences would be impacted by the breach flow*; however, no mitigation measures are described in the EIA to address the effect of a dam breach on the downstream residents other than referencing breaching of the existing dam on impacts to workers during construction.

Information Request:

a. Provide map(s) of the lateral extent of fair-weather and flood-induced dam breaches relative to the residences that are located in the Chin Coulee.

b. Provide mitigation measures to protect these residences in the event of a dam breach during the operation phase of the Project.

c. Describe how residents will be contacted during emergencies other than fires and the type of information that will be communicated to them, similar to *Community Engagement and Preparedness* Section for fire control.

d. Document any safety concerns raised by stakeholders during consultation on the Project and the actions taken to address those concerns, per the final Terms of Reference.

Response:

a. The New East Dam Breach Inundation Study is included in Appendix VI of the New East Dam PDR. The dam breach inundation maps, showing the lateral extent of fair-weather induced dam breaches in Appendix VI are presented on Figure Nos. II-1 and II-2 and for flood-induced dam breaches on Figure Nos. II-3 and II-4. Figure Nos. II-1 to II-4 show the permanent population at risk (i.e., residences), PAR 1 to 4. The PDR is provided in Appendix 1.1 of this SIR#1 Response Document.

b. In accordance with the Alberta Dam and Canal Safety Directive, the SMRID, as the dam owner, will prepare an Emergency Preparedness Plan, Emergency Response Plan, and a Flood Action Plan. Upon receiving acceptance of the Emergency Preparedness Plan in writing by the Director of Alberta Agriculture and Irrigation Dam Safety, the SMRID will communicate to persons directly affected by the New East Dam any information from the Emergency Preparedness Plan that is relevant to them.

c. As will be specified in the Emergency Preparedness Plan, residents, municipalities, and local road authorities will be contacted during emergencies by telephone call-out, cellular text messaging, and, if applicable, e-mail. In addition, designated SMRID personnel will travel to site to communicate with potentially impacted residents.

d. To date, there have not been any safety concerns raised by stakeholders during consultation on the Project. Summaries of consultations with stakeholders and the public for the Chin Reservoir Expansion Project are provided in the response to SIR#1 Question 44 (a), Table 44.1, Table 44.2, and Table 44.3.

Question 22

Reference:

Volume 2, Section 2.8.4.2.2, Page 135;
Volume 5, Section 3, 3.10.2 [B] (c)

Rationale/Preamble:

Final Terms of Reference 3.10.2[B] (c) requires descriptions of *Procedures that will be followed in compensating landowners for lands required for the Project and for associated damages or disturbances.*

Information Request:

a. Provide information regarding the procedures that will be used.

b. Discuss the status of negotiations with affected landowners/grazing lease holders.

Response:

a. In Alberta, the process of land acquisition by the SMRID for the construction or maintenance of irrigation works is carried out under the authority granted by Section 9 of the *Irrigation Districts Act* (R.S.A. 2000, c. I-11).

   SMRID is committed to working collaboratively and in good faith with landowners throughout the negotiation process, striving to reach mutually agreeable solutions. The organization adheres to fair market value principles when determining compensation for acquired land, ensuring landowners are treated equitably based on current market conditions.

   These efforts reflect SMRID's strong preference to secure land through voluntary agreements. However, when such efforts are unsuccessful, SMRID may proceed with land acquisition through expropriation—a legal process governed by Alberta's *Expropriation Act* (R.S.A. 2000, c. E-13). Expropriation, used only as a last resort, allows an expropriating authority to acquire land without the owner's consent in accordance with statutory powers and defined procedures.

b. A Land Agent first engaged the landowners in the spring / summer of 2023. The following items were left with the landowners following the rules of engagement as per the *Expropriation Act*:

   - Land Agent's business card citing Land Agent # 4832 that included contact information.
   - Appraisal dated May 2023 completed by Serecon.
   - Appraisal dated March 2023 completed by Tru Appraisals.
   - Letter citing the number of acres the SMRID wishes to purchase. The letter explains the terms of the funding through the Canadian Infrastructure Bank, to be applicable for funding we can not pay more than fair market value. The letter further explains that if they would like to engage a third opinion of a certified appraiser, the SMRID would pay up to $5,000 to have one completed.

- Agreement for the purchase of lands as required by the project.
- Plan view drawings of the project.

Numerous discussions have taken place with each affected landowner as SMRID requested access to their lands to conduct necessary testing or assessments for the Project. In every instance, verbal or written consent was granted when access was requested. In some cases, compensation was provided to landowners for any inconvenience or disturbances caused by the testing or assessment activities.

In March 2024, a group of landowners known as the Chin Coulee Landowners Group attended an SMRID Board of Directors meeting to discuss their concerns. The group had recently held a meeting and decided to engage with the Board regarding issues they were facing. SMRID appreciated the constructive points raised during the meeting and values the ongoing collaboration and cooperation demonstrated by the landowners.

The Chin Coulee Landowners Group has expressed their intent to retain their lands until government approvals for the Project are secured. SMRID greatly appreciates their willingness to permit the required testing on their lands during this period.

Upon receiving NRCB Approval following the public interest hearing, SMRID will commission updated appraisals for each affected property at SMRID's expense. Additionally, SMRID will cover the costs for each landowner to obtain their own independent appraisal. Once the updated appraisals are available, SMRID will endeavor to hold a minimum of two follow-up meetings with landowners to facilitate open dialogue and work towards mutually agreeable terms before initiating any expropriation process.

As the Project in entirety is taking place on fee simple land, there are no grazing lease holders.

Question 23

Reference:

Volume 2, Section 3, Page 151;
Volume 2, Appendix 14;
Volume 5, Section 6, 6.1 [C] and [D]

Rationale/Preamble:

The final Terms of Reference Sections 6.1 C states *Document health concerns raised by stakeholders during consultation on the Project* and 6.1 D states *Document health concerns identified by Indigenous communities or groups resulting from impacts of existing development and of the Project, specifically on their traditional lifestyle* and *Include an Indigenous receptor type in the assessment.*

Information Request:

a. Provide the requested documentation.

b. Provide the results of a human health risk assessment that includes an indigenous receptor.

Response:

a. SMRID's consultation on the Project is described in Volume 1, Section 1.13 for the various stakeholders, and in Volume 1, Section 1.14 for the Indigenous Consultations. An information package on the Project was provided for public viewing at the SMRID office in Lethbridge in October 2022. In addition, an information guide was posted online on the SMRID website in October 2022. Public notifications regarding the proposed Terms of Reference (pToR) for the EIA were published on November 15 and 16, 2022, which initiated a 48-day public review period.

   Summaries of consultations with stakeholders and the public for the Chin Reservoir Expansion Project are provided in the response to SIR#1 Question 44 (a), Table 44.1, Table 44.2, and Table 44.3. To date, SMRID has received no health-related concerns about the Project.

b. An Indigenous receptor was not included in the Assessment of the Potential Risks to Human Health (HHRA) (Volume 2, Appendix 14) for the following reasons.

   There are no First Nations communities close to the Project Area. In the Land Use and Management assessment (Volume 2, Section 2.8), the Project Area includes the Expanded Chin Reservoir, the predicted inundation area around the Existing Reservoir, access roads, laydown areas, and any sites temporarily disturbed during construction. The LSA comprises all areas that may be affected by the Project and includes Chin Coulee surrounding the Project Area, secondary coulees, and the tablelands between them, along with a 100 m buffer. While no urban or residential communities exist within the Land Use and Management LSA, there are residential-farm operations that exist throughout. Land within the LSA is dominated by farming and ranching.

The Project is located within the traditional lands of the Blackfoot Confederacy, composed of the Kainai, Piikani, and Siksika First Nations. The closest First Nation reserve is the Blood Indian Reserve #148, located approximately 45 km southwest of the LSA.

There is no public access to any private lands within the LSA, nor is there public access to the dam or a public roadway across the Existing East Dam. Due to the topography, land ownership within the LSA, and limited road access to the Existing Reservoir, public access to the area is very limited. Access for consumptive recreation (e.g., fishing) and non-consumptive recreation (e.g., boating) is primarily through the Chin Coulee Provincial Recreation Area.

During the construction phase, public access to the isolated portion of the reservoir in the immediate vicinity of construction works will be restricted during decommissioning of the Existing East Dam. This would represent a minor temporary loss in access to the isolated portion of the reservoir for consumptive activities, such as fishing, and non-consumptive activities, such as boating.

As described in Section 1.14 of Volume 1, engagement was initiated with the Blood Tribe in October 2022. Members of the Blood Tribe were provided with the background, purpose, and schedule of the Project. The Blood Tribe requested access to the inundation area prior to flooding to conduct a walk-through with elders. The SMRID has invited the Blood Tribe to conduct a walk-through of the Project area prior to winter 2025. Following this walk-through, SMRID will further discuss potential next steps and determine any additional involvement the Blood Tribe may have during Project development and operation. No health-related concerns were raised by members of the Blood Tribe. For further discussion on the engagement process with members of the Blood Tribe, please refer to the response to SIR#1 Questions 43 (b), 46, 48, and 49 (a).

Members of the Blood Tribe are not expected to be disproportionately affected by the Project when compared to the residents of the sensitive receptor locations within the LSA. The potential health risks presented at the locations closest to the Project and described in the HHRA (Volume 2, Appendix 14) are expected to be greater than those presented for individuals who intermittently spend time in the areas surrounding the reservoir, which would include traditional use of the land. As such, risks to Indigenous receptors were not explicitly described in the HHRA.

Question 24

Reference:

Volume 2, Section 5.1.2, Page 171;
Volume 5, Section 2, 2.4 [B], [C], [E] and [F]

Rationale/Preamble:

SMRID indicates that the Highway 36 re-design is currently in the preliminary design phase, with design completion anticipated in December 2024.

Information Request:

a. Answer all final Terms of Reference questions in Section 2.4 [B], [C], [E] and [F].

b. Provide this report once the preliminary design is completed.

Response:

a. Preliminary design of the Highway 36 Bridge Replacement project is currently being carried out by TEC. The Highway 36 Bridge is reaching its service life span and requires replacement. As part of the re-design, the bridge replacement will involve alterations to the alignment, height, and span across Chin Reservoir to account for the higher reservoir FSL proposed for the Chin Reservoir Expansion Project. The approach of Highway 36 will also be re-aligned as part of the re-design. TEC and SMRID have engaged in numerous collaborative discussions during the preliminary design phases of each project and will continue to coordinate on the status of both. The collaborative discussions have included a variety of topics including water levels, clearance requirements, the low-level channel, span of the bridge openings, piers, etc.

   The Highway 36 Bridge Replacement project is being carried out in accordance with TEC's transportation policies and technical guidelines and will comply with applicable provincial and federal environmental regulatory requirements. Terms specified in the fToR Section 2.4 [C] will be addressed by TEC in the Highway 36 Bridge Replacement project's PDR. SMRID does not have access to this PDR. However, a letter from TEC (provided in Appendix 24.1 of this SIR#1 Response Document) confirms that the bridge replacement will be completed in a manner that accommodates the proposed FSL increase. The reservoir FSL raise will not occur until after the bridge replacement has been completed. The Expanded Chin Reservoir can continue to operate at the existing FSL after the New East Dam is constructed until the bridge replacement is complete.

   To address the term specified in the fToR Section 2.4 [E], there is no potential for Project infrastructure to affect provincial highways as there is no proposed infrastructure that will cross a provincial highway or will be constructed in close proximity to any provincial highway. Construction-related impacts that pertain to air and noise effects are temporary in nature and localized to the construction footprints and will not have an impact on highway users.

Air and noise effects are discussed in more detail in the responses to SIR#1 Questions 52 - 57 and 87 - 91.

A temporary construction-related effect that may impact highway users relates to truck traffic that may utilize sections of highway to transport materials to the construction site. Please refer to the response to SIR#1 Question 71 that provides a Traffic Impact Assessment (TIA).

Operation of the Expanded Chin Reservoir will not impact provincial highways.

b. Please refer to the response to SIR#1 Question 24 (a).

Question 25

Reference:

Volume 3, Section 2.2, Table 4, Page 29

Rationale/Preamble:

SMRID describes the type of direct, indirect, and induced impacts that are estimated in the assessment. It appears that some indirect impacts to irrigation producers are estimated independently, while some are estimated using an Input-Output model.

Information Request:

a. Provide clarification on what activities are considered direct, indirect, and induced with respect to irrigation production expansion afforded by the Project.

b. Provide clarification on which impacts were estimated outside of the Input-Output model and which were estimated using the Input-Output model.

c. Provide clarification on how double counting was avoided when estimating direct, indirect, and induced economic impacts.

Response:

a. ***Direct Activities***

Direct activities are associated with irrigation production as well as those on-farm activities associated with irrigation production. An example of an associated activity is livestock production which is possible through greater availability to forage (especially silage barley or corn).

The following activities are considered to be direct activities:

- Investment in pivot irrigation systems, and associated infrastructure costs (e.g., water supply and electricity).
- Purchase of specialized machinery and equipment specifically needed for irrigated production (e.g., potato production equipment and storage facilities).
- Irrigated crop production.
- Irrigation-related livestock production on-farm.
- Drought mitigation (farm-level).
- Construction of the New East Chin Dam and associated costs.

Indirect Activities

Indirect activities are those activities in other economic sectors that are linked to irrigated crop production. These activities are a result of two types of linkages - Backward Linkages and Forward Linkages. Backward linkages are those that are generated through purchase of inputs

needed for irrigated production (e.g., seed, fertilizer, pesticides, and fuel). Forward linkages are those that create additional economic activities through purchase of products produced under irrigation.

Induced Activities

Induced activities relate to additional income generated through direct/associated and indirect activities. These activities result in the hiring of additional production personnel. This income is subsequently spent on various consumer goods, which require consumer goods producing sectors to increase their production capacity.

b. The following economic impacts were estimated using the Input-Output model:

- Investment in on-farm infrastructure (e.g., pivot systems, water supply infrastructure, and 3-phase electricity) to enable irrigation.
- Purchase of specialized machinery and equipment needed for irrigated production.
- Costs related to irrigated crop production (e.g., seed, fertilizer, pesticides, fuel, electricity, etc.).
- Costs related to livestock production (feed, water, bedding, corrals, etc.).
- Backward linkage-based impacts related to crop production.
- Backward linkage-based impacts related to livestock production.
- Forward linkage-based economic impacts related to crop and livestock production.
- Construction of Chin Reservoir expansion infrastructure (dam and associated infrastructure).
- Flood Mitigation.

The following economic impacts were carried out without using the input-output model:

- Drought Mitigation.
- Fiscal Impacts.

The following impacts were not estimated in this study:

- Rural development impacts.
- Enhanced habitat development.
- Renewable energy production.

c. Double counting in this study was avoided through the following methods:

- Crop and livestock production, area and animals (poultry) were estimated for only irrigation to avoid double counting with dryland production.
- Backward and forward linked impacts were based on the quantities relevant to irrigation only.

- In the forward linked-impacts production that has already been included in the Input-output analysis was taken out for estimating these economic impacts.
- Drought mitigation impacts were estimated only for the irrigated area (ignoring dryland area).

Question 26

Reference:

Volume 3, Section 2.2.1, Page 30

Rationale/Preamble:

SMRID refers to several sources of historical data.

Information Request:

a. Provide clarification whether historical data relied upon in the assessment was inflated and what year dollars are presented in the report (e.g., are all dollars $2023?).

Response:

a. The study was undertaken using nominal dollars. Crop and livestock production analysis used an average of the 2018-2020 prices and yields. No inflation adjustment was made in the prices.

Question 27

Reference:

Volume 3, Section 2.2.2, Page 31

Rationale/Preamble:

SMRID describes the assessment of forward linkages associated with expanded irrigation production afforded by the Project.

Information Request:

a. Justify the inclusion of forward linkage impacts in the analysis. For example, establish what, if any, excess capacity exists with processors.

b. Specify all forward linkage industries analyzed in the assessment.

c. Provide a clarification for how much additional production resulting from the Project is assumed to be purchased by forward linkage industries in Alberta versus exported.

Response:

a. Forward linkages were based on information related to the irrigation districts, and information in the Alberta Input-output model. Table 27.1 provides a detailed table of Alberta Input-Output coefficients for the agricultural processing sector.

b. Because there are so many crops and livestock commodities produced under irrigation, a commodity-by-commodity analysis was not considered to be feasible. In addition, since the input-output model is based on a demand driven methodology, it was assumed that all sectors have the capacity to absorb the added irrigated-related outputs.

   The following forward-linked industries were included in this study:

   - Slaughter and Meat Processing
   - Grain Processing and Bakeries
   - Animal Food Processing
   - Fruits and Vegetable Processing
   - Sugar Manufacturing
   - Dairy Product Manufacturing
   - Other Food Processing

c. Analyses for this study were based on an aggregate of all commodities. Information for individual commodities was not collected.

   Our experience indicated that nearly all value-added crops [e.g., Potatoes, Sugar Beets, Seed Canola, Alfalfa Seed, Dry Beans, Mint, Dill, Grass Seed, Fresh Vegetables (corn, peas, onions)]

are all processed in Alberta. Crops such as grain corn, feed barley, and silage (corn and barley) are sold to intensive livestock feeding operations—mainly cattle feedlots. In addition, intensive livestock feeding operations purchase feed barley and corn from dryland areas in Alberta, Saskatchewan, Manitoba, Montana, and Nebraska.

Poultry (chickens and turkeys) would also be processed mainly in Alberta. All dairy products would also be processed in Alberta.

While feeder cattle and hogs are also processed in Alberta, some may also be shipped out the province for processing in the U.S. Pacific Northwest. The number of livestock exported for processing in the U.S. will vary, depending on the demand, supply and capacity of the Alberta processing plants. We do not have the specific information related to this issue.

Table 27.1 Alberta Input-Output Coefficients for the Agricultural Processing Sector

Alberta Input-output coefficients for the Agricultural Prodcessing sector							
	Animal Food Manuf.	Grain & Oilseed Milling	Sugar Prod. Manuf.	Fruits & Veg. Processors	Dairy Prod. Manuf.	Meat Prod. Manuf.	Other Food manuf.
1 Irrigated Other Crop Production	0.006518858	0.033840077	0.002269002	0.012343416	3.7201E-06	6.12911E-05	0.002305199
2 Dryland Other Crop Production	0.066931045	0.347446073	0.023296514	0.126733495	3.81953E-05	0.000629294	0.023668158
3 Irrigated Feed Production	0.002208525	0.011464687	0.000768716	0.004181828	1.26033E-06	2.07648E-05	0.000780979
4 Dryland Feed Production	0.004903393	0.025454029	0.001706711	0.009284543	2.7982E-06	4.61023E-05	0.001733938
5 Greenhouse, nursery and floriculture production (except cannabis)	0.001781926	0.009248737	0.000620633	0.003392196	1.23554E-06	1.78733E-05	0.000632414
6 Irrigated Cattle Production	0.000187894	2.94384E-05	2.63379E-05	0.0003309	0.029283414	0.029696128	0.000303452
7 Dryland Cattle Production	0.001998971	0.00031319	0.000280204	0.00352038	0.311540615	0.315931398	0.003228372
8 Irrigated Other Animal Production	5.82419E-05	9.12507E-06	8.164E-06	0.00010257	0.009077029	0.009204959	9.40617E-05
9 Dryland Other Animal Production	0.000670713	0.000105084	9.40166E-05	0.001181191	0.104530981	0.106004217	0.001083213
10 Forestry and Logging	6.96891E-05	0.000321865	3.38329E-05	0.000164745	5.99638E-06	5.12549E-06	3.56502E-05
11 Mining & Quarry.	0.003043391	0.002672375	0.008135616	0.004103905	0.002068043	0.001922844	0.004452702
12 Utilities	0.006718	0.006111049	0.004723755	0.012058264	0.009252591	0.003955166	0.008612924
13 Bldg. Construction	0	0	0	0	0	0	0
14 Eng. Construction	0	0	0	0	0	0	0
15 Other Construction	0.002349189	0.001312604	0.009085016	0.002018995	0.003675008	0.001202972	0.002670918
16 Animal Food Manuf.	0.015766274	2.55787E-05	0.000106168	5.00946E-05	1.10612E-05	0.000100592	6.35383E-05
17 Grain & Oilseed Milling	0.022329228	0.004617511	0.045889348	0.012886224	0.000253173	0.000227385	0.017505598
18 Sugar Prod. Manuf.	0.001026659	0.000185636	0.002118376	0.000585194	1.02749E-05	1.04764E-05	0.000807949
19 Fruits & Veg. Processors	0.003951497	0.000708963	0.00801542	0.002223492	4.13589E-05	6.35564E-05	0.003089069
20 Dairy Prod. Manuf.	0.000322718	8.63019E-05	0.000616721	0.002130109	0.007067197	2.88463E-05	0.001120236
21 Meat Prod. Manuf.	0.067002254	7.44108E-05	0.000287646	0.000987662	0.001235254	0.026720743	0.003931977
22 Seafood Prod. Manuf.	8.6422E-06	1.90064E-07	2.32252E-07	2.0536E-07	4.92199E-08	3.08457E-06	1.42855E-07
23 Other Food manuf.	0.01215413	0.002281647	0.024928874	0.006966903	0.000143944	0.000139738	0.009642857
24 Beverage & Tobacco Manuf.	0.002703078	0.007637888	0.002071436	0.003565439	0.000171076	6.91337E-05	0.002998426
25 Textile Mills	2.48272E-05	6.68433E-06	7.29E-06	1.54268E-05	8.03017E-06	1.12067E-05	1.58312E-05
26 Clothing Manuf.	2.56713E-05	1.77325E-06	5.11305E-06	5.77886E-06	3.13975E-06	1.07591E-05	6.97061E-06
27 Paper Manuf.	0.002451616	0.000725224	0.000467623	0.006872128	0.001587923	0.002721392	0.004125655
28 Printing	0.000837396	0.000255788	0.000186893	0.002287936	0.000530596	0.000904038	0.001377742
29 Petropleum & Coal Manuf.	0.00670393	0.002014013	0.00459171	0.009784326	0.003910529	0.003274814	0.007216056
30 Chemical Manuf.	0.011797687	0.00141024	0.000960919	0.000774457	0.0007388	0.000258284	0.001856978
31 Plastic & Rubber Manuf.	0.001053341	0.000346397	0.000753495	0.001532135	0.000581808	0.000505138	0.001119193
32 Metalic and Min Manuf.	0.002597069	0.000771463	0.00150405	0.002971084	0.001098571	0.000799791	0.001963707
33 Other Non Food Manu.	0.002698935	0.000413294	0.00031473	0.002485339	0.000943123	0.001269961	0.001814976
34 Equipment Manuf.	0.002149699	0.000670453	0.002618479	0.001114799	0.001108988	0.000491718	0.001137143
35 Vehical Manu.	1.57326E-05	3.4323E-06	1.21779E-05	6.31394E-06	8.75779E-06	6.61965E-06	1.00565E-05
36 Wholesale Trade	0.02587644	0.020426499	0.026168357	0.022082905	0.00575762	0.005929027	0.014998011
37 Retail Trade	0.029662075	0.023566905	0.02985562	0.025184412	0.006093051	0.006654097	0.016940468
38 Air Transp.	0.005756847	0.005132493	0.004727601	0.00439544	0.004226546	0.00186159	0.004055492
39 Rail Transp.	0.003916683	0.003527354	0.003218934	0.003035974	0.002883102	0.00127313	0.002759945
40 Truck Transp.	0.01553411	0.021240584	0.013319963	0.021655015	0.012247195	0.006224666	0.01091449
41 Passenger Transp.	0.002170092	0.001929959	0.001784824	0.001661757	0.00160468	0.000704955	0.0015369
42 Pipeline Transp.	0.008819429	0.007837312	0.007221712	0.006773848	0.006528895	0.002871741	0.006264204
43 Couriers & Messengers	0.002209625	0.001973619	0.001813652	0.001699812	0.001624892	0.000717175	0.001559684
44 Warehousing & Stor.	0.002200216	0.011609142	0.002543732	0.014481624	0.002680492	0.002272823	0.001505889
45 Publishing Industr.	0.000733959	0.000300396	0.000272937	0.001051175	0.000641171	0.000160089	0.001825894
46 Motion Picture Industr.	8.30124E-05	4.22118E-05	5.22193E-05	7.977E-05	6.20206E-05	2.00864E-05	8.00716E-05
47 Broadcasting	0.00249242	0.000756957	0.000930701	0.002577855	0.002640724	0.000478635	0.003490759
48 Finance and Insurance	0.007928694	0.007330274	0.006213405	0.011791985	0.007259161	0.006683703	0.00995264
49 Professional and Personal Serv.	0.018234156	0.008274725	0.014795203	0.024693204	0.02288377	0.010029828	0.025521496
50 Administrative, Wst. Mgt	0.004915634	0.004036343	0.004007084	0.006613478	0.004051589	0.001926204	0.004245522
51 Educational Serv.	0.000534819	0.00024266	0.000258899	0.000695882	0.000642937	0.000294302	0.000715835
52 Health Care & Soc. Asst.	0.000727751	0.000102913	0.000290524	0.000252176	0.000402438	8.82927E-05	0.000396316
53 Arts, Enter. & Recr	0.000846068	0.000311531	0.00037282	0.001004502	0.000760753	0.000183171	0.0015259
54 Accomodation & Food	0.0046818	0.002186113	0.004239952	0.005284896	0.003997762	0.001038982	0.007526032
55 OtherNon-Pub. Admn. Serv.	0.000265358	0.000142176	0.000176627	0.00027302	0.000150444	6.26493E-05	0.00034203
56 Other Federal Govt. Serv.	0.00024458	0.000136353	0.000683402	0.000246413	0.00033702	0.000123408	0.000300836
57 Other Provincial Govt. Serv.	0.000441198	0.000286121	0.000695381	0.000489472	0.000492468	0.000259946	0.000491489
58 Other Municipal & Aborg. Serv.	0.00096769	0.000797698	0.000827026	0.006047393	0.000735595	0.00058025	0.001536849
59 Indirect taxes	0.006092742	0.002720044	0.005280039	0.006383112	0.003840692	0.001887951	0.005378462
60 Subsidies	0	0	0	0	0	0	-6.95971E-07
61 Labour Income	0.091185814	0.038979181	0.20461713	0.149697148	0.118813065	0.095420773	0.194030381
62 Other operating surplus	0.112319135	0.100748064	0.125327211	0.163691752	0.120933495	0.12739751	0.327586471
63 Imports Interprovincial	0.214444422	0.150443852	0.18621885	0.149550475	0.120871068	0.182614965	0.122816469
64 Imports Foreign	0.179161354	0.124154738	0.206854031	0.131505295	0.056642135	0.029644654	0.121673781
65 Other Leakages	0.004493657	0.000198562	0.000726947	0.000438738	0.001260678	0.006279986	0.000622298
Total	1	1	1	1	1	1	1

Question 28

Reference:

Volume 3, Section 3.3.1, Page 41

Rationale/Preamble:

SMRID refers to both gross domestic product (GDP) and labour income; however, it is not clarified in the assessment that labour income is a component of GDP.

Information Request:

a. Include a clarification in the assessment that labour income is a subset of GDP and that the two measures are not additive.

Response:

a. GDP, using the income approach, is a sum of value of five economic entities:
    i. Wages, salaries, and supplementary labor income.
    ii. Corporate profits.
    iii. Interest and miscellaneous investment income.
    iv. Income earned by sole proprietors and from the Housing subsector (net of expenses).
    v. Net income from transfer payments from businesses (indirect taxes less subsidies).

    Within Volume 3, the GDP includes labour income but not the other entities shown above. Labour income is a part of GDP. However, the two measures (GDP and labour income) are not additive.

Question 29

Reference:

Volume 3, Section 4.1, Page 48-53;
Volume 4-1, Section 2.3-3.1.1, Page 12-15

Rationale/Preamble:

A discrepancy appears to exist between the runoff estimates in the hydrology baseline study and the estimated value of flood mitigation in the socio-economic assessment. In the hydrology baseline study, SMRID summarizes that runoff entering the Expanded Chin Reservoir from the effective drainage area is expected to be low. Here, SMRID references a number of reports in their discussion on effective or contributing drainage areas (KCB 2022a), probable maximum precipitation and flood (Matrix 2017), and the Inflow Design Flood (IDF) for the East Dam (KCB 2022b) that establish the basis for runoff estimates. However, no specific or summary information were presented in the EIA, and these reports are not publicly available for cross-referencing. In the socio-economic assessment, SMRID states that the main canal intercepts runoff from storm events and emphasizes the importance of the Project for flood mitigation, stating an overall economic impact of $155,926,700, and a 50-year revenue and expense saving of $326,375,896. The assumptions made in the expected value of flood mitigation are for a 1:10 year flood return interval, but no specific information is provided on the hydrological or areal extent of the 1:10 year flood.

Information Request:

a. Provide a detailed summary of all relevant information related to runoff estimation and flood mitigation including, but not limited to:
    i. Maps of the LSA and RSA used in the hydrological baseline study relevant to runoff capture by Chin Reservoir.
    ii. Topographic maps of the contributing catchment area for the existing and Expanded Chin Reservoirs used in the hydrology study and for the flood inundation areas assessed in the socio-economic assessment.
    iii. Summary of the land use and land cover classes that exist in the contributing catchment and flood inundation areas.
    iv. The depth of precipitation used to estimate runoff volumes according to the return intervals used in the hydrology study.
    v. Details of the design storm event(s) that would be expected to trigger a 1:10 year flood event assumed for the socio-economic assessment.
    vi. A description of methods used to calculate the runoff coefficient that was reported to range from 0.46-0.60. Provide evidence to support the calculation.
    vii. Explain how this coefficient is considered low. Provide evidence to support this conclusion.

viii. Quantitative estimates of surface runoff volumes for the assumed precipitation return intervals.

ix. Estimates of the expected change in reservoir water level of the existing and Expanded Chin Reservoir assuming the modelled events.

b. Justify the estimated value of flood mitigation for the Chin Reservoir Expansion Project in the context of the estimated volume of runoff water captured per the methods used and results reported in the hydrology baseline study.

c. Provide the reports cited as KCB (2022a), KCB (2022b), and Matrix (2017) that were referenced as supporting information for the hydrology baseline study.

Response:

a.

i. Please refer to Figures 2.1 and 2.2 provided in the response to SIR#1 Question 2 (a).

ii. Please refer to Figure 2.1 provided in the response to SIR#1 Question 2 (a) to show the contributing catchment area for the existing and Expanded Chin Reservoirs used in Volume 4-1, Hydrology TBR. Refer to the New East Dam PDR, Appendix V – Inflow Design Flood Estimate, Figure 3.1 that shows the contributing catchment area for the existing and Expanded Chin Reservoirs, as well as estimations of the contributing catchment area from other studies.

iii. A summary of the land use and land cover classes that exist in the contributing catchment areas is presented in the New East Dam PDR, Appendix V – Inflow Design Flood Estimate, Section 3.2 which states:

"Land use in the Chin Reservoir catchment is agricultural, primarily consisting of dryland grain crops.

The surficial geology in the Chin Reservoir catchment consists primarily of stagnant ice moraine, described as "Sediments resulting from the collapse and slumping of englacial and supraglacial debris due to the melting of buried stagnant ice at the glacier margin; sediment is mainly till but locally includes stratified glaciolacustrine or glaciofluvial sediments; characterized by low- to high-relief hummocky topography" (Fenton et al. 2013). The soil is from the Maleb group, classified as an Orthic Brown Chernozem on medium textured (L, CL) till (Alberta Institute of Pedology [AIP] 1984; Alberta Agriculture and Forestry 2021).

The Maleb soil texture is reported as loam at the surface to clay loam at the C horizon, 35 cm deep (AIP 1984). The AIP describes the Maleb soil generally as a CL, although only 41% passes the No. 200 sieve. AIP maps indicate a moderately fine to medium-textured soil."

A summary of the land use and land cover classes that exist in the flood inundation areas downstream of the New East Dam is presented in the New East Dam PDR, Appendix VI – New East Dam Breach Inundation Study, Section 3.6 which states:

"Based on Google Earth Satellite imagery, the coulee is characterized by barren earth with intermittent deep pools, ridges, pasture, and farmland."

iv. The depth of precipitation used to estimate runoff volumes according to the return intervals used in the hydrology study are presented in Table 4.2 (probable maximum precipitation) and Table 5.1 (1:2 year to 1:1,000 year rainfall) in the New East Dam PDR, Appendix V – Inflow Design Flood Estimate.

Excerpts on the derivation of the probable maximum precipitation (PMP) from the New East Dam PDR, Appendix V – Inflow Design Flood Estimate, Section 4.2.1, Page 17 and 18 are provided below.

"Two physically-based PMP estimates are available for the Chin Reservoir catchment. A site-specific analysis was conducted by Hopkinson (1984) to estimate a 6-hour PMP depth of 305 mm for the catchment. Although the estimate is almost 40 years old, it is the only site-specific PMP study conducted using a physically-based approach. However, the original report could not be found for review.

Later, Hopkinson (1999) presented mapping showing isopleths of point (i.e., up to 10 km^2 catchment size) 24-hour PMP depths for the Canadian prairies. Based on that mapping, the point 24-hour PMP for the Chin Reservoir catchment is 536 mm. That value is for the annual maximum PMP, and applies to the period July 15 – 31. PMP values used in the current analysis were based on the Hopkinson (1999) mapping.

The 24-hour PMP estimate was extended to 48-hour and 72-hour durations by proportion to statistically-based PMP estimates for 24-hour and longer durations published by Environment Canada (2016) for the Taber climate station (Station no. 3036360).

A 12-hour PMP depth was also desired for use in distributing the PMP over time. Published estimates for Taber did not include a 12-hour PMP rainfall depth, so the 12-hour PMP was estimated based on the ratio of 12-hour to 24-hour 1:100 year depths at Lethbridge (Station No. 3033890).

Resulting PMP estimates used for the current analysis are summarized in [Table 29.1]."

Table 29.1 Chin Reservoir Catchment Areal PMP Estimates

Duration (hours)	*PMP Depth (mm)*
12	*342*
24	*429*
48	*512*
72	*556*

Excerpts on the derivation of the return period rainfall estimates from the New East Dam PDR, Appendix V – Inflow Design Flood Estimate, Section 5.2, Page 29 are provided below.

"Return period rainfall estimates for durations of 1, 2, and 3 days were derived from the record of Taber (ID3036360) with 65 years of record from 1907-2020. A frequency analysis was conducted using the Gumbel distribution in the HyfranPlus software. Details of the analysis are provided in Appendix I and the results are summarized in [Table 29.2]."

Table 29.2 Chin Reservoir Rainfall Frequency Estimates

Return Period (year)	*1-Day (mm)*	*2-Day (mm)*	*3-Day (mm)*
1000	*145*	*185*	*202*
200	*118*	*150*	*165*
100	*106*	*136*	*149*
50	*95*	*121*	*133*
20	*79*	*101*	*111*
10	*67*	*86*	*94*
5	*55*	*70*	*77*
3	*45*	*57*	*63*
2	*36*	*46*	*51*

v. The ACERA economic flood mitigation analysis utilized data from both the 2010 MPE study and 2014 Regional Drainage Committee, Southern Regional Stormwater Management Plan, Volume 1 report (MPE 2014). The beginning of Volume 3, Section 4.1.3.1 should have included mention of both MPE reports, rather than just the 2010 report.

- The 144,000 acre number is derived from the map shown in Figure 13 (Page 50) of Volume 3.
- Figure 13 was pulled from the 2014 MPE report.
- Figure 13 shows the "flooding hot spots" which were identified by stakeholders in a questionnaire.
- ACERA estimated the total area affected by flooding problems in these "hot spots" to be 160,000 acres. Using Google Earth Pro, the 160,000 acres could be sub-divide to identify 144,000 acres of irrigated land and 16,000 acres of dryland.
- For the economic calculations made in Volume 3, it was assumed that these land areas (144,000 irrigated and 16,000 acres dryland) were affected by flooding during the 2005 event.
- In calculating the total impact of the flood damages in the region, it was assumed that a serious flood event could take place once every 10 years (five flood events) during the 50-year life of the proposed Chin Reservoir Expansion Project. This flood frequency

was considered to be possible, given the fact that five flood events had occurred in this region from 2010 to 2020 (i.e., 2010, 2011, 2013, 2014, and 2018).

vi. The approach adopted for rainfall-runoff modelling was to use two separate models to simulate the processes of infiltration and depression storage. Infiltration losses were estimated using a rainfall-runoff model (HEC-HMS) to produce rainfall excess on a unit area basis. Then the rainfall excess timeseries was applied to the catchment topography in a two-dimensional hydraulic model (HEC-RAS). Some of the rainfall excess was captured in depression storage and the remainder was routed over the land surface to the reservoir. A comprehensive discussion of the methodology, numeric models used, and results is presented in the New East Dam PDR, Appendix V – Inflow Design Flood Estimate, Section 3.3.

Total runoff was measured within the HEC-RAS model for the period five days after the end of the PMP. This duration meets the spirit of the TEC (2004) guideline that for the purpose of checking inputs vs outputs, the hydrograph tail should be extended to at least five times the PMP duration, because the effective duration of all three events was 24 hours.

The runoff coefficient, calculated as PMP runoff divided by PMP rainfall (i.e., excluding the antecedent event), and loss estimates for the upland area of the Expanded Chin Reservoir catchment are summarized in Table 29.3.

Table 29.3 Chin Expanded Chin Reservoir Upland PMF Estimate: Runoff vs Water Inputs

PMP Duration (h)	Rainfall Depth (mm)	Runoff Volume (dam^3)	Runoff Depth (mm)	Runoff Coefficient	Losses (mm)
24	429	77,800	257	0.60	172
48	512	77,800	257	0.50	255
72	556	77,800	257	0.46	299

The runoff coefficients are unusually low, and the losses unusually high, relative to other PMF studies on the Canadian prairies. These results are consistent with the unusually high depression storage in the catchment.

vii. The runoff coefficients presented in Table 4.5 are considered low compared to PMF runoff coefficients presented in the Canadian Dam Association (CDA) 2019 Annual Conference Paper by Wes Dick, Ron Woodvine, Brian Abrahamson, and Mohanath Acharya entitled “PMP and PMF Estimates in Alberta and Saskatchewan: Initial Review” (Dick et al. 2019). Dick et al. (2019) collected and reviewed 65 PMF estimates for 50 sites across Alberta, Saskatchewan and Manitoba. The study presented that the average coefficient across 65 PMF studies was 0.66, while the coefficient ranged from 0.27 to 1.08. According to Figure 12 in Dick et al. (2019), the estimated runoff coefficient for a catchment area of 282 sq.km. is 0.7. The current runoff coefficients, while lower than other PMF studies across Alberta, Saskatchewan and Manitoba, fall within the large scatter of Plains dataset. The low runoff coefficient is attributed to the unusually high depression storage in the Chin Reservoir catchment which is captured well in the

topographic data of the catchment area. Utilizing a numeric hydraulic routing model to simulate the high depression storage versus a visual approximation of effective versus gross catchment area resulted in lower runoff coefficients for the PMF than published values.

viii. Quantitative estimates of surface runoff volumes for the assumed precipitation return intervals are presented in Table 4.4 (PMF) and Table 5.3 (1:1,000) in the New East Dam PDR, Appendix V- Inflow Design Flood Estimates. Subsequent to the issuance of the PDR, the 1:20, 1:100, and 1:300 year runoff event volumes were determined. Table 29.4 presents the runoff volumes and corresponding maximum reservoir levels within the Expanded Chin Reservoir for the 1:20, 1:100, 1:300, 1:1,000, inflow design flood (2/3rd between the 1:1,000 year flood and the PMF), and the runoff volume for the PMF. The maximum reservoir levels are based on the assumption that Chin Reservoir is at FSL at the onset of the rainfall runoff event.

Table 29.4 Surface Runoff Volumes and Maximum Expanded Chin Reservoir Levels

Runoff Event	Runoff Volume (dam^3)	Maximum Reservoir Level (m)
1:20	2,057	864.09
1:100	4,879	864.20
1:300	7,236	864.30
1:1000	13,700	864.63
IDF	71,300	866.54
PMF	77,800	Not applicable

ix. Please refer to the response provided for SIR#1 Question 29 (a (viii)).

b. Runoff into Chin Reservoir is relatively low, as described in the New East Dam PDR (Appendix 1.1). The primary flood mitigation benefit is derived from increased storage capacity to receive runoff from the SMRID Main Canal and the Malloy Basin, where these areas are highly developed and produce high value crops. In addition, the Existing Chin Reservoir can not effectively pass the Inflow Design Flood (IDF) as per the CDA guidelines to prevent a potential dam failure due to flooding. With the upgrades, the reservoir will effectively be able to pass the IDF.

c. The New East Dam PDR is provided in Appendix 1.1 of this SIR#1 Response Document. The report referenced in Volume 4-1, Hydrology TBR as KCB (2022a) is the New East Dam PDR, Appendix V – Inflow Design Flood Estimate. The report referenced in Volume 4-1, Hydrology TBR as KCB (2022b) is the New East Dam PDR, Appendix VI – New East Dam Breach Inundation Study.

The Matrix (2017) report referenced in Volume 4-1, Hydrology TBR is superseded by the New East Dam PDR, Appendix V – Inflow Design Flood Estimate and has therefore not been provided.

Question 30

Reference:

Volume 3, Section 4.1.3, Page 49

Rationale/Preamble:

SMRID reference an MPE Engineering Ltd. report that *…identified nine inter-related infrastructure improvements which, when implemented, are expected to significantly mitigate the impacts of future excess stormwater runoff events.* The proposed Project is described as being one of these nine inter-related improvements.

Information Request:

a. List how many (and which) of the eight other inter-related infrastructure improvements described in the cited engineering report will be constructed and functioning prior to the Project being constructed.

b. Provide a clarification whether and to what extent the Project provides the flood mitigation benefits relied upon in the assessment in the absence of any or all of the eight other inter-related infrastructure improvements.

Response:

a. Two of the inter-related infrastructure projects have been completed (Sauder Spillway Expansion and Taylor Wasteway), two are under construction (Horsefly Regional Emergency Spillway and Malloy Drain Improvements) and anticipated to be functional by 2027, the six remaining projects (Chin Reservoir Expansion, Sherburne Spillway and Reservoir Expansion, Murray Reservoir Expansion, Paradise Creek Dry Dam, and Main Canal Drain Inlet Pumping Stations) have no defined timetable for completion.

b. The Chin Reservoir Expansion Project still provides flood mitigation benefits to the SMRID Main Canal from Ridge Reservoir to Chin Reservoir by allowing storage of runoff that enters this reach of canal. It also permits drainage from the Malloy Basin to enter Stafford Reservoir. Due to the increased storage in Chin Reservoir, drainage can be retained in Chin Reservoir rather than passing downstream into Stafford Reservoir. The nine inter-related infrastructure projects provide benefit to different regions and do not rely upon each other to function; though all nine together allow the SMRID Main Canal to convey a 1:100 year flood event.

Question 31

Reference:

Volume 3, Section 4.1.4, Page 53

Rationale/Preamble:

SMRID states that *Flood mitigation related to the Chin Reservoir expansion would generate an increased level of economic activity in Alberta, not only for those who are directly affected by flood events, but also for others who are indirectly impacted.* Relative to a status quo year, flood mitigation efforts reduce economic losses, they do not generate economic activity.

Information Request:

a. Include a clarification in the assessment that flood mitigation impacts of the Project represent avoided economic losses.

Response:

a. It was identified in the Socio-economic Assessment (Volume 3) that the Chin Reservoir Expansion Project could account for 35% of the total flood mitigation benefits. The flood mitigation impacts represent avoided economic losses. However, for the economic analyses and cost-benefit calculations, it was assumed these avoided economic losses to be benefits accrued because of the proposed Chin Reservoir Expansion Project. Please refer to the *Cost-benefit analysis of flood mitigation measures: as case study employing high-performance hydraulic and damage modelling* report (Molinari et al. 2021) as a case study that supports this assumption.

Question 32

Reference:

Volume 3, Section 4.2, Page 53 and 54

Rationale/Preamble:

SMRID states that *Based on an 8% drought probability in any given year, the annual irrigation benefits are estimated to generate about $3.3 million to the provincial GDP and $3.3 million in labour income. No FTEs are supported.* Relative to a status quo year, drought mitigation efforts reduce economic losses, they do not generate economic activity.

Information Request:

a. Provide a clarification in the assessment that drought mitigation impacts of the Project represent avoided economic losses.
b. Provide a clarification in the assessment that the estimated $3.3 million in provincial GDP is not an annual estimate, but rather an estimate for a drought year.
c. Clarify why the estimated $3.3 million in provincial GDP is entirely attributed to labour income.
d. Provide clarification why there are no full-time equivalents (FTEs) supported by the $3.3 million in labour income.

Response:

a. Drought mitigation value for irrigation producers is the difference between irrigated value of production of various crops and dryland production. Under irrigation, the producer can generate income from crops during a drought, while dryland producers may not.

   We agree with the questioner that, by itself, irrigation does reduce economic losses during a drought.

   However, a key premise of ACERA's economic study is to "assess the overall benefits of the Chin Reservoir expansion by creating two regional economies; one that includes irrigation and one that is dryland. Dryland production is considered the current baseline economy in the proposed expansion area, and irrigation production is the proposed economy resulting from the Chin Reservoir Expansion" (Volume 3, Section 2.2, Page 28).

   In that context, ACERA compared the drought mitigation value of irrigation production with dryland crop production. During a short-term drought, irrigation producers will likely optimize their income from crop production, while dryland producers will likely experience reduced incomes because of water shortages. In the Socio-economic Assessment, ACERA identified this difference as a benefit.

   Since irrigation producers have already carried out their cropping operations, even in a drought year, there is no significant change in the manpower resources for the farm.

b. Volume 3, Section 6.2.1 states that the value of drought mitigation occurs only during a drought year.

c. Since labor income in this context refers to the income of farm operators, under the assumption that producers do not change their cultural practices or crop mix, the drought would only affect crop yields, which only result in income to the producers. Thus, under a drought year, all the income is labor income.

d. Because of drought uncertainties, we assumed that farmers, even in a potential drought year, will continue to seed their crops, and carry out all cultural practices required. Even during a drought period, at least in the short term, producers would not stop agricultural pursuit. Therefore, the number of active farms in a drought region would likely remain unchanged. This results in no change in the FTE numbers during a drought period.

Question 33

Reference:

Volume 3, Section 6.6, Table 36, Page 65 and 66

Rationale/Preamble:

Economic impacts presented in Table 36 suggest that several categories of activity yield total GDP impacts that are greater than the initial output shock (direct output). Alberta economic multipliers for many of the relevant industries describe total multipliers of less than 1.

Information Request:

a. Demonstrate the calculation of GDP impacts and clearly describe all multipliers relied upon.

Response:

a. Estimates in Table 36 (Volume 3, Section 6.6) are not based on the use of multipliers. Use of multipliers may result in biased estimates of total impacts. In addition, the number of sectors for which such multipliers are available is somewhat limited.

   In this study, we used the input-output model to estimate total impacts. The procedure used was as follows:

   Total Output Impacts = (Inverse of unit direct input requirements matrix) * (Change in expenditures resulting from the project in question)

   Each of the other (GDP, Labor Income, Employment) changes are related to the output changes estimated above.

   The model is linear in nature and assumes that no economies of scale are present. This assumption can be sustained for small amounts of changes in final demand (expenditures).

Question 34

Reference:

Volume 3, Section 6.6, Table 37, Page 66

Rationale/Preamble:

In Table 37, SMRID sums all estimated impacts (short-term, periodic, and annual).

Information Request:

a. Provide the rationale for aggregating impacts that occur over varying timescales and frequencies.

Response:

a. The rationale for Table 37 (Volume 3, Section 6.6) is to illustrate different types of impacts of the Chin Reservoir Expansion Project. This shows that some impacts are short-lived, while others occur on a more regular basis over the life of the Project.

   Table 36 (Volume 3, Section 6.6, Pages 65 and 66) provides a detailed breakdown of the short-term, periodic, and annual economic impacts over the 50-year life of the Chin Reservoir Expansion Project. Table 37 (Volume 3, Section 6.6, Page 66) does aggregate the sub-totals for each category (short-term, periodic, and annual) to show the total economic impacts (GDP, Labour, FTEs) over the Project life.

Question 35

Reference:

Volume 3, Section 7.1, Table 38, Page 67

Rationale/Preamble:

SMRID summarizes the costs and benefits evaluated in the farm financial analysis in Table 38, including capital asset charges to producers.

Information Request:

a. Describe what the revenue collected from the capital asset charges is used for.

Response:

a. Revenue generated from Capital Asset Charges will:
    - Help the irrigation district pay for new irrigation projects and reduce the burden of this payment on existing irrigators.
    - Provide revenue to the irrigation district for continued rehabilitation of irrigation infrastructure.
    - Allow for creation of a financial reserve to fund disaster repairs.
    - Allow for enhancements and modernization to existing infrastructure.

Question 36

Reference:

Volume 3, Section 7.2, Pages 68-70

Rationale/Preamble:

SMRID describes the benefits and costs evaluated in the social-benefit cost analysis, including multiplier/secondary effects (i.e., direct, indirect, and induced benefits and costs). Best practices for cost-benefit analysis suggests that all multiplier/secondary effects be excluded.

Information Request:

a. Justify why multiplier/secondary effects are included in the social cost benefit analysis (CBA).
b. Itemize what costs related to food processing (forward linkages) were included in the analysis.
c. Clarify and explain any adverse effects to existing producers that may occur as a result of the Project (e.g., during periods of drought).
d. Clarify and explain whether any sensitivity analyses were completed for either the financial analysis or the social benefit-cost analysis and provide the results.
e. Calculate and provide the breakeven discount rate for the social benefit-cost analysis.

Response:

a. We feel that the inclusion of secondary benefits is supported when assessing the objective of the government policy. If the objective of the policy (or expenditure) is solely to improve the well-being of a select group of people, such impacts are not included. However, in the context of irrigation development in Alberta, we assumed that a key policy objective is economic development. Economic development includes all people and sectors. Therefore, inclusion of both direct as well as secondary impacts or benefits are justified.

   We provided Benefit-Cost Analyses that are based on both direct changes, as well as direct and secondary changes.

b. We included all costs of production for the food processing industries. Table 36.2 provides a more detailed list.

Table 36.2 A Detailed List of Food Processing Industries

Number	Commodity
1	Dryland grain and other crops
2	Irrigated grains and other crops
3	Dryland live animals
4	Irrigated live animals
5	Other farm products
6	Forestry products and services
7	Support services related to farming and forestry
8	Mineral fuels
9	Non-metallic minerals
10	Utilities
11	Repair construction services
12	Wood products
13	Wood pulp, paper and paper products and paper stock
14	Refined petroleum products (except petrochemicals)
15	Chemical products
16	Plastic and rubber products
17	Non-metallic mineral products
18	Primary metallic products
19	Fabricated metallic products
20	Motor vehicle parts
21	Other manufactured products and custom work
22	Wholesale margins and commissions
23	Transportation and related services
24	Telecommunications
25	Depository credit intermediation
26	Other finance and insurance
27	Real estate, rental and leasing and rights to non-financial intangible assets
28	Professional services (except software and research and development)
29	Administrative and support, head office, waste management and remediation services
30	Taxes on products
31	Subsidies on products
32	Taxes on production
33	Wages and salaries
34	Employers' social contributions
35	Gross operating surplus

c. Irrigation producers are not immune from the impacts of drought, particularly if a drought lasts more than one year. The recent example of this occurred in 2023/2024. Southern Alberta experienced a significant drought in 2023, which seriously impacted dryland producers. However, irrigation producers were not impacted because the water storage reservoirs were full at the beginning of the crop year, and sufficient water was available for all irrigation producers in the irrigation districts.

However, water levels in the storage reservoirs were very low at the end of the 2023 crop year, and it was predicted that winter snowpacks would be low for the start of 2024. Based on the

predictions, the SMRID reduced water availability to irrigation producers by about 50% for the year 2024 crop, which would have significantly impacted irrigated crop production. Luckily, spring precipitation levels (snow and rain) returned to near normal, and the drought impacts were minimized.

Irrigation producers understand that droughts can and will occur. Many producers prepare early to change their cropping pattern (if possible), divert their irrigation water supplies to their higher value crops (e.g. potatoes, sugar beets, seed canola), and even pre-emptively purchase water licenses from other producers to ensure their higher value crops (and crops under contract), are supplied with sufficient water.

d. A sensitivity analysis was not conducted for the social or financial benefit-cost analyses.

e. A breakeven discount rate was not estimated in this study.

Question 37

Reference:

Volume 3, Section 7.2, Table 40, Page 69

Rationale/Preamble:

SMRID summarize the benefits and costs evaluated in the social-benefit cost analysis in Table 40.

Information Request:

a. Explain how the net benefits of crop and livestock production were calculated.

Response:

a. Net benefits related to crop and livestock production were estimated as a difference between gross sales and all out-of-pocket cash cost. Operator or family members labour was not included in these costs. Out-of-pocket costs included depreciation and all indirect taxes, and subsidies.

Question 38

Reference:

Volume 3, Appendix D, Pages 101-105;
Volume 3, Appendix D, Table 59, Page 103

Rationale/Preamble:

SMRID describe the methods used to estimate provincial and federal government revenues associated with the Project, including a series of regressions developed for tax estimation. SMRID also states that the provincial and federal governments will not be funding the Project and so face no costs.

Information Request:

a. Justify the use of linear regression analysis for the estimation of government revenue associated with the Project.

b. Provide a detailed description and list of what other functional model forms were considered and provide the rationale for selecting the models described in Appendix D.

c. Justify relying on coefficients and/or regression models that are not statistically significant.

d. With respect to the provincial model, justify the assumption that implies a corporate tax rate of 2.1%, which is materially different than the current tax rate of 8% as well as the corporate income tax rates in place for the time period reflected in the underlying data.

e. Justify estimating total government revenue and its contingent parts individually and discuss what methodological issues may arise in summing these estimates.

f. On Page 103 and with regards to personal income tax, the SMRID states *For every $1.00 of income earned, an average of $0.112 goes to the GOA*. The coefficient on personal (household) income in Table 59 is 0.0529. Explain this discrepancy.

g. Explain how the Project will be funded.

Response:

a. Regression analysis yields marginal values for different revenues and costs. These marginal changes are appropriate for smaller changes in the economy. Since investment in irrigation development is a very small portion of the Alberta government budget, such marginal changes are a better way to measure the impact.

b. A thorough search of other functional model forms was not undertaken in this study. Our experience using the linear form has shown it to provide satisfactory results. If the fit for the variable was not appropriate, other non-linear forms were estimated, and only if these non-linear forms were better.

c. Regression coefficients that were not significantly different from zero were used if no other model (linear or non-linear) yielded a significant coefficient.

d. A comparison of marginal value against a total change is neither a fair nor accurate method of comparison. It should be noted that in addition to the 2.1% tax rate, there is a fixed tax level of $2,156.86. The calculation should include both these values divided by the corporation income, and only then compare it with 8%.

e. We carried out extensive literature searches and established that many studies have followed a disaggregated approach to fiscal revenue estimation at the sub-national level. For these studies, no methodological issues have been reported. However, if a methodological issue was reported, it could be assessed to identify the interrelationship among various sources of revenue. However, that would require a separate analysis, which was not identified in the fToR for the Socio-economic Assessment.

f. The answer is similar to that given above for the corporation taxes. A comparison in this case should be based on the sum of the 0.0529 times income plus $451.38, and then expressed as a percent of the total personal income.

g. The Project is part of the Alberta Irrigation Modernization (AIM) program which was reported as a $933 million investment, where 70% of the costs are covered by the participating irrigation districts (which includes the SMRID) and the remaining 30% is a grant from the GoA. The participating districts pay 20% upfront and 50% is an interest-bearing loan from the Canadian Infrastructure Bank (CIB). Any cost overruns are covered 100% by the participating irrigation districts. The AIM program in and of itself is not a project, but rather a funding program for the modernization projects and off-stream reservoir projects throughout the participating districts. Refer to Volume 1, Section 1.9 of the EIA submission for more information.

Question 39

Reference:

Volume 3, Appendix E, Section E.1 and E.4, Page 106 and 107

Rationale/Preamble:

SMRID lists assumptions for the "Financial Benefit-Cost Analysis" and the "Benefit-Cost Analysis" stating that, for the financial benefit-cost analysis *Discounted value used for this analysis was assumed to be 4%* and for the benefit-cost analysis *The social discount rate was maintained at 4%.*

Information Request:

a. Justify the use of a 4% discount rate and provide a source that supports use of the rate.

b. Explain why a social discount rate was used for both the farm financial analysis and the social cost-benefit analysis.

Response:

a. Our study followed The Government of Canada guide for benefit cost analysis (GoC 2022). A social discount rate of 4% is supported for the social cost-benefit analysis for the Socio-economic Assessment. This discount rate is also recommended for risk premium models by L. Booth (Booth 2015).

b. We recognize the error in employing a 4% discount rate for both the social and farm financial analyses. For the farm financial analysis, a revised interest rate of 4.85%, which relates to farm loan rates in 2020, should have been used. We have since revised the farm financial analysis. During a review of the farm financial analysis, we also realized that we had not adequately accounted for the $4,000/acre capital cost. We revised the farm financial analysis to account for the increased discount rate and capital costs. This results in a Financial Benefit-Cost Ratio of 0.94 (instead of 1.00). Revised Farm Financial Benefit Cost Analysis tables have been provided below.

Table 39.1 Present Value of Benefits and Costs Related to Chin Reservoir Expansion (Revised)

Particulars	Costs ('000)
Benefits	
Gross Income from Crop Production	$390,201,000
Gross Income from Livestock Production	$1,400,631,000
Benefits from Drought Mitigation	$11,199,000
Total Benefits	**$1,802,031,000**
Costs	
Cost of Production - Crops	$230,727,000
Cost of Production - Livestock	$1,308,154,000
Investment in On-Farm Pivot Systems	$161,447,000
Investment in Specialized Farm Machinery and Equipment	$74,064,000
Capital Asset Charge	$147,354,000
Total Costs	**$1,921,746,000**

Table 39.2 Financial Analysis Results for the Chin Reservoir Expansion Project (Revised)

Indicators	Results
Net Present Value	$-119,714
Financial Benefit-Cost Ratio	0.94
Internal Rate of Return (%)	-0.74%
Return Period (Years)	>50

Question 40

Reference:

Volume 3, Appendix E, Section E.4, Page 107

Rationale/Preamble:

SMRID provided additional details regarding the assumptions employed for the benefit-cost analysis (i.e., the social cost-benefit analysis). SMRID states that *Flood damage mitigation was assumed to occur once every 10 years. The first flood year was determined using a random number table.*
No additional details are provided with respect to how drought frequency is applied to the model. Best practices for flood damage assessment suggests that an expected value be taken to estimate annual flood damages, also known as an Average Annual Damage (AAD).

Information Request:

a. Explain how the random assignment of flood events using a random number table may impact the final results of the social benefit-cost analysis.
b. Explain why an AAD estimate was not relied upon to estimate the flood mitigation benefits in the social benefit-cost analysis.
c. Clarify and explain how drought damage mitigation was assumed to occur in the social benefit-cost analysis.

Response:

a. The random number table (referenced above) was used to make an unbiased assignment of the first flood event year during the 50-year life of the Project. The study did not attempt to assess how changes to the random number selection might impact the results of the Benefit-Cost analysis.
b. Volume 3, Section 4.1.2 indicates that the area served by the SMRID Main Canal experienced five significant stormwater runoff events from 2010 to 2020 – an average of one event every two years. Given the number and frequency of flood events in a relatively short time, it was reasonable to assume that flood events on a 1:10 year occurrence was a conservative estimate for the analysis and, therefore, an Average Annual Damage (AAD) estimate was not used.
c. Benefits through drought management were assumed to take place with a probability of 8% (Volume 3, Appendix E.1, Page 106). The benefits related to drought management occurred only during a drought event.

Question 41

Reference:

Volume 4-1, Section 2.3, Table 2.5, Page 11

Rationale/Preamble:

SMRID states that the average runoff volume of the RSA and LSA has reduced in comparison to estimates obtained from Niell et al. (1970). However, the runoff estimates in the baseline study appear to be calculated from simple subtraction of the long-term average annual evapotranspiration (assumed to be actual) from long-term average annual precipitation. No mention is made to the equivalence of methods used in this study to those used by Niell et al. (1970) for estimating runoff. Best practice is to calculate elements of a water balance at common timepoints (e.g., monthly, annually) and aggregate summary statistics from common timepoints rather than to calculate some elements based on aggregating or averaging functions of others.

Information Request:

a. Specify that the annual evapotranspiration referred to in Table 2.5 is either potential or areal evapotranspiration (ET).

b. Compare the methods used against the cited reference and justify the appropriateness of subtracting two long-term averages of precipitation (PPT) and (Potential or Actual) ET to calculate an element of the water balance (i.e., runoff) to conclude a temporal effect.

Response:

a. The annual evapotranspiration presented in Volume 4-1, Section 2.3, Table 2.5 is areal evapotranspiration.

b. As stated in Volume 4-1, Section 1.4.1, both the LSA and RSA are not a natural stream course. Therefore, the baseline water balance review is a limited review of average annual natural water balance (precipitation vs. actual evapotranspiration) of the region. Table 2.5 presents that the LSA and RSA are located in a water deficit region where on an average year, rainfall depth is equal or less than evapotranspiration depth. The estimated annual water balance including irrigation supply and demand and reservoir operation is presented in the WaterSMART report entitled “Hydrological Modelling to Evaluate Changes in Streamflow Availability in the St. Mary River Watershed” (WaterSMART 2023). This report is provided as Appendix 1.2 of this SIR#1 Response Document.

Question 42

Reference:

Volume 4-3, Section 4.6, Page 38-49

Rationale/Preamble:

SMRID provides groundwater chemistry data for common anions, nutrients, and metals from installed monitoring wells and existing/historical wells at the project location. Analysis for hydrocarbon indicators was not conducted for any of the installed wells and may not have been analyzed for private wells.

Information Request:

a. Explain why hydrocarbon indicators were excluded from monitoring well analysis and whether hydrocarbon indicators be included in continued sampling efforts for the monitoring wells.

Response:

a. Hydrocarbon indicators were not included in the analysis of samples from monitoring wells as the Project was not identified as having a potential impact on hydrocarbon parameters in groundwater.

   Samples collected in March 2025 from all of the sampling locations in the Shallow Flow System that had water and two locations in the Deep Flow System were analyzed for hydrocarbon parameters. The results are summarized in Table 42.1 and the laboratory analytical report is included in Appendix 42.1. The results show no detectable concentrations for petroleum hydrocarbon parameters.

Table 42.1 Groundwater Petroleum Hydrocarbon Concentrations (Concentrations in mg/L)

Sample ID	MW22-04	MW22-02	MW22-03	MW22-01	151387	BH24-S-14B	BH24-D-16	BH21-03	2096581
Date Sampled	2025-03-24	2025-03-24	2025-03-25	2025-03-25	2025-03-25	2025-03-26	2025-03-26	2025-03-26	2025-03-26
Benzene	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Toluene	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Ethylbenzene	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Xylenes	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
C6-C10 (F1)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
C10-C16 (F2)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

3 GENERAL

3.1 Public Engagement and Aboriginal Consultation

Question 43

Reference:

Volume 1, Section 1.13.2;
Volume 1, Section 1.14

Rationale/Preamble:

SMRID discussed that the Southern Alberta Group for the Environment (SAGE) has registered to receive project updates from Environment and Protected Areas (EPA) and the Natural Resource Conservation Board (NRCB). SMRID has also provided an invitation to the Blood Tribe for participation in ongoing dialogue and discussions.

Information Request:

a. Discuss SMRID's plans to maintain public engagement during the Project's development, operation, and reclamation.

b. Discuss how the invitation to the Blood Tribe for participation in an ongoing dialogue and discussions of project-related issues or concerns will be maintained through project development, operation, and reclamation.

Response:

a. SMRID is committed to maintaining transparent and ongoing public engagement throughout the development and operation phases of the Chin Reservoir Expansion Project. As a public entity, SMRID ensures accessibility and open communication with the public through multiple channels.

    i. Public Accessibility:
    SMRID operates with an open-door policy, offering various points of contact for the public. This includes a public phone number (587-220-5652) and email address (chin.expansion@smrid.com), which are both available for inquiries, concerns, and feedback throughout the Project's lifecycle.

    ii. Public Website, Social Media, and Updates:
    SMRID maintains a comprehensive website where regular Project updates are posted, ensuring that members of the public can access current information including a link to the NRCB Project page. The website serves as a key tool for sharing project information, developments, reports, and engaging with the community. SMRID is also active on social media, providing regular updates on Project developments, notifications of document

submissions, invitations to join open houses or annual general meetings (AGMs), etc. The social media posts provide a link back to the SMRID public website for more information.

iii. Annual General Meetings (AGMs):
SMRID holds AGMs that are open to all members of the public. During these meetings, the status of the Chin Reservoir Expansion Project is highlighted, and a question period allows the public to provide comments, raise concerns, or ask questions regarding the Project. Invitations to these AGMs are provided on the SMRID website and social media pages.

iv. Open Houses:
SMRID will continue to host open houses where the Chin Reservoir Expansion Project will be presented to SMRID irrigators and is open to members of the public. These events are open to all and offer an opportunity for attendees to ask questions, voice concerns, and learn more about the Project in an informal setting. Invitations to these open houses are provided on the SMRID website and social media pages.

v. Office Hours and In-Person Engagement:
SMRID's offices in Taber and Lethbridge are open during regular business hours, providing another avenue for public engagement. Individuals can visit in person to discuss concerns or obtain information regarding the Project.

vi. Complaint Management During Construction:
During the construction phase, SMRID will maintain active communication channels including phone and email to receive and document public complaints or concerns. All complaints will be logged and directed to the appropriate staff or contractors for follow-up. SMRID will make reasonable efforts to respond promptly and, where applicable, address issues in coordination with the construction team to minimize disruption to the public. In addition, the selected contractor will be required to post signage at the entrance to the construction site that includes contact information for both SMRID and the contractor, allowing members of the public to easily submit complaints or raise concerns during construction activities.

vii. Post-Construction Engagement:
Once construction is complete, SMRID's offices will remain open for continued public engagement. Regular updates on the status of Chin Reservoir will be provided during future AGMs, and the public will continue to have opportunities to provide feedback or raise concerns.

The Project is intended to function as permanent water management infrastructure that will be maintained. Therefore, decommissioning and reclamation have not been proposed and are not considered as a Project phase.

b. SMRID has solicited input on required consultation through the Aboriginal Consultation Office (ACO) process on two occasions (FNC202202151). The Pre-Consultation Assessment conducted by ACO determined that consultation with Indigenous Groups would not be required for the Project. However, recognizing the relevance of the Project to the Blood (Kainai) Tribe,

particularly given the shared use of the water delivery system through the BTAP, SMRID has proactively engaged with the Blood Tribe to ensure they are informed about the Project's development.

SMRID has maintained an open line of communication with the Blood Tribe throughout the design phase and plans to continue this engagement throughout the Project's lifecycle. At key points in the design and construction process, SMRID will provide updates and keep the Blood Tribe informed of progress and any changes as needed. SMRID will also keep the Blood Tribe informed on the progress of the historic resource impact assessments (HRIAs) being conducted by Bison Historical Services Ltd. (Bison).

In July 2025, the SMRID invited the Blood Tribe to conduct a walk-through of the Project Area prior to winter 2025. Following this walk-through, SMRID will further discuss potential next steps and determine any additional involvement the Blood Tribe may have during Project development and operation.

This ongoing dialogue reflects SMRID's commitment to maintaining an open and responsive relationship with the Blood Tribe throughout all stages of the Project.

The Project is intended to function as permanent water management infrastructure that will be maintained. Therefore, decommissioning and reclamation have not been proposed and are not considered as a Project phase.

Question 44

Reference:

Volume 1, Section 1.13.1, Page 24;
Volume 1, Appendix IV;
Volume 5, Section 1, 1.0 [A] (a) and (c)

Rationale/Preamble:

The final Terms of Reference states *Document the public engagement program implemented for the Project including:*

a) a list of meetings and the specific comments or issues raised at the meetings

c) a description and documentation of concerns and issues expressed by the public, SMRID's analysis of those concerns and issues and the actions taken to address those concerns and issues

SMRID identified multiple meetings with stakeholders and the public. The meetings include a landowner meeting on March 11, 2022, a county council meeting on September 20, 2022, and 4 meetings held for landowners and the public.

The meeting minutes and/or the specific comments or issues raised at the Seven Persons Community Hall on November 24, 2022, and Readymade Community Hall on November 25, 2022, have not been provided.

Information Request:

a. Provide a description of the specific concerns and issues raised at all meetings, include SMRID's analysis of the concerns and issues raised, and how each were addressed.

b. If there are any outstanding issues, describe how SMRID plans to address these issues.

Response:

a. Representatives from the SMRID, MPE, and KCB met with 17 landowners affected by the Chin Reservoir Expansion Project on March 11, 2022. The agenda for the initial meeting included a briefing of the proposed Project, the regulatory framework for the Project, and a question-answer period. Attendees were provided with additional time to review the Project and ask additional questions during a poster session held after the presentation. The support for the Project amongst those that attended was high. No conflicting opinions of the Project were voiced at this meeting.

   SMRID and MPE provided an update meeting on the status of the Chin Reservoir Expansion Project with the Twelve Mile Road Water Coop and Skiff Water Coop on June 20, 2022. The meeting minutes that were compiled to document the discussion are provided in Appendix 44.1 of this SIR#1 Response Document. Both water coops voiced that they were interested in the expansion of the water coop distribution areas. The primary concern raised by the water coops

pertained to the supply of water year-round through the construction phases. SMRID confirmed that the water coops would continue to receive water through construction and that they would investigate the opportunity to relocate the intake that is currently near the New East Dam. One provided suggestion was having a combined intake off the reservoir for the coop and irrigation deliveries. SMRID will continue to engage with the water coops through the design phase. The relocation of the intake will be considered as part of the relocation of all utilities within the expansion footprint.

In the fall of 2022, SMRID contacted and provided notification packages of the Chin Reservoir Expansion Project to the nearby municipalities (refer to Volume 1, Section 1.12.3 of the EIA submission). Consultations with the municipalities were conducted individually. All municipalities are in favour of the Project and no concerns were raised during the consultations.

Four public information meetings were held in November 2022 to present the proposal for the 80,000-acre expansion as part of the AIM program (refer to Volume 1, Section 1.13.1 of the EIA submission). The meetings were held throughout the district to inform irrigators about the proposed expansion and to prepare them for the plebiscite planned for November 28, 2022 asking water users to approve the phased expansion of the district by 80,000 acres.

A summary of the specific comments and concerns raised during the four public meetings and how SMRID responded to the various concerns is provided in Table 44.1. Copies of the meeting minutes of each of the four meetings were provided in Volume 1, Appendix IV of the EIA submission. Of note, the 80,000-acre expansion included various projects to replace open canals with pipelines, as well as the proposal for the expansion of the Chin Reservoir. Of the 80,000 acres, 40,000 acres would be created by the efficiency gains generated by converting the canals to pipelines and 40,000 acres would be contingent on the expansion of Chin Reservoir. The concerns raised during the four meetings preceding the plebiscite are largely not specific to the Chin Reservoir Expansion Project but rather the initial available 40,000 acres related to the pipeline projects. The *Proposed Irrigation Expansion Information Package* that was distributed for the meetings is provided in Appendix 44.2 of this SIR#1 Response Document. Refer to this information package for clarity on the questions raised in Table 44.1.

Table 44.1 Comments and Concerns Raised during the Public Engagement Meetings in November 2022

Question	Response	Meeting Location and Date
▪ Questions regarding lottery style and process regarding capacity checks. ▪ Can irrigation acres be purchased speculatively?	▪ We will assess each application as it comes in and respond if there are capacity issues. ▪ No speculative irrigation acres sales. Each application for irrigation acres needs to include the acres of land owned by the same proprietary owner.	▪ Bow Island– Legion Hall on Nov. 23, 2022 ▪ Readymade – Community Hall on Nov. 25, 2022

Question	Response	Meeting Location and Date
▪ Regarding capital acre charge of $4,000/acre, what does it cover? ▪ Will the SMRID cover the cost of pipelines through my neighbours?	▪ The capital acre charge covers the purchase of new irrigation acres. ▪ Infrastructure required by landowners to service the newly purchased parcels is entirely their own responsibility.	▪ Bow Island – Legion Hall on Nov. 23, 2022 ▪ Readymade – Community Hall on Nov. 25, 2022
▪ Additional information request.	▪ Directed irrigator to online document that provided greater information than the information package.	▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ Can someone vote in the plebiscite on my behalf?	▪ For individuals no; for corporations, yes.	▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ Can parcels without previous irrigation be applied for?	▪ Yes, dryland parcels are eligible for the expansion.	▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ Is there a timeline to develop an irrigation project?	▪ No, you can purchase the acres and not develop, but you will still be charged all fees regardless of usage or non-usage.	▪ Taber – Heritage Inn on Nov. 22, 2022 ▪ Bow Island – Legion Hall on Nov. 23, 2022 ▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Will $4,000/acre be sufficient to cover the expenses incurred under the AIM program projects, or will annual fees be increased to cover shortfalls?	▪ The first 15,000 acres released as part of Phase 1 will be priced at $4,000/acre. ▪ There is a chance annual fees will be utilized to cover AIM project overages. ▪ The price will be evaluated every year, but the first 15,000 acres will be at $4,000/acre. Once Phase 1 is complete, SMRID will be reviewing the price.	▪ Taber – Heritage Inn on Nov. 22, 2022 ▪ Bow Island – Legion Hall on Nov. 23, 2022 ▪ Readymade – Community Hall on Nov. 25, 2022
▪ If the expansion plebiscite passes and not enough acres are sold, will my annual fee be increased to cover the AIM projects? ▪ If the plebiscite fails, will annual fees be increased?	▪ There is a bigger chance of increased annual fees if a “no” vote of the expansion plebiscite is received, as the SMRID has committed to the modernization projects (canal to pipe projects).	▪ Taber – Heritage Inn on Nov. 22, 2022 ▪ Bow Island – Legion Hall on Nov. 23, 2022 ▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Will there be a preference given to applied for parcels?	▪ Whatever parcels you apply for you have to provide proper soils analysis.	▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ How are budget exceedances in the AIM program handled? Will the CIB loan more money to the irrigation districts?	▪ SMRID received good pricing in the beginning. Although pricing is now starting to escalate, SMRID believes it’s going to come back a bit. ▪ SMRID has spoken to the GoA regarding the inflation from the original proposals. They understand that the economy has changed and realize that the discussions will need to be formalized as things unfold. ▪ SMRID will revisit the pricing with the GoA and CIB and will consider inflation.	▪ Bow Island – Legion Hall on Nov. 23, 2022 ▪ Readymade – Community Hall on Nov. 25, 2022

Question	Response	Meeting Location and Date
▪ What is the threshold for the expansion plebiscite?	▪ 50% +1.	▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ How solid are the funding agreements with the GoA if a new government comes into power?	▪ SMRID approached the GoA about this, they stated that once something has been passed with treasury, it is going to happen. ▪ Yes, the contract is all through to 2028.	▪ Taber – Heritage Inn on Nov. 22, 2022 ▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ When can applications be made, can I submit multiple parcels?	▪ You can make your application for up to 150 acres now and have them sitting there but they have to be on proper parcels with appropriate soils and capacity. Only if your system is on an AIM project, we will allow those people that they can pay the down payment and wait for the project to finish to continue development.	▪ Taber – Heritage Inn on Nov. 22, 2022 ▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ What happens if the first tranche of 15,000 irrigation acres sell very quickly?	▪ The intent is to do Phase 1 to cover as many small parcels as possible to allow our existing irrigators to maximize the irrigation acres of their farms. If only 10,000 acres sell in Phase 1, then the remaining 5,000 acres would likely go into the next phase or another lottery.	▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ Will we be able to develop irrigation acres for the year 2023?	▪ SMRID's goal is to be able to begin developing the acres in 2023. SMRID will expedite the process as much as possible but the rules have to be followed.	▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ When will Phase 2 of expansion begin? *(refer to the Proposed Irrigation Expansion Information Package provided in Appendix 44.2 that outlines the two phases of irrigation expansion).*	▪ It's difficult to determine that timeline as there are many different scenarios. The primary goal of Phase 1 is to allow our existing irrigators to maximize the irrigation acres of their farms. Whereas Phase 2 is intended to target the bigger irrigation projects. The acreage limit and timing of future rounds will be based on initial interest, the District's ability to provide adequate capacity, verified capacity gains from completed modernization projects, and or until all eligible requests from Phase 1 are satisfied. ▪ The main thing is that the Board of Directors will review the expansion progress at the end of each irrigation season. If the rate of expansion is found to be detrimental to the interests of the irrigators, the Board of Directors has the option of adjusting or delaying any further expansion within each block. The Board of Directors will be cautious and prudent about the release of acres. ▪ Phase 2 will likely align with the timeline of the Chin Reservoir Expansion. It may be 10, 15, or even 20 years. ▪ Every year the capital charge will be assessed.	▪ Bow Island – Legion Hall on Nov. 23, 2022 ▪ Readymade – Community Hall on Nov. 25, 2022

Question	Response	Meeting Location and Date
▪ The modelling, is it a fair assessment, based on historical data, our cropping has changed, and with APAs and land swapping, the higher use crops will be using more and more water especially in my area, will that be taken into account?	▪ The modeling takes into account the changing irrigation demands, recognizing that efficiency improvements can still be made both on-farm and through infrastructure modernization projects. ▪ SMRID engaged WaterSMART Solutions Ltd. (WaterSMART) to conduct the modelling of the Chin Reservoir expansion. Although the modelling does not eliminate risk, the modelling showed that the 75,000 ac-ft was adequate to support the proposed expansion with minimal additional risk. ▪ SMRID will continue to put pipe in the ground to increase our savings and efficiency gains.	▪ Bow Island – Legion Hall on Nov. 23, 2022 ▪ Readymade – Community Hall on Nov. 25, 2022
▪ When will we know the outcome of the vote?	▪ Mid-day next week. SMRID will communicate the result.	▪ Bow Island – Legion Hall on Nov. 23, 2022
▪ Regarding CIB Loan. What is the interest rate and duration? Can it be paid back early?	▪ 1% over 35 years. ▪ It can be paid back early without penalty.	▪ Readymade – Community Hall on Nov. 25, 2022
▪ What are we voting on?	▪ To increase the SMRID's total acres from 504,200 to 584,200 acres, an increase of 80,000 acres total.	▪ Readymade – Community Hall on Nov. 25, 2022
▪ Comment: Thanking the board for providing such a thorough presentation for irrigators and using conservative figures to do so. Commend the SMRID board for going after the opportunity when it presented itself. Shows good foresight and created all of this for the future benefit of our kids.	▪ N/A	▪ Readymade – Community Hall on Nov. 25, 2022

Question	Response	Meeting Location and Date
▪ Regarding Main Canal capacity, and irrigation development along the canal.	▪ At this time, the Main Canal has capacity from start until end for irrigation development. It is expected that eventually bottlenecks will reveal themselves, and limits on development will be put in place. It is anticipated that development may need to be focused on reaches of the canal with excess capacity or via reservoirs. ▪ Through infrastructure modernization projects (canal to pipe conversions), there is an elimination of seepage, evaporation, and spill losses, allowing irrigators to irrigate more acres with the same amount of water. SMRID is reducing the spill to the rivers, and making use of that water. SMRID does not get credit for return flows to the river.	▪ Readymade – Community Hall on Nov. 25, 2022
▪ Does the Chin Expansion Project provide for greater storage in the winter?	▪ Yes, the Chin Expansion has a higher winter carry over. ▪ Water carried over from the previous season is the water delivered to farms at the beginning of the next season. ▪ The added flood storage capacity of the Expanded Chin Reservoir allows for more irrigation water to be stored safely from one season to the next.	▪ Readymade – Community Hall on Nov. 25, 2022
▪ Will the SMRID continue to treat the water for aquatic weeds?	▪ Yes, SMRID will maintain our aquatic weed control program, while continuing to explore other technologies.	▪ Readymade – Community Hall on Nov. 25, 2022
▪ How much of the added volume of the Chin Expansion is Live Storage?	▪ 103,000 ac-ft is the added volume of live storage.	▪ Readymade – Community Hall on Nov. 25, 2022
▪ With the Chin Expansion Project, will additional Hydropower be developed?	▪ We will explore opportunities to add hydropower facilities where feasible.	▪ Taber – Heritage Inn on Nov. 22, 2022 ▪ Readymade – Community Hall on Nov. 25, 2022
▪ Regarding Chin Expansion. Will there be a recreation component?	▪ We recognize that the Chin Park will be impacted by the water level raise at Chin Reservoir. The SMRID would like to see a joint venture on a recreation area, similar to what has been developed at Stafford.	▪ Readymade – Community Hall on Nov. 25, 2022
▪ I have trouble understanding the feasibility of the Chin Expansion and additional acres when I see the low water levels at St. Mary Reservoir.	▪ Water levels in the reservoirs are highly dependent on the time of year, run-off conditions.	▪ Readymade – Community Hall on Nov. 25, 2022

Question	Response	Meeting Location and Date
▪ Regarding the water sharing treaty administered through the International Joint Commission (IJC). Are we treated as an equal partner? What is the risk of the agreement not being honoured?	▪ If you are asking if the USA has the power to change the allocations on their own, the answer is No. ▪ Currently, SMRID is a part of the committee going through a review and determination of the allocations between the US and Canada. That review is going to take four years and will include public and stakeholders' input on the review. We have Richard Phillips from the Bow River Irrigation District on that panel. Both parties have met and to date there are no changes. ▪ We don't know what the future will hold. If something were to happen to our allotment, we would take that into consideration.	▪ Taber – Heritage Inn on Nov. 22, 2022 ▪ Readymade – Community Hall on Nov. 25, 2022
▪ Will irrigation licenses for other irrigation districts such as Magrath need to be adjusted?	▪ No water licenses will be adjusted. The expansion will work withing existing licenses.	▪ Readymade – Community Hall on Nov. 25, 2022
▪ Regarding the Chin Expansion. What push back are you getting from Environmental Groups?	▪ We have been in discussions with environmental groups. One group requested that the Chin Expansion Project be reviewed at the federal level, which has been determined by the Federal Minster of Environment to not be warranted. It was determined that the Environmental Impact Assessment (EIA) administered through the GoA is sufficient.	▪ Readymade – Community Hall on Nov. 25, 2022
▪ Was historical data being used in the modeling, is it considered appropriate? Was climate change included in the modeling? Have you accounted for river stress in your modeling?	▪ Climate change modeling is being finalized, and will be included in the regulatory submission. Our initial expansion modeling has verified that there will be enough to maintain stream flow in the rivers. Final results will be included in the regulatory submission. ▪ As demonstrated by the droughts in 1988 and 2001, we have been able to mitigate the impacts of drought, while maintaining flows to the river. Generally, the storage in the reservoirs will get us through the first season of drought.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ With the conversion of canals to pipe, are additional flood mitigation projects planned?	▪ When we execute a canal to pipe conversion, we take into account the impacts of removing the canal has with respect to flood mitigation.	▪ Taber – Heritage Inn on Nov. 22, 2022

Question	Response	Meeting Location and Date
▪ Comment – If this expansion has the same outcome as previous expansion, it will be positive for the Irrigation district. I am concerned that added acres will strain already at capacity systems.	▪ All irrigation acre applications will be reviewed for capacity.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ How will we know if proposed irrigation projects are underway that could affect my existing systems?	▪ As is required, parcels petitioned into the district are advertised in the newspapers. If there are objections, the necessary discussions will take place.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ Why were we not given extra annual allocation if there is still water in the reservoirs? While other irrigation districts increased their allocation. ▪ Why not increase the annual irrigation allotment rather than expand?	▪ Not all irrigation districts operate the same, and each has its own challenges and limits. ▪ SMRID continuously reviews water supply and weather forecasts when we determine the allocation for the year. What we have seen in the last few years is that 16 inches is sufficient. Historically, the average usage is 13 inches district wide. This year, because we had a good supply, we increased allocation to 18 inches. ▪ 16 inches of allocation has been determined to be appropriate allocation to meet the different crop types throughout the district. We are happy with how that has been reflected in recent years.	▪ Taber – Heritage Inn on Nov. 22, 2022 ▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Why is the GoA interested in flood mitigation?	▪ Overland flooding costs the GoA millions. The flood mitigation component of Chin Reservoir means that that water can be repurposed. Flood mitigation is always something that we need to consider as we operate our reservoirs, this project makes that easier.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ Why is the district not able to deliver first water to every user by May 1?	▪ We usually start flushing flows in April to meet start up targets district wide. It's a big system, with lots of things to consider. We have no control over an individual's location. We understand the start is always important to our irrigators, and we strive to have water delivered in the first week of May unless there is an extraordinary circumstance.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ At times in the summer, you struggle to get enough water to maintain Chin Reservoir levels.	▪ Our operational strategy is to fill Chin early in the season, and draw on that storage as irrigation demand increases. That is how the system was designed. ▪ There is a bottleneck at Chin Chute, which is undersized for high flow. The plan is to replace that structure.	▪ Taber – Heritage Inn on Nov. 22, 2022

Question	Response	Meeting Location and Date
▪ Regarding Alternate Parcel Agreements (APAs), do APAs get reviewed for capacity every year?	▪ Yes, the capacity is reviewed for every APA when you choose to change the location of the APA.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ When will the application to the lottery process being?	▪ January, depending on the outcome of the vote. If the plebiscite fails, there will be no expansion. Failure of the vote would jeopardize the Chin Expansion Project.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ Is there expansion capacity upstream of Stafford Reservoir?	▪ Yes, based on the individual systems capacity.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ If we cannot build Chin Reservoir, will the first 40,000 acres of expansion happen?	▪ Yes, but we still require a Yes vote for the plebiscite. The initial 40,000 acres expansion is provided by the efficiency gains made by the canal to pipe projects, and on-farm efficiency gains.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ Why not just a plebiscite on just 40,000 acres? Why do we need to vote on the additional acres expansion provided by the Chin Expansion?	▪ We wanted to know what the irrigators felt about the Chin Expansion Project, and this was part of the agreement with the GoA.	▪ Taber – Heritage Inn on Nov. 22, 2022 ▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ The new capital acre charges, will that money be used to finance the Chin Expansion Project?	▪ Yes, the money will go towards both the modernization projects and Chin Expansion.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ Irrigators downstream of 40 Mile Reservoir are concerned about capacity. Why not more storage downstream?	▪ We have changed our operational strategy at 40 Mile Reservoir to run the pumps more frequently to use that storage to supply downstream users. ▪ It is more beneficial to everyone to have a storage reservoir upstream, because you can't run water backwards through the system.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ Are there any plans to rehabilitate the Main Canal to increase its capacity?	▪ The Main Canal is not currently operated at 100%. We will be utilizing existing capacity.	▪ Taber – Heritage Inn on Nov. 22, 2022
▪ What happens when we are in periods of restricted water availability?	▪ We are not eliminating all risk. WaterSMART has modeled the expansion so as not to unnecessarily increase risk. When water availability is low, it will be reflected in lower water allocations, as it is now. ▪ With the modernization projects, we are reducing spill and using that for irrigation, which is more efficient.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Is there a certain amount of water that needs to be returned to the river by spill?	▪ No, we can theoretically eliminate spill to the rivers entirely. We do not get credit for water returned to the rivers.	▪ Seven Persons – Community Hall on Nov. 24, 2022

Question	Response	Meeting Location and Date
▪ We've had more dry years recently. 13 inches of allocation is not enough to get us through those years. Can we look at increasing the allocation in dry years?	▪ We have found that our historical average diversion is 13 inches after many years. This has been found to be enough.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Why are you targeting an initial allocation of 16 inches at the beginning of the year, and increasing to 18 inches? We could have used those extra 2 inches at the beginning of the year.	▪ Each year is a case-by-case basis, depending on water supply and weather forecasts.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ The $4,000/acre capital charge for new acres is too steep. This is not feasible for this area of the district, considering we don't get the best quality water compared to users upstream.	▪ We're sympathetic to your concerns. But in order to make this work, we can't pick favorites and we cannot have a 2-price system. With the money spent on the modernization projects, we are improving water quality, which we can't do if we undervalue the acres we sell. ▪ The way the irrigation district is structured, everyone is considered equal regardless of their location in the district. ▪ The capital asset charge was selected to reflect market rates, without jeopardizing our financial sustainability.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Will the SMRID provided leasing/financing over say a 20-year period for the capital asset charge?	▪ No, you have to make that arrangement with your lending institution. ▪ If you are troubled by the purchase of new irrigation acres, you could choose to rent them from neighbors rather than purchasing them. You have less security, but it might be cheaper. ▪ Keep in mind, when you purchase irrigation acres and assign them to a property, the value of that property goes up. You can use that gained equity to expand your farming operation.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Why $4,000/acre?	▪ In a recent expansion in the Bow River Irrigation District (BRID), they found that $3,000/acre sold out almost instantaneously. This better reflects market conditions, and allows us to fund the projects like the canal to pipe conversions and the Chin Reservoir Expansion.	▪ Seven Persons – Community Hall on Nov. 24, 2022

Question	Response	Meeting Location and Date
▪ What is the productivity change when a parcel is converted from dryland to irrigation? Any numbers to present?	▪ Several economic studies are available publicly to determine the increase in productivity that you can search for yourself. The regulatory submission for Chin Expansion will include an analysis of the productivity gains to farms (refer to Volume 3, Socio-economic Assessment, Chapter 7 of the EIA submission). ▪ A lot depends on the crops grown, and it's a case-by-case basis.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Has the SMRID considered the impacts of variable rate irrigation to improve on-farm efficiencies?	▪ On-farm technologies could increase on-farm efficiencies.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Will the provincial government tax water usage?	▪ Theoretically, the government could choose to tax water in a royalty structure, like they do for oil and gas. However, we have not seen an indication that the GoA is considering this.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Have you seen changes in water quality being delivered by the headworks systems, specifically Ridge Reservoir (Ridge Water Coop user)?	▪ We have a representative that has been looking into water quality at Ridge Reservoir, who is suggesting water quality has been improving.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ The lottery process being applied throughout the district?	▪ Yes	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Will the capital charge be increased in the future if there is a shortfall for Chin Reservoir?	▪ The capital charge will be reviewed periodically as acres are released.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Will lottery applications for 150 acre be favoured over smaller applications?	▪ No, it is equal opportunity for all applications, depending on capacity.	▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ Comment – If the plebiscite vote fails, it will signal to the government that we do not want development/investment like Hwy. 3 twinning.		▪ Seven Persons – Community Hall on Nov. 24, 2022
▪ What is the risk to irrigators that are not planning on participating in the expansion?	▪ The modelling is showing that there is a negligible increase in on-farm risk, through the efficiency gains and added storage.	▪ Seven Persons – Community Hall on Nov. 24, 2022

Updates regarding the Chin Reservoir Expansion Project were also presented at various AGMs including a virtual SMRID AGM on March 31, 2021, a Taber Irrigation District AGM held at the Heritage Inn in Taber, Alberta on March 23, 2022, and at an SMRID AGM held at the Heritage Inn in Taber, Alberta on March 30, 2022. A summary of the concerns raised during the AGMs that pertained to the Chin Reservoir Expansion Project and how SMRID addressed the concerns is presented in Table 44.2.

Table 44.2 Comments and Concerns Raised during Various AGMs

Question	Response	Meeting Location and Date
▪ Pertaining to off-stream projects – an irrigator asked where the other off-stream reservoir projects are located.	▪ There are three off-stream projects: Snake Lake in the Eastern Irrigation District (EID), Dead Horse Coulee in the Bow River Irrigation District (BRID), and Chin Expansion in SMRID.	▪ SMRID AGM – Virtual Meeting on March 31, 2021
▪ Would there need to be an increase in our water license for this expansion?	▪ Part of the irrigation expansion is being handled through efficiency gains of the canal to pipe projects, and part through the Chin Reservoir Expansion Project. There will be no need to increase our water licenses, which we are able to work within.	▪ Taber Irrigation District AGM – Heritage Inn, Taber, Alberta on March 23, 2022
▪ With the expansion of Chin, is SMRID considering an additional hydro site?	▪ Yes, we are looking at it. With economics being somewhat marginal, SMRID is looking to see where we might have any savings, such as building a new outlet (which we are) and installing with a dual purpose.	▪ SMRID AGM – Heritage Inn, Taber, Alberta on March 30, 2022
▪ What is a plebiscite all about?	▪ If we want to expand the District, we have to take that to our existing water users and have a vote, yes or no. As board members, it is our job to educate our water users and make sure they have all the facts. We pushed our plebiscite back as we are in the process of amalgamation and didn't want to have two votes. We were hoping for a spring plebiscite but with spring work starting we decided to move it back after the farming season.	▪ SMRID AGM – Heritage Inn, Taber, Alberta on March 30, 2022

Since the submission of the EIA, additional open houses have been conducted at the Bow Island Legion Hall on December 3, 2024, the Taber Civic Centre on December 4, 2024, and the Readymade Community Hall on December 5, 2024. A summary of the specific comments and concerns raised during these open houses and how SMRID responded to the various concerns is provided in Table 44.3.

Table 44.3 Comments and Concerns Raised during the Open House Meetings in December 2024

Question	Response	Meeting Location and Date
▪ There seems to be a lot of government bureaucracy and getting this thing built. What is taking so long? ▪ What is the delay on the expansion?	▪ Projects of this nature have to go through a rigorous EIA, which is required by Provincial Legislation. Generally, for projects of this scale, four years is the minimum timeline to complete the regulatory process.	▪ Bow Island – Legion Hall on December 3, 2024 ▪ Taber – Civic Centre on December 4, 2024
▪ Will the SMRID be building new canals to provide water to the area?	▪ New conveyance infrastructure is not part of the reservoir expansion. Servicing new irrigation parcels is the responsibility of private project proponents.	▪ Bow Island – Legion Hall on December 3, 2024
▪ Will the [Existing] East Dam be removed completely? ▪ How will the Exiting East Dam be removed/decommissioned?	▪ No, the Existing East Dam will be notched to allow the free movement of water between the Existing Reservoir and the expansion area (shown on a figure included on the poster – refer to the response to SIR#1 Question 49).	▪ Bow Island – Legion Hall on December 3, 2024 ▪ Readymade – Community Hall on December 5, 2024
▪ Is this ($130M) an up-to-date budget number?	▪ We have experienced upward cost pressure. An updated budget amount will be presented at the coming AGM.	▪ Bow Island – Legion Hall on December 3, 2024
▪ Is it fair to assume the budget has doubled from 2020? ▪ Should I shoot higher than that [2020] number?	▪ The engineering team is reviewing the estimated budget, and will present it at the coming AGM.	▪ Bow Island – Legion Hall on December 3, 2024 ▪ Taber – Civic Centre on December 4, 2024
▪ How can we get the New East Dam faster?	▪ Unfortunately, there are not many ways to push the Project schedule faster. We have a regulatory requirement we need to follow, which is dictated by Provincial Legislation.	▪ Taber – Civic Centre on December 4, 2024
▪ I am worried about water availability engagement sessions. How come the GoA is putting so much money into other [infrastructure], Highway 3 twinning and all of this irrigation stuff. Just to change the Water Act.	▪ We are unsure of what the full intent of the GoA is. It would be valuable to speak with your local MLA to express your concerns.	▪ Taber – Civic Centre on December 4, 2024
▪ I don't think that the capacity created by the Chin Expansion should go to new farmers. I believe it should go to farmers or current irrigators within the district.	▪ A portion of the expanded storage would be used for additional storage that benefits existing irrigators (~28,500 ac-ft) as detailed in the expansion plebiscite information package from 2022 (refer to the response to SIR#1 Question 49).	▪ Taber – Civic Centre on December 4, 2024

Question	Response	Meeting Location and Date
▪ When will the expansion start?	▪ Future rounds of irrigation expansion, utilizing irrigation acres that are made available by the AIM program (canal to pipe projects) will be determined by the Board of Directors. Expansion supplied by the Chin Reservoir Expansion Project will not come online until the New East Dam is built and the expansion area is filled.	▪ Taber – Civic Centre on December 4, 2024
▪ When will you be selling acres from the new water?	▪ Expansion supplied by the Chin Reservoir Expansion Project will not come online until the New East Dam is built and the expansion area is filled.	▪ Taber – Civic Centre on December 4, 2024
▪ I would like the road top of the new Chin West Dam to be 70 feet wide, minimum for equipment crossing through there.	▪ The new West Dam will relocate the power poles and control building to provide greater clearance for wide loads.	▪ Readymade – Community Hall on December 5, 2024
▪ Where is the dirt from construction going to go?	▪ Soil will be used to build up the backslope and raise the Chin West Dam. Excess soil will be disposed of in adjacent land features that can store the soil.	▪ Readymade – Community Hall on December 5, 2024
▪ Is the SMRID going to be doing any sort of cost-sharing with the farmers for installing new canals and pipelines to service the new irrigation acres?	▪ No. Private irrigators are responsible for the infrastructure required to service their new parcels, which is consistent with the rules of expansion.	▪ Readymade – Community Hall on December 5, 2024
▪ Hill Ridge Colony discussed intakes that they want to install near the Existing West Dam.	▪ Yes, SMRID is aware of your plans, and encourages you to meet with us to discuss your project.	▪ Readymade – Community Hall on December 5, 2024
▪ How is Stafford [Reservoir] going to be impacted by the expansion?	▪ There will be no changes to Stafford Reservoir. Operation of Stafford Reservoir will remain the same.	▪ Readymade – Community Hall on December 5, 2024
▪ How will the existing intakes along the Chin [reservoir] be impacted?	▪ The engineering team has assessed the existing pumpsites, and are developing a plan to address the impacts to those structures.	▪ Readymade – Community Hall on December 5, 2024
▪ Will there be power lines located along the Existing West Dam?	▪ Existing Fortis distribution powerlines will be relocated off the road way.	▪ Readymade – Community Hall on December 5, 2024

In March 2025, members of the Hillridge Colony asked SMRID to comment on the potential impacts that the rise in FSL within the reservoir may have on the Hillridge Colony. Members have noted water infiltration into their basements when the water levels in Chin Reservoir are high. The Hillridge Colony is located approximately 4 km north of the Existing West Dam along Range Road 182. SMRID stated that the groundwater surface is expected to follow topography and therefore be highest in the area underlying the ridge that separates the Chin Reservoir from the Hillridge Colony. It is assumed that bedrock groundwater would diverge from the ridge, moving south towards the reservoir and north towards the Hillridge Colony. The reservoir levels would need to be substantially higher than 864 metres above sea level (masl) to generate groundwater flow from the reservoir under the ridge to the Hillridge Colony. No further questions or concerns have been raised by the Hillridge Colony.

b. SMRID will continue to engage with the Twelve Mile Road Water Coop and Skiff Water Coop to relocate the intake near the New East Dam to ensure that the water coops do not have interrupted water delivery during construction or the Expanded Chin Reservoir filling process.

   There are no other outstanding issues that have arisen as part of the public consultation process.

   Landowner concerns pertaining to SMRID's purchase of the lands within the Project footprint are still undergoing negotiations. Please refer to the response to SIR#1 Question 22 that outlines the process of land acquisition and the current status of these negotiations.

Question 45

Reference:

Volume 1, Section 1.13.2, Page 24

Rationale/Preamble:

SMRID states *On March 31, 2021, the SMRID received an email outlining concerns with the Project from the Southern Alberta Group for the Environment (SAGE).*

Information Request:

a. Provide a description and documentation of the concerns and issues expressed by SAGE.

b. What were SMRID's analysis of these concerns and issues expressed, and what actions did SMRID take to address the concerns and issues?

Response:

a. On March 31, 2021 a letter was sent collectively by the Southern Alberta Group for the Environment (SAGE), Alberta Wilderness Association, Trout Unlimited Canada, and the Bow Valley Naturalists to various contacts in the GoA, Government of Canada (GoC), and the CIB (EIA Volume 1, Appendix II). The letter outlined concerns raised regarding the proposed Alberta Irrigation Expansion Project as a partnership of the GoA, CIB, and Irrigation Districts, not explicitly the Chin Reservoir Expansion Project.

   A summary of the concerns raised in the March 2021 letter regarding the proposed Alberta Irrigation Expansion Project is provided below:

   - Environmental Assessment and Consultation: SAGE requests that the Project be subject to a comprehensive environmental assessment, regulatory review, and public and Indigenous consultation.
   - Aquatic Ecosystem Health: SAGE is concerned about the potential negative impact of the Project on already stressed aquatic ecosystems, particularly in the Bow, Oldman, and South Saskatchewan sub-basins.
   - Water Conservation and Use: While acknowledging the potential benefits of irrigation efficiency improvements, SAGE questions whether such improvements would free up enough water for ecological purposes, particularly instream flows.
   - Increase of Off-Stream Water Storage: SAGE expresses concern about the proposed increase in off-stream water storage, which they believe may increase environmental risks. SAGE questions whether non-structural storage opportunities were explored.
   - Consultation and Public Input: SAGE stresses the need for full consultation with the public and stakeholders. They request to be kept informed about the Project's assessment and regulatory review process, as well as opportunities for input on environmental assessments, water license applications, and expansion of irrigated acres.

An additional letter prepared by SAGE on November 10, 2022 was submitted to various contacts in the GoA, GoC, CIB, and the Impact Assessment Agency of Canada (IAAC), provided in Appendix 45.1. This letter was in response to the Minister Guilbeault's decision that three proposed irrigation reservoir projects (including Chin Reservoir, Deadhorse Coulee Reservoir, and Snake Lake Reservoir), that are a part of the larger Alberta Irrigation Expansion Project, did not warrant designation under the *Impact Assessment Act*. The Minister's rationale was that existing legislation and processes provide a framework to address potential adverse effects within federal jurisdiction. Within the November 2022 letter, SAGE outlined gaps and requested confirmation on various uncertainties that should be addressed as part of the assessment of the proposed irrigation reservoir projects (collectively referred to as the "historic expansion of Alberta irrigation").

A summary of the concerns raised in the November 2022 letter regarding the historic expansion of Alberta irrigation is provided below:

- Uncertainty if there is a requirement for an EIA for each of the proposed irrigation reservoir projects.
- Uncertainty if there is a requirement and scope for a cumulative effects assessment (CEA), including transboundary effects.
- Identified that public access to the impact assessment process is constrained due to the NRCB's specifications that only "directly affected" individuals or groups are permitted to participate. SAGE commented that they have been unable to contribute information to the NRCB's determination of whether or not the projects are in the public's interest, as well as to the Director's decisions on specific approvals related to the projects. SAGE requested that they receive notification of when the EIA ToR are available for each project.
- Uncertainty if there will be meaningful consultation with Indigenous people.
- Identified that the monitoring and public reporting obligations of the CIB have not been defined. SAGE requested clarity on what the CIB's process is to ensure they are meeting all of their legal obligations, including responding to the Duty to Consult to Indigenous groups and ensuring that the Project has met environmental assessment requirements.

In December of 2024, a representative of SAGE reached out to SMRID requesting shapefiles of the proposed extent of the Expanded Chin Reservoir and of the four areas proposed for expansion of irrigation acres as part of the Project (as referenced in Volume 3, Socio-economic Assessment of the EIA submission). A shapefile of the Expanded Chin Reservoir at the FSL of 864.0 m was provided to SAGE. Since the proposed areas for expansion of irrigation acres is not targeting specific land parcels, SMRID was unable to provide shapefiles pertaining to the second request from SAGE. However, the response to SIR#1 Question 5 provides Figure 5.1 which depicts land parcels that are currently irrigated within the SMRID and RID by the existing infrastructure. The four areas referenced in the Socio-economic Assessment that can support sustained irrigation of existing dryland farms will be in the areas served by the RID and SMRID.

b. The two letters that were provided by SAGE were completed prior to the announcement that the Chin Reservoir Expansion Project would be subject to a provincially regulated EIA. The concerns highlighted in the SAGE letters that are pertinent to the Chin Reservoir Expansion Project specifically have been addressed in the fToR and the EIA submission, as follows:

- Environmental Assessment and Consultation: Chin Reservoir Expansion is progressing through the provincially regulated Environmental Impact Assessment, thus, fulfilling the request by SAGE.
- Aquatic Ecosystem Health: Refer to Chin Reservoir Expansion – Environmental Impact Assessment Volume 4 Technical Baseline Reports – Aquatic Ecology.
- Water Conservation and Use: Refer to the Chin Reservoir Expansion – Environmental Impact Assessment Volume 1 – Introduction and Rationale, Volume 2 – Assessment of Effects, and Volume 4 – Technical Baseline Reports. Furthermore, hydrological modelling has been provided by WaterSMART and summarized in the 2023 *Hydrological Modelling to Evaluate Changes in Streamflow Availability in the St. Mary River Watershed* report (provided in Appendix 1.2 of this SIR#1 Response Document), WaterSMART's *Technical Memorandum Regarding the Chin Reservoir Expansion Project Supporting SIR Response* (Appendix 4.1), and the SIR#1 responses.
- Increase of Off-Stream Water Storage: Refer to the Chin Reservoir Expansion – Environmental Impact Assessment Volume 1 – Introduction and Rationale, Volume 2 – Assessment of Effects, and Volume 4 – Technical Baseline Reports.
- Consultation and Public Input: No further information requests have been received from SAGE. SMRID will continue to host open houses where the Chin Reservoir Expansion Project will be presented to SMRID irrigators which will be open to all and offer an opportunity for attendees to ask questions, voice concerns, and learn more about the Project in an informal setting.
- EIA: An EIA has been prepared and submitted to fulfill the requirements of the Provincially mandated review process, according to the terms of the fToR. This includes conditions for assessing cumulative effects such as apportionment.
- As noted in the response to SIR#1 Question 43 (b), the Pre-Consultation Assessment (FNC202202151) conducted by ACO determined that consultation with Indigenous Groups would not be required for the Project. SMRID has engaged with the Blood Tribe, the developer of the BTAP, as they are a shared water user.

Question 46

Reference:

Volume 1, Section 1.14, Page 25

Rationale/Preamble:

SMRID outlines the consultation completed with the Blood Tribe and the request for access of the inundation area for a walk-though prior to filling.

Information Request:

a. Explain if any additional consultation will occur with Indigenous communities and groups with respect to traditional ecological knowledge, and traditional use of land and water.

Response:

a. As noted in the response to SIR#1 Question 43 (b), the Pre-Consultation Assessment (FNC202202151) conducted by ACO determined that consultation with Indigenous Groups would not be required for the Project. SMRID has engaged with the Blood Tribe, the developer of the BTAP, as they are a shared water user.

   A legal representative of the Blood Tribe submitted a letter to the IAAC on May 12, 2022 to request that the Chin Reservoir Expansion Project and Modernization project be designated for review under the *Impact Assessment Act* (Appendix 46.1). The letter broadly noted the Blood Tribe's concerns related to assessing the potential for adverse project effects on water resources and ecosystem components, which could in turn affect the conditions necessary for the practice of Blackfoot rights by Blood Tribe members. The letter was tailored to not only the Chin Reservoir Expansion Project, but also the AIM program as a whole which includes the replacement of the canal systems with pipelines across the whole district and four new or expanded off-stream storage reservoirs. The letter notes that the Blood Tribe "have used and continue to use the lands, waters, and resources within Blackfoot traditional territory for a variety of purposes including: hunting, fishing, trapping, gathering, travelling, and cultural practices." It is noted that "Blackfoot traditional territory extends from the Rocky Mountains in the west to the Sand Hills in the east, and from the North Saskatchewan River in the north to the Yellowstone River in the south (present day Montana)."

   On October 12, 2022, MPE sent a letter to Mike Oka, consultation coordinator on behalf of the Kainai Nation, providing him with a description of the Project and inviting him to identify any potential adverse impacts that the Project may have on their Treaty rights and traditional uses. Within this letter, MPE requested the opportunity to provide a presentation on the Project to the Kainai Nation, allowing representatives to ask questions in person.

   The meeting with the Blood Tribe occurred on December 15, 2022 and the Blood Tribe requested to have a follow-up site visit prior to construction commencing. The anticipated requirements for construction mitigation to avoid impacts on fish and fish habitat were

discussed at the meeting, as well as ongoing HRIAs. No additional discussion has occurred in response to SMRID outreach since the initial meeting. Meeting minutes from the December 15, 2022 discussion between the SMRID and Blood Tribe have been appended to this SIR#1 Response Document in Appendix 46.2. This was the only meeting with the Blood Tribe that occurred prior to the EIA submission.

No specific Traditional Ecological Knowledge (TEK) or information on Traditional Land Use (TLU) in the Chin Reservoir Expansion Project Area has been received from the Blood Tribe. However, SMRID's ongoing dialogue reflects their commitment to maintaining an open and responsive relationship with the Blood Tribe throughout all stages of the Project.

The SMRID has invited the Blood Tribe to conduct a walk-through of the Project area prior to winter 2025. Following this walk-through, SMRID will further discuss potential next steps and determine any additional involvement the Blood Tribe may have during Project development and operation.

Outside of the information and commitments detailed above, the SMRID does not plan to conduct additional Indigenous consultation.

Question 47

Reference:

Volume 1, Section 1.14, Page 25;
Volume 5, Section 1, 1.0 [B] (c)

Rationale/Preamble:

The final Terms of Reference states *Document the Indigenous consultation program implemented for the Project including:*

c) a description of how Indigenous values are considered in the framework of decision making.

Information Request:

a. Based on the consultation SMRID has completed, describe how Indigenous values are considered in the framework of decision making.

b. Discuss how Indigenous values will be considered if additional information is identified during the walk-through with the Blood Tribe prior to inundation.

Response:

a. Please refer to the responses to SIR#1 Question 43 (b) and Question 46 (a). The SMRID solicited input on required consultation through the ACO process on two occasions (FNC202202151). Even though consultation was deemed not to be required, SMRID proactively engaged with the Blood Tribe to ensure they were informed about the Project's development.

   The letter submitted by the Blood Tribe to the IAAC on May 12, 2022 (refer to SIR#1 Question 46) broadly noted the Blood Tribe's concerns related to assessing the potential for adverse Project effects on water resources and ecosystem components, which could in turn affect the conditions necessary for the practice of Blackfoot rights by Blood Tribe members. Although it was decided that the Project did not warrant designation under the *Impact Assessment Act*, the concerns raised by the Blood Tribe were assessed as part of the provincial EIA process.

   Prior to the submission of the EIA, SMRID and MPE met with the Blood Tribe on December 15, 2022 (meeting minutes appended to this SIR#1 Response Document in Appendix 46.2). The SMRID has invited the Blood Tribe to conduct a walk-through of the Project area prior to winter 2025. Following this walk-through, SMRID will further discuss potential next steps and determine any additional involvement the Blood Tribe may have during Project development and operation.

   SMRID has maintained an open line of communication with the Blood Tribe throughout the design phase and plans to continue this engagement throughout the Project's lifecycle. At key points in the design and construction process, SMRID has provided updates to keep the Blood Tribe informed of progress. SMRID has also informed the Blood Tribe of document submissions.

No further discussion has occurred in response to SMRID outreach since the initial meeting in December of 2022. No specific TEK or information on TLU in the Project Area have been received from the Blood Tribe.

b. Please refer to the response to SIR#1 Question 46 (a).

Question 48

Reference:

Volume 1, Section 1.14, Page 25-26

Rationale/Preamble:

SMRID states *Indigenous Consultation was initiated with Mike Oka of the Blood Tribe on October 12, 2022…a site meeting was delayed until December 15, 2022.*

Information Request:

a. Provide a description and documentation of the specific concerns, comments, or issues raised by the Blood Tribe, SMRID's analysis of these concerns and issues, and how these were addressed.

b. If there are any outstanding issues, concerns, or comments describe how SMRID plans to address these concerns.

Response:

a. Meeting minutes from the December 15, 2022 discussion between the SMRID, MPE, and Blood Tribe have been appended to this SIR#1 Response Document in Appendix 46.2. During the December 15, 2022 meeting, the Blood Tribe highlighted the following concerns with respect to the Chin Reservoir Expansion Project:

    i. The Blood Tribe requested a site walk-through of the expansion area prior to inundation or construction works. SMRID has agreed to this request and has invited the Blood Tribe to conduct the walk-through prior to winter 2025.

    ii. The Blood Tribe inquired about the measures in place to protect fish during construction works. MPE detailed the anticipated construction methodologies that will be in place to protect fish and fish habitat.

    iii. The Blood Tribe inquired about who was conducting the HRIAs. MPE stated that Bison Historical Services Ltd. was conducting the HRIAs.

    iv. As this meeting was held prior to the submission of the EIA, the assessments conducted as part of the EIA went further into addressing the Blood Tribe's concerns regarding the potential for adverse project effects on water resources and ecosystem components as initially raised in the Blood Tribe letter to the IAAC on May 12, 2022.

    v. The SMRID remains in frequent communications with the Blood Tribe providing Project updates at major milestones. The Blood Tribe was notified via email correspondence on July 18, 2024 that the EIA was nearing completion. In addition, the Blood Tribe was notified via email correspondence on February 18, 2025 that SMRID is working through the first round of SIR responses.

b. No additional issues, concerns, or comments have been raised by the Blood Tribe since the December 15, 2022 meeting. The SMRID has invited the Blood Tribe to conduct a walk-through of the Project area prior to winter 2025. Following this walk-through, SMRID will further discuss potential next steps and determine any additional involvement the Blood Tribe may have during Project development and operation.

Question 49

Reference:

Volume 1, Appendix IV;
Volume 1, Appendix VI

Rationale/Preamble:

SMRID has identified topics discussed, information packages provided, and presentations materials used at the stakeholder, public, SAGE, and Indigenous consultation meetings.

Information Request:

a. Provide clarification if the Appendix IV Chin Reservoir Expansion – Environmental and Regulatory and Appendix VI – Chin Reservoir Expansion HRIA are all the presentation materials and information packages that were presented to the public and Indigenous for consultation.

b. If not, provide all presentation materials and information packages used for all public meetings and Indigenous groups for consultation.

Response:

a. The regulatory poster prepared in February 2022 that was provided as part of Volume 1, Appendix IV of the EIA submission was the primary presentation material used throughout the consultation process. This regulator poster was first presented as part of the poster session that occurred following the landowner meeting on March 11, 2022 and was continued to be shown at open houses.

   Notification packages were sent to nearby municipalities in March of 2022 (as mentioned in Volume 1, Section 1.12.3 of the EIA submission). This included the County of Lethbridge, County of Warner, Municipal District of Taber, and the Town of Taber. An example of a notification package that was sent is included in Appendix 49.1 of this SIR#1 Response Document. The notification package included a Project summary letter and a copy of a Chin Reservoir Expansion poster. The poster displayed information about the Chin West Dam project, Chin Reservoir Expansion Project, background information, and an overall Project timeline. This poster included an overhead view of the Chin Reservoir and expansion footprint, highlighting the Project components.

   In addition to the notification packages, SMRID also gave a presentation to the councils at the County of Lethbridge, Municipal District of Taber, and the County of Warner. An example of the slide deck for the presentations is provided in Appendix 49.2 of this SIR#1 Response Document.

   The regulatory poster and the Chin Reservoir Expansion poster were once again utilized during the November 2022 open houses that occurred prior to the plebiscite. A supplemental zoomed-in view of the expansion footprint was also provided (Appendix 49.3). A copy of the slide deck for the presentation that was presented during the November 2022 open houses has also been included in Appendix 49.4. The open house invitation that was posted on the SMRID website

and social media pages that notified the public of the various meeting dates and locations is included in Appendix 49.5 of this SIR#1 Response Document. The invitation provided rationale for the expansion and general information about the AIM program and the Chin Reservoir Expansion Project.

An updated Chin Reservoir Expansion poster was prepared in 2024, after the submission of the EIA. This poster presents engineering details for the Chin West Dam project, Chin East Expansion Project, and the Decommissioning Plan for the Existing East Dam. This poster was presented during the December 2024 open house meetings in Bow Island, Taber, and Readymade. The updated poster is provided in Appendix 49.6 of this SIR#1 Response Document.

As mentioned in the response to SIR#1 Question 44, the irrigation expansion brochure that was distributed at the November 2022 open houses prior to the plebiscite is provided in Appendix 44.2 of this SIR#1 Response Document.

Pertaining to consultations with SAGE, please refer to the response to SIR#1 Question 45.

Pertaining to the Indigenous consultations, the copy of the slide deck provided in Volume 1, Appendix VI of the EIA submission was presented to the Blood Tribe during the December 15, 2022 meeting. The presentation informed the Blood Tribe on the status of the HRIAs and the preliminary findings. As part of the October 12, 2022 invitation sent to Mike Oka, consultation coordinator of the Kainai Nation, MPE supplied two figures that outlined the Project footprint and expansion footprint. The invitation with supporting figures that was sent to Mike Oka on October 12, 2022 is provided in Appendix 49.7 of this SIR#1 Response Document. The result of this invitation was the December 15, 2022 meeting. In July 2025, MPE reached out to Mike Oka via email to schedule the requested walk-through of the expansion footprint.

b. Please refer to the response to SIR#1 Question 49 (a).

Question 50

Reference:

Volume 5, Section 1, 1.0 [A] (d)

Rationale/Preamble:

The final Terms of Reference states *Document the public engagement program implemented for the Project including:*

d) a description of how the public input was incorporated into the Project development, impact mitigation and monitoring.

Volume 5, Section 1.0 [A] (d) indicates that this information can be found in Volume 1, Section 1.13 however this information is not discussed.

Information Request:

a. Provide the sections where this information is discussed.

b. If this information is not identified in another section, provide a description of how the public input was incorporated into the Project development, impact mitigation, and monitoring.

Response:

a. This information is not discussed in other sections of the EIA. Please refer to the response to SIR#1 Question 50 (b).

b. Please refer to the response to SIR#1 Questions 44 and 45. During the planning process, SMRID spoke with many of their irrigators throughout the District to collect their views on expansion. They found that there was general support for the concept with one provision: water security must not be harmed. This message was taken to the design teams where they asked for an expansion limit that would retain or improve water security to their current users. The expansion plan was also designed to regulate the allotment of acres in a prudent and cautious manner assuring those new acres were added only when it was wise to do so. The plebiscite held in November of 2022 was decided in favour of the expansion program (AIM program), which included the Chin Reservoir Project. Questions raised during various public engagement opportunities have largely been to seek clarity and have not raised concerns. SMRID is committed to maintaining transparent and ongoing public engagement throughout the development and operation phases of the Chin Reservoir Expansion Project. Should issues or concerns be raised in future, SMRID will individually assess and respond to each concern, taking full consideration of the issue and implementing appropriate mitigations, as required.

Question 51

Reference:

Volume 5, Section 1, 1.0 [B] (d)

Rationale/Preamble:

The final Terms of Reference states *Document the Indigenous consultation program implemented for the Project including:*

d) How Indigenous knowledge helped shape project development, impact mitigation, monitoring and reclamation.

Volume 5, Section 1.0 [B] (d) indicates that this information can be found in Volume 1, Section 1.14 however this information is not discussed.

Information Request:

a. Provide the sections where this information is discussed.

b. If this information is not identified in another section, describe how the Indigenous knowledge helped shape the Project's development, impact mitigation, monitoring program and reclamation.

Response:

a. This information is not discussed in other sections of the EIA. Please refer to the response to SIR#1 Question 51 (b).

b. Please refer to the response to SIR#1 Questions 46, 47, and 48.

3.2 Noise

Question 52

Reference:

Volume 2, Section 3.3, Page 152–157;
Volume 5, Section 3, 3.1.1 [B];
Volume 5, Section 3, 3.1.2 [B] and [F]

Rationale/Preamble:

SMRID has not provided a table for noise prediction results as stated in the Guide to Preparing Environmental Impact Assessment Reports in Alberta.

The Guide to Preparing Environmental Impact Assessment Reports in Alberta states *Noise prediction results should be presented at each assessment stage in a Noise Contribution Table similar to the one shown in Appendix A.*

The Guide to Preparing Environmental Impact Assessment Reports in Alberta states *The Baseline Case establishes the conditions that exist or would exist prior to development of the project or the conditions that would exist if the project were not developed* and *Proponents must present sufficient data, from detailed and current field surveys or existing databases, to provide a clear description of current environmental conditions in the area that will be directly and indirectly affected by the project.*

The Guide to Preparing Environmental Impact Assessment Reports in Alberta states *The Application Case describes the Baseline Case with the effects of the project added.*

The Guide to Preparing Environmental Impact Assessment Reports in Alberta states *The Planned Development Case describes the environmental conditions that would exist as a result of the interaction of the proposed project, other existing projects and other planned projects that can be reasonably expected to occur.*

The final Terms of Reference states:

3.1.1 [B] *Discuss baseline air quality conditions including appropriate ambient air quality parameters and baseline noise conditions.*
3.1.2 [B] *Discuss the nature, severity, extent, and duration of activities likely to produce noise, vibration, dust, or affect air quality that could impact residences, livestock, other facilities or receptors during construction and operation.*
3.1.2 [F] *Discuss the Project's relative contribution to cumulative effects on regional air quality and noise.*

SMRID states … *Based on research conducted by the Environment Council of Alberta, the average rural ambient sound level at nighttime in Alberta is approximately 35 dBA Leq and the BSL was determined to be 40 dBA Leq (AER 2023).*

SMRID provides an example of a grader using the inverse square law to determine sound pressure levels that would be detected at the closest residences.

SMRID states … *In addition, most of the construction activity would be located within the coulee, further shielding residences from construction noise.*

SMRID states … *the potential effects of excessive noise of the Project would be expected to be localized, short in duration, and temporary* and *In general, residual effects of Project noise are not expected. Significant cumulative effects of noise are not expected due to very limited additional sources of noise across the Chin Coulee region.*

Information Request:

a. Provide justification for using the AER 2023 report for baseline conditions and not current field surveys.
b. Provide justification and evidence to show that the grader mentioned in Section 3.3.4 is sufficient for the Application Case showing the Baseline Case with the effects of the Project added.
c. Provide evidence to show that the coulee will shield residence from the construction noise.
d. Provide justification and evidence that the excessive noise would be localized, short in duration, and temporary, and that residual effects of the Project are not expected.
e. Provide justification for the statement that significant cumulative effects are not expected.

Response:

a. The baseline conditions presented in AER Directive 038: Noise Control (referred to as the AER 2023 report in the EIA submission) are used for noise impact assessments in Alberta as the standard ambient sound levels provide a common baseline sound metric for evaluation of project noise impacts. Table 1 in AER Directive 038 (AER 2024b) identifies the basic sound levels for receptors considering dwelling density and distance to traffic corridors and the ambient sound level is assumed to be 5 A-weighted decibels (dBA) less than the levels cited in Table 1.

   Field surveys conducted for assessing ambient noise levels at receptors are only advised where the standard ambient sound levels are considered not representative of the existing soundscape. As the location is typical of rural Alberta, with existing agricultural activity and no other large industrial sound sources, an ambient sound survey at this location would be expected to yield generally the same results at the ambient value of 45 dBA day and 35 dBA night cited in AER Directive 038. While a small, unregulated, gravel quarry is located near the Project Area and receptor R1, the level of noise related to this operation is expected to be reflective of the type of activity normally occurring in rural Alberta so is considered part of the ambient conditions.
b. A more detailed assessment was completed to evaluate Project effects and is documented in the RWDI *Chin Reservoir Expansion Noise Impact Assessment* (*NIA*), provided as Appendix 52.1 of this SIR#1 Response Document. The *Chin Reservoir Expansion NIA* presents predicted sound

levels and an assessment of compliance with AER Directive 038. Section 5.1.1 and Appendix C of the *Chin Reservoir Expansion NIA* includes a broader estimation of the types and number of equipment that could be expected for this scale of construction project.

c. The modelling completed for the appended *NIA* indicates that the coulee has potential to provide some shelter to residences from construction noise. The *Chin Reservoir Expansion NIA* (Appendix 52.1), Section 2.2 indicates ground topography with elevation changes in 1 m increments were considered in the updated assessment. The model takes the terrain into account when calculating noise propagation. Any shielding of the line of noise propagation for activities occurring at the bottom of the coulee is automatically determined by the model calculation algorithm to ensure a conservative approach.

d. Noise sources associated with the Project would occur during the construction phase and noise will stop when construction stops, limiting the potential for a residual effect. There are no major noise sources associated with operation of the Project, aside from water moving through the Chin Chute inlet structure and through the outlet structure into Stafford Reservoir.

   Construction activity occurs over time and will move around the site as construction progresses. Section 5.2, Table 4 in the appended *Chin Reservoir Expansion NIA* (Appendix 52.1) presents predicted sound levels and an assessment of compliance with daytime permissible sound levels (PSLs) in accordance with AER Directive 038. The predicted cumulative sound levels are below the Directive 038 PSLs. Vehicle pass-bys are considered in the predicted results for the dam construction phase. While the temporal boundaries of the construction activities near the Evergreen Colony (R1 in the NIA) extend until 2029, the analysis specifically included the access road phase of construction as it occurs nearest the colony. This was to estimate the highest potential impacts. As construction activity meets the PSL requirements and will stop when construction activity stops, no residual effect is expected to occur.

e. Assessments completed using AER Directive 038 are cumulative in nature, requiring that baseline (the ambient defined by the Table 1 values), other energy activity (oil, gas and power facilities), and the proposed project noise be considered together when determining compliance. The *Chin Reservoir Expansion NIA* (Appendix 52.1), Section 5.2, Table 4 presents the predicted sound levels and assessment of compliance with daytime PSLs. The predicted cumulative sound levels are below the Directive 038 PSLs therefore cumulative effects are not expected.

Question 53

Reference:

Volume 2, Section 3.3.2.1, Page 154 and 155;
Volume 5, Section 3, 3.1.2 [A]

Rationale/Preamble:

SMRID states *During the construction phase the major sources of environmental noise associated with Project activities are:*

- *On-site heavy-duty machinery operation;*
- *Loading, stockpiling, and excavation activities; and*
- *Local traffic.*

The final Terms of Reference states *Identify construction and operational components of the Project that have the potential to increase noise levels or affect air quality.*

Information Request:

a. Identify operational components of the Project, if any, that have the potential to increase noise levels.

Response:

a. There will be no major sound sources associated with Project operations that have the potential to increase noise levels relative to the baseline condition. Therefore, the *Chin Reservoir Expansion NIA* focused on the construction phase of the Project only (Appendix 52.1).

Question 54

Reference:

Volume 2, Section 3.3.2.1, Page 155;
Volume 2, Section 3.3.2, Table 3.2, Page 155

Rationale/Preamble:

SMRID states *The equipment may also not be an accurate representation of actual equipment which would be used during construction.*

Information Request:

a. Explain why the equipment listed may not be an accurate representation for equipment used during construction.

b. Explain if SMRID will be using equipment that is expected to produce higher noise levels than what is outlined in Table 3.2.

c. Explain what additional mitigation measures would be included if equipment is expected to be louder than what is outlined in Table 3.2.

Response:

a. *Chin Reservoir Expansion NIA*, Appendix C presents an updated list of the expected types of equipment that would be required for construction (refer to Appendix 52.1 of this SIR#1 Response Document). Final selection of equipment and scheduling of what equipment is used during each phase of construction is not fully known until a contractor has been selected and construction plans are fully developed. The contractor will have the final decision on the equipment to be used based on the job at hand and the equipment available.

b. The equipment noise emission data used in the *Chin Reservoir Expansion NIA* (Appendix 52.1) are based on the best estimates of the size of equipment that will be required. The data is based on historical measurement data of the same or similar sized equipment available to RWDI. Should larger equipment be available or used, the sound emissions may differ. To ensure conservatism in the modelling, the largest available equipment that is excepted to be used was evaluated, and the loudest measured value in the RWDI library was used. Section 2.3 of the appended *NIA* outlines how conservativism is incorporated into the assessment to minimize uncertainty associated with the assessment.

c. In the event of a validated noise complaint, or non-compliance found to be due to equipment louder than the values used in the *NIA*, or if more equipment that expected is used concurrently, the following bulleted points outline standard approaches that can be considered to manage construction noise:

    - Sourcing quieter equipment.

- Installing better equipment sound mitigation devices (i.e., better mufflers, or smaller equipment).
- Installing localized/temporary barriers around loud activities or stationary equipment (e.g., generators).

These are primary engineering control strategies that would be considered effective given the spatial layout for the Project and the nature of the construction activities. Secondary control strategies that could be considered, but may have a greater potential to affect Project scheduling, includes reduced equipment operating time or reduced concurrent activities.

Question 55

Reference:

Volume 2, Section 3.3.2.1, Table 3.2, Page 154 and 155

Rationale/Preamble:

SMRID provides Table 3.2 that lists examples of potential equipment that will be used at the Project site. This table lists the potential noise level for one of each type of equipment.

Information Request:

a. Discuss how the amount of equipment working may impact the severity of the potential noise levels.

Response:

a. Multiple pieces of equipment would result in cumulative noise effects. This was considered in the modelling as described in Section 5.1.1 and discussed in the results presented in Section 5.2.1, Table 4 of the *Chin Reservoir Expansion NIA* (Appendix 52.1).

Question 56

Reference:

Volume 2, Section 3.3.4, Page 157;
Volume 5, Section 11 [B]

Rationale/Preamble:

SMRID states *With mitigation strategies in place, the potential effects of excessive noise of the Project would be expected to be localized, short in duration, and temporary.*

The final Terms of Reference states *Describe SMRID's current and proposed monitoring programs…*

Information Request:

a. Discuss the monitoring program that will be implemented during construction and operation to ensure mitigation strategies are successful.

Response:

a. Predicted sound levels considering the equipment sound power levels and time utilization factors as shown in the *Chin Reservoir Expansion NIA* (Appendix 52.1) indicate compliance with the PSLs at the nearest residences with no additional mitigation required. Therefore, a monitoring program is not proposed during construction. If a noise complaint is received during construction, then a comprehensive sound monitoring survey measurement program, as defined in Directive 038, would be implemented in response to the complaint. The response to SIR#1 Question 218 (b) describes how complaints would theoretically be received during construction.

Question 57

Reference:

Volume 2, Map Figure 3.3.1

Rationale/Preamble:

The Map Figure 3.3.1 does not include the spatial extent for the wildlife noise assessment.

Information Request:

a. Update the Map Figure 3.3.1 to include the spatial boundary for the wildlife noise assessment.

Response:

a. The spatial boundary for the identification of receptors for the noise assessment was defined as a 1.5 km buffer area surrounding the proposed Project Footprint. The boundary shown on Map Figure 3.3.1 was used to identify human and ecological receptors which may be exposed to noise impacts resulting from construction activities at the Project sites. The noise assessment boundaries shown on Map Figure 3.3.1 were labeled incorrectly. The noise assessment labels for the Existing East Dam Removal Disturbance and the New East Dam Construction Disturbance should have read “Human and Ecological Receptor Noise Assessment”. The updated Map Figure 3.3.1 is appended as Figure 57.1 to this SIR#1 Response Document.

FIGURE

Figure 57.1 Noise and Air Quality

412500 420000 427500 435000 442500 450000

5497500

5490000

5482500

N

10km

5km

1.5km

36 513 877 61



Legend

- Potential Human Receptor
- All Weather Road
- Existing East Dam Decommission Footprint
- New East Dam Construction Footprint

Existing East Dam Decommissioning Disturbance

- Human and Ecological Receptor Noise Assessment
- Wildlife Receptor Air Quality Assessment
- Human Receptor Air Quality Assessment

New East Dam Construction Disturbance

- Human and Ecological Receptor Noise Assessment
- Wildlife Receptor Air Quality Assessment
- Human Receptor Air Quality Assessment

0 5 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, EARTHSTAR GEOGRAPHICS

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: NOISE AND AIR QUALITY

SCALE	PROJECT No.	FIG No.
1:120,000	A03701E05	57.1

File: Z:\AIC\GY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Creator: : HManandyan

3.3 Socio-Economic

Question 58

Reference:

Volume 3

Rationale/Preamble:

A list of acronyms was not provided in Volume 3.

Information Request:

a. Provide a list of acronyms for Volume 3.

Response:

a. Acronyms used in Volume 3 of the EIA report are provided below in Table 58.1.

Table 58.1 Irrigation Districts Acronyms as used in Volume 3 of the EIA Submission

Abbreviation/Acronym	Definition
AAF	Alberta Agriculture and Forestry
AAFC	Agriculture and Agri-Food Canada
AFRED	Alberta Agriculture, Food and Rural Development
AFSC	Alberta Financial Services Corporation
AGDP	Gross Domestic Product
COP	Cost of Production
EIA	Economic Impact Analyzer
FTE	Full Time Equivalent
GOA	Government of Alberta
GOC	Government of Canada
ICDC	Saskatchewan Irrigation Crop Diversification Corporation
IRR	Internal Rate of Return
MAFRD	Manitoba Agriculture Food and Rural Development
MW	Megawatt
NVP	Net Present Value

Question 59

Reference:

Volume 3, Section 4.1.3.1, Page 51;
Volume 3, Section 4.1.3.2, Page 52;
Volume 3, Section 4.1.3, Table 26, Page 52

Rationale/Preamble:

The assessment of economic benefits for the two categories in Table 26 are based on 1:10 year flood probability in the region. The damage caused by 2005 flood event is later discussed in Sections 4.1.3.1 and 4.1.3.2. The 2005 flood event is used as basis to estimate economic losses. However, the estimated return period of 2005 flood event is not clear.

Information Request:

a. Provide clarification on if the 2005 flood was a 1:10 year flood.

Response:

a. The 2005 flood event was used as the baseline dataset in the economic assessment because this event provided the most comprehensive analysis of flood impacts and costs in the region associated with the Chin Reservoir Expansion. We did not assess the probability factor this this flood event.

   To calculate the Chin Reservoir Expansion mitigation impacts, we assumed that this scale of the 2005 flood event would occur once every ten years over the 50-year life of the project. This return period was chosen to reflect the number of flood events that had occurred in the years prior.

Question 60

Reference:

Volume 3, Section 7.2, Table 40, Page 69

Rationale/Preamble:

Information Request:

Provide a table showing the cash flow that underlies Table 40 for each year of the 50-year project showing annual undiscounted benefits and costs separated for: crops, livestock, drought mitigation, food processing, flood damage mitigation, construction costs, and pivot system and specialized farm equipment. The table must include:

a. The cash flow table only for "direct benefits/costs".

b. A line in the table that indicates the total cumulative number of acres brought online for irrigation for each corresponding year column of the table.

   Note - Benefits as defined herein are not to include:

   - Transfer payments
   - Taxes and fees (these are counted as transfers)
   - "Food Processing" (unless irrigation provides inputs to food processors at market discount)
   - Land value increases already included in "Net Irrigation Crops Direct"

Response:

a. The annual disaggregated value of benefits and costs for the Chin Reservoir Expansion Project for the 50-year project life is shown below in Table 60.1.

   It is noted that since models are linear in nature, with no inflation adjustment, these annual values will be similar for each year (except when drought and flood mitigation events are included, and when there are specific inputs (construction costs, purchases of new pivot systems, and other farm machinery and equipment).

b. Volume 3 states that the 46,500-acre expansion adoption would take place over a period of 10 years after construction was complete. This would equate to 4,650 acres per year.

   For the Socio-economic Assessment, the estimation of benefits was based on labour income (excluding any taxes and subsidies) and income of un-incorporated businesses. Transfer payments were not included.

   For food processing companies, inputs were estimated only for that portion of their production that is supplied by products related to the irrigation expansion area.

Table 60.1 Annual Disaggregated Value of Benefits and Costs for the Chin Reservoir Expansion

Year	Direct Benefits ($'000)			External Benefits ($'000)				Total Direct Benefits ($'000)	Project Costs in Thousand $			Net Social Benefit
	Irrigation Crops	Irrigation Livestock	Drought Proofing	Forward Linkages	Pivots	Farm Machinery	Flood Control		Construction Costs	Pivot and Farm Machinery Costs	Total Costs	
1	$0	$0	$0	$0	$0	$0	$0	$0	$95,000	$0	$95,000	-$95,000
2	$0	$0	$0	$0	$0	$0	$0	$0	$47,500	$0	$47,500	-$47,500
3	$0	$0	$0	$0	$0	$0	$0	$0	$47,500	$0	$47,500	-$47,500
4	$1,416	$730	$0	$1,459	$0	$0	$0	$3,604	$0	$7,931	$7,931	-$4,327
5	$2,831	$1,460	$3,300	$2,917	$0	$0	$0	$10,508	$0	$8,436	$8,436	$2,072
6	$4,247	$2,190	$0	$4,376	$0	$0	$0	$10,813	$0	$8,942	$8,942	$1,871
7	$5,662	$2,920	$0	$5,834	$0	$0	$42,520	$56,937	$0	$9,447	$9,447	$47,490
8	$7,078	$3,650	$0	$7,293	$0	$0	$0	$18,021	$0	$9,952	$9,952	$8,069
9	$8,494	$4,380	$0	$8,752	$0	$0	$0	$21,625	$0	$10,457	$10,457	$11,168
10	$9,909	$5,110	$0	$10,210	$0	$0	$0	$25,229	$0	$10,962	$10,962	$14,267
11	$11,325	$5,840	$0	$11,669	$0	$0	$0	$28,834	$0	$11,467	$11,467	$17,366
12	$12,740	$6,570	$0	$13,128	$0	$0	$42,520	$74,958	$0	$11,973	$11,973	$62,985
13	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
14	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
15	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
16	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
17	$14,156	$7,300	$3,300	$14,586	$0	$0	$42,520	$81,862	$0	$5,052	$5,052	$76,810
18	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
19	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
20	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
21	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
22	$14,156	$7,300	$0	$14,586	$0	$0	$42,520	$78,562	$0	$12,478	$12,478	$66,084
23	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
24	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
25	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
26	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
27	$14,156	$7,300	$0	$14,586	$0	$0	$42,520	$78,562	$0	$12,478	$12,478	$66,084
28	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
29	$14,156	$7,300	$3,300	$14,586	$0	$0	$0	$39,342	$0	$5,052	$5,052	$34,290

Year	Direct Benefits ($'000)			External Benefits ($'000)				Total Direct Benefits ($'000)	Project Costs in Thousand $			Net Social Benefit
	Irrigation Crops	Irrigation Livestock	Drought Proofing	Forward Linkages	Pivots	Farm Machinery	Flood Control		Construction Costs	Pivot and Farm Machinery Costs	Total Costs	
30	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
31	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
32	$14,156	$7,300	$0	$14,586	$0	$0	$42,520	$78,562	$0	$5,052	$5,052	$73,510
33	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
34	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
35	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
36	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
37	$14,156	$7,300	$0	$14,586	$0	$0	$42,520	$78,562	$0	$12,478	$12,478	$66,084
38	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
39	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
40	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
41	$14,156	$7,300	$3,300	$14,586	$0	$0	$0	$39,342	$0	$12,478	$12,478	$26,864
42	$14,156	$7,300	$0	$14,586	$0	$0	$42,520	$78,562	$0	$12,478	$12,478	$66,084
43	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
44	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
45	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
46	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
47	$14,156	$7,300	$0	$14,586	$0	$0	$42,520	$78,562	$0	$5,052	$5,052	$73,510
48	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$5,052	$5,052	$30,990
49	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
50	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
51	$14,156	$7,300	$0	$14,586	$0	$0	$0	$36,042	$0	$12,478	$12,478	$23,564
52	$14,156	$7,300	$0	$14,586	$0	$0	$42,520	$78,562	$0	$12,478	$12,478	$66,084
53	$14,156	$7,300	$0	$14,586	$0	$0		$36,042	$0	$12,478	$12,478	$23,564
Total	$644,098	$332,150	$13,200	$663,668	$0	$0	$425,200	$2,078,316	$190,000	$489,767	$679,767	$1,398,550

Question 61

Reference:

Volume 3, Section 7.2, Table 40, Page 69

Rationale/Preamble:

Information Request:

a. Provide definitions of each row label in the column called “Particulars” in regard of the “Direct Benefits/Costs” only.

Response:

a. Table 61.1 shows the definitions of each of the “Particulars” in regards to the “Direct Benefits/Costs” as presented in Volume 3, Section 7.2, Table 40 (Page 69).

Table 61.1 Definition of Direct Benefits/Costs Particulars Estimated in Volume 3

Benefits
Net Benefits from Crop Production This is an increase in the producer’s income from irrigated crop production over and above the income for dryland crop production.
Net Benefits from Livestock Production This is the amount of additional income to producers from irrigated livestock production over and above dryland livestock production.
Benefits from Drought Mitigation This represents income from irrigated crop and livestock enterprises during a drought period.
Food Processing (Forward Linkages) Benefits This is the additional income generated by agricultural processing enterprises in Alberta through purchase of irrigated crops and livestock.
Benefits to Irrigation Equipment Dealers This is the additional income received by on-farm irrigation infrastructure and systems supplied to irrigation producers.
Benefits to Specialized Machinery and Equipment Dealers This is the additional income received by dealers of specialized machinery and equipment provided to irrigation producers in Alberta.
Benefits of Mitigated Flood Damage This represents the value of flood damage saved to communities and businesses in the region.
Total Benefits This is a sum of all the above seven categories of benefits listed above.
Costs
Construction Cost This is the cost of construction of the dam and reservoir for the Chin Expansion Project.
Investment in Pivot Systems/Specialized Farm Equipment This is the value of expenditures made by irrigation producers for on-farm irrigation infrastructure (pivots, electricity, water supply) and specialized farm machinery and equipment.
Total Cost Sum of construction and on-farm equipment and infrastructure.
Net Present Value. This is the difference between Total Benefits and Total Costs.

Question 62

Reference:

Volume 3, Section 7.2, Table 40, Page 69

Rationale/Preamble:

Information Request:

a. State what items in Table 40 are discounted and the rate of discount. Label all items in the "Particulars" column that it is present valued/NPV'ed.

Response:

a. All values in Table 40 (Volume 3, Section 7.2, Page 69) are discounted values for a 50-year period using a 4% discount rate.

Question 63

Reference:

Volume 3, Section 7.2, Table 40, Page 69

Rationale/Preamble:

Information Request:

a. In Table 40:
    i. Add the costs of reconstruction of the bridge over the reservoir's new FSL or explain why it is irrelevant.
    ii. Add costs of relocating the recreation area or explain why it is irrelevant.
    iii. Add a list of costs and benefits that are relevant but that were not quantified.
b. Discuss how benefits of drought mitigation for current acres, assuring volume for flood mitigation, and satisfying requirements of new acres is managed so as not be conflicting objectives.
c. Discuss uncertainty estimate to benefits and costs.

Response:

a.

    i. The costs of the bridge reconstruction are irrelevant as the bridge has reached its end of life. Therefore, the Highway 36 Bridge Replacement project is required regardless of the Project and replacement has been proposed by TEC. SMRID is coordinating with TEC to ensure the design of the bridge is built with the new FSL in mind. Please refer to the response to SIR#1 Question 24.
    ii. Construction of new recreation facilities is not anticipated. Upgrading to maintain the existing recreation facilities is anticipated and the cost is included in the $190 million budget. This is discussed in Volume 3, Section 4. 4.
    iii. This information is shown in Volume 3, Sections 8.4 and 8.5. For the farm level benefit-cost ratio, the following are relevant but not included:
        - Increase in the land value after the adoption of irrigation.
        - Ease in selling the farm at higher prices at some future date.
        - Integration with local food processors and input suppliers resulting from higher quantities.
        - Stability in farm income under irrigation (compared to dryland farming).
        - Presence of community business and non-commercial services nearby.

- More reliable crop yields.
- Higher level of diversity on farms.

For the social benefit cost analysis, the benefits that are relevant but not estimated:

- Stability in communities.
- Reduced dependence on transfer payments to people and communities.
- Reduced fiscal costs.
- Increased agricultural output, enabling Canada to earn more foreign exchange.
- Reduced crop insurance costs.
- Increased employment opportunities.
- Reduced poverty among direct beneficiaries and urban consumers.
- Improved quality of life for rural populations.
- Increased diversity in farm production.
- Recreation associated with reservoir.
- Sales by irrigated farms to dryland producers for forage.

b. For the Socio-economic Assessment, drought benefits were based on a 2008 study by Samarawickrema and Kulshreshtha titled “Value of Irrigation Water for Drought Proofing in the South Saskatchewan River Basin”. Drought impacts were based on differences in crop yields between dryland and irrigation production during a drought. Please refer to the response to SIR#1 Question 1 (a) for additional information regarding Project priorities as they relate to irrigation expansion, water security, flood and drought mitigation.

c. Uncertainties in the benefit-cost analysis can be contributed through:

- Change in market costs that affects the economics of various crop and livestock enterprises.
- Exchange rate of Canadian and U.S. dollar that affects the value of imported on-farm irrigation systems and specialized machinery.
- Construction costs related to the Chin Reservoir Expansion.
- The rate of adoption of irrigation by farmers.
- Changes in government policies related to irrigation development.

Question 64

Reference:

Volume 3, Section 8.6;
Volume 5, Section 7, 7.1 [B] (b), (c), (d), (e) and (f);
Volume 5, Section 7, 7.2 [C], [D] and [E]

Rationale/Preamble:

Information Request:

a. Provide the following information as required in the final Terms of Reference Section 7.1 and 7.2 or identify where they are in the EIA as they are not in Volume 3 as indicated in the concordance table:

   7.1 [B] *Describe factors that may affect existing socio-economic conditions including:*
   b) workforce requirements for all stages of the Project, including a description of when peak activity periods will occur;
   c) planned accommodations for the workforce for all stages of the Project. Discuss the rationale for their selection;
   d) the SMRID's policies and programs regarding the use of local, regional and Alberta goods and services;
   e) The project schedule; and
   f) the overall engineering and contracting plan for the Project.

   7.2 [C] *Discuss opportunities to work with Indigenous communities and groups, other local residents, and businesses regarding employment, training needs and other economic development opportunities arising from the Project.*

   7.2 [D] *Provide the estimated total project cost, including a breakdown for engineering and project management, equipment and materials, and labour for both construction and operation stages, including maintenance of the Project. Indicate the percentage of expenditures expected to occur in the region, Alberta, Canada, outside of Alberta, and outside of Canada.*

   7.2 [E] *Provide an estimate of the costs and benefits of providing livestock watering facilities supported from the Project as it relates to improved range management and livestock production.*

Response:

a. Pertaining to 7.1 [B] (b), it was assumed that 50% of the construction workforce would take place in year 1 of the 3-year construction period, 35% in year 2, and 25% in year 3. This was a preliminary estimate, and it is recognized that these values might change. On-Farm workforce requirements are assumed to be equal for each of the 10 years after construction – during the expansion development of the 46,500 acres. This workforce would include specialized people within the irrigation development companies (e.g., design, construction of water supply

infrastructure, pivot irrigation systems). Factors affecting workforce availability for all stages of the Project development include:

- Labour wages
- Unemployment levels
- Inflation

Pertaining to 7.1 [B] (c), planned accommodations are not required as this Project will be spread over 3 to 4 years and has two main population centers, Lethbridge and Taber, with many places to stay nearby.

Pertaining to 7.1 [B] (d), SMRID does not have policies and programs regarding the use of local, regional, and Alberta goods and services. Goods and services are evaluated based on the specified parameters and cost. Typically, this encourages local, regional, and Alberta goods and services to be competitive and successful in conducting the Project.

Pertaining to 7.1 [B] (e), with the extended schedule of the construction, there will be little to no effect on the socio-economic condition.

Pertaining to 7.1 [B] (f), the engineering and contracting will not affect the socio-economic condition.

Pertaining to 7.2 [C], SMRID is not directly providing opportunities. However, it would be up to the successful contractors and local farmers to provide those opportunities indirectly because of the added economic development.

Pertaining to 7.2 [D] regarding the estimated total Project costs, Table 64.1 presents a cost summary of the New East Dam and appurtenant structures and the decommissioning of the Existing East Dam.

Table 64.1 New East Dam Cost Summary

Description	Cost Estimate ($ million)
New East Dam and Appurtenant Structures	$91.8
Chin 2 (East) Dam Decommissioning	$4.2
Subtotal Construction	$96.0
Contingency (15%)	$14.4
Engineering, Environmental, and Project Management (12%)	$13.2
Total New East Dam Project Cost (2025 dollars)	**$123.6**

An estimated cost of construction equipment, materials, and labour is speculative as construction contractors will develop their own construction methodology, equipment fleet, corresponding labour requirements, etc. The construction materials, required for the construction of the New East Dam, will be either sourced on site (earthfill from required excavations and borrow areas) or imported to site from commercial aggregate processing facilities. Table 64.2 presents the estimated equipment, materials, and labour costs for the

construction stage and the estimated percentage of expenditures that are sources locally, within Alberta, Canada, and outside of Canada.

Table 64.2 Estimated Equipment, Materials, and Labour Costs – Construction Stage

Description	Cost Estimate ($ million)	% Expenditures in the Region	% Expenditures in Alberta	% Expenditures Elsewhere in Canada	% Expenditures Outside of Canada(1)
Construction Equipment	$54.2	25%	75%	0%	0%
Materials	$20.1	58%	28%	14%	0%
Labour	$36.1	25%	70%	5%	0%
Total	**$110.4**				

Notes:
(1) It is noted that it is assumed that construction of the New East Dam will be conducted by a Canadian construction contractor. However, it is conceivable that a construction contractor based outside of Canada could be selected for this work (similar to what occurred for Springbank Reservoir 1). However, the majority of the construction equipment and materials would still be sourced from within Alberta and Canada with the possibility of some labour being from outside of Canada.

Estimates of annual costs for project operation and maintenance are often based on a percentage of project capital cost. Studies of operation and maintenance costs for water resources projects were conducted by the Saskatchewan Nelson Basin Board (SNBB) which were based largely on earlier reports by the U.S. Bureau of Reclamation (USBR). Based on the work completed by the SNBB and USBR and from a review of costs from previous studies in Alberta, the estimated average annual operation and maintenance costs for the New East Dam and appurtenant structures is 0.5% of Project capital costs or $550,000/year.

The estimated equipment cost and labour cost for operation and maintenance is $200,000/year and $350,000/year, respectively.

Pertaining to 7.2 [E], the Socio-economic Assessment study did not attempt to specifically identify the impact of the Chin Reservoir Expansion Project on livestock watering facilities. It was assumed that livestock watering within the irrigated areas would be accounted for in the water supplies allocated to new irrigation acres (46,500 acres).

Question 65

Reference:

Volume 5, Section 7, 7.2 [A];
Volume 5, Section 8, [A]

Rationale/Preamble:

The final Terms of Reference 7.2 [A] states *Describe the socio-economic impacts of construction and operation of the Project on:*
a) land owners;
b) agricultural productivity;
c) local and regional infrastructure and community services;
d) availability and quality of health care services;
e) local training, employment and business opportunities;
f) housing;
g) recreational activities; and
h) First Nations and Métis (e.g., traditional land use and social and cultural implications).

The final Terms of Reference 8 [A] states *Discuss mitigation measures planned to avoid, minimize, or eliminate the potential impacts for all stages of the Project.*

Information Request:

b. Provide the information as required in the final Terms of Reference.

c. The final Terms of Reference 8 [A] was not answered with respect to the socio-economic impacts. Discuss mitigation measures planned to avoid, minimize, or eliminate the potential impacts for all stages of the Project.

Response:

a. [a] Landowners

Landowners who own suitable land that meets GoA irrigation land classification standards, and are willing to convert from dryland production to irrigation production, will realize a significant increase in their land value, achieve increased productivity per acre, increased quality of crops grown, and increased potential to grow value-added crops (potatoes, seed canola, dry beans, alfalfa, intensive livestock feeding) that can be sold at higher prices to Alberta processors.

Major food processing enterprises are associated with the irrigation districts because of ready and dependable access to specialty crop inputs for their operations. The following are examples of major processing plants that utilize irrigated crops and livestock produced in the Irrigation Districts.

- **Lantic Inc.** (Taber). About 30,000 acres of sugar beets are grown on irrigated fields as the primary input into sugar production. Lantic Inc. (Rogers Sugar) is dependent on local

irrigated sugar beet production. About 200 production contracts are arranged with 150 irrigation growers each year. The company employs 100 people full time, another 150 people at harvest, and an additional 50 to 70 people when processing is in operation.

- **Lamb-Weston Inc.** (Taber). Lamb-Weston uses irrigated potatoes to process frozen potato products. The Lamb-Weston plant also depends on water supplied through the Taber Irrigation District. Lamb-Weston employs approximately 200 people.
- **McCain Foods Ltd.** (Chin). McCain Foods is the world's largest manufacturer of frozen potato products. One of their processing facilities is just east of Coaldale, and is similar in size to the Lamb-Weston facility.

Note – the Lamb-Weston and McCain plants are undergoing major expansions to accommodate processing of significantly more potatoes.

- **Cavendish Farms.** (Lethbridge). Cavendish Farms is also a producer of frozen potato products and supplies clients throughout the world. In 2019, Cavendish Farms constructed a new potato processing facility in Lethbridge. The plant employs about 200 staff at the Lethbridge facility, and is capable of processing about 333 million kg of potatoes annually.
- **Frito Lay Canada.** (Lethbridge, Taber). The Taber plant specializes in potato chips and other potato-based products, using irrigated potatoes from the irrigation districts. The Lethbridge plant also operates a corn-based plant. Combined, the two plants employ about 525 people.
- **Old Dutch Foods Ltd.** (Calgary and Airdrie). Specializes in production of potato chips using irrigated potatoes, and associated snack products.
- **Whole Leaf Ltd.** (Coaldale, Calgary). This company's 4.5 hectare (ha) greenhouse is the largest lettuce greenhouse operation in North America. It produces chemical-free leafy greens in climate-controlled greenhouses. The company employs 130 people and uses water from the SMRID. The company produces 40,000-55,000 heads of lettuce each day, and ships to clients across Canada. It is the sole supplier of lettuce to Wendy's restaurants throughout Canada.
- **Viterra Inc.** (Bow Island). Processes about 45,000 acres of irrigated beans and about 25,000 acres of dry peas. The company also processes chickpeas and lentils.
- **Cargill Beef Processing.** (High River). Employs about 2,200 people and processes about 4,500 head of cattle each day. Most of the processed cattle come from the beef feedlots located within or adjacent to the irrigation districts.
- **JBS Canada.** (Brooks). A beef processing plant that employs about 2,000 people and processes about 4,000 head of cattle each day. The majority of processed cattle come from feedlots associated with the irrigation districts.
- **Harmony Beef.** (Airdrie). Beef processing plant employs about 200 people and processes about 800 cattle per day. Its focus is on specialty meat products.

[b] Agricultural Productivity

- Agricultural productivity for the expanded irrigation area will increase substantially relative to the same area under dryland production. For example, net revenue for dryland crops in the expansion region is about $25.00/acre, while net revenue for irrigated crops is about $252.00/acre. In addition (as discussed above), irrigation allows producers to grow specialty, valued-added crops that dryland producers cannot grow because of a lack of water.

[c] Local and Regional Infrastructure and Community Services

- Expansion of irrigation by 46,500 acres is not expected to significantly impact local and regional infrastructure and community services since the expansion areas will be spread over a large regional area (Raymond to Medicine Hat).

[d] Availability and Quality of Health Care Services

- Availability and quality of health care services are not expected to be affected or overwhelmed, for the same reasons discussed above.

[e] Local Training, Employment, and Business Opportunities

- Employment and business opportunities within the expansion area are expected to increase in the irrigation expansion area because of increased demand for agricultural inputs (seed, fertilizer, pesticides, trucking, storage facilities, etc.). Irrigation farms require additional labour to manage land preparation, seeding, irrigation, harvesting, and trucking. Please refer to *The Economic Value of Alberta's Irrigation Districts* (Acera 2021) for more information.

[f] Housing

- Additional labour requirements within the irrigation expansion area will increase demand for housing as new families move into the area.

[g] Recreational Activities

- No significant changes in development of recreational facilities because the irrigation expansion area is spread over such a large area (Raymond to Medicine Hat).
- The Chin Park campground will be affected by Chin Reservoir Expansion and replacement of the Highway 36 Bridge (refer to SIR#1 Question 69).

[h] First Nations and Métis

- SMRID has maintained communication with the Blood Tribe throughout the design process. SMRID plans to continue that same dialogue providing updates at critical points of the design. The SMRID has invited the Blood Tribe to conduct a walk-through of the Project area prior to winter 2025. Following this walk-through, SMRID will further discuss potential next steps and determine any additional involvement the Blood Tribe may have during Project development and operation. Please refer to the response to SIR#1 Question 43 (b) for more context. Currently, no socio-economic impacts have been identified or are anticipated with respect to First Nations and Métis.

b. As noted in the response to SIR#1 Question 69, SMRID intends to work with TEC to design and implement relocation of the campground facilities to avoid an adverse effect.

   No significant adverse residual effects have been identified and mitigation measures are not practical for the incidental adverse effects that are anticipated. The positive residual effects do not require mitigation. No additional mitigation measures are anticipated.

3.4 Transportation

Question 66

Reference:

Volume 1, Section 2.5.1, Page 34

Rationale/Preamble:

SMRID states *the alignment of the permanent road will be developed once the dam has been constructed.*

Information Request:

a. Explain why the access roadway design was not prepared in the engineering assignment for this project? When will the access roadway design be ready? How will this design be communicated to Transportation and Economic Corridors so it can be reviewed?

b. If the design has been developed, provide the design and the methodology behind how it was developed.

Response:

a. The proposed access road design is presented in the New East Dam PDR, Appendix I – General Arrangement of New East Dam Site Works, Section 2.6, Page 8 and the design plan, profile, and typical sections are presented on Drawing No. 015 in the New East Dam PDR. The New East Dam PDR was issued to AGI Dam Safety on March 15, 2024 (Application #DAPP0071185) and is provided with the SIR#1 Response Document in Appendix 1.1.

b. The access road geometric design is based on TEC's Geometric Design Guide for Low Volume Rural Roads. The access road design speed is 50 kph.

   As noted in Volume 1, Section 2.5.1 of the EIA submission, the access road alignment is pending landowner negotiations. An alternate access road alignment, located west of the north dam abutment as described in Volume 1, Section 2.5.1, is being considered. If required, a revised access road design will be submitted as an amendment to the AGI Dam Safety submission.

Question 67

Reference:

Volume 1, Section 2.5.6, Page 38

Rationale/Preamble:

Information Request:

a. Provide the section of the EIA report where the impacts of the existing east dam decommissioning are discussed.

Response:

a. The proposed method of decommissioning the Existing East Dam is presented in the New East Dam PDR, Appendix II – Reservoir Filling and East Dam Decommissioning (Appendix 1.1 of this SIR#1 Response Document). The report documents an assessment of options for filling the expanded footprint of the reservoir through the Existing East Dam, a reservoir filling schedule, temporary diversion discharges and volumes, and the strategy to decommission the Existing East Dam.

   The assessment of potential environmental effects of the proposed Project was conducted through a multi-step evaluation process. The potential effects assessment considered the various Project component and conceptual designs, expected construction methodology, and a consideration of the proposed operation of the Project. As described in Volume 2, Section 1.2 of the EIA submission, effects associated with three phases of construction (i.e., construction of the New East Dam, reservoir filling, and decommissioning of the Existing East Dam) and the operation of the Expanded Chin Reservoir were assessed. Within Volume 2, Section 2 of the EIA submission, potential Project-related effects to each of the valued components (VCs) were assessed. A summary of the assessment of potential Project-related effects is provided in table format in Volume 2, Appendix I of the EIA submission (Table I.1 through I.8). A table for each of the VCs assessed in Volume 2, Section 2 is provided and categorizes the effects by either construction-related effects or operational-related effects, highlighting the effects specific to decommissioning of the Existing East Dam.

Question 68

Reference:

Volume 1, Section 2.7.4, Page 40

Rationale/Preamble:

Information Request:

a. Explain if the removal and construction of a new Highway 36 bridge is expected to have any residual impacts.

Response:

a. Please refer to the response to SIR#1 Question 24 (a). The Highway 36 Bridge Replacement project will be subject to a separate regulatory process. It is anticipated that any residual impacts that are encountered by TEC that pertain to the reservoir and SMRID operations will be communicated to SMRID.

Question 69

Reference:

Volume 1, Section 2.7.13, Page 42

Rationale/Preamble:

The Chin Park Campgrounds are accessed via Highway 36 and as a result will be inundated by the Project. SMRID has stated that a new campground location is being discussed. The new location has the potential to impact the Highway 36 bridge replacement/realignment project from an access management and design standards perspective.

Information Request:

a. Describe SMRID's plan to include Transportation and Economic Corridors in these discussions.

Response:

a. The SMRID has had discussions with the TEC design team that is responsible for the Highway 36 Bridge Replacement project and they are aware of the scope of the Chin Reservoir Expansion Project. As the Project progresses, the SMRID plans to continue working together with the TEC design team to determine locations for the Chin Park Campgrounds. Regular meetings have been held between the SMRID staff and its agents involved on the Chin Reservoir Expansion Project and TEC staff and agents, and regular meetings will continue throughout the design process.

Question 70

Reference:

Volume 2, Section 5

Rationale/Preamble:

Information Request:

a. Provide an explanation as to whether or not the Transportation and Economic Corridors' Water Control Structures Selected Design Guidelines were used in the Project. If not, provide justification for why the guidelines were not used.

Response:

a. TEC's Water Control Structures Selected Design Guidelines (2004) were used in the design of the New East Dam and appurtenant structures. Specifically, the Water Control Structures Selected Design Guidelines were referenced for:
    - Earth and rock material types and design.
    - Erosion protection design.
    - Foundation considerations.
    - Seepage and drainage.
    - Dam freeboard.

Question 71

Reference:

Volume 2, Section 5.2.3.3.3, Page 178;
Volume 2, Section 5.2.4.1, Page 179

Rationale/Preamble:

The EIA's Traffic Impact Assessment did not provide an assessment of the adequacy of highway intersections, such as whether they can accommodate additional traffic volume and truck type generated by the construction phase of the Project, and whether any improvements are required. Instead, the EIA deferred to future analysis when a construction plan is developed.

In addition, the estimated truck volumes during peak hours are inconsistent (e.g., Section 5.2.3.3.3 states *10 trucks*, while Section 5.2.4.1 states *20 trucks*).

Information Request:

a. Explain why the construction plan has not been developed prior to the submission of the EIA. How will the construction plan be provided to Transportation and Economic Corridors for review? If a construction plan has been developed, provide the plan.

b. Provide the correct estimations for truck volumes during peak hours.

c. Assess and discuss the adequacy (e.g., geometric and level of service) of highway intersections that are impacted by the Project. Explain if any intersection improvements are required, what they are, and when they will be completed.

Response:

a. A detailed construction plan was not developed prior to the submission of the EIA because key inputs such as pit locations and haul routes were not known at the time. At this time, the specific locations of the material source pits to be utilized during the various phases of construction have not been confirmed and will be dependent on the contractor that is selected during the tendering process. Once a contractor is secured, the contractor will determine the pit locations and preferred haul routes. Without this information, it is not possible to complete an appropriate and accurate construction plan at this stage.

   However, MPE prepared an updated Traffic Impact Assessment (TIA), based on assumed conditions as noted below, to address the fToR Section 2.4 [D] and the SIR#1 comments. The updated TIA has been provided in Appendix 71.1 of this SIR#1 Response Document. Although the specific locations of the material source pits are not known at this time, it is anticipated that the most viable options will be pits situated to the north and south of the construction site, both with access to Highway 36. Additionally, it was assumed that construction personnel will primarily originate from, or be destined for, the Town of Taber and the City of Lethbridge. From Highway 36, construction traffic will access the construction site along Township Road 80 and Range Road 152.

A comprehensive Traffic Accommodation Strategy (TAS) will be prepared following contractor selection and finalization of haul routes. The contractor will be responsible for developing the TAS, which will be required as part of the Issued for Construction Specifications. The completed TAS will be submitted to TEC, the Municipal District of Taber, and the County of Warner No. 5 for review and coordination.

b. As per the TIA provided in Appendix 71.1 of this SIR#1 Response Document, the proposed construction is anticipated to generate:

- 12 new truck trips (6 in and 6 out) during AM and PM peak hours, and 110 new truck daily trips (55 in and 55 out), during Phase 4 by 2029. These truck trips are anticipated between the pit locations and the construction site.
- 20 new trips (10 in and 10 out) during the AM and PM peak hours, and 140 new daily trips (70 in and 70 out), during Phase 4 by 2029. These trips are anticipated between the construction site and two key urban centres (City of Lethbridge and Town of Taber).

The 2029 horizon year was identified as the peak construction period and is therefore selected as the horizon for traffic analysis. Phase 4, anticipated to be underway by 2029, is expected to generate the highest combined volume of background traffic, construction-related truck traffic, and commuter traffic. As such, this horizon represents the worst-case scenario for traffic operations.

c. Please refer to Section 5.0 of the TIA provided in Appendix 71.1 of this SIR#1 Response Document. It is recommended that the Highway 36 and Township Road 80 intersection layout be maintained to accommodate the post-development traffic conditions (temporary construction traffic). The following temporary mitigation measures are recommended to improve the safety and efficiency of truck operations at the intersection of Highway 36 and Township Road 80:

- Implement a temporary speed reduction of the posted speed limit to 90 kph along Highway 36 in the vicinity of the intersection with Township Road 80.
- Install temporary advance warning signage, such as a *Truck Entrance Sign (WC-8)*, to alert drivers of increased truck activity where unusual maneuvers or geometric constraints may pose an uncommon degree of hazard.
- Deploy temporary traffic control (TTC) measures, including flagging personnel or portable traffic signals, to facilitate one-direction-at-a-time truck movements during peak hauling operations.
- As part of the TAS, provide targeted instruction to construction personnel and truck drivers regarding the geometric limitations at the intersection and emphasize the need for staggered turning movements, ensuring that only one truck navigates the intersection at a time to avoid conflicts.

A detailed TAS will be developed by the contractor once pit locations and haul routes are finalized. The TAS will be required as part of the Construction Specifications and will be submitted to TEC, the Municipal District of Taber, and the County of Warner No. 5 for review.

If required intersection improvements are identified through this process, they will be implemented prior to or during construction, as appropriate.

Question 72

Reference:

Volume 5, Section 2, 2.4 [A]

Rationale/Preamble:

The final Terms of Reference states *Assess the geotechnical impacts of the Project on rate of retrogression and overall stability of the Highway 36 Chin Coulee landslide (identified as site S005 in Transportation and Economic Corridors' Geohazard Risk Management Program).*

Site S005 is not fully documented in the EIA (e.g., boundary, groundwater, slip surface, movement rate, instrumentation, relationship with the water level of the reservoir, past repair, maintenance history, etc.).

Information Request:

a. Assess the geotechnical impacts of the Project on rate of retrogression and overall stability of the Highway 36 Chin Coulee landslide (Site S005) and risks that the landslide may pose to the reservoir.

b. A geotechnical assessment has not been submitted for the Project. If an assessment has been completed, provide the results of the assessment. The assessment should include a rapid drawdown analysis, in addition to, bare earth LiDAR for the known land slide Site S005 and analysis of any additional landslide features for the reservoir banks and surrounding terrain. Transportation and Economic Corridors can provide background information and data if requested.

Response:

a. The Chin Coulee landslide (Site S005) is located at 49° 36' 17.0" N, 112° 10' 45.9" W on the north coulee wall of Chin Reservoir, approximately 650 m east along the shoreline of the reservoir from the north abutment of the Highway 36 Bridge, downslope from the south shoulder of Highway 36 (Deane et al. 2019; Deane et al. 2020a; Deane et al. 2020b). The slide extends approximately 200 m in length, 350 m in width, and reaches up to 45 m in depth, with a slope inclination ranging from 9° to 20° (Deane et al. 2019; Garcia et al. 2024). The estimated slide volume totals 2 million m3 (Deane et al. 2019). The toe of the slide likely daylights within the reservoir as no discernible toe failure has been observed (Deane 2020c).

   Prior to the existence of Chin Reservoir, Highway 36 was located on the coulee floor below the toe of the present-day Chin Coulee landslide. In 1960, Highway 36 was realigned up slope at the top of the coulee wall in association with the construction of the Existing East Dam and Highway 36 Bridge and the filling and operation of the Existing Chin Reservoir. Between 1960 and 1970, the highway was realigned and shifted south towards the present-day landslide's head scarp to facilitate highway curve alignment. As a part of these improvements, an earthfill berm was

constructed within the current landslide extents and regraded, which steepened the configuration and increased the loading on the slope.

Following significant precipitation in the fall of 1978, TEC identified a substantial slope failure of the Chin Coulee landslide undermining the south shoulder of the highway. After this initial movement event, displacements of the slope continued, eventually causing substantial undermining of the northbound lane in 1997. The Chin Coulee landslide was then added to the TEC Geohazard Risk Management Program (GRMP) as Site S005 for regular monitoring. In 2016, an approximate 600 m segment of the highway was shifted 10 to 20 m north as a precautionary measure to increase local stability of the road embankment in response to the slow retrogression of the landslide (Deane et al. 2020b; Rodriguez et al. 2021).

Previous investigations determined the landslide was likely a retrogressive landslide driven by deep-seated movement along a weak layer associated with an inclined coal seam within the bedrock. During early GRMP monitoring of slope inclinometers installed through the landslide, the maximum retrogressive movement rate was reported as 5 mm/year with alternating periods of movement and dormancy (Deane 2020c). Recent studies utilizing modern technology (i.e., terrestrial light detection and ranging (LiDAR) change detection surveys, single frequency differential global navigation satellite system (dGNSS,), photogrammetry, etc.) have revealed more complex deformations of the slide, characterised by a combination of translational rotational sliding and lateral spreading, suggesting the kinematics of the landslide to be more accurately classified as a compound slide (Deane et al. 2019; Rodriguez et al. 2021; Garcia et al. 2024).

Early in 2018, two slope inclinometers and four vibrating wire piezometers were installed to provide subsurface monitoring of deformations that could retrogress towards the highway (KCB 2018a). Later in 2018, nine Geocube dGNSS devices were installed by KCB, working for TEC. Four Geocubes were installed within the landslide extent, five Geocubes were installed around the perimeter of the landslide, and one base station was installed across the reservoir on stable ground (KCB 2018b; Garcia et al. 2024). The Geocubes were in operation recording surficial displacements between 2018 and 2023 after which they were removed. The latest monitoring data from Geocubes taken in 2023 shows displacements rates ranging from 4 mm/year to 120 mm/year at different location which indicates that the movement is not uniform; furthermore, monitoring data have shown variability in the rates of movement through the year which confirms that the landslide exhibits cycles of movement and dormancy (Deane 2020c; Rodriguez et al. 2021).

Based on the evolution of the Chin Coulee landslide, two primary factors contributing to its displacement have been identified as: (1) the realignment of Highway 36 leading to the increased loading at the head of the landslide scarp, and (2) filling and operation of Chin Reservoir which includes seasonal filling and drawdown (Deane 2020c). Drawdown of the reservoir has an impact on the low permeable soils within the coulee wall which have a slower rate of groundwater level drawdown compared to the rate of reservoir drawdown. There is an acceleration of the rate of movement of the landslide mass during drawdown due to the reduction of hydrostatic pressure exerted by the reservoir on the landslide mass. The surficial

monitoring data confirmed displacement rates within the active landslide area vary with reservoir levels—increasing in relation to drawdowns and decreasing in periods of filling (Deane 2020c). A rapid drawdown analysis conducted by Garcia et al. (unpublished) reported a similar conclusion that the rate of reservoir drawdown affects the retrogression and stability of the slide (Garcia et al. unpublished). The monitoring data from the Geocubes also suggested increased rates of movement within the landslide during reservoir drawdown (Rodriguez et al. 2021).

It is believed the basal failure surface of the Chin Coulee landslide is fully formed, with residual strength along the basal failure plane. As a result, further deformation of the landslide will not result in further loss of strength (a brittle failure mechanism is not believed to be possible). A sudden collapse or mass failure of the landslide into the reservoir caused by increased drawdown rates or increased reservoir elevation resulting in the pinching off of the reservoir or generation of impulse waves is not expected.

Although the landslide will continue to creep, the rate at which the landslide creeps will potentially increase due to the rise in FSL of the Expanded Chin Reservoir which results in greater fluctuations in water level due to drawdown. During construction of the New East Dam and filling of the Expanded Chin Reservoir, the Chin Coulee landslide will continue to be exposed to similar reservoir operating conditions, with a rise in water level in the spring up to the existing FSL, followed by drawdown throughout the summer and a brief filling period at the end of the irrigation season.

As discussed in the response to SIR#1 Question 24, the rise in FSL of the Expanded Chin Reservoir will not occur until the Highway 36 Bridge Replacement project has been completed. The Expanded Chin Reservoir will continue to operate at the existing FSL after the New East Dam is constructed until the bridge replacement is complete and Highway 36 is realigned. Until this time, the Chin Coulee landslide will continue to creep as it has been under existing conditions. To accommodate the bridge replacement, Highway 36 will be realigned through the SW and SE quarter sections of 1-8-17 W4M, nearly 1 km north of the head scarp of the Chin Coulee landslide. At such time when the Expanded Chin Reservoir operates at the higher FSL, the rate of movement of the Chin Coulee landslide is likely to increase, leading to further retrogression upslope. As mentioned, Highway 36 will have been realigned by this time. Therefore, the operation of the Expanded Chin Reservoir at the higher FSL will not impact highway infrastructure as a result of further instability in the Chin Coulee landslide and the landslide is not expected to suddenly collapse into the reservoir.

b. No geotechnical assessment of the Chin Coulee landslide was completed as part of this Project. However, the slide was identified in the New East Dam PDR (refer to Appendix 1.1 of this SIR#1 Response Document) as a part of landslide instability review for setbacks and future wave erosion. Further characterization of this slope was noted in Volume 4-5: Soils and Terrain TBR (as part of the EIA submission), which classified the slopes inclination ranging between 10 to > 30%.

Additionally, there has been extensive monitoring and research conducted at the Chin Coulee landslide with many years of monitoring data collected to understand both recent and historical

slide behaviours. Studies conducted as part of a highway geohazard research project conducted through a partnership of KCB, UofA, and TEC have analyzed the failure mechanisms and trigger factors through review of data collected by Geocube dGNSS systems, LiDAR laser scanning, and unmanned aerial vehicle (UAV) photogrammetry data and associated change detection analysis completed as part of the research project. As part of these studies, stability models and a rapid drawdown analyses have been conducted to quantify the overall slope stability and identify factors contributing to both retrogression, further instability of the slope, and impacts of increased rate of drawdown on movement rates. The two slope inclinometers and four vibrating wire piezometers that were installed in 2018 will allow TEC to be able to continue monitoring the movement of the Chin Coulee landslide and provide TEC with an early warning indicator of larger slope movement events. GRMP inspection reports of the landslide can be requested from TEC.

Refer to the response in SIR#1 Question 72 (a) for more information pertaining to studies conducted at the Chin Coulee landslide.

3.5 Historic Resources

Question 73

Reference:

Environmental Impact Assessment Report Summary, Section 4.3.5, Page 20

Rationale/Preamble:

The summary description of Historic Resources includes only a discussion of archaeological resources.

Information Request:

a. What development effects are anticipated for the other types of resources within the project area that are protected under the *Historical Resources Act*, including palaeontological resources and historic built heritage?

Response:

a. [add the text "4.3.5.1 Archaeological Resources:" to the beginning of the existing paragraph in 4.3.5, and then add the following 2 paragraphs:]

   4.3.5.2 Palaeontological Resources: Filling of the Expanded Chin Reservoir area, future reservoir operation, and erosion of shoreline areas is also expected to impact palaeontological sites. Pre-disturbance fossil collection will be conducted at selected palaeontological localities, and monitoring of construction impacts to bedrock will be conducted in accordance with regulatory determinations.

   4.3.5.3 Built Heritage (Historic Structures): Filing of the Expanded Chin Reservoir is expected to impact a single historic built heritage site. It is "HS 45116 – Campground", and is the current Kinsmen Club group camping area on the west side of Highway 36 in LSD 8-35-7-17-W4M. The site was fully recorded during the HRIA and no further historical investigations were recommended. No other buildings that would fall under the definition of "historic built heritage" will be impacted through inundation or construction activities.

Question 74

Reference:

Volume 1, Section 1.12.1.5, Page 21

Rationale/Preamble:

A summary of the permit application, field investigation and reporting schedule has been provided for the archaeological Historic Resources Impact Assessment (HRIA) conducted, but there is no mention of the palaeontological HRIA.

Information Request:

a. What was the schedule of the acquisition of the palaeontological HRIA permit, and the completion of the subsequent fieldwork and reporting?

Response:

a. [revise the first sentence of the final paragraph to read "*On May 16, 2022, a permit application was submitted by Bison Historical Services Ltd. for the Archaeological HRIA for the Project*" i.e., add the word "Archaeological".]

   [revise the third sentence of the same paragraph to change a typo: 2023 should be 2022. The fieldwork was completed in 2022.]

   [Then add the following paragraph:]

   On May 6th, 2022, the Palaeontology HRIA (pHRIA) permit application was submitted to the HRMB by Steppe Consulting Ltd., as a sub-consultant to Bison Historical Services Ltd. Fieldwork for the pHRIA was carried out under permit 22-049 from May 16 to May 27, 2022. The final report of the pHRIA was submitted to the HRMB on November 27, 2023.

Question 75

Reference:

Volume 1, Section 2.7.13, Page 42

Rationale/Preamble:

Two campgrounds described in Section 2.7.13 on the south shore of the Chin Coulee Reservoir are identified as being locations that will be inundated as the result of the Project.

Information Request:

a. Clarify whether these sites have sufficient characteristics to be recorded as Heritage Survey sites under the *Historical Resources Act*.

Response:

a. [add the following text after the existing paragraph in 2.7.13]

   Campground 1: The Kinsmen Club group camping area was previously recorded as "HS 45116 – Campground", and was revisited during the 22-047 HRIA (see response to SIR#1 Question 74). The site was fully recorded during the HRIA and no further historical investigations were recommended.

   Campground 2: Chin Park, on the east side of Highway 36, does not have sufficient characteristics to be recorded as a Heritage Survey site, since none of the buildings appear old enough to qualify as historical in nature.

Question 76

Reference:

Volume 2, Map Figures 2.9.1-2.9.4

Rationale/Preamble:

Map Figures 2.9.1 to 2.9.4 show the extent of the Historic Resources Impact Assessment conducted for the project.

Information Request:

a. Within these maps, clarify which portion of the study area was investigated relative to archaeological resources, and which portion of the study area was investigated relative to palaeontological resources.

Response:

a. [We assume that the above SIR is asking for the "ground survey maps" which were included in the HRIA and pHRIA reports.]

   Figures 76.1 to 76.4 represent the archaeology ground survey area. The title for these figures has been updated and the figures are provided below. We have attached new Figures 76.5 to 76.8 that show the palaeontology ground survey area. These figures do not contain confidential information and may be distributed.

FIGURES

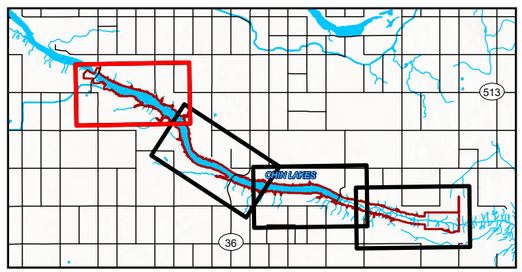
Figure 76.1 Historic Resources Impact Assessment Archaeology Survey Tracks (Sheet 1 of 4)
Figure 76.2 Historic Resources Impact Assessment Archaeology Survey Tracks (Sheet 2 of 4)
Figure 76.3 Historic Resources Impact Assessment Archaeology Survey Tracks (Sheet 3 of 4)
Figure 76.4 Historic Resources Impact Assessment Archaeology Survey Tracks (Sheet 4 of 4)
Figure 76.5 Historic Resources Impact Assessment Palaeontology Survey Tracks (Sheet 1 of 4)
Figure 76.6 Historic Resources Impact Assessment Palaeontology Survey Tracks (Sheet 2 of 4)
Figure 76.7 Historic Resources Impact Assessment Palaeontology Survey Tracks (Sheet 3 of 4)
Figure 76.8 Historic Resources Impact Assessment Palaeontology Survey Tracks (Sheet 4 of 4)

34-08-18-W4M
35-08-18-W4M
36-08-18-W4M
31-08-17-W4M
32-08-17-W4M
33-08-17-W4M
27-08-18-W4M
26-08-18-W4M
25-08-18-W4M
30-08-17-W4M
29-08-17-W4M
28-08-17-W4M
22-08-18-W4M
23-08-18-W4M
24-08-18-W4M
19-08-17-W4M
20-08-17-W4M
21-08-17-W4M
15-08-18-W4M
14-08-18-W4M
13-08-18-W4M
18-08-17-W4M
17-08-17-W4M
16-08-17-W4M

N

Legend

- Road
- Study Boundary
- Alberta Township Section
- Ground Survey



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HISTORIC RESOURCES IMPACT ASSESSMENT ARCHAEOLOGY SURVEY TRACKS SHEET 1 OF 4

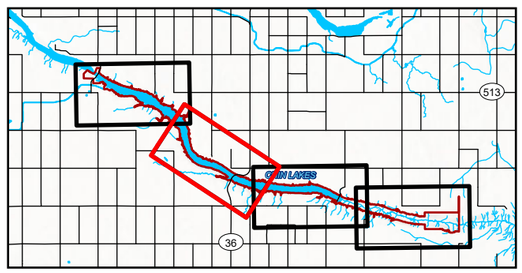
SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	76.1

File: \\int.klohn.com\Proj\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_230301.aprx Date:4/24/2025 3:52 PM Creator: HManandyan

21-08-17-W4M
14-08-17-W4M
12-08-17-W4M
5-08-16-W4M
15-08-17-W4M
6-08-16-W4M
32-07-16-W4M
11-08-17-W4M
16-08-17-W4M
1-08-17-W4M
36
10-08-17-W4M
31-07-16-W4M
2-08-17-W4M
36
9-08-17-W4M
36-07-17-W4M
3-08-17-W4M
30-07-16-W4M
36
8-08-17-W4M
35-07-17-W4M
4-08-17-W4M
25-07-17-W4M
34-07-17-W4M
36
5-08-17-W4M
26-07-17-W4M
33-07-17-W4M
24-07-17-W4M
27-07-17-W4M

Legend

- Road
- Study Boundary
- Alberta Township Section
- Ground Survey



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HISTORIC RESOURCES IMPACT ASSESSMENT ARCHAEOLOGY SURVEY TRACKS SHEET 2 OF 4

SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	76.2

File: \\int.klohn.com\Proj\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_230301.aprx Date:4/24/2025 3:52 PM Creator: HManandyan

6-08-16-W4M | 5-08-16-W4M | 4-08-16-W4M | 3-08-16-W4M | 2-08-16-W4M | 1-08-16-W4M

N

31-07-16-W4M | 32-07-16-W4M | 33-07-16-W4M | 34-07-16-W4M | 35-07-16-W4M | 36-07-16-W4M

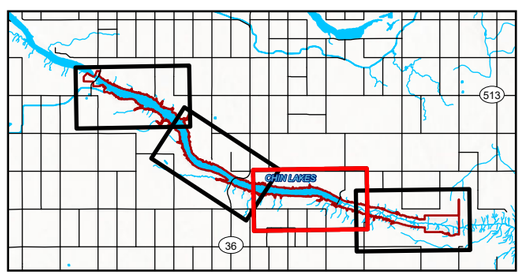
30-07-16-W4M | 29-07-16-W4M | 28-07-16-W4M | 27-07-16-W4M | 26-07-16-W4M | 25-07-16-W4M

19-07-16-W4M | 20-07-16-W4M | 21-07-16-W4M | 22-07-16-W4M | 23-07-16-W4M | 24-07-16-W4M

18-07-16-W4M | 17-07-16-W4M | 16-07-16-W4M | 15-07-16-W4M | 14-07-16-W4M | 13-07-16-W4M

Legend

- Road
- Study Boundary
- Alberta Township Section
- Ground Survey



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HISTORIC RESOURCES IMPACT ASSESSMENT ARCHAEOLOGY SURVEY TRACKS SHEET 3 OF 4

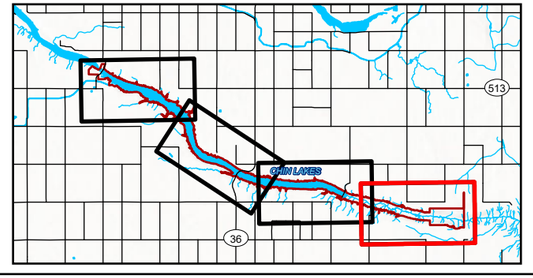
SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	76.3

File: \\int.klohn.com\ProjData\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_230301.aprx Date:4/24/2025 3:52 PM Creator: HManandyan

25-07-16-W4M
30-07-15-W4M
29-07-15-W4M
28-07-15-W4M
27-07-15-W4M
26-07-15-W4M
25-07-15-W4M
36-07-15-W4M
N
24-07-16-W4M
19-07-15-W4M
20-07-15-W4M
21-07-15-W4M
22-07-15-W4M
23-07-15-W4M
24-07-15-W4M
13-07-16-W4M
18-07-15-W4M
17-07-15-W4M
16-07-15-W4M
15-07-15-W4M
14-07-15-W4M
13-07-15-W4M
12-07-16-W4M
7-07-15-W4M
8-07-15-W4M
9-07-15-W4M
10-07-15-W4M
11-07-15-W4M
12-07-15-W4M

Legend

- Road
- Study Boundary
- Alberta Township Section
- Ground Survey



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HISTORIC RESOURCES IMPACT ASSESSMENT ARCHAEOLOGY SURVEY TRACKS SHEET 4 OF 4

SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	76.4

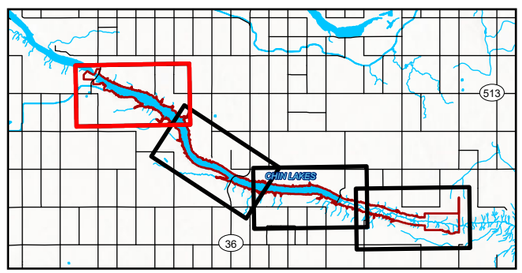
File: \\int.klohn.com\Pro\Data\A\CGY\Alberta\A03701\E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_230301.aprx Date:4/24/2025 3:52 PM Creator: HManandyan

34-08-18-W4M
35-08-18-W4M
36-08-18-W4M
31-08-17-W4M
32-08-17-W4M
33-08-17-W4M
27-08-18-W4M
26-08-18-W4M
25-08-18-W4M
30-08-17-W4M
29-08-17-W4M
28-08-17-W4M
22-08-18-W4M
23-08-18-W4M
24-08-18-W4M
19-08-17-W4M
20-08-17-W4M
21-08-17-W4M
15-08-18-W4M
14-08-18-W4M
13-08-18-W4M
18-08-17-W4M
17-08-17-W4M
16-08-17-W4M

N

Legend

- Road
- Study Boundary
- Alberta Township Section
- Ground Survey



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HISTORIC RESOURCES IMPACT ASSESSMENT PALAEONTOLOGY SURVEY TRACKS SHEET 1 OF 4

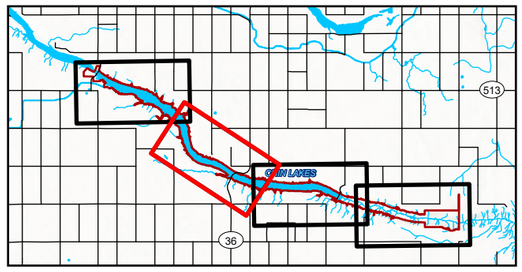
SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	76.5

File: \\int.klohn.com\ProjData\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301ChinReservoir_EIA_230301.aprx Date:4/24/2025 3:54 PM Creator: HManandyan

21-08-17-W4M
14-08-17-W4M
12-08-17-W4M
5-08-16-W4M
15-08-17-W4M
6-08-16-W4M
32-07-16-W4M
11-08-17-W4M
16-08-17-W4M
1-08-17-W4M
36
10-08-17-W4M
31-07-16-W4M
2-08-17-W4M
36
9-08-17-W4M
36-07-17-W4M
3-08-17-W4M
30-07-16-W4M
36
8-08-17-W4M
35-07-17-W4M
4-08-17-W4M
25-07-17-W4M
34-07-17-W4M
36
5-08-17-W4M
26-07-17-W4M
33-07-17-W4M
24-07-17-W4M
27-07-17-W4M

Legend

- Road
- Study Boundary
- Alberta Township Section
- Ground Survey



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HISTORIC RESOURCES IMPACT ASSESSMENT PALAEONTOLOGY SURVEY TRACKS SHEET 2 OF 4

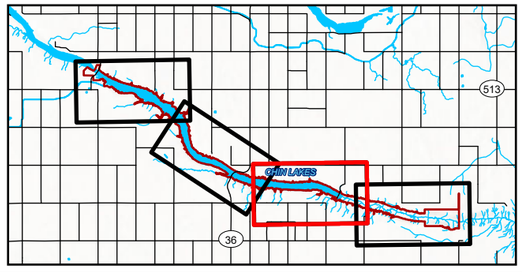
SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	76.6

File: \\int.klohn.com\Proj\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301ChinReservoir_EIA_230301.aprx Date:4/24/2025 3:54 PM Creator: HManandyan

6-08-16-W4M
5-08-16-W4M
4-08-16-W4M
3-08-16-W4M
2-08-16-W4M
1-08-16-W4M
N
31-07-16-W4M
32-07-16-W4M
33-07-16-W4M
34-07-16-W4M
35-07-16-W4M
36-07-16-W4M
30-07-16-W4M
29-07-16-W4M
28-07-16-W4M
27-07-16-W4M
26-07-16-W4M
25-07-16-W4M
19-07-16-W4M
20-07-16-W4M
21-07-16-W4M
22-07-16-W4M
23-07-16-W4M
24-07-16-W4M
18-07-16-W4M
17-07-16-W4M
16-07-16-W4M
15-07-16-W4M
14-07-16-W4M
13-07-16-W4M

Legend

- Road
- Study Boundary
- Alberta Township Section
- Ground Survey



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.

CLIENT: SMRID

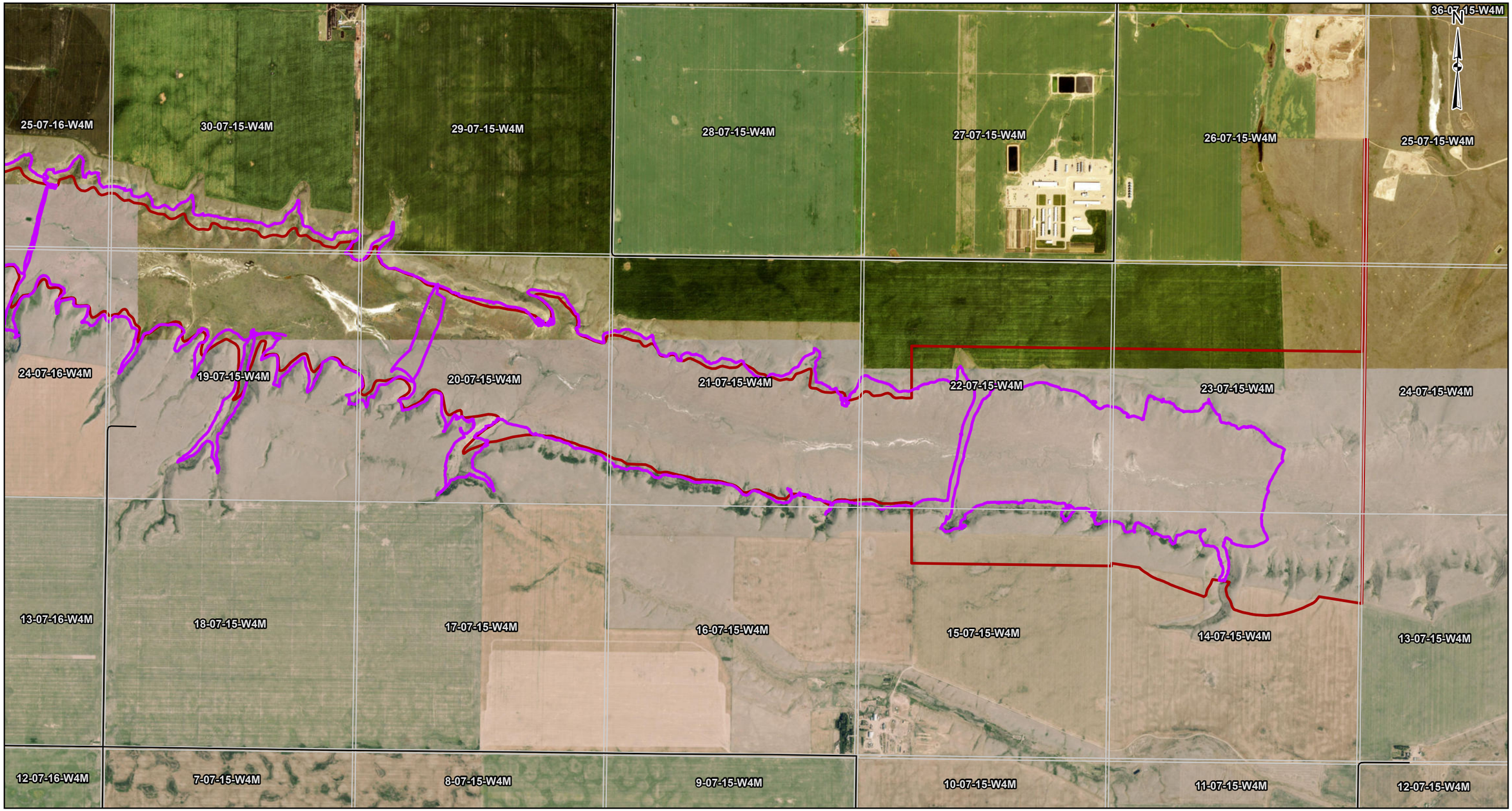
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HISTORIC RESOURCES IMPACT ASSESSMENT PALAEONTOLOGY SURVEY TRACKS SHEET 3 OF 4

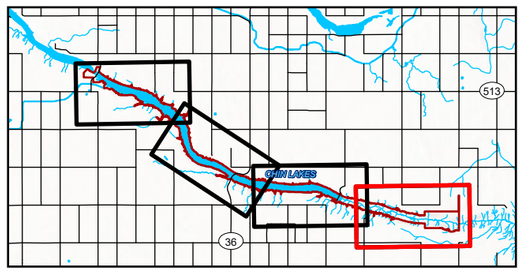
SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	76.7

File: \\int.klohn.com\Pro\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_230301.aprx Date:4/24/2025 3:54 PM Creator: HManandyan



Legend

- Road
- Study Boundary
- Alberta Township Section
- Ground Survey



0 1 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HISTORIC RESOURCES IMPACT ASSESSMENT PALAEONTOLOGY SURVEY TRACKS SHEET 4 OF 4

SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	76.8

File: \\int.klohn.com\Proj\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_230301.aprx Date:4/24/2026 3:54 PM Creator: HManandyan

Question 77

Reference:

Volume 2, Section 2.9.1.2, Page 145;
Volume 5, Section 4, 4.1 [B]

Rationale/Preamble:

The final Terms of Reference Section 4.1 [B] requires a map of known historic resource sites represented by Historic Resource Value (HRV). No map of archaeological and historic built heritage HRV ratings across the project study area has been provided.

Information Request:

a. What is the mapped representation of Historic Resource Values for archaeological resources and historic built heritage sites within the project study area?

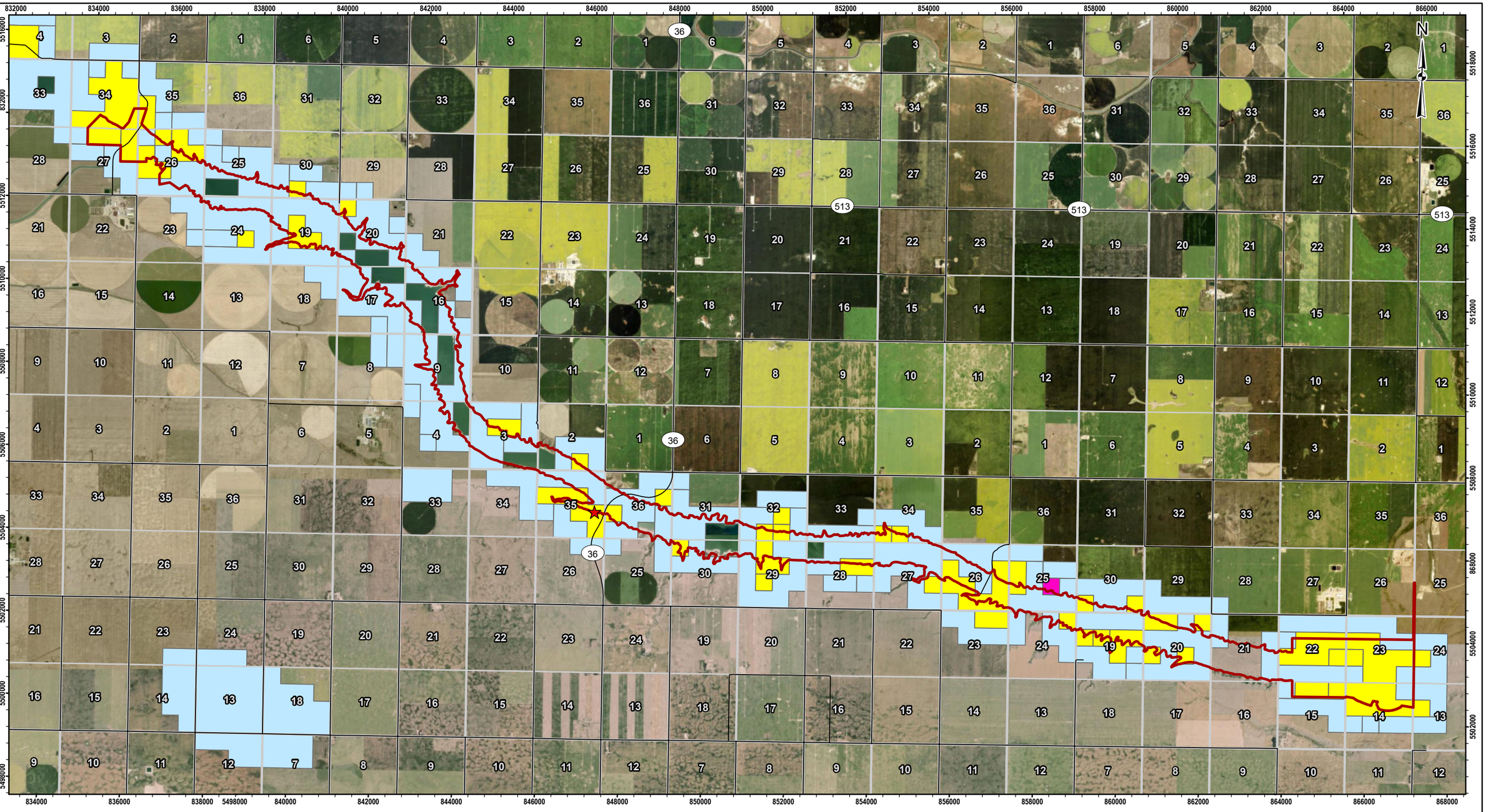
Response:

a. As the Historic Resource Value (HRV) information is publicly available and has recently been updated in the Provincial database, we have prepared a figure that shows the Archaeological HRVs throughout the Project area. Please see attached Figure 77.1. This figure does not contain confidential sensitive historical information and may be distributed.

   The concordance table has been updated accordingly (refer to Appendix 6.1).

FIGURE

Figures 77.1 Public Listing of Archaeology Historic Resource Values



Legend

- Heritage Built Site
- Road
- HRIA Study Area
- Alberta Township Section

Historic Resource Values

- HRV-3a
- HRV-4a
- HRV-5a

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.
5. HRV SOURCE: ALBERTA LISTING OF HISTORIC RESOURCES (SPRING 2025)

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: PUBLIC LISTING OF ARCHAEOLOGY HISTORIC RESOURCE VALUES

SCALE	PROJECT No.	FIG No.
1:90,000	A03701E05	77.1

File: \\int.klohn.com\Proj\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_230301.aprx Date:4/24/2026 3:51 PM Creator: HManardyan

Question 78

Reference:

Volume 2, Section 2.9.2, Page 148;
Volume 5, Section 4, 4.1 [B]

Rationale/Preamble:

The final Terms of Reference Section 4.1 [B] requires a map of known historic resource sites represented by Historic Resource Value (HRV). No map of palaeontological HRV ratings across the project study area has been provided.

Information Request:

a. What is the mapped representation of Historic Resource Values for palaeontological resources within the project study area?

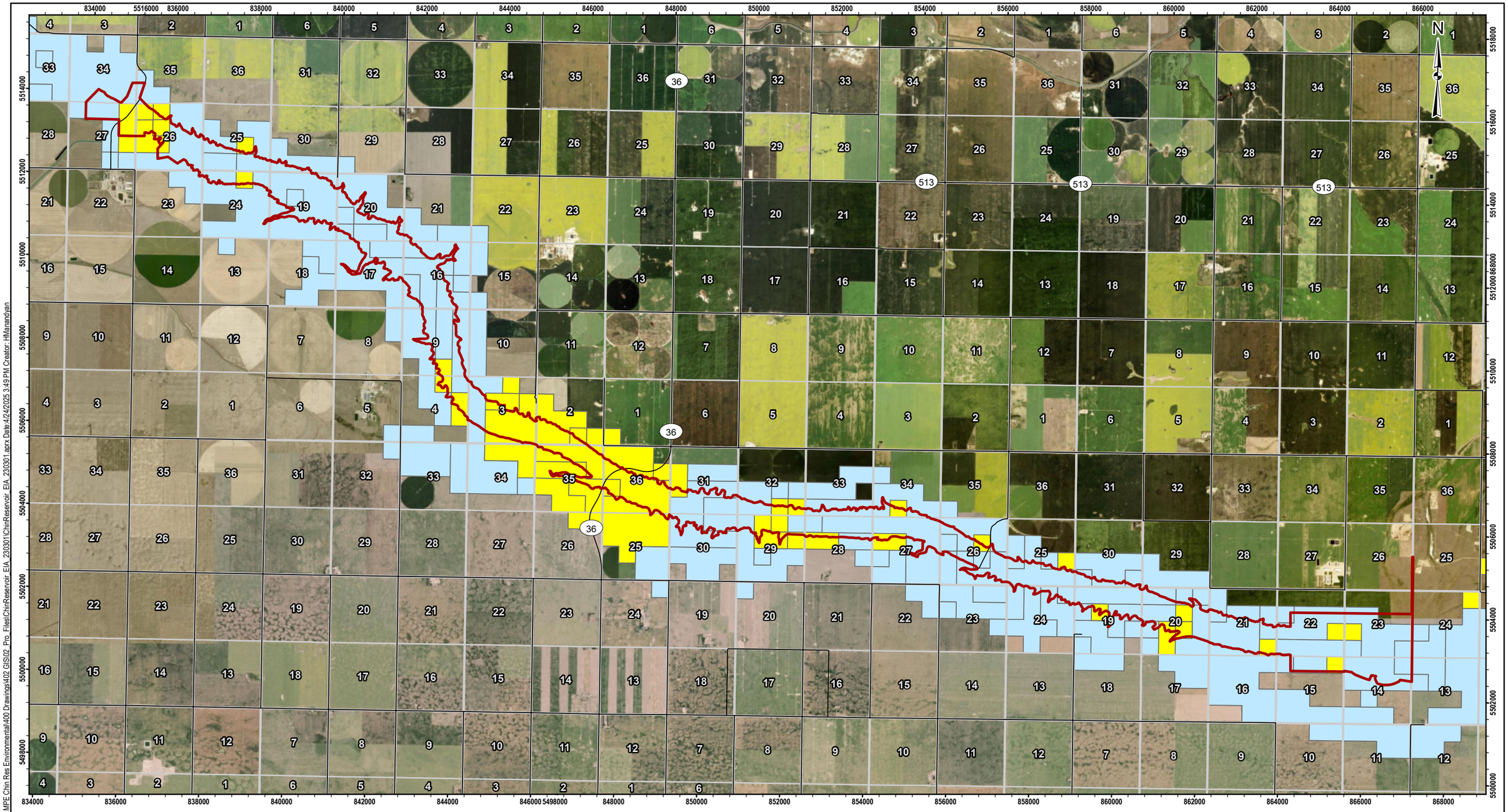
Response:

a. As HRV information is publicly available and has recently been updated in the Provincial database, we have prepared a figure that shows the Palaeontological HRVs throughout the Project area. Please see attached Figure 78.1. This figure does not contain confidential sensitive historical information and may be distributed.

   The concordance table has been updated accordingly (refer to Appendix 6.1).

FIGURE

Figure 78.1 Public Listing of Palaeontology Historic Resource Values



Legend

- Road
- HRIA Study Area
- Alberta Township Section

Historic Resource Values

- HRV-4p
- HRV-5p

0 5 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, MAXAR
4. GROUND SURVEY AND STUDY BOUNDARY DATA PROVIDED BY BISON HISTORICAL SERVICES LTD.
5. HRV SOURCE: ALBERTA LISTING OF HISTORIC RESOURCES (SPRING 2025)

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: PUBLIC LISTING OF PALAEONTOLOGY HISTORIC RESOURCE VALUES

SCALE	PROJECT No.	FIG No.
1:90,000	A03701E05	78.1

File: \\int.klohn.com\ProjData\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_230301.aprx Date:4/24/2025 3:49 PM Creator: HManandyan

3.6 Climate Change

Question 79

Reference:

Volume 1, Section 1.5, Page 9 and 10

Rationale/Preamble:

SMRID states *By 2021-2050, annual precipitation is projected to increase by roughly 100 mm/year relative to the 1991-2020 period*.

Based on the above statement, with annual precipitation ranging from 300 mm/year to 400 mm/year in prairie area, the annual precipitation is estimated to increase by 25%~35%.

In a recent climate change study (Eum et al., 2023) that investigated potential changes in the natural regions in Alberta under the latest Coupled Model Intercomparison Project Phase 6 (CMIP6) climate projections, +2.24 mm/decade in annual precipitation was expected in the Grassland region, southern part of Alberta, resulting in an increase of 6.72mm in annual precipitation.

Information Request:

a. Explain and provide the data that was used to calculate the projections in Section 1.5.
b. Provide the justification for using the Coupled Model Intercomparison Project Phase 5 (CMIP5) climate projections when more recent studies have been conducted.

Response:

a. Future climate change scenarios were developed using downscaled climate scenarios obtained from ECCC in 2021 under two representative concentration pathways (RCPs). RCP 4.5 corresponds to an emissions scenario where carbon emissions stabilize by 2040, while RCP 8.5 represents an emissions scenario with minimal greenhouse gas mitigation. These scenarios applied the median projection from an equal-weighting ensemble forecast of 24 General Circulation Models (GCM) from The Coupled Model Intercomparison Project Phase 5 (CMIP5) from 2021-2100.

   A process-based hydrological model driven by the two future climate scenarios was used to assess potential future changes in streamflow within the St. Mary River watershed. The study focused specifically on the catchment areas upstream of the Waterton, Belly, and St. Mary Rivers. This geographic scope is appropriate, as these headwater systems supply the entirety of SMRID's licensed water allocations.

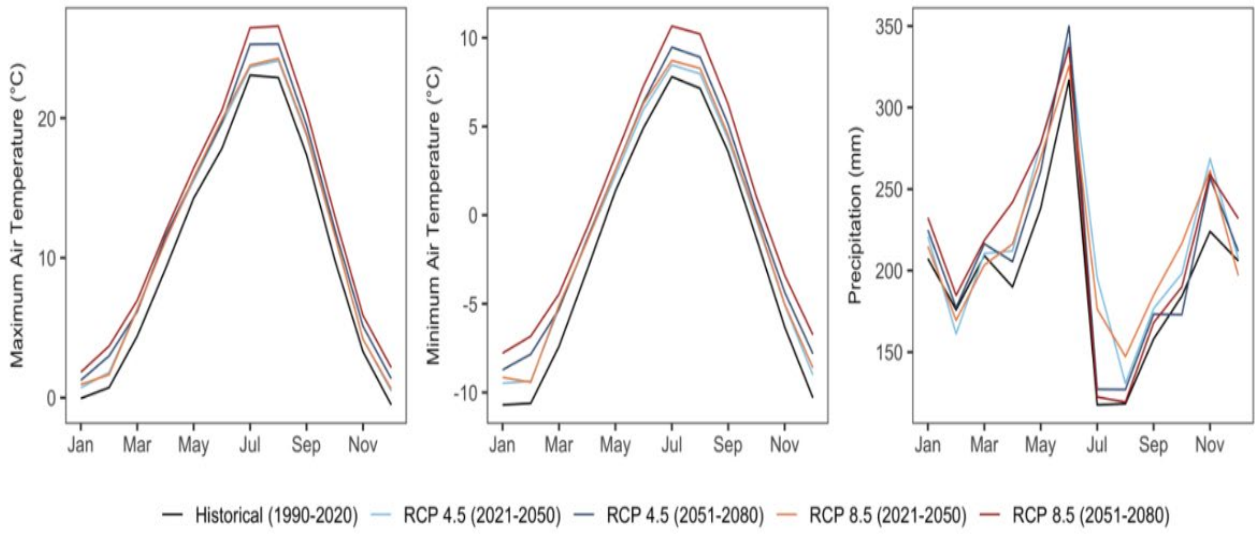
   Under future climate change scenarios (RCP 4.5 and RCP 8.5), the modelling indicates there is likely to be a substantial increase in annual precipitation across the study area. The discrepancy between the hydrological model's projected precipitation increase of 100 mm/year and that identified in the SIR #79 rationale reference study (Eum et al. 2023) partly arises due to the

differences in the geographic areas considered. The results from the reference study covers the broader grasslands region, whereas the SMRID hydrological modelling encompasses Rocky Mountain, foothill, and grassland zones. As such, a direct comparison between the two projections is not possible.

Additionally, it is worth noting that projections among climate models can vary because of differences in their underlying representation of earth system processes. The scenarios used in this study are meant to be representative and use a scientifically defensible and robust approach. However, this study does not provide precise predictions of future conditions.

Figure 79.1 shows the projected variability in the air temperature and precipitation data for the RCP 4.5 and RCP 8.5 scenarios in the study area, compared to the historical record. These projections form the basis for the streamflow inputs in the climate change scenarios.

Figure 79.1 Projected changes in precipitation and temperature under RCP 4.5 and 8.5 scenarios for the study area, for the periods 2021-2050 and 2051-2080, relative to the 1991-2020 historical baseline (WaterSMART 2023)



b. CMIP5 climate projections were used in the model, as they represented the most recent publicly available data from Environment and Climate Change Canada at the time of model development. Updating the model, including incorporating newer climate change projections, was outside the scope of this work. We recognize that CMIP6 is now available, and the timing and effort to do a full model update and rerun with new data is a limitation of this study.

Question 80

Reference:

Volume 1, Section 1.5, Page 9 and 10;
Volume 1, Section 1.6.1, Page 10 and 11

Rationale/Preamble:

SMRID states *As temperatures rise, evapotranspiration is expected to increase, leading to overall decreases in soil moisture, especially during the summer months.*

In addition, SMRID also states *This is true even if there are no significant changes in precipitation levels during the growing season (Hayhoe and Stoner 2019).*

Section 1.5 discusses how an increase in precipitation and temperature may induce an off-set effect on soil moisture rather than a decrease in soil moisture. A recent study by Eum et al. (2023) evaluated a trend in a drought index (Standardized Precipitation Evapotranspiration Index, SPEI) and projected a decrease in SPEI under climate change, particularly a larger decreasing trend in the southern Alberta.

Information Request:

a. Provide the rationale as to why more recent studies were not used when projecting future drought conditions.

Response:

a. CMIP5 climate projections were used in the model, as they represented the most recent publicly available data from Environment and Climate Change Canada at the time of model development. Updating the model, including incorporating newer climate change projections, was outside the scope of this work. We recognize that CMIP6 is now available, and the timing and effort to do a full model update and rerun with new data is a limitation of this study.

Question 81

Reference:

Volume 2, Section 2.2.3.2.3, Page 30 and 31

Rationale/Preamble:

SMRID states *Therefore, the addition of storage capacity will provide the means to capture the increased early* runoff *(including extreme events which currently would lead to flooding) and have a reliable source to continue to support irrigation throughout the growing season*. As the main source of inflow to the Chin Reservoir is from the upstream diversion infrastructure and any changes in the operation policies are not expected, the additional storage capacity may not have any contributions to storing surplus inflows under climate change unless the operation policies on the upstream diversion infrastructure are altered to adapt to climate change.

Information Request:

a. Explain under what conditions surplus inflows are expected and how the additional storage capacity can store the surplus inflows without alterations of upstream diversion operating policies.

Response:

a. Surplus inflows to the Chin Reservoir are expected under conditions of extreme weather events, such as high-intensity rainfall or rapid snowmelt, which generate significant runoff within the reservoir's catchment area (332 km^2) in addition to rainfall/meltwater that is collected within the Main Canal. The hydrologic studies included in the New East Dam PDR indicate that inflows from extreme precipitation events, including 1:1,000-year floods and probable maximum flood (PMF) scenarios, can result in large volumes of water entering the reservoir system.

   The additional storage volume of 172,832 dam^3 (149,166 ac-ft) increases the reservoir's ability to manage peak inflows by storing excess water as it becomes available and managing the release in a controlled manner.

   Importantly, while the operational policies of the upstream diversion infrastructure are not expected to change, the additional storage at Chin Reservoir enables the entire irrigation network the flexibility to accommodate surplus inflows without diversion adjustments. The water captured by Chin Reservoir during flood events can be stored in a manner that maintains safe operation of the reservoir and can be redistributed as water for irrigation as time allows. Currently during flood events, due to insufficient flood storage capacity, flood waters are discharged downstream which causes strain on the irrigation infrastructure as well as flooding.

3.7 Traditional Ecological Knowledge and Traditional Land Use

Question 82

Reference:

Volume 1, Section 1.14;
Volume 5, Section 5 [A] (a) and (b)

Rationale/Preamble:

The final Terms of Reference states *If consultation with Indigenous groups reveals traditional use areas and spiritual sites within lands affected by the Project, provide:*

a) a map and description of traditional land use areas including fishing, hunting, trapping, water use (e.g., for drinking, cooking and navigation) and nutritional, medicinal, or cultural plant harvesting by affected Indigenous peoples (if the Indigenous community or group is willing to have these locations disclosed); and

b) a map of cabin sites, spiritual sites, cultural sites, graves and other traditional use sites considered historic resources under the Historical Resources Act (if the Indigenous community or group is willing to have these locations disclosed), as well as traditional trails and resource activity patterns.

In addition, the concordance table indicates that [A] (a) and (b) are located in Volume 1, Section 1.14. There are no maps in this section or in the Volume 1 appendices that relate to these questions.

Information Request:

a. Provide the maps for [A] (a) and (b).

Response:

a. As noted in the response to SIR#1 Question 43 (b), the Pre-Consultation Assessment (FNC202202151) conducted by ACO determined that consultation with Indigenous Groups would not be required for the Project. SMRID has engaged with the Blood Tribe, the developer of the BTAP, as they are a shared water user. No specific TEK, TLU, or spiritual sites information has been received; therefore, maps showing this information cannot be prepared and maps have not been provided in the EIA submission or SIR#1 Response Document.

Question 83

Reference:

Volume 1, Section 1.14;
Volume 2, Section 2.8.4.4, Page 137;
Volume 5, Section 5 [C]

Rationale/Preamble:

The final Terms of Reference states *Discuss access for traditional uses during all stages of the Project.*

Volume 5, Section 5, [C] indicates that this information can be found in Volume 1, Section 1.14 however the information is not present. Volume 2, Section 2.8.4.4 discusses access for traditional uses.

Information Request:

a. Provide all sections where this information is discussed.

Response:

a. Access for traditional uses is not discussed in the EIA submission.

   As noted in the response to SIR#1 Question 43 (b), the Pre-Consultation Assessment (FNC202202151) conducted by ACO determined that consultation with Indigenous Groups would not be required for the Project. SMRID has engaged with the Blood Tribe, the developer of the BTAP, as they are a shared water user. No specific TLU information has been received and access for traditional uses has not been requested; therefore, no specific accommodations for access for traditional uses have been identified.

   The SMRID has invited the Blood Tribe to conduct a walk-through of the Project area prior to winter 2025. Following this walk-through, SMRID will further discuss potential next steps and determine any additional involvement the Blood Tribe may have during Project development and operation.

Question 84

Reference:

Volume 1, Section 1.14;
Volume 5, Section 5 [D]

Rationale/Preamble:

The final Terms of Reference states *Describe how TEK and Traditional Land Use information was incorporated into the Project, EIA development, the conservation and reclamation plan, monitoring and mitigation.*

Volume 5, Section 5, [D] indicates that this information can be found in Volume 1, Section 1.14 however the information is not present.

Information Request:

a. Provide the sections where this information is discussed.

b. If this information is not identified in another section, describe how TEK and Traditional Land Use information was incorporated into the Project, EIA development, the conservation and reclamation plan, monitoring, and mitigation.

Response:

a. TEK and TLU information is not discussed in the EIA.

b. As noted in the response to SIR#1 Question 43 (b), the Pre-Consultation Assessment (FNC202202151) conducted by ACO determined that consultation with Indigenous Groups would not be required for the Project. SMRID has engaged with the Blood Tribe, the developer of the BTAP, as they are a shared water user. No specific TEK or TLU information has been received; therefore, TEK and TLU was not incorporated into the Project, EIA development, the conservation and reclamation plan, monitoring, or mitigation, and this information cannot be provided in the SIR#1 Response Document.

   The SMRID has invited the Blood Tribe to conduct a walk-through of the Project area prior to winter 2025. Following this walk-through, SMRID will further discuss potential next steps and determine any additional involvement the Blood Tribe may have during Project development and operation. Any information shared during the site visit would be considered for Project planning.

Question 85

Reference:

Volume 4-4, Section 3.5, Page 39;
Volume 5, Section 5 [B]

Rationale/Preamble:

The final Terms of Reference states *Discuss the species, abundance and availability of vegetation, fish and wildlife used for food, traditional, medicinal, and cultural purposes in the identified traditional land use areas, considering all project related impacts.*

SMRID states *Traditional use of the fishery is undetermined.*

Information Request:

a. Provide an explanation for why the traditional use is undetermined for the current Chin Reservoir.

b. Explain what, if any, fish species are being used for food, traditional, medical, or cultural purposes in the current Chin Reservoir.

Response:

a. As noted in the response to SIR#1 Question 43 (b), the Pre-Consultation Assessment (FNC202202151) conducted by ACO determined that consultation with Indigenous Groups would not be required for the Project. SMRID has engaged with the Blood Tribe, the developer of the BTAP, as they are a shared water user. No specific TLU information has been received and there is no known use of vegetation, fish, or wildlife for food, traditional, medicinal, or cultural purposes occurring within the Existing Chin Reservoir or the Project Area.

b. No specific TLU information has been received and there is no known use of fish species for food, traditional, medicinal, or cultural purposes occurring within the Existing Chin Reservoir or the Project Area.

Question 86

Reference:

Volume 5, Section 5

Rationale/Preamble:

The final Terms of Reference states *Determine the impacts of the Project on traditional, medicinal, and cultural land use and identify possible mitigation strategies.*

This question is missing from the concordance table under Volume 5, Section 5 and it's unclear where this question is addressed in the EIA.

Information Request:

a. Provide the sections where this information is discussed.
b. If this information is not found in the EIA, provide the determination of the impacts of the Project on traditional, medicinal, and cultural land use and identify possible mitigation strategies.

Response:

a. The fToR Section 5 [E] has been added to the updated concordance table in Appendix 6.1.
b. As noted in the response to SIR#1 Question 43 (b), the Pre-Consultation Assessment (FNC202202151) conducted by ACO determined that consultation with Indigenous Groups would not be required for the Project. SMRID has engaged with the Blood Tribe, the developer of the BTAP, as they are a shared water user. No specific TLU information has been received. Therefore, no concerns related to effects on traditional, medicinal, and cultural land use have been identified, no impacts are predicted, and mitigation strategies are not required.

4 AIR

4.1 Air Quality Assessment

Question 87

Reference:

Volume 2, Section 3.1, Page 151

Rationale/Preamble:

SMRID states *The available data for construction-phase emissions of air contaminants from EIAs for analogous projects involving the use of heavy equipment to modify and build water reservoirs or flood retention structures suggest that any increases in the ground-level air concentrations outside the immediate PA are not expected to be significant.*

Information Request:

a. Provide supporting evidence and examples for this statement.

Response:

a. The material in Volume 2, Section 3.1, Page 151 was intended to be summary material only. A more comprehensive assessment of the types and number of heavy equipment from analogous projects (specifically, the Springbank Off-Stream Reservoir Project [the Springbank Project], and the Canmore Cougar Creek Debris Flood Retention Project [Cougar Creek Project]) and potential health risks was provided in the HHRA (Volume 2, Appendix 14).

   The Springbank Project involved the construction of a water retention structure and is thus comparable to the Chin Reservoir Expansion Project (the Chin Project) in scope. Construction for the Chin Project will involve similar construction activities and utilize similar construction equipment to those for the Springbank Project; thus it will have similar air emission sources. The Chin Project will have fewer construction equipment (discussed further in the response to SIR#1 Question 90) and thus the air emissions would be lower than those for the Springbank Project.

   For the EIA for the Springbank Project, a comprehensive air quality dispersion modelling assessment of construction emissions was conducted. Since the Springbank Project is analogous to the Chin Project in scope, the air quality assessment results and conclusions for the Springbank Project can be used as a basis to form conclusions about the potential air quality impacts from the Chin Project. Since the overall emissions for the Chin Project are expected to be lower than those from the Springbank Project construction, the air quality impacts from the construction of the Chin Project are also expected to be lower (the expected air quality impacts from the Chin Project in relation to the Springbank Project are discussed further in the response to SIR#1 Question 88 (a)).

The air quality assessment for the Springbank Project construction phase was included in the EIA, Volume 3A: Effects Assessment (Construction and Dry Operations) (TEC 2018b). The emission inventory for the Springbank Project included diesel combustion exhaust emissions from off-road construction equipment and haul trucks, as well as fugitive dust emissions from various construction activities and sources (e.g., earthmoving, haul roads, truck loading and unloading, and wind erosion).

The dispersion modelling assessment for the Springbank Project predicted ground level concentrations and dustfall that would exceed applicable air quality objectives for some contaminants, especially near the construction area. The dispersion modelling predicted exceedances of fine particulate matter smaller than 2.5 µm ($PM_{2.5}$) and total suspended particulates (TSP) over a large area, and an ambient monitoring program was proposed. Ambient concentration measurements would be monitored once construction commenced. Based on the monitoring results, appropriate mitigation measures would be implemented through adaptive management to adequately address potential air quality exceedances from construction emissions.

The determination of significance of potential air quality effects for the Springbank Project was discussed in Section 3.5 of Volume 3A (TEC 2018b). As per the report, a residual effect is rated as significant if: (a) predicted concentrations of assessed contaminants exceed applicable regulatory objectives, and (b) they are of concern because of their geographic extent and frequency of occurrence, and the presence of potentially sensitive receptors (e.g., human, wildlife, vegetation, soils, or waterbodies). Using this definition of significance, none of the air quality impacts from the Springbank Project were deemed significant since the exceedances were generally predicted close to the construction area and not close to sensitive receptors or were expected to be manageable by responding to feedback or complaints received during construction.

Air quality impacts from the Chin Project are expected to be lower than those from the Springbank Project. Similar to the Springbank Project, several dust mitigation and air quality mitigation strategies are planned for the Chin Project (discussed below in the response to SIR#1 Question 88 (b)). Collecting and handling complaints forms part of the adaptive mitigation strategy for the Chin Project. The process for collecting and handling complaints during the construction is discussed in the response to SIR#1 Question 218 (b). SMRID anticipates that these will be sufficient to reduce the occurrence of exceedances of applicable air quality objectives. Taking these factors into account, and since the impacts from the Springbank Project were deemed not to be significant outside the immediate project construction area, it is reasonable to conclude that the impacts from the Chin Project will not be significant outside the immediate Project Area (as defined as the Project Area on Map Figure 2.8.1 in the Chin EIA, Volume 2).

Question 88

Reference:

Volume 2, Section 3.1, Page 151

Rationale/Preamble:

SMRID states *While the Springbank Off-Stream Reservoir Project identified potential short-term inhalation exposure risks for PM2.5, the authors noted that these risks were manageable with the use of dust suppression and other mitigation strategies*.

Information Request:

a. Describe the potential air quality risks associated with the Chin Reservoir Expansion Project in relation to the Springbank Off-Stream Reservoir Project.

b. Describe dust mitigation and air quality risk mitigation strategies planned during construction of the Chin Reservoir Expansion Project.

c. Discuss the rational and effectiveness of proposed mitigation strategies for the Chin Reservoir Expansion Project.

Response:

a. Air quality impacts at the closest sensitive receptor identified in the vicinity of the Chin Project Area are relevant in assessing potential air quality risks associated with the Project. As mentioned in the EIA for the Chin Project, Volume 2, Section 3.1 and Volume 2, Appendix 14, Section 4.6, the nearest sensitive receptor for the Chin Project is located 1.5 km away from where the construction emission sources would be located. Whereas for the Springbank Project, the nearest sensitive receptor was only 50 m away. As part of the analysis completed to support the SIR#1 responses, the United States Environment Protection Agency (U.S. EPA) screening dispersion model AERSCREEN was used to assess the difference in predicted concentrations at a distance of 1.5 km vs. 50 m from an emission source. The emission source parameters used in the screening model runs were based on the source parameters used in the Springbank Project modelling assessment. The results showed that at a distance of 1.5 km away, the predicted concentrations are expected to be between 10 to 20 times lower, i.e., over an order of magnitude lower than the results at 50 m.

   Predicted ground level concentrations and dustfall from construction operations at a distance of 1.5 km away can be estimated by scaling down the maximum results from the Springbank Project air quality assessment by 10 to 20 times, since the maximum results were predicted to occur in the immediate vicinity of the construction area (i.e., at a distance of 50 m away or closer). The scaled down predictions would apply for construction emissions that were similar in magnitude to those included in the emission inventory for the Springbank Project. The proposed construction fleet for the Chin Project is smaller than what was proposed for the Springbank

Project; therefore, the air quality predictions are expected to be even lower (a comparison of the construction emission sources is discussed further in the response to SIR#1 Question 90).

Air quality results for the Springbank Project are presented in Table 3-18 of the project EIA, Volume 3A: Effects Assessment (Construction and Dry Operations) (TEC 2018b). The table shows that NO_2, $PM_{2.5}$, TSP, dustfall, and acrolein were predicted to exceed the applicable ambient air quality objectives for the Project Case, i.e., the case considering the project-related construction activities. After scaling the maximum concentrations down by an order of magnitude in order to estimate the corresponding predictions at a distance of 1.5 km away (i.e., the distance of the closest sensitive receptor for the Chin Project), the results were well below the applicable air quality thresholds with the exception of the 24-hour average TSP.

As per the Springbank Project report (TEC 2018b), a number of conservative assumptions were made in calculating the fugitive particulate matter emission rates. Upon reviewing these assumptions, it was understood that the particulate matter emission rates and corresponding predicted concentrations were overestimated. For example, maximum hourly emission rates were calculated assuming that almost 80% of total construction emissions would occur over the duration of one year; whereas in reality, construction for the Chin Project will be spread out over 3-4 years. Additionally, various construction activities that occur 24-hours per day were assumed to be operating simultaneously, and conservative wind erosion emission factors were used in emission calculations.

Accounting for the conservatism in the Springbank Project 24-hour TSP predictions, as well as the fact that emissions for the Chin Project are expected to be lower than those for the Springbank Project, and the nearest sensitive receptor is much farther away in the Chin Project than in the Springbank Project, it's expected that concentrations of 24-hour TSP from the Chin Project are expected to comply with air quality objectives at the nearest sensitive receptor.

A number of dust mitigation and air quality mitigation measures are planned for the Chin Project (discussed below in the response to SIR#1 Question 88 (b)). It's expected that the mitigation measures will be sufficient to reduce the occurrence of exceedances of applicable air quality objectives in the immediate surrounding Project Area. The process for collecting and handling complaints is discussed in the response to SIR#1 Question 218 (b).

b. Dust and air quality mitigation measures planned during the construction phase of the Chin Project were included in the EIA, Volume 2, Appendix 14 – Assessment of the Potential Risks to Human Health, Section 6. They are summarized below:

- Fugitive dust emissions on site roads would be controlled by the application of water or other dust suppressants at regular intervals.
- Mud would be removed from paved roads should it be tracked to distant paved surfaces.
- Heavy vehicles transferring stockpiled materials across the site would be fitted with appropriate sheeting and covers for dust control.
- Dust filters and dust containment measures would be used during drilling activities.

- Material handling areas, such as loading and unloading, and transfer points would be designed to suppress the generation of fugitive dust.
- Stockpiles and storage areas would be wetted to suppress dust.
- Soil stockpiles would be placed in areas least prone to impact from prevailing winds.
- When required, dust generating construction activities would be suspended during periods of excessive winds if dust suppression measures are not working adequately.
- Equipment would be in compliance with federal provincial, regional district, and municipal regulations and standards for emissions.
- Combustion engines would be located away from sensitive receptors and would be inspected and maintained regularly.
- Uncontrolled burning of waste on-site would be prohibited.
- Water or other dust suppressants would be applied to large arid surfaces (e.g., stockpiles and haul roads on a regular basis during dry weather conditions).

c. The proposed mitigation strategies for the Chin Project were developed with the goal in mind of suppressing fugitive dust (e.g., watering roads and stockpiles, covering truck loads, and designing material handling areas and operations in a way that will reduce the amount of dust that becomes airborne). By reducing dust at its source, the Project will reduce the impact of dust at sensitive receptors farther away. Using construction equipment that complies with applicable emission limits and regularly maintaining the equipment will similarly reduce the impact of combustion emissions.

   The proposed strategies employ the use of physical mitigation as well as good planning. Sheltering stockpiles from the wind, using dust filters during drilling and maintaining equipment collectively act to reduce emissions. The mitigation plan also adapts to prevailing weather conditions (e.g., pausing dusty activities during windy periods if required). These methods are common in construction and have proven effective in other projects. The different levels of controls act together to reduce dust at its source and thus reduce the overall impact of construction activities.

Question 89

Reference:

Volume 2, Section 3.1, Page 151

Rationale/Preamble:

SMRID states *The construction emission sources for the Chin Reservoir Expansion Project will be located primarily in a low point of the Chin coulee. The nearest residence is on top of the coulee, so the opportunity for exposure to the construction emissions will be reduced with the walls of the coulee limiting the ability of the construction emissions to disperse to nearby receptors.*

Information Request:

a. Provide justification and supporting evidence to verify the statement that exposure to construction emissions will reduce due to the walls of the coulee.

Response:

a. The Chin Coulee is a lower area surrounded by higher terrain. The shape of the coulee can influence wind patterns inside the coulee. The topography can thus channel the movement of air in specific directions, making dispersion less efficient. In the event of calm conditions (i.e., winds with low wind speeds), the emitted pollutants can get trapped for extended periods of time before escaping and dispersing up to the top of the coulee. Valleys also often have temperature inversions, where a layer of warmer air lies on top of layers of cooler air. Inversions can stop pollutants from dispersing upwards, thus trapping them close to the surface. This is a well-known phenomenon that is often accounted for in air quality tools. For example, within the U.S. EPA AERMOD regulatory dispersion model, there is a source type defined as OPENPIT which is used to simulate emissions from open pit mines, specifically to account for reduced dispersion from such configurations. Once the inversions break up, higher winds are then able to disperse the pollutants.

   Fugitive dust is often one of the main concerns from earthmoving construction activities. Dust from these activities is generally comprised of relatively heavy particles that settle quickly to the ground before they can be dispersed further.

Question 90

Reference:

Volume 2, Section 3.1, Page 151

Rationale/Preamble:

SMRID states *Construction of the Chin Reservoir Expansion Project will involve comparatively fewer emission sources than the construction of the Springbank Off-Stream Reservoir.*

Information Request:

a. Provide a list of anticipated Project construction emission sources.

b. Compare the anticipated Project construction emission source list to those of the analogous Springbank Off-Stream Reservoir Project and discuss the difference in potential impacts.

Response:

a. A list of the anticipated construction equipment fleet for the Chin Reservoir Expansion Project is shown below. The final fleet will be decided by the awarded contractor and may differ slightly than the list presented below. The quantity of each piece of equipment will vary depending on the phase of construction. Refer to the New East Dam PDR, Appendix XVII – New East Dam Project Schedule for a breakdown of the Project construction phases. The New East Dam PDR is provided in Appendix 1.1 of this SIR#1 Response Document. An updated Project schedule has also been provided in response to SIR#1 Question 8. The required list of equipment in Phases 3 and 4 will be smaller than the list provided below, particularly for haul trucks.

   - Light Duty Vehicles: 20
   - Earthworks Haul Fleet (Earth Fill):
     - 12 scrapers, or
     - 6 x CAT 777 (100 tonne) offroad rock trucks, or
     - 12 x Cat D400 (40 tonne) offroad rock trucks.
   - Granular Fill/Riprap Fleet:
     - Truck and trailers haul to site: 10
     - Loaders: 2
     - Offroad Cat D400 dump truck: 3
   - Dozers: 10
   - Excavators: 7
   - Sheepfoot packers/push blades: 5
   - Roller/Vibratory Padfoot Packers: 5

- Water Trucks: 6
- Graders: 3
- Skid Steers: 3
- Drill rigs for grouting (Years 1 and 2 only): 2
- Grout plant (Years 1 and 2 only): 2
- Drill rig for instrumentation: 1
- Gensets: 5
- Gravel Pit Crusher

b. A comparison of construction emission sources between the Springbank Project and the Chin Project was provided in Volume 2, Appendix 14 – Assessment of the Potential Risks to Human Health, Section 4.3. Since the time the EIA was submitted, the anticipated construction equipment list has been updated, and is provided in the response to SIR#1 Question 90 (a) above. The comparison table has been updated below (Table 90.1).

   Overall, the Springbank Project has a higher number of total equipment than the Chin Project. Most notably, the number of dump trucks which would travel on haul roads is much higher. Dump trucks have large engines and frequent load-haul cycles, which makes them some of the higher emitting sources at a construction site. The emission inventory for the Springbank Project is included in its EIA, Volume 4, Appendix E: Air Quality and Climate, Attachment 3A (TEC 2018c). It shows that truck traffic on haul roads is the biggest contributor by far to total particulate matter emissions.

   The equipment listed in higher numbers for the Chin Project would also travel on haul roads and contribute to fugitive dust emissions (e.g., the dozers, water trucks, packers, and riprap trucks with trailers), but the overall emissions from the Chin Project would still be lower. The Springbank Project emission summary table 3A-2 in Volume 4, Appendix E shows that the fugitive dust from off-road equipment in transition (not including trucks) is much lower than the contribution from truck traffic.

   In terms of diesel combustion exhaust emissions, similar conclusions can be drawn. The lower overall equipment number for the Chin Project and much larger number of trucks for the Springbank Project indicates that diesel combustion emissions are expected to be lower.

Table 90.1 Comparison of construction vehicle types and numbers between the Chin Reservoir Expansion Project and the Springbank Off-Stream Reservoir Project

Vehicle / Source Type	Chin Reservoir Expansion	Springbank Off-stream Reservoir
Wheel-tractor scrapers and rock trucks (1)	12	11
Dozers (medium to heavy duty)	10	7
Excavators (medium to heavy duty)	7	7
Roller / sheepfoot packers	10	3
Water truck	6	3
Grader	3	3
Skid steer	3	3
Dump trucks and trucks with trailers	13	56
Loader	2	Unknown
Drill rigs (grouting, instrumentation)	3	Unknown
Grout plant	2	Unknown
Gensets	5	Unknown
Crusher	1	Unknown
Light duty vehicles (2)	20	Excluded from assessment

Notes:
(1) Scrapers and rock trucks were combined since the Chin Project earthworks haul fleet will have a combination of scrapers and rock trucks but the quantities of each are not yet known.
(2) Not included in the Springbank Project assessment because it was assumed they are of short duration and on paved roads, thus would have a relatively small contribution to total emissions.

Question 91

Reference:

Volume 2, Section 3.1, Page 152

Rationale/Preamble:

SMRID states *Based on the findings of air quality assessments of similar projects, the construction emissions from the Project are not expected to result in adverse health effects*.

Information Request:

a. Provide justification for this statement.

Response:

a. Supporting rationale for this statement was provided in Volume 2, Appendix 14 – Assessment of the Potential Risks to Human Health for the Chin Reservoir Expansion Project.

   In place of an air quality dispersion modelling study of the construction of the Chin Reservoir Expansion Project, reliance was placed on available air quality and health risk assessments for similar projects involving construction of water retention structures in Alberta (i.e., Springbank Project and Cougar Creek Project). These applications were considered suitable for comparison to the Chin Reservoir Expansion Project because they involved a comparable number of emission sources, similar emission types and were restricted to construction emissions only.

   Available data for construction-phase emissions of air contaminants from EIAs for projects involving the use of heavy equipment to modify and build water reservoirs or flood retention structures indicate that any increases in ground-level air concentrations outside the immediate project area are expected to be minimal and not result in adverse health effects (refer to Volume 2, Appendix 14, Section 4.6).

5 WATER

5.1 Water Management

Question 92

Reference:

Volume 1, Map Figure 1 and Map Figure 2

Rationale/Preamble:

Information Request:

For clarity:

a. Add flow directions (arrows) on Map Figure 1 and Map Figure 2 in the EIA.

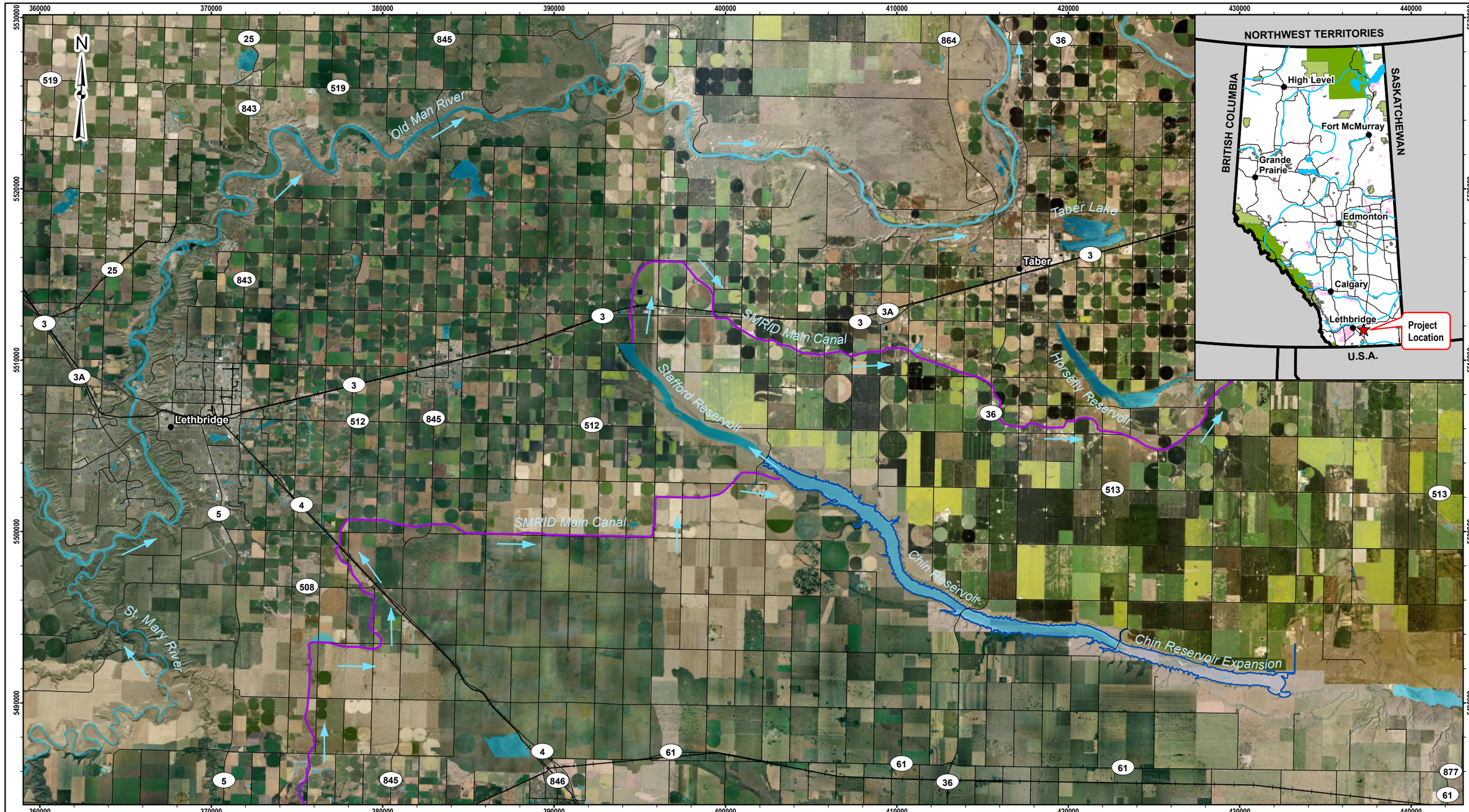
Response:

a. Map Figure 1 and Map Figure 2 have been updated to show the flow directions. The updated figures are appended as Figures 92.1 and 92.2, respectively.

FIGURES

Figure 92.1 Regional Location Map

Figure 92.2 Existing Components



Legend

- City or Town
- All Weather Road
- Railway
- Main Canal
- Flow Direction
- Water Feature
- Project Area

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, EARTHSTAR GEOGRAPHICS

CLIENT: SMRID

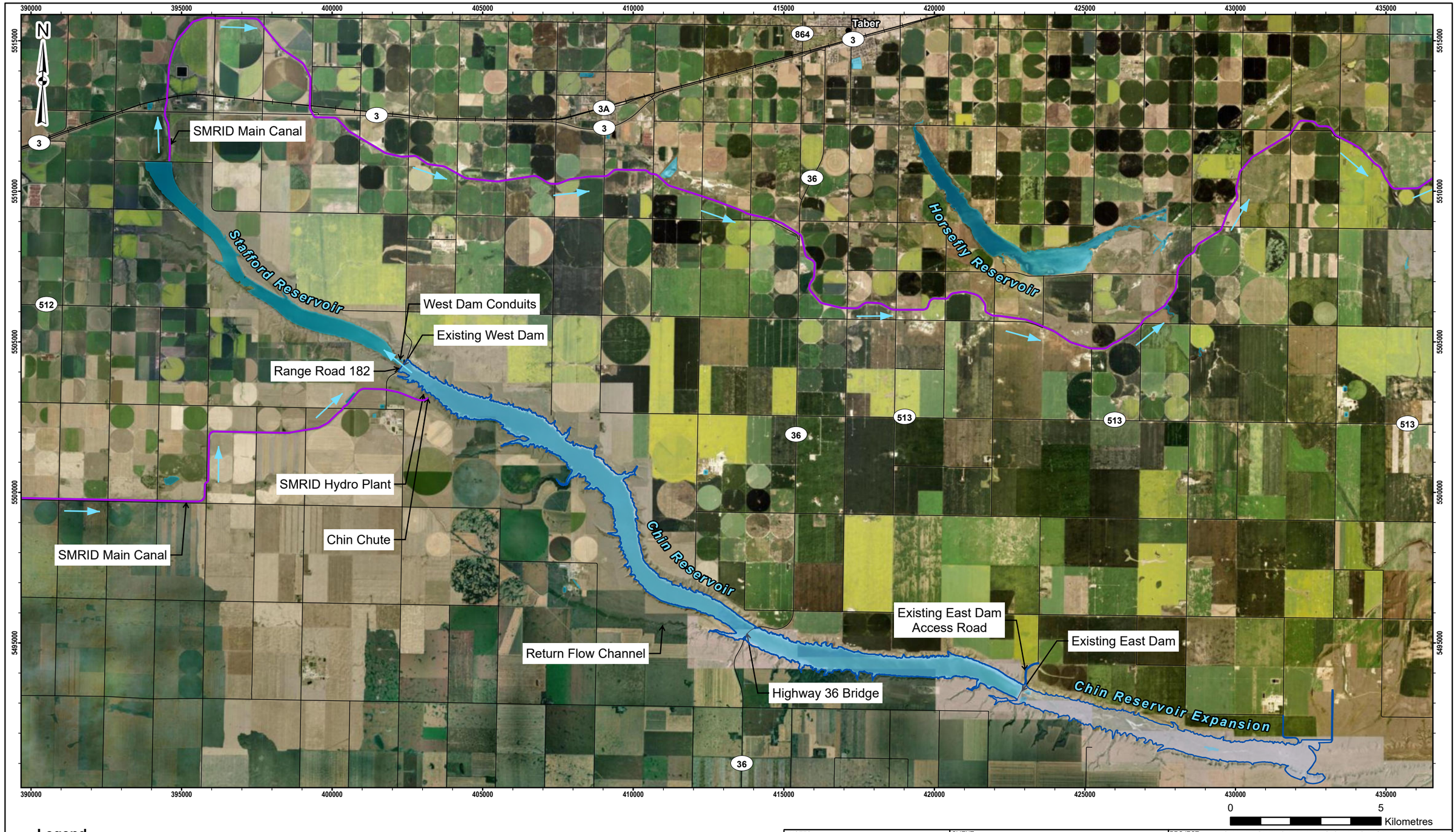
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: REGIONAL LOCATION MAP

SCALE	PROJECT No.	FIG No.
1:215,000	A03701E05	92.1

File: \\int.klohn.com\ProjData\AI\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_240517.aprx Creator: : HManandyan



Legend

- City or Town
- Railway
- All Weather Road
- Main Canal
- Flow Direction
- Water Feature
- Project Area

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: SOUTHERN ALBERTA, EARTHSTAR GEOGRAPHICS

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: EXISTING COMPONENTS

SCALE	PROJECT No.	FIG No.
1:120,000	A03701E05	92.2

File: \\int.klohn.com\ProjData\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\ChinReservoir_EIA_230301\ChinReservoir_EIA_240517.aprx Creator: : HMarandyan

Question 93

Reference:

Volume 1, Section 1.2.1, Page 6 and 7

Rationale/Preamble:

While the priority of rights of the SMRID licences is described, they are not described in context of other users upstream of their diversion from the headworks. Further, there is no explanation about how decisions are made from the source with regards to water supply.

Information Request:

a. Describe priority of rights of the SMRID licences in the context of other users upstream of their diversion from the headworks. Explain how decisions are made with respect to annual diversions from the source of the SMRID water supply.

Response:

a. Please refer to the *Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum* provided in Appendix 2.1 of this SIR#1 Response Document.

Question 94

Reference:

Volume 1, Section 1.4, Page 8

Rationale/Preamble:

SMRID states *In general, the overall amount of precipitation is expected to increase in Alberta; however, when and in what form the precipitation will fall is predicted to change.*

Information Request:

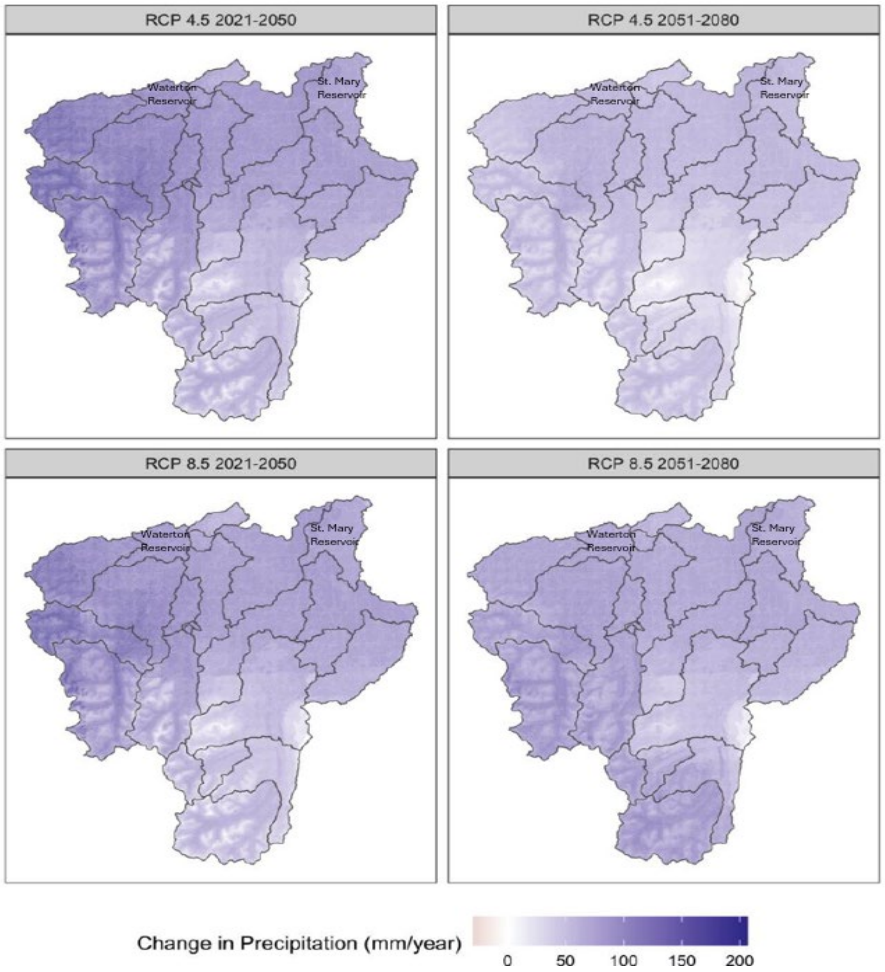
a. Clarify the statement by providing specific details about how precipitation is expected to change (e.g., numbers referring to amount, timing, and duration, etc.).

Response:

a. Please see the WaterSMART report *Hydrological Modelling to Evaluate Changes in Streamflow Availability in St. Mary River Watershed* (2023) provided in Appendix 1.2 for details on the climate change scenario analysis. The following response is a summary from that document which directly responds to this question.

   Under future climate change scenarios, annual precipitation in the study area is projected to increase, particularly along the western and northern portions of the watershed, primarily within the Waterton River watershed (see Figure 94.1).

Figure 94.1 Change in average annual precipitation in the Waterton, Belly, and St. Mary River watersheds under two climate change scenarios (RCP 4.5 and 8.5) for two future 30-year periods (2021-2050 and 2051-2080), relative to the 1991-2020 historical period (adapted from WaterSMART 2023)



Between 2021 and 2050, annual total precipitation is expected to increase by approximately 100 mm/year compared to the 1991-2020 baseline in both RCP 4.5 and RCP 8.5, as shown in Figure 94.1. These increases are largely due to a projected increase in summer precipitation.

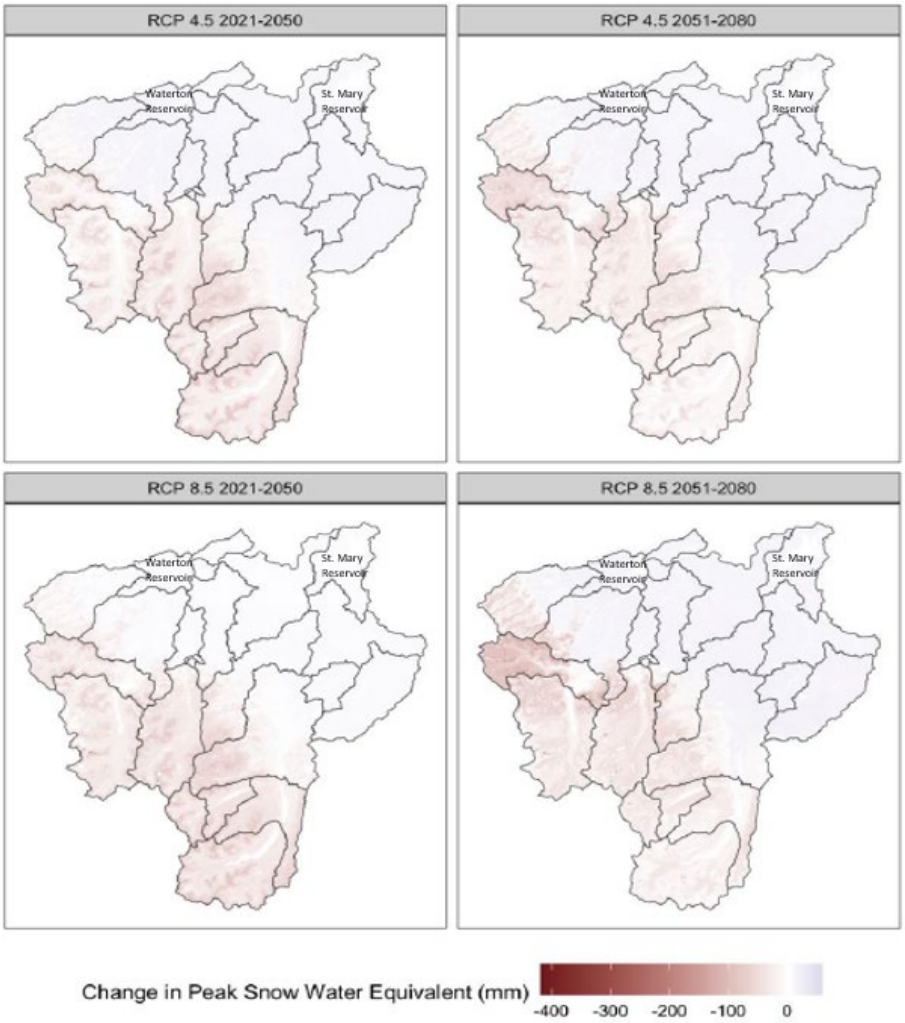
During the 2051-2080 period, annual total precipitation is projected to decline relative to the 2021-2050 period. However, when compared to the 1991-2020 baseline, annual precipitation is still projected to increase by an average of 100 mm/year, with the most substantial increases projected under the RCP 8.5 emissions scenario.

Monthly precipitation is expected to increase overall, with decreases in the 2021-2050 period for February under RCP 4.5 and RCP 8.5. Reductions are also projected during the 2021-2050 period in October and December under RCP 4.5 and RCP 8.5, respectively.

Despite the projected increase in total annual precipitation, the form and timing of that precipitation is expected to shift. Notably, the winter snowpack (as measured by snow water

equivalent, or SWE) is projected to decline across most of the watershed. Exceptions include portions of the prairie, where only small increases in SWE may occur (Figure 94.2).

Figure 94.2 Change in average peak snow water equivalent in the Waterton, Belly and St. Mary River watersheds under two climate change scenarios (RCP 4.5 and 8.5) for two future 30-year periods (2021-2050 and 2051-2080), relative to the 1991-2020 historical period (adapted from WaterSMART 2023)



The most substantial decreases in SWE are projected for mid- to high-elevations, driven by projected air temperature increases of 1 – 3°C. These warmer conditions are expected to result in a greater proportion of precipitation falling as rain rather than snow, more frequent mid-winter melt events, and earlier onset of spring snowmelt.

These changes in climatic patterns, including increased summer rainfall and reduced winter snow accumulation, are projected to intensify in the coming decades, particularly under high-emissions scenario RCP 8.5.

Question 95

Reference:

Volume 1, Section 1.7, Page 12

Rationale/Preamble:

SMRID states *Therefore, the addition of storage capacity will provide the means to capture the increased early runoff (including extreme events which currently would lead to flooding) and have a reliable source to continue to support irrigation throughout the growing season.*

Information Request:

a. Explain the timing for the projected early runoff.

b. Explain the timing of the projected early runoff and if it coincides with the operational availability of the headworks canal systems, i.e. diversion structures and canals are free of ice and snow to permit safe operation.

c. Explain if the projected early runoff will only be captured in the onstream headworks storage reservoirs.

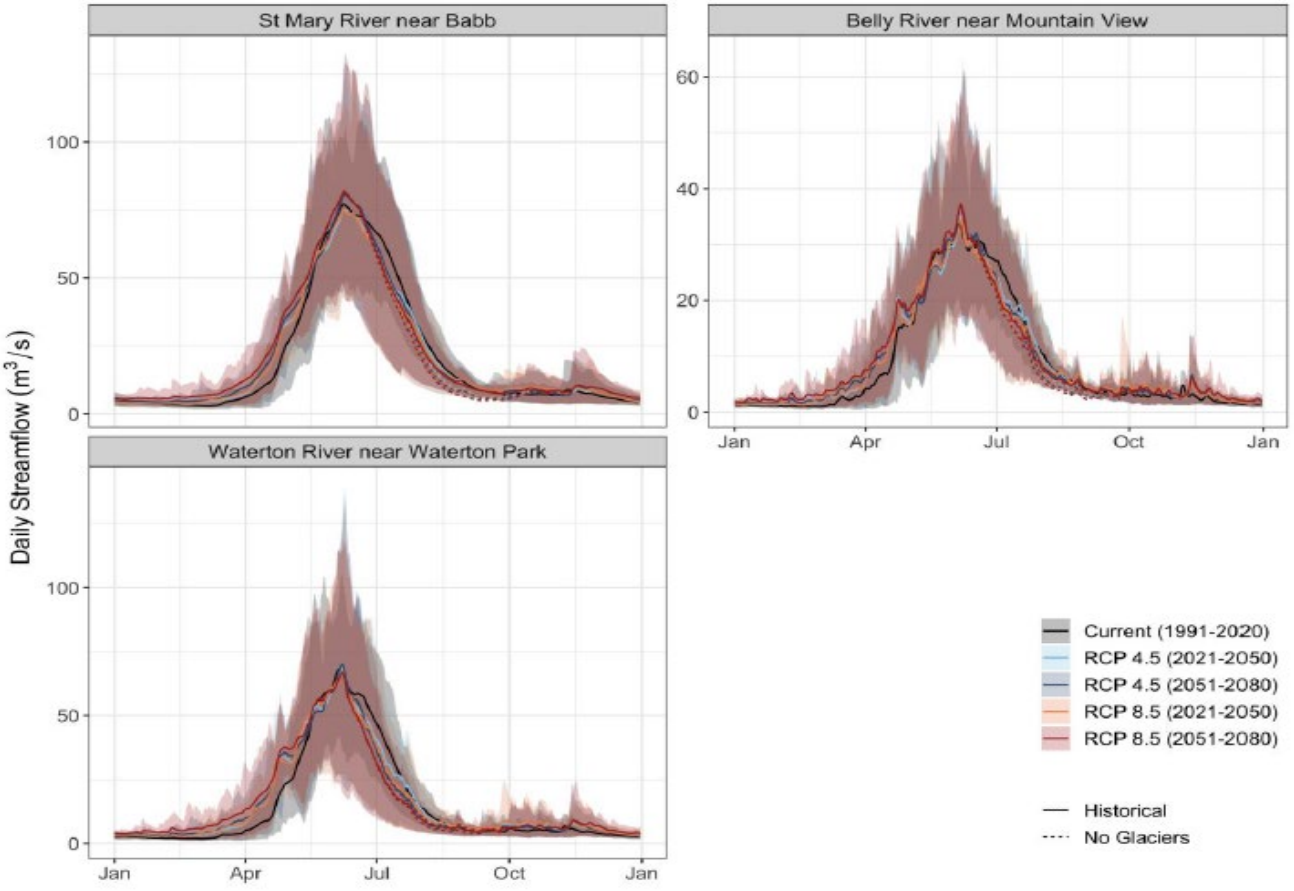
Response:

a. Please refer to the WaterSMART report *Hydrological Modelling to Evaluate Changes in Streamflow Availability in St. Mary River Watershed* (2023) provided in Appendix 1.2 for details on the climate change scenario analysis. The following response is a summary relevant to this question.

   With rising air temperatures, increasing precipitation, earlier snowmelt, and enhanced evapotranspiration, SOAP Model simulations indicate that the timing and magnitude of streamflow in the major SMRID tributaries are projected to shift under future climate scenarios.

   In snowmelt-dominated systems such as the St. Mary River, these changes shown in Figure 95.1 are expected to result in an earlier spring freshet due to the earlier onset of snowmelt. This results in an earlier recession towards baseflow and lower summer streamflow. Figure 95.1 shows that the Belly River is also expected to see higher peak flows with earlier recession towards baseflow and lower summer streamflow. Figure 95.1 shows that the Waterton River has smaller shifts in peak flow timing but still exhibits earlier runoff and lower summer streamflow under both RCP 4.5 and RCP 8.5 scenarios.

Figure 95.1 Daily hydrographs for the Southern Tributaries (major study area watersheds) under two climate change scenarios (RCP 4.5 and 8.5) for two future 30-year periods (2021-2050 and 2051-2080), relative to the 1991-2020 period



Notes: The model simulation includes the Historical and No Glaciers land cover scenarios. Solid lines represent the average streamflow while shaded areas correspond to 10-90% quantiles (WaterSMART 2023).

b. Irrigation operations in the SMRID system begin in the spring, once snow and ice have melted sufficiently to allow safe operation of canals and diversion structures. While timing varies annually with weather conditions, headworks infrastructure is generally operational by mid-April.

   Early runoff, driven by warming temperatures, would occur at a time when snowmelt is also advancing at infrastructure sites such as the Waterton–St. Mary headworks, making it likely that the system is ready to begin diversion at the same time as runoff. The projected shifts in runoff timing under future climate scenarios are expected to remain within the current operational window (by mid-April). Therefore, the existing infrastructure is expected to be capable of managing early-season runoff without significant changes to the current operating schedule.

Coordination between SMRID and AGI, which owns and operates the Waterton–St. Mary headworks, ensures that water supply and operational readiness are managed in response to real-time conditions.

c. The Waterton Reservoir and St. Mary Reservoir are specifically designed to capture spring runoff, providing essential operational flexibility in the headworks system. Under projected climate scenarios, early-season runoff will first be captured in these on-stream headworks storage reservoirs, provided there is available capacity at the time.

   If storage space is unavailable, runoff will continue downstream to the Waterton River or to the St. Mary River. If the canal system operated by AGI has started operation for that year then water may also be directed to the MRRR, ultimately reaching the SMRID headworks, and therefore concurrently free up storage space in the Waterton Reservoir and the St. Mary Reservoir. Management of this runoff depends on real-time operational decisions by AGI, in coordination with SMRID, based on available storage, system demands, and hydrologic conditions. For a detailed description of the water flow in this system, and the process of operational coordination, please refer to the *Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum* prepared by SMRID and provided in Appendix 2.1.

Question 96

Reference:

Volume 1, Section 1.7, Page 12;
Volume 2, Section 2.2.1, Page 25

Rationale/Preamble:

SMRID states *The typical operation that is described represents an ideal condition in years when water supply is not limited, which is often not the case.*

Information Request:

a. If typical operation only occurs in years when water supply is not limited, then provide and discuss the percentage of years water supply is not limited to years that it is limited.

b. Under the modelled scenarios described in Volume 1, Section 1.7, Page 12, discuss the likelihood of filling the expanded Chin Reservoir each year.

Response:

a. Limited water supply would be defined as when the water supply forecast indicates management is needed to balance the timing and needs of all water users. These decisions are made year to year and cannot be captured in the SOAP Model. For details on this decision-making process, please refer to the *Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum* provided in Appendix 2.1.

   The SOAP Model represents the operations of the AGI reservoirs, conveyance canal network, SMRID irrigation network, and SMRID-owned and operated reservoirs. It incorporates current operating rules, instream objectives, and infrastructure design. While the model uses historical inflow data from 1928 to 2009, it applies present-day operational conditions. As a result, the modelled outputs do not match historical observations; instead, they reflect how the current system would have performed under past hydrologic conditions. Further details on the model and its assumptions are provided in the *Technical Memorandum Regarding Chin Reservoir Expansion Project Supporting SIR Response* (Appendix 4.1).

   An estimate of the percentage of years where water supply is limited can be derived from the SOAP Model. It should be noted that the model utilizes typical operations and does not incorporate year-to-year decision making noted above. This reliance on typical operations is a recognized limitation of the modelling approach.

   Estimating when water supply is limited is based on the number of years where the water supply data in the model does not support the demand data in the model (from the provincial Irrigation Demand Model (IDM)), for that simulation year. Water supply is considered “limited” when the forecasted supply is not sufficient to meet the full crop demand, requiring water managers to adjust or restrict allocations. A shortage is recorded in the model whenever the demand provided by the IDM cannot be met. For this analysis, a year is classified as having

limited water supply if modelled delivery falls short of the demand by more than 2 inches per acre over the growing season. This 2-inch threshold is based on operational experience and reflects a level at which shortages are considered meaningful for irrigation delivery.

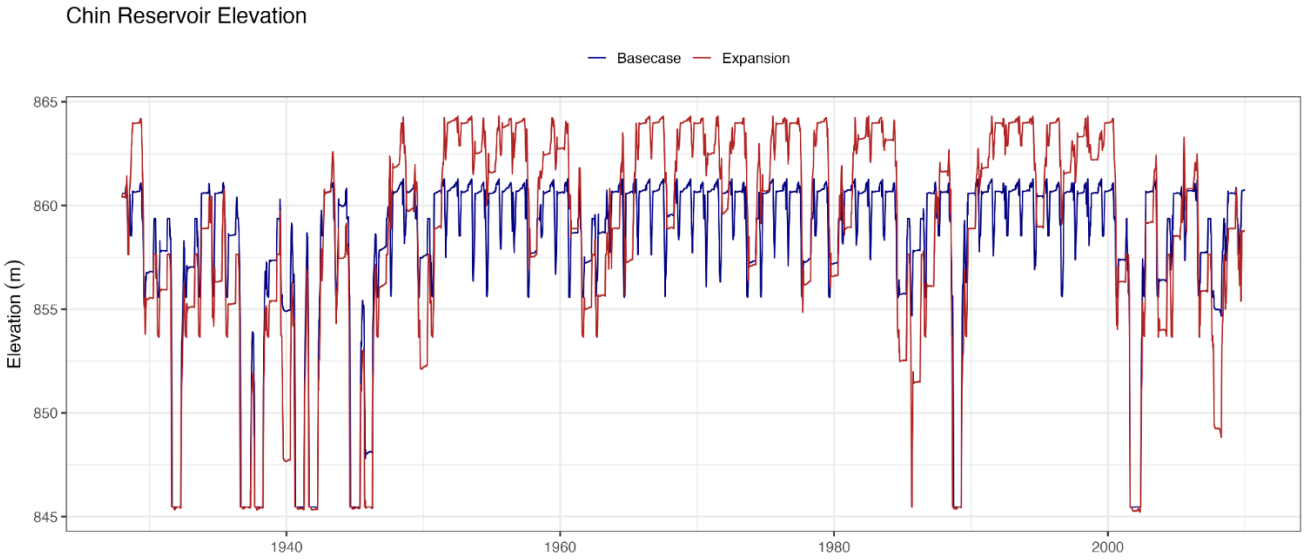
Based on this definition, shortages exceeding 2 inches per acre occur in 10 out of 82 simulated years in the Base case – approximately 12% of the simulation period. Conversely, in 72 of the 82 years or 88% of the simulation period, the model indicates sufficient water supply. In the model simulation of the Chin Reservoir Expansion Project two additional years occur where shortages exceed 2 inches per acre, therefore 85% of the Expansion Scenario simulation period there is sufficient water.

b. The SOAP Model simulations used to assess the Chin Reservoir Expansion Project can be analyzed to determine the likelihood of filling the expanded Chin Reservoir each year. It should be noted that in reality there are frequent occurrences where Chin Reservoir does not meet the winter storage target. In many cases these are intentional decisions made by SMRID operators, with input from AGI operators, that consider a variety of reasons including storage in other reservoirs. Failing to fill the expanded Chin Reservoir should not be considered a deviation from normal.

   Potential changes from the Chin Reservoir Expansion Project were assessed by comparing two scenarios: the Base case Scenario, representing the current system, and Expansion Scenario, which includes 127,650 dam^3 (103,500 ac-ft) of additional storage in the Chin Reservoir and 46,500 additional irrigated acres.

   Figure 96.1 illustrates the SOAP Model simulations of water elevation in Chin Reservoir, comparing the Base case Scenario (blue line) with Expansion Scenario (red line). The existing reservoir reaches full supply at approximately 861 meters, whereas the expanded reservoir would have a full supply level of 864 meters. Based on historical inflow data from 1928 to 2009 and applying current operational assumptions, the SOAP Model projects that the expanded Chin Reservoir could fill 35 out of the 82 years, which is 43% of the time. Comparatively, the existing Chin Reservoir could fill 53 years out of 82 years, which is 65% of the time. However, it is worth noting that the reservoir provides additional benefit in years where it is unable to fill yet still reaches a greater storage than the current reservoir would allow. If the analysis is expanded to count the number of years where Chin Reservoir stores more water than the existing reservoir, the percent of years showing benefit from the expanded reservoir increases to 55 out of 82 years, or 67% of the time.

Figure 96.1 Modelled results of Chin Reservoir elevation over the full series of simulation years (1928 – 2009) comparing the Base case Scenario (blue line) and the Expansion Scenario (red line)



Question 97

Reference:

Volume 1, Section 2.6.1, Page 39

Rationale/Preamble:

SMRID states *As noted for the Existing Chin Reservoir operating condition, reservoir operation will vary depending on inflows and demands, and under drought conditions the reservoir level would be drawn down as far as the outlet structure invert elevation will allow.*

Information Request:

a. Explain the impacts to other off stream reservoirs and the water supply headworks reservoirs for recovering the storage in the expanded Chin Reservoir under drought conditions.

b. Explain the impact and likelihood of consecutive multi-season drought conditions on the ability to refill the expanded Chin Reservoir.

Response:

a. The response below explains the potential effect of recovering storage in the expanded Chin Reservoir under drought conditions for SMRID reservoirs (e.g., Stafford, Grassy, Sauder) and the water supply headworks (Waterton Reservoir, St. Mary Reservoir and MRRR).

   The SOAP Model represents the operations of the AGI reservoirs, conveyance canal network, the SMRID irrigation network, and SMRID-owned and operated reservoirs. It incorporates current operating rules, instream objectives, and infrastructure design. While the model uses historical inflow data from 1928 to 2009, it applies present-day operational conditions. As a result, the modelled outputs do not match historical observations; instead, they reflect how the current system would have performed under past hydrologic inflow conditions. Further details on the model and its assumptions are provided in the accompanying technical memorandum (Appendix 4.1).

   Potential changes from the Chin Reservoir Expansion Project were assessed by comparing two scenarios: the Base case Scenario, representing the current system, and the Expansion Scenario, which includes 127,650 dam^3 (103,500 ac-ft) of additional storage in the Chin Reservoir and 46,500 additional irrigated acres.

   The SOAP modelling results demonstrate how the system would respond to drought conditions with no change to operating priorities and no decisions based on knowing water availability for the current year. In addition, the SOAP Model aims to maintain no change in flows on the Waterton, Belly, and St. Mary rivers relative to the Base case simulation. It is important to note these results reflect a simulation, not real-world operations and water managers have the ability to adapt operations within the context of within-year water supply.

Impacts to other off stream reservoirs

There will be no negative impacts on other SMRID off stream reservoirs as a result of recovering storage in the expanded Chin Reservoir. All storage in the SMRID reservoirs is for the purpose of supporting the SMRID members' needs, and all water storage is considered collectively in SMRID operations. As such, the additional storage opportunities offered by an expanded Chin Reservoir provides increased flexibility in the system. Since Chin is one of the first in SMRID's series of reservoirs, storage held there can be redirected to nearly any other field; storage in a downstream reservoir, 40-mile for example, can only reach a limited subset of SMRID's irrigated acreage. SMRID's operators will manage their full reservoir assets to optimize their system beyond what the SOAP Model might suggest.

Impacts to water supply headworks reservoirs

The SOAP Model results below describe drought conditions and the potential impacts to the headworks reservoirs operated by AGI. The water flow through this system is described in detail in Appendix 4.1.

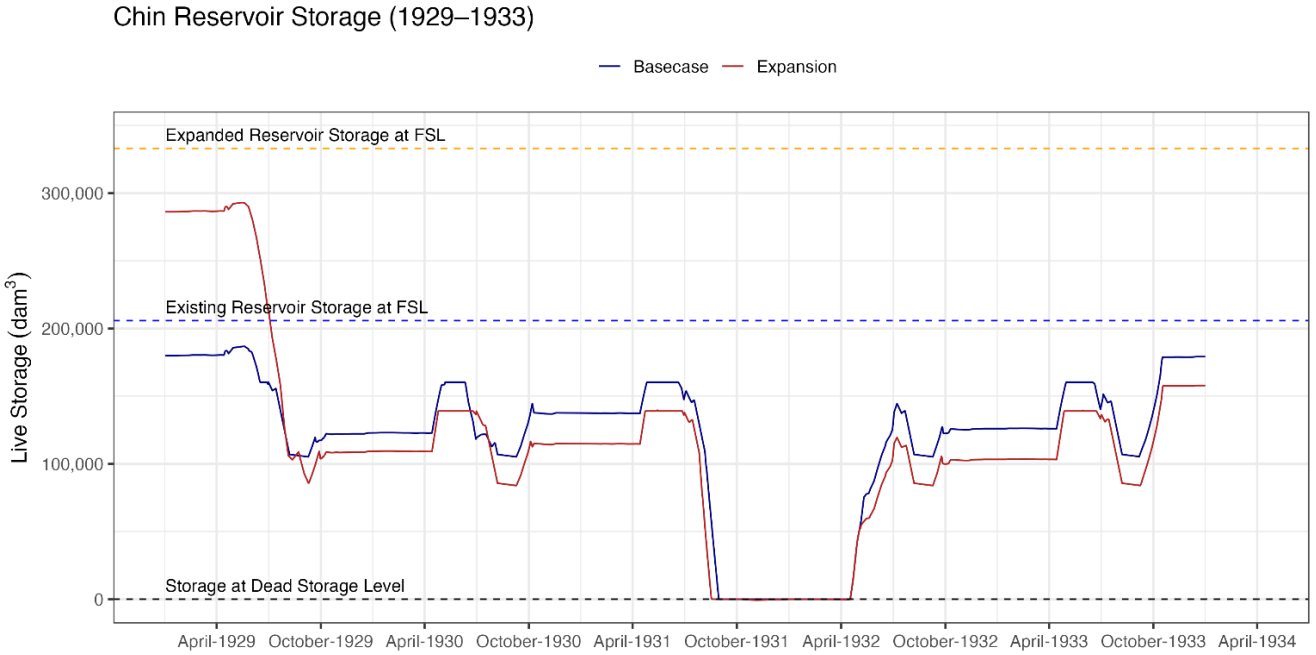
b. For the purpose of understanding multi-season droughts, two known drought events from within the 1928 to 2009 record are examined. Comparing the SOAP Model results from the Base case Scenario and the Expansion Scenario show the potential impact of the Chin Reservoir Expansion Project. The two known multi-season droughts selected are from 1929 to 1933, and from 2000 to 2002. The years 2005 to 2009 are also included as a reference because that series of years in the historical record is neither a drought nor a period of excess water supply.

   Within each plot described below for the three timeframes the Base case Scenario is shown with a blue line and the Expansion Scenario is shown with a red line. The figures include the FSL which is the level when the reservoir is considered full, and the irrigation tunnel invert which is the lowest level in the reservoir where water can be diverted to irrigation, including to SMRID.

   1929 to 1933 drought simulation

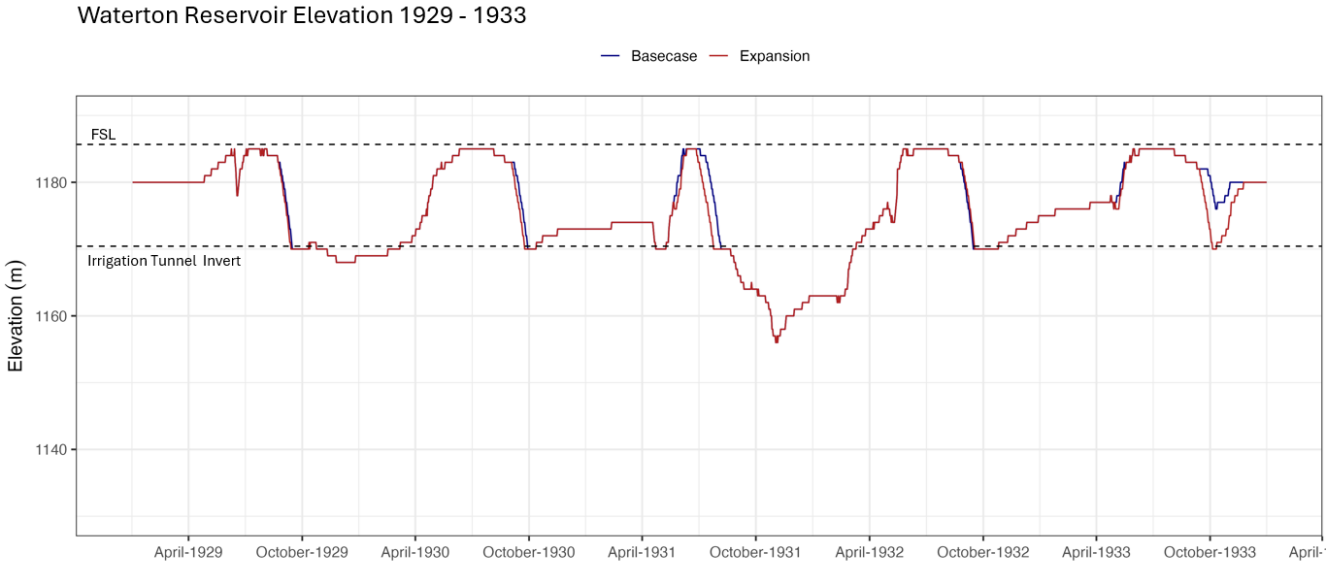
   SOAP Model simulated storage in the Chin Reservoir, and water level elevation in the Waterton, St. Mary, and Milk River Ridge Reservoirs for the 1929-1933 historical drought are presented in Figures 97.1, 97.2, 97.3, and 97.4, respectively. The Chin Reservoir is shown in storage rather than elevation because the size of the reservoir changes in the Expansion Scenario. The four figures are presented below with the interpretation following.

Figure 97.1 Modelled results comparing storage in the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1929 through 1933



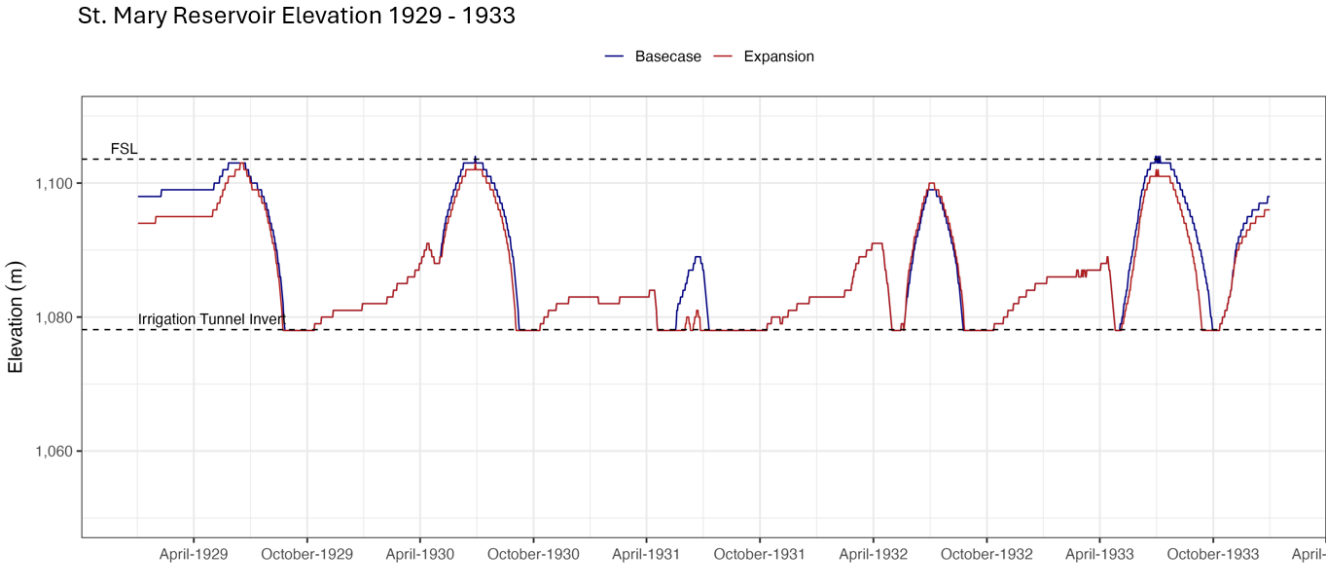
Note: Where no blue line is visible it is because the red line is overlying it.

Figure 97.2 Waterton Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1929 through 1933



Note: Where no blue line is visible it is because the red line is overlying it.

Figure 97.3 St. Mary Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1929 through 1933



Note: Where no blue line is visible it is because the red line is overlying it.

Figure 97.4 MRRR water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1929 through 1933



Note: Where no blue line is visible it is because the red line is overlying it.

SOAP Modelled results: 1929 - 1933

Figures 97.1, 97.2, 97.3, and 97.4, allow for direct comparison of the water levels in all the reservoirs across the 1929-1933 timeframe. In particular, comparing the timeframe from April to October 1932 demonstrates how the water level in the headworks reservoirs change because of recovering the storage of the Chin Reservoir Expansion Project. These plots enable quick identification of the impact to headworks reservoir water levels by the Expansion. The following observations are made:

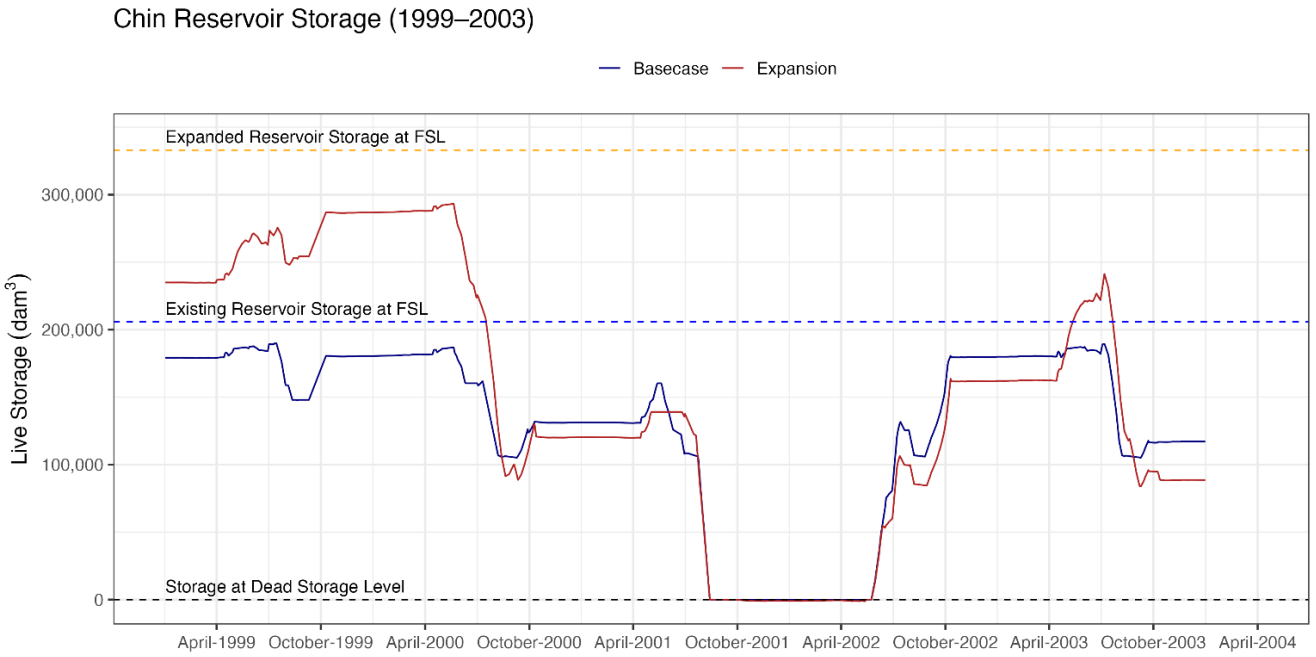
- Figure 97.1, after the initial drawdown in simulation year 1929, the lines from the two scenarios run in parallel for the whole drought period, with the Expansion Scenario having greater storage than the Base case Scenario. During the worst part of the drought (fall and winter 1931 to spring 1932) the reservoir is drawn all the way down to dead storage level in both scenarios. This shows that inflow is limited in both scenarios.
- Figure 97.1, the Expansion Scenario is not refilled by the end of 1933. Just as with the Base case Scenario, the reservoir continues to operate for SMRID benefit but is only able to refill after the drought period ends.
- Figure 97.2, the Waterton Reservoir water levels remain similar throughout the drought although drawdown occurs a few weeks earlier in 1931 under the Expansion Scenario. Waterton Reservoir operations in the SOAP Model are programmed to prioritize maintaining more storage in St. Mary Reservoir whenever possible. As such, few opportunities for change are possible because the canal is at maximum capacity much of the time already to direct water to St. Mary Reservoir.
- Figure 97.2, the one major deviation in this period between the Expansion and Base case Scenarios occurs in late 1933. In this period Waterton shows a greater drawdown under the Expansion Scenario as the St. Mary-Waterton headworks system attempts to help Chin Reservoir refill. Notably, though, the reservoir returns to the same level as the Base case Scenario by the end of the calendar year despite this additional withdrawal.
- Figure 97.3, in most years of the dry period the St. Mary Reservoir's water level is slightly lower in the Expansion Scenario than under the Base case Scenario. 1931 is the most notable exception to this, as water that would otherwise be maintained in the reservoir is instead being directed to support the additional acreage in the SMRID approved under an Expansion Scenario. AGI operators would be responsible for the real-world decisions on approving volumetric releases across the diversion and balancing storage priorities on either side thereof. In this analysis it was assumed that all requests for diversion would be granted to show maximum impact on provincial storage.
- Figure 97.3, the recovery of Chin Reservoir beginning in April 1932 does not appear to significantly change the modelled levels in St. Mary Reservoir over the same timeframe under both the Base case and Expansion Scenarios.
- Figure 97.4, the MRRR cycles from FSL to empty during every plotted year. Note that the water level is maintained for a greater duration in the years 1929 and 1930 under the

Expansion Scenario. In the following years, 1931 and 1932, the water level drops a few weeks earlier under the Expansion Scenario, as the Expanded Chin Reservoir is filled. Deviations in storage between the MRRR and Chin Reservoir could be re-managed to shift the burden as appropriate in the real world.

1999 to 2003 drought simulation

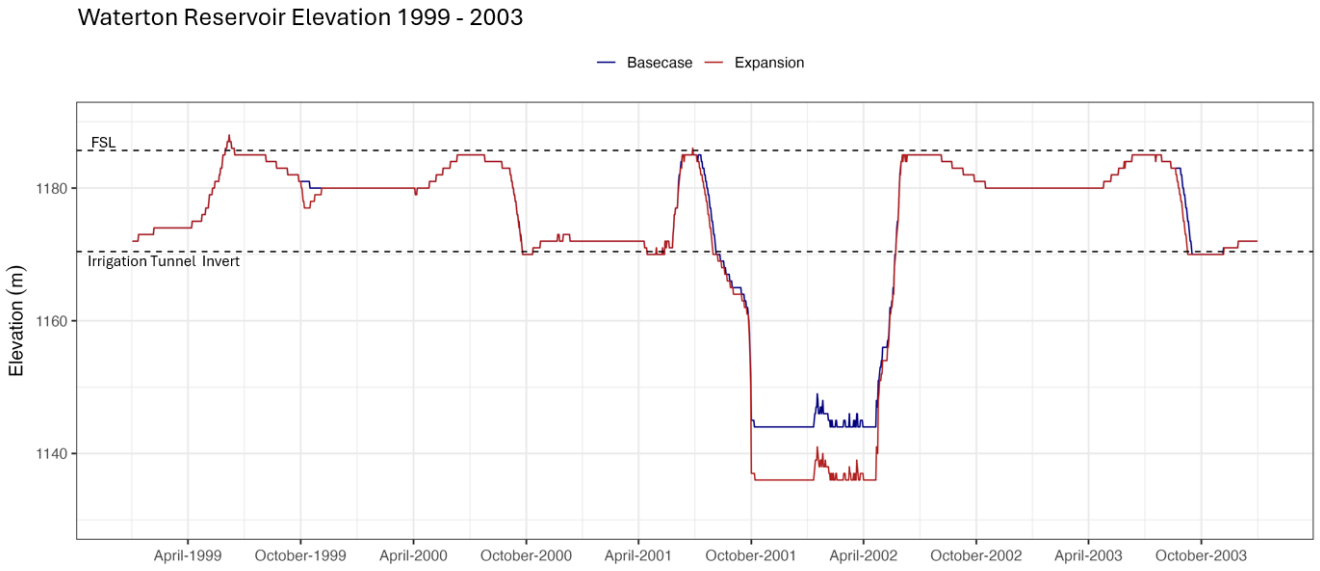
Simulated storage in the Chin Reservoir, and water level elevation in the Waterton, St. Mary, and MRRR Reservoirs for the relatively recent 1999-2003 historical drought are presented in Figures 97.5, 97.6, 97.7, and 97.8, respectively. The four figures are presented below with the interpretation of them afterward.

Figure 97.5 Modelled results comparing storage in the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1999 through 2003.



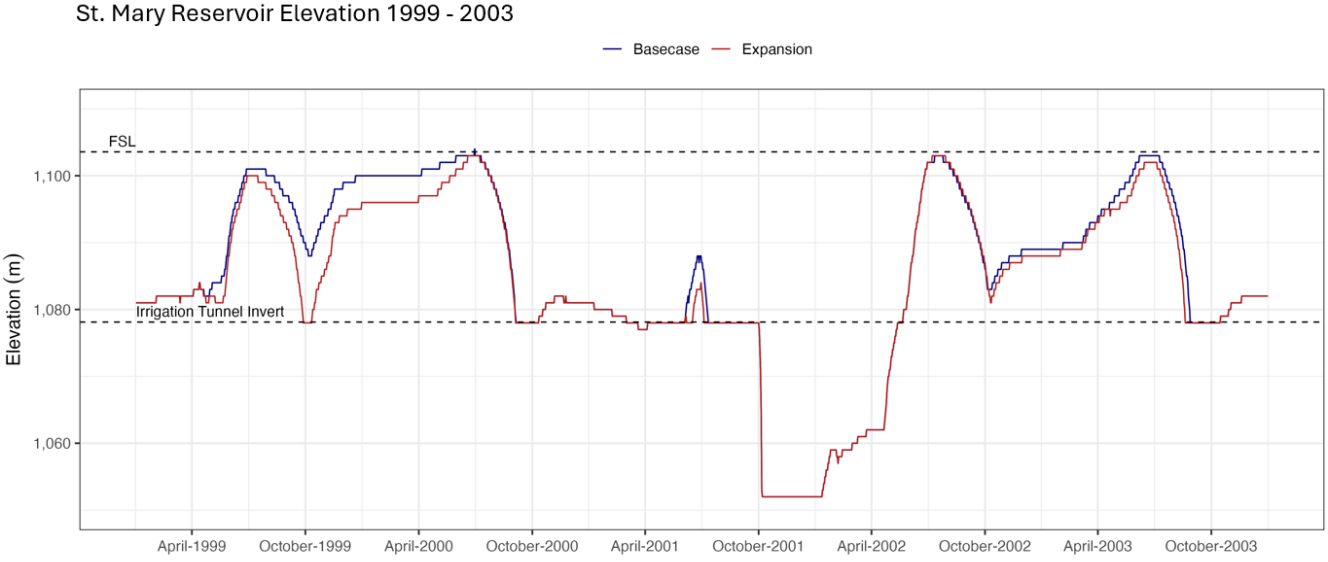
Note: Where no blue line is visible it is because the red line is overlying it.

Figure 97.6 Waterton Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1999 through 2003



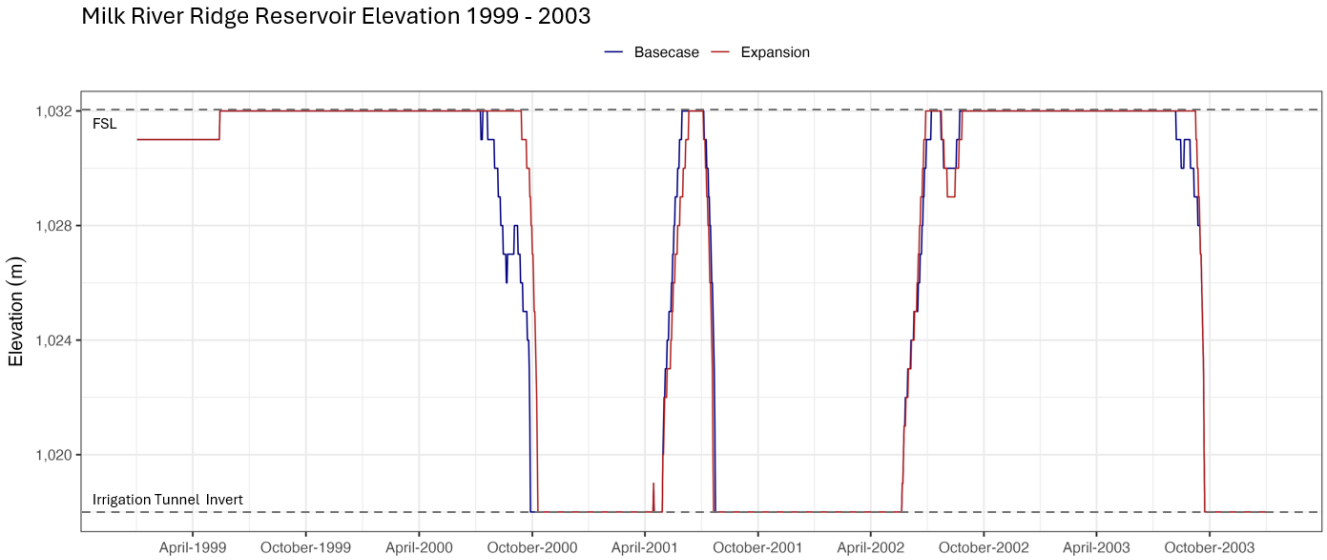
Note: Where no blue line is visible it is because the red line is overlying it.

Figure 97.7 St. Mary Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1999 through 2003.



Note: Where no blue line is visible it is because the red line is overlying it.

Figure 97.8 MRRR water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 1999 through 2003



Note: Where no blue line is visible it is because the red line is overlying it.

Modelled results: 1999 - 2003

As done previously, Figures 97.5, 97.6, 97.7, and 97.8, allow for comparison of the water levels in all the reservoirs across the 1999-2003 timeframe, which captures the 2000-2002 drought. The following observations are made.

- Figure 97.5, the expanded Chin Reservoir maintains more storage than the Base case Scenario throughout the 1999-2003 drought simulation. In 2000 there is an initial significant drawdown of storage in the Expansion Scenario, and in 2001 slightly more storage is maintained for about a month longer than the Base case Scenario before dropping down. Finally, in 2003 there is more water supply and Expanded Chin Reservoir is able to draw on that to partially refill (above the volume that existing Chin Reservoir fills to) before beginning its seasonal drawdown.
- Figure 97.6, the water level of Waterton Reservoir does not substantially deviate until the year 2001. The Expansion Scenario resulted in an additional 10 m drawdown of Waterton Reservoir in 2001, when compared to the Base case Scenario.
- Figure 97.6, from April to October 2002, water levels in Waterton Reservoir do not differ between the Base case and Expansion Scenarios.
- Figure 97.7, the water level of St. Mary Reservoir is lower in 1999 until mid 2000 under the Expansion Scenario as the SMRID diverts additional water to keep the Expanded Chin Reservoir full while also providing water to the expanded acres. From October 2000 to October 2002 the water levels of St. Mary Reservoir show few meaningful differences between the two scenarios, with exception of the brief period in spring 2001 when, during

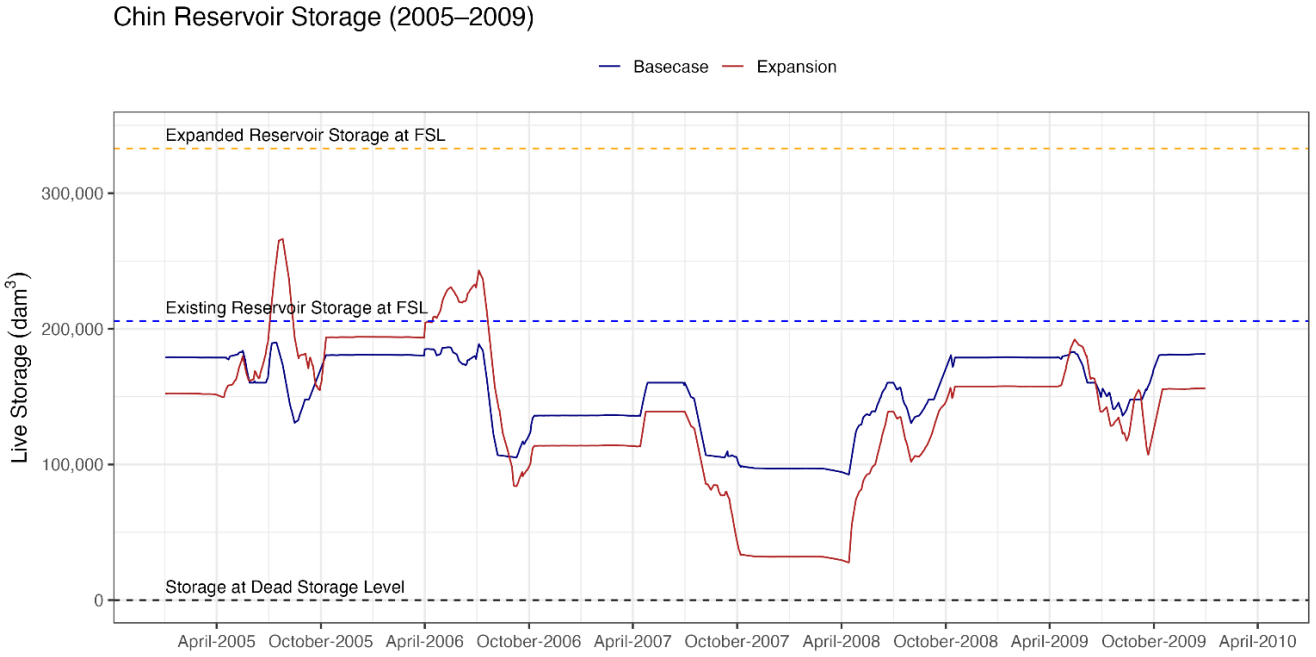
a low inflow year, Chin Reservoir tries to withdraw some additional water to provide for those additional acres again.

- Figure 97.8, the water levels simulated for MRRR follow each other closely. In 2000 the water level of MRRR is maintained for about one month longer under the Expansion Scenario than the Base case Scenario. The water level reaches the same minimum level about one week later in October 2000. Again, balancing the storage between these two reservoirs is a question that would be resolved through real-world operations.

2005 to 2009 average water supply simulation

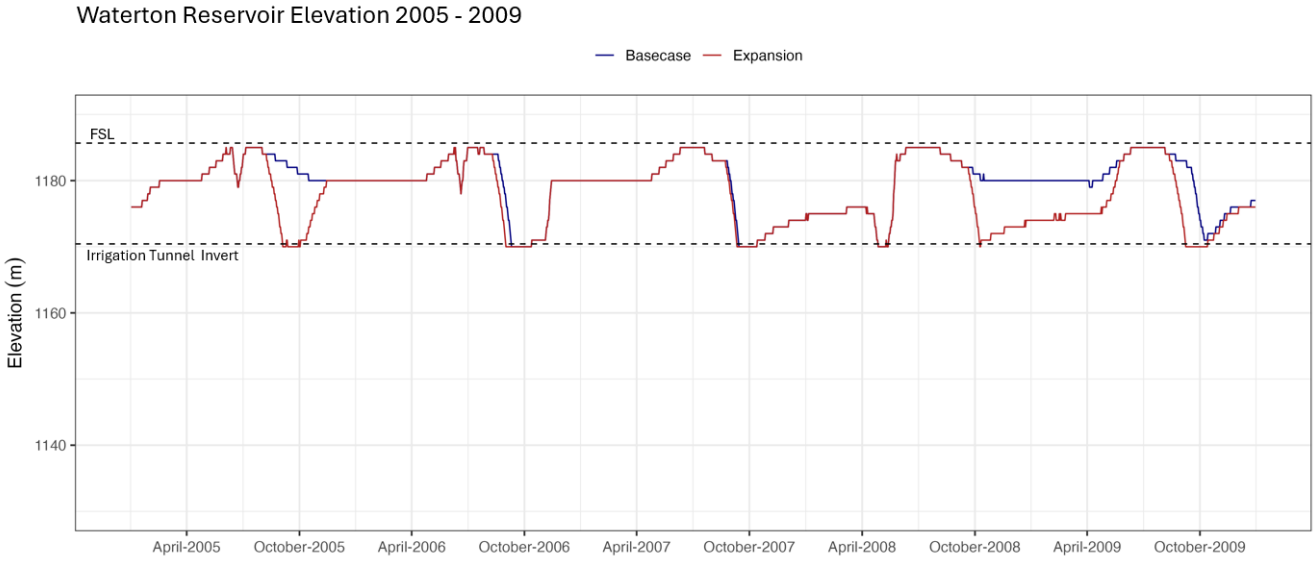
Figures 97.9, 97.10, 97.11, and 97.12 are provided below for comparison to the above two drought simulations. The years 2005 to 2009 had a natural water supply that was neither limited nor excessive and therefore these plots are offered as a point of reference for Figures 97.1 through 97.8.

Figure 97.9 Modelled results comparing storage in the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 2005 through 2009



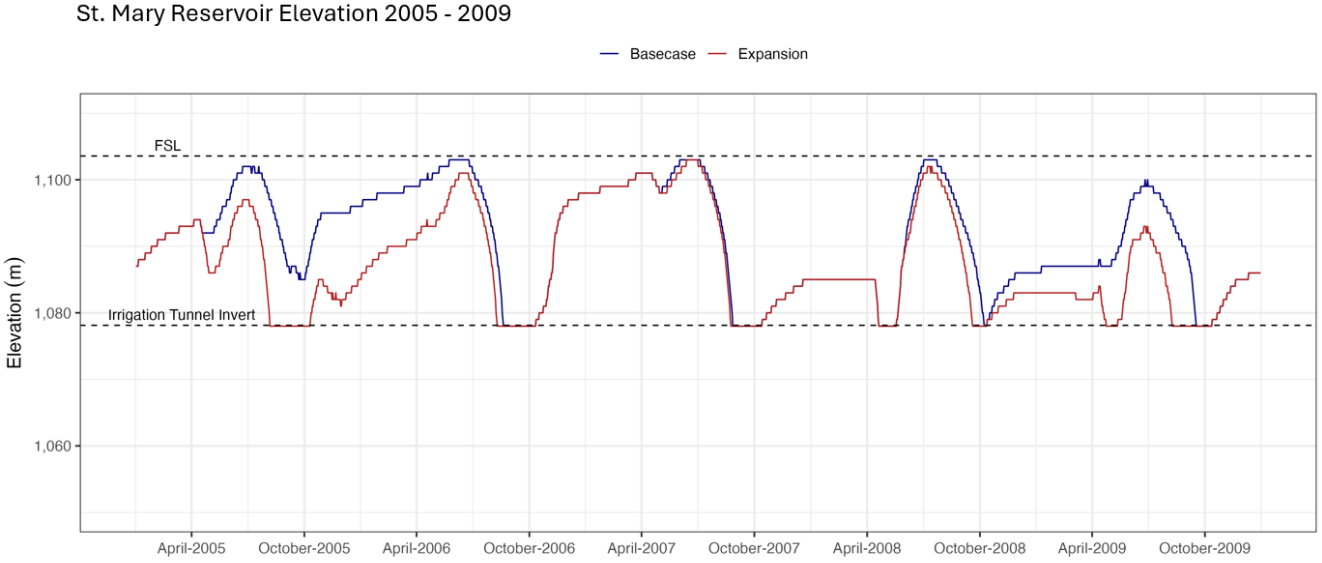
Note: Where no blue line is visible it is because the red line is overlying it.

Figure 97.10 Waterton Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 2005 through 2009



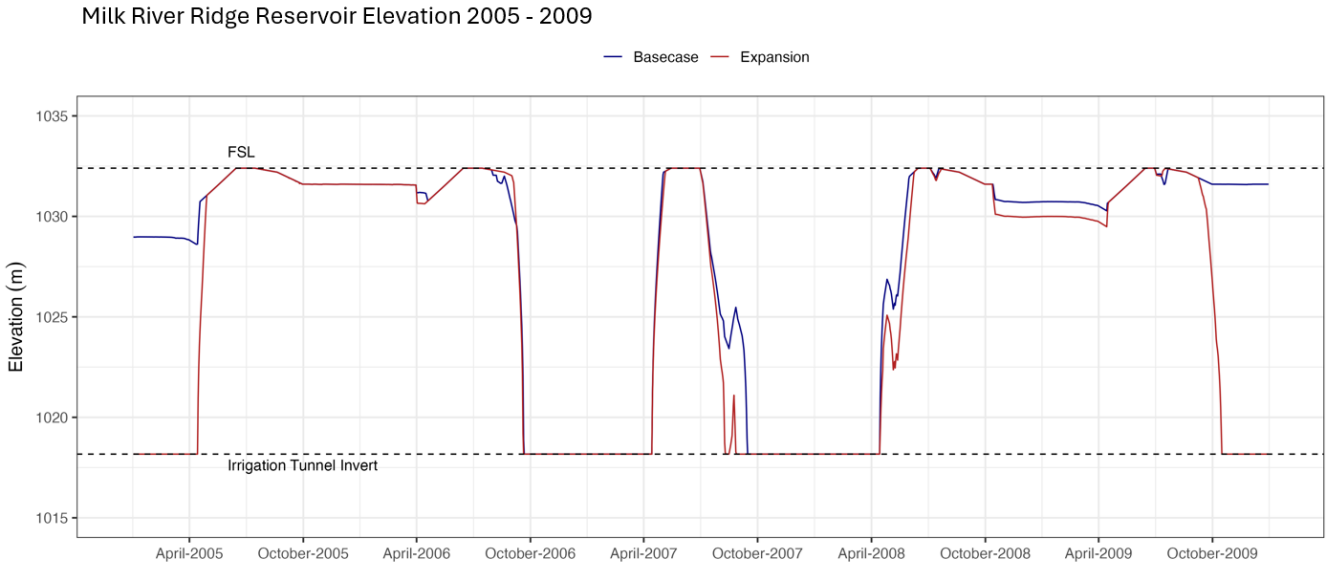
Note: Where no blue line is visible it is because the red line is overlying it.

Figure 97.11 St. Mary Reservoir water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 2005 through 2009



Note: Where no blue line is visible it is because the red line is overlying it.

Figure 97.12 MRRR water elevation with the Existing Chin Reservoir (blue line) and Chin Reservoir Expansion Project (red line) over the simulation years 2005 through 2009.



Note: Where no blue line is visible it is because the red line is overlying it.

Modelled results: 2005 – 2009

- Figure 97.9, the larger size of Chin Reservoir has more storage in the Expansion Scenario when it is available. The expanded reservoir storage goes above and below the Base case reservoir storage showing the additional capacity is used. This is beneficial for irrigators even if the reservoir does not refill completely.
- Figure 97.10, the water elevation of Waterton Reservoir is drawn down more heavily in the Expansion Scenario, particularly in the end of the irrigation season in 2005 and 2008. This is the time when the SOAP Model is directing flows to refill the Chin Reservoir.
- Figure 97.11, the water elevation of St. Mary Reservoir is drawn down more heavily in the Expansion Scenario, particularly in 2005 and 2009. There is some impact on the ability of St. Mary (and Waterton) to refill, but AGI operators could choose to reoperate the diversion to preserve storage in the St. Mary and Waterton Reservoirs over Chin Reservoir if desired.
- At no point do any of the reservoirs fall below irrigation invert levels.

Question 98

Reference:

Volume 2, Section 2.2.3.2.1, Page 30

Rationale/Preamble:

SMRID states that there will be no effect on transboundary apportionment because the Project will be drawing water from the Milk River Ridge Reservoir and not directly from the river.

Information Request:

a. Provide impacts on downstream flow as well as headwater storages. What impact will there be on the Milk River Ridge, Waterton, and St. Mary reservoirs? Will volume be drawn to fill the Expanded Chin Reservoir, or will the Chin Reservoir expanded area only be filled in certain years?

Response:

a. ***Provide impacts on downstream flow***

Please refer to the response to SIR#1 Question 4 (b) for analysis and discussion regarding the impacts on downstream flow. For the part of the question that asks, “provide impacts on headwater storages”, the following response has been provided.

Provide impacts on headwater storages

The SOAP Model represents the operations of the AGI reservoirs, conveyance canal network, the SMRID irrigation network, and SMRID-owned and operated reservoirs. It incorporates current operating rules and infrastructure design. While the model uses historical inflow data from 1928 to 2009, it applies present-day operational conditions. As a result, the modelled outputs do not match historical observations; instead, they reflect how the current system would have performed under past hydrologic inflow conditions. Further details on the model and its assumptions are provided in Appendix 4.1.

Potential changes from the Chin Reservoir Expansion Project were assessed by comparing two scenarios: the Base case Scenario, representing the current system, and the Expansion Scenario, which includes 127,650 dam^3 (103,500 ac-ft) of additional storage in the Chin Reservoir and 46,500 additional irrigated acres.

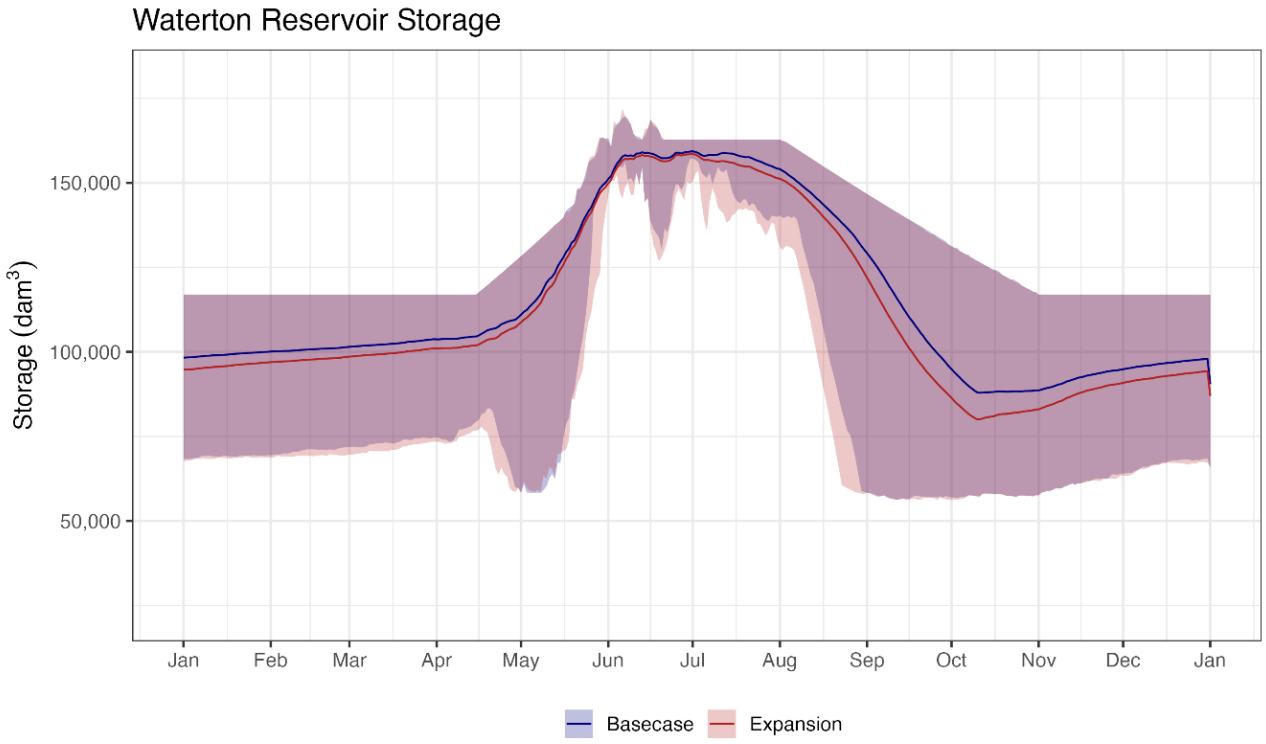
The SOAP Model simulations can illustrate changes in the storage of the Waterton Reservoir, St. Mary Reservoir and MRRR, as illustrated in Figure 98.1, 98.2, and 98.3 respectively, which show the mean and range of storage volume.

Waterton Reservoir

At a broad level there are only small differences in storage in the Waterton Reservoir, though the average annual storage is slightly lower before and after the freshet in the Expansion Scenario. Starting in mid-to-late May until the end of June there is a minor difference in average

storage between the scenarios. From July on the average storage is again lower in the Expansion Scenario, with the greatest difference of approximately 12,500 dam^3 less storage occurring at the end of the irrigation season (October). Essentially, although the reservoir is utilized more under the Expansion Scenario, it does not seem to impact the ability to refill during the freshet in most cases.

Figure 98.1 Monthly storage in the Waterton Reservoir, comparing SOAP Model simulated results for the Base case Scenario (blue line) and the Expansion Scenario (red line), based on historical inflow data (1928-2009)

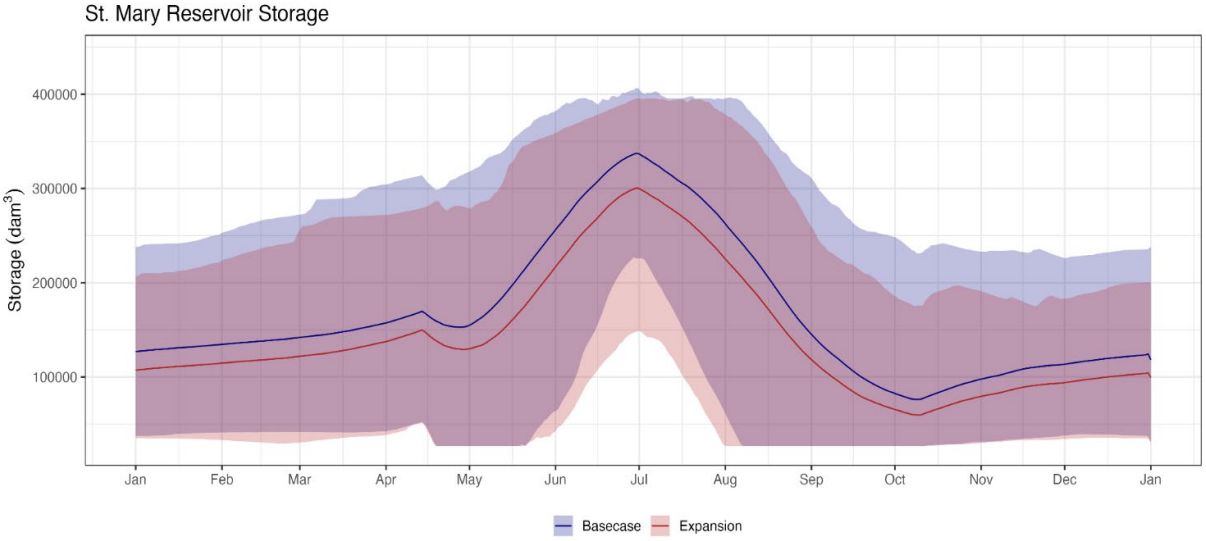


Note: Where no blue is visible it is because the red is overlying it.

St. Mary Reservoir

In the St. Mary Reservoir, the average annual storage is consistently lower in the Expansion Scenario compared to the Base case Scenario, with a consistent 20,000 to 30,000 dam^3 less storage in the Expansion Scenario. This reflects the consistent preference in the model for Chin Reservoir storage over St. Mary Reservoir storage.

Figure 98.2 Monthly storage in the St. Mary Reservoir, comparing SOAP Model simulated results for the Base case Scenario (blue line) and the Expansion Scenario (red line), based on historical inflow data (1928-2009)

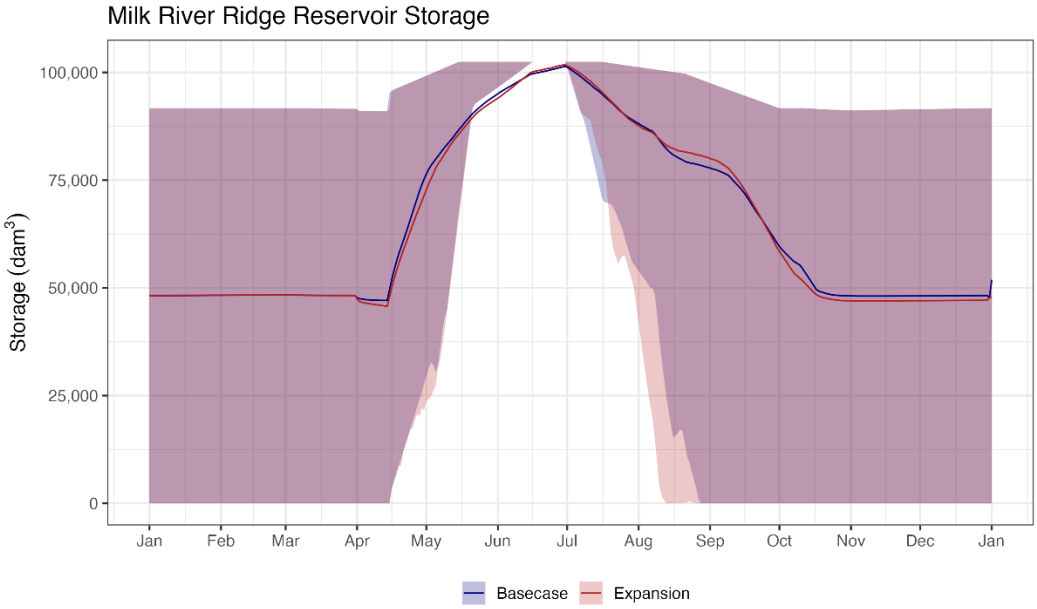


Note: Where no blue is visible it is because the red is overlying it.

Milk River Ridge Reservoir

In the MRRR, there is no meaningful difference in storage, save for a slightly increased risk of empty in the late August period as shown by the range reaching zero live storage earlier in the Expansion Scenario. As stated in prior questions, SMRID and AGI system managers could mitigate this risk through storage controls outside the scope of this modelling effort.

Figure 98.3 Monthly storage changes in the MRRR, comparing SOAP Model simulated results for the Base case Scenario (blue line) and the Expansion Scenario (red line), based on historical inflow data (1928-2009)



Note: Where no blue is visible it is because the red is overlying it.

Please refer to SIR number 97 for additional commentary and discussion of impacts to headwater storages.

Will volume be drawn to fill the expanded Chin Reservoir, or will the Chin Reservoir expanded area only be filled in certain years?

Water can be drawn to fill the expanded Chin Reservoir in years when supply is available, and the model has a preference for storage in the Chin Reservoir over storage in St. Mary Reservoir when infrastructure and license limitations (e.g. IO/WCOs, invert elevation) allow. The Chin Reservoir will thus fill as much as possible whenever such constraints allow, though not necessarily all the way to full.

In practice, the Chin Reservoir frequently does not meet its winter storage target, not necessarily due to water availability, but as a result of intentional decisions made by SMRID operators, acting in coordination with AGI operators. These decisions consider a range of factors, including storage availability in other reservoirs. A failure to fill the expanded Chin Reservoir to the winter level in a given year should not be interpreted as a deviation from standard operations, but rather as a reflection of active water management priorities.

Question 99

Reference:

Volume 2, Section 2.2.3.2.1, Page 30

Rationale/Preamble:

The section identifies that the headworks system (the source) from which Chin Reservoir is filled from. It does not appear that there is any quantitative assessment of the impact to the headworks system (Waterton Reservoir, St. Mary Reservoir, Milk River Ridge Reservoir).

The additional volume needed to fill the expanded Chin Reservoir must be analyzed to determine the impact to storage volumes within the headworks reservoirs. Further, the change in timing of diversions must be analyzed if withdrawals are anticipated to occur earlier or later.

Information Request:

a. Analyze and discuss the impacts to storage volumes within the headworks reservoirs (Waterton Reservoir, St. Mary Reservoir, Milk River Ridge Reservoir) with the additional volume needed to fill the expanded Chin Reservoir.

b. Analyze and discuss the change in timing of diversions if withdrawals are anticipated to occur earlier and/or later in the year.

Response:

a. Refer to the response to SIR#1 Question 98 (a) for analysis and discussion regarding the impacts on the storage volumes within the headworks reservoirs due to the Chin Reservoir Expansion Project.

b. The timing of diversions from the headworks reservoirs (Waterton, St. Mary, and Milk River Ridge) is expected to change as a result of the Chin Reservoir Expansion Project. These changes can be evaluated based on simulations conducted using the SOAP Model. A key modelling assumption relative to timing is that diversions from MRRR to the SMRID begin one week earlier and end one week later with the Chin Reservoir Expansion Project.

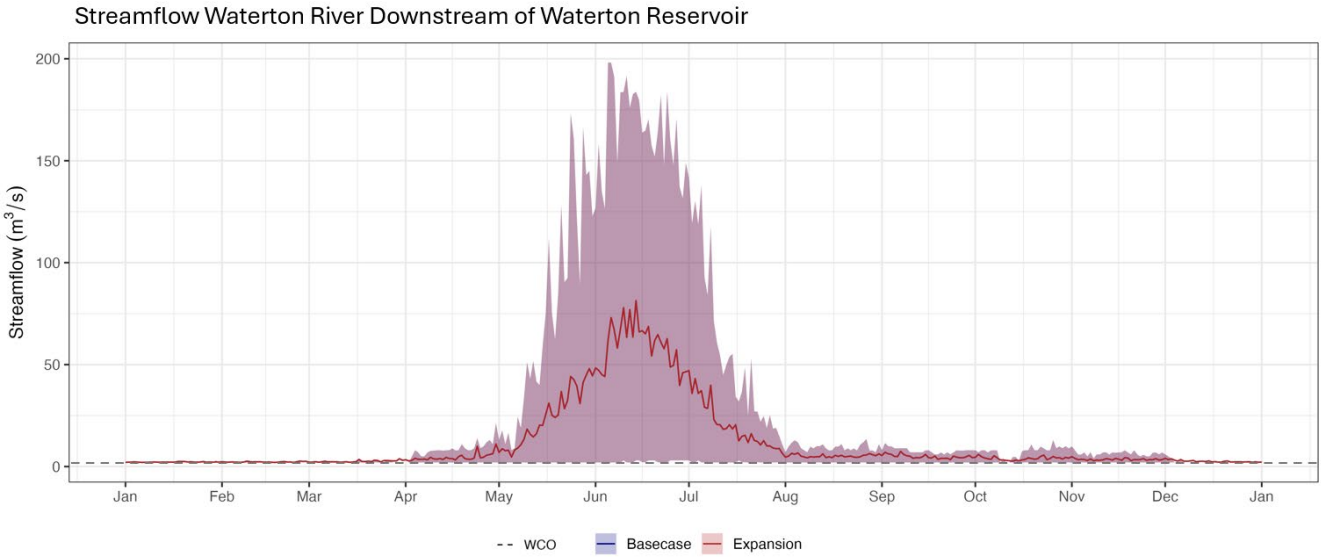
   The SOAP Model simulates simplified operations of the AGI reservoirs, conveyance canal network, the SMRID irrigation network, and SMRID owned and operated reservoirs using current operating rules, instream objectives, and infrastructure design. The model uses historical inflow data from 1928 to 2009 but applies current operations. As a result, the modelled outputs will not match historical observations; instead, they illustrate how the current system would have operated under past hydrologic inflow conditions. Refer to Appendix 4.1 for further details on the model and the assumptions underlying these results.

   To analyze timing changes, the outflow from the reservoirs was determined through SOAP Model simulations that considered the two scenarios: the Base case Scenario, representing the current system, and the Expansion Scenario, which includes 127,650 dam^3 (103,500 ac-ft) of

additional storage in the Chin Reservoir and 46,500 additional irrigated acres. The Expansion Scenario assumes that diversions from MRRR to the SMRID begin April 8 and end October 17 every year, which is one week earlier and one week later compared to the Base case Scenario. However, in practice the timing of startup and end of diversions each year from MRRR to the SMRID is determined by AGI and SMRID operators based on the current context of weather forecasts, snowpack, soil moisture, reservoir levels, predicted demand, etc.

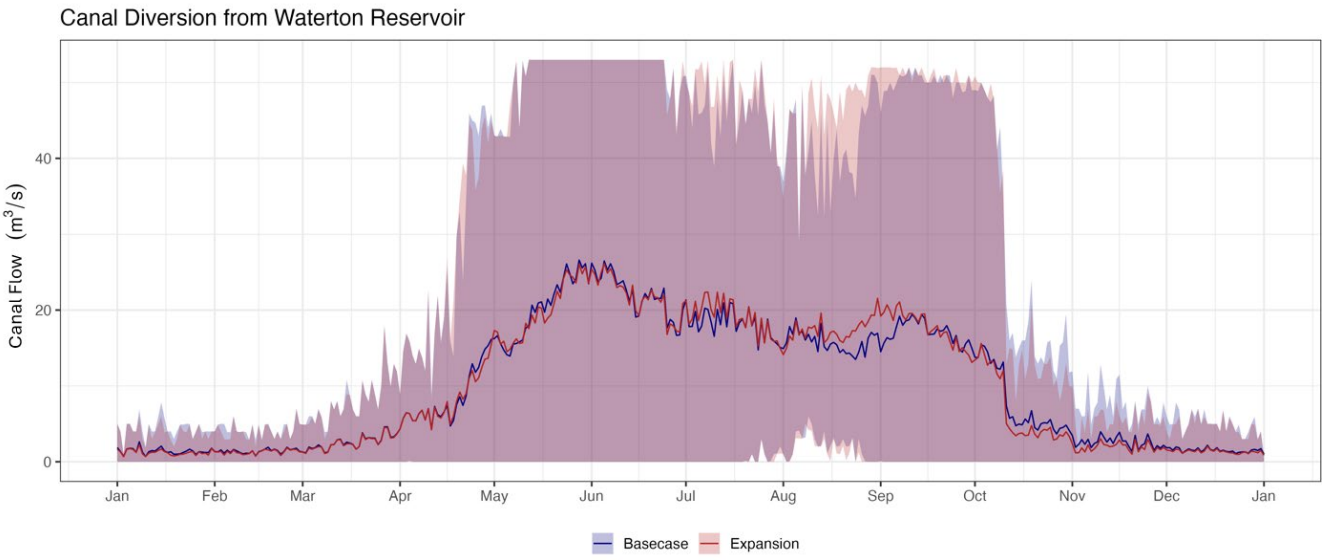
Figures 99.1 and 99.2 illustrate the water leaving Waterton Reservoir to the Waterton River downstream (Figure 99.1) and the water diverted to the Waterton to St. Mary (WSTM) canal system (Figure 99.2). In Figure 99.1 the scenario outputs overlay each other exactly, indicating the timing of dam releases to the Waterton River does not change with the Chin Reservoir Expansion Project. This is a standing assumption of the SOAP model, where Waterton River flows are "locked" so that impacts of changes in the SMRID system are confined to storage or within SMRID itself. Figure 99.2 shows that the average canal flow stays very similar throughout the year except August through mid-September when the Expansion Scenario has higher flow than the Base case Scenario by approximately 5 m^3/s. This is generally due to attempts to refill a larger Chin Reservoir prior to winter. The average canal flow in the Expansion Scenario is slightly lower (approximately 1 m^3/s) than the Base case in the month of October, likely because a more aggressive draw results in the reservoir reaching the invert level sooner in some years and therefore cannot send water down the canal.

Figure 99.1 Hydrograph comparing annual flows for Waterton River under the Base case Scenario and Expansion Scenario



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

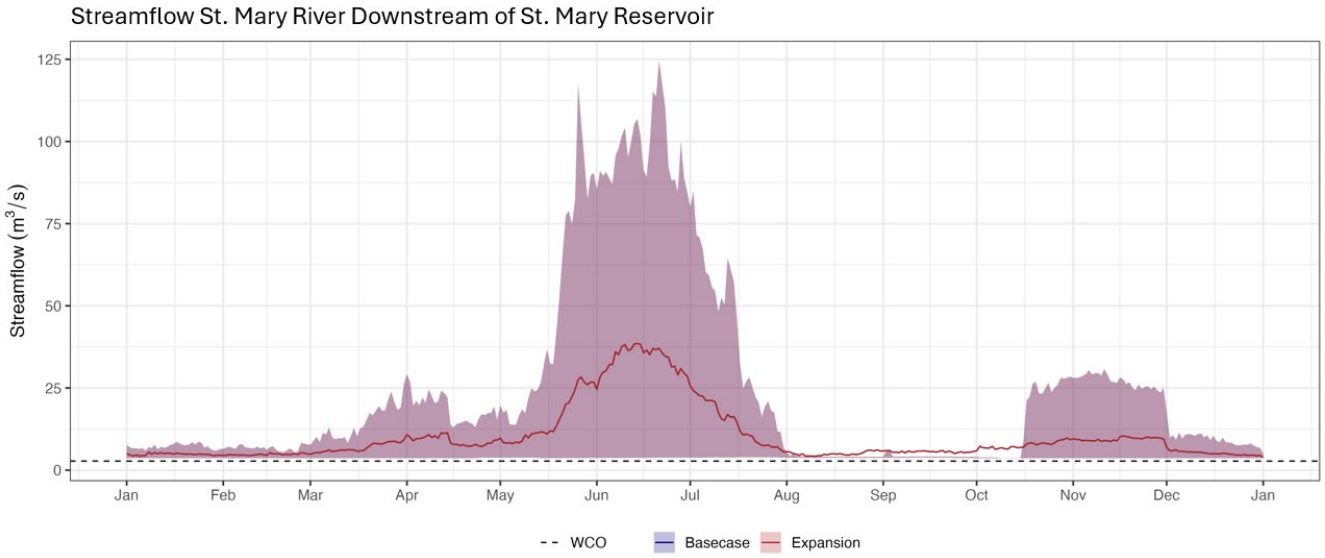
Figure 99.2 Average annual canal flow going from Waterton Reservoir to St. Mary Reservoir.



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

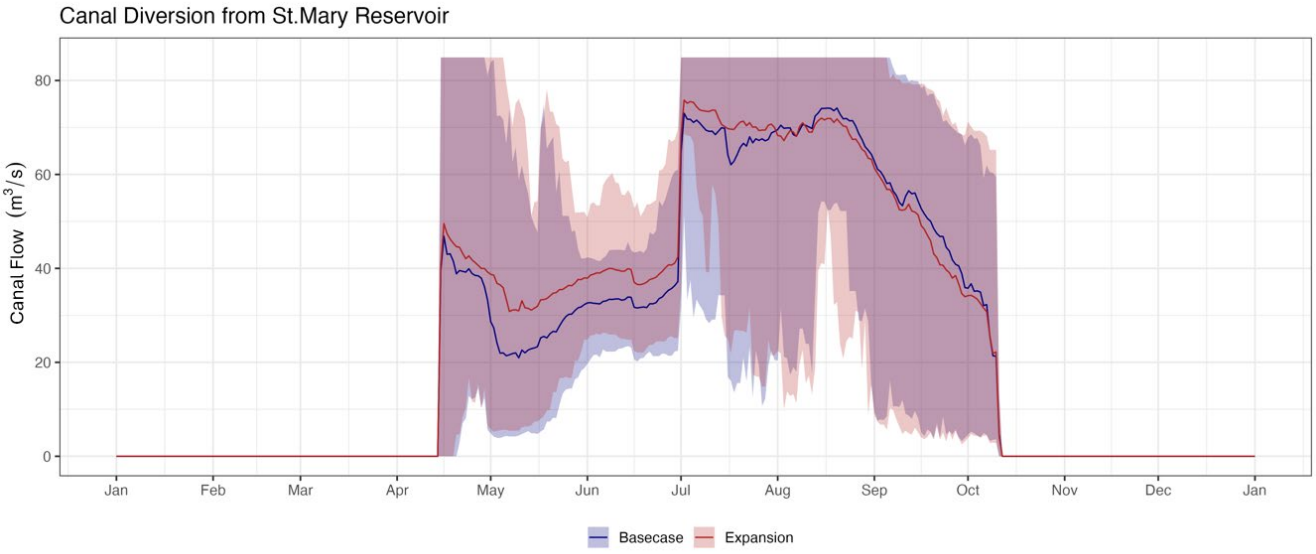
Figures 99.3 and 99.4 illustrate the water leaving the St. Mary Reservoir to the St. Mary River downstream (Figure 99.3) and the water diverted to the WSTM canal system (Figure 99.4). Figure 99.3 shows the scenario outputs overlay each other exactly, indicating the timing of dam releases to the St. Mary River does not change with the Chin Reservoir Expansion Project. In Figure 99.4 the average canal flow between mid-April and mid-July is approximately 2 to 12 m^3/s greater in the Expansion Scenario compared to the Base case Scenario. The outflow is slightly less through September under the Expansion Scenario compared to the Base case Scenario. These changes are likely due to increased draw on St. Mary Reservoir to fill the Expanded Chin Reservoir early in the season if it did not fill the prior fall. The average canal flow of the Expansion is likely lower late in the season due to more years when St. Mary Reservoir is drawn down to the invert elevation earlier in the season (similar to Waterton) and therefore sometimes sends less water at the end of the season. It is likely possible to retime these canal flows through the use of a more nuanced fill target curve for the expanded Chin, although pre-freshet deficits in the St. Mary Reservoir would allow for a fuller capture of available flow during the freshet season.

Figure 99.3 Hydrographs comparing annual flows leaving the St. Mary Reservoir, both to the downstream St. Mary River and to the Waterton-St. Mary Canal under the Base case and the Expansion Scenarios



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

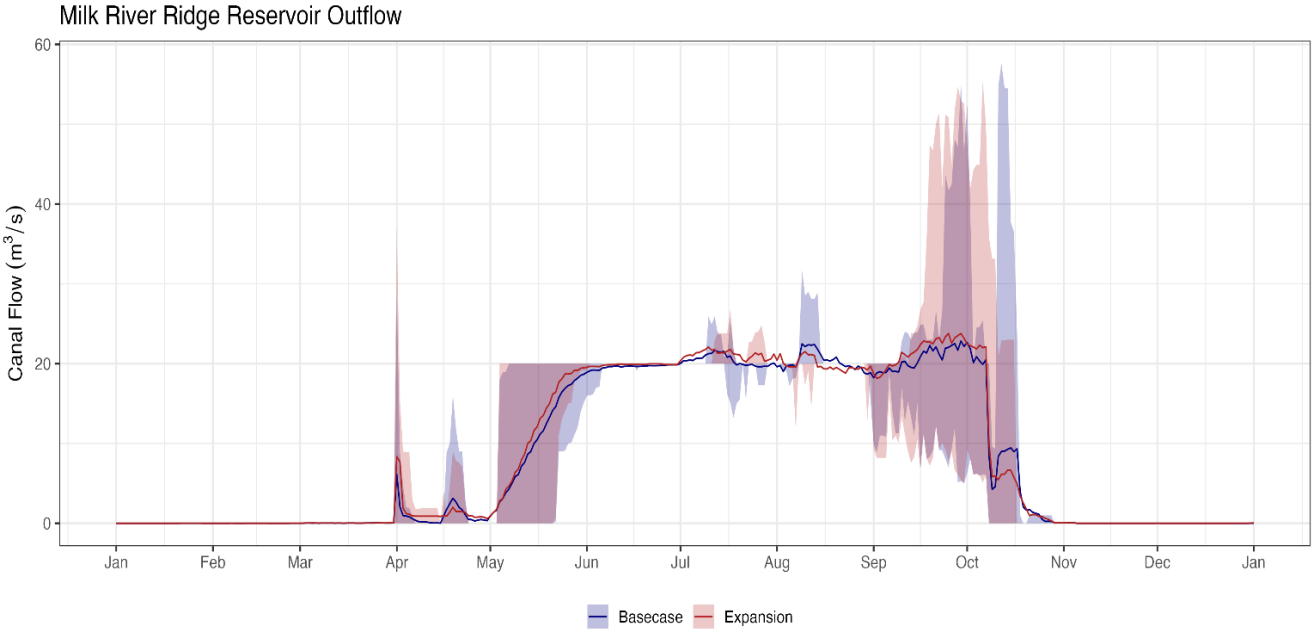
Figure 99.4 Average annual canal flow going from St. Mary Reservoir toward MRRR under the Base case and the Expansion Scenarios



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

Figure 99.5 illustrates the SOAP Model simulated flow diverted from the MRRR to the SMRID main canal. The average canal flow increases slightly during the refill (spring and late fall) periods. There are some small increases and decreases in the average flow in July and August, and then at the very end of the season in mid-October the Expansion Scenario has lower flow compared to the Base case Scenario. Given that the MRRR's operations in the SOAP Model are quite simplistic, changes here are not anticipated to be substantial and, as mentioned previously, are likely ameliorated in the real world through operational coordination.

Figure 99.5 Average annual canal flow going from MRRR to SMRID under the Base case and the Expansion Scenarios



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

Question 100

Reference:

Volume 2, Section 2.2.3.2.2, Page 30

Rationale/Preamble:

SMRID has mentioned 1:1,000 year flood and probable maximum flood (PMF) but have not provided the discharge values for these return periods.

Information Request:

a. Provide a table of return periods (e.g, 1:2, 1:5, 1:10, 1:20, 1:35, 1:50, 1:75, 1:100, 1:200, 1:350, 1:500, 1:750, and 1:1000 return periods) with associated discharge values for a range of low and high flood events.

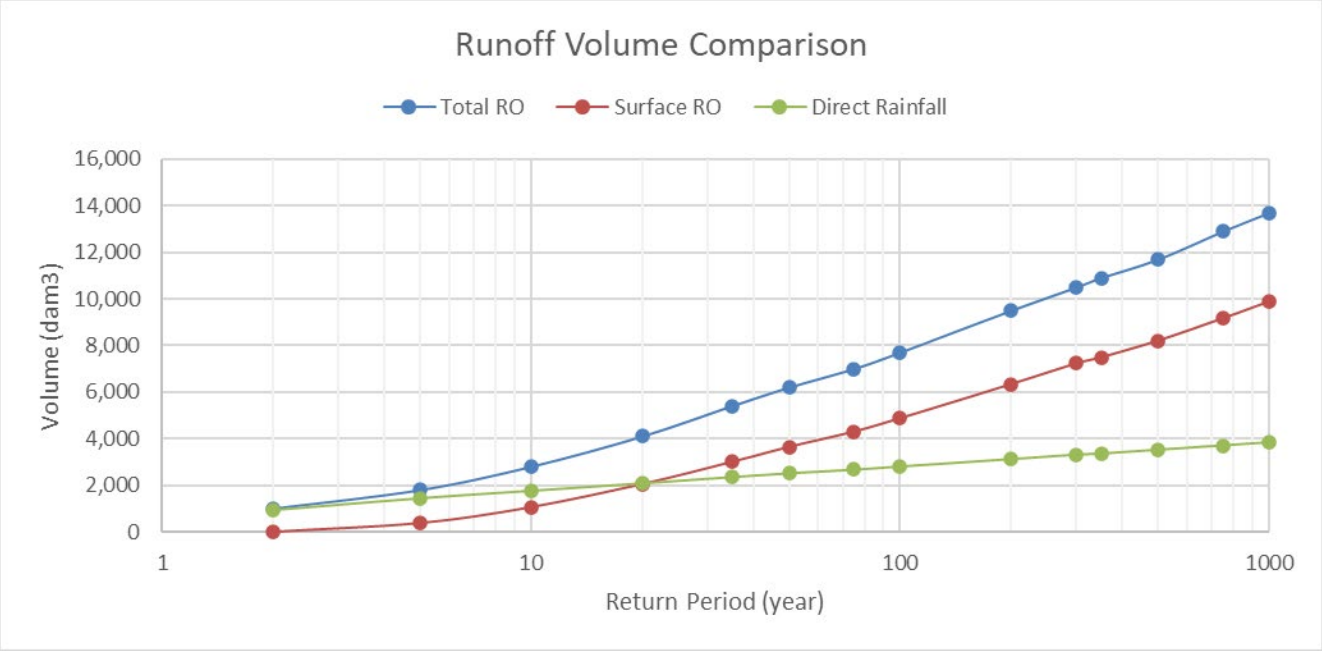
Response:

a. Runoff volume for the specified return periods is provided in Table 100.1, based on a 24-hour duration rainfall event for the Expanded Chin Reservoir catchment. Volumes are rounded to the nearest 100 dam^3. Depressional losses are expected to limit surface runoff that reports to the reservoir below the 1:10-year event. Runoff volume is also depicted graphically in Figure 100.1.

Table 100.1 Chin Reservoir Runoff Volume

Return Period Events	Surface Runoff (Reservoir Inflow) Peak Discharge (m^3/s)	Surface Runoff Volume (dam^3)	Direct Rainfall on Reservoir (dam^3)	Total Runoff Volume (dam^3)
1:2-year, 24-hour	0	0	1,000	1,000
1:5-year, 24-hour	9	400	1,400	1,800
1:10-year, 24-hour	35	1,000	1,800	2,800
1:20-year, 24-hour	70	2,000	2,100	4,100
1:35-year, 24-hour	101	3,000	2,400	5,400
1:50-year, 24-hour	121	3,700	2,500	6,200
1:75-year, 24-hour	142	4,300	2,700	7,000
1:100-year, 24-hour	161	4,900	2,800	7,700
1:200-year, 24-hour	206	6,400	3,100	9,500
1:300-year, 24-hour	232	7,200	3,300	10,500
1:350-year, 24-hour	241	7,500	3,400	10,900
1:500-year, 24-hour	266	8,200	3,500	11,700
1:750-year, 24-hour	304	9,200	3,700	12,900
1:1,000-year, 24-hour	446	9,900	3,800	13,700

Figure 100.1 Chin Reservoir Runoff Volume Comparison



Question 101

Reference:

Volume 2, Section 4.2.1.2, Table 4.4, Page 161;
Volume 2, Section 4.2.1.2, Table 4.5, Page 162

Rationale/Preamble:

Information Request:

For context and a better understanding of inundation depths:

a. Provide the flood inundation extent and depths on maps and identify on those maps the areas discussed in Table 4.4 and 4.5.

b. Explain if all flood water is contained in the coulee.

Response:

a. The flood inundation maps, which present the flood inundation extent and depths, are included in the New East Dam PDR, Appendix VI – New East Dam Breach Inundation Study, Figures II-1 to II-4.

b. As shown on Figures II-1 and II-2, the fair-weather dam breach inundation is contained within the coulee. As shown on Figures II-3 and II-4, the flood induced dam breach inundation is contained within the coulee to Murray Reservoir.

5.2 Hydrogeology

Question 102

Reference:

Volume 2, Section 2.1.2.2.2, Page 17;
Volume 2, Section 2.1.3.1, Pages 19 and 20

Rationale/Preamble:

The EIA indicates that historical water supply wells are submerged in the existing reservoir (e.g. Chin Park) and those potentially/likely not grout sealed, which provide a potential vertical conduit for reservoir water to flow into the Milk River Aquifer.

Information Request:

a. Explain measures taken to ensure that all water wells submerged by the Project are properly grouted and sealed to prevent the potential mixing of different water qualities and therefore potentially negatively impacting water quality (e.g. contamination from manure, fertilizer, oil and gas spills, pesticides, herbicides, etc.) of aquifers located below the reservoir expansion footprint including the Milk River aquifer.

b. Provide the procedure and process used to identify and reclaim the wells located in the Chin Reservoir Expansion footprint and the material used to reclaim each water well. Who will be the responsible party to undertake and pay for this reclamation to ensure it meets all government requirements?

Response:

a. The procedure to ensure that all wells located in the reservoir expansion footprint are identified includes the following:

    i. Re-query the Alberta provincial water well database and Alberta Authorization/ Approval viewer for any new information. The Alberta provincial water well database was previously queried to identify water well records that are within or adjacent to the reservoir expansion and this information was included in Volume 4-3, Hydrogeology TBR, Appendix I. Three of six wells potentially located within the reservoir expansion area have been field verified and sampled.

    ii. Obtain a list of local landowners through a search of land titles, within the Hydrogeology LSA.

    iii. In concert with the discussions between landowners and SMRID, current landowners will be asked about the well(s) on their property. If possible, the wells will be correlated to the appropriate water well record. For any wells for which a water well record can not be identified or for which information is incomplete, information will be collected in alignment with the field-verified survey requirements outlined in the *Guide to*

Groundwater Authorization (GoA 2023a). Although this Guide is not directly applicable, the information specified is relevant, particularly the location and well construction details. Landowners are often the best source of information regarding local water wells and this step will ensure that landowners have been consulted as to which wells are present within the reservoir expansion footprint, including any water wells that may not be listed in the water well database.

iv. Document the water well survey information including clearly identifying the locations and available information regarding wells within the reservoir expansion footprint.

As part of the future Project construction program, water well(s) identified for reclamation will be abandoned in accordance with Part 7 of the provincial *Water (Ministerial) Regulation* (GoA 2023b) and The *Water Wells and Ground Source Heat Exchange Systems Directive* (GoA 2018c). The regulations specify the procedure and materials to be used. The reclamation process will include the following:

i. Retain a water well driller with a Class A Approval and provide all available information regarding the water wells required for reclamation obtained in the process described above.

ii. Site visit by the driller, if beneficial, to verify the water well information or address any data gaps required to establish the well-specific reclamation plan. It is anticipated that water wells within the Chin Coulee completed in the Milk River aquifer will be flowing artesian.

iii. Reclamation of the well to include flushing, disinfection, removal of all equipment and materials (if practicable), and filling the full length of the water well from the bottom up with suitable cement, grout, concrete, bentonite or slurry. If equipment or materials have not already been removed, all equipment and materials will be cut off 0.5 m below ground level. The procedure for artesian well(s) may deviate in some details but the well will be sealed to prevent flow into the reservoir.

iv. Document the reclamation of each well.

v. A final inspection at an appropriate interval following reclamation is suggested to confirm that the water well seal is intact, and no subsidence or leakage (for artesian wells) is visible.

b. The procedure and process to identify and reclaim water wells located in the Chin Reservoir Expansion footprint is outlined in the response to part (a). The specific material used to reclaim each well will be determined by the water well driller based on the conditions of that individual well. SMRID will be responsible for negotiating with each water well owner regarding the abandonment of water wells within the area of the reservoir expansion, and will cover the costs associated with undertaking reclamation and ensure that work is undertaken in accordance with applicable regulations.

Question 103

Reference:

Volume 2, Section 2.1.2.2.2, Page 18

Rationale/Preamble:

The EIA discusses legacy oil and gas wells existing east of the existing East Dam; however, no formal public information is available on these wells.

Information Request:

a. Provide the procedures and processes used to identify and reclaim the oil and gas wells located in the Chin Reservoir Expansion footprint and the material used to reclaim each legacy gas well as per Alberta Energy Regulator (AER) Guidelines and Regulations.

Response:

a. As identified in Volume 1, Section 2.7.11 and in the response to SIR#1 Question 11, oil and gas infrastructure within the reservoir expansion area will need to be removed and wells are to be abandoned. Oil and gas infrastructure will be identified through a review of available information from the AER. A review of AER records shows the two wells identified during the hydrogeology site reconnaissance as orphaned gas wells (Volume 4-3, Hydrogeology TBR, Section 4.1) are abandoned (AER 2025). Information regarding these two wells is summarized in Table 103.1.

Table 103.1 Abandoned Well Information Summary

License Number	Licensee Name	Status	Surface Location	Fluid
0212591	Blue Sky Resources Ltd.	Abandoned	04-30-007-15W4	Crude oil
0032019	Mana Resources Inc.	Rec Certified	04-30-007-15W4	Not Applicable

AER information will be reviewed for these and any other facilities within the proposed reservoir expansion. If the information review determines that actions associated with well abandonment, infrastructure removal, reclamation or other actions could be required, the licensee will be contacted by SMRID and, if appropriate, an agreement will be obtained with the licensee regarding costs and responsibilities. Well abandonment will be undertaken in accordance with Directive 020 (AER 2024a) and include the following:

- Obtain AER approval for any nonroutine abandonments (if required).
- Seal all zones that contain non-saline groundwater (i.e., groundwater with a total dissolved solids concentration of less than 4,000 mg/L).
- Isolate or cover all porous zones.
- Cut and cap the well casing a minimum of 1 meter below the ground surface.

Question 104

Reference:

Volume 2, Section 2.1.2.2.3, Page 18

Rationale/Preamble:

The EIA states that the Chin Reservoir expansion will submerge 4 of 5 current flowing artesian water wells used for stockwatering that are supplied from the Milk River aquifer.

Information Request:

a. Explain if these 4 water wells will be replaced for their current owners. If the wells will be replaced, provide a discussion on the party responsible for paying to redrill the new water wells.

b. Provide a description on where these new water wells will be drilled. Discuss if the current owners have land outside of the reservoir expansion that will allow for replacement wells to be redrilled. If they do not have land to accommodate a new well, how will the current owners be compensated?

c. Explain who will assist the landowners with any water well licensing, testing, and reporting requirements.

Response:

a. The existing water wells used for stock watering support cattle grazing within the Chin Coulee. When the water wells are submerged, the surrounding lands used for cattle grazing will also be submerged and cattle grazing will no longer occur in these areas. Therefore, it is not anticipated that replacement water wells will be required. If the distribution of grazing land and water supplies are such that an alternate water supply is required to support grazing on adjacent lands, this will be addressed in the landowner property sale negotiations for lands within the Chin Coulee including existing water wells.

b. The property sale agreement could include a payment by SMRID that is intended to cover anticipated costs associated with the water well drilling, testing, reporting and licensing (as applicable). This would enable the landowner to maintain direct control over decisions associated with the new water supply. Alternatively, the agreement may define that these costs will be covered by SMRID directly. The details of each agreement will vary according to each specific situation and landowner preferences.

c. The location of any replacement wells will depend on the distribution of the landowner's property, assuming a replacement well is required. The widespread presence of the Milk River Aquifer ensures a water well can be installed in the selected location, although outside of the Chin Coulee, pumping will be required as the well is unlikely to be flowing artesian on the higher ground. Regardless of whether a replacement well is required, the landowners will be compensated for the sale of their property, including any infrastructure.

Landowner assistance will depend on the details of the property sale agreement. Landowners may be familiar with the process of water well installation and licensing and prefer compensation over assistance. Assistance will be discussed as part of the property sale negotiations.

Question 105

Reference:

Volume 2, Section 2.1.3.1, Page 19

Rationale/Preamble:

SMRID states *Seepage of water is anticipated through shallow alluvium from upstream of the New East Dam to downstream of the New East Dam…*

Information Request:

a. Explain if additional fieldwork and testing will be completed to better identify and understand the degree of hydraulic connectivity in these sediments. Provide justification if no additional fieldwork and testing will be completed.

Response:

a. Additional field investigations continue to be conducted to further characterize the site, support seepage analyses and design of seepage control systems as part of the engineering design. These investigations include the following:

   - Continuous groundwater level measurements using pressure transducer data-loggers.
   - Installation of additional monitoring wells.
   - Packer testing and lab permeability tests to determine hydraulic conductivities.

   Further description of the engineering design mitigation related to seepage management, monitoring and potential mitigation are outlined in the response to SIR#1 Question 106. Additional data is presented in the *Hydrogeology Supplemental Technical Report* provided in Appendix 105.1.

Question 106

Reference:

Volume 2, Section 2.1.3.1, Page 19

Rationale/Preamble:

The EIA identifies two potential impacts of enhanced seepage to the east of the New East Dam, those being a heightened water table and salinization.

Information Request:

a. Describe the mitigation measures that are planned to mitigate these issues and discuss if the productivity of these lands will be reduced including if arable lands will be lost for grazing.

b. Provide a discussion on how affected landowners will be compensated and identify the party who will be responsible for providing compensation.

Response:

a. Seepage through the alluvium underneath the New East Dam will be managed and mitigated through engineering design. Preliminary engineering design includes the following features, which will be refined as additional site characterization information is obtained and through the engineering design process:

   - A cut-off trench of up to 5 m depth and 5 m width is proposed beneath the footprint of the New East Dam, which is estimated to reduce seepage by more than 95% within the upper and middle alluvium units. At the abutments, the cut-off trench depth is 3 m into bedrock and a base width of 25 m to reduce seepage within colluvium.
   - A grout curtain will be installed in the bedrock at both the north and south abutments to reduce seepage within these units. The grout curtain will overlap with the cut-off trench.
   - An internal drainage system within the dam includes chimney and blanket drains. Collector and finger drains will link the drainage blanket to the downstream toe of the dam.

   In keeping with the principles of the observational approach and adaptive management, an observational monitoring program will be implemented to evaluate changes to groundwater conditions downgradient of the New East Dam following construction. Observed changes will be reviewed and assessed. If the monitoring program indicates that adverse impacts associated with seepage through the alluvium from the reservoir expansion could occur and mitigation is required, mitigation measures could include the installation of a shallow interception trench, interception wells or a cut-off wall near the toe of the New East Dam. If required to support the identification of adaptive management measures, numerical seepage modelling could be undertaken to simulate whether the mitigation measures will achieve the objectives of lowering the water table or intercepting salinized groundwater or both. Additional groundwater

monitoring locations could be required following this assessment or implementation of any mitigative measures to verify groundwater objectives are met.

The Chin Coulee downgradient of the Existing East Dam is an excellent analogue for potential effects downstream of the New East Dam. The Chin Coulee bottom in the area downgradient of the Existing East Dam is actively used as grazing pasture for cattle (Volume 6, Section 3.1.1). Productivity of the land downgradient of the New East Dam is not expected to be reduced with respect to the suitability for grazing, based on the design for the dam and proposed seepage mitigation measures.

b. SMIRD would be responsible for compensation associated with lost use of any lands east of the New East Dam resulting from the reservoir expansion, if post-construction monitoring identified that unpredicted adverse effects to grazing suitability had occurred, despite the application of mitigation measures.

Question 107

Reference:

Volume 2, Section 2.1.3.1, Pages 19 and 20

Rationale/Preamble:

SMRID states *With the enlargement of the footprint of the Chin reservoir and raising of the FSL, the seepage to the Milk River Aquifer could be enhanced (Note '4' on Map Figure 2.1.4). Like the existing conditions conceptual flow regime, a component of this seepage could discharge along the coulee downstream of the New East Dam and a component could contribute to a more regional groundwater flow system in the Milk River Aquifer and ultimately discharge in areas outside of the confines of the Chin Coulee. The enlargement and heightening of the reservoir level could result in a redistribution of the percentage of flow to local and regional flow paths. The magnitude of the effect depends on the degree of hydraulic connection through the Foremost Fm and the Lea Park Fm through fractures, which is currently uncharacterized. Based on the operation of the Chin reservoir over several decades, the magnitude of this impact is negligible.*

Information Request:

a. Provide post Chin Reservoir supporting documentation (monitoring data, reports, studies, etc.) that supports the above claim.

Response:

a. The referenced text discusses the conceptual linkage between the Chin Reservoir and recharge to the Milk River Aquifer. Additional information is reviewed in the *Hydrogeology Supplemental Technical Report* (Appendix 105.1) providing confidence in a lack of interaction between the reservoir and the underlying Milk River Aquifer through overlying strata. Some key information is summarized as follows:

   - Consistent groundwater chemistry over time is observed in one local water well completed in the Milk River Aquifer within the Chin Coulee sampled in 1937, prior to the Chin Reservoir construction, and recently.
   - The distinct water chemistry between the Milk River Aquifer and groundwater from shallower surficial and bedrock units indicates a lack of interaction between these groundwater units.
   - Isotopic analyses within the Hydrogeology RSA confirm groundwater in the Milk River Aquifer is over a million years old in this area (Pétré et al. 2015).

   Groundwater within the Milk River Aquifer underlying the Hydrogeology RSA is characterized as having a long residence time and no significant interaction with other aquifer units in this area.

Question 108

Reference:

Volume 2, Section 2.1.3.1, Pages 19 and 20

Rationale/Preamble:

There are 4 monitoring wells two of which (MW22-02 and MW22-03) are located in the very upper few meters of the Foremost Formation.

Information Request:

a. Explain how 4 monitoring wells are representative of groundwater flow and how these monitoring wells provide an understanding of the fractures in these formations and the degree of hydraulic connectivity.

b. Explain if additional fieldwork and testing will be conducted to identify and understand the fractures in these formations and the degree of hydraulic connectivity. Provide justification if no additional fieldwork and testing will be completed.

c. Explain the potential risks for leakage outside the confines of Chin Coulee and the mitigation strategies in place to address these risks.

Response:

a. The four monitoring well locations were selected to provide information from different physiographic areas and multiple geological units within the Hydrogeology LSA. Responses to SIR#1 Questions 122, 127, and 128 provide additional information regarding factors considered in designing and planning the drilling program.

   Information from the monitoring wells is combined with data from water well records, site geotechnical investigations and regional studies to provide an augmented understanding of the groundwater flow system presented in the *Hydrogeology Supplemental Technical Report* (Appendix 105.1).

b. Additional testing has been undertaken to assess bedrock fracturing, particularly around the New East Dam as this is the focus for engineering design including seepage management. Please refer to the *Hydrogeology Supplemental Technical Report* (Appendix 105.1) for additional information regarding the Foremost Formation.

c. Seepage from the Chin Coulee Expanded Chin Reservoir is not anticipated to be a concern for the reasons listed below. Please refer to the *Hydrogeology Supplemental Technical Report* (Appendix 105.1) for supporting information.

   - Seepage losses have not been quantified for the Existing Chin Reservoir, but no concerns related to seepage have been identified in the area. The geology of the proposed reservoir expansion area is consistent overall with the Existing Reservoir and therefore the

performance of the Expanded Chin Reservoir is expected to be analogous to the current reservoir.

- The geometric mean hydraulic conductivity for the Foremost Formation is regionally reported as 1×10^{-8} m/s (Sracek 1993) and locally as 1.7×10^{-6} m/s based on single well response and packer tests. These hydraulic conductivity values are slightly to poorly conductive, which will limit the rate of groundwater movement through the Foremost Formation.
- A review of the interpreted groundwater elevations in the Foremost Formation indicates that groundwater elevations are generally higher than the current and proposed FSL along the Chin Coulee and therefore groundwater will discharge into the reservoir, rather than seep into the bedrock from the reservoir. This is consistent with the understanding of the groundwater flow system with recharge to groundwater from precipitation infiltrating at higher elevations and groundwater discharge in the low topography of the coulee. The ephemeral watercourse (Watercourse 126419) in the Chin Coulee is dry most of the year, reflecting low runoff rates and evaporation of any groundwater discharge.

Question 109

Reference:

Volume 2, Section 2.1.3.1, Page 20

Rationale/Preamble:

The EIA states that it is highly likely that any open groundwater wells not grouted properly will have flow greatly impeded by silt.

Information Request:

a. Provide documentation from previous monitoring data, reports, studies etc. that substantiates this claim.

Response:

a. This observation was made based on KCB professional experience of open (i.e., uncapped wells) following flood events. This information is not recorded in publicly available documents. Water wells within the Reservoir Expansion Area will be decommissioned as per the process outlined in the response to SIR#1 Question 102, which will prevent water wells acting as a conduit for flow.

Question 110

Reference:

Volume 2, Section 2.1.3.1, Pages 19 and 20;
Volume 2, Section 2.1.3.2, Pages 20 and 21

Rationale/Preamble:

The EIA states that the injection of water into the reservoir could cause significant water quality concerns for wells in the Milk River aquifer by altering its chemistry, however the volumes due to leakage would be low.

The EIA further states that it is anticipated that these wells would be properly decommissioned prior to reservoir filling.

Information Request:

a. Provide the procedure and process to identify and reclaim all wells located in the Chin reservoir expansion footprint and the material used to reclaim each water well.

b. Who will be the responsible party to undertake and pay for this reclamation to ensure it meets all government requirements?

Response:

a. Please refer to the response to SIR#1 Question 102 (a) and (b).

b. Please refer to the response to SIR#1 Question 102 (b).

Question 111

Reference:

Volume 2, Section 2.1.3.2, Pages 20 and 21

Rationale/Preamble:

SMRID states *Injection of reservoir water into the Milk River Formation via newly submerged Milk River Aquifer wells (Note '1' on Map Figure 2.1.4) could introduce oxygenated water, altering the redox conditions in the Milk River Aquifer resulting in mineral dissolution or precipitation or introduction of nutrients and bacteria resulting in biofouling. However, the ratio of reservoir leakage volumes through wells, to regional aquifer throughflow, makes this a low potential risk.*

The EIA report further states that it is anticipated that these wells would be properly decommissioned prior to reservoir filling.

Information Request:

a. Provide the procedure and process(s) used to identify and reclaim the wells located in the Chin Reservoir Expansion footprint and the material used to reclaim each water well.
b. Explain who the responsible party will be to undertake and pay for this reclamation to ensure it meets all government requirements.
c. Explain how the reclamation will be completed in accordance with the EPA Reclamation guidelines in the Water (Ministerial) Regulation and the Water Wells and Ground Source Heat Exchange Systems Directive.

Response:

a. Please refer to the response to SIR#1 Question 102 (a) and (b).
b. Please refer to the response to SIR#1 Question 102 (b).
c. Please refer to the response to SIR#1 Question 102 (a).

Question 112

Reference:

Volume 2, Section 2.1.3.2, Pages 21 and 22

Rationale/Preamble:

The EIA states that based upon water chemistry samples from wells completed in the Milk River Formation, the results appear to indicate that the water chemistry in these wells has not been negatively impacted by any reservoir water that may have moved vertically downwards through the Foremost and Lea Park Formations and mixed with the rocks in these formations to form poorer quality water that then impacts/alters the water quality of the Milk River Formation.

The EIA also states that since the current Chin Reservoir has been in operation since 1955, (which is assumed to be an adequate amount of time for reservoir water to seep into the Milk River Aquifer) that the new expansion of the reservoir will similarly have no anticipated impacts on Milk River Aquifer's water quality.

While approximately 70 years may seem like an adequate amount of time in most circumstances for cause and effect to occur it is known from literature that vertical hydraulic conductivity values are generally 1 - 2 orders of magnitude lower than those for horizontal hydraulic conductivity value, thereby subsequently impacting travel time calculations.

Information Request:

a. Provide the vertical hydraulic conductivity values and subsequent vertical travel time calculations for the movement of reservoir water between the surficial alluvial sediments and the Milk River aquifer to support the conclusion that 70 years is an appropriate amount of time.

Response:

a. This statement was intended to indicate that a change in groundwater chemistry in the Milk River Aquifer has not been observed within 70 years and not that one should have been detected in this timeframe.

   Further review of hydrogeological information confirms the improbability of impacts to the Milk River Aquifer from the proposed reservoir including (a) groundwater elevations that indicate an upward gradient from the Milk River Aquifer to the reservoir, (b) low hydraulic conductivities of the bedrock materials overlying the Milk River Aquifer, and (c) isotopic studies that identify groundwater in the Milk River Aquifer is more than one million years old and therefore has no significant interaction with modern near surface groundwaters. Additional information is provided in the *Hydrogeology Supplemental Technical Report* (Appendix 105.1).

Question 113

Reference:

Volume 2, Section 2.1.3.3, Pages 22 and 23

Rationale/Preamble:

The EIA states that a three-dimensional steady-state numerical model of groundwater flow would be required to adequately determine the potential for soil salinity impacts from groundwater seepage downstream of the New East Dam. As a proxy a qualitative assessment was used that considered the long history of operation of the existing East Dam. The qualitative assessment involved the results of a single soil salinity mapping survey done in 1997, with no pre dam and reservoir conditions to compare and contrast against. Since the survey identified only negligible impacts the conclusion was made that no new impacts are anticipated from the reservoir expansion.

Information Request:

a. Explain the rationale as to why a three-dimensional steady-state model of groundwater flow was not completed.

Response:

a. Mitigation of seepage is a key component of the engineering design for the New East Dam. This mitigation in combination with an observational monitoring program is expected to address potential impacts and verify the mitigation effectiveness. If adverse environmental effects are observed, additional mitigation options are available.

   The area downgradient of the Existing East Dam is an analogue for potential effects downstream of the New East Dam and continues to be used as grazing pasture for cattle (Volume 4-6, Vegetation and Wetlands TBR, Section 3.1.1) indicating that impacts to the use of this land for grazing are not expected to occur. A more detailed discussion of these aspects is provided in the response to SIR#1 Question 106.

   As a result of the planned mitigation and observational monitoring program, availability of additional mitigation measures (if required) and the continued use of the lands east of the Existing East Dam for grazing, significant adverse effects are not expected and the development of a three-dimensional steady state numerical groundwater model to undertake a detailed assessment was considered unwarranted.

Question 114

Reference:

Volume 2, Section 2.1.3.5, Page 23

Rationale/Preamble:

SMRID states *There remain several unknowns relating to hydrogeology and groundwater conditions in the LSA. Given the size and complexity of the groundwater system within, under, and adjacent to Chin Coulee, it is impractical to attempt to quantify these unknowns over the area of the LSA. However, the hydrogeological system pertaining to the Expanded Chin Reservoir is very similar to that of the Existing Reservoir and the latter has been in operation since 1955 with no apparent negative impacts to groundwater quantity or quality…it is reasonable to expect that the proposed reservoir expansion will not introduce any new negative impacts that cannot be mitigated with engineering design of the New East Dam*.

Information Request:

a. Provide evidence to support this statement. Including previous monitoring data from reports, studies, etc. that provides background data from the previous Chin Reservoir Project that would validate the above assumption.

b. Provide the monitoring sites/locations and the data from the previous Chin Reservoir Project.

c. Explain how collection, analysis, and quality control for the data was completed. In addition, indicate where this data is stored and how it can be accessed by EPA or when this information will be submitted to EPA for review.

Response:

a. The evidence supporting a lack of apparent impacts with respect to groundwater quality and quantity associated with the Existing Chin Reservoir is largely an absence of identified effects. Concerns could include changes in water level or quality observed in local water wells or wet ground conditions. Although an absence of concerns seems less concrete than historic or time-series data records, it is valid and notable. One positive observation is that the Chin Coulee bottom in the area downgradient of the Existing East Dam is actively used as grazing pasture for cattle (Volume 4-6, Vegetation and Wetlands TBR, Section 3.1.1).

   The *Hydrogeology Supplemental Technical Report* (Appendix 105.1) combines additional information from water well records, site geotechnical investigations and regional studies with information presented in Volume 4-3, Hydrogeology TBR to augment our understanding of the groundwater flow system.

b. Time-series data has been reviewed, where available, but typically post-dates the construction of the Chin Reservoir. These data include (a) an air photo review (1985 onward) in Volume 4-1, Hydrology TBR, Appendix I; (b) historic groundwater level hydrographs (1986 onward) in the *Hydrogeology Supplemental Technical Report* (Appendix 105.1); and (c) historical groundwater

chemistry (1937 onward) in Volume 4-3, Hydrogeology TBR and the *Hydrogeology Supplemental Technical Report* (Appendix 105.1).

c. This information is publicly available or was provided in reports included in the Project submission as referenced in the response to (b).

Question 115

Reference:

Volume 2, Section 2.1.3.5, Page 23

Rationale/Preamble:

SMRID states *Operational monitoring of groundwater downstream from the New East Dam will provide the data to verify these statements*.

Information Request:

a. Explain if there is more than one monitoring site. If there is only one monitoring site, provide the justification and rationale to show that this site is representative of all areas of concern.

b. Provide the locations of the operation monitoring sites that will be used to verify cause and effect.

c. Describe how the site(s) were chosen.

d. Provide a description of the types of data will be collected and who will be responsible for data collection.

e. Explain who will review the data, perform quality control of the data, and analyze and compare the results with previous baseline data.

f. Explain how long, at what intervals, and during what seasons the data will be collected?

g. Explain where the data be stored and who will have access to the data. How will this data be provided to EPA for review?

h. Describe the mitigation measures that are in place to address any negative impacts that might be identified during the monitoring and analysis of the data.

Response:

a. Multiple monitoring sites will be included in the observational monitoring program, which are summarized in Table 5.3 and include the following:

   - Existing monitoring wells MW22-01, MW22-02 and, if possible, MW22-04 and AH22-01. MW22-04 and AH22-01 are located outside the coulee but are proximal (~200 m) to the New East Dam site. These monitoring wells enable monitoring of the Lower Surficial Unit (MW22-01), Foremost Formation (MW22-02), and Upper Surficial Unit (MW22-04 and AH22-01).
   - Monitoring of one location in the Milk River Aquifer is proposed. The existing water well, ID# 151387, has been sampled during at least one event and would be suitable if permission can be obtained and depending on usage by the owner.

- An additional nested well within the alluvium and Lower Surficial Unit closer to the New East Dam (i.e., approximately 50 m to the east) within the coulee is also proposed to be installed.

Table 115.1 Summary of Proposed Project Monitoring and Water Wells for the Observational Monitoring Program

Location	Completion Unit	Position relative to New East Dam	Ground Elevation (m asl)	Completion Depth (m bgl)	Depth to Water (m bgl) March 2024
MW22-01	Lower Surficial	East (downgradient), in coulee, ~ 700 m	824.82	38.4 to 39.92	1.41
MW22-02	Foremost Formation	Northeast (downgradient), outside coulee, > 1 km	884.85	40.68 to 42.21	38.36
MW22-04	Upper Surficial	North (lateral), outside coulee, ~ 200 m	904.49	30.76 to 32.29	29.92
AH22-01	Upper Surficial	South (lateral), outside coulee, ~ 200 m	TBD	29.4 to 30.9	TBD
New	Alluvium	East (downgradient), in coulee, ~ 50 m	TBD	TBD	TBD
New	Lower Surficial	East (downgradient), in coulee, ~ 50 m	TBD	TBD	TBD
151387	Milk River Aquifer	East (downgradient), in coulee, ~ 1.5 km	TBD	139.6 to 172.21	TBD

Notes:
m asl = meters above sea level
m bgl = meters below ground level
TBD – To Be Determined (information to be obtained for the monitoring program)

b. The lateral monitoring wells in the Upper Surficial Unit (MW22-04 and AH22-01) and Milk River Aquifer should show no Project related changes in groundwater quality or quantity outside of normal variations (i.e., based on observed variation during baseline sampling). Monitoring wells in the alluvium, Lower Surficial Unit and Foremost Formation all have water elevations below the FSL and increasing water levels outside of natural variation could be an indicator of seepage into these units that has not been mitigated by engineering design and could represent an environmental concern.

c. Sites were located in proximity and to the east (i.e., downgradient) of the New East Dam where seepage could potentially occur. Existing wells will be utilized where appropriate.

d. SMRID will be responsible for collecting water levels at each monitoring location. Continuous (daily) measurements using pressure transducer data-loggers is proposed. Water samples will also be collected for analysis of groundwater chemistry.

e. SMRID will direct an appropriately qualified professional to review the data, conduct quality control, complete data analysis including comparison to baseline conditions and provide recommendations to improve the observational monitoring program.

f. For new monitoring wells, baseline data will be collected for a full twelve-month period for water levels and at least eight samples for groundwater quality at each location prior to commissioning of the Project. Post-construction monitoring will occur during the first two years of operations at all proposed monitoring locations. Data will be collected continuously (daily) for water levels and bi-annually for groundwater quality. The data types and monitoring frequency can then be reviewed based on the first two years of operations. Data review will occur quarterly during the first two years of operations to assess whether effects have been detected that could warrant adaptive management or additional mitigation.

g. SMRID will maintain copies of all data and will provide data to EPA in an annual monitoring report.

h. Mitigation options and potential adaptive management were discussed in the response to SIR#1 Question 106.

Question 116

Reference:

Volume 2, Section 2.1.4, Page 23

Rationale/Preamble:

SMRID states that *aside from abandonment of Milk River Aquifer wells and orphaned gas wells no additional mitigation is anticipated for groundwater.*

Information Request:

a. Provide the mitigation measures and strategies for other potential groundwater concerns such as the production of new flowing wells outside the reservoir proper, groundwater seepage downstream of the New East Dam, and replacement of inundated water wells.

b. Provide justification if no mitigation plans or strategies for these additional groundwater concerns will be completed.

Response:

a. The development of new flowing wells is not expected to occur. The ground surface within the table lands outside of the coulee adjacent to the Current and Expanded Chin Reservoir is typically above 900 m asl. Water levels at the same elevation as the reservoir FSL of 864 m asl would be below ground level and not artesian flowing. In the event that a water well outside the reservoir did begin to flow as a result of the reservoir expansion or change in level, a water well driller with a Class A Approval would be retained to ensure that pressure control was installed and the well was not allowed to flow continuously.

   Mitigation measures with respect to seepage downstream of the New East Dam were discussed in the response to SIR#1 Question 106. Mitigation with respect to the replacement of inundated water wells is discussed in the response to SIR#1 Question 104.

b. Mitigation measures have been identified in the response to SIR#1 Question 116 (a).

Question 117

Reference:

Volume 2, Section 2.1.5, Page 23

Rationale/Preamble:

SMRID states *Due to the presence of a snake hibernaculum, groundwater investigations were restricted until after April 2022*.

Due to the hibernaculum, it appears that the location of the monitoring well(s) would have to be moved to allow for year-round access to the site.

Information Request:

a. Explain which monitoring well(s) are located near the snake hibernaculum.
b. Identify where the new monitoring well(s) would be located.
c. Explain who will conduct the drilling, installation and testing of the new well(s) to ensure they will collect the appropriate data to address any concerns with the Project.
d. Explain when the new well(s) will be constructed and when and how the results will be submitted to EPA for review.
e. Explain how moving the monitoring well(s) will affect the overall timeframe and goals of the Project in the context of the current monitoring regime.

Response:

a. One of the monitoring wells, MW22-01, is located approximately 500 m from a snake hibernaculum. In accordance with the approved Snake Protection Plan (KCB 2021), unavoidable ground disturbance within 500 m is to be scheduled from May through September when snakes are not overwintering in underground chambers. This measure required deferring the drilling activities to install the monitoring well until after April 2022. This measure is specific to ground disturbance and does not limit monitoring and sampling activities. There are no ongoing restrictions that prevent access to the monitoring well and a replacement well is not planned.
b. New monitoring wells are not required to be installed to replace existing monitoring wells due to the presence of the snake hibernaculum. New monitoring wells for the observational monitoring program are identified in the response to SIR#1 Question 115.
c. SMRID will direct qualified individual(s) to undertake monitoring well installation as required.
d. New monitoring wells are not required to be installed to replace existing monitoring wells due to the presence of the snake hibernaculum. New monitoring wells for the observational monitoring program are identified in the response to SIR#1 Question 115 and will need to be installed during the period of May to September where in proximity to the snake hibernaculum.
e. There is no impact to the Project schedule as no replacement monitoring wells are required.

Question 118

Reference:

Volume 2, Section 2.1.5, Pages 23

Rationale/Preamble:

SMRID states *The groundwater monitoring network was instrumented…and these instruments continue to monitor groundwater levels in the project monitoring wells.*

SMRID also states that *periodic groundwater quality monitoring of flowing artesian Milk River Aquifer wells downstream of the New East Dam is also recommended.*

Information Request:

a. Provide the monitoring schedule and frequency of the groundwater monitoring network and artesian wells.
b. Explain who will be responsible to complete the monitoring, analyze the data, complete quality control, and assess if additional monitoring sites or samples are required.
c. Explain where the data will be stored and how will data be submitted to EPA for review.

Response:

a. Baseline data will be collected as part of the observational monitoring program for a full twelve-month period for water levels and seasonally (approximately quarterly) for groundwater quality until eight samples have been collected at each location. Data will be collected at a similar frequency for water levels and bi-annually for groundwater quality during the first two years of operations. The data types and frequency will then be reviewed based on the first two years of operations.
b. SMRID will direct an appropriately qualified professional to complete the monitoring, analyze the data, conduct quality control and provide recommendations to improve the observational monitoring program.
c. SMRID will maintain copies of all data and will provide data to EPA in an annual monitoring report.

Question 119

Reference:

Volume 2, Section 2.1.5, Page 23;
Volume 4-3

Rationale/Preamble:

SMRID states *The environmental assessment is based on the data provided in the Hydrogeology TBR (Volume 4) and does not currently include groundwater quality monitoring through a full year, including a freshet*. *An update to the TBR and, potentially, to the environmental assessment is anticipated based on the acquisition of seasonal groundwater quality data*.

Information Request:

a. Provide the rationale as to why the EIA was submitted prior to a full year of groundwater quality monitoring being completed including a freshet. Provide the completed Hydrogeology TBR and revised Section 2.1 in the Supplemental Information Request (SIR) 1 response.

b. Discuss the mitigation strategies if new or additional groundwater concerns are identified from the data.

c. Provide a strategy or plan if additional monitoring is required. In addition, explain under what circumstances would additional monitoring be required.

Response:

a. Spring and fall groundwater samples were collected in 2022 from all the sampling sites that contained sufficient water, and some locations were also sampled earlier in the fall 2021. Results from these samples would be expected to reflect some seasonal variations but are chemically consistent as was shown on the Piper and Durov diagrams included as Figure 4.10 and Figure 4.11 of Volume 4-3, Hydrogeology TBR.

   In addition, water level measurements were collected continuously over a period of almost two years, from May 2022 to March 2024. Several of the monitoring wells show no apparent seasonal variation and are interpreted as hydraulically isolated, while two monitoring wells, MW22-01 and MW22-03, show delayed seasonal temperature changes but no seasonal hydraulic response. MW22-03 is located some distance (> 700 m) from the proposed reservoir, is higher in elevation than the proposed reservoir FSL and not expected to be influenced by the Expanded Chin Reservoir. MW22-01 is located above the bedrock and beneath more than 30 m of alluvium in the Chin Coulee. Additional information includes a vertical hydraulic conductivity analysis that shows very low infiltration is expected through the overlying alluvium. Other studies in the region have shown similar deposits to have groundwater with an age of more than 50 years old and therefore a close hydraulic connection to near surface changes is not expected.

This data set includes some seasonal sampling, almost two years of water level measurements and was the basis for the Hydrogeology TBR. Additional information compiled in the *Hydrogeology Supplemental Technical Report* (Appendix 105.1) indicates the groundwater flow system is generally slow moving and not expected to respond quickly to seasonal changes. Quarterly sampling is being undertaken in 2025 and June 2025 will be the first opportunity since the Hydrogeology TBR was prepared in July 2024 to collect groundwater samples during a freshet. This work is planned to be completed in June 2025. An update as to whether there is any significant change to the findings will be provided once available.

b. Mitigation strategies would be dependent on the outcome of the additional testing, specifically whether a hydraulic connection represents a potential seepage pathway from the proposed Expanded Chin Reservoir, as well as the nature and degree of this connection. With respect to the monitoring wells discussed in the response to part (a), a strong hydraulic connection to surface recharge identified at MW22-03 would not represent a potential seepage pathway due its elevation above the proposed Expanded Chin Reservoir and no mitigation would be required. In contrast a similar finding at MW22-01 could indicate a potential seepage pathway. Analysis and mitigation would focus on one or more of (a) whether a flow pathway is present or (b) whether the planned seepage mitigation measures will be effective at sufficiently reducing flow into this unit upgradient of this location.

c. The observational monitoring program is outlined in the response to SIR#1 Question 115. The program includes monitoring for changes in groundwater quality and elevation in the Lower Surficial Unit at MW22-01 and at an upgradient location closer to the New East Dam. Additional monitoring may be required in the event that changes are observed at one or more of these locations to further assess the extent of impacts upgradient of any receptors.

Question 120

Reference:

Volume 4-3, Section 2.1.1, Map Figure 2.1, Page 7

Rationale/Preamble:

The EIA references Map Figure 2.1, however, this Map Figure is not provided.

Information Request:

a. Provide the location in the EIA where Map Figure 2.1 is found. If it is not in the EIA, provide the map figure.

Response:

a. Map Figure 2.1 was incorrectly labeled as Figure 2.0 but was included in the EIA submission in Volume 4-3, Hydrogeology TBR, Page 57. It is the first figure in the Map Figures section of Volume 4-3.

Question 121

Reference:

Volume 4-3, Section 3.3.2.2, Page 16

Rationale/Preamble:

25 well logs are noted in the EIA within the LSA. However, only one cross-section was produced crossing back and forth across the Chin Coulee, but no cross section was produced perpendicular to Chin Coulee for comparisons of subsurface sediments and bedrock thicknesses and variability.

Information Request:

a. Provide additional cross sections to better understand and constrain the surficial and bedrock geology in the LSA.

Response:

a. A cross section perpendicular to the Chin Coulee was provided in Figure 4.3 of Volume 4-3 and shows the distribution of surficial deposits and bedrock. Additional regional cross sections perpendicular to the Chin Coulee are provided in the *Hydrogeology Supplemental Technical Report* (Appendix 105.1) from publicly available information. It is noted that of the twenty-five water well records within the LSA, only fourteen include any geology information and eight were included in the section referenced in Section 3.3.2.2 of Volume 4-3.

Question 122

Reference:

Volume 4-3, Section 3.3;
Volume 4-3, Section 3.3.2.1, Page 16;
Volume 4-3, Map Figure 3.6;
Volume 5, Section 3, 3.2.1 [A] (a) and (b)

Rationale/Preamble:

The final Terms of Reference states *Provide an overview of the existing geologic and hydrogeologic setting. Document new hydrogeological investigations, including methodologies, analysis, results, and interpretations undertaken as part of the EIA, and:*

a) present regional and project area geology to illustrate depth, thickness and spatial extent of lithology, stratigraphic units, and structural features; and
b) describe and review the geology of the region and project area, including both surficial and bedrock units (both aquifer and non-aquifer units).

Given the inherent subsurface variability over such a large area the use of 1 monitoring well in each of the 4 identified physiographic areas does not appear to be representative of these spatially extensive physiographic areas.

Information Request:

a. Provide the justification for the use of 1 monitoring well in each of the 4 identified physiographic areas.

b. Provide confirmation of sand and gravel thicknesses using field data to verify the thicknesses mapped in Map Figure 3.6.

Response:

a. The intent of selecting one drilling location in each of the four physiographic areas was to verify conditions within each of these areas. One location provides only a limited amount of information, but it does enable some comparison of hydrogeological conditions between these areas. Please also see the response to SIR#1 Question 127 which provides some additional information regarding the drilling program.

   Information from the monitoring wells is combined with data from water well records, site geotechnical investigations, and regional studies to provide an augmented understanding of the groundwater flow system in the *Hydrogeology Supplemental Technical Report* (Appendix 105.1).

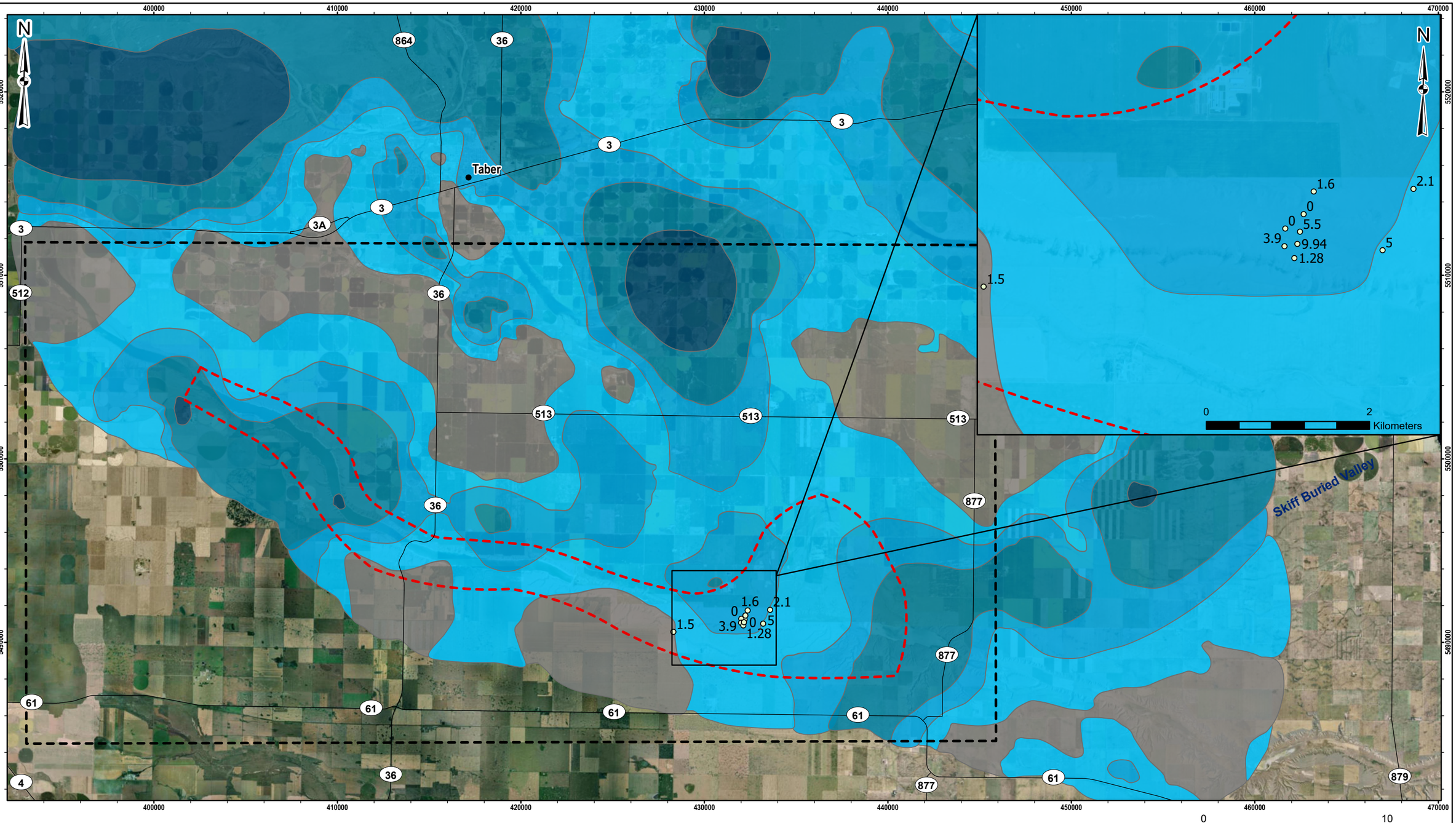
b. The thickness of saturated sand and gravel from the 2021-2022 drilling program is overlain on Figure 122.1. Intervals with no recovery adjacent to sand or gravel were included in the determined unit thickness and may result in an overestimate in some instances. For example, the location noted as having a thickness of 9.9 m has a minimum thickness of 5.7 m. In general, there appears to be a reasonably good match between the site-specific information and

Hydrogeological Consultants Ltd. (HCL 2007) regional mapping. The extent of the 2-5 m thickness polygon does appear too large, specifically on the north side of Chin Coulee where the drilling program identified locations in the 0-2 m range.

It should be noted that the borehole information includes all saturated sand and gravel material within the vertical profile at a particular location. Therefore, the sand and gravel thickness at a particular location may represent one or multiple intervals and may or may not be at a similar elevation relative to adjacent locations.

FIGURE

Figure 122.1 Sand and Gravel Thickness (after HCL 2007) with 2021-2022 Investigation Data



Legend

- Place Names
- Total Sand and Gravel Thickness (m)
- All Weather Road
- Local Study Area
- Regional Study Area

Aquifer Thickness (m)

- 0-2
- 2-5
- 5-15
- >15
- Saturated Sand and Gravel Absent

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE:
4. SAND AND GRAVEL THICKNESS DERIVED FROM HCL 2007

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: SAND AND GRAVEL THICKNESS (AFTER HCL 2007) WITH 2021-2022 INVESTIGATION DATA

SCALE	PROJECT No.	FIG No.
1:200,000	A03701E05	122.1

File: \\int.klohn.com\ProjData\ACGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Creator: : HMarandyan

Question 123

Reference:

Volume 4-3, Section 3.5.2, Table 3.1, Pages 19;
Volume 4-3, Appendix IV

Rationale/Preamble:

Having the most accurate aquifer parameters is of importance when determining the potential flow paths of these aquifer systems, the connection to one another, the surface water and potential leakage and flow to surrounding wells and springs resulting from the filling of the reservoir.

Information Request:

a. Explain why long-term pump tests were not conducted in all aquifer units identified in Table 3.1 given the increased accuracy of their results as compared to slug tests, which only provide short term snapshot estimates of the aquifer parameters close to the wellbore.

Response:

a. Multiple factors were considered in the planning of the field investigation program. The approach taken was to spatially distribut the drilling locations to investigate the hydrogeological conditions of multiple physiographic areas as discussed in the response to SIR#1 Question 122. An effective pumping test program includes one or more observation wells, typically in the same unit or potentially connected unit(s) as the completion interval of the pumping well to provide information on the hydraulic connectivity (or lack thereof). Focusing the drilling program on a pumping test program would have resulted in the wells being clustered and information would not have been obtained from other areas.

   Please refer to the *Hydrogeology Supplemental Technical Report* (Appendix 105.1) which provides an augmented understanding of the hydrogeological baseline conditions, particularly the properties of the aquifer units, potential flow paths and connections between units. This improved understanding increases confidence in the assessment of Project-related effects associated with potential leakage and flow to surrounding springs and wells.

Question 124

Reference:

Volume 4-3, Section 3.5.2, Table 3.1, Page 19;
Volume 4-3, Section 4.5, Pages 27 and 28

Rationale/Preamble:

There is potential for gradient changes to occur with the filling of the reservoir expansion specifically in wells that are not decommissioned/improperly decommissioned and between aquifers through bedrock cracks and fractures to overlying aquifer units.

Information Request:

a. Explain why vertical hydraulic gradients were not calculated between the various identified aquifer units in Table 3.1 (i.e., surficial deposits (2 aquifers)) and Foremost and Milk River Formations. Provide these calculations and a discussion of the results.

Response:

a. A discussion of vertical gradients and relationships between the hydrostratigraphic units is provided in Sections 3.5 and 3.6 of the *Hydrogeology Supplemental Technical Report* (Appendix 105.1).

Question 125

Reference:

Volume 4-3, Section 3.5.2.2, Page 20;
Volume 5, Section 3, 3.2.1 [B] (a), (b), (c) and (d)

Rationale/Preamble:

The final Terms of Reference states *Present regional and project area hydrogeology describing:*

a) the major aquifers, aquitards and aquicludes (quaternary and bedrock), their spatial distribution, properties, hydraulic connections between aquifers, hydraulic heads, gradients, groundwater flow directions and velocities, include maps and cross sections;
b) the chemistry of groundwater aquifers including baseline concentrations of major ions, metals and hydrocarbon indicators;
c) the potential groundwater discharge zones, potential sources and zones of groundwater recharge, areas of groundwater-surface water interaction and areas of quaternary aquifer-bedrock groundwater interaction; and
d) an inventory of water well development and groundwater use.

SMRID states *Well completions in the overburden were not identified. Lacking regional overburden information in the public domain, the flow in the overburden is described qualitatively as follows.*

The description of the hydrogeology in the Project area is lacking hydraulic head information of all major subsurface units identified (i.e., surficial allivium, Foremost and Lea Park Formations, not restricted to the Milk River Aquifer), groundwater flow directions and velocities (vertical and horizontal) within each unit and between units, groundwater-surface water interactions, cross sections, baseline water chemistry of all major units identified, zones of groundwater recharge identified, and inventory of groundwater use in the area.

Information Request:

a. Provide a response to the final Terms of Reference [B] (a), (b), (c), and (d).

Response:

a. Please see the attached *Hydrogeology Supplemental Technical Report* (Appendix 105.1) which combines information from the Hydrogeology TBR in Volume 4-3 with data from water well records, site geotechnical investigations, and regional studies to provide an augmented understanding of the groundwater flow system.

Question 126

Reference:

Volume 4-3, Section 3.5.3, Table 3.2, Page 20;
Volume 4-3, Map Figure 4.2

Rationale/Preamble:

None of the samples listed in Table 3.2 appear to be linked to any of the major subsurface units. If there are multiple samples representative from each unit and historical versus recent samples then these comparisons need to be provided. In addition, Map Figure 4.2 groundwater sampling locations do not appear to indicate a representative spread and coverage of these sites across the LSA, with the majority clustered around the New East Dam location.

Information Request:

a. Link the samples in Table 3.2 to the major subsurface units. If multiple samples are being used (historical and recent) then provide a comparison.

b. Explain how the groundwater sampling locations were chosen and how these are representative of the LSA.

Response:

a. Please find the following Table 126.1, which is an updated version of Table 3.2 with the major subsurface unit included. One of the wells has no well depth or completion information included on the water well report and therefore the well can not be linked to a major subsurface unit. All samples are historical from the Alberta database of water well records and based on dates available were collected prior to 1972.

Table 126.1 Regional Groundwater Quality Based on Private Well Records (concentrations in mg/L)

GIC Number	121766	186381	197490	197494	197499	197503	234516	2096581
Sample Date	Not available	1970-06-05	Not available	1971-07-21	1971-10-02	1967-08-171	1971-07-21	1937-06-30[1]
Major Subsurface Unit	Milk River	Unknown	Upper Surficial	Milk River	Milk River	Upper Surficial	Upper Surficial	Milk River
Total Alkalinity	1,324	1,235	194	1,112	249	1,004	306	1,305
TDS	2,114	2,362	644	2,902	5,696	3,742	702	2,020
Calcium	2.4	-	50	3.70	485	-	73	21
Chloride	307.4	580.8	9.0	640.9	186.3	26.0	6.0	327
Nitrate-N	9	0	60	2	151	0	29	-
Nitrite-N	-	0	-	-	-	-	-	-
Iron	<0.05	0.55	0.05	0.1	0.29	30	0.14	-
Sodium	831	-	29.0	919	663	-	19	789
pH	8.7	-	8.2	8.2	7.9	-	7.8	-
Conductivity	-	3,620	-	-	-	-	-	-
Fluoride	5.4	-	0.37	3.32	0.34	-	0.46	-
Bicarbonate	1,172	-	194.0	1,112	249	-	306	-
Carbonate	152.001	-	0	0	0	-	0	-
Magnesium	1.20	-	79.07	1.4	276.23	-	72.06	9
Potassium	2.556	-	5.116	2.556	21.792	-	5.116	-
Sulphate	0	21.03	205.30	22.23	3,164.61	1,488.17	143.21	33
Total Hardness	11	35	450	15	2,344	1,300	478	20

Note: [1] Analysis date as no sampling date was provided.

One of these locations, ID# 2096581, was also sampled in 2021 and 2022. That information was reported in Table 4.8 of Volume 4-3 and is provided in the following Table 126.2 with the original sample for the parameters measured in both samples.

Table 126.2 Historical Groundwater Quality from Private Wells (concentrations in mg/L)

GIC Number	2096581	2096581	2096581	2096581
Sample Date	1937-06-30[1]	2021-10-20	2022-05-16	2022-10-13
Total Alkalinity	1305	1350	1390	1380
TDS	2020	1980	2120	2040
Calcium[2]	21	2.19	2.98	2.49
Chloride	327	360	332	339
Sodium[2]	789	799	932	851
Magnesium[2]	9	0.933	1.11	1.03
Sulphate	33	<1.5	<1.50	<1.50
Total Hardness	20	9.3	12.0	10.4

Notes:
[1] Analysis date as no sampling date was provided.
[2] Results from 2021 and 2022 are dissolved. Original (1937) laboratory report is total.

b. Sampling locations were selected to include the following:

- All monitoring wells installed as part of the hydrogeology baseline study or from geotechnical investigations.
- Identified springs or seeps within the Chin Coulee bottom between the Existing East Dam and approximately 2 km to the east of the New East Dam location.
- Confirmed and accessible water wells within the Chin Coulee bottom between the Existing East Dam and approximately 2 km downslope of the New East Dam location.

These sampling locations include the available groundwater features within the footprint of the reservoir expansion and a distance downslope.

Question 127

Reference:

Volume 4-3, Section 4.2, Page 23

Rationale/Preamble:

SMRID describes the 4 monitoring well locations and the rationale for their selection; however, the monitoring wells are only completed in the lower surficial sand and gravel alluvial unit or the upper Foremost Formation bedrock unit. None of the other major subsurface units have monitoring wells.

Information Request:

a. Explain why no other major subsurface units have monitoring wells.

Response:

a. The drilling program targeted the uppermost units as these are the materials in contact or proximal to the proposed Expanded Chin Reservoir and therefore of greater importance than units at greater depths. The desktop study undertaken prior to the field program indicated that the investigation should focus on shallow, potentially permeable units and that seepage from the reservoir, if it occurred, would be primarily lateral as anisotropy would limit vertical leakage. For these reasons, the drilling program was focused on the shallow groundwater system.

   Drilling at three of the four locations was advanced to depths exceeding 40 m and provides key geological and hydrogeological information over this interval. The units within this depth profile are the surficial deposits and Foremost Formation.

   Additional information regarding the hydrogeological characteristics and properties of all major subsurface units is provided in the *Hydrogeology Supplemental Technical Report* (Appendix 105.1).

Question 128

Reference:

Volume 4-3, Section 4.2, Page 23

Rationale/Preamble:

Area B (Chin Coulee) is the most important area when determining if underlying aquifer units have the potential to cause increased flow, changes in flow direction, etc. resulting from the filling of the reservoir expansion.

Information Request:

a. Provide the justification as to why 3 of the 4 monitoring well locations were chosen based on their close proximity of the New East Dam.

b. Explain why more monitoring wells were not installed within the LSA, most importantly in Area B (Chin Coulee).

Response:

a. The investigation targeted the area of the New East Dam as this location is the focus for managing and mitigating seepage to the east along Chin Coulee. It was therefore a priority to collect information in this area.

   In addition, the distribution of geological materials in this area is consistent with that identified in the rest of Chin Coulee. Information obtained in this area should be representative of the geological materials throughout much of the Hydrogeology LSA.

b. The drilling program had to consider and collect information from multiple physiographic areas (as discussed in the response to SIR#1 Question 122), multiple geological materials (as discussed in the response to SIR#1 Question 127) over the Hydrogeology LSA. Boreholes or monitoring wells within the Reservoir Expansion Area would require to be abandoned and sealed prior to reservoir filling, whereas those outside that area, might provide future value for observational monitoring purposes.

Question 129

Reference:

Volume 4-3, Section 4.3, Pages 24 and 25;
Volume 4-3, Appendix III

Rationale/Preamble:

SMRID indicates that sand was observed in the following monitoring wells:

MW22-01 : 24.7-26.8 m (artesian conditions between 24.5-26 m)
MW22-02 : 0-2.1 m, 19.8-21 (initially dry)
MW22-03 : 4.6-6.4 m (wet)
MW22-04 : 21.6-22.9, 25-26.5

Each of these units appears to have the potential to have high hydraulic conductivity values even though some were initially dry. Therefore, they serve as preferential flow pathways by which water from lower aquifer units could potentially flow into and surcharge these units as a result of the filling of the reservoir. This could result in flow beyond the New East Dam of the reservoir.

Information Request:

a. Explain why screens not completed for each unit or at a minimum why a slug test was not conducted in each unit.

b. Explain why the water table level was not recorded or noted on the monitoring well logs. Provide the missing information.

Response:

a. To complete slug tests a monitoring well would have needed to be installed in each zone and the preferred approach is to drill a separate borehole for each monitoring well. Drilling time was significant and well development would also been required prior to slug testing. The extent of the drilling and testing program was based on drilling observations and objectives to target one zone in each borehole.

b. The water level shown on the monitoring logs in Volume 4-3, Appendix III is the water level from the completed monitoring wells as recorded in Table 4.2 of Volume 4-3 in May 2022. The monitoring wells were intended to target permeable saturated zones and boreholes were drilled to intersect the bedrock surface, as such these water levels do not necessarily reflect the water table. Drilling observations of the water table are approximate and leaving the borehole open to establish the water table was impractical due to the time for the water table to stabilize or would not have provided a clear interpretation of the water table, such as at MW22-01 where an artesian zone was encountered between 24.7 m and 26.8 m.

Question 130

Reference:

Volume 4-3, Section 4.3, Pages 24

Rationale/Preamble:

SMRID states *After well completion and a period for equilibration after well development, the depth to water on May 18, 2022 was 32.98 m bgs*.

Information Request:

a. Explain why the well screen was completed between 30.76 and 32.29 m bgs, as this is above the water level.

Response:

a. The objective of MW22-04 was to investigate if permeable materials at depth could represent a groundwater pathway for leakage around the dam structure. Accordingly, a monitoring well was installed in the deepest potentially permeable interval above the bedrock surface. Water level measurements following completion and March 2025 indicate a depth to water above the top of the screen, such as recorded in Volume 4-3, Hydrogeology TBR, Tables 4.2 and 4.3.

Question 131

Reference:

Volume 4-3, Section 4.4, Pages 25 and 26;
Volume 4-3, Appendix IV

Rationale/Preamble:

Early-time data is typically more indicative of aquifer properties adjacent to the well, while late-time data is typically more indicative of aquifer properties at a distance from the well. The various properties and characteristics of the aquifer (i.e. thickness, grain size, hydraulic conductivity, etc.) result in different values after the inflection point/slope change.

Information Request:

Explain why in the Slug test:

a. Time-Displacement plots for BH21-03\VT21-01 only the Bouwer-Rice solution method was used in the analyses, while in the other monitoring well slug test analyses for confined aquifer models the Cooper-Bredehoeft-Papadopulos solution method (primarily applicable to confined aquifers) was also used to compare and contrast between the solution method results.
b. Time-Displacement plots for MW22-03 only the Cooper-Bredehoeft-Papadopulos solution method was used in the analyses, while in contrast MW22-01 and MW22-04 analyses used both the Cooper-Bredehoeft-Papadopulos and Bouwer Rice solution methods to compare and contrast between the solution method results.
c. Time-Displacement plots for MW22-04 using the Bouwer Rice solution method is matched to the late-time data points (i.e. after the inflection point/change of slope) to calculate the aquifer's k value, while in monitoring well numbers BH21-03\VT21-01, MW22-01 and MW22-02, the early-time portion data (i.e. after inflection point/change of slope) is matched.
d. Explain what properties of the aquifer(s) SMRID is most concerned with to best characterize the hydrogeology of the LSA. Explain if the concerns are aquifer properties near the well, the properties at a distance, or both, and provide the rationale for this decision.
e. Provide justification for the short duration slug tests, and evidence to show that the early-time data point matches using the Bouwer Rice solution method (i.e. 1000 seconds and under) are valid when determining accurate aquifer parameters.

Response:

a. The Cooper-Bredehoeft-Papadopulos solution was used as a check where the Bouwer-Rice solution did not provide a good fit. The Bouwer-Rice solutions for BH21-03/VT21-01 had a good fit with consistent results between rising and falling head tests and therefore the Cooper-Bredehoeft-Papadopulos solution was not also applied to these tests.

b. The Cooper-Bredehoeft-Papadopulos solution provided an excellent fit and therefore no additional solutions were applied as a check.

c. The early response observed in MW22-04 was interpreted to be a result of filter pack drainage and therefore the second portion of the response was used in the analysis. This contrasts with the other tests where the early portion of the response was analyzed as being representative of the hydraulic response of the geologic material.

d. The intent of the field investigation program was to obtain information regarding the hydrogeologic properties of the key units for comparison with other information, as available. Information obtained included geological descriptions, water levels, groundwater quality and hydraulic conductivity. The proximity to a well is not the focus per se but the aim is an understanding of the variation in hydraulic property values (i.e., minimum and maximum) and spatial distribution.

   Slug or packer tests provide a practical estimate of hydraulic conductivity that can help to develop an understanding of the range and distribution of hydraulic conductivities present. These characteristics are useful in understanding the larger scale flow system. Slug or packer tests are also useful in lower conductivity materials where pumping tests can not reasonably be undertaken. Further discussion on the usage of slug tests to assess hydraulic conductivity is provided in the response to SIR#1 Question 123.

e. Analysis of the slug test data is focused on obtaining a match with the interval of recovery that best approximates the response of the geological material, irrespective of when this occurs temporally. A best practice using the Bouwer-Rice method is to match the recovery curve when the drawdown is 30-20% of the initial displacement (Butler 1998).

Question 132

Reference:

Volume 4-3, Section 4.6.1, Page 40;
Volume 4-3, Figure 4.10, Page 44

Rationale/Preamble:

SMRID provides a sodium-chloride water type conclusion for the overburden flow system. However, based on the data in the lower right anion triangle of the Piper Trilinear diagram it appears as though this should be sodium-sulphate rather than sodium-chloride.

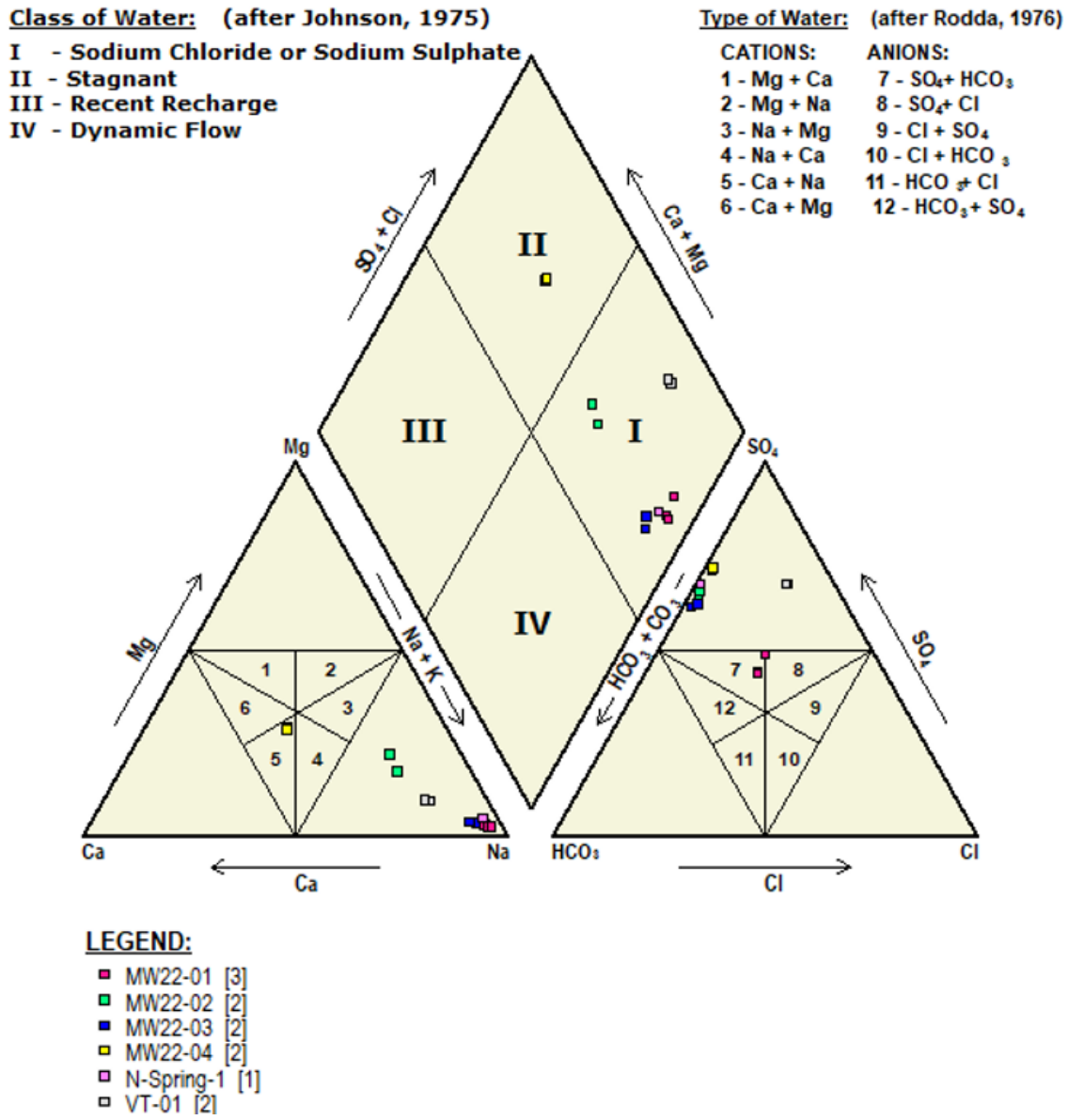
Information Request:

a. Confirm if a sodium-chloride water type conclusion was used for the overburden flow system or if this should read sodium-sulphate. If a sodium-chloride water type conclusion was used, provide the rationale for how this conclusion was reached.

Response:

a. The water type for most samples obtained from the overburden flow system is sodium-sulphate as shown on Figure 132.1 which is a reproduction of Figure 4.10 from Volume 4-3 with the water type domains included. Samples from MW22-01 do not have a dominant anion (mixed type) and the water from MW22-04 does not have a dominant cation (calcium and sodium type).

Figure 132.1 Piper Plots of Major Ion Chemistry with Water Type



Question 133

Reference:

Volume 5, Section 3, 3.2.1 [C]

Rationale/Preamble:

The final Terms of Reference states *Provide a detailed review and inventory with site reconnaissance for the entire project area to determine what boreholes are present, including:*

a) a determination of which party will be responsible for the cost of decommissioning and if replacement is required. Identify where the new wells will be installed;
b) an outline of how decommissioning will be completed. Identify what regulatory authorizations are required for the replacement of existing water wells; and
c) details of the compensation requirements if new wells cannot be installed.

Information Request:

a. A response to this question has not been provided. Answer the final Terms of Reference question.

Response:

a. Information regarding water wells within the Reservoir Expansion Area is summarized in Table 133.1 from data provided in Volume 4-3, Section 4.6 and Appendix I. Costs for decommissioning of water wells will be covered by SMRID. Replacement wells are not anticipated to be required, but if they are, costs will be negotiated as part of the property sale agreements. Further details regarding the procedure for decommissioning and compensation are provided in the responses to SIR#1 Questions 102 and 104, respectively.

Table 133.1 Summary of Water Wells within the Reservoir Expansion Area

GIC Well ID	Location	Well Owner	Verified
121766/121767/121768	7-26-7-16-W4		No
197496	NE-19-7-15-W4	Owen, Richard	Yes
“W-Spring”			Yes
293996	SW-23-7-15-W4	Owen, Clifford	Yes
2096581	SW-23-7-15-W4	Unknown	Yes

Question 134

Reference:

Volume 5, Section 3, 3.2.1 [D]

Rationale/Preamble:

The final Terms of Reference states *Describe the potential for current seeps or flows from watercourses (permanent and intermittent) bringing overland agricultural contaminated runoff into the current channel or the proposed reservoir expansion.*

Information Request:

a. A response to this question has not been provided. Answer the final Terms of Reference question.

Response:

a. The potential for overland agricultural contaminated runoff to be transported by surface or groundwater flows into the current channel or reservoir expansion is considered low because of the information outlined below:
    - As outlined in the Hydrology TBR (Volume 4-1), the estimated mean annual runoffs are low (less than 25 mm) with a deficit annual water balance resulting from annual evapotranspiration that exceeds annual precipitation. Only a fraction of the generated runoff would discharge into water bodies, with a runoff coefficient of 0.1 to 0.25, because of local depressions in the ground surface that need to be filled before runoff occurs.
    - The Watercourse 126419 within the current channel is ephemeral and dry most of the year demonstrating the limited inflows (Volume 4-1, Section 3.1.1).
    - Water quality sampling at multiple locations in the Current Reservoir and Watercourse 126419 was undertaken quarterly between May 2021 and March 2022 (Volume 4-2, Appendix I). Samples were analyzed for total ammonia (as N), nitrate, nitrite, total nitrogen, dissolved orthophosphate (as P), total phosphorus, and bacteria. Results from sampling of the reservoir showed no concentrations of ammonia, nitrate or nitrite exceeding guidelines for protection of aquatic life. Fecal coliform concentrations exceeding irrigation guidelines were identified in July 2021 from three of the deepest sampling locations in the reservoir. Water chemistry in the Current Reservoir did not demonstrate seasonal variations, was neutral to slightly alkaline, hard, calcium bicarbonate type with major ion, nutrient, petroleum hydrocarbon and metal parameter concentrations below guidelines for protection of aquatic life, irrigation, and livestock.
    - Water quality in the ephemeral watercourse (Watercourse 126419) was poorer than the reservoir with elevated anion, nutrient, metals and coliform levels. Sodium-sulphate and sodium-bicarbonate types were observed in dugout and wetland locations, respectively. The concentration of total dissolved solids in the dugout was observed to increase from

May to September as salts leach from the soils and are concentrated by evapotranspiration, then decreases by March due to rainfall or snowmelt.

- Two seepage locations were identified within the Chin Coulee between the Existing East Dam and approximately 1 km east of the proposed New East Dam location (Volume 4-3, Section 4.1). The spring within the proposed Reservoir Expansion appears to flow year-round. The seepage downslope of the New East Dam only flows intermittently; it was flowing in September 2021 and not during subsequent monitoring events in May and October 2022.

In summary, runoff amounts are expected to be limited and the Watercourse 126419 within Chin Coulee is dry most of the year. Water quality in the Existing Reservoir is generally good while water quality the Chin Coulee east of the Existing East Dam is generally poor as a result of evapotranspiration and soil leaching. Only one groundwater spring was identified within the proposed Reservoir Expansion Area with limited potential to transport surface contaminants into the proposed Expanded Chin Reservoir. Water quality within the Expanded Chin Reservoir is expected to be similar to that of the Existing Reservoir and heavily dominated by canal inflow, as described in the response to SIR#1 Question 170.

Question 135

Reference:

Volume 5, Section 3, 3.2.2 [B] (b), (d), (f), and (h)

Rationale/Preamble:

The final Terms of reference 3.2.2 [B] states: *Describe the nature and significance of the potential project impacts on groundwater with respect to:*

b) implications for terrestrial or riparian vegetation, wildlife and aquatic resources including wetlands;

d) conflicts with other groundwater users, and proposed resolutions to these conflicts;

f) potential implications of seasonal variations;

h) a discussion of the groundwater vulnerability below the proposed reservoir expansion and along the meltwater valley channel.

Information Request:

a. Responses to these questions have not been provided. Answer the final Terms of Reference questions.

Response:

a. The potential Project impacts on groundwater with respect to each of the items referenced in the fToR are discussed in the following sections numbered as per the fToR.

- *(b)* As discussed in Volume 2, Section 2.1.3.2 and 2.1.3.3, seepage through the alluvium within the Chin Coulee could cause the water table to rise and locally create ephemeral wetlands. Raising the water table to within 2 m of surface could result in saturated conditions at or near surface, soil salinization, and vegetation die-off in the long-term. Mitigation with respect to potential seepage and transport of salts within the alluvium is discussed in the response to SIR#1 Question 106. Based on the application of mitigation measures, residual effects are expected to be of negligible magnitude. Monitoring will be conducted to confirm that mitigation measures are effective in avoiding adverse effects. Adaptive management opportunities are available if the results of post-construction monitoring indicate that effects have been observed.
- *(d)* The main potential concern with regards to other groundwater users is the lost use of water wells within the proposed Expanded Chin Reservoir footprint. As discussed in the response to SIR#1 Question 104, this loss will be associated with the loss of use of grazing lands within the proposed Expanded Chin Reservoir footprint. These concerns will be addressed in the negotiation of property sale agreements.
- *(f)* The groundwater system displays limited, if any, seasonal variation and no change to this is expected due to the Project. The reservoir is a source of potential recharge to local hydrostratigraphic units and some of this groundwater could discharge to the ephemeral

watercourse (Watercourse 126419) within the coulee. Evidence from air-photo review of the Existing Reservoir is that the ephemeral watercourse downslope of the Existing East Dam is typically dry. Potential impacts to groundwater are not anticipated to result in observable changes in seasonal variations within the Chin Coulee with respect to the ephemeral watercourse.

- *(h)* The Upper Surficial Unit and Foremost Formation, which forms the upper bedrock, are inferred to have hydraulic conductivity values that range from moderate to low and are generally more consistent with an aquitard, than an aquifer. Seepage into these units from the reservoir is not expected to be substantial (see the response to SIR#1 Question 108 (c)). The alluvium (Upper Surficial Unit) within the Chin Coulee will limit seepage from the reservoir into the more permeable Lower Surficial Unit, as well as the Milk River Formation which is further separated by the Lea Park Formation (refer to the *Hydrogeology Supplemental Technical Report* (Appendix 105.1) for additional information). For these reasons the groundwater vulnerability is considered low.

Question 136

Reference:

Volume 5, Section 3, 3.2.2 [C]

Rationale/Preamble:

The final Terms of Reference states *Detail the proposals, and/or mitigation strategies to protect the potential contamination of groundwater aquifers.*

Information Request:

a. A response to this question has not been provided. Answer the final Terms of Reference question.

Response:

a. As discussed in the response to SIR#1 Question 135 (h), the potential for contamination of groundwater aquifers is assessed as low. Mitigation with respect to potential transport of salts within the alluvium is discussed in the response to SIR#1 Question 106.

Question 137

Reference:

Volume 5, Section 3, 3.2.2 [D]

Rationale/Preamble:

The final Terms of Reference states *Discuss the Project's relative contribution to cumulative effects on regional groundwater with respect to:*

a) changes in regional groundwater quality and quantity; and
b) conflicts with regional groundwater users.

Information Request:

a. A response to this question has not been provided. Answer the final Terms of Reference question.

Response:

a. The Project's relative contribution to cumulative effects on regional groundwater with respect to each of the items referenced in the fToR are discussed in the following sections numbered as per the fToR.

- *(a)* The assessed effects of the Project (Volume 2, Section 2.1 and Table I.1) include potential changes in groundwater quantity or quality in the Milk River Aquifer associated with (a) potential leakage through submerged water wells located within the Existing Reservoir footprint and (b) seepage through bedrock units that separate the base of the reservoir and the Milk River Aquifer. Potential effects to quantity were assessed positively as they could result in minor recharge to the Milk River Aquifer, whereas potential effects to quality associated with seepage through the bedrock overlying the Milk River Aquifer were assessed as negative, but not significant.

  Pétré et al. (2015) shows that groundwater within the Milk River Aquifer in the RSA has an age of more than one million years and has migrated from the south. Groundwater within the Milk River Aquifer has a long residence time and no significant interaction with other aquifer units in this area. This information provides a high degree of confidence that potential effects to groundwater quality in the Milk River Aquifer due to seepage from the reservoir through the overlying bedrock units will not occur.

  These effects are limited or positive, are not expected to interact cumulatively in a negative manner with other activities within the RSA and therefore no cumulative effects are identified.

- *(b)* Effects to regional groundwater users will be limited to the loss of groundwater use from existing water wells within the proposed Reservoir Expansion Area. This loss will be combined with loss of the use of these lands for grazing purposes. No other activities have

been identified within the RSA that would also cause loss of groundwater usage by landowners and therefore no cumulative effects are identified.

5.3 Hydrology

Question 138

Reference:

Volume 1, Section 1.5, Page 9

Rationale/Preamble:

SMRID states *Compared to baseline conditions, annual precipitation is projected to increase upstream of the diversion from Government of Alberta water resource infrastructure into the SMRID system (the diversion) (WaterSMART 2023). By 2021-2050, annual precipitation is projected to increase by roughly 100 mm/year relative to the 1991-2020 period. Increases are expected to be the greatest at lower elevations, due predominantly to the increase mostly occurring during the summer months, when convective storms have a less defined elevational gradient. By 2051-2080, annual precipitation is projected to decrease relative to 2021-2050, though relative to 1991-2020, annual precipitation is still projected to increase by approximately 100 mm/year (WaterSMART 2023).*

Information Request:

a. Provide and discuss the assumptions and calculations made for the future time periods annual precipitation increases.

Response:

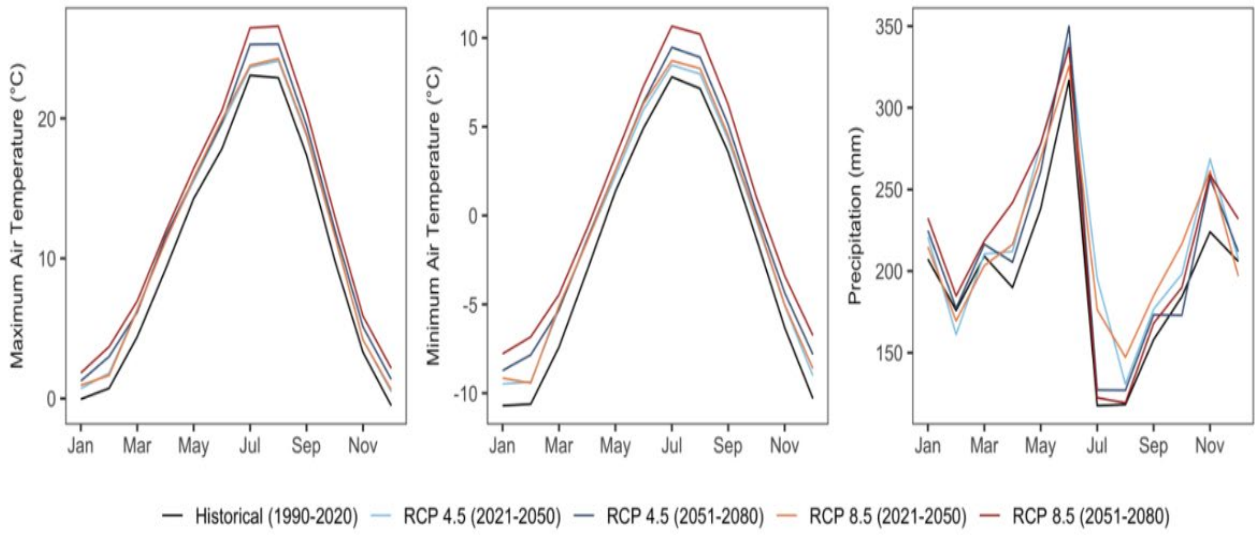
a. Please refer to the WaterSMART report *Hydrological Modelling to Evaluate Changes in Streamflow Availability in St. Mary River Watershed* (2023) for details on the climate change scenario analysis (Appendix 1.2). The following response is an excerpt from that document which directly responds to this question.

   Future climate change scenarios were generated from statistically downscaled climate scenarios obtained from ECCC under RCPs. RCP 4.5 corresponds to a scenario where carbon dioxide emissions stabilize by 2040, while RCP 8.5 represents a scenario with minimal greenhouse gas emission mitigation. These scenarios applied the median projection from an equal-weighting ensemble forecast of 24 GCMs from the CMIP5 from 2021-2100.

   Daily future weather conditions were generated by first bias-correcting projected climate values. Each future month and year were then matched with a proxy month from the baseline (observed) period. These scaling factors for each month and year (i.e., fractional difference in precipitation and absolute difference in air temperature between the proxy and scenario) were then used to correct the daily observed record for each climate scenario (Figure 138.1).

   Figure 138.1 shows the SOAP Model simulations projected variability in the air temperature and precipitation data for the RCP 4.5 and RCP 8.5 scenarios in the study area, compared to the historical data.

Figure 138.1 Projected monthly average changes in precipitation and temperature under RCP 4.5 and 8.5 scenarios for the study area, for the periods 2021-2050 and 2051-2080, relative to the 1991-2020 historical baseline (WaterSMART 2023)



Please refer to the response to SIR#1 Question 94 for specific discussion of the projected changes in precipitation from the climate change modelling done to support the Chin Reservoir Expansion Project.

Question 139

Reference:

Volume 1, Section 1.7, Page 12

Rationale/Preamble:

SMRID states *The results of the hydrological modeling conducted by WaterSMART (2023) demonstrated that under predicted climate change conditions, RCP's 8.5 and 4.5, along with two scenarios of glaciers present and absent, the water supply to the SMRID is predicted to remain sufficient to fill the expanded Chin Reservoir.*

Information Request:

a. Explain the impacts of filling the expanded Chin Reservoir on storage volumes in the water supply headworks at the end of the irrigation operating season under the various scenarios modelled.

b. Explain if modelling of the various scenarios utilized target elevations in the water supply headworks reservoirs at the end of the irrigation operating season.

c. Explain if the modelling of the various scenarios identified any changes to the operation of the water supply headworks storage reservoirs in support for filling the expanded Chin Reservoir.

Response:

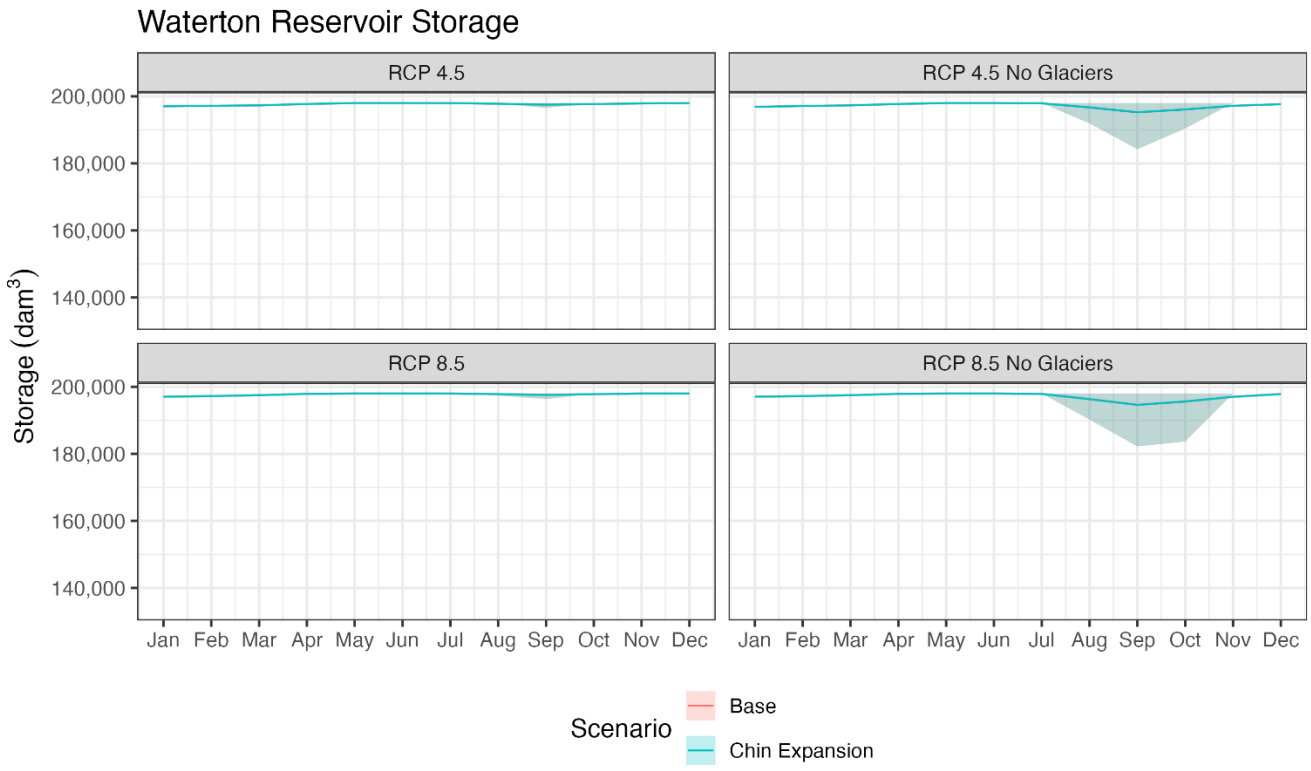
a. Looking at the storage in the water supply headworks reservoirs between September 1 to October 31 timeframe comparing the scenarios with and without the Chin Reservoir Expansion Project simulates the impacts of filling the expanded Chin Reservoir. September 1 to October 31 is the end of the irrigation season, and during that time the SMRID will fill their reservoirs (including the Expanded Chin Reservoir) to the preferred winter carryover level if water is available.

   This analysis is based on simulations conducted using the SOAP Model, which represents simplified operations of the AGI reservoirs, conveyance canal network, the SMRID irrigation network, and SMRID owned and operated reservoirs using current operating rules, instream objectives, and infrastructure design. Refer to the Appendix 4.1 for further details on the model and the assumptions underlying these results.

   The following visuals show the SOAP Model simulated storages and elevations in the Waterton Reservoir, St. Mary Reservoir, and the Expanded Chin Reservoir in the two climate change scenarios with glaciers and no glaciers qualifiers (four scenarios total). The figures show the full year to provide context and supporting information. The discussion will focus on only the period of September and October as the SIR has specifically asked about the end of irrigation season. The figures demonstrate the behaviour of each reservoir under climate change in terms of seasonal patterns, where the reservoirs are held steady during the late fall and winter, filling in

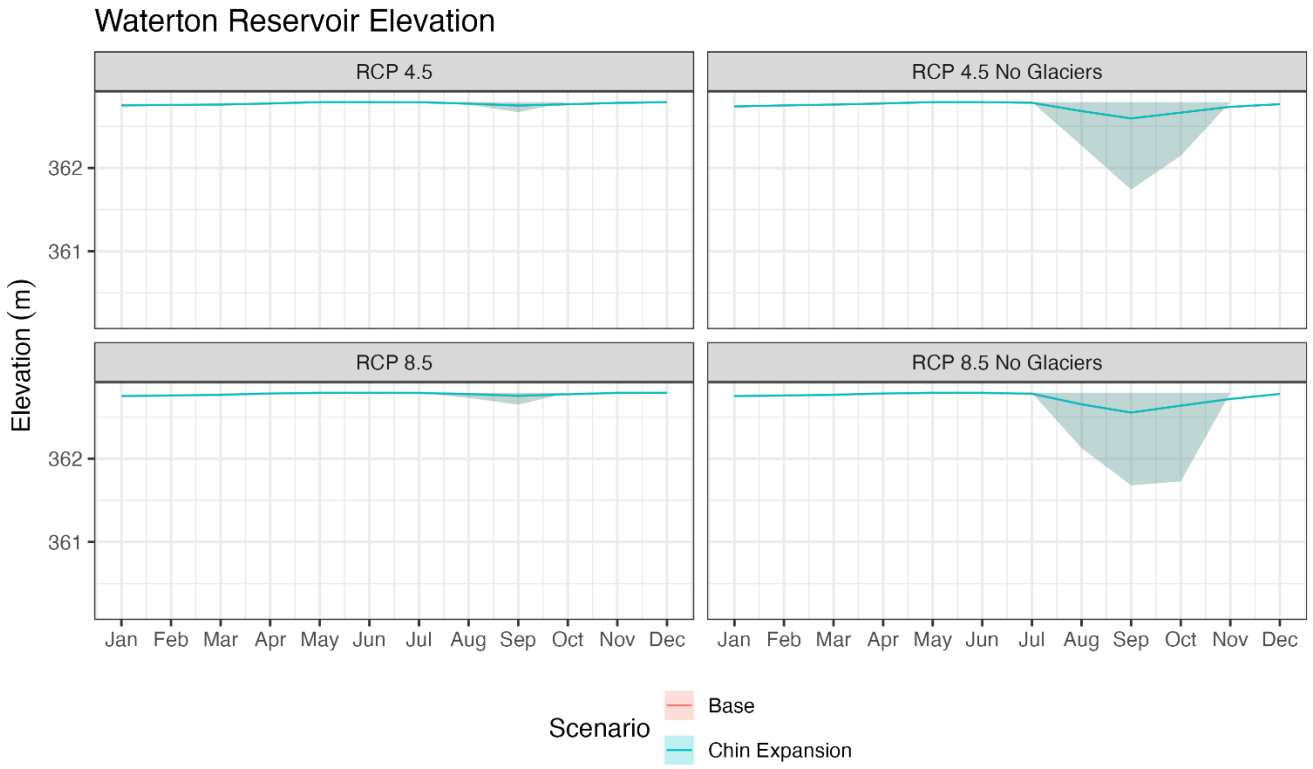
Figures 139.1 and 139.2 demonstrate there is no effect on storage and elevation in Waterton Reservoir with the Chin Reservoir Expansion Project under climate change.

Figure 139.1 Projected monthly storage in Waterton Reservoir under future climate scenarios with Chin Reservoir Expansion



Notes: Mean storage (solid lines) and the 10th–90th percentile range (shaded ribbons) are shown for each scenario. Where no blue is visible it is because the red is overlying it.

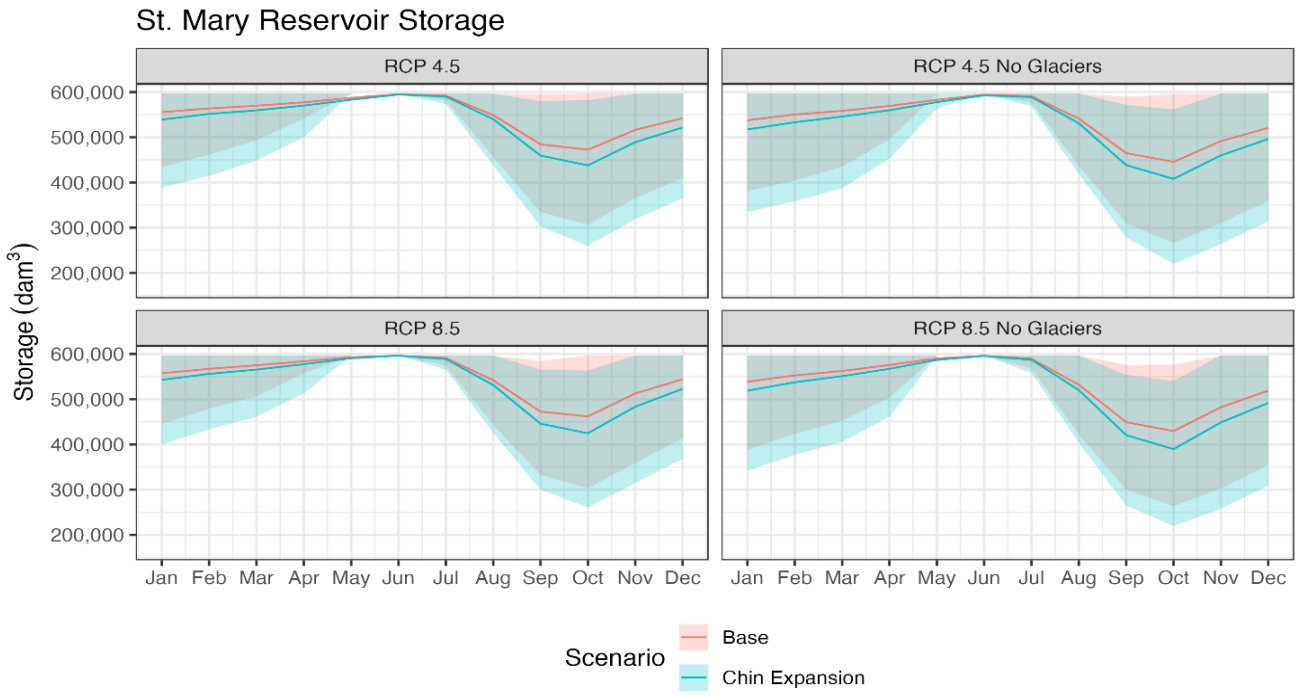
Figure 139.2 Projected monthly elevation in Waterton Reservoir under future climate scenarios with Chin Reservoir Expansion



Notes: Mean elevation (solid lines) and the 10th–90th percentile range (shaded ribbons) are shown for each scenario. Where no blue is visible it is because the red is overlying it.

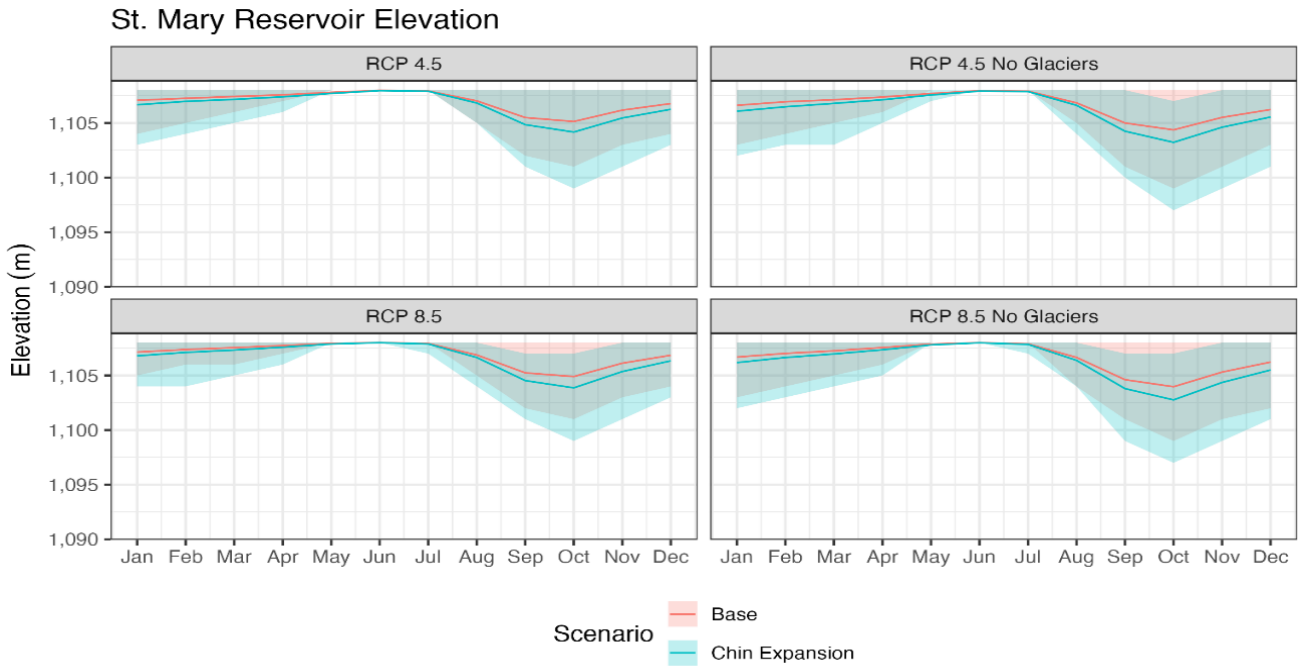
Figures 139.3 and 139.4 suggest the Project would result in a larger drawdown of the St. Mary Reservoir, where the Expansion Scenario is consistently lower than the Base case Scenario under both climate change scenarios and with or without glaciers.

Figure 139.3 Projected monthly storage in St. Mary Reservoir under future climate scenarios with Chin Reservoir Expansion



Notes: Mean storage (solid lines) and the 10th–90th percentile range (shaded ribbons) are shown for each scenario. Where no blue is visible it is because the red is overlying it.

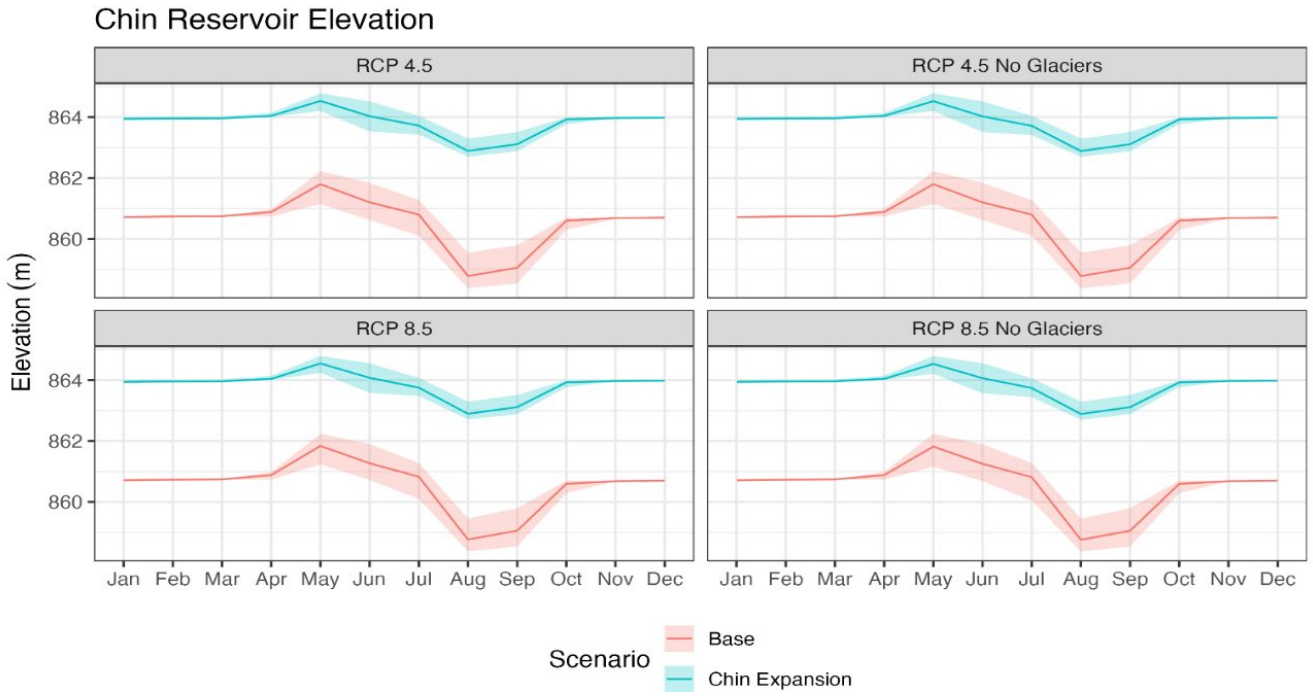
Figure 139.4 Projected monthly elevation in St. Mary Reservoir under future climate scenarios with Chin Reservoir Expansion



Notes: Mean elevation (solid lines) and the 10th–90th percentile range (shaded ribbons) are shown for each scenario. Where no blue is visible it is because the red is overlying it.

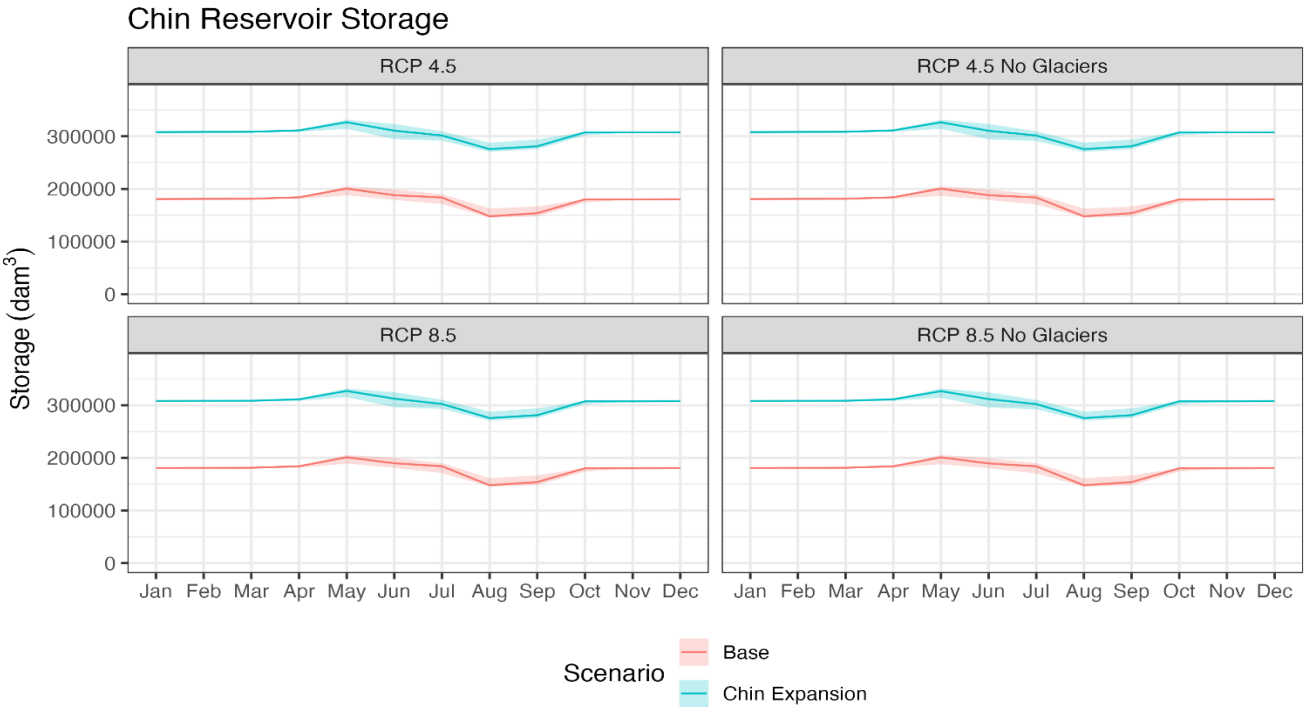
Figures 139.5 and 139.6 clearly show that the Chin Reservoir has higher overall storage in the Expansion Scenario as the reservoir is substantially larger compared to the Existing Chin Reservoir modeled in the Base case Scenario. The Expansion Scenario also varies less than the Base case Scenario on a seasonal scale.

Figure 139.5 Projected monthly elevation in Chin Reservoir under future climate scenarios with Chin Reservoir Expansion



Note: Mean elevation (solid lines) and the 10th–90th percentile range (shaded ribbons) are shown for each scenario.

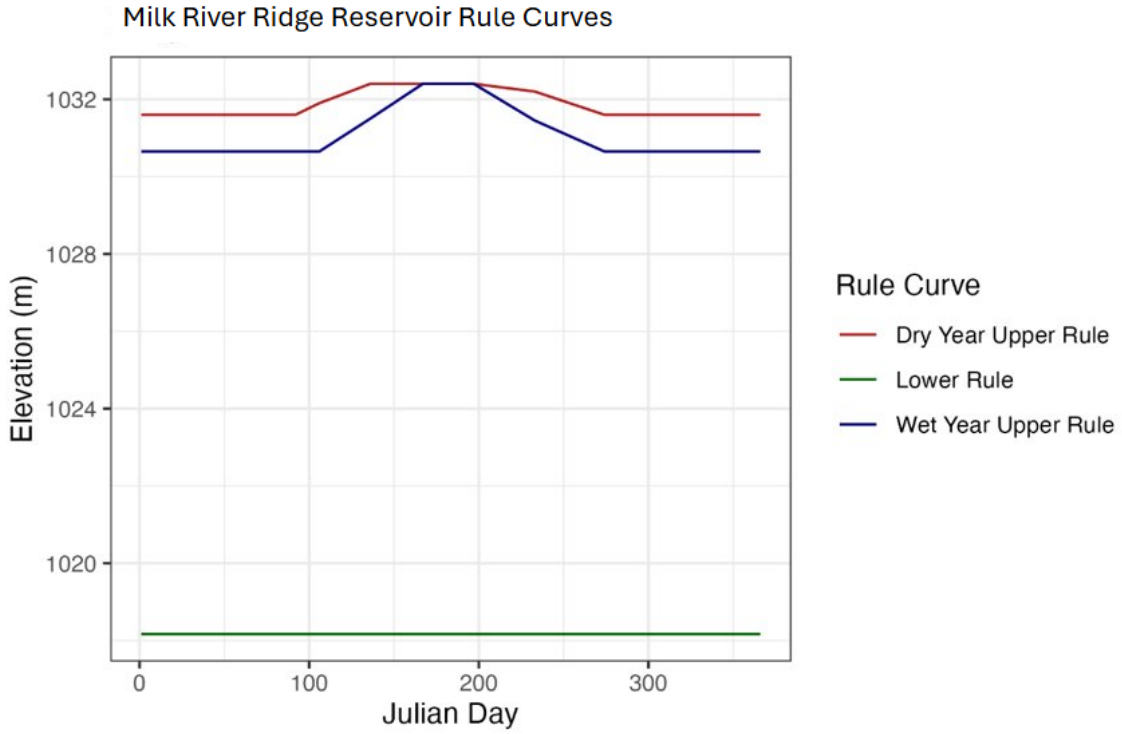
Figure 139.6 Projected monthly storage in Chin Reservoir under future climate scenarios with Chin Reservoir Expansion



Note: Mean storage (solid lines) and the 10th–90th percentile range (shaded ribbons) are shown for each scenario.

b. The SOAP Model simulations of the operations of the upstream reservoirs used target elevations (i.e., rule curves) in the Waterton, St. Mary, and MRRR Reservoirs at the end of the irrigation season. These target elevations were provided by AGI through long-term collaboration in the SSRB using the SSROM. Figures 139.7, 139.8, and 139.9 below demonstrate the elevation targets used by showing the rule curves used in the model. These target elevations only encourage fill to the desired level if possible; they do not "force" the model to accommodate.

Figure 139.7 The MRRR elevation rule curve used in the SOAP Model



Note: Where no blue is visible it is because the red is overlying it.

Figure 139.8 The Waterton Reservoir elevation rule curve used in the SOAP Model

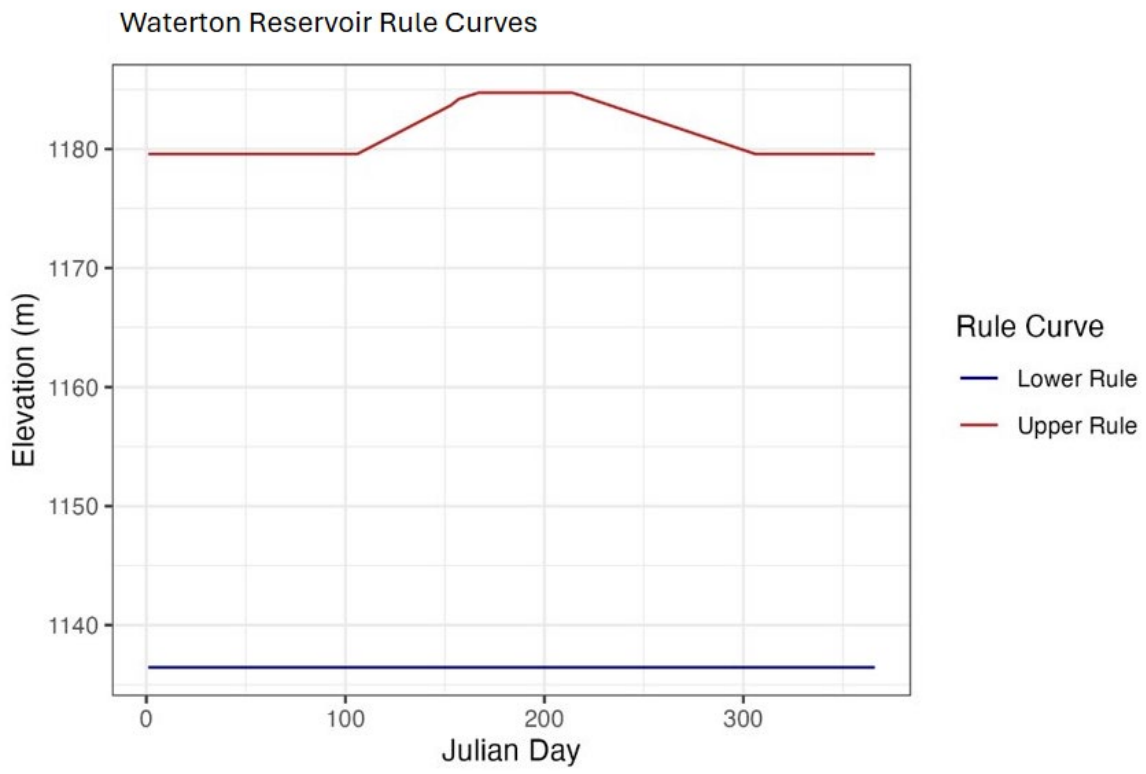
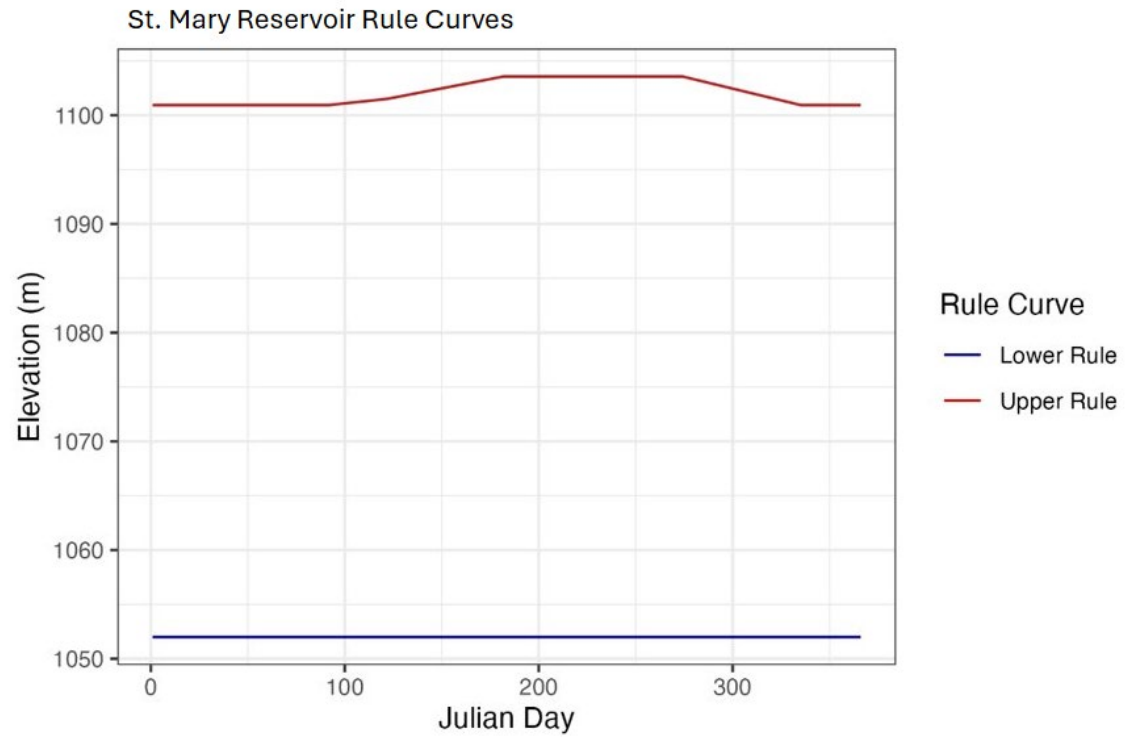


Figure 139.9 The St. Mary Reservoir elevation rule curve used in the SOAP Model



c. The modelling did identify potential changes to storage in the headworks reservoirs. Refer to the response to SIR#1 Question 98 for analysis and discussion of the impacts on the headworks storage reservoirs related to the filling of the expanded Chin Reservoir.

Question 140

Reference:

Volume 1, Section 2.1, Figure 2.1, Page 28

Rationale/Preamble:

SMRID provides a table titled *Existing Chin Reservoir – Mean and Range of Reservoir Levels – 1994 to 2009* and *The average total diversion volume over 1992-2021 period is..*

Information Request:

a. Provide justification for why the entire period of record for the existing project isn't being used to illustrate the mean and range of reservoir levels and average total diversion volume for the proposed project.

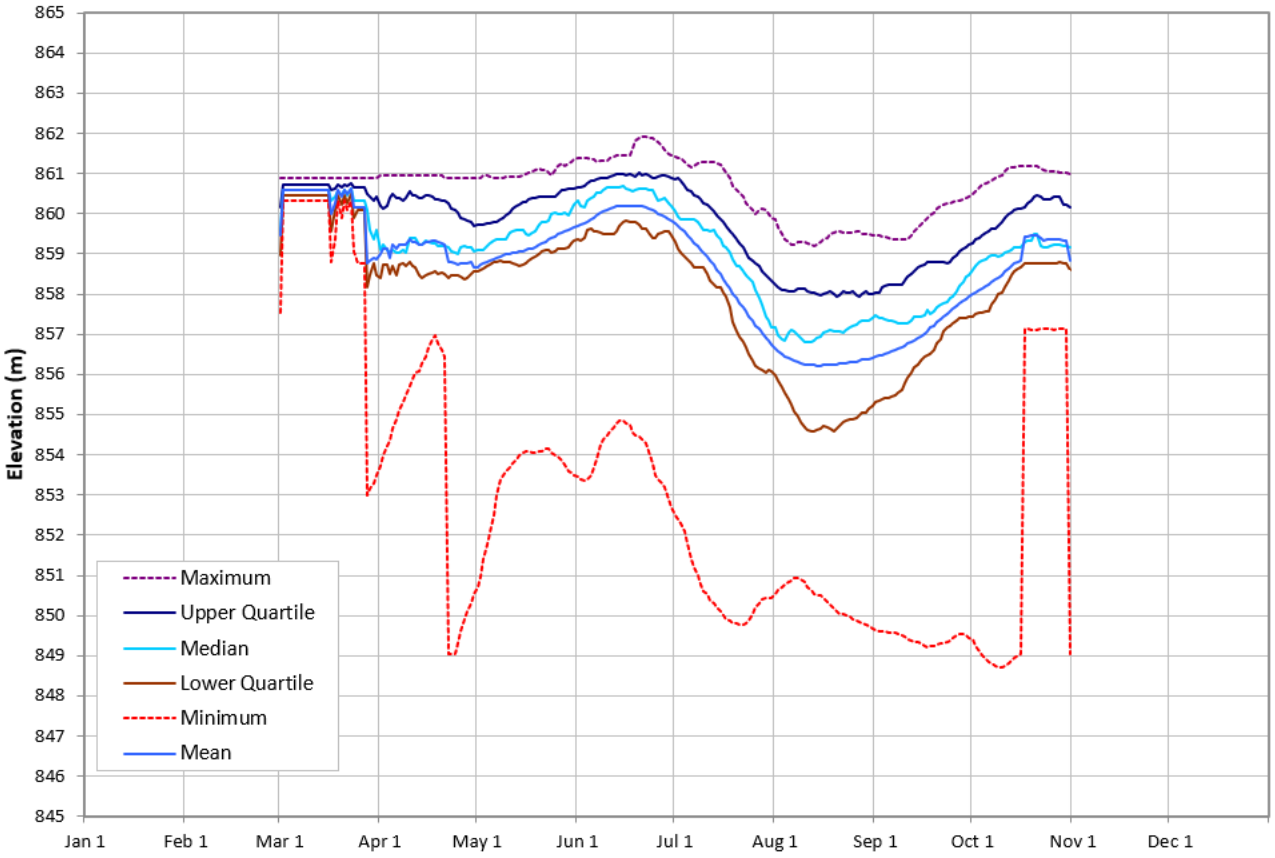
b. Provide justification for why the range of records used to illustrate the mean and range of reservoir levels and average total diversion volume provides a full representation of climatic and water supply conditions the project has historically operated under.

Response:

a. The mean and range of reservoir levels for the Existing Chin Reservoir was shown on Figure 2.1, included in both Volume 1 and Volume 2 of the EIA. At the time that the preliminary design was developed, the period of record for which historical reservoir level data was available was 1994 to 2020. The SOAP model uses historical naturalized inflow data to simulate operating scenarios for a range of dates extending from 1928 to 2009. The period of record used to generate this figure was 1994 to 2009, which was truncated to allow for a consistent date range to be used for comparison to the predicted condition of the Expanded Chin Reservoir. However, we acknowledge that the historical operating conditions cannot be directly compared to the simulated conditions. Figure 3.3 from the New East Dam PDR (Appendix 1.1) presents the mean and range of Chin Reservoir levels based on historical data for the period from 1994 to 2020. This information is presented here as Figure 140.1.

   The average total diversion volume for SMRID was reported, along with other districts, based on information available from Alberta Agriculture, Forestry and Rural Economic Development at the time that the design was developed. This data spanned from 1992 to 2021.

Figure 140.1 Mean and Range of Chin Reservoir Levels Based on Historical Data (1994 to 2020)



b. The mean and range of historical Chin Reservoir levels has been presented on Figure 140.1 for the full range of time for which data was available for the design. The full range of historical data available has been used to represent the average total diversion volumes. Historical diversion data is also provided in the response to SIR#1 Question 4 based on data from the Water Survey of Canada hydrometric gauge station from the past 30 years.

Question 141

Reference:

Volume 2, Section 2.2.1, Page 24

Rationale/Preamble:

SMRID states *The RSA (Map Figure 1.1 in Volume 4: Hydrology TBR) included the SMRID infrastructure from Milk River Ridge Reservoir (MRRR) diversion to Medicine Hat in assessing surface water hydrology and the potential for cumulative effects from the Project. MRRR receives inflow from St Mary Reservoir, which in turn receives from the Waterton Reservoir. Both reservoirs receive inflow from three headwater watersheds – Waterton River watershed, Belly River watershed, and St. Mary River watershed.*

Information Request:

a. Since both reservoirs receive inflow from three headwater watersheds, Waterton River watershed, Belly River watershed, and St. Mary River watershed, describe the impacts on the three headwater watersheds and Oldman and South Saskatchewan Rivers mainstem downstream of the diversion to the Project. Provide evidence to support these findings.

b. Explain mitigation measures to address the potential regional effects.

Response:

a. Refer to the response to SIR#1 Question 4 (b) for analysis and discussion regarding the impacts on the three headwater watersheds and Oldman and South Saskatchewan Rivers mainstem downstream of the diversion to the Project.

   The river flow rate and timing are the parameter of interest for describing the impacts to the Waterton River watershed, Belly River watershed, St. Mary River watershed, the Oldman River watershed, and the South Saskatchewan River watershed. The three headwater watersheds, above the point where water is diverted toward SMRID, are not likely to experience changes in flow or timing directly due to the Project given that storage can be drawn upon.

b. The adaptive approach to water management decision-making used every year is seen as the best way to mitigate potential regional effects from the Chin Reservoir Expansion Project. This approach to water management decisions is described in detail in Appendix 2.1.

   Regional effects are mitigated through this approach because the additional water storage capacity of the Chin Reservoir is only filled if water supply is available (as determined by AGI), and the increased water demand of the additional irrigated acres is reduced when the farm gate allocation is decided, which is also based on the water supply available (as determined by GOA). The water supply availability to the SMRID is determined after accounting for all the existing water users and therefore effectively manages impacts to other water users in the basin.

Question 142

Reference:

Volume 2, Section 2.2.2, Page 24

Rationale/Preamble:

Information Request:

a. Provide map(s) showing climate and hydrology conditions in the Regional Study Area.

Response:

a. Please refer to Figures 2.1 and 2.2 provided in the response to SIR#1 Question 2 (a).

Question 143

Reference:

Volume 2, Section 2.2.2, Page 24

Rationale/Preamble:

Information Request:

a. Provide details, including location, of existing flow monitoring and meteorological station(s) in the area.

Response:

a. Please refer to Figure 2.2 provided in the response to SIR#1 Question 2 (a). The details of the nearby ECCC climate stations in the RSA with 30 or more years of record and with 30-years climate normal data are presented in Table 2.2 in Volume 4-1, Section 2.2, Page 6. The details of the WSC streamflow measurement stations are presented in Table 2.7 in Volume 4-1, Section 2.4.1, Page 14.

Question 144

Reference:

Volume 2, Section 2.2, Page 24

Rationale/Preamble:

Information Request:

a. Provide datasets used for hydrologic analysis.

Response:

a. The naturalized flow data for the South Saskatchewan River Basin that was used as the input for the hydrologic analysis is provided in Appendix 144.1.

Question 145

Reference:

Volume 2, Section 2.2.3, Page 28;
Volume 2, Section 2.2.3.2.2, Page 30

Rationale/Preamble:

Information Request:

a. In addition to flood mitigation, explain the potential influence on low flows (e.g., 7Q10).

Response:

a. Refer to the response to SIR#1 Question 4 (b) for analysis and discussion regarding the impacts on the three headwater watersheds and Oldman and South Saskatchewan Rivers mainstem downstream of the diversion to the Project. The simulation shows no increase in the frequency that WCO would not be met, so there is no anticipated influence on low flow conditions such as the 7Q10 flow.

Question 146

Reference:

Volume 2, Section 2.2.3.1.2, Page 29;
Volume 5, Section 3, 3.3.2 [E]

Rationale/Preamble:

SMRID evaluated impacts to licences in the footprint of the new reservoir, A description of impacts on water users downstream of the New East Dam were not provided.

The final Terms of Reference states *Describe the impacts on other surface water users resulting from the Project. Identify any potential water use conflicts.*

Information Request:

a. Describe the impacts on surface water users downstream of the New East Dam. Identify any potential water use conflicts.

Response:

a. Refer to the response to SIR#1 Question 14. The reduction in catchment area is expected to result in a minor decrease in discharge reporting to Watercourse 126419, which already has limited potential for use. The magnitude of the potential adverse effect is considered to be within the range of natural variability, resulting in no measurable effect on surface water users drawing from downstream impoundments and no change in potential for water use conflicts.

Question 147

Reference:

Volume 2, Section 2.2.3.2.1, Page 30

Rationale/Preamble:

Given the same operation of the upstream diversion infrastructure and SMRID's water license, it is expected that water quantity will be reduced downstream of Chin Reservoir during a period of filling the enlarged portion of the reservoir over several years.

Information Request:

a. Discuss the potential effects on downstream water quantity during the period of filling the expanded portion of the reservoir.

Response:

a. The following proposed filling schedule of the Chin Reservoir expanded area is presented in Appendix II of the New East Dam PDR (Appendix 1.1). The schedule has been proposed to reduce the potential for reservoir drawdown during expanded area filling to affect fall spawning activity of fish within the Existing Chin Reservoir, and to avoid flooding of migratory bird nests in the Reservoir Expansion Area in the spring (i.e., after April 1st):

   - September 1 to October 31: No limit on release discharge or reservoir drawdown.
   - November 1 to March 31: Limit releases from the reservoir such that Chin Reservoir drawdown is less than 1 m from November 1 to March 31.
   - April 1 to August 31: No releases from the existing reservoir to the expanded area.

   The proposed temporary gated outlet structure at the north abutment of the Existing East Dam would convey discharges of approximately 4 m^3/s in September and October and an approximate average of 0.5 m^3/s from November to March. Consequently, diversion volumes in September and October would either be supplied by inflows from the Waterton-St. Mary Headworks System to Chin Reservoir, if water is available, or Chin Reservoir would be drawn down. Assuming canal inflow to Chin Reservoir equals outflow to Stafford Reservoir in September to October, this means that Chin Reservoir would be drawn down approximately 2 m with an additional 1 m of drawdown from November to March. This range of reservoir draw down is within historic Chin Reservoir level variability from September to October (see Figure 140.1). With the proposed diversion schedule and discharge/volumes, it will take a minimum of three years and possibly longer depending on water availability, water demands, and climate variability to fill the Chin Reservoir Expansion Area to a target elevation of 856 m to facilitate decommissioning of the Existing East Dam.

Question 148

Reference:

Volume 2, Section 2.2.3.2.2, Page 30

Rationale/Preamble:

SMRID states *With the expanded stormwater retention capability, it is estimated that all stormwater runoff entering the main canal between Ridge Reservoir and Chin Reservoir could be contained, resulting in zero outflow downstream of Chin Reservoir*.

The Expanded Chin Reservoir should be infilled up to a normal condition, zero outflow downstream of Chin Reservoir under a Inflow Design Flood (IDF). The IDF seems to be overestimated with regard to flood mitigation capacity.

Information Request:

a. Provide the rationale as to how the IDF was estimated.

Response:

a. The derivation of the IDF is presented in the New East Dam PDR, Appendix V – Inflow Design Flood Estimate. The magnitude of the IDF is based on the recommended consequence classification for the New East Dam which is presented in the New East Dam PDR, Appendix VI – New East Dam Breach Inundation Study. For a consequence classification of Very High, the IDF is 2/3rd between the 1:1,000 year flood and the PMF.

   The Spillway Design Flood (SDF) is the 1:1,000 year flood event. As stated in the New East Dam PDR, Appendix XVI – Auxiliary Spillway Design, the West Dam outlet structure is the service (primary) spillway used to regulate levels within Chin Reservoir. It is proposed that the Project will be protected against floods with return periods up to the 1:1,000 year flood by provision of temporary flood storage and releases via the West Dam outlet structure. Reservoir storage is provided above the FSL to store the total 1:1,000 year flood volume with releases via the West Dam outlet structure matching the SMRID main canal inflow discharge. The West Dam outlet structure would be operated to lower reservoir levels after the inflow flood event. The combination of reservoir storage and West Dam outlet structure operation to temporarily store/convey the 1:1,000 year flood event is the recommended SDF event.

   The New East Dam PDR is provided as Appendix 1.1 of this SIR#1 Response Document.

Question 149

Reference:

Volume 2, Section 2.2.3.2.3, Page 30

Rationale/Preamble:

SMRID has repeatedly quoted WaterSMART modeling results to confirm no impacts on hydrology and a sufficient supply of water. The WaterSMART 2023 report is not listed in the references for review.

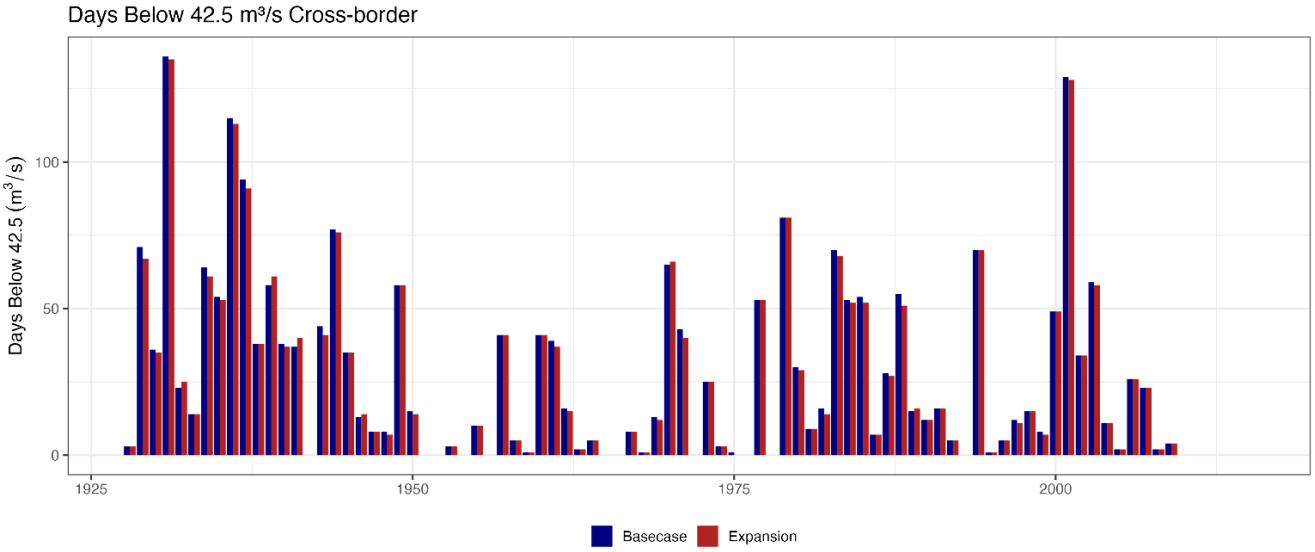
Information Request:

a. Provide charts and/or summaries of WaterSMART modelling results with and without Chin Reservoir Expansion Project for the following performance measures listed in "Adaptation Roadmap for the SSRB: Assessment of Strategic Water Management Projects to Support Economic Development in the South Saskatchewan River Basin (SSROM Phase 3) Final Report": Cross-border apportionment contribution, Flow less than 42 m^3/s at the AB/SK border, minimum flows by year, and Oldman Shortages.

Response:

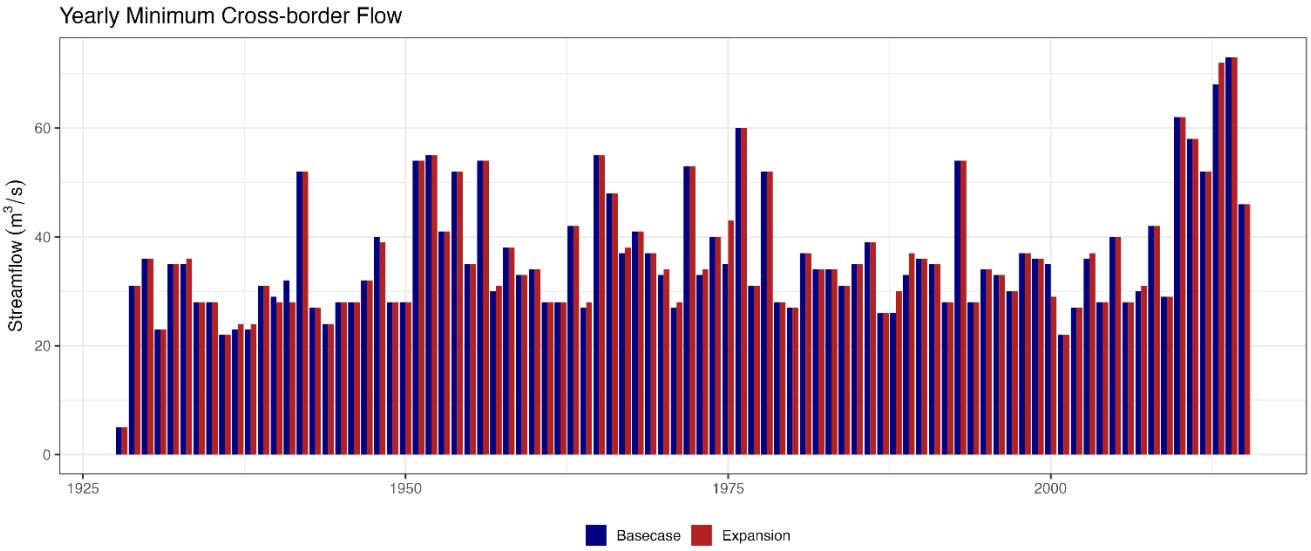
a. The following are the visuals from the SSROM simulation for days with flow below 42.5 m^3/s at the AB/SK border (Figure 149.1), yearly minimum cross-border flow (Figure 149.2), water shortages for the Oldman Basin (Figure 149.3), and cross-border apportionment contribution by sub-basin (Figure 149.4) comparing scenarios with and without the Chin Reservoir Expansion Project. There were no substantial changes in days below 42.5 m^3/s at the AB/SK border or yearly minimum cross-border flows.

Figure 149.1 The number of days each year in the simulation when the flow of the South Saskatchewan River crossing the interprovincial border was below 42.5 m³/s



Note: Comparing the Base case Scenario (blue bars) and the Expansion Scenario (red bars).

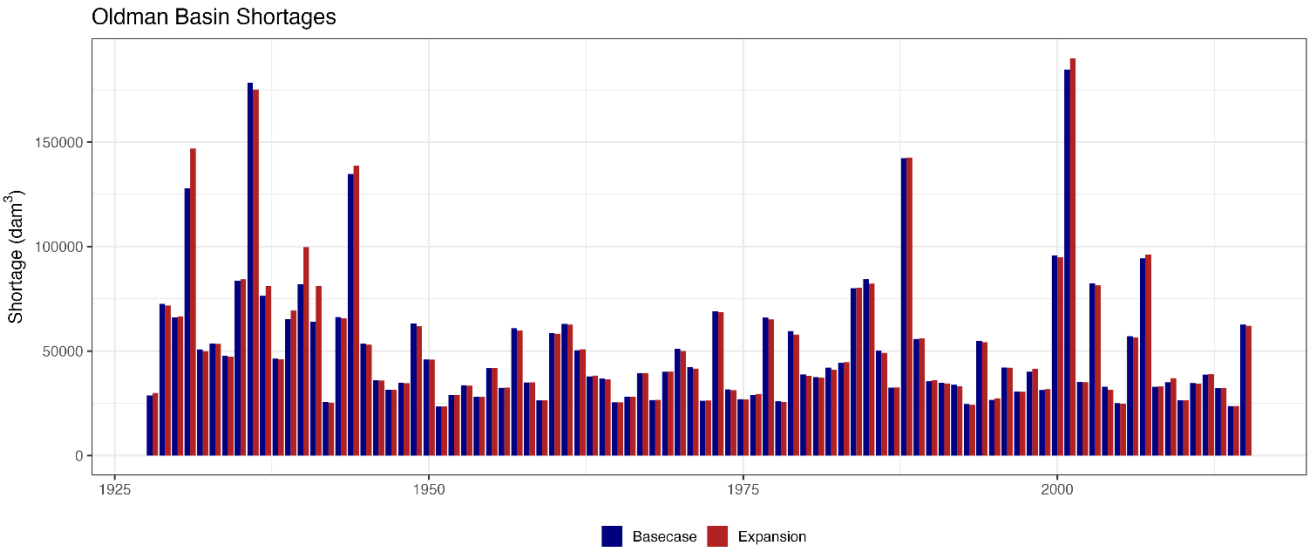
Figure 149.2 The minimum flow of the South Saskatchewan River at the interprovincial border each year of the simulation



Note: Comparing the Base case Scenario (blue bars) and the Expansion Scenario (red bars).

Figure 149.3 shows the Oldman Basin Shortage. The only meaningful increase to shortages in the Oldman Basin, not including the Southern Tributaries, occurs in three years of the dust bowl in the mid-1930s. The dust bowl represents the most severe multi year drought in the historical record. The SSROM model does not implement drought mitigation measures, which would be necessary to navigate that period. Appropriate diversion limitations placed on the St. Mary River system would be necessary in that circumstance. Post 1950, difference in shortages is negligible and easily managed in the real world, since the SSROM water demand assumptions are conservative. Further details on the SSROM and its assumptions are provided in Appendix 4.1.

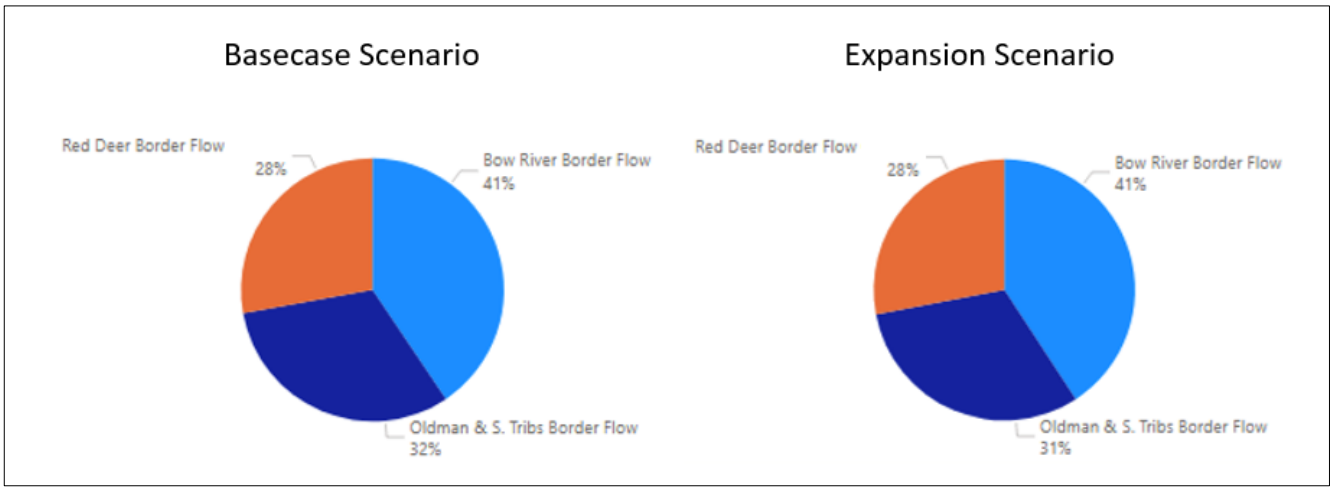
Figure 149.3 The volume of water shortage for the entire Oldman River watershed demands each year of the simulation



Note: Comparing the Base case Scenario (blue bars) and the Expansion Scenario (red bars).

Figure 149.4 shows the proportion of river flow contributed by each sub-basin to meet the apportionment requirements. The result from the Base case Scenario is on the left and the Expansion Scenario is on the right. The Oldman and Southern Tributaries contribute 32% in the Base case and 31% in the Expansion Scenario; however, the difference is less than one percent as the total of all three sub-basins in the Base case sum to 101%, which indicates a rounding error.

Figure 149.4 Cross-border apportionment contribution by sub-basin showing the Base case Scenario and the Expansion Scenario



Question 150

Reference:

Volume 2, Section 2.2.3.2.1, Page 30

Rationale/Preamble:

SMRID states *As the Chin Reservoir Expansion will operate under the existing conditions of SMRID's water license, changes in flow regimes from source rivers are not anticipated as it is assumed that changes to government-controlled water allocation will not change.*

Information Request:

a. Provide evidence to support this assumption.

b. Explain how the downstream water quantity and pattern will be impacted, comparing conditions before and after the project, and indicating the change in timing and quantifying the magnitude of the impact.

c. Explain mitigation measures to address the potential regional effects.

Response:

a. Please refer to the response to SIR#1 Question 4 (b), which provides a comparison of streamflow and timing downstream of the project, under the Base case Scenario and the Expansion Scenario. All modelling analyses assume that the provincial water allocation system remains the same as it is today under the *Water Act*.

b. Please refer to the response to SIR#1 Question 4 (b), which provides a comparison of streamflow and timing downstream of the project, under the Base case Scenario and the Expansion Scenario.

c. The adaptive approach to water management decision-making used every year is seen as the best way to mitigate potential regional effects from the Chin Reservoir Expansion Project. This approach to water management decisions is described in detail in Appendix 2.1.

   Regional effects are mitigated through this approach because the additional water storage capacity of the Chin Reservoir is only filled if water supply is available (as determined by AGI), and the increased water demand of the additional irrigated acres is reduced when the farm gate allocation is decided, which is also based on the water supply available (as determined by AGI). The water supply availability to the SMRID is determined after accounting for all the existing water users and therefore effectively manages impacts to other water users in the basin.

Question 151

Reference:

Volume 2, Section 2.2.3.2, Page 30 and 31

Rationale/Preamble:

Information Request:

a. Explain the difference in timing and magnitude of potential regional effects on in-stream flow needs and water conservation objectives, including impacts on the three headwater watersheds and Oldman and South Saskatchewan Rivers mainstem downstream of the diversion to the project, and comparing conditions before and after the Project. Provide evidence to support these findings.

b. Explain the difference in timing and magnitude of potential regional effects on other surface water users, including impacts on the three headwater watersheds and Oldman and South Saskatchewan Rivers mainstem downstream of the diversion to the Project, comparing conditions before and after the Project. Provide evidence to support these findings.

c. Explain mitigation measures to address the potential regional effects.

Response:

a. Model simulations are used to estimate the difference and magnitude of change for low flow conditions relative to the WCO in the Belly River, Waterton River, St. Mary River, Oldman River, and the South Saskatchewan River.

   Potential changes from the Chin Reservoir Expansion Project were assessed by comparing two scenarios: the Base case Scenario, representing the current system, and the Expansion Scenario, which includes 127,650 dam^3 (103,500 ac-ft) of additional storage in the Chin Reservoir and 46,500 additional irrigated acres.

   Headwater Watersheds (Belly River, Waterton River and St. Mary River)

   The SOAP Model represents the simplified operations of the AGI reservoirs, conveyance canal network, the SMRID irrigation network, and SMRID-owned and operated reservoirs. It incorporates current operating rules, instream objectives, and infrastructure design. While the model uses historical inflow data from 1928 to 2009, it applies present-day operational conditions. As a result, the modelled outputs do not match historical observations; instead, they reflect how the current system would have performed under past hydrologic conditions.

   The SOAP Model was developed from the original SSROM with the objective of evaluating SMRID internal operations. The SOAP Model was intentionally limited to operations that have minimal impact to downstream flows. Further details on the SSROM and the SOAP Model are found in Appendix 4.1. One of the assumptions of the SOAP Model is that flows downstream of the Waterton and St. Mary Reservoirs are consistent with SSROM (the larger, watershed scale

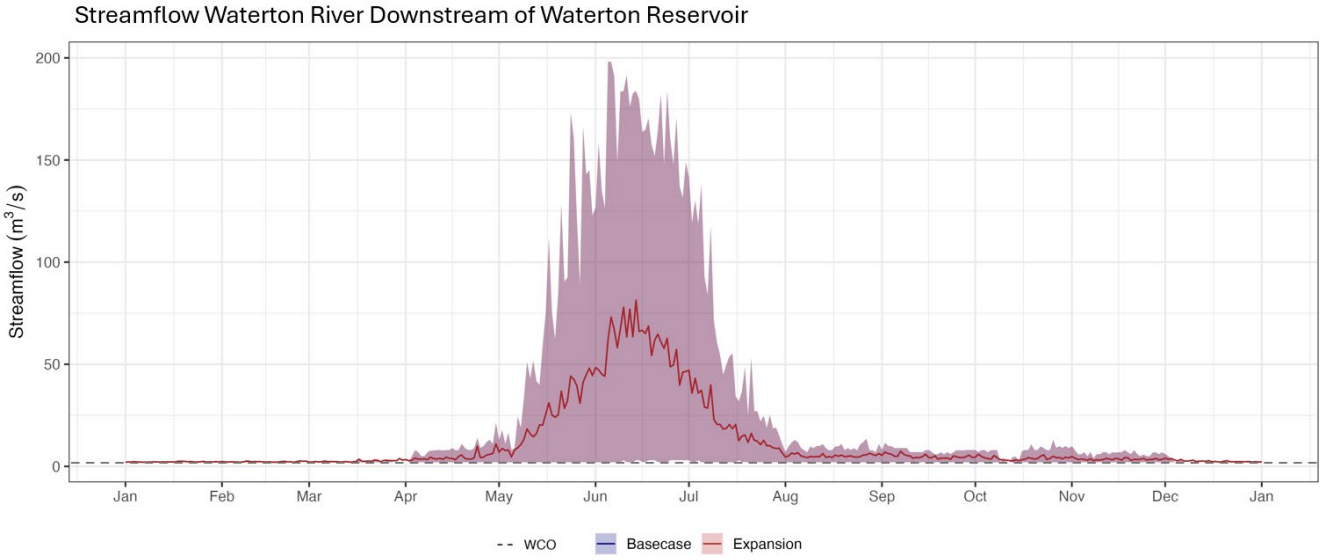
model). Timeseries from the SSROM Base case were used as an input to the SOAP Model for the Waterton and St. Mary Rivers and the SOAP Model aimed to always match that timeseries.

A primary objective in the SSROM is to maintain minimum flow requirements in the Southern Tributaries system. The WCOs are set at 2.27 m^3/s for the Waterton River, 2.75 m^3/s for the St. Mary River, and 0.93 m^3/s for the Belly River (Government of Alberta 2006). Maintaining these flows is a high priority and the models are designed to uphold them whenever possible. The SOAP Model carries the modeled flows from SSROM into its smaller geographic scope and then does its best to match those flows.

Figures 151.1 and 151.2 illustrate the SOAP Model simulations of the Waterton and St. Mary Rivers streamflow and flow ranges, downstream of their respective reservoirs under the Base case Scenario and the Expansion Scenario. As noted, the minimum flows in the rivers are preserved in the Model by drawing on storage in the Waterton Reservoir and the St. Mary Reservoir, which are operated by AGI. The major consequences to the basin are thus limited to storage differentials in the Waterton Reservoir and the St. Mary Reservoir. Under actual operation AGI would be responsible for allocating impacts in the basin between storage and instream flows.

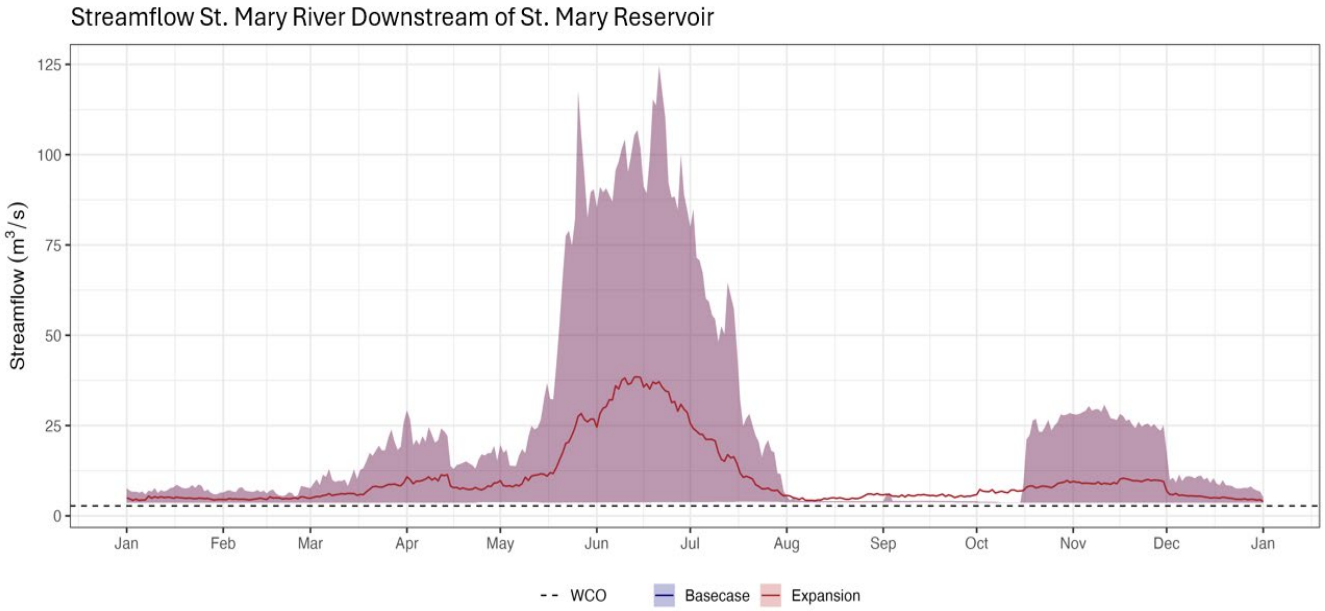
Both figures indicate that there is no impact or change to the average streamflow or flow ranges due to the Chin Reservoir Expansion Project.

Figure 151.1 Hydrograph comparing SOAP-simulated annual flows for Waterton River under the Base case Scenario and Expansion Scenario



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

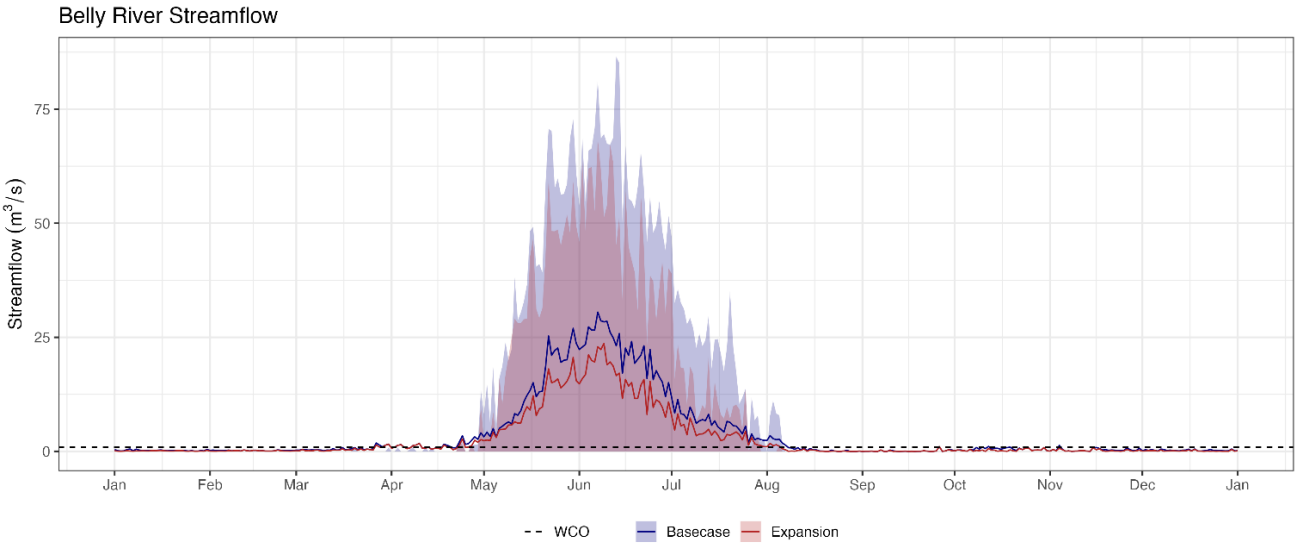
Figure 151.2 Hydrograph comparing SOAP-simulated annual flows for St. Mary River under the Base case Scenario and Expansion Scenario



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

Figure 151.3 shows the Belly River average streamflow and flow range under the Base case Scenario and the Expansion Scenario. The average streamflow decreases under the Expansion Scenario between mid-May and the end of July (the red line is below the blue line) with flows ranging from 0.1 m^3/s to 6.5 m^3/s less. The average streamflow stays the same in the month of April, is slightly lower in early May, and minimum flows stay the same between mid-August through to April of the next year. Note that the SOAP Model does not lock the Belly River flows to SSROM output, so these impacts are consistent with the reoperation of the canal to meet an Expanded Chin Reservoir scenario. As expected, most effects are seen during the irrigation season but do not approach the WCO except in early August.

Figure 151.3 Hydrograph comparing SOAP-simulated annual flows for the Belly River under the Base case Scenario and the Expansion Scenario



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

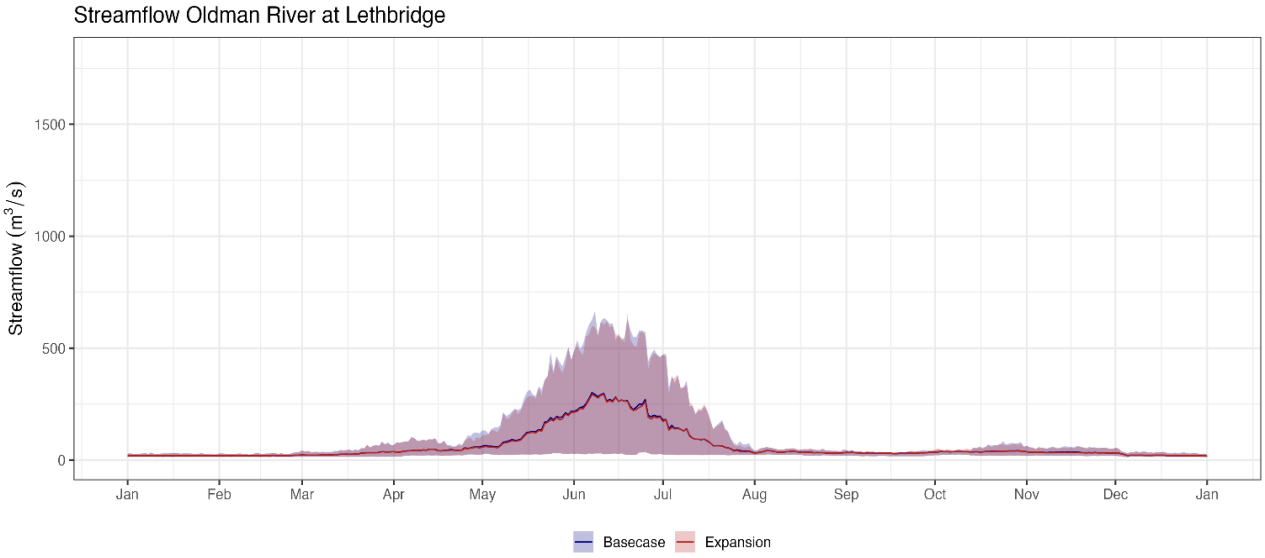
Oldman River and South Saskatchewan River

SIR#1 Question 151 has also asked for information regarding the impacts on the Oldman and South Saskatchewan Rivers mainstem, which are downstream of the diversion to the Project. These locations are outside the RSA and outside the scope of the SOAP Model. Results from a parallel analysis performed in the SSROM are provided as shown in Figures 151.4 and 151.5. The SSROM does not model the SMRID system as precisely as the SOAP Model, so these figures should be viewed as representative of the same changes but not identical to SOAP results.

The WCOs for the Oldman River mainstem and the South Saskatchewan River mainstem are not defined by a single flow value; rather they are expressed relative to the natural flow and incorporate additional considerations, such as the habitat fish rule curve. The WCOs in these two rivers are not currently maintained by operations and river management due to factors such as the number of existing water licences that are not subject to the WCO. Therefore, violations of the WCOs are allowed to occur in model simulations, which are consistent with real-world experience.

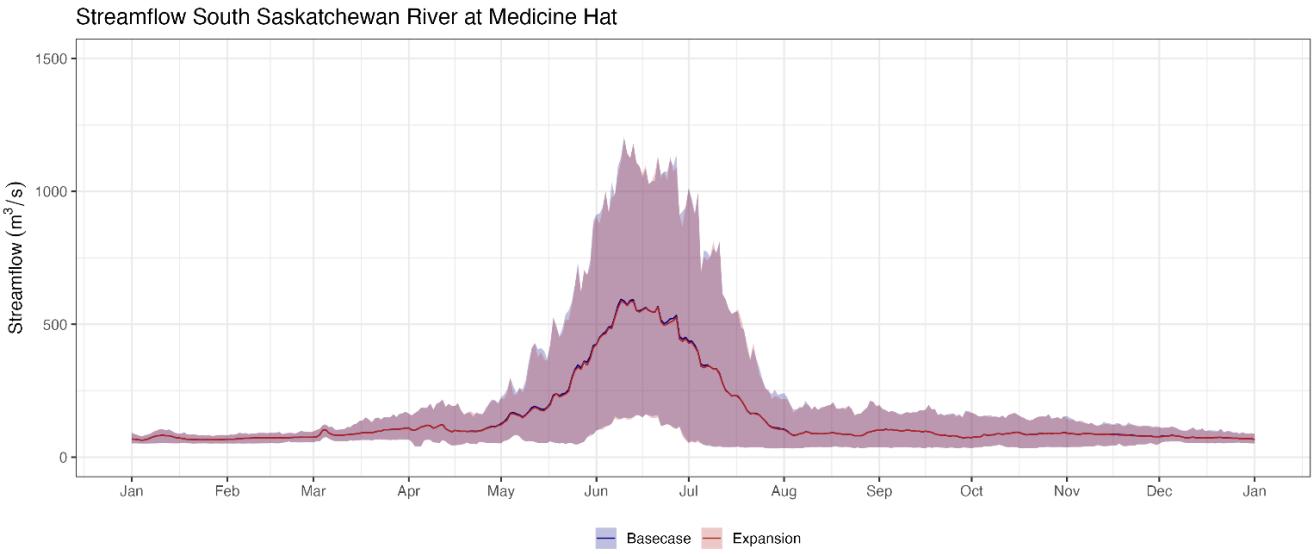
Figures 151.4 and 151.5 illustrate the SSROM simulations of the Oldman River and South Saskatchewan River streamflow and flow ranges, respectively, under the Base case Scenario and the Expansion Scenario. There are no changes to timing and magnitude shown and therefore there is limited to no impact on the WCOs of both rivers due to the Chin Reservoir Expansion Project.

Figure 151.4 Hydrograph comparing SSROM-simulated annual flows for Oldman River under the Base case Scenario and Expansion Scenario



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

Figure 151.5 Hydrograph comparing SSROM-simulated annual flows range for South Saskatchewan River under the Base case Scenario and Expansion Scenario



Notes: Solid lines represent the average flow, and shaded areas indicate the range of flow throughout the year. The Expansion Scenario is shown in red and the Base case Scenario is shown in blue. Where no blue is visible it is because the red is overlying it.

b. The storage in the St. Mary and Waterton Reservoirs are the parameter of interest for assessing potential regional effects because the storage and operations of these two reservoirs are what other water users rely on. Please see the response to SIR#1 Question 98 for a discussion of the modelled impacts to storage in the Waterton and St. Mary Reservoirs.

c. Please refer to the response to SIR#1 Question 150 (c).

Question 152

Reference:

Volume 2, Section 2.2.6, Page 32;
Volume 5, Section 11 [B]

Rationale/Preamble:

The final Terms of Reference states *Describe SMRID's current and proposed monitoring programs, including:*

- *a) how the monitoring programs will assess any project impacts and measure the effectiveness of mitigation plans. Discuss how SMRID will address any project impacts identified through the monitoring program;*
- *b) how SMRID will contribute to current and proposed regional monitoring programs;*
- *c) monitoring performed in conjunction with other stakeholders, including Indigenous communities and groups;*
- *d) new monitoring initiatives that may be required as a result of the Project;*
- *e) regional monitoring that will be undertaken to assist in managing environmental effects and improve environmental protection strategies;*
- *f) how monitoring data will be disseminated to the public, Indigenous communities, or other interested parties; and*
- *g) how the results of monitoring programs and publicly available monitoring information will be integrated with SMRID's environmental management system.*

SMRID states *Monitoring requirements related to hydrology have not been identified.*

Information Request:

a. Provide justification as to why a monitoring plan has not been identified.

b. When will the monitoring plan will be prepared, and how will it be submitted to EPA for review?

c. If a monitoring plan has been prepared, provide the plan.

Response:

a. Specifically relating to the potential for effects on hydrology, Chin Reservoir is a component of an irrigation water distribution system that is carefully managed to serve the requirements of the irrigation district. Water management within the system is continuously monitored during operation, from the AGI-managed headworks through SMRID's distribution system. The collaborative nature of this operation is described in more detail in Appendix 2.1. The adaptive approach to water management decision-making used every year is seen as the best way to mitigate potential regional effects from the Chin Reservoir Expansion Project. The additional water storage capacity of the Chin Reservoir is only filled if water supply is available (as determined by AGI), and the increased water demand of the additional irrigated acres is reduced when the farm gate allocation is decided, which is also based on the water supply

available (as determined by AGI). The water supply availability to the SMRID is determined after accounting for all the existing water users and therefore effectively manages impacts to other water users in the basin.

b. The technical memorandum titled *Adaptive Water Management and Operations within the Southern Tributaries* is provided in Appendix 2.1. As described in the response to SIR#1 Question 152 (a), a monitoring plan is not proposed because the irrigation system is operated through collaboration with AGI and an adaptive management system.

c. A monitoring plan has not been prepared.

Question 153

Reference:

Volume 4-1, Section 2.1.2, Figure 2.1, Page 5

Rationale/Preamble:

Figure 2.1 is mentioned in Section 2.1.2, but it is not provided in Volume 4-1 TBR. The Figure 2.1 citation is linked to the monthly temperature graph.

Information Request:

a. Provide the correct Figure 2.1.

Response:

a. Figure 2.1 referenced in Volume 4-1, Section 2.1.2, Page 5 was not provided, in error, and the in-text reference was linked to an incorrect figure. The missing Figure 2.1 is provided in the response to SIR#1 Question 140 as Figure 140.1.

Question 154

Reference:

Volume 4-1, Section 2.2, Page 6

Rationale/Preamble:

SMRID states that *Nearby Environment Climate Change Canada (ECCC) climate stations were identified..*

Information Request:

a. Provide a map showing the spatial distribution of ECCC stations and the Chin Reservoir.

Response:

a. Please refer to Figure 2.2 provided in the response to SIR#1 Question 2 (a) to show the spatial distribution of ECCC stations in relation to Chin Reservoir. The details of the nearby ECCC climate stations in the RSA with 30 or more years of record and with 30-years climate normal data are presented in Table 2.2 in Volume 4-1, Section 2.2, Page 6.

Question 155

Reference:

Volume 4-1, Section 2.2, Table 2.2, Page 6

Rationale/Preamble:

Table 2.2 shows two climate normal periods: 1971-2000 and 1981-2010.

Information Request:

a. Explain why the two climate periods were not provided for all of the stations.

Response:

a. Table 2.2 in Volume 4-1, Section 2.2, Page 6 presents a summary of available ECCC climate normal data. Table 2.2 does not present 1971-2000 climate normal data for Vauxhall and Warner West as it was not available in ECCC climate normal database.

Question 156

Reference:

Volume 4-1, Section 2.2.1, Page 6

Rationale/Preamble:

SMRID states that *The comparison of 1971-2000 and 1981-2010 climate normal data shows that the low winter temperatures increase, with the mean monthly temperature between 5°C and -9°C.*

Information Request:

a. Explain why a trend detection method wasn't used to detect temperature change between the two climate time periods.

Response:

a. The objective of Section 2.2.1 was to summarize available temperature data to establish baseline temperature of the LSA and RSA. ECCC 30-year climate normal reports (1971-2000 and 1981-2010) were used to provide average monthly and annual temperature summary. The comparison of two climate normal reports is not intended to indicate a trend nor a statistical significance between the two climate normal reports. The projected changes in hydroclimatic conditions are presented in Section 4.4 of the WaterSMART report entitled *Hydrological Modelling to Evaluate Changes in Streamflow Availability in the St. Mary River Watershed* (WaterSMART 2023). The WaterSMART (2023) report is provided as Appendix 1.2 of this SIR#1 Response Document.

Question 157

Reference:

Volume 4-1, Section 2.2.2, Table 2.3, Page 8

Rationale/Preamble:

SMRID states that *The comparison of 1971-2000 and 1981-2010 annual precipitation shows that the average annual precipitation remains similar (+/- 5%) between the two 30-year periods.*

Information Request:

a. Explain why a trend detection method wasn't used to detect precipitation change between the two climate time periods.

Response:

a. The objective of Section 2.2.2 was to summarize available precipitation data to establish baseline temperature of the LSA and RSA. ECCC 30-year climate normal reports (1971-2000 and 1981-2010) were used to provide average monthly and annual precipitation summary. The comparison of two climate normal reports is not intended to indicate a trend nor a statistical significance between two climate normal reports. The projected changes in hydroclimatic conditions are presented in Section 4.4 of the WaterSMART report entitled *Hydrological Modelling to Evaluate Changes in Streamflow Availability in the St. Mary River Watershed* (WaterSMART 2023). The WaterSMART (2023) report is provided as Appendix 1.2 of this SIR#1 Response Document.

Question 158

Reference:

Volume 4-1, Section 2.2.2, Figure 2.5 and 2.6, Page 9 and 10

Rationale/Preamble:

SMRID states that *The comparison of 1971-2000 and 1981-2010 climate normal data shows that the June precipitation increased in 1981-2010 (June precipitation exceeding 60 mm) compared to the previous 30-year estimate.*

Information Request:

a. Explain how this conclusion was reached based on Figure 2.5 and Figure 2.6.

b. Provide evidence to support how this conclusion was reached based on Figure 2.5 and Figure 2.6.

c. Include a figure that shows the difference between 1971-2000 and 1981-2010.

Response:

a. The statement is based on comparison of average June precipitation depth shown on Figure 2.5 (1971-2000 climate normal) and Figure 2.6 (1981-2000 climate normal) found within Volume 4-1, Section 2.2.2 of the EIA submission.

b. Figure 2.5 shows that 1971-2000 average June precipitation depth is approximately 60 mm across five available climate stations. Additional ECCC climate stations were available for 1981-2000 period and Figure 2.6 presents average monthly precipitation for seven ECCC stations. Figure 2.6 shows that all seven stations reported average June precipitation exceeding 60 mm, with Warner West station reporting average precipitation exceeding 100 mm. Five stations shown on Figure 2.5 also showed increases in June precipitation.

c. The information shown on Figures 2.5 and 2.6, demonstrate the difference in average monthly precipitation graphically. There is no trend or statistical significance to be shown here.

Question 159

Reference:

Volume 4-1, Section 2.3, Table 2.5, Page 11

Rationale/Preamble:

Table 2.5 suggests that there will be no runoff generated, therefore the reservoir will be recharged solely by diverting from St. Mary Reservoir. Throughout most of the year, the Chin Reservoir catchment area does not have enough water to meet existing demand.

Information Request:

a. Explain where water for the Chin Reservoir Expansion would come from.

b. Explain how demand for water would be met in instances where St. Mary's Reservoir is low.

Response:

a. Water supply for the Chin Expansion Project is sourced from the headworks, supplied by the Waterton and St. Mary Reservoirs. The water flow through this system is described in detail in the *Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum* provided in Appendix 2.1.

b. The Chin Reservoir Expansion will not be filled to the design level in instances where St. Mary Reservoir is low. The demand for water would be adjusted through advanced planning and coordination with AGI to ensure that the natural water supply in not exceeded by demand.

   For a detailed description of how water demand is met in times of limited water supply, please refer to the *Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum* provided in Appendix 2.1.

Question 160

Reference:

Volume 4-1, Section 3.1.2, Page 17

Rationale/Preamble:

Despite being titled *Chin Reservoir and Stafford Reservoir Water Balance* this section only considers inflow and outflow which is not a complete water balance analysis.

Information Request:

a. Provide a complete water balance analysis (1994– 2023) showing past and projected balances for the Chin Reservoir and Stafford Reservoir.

Response:

a. The Chin Reservoir and the Stafford Reservoir are directly connected to each other and therefore the water balance is discussed jointly. The water balance discussed for the years 1994 to 2023 is based on actual data collected by the SMRID for the existing Chin Reservoir and the Stafford Reservoir.

   Table 5.2 provides the data for a macro-level water balance, including the total annual volume in cubic decameters flowing into Chin Reservoir from the Main Canal, the volume flowing out of Stafford Reservoir to the Main Canal, the start of season storage, and the end of season storage in both reservoirs. This data is from the SMRID measurement stations.

Table 160.1 Total annual inflows and outflows and storage at the start and end of the season for the Chin and the Stafford Reservoirs by operational season

Year	Flow into Chin Reservoir (dam^3)	Flow out of Stafford (dam^3)	Storage in Chin at start of season (dam^3)	Storage in Stafford at start of season (dam^3)	Storage in Chin at end of season (dam^3)	Storage in Stafford at end of season (dam^3)
1994	232,399	213,480	98,876	13,445	159,557	10,953
1995	210,388	242,810	149,166	19,292	150,962	11,397
1996	244,357	265,143	151,411	13,494	187,567	12,226
1997	220,980	259,569	182,931	21,142	176,004	12,707
1998	206,947	239,883	174,628	12,868	176,924	11,013
1999	200,758	236,281	173,251	10,717	179,692	11,906
2000	216,835	297,585	176,873	11,891	88,940	12,538
2001	148,881	217,991	87,521	13,785	22,308	7,960
2002	263,624	211,198	22,308	7,960	179,227	10,518
2003	169,122	207,683	179,147	10,647	136,063	9,218
2004	190,299	176,364	136,133	8,359	177,705	11,036
2005	165,028	180,811	175,698	12,536	181,540	11,460
2006	170,659	216,575	180,788	13,485	166,690	11,412
2007	190,929	232,013	165,168	11,698	127,265	11,412
2008	195,770	183,969	124,743	10,934	184,318	12,323
2009	184,251	228,268	183,856	12,429	154,721	10,934
2010	118,632	138,955	156,077	12,429	171,874	11,078
2011	139,598	186,506	180,788	15,507	151,834	11,173
2012	159,182	206,109	148,717	11,746	140,211	10,409
2013	163,957	188,287	139,913	10,839	151,693	11,173
2014	161,323	201,446	153,245	12,536	158,044	10,696
2015	208,886	246,001	159,859	11,698	155,624	10,696
2016	168,342	190,124	153,819	10,361	167,907	10,552
2017	226,017	281,984	168,059	10,934	133,255	11,221
2018	223,673	244,885	138,276	16,830	170,871	8,571
2019	231,549	262,083	170,440	10,320	148,866	10,115
2020	205,156	226,296	153,104	10,197	156,833	10,505
2021	231,574	280,611	156,379	10,361	137,238	9,128
2022	263,837	324,595	135,758	8,571	153,386	10,934
2023	192,148	276,123	151,261	12,323	71,585	10,887

Question 161

Reference:

Volume 5, Section 3, 3.3.1 [B]

Rationale/Preamble:

No inventory of licensed water users was included for either the RSA or the LSA.

The final Terms of Reference states *Provide an inventory of surface water users who have existing approvals, permits or licenses in the local and regional study areas, including traditional agricultural and household users*.

Information Request:

a. Provide an inventory of surface water users who have existing approvals, permits or licenses in the local and regional study areas, including traditional agricultural and household users.

Response:

a. An inventory of surface water users was provided in Table 2.1 of the Surface Water Quality TBR (Volume 4-2). This information is presented again below.

   A desktop review of existing information was conducted to identify existing approvals, permits or licence in the Study Areas and to characterize the surface water quality and sediment. The Alberta Water Licence Viewer (GoA 2023c) was queried to identify surface water licences in the LSA and RSA. A summary of the water licences is provided in Table 161.1.

Table 161.1 Summary of Surface Water Licences

Approval ID	Priority	Location	Source	Volume (m^3)	Purpose
231778	2006-06-16-002	SE-30-009-21-4	Oldman River	5150	Other Purpose Specified by the Director
31608	1992-09-29-007	SW-03-011-11-4	Cherry Coulee	9860	Water Management
465023	1992-05-19-001	NE-22-010-18-4	Oldman River	10597.5	Government Holdback
465022	2001-08-16-003	NE-22-010-18-4	Oldman River	12301	Government Holdback
465021	2003-01-14-003	NW-23-010-18-4	Oldman River	6914	Government Holdback
465020	2000-03-31-001	NE-22-010-18-4	Oldman River	38484	Government Holdback
465018	1974-07-15-001	NE-22-010-18-4	Oldman River	12118	Government Holdback
465017	2001-08-02-001	NE-22-010-18-4	Oldman River	6914	Government Holdback
391131	1992-05-19-001	NE-22-010-18-4	Oldman River	11775	Government Holdback
391130	2001-08-16-003	NE-22-010-18-4	Oldman River	13668	Government Holdback
376923	1992-05-19-001	NE-22-010-18-4	Oldman River	105975	Irrigation
188484	2002-10-17-001	NE-22-010-18-4	Oldman River	290123.46	Irrigation
78836	1998-01-20-002	SW-15-012-10-4	Tributary to South Saskatchewan River	64170	Irrigation
74550	1937-06-08-001	NW-28-011-05-4	Bullshead Creek	74040	Irrigation
44804	1926-06-15-001	SW-06-010-07-4	Seven Persons Creek	260260	Irrigation
44321	1935-10-07-010	SW-04-010-08-4	Thirty Mile Coulee	55510	Irrigation
43596	1937-09-08-001	SE-09-010-08-4	Whitla Coulee	175150	Irrigation
43595	1985-08-22-003	NE-09-010-08-4	Whitla Coulee	0	Irrigation
43347	1937-12-28-002	NE-07-008-11-4	Tributary to Forty Mile Coulee	123350	Irrigation
43171	1977-01-24-007	NE-34-008-11-4	Tributary to Forty Mile Coulee	123340	Irrigation
42483	1941-06-26-001	NW-33-010-07-4	Seven Persons Creek	986790	Irrigation
41792	1944-10-03-001	NW-08-008-11-4	Tributary to Forty Mile Coulee	22210	Irrigation
40705	1950-11-20-001	NE-26-012-07-4	Tributary to South Saskatchewan River	14800	Irrigation
40370	1954-10-25-002	NW-24-012-10-4	Tributary to South Saskatchewan River	37000	Irrigation
40351	1954-12-17-001	NE-08-010-07-4	Tributary to Seven Persons Creek	40700	Irrigation
39917	1958-10-14-004	SW-19-012-09-4	Tributary to South Saskatchewan River	24670	Irrigation
38634	1963-04-29-002	NW-19-011-06-4	Seven Persons Creek	16040	Irrigation
37895	1966-03-02-001	SE-15-008-11-4	Tributary to Forty Mile Coulee	53040	Irrigation
37546	1967-07-02-001	NE-10-008-11-4	Tributary to Forty Mile Coulee	61670	Irrigation
36106	1972-05-26-001	NE-17-008-15-4	Tributary to Oldman River	117920	Irrigation
35763	1971-07-22-001	NW-20-011-06-4	Seven Persons Creek	74010	Irrigation
34607	1975-09-23-002	NE-14-008-14-4	Tributary to Chin Coulee	44400	Irrigation

Approval ID	Priority	Location	Source	Volume (m^3)	Purpose
34212	1975-02-19-007	NE-24-011-07-4	Seven Persons Creek	83880	Irrigation
33788	1976-02-27-001	NW-14-008-14-4	Tributary to Forty Mile Coulee	3700	Irrigation
33431	1976-09-14-001	NW-29-011-06-4	Seven Persons Creek	14800	Irrigation
31645	1980-01-08-004	NW-26-009-08-4	Tributary to Seven Persons Creek	43170	Irrigation
30779	1983-04-11-006	NW-36-011-09-4	Tributary to South Saskatchewan River	7400	Irrigation
28915	1986-12-22-002	SE-29-012-07-4	Tributary to South Saskatchewan River	6170	Irrigation
28275	1988-07-18-004	NW-23-012-07-4	Tributary to Seven Persons Creek	6173	Recreation
43104	1938-08-12-002	NE-02-011-08-4	Tributary to Stornham Coulee	2460	Agricultural
78379	1999-11-22-001	NE-22-012-07-4	Seven Persons Coulee	987	Agricultural
68448	1998-04-09-005	SE-01-011-08-4	Seven Persons Creek	3700	Agricultural
44852	1958-12-15-003	NW-07-011-06-4	Tributary to Seven Persons Creek	1240	Agricultural
44650	1963-06-18-001	SE-33-011-06-4	Seven Persons Creek	6160	Agricultural
44521	1934-10-04-001	NW-01-011-10-4	Tributary to South Saskatchewan River	19730	Agricultural
44487	1935-06-28-003	SW-34-010-08-4	Tributary to Stornham Coulee	1240	Agricultural
44481	1935-07-08-003	SE-01-012-07-4	Tributary to Seven Persons Creek	2460	Agricultural
44467	1935-07-22-002	NE-03-011-08-4	Tributary to Stornham Coulee	3700	Agricultural
44425	1935-08-23-006	SE-31-011-08-4	Tributary to Rattlesnake Lake	30830	Agricultural
44361	1935-10-03-001	SW-13-012-08-4	Tributary to Rattlesnake Lake	1240	Agricultural
44107	1936-08-11-001	SW-15-012-08-4	Tributary to South Saskatchewan River	2460	Agricultural
44037	1936-10-10-001	NE-05-012-07-4	Tributary to Seven Persons Creek	2460	Agricultural
43944	1936-12-02-001	NE-27-009-11-4	Tributary to Yellow Lake	4930	Agricultural
43811	1937-05-04-001	SW-10-012-06-4	Tributary to Seven Persons Creek	1240	Agricultural
43789	1937-05-28-002	NE-04-012-06-4	Tributary to Seven Persons Creek	4930	Agricultural
43703	1937-07-07-002	NW-32-009-07-4	Tributary to Murray Lake	60440	Agricultural
43697	1937-07-13-002	SE-01-011-10-4	Tributary to South Saskatchewan River	12330	Agricultural
43388	1938-06-29-002	SW-01-012-07-4	Tributary to Seven Persons Creek	6160	Agricultural
43344	1938-10-31-001	NE-09-012-06-4	Tributary to Seven Persons Creek	3700	Agricultural
43290	1941-10-27-002	NW-16-012-07-4	Tributary to Seven Persons Creek	2460	Agricultural
43274	1938-03-19-001	SE-03-012-08-4	Tributary to Rattlesnake Lake	1240	Agricultural
43150	1938-07-23-001	NE-26-007-17-4	Tributary to Chin Lakes	2460	Agricultural
43104	1982-02-04-001	NE-02-011-08-4	Tributary to Stornham Coulee	11100	Agricultural
43091	1938-08-29-002	NW-10-010-10-4	Tributary to Cherry Coulee	2460	Agricultural
43082	1955-10-03-001	SE-18-008-11-4	Tributary to Forty Mile Coulee	1240	Agricultural
43052	1943-02-04-001	SW-34-008-15-4	Tributary to Oldman River	12330	Agricultural

Approval ID	Priority	Location	Source	Volume (m^3)	Purpose
42994	1974-09-17-001	NE-34-012-07-4	Tributary to South Saskatchewan River	4930	Agricultural
42923	1939-05-22-001	SW-32-011-07-4	Tributary to Seven Persons Creek	4930	Agricultural
42922	1939-05-22-002	NE-09-010-07-4	Tributary to Seven Persons Creek	1240	Agricultural
42893	1939-07-06-001	SE-35-012-07-4	Tributary to South Saskatchewan River	3700	Agricultural
42883	1939-06-15-001	NW-20-011-05-4	Tributary to Bullshead Creek	2460	Agricultural
42854	1939-08-10-001	NW-24-008-11-4	Tributary to Forty Mile Coulee	6160	Agricultural
42678	1939-11-23-002	SE-10-010-08-4	Tributary to Whitla Coulee	2460	Agricultural
42411	1941-09-12-004	NE-29-012-06-4	Tributary to Seven Persons Creek	3699.13	Agricultural
42386	1941-10-20-001	NW-13-008-14-4	Tributary to Forty Mile Coulee	8630	Agricultural
42346	1941-12-05-002	SW-30-011-07-4	Tributary to Seven Persons Creek	1240	Agricultural
42336	1942-02-10-001	SW-15-010-10-4	Tributary to Cherry Coulee	2460	Agricultural
42282	1942-06-12-001	SE-08-012-07-4	Tributary to Seven Persons Creek	6160	Agricultural
42236	1942-08-28-001	NW-33-008-16-4	Tributary to Taber Lake	1240	Agricultural
42228	1943-10-25-001	NW-32-011-06-4	Tributary to Seven Persons Creek	7400	Agricultural
42042	1943-12-11-001	NW-33-011-07-4	Tributary to Seven Persons Creek	4930	Agricultural
42032	1943-12-20-002	SW-17-010-08-4	Tributary to Whitla Coulee	3700	Agricultural
41963	1944-06-10-001	NE-06-012-07-4	Tributary to Seven Persons Creek	7400	Agricultural
41772	1944-11-22-001	SW-11-011-07-4	Tributary to Seven Persons Creek	12330	Agricultural
41620	1947-07-05-001	NW-22-008-11-4	Tributary to Forty Mile Coulee	2460	Agricultural
41512	1946-04-23-002	SE-04-011-07-4	Seven Persons Creek	16030	Agricultural
40956	1949-09-23-001	SW-20-012-07-4	Tributary to South Saskatchewan River	3700	Agricultural
40936	1950-01-18-003	NE-30-012-06-4	Tributary to Seven Persons Creek	6160	Agricultural
40847	1950-05-30-002	NW-10-012-08-4	Tributary to South Saskatchewan River	2460	Agricultural
40844	1950-06-02-002	SW-36-012-07-4	Tributary to South Saskatchewan River	3700	Agricultural
40811	1950-07-22-001	NE-18-012-07-4	Tributary to South Saskatchewan River	6160	Agricultural
40560	1952-11-24-001	NW-05-011-06-4	Tributary to Seven Persons Creek	3700	Agricultural
40536	1953-11-25-001	NE-14-012-07-4	Tributary to Seven Persons Creek	4930	Agricultural
40457	1953-11-30-001	NE-22-009-13-4	Tributary to Yellow Lake	2460	Agricultural
40374	1954-10-20-001	NW-10-011-11-4	Tributary to South Saskatchewan River	1240	Agricultural
40044	1958-01-10-001	NW-07-012-07-4	Tributary to Rattlesnake Lake	9860	Agricultural
40026	1958-03-12-001	NE-31-009-12-4	Tributary to Yellow Lake	2460	Agricultural
39977	1958-08-11-001	NE-10-011-07-4	Tributary to Seven Persons Creek	2460	Agricultural
39793	1959-08-25-001	SE-13-007-15-4	Tributary to Chin Coulee	3700	Agricultural
39750	1959-11-09-001	NE-06-009-11-4	Tributary to Forty Mile Coulee	6160	Agricultural

Approval ID	Priority	Location	Source	Volume (m^3)	Purpose
39725	1959-10-16-001	SE-36-011-07-4	Tributary to Seven Persons Creek	4930	Agricultural
39718	1959-11-25-001	SW-28-012-06-4	Tributary to Seven Persons Creek	4930	Agricultural
39695	1959-11-13-001	NE-03-011-06-4	Tributary to Seven Persons Creek	4930	Agricultural
39405	1961-06-07-002	NW-29-012-06-4	Tributary to Seven Persons Creek	4930	Agricultural
39362	1961-08-02-002	SE-32-012-06-4	Tributary to South Saskatchewan River	2460	Agricultural
39157	1962-03-07-002	SE-13-012-07-4	Tributary to Seven Persons Creek	1240	Agricultural
38554	1963-06-24-001	NE-10-007-15-4	Tributary to Chin Coulee	13560	Agricultural
38478	1963-08-19-001	SE-21-010-08-4	Tributary to Murray Lake	6160	Agricultural
37972	1965-09-23-004	SE-07-012-06-4	Tributary to Seven Persons Creek	1240	Agricultural
37945	1965-11-30-002	NW-19-009-07-4	Tributary to Seven Persons Creek	2460	Agricultural
37419	1969-05-08-001	NW-20-011-06-4	Tributary to Seven Persons Creek	8630	Agricultural
37413	1968-11-29-001	SW-34-011-06-4	Tributary to Seven Persons Creek	4930	Agricultural
36798	1971-01-18-001	NW-22-010-10-4	Tributary to Cherry Coulee	1240	Agricultural
36617	1971-08-17-001	SE-03-013-07-4	Tributary to South Saskatchewan River	3700	Agricultural
34839	1974-01-17-003	SE-17-011-14-4	Tributary to Oldman River	1240	Agricultural
34518	1974-06-06-002	SE-10-011-08-4	Tributary to Stornham Coulee	3700	Agricultural
34410	1974-08-22-001	NW-28-012-07-4	Tributary to South Saskatchewan River	3700	Agricultural
34146	1975-03-17-002	SE-30-011-06-4	Tributary to Seven Persons Creek	3700	Agricultural
31073	1982-04-20-016	05-15-008-21-4	Tributary to Oldman River	2460	Agricultural
30996	1935-07-22-003	NW-34-010-08-4	Tributary to Stornham Coulee	3700	Agricultural
30911	1982-10-01-002	SW-33-008-15-4	Tributary to Horsefly Lake	18500	Agricultural
30784	1983-04-12-009	NW-36-012-07-4	Tributary to South Saskatchewan River	1240	Agricultural
28841	1987-02-05-003	SW-17-011-06-4	Tributary to Seven Persons Creek	2460	Agricultural
28626	1987-10-08-003	NW-22-008-11-4	Tributary to Forty Mile Coulee	2460	Agricultural
28323	1988-05-26-010	SE-26-010-20-4	Tributary to Oldman River	1240	Agricultural
28275	1988-07-18-004	NW-23-012-07-4	Tributary to Seven Persons Creek	7400	Agricultural
26596	1990-12-03-009	NW-36-012-07-4	Tributary to South Saskatchewan River	3690	Agricultural
26234	1991-04-03-003	NE-19-011-07-4	Tributary to Seven Persons Creek	4930	Agricultural
23630	1994-11-21-009	SW-08-011-16-4	Oldman River	1220	Agricultural
31606	1980-03-21-001	SE-28-012-07-4	Tributary to Seven Persons Creek	12330	Habitat Enhancement
29721	1985-03-27-004	SW-13-011-16-4	Tributary to Oldman River	7400	Habitat Enhancement

5.4 Surface Water Quality

Question 162

Reference:

Volume 2, Section 1.7, Page 10 and 11;
Volume 2, Section 2.3.5, Page 39

Rationale/Preamble:

Section 2.3.5 refers to Section 1.7 however, Section 1.7 does not seem to contain the information described. It seems to be an error.

Information Request:

a. Provide the correct section that discusses the methods and ranking used to assess residual effects on surface water quality.

Response:

a. Volume 2, Section 1.7 is the correct section. Table 1.2 in Volume 2, Section 1.7 includes a description of the classifications that were used to characterize all residual effects in terms of Direction, Magnitude, Geographic Extent, Duration, and Reversibility. Volume 2, Section 1.7 also describes the criteria used to determine the significance of residual effects.

Question 163

Reference:

Volume 2, Section 2.3.2.3, Page 34;
Volume 4-2

Rationale/Preamble:

The SMRID states that *Sediment in Chin Reservoir was found to be silty sand to silty clay with trace sand.*

Based on the context and description in Volume 4-2 TBR, the sediment quality is described only for the grab samples collected from the reservoir bed surface.

Information Request:

a. Provide an assessment for Total Suspended Solids (TSS) in waterbodies and the quality of suspended sediment.

Response:

a. Please refer to the *Sediment Modeling Technical Memorandum* (Appendix 163.1) for details. The same mass balance modeling approach was used, with additional terms incorporated into the model. In addition to inflows and outflows, erosion and settling processes were also included. The model results indicated a slight reduction in average TSS concentrations in the Project Case compared to the Base Case during reservoir operation following commissioning.

Question 164

Reference:

Volume 2, Section 2.3.6, Page 42

Rationale/Preamble:

The SMRID states that *an adaptive management plan is to be developed to monitor water quality parameters. SMRID will implement a detailed sampling schedule to track water quality parameters at various stages of the filling process.*

Information Request:

a. Explain why the adaptive management plan was not developed prior to the EIA being submitted. In addition, how will this plan be communicated to EPA so it can be reviewed?

b. If the adaptive management plan has been developed, provide the plan.

Response:

a. The Adaptive Management Plan was not available at the time that the EIA was submitted. Please refer to the *Adaptive Management Plan for Water Quality Technical Memorandum* included as Appendix 164.1, provided for EPA review.

b. The Adaptive Management Plan is provided in Appendix 164.1.

Question 165

Reference:

Volume 2, Section 2.3.2;
Volume 4-2, Section 2.2.4, 2.2.5, and 2.2.6;
Volume 4-2, Section 3.1;
Volume 4-2, Section 3.3, Figures 3.3–3.10;
Volume 4-2, Appendix I and II;
Volume 5, Section 3, 3.4.1 [A]

Rationale/Preamble:

The Final Terms of Reference states *Describe the baseline water quality of water courses and water bodies (current Chin Reservoir and downstream (natural or man-made) bodies of water).*

Only raw data was found in Appendix I and Appendix II for parameters listed in Sections 2.2.4, 2.2.5, and guideline exceedances in Section 2.2.6 of Volume 4-2 TBR, but actual descriptions of water quality were only provided for very select parameters in Section 3.3 (Figures 3.3 to 3.10) of Volume 4-2 TBR and Volume 2, Section 2.3.2.

A description should include additional parameters and an increased level of complexity in describing the results, but a sufficient description was not found for all parameters.

Volume 4-2 TBR Section 2.2.6.1 states *For guidelines related to the protection of irrigation where guidelines varied for crops and livestock, the appropriate guideline was based on the dominant agricultural practice in the RSA.*

Guideline comparisons should include the most sensitive crop grown in the RSA (not only on the dominant crop).

Volume 4-2 TBR, Section 3.1 states *Surface water quality was compared to the applicable guidelines for the PAL, irrigation and livestock and summarized in Appendix I: Tables I.1 to I.8 and Appendix II: Tables II.1 to II.3 for historic data*. Providing highlighted raw data for select guideline exceedances is not a description.

Identifying guideline exceedances with italics or underlining is difficult to see in the small font and thick cell bordering.

Information Request:

Answer the final Terms of Reference by:

a. Describing the baseline water quality that the raw data embodies for all parameters in the Appendix Tables using descriptive text and graphs.

b. Describing and summarizing guideline exceedances for all parameters that have guidelines and for all types of guidelines individually (Irrigation, livestock, recreation, protection of aquatic life,

etc.), for parameters that have multiple. Ensure that all guideline values for all parameters are included as some guidelines are missing in the current Appendix Tables.

c. Providing guideline comparisons to the most sensitive crop grown in the RSA (not only on the dominant crop).

d. Providing the Appendices in different highlighting (e.g. full cell fill coloring) to identify guideline exceedances (PAL (Acute, Chronic), Irrigation, Livestock etc.).

Response:

a. Additional detail is provided to describe the baseline water quality within Chin Reservoir, Stafford Reservoir, and Watercourse 126419 for metals, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, bacteria, organics and phenol, methylmercury, and pesticides. Updated tables for baseline surface water quality measurement are presented in Appendix 165.1. Historical water quality sampling at the sampling point within the SMRID Main Canal upstream from Chin Reservoir (SMW-P1) is described further, based on the sampling data presented in Appendix 165.2. Historical sampling data from within the SMRID system is discussed further in the response to SIR#1 Question 169.

   Appendices I and II of Volume 4-2, Water Quality TBR have been updated to include comparison to all noted guideline criteria and to address comments related to formatting. The updated tables for baseline surface water quality measurement within Chin Reservoir, Stafford Reservoir, and Watercourse 126419 are presented in Appendix 165.1. Historical water quality sampling data from within the SMRID system, both upstream and downstream of Chin Reservoir, is presented in updated tables in Appendix 165.2. Additional historical records of sampling within Chin and Stafford Reservoirs have also been added to Appendix 165.2.

   Baseline and historical surface water quality data were compared to the available criteria for sampled parameters from the following guidelines:

   - Environmental Quality Guidelines for Alberta Surface Waters (GoA 2018a)
     - Surface water quality guidelines for the protection of freshwater aquatic life – Long-term (Chronic)
     - Surface water quality guidelines for the protection of freshwater aquatic life – Short-term (Acute)
     - Water quality guidelines for the protection of agricultural water uses – Irrigation
     - Water quality guidelines for the protection of agricultural water uses – Livestock Water
     - Surface water quality guidelines for recreation and aesthetics
   - Canadian Environmental Quality Guidelines (CCME 1999)
     - Canadian Water Quality Guidelines for the Protection of Aquatic Life – Chronic
     - Canadian Water Quality Guidelines for the Protection of Aquatic Life – Acute
     - Canadian Water Quality Guidelines for the Protection of Agriculture – Irrigation

- Canadian Water Quality Guidelines for the Protection of Agriculture – Livestock

Comparison to guideline values for individual sample results is presented for baseline and historical data in Appendices 165.1 and 165.2, respectively. Exceedance of guideline criteria is highlighted as described in the appendices. A summary of exceedances noted within each water body and under each guideline type is provided for baseline data for Chin Reservoir, Stafford Reservoir, and Watercourse 126419 in Table 165.1. Exceedances noted for historical data from SMRID canal sampling locations upstream and downstream of Chin Reservoir are summarized in Table 165.2. For historical samples in Chin and Stafford Reservoir included in Appendix 165.2, the only reported exceedance for sampled parameters was for irrigation criteria for fecal coliforms and E. coli, from the August 13, 2013 sample collected at Stafford Reservoir.

Table 165.1 Summary of Guideline Exceedances for Baseline Data from Chin Reservoir, Stafford Reservoir, and Watercourse 126419

	Chin Reservoir								Stafford Reservoir								Watercourse 126419							
Parameter	n	> PAL Chronic	> PAL Acute	> GL Irrigation	> GL Livestock	> GL Recreation	Total Samples > GL	Total %	n	> PAL Chronic	> PAL Acute	> GL Irrigation	> GL Livestock	> GL Recreation	Total Samples > GL	Total %	n	> PAL Chronic	> PAL Acute	> GL Irrigation	> GL Livestock	> GL Recreation	Total Samples > GL	Total %
Anions and Nutrients																								
Alkalinity, Total (as CaCO3)	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Ammonia, Total (as N)	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	4	0	0	0	0	4	50%
Chloride (Cl)	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	4	3	4	0	0	4	50%
Fluoride (F)	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	4	0	4	4	0	4	50%
Nitrate and Nitrite (as N)	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Nitrate (as N)	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Nitrite (as N)	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
pH	27	0	0	0	0	0	0	0%	4	0	0	0	0	0	0	0%	8	5	0	0	0	5	5	63%
TDS (Calculated)	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	7	6	0	7	88%
Sulfate (SO4)	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	3	3	0	3	38%
Sulphide as S	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Bacteriological Tests																								
Coliform Bacteria - Fecal	27	0	0	3	0	2	3	11%	5	0	0	0	0	0	0	0%	8	0	0	3	0	3	3	38%
MPN - Total Coliforms	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	7	0	0	7	88%
Metals																								
Aluminum (Al)-Total	27	5	0	0	0	0	5	19%	5	5	0	0	0	0	5	100%	8	8	0	5	5	0	8	100%
Aluminum (Al)-Dissolved	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	2	0	0	0	0	2	25%
Arsenic (As)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	7	0	3	7	0	7	88%
Beryllium (Be)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Boron (B)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	4	0	4	2	0	4	50%
Cadmium (Cd)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Calcium (Ca)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Chromium (Cr)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	4	0	4	5	0	5	63%
Cobalt (Co)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	5	0	0	0	0	5	63%
Copper (Cu)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	6	2	0	0	0	6	75%
Iron (Fe)-Total	27	0	0	0	0	0	0	0%	5	1	0	0	0	0	1	20%	8	7	0	5	0	0	7	88%
Iron (Fe)-Dissolved	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	1	0	0	0	0	1	13%
Lead (Pb)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Lithium (Li)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Manganese (Mn)-Total	27	0	0	1	0	0	1	4%	5	0	0	0	0	0	0	0%	8	0	0	5	0	0	5	63%
Mercury (Hg)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	5	3	0	0	0	5	63%
Methylmercury (as MeHg)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Molybdenum (Mo)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Nickel (Ni)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	6	0	0	0	0	6	75%
Selenium (Se)-Total	27	0	0	0	0	0	0	0%	5	1	0	0	0	0	1	20%	8	2	0	0	0	0	2	25%
Silver (Ag)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	1	0	0	0	0	1	13%
Thallium (Tl)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Uranium (U)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	3	1	3	0	0	3	38%
Vanadium (V)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	1	1	0	1	13%
Zinc (Zn)-Total	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	4	0	0	0	0	4	50%
Organics																								
Phenols (4AAP)	27	7	0	0	8	0	8	30%	5	1	0	0	1	0	1	20%	6	0	0	0	0	2	2	33%
Benzene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	6	0	0	0	0	0	0	0%
Ethylbenzene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0		0%	6	0	0	0	0	0	0	0%
Styrene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	6	0	0	0	0	0	0	0%
Toluene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	6	0	0	0	0	0	0	0%
Acenaphthene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Acridine	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Anthracene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Benz(a)anthracene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%

	Chin Reservoir								Stafford Reservoir								Watercourse 126419							
Parameter	**n**	**> PAL Chronic**	**> PAL Acute**	**> GL Irrigation**	**> GL Livestock**	**> GL Recreation**	**Total Samples > GL**	**Total %**	**n**	**> PAL Chronic**	**> PAL Acute**	**> GL Irrigation**	**> GL Livestock**	**> GL Recreation**	**Total Samples > GL**	**Total %**	**n**	**> PAL Chronic**	**> PAL Acute**	**> GL Irrigation**	**> GL Livestock**	**> GL Recreation**	**Total Samples > GL**	**Total %**
Benzo(a)pyrene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Fluoranthene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Fluorene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Naphthalene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Phenanthrene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Pyrene	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Quinoline	27	0	0	0	0	0	0	0%	5	0	0	0	0	0	0	0%	8	0	0	0	0	0	0	0%
Total	**1458**	**12**	**0**	**4**	**8**	**2**	**17**	**1%**	**269**	**8**	**0**	**0**	1	**0**	**8**	**3%**	**422**	**82**	**9**	**58**	**33**	**10**	**111**	**26%**

Notes:

1. Guidelines are based on Environmental Quality Guidelines for Alberta Surface Waters (GoA 2018a) and Canadian Council of Ministers of the Environment (CCME) (1999). Exceedances are highlighted as:

1a. Value (a) AB Surface Water Quality Guidelines for Freshwater Aquatics - Chronic OR CCME Water Quality Guidelines for the Protection of Aquatic Life - Chronic

1b. Value (b) AB Surface Water Quality Guidelines for Freshwater Aquatics - Acute OR CCME Water Quality Guidelines for the Protection of Aquatic Life - Acute

1c. Value (c) AB Surface Water Quality Guidelines for Irrigation OR CCME Water Quality Guidelines for the Protection of Agriculture - Irrigation

1d. Value (d) AB Surface Water Quality Guidelines for Livestock OR CCME Water Quality Guidelines for the Protection of Agriculture - Livestock

1e. Value (e) AB Surface Water Quality Guidelines for Recreation and Aesthetics

1f. Value (f) Total number of samples exceeding one or more guidelines for a parameter

Table 165.2 Summary of Guideline Exceedances for Historical Data from SMRID Canal Sampling Locations Upstream and Downstream of Chin Reservoir

Parameter	Upstream of Chin Reservoir								Downstream of Chin Reservoir							
	n	> PAL Chronic	> PAL Acute	> GL Irrigation	> GL Livestock	> GL Recreation	Total Samples > GL	Total %	n	> PAL Chronic	> PAL Acute	> GL Irrigation	> GL Livestock	> GL Recreation	Total Samples > GL	Total %
Anions and Nutrients																
Alkalinity, Total (as CaCO3)	55	0	0	0	0	0	0	0%	650	0	0	0	0	0	0	0%
Ammonia, Total (as N)	40	0	0	0	0	0	0	0%	439	4	0	0	0	0	4	1%
Chloride (Cl)	55	0	0	0	0	0	0	0%	650	0	0	0	0	0	0	0%
Nitrate (as N)	55	0	0	0	0	0	0	0%	650	0	0	0	0	0	0	0%
Nitrite (as N)	55	17	10	0	0	0	17	31%	650	50	19	0	0	0	50	8%
pH	55	0	0	0	0	0	0	0%	650	40	0	0	0	40	40	6%
TDS (Calculated)	55	0	0	0	0	0	0	0%	648	0	0	3	0	0	3	0%
Sulfate (SO4)	55	0	0	0	0	0	0	0%	650	0	0	0	0	0	0	0%
Metals																
Aluminum (Al)-Total	36	34	0	0	0	0	34	94%	382	233	0	0	0	0	233	61%
Arsenic (As)-Total	36	0	0	0	0	0	0	0%	382	13	0	0	0	0	13	3%
Beryllium (Be)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Boron (B)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Cadmium (Cd)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Calcium (Ca)-Total	55	0	0	0	0	0	0	0%	650	0	0	0	0	0	0	0%
Chromium (Cr)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Cobalt (Co)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Copper (Cu)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Iron (Fe)-Total	36	6	0	0	0	0	6	17%	382	117	0	0	0	0	117	31%
Lead (Pb)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Lithium (Li)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Manganese (Mn)-Total	36	0	0	0	0	0	0	0%	382	0	0	4	0	0	4	1%
Mercury (Hg)-Total	36	2	2	0	0	0	2	6%	382	41	37	0	25	0	41	11%
Molybdenum (Mo)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Nickel (Ni)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Selenium (Se)-Total	36	2	0	0	0	0	2	6%	382	2	0	0	0	0	2	1%
Silver (Ag)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Sodium (Na)-Total	16	0	0	0	0	0	0	0%	104	0	0	0	0	0	0	0%
Thallium (Tl)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Uranium (U)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Vanadium (V)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Zinc (Zn)-Total	36	0	0	0	0	0	0	0%	382	0	0	0	0	0	0	0%
Pesticides																
2,4-Dichlorophenol	26	0	0	0	0	0	0	0%	319	0	0	0	0	0	0	0%
2,4-Dichlorophenoxyacetic acid	50	0	0	0	0	0	0	0%	486	3	0	0	0	0	3	1%
4-(2,4-dichlorophenoxy) butyric acid	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Atrazine	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Bromacil	48	0	0	0	0	0	0	0%	462	0	0	0	0	0	0	0%
Bromoxynil	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Captan	18	0	0	0	0	0	0	0%	216	0	0	0	0	0	0	0%
Carbaryl	18	0	0	0	0	0	0	0%	216	0	0	0	0	0	0	0%
Carbofuran	18	0	0	0	0	0	0	0%	216	0	0	0	0	0	0	0%
Chlorothalonil	16	0	0	0	0	0	0	0%	192	0	0	0	0	0	0	0%
Chlorpyrifos	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Deltamethrin	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Diazinon	34	0	0	0	0	0	0	0%	406	0	0	0	0	0	0	0%
Dicamba	50	0	0	6	0	0	6	12%	485	0	0	56	0	0	56	12%
Diclofop	48	0	0	0	0	0	0	0%	462	0	0	0	0	0	0	0%
Dimethoate	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Glyphosate	0	0	0	0	0	0	0	0%	84	0	0	0	0	0	0	0%

Parameter	Upstream of Chin Reservoir								Downstream of Chin Reservoir							
	n	> PAL Chronic	> PAL Acute	> GL Irrigation	> GL Livestock	> GL Recreation	Total Samples > GL	Total %	n	> PAL Chronic	> PAL Acute	> GL Irrigation	> GL Livestock	> GL Recreation	Total Samples > GL	Total %
Lindane (Hexachlorocyclohexane-gamma)	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Malathion	18	0	0	0	0	0	0	0%	216	0	0	0	0	0	0	0%
MCPA (2-methyl-4-chlorophenoxyacetic acid)	50	0	0	8	0	0	8	16%	486	0	0	166	0	0	166	34%
Mecoprop (methylchlorophenoxypropionic acid)	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Methoprene	16	0	0	0	0	0	0	0%	192	0	0	0	0	0	0	0%
Methoxychlor	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Metolachlor	34	0	0	0	0	0	0	0%	406	0	0	0	0	0	0	0%
Metribuzin	34	0	0	0	0	0	0	0%	406	0	0	0	0	0	0	0%
Mirex	34	0	0	0	0	0	0	0%	406	0	0	0	0	0	0	0%
Picloram	48	0	0	0	0	0	0	0%	462	0	0	0	0	0	0	0%
Simazine	34	0	0	0	0	0	0	0%	406	0	0	0	0	0	0	0%
Triallate	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Trifluralin	50	0	0	0	0	0	0	0%	486	0	0	0	0	0	0	0%
Total	**2396**	**61**	**12**	**14**	**0**	**0**	**75**	**3%**	**25633**	**503**	**56**	**229**	**25**	**40**	**732**	**3%**

Notes:

1. Guidelines are based on Environmental Quality Guidelines for Alberta Surface Waters (GoA 2018a) and Canadian Council of Ministers of the Environment (CCME) (1999). Exceedances are highlighted as:

1a. Value (a) AB Surface Water Quality Guidelines for Freshwater Aquatics - Chronic OR CCME Water Quality Guidelines for the Protection of Aquatic Life - Chronic

1b. Value (b) AB Surface Water Quality Guidelines for Freshwater Aquatics - Acute OR CCME Water Quality Guidelines for the Protection of Aquatic Life - Acute

1c. Value (c) AB Surface Water Quality Guidelines for Irrigation OR CCME Water Quality Guidelines for the Protection of Agriculture - Irrigation

1d. Value (d) AB Surface Water Quality Guidelines for Livestock OR CCME Water Quality Guidelines for the Protection of Agriculture - Livestock

1e. Value (e) AB Surface Water Quality Guidelines for Recreation and Aesthetics

1f. Value (f) Total number of samples exceeding one or more guidelines for a parameter

Chin Reservoir

The baseline sampling conducted in Chin Reservoir included collection of 27 samples from a total of three sampling locations. The total number of sample results reported for which guideline criteria were available was 1,458 (Table 165.1). There were 10 reported exceedances of chronic PAL guidelines, and no exceedance of acute thresholds. Four exceedances of irrigation guidelines were noted, eight exceedances of livestock guidelines, and the recreation guidelines were exceeded twice. Overall, 15 parameter samples resulted in exceedance of one or more guidelines, which represented 1% of the total number of samples analyzed for which guidelines exist.

Record of historical samples collected from Chin Reservoir in 2008 have been included in Appendix 165.2. No exceedance of guideline criteria was noted in any of these sample results.

Anions and Nutrients

Information related to anions and nutrients was presented in Volume 4-2, Section 3.3.2 of the EIA. Additional analysis of the data presented in Appendix 165.1: Tables 2 to 7 was conducted to supplement the Water Quality TBR. The mean and range of measured concentrations for anion and nutrient parameters in samples collected from Chin Reservoir are summarized in Table 165.3. A total of 27 samples were collected and analyzed for most parameters, except for carbonate (26) and dissolved orthophosphate (20). The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.3. Parameters that were not detected included hydroxide, orthophosphate, sulphide and biochemical oxygen demand.

Table 165.3 Mean and Range of Anion and Nutrient Concentrations in Chin Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
Alkalinity, Total (as CaCO3)	mg/L	27	0	134	121	148
Ammonia, Total (as N)	mg/L	27	25	0.0301	0.0179	0.0422
Bicarbonate (HCO3)	mg/L	27	0	163	147	181
Carbonate (CO3)	mg/L	26	23	2.8	2.5	3
Chloride (Cl)	mg/L	27	0	0.84	0.55	1.07
Conductivity (EC)	uS/cm	27	0	277	212	303
Fluoride (F)	mg/L	27	0	0.047	0.038	0.059
Hardness (as CaCO3)	mg/L	27	0	134	113	151
Hydroxide (OH)	mg/L	27	27	ND	0	0
Ion Balance	%	27	0	94.7	85.4	103
Nitrate and Nitrite (as N)	mg/L	27	22	0.063	0.027	0.138
Nitrate (as N)	mg/L	27	21	0.058	0.027	0.138
Nitrite (as N)	mg/L	27	27	ND	0	0
Total Kjeldahl Nitrogen	mg/L	27	16	0.201	0.084	0.45
Total Nitrogen	mg/L	27	16	0.227	0.084	0.45
pH	pH	27	0	8.21	8.01	8.39
Orthophosphate-Dissolved (as P)	mg/L	20	20	ND	0	0
Phosphorus (P)-Total	mg/L	27	9	0.007	0.004	0.0163
TDS (Calculated)	mg/L	27	0	165	134	190
Sulfate (SO4)	mg/L	27	0	25.6	15	35.5
Sulphide as S	mg/L	27	27	ND	0	0
Biochemical Oxygen Demand	mg/L	27	27	ND	0	0

There was no exceedance of applicable water quality guideline criteria noted for anion and nutrient parameters in any of the samples collected in Chin Reservoir (Table 165.1).

Metals

Based on analysis of the data presented in Appendix 165.1: Tables 2 to 7, the mean and range of measured total metals concentrations for sampled parameters in Chin Reservoir are summarized in Table 165.4. A total of 27 samples were collected and analyzed for all reported parameters. The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.4. Assessed metals that were not detected in at least one sample included beryllium, silver and tin. The concentrations of dissolved aluminum and iron (i.e., parameters for which dissolved metal guidelines exist) are also reported. The mean concentration of dissolved aluminum was 0.0015 mg/L, with a range of 0.001 mg/L to 0.002 mg/L. Dissolved iron was not detected in any of the Chin Reservoir samples.

Table 165.4 Mean and Range of Total Metals Concentrations in Chin Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
Aluminum (Al)-Total	mg/L	27	0	0.0701	0.016	0.188
Antimony (Sb)-Total	mg/L	27	6	0.0001	0.0001	0.0002
Arsenic (As)-Total	mg/L	27	0	0.0009	0.00064	0.00241
Barium (Ba)-Total	mg/L	27	0	0.117	0.094	0.144
Beryllium (Be)-Total	mg/L	27	27	ND	0	0
Boron (B)-Total	mg/L	27	8	0.011	0.010	0.014
Cadmium (Cd)-Total	mg/L	27	6	0.000012	0.0000054	0.000029
Calcium (Ca)-Total	mg/L	27	0	33.8	28.8	38.6
Chromium (Cr)-Total	mg/L	27	8	0.00017	0.00011	0.00030
Cobalt (Co)-Total	mg/L	27	25	0.00021	0.00015	0.00027
Copper (Cu)-Total	mg/L	27	0	0.00090	0.00069	0.00110
Iron (Fe)-Total	mg/L	27	0	0.083	0.016	0.245
Lead (Pb)-Total	mg/L	27	12	0.00007	0.00005	0.00010
Lithium (Li)-Total	mg/L	27	0	0.0045	0.0030	0.0058
Magnesium (Mg)-Total	mg/L	27	0	12.8	11.0	14.3
Manganese (Mn)-Total	mg/L	27	0	0.03281	0.00102	0.51300
Mercury (Hg)-Total	ug/L	27	23	0.00053	0.00050	0.00056
Molybdenum (Mo)-Total	mg/L	27	0	0.00104	0.000584	0.00473
Nickel (Ni)-Total	mg/L	27	5	0.00090	0.00051	0.00191
Potassium (K)-Total	mg/L	27	0	1.01	0.646	1.23
Selenium (Se)-Total	mg/L	27	0	0.00026	0.00020	0.00034
Silver (Ag)-Total	mg/L	27	27	ND	0	0
Sodium (Na)-Total	mg/L	27	0	8.36	4.29	10.40
Thallium (Tl)-Total	mg/L	27	26	0.000012	0.000012	0.000012
Tin (Sn)-Total	mg/L	27	27	ND	0	0
Titanium (Ti)-Total	mg/L	27	1	0.00166	0.00044	0.00432
Uranium (U)-Total	mg/L	27	0	0.000686	0.000425	0.000889
Vanadium (V)-Total	mg/L	27	0	0.00112	0.00069	0.00213
Zinc (Zn)-Total	mg/L	27	24	0.0052	0.0038	0.0060

Exceedance of applicable guideline criteria for metals in samples collected in Chin Reservoir is summarized in Table 165.1. Exceedance of chronic PAL guideline criteria was noted for aluminum (total) in 5 (19%) samples. The exceeding samples were collected at deep sites (WQCR1-D and WQCR2-D) during multiple sampling events. A single manganese sample (4%) exceeded guideline criteria for irrigation, collected at WQCR2-D in July 2021.

Petroleum Hydrocarbons

There was no petroleum hydrocarbon detected and no exceedance of guideline criteria at Chin Reservoir sampling sites (Appendix 165.1: Tables 2 to 7).

Polycyclic Aromatic Hydrocarbons

There was no PAH detected and no exceedance of guideline criteria at sampling sites in Chin Reservoir (Appendix 165.1: Tables 2 to 7).

Bacteria

Fecal and total coliforms were sampled in Chin Reservoir (Appendix 165.1: Tables 2 to 7). The mean count of fecal coliforms was 56.4 Colony-forming units (cfu)/100 mL, with a range of 1 cfu/100 mL to 267 cfu/100 mL. Total coliforms were measured as a count of coliform bacteria in each sample reported as the Most Probable Number (MPN). The mean count of total coliforms was 123 MPN/100 mL, with a range of 3 MPN/100 mL to 690 MPN/100 mL. Fecal coliforms were detected in 16 samples (59%), while total coliforms were above detection limit in 24 samples (89%).

Exceedance of irrigation guideline criteria was noted for fecal coliforms in three (11%) of samples within Chin Reservoir (Table 165.1), all at deep sampling locations (WQCR1-D, WQCR2-D and WQCR3-D) in July 2021. Two of these samples also exceeded the recreation guideline criteria for fecal coliforms. No exceedance of guideline criteria for total coliforms was noted.

Total Organic Carbon and Phenol

The 20 total organic carbon samples collected within Chin Reservoir had a mean concentration of 2.6 mg/L and a range of 1.6 mg/L to 4.1 mg/L (Appendix 165.1: Tables 2 to 7).

Phenol samples collected in Chin Reservoir ranged in concentration from 0.0011 mg/L to 0.0113 mg/L, with a mean of 0.0054 mg/L. Fifteen samples were below the detection limit. Seven samples (26%) exceeded the chronic PAL guideline criteria (Table 165.1). One additional sample (i.e., total of eight or 30%) also exceeded livestock guidelines. Winter samples collected at all sites in March 2021 exceeded both guideline criteria. The only exceedance noted outside of winter was the exceedance of livestock criteria that was noted in July 2021 at WQCR1-D.

Methylmercury

The methylmercury concentration measured in Chin Reservoir ranged from 0.00002 µg/L to 0.00012µg/L, which represented a mean of 0.00034 µg/L (Appendix 165.1: Tables 2 to 7). Fifteen samples were below the detection limit of analysis. No exceedance of applicable guideline criteria was noted.

Stafford Reservoir

Baseline samples were collected at the inlet to Stafford Reservoir, downstream from the outlet where water is released from Chin Reservoir. A single sample was collected during each sampling event, with one duplicate sample collected in May 2021, for a total of 5 samples, assessed for various parameters.

The total number of sample results reported for which guideline criteria were available was 269 (Table 165.1). There were eight reported exceedances of chronic PAL guidelines, and no exceedance of acute thresholds. One exceedance of livestock guidelines was noted. Overall,

eight parameter samples resulted in exceedance of one or more guidelines, which represented 3% of the total number of samples analyzed for which guidelines exist.

Historical sampling reported for Stafford Reservoir included pesticide samples collected in 2013, which were analyzed for 46 parameters (Appendix 165.2: Table 3). However, no pesticides were detected during the three sampling events.

Anions and Nutrients

Information related to anions and nutrients was presented in Volume 4-2, Section 3.3.1 of the EIA. Additional analysis of the data presented in Appendix 165.1: Table 1 was conducted to supplement the Water Quality TBR. The mean and range of measured concentrations for anion and nutrient parameters in samples collected at Stafford Reservoir are summarized in Table 165.5. A total of 5 samples were collected and analyzed for most parameters, except for dissolved orthophosphate (4). The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.5. Parameters that were not detected included hydroxide and orthophosphate.

Table 165.5 Mean and Range of Anion and Nutrient Concentrations in Stafford Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
Alkalinity, Total (as CaCO3)	mg/L	5	0	133	121	151
Ammonia, Total (as N)	mg/L	5	4	0.0208	0.0208	0.0208
Bicarbonate (HCO3)	mg/L	5	0	163	147	185
Carbonate (CO3)	mg/L	5	4	4.8	4.8	4.8
Chloride (Cl)	mg/L	5	0	1.07	0.51	2.29
Conductivity (EC)	uS/cm	5	0	378	235	807
Fluoride (F)	mg/L	5	0	0.044	0.038	0.048
Hardness (as CaCO3)	mg/L	5	0	125	111	139
Hydroxide (OH)	mg/L	5	5	ND	0	0
Ion Balance	%	5	0	84.9	50.8	97.2
Nitrate and Nitrite (as N)	mg/L	5	3	0.525	0.061	0.988
Nitrate (as N)	mg/L	5	3	0.520	0.061	0.978
Nitrite (as N)	mg/L	5	4	0.01	0.01	0.01
Total Kjeldahl Nitrogen	mg/L	5	3	0.586	0.250	0.921
Total Nitrogen	mg/L	5	3	1.11	0.31	1.91
pH	pH	5	0	8.30	8.15	8.59
Orthophosphate-Dissolved (as P)	mg/L	4	4	ND	0	0
Phosphorus (P)-Total	mg/L	5	0	0.0203	0.0088	0.0424
TDS (Calculated)	mg/L	5	0	221	138	485
Sulfate (SO4)	mg/L	5	0	78.3	17.1	292
Sulphide as S	mg/L	5	4	0.0025	0.0025	0.0025
Biochemical Oxygen Demand	mg/L	5	4	8.5	8.5	8.5

There was no exceedance of applicable water quality guideline criteria noted for anion and nutrient parameters in any of the samples collected at Stafford Reservoir (Table 165.1).

Metals

Based on analysis of the data presented in Appendix 165.1: Table 1, the mean and range of measured total metals concentrations for sampled parameters in Stafford Reservoir are summarized in Table 165.6. A total of 5 samples were collected and analyzed for all reported parameters. The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.6. Assessed metals that were not detected in at least one sample included silver, thallium and tin. The concentrations of dissolved aluminum and iron (i.e., parameters for which dissolved metal guidelines exist) are also reported. The mean concentration of dissolved aluminum was 0.0040 mg/L, with a range of 0.0011 mg/L to 0.0136 mg/L. Dissolved iron was not detected in any of the Stafford Reservoir samples.

Table 165.6 Mean and Range of Total Metals Concentrations in Stafford Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
Aluminum (Al)-Total	mg/L	5	0	0.161	0.110	0.324
Antimony (Sb)-Total	mg/L	5	2	0.00014	0.00011	0.00018
Arsenic (As)-Total	mg/L	5	0	0.00097	0.00092	0.00101
Barium (Ba)-Total	mg/L	5	0	0.1218	0.0762	0.1540
Beryllium (Be)-Total	mg/L	5	4	0.000023	0.000023	0.000023
Boron (B)-Total	mg/L	5	2	0.015	0.011	0.024
Cadmium (Cd)-Total	mg/L	5	0	0.000014	0.0000084	0.0000247
Calcium (Ca)-Total	mg/L	5	0	35.1	28.8	47.6
Chromium (Cr)-Total	mg/L	5	1	0.00020	0.00017	0.00024
Cobalt (Co)-Total	mg/L	5	1	0.00018	0.00010	0.00039
Copper (Cu)-Total	mg/L	5	0	0.00113	0.00078	0.00225
Iron (Fe)-Total	mg/L	5	0	0.211	0.135	0.443
Lead (Pb)-Total	mg/L	5	0	0.00017	0.00009	0.000376
Lithium (Li)-Total	mg/L	5	0	0.0061	0.0028	0.0124
Magnesium (Mg)-Total	mg/L	5	0	15.0	11.3	24.2
Manganese (Mn)-Total	mg/L	5	0	0.0309	0.00983	0.11
Mercury (Hg)-Total	ug/L	5	1	0.00089	0.00060	0.00169
Molybdenum (Mo)-Total	mg/L	5	0	0.00075	0.00056	0.00115
Nickel (Ni)-Total	mg/L	5	0	0.0009	0.00053	0.00168
Potassium (K)-Total	mg/L	5	0	1.11	0.656	1.66
Selenium (Se)-Total	mg/L	5	0	0.00042	0.00020	0.00112
Silver (Ag)-Total	mg/L	5	5	ND	0	0
Sodium (Na)-Total	mg/L	5	0	27.3	4.64	104
Thallium (Tl)-Total	mg/L	5	5	ND	0	0
Tin (Sn)-Total	mg/L	5	5	ND	0	0
Titanium (Ti)-Total	mg/L	5	0	0.00310	0.00214	0.00604
Uranium (U)-Total	mg/L	5	0	0.00190	0.00046	0.00678
Vanadium (V)-Total	mg/L	5	0	0.00130	0.00097	0.00176
Zinc (Zn)-Total	mg/L	5	4	0.0047	0.0047	0.0047

Exceedance of applicable guideline criteria for metals in samples collected in Stafford Reservoir is summarized in Table 165.1. Exceedance of chronic PAL guideline criteria was noted for aluminum (total) in all 5 samples collected. A single iron (total) sample (20%) exceeded chronic PAL guideline criteria, as did one sample (20%) for selenium. These single exceedances were noted in the winter (March 2022) sample.

Petroleum Hydrocarbons

There was no petroleum hydrocarbon detected and no exceedance of guideline criteria at Chin Reservoir sampling sites (Appendix 165.1: Table 1).

Polycyclic Aromatic Hydrocarbons

Only two PAH parameters were detected at Stafford Reservoir, in the March 2022 winter sample (Appendix 165.1: Table 1). 1-Methylnaphthalene and 2-Methylnaphthalene were above the detection limit. No guidelines exist for these parameters.

Bacteria

Fecal and total coliforms were sampled in Stafford Reservoir (Appendix 165.1: Table 1). The mean count of fecal coliforms was 12 cfu/100 mL, with a range of 3 cfu/100 mL to 23 cfu/100 mL. The mean count of total coliforms was 303 MPN/100 mL, with a range of 91 MPN/100 mL to 850 MPN/100 mL. Fecal coliforms were detected in four samples (80%), while total coliforms were above detection limit in all five samples (100%).

No exceedance of guideline criteria for fecal or total coliforms was noted.

Historical samples collected from Stafford Reservoir in 2013 (Appendix 165.2) included analysis for bacteriological parameters. The only reported exceedance for these historical samples was for irrigation criteria for both fecal coliforms and Escherichia coli, from the August 13, 2013 sample.

Total Organic Carbon and Phenol

The 4 total organic carbon samples collected within Stafford Reservoir had a mean concentration of 2.5 mg/L and a range of 1.7 mg/L to 3.5 mg/L (Appendix 165.1: Table 1).

Two of the five phenol samples collected in Stafford Reservoir were above the method detection limit, with concentrations of 0.0012 mg/L and 0.0081 mg/L, resulting in a mean of 0.0047 mg/L. One sample (20%) exceeded both the chronic PAL and livestock guideline criteria (Table 165.1). The exceedances were noted in the winter sample, collected in March 2022.

Methylmercury

The methylmercury concentration measured in Stafford Reservoir ranged from 0.00003 µg/L to 0.00025 µg/L, which represented a mean of 0.00008 µg/L (Appendix 165.1: Table 1). All five samples were above the detection limit of analysis. No exceedance of applicable guideline criteria was noted.

Watercourse 126419

Surface runoff to Watercourse 126419 and to Chin Coulee is very limited due to high depressional storage within the basin, resulting in a low runoff coefficient and low inflows. Limited local runoff and groundwater seepage contribute to the watercourse, which is typically restricted to residual pools with no active surface flow. As a result, the limited residual water in the watercourse is subject to evapo-concentration of solutes and elevated concentrations of various parameters.

The baseline sampling conducted in Watercourse 126419 included collection of 8 samples from a total of two sampling locations. The total number of sample results reported for which guideline criteria were available was 422 (Table 165.1). There were 82 reported exceedances of

chronic PAL guidelines and nine exceedances of acute PAL thresholds. There were 58 exceedances of irrigation guidelines noted, 33 exceedances of livestock guidelines, and 10 exceedances of the recreation guidelines. Overall, 111 parameter samples resulted in exceedance of one or more guidelines, which represented 26% of the total number of samples analyzed for which guidelines exist.

Anions and Nutrients

Information related to anions and nutrients was presented in Volume 4-2, Section 3.3.3 of the EIA. Additional analysis of the data presented in Appendix 165.1: Tables 8 and 9 was conducted to supplement the Water Quality TBR. The mean and range of measured concentrations for anion and nutrient parameters in samples collected from Watercourse 126419 are summarized in Table 165.7. A total of 8 samples were collected and analyzed for most parameters, except dissolved orthophosphate (6) and biochemical oxygen demand (6). The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.7.

Table 165.7 Mean and Range of Anion and Nutrient Concentrations in Watercourse 126419

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
Alkalinity, Total (as CaCO3)	mg/L	8	0	1250.5	109	3070
Ammonia, Total (as N)	mg/L	8	3	0.2110	0.0131	0.5
Bicarbonate (HCO3)	mg/L	8	0	1226.4	112	3180
Carbonate (CO3)	mg/L	8	1	196.7	24	452
Chloride (Cl)	mg/L	8	0	337.0	2.77	861
Conductivity (EC)	uS/cm	8	0	5525	410	9390
Fluoride (F)	mg/L	8	3	5.11	0.05	7.58
Hardness (as CaCO3)	mg/L	8	0	749.0	24.3	2470
Hydroxide (OH)	mg/L	8	8	ND	0	0
Ion Balance	%	8	0	91.9	83.7	99.6
Nitrate and Nitrite (as N)	mg/L	8	7	0.05	0.05	0.05
Nitrate (as N)	mg/L	8	7	0.05	0.05	0.05
Nitrite (as N)	mg/L	8	7	0.11	0.11	0.11
Total Kjeldahl Nitrogen	mg/L	8	0	3.30	1.84	6.06
Total Nitrogen	mg/L	8	0	3.32	1.84	6.06
pH	pH	8	0	8.89	7.97	9.57
Orthophosphate-Dissolved (as P)	mg/L	6	1	0.2297	0.0834	0.385
Phosphorus (P)-Total	mg/L	8	0	0.7343	0.0394	1.84
TDS (Calculated)	mg/L	8	0	4156.5	262	8640
Sulfate (SO4)	mg/L	8	0	1673.1	13.9	5880
Sulphide as S	mg/L	8	0	0.0177	0.0034	0.049
Biochemical Oxygen Demand	mg/L	6	1	12.56	6.4	20.1

Exceedance of applicable water quality guideline criteria was noted for multiple parameters for samples collected in Watercourse 126419, as summarized in Table 165.1. Exceedance of the chronic PAL guideline was noted for ammonia, chloride, fluoride, and pH, while three chloride samples also exceeded the acute PAL threshold. Irrigation guidelines were exceeded for four parameters: chloride, fluoride, TDS, and sulfate. The applicable criteria for livestock guidelines were also exceeded for fluoride, TDS, and sulfate. Five samples (63%) also exceeded the pH guideline for recreation.

Metals

Based on analysis of the data presented in Appendix 165.1: Tables 8 and 9, the mean and range of measured total metals concentrations for sampled parameters in Watercourse 126419 are summarized in Table 165.8. Eight samples were collected and analyzed for all reported parameters. The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.8 and all metals assessed were detected in at least one sample. The concentrations of dissolved aluminum and iron (i.e., parameters for which dissolved metal guidelines exist) are also reported. The mean concentration of dissolved aluminum was 0.0916 mg/L, with a range of 0.0134 mg/L to 0.203 mg/L. Dissolved iron was detected in only two samples and ranged in concentration from 0.17 mg/L to 0.806 mg/L.

Table 165.8 Mean and Range of Total Metals Concentrations in Watercourse 126419

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
Aluminum (Al)-Total	mg/L	8	0	19.411	0.174	69.3
Antimony (Sb)-Total	mg/L	8	6	0.00106	0.00061	0.0015
Arsenic (As)-Total	mg/L	8	0	0.01883	0.0032	0.0361
Barium (Ba)-Total	mg/L	8	0	0.41141	0.0485	1.19
Beryllium (Be)-Total	mg/L	8	5	0.00189	0.00034	0.00312
Boron (B)-Total	mg/L	8	1	2.67	0.25	5.85
Cadmium (Cd)-Total	mg/L	8	2	0.00065	0.000196	0.00143
Calcium (Ca)-Total	mg/L	8	0	81.28	12.9	201
Chromium (Cr)-Total	mg/L	8	3	0.03592	0.00817	0.0823
Cobalt (Co)-Total	mg/L	8	2	0.01360	0.001	0.0359
Copper (Cu)-Total	mg/L	8	2	0.03297	0.0055	0.078
Iron (Fe)-Total	mg/L	8	0	22.45	0.26	78
Lead (Pb)-Total	mg/L	8	3	0.01622	0.00476	0.034
Lithium (Li)-Total	mg/L	8	0	0.17978	0.0162	0.383
Magnesium (Mg)-Total	mg/L	8	0	163.9	11.8	522
Manganese (Mn)-Total	mg/L	8	0	0.46601	0.0376	1.65
Mercury (Hg)-Total	ug/L	8	0	0.01415	0.00051	0.0405
Molybdenum (Mo)-Total	mg/L	8	0	0.00392	0.00215	0.00641
Nickel (Ni)-Total	mg/L	8	1	0.03206	0.0052	0.0923
Potassium (K)-Total	mg/L	8	0	18.1	10.1	27.3
Selenium (Se)-Total	mg/L	8	3	0.00098	0.00049	0.00166
Silver (Ag)-Total	mg/L	8	5	0.00020	0.00007	0.000319
Sodium (Na)-Total	mg/L	8	0	1292.7	42.2	2020
Thallium (Tl)-Total	mg/L	8	4	0.00030	0.00011	0.00052
Tin (Sn)-Total	mg/L	8	7	0.001	0.001	0.001
Titanium (Ti)-Total	mg/L	8	0	0.13195	0.0055	0.422
Uranium (U)-Total	mg/L	8	0	0.01387	0.00103	0.0402
Vanadium (V)-Total	mg/L	8	2	0.0608	0.0099	0.157
Zinc (Zn)-Total	mg/L	8	4	0.1732	0.0346	0.321

Exceedance of applicable guideline criteria for metals in samples collected in Watercourse 126419 is summarized in Table 165.1. Exceedance of guideline criteria was noted for 17 of the 30 assessed metals parameters, which represented the majority of the parameters for which guidelines exist. Chronic PAL guideline criteria were exceeded for 15 parameters: total and dissolved aluminum, arsenic, boron, chromium, cobalt, copper, total and dissolved iron, manganese, mercury, nickel, selenium, thallium, uranium, vanadium, and zinc. The acute PAL guideline criteria were exceeded for copper (two samples), mercury (three samples), and uranium (one sample). Many irrigation guideline criteria were also exceeded, including for aluminum (total), arsenic, boron, chromium, iron (total), manganese, uranium and vanadium.

The livestock guidelines were exceeded for five parameters: aluminum (total), arsenic, boron, chromium, and vanadium. The rate of exceedance was greater than 50% of samples for most parameters. The rate of exceedance of at least one metals guideline for total number of samples was higher at WQDS-2 (42%) than at WQDS-1 (20%).

Petroleum Hydrocarbons

There was no petroleum hydrocarbon detected and no exceedance of guideline criteria at sampling sites WQDS-1 and WQDS-2 within Watercourse 126419 (Appendix 165.1: Tables 8 and 9).

Polycyclic Aromatic Hydrocarbons

There was no PAH detected and no exceedance of guideline criteria at sampling sites WQDS-1 and WQDS-2 within Watercourse 126419 (Appendix 165.1: Tables 8 and 9).

Bacteria

Fecal and total coliforms were sampled in Watercourse 126419 at sampling sites WQDS-1 and WQDS-2 (Appendix 165.1: Tables 8 and 9). The mean count of fecal coliforms was 170.6 cfu/100 mL, with a range of 13 cfu/100 mL to 300 cfu/100 mL. The mean count of total coliforms was 33,932 MPN/100 mL, with a range of 3 MPN/100 mL to 160,000 MPN/100 mL. Fecal coliforms were detected in 5 samples (63%) and total coliforms were above detection limit in all samples.

Exceedance of both irrigation and recreation guideline criteria was noted for fecal coliforms in three (38%) of samples within Watercourse 126419 (Table 165.1). Three samples were below the detection limit. Seven (88%) of the eight samples exceeded irrigation criteria for total coliforms.

Total Organic Carbon and Phenol

Samples for total organic carbon collected within Watercourse 126419 had a mean concentration of 63.3 mg/L and a range of 5.9 mg/L to 220 mg/L (Appendix 165.1: Tables 8 and 9).

Six phenol samples were collected in Watercourse 126419, which ranged in concentration from 0.0017 mg/L to 0.0097 mg/L, with a mean of 0.0055 mg/L. Three samples were below the detection limit and two samples exceeded both chronic PAL and livestock guideline criteria (Table 165.1).

Methylmercury

The methylmercury concentration within eight samples collected ranged from 0.000083 µg/L to 0.00058 µg/L, which represented a mean of 0.00024 µg/L (Appendix 165.1: Tables 8 and 9). One sample was below the detection limit of analysis. No exceedance of applicable guideline criteria was noted.

SMRID System Upstream of Chin Reservoir

Historical records from sampling conducted within the SMRID canal system to support the IDWQ program have been provided in Appendix 165.2. Sampling conducted at locations upstream from Chin Reservoir included collection of up to 55 samples from two sites: SMW-P1 and SMW-S1. Historical sampling did not include analysis for petroleum hydrocarbons, PAHs, bacteria, total organic carbon, phenol, or methylmercury. The results include anions, nutrients, total metals, and pesticides, as discussed below.

The total number of sample results reported for which guideline criteria were available was 2,396 (Table 165.2). There were 61 reported exceedances of chronic PAL guidelines and 12 exceedances of acute thresholds. Fourteen exceedances of irrigation guidelines were noted. There were no exceedances of livestock or recreation guidelines. Overall, 75 parameter samples resulted in exceedance of one or more guidelines, which represented 3% of the total number of samples analyzed for which guidelines exist.

Anions and Nutrients

The mean and range of measured concentrations for anion and nutrient parameters in samples collected from the SMRID system upstream of Chin Reservoir are summarized in Table 165.9, based on analysis of the data in Appendix 165.2: Table 1. A total of 55 samples were collected and analyzed for most parameters. The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.9. All reported parameters were detected in at least one sample.

Table 165.9 Mean and Range of Anion and Nutrient Concentrations in SMRID System Upstream from Chin Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
pH	-	55	0	8.18	7.10	8.70
Electrical Conductivity	µS/cm	55	0	24.3	19.2	41.7
Total Dissolved Solids	mg/L	55	0	139.2	107.0	254.0
Total Alkalinity	mg/L	55	0	113.5	98.3	151.0
Bicarbonate - HCO_3	mg/L	55	0	136.9	117.0	184.0
Carbonate - CO_3	mg/L	55	49	6.33	6.00	8.00
Hardness	mg/L	55	0	117.9	96.0	174.0
Nitrite (as N)	mg/L	55	23	0.07	0.01	0.26
Nitrate (as N)	mg/L	55	51	0.01	0.01	0.01
Total Nitrogen	mg/L	39	0	0.26	0.10	0.64
Ammonia	mg/L	40	40	ND	0.00	0.00
Total Phosphorus	mg/L	55	19	0.02	0.01	0.04
Sodium	mg/L	16	0	6.63	3.00	11.00
Magnesium	mg/L	16	0	10.71	9.40	12.80
Potassium	mg/L	16	0	1.00	0.70	1.60
Chloride	mg/L	55	0	0.81	0.40	2.40
Sulfate	mg/L	55	1	20.86	9.50	76.70

The only parameter for which exceedance of water quality guideline criteria was noted is nitrite (Table 165.2). Seventeen samples (31%) exceeded the chronic PAL guideline, 10 (18%) of which also exceeded the threshold for acute PAL guideline. These exceedances were noted at both sampling locations. The wider period of record at site SMW-P1 included exceedances in 2006, 2011, 2014, 2016, 2019 and 2020.

Metals

Based on analysis of the data presented in Appendix 165.2: Table 2, the mean and range of measured total metals concentrations for sampled parameters in the SMRID system upstream from Chin Reservoir are summarized in Table 165.10. A total of 36 samples were collected and analyzed for most of the reported parameters. The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.10. Assessed metals that were not detected in at least one sample included beryllium, bismuth, molybdenum, and tin.

Table 165.10 Mean and Range of Total Metals Concentrations in SMRID System Upstream from Chin Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
Aluminum	mg/L	36	0	0.2574	0.0800	0.5800
Antimony	mg/L	36	28	0.0009	0.0005	0.0015
Arsenic	mg/L	36	0	0.0008	0.0005	0.0015
Barium	mg/L	36	0	0.1168	0.0980	0.1480
Beryllium	mg/L	36	36	ND	0	0
Bismuth	mg/L	20	20	ND	0	0
Boron	mg/L	36	13	0.0260	0.0070	0.1500
Cadmium	mg/L	36	30	0.00002	0.00001	0.00003
Calcium	mg/L	55	0	28.8	23.5	39.0
Chromium (Trivalent)	mg/L	36	30	0.00002	0.00001	0.00003
Cobalt	mg/L	36	25	0.0002	0.0001	0.0002
Copper	mg/L	36	21	0.001	0.001	0.004
Iron	mg/L	36	0	0.206	0.080	0.444
Lead	mg/L	36	9	0.0002	0.0001	0.0003
Lithium	mg/L	36	15	0.005	0.002	0.014
Manganese	mg/L	36	0	0.0137	0.0080	0.0310
Mercury	mg/L	36	34	0.000023	0.000018	0.000028
Molybdenum	mg/L	36	36	ND	0	0
Nickel	mg/L	36	28	0.0007	0.0005	0.0011
Selenium	mg/L	36	19	0.0005	0.0002	0.0013
Silver	mg/L	36	31	0.0000	0.0000	0.0000
Strontium	mg/L	20	0	0.123	0.079	0.241
Thallium	mg/L	36	35	0.0004	0.0004	0.0004
Tin	mg/L	36	36	ND	0	0
Titanium	mg/L	36	0	0.0073	0.0014	0.0400
Uranium	mg/L	36	10	0.0007	0.0004	0.0016
Vanadium	mg/L	36	9	0.0011	0.0005	0.0020
Zinc	mg/L	36	11	0.0062	0.0010	0.0160

Exceedance of applicable guideline criteria for metals in samples collected in the SMRID system upstream from Chin Reservoir is summarized in Table 165.2. Exceedance of chronic PAL guideline criteria was noted for aluminum in 34 (94%) samples, iron in six (17%) samples, and for both mercury and selenium in two (6%) samples. The acute PAL guideline threshold was also exceeded by the two elevated mercury samples. No exceedance of irrigation, livestock, or recreation guidelines was noted.

Pesticides

Pesticide samples collected upstream of Chin Reservoir within the SMRID canal system included analysis for 176 different pesticide parameters, with tests including different varieties of parameters at various times throughout the IDWQ program (Appendix 165.2: Table 3). A total of 4,904 samples were analyzed for the range of parameters tested and a total of eight parameters were detected at least once. The mean and range of measured pesticide concentrations are summarized in Table 165.11 for all parameters that were detected, or for which guideline criteria exist.

Table 165.11 Mean and Range of Pesticide Concentrations in SMRID System Upstream from Chin Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
2,4-Dichlorophenol	ug/L	26	26	ND	0	0
2,4-Dichlorophenoxyacetic acid	ug/L	50	8	0.1136	0.0245	1.7654
4-(2,4-dichlorophenoxy) butyric acid	ug/L	50	50	ND	0	0
Atrazine	ug/L	50	50	ND	0	0
Bentazon	ug/L	26	25	0.0401	0.0401	0.0401
Bromacil	ug/L	48	48	ND	0	0
Bromoxynil	ug/L	50	48	0.0221	0.0147	0.0295
Captan	ug/L	18	18	ND	0	0
Carbaryl	ug/L	18	18	ND	0	0
Carbofuran	ug/L	18	18	ND	0	0
Chlorothalonil	ug/L	16	16	ND	0	0
Chlorpyrifos	ug/L	50	50	ND	0	0
Clopyralid	ug/L	50	49	0.0413	0.0413	0.0413
Deltamethrin	ug/L	18	18	ND	0	0
Diazinon	ug/L	34	34	ND	0	0
Dicamba	ug/L	50	44	0.0378	0.0110	0.1166
Dichlorprop	ug/L	48	46	0.0426	0.0302	0.0550
Diclofop	ug/L	48	48	ND	0	0
Dimethoate	ug/L	50	50	ND	0	0
Fluroxypyr	ug/L	26	24	0.0750	0.0559	0.0941
Glyphosate	ug/L	0	0	ND	0	0
Lindane	ug/L	50	50	ND	0	0
MCPA	ug/L	50	42	0.0515	0.0255	0.0867
Mecoprop	ug/L	50	50	ND	0	0
Methoprene	ug/L	16	16	ND	0	0
Methoxychlor	ug/L	50	50	ND	0	0
Metolachlor	ug/L	34	34	ND	0	0
Metribuzin	ug/L	4	4	ND	0	0
Mirex	ug/L	34	34	ND	0	0
Picloram	ug/L	48	48	ND	0	0
Simazine	ug/L	34	34	ND	0	0
Triallate	ug/L	50	50	ND	0	0
Trifluralin	ug/L	50	50	ND	0	0

Exceedance of irrigation guideline criteria was noted for dicamba in 6 (12%) samples and for MCPA (2-methyl-4-chlorophenoxyacetic acid) in 8 (16%) samples (Table 165.2). Exceedances for both parameters were noted at both the primary and secondary sample locations.

SMRID System Downstream of Chin Reservoir

Historical records from sampling conducted at locations within the SMRID canal system downstream from Chin Reservoir included collection of up to 652 samples from 16 sites: SMC-P1, SMC-R1, SMC-R2, SMC-R3, SMC-R4, SMC-S1, SMC-S2, SMC-S3, SME-P1, SME-R1, SME-R1A, SME-R2, SME-S1, SMW-R1, SMW-R2, and SWM-S2. Historical sampling did not include analysis for petroleum hydrocarbons, PAHs, bacteria, total organic carbon, phenol, or methylmercury. The results include anions, nutrients, total metals, and pesticides, as discussed below.

The total number of sample results reported for which guideline criteria were available was 25,633 (Table 165.2). There were 503 reported exceedances of chronic PAL guidelines and 56 exceedances of acute thresholds. Exceedance of irrigation guidelines was noted in 229 samples, livestock guidelines were exceeded in 25 samples, and recreation guidelines in 40 samples. Overall, 732 parameter samples resulted in exceedance of one or more guidelines, which represented 3% of the total number of samples analyzed for which guidelines exist.

Anions and Nutrients

The mean and range of measured concentrations for anion and nutrient parameters in samples collected from the SMRID system downstream of Chin Reservoir are summarized in Table 165.12, based on analysis of the data in Appendix 165.2: Table 2. Approximately 650 samples were collected and analyzed for most parameters. The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.12. All reported parameters were detected in at least one sample.

Table 165.12 Mean and Range of Anion and Nutrient Concentrations in SMRID System Downstream from Chin Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
pH	-	650	0	8.40	7.20	9.90
Electrical Conductivity	µS/cm	652	0	33.4	0.0	97.3
Total Dissolved Solids	mg/L	648	0	201.5	90.0	663.0
Total Alkalinity	mg/L	650	0	128.4	71.9	286.0
Bicarbonate - HCO_3	mg/L	650	0	149.4	51.0	280.0
Carbonate - CO_3	mg/L	650	441	11.87	5.00	62.00
Hardness	mg/L	648	0	143.0	81.6	337.0
Nitrite (as N)	mg/L	650	475	0.06	0.01	0.86
Nitrate (as N)	mg/L	650	591	0.03	0.01	0.35
Total Nitrogen	mg/L	546	0	0.53	0.11	3.10
Ammonia	mg/L	439	413	0.10	0.03	0.66
Total Phosphorus	mg/L	650	81	0.06	0.01	0.54
Calcium	mg/L	650	0	31.55	15.50	69.30
Sodium	mg/L	104	0	17.38	3.00	42.00

Exceedance of water quality guideline criteria was noted for ammonia, nitrite, pH, and TDS (Table 165.2). The chronic PAL guideline was exceeded in 4 (1%) ammonia samples, 50 (8%) nitrite samples, and 40 (6%) pH samples, the latter also exceeding the recreation guideline criteria. Nineteen (3%) of the nitrite samples also exceeded the threshold for acute PAL guideline. There were three (<1%) noted exceedances of the irrigation guideline for TDS. These exceedances were more prevalently noted at return sampling locations, though pH, TDS, nitrite, and ammonia exceedances were also noted at primary and secondary locations.

Metals

Based on analysis of the data presented in Appendix 165.2: Table 2, the mean and range of measured total metals concentrations for sampled parameters in the SMRID system downstream from Chin Reservoir are summarized in Table 165.13. A total of 382 samples were collected and analyzed for most of the reported parameters. The number of samples that had a concentration lower than the method detection limit is also noted in Table 165.13. All assessed metals were detected in at least one sample, except for bismuth which was not detected.

Table 165.13 Mean and Range of Total Metals Concentrations in SMRID System Downstream from Chin Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
Aluminum	mg/L	382	20	0.2443	0.0100	2.8400
Antimony	mg/L	382	309	0.0008	0.0002	0.0033
Arsenic	mg/L	382	0	0.0020	0.0006	0.0127
Barium	mg/L	382	0	0.0949	0.0460	0.1500
Beryllium	mg/L	382	379	0.0001	0.0001	0.0001
Bismuth	mg/L	275	275	ND	0	0
Boron	mg/L	382	89	0.0278	0.0070	0.2500
Cadmium	mg/L	382	267	0.00002	0.00001	0.00006
Chromium (Trivalent)	mg/L	382	267	0.00002	0.00001	0.00006
Cobalt	mg/L	382	162	0.0002	0.0001	0.0006
Copper	mg/L	382	132	0.0015	0.0010	0.0050
Iron	mg/L	382	34	0.278	0.019	2.440
Lead	mg/L	382	169	0.0002	0.0001	0.0015
Lithium	mg/L	382	84	0.012	0.002	0.083
Manganese	mg/L	382	0	0.0393	0.0060	0.2640
Mercury	mg/L	382	342	0.007130	0.000005	0.024000
Molybdenum	mg/L	382	285	0.0011	0.0010	0.0020
Nickel	mg/L	382	150	0.0013	0.0005	0.0113
Selenium	mg/L	382	106	0.0004	0.0002	0.0012
Silver	mg/L	382	334	0.0000	0.0000	0.0003
Strontium	mg/L	275	0	0.180	0.080	0.407
Thallium	mg/L	382	373	0.0001	0.0001	0.0004
Tin	mg/L	382	380	0.0015	0.0010	0.0020
Titanium	mg/L	382	26	0.0078	0.0005	0.0598
Uranium	mg/L	382	10	0.0011	0.0005	0.0043
Vanadium	mg/L	382	41	0.0015	0.0004	0.0070
Zinc	mg/L	382	48	0.0049	0.0010	0.0290

Exceedance of applicable guideline criteria for metals in samples collected in the SMRID system downstream from Chin Reservoir is summarized in Table 165.2. Exceedance of chronic PAL guideline criteria was noted for aluminum in 233 (61%) samples, arsenic in 13 (3%) samples, iron in 117 (31%) samples, mercury in 41 (11%) samples, and selenium in two (1%) samples. The acute PAL guideline threshold was also exceeded in 37 (10%) of the mercury samples. The livestock guideline was also exceeded in 25 (7%) of the mercury samples. Exceedance of all three mercury guidelines occurred in 25 of 28 samples collected at site SMC-R1. Exceedance of the irrigation guideline for manganese was noted in 4 (1%) of the samples.

Pesticides

Pesticide samples collected downstream of Chin Reservoir within the SMRID canal system included analysis for 176 different pesticide parameters, with tests including different varieties of parameters at various times throughout the IDWQ program (Appendix 165.2: Table 3). A total of 55,804 samples were analyzed for the range of parameters tested and a total of 27 parameters were detected at least once. The mean and range of measured pesticide concentrations are summarized in Table 165.14 for all parameters that were detected, or for which guideline criteria exist.

Table 165.14 Mean and Range of Pesticide Concentrations in SMRID System Upstream from Chin Reservoir

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
2,4-Dichlorophenol	ug/L	311	311	ND	0.00	0.00
2,4-Dichlorophenoxyacetic acid	ug/L	486	19	0.2905	0.0286	37.3842
4-(2,4-dichlorophenoxy) butyric acid	ug/L	486	486	ND	0.00	0.00
Aminomethyl phosphonic acid	ug/L	84	72	0.6005	0.1140	1.2990
Atrazine	ug/L	486	468	0.0527	0.0238	0.1671
Bentazon	ug/L	311	292	0.0645	0.0249	0.1425
Bifenthrin	ug/L	406	405	1.5255	1.5255	1.5255
Boscalid	ug/L	216	192	0.0467	0.0268	0.0987
Bromacil	ug/L	462	462	ND	0	0
Bromoxynil	ug/L	486	482	0.0472	0.0260	0.0945
Captan	ug/L	216	216	ND	0	0
Carbaryl	ug/L	216	216	ND	0	0
Carbofuran	ug/L	216	216	ND	0	0
Chlorothalonil	ug/L	192	192	ND	0	0
Chlorpyrifos	ug/L	486	486	ND	0	0
Clopyralid	ug/L	486	475	0.0392	0.0260	0.0747
Deltamethrin	ug/L	216	216	ND	0	0
Diazinon	ug/L	406	406	ND	0	0
Dicamba	ug/L	485	429	0.0532	0.0108	0.4599
Dichlorprop	ug/L	462	448	0.0288	0.0140	0.0904
Diclofop	ug/L	462	462	ND	0	0
Difenoconazole	ug/L	192	189	0.0957	0.0700	0.1124
Dimethoate	ug/L	486	486	ND	0	0
EPTC	ug/L	406	382	0.0591	0.0256	0.2190
Flamprop-Methyl	ug/L	382	381	0.0821	0.0821	0.0821
Fluroxypyr	ug/L	311	235	0.0735	0.0250	0.5679
Glyphosate	ug/L	84	59	0.3475	0.0470	1.2000
Hexazinone	ug/L	216	214	0.0553	0.0529	0.0577
Imazamethabenz	ug/L	216	215	0.7590	0.7590	0.7590

Parameter	Units	Number of Samples	Number < Detection Limit	Mean	Minimum	Maximum
Lindane	ug/L	486	486	ND	0	0
Malathion	ug/L	216	216	ND	0	0
MCPA	ug/L	486	314	0.1285	0.0147	2.0741
MCPB-methyl	ug/L	216	216	ND	0	0
Mecoprop	ug/L	486	476	0.0893	0.0415	0.2249
Metalaxyl	ug/L	216	214	0.1249	0.0650	0.1848
Methoprene	ug/L	192	192	ND	0	0
Methoxychlor	ug/L	486	486	ND	0	0
Metolachlor	ug/L	406	403	0.0350	0.0313	0.0383
Metribuzin	ug/L	48	48	ND	0	0
Mirex	ug/L	406	406	ND	0	0
Picloram	ug/L	462	461	0.0506	0.0506	0.0506
Prometryn	ug/L	216	215	0.0308	0.0308	0.0308
Prothioconazole-Desthio	ug/L	192	191	0.0310	0.0310	0.0310
Simazine	ug/L	406	406	ND	0	0
Sulfentrazone	ug/L	144	143	0.5963	0.5963	0.5963
Tebuconazole	ug/L	192	190	0.0485	0.0430	0.0541
Triallate	ug/L	486	485	0.0270	0.0270	0.0270
Trifluralin	ug/L	486	486	ND	0.00	0.00

The chronic PAL guideline criteria for 2,4-Dichlorophenoxyacetic acid were exceeded in three (1%) samples. Exceedance of irrigation guideline criteria was noted for dicamba in 56 (12%) samples and for MCPA in 166 (34%) samples (Table 165.2). Exceedances were noted at all of the assessed sites over the course of the IDWQ program.

b. Please refer to the response to SIR#1 Question 165 (b) for a description and summary (Tables 165.1 and 165.2) of guideline exceedances for each sampling area, for all parameters that have guidelines, and for all types of guidelines individually.

c. Guideline comparisons noted in Appendices 165.1 and 165.2 and in the response to SIR#1 Question 165 (b) refer to the most sensitive crop type that is expected to potentially be grown in the RSA. For livestock water guideline comparisons, the most sensitive livestock type was conservatively selected where variable guidelines were available.

d. Appendices 165.1 and 165.2 include updated symbology to identify guideline exceedances in a more discernible manner, removing italics and single underline from the symbols used. Alternating bar fill and cell borders are used to visualize instances of multiple guideline exceedance.

Question 166

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7;
Volume 4-2, Section 3.3;
Volume 5, Section 3, 3.4.1 [A];
Volume 5, Section 3, 3.4.2 [C]

Rationale/Preamble:

The final Terms of Reference Section 3.4.1 [A] states *Include water quality for high flow events (1 in 20-year and 1 in 100-year and 1 in 300-year) under current conditions.*

The final Terms of Reference Section 3.4.2 [C] also states *Describe the water quality expected in the Project and downstream (natural or manmade) bodies of water. Include water quality for high flow events (1 in 20-year and 1 in 100-year and 1 in 300-year) under expected reservoir conditions.*

Information in response to Section 3.4.1 [A] was not found in the EIA sections referenced (Volume 4-2, Section 3.3**)**. For Section 3.4.2 [C], Volume 2, Section 2.3 or Appendix 7 did not appear to include the three high flow event scenarios in the analysis and Appendix 7 states *the model was deemed sufficiently representative of the Chin Reservoir System without any further efforts to specifically model the effects of rare storm events (1:20, 1:100, 1:300) on the system.*

The final Terms of Reference asks for 'high flow' events not 'rare storm' events.

The Volume 2, Section 2.3 information and the statement provided in Appendix 7 is insufficient to address changes in water quality due to variable changes in flow.

Information Request:

Answer the final Terms of Reference by:

a. Providing a description of water quality for high flow events (1 in 20-year and 1 in 100-year and 1 in 300-year) under current conditions for all parameters as required by the Baseline Section 3.4.1 [A] of the final Terms of Reference.
b. Providing a description of predicted water quality for high flow events (1 in 20-year and 1 in 100-year and 1 in 300-year) under expected conditions for all parameters as required by the Impact Assessment Section 3.4.2 [C] of the final Terms of Reference.

Response:

a. Please refer to the *Water Quality Analysis Technical Memorandum* (Appendix 13.1) for the results of predicted water quality during high flow events simulated for 1 in 20-year, 1 in 100-year, and 1 in 300-year events under Base Case (current) conditions.

The water quality analysis utilizes a long duration mass balance model to represent the mass and subsequent concentration found in the reservoir. Due to the use of event mean concentrations based on long-term water quality averages, simulating specific design storm events does not produce significantly different results. The storage in the reservoir serves as a buffering mechanism and therefore loads from a storm inflow event will mix with the volume in the reservoir thus diminishing the impacts of a dose of water quality loads. The high flow simulations show little change in the reservoir water quality even though the concentration of local runoff added to the reservoir was set to double the average canal inflow concentration. This is because the volume of storm runoff reporting to the reservoir is expected to be small in comparison to the stored reservoir volume, even during significant storm events. In some cases, direct precipitation on the reservoir actually diluted the reservoir's mass, decreasing the concentrations.

b. Please refer to the *Water Quality Analysis Technical Memorandum* (Appendix 13.1) for the results of predicted water quality during high flow events simulated for 1 in 20-year, 1 in 100-year, and 1 in 300-year events under Project Case (expected) conditions.

   The results indicate that predicted concentrations during high flow events for the Project Case do not vary in comparison to the Base Case condition.

Question 167

Reference:

Volume 2, Section 2.3.2.2, Page 34;
Volume 2, Appendix 7;
Volume 4-2, Section 3.3.3;
Volume 4-2, Appendix III;
Volume 5, Section 3, 3.4.1 [A]

Rationale/Preamble:

The final Terms of Reference Section 3.4.1 [A] states *Describe the baseline water quality of water courses and water bodies (current Chin Reservoir and downstream (natural or man-made) bodies of water). Discuss the effects of seasonal and flow variations, other controlling factors, and temporal and spatial trends. Include water quality for high flow events (1 in 20-year and 1 in 100-year and 1 in 300-year) under current conditions. Consider appropriate water quality parameters (e.g., metals, nutrients, pesticides, temperature, BOD/TOC, bacteria, aquatic and benthic invertebrates, aquatic plants, algae, dissolved oxygen, etc.).*

The Baseline Surface Water Quality summaries provided in Section 3.3.3 of Volume 4-2 TBR describes the water quality in Watercourse 126419 as poor quality with multiple elevated concentrations and guideline exceedances. This is reiterated in Volume 2 Section 2.3.2.2, and in Appendix III of Volume 4-2 TBR. It is also mentioned in the Volume 2 Appendix 7 but only for a very few select parameters.

Information Request:

a. Answer the final Terms of Reference by describing why water quality is poor in this area and demonstrate (with modelling or science) how the source will impact the water quality in the Expanded Chin Reservoir after mixing (and if any guideline exceedances are expected) for all parameters.

Response:

a. Surface runoff to Watercourse 126419 and to Chin Coulee is very limited due to high depressional storage within the basin, resulting in a low runoff coefficient and low inflows. Limited local runoff and groundwater seepage contribute to the watercourse, which is typically restricted to residual pools with no active surface flow. As a result, the limited residual water in the watercourse is subject to evapo-concentration of solutes and elevated concentrations of various parameters.

   During initial filling of the Reservoir Expansion Area, inundated soils may be prone to erosion and soils in the expanded area could leach metals or salt, which could affect the water quality of the Reservoir Expansion Area. The primary mechanism for mitigating the potential for adverse effects on water quality will be to fill the expanded portion of the reservoir in isolation from the existing reservoir. The evolution of water quality in the expanded portion of the reservoir

cannot be precisely characterized through modeling; therefore, we propose monitoring to inform adaptive management and confirm that adverse effects have been avoided prior to commissioning of the Expanded Reservoir.

The mass balance modeling of the Chin Reservoir during future operation shows that water quality in the Project Case (Expanded Reservoir) will essentially be the same as the Base Case condition. Expanding the reservoir will change the mass stored due to the increased reservoir volume but will not change the water quality concentrations appreciably since inflow canal chemistry dominates the water quality of the reservoir.

The local inflows and groundwater seepage that influence water quality within Watercourse 126419, in conjunction with evapo-concentration, will have a negligible influence on water quality in the Expanded Chin Reservoir during operation as the load will be negligible compared to the diluting volume of inflows to the reservoir from the main canal. The water chemistry in Watercourse 126419 is not indicative of potential water quality in the Expanded Chin Reservoir as canal inflow dominates the water quality of the reservoir.

Question 168

Reference:

Volume 4-2, Section 3.3;
Volume 4-2, Section 3.3, Figure 3.2–3.10;
Volume 4-2, Appendix I and II;
Volume 5, Section 3, 3.4.1 [A]

Rationale/Preamble:

The final Terms of Reference Section 3.4.1 [A] states *Describe the baseline water quality of water courses and water bodies (current Chin Reservoir and downstream (natural or man-made) bodies of water). Discuss the effects of seasonal and flow variations, other controlling factors, and temporal and spatial trends. Include water quality for high flow events (1 in 20-year and 1 in 100-year and 1 in 300-year) under current conditions. Consider appropriate water quality parameters (e.g., metals, nutrients, pesticides, temperature, BOD/TOC, bacteria, aquatic and benthic invertebrates, aquatic plants, algae, dissolved oxygen, etc.)*

The Baseline Surface Water Quality descriptions provided in Section 3.3 of Volume 4-2 TBR are insufficient. The EIA only provides descriptive details for select Physical Parameters (depth/pH), Major Ions and Nutrients (phosphorus only) (Figures 3.3 to 3.10), while there is insufficient information provided for Metals, Hydrocarbons, PAH's, Bacti, Organic and Phenol, and methyl-mercury. Pesticide results for sites sampled in 2021 and 2022 were not found at all in Section 3.3 of the EIA. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions.

Information Request:

a. Answer the final Terms of Reference by providing figures, graphs, and descriptions for all parameters.
b. Provide pesticide results and descriptions for 2021 and 2022 sampling and include pesticide sampling in future monitoring.

Response:

a. Please refer to the response to SIR#1 Question 165 for a more detailed description of baseline water quality.
b. Pesticides were not included in baseline sampling conducted in 2021 and 2022. Please refer to the response to SIR#1 Question 165 for a more detailed description of historical sampling data for pesticides within the SMRID conveyance system. Pesticides have been included in the list of proposed sample parameters for future monitoring (Appendix 164.1).

Question 169

Reference:

Volume 4-2, Section 3.2, Page 19;
Volume 4-2, Section 3.2, Figure 3.1 and 3.2, Page 20 and 21;
Volume 5, Section 3, 3.4.1 [A]

Rationale/Preamble:

The final Terms of Reference states *Provide a summary of existing information available from literature review(s).*

Other than the Alberta Agriculture and Forestry-Irrigation District Water Quality (AAF-IDWQ) project information (Section 3.2 of Volume 4-2 TBR), a literature review was not found in the EIA.

The AAF-IDWQ project information provided (Section 3.2 of Volume 4-2 TBR) is incomplete. The AAF-IDWQ summary provided in Section 3.2 of Volume 4-2 TBR mentions a water quality index (WQI), but index results are not provided for each station in the appendix of the EIA and the external reference indicates an unconventional combined general/pesticide WQI which could mask important results.

The AAF-IDWQ summary mentions a water quality index (WQI) and indicates a rating for irrigation, livestock, and protection of aquatic life but the external reference does not concretely confirm this.

The AAF-IDWQ summary only provides analysis for Ions and TDS (Figures 3.1 & 3.2) for spatial and temporal patterns and trends and information on chosen statistic was not found for each test ran.

Information Request:

Answer the final Terms of Reference by:

a. Providing a summary of existing information available from literature review(s).
b. Providing the WQI results for each station and each WQI sub-grouping (Routine, Nutrients, Metals, Pesticide) and not a combined general/pesticide WQI.
c. Providing evidence that all protection of aquatic life guidelines were included in the WQI calculations for all parameters and guideline types (AAF 2021a) and that sub-indices are not combined (i.e. general/pesticide).
d. Providing figures and graphs similar to Figures 3.1 & 3.2 for all parameters and provide the results for all statistical trend analysis results (including which statistic was chosen (Mann Kendall or Seasonal Mann Kendall) for each.

Response:

a. A more detailed discussion of the results of the Irrigation District Water Quality (IDWQ) program is provided in the response to SIR#1 Questions 165 and 169 (b). Although additional historical sources of water quality information related to irrigation within the region exist

(e.g., Bolseng 1991; Cross 1997; Greenlee et al. 2000; Saffran 2005; Little et al. 2010; Palliser Environmental Services Ltd 2011), Villeneuve et al. (2024) note that variations in design, parameters, and methodology among historical studies make comparison of these data difficult. The IDWQ was developed in response to this need for a long-term, consistent database of irrigation water quality, and this program is considered to provide the most suitable recent context for understanding regional water quality, specific to the SMRID system and the Project.

b. The incorrect external reference was provided for the AAF 2021a citation, related to the discussion of IDWQ water quality indices (WQI). The correct reference is:

   Alberta Agriculture and Forestry (AAF). 2021a. Irrigation Water Quality Project. Volume 7: Water Quality Indices of Irrigation Water of Southern Alberta.

   The Canadian Council of Ministers of the Environment (CCME) WQI (2017) was used to derive the indices for the IDWQ study (AAF 2021a). Three WQI were calculated to evaluate the suitability of irrigation water for different uses: irrigation of agricultural crops, livestock watering, and the protection of aquatic life. Sub-indices were developed based on similar categories of parameters to summarize water quality. The sub-indices that were created for both the Agricultural Irrigation WQI and the Agricultural Livestock WQI: general/pesticide and metals. Three sub-indices were created for the Protection of Aquatic Life (PAL) WQI: general water quality, pesticide, and metals. These sub-indices each included between 6 to 22 parameters, as described by AAF (2021a). Only parameters that had sufficient duration of data collection were included in the WQI. AAF noted that Tri-Star Environmental Consulting (2012) tested the sensitivity and behaviour of the CCME WQI and recommended that between 8 to 20 parameters should be used in an index to yield meaningful results. No specific rationale was provided by AAF for combining general parameters and pesticides in the indices for irrigation and livestock uses.

   The WQI results for each sampling station within the SMRID system, for each of the WQI sub-indices, are provided in Appendix 169.1. The results are presented according to the sub-groupings that are reported in the AAF study, which includes a combined general/pesticide WQI for irrigation and livestock uses, and separate sub-groupings for general water quality and pesticides for the PAL WQI (2021a).

   The summarized results show that water quality at the SMW-P1 site upstream from Chin Reservoir has a WQI value of 100, meeting the category of “Excellent”, in all years and for all sub-indices, except the Irrigation general/pesticide sub-index (Appendix 169.1). For this sub-index, the category was “Excellent”, except in 2006 and 2011 when the value was in the category of “Good.”

   All sampling locations within the SMRID system had a value within the “Excellent” category for all years according to the following sub-indices: Irrigation WQI metals, Livestock WQI general/pesticide, Livestock WQI metals, and PAL WQI metals (Appendix 169.1). All sampling locations were rated as “Excellent” for all years under the PAL WQI pesticides, except for one return site (SMC-R1) in one year (2006) which was rated as “Good.” Under the PAL WQI general, sites within the SMRID system ranged from “Fair” to “Excellent”, with eight instances of a “Fair”

rating at secondary and return sites. The results compared to the Irrigation WQI general/pesticide sub-index showed the largest variation in category. The WQI category ranged from “Marginal” to “Excellent.” Primary and secondary sites were “Fair” or higher, and “Marginal” ratings were noted in three years at return sites (Appendix 169.1).

c. The AAF study calculated three WQI to evaluate the suitability of irrigation water for different uses: irrigation of agricultural crops, livestock watering, and the protection of aquatic life. Only parameters that had sufficient duration of data collection were included in the WQI, not all parameters for which guidelines exist. The guidelines that were used for each parameter included in a sub-index were defined based on the intended use associated with each WQI. The Agricultural Irrigation WQI uses guidelines that are protective of crop species, the Agricultural Livestock WQI uses guidelines that protect the health of livestock species, and the PAL WQI uses guidelines protective of aquatic life.

   Please see the response to SIR#1 Question 169 (b) for a description of the sub-indices created for the AAF study, which includes a combined general/pesticide WQI for irrigation and livestock uses, and separate sub-groupings for general water quality and pesticides for the PAL WQI (2021a).

d. Please refer to the *Chin Reservoir Historical Canal Inflow and Modeled Arsenic Trend Analysis Technical Memorandum* in Appendix 17.1 for the results of statistical trend analysis for the historical sampling sites within the SMRID system, which supplements the regional analysis presented in AAF (2021b).

Question 170

Reference:

Volume 2, Section 2.3.2, Page 33;
Volume 2, Section 2.3.3.2.5, Page 37;
Volume 2, Section 2.3.4, Page 37;
Volume 5, Section 3, 3.4.2 [A]

Rationale/Preamble:

The final Terms of Reference states *Identify project activities that may affect surface water during all stages of the Project (including site preparation, construction, operation, maintenance, decommissioning and reclamation). Determine the local and regional extent of potential impacts as well as their frequency, duration, magnitude, and seasonality.*

In the Volume 2 Section 2.3.2 and Section 2.3.4, impacts of project activities are described in some detail but minimal detail is provided to address potential impacts in Section 2.3.3.2.5 Potential Regional Effect and the frequency duration, magnitude, and seasonality of each was not found.

Information Request:

a. Answer the final Terms of Reference by expanding on Potential Regional Effects to water quality including determining their frequency, duration, magnitude, and seasonality during all stages of the Project, at a local and regional extent.

Response:

a. As noted in the response to SIR#1 Question 4, the simulation of potential operating conditions (Project Case) noted that minor increases or decreases could occur in discharge within Waterton, Belly, and St. Mary Rivers downstream from headworks diversion locations compared to the Base Case. These changes were predicted to be within the range of natural variability. As noted in the response to SIR#1 Question 150, the simulation shows no difference in the number of days where WCOs are not achieved. Since only minor variation in downstream flows is predicted, above the threshold of the WCOs, residual effects on water quality within downstream watercourses are not predicted.

   The mass balance models indicate minimal change in water quality when comparing the existing Chin Reservoir (Base Case) to the expanded reservoir (Project Case) during future operation. In both scenarios, the canal inflow largely controls and will maintain the inflow concentration. As changes in the quality of water released from Chin Reservoir are expected to be minimal, residual effects are not anticipated within Stafford Reservoir or other downstream portions of the irrigation conveyance system within the RSA.

   The potential for effects during construction can be managed through application of standard mitigation measures and the filling phase will be best managed through the Adaptive

Management Plan. Based on the application of mitigation measures, residual effects are not predicted that could lead to regional effects.

Question 171

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7, Page 1 and 2;
Volume 2, Appendix 7, Table 1, Page 3;
Volume 2, Appendix 7, Figure 3 and 4, Page 7 and 8;
Volume 2, Appendix 7, Table 4, 5 and 6, Page 9 and 10;
Volume 2, Appendix 7, Figure 19, Page 20;
Volume 4-2, Appendix I and II;
Volume 5, Section 3, 3.4.2 [B] (a), (b) (i)-(ix), (c) and (d)

Rationale/Preamble:

Volume 2 Section 2.3 references Appendix 7.

INTERA Figure 19 indicates increased downstream observed values for Arsenic, Lead and Mercury but an assessment of the potential impacts of the Project (during site preparation, construction, operation, maintenance, decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water for these metals or other metals was not found in the EIA.

INTERA states *The models do not estimate the incremental filling of the reservoir, salinity, or nutrient water quality, as those would involve further complex efforts to analyze which are beyond the scope of this work.*

INTERA states *Nutrient water quality was not explicitly modeled. However, using existing water quality in the Chin Reservoir system as an analog, future water quality with the Expanded Chin Reservoir volume can be reasonably estimated*. And that incremental filling scenarios*…were not modeled, due to the difficulty of representing the complex interactions.*

Nutrients are commonly increased during reservoir filling from extensive erosion and should not be overlooked. *Difficulty of representing the complex interactions* is not a reason for not completing the modelling.

INTERA Table 1 shows high Nutrient values for Total Phosphorus (TP) and Total Nitrogen (TN) indicating the need for modelling these parameters.

INTERA states *The observations from the existing reservoir indicate that neither conductivity nor salinity are currently an issue. Safe conductivity values should be in the range of 200 to 800 µS/cm. There is a potential for salt to leach from the soils and into the reservoir during the incremental filling stages, but once connected to the full reservoir, the salinity would quickly equilibrate to the low values characterizing the existing reservoir salinity…*

INTERA Figure 3 and 4 and Table 4, 5 and 6 indicate high electrical conductivity (EC), sodium adsorption ratio (SAR) and salinity results. INTERA states *The impact of the increased salinity is difficult to assess at this time due to insufficient data with which to estimate salt mass in the area…*

There is salinity data available (especially in Appendix I and II) as well as other publicly available data sources and being difficult to assess is not justification for not completing the modelling.

The final Terms of Reference section 3.4.2 [B] states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach*…for aspects in all sub clauses listed in bullet [B].

Information Request:

a. Answer the final Terms of Reference 3.4.2 [B] (a), (b) (i)-(ix), (c) and (d) by providing descriptions and predictions of the potential impacts of the Project (during site preparation, construction, operation, maintenance, decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach for all parameters that have the potential to be affected by the project.

Response:

a. Please see the *Water Quality Analysis Technical Memorandum* (Appendix 13.1) which addresses for all parameters that have the potential to be affected by the project. The memo presents a mass balance model of the simulated Base Case and Project Case during operation, for all water quality parameters for which sufficient baseline data was available to support modeling. Reservoir water quality is mainly dictated by the canal inflow. This project through all phases of construction will not impact the water quality of the inflow canal.

   The primary pathway for effect is through erosion and leaching of soils during the initial filling process. Filling of the Reservoir Expansion Area will occur in isolation from the Existing Chin Reservoir over multiple years, allowing for an Adaptive Management Plan (Appendix 164.1) to be implemented. The Adaptive Management Plan will include monitoring to assess changes in water quality and to confirm that any identified concerns have been addressed before decommissioning of the Existing East Dam and commissioning of the Expanded Chin Reservoir.

Question 172

Reference:

Volume 2, Section 2.3;
Volume 2, Section 2.3.6, Page 42;
Volume 2, Appendix 7;
Volume 5, Section 3, 3.4.2 [B] (a)

Rationale/Preamble:

The final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

> *a) changes in water quality that may exceed the Environmental Quality Guidelines for Alberta Surface Waters, the Canadian Water Quality Guidelines, the Federal Environmental Quality Guidelines or mainstem reaches in the Surface Water Quality Management Framework included as part of the South Saskatchewan Regional Plan;*

Volume 2, Section 2.3.6 The Monitoring Requirements section states that *The adaptive management plan should include contingency plans for scenarios where concentrations approach or exceed water quality guidelines.*

Water quality guidelines are not designed to be pollute up to levels and adaptive management plans should include evaluations for undesirable change (before approaching guidelines).

Volume 2 Section 2.3 references Appendix 7 which addresses this part of the final Terms of Reference specific to guideline exceedances, but only with mass balance modelling for four parameters (Arsenic, Cadmium, Lead, Mercury, Selenium) and analysis or modelling was not found for nutrients, dissolved oxygen, blue-green algae or salts. Moreover, analysis or modelling was not found in the EIA for the remaining parameters with guidelines.

Volume 2 Appendix 7 does not provide a reference citation for the model used (if trademarked) or provide a detailed description of how the model works (e.g. mathematics), is calibrated or the merits of its robustness if self-developed (e.g. accepted as part of a peer reviewed publication, or other confirmation of scientifically defensible approach).

A reference to the South Saskatchewan Regional Plan (SSRP) Surface Water Quality Management Framework (SWQMF) was not found in the EIA in Volume 4-2 TBR or Volume 2, Section 2.3.

Information Request:

Answer the final Terms of Reference by:

a. Providing a modelled response or other scientifically defensible approach to the final Terms of Reference question for predicting potential changes in downstream guideline exceedances for

all parameters that have guidelines, and include all types of guidelines (Irrigation, livestock, recreation, protection of aquatic life, etc.) for parameters that have multiple guidelines.

b. Providing a revised statement to Volume 2, Section 2.3.6, Page 42 to reflect an adaptive management plan that includes undesirable change.

c. Providing the reference citation for the model used or a detailed description of the model workings and confirmation of the model as a scientifically defensible approach.

d. Describing and predicting the potential impacts of the Project (during site preparation, construction, operation, maintenance, decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream defensible approach, including predicting changes in water quality that may exceed triggers for mainstem reaches in the Surface Water Quality Management Framework included as part of the South Saskatchewan Regional Plan.

Response:

a. All water quality parameters for which baseline data are available have been included in an updated modeling assessment and the model results and comparison to water quality guidelines are presented in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1).

b. The *Adaptive Management Plan for Water Quality Technical Memorandum* is provided in Appendix 164.1. The plan notes that water quality parameter concentrations that indicate undesirable trends, approach or exceed regulatory thresholds (as applicable), or greater than an agreed upon change from the baseline condition or background condition in the existing reservoir, will be flagged for further evaluation or plan adaptation.

c. The water quality model is a spreadsheet mass balance model, developed by INTERA for the Project, as described further in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1). It preserves the same reservoir inflow and outflow fluxes as defined by the SOAP model. It tracks the mass of water quality parameters through the storage of the reservoir. Inflow mass is the Total Inflow from the SOAP model multiplied by the average baseline concentration of the inflow canal. Outflow mass is based on the simulated Total Outflow from the SOAP model multiplied by the simulated concentration in the reservoir. Net climate fluxes represent the rainfall and evapotranspiration from the reservoir with no mass exchange.

   Since the reservoir water quality during operation is influenced most dominantly by the water quality of the canal inflow, the model results for the Base Case and Project Case shows negligible change in water quality.

d. As noted in the response to SIR#1 Question 170, based on simulated operating conditions, the Project is not expected to result in residual effects on water quality within Waterton, Belly or St. Mary Rivers that could cause exceedance of triggers in the Surface Water Quality Management Framework included as part of the South Saskatchewan Regional Plan.

Question 173

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7;
Volume 5, Section 3, 3.4.2 [B] (b) (i)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

- *b) changes in concentrations, loading amounts, and timing of key water quality parameters including routine parameters that could impact the current Chin Reservoir and downstream (natural or manmade) bodies of water, including:*
  - *i) impacts on their use as a drinking water supply, recreation, agriculture, domestic use, aesthetics, and other water uses,*

While information was provided for current and past water quality in the local and regional study areas the parameters reported on were not comprehensively described and not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions. Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, of changes in concentrations, loading amounts and timing of key water quality parameters including routine parameters during site preparation, construction, operation, maintenance, decommissioning and reclamation and addressing impacts on their use as a drinking water supply, recreation, agriculture, domestic use, aesthetics, and other water uses. While Section 2.2.3 and Appendix 7 mention select potential impacts, all aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation and for each water use including drinking water supply, recreation, agriculture, domestic use, aesthetics, and other.

Response:

a. All water quality parameters for which baseline data are available have been included in an updated modeling assessment and the model results and comparison to water quality

guidelines are presented in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1). The mass balance model results indicate minimal change in water quality when comparing the existing Chin Reservoir (Base Case) to the expanded reservoir (Project Case) during future operation. The water quality of the expanded reservoir is essentially the same as the base case and dominated by the water quality of the inflow canal. Changes in water quality within Chin Reservoir are expected to be minimal for all modelled parameters and the frequency of guideline criteria exceedance is not expected to change. The Adaptive Management Plan for Water Quality (Appendix 164.1) will be applied to mitigate the potential for effects during the filling phase of the project and mitigation will be applied to avoid construction-related introduction of sediment or other deleterious substances that could affect water quality. Therefore, residual effects are not anticipated for reservoir and downstream water use for drinking water supply, recreation, agriculture, domestic use, aesthetics, or other uses.

Question 174

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3.4.2 [B] (b) (ii)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

- *b) changes in concentrations, loading amounts, and timing of key water quality parameters including routine parameters that could impact the current Chin Reservoir and downstream (natural or manmade) bodies of water, including:*
  - *ii) potential implications to water quality on the current Chin Reservoir and downstream (natural or manmade) bodies of water due to the water drawn during the initial filling of the Project,*

While information was provided for current and past water quality in the local and regional study areas the parameters reported on were not comprehensively described and were not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions. Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, of changes in concentrations, loading amounts and timing of key water quality parameters including routine parameters during site preparation, construction, operation, maintenance, decommissioning and reclamation and addressing impacts for potential implications to water quality due to the water drawn during the initial filling of the project. All aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation to identify potential implications to water quality due to the water drawn during the initial filling of the project.

Response:

a. The Reservoir Expansion Area will be filled over multiple years as water is available. As noted in the response to SIR#1 Question 147, the assessment of the filling process assumed that there would be no change to inflow rates and that irrigation demands would be met, which conservatively means that the water used for filling would be derived from available storage within Existing Chin Reservoir. If water is not available based on climatic conditions, then the duration of time required to fill the reservoir would increase. No impact on Waterton-St. Mary Headworks System reservoirs or flows within Waterton, Belly or St. Mary Rivers are expected. The predicted range of reservoir drawdown required to facilitate initial filling is within historic Chin Reservoir level variability. The anticipated condition in the existing Chin Reservoir during the multi-year filling process would be comparable to a series of dry years.

Question 175

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [B] (b) (iii)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

a) changes in concentrations, loading amounts, and timing of key water quality parameters including routine parameters that could impact the current Chin Reservoir and downstream (natural or manmade) bodies of water, including:

iii) potential implications to aquatic resources (e.g., aquatic and benthic invertebrates, biota, vegetation, algae, biodiversity, habitat),

While information was provided for current and past water quality in the local and regional study areas the parameters reported on were not comprehensively described and were not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions provided. Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, of changes in concentrations, loading amounts and timing of key water quality parameters including routine parameters during site preparation, construction, operation, maintenance, decommissioning and reclamation and addressing impacts for potential implications to aquatic resources (e.g., aquatic and benthic invertebrates, biota, vegetation, algae, biodiversity, habitat). All aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation to identify potential implications to aquatic resources (e.g., aquatic and benthic invertebrates, biota, vegetation, algae, biodiversity, habitat).

Response:

a. The mass balance models indicate minimal change in water quality when comparing the Existing Chin Reservoir (Base Case) to the Expanded Chin Reservoir (Project Case) during future operation (Appendix 13.1). The Adaptive Management Plan for Water Quality (Appendix 164.1) will be applied to mitigate the potential for effects during the filling phase of the project and mitigation will be applied to avoid construction-related introduction of sediment or other deleterious substances that could affect water quality. As changes in the quality of water within and released from Chin Reservoir are expected to be minimal, local and regional residual effects are not anticipated that would have potential implications for aquatic and benthic invertebrates, biota, vegetation, algae, biodiversity, or habitat suitability.

Question 176

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [B] (b) (iv)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

b) changes in concentrations, loading amounts, and timing of key water quality parameters including routine parameters that could impact the current Chin Reservoir and downstream (natural or manmade) bodies of water, including:

iv. changes in water quality due to seasonal and flow variation;

While information was provided for current and past water quality in the local and regional study areas the parameters reported on were not comprehensively described and were not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions. Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, of changes in concentrations, loading amounts and timing of key water quality parameters including routine parameters during site preparation, construction, operation, maintenance, decommissioning and reclamation and addressing impacts for changes in water quality due to seasonal and flow variation. All aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation to identify changes in water quality due to seasonal and flow variation.

Response:

a. The *Chin Reservoir Historical Canal Inflow and Modeled Arsenic Trend Analysis Technical Memorandum* (Appendix 17.1) notes that significant increasing trends have not been observed at inflow canal stations. Although there was some evidence of early season flushing within the

canal inflow, seasonal trends were not detected when the simulated base case was assessed. The irrigation system is only operated through the open water period. The frequency of data collection and number of available records does not allow for the accurate representation of potential seasonal variability. Baseline sampling within Chin Reservoir showed little seasonal variation in water chemistry and only minor seasonal stratification with depth (Volume 4-2). Canal inflow chemistry and low residence time drive the water chemistry in the reservoir. As shown in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1), there was no significant change in water quality between the base case and the expanded reservoir case.

Question 177

Reference:

Volume 2, Section 2.1;
Volume 2, Section 2.3;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [B] (b) (v)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

b) changes in concentrations, loading amounts, and timing of key water quality parameters including routine parameters that could impact the current Chin Reservoir and downstream (natural or manmade) bodies of water, including:

v. groundwater and surface water interactions,

While information was provided for current and past water quality in the local and regional study areas the parameters reported on were not comprehensively described and were not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions. Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, of changes in concentrations, loading amounts and timing of key water quality parameters including routine parameters during site preparation, construction, operation, maintenance, decommissioning and reclamation and addressing impacts for changes in water quality due to groundwater and surface water interactions. The concordance table refers to Volume 2 Section 2.1 but insufficient information is found regarding the above clause. All aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation to identify changes in water quality due to groundwater and surface water interactions.

Response:

a. The potential for groundwater interactions to influence surface water chemistry was assessed in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1). The assessment indicated that the groundwater contribution to Chin Reservoir is roughly 0.4% of the total inflow on average. The modeled constituents show that it is possible for groundwater inflows to influence modeled water quality but only when the groundwater and surface water quality are substantially different, such as the case of the Sulfate concentrations between the two inflow types. In most cases, such as Antimony, the model results vary little regardless of whether groundwater is included as a separate inflow, given the low groundwater inflow rates.

   Groundwater inflow would have the greatest potential to influence water quality during the initial period of filling within the Reservoir Expansion Area, while inflow volume represents a greater proportion of total volume. Filling in isolation will avoid the potential for water within the Reservoir Expansion Area to mix with or be released to other water bodies. By the time that the expanded reservoir is commissioned, the Reservoir Expansion Area will be subject to similar head differential as the existing reservoir, and only a small proportion of total volume would be represented by groundwater contribution (Appendix 13.1). No residual effects on Chin Reservoir or downstream water quality are anticipated due to surface water and groundwater interactions.

Question 178

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [B] (b) (vi)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

b) changes in concentrations, loading amounts, and timing of key water quality parameters including routine parameters that could impact the current Chin Reservoir and downstream (natural or manmade) bodies of water, including:

vi. changes in the quality of surface water runoff,

While information was provided for current and past water quality in the local and regional study areas the parameters reported on were not comprehensively described and were not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions. Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, of changes in concentrations, loading amounts and timing of key water quality parameters including routine parameters during site preparation, construction, operation, maintenance, decommissioning and reclamation and addressing impacts for changes in the quality of surface water runoff. All aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation to identify changes in the quality of surface water runoff.

Response:

a. Temporary disturbance associated with access and construction of the permanent works is anticipated to include the east access road, access to the Dam Fill Waste Area, laydown area, and temporary disturbance in the vicinity of permanent structures. As described in the

Conceptual Conservation and Reclamation Plan (Volume 2, Appendix 8, Section 8-4), the areas of temporary disturbance will be reclaimed through topsoil salvage, stockpiling and replacement, grading to restore natural stormwater drainage pathways, and revegetating with native species. Reclamation works will be implemented progressively over the course of construction. Temporary ESC measures will be implemented to control the potential for runoff from areas of temporary disturbance and during establishment of permanent vegetative cover for erosion control and monitoring to confirm compliance with ECO Plan and ESC Plan requirements will be conducted, in accordance with the construction environmental management requirements described in Volume 2, Appendices 2-6. Although the water quality of surface runoff from construction areas cannot be modelled, ESC measures can be effectively applied to reduce the potential for surface water quality to be impacted by runoff.

The only potential pathway for the Project to affect surface water runoff from the watershed during operation will be the presence of the permanent west access road, East Dam abutments and spillway. These structures have been designed to integrate with the landscape such that natural drainage can be maintained.

The restoration of associated temporary disturbance areas will be confirmed through the contract warranty process. Based on the application of mitigation measures and design of permanent structures, no residual effects on the quality of surface water runoff are predicted.

Question 179

Reference:

Volume 2, Section 2.6;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [B] (b) (vii)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

b) changes in concentrations, loading amounts, and timing of key water quality parameters including routine parameters that could impact the current Chin Reservoir and downstream (natural or manmade) bodies of water, including:
vii. implications to the health and extent of riparian lands

While information was provided for current and past water quality in the local and regional study areas the parameters reported on were not comprehensively described and were not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions. Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, of changes in concentrations, loading amounts and timing of key water quality parameters including routine parameters during site preparation, construction, operation, maintenance, decommissioning and reclamation and addressing impacts for implications to the health and extent of riparian lands. The concordance table refers to Volume 2 Section 2.6 but insufficient information is found regarding the above clause specifically for water quality changes due to changes is riparian lands. All aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation specifically regarding water quality changes due to possible implications to the health and extent of riparian lands.

Response:

a. As discussed in Volume 2, Section 2.6.3.2.1, expansion of the reservoir and change in FSL is expected to result in a transition of vegetation species at the margin of the reservoir, shifting to riparian species in response to the altered moisture regime. There will be a short-term decrease in riparian vegetation abundance during the period of transition, but a net increase in riparian vegetation habitat is expected due to reservoir expansion. Adverse effects on water quality are not anticipated in conjunction with this transition of vegetation species.

   Project Case water quality is not predicted to vary significantly from the Base Case condition during future operation (Appendix 13.1). Therefore, there is no anticipated potential for water quality changes to adversely affect riparian lands or occurrence of riparian vegetation during future operation.

Question 180

Reference:

Volume 2, Section 4.2;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [B] (b) (viii)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

b) changes in concentrations, loading amounts, and timing of key water quality parameters including routine parameters that could impact the current Chin Reservoir and downstream (natural or manmade) bodies of water, including:

viii. impacts in the event of a catastrophic failure of the structure

While information was provided for current and past water quality in the local and regional study areas the parameters reported on were not comprehensively described and were not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions. Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, of changes in concentrations, loading amounts and timing of key water quality parameters including routine parameters during site preparation, construction, operation, maintenance, decommissioning and reclamation and addressing all possible impacts in the event of a catastrophic failure of the structure. The concordance table refers to Volume 2 Section 4.2 but insufficient information is found regarding the above clause for water quality changes due to catastrophic structure failure. All aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation specifically for water quality changes for all parameters to address all possible impacts in the event of a catastrophic failure of the structure.

Response:

a. The consequence classification for the New East Dam is described in the Breach Inundation Study, in Appendix VI of the New East Dam Preliminary Design Report (Appendix I). Failure of the New East Dam would be expected to result in a surge of turbid water within the downstream coulee, causing scouring and inundation of terrestrial and wetland habitats up to approximately 105 km downstream at Murray Lake. Sediment-laden water would be transported throughout the inundation extents, with residual pooling expected in low areas following initial inundation and draining, including Watercourse 126419, small impoundments, and Murray Lake. Following flooding, downstream water users could experience elevated suspended sediment concentrations. Dam breach would be considered a catastrophic event.

Question 181

Reference:

Volume 2, Section 2.3;
Volume 2, Section 4.2;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [B] (b) (ix)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

b) changes in concentrations, loading amounts, and timing of key water quality parameters including routine parameters that could impact the current Chin Reservoir and downstream (natural or manmade) bodies of water, including:

ix. impact on creek banks during flood events;

While information was provided for current and past water quality in the local and regional study areas the parameters reported on were not comprehensively described and were not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions. Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, of changes in concentrations, loading amounts and timing of key water quality parameters including routine parameters during site preparation, construction, operation, maintenance, decommissioning and reclamation and addressing all possible impacts impact on creek banks during flood events. The concordance table is blank but assumedly refers to Volume 2 Section 4.2, however insufficient information is found regarding the above clause for water quality changes due to impacts on creek banks during flood events. All aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation specifically for water quality changes to address all possible impacts on creek banks during flood events.

Response:

a. Chin Reservoir will not discharge to Watercourse 126419 via the New East Dam under typical operating conditions. The catchment of Watercourse 126419 is small and there is significant depressional storage capacity that would limit stormwater runoff to the watercourse during floods less than the 1:10-year event. The channel of Watercourse 126419 is poorly defined and there was limited evidence of scour and channel forming flows observed during baseline studies (Volume 4-4). Cattle travel within the residual pools of water within Watercourse 126419 is considered to be a more significant source of sediment mobilization than flooding under baseline conditions.

   The Project is expected to result in a minor decrease in the catchment area of Watercourse 126419 and an associated minor decrease in storm discharge, so the potential for scouring flow during flood events will not increase relative to the baseline condition. However, the New East Dam will include an Auxiliary Spillway that would discharge to Watercourse 126419 in the event that the spillway was activated, which would be expected during flood events exceeding the 1:1,000-year event. In the unlikely event that the Auxiliary Spillway was activated, the release would be expected to result in a surge of turbid water within the downstream coulee, causing scouring of the banks of Watercourse 126419 and inundation of terrestrial and wetland habitats downstream. Sediment-laden water would be transported throughout the inundation extents, with residual pooling expected in low areas following initial inundation and draining. Following flooding, downstream water users could experience elevated suspended sediment concentrations.

Question 182

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [B] c)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

c) the level of uncertainty derived from the models and tools used in the analysis

The full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for descriptions and predictions, the potential impacts of the Project (during site preparation, construction, operation, maintenance, decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water.

The modelling that was provided in Appendix 7 addresses uncertainties in data as an argument for not doing a complete analysis but an assessment about the level of uncertainty derived from the models and tools that were used in the analysis was not found in the EIA.

Information Request:

a. Answer the final Terms of Reference question by addressing the level of uncertainty derived from the models or other scientifically defensible approaches used in the analysis of all parameters that have the potential to be influenced by the project, to both describe and predict changes in each concentrations, loading amounts and timing during all stages of the Project (site preparation, construction, operation, maintenance, decommissioning and reclamation) for each parameter.

Response:

a. The level of uncertainty derived from the water quality model for the Chin Reservoir is considered to be low and related primarily to uncertainty in the timing of loadings. The developed mass balance models simulate the movement of water and the mass of solutes through the reservoir for both the Base case and Project Case. Given the canal is the largest source, the concentration in the reservoir should mimic the canal. As significant increasing trends were not identified for inflow canal historical data, a mean inflow concentration was adopted for each modelled parameter (Appendix 17.1). Although there was some evidence of early season flushing within the canal inflow, seasonal trends were not detected when the simulated base case was assessed. As mentioned before, the mass balance model replicates over 80 years of inflow for both the base case and the expanded reservoir case. This model,

therefore, covers a range of annual loading rates from wet years to dry years, reducing uncertainty.

There would be a high level of uncertainty associated with modeling of the construction or maintenance stages, which would be too short to model, and it is expected that the potential for effects can be managed through application of mitigation measures. Likewise, the filling process during construction cannot be effectively modelled without introducing significant uncertainty. However, the potential for adverse effects on reservoir water quality can be managed by conducting filling in isolation and applying an Adaptive Management Plan (Appendix 164.1). Therefore, construction, filling, and maintenance phases were not modeled.

Question 183

Reference:

Volume 2, Section 2.3;
Volume 2, Section 3;
Volume 2, Appendix 7;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [B] (d)

Rationale/Preamble:

The Final Terms of Reference states *Describe and predict the potential impacts of the Project (during site preparation, construction, operation, maintenance decommissioning and reclamation) on surface water quality of the current Chin Reservoir and downstream (natural or manmade) bodies of water using modelling or other scientifically defensible approach, including:*

d) any limitations of expected water quality on municipal/domestic use, recreational use, fisheries, stock watering or other uses.

While information was provided for current and past water quality in Section 3 and in the local and regional study areas, the parameters reported on were not comprehensively described and were not fully representative of all of the parameters (key parameters) that could be influenced by the project. The suite of parameters where data is available is numerous for the tables SMRID provided in appendices and should be used to provide summaries and descriptions.

Moreover, the full final Terms of Reference requirement is to use modelling or other scientifically defensible approach for addressing any limitations of expected water quality on municipal/domestic use, recreational use, fisheries, stock watering or other uses. All aspects of this clause are required by the final Terms of Reference, but all aspects were not found in the EIA.

Information Request:

a. Answer the final Terms of Reference by using modelling or other scientifically defensible approach for all parameters that have the potential to be influenced by the project. For each parameter both comprehensively describe and predict changes in each concentrations, loading amounts, and timing during each project stage including site preparation, construction, maintenance, decommissioning and reclamation to address any limitations of expected water quality on municipal/domestic use, recreational use, fisheries, stock watering or other uses.

Response:

a. All water quality parameters for which baseline data are available have been included in an updated modeling assessment and the results are presented in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1). The water quality analysis provided is a long duration mass balance model that represents the mass and subsequent concentration found in the reservoir. Since water quality was not shown to change appreciably between the Base Case and the Project Case, impacts on municipal/domestic use, recreational use, fisheries, stock watering

or other uses during operation are not predicted. The potential for adverse effects to occur during construction will be addressed through mitigation. Filling of the expanded reservoir will occur in isolation to avoid potential effects on the identified receptors and adaptive management will be applied to confirm that effects will be avoided prior to commissioning.

Question 184

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7, Table 2 and 3, Page 7-9;
Volume 2, Appendix 14, Section 5-5.2;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [D] (a)

Rationale/Preamble:

The final Terms of Reference states *Describe the potential and implications for metals (e.g., lead, arsenic, cadmium, selenium, and mercury) methylation in the Project to:*

a) enter the aquatic food chain, including downstream in the Project and downstream (natural or manmade) bodies of water

While some information was provided in Appendix 7 it was only for the four metals given as examples in the final Terms of Reference, which is insufficient and a description of the potential and implications for metals to enter the aquatic food chain including downstream bodies of water was not found in sufficient detail in the EIA. The submission provided in Volume 2 Appendix 14 sections 5.0 to 5.2 is an example of an informative level of detail, but it was not part of the water quality submission and is only for Mercury and not all metals that may impact water uses.

Data in Appendix 7 Table 3 Water Quality Limits is displayed in number format (e.g. Mercury PAL Acute 0.013 ug/L) while the data is displayed in Table 2 in scientific format (e.g. Mercury WQCR3-S 4.18E-02 which is 0.04 ug/L and an exceedance, although this is not mentioned in the text). As this is a public document, do not display data in scientific format (8.00E-04) display all data as number format.

Concentration sum is not defined as it is used in the table caption.

INTERA Appendix 7 Table 3 displays water quality limits but is missing the Cadmium (acute and chronic) and Lead (chronic) guidelines for Freshwater Protection of Aquatic Life. While these metals guidelines are based on hardness and must be individually calculated from tables they should also be included in the table, assessed, and results provided in respective tables (e.g. 7, 8, 9) and text in the EIA.

Information Request:

a. Answer the final Terms of Reference for all applicable metals parameters (not limited to those given “as examples” in the final Terms of Reference).
b. Answer the final Terms of Reference by addressing the potential and implications of metals entering the aquatic food chain including downstream bodies of water.
c. Display data consistently in number format.

d. Compare metals to all water use guidelines (and not a chosen subset).

Response:

a. All water quality parameters for which baseline data are available have been included in an updated modeling assessment and the results are presented in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1).

b. Updated model results and comparison to all applicable guidelines are presented in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1). The predicted metal concentrations are all below the guideline thresholds for the protection of aquatic organisms (GoA 2018a; CCME 1999), except for aluminum and mercury. Maximum and mean concentrations of aluminum were predicted to exceed the CCME long-term (chronic) guideline for both Base Case and Project Case, with no change associated with the Project condition. The modeling results indicate that exceedance of acute and chronic mercury guidelines for protection of aquatic life would occur in both the Base Case and Project Case (Appendix 13.1); however, this is considered to be an erroneous result as historical sampling used a method detection limit higher than the guideline criteria, resulting in flagged exceedance when 0.5 times the detection limit was used to populate many of the sample points for modeling purposes. The potential for metals to be mobilized through leaching or erosion of soils within the Reservoir Expansion Area will be mitigated by conducting filling through a multi-year process, in isolation from the Existing Chin Reservoir.

   Despite the application of mitigations, it is conservatively predicted that the methylmercury concentrations in sportfish in the Chin Reservoir may increase, albeit on a temporary basis, with expansion of the reservoir, based on observations following the inundation of other reservoirs in southern Alberta. Although the concentration of total mercury measured in water may not exceed guideline criteria (e.g., observed baseline condition in the Existing Chin Reservoir), there is considered to be potential for mercury to become bioavailable (i.e., through methylation) and enter the food chain, resulting in accumulation in fish tissue. Although the magnitude of the anticipated increase cannot be quantified, an increase in mercury concentration in fish tissue would be of concern, since the condition measured at baseline is already exceeding guideline criteria for human consumption, in addition to the criteria for consumption by wildlife. SMRID will coordinate with EPA to request that the Chin Reservoir be included in the EPA fish monitoring program so that the data can be shared with Alberta Health for inclusion in their Alberta Fish Consumption Program.

   The proposed mitigation of conducting filling in isolation is also expected to limit the potential for other metals to be methylated and enter the food chain. There are no guideline criteria for fish tissue residue for wildlife or human consumption for other metals, except for selenium, which has not been measured. The presence of selenium has been shown to reduce the effects of methylmercury (CCME 2000). Mercury is considered to be the parameter of primary concern for bioaccumulation at Chin Reservoir, which has been noted as an existing concern at baseline.

c. Data has been displayed consistently in number format in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1).

d. A comparison of predicted metals concentrations to all water use guidelines is provided in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1).

Question 185

Reference:

Volume 2, Section 2.3;
Volume 2, Appendix 7, Table 1, Page 3-4;
Volume 2, Appendix 7, Page 1-2, and 20;
Volume 5, Section 3, 3.4.2 [E]

Rationale/Preamble:

Volume 2 Section 2.3 references Appendix 7.

INTERA states *INTERA did not analyze a gradual reservoir filling scenario, nor were organic carbon, nutrient management, or other organic water quality parameters examined within the project confines* and *As the reservoir expands, the low flow rate is likely to increase at least slightly the growth of organics within the water volume, such as cyanobacteria/microcystin. However, like the nutrients above, these scenarios were not modeled, due to the difficulty of representing the complex interactions that determine the growth of such elements falling outside the scope.*

INTERA states *The models do not estimate the incremental filling of the reservoir, salinity, or nutrient water quality, as those would involve further complex efforts to analyze which are beyond the scope of this work.*

INTERA states *Nutrient water quality was not explicitly modeled. However, using existing water quality in the Chin Reservoir system as an analog, future water quality with the Expanded Chin Reservoir volume can be reasonably estimated.* And that incremental filling scenarios…*were not modeled, due to the difficulty of representing the complex interactions.*

INTERA Table 1 shows high Nutrient values for TP and TN indicating the need for modelling these parameters.

Organic Carbon and Nutrients are commonly increased during reservoir filling from extensive erosion, are drivers of ecosystem productivity which influences drinking water treatment and should not be overlooked.

Difficulty of representing the complex interactions is not a reason for not completing the modelling.

The final Terms of Reference states *Describe the potential and implications for organic carbon and nutrient management in the Project, based on the proposed operating regime to:*

a) *Impact treatment of water the Project and downstream (natural or manmade) bodies of water for drinking water purposes (e.g., disinfection by-products); and*
b) *Impact productivity of aquatic vegetation (e.g., macrophyte, algae).*

Information Request:

Answer the final Terms of Reference by describing the potential and implications for organic carbon and nutrient management in the Project, based on the proposed operating regime to:

a. Impact treatment of water the Project and downstream (natural or manmade) bodies of water for drinking water purposes (e.g., disinfection by-products); and

b. impact productivity of aquatic vegetation (e.g., macrophyte, algae). Blue-green algae includes *cyanobacteria/microcystin.*

Response:

a. The potential for adverse effects to occur during construction will be addressed through mitigation. Filling of the expanded reservoir will occur in isolation to avoid potential effects on the identified receptors and adaptive management will be applied to confirm that effects will be avoided prior to commissioning. The mass balance models indicate minimal change in water quality when comparing the existing Chin Reservoir (Base Case) to the expanded reservoir (Project Case) during future operation (Appendix 13.1). The Project is not expected to affect treatment of water from Chin Reservoir or downstream bodies of water for drinking water purposes.

b. All water quality parameters for which baseline data are available have been included in an updated modeling assessment and the results are presented in the *Water Quality Analysis Technical Memorandum* (Appendix 13.1). The model has been updated to include nutrients. Project Case nutrient concentrations are not predicted to vary significantly from the Base Case condition during future operation. Therefore, there is no anticipated potential for water quality changes to adversely affect treatment of water that is drawn from the reservoir or downstream water bodies for use as drinking water during future operation.

   Likewise, as Project Case nutrient concentrations are not predicted to vary significantly based on the application of mitigation and adaptive management, there is no anticipated potential for water quality changes to adversely affect productivity of aquatic vegetation including macrophytes and algae. Total phosphorus and chlorophyll-a concentrations measured in the Existing Chin Reservoir ranged from ultra-oligotrophic to mesotrophic status (Volume 4-2: Surface Water Quality TBR). Aquatic vegetation productivity is considered to be low in the Existing Chin Reservoir, with limited occurrence of aquatic macrophytes in areas of wind protection. The Reservoir Expansion Area is expected to provide similar habitat conditions, with similar water quality. Therefore, increased aquatic vegetation productivity is not anticipated.

Question 186

Reference:

Volume 2, Section 2.3;
Volume 2, Section 3;
Volume 4-2, Appendix 1;
Volume 5, Section 3, 3.4.2 [H]

Rationale/Preamble:

The final Terms of Reference states *Describe mitigation measures to address surface water quality impacts during all stages of the Project including:*

a) alteration in flow regimes;
b) potential flood events;
c) potential water use and operations conflicts; and
d) increased loading of water quality parameters of concern.

A description of mitigation measures to address all applicable parameters at all stages, were not sufficiently addressed (in Appendix 1 Tables) in the Volume 4-2 TBR, Volume 2 Section 2.3, Volume 2 Section 3 or do not seem to specifically address the subclauses regarding water quality.

Information Request:

Answer the final Terms of Reference:

a. for alterations in flow
b. for flood
c. for operations conflicts, and,
d. for increased loading of parameters.

Response:

a. The SOAP model was applied to simulate potential operation of the Project to confirm that variability in flow conditions will not affect the viability of the Project. These flow simulations are applied in the water quality mass balance model to simulate a long period from 1928 to 2009. That is over 80 years of simulated hydrologic conditions which would include extreme conditions such as drought and flood. Based on these simulations, alterations in flow are not predicted to adversely affect water quality in the Expanded Chin Reservoir, when compared to how the Existing Chin Reservoir operates.

   A potential pathway of effect through which the Project could cause alterations in flow is during the filling process. However, as noted in the responses to SIR#1 Questions 147 and 174, the assessment of the filling process assumed that there would be no change to inflow rates and that irrigation demands would be met, which conservatively means that the water used for filling would be derived from available storage within Existing Chin Reservoir. If water is not

available based on climatic conditions, then the duration of time required to fill the reservoir would increase. This strategy represents the mitigation that will be applied to avoid adversely affecting water quantity or quality. The predicted range of reservoir drawdown required to facilitate initial filling is within historic Chin Reservoir level variability. Impacts on water quality are therefore not expected beyond the typical range of variation, as represented in the mass balance modeling results. The anticipated condition in the existing Chin Reservoir during the multi-year filling process would be comparable to a series of dry years.

b. Given the over 80 years of record applied for simulating operating conditions, the mass balance model results are considered to represent periods of extremely wet conditions. The expanded reservoir will be able to attenuate large flood events and inflows will represent increased storage. As described in the response to SIR#1 Question 166, large flood events have been simulated for representative parameters using the mass balance model to assess the influence on water quality. As noted in the response to SIR#1 Question 180, a significant flood event does not represent typical operation of the system and mitigation measures are not considered feasible or warranted.

c. The SOAP model considers multiple licensed uses and operational constraints/conflicts in assessing the availability and use of water for operation of the SMRID irrigation system. The additional storage of the expanded reservoir will allow for flexibility in the dam operations. The additional storage can be used to store water for later discharge or increased outflow. Residual effects on water quality are not anticipated for reservoir and downstream water use for drinking water supply, recreation, agriculture, domestic use, aesthetics, or other uses. Therefore, additional mitigation is not proposed. The Adaptive Management Plan and associated monitoring program will serve to detect unanticipated adverse effects during the filling process. Additional management measures would be applied prior to commissioning the reservoir if the potential for adverse effects is identified that could lead to operational conflicts.

d. The average concentration and therefore the average loading was used in the mass balance model. The loadings were varied throughout the over 80-year simulation. Years with higher flows would have higher loads and lower flows would have lower loads. The additional storage of the expanded reservoir will act as a buffer for short increases in water quality loads. The mass balance model results indicate that residual adverse effects on water quality are not predicted during future operation (Appendix 13.1).

   Construction-related mobilization and introduction of sediment could result in additional loading to the system. As described in the response to SIR#1 Question 178, reclamation works will be implemented progressively over the course of construction. Temporary ESC measures will be implemented to control the potential for runoff from areas of temporary disturbance and during establishment of permanent vegetative cover for erosion control, in accordance with the construction environmental management requirements described in Volume 2, Appendices 2-6.

   Filling of the Reservoir Expansion Area could potentially result in increased loading. A key mitigation strategy that will be applied is to conduct filling of the reservoir under isolated conditions. This will allow for loads to settle and be diluted over the multi-year filling process,

without mixing with and causing adverse effects within the Existing Chin Reservoir. Monitoring and adaptive management will be conducted to confirm that effects will be avoided prior to commissioning of the expanded reservoir.

Question 187

Reference:

Volume 2, Section 2.3;
Volume 2, Section 3;
Volume 2, Section 4;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [I]

Rationale/Preamble:

The final Terms of Reference states *Provide a summary of the management plan to prevent or reduce impacts to surface water, and a spill response plan should an accidental release occur.*

No summary of the management plan to prevent or reduce impacts to surface water or a summary of a spill response plan were found in Volume 2 (Sections 2.3, 3, or 4) or Volume 4-2 TBR. Only reference to the need for them to be developed later were found.

Information Request:

Answer the final Terms of Reference by:

a. Providing a summary of the management plan to prevent or reduce impacts to surface water for all applicable parameters.

b. Providing a summary of a spill response plan for all applicable parameters.

Response:

a. Please refer to the Adaptive Management Plan provided in Appendix 164.1. The Adaptive Management Plan will include monitoring to assess changes in water quality and to confirm that any identified concerns have been addressed before decommissioning of the Existing East Dam and commissioning of the Expanded Chin Reservoir.

b. A spill response plan will be established by the contractor conducting construction works. The spill response procedures would include the following sequence:

   - As soon as a spill is noticed, STOP work.
   - STOP the flow (where possible).
   - Qualified workers will provide appropriate and prompt response to reduce risks and damage (i.e.; stop product flow, place absorbent materials to contain the spill, etc.).
   - Cordon off spill area.
   - Contain the spill.
   - Inform the environmental monitor, construction site superintendent, and project manager.

- Report to Energy and Environmental Response Line (1-800-222-6514), as per reporting regulations.
- Complete spill cleanup.
- Ensure site is safe and give the go ahead for work to resume (if deemed safe to proceed).
- Perform a thorough incident investigation and complete reporting.
- Review incident findings with workers during the next safety meeting.

The emergency spill response sequence will be posted on-site and all personnel will be made aware of location of spill response materials, protective equipment, and emergency contact names and numbers.

Spills of hazardous materials will be handled in accordance with material-specific information in its respective Safety Data Sheet (SDS). Spill response teams capable of containment, remediation, communication, and reporting will be utilized when and where necessary.

Question 188

Reference:

Volume 2, Section 2.3;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [J]

Rationale/Preamble:

The final Terms of Reference states *Discuss the contribution of the Project to cumulative effects on water quality, including downstream (natural or manmade) bodies of water and discuss the implications to the South Saskatchewan Region - Surface Water Quality Management Framework and any other regional initiatives.*

Discussion for all applicable parameters on cumulative effects or the surface water quality management framework was not found in the Volume 4-2 TBR or Volume 2, Section 2.3.

Information Request:

Answer the final Terms of Reference by:

a. Discussing the contribution of the Project to cumulative effects on water quality, including downstream (natural or manmade) bodies of water for all applicable parameters.

b. Discussing the implications to the South Saskatchewan Region - Surface Water Quality Management Framework and any other regional initiatives.

Response:

a. As noted in the response to SIR#1 Question 170, residual effects on water quality are not predicted at a regional scale. The SOAP model used to assess changes in water quantity within the SMRID system is based on the Provincial SSROM model and it does account for potential cumulative effects of water use within the Southern Tributaries system. A long historical record was used to simulate the natural variations in the inflow time series. Since only minor variation in downstream flows is predicted, with no increase in the frequency of WCOs not being met, residual effects on water quality within downstream watercourses are not predicted regionally, or cumulatively. Based on the water quality modeling conducted, changes in the quality of water released from Chin Reservoir are expected to be minimal and residual effects are not anticipated within Stafford Reservoir or other downstream portions of the irrigation conveyance system within the RSA. Application of mitigation measures and adaptive management is proposed to manage the potential for effects during construction and filling phases. Please refer to the *Water Quality Analysis Technical Memorandum* (Appendix 13.1) and the Adaptive Management Plan (Appendix 164.1) for additional details. Downstream regional effects are not predicted; therefore, cumulative effects are also not anticipated.

b. As noted in the response to SIR#1 Question 170, based on simulated operating conditions, the Project is not expected to result in residual effects on water quality within Waterton, Belly or

St. Mary Rivers that could cause exceedance of triggers in the Surface Water Quality Management Framework included as part of the South Saskatchewan Regional Plan.

Question 189

Reference:

Volume 2, Section 2.3;
Volume 4-2;
Volume 5, Section 3, 3.4.2 [K]

Rationale/Preamble:

The final Terms of Reference states *Discuss the impact of low flow conditions and in-stream flow needs on water quality and water and wastewater management strategies.*

Discussion was not sufficiently found in the Volume 4-2 TBR or Volume 2, Section 2.3. for all applicable parameters.

Information Request:

a. Answer the final Terms of Reference by discussing the impact of low flow conditions and in-stream flow needs on water quality for all applicable parameters.

Response:

a. As noted in the response to SIR#1 Question 2, the SMRID system is operated in a collaborative manner with AGI and other water users, which includes forecasting and proactively setting lower farmgate allocations in times of low predicted water supply. Please refer to Appendix 2.1 (*Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum*) for additional detail related to operating practices. As described in the response to SIR#1 Question 4, the simulation of operating conditions suggests that the Project can be operated without causing significant change in flows within regional watercourses, or an increase in the frequency that WCO is not met. As such, the potential for the Project to incrementally affect the persistence of low flow conditions or to influence associated water quality is expected to be low.

   Few exceedances of irrigation water quality guideline criteria have been noted in Chin Reservoir, Stafford Reservoir, and the irrigation canal based on baseline and historical sampling data, which have included TDS, manganese, and fecal coliforms (refer to the response to SIR#1 Question 165 for more detail). The sampling period covers a range of flow conditions, including periods of low flow such as August 2006. Flow variation and low flow conditions in source streams is not expected to adversely affect the quality of diverted water in a manner that could cause an effect on the Project and operation of the SMRID system.

Question 190

Reference:

Volume 2, Section 2.3.6, Page 41 and 42

Rationale/Preamble:

A detailed monitoring plan for all stages of operations going forward was not found. Section 2.3.6 only mentions one parameter Total Suspended Solids but indicates a plan will be developed.

Information Request:

a. Provide a detailed monitoring plan including all parameters, stations, and frequency of monitoring.

Response:

a. Please refer to the Adaptive Management Plan (Appendix 164.1). The Adaptive Management Plan outlines the required monitoring activities. Monitoring at the three existing stations within the Existing Chin Reservoir will continue, with sampling covering all previously monitored parameters. In addition, three new stations will be established in the Reservoir Expansion Area, also including the full set of parameters. Sampling at all stations will continue through filling, decommissioning of the existing dam, and for the first three years of operation following commissioning.

Question 191

Reference:

Volume 2, Appendix 7, Page 5

Rationale/Preamble:

INTERA states *Analysis of the spatial distribution of surface water sampling locations and the average constituent concentrations recorded at those locations revealed no significant spatial trends between the north and south ends of the chin reservoir.*

Statistical trend analysis does not use averages as input data, it must input raw data points.

Information Request:

a. Complete the methodology for spatial and temporal trends and seasonality analysis using raw data and following all assumptions of the statistics used. Provide statistical tests chosen and statistical analysis results for all parameters.

Response:

a. Spatial and temporal trends have been evaluated for the baseline and historical data and the statistical analyses and results are described in the *Chin Reservoir Historical Canal Inflow and Modeled Arsenic Trend Analysis Technical Memorandum* (Appendix 17.1). The analysis of historical data for sampling sites within the SMRID system supplements the regional analysis presented in AAF (2021b).

Question 192

Reference:

Volume 4-2, Table 2.2, Page 10

Rationale/Preamble:

The SMRID states, *Sample Frequency* in the last column of Table 2.2.

The last column lists the sampling time rather than frequency.

Information Request:

a. Provide an updated table with the corrected title for sampling time and add a column for sampling frequency (e.g., bi-weekly or monthly).

Response:

a. An updated table is provided below as Table 192.1 to reflect the corrected title for sampling time. Data from the Irrigation District Water Quality Project was available for sampling within the SMRID area from the following years: 2006, 2007, and 2011 to 2020. Within each year, four sampling events were typically conducted separated by two to five weeks, targeting a monthly sampling frequency for the period from May to August. Collection times were optimized to occur during periods of active irrigation demand, typically beginning in late May and extending to the beginning of September. During each sampling event, the sampling locations within the SMRID area were sampled within three consecutive days (AAF 2021a).

Table 192.1 IDWQ Project Monitoring Locations

Sample Location	Site Type	Location Description	Coordinates in UTM NAD83[1]		Sampling Times	Sampling Frequency Target
			Easting (m)	Northing (m)		
SMC-P1	Primary	SMRID main canal downstream of Horsefly Creek	427736.18	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SMC-R1	Infrastructure Return	North Grassy Main Canal spillway into South Saskatchewan River	451435.04	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SMC-R2	Secondary	Yellow Lake off Township Road 10-0	460581.98	2006, 2007	Monthly from May to August	x4 sampling events/sampling year
SMC-R3	Infrastructure Return	North Burdett Main Canal Spillway to South Saskatchewan River	462907.78	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SMC-R4	Infrastructure Return	Bow Island Lateral Spillway to South Saskatchewan River	467678.39	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SMC-S1	Secondary	Grassy Outlet Channel at outlet of the Sherburne Reservoir	447702.45	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SMC-S2	Secondary	Grassy Outlet Channel downstream of Yellow Lake siphon at North Grassy Main Canal / North Burdett Main Canal Split	451966.75	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SMC-S3	Secondary	SMRID Main Canal downstream of Forty-Mile Reservoir pumps	469174.79	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SME-P1	Primary	SMRID Main Canal at outlet of Sauder Reservoir	500764.62	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SME-R1	Watershed Return	Bullshead Reservoir Water just before entering Bullshead Creek	526432.50	2006, 2007	Monthly from May to August	x4 sampling events/sampling year
SME-R1a	Infrastructure Return	Bullshead Spillway into Bullshead Reservoir	525958.79	2011-2020	Monthly from May to August	x4 sampling events/sampling year
SME-R2	Watershed Return	Seven Person Creek at Range Road 62 (combination of overflow from Seven Persons Reservoir, irrigation lateral tailouts and surface runoff)	519199.96	2011-2020	Monthly from May to August	x4 sampling events/sampling year
SME-S1	Secondary	SMRID Main Canal below Murray Reservoir	504707.57	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SMW-P1	Primary	SMRID Main Canal southeast of Lethbridge at Range Road 13-3	376229.42	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SMW-R1	Watershed Return	Malloy Drain (East Lateral tailout to Stafford Reservoir)	392753.32	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year

Sample Location	Site Type	Location Description	Coordinates in UTM NAD83[1]		Sampling Times	Sampling Frequency Target
			Easting (m)	Northing (m)		
SMW-R2	Infrastructure Return	Cameron 7 Spillway to Oldman River	397321.02	2006, 2007, 2011-2020	Monthly from May to August	x4 sampling events/sampling year
SMW-S1	Secondary	Lethbridge Lateral downstream of headgates	377421.14	2006, 2007	Monthly from May to August	x4 sampling events/sampling year
SMW-S2	Secondary	Northeast Lateral at Eat Lateral headgates	378497.90	2011-2020	Monthly from May to August	x4 sampling events/sampling year

Source: Irrigation District Water Quality Project Volume 7: Water Quality Indices of Irrigation Water of Southern Alberta (AAF 2021a).

Question 193

Reference:

Volume 4-2, Section 2.2.4, Page 14 and 15

Rationale/Preamble:

SMRID lists parameters that were analyzed. E.coli and Total mercury were seemingly missed.

Information Request:

a. Provide an updated list to include E.coli and Total Mercury to future sampling.

Response:

a. The *Adaptive Management Plan for Water Quality Technical Memorandum* provided in Appendix 164.1 includes a list of parameters that will be sampled during monitoring of the filling process and the first three years of operation following commissioning. The list of parameters has been updated to include Escherichia coli, total mercury, and pesticides.

Question 194

Reference:

Volume 4-2;
Volume 5, Section 3, 3.4.1 [A]

Rationale/Preamble:

The final Terms of Reference states *Discuss the effects of seasonal and flow variations, other controlling factors, and temporal and spatial trends.*

A discussion was not sufficiently provided in Volume 4-2 TBR for all parameters sampled (and in the appendix tables). Some parameters are described in detail while others only mention some guideline exceedances.

Information Request:

a. Answer the final Terms of Reference by providing a discussion on the effects of seasonal and flow variations and temporal and spatial trends in the highest provided level of detail for all parameters with available data.

Response:

a. Please refer to the response to the *Chin Reservoir Historical Canal Inflow and Modeled Arsenic Trend Analysis Technical Memorandum* (Appendix 17.1) for discussion of the potential effects of seasonal and flow variations and temporal and spatial trends. Seasonal trend analysis is not feasible due to limited data availability. Additional detail regarding baseline surface water quality conditions is provided in the response to SIR#1 Question 165.

Question 195

Reference:

Volume 4-2, Appendix II, Table II.3;
Volume 5, Section 3, 3.4.1 [A];
Volume 5, Section 3, 3.4.2. [A], [B], [C], [H], [J], [K]

Rationale/Preamble:

In the raw data provided in Table II.3 *Summary of Historic Pesticide Parameters,* 2,4-Dichlorophenoxyaceticacid (4-D) appears to be ubiquitous in the sample results at all locations. Some values are above guidelines. Except for these raw data tables and a brief mention of combined parameter results from a reference document, pesticides do not appear to be addressed in this section of the EIA.

Information Request:

a. Answer the final Terms of Reference by including a description of 2,4-D and all pesticides detected at the stations and a response as to how 2,4-D (and all pesticides detected) detection frequencies and concentrations will be influenced by the Project as per the final Terms of Reference 3.4.1 [A] and 3.4.2 [A], [B] (a), (b) (i) - (ix), (c), and (d), [C] [H] [J] [K].

Response:

a. The water quality model has been updated to include assessment of 2,4-D. Sampling results for other pesticides and herbicides were mostly below reported method detection limits and thus were not reported at a sufficient frequency to be included in the model. 2,4-D was not modeled in the original submittal because there were no data to use as an initial condition in the reservoir. For the current water quality model, it was assumed that the reservoir was initialized at 0.5 times the average 2,4-D concentration measured in the canal. The model results indicate that the concentration of 2,4-D in the Project Case will be similar to the base case, dictated by the inflow concentrations. Please refer to the *Water Quality Analysis Technical Memorandum* (Appendix 13.1) for additional details.

Question 196

Reference:

Volume 5, Section 3, 3.4.1 [A]

Rationale/Preamble:

The final Terms of Reference states *Describe the baseline water quality of water courses and water bodies (current Chin Reservoir and downstream (natural or man-made) bodies of water).*

Information Request:

a. Include available data on the Milk River Ridge Reservoir, SMRID main canal, Chin canal or other source water (upstream) data in the baseline information for Section 3.4 of the final Terms of Reference.

Response:

a. Historical water quality sampling station SMW-P1 is located on the SMRID main canal and represents a primary sampling site where source water enters the irrigation district (AAF 2021a). Sampling site SMW-S1 is a secondary site on a lateral canal, which is also considered to be upstream of Chin Reservoir within the irrigation system. The other sampling sites for which historical data was collected to support the Irrigation District Water Quality Project (AAF 2021a) are all located downstream from Chin Reservoir within the system, including primary, secondary and return flow sites. Station SMW-P1 is directly upstream from Chin Reservoir and was considered to be representative of inflow conditions from the headworks system and data from this station was used as the input for the water quality model analysis.

   Based on the responses to SIR#1 Questions 97 and 98, impacts on MRRR storage are not anticipated as a result of the Project; therefore, effects on water quality are not expected in this upstream reservoir and it has not been characterized.

   Additional historical sampling data from Chin Reservoir (2008) and Stafford Reservoir (1983 and 2013) have been retrieved from the GoA Water Quality Data Portal and added to the historical data compiled in Appendix 165.2.

6 TERRESTRIAL

6.1 Land Use and Land Management

Question 197

Reference:

Volume 2, Section 2.8

Rationale/Preamble:

SMRID does not provide a discussion on the occupation of bed and shore of the newly created dam structure on crown lands.

Information Request:

a. Explain what type of disposition or how the occupation of Crown Lands, primarily the bed and shore area of the newly proposed reservoir site, will be obtained.

Response:

a. SMRID will submit a LOC disposition application under the *Public Lands Act* (R.S.A. 2000, c. P-40) for the occupation of bed and shore for the newly created dam structure that is on crown lands within the ephemeral Watercourse 126419.

Question 198

Reference:

Volume 2, Section 2.8.4.1.2, Page 132;
Volume 2, Map Figure 2.8.25

Rationale/Preamble:

The map of Public Lands refers to crown land dispositions that may be occupying future dam areas and becoming inundated. There are identified dispositions that may be affected by this change and not only a grazing lease.

Information Request:

a. Discuss the mitigation measures implemented by SMRID and provide details on how SMRID will discuss these potential impacts with all affected disposition holders.

b. Provide documentation of any discussions with the Lease and disposition holders.

Response:

a. Please refer to Volume 1, Section 2.7 of the EIA submission for information on the existing infrastructure within the Project Area, initial engagement with utility owners, and a brief highlight of potential mitigation measures. Additional information regarding mitigation measures for existing infrastructure and utilities is available in Volume 2, Section 2.8.4.3 of the EIA. Please refer to the response to SIR#1 Question 11 for information regarding the ongoing discussions with affected disposition holders and the proposed mitigation measures. Please refer to the response to SIR#1 Question 103 for information on mitigation measures specifically for oil and gas wells.

   At this time, formal plans for mitigating effects have not been established with affected disposition holders, as SMRID intends to complete the regulatory approval process prior to advancing this phase of work. Initial engagement with AltaLink, ATCO, Fortis, Inter Pipeline, and Telus has taken place. SMRID has committed to funding the remedial measures required for each affected disposition holder and ensuring completion of the remedial activities prior to reservoir filling. The specific remedial measures required for each disposition/utility will vary depending on the agreements with the affected owner.

b. In January 2022, Altalink was provided with the Project plans to review. Altalink noted that they have a single transmission line crossing within the Reservoir Expansion Area. In March 2024, Altalink provided a conceptual cost for the removal of the affected poles within the inundation area and a proposed solution for maintaining transmission.

   SMRID has been in communication with ATCO with regards to a pipeline that occurs beneath the Existing Chin Reservoir, located east of the Highway 36 Bridge. As noted in the response to SIR#1 Question 11, ATCO will evaluate the implications of the FSL increase on the integrity of its infrastructure.

SMRID initiated discussions with Fortis in September 2021 notifying Fortis of the locations of overhead powerlines what would need to be moved as a result of the Chin Reservoir Expansion Project. SMRID followed up with Fortis in May 2022 to discuss further. In September 2022, preliminary cost estimates were requested from Fortis for budgetary purposes. In early 2023, communications with Fortis continued to discuss possible solutions for moving the potentially affected powerlines. In May 2025, MPE confirmed that there were no Fortis easements that would be impacted by the raise in FSL within the Existing Chin Reservoir.

As noted in the response to SIR#1 Question 11, initial discussions with Inter Pipeline began in November 2021. Discussions with Inter Pipeline are ongoing as they continue their FEED for the affected pipelines.

Discussions with Telus have been preliminary and largely pertaining to the construction works occurring at the West Dam. Based on these discussions, the Chin Reservoir Expansion Project is not expected to affect Telus infrastructure or require mitigation.

6.2 Conservation and Reclamation

Question 199

Reference:

Volume 2, Section 2.5.4, Page 72

Rationale/Preamble:

SMRID states *a site-specific conservation and reclamation plan (C&R Plan) will be developed.*

Information Request:

a. Explain why the site-specific conservation and reclamation plan was not developed prior to the EIA being submitted? In addition, how will this plan be communicated to EPA so it can be reviewed? If the plan has been developed, provide the plan.

Response:

a. The EIA fToR specified that a conceptual C&R Plan was required. A conceptual-level site-specific C&R Plan was included in the EIA (Volume 2, Appendix 8). A detailed site-specific C&R Plan requires targeted soil and vegetation assessments within the Project footprint and a detailed engineered design to develop details required for a construction-ready C&R Plan. These assessments were not completed at the time of EIA field studies as exact footprint, component design, construction schedule, and construction methods of temporary and permanent infrastructure were not known at the time of the EIA field assessments for vegetation and soils. When these Project details are known, a detailed site-specific C&R Plan targeting provincial reclamation criteria (GoA 2013a) and following the guidance of the *Recovery Strategies for Industrial Development in Native Grassland for the Dry Mixedgrass Natural Subregion* (Grassland Restoration Forum 2023) will be developed and will be submitted to EPA for review.

Question 200

Reference:

Volume 2, Appendix 8;
Volume 5, Section 2, 2.9 [A]

Rationale/Preamble:

The final Terms of Reference Section 2.9 [A] states *Provide a conceptual conservation and reclamation plan for all phases of the Project. Describe and map as applicable:*

- *a) borrow pits;*
- *b) waste material disposal sites;*
- *c) temporary roadways or utility corridors;*
- *d) any other disturbance;*
- *e) current land use and capability and proposed post-development land use and capability;*
- *f) anticipated timeframes for completion of reclamation stages including an outline of the key milestone dates for reclamation and how progress to achieve these targets will be measured;*
- *g) constraints to reclamation such as timing of activities, availability of reclamation materials and influence of natural processes and cycles including natural disturbance regimes;*
- *h) a revegetation plan for the disturbed terrestrial, riparian, and wetland areas;*
- *i) reclamation material salvage, storage areas, and handling procedures; and*
- *j) existing and final reclaimed site drainage plans.*

It is unclear where the applicable maps are for the conservation and reclamation plans for all phases of the project.

Information Request:

a. Provide the section of the EIA where these maps are located.

b. If they are not in the EIA, provide the applicable maps.

Response:

a. A map showing the location of Project Components was provided as Figure 3 in Volume 1 – Introduction and Rationale of the EIA submission. Current land capability (for agriculture) is shown in Figure 7 of Volume 4-5, Soils and Terrain TBR. Current land use maps are provided in the Baseline Land and Resource Use Map Figures 2.8.9 to 2.8.14 in Volume 2 – Assessment of Effects. Maps of current agricultural capability and post-development agricultural capability showing the Project Components have been provided as Figures 200.1 and 200.2. Simplified current land use and post-development land use maps showing the Project Components have been provided as Figures 200.3 and 200.4. Table 200.1 describes the Project Components as classified according to conceptual C&R plan component requirements as per terms *a* to *d* above. A description of these Project Components is provided in Volume 1, Section 2.4 Project Design

Elements. Mapping is not applicable for the required components described in terms *e* to *j,* and these components are described in the conceptual C&R Plan (Volume 2, Appendix 8).

Table 200.1 Project Component Names of Conceptual C&R Plan Component Requirements

Conceptual C&R Plan Component	Project Component Name
Borrow Pits	New East Dam Work Temporary Stockpile and Borrow Area
Waste Material Disposal Sites	Proposed Dam Fill Waste Area
Temporary Roadways or Utility Corridors	Proposed East Access Road and Laydown
Other Disturbance	Reservoir Expansion Area
	Proposed New East Dam Footprint
	Auxiliary Spillway
	West Access Road
	Temporary Stockpile/Borrow Area
	Temporary Work Area

b. Please refer to the response to SIR#1 Question 200 (a).

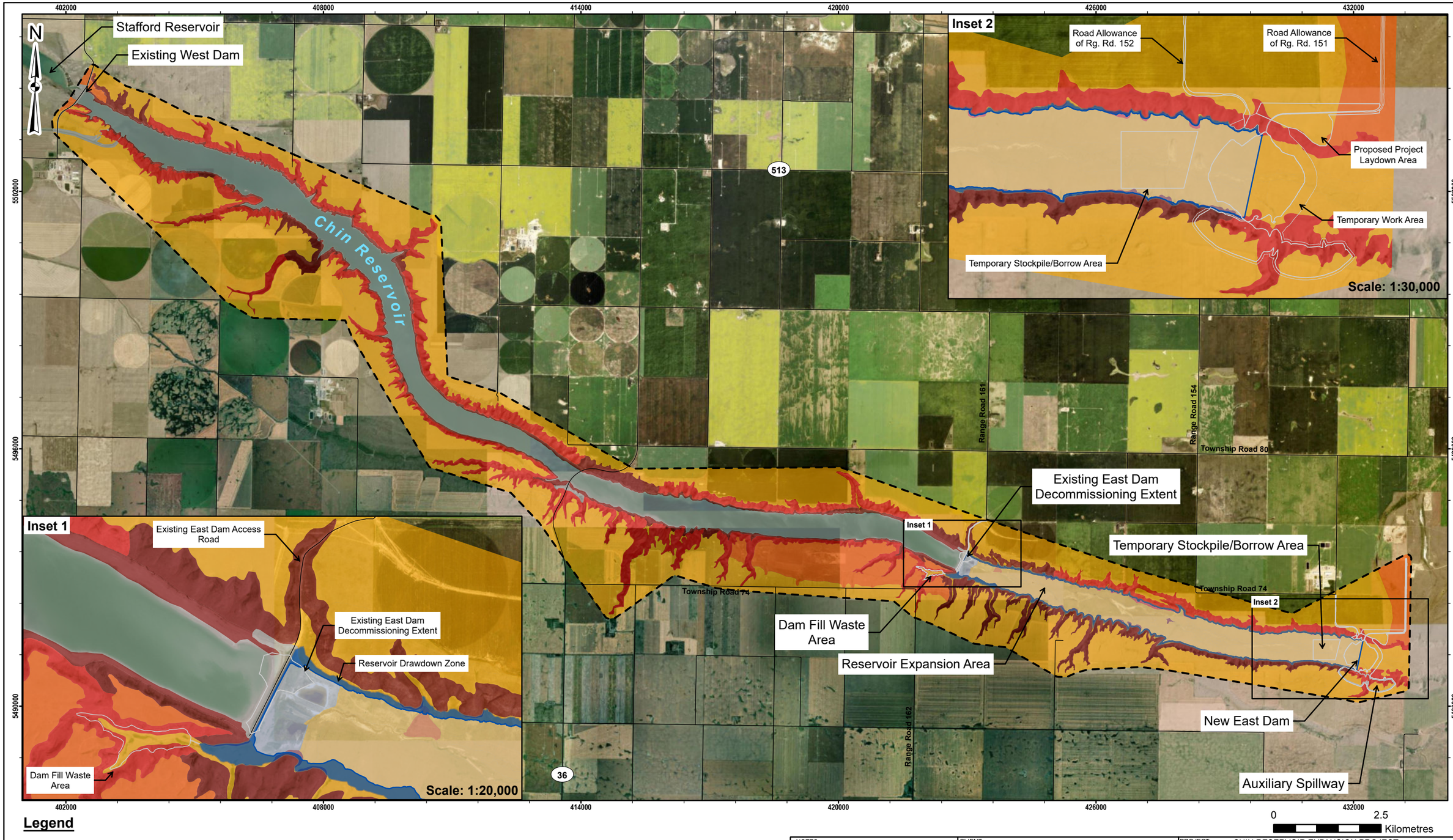
FIGURES

Figure 200.1 Pre-Development Land Suitability Rating System for Agriculture in the Soils and Terrain LSA

Figure 200.2 Post-Development Land Suitability Rating System for Agriculture in the Soils and Terrain LSA

Figure 200.3 Pre-Development Land Use in the LSA

Figure 200.4 Post-Development Land Use in the LSA



Legend

- All Weather Road
- Local Study Area (LSA)
- Project Component
- Expansion Drawdown Zone

Land Suitability Rating System

- Not Rated
- 4 - Severe Limitations
- 5 - Very Severe Limitations
- 6 - Extremely Severe Limitations
- 7 - Unsuitable

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, MAXAR
4. LSRS RATINGS PRESENTED ARE FOR SMALL GRAIN CROPS

CLIENT: SMRID

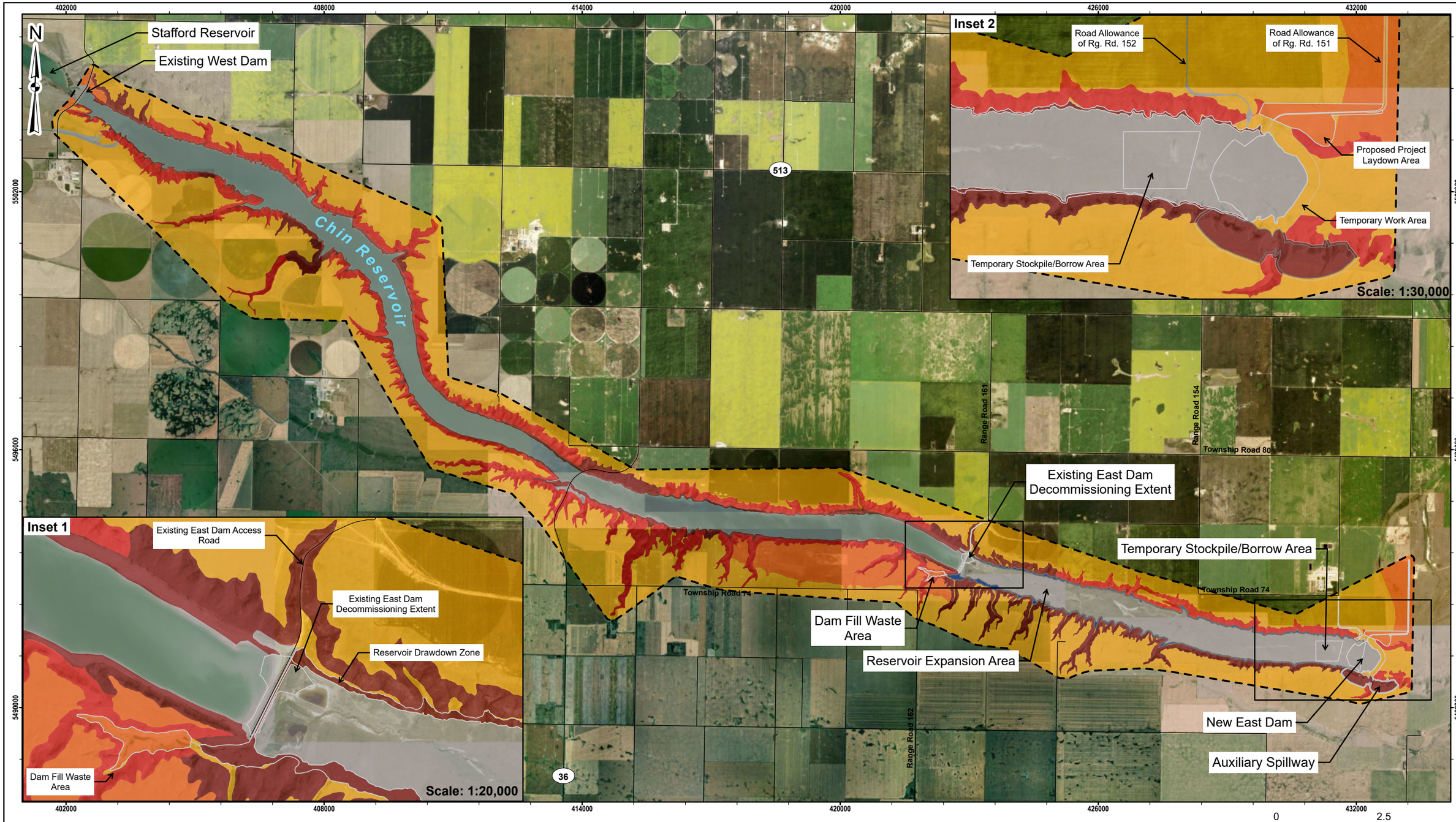
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: PRE-DEVELOPMENT LAND SUITABILITY RATING SYSTEM FOR AGRICULTURE IN THE SOILS AND TERRAIN LSA

SCALE	PROJECT No.	FIG No.
1:85,000	A03701E05	200.1

File: \\int.klohn.com\Proj\Data\AI\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Creator: : HManandyan



Legend

- All Weather Road
- Local Study Area (LSA)
- Project Component
- Expansion Drawdown Zone

Land Suitability Rating System

- Not Rated
- 4 - Severe Limitations
- 5 - Very Severe Limitations
- 6 - Extremely Severe Limitations
- 7 - Unsuitable

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, MAXAR
4. LSRS RATINGS PRESENTED ARE FOR SMALL GRAIN CROPS

CLIENT: SMRID

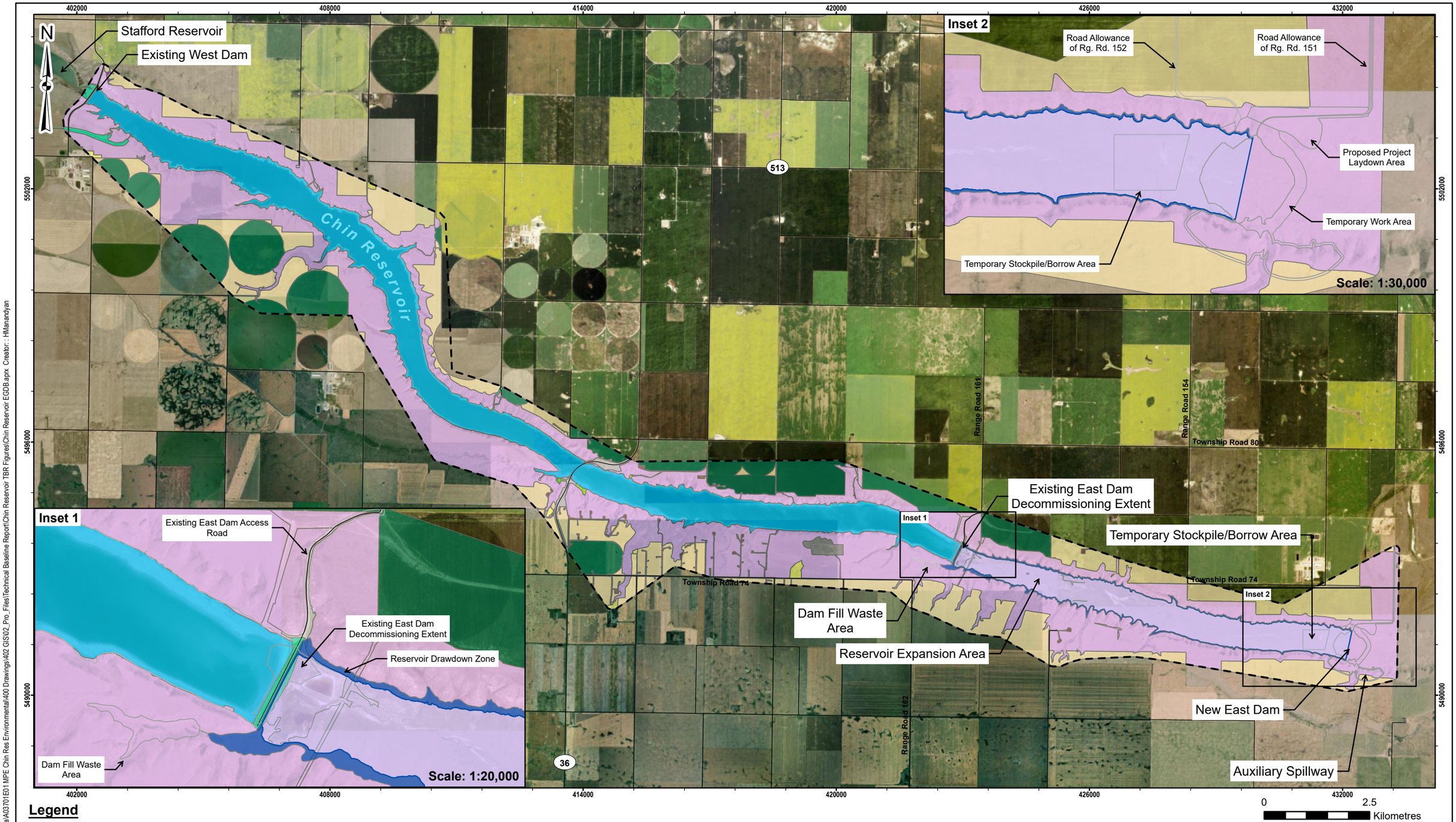
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: POST-DEVELOPMENT LAND SUITABILITY RATING SYSTEM FOR AGRICULTURE IN THE SOILS AND TERRAIN LSA

SCALE	PROJECT No.	FIG No.
1:85,000	A03701E05	200.2

File: \\int.klohn.com\ProjData\ACGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Creator: : HManandyan



Legend

- All Weather Road
- Local Study Area (LSA)
- Project Component
- Expansion Drawdown Zone

Land Cover Class

- Dryland
- Farm/Residential
- Gravel
- Irrigated
- Oil and Gas
- Park and Public Land
- Land-based Recreation
- Renewable Energy Production
- Reservoir
- Road
- Grazed
- Water Resources Infrastructure

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, MAXAR

CLIENT: SMRID

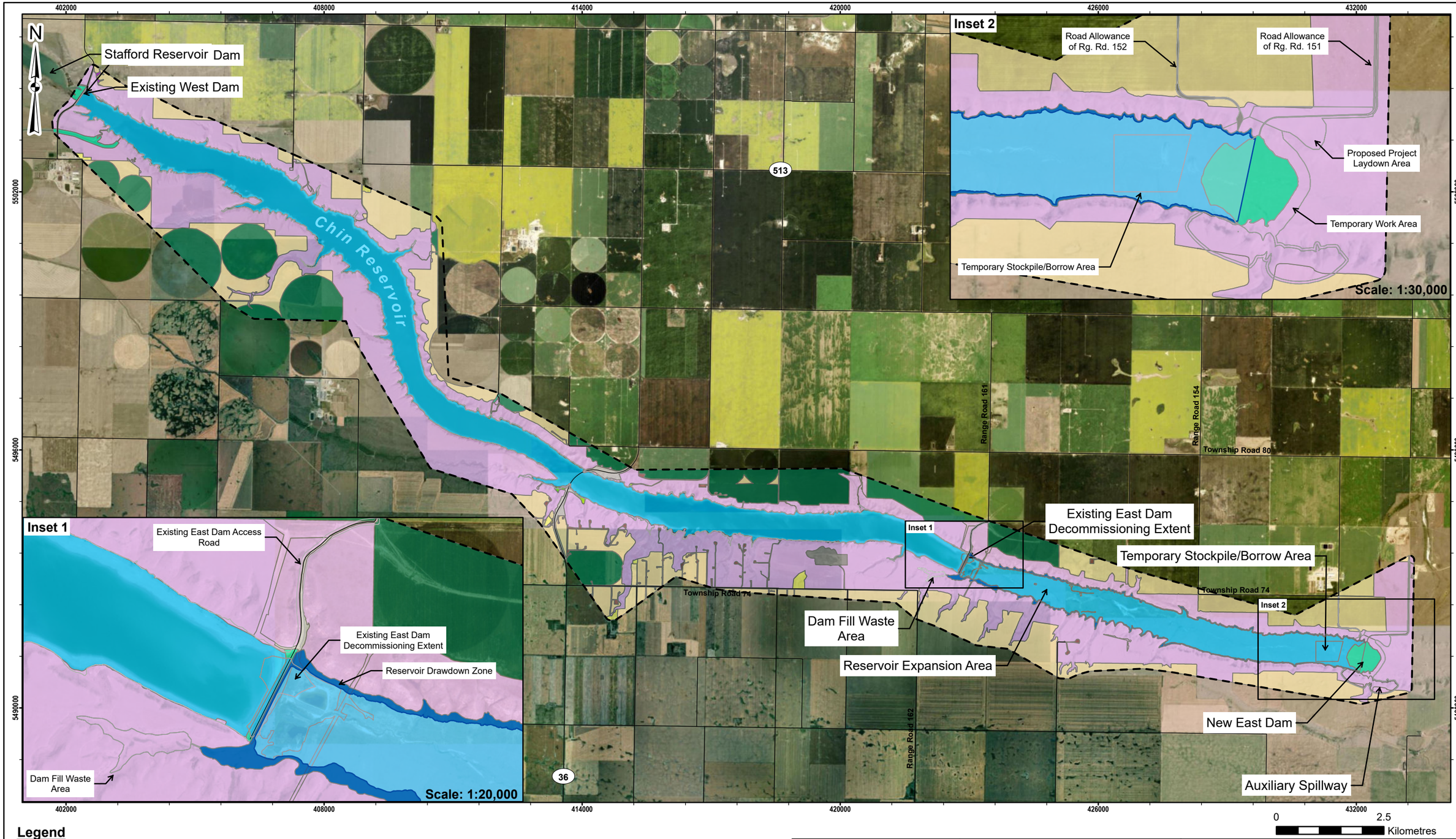
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: PRE-DEVELOPMENT LAND USE IN THE LSA

SCALE	PROJECT No.	FIG No.
1:85,000	A03701E05	200.3

File: \\int.klohn.com\ProjData\AICG\YA\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Creator: : HManandyan



Legend

- All Weather Road
- Local Study Area (LSA)
- Project Component
- Expansion Drawdown Zone

Land Cover Class

- Dryland
- Farm/Residential
- Gravel
- Irrigated
- Oil and Gas
- Park and Public Land
- Land-based Recreation
- Renewable Energy Production
- Reservoir
- Road
- Grazed
- Water Resources Infrastructure

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, MAXAR

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: POST-DEVELOPMENT LAND USE IN THE LSA

SCALE	PROJECT No.	FIG No.
1:85,000	A03701E05	200.4

File: \\int.klohn.com\ProjData\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Creator: : HManandyan

Question 201

Reference:

Volume 5, Section 2.9

Rationale/Preamble:

The concordance table only references Volume 2: Section 2.6 for Section 2.9 Conservation and Reclamation. SMRID confirmed that there is also conservation and reclamation content in Section 2.5. Appendix 8 is also missing from the concordance table.

Information Request:

a. Provide all sections where conservation and reclamation are addressed.

Response:

a. The conceptual C&R Plan is presented in Volume 2, Appendix 8 of the EIA submission. Mitigations to support conservation and reclamation planning, implementation, or monitoring are presented in the Mitigations and Monitoring subsections of Section 2.5 (Soils and Terrain) and Section 2.6 (Vegetation and Wetlands).

6.3 Terrain and Soils

Question 202

Reference:

Volume 2, Section 2.5, Page 63

Rationale/Preamble:

Information Request:

a. Provide the data sources (e.g., soil survey) that were used for soil analysis under baseline conditions.

Response:

a. The primary data sources are the Agricultural Region of Alberta Soil Inventory Database (AGRASID) Soil Database, the Alberta Soil Name File (Gen 4) and the associated soil layer file, and AGRASID Version 3.0 Soil Landscapes User Manual, analysis and correlation of field samples collected during the July 2021 field program, and the 1:50,000 Soil Survey of the County of Forty-Mile No. 8 (Alberta Soil Survey No.54 – R.L McNeil, R.W Howitt, I.R Whitson, A. Chartier). Secondary sources included a review of Soils of the Lethbridge Area 82-H, Quaternary Geology, Southern Alberta (I. Shetsen, Alberta Geological Survey, 1983), and Soil Series Information on Reclamation Planning Vol. 1 (Conservation and Reclamation Council-Reclamation Research Technical Advisory Committee).

   The references for these data sources were listed in the Reference section of Volume 4-5, Soils and Terrain TBR and have been provided below.

References

Alberta Soil Information Centre (ASIC). 2001. *AGRASID 3.0: Agricultural Region of Alberta Soil Inventory Database Version 3.0.* J.A. Brierley, T.C. Martin, and D.J. Spiess (eds.). Agriculture and Agri-Food Canada - Research Branch, Alberta Agriculture, Food and Rural Development, Conservation and Development Branch. [spatial database]

McNeil, R.L., R.W. Howitt, I.R. Whitson and A.G. Chartier. 1994. Soil Survey of the County of Forty Mile No. 8, Alberta: Alberta Soil Survey Report No. 54. Alberta Research Council, Environmental Research and Engineering Department, Edmonton, Alberta.

Shetsen, I. 1987. Quaternary Geology, Southern Alberta: Map 207. Alberta Research Council. Accessed May 2024. https://ags.aer.ca/publication/map-207.

Pedocan Land Evaluation Ltd. (Pedocan). 1993. Soil Series Information for Reclamation Planning in Alberta. Prepared for the Alberta Conservation & Reclamation Council, Report No. RRTAC 93-7.

Question 203

Reference:

Volume 5, Section 3, 3.6.2 [A] (c)

Rationale/Preamble:

The final Terms of Reference states *Describe project activities and other related issues that could affect soil quality (e.g., wetting/drying/rewetting of soil, salinization, silt accumulation, soil crusting, compaction, anaerobic decomposition of organic matter, contaminants) and:*

c) describe potential sources of soil contamination (e.g., industry infrastructure and activities, agriculture infrastructure and activities, contaminated sites, etc.), along with the appropriate remedial measures.

SMRID does not mention a plan for encountering unknown/undocumented contamination during construction. (i.e., old automotive battery pits, used oil disposal or anything buried from previous decades).

Information Request:

a. Provide a plan for encountering unknown/undocumented contamination during construction and operation. The plan should include identification, reporting, and possible next steps (i.e., phase 1 environmental site assessment (ESA), phase 2 ESA and remediation.

Response:

a. If construction activities encounter unknown or undocumented contamination during construction, any activities at that location will be halted. The likely approach would be to cordon off the area and the regulator will be notified to discuss the appropriate next steps which will include at a minimum a further search of the Environmental Site Assessment Repository (ESAR) database and/or a Phase 1 environmental site assessment (ESA) to determine, if possible, the source and type of contamination. The second step in conjunction with the first will be to sample the affected area using appropriate sampling techniques to identify the contaminant(s) (Phase 2 ESA). KCB will submit the samples to an accredited laboratory (i.e., Canadian Association for Laboratory Accreditation [CALA]) for analysis. If the area affected by the contamination is restricted to the surface soil over a relatively small area, the material will be excavated and disposed of at an appropriate facility after testing (i.e., Class 2 landfill) (Phase 3 ESA). During excavation, a representative of SMRID will supervise the cleanup. Once excavation is complete, the area will be sampled to ensure that the site meets the Albert Tier 1 criteria for the appropriate land use and then back filled and reclaimed, if necessary. A report outlining the response will be prepared and submitted to the regulator for review once the cleanup is complete. If the contamination appears widespread and extends into deeper soil layers and/or threatens an aquatic system, a broader Phase 2 ESA will be conducted to assess the areal extent and depth of the contamination to determine the best course for remedial action.

6.4 Vegetation and Wetlands

Question 204

Reference:

Volume 2, Section 2.1.3.1, Page 19

Rationale/Preamble:

The SMRID states *Discharge to the coulee and the ephemeral stream east of the New East Dam could have two potential problematic effects. Areas of grazing land could become seasonally saturated, and a heightened water table could result in the salinization of soils along the base of the Chin Coulee.*

Information Request:

a. Explain if any wetlands may experience a change in classification or function as a result of this additional discharge. Describe the area and nature of changes to wetland classification or function that are anticipated.

Response:

a. In areas where groundwater discharge would seasonally saturate grazing land, those areas may become ephemeral, temporary, or seasonal wetlands depending on the average seasonal discharge and influence of freshwater inputs from stormwater flowing into the area overland or from the ephemeral stream. Where groundwater will regularly discharge to the surface and evaporate with no freshwater inputs, intermittent saline wetlands would likely develop. The proposed seepage mitigations are expected to limit the potential for these effects to develop. Monitoring has been proposed, as noted in the response to SIR#1 Question 106.

Question 205

Reference:

Volume 2, Section 2.6.4.1.1, Page 86

Rationale/Preamble:

SMRID states *Native seed mix will be applied at appropriate times to promote germination, growth, and reproduction of native grasses* and *native seed and root propagules of forbs will be conserved through the salvage and placement of topsoil.*

Information Request:

a. Provide the species included in the Native seed mix and discuss if wetland adapted species were included in the mix. Provide justification if wetland adapted species were not included.

b. Describe if wetland material salvaged will be reserved for reclamation of wetland impacts or if this material will be combined with upland materials.

Response:

a. Multiple native seed mixes including wetland plant community seed mixes will be developed based on the targeted post-reclamation vegetation community. The data gathered in the pre-disturbance soil and vegetation assessment targeting the project footprint, the physical conditions of the reclaimed area (i.e., slope, aspect, moisture regime), the projected availability of seed, and natural succession processes in the dry mixedgrass prairie ecosystem will inform the native seed mixes. The species and quantities of each of the native seed mixes will be included in the site-specific detailed C&R Plan.

b. Wetland soils will be salvaged and stored separately from upland soils and will be used to reclaim temporary wetland impacts and in areas where wetlands are anticipated to develop post-construction.

Question 206

Reference:

Volume 2, Section 2.6.4.1.3, Page 87

Rationale/Preamble:

SMRID states *Pre-disturbance surveys will be conducted to inventory wetland habitat to support an application for Approval under the Water Act (2000), and to identify opportunities to restore or enhance degraded wetlands to compensate for wetland impacts. Draining, infilling, inundating, or alteration (including vegetation clearing) of wetlands will be conducted in accordance with the conditions of a Water Act (2000) Approval. Permanently affected wetlands will be replaced by undertaking a wetland replacement or restoration project or by paying wetland replacement fees.*

Alberta Wetland Policy, and the supporting Alberta Wetland Mitigation Directive, places an emphasis on avoidance and minimization as preferable mitigation options for wetland impacts. The mitigation directive requires applicants to demonstrate that they have made concerted effort to avoid wetland impacts or minimize impacts prior to using replacement as a mitigation option. There is very high likelihood that some of the wetlands impacted by the proposed project will be A-value wetlands, (given location in area of high historic wetland loss and location in rare species areas), which at the time of *Water Act* application may require a comparative analysis of options, including at least one option that will avoid A-value wetland(s) entirely.

Information Request:

a. Describe the alternative locations for the reservoir that were considered that would avoid or minimize the loss of wetland area that will occur with the current proposed design. Explain why these alternative locations were not chosen.

b. Explain the alternative activities that were considered at the proposed location that would avoid impacts to wetlands. Explain why these alternative activities were not chosen.

c. Explain the modifications to the proposed design that were considered that might have avoided or minimized the area of wetland loss. Provide an explanation if no modifications were made to avoid or minimize wetland loss.

Response:

a. Alternative locations for the reservoir were not considered with respect to specifically avoiding or minimizing the loss of wetland area. However, opportunities for increased storage capacity within the SSRB have been examined at length over the last decade. The rationale for new/additional storage has been based on water allocation needs, the significant variability of water supply, and previous research indicating that new storage could enhance the resilience of the SSRB, protecting them from climate variability and extreme weather events (AMEC 2014; Alberta Irrigation Districts Association [AIDA] 2019). Although water storage in the region is

currently adequate for most irrigation districts most years, some districts do not have enough storage in dry years and are vulnerable when two or more dry years occur in a row (AIDA 2019).

In the 2019 study, AIDA ranked the irrigation benefits of 13 proposed storage reservoir projects. Out of the 13 proposed projects, off-stream reservoir concepts were favoured due to the reduced environmental impacts or improved water management compared to on-stream reservoirs. While off-stream reservoirs require the diversion of water from rivers, they offer the advantage of not flooding natural riverine and riparian habitats. For example, the highest ranked proposal considered in the AIDA 2019 study was the on-stream Eyremore Reservoir which would require the flooding of approximately 40 km of the Bow River Valley downstream of the Bassano Dam. The Chin Reservoir Expansion Project was among the top four ranked options and was an off-stream proposal.

The high ranking of the Chin Reservoir Expansion Project in the AIDA 2019 study provided support for the SMRID to investigate the feasibility of the option. Four general design options with different reservoir FSLs and dam locations were considered for the Chin Expansion (MPE 2020).

A summary of the storage alternatives considered was discussed in Volume 1, Section 2.2 of the EIA submission.

b. The location of Project components such as the Dam Fill Waste Area were chosen in upland areas where wetlands would not be affected.

c. Wetlands in the Project Area are generally concentrated in the bottom of Chin Coulee in and adjacent to the ephemeral Watercourse 126419. Construction of a New East Dam and filling of the Chin Coulee Reservoir Expansion Area could not be designed to avoid these wetlands. Temporary workspace downstream of the New East Dam will be minimized and temporary disturbance of the adjacent wetlands will be avoided as much as possible. Some temporary disturbance at the downstream toe of the New East Dam is expected to occur and will be restored following the detailed site-specific C&R Plan.

Question 207

Reference:

Volume 2, Section 2.6.4.1.3, Page 88

Rationale/Preamble:

SMRID states *Where temporary disturbance and restoration of wetlands is anticipated, restoration will occur in accordance with a site-specific C&R Plan.*

Information Request:

a. Explain how wetlands will be restored in accordance with the Wetland Assessment and Impact Report Directive.

Response:

a. Wetland impacts will be described in a Wetland Assessment and Impact Report (WAIR) submitted as part of a *Water Act* Approval application. Construction activities within wetlands will be conducted in accordance with the *Water Act* Approval conditions and best practices for wetland impact avoidance and minimization. A site-specific detailed C&R Plan will describe conservation and salvage of wetland soils, storage or direct placement of wetland soils, water management for wetland establishment, and revegetation techniques to restore temporarily disturbed wetlands. Relevant details from the site-specific detailed C&R Plan will be used to inform the Mitigation Proposal of the WAIR, as described in Section 2.7 of the Wetland Assessment and Impact Report Directive (GoA 2017).

Question 208

Reference:

Volume 2, Section 2.6.5.1.3, Page 90

Rationale/Preamble:

SMRID states *It is anticipated that wetland replacement will be required to compensate for loss of wetland habitat, in accordance with the Alberta Wetland policy, which will offset the loss of habitat value resulting from the Project. As a result, residual adverse effects on wetland habitat are not anticipated.*

Opportunities to replace wetlands have not been identified within the LSA.

Information Request:

a. Explain why permanent losses of wetland habitat are not reported as residual at the local scale.

Response:

a. It is anticipated that wetland replacement will be required to compensate for loss of wetland habitat resulting from the Project, in accordance with the Alberta Wetland Policy (GoA 2013b). Wetland replacement projects should target areas of historical wetland loss. Therefore, wetland replacement in the local area is the assumed condition for the assessment of effects.

Question 209

Reference:

Volume 5, Section 3, 3.7.2 [J]

Rationale/Preamble:

SMRID did not address the final Terms of Reference 3.7.2 [J].

The final Terms of Reference states *Discuss the regional significance of the indirect effects of the conversion of native grassland pasture to tame pasture or cultivated lands with an increase in water availability.*

Information Request:

a. Discuss the regional significance of the indirect effects of the conversion of native grassland pasture to tame pasture or cultivated lands with an increase in water availability.
b. Provide maps and figures indicating the locations and extent of associated local and regional water and/or irrigation infrastructure (canals, irrigation networks, water pipelines, etc.) that may arise after the completion of the reservoir expansion.

Response:

a. In the LSA, land capability for agriculture ranges from Class 4 (severe limitations) to Class 7 (unsuitable) with limiting factors of water holding capacity, slope, inundation, salinity, and drainage. Lands with Class 5 (very severe) to Class 7 (unsuitable) land capability are generally not used for forage or cultivated crops. Class 4 lands in the LSA are used for both irrigated and dry-land farming with irrigation observed in locations where irrigation sprinkler equipment can be placed and generally not on land parcels where drainage pathways or secondary coulees create irregularly shaped agricultural fields. Land capability conditions have not been assessed outside of the LSA but would be expected to follow the same general pattern.

   As observed within the LSA, and according to the State of the Prairie (Prairie Conservation Forum 2019), most lands suitable for tame pasture (forage crops) or cultivated crops have already been converted from native grassland to agricultural lands for either irrigated or dry-land farming of crops. It is anticipated that the proposed 46,500-acre irrigation expansion will only include conversion of existing cultivated dryland parcels to irrigation parcels. Conversion of native grassland to irrigation production is not anticipated by the SMRID and RID and incremental indirect effects on native grassland are not predicted.

b. The extent and locations of local and regional water and/or irrigation infrastructure that may arise after the completion of the reservoir expansion is not currently known and cannot currently be assessed. Please refer to the response to SIR#1 Question 5, Figure 5.1 which depicts the current extent of the irrigation acres within the SMRID and RID.

6.5 Wildlife

Question 210

Reference:

Volume 2, Section 2.7.4, Page 111-119;
Volume 4-7, Section 3.2.1, Page 19

Rationale/Preamble:

SMRID states *No Burrowing Owls were detected during either survey. A single young of the year owl was observed on the fence line…*

Mitigation measures for potential Burrowing Owl (BUOW) nests were not provided.

Information Request:

a. Describe species-specific mitigation measures for potential BUOW nests.

Response:

a. Chin Coulee is within the burrowing owl species range in Alberta. However, the suitability for nesting of the habitat available within the Project Footprint is low, due to the presence of the coulee. As burrowing owls nest on the ground, they are vulnerable to both avian and ground predators. A basic characteristic of suitable nesting habitat includes high visibility in the surrounding area so that the owls may effectively defend their burrow. Suitable habitat is typically flat native grasslands of moderate size with short or sparse vegetation and open terrain with few visible fences, perches, and farmyards. The availability of suitable habitat within the Project Footprint is minimal.

   As discussed in Volume 4-7, Section 3.2.1, Page 19, the single young of the year owl that was observed on the fence line near the Project Footprint was observed on September 18, 2022. Typically, young of the year fledge from their nesting site in early autumn, starting from late August until October. The young of the year sighting in mid-September was likely that of a migrating individual and was not indicative of a breeding nest site nearby.

   Prior to the start of construction, a pre-disturbance wildlife sweep will be conducted. Pre-disturbance wildlife sweeps are conducted to ensure that important nests, dens, burrows, and other key wildlife features are not disturbed or destroyed during clearing and construction activities. The pre-disturbance wildlife sweep will incorporate a buffer zone with a minimum width of 100 m around the disturbance area. The disturbance area includes the construction site, access routes, laydowns, and stockpile areas. The sweep will be conducted by a permit holding, qualified professional biologist or wildlife specialist. A call playback survey will be incorporated into the pre-disturbance wildlife sweep to increase the probability of detecting burrowing owls, should they be present in the area. A detailed description of pre-disturbance wildlife sweeps is included in Volume 2, Section 2.7.4.1.1, Page 111-113.

In the event that an active burrowing owl nest is detected, a species-specific mitigation strategy would be developed by the permit holding, qualified professional biologist. The specific mitigations prescribed would be dependent on where the nest is located, the time of year when the nest was detected, and the type of construction activities that are occurring within the area. As a best management practice, construction activities should be avoided within 500 m of an active burrowing owl nest (GoA 2011c; GoA 2024). As per the *Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat Within Grassland and Parkland Natural Regions of Alberta* (GoA 2011c), the 500 m setback is prescribed during the critical breeding period for burrowing owls (April 1 to August 15). A reduced setback distance may be applied outside of this time frame for varying levels of disturbance. Applying a setback around an active nest is the primary mitigation strategy for avoiding adverse affects to burrowing owls. Additional mitigation strategies may also include restrictions to the time of day that construction occurs to allow for nocturnal hunting activities, restrictions on the maintenance of ground vegetation within the disturbance footprint, specific site access requirements, the restriction of pets on site, or the restriction of firearms, hunting, or shooting on site.

Question 211

Reference:

Volume 4-7, Section 2.1, Page 4

Rationale/Preamble:

Information Request:

a. Provide the shapefiles of the Project footprint (including all project components) that were used for the valued components.

Response:

a. The shapefiles of the Project footprint that were used for the wildlife valued component found within Volume 4-7, Wildlife TBR have been submitted directly to the EPA reviewer with this SIR response. The shapefiles include the data that is displayed on Map Figures 1 and 2 within Volume 4-7.

Question 212

Reference:

Volume 4-7, Section 3.2.4, Page 21

Rationale/Preamble:

Information Request:

a. Provide details on the snake surveys that were completed including GPS tracks, number of operators, weather conditions, and any ancillary observation (e.g., burrows).

Response:

a. On October 10, 2024, KCB submitted a Final Report with associated loadforms to the Online Permitting and Clearance (OPaC) System to close wildlife research permit #21-164 that was issued to KCB to conduct the baseline wildlife surveys for the Chin Reservoir Expansion Project. A snake hibernaculum search loadform was included as one of the associated loadforms.

   Standardized snake hibernacula search surveys were conducted by an experienced wildlife biologist, Jason Duxbury, on three occurrences: April 28-30, 2021; October 14-15, 2021; and May 11-13, 2022. Incidental snake observations were also recorded by biologists, archaeologists, and paleontologists during field studies conducted in Chin Coulee between April 2021 and September 2022.

   Snake hibernacula search surveys were conducted in accordance with the Alberta Environment and Sustainable Resource Development (ESRD) Sensitive Species Inventory Guidelines (GoA 2013c). The April 2021 surveys were conducted when ambient temperatures ranged between 13°C and 24°C and the October 2021 surveys and May 2022 surveys were conducted when ambient temperatures ranged between 7°C and 18°C. No precipitation fell during the surveys. Wind speeds were generally less than 30 km/hr (Beaufort Wind Code >4). Weather conditions ranged from sunny and clear to partly cloudy.

   Prior to the first survey, aerial imagery was assessed to locate promising landscape features and focus the search efforts. Promising landscape features included low-grade or moderate-grade slopes with a southern, southeastern, or eastern exposure and the presence of rock outcrops, rock piles, or boulder complexes. The location of identified features from the desktop review were recorded and the biologist focused the April survey on these locations. While conducting the survey, the biologist was on the lookout for additional suitable habitat features to investigate. Where signs of snakes were found (i.e., shed skins), additional search efforts were conducted in the surrounding area. In the October 2021 and May 2022 surveys, the biologist returned to the same areas assessed in April 2021, as well as areas where incidental snake observations were made during other field studies. Mammal burrows that were found during the surveys were also investigated for signs of snake presence. The location of each mammal burrow found during the surveys was not individually recorded. GPS tracks of the snake hibernacula search surveys are not available.

7 HEALTH

Question 213

Reference:

Volume 1, Section 1.13, Page 23;
Volume 2, Section 2.3.3.2.1, Page 35;
Volume 2, Section 2.3.3.2.2, Page 36

Rationale/Preamble:

SMRID states *In addition to irrigation, the SMRID maintains agreements to provide water for other uses such as municipal water supply, stock watering, commercial and industrial use, wildlife habitat maintenance and enhancement, and recreation (Table 1.4). In addition, the SMRID has support agreements with 1536 households to supply domestic water from the irrigation portion of the annual licensed volume.*

SMRID states *The expansion of a reservoir can increase the occurrence and concentration of cyanobacteria, which can produce various toxins, including neurotoxins (e.g., anatoxins), hepatotoxins (e.g., microcystins), skin irritants, and other harmful substances which can be toxic to humans, livestock and wildlife (GoC 2018).*

SMRID states *The expansion of a reservoir can have potential effects on the inorganic water quality. Construction activities can disturb sediments, releasing metals such as arsenic, lead, mercury, and nickel into the water column.*

The Human Health Risk Assessment (HHRA) does not assess the potential risk of drinking water or recreational activity exposure pathways.

Information Request:

a. Provide an assessment of potential risk to human health associated with using the proposed reservoir water as a human drinking water and domestic water source as per Alberta Health (2019) guidance.
b. Provide an assessment of potential risk to human health associated with recreational use of the proposed reservoir as per Alberta Health (2019) guidance.

Alberta Health, Government of Alberta. August 2019. Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta, Version 2.0 ISBN: 978-1-4601-4359-9, https://open.alberta.ca/publications/9781460143599

Response:

a. The formation of cyanobacterial blooms (also known as blue/green algae) is dependent upon water quality related factors such as pH, total phosphorus, turbidity, higher water temperatures, water residence times, and flow rates (Health Canada 2022b). Monitoring of water quality, algae blooms, and related risk management actions (e.g., temporary access restrictions) are possible options to reduce exposures to cyanobacteria and related substances, should a bloom occur (Health Canada 2022b).

   As noted in the response to SIR#1 Question 185, nutrients have been included in the updated modelling and Project Case nutrient concentrations are not predicted to vary significantly from the Base case condition during future operation. Therefore, there is no anticipated potential for water quality changes to increase aquatic vegetation productivity or adversely affect treatment of water that is drawn from the reservoir or downstream water bodies for use as drinking water during future operation. Filling of the Reservoir Expansion Area will occur in isolation and monitoring and adaptive management will be applied to confirm that effects will be avoided prior to commissioning.

   Not all cyanobacterial species produce toxins, and those that do have variable toxin production depending on site-specific conditions (Health Canada 2022b; US EPA 2025). Toxin production by cyanobacteria involves many environmental factors such as nutrient concentrations (nitrogen, phosphorus, and nitrates), light intensity, turbidity, pH temperature, nitrogen-fixing capabilities of the organisms present in the algae bloom, and the presence of other microorganisms in sediment (US EPA 2015).

   The most common cyanotoxin produced by cyanobacterial blooms in surface water is microcystin-LR (US EPA 2025). The detection of the genes related to microcystin production can be and is often used to identify toxigenic species (AEPHIN 2025a; Health Canada 2022b).

   Not all cyanobacterial toxins are of relevance to Canadian waters. The toxin anatoxin is not routinely reported in Canadian surface waters, and other known cyanobacterial toxins (cyindrospermopsin, nodularia toxin) are primarily reported in tropical and warm areas outside of Canada (Health Canada 2022b). Saxitoxins are not considered to be of concern in Canadian surface waters as it relates to recreational use (Health Canada 2022b). Health Canada currently only has a guideline for total microcystins in recreational water, as guideline values for other toxins have not been developed due to a lack of information (Health Canada 2022b).

   Health Canada (2022) notes that the best strategy for reducing risks related to cyanobacteria is to reduce the incidence of the blooms by reducing nutrient input (specifically, phosphorus and nitrogen) into the water body via runoff, discharges and sediment management.

   Currently, the Existing Chin Reservoir is not included in the Alberta Environmental Public Health Information Network (AEPHIN) monitoring program for cyanobacterial blooms. This program monitors several surface water bodies in Alberta, including reservoirs for cyanobacterial blooms, microcystins, cell counts and microcystin synthase gene E (mcyE), among other microbial parameters (AEPHIN 2025a).

With respect to inorganic constituents (including metals) in surface water, the responses to SIR#1 Questions 173 and 186, as well as the *Water Quality Analysis Technical Memorandum* (Appendix 13.1), describe that changes in water quality within Chin Reservoir between the Base case and Project Case are expected to be minimal for all modelled parameters and the frequency of guideline criteria exceedance is not expected to change. Therefore, residual effects are not anticipated for reservoir and downstream water use for drinking water supply, recreation, agriculture, domestic use, aesthetics, or other uses.

Volume 2, Section 2.3.6 outlined the monitoring plans for TSS within the wetted perimeter of the Chin Reservoir during construction. An Adaptive Management Plan for Water Quality has been provided in Appendix 164.1 that will include monitoring of water quality parameters through the isolated reservoir filling process to identify trends or spikes in water quality parameters. Operations monitoring will be completed for the first three years following the completion of construction, as noted in Volume 2, Section 2.3.6, with the need for further monitoring to be determined based on the results.

With respect to drinking water, the monitoring data collected from the Expanded Chin Reservoir, once completed, will be screened against applicable drinking water guidelines (e.g., Health Canada 2025). It is expected that any water drawn for human consumption via any agreements between the SMRID and households would be properly treated by the water users before consumption is permitted.

In summary, the HHRA did not complete a quantitative assessment of recreational water exposure, as modelled data are not available. The use of predicted data would be fraught with uncertainty, given the potential for multiple variables that are physical (e.g., construction related activities) and environmental (potential for run-off, nutrient loading, temperature, pH, light intensity, presence of organisms in water and sediment).

A strategy focused on sediment management and water quality monitoring will be implemented to confirm that construction-related introduction of sediment is mitigated. Filling of the Reservoir Expansion Area will occur in isolation to mitigate the potential for adverse effects to occur within the Existing Chin Reservoir, which will be monitored and adaptive management applied, if required, prior to commissioning of the Expanded Chin Reservoir. Cyanobacterial bloom and microcystin monitoring during construction and future operation would be covered by the existing programs completed by AEPHIN for provincial surface water bodies and recreational areas.

b. As described in the responses to SIR#1 Questions 173 and 186, as well as the *Water Quality Analysis Technical Memorandum* (Appendix 13.1), the conditions of the reservoir system are not expected to change sufficiently to result in a marked change in either salinity or nutrient components within the system. Furthermore, concentrations of inorganic constituents (e.g., metals) within the reservoir are not expected to exceed the applicable drinking water quality guidelines. Therefore, recreational use of the reservoir is not expected to result in elevated health risks.

Question 214

Reference:

Volume 2, Section 2.4.4.2.4, Page 59;
Volume 2, Appendix 14, Section 5, Pages 22;
Volume 2, Appendix 14, Section 6, Page 23

Rationale/Preamble:

SMRID states *Based on the limitations of predicting mercury and methylmercury concentrations post-inundation and the fact that the baseline total mercury levels measured in walleye and northern pike from Chin Reservoir meet Alberta Health's (2019) criteria for issuing fish consumption advisories, the establishment of an environmental monitoring program after the expansion of the reservoir is expected to be the most effective way to determine the evolution of mercury concentrations in sportfish in Chin Reservoir.*

SMRID states *…it is expected that mercury concentrations in fish at Chin Reservoir will increase for approximately 4-6 years before beginning to decline*.

SMRID states *SMRID plans to monitor the mercury concentrations in fish from the Chin Reservoir over time. A methylmercury monitoring plan will be developed and shared with Alberta Environment and Protected Areas and Alberta Health*.

Information Request:

a. Confirm the conclusions of the HHRA and water quality assessment are that the Project is expected to result in an increased concentrations of methylmercury in fish tissue that would not meet current guidance for sportfish consumption.
b. Discuss any stakeholders concerns regarding this conclusion.
c. Discuss any Indigenous communities' concerns regarding this conclusion.
d. Provide details for the development of the proposed fish methylmercury monitoring plan.

Response:

a. When issuing its consumption advisories, Alberta Health relies on an average (mean) of the measured fish tissue concentrations. The average mercury concentrations measured in three species of sportfish collected from the Chin Reservoir were described in Volume 2, Appendix 14, Section 5.1:
    - Lake Whitefish = 0.12 µg/g (n=37)
    - Walleye = 0.27 µg/g (n=20)
    - Northern Pike = 0.50 µg/g (n=8)

Alberta Health's criteria for issuing fish consumption advisories are as follows:

- Mercury concentrations greater than 0.5 µg/g will result in an "avoid consuming fish" recommendation for women of reproductive age and children under 12 years old.
- Mercury concentrations between 0.2 µg/g and 0.5 µg/g will result in "consumption limit" advice.
- Mercury concentrations less than 0.2 µg/g will not result in any consumption recommendations.
- If the number of fish collected from a water body is less than five (5), fish consumption advice will not be issued (due to insufficient sample size).
- If the lakes are used for commercial fishing, fish consumption advice will not be issued until consulting with the Canadian Food Inspection Agency.

Review of the AEPHIN indicates that Alberta Health has not issued consumption limits for fish caught from the Chin Reservoir. However, baseline mercury concentrations measured in Walleye and Northern Pike from Chin Reservoir meet Alberta Health's criteria for issuing a fish consumption advisory.

The measured concentrations of total mercury and methylmercury in Chin Water quality baseline samples were below the applicable guidelines for freshwater aquatics (Volume 4-2) and exceedances have not been predicted for these parameters based on simulation of future reservoir operation (see the response to SIR#1 Question 184). Filling of the Reservoir Expansion Area will occur in isolation from the Existing Chin Reservoir over a multi-year process to mitigate the potential for leaching and soil erosion to result in mobilization of metals and other constituents. Despite the application of mitigations, it is conservatively predicted that the methylmercury concentrations in sportfish in the Chin Reservoir may increase, albeit on a temporary basis, with expansion of the reservoir, based on observations following the inundation of other reservoirs in southern Alberta.

Although the concentration of mercury measured in water may not exceed guideline criteria (e.g., observed baseline condition in the Existing Chin Reservoir), there is considered to be potential for mercury to become bioavailable (i.e., through methylation) and enter the food chain, resulting in accumulation in fish tissue. Although the magnitude of the anticipated increase cannot be quantified, an increase in mercury concentration in fish tissue would be of concern, since the average condition measured at baseline is already exceeding guideline criteria for human consumption, in addition to the criteria for consumption by wildlife. Any increase in mercury concentrations in Northern Pike would result in average mercury concentrations above 0.5 µg/g, which is the mercury concentration at which Alberta Health recommends that women of reproductive age and children under 12 years old avoid fish consumption (GoA 2019).

As a result of the possession limits on Chin Reservoir, Northern Pike caught from Chin Reservoir would have to be released back into the reservoir (GoA 2023d); thus, northern pike caught from Chin Reservoir would not be kept or consumed by local sport fishers.

b. To date, no health-related concerns have been raised regarding these conclusions.

c. To date, no health-related concerns were raised by Indigenous communities regarding these conclusions.

d. The GoA monitors mercury concentrations in fish collected from Alberta waterbodies. Fish sampling is the responsibility of EPA, while the interpretation of the mercury data and eventual development of fish consumption advice is the responsibility of Alberta Health. The information is shared with the public through the AEPHIN, specifically through the “Should I Eat This Fish” link (AEPHIN 2025b). SMRID will coordinate with EPA to request that the Chin Reservoir be included in the EPA fish monitoring program so that the data can be shared with Alberta Health for inclusion in their Alberta Fish Consumption Program.

Question 215

Reference:

Volume 2, Section 3.1, Page 151 and 152;
Volume 5, Section 2, 2.5 [B] (a), (b), and (c)

Rationale/Preamble:

For response to the Air Emissions Management final Terms of Reference Section 2.5, SMRID refers to Volume 2: Section 3.1 (the HHRA). Although there is a discussion of potential air quality associated with the construction phase of the proposed Chin Reservoir Expansion Project, the HHRA does not address subsections of Section 2.5 [B] (a), (b), and (c).

Information Request:

a. Provide correct references to the responses developed for the final Terms of Reference Section 2.5 [B] (a), (b), and (c).

Response:

a. An updated concordance table has been provided in Appendix 6.1 that identifies how terms 2.5 [B] (a), (b), and (c) have been addressed in the responses to SIR#1.

   The response to SIR#1 Question 3 (a) addresses emissions profile and sources of greenhouse gasses for the phases of the Project.

Question 216

Reference:

Volume 2, Section 3.3.1.2, Page 153

Rationale/Preamble:

SMRID states *The spatial boundary for identification of receptors for the noise assessment was defined as a 1.5 km area surrounding the proposed Project Footprint (Map Figure 3.3.1). The boundary was used to identify human and ecological receptors which may be exposed to noise impacts resulting from construction activities at the Project sites.* Figure 3.3.1 is difficult to locate in Volume 2.

Information Request:

a. Provide the location of Map Figure 3.3.1 - Noise and Air Quality.

Response:

a. Map Figure 3.3.1 is appended to the end of Volume 2 along with all of the Map Figures (page 285 of the PDF). Refer to the Table of Contents at the beginning of Volume 2. The Map Figures were included in sequence prior to the appendices.

   An updated copy of Map Figure 3.3.1 is provided as Figure 57.1 in this SIR#1 Response Document to respond to SIR#1 Question 57.

Question 217

Reference:

Volume 2, Appendix 14, Section 2, Figure 2-2, Page 2

Rationale/Preamble:

SMRID identifies two residential receptors in Figure 2-2; a discussion of receptor characteristics and types was not provided. SMRID also identified two recreational receptors; their locations are not identified in Figure 2-2 and receptor characteristics were not discussed.

A brief Google Maps search identified one of the residential receptors identified to potentially be the Evergreen Hutterite colony (population 99). The search also identified additional potential receptors seen south of the proposed dam's location. These included: Owen Oil (potential worker receptor), two potential farms (potential agricultural receptors) one east and one west of the Owen Oil location, and a second Hutterite colony (Prairie Home Farms, population 122) farther south. SMRID did not identify these receptors in the HHRA.

SMRID did not provide a discussion of the receptor types for potential receptors located near the proposed dam (e.g., agricultural, residential, worker, Indigenous). It is likely that some receptors are agricultural and therefore would be assumed to consume locally grown produce. Alberta Health (2019) guidance requires a description of potential receptor characteristics including assessment of individuals who may consume "country" or "natural foods" (i.e., Indigenous people and persons eating locally grown produce).

Information Request:

a. Provide a description of the receptor types and characteristic identified in Figure 2-2 and other receptors in the LSA and RSA.
b. Provide a description of the types and characteristics of human receptor identified (e.g., residential, agricultural, recreational, worker, Indigenous) and the age classes (e.g., infant, toddler, child, adult).
c. Provide a discussion with adequate supporting evidence for screening of any receptor types (residential, agricultural, recreational, worker, Indigenous).
d. Provide an adequate scientific rationale for exclusion of the consumption of local foods and traditional foods pathway.

Google map search, August 2024: https://www.google.com/maps/@49.5645327,-112.049986,8604m/data=!3m1!1e3!5m1!1e1?entry=ttu

The Hutterite Brethren: Colonies of North America (Evergreen Colony population 99; and Prairie Home, population 122) https://storymaps.arcgis.com/stories/4ae1b9d48aee41d9a379d7c1946596e2

Alberta Health, Government of Alberta. August 2019. Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta, Version 2.0 ISBN: 978-1-4601-4359-9, https://open.alberta.ca/publications/9781460143599

Response:

a. The health assessment identified the receptor locations closest to the proposed construction area for the Chin Reservoir Expansion Project in Volume 2, Appendix 14. As air dispersion modelling was not completed for this project application, the health assessment consisted of a qualitative, comparative assessment of the proposed Chin Reservoir Expansion construction phase air emissions with the Springbank Project and the Cougar Creek Project. The EIAs for those two projects were completed for structures that were proposed for locations in close proximity to residences. In contrast, the proposed Chin Reservoir Expansion Project is located in a less populated area that is dominated by agricultural lands.

   A list of receptor locations and corresponding UTM coordinates is presented in Table 217.1. A visual representation of these locations is provided in Figure 217.1. The focus of the discussion in the health assessment was on the closest receptor location (location 12 in Figure 217.1). In the HHRA presented in Volume 2, Appendix 14, a qualitative approach was used that compared emission sources and discussed potential ground-level air concentrations based on the two aforementioned EIAs for the nearest sensitive receptor locations. As such, the classification of individual locations as being of a specific type or category based on human activities (i.e., residential, agricultural, recreational, worker, Indigenous) was not necessary. The discussion of potential health risks was intentionally kept at a high level, to be inclusive of all types of individuals who may be in the area. Further, the air quality emissions are only relevant to the construction phase of the project, not the lifetime of the Expanded Chin Reservoir. All individuals who may be present in the study area are residents (living on farms), workers at industrial locations or commercial farms, or visitors/recreational users (see Table 217.1).

Table 217.1 Receptor Locations for the Chin Reservoir Expansion Assessment

Point ID	Distance to Existing East Dam (m)	Distance to New East Dam (m)	Coordinates		Receptor Type
			UTM12N_X	UTM12N_Y	
1	7,246	9,189	424,352	5,486,296	Residential Farm
2	11,742	9,669	427,603	5,482,638	Residential Farm
3	18,387	10,163	437,949	5,482,841	Residential Farm
4	19,612	10,279	441,154	5,486,245	Residential Farm
5	14,628	5,508	436,327	5,487,604	Residential Farm
6	14,581	5,992	435,644	5,486,320	Residential Farm
7	10,067	4,754	430,445	5,486,735	Hutterite Colony
8	8,141	2,644	430,065	5,489,535	Residential Farm
9	11,318	2,781	433,141	5,488,585	Residential Farm
10	11,359	2,262	433,526	5,489,393	Residential Farm
11	3,782	6,288	426,600	5,494,159	Residential Farm
12	8,405	1,982	431,290	5,492,970	Hutterite Colony
13	5,746	5,361	428,405	5,495,027	Residential Farm
14	3,310	10,125	423,602	5,496,625	Residential Farm
15	6,064	6,447	428,218	5,496,298	Residential Farm
16	14,255	7,561	436,610	5,497,274	Residential Farm
17	9,267	8,220	430,152	5,499,155	Residential Farm
18	8,882	9,965	428,354	5,500,397	Commercial Farm
19	7,158	7,581	428,508	5,497,835	Residential Farm
20	5,475	10,970	421,615	5,488,071	Residential Farm
21	7,468	12,015	421,242	5,486,113	Residential Farm
22	7,333	12,218	420,921	5,486,334	Residential Farm
23	8,734	14,644	418,496	5,485,851	Residential Farm
24	9,079	15,558	417,408	5,486,165	Oil & Gas Infrastructure
25	10,235	16,620	416,571	5,485,352	Residential Farm
26	8,766	10,108	424,338	5,484,748	Residential Farm
27	6,452	14,602	417,610	5,489,700	Residential Farm
28	10,011	18,486	413,741	5,489,355	Residential Farm
29	8,365	17,456	414,691	5,491,789	Residential Farm
30	6,973	15,889	416,248	5,491,303	Residential Farm
31	6,283	15,147	416,990	5,491,261	Oil & Gas Infrastructure
32	3,804	13,114	419,132	5,492,869	Residential Farm
33	3,945	13,265	418,985	5,492,909	Residential Farm
34	10,107	6,939	428,726	5,485,135	Residential Farm
35	12,085	8,483	429,342	5,483,168	Residential Farm
36	7,712	14,287	421,779	5,501,020	Residential Farm
37	7,342	14,560	420,918	5,500,459	Residential Farm
38	9,259	13,624	424,555	5,502,498	Residential Farm
39	8,521	16,531	418,695	5,500,801	Residential Farm
40	7,687	16,433	417,725	5,499,075	Residential Farm
41	8,880	17,850	416,199	5,499,217	Residential Farm
42	8,777	18,117	415,190	5,497,584	Residential Farm

Point ID	Distance to Existing East Dam (m)	Distance to New East Dam (m)	Coordinates		Receptor Type
			UTM12N_X	UTM12N_Y	
43	8,551	18,035	414,760	5,496,007	Oil & Gas Infrastructure
44	9,615	19,104	413,437	5,495,087	Recreational
45	9,009	18,494	414,012	5,494,856	Recreational
46	8,050	16,449	415,757	5,489,676	Residential Farm
47	9,440	17,128	415,363	5,487,711	Residential Farm
48	5,773	7,884	424,926	5,487,989	Residential Farm
49	4,258	8,925	425,295	5,496,910	Oil & Gas Infrastructure
50	2,686	10,784	422,516	5,496,050	Residential Farm
51	5,135	11,249	423,580	5,498,480	Residential Farm
52	3,677	12,741	420,367	5,496,057	Residential Farm
53	15,104	6,803	435,707	5,485,388	Residential Farm
54	8,107	15,601	416,869	5,487,972	Residential Farm
55	11,301	5,453	433,800	5,496,372	Oil & Gas Infrastructure
56	7,759	8,822	425,042	5,485,935	Industrial
57	9,869	18,861	413,276	5,491,200	Residential Farm
50	2,686	10,784	422,516	5,496,050	Residential Farm
51	5,135	11,249	423,580	5,498,480	Residential Farm
52	3,677	12,741	420,367	5,496,057	Residential Farm
53	15,104	6,803	435,707	5,485,388	Residential Farm
54	8,107	15,601	416,869	5,487,972	Residential Farm
55	11,301	5,453	433,800	5,496,372	Oil & Gas Infrastructure
56	7,759	8,822	425,042	5,485,935	Industrial
57	9,869	18,861	413,276	5,491,200	Residential Farm

b. The qualitative health assessment took a high-level approach by comparing the Project emission sources with those of previously filed EIAs for similar projects in Alberta (i.e., Springbank Project and Cougar Creek Project). Quantitative exposures estimates were not used for age-groups; rather a generalized approach that is inclusive of all ages and groups was utilized.

c. Please refer to the responses to SIR#1 Question 217 (a) and (b) above.

d. The Project emissions are restricted to the construction phase of the proposed Chin Reservoir Expansion Project and are not anticipated to continue beyond construction. Using a scaling approach based on the emissions from the Springbank Project, the expected emissions from the construction of the Chin Reservoir Expansion Project will be below Alberta's Ambient Objectives at the closest human receptor locations (refer to the response to SIR#1 Question 88 (a) and as discussed in Volume 2, Section 3.1 and Volume 2, Appendix 14, Section 4.6). Fugitive dust emissions (which are of primary concern in relation to earth moving construction activities) are comprised of relatively heavy particles that settle to the ground within the vicinity of the construction. Lighter particles may be able to travel further, but their movement would be

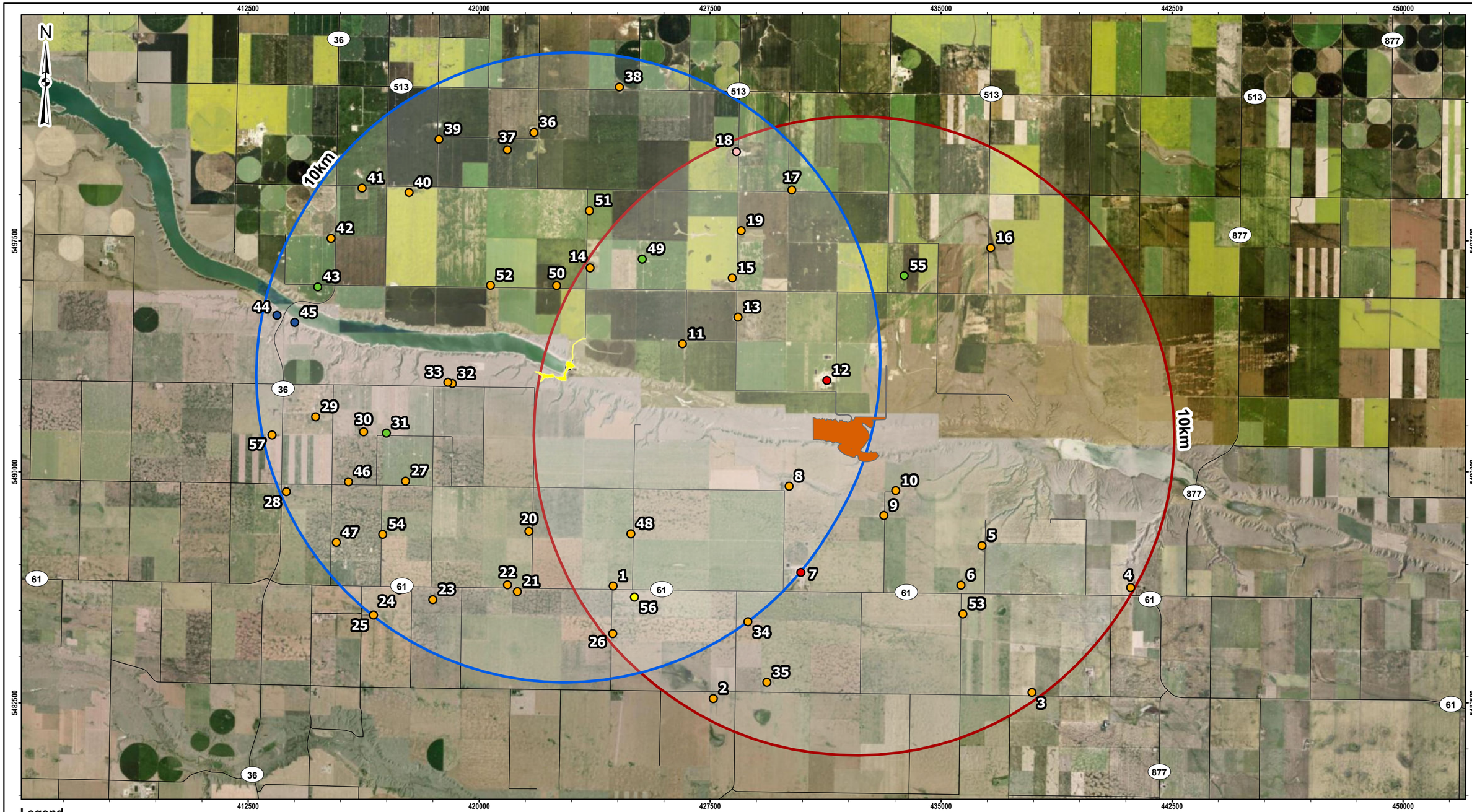
limited by the atmospheric conditions in the coulee formation, within which the construction will be taking place (refer to the response to SIR#1 Question 89). Agricultural operations and residences are located on higher terrain.

The Springbank Project EIA included an assessment of potential impacts to country foods. The Springbank Project EIA concluded that there were no project interactions for changes in human health from consumption of country foods during construction or dry operations. The authors of the EIA further concluded that "*the quantity of Project-related emissions of chemicals that could persist in the environment (such as metals and polycyclic aromatic hydrocarbons in diesel emissions during construction) would not affect concentrations in edible tissues. Dust generated by earthworks during construction is inert earthen material and would be of similar quality as the surrounding soil in the construction area and therefore would be no change to plant tissue concentrations due to uptake from soil*" (TEC 2019). Consistent with the conclusions of the Springbank Project EIA, the potential risks to human health from the consumption of country foods or traditional foods are negligible for the Chin Reservoir Expansion Project.

Finally, fish consumption was assessed qualitatively in Volume 2, Appendix 14. Due to the qualitative nature of the assessment, and the recommendation that future monitoring of fish tissue be conducted, the conclusions of the assessment apply to all individuals, regardless of human activity patterns (consumption rates and frequencies, reliance on traditional foods, etc.). Please see the response to SIR#1 Question 214 above.

FIGURE

Figure 217.1 Human Health Receptor Locations



NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, EARTHSTAR GEOGRAPHICS

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: HUMAN HEALTH RISK ASSESSMENT RECEPTORS

SCALE	PROJECT No.	FIG No.
1:120,000	A03701E05	217.1

File: Z:\AC\GY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Creator: : HManandyan

Question 218

Reference:

Volume 2, Appendix 14, Section 4.3.2, Page 8

Rationale/Preamble:

SMRID states *The conclusions of the Springbank Off-Stream Reservoir HHRA noted that "the emissions from the limited number of vehicles would not affect the regional air quality to a degree that could affect the health of the population" (Stantec 2018)*.

The Springbank HHRA reported Contaminant of Potential Concern (COPC) exceedances at numerous residential receptor locations (Springbank EIA, Volume 4, Appendix O Section 8) as follows:

- Acute concentrations of $PM_{2.5}$, for which both short-term (1-hour or 24-hour) and long-term (annual) ERs are greater than 1.0 at up to 18 of the 58 human receptor locations. Even with partial mitigations, model results indicate there could still be an unacceptable short-term risk to human health for residents and people adjacent to the PDA. Although concentrations of $PM_{2.5}$ are expected to be lower than the modelled predictions, more intensive dust mitigation measures may be considered during the construction phase, including dust suppressants or water on haul roads on an as-needed basis during dry periods with high wind conditions.
- 1-hour concentrations of DEP at some receptor locations may exceed the acute (2-hour) DEP exposure limit (maximum frequency of exceedances is less than 5%). Based on multiple studies on test subjects, Health Canada (2016b) concluded that at concentrations above the DEP exposure limit, healthy and/or mildly asthmatic participants may experience increased measures of airway resistance and/or respiratory inflammation. Additional mitigation that may be used to reduce $PM_{2.5}$ exposures (such as adjusting the construction schedule to reduce the number of vehicles operating in an area during dry periods with high wind conditions) would also mitigate acute DEP exposures.

Alberta Transportation provided an air mitigation and monitoring plan which included dust mitigation and an air monitoring program in response to an air quality round 2 SIR (IR4-04). The SIR was made in response to predicted Alberta Ambient Air Quality Objectives (AAAQO) exceedances in the Springbank air quality assessment.

Information Request:

a. Provide evidence that the mitigative measures proposed for the Springbank construction phase will be effective (*e.g.,* results of air monitoring data during the predicted air quality modelling results).

b. Discuss SMRID's plan for collecting and responding to potential air quality complaints during the construction phase of the proposed Chin Reservoir Expansion Project.

Springbank EIA https://open.alberta.ca/dataset/ed520427-3b66-41c5-b36a-33fbdeaea9aa/resource/18aa2004-bed8-46d0-986d-0c80d5581971/download/vol_4_appo_public_health.pdf

IR4-04, page 107 / 256)
https://www.alberta.ca/system/files/custom_downloaded_images/trans-springbank-reservoir-ir-response-package-4-round-2.pdf

Response:

a. SMRID does not have access to construction monitoring data from the Springbank Project to be able to provide evidence that the mitigation measures applied were effective. Dust and air quality mitigations have been specified to control the potential for effects. Complaint-based response will be implemented to adaptively address concerns, if noted, during the construction process.

b. Please refer to the response to SIR#1 Question 43 (a).

   To facilitate communication, SMRID provides multiple channels for the public to report concerns, including a phone line (587-220-5652) and email address (chin.expansion@smrid.com). Additionally, SMRID's offices in Lethbridge, Bow Island, and Taber are open to the public for in-person inquiries and complaints. The SMRID has communicated with the public and key stakeholders of the Project schedule and Project details.

   SMRID will individually assess and respond to each complaint, taking full consideration of the issue and implementing appropriate mitigation measures as needed. In addition, the site signage will be displayed at the entrance to the Project location which will identify contact information of the construction team responsible for overseeing the Project.

Question 219

Reference:

Volume 2, Appendix 14, Sections 4.3, 4.4 and 4.5, Pages 5-9

Rationale/Preamble:

SMRID provides four historical project EIAs as supporting evidence for not completing an HHRA for the Chin Reservoir Expansion emissions. The oldest was completed 17 years ago and most current seven years ago (Dunvegan Project in 2007; Tazi Twé Hydroelectric Project in 2014; Cougar Creek in 2016; Springbank in 2018). Guidance for the assessment of criteria air contaminants has evolved over the last 17 years which may impact historical HHRA conclusions. Air quality objectives have been reduced and PM2.5 and NO2 have been defined as non-threshold contaminants.

Information Request:

a. Provide a discussion of changes in HHRA guidance and criteria air quality guidelines used in the historical projects compared to current guidance.

b. Provide discussion on how any changes would impact the conclusions of the SMRID HHRA conclusions.

Response:

a. Alberta Health guidance on the completion of provincial HHRAs was in place at the time of the Cougar Creek Project and Springbank Project. Alberta Health first issued its Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta in August 2011, which predates the completion of the two analogous projects. While the guidance was updated in 2019, the changes in the HHRA guidance were such that they do not affect the conclusions of the Cougar Creek or Springbank Projects. Nor do these changes influence the suitability of comparing the Chin Reservoir Expansion Project health assessment to the conclusions of those two previous applications. Please see specific examples below.

   A comparison of all air quality criteria used in the project applications noted in Volume 2, Appendix 14 is presented in Table 219.1, alongside the current AAAQO (EPA 2024). No assessment of regional air quality or air quality dispersion modelling was completed for the Glacier Power Ltd. (GPL) Dunvegan Hydroelectric Project (GPL 2006); therefore, this project is not included in Table 219.1.

   The only AAAQO that has changed since submission of the EIAs for the other projects is the 24-hour AAAQO for $PM_{2.5}$ (changed from 30 µg/m^3 to 29 µg/m^3).

Table 219.1 Comparison of Air Quality Criteria from the Canmore Cougar Creek Flood Retention, Tazi Twé Project, and the Springbank Off-Stream Reservoir Project with Current Alberta Ambient Air Quality Objectives

Air Contaminant	Current Alberta AAQO (EPA 2024)		Canmore Cougar Creek Flood Retention (Town of Canmore 2017)		Tazi Twé Project (SaskPower 2014)		Springbank Off-Stream Reservoir (TEC 2018b)	
CO	1-hr	15,000	1-hr	15,000	1-hr	15,000	1-hr	15,000
	8-hr	6,000			-	-	8-hr	6,000
NO_2	1-hr	300	1-hr	300	-	-	1-hr	300
	Annual	45	Annual	45	-	-	Annual	45
$PM_{2.5}$	-	-	-	-	1-hr	80	1-hr	80
	24-hr	29	24-hr	30	-	-	24-hr	-
	-	-	24-hr CCME	28	-	-	24-hr CCME	28
SO_2	1-hr	450	1-hr	450	1-hr	450	1-hr	450
	24-hr	125	-	-	-	-	24-hr	125
	30-day	30	-	-	-	-	30-day	30
	Annual	20	Annual	20	-	-	Annual	20
TSP	24-hr	100	-	-	-	-	24-hr	100
	Annual	60	-	-	-	-	Annual	60
DPM	-	-	1-hr	-	-	-	2-hr	10
	-	-	Annual	5	-	-	Annual	5

Notes:
- Grey values indicate deviations from the current Alberta AAQO.
- CCME: this value is not an Alberta AAQO but is a Canada-Wide Standard from the CCME (2024) that was in place at the time of the application, which is now considered to be a Canadian Ambient Air Quality Standard (CAAQS).

b. The changes in the provincial HHRA guidance since 2019 and the $PM_{2.5}$ AAAQO are inconsequential in that they do not change the conclusions of the SMRID health assessment.

For 24-hour $PM_{2.5}$, an exceedance was predicted for the Cougar Creek Project based on the Alberta AAQO of 30 µg/m^3. The decrease of this value to 29 µg/m^3 (a change of 1 µg/m^3) suggests that there is also an exceedance based on the current AAAQO.

Question 220

Reference:

Volume 2, Appendix 14, Pages 1-24

Rationale/Preamble:

The SMRID HHRA did not follow standard risk assessment framework as described by Alberta Health (2019) (problem formulation, exposure assessment, hazard/toxicity assessment and risk characterization). Adequate scientific rationale was not provided to support screening out completion of a detailed HHRA.

Information Request:

a. Provide a problem formulation as per Alberta Health (2019) guidance which includes: a list of project related COPC, potential exposure pathways, potential receptor descriptions, and a conceptual site model (CSM).

b. The problem formulation should provide scientific rationale and discussion for the screening of COPC, receptor types and exposure pathways (including multimedia exposure and cumulative exposures) from a detailed HHRA.

c. The problem formulation should provide scientific rationale and discussion for the screening of the exposure assessment, hazard/toxicity assessment and risk characterization steps typical of an HHRA.

Alberta Health, Government of Alberta. August 2019. Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta, Version 2.0 ISBN: 978-1-4601-4359-9, https://open.alberta.ca/publications/9781460143599

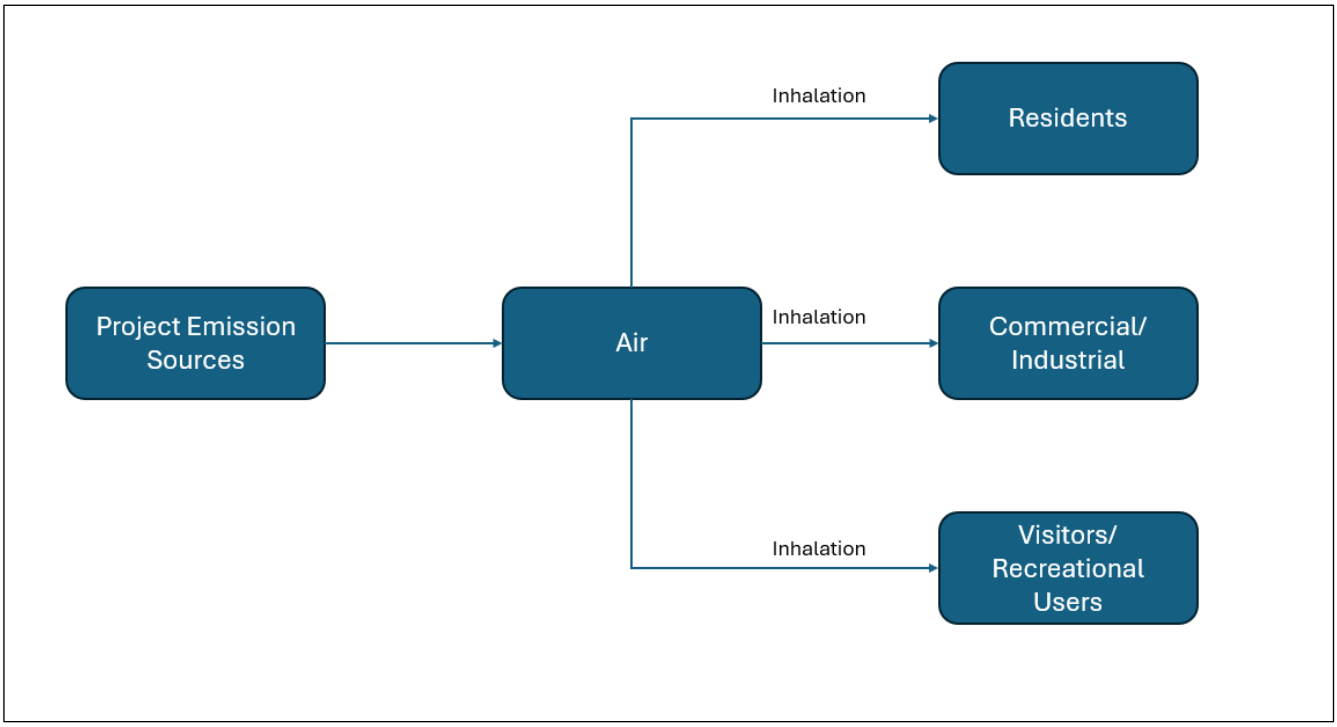
Response:

a. In the meeting on January 8, 2025 held with representatives from EPA, NRCB, Alberta Health, and SMRID, it was agreed that air dispersion modelling was not required for the Chin Reservoir Expansion Project, and that a qualitative assessment of air quality emissions would be adequate.

   The Alberta Health (2019) guidance for HHRA is applicable when a quantitative assessment is required. As this is not the case for this Project due to the duration, type and nature of the emissions (construction-phase only; related to machinery and earth moving), and due to the use of a qualitative format for the health assessment, not all aspects or requirements described in Alberta Health's HHRA guidance are considered applicable to the Chin Reservoir Expansion Project. However, information related to the chemicals of potential concern, applicable exposure pathways, and relevance of various receptor types is presented in Volume 2, Appendix 14 and in the responses to SIR#1 Questions 213, 214 and 217.

A conceptual site model (CSM) is presented in Figure 220.1, using the receptor groups that are relevant to the receptor locations listed in Table 217.1 (refer to SIR#1 Question 217).

Figure 220.1 Conceptual Site Model for the Chin Reservoir Expansion Project



A list of project-related chemicals of potential concern was provided, based on the assessment of similar projects and emission source types, in Volume 2, Appendix 14, Section 4.1, and included: carbon monoxide (CO), nitrogen dioxide (NO2), fine particulate matter (PM2.5), coarse particulate matter (PM10), sulphur dioxide (SO2), total suspended particulate (TSP), and diesel particulate matter (DPM). A qualitative assessment of the potential exposures and risks associated with these contaminants of potential concern (COPCs) was provided in Volume 2, Appendix 14. Please refer to the responses provided for SIR#1 Questions 87 through 91 for additional information pertaining to the magnitude of the estimated emissions from the Project-related construction emissions in relation to current Alberta AAQO.

b. Please refer to the response to SIR#1 Question 220 (a) above and SIR#1 Question 217 (d).

c. Please refer to the response to SIR#1 Question 220 (a) above.

Question 221

Reference:

Volume 2, Appendix 14, Pages 1-24

Rationale/Preamble:

Alberta Health (2019) guidance for HHRA requires definition of spatial boundaries for the HHRA, a RSA and a LSA. The guidance states *Adequate definition of these study area boundaries from the standpoint of potential human exposure is critical to the identification of human receptors for the HHRA.*

Information Request:

a. Describe the LSA and RSA defined for the HHRA.
b. Provide on a map, the LSA, RSA and locations of all human receptors identified within the LSA and RSA.

Alberta Health, Government of Alberta. August 2019. Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta, Version 2.0 ISBN: 978-1-4601-4359-9, https://open.alberta.ca/publications/9781460143599

Response:

a. Please refer to Figure 217.1 provided in the response to SIR#1 Question 217 for the LSA and RSA boundaries as defined in the HHRA.
b. Please refer to the response to SIR#1 Question 217.

Question 222

Reference:

Volume 2, Appendix 14, Page 1-24

Rationale/Preamble:

The HHRA does not include an evaluation of data gaps and uncertainties as per Alberta Health (2019) guidance.

Information Request:

a. Provide an evaluation of the data gaps and uncertainties associated with the HHRA.
In particular, discuss the potential for human health impacts to be greater than those predicted in the assessment.

Alberta Health, Government of Alberta. August 2019. Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta, Version 2.0 ISBN: 978-1-4601-4359-9, https://open.alberta.ca/publications/9781460143599

Response:

a. In place of a comprehensive air dispersion modelling study of the Chin Reservoir Expansion construction emissions, the health assessment relied on the findings of the HHRA completed for comparable projects in Alberta (i.e., Cougar Creek and Springbank Projects). These two projects were considered suitable for comparison to the Chin Reservoir Expansion Project because they involved a comparable or greater number of emission sources, similar emission types, and, like the Chin Reservoir Expansion Project, were restricted to construction emissions only. The potential health risks associated with the construction emissions are considered manageable with the use of dust suppression and other mitigation strategies described in Volume 2, Appendix 14, Section 6. Although there are no predicted ground-level air concentrations available for the Chin Reservoir Expansion Project, comparisons to the findings of the two analogous projects allows us to confidently draw conclusions on the potential health risks of the construction of the Chin Reservoir Expansion Project.

   As described in Volume 2, Appendix 14, Section 5.2, there is considerable uncertainty in the prediction of mercury concentrations in fish with the expansion of the Chin Reservoir. Based on the limitations of predicting mercury and methylmercury concentrations post-inundation and the fact that the baseline mercury concentrations in walleye and northern pike from Chin Reservoir meet Alberta Health's criteria for issuing fish consumption advice, the establishment of a monitoring program after the expansion of the reservoir is expected to be the most effective way to reduce the uncertainty in the risk predictions. Please see the response to SIR#1 Question 214 above.

   Overall, the potential for human health impacts to be greater than those described in Volume 2, Appendix 14 is low. Collaborating with EPA and Alberta Health, SMRID plans to monitor the

mercury concentrations in fish from the Chin Reservoir. SMRID will coordinate with EPA to request that the Chin Reservoir be included in the EPA fish monitoring program so that the data can be shared with Alberta Health for inclusion in their Alberta Fish Consumption Program.

Question 223

Reference:

Volume 2, Appendix 14, Page 1-24

Rationale/Preamble:

The conclusions of the HHRA are dependent on the predicted air and water quality impact assessment results. Through the SIR process, additional assessment may be required for the air and surface water quality portions of the application thus generating new predicted concentration data.

Information Request:

a. In the event that new or additional concentration data is generated for selected COPC, compare the results to health-based Toxicity Reference Values (TRVs) and discuss the potential health impact or provide justification for not completing these steps.

Response:

a. In the event that new or additional concentration data are generated, SMRID will review and interpret that data, determine the need to update the health assessment, and share all relevant information with Alberta Health.

8 APPROVALS

The responses to questions in Section 8 will not be considered as part of the EIA completeness decision made by Alberta Environment and Parks.

8.1 Public Lands Act

Question 224

Reference:

Volume 1, Section 2.3.2, Page 30;
Volume 1, Section 2.4.3 and 2.4.4, Page 33

Rationale/Preamble:

SMRID has proposed buried riprap for the auxiliary spillway channel to prevent headcut erosion progressing upstream of the spillway crest. SMRID has also proposed to armor the outer face of the cofferdam with riprap to limit the potential for wave erosion. The size of the riprap is not discussed for the auxiliary spillway channel or the outer face of the cofferdam.

Riprap size to protect the dam embankment slope from erosion was mentioned. However, it appears water velocity was not considered in estimating the rock size.

Information Request:

a. Provide a discussion on the consideration of erosion at downstream infrastructure (i.e. bridges) and provide the estimated appropriate size of riprap to prevent erosion.
b. Discuss how the flood water velocity has been considered when determining riprap size.
c. Provide the riprap size that will be used to armor the outer face of the cofferdam.
d. Provide justification for why water velocity was not considered when determining riprap size to protect the dam embankment slope.

Response:

a. The Chin Reservoir Expansion Project does not result in higher maximum discharges than historic being released via the outlet structure at the West Dam, through Stafford Reservoir and downstream. Consequently, no consideration of erosion at downstream infrastructure (i.e., bridges) is warranted.

   The proposed auxiliary spillway at the New East Dam will convey flood events greater than the 1:1,000 year flood. Flow from the auxiliary spillway will be conveyed to Chin Coulee east/downstream of the New East Dam. Existing infrastructure downstream/east of the New East Dam consists of eight road crossing culverts between the proposed New East Dam and Murray Reservoir. These road crossing culverts are sized to convey flood events much smaller than the 1:1,000 year flood and these structures would likely be subject to flood flows

exceeding their capacity at storm events much smaller than the storm at which the auxiliary spillway would be activated; consequently, the Chin Reservoir Expansion Project will not impact existing downstream road infrastructure.

b. Please refer to the response to SIR#1 Question 224 (a).

c. Riprap on the outside face of the cofferdam, required to construct the temporary outlet structure at the existing East Dam, will be sized to prevent wave erosion due to the 1:100 year wind. Sizing of the riprap slope protection for the New East Dam is presented in the New East Dam PDR, Appendix III – New East Dam Freeboard Assessment and Slope Protection, Section 2.0. For the 1:100 year wind-generated waves, riprap with a $d_{50} \geq 640$ mm is required (denoted Riprap 6D). Riprap 6D will be placed on the outer face of the temporary cofferdam at the existing East Dam such that it can be salvaged during cofferdam removal and incorporated in the slope protection for the New East Dam.

d. There is very little to no velocity/current along the New East Dam embankment slope. The governing event for erosion protection on the New East Dam embankment is wave erosion due to wind-generated waves. The design of the slope protection on the New East Dam embankment is presented in the New East Dam PDR, Appendix III – New East Dam Freeboard Assessment and Slope Protection (refer to Appendix 1.1 of this SIR#1 Response Document for the New East Dam PDR).

9 ERRATA

Question 225

Reference:

Environmental Impact Assessment Report Summary, Section 1.1, Page 1

Rationale/Preamble:

The SMRID states *With the dam relocation and the rise in FSL, the total estimated storage would increase to 257,820 ac-ft and add 1,000 acres to the reservoir's footprint.*

Information Request:

a. Provide the reservoir storage volume in both cubic decameters and acre-feet for clarity.

Response:

a. The value reported in the EIA Report Summary is incorrect. The correct value for the total estimated storage with the reservoir expansion and increase in FSL is equal to 390,571 dam^3 (316,641 ac-ft) as reported on page 5 and shown on Figures 3.1 and 3.2 in the New East Dam PDR (Appendix 1.1).

Question 226

Reference:

Environmental Impact Assessment Report Summary, Section 3.3, Page 13

Rationale/Preamble:

SMRID states *A federal duty to consult may yet be triggered during federal approvals reviews as outlined in Section* ***Error! Reference source not found...***

Information Request:

a. Provide the correct section reference.

Response:

a. This section reference was added in error. The sentence is revised to read, *"A federal duty to consult may yet be triggered during federal approvals review."*

Question 227

Reference:

Environmental Impact Assessment Report Summary, List of Abbreviations and Acronyms, Page ii
Volume 1, List of Abbreviations and Acronyms, Page ii
Volume 2, List of Abbreviations and Acronyms, Page ii
Volume 4, List of Abbreviations and Acronyms

Rationale/Preamble:

The acronyms HRA *(Historical Resources Impact Assessment), HRMB (Historical Resources Management Branch)* and *pHRIA (Paleontological Historical Resources Impact Assessment)* have all incorporated the word historical rather than the correct term historic. While these represent processes and an agency that operate under the *Historical Resources Act*, all address historic resources, as defined under Section 1(e) of the Act.

Information Request:

a. Provide the correct term.

Response:

a. The following acronyms are revised in the acronym tables of the EIA Report Summary and Volumes 1, 2, and 4 to read:
   - *Historic Resources Impact Assessment (HRIA)*
   - *Historic Resources Management Branch (HRMB)*
   - *Paleontological Historic Resources Impact Assessment (pHRIA)*

Question 228

Reference:

Volume 1, Section 1.11.1, Page 17

Rationale/Preamble:

Under the heading *Natural Resources Conservation Board*, the second bulleted point from the bottom of the list of legislation describes the *Historical Resources Act* as being *Enacted to preserve, protect, and present historical and archaeological resources of provincial, national, and international significance.* This is incorrect, as the Act does not apply to national or international interests and includes the protection of more sites than just those of archaeological or historic interest. The definition should reflect that the *Historical Resources Act* is enacted to promote the preservation, study, interpretation and promotion of appreciation of historic resources in the Province of Alberta, which includes archaeological, palaeontological, historic structure (built heritage) and cultural (traditional land use) sites.

Information Request:

a. Provide a correction of this definition.

Response:

a. Volume 1, Section 1.11.1, Page 17 is revised to read "*Historical Resources Act* (*HRA*): Enacted to promote the preservation, study, interpretation and promotion of appreciation of historic resources in the Province of Alberta, which includes archaeological, palaeontological, historic structure (built heritage) and cultural (traditional land use) sites. (R.S.A. 2000, c. H-9). A component of the EIA for the Project will be a Historic Resources Impact Assessment (HRIA) as required by Alberta Arts, Culture and Status of Women (Alberta Culture)."

Question 229

Reference:

Volume 1, Section 1.12.1.5, Page 21

Rationale/Preamble:

The heading of Section 1.12.1.5 is *Alberta Culture, and the Status of Women*. The correct name of this agency is Alberta Arts, Culture and Status of Women.

Information Request:

a. Provide the correct heading.

Response:

a. The correct name of Alberta Arts, Culture and Status of Women was replaced in the following locations:
   - The heading of Section 3.1.1.5 in the Environmental Impact Assessment Report Summary, Page 8;
   - The heading of Volume 1, Section 1.12.1.5, Page 21; and,
   - The bulleted text found in Volume 2, Section 2.9.2.1, Page 149.

Question 230

Reference:

Volume 1, Section 1.12.1.5, Page 21

Rationale/Preamble:

Within this Section, reference is made to a *Historical Resources Application,* the *Historical Resources Management Branch,* and an archaeological and palaeontological *Historical Resources Impact* Assessment. This application, agency and investigation should be correctly identified as a Historic Resources Application, the Historic Resources Management Branch and a Historic Resources Impact Assessment.

Information Request:

a. Provide the correct terms.

Response:

a. Section 1.12.1.5 is revised to read:

"An initial HRA application was submitted to the Historic Resources Management Branch (HRMB) by Bison Historical Services Ltd., on behalf of Klohn Crippen Berger Ltd. (KCB) and the SMRID, on August 8, 2021. The HRMB reviewed the application and issued a HRA Requirements document for the Project on September 10, 2021 that required both an archaeological HRIA and paleontological Historic Resources Impact Assessment (pHRIA). The HRMB required the assessment for:

- *The proposed expansion footprint.*
- *Areas around the existing West Dam.*
- *Areas around the proposed site of the proposed New East Dam.*
- *Areas around the Existing Reservoir that may be affected by a raise in reservoir levels.*
- *Along proposed construction access roads.*
- *At the locations of potential borrow pits.*

On May 16, 2022, a permit application was submitted by Bison Historical Services Ltd. for the HRIA for the Project. The HRMB reviewed the HRIA permit application and issued ASA permit 22-047 for the HRIA on May 17, 2022. Fieldwork for the HRIA was conducted between May 26 to October 31, 2023. The final report for the HRIA was submitted to the HRMB on September 25, 2023. The Historic Resources Application process is summarized in Volume 2: Section 2.9."

Question 231

Reference:

Volume 1, Section 1.13.3, Page 25

Rationale/Preamble:

SMRID states *The publication initiated a 50-day public review period…*

Information Request:

a. This number is incorrect. It was a 48-day comment period from November 16, 2023, to January 3, 2024. Revise the statement with the correct number.

Response:

a. Section 1.13.3 of Volume 1 is revised to read:

"An information package regarding the proposed changes and expansion was provided for public viewing at the SMRID office in Lethbridge, Alberta on October 13, 2022. An information guide was provided online on the SRMID website on October 25, 2022 (SMRID 2022a). As noted in Section 2.2, public notifications regarding the pToR for the EIA were published on November 15 and 16, 2022. The publication initiated a 48-day public comment period for the pToR as set by EPA, with an end date of January 3, 2023."

Question 232

Reference:

Volume 1, Section 1.14;
Volume 2, Section 2.6 and 2.7;
Volume 4-6; Volume 4-7;
Volume 5, Section 5 [B]

Rationale/Preamble:

The final Terms of Reference states *Discuss the species, abundance and availability of vegetation, fish and wildlife used for food, traditional, medicinal, and cultural purposes in the identified traditional land use areas, considering all project related impacts.*

The concordance table lists Volume 1: Section 1.14 and Volume 2: Section 2.6 and 2.7. This information is not found in Volume 1: Section 1.14. This information was also discussed in Volumes 4-6 and 4-7.

Information Request:

a. Provide the sections for where this information is located.

Response:

a. Discussion of the forementioned term found in Section 5 [B] of the fToR can be found within the following sections of the EIA submission:
    - Volume 2, Section 2.6 and Section 2.7, Appendix I (Table I.6);
    - Volume 4-6, Vegetation and Wetlands TBR, Section 3.4; and
    - Volume 4-7, Wildlife TBR, Section 2.3.1 and Section 3.1.1, Appendix II (Table II-4).

    The concordance table has been updated accordingly (Appendix 6.1 of this SIR#1 Response Document). Further discussion that pertains to this term can be found in the responses to SIR#1 Questions 82 through 86.

Question 233

Reference:

Volume 1, References, Page 45;
Volume 2, References, Page 188

Rationale/Preamble:

The Volume 1 References list the report *Klohn Crippen Berger Ltd. (KCB) 2023. Chin Reservoir Expansion – New East Dam Preliminary Design Report. Prepared for MPE Engineering Ltd. and St. Mary River Irrigation District. December 2023.*

The Volume 2 References list lists the report *KCB. 2023. Chin Reservoir Expansion – New East Dam Preliminary Design Report. Prepared for MPE Engineering Ltd. and St. Mary River Irrigation District, January 2023.*

Information Request:

a. Provide the correct reference used for the EIA. If two reports have been referenced provide both reports.

Response:

a. The correct reference for the Preliminary Design Report, prepared by KCB, is as follows:

Klohn Crippen Berger Ltd. (KCB). 2023. Chin Reservoir Expansion – New East Dam Preliminary Design Report (Dam Safety Submission). Prepared for MPE Engineering Ltd. and St. Mary River Irrigation District. December 2023.

The New East Dam PDR has been appended to this SIR#1 Response Document in Appendix 1.1.

Question 234

Reference:

Volume 2, Table of Contents, Pages vi, xi and xii

Rationale/Preamble:

Section 2.9 is identified as *Historical Resources* and the map titles for Map Figures 2.9.1 to 2.9.4 are labelled as *Historical Resources Impact Assessment.* The proper name of this discipline area and the investigation process in Alberta uses the term Historic, not historical.

Information Request:

a. Provide the correct heading and titles.

Response:

a. The following list of corrections shown in Table 234.1 are made to headers and figure titles found within the Volume 2 Table of Contents and locations in text within Volume 2.

Table 234.1 Revised Text Mentioning Historic Resources

Text Location	Revised Text
Volume 2, Section 2.9 header (page vi)	*Historic Resources* (refer to the response to SIR#1 Question 235 to see the updated table of contents (ToC) for Volume 2)
Volume 2, Map Figure section header (page xi);	*Historic Resources*
Volume 2, Map Figure titles (pages xi and xii)	*Map Figure 2.9.1 – Historic Resources Impact Assessment (Sheet 1 of 4)* *Map Figure 2.9.2 – Historic Resources Impact Assessment (Sheet 2 of 4)* *Map Figure 2.9.3 – Historic Resources Impact Assessment (Sheet 3 of 4)* *Map Figure 2.9.4 – Historic Resources Impact Assessment (Sheet 4 of 4)*
Volume 2, Section 1.4.1.10 header (page 8)	*Historic Resources*
Volume 2, Section 1.4.1.10, paragraph on page 8	*Historic resources, such as archaeological and palaeontological elements, cultural landscapes, and historic structures, often have important cultural value. They may be important to local communities, Indigenous Groups, or the broader society. The identification and preservation of these resources is necessary for the maintenance of cultural heritage. There is potential for the Project to disturb or destroy historic resources and sites that hold valuable information about pre-historic conditions, along with past human activities, lifestyles, and technologies. The assessment of historic resources helps identify archaeological and paleontological sites to implement strategies to mitigate potential adverse effects to the resources and/or the loss of invaluable pre-historical and post-settlement information.* *Environmental effects on the VC of Historic Resources were evaluated using two KIs:…*
Volume 2, Section 1.7, bullet on page 10	*An adverse, unmitigable effect on existing socio-economic conditions, historic resources, air quality, groundwater, geomorphology, undisturbed soils, or natural surface water bodies or watercourses that are characterized as high magnitude, regional extent, far-future in duration, and is not reversible.*

Text Location	Revised Text
Volume 2, Section 2.7.4.1.6, paragraph on page 119	*Fencing erected to exclude humans and cattle from construction sites or historic resources should limit the use of barbed wire if possible. If extensive lengths of barbed wire fencing is required, the bottom wire of the fence should be a smooth wire and placed at a height of 46 cm from the ground to allow effective passage of Pronghorn under the wire without snaring or causing fatal entanglements (Jones et al. 2018, Paige 2020, Jones and MacDonald 2024).*
Volume 2, Section 2.8.3.5, paragraph on page 131	*A Historic Resources Impact Assessment (HRIA) was completed for the Project (Section 2.9). The results of the HRIA identified a high number of sites where avoidance was the primary mitigation. A Paleontological HRIA (pHRIA) completed for the Project (Section 2.9) indicated paleontological significant areas would need to be avoided or mitigated during construction. Mitigation of potential effects to historic and paleontological resources are addressed in the Historic Resources Assessment in Section 2.9.*
Volume 2, Section 2.8.4.6, paragraph on page 138	*The Historic Resources Impact Assessment (HRIA) (Section 2.9) identified numerous archaeological and paleontological sites. Avoidance of these locations is recommended, or they will require mitigative mapping and excavations (Bison Historical Services Ltd. 2023).*
Volume 2, Section 2.9.1, paragraph on page 144	*A Historic Resources Impact Assessment (HRIA) of the Project was conducted to assess potential Project effects (Pickering et al. 2023). In response to an Historic Resources Overview (HRO) submission (OPaC Application Number: 21203073), the investigation was initiated in response to a Historical Resources Act Requirements document issued by the Historic Resources Management Branch (HRMB), within the Alberta Ministry of Arts, Culture and Status of Women, stating that an HRIA is required (HRA Number 4825-21-0028-001).*
Volume 2, Section 2.9.1.2, paragraph on page 145	*The first objective of the review of previously conducted research was to identify any previously recorded historic sites that may be impacted by the proposed development. A second goal was to provide a reasonable assessment of the quantity, type, and distribution of known sites in the near vicinity of the proposed development. The final goal was to provide an indication of the nature and scope of previous investigations in the development area.* *Details of known historic resource sites are recorded in Archaeological Site Inventory Data forms, Historic Site forms, and final project reports, all of which are kept on file with the HRMB. The significance of historic resources is denoted by a ranked Historic Resource Value (HRV), ranging from 5 for potential significance through 1 for the most important known historic sites in the province, with 2 no longer in use (Table 2.23, HRMB 2022). According to the Listing of Historic Resources (HRMB 2023), the proposed project occurs in lands that have been assigned HRV notations of 3a, 4a, 4p, 5a, 5p. Notations of "a" or "p" note whether the resources are expected to be archaeological or palaeontological in nature."*
Volume 2, Section 2.9.1.3, paragraph on page 146	*The HRIA field investigations were carried out from May 26, 2022, to October 31, 2022, under frost-free conditions. Areas of native vegetation were examined by pedestrian survey, while subsurface testing was concentrated in areas thought to have a potential for buried historic resources. Archaeological sites identified, and cultural features within sites, were photographed, sketch mapped, and described. Site locations were noted on 1:50,000 or better NTS map sheets, aerial imagery; and ultimately positioned by handheld GPS receivers. Historic Structures identified in the field were recorded as per guidelines included in The Requirements for Recording and Reporting Historic Structures within the Context of Archaeological HRIAs (HRMB 2022).*

Text Location	Revised Text
Volume 2, Section 2.9.1.4, paragraph on page 147	*A single historic structure was revisited during fieldwork. This structure was re-recorded and photographed. No further historic resource investigations are recommended at this structure, and Historical Resources Act Approval was recommended for the historic structure in association with construction for the current proposed development.*
Volume 2, Section 2.9.2, paragraphs on page 148	*A Palaeontological Historic Resources Impact Assessment (pHRIA) of the Project was conducted to assess potential Project effects (McNeil 2023). The pHRIA was carried out under Permit to Excavate Palaeontological Resources 22-049 from May 16th to the 27th, 2022. The trigger for the pHRIA requirements was the potential for the Project to impact Cretaceous aged fossils in bedrock of the Foremost Formation. Due to the sensitive nature of the assessment and restrictions imposed by the HRMB, the pHRIA remains outside of the public domain. A summary of the assessment is provided below. To review the data and documentation of the pHRIA, those seeking greater detail must contact the HRMB directly.* *…* *Palaeontological Historic Resources are concentrated on the coulee system where the surficial glacial till cover has been eroded away, exposing bedrock on the coulee floor and walls. Examples of local fossil records include; teeth of Tyrannosaurs, Ankylosaurs, Nadosaurs and crocodiles, Adocus, Solemydidae and Trionychid turtle shells, ornithischian femur, Hadrosaur skeleton, the skulls of Pachycephalosaur and Stegosaurus.*
Volume 2, Section 2.9.2.1, bullets on pages 148 and 149	*The requirements for the paleontological pre-construction HRIA under the Historical Resources Act were:* ▪ *The Historic Resources Impact Assessment must address all areas of high palaeontological potential within the PA.* ▪ *The Historic Resources Impact Assessment is to be carried out prior to the initiation of any land surface disturbance activities under snow free, unfrozen ground conditions. Should the project require survey under winter conditions, assessment procedures must be discussed in advance with the Royal Tyrrell Museum of Paleontology.* ▪ *Results of the Historic Resources Impact Assessment must be reported to Alberta Arts, Culture and Status of Women and subsequent Historical Resources Act approval must be granted before development proceeds.*
Volume 2, Section 2.9.3, paragraphs on page 150	*Short term, or immediate, impacts to historic resources for the Project include construction of the New East Dam and associated infrastructure, the Auxiliary Spillway, roads, borrow pits, etc., as well the inundation of sites with reservoir water. This includes sites in the Reservoir Expansion Area that have never before been inundated, and sites within the Existing Reservoir that will either be further inundated, or inundated for the first time, when the water level of the reservoir is increased.* *…* *A long-term monitoring program to assess ongoing effects from erosion, undercutting and slumping is proposed to monitor for the indirect disturbance of historic resources and loss of in situ context for archaeological and palaeontological materials and features at these sites.*
Volume 2, Section 2.9.4, paragraph on page 150	*No issues with respect to historic resources have been noted during public consultations. During consultation with the Blood Tribe, it was noted that a review of the results of the HRIA and pHRIA will be requested by the Blood Tribe. A request to review the assessments will need to be submitted directly to the HRMB (780-431-2300 or hra.team@gov.ab.ca).*

Question 235

Reference:

Volume 2, Table of Contents, Page v;
Volume 2, Section 2.3, 2.3.1 – 2.3.6, Page 33 – 42

Rationale/Preamble:

SMRID states only one sub-section *2.3.6 Monitoring Requirements* under *2.3 Surface Water Quality* in the Table of Contents (TOC).

In Section 2 of Volume 2, Section 2.3 assesses the surface water quality in sub-sections 2.3.1-2.3.6. However, the TOC of Volume 2 is missing sub-sections 2.3.1-2.3.5.

Information Request:

a. Provide an updated TOC.

Response:

a. The updated ToC is provided below. The content below is a screenshot of the updated ToC from Volume 2 of the EIA submission and does not contain live links.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS AND ACRONYMS I
UNITS OF MEASUREMENT IV
CLARIFICATIONS REGARDING THIS REPORT XIV
1 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLGY 1
1.1 Background and Objectives 1
1.2 Project Understanding 1
1.2.1 East Dam Construction 2
1.2.2 Reservoir Filling 2
1.2.3 Existing East Dam Decommissioning 2
1.2.4 Operation of the Expanded Reservoir 2
1.3 Assessment Scales and Boundaries 3
1.3.1 Spatial Scales 3
1.3.2 Temporal Boundaries 3
1.4 Valued Components and Key Indicator Identification 3
1.5 Potential Effects Assessment Process 9
1.6 Standard Mitigations 9
1.7 Residual Effects Characterization 10
2 ENVIRONMENTAL IMPACT ASSESSMENT 14
2.1 Hydrogeology 14
2.1.1 Spatial Extents 14
2.1.2 Baseline Conditions 14
2.1.3 Potential Project Effects 19
2.1.4 Mitigation 23
2.1.5 Monitoring Requirements 23
2.2 Hydrology 24
2.2.1 Spatial Extents 24
2.2.2 Baseline Conditions 24
2.2.3 Potential Project Effects 28
2.2.4 Mitigation 31
2.2.5 Assessment of Residual Effects 31
2.2.6 Monitoring Requirements 32
2.3 Surface Water Quality 33
2.3.1 Spatial Extents 33
2.3.2 Baseline Conditions 33

TABLE OF CONTENTS
(continued)

2.3.3 Potential Project Effects 34
2.3.4 Mitigation 37
2.3.5 Assessment of Residual Effects 39
2.3.6 Monitoring Requirements 41
2.4 Aquatic Ecology 43
2.4.1 Baseline Conditions 43
2.4.2 Potential Project Effects 44
2.4.3 Mitigation 50
2.4.4 Assessment of Residual Effects 54
2.4.5 Monitoring Requirements 62
2.5 Soils and Terrain 63
2.5.1 Spatial Extents 63
2.5.2 Baseline Conditions 63
2.5.3 Potential Project Effects 64
2.5.4 Mitigation 71
2.5.5 Assessment of Residual Effects 74
2.5.6 Monitoring Requirements 74
2.6 Vegetation and Wetlands 75
2.6.1 Spatial Extents 75
2.6.2 Baseline Conditions 75
2.6.3 Potential Project Effects 76
2.6.4 Mitigation 86
2.6.5 Assessment of Residual Effects 89
2.6.6 Monitoring Requirements 92
2.7 Wildlife and Wildlife Habitat 93
2.7.1 Spatial Extents 93
2.7.2 Baseline Conditions 93
2.7.3 Potential Project Effects 96
2.7.4 Mitigation 111
2.7.5 Monitoring Requirements 119
2.7.6 Assessment of Residual Effects 120
2.8 Land Use and Management 125
2.8.1 Definitions 125
2.8.2 Spatial Extents 127

TABLE OF CONTENTS
(continued)

2.8.3 Baseline Conditions 127
2.8.4 Potential Project Effects 131
2.8.5 Mitigation 138
2.8.6 Regulatory Framework, Land Use Policies, and Resource Management Initiatives 139
2.9 Historic Resources 144
2.9.1 Archaeological Assessment 144
2.9.2 Palaeontological Assessment 148
2.9.3 Summary of Potential Effects 150
2.9.4 Consultation 150
3 HUMAN HEALTH ASSESSMENT 151
3.1 Air Quality 151
3.2 Fish Tissue Mercury Content 152
3.3 Noise 152
3.3.1 Baseline Conditions 152
3.3.2 Potential Project Effects 153
3.3.3 Mitigations 155
3.3.4 Assessment of Effects 156
4 ACCIDENTS AND MALFUNCTIONS 158
4.1 Accident Prevention and Response 158
4.2 Potential Accidents and Malfunctions During Construction 159
4.2.1 Flooding 159
4.2.2 Grass Fire 163
4.2.3 Snake Bites 165
4.2.4 Hazardous Materials Spills 166
4.2.5 Construction Equipment Malfunctions or Accidents 167
4.2.6 Vehicle Collisions 168
4.3 Potential Accidents and Malfunctions During Operation 169
4.3.1 Flooding 169
4.3.2 Pipeline Breach 169
4.3.3 Vehicle Collisions 170
4.3.4 Recreation 170
5 TRAFFIC 171
5.1 Infrastructure 171

TABLE OF CONTENTS
(continued)

5.1.1 Roadway Slope Retrogression 171
5.1.2 Highway 36 Bridge 171
5.2 Traffic Impact Assessment 171
5.2.1 Introduction 171
5.2.2 Baseline Conditions 172
5.2.3 Project Case 175
5.2.4 Conclusions and Mitigations 179
5.2.5 Potential Cumulative Effects 180
REFERENCES 182

Question 236

Reference:

Volume 2, Section 2.3.1, Page 33;
Volume 4-2, Map Figure 2

Rationale/Preamble:

SMRID states that *The LSA includes:*

- The catchment area of Chin Reservoir and the proposed expansion;
- The unnamed ephemeral watercourse downstream (hereafter named Watercourse 126419) of the Existing East Dam in Chin Coulee; and
- The Stafford Reservoir catchment area.

The catchment areas of Stafford Reservoir, Chin Reservoir and the proposed expansion are not included in the LSA based on Map Figure 2 of Volume 4-2. Map Figure 2 indicates that the catchment areas are included in the RSA, whereas the reservoir bodies are in the LSA.

Information Request:

a. Update Map Figure 2 with the boundaries for the three reservoir areas and the Watercourse 126419. Revise the LSA statement to match Figure 2.

Response:

a. The following updated text correctly describes the LSA that was defined for the Surface Water Quality assessment, as described in Volume 2, Section 2.3.1, Page 33. An updated Map Figure 2 is provided below as Figure 236.1 that more clearly identifies the extent of water bodies.

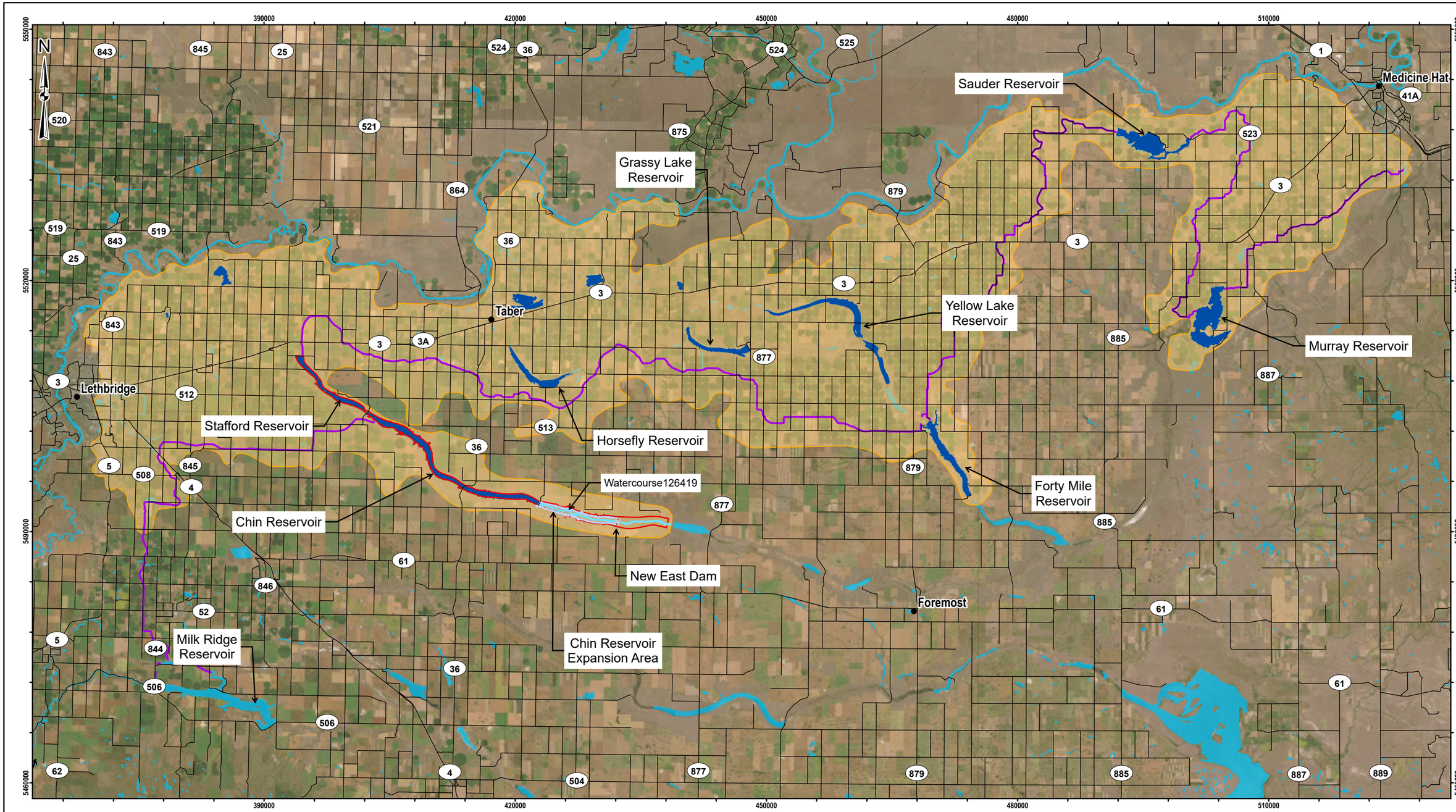
"The Study Area was defined as the spatial and temporal boundaries at which environmental effects from Project activities could potentially occur. The spatial boundaries were divided into the LSA and RSA. The temporal boundaries for both the LSA and RSA encompass the construction, operation and/or maintenance (i.e., the entire lifespan) of the Project. The LSA was defined to include the area of potential direct effects from the Project. The LSA includes:

- Chin Reservoir and the proposed expansion;
- The unnamed ephemeral watercourse downstream (hereafter named Watercourse 126419) of the Existing East Dam in Chin Coulee; and,
- Stafford Reservoir.

The environmental LSA includes the Stafford Reservoir to assess its impact on water quality from the construction and operation of the Project."

FIGURE

Figure 236.1 Surface Water Quality Assessment Study Boundaries



Legend

- Place Names
- All Weather Road
- Proposed Dam Location
- Main Canal
- Watercourse
- Water Feature
- SMRID Infrastructure
- Chin Reservoir Expansion Area
- Regional Study Area (RSA)
- Local Study Area (LSA)

0 25 Kilometres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: FORTY MILE COUNTY NO.8, TOWN OF PINCHER CREEK, EARTHSTAR GEOGRAPHICS
4. SMRID = SAINT MARY RIVER IRRIGATION DISTRICT

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: SURFACE WATER QUALITY ASSESSMENT STUDY BOUNDARIES

SCALE	PROJECT No.	FIG No.
1:440,000	A03701E05	236.1

File: \\int.klohn.com\Proj\Data\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\ChinReservoir_TBRFigures_220802\ChinReservoir_TBRFigures_221114.aprx Creator: : HManandyan

Question 237

Reference:

Volume 2, Section 2.8;
Volume 2, Section 4.2;
Volume 5, Section 2, 3.10.2

Rationale/Preamble:

The concordance table incorrectly identifies Section 3.10.2 [D] in Volume 2, Section 2.8 of the EIA. The fire control plan is located in Volume 2, Section 4.2.

Information Request:

a. Provide the correct EIA sections for 3.10 Land Use and Management.

Response:

a. The fToR Section 3.10.2 [D] regarding the fire control plan is discussed in Volume 2, Section 4.2.2. Refer to the response to SIR#1 Question 235 for the updated Volume 2 ToC. The concordance table has been updated accordingly (Appendix 6.1 of this SIR#1 Response Document).

Question 238

Reference:

Volume 2, Section 2.9, Page 144

Rationale/Preamble:

The heading used for Section 2.9 is *Historical Resources*, although the project Terms of Reference correctly identifies this discipline area as Historic Resources. Although the resources associated with this discipline are protected under the *Historical Resources Act*, the resources themselves are actually historic resources, as defined under Section 1(e) of the Act.

Information Request:

a. Provide the correct heading, to ensure consistency with the discipline heading in Section 4 of the Final Terms of Reference.

Response:

a. Please refer to the response to SIR#1 Question 234 (a).

Question 239

Reference:

Volume 2, Section 3.3.1, Page 153;
Volume 2, Section 3.3.1, Table 3.2, Page 155;
Volume 2, Section 5.2.3.3.3, Page 178

Rationale/Preamble:

SMRID states *The greatest source of noise associated with the construction of the Project would be construction and drilling equipment*. However, Table 3.2 does not include drilling equipment.

Section 5.2.3.3.3 of Volume 2 identifies that 70 trucks are assumed to be moving material to and from the construction site on a daily basis. Trucks are also missing from Table 3.2.

Information Request:

a. Add drilling equipment to Table 3.2.

b. Add trucks to Table 3.2.

Response:

a. Please refer to the response provided in SIR#1 Question 90, which includes an updated list of anticipated construction equipment.

b. Please refer to the response provided in SIR#1 Question 90, which includes an updated list of anticipated construction equipment.

Question 240

Reference:

Volume 4-2, Section 2.1, Page 5;
Volume 4-2, Map Figure 2

Rationale/Preamble:

SMRID states that the LSA includes catchment areas of Stanford Reservoir, Chin Reservoir and Chin expansion.

As per Map Figure 2, the LSA consists of the reservoirs and unnamed ephemeral watercourse downstream, while their catchment areas are part of the RSA.

The three areas of Stanford Reservoir, Chin Reservoir and Chin expansion shall be clearly indicated with their own boundaries within the LSA. In addition, the unnamed ephemeral watercourse downstream (Watercourse 126419) needs to be added into the LSA for ease of reading and understanding.

Information Request:

a. Update Map Figure 2 with the boundaries for the three reservoir areas and the Watercourse 126419. Revise the LSA statement to match Map Figure 2.

Response:

a. Refer to the updated Figure 236.1 provided in SIR#1 Question 236.

Question 241

Reference:

Volume 4-3, Section 2.3.4, Page 9;
Volume 4-3, Map Figure 4.2

Rationale/Preamble:

The EIA references monitoring well VT21-01, however, this well cannot be found on any Figures other than Map Figure 4.2. VT21-01 is incorrectly identified on this Map Figure.

Information Request:

a. Provide the corrected monitoring well VT21-01 on Map Figure 4.2.
b. Monitoring well VT21-01 appears to be missing from Map Figure 2.2, provide the corrected Map Figure.

Response:

a. The updated Map Figure 4.2 is provided below as Figure 241.1 and now correctly includes VT21-01, which was previously noted as “VT-01”.
b. The updated Map Figure 2.2 is provided below as Figure 241.2 and now includes VT21-01 located adjacent to BH21-03.

FIGURES

Figure 241.1 Groundwater Sampling Locations

Figure 241.2 Monitoring Well Locations and Access Routes



Legend

- Groundwater Sampling Location
- All Weather Road
- Access Roads
- New East Dam Footprint
- Project Area (PA)

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, MAXAR

CLIENT: SMRID

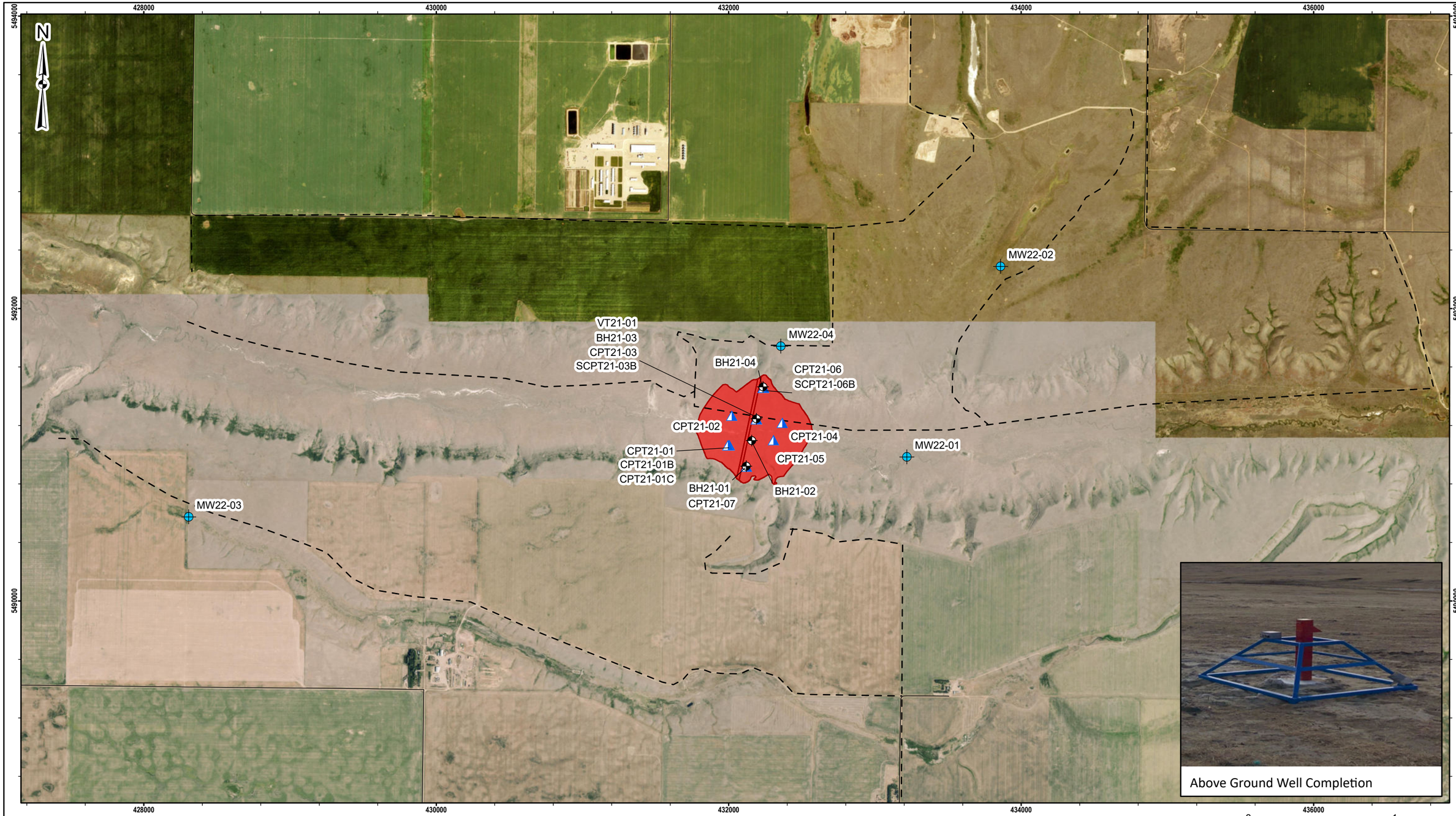
Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: GROUNDWATER SAMPLING LOCATIONS

SCALE	PROJECT No.	FIG No.
1:30,000	A03701E05	241.1

File: Z:\A\CGY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Date: Time: Creator: : HMarandyan



Legend

- CPT
- Borehole
- Monitoring Well
- All Weather Road
- Access Roads
- New East Dam Footprint

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: TOWN OF PINCHER CREEK, MAXAR

CLIENT: SMRID

Klohn Crippen Berger

PROJECT: CHIN RESERVOIR EXPANSION PROJECT - ENVIRONMENTAL IMPACT ASSESSMENT SIR#1 RESPONSE DOCUMENT

TITLE: MONITORING WELL LOCATIONS AND ACCESS ROUTES

SCALE	PROJECT No.	FIG No.
1:25,000	A03701E05	241.2

File: Z:\AC\GY\Alberta\A03701E01 MPE Chin Res Environmental\400 Drawings\402 GIS\02_Pro_Files\Technical Baseline Report\Chin Reservoir TBR Figures\Chin Reservoir EGDB.aprx Creator: : HManandyan

Question 242

Reference:

Volume 4-3, Section 4.5, Page 27

Rationale/Preamble:

SMRID states *Figure 4.1 through to shows the hydrographs…*

Information Request:

a. A Figure reference is missing in this statement. Provide the missing Figure reference.

Response:

a. Volume 4-3, Section 4.5 on page 27 is revised to read:

"Figure 4.1 through to Figure 4.9 show the hydrographs for wells MW22-01 through to MW22-04."

Question 243

Reference:

Volume 5, Section 3.1

Rationale/Preamble:

The concordance table outlines Volume 2, Section 2.5, Section 3.1 and Section 3.2 for the location of air quality and noise content in the EIA. Noise is addressed in Volume 2 Section 3.3.

Information Request:

a. Provide all sections where air quality and noise information are found.

Response:

a. Noise is addressed in Volume 2 Section 3.3, as well as the responses to SIR#1 Questions 52 to 57. An updated concordance table has been provided in Appendix 6.1.

REFERENCES

Acera Consult Inc. (Acera). 2021. Economic Value of Alberta's Irrigation Districts. Prepared for Alberta Irrigation Districts Association. Lethbridge, Alberta, Canada. 142 pp. Accessed July 2025. https://www.albertairrigation.ca/?page_id=148.

Alberta Agriculture and Forestry (AAF). 2016. Land Classification for Irrigation in Alberta – Agri-Facts. Accessed July 2025. https://open.alberta.ca/dataset/cff31d54-1cbd-40c2-8536-6ae0e16e54a7/resource/6b650322-9e9a-4de8-ba0b-606bf3c48c0e/download/2016-560-3.pdf.

AAF. 2021a. Irrigation Water Quality Project. Volume 7: Water Quality Indices of Irrigation Water of Southern Alberta.

AAF. 2021b. Irrigation Water Quality Project. Volume 8: Water Quality Trends in Irrigation Water of Southern Alberta.

Alberta Agriculture, Food, and Rural Development (AAFRD). 2004. Procedures Manual for the Classification of Land for Irrigation in Alberta. Lethbridge, Alberta. Accessed July 2025. https://open.alberta.ca/publications/procedures-manual-for-the-classification-of-land-for-irrigation-in-alberta-2004.

Alberta Energy Regulator (AER). 2024a. Directive 020: Well Abandonment. Dated November 6, 2024. Accessed July 2025. https://www.aer.ca/regulations-and-compliance-enforcement/rules-and-regulations/directives.

AER. 2024b. Directive 038: Noise Control. Dated April 2, 2024. Accessed July 2025. https://www.aer.ca/regulations-and-compliance-enforcement/rules-and-regulations/directives.

AER. 2025. Abandoned Well Map Viewer. Accessed March 2025. https://extmapviewer.aer.ca/AERAbandonedWells/Index.html.

Alberta Environment and Protected Areas (EPA). 2024. Alberta Ambient Air Quality Objectives and Guidelines. July 19, 2024. https://open.alberta.ca/dataset/09a63fe8-11ae-420e-9008-82aa4db4824a/resource/094dae9e-b6f9-4de9-86c7-a651019f3aab/download/epa-ambient-air-quality-objectives-and-guidelines-2024.pdf.

Alberta Health. 2019. Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta, Version 2.0. Government of Alberta. Accessed July 2025. https://open.alberta.ca/publications/9781460143599.

Alberta Irrigation Districts Association (AIDA). 2019. Report on Proposed Irrigation Storage Reservoir Ranking. Prepared for the Minister of Agriculture and Forestry. Lethbridge, Alberta. Accessed April 2025. https://www.albertairrigation.ca/?page_id=148.

Alberta Land Stewardship Act. 2009. In *Statutes of Alberta*, 2009, Chapter A-26.8. Edmonton: Alberta King's Printer.

Alberta Public Health Information Network (AEPHIN). 2025a. Cyanobacterial Blooms in Alberta Recreational Waters. http://aephin.alberta.ca/cyano/?sortState=ppi&sizeBy=ppi&selectedBeachId=null&colorBy=ppi&ppi=null&mcyE=null&cellCount=null&year=2023&visualEvidence=null.

AEPHIN. 2025b. AEPHIN Fish Consumption Advice: Should I Eat This Fish. Accessed July 2025. http://aephin.alberta.ca/shouldIEatThisFish/.

Alberta Soil Information Centre (ASIC). 2001. *AGRASID 3.0: Agricultural Region of Alberta Soil Inventory Database Version 3.0.* J.A. Brierley, T.C. Martin and D.J. Spiess (eds.). Agriculture and Agri-Food Canada - Research Branch, Alberta Agriculture, Food and Rural Development, Conservation and Development Branch. [spatial database].

Alberta Transportation and Economic Corridors (TEC). 2004. Water Control Structures: Selected Design Guidelines. Prepared by Mack, Slack & Associates Inc. Published by TEC. Edmonton, Alberta. November 2004.

TEC 2018a. Springbank Off-Stream Reservoir Project Environmental Impact Assessment. Prepared for Alberta Transportation by Stantec Consulting Ltd. Submitted March 26, 2018. https://www.nrcb.ca/natural-resource-projects/natural-resource-projects-listing/83/springbank-off-stream-reservoir-project.

TEC. 2018b. Springbank Off-Stream Reservoir Project Environmental Impact Assessment Volume 3A: Effects Assessment (Construction and Dry Operations). Prepared for Alberta Transportation by Stantec Consulting Ltd. Submitted March 2018. https://www.nrcb.ca/natural-resource-projects/natural-resource-projects-listing/83/springbank-off-stream-reservoir-project/documents/8762/20180326-at-eia-to-nrcb-re-vol-3a-s03-air-quality-and-climate.

TEC. 2018c. Springbank Off-Stream Reservoir Project Environmental Impact Assessment Volume 4, Appendix E: Air Quality and Climate, Attachment 3A. Prepared for Alberta Transportation by Stantec Consulting Ltd. Submitted March 2018. https://www.nrcb.ca/natural-resource-projects/natural-resource-projects-listing/83/springbank-off-stream-reservoir-project/documents/8780/20180326-at-eia-to-nrcb-re-vol-4-appe-air-quality-and-climate.

TEC. 2019. Springbank Off-Stream Reservoir Project Response to NRCB and AEP Supplemental Information Request 2 – Questions 1 and 27. Prepared for Alberta Transportation by Stantec Consulting Ltd. Submitted November 18, 2019. https://open.alberta.ca/dataset/f2af0973-5660-4cc3-afe0-60182f4bfeca/resource/a4c55a47-24fd-481b-b2ca-b100b2d7f889/download/20200407-at-sir-to-aep-re-ir-response-round-2-questions-1-and-27.pdf.

TEC. 2020. Environmental Construction Operations (ECO) Plan Framework. Instructions for Preparing ECO Plans for Alberta Transportation, City of Calgary and City of Edmonton Construction Projects.

AMEC Environment & Infrastructure (AMEC). 2014. Water Storage Opportunities in the South Saskatchewan River Basin in Alberta. Prepared by AMEC Environment and Infrastructure for SSRB Water Storage Opportunities Steering Committee. Lethbridge, Alberta. July 2024. Accessed July

2025. https://open.alberta.ca/publications/water-storage-opportunities-in-the-south-saskatchewan-river-basin-in-alberta.

Bolseng, T.A. 1991. *Water quality in selected return-flow channels. Irrigation and resource management division*. Alberta Agriculture. Lethbridge, Alberta.

Booth, L. 2015. Estimating Discount Rates. Research Paper. *The School of Public Policy Publications*. Volume 8. Issue 18. University of Toronto. https://journalhosting.ucalgary.ca/index.php/sppp/article/view/42518.

Butler. 1998. The Design, Performance, and Analysis of Slug Tests. Lewis Publishers. 252 p.

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian environmental quality guidelines. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba.

CCME. 2000. Canadian tissue residue guidelines for the protection of wildlife consumers of aquatic biota: Methylmercury. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba.

CCME. 2017. Canadian water quality guidelines for the protection of aquatic life: CCME Water Quality Index, User's Manual – 2017 Update. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba.

CCME. 2024. Canada's Air. Accessed July 2025. https://ccme.ca/en/air-quality-report.

Cross, P.M. 1997. *Review of irrigation district water quality. Prepared for CAESA Water Quality Monitoring Committee*. Madawaska Consulting. Alberta, Canada.

Deane, E., R. Macciotta, M.T. Hendry, C. Gräpel and R. Skirrow. 2019. The use and limitations of modern technologies for slow, vegetated landslide monitoring – Chin Coulee Landslide. In *GeoSt.John's 2019 Conference*, *29 September to 2 October 2019*. St. John's, NL, Canada: The Canadian Geotechnical Society.

Deane, E., R. Macciotta, M.T. Hendry, C. Gräpel and R. Skirrow. 2020a. Leveraging historical aerial photographs and digital photogrammetry techniques for landslide investigation—a practical perspective. *Landslides.* 17:1989-1996.

Deane, E., R. Macciotta, M.T. Hendry, C. Gräpel and R. Skirrow. 2020b. Historical aerial photographs and digital photogrammetry techniques to investigate the development and evolution of the Chin Coulee landslide in Alberta. In *Canadian Geotechnical Conference: GeoVirtual, 14 to 16 September 2020*. The Canadian Geotechnical Society. Calgary, Alberta.

Deane, E. 2020c. The Application of Emerging Monitoring Technologies on Very Slow Vegetated Landslides. Thesis Paper. University of Alberta, Department of Civil and Environmental Engineering.

Dick, W., R. Woodvine, B. Abrahamson and M. Acharya. 2019. PMP and PMF Estimates in Alberta and Saskatchewan: Initial Review. In Canadian Dam Association's 2019 Annual Conference.

Expropriation Act. 2000. In *Revised Statutes of Alberta*, 2000, Chapter E-13. Edmonton: Alberta King's Printer.

Environment and Climate Change Canada (ECCC). 2019. Canada's Changing Climate Report. Edited by E. Bush, and D.S. Lemmen. Government of Canada. Ottawa, Ontario. Accessed July 2025. https://natural-resources.canada.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR_FULLREPORT-EN-FINAL.pdf.

ECCC. 2021. Draft Technical Guide Related to the Strategic Assessment of Climate Change: Guidance on Quantification of Net GHG Emissions, Impact on Carbon Sinks, Mitigation Measures, Net Zero Plan and Upstream GHG Assessment. Government of Canada. Accessed July 2025. https://www.canada.ca/en/environment-climate-change/corporate/transparency/consultations/draft-technical-guide-strategic-assessment-climate-change.html.

ECCC. 2025a. National Inventory Report Annex 6: Emission Factors. Accessed July 2025. https://data-donnees.az.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/D-Emission-Factors/?lang=en.

ECCC. 2025b. National Inventory Report 1990-2023: Greenhouse Gas Sources and Sinks in Canada.. Accessed July 2025. https://publications.gc.ca/collections/collection_2025/eccc/En81-4-2023-2-eng.pdf.

ECCC. 2025c. Normals: Maximum Wind Speed – Monthly data for Lethbridge. Weatherstats.ca based on ECCC data. Accessed July 2025. https://lethbridge.weatherstats.ca/charts/normal_max_wind_speed-monthly.html.

Environment Canada. 2016. Rain Depth, Duration, Frequency Values Prepared by the Engineering Climate Services Unit, Meteorological Service of Canada. Taber, Station Number 3036360.

Eum, H., B. Fajard, T. Tang and A. Gupta. 2023. Potential Changes in Climate Indices in Alberta Under Projected Global Warming of 1.5-5°C. *Journal of Hydrology*. Regional Studies 47. https://doi.org/10.1016/j.ejrh.2023.101390.

Fenton, M.M., E.J. Waters, S.M Pawley, N. Atkinson, D.J. Utting and K. Mckay. 2013. Surficial Geology of Alberta: Map 601. Alberta Energy Regulator and Alberta Geological Survey. Accessed July 2025. https://ags.aer.ca/publication/map-601. [map].

Garcia, I.A.B., R. Macciotta, J. Rodriguez, C. Gräpel, R. Skirrow and K. Tappenden. 2024. Method for Estimating Landslide Stability under Future Drawdown Scenarios due to Climate Change - Chin Coulee Landslide Case. Thesis Paper. University of Alberta,Department of Civil and Environmental Engineering.

Glacier Power Ltd. (GPL). 2006. Environmental Impact Assessment for the Proposed Dunvegan Hydroelectric Project. Section 4.4. Climate, Air Quality and Noise. Prepared by Jacques Whitford. October 2006.

Government of Alberta (GoA). 2006. *Approved Water Management Plan for the South Saskatchewan River Basin (Alberta)*. Accessed July 2025. https://open.alberta.ca/dataset/7541cb1e-b511-4a98-8b76-af33d7418fa1/resource/483eb9b0-29fd-41d4-9f81-264d53682b9a/download/2006-ssrb-approvedwatermanagementplan-2006.pdf.

GoA. 2008. Land-Use Framework. Land Use Secretariat. Accessed July 2025. https://open.alberta.ca/publications/9780778577140.

GoA. 2011a. Alberta Regulation 179 - Alberta Land Stewardship Regulation under the Alberta Land Stewardship Act, S.A. 2000, c. A-26.8. With amendments up and to including Alberta Regulation 218/2022. Edmonton: Alberta King's Printer.

GoA. 2011b. Alberta Regulation 187 – Public Lands Administration Regulation under the Public Lands Act, R.S.A. 2000, c. P-40. With amendments up and to including Alberta Regulation 9/2023. Edmonton: Alberta King's Printer.

GoA. 2011c. Recommended Land use Guidelines for Protection of Selected Wildlife Species and Habitat within Grassland and Parkland Natural Regions of Alberta. Fish and Wildlife Division, Sustainable Resource Development, Government of Alberta. Accessed March 2025 at: https://open.alberta.ca/publications/3054250.

GoA. 2013a. 2010 Reclamation Criteria for Wellsites and Associated Facilities for Native Grasslands (Updated July 2013). Environment and Sustainable Resource Development. Edmonton, Alberta 92 pp.

GoA. 2013b. Alberta Wetland Policy. Environment and Sustainable Resource Development. Issued September 1, 2013. https://open.alberta.ca/publications/9781460112878#summary.

GoA. 2013c. Sensitive Species Inventory Guidelines. ESRD-Wildlife Management. Accessed March 2025.https://open.alberta.ca/publications/sensitive-species-inventory-guidelines.

GoA. 2016. Principles for Minimizing Surface Disturbances in Native Grassland - Principles, Guidelines, and Tools for all Industrial Activity in Native Grassland in the Prairie and Parkland Landscapes of Alberta. Alberta Environment and Parks. Accessed July 2025. https://open.alberta.ca/publications/9781460130551.

GoA. 2017. Alberta Wetland Assessment and Impact Report Directive. Water Policy Branch, Alberta Environment and Parks. Edmonton, Alberta. 10 pp.

GoA. 2018a. Environmental Quality Guidelines for Alberta Surface Waters. Water Policy Branch, Environment and Parks. Edmonton, Alberta. Accessed July 2025. https://open.alberta.ca/publications/9781460138731.

GoA. 2018b. South Saskatchewan Regional Plan 2014-2024: Amended May 2018. Accessed July 2025. https://open.alberta.ca/publications/9781460139417.

GoA. 2018c. Water Wells and Ground Source Heat Exchange Systems Directive. Environment and Parks. Edmonton, Alberta. Accessed July 2025. https://open.alberta.ca/dataset/9781460141588#summary.

GoA. 2019. Recommended Fish Consumption Limits in Alberta: Fish Consumption Advice Information. Accessed July 2025. https://mywildalberta.ca/fishing/advisories-corrections-closures/documents/FishConsumptionLimitsAlberta-Jun2019.pdf.

GoA. 2021. Hydrologic Unit Code Watersheds of Alberta. Alberta Environment and Parks. Accessed June 2025. [spatial dataset]. https://geodiscover.alberta.ca/geoportal/rest/metadata/item/243f7273de0a435f8099f193f81662b3/html.

GoA. 2022. Turbidity Monitoring for In-stream Construction Activities. Environment and Protected Areas. Accessed July 2025. https://open.alberta.ca/publications/construction-activities-creating-turbidity-in-waterbodies-guideline.

GoA. 2023a. Guide to Groundwater Authorization. Environment and Protected Areas. Accessed July 2025. https://open.alberta.ca/publications/guide-to-groundwater-authorization.

GoA. 2023b. Water (Ministerial) Regulation. Alberta King's Printer.

GoA. 2023c. Alberta water Licence Viewer. Environment and Protected Areas. Accessed July 2025. https://geospatial.alberta.ca/erv/.

GoA. 2023d. 2023 Alberta Guide to Sportfishing Regulations: Fish Management Zone 2 – Parkland-Prairie, PP1 Waterbody Specific Regulations. https://geospatial.alberta.ca/afr/.

GoA. 2024. Master schedule of standards and conditions. Alberta Environment and Parks. Accessed March 2025. https://open.alberta.ca/publications/master-schedule-of-standards-and-conditions.

Government of Canada (GoC). 2020. Soil Management. Agriculture and Agri-Food Canada (AAFC). Accessed July 2025. https://agriculture.canada.ca/en/agricultural-production/soil-and-land/soil-management#c.

GoC. 2022. Canada's Cost-Benefit Analysis Guide for Regulatory Proposals. Treasury Board of Canada Secretariat. https://publications.gc.ca/site/eng/9.910204/publication.html.

Grassland Restoration Forum. 2023. Recovery Strategies for Industrial Development in Native Grassland for the Dry Mixedgrass Natural Subregion of Alberta – Second Edition. Published by the Grassland Restoration Forum. Pincher Creek, Alberta. 188 pp.

Greenlee, G.M., P.D. Lund, D.R. Bennett and D.E. Mikalson. 2000. Surface water quality studies in the Lethbridge northern and Bow River irrigation districts. Alberta agriculture, food and rural development. Lethbridge, Alberta.

Hayhoe, K. and A. Stoner. 2019. Alberta's Climate Future - Final report. Prepared for the Government of Alberta. Accessed July 2025. https://open.alberta.ca/publications/albertas-climate-future-final-report-2019.

Health Canada. 2016b. Human Health Risk Assessments for Diesel Exhaust. Healthy Environments and Consumer Safety Branch, Health Canada. Ottawa, Ontario.

Health Canada. 2022a. *Guidelines for Canadian Drinking Water Quality – Summary Table*. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Ottawa, Ontario.

Health Canada. 2022b. Guidelines for Canadian Recreational Water Quality – Cyanobacteria and Their Toxins. Guideline Technical Document. Accessed February 2022. https://www.canada.ca/content/dam/hc-sc/documents/services/publications/healthy-living/guidance-canadian-recreational-water-quality-cyanobacteria-toxins/water-quality-cyanobacteria-toxins-en.pdf.

Health Canada. 2025. Guideline for Canadian Drinking Water Quality - Summary Tables. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Accessed July 2025. https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html.

Historical Resources Act. 2000. In *Revised Statutes of Alberta*, 2000, Chapter H-9. Edmonton, AB: Alberta King's Printer.

Historical Resources Management Branch (HRMB). 2022. The Requirements for Recording and Reporting Historical Structures within the Context of Archaeological HRIAs Document. Archaeological Survey of Alberta, Historic Resources Management Branch, Alberta Culture and Tourism.

HRMB. 2023. Listing of Historic Resources, Restricted Version. Historic Branch, Alberta Culture, Multiculturalism and Status of Women. Edmonton, Alberta.

Hopkinson, R.F. 1984. An Assessment of Probable Maximum Precipitation and Snowmelt for the Drainage Area Above Chin Reservoir. Letter, Atmospheric Environmental Services, Environment Canada.

Hopkinson, R.F. 1999. Point Probable Maximum Precipitation for the Prairie Provinces. Report No. AHSD-R99-01.

Hydrogeological Consultants Ltd. (HCL). 2007. M.D. of Taber, Part of the South Saskatchewan River Basin Regional Groundwater Assessment, Parts of Tp 007 to 015, R 12 to 20, W4M.

INTERA Inc. (INTERA). 2025a. Water Quality Analysis Technical Memorandum. Prepared for MPE Engineering Ltd. by INTERA Inc. Submitted June 30, 2025.

INTERA. 2025b. Phenols Modeling Technical Memorandum. Prepared for MPE Engineering Ltd, by INTERA Inc. Submitted June 30, 2025.

INTERA. 2025c. Chin Reservoir Historical Canal Inflow and Modeled Arsenic Trend Analysis. Prepared for MPE Engineering Ltd. By INTERA Inc. Submitted June 30, 2025.

INTERA. 2025d. Chin Reservoir Expansion – Sediment Modeling Technical Memorandum. Prepared for MPE Engineering Ltd. by INTERA Inc. Submitted June 30, 2025.

INTERA. 2025e. Chin Reservoir Expansion – Adaptive Management Plan for Water Quality Technical Memorandum. Prepared for MPE Engineering Ltd. by INTERA Inc. Submitted June 30, 2025.

Intergovernmental Panel on Climate Change (IPCC). 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories- Volume 4. Agriculture, Forestry and Other Land Use. Accessed July 2025. https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html.

IPCC. 2014. Fifth Assessment Report: AR5 Climate Change 2013: The Physical Science Basis. Accessed July 2025. https://www.ipcc.ch/report/ar5/wg1/.

IPCC. 2019. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories - Volume 4. Agriculture, Forestry and Other Land Use. Accessed July 2025. https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol4.html.

Irrigation Districts Act. 2000. In *Revised Statutes of Alberta*, 2000, Chapter I-11. Edmonton, AB: Alberta King's Printer.

Klohn Crippen Berger (KCB). 2018a. S005 Hwy 36:02 Chin Coulee Slide – Geotechnical Drilling and Instrument Installation. Southern Region GRMP. Prepared for Alberta Transportation. May 15, 2018.

KCB. 2018b. S005 Hwy 36:02 Chin Coulee Slide – Geocube Installation Report. Southern Region GRMP. Prepared for Alberta Transportation. October 9, 2018.

KCB. 2021. Chin Reservoir Expansion Project. Snake Protection Plan. Prepared for MPE Engineering Ltd. September 2021.

KCB. 2023. Chin Reservoir Expansion – New East Dam Preliminary Design Report (Dam Safety Submission). Prepared for MPE Engineering Ltd. and St. Mary River Irrigation District. December 2023.

KCB. 2025. Hydrogeology Supplemental Technical Report. Project No. A03701E05. Prepared for St. Mary River Irrigation District. August 8, 2025.

Land Titles Act. 2000. In *Revised Statutes of Alberta*, 2000, Chapter L-4. Edmonton, AB: Alberta King's Printer.

Little, J., A. Kalischuk, D. Gross and C. Sheedy. 2010. Assessment of water quality in Alberta's irrigation districts, Second edition. Lethbridge, Alberta, Canada: Alberta Agriculture and Rural Development.

Matrix Solutions Inc. (Matrix). 2019. 2018 Chin Reservoir Damn Safety Review – Chin 1 Dam (West) and Chin 2 Dam (East). Prepared for the St. Mary Irrigation District by Matrix Solutions Inc. with Tetra Tech Inc, Calgary, Alberta.

McNeil, P.E. 2023. Paleontological Historical Resource Impact Assessment – Mary River Irrigation District: Chin Reservoir Expansion Project (ASA permit 22-049). Manuscript on file with the Archaeological Survey of Alberta, Edmonton.

McNeil, R.L., R.W. Howitt, I.R. Whitson and A.G. Chartier. 1994. Soil Survey of the County of Forty Mile No. 8, Alberta: Alberta Soil Survey Report No. 54. Alberta Research Council, Environmental Research and Engineering Department. Edmonton, Alberta.

Molinari, D., S. Dazzi, E. Gattal, G. Minucci, G. Pesaro, A. Radici and R. Vacondio. 2021. Cost-benefit analysis of flood mitigation measures: a case study employing high-performance hydraulic and damage modelling. *Natural Hazards*. 108: 3061-3084.

MPE Engineering Ltd. (MPE). 2014. Regional Drainage Committee, Southern Regional Stormwater Management Plan, Volume 1. Lethbridge, Alberta.

MPE. 2020. Chin Reservoir Expansion Conceptual Design Report. September 2020. Final Report for: St. Mary River Irrigation District.

MPE. 2022. Chin Reservoir Expansion, Chin Outlet – Conceptual Design Report. Report for: St. Mary River Irrigation District.

MPE. 2025. Chin Reservoir Expansion – East Dam Traffic Impact Assessment. Prepared for St. Mary River Irrigation District by MPE Engineering Ltd. Submitted July 22, 2025.

Natural Resources Canada (NRCan). 1978. Plate 19: Freeze-Up and Break-Up of Rivers and Lakes. Accessed August 2025. https://ftp.geogratis.gc.ca/pub/nrcan_rncan/raster/atlas/eng/hydro_1978/water_quantity_temperature_winds/19_Freeze_Break_Up_Rivers_Lakes_1978_150.jpg. [map compilation].

Niell, C., D. Bray, M. Schouten and J. Card. 1970. Selected Characteristics of Streamflow in Alberta. River Engineering and Surface Hydrology report 70-1. Research Council of Alberta, Edmonton.

Palliser Environmental Services Ltd. 2011. *Western Irrigation District water quality monitoring program 2011*. Mossleigh, Alberta.

Pedocan Land Evaluation Ltd. (Pedocan). 1993. Soil Series Information for Reclamation Planning in Alberta. Prepared for the Alberta Conservation & Reclamation Council, Report No. RRTAC 93-7.

Pétré, M-A., A. Rivera, R. Lefebvre, M.J. Hendry and A. Folgnagy. 2015. A unified hydrogeological conceptual model of the Milk River transboundary aquifer, traversing Alberta (Canada) and Montana (USA). *Hydrogeology Journal*. 24: 1847-1871.

Prairie Conservation Forum (PCF). 2019. State of the Prairie Technical Report. Accessed August 2025. https://albertapcf.org/state-of-the-prairie.

PCF. 2021. Alberta Prairie Conservation Action Plan: 2021-2025. Lethbridge, Alberta. Accessed July 2025. https://albertapcf.org/about-prairies/prairie-conservation-action-plan.

Provincial Parks Act. 2000. In *Revised Statutes of Alberta*, 2000, Chapter P-35. Edmonton, AB: Alberta King's Printer.

Public Lands Act. 2000. In *Revised Statutes of Alberta*, 2000, Chapter P-40. Edmonton: Alberta King's Printer.

Rodriguez, J., E. Deane, M.T. Hendry, R. Macciotta, T. Evans, C. Gräpel and R. Skirrow. 2021. Practical evaluation of single-frequency dGNSS for monitoring slow-moving landslides. *Landslides.* 18: 3671-3684.

RWDI Air Inc. (RWDI). 2025. Chin Reservoir Expansion Project – Noise Impact Assessment. Prepared for Klohn Crippen Berger Ltd. April 24, 2025.

Saffran, K.A. 2005. *Oldman River basin water quality initiative (ORBWQI): surface water quality summary report April 1998—march 2003. Prepared for the Oldman River basin water quality initiative*. Lethbridge, Alberta, Canada: Published by the Oldman River Basin Water Quality Initiative.

Samarawickrema, A. and S Kulshreshtha. 2008. Value of Irrigation Water for Drought Proofing in the South Saskatchewan River Basin. *Canadian Water Resources Journal.* 33:1–10.

Saskatchewan Power Corporation (SaskPower). 2014. Tazi Twé Hydroelectric Project Environmental Impact Summary. Submitted February 2014. Accessed August 2025. https://iaac-aeic.gc.ca/050/documents/p80031/98788E.pdf.

Shetsen, I. 1987. Quaternary Geology, Southern Alberta: Map 207. Alberta Research Council. Accessed May 2024. https://ags.aer.ca/publication/map-207.

St. Mary River Irrigation District (SMRID). 2022a. SMRID Proposed Irrigation Expansion Information Package. November 2022.

SMRID. 2025. Adaptive Water Management and Operations within the Southern Tributaries Technical Memorandum. Prepared by SMRID. Submitted June 27, 2025.

Sracek, O. 1993. Hydrogeology and Hydrogeochemistry of Buried Preglacial Valleys in the Lethbridge Area, Southern Alberta. MSc. Thesis. Waterloo, ON.

Stantec Consulting Ltd. (Stantec). 2018. Environmental Impact Assessment – Springbank Off-Stream Reservoir Project. Volume 3A: Effects Assessment (Construction and Dry Operating). Prepared by Stantec.

Town of Canmore. 2017. Cougar Creek Debris Flood Retention Structure. Supplemental Information Request Round 1. Submitted to Alberta Environment and Parks and the Natural Resources Conservation Board. June 2017. https://open.alberta.ca/dataset/242dac01-07a1-4453-87e3-a7b96ee13a13/resource/184a7123-8ef4-4f3c-9d31-ccac3a7e3e67/download/sir-responses-round-1.pdf.

Tri-Star Environmental Consulting. 2012. Synthesis of research and application of the CCME water quality index. March 2012. 54 pp.

United States Environmental Protection Agency (US EPA). 2015. Health Effects Support Document for the Cyanobacterial Toxin Microcystins. Office of Water. EPA 820R15102. Accessed August 2025. https://www.epa.gov/sites/default/files/2017-06/documents/microcystins-support-report-2015.pdf.

US EPA. 2025. Harmful Algal Blooms (HABs) in Water Bodies – Basic Information on HABs. https://www.epa.gov/habs/learn-about-harmful-algae-cyanobacteria-and-cyanotoxins.

Villeneuve, J., J. Kohn, N. Seitz Vermeer and M. Kobryn. 2024. Trend analysis of water quality in the irrigation districts of southern Alberta, Canada. *Irrigation and Drainage.* 74(2): 780–794.

Water Act. 2000. In *Revised Statutes of Alberta*, 2000, Chapter W-3. Edmonton: Alberta King's Printer.

WaterSMART Solutions Ltd. (WaterSMART). 2023. *Hydrological Modelling to Evaluate Changes in Streamflow Availability in the St. Mary River Watershed.* Prepared for St. Mary River Irrigation District.

WaterSMART. 2025. Technical Memorandum Regarding Chin Reservoir Expansion Project Supporting SIR#1 Response. Prepared for St. Mary River Irrigation District. June 10, 2025.

Windy Weather World. 2025. Chin Lakes: weather statistics and wind history. Accessed July 2025. https://windy.app/forecast2/spot/7402713/Chin+Lakes/statistics.